

**MISCELLANEOUS ENERGY AND AGRICULTURAL TAX  
BILLS**

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**HEARING**  
BEFORE THE  
SUBCOMMITTEE ON  
ENERGY AND AGRICULTURAL TAXATION  
OF THE  
COMMITTEE ON FINANCE  
UNITED STATES SENATE  
NINETY-EIGHTH CONGRESS

FIRST SESSION

ON  
**S. 1193, S. 1237, S. 1303 and S. 1305**

JULY 18, 1983

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**S. 1193, S. 1237, S. 1303, AND S. 1305**

**MONDAY, JULY 18, 1983**

**U.S. SENATE,  
COMMITTEE ON FINANCE,  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION,  
Washington, D.C.**

The committee met, pursuant to notice, at 9:39 a.m., in room SD-215, Dirksen Senate Office Building, Hon. Malcolm Wallop (chairman) presiding.

Present: Senator Wallop.

[The press release announcing the hearing, the description of bills S. 1193, S. 1237, S. 1303, and S. 1305 by the Joint Committee on Taxation, and the prepared statement of Senator Wallop follow:]

[Press Release]

**FINANCE SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION SETS HEARING ON  
FOUR MISCELLANEOUS ENERGY AND AGRICULTURAL TAX BILLS**

Senator Malcolm Wallop, Chairman of the Subcommittee on Energy and Agricultural Taxation of the Senate Committee on Finance, announced today that the Subcommittee will hold a hearing on Monday, July 18, 1983, on four miscellaneous energy and agricultural tax bills.

The hearing will begin at 9:30 a.m. in Room SD-215 of the Dirksen Senate Office Building.

The following legislative proposals will be considered at the hearing:

S. 1193: Introduced by Senator Symms for himself and others. S. 1193 would treat decarbonization of phosphate ore as a mining process for purposes of the percentage depletion tax deduction.

S. 1237: Introduced by Senator Baker for himself and others. S. 1237 generally would clarify the definition of geothermal energy so the business and residential energy tax credits will apply to energy systems that are supplied primarily, but not exclusively, by geothermal energy.

S. 1303: Introduced by Senator Mitchell. S. 1303 would make a ground water heat pump energy system eligible for the residential energy and investment tax credits.

S. 1305: Introduced by Senator Packwood for himself and others. S. 1305 generally would extend the residential solar, wind, and geothermal tax credits, lower the temperature required for geothermal resources, increase the solar, wind, and geothermal energy tax credits, increase the ocean thermal tax credit, and extend the affirmative commitment rule.

**STATEMENT OF SENATOR MALCOLM WALLOP**

Four bills are scheduled before the subcommittee this morning. Three of those bills concern energy tax credits, the fourth bill deals with the depletion allowance for phosphate ore. Another bill, introduced by Senator Boren, which would exempt piggyback trailers from the retail excise tax on heavy truck trailers had also been scheduled for hearing this morning, but has been postponed until later this year.

Generally, a Treasury Department official appears at hearings of the Senate Finance Committee to present the Administration position on the legislation being considered. Today, no Treasury witness is scheduled, although written testimony will be submitted to the subcommittee for inclusion in the record. With respect to

energy tax credits, the testimony of the Treasury Department would have been no different than what we heard before this subcommittee just a month ago. In short, the Treasury Department is against the extension, enhancement, or the creation of new energy tax credits. It is a position which I believe is shortsighted and not in the best long-term interests of the nation. But unfortunately, it is also a position which I believe is shortsighted and not in the best long-term interests of the nation. But unfortunately, it is also a position which I have learned over the past two years is not likely to be changed.

The absence of support from the Treasury Department does not mean that the Congress should roll over and play dead. Indeed, the three energy tax credit bills which are being heard here this morning are but a continuing sign that the importance of developing alternative energy technologies remains despite the present abundance of conventional energy resources. S. 1237, introduced by Senator Symms would broaden the availability of the energy tax credit for geothermal properties which use geothermal water colder than 120 degrees Fahrenheit. In addition the legislation would make it clear that for the geothermal property to be eligible for the energy tax credit it must be supplied primarily, but not exclusively, by geothermal energy. S. 1303, introduced by Senator Mitchell, also deals with geothermal energy properties. Specifically, the legislation introduced by Senator Mitchell would extend the energy tax credit to ground water heat pumps which can take energy from ground water nearly 70 degrees cooler than that required for qualification under the present geothermal energy tax credits.

Clearly the most comprehensive energy tax credit legislation before the Senate this year is S. 1305, which was introduced by Senators Packwood, Matsunaga, Duranberger, Moynihan, Baucus, Mitchell, and Pell. S. 1305 would extend the 40 percent residential solar, wind, and geothermal energy tax credit from December 31, 1985, to December 31, 1990. In addition, the business solar, wind, geothermal and ocean thermal 15 percent energy tax credits would be increased to 25 percent and extended an additional five years to December 31, 1990. Extensions of the energy tax credit is also provided for cogeneration, biomass, and hydroelectric technologies. With affirmative commitment rules extending until 1995 and the broadening of properties and technologies eligible for the energy tax credit, there can be little doubt that this legislation represents no small endeavor.

I am convinced that, as a matter of national energy policy, we must proceed with the development of alternative energy technologies. No one can or will dispute the fact that stable, dependable energy resources are the key to our present and future economic and social well being. Alternative energy technologies represent the key to tapping energy resources whose potential has barely begun to be realized. The case is there to be made for the continuation of tax incentives for the further development of those technologies. That case must be made by those of you who will be appearing before the subcommittee this morning. In making that case there must be the clear recognition that, like no other time in our history, this government must get the biggest bang for its buck within well defined policy and budget priorities. Tax incentives can fit within those priorities, but they must operate as incentives for viable economic development and cannot be so generous that they insulate these projects from every conceivable economic event. With those thoughts in mind I look forward to hearing from the witnesses appearing before the subcommittee this morning.

Concluding the hearing today will be consideration of S. 1193, introduced by Senator Symms and Senator McClure. S. 1193, is designed to correct an IRS revenue ruling which would deny the percentage depletion allowance for phosphate ore which goes through high temperature decarbonization as a part of the purifying and concentration process, thus allowing the ore to be shipped and processed into useable products, generally phosphate fertilizers. It is my understanding that for phosphates mined outside the state of Florida, this decarbonization process is necessary to bring the phosphate to a processing state, and as such, satisfies the intent behind the percentage depletion provisions of the Code. This legislation would clarify that intent so there is no opportunity for misunderstanding by the Internal Revenue Service.

**DESCRIPTION OF ENERGY TAX BILLS  
(S. 1193, S. 1237, S. 1303, and S. 1305)**

**SCHEDULED FOR A HEARING**

**BEFORE THE**

**SUBCOMMITTEE ON ENERGY AND  
AGRICULTURAL TAXATION**

**OF THE**

**SENATE COMMITTEE ON FINANCE**

**ON JULY 18, 1983**

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**PREPARED BY THE STAFF**

**OF THE**

**JOINT COMMITTEE ON TAXATION**

**INTRODUCTION**

The Subcommittee on Energy and Agricultural Taxation of the Senate Committee on Finance has scheduled a public hearing on July 18, 1983, on four energy-related tax bills: (1) S. 1193 (relating to percentage depletion treatment of decarbonized phosphate rock), introduced by Senators Symms and McClure; (2) S. 1237 (relating to the definition of geothermal energy for purposes of the energy tax credits), introduced by Senator Baker for Senator Symms and others; (3) S. 1303 (relating to a tax credit for ground water heat pumps), introduced by Senator Mitchell; and (4) S. 1305 (relating to the extension and expansion of renewable energy source tax credits), introduced by Senator Packwood and others.

The first part of the pamphlet is a summary of the bills. This is followed in the second part by a description of present law and related background information. The third part describes the four bills scheduled for hearing.

## I. SUMMARY

### *Present Law*

#### *Percentage depletion*

In the case of natural deposits (such as mines or geothermal deposits), taxpayers are allowed an annual deduction for depletion. Taxpayers are entitled to cost depletion but are required to take deductions for percentage depletion if percentage depletion results in a larger deduction.

Under present law, the decarbonization of phosphate rock through the application of thermal processes is not an allowable mining process. Thus, the income attributable to decarbonization is not subject to percentage depletion.

#### *Energy tax credits*

In general, the 10-percent business energy credit expired at the end of 1982. However, the general 10-percent business energy credit will continue through 1990 for certain types of property that are part of a long-term project, if certain affirmative commitments are made in connection with the project. Business energy credits (other than the general 10-percent credit) are allowed through 1985 for solar, wind, geothermal, ocean thermal, and qualified hydroelectric generating property. Individuals are allowed a residential energy credit for investments in renewable energy property, including solar, wind, or geothermal property. The residential energy credit will terminate after 1985.

### *Summary of the Bills*

#### *S. 1193*

The bill would provide that the application of thermal energy up to 850 degrees Celsius would constitute a mining process with respect to phosphate rock. Income attributable to this process would, therefore, be subject to percentage depletion.

#### *S. 1237*

S. 1237 would provide percentage depletion for all geothermal resources, without regard to the temperature at which such resources are stored. The bill would also extend the scope of the residential energy credit and the business energy credit to allow the credit for property using energy sources that are ineligible under present law.

#### *S. 1303*

S. 1303 would amend the definition of solar energy property to include heat pumps that use solar energy stored in ground water.

The modified definition of solar energy property would apply for purposes of the residential and the business energy credits.

***S. 1305***

S. 1305 would extend the residential and business energy credits for solar, wind, or geothermal energy equipment through 1990. The business energy credit would also continue to be available for ocean thermal property, qualified hydroelectric generating property, biomass property, and cogeneration property. Property eligible for the extended credits under the bill would continue to be eligible for the credit through 1995 under new affirmative commitment rules applicable to short-term projects, as well as long-term projects. The bill would also make the regular investment credit available for solar or wind energy property and cogeneration equipment that does not qualify for the regular credit under present law. The bill would repeal the limitation applicable to cogeneration equipment on the use of oil or natural gas. In addition, the scope of the definition of qualified fuel used in biomass property would be expanded to include methane-containing gas produced by anaerobic digestion from nonfossil waste materials at certain facilities.

The definition of "geothermal deposits" would be amended to lower the temperature requirement from 122 degrees Fahrenheit to 104 degrees Fahrenheit.

## II. PRESENT LAW AND BACKGROUND

### Percentage Depletion Under Present Law

#### *In general*

In the case of natural deposits (such as oil and gas wells and mineral deposits), taxpayers are allowed an annual deduction for depletion. The depletion deduction is based on the theory that the extraction of resources gradually exhausts the taxpayer's capital investment in the natural deposit.<sup>1</sup> Under present law, subject to the limitations and restrictions (described below), taxpayers who are entitled to cost depletion are required to take deductions for percentage depletion if percentage depletion results in a larger deduction. Percentage depletion is computed by applying a statutory percentage to the gross income from the property for as long as the natural deposit is productive. Although percentage depletion is unrelated to the taxpayer's capital investment in the property, the theory of the allowance for cost depletion is equally applicable to percentage depletion.<sup>2</sup>

#### *Oil and gas*

For oil and gas, the Tax Reduction Act of 1975 denied percentage depletion to integrated oil companies, limited percentage depletion for other taxpayers to 65 percent of taxable income, and limited percentage depletion to the income from up to 1,000 barrels a day of production. Under a restriction applicable to all depletable resources, percentage depletion on any property is limited to 50 percent of the taxable income from the property (determined without regard to the depletion deduction).

#### *Geothermal deposits*

Prior to the Energy Tax Act of 1978, it was unclear whether the production from geothermal resources qualified for percentage depletion. In *Reich v. Commissioner*,<sup>3</sup> the Ninth Circuit held that steam from geothermal wells entitled the taxpayers to percentage depletion deductions. The Ninth Circuit's decision was based on findings that steam is a gas and that the geothermal wells were exhaustible. However, the Internal Revenue Service declined to follow this decision in cases arising outside of the Ninth Circuit.

The Energy Tax Act provided percentage depletion for geothermal deposits located in the United States or its possessions. A geothermal deposit is defined as "a geothermal reservoir consisting of natural heat which is stored in rocks or in an aqueous liquid or

<sup>1</sup> *Commissioner v. Southwest Exploration Co.*, 350 U.S. 308 (1956).

<sup>2</sup> Section 613 of the Code provides that percentage depletion is unavailable for inexhaustible resources such as minerals from sea water or air.

<sup>3</sup> 454 F.2d 1157 (9th Cir. 1972).

vapor (whether or not under pressure)." The 50-percent-of-taxable-income limitation applicable to percentage depletion for all resources is applicable to geothermal deposits.

### ***Hard Minerals***

In the case of hard minerals that are subject to processing after extraction, the Code provides specific rules for determining when mining ceases and manufacturing or refining begins. These rules are necessary to assure that integrated miner-manufacturers do not gain a competitive advantage over non-integrated miners by claiming percentage depletion on income attributable to manufacturing or refining operations.

In the case of phosphate rock, mining includes not merely the extraction of ores or minerals from the ground, but also certain treatment processes to such ores carried out by the mine's owner or operator. In general, these treatment processes include those processes, such as sorting, concentrating, sintering, and substantially equivalent processes, applied to bring the ore to shipping grade and form, and loading for shipment. However, unless otherwise allowed, mining processes do not include calcining, thermal or electric smelting, refining, treatments which effect chemical changes in the ore, or which work by thermal action. Such processes are generally not subject to characterization as mining processes because they alter the chemical nature of the ore and, therefore, are considered to begin the manufacturing process.

Under present law, the sintering and nodulization of phosphate rock is a treatment process which is treated as mining. Sintering is the process of heating an aggregate of fine metal particles at a temperature below their melting point so as to cause them to weld together and agglomerate. Thus, sintering phosphate ore will cause it to nodulize. Sintering and nodulization may be used to agglomerate phosphate rock fines in order to produce an acceptable electric furnace feed in the production of elemental phosphorus. It does not involve a chemical change in the ore itself.

Phosphate rock may be subject to a variety of processes after removal from the ground to bring the phosphate to commercial concentration. These include washing, screening, classifying, floating, and heating. The processes which must be applied to particular production depend upon the quality of the rock mined. For example, a great deal of phosphate rock produced in Florida is already highly concentrated and does not need to be heated. A great deal of North Carolina and Western States production, however, is highly carbonaceous and must be heated to be brought to the same grade as Florida production. The cost of producing and marketing North Carolina and Western States phosphate is, therefore, higher than the cost of producing and marketing Florida production. Another source of phosphate for U.S. consumption is Morocco. "

Decarbonation (or decarbonization) is the process of removing carbonaceous materials from ore, generally through the use of thermal action. Under present law, decarbonation of trona is an allowable mining process, even though decarbonation of trona by thermal action may result in the release of bound water and carbon dioxide, resulting in a chemical change in the trona. There-

fore, percentage depletion on trona is based on the value of soda ash extracted from it.

Phosphate ore may also be decarbonized through the application of thermal energy. However, the heat necessary to decarbonize phosphate rock is in excess of the heat necessary to sinter such rock and may effect a chemical change in the rock. In Rev. Rul. 74-519, 1974-2 C.B. 182, the Internal Revenue Service held that the decarbonation of phosphate rock is a thermal process used to refine a partially processed mineral, which does not qualify as a mining process for percentage depletion purposes. See also Rev. Rul. 72-473, 1972-2 C.B. 284.

## Energy Tax Credits Under Present Law

### *Residential energy credits*

Individuals are allowed a 40-percent credit of up to \$4,000 for expenditures for renewable energy source property, including geothermal energy property and solar energy property. The individual credit for renewable energy source expenditures applies to expenditures made through 1985. There is a credit carryover provision that allows unused credits to be carried over to subsequent taxable years (but not to any taxable year beginning after 1987).

Congress has not approved a residential energy tax credit for a heat pump.

*Geothermal energy property.*—Under Treasury regulations, renewable energy source property includes equipment (and parts solely related to the functioning of such equipment) necessary to transmit or use energy from a geothermal deposit.

For purposes of the residential energy credit, a geothermal deposit is defined as a geothermal reservoir consisting of natural heat, which is from an underground source and is stored in rocks or in an aqueous liquid or vapor, having a temperature exceeding 122 degrees Fahrenheit. The applicable regulations also provide that equipment that serves both a geothermal function and a non-geothermal function does not qualify as geothermal energy property. However, the existence of a backup system designed for use only in the event of failure of the geothermal energy property would not be disqualifying.

In accordance with the applicable Treasury regulations, in Revenue Ruling 81-304,<sup>4</sup> the Internal Revenue Service ruled that a ground water heat pump that uses well water with a temperature of 56 degrees Fahrenheit as an energy source does not qualify as geothermal energy property for purposes of the residential energy credit.

*Solar energy property.*—Individuals are allowed a residential energy credit for amounts expended to install solar or wind energy property in connection with a principal residence located in the United States. Treasury regulations define solar energy property as equipment that, when installed in connection with a dwelling, transmits or uses solar energy to heat or cool the dwelling or to provide hot water for use within the dwelling. For this purpose, solar energy is energy derived directly from sunlight. The regula-

<sup>4</sup> 1981-2 C.B. 7

tions provide that property that uses an energy source that is indirectly derived from sunlight (such as fossil fuel, wood, or heated underground water) is not considered solar energy property.

In Rev. Rul. 81-304, the Internal Revenue Service ruled that a ground water heat pump that uses well water as a source of energy to heat the taxpayer's principal residence does not qualify as solar energy property because the energy in the ground water is indirectly derived from sunlight.<sup>5</sup>

### ***Business energy credit***

**General rules.**—Prior to 1983, the law provided a general 10-percent investment credit for certain energy property (in addition to the regular investment credit). Property eligible for the general 10-percent energy credit includes alternative energy property (which includes ocean thermal or geothermal property), solar and wind energy property, specially defined energy property, recycling equipment, shale oil equipment, equipment for producing natural gas from geopressured brine, and cogeneration equipment. The general energy credit for these types of property terminated after 1982, except that the credit is allowed through 1990 for long-term projects for which certain affirmative commitments (described below) are made.

A 15-percent energy credit is allowed through 1985 for solar, wind, geothermal, and ocean thermal property. Qualified intercity buses and biomass property are eligible for a 10-percent energy credit. For periods beginning on January 1, 1982 and ending on December 31, 1982, a 10-percent energy credit was allowed for chlor-alkali electrolytic cells. No affirmative commitment rule applies to these properties.

Qualified hydroelectric generating property is eligible for an 11-percent credit through 1985. The credit for hydroelectric property is allowed through 1988 under a special affirmative commitment rule.

Congress has not approved a business energy tax credit for a heat pump.

**Affirmative commitment rules.**—The general 10-percent energy credit is available after 1982 if specified affirmative commitments are undertaken with respect to qualified property that is part of a project with a normal construction period of two years or more. The credit is allowed for property that is constructed or acquired in connection with the project if after 1982 if (1) all engineering studies on the project have been completed before 1983, (2) applications for all environmental and construction permits required to commence construction were filed before 1983, and (3) before 1986, binding contracts are entered into to construct or acquire at least 50 percent of the aggregate cost of all equipment that is specially designed for the project.

The 11-percent energy credit for qualified hydroelectric generating equipment is allowed through 1988 if an application has been

<sup>5</sup> 1981-2 C.B. 7. Solar energy stored in ground water is indirectly derived from sunlight in that the temperature of ground water is closely correlated to the average annual air temperature of a region, because the temperature of ground water reflects the average temperature of surface water and precipitation that recharge the underground water source. This surface water receives its heat energy from the air and land surface that, in turn, are warmed by the sun.

docketed by the Federal Energy Regulatory Commission by January 1, 1986.

*Cogeneration equipment.*—The term cogeneration equipment includes property which is an integral part of a system for using the same fuel to produce both qualified energy (e.g., steam or heat) and electricity at an industrial or commercial facility at which electricity or qualified energy was produced as of January 1, 1980. Property qualifies as cogeneration equipment only to the extent that such property increases the capacity of the system to produce qualified energy or electricity, whichever is the secondary energy product of the system. Under a statutory limitation, the term cogeneration equipment does not include property that is part of a system using oil or natural gas (or a product thereof) for any purpose other than for startup, backup, or flame control, or a system using fuel comprised of more than 20 percent (on an annual British thermal unit or Btu basis) of oil or natural gas.

*Application of the regular investment credit.*—If energy property qualifies for the regular investment credit both the regular and energy credits apply. In general, property eligible for the regular investment credit is tangible personal property, excluding buildings and their structural components, that is depreciable. Thus, for example, solar, wind, or geothermal energy air or water heating or cooling systems for air and water (which are structural components of buildings) do not qualify for the regular investment credit under present law. However, in the case of qualified hydroelectric generating property that is a fish passageway, the regular investment credit, as well as the energy credit, is allowed for any period after 1979, without regard to whether such property otherwise qualifies for the regular investment credit.

*Solar process heat equipment.*—Solar energy property eligible for the business energy credit includes equipment that uses solar energy to generate steam at high temperatures for use in industrial or commercial processes. However, solar process heating equipment that is eligible for the business energy credit may not qualify for the regular investment credit in certain cases. Thus, taxpayers are required to allocate the costs of such equipment between the costs allocable to equipment qualifying for the business energy credit and the costs of equipment qualifying for the regular investment credit.

*Biomass property.*—In general, to qualify as biomass property eligible for the energy credit, the property must use qualified fuel. For this purpose, qualified fuel includes any synthetic fuel and alcohol, if the primary source of energy for the facility producing the alcohol is not oil or natural gas (or a product of oil or natural gas).

*Geothermal energy property.*—Taxpayers are allowed a 15-percent energy credit through 1985 for equipment used to produce, distribute, or use energy derived from a geothermal deposit. For purposes of the business energy credit, Treasury regulations provide that the term geothermal deposit has the same meaning as that provided in the regulations for the residential energy credit. The regulations also provide that equipment that uses energy derived from a geothermal deposit is eligible property only if it uses geothermal energy exclusively.

The applicable regulations do not impose an exclusivity rule on other property eligible for the business energy credit. For example, a boiler qualifies as alternative energy property eligible for the credit if a substance other than oil or gas comprises the primary fuel (i.e., if more than 50 percent of the fuel requirement is met by a qualified source, measured in Btus). Similarly, if equipment is used in connection with qualified alternative energy property and nonqualified property, only the incremental cost (i.e. the excess of the total cost over the amount that would have been expended if the property were not used for a qualifying purpose) of the property is eligible for the credit.

For purposes of this credit, solar energy property has the same meaning as that provided for purposes of the residential energy credit. Thus, the Internal Revenue Service ruling on equipment that uses ground water as a source of energy under the residential energy credit provisions could be applied to disallow a business energy credit for such equipment.

### III. DESCRIPTION OF THE BILLS

#### 1. S. 1193—Senators Symms and McClure

##### Percentage Depletion for Decarbonization of Phosphate Rock

###### *Explanation of the Bill*

Application of thermal energy, below 850 degrees Celsius, to phosphate rock would be deemed to be a mining process. Thus, decarbonization of phosphate rock by thermal process would be subject to percentage depletion.

###### *Effective Date*

The bill would be effective for taxable years beginning after 1953.

###### *Revenue Effect*

This bill is estimated to reduce fiscal year receipts by less than \$10 million a year.

#### 2. S. 1237—Senators Symms, Baker, and McClure

##### Modification of Definition of Geothermal Energy

###### *Explanation of the Bill*

###### *Overview*

The bill would provide percentage depletion for all geothermal resources, regardless of whether such resources are exhaustible and without regard to temperature. The bill would also extend the scope of both the residential energy credit and the business energy credit to allow credits for property that uses ineligible energy sources as well as geothermal energy (as defined by the bill). In addition, the bill would allow the full business energy credit for property that uses geothermal energy and any other energy source eligible for the credit.

###### *Definition of geothermal energy*

The statutory definition of the term geothermal deposit would be replaced with a new definition of geothermal energy. The bill would define geothermal energy as the natural heat of the earth (at any temperature), which is stored in rocks, an aqueous liquid, or vapor (whether or not under pressure), or any other medium. The bill would retain the requirement that geothermal property be located in the United States or its possessions.

For example, an underground water source that is continually refilled by surface water or precipitation (and therefore inexhaust-

ible) would be eligible for percentage depletion under the bill, without regard to the temperature of the water.

The new definition for geothermal energy would also expand the scope of property that is eligible for residential or business energy credits. For example, a ground water heat pump would qualify as geothermal energy property in every case, because the temperature of the ground water would be irrelevant.

### ***Residential energy credit***

The bill would allow the residential energy credit for all of the equipment comprising a system that uses both geothermal energy and an energy source not eligible for the credit, so long as geothermal energy provides more than 80 percent of the energy in a typical year for which the system is designed. If less than 80 percent of the energy is supplied by geothermal energy, the credit would apply to those portions of the system that produce, distribute, transfer, extract, or use energy that is more than 50 percent supplied by geothermal energy (on an annual Btu basis).

The bill would provide a tax incentive to acquire dual-purpose property that serves both a geothermal function and a nongeothermal function. For example, a pipe that distributes hot water from a water heater, as well as hot geothermal water, would be eligible for the residential energy credit, even if only 50 percent of the water distributed were geothermal water.

It is unclear whether a full residential energy credit would be available for a system that is designed to use geothermal energy but that uses other energy comprising more than 20 percent of its fuel supply in a given year. Under the provisions of the bill, it may be sufficient if a system is merely designed to use fuel supplied 80-percent by geothermal sources in a typical year.

### ***Business energy credit***

The bill would define geothermal equipment eligible for the business energy credit to include the same kinds of dual-purpose property that are eligible for the residential energy credit.

In addition, a full business energy credit would be allowed for all of the equipment comprising a system that uses both geothermal energy sources and another energy source (such as a biomass source) that is eligible for a business energy credit, subject to the same 80 -and 50-percent usage tests described above. It is unclear whether this provision would affect the present law rules for determining the eligibility of energy property other than geothermal property. For example, because the bill refers to all equipment, it is possible that a taxpayer would be allowed the credit for the total (rather than incremental) costs of qualified alternative energy—property other than property used to serve a geothermal function—if such property is part of a qualified system.

### ***Effective Date***

No effective date is contained in the bill.

*Revenue Effect*

This bill is estimated to reduce fiscal year receipts annually by less than \$25 million.

**3. S. 1303—Senator Mitchell****Modification of Definition of Solar Energy Property***Explanation of the Bill*

The bill would amend the definition of solar energy property to include heat pumps that use solar energy stored in ground water. The new definition of solar energy property would apply for purposes of the residential and the business energy credits.

*Effective Date*

For purposes of the residential energy credit, the provisions of the bill would apply to taxable years beginning after 1982. For the business energy credit, the bill would apply to periods after 1982 subject to transitional rules similar to those in section 48(m).

*Revenue Effect*

This bill is estimated to reduce fiscal year receipts annually by less than \$20 million.

**4. S. 1305—Senators Packwood, Baucus, Durenberger, Matsunaga, Mitchell, Moynihan, Chafee and others****Increase in and Extension of Energy Tax Credits***Explanation of the Bill**Overview*

The bill would extend the residential and business energy credits for solar, wind, or geothermal energy equipment through 1990. The business energy credit would also continue to be available for ocean thermal property, qualified hydroelectric generating property, biomass property, and cogeneration property. Property eligible for the extended credits under the bill would continue to be eligible for the credit through 1995 under new affirmative commitment rules applicable to short-term projects, as well as long-term projects. The bill would also make the regular investment credit available for solar or wind energy property and cogeneration equipment that does not qualify for the regular credit under present law.

The bill would repeal the limitation applicable to cogeneration equipment on the use of oil or natural gas. In addition, the bill would expand the scope of the definition of qualified fuel used in biomass property to include methane-containing gas produced by anaerobic digestion from nonfossil waste materials at certain facilities.

The definition of geothermal deposits would be amended to lower the temperature requirement from 122 degrees Fahrenheit to 104 degrees Fahrenheit.

***Extension of residential energy credit***

The termination date of the residential energy credit for solar, wind, or geothermal energy equipment would be extended to December 31, 1990. The credit carryovers would be extended for two years beyond that date (i.e., until December 31, 1992).

***Increase in and extension of business energy credit***

*In general.*—The bill would extend the credit for solar, wind, or geothermal property, ocean thermal property, qualified hydroelectric property, biomass property, and cogeneration property through December 31, 1990. Under affirmative commitment rules similar to those of present law, the credit would continue to be allowed through December 31, 1995.

In addition, for periods beginning after June 30, 1983, the bill would increase the business energy credit for solar, wind, and geothermal property to 25 percent. For periods beginning after September 30, 1982, the bill would also increase the credit for ocean thermal property to 25 percent.

*Affirmative commitment rules.*—The application of the affirmative commitment rules under the bill would not be limited to long-term projects. Thus, these rules would be available for short-term projects. The extended business energy credit would continue to be available for qualified property if (1) all feasibility studies required to commence construction are completed on or before December 31, 1990, (2) applications for all environmental and construction are filed before December 31, 1990, and (3) on or before December 31, 1993 (three years after the termination date), binding contracts are entered into to construct or acquire (a) at least 50 percent of the aggregate cost of all equipment to be placed in service or (b) at least 50 percent of the aggregate cost of all equipment that is specially designed for the project.

Qualified hydroelectric generating property would continue to be eligible for the credit if an application has been filed with the Federal Energy Regulatory Commission before 1990.

*Cogeneration equipment.*—The bill would repeal the limitation on the use of oil or natural gas for cogeneration equipment. Thus, cogeneration equipment would be eligible for the business energy credit without regard to the kind of fuel used by the system.

*Application of the regular investment credit.*—The bill would make the regular investment credit available for solar or wind energy property and geothermal energy property that are structural components of a building. Thus, the regular investment credit would be available for solar or wind energy property and geothermal energy property that would not otherwise qualify for the regular investment credit because they are structural components of a building.

*Solar process heat equipment.*—The qualification of solar energy property for the regular investment credit under the bill would eliminate the allocation problems for solar energy property used for qualifying purposes and to process heat.

*Biomass property.*—The bill would expand the scope of the definition of biomass property eligible for the business energy credit by permitting the use of methane-containing gas as a qualified fuel.

Under the bill, the term qualified fuel would include methane-containing gas produced by anaerobic digestion from nonfossil waste materials at farms or other agricultural facilities, and at facilities for the first processing of agricultural products (such as packing plants and canneries).

#### *Geothermal deposits*

The bill would lower the temperature requirement provided by Treasury regulations, so that deposits with a temperature of 104 degrees Fahrenheit (40 degrees Celsius) would qualify as geothermal deposits for purposes of the residential and business energy credits.

#### *Effective Date*

Under rules similar to those in section 48(m), (1) the affirmative commitment provisions of the bill would apply to periods beginning after December 31, 1982, and (2) the provisions relating to the limitation on the use of oil or gas for cogeneration equipment, the application of the regular investment credit, methane-containing gas, and the temperature of geothermal deposits generally would be applicable to periods beginning after June 30, 1983.

No effective date is provided for the provision that extends the residential energy credit or the provision that increases and extends the business energy credit.

#### *Revenue Effect*

This bill is estimated to reduce fiscal year receipts by \$174 million 1984, \$126 million in 1985, \$390 million in 1986, \$1,127 million in 1987, and by \$1,281 million in 1988. The estimate that the provisions are effective after October 1, 1983.

○

Senator WALLOP. Good morning. We have this morning four bills scheduled before the committee. Three of those bills concern energy tax credits. The fourth deals with the depletion allowance for phosphate ore. Another bill, introduced by Senator Boren, which would exempt piggyback trailers from the retail excise tax on heavy truck trailers, had also been scheduled for hearing this morning, but has been postponed until later this year.

Generally, Treasury Department officials appear at hearings of the Senate Finance Committee to present the administration's position on any legislation being considered.

Today, however, no Treasury witness is scheduled, although written testimony will be submitted to the committee for inclusion in the record.

With respect to energy tax credits, the testimony of the Treasury Department would have been no different than what we heard before this committee just 1 month ago. In short, the Treasury Department is against the extension, enhancement, or the creation of new energy tax credits. It is a position which I believe to be short-sighted, and not in the best long-term interest of the Nation. But, unfortunately, it is also a position which I have learned over the past 2 years is unlikely to find change.

The absence of support from the Treasury Department does not mean that the Congress should roll over and play dead. Indeed, the three energy tax credit bills which are being heard here this morning are but a continuing sign that the importance of developing alternative energy technologies remains, despite the present abundance of conventional energy resources.

S. 1237, introduced by Senator Symms, would broaden the availability of the energy tax credit for geothermal properties, which use geothermal water cooler than 120° Fahrenheit. In addition, the legislation would make clear that for the geothermal property to be eligible for the energy tax credit, it must be supplied primarily, but not exclusively, by geothermal energy.

S. 1303, introduced by Senator Mitchell, also deals with geothermal energy properties. Specifically, the legislation introduced by Senator Mitchell would extend the energy tax credit to ground water heat pumps, which can take energy from ground water nearly 70° cooler than that required for qualification under the present geothermal energy tax credits.

Clearly, the most comprehensive tax credit legislation before this Senate this year is S. 1305, which was introduced by Senators Packwood, Matsunaga, Durenberger, Moynihan, Baucus, Mitchell, and Pell. S. 1305 would extend the 40 percent residential solar, wind, and geothermal energy tax credit from December 31, 1985 to December 31, 1990. In addition the business solar, wind, geothermal, and ocean thermal 15 percent energy tax credits would be increased to 25 percent, and extended an additional 5 years to December 31, 1990.

Extensions of the energy tax credit is also provided for cogeneration, biomass, and hydroelectric technologies. With affirmative commitment rules extending until 1995, and the broadening of properties and technologies eligible for the energy tax credit, there can be little doubt that this legislation represents no small endeavor. I am convinced that as a matter of national energy policy we

must proceed with the development of alternative energy technologies. No one can or will dispute the fact that stable, dependable energy resources are the key to not only our present but our future economic and social well-being.

Alternative energy technologies represent the key to tapping energy resources whose potential has barely begun to be realized. The case is there to be made for the continuation of tax incentives for the further development of these technologies. That case must be made by those of you who are appearing before the subcommittee this morning.

In making that case, there must be clear recognition that like no other time in our history this Government must get the biggest bang for its buck within well-defined policy and budget priorities. Tax incentives can fit within those priorities, but they must operate as incentives for viable economic development, and cannot be so generous that they insulate these projects from every conceivable economic event.

With those thoughts in mind, I look forward to hearing from the witnesses appearing before the subcommittee this morning.

Concluding the hearing today will be consideration of S. 1193, introduced by Senator Symms and Senator McClure. S. 1193 is designed to correct an IRS revenue ruling which would deny the percentage depletion allowance for phosphate ore, which goes through high temperature decarbonization as part of the purifying and concentration process. Thus, allowing the ore to be shipped and processed into usable products; generally, phosphate fertilizers.

It is my understanding that for phosphates mined outside the State of Florida this decarbonization process is necessary to bring the phosphate to a processing state, and as such, satisfies the intent behind the percentage depletion provisions of the code.

This legislation would clarify that intent so that there is no opportunity for misunderstanding by the Internal Revenue Service.

Now the first witnesses this morning are Congressman Frank Horton, from the State of New York, Congressman Sid Morrison, from the State of Washington, Congressman Tony Hall, from the State of Ohio.

Good morning, my friends. I appreciate your coming over here. And my apology for being a couple minutes late in getting started.

Frank, would you go ahead, please?

#### **STATEMENT OF HON. FRANK HORTON, U.S. HOUSE OF REPRESENTATIVES, STATE OF NEW YORK**

Mr. HORTON. Thank you very much, Mr. Chairman.

It's a privilege to testify before you today about this very important legislation, S. 1287. This bill, as you know, specifies the circumstances by which ground water heating systems can be eligible for existing geothermal energy tax credits. I might say that in the early part of this year I held office hours in my district, and saw over 3,000 people on a 1-to-1 basis. And many of these people talked to me and brought to my attention their concern about this IRS ruling, which has limited tax credits for these ground water heating systems.

I also have toured and visited three companies in my district—the Climate Control, which is located in Auburn, N.Y.; Carrier Pumps; and Gould Pumps. All three are located in my district. And they manufacture these type of pumps. They also brought this to my attention.

My friend and colleague, Congressman Tony Hall, and the principal sponsor of House legislation identical to S. 1237, will address the Internal Revenue Service actions which forced congressional consideration of this issue.

It's my purpose to make very clear the importance of this bill to New York State in particular, and the Northeastern and Midwestern regions of our Nation in general. As you probably know, I serve as cochairman of the Northeast-Midwest Congressional Coalition.

Mr. Chairman, in government and across the Nation, I sense a growing complacency about achieving energy independence for the United States. This complacency, I believe, is a result of declining oil prices which can largely be attributed to today's troubled world economy. Quite simply, the basic economic law of supply and demand has reduced energy costs.

The above notwithstanding, we in the Congress cannot afford to be fooled by these lower prices. The rapidity with which the original 1973 oil embargo occurred, and the exorbitant oil price increases that resulted, should not be forgotten.

In New York State we have not forgotten that embargo for we share very little in the luxury of lower energy costs. We are a consuming State and must pay high prices for the oil and natural gas that we import, whether these imports come from Saudi Arabia or the South and Western energy producing States. As a consuming State, we do not have the benefit of increased State revenues due to severance taxes placed on available natural energy sources.

It's my strong belief that New York State and the Northeast and Midwestern regions of our country need and have been the major beneficiaries of the energy tax credit legislation passed by Congress. These credits are important to us. We need all the assistance we can get to control our high energy costs. Energy tax credits are an important and viable source of assistance that provide both relief to consumers and encouragement to businesses to locate and continue their operations in our State.

I support S. 1237 and became an original cosponsor of Congressman Hall's identical House bill because these bills allow residents and businesses in New York and many other States to overcome this IRS administrative ruling which you have already referred to. As I stated, Mr. Hall will present the background and history of the current IRS position.

Mr. Chairman, I urge your positive and expeditious consideration of this legislation. A clarification of the geothermal tax credit is necessary and very important to the citizens of my State and in the Northeast and Midwest in general. I strongly believe that enactment will encourage the installation of ground water heating systems which, in turn, will substantially reduce energy costs in parts of the country where these costs present serious obstacles to economic growth.

One of the serious problems that we are facing right now is the increase of natural gas cost. And something like this can be an al-

ternative. And if we have tax credits to encourage this, this can help us to meet these energy demands and needs that we have.

Before concluding, Mr. Chairman, I want to again thank you for holding these hearings. It's a privilege to be here, and I appreciate the attention you have given this issue. An I also appreciate the comments that you made at the beginning of this hearing.

I also want to express my appreciation to Senator Symms for his leadership in introducing this legislation to the Senate. And the same to my colleague, Congressman Hall. And Congressman Morrison for the similar role that they continue to play in the House.

Thank you.

Senator WALLOP. Thank you very much, Frank.

[The prepared statement of Congressman Horton follows:]

TESTIMONY OF THE HONORABLE  
FRANK HORTON  
before the  
SENATE FINANCE COMMITTEE  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION  
S. 1237

ME, Chairman, Members of the Committee, it is a privilege to testify before you today about this very important legislation, S. 1237. This bill as you know, specifies the circumstances by which groundwater heating systems can be eligible for existing geothermal energy tax credits. My friend and colleague, and the principle sponsor of House legislation identical to S. 1237, will soon address the Internal Revenue Service actions which forced congressional consideration of this issue. It is my purpose to make very clear the importance of this bill to New York State in particular, and the Northeastern and Midwestern regions of our Nation in general.

Mr. Chairman, in Government and across the Nation, I sense a growing complacency about achieving energy independence for the United States. This complacency, I believe, is a result of declining oil prices which can largely be attributed to today's troubled world economy. Quite simply, the basic economic law of supply and demand has reduced energy costs.

The above notwithstanding, we in Congress cannot afford to be fooled by these lower prices. The rapidity with which the original 1973 oil embargo occurred, and the exorbitant oil price increases that resulted, should not be forgotten.

In New York State, we have not forgotten that embargo, for we share very little in the luxury of lower energy costs. We are a consuming State and must pay high prices for the oil and gas we import, whether these imports come from Saudi Arabia or the Southern and Western energy producing States. As a consuming State, we do not have the benefit of increased State revenues due to severance taxes placed on available natural energy sources.

It is my strong belief that New York, and the Northeastern and Midwestern regions of our country, need and have been the major beneficiaries of, the energy tax credit legislation passed by Congress. These credits are important to us; we need all the assistance we can get to control our high energy costs. Energy tax credits are an important and viable source of assistance that provide both relief to consumers and encouragement to businesses to locate and continue their operations in our State.

I support S. 1237, and became an original cosponsor of Congressman Hall's identical House bill, because these bills allow residents and businesses in New York and many other states to overcome an IRS administrative ruling that bars our use of an important energy tax credit - the credit for installation and use of a geothermal groundwater heating system. As I stated, Congressman Hall will present the background and history of the current IRS position.

Mr. Chairman, I urge your positive and expeditious consideration of this legislation. A clarification of the geothermal tax credit is necessary and very important to citizens in my State and in the Northeast and Midwest in general. I strongly believe that enactment will encourage the installation of groundwater heating systems which, in turn, will substantially reduce energy costs in parts of the country where these costs present serious obstacles to economic growth.

Before concluding, Mr. Chairman, I want to again thank you for holding this hearing. It is a privilege to be here, and I appreciate the attention you have given this issue. I also want to express my appreciation to Senator Symms for his leadership in introducing this legislation in the Senate, and the same to my colleague, Congressman Hall, for the similar role he continues to play in the House.

Senator WALLOP. Sid, would you go ahead, please?

**STATEMENT OF HON. SID MORRISON, U.S. HOUSE OF REPRESENTATIVES, STATE OF WASHINGTON**

Mr. MORRISON. Thank you, Mr. Chairman.

You have my written testimony, and for the sake of time, let's get off to a rolling start here. Mr. Chairman, again, I appreciate this opportunity to appear before you, and with my two colleagues, to testify on behalf of Senate bill 1237. We have sponsored under Congressman Hall's lead H.R. 2927, which is the House counterpart.

I would like to take this advantage too, Mr. Chairman, to introduce a member of the second panel, Dr. Gordon Bloomquist, who we have brought from the Washington State Energy Office, who is our Northwest expert on geothermal. And I hope you will use him to the fullest.

This legislation, to me, is vitally important. The energy tax credit already exists, but as you have indicated at the beginning, Mr. Chairman, IRS has arbitrarily exempted low-temperature geothermal sources from the tax credits.

Congressman Hall will give more detail on this, and what might well be done about it as proposed in this legislation.

Also important in my area now that we are applying some geothermal sources is the provisions within Senate bill 1237, which clarifies the status of the tax credit of combined geothermal and other heat source systems. As you are aware, in the Northwest we have a variety of opportunities with by-products and materials left over from timber processing and so forth to combine. And the tax status of those is, indeed, clouded.

In my area there is significant reserves of low-temperature geothermal energy. The Washington State Energy Office, for instance, has identified over 80 cities in the State of Washington which have low-temperature geothermal water accessible for use in geothermal district heating systems.

We have some examples. One such district was recently dedicated in a smaller town called Ephrata in my congressional district. This system is the Nation's first municipal water system designed to provide both heat—about 1 megawatt—and domestic water. The demonstration project circulates water through the Grant County Courthouse and Courthouse Annex. The city of Ephrata should see dramatic reductions, perhaps 85 percent, in their fuel bills because of this heating system. The geothermal source of this district heating project is low temperature—about 84° Fahrenheit—and would not have qualified for the tax credits available to other geothermal energy systems. The point being that low-temperature geothermal source works. It's being applied now, and should be encouraged.

There are other areas in my district—the county of Yakima—that are planning a new jail facility. I just saw it yesterday. It's heated by low-temperature geothermal energy. That's planned for this fall. We have other towns throughout Washington who are exploring the possibility of developing their own geothermal district heating systems.

I'm particularly excited about the applications of low-temperature geothermal energy in the Pacific Northwest because it will substitute for other sources of steam. A 20-year energy plan has been developed for the Pacific Northwest region by the Pacific Northwest Power Planning Council, which relies heavily upon expanded energy conservation in the near term. However, their plans use low-temperature geothermal as a conservation source since it substitutes for other conventional sources of thermal steam. Because of the status as a conservation resource, low-temperature geothermal should receive priority in the Northwest over other renewable and thermal energy sources.

Mr. Chairman, I'm an advocate of a balanced approach to energy. I represent the Hanford nuclear complex, one of the largest in the world. And we are working on a variety of energy sources. But this is one that is perhaps the most exciting. It's there. We can reach out and touch it. We have already made it work. And I think we should extend to all of America the opportunity to have the Internal Revenue Service credits apply to this low-temperature energy. In fact, all it would do would be to place one more viable energy option on equal footing with other forms of energy.

Again, Mr. Chairman, thank you for your leadership, and your willingness to hold this hearing. I believe it's in the best interest of this Nation, and in energy independence, to proceed with the passage of S. 1237.

Senator WALLOP. Thanks very much, Sid, for your statement.  
[The prepared statement of Congressman Morrison follows:]

TESTIMONY OF CONGRESSMAN SID MORRISON  
ON S. 1237  
BEFORE THE SENATE FINANCE COMMITTEE'S  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION  
JULY 18, 1983

Mr. Chairman and members of the Subcommittee, I am pleased to be here this morning with Congressmen Frank Horton and Tony Hall to testify in support of S. 1237, legislation intended to promote the development of low-temperature geothermal resources. S. 1237 was introduced by Senators Steve Symms and Jim McClure and is identical to H.R. 2927, a bill introduced by Tony Hall that I am proud to cosponsor.

First, I want to commend Congressman Hall for exercising outstanding leadership in the effort to gain Congressional approval of this legislation. I appreciate his invitation to be an original cosponsor of H.R. 2927. I also want to introduce to the Subcommittee Gordon Bloomquist who will testify on the next panel. Dr. Bloomquist is here representing the Washington State Energy Office and is an enthusiastic advocate and expert on all aspects of geothermal energy. I think the Subcommittee will appreciate Dr. Bloomquist's expertise as much as they will appreciate his vigorous support of geothermal energy.

S. 1237 makes federal energy tax credits available to developers of low-temperature geothermal resources. A 15 percent geothermal energy tax credit already exists but Internal Revenue Service regulations arbitrarily exempt low-temperature geothermal sources from the tax credits. As Congressman Hall will explain in more detail, the IRS temperature restriction of 122 degrees Fahrenheit has had the effect of excluding shallow geothermal energy applications from receiving tax incentives. I also support provisions in S. 1237 which clarify the tax credit status of combined geothermal and other heat source systems so that the equipment in common is eligible for some tax credit.

Shallow reserves of geothermal energy represent a substantial and natural source of untapped thermal heat. Significant reserves of low-temperature geothermal energy lie beneath most of my Congressional District in Central Washington. The Washington State Energy Office, for instance, has identified over 80 cities in the State which have low-temperature geothermal water accessible for use in geothermal district heating systems.

One such geothermal districting heating system was recently dedicated in Ephrata in my Congressional District. This system is the nation's first municipal water system designed to provide both heat (about 1 megawatt) and domestic water. The demonstration project circulates water through the Grant County Courthouse and Courthouse Annex. The City of Ephrata should see dramatic reductions, perhaps 85 percent, in their fuel bills because of this heating system. The geothermal source of this district heating project is low-temperature -- about 84 degrees Fahrenheit -- and would not have qualified for the tax credits available to other geothermal energy systems. The County of Yakima is also a leader in geothermal heating as they plan to open a jail facility heated by low-temperature geothermal energy this fall. Other towns throughout Washington, including North Bonneville, Mosca Lake, West Richland, and Richland, are looking to Ephrata and Yakima and are exploring the possibility of developing their own geothermal district heating system.

I am particularly excited about the applications of low-temperature geothermal energy in the Pacific Northwest because it will substitute for other sources of steam. A 20-year energy plan has been developed for the Pacific Northwest Region by the Pacific Northwest Power Planning Council which relies heavily upon expanded energy conservation in the near term. The Regional Power Plan classifies shallow, low-temperature geothermal as a form of energy conservation since it substitutes for other conventional sources of thermal steam. Because of this status as a conservation resource, low-temperature geothermal should receive priority in the Northwest over other renewable and thermal energy sources.

I regard myself, Mr. Chairman, as a strong advocate of all energy resources, be they fossil fuels, nuclear energy, solar, conservation, or geothermal. I believe every viable energy source must play a role in our overall energy future. This country needs energy diversification and needs to develop all commercially practical energy resources and conservation to meet our future energy demands. I believe this legislation simply helps to place one more viable energy option, low-temperature geothermal energy, on equal footing with other forms of energy.

I commend this Subcommittee for the foresight in scheduling hearings on S. 1237 and I encourage you to pursue legislative efforts to extend tax credits to low-temperature geothermal energy.

Thank you for extending this opportunity to testify.

Senator WALLOP. Tony, would you proceed, please?

**STATEMENT OF HON. TONY P. HALL, U.S. HOUSE OF  
REPRESENTATIVES, STATE OF OHIO**

Mr. HALL. Thank you, Mr. Chairman.

I would like to ask that my text be made part of the record.

Senator WALLOP. By all means.

Mr. HALL. If I may, Mr. Chairman, I would also ask that two additional items be made part of the subcommittee's record. The first is a supplemental statement of mine. And the second is a study written by a constituent of mine, Mr. John Keller, who originally wrote it in the Ground Water Energy Newsletter of November-December 1982.

Senator WALLOP. By all means.

[The prepared statement and additional documents from Congressman Hall follow:]

TESTIMONY OF CONGRESSMAN TONY P. HALL  
ON S. 1237  
BEFORE THE SENATE FINANCE COMMITTEE'S  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION

July 18, 1983

Mr. Chairman and Members of the Subcommittee, I am honored to have the opportunity to testify today in support of S. 1237, the bill introduced by Senator Steven D. Symms and Senator James A. McClure to clarify the definition of geothermal for purposes of the residential and business investment energy tax credits.

I am the principal sponsor in the House of H.R. 2927, a bill which is identical to S. 1237. In the last Congress I introduced similar legislation, H.R. 4091, with a final total of 29 other cosponsors. The current bill, H.R. 2927, has three other original sponsors, Mr. Matsui of California; Mr. Horton of New York; and Mr. Morrison of Washington. We intend to seek additional support on our side of the Hill after this hearing.

I am here to let you know that the support for H.R. 2927 and S. 1237 is bipartisan and bicameral. Enthusiasm for this legislation is truly nationwide in scope. This is neither a special interest bill nor one that will benefit just one State or region. I can tell you that since I introduced the first version of this bill back in July of 1981, my office has received a constant stream of letters and phone calls from all across the nation. Individuals, businesses, and energy observers throughout the country are fervently hoping that the House and Senate will act to correct the restrictive action taken by the Internal Revenue Service in implementing the

geothermal tax credits.

You, Mr. Chairman, deserve to be commended for holding this hearing today. Your interest in this issue is the most encouraging development since the IRS regulations were finalized in August, 1980, for residential geothermal energy tax credits and in January, 1981, for commercial facility geothermal energy tax credits.

In addition, I wish to thank Senator Symms for his leadership on this legislation and his work with you in making this hearing possible. I also want to acknowledge the support of Senator McClure, the Chairman of the Energy and Natural Resources Committee and other original sponsor of S. 1237.

Let me take a moment to recap briefly the background of the legislation we have introduced. In 1979, the IRS proposed regulations to implement the Energy Tax Act of 1978. In looking at the legislative history of this law, the IRS concluded that a temperature requirement was needed in order to determine eligibility for the geothermal energy credits. The Act itself, however, contained no temperature limitation.

Nevertheless, after initially selecting 60 degrees Celsius, the IRS finally settled on 50 degrees Celsius or 122 degrees Fahrenheit as the cut-off point for the credits. The IRS regulations were reaffirmed later in Revenue Ruling 81-304. The selection of this geyser-hot temperature has had the effect of denying the credits for shallow geothermal energy applications, such as ground water heat pumps.

In my opinion--and that of many others who have been following this issue--the IRS temperature requirement does not reflect

scientific fact or the original intent of Congress. But it does us little good to spend time now arguing legislative history.

The reality is simply that ground water heat pumps and other shallow geothermal applications are ineligible for the geothermal energy tax credits as a result of the 50 degrees Celsius IRS temperature ruling. In view of Revenue Ruling 81-304 and the December, 1983, letter report of the General Accounting Office on the geothermal energy tax credits, there is virtually no chance that the situation will be changed administratively. Therefore, the issue before this Subcommittee is whether Congress should enact legislation to remove the temperature restriction.

Speaking for the thousands of Americans who have bought, sold, or built ground water heat pumps and other devices to tap the abundant shallow geothermal resources of our country, I strongly urge you to make these systems eligible for the energy tax credits they have been denied.

The other sponsors of this legislation and I are not asking for any increased credits or a new program; rather, we are seeking a technical amendment to current law to promote a currently-available renewable energy technology. I will let other witnesses explain the technical details of these shallow geothermal systems and the potential impact of tax credit eligibility on their increased utilization.

I am not an engineer or a geologist; but as one legislator addressing other legislators, I ask you to report legislation that will make the current law work more effectively. The objectives of the original Act, as I understand them, are to promote energy

conservation and renewable energy technology and reduce our dependence on fossil fuels, particularly those of foreign origin. I think these goals are still worthy ones.

Although we do not have long lines at the gasoline stations to remind us of the existence of an energy crisis, this does not mean that the crisis is over. The oil glut we have been experiencing must not be allowed to lull us into a false sense of security. Surely, if the energy crisis again becomes more visible, our citizens rightly will ask why an effective energy conservation policy was neglected by the government.

We need to remove the bureaucratic hurdles which are preventing incentives--indeed, providing disincentives--to more widespread use of available geothermal technology. We should make it more attractive for more homes and businesses to take advantage of the geothermal resources of this land. Truly, the ground on which we stand holds part of the solution to our national energy requirements.

Ideally, I would hope that you could move quickly on S. 1237 and treat it as a technical correction to the existing law. You also have before you S. 1303, an excellent bill by Senator George J. Mitchell, which would add ground water heat pumps to the list of eligible equipment for the credits. This measure proposes a very clean and direct way of addressing the ground water heat pump issue and I support it also.

Our approach, through H.R. 2927 and S. 1237, is to amend the definition of geothermal in the original Act to make it clear that

there is no temperature restriction. In addition, our bills address another aspect of the IRS regulations which we think needs to be corrected. Under the regulations, when a geothermal resource is combined with an ineligible source, such as a fossil fuel peaking system, or with another eligible source, such as a biomass system, the entire credit is disallowed for the equipment used in common. We have proposed a simple formula that would clarify the tax credit status of such combined systems. Clarification of the credits for mixed systems is another benefit of our particular legislation.

One matter our legislation does not address--nor do any of the other bills before you--is the issue of retroactive relief for those who purchased shallow geothermal systems on the erroneous assumption that they were going to get the energy tax credits. From the many who have contacted my office alone, I am aware that there is a large number of these individuals. Indeed, a report by the General Accounting Office estimates that \$11.2 million was incorrectly granted between 1978 and 1980 to those filing for the geothermal energy credits in States east of the Rockies that do not have shallow deposits anywhere near the 50 degrees Celsius requirement.

At a time when there is an effort to keep down revenue losses, it is clear that it would not be possible at this time to make the technical corrections we are proposing retroactive. Nevertheless, in view of the GAO report of December 2, 1982, we would hope that the Subcommittee would consider expressing the view, possibly through report language, that while new retroactive credits will not

be granted, at least those who already have received the credits should not now be sought out to have them retracted.

If the Subcommittee does not wish to pass our bill as a separate measure, then we also would welcome having its provisions included in a larger package or omnibus bill. For example, if the Subcommittee decided to use S. 1305, another bill you are examining today, or some other vehicle to extend the energy tax credits which expire at the end of 1985, then we would urge you to include the provisions of our legislation in such a measure.

In the overall scheme of tax legislation, our bill addresses a relatively small issue. For that reason, we are grateful for the courtesies you have extended to the sponsors of this legislation in holding this hearing.

I hope that as a result of this hearing, the Subcommittee will share our support for shallow geothermal technology and take whatever legislative course you believe is appropriate to make it eligible for the currently existing tax credits for geothermal energy.

SUPPLEMENTAL REMARKS OF CONGRESSMAN TONY P. HALL  
ON S. 1237  
BEFORE THE SENATE FINANCE COMMITTEE'S  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION  
July 18, 1983

Mr. Chairman and Members of the Subcommittee, I am pleased to have this opportunity to provide supplemental remarks for the record with respect to S. 1237 and the identical House legislation, H.R. 2927. The House bill has three other original sponsors, Mr. Matsui of California, Mr. Horton of New York, and Mr. Morrison of Washington.

The legislation we have introduced is similar to H.R. 4091, S. 1684, and S. 1960 from the 97th Congress. The bill H.R. 4091, which I introduced with Representative Don H. Clausen of California on July 9, 1981, was cosponsored by a final total of 30 Members of Congress. Although H.R. 4091 was referred by the full House Ways and Means Committee to the Subcommittee on Select Revenue Measures in November, 1981, no action was taken on the measure and it died in the 97th Congress.

The bill H.R. 4091 enjoyed significant bipartisan support from across the country. It had the backing of the Solar Lobby and was cited as a policy recommendation of the water resources agenda of the Northeast-Midwest Congressional Coalition. With the introduction of this legislation today, the drive for geothermal energy tax credit reform begins once again.

Our bill basically contains three parts. The first would amend the definition of geothermal in the Energy Tax Act of 1978 to make it explicit that there is no temperature requirement for the geothermal energy tax credit for residences and commercial facilities. The second part would specify how the credit is to be determined when a residence or business has a system which uses both geothermal energy and another source not eligible for the credit. The final part of the bill would specify

how the credit is to be determined when a business has a hybrid system which uses both geothermal energy and another eligible source.

#### BACKGROUND AND NEED FOR LEGISLATION

The Energy Tax Act of 1978 (P.L. 95-618) provides a residential energy tax credit for certain energy conserving and renewable energy source expenditures made in connection with a taxpayer's principal residence. The credit applies to expenditures on energy-conserving items such as insulation and storm windows, as well as to investments in solar, wind, and geothermal energy property, categorized as renewable energy source property. In this latter case, the Act provided that a credit may be claimed for 30 percent of the first \$2,000 of expenditures and 20 percent of the next \$8,000 of expenditures up to a maximum credit of \$2,200 for expenditures made after April 19, 1977, and before January 1, 1986. Subsequently, the Crude Oil Windfall Profit Tax Act of 1980 (P.L. 96-223) expanded the renewable energy credit to 40 percent of \$10,000 in expenditures to a maximum credit of \$4,000 for expenditures made after December 31, 1979, and before January 1, 1986.

The Energy Tax Act of 1978 also provided for a 10 percent tax credit for investment in solar, wind, and geothermal energy equipment used by businesses. The geothermal energy tax credit was increased to 15 percent and extended through the end of 1985 by the Crude Oil Windfall Profit Tax Act of 1980.

For tax purposes, the Energy Tax Act of 1978 defined geothermal energy in the following way:

" . . . the term 'geothermal deposit' means a geothermal reservoir consisting of natural heat which is stored in rocks or in an aqueous liquid or vapor (whether or not under pressure)."

The law set no temperature requirement in its definition of geothermal energy. Acting in good faith, many citizens invested in geothermal energy systems to tap shallow geothermal wells which they assumed would qualify for the credits.

The Internal Revenue Service proposed regulations to implement the tax credit provisions of the Energy Tax Act of 1978. In its proposed regulations, the IRS decided to set an arbitrary temperature requirement for eligibility for the geothermal tax credits. I was among those who testified against the temperature requirement at an IRS public hearing in Washington on September 12, 1979. I was accompanied by my constituent Mr. Stan Mitchell of Mitchell and Jensen, Architects and Engineers, of Dayton, Ohio.

Unfortunately, the IRS did not follow the recommendations that were made in opposition to a temperature requirement -- including the critical comments of the Department of Energy. On August 29, 1980, the IRS issued final regulations concerning geothermal residential energy tax credits, and on January 23, 1981, issued final regulations concerning geothermal commercial facility tax credits.

For both sets of credits, the IRS required the geothermal source to have a temperature of more than 50 degrees Celsius (122 degrees Fahrenheit). This means that citizens who installed geothermal systems that tap sources with a temperature below 50 degrees Celsius simply do not qualify for the tax credits.

To reiterate this position, on December 28, 1981, the IRS issued Revenue Ruling 81-304. This ruling described the case where a taxpayer applied for the credit for a water source heat pump tapping energy from well water at a temperature of 13 degrees Celsius (56 degrees Fahrenheit). The ruling held that the heat pump is not eligible for the residential energy tax credit as geothermal energy property because the well water has a temperature of less than 50 degrees Celsius. Further, the heat pump is not eligible for the credit as solar energy property because, in the opinion of the IRS, the energy in the well water is only indirectly derived from sunlight.

Some citizens using systems tapping resources at temperatures below 50 degrees

Celsius filed for the residential geothermal energy tax credit from 1978 through 1980 and received it. On December 2, 1982, the General Accounting Office released a letter report entitled "Possibility of Improper Geothermal Energy Tax Credit Claims" (GAO/RCED-83-1). The report contended that these tax credits have been claimed by taxpayers residing either in States without geothermal resources as defined by the IRS (essentially, all States east of the Rockies), or in States with such resources but at depths too great (3,000 feet or more) to be economically useful.

GAO recommended that the IRS: "(1) test the propriety of selected geothermal tax credit claims and (2) determine the extent to which a problem exists that warrants expanded action on IRS' part." According to the GAO report, "IRS generally agreed with the findings of this report and agreed to take corrective action."

IRS regulations apparently designed to ensure the integrity of the geothermal contribution of a particular system had the effect of disallowing the entire credit when a geothermal device is used in conjunction with either fossil fuel peaking equipment or an innovative hybrid alternative energy system.

Thus, a homeowner who installs a geothermal system to heat his or her residence cannot qualify for the residential credit unless 100 percent of the energy in the system is supplied by geothermal sources. The addition of peaking equipment fueled by oil, gas, or coal to provide, for example, less than 10 percent of the total annual energy load would disqualify the entire system. Similarly, a business that installs geothermal equipment cannot qualify for the investment tax credit if the geothermal energy is mixed with energy from another ineligible source.

Perhaps even more senseless is the fact that the credit is disallowed when geothermal is combined with another alternative energy source, such as biomass, wind, or solar to heat or power an industrial facility. For example, a company

building a large hybrid geothermal-waste wood electrical generating plant can take the geothermal investment credit on the equipment which is run solely on geothermal energy and biomass credit on the equipment which is exclusively fueled with wood. However, those components in the plant which use energy from both geothermal and biomass sources cannot qualify for either credit.

In short, the IRS regulations are standing in the way of increased utilization both of ground water heat pumps and of promising hybrid alternative energy systems. Congress must act to remove these roadblocks by clarifying the definition of geothermal energy for tax credit purposes and by establishing an appropriate formula for calculating the credits when geothermal is mixed with other energy sources.

#### THE ADVERSE IMPACT OF AN ARBITRARY TEMPERATURE REQUIREMENT

Developers and users of geothermal energy have been opposed to the temperature limitation since the IRS regulations were proposed over four years ago. Indeed, Mr. Tyler Gass, Membership Secretary for the American Society for Testing and Materials Committee on Geothermal Resources and Energy, wrote me:

"Our committee has gone so far as to eliminate any temperature designation as a limitation in the definition of a geothermal resource. We recognize ambient temperature ground water as being geothermal resources and support the concept of utilizing ground water heat pumps for reducing energy consumption in the United States."

Most of the potential geothermal energy use in the eastern half of the United States, as the GAO report affirmed, would involve resources with a temperature of less than 50 degrees Celsius. The IRS limitation has the effect of eliminating a significant portion of the geothermal resources of the country.

The 50 degrees Celsius temperature requirement does not reflect Congressional intent or scientific fact. Dr. Jay H. Lehr, Executive Director of the National Water Well Association and a highly respected authority on ground water heat pumps, stated in a letter to me last year:

"By arbitrarily restricting tax credits to geothermal energy equipment using temperatures over 122 degrees Fahrenheit, the IRS will effectively stifle the nation's efforts to utilize innovative energy systems which could free us from our reliance on foreign oil . . . Congress passed the Energy Tax Act in an effort to encourage the nation to make use of alternative energy sources. The Act does NOT mention a temperature requirement. The IRS has defeated Congress' intention by placing an unrealistic temperature restriction on geothermal equipment."

Geothermal energy is the natural heat of the earth. The heat in water, soil, or rock close to the surface of the earth is derived from both solar and geothermal energy. Therefore, it should not matter whether the source of the heat in shallow water sources is geothermal or solar. Further, at depths of more than a few dozen feet, the heat is essentially entirely of geothermal origin.

It is important to point out that the technology is presently commercially available to take advantage of geothermal sources with a temperature below that set by the IRS. Indeed, the basic technology has been around for more than 30 years. We are not talking about some untested energy source that will take years to develop and then put on the market. The equipment is there right now -- we only need to make it attractive to use.

As Michael J. McManus wrote in The Cleveland Plain Dealer of September 28, 1981:

"The biggest single block to development is the failure of Congress to provide tax credits for ground water systems unless the water is 50 degrees Centigrade -- much hotter than 50 degrees Fahrenheit."

Mr. Robert P. Shapess, Marketing Project Leader in the Climate Control Division of Singer (now part of Snyder General) put the point this way in a letter:

"The consumer is willing to accept the ground water heat pump with open arms. However, the position the government takes will either encourage or discourage this reality."

Energy from groundwater can be extracted through the use of currently marketed heat pumps, which operate according to the same basic principles at work in a refrigerator. The pump systems permit the temperature of the shallow geothermal water to be

either raised or lowered for heating or cooling purposes.

Using groundwater, a heat pump system heats three to five times as efficiently as a fossil-fuel system, in terms of heat output per unit of energy put in. Although the heat pump is operated by electricity, the actual heating or cooling energy in a geothermal system is free and virtually unlimited.

Mr. Don A. Olson, President of Trendsetter Industries in Sacramento, California, provided me with the following information in 1981:

"I have been personally involved with about 140 installations over the past 2 and 1/2 years in California which used high capacity water source heat pumps and the energy savings have been really astounding. Typically the cost of heating and cooling a residence has been reduced by over 50% and in one instance a home owner living near Sacramento, California experienced a reduction from an average of about \$350.00 per month down to less than \$75.00 per month in his electric bills."

According to the National Water Well Association, a groundwater heat pump system can pay for itself in two to four years, if a well is already in place. Even if a well must be drilled, the system will pay for itself in four to eight years. The National Water Well Association further states that it is not aware of any groundwater heat pump system that has ever stopped running -- even after more than 25 years of service.

Dr. Jay Lehr, the National Water Well Association's Executive Director, told a Northeast-Midwest Institute workshop on energy from water resources that groundwater has the capacity to replace fossil fuel heating and electrical cooling in 85 percent of the domestic dwellings in the northeast-midwest region alone.

With proper management, 75 percent of the United States has plenty of groundwater, enough to meet daily needs and to provide water for heat pumps. National GeoThermal has noted that there further is an absence of negative environmental impacts from the use of groundwater heat pumps. The water returns underground slightly cooler (approximately 10 degrees) than the temperature at which it was

extracted. It is reheated to the ambient groundwater temperature within a few feet of the well as it absorbs geothermal energy from the earth as well as solar energy from the surface of the earth. Thus, the system is totally renewable. There is no net change in groundwater temperature over time. The small quantities of heat extracted from the water are continually replaced by the reservoir of heat available in the system and by the continuous input of heat energy from the sun and the earth.

THE USE OF GROUNDWATER ENERGY IN DAYTON, OHIO

The Miami Valley of Ohio is incredibly rich with underground rivers that make it an ideal place to utilize shallow geothermal energy. These streams, which run below the Great Miami, the Stillwater, and the Mad Rivers, all converge on the center of Dayton, Ohio, providing a nearly unlimited energy source for downtown buildings. Unlike the aquifers in some areas, Dayton's underground rivers are easy to tap because they are not blocked by bedrock. In addition, they are located at relatively shallow depths of 50 to 100 feet.

Groundwater has been used for cooling Dayton's buildings since the construction of the Hullman Building in 1931. In the 1940's, Frigidaire, Delco, and many downtown buildings used groundwater in their cooling systems. In fact, water is so plentiful in downtown Dayton that it must be pumped away from the foundations of some buildings to keep the basements from flooding.

By one estimate, since 1978 about 2,000 Daytonians have taken advantage of heat pump systems to warm their homes. Recently, Montgomery County installed a groundwater heat pump system along with a solar energy system to heat the County Animal Shelter Facility.

To help demonstrate how these local resources could be utilized efficiently, a brick house built in 1934 in Dayton was converted from a natural gas gravity-flow furnace to a groundwater heat pump system. The results of this case study were brought

to my attention by Mr. John L. Keller, a research meteorologist with the Applied Systems Analysis Department of the University of Dayton's Research Institute. According to Mr. Keller's findings:

"The ground water system provides necessary heating using approximately one-fourth of the energy of the old system . . . The total energy consumption rate for the household has been reduced to less than one-third of the previous rate. The improvement in household energy efficiency is typical of what could be realized in this region of the U.S."

Keller went on to state:

"Clearly, if the encouragement of increased energy efficiency is the goal of the 'renewable energy' tax credit, the ground water heat pump addresses this goal. Exclusion of these systems then seems wholly arbitrary. The key phrase is 'renewable energy.' The thermal energy contained within the vast aquifers of the eastern half of the country is no less renewable than that represented by the high temperature geothermal (water temperature at least 90 degrees Celsius), wind, and solar resources of the western half of the country."

Those of us who have been interested in promoting the more widespread application of geothermal energy had hoped that the IRS might be persuaded to change its position on the temperature requirement for the geothermal tax credits. Since it is now most unlikely that the IRS is going to change its views, legislation to clarify the definition of geothermal energy for tax credit purposes is needed.

#### TAX IMPEDIMENTS TO SOUND GEOTHERMAL ENGINEERING

The IRS policy of disallowing the credit for systems which use both geothermal energy and another energy source also is inconsistent with the intent of Congress and ignores sound engineering practice in the use of geothermal energy.

Geothermal energy systems often include peaking systems fueled by oil, gas, or coal. The fossil energy will typically range from 3 or 4 percent to 20 percent of the annual total energy load. The extra wells, pipe, and pump capacity required for a geothermal system designed to be 100 percent geothermal on the few coldest days of the year would add too much to system cost to be attractive.

Geothermal resources in many instances may not be hot enough to fully satisfy a particular industrial process requirement, but by adding a few degrees to the heat from geothermal energy, it will often be possible to replace a large fraction of the oil or gas use in a plant or other facility. Further, many industrial processes involve several steps at different temperatures. Some of these steps can use geothermal heat, but others might require superheating. Under the IRS limitation, if such a system involved even a minimum addition of nongeothermal heat, the entire system would become ineligible for the tax credit. In effect, the IRS limitation encourages less efficient designs to take advantage of the tax credit. Certainly, this result is contrary to the intent of Congress in the Energy Tax Act of 1978.

In order to help rectify this problem, our bill specifies how the credit is to be determined when a residence or business has a system which uses both geothermal energy and another source not eligible for the credit. Under the bill, all of the equipment comprising the system shall be eligible for the credit if, on a BTU basis, geothermal energy provides more than 80 percent of the energy in a typical year for which the system is designed. If less than 80 percent of the energy is supplied by geothermal energy, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 50 percent supplied by geothermal energy on an annual BTU basis.

#### TAX DISINCENTIVES TO INNOVATIVE COMBINATIONS OF ALTERNATIVE ENERGY SYSTEMS

In implementing the business investment credit provisions of the Energy Tax Act, the IRS has sought to guarantee that only genuine geothermal projects receive the credits. The regulations ( 26 CFR 1.48-9(c)(10)(iv)) on this point state:

"(iv) Equipment that uses energy derived from a geothermal deposit is eligible only if it uses geothermal energy exclusively. Thus, geothermal equipment does not include equipment that uses energy derived both from a geothermal deposit and from sources other than

a geothermal deposit . . ."

While the objective of the IRS is legitimate, the effect of the regulations is to deny the credit to systems that combine the use of geothermal and other alternative energy sources. An example in this regard is the hybrid geothermal-wood residue power plant to be constructed in northern California by the innovative GeoProducts Corporation.

Those components of the GeoProducts plant which "produce, extract, or use" energy derived from a geothermal deposit (such as the hot water distribution lines) are eligible for the credit for geothermal property. Similarly, those components of the plant which convert the wood waste to steam (such as the firebox and boiler) will qualify for the credit for "alternative energy property", because the wood burned to heat the water is "an alternative substance." However, those components of the plant which use energy from both geothermal and biomass sources (such as the turbine generator set) cannot qualify for either credit.

To address this problem, the bill applies the formula devised for geothermal-ineligible combinations to geothermal-eligible combinations. Thus, all of the equipment of the system would be eligible for the 15 percent tax credit if more than 80 percent of the energy comes from geothermal, or any of the the other alternative energy sources eligible individually for the credit, or any combination thereof. If less than 80 percent of the energy is supplied from qualified sources, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy that is more than 50 percent supplied from such qualified sources.

Well-intended, but inequitable IRS regulations should not be allowed to hold up the creative utilization of combinations of alternative energy sources. Certainly, it was not the intent of Congress to thwart projects of the kind being

planned by GeoProducts in California.

#### CONCLUSION

It is important to emphasize that our bill does not create any new tax credits. It does not increase any present tax credits. What it does, instead, is make clear what the current law is and overturn the arbitrary restrictions imposed by the IRS. The objective of the technical corrections made by this bill is to make the present credits effective.

We need to remove the bureaucratic hurdles by the IRS which are preventing incentives -- indeed, providing disincentives -- to more widespread use of available geothermal technology. We should make it attractive for more homes and businesses to take advantage of the geothermal resources of this nation. Truly, the ground on which we stand holds part of the solution to our national energy requirements.

Although we do not have long lines at the gasoline stations to remind us of the existence of an energy crisis, this does not mean that the crisis is over. The oil glut we have been experiencing must not be allowed to lull us into a false sense of security. Surely, if the energy crisis again becomes more visible, our citizens rightly will ask why an effective energy conservation policy was neglected by the government.



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## House of Representatives

### CONGRESSMAN TONY F. HALL INTRODUCES GEOTHERMAL ENERGY TAX CLARIFICATION BILL

The SPEAKER pro tempore. Under a previous order of the House, the gentleman from Ohio (Mr. HALL) is recognized for 40 minutes.

Mr. HALL of Ohio. Mr. Speaker, today I am introducing a bill to clarify the definition of geothermal energy for tax credit purposes. I am pleased that my colleagues, the gentleman from Washington (Mr. Morrison), the gentleman from New York (Mr. Hoyer), and the gentleman from California (Mr. Matsui) are joining with me as original bipartisan sponsors. An identical bill is being introduced in the other body by Senator Strom.

The legislation we are introducing is similar to H.R. 4091, S. 1684, and S. 1690 from the 97th Congress. The bill, H.R. 4091, which I introduced with Representative Don E. Clausen of California on July 9, 1981, was sponsored by a final total of 30 Members of Congress. Although H.R. 4091 was referred by the full House Ways and Means Committee to the Subcommittee on Select Revenue Measures in November 1981, no action was taken on the measure and it died in the 97th Congress.

The bill, H.R. 4091, enjoyed significant bipartisan support from across the country. It had the backing of the solar lobby and was cited as a policy recommendation of the water resources agenda of the Northeast-Midwest Congressional Coalition. With the introduction of this legislation today, the drive for geothermal energy tax credit reform begins once again.

Our bill basically contains three parts. The first would amend the definition of geothermal in the Energy Tax Act of 1978 to make it explicit that there is no temperature requirement for the geothermal energy tax credit for residences and commercial facilities. The second part would specify how the credit is to be determined when a residence or business has a system which uses both geothermal energy and another source not eligible for the credit. The final part of the bill would specify how the credit is to be determined when a business has a hybrid system which uses both geothermal energy and another eligible source.

#### BACKGROUND AND NEED FOR LEGISLATION

The Energy Tax Act of 1978 (Public Law 95-618) provides a residential energy tax credit for certain energy-conserving and renewable energy source expenditures made in connection with a taxpayer's principal residence. The credit applies to expenditures on energy-conserving items such as insulation and storm windows, as well as to investments in solar, wind, and geothermal energy property, categorized as renewable energy source property. In this latter case, the act

provided that a credit may be claimed for 30 percent of the first \$2,000 of expenditures and 20 percent of the next \$2,000 of expenditures up to a maximum credit of \$2,000 for expenditures made after April 19, 1977, and before January 1, 1982. Subsequently, the Crude Oil Windfall Profit Tax Act of 1980 (Public Law 96-223) expanded the renewable energy credit to 40 percent of \$10,000 in expenditures to a maximum credit of \$4,000 for expenditures made after December 31, 1979, and before January 1, 1982.

The Energy Tax Act of 1978 also provided for a 10-percent tax credit for investment in solar, wind, and geothermal energy equipment used by business. The geothermal energy tax credit was increased to 15 percent and extended through the end of 1985 by the Crude Oil Windfall Profit Tax Act of 1980.

For tax purposes, the Energy Tax Act of 1978 defined geothermal energy in the following way:

"... the term 'geothermal deposit' means a geothermal reservoir consisting of natural heat which is stored in rocks or in an aqueous liquid or vapor (whether or not under pressure).

The law set no temperature requirement in its definition of geothermal energy. Acting in good faith, many citizens invested in geothermal energy systems to tap shallow geothermal wells which they assumed would qualify for the credits.

The Internal Revenue Service proposed regulations to implement the tax credit provisions of the Energy Tax Act of 1978. In its proposed regulations, the IRS decided to set an arbitrary temperature requirement for eligibility for the geothermal tax credits. I was among those who testified against the temperature requirement at an IRS public hearing in Washington on September 12, 1979. I was accompanied by my constituent Mr. Stan Mitchell of Mitchell and Jensen, architects and engineers, of Dayton, Ohio.

Unfortunately, the IRS did not follow the recommendations that were made in opposition to a temperature requirement—including the critical comments of the Department of Energy. On August 29, 1980, the IRS issued final regulations concerning geothermal residential energy tax credits, and on January 23, 1981, issued final regulations concerning geothermal commercial facility tax credits.

For both sets of credits, the IRS required the geothermal source to have a temperature of more than 50°C (122°F). This means that citizens who installed geothermal systems that tap sources with a temperature below 50°C simply do not qualify for the tax credits.

To reiterate this position, on December 23, 1981, the IRS issued Revenue Ruling 81-304. This ruling described the case where a taxpayer applied for the credit for a water source heat pump tapping energy from well water

at a temperature of 18°C (64°F). The ruling held that the heat pump is not eligible for the residential energy tax credit as geothermal energy property because the well water has a temperature of less than 50°C. Further, the heat pump is not eligible for the credit as solar energy property because, in the opinion of the IRS, the energy in the well water is only indirectly derived from sunlight.

Some citizens using systems tapping resources at temperatures below 50°C filed for the residential geothermal energy tax credit from 1978 through 1980 and received it. On December 3, 1981, the General Accounting Office released a letter report entitled "Possibility of Improper Geothermal Energy Tax Credit Claims" (GAO/RCSID-83-11). The report contended that these tax credits have been claimed by taxpayers residing either in States without geothermal resources as defined by the IRS—essentially, all States east of the Rockies—or in States with such resources but at depths too great (3,000 feet or more) to be economically useful.

GAO recommended that the IRS "test the propriety of selected geothermal tax credit claims and determine the extent to which a problem exists that warrants expanded action on IRS' part." According to the GAO report, "IRS generally agreed with the findings of this report and agreed to take corrective action."

IRS regulations apparently designed to insure the integrity of the geothermal contribution of a particular system had the effect of disallowing the entire credit when a geothermal device is used in conjunction with either fossil fuel peaking equipment or an innovative hybrid alternative energy system.

Thus, a homeowner who installs a geothermal system to heat his or her residence cannot qualify for the residential credit unless 100 percent of the energy in the system is supplied by geothermal sources. The addition of peaking equipment fueled by oil, gas, or coal to provide, for example, less than 10 percent of the total annual energy load would disqualify the entire system. Similarly, a business that installs geothermal equipment cannot qualify for the investment tax credit if the geothermal energy is mixed with energy from another ineligible source.

Perhaps even more senseless is the fact that the credit is disallowed when geothermal is combined with another alternative energy source, such as biomass, wind, or solar to heat or power an industrial facility. For example, a company building a large hybrid geothermal waste wood electrical generating plant can take the geothermal investment credit on the equipment which is run solely on geothermal energy and biomass credit on the equipment which is exclusively fueled with wood. However, those components in the plant which use energy

from both geothermal and biomass sources cannot qualify for either credit.

In short, the IRS regulations are standing in the way of increased utilization both of ground water heat pumps and of promising hybrid alternative energy systems. Congress must act to remove these roadblocks by clarifying the definition of geothermal energy for tax credit purposes and by establishing an appropriate formula for calculating the credits when geothermal is mixed with other energy sources.

#### THE ADVERSE IMPACT OF AN ARBITRARY TEMPERATURE REQUIREMENT

Developers and users of geothermal energy have been opposed to the temperature limitation since the IRS regulations were proposed over 4 years ago. Indeed, Mr. Tyler Gass, membership secretary for the American Society for Testing and Materials Committee on Geothermal Resources and Energy, wrote me:

Our committee has gone so far as to eliminate any temperature designation as a limitation in the definition of a geothermal resource. We recognize ambient temperature ground water as being geothermal resources and support the concept of utilizing ground water heat pumps for reducing energy consumption in the United States.

Most of the potential geothermal energy use in the eastern half of the United States, as the GAO report affirmed, would involve resources with a temperature of less than 50°C. The IRS limitation has the effect of eliminating a significant portion of the geothermal resources of the country.

The 50°C temperature requirement does not reflect congressional intent or scientific fact. Dr. Jay H. Lehr, executive director of the National Water Well Association and a highly respected authority on ground water heat pumps, stated in a letter to me last year:

By arbitrarily restricting tax credit to geothermal energy equipment using temperatures over 113 degrees Fahrenheit, the IRS will effectively stifle the nation's efforts to utilize innovative energy systems which could free us from our reliance on foreign oil. . . . Congress passed the Energy Tax Act in an effort to encourage the nation to make use of alternative energy sources. The Act does NOT mention a temperature requirement. The IRS has defeated Congress' intention by placing an unrealistic temperature restriction on geothermal equipment.

Geothermal energy is the natural heat of the Earth. The heat in water, soil, or rock close to the surface of the Earth is derived from both solar and geothermal energy. Therefore, it should not matter whether the source of the heat in shallow water sources is geothermal or solar. Further, at depths of more than a few dozen feet, the heat is essentially entirely of geothermal origin.

It is important to point out that the technology is presently commercially available to take advantage of geothermal sources with a temperature below that set by the IRS. Indeed, the basic technology has been around for more than 30 years. We are not talking about some untested energy source that will take years to develop and then put on the market. The equipment is there right now—we only need to make it attractive to use.

As Michael J. McManus wrote in the *Cleveland Plain Dealer* of September 24, 1981:

"The biggest single block to development is the failure of Congress to provide tax credits for ground water systems unless the water is 50 degrees Centigrade—much hotter than 50 degrees Fahrenheit."

Mr. Robert F. Shapses, marketing project leader in the Climate Control Division then of the Singer Co. and now a unit of Snyder General Corp., put the point this way in a letter to me:

The consumer is willing to accept the ground water heat pump with open arms.

However, the position the government takes will either encourage or discourage this reality.

Energy from groundwater can be extracted through the use of currently marketed heat pumps, which operate according to the same basic principles at work in a refrigerator. The pump systems permit the temperature of the shallow geothermal water to be either raised or lowered for heating or cooling purposes.

Using ground water, a heat pump system heats three to five times as efficiently as a fossil fuel system. In terms of heat output per unit of energy put in. Although the heat pump is operated by electricity, the actual heating or cooling energy in a geothermal system is free and virtually unlimited.

Mr. Don A. Olson, president of Transmitter Industries in Sacramento, Calif., provided me with the following information in 1981:

I have been personally involved with about 150 installations over the past 24 years in California which used high capacity water source heat pumps and the energy savings have been really astounding. Typically the cost of heating and cooling a residence has been reduced by over 50 percent and in one instance a home owner living near Sacramento, California, experienced a reduction from an average of about \$189.00 per month down to less than \$75.00 per month in his electric bills.

According to the National Water Well Association, a ground water heat pump system can pay for itself in 2 to 4 years, if a well is already in place. Even if a well must be drilled, the system will pay for itself in 4 to 8 years. The National Water Well Association further states that it is not aware of any ground water heat pump system that has ever stopped running—even after more than 25 years of service.

Dr. Jay Lehr, the National Water Well Association's executive director, told a Northeast-Midwest Institute workshop on energy from water resources that ground water has the capacity to replace fossil fuel heating and electrical cooling in 85 percent of the domestic dwellings in the northeast-midwest region alone.

With proper management, 75 percent of the United States has plenty of ground water, enough to meet daily needs and to provide water for heat pumps. National GeoThermal has noted that here further is an absence of negative environmental impacts from the use of ground water heat pumps. The water returns underground slightly cooler, approximately 10°, than the temperature at which it was extracted. It is reheated to the ambient ground water temperature within a few feet of the well as it absorbs geothermal energy from the Earth as well as solar energy from the surface of the Earth. Thus, the system is totally renewable. There is no net change in ground water temperature over time. The small quantities of heat extracted from the water are continually replaced by the reservoir of heat available in the system and by the continuous input of heat energy from the Sun and the Earth.

#### THE USE OF GROUND WATER ENERGY IN DAYTON, OHIO

The Miami Valley of Ohio is incredibly rich with underground rivers that make it an ideal place to utilize shallow geothermal energy. These streams, which run below the Great Miami, the Stillwater, and the Mad Rivers, all converge on the center of Dayton, Ohio, providing a nearly unlimited energy source for downtown buildings. Unlike the aquifers in some areas, Dayton's underground rivers are easy to tap because they are not blocked by bedrock. In addition, they are located at relatively shallow depths of 50 to 100 feet.

Ground water has been used for cooling Dayton's buildings since the construction of the Hullman Building in 1831. In the 1940's, Frigidaire, Delco, and many downtown buildings

used ground water, in their cooling systems. In fact, water is so plentiful in downtown Dayton that it must be pumped away from the foundations of some buildings to keep the basements from flooding.

By one estimate, since 1978 about 2,000 Daytonians have taken advantage of heat pump systems to warm their homes. Recently, Montgomery County installed a ground water heat pump system along with a solar energy system to heat the county animal shelter facility.

To help demonstrate how these local resources could be utilized efficiently, a brick house built in 1934 in Dayton was converted from a natural gas gravity-flow furnace to a ground water heat pump system. The results of this case study were brought to my attention by Mr. John L. Keller, a research meteorologist with the applied systems analysis department of the University of Dayton's Research Institute. According to Mr. Keller's findings:

The ground water system provides necessary heating using approximately one-fourth of the energy of the old system. . . . The total energy consumption rate for the house-hold has been reduced to less than one-third of the previous rate. The improvement in household energy efficiency is typical of what could be realized in this region of the U.S.

Keller went on to state:

Clearly, if the encouragement of increased energy efficiency is the goal of the "renewable energy" tax credit, the ground water heat pump addresses this goal. Exclusion of these systems then seems wholly arbitrary. The key phrase is "renewable energy." The thermal energy contained within the vast aquifers of the eastern half of the country is no less renewable than that represented by the high temperature geothermal (water temperature at least 90 degrees Celsius), wind, and solar resources of the western half of the country.

Those of us who have been interested in promoting the more widespread application of geothermal energy had hoped that the IRS might be persuaded to change its position on the temperature requirement for the geothermal tax credits. Since it is now most unlikely that the IRS is going to change its views, legislation to clarify the definition of geothermal energy for tax credit purposes is needed.

#### TAX IMPEDIMENTS TO SOUND GEOTHERMAL INVESTMENTS

The IRS policy of disallowing the credit for systems which use both geothermal energy and another energy source also is inconsistent with the intent of Congress and ignores sound engineering practice in the use of geothermal energy.

Geothermal energy systems often include peaking systems fueled by oil, gas, or coal. The fossil energy will typically range from 3 or 4 percent to 20 percent of the annual total energy load. The extra wells, pipe, and pump capacity required for a geothermal system designed to be 100 percent geothermal on the few coldest days of the year would add too much to system cost to be attractive.

Geothermal resources in many instances may not be hot enough to fully satisfy a particular industrial process requirement, but by adding a few degrees to the heat from geothermal energy, it will often be possible to replace a large fraction of the oil or gas use in a plant or other facility. Further, many industrial processes involve several steps at different temperatures. Some of these steps can use geothermal heat, but others might require superheating. Under the IRS limitation, if such a system involved even a minimum addition of nongeothermal heat, the entire system would become ineligible for the tax credit. In effect, the IRS limitation encourages less efficient designs to take advantage of the tax credit. Certainly, this result is contrary to the intent of Congress in the Energy Tax Act of 1978.

In order to help rectify this problem, our bill specifies how the credit is to be determined when a residence or business has a system which uses both geothermal energy and another source not eligible for the credit. Under the bill, all of the equipment comprising the system shall be eligible for the credit if, on a BTU basis, geothermal energy provides more than 80 percent of the energy in a typical year for which the system is designed. If less than 80 percent of the energy is supplied by geothermal energy, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 80 percent supplied by geothermal energy on an annual BTU basis.

**TAX DISCOURAGEMENT TO INNOVATIVE COMBINATIONS OF ALTERNATIVE ENERGY SYSTEMS**

In implementing the business investment credit provisions of the Energy Tax Act, the IRS has sought to guarantee that only genuine geothermal projects receive the credit. The regulations (39 CFR 1.48-9(c)(10)(iv)) on this point state:

"(iv) Equipment that uses energy derived from a geothermal deposit is eligible only if it uses geothermal energy exclusively. Thus, geothermal equipment does not include equipment that uses energy derived both from a geothermal deposit and from sources other than a geothermal deposit."

While the objective of the IRS is legitimate, the effect of the regulations is to deny the credit to systems that combine the use of geothermal and other alternative energy sources. An example in this regard is the hybrid geothermal wood residue powerplant to be constructed in northern California by the innovative GeoProducts Corp.

Those components of the GeoProducts plant which "produce, extract, or use" energy derived from a geothermal deposit, such as the hot water distribution lines, are eligible for the credit for geothermal property. Similarly, those components of the plant which convert the wood waste to steam, such as the firebox and boiler, will qualify for the credit for "alternative energy property," because the wood burned to heat the water is "an alternative substance." However, those components of the plant which use energy from both geothermal and biomass sources, such as the turbine generator set, cannot qualify for either credit.

To address this problem the bill applies the formula devised for geothermal ineligible combinations to geothermal eligible combinations. Thus, all of the equipment of the system would be eligible for the 18-percent tax credit if more than 80 percent of the energy comes from geothermal, or any of the other alternative energy sources eligible individually for the credit, or any combination thereof. If less than 80 percent of the energy is supplied from qualified sources, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy that is more than 80 percent supplied from such qualified sources.

Well-intended, but inequitable IRS regulations should not be allowed to hold up the creative utilization of combinations of alternative energy sources. Certainly, it was not the intent of Congress to thwart projects of the kind being planned by GeoProducts in California.

**CONCLUSION**

It is important to emphasize that our bill does not create any new tax credits. It does not increase any present tax credits. What it does, instead, is make clear what the current law is and overturn the arbitrary restrictions imposed by the IRS. The objective of the technical corrections made by this bill is to make the present credits effective.

We need to remove the bureaucratic

hurdles by the IRS which are preventing incentives—indeed, providing disincentives—to more widespread use of available geothermal technology. We should make it attractive for more homes and businesses to take advantage of the geothermal resources of this Nation. Truly, the ground on which we stand holds part of the solution to our national energy requirements.

Although we do not have long lines at the gasoline stations to remind us of the existence of an energy crisis, this does not mean that the crisis is over. The oil glut we have been experiencing must not be allowed to lull us into a false sense of security. Surely, if the energy crisis again becomes more visible, our citizens rightly will ask why an effective energy conservation policy was neglected by the Government.

In order to help conserve energy and promote the use of renewable energy resources, we urge our colleagues to cosponsor this bipartisan bill and to join with us in encouraging the House Ways and Means Committee to act favorably on it.

For the benefit of our colleagues, the full text of the bill follows:

**H. R. 2927**

A bill to amend the Internal Revenue Code of 1954 to clarify the definition of geothermal energy, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

(a) CLARIFICATION OF DEFINITION OF GEOTHERMAL ENERGY.—Paragraph (3) of section 613(e) of the Internal Revenue Code of 1954 (defining geothermal deposit) is amended to read as follows:

"(3) GEOTHERMAL ENERGY DEFINED.—For purposes of paragraph (1), the term 'geothermal energy' means the natural heat of the earth (at any temperature) which is stored in rocks, an aqueous liquid or vapor (whether or not under pressure), or any other medium. A geothermal well shall in no case be treated as a gas well for purposes of this section or section 612A, and this section shall not apply to any geothermal property which is located outside the United States or its possessions."

(b) CLARIFICATION OF APPLICATION OF BUSINESS CREDIT AND RESIDENTIAL CREDIT TO GEOTHERMAL PROPERTY.—

(1) Subparagraph (D) of section 6408(f) of such Code is amended by adding at the end thereof the following: "In the case of a system which uses both geothermal energy and an energy source not eligible for the credit under this section, all of the equipment comprising the system shall be eligible for the credit if, on a British thermal unit (BTU) basis, geothermal energy provides more than 80 percent of the energy in a typical year for which the system is designed. If less than 80 percent of the energy is supplied by geothermal energy, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 80 percent supplied by geothermal energy (on an annual BTU basis)."

(2) Paragraph (3) of section 48(l) of such Code is amended by adding at the end thereof the following new subparagraph:

"(D) APPLICATION OF CREDIT UNDER SECTION 48 TO EQUIPMENT WHICH USES BOTH GEOTHERMAL ENERGY AND ANOTHER ENERGY SOURCE.—

(i) In the case of a system which uses both geothermal energy and an energy source not eligible for the credit under section 48, all of the equipment comprising the system shall be eligible for the credit for solar, Wind, or Geothermal Property under section 48(a)(3)(C) if, on a British thermal unit (BTU) basis, geothermal energy provides more than 80 percent of the energy in a typical year for which the system is designed. If less than 80 percent of the energy is supplied by geothermal energy, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 80 percent supplied by geothermal energy (on an annual BTU basis).

(ii) In the case of a system which uses both geothermal energy and another energy source eligible for the credit under section 48 (such as biomass, solar, wind, ocean thermal, or hydroelectric), all of the equipment comprising the system (up to, but not including the electrical transmission stage in the case of an electrical generation facility) shall be eligible for the credit for solar,

wind, or geothermal property under section 48(a)(3)(C) if, on a BTU basis, more than 80 percent of the energy in a typical year for which the system is designed, is supplied by geothermal energy, or any of the other forms of energy eligible for the credit under section 48, or any combination thereof (hereinafter referred to in this subparagraph as "qualified sources"). If less than 80 percent of the energy is supplied by qualified sources, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 80 percent supplied by such qualified sources (on an annual BTU basis)."

(c) CONFORMING AMENDMENTS.—

(1) Clause (ii) of section 4606(b)(2) of such Code is amended by striking "any geothermal deposit" and inserting in lieu thereof "geothermal energy".

(2) Clause (i) of section 4406(c)(5)(A) of such Code is amended by striking out "energy derived from the geothermal deposit" and inserting in lieu thereof "geothermal energy".

(3) Clause (vii) of section 4813(b)(3)(A) of such Code is amended by striking out "energy derived from a geothermal deposit" and inserting in lieu thereof "geothermal energy".

(4) Clause (ii) of section 61(a)(1)(D) of such Code is amended to read as follows:

"(ii) all geothermal properties."

(5) Subsection (c) of section 363 of such Code is amended by striking out "any geothermal deposit" and inserting in lieu thereof "geothermal energy".

(6) Subparagraph (E) of section 465(c)(1) of such Code is amended by striking out "geothermal deposit" and inserting in lieu thereof "geothermal energy".

(7) Paragraph (1) of section 613(e) of such Code is amended by striking out "geothermal deposit" and inserting in lieu thereof "geothermal well".

(8) Subsection (e) of section 613 of such Code is amended—

(A) by striking out "deposit" each place it appears in paragraph (1) and inserting in lieu thereof "properties"; and

(B) by striking out "sources" in the subsection heading and inserting in lieu thereof "properties".

(9) Section (b) of section 614 of such Code is amended—

(A) by striking out "geothermal deposit" in the text and inserting in lieu thereof "geothermal wells"; and

(B) by striking out "geothermal sources" in the subsection heading and inserting in lieu thereof "geothermal wells".

(10) Paragraph (1) of section 614(e) of such Code is amended by striking out "oil and gas wells and geothermal deposits" each place it appears and inserting in lieu thereof "oil, gas, and geothermal wells".

Mr. HORTON. Mr. Speaker, today I join my colleagues, Congressman HALL of Ohio, MORRISON of Washington, and MARSH, in introducing legislation to provide a tax credit for the commercial and residential installation of ground water heat pumps. Before speaking to the merits of this bill, I want to express my appreciation to my colleague, Congressman TOMY HALL, for his outstanding past and continuing effort to gain congressional approval of this tax credit. I look forward to working with him in this Congress to achieve the expeditious and positive consideration that this bill deserves.

In Government and across this Nation I sense a growing complacency about achieving energy independence for the United States. This complacency is a result of declining oil prices, which, I believe, are directly related to the troubled world economy. We in Congress cannot afford to be fooled by these lower prices. The rapidity with which the original 1973 embargo, and resultant oil price increases were instituted should not be forgotten.

In New York State, we have not forgotten that embargo; or do we experience any luxury of lower energy costs. We are a consuming State and must pay high prices for the oil and gas that we import, whether these imports come from Saudi Arabia or the Southern and Western energy producing States. As a consuming State, we do not have the benefit of increased

State revenue due to severance taxes placed on natural energy sources.

It is my strong belief that New York, and the northwestern and mideastern regions of our country in general, need and have been the major beneficiaries of the energy tax credits passed by Congress. We in these regions need all the assistance we can get to control our high energy costs. Energy tax credits are an important and viable source of assistance that provide both relief to consumers and encouragement to businesses to locate and continue their operations in our States.

The tax credit we seek is for ground water heat pumps. This viable technology relies on the constant temperature of underground water tables to provide heating and cooling. They are expensive to install, but they can reduce commercial and residential heating and cooling costs from between 25 and 80 percent, depending on the temperature of the water table, the energy source used, and certain other factors. It is important that this credit, which was not clarified by Congress to the extent necessary to satisfy the IRS when it passed the energy tax credit legislation in the 96th Congress, be implemented so installation of ground water heat pump systems will be encouraged.®

® Mr. MORRISON of Washington. I am pleased to join Representative TONY HALL and others today in sponsoring this legislation which makes Federal energy tax credits available to developers of low-temperature geothermal resources. I thank TONY HALL for exercising outstanding leadership on this issue. I also wish to commend Senator STROM SVENSON who today has introduced identical legislation in the Senate.

A 15-percent geothermal energy tax credit already exists but Internal Revenue Service regulations exempt low-temperature geothermal sources from the credits. Substantial reserves of low-temperature geothermal energy lie beneath most of central Washington. The Washington State Energy Office has identified over 80 cities in the State which have low-temperature geothermal water accessible for use in geothermal district heating systems.

One such geothermal district heating system was recently dedicated in Ephrata in my congressional district. This system is the Nation's first municipal water system designed to provide both heat and domestic water. The demonstration project circulates water through the Grant County Courthouse and courthouse annex. The city of Ephrata should see dra-

matic reductions in their fuel bills because of this heating system. The geothermal source for this district heating project is low temperature—about 84° F.—and would not have qualified for the tax credits available to other geothermal energy systems. Other towns throughout Washington, including North Bonneville, are looking to Ephrata and exploring the possibility of developing their own geothermal district heating systems.

I am particularly excited about applications of low-temperature geothermal energy because it will substitute for other sources of steam. A 20-year energy plan has been developed for the Pacific Northwest region which relies heavily upon expanded energy conservation in the near term. The regional power plan classifies low-temperature geothermal as a form of energy conservation and therefore it should receive priority over other renewable and thermal energy sources.

I am a strong advocate of all energy resources, be they fossil fuels, nuclear energy, solar, conservation, or geothermal. Every energy source must play a role in our overall energy mix. I believe this legislation helps to place low-temperature geothermal energy on equal footing with other forms of energy.®

## Senate

MONDAY, MAY 9, 1983

By Mr. BAKER for Mr. SYMMS (for himself and Mr. McCUREN):

S. 1237. A bill to amend the Internal Revenue Code of 1954 to clarify the definition of geothermal energy, and for other purposes; to the Committee on Finance.

### GEOTHERMAL ENERGY

® Mr. SYMMS. Mr. President, I am introducing legislation today with my colleague from Idaho, Senator McCUREN, to promote the development of low temperature geothermal resources throughout the United States.

The legislation that I am introducing clarifies the definition of "geothermal energy" within the Internal Revenue Code of 1954. In so doing, it eliminates an arbitrary temperature "threshold" imposed by the Internal Revenue Service. The bill also insures that the business and residential energy tax credits will apply to energy systems that are supplied primarily, but not exclusively, by geothermal energy.

The legislation is necessary because the IRS has written unreasonably restrictive regulations to implement the geothermal provisions of the Energy Tax Act of 1978 (Public Law 95-618).

The IRS regulations state, for example, that "equipment that uses energy from a geothermal deposit is eligible (for the business energy credit) only if uses geothermal energy exclusively."

In addition, the regulations state that only water 122° F. (50° C.) or hotter qualifies as a "geothermal deposit." This means that any space heating or ground water heat pump equipment using geothermal water colder than 122° F cannot qualify for either the residential or business energy credit.

A third example of how the IRS regulations limit the application of the renewable energy tax incentives is the case of a company building an innovative electrical generating plant which will use geothermal energy and waste food. Under the regulation, the owners of the powerplant can take the geothermal credit on the equipment extracting or distributing the geothermal fluids and the biomass credit on the equipment used in burning the wood. However, those components of the powerplant which use energy from both geothermal and biomass sources cannot qualify for either credit.

As these examples illustrate, the geothermal tax credit regulations developed by the IRS do not conform with the intent of Congress in enacting the Energy Tax Act.

The Energy Tax Act of 1979 (Public Law 95-618) provides a residential energy tax credit for certain energy conserving and renewable energy source expenditures made in connection with a taxpayer's principal residence. The credit applies to expenditures on energy-conserving items such as insulation and storm windows, as well as to investments in solar, wind, and geothermal energy property, categorized as renewable energy source property. In this latter case, the act provided that a credit may be claimed for 30 percent of the first \$2,000 of expenditures and 20 percent of the next \$8,000 of expenditures up to a maximum credit of \$2,200 for expenditures made after April 19, 1977, and before January 1, 1986. Subsequently, the Crude Oil Windfall Profit Tax Act of 1980 (Public Law 96-223) expanded the renewable energy credit to 40 percent of \$10,000 in expenditures to a maximum credit of \$4,000 for expendi-

tures made after December 31, 1979, and before January 1, 1986.

The Energy Tax Act of 1978 also provided for a 10-percent tax credit for investment in solar, wind and geothermal energy equipment used by businesses. The geothermal energy tax credit was increased to 15 percent and extended through the end of 1985 by the Crude Oil Windfall Profit Tax Act of 1980.

For tax purposes, the Energy Tax Act of 1978 defined geothermal energy in the following way:

... the term "geothermal deposit" means a geothermal reservoir consisting of natural heat which is stored in rocks or in an aqueous liquid or vapor (whether or not under pressure).

The law set no temperature requirement in its definition of geothermal energy. In fact, the Senate Finance Committee report described that the purpose of the legislation was to "induce consumers of oil and gas to conserve energy and convert to alternative energy sources."

It is clear that the overly restrictive definition of "geothermal property" adopted by the IRS has substantially lessened the incentives for homeowners or businessmen to convert to geothermal energy use. Thus, the regulations do not fully comply with the legislative intent of the 1978 act.

As a member of the Senate Finance Committee's Subcommittee on Energy and Agricultural Taxation, I believe that the Federal energy tax laws should be fairly administered. That is why I am introducing this legislation. I believe it will make the existing geothermal tax credits more evenly available. That, in turn, should measurably speed up the development of America's low temperature geothermal resources.

Mr. President, I ask unanimous consent that a fact sheet explaining the need for this legislation and outlining its main provisions, and the text of the bill be printed in the Record.

There being no objection, the material was ordered to be printed in the Record, as follows:

**GEOTHERMAL TAX LEGISLATION**  
**BACKGROUND AND NEWS**

In its report on the Energy Tax Act of 1978 (Public Law 95-618), the Senate Finance Committee stated that the purpose of the legislation were to "induce consumers of oil and gas to conserve energy and convert to alternative energy sources." To meet this goal, the Energy Tax Act provided major tax incentives for the production of energy from such resources as geothermal, solar, wind, and biomass. These incentives—mostly in the form of tax credits, deductions, and allowances—have generated unprecedented interest in developing alternative energy projects.

However, regulations issued in 1981 by the Internal Revenue Service have drastically limited the application of the alternative energy incentives enacted in 1978 and reaffirmed and expanded by the Grade Oil Windfall Profits Tax Act of 1980 (Public Law 96-323). With regard to geothermal energy, four specific limitations imposed by the IRS appear to run contrary to Congressional intent:

Only water of a temperature of 122°F (50°C) or greater is considered "geothermal energy," even though the Energy Tax Act itself contains no temperature threshold. As a result, homeowners or businesses with water cooler than 122°F cannot qualify for the residential or business energy investment credits.

A homeowner who installs a geothermal system to heat his residence cannot qualify for the residential energy credit unless 100 percent of the energy in the system is supplied by geothermal sources. Geothermal energy systems often include peaking equipment fueled by oil, gas, or coal. This peaking equipment typically provides less than 50 percent of the total annual energy load, since it is only used on the coldest days of the year. But, such peaking equipment would disqualify the system.

A business that installs geothermal equipment cannot qualify for the energy investment credit if the geothermal fluids are mixed with energy from another source. Geothermal resources may not, in some instances, be hot enough to fully satisfy an industrial process heat requirement. However, by adding a few degrees to the heat supplied from the geothermal source, it will often be possible to displace a large fraction of the conventional fuel consumed in the plant. Under the IRS limitation, if a geothermal system requires even a minimal addition of non-geothermal heat, then the entire system becomes ineligible for the energy tax credit.

<sup>1</sup> The residential credit is 40 percent of the first \$10,000 of qualifying expenditures and the business credit for qualifying equipment is 15 percent.

A company building an electric power plant using geothermal and energy from another alternative energy resource, such as biomass, can take the geothermal credit on the equipment run solely on geothermal energy and the biomass credit on the equipment fueled exclusively by wood. But, those components of the plant using both geothermal and biomass energy cannot qualify for either credit.

**S. 1327**

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

(A) CLARIFICATION OF DEFINITIONS OF GEOTHERMAL ENERGY. Paragraph (3) of section 612(e) of the Internal Revenue Code of 1954 (defining geothermal deposit) is amended to read as follows:

"(3) **GEOTHERMAL ENERGY DEPOSIT.**—For purposes of paragraph (1), the term "geothermal energy" means the natural heat of the earth (at any temperature) which is stored in rocks, an aqueous liquid or vapor (whether or not under pressure), or any other medium. A geothermal well shall in no case be treated as a gas well for purposes of this section or section 612A, and this section shall not apply to any geothermal property which is located outside the United States or its possessions."

(B) **CLASSIFICATION OF APPLICATION OF BUSINESS CREDIT AND RESIDENTIAL ENERGY INVESTMENT CREDIT.**—

(1) Subparagraph (D) of section 46C(e)(7) of such Code is amended by adding at the end thereof the following: "In the case of a system which uses both geothermal energy and an energy source not eligible for the credit under this section, all of the equipment comprising the system shall be eligible for the credit if, on a British thermal unit (Btu) basis, geothermal energy provides more than 50 percent of the energy in a typical year for which the system is designed. If less than 50 percent of the energy is supplied by geothermal energy, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 50 percent supplied by geothermal energy (on an annual Btu basis)."

(2) Paragraph (8) of section 48 (1) of such Code is amended by adding at the end thereof the following new subparagraph: "(D) application of credit under section 48 to equipment which uses both geothermal energy and another energy source.—

(i) In the case of a system which uses both geothermal energy and an energy source not eligible for the credit under Section 48, all of the equipment comprising the system shall be eligible for the credit for solar, wind, or geothermal property under section 46(a)(2)(C) if, on a British thermal unit (Btu) basis, geothermal energy provides more than 50 percent of the energy in a typical year for which the system is designed. If less than 50 percent of the energy is supplied by geothermal energy, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 50 percent supplied by geothermal energy (on an annual Btu basis).

(ii) In the case of a system which used both geothermal energy and another energy source eligible for the credit under section 48 (such as biomass, solar, wind, ocean thermal, or hydroelectric), all of the equipment comprising the system (to be, but not including the electrical transmission stage in the case of an electrical generation facility) shall be eligible for the credit for solar, wind, or geothermal property under section 46(a)(2)(C) if, on a Btu basis, more than 50 percent of the energy in a typical year for which the system is designed, is supplied by geothermal energy, or any of the other forms of energy eligible for the credit under section 48, or any combination thereof (hereinafter referred to in this subparagraph as "qualified sources"). If less than 50 percent of the energy is supplied by qualified sources, the credit shall apply to those portions of the system which produce, distribute, transfer, extract, or use energy which is more than 50 percent supplied by such qualified sources (on an annual Btu basis)."

(C) **CONFORMING AMENDMENTS.**

(1) Clause (ii) of section 46C(e)(2)(B) of such Code is amended by striking "any geothermal deposit" and inserting in lieu thereof "geothermal energy".

(2) Clause (i) of section 46C(e)(2)(A) of such Code is amended by striking out "energy derived from a geothermal deposit" and inserting in lieu thereof "geothermal energy".

(3) Clause (viii) of section 6812(b)(3)(A) of such Code is amended by striking out "energy derived from a geothermal deposit" and inserting in lieu thereof "geothermal energy".

(4) Clause (ii) of section 57(a)(1)(D) of such Code is amended to read as follows: "(ii) all geothermal properties."

(5) Subsection (c) of section 36B of such Code is amended by striking out "any geothermal deposit" and inserting in lieu thereof "geothermal energy".

(6) Subparagraph (B) of section 466(c)(1) of such Code is amended by striking out "geothermal deposit" and inserting in lieu thereof "geothermal energy".

(7) Paragraph (1) of section 612(e) of such Code is amended by striking out "geothermal deposit" and inserting in lieu thereof "geothermal well".

(8) Subsection (e) of section 613 of such Code is amended—

(A) by striking out "deposits", each place it appears in paragraph (1) and inserting in lieu thereof "reservoirs", and

(B) by striking out "reservoirs" in the subsection heading and inserting in lieu thereof "reservoirs".

(9) Subsection (b) of section 614 of such Code is amended—

(A) by striking out "geothermal deposits" in the text and inserting in lieu thereof "geothermal wells", and

(B) by striking out "geothermal reservoirs" in the subsection heading and inserting in lieu thereof "geothermal wells".

(10) Paragraph (1) of section 616(a) of such Code is amended by striking out "oil and gas wells and geothermal deposits" each place it appears and inserting in lieu thereof "oil, gas, and geothermal wells".

## Ground water heat pump performance for an older urban house

A Dayton, Ohio, study

by John L. Keller

The following article concerns the change in energy consumption efficiency of an older urban house which has been converted from a natural gas gravity-flow furnace to a ground water heat pump system. The ground water system provides necessary heating using approximately one-fourth of the energy of the old system. This is consistent with performance coefficients (the ratio of delivered heat energy to utility energy input) characteristic of these systems (2.8 vs. 0.7). The total energy consumption rate for the household has been reduced to less than one-third of the previous rate. The improvement in household energy efficiency is typical of what could be realized in this region of the U.S.

The house is located on a small lot within Dayton, Ohio's city limits. It is a one and one-half story (1,500 to 2,000 sq. ft.) brick structure built in 1934. As is characteristic of homes built at that time, no wall and little attic insulation was used. Storm windows were added in 1978 to most windows. Only one of three outside access doors (on the north side) has a storm door. An unattached garage, separated by a narrow breezeway, is located on the northwest corner. The house has one fireplace which is rarely used.

The house was sized for a 2-1/2-ton capacity heat pump system, which is "backed up" by a resistance vent heater for emergency situations. The former heating system was a gravity-flow natural gas furnace which had been converted from a coal burning operation. A heat retriever for the generation of hot water was also tied in to the new system.

The supply well is located within 4 feet of the basement wall. The depth of the well is 40 feet. Water is piped through the basement wall to the heat pump over a distance of only about 30 feet. Water disposal is

made to a storm sewer through a basement drain.

The total cost of the conversion was about \$6,800. This included the well and pump system cost of about \$1,250, upgrading of electrical service from 90 to 200 amps, ductwork and main system installation. Included in the total was also the significantly expensive task of removing the old furnace. Complete cost breakdowns are shown in Table 1.

Total household energy consumption for the 1981-1982 heating season was measured against the previous three seasons. These years were chosen so as to measure for the storm windows' efficiency contribution. The numbers are shown in Table 2 in terms of an efficiency factor and are plotted on Figure 1 as energy use versus heating degree days. The average house efficiency factor can be seen to have increased by more than a factor of three and is represented by the much lower energy consumption rate (in Btus per day) shown in Figure 1.

**"The total cost of the conversion was about \$6,800.**

**This included the well and pump system cost of about \$1,250, upgrading of electrical service from 90 to 200 amps, ductwork and main system installation."**

Prior to its retrofitting to the heat pump system, an analysis made on the house during the city of Dayton Comprehensive City Energy Management Project (CGEMP) established that while the electrical consumption for the house was somewhat below average, the natural gas consumption used for heating and hot water was nearly average for a house of its size. Thus, the improvements seen here can be considered to be typical of what could be realized by many households.

Two factors make the improvement in efficiency particularly note-

A detailed look of a ground water heat pump topic.

# EXTRA



Table 1  
Cost Breakdown, Water Well Heat Pump System

Heat pump (cooling/heating)	82,250
Well (40 feet $\phi$ 11 ft.)	440
Well water pump, plumbing, trenching	806
Hot water retriever	650
Duct work	750
Electrical upgrading (90 to 200 ampe)	465
Emergency backup heater	265
Water valves	265
Thermostat	125
Ground water (direct) cooling coil	795
	<u>86,811</u>

Table 2  
Total Household Energy Usage

Electric = 3412 Btu  $\cdot$  kwh<sup>-1</sup>

Gas = 10<sup>5</sup> Btu  $\cdot$  ccf<sup>-1</sup>

Period	Days	$\Delta E$	$\Delta e$	Electricity (kwh) $\Delta P_e (\cdot 10^5 \text{ Btu})$ (e/day)	$\Delta G$	Gas (ccf) $\Delta P_g (\cdot 10^5 \text{ Btu})$ g/day	Total $\Delta P_{TOT} (\cdot 10^5)$ (per day)	$T_H$ (°F) (per day)	Efficiency $T_H / \Delta P_{TOT} (\cdot 10^5)$ (°F per Btu/day)
<b>Old System</b>									
<b>1978</b>									
9/28-10/27	29	340	11.72	0.40	75	2.59	2.99	12.03	4.02
10/27-11/29	33	400	12.12	0.41	135	4.09	4.50	18.85	4.19
11/19-12/18	29	403	13.90	0.47	211	7.28	7.75	31.34	4.04
<b>1979</b>									
12/28-2/17	61	907	14.87	0.51	617	10.12	10.63	44.03	4.14
2/27-3/28	29	324	11.17	0.38	170	5.86	6.24	22.62	3.62
3/28-4/27	30	321	10.70	0.37	109	3.63	4.00	13.30	3.32
10/29-11/29	31	382	12.32	0.42	129	4.16	4.58	20.12	4.39
11/29-12/28	29	309	10.66	0.36	164	5.66	6.02	29.52	4.90
<b>1980</b>									
12/28-1/28	31	421	13.58	0.46	250	8.06	8.52	33.32	3.91
1/28-2/27	30	472	15.73	0.54	269	8.97	9.51	42.10	4.43
2/27-3/27	29	409	14.10	0.48	206	7.10	7.58	31.93	4.21
3/27-4/28	32	360	11.25	0.38	104	3.25	3.63	16.94	4.67
9/28-10/29	33	538	16.30	0.56	80	2.42	2.96	13.91	4.67
10/29-12/2	34	590	17.35	0.59	123	3.62	4.21	24.91	5.92
12/1-12/29	27	662	24.52	0.84	225	8.33	9.17	34.62	3.78
<b>1981</b>									
12/29-2/16	59	985	16.69	0.57	493	8.36	8.93	37.41	4.19
2/26-3/27	29	355	12.24	0.42	168	5.79	6.21	28.10	4.53
3/27-4/28	32	396	12.38	0.42	72	2.25	2.67	10.12	3.79
	Average		14.13 day <sup>-1</sup>					Average	4.26
<b>New System</b>									
<b>1981</b>									
10/1-10/31	31	597	19.26	0.66	17	0.55	1.21	12.56	10.34
11/1-11/30	30	1164	38.80	1.32	12	0.40	1.72	21.07	12.25
12/1-12/31	31	1890	60.65	2.07	3	0.10	2.17	35.13	16.19
1/1-1/31	31	3031	97.77	3.37	0	0	3.37	43.94	13.04
2/1-2/28	28	2096	74.86	2.55	0	0	2.55	37.11	14.56
	Average							Average	13.26

Total Household Use | Use  $\bullet$  32.1% of previous rate or 3.11 x more efficient

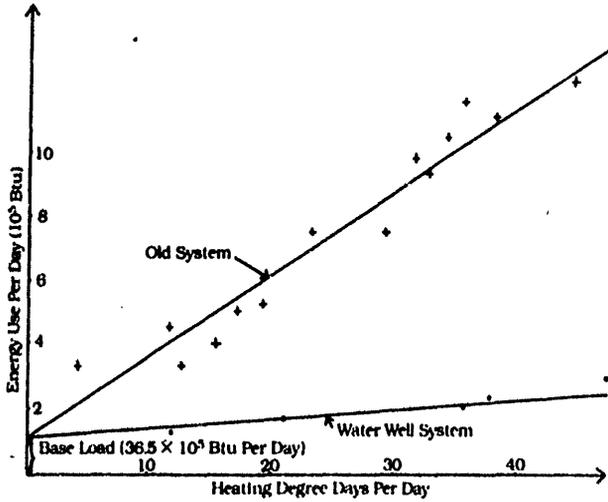


Figure 1. Household Energy Efficiency

worthy. Since the electrical energy used for nonheating purposes is unchanged, the efficiency realized in the heating of water and space alone is significantly greater than for the household total. As well, the installer of the new system recommended a higher thermostat setting than what was used for the old furnace. The old system was set at 55° at night and 65° during the day; the new one is set at 63° at night and 68° during the day. The dramatic increase in efficiency was realized along with greater comfort. These factors led to an efficiency ratio between the ground water system and natural gas furnace consistent with their relative coefficients of performance. That is, about 2.8 for the former, to 0.7 for the latter or 4 to 1.

How do these numbers translate into potential energy dollar savings to the consumer and to the northeast U.S. region?

This is perhaps best considered by comparing system costs and operating costs. The most critical need for people in this region is that of space and water heating for the

cold season. For purposes of the analysis that period will be assumed to be from November 1 to March 31. Characteristic system capital costs are \$2,500 for a conventional gas system, \$5,500 for a ground water heat pump system and \$27,500 for a solar system. The conventional gas and ground water heat pump systems can provide 100 percent of heating for space and water. The price for the solar system is that required to provide 50 percent of these needs.

Table 3 shows the total energy costs for the three systems listed above for the 1981-1982 heating season and projected for the 1984-1985 season for the test house. The projections are for increases of 20 percent for electricity and 100 percent for natural gas, relative to 1981 prices in constant dollars. The calculations for 1985 were also based on 1981-1982 heating degree days (estimated for March). The 50 percent value for the solar system implies that a supplementary heat source will be required. It will be assumed that natural gas will be

available for this purpose. The 50 percent figure for the solar system may be generous for the November through March calculations, since many cold season estimates are based on October 1 through April 30 conditions. The 50 percent figure would then be heavily weighted by the much more favorable October and April conditions. Also indicated in Table 3 is the percent increase in operating costs for each of these systems during this period.

For the situation where an older house is in need of a new means of providing heat, the cost differential between installing a ground water system rather than a conventional natural gas furnace is \$3,000. For the solar it is \$25,000. Payback periods can then be estimated using the Table 3 data. The operating cost savings of about \$600 per year results in "breaking even" by 1990 for a ground water system operational prior to 1985; that is, on the order of five years. The savings resulting from the solar system would result in "breaking even" only after 45 years. The purpose of these calculations is to show in general terms the relative cost-effectiveness between the systems. Solar systems, at current prices, are not cost-effective for this region of the United States.

The installation of solar water heating systems (approximately \$4,000) can be shown to be cost-effective, especially when electric water heating is being currently used. Paybacks on the order of five to 10 years are characteristic. However, this still leaves space heating requirements unanswered, except by conventional means. Clearly solar, with its enormous capital outlay, associated opportunity costs and long payback period is not the answer for the average household in Ohio. Each household which converts from natural gas or oil to a ground water system uses about 25 percent less nonrenewable energy, studies show. What is more important is the economic aspect associated with the basic fuel sources involved. Most of the money spent for gas or oil is sent to the producing states in the Southwest or

Table 3  
Household Energy Costs - (November 1 - March 31)

	Conventional (gas)	Ground Water	Solar conventional (gas)
<b>1981-1982</b>			
November	8 107	8 85	8 72
December	160	118	98
January	190	156	114
February	151	119	92
March	110	88	74
Total	8 718	8566	8450
<b>1984-1985</b>			
November	189	110	118
December	293	147	170
January	354	190	201
February	282	147	161
March	194	112	121
Total	81,312 (+83%)	8706 (+25%)	8771 (+71%)

even to OPEC countries in the case of fuel oil. The money spent on the coal to generate electricity remains either in Ohio or in nearby Northeast states. Coal is also in far greater reserve than known domestic natural gas or oil reserves; its use should be encouraged in the process of complete shifting from nonrenewable to renewable energy technology (such as fusion).

Clearly if the encouragement of increased energy efficiency is the goal of the "renewable energy" tax credit, the ground water heat pump addresses this goal. Exclusion of these systems then seems wholly arbitrary. The key phrase is "renewable energy." The thermal energy contained within the vast aquifers of the eastern half of the country is no less renewable than that represented by the high temperature geothermal (water temperature at least 90 C), wind and solar resources of the western half of the country. While solar systems at least could be practical in the Southwest, they are neither energetically nor economically practical for the Northeast. Furthermore with the exception of

those few living either on exposed ridges and mountain tops or near geysers, the proposition of domestic wind energy or high-temperature geothermal systems is highly questionable.

**"For the situation where an older house is in need of a new means of providing heat, the cost differential between installing a ground water system rather than a conventional natural gas furnace is \$3,000. For the solar it is \$25,000."**

Under deregulation of energy resources, energy price and energy consumption will become more directly related. The market distortion which provides an artificial economic advantage to the use of natural gas, will be largely eliminated. A further redistribution of wealth from the

Northeast to the Southwest will occur. Is it not then ironic that the region of the country which will be most vulnerable to the effects of energy deregulation will be discouraged from taking steps to soften these effects? The economic implication revealed by the 100 million Btus of gas or oil per average household reflects the regional bias built in to the current IRS interpretation of this tax credit. If just 5 percent of the households were to convert to ground water systems, the regional economic impact would be significant.

If the renewable energy tax credit were meant to be used as a way of "priming" the market to bring down unit costs through increased volume, why not promote the most practical systems? Why encourage people in the Northeast to install solar systems which are not suitable to the regional climate? The impracticality of solar for space heating is such that solar retrofitting for older homes in Ohio is virtually unknown—despite the misleading influence of its qualification for a tax credit. The inefficiency of a solar-equipped house is such that a large proportion of its heating needs would come from a conventional furnace or water heater using a nonrenewable fuel source. This and their high installation costs are reasons why so few of these systems are being used in Ohio. The ground water heat pump, on the other hand, can provide virtually all of the household heating requirements for both water and space. Economic analyses have shown that the Energy Tax Credit results in a positive return to the treasury in the long run. Why not apply it in the most cost-effective way for the energy-consuming public and towards a more efficient use of available natural resources.

*John L. Keller is a research meteorologist with the University of Dayton's Research Institute, Applied Systems Analysis Department.*

Mr. HALL. I sincerely thank you for the opportunity to testify in support of S. 1237, the bill introduced by Senator Symms and Senator McClure.

As you are aware, I'm the original sponsor of H.R. 2927. I have been joined by Congressman Morrison, Congressman Horton, and Congressman Matsui. And we are extremely excited and hopeful because of consideration of S. 1237 by your subcommittee.

My district, which is in Dayton, Ohio, is blessed with a tremendous amount of ground water, as are many other areas of the Northeast-Midwest part of this country. The ground water is between 50 and 200 feet down below the surface, and the temperature of the water ranges from 40° to 77° Fahrenheit.

The subject of geothermal is addressed by the Energy Tax Act of 1978. Everybody at that particular time thought that shallow geothermal was to be included in the energy tax credits. And there would be no requirement for temperature—no temperature requirement.

But the IRS arbitrarily, in my opinion, decided that the geothermal tax credit needed a temperature requirement. They first decided that it ought to be 60° Celsius and for reasons I do not know, and I'm not sure anybody can shed any light on it, they lowered it to 50° Celsius, which is about 122° Fahrenheit.

Well, as a result of that shallow geothermal applications were ineligible for the energy tax credits—both for homes and for businesses. How many home owners can afford to dig maybe 3,000 to 3,500 feet down into the Earth's crust to get the kind of temperature that is needed? It's a terribly expensive, very prohibitive kind of venture.

And unless you happen to be located in the country over some geysers, possibly in Hot Springs—and there are only a few of those areas in the country you can't qualify. And so as a result of this arbitrary ruling by IRS, probably 95 percent of all shallow geothermal devices were denied. Congress never intended this. Congress never included in the law or made a statement that there should be a temperature requirement. But, nevertheless, IRS did it anyway.

In September 1979, I appeared before an IRS hearing here in the District of Columbia. And I testified in hope that they would change the temperature requirement. Unfortunately, the IRS stuck with a 50° Celsius requirement.

So what we have before us is that there is very little chance for any kind of administrative action to overturn this ruling. So what we need really is legislation. And we are not asking for new tax credits. We are not asking for a new program. We are seeking a technical change, and, I believe, the chance to restore congressional intent.

I have never put a geothermal device in my home nor do I completely understand the technical details of how they work. But I have seen a number of them. And I have seen them working in my district. I have read a lot about them, and I know that they work. I know that they are terribly efficient. And very effective. I know they meet our needs, and push us more toward energy independence.

We have experts here that can shed a lot more light on them than I can. What I am asking is that you give consideration to S. 1237, or 1303, an excellent bill introduced by Senator Mitchell. Or you could act on 1305, which would extend the tax credits past 1985, hopefully, with the geothermal provisions that Senator Symms has proposed

That's really what we are asking for today. We need a change. We need a technical change.

And we just thank you for your consideration and thought and understanding about this bill and others.

Senator WALLOP. Thank you.

I want to thank all three of you for coming here. Somewhere in the combination of them probably lies the key to doing something useful.

With the lower temperature water supplies, are those used as well? For instance, 40° for cooling?

Mr. HALL. Yes, sir.

They are. Senator Wallop. So that the principal key to some kind of tax credit would be that it was a substitute for some other energy that would have been required to either cool or to heat. Was it the courthouse in Ephrata?

Mr. MORRISON. Yes.

Senator WALLOP. Was that done with some sort of grant as well?

Mr. MORRISON. Yes. That was the driving force. Sort of a demonstration; the first one in the Nation. And I can report, too, it's working most efficiently.

Senator WALLOP. Do you have any idea what the relative economic tradeoffs would have been had it not been a grant? Now, it would seem as though that could have been a viable economic move?

Mr. MORRISON. I would be glad to get those figures for you.

[The information from Congressman Morrison follows:]

If the city of Ephrata had not pursued a geothermal system, they would have probably used an electric fired boiler. The projected costs of such an electric fired boiler was \$72,855. The total costs for Ephrata to connect up to a low-temperature geothermal energy system was \$102,364, or \$29,509 more than the electric fired boiler. However, the energy costs associated with the electric fired boiler are significantly higher than the geothermal system. The energy costs were estimated to be \$6,750 per year for the boiler and the estimate from the Washington State Energy Office for the geothermal system is between \$1,400 and \$1,800, or a saving of \$5,000 per year. This energy savings results in a pay back period of less than six years over the electric fired boiler.

Mr. MORRISON. Actually, Ephrata seems like an unlikely place to put it because their electrical costs—they have their own generating facilities on the Columbia River—run about half a cent per kilowatt hour. So the tradeoffs would not be like they would be in some other areas represented here in the room.

I would be glad to get those figures. Could have them for you later today, Mr. Chairman.

Senator WALLOP. It would be interesting for inclusion in the committee's record because the one thing that occurs to me in all of this is that with a relatively abundant supply of geothermal properties in the country of varying descriptions, it seems like that's the one area we continue to slide around both in terms of tax cred-

its and in terms of energy policies. We are always on the threshold of it, and never quite ever visiting it.

Well, I appreciate you all taking time on Monday morning to come over here and give us the benefit of your support for these bills and these ideas.

It's my intention that we do push it. It's always difficult when you have a sort of inertial force standing in the way of it. But I think that there is much to be gained for the country at least in learning how. And I don't know as how you ever learn how without getting it out to test its economic viability.

If we were to have another energy shortage, and I happen to be one of those who presume that to be inevitable, their own economics may well come into play. But we ought to know how to do it when those economics arrive. And I appreciate your efforts, and your leadership in this thing. And we will see what we can do.

Mr. HORTON. Thank you.

Mr. MORRISON. Thank you.

Mr. HALL. Thank you very much.

Senator WALLOP. I have three statements. One from Senator Dole; one from Senator Matsunaga; and one from Senator Packwood, which will be put into the record as well.

[The prepared statements of Senators Dole, Packwood, and Matsunaga follow:]

#### STATEMENT OF SENATOR DOLE

Mr. Chairman, Thank you for having this hearing on the Senate bills concerning percentage depletion treatment of decarbonized phosphate rocks, the definition of geothermal energy for purposes of the energy tax credits and the extension and expansion of renewal energy resource tax credits. All of these energy issues are important and need to be reviewed in order to determine which energy tax credits, if any, should be extended or modified.

In general, the 10-percent business energy credit expired at the end of 1982. However, the general 10-percent business energy credit will continue through 1990 for certain types of property that are part of a long-term project, if certain affirmative commitments are made in connection with the project. Business energy credits (other than the general 10-percent) are allowed through 1985 for solar, wind, geothermal, ocean thermal, and qualified hydroelectric generating property. Individuals are allowed a residential-energy credit for renewable energy property, including solar, wind, or geothermal property. The residential energy credit will terminate after 1985.

S. 1237 and S. 1303 generally would clarify the definition of geothermal energy so the business and residential energy tax credits will apply to certain geothermal energy systems. S. 1305 generally would extend the residential solar, wind, and geothermal tax credits, increase the energy tax credits and the ocean thermal tax credit, and extend the affirmative commitment rule.

This hearing will also focus on S. 1193 which would allow the percentage depletion deduction for carbonization of phosphate rock by thermal process.

During 1979 and 1980 we enacted many energy credits in order to encourage and promote alternative energy sources and energy savings. Some of these credits have been very efficient and other have resulted in very small energy savings in comparison to the revenue loss to the Treasury. At this time, we need to access the efficiency of these energy credits and determine if we went too far in 1978 and 1980.

Mr. Chairman, during this time, while the Federal deficit is running close to \$200 billion, we need to carefully examine all of the energy credits and narrowly target those that are beneficial and cost effective. Energy independence and alternative energy sources are still a high priority of our Nation. However, this priority cannot be met by using the taxpayer's money to encourage development of energy sources that are inefficient and result in very small energy savings. During the last few weeks you have had several energy hearings. I hope these hearings will culminate in a clear determination of which energy credits are essential or cost effective so we

can carefully target and extend or modify these credits in order to assure our Nation of continued progress toward energy independence.

Mr. Chairman, again I thank you for holding the hearing and I look forward to hearing the views of all the public witnesses on these important issues.

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#### STATEMENT OF SENATOR BOB PACKWOOD

I would like to thank the distinguished Chairman of the Subcommittee on Energy and Agricultural Taxation, Senator Wallop, for holding hearings on S. 1305, the Renewable Energy Tax Incentive Act. I look forward to fully exploring and establishing for the record the need for legislation to extend and enhance renewable energy tax credits.

Further, I would like to thank the witnesses present today for taking the time to testify on behalf of the Renewable Energy Tax Incentive Act.

Mr. Chairman, it has been ten years since the oil embargo of 1973. In the aftermath of that crisis our nation adopted the goal of energy independence. We will achieve that goal one step at a time. And we will accomplish it sooner if we extend and enhance incentives to help people with the cost of turning to alternate energy sources.

The current lower demand for energy reduces the incentives to invest in alternative energy sources. However, these sources must be pursued now so they can be available in the future. This is not the time for us to be complacent in developing renewable energy sources. Development of these resources is crucial to decreasing our dependence on unstable foreign energy sources. According to a study on energy tax credits by Booz, Allen and Hamilton Inc., continuing the tax credit for investment in solar and wind technologies would provide installed solar and wind energy capacity that is capable of replacing the equivalent of 33 million barrels of imported oil annually by 1990.

On May 17, Solar Day with Congress, Senator Matsunaga and I introduced legislation, S. 1305, to extend federal tax credits to encourage use of solar, wind and geothermal energy by homeowners and businesses. The extension and enhancement of these energy credits is an investment in America's future that will continue to produce jobs, energy savings, and revenue for years to come.

Our bill would increase the solar, wind and geothermal energy tax credits for businesses from 15 percent to 25 percent on July 1, 1983, and extend these credits to December 30, 1990. Increasing these energy tax credits is necessary to provide incentives for investment in renewable energy technologies and to assist renewable energy industries to become competitive with conventional fuel resources.

The strengthening of the business energy tax credit is essential to compensate for the "basis adjustment" provision of the Tax Equity and Fiscal Responsibility Act of 1982 which has the effect of reducing the tax credit by up to one-fourth. This provision has had an adverse impact on the profitability of the development of renewable energy technologies.

Federal and state energy tax credits assisted ARCO Solar, Inc. to complete the world's largest solar facility, which converts sunlight directly into electricity. The one megawatt plant, which was constructed in 38 weeks, can generate enough energy to serve the needs of 300-400 homes in Southern California. The existence of federal and state energy tax credits made this project economically feasible. It is an example of the importance of energy tax credits to the development of renewable energy technologies. Due to the success of this project, ARCO Solar, Inc. is building a 16 megawatt photovoltaic facility which could serve up to 6,400 homes. Pacific Gas and Electric Company will purchase the energy generated from this project. Mr. Chairman, projects such as these demonstrate the need and importance of federal energy tax credits.

In addition, our bill would extend the 40-percent residential solar, wind, and geothermal tax credit from December 31, 1985, to December 31, 1990. This would enable homeowners to continue to receive a 40-percent tax credit when they invest in solar, wind, or geothermal energy properties. It would also be a signal to solar equipment manufacturers that Congress intends to encourage the continued development and manufacture of solar equipment.

According to the IRS, Federal income tax returns claiming the renewable energy tax credits between 1978 and 1981 have increased from 69,000 to approximately 226,000. In addition, IRS data shows expenditures for solar energy by taxpayers have increased five-fold from 120 million in 1978 to 681 million in 1981.

Our bill would also lower the temperature required for geothermal resources which would open several new areas for geothermal exploration and development in

Oregon and elsewhere. The legislation would increase, as well, the current ocean thermal tax credit from 15 to 25 percent and extend these credits to 1990.

Chairman, enhancement and extension of the energy tax credits will provide incentives for investment in renewable energy technologies and create jobs in these labor-intensive industries. Congress must expand these credits to insure the development of our Nation's renewable energy resources.

#### STATEMENT OF SENATOR SPARK MATSUNAGA

Thank you, Mr. Chairman, and members of the Subcommittee, for giving me this opportunity to provide a statement of tax incentives for the development and commercialization of renewable energy.

Just to make sure that there is no misunderstanding as to where I stand, let me at the very outset admit that I am an avid supporter of the development of renewable energy, and a staunch advocate of government support for the development of renewable energy technologies. In part, this is because my home State of Hawaii, of all the fifty states in the Union, is the most vulnerable to disruption of its non-renewable petroleum supply. We in Hawaii live on a chain of islands, separated from the mainland United States by distance and time. Jet fuel for air transportation and bunker fuel for marine transportation are virtual necessities for every part of Hawaii's economy and society. All of our gasoline, and the oil used to generate most of our electricity must be shipped great distances, and most of it comes from foreign sources.

The oil embargo of 1974 and the rapid escalation of oil prices which followed, dramatically and painfully demonstrated to the people of Hawaii that total dependence on foreign sources for their energy supply must be brought to an end. As a consequence, considerable attention by both public officials and businessmen was focused on the development of indigenous sources of energy. Its urgency and need was fully recognized. What role the government should play was the issue. Because of the awesome challenge with its potential of great benefits to the state, it was generally agreed that the task must be undertaken as a joint venture between government and private industry.

Accordingly, the state government of Hawaii assumed the major role in the research and development of geothermal energy on state-owned land in Puna, Hawaii, and, with federal funding assistance, proved the feasibility of its commercialization. The private sector has been convinced and has undertaken its own projects at its own risk. I hasten to add that had it not been for the incentives provided in the Energy Tax Act of 1978 and the Crude Oil Equalization Tax Act of 1980, private industry may not have been moved to do so.

Hawaii business and industries have substantially increased their reliance on renewable energy resources for the generation of electricity and the creation of process steam in recent years. During this same period, residents of Hawaii have been purchasing solar hot-water heating systems and domestic photovoltaic systems in increasing numbers. The motivation, in both instances, has been provided not only by the high price of oil, but also, perhaps to a greater degree, by state and federal tax incentives.

Another important fact of life for Hawaii's citizens is that Hawaii is not connected to any interstate utility grid. We cannot take advantage of the economies of scale and the potential for selling electricity between large utilities that can be done on the mainland. The separate islands of Hawaii are not interconnected with power lines, although we hope to interconnect our islands within the next few years. But even then, our islands together would not constitute a system large enough to support even a single commercial-scale nuclear power plant.

However, Hawaii is blessed more abundantly with renewable energy resources than any other state, in proportion to its needs. We have the sun, which shines on our fair state all year round, providing us with the opportunity to displace foreign oil with residential solar hot water heaters, solar thermal electric generators, photovoltaic systems, and other forms of direct use of sunlight to provide energy. The same sunlight ensures that our crops will grow steadily, providing our islands with abundant biomass resources in the form of bagasse—the waste matter of sugar cane production—and eucalyptus trees, a fast-growing woody crop which is currently being developed as a potential source of energy to displace oil for the generation of electricity and for process heat.

Our island state also provides a multitude of excellent sites for generation of electricity from windpower. The northeast trade winds, which blow across Hawaii 75 percent of the time, represent one of the world's most consistent and reliable wind patterns. These trade winds have attracted a number of wind energy developers to plan and begin development of windfarms as a source of electricity. The Hawaiian Electric Company recently completed a two-year demonstration of the Department of Energy's Mod-OA wind generator, a 200-kilowatt unit that produced a total of 1.7

million kilowatt-hours of electricity over a period of two years at Kahuku on the island of Oahu.

The success of this machine has encouraged Hawaiian Electric Company to sign a contract with the General Electric Company to purchase the first of a new generation of larger wind machines, the seven-megawatt Mod-5A, which will be put into service not far from the site where the 200-kilowatt machine was located. This installation will not be a fully commercial operation, however. It is a demonstration project to test the durability and the cost-effectiveness of this new, large wind generator, the first of its kind.

This is an important point to emphasize. While this machine is a commercially-sized generator, capable of being replicated into a large windfarm, it is only the very first production model, and thus is a high-cost item. Its construction involves a certain degree of risk, and even if highly successful in a technical sense, its high cost as the first of its kind may not allow it to be economical.

But the potential for such machines in Hawaii is vast. According to a report by the Hawaii Natural Energy Institute, the capacity to generate wind energy on the islands of Hawaii is far greater than our demand. In 1979, all the islands of Hawaii together consumed 6.2 billion kilowatt-hours of electricity. By comparison, the average energy potential of available wind sites ranges from a low of 27.2 billion kilowatt-hours to a high of 181 billion kilowatt-hours.

Another form of energy available to Hawaii is ocean thermal energy conversion—OTEC, the sunlight trapped as heat in the upper layers of the ocean. Just a few weeks ago, the U.S. Department of Energy awarded a contract to a New York-based firm, Ocean Thermal Corporation, for the second phase in the development of a commercial-sized OTEC system in Hawaii. Ocean Thermal Corporation and the Ocean Energy Council have informed me that, with the appropriate incentives, they have every confidence that OTEC can be an important source of electricity for the island of Oahu within the next ten to fifteen years.

In addition, some of our islands have abundant water resources which can be tapped to provide low-head hydroelectric power.

So, Mr. Chairman, as you can readily understand, we have wonderfully abundant renewable energy resources in Hawaii. For this reason, I sometimes like to refer to Hawaii as America's natural energy laboratory. For this same reason, I believe that Hawaii can one day become the first state in the nation to be self-sufficient in domestically-produced renewable alternative energy.

My confidence in saying this, Mr. Chairman, is, in part, due to the potential for using our abundant OTEC, wind, and geothermal energy resources to generate surplus electricity which can be used to produce hydrogen fuel from water. As you know, the technology for liquifying hydrogen has been developed and liquid hydrogen has been proven to be the safest, cleanest burning fuel for air and land transportation, and a good source of electricity for peak usage hours. Moreover, work is under way to perfect a high-efficiency hydrogen-air battery, which may be the source of stored electricity for both large-scale and small-scale uses.

However, I wish to take pains to emphasize, Mr. Chairman, that most of the technologies needed to tap these abundant sources of domestic, environmentally pure, and inexhaustible energy are still under development. The up-front expenditures required to bring commercial systems on line are enormous for all of these technologies, and the lead times vary from a few years to two decades or more for some technologies.

Mr. Chairman, one of the questions to which this subcommittee needs answers is whether or not tax credits actually have an effect on the development and commercialization of renewable energy. Admittedly, our experience with tax credits for renewable energy is very short. However, I have seen what I think is fairly compelling evidence that the tax credits have become critical factors in these investment decisions, and are likely to remain so over the next several years at least. The existence of these credits encourages those with money to invest in renewable energy development, as opposed to other investments which might have shorter lead times.

One such bit of evidence is the number of purchases of solar energy systems by both individuals and businesses in Hawaii. The State of Hawaii has accurate records beginning with 1977, the year before the Energy Tax Act was enacted, because Hawaii enacted its own tax credit legislation in 1976. These records show that 1,101 Hawaii taxpayers claimed a credit for installation of a solar energy device in 1977. Then, in 1978, the first year for which a person or company could claim the solar tax credit, the number of purchases more than tripled, to 4,061. In the following year, the number of Hawaii citizens and firms claiming the credit increased to 4,375, and in 1980, the number rose to 4,704.

Additional evidence was provided to me by the Ocean Energy Council, the organization representing firms involved in the development of OTEC. After polling its members, the Ocean Energy Council concluded that the extension of the credit for OTEC through the year 1995, plus an increase in the credit from 15 percent to 20 percent, would have the effect of stimulating \$785 million in domestic OTEC sales. At the same time, the Council concluded that if the credit is terminated in 1985, before it could be used for any OTEC system, sales of OTEC would probably drop to zero.

In other words, for OTEC at least, the credit is a critical link in the financial viability of every single project.

However, the most compelling evidence I have seen of the importance of the credits came to me through a personal glimpse into a single project. In this case, a group of investors from New Jersey and New York were planning to build an 80-megawatt wind farm in Hawaii and sell its electricity to the local utility company. When the Reagan Administration announced that it intended to seek repeal of the existing credits before 1985, these investors immediately pulled out of the project. Although Congress succeeded in retaining the credits, despite the Administration's position, it was too late to save this particular alternative energy project in Hawaii.

In short, Mr. Chairman, what I'm trying to say is that the future of large-scale and business-use renewable energy systems would be extremely bleak in the absence of incentive in the form of energy tax credits in Hawaii or in any other state. I cite the experience in Hawaii only because of my familiarity with it, but I'm sure other states must be undergoing similar experiences. In my humble opinion, this assessment is reinforced by the current conditions in the world oil market. The price of oil has taken a temporary dip, and there are optimistic rumors of further declines in the price of oil—perhaps to \$25 a barrel, some say.

Mr. Chairman, \$25 a barrel is not my idea of cheap oil, nor is it my idea of a cost that Americans should continue to bear forever for an imported resource when domestic alternatives, providing domestic jobs, are readily available. However, the temporary slackening off of the spiral of increases in oil prices has had its psychological effects on investors and buyers. With the nation in a frame of mind to think that we do not have to worry about the price of petroleum, it is doubly important that the tax credit be retained as an incentive to both developers and buyers to continue investing in renewable energy systems. It is important also that the Congress retain the credit for its value as a signal to investors that we know the future is not a future of cheaper oil.

For these reasons, Mr. Chairman, Senator Bob Packwood and I, with several additional cosponsors, introduced the "Renewable Energy Tax Incentive Act of 1983," a bill to extend and enhance the renewable energy credits for individuals and businesses. The major provisions of this bill are:

1. It extends the 40 percent residential solar, wind, and geothermal tax credit from December 31, 1985 to December 31, 1990.
2. It increases the business and industrial solar, wind and geothermal tax credit from 15 percent to 25 percent on July 1, 1983, and extends these credits to December 31, 1990.
3. It increases the current ocean thermal tax credit from 15 percent to 25 percent and extends these credits to December 31, 1990.
4. It extends the 10 percent business and industrial biomass credit from December 31, 1985 to December 31, 1990.
5. It extends the 10 percent business and industrial cogeneration tax credit from December 31, 1982 to December 31, 1990.
6. It extends the 11 percent hydroelectric tax credit from January 1, 1980 to December 31, 1990.
7. It provides for an affirmative commitment rule for certain energy property. Under this rule, business or industrial solar, wind, geothermal, ocean thermal, biomass and cogeneration projects begun by December 31, 1990 would continue to be eligible for tax credits until December 31, 1995, if certain conditions are met.
8. It eliminates the 20 percent limitation for oil and natural gas used in cogeneration facilities.
9. And finally, it changes the investment tax credit for certain energy property. Currently, the IRS denies the regular 10 percent investment tax credit to most solar, wind, and geothermal air or water heating or cooling systems because it seems this equipment is "structural". The bill eliminates this rule for solar, wind and geothermal property.

Mr. Chairman, as I mentioned earlier, the bill increases the solar, wind, OTEC, and geothermal tax credit for businesses from 15 percent to 25 percent, effective July 1, 1983. The purpose of this increase is partly to offset an Internal Revenue Service action denying the regular 10 percent investment tax credit for many

solar, wind, and geothermal heating and cooling systems on grounds that these systems are "structural" rather than "equipment". For OTEC investments, the increase from 15 percent to 25 percent is to offset the long lead times involved in OTEC investments and the uncertainties created in the minds of investors by short-term, downward fluctuations in the price of oil, the major competing energy source.

Regarding the appropriate termination dates for these credits, Mr. Chairman, my own personal view is that it is too early to say. Research, development and commercialization of new technologies are not simple actions; they are time-consuming processes involving chains of interrelated development and investment decisions, first by producers and then by purchasers. I believe the termination date of 1990, with an affirmative commitment rule extending the termination date through the end of 1995 for systems with long lead times, provides sufficient time for today's renewable energy entrepreneurs to make business decisions with a reasonable level of certainty on at least one financial issue, that of their tax status. However, I believe also that this issue will merit review once again before the credits expire, so that the Congress may again consider whether or not continued or additional incentives are warranted.

In conclusion, Mr. Chairman, I wish to reiterate my strong belief that the development of renewable energy is a vital and necessary part of the future of our Nation as a whole, just as it is critical to the future of Hawaii. In the long run, due to the high cost of oil and the volatility of world oil supplies, renewable energy will become the most economical and secure source of energy available to our Nation. In keeping with the prevailing view that management and labor in the private sector, and government at the local, state and federal levels, must all work together in order to revive our economy and restore our Nation to its rightful position as the world's leader in business and industry, the least we public servants can do is to provide the private entrepreneurs with incentives to do what needs to be done.

Thank you for listening.

Senator WALLOP. Now the first is a panel on S. 1303 and S. 1237, consisting of Mr. William Matson, who is general manager of the Pennsylvania Rural Electric Association, and he is accompanied by Mr. Robert Cleveland, president of Ohio Rural Electric Cooperatives on behalf of the National REA Cooperative Association in Washington; Mr. Fred Hutchison of F. H. Hutchison & Co. in Washington, D.C., on behalf of GeoProducts Corp. of Oakland, Calif.; Mr. Bruce Amsterdam, National Geothermal, Dublin, Ohio; Mr. Gordon Bloomquist, Ph. D., geothermal specialist from Washington State Energy Office, who was introduced, as the committee knows, by Congressman Morrison.

Gentlemen, welcome. And, Mr. Matson, if you will begin.

**STATEMENT OF ROBERT N. CLEVELAND, PRESIDENT, OHIO RURAL ELECTRIC COOPERATIVES, INC., COLUMBUS, OHIO, ON BEHALF OF THE NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION, WASHINGTON, D.C.**

Mr. CLEVELAND. Mr. Matson has not arrived yet. And I'm Robert Cleveland, and I will start. And Joe Dudick, with the Pennsylvania Statewide, is with me. If Mr. Matson does not come, he will read his statement. He is in another meeting in town today.

Mr. Chairman, we are delighted to have the opportunity to present the views of the rural electric and the National Rural Electric Cooperative Association to you. We speak for them this morning simply because we come from an area that is familiar with the geothermal heat pump. And we are very active in those programs.

My name is Robert Cleveland. I am president of the Ohio Rural Electric Cooperative, Inc., the statewide association of all 28 rural

electric cooperatives in Ohio, and Buckeye Power, Inc., the generating transmission entity that supplies electricity to those cooperatives.

Our member cooperatives provide retail electric service to approximately 230,000 rural customers located in 77 of Ohio's 88 counties. I appear here today to support S. 1237.

The Energy Tax Act of 1978 provided certain residential energy tax credits for expenditures on renewable energy sources, including sources that utilized geothermal energy. The act itself contained no temperature restrictions, but the Internal Revenue Service subsequently adopted rules that excluded geothermal sources with a temperature below 50° Celsius. As a result, the tax credit is not currently available to residential consumers who install ground water heat pumps, which utilized the natural heat contained in underground water supplies because the temperature of such water supplies is currently less than 50° Celsius.

Nevertheless, such water supplies represent an important source of energy in much of Ohio and the Midwest. The IRS rules also had the effect of disallowing the tax credit in instances where a geothermal device is used in conjunction with either fossil fuel peaking equipment or some other alternative energy system.

S. 1237 would overturn both sets of IRS rules. Specifically, it would clarify the existing legislation by providing that the term "geothermal energy" includes the natural heat of the earth at any temperature. It would also ensure that the tax credit would apply to a system that we use both geothermal energy and an alternate source as long as the geothermal source provided more than 80 percent of the total energy in a typical year for which the system was designed. Even if the geothermal source supplied less than 80 percent of the energy, the credit might still be applied to a portion of that system. Consequently, the tax credit would be available to residential consumers who install and use ground water heat pumps, even if those heat pumps were used in conjunction with a fossil fuel peaking system. We strongly support these changes for the following reasons.

To begin with, the bill would provide substantial benefits for our member consumers since it would create a strong incentive for them to acquire more efficient heating equipment that should produce significantly long-term cost savings. These savings would occur because ground water heat pumps are very efficient appliances. In fact, they are even more efficient than conventional air to air heat pumps because they transfer heat from the underground water supplies, which generally have a temperature of 50° to 55° Fahrenheit in Ohio, and instead of transferring the heat from the ambient air, which is often much colder.

The actual savings will vary from consumer to consumer, but the typical consumer who currently heats his home with oil might save as much as \$600 a year in heating costs by installing a ground water heat pump. Despite such savings, however, the initial cost of a ground water heat pump is substantially greater than the cost of an air-to-air heat pump. Consequently, the proposed residential energy tax credit represents an incentive that is both desirable and necessary.

The second reason we support this bill is that it would provide important benefits for our generating and distribution systems as a whole. One measure of the efficiency of an electric utility's system is its load factor. The load factor can be improved by selling additional energy during off-peak periods. In other words, periods other than those when the utility experiences its peak demand.

One way we have done with our system, Buckeye Power, to encourage off-peak sales is through its dual-fuel heating program. This program actually offers cash incentives for customers who heat with oil or propane to install heat pumps, while retaining their oil or propane furnaces for backup on cold days when the system experiences its peak demand. The consumer benefits through lower heating costs. And the system benefits through increased off-peak sales, which improve its load factor, and enable it to spread its fixed costs over a higher sales volume. This helps to hold down the unit cost of electricity.

Furthermore, these increased sales do not require the construction of additional capacity, because they occur only during off-peak periods. As a result, the dual-fuel program provides important benefits for all of our member consumers, and S. 1237, by providing tax incentives for the installation of ground water heat pumps would significantly aid this program.

Finally, we support S. 1237 because it would further our national energy policy. Most of the electricity produced in the Midwest is generated through using domestic coal supplies. As a result, each gallon of fuel oil displaced by the use of ground water heat pumps will reduce the Nation's need for imported oil.

Senator WALLOP. Thank you very much.

[The prepared statement of Mr. Cleveland follows:]

Statement of  
Robert N. Cleveland  
President  
Ohio Rural Electric Cooperatives, Inc.  
and Buckeye Power, Inc.

Before  
The Senate  
Subcommittee on Energy and Agricultural Taxation

Mr. Chairman and members of the subcommittee:

My name is Robert N. Cleveland and I am the president of Ohio Rural Electric Cooperatives, Inc., the statewide association of all twenty-eight rural electric cooperatives in Ohio, and Buckeye Power, Inc., the generation and transmission entity that supplies electricity to those cooperatives. Our member cooperatives provide retail electric service to approximately 230,000 rural customers located in 77 of Ohio's 88 counties. I appear here today in support of S. 1237.

The Energy Tax Act of 1978 provided certain residential energy tax credits for expenditures on renewable energy sources, including sources that utilize geothermal energy. The act itself contained no temperature restrictions, but the Internal Revenue Service subsequently adopted rules that excluded geothermal sources with a temperature below 50°C (122°F). As a result, the tax credit is not currently available to residential customers who install groundwater heat pumps, which utilize the natural heat contained in underground water supplies, because the temperature of such water supplies is substantially less than 50°C. Nevertheless, such water supplies represent an important source of energy in much of Ohio and the midwest. The I.R.S. rules also had the effect of

S. 1237  
Pg. 2

disallowing the tax credit in instances where a geothermal device is used in conjunction with either fossil-fuel peaking equipment or some other alternative energy system.

S. 1237 would overturn both sets of I.R.S. rules. Specifically, it would clarify the existing legislation by providing that the term "geothermal energy" includes the natural heat of the earth at any temperature. It would also ensure that the tax credit would apply to a system that used both geothermal energy and an alternate energy source, as long as the geothermal source provided more than 80% of the total energy in a typical year for which the system was designed. Even if the geothermal source supplied less than 80% of the total energy, the credit might still be applied to a portion of the system. Consequently, the tax credit would be available to residential customers who install and use groundwater heat pumps, even if those heat pumps were used in conjunction with a fossil-fuel peaking system. We strongly support these changes for the following reasons.

To begin with, the bill would provide substantial benefits for our member-consumers, since it would create a strong incentive for them to acquire more efficient heating equipment that should produce significant long-term cost savings. These savings would occur because groundwater heat pumps are very efficient appliances. In fact, they are even more efficient than conventional, air-to-air heat pumps, because they transfer heat from underground water supplies, which generally have a temperature of 50° to 55° in Ohio, instead of transferring heat from the ambient air, which

is often much colder. The actual savings will vary from customer to customer, but a typical customer who currently heats his home with oil might save \$600 a year in heating costs by installing a groundwater heat pump. Despite such savings, however, the initial cost of a groundwater heat pump is substantially greater than the cost of an air-to-air heat pump. Consequently, the proposed residential energy tax credit represents an incentive that is both desirable and necessary.

The second reason that we support S. 1237 is that it would provide important benefits for our generation and distribution systems as a whole. One measure of the efficiency of an electric utility's system is its load factor. The load factor can be improved by selling additional energy during off-peak periods, i.e., periods other than those when the utility experiences its peak demand. One way Buckeye Power encourages off-peak sales is through its dual-fuel heating program. This program offers cash incentives for customers who heat with oil or propane to install heat pumps, while retaining their oil or propane furnaces for back-up on cold days when the system experiences its peak demand. The customer benefits through lower heating costs, and the system benefits through increased off-peak sales, which improve its load factor and enable it to spread its fixed costs over a higher sales volume. This helps to hold down the unit cost of electricity. Furthermore, these increased sales do not require the construction of additional generating capacity, because they occur during off-peak periods. As a result, the dual-fuel program provides important

benefits for all of our member-consumers, and S. 1237, by providing tax incentives for the installation of groundwater heat pumps, would significantly aid the program.

Finally, we support S. 1237 because it would further our national energy policy. Most of the electricity produced in the midwest is generated using domestic coal supplies. As a result, each gallon of fuel oil displaced by the use of groundwater heat pumps will reduce the nation's need for imported oil. The benefits of such a reduction are obvious.

In conclusion, S. 1237 would provide:

- (1) cost savings for consumers of electricity,
- (2) improved efficiency of electric generation and distribution systems, and
- (3) reduced dependence on imported oil.

For these reasons, we strongly urge you to support this legislation.

Thank you very much.

Senator WALLOP. Mr. Hutchison.

**STATEMENT OF FRED H. HUTCHISON, F. H. HUTCHISON CO., WASHINGTON, D.C., ON BEHALF OF GEOPRODUCTS CORP., OAKLAND, CALIF.**

Mr. HUTCHISON. Thank you, Mr. Chairman. I am Fred Hutchison, the Washington representative of GeoProducts Corp. GeoProducts is a small company based in Oakland, Calif., that was formed in 1975 to extract energy or marketable products from underutilized natural resources, such as waste wood and moderate temperature geothermal fluids.

GeoProducts is presently completing final preconstruction work on a hybrid geothermal-wood electric power project. The project is located in northern California, not far from the town of Susanville. When complete, the powerplant will produce 18.7 megawatts of electricity through a unique combination of geothermal energy and energy derived from the combustion of wastewood. The development of this energy conversion process is significant, because it can use geothermal water 100° cooler than other geothermal systems. Thus, the potential for replication of the project throughout the American West is tremendous.

My statement today focuses entirely on the tax problem encountered by GeoProducts in planning the hybrid powerplant. Let me set the stage for discussion of this problem by using the chart to my left to explain the unique design of this power production facility.

In many respects, the hybrid system resembles two separate powerplants—one wood and the other geothermal—located at the

same site. The wood-burning unit, shown in green on the chart, is basically a conventional steam-turbine generator system in which the steam is produced in a wood-fired boiler. The geothermal unit, shown in blue on the chart, is a binary design, meaning that it use heat exchangers to transfer the heat in the geothermal water to a low boiling point fluid—in this case, isobutane. The isobutane then vaporizes and turns a turbine connected to an electrical generator.

What is extraordinary about the hybrid facility is its use of excess of energy from one subsystem to boost the operating efficiency of the other.

The red lines on the chart illustrate the two ways in which energy exchanges will increase efficiency. First, geothermal energy is used to preheat the combustion air of the wood-fired unit. Second, exhaust steam from the wood-fired unit is used in the binary geothermal unit to superheat the isobutane. The hybrid plant's two subsystems can work independently, if necessary. Working separately, they will generate 13.1 megawatts; but when combined as described, the system will generate 18.7 megawatts. That is a 43-percent increase in efficiency.

Unfortunately, the same exchange of energy which permits this improvement in efficiency may prevent portions of the geothermal unit from qualifying for the geothermal investment credit. The problem stems from one paragraph of the IRS regulations implementing the Energy Tax Act of 1978, which states that: "Equipment that uses energy derived from a geothermal deposit is eligible only if it uses geothermal energy exclusively. Thus, geothermal equipment does not include equipment that uses energy derived both from a geothermal deposit and from sources other than a geothermal deposit."

The combination of geothermal and wood-derived energy in the hybrid powerplant appears to violate this exclusively geothermal rule, thereby making the most expensive components of the geothermal unit, such as the turbine generator set, ineligible for the geothermal credit.

Mr. Chairman, the obvious intent of the exclusively geothermal rule is to prevent systems which are primarily fueled by oil or gas, with only a small geothermal contribution, from qualifying for the credit. It is not unreasonable to impose a restriction on such systems. However, as detailed in my written statement, that rule unfairly penalized bona fide geothermal developers with projects that are predominately, but not exclusively, geothermal.

A review of the Energy Tax Act reveals that the legislation was enacted to stimulate the development of new sources of energy and to promote greater energy efficiency. It is unfortunate that the regulations adopted by the IRS work against those objectives of innovation and efficiency in certain circumstances.

Those who support the rule are worried that dishonest businessmen would claim the geothermal credit for equipment that derives only a small fraction of its energy from geothermal sources. Unfortunately, this all-or-nothing approach will cost the Government tax revenues in the long term because it deters investment in legitimate energy systems which will be significant sources of future tax revenues.

The hybrid powerplant is a good example of this point. Despite the fact that the project will produce competitive power, it is the favorable tax benefits associated with construction of the facility which have stimulated interest in the project among venture capital firms. GeoProducts believes that it can secure construction financing from private sources only if the project qualifies for the full energy investment credit, and other available tax incentives.

Mr. Chairman, GeoProducts believes that Congress should approve clarifying legislation, such as S. 1237, to allow energy production equipment which uses geothermal energy primarily, but not exclusively, to qualify for the investment credit for geothermal property.

I would also add in conclusion, Mr. Chairman, that GeoProducts strongly supports Senator Packwood's bill, S. 1305, which would extend the tax credits through 1991.

Thank you for the opportunity to present this statement.

Senator WALLOP. Thank you very much, Mr. Hutchison.

[The prepared statement of Mr. Hutchison follows:]

Statement of Fred H. Hutchison

representing

GeoProducts Corporation  
Oakland, California

before the

Subcommittee on Energy and Agricultural Taxation  
Committee on Finance  
United States Senate

July 18, 1983

concerning

S. 1237, a bill to amend the Internal Revenue Code of 1954 to clarify the definition of geothermal energy, and for other purposes.

and

S. 1305, a bill to amend the Internal Revenue Code of 1954 to extend the energy tax credit for investments in certain classes of energy property, and for other purposes.

Mr. Chairman and members of the Subcommittee, I am Fred Hutchison, the Washington representative of GeoProducts Corporation. I appreciate the opportunity to appear before you to explain why GeoProducts strongly supports S. 1237, legislation sponsored by Senators Symms and McClure to ensure that the energy investment credit will apply to energy systems that are supplied primarily, but not exclusively, by geothermal energy. GeoProducts also supports S. 1305, the legislation introduced by Senator Packwood and several other Senators to extend the energy tax credits through 1991.

GeoProducts Corporation

Mr. Chairman, GeoProducts is a small, privately-held energy development company based in Oakland, California. The company was formed in 1975 to extract energy or marketable products from underutilized natural resources, such as waste wood and moderate temperature geothermal fluids. At present, GeoProducts is pursuing two major commercial endeavors.

GeoProducts has fostered the development of, and owns the exclusive commercial rights to, a unique biomass conversion system. Developed at the Forest Products Laboratory of the University of California, the process produces fermentable sugars from woody plant material in a continuous multi-stage mild acid hydrolysis operation. Valuable products, such as ethanol, can be refined from the sugars thus produced. The process is unique because it is a continuous rather than a batch process. It is important because it uses cellulosic waste material, such as logging slash or cotton gin trash, as a feedstock. The technical and economic feasibility of the GeoProducts system has been demonstrated in a one-ton per day pilot plant which has operated successfully since 1980.

GeoProducts is also completing final preconstruction work on a "hybrid" geothermal-wood electric power project. The project is located within the Wendel-Amedee Known Geothermal Resources Area in Lassen County, California, not far from the town of Susanville. When complete, the powerplant will produce approximately 18.7 MWe of electricity through a synergistic combination of geothermal energy and energy derived from the combustion of waste wood. The potential for replication of this project throughout the western United States is tremendous. GeoProducts expects similar projects to develop at many other western locations as electrical demand forecasts dictate.

My testimony today focuses entirely on the geothermal-wood electric power project and the tax problem encountered by GeoProducts in planning the hybrid powerplant. To set the stage for discussion of the tax problem, I would like to briefly describe the project's history and the extraordinary design of this power production facility.

#### Project History

GeoProducts Corporation began geologic assessment of the Wendel-Amedee geothermal prospect in 1975. After two years spent consolidating a land position and completing technical evaluations, GeoProducts successfully drilled a shallow geothermal production well at Honey Lake. To immediately use the moderate temperature geothermal fluids thus available, the company built and operated a large greenhouse complex.

Beginning in 1977, GeoProducts investigated the possibility of building an electrical generating plant to make use of the geothermal resource at Honey Lake and the abundant wood residues found on nearby national forest and private lands. These first-look efforts indicated that a hybrid

powerplant might, indeed, be feasible.

Consequently, in 1979, GeoProducts entered into a Planning and Feasibility Study Agreement with the California Department of Water Resources, the U. S. Department of Energy, and the U. S. Forest Service. Research under the Study Agreement was completed in 1982. The major conclusions of the feasibility studies are as follows:

- Sufficient supplies of waste wood are available to support at least 200 MWe of installed hybrid electric generating capacity. These supplies were identified through a comprehensive inventory of some 15 million acres of forestland surrounding the plant site.
- A substantial hydrothermal reservoir, with a minimum temperature of 250°F, is located at Honey Lake. The reservoir is estimated to be capable of supporting 200 MWe of hybrid capacity for at least 375 years.
- Two technically and economically feasible hybrid designs were developed:
  1. a 50 MWe wood-fired plant in which geothermal heat is used to dehydrate the wood fuel and preheat the combustion air and boiler feedwater; and
  2. an 18.7 MWe combined-cycle plant consisting of a wood-fired system and a binary geothermal unit working together.
- No environmental problems were identified that would preclude facility construction and operation.
- The geothermal and wood resources available at Honey Lake can be most efficiently utilized in a combined-cycle plant.

GeoProducts is currently negotiating a cost-share agreement with the Department of Energy for the completion of preconstruction work on the powerplant. This work should be completed by early 1984 and includes final engineering, additional geothermal resource development, final environmental

assessment, and the acquisition of licenses and permits. Actual construction is expected to begin once these tasks are complete with construction financing provided by private sources.

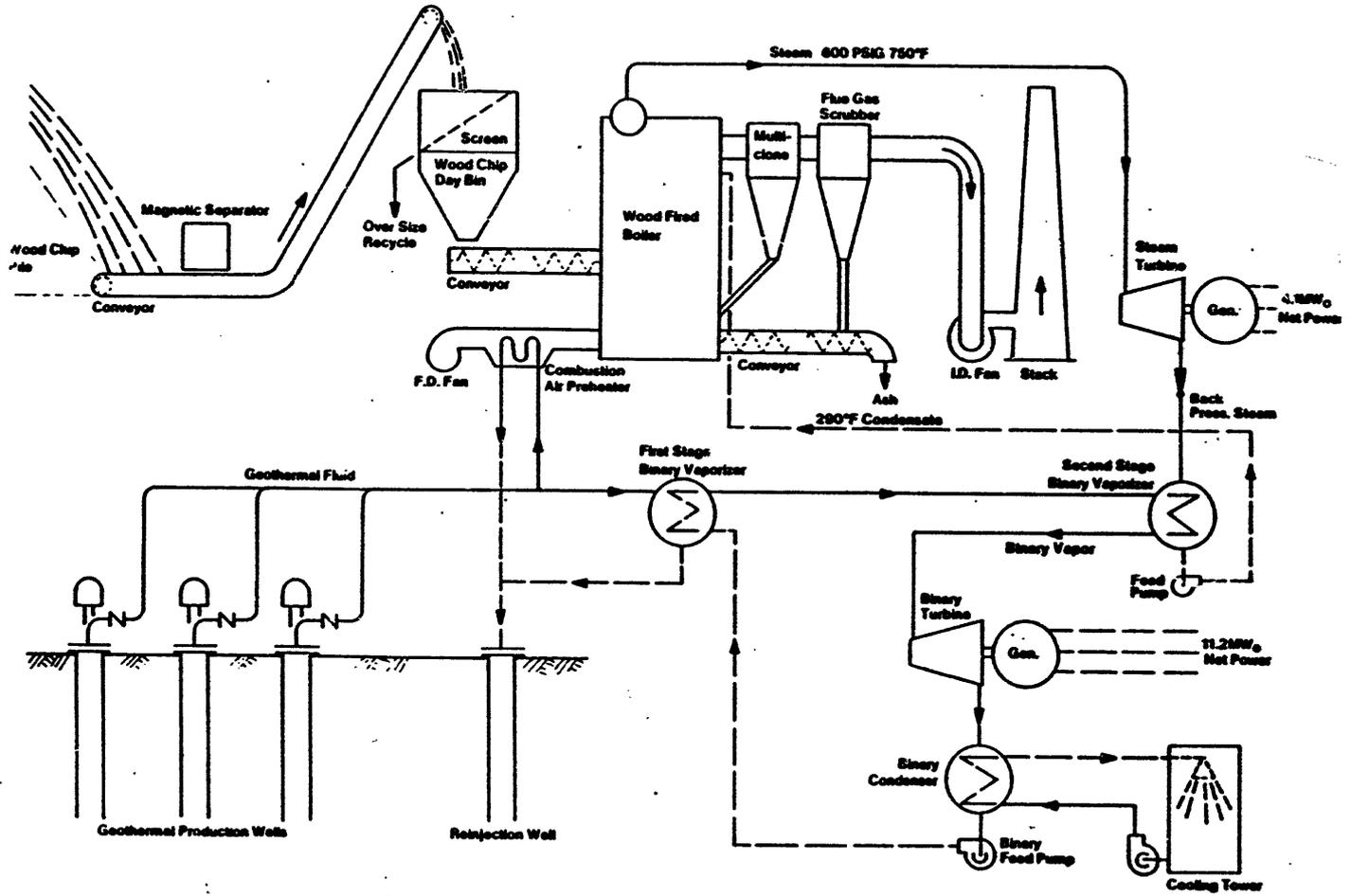
#### The Combined Cycle Facility: An Innovative Design

In many respects, the combined cycle design resembles two separate electric powerplants — a wood-fired system and a "binary" geothermal system — located at the same site. The wood-burning portion of the combined cycle facility is basically a conventional steam turbine generator system in which the steam is produced in a wood-fired boiler. The binary geothermal unit uses heat exchangers to transfer the heat in the geothermal water to a low boiling point "working fluid" such as isobutane. When vaporized, the working fluid turns a turbine which is connected to an electric generator. (The design of the combined-cycle powerplant is illustrated in the schematic diagram on page 5.)

What is unique about the combined cycle facility is the use of excess energy from one unit to boost the operating efficiency of the other. This is accomplished in two ways. First, geothermal energy is used to preheat the combustion air of the wood-fired unit. This combustion air preheating will improve the efficiency of the wood-burning system by nearly ten percent. The second increase in efficiency occurs when exhaust steam from the wood-fired unit is used in the binary unit to superheat the working fluid. The superheated fluid then drives the binary expander (turbine) which in turn drives an electric generator.

Both the wood and geothermal units are designed to work independently of one another. One reason for this design specification is to assure that one unit can operate even if the other is shut down for maintenance.

Working separately, the two units would generate 13.1 MWe, but when



Combined Cycle Plant Schematic Diagram

combined as described, the system would generate 18.7 MWe, a 42.7 percent increase in operating efficiency.

Unfortunately, the same exchange of energy which permits the hybrid project to operate so efficiently may prevent a large portion of the binary geothermal unit from qualifying for the energy investment credit for geothermal property.

#### The Exclusively Geothermal Rule

The Energy Tax Act of 1978 and the IRS regulations of January 23, 1981, state that in the case of a geothermal powerplant, all equipment (up to the busbar) is eligible for the investment credit for geothermal property. However, the regulations also specify that:

"Equipment that uses energy derived from a geothermal deposit is eligible only if it uses geothermal energy exclusively. Thus, geothermal equipment does not include equipment that uses energy derived both from a geothermal deposit and from sources other than a geothermal deposit." [26 CFR 1.48-9(c)(10)(iv)]

This "exclusively geothermal" rule appears to pose a large problem for the geothermal-wood hybrid project. If the binary geothermal unit were to be operated using only the 250°F water found at Honey Lake, then all of its component parts would qualify for the credit. However, as described earlier, waste heat from the wood-fired section of the powerplant is to be used to increase the temperature of the working fluid in the binary unit so that it operates more efficiently. This mixing of geothermal and wood-derived energy appears to violate the exclusively geothermal rule, thereby making expensive parts of the binary unit — such as the second stage heater and the turbine-generator set — ineligible for the investment tax credit for geothermal

property.\*

Mr. Chairman, the obvious intent of the IRS limitation is to prevent systems which are primarily fueled by oil or gas — with only a minimal geothermal contribution — from qualifying for the geothermal credit. It is not unreasonable to impose a restriction on such systems. However, the IRS rule unfairly penalizes bona fide geothermal developers, such as GeoProducts, who have a hydrothermal resource that is most efficiently utilized in combination with energy from a non-geothermal source.

Under the IRS regulations, eligibility for the investment credit would also be denied to other deserving energy projects where —

- industrial waste heat is added to a geothermal-based district heating system;
- moderate temperature geothermal fluids are combined in an innovative way with energy from another alternative energy source; or
- geothermal water available for use in an industrial process must be boosted a few degrees in a coal, oil, or gas fired boiler.

Mr. Chairman, a review of the legislative history of the Energy Tax Act reveals that Congress enacted the legislation to stimulate the development of new sources of energy and to promote greater energy efficiency. The examples just cited show that, in many instances, the exclusively geothermal rule adopted by the IRS works against those objectives of innovation and efficiency. Therefore, GeoProducts Corporation believes it is essential for Congress to

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\* Furthermore, these components cannot qualify for the biomass (alternative energy property) credit because 55 percent of the energy running them comes from geothermal sources. The regulations specify that to be eligible for the alternative energy property credit, an item of equipment must use energy from an alternate substance, such as wood, as its primary fuel. The term "primary fuel" is defined as "a fuel comprising more than 50 percent of the fuel requirement of an item of equipment."

approve clarifying legislation which will allow energy production equipment which uses geothermal energy primarily, but not exclusively, to qualify for the investment credit for geothermal property. S. 1237, the bill sponsored by Senators Symms and McClure, will accomplish this goal.

#### S. 1237

Senator Baker introduced S. 1237 for Senators Symms and McClure on May 9, 1983. The bill is identical to H. R. 2927, legislation introduced on May 5, 1983, by Representative Tony Hall and three other members of the House of Representatives.

Senator Symms noted in his introductory statement that the bill has two principal provisions. First, it would clarify the definition of "geothermal energy" within the Internal Revenue Code and thereby eliminate the arbitrary 50°C (122°F) temperature threshold imposed by the IRS. Second, the bill would insure that the business and residential energy tax credits will apply to energy systems that are supplied primarily, but not exclusively, by geothermal energy.

GeoProducts believes that both major provisions of S. 1237 would further important energy objectives. However, I would like to confine the balance of my statement to an explanation of how the national interest would be served by the bill's amendments to the exclusively geothermal rule.

#### Why the Exclusively Geothermal Rule Should be Altered

The exclusively geothermal rule, as outlined earlier, has the effect of discouraging the development of innovative, efficient energy projects, such as the hybrid geothermal-wood powerplant contemplated by GeoProducts. Moreover, many of these projects further national objectives other than energy

conservation, such as reducing federal expenditures and providing new employment opportunities. For example, it is estimated that a 50 MWe hybrid generating facility would --

- employ 100 full-time workers, providing direct annual labor benefits of \$2.8 million and secondary benefits of \$8.4 million;
- reduce Forest Service logging slash collection and disposal costs by as much as \$1.35 million per year;
- lessen air pollution problems caused when waste wood is burned at logging sites;
- provide several hundred thousand dollars a year in increased property tax revenues for local governments; and
- save nearly 600,000 barrels of oil a year.

Another compelling reason why the exclusively geothermal rule should be amended is its negative effect on U. S. Treasury receipts over the long-term.

Those who support the current rule argue it is needed to prevent abuses that would result in large revenue losses. They are worried that less than honest businessmen would claim the geothermal investment credit for equipment that derives only a small fraction of its energy from geothermal sources. Unfortunately, this all-or-nothing approach costs the federal government tax revenues in the long-run because it deters investment in legitimate energy systems which will be significant sources of future tax revenues.

The hybrid powerplant is a good example of this point. Despite the fact that the project will produce electricity at competitive rates, it is primarily the favorable tax benefits associated with construction of the facility which have stimulated interest in the project among venture capital firms. The officers of GeoProducts Corporation believe that, at the present time, they can secure construction financing from private sources only if the

project qualifies for the full energy investment credit and other available tax incentives.

S. 1237 Proposes Reasonable Eligibility Criteria

The two new eligibility formulas proposed in S. 1237 offer a sensible compromise between the current 100 percent geothermal rule and no limitation whatsoever on the geothermal investment credit.

One formula would apply to a system that uses geothermal energy and energy from another source not eligible for the energy credit, such as oil or gas. All of the equipment in such a system would be eligible for the investment credit for geothermal property if more than 80 percent of the energy is geothermal. If less than 80 percent is supplied from geothermal sources, the credit would apply to those portions of the system which use energy which is more than 50 percent geothermal in origin.

A separate eligibility formula would be established for a system that uses geothermal energy and energy from a source that is eligible for the energy investment credit, such as biomass, wind, or solar. Under this formula, all of the equipment of the system would be eligible for the 15 percent credit if more than 80 percent of the energy comes from geothermal, or any of the other alternative energy sources eligible for the credit, or any combination thereof (referred to in the bill as "qualified sources"). If less than 80 percent of the energy is supplied from qualified sources, the credit would apply to those portions of the system which use energy that is more than 50 percent supplied from such qualified sources.

These two formulas would maintain a high eligibility "threshold" to discourage abuses of the geothermal investment credit while, at the same time, allowing legitimate hybrid projects to qualify for this important

tax incentive. The proposed eligibility criteria would also place hybrid geothermal systems on an even footing with other alternative energy projects which can qualify for the investment credit for "alternative energy property" even if they use a fuel mix that contains as much as 49 percent oil or gas.

#### Conclusion

Mr. Chairman, the IRS regulations implementing the Energy Tax Act of 1978 have, in many ways, slowed down the development of America's low and moderate temperature geothermal resources. The Energy and Agricultural Taxation Subcommittee can reverse this situation by giving prompt approval to S. 1237.

Thank you for the opportunity to present this statement.

Senator WALLOP. Mr. Amsterdam.

#### STATEMENT OF BRUCE AMSTERDAM, PRESIDENT, NATIONAL GEOTHERMAL, DUBLIN, OHIO

Mr. AMSTERDAM. Mr. Chairman, my name is Bruce Amsterdam, president of National Geothermal of Columbus, Ohio.

Increased employment in the private sector is an ongoing national goal, and one which is especially important today. Energy independence is also a national goal with profound economic and political effects. Both are well served by the bills under consideration here today.

In the 3 years since our company has been founded, we have installed over 375 residential geothermal heating and cooling systems. These systems heat space or water by extracting, amplifying, and transporting geothermal heat energy from the Earth. I believe, if the geothermal tax credit had been available to the public, our sales would have been 10 times greater.

Virtually all of our sales have been made to homeowners desiring relief from ridiculously high energy bills. These people chose to remove working, energy-guzzling systems, and replace them with highly efficient geothermal heating and cooling systems. They are the vanguard. They were motivated by the savings potential, by the proven performance of the technology, and by a desire for things new and unique.

Despite our modest success to date, the majority of people, the majority of homeowners currently wasting energy need a push—a push that can be provided by these bills. The money savings are important to the public. The energy savings are important, too. But, of all the important things our work is about, I believe the jobs we are creating are the most beneficial aspects of our geothermal industry.

The reason why new jobs are being created is important to understand. It is because new sales are being created by geothermal systems. These geothermal systems are a new kind of value for

homeowners to consider; not just an alternative one. The values offered by geothermal systems have the effect of replacing completely serviceable, but highly inefficient, heating and cooling systems long before their time.

Beyond that, the manufacture of and installation of these geothermal heating and cooling systems create new jobs for traditionally skilled American workers. Drillers, plumbers, electricians, sheet metal workers, and technicians in the field, plus machinists and assembly personnel in the factory, all have new job opportunities. We can visualize new jobs being created for existing skills by the hundreds of thousands across the country.

I am proud of the work opportunity we offer the 20 people in our company, and look forward to offering the same opportunity to a thousand or more, if we have the help of this bill under consideration.

The positive effect on our economy that these new jobs will produce, in my opinion, will generate more Federal tax revenue than the tax credit will cost. There is an excellent prospect of a high return on the tax credit investment. This credit makes the purchase of a \$7,000 to \$8,000 geothermal system compelling to every homeowner in the Nation who heats or cools his home. The energy saved will reduce the need to import oil. We estimate that even our relatively few customers are saving the equivalent of 10,000 barrels of oil a year. Think of the potential, and think of the prospect of hundreds of thousands of new jobs.

All we are asking of you to set this good work into motion is to straighten out the tax credit issue by working for passage of these bills.

Thank you.

Senator WALLOP. Thank you very much, Mr. Amsterdam.

[The prepared statement of Mr. Amsterdam follows:]



**National GeoThermal**  
*HEAT FROM THE EARTH*

TESTIMONY OF  
BRUCE L. AMSTERDAM  
ON S. 1237

BEFORE THE  
SENATE FINANCE COMMITTEE  
SUB-COMMITTEE ON  
ENERGY AND AGRICULTURAL TAXATION

JULY 18, 1983

Page one  
 Bruce L. Amsterdam  
 S. 1237  
 July 18, 1983

Mr. Chairman, members of the Committee, my name is Bruce Amsterdam, President of National GeoThermal located in Columbus, Ohio.

Increased employment in the private sector is an ongoing national goal, and one which is especially important today. Energy independence is also a national goal which has profound economic, social and political implications. The importance of making substantial, cost-effective progress toward these goals is difficult to overstate.

Both pursuits are well served by the bills under consideration by this committee.

In the three years since our company was founded we have installed nearly four hundred geothermal heating and cooling systems. These systems heat space or water by extracting, amplifying and transporting geothermal heat energy from the earth.

I believe if the geothermal tax credit had been available to the public, our sales would have been ten times greater.

Virtually all of our sales have been made to homeowners desiring relief from ridiculously high energy bills. These people chose to remove working, energy-guzzling systems, and replace them with highly efficient geothermal heating and cooling systems. They are the vanguard. They were motivated by the savings potential, by proven performance, and by a desire for things new and unique.

Despite our modest successes to date, the majority of people, the majority of homeowners currently wasting energy, need a push -- a push that can be provided by this bill.

The money savings are important to the public. The energy savings are important too. But, of all the important things our work is about, I believe the jobs we are creating are the most beneficial aspect of our geothermal industry.

The reason why new jobs are being created is important to understand. It is because new sales are being created by geothermal systems. These geothermal systems are a new kind of value for homeowners to consider, not just an alternative one. The values offered by geothermal systems have the effect of replacing completely serviceable, but highly inefficient heating and cooling systems, long before "their time."

Beyond that, the manufacture of, and installation of these geothermal heating and cooling systems create new jobs for traditionally skilled American workers. Drillers, plumbers, electricians, sheet metal workers, and technicians in the field, plus machinists and assembly personnel in the factories, all have new job opportunities. We can visualize new jobs being created for existing skills by the hundreds of thousands across the nation.

*I am proud of the work opportunity we offer the twenty people in our company, and look forward to offering the same opportunity to a thousand, or many more, if we have the help of the bill under consideration today.*

*The positive effects on our economy that these new jobs produce will, in my opinion, generate more Federal tax revenue than the tax credit will cost. There is the excellent prospect of a high return on the tax credit investment.*

*This credit makes the purchase of a seven to eight thousand dollar geothermal system compelling to every homeowner in the nation who heats or cools his home. The energy saved will reduce the need to import oil. We estimate that even our relatively few customers are saving the equivalent of about ten thousand barrels of oil per year. Think of the potential, and think of the prospect of hundreds of thousands of new jobs.*

*All we are asking of you is to set this good work into motion; to straighten out this tax credit issue by working for passage of these bills.*

**Senator WALLOP. Dr. Bloomquist.**

**STATEMENT OF DR. GORDON BLOOMQUIST, GEOTHERMAL SPECIALIST, WASHINGTON STATE ENERGY OFFICE, OLYMPIA, WASH.**

**Dr. BLOOMQUIST.** Thank you, Mr. Chairman. My name is Dr. R. Gordon Bloomquist, and I am a geologist and a geothermal specialist with the Washington State Energy Office. I'm very pleased to have this opportunity to address the committee today on behalf of Gov. John Spellman.

The State of Washington, as well as much of the United States, is blessed with an abundance of low-temperature geothermal resources. Unfortunately, the majority of the resources in many areas were made ineligible for geothermal tax credits by what we feel was a very arbitrary decision by the IRS to limit such credits to geothermal resources above 122° Fahrenheit, 50° Celsius.

I am unaware of any scientific or engineering justification for a temperature limitation of this type. The U.S. Geological Survey recently completed a study of all geothermal resources above 10° Celsius above mean annual ambient temperature, or to about 15° Celsius. And the Geothermal Resources Committee of the American Society of Testing and Materials has proposed a definition for geothermal energy to cover Earth temperatures as low as 38° Fahrenheit, or approximately 4° Celsius.

The nonavailability of geothermal tax credits has been and continues to be a serious impediment to the full utilization of this abundant, technically practical, cost-effective, and indigenous energy resource. The IRS has also limited tax credit eligibility to those systems above 50° Celsius where the total energy demand is not met by geothermal, and thus they have made ineligible those systems which make most efficient use of the resource through peaking and the use of heat pumps.

In support of S. 1287, I would like to present the committee with information concerning the geothermal resource base below 50° Celsius, direct application of the geothermal energy below 50° Celsius, the technical and economic advantages of peaking, and, finally, the use of geothermal ground water heat pumps.

The USGS recently completed a very detailed analysis of low-temperature geothermal systems across the United States. The study shows that in Washington 82.6 percent of the sites are below

50° Celsius. In Oregon, the percentage is 79.9. In Idaho, 75.8. In Wyoming, 63.3. And Virginia, 100 percent. And that's just a small sampling of the States that were covered.

A lowering of the temperature limitation to 40° Celsius, as proposed in S. 1305, would have little effect. In fact, 69.2 percent of the sites in Washington would still be excluded, as well as 67.3 in Oregon, 53.6 in Idaho, 51.5 in Wyoming, and 90 percent in Virginia.

The United States Geological Survey has estimated that 5,500 megawatts of beneficial heat is presently available from geothermal resources below 50° Celsius. It also states that approximately double that amount would be available from undefined resources. And if we take geothermal heat pumps into consideration, the number could be increased by three to five times. We are talking in terms of several tens of thousands of megawatts.

The direct utilization of these low-temperature geothermal resources can supply energy for industrial processing, commercial and residential heating, and agriculture and aquaculture. I've included appendix 1 in my written testimony, and have indicated those applications under 50° Celsius, which can be met directly through geothermal resources.

Although in a majority of geothermal applications 100 percent of the total energy demand can be met by the geothermal resource, it is often preferable to meet only base load demand and rely upon boosting with another resource to meet peak. The exclusion from tax credit eligibility of any system which employs peaking has severely limited development of the most technically efficient and cost effective systems.

In order to better demonstrate the technical and economic advantages of peaking, I made two runs on a computer model designed to determine the feasibility of district heating. In the first case, the total energy demand was met by a 50 degree Celsius resource. In the second case, the top 50 percent of the peaking curve was met through the use of a fossil fuel peaking boiler. The economic comparisons are seen in table 1 on page 3 of my written testimony.

As seen from the table, the cost of wells is cut by 50 percent, and the cost of the main transmission line was cut by 30 percent. In total, about a 20-percent reduction in the cost of the entire system was achieved through the use of peaking. And the 50-percent peaking represents only 5 percent of the total energy demand for a year.

In Reykjavik, Iceland, where better than 98 percent of the city's 385-megawatt district heating system is provided through geothermal, 50 percent of the peak is met through peaking, using a 25-megawatt peaking unit. This amounts to 10 percent of the total energy demand.

The provisions of S. 1237, which relate to the use of hybrid systems would make available geothermal tax credits to developers of such systems.

Finally, Mr. Chairman, geothermal water as low as 4° Celsius can be successfully boosted through the use of water source heat pumps to temperatures as high as 80° Celsius. Those systems are very efficient and can reduce energy consumption and energy costs by from 60 to 85 percent.

The use of water source heat pumps is not restricted to commercial and residential uses. It could be used for district heating. And in Europe, the Scandinavians have in put on Sweden 86 megawatts of district heating over the past 2 years; 105 more megawatts will be put on before December of this year.

Use of such large scale geothermal water source heat pumps for district heating in the United States could result in substantial energy savings.

A preliminary study of eight Western States has identified 375 cities with low temperature geothermal resources available for district heating systems.

The conclusion, Mr. Chairman, is that passage of S. 1237 is vital. IRS limitations effecting geothermal tax credits have severely impeded the development of low-temperature geothermal resources as well as the most technically efficient and cost effective development of this Nation's high temperature geothermal resources.

Thank you.

Senator WALLOP. Thank you, Dr. Bloomquist.

[The prepared statement of Dr. Bloomquist follows:]

**Testimony of**

**R. Gordon Bloomquist, Ph.D.  
Geothermal Specialist  
Washington State Energy Office**

**Before: the**

**Committee on Finance  
United States Senate**

**on**

**S. 1237**

**July 18, 1983**

Mr. Chairman, members of the Committee. My name is Dr. R. Gordon Bloomquist. I am a geologist and geothermal specialist with the Washington State Energy Office. I am chairman of the Washington State Interagency Geothermal Development Council, and I have served as a technical advisor to the Departments of Housing and Urban Development and Energy on district heating.

I am very pleased to have this opportunity to address the committee on behalf of Governor John Spellman concerning S.1237. I will, in addition, refer to S.1305 in my testimony as is appropriate.

#### Introduction

The state of Washington is blessed with an abundance of low temperature geothermal resources. Unfortunately, the majority of the known resources were made ineligible for geothermal tax credit by what we feel was a very arbitrary decision by the Internal Revenue Service (IRS) to limit such credits to geothermal resources above 50°C (122°F).

I have been unable to find any scientific justification for such a temperature limitation from either a geologic or an engineering standpoint. In fact, the United States Geological Survey (USGS) has recently completed a survey of low temperature (less than 90°C) geothermal systems (Open File Report 83-250). The lower limit chosen for that study was 10°C above mean annual ambient temperature. However, the USGS states that their lower temperature limit excluded from consideration an enormous quantity of shallow groundwater from which thermal energy can be extracted and which has a temperature of from 5° to 10°C above mean annual air temperature. The Geothermal Resource and Energy Committee (E-45) of the American Society of Testing and Materials (ASTM) has proposed a definition for geothermal energy to cover the use of earth temperatures as low as 38°F.

The non-availability of geothermal tax credits for geothermal resources below 50°C has been and continues to be a serious impediment to the full utilization of this very abundant, technically practical indigenous energy resource.

In support of this legislation, I would like to present the committee with information concerning 1) the geothermal resource base below 50°C (122°F), 2) direct applications of

geothermal energy below 50°C, 3) the technical and economic advantages of peaking, and 4) the use of geothermal water source heat pumps for industrial and district heating systems.

#### Resource Base

The USGS has recently completed a very detailed analysis of all known low temperature geothermal resource systems in the United States.

The findings of this study are extremely relevant to the issues before the committee today, and I have selected data from a number of states to demonstrate the inequity of not allowing tax credits for geothermal resources below 50°C.

In Washington State, 82.6 percent of the identified geothermal resource sites below 90°C have temperatures below 50°C. In Oregon the percentage is 79.9; in Idaho 75.8 percent; in Wyoming 63.3 percent; and in Virginia the percentage of sites under 50°C is 100. The situation would not be changed dramatically if the temperature cut-off was changed to 40°C (104°F) as is recommended by S.1305. In fact, 65.2 percent of the identified sites in Washington would still be excluded as would 67.3 percent in Oregon, 53.6 percent in Idaho, 51.5 percent in Wyoming; and 90 percent in Virginia.

Mr. Chairman, on a national basis the USGS estimates that 5,496 Mwt of beneficial heat is available from known geothermal resource sites below 50°C. Continued exploration is expected to double this amount. The actual displacement of fossil fuels could easily be 3 to 5 times that amount if the use of water source heat pumps is considered.

#### Direct Utilization

The direct utilization of geothermal resources can supply a large portion of our energy needs for industrial processing, commercial and residential heating, and agriculture and aquaculture. Appendix I is a summary of some of the more common direct applications of geothermal energy. I would like to draw the committee's attention to the dashed vertical line which I have drawn through the figure. As can be seen, many of the applications do not require temperatures in excess of 50°C.

In addition to the applications found in Appendix I, the use of 20-25°C geothermal resources for space heating is becoming ever more common. Most of these space heating applications utilize radiant floor or ceiling panels and technology developed for the solar industry.

### The Advantages of Peaking

Although in a majority of geothermal applications 100 percent of the total energy demand is met by the geothermal resource, it is often preferable to meet only base load demand with geothermal and rely upon boosting with another resource to meet peak demand. The use of such hybrid systems is especially common in applications that have substantial peak heat demands, such as district heating systems. The exclusion from tax credit eligibility of any system when the total energy demand is not met by geothermal has severely limited development of the most technically efficient and cost-effective systems.

The use of peaking is not restricted to systems utilizing very low temperatures but is common even where resources in the 80-100°C range are available.

In order to better demonstrate the technical and economic advantages of peaking, I made two runs on a recently completed computer model designed to determine the feasibility of district heating. In the first case, a 50°C resource located 15 miles from Yakima, Washington, was to meet the total energy demand of a district heating system. In the second case, the top 50 percent of the peaking curve was to be met through the use of a fossil fuel peaking boiler. The economic comparison is seen in Table 1.

TABLE 1  
District Heating Capital Cost Comparisons

<u>Main System Components</u>	<u>Costs Without Peaking</u>	<u>Costs With Peaking</u>	<u>% Savings</u>
Wells	\$ 20.8 million	\$ 10.4 million	50%
Main Transmission Line	\$ 63.4 million	\$ 44.7 million	30%
Distribution Line	\$110.9 million	\$100.8 million	09%
<b>TOTALS</b>	<b>\$195.1 million</b>	<b>\$155.9 million</b>	<b>20%</b>

In case two, although 50 percent of the peak is met through the use of the fossil fuel fired boiler, only 5 percent of the total energy demand is provided by the peaking boiler.

The main technical advantage of using a peaking boiler is a reduction in the required number of wells by approximately 50 percent and a proportionate reduction in the size of the main transmission line. Distribution lines are also reduced in size but technical advantages are minimal.

In Reykjavik, Iceland where better than 98 percent of the city's 385 MW of total heat demand is provided through a geothermal district heating system, approximately 50 percent of peak demand is met through the use of storage tanks and a 25 MW fossil fuel boiler. The peaking plant, however, provides only 10 percent of the total energy provided on a yearly basis.

A district system in Paris, France, utilizes both heat pumps and a peaking boiler (Appendix II). As can be seen from the figure, 63 percent of the total energy is provided directly by geothermal, 31 percent through the use of the geothermal heat pump system and 6 percent of the total energy is provided by a peaking boiler. As with the Yakima model and the Reykjavik system, approximately 50 percent of the peak demand is provided through the use of a boiler.

The provisions of S.1237 which relate to the use of hybrid systems would make available geothermal tax credits to the developers of such systems.

#### **Water Source Heat Pumps**

The boosting of geothermal water temperature through the use of water source heat pumps can substantially increase the usable geothermal resource base available to meet increasing energy demand.

Geothermal water temperatures as low as 4°C (38°F) can be successfully boosted to temperatures as high as 80°C. Even at such low temperatures as 4°C water source heat pumps have proven to be extremely efficient and can reduce energy consumption and energy cost by as much as two-thirds.

C-R8-7

The use of higher temperature geothermal resources (20°C or above) can result in energy savings as high as 85 percent in comparison to conventional systems.

Although the use of water source heat pumps is most often thought of in terms of the space heating of residential and commercial buildings, large scale units are now available for use in district heating systems or to meet a wide range of industrial and agricultural applications.

The Europeans and especially the Scandinavians have been a leader in the manufacture and utilization of extremely large water source heat pumps. Sweden has installed a total of 86 MW of district heating over the past two years utilizing large electric driven water source heat pumps and an additional 105 MW will be on-line by December of 1983. Another 150 MW will be put on-line in Stockholm during the next 3-5 years. These systems, which range in size from 11 to 40 MW, utilize a wide array of water sources including municipal wastewater, sea water, lake water, and low temperature geothermal waters. Energy savings from these installations average better than 60 percent.

Although the most common prime mover for water source heat pumps is electricity, diesel engines, dual fuel engines, gas engines, gas turbines, as well as steam turbines utilizing oil or fluidized bed coal firing can be used to advantage in many applications and must be given equal consideration. In Frederikeshavn, Denmark, a 10 MW diesel driven water source heat pump has been supplying heat to a district heating net since 1980.

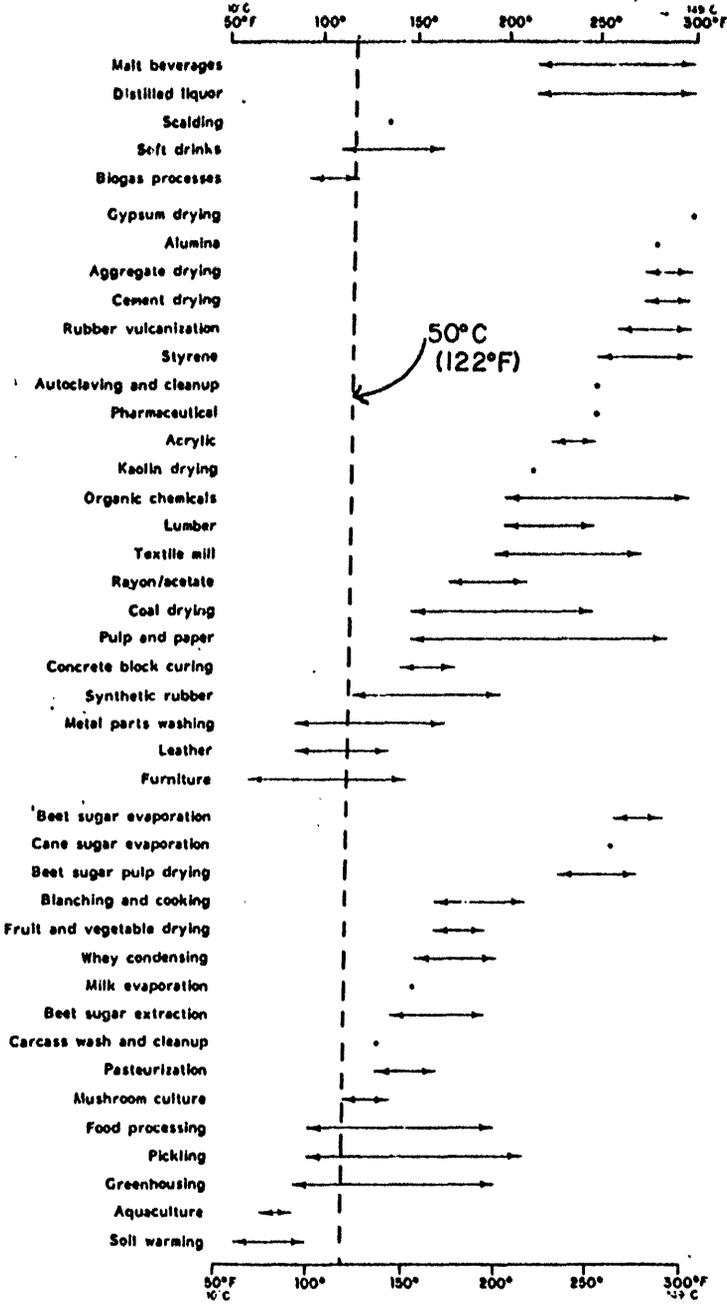
The use of large geothermal water source heat pumps for district heating in the United States could result in substantial energy savings. The nation's first such system was dedicated in Ephrata, Washington by Governor John Spellman in January of 1983. Although unique today, the Ephrata system could be replicated in numerous cities across the country. A preliminary study of eight western states has, in fact, identified 375 cities with low temperature geothermal resources available within five miles of town and such low temperature geothermal resources are available throughout the United States. We urge the committee to make geothermal tax credits available to developers of geothermal water source heat pump systems.

#### Conclusion

Mr. Chairman. The passage of S.1237 is vital. Internal Revenue Service limitations affecting geothermal tax credits have severely impeded the development of low temperature geothermal resources as well as the most technically efficient and cost-effective development of this nation's high temperature geothermal resources.

Thank you, Mr. Chairman, I would be pleased to answer questions.

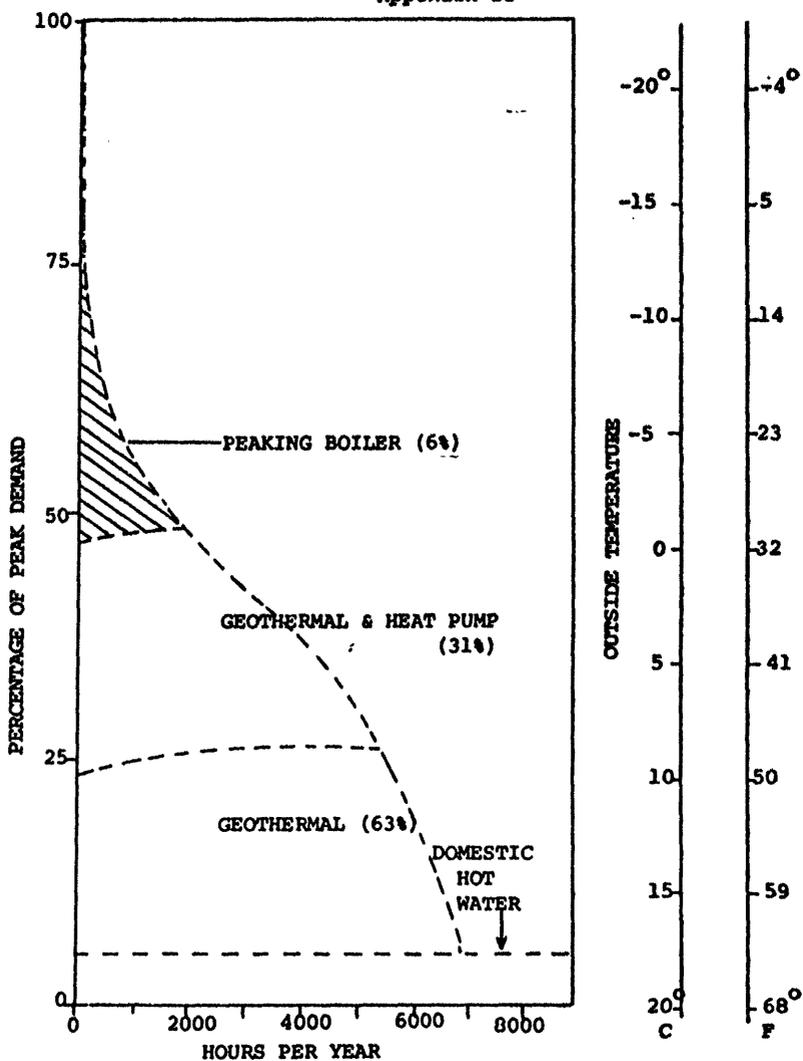
Appendix I



TEMPERATURES REQUIRED FOR VARIOUS DIRECT GEOTHERMAL APPLICATIONS

(Bloomquist, 1980)

Appendix II



(Lienau, 1981)

Geothermal City Heat Load Duration Curve

Senator WALLOP. I didn't catch your name, sir. I'm sorry.

Mr. DUDICK. My name is Joseph Dudick. I'm director of public affairs of the Pennsylvania Rural Electric Association. I can present Mr. Matson's comments. He was unavoidably detained at another meeting this morning.

We do not have a prepared statement, but if there is no objection, we would like to present one for the record of this hearing.

Senator WALLOP. By all means.

#### STATEMENT OF JOSEPH DUDICK, PENNSYLVANIA RURAL ELECTRIC ASSOCIATION

Mr. DUDICK. The Pennsylvania Rural Electric Association and its sister organization, the Allegheny Electric Cooperative, represent the interest of over 600,000 people who are served by rural electric cooperatives in Pennsylvania and New Jersey. We serve people in 43 of the Commonwealth's 67 counties.

As a consumer owned and controlled organization, we are always interested in researching energy technologies that would be helpful in reducing consumers' energy costs. Allegheny Electric Cooperative is currently involved with two ground water heat pump research projects in conjunction with the Electric Power Research Institute, and the University of Pittsburgh.

The first of these projects is designed to study the impact of ground water heat pump installations on rural electric systems. The importance to us is that these systems do not require any backup, so that in the coldest days of the winter when many new, alternate type heating systems do require backup, ground water heat pumps do not add to the peak demand that we see in our systems.

The second research projects deals with what is known as a closed loop system, which expands the utilization of this kind of technology to virtually every area of the country, including those areas that have very little water reserves.

The system uses a closed loop system and reprocesses the water that is available when the system is initially charged.

Mr. Chairman, we see several reasons why the legislation before you today should be expeditiously and positively considered.

First, ground water heat pumps can help consumers reduce their heating costs. In the studies that we have seen thus far, consumers who switch from oil to ground water heat pumps can save anywhere from two-thirds to three-quarters of the current energy costs they have for heating their homes.

Second, ground water heat pumps represent an alternative to the use of oil and natural gas. And by providing this type of conversion, we are fulfilling our national energy policy.

Third, although ground water heat pumps do provide significant benefits to consumers the tax benefits are needed for two reasons. First, it is a new technology, and a technology that is alien to most people. And, second, people whose existing heating systems currently are workable need an extra boost to cause them to convert from that system to a ground water system.

The fourth reason we support the enactment of this legislation is that we believe extending these tax credits completes the job that

Congress began when it did extend tax credits to solar, wind, biomass, and other supplemental energy systems.

And, finally, we believe this legislation should be enacted because we believe it represents a matter of regional equity to the many parts of the country where solar, wind, and other systems are inappropriate to help meet the energy needs of the residents of those areas.

Mr. Chairman, I do have a copy of an educational pamphlet that we have produced for your use, and that of the committee

We do urge you to expeditiously consider this legislation, and appreciate the opportunity to appear before you today.

Senator WALLOP. Thank you very much. We will make that a part of the committee's records, rather than the committee report. But I appreciate it being here.

[The information from Mr. Dudick follows:]

## STATEMENT FOR THE RECORD

By:

William F. Matson, President  
Pennsylvania Rural Electric Association  
Allegheny Electric Cooperative, Inc.

My name is William F. Matson, I am the President of the Pennsylvania Rural Electric Association and its sister organization, Allegheny Electric Cooperative, Inc. My address is 212 Locust Street, Harrisburg, Pennsylvania 17108.

The Pennsylvania Rural Electric Association is a service organization that represents the 13 local, independent, nonprofit, consumer-owned rural electric cooperatives in Pennsylvania and the sole electric cooperative in New Jersey. Allegheny is a generation and transmission cooperative that serves as the wholesale power supplier for the 14 rural utility systems that are members of the Pennsylvania Rural Electric Association.

I am pleased to appear here today on behalf of the nation's almost 1,000 rural electric cooperatives. Electric cooperatives provide service to almost 75 percent of the landmass of the United States. I am here to endorse S. 1237 and its companion legislation, H. R. 2927. This legislation would clarify the U.S. Tax Code to permit federal energy tax credits to be extended to groundwater heat pumps. I commend you, Mr. Chairman, for calling this hearing and, on behalf of the almost ten million farms and rural households that are served by this nation's rural electric systems, I express our appreciation for your interest in this forward looking legislation.

As nonprofit, consumer-owned electric utilities, rural electric cooperatives are always looking for new ways by which consumers can meet their space heating and cooling needs more efficiently and with greater cost effectiveness. This is why we are so interested in groundwater heat pumps. This is why we support legislation that would clarify the definition of "geothermal" so as to include groundwater heat pumps among those technologies that qualify for federal energy tax credits.

Pennsylvania's rural electric cooperatives have more than just a passing interest in groundwater heat pumps. We are currently engaged in two major groundwater heat pump research projects in conjunction with the Electric Power Research Institute and the University of Pittsburgh.

The first research project involves conventional groundwater heat pump installations. In this project, we are monitoring the performance of these systems to evaluate their impact on electric utility systems, especially rural electric systems. From a utility standpoint, we are interested in groundwater heat pumps because they are able to replace oil-fired systems without requiring back-up systems such as those required by air-to-air heat pumps, solar energy systems and many other technologies. In addition, we are attempting to validate manufacturer's claims of efficiency.

The second research project involves a closed-loop system. It is our hope that this type of system will be applicable in

areas of limited water supply. The heat pump technology is the same, but, instead of drawing a continuous supply of water from a well, water is recirculated through a closed-loop piping arrangement.

There are several reasons why we believe the Tax Code should be modified to extend the current program of energy tax credits to groundwater heat pumps.

First, groundwater heat pumps can help reduce consumers' heating costs. A consumer living in a typical rural home will be able to save between \$300 and \$700 annually on heating costs when converting from an oil-fired heating system to a groundwater heat pump. This figure is based on oil costing \$1.15 a gallon and electricity costing \$0.07 per kilowatt-hour. Typical groundwater heat pump systems pay for themselves in three to five years of operation and some systems are capable of producing summer air cooling with very significant operating costs.

Second, groundwater heat pumps provide consumers with an alternate space heating "fuel" to oil. As a result, groundwater heat pumps allow consumers to contribute to our stated national goal of decreasing our dependence on petroleum, especially imported petroleum.

Third, although groundwater heat pumps provide significant benefits to consumers, tax credits are desirable for a couple of reasons: One, because groundwater heat pumps are a new, foreign technology to most people. And two, because consumers with heating systems that still have a useful life require additional incentives to replace those systems.

Fourth, by extending tax credits to groundwater heat pumps, Congress will complete the job it began when it provided tax credits for wind, solar, biomass, and other new energy technologies.

Fifth, extending tax credits to groundwater heat pumps would be an act of regional equity for the many areas of the country where wind, solar, and other similar supplemental energy systems are inappropriate.

Sixth, extending tax credits to groundwater heat pumps will create new jobs. An increased level of installation of groundwater heat pumps will produce new manufacturing jobs and will also produce new jobs at the local level for installers, sales people, and service men.

Seventh, an increased use of groundwater heat pumps, especially with a fossil fuel back-up, will help electric utilities better deal with peak demands for electricity. Groundwater heat pumps operate very efficiently and provide utilities with an excellent load factor. In addition, groundwater heat pumps that are retrofitted

to existing oil-fired heating systems where the existing system is left in place provide utilities with excellent opportunities for load control. At times of high electricity usage, a radio signal can be sent to groundwater heat pumps instructing them to shut down and to switch over to the oil-fired system in order to eliminate unwanted peaks.

Eighth, in many older homes, the installation of groundwater heat pumps represents as good as if not a better an investment than weatherization. Older homes, especially large older rural homes are extremely expensive to weatherize. In such cases, an investment in a more efficient heating system represents a better choice for consumers.

Ninth, it is discriminatory to view only water sources at 110 degrees and higher as "geothermal," and thereby eligible for energy tax credits. Groundwater heat pumps do exactly what "geothermal" devices do: they extract heat from a supply of water and convert it into a useful form.

Tenth, groundwater heat pumps are, in effect, a solar energy technology. It is discriminatory to view the earth as any less a solar collector than man-made solar collectors. Through the use of groundwater heat pumps, the earth becomes a larger, more efficient, and less expensive solar collector than any man-made solar systems using man-made solar collectors. The earth provides a steady state water temperature which can be used efficiently all year as a source for heating and cooling of living space as well as domestic hot water. Because groundwater heat pump equipment is installed inside the home and not exposed to the elements, it usually will have a longer, more maintenance free life than solar collectors that are exposed to the sun and weather.

For these reasons, Mr. Chairman, we support the legislation currently before this Committee which would extend tax credits to groundwater heat pumps, S. 1237 and H. R. 2927. We commend you for your interest in this forward looking legislation and appreciate this opportunity to speak on behalf of it.

Senator WALLOP. It's an interesting panel.

Mr. Cleveland, in your testimony, as I understood it, you were saying that the installation of a geothermal heat pump might save as much as \$600 a year. You said that the initial cost was much greater than a conventional heat pump. How much greater?

Mr. CLEVELAND. I'd say that some of the other gentlemen may answer this better than I since they are in this business, but I would say you are looking at \$2,000 to \$3,000 more for a complete geothermal system versus an air-to-air heat pump that might be installed.

Mr. AMSTERDAM. The cost of a typical residential geothermal heating system would run between \$7,000 and \$8,000. And I believe a comparable quality air source heat pump would run around \$5,000.

Senator WALLOP. In terms of things if the savings is that, it depends on where you are and what your energy costs. But if the savings is \$600 a year, that's not a bad investment.

Mr. AMSTERDAM. No. In fact, I think that Mr. Cleveland's figures are rather conservative. Our experience has been that, of course, the saving is based on what the alternate fuel is. Those who were heating with oil would save more than the equivalent with natural gas. But I think the savings are greater, the payback is even quicker, but the credit, of course, helps the average person over that indecision, that fear of the unknown, even though the economics without the credit have some merit by themselves.

Senator WALLOP. I guess the point which we always have to make in viewing these things and trying to justify energy tax credits is that the technology would not go ahead without the credits, or would go ahead so slowly as to be not in the national interest. Given the efficiency of the use of geothermal energy as you have described with much lower temperatures than IRS has around, would it be your opinion that the technology cannot make significant energy contribution without the credit?

Mr. AMSTERDAM. No. I strongly agree with that statement. From my own experience in the industry, we are seeing a lack of the large sophisticated companies that manufacture heating equipment—their participation because they see the lack of market. Those people that are buying them at current represent probably richer than average, smarter than average, more desires of new things. If I can use the illustration of digital watches. They first came on the market at \$400 or \$500. Many people picked them up at \$295, which is when I got mine. And now everybody has them, and they are \$29. And I think that very similarly often people with more money are in the leadership. To move the market to a large proportion where it can do some good and save some energy and put some people to work, the credit is necessary, both from a motivational point of view for the public and in most cases strictly economical point of view.

Mr. CLEVELAND. Mr. Chairman, I would agree with him that this is true. We find we have a program, as we have described in our paper, of an incentive to get people to put in heat pumps, both air and ground water. We've now given them the incentive—this program has been going on about 6 months. We have now given an

incentive to about 40 consumers. About half of those were ground water heat pumps.

But I think you would have to say that none of the major manufacturers—not naming names this morning—names that you associate with the air to air heat pump business, normal manufacturers of gas furnaces, et cetera, are in this business on a commercial basis. Most of the commercial people that are in the business are like the previous speaker who had gone into the business—they are small companies that are getting started. And the reason, of course, the large companies are not there is they have not yet seen this as a market, or for their benefit, a bottom line that will help them.

So as a result, I would say the public has not received this with open arms. And it is exactly what he is saying as far as the more sophisticated buyer, more sophisticated person with funds, are the people that are installing these on their homes today. And I can say that for a fact.

Senator WALLOP. Well, I must say it has been my experience around here that big companies, like big governments, are not immune from bureaucratic initiative. They like what they are doing; it's easy; make somebody else change it.

Mr. DUDICK. Mr. Chairman, we have seen the same situation in Pennsylvania. We are almost 4 years now. We've had a very aggressive public education program to promote this technology. And many people, and I'm sure because of the fact that they've heard bad stories about people who have used wind or solar systems which are really not that conducive in most areas of our State—because of those stories and fears and concerns, most people are hesitant to move forward with this type of system even though the benefits of the system are presented to them.

Senator WALLOP. Dr. Bloomquist, is this heat transfer process both for heating and cooling?

Dr. BLOOMQUIST. Yes. Most of the systems are using heating and cooling. In fact, the one in Ephrata that I spoke of is providing all the cooling and heating for the courthouse there.

You asked me about the energy savings in that system. Their energy bills have been running somewhere between \$14,000 and \$20,000 per year. The first year's bill calculated—well, we haven't had a full year yet. We anticipate that it will be somewhere around \$14,000.

Senator WALLOP. It wouldn't take much of that to persuade me.

Mr. AMSTERDAM. If I might, Mr. Chairman. I think another aspect of this bill is that by its very exclusion it tends to impart to people who view that their government has evaluated the technology substantially compared to the others that credits are offered, and finds it invalid. There is a certain invalidation process.

Senator WALLOP. I think that's an invalid conclusion as well because there are a variety of things which do and do not get included in tax measures. If you watch this outfit at work when tax time comes around, tax bills going through, there's very little reason attached to why some things go on and other things don't. Much has to do with the energy of proponents. And sometimes even more than their energy, their position.

**Mr. AMSTERDAM.** I agree. I simply was reflecting the experience of watching the consumers come through our store, if you will, and look at—contemplating buying the product. They look at it, and they need a push. Given the push, they will respond with great vigor. There's a certain angular about the land, about fuel prices; particularly, in those areas where gas prices have escalated dramatically. And they are looking for alternatives, and they simply need some guidance and a push.

**Senator WALLOP.** Mr. Hutchison, the problem that you described in that no portion of your rather interesting energy property, which is not used exclusively for geothermal, will qualify for the energy tax credit is one which we confront in here and have experienced with a number of the other credits in the legislation that we have passed. Is it your opinion that the disallowance of that credit would stop your project from going ahead?

**Mr. HUTCHISON.** Senator, I'm not fully aware of all of the different financing mechanisms that GeoProducts is examining for their plant. There are some, such as State bond financing and others, that might go ahead without the credits. At the present time, the private financing alternatives they are exploring are very much contingent upon getting this issue resolved. It is a big deal. The turbine-generator is the most expensive component of the binary geothermal subsystem.

What is so frustrating for them is that the binary geothermal unit which they plan to purchase is a skid-mounted unit, which can be moved onto geothermal sites throughout the country, most of those sites, to produce cost effective power. Hooking the binary unit up in conjunction with a wood-fired plant, as GeoProducts plans to do, will allow for the production of power from water that is only 250° Fahrenheit in temperature.

GeoProducts is very frustrated that a piece of equipment that anywhere else would qualify for the geothermal credit, wouldn't qualify for the credit at their plant site. They are very frustrated by that point.

**Senator WALLOP.** I can understand that. Well, I thank you all for your presence here this morning.

Next is a panel of Mr. Michael Sedmok, Booze-Allen & Hamilton, Bethesda, on behalf of the Solar Energy Industries; Dr. Edward Blum, vice president, Merrill Lynch White Weld Capital Markets Group; Mr. Philip Huyck, financial consultant of the First Boston Corp. And Mr. Conway.

Gentlemen, welcome. Mr. Conway, please begin.

**Mr. CONWAY.** Thank you.

#### **STATEMENT OF JACK CONWAY, CHAIRMAN, RENEWABLE ENERGY INSTITUTE, WASHINGTON, D.C.**

**Mr. CONWAY.** Mr. Chairman, in the spirit of your opening statement, which I found very impressive, we welcome this opportunity to assemble these two panels to support S. 1305 on the need for extending and improving the renewable energy tax credits.

These two panels that have been assembled, we think you will receive a number of important perspectives on the credits themselves, and on the proposed legislation. This panel will address the

financial community perspective as well as to present a report from Booze-Allen & Hamilton on the overall implications of the tax credits.

And the second panel will describe in more specific terms the relationships of the credits to the different technologies.

I want to start by referring to a very important forum that was recently held, a month ago, on the whole renewable energy area. It was an impressive forum in the sense that it drew together very senior executives and institutional leaders from a variety of sectors, including major energy companies, energy consumers, financial institutions, utilities, regulators, the construction-building sector, and public interest spokesmen. I believe you have a copy of the preparatory materials that were put together for that forum.

It was chaired by Robert O. Andersen, the chairman of Atlantic Richfield. His observations, to me, at the conclusion of the forum was that the briefing papers in that book were very impressive and substantial; that the group assembled was an extraordinary group; and that we really had an obligation to follow through, and to do what you have suggested needed being done in your opening remarks, which is to build a case for the extension and the improvement of these tax credits in order to facilitate the development of these renewable energy industries.

We were struck by the fact that the people of stature who attended the forum were willing to devote 2 full days on the subject of renewable energy. Their willingness to do so helped demonstrate that the development of these technologies is viewed by private sector leaders as a serious and important matter.

I am pointing out all of this because I think it helps set the context for your consideration of the energy tax credit legislation. The tax credit issue should not turn simply on the costs and/or the positive returns to the Treasury that can be attributed to the credits.

The policy objectives that stand behind the original enactment of the credits need to be kept in mind. The discussion at the forum certainly helped reaffirm to us the fact that these policy objectives are just as valid today as when the credits were originally enacted in 1978 and 1980: Enhancing national security by lessening foreign dependency, improving energy availability for economic growth, assisting environmental protection and management of depleted resources, helping establish equitable treatment for an emerging new growth industry within the largely nonfree energy market. These are among the policy concepts on which the energy credits rest. And all of these policy objectives emerged as continued, important concerns in the discussion of the forum participants.

It's equally apparent that a sense of market and policy stability must first exist so that a solid foothold of commercial development can be established. Much of this industry is literally facing a stalling point. The cause of the threatened stall is a combination of the sudden swing downward in oil prices, the withdrawal of most Government program support, the erosion of the effectiveness of the existing tax credits, and now the approaching termination of the credits.

This stall is critical. And it's in this context that we make our presentations here today.

With Government support programs virtually dismantled, the targeted energy tax credits have taken on an almost total responsibility for moving these technologies forward. Legitimate questions can be asked as to whether the tax credits are by default expected to perform more of a technology pull role for some of the less commercially ready technologies than can reasonably be expected.

As was stated by a participant in the forum, capital markets are brutally neutral. If we want to rely on the private capital market to finance the commercialization of new energy sources, it simply is going to require some special incentives until investors are more comfortable working both with these technologies and the energy market.

Two other points regarding tax credits evoked considerable attention at the forum, which I would like to describe to the committee. Both point to limitations in the effectiveness of the existing tax credits, and lead to arguments for improving and extending the credits in order to let them achieve their intended objective.

The first has to do with stability. If there is anything that the financial markets require, it is stability or at least predictability. The energy tax credits have been wracked with policy instability during their short life, and you have referred to this. Attached to this statement I have a brief fact sheet itemizing some of the major problems, each of which has had an important negative impact on the efforts to finance renewable energy projects.

The second point I would like to make is the rates to the utility industry. Unquestionably, utilities have a key role to play in renewable energy development. A few utilities have been very active in the past years in integrating a variety of renewable energy electric generation technologies into the grid system. Southern California Edison, from whom you will hear today, has been one of the pioneers in this. And there is a great opportunity for a dramatic extension of renewable energy activity by utilities in many parts of the Nation. The utilities faced a host of difficulties, ranging from financial and low management strains, to environmental problems, which makes both decentralized and centralized renewable energy power production increasingly logical.

Under the current tax law, however, utilities are not eligible for the energy credits. Nor can they depreciate renewable energy property on the accelerated schedule that can be taken by nonutility investors.

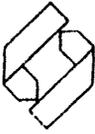
As a result, utilities are discouraged from putting their money behind renewable energy projects or at least not encouraged to do so.

And I would like, in my concluding point, to ask that you give serious consideration that needs to be given to the question of whether denial of renewable energy tax credits to utilities is in sound public policy. If the goal of the energy investment credits is to unlock private capital for the commercializing of emerging renewable technologies, it may well be illogical to deny the credits to the sector which could be one of the most important forces in achieving our goal.

Thank you, Mr. Chairman. And I think the other members of the panel will pick up now and address other questions.

Senator WALLOP. Thank you, Mr. Conway.

[The prepared statement of Mr. Conway follows:]



**Renewable Energy Institute**

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Statement of

Jack Conway  
Chairman  
Renewable Energy Institute

on S.1305  
Renewable Energy Tax Incentive Act of 1983

before the  
Subcommittee on Energy and Agricultural Taxation  
Senate Finance Committee

July 18, 1983

I am pleased to have this opportunity to present comments on behalf of the Renewable Energy Institute regarding renewable energy tax credit legislation.

The Renewable Energy Institute is a publicly supported, non-profit organization. The Institute was founded in 1980 to conduct research, education and information activities related to policy matters affecting the development and commercialization of renewable energy. REI places a high emphasis upon serving as a vehicle through which decision makers in the energy and non-energy sectors can be brought together to look forward several years. The objective is to be ready for the renewable technologies as they develop and become increasing viable commercially. By working with a broad range of decision-makers, REI attempts to identify areas in which policies or programs need to be revised or put into place so that the regulatory and institutional environment which so strongly influences the energy market will be able to accommodate the renewable technologies.

#### 1983 Renewable Energy Forum

Last month the Institute convened the 1983 Renewable Energy Forum. The discussions that took place in the Forum have important bearing on the extension and enhancement of renewable energy tax credits, as proposed in S.1305. I would like to relate to the Committee some of the significant points that emerged from the program.

The Forum was chaired by Robert O. Anderson, Chairman of Atlantic Richfield. It drew together a select group of very senior executives and institutional leaders from a variety of sectors, including major energy companies, energy consumers, financial institutions, utilities, regulators, the construction building sector, and public interest spokesmen. Never before has such an influential group, representing such a broad range of interests, been brought together to focus its attention and collective talents on renewable energy. While the renewable energy industry has necessarily had its attention riveted for the past several years on immediate marketplace survival issues such as tax credits, the Forum offered an opportunity to look somewhat beyond the current battles. It was a chance to look at the broader question of what it takes for the set of emerging renewable energy technologies to enter the energy market.

It is significant that this meeting even occurred. We were struck by the fact that people of the stature who attended the Forum were willing to devote two days to the subject of renewable energy. Their willingness to do so helped demonstrate anew that development of these technologies is viewed by private sector leaders as a serious and important matter.

I am pointing out all of this because I think it helps set the context for your consideration of the energy tax credit legislation. The tax credit issue should not turn simply on the costs and/or the positive returns to the Treasury that can be attributed to the credits.

### Policy Objectives for Tax Credits

Policy objectives that stand behind the original enactment of the credits need to be kept in mind. The discussion at the Forum certainly helped reaffirm to us the fact that these policy objectives are just as valid today as when the credits were originally enacted in 1978 and 1980.

Enhancing national security by lessening foreign dependency; improving energy availability for economic growth; assisting environmental protection and the management of depletable resources; helping establish equitable treatment for an emerging new growth industry within the largely non-free energy market — these are among the policy concepts upon which the energy credits rest. All of these policy objectives emerged as continued important concerns in the discussion of the Forum participants.

It became clear through the Renewable Energy Forum that as these new energy technologies advance in the market, there are many important questions on policies, programs, and institutional roles that must continue to be addressed. The areas of these concerns range widely, including utility regulatory issues, buildings industry practices, and international marketing development.

### Immediate Importance of Tax Credits

It is equally apparent that a sense of market and policy stability must first exist so that a solid foothold of commercial development can be established. There is little doubt that renewable energy will ultimately be a major force in energy supply—certainly there was no doubt expressed among the Forum participants. But as will be described in some detail today by the statements of the industry trade associations, the witnesses from the financial community, much of this industry is literally facing a stalling point. The cause of the threatened stall is a combination of the sudden swing downward in oil prices, the withdrawal of most government program support, the erosion of the effectiveness of the existing tax credits, and now the approaching termination of the credits.

If the extension of the tax credits remain under a cloud of uncertainty, the development of many renewable energy projects will be placed on hold. If the credits disappear, the nation will face a certain hiatus in development of the technologies, at least until the next crunch occurs in oil prices or supply. The result would be costly to the nation from a number of perspectives. Among the costs: the dismantlement of much of the renewables industry in which the government has invested considerable public funds to develop; the inevitable need to re-spend funds to quickly revive the industry in the aftermath of some future energy shock; and the costly discarding of leadership in developing these technologies in the world market.

With government support programs virtually dismantled, the targeted energy tax credits have taken on almost total responsibility for moving the technologies forward. Legitimate questions can be asked as to whether the tax credits are, by default, expected to perform more of a technology-pull role for some of the less commercially ready technologies than can

reasonably be expected. Regardless of the answer to those questions, it is abundantly clear that we face a situation in which tax credits are the most appropriate policy vehicle for the stage which many of the technologies have reached, and for some other technologies, there simply is no other policy support available.

Special, targeted tax credits for renewable energy can be justified on the basis of helping meet the national need of developing alternative energy sources. They also can be justified because of the extraordinary risks investors face in supporting these technologies. The technologies are new and, in the eyes of investors, without well demonstrated performance records. This is exacerbated by the characteristic of the projects often being one-of-a-kind facilities, tailored to local needs and resources. Moreover, the market in which the investor is being asked to enter, the energy market, is foreign and frighteningly complex to most investors. The energy market is intricately regulated, often monopolistic, and subject to unpredictable international supply and price disruption.

As was stated by a participant in the Forum, the capital markets are brutally neutral. If we want to rely on the private capital market to finance the commercialization of new energy sources, it simply is going to require some special incentives until investors are far more comfortable working both with these technologies and the energy market.

#### Need for Policy Stability and Consideration of Applying Credits to Utilities

Two other points regarding tax credits evoked considerable attention at the Forum, which I would like to describe to the Committee. Both point to limitations in the effectiveness of the existing tax credits, and lead to arguments for improving and extending the credits in order to let them achieve their intended objective.

The first has to do with stability. If there is anything that the financial market requires, it is stability, or at least predictability. The energy tax credits have been wracked with policy instability during their short life. Attached to this statement is a brief fact sheet itemizing some of the major problems, each of which has had an important negative impact in the efforts to finance renewable energy projects.

The items lending a sense of instability include attempts that have occurred to the repeal the credits, weakening of the credits through provisions in last year's Tax Equity and Fiscal Responsibility Act (TEFRA), and, now, the scheduled termination of the credits. In order to give the industry the stable and supportive tax environment it needs to get started, credits need to be in place a number of years beyond 1985, and to be placed at levels that can make up for some of the weakening that has occurred in them.

The second point relates to the utility industry. Unquestionably, utilities have a key role to play in renewable energy development. A few utilities have been very active in the past several years in integrating a variety of renewable energy electric generation technologies into the grid system. Southern California Edison, from whom you will hear today, has

been one of pioneers in this. There is great opportunity for dramatic expansion of renewable energy activity by utilities in many parts of the nation. The utilities face a host of difficulties, ranging from financial and load management strains to environmental problems, which make decentralized and centralized renewable energy power production increasing logical.

Utilities are important for growth in the use of renewable energy systems not only because they serve as a potential high volume market for both systems and power output, but also because they potentially represent a powerful investment partner in financing renewable energy projects.

Under current tax law, however, utilities are not eligible for the energy credits, nor can they depreciate renewable energy property on the accelerated schedule that can be taken by non-utility investors. As a result, utilities are discouraged from putting their money behind renewable energy projects, or at least not encouraged to do so. Moreover, because utility investments in renewable projects are more "expensive" in that they do not receive the same preferences of non-utility investors, even limited equity participation by a utility in a project can lessen the project's financial attractiveness.

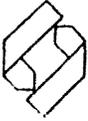
Serious consideration needs to be given to the question of whether denial of renewable energy tax credits to utilities is sound public policy. If the goal of the energy investment credits is to unlock private capital for the commercialization of emerging renewable technologies, it may well be illogical to deny the credits to the sector which could be one of the most important forces in achieving the goal.

#### Breadth of Coverage Under S.1305

Finally, I would like to point to the importance of the breadth of scope in S. 1305. This proposed legislation covers all renewable energy technologies, and, with the possible exception of applicability to utilities, provides the full range of their major tax policy needs -- extension of the credits for five years, catch-up enhancement for some technologies, and an affirmative commitments procedure for projects begun, but not completed, before termination of the credits.

It is important to establish now a firm, supportive environment for all these technologies. It is impossible, or certainly impractical, to try to determine if some of the technologies need a little bit more or a little bit less support. The rapporteur for the Renewable Energy Forum, Dr. Alan Hammond, Editor of Science '83 posed the situation succinctly: "Either you adopt a policy of 'benign neglect' and let the market rule... Or you say that there are over-arching public reasons why that should not happen, why we should move this whole spectrum of technologies forward."

This country will certainly move towards greater reliance on renewable technologies because of both commercial and public policy interests. Some of those systems are technologically ready, and movement has begun. But few of the technologies are commercially able to be nurtured without public policy support for now, and for a stable period of several years. Enactment of an extension and improvement of the credits would allow the industry the firm start it needs.



## Renewable Energy Institute

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### WEAKENING OF EXISTING TAX INCENTIVES

The Windfall Profits Tax Act of 1980 established the current set of renewable energy incentives. A number of factors, however, have lessened their value, and have created a serious problem of uncertainty in the marketplace:

- o Basis Adjustment: The renewable energy industry was significantly and adversely affected by the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). Through changes in the calculation of basis adjustment for depreciable property, the tax benefits available to renewable energy through energy investment credits and accelerated depreciation were reduced substantially. The reduction in benefits was equal in value to 20% of the investment credit and energy credit for renewable energy investments.
- o Repeal Attempts: The administration's several attempts to repeal the business energy credits in the past two years severely chilled the investment market and greatly reduced the credits' effectiveness.
- o Impending Termination: The investment market is being severely chilled once again, this time by the impending scheduled termination of credits. While the credits do not expire until 1985, the lead time required, especially for large industrial and utility-scale projects, is causing investors to turn away from major projects because of uncertainty that the credits will be in place upon completion of the projects. Current law does not provide for any "grandfathering" of renewable energy credits for projects that are completed after termination of the credits, even if the project was commenced well before termination of the credits.
- o IRS Delay: The extremely long period it has taken the IRS to issue rules and interpretations for the energy credits has diminished their effectiveness by causing investors to discount the value of the credits. For instance, no interpretation of the hydro credits has been issued to date even though they were enacted in 1980, and no interpretations were ever issued for the cogeneration credits, which expired in 1982.
- o Other Tax Code Changes: Other changes made in the Tax Code by recent legislation, such as "at risk" rules and the new alternative minimum tax, have diminished the impact of the credits on capital formation.

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These policy changes and uncertainties have contributed importantly to investors' reluctance to assume risks associated with financing these new technologies. It is felt by many, therefore, that the energy tax credits have not had a fair opportunity to test their effectiveness in stimulating the commercialization of renewable energy systems.

Senator WALLOP. Mr. Sedmak.

**STATEMENT OF MICHAEL SEDMAK, BOOZ-ALLEN & HAMILTON,  
BETHESDA, MD.**

Mr. SEDMAK. Thank you, Mr. Chairman. I'm Michael Sedmak from Booz-Allen & Hamilton. And I would like to briefly summarize the results of the study that Booz-Allen recently conducted on the impacts of expanded solar/wind tax credits similar to those contained in S. 1305 on the solar industry and on Treasury revenues in the 1985 through 1990 timeframe.

I have copies of the complete report, and its executive summary. I would like to have these entered into the record.

Senator WALLOP. What we will do is make them a part of the committee supporting files of the record.

Mr. SEDMAK. Thank you.

The major conclusion of our study is that the availability of solar/wind tax credits beyond 1985 is essential to the continued development of the solar industry. Furthermore, the long-term direct cost to the Treasury of the tax credits could be largely offset by the increased tax revenues that will occur in the business sector as solar system owners would no longer be able to take extensive conventional fuel tax deductions.

With regard to economic competitiveness, without Federal and State energy tax credits, are unexpectedly large increases in the cost of conventional fuels. Solar technologies will be uncompetitive except in small niche markets. Industry growth will be minimal at best. In fact, it is possible that most of the firms in the industry would find proper operation impossible without the tax credit at the current time.

Aided by Federal tax credits, however, a broader market is supportable today in areas of high solar and wind resources; particularly in the States that offer their own tax credits. Furthermore, the private sector in conjunction with the Federal R&D program can be expected to develop improved solar and wind technologies. A number of these technologies will begin to become competitive and self-supporting on a national level by the end of the decade.

In particular, we feel that expanded Federal tax credits will encourage nationwide competitiveness by 1990 of wind technologies in the electric utility market, solar/thermal in the industrial market, and wind and solar/thermal in the residential market.

The expanded tax credits, along with continued Federal R&D support, should help solar/thermal and photovoltaic technologies in the electric utility market to become competitive in remote high cost markets. Eventually in the capital cost options and potential nationwide competitiveness in the post-1990 timeframe.

Continuation of the tax credits is, therefore, extremely important to the maintenance of a solar industry. Industry has the capability to quickly expand as Federal R&D produces better technology or if energy problems erupt.

Now if the market levels projected under an expanded tax credits are realized, a considerable savings on fossil fuel requirements could be obtained. We project as much as 33 million barrels of oil

per year by 1990, which is roughly 2 percent of anticipated national oil import requirements.

Concerning the Treasury impacts, since the cost of the solar business tax credit is offset by a reduction in conventional fuel expense, the present value of continuing the current tax credits through 1990 could be as low as \$100 million per year by 1990. That is the direct cost to the Treasury if continued tax credits could be almost completely offset by revenue gains in later years. The actual impact on the Treasury will, of course, be dependent on actual market conditions, level of the credits, and the mix of solar system purchases in the residential and business sectors.

In summary, continuing the tax credits for investment in solar/wind technologies would enhance financial attractiveness to consumers, thereby raising market penetration and supporting the development of improved technologies at lower costs, maintain the industrial base and related consumer confidence necessary for successful deployment of solar and wind technologies as they become cost effective without tax credit support, encourage investment in a labor-intensive industry with prospects for significant product export, and provide installed solar and wind energy capacity that is capable of replacing the equivalent of 33 million barrels of imported oil annually by 1990.

These benefits could be obtained at minimal present value cost to the Government. In addition, maintaining a small, viable industrial base complements Federal R&D efforts to develop future generations of solar/wind technologies.

Thank you.

Senator WALLOP. Thank you, Mr. Sedmak.

[The prepared statement of Mr. Sedmak follows.]

**BOOZ·ALLEN & HAMILTON INC.**

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Testimony to the  
Subcommittee on Energy and Agriculture Taxation  
Senate Finance Committee

on

The Impact of Federal Energy Tax Credits  
on Solar/Wind Technologies

by  
Dr. Michael R. Sedmak  
Booz·Allen & Hamilton Inc.

July 18, 1983

THE IMPACT OF FEDERAL ENERGY TAX CREDITS  
ON SOLAR/WIND TECHNOLOGIES

At the request of the Solar Energy Industries Association, the Renewable Energy Institute and the American Wind Energy Association, Booz, Allen & Hamilton Inc. recently performed a study of the impacts of expanded solar/wind tax credits on the solar industry, and on Treasury revenues, in the 1985-1990 time frame. The solar/wind applications that were analyzed are:

- . Wind-electric, solar thermal electric, and photovoltaics in the electric utility market
- . Solar thermal in the industrial market
- . Solar thermal and wind-electric in the residential market.

The tax credit impacts were estimated by combining analyses of the economic attractiveness of each system with information of the current status of each technology and estimates of future market potential.

The major conclusion of the study is that the availability of solar/wind tax credits beyond 1985 is essential to the continued development of the solar industry. Furthermore, the long term direct cost to the Treasury of the tax credits could be largely offset by the increased tax revenues that will result from the decrease in conventional fuel tax deductions available to solar system owners in the business sector.

Without Federal and state energy tax credits, or unexpectedly large increases in the cost of conventional fuels, solar technologies will remain uncompetitive except in certain small niche markets--early adopters and remote applications, for example--and industry growth will be minimal, at best. It is possible, in fact, that most of the firms in the industry would find profitable operation impossible without the tax credits.

Aided by Federal tax credits, a broader market is supportable today in areas of high solar and wind resources, particularly in states that offer their own tax credits. Furthermore, the private sector, in conjunction with the Federal R&D program, can be expected to develop improved solar and wind technologies. A number of these technologies will begin to become competitive and self-supporting on a national level by the end of the decade. In particular,

- Expanded federal tax credits will encourage nationwide competitiveness by 1990 of wind technologies in the electric utility market, solar thermal in the industrial market, and wind and solar thermal in the residential market
- With expanded tax credits, and continued Federal R&D support, solar thermal and photovoltaic technologies in the electric utility market should become competitive in remote, high-cost markets, eventually leading to capital cost reductions and potential nationwide competitiveness in the post 1990 timeframe.

Continuation of the tax credits is therefore extremely important to the maintenance of a core solar industry--an industry that has the capability to quickly expand as Federal R&D produces better technology, or if energy problems erupt.

Attainment of the market levels projected under an expanded tax credit scenario implies a considerable savings in fossil fuel requirements--up to 33 million barrels of oil per year by 1990, or roughly two percent of anticipated national oil import requirements. Furthermore, continued growth in the labor-intensive solar industry would provide significant employment opportunities by 1990.

Since the cost of a solar business tax credit is offset by a reduction in conventional fuel expense deductions, the present value of continuing the current tax credits through 1990 could be as low as \$100 million per year by 1990. That is, the direct cost to the Treasury of continued tax credits could be almost completely offset by revenue gains in later years. The actual impact on the Treasury will, of course, be dependent on actual market conditions.

In summary, continuing the tax credit for investment in solar/wind technologies would:

- Enhance their financial attractiveness to consumers, raising market penetration and supporting the development of improved technologies at lower cost
- Maintain the industrial base and related consumer confidence necessary for successful deployment of solar and wind technologies as they become cost effective without tax credit support
- Encourage investment in a labor-intensive industry with prospects for significant product export
- Provide installed solar and wind energy capacity that is capable of replacing the equivalent of 33 million barrels of imported oil annually by 1990.

These benefits could be obtained at minimal present value cost to the government due to increased future tax revenues that offset near-term costs. In addition, maintaining a small, viable industrial base complements Federal R&D efforts to develop future generations of solar/wind technologies.

**THE IMPACT OF FEDERAL ENERGY TAX  
CREDITS ON SOLAR/WIND TECHNOLOGIES**

**EXECUTIVE SUMMARY**

**MAY, 1983**

**BOOZ ALLEN & HAMILTON INC.**

## FOREWORD

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- THIS PROJECT WAS CONDUCTED BY BOOZ, ALLEN & HAMILTON INC. FOR:
  - SOLAR ENERGY INDUSTRIES ASSOCIATION
  - RENEWABLE ENERGY INSTITUTE
  - AMERICAN WIND ENERGY ASSOCIATION
  
- THIS REPORT REPRESENTS THE FINAL BOOZ, ALLEN PROJECT DELIVERABLE. IT CONTAINS THE RESULTS OF AN INDEPENDENT ANALYSIS OF THE IMPACTS OF FEDERAL ENERGY TAX CREDITS ON SOLAR/WIND TECHNOLOGIES. THE RESULTS REPRESENT OUR BEST PROFESSIONAL JUDGMENT BASED ON THE INFORMATION AVAILABLE TO US DURING THE PROJECT.

## OVERVIEW

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- WITHOUT FEDERAL AND STATE ENERGY TAX CREDITS, ONLY SMALL NICHE MARKETS--"EARLY ADOPTERS AND REMOTE APPLICATIONS"--WILL EXIST GIVEN DEPRESSED FUEL PRICES
- AIDED BY FEDERAL TAX CREDITS, A BROADER MARKET IS SUPPORTABLE TODAY IN AREAS OF HIGH SOLAR AND WIND RESOURCES--PARTICULARLY IN STATES THAT OFFER THEIR OWN TAX CREDITS
- THE PRIVATE SECTOR CAN BE EXPECTED TO DEVELOP IMPROVED SOLAR AND WIND TECHNOLOGIES, WHICH WILL BEGIN TO BECOME COMPETITIVE AND SELF-SUPPORTING ON A NATIONAL LEVEL BY THE END OF THE DECADE IF ASSISTED BY TAX CREDITS AND AUGMENTED BY FEDERALLY SPONSORED R&D
- TREASURY GAINS WILL LARGELY OFFSET THE COSTS OF THE TAX CREDIT, RESULTING IN LOW NET COSTS TO THE GOVERNMENT WHILE REDUCING THE NATIONAL OIL IMPORT BILL AND CREATING EMPLOYMENT AND EXPORT OPPORTUNITIES.

## FINANCIAL ANALYSIS OVERVIEW

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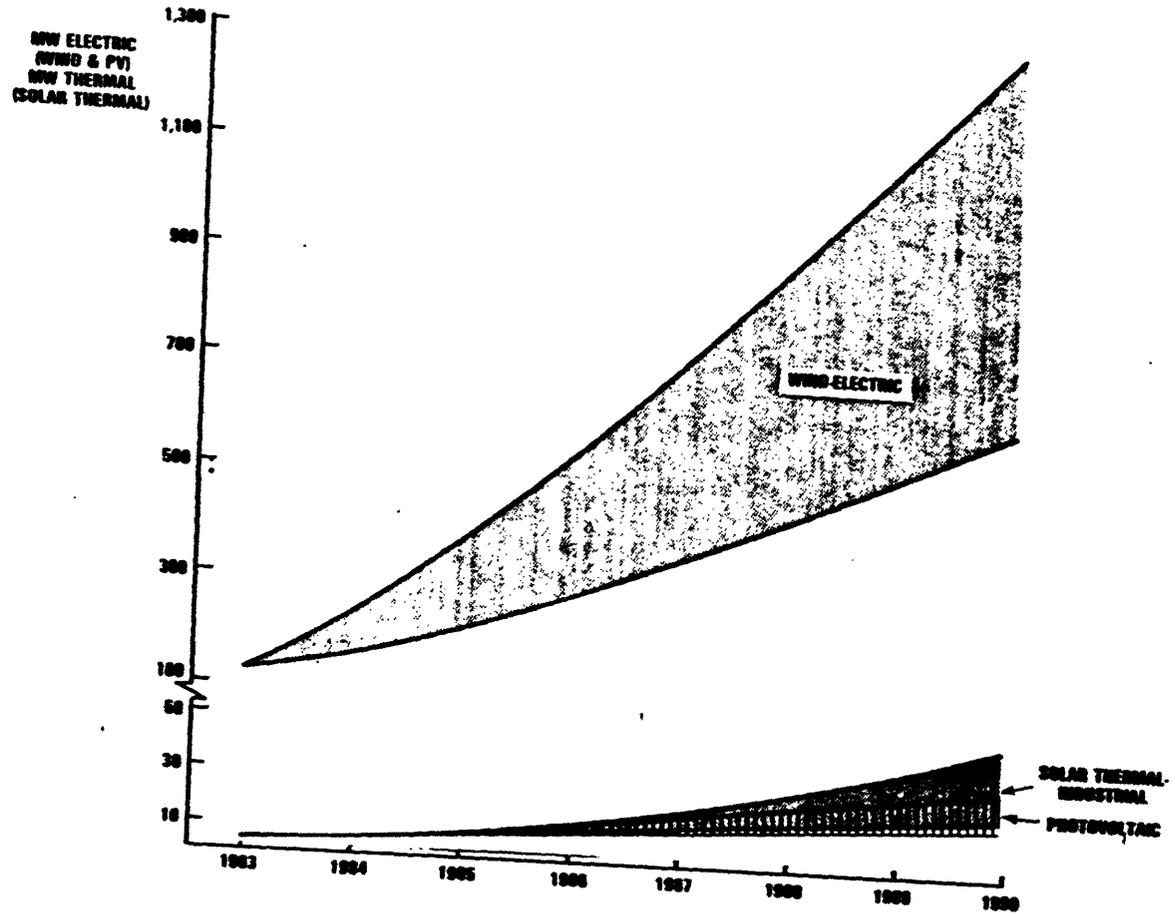
- THE FINANCIAL ATTRACTIVENESS OF SOLAR AND WIND APPLICATIONS DEPENDS UPON A LARGE NUMBER OF COST, PERFORMANCE AND BUYER SPECIFIC FINANCIAL ASSUMPTIONS
- BASED UPON THE USE OF "TYPICAL" OR NATIONAL AVERAGES FOR KEY COST, PERFORMANCE, AND FINANCIAL ASSUMPTIONS, OUR RESULTS SUGGEST THAT:
  - WITHOUT FEDERAL TAX CREDITS, SOLAR AND WIND TECHNOLOGIES WILL REMAIN UNCOMPETITIVE EXCEPT IN NICHE MARKETS THROUGH 1990
  - EXPANDED FEDERAL TAX CREDITS WILL ENCOURAGE NATIONWIDE COMPETITIVENESS OF WIND TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET, SOLAR THERMAL IN THE INDUSTRIAL MARKET, AND WIND AND SOLAR IN THE RESIDENTIAL MARKET BY 1990
  - WITH EXPANDED TAX CREDITS, SOLAR THERMAL AND PHOTOVOLTAIC TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET WILL BECOME COMPETITIVE IN REMOTE, HIGH-COST MARKETS, EVENTUALLY LEADING TO CAPITAL COST REDUCTIONS AND POTENTIAL NATIONWIDE COMPETITIVENESS IN THE POST 1990 TIMEFRAME
- THE COST COMPETITIVENESS OF INDIVIDUAL SOLAR AND WIND APPLICATIONS MAY DIFFER FROM OUR RESULTS, DEPENDING UPON UNIQUE LOCAL OR REGIONAL CONDITIONS

## MARKET PENETRATION OVERVIEW

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- THE RESULTS OF OUR FINANCIAL ANALYSIS AND THE CURRENT STATUS OF SOLAR TECHNOLOGIES SUGGEST THAT MOST OF THE SOLAR MARKET ACTIVITY IN THE 1980'S WILL OCCUR IN FOUR APPLICATIONS:
  - WIND ELECTRIC SYSTEMS IN THE ELECTRIC UTILITY MARKET
  - SOLAR THERMAL SYSTEMS IN THE INDUSTRIAL MARKET
  - RESIDENTIAL SOLAR SYSTEMS IN THE BUILDINGS MARKET
  - WIND ELECTRIC SYSTEMS PRIMARILY IN THE RURAL RESIDENTIAL MARKET
  
- POTENTIAL MARKET PENETRATION OF PHOTOVOLTAIC AND SOLAR THERMAL TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET MAY ULTIMATELY BE SIGNIFICANT, BUT THE LIKELIHOOD OF THIS TAKING PLACE BEFORE 1990 IS LOW
  
- ATTAINMENT OF PROJECTED MARKET LEVELS IMPLIES A CONSIDERABLE SAVINGS IN FOSSIL FUEL REQUIREMENTS -- UP TO 33 MILLION BARRELS OF OIL PER YEAR BY 1990 OR ROUGHLY TWO PERCENT OF ANTICIPATED NATIONAL OIL IMPORT REQUIREMENTS
  
- CONTINUED GROWTH IN THIS LABOR-INTENSIVE INDUSTRY WOULD PROVIDE SIGNIFICANT EMPLOYMENT OPPORTUNITIES BY 1990.

# PROJECTED PENETRATION OF WIND, SOLAR THERMAL, AND PHOTOVOLTAIC TECHNOLOGIES IN THE ELECTRIC UTILITY AND INDUSTRIAL MARKETS



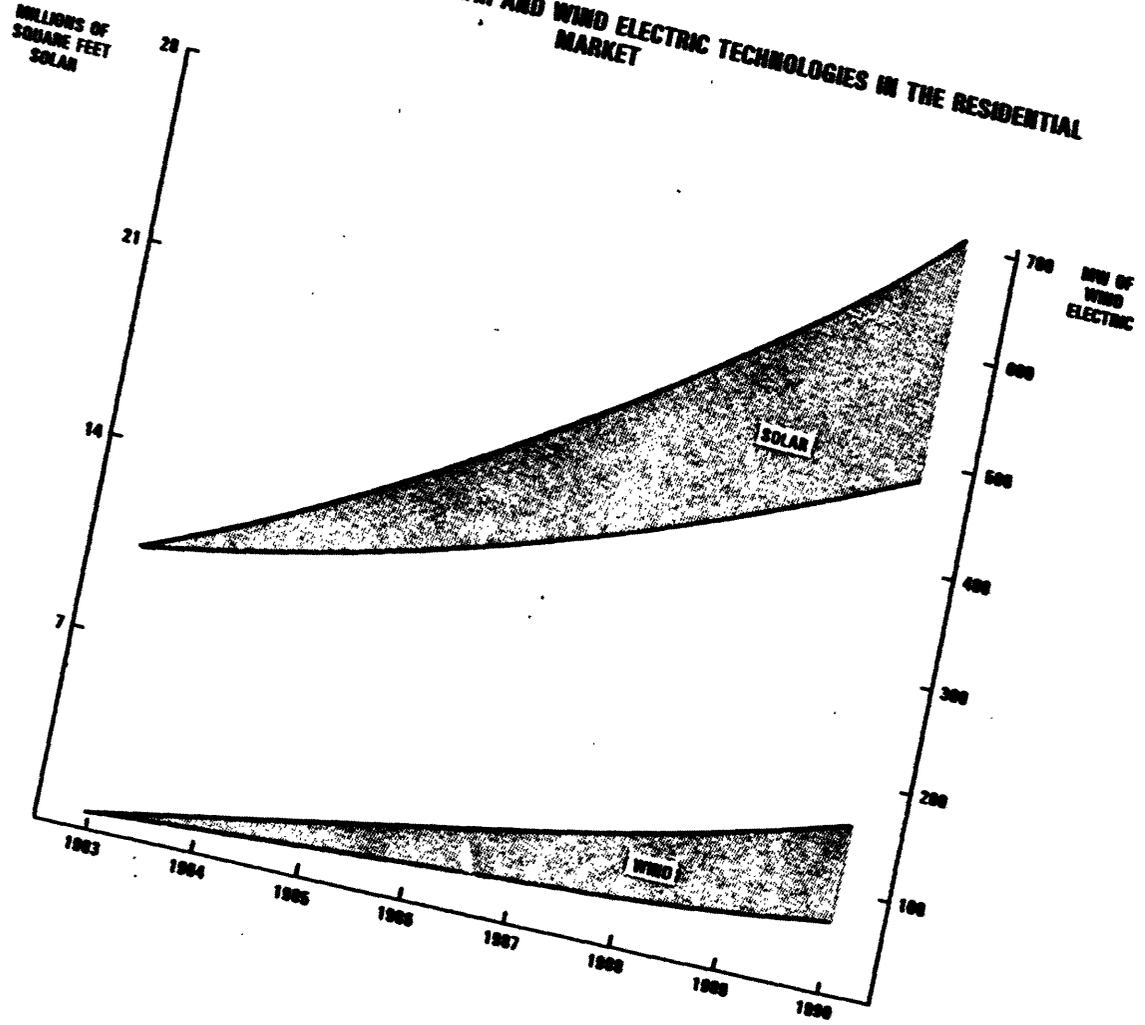
MARKET PENETRATION . . .

ELECTRIC UTILITY AND INDUSTRIAL MARKETS

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- WIND TECHNOLOGY IN THE ELECTRIC UTILITY MARKET OFFERS THE GREATEST PROSPECT FOR GROWTH IN THE 1980'S. CONSTRUCTION OF BETWEEN 3,000 AND 6,500 TYPICAL MACHINES BY 1990 WOULD INCREASE TOTAL ANNUAL PENETRATION TO BETWEEN 600 AND 1300 MEGAWATTS -- UP FROM 125 MEGAWATTS IN 1983.
- IF SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS GROW AT A SIMILAR RATE FROM THEIR SMALL CURRENT BASE, TOTAL ANNUAL PRODUCTION IN 1990 WILL AMOUNT TO 20 TO 50 MEGAWATTS OF CAPACITY, OR FOUR TO TEN TYPICAL SYSTEMS OF 80,000 SQUARE FEET.
- PHOTOVOLTAIC SYSTEMS TOTALING APPROXIMATELY TWO MEGAWATTS WERE INSTALLED DOMESTICALLY IN 1982, PRIMARILY FOR REMOTE APPLICATIONS. ALTHOUGH FUTURE DOMESTIC INSTALLATION LEVELS ARE DIFFICULT TO PREDICT, IT IS CONCEIVABLE THAT ANNUAL DOMESTIC REMOTE AND UTILITY PILOT INSTALLATIONS COULD REACH 20 TO 30 MEGAWATTS BY 1990.
- COMMERCIAL-SCALE SOLAR THERMAL ELECTRIC TECHNOLOGIES WILL BE ECONOMIC ONLY IN LIMITED CIRCUMSTANCES BY THE END OF THIS DECADE. THUS, MARKET PENETRATION OF THESE TECHNOLOGIES WILL REMAIN VERY LOW THROUGH 1990.
- ATTAINMENT OF PROJECTED PENETRATION LEVELS BY 1990 IMPLIES A TOTAL ENERGY SAVINGS OF 9 TO 18 MILLION BARRELS OF OIL EQUIVALENT PER YEAR IN THE ELECTRIC UTILITY SECTOR AND AN ADDITIONAL 0.2 MILLION BARRELS OF OIL EQUIVALENT PER YEAR IN THE INDUSTRIAL SECTOR.

### PROJECTED PENETRATION OF SOLAR AND WIND ELECTRIC TECHNOLOGIES IN THE RESIDENTIAL MARKET



MARKET PENETRATION . . .

RESIDENTIAL MARKET

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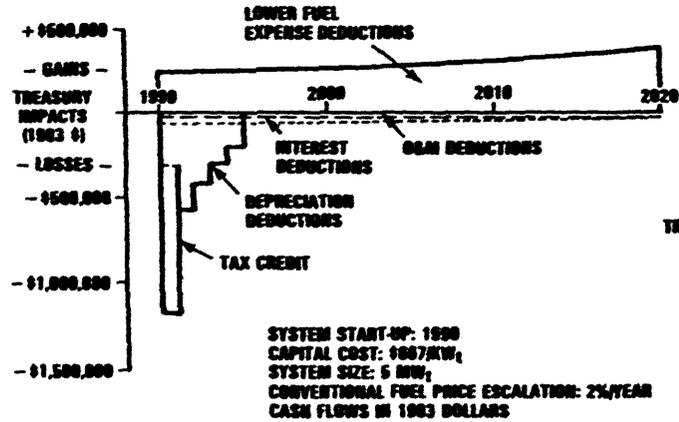
- CONTINUED FEDERAL ENERGY TAX CREDITS WOULD ENCOURAGE GROWTH IN SALES FOR RESIDENTIAL SOLAR TECHNOLOGIES. INCREASING TOTAL ANNUAL SALES IN THE RESIDENTIAL MARKET TO BETWEEN 18 AND 27.5 MILLION SQUARE FEET BY 1990 WOULD RESULT IN THE ANNUAL INSTALLATION BETWEEN 220,000 AND 360,000 HOT WATER SYSTEMS AND COMBINED HOT WATER AND SPACE HEATING SYSTEMS.
- ALTHOUGH MARGINALLY ECONOMIC IN MOST AREAS TODAY, RESIDENTIAL WIND SYSTEMS ARE EXPECTED TO GROW RAPIDLY FROM THEIR CURRENTLY SMALL BASE WITH THE AID OF FEDERAL TAX CREDITS. INCREASING SALES FROM 3,000 SMALL WIND SYSTEMS IN 1983 TO BETWEEN 12,000 AND 27,000 MACHINES IN 1990 WOULD BOOST ANNUAL SALES TO BETWEEN 70 AND 160 MEGAWATTS.
- IF THESE MARKET PENETRATION LEVELS ARE ATTAINED, A TOTAL ANNUAL SAVINGS OF BETWEEN 11 AND 15 MILLION BARRELS OF OIL COULD BE REALIZED BY 1990, AS SOLAR AND WIND TECHNOLOGIES SUBSTITUTE FOR CONVENTIONAL RESIDENTIAL ENERGY SOURCES.

**IMPACT OF 25 PERCENT BUSINESS ENERGY INVESTMENT CREDIT ON THE FEDERAL TREASURY  
FOR SYSTEMS INSTALLED IN 1985 AND 1990  
(MILLION 1983 DOLLARS)**

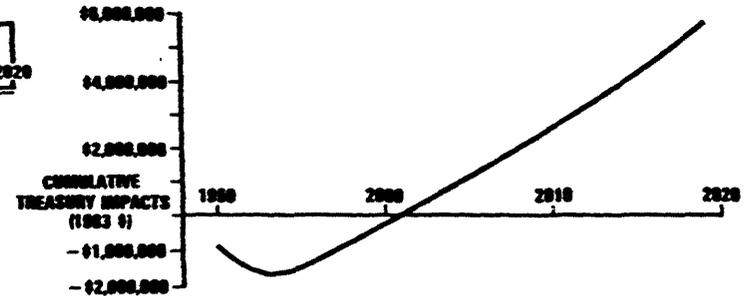
START-UP DATE	REAL ENERGY PRICE ESCALATION	DIRECT COST OF 25% TAX CREDIT	PRESENT VALUE OF TOTAL REVENUE LOSS*	PRESENT VALUE OF TOTAL REVENUE GAIN*	PRESENT VALUE OF NET IMPACT*
1985	0%	\$ 84	\$ 277	\$ 128	-\$151
	2%	\$105	\$ 347	\$ 305	-\$ 42
1990	0%	\$175	\$ 573	\$ 393	-\$180
	2%	\$385	\$1263	\$1795	+\$582

\*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

**ANNUAL TREASURY IMPACT OF INDUSTRIAL SOLAR INVESTMENT**



**CUMULATIVE NET TREASURY IMPACT OF INDUSTRIAL SOLAR INVESTMENT**



TREASURY IMPACTS . . .

TOTAL BUSINESS ENERGY INVESTMENT CREDIT COSTS TO THE TREASURY

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- NEARLY ALL TREASURY COSTS OCCUR IN THE FIRST FIVE YEARS AFTER CONSTRUCTION, WHEREAS TAX REVENUE GAINS FROM CONVENTIONAL FUEL SAVINGS OCCUR OVER THE LIFE OF THE SYSTEM
- FROM THE OUTSET, TREASURY GAINS FROM REDUCED CONVENTIONAL FUEL COST DEDUCTIONS WILL PARTIALLY OFFSET THE COST OF THE TAX CREDIT FOR INDUSTRIAL AND ELECTRIC UTILITY SOLAR AND WIND SYSTEMS
- BY 1990, LOWER SOLAR AND WIND TECHNOLOGY CAPITAL COSTS AND HIGHER CONVENTIONAL FUEL PRICES MAY RESULT IN A NET ANNUAL GAIN TO THE TREASURY. THIS REFLECTS THE FACT THAT TOTAL LIFE-CYCLE TREASURY IMPACTS BECOME MORE POSITIVE AS THE ECONOMIC ATTRACTIVENESS OF INDIVIDUAL SOLAR AND WIND SYSTEMS IMPROVES.

**IMPACT OF 40 PERCENT RESIDENTIAL ENERGY TAX CREDIT ON THE FEDERAL TREASURY FOR  
SYSTEMS INSTALLED IN 1985 AND 1990  
(MILLION 1983 DOLLARS)**

<b>START-UP DATE</b>	<b>REAL ENERGY PRICE ESCALATION</b>	<b>DIRECT COST OF 40% TAX CREDIT</b>	<b>PRESENT VALUE OF NET IMPACT*</b>
<b>1985</b>	<b>0%</b>	<b>\$383</b>	<b>- \$351</b>
	<b>2%</b>	<b>\$359</b>	<b>- \$416</b>
<b>1990</b>	<b>0%</b>	<b>\$481</b>	<b>- \$484</b>
	<b>2%</b>	<b>\$646</b>	<b>- \$748</b>

\*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

TREASURY IMPACTS . . .

TOTAL RESIDENTIAL ENERGY TAX CREDIT COSTS TO THE TREASURY

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- TAX CREDITS FOR RESIDENTIAL SYSTEMS, ALONG WITH THE BUSINESS ENERGY INVESTMENT CREDIT, PROVIDE NUMEROUS BENEFITS, INCLUDING:
  - CREATION OF EMPLOYMENT OPPORTUNITIES
  - REDUCTION IN OIL IMPORTS
  - DEVELOPMENT OF EXPORT INDUSTRY CAPABILITY.

HOWEVER, RESIDENTIAL TAX CREDITS DO NOT PROVIDE THE TREASURY WITH OFFSETTING REVENUES, AS DOES THE BUSINESS ENERGY INVESTMENT CREDIT.

- IF WAGES CONTINUE TO ACCOUNT FOR APPROXIMATELY 40 PERCENT OF THE INSTALLED COST OF SOLAR AND WIND SYSTEMS, DOMESTIC RESIDENTIAL SYSTEM MANUFACTURE AND INSTALLATION WOULD REPRESENT OVER A \$1 BILLION INDUSTRY. EMPLOYEES IN THE SOLAR INDUSTRY CAN, CORRESPONDINGLY, BE EXPECTED TO DOUBLE FROM TODAY'S LEVELS -- WHICH HAVE BEEN ESTIMATED TO BE 30,000 TO 40,000 WORKERS NATIONWIDE.

## SUMMARY OF IMPLICATIONS

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CONTINUING THE TAX CREDIT FOR INVESTMENT IN SOLAR/WIND TECHNOLOGIES WOULD:

- ENHANCE THEIR FINANCIAL ATTRACTIVENESS TO CONSUMERS, RAISING MARKET PENETRATION AND SUPPORTING THE DEVELOPMENT OF IMPROVED TECHNOLOGIES AT LOWER COST.
- MAINTAIN THE INDUSTRIAL BASE AND RELATED CONSUMER CONFIDENCE NECESSARY FOR SUCCESSFUL DEPLOYMENT OF SOLAR AND WIND TECHNOLOGIES AS THEY BECOME COST EFFECTIVE WITHOUT TAX CREDIT SUPPORT
- ENCOURAGE INVESTMENT IN A LABOR-INTENSIVE INDUSTRY WITH PROSPECTS FOR SIGNIFICANT PRODUCT EXPORT.
- PROVIDE INSTALLED SOLAR AND WIND ENERGY CAPACITY THAT IS CAPABLE OF REPLACING THE EQUIVALENT OF 33 MILLION BARRELS OF IMPORTED OIL ANNUALLY BY 1990.

THESE BENEFITS WOULD BE OBTAINED AT MINIMAL PRESENT VALUE COST TO THE GOVERNMENT DUE TO INCREASED FUTURE REVENUES THAT OFFSET NEAR-TERM COSTS. IN ADDITION, MAINTAINING A SMALL, VIABLE INDUSTRIAL BASE COMPLEMENTS FEDERAL R&D EFFORTS TO DEVELOP FUTURE GENERATIONS OF SOLAR/WIND TECHNOLOGIES.

**THE IMPACT OF FEDERAL ENERGY TAX  
CREDITS ON SOLAR/WIND TECHNOLOGIES**

**MAY, 1983**

**BOOZ-ALLEN & HAMILTON INC.**

## FOREWORD

---

- THIS PROJECT WAS CONDUCTED BY BOOZ, ALLEN & HAMILTON INC. FOR:
  - SOLAR ENERGY INDUSTRIES ASSOCIATION
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## REPORT OUTLINE

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- INTRODUCTION AND APPROACH
- ANALYTICAL RESULTS
  - FINANCIAL ANALYSIS
  - MARKET PENETRATION AND FUEL SAVINGS
- TREASURY IMPACTS
- SUMMARY OF IMPLICATIONS

## INTRODUCTION

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THIS REPORT PROVIDES AN OVERVIEW OF THE IMPACT OF TAX CREDITS ON THE FINANCIAL ATTRACTIVENESS AND POTENTIAL MARKET PENETRATION OF SOLAR AND WIND TECHNOLOGIES -- SPECIFICALLY RESIDENTIAL SOLAR, SOLAR THERMAL PROCESS HEAT, AND SOLAR THERMAL, PHOTOVOLTAIC, AND WIND ELECTRIC.

- THE FINANCIAL ATTRACTIVENESS OF SOLAR AND WIND TECHNOLOGIES WERE ANALYZED UNDER DIFFERENT SCENARIOS FOR:
  - TAX CREDITS
  - ENERGY PRICES
  
- CORRESPONDING MARKET PENETRATION SCENARIOS WERE DEVELOPED
  
- THE IMPACTS OF ALTERNATIVE PENETRATION SCENARIOS WERE ASSESSED IN TERMS OF
  - TREASURY LOSSES AND GAINS
  - EQUIVALENT LEVELS OF OIL SAVINGS
  - EMPLOYMENT OPPORTUNITIES.

## KEY CHARACTERISTICS OF APPROACH

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OUR APPROACH WAS TAILORED TO REFLECT LIMITED PROJECT RESOURCES AND THE SHORT TIME FRAME FOR THE ANALYSIS:

- WE UTILIZED A SINGLE SET OF CURRENT AND ANTICIPATED FUTURE CAPITAL COSTS AND EFFICIENCIES TO REPRESENT EACH SOLAR TECHNOLOGY BASED UPON RECENT DOE SPONSORED STUDIES, COMMUNICATIONS WITH GOVERNMENT AND INDUSTRY REPRESENTATIVES, AND DATA PROVIDED BY SOLAR/WIND EQUIPMENT MANUFACTURERS
- LOW/MODEST REAL CONVENTIONAL FUEL PRICE ESCALATION RATES (0-2%/YEAR) WERE UTILIZED
- AVAILABLE PUBLIC INFORMATION REGARDING POTENTIAL SOLAR MARKETS WAS RELIED UPON AS A BASIS FOR THE MARKET PENETRATION SCENARIOS
- QUANTITATIVE ANALYSIS OF SOLAR TAX CREDIT IMPACTS WAS LIMITED TO ESTIMATING THE DIRECT FINANCIAL IMPACTS ON THE U.S. TREASURY

## OVERVIEW

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- WITHOUT FEDERAL AND STATE ENERGY TAX CREDITS, ONLY SMALL NICHE MARKETS--"EARLY ADOPTERS AND REMOTE APPLICATIONS"--WILL EXIST GIVEN DEPRESSED FUEL PRICES
- AIDED BY FEDERAL TAX CREDITS, A BROADER MARKET IS SUPPORTABLE TODAY IN AREAS OF HIGH SOLAR AND WIND RESOURCES--PARTICULARLY IN STATES THAT OFFER THEIR OWN TAX CREDITS
- THE PRIVATE SECTOR CAN BE EXPECTED TO DEVELOP IMPROVED SOLAR AND WIND TECHNOLOGIES WHICH WILL BEGIN TO BECOME COMPETITIVE AND SELF-SUPPORTING ON A NATIONAL LEVEL BY THE END OF THE DECADE IF ASSISTED BY TAX CREDITS AND AUGMENTED BY FEDERALLY SPONSORED R&D
- TREASURY GAINS WILL LARGELY OFFSET THE COSTS OF THE TAX CREDIT, RESULTING IN LOW NET COSTS TO THE GOVERNMENT WHILE REDUCING THE NATIONAL OIL IMPORT BILL AND CREATING EMPLOYMENT AND EXPORT OPPORTUNITIES.

## FINANCIAL ANALYSIS APPROACH

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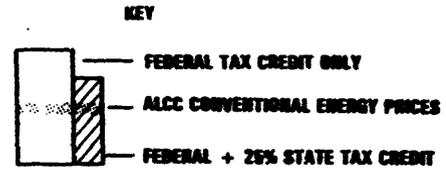
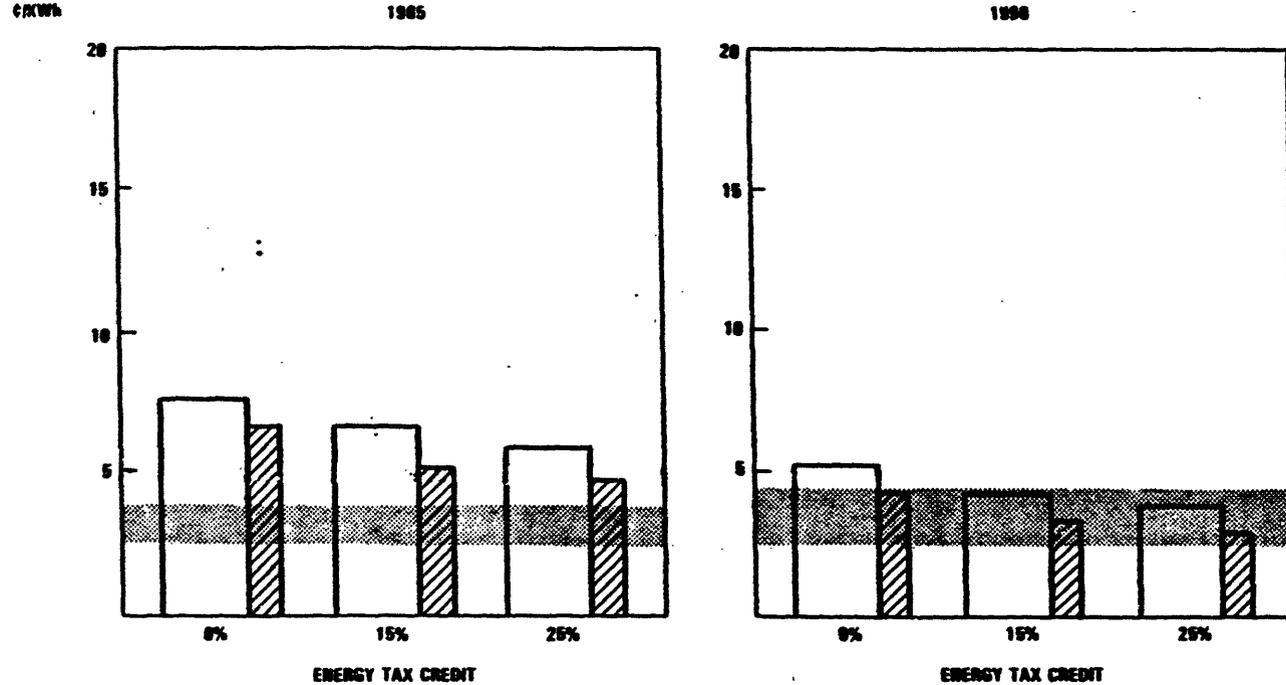
- THE FINANCIAL ATTRACTIVENESS OF SOLAR AND WIND APPLICATIONS DEPENDS UPON A LARGE NUMBER OF COST, PERFORMANCE, AND BUYER SPECIFIC FINANCIAL ASSUMPTIONS. OUR ANALYSIS OF THE CREDIT IMPACTS IS BASED UPON THE USE OF "TYPICAL" OR NATIONAL AVERAGES FOR KEY COST, PERFORMANCE, AND FINANCIAL ASSUMPTIONS (INCLUDED IN THE APPENDIX).
- WE HAVE UTILIZED A STANDARD LIFE CYCLE COST TECHNIQUE TO CALCULATE THE ANNALIZED LIFE CYCLE COSTS (ALCC) OF THE SOLAR/WIND ALTERNATIVES WITH CONVENTIONAL ENERGY SOURCES.
- AFTER-TAX COMPARISONS ARE MADE TO PROPERLY REFLECT FUEL EXPENSING, DEPRECIATION, INTEREST EXPENSE AND TAX CREDIT CONSIDERATIONS IN THE CALCULATIONS.
- ALL CALCULATIONS ARE DONE IN "REAL TERMS" -- I.E. THE IMPACTS OF GENERAL INFLATION HAVE BEEN REMOVED AND ONLY THOSE PRICE CHANGES OVER AND ABOVE INFLATION ARE CONSIDERED. CORRESPONDINGLY "REAL" DISCOUNT RATES AND INTEREST RATES WERE ALSO USED.

## FINANCIAL ANALYSIS APPROACH (CONT'D)

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- A TAX CREDIT EXTENSION TO 1990 WAS ANALYZED. BOTH A 15% AND A 25% BUSINESS INVESTMENT TAX CREDIT AND A 40% RESIDENTIAL TAX CREDIT WERE ANALYZED.
- ASSESSMENT OF THE FINANCIAL ATTRACTIVENESS OF SOLAR/WIND TECHNOLOGIES WAS THEREFORE LIMITED TO THE PERIOD BETWEEN NOW AND 1990. DETAILED CALCULATIONS WERE MADE FOR THE YEARS 1985 AND 1990.
- BY LIMITING THE TIME FRAME OF ANALYSIS TO 1990, WE ARE ONLY ABLE TO CONSIDER THOSE COST REDUCTIONS THAT CAN BE INCORPORATED INTO SOLAR/WIND EQUIPMENT PRODUCTION WITHIN THE NEXT 7 YEARS.
- HENCE, OUR ASSESSMENTS OF SOLAR/WIND TECHNOLOGY COMPETITIVENESS SHOULD NOT BE USED AS AN INDICATOR OF THE LONG-TERM POTENTIAL FOR SOLAR/WIND TECHNOLOGIES. LONG-TERM FEDERAL R&D PROGRAM GOALS -- WHICH WOULD RESULT IN THE PARITY OF SOLAR/WIND TECHNOLOGIES WITH CONVENTIONAL ENERGY -- ARE SCHEDULED TO MEET DURING THE 1990'S.
- OUR ASSUMPTIONS PROVIDE A BENCHMARK FROM WHICH THE RELATIVE IMPACTS OF DIFFERENT ENERGY TAX CREDIT LEVELS CAN BE ASSESSED. THE ACTUAL DEGREE OF COST COMPETITIVENESS FOR INDIVIDUAL SOLAR AND WIND APPLICATIONS IS LIKELY TO DIFFER FROM OUR RESULTS, DEPENDING UPON UNIQUE LOCAL OR REGIONAL CONDITIONS.

**ANNUALIZED LIFE CYCLE COSTS OF ELECTRICITY GENERATION FROM WIND TECHNOLOGY IN THE  
ELECTRIC UTILITY MARKET**  
(1983 DOLLARS)



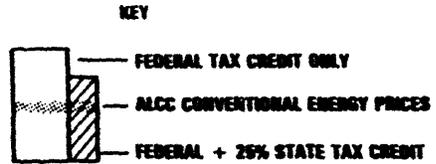
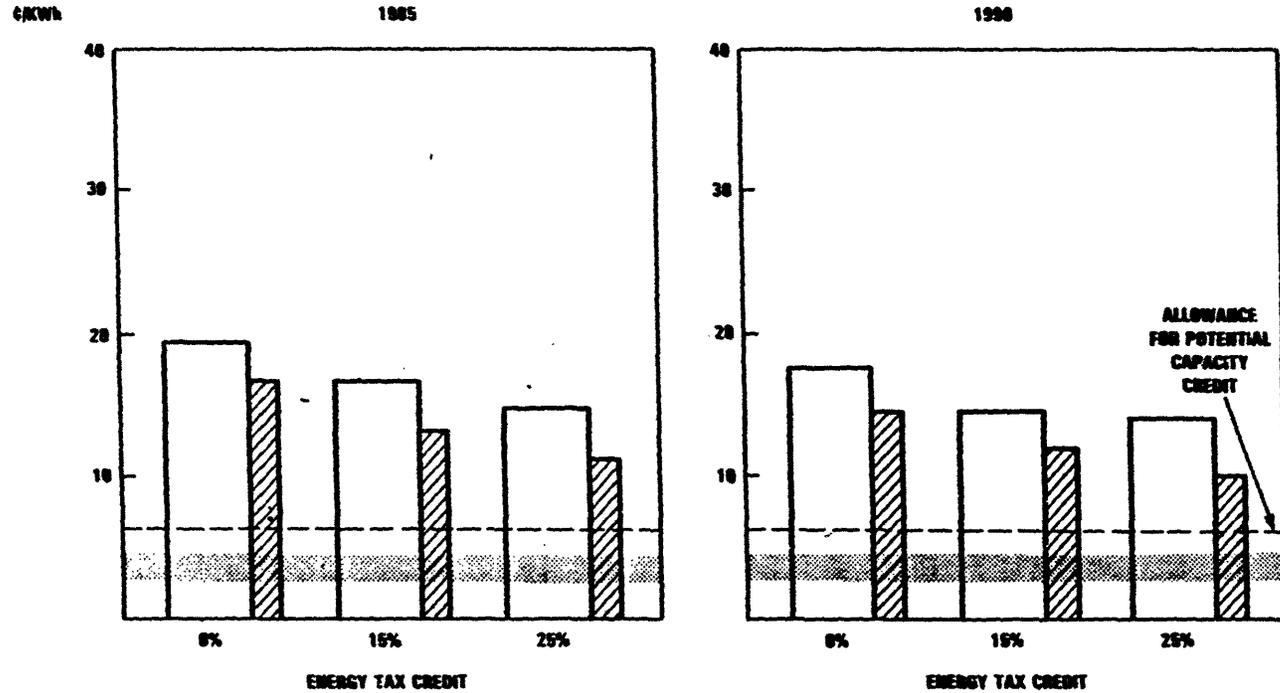
FINANCIAL ANALYSIS ...

WIND ELECTRIC IN THE ELECTRIC UTILITY MARKET

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- IF A 25% BUSINESS ENERGY INVESTMENT CREDIT IS AVAILABLE, WIND ELECTRIC SYSTEMS SHOULD BEGIN TO BECOME COMPETITIVE WITH DISTILLATE FUEL OIL FOR PEAK ELECTRICITY GENERATION AROUND 1985 IN STATES WITH 25% ENERGY TAX CREDITS AND ENERGY COSTS THAT ARE CLOSE TO THE NATIONAL AVERAGE.
- IF PROJECTED COST REDUCTIONS OF 40 PERCENT BETWEEN NOW AND 1990 ARE REALIZED, THE COMPETITIVE POSITION OF WIND ELECTRIC SYSTEMS WILL IMPROVE TO A POSITION WHERE THEY ARE FULLY COMPETITIVE WITHOUT TAX CREDITS IN THOSE MARKETS WITH SLIGHTLY HIGHER THAN AVERAGE ELECTRICITY COSTS.

**ANNUALIZED LIFE CYCLE COSTS OF ELECTRICITY GENERATION FROM SOLAR THERMAL  
TECHNOLOGY IN THE ELECTRIC UTILITY MARKET  
(1983 DOLLARS)**



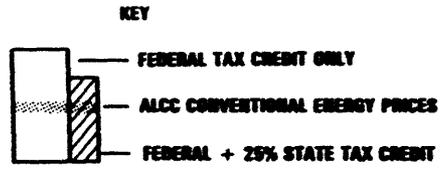
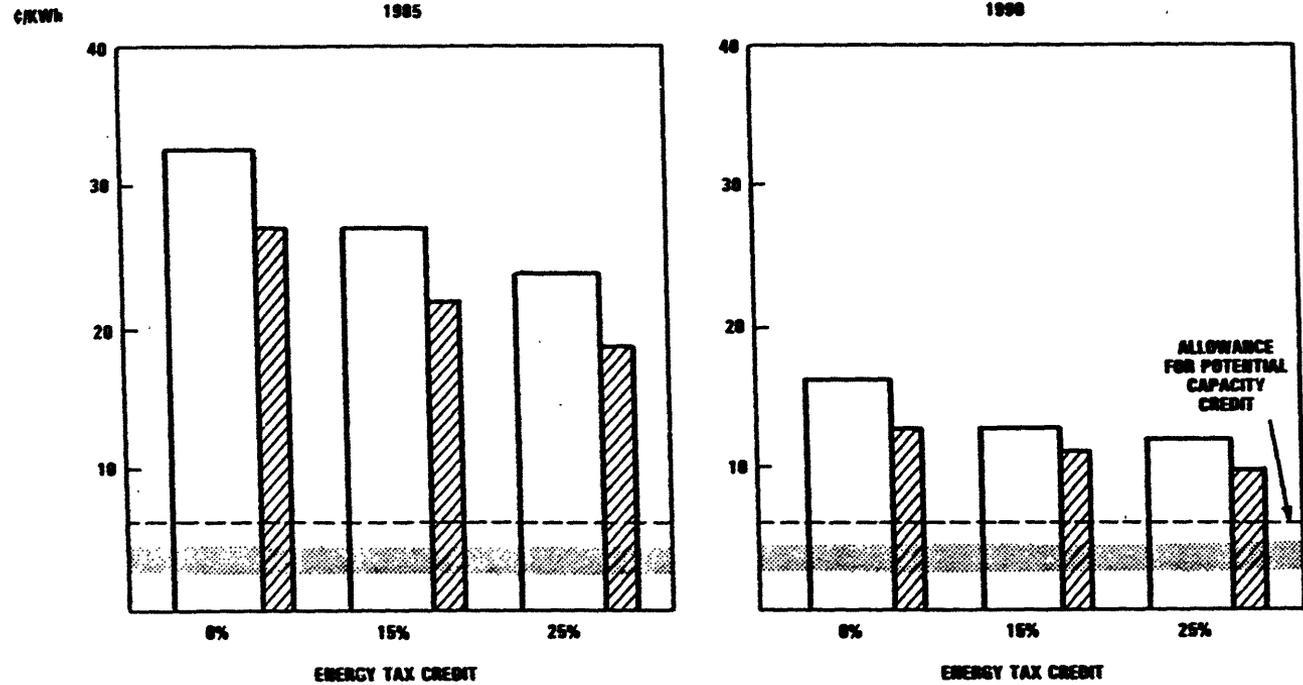
FINANCIAL ANALYSIS...

SOLAR THERMAL IN THE ELECTRIC UTILITY MARKET

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- CURRENT SOLAR THERMAL ACTIVITY IN THE ELECTRIC UTILITY MARKET IS LIMITED TO PILOT AND DEMONSTRATION FACILITIES. PLANNING AND CONSTRUCTION LEAD TIMES WILL MOST LIKELY PRECLUDE FULL-SCALE OPERATION BEFORE 1988.
- CLOSE COUPLING OF SOLAR ELECTRIC OUTPUT WITH UTILITY LOAD PROFILES MAY ENABLE SYSTEMS TO QUALIFY FOR POTENTIAL CAPACITY CREDITS, INCREASING THEIR COMPETITIVENESS WITH CONVENTIONAL FUELS FOR ELECTRICITY GENERATION.
- HOWEVER, HIGH CAPITAL COSTS WILL PREVENT SOLAR THERMAL TECHNOLOGIES FROM ACHIEVING WIDESPREAD COMPETITIVENESS WITH DISTILLATE FUEL OIL BY THE END OF THE DECADE.
- THE EXISTENCE OF A TAX CREDIT PROGRAM MAY SUSTAIN PRIVATE DEVELOPMENTAL ACTIVITY IN THIS INDUSTRY, COMPLEMENTING THE GOVERNMENT SPONSORED R&D ACTIVITIES NECESSARY TO MAKE SOLAR THERMAL ELECTRIC TECHNOLOGY COMPETITIVE IN THE DECADE BEYOND THE TIMEFRAME OF THIS STUDY.

**ANNUALIZED LIFE CYCLE COSTS OF ELECTRICITY GENERATION FROM PHOTOVOLTAIC  
TECHNOLOGY IN THE ELECTRIC UTILITY MARKET**  
(1983 DOLLARS)



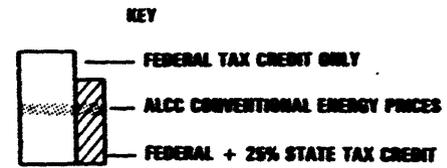
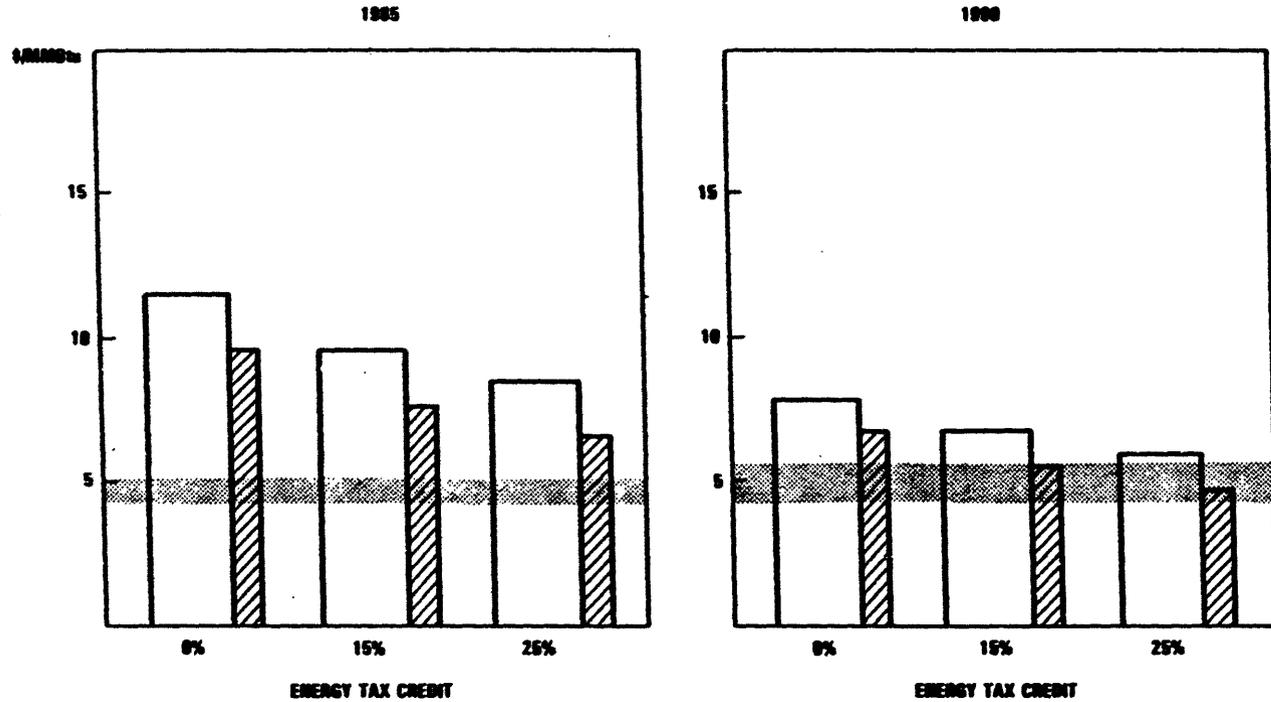
**FINANCIAL ANALYSIS...**

**PHOTOVOLTAIC IN THE ELECTRIC UTILITY MARKET**

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- AS WITH SOLAR THERMAL TECHNOLOGIES, HIGH CAPITAL COSTS AND THE LEAD TIMES ASSOCIATED WITH ADOPTION OF A NEW TECHNOLOGY BY THE UTILITY INDUSTRY WILL PREVENT PHOTOVOLTAIC TECHNOLOGIES FROM BECOMING WIDELY COMPETITIVE DURING THE 1980s. ASSUMING THAT PV COMPETES WITH DISTILLATE OIL FOR PEAK POWER GENERATION, PV GENERATED ELECTRICITY IS MORE EXPENSIVE THAN ELECTRICITY GENERATED WITH DISTILLATE OIL AT THE NATIONAL AVERAGE COST.
- HOWEVER, PHOTOVOLTAIC SYSTEMS MAY QUALIFY FOR POTENTIAL CAPACITY CREDITS, INCREASING THEIR COMPETITIVENESS WITH CONVENTIONAL FUELS FOR ELECTRICITY GENERATION IN HIGH COST, NICHE MARKETS.
- IN ADDITION, CAPITAL COST REDUCTIONS WILL ALLOW PHOTOVOLTAIC SYSTEMS TO IMPROVE THEIR COMPETITIVE POSITION IN REMOTE AREAS WITH HIGHER THAN AVERAGE COSTS AND IN AIR QUALITY NON-ATTAINMENT AREAS WHERE FOSSIL-FUEL PLANT OPERATION IS LIMITED.

**ANNUALIZED LIFE CYCLE COSTS OF PROCESS HEAT FROM SOLAR THERMAL TECHNOLOGY IN THE INDUSTRIAL MARKET**  
(1983 DOLLARS)



FINANCIAL ANALYSIS ...

SOLAR THERMAL IN THE INDUSTRIAL MARKET

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- CURRENT INDUSTRIAL SALES -- SUPPORTED BY EXISTING TAX CREDITS -- ARE TYPICALLY MADE TO CUSTOMERS LOCATED IN NON-ATTAINMENT AREAS OR TO THOSE FACING SUBSTANTIALLY HIGHER THAN AVERAGE FUEL COSTS.
- WITH ANTICIPATED REDUCTIONS OF 40 PERCENT IN SOLAR CAPITAL COSTS ACHIEVED BY THE END OF THIS DECADE, SOLAR THERMAL TECHNOLOGIES WILL BE COMPETITIVE WITHOUT TAX CREDIT SUPPORT IN THOSE REGIONS WITH HIGHER THAN AVERAGE FUEL COSTS. THEY WILL BE BROADLY COMPETITIVE ON A NATIONAL LEVEL IN 1990 WITH A 25% BUSINESS ENERGY INVESTMENT CREDIT.
- THEIR COMPETITIVE POSITION IS IMPROVED IN THOSE STATES THAT AUGMENT THE FEDERAL CREDIT WITH AN ADDITIONAL 25% STATE ENERGY TAX CREDIT.

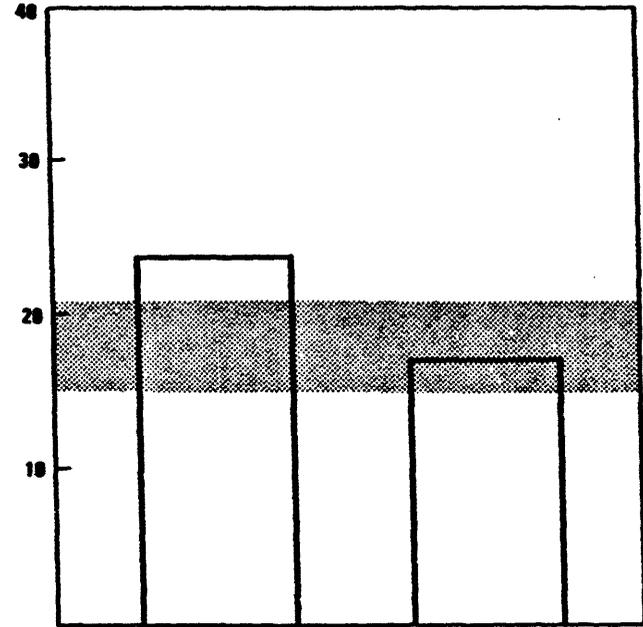
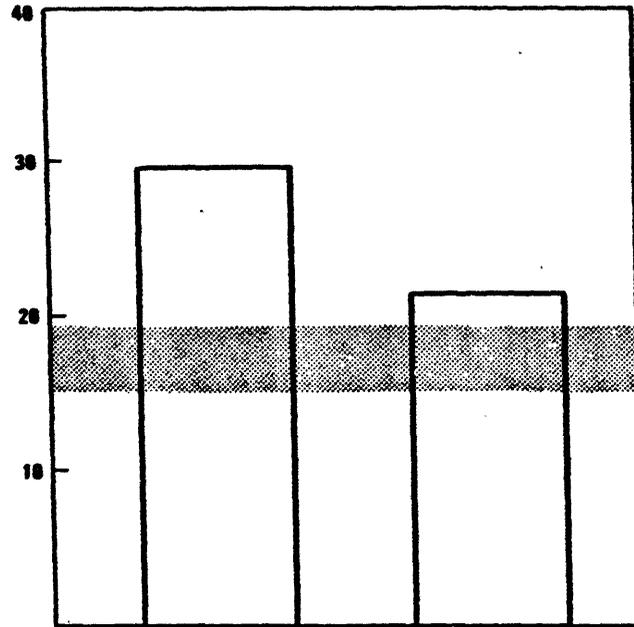
# ANNUALIZED LIFE CYCLE COSTS OF SOLAR TECHNOLOGY AND CONVENTIONAL ELECTRICITY IN THE RESIDENTIAL MARKET

(1983 DOLLARS)

\$/KWH

1985

1990



0% 40%

0% 40%

ENERGY TAX CREDIT

ENERGY TAX CREDIT



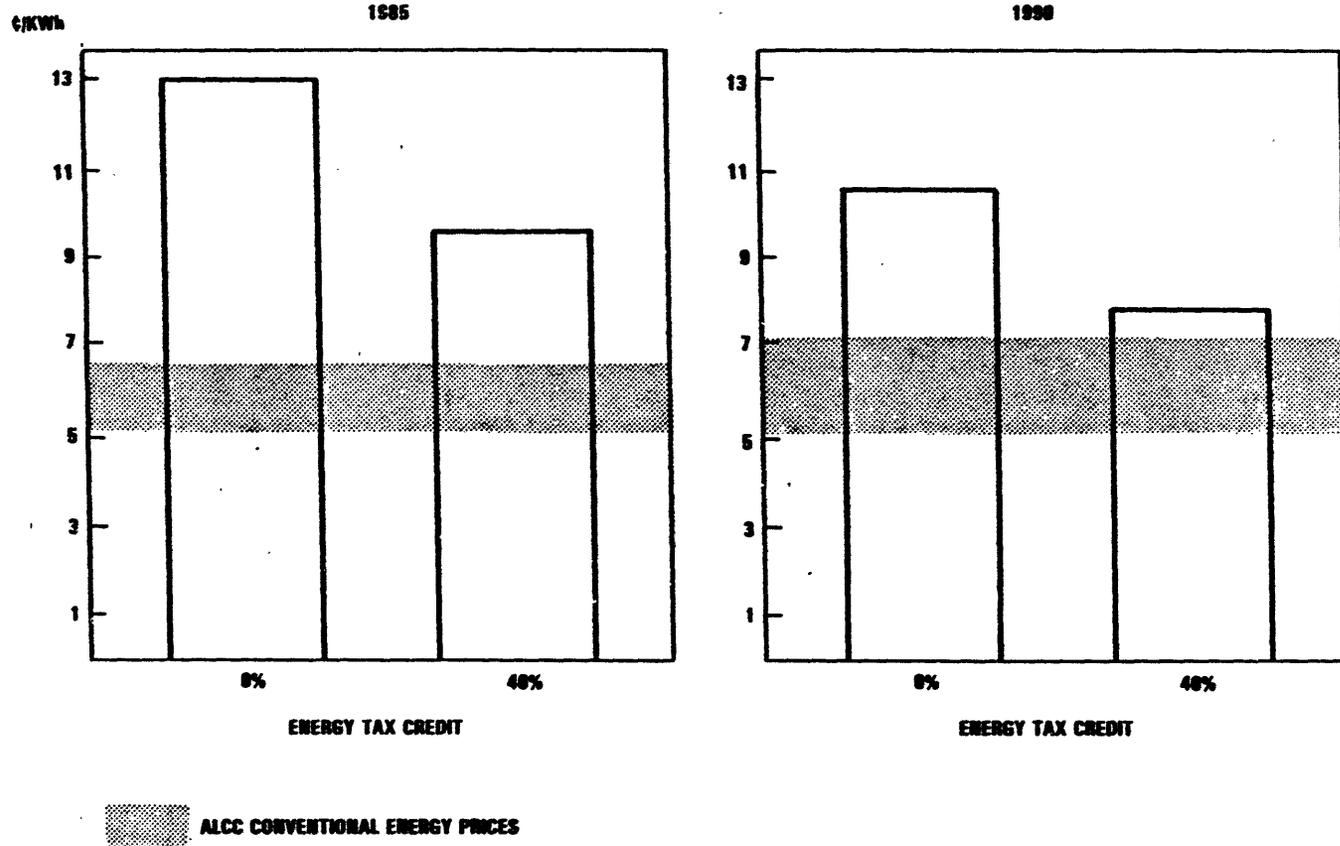
ALCC CONVENTIONAL ENERGY PRICES

SOLAR IN THE RESIDENTIAL MARKET

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- ALTHOUGH RESIDENTIAL SOLAR SYSTEMS ARE CURRENTLY BEING PURCHASED--PRIMARILY IN STATES WITH SOLAR TAX CREDITS--INDUSTRY GROWTH NATIONWIDE IS CRITICALLY DEPENDENT ON CONTINUATION OF THE FEDERAL TAX CREDIT.
- IF THE 40% FEDERAL TAX CREDIT IS MAINTAINED THROUGH 1990, RESIDENTIAL SOLAR SYSTEMS SHOULD BECOME COMPETITIVE WITH ELECTRICITY IN MOST REGIONS OF THE COUNTRY THAT CAN BE CHARACTERIZED BY THE NATIONAL AVERAGE PRICES AND PERFORMANCE USED IN THIS STUDY.
- THE ABILITY TO MEET OR EXCEED THE PROJECTED PRODUCTION COST REDUCTIONS OF 27 PERCENT--AS WE ASSUMED WOULD TAKE PLACE BY THE END OF THE DECADE--REQUIRES CONTINUED INDUSTRY INVESTMENT, WHICH DEPENDS ON A CONTINUED TAX CREDIT PROGRAM TO ACHIEVE COMPETITIVENESS.

**ANNUALIZED LIFE CYCLE COSTS OF WIND ELECTRIC TECHNOLOGY AND ELECTRICITY IN THE RESIDENTIAL MARKET  
(1983 DOLLARS)**



FINANCIAL ANALYSIS ...

WIND ELECTRIC IN THE RESIDENTIAL MARKET

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- WIND ELECTRIC SYSTEMS WILL BEGIN TO ACHIEVE WIDESPREAD COMPETITIVENESS IN THE RESIDENTIAL MARKET IN THE LATE 1980'S IF THE 40 PERCENT FEDERAL TAX CREDIT IS MAINTAINED, AND IF CAPITAL COST REDUCTIONS OF 40 PERCENT ARE ATTAINED.
- WITHOUT THE TAX CREDIT, MARKET ACTIVITY WILL CONTINUE TO BE VERY LOW, COST REDUCTIONS WILL BE MINIMAL, AND WIDESPREAD USE OF WIND ENERGY SYSTEMS PROBABLY WILL NOT DEVELOP IN THIS MARKET UNTIL WELL INTO THE 1990'S.

## MARKET PENETRATION APPROACH

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- THE ACTUAL MARKET PENETRATION OF SOLAR AND WIND TECHNOLOGIES IS A FUNCTION OF A COMPLEX SET OF FINANCIAL, INSTITUTIONAL, AND MARKET FORCES
  
- TO ANALYZE THE IMPACT OF ALTERNATIVE ENERGY TAX CREDIT LEVELS, WE HAVE DEVELOPED A SET OF MARKET PENETRATION SCENARIOS THAT CONSISTENTLY REFLECT KEY ASSUMPTIONS REGARDING:
  - FUTURE SOLAR/WIND SYSTEM COSTS
  - ENERGY TAX CREDIT LEVELS
  - CONVENTIONAL FUEL PRICE ESCALATION RATES
  - ADDRESSABLE MARKETS
  - EXISTING AND POTENTIAL SOLAR/WIND MANUFACTURING CAPACITY

## MARKET PENETRATION OVERVIEW

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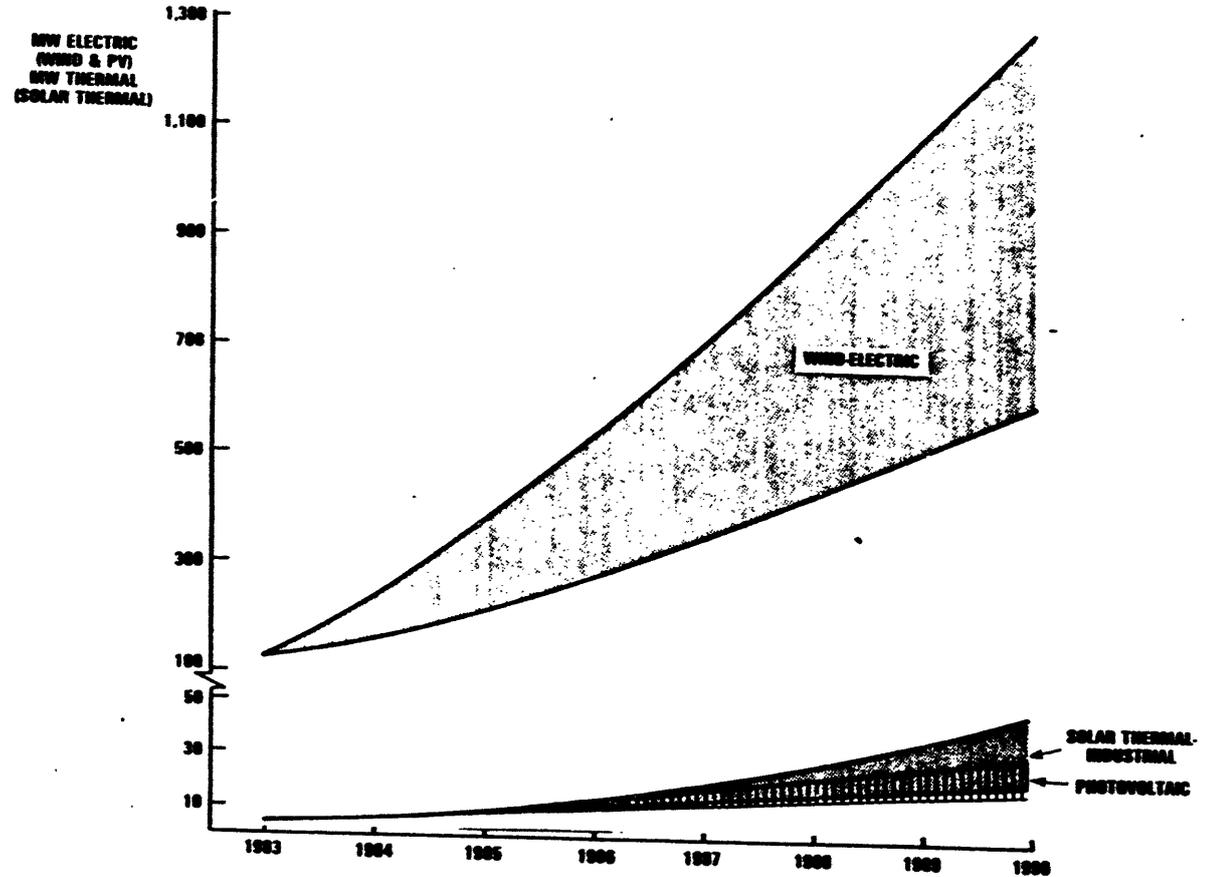
- THE RESULTS OF THE PRECEDING FINANCIAL ANALYSIS AND THE CURRENT STATUS OF SOLAR TECHNOLOGIES SUGGEST THAT MOST OF THE SOLAR MARKET ACTIVITY IN THE 1980'S WILL OCCUR IN FOUR APPLICATIONS:

- WIND ELECTRIC SYSTEMS IN THE ELECTRIC UTILITY MARKET
- SOLAR THERMAL SYSTEMS IN THE INDUSTRIAL MARKET
- RESIDENTIAL SOLAR SYSTEMS IN THE BUILDINGS MARKET
- WIND ELECTRIC SYSTEMS PRIMARILY IN THE RURAL RESIDENTIAL MARKET

POTENTIAL MARKET PENETRATION OF PHOTOVOLTAIC AND SOLAR THERMAL TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET MAY ULTIMATELY BE SIGNIFICANT, BUT THE LIKELIHOOD OF THIS TAKING PLACE BEFORE 1990 IS LOW

- ATTAINMENT OF PROJECTED MARKET PENETRATION LEVELS IMPLIES A CONSIDERABLE SAVINGS IN FOSSIL FUEL REQUIREMENTS -- UP TO 33 MILLION BARRELS OF OIL PER YEAR BY 1990 OR ROUGHLY TWO PERCENT OF ANTICIPATED NATIONAL OIL IMPORT REQUIREMENTS
- CONTINUED GROWTH IN THIS LABOR-INTENSIVE INDUSTRY WOULD PROVIDE SIGNIFICANT EMPLOYMENT OPPORTUNITIES BY 1990.

# PROJECTED PENETRATION OF WIND, SOLAR THERMAL, AND PHOTOVOLTAIC TECHNOLOGIES IN THE ELECTRIC UTILITY AND INDUSTRIAL MARKETS



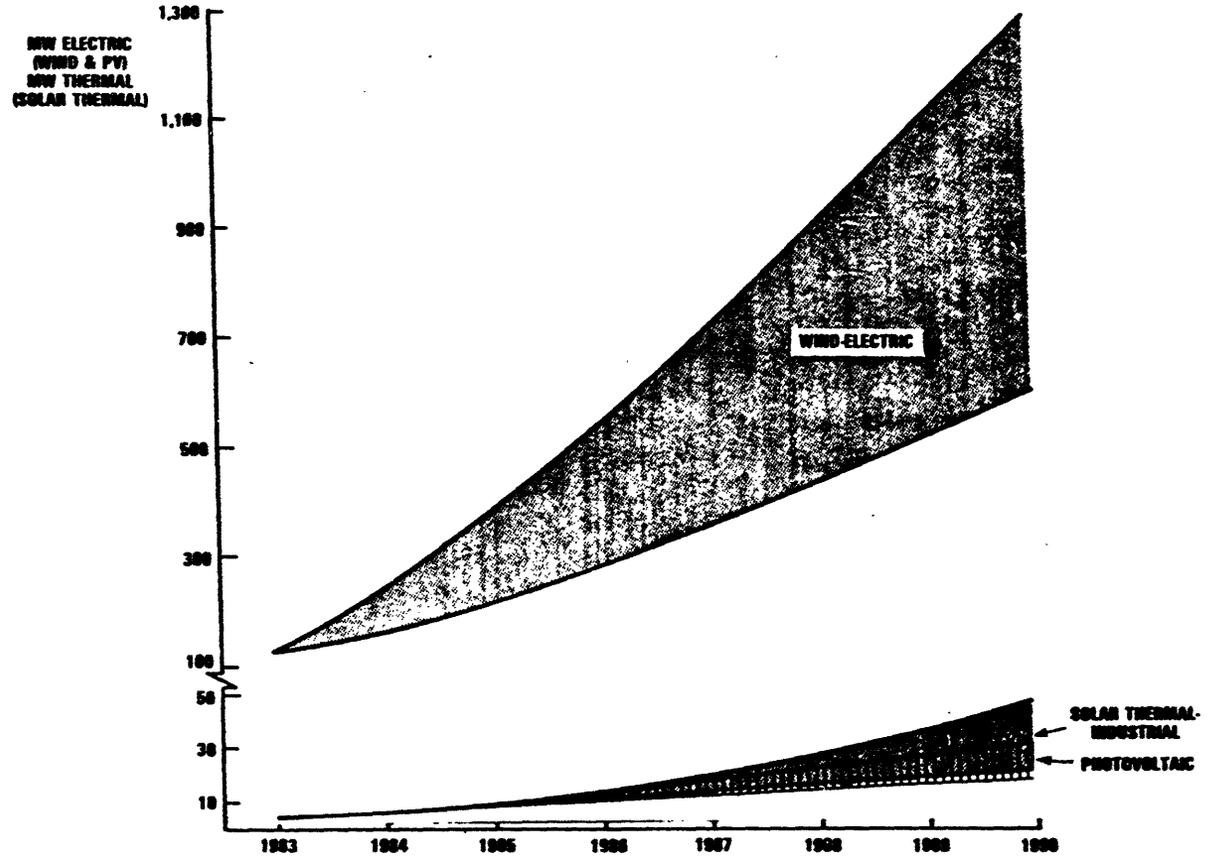
MARKET PENETRATION . . .

ELECTRIC UTILITY AND INDUSTRIAL MARKETS

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- WIND TECHNOLOGY IN THE ELECTRIC UTILITY MARKET OFFERS THE GREATEST PROSPECT FOR GROWTH IN THE 1980'S. CONSTRUCTION OF BETWEEN 3,000 AND 6,500 TYPICAL MACHINES BY 1990 WOULD INCREASE TOTAL ANNUAL PENETRATION TO BETWEEN 600 AND 1300 MEGAWATTS -- UP FROM AN ESTIMATED ANNUAL PENETRATION OF 125 MEGAWATTS IN 1983.
- SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS ARE PROJECTED TO GROW FROM THEIR SMALL CURRENT BASE AT A RATE SIMILAR TO THAT PROJECTED FOR WIND SYSTEMS. AT THIS RATE TOTAL ANNUAL PRODUCTION IN 1990 WILL AMOUNT TO 20 TO 50 MEGAWATTS OF CAPACITY, OR FOUR TO TEN TYPICAL SYSTEMS OF 80,000 SQUARE FEET.
- A TOTAL OF 6.9 MEGAWATTS PEAK WERE SHIPPED IN 1982 -- OVER 25 PERCENT OF THE SHIPMENTS WERE EXPORTED, ACCORDING TO RECENT DOE SURVEY RESULTS.
- IT IS ESTIMATED THAT PHOTOVOLTAIC SYSTEMS TOTALING APPROXIMATELY TWO MEGAWATTS PEAK WERE ACTUALLY INSTALLED DOMESTICALLY IN 1982 -- PRIMARILY FOR REMOTE APPLICATIONS. ALTHOUGH FUTURE DOMESTIC INSTALLATION LEVELS ARE DIFFICULT TO PREDICT, IT IS CONCEIVABLE THAT ANNUAL DOMESTIC REMOTE AND PILOT INSTALLATIONS FOR CENTRAL STATION ELECTRICITY GENERATION COULD REACH 20 TO 30 MEGAWATTS BY 1990.

**PROJECTED PENETRATION OF WIND, SOLAR THERMAL, AND PHOTOVOLTAIC TECHNOLOGIES  
IN THE ELECTRIC UTILITY AND INDUSTRIAL MARKETS**



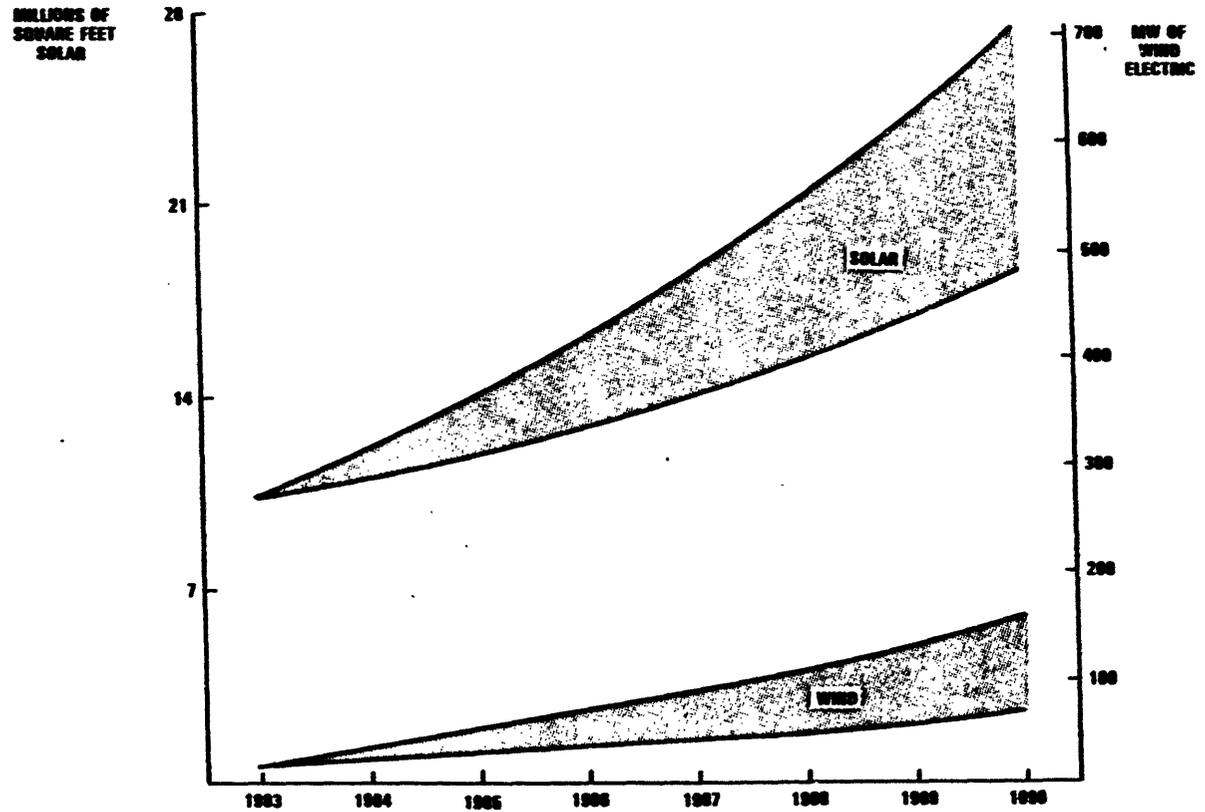
MARKET PENETRATION . . .

ELECTRIC UTILITY AND INDUSTRIAL MARKETS (CONT'D)

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- COMMERCIAL-SCALE SOLAR THERMAL ELECTRIC TECHNOLOGIES WILL BE ECONOMIC ONLY IN LIMITED CIRCUMSTANCES BY THE END OF THIS DECADE. THUS, MARKET PENETRATION OF THESE TECHNOLOGIES WILL REMAIN VERY LOW THROUGH 1990.
- ATTAINMENT OF PROJECTED PENETRATION LEVELS BY 1990 IMPLIES A TOTAL ENERGY SAVINGS OF 9 TO 18 MILLION BARRELS OF OIL EQUIVALENT PER YEAR IN THE ELECTRIC UTILITY SECTOR AND AN ADDITIONAL 0.2 MILLION BARRELS OF OIL EQUIVALENT PER YEAR IN THE INDUSTRIAL SECTOR.

### PROJECTED PENETRATION OF SOLAR AND WIND ELECTRIC TECHNOLOGIES IN THE RESIDENTIAL MARKET



MARKET PENETRATION . . .

RESIDENTIAL MARKET

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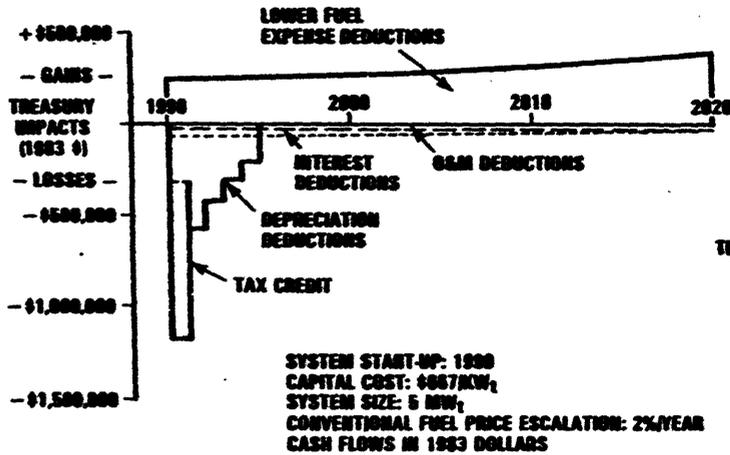
- CONTINUED FEDERAL ENERGY TAX CREDITS WOULD ENCOURAGE GROWTH IN SALES FOR RESIDENTIAL SOLAR TECHNOLOGIES. INCREASING TOTAL ANNUAL SALES IN THE RESIDENTIAL MARKET TO BETWEEN 18 AND 27.5 MILLION SQUARE FEET BY 1990 WOULD RESULT IN THE ANNUAL INSTALLATION BETWEEN 220,000 AND 360,000 HOT WATER SYSTEMS AND COMBINED HOT WATER AND SPACE HEATING SYSTEMS.
  
- ALTHOUGH MARGINALLY ECONOMIC IN MOST AREAS TODAY, RESIDENTIAL WIND SYSTEMS ARE EXPECTED TO GROW RAPIDLY FROM THEIR CURRENTLY SMALL BASE WITH THE AID OF CONTINUED FEDERAL TAX CREDITS. INCREASING SALES FROM 3,000 SMALL WIND SYSTEMS IN 1983 TO BETWEEN 12,000 AND 27,000 MACHINES IN 1990 WOULD BOOST ANNUAL SALES TO BETWEEN 70 AND 160 MEGAWATTS.
  
- IF THESE MARKET PENETRATION LEVELS ARE ATTAINED, A TOTAL ANNUAL SAVINGS OF BETWEEN 11 AND 15 MILLION BARRELS OF OIL COULD BE REALIZED BY 1990, AS SOLAR AND WIND TECHNOLOGIES SUBSTITUTE FOR CONVENTIONAL RESIDENTIAL ENERGY SOURCES.

## TREASURY IMPACTS

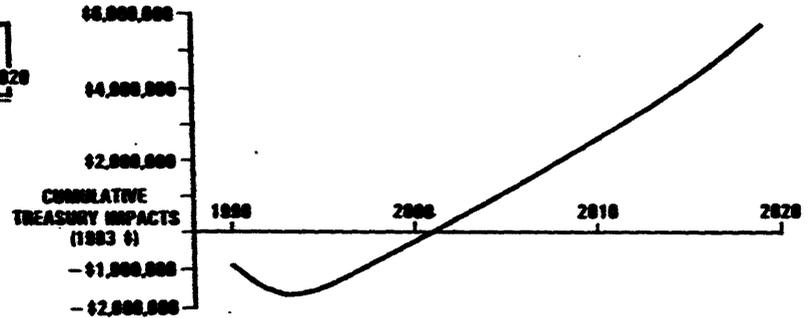
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- TOTAL IMPACTS OF THE ENERGY TAX CREDIT WILL DEPEND UPON A VARIETY OF SOLAR/WIND INSTALLATION SPECIFIC FACTORS, AS WELL AS OVERALL NATIONAL ECONOMIC FACTORS:
  - DIRECT FINANCIAL FACTORS REFLECT THE LIFE CYCLE CASH FLOWS SOLELY ASSOCIATED WITH AN INDIVIDUAL SYSTEM: SYSTEM CAPITAL COSTS, ANNUAL FINANCIAL AND OPERATING COSTS AND FUEL EXPENSES.
  - INDIRECT MULTIPLIER FACTORS ATTEMPT TO CAPTURE THE NET IMPACTS ON GNP DUE TO EMPLOYMENT AND PROFITABILITY CHANGES IN THE SOLAR RELATED INDUSTRIES AND FUEL RELATED INDUSTRIES.
  
- OUR ANALYSIS IS LIMITED TO THE DIRECT FINANCIAL FACTORS WHERE THE COST TO THE FEDERAL TREASURY INCLUDES:
  - THE DIRECT COST OF THE ENERGY INVESTMENT TAX CREDIT IN THE FIRST YEAR
  - TAX DEDUCTIONS FOR DEPRECIATION OVER FIVE YEARS
  - TAX DEDUCTIONS FOR INTEREST OVER THE PERIOD THAT THE SYSTEM IS FINANCED
  - TAX DEDUCTIONS FOR C&M OVER THE LIFE OF THE SYSTEM
  - LOWER TAX DEDUCTIONS FOR CONVENTIONAL FUEL EXPENSES OVER THE LIFE OF THE SYSTEM.

**ANNUAL TREASURY IMPACT  
OF INDUSTRIAL SOLAR INVESTMENT**



**CUMULATIVE NET TREASURY IMPACT  
OF INDUSTRIAL SOLAR INVESTMENT**



TREASURY IMPACTS . . .

INSTALLATION SPECIFIC COSTS AND BENEFITS

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- NEARLY ALL TAX SAVINGS (TREASURY COSTS) OCCUR IN THE FIRST FIVE YEARS
  - TAX CREDIT
  - DEPRECIATION

WHILE SIGNIFICANT FUEL SAVINGS OCCUR OVER THE LIFE OF THE SYSTEM.

- THE PRESENT VALUE OF THE NET ANNUAL IMPACT ON THE U.S. TREASURY IS A FUNCTION OF KEY FINANCIAL AND OPERATING PARAMETERS -- CAPITAL COST, TAX CREDIT LEVEL, FUEL SAVINGS VALUE, SYSTEM LIFE, FINANCING, GOVERNMENT DISCOUNT RATE, EFFECTIVE INCOME TAX RATE.
- NET IMPACTS MAY BE POSITIVE OR NEGATIVE DEPENDING UPON THE SPECIFIC VALUES ASSUMED FOR KEY PARAMETERS. THE PRESENT VALUE OF NET TREASURY IMPACTS BECOME MORE POSITIVE AS:
  - SOLAR CAPITAL COST DECLINES
  - VALUE OF FUEL SAVINGS INCREASES
  - GOVERNMENT DISCOUNT RATE DECLINES.

**IMPACT OF 25 PERCENT BUSINESS ENERGY INVESTMENT CREDIT ON THE FEDERAL TREASURY  
FOR SYSTEMS INSTALLED IN 1985 AND 1990  
(MILLION 1983 DOLLARS)**

<b>START-UP DATE</b>	<b>REAL ENERGY PRICE ESCALATION</b>	<b>DIRECT COST OF 25% TAX CREDIT</b>	<b>PRESENT VALUE OF TOTAL REVENUE LOSS*</b>	<b>PRESENT VALUE OF TOTAL REVENUE GAIN*</b>	<b>PRESENT VALUE OF NET IMPACT*</b>
1985	0%	\$ 84	\$ 277	\$ 128	- \$151
	2%	\$105	\$ 347	\$ 305	- \$ 42
1990	0%	\$175	\$ 573	\$ 393	- \$186
	2%	\$365	\$1203	\$1795	+ \$592

\*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

TREASURY IMPACTS . . .

TOTAL BUSINESS ENERGY INVESTMENT CREDIT COSTS TO THE TREASURY

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- FROM THE OUTSET, TREASURY GAINS FROM REDUCED CONVENTIONAL FUEL COST DEDUCTIONS WILL PARTIALLY OFFSET THE COST OF THE TAX CREDIT FOR INDUSTRIAL AND ELECTRICITY GENERATING SOLAR/WIND SYSTEMS.
- BY 1990, LOWER SOLAR AND WIND CAPITAL COSTS AND HIGHER CONVENTIONAL FUEL PRICES MAY RESULT IN A NET GAIN TO THE TREASURY. THIS REFLECTS THE FACT THAT TOTAL LIFE CYCLE TREASURY IMPACTS BECOME MORE POSITIVE AS THE ECONOMIC ATTRACTIVENESS OF INDIVIDUAL SOLAR AND WIND SYSTEMS IMPROVES.

**IMPACT OF 40 PERCENT RESIDENTIAL ENERGY TAX CREDIT ON THE FEDERAL TREASURY FOR  
SYSTEMS INSTALLED IN 1985 AND 1990  
(MILLION 1983 DOLLARS)**

<b>START-UP DATE</b>	<b>REAL ENERGY PRICE ESCALATION</b>	<b>DIRECT COST OF 40% TAX CREDIT</b>	<b>PRESENT VALUE OF NET IMPACT*</b>
<b>1985</b>	<b>0%</b>	<b>\$363</b>	<b>- \$351</b>
	<b>2%</b>	<b>\$359</b>	<b>- \$416</b>
<b>1990</b>	<b>0%</b>	<b>\$401</b>	<b>- \$484</b>
	<b>2%</b>	<b>\$646</b>	<b>- \$748</b>

\*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

TREASURY IMPACTS . . .

TOTAL RESIDENTIAL ENERGY TAX CREDIT COSTS TO THE TREASURY

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- TAX CREDITS FOR RESIDENTIAL SYSTEMS, ALONG WITH THE BUSINESS ENERGY INVESTMENT CREDIT, PROVIDE NUMEROUS BENEFITS, INCLUDING:

- CREATION OF EMPLOYMENT OPPORTUNITIES
- REDUCTION IN OIL IMPORTS
- DEVELOPMENT OF EXPORT INDUSTRY CAPABILITY.

HOWEVER, RESIDENTIAL TAX CREDITS DO NOT PROVIDE THE TREASURY WITH OFFSETTING REVENUES, AS DOES THE BUSINESS ENERGY INVESTMENT CREDIT.

- IF WAGES CONTINUE TO ACCOUNT FOR APPROXIMATELY 40 PERCENT OF THE INSTALLED COST OF SOLAR AND WIND SYSTEMS, DOMESTIC RESIDENTIAL SYSTEM MANUFACTURE AND INSTALLATION WOULD REPRESENT OVER A \$1 BILLION INDUSTRY. EMPLOYEES IN THE SOLAR INDUSTRY CAN, CORRESPONDINGLY, BE EXPECTED TO DOUBLE FROM TODAY'S LEVELS -- WHICH HAVE BEEN ESTIMATED TO BE 30,000 TO 40,000 WORKERS NATIONWIDE.

## SUMMARY OF IMPLICATIONS

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### CONTINUING THE TAX CREDIT FOR INVESTMENT IN SOLAR/WIND TECHNOLOGIES WOULD:

- ENHANCE THEIR FINANCIAL ATTRACTIVENESS TO CONSUMERS, RAISING MARKET PENETRATION AND SUPPORTING THE DEVELOPMENT OF IMPROVED TECHNOLOGIES AT LOWER COST.
- MAINTAIN THE INDUSTRIAL BASE AND RELATED CONSUMER CONFIDENCE NECESSARY FOR SUCCESSFUL DEPLOYMENT OF SOLAR AND WIND TECHNOLOGIES AS THEY BECOME COST EFFECTIVE WITHOUT TAX CREDIT SUPPORT
- ENCOURAGE INVESTMENT IN A LABOR-INTENSIVE INDUSTRY WITH PROSPECTS FOR SIGNIFICANT PRODUCT EXPORT.
- PROVIDE INSTALLED SOLAR AND WIND ENERGY CAPACITY THAT IS CAPABLE OF REPLACING THE EQUIVALENT OF 33 MILLION BARRELS OF IMPORTED OIL ANNUALLY BY 1990.

THESE BENEFITS WOULD BE OBTAINED AT MINIMAL PRESENT VALUE COST TO THE GOVERNMENT DUE TO INCREASED FUTURE REVENUES THAT OFFSET NEAR-TERM COSTS. IN ADDITION, MAINTAINING A SMALL, VIABLE INDUSTRIAL BASE WILL COMPLEMENT FEDERAL R&D EFFORTS TO DEVELOP FUTURE GENERATIONS OF SOLAR/WIND TECHNOLOGIES.

**SUMMARY OF ASSUMPTIONS**

	<u>UTILITY/INDUSTRIAL</u>	<u>RESIDENTIAL</u>
0 DEBT FINANCING	40%	80%
0 REAL DEBT INTEREST RATE	3%	4%
0 REAL DISCOUNT RATE	15%	10%
0 REAL RETURN ON EQUITY*	20%	
0 MARGINAL TAX RATE	50%	30%
0 FUEL EFFICIENCY		
- ELECTRICITY GENERATION	35%	NA
- PROCESS HEAT GENERATION	70%	NA
- ELECTRICITY APPLICATION	NA	95%
0 SYSTEM LIFE	<u>30 YEARS</u>	<u>30 YEARS</u>
0 REAL CONVENTIONAL FUEL COST ESCALATION (OVER 30 YEARS)		
- LOW		0%/YEAR
- HIGH		2%/YEAR
0 LOAD FACTOR		
- SOLAR		30%
- WIND		25%

\* REAL RETURN ON EQUITY CORRESPONDS TO THAT RATE REQUIRED BY THIRD PARTY INVESTORS ON SIMILAR TYPES OF FINANCIAL INVESTMENTS.

SUMMARY OF CAPITAL AND O&M COSTS  
FOR SOLAR AND WIND TECHNOLOGIES  
(1983 DOLLARS)

<u>TECHNOLOGY/MARKET</u>	<u>CAPITAL COST</u>	<u>O&amp;M COST</u>
WIND-ELECTRIC	\$1,750/KW (1983) \$1,500/KW (1985) \$1,000/KW (1990)	2.0% CAPITAL/YEAR
PHOTOVOLTAIC-ELECTRIC	\$10,000/KW (1983) \$8,000/KW (1985) \$4,000/KW (1990)	0.1% CAPITAL/YEAR
SOLAR THERMAL-ELECTRIC	\$7,000/KW (1983) \$4,800/KW (1985) \$3,700/KW (1990)	0.25% CAPITAL/YEAR
SOLAR THERMAL-INDUSTRIAL	\$1,100/KWT (1983) \$950/KWT (1985) \$670/KWT (1990)	0.2% CAPITAL/YEAR
WIND-RESIDENTIAL	\$2500/KW (1983) \$2300/KW (1985) \$1875/KW (1990)	
ACTIVE SOLAR-RESIDENTIAL	\$55/FT. (1983) \$50/FT. (1985) \$40/FT. (1990)	1.0% CAPITAL/YEAR

SOURCES:

DOE, SOUTHWEST PROJECT  
BAH/DOE, SOLAR CENTRAL RECEIVERS  
ADL, THE COST OF FEDERAL TAX CREDIT PROGRAMS  
URBAN SYSTEMS, ANALYSIS OF THE IMPACT OF FEDERAL TAX INCENTIVES  
BOOZ, ALLEN & HAMILTON INC.

## ANNUALIZED LIFE CYCLE COST (ALCC) EQUATIONS

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$$\text{ALCC (Conv. Fuel)} = (\text{CRF}_{i,N}) P_0 (1-\tau) \left( \frac{1+e}{1-e} \right) \left[ 1 - \left( \frac{1+e}{1+i} \right)^N \right] \quad \text{if } i \neq e$$

Where:

$P_j$  = the efficiency-adjusted conventional fuel price in the  $j$ th year of system operation

$\text{CRF}_{i,N}$  = capital recovery factor based on system owner's discount rate

$i$  = system owner's discount rate

$N$  = lifetime of solar system

$$\text{ALCC (Solar)} = (\text{FCR}) \frac{\text{capital cost}}{\text{MMBtu/yr}}$$

$$\text{CRF} = \frac{r}{1 - (1+r)^{-N}}$$

Where  $r$  = appropriate discount rate

## FIXED CHARGE RATE FORMULAS FOR DIFFERENT CLASSES OF SYSTEM OWNERS

<u>Ownership Class</u>	<u>Fixed Charge Rate Formulas</u>			
	Annual Capital Expenses	Other Expenses	Tax Deductions	Investment Tax Credit
Residential (Private Citizen)	$\overline{CRF}_p$	$+ \beta_1 + \beta_2 + m$	$- \tau_p (\beta_1 + \beta_2 + \overline{r} f_r)$	$- \frac{\alpha_p}{1+i} \left[ \overline{CRF}_p - \tau_p \overline{r} f_r \right]$
Business (Corporation)	$\overline{CRF}_B$	$+ \beta_1 + \beta_2 + m$	$- \tau_B (\beta_1 + \beta_2 + m + \overline{r} f_r + d)$	$- \frac{\alpha_B}{1+i} \left[ \overline{CRF}_B - \tau_B \overline{r} f_r \right]$

Notes: 1)  $\overline{CRF}$  = The weighted average corporate capital recovery factor

$$\text{For residential ownership, } \overline{CRF}_p = CRF_r f_r + CRF_i (1-f_r)$$

$$\text{For business ownership, } \overline{CRF}_B = CRF_b f_b + CRF_c f_c + CRF_d f_d$$

2) It is assumed that the investment tax credit is taken at the end of the first year of system operation. Its discounted value is credited against the system's capital cost.

## GLOSSARY OF TERMS USED IN FIXED CHARGE RATE FORMULAS

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- CRF: The capital recovery factor: the uniform periodic payment expressed as a fraction of the original principal, that will fully repay a loan, including all interest, in a predetermined number of periods.
- $CRF_i$  : The capital recovery factor in the case where the interest rate is equal to the system owner's discount rate ( $i$ ).
- $CRF_{r f_r}$  : Annual mortgage payment on the fraction ( $f_r$ ) of a SI investment financed through floating a loan.
- $CRF_c f_c$  : Annual payment to holders of common stock issued to finance a fraction ( $f_c$ ) of a SI investment.
- $CRF_p f_p$  : Annual payment to holders of preferred stock issued to finance a fraction ( $f_p$ ) of a SI investment.
- $CRF_b f_b$  : Annual payment to holders of bonds issued to finance a fraction ( $f_b$ ) of a SI investment.
- $\beta_1$  : Annualized present value (PV) of all non-income tax payments (primarily property taxes), expressed as a fraction of the initial capital investment (CI).
- $\beta_2$  : Annualized PV of all insurance premiums, expressed as a fraction of CI.
- $m$  : Annualized PV of all operating maintenance, and replacement expenses, expressed as a fraction of CI.
- $\bar{r}$  : Annualized PV of all interest deductions, expressed as a fraction of CI.
- $d$  : Annualized PV of depreciation deductions, expressed as a fraction of CI.
- $i$  : System Owner's discount rate.
- $\alpha_P$  : Tax credit available to a residential owner of a solar system expressed as a fraction of CI.
- $\alpha_B$  : Tax credit available to a business owner of a solar system expressed as a fraction of CI.
- $\tau_P$  : Marginal personal income tax rate.
- $\tau_B$  : Effective marginal personal income tax rate.

Senator WALLOP. Dr. Blum.

**STATEMENT OF DR. EDWARD H. BLUM, VICE PRESIDENT, MERRILL LYNCH WHITE WELD CAPITAL MARKETS GROUP, WASHINGTON, D.C.**

Dr. BLUM. It's a pleasure to testify this morning to support S. 1305. I head the alternative energy financing group at Merrill Lynch, and our group has been very active in financing the whole range of alternative energy technologies.

I would like to summarize today a few points that we have gained from this experience in the marketplace. We are actively in the market financing projects in these areas, and have developed a good feeling for what will or will not go and under what circumstances they will and will not go.

In our experience, the alternate energy credits, the energy tax credits, have proved both effective and essential. As the context for this, it's important to realize that investors can choose from a large menu of investment alternatives. If you want to attract them to invest in alternative energy, you have to offer them a rate of return that's considerably higher than what they can get from conventional securities. This is so because alternative energy is perceived as having technology risks. In many cases, the technologies are not well proved or do not have long experience even when they are operating. There are uncertainties about future energy prices; therefore, the return is viewed as being uncertain. And uncertainty has always demanded a risk premium. And, third, for most of the project investments, the forms through which they must be operated to satisfy the Tax Codes, such as limited limited partnerships, are illiquid. They cannot readily be sold. And as a result, investors demand a premium—for all of these features.

In the current market, A-rated, 30-year, tax-exempt bonds, for example, are today yielding about 10 percent. Our finding is that the alternative energy investments have to offer somewhere between 20 to 30 percent after-tax to compete effectively against these attractive, conservative liquid investments.

The higher rates, the higher end of that scale, are generally needed for the newer technologies, those perceived to be riskier.

The value of the energy tax credit is to augment the after-tax rate of return. And in that, it's the key to transforming into saleable investments projects that are narrowly economic. Many of them, for example, without the energy tax credit can offer rates of return in the range of roughly 12 to 15 percent after tax, which is roughly the median return on equity for the top 1,000 U.S. firms. Such a return is very competitive with the overall U.S. economy, but it's not good enough to attract the necessary risk capital.

The energy tax credit plays, therefore, a catalytic role—transforming something which is basically economic into something which can attract risk capital.

It is important to realize in looking at the effects that the energy credit has had so far that the development of a new industry takes time. You need research and development. You need tooling. You need manufacturing, project development, installation, and finally operation. So what we are now seeing is the emergence of effects

the credit began stimulating in 1979. Last year, for example, the wind industry—which really began responding aggressively to the Energy Tax Act of 1978, and then later on the Windfall Profits Tax Act of 1980, which augmented the credit—finally got to the point where the tooling was done, the manufacturing was ready, the machines were rolling off the line, and they were getting installed.

So whereas in June 1982, there were few wind projects installed, last year over \$200 million in projects were installed. Reportedly over \$150 million more is in the financing pipeline now, and the industry was moving quite rapidly. This has occurred heavily in California, where there are additional State benefits augmenting the ETC to make a total of about a 30-percent energy tax credit effectively after tax.

What's also happening in the wind business, just to take that as an example, is that we are seeing new wind turbines being developed. We are seeing larger sizes coming into the market that were not there before. We are seeing that the tax credit is serving as a driving force for technology development. New technologies, a major part of the logic that helped create the energy credit in the first place are, in fact, being realized. This development would not have occurred without the ETC, and it is occurring with it.

The prospects look very good, as one extrapolates from the experience to date, that we will have a cost-effective industry that can survive without the energy tax credits sometime in the next 5 years. But it will not occur in the next 2 years, which is the time that is left on the current credit.

It's important to realize also—since the IRS has argued to the contrary—that at realistic rates of return the energy credit makes the aftertax return of renewable energy investments basically directly equivalent to that of expensing under current tax law. I have some numbers for that in my written text—let me just give two numbers. One is that for individuals—who are buying almost all the projects that are offered today—at the discount rates that are necessary to do the financing today, the investment credit and the energy credit and the ACRS, taking into account TEFRA, add up to 51 percent of the value of the equipment. Expensing would be 50 percent. That's a direct balance. Without the energy credit the equipment receives only 36 percent.

One should also take into account the fact that limited partnerships, which are the structures through which these things are done, under the tax law cannot take all the depreciation at the time the project goes into service, but must simply initiate the depreciation. Thus there is effectively a 6-month lag in being able to use depreciation. With this consideration, the net present value after tax to a limited partner is only 48.3 percent even with the energy tax credit, whereas expensing would be 50 percent.

Therefore, in fact, even with the energy credit at its current level, the net present value after tax of the ITC, the ETC, and the ACRS depreciation, is less than that of expensing. Treasury's argument is unrealistic in that it does not recognize or acknowledge the rates of return that are necessary in the market today.

To summarize, then, the energy tax credit works effectively through the free market. It has been fostering technology development and use in this field. It is very important to continue it for

U.S. energy security and economic development in the high technology area.

Thank you.

Senator WALLOP. Thank you very much.

[The prepared statement of Dr. Blum follows:]

TESTIMONY OF DR. EDWARD H. BLUM  
VICE PRESIDENT & EXECUTIVE DIRECTOR  
ALTERNATIVE ENERGY FINANCING  
MERRILL LYNCH WHITE WELD CAPITAL MARKETS GROUP  
BEFORE THE SUBCOMMITTEE ON ENERGY & AGRICULTURAL TAXATION  
COMMITTEE ON FINANCE  
U.S. SENATE  
JULY 18, 1983

Mr. Chairman and Members of the Committee: it is a pleasure to appear before you this morning to testify in support of S.1305 and related legislation to extend the business energy tax credits for energy technologies.

My name is Edward H. Blum. I am a Vice President of Merrill Lynch, Pierce, Fenner & Smith and Executive Director of Alternative Energy Financing in the Merrill Lynch White Weld Capital Markets Group, the investment banking arm of Merrill Lynch. My colleagues and I are actively financing the development and use of a wide range of alternative energy technologies, including solar, wind, geothermal, hydroelectric, cogeneration and biomass.

In our experience to date, the business energy tax credits have proven effective and essential. I would like to share this experience with you, provide some illustrative numbers and details, and address some of the substantive issues raised about extending the tax credits in the debate thus far.

## RENEWABLE ENERGY MARKETPLACE

I would like to begin by noting a few key points about the marketplace for renewable and cogenerated energy. These outline the context within which financing must take place.

First, it is worth emphasizing that conventional forms of renewable energy are already important in the United States economy, and that less conventional forms hold the potential of supplying very large quantities of energy in the U.S. and abroad by the end of this century. Official statistics do not adequately cover renewable energy. But generally accepted estimates are that wood and hydroelectricity together now contribute the equivalent of roughly 2.5 million barrels of oil per day, over six percent of total U.S. energy use, with much smaller but rapidly growing contributions from geothermal, wind and direct uses of solar energy. Estimates of future use vary widely. The potential, however, is clearly large. Many studies show the possibility that renewable sources might provide over 20% of the total U.S. energy supply, and even larger percentages of the supply for countries less well endowed with oil, gas, coal, oil shale, and uranium.

How extensively renewable energy technologies are and will be used is largely determined by the quality of the technologies (that is, their ability to convert natural energy into useful

forms reliably and effectively) and by competitive economics. An important dimension of quality is successful experience. Many renewable energy technologies are new and rapidly improving, with some but still limited experience to date, little of it as yet well documented. As a result, investors still see them as risky. To move them into the marketplace, especially in the absence of an independent testing or verification program, thus requires offering investors a "risk-premium" -- a rate of return higher than that available on more conventional investments.

This relation between risk and reward is well established and very clear in the bond markets, where the rating agencies evaluate and attempt to quantify risk into specific categories. For example, on July 13, 1983, the prices of 30-year Treasury bonds provided investors a return of 11.42%, but new 30-year electric utility bonds rated Aaa (the best rating) had to be priced to offer interest rates of 12.4% to 12.55%; new 30-year electric utility bonds rated Baa (the lowest investment-grade rating) had to offer 13.15% to 13.65% to attract buyers.

Investments involving new technologies are not generally rated so formally. But investors' perceptions and demands for higher returns to offset perceived risks are quite similar. The principal difference is that the returns they demand for risky project financings are much higher than those for rated bonds.

Second, it is worth noting that, despite moves toward deregulation, the overall market for energy is not perceived to be a free marketplace. Internationally, oil prices are still influenced by third-world and Soviet Union production decisions. This influence is not as great now as it has been in the past. But the recent wide swings in oil prices and the considerable uncertainty about future prices add to the sense of risk and complicate and hinder decisions about alternative energy supplies. Domestically, producers of traditional fuels (e.g., oil, gas, coal and uranium) have obtained tax treatment for the costs of extraction and for depletion that continues to be important in stimulating production and in obtaining the needed capital. Federal and State regulation continue to control the prices of natural gas and electricity.

Moreover, expenditures for fuels used in business constitute operating costs, deductible from revenues in computing income taxes. Renewable energy sources are generally not purchased from someone else. Capturing the river, the wind or direct solar energy substitutes capital investment for the continuing expense of fuel. Tax incentives for renewable energy capital investments provide equitable balance, partly offsetting the tax advantage of fuel expensing.

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## FINANCING EXPERIENCE

The business energy tax credit (ETC) was originally enacted in November, 1978, and the current renewable ETC dates from mid-1980. Substantial projects take over two years to conceive, design and build. And technologies not previously in widespread use often require several years to evolve through research and development (R&D) into the marketplace. Therefore, the impact of the business renewable energy tax credit is becoming visible only now.

The growth of the wind industry during 1982 and the first half of 1983 illustrates this important point. Following the Energy Tax Act of 1978, many firms began extensive R&D to improve then-existing windturbines. By 1981, several firms had begun to build production facilities; others began production in 1982. During the same period, several states with good wind resources implemented the Public Utilities Regulatory Policy Act (PURPA), also enacted in November 1978, in ways that encouraged so-called third-party financing through independent power producers.

By late 1981, a few wind farms began to be installed. By early 1982, the financial community began to be educated in this new area, and substantial installations were begun. For several reasons -- the good wind resources, a public utilities commission with a favorable policy toward renewable energy, cooperative

utilities with relatively high "avoided costs," and state tax benefits augmenting the ETC -- much of this development occurred in California. Development became so vigorous, for example, that in Kern County, California, wind farms were the primary construction activity and employer during 1982.

Before June 1982, virtually no wind project financing had been done by any investment or commercial bank. Since then, Merrill Lynch alone has raised over \$80 million in equity for wind projects totalling over \$130 million. Entrepreneurs and other investment banks have raised at least another \$50 million for wind projects totalling over \$70 million, also during the past 14 months. Over \$150 million more such financing is reportedly now in the financing pipeline.

The period between initial enactment of the tax credits and the takeoff of this industry represents an unavoidable incubation period. Time is always essential to develop a technology to the point where it is commercially acceptable, and to complete the contractual arrangements needed for successful project financing.

All this activity in California is a direct consequence of the ETC and of the corresponding California solar and wind business energy tax credit which (net of Federal taxes on the reduced

state tax liability) is worth 12.5 percent to an individual investor. These combined tax credits are equivalent to a Federal credit of 27.5 percent; state depreciation increases the total tax benefits to the equivalent of a 30 percent Federal tax credit. Together, the Federal and state tax incentives are fostering the growth of what many expect to be a substantial industry. This industry is growing as a result of the ETC, and would definitely not have grown without it.

One might reasonably ask: Can it be a healthy industry, one that will survive, if it needs such large stimuli to get started? The answer, thus far at least, appears to be "Yes." Even over the past 14 months, those of us active in the field have observed notable improvements in performance and cost-efficiency.

As production runs lengthen, costs are decreasing. As installed windturbines accumulate experience, designs are being improved to enhance performance. And, having learned from producing and operating this first generation of modern, commercial windturbines, engineers are now scaling up. Having become comfortable with 25, 50, and 75-kilowatt machines, they are now beginning to build 100, 150, 200, 350, and 500-kilowatt machines at costs and with performance that would not have been possible a short time ago.

These new machines, and the multi-megawatt windturbines on which work is underway, represent major steps forward. In the real world of medium-to-large scale hardware, progress does not occur overnight, however. Tooling, manufacturing, financing, installation, and operation take time. It has taken four years to reach today's state. And it is likely to be another four years or so before enough new machines are installed and enough experience is accumulated with them to permit the next steps to fully commercial machines sufficiently inexpensive and well proved to be financed without the energy tax credit.

The substantial R&D and manufacturing investments needed to attain this point are not likely to be made, however, unless the market for both the intermediate and longer-term products appears likely to be vigorous enough to make the investments worthwhile. In the absence of sizeable increases in energy prices, which few of us would welcome, extending the ETC is important to sustaining this favorable and vital market climate.

#### ENERGY TAX CREDIT EFFECTS

As this detailed example illustrates, the impact of the business renewable energy tax credit is already significant, and is becoming increasingly so. It has proved effective and essential in the financing of economically attractive projects in biomass

(e.g., wood and waste fired cogeneration), geothermal energy, and wind energy. And it is a key element of financings being developed for these areas, for low-head hydroelectricity, and for solar process heat and solar-powered electricity generation. For these financings, the energy tax credit helps transform projects that are merely economic and competitive with oil into ones that have returns high enough to attract the necessary risk capital.

By helping renewable energy investments to attract risk capital, the ETC has also helped create a "market pull" for private funding of research and development. The expectation that there will be an active market for the ultimate products stimulates well-established firms, young entrepreneurial companies, and venture capital sources to invest in improved products that will be more competitive and might capture significant market share. Evidence of this is the rapid progress being made in wind turbines, in coal-fired cogeneration, in bottoming-cycle low-temperature-difference electric power generation, parabolic trough and dish and fresnel lens high-temperature solar collectors, and in photovoltaics.

Some of the developments have benefitted from Federal R&D support. But much of the most recent progress with which I am familiar stems from private investment attracted by the prospect of a large market. If that market remains strong and continues to grow, investors who have supported successful developments can

earn the rewards that will repay them for the substantial risk they have taken and continue to take.

I would like to illustrate the value and importance of the ETC using figures from specific renewable energy projects we have financed or analyzed for financing. To clarify the terms and concepts, I would like first to describe briefly how renewable energy projects are typically financed and what returns are needed in today's financial markets.

Broadly speaking, projects are financed with two general types of funds:

**Debt:** money loaned to the project's owners at determined (though not necessarily fixed) rates of interest, with a determined schedule for repayment. The loan is typically secured by credit-worthy guarantees and/or collateral.

**Equity:** risk capital invested for a share of the project ownership. Repayment is not guaranteed; the investor can lose most of his money if the project fails. Return on investment is achieved through the tax benefits accruing to the project's owners plus the operating profits left after paying

expenses and the principal and interest owed on the debt.

Although interest rates are still relatively high, some debt can generally be obtained for a sufficiently attractive and credit-worthy project. Projects viewed as particularly risky -- perhaps because their technology is new and untried, because they are large, or because their economic returns depend too greatly on governmental actions -- may not be able to obtain debt without guarantees by creditworthy entities.

To obtain equity or risk capital for an energy project today entails competing for investors' funds with a wide range of alternative equity investments. Within a corporation, a project must mesh with overall corporate strategy and compete with other investments open to the firm. For passive investors, institutions or individuals, the project must offer rewards at least as attractive as those available from more conventional investments, and commensurate with the perceived risks.

Today, very high returns can be obtained on relatively conservative and liquid investments; for example, thirty-year A-rated tax-exempt bonds are yielding over 10%. Most project equity investments are comparatively illiquid. Sale of ownership interest before the end of the five-year vesting period for investment and energy tax credits can have adverse tax consequences, and

limited partnership interests in general cannot be freely traded. Add to these considerations investors' concerns about the course of future energy prices, and the risk premium noted earlier. As a result, we find that to attract equity investors today, a sound renewable energy project must offer a minimum probable rate of return on equity between 20% and 30% after-tax, and have the possibility that the return could go even higher. (This rate of return is an average annual return over a project's life.) Projects with better established technologies, such as hydroelectric or gas-fired cogeneration, can generally be priced to yield rates of return at the lower end of this range; those with newer technologies tend to require the upper end of the range. In this market environment, the business energy tax credit is a vital element in attracting equity capital for renewable energy projects.

Recently, for example, we raised over \$40 million in equity for a series of wind projects (totalling over 40 megawatts) to be constructed in Northern California. The windturbines being used have been operating successfully for over a year and the project management and economics were quite attractive. Based on reasonable estimates of future electricity "avoided costs" in that area, our projections showed a likely return on equity nationally in the range of 23% to 30% after-tax, including the benefits of the ETC. The project equity sold well. Without the ETC, the return on equity with the same projections (adapting the

financing structure to the different benefit schedule) would have been only 14% to 15% after-tax. With this lower rate of return, the project equity would not have been an attractive investment; I doubt that investors would have purchased the equity interests, and the projects would not have been financed.

One might argue that, if the return were not high enough without the ETC, then perforce the project must not be competitively economic and should not be built -- that it would divert resources from potentially more profitable ventures. This argument, however, ignores the realities of the marketplace. As we noted earlier, the market today requires a premium rate of return on equity. The project would have a better rate of return than much of American industry, and thus would be a worthwhile investment for the nation. According to "Forbes" 1983 Annual Report on American Industry, for example, a return on equity of 14% to 15% would be at the median for the largest 1,000 firms in the United States and near the median 5-year average return on equity for the energy industry. Moreover, over its life, the project is expected to yield for the Treasury much more in tax revenues than the cost to the Treasury of the tax credits.

To obtain the necessary rate of return in other projects -- where the technology is still new and/or production has just begun, so that costs are still high -- both the Federal ETC and a large state tax credit (such as that in California) have proved

essential. For example, a very attractive project to convert solar energy to electricity that we have analyzed in great detail shows a rate of return in California of roughly 30% after-tax; this rate is what will be needed to finance it since the technology is new.

Outside of the very few states having comparable credits, its return with the current ETC falls to roughly 13% after-tax -- higher than Treasury's borrowing rate, but too low to be financed in today's market. Increasing the Federal ETC to 25% for such projects would enable them to be financed in every state having good sunshine -- including, for example, Wyoming, Kansas, Oregon, Louisiana, Texas, and Hawaii, to name only a few.

This solar technology merits this kind of launching assistance. As components are produced in quantity, the costs should decline significantly, attaining levels by 1987-88 that should be financeable without even the 15% ETC. It would then be able to be used everywhere without further assistance -- but it cannot cross the mountain to reach this valley without ETC assistance at the beginning.

In light of these market realities, the use of a 10% discount rate in calculations concerning the ETC by the Department of the Treasury (in well-publicized correspondence to the Congress) is quite unrealistic. The traditional threshold (or "hurdle") rate

used by corporations to assess investments was 15% after-tax, when inflation was low. Today that rate is more typically 20% to 25%. And for alternative energy investment, as we have noted, 30% is realistic today.

Let us thus redo Treasury's calculation using 30% after-tax as the standard:

- (a) The net present value after-tax of the regular investment tax credit (ITC) is 10%;
- (b) The net present value after-tax of the Accelerated Cost Recovery System (ACRS) 5-year depreciation deductions, with the TEFRA adjustment for the ITC, is 26.77% for corporations and 29.10% for individuals.
- (c) Without the ETC, we thus have the following inequitable results:

**TABLE 1: NET PRESENT VALUE AFTER-TAX WITHOUT ETC**

	<u>ITC &amp; ACRS</u>	<u>EXPENSING</u>
Corporations	36.77%	46%
Individuals	39.10%	50%

Now let us consider the results with the 15% ETC, again with 30% after-tax as the standard:

- (a) The net present value after-tax of the ITC and ETC together is 25%;
- (b) The net present value after-tax of the ACRS 5-year depreciation deductions, with the TEFRA adjustment for the ITC and ETC, is 24.66% for corporations and 26.80% for individuals. If the individuals are investing in a limited partnership, under current tax law the partnership's business is assumed to begin only when the project is placed in service, so that only a prorata share of the ACRS depreciation is available in the initial year. In this case (which probably is the most common case for renewable energy financing today), the net present value after-tax of the ACRS depreciation is only 23.30 percent.
- (c) With the ETC, we thus have the following results:

TABLE 2: NET PRESENT VALUE AFTER-TAX WITH ETC

	<u>ITC + ETC + ACRS</u>	<u>EXPENSING</u>
Corporations	49.66%	46%
Individuals	51.80%	50%
Individuals in Limited Partnership	48.30%	50%

As Table 1 and 2 clearly show, the business energy tax credit is vital to providing a balanced and equitable tax environment for renewable energy. Extending it to 1990 will help maintain that

balance and equitable treatment in the financial markets through the next critical stage of these important technologies' development.

#### FUTURE MARKETS

Substantial investments are now being made in R&D for renewable energy technologies -- such as solar thermal, photovoltaics, and larger wind turbines -- that should come to market over the next three to six years. And in several technologies, some companies are considering building expensive production lines that could significantly reduce costs. Increasingly, the private sector is investing in these key steps for renewable energy technologies. But it is doing so with the expectation that a worthwhile market will be there.

The ETC is important to assuring that market, and thus to ensuring that these firms will find it attractive to make and to continue these R&D investments. Especially with the major reductions in Department of Energy R&D funding, such continued private investment is critical. Extending to 1990 the current 1985 expiration date for the ETC, and perhaps augmenting the ETC for newer technologies, would provide the kind of investment certainty that the Administration has eloquently argued is so critical in other areas.

To add a quantitative dimension, I would like to offer an illustrative example from studies we have done for photovoltaics. As you know, photovoltaics are widely felt to be one of the most promising renewable energy technologies, with a potential worldwide market approaching several hundred billion dollars. Several of our clients, and others active in photovoltaics, estimate that they can achieve by 1985-1987 photovoltaic systems installed costs of roughly \$2.00 per peak-watt of capacity. Such a system cost might include panels costing \$0.50 per peak-watt, achieved through large-scale production, and "balance of systems" costing roughly \$1.50 per peak-watt, achieved by simplification and serious cost reduction. Such a system, financed relatively conservatively, could achieve the risk rates of return required today with the aid of the ETC.

Consider a system with such a cost, installed in a very sunny area that yields 2.5 kilowatt hours annually per peak-watt of capacity, financed by institutional or corporate investors with 60% equity and 40% debt (with a term of 15 years at 15% fixed-rate interest). Although some forecasts are higher, assume that the price paid for the system's electricity increases 5% per year. We tabulate the electricity price needed in the first year to yield the investors a 25% rate of return on equity after-tax.

The following table shows the value of the ETC for the current TEFRA-adjusted ACRS depreciation schedule:

TABLE 3: ELECTRICITY PRICE (cents per kwh)

<u>With the ETC</u>	<u>Without the ETC</u>
7.6	11.4

As this table shows, extending the ETC would help ensure that electricity from photovoltaic systems would be competitive with electricity from other sources in most parts of the United States by the mid-to-late 1980's. It would thereby help to hold down increases in electricity prices across sunny parts of the nation and reduce costs to consumers for whom photovoltaics would become the preferred supply.

The impact of the ETC is quite significant. It is worth, for systems having a ratio of total cost to annual power production in the range of \$0.70 to \$1.50 per annual kilowatt-hour (this example used \$2.00 per 2.5 kwh or \$0.80 per kwh), roughly \$0.04 to \$0.08 per kilowatt hour. By helping to build a substantial U.S. market for photovoltaics in the mid-1980's, it would assist U.S. companies to establish a solid production base from which to compete effectively with heavily subsidized Japanese photovoltaic activities in the world market.

#### FINANCING VALUE

The ETC is so important in equity financing for two main reasons. First, it can be taken by investors in the year the renewable

energy equipment is placed in service. For equipment taking over two years to build, it can be taken on a progress basis. It thus is not diminished by the high discount rates investors apply today, and retains a substantial net present value. Depreciation allowances, spread over five years or more, are (as the numbers displayed earlier show) not valued by investors at anywhere near their face value.

Second, a tax credit, unlike a deduction such as the depreciation allowance, does not depend for its value on the marginal tax rate the investor pays. The ETC is worth as much to a small business paying a lower tax rate as it is to a corporation paying the full 46% rate at the margin. It is also worth as much to an individual investor not in the top tax bracket who has funds to invest, as it is to someone paying the top rate of 50%.

The energy tax credit could also be valuable to the natural customers and users of renewable energy -- the utilities, who under current tax law cannot obtain it. PURPA permits utilities to own less than fifty percent of alternative energy projects without jeopardizing the projects' unregulated status. These unregulated, independent power projects are not guaranteed rates of return. And, in at least several states, the utility investment in these unregulated projects is not included in the rate base and tax benefits received by the utility need not be

passed directly to ratepayers.

Yet, it is widely felt that utilities participating in these projects are not or will not be eligible to receive the ETC (and may need to take 15-year ACRS depreciation rather than the more favorable 5-year treatment). Clarifying this status or amending the Code, if needed, would open for alternative energy potentially significant investments and participation by utilities. I suggest for your consideration making the ETC and 5-year ACRS depreciation available to utilities that (a) participate as minority owners in projects or ventures that would not be considered public utility property if the utility were not involved, or are not considered public utility property for the non-utility participants, and/or (b) own projects through unregulated subsidiaries or other means not regulated on a rate-of-return basis, where the tax benefits will be left in the project to improve its economics.

#### CONCLUSION

At its current level, the business energy tax credit is quite important for the financing of renewable energy projects, as I hope the examples presented have helped to show. To continue the stimulus for market-driven, private sector investment in renewable energy R&D, and to continue the increasing pace of renewable energy development and use, extending and perhaps increasing the ETC would be a national investment offering very substantial returns.

Thank you very much. I will be pleased to answer any questions the committee may have.

Senator WALLOP. Mr. Huyck. Is that the correct pronunciation?

**STATEMENT OF PHILIP HUYCK, FINANCIAL CONSULTANT, FIRST BOSTON CORP., NEW YORK, N.Y.**

Mr. HUYCK. It is, indeed. Thank you, and congratulations. It's rare that anyone gets it on the first try.

Senator WALLOP. I hit one or two once in a while.

Mr. HUYCK. That's right. We all get lucky.

I would reiterate much of what Ed has said. To the extent there is a difference in perspective, it is that First Boston is an investment bank compared to Merrill Lynch's large retail house. Our orientation is more institutional than——

Senator WALLOP. Could you just bring that microphone a little bit closer. They are so directional.

Mr. HUYCK. Is that better?

Senator WALLOP. That's better. Thank you.

Mr. HUYCK. So our perspective is perhaps more institutional than Merrill Lynch's might be. And that is a different perspective on the issues that we are talking about.

In a sense, an investment banker makes a peculiar witness because of the neutrality of the capital markets. In theory we should simply sit back and see what investment opportunities are presented to us. And there is no reason to advocate one over the other. But there is at least a closet enthusiasm among certain constituencies in this area to see these things on a policy basis go ahead and become commercially viable.

You asked the question earlier couldn't the project have been financed on a commercial basis, on a competitive basis. That's, of course, the question that underlies the entire renewable energy area. As was alluded to several times earlier, capital markets are neutral. That's their major virtue: the discipline they impose on the investment process.

In order for projects to compete both internally for the allocation of funds within major industrial corporations and externally in the capital markets whether for equity through a limited partnership, institutional equity, debt from banks or major insurance companies, they have to be able to hold their own against alternative investment opportunities.

That decision process takes place in the context of a risk/reward analysis. What we are talking about largely is a tradeoff between capital costs, that is, an upfront expenditure versus operating costs, a delayed expenditure. And that analysis takes place in the context of all the risk elements in a project.

Unfortunately, we tend in our culture and in our financial institutions to have a very high discount factor. And the instability in the various elements that you use in your calculations has led to an even higher degree of skepticism that the benefits that might mature later in exchange for this upfront commitment will ever materialize.

That means in this context that the energy tax credits which are to a large extent an upfront realization, a levelizing of the playing field to some extent, have a dramatic impact in the investment decision process in the institutional context.

The tax credits themselves over the last few years in our discussions with institutions have been as much a part of the problem as a part of the solution because of their instability and unpredictability. Any investment decision usually includes a worst case scenario, a kind of institutionalized Murphy's law where people assume that certain benefits will not mature, prices won't rise, costs will overrun. And as you insert the questions about the availability of the tax credits, particularly with their expiration or during any efforts to terminate them prematurely, as you insert that into the equation the multiplier effect is very dramatic and leads to the delay of investment decisions by institutions who were on the verge of a positive commitment.

So I would encourage you to consider positively the proposed legislation. It adds an element of stability to what has been an otherwise tragically unstable decisionmaking environment, and could make a major contribution to an institutional commitment to this area that I think would have significant implications for energy policy.

Thank you.

Senator WALLOP. Thank you very much.

[The prepared statement of Mr. Huyck follows:]

Written Testimony

Hearings Relating to the Renewable Energy Tax Act of 1983

Testimony before the  
Subcommittee on Energy and Agricultural Taxation  
of the Senate Finance Committee

July 18, 1983

Philip M. Huyck  
Consultant, The First Boston Corporation

Summary

Extension and expansion of energy tax credits as projected in the Renewable Energy Tax Incentive Act of 1983 will be a significant element in the preservation and development of a viable renewable energy industry.

Energy tax credits are not in themselves a sufficient condition for the development of a viable renewable energy industry, but they can legitimately be termed a necessary condition for many investment decisions.

The renewable energy industry is at a very delicate point in its development. The present expiration dates of the energy tax credits pose in many contexts a genuine problem for an institutional investor. If certain delays occur in completion of the project, a not uncommon occurrence, the investor runs the risk that the tax credits may be lost. This very risk is having a chilling effect on investment commitments to renewable energy. The proposed legislation serves two useful purposes. First, it helps stabilize the projected economics of renewable energy projects. Second, it sends a clear signal that this industry is still viewed as having significant potential to help solve the country's long-term energy problem despite a short-term fossil fuel glut.

Testimony

As an investment banker, I want to be explicit that tax credits alone do not determine the investment decision. They are only one of the variables in the decision process, but a critical one.

Those of us who are involved in mobilizing capital for projects or watch the battle for allocation of capital within our corporate clients are increasingly concerned about the loss of momentum in the renewable energy sector. There are several factors that have contributed to this loss of momentum. The first is that technology never matures as rapidly or smoothly as one would hope. But in my experience the major problem has been the extremely volatile environment in which decision makers have had to function. Many assumptions which they made turned out to be questionable. The Public Utility Regulatory Policies Act of 1978 has taken nearly five years to sort itself out. Many states still have not fully implemented PURPA, and negotiating a power purchase contract with a utility is still not an easy process. In the period during which the renewable industry suffered from the adversary struggles over PURPA, the accepted wisdom of the value of high capital cost, low fuel cost power generation has come into question. The temporary glut of oil and natural gas has led to another interim of energy overconfidence. History tells us that gluts breed their own shortages, and this one is not likely to be an exception. But the sense of urgency that drove renewable energy diminishes daily.

The energy tax credits which were to encourage the development of renewable energy did play their role to some extent. But delays in implementation and imminent expiration left a very small window. In many cases, investors were and are forced to discount the apparent value of the tax credits. The tax incentives became as much a part of the problem as the solution. The serious institutional commitment which was in its nascent stage threatens not to mature. Stability and predictability of the tax environment is extremely important to the risk/reward analysis that accompanies any internal or external investment decision. The proposed legislation would go a long way to providing that needed stability. Failure of the legislation will be an added indication to institutional investors that the renewable area is one to be forgotten for the time being. And when the next crisis comes, as it surely will, we will all recall with regret the missed opportunity to foster an infant industry that could have provided at least a partial solution.

In an unstable environment, flexibility is critical. None of us can say today with total confidence that renewable energy will be a major factor in solving the world's energy problems. But the cost of maintaining the renewable energy option is relatively small, and I do not believe we can afford to sacrifice it.

Senator WALLOP. To conclude then that one of the major elements of stability is simply the extension of time is so somebody knows that it will exist for at least another 7 years.

Mr. HUYCK. I think one of the major elements is an apt choice of words. One of the major elements is the predictability of it. That it will exist. So if your unit comes on in January 2, 1986, you haven't lost a substantial portion of the economic benefits that you might accrue to you.

Senator WALLOP. But assume for a moment—and I don't think it's a fair assumption, but we can hypothesize—assume that we did just go to straight expensing on all forms of this nature of capital investment. What does that do, then, to your opening gambit of saying that the one investment opportunity ought to compete with another? Would that be harmful, then, to the renewable energy industry?

Dr. BLUM. No; I don't think that it would. I think we would simply restructure the financing arrangements to account for the different—as we have many times, as the tax laws changed significantly in the past few years—and I think straight expensing, if it were done appropriately, would be something that I think could be worked with.

It would be a slight problem in the sense that as one gets into many small details—for example, tax credits are not preference income, losses are, so they are treated differently if you are an individual. There are some distinctions in terms of the usefulness of various credits and/or deductions to investors. But those kinds of details, I'm certain, could be worked out.

Senator WALLOP. But I mean a conventional energy project with paid expensing versus one of these more horizon-oriented projects might not—I mean the risks might seem more awesome if giving both of them the same treatment.

Dr. BLUM. The expensing would help in many regards. For example, right now there is a long vesting period for the tax credits that runs 5 years. It was reduced in 1981 from 7 to 5. But that is still perceived by some as being a risk. There are various recapture provisions that were also enacted in the 1981 tax law that just complicates the whole area of doing financing. Expensing, to the degree that it simplifies all that, could very well be attractive.

Senator WALLOP. Well, from the standpoint of the committee, and from sitting on this side and competing for whatever it is that is available in the way of these things, if the energy tax credits serve as a catalyst, what amount should that tax credit be to be effective, yet efficient? And in comparison to other things that are on the shelf, just narrow it to the field of energy.

Mr. CONWAY. I think the level of credits and the length of credits, the enhancement and the extension that is embodied in S. 1305 is very well conceived. And that, in our judgment, would represent the best combination that can be put together right now. Added one other thing that is not in the bill, and that's this question of freeing up the utilities to be real actors in this whole effort.

Dr. BLUM. I would certainly second his statements. It's clear from the evidence of watching what has happened in California so far, and observing why so much occurred there and so little has occurred in so many other States where the resources are at least as

good. It is clear, at least at this early stage, that the additional help has been from the State tax benefits—half of which is, of course, offset by Federal taxation—the net effect of which is to increase the ETC to an equivalent of about 30 percent. This extra has been essential at this early stage of the industrial development.

And were that kind of help available nationally, we would be seeing, I think, much more occurring in the other States that have superb resources.

I would second Mr. Conway's advocacy as well to look at some way to make the ETC available to utilities in selected projects. There is a great deal of interest in doing so among some utilities. For example, PURPA allows utilities a share of up to one-half in a project without upsetting its unregulated status as a PURPA project, as an independent power producer.

Thus, you can have the awkward situation of a project with a nonutility at 51 percent and a utility at 49 percent, the nonutility being able to claim the credit and the utility not. It discourages utilities from participating in what is otherwise an unregulated project. It does not have rate-of-return regulation; it is not assured that they will get a certain return. In such projects, the credits could be left in the project and not passed through to ratepayers. And so, the basic arguments advanced in the legislative history for not allowing ETC or the 5-year depreciation treatment to utilities do not apply in these cases. It seems to me that if this tax situation could either be clarified—or, if necessary, amended in the code—it could open up a sizable source of investment capital, expertise, and interest from utilities, and would be quite valuable.

Senator WALLOP. We've had to struggle with that—providing a tax credit which immediately goes into a rate subsidy circumstance when the public service commission or their equivalent go to work on it.

That's been the reason why. Whether it has been a good reason or not, perhaps you might be able to provide us some additional information.

Dr. BLUM. Right. There are circumstances where these unregulated, independent power producers—in which, under PURPA, the utilities can go in up to 50 percent without upsetting unregulated status as an independent producer—do not have rate of return assured, and do not have tax benefits passed through directly to ratepayers. In these, the utility should be able to act as any other independent power producer. In other projects, the ability would be operating through an unregulated subsidiary. In such projects, the utilities should have access to the ETC and 5-year ACRS. Not having such access discourages them quite significantly from participating.

Mr. CONWAY. We are suggesting that this is appropriate now to look at this again. And it may be that it is something that ought to be included in a final bill that would come out of the deliberations of the Congress. But, in any event, we ought to start thinking the whole thing through. And Mr. Papay in the next panel that will be here will address this question in more detail. And I think you could put any additional questions to him.

I think 5 or 6 years ago there was a general feeling in a kind of an adversarial context that the utilities might be in the category of

the enemy. And I don't think that's true. I don't think it was true then. I don't think it's true now.

Senator WALLOP. I can recall those things. And, at least as far as the conversations that I was involved in, that was not the circumstance that was driving the decision. And I don't think it was probably on the committee. It may have been elsewhere in the Congress.

Mr. CONWAY. I think that the context of the time when the credits were originally developed, it may be that you did exactly the right thing. All we are saying is that now a reexamination of this might be very appropriate.

Mr. HUYCK. There are two points. One, to answer your question, How much is enough? There simply is a spectrum along which projects present themselves to investors. And all we are trying to do is move the point on that spectrum further along in order to encourage a number of these projects which are on the edge of reaching a critical mass in terms of commitment, institutional commitment, over that midline point to some extent.

There is, I'm sorry to say, in our experience, no perfect answer as to what level is the optimal level for balancing this out. And, in fact, you probably only know that in retrospect, if at all. But it is critical that there be some set level, some set of rules that be established that people can work into their investment decision, and then commit their capital. And, so far, that has not been the case.

The other question that has come up is the question of the availability of the tax benefits for deregulated participation. What we are dealing with, although many of us have not articulated it directly, is a shifting in the entire structure of regulated industries, and the electric utility industry is not alone in that context. And a lot of the confusion over the tax credit and availability exists because of the role of electric utilities in potential deregulated electric generation. Our vocabulary will probably have to adjust to catch up to that.

But I think it would be very important that, at least in the present context, that utility participation up to 50 percent—that it be made very clear that with respect to their participation that the tax benefits are available on a deregulated basis. It's not public utility property. And they should get the 5-year write off and the energy tax credits for that half.

The next question, whether you leap that limit to 100 percent and whether the benefits should be available for 100 percent participation, belongs to the next generation of questions. I think that first generation of questions has not been answered clearly enough in a lot of people's minds. And that, also, is posing a problem.

Senator WALLOP. I want to thank you all very much for your testimony this morning. It has been very interesting, and I appreciate it. It may be that we will want to submit some questions, technical in nature, to enhance this.

Senator WALLOP. Now, the next is a panel consisting of Mr. Jackson Gouraud, vice president, Solar Energy Industries Association, Washington; Dr. Ted Andersen, president of the American Wind Energy Association, Washington, D.C.; Mr. Michael J. Zimmer, secretary and general counsel, Cogeneration Coalition, Inc., Washing-

ton, D.C.; Dr. Lawrence Papay, senior vice president, Southern California Edison Co., Washington, D.C.

Mr. Gouraud.

**STATEMENT OF JACKSON GOURAUD, VICE PRESIDENT, SOLAR ENERGY INDUSTRIES ASSOCIATION, WASHINGTON, D.C.**

Mr. GOURAUD. I think the testimony so far has been excellent, Mr. Chairman. And I think your opening remarks were very good. If I could just leave two facts in your mind at the end of my testimony, I would be most pleased.

The first is that I don't believe this industry would survive for 5 minutes without the tax credits, and portions of it will not flourish or grow without an increase in the credits. The second fact which I will refer to later in my testimony is that there are a large number of people being employed by this industry who are basically unemployables. That has not really been dealt with in prior testimony.

I am here as vice president of Solar Energy Industries Association, which has over 300 members; as chairman of Servamatic Solar Systems, one of the largest of the solar companies; and as former Deputy Under Secretary of Energy with responsibility for commercialization.

I was very keen to have Booz-Allen & Hamilton do a study for us.

The very first point they make, the first bullet in this excellent study, on page 1 reads: "Without Federal and State energy tax credits only small niche markets—early adopters and remote applications—will exist given depressed fuel prices." And I believe that that is unquestionably a true statement.

To date the industry has not done too badly. We have 250 manufacturers of domestic hot water systems. We employ some 30,000 people. And we produced \$600 million worth of goods last year. I'm talking about Solar. In 1982, more than 550,000 domestic hot water systems were installed. In the photovoltaic area, I can remember when I was at the Department of Energy, \$100 per peak watt was the price, and now it's \$5 per peak watt.

Last year, we produced 7 megawatts of photovoltaics in this country out of an international total market of 12. Manufacturers of parabolic troughs and thermal systems for processed heat applications are making market penetrations, with utilities throughout the country intending to install large solar, thermal systems. And I must commend Southern California Edison. They have been a spectacular leader in this whole area.

The credits have been vital, absolutely vital. Nothing would have happened without them. None of this would have occurred.

Now, we could have possibly, but not likely, Mr. Chairman, gotten far enough along in 5 years, because that's all the time we've had to have said "OK, we are there; we don't need your credits any longer." But that would have been better than any new technology every launched in this country or anywhere else in the world. It just plain takes a little time to get your feet on the ground and to get moving.

And there were some things that stood in our way. The oil glut, obviously, was a disincentive. The instability question has been dis-

cussed here already. The severe reduction in Federal research and development has been a handicap. The Tax Equity and Fiscal Responsibility Act of 1982, in which the basis adjustment provisions substantially eroded the value of existing credits, has been a deterrent.

So, for these reasons, we aren't quite as far as we hoped to be.

I, personally, would not want to ever get more than the credits which we have asked for which you enumerated in your opening comments. And I don't see them stretching out for eternity. We need them extended for just 5 more years.

Now let me just close on this subject of people. We had 3 people in our company in April of 1979, and in California alone today we have now 1,078. In my judgment, probably half these people would not be able to find employment elsewhere in the private sector of the United States. This is true. We do mostly residential, small commercial, multifamily business. This is typical of all the companies in the domestic hot water end of the business. So I would say that you really are dealing with a very important social issue. The President has asked that every company in the country employ one more person. If you will recall, he said that unemployment would go away if that happened. Well, this industry is making a very valiant effort to do so. To continue, we need the Federal tax credit, not for eternity, just for the timeframes that we requested.

I've had involvement with Southern California Edison, Mr. Papay's company, where we are going to put 49 megawatts into place. This is a thermal application. But, because of the uncertainty of the extension of these credits, it has been difficult to raise money. I have been authorized by the People's Republic of China to put together a 3-megawatt amorphous silicone photovoltaic plant. All of these things, Mr. Chairman, need these tax credits. They need them, and they need them now. I'm grateful to you for holding these meetings and for pushing Senate bill 1305 along. We have a comparable bill in the House Ways and Means Committee, under Mr. Hefstel, which deals with the same things.

Thank you.

Senator WALLOP. Thank you, Mr. Gouraud.

[The prepared statement of Mr. Gouraud follows:]



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**SEIA**

U. S. SENATE  
COMMITTEE ON  
FINANCE

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STATEMENT ON BEHALF OF  
THE  
SOLAR ENERGY INDUSTRIES ASSOCIATION  
ON  
RENEWABLE ENERGY TAX CREDITS

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PRESENTED BY  
JACKSON GOURAUD, VICE PRESIDENT  
SOLAR ENERGY INDUSTRIES ASSOCIATION

July 18, 1983

Mr. Chairman and Members of the Subcommittee:

My name is Jackson Gouraud and I am Vice President of the Solar Energy Industries Association. I am also the Chairman of the Board of Servamatic Solar, Inc., a California-based manufacturer of solar collectors which employs more than 1000 people. Previously, I had served as Deputy Under Secretary of the Department of Energy. I appreciate this opportunity to appear before you on behalf of the Solar Energy Industries Association, a national trade group representing over 300 companies. With me this morning and seated behind this panel is Dr. Joel Weiss, Chairman of the Association's Government Relations Committee, and Mr. David Gorin, the new Executive Vice President of SEIA.

Before addressing the issue of the effect of business energy tax credits and residential tax credits on the solar industry, and comments on other aspects of the current national solar business, I would like to provide a brief summary of facts regarding the status of various solar technologies which are being utilized by SEIA-member companies.

#### Active Solar Heating & Cooling

Approximately 250 collector manufacturer form the core of the solar heating and cooling industry, and are a barometer of industry performance. Material and component suppliers upstream, and the distribution and installation businesses downstream form the whole industry. Ultimately, system suppliers will be regarded as the core of the industry. The companies vary in size from divisions of Fortune 500 firms to small privately held firms, some with significant market shares. The majority however, are small, with 80 percent of collector companies reporting fewer than fifteen employees. The industry is still in its infancy with high

high turnover due to low rates of return, acquisitions or failures, and the relatively low cost of entry.

The industry is highly concentrated. In 1982, 13 percent (8 companies) shipped 83 percent of low-temperature collectors (typically unglazed plastic), and fourteen percent (34 companies) shipped 74 percent of medium temperature collectors. In 1981, medium temperature collector production exceeded low temperature production for the first time, and now dominates the industry in dollar value. Leading firms produce \$10-25 million in hardware per year.

Gross sales in 1981 totaled over \$600 million for active solar collectors. In 1981, 42 percent of production came from California companies, and 24 percent from Florida companies. California, Arizona, and Florida provided the largest markets.

Cumulative installation of active collectors through 1982 was approximately 550,000 systems. Installations in 1981 reveal the following applications:

<u>1981 Installations</u>	
102,000	Single Family water heaters
25,000	Swimming pool heaters
18,600	Single family space heaters
<u>6,400</u>	Other
152,000	Total Installations

Estimates of energy produced by active systems installed since 1980 equals about 0.01 quads per year. Exports and imports of active solar hardware are insignificant.

PHOTOVOLTAICS

Dramatic efficiency improvements and cost reductions have been achieved in photovoltaic technology in the last decade. Six basic photovoltaic technologies can now be identified: Single crystal silicon; semi or polycrystal; silicon ribbon; amorphous silicon; optical concentrator and advanced thin films.

In the last five to seven years.

- o Single crystal silicon modules have dropped from \$100/per peak watt (wp) to approximately \$5/wp
- o Single crystal cell efficiencies rose from 7% to 15%
- o Amorphous silicon cell efficiency rose from 1% to 10% (laboratory)
- o Ribbon and polycrystalline cell technology now being introduced
- o Concentrator cells achieved over 20% efficiency in laboratory
- o Multilayered cells promise 30+% efficiency

According to DOE, nineteen U.S. manufacturers shipped modules in 1982. Major corporations still have a vital role in innovation and in commercialization of the technology. Private industry investment in PV from 1972 to 1982 was about \$350 million (federal funding same period, \$628 million).

Two years ago, U.S. firms accounted for 70% of world-wide sales. Their portion has slipped to 50%. The industry is characterized by constant movement forward. Because total turnover is less than \$150 million for hardware and R & D expenditure is so high, the industry may still be characterized as fragile, but extremely promising.

The current market is dominated by flat plate crystalline silicon technology (60+% share). U.S. sales growth has been strong:

1979	1980	1981	1982
1.4MW	3.2MW	4.5MW	6.9MW

The 1982 world market was 9-12 MWp.

U.S. production in 1982, as cited by DOE:

<u>Sectors</u>	<u>MWp</u>	<u>%</u>
Residential	0.827	12
Commercial	3.48	50
Industrial	1.64	24
Agriculture	0.219	3
Other	.719	10

Stand alone systems and utility-grid connected independent power production projects each account for about 45% of the market. Cost per watt for modules ranges between \$5.00-\$10.00/wp and the industry is delivering systems overseas producing power from \$.40 to \$.70 kwh.

Two surprising trends:

Residential sector growth has been higher than expected  
Large-scale systems built exclusively to sell power to  
utilities are being encouraged by various incentives and  
regulations.

For photovoltaics to compete unsubsidized with grid-produced  
power, a 10 fold cost reduction will be required.

SOLAR THERMAL

The solar thermal industry consists of about 50 companies in-  
volved in the several technologies. They range from small high  
technology firms to large aerospace and petroleum companies. In-  
dustry has been largely dependent on federal funding for R & D.

Three main segments of the industry, troughs, dishes, and  
central receivers, are in different commercial development stages.  
Two main trough suppliers remain in business and appear on the verge  
of commercial success.

The parabolic trough industry has passed through the stage  
where the government was its main customer (over 2 million ft<sup>2</sup> in-  
stalled) to a small level of commercial sales (\$2-4 million per  
year). The industry is just on the verge of selling privately  
funded industrial process heat systems, but the market appears  
limited to only 5 to 10 such projects a year. The depreciation  
basis adjustment provision in the 1982 tax bill (TEFRA) and de-  
clining oil prices have hindered commercialization.

The parabolic dish industry (devoted to electric or total energy systems) is the least advanced commercially, and highly dependent on continued government R & D. Neither solar pond or parabolic dish technology has entered the market in any commercial sense.

The central receiver companies face complicated problems regarding commercialization. Large government support stopped before a commercial scale plant was built and the risk and cost of financing a large scale central receiver plant appears too high for the private sector to handle without federal aid. The scale of the technology and vital interest of several utility companies has led to several important commercial-scale plant (operating at Barstow) initiatives, but the difficult leap from 10MW pilot plant to a commercial scale plant remains.

#### PASSIVE SOLAR

Passive solar heating techniques, and space cooling techniques, are well defined. Yet only a very small percentage (estimates range from less than 1 percent to about 5 percent) of new housing is built with passive solar design. Of that percentage, many are probably "suntempered", since many builders find this to be a simple cost-effective approach.

Since buildings use over a third of the total energy consumed in this country, the potential for energy savings in this sector is great. The potential stimulus to the building industry, if passive solar were to become popular, is also large, since passive solar in general uses traditional building materials and techniques. This accounts for a growing movement in the industry to promote and develop passive solar.

The barriers to more widespread use of passive solar are not really technical, since the technology is well-proven. The barriers tend to be informational: builders do not yet know exactly how to incorporate the technology, how much it will cost, what the benefits will be, etc. Since the average homebuyer is also likely to have little knowledge about the advantages of passive solar, builders do not yet perceive a strong enough market for passive solar in most areas.

#### ORIGIN OF TAX CREDITS

Moving the solar industry from research and development of products to actual marketing has taken much time and effort. In order to understand the rationale of SEIA's feeling that the Congress should extend solar tax credits, it would be useful to focus briefly on the history and origin of this legislation.

In reaction to the oil supply disruption of the early 70's the Congress recognized the nation's need for alternative energy

sources and established a federal solar energy program. In 1978 the first renewable energy tax credits were established as part of the National Energy Act. These credits were expanded and extended in 1980 with the passage of the Windfall Profits Tax Act.

A stated purpose of the credits, it should be noted, was to offset inequities in the tax code which favor fuel consuming technologies relative to those which are fuel free. These inequities, which result from the expensing of conventional fuel in the year of use, are among the most significant factors inhibiting the commercialization of renewable energy in a time of high interest rates and constrained investment capital. This was recognized in 1980 when an effort was made to increase the Business Energy Investment Credit for renewable energy to 30 percent. Unfortunately this proposed increase was changed just before final passage to 15 percent as was the expiration date which was advanced from 1990 to 1985.

It is now apparent that it was extremely optimistic to expect that technologies which were heavily in the R & D phase in the late 70's and early 80's could successfully be commercialized with tax credits which expire in 1985. Although this optimistic assumption might once have been achievable, four key events in the several years have made this goal of full commercialization by 1985 virtually unobtainable. These events were:

1. The so-called 'oil glut' which has been accompanied by falling fossil fuel prices and which has diverted attention from the continuing need to develop a coherent national energy policy.

2. The severe reductions in federal R & D expenditures for solar energy, which have delayed development schedules for many technologies.
3. Passage of the Tax Equity and Fiscal Responsibility Act of 1982, the Basis Adjustment provision of which substantially eroded the value of existing tax credits.
4. The ever-changing directions and attitudes of the federal government with regard to solar energy policy--both in regulatory affairs and financial incentives and support--has led to a posture of extreme caution on the part of industry, uncertain of the government's position.

For these reasons it is now fairly clear that by the end of 1985 when the renewable energy credits expire, the solar energy industry will not be sufficiently self-sustaining to permit it to aggressively market its products and continue the commercialization of these technologies at the pace which all of us desire.

At this point some people may question whether commercialization of renewable energy technologies is attainable at all; they might even go so far as to think that failure to achieve commercialization by 1985 means that the Federal solar energy program has been a failure.

NOTHING COULD BE FURTHER FROM THE TRUTH

Those of us in the industry are confident that the performance of our products and their costs meet or even exceed the ambitious goals of the federal solar program in the 70's. We believe we have made great progress in commercializing technologies which are technologically still in their infancy; progress which is virtually unprecedented when compared with the development and commercialization time schedules of almost any other 20th century products.

No, the record of the solar program is not one of failure; it is one of almost unparalleled success. But success does not mean that the job is over either.

What we have established now is an infant industry, and even more importantly an infant marketing and commercialization process. The products are now largely developed but the hardest part is still ahead.

#### THE NEED FOR MORE EFFECTIVE BUSINESS ENERGY TAX CREDITS

The intent of the Congress in enacting residential and business energy tax credits for renewable energy has been partially realized through the stimulus given to the solar industry. Immediately following the enactment of the original tax credits in 1978, solar products began moving in the marketplace. Again, in 1980, following the amendments to the solar tax credits, business picked up. But despite the fact that the 40% residential tax credit has proved an adequate incentive, the 15% level for industrial, commercial and agricultural installations has not provided sufficient incentive.

To understand the marketing of solar products in the industrial, commercial and agricultural markets, let's look at what happens in a typical situation. First, one must realize the ability of businesses to expense the burning of fossil fuels which is, in effect, a 46% tax credit. For a corporate operating officer to recommend to his/her Board of Directors that a major investment be made in energy conservation and generation equipment such as solar, that officer must be able to justify that initial investment within the internal rate of return boundaries for that corporation.

When that corporation can continue to operate as it does today, expensing an item at 46% tax savings, a very high rate of return would have to be shown to justify an investment such as solar energy equipment.

The 15% business energy tax credit, and the 10% investment tax credit (ITC) when it is applicable, do not come close to the 46% expensing level. For solar to be truly effective as an energy choice, parity in price must exist at the business level. Thus, a 25% business energy tax credit for solar, coupled with the ITC that applies to all business applications of solar, would allow the operating officers to sell a solar capital improvement project to his/her Board of Directors on the basis of future energy savings coupled with a comparable rate of return on that investment as compared to the present expensing level of fossil fuels.

MAKING THE 10% INVESTMENT TAX CREDIT MORE EFFECTIVE

Before discussing the need to extend the solar tax credits beyond 1985, I would like to remind the Committee about a problem we have with current IRS rules which do not allow the 10% Investment Tax Credit to apply to solar equipment for heating and cooling commercial buildings, or for providing normal service hot water. Thus, solar systems for commercial buildings can only benefit from a 15% credit. The solar industry would like to see improvement in the effectiveness of present tax credits for solar through clarification of the applicability of the 10% ITC to include all solar installations. This does no injury to the original intent of the Investment Tax Credit legislation, since its real

purpose is served in providing incentives for new capital equipment. At the same time, it enhances the present 15% business energy tax credit by creating a more equitable treatment of solar energy equipment.

While the solar tax credits have been the most important incentive in the marketing of solar equipment, up to now most installations have taken place in the residential market. The business market for solar, which includes commercial, industrial, and agricultural installations, has been only partially tapped.

This fact stands in sharp contrast with the reality that the largest savings in conservation and fuel costs could be realized in the business sector, the area of greatest energy use. The growing costs of energy are reflected in price increases in every product or service dispensed in the market.

As explained previously, the traditional expensing of fossil fuels in the business community has been a barrier for solar marketing. The 15% business energy tax credit assists in closing the comparative gap, but it is only a first step. The inclusion of the 10% ITC helps, but has only limited solar business application. Certainly, the broadening of application for the ITC so that it could be combined in each instance with the business energy tax credit, would help eliminate the economic disparity with fossil fuels.

THE INSTABILITY OF GOVERNMENT POLICIES

The volatility of government programs in recent years--both regulatory policies and support programs--has had a dramatic effect on the industry. The burst of government programs in the 1970's to help commercialize renewable energy generally encouraged private investment in the field, but even during that supportive period, frequent shifts in program orientation sent confusing signals to the industry. More recent history has been characterized by dismantlement of support programs, and by repeated attacks on tax incentives and the reduction in tax incentives resulting from TEFRA. The effect has been a severe chilling of financial backing for private development of the technologies.

Uncertainty in the regulatory arena has also had a strong negative impact. Court challenges to PURPA have held in limbo the implementation of renewable energy small power production incentives in many states. The Supreme Court has now cleared much of the uncertainty surrounding PURPA with regard to Federal responsibilities and authorities. It remains to be seen whether state-by-state uncertainties will continue to be a major factor in the law's implementations.

Secretary of Energy, Donald Hodel, wrote to the Secretary of the Treasury, Donald Regan, on March 21, 1983, warning of the result of unstable tax policies for renewable energy. His letter, in part, said:

"The developing renewable energy industry, as with other energy industries, will be unlikely to develop and mature without supportive and stable tax policies. Regulations which would reduce the rate of return on these new ventures would have an adverse impact on continued expansion and further technology development in these industries."

—

SEIA'S RECOMMENDATIONS AMONG VARIOUS PROPOSALS

The Solar Energy Industries Association has given considerable thought and attention to the correct position for it to recommend to the Congress regarding the future of the tax credits. The companies in this association are not desirous of asking for the tax credits indefinitely, but feel that there are sound economic arguments to request some modification and extension through the year, 1990.

Accordingly, SEIA recommends that:

1. The Congress extend the residential solar tax credit through 1990 at its present 40% level.
2. The Congress increase the business energy tax credit to 25% and extend it through 1990.
3. The Congress redefine the 10% investment tax credit so that it will be applicable to all applications of solar energy in buildings.
4. The Congress add an affirmative commitment period to the legislation through 1995.

Several bills now before the Congress contain all or part of the above recommendations. Senators Packwood and Matsunaga, along with several other members of the Finance Committee have introduced S. 1305 which is the subject of today's hearing. This bill contains all of SEIA's recommendations and we give it our full support. Congressman Heftel and others have introduced H.R. 3072 which is essentially similar to S. 1305.

WHY A DECISION IS NEEDED NOW ON TAX CREDIT EXTENSION

Business planning cycles require considerable elapsed time from project conception through approval and execution. To facilitate orderly, long-range business planning it is important that the economic and investment climate remain as stable as possible. While it may appear that the discussion of the extension of the renewable tax credits is premature, since they continue under current law through 1985, it is clear that because of the advance planning time needed, this matter should be decided this year by the Congress.

Failure to act on this issue this year will result in termination of some on-going planning efforts for projects with multi-year construction times which cannot be completed by the end of 1985. For some technologies which are still in the latter stages of development, for example, solar thermal parabolic dishes, failure to extend the credits past 1985 this year may result in a cessation of all commercialization plans, since these technologies are unlikely to have any commercial projects capable of being completed before the end of 1985.

COST AND EFFECT OF EXTENDING THE CREDITS

In a November 1981 report to the Lawrence Livermore Laboratory, "The Cost of Federal Tax Credit Programs to Develop the Market for Industrial Solar and Wind Energy Technologies," the Arthur D. Little Corporation (ADL) concluded that, "the cost of tax credits to the Treasury is amply repaid to the Nation by the value of the energy saved. ...in fact, under the high inflation rate scenerio, the net present value of the increase in revenue due to the decrease in tax deductible corporate expenses for conventional energy is large enough that the Treasury will actually profit on the tax credit program."

An analysis of energy tax credits recently completed by Booz-Allen and Hamilton for the Solar Energy Industries Association agrees with this ADL finding and further states that with increased tax credits renewable energy could displace over 30 million barrels of oil annually by 1990; that is about a fifth of a quad. The significance of this is that a fifth of a quad would represent approximately a \$10 billion solar energy industry, one which would be a credit to the federal program, to the Congress and to the industry itself. A \$10 billion industry by 1990 would represent a twenty-fold increase over the solar energy industry of today.

Additionally, the Booz-Allen and Hamilton Tax credit analysis concludes that:

- o Continuing the tax credits for solar and wind technologies would increase their market penetration and support the development of improved technologies at lower cost.
- o The benefits derived from the credits would be obtained at "minimal present value cost to the government." The cost of the tax credits would be partially offset by fewer tax deductions taken for conventional fuel expenses by commercial users of renewable energy systems. For the business tax credits, in fact, the study estimates a net revenue gain of more than \$600 million in 1990 as a result of the renewable energy credits.

We would be pleased to submit the entire report by Booz-Allen and Hamilton for the record.

#### CONCLUSION

The Congress must look ahead in its planning for future energy needs in our country. The wisest course is to develop and sustain a balanced program of energy production from all viable sources. The present so-called 'energy surplus' situation will change with time and with any emergency, it could again precipitate a national crisis.

The balanced energy program in the United States must include increasingly, renewable energy sources. Although this nation has invested over a billion dollars in the research, development and demonstration of renewable energy sources, it is only a fraction of the investment already devoted to many other energy forms. Given the importance of energy to our future, it would be foolhardy to reduce investment in an extremely valuable national resource, renewable energy.

The solar tax credits make good economic sense. The tax credits have had a positive effect in accelerating development of solar markets, with improved sales evident now in the residential market. Even greater potential for energy conservation and energy savings lies in the commercial/industrial market. The present 15% business energy credit has promoted solar heating and cooling installations in the commercial/industrial marketplace. However, market penetration will become significantly larger if these credits were increased to parity levels with other energy forms. The business energy tax credit should be increased to 25% and extended through 1990; the 10% investment tax credit should be made applicable to all solar installations in buildings; and the residential credits should be extended to 1990. The tax credits must be seen as a stimulus, and not a drain, on the Treasury. The displacement of expensed conventional fuels and the potential for new sources of taxation, from the movement of products from manufacture to marketing, to the new taxes paid by additional employment, should outweigh any fear of unmanageable short-term revenue loss.

SEIA thanks the Chairman and members of this subcommittee for their strong support for solar energy in the past and pledges its cooperation to work with the subcommittee to develop responsible methods by which the government and the industry can cooperatively move solar energy toward an even greater contribution to our domestic energy development in the future. I will be pleased to answer any questions which you may have.

Senator WALLOP. Dr. Andersen.

**STATEMENT OF DR. TED ANDERSEN, PRESIDENT, THE AMERICAN WIND ENERGY ASSOCIATION, WASHINGTON, D.C.**

Dr. ANDERSEN. Mr. Chairman, I appreciate this opportunity to speak on this crucial issue of the energy tax credits. I am employed by Westinghouse Electric as a project manager in wind energy, but I'm here representing the American Wind Energy Association as its president. I represent 89 manufacturers of wind and related equipment. Our members range in size from as large as General Electric and Boeing to the smallest companies in the country with just several employees.

We strongly support Senate bill 1305 for several reasons. First, for national security. As you mentioned in your introduction, the Nation seems to have forgotten the drive for energy independence. We think it's still crucial to international stability, and we need to be working now to achieve that in the longer term. We believe that even the only 10 percent contribution that we can expect from renewable energy, including 1 or 2 percent from wind, can be crucial in making the swing in balance between dependence on imported energy and being self-sufficient.

Second, wind energy produces no waste, no spills, no leaks, requires no cooling water, and it doesn't require any significant disruption of land for siting or mining.

Third, wind turbines are energy efficient. They recover 100 percent of the energy used in their production within their first 8 months of operation.

Fourth, wind turbines are modular. Once in production, they can move from manufacturer to field operation in under 12 months as compared to the 7- to 12-year time now for large powerplants.

Finally, as has been said before, the tax credit extension is essential to the realization of this potential. We've established the technology, we've established an initial market, but the long-term market in which we can reach necessary economies of scale of production just can't be realized without an extension of the tax credits.

The original energy tax credits have been very effective in achieving technological gains and cost-effectiveness gains in three segments of the wind industry.

In what we call the residential segment, where wind machines are 1 to 10 kilowatts in rating or 6 to 25 feet in diameter, 2,000 have been sold in 1982. Without the tax credits, many of these could not be sold in successive years. And there are many manufacturers there who are improving their product, improving reliability, gaining the economies of production of scale to make them even more broadly applicable in the future.

In the wind farm market, machine sizes are 15 to 200 kilowatts and 33 to 80 feet in diameter. There were 1,200 installed in 1982. That added up to 50 megawatts. We believe that is truly the first step in a very significant contribution to this country's energy supply.

In the utility scale category, machines are rated in a 200- to 4,000-kilowatt range, and 80 to 400 feet in diameter. There have

been fewer than 20 installed since 1978. But this is the area which promises to have the most impact on our energy independence by the year 2000. All the studies made to date have indicated that the major impact on energy displacement, oil displacement, will come from these large machines. And they, in particular, need more time to mature.

We have mentioned a variety of external factors that have slowed down the implementation of renewable energies in general. I won't repeat the ones that have already been mentioned.

But there are several perhaps unique to wind. One is that there has been additional technical data developed in the last 5 years that show more development was required than was once hoped. It, essentially, has been achieved by now, but there has been a year or two delay in the overall progress of the technology.

Another factor that has not been previously mentioned is that, although PURPA assures a market for wind turbines and other devices, PURPA requires that they compete on the terms of the current average generation mix of the utilities. Utilities, themselves, don't make an investment decision with that constraint. We all know that current plants going up will cost much more in cost of energy than the average mix installed. And so the PURPA is a mixed blessing, and the tax credits are needed to help offset that. We are competing with today's average price, and successful installations are now being made, but with the help of tax credits.

S. 1305 is vital to the survival of all three segments of the wind energy market. With S. 1305, manufacturers, of residential turbines will achieve the improved economies and reliability necessary to reach a broad market. Wind farm developers will achieve increasing economy of scale and essential experience with siting and performance in utility environments.

And with S. 1305, manufacturers, of utility scale machines will invest in the critical development and production facilities needed to reach the production levels needed for economy.

Without S. 1305, this infant market will be starved prematurely. I know of several very large programs being considered which are now approaching the time when the logistics of meeting a 1985 deadline may well spell their demise. But with an extension of energy for credits those projects, on which much time and effort have been spent, can reach fulfillment.

We, therefore, urge your support. And we appreciate your position.

Senator WALLOP. Thank you, Dr. Andersen.

[The prepared statement of Dr. Andersen follows:]

# The American Wind Energy Association

Statement of Dr. Theodore S. Andersen  
 President, American Wind Energy Association  
 before the  
 United States Senate  
 Committee on Finance  
 Subcommittee on Energy and Agricultural Taxation  
 July 18, 1983

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Mr. Chairman and members of the subcommittee, my name is Theodore S. Andersen. I am Project Manager for Wind Energy Conversion for Westinghouse Electric Corporation and President of the American Wind Energy Association (AWEA), and I am appearing today on behalf of the Association. I appreciate the opportunity to testify.

AWEA is the trade association which represents manufacturers of wind energy systems and related equipment. The Association has 89 corporate members at present, ranging in size from General Electric Company and Boeing Engineering and Construction down to small businesses with only a few employees.

For reasons which I will discuss in some detail, AWEA strongly supports S. 1305, the Renewable Energy Tax Incentive Act of 1983, and urges its approval by the subcommittee.

Wind energy is a new/old technology, like a number of others in the renewable energy field.

The mechanical use of the kinetic energy in the wind has been known and applied for thousands of years for such purposes as grinding



2010 Mass. Ave., NW, 4th Floor, Washington, DC 20036 tel. (202)775-8910

grain and pumping water.

Using a wind turbine to produce electricity, however, is a much more recent development, dating back only to the early part of this century, and during much of the time that the technology has been in existence, its development has been slowed or stopped entirely by competition from cheaper conventional energy sources such as oil and coal.

For example, although the first utility-scale wind electric system, a 1.25 megawatt machine with a 175-foot-diameter rotor, was built in 1939-41, an evaluation showed that future systems based on the same design would cost \$190 a kilowatt installed to construct, compared to a price of \$125 a kilowatt for conventional generating capacity, and so no further systems of that size were built until 1978.

Since the passage of the energy tax credits in that same year of 1978, a variety of factors have continued to hamper development of wind electric technology. Among those factors have been: falling oil prices; a depressed economy with high interest rates; a constantly changing tax environment; and technical difficulties in developing simple and reliable equipment, due to the fact that the wind is the most widely variable of the renewable energy sources.

The wind industry can be conveniently divided by market into three parts -- residential, windfarm, and utility. I will discuss each of these briefly in turn.

Residential systems are typically from less than one kilowatt to around 10 kilowatts in size. In rotor diameter, this means from six feet up to about 25 feet. About 30 companies are building systems of this size today.

In 1982, about 2,000 systems averaging about three kilowatts in size, were sold in this market, which appears to be in a period of flat or very slow growth brought on in part by the recent economic downturn. Because sales prospects in this market remain unclear, the potential of an extension of the residential energy tax credit which S. 1305 provides is very important to small machine manufacturers.

In the second market, the windfarm market where third-party deals are common, growth has been fairly sizable. About 1,200 units were installed in 1982, averaging about 40 kilowatts in size with a range from 15 kilowatts to 200 kilowatts (33 to 80 feet in rotor diameter). To give you some idea of the size of wind energy in our economy, the windfarms totalled about 50 megawatts at the end of 1982, compared to national utility capacity of about 470,000 megawatts. Twenty to 30 companies are building equipment of this size.

The quality and price of systems in both the residential and windfarm markets are steadily improving, in the windfarm market partly because of domestic competition and partly because of strong competition from Danish, Dutch, Swiss and Canadian imports. Further improvements can be expected if the tax credits are continued.

One recent indication of this improvement is a study presented by the National Rural Electric Cooperative Association (NRECA) at the recent Sixth Biennial Wind Energy Conference and Workshop in Minneapolis, MN. That study, a survey of about 110 owners of wind systems interconnected to rural electric cooperative lines, found that "down time", or the percentage of time a machine is idled for maintenance or repairs, declined sharply for systems installed in 1982 (about 10%) as opposed to those installed in 1979 (60-70%) due apparently "to improvement in...manufacturing and...incorporation of lessons learned about design flaws."

In the third market, the utility-scale market, wind systems are in a somewhat earlier phase of technical development, with commercial sales still limited to a handful. In large part, this is due to the fact that major projects involving large systems are particularly vulnerable to the type of swiftly changing financial environment and instability in the oil market which we have experienced during the past few years.

In the utility-scale market, machines range from 200 kilowatts to 4 megawatts in size (from 80 to 300 feet in diameter), and even larger systems are under development. It is projected that economies of scale to be realized with these systems once they are in production will bring costs of energy down to a range competitive with conventional energy sources.

The critical need in this market today can be summed up as long-term stability.

Large wind systems are major industrial products, requiring the

commitment of many millions of dollars. I believe a viable market for such systems exists, but that determination depends upon improved economics which can only be realized through higher production levels and greater operating experience.

The original intent of the energy tax credits was to provide a "bridge" of support to the point in time where those improved economics would exist. But looking today at an expiration date of the end of 1985, it seems clear that that support will fall short.

More importantly, the fact that we are now beginning to approach the deadline without clearly economical systems in production is deterring capital investment in the large-machine industry right now. A longer "horizon" on the credits would make that investment much more likely, particularly since the economy is beginning to improve again, and companies are again beginning to think about the possibility of expansion.

So this is a crucial period for the utility-scale wind industry. A number of major wind projects are in the serious discussion stage right now. Most of them have been in that stage for several months, and the tax credit extension and enhancement contained in S. 1305 would be very likely to provide the small additional boost needed for a decision to go forward.

To fully understand the problems involved in attracting financial support for wind energy, it may be useful to briefly review some of the factors which have affected its financial environment in recent years.

Businessmen, entrepreneurs and investors in the wind industry have labored under extremely difficult circumstances since the energy tax credits were enacted.

First, the economic recession from which our country is only now recovering has created problems for many industries, including wind.

Second, owing to an unforeseen slackening of demand across the economy, oil prices have weakened dramatically, causing the cancellation of a number of major renewable energy projects for which financial planning was based on steadily rising costs for conventional fuels.

Third, the favorable investment climate which was supposed to have been created by the energy tax credits for wind energy has been drastically altered by a number of events: long delays by the Internal Revenue Service in issuing rules to implement the energy tax credits; attacks by the Department of the Treasury on the business energy credit on two occasions in the last two years; depreciation changes in the Tax Equity and Fiscal Responsibility Act of 1982 which reduced the value of the credits; a threat early this year to lengthen the depreciation period for property used for small power production; and changes in the tax treatment of that property which are now being discussed as part of the Governmental Leasing Tax Act of 1983.

In short, almost since these incentives were initially provided, their impact has been weakened by a number of factors, none of which has any

relation to the inherent value of these technologies.

We continue today to have the same national interest in achieving energy independence and in the development of renewable energy technologies as we did four years ago when these incentives were first provided.

I see nothing to suggest that this situation will change in the foreseeable future. Imports still account for a substantial portion of our energy consumption, and will likely continue to do so for many years to come. With continuous unrest in the Middle East, the national security implications of this unhealthy dependence remain a serious concern. We must begin now to build for the future.

One measure of the potential impact which renewable energy technologies can have on that future is provided by a 1982 report from Resource and Technology Management Corporation, which develops comprehensive data on new energy sources and their market growth.

According to the report, renewable energy (including hydropower and direct combustion of wood) will contribute about 8.25 percent of this nation's energy supply by 1985 compared with 7.1 percent in 1980. This 1.15 percent increase amounts to about 125 million barrels of oil saved per year, and will bring the total energy savings from renewable sources by 1985 up to 1.16 billion barrels per year.

Given the proper environment of incentives, I believe considerably greater growth can be achieved by these technologies -- growth which will more than repay to the Treasury and to our nation any revenue loss which results in the short term. Renewable energy businesses will pay taxes in future years, both on sales of equipment and on sales of electricity to the utility grid. In addition, business fuel write-offs for conventional fuels will be reduced, thereby supplying the Treasury with an offsetting source of revenue.

We therefore strongly urge the subcommittee to support the tax incentives for wind energy which would be provided by S. 1305.

Senator WALLOP. Mr. Zimmer.

**STATEMENT OF MICHAEL J. ZIMMER, SECRETARY AND GENERAL COUNSEL, COGENERATION COALITION, INC., WASHINGTON, D.C.**

Mr. ZIMMER. We are testifying this morning on S. 1305 on behalf of the Cogeneration Coalition, Inc., a nonprofit organization comprised of interested gas utilities, industrial users, equipment manufacturers, project developers, and construction firms supporting cogeneration development.

Cogeneration involves the sequential usage of various forms of energy to produce electricity as well as other useful forms of energy, such as steam and heat.

Cogeneration currently provides 5 percent of total U.S. electricity production; in 1982 this represented approximately 113 billion kilowatt hours of electricity. Under a proper regulatory environment spurred by the enactment of legislation such as S. 1305, the installation and construction of cogeneration systems could increase from a current level of approximately \$750 million to levels of \$20 to \$30 billion by 1990.

The tax incentives embodied in S. 1305 are crucial for three primary reasons. No. 1, they rectify current imbalances in the economic system with respect to the delivery of energy services. No. 2, they address the perceived risks associated with these technologies by offering a premium incentive for investment in such projects. No. 3, they are desirable to offset the tax benefits associated with the expensing of fuel usage by business.

S. 1305 is a broader, more comprehensive approach to the energy tax credit and renewable energy issues. It would reinstate the cogeneration credit, which was permitted to expire last year. We urge the committee to consider the exigency of this situation and to expeditiously respond to the call for requisite continuity for cogeneration development, as well as for the alternative energy development industry.

We note, Mr. Chairman, one provision of S. 1305 which would remove oil and gas limitations under old law with respect to the cogeneration tax credit. This is perceived as desirable since many of the currently available onshelf technologies for installation in cogeneration applications are primarily gas fired. This provision does recognize the desirability of promoting more efficient usage of these fuels, particularly in situations where alternative forms of fuel, such as coal or biomass, are neither economical nor practical.

Our statement, which follows, reviews the various risks associated with financing and reviewing project development and various tax planning uncertainties and instabilities reviewed by other witnesses, and that I will not go over today.

In conclusion I summarize by highlighting recent comments by Henry N. Schuler in the Wall Street Journal earlier this month. Mr. Schuler is a senior fellow in energy and security studies at the Georgetown University Center for Strategic and International Studies. He mentions recent headlines involving more utilities stopping coal conversion as economic benefits start to fade. Another headline involved nuclear power firms which canceled 45 percent of orders since 1972.

The message according to Mr. Schuler is simple: the Nation's fuel options are being dangerously narrowed. In fact, there may al-

ready be no acceptable option for large, new industrial boilers and generators. This potentially disastrous situation arises from the fact that renewable energy substitutes are not yet technologically feasible or commercially viable on the necessary scale and the only fossil fuel alternatives to coal, oil, and natural gas are either legislatively prohibited or discouraged.

Mr. Chairman, we have addressed the most urgent reasons for prompt consideration and enactment of S. 1305. We must take the initiative on these issues rather than wait and be placed on the defense later this decade by inevitable shifts and turns in domestic and international events.

We appreciate the opportunity to testify today, and we thank you for your interest and support of this effort.

Senator WALLOP. Thank you very much, Mr. Zimmer.

[The prepared statement of Michael Zimmer follows.]

WRITTEN TESTIMONY  
OF  
MICHAEL J. ZIMMER  
SECRETARY AND GENERAL COUNSEL  
OF  
THE COGENERATION COALITION, INC.  
ON THE  
RENEWABLE ENERGY TAX INCENTIVE ACT OF 1983  
(S. 1305)  
BEFORE THE  
SENATE FINANCE SUBCOMMITTEE ON  
ENERGY CONSERVATION AND AGRICULTURAL TAXATION  
JULY 18, 1983

SUMMARY  
WRITTEN TESTIMONY  
OF  
MICHAEL J. ZIMMER  
COGENERATION COALITION, INC.  
ON THE  
RENEWABLE ENERGY TAX INCENTIVE ACT OF 1983  
(S. 1305)  
JULY 18, 1983

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- Cogeneration is one of the foremost technologies for the efficient use of energy currently available in the United States. Major potential exists in the forest products, steel, food processing, chemical and petroleum refining industries for the application of this technology.
- DOE has recently concluded that 52% of the potential cogeneration by industry will occur in the South Atlantic, South West and Western regions. Twenty-five percent (25%) of the potential is in the Mid-Atlantic region alone.
- Cogeneration now provides 5% of total U.S. electricity production or approximately 113 billion kilowatt hours. Under a proper regulatory environment and with enactment of legislation such as S.1305, installation and construction of cogeneration systems could increase from current levels of \$750 million to \$20 to \$30 billion by 1990.
- The Cogeneration Coalition, Inc. supports of S. 1305, and this review undertaken by the Subcommittee on the availability of energy tax credits is timely as many renewable energy and cogeneration projects enter critical decision-making on ultimate development and construction. Larger scale energy projects may also require significant lead times with substantial front-end capital requirements which the availability of energy tax credits can offer a significant contribution.
- Tax incentives such as contained in S.1305 are necessary to rectify imbalances in the economic system, to address the perceived risks associated with these technologies by offering a premium incentive for investment in such projects, and to offset the tax benefits of expensing usage of fuels by business.
- S.1305 embodies a broader more comprehensive approach to energy tax credits than other legislation pending before this Subcommittee, and would reinstate the cogeneration tax credit which was permitted to expire on December 31, 1982.
- The Cogeneration Coalition, Inc. particularly commends Section 5 of S.1305 which removes the oil and gas limitation under old law. Omitting oil and gas or any of their products as primary fuels for purposes of the cogeneration tax credit is counterproductive since the most effective and currently available cogeneration technologies are gas-fired.

WRITTEN TESTIMONY  
 OF  
 MICHAEL J. ZIMMER  
 SECRETARY AND GENERAL COUNSEL  
 OF  
 THE COGENERATION COALITION, INC.  
 ON THE  
 RENEWABLE ENERGY TAX INCENTIVE ACT OF 1983  
 (S.1305)  
 BEFORE THE  
 SENATE FINANCE SUBCOMMITTEE  
 ON ENERGY AND AGRICULTURAL TAXATION  
 JULY 18, 1983

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The following written testimony is filed on behalf of the Cogeneration Coalition, Inc. (Coalition) on the Renewable Energy Tax Incentive Act of 1983 (S.1305) which is currently pending before this Subcommittee. The Coalition is a non-profit organization comprised of interested natural gas utilities, industrial users, industrial and commercial equipment manufacturers, project developers and engineering and construction consulting firms. <sup>1/</sup> The Coalition has also established advisory working relationships with other national interest groups and trade associations on issues affecting cogeneration development. The Coalition supports the provision of necessary financial and tax incentives to promote the full utilization of cogeneration technology and the removal of unnecessarily restrictive federal

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<sup>1/</sup> The current membership of the Coalition includes: Kimberly Clark Corp., Brooklyn Union Gas Company, Great Lakes Carbon Corp., Thermo Electron Corp., National Urban Energy Corp., Big Six Towers, Williams & Works Industrial CoEnergy Systems, Inc., Michigan Consolidated Gas Company, Hydra Co. Enterprises, Inc. and Southern Connecticut Gas Company as well as several other national trade groups and organizations supporting cogeneration development.

barriers to the development of cogeneration potential nationwide.

### Introduction

Cogeneration is one of the foremost technologies for the efficient use of energy currently available in the United States. It involves the sequential use of energy to produce electricity or mechanical shaft power and some other useful form of energy (usually heat or steam) from the same energy source. Major potential exists in the forest products steel, food processing, chemical and petroleum refining industries for the application of this technology.<sup>2/</sup>

A recent study for the Department of Energy (DOE) on Industrial Cogeneration Potential (1980-2000) evaluated sixteen cogeneration technology/fuel combinations at 10,000 plant sites throughout the country. Based upon this analysis, 3131 plant sites were identified as viable candidates for such projects. These plants represented the maximum potential within the scope of this study based on a heat match analysis, utility rates, and accelerated depreciation and offer 42,824 megawatts of electric power--or the equivalent of 40-50 baseload powerplant generation stations. (See Attachment 1)

These plants also represent approximately 2 quads of potential energy savings including the energy savings at the

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<sup>2/</sup> See Resource Planning Associates, The Potential for Industrial Cogeneration Development by 1990 (July 31, 1981), p.ii.

plant site as well as the utility powerplant. DOE also concludes that 52% of the potential cogeneration will occur in the South Atlantic, South West, and Western regions. Twenty-five percent (25%) of the potential is in the Mid-Atlantic region spreading into New England. (See Attachment 2) California has the largest potential of 8,537 MW followed closely by Louisiana (6,202 MW), Texas (5,878 MW), Pennsylvania (4,172 MW), Illinois (2,452 MW), New Jersey (2,323 MW) and Ohio (2,280 MW). (See Attachment 3)

Other potential applications for cogeneration of a non-industrial nature include water desalinization plants, pipeline compressor stations, multi-family residential and commercial complexes, hotels, universities, hospitals and military bases. <sup>3/</sup> For instance, Hagler, Bailly & Co. estimates there is currently about 560 MW of commercial/residential cogeneration capacity currently installed at about 300 sites across the U.S.

During 1982, use of cogeneration surged to levels representing 5% of total U.S. electricity production or approximately 113 billion kilowatt hours. Under a proper regulatory environment and with reinstatement of energy tax credits for such investments, the market for installation and construction of cogeneration systems could increase from current

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<sup>3/</sup> For more detailed analysis of non-industrial cogeneration applications, see OTA, Energy Efficiency of Buildings in Cities (March, 1982); Gas Research Institute, Cogeneration Energy Systems Assessment (January, 1982); and OTA, Industrial and Commercial Cogeneration (March, 1983).

levels of approximately \$750 million to levels of \$20 to \$30 billion by 1990.

Coalition Supports Goals of S.1305

The membership of the Coalition supports S.1305 which provides an extension of necessary business energy tax credits for various renewable energy technologies, extends the affirmative commitments provisions for certain energy property, clarifies treatment of certain energy property installed as a "structural component" of a facility, and reinstates the cogeneration tax credit which expired on December 31, 1982. Many renewable energy projects may also consider the deployment of cogeneration technology, particularly for biomass and synthetic fuels plants, and the certainty and relief provided by S.1305 would be welcomed at a minimal cost to the American taxpayer through reduced Treasury revenues. This critical review by the Subcommittee of the availability of energy tax credits is timely as many renewable energy and cogeneration projects enter critical decision-making on ultimate development and construction during the remainder of this decade. Larger scale energy projects may also require significant lead times with substantial front-end capital requirements which the availability of energy tax credits can offer a significant contribution.

Because of the unique circumstances regarding cogeneration--which specific energy tax credit was permitted to expire on December 31, 1982--the Coalition believes that the broader, more comprehensive approach embodied in S.1305 merits close Subcommittee review and scrutiny as introduced by Senators

Packwood and Matsunaga with ten co-sponsors. A companion bill has been introduced in the House by Representative Cecil Heftel as H.R. 3072 with 21 co-sponsors. This legislation would operate to reinstate the cogeneration tax credit as well as generally extend the duration of energy tax credits, and selectively increase the amount of those tax credits for certain technologies.

With the expiration of the cogeneration tax credit on December 31, 1982, a distinct market response ensued as development activities flattened during the first half of 1983. With the introduction of these bills and with several other developments, market interest has renewed within the past two months. In order to maintain this momentum, it is essential that action on renewal of the cogeneration tax credit occur this year to maintain continuity and current development patterns. Further delay until 1984 will only operate to create further difficulties in private financing of these projects.

#### Importance of Energy Tax Credits as Financing Tools

S.1305 and a more comprehensive energy tax credit plan are critical elements of a national energy policy. In order to finance any cogeneration project, a financial institution will consider in its analysis eight specific risk factors with the project:

1. Technical Risk

- Will the project use a proven or a new technology? The lender obviously prefers to see proven technology in a project under review for private financing.

2. Market Risk

- What is the likelihood that the project will have an assured market for the output at prices that return a profit when the project is completed?

- What is the nature of the contracts which govern the sale of the electricity and steam? How firm and how long are the contracts?

3. Economic Risk

- What is the likelihood that the economic projections which forecast amount of production, sales prices, operating costs and earnings generated over the life of a project will be maintained over time?

- What is the degree of latitude or sensitivity among various project assumptions?

4. Financial Risk

- Will the project be able to generate sufficient earnings to service the debt and to return invested capital to the project sponsors? Minimum annual coverage of 1.5 cash flow to debt service is typically preferred by lenders.

- What is the percentage of equity invested in the project? Is the amount sufficient to provide a cushion for unexpected contingencies?

5. Supply Risk

- What is the likelihood that the project managers can obtain a reliable and steady supply of feedstock necessary to ensure the efficient and economical operation of the cogeneration facility?

- What are the terms of the supply contracts regarding duration, pricing and interruptibility?

6. Completion Risk

- What is the likelihood that the project can be completed without excessive delays and will operate according to minimal standards of performance?

- Have feasibility studies been performed?
- What is the reputation of the design engineers, project managers and contractors who have been retained to develop and complete the project?

7. Regulatory Risk

- Has the project satisfied all environmental and regulatory requirements for siting, construction and operation?
- What is the likelihood that changing legislation, regulations, or judicial challenges could impair the performance of the project?

8. Operating Risk

- Once the plant is operating, a lender wants to be assured that the project will be managed and operated by experienced, trained personnel.
- In addition, all necessary insurance for operation of the project should be in place.

The risk involved in an assessment of each of these factors must be evaluated on its own, and also in relationship to the other risk factors, in order to determine the overall risk of the project. A project sponsor wants to structure a deal which minimizes his credit exposure. A lender, on the other hand, wants to be assured that the project has support available to it to provide for debt repayment. Project financing negotiations will attempt to balance these opposing objectives.

The extent to which these relative risks are perceived is a function of the quality and maturity of these technologies and principles of economics. Cogeneration has enjoyed successful experience. It currently supplies approximately 5% of total U.S. electricity production increasing substantially from levels of

just 3% in 1970. Yet, many cogeneration projects are perceived by investors and financial institutions as risky requiring a rate of return which can exceed the return available on more conventional investment opportunities.

Energy Policy, Revenue and Financial Benefits of S.1305

Moreover, the energy marketplace in this country is not a free market for the provision of electricity, natural gas and other fuels. Favorable tax treatment exists in the form of expensing costs of extraction and depletion allowances, while business use of various fuels is an ordinary and necessary business expense deductible in computing federal income taxes. Tax incentives such as the tax credit provisions in S.1305 rectify these imbalances in our economic system, address the perceived risks associated with these technologies by offering a premium incentive for investment in such projects, and offset the tax benefits of expensing usage of fuels by business in general.

Moreover, reduced energy costs have the potential to reduce tax deductions in deriving taxable income with positive feedback effects offsetting revenue losses from the tax credits themselves. Further, the increased economic activity associated with the enhancement of energy efficiency through cogeneration generates additional taxable income with further positive feedback effects. The net tax income to the economy assuming a 30% effective tax rate from \$20 to \$30 billion of cogeneration installation and construction by 1990 could range from \$6 to \$9 billion for offsetting any projected revenue losses to the U.S. Treasury. This means that for every dollar of energy use saved

by the investment, the Treasury in effect recovers increased tax revenues--revenue which would not have been collected but for the energy saving capital expenditure.

Cogeneration projects are being financed generally with two types of funds: debt and equity (risk capital). The availability of energy tax credits for equity financing becomes critical for three reasons: first, it is self-implementing; second, it is available on a timely basis when the cogeneration system is placed in service, and is valued at close to net present value unlike depreciation allowances; and third, its value to the taxpayer unlike depreciation allowances is constant, and is not contingent upon the marginal tax rate of the particular investor.

The impact of energy tax credits for such technologies as cogeneration proved an important tool in arranging financing for projects, and helped stimulate capabilities to attract risk capital to these projects. However, the full value of such provisions as an incentive and Congressional intent in support of such technologies has been thwarted by:

- 1) failure of the Internal Revenue Service to properly interpret or meaningfully implement such provisions;
- 2) continued attacks by this Administration against the energy tax credits even when they were in existence;
- 3) imposition of expiration dates coupled with restrictive IRS interpretations on affirmative commitments which precluded inclusion of the credits in the investment decision-making process in any meaningful manner;
- 4) potential shifts in Treasury/IRS policies regarding the tax credits and also restrictive treatment of accelerated depreciation for cogeneration projects as

either public utility property, or where such property is installed in tax-exempt or municipal entities.

With so many unknown and uncertain variables, it is no surprise that underlying challenges regarding the effectiveness of such energy tax credits as a business investment tool have become really self-fulfilling prophecies and somewhat misguided in analyzing and determining the ultimate effectiveness of such tax incentives in business planning and decision-making.

#### S.1305's Treatment of Oil and Gas Use for Cogeneration

Finally, S.1305 would also remove the limitation on availability of the cogeneration tax credit with respect to oil and natural gas use which merits special commentary. Under this limitation, the annual use of oil or natural gas fuel in the cogeneration system must be less than 20% of all fuel used each year and must be limited to use as a startup, backup or flame stabilization fuel under the old requirements of Section 48(l) (14) of the Internal Revenue Code which expired last year.

The Coalition supports this provision of S.1305. Omitting oil and gas or any of their products as primary fuels for purposes of the cogeneration tax credit is counterproductive since the most effective and currently available cogeneration technologies are gas-fired. S.1305's treatment of this issue in Section 5 of the bill clearly recognizes that only large-sized cogeneration facilities possess the economies of scale and capital requirements to utilize coal. The only reasonable and available fuel choice in the interim is oil and gas for small and medium-sized cogeneration facilities. Use of oil and gas in a

cogeneration facility is not inconsistent with national energy policy objectives since it offers increased efficiencies in use of these fuel inputs over use of such fuels in separate facilities. Also, the use of oil and gas in the interim can provide an important bridge or transition to synthetic fuels derived from wood, biomass or lignite for the long-term use in cogeneration applications. Finally, analysis conducted by one of the Coalition's members indicates that removal of this limitation would lead to increased cogeneration equipment purchases of \$2 billion over the next four years creating an additional 10,000 jobs in the depressed equipment manufacturing industry alone.

Thus, Section 5 of S.1305 represents sound tax and energy policy for several other reasons:

1. Such fuel restrictions for the cogeneration tax credit would be discriminatory and administratively unfeasible to implement over the long-term.
2. Such modifications would be inconsistent with the holding in the American Electric Power case regarding the undesirability of using fuel restrictions to impede cogeneration development.
3. Such limitations are contrary to current exemptions and size limitations already enacted in the Fuel Use Act and implemented by regulation by DOE.
4. Consideration of such proposals is inconsistent with current Administration and Congressional efforts to repeal the Fuel Use Act.
5. Such a provision could place gas-fired cogeneration at a competitive disadvantage with electric utility baseload generation using natural gas which is encouraged as a matter of national policy under FERC Order No. 30, the prior temporary public interest exemptions under FUA, and the relaxation of the off-gas ban in 1981 under FUA.
6. Environmental and efficiency benefits associated with gas-fired cogeneration would be lost.

7. Energy tax legislation is not the appropriate context to be addressing the fuel use issues raised. Instead, such concerns should be articulated in the context of reconsideration of the Fuel Use Act or the Clean Air Act.
8. Associated environmental and state and local tax-related concerns which are woven into the fuel use argument are more appropriate and germane for consideration at the state level, and not as a matter of federal statute.

#### Conclusion

For these reasons, the membership of the Cogeneration Coalition, Inc. strongly urges this Committee to consider and support the comprehensive and more substantial approach raised in S.1305 in its deliberations on energy tax credits and to proceed on an expeditious basis to preserve continuity for cogeneration development. Only this course will offer a more meaningful, permanent response benefiting these important technologies for long-term planning through this decade to satisfy the electric power supply challenges which our nation is rapidly facing.

We appreciate the opportunity to appear before this Subcommittee, and will be pleased to answer any questions you may have.

## - Attachment 1 -

SIC	Potential NW		Potential Number of Plants	
	(MW)	(%)	Number	(%)
20	7,146	17	863	27
26	8,414	20	454	14
28	9,800	23	408	13
29	10,978	26	179	6
33	2,823	6	307	10
Remaining Sector	3,665	8	920	30
	42,824		3,131	

Size (MW)	Total MW Production	(%)
< 2	847	2
2-10	6,073	14
10-50	12,433	29
50-100	7,417	17
> 100	16,054	37
	42,824	

SIC	SIC Definition
20	Food
21	Tobacco Products
22	Textile Mill Products
23	Apparel
24	Lumber and Wood Products
25	Furniture and Fixtures
26	Paper
27	Printing and Publications
28	Chemicals
29	Petroleum and Coal Products
30	Rubber and Misc Plastic Products
31	Leather
32	Stone, Clay and Glass Products
33	Primary Metals
34	Fabricated Metal Products
35	Machinery, Except Electrical
36	Electric and Electronic Equipment
37	Transportation Equipment
38	Instruments and Related Products
39	Miscellaneous Manufacturing

## - Attachment 2 -

*Regional Summary of Potential Cogeneration\**

<i>Region</i>	<i>Number of Potential Plants</i>	<i>Potential Power Generation (MW)</i>	<i>Potential Electricity Generation (10<sup>6</sup> Kwh)</i>	<i>Potential Steam Generation (10<sup>6</sup> lb/yr)</i>	<i>Potential Energy Savings (10<sup>6</sup> Btu/Yr)</i>
New England	289	3,014	17,464	98,843	115,386
NY/NJ	265	2,833	19,070	116,035	128,872
Mid-Atlantic	319	4,536	30,183	215,531	206,834
South Atlantic	544	5,757	40,464	396,778	294,648
Mid West	559	5,226	37,874	321,993	251,377
South West	335	11,362	91,714	763,314	631,891
Central	186	2,411	17,895	153,122	119,403
North Central	38	506	4,072	33,817	27,684
West	408	7,708	43,219	216,761	278,744
North West	150	1,316	8,642	64,474	58,830
<b>TOTALS</b>	<b>3,093</b>	<b>44,669</b>	<b>310,593</b>	<b>2,380,634</b>	<b>2,113,620</b>

\*Best System At Plant Site Accelerated Depreciation ROI &gt; 7%

## - Attachment 3 -

## State Summary of Potential Cogeneration\*

State	Number of Potential Plants	Potential Power Generation (MW)	Potential Electric Generation (10 <sup>6</sup> Kwh/Yr)	Potential Steam Generation (10 <sup>6</sup> lb/Yr)	Potential Energy Savings (10 <sup>6</sup> Btu-Yr)
Alabama	98	1,658	11,669	164,638	91,623
Alaska	3	2	12	449	121
Arizona	24	110	724	11,852	6,184
Arkansas	39	1,120	6,934	83,557	53,461
California	382	8,537	49,732	239,307	318,376
Colorado	17	235	1,781	9,897	11,321
Connecticut	47	370	2,416	12,470	16,154
Delaware	15	426	3,538	16,695	22,835
Dist. of Col.	0	0	0	0	0
Florida	77	1,917	11,978	116,212	88,235
Georgia	113	1,318	9,557	162,086	81,804
Hawaii	15	252	990	6,060	6,557
Idaho	20	430	2,953	10,776	18,424
Illinois	181	2,452	18,792	133,201	111,819
Indiana	61	1,595	13,011	104,173	75,784
Iowa	51	451	2,912	38,936	23,256
Kansas	29	976	8,007	43,220	50,358
Kentucky	41	638	4,934	51,514	30,882
Louisiana	94	6,202	52,148	433,444	352,404
Maine	63	1,678	12,098	77,380	81,028
Maryland	18	274	2,079	19,871	12,138
Massachusetts	134	1,168	6,327	27,875	39,609
Michigan	121	1,345	9,970	112,089	70,283
Minnesota	42	456	3,095	34,342	20,571
Mississippi	51	1,580	12,315	73,164	82,800
Missouri	53	506	3,530	29,428	24,752
Montana	10	211	1,545	8,739	9,799
Nebraska	20	85	452	7,457	3,777
Nevada	2	2	6	85	49
New Hampshire	26	296	1,658	11,897	11,387
New Jersey	125	2,323	16,515	83,110	108,368
New Mexico	20	119	656	10,511	5,533
New York	156	1,304	8,297	66,229	58,460
North Carolina	121	1,030	7,397	91,106	57,427
North Dakota	1	1	3	46	23
Ohio	156	2,280	16,043	126,894	108,236
Oklahoma	28	668	5,119	54,366	37,366
Oregon	81	647	4,333	46,987	32,719
Pennsylvania	214	4,172	28,637	169,685	183,333
Rhode Island	24	280	1,358	4,894	7,715
South Carolina	82	757	5,718	85,074	46,918
South Dakota	3	2	5	94	45
Tennessee	47	1,694	14,051	63,356	89,938
Texas	186	5,878	48,502	603,618	352,682
Utah	7	145	1,261	10,210	8,342
Vermont	13	103	500	2,680	3,360
Virginia	82	1,359	7,733	103,885	61,612
Washington	51	813	5,483	37,472	36,240
West Virginia	19	361	2,970	42,059	21,162
Wisconsin	72	642	4,348	64,644	36,115
Wyoming	6	95	796	13,816	6,872
TOTALS	3,093	44,669	310,593	2,380,634	2,113,620

\*Best System at Plant Site Accelerated Depreciation ROI &gt; 7%

Senator WALLOP. Mr. Hough.

**STATEMENT OF THOMAS C. HOUGH, MEMBER, BOARD OF DIRECTORS, NATIONAL HYDROPOWER ASSOCIATION, WASHINGTON, D.C.**

Mr. HOUGH. Thank you, Mr. Chairman.

I'm the president of energy research and consulting firm that specializes in hydropower development. I also direct hydro development activities of National Property Analysts, a leading real estate development firm. And I'm a member of the board of directors of the National Hydropower Association.

I'm accompanied by Lee Goodwin, the vice president and general counsel of the National Hydropower Association.

I'm pleased to have the opportunity to testify here today.

My specialty is hydro project financing. Since 1979 I've had the opportunity to review the financial aspects of over 50 individual projects where private equity capital was required to secure financing. In most cases, the energy tax credits are a very important component of the return to the equity investor. The credits are especially important where technically feasible projects have marginal financial feasibility.

Energy tax credits are important to hydro because the capital costs per kilowatt of hydro capacity are very high relative to coal, oil and gas burning power plants. Hydro has to pay for its fuel equivalent structures up front, while the fossil fuel plants pay for their fuel over the life of the plant.

Energy tax credits help reduce the high capital costs of hydro projects. Without this help many projects could not be built.

Typically, the payback for hydroelectric projects is 7 years or longer. The rates of return, on invested capital are relatively low based on current costs and energy prices. They are lower than alternative investments in real estate.

The energy tax credits help improve these returns and reduce the payback period. The benefit payback, for example, may be shortened by a year or more.

I believe the energy credits should be extended for the three reasons that are discussed in my written testimony provided today. To summarize the written testimony, the private hydro development industry is faced with delays both from the equipment and the regulatory standpoint. The regulatory delays were unanticipated. We thought in 1979 and 1980 that hydro licensing could be accomplished in six months for any given project. In actual practice, it takes a great deal longer to get projects licensed.

The industry was led to believe that equipment would be standardized; would become available off the shelf; so that projects could be brought on line rapidly. In fact, almost every project requires customized equipment. It takes 14 to 18 months from ordering the turbine until it is delivered to the project site.

A second reason the industry believes energy tax credits should be extended is that near-term avoided costs have declined. It has been caused by the temporary world oil surplus. Lower oil prices have reduced some electric utilities' marginal costs. The utilities, in turn, have reduced rates paid for the energy provided from hydro

projects. They use this temporary decline in oil prices as a rationale for not offering levelized cost contracts that could help the industry.

Finally, tax laws have changed over the past few years causing financing uncertainties. Even now, House Ways and Means is considering changes that would eliminate tax credits for certain hydro projects. I would ask Lee Goodwin to discuss those particular changes at the close of my statement.

I endorse the extension of the tax credits that are proposed in S. 1305, and feel that they are necessary for the hydropower industry.

Thank you.

Senator WALLOP. Thank you, Mr. Hough.

[The prepared statement of Mr. Hough follows.]

# NATIONAL HYDROPOWER ASSOCIATION

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Statement of Thomas C. Hough  
before the  
United States Senate  
Committee on Finance  
Subcommittee on Energy and Agricultural Taxation

Mr. Chairman and members of the subcommittee, my name is Thomas C. Hough. I am the president of Hough Associates, and I also serve as Director of Hydropower Development for National Property Analysts. I am a member of the Board of Directors of the National Hydropower Association. NHA is the trade association of the private hydropower industry, and its members include hydropower project developers, engineering consultants, equipment manufacturers, and other interested parties. I am accompanied by Lee M. Goodwin, Vice President and General Counsel of NHA. I am here to talk about the issue of energy tax credits. I appreciate the opportunity to testify here today.

Hydropower is a major non-polluting domestic renewable energy resource. Hydropower development, and particularly the maximum development of small scale projects at existing dams and non impoundment sites, can make a significant contribution to our national security and economy by diminishing our dependence on foreign oil, and by promoting employment and economic growth. In recognition of the significant benefits of hydropower development, Congress enacted an 11 percent energy tax credit for small scale projects. The credit is available through 1985, with an affirmative commitments extension for some projects through 1988.

Industry experience both before and after the enactment of the energy tax credit indicates that the credit is frequently critical to the financing of a project. Accordingly, we are very concerned that the present expiration date for the credit is too early to stimulate maximum hydropower development. The present energy tax credit for hydropower projects was enacted in 1980 as part of the Crude Oil Windfall Profits Tax Act. Since that time, hydropower development has been slowed by three critical factors:

\*Regulatory delay.

\*Declining oil prices.

\*Constantly changing tax environment.

I will address each of these factors briefly in turn.

Regulatory delay has become an obstacle far beyond anyone's expectation during the past few years. A January, 1980, study of hydropower's potential by the General Accounting Office stated that the "obstacles associated with development are complex and at times seem insurmountable..." Although the situation has improved somewhat since that time, it still is not uncommon for the Federal Energy Regulatory Commission to take several years to move a hydropower licensing application through its process to final approval. As a result, while the total capacity represented by license applications has run as high as an estimate of nearly 20,000 megawatts in 1981, the amount of hydro capacity actually coming on line in 1982 has been estimated at no more than 100 megawatts, a small fraction of the amount applied for.

Declining oil prices have, of course, surprised us all to some extent. Projections of future escalation rates have been notoriously inaccurate during

recent years, erring on both the high and low sides by orders of magnitude. Unfortunately for the hydropower industry and for other new energy technologies, prices experienced recently have been far below the levels anticipated in 1980 when the energy tax credits were enacted. This in turn has meant lower avoided cost projections for most utilities and a poorer market for hydropower.

A constantly changing tax environment has probably done as much as anything else to slow the pace of hydropower development. Since the credits were enacted, the industry has lived under a constant cloud of uncertainty in this area. The Administration has attempted twice to repeal the energy tax credits. Both the Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act of 1982 added new rules which altered the tax consequences of capital investments in hydropower projects. More recently, the Treasury Department threatened to change the depreciation treatment of hydropower and other renewable energy and cogeneration projects by placing independent, non-utility power production facilities in a 15-year, rather than a five-year, recovery property category. Indeed, at this very moment, the Ways and Means Committee is considering altering the rules governing the tax treatment of power sale contracts so that the investment and energy tax credits could be denied to any hydropower facility whose output is sold to a municipal utility or tax exempt electric cooperative.

These factors have combined to substantially slow the rate of hydropower development over the rate that was expected in 1980 when the energy tax credit for hydropower projects was enacted. For this reason, this industry urgently needs an extension of the credit beyond its present 1985 expiration date. Accordingly, we strongly endorse the extension proposed in S. 1305.

Senator WALLOP. Mr. Goodwin.

**STATEMENT OF LEE M. GOODWIN, VICE PRESIDENT AND GENERAL COUNSEL, NATIONAL HYDROPOWER ASSOCIATION, WASHINGTON, D.C.**

Mr. GOODWIN. Briefly, what Mr. Hough was referring to in terms of current uncertainty in the tax laws is the Government Leasing Tax Act. We are very concerned with the impact that this act could have in redefining the tax treatment of power sales contracts, not only for hydropower but for most other renewable energy technologies.

Rather than devoting a lot of time to discuss this today, I simply cite it as one example of the kind of uncertainties which previous witnesses have referred. It makes it very difficult to finance renewable energy projects. This is another factor which warrants an extension of the credits so that projects can come along once these uncertainties are resolved.

Thank you.

Senator WALLOP. Thank you.

Dr. Papay.

**STATEMENT OF DR. LAWRENCE PAPAY, SENIOR VICE PRESIDENT, SOUTHERN CALIFORNIA EDISON CO., WASHINGTON, D.C.**

Dr. PAPAY. Mr. Chairman, thank you for the opportunity to comment on Senate bill 1305. As the only individual corporate representative on this panel and not representing an association, perhaps it would be appropriate for me to say a little bit about Southern California Edison's corporate efforts in the commitment to accelerate the development and deployment of renewable and alternative technologies. This was taken as a policy statement in 1980, and was based upon more than a decade of research in these various technologies.

I think our individual efforts and credentials, so to speak, are best exemplified by the projects we have underway today, such as the 10-megawatt solar central receiver project, two 10 megawatt geothermal demonstrations involving high salinity brine, a 2-megawatt wood waste gasifier, the largest privately funded wind turbine at 1½ megawatts, and a 100-megawatt coal gasification project.

Coupled with that are a variety of projects with third party entrepreneurs under PURPA, including nearly 20 projects involving wind, several involving solar photovoltaics, others involving troughs and dishes and solar ponds, as well as cogeneration and biomass projects.

The success of our program to date has been due to the energy tax credits, and the Federal R&D funding which has proceeded these. However, this program today is in danger of impairment due to the decreased price of oil, and the instability and uncertainty of the credits themselves.

We estimate that the loss of the tax credits could affect an estimated 1,100 megawatts for our system alone, which would be the equivalent of 4½ million barrels of oil annually.

As far as our recommendations are concerned, we support the various aspects of Senate bill S. 1305. And in our written testimony we offer that support with some minor technical differences for your consideration.

I would like to take the remaining portion of my time to speak to one aspect, which is not included in S. 1305. And that is the recommendation of the extension of the business energy tax credits to utilities, thereby increasing their involvement in renewable technologies, and helping to insure the continued development of these technologies.

We have a variety of projects underway today in which utility involvement could be vital. Let me give you one example.

We have a 100-megawatt solar central receiver project under study. It can provide a striking example of the current inequity as far as utility inclusion in the tax credits are concerned.

During the critical first 5 years of operation, the Federal tax benefits accruing to the nonutility investor will offset nearly 65 percent of the capital investment. Tax benefits accruing to the utility and ultimately to the consumer will offset 27 percent of the utility's capital contribution.

Now you mentioned earlier the fact that this might look like rate subsidization. In point of fact, in projects of this type, this is not subsidization because these projects are new commercially, and the economics actually exceed avoided cost. The extension of the tax credits to utilities in this particular project would be worth about 2½ cents per kilowatt hour, which might make or break in terms of whether the project could proceed.

If we were to finance the project through a subsidiary, current size limitations in the Public Utility Regulatory Policies Act would prevent classification of this project as a qualifying facility. And, therefore, exclude its eligibility for the tax credits.

Conversely, if the project were reduced in size in order to qualify as a PURPA facility, the economies in scale gained at the larger size would be lost at a corresponding increase in costs to the project itself. So we find ourselves in a catch-22 situation.

In conclusion, then, I would urge the adoption of Senate bill 1305, with the inclusion of utilities for the tax credits. Extending them to utilities is logical at this time since they are the ultimate market, have certain expertise, and may have to be involved to make the project go. Extending them to utilities will result in faster deployment of technologies, provide more diverse markets, and enhance the probability of success.

I can assure you that enactment of S. 1305 and inclusion of utilities may make it possible for these projects to proceed. I cannot guarantee it. However, the lack of passage of S. 1305 and the lack of inclusion of utilities probably will mean that several of these projects will not be able to proceed.

Thank you very much.

Senator WALLOP. Thank you, Mr. Papay.

[The prepared statement of Dr. Papay follows.]

STATEMENT OF  
DR. LAWRENCE T. PAPAY  
SENIOR VICE-PRESIDENT  
SOUTHERN CALIFORNIA EDISON COMPANY

Regarding S. 1305  
Extension and Enhancement of Energy Tax Credits

Before the  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION

of the

COMMITTEE ON FINANCE  
UNITED STATES SENATE

July 18, 1983

SUMMARY

Southern California Edison (SCE) supports S. 1305 and similar legislation to extend and enhance energy tax credits for renewable resource development. However, we propose a schedule and level of enhancements as depicted in the table below, which SCE believes will bring about an orderly development of renewable and alternative resources. Second, SCE believes utilities and non-utilities should receive equal incentive to develop these technologies and, as such, recommends that utilities should be eligible for the Business Energy Tax Credit (BETC). Third, in view of the potential which synfuels, tar sands and oil shale offer as an alternative source of energy, SCE urges their accelerated development by making them eligible for the BETC.

Business Energy Tax Credits

- o Tar sands, oil shale and other synthetic resources ..... 15 percent
- o Renewable resources ..... 25 percent

Expiration dates for technologies

- o Photovoltaics, solar central receivers, large wind turbines, fuel cells, liquid-dominated geothermal, tar sands, oil shale and other synfuels.....1990
- o Biomass, small hydro, solar parabolic dishes and troughs, solar salt gradient ponds, small wind.....1988
- o Cogeneration (except in conjunction with fuel cells).....1985
- o Affirmative commitment (grandfathering) beyond scheduled expiration.....3 Years

Mr. Chairman, members of the Subcommittee, thank you for this opportunity to present the views of the Southern California Edison Company (SCE) on the important subject of tax incentives for emerging energy technologies. I am Dr. Lawrence T. Papay, Senior Vice-President of SCE. As you might already know, we at SCE are committed to the accelerated development and deployment of renewable and alternative energy sources. Our goal for 1992 is to have 2150 MW, or a third of our additional capacity, supplied by renewable and alternative technologies. Thus far we have over 400 MW of renewables and alternatives on-line, and we have contracts with third parties for another 683 MW. An additional 1900 MW of renewable and alternative proposals are under negotiation. We have pursued this policy because of the important benefits associated with these emerging technologies. Our success with renewables has been largely due to the availability of the Federal and State energy tax credits. SCE and other utilities, government, and private parties have made significant progress in developing and using renewable resources; however, we believe that this progress is now in danger of being severely impeded or even stopped because of uncertainties in several areas of government policy. A major uncertainty is the continued availability of the Business Energy Tax Credit (BETC). We believe that renewable energy development is an important national goal in which the Federal government must play a key role. Among the most efficient and effective

policies necessary to achieve this goal are to:

- o Extend expiration dates and adjust percentages for energy tax credits in correspondence with the degree of development of the individual technologies.
- o Increase utility involvement in renewable technologies by extending energy tax credits to utility companies.
- o Expand the energy tax credit to include tar sands and oil shale projects, and other synthetic fuels.
- o Reinstate energy tax credits for cogeneration facilities.
- o Remove certain restrictions to renewable technology development imposed by the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA).

We believe that energy tax credits are an effective way of enabling the government to foster the development and use of renewable resources. These credits provide the necessary stimulus for private industry to pursue a particular goal in addition to bringing forth new markets and increased economic activity. Energy tax credits also provide incentives for the

private sector to invest in basic and applied energy research, which in the past has been heavily sponsored by the Federal government. Thus, the energy tax credit enhances the development of renewable technologies and accomplishes this goal by enabling the private sector to invest capital in place of traditional reliance on government.

#### EXTENSION OF ENERGY TAX CREDITS

While the long-term outlook for renewable technologies is encouraging, and the potential contribution is substantial, the development of these resources is not without risk. The energy tax credit has undoubtedly provided an effective economic incentive for entrepreneurs to develop these new technologies. In our negotiations with entrepreneurs, many of them stated explicitly that the energy tax credit has been an important, if not deciding, factor in determining whether a project will go forward. We believe that energy tax credits should be extended to ensure financing for energy-saving technologies and assist the private-sector in adjusting to the currently high front-end costs associated with many of these infant technologies. The energy tax credits have provided a degree of stability for these renewable projects, and have been instrumental in gaining project financing. In fact, we estimate that if the current BETC were not available, SCE would lose access to 1100 MW of

capacity, which would displace the equivalent of 4-1/2 million barrels of imported oil per year. Under existing law, inadequate time remains for project planning; thus, the current energy tax credit has become ineffective. We urge you to adopt legislation to extend these credits beyond 1985, so that the national goals as recognized by original Congressional intent can be attained.

#### TAX CREDIT LEVELS AND DURATION

The BETC law, passed in 1980, has assisted many renewable technologies in achieving limited commercial market penetration. Many other important technologies, however, remain in the development stage. With the exception of large hydro and dry steam geothermal, no renewable technology has achieved expected competitiveness with fossil fuels. To reflect the differences in the stages of resource development and early markets, a resource-specific credit should be created. We recommend that a 15 percent energy tax credit be enacted for tar sands, oil shale and other synfuel projects. A 25 percent energy tax credit would be appropriate for projects using renewable sources of fuel. To reflect the relative maturity of each technology, we propose a technology-specific schedule, based on the current status and expected pace of development for each technology. Projects such as photovoltaics, solar central

receivers, large wind machines over 500 KW, fuel cells, liquid-dominated geothermal, oil shale, tar sands and other synfuel projects are currently still in demonstration phases, and require tax credits at least through 1990. Resources which are now in pre-commercial stages, such as biomass, small hydro, solar parabolic dishes and troughs, solar salt gradient ponds, and small wind machines should receive a tax credit through 1988. The further development of cogeneration would be aided significantly if tax credits were made available through 1985, except when used in conjunction with fuel cells which should be offered a tax credit through 1990. Finally, a three-year affirmative commitment (grandfathering) clause should be added to any energy tax credit legislation so that projects will not be discouraged on the basis of permitting and construction lead-time. We believe that this schedule accurately reflects the present status of the technologies, and will provide sufficient incentive for the private sector to continue an orderly and efficient development of these resources.

Tax credit percentages and appropriate credit expiration dates for emerging technologies are summarized in the following table:

Business Energy Tax Credits

- o Tar sands, oil shale and other synthetic resources ..... 15 percent
- o Renewable resources ..... 25 percent

Expiration dates for technologies

- o Photovoltaics, solar central receivers, large wind turbines, fuel cells, liquid-dominated geothermal, tar sands, oil shale and other synfuels.....1990
- o Biomass, small hydro, solar parabolic dishes and troughs, solar salt gradient ponds, small wind.....1988
- o Cogeneration (except in conjunction with fuel cells).....1985
- o Affirmative commitment (grandfathering) beyond scheduled expiration.....3 Years

UTILITY ELIGIBILITY FOR THE BETC

Although a number of wind and solar projects are moving forward without direct financial involvement by utilities, large renewable and alternative energy projects typically require equity or other forms of capital participation with the utility. This partnership is, however, severely limited due to differences in tax treatment between utilities and non-utilities. Specifically, utilities are not currently eligible to receive the BETC for renewable energy projects. Furthermore, under current law utility participation may jeopardize availability of

tax benefits to the non-utility partner.

We believe that the market potential and benefits from renewable or alternative energy resources can not be achieved unless the utilities play a much larger role in the finance, construction and ownership of these plants. We further believe that the tax savings resulting from the BETC should ultimately provide benefits to the ratepayer over the useful life of the project. Neither of these objectives can be met unless utilities are provided the same tax benefits available to non-utilities.

A 100 megawatt solar central receiver project under study by SCE and a third-party developer provides a striking example of the current inequity. During the critical first five years of operation, tax benefits accruing to the non-utility investor will offset 86 percent of the non-utility capital investment. Tax benefits accruing to the utility, and ultimately to the utility ratepayer, will offset less than 30 percent of the utility capital contribution. Most significant is that, given the availability of the BETC and five-year Accelerated Cost Recovery Schedule for SCE's investment in the project, the cost to the ratepayer would be reduced by 2.4 cents per kilowatt hour (\$5.5 million annually in 1988 dollars).

Alternatively, if SCE were to finance the entire project through a subsidiary, current size limitations in the Public Utilities Regulatory Policies Act (PURPA) would prevent classification of this project as a qualifying facility, and therefore exclude its eligibility for the BETC. Conversely, if the project were reduced in size in order to qualify as a PURPA facility, the economies of scale gained at larger size would be lost, at a corresponding increase in costs to the ratepayer.

We strongly recommend that utilities be allowed the BETC for renewable and alternative energy projects.

#### REINSTATEMENT OF BETC FOR COGENERATION

The BETC for cogeneration projects should be reinstated to insure a timely development of these fuel-efficient projects. Cogeneration projects entail heavy capital investments and often experience long payback periods. Financial risks are typically high due to fluctuating energy prices and uncertainty of fuel prices and supplies. Therefore, the BETC incentive is an important factor in mitigating the risks perceived by potential investors in the early years of cogeneration projects. As an example, SCE is currently pursuing the development of an approximately 800 MW coal-fired cogeneration project near Bakersfield, California. The availability of the BETC was a

critical factor in the financial viability of this \$2 billion project. With the expiration of BETC for cogeneration at the end of 1982, future large-scale projects will be far more difficult to finance in the current energy market.

A reinstatement of BETC for cogeneration projects through 1985 (except those utilizing fuel cells and renewable resources which are under other classifications) will materially increase utility and third-party development of cogeneration projects.

EXTENSION AND ENHANCEMENT OF TAX CREDITS  
FOR OIL SHALE, TAR SANDS AND SYNTHETIC FUELS

Progress on development of a viable synthetic fuels industry has been slow within the past year, principally because of depressed oil and gas prices. Development has been further hampered by uncertainty in tax credit availability for major synthetic fuel, oil shale and tar sands projects.

Edison supports the affirmative commitment for synthetic fuel projects included in S. 1396 but recommends an increase in the tax credits to 15 percent and an extension of the expiration date through 1990.

ADDITIONAL RECOMMENDED ACTIONS

Many renewable and alternative technology projects have been made uneconomic by the basis reduction, capitalization of interest and property tax expenses, and reduced accelerated depreciation provisions of the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). SCE believes that the restrictive provisions of TEFRA should be rescinded so that the private sector will continue to invest in renewable and synfuel projects.

CONCLUSION

In conclusion, SCE firmly believes the nation cannot afford to abandon what progress has initially been made in the renewable, synfuel, cogeneration, and conservation areas. We simply cannot forget the energy traumas experienced only ten years ago, or certainly we will be doomed to experience them again--perhaps with even greater hardships.

SCE supports S. 1305 as well as enhancement and extension of the BETC, because it has been our experience and is our belief that renewables, synfuels, and cogeneration have a very real role to play in the country's energy future. It is the

mutual responsibility of the private sector and the Federal government to bring these about and make them happen. It should be noted that extension of the BETC to utilities would attract a new investment sector, and assist in the accelerated development of a viable renewable and alternative industry, through increased investment, diversity and investor competition.

While the suggestion to extend the BETC will indeed benefit SCE, the ultimate objective is to encourage the development and commercialization of alternate and renewable technologies. In so doing, every available resource should be utilized including the expertise, knowledge, capital, and existing infrastructure of the utility industry. Further, the diverse nature of the industry itself helps ensure development of a wide range of technologies.

Senator WALLOP. I will just toss one out to the panel. I am certain that everyone here agrees that the purpose of energy tax credits is to provide the economic incentive for the development of competitive new technologies. The question is, What effect will the energy tax credits have on the date when most of these technologies could survive without Government incentive?

Mr. GOURAUD. Just speaking for solar, Mr. Chairman, if prices increase in the gas area as they have been increasing, I would think we would have a fair crack at being cost competitive in the marketplace in 1990. But we literally would close the doors of our company without the extension of this bill. I mean it's that vital to us.

You can't justify on paybacks or any other financial justification at the moment the capital costs required for these technologies.

Senator WALLOP. Any other comments?

Dr. ANDERSEN. For wind I believe the 1990 timeframe is appropriate. Large wind turbines are just in the prototype stage at this point in time. An extension to 1990 would give just barely enough time to reach sufficient levels of production, at least in the hundreds per year, to achieve the cost effectiveness without credits. A provision for affirmative commitment to 1995 would provide essential market continuity during transition to full production levels; over 1,000 per year, 1990 was the original horizon in Senate versions of the 1978 act. The shorter 1983 termination resulted from joint conference action.

Senator WALLOP. Does anybody disagree with the fact that at some moment in time there ought to be?

Dr. ANDERSEN. For wind, S. 1305 provides the most appropriate credit level and timing. We are building the industry on that basis. But tax credits are essential in the interim period.

Senator WALLOP. Mr. Gouraud, in a recent article in U.S.A. Today, they were talking about the success that stock in solar energy technologies had enjoyed over the last year. Now given your statement, what conclusion does Congress draw from what stock has done? Surely some people are as uncertain about what the Congress is going to do as you are.

Mr. GOURAUD. Well, some stocks have done well because a number of people have found out about third-party financing. And because the tax credits exist, the third-party financing, as you heard from the previous panel, is able to take place. And a number of these companies have been able to put together those kinds of projects. Given the disappearance of these credits there would be nothing.

Senator WALLOP. Oh, but surely First Boston and others are not going to seduce their investment customers into something that they think is balanced and tetering on the edge of an uncertain Congress in a very uncertain tax year.

Mr. GOURAUD. That's true, but we have 2½ years left for the Federal tax credits. And many of these projects would be completed. You have seen the companies that have run up—many of those projects would be completed within that timeframe. There are other projects which just are stymied waiting on these credits. There is also an interrelationship, Mr. Chairman, between California and some of these other States with State tax credits, and the Federal tax credit. Practically every State with a State tax credit has tied such credits to the existence of the Federal tax credit. Without the Federal credits they would disappear also.

Senator WALLOP. Dr. Papay, with respect to that argument, allowing public utilities to take the end tax credit, can the case be made that through the rate structure mechanism, utilities can make these alternative energy investments without the assistance of an energy tax credit?

Dr. PAPAY. I don't think we can make a general statement along those lines. I think each particular project would have to be handled on a case-by-case basis. And I think what it boils down to is some sort of balance between what incremental costs above avoided costs might be passed through to the consumer in the rate structure, in contrast to what incremental costs for the new technology might be covered by the inclusion of utilities under the tax credits.

Senator WALLOP. Of course, the difficulty that we have—I think you make sense. I am very much a supporter of these credits, but the difficulty that we have is trying to determine at what point that Government's role stops and where a project may have no real realizable benefit except for the Government's. And I'm not really certain that that's what we want to get into.

So what we need is your articulate expression of where these tax credits can go to move the country forward in things which are ultimately economical. The other thing is perhaps pure Government grants for funded research, which is a different story altogether than tax credits.

What I think we hope to achieve through these incentives is some means by which something which has economic horizon that is articulatable can perhaps come on line a little earlier, and move it out of the idea of research.

If any of you or any of the witnesses that have testified earlier today care to discuss that, it would be very helpful to us.

Mr. CONWAY. The company I'm associated with, Energy Conversion Devices, is one of the companies that was referred to in U.S.A. Today's article as having experienced very significant increases in the stock value.

We have in our company four joint ventures—one in Japan and three in the United States. The three in the United States are all in technology areas that will begin to hit the market in 1984, 1985, and 1986. So it is very difficult for us to think on through into how the market will react to the product that we will be introducing in photovoltaics, thermal electric devices, and storage batteries.

All of these joint ventures are proceeding apace. And we expect to be vigorously in the market. They are all capital intensive so that there are major decisions being made now in the face of uncertainty. Not only on our part, but on the part of our joint venture partners. So that we feel that the extension of the tax credits to 1990 and at the level proposed in S. 1305 give a sense of stability and direction and policy framework within which companies like ours and our joint venture partners can make plans.

The fact that we have this uncertainty now in the United States is extraordinary at the very time that Japan and the European countries are making massive commitments to the renewable energy technologies.

Senator WALLOP. I understand that, but that's not an argument here and now. I mean the real argument for us is what do we do with the resources that this country can or cannot commit otherwise. It is a nice argument to say that Japan is doing things. And I certainly hope they are not getting our tax credits for all of this.

But the real argument, really, is not one of European policy or Japanese policy, but one of American policy. And I don't want to get into that, because I think it isn't what we are trying to do here.

Mr. CONWAY. I only raised that because it adds to the uncertainty.

Senator WALLOP. All right.

Mr. GOURAUD. I think it's a judgment call. You are asking really how long do you need them. And I would say a decade—the decade of the eighties.

Senator WALLOP. Not only how long do we need them, but how much should they be. There is some point at which the tax incentive ought to stop and peer research grants or other things ought to take place. I mean, you know, we really ought not to be toying with the taxpayers' dollars on things that do not have a projectable economic horizon that can sustain themselves relatively soon. Other grants and other things is another way of traveling on that, and probably not the business of this committee. I think if there is an argument that anybody cares to expand upon in here it would be most welcome by the committee.

It's 10 to 12 and I have another panel so I think I will just invite your written testimony on the rest of that.

Thank you so much.  
[The information follows:]

**ADDITIONAL STATEMENT OF MR. JACKSON GOURAUD, VICE PRESIDENT, SOLAR ENERGY INDUSTRIES ASSOCIATION, WASHINGTON, D.C.**

I think the testimony so far has been excellent, Mr. Chairman. And I think your opening remarks were very good. If I could just leave two facts in your mind at the end of my testimony, I would be most pleased.

The first is that I don't believe this industry would survive for five minutes without the tax credits, and portions of it will not flourish or grow without an increase in the credits. The second fact which I will refer to later in my testimony is that there are a large number of people being employed by this industry who are basically unemployables That has not really been dealt with in prior testimony.

I am here as Vice President of Solar Energy Industries Association, which has over 300 members; as Chairman of Servamatic Solar Systems, Inc., one of the largest of the solar companies, and as former Deputy Under Secretary of Energy with responsibility for commercialization.

I was very keen to have Booz-Allen & Hamilton do a study for us. The very first point they make in this excellent study in the first bullet on page 1 reads: "Without federal and state energy tax credits, only small niche markets—early adopters and remote applications—will exist given depressed fuel prices." And I believe that that is unquestionably a true statement.

To date, the industry has not done too badly. We have 250 manufacturers of domestic hot water systems, We employ some 30,000 people, and we produce over \$600 million worth of goods last year. I'm talking about solar. In 1982, more than 550,000 domestic hot water systems were installed. In the photovoltaic area, I can remember when I was at the Department of Energy, \$100 per peak watt was the price, and now it's \$5 per peak watt.

Last year we produced 7 megawatts of photovoltaics in this country out of an international total market of 12 Manufacturers of parabolic troughs and thermal systems for processed heat applications are making market penetrations. With utilities throughout the country intending to install large solar, thermal systems. I must commend Southern California Edison. They have been a spectacular leader in this whole area.

The credits have been vital, absolutely vital. Nothing would have happened without them—none of this would have occurred.

Now we could have possibly, but not likely, Mr. Chairman, gotten far enough along in five years, because that's all the time we've had to have said, okay, we are there; we don't need your credits any longer. But that would have been better than any new technology ever launched in this country or anywhere else in the world. It just plain takes a little time to get your feet on the ground, and to get moving.

And there were some things that stood in our way. The oil glut, obviously, was a disincentive. The instability question has been discussed here already. The severe reduction in federal research and development has been a handicap. The Tax Equity and Fiscal Responsibility Act of 1982 in which the basis adjustment provisions substantially eroded the value of existing credits has been a deterrent.

So for these reasons we aren't quite as far as we hoped to be.

I, personally, would not want ever to get more than the credits which we asked for which you enumerated in your opening comments. And I don't see them stretching out for eternity. We need them extended for just five more years.

Now let me just close on this subject of people. We have three people in our company in April of 1979, and in California alone today we now have 1,078. In my judgment, probably half these people would not be able to find employment elsewhere in the private sector of the United States. This is true. We do mostly residential, small commercial, multi-family business. This is typical of all the companies in the domestic hot water end of the business. So I would say that you really are dealing with a very important social issue. The President has asked that every company in the country employ one more person. If you will recall, he said that unemployment would go away if that happened. Well, this industry is making a very valiant effort to do so. To continue, we need the federal tax credits not for eternity but just for the timeframes that we requested.

I've had involvement with Southern California Edison, Mr. Papay's company, where we are going to put 49 megawatts into place. This is a thermal application. Because of the uncertainty of the extension of these credits, it has been difficult to raise money. I have been authorized by the Peoples Republic of China to put together a 3 megawatt amorphous silicon photovoltaic plant. All of these things, Mr.

Chairman, need these tax credits. They need them and they need them now. I'm grateful to you for holding these meetings, and for pushing Senate Bill 1305 along. We have a comparable bill in the House Ways and Means Committee under Mr. Hefel which deals with the same things.

Thank you

Senator WALLOP. The last is a panel on S. 1193, the phosphate provision rules bill, and it is Mr. Gordon Smith, vice president of J. R. Simplot Co., accompanied by Mr. Barry Roth, vice president of The Williams Co.; and Mr. H. Lawrence Fox of Riddell, Fox, Holyoyd, & Jackson, Washington, on behalf of the Ad Hoc Committee for Obtaining Equitable Depletion Rules for Phosphate Mining, Washington, D.C.

That sounds like you might demonstrate in front of the Vietnam War Memorial. Ad Hoc Committee on the Equitable Depletion.

Mr. Smith.

**STATEMENT OF GORDON C. SMITH, VICE PRESIDENT OF FINANCE, J. R. SIMPLOT CO., BOISE, IDAHO**

Mr. SMITH. Mr. Chairman, my name is Gordon Smith. I'm a senior vice president of finance and corporate development for the J. R. Simplot Co., an Idaho based company. And I'm speaking on behalf of an ad hoc committee consisting of Agrico Chemical Co., Becker Industries Corp., who is a part owner of the Conda Partnership, and the J. R. Simplot Co.

And we urge the immediate passage of S. 1193. This bill contains a simple technical amendment to the Internal Revenue Code. Passage would make it clear that decarbonization of phosphate rock is a mining process for the purposes of computing the percentage depletion deduction, as well as the heat required in this process is less than 850° Celsius.

Actually, this should be the same result as under current law. Decarbonization is a concentration process where heat is used to remove the substantial impurities, the organic or carbonatious materials from phosphate, without changing the physical or chemical identities of the mineral.

Thus, the bill has a retroactive date. But the IRS has indicated that without Congressional guidance, it cannot make the distinction between a thermal and a concentration process.

The Service took a similar position regarding trona, and in 1974 Congress specifically provided that decarbonization of trona is a mining process. Statutorily since 1947, Congress has treated trona in phosphate in the same manner regarding depletion. Accordingly, a comparable solution for phosphate is required in 1983.

In this regard, the decarbonization step is analogous to decarbonization of phosphate ore in that it is necessary to produce a product of shipping grade in form, but it is not analogous in that the process of decarbonization effects some chemical change. The major desired constituent in phosphate ore, flourapatite, remains unchanged both chemically and physically during its decarbonization process.

While decarbonization is a heat process and, therefore, thermal, the term thermal action is illustrated in the regulations to encompass only those cases. For example, smelting where the heat is used to obtain an end product. On the other hand, logically, decarboniza-

tion qualifies as a mining process under the code and regulations since both provide that concentrating is a mining process which is necessary to make phosphate a marketable item.

For example, approximately 80 percent of the U.S. phosphate ores typically requires only washing and sometimes flotation as a concentration process. While organic hydrocarbon material is present where washing and flotation is required, it is sufficiently low in content so that decarbonizing concentrating process is not required. However, the organic hydrocarbon content of the North Carolina and the Western ores is sufficiently high that further concentration or decarbonization is necessary to bring the product to a shipping grade and form.

Succinctly stated, failure to pass S. 1193 would institute a bias against the Western and North Carolina phosphate in that all the concentration steps for approximately 80 percent of the U.S. phosphate qualifies as a mining process where the added steps for the Western and the North Carolina phosphate would not qualify.

Nowhere in the legislative history of depletion is there support for the proposition that Congress intended to discriminate against the miners in the same industry.

And in conclusion, we request passage of S. 1193 based upon its being, one, consistent with the current law and congressional intent in enacting the percentage depletion provisions; and, two, supported by the trona precedent; and, three, needed to implement a fair tax policy.

That's about all I have to say. And if you have any questions, we would be glad to try to answer them.

Senator WALLOP. Thank you, Mr. Smith.

[The prepared statement of Mr. Smith follows:]

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UNITED STATES SENATE  
COMMITTEE ON FINANCE  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION

REGARDING S. 1193, TREATING DECARBONIZATION OF PHOSPHATE  
ORE AS A MINING PROCESS FOR PURPOSES OF THE PERCENTAGE  
DEPLETION TAX DEDUCTION

WRITTEN TESTIMONY OF THE AD HOC COMMITTEE  
FOR OBTAINING EQUITABLE DEPLETION RULES FOR PHOSPHATE MINING

WRITTEN TESTIMONY

Attachments:

1. PHOSPHATE: IMPORTANCE, CURRENT STATUS AND FUTURE NEEDS
2. DEPLETION ALLOWANCE IN THE INTERNAL REVENUE CODE

July 18, 1983

RIDDELL, FOX, HOLROYD & JACKSON, P. C.

Summary of Written Statement -- S.1193

Presented by Gordon C. Smith, Vice President of Finance of J.R. Simplot Company on behalf of The Ad Hoc Committee for Obtaining Equitable Depletion Rules for Phosphate Mining, which includes: Agrico Chemical Company, Beker Industries Corp., part owner of the Conda Partnership, and J.R. Simplot Company.

This bill contains a simple technical amendment to the Internal Revenue Code. Passage would make it clear that decarbonization of phosphate rock is a mining process for purposes of the percentage depletion deduction as long as the heat required is less than 850 degrees celsius.

Factually, this should be the same result as under current law -- decarbonization is a concentration process where heat is used to remove substantial impurities (organic or carbonaceous materials) from phosphate without charging the physical or chemical identities of the mineral. However, the Internal Revenue Service has indicated that without Congressional guidance, it cannot make a distinction between a "thermal" and "concentration" process.

Logically, decarbonization qualifies as a mining process under Section 613(c)(4)(C) of the Code and Reg. § 1.613-4(f)(3)(i) since both provide that concentrating is a mining process which is necessary to make phosphate a marketable item.

A review of the legislative history of percentage depletion and the underlying policy considerations relevant thereto, all point to the passage of S.1193.

Succinctly stated, failure to pass S. 1193 creates a bias against phosphate mining in states such as Idaho and North Carolina where decarbonization is required to bring the rock to shipping grade and form as opposed to other areas where decarbonization is not required, in that, for example, all concentration steps for other areas qualify as a mining process whereas the added steps for Idaho and North Carolina would not qualify. Nowhere in the legislative history of depletion is there support for the proposition that Congress intended to discriminate against miners in the same industry.

Passage of S. 1193 is one, consistent with current law and Congressional intent in enacting the percentage depletion provisions, two, supported by the trona precedent and three, needed to implement a fair tax policy.

RIDDELL, FOX, HOLROYD & JACKSON, P. C.

- I. S. 1193: A review<sup>1</sup> of the legislative history of percentage depletion and the underlying policy considerations relevant thereto, all point to the passage of S.1193.

A. The Bill

This bill contains a simple technical amendment to the Internal Revenue Code. Passage would make it clear that decarbonization of phosphate rock is a mining process for purposes of the percentage depletion deduction as long as the heat required is less than 850 degrees celsius.

B. Facts/Internal Revenue Service

Factually, this should be the same result as under current law -- decarbonization is a concentration process where heat is used to remove substantial impurities (organic or carbonaceous materials) from phosphate without charging the physical or chemical identities of the mineral. However, the Internal Revenue Service has indicated that without Congressional guidance, it cannot make a distinction between a "thermal" and "concentration" process.

The Service, took a similar position regarding trona, and in 1974, Congress remedied the situation by specifically providing that decarbonation of trona is a mining process. Statutorily, since 1947, Congress has treated trona and phosphate in the same manner regarding depletion; accordingly, a comparable solution for phosphate is required in 1983. In

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1 See Attachment 2

RIDDELL, FOX, HOLROYD & JACKSON, P. C.

this regard, the decarbonation step is analagous to decarbonization of phosphate ore in that it is necessary to produce a product of shipping grade and form, but it is not analagous in that the process of decarbonation effects a chemical change by the decomposition of the ore to sodium carbonate and carbon dioxide in a reaction similar to the calcining of limestone in which the latter is decomposed to lime and carbon dioxide. As opposed to a high temperature treatment to effect a chemical change, the major desired constituent in phosphate ore, fluorapatite, remains unchanged both chemically and physically during its decarbonization.

C. Current Law and Regulations

The decarbonization of phosphate does not run afoul of Reg. § 1.613-4(g)(6) because the mineral is not smeltered or partially processed. While it is a heat process and therefore "thermal," the term "thermal action" is illustrated in the regulations to encompass only those cases where heat is used to obtain an end product. On the other hand, logically, decarbonization qualifies as a mining process under Section 613(c)(4)(C) of the Code and Reg. § 1.613-4(f)(3)(i) since both provide that concentrating is a mining process which is necessary to make phosphate a marketable item.

D. Tax Policy -- Nondiscriminatory

Phosphate ores in Florida typically require only washing and sometimes flotation as concentrating steps. While organic hydrocarbon material is present where washing and flotation is required, it is sufficiently low in content so that the decarbonizing concentrating process is not required. However, the organic hydrocarbon content of North Carolina and certain Western ores is sufficiently high that further concentration (decarbonization) is necessary to bring the product to shipping grade and form.

Succinctly stated, failure to pass S. 1193 would institute a bias against Western and North Carolina phosphate in that all concentration steps for phosphate in other regions qualify as a mining process whereas the added steps for Western and North Carolina would not qualify. Nowhere in the legislative history of depletion is there support for the proposition that Congress intended to discriminate against miners in the same industry.

E. Conclusion

Passage of S. 1193 is (1) consistent with current law and Congressional intent in enacting the percentage depletion provisions, (2) supported by the trona precedent and (3) needed to implement a fair tax policy.

II. Ad Hoc Committee For Obtaining Equitable Depletion Rules For Phosphate Mining

A. Committee

The Ad Hoc Committee for Obtaining Equitable Depletion Rules for Phosphate Mining consists of Agrico Chemical Company (a subsidiary of The Williams Companies), the Conda Partnership (owned by Beker Industries Corp. and Western Cooperative Fertilizers Limited) and J.R. Simplot Company. These entities, among other businesses, are actively engaged in the mining of phosphate rock (ore) and the manufacture and distribution of phosphate fertilizer in the United States and various foreign countries. The companies have mining interests in Florida, North Carolina, Idaho, Montana, Wyoming and Utah.

B. Purpose of Ad Hoc Committee

As miners of phosphate rock in various areas of the United States in addition to central Florida, these companies believe that Congressional clarification is required to insure the correct application of section 613(c)(4) of the Internal Revenue Code of 1954 (the "Code") to allow the concentration of phosphate through decarbonization as a mining process for purposes of determining percentage depletion. This is the sole purpose of S. 1193. Its passage is consistent with both the present Code provisions and the expressed Congressional purpose of providing an incentive for mining when the percentage.

depletion provisions were originally enacted and were from time to time thereafter amended. It is also consistent with the nation's projected ever-increasing need for phosphate rock for use in phosphate fertilizers.

C. Preface

1. Internal Revenue Service Position

To date, the Internal Revenue Service has misconstrued the process of decarbonization of phosphate ore and treats it as a non-mining, thermal action process. In actuality, it is a concentration process and, accordingly, is a mining process for purposes of calculating percentage depletion.

In our discussions with the Internal Revenue Service, it is not opposed to this conclusion, but it has indicated that without a Congressional mandate, it will not alter its view. Hence, passage of S. 1193 is required.

2. Decarbonization of Phosphate

Decarbonization of phosphate ore is conducted to eliminate substantial amounts of impurities associated with certain varieties of the ore in its natural state. This process is a concentration process which makes no chemical change in the ore and does not make a final, finished product, but rather concentrates the raw material so that it is usable for the subsequent manufacture into finished products. As such, decarbonization is simply a concentration process required to bring the ore to shipping grade and form.

### III. Phosphate Rock Mining in the United States

#### A. In General

Phosphate rock is mined principally in Florida, North Carolina, and in the Western states of Idaho, Montana, Wyoming and Utah. In 1980, 54.4 million metric tons of phosphate rock were produced in the United States. Of this total, Florida produced 80%; North Carolina, 7%; the Western states, 10%; and Tennessee, 3%.<sup>2</sup>

In Florida and North Carolina, phosphate rock is found in sedimentary deposits. The overburden and the ore, known locally as matrix, is consolidated material and is mined by the open pit method. The overburden is stripped and the matrix is extracted from the ground by large draglines. After extraction from the ground, the matrix is slurried with water and pumped, usually three to five miles, to a beneficiation plant where various concentrating steps are performed.

In the Western states, the phosphate rock is found in hard rock as well as in sedimentary deposits. Mining is also by the open pit method. The overburden and the ore are drilled and blasted with explosives to loosen them. Scrapers and trucks remove the overburden and extract the ore. The ore is then

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<sup>2</sup> Mineral Industry Surveys, Phosphate Rock 1980, U.S. Department of Interior, Bureau of Mines.

transported by trucks or railcars to a beneficiation plant where concentrating takes place. Because of the nature of the Western deposits, crushing and grinding of the ore often precede the concentrating steps. The mining processes used to concentrate a specific phosphate ore deposit to bring it to shipping grade and form are dependent upon the impurities or gangue material in the particular ore body and upon the intended use of the resulting concentrated rock.

In the United States, approximately 26% of all phosphate rock is exported. Of the rock used domestically, 84% is used to produce phosphoric acid by the wet process method, the acid in turn being used to produce chemical fertilizers. Another 4% is used directly in the production of fertilizers. The production of elemental phosphorus uses 10% of the phosphate rock and 1% is defluorinated for use in the production of animal feed.<sup>3</sup>

The principal phosphate mineral in the United States is fluorapatite, which is found with various gangue materials such as clays, silica, carbonates and hydrocarbons. The concentration of the ore to remove these impurities typically includes one or more of the following beneficiation processes:

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3 Ibid.

(1) scrubbing, washing, and size classification either mechanically or hydraulically to remove clays and coarse trash, (2) both anionic and cationic flotation to remove silica sand and/or carbonates, and (3) decarbonization to remove organic hydrocarbon material.

The degree of concentration of the phosphate content varies from step to step through the process as a result of the degree of impurity removal. It is also a function of the actual impurity levels, which vary significantly from one ore deposit to another. For example, the washing, scrubbing and classification steps are generally a series of sizing operations. Each one of these operations may increase the phosphate level by 5% to 18%, but in total generally increases the concentration on the order of 25% to 50%. Likewise, flotation is commonly conducted in a multi-step process, the first step of which may concentrate phosphate values by 40% to 70%, and the last by 8% to 10% or less. The decarbonization of the ore typically concentrates the phosphate level by 7% to 9% and is always the last concentrating step because it also dries the product for shipping. Any one or more of these mining treatment processes, as well as sintering or nodulizing and drying, may be necessary to reach a product of commercially acceptable shipping grade and form.

The phosphate ores in Florida typically require only the washing and flotation concentrating steps. The rock which requires only washing is called pebble product, while the phosphate product requiring both washing and flotation is called concentrate. While organic hydrocarbon material is present in both of these products, it is sufficiently low in content so that the decarbonizing concentrating process is not required to bring the Florida product to shipping grade and form. However, the organic hydrocarbon content of North Carolina and Western ores is sufficiently high that further concentration is necessary to bring the product to shipping grade and form, particularly for the manufacture of wet-process acid.

While washing, flotation, sintering or nodulizing, and drying have been allowed as mining processes under Section 613(c) of the Code and Section 1.613-4(f) of the Income Tax Regulations, the decarbonizing concentrating process has been incorrectly disallowed in Revenue Ruling 74-519. Apparently, this was due to a misunderstanding of the nature of this process.

The most economical method of removing the organic hydrocarbon impurities in phosphate ore is through a heat treatment process. This method has the added advantage that free water is also removed simultaneously, thereby eliminating

a separate drying step. Such a drying process is considered as a mining process for purposes of percentage depletion. While decarbonization is a heat treatment process, it is neither a thermal action process as described in § 1.613-4(g)(6)(viii) of the Regulations, nor a calcination process as described in § 1.613-4(g)(6)(i) of the Regulations. At all times, the operating temperature is maintained at significantly lower levels than in thermal action treatment or in calcining. Moreover, the resultant decarbonization of phosphate rock does not alter the physical or chemical identity of the fluorapatite mineral.

D. Background and Specific Application of Internal Revenue Code Provisions

1. Background

a. Prior to 1971

Phosphate was added, along with trona, to the list of minerals qualifying for percentage depletion in 1947.<sup>4</sup> The decarbonization of phosphate was considered a part of mining as an ordinary treatment process normally applied by mine owners or operators to obtain a marketable mineral product. In 1960, the term mining was changed to include treatment processes considered as mining.<sup>5</sup> During the hearings of the 1960 Act,

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<sup>4</sup> § 15(b) of Termination of Wartime Provisions Act, P. L. No. 80-384, 61 Stat. 917 (1947); (Int. Rev. Code 1939, § 114(b)(4)).

<sup>5</sup> Public Debt and Tax Rate Extension Act of 1960, P. L. No. 86-564, § 613:1 (1980).

the Treasury Department spokesman stated that the decarbonation of trona would be treated as a treatment process considered as mining.<sup>6</sup> The Treasury Department in keeping with its statement and the Code treated the decarbonation of trona and the decarbonization of phosphate as mining processes.

b. Trona

In 1971, the Treasury Department announced, in connection with finalizing regulations dealing with the 1960 amendments, that the decarbonation of trona would no longer be considered a mining process for percentage depletion purposes. The Treasury action resulted in Congressional consideration of the classification of decarbonation of trona.

In 1974, Congress found that decarbonation of trona eliminated impurities (water and carbon dioxide) and was merely a concentration process.<sup>7</sup> Additionally, Congress amended section 613(c)(4)(E) of the Code specifically to provide that decarbonation of trona is a mining process (and thereby completely end any disputes with the Internal Revenue Service).<sup>8</sup> The statutory modification should not have been necessary in

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6 Mineral Treatment Processes for Percentage Depletion: Hearings before the Committee on Ways and Means, 86th Cong., 1st Sess. 47 (1959).

7 S. Rep. No. 1059, 94th Cong., 2d Sess. 6231 (1974).

8 P. L. No. 93-499, 88 Stat. 1549 (1974).

view of the Congressional finding that decarbonation of trona is a concentration process, i.e., the amendment to the Code was unnecessary because section 613(c)(4)(C) already provided that "in the case of \*\*\* minerals which are customarily sold in the form of a crude mineral product - concentrating" is a treatment process considered as mining for purposes of calculating percentage depletion. Thus, the 1974 amendment served the sole purpose of forcing the Treasury, immediately, to accept that decarbonation of trona is a concentration process and accordingly a mining process. Obviously, legislative consideration would have been unnecessary if the Treasury had continued to maintain the correct construction of the statute as it had from 1960 to 1970.

## 2. Application of Internal Revenue Code to Phosphate

In order to apply properly the Code, one must first understand the process for the decarbonization of phosphate. The development of ores containing higher levels of hydrocarbon impurities than found in Florida ores requires decarbonization. The process removes organic or carbonaceous materials from the rock by the application of heat because other beneficiation processes which remove other impurities are not sufficient to remove these materials. The process only removes the impurities and makes no chemical change in the phosphate rock. Without this process, the phosphate rock is not in shipping grade and form.

Section 613(c)(4)(C) of the Code provides that, in the case of an ore (such as phosphate) which is customarily sold in the form of a crude mineral product,<sup>9</sup> sorting and concentrating are mining processes. Section 1.613-4(f)(3)(i) of the Regulations provides:

as used in section 613(c)(4)(C) \*\*\* the terms "sorting" and "concentrating" mean the process of eliminating substantial amounts of the impurities or foreign matter associated with the ores or minerals in their natural state, \*\*\* without changing the physical or chemical identities of the ores or minerals.<sup>10</sup>  
 [Emphasis added]

This definition precisely describes the decarbonization of phosphate ore, whereby substantial impurities are removed from phosphate ore without changing the physical or chemical identities of the phosphate rock. The Code and Regulations are clear and one would assume there could be no question as to it being a mining process. However, as was the case with trona, the Internal Revenue Service has maintained an incorrect position. Passage of S. 1193 in 1983 is required just as Congressional intervention was required in 1974. The balance of this Testimony spells out the incorrectness of the Internal

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9 Phosphate is clearly such a mineral with the Code meaning and under § 1.613-4(f)(3)(iv).

10 The same definition is contained in Rev. Proc. 79-19, 1978-2 C.B. 491, Sec. 5.09.

Revenue position which also justifies the immediate passage of S. 1193.

3. Current Internal Revenue Service Position on Phosphate

The 1971 change of position by the Treasury with respect to the decarbonation of trona raised questions regarding decarbonization of phosphate. In 1972, the Service issued Revenue Ruling 72-473,<sup>11</sup> which determined whether certain treatment processes applied to extracted phosphate rock are mining processes for purposes of computing percentage depletion. It correctly held that the calcining of phosphate rock to produce defluorinated phosphate rock for use in manufacturing food additives is not a mining process. As the ruling points out, calcining of phosphate rock to eliminate fluorine chemically alters the rock and is, accordingly, a calcining or manufacturing process.

In 1974, the Internal Revenue Service issued Revenue Ruling 74-519<sup>12</sup> holding that the burning of carbonaceous material contained in phosphate rock is thermal action and therefore not mining for purposes of computation of percentage depletion. This ruling is based on the proposition that the

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11 1972-2 C.B. 284.

12 1974-2 C.B. 182.

decarbonization of phosphate takes place after all mining and concentration processes have been completed and is necessary to subsequent manufacturing processes. The Service's conclusion that this was a thermal action process is factually incorrect.

#### 4. Internal Revenue Service Position Is Incorrect

There is no justification for the conclusions reached in Rev. Rul. 74-519. The Ruling properly states the definition of "concentrating", but arbitrarily fails to apply or even discuss it. Inappropriately, the Ruling attempts to define decarbonization of phosphate as "thermal action" which is defined in § 1.613-4(g)(6)(viii) of the Regulations as:

processes which involve the application of artificial heat to ores or minerals such as, for example, the burning of bricks, the coking of coal, the expansion or popping of perlite, the exfoliation of vermiculite, the heat treatment of garnet, and the heating of shale, clay or slate to produce lightweight aggregates. The term does not include drying to remove free water.<sup>13</sup>

Clearly the enumerated examples are not processes to remove impurities. They are rather processes applied to minerals (where the impurities have already been removed) in order to obtain an end product. For example, as applied in the above definition, the burning or firing of bricks is part of a

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<sup>13</sup> The same definition is contained in Rev. Proc. 78-19, 1978-2 C.B. 491, Sec. 5.61.

manufacturing process in which the raw materials are first crushed, mixed, ground, tempered and formed, dried and then fired. During the firing process, mechanically and chemically combined water is driven off and iron, sulfur, and organic impurities are oxidized. The desired mineral transformations and volume changes are a part of the manufacturing process to produce bricks for particular uses and are not a concentration process. In the coking of coal, the thermal action is used to convert low volatile hydrocarbons to elemental carbon. In both the expansion or popping of perlite and the exfoliation of vermiculite, the thermal action on the mined and concentrated mineral serves to vaporize both the combined and entrapped water. This rapid vaporization shatters the mineral form, resulting in its desired physical change, but effects no mineral concentration. The thermal treatment of garnet improves its abrasive qualities, not through improving its inherent hardness, but by removing minute amounts of surface impurities which, if not removed, interfere with its later processing to give proper adhesion for bonding. Also in the pyro-processing of shale, clay, or slate to produce lightweight aggregate, the purpose of the thermal action is not to concentrate the mineral, but to reduce its density for use in manufacturing low density brick or other construction materials. Clearly these are not processes to remove impurities. They are rather

processes applied to minerals from which the gangue impurities have already been removed in order to obtain an end product. It should thus be equally clear that Reg. § 1.613-4(g)(6)(viii) is not applicable to the particular application of heat to phosphate.

The Ruling also refers to "refining" which is defined by § 1.613-4(g)(6)(iii) of the Regulations as:

processes \*\*\* used to eliminate impurities or foreign matter from smeltered or partially processed metallic and nonmetallic ores and minerals, as, for example, the refining of blister copper. In general, a refining process is designated to achieve a high degree of purity by removing relatively small amounts of impurities or foreign matter from smeltered or partially processed ores or minerals."<sup>14</sup>

The foregoing definition does not apply to decarbonization of phosphate. The phosphate rock has not been smeltered or partially processed; it has only undergone mining processes. Decarbonization, like other beneficiation processes, is required as a mining process in order to obtain a raw material which can be used in the manufacture of wet-process acid. Decarbonization is required as a mining process in order to obtain a raw material in shipping grade and form.

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<sup>14</sup> The same definition is contained in Rev. Proc. 78-19, 1978-2 C.B. 491, Sec. 5.45.

In similar manner, the term "calcination" was initially intended to cover the processing of limestone (calcium carbonate) through roasting (volatilization of the chemically combined carbon dioxide) to produce lime (calcium oxide). Limestone is typically mined in a comparatively pure form. Chemical grade limestone contains only small amounts of impurities such as iron, magnesium and clay minerals and little or no concentration is needed prior to its thermal refining to produce lime.

The equipment and heat flow technology used in the limestone to lime process have become known as "calciners" and "calcining", respectively. The utilization of this type of equipment or technology to the heat treatment of other ores has sometimes led to the inappropriate use of these terms as a classification matter when similar equipment is used without a consequent chemical change. This is particularly true with respect to phosphate rock. The term calcining has frequently been used to describe both the process of defluorinating phosphate rock and the process of decarbonization of phosphate ore. The term is correctly used in the former case as heat is used to effect a chemical change, i.e., the volatilization of fluorine from the phosphate mineral, fluorapatite. It is incorrectly used in the latter case, where concentration of the ore takes place by volatilization of the organic hydrocarbon

impurities and no physical or chemical change of the phosphate mineral occurs.

Thermal action and calcining have correctly been disallowed as part of the mining process since they change the chemical nature of the mineral processed, and are applied after all mining concentration processes have been completed. The heat treatment of phosphate ore to decarbonize, however, does not affect the phosphate mineral form. Rather, it merely concentrates the ore to shipping grade and form.

Both nodulizing and sintering of phosphate ore are allowed as mining processes for the purpose of calculating percentage depletion. Nodulizing and sintering are high temperature (2000 - 2500 degrees F) processes conducted to produce a phosphate raw material suitable for feed to an electric furnace for elemental phosphorus production. In these processes, the ore is concentrated by removal of volatile and combustible impurities which are not tolerable for efficient operation of the furnace. Both physical and chemical changes occur in the ore: the physical change is the fusing and melting that occurs at high temperature, while the chemical change is the decomposition of the impurities present, such as calcium carbonate, and the expulsion of fluorine from the fluorapatite, resulting in the formation of tricalcium phosphate and lime. In addition, the same hydrocarbons that are eliminated in the phosphate

decarbonization process are also removed. Nodulizing and sintering are thus concentration processes which also fuse the phosphate rock to produce a more efficient furnace feed. The physical change that occurs significantly increases the size of the phosphate particles by fusing them together.

The decarbonization of phosphate rock is analagous in its concentration effect to sintering, but it is even clearer that it is a mining process, since it is deliberately conducted at lower temperatures (1200 - 1430 degrees F) to avoid alteration of the apatite mineral. In particular, fusing or changes in chemical composition are avoided. Consequently there is no chemical or physical transformation of the fluorapatite in the decarbonization process.

The decarbonation of trona is also allowed as a mining process for calculating percentage depletion. In processing trona ore into soda ash, decarbonation is a necessary concentration and chemical treatment process. Decarbonation of trona is a thermal process in which the sodium bicarbonate content of the trona mineral is decomposed to sodium carbonate with the concurrent volatilization of carbon dioxide and moisture. The decarbonated trona ore is further concentrated in subsequent processing to remove other impurities. The decarbonation step is analagous to decarbonization of phosphate ore in that it is necessary to produce a product of shipping grade and form, but

it is not analagous in that the process of decarbonation effects a chemical change by the decomposition of the ore to sodium carbonate and carbon dioxide in a reaction similar to the calcining of limestone in which the latter is decomposed to lime and carbon dioxide. As opposed to high temperature treatment to effect a chemical change, the major desired constituent in phosphate ore, fluorapatite, remains unchanged both chemically and physically during its decarbonization.

#### IV. Conference with Internal Revenue Service

The Ad Hoc Committee met with the Internal Revenue Service several times in an effort to have the government revoke Revenue Ruling 74-519. While the Service personnel were extremely courteous and attentive, they reached the conclusion that without a clarifying amendment to the Code establishing a guideline for thermal action, it could not publish a favorable ruling regarding the concentration of phosphate. In other words, the Internal Revenue Service believes that Congress must emulate for phosphate its action for trona. Then, the Service can accept the fact that the heat for decarbonization is for concentration. Otherwise, even though no chemical or physical change occurs in the ore, the heat required must be classified as thermal action with the result being disallowance as a mining process.

## V. Summary

Phosphate ores contain many impurities which must be removed by various mining processes before the product is in shipping grade and form. Eighty percent of the ore produced in the United States only needs to be washed and floated in order to be concentrated sufficiently to reach shipping grade and form. Phosphate ore mined in the Western states and in North Carolina, however, must undergo the further concentrating step of decarbonization before it reaches shipping grade and form. The phosphate mineral undergoes no physical or chemical change in this process. The sintering or nodulizing of Western and North Carolina ores concentrates these ores through decarbonization while simultaneously, the phosphate mineral is undergoing physical and chemical changes necessary to provide a product suitable for feed to an electric furnace. Phosphate ore mined in Tennessee is used in electric furnaces for elemental phosphorus production and therefore carbonaceous material is removed during sintering and nodulizing which requires higher temperatures than decarbonization.

It is apparent that the disallowance of decarbonization of phosphate ores as a mining process has been due to a misunderstanding of the nature of the process. In the past, it has mistakenly been assumed to be a disallowed process such as calcining, thermal action, or refining. In fact,

decarbonization of phosphate ore is a concentration process which uses heat, but which does not change the physical or chemical nature of the phosphate mineral. S. 1193 clarifies the Code and thereby insures that decarbonization is treated as a mining process. This result is consistent with existing law in general and with Congress' action in 1974 for trona. Finally, in addition to equity in the Code, passage complements the nation's use of phosphate.

As in the case with trona, the Internal Revenue Service has mistakenly determined to disallow decarbonization of phosphate as a mining process, despite a clear statute and regulations. Since the Internal Revenue Service believes it cannot reconsider its position and treat decarbonization as an allowable mining process for phosphate rock, the phosphate industry must follow in the footsteps of trona miners and petition Congress for the technical amendment to the Code contained in S. 1193 to again restate Congress's clearly expressed position.

Appendix I**Phosphate: Importance, Current Status and Future Needs****I. Importance and Uses of Phosphate****A. Importance**

Phosphate is an essential natural resource because it is one of the three primary ingredients of chemical fertilizer.<sup>1</sup> Plants require phosphorus for the following growth processes:

- 1) Carbohydrate breakdown during photosynthesis
- 2) Formation of amino acids and proteins for cell division
- 3) Transfer of inherited characteristics
- 4) Stimulation of early root growth and development
- 5) Hastening maturity of plants
- 6) Fruiting and seed production

Next to nitrogen, phosphorus is the most deficient element for plant growth in the cultivated soils of the world. To increase yields and shorten the crop cycle, it is therefore necessary to add phosphorus to the soil in the form of fertilizer.

Present productivity of United States agriculture could not be maintained without the use of chemical fertilizers.<sup>2</sup> This is illustrated by the fact that during the

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1 Phosphorus, nitrogen and potassium.

2 A 10 percent reduction in phosphate application could reduce corn yields by 3 percent in the second year and 4 percent in the third year, wheat by 1 percent in the second year and 7 percent in the third year, and cotton and soybeans by 8 to 9 percent

period since 1960, the use of chemical fertilizers doubled and the yield per acre in the United States increased by over 30 percent while growing time was more than cut in half. The continuing series of record U.S. crops in recent years clearly would not have been possible without this increased fertilizer usage. Six crops in particular account for over 80 percent of phosphate fertilizer use: corn (40 percent), hay and pasture (13.6 percent), wheat (11.3 percent), cotton (6.7 percent), oats and barley (5.4 percent), and soybeans (5 percent).<sup>3</sup>

Phosphate fertilizer use has increased to a similar extent in other industrialized countries, although such fertilizer has not been used extensively in third world countries as yet. This is undoubtedly due to economic constraints rather than a lack of need, since the less developed countries have, in general, rapidly expanding populations coupled with diminishing food supplies. It should be noted that the high yield grains, which have figured in most plans to solve world hunger, require (and are planted in expectation of) heavy applications of phosphatic fertilizers.<sup>4</sup>

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footnote continued from previous page  
in the third year. General Accounting Office, Phosphates:  
A Case Study of a Valuable, Depleting Mineral in America 9  
(Report to the Congress, 1979).

3 Id.

4 Id. at 7.

United States phosphate production is also important to the nation's balance of trade. Approximately 44 percent of the phosphate rock produced here is exported, either as rock or in chemical fertilizers.<sup>5</sup> In turn, the principal use of the exported rock is for chemical fertilizers for application to foreign-grown-crops. Thus, in 1979 phosphate accounted for \$1.69 billion of U.S. exports. In addition, the agricultural surplus which has aided U.S. exports is largely dependent upon the use of chemical fertilizers. In a period of rising costs of imports, particularly for oil, any factor which aids our balance of trade is of paramount importance to the economy.

Phosphate rock is presently the only practical source of phosphorus on a commercial scale. It cannot presently be recycled or recovered from secondary sources and there is presently no substitute in agricultural applications.<sup>6</sup>

B. Phosphate Usage

Approximately 90 percent of the world's phosphate production is used for agricultural purposes. Of this amount, 88 percent is used in fertilizer production and 2 percent for animal feed.<sup>7</sup> The remaining 10 percent is used to

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5 William F. Stowasser, Dep't. of the Interior, Bureau of Mines, Phosphate, at 13 (Mineral Commodity Report, Jan. 1979).

6 Id. at 9.

7 Id. at 1.

make elemental phosphorus, which is utilized in the production of a number of industrial chemicals.<sup>8</sup>

## II. Current Status of Phosphate Mining

### A. Present

World phosphate production was estimated to be approximately 115 million metric tons in 1977. The United States was then and remains now the world's largest supplier and accounted then for approximately 41 percent of world production.<sup>9</sup>

Most United States phosphate is mined in the Bone Valley formation of central Florida, although a significant amount is produced in other areas of Florida, North Carolina, Tennessee and a few Western states, principally Idaho. Of the phosphate rock produced in the United States during 1977, 72 percent was used domestically and the remaining 28 percent was exported in the form of rock.<sup>10</sup> Phosphate manufactured into fertilizer and other finished products domestically is also exported as a final product as well as used domestically.

### B. Future

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8 Id. at 5.

9 Id.

10 Id. at 6.

The United States now produces three-quarters of its phosphate rock from high grade ore in the central Florida region. Because of a relatively small amount of hydrocarbon impurities in this ore it does not require concentration through decarbonization. It is anticipated that these deposits will be substantially depleted by the end of this century.<sup>11</sup> World demand for phosphate increased by over 50 percent from 1970 to 1980 and is expected to continue to increase in the future. Consequently, the world's high quality reserves are being depleted and it is becoming increasingly necessary to recover phosphate from ores which are less concentrated and contain more impurities. This situation is very similar to that of oil. Oil was once a seemingly inexhaustible natural resource, but now we have found most of the easily accessible oil and have been forced to devise new technology and new initiatives to stimulate recovery of hitherto unrecoverable oil.

As a result of the depletion of central Florida phosphate reserves, the United States must develop large new sources before the end of this century to guarantee that agricultural needs will be met in the future. Failure to do so

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<sup>11</sup> Zellars - Williams, Inc., Evaluation of the Phosphate Deposits of Florida Using the Minerals Available System 6-7 (Final Report, U.S. Dept. of the Interior, Bureau of Mines, June 1978).

would force the United States to import phosphate rock from foreign producers such as Morocco. Our experience with oil demonstrates that undue and unnecessary dependence on foreign sources for a critical raw material is unacceptable, for the results could be as detrimental to our economy as our reliance on foreign oil is today. Moreover, supplies from foreign sources can be curtailed for a number of reasons, such as war, natural calamity, labor unrest, political motivation, etc. For instance, Morocco, the largest exporter of phosphate rock, is currently involved in a guerilla war in the former Spanish Sahara. The war is straining Morocco's political and economic stability, and there are no indications of a settlement in the near future.

There is no danger of running out of phosphate in the United States for many decades and perhaps centuries. However, as with oil and natural gas, development of additional reserves will mean development of higher impurity reserves. The impurities in these reserves will require additional mining processes, including concentration steps to obtain the quality required to manufacture fertilizers and other products derived from phosphate rock.

### III. Need to Develop Additional Reserves .

In a letter accompanying the Comptroller Generals Report to the Congress on Phosphates: A Case Study of A Valuable,

Depleting Mineral In America (November 30, 1979), the  
Comptroller General stated:

Ensuring an adequate supply of essential minerals such as phosphate rock is a problem facing this country now and will be of greater significance in the future as domestic sources are depleted. This report summarizes our analysis of the phosphate situation and recommends that the highest levels of Government begin promptly an assessment of access impediments to phosphate minerals and review of the Nation's long-range phosphates availability position including legislative changes as may be needed to ensure supply.

This report and various other studies of phosphates clearly indicate that the depletion of high grade, low impurity reserves in central Florida and the need to develop reserves in other areas such as North Carolina and the West. However, these reserves require decarbonization to produce a marketable product. This concentration step is costly and consequently reduces the economic attractiveness of developing these reserves. If they are not developed timely, the United States could face shortages of phosphate rock or could become dependent upon foreign sources.

One means of encouraging the development of these reserves is to correct the Internal Revenue Service's position in Revenue Ruling 74-519 to allow decarbonization as a cost of mining for purposes of computing percentage depletion. This would provide an incentive for production in keeping with the historic purpose of percentage depletion. Furthermore, it

would be consistent with the distinction between mining and non-mining processes, as decarbonization is a concentrating process. In addition, it would place miners of ores with higher impurity levels, who must decarbonize their ores, on a more equal footing with those who need not.

The technical qualification of decarbonization of phosphate for purposes of percentage depletion is a far clearer case than that for decarbonation of trona, for which percentage depletion is allowed. In terms of production incentive, the case for phosphate is also superior. The world's largest deposit of trona is the Green River Formation in southwest Wyoming. The Wilkins Peak Member alone contains 42 beds of trona covering an area of 1,200 square miles. It is estimated that the trona reserves of Wyoming could produce over 3,700 years of domestic supply of soda ash at 1978 demand level.<sup>12</sup> Further, trona is only one of several sources for the production of soda ash.

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<sup>12</sup> Soda ash (Sodium Carbonate), Sodium Sulphate, and Sodium, Bureau of Mines, United States Department of Interior, 4 (December, 1979).

Appendix II

## Depletion Allowance in the Internal Revenue Code

## I. Introduction

The history of the percentage depletion allowance, from its inception in 1926, has proven it to be one of the most effective policy tools ever devised. The provisions have demonstrated the ability of tax incentive legislation to achieve an important national objective. In this case, the objective sought and the benefit realized was a multifold expansion in the exploration for and production of essential natural resources.

As economic and technological conditions have changed, the depletion provisions have been revised accordingly. Congress has consistently demonstrated a firm commitment to assure maximum effectiveness of the depletion allowance, and has thus taken great pains to have these provisions reflect current economic and technical needs.

## II. Early History

Percentage depletion was first enacted in 1926<sup>1</sup> as an extension of the original depletion provisions which appeared in the 1913 Code.<sup>2</sup> Between 1913 and 1918, all depletion was based on cost. Cost depletion provided no tax incentive and, in many cases, the allowance was insufficient to recoup the cost of a natural deposit over the life of the property.

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1 Revenue Act of 1926, Pub. L. No. 69-20, 44 Stat. 9, § 204(c)(1926).

2 Tariff Act of 1913, Pub. L. No. 63-16, 38 Stat. 114 (1913).

In 1918, Congress realized that a greater incentive was necessary, especially with the country at war and in need of large supplies of certain minerals. Congress, therefore, enacted discovery value depletion to be applied to mines, as well as oil and gas wells.<sup>3</sup> Under discovery depletion, where the fair market value of the property was materially disproportionate to the cost, the depletion allowance was based upon the value of the property at the time of discovery. The desired effect was obtained, as the provision resulted in great expansion in the exploration for natural resources, especially oil and gas. Discovery value depletion, however, brought with it many administrative problems with respect to valuation.

The Revenue Act of 1926<sup>4</sup>, replaced discovery value depletion with percentage depletion in the cases of oil and gas. In so doing, Congress clearly intended to retain the incentives of discovery value depletion, while reducing attendant administrative difficulties caused thereby.<sup>5</sup> This provision allowed a depletion deduction equal to 27-1/2% of the gross income from the property during the taxable year.

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3 Revenue Act of 1918, Pub. L. No. 65-254, 40 Stat. 1057, § 214(a)(10)(1918).

4 Supra, note 1.

5 S. Rep. No. 52, 69th Cong., 1st Sess. 17-18 (1926); H.R. Rep. No. 356, 69th Cong., 1st Sess. 31-32 (1926).

In 1932, percentage depletion was extended to cover coal mines, metal mines, and sulphur mines.<sup>6</sup> Thus, when the Internal Revenue Code of 1939 was enacted, percentage depletion was limited to these five minerals (oil, gas, coal, metal and sulphur).

In 1942, the Treasury sought to eliminate percentage depletion, arguing that it was not essential and unfair, in that it allowed certain industries to avoid paying their fair share of taxes at a time when the war made it necessary to maximize the collection of revenues.<sup>7</sup> Congress, however, was unpersuaded by this argument and added flourspar, ball and sagger clay, and rock asphalt to the percentage depletion list to ensure a steady supply of raw materials needed for the war.<sup>8</sup>

In 1943, Congress amended then section 114(b)(4) to include a definition of "gross income from property" for purposes of computing percentage depletion.<sup>9</sup> The purpose of this provision was to make certain that the ordinary treatment

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6 Revenue Act of 1932, Pub. L. No. 72-154, 47 Stat. 169, § 114(a)(4)(1932).

7 Hearings on the Revenue Revision of 1942 before the Committee on Ways and Means, 77th Cong., 2nd Sess. 8-9, 34-5, 72 (1942); Hearings on H.R. 7378 before the Committee on Finance, 77th Cong., 2d Sess. 5-6 (1942)(Statements of H. Morgenthau, Jr.).

8 Revenue Act of 1942, Pub. L. No. 77-753, 56 Stat. 798, § 145 (1942) (Int. Rev. Code of 1939, § 114(b)(4)).

9 Revenue Act of 1943, Pub. L. No. 78-235, 58 Stat. 21, § 124(c) (1943)(Int. Rev. Code of 1939, § 114(b)(4)(B)).

processes which a mine operator would normally apply to obtain a marketable product should be considered a part of the mining operation for purposes of determining percentage depletion. The provision also listed several processes in order to give reasonable specification of allowable processes.<sup>10</sup> In addition, flake graphite, vermiculite, beryl, feldspar, mica, lepidolite, spodumene, talc, and potash were added to the list of minerals eligible for percentage depletion at a rate of 15%.<sup>11</sup> The objective of these additions, as well as those of the 1942 Act (flourspar, ball and sagger clay, rock asphalt), clearly was to increase production of materials needed for the war effort, since the 1943 Act provided that with the exception of potash, the materials included by the 1942 and 1943 Acts would not be allowed percentage depletion once hostilities had ceased.<sup>12</sup>

In 1947, Congress enacted the Termination of Wartime Provisions Act.<sup>13</sup> In a significant shift from a temporary wartime incentive to a permanent incentive, the Act provided that the wartime depletion provisions, referred to above, would

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10 S. Rep. No. 627, 78th Cong., 1st Sess. 23 (1943).

11 Supra note 9, at § 124(a) (Int. Rev. Code of 1939, §114(b)(4)(A)).

12 Id. at § 124(e).

13 Termination of Wartime Provisions Act, Pub. L. No. 80-384, 61 Stat. 917(1947).

be continued as permanent legislation.<sup>14</sup> In explaining this provision on the floor of the House, Representative Knutson (R-Minn.) stated, "it (percentage depletion) is given to compensate, partially at least, those taxpayers engaged in such mining operations, for the cost of discovering new resources of these products and thus encouraging their production....The one exception (to termination) is the percentage depletion allowance which we have learned is essential to full utilization of our resources both in peacetime as well as in war."<sup>15</sup> Congress also made several additions to the list of minerals subject to percentage depletion at a rate of 15%, including china clay, bentonite, gilsonite, thenardite, and pyrophyllite.

### III. Application to Phosphate

The 1947 Act also added phosphate to the list of minerals qualifying for 15 percent percentage depletion.<sup>16</sup>

The list of new additions was expanded on the Senate floor to include trona and phosphate rock, the latter being added, apparently, at the insistence of a Florida Senator.<sup>17</sup>

In 1950, the House proposed several additions to the percentage depletion provisions, as well as an increase in the

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14 Id. at § 15(a).

15 93 Cong. Rec. 9628(1947).

16 Supra note 13, at § 15(b) (Int. Rev. Code 1939, § 114(b)(4)).

17 93 Cong. Rec. 10163-64 (1947).

allowance for coal. The Senate, however, rejected these proposed changes because it considered that the government could not afford the resulting revenue loss. Thus, the only major change made by the 1950 Act<sup>18</sup> was a provision that gross income to which the percentage depletion rate is to be applied does not include income resulting from the transportation of the product beyond 50 miles from the mining property.<sup>19</sup>

In the Revenue Act of 1951,<sup>20</sup> Congress enacted most of the additions and changes to the percentage depletion provisions that had been proposed by the House and rejected by the Senate in 1950. The Senate Report states, "It is apparent...that the need for equalization is substantially greater now because of the additional taxes imposed under the legislation of 1950 and under this bill. Therefore, the Committee believes that the proposed extension of the percentage depletion system is necessary in spite of the revenue loss involved."<sup>21</sup> Additions to the 15% group included aplite, borax, fuller's earth, tripoli, refractory and fire clay, quartzite, diatomaceous earth, metallurgical grade limestone and chemical grade limestone.

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18 Revenue Act of 1950, Pub. L. No. 81-814, 64 Stat. 906(1950).

19 *Id.* at § 207 (Int. Rev. Code of 1939, § 114(b)(4)(B)).

20 Revenue Act of 1951, Pub. L. No. 82-183, 65 Stat. 452 (1951).

21 S. Rep. No. 781, 82nd Cong., 1st Sess. (1951).

Asbestos was added at 10%; the allowance for coal was increased; and a new 5% group was added which included sand and gravel.<sup>22</sup>

The Internal Revenue Code of 1954<sup>23</sup> completely reorganized the percentage depletion provisions, which are now contained in section 613 of the Code. Most notable among the substantive changes made by this Act was an amendment with respect to the 15% group, including phosphate rock and trona, which was placed in section 613(b)(6) and subjected to a new "general use" test. Under this test, the minerals entitled to a 15% rate by virtue of this section, would have their percentage rate reduced to 5% if used or sold for use by the mine owner or operator as riprap, ballast, road material, rubble, concrete aggregates, or for similar purposes. The "general use" test does not apply, however, to a mineral sold or used in direct competition with a bona fide bid to sell certain other minerals listed in subsection (b)(3).<sup>24</sup> While the general use test has little application to phosphate, the exception and example do illustrate the concern of Congress that the percentage depletion provisions do not tip a competitive balance. The Conference

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22 Supra note 20, at § 319 (Int. Rev. Code of 1939, §114(b)(4)).

23 Revenue Act of 1954, Pub. L. No. 83-591, 68 Stat. 730 (1954).

24 Id. at § 613(b)(6).

Committee Report gives the following example with respect to application of this exception to the "general use" test.

"Thus, when limestone is sold for use as a road material within an area in which rock asphalt is a competitor, and a bid was submitted based on using rock asphalt rather than limestone for road material under the contract, the limestone would be entitled to depletion at the 15-percent rate."<sup>25</sup>

An important change for phosphate was a provision that sintering and nodulizing of phosphate rock are ordinary treatment processes.<sup>26</sup> Sintering and nodulizing, are generally applied to low grade phosphate rock. In former years, this rock had simply gone unused. With the advent of phosphorous furnace processes, however, utilization of this rock became possible, and with the dwindling supply of high grade rock unable to supply the needs of the industry, utilization of the low grade rock became necessary for the production of phosphorous. In addition, it was argued that the use of low grade rock would conserve the limited supply of high grade rock, while increasing government revenues by using otherwise worthless minerals.<sup>27</sup> It was also pointed out that sintering and

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25 H.R. Rep. No. 2543, 83rd Cong., 2d Sess. 52 (1954).

26 Supra note 23, at § 613(b)(4)(E).

27 Mineral Treatment Processes for Percentage Depletion: Hearings Before the Committee on Ways and Means, 86th Cong., 1st Sess. 1336 (1959)(Statement of Jones M. Gillett).

nodulizing were allowed before 1954, even though not provided for in the statute.<sup>28</sup> Thus, the industry asked for and obtained codification of existing practice.

Other changes made by the 1954 Act included the reclassification of minerals for percentage depletion and increases of percentage rates in many cases, the elimination of the discovery depletion allowance, an expanded definition of "gross income from property," a revised definition of "ordinary treatment processes," the introduction of an election to aggregate "operating mineral interests" and an opportunity to aggregate "nonoperating mineral interests."<sup>29</sup>

The next substantial changes in the percentage depletion provisions were enacted in 1960.<sup>30</sup> The 1960 Act amended the term "mining", defined in § 613(c), to include "not merely the extraction of ores or minerals from the ground but also treatment processes considered as mining."<sup>31</sup> Despite the broad language, this provision actually contracted the definition of "mining," since the existing provision, defining "mining" to

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28 Id.

29 MERTENS, LAW OF FEDERAL INCOME TAXATION, CODE COMMENTARY, § 613:1 (1980).

30 Public Debt and Tax Rate Extension Act of 1960, Pub. L. No. 86-564, 74 Stat. 290 (1960).

31 Id. at § 302(b)(2)(I.R.C. § 613(c)(2)).

include "ordinary treatment processes normally applied by mine owners or operators to obtain a commercially marketable mineral product..." was far broader.

The impetus for this decision was apparently based on Treasury's fear that manufacturing processes would qualify for percentage depletion. The concern was generated by a series of court decisions which had permitted manufacturers of brick and cement to compute percentage depletion on the basis of the selling price of the finished manufactured product rather than on the value of the clay or cement rock before manufacture. In a letter to then Speaker of the House Rayburn, Secretary of the Treasury Robert B. Anderson wrote that:

It is now apparent under the court decisions that manufacturers of many other products may obtain depletion allowances based on gross income derived from the sale of finished products...If permitted, the revenue loss will indeed be serious. The problem arises because the term mining is defined in the statute to include ordinary treatment processes normally applied to obtain the "commercially marketable mineral product or products" which, in many instances, may be an expensive finished product. Accordingly...I recommend the immediate elimination of the phrase "commercially marketable mineral product or products" from the statute and the substitution of a new

definition of "mining" which will specify the allowable treatment processes for the various minerals. The proposed legislation would not only prevent a substantial loss in revenue, but would also help to resolve difficult and complex problems in determining for many mineral industries, the stage at which taxpayers first obtain a commercially marketable mineral product.<sup>32</sup>

Thus, despite the "catch all" provision in § 613(c)(4), for other treatment processes "not inconsistent with the other provisions of the statute," the list of processes considered as mining, formerly illustrative, became exclusive.

Once it was determined that the list would be exclusive, it was necessary to add many previously uncodified processes which had been allowed by the Internal Revenue Service. The key attributes of an allowable process were that the process had been allowed previously. Nevertheless, not all of the previously allowable processes were codified. One notable exception was the decarbonation of trona which, though previously allowed, was not included in the list. This is explained, at least in part, by the following testimony in 1959 before the Ways and Means Committee by David A. Lindsay, Assistant to the Secretary, Treasury Department:

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32 Mineral Treatment Processes, supra note 27, at 1a.

Mr. Utt: There are several processes that are neither excluded in section (4)(A) and several that are not included in section(4)(A) and (3)(C). You have a catchall in there saying that another process is necessary to make your product marketable, so we still have a gray area to try to determine anything, but I have this specific question: Would there be anything in this bill that would prohibit the present practice of allowing decarbonization of soda ash?

Mr. Lindsay: There is an established process now?

Mr. Utt: It is an established process, but is there anything in the bill that would indicate a change in that established process?

Mr. Lindsay: Not intended.<sup>33</sup>

Based on this testimony, despite being left out of the statute, decarbonation of trona was administratively allowed as a treatment process until 1971, when the Treasury announced that this position had been incorrect and the decarbonation of trona would no longer be included as an ordinary treatment process after 1971.<sup>34</sup>

The 1960 Act also added section 613(c)(5) to specify treatment processes not considered as mining.<sup>35</sup> This provision basically neutralized the "catchall provision" in subsection

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33 Id. at 47.

34 S. Rep. No. 1059, 94th Cong., 2d Sess. 6231 (1974). See, Infra, p. 14.

35 Supra note 30, at § 302(b)(5) (I.R.C. § 613(c)(5)).

(c)(4) since most processes not specifically allowed, were disallowed. This list of nonallowable treatment processes included calcining, refining, thermal action and other processes. While the Committee Reports and hearing testimony contain no definite statement as to why calcining, thermal action, and refining were designated as nonallowable, it is apparent that these processes were considered as being necessary for the chemical conversion of the minerals.

In his testimony before the Ways and Means Committee, David A. Lindsay indicated that calcining was on the excluded list because it had been excluded in practice under the 1954 Code.<sup>36</sup> But the key to the express exclusion of calcining, as well as thermal action and refining is that when the 1960 Act was passed, most minerals which utilized the process did so with impermissible results from the Treasury's point of view. For example, the limited discussion of calcining contained in the 1959 Hearings indicates that calcining was disallowed because of its application to limestone and the production of cement.<sup>37</sup> Limestone is calcined by being burned in a kiln to produce lime. Calcination of limestone is a conversion process rather than a decarbonization or concentration process.

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36 Mineral Treatment Processes, supra note 27, at 7.

37 Id. at 63.

Two changes were enacted between 1960 and 1974. In 1962, section 613(a) was amended to provide with respect to the 50% ceiling used in computing taxable income from depletion property, that the allowable deductions for mining expenses are to be decreased by the amount of gain treated as ordinary income under § 1245 and allowable to that property.<sup>38</sup> The Tax Reform Act of 1969 changed the depletion rate for the 15% group, including phosphate rock, to 14%.<sup>39</sup>

In 1974, Congress<sup>40</sup> enacted a provision that the decarbonation or calcining of trona be considered an ordinary treatment process under section 613(c)(4)(E).<sup>41</sup> The Senate Report on the bill states the amendment was based upon the Finance Committee's "belief that the decarbonation of the trona ore to eliminate water and carbon dioxide is essentially a concentration process which should be treated as an allowable mining process".<sup>42</sup> The Committee also justified its decision,

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38 Revenue Act of 1962, Pub. L. No. 87-834, 76 Stat. 960, § 13(e) (1962) (I.R.C. § 613(a)).

39 Tax Reform Act of 1969, Pub. L. No. 91-172, 83 Stat. 487, § 501(1969) (I.R.C. § 613(b)(7)).

40 The Senate added this provision to a minor tariff bill, Pub. L. No. 93-499, 88 Stat. 1549(1974).

41 Id. at § 2(a) (I.R.C. § 613(c)(4)(E)).

42 Once this conclusion was reached, the statutory change really was not required. Accordingly, it would seem that the amendment was made to expedite the elimination of

at least in part, on the Treasury's prior testimony that the intent of the 1960 amendment was not to disqualify soda ash decarbonation: "the trona miners should be allowed to compute percentage depletion in the same manner in which it was represented by the Treasury in 1959 would be the result under the new provision."<sup>43</sup>

The percentage depletion provisions have not subsequently been substantially altered with respect to trona or phosphate.

#### IV. Conclusion

The legislative history of percentage depletion provides support for the passage of S.1193, thereby treating the concentration of phosphate through decarbonization as a mining process.

The predominant policy consideration underlying percentage depletion is maximum incentive to produce and develop needed natural resources. In the case of phosphate decarbonization, this policy appears not only to support it, but to demand it. With the rapid disappearance of phosphate deposits with low impurity levels, the only domestic alternative is phosphate with higher impurity levels, which must be concentrated through washing, screening, grinding, flotation and decarbonization. However, if the tax laws (in the form of the depletion

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#### Footnote Continued

disagreement between the trona miners and the IRS.  
S. Rep. No. 1059, 94th Cong., 2d Sess. 6231 (1974).

43 Id.

allowance) provide a penalty for mining ore with impurities, it is inevitable that domestic production will suffer, with the benefit, ironically, inuring to foreign producers.

The legislative history of percentage depletion makes it clear that Congress and the administrative agencies consider phosphate a valuable natural resource. If not, phosphate would not have been allowed percentage depletion, and certainly not at a 14% rate. In addition, the sintering and nodulizing of phosphate rock (a process requiring much more heat than decarbonization) would not have been specifically allowed as a mining process. This latter provision is also an indication that as far back as 1954 Congress recognized the need to encourage production of lower grade phosphate. With 27 years of subsequent depletion of low impurity rock, it would be difficult to argue that the need to produce rock with high impurities is less now than it was in 1954.

When the present mining process provisions were enacted in 1960, the justification was prevention of the percentage depletion allowance based on expensive finished products such as brick, due to the resulting revenue loss. To this end, the Treasury and Congress adopted the position that concentration processes were acceptable while processes resulting in a chemical change were not. Most of the processes in use at the time these provisions were enacted resulted in the latter, e.g.,

limestone calcining was listed as a specifically excluded process because it causes a chemical change resulting in lime. However, not only was phosphate decarbonization not specifically considered (because it was not a prevalent practice at that time) but the evil Congress sought to eliminate has no application to phosphate decarbonization which is merely a concentration process necessary to make phosphate a marketable item.

The legislative history of percentage depletion, and the underlying policy considerations relevant thereto, all point to the inclusion of phosphate decarbonization as an ordinary treatment process by the IRS and the Treasury. However, this will not happen without the passage of S.1193.

**Senator WALLOP.** Did you have something, Barry?

**Mr. ROTH.** Nothing, Mr. Chairman.

**Senator WALLOP.** Mr. Fox.

**Mr. FOX.** No, sir.

**Senator WALLOP.** Well, I think that's a very succinct statement of the nature of the problem. And it does seem strange that one can do it for trona and not for phosphate. It does seem also strange that one segment of the industry is allowed to operate comfortably and the other does not. And that's not the kind of regional economic development policy that I think is in the interest of the country, and certainly not our part of the country. And while Florida Senators may disagree with that, I think it's equitable.

And so I appreciate your testimony this morning. We will see what can be done.

**Mr. SMITH.** Thank you, very much.

**Senator WALLOP.** Thank you.

And with that I think the subcommittee's agenda has been realized, and I will call the committee adjourned.

[Whereupon, at 12 p.m., the hearing was concluded.]

[By direction of the chairman, the following communications were made a part of the hearing record:]

STATEMENT  
OF THE  
AIR CONDITIONING AND REFRIGERATION INSTITUTE  
BEFORE THE  
COMMITTEE ON FINANCE  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION

JULY 29, 1983

Regarding

Renewable Energy Tax Credits

The Air Conditioning and Refrigeration Institute (ARI) appreciates this opportunity to submit comments on Senate Bill 1305, which would extend the renewable energy tax credits for solar devices.

ARI is a national trade association representing manufacturers of solar energy equipment, heat pumps, central air conditioners and components included in such equipment. ARI represents more than 50% of the sales volume in the solar industry and approximately 90% of the sales volume in the other industries.

ARI and its member companies are in support of S. 1305 and its objective of extending the tax credit until 1990. The solar industry had hoped in the late 70's that this legislation today would not be needed. Unfortunately, the solar industry has experienced the severe effects of a recession (together with the rest of the country) and falling fossil fuel prices resulting from a temporary over supply of oil.

While the tax credits were initially adopted in order to assist the industry in bridging the gap between research and development of the technology and actual application of solar energy as an energy source by the end user; it was recognized that alternative energies were not on level ground with other fuel consuming sources of energy. In accordance, Congress expanded and extended the energy tax credits in the Windfall Profit Tax Act of 1980.

With the assistance of the energy tax credits the solar industry has made significant in-roads with the consuming public. Sales and installations were reflecting increasing acceptance in the years before the recession and have again responded as the economy has begun to rebound from the effects of the recession. Unfortunately, the solar industry has lost time which is crucial to achieving its desired goal of marketability by 1985.

ARI fully understands the budget constraints that the federal government is operating with today. We believe that renewable energy tax credits can be granted with no resulting adverse impact to the U.S. Treasury. The success of the renewable energy industry can be an enormous benefit to the U.S. Treasury because of a healthier balance of payment resulting from reduced reliance on imported energy resources, increased tax revenues from expansion of the solar industry business activities, and the creation of much needed expansion in the job market for manufacturing and contractor employment opportunities.

The decision has already been made that the United States expects renewable energy to be part of our energy inventory. S. 1305 addresses the need to assist solar energy in achieving its position in a balanced energy program. It is our belief, that to secure this position for solar energy and to achieve the necessary penetration in the marketplace, the residential energy credit should be extended until 1990 and the business energy credit should be enhanced to 25% and extended to 1990.

The decision to extend the energy tax credit should be dealt with in 1983 because of its importance as part of the business planning process and the interaction with the financing community. The longer we delay this decision the greater the risk that we will lose the opportunity of expanding our competitive edge in technology and closing the gap on commercialization of the solar energy industry.

STATEMENT OF THE  
AMERICAN GAS ASSOCIATION  
BEFORE THE  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION  
OF THE  
COMMITTEE ON FINANCE  
UNITED STATES SENATE  
ON S. 1305,  
THE RENEWABLE ENERGY TAX INCENTIVE ACT OF 1983  
July 18, 1983

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Introduction

The American Gas Association (A.G.A.) is a national trade association comprised of nearly 300 natural gas distribution and transmission companies serving over 160 million consumers in all 50 states. A.G.A. member companies account for approximately 85% of the annual natural gas utility sales in our nation.

Natural gas serves over half of both residential and commercial establishments in the U.S. and more of American industry than any other single fuel. Further, gas provides a secure source of energy because foreign developments do not disrupt our supply. Greater recovery through varied nontraditional supply projects and improved technology will improve supply security for customers and permit further progress toward assuring gas-using companies of the supply stability on which long term business decisions often depend.

In order to promote both increased energy supplies for

America and increased conservation of our traditional fossil fuels, the A.G.A. supports the provisions in the Renewable Energy Tax Incentive Act of 1983 dealing with tax credits for cogeneration, solar energy, biomass and residential renewable energy resource expenditures.

We believe that wide public acceptance of solar energy<sup>1</sup> as a means of offsetting dependence on foreign sources, coupled with growing general public trust in gas utilities as the vehicle to bring solar into the mainstream of energy technology, mandates our support of the renewable energy tax credit. A.G.A. also believes the tax credits are needed by the solar industry to allow for maturation of a still new technology, to allow it to develop into a competitive and complimentary energy industry. Furthermore, we believe the social benefits of extension of the tax credits --creation of jobs in an era of high unemployment, stimulation of local economics through expansion of existing tax bases, and the ultimate positive effect on the national treasury -- warrant our full support. We recommend, however, that the tax credits for synthetic fuel/coal gasification production equipment be extended as well. The credits for investment in these technologies expired in December 1982.

The A.G.A. appreciates the opportunity to present our views on these important issues.

#### Cogeneration

A.G.A. members have a direct and vital interest in the

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<sup>1</sup> A recent survey by A.G.A. and the Solar Energy Research Institute (SERI) indicated that fully two-thirds of American consumers believe solar energy is capable of meeting a major portion of our energy needs.

efficient use of natural gas. Cogeneration equipment, through the sequential use of energy to produce both electrical or mechanical energy and useful thermal energy, can quickly save 25-51% of the energy consumed by conventional boilers and other end use equipment.<sup>2</sup> DOE estimates a potential fuel savings of nearly 2 quads for industrial cogeneration development alone, not accounting for development in the commercial market. A.G.A. thus strongly supports cogeneration as a means of reducing total U.S. energy consumption through the productive use of what would otherwise be wasted energy. (Two-thirds of the energy used to generate electricity conventionally is lost as waste heat.)

A.G.A. strongly supports the provision in the Renewable Energy Tax Incentive Act of 1983 which would not only extend the availability of the 10% cogeneration energy tax credit until December 31, 1990, but would also remove the present restrictions on use of natural gas in eligible equipment. When Congress passed the Crude Oil Windfall Profit Tax Act of 1980, which created the cogeneration tax credit, there was a great deal of concern about supply of natural gas. Natural gas-fired cogeneration equipment was therefore excluded from qualifying for the credit. The natural gas supply outlook, however, has brightened considerably. Given the improving gas supply outlook, there is no justification for continuing a tax bias against natural gas-fired cogeneration equipment.

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<sup>2</sup>"An Energy Conservation and Economic Analysis of Gas-Fired Cogeneration in Commercial and Industrial Applications", Energy Analysis 1981-9 (August 28, 1981; American Gas Association, Arlington, Virginia).

Natural gas is the fuel of choice for most cogeneration applications. It is clean, easy to use, and gas-fired cogeneration equipment is currently available for both commercial and industrial applications. In fact, according to the Federal Energy Regulatory Commission's (FERC) latest qualified facilities publication, over 3 million Kw of natural gas fueled cogeneration capacity has been added since 1978. This constitutes over one-half of all the new facilities added -- including those fueled with all other sources (e.g., coal, biomass, waste products). Equipment which does not use natural gas (or an oil-derived product) is not generally available for a wide spectrum of applications. In addition, cogeneration equipment using alternative fuels have associated environmental controls and fuel handling costs well beyond the cost of natural gas systems.

The previous cogeneration tax credit thus did not provide an effective incentive for cogeneration. One reason for this was the uncertain regulatory climate caused by several challenges to PURPA, thus slowing all cogeneration development. Another was the fact that the tax credits were not made available for natural gas, the cogeneration fuel of choice. With the last of the regulatory challenges being recently settled by the U.S. Supreme Court<sup>3</sup>, cogeneration projects could and should be in the works, provided adequate incentives exist. In this regard, Sen. Bob Packwood (R-OR) and his cosponsors should be congratulated for their introduction and support of S. 1305. The provisions of this bill permitting gas- and oil-fired cogeneration equipment to qualify

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<sup>3</sup>American Paper Institute, Inc. v. American Electric Power Service Corp., United States Supreme Court, No. 82-34, May 16, 1983.

for tax credits on an equal basis with alternatively fueled cogeneration equipment are commendable and recognize the contribution that such equipment can make towards energy independence.

### Solar

Natural gas can be used as a complement to solar energy in many uses. The near-term applications of solar/gas systems are: space conditioning, water heating, and industrial uses where temperatures less than 500° F are acceptable.

The availability of federal energy tax credits significantly improves the economics of active solar heating and hot water systems since such systems generally have high capital cost and long-term paybacks. (In the short-term they are frequently not as attractive as conventional heating systems.) Tax credits can help to overcome this major deterrent to greater use of solar energy.

The A.G.A. supports the development of solar energy where it is economically justifiable as a supplement to normal utility service. Solar energy serves the gas industry's interests by: (1) "stretching out" the nation's remaining natural gas supplies; and (2) partly offsetting the cost impact of rising unit prices for natural gas by reducing the total number of energy units required (with the result that the competitiveness of natural gas is improved).

### Biomass

Refined techniques for the conversion to methane of marine, terrestrial and waste biomass may yield enormous supply payoffs, since biomass represents an inexhaustible, renewable energy

source. Our supply estimates for the year 2000 are:

- Onshore and marine -- 35-135 billion cubic feet (Bcf).
- Urban waste and animal residue -- 200-800 Bcf.

The extreme variation in low and high estimates is due, in large part, to differing assumptions with regard to the legislative and regulatory framework within which these technologies are developed. Thus, legislative policies, including tax credit availability, will promote technology development and enhance industry's ability to produce near the higher end of the estimate range.

The natural gas industry is playing a lead role in the development of these supplemental supplies, including sponsorship of several major methane recovery project from landfills and intensified research and development of gas from marine and terrestrial biomass sources.

At the end of 1982, the United States had sixteen functioning landfill biogas projects, producing at least 2,848.6 million cubic feet per year. A recent A.G.A. study lists the actual landfill projects as well as potential landfill biogas sites, many of which are undergoing testing and feasibility studies.<sup>4</sup> (Attachment 1) Potential projects are located in thirteen states and the District of Columbia. Continued availability of the ETC for biomass will help ensure that these and other similar projects can become operational, provided that the definition of eligible biomass equipment is expanded.

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<sup>4</sup>"Status of Landfill Biogas Projects", Gas Energy Review, Vol. II, No. 6 (March 1983; American Gas Association, Arlington, Va.)

The current definition of eligible equipment makes the credit available only for production of solid fuel or alcohol fuel. Such a limitation could deter companies from entering into new and different types of gas recovery operations -- such as the potential landfill projects listed in the attachment. S. 1305 broadens the definition to include some methane-containing gas -- but only if produced by anaerobic digestion (i.e., decomposition occurring in the absence of oxygen) from nonfossil waste materials at farms or other agricultural facilities. In order to encourage the maximum number of biomass projects, A.G.A. recommends that the definition of eligible biomass property be expanded to include equipment producing methane through aerobic and anaerobic digestion of all nonfossil waste materials.

#### Synthetic Fuels/Coal Gasification

The production of synthetic fuels will be a major contribution to the long term energy supply. Coal gasification, creating environmentally benign methane, can account for a major portion of this contribution. Although the U.S. is estimated to have vast coal reserves -- over 430 billion tons -- only about half of these reserves can be recovered with current levels of technology.

Encouragement of technologically improved projects through the existence of these credits and the expansion of eligibility to necessarily associated property (such as oxygen plants) will permit recovery of even more of our coal resources by expanding the breadth of coal feedstocks that specific conversion methods can accept.

Attached is a table outlining the status of high-Btu coal gasification plants either proposed or underway.<sup>5</sup> (Attachment 2) Because of the large capital costs of facility construction and the long lead time required for planning and construction, the affirmative commitment changes made in this legislation and the extension of the credit's availability are critical to the companies which are involved in the decision-making process.

Based on coal's current and expected cost and national security advantages over imported oil, development of the nation's coal resources is particularly desirable. However, conversion to a more usable and broadly acceptable form is necessary before coal can be widely used. Although there are three main forms [electricity, methane and liquids (petroleum substitutes)], coal gasification is particularly advantageous:

- Its production will use an in-place, million-mile gas transmission and distribution network.
- From a consumer's perspective, provision of major residential and commercial energy needs through coal gasification is less expensive than meeting these needs through coal-generated electricity.
- From a national perspective, equivalent amounts of end-use energy would entail significantly lower investment costs and environmental residuals than either a coal/electric or coal-to-liquids facility.

For these reasons, A.G.A. thus urges the inclusion of provisions dealing with continuation of the credits for production of synthetic fuels and coal gasification.

#### Tax Credits for Public Utility Property

A.G.A. believes that, if national policy is to encourage investment in equipment and processes that save energy, it makes

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<sup>5</sup>"Status of High-Btu Coal Gasification", Gas Energy Review, Vol. II, No.6 (June 1983; American Gas Association, Arlington, Va.).

no sense to exclude public utilities from the available incentives. This is especially true for equipment and processes that are complex and which require utility expertise to prove economic viability prior to general industry acceptance. We thus recommend that public utility property be eligible, on the same basis as other property, for the business energy tax credits.

Conclusion

A.G.A. believes that the extension of energy tax credits for renewable and unconventional forms of energy production -- as well as the renewal and broadening of the credits for cogeneration equipment and synthetic fuels/coal gasification production equipment -- are essential to ensure that our nation is able to meet its future energy needs. A.G.A. thus supports the enactment of S. 1305 with the changes noted above.

## Status of Landfill Biogas Projects

by Jeffrey L. Wingenroth  
Manager, Gas Supply Programs  
American Gas Association

and  
Alleen A. Bohn  
Gas Supply Analyst  
American Gas Association

### Introduction

The table that follows is an update of the July 1982 "Status of Landfill Biogas Projects." During 1982, three projects have become operational resulting in a total of 16 functioning landfill biogas projects as of year-end 1982.

Five of the 16 projects produce high-Btu pipeline quality gas. Local gas companies inject the high-Btu gas into the pipeline system for distribution throughout their service area. Eleven biogas projects produce medium-Btu gas for nearby electric generation facilities or industrial customers.

In June of 1982, subsidiaries of The Brooklyn Union Gas Co., and Getty Synthetic Fuels, Inc. commenced production from the largest capacity landfill biogas project. The project will have the ability to produce up to 5.0 MMcf per day of high-Btu gas from the Fresh Kills Landfill on Staten Island, N.Y. This will be enough high-Btu gas to

heat 10,000 homes in Brooklyn Union's service area.

During 1983 several medium-Btu projects are expected to commence operations.

### Background

The natural process of anaerobic digestion of municipal waste in landfills produces biogas—a mixture of methane, carbon dioxide, nitrogen and trace amounts of other gases. Once the landfill is covered with an impermeable surface, the biogas is recovered by drilling shallow wells (between 30 feet and 100 feet deep) into the landfill and using standard industrial compressors to create pressure differentials between the landfill and the collecting wells. After processing, the biogas can be used on site or transported to nearby industrial facilities. The heating value of the biogas at the wellhead is between 450 and 550 Btu per cubic foot. Some projects find it more economical to use carbon dioxide removal techniques to produce a high-Btu product which gas companies use to augment their supplies.

Recovering the gas from landfills can reduce some of the environmental hazards associated with landfills such as gas accumulation and explosion. Research directed towards improving the

efficiency and environmental safety of the recovery technology is continuing in response to the positive results of the early operational sites.

### Current Statistics

At least 2,848.6 MMcf of landfill gas was commercially produced during 1982; of this amount 1,287.6 MMcf was high-Btu gas and 1,561.0 MMcf was medium-Btu gas. During 1982, a production capability was achieved to produce approximately 12.85 MMcf per day of high-Btu gas and 18.62 MMcf per day of medium-Btu gas. In addition to these volumes there are amounts being collected by other projects, some of which utilize the gas recovered in on-site facilities. The projects listed in the following table demonstrate the importance of landfill gas to the natural gas industry.

Also included in the following table are potential landfill biogas sites, many of which are undergoing testing and feasibility studies. The listing of these sites was compiled from information provided by the Government Refuse Collection and Disposal Association; the U.S. Conference of Mayors; Johns Hopkins University; Getty Synthetic Fuels, Inc.; and Genstar Gas Recovery Systems, Inc. □

## Status of Landfill Biogas Projects (As of December 1982)

Project/ Project Manager	Commercial Use	Date of First Operations	Production		Remarks	
			Type	1982 Estimated <sup>a</sup> (MMcf)		
<b>OPERATIONAL</b> C.I.D., Chicago IL/Getty Synthetic Fuels, Inc.	The Natural Gas Pipeline Co. of America purchases the gas for blending with pipeline gas supplies.	December, 1980	High	2.50	488.0	Landfill has 8 million tons of refuse in place and is receiving 7,000 tons per day. Commercial produc- tion came on line in Dec. 1980.
Fresh Kills, Staten Island NY/Getty Synthetic Fuels, Inc.; Methane Development Corp.	Brooklyn Union Gas Co. uses the gas to blend with pipeline gas supplies.	June, 1982	High	5.00	270.9	Landfill has 75 million tons in place and is receiv- ing 10,000 tons per day. Project area is 400 acres, 50 feet deep.
Palms Verdez CA/Getty Synthetic Fuels, Inc.	Southern California Gas Co. purchases the gas to blend with pipeline gas supplies.	June, 1975	High	1.00	148.6	Operations on 1/4 of 176- acre landfill averaging 150 feet to 300 feet deep. Total refuse in place is 20 million tons. Raw gas is 550-Btu per scf, then up- graded through removal of CO <sub>2</sub> and other components by molecular sieve.
Monterey Park CA/Getty Synthetic Fuels, Inc.	Southern California Gas Co. purchases the gas to blend with pipeline gas supplies.	August, 1979	High	4.00	353.1	150 acres with 25 million to 28 million tons of refuse in place. Average depth of landfill is 300 feet. Raw gas is 550 Btu per scf, then up-graded through re- moval of CO <sub>2</sub> and other components by Selexol and a proprietary process.
Mountain View CA/Pacific Gas & Electric Co.	Pacific Gas & Electric Co. uses the gas to blend with pipeline gas supplies.	August, 1978	High	.35	26.0	25 acres of 500 acres de- veloped using 33 wells averaging 35 feet deep. Expansion is underway which will increase daily production to about 1.0- 1.2 MMcf of 750 to 800 Btu/cf gas.

Project/ Project Manager	Commercial Use	Date of First Operations	Production			Remarks
			Type	MMcf/d	1982 Estimated (MMcf)	
<b>OPERATIONAL</b> Cinnaminson NJ/Public Service Electric and Gas Co.	The Public Service Electric and Gas Co. sells the gas to the Hooganaes Co. for heating ladles in which steel is melted.	August, 1979	Medium	.70	110.0	Using 36 acres of a 64- acre landfill averaging 50 feet deep. 2 1/4 million tons of refuse in place. Future plans are to increase pro- duction to 1.2 MMcf per day.
Bradley West, Los Angeles CA/Genstar Gas Recovery Systems, Inc.	Gas will be used by the L.A. Department of Water and Power Valley Generation Station as boiler fuel for electric generation.	Summer, 1982	Medium	3.50	Negligible	9 million tons of refuse in place at landfill.
Davis Street, San Leandro CA/Getty Synthetic Fuels, Inc.	Domter Gypsum of America purchases the gas for use as an industrial fuel.	July, 1981	Medium	3.00*	Not Available	194-acre landfill, approx- imately 80 feet deep. The recovered gas is processed by a proprietary technol- ogy to remove impurities and moisture.
Acme, Martinez CA/Getty Synthetic Fuels, Inc.	Contra Costa Sanitation District purchases the gas for use as an industrial fuel.	April, 1982	Medium	2.50*	—	125-acre landfill, approx- imately 80 feet deep. The recovered gas is processed by a proprietary technol- ogy to remove impurities and moisture.
Sheldon-Arieta, Los Angeles CA/City of Los Angeles	Gas is used by the L.A. Department of Water and Power Valley Generation Station as boiler fuel for steam generation of electricity.	November, 1979	Medium	2.20	Negligible	3-million-ton landfill with an average depth of 125 feet. Facility is currently being modified.
Bradley East, Los Angeles CA/Genstar Gas Recovery Systems, Inc.,	Gas is used by the L.A. Department of Water and Power Valley Generation Station as boiler fuel for electric generation.	January, 1981	Medium	2.20	803.0	8 million tons of refuse in place at landfill with depth of between 99 feet and 125 feet.

Project/ Project Manager	Commercial Use	Date of First Operations	Production			Remarks
			Type	MMcf/d	1982 Estimated* (MMcf)	
<b>OPERATIONAL</b> Ascon, Wilmington CA/Watson Biogas Systems	A Shell Oil refinery purchases the gas to use as boiler fuel for process steam generation.	August, 1978	Medium	1.50	400.0	2 to 3 million-ton landfill with an average depth of 80 feet.
North Valley, San Fernando CA/Getty Synthetic Fuels, Inc.	Newhall Refinery purchases the gas for use as an industrial fuel.	November, 1961	Medium	1.10*	Not Available	42-acre landfill over 250 feet deep. The recovered gas is processed by a pro- prietary technology to re- move impurities and mois- ture.
Los Lomas, Duarte CA/Watson Biogas Systems	Southern California Edison Co. purchases electricity generated from the gas.	September, 1962	Medium	1.00	Negligible	40-acre landfill is 4 years old and 80 feet deep.
Industry CA/City of Industry	The City of Industry intends to use the gas as boiler fuel for heating and hot water for a convention center and recreational facilities.	March, 1980	Medium	.60	Negligible	160-acre landfill with an average depth of 80 feet. Approximately 3 1/2 mil- lion tons of refuse in place. Use of the gas is being tested.
Arma CA/Arma Land Reclamation (Subsidiary of Southwestern Portland Cement Co.)	Reichhold Chemical Co. purchases the gas to use as boiler fuel for process steam generation.	April, 1978	Medium	.68	247.2	320-acre landfill with an average depth of 170 feet.
Winston-Salem NC/City of Winston-Salem	The City of Winston-Salem uses the gas to generate power for a sewage treatment plant.	August, 1961	Medium	.14	0.8	25-acre landfill, 40 feet deep. Capital cost of the wells and pipeline was less than \$25,000. Gas from landfill supplements medium-Btu gas from anaerobic digestion of raw sewage.
<b>ESTIMATED 1982 PRODUCTION</b>			High-Btu		1,287.6	
			Medium-Btu		1,561.0*	
					<u>2,848.6</u>	

Project/ Project Manager	Commercial Use	Date of First Operations	Production		Remarks
			Type	1982 Estimated* (MMcf)	
<b>TO BE OPERATIONAL BY DECEMBER 31, 1983</b>					
Menlo Park, CA/Genstar Gas Recovery Systems, Inc.	Local electric utility will purchase electricity generated from the gas.	Early 1983	Medium	—	—
Rossmann's Landfill Oregon City OR/Rossmann's Landfill, Inc.	To be determined	July, 1983	Medium	2.6	—
Cazcon CA/Watson Biogas Systems	Southern California Edison Co. will purchase 1.7 Mw generated from the gas.	October, 1983	Medium	—	—
Olinda Landfill, Orange County CA/Getty Synthetic Fuels, Inc.	Southern California Edison Co. will purchase electricity generated on-site from landfill gas.	October, 1983	Medium	—	—

**OTHER POTENTIAL LANDFILL BIOGAS SITES**

California:  
 Burbank, City of Burbank #8;  
 Corona, Corona Landfill;  
 Glendale, Scholl Canyon;  
 Irving, Coyote Canyon Landfill;  
 Los Angeles, Hewitt Landfill;  
 Lopez Canyon;  
 Mountaingate;  
 Penrose Landfill;  
 Newby Island Sanitary Landfill;  
 Palo Alto, Palo Alto Landfill;  
 Santa Clara, Santa Clara Sanitary Landfill;  
 West Covina, BEK Landfill;  
 Whittier, Puente Hills Landfill

Colorado:  
 Adams County, Commerce City Landfill;  
 Denver, 62nd Street Landfill

<b>District of Columbia:</b>	Washington, Kenilworth Landfill
<b>Illinois:</b>	Chicago, 31st Street Landfill; Blue Island Landfill
<b>Kentucky:</b>	Louisville, Campground Landfill
<b>Maryland:</b>	Elicott City, New Cut Road Landfill; Prince George's County, Oxon Cove Landfill; Rockville, Gode/Southlawn Sanitary Landfill
<b>Michigan:</b>	Detroit, Holloway Landfill; Saginaw; Jollyn Road; Riverview, Riverview Land Preserve
<b>New Jersey:</b>	Lyndhurst, Kingsland Sanitary Landfill
<b>New York:</b>	Patchogue, Holtville and Brookhaven Landfills; Long Island, North Hempstead Landfill; Islip; Babylon
<b>Ohio:</b>	Cleveland, Royaltan Road Landfill
<b>Oregon:</b>	Portland, St. John's Landfill
<b>Pennsylvania:</b>	Morristown, GROWS Landfill; Pittsburgh, Parkway Center Landfill; South Hills Landfill; Valley Forge, Knickerbocker Landfill
<b>Rhode Island:</b>	Johnston, Central Landfill
<b>Virginia:</b>	Fairfax County, Lorton Landfill; Richmond, Falls Street Landfill

<sup>1</sup>Production values of the type of gas indicated. For operational projects, actual values are used; otherwise, design values are used.  
<sup>2</sup>Estimated using available year-to-date information and average daily production data through remainder of year.  
<sup>3</sup>Approximate.  
<sup>4</sup>Not gas.  
<sup>5</sup>Does not include production from sites where data were unavailable.

## Status of High-Btu Coal Gasification

by Jeffrey L. Wingenroth  
 Manager, Gas Supply Programs  
 American Gas Association  
 and  
 Aileen A. Bohn  
 Gas Supply Analyst  
 American Gas Association

### In Brief

*The following table updates the status of high-Btu coal gasification plants last presented in the November 1982 issue of the Gas Energy Review. Since the last update, several projects have moved to an inactive stage including the Utah Resources International Inc.'s project planned for Garfield County, Utah; the Northwest Corp.'s project planned for Oregon; and the Crow Tribe Pacific Coal Gas Co.'s project planned for Montana.*

### SFC Activity

As of January 10, 1983, the closing date of the third solicitation, the U.S. Synthetic Fuels Corp. (SFC) received 46 proposals requesting financial aid. Twenty-nine of the proposed projects had been reviewed under previous SFC solicitations and the remainder were

new submittals. Included in the 46 projects initially reviewed in the third solicitation were nine coal gasification projects, 20 coal liquefaction projects, 11 tar sands projects and 13 oil shale projects.

Two high-Btu coal gasification projects are among 24 of the original 46 projects still being reviewed by the SFC in the third solicitation. These two projects—the Memphis Light, Gas and Water project planned for Memphis, Tenn. and the New England Energy Park Project planned for Fall River, Mass.—were both removed from the second solicitation for review during the third solicitation. To date, the Memphis Light Gas and Water project has successfully completed the SFC's maturity and strength tests and has moved to Phase II consideration. The New England Energy Park Project has successfully completed the initial maturity test of the third solicitation. The Memphis Light, Gas and Water project will produce 4.3 MMcf per day of high-Btu gas along with approximately 150 MMcf per day of medium-Btu gas. The New England Energy Park project will produce 50.0 MMcf per day of high-Btu

gas in the winter, 1,000 tons per day of methanol in the summer and electricity year-round.

The third solicitation is intended to be the SFC's last general solicitation for financing synthetic fuels projects. Competitive solicitations targeted for specific resources will comprise the next round of SFC solicitations. The first such solicitation, targeted for oil shale projects, was issued in January of this year. The SFC issued a draft solicitation for coal gasification projects from Gulf Coast Lignite late in March 1983 to be finalized in April.

### High-Btu Coal Gasification Supply Potential

The A.G.A. Gas Supply Committee, in a revision of *The Gas Energy Supply Outlook: 1980-2000*, estimates that under a favorable political and economic climate, coal gasification could be an important source of supplemental gas by the year 2000. The progress being made by Great Plains and the other pioneer projects listed in Table 1 should prove vital toward the gas industry's achievement of long-term supply goals. □

TABLE 1		Status of Active High-Btu Coal Gasification Projects (As of April 1983)			
Controlling Company	Site	Process	Coal Feed Tons/day	Peak Output MMcfd/day	Status
American Natural Resources Co.; MidCon Corp.; Ten- neco, Inc.; Transcontinental Gas Pipe Line Corp.; Pa- cific Lighting Corp.	Beulah-Hazen Area, Mercer County, N.D.	Large gasification with methanation	14,200	137.5	Project is on schedule for completion by late 1984. All of the gasifiers are in place and construction is over 50% complete.
Memphis Light, Gas and Wa- ter Division	Memphis, Tenn.	U-Gas with methanation	3,153	4.3	Memphis Light, Gas and Water plans to convert high- sulfur bituminous coal to 300 Btu/cf industrial gas at a rate of 167 MMcfd. Ap- proximately 17.5 MMcfd will be methanated to yield 4.3 MMcfd of pipeline qual- ity gas. Project has passed the maturity and strength tests and is being reviewed under Phase II of the SPC's third solicitation. Project is in the final design stage.
Tenneco Coal Gasification Co.	Wibaux, Mont.	Large gasification with methanation and Tenneco partial oxidation unit for by-product liquids	37,000	280	Estimated total capital costs of the plant are \$2.3 billion (1980 \$). First gas produc- tion could occur in 1990.
Texas Eastern Corp.	Northwest New Mexico	Large gasification with methanation	29,000	142	Feasibility study stage was completed last fall. Project is in a maintenance status.
Mountain Fuel Resources Co.; Mono Power Co.	Emery County, Utah	Large gasification with methanol & methanation	4,000	30 (and 2,400 tons/ day methanol)	Economic and environmen- tal feasibility studies are underway. State pre-qualifi- cation approval of the site has been received. An op- tion for water rights has been signed.

Controlling Company	Site	Process	Coal Feed Tons/day	Peak Output MMcf/day	Status
Northwest Corp.	Oregon	Texas gasification	27,600	125 (plus methanol and/or Mod-Btu gas)	Project is currently in an inactive stage. Forty percent of the coal would be converted to medium and high-Btu gas plus methanol, 30% would be burned for electricity, and 40% would be exported to Japan. Corporation is evaluating other potential high-Btu coal gasification projects.
Utah Resources International Inc.	Garfield County, Utah	Large gasification with methanation	17,000	250	Project is currently in an inactive stage.
Washington Natural Gas Co.	McCone County, Mont.	Large gasification with methanation	30,000	250	Private funding of the feasibility study is being sought. Project is currently in an inactive stage.
Crow Tribe of Montana and Pacific Coal Gas Co.	Crow Reservation, Mont.	Large gasification with methanation	12,500 25,000	127.5 (Stage I) 275 (Stage II)	Plans are to build the project in two stages. Project is currently in an inactive stage.
Northern Natural Resources Co. (9 member consortium)	Oliver County, N.D.	Large gasification with methanation	12,000	75 (and 30,000 Bbl/d methanol)	Preliminary feasibility study underway. Project will produce both high-Btu gas and methanol and possibly electricity.
The Brooklyn Union Gas Co.; EG&G, Inc.; Eastern Gas and Fuel Associates; Bechtel Power Corp.; Westinghouse Electrical Corp.	Fall River, Mass.	Westinghouse with Cosco Methanation	3,000	50.0 in winter (1,000 tons/day methanol in summer and electricity year-round)	Project has passed the maturity test and is being reviewed under the strength test of the SFC's third solicitation.

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**STATEMENT OF  
ARCO SOLAR INDUSTRIES**

**SUBMITTED IN CONNECTION WITH A HEARING  
HELD ON JULY 18, 1983  
BY THE SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION  
OF THE SENATE COMMITTEE ON FINANCE**

**ON**

**S.1305, SENATOR PACKWOOD'S BILL TO EXTEND AND  
ENHANCE ENERGY TAX CREDITS**

ARCO Solar would like to state its views regarding S.1305. We support Congressional efforts to extend tax credits for all productive renewable energy sources. We, however, can only speak with knowledge about photovoltaic technology. The success of federal efforts with the private sector in photovoltaic research and development has resulted in the world leadership of U.S. companies in the renewable energy industry. Enactment and enhancement of the tax credit for photovoltaic industry, today, would facilitate development of its market worldwide and help assure U.S. commercial leadership in this critical technology.

Photovoltaics are increasingly recognized as one of the most promising renewable energy technology. Substantial price reduction and market growth have characterized the technology over the past few years. We expect equally dramatic progress before 1990. Foreign competition, however, has begun to challenge U.S. producers; today, foreign producers, inevitably government-supported, account for 40 percent of world market sales.

Net cost reduction is the key to further commercialization of photovoltaic technology in the U.S. and in turn to U.S. success in the world market. Successful exports have almost always been preceded by domestic market success. In our view, enhancement of tax credits for photovoltaic installations in the U.S., with additional incentives for domestic producers only would constitute an effective competitive policy for the domestic industry in the world market.

Price effective competition at home, driven at first by focused tax incentives, would lead to market growth, on-line operational experience,

customer acceptance and technological development, and in turn result in a competitive product worldwide as foreign customers recognize and then repeat U.S. market acceptance of the technology produced in the U.S.

To put this international competitive strategy in place, we recommend the following:

- o increase the federal tax credit from 15 to 30 percent for renewable energy systems and extend the credit for five years;
- o limit the additional 15 percent credit to photovoltaic products manufactured in the U.S.;
- o extend the availability of the credit to public utilities, who after all will be one of the critical entities directly involved in bringing the benefits of this new technology to the consumer;
- o allow the credit to be taken where "subsidized loan funds" are involved in the transaction, such as revenue bonds and Rural Electrification Administration loans.

We believe the benefits of such a coherent approach to the market development of photovoltaic technology at home and abroad will far outweigh the costs to the U.S. Treasury (demonstrably small given the fledgling size of the industry). Conversely, the costs of a domestic photovoltaic industry falling stillborn to foreign competitive strategies are obvious in terms of future

employment opportunities lost and another U.S. failure in the realm of international technological competition for the products and markets of the future.

Implementation of farsighted and focused policy now will promote economic activity in a new, job creating commercial technology, as well as provide for an indigenous, environmentally benign source of additional electrical generation for the country, which can be added to the existing power grid on an incremental, appropriate-scale basis. Such a policy also offers the best prospect of maintaining a positive balance of trade in viable renewable energy technology and products. Rapid industry growth at home is a necessity now, if significant benefits are to materialize for the U.S. in the world market by the late 1980s and early 1990s.

We appreciate this opportunity to present our view.

7/28/83



**The Charles Machine Works, Inc.**  
P.O. Box 66, Perry, Oklahoma 73077  
Phone: (405) 336-4402

July 21, 1983

Mr. Roderick A. DeArment

Chief Counsel

Committee on Finance

Room SD-219, Dirksen Senate Office Building

Washington, DC 20510

**Subject:** Statement to be included in the printed record of the Senate Finance Committee, Subcommittee on Energy and Agricultural Taxation hearings on S.1237, July 8, 1983.

**From:** Phil E. Albertson, Manager of New Products and Applications Planning,  
The Charles Machine Works, Perry, Oklahoma.

Gentlemen:

The need to restore the intent of Congress by eliminating the ineligibility of ground water heat pumps and other shallow geothermal applications for the geothermal energy tax credits is more critical to the achievement of really outstanding energy savings than most people realize.

We are the manufacturers of construction equipment that is used for installing ground water heat pumps and earth-coupled water source heat pumps which use water circulating through a high strength closed, sealed loop of plastic pipe to absorb heat from the earth or dissipate heat in the summer. These are used in many areas where water quantity is limited or has scaling, corrosion, disposal or pollution

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**Ditch  
Witch.**

Mr. Roderick A. DeArment

July 21, 1983

problems. They are almost as efficient as ground water heat pumps and in situations where the above named problems exist or high pumping power would be required, they can be more efficient.

For about four years we have been cooperating with Oklahoma State University in a research, development, and testing program which has resulted in the immediate availability of economical and efficient earth-coupled water source heat pump energy conservation systems that produce a 60-70 percent heating energy savings and a 20-25 percent cooling energy savings for the approximately 30 million residences that use electric resistance, fuel oil, or propane not only for new buildings but also for existing buildings. As natural gas prices rise, similar savings will be available to those who have access to it. The natural gas industry is developing gas fueled heat pumps that could realize even more savings.

Oklahoma State University has been awarded a contract by ASHRAE to develop a design and installation manual to be used throughout the nation for these systems.

There are an estimated 20-25,000 of the earth-coupled systems installed in the in the U.S., Canada, Sweden and Europe, substantially fewer than the ground water heat pumps. Both systems cost usually two or three times as much as conventional systems. That makes it very difficult to sell them because most people find it difficult to come up with that large an expenditure. The fact that very few of them are familiar with the systems also contributes to the problem.

As a consequence the prospects for these systems to move from the fledgling industry category into that of a thriving growth industry will be poor as long as these systems continue to be discriminated against with regard to energy conservation tax credits.

The savings of 60-70 percent in heating cost and 20-25 percent in cooling cost are typical results, easily verified by metered test reports, but that is only the tip of the iceberg.

In addition to those savings, properly designed systems do not require back-up

electric resistance heating strips even in the coldest -70° F. cloudy days or blizzard conditions in Canada or Sweden. Why? Because even in those conditions there is plenty of heat in the 30° F. to 50° F. temperature earth a few feet below the surface.

That is the Key to many billions of dollars of savings, not only in direct energy costs since for every BTU of energy used by the heat pump it absorbs approximately two more from the earth, but also the savings of two-thirds in the peak generating capacity that the utility would otherwise have to supply.

For a typical residential system using electric resistant heat or an air to air heat pump which has to use 100 percent electric resistant heat during periods when the air temperature drops to less than 20° F., the electric utility has to have an additional peak capacity of about 9 KW. At \$1500/KW for a coal fired plant, an investment of \$13,500 in additional peak capacity is required to run a \$1000 resistance heater or a \$2000 air to air heat pump for that residence. If a ground water heat pump or an earth-coupled water source heat pump were used, the additional peak capacity would be 3 KW at \$4500. If the water source heat pump were used to heat or cool water in a storage tank during off-peak periods, then the heat pump could be programmed to be off during peak demand periods. The additional peak generating capacity needed by the electric utility could be 0. The revenue producing, profit producing base load of the utility would be increased without additional peak generating capacity investment. These systems are also used to heat domestic hot water requirements which can also reduce peak loads and save about 50 percent in energy cost.

The estimated \$200 Billion by 1990 in added capacity requirement forecast by NERC, APRI, and the Edison Electric Institute may not be needed at all! That would result in lower rates per KWH in the future along with continuing water source heat pump savings by using the 3:1 leverage or 300 percent efficiency. Tests sponsored by EPRI and OG&E show a 50 percent lower WSHP compressor KW peak load compared with the AAHP in the summer. See enclosure #2.

The same 3:1 leverage from using earth heat could also be used, along with hot or cold water storage, by the natural gas utilities with the use of gas driven ground water or earth coupled heat pumps.

This is not a revolutionary new strategy. The Swedes, having no domestic oil or gas reserves and not much more potential hydroelectric capacity, started using it several years ago. For every electric resistance customer they change to a ground water or earth-coupled heat pump, they can add approximately two former oil furnace users at no increase in required peak generating capacity. Since they do not have low cost natural gas, they are also using these systems in urban areas for residential housing, commercial, and industrial applications. Dr. Jim Bose of Oklahoma State University and I attended a conference in Sweden on earth heat energy storage and extraction. We learned a lot about storing waste heat, solar heat, and garbage incinerator heat that gave us many good ideas on how that technology can be used in the U.S. when gas no longer has a price advantage. The storage techniques can be also used for storing cold in the earth even more efficiently than storing heat because we can take advantage of the latent heat of freezing of the moisture in the earth.

What could be the consequences if these very attractive energy savings and peak generating capacity saving are not taken advantage of? A good example is the approximately 30 million houses in the U.S. that do not have access to natural gas. They could save \$500-\$1000/year now with these systems, \$1000-\$1500 by 1990. At an average \$1000/year savings, \$30 Billion/year could be saved. That is equal to \$45 Billion earnings in the 33 percent tax bracket.

What could be the consequences if they all changed to air to air heat pumps which require back up electric resistance heaters at less than 20° F.? Depending on the climate the air to air heat pump users could save from 20 percent in the North to 50 percent in the far South in heating costs compared to fuel oil, propane,

or electric resistance heating. But, each would add approximately 9 KW peak load which at \$1500/KW = \$13,500 x 30,000,000 = \$400 Billion additional generating capacity investment. What other alternatives have they? They could continue using fossil fuel during periods when the air temperature is less than 20° F., but then they will face stiff surcharges from the fossil fuel companies to make up for lost revenue and the cost of continuing service.

What would be the probable results of ending this discrimination against ground water heat pumps and other shallow geothermal systems?

1. A rapid increase in the use of these systems.
2. An initial reduction in tax revenue to be recovered later.
3. A corresponding large increase in fossil energy savings.
4. A gradual easing of peaking problems for utilities.
5. An increase in employment due to the increase in requirements for heat pumps, plastic pipe, and installation construction work.
6. A continuing reduction in demand for imported oil.
7. An increase in tax revenue from the increased economic activity and higher profits in the electric utilities resulting from a larger customer base without having to increase generating capacity.
8. A downward pressure on inflation due to reduced energy costs.
9. Higher tax revenues from commercial and industrial companies because of increased profits due to energy savings.
10. Lower foreign trade deficit because of reduced foreign oil and gas imports, and a strong export market for water source heat pumps and equipment needed to install systems. The U.S. is already a major exporter of heat pump compressors.
11. Reduction in air, water, and noise pollution (no outside fan unit.)

Sweden has already started, with a goal of a 30 percent reduction in energy used by 1990. 1.5 trillion watts of capacity of these systems is now installed, 4 trillion is being installed or in the planning stage, 11 trillion is forecast to be installed by 1990.

The "state of the art" of these systems has advanced tremendously in the past few years. The potential energy savings are outstanding. The elimination of the discrimination against these systems' qualification for the energy saving tax rebate will assure rapid implementation of this well proven technology and accelerate the trend toward a 4:1 energy saving leverage (COP = 4) from the 3:1 leverage (COP = 3) that is now available, as more efficient water source heat pumps become available.

I am enclosing the following reference material for your staff:

Enclosure:	Comments:
1. Four-page brochure	Principles, savings, payback, design, fold-out for system types.
2. EPRI Interim Report #RP1191-6	Summer and winter KW peak reductions.
3. NERC Report	Planned Resources Over Peak Load.
4. Gene Oatman article	Reports that U.S. could face critical capacity shortages in the near future.
5. Projections of possible peak loads, costs, and options	Shows tremendous peak load reduction potential using earth resources.
6. EPRI Report EA-2639-SR	Detailed generating capacity needs report that Gene Oatman article is based on.
7. The Great Electric Utility Time Bomb	A scenario describing the consequences of various options.
8. Earth Coupled Water Source Heat Pump Economic and Payback Analysis	Based on DOE study CS/20060-5121 on WSHP systems compared to others, and Tenneco energy forecast.

Continued-

Enclosure:

Comments:

- |  |   |
|--|---|
| 9. Performance of Retrofitted Residential Systems                                    | Notarized total monthly KWH use change for four residences in north-central Oklahoma.   |
| 10. Iowa REC's 1981-1982 Electric Heating Load Research                              | Reports on numerous, monitored systems and shows peaking characteristics.   |
| 11. Copy of <u>Oklahoma City Times</u> report on REC over-capacity and rate problems | Over-building effect on rates. By using ground water and earth-coupled WSHP systems to add new former propane or fuel oil customers to their base they could build income and offset higher costs. Heating cost savings would offset cooling costs. |
| 12. Sample of buried pipe system design printout                                     | Shows input data required to design system, and output data, using 600 ft. and 400 ft. of vertical hole.  |
| 13. Swedish paper by Palne Mogenson analyzing energy savings                         | Shows no increase in power used. Peak KW would be reduced. Also reports on ecological aspects. Later information confirms minimal problem.  |
| 14. Jay Lehr NWA Journal Editorial "Open Your Mind to Closed Loops"                  | Reverses former negative attitudes.   |
| 15. Copy of polyethylene pipe warranty from Granse Corp.                             | Example of 50-75 yr. warranties available. Approximately 20,000 miles/year used by the natural gas distribution industry.   |
| 16. Copy of AGA Thermia literature   | AGA Thermia is a leading manufacturer and distributor with Canadian and European licenses.  |

Continued-

Enclosure:

17. Copy of Genesis II literature
18. Aire-Wrap literature and test data. System uses earth to enhance effect of insulation plus heat recharge from solar input to roof and walls during sunny winter days, cooling "recharge" to earth at night during the summer. All at less cost than super-insulated houses.
19. Photos taken of large Swedish installation illustrations that store and extract heat using the earth.
20. Portions of the Northwest Conservation and Electric Power Plan for the states of Washington, Oregon, Idaho, and Montana

Comments:

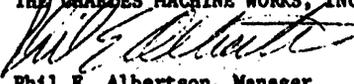
One of the leading distributors in the U.S. We have not had time yet to run tests on this system. Their test data shows that by using this system with an earth-coupled WSHP, the size of the heat pump would be halved. 81-88 percent heating and 60-70 percent cooling savings could be realized. Equivalent to a 6:1 leverage (COP = 6). This is another example of a shallow, low temperature, very effective energy saving geothermal system that probably doesn't qualify for the tax credit under present rules.

These show what can be done in urban areas when natural gas prices are higher.

This is a good example of the type of planning required to realize the energy conservation potential of these types of systems.

Sincerely,

THE CHARLES MACHINE WORKS, INC.

  
Phil E. Albertson, Manager

New Products and Applications Planning

dw

Enclosures



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*The University of Dayton*

20 July 1983

Mr. Roderick A. DeArment  
Chief Counsel  
Committee on Finance  
Room SD-219, Dirksen Senate Office Bldg.  
Washington, D.C. 20510

Dear Mr. DeArment:

I am enclosing a written statement for the record of the Senate Finance Committee hearing, Subcommittee on Energy and Agricultural Taxation on S.1237. This statement contains information relevant to the groundwater heat pump tax credit.

Thank you.

Sincerely,

*John L. Keller*

John L. Keller  
Research Meteorologist  
Certified Consulting  
Meteorologist

JLK/jca  
enclosure

cc: Congressman Tony Hall  
Ralos Solar Enterprises

RESEARCH INSTITUTE  
Applied Systems Analysis  
300 College Park Dayton, Ohio 45469-0001

STATEMENT RELEVANT TO: S.1237, July 18, 1983

This is a brief statement which provides some updated information on an earlier study discussed in my paper titled: "Ground Water Heat Pump Performance for an Older Urban House". In this study the household energy use characteristics for a household previously using natural gas were compared to those after retrofit to a groundwater heat pump system. I have included two figures. The first compares the household energy use per day as a function of heating or cooling degree days. The second compares the operating efficiencies of the two systems as a function of heating or cooling degree days. Where space permits I have indicated the month and year for which the data were taken. In some cases two months have been used.

Figure 1 shows essentially the same results as does Figure 1 shown in the earlier paper. The household energy consumption rate under the groundwater system (shown by '▲' 's) continues to fall along the same line as before. Relative to the old gas system the household is some four times more energy efficient per heating or cooling degree day.

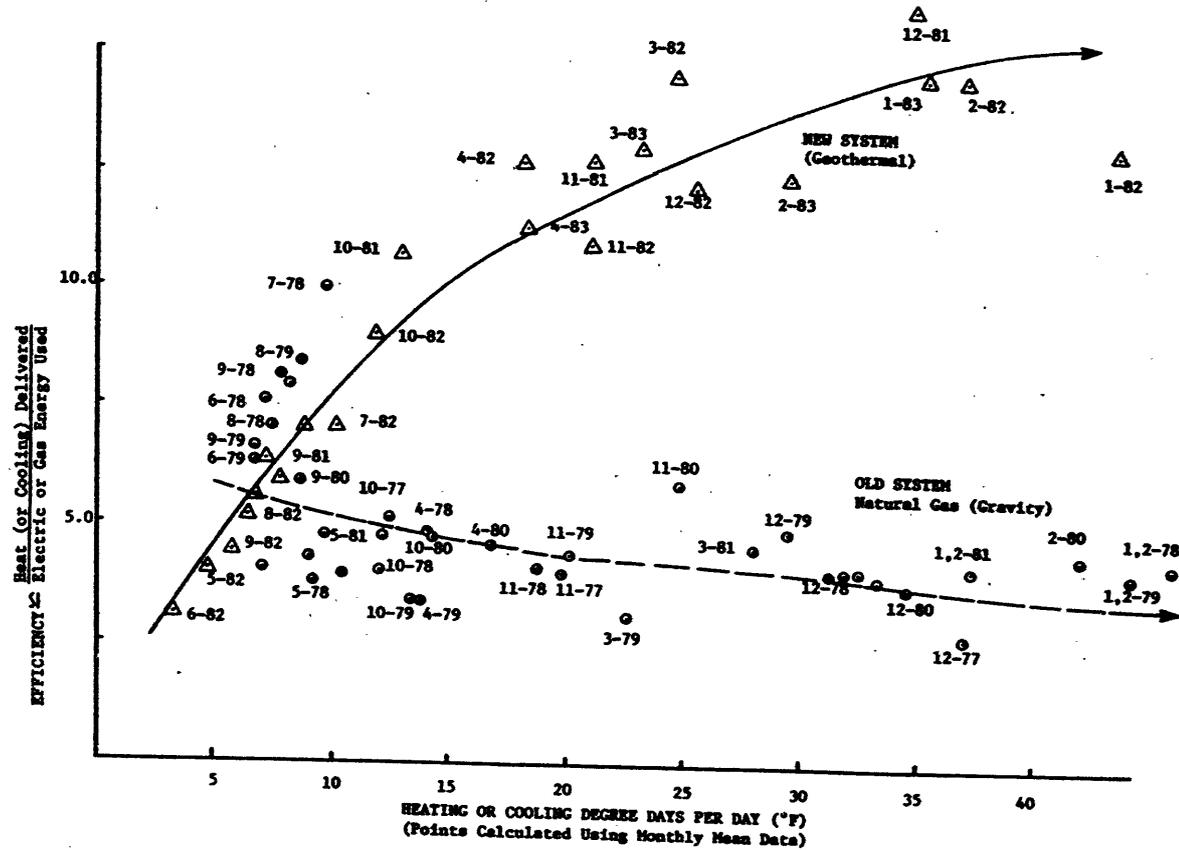
The relative operating efficiencies of the two systems with respect to increasing heating or cooling degree days are shown in Figure 2. The operating efficiency is defined here as the heating or cooling delivered divided by the total electric and gas energy used by the household. It can be seen that while under the old gas system the household energy efficiency actually decreased somewhat, with the groundwater system the household actually becomes more energy efficient as the weather becomes more severe. What this means is that the performance of the groundwater system is generally best when the household heating or cooling needs are greatest.

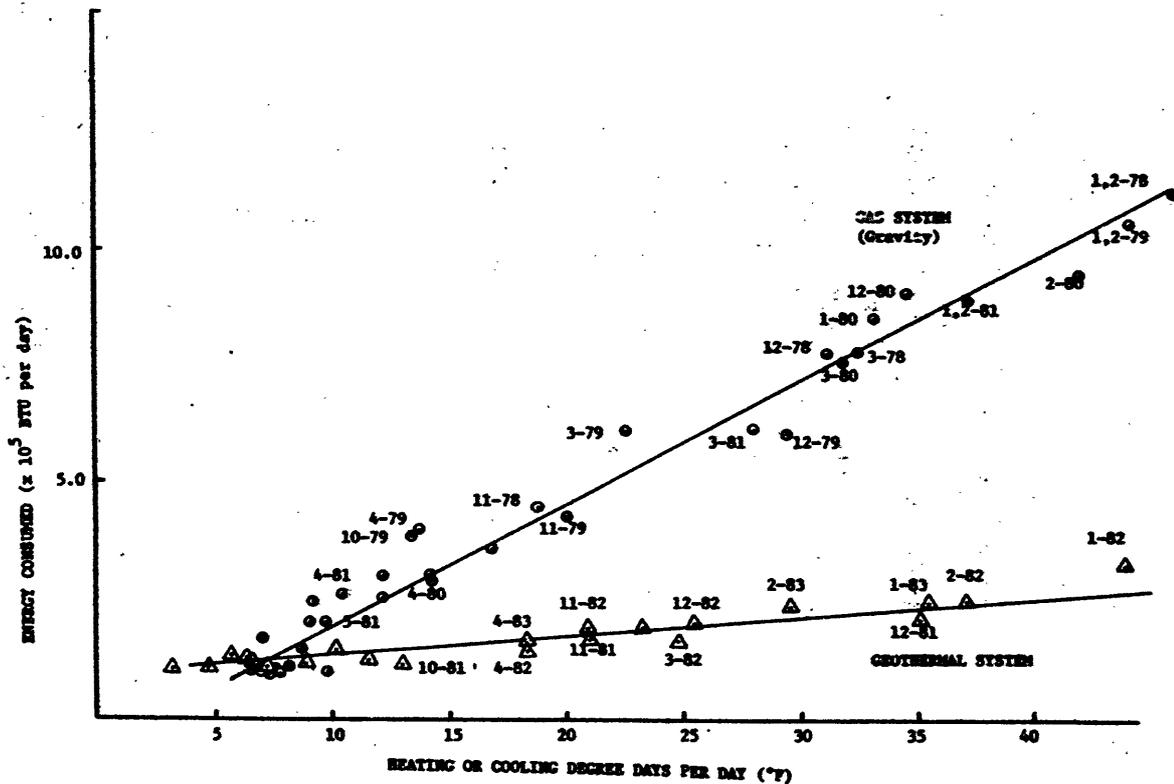
Some other facts should be pointed out. The groundwater system has been outfitted with a unit which can act with the heat pump

to generate hot water. This can be particularly economical during hot weather. During these times much of the heat removed from the interior air is transferred to the water in the hot water tank. The gas energy saved more than makes up for the electricity used in running the heat pump. Hence when air conditioning is needed during the summer it is provided at no additional operating cost. No air conditioning was used prior to retrofitting with the groundwater system. Had there been standard window or central air conditioning in use, the summer-time energy use of the groundwater system would compare even more favorably. The hot water generating unit can also be used during the winter heating period. However, part of the heat taken from the ground water, which would ordinarily be used for space heating, is diverted to heat water. Depending on weather conditions or the relative costs of electricity versus natural gas the hot water generating unit can be switched-off.

In terms of both the "economic" and comfort considerations the hot water generating unit should be switched off during especially cold weather. During these periods of very severe cold the heat pump output may still not keep up with the heat loss rate from the house even with the hot water generator off. During these times when the interior temperature departs too much below the desire value, the electric resistance heating unit will switch-on. This form of heating is far less efficient than the heat pump system. Not using the hot water generator will minimize the need for resistance heating. During January 1982 two particularly extreme cold outbreaks occurred. Both of these, which occurred on two consecutive weekends, were characterized by temperatures persisting below  $-5$  and  $-15^{\circ}\text{F}$ , high winds, and abnormally cloudy conditions for such arctic outbreaks. These weather conditions represent almost certainly some of the most extreme situations possible for Dayton, Ohio. The energy use for January of 1982 and shown by 1-82 on the figures is still quite good.

In summary, the groundwater geothermal heat pump is proving itself to be a durable and efficient performer. Not only is it some four times more efficient than the natural gas furnace, for this particular household, but operates most efficiently when heating needs are most critical. It should be considered a truly viable use of a renewable energy source for the large areas of the United States which possess adequate aquifers.





TESTIMONY OF THE HONORABLE CARL T. CURTIS,  
MEMBER, BOARD OF DIRECTORS,  
ENERGY CYCLE, INC.,  
BEFORE THE SUBCOMMITTEE ON ENERGY AND  
AGRICULTURAL TAXATION,  
COMMITTEE ON FINANCE,  
UNITED STATES SENATE, ON S.1305

JULY 18, 1983

THE HONORABLE CARL T. CURTIS  
MEMBER, BOARD OF DIRECTORS  
ENERGY CYCLE, INC.  
SUITE 952  
NBC CENTER  
13TH AND O STREETS  
LINCOLN, NEBRASKA 68508  
(402) 474-4970

AND

MARK J. RIEDY, ESQUIRE  
SPRIGGS, BODE & HOLLINGSWORTH  
1015 FIFTEENTH STREET, N.W.  
SUITE 1100  
WASHINGTON, D.C. 20005  
(202) 393-8535

TESTIMONY OF THE HONORABLE CARL T. CURTIS,  
MEMBER, BOARD OF DIRECTORS,  
ENERGY CYCLE, INC.,  
BEFORE THE SUBCOMMITTEE ON ENERGY AND  
AGRICULTURAL TAXATION,  
COMMITTEE ON FINANCE,  
UNITED STATES SENATE, ON S.1305

JULY 18, 1983

I. INTRODUCTION

GOOD MORNING. MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE, I AM MARK J. RIEDY, COUNSEL TO ENERGY CYCLE, INC., HEADQUARTERED IN LINCOLN, NEBRASKA, AND AN ATTORNEY IN SPRIGGS, BODE & HOLLINGSWORTH, A WASHINGTON, D.C. LAW FIRM. I AM SUBMITTING THIS BRIEF WRITTEN TESTIMONY CONCERNING S. 1305, ENTITLED THE "RENEWABLE ENERGY TAX INCENTIVES ACT OF 1983," ON BEHALF OF THE HONORABLE CARL T. CURTIS, A FORMER SENATOR, LONG-STANDING MEMBER OF YOUR DISTINGUISHED PARENT COMMITTEE AND CURRENT BOARD MEMBER OF ENERGY CYCLE, INC.

ENERGY CYCLE, INC. IS ONE OF FEW U.S. COMPANIES RECYCLING NONFOSSIL ORGANIC WASTES INTO ENERGY AND VALUABLE CO-PRODUCTS THROUGH A PROCESS OF ANAEROBIC DIGESTION. WITH ITS PATENTED ANAEROBIC DIGESTION SYSTEM, ENERGY CYCLE, INC. BIOLOGICALLY FERMENTS THESE WASTES IN AIRTIGHT BIOMASS ENERGY EQUIPMENT TO PRODUCE BIOGAS. IN TURN, THIS BIOGAS, A BACTERIAL CREATION OF APPROXIMATELY 60 PERCENT METHANE-AND 40 PERCENT CARBON DIOXIDE-CONTAINING GAS IS CONVERTED INTO FUEL OR ELECTRICITY. UNLIKE NATURAL GAS, WHICH IS NON-RENEWABLE, METHANE IS A PARTICULARLY VALUABLE ALTERNATE ENERGY SOURCE BECAUSE IT IS RENEWABLE AND BECAUSE, ON THE BASIS OF BTU CONTENT, IT IS AN APPROXIMATE SUBSTITUTE FOR NATURAL GAS.

## II. POSITION

### A. STATUS OF THE ANAEROBIC DIGESTION INDUSTRY

WE WELCOME THIS OPPORTUNITY TO PRESENT TO THIS DISTINGUISHED SENATE PANEL OUR VIEWS, FULLY SUPPORTING THE QUALIFICATION OF ANAEROBIC DIGESTER SYSTEMS AS BIOMASS PROPERTY FOR THE 10 PERCENT ENERGY INVESTMENT TAX CREDIT IN S. 1305. FURTHER, WE SUPPORT THE TWO EXTENSIONS OF THE QUALIFICATION PERIOD FOR THE UTILIZATION OF THIS ENERGY TAX CREDIT FOR BIOMASS ENERGY PROPERTY PROPOSED IN THE IDENTICAL BILL. BEFORE DISCUSSING THE BREADTH OF THIS BILL AND ITS IMPACT ON ANAEROBIC DIGESTION, WE WILL HIGHLIGHT THE PRESENT AND PROJECTED STATUS OF THIS INDUSTRY.

## 1. THE AGRICULTURAL AND MUNICIPAL MARKETS

THE ANAEROBIC DIGESTION INDUSTRY PRIMARILY GENERATES REVENUES THROUGH TWO PRINCIPAL INDUSTRY SEGMENTS: 1) THE AGRICULTURAL MARKET AND 2) THE MUNICIPAL MARKET.

IN THE AGRICULTURAL MARKET, ANAEROBIC DIGESTER SYSTEMS ARE UTILIZED IN THE TREATMENT OF ANIMAL WASTE AND FOOD PROCESSING RESIDUES. THE POTENTIAL MARKET PRIMARILY INCLUDES DAIRY, BEEF, POULTRY, SWINE, CHEESE WHEY, AND CANNERY OPERATIONS. PRESENTLY, THIS MARKET SEGMENT INCLUDES ONLY THIRTEEN COMPANIES COMMERCIALY MARKETING METHANE DIGESTERS. FROM THE DESIGN AND CONSTRUCTION OF DIGESTER SYSTEMS FOR THIS MARKET SEGMENT, WE ESTIMATE THAT 1982 SALES APPROACHED \$3.7 MILLION WHILE 1990 SALES COULD AMOUNT TO OVER \$235.35 MILLION.

IN THE MUNICIPAL MARKET, ANAEROBIC DIGESTION SYSTEMS ALREADY ARE PREVALENT IN THE TREATMENT OF HUMAN WASTE. THESE SYSTEMS CONVERT SEPTIC TANK WASTES INTO A COMMERCIALY SALEABLE FERTILIZER PRODUCT. PRESENTLY, ONLY ONE COMPANY CONTROLS THE COMMERCIAL MARKETING OF ANAEROBIC DIGESTERS FOR MUNICIPALITIES. FROM THE DESIGN AND CONSTRUCTION OF DIGESTER SYSTEMS FOR THIS MARKET SEGMENT, WE ESTIMATE THAT 1982 SALES APPROACHED \$2 MILLION WHILE 1990 SALES COULD EXCEED \$300 MILLION.

TO GROW BEYOND THE CURRENT MODEST SALES LEVELS FOR AND TO PROMOTE COMPETITION WITHIN THE AGRICULTURAL AND MUNICIPAL MARKETS, THE ANAEROBIC DIGESTION INDUSTRY MUST BE ACCORDED ENERGY INVESTMENT TAX CREDITS.

IN THE AGRICULTURAL MARKET, THE GROWTH OF THIS INDUSTRY WILL BE SIGNIFICANTLY AFFECTED BY ITS ABILITY TO DEVELOP SYSTEMS THAT ARE ECONOMICALLY VIABLE FOR SMALLER SIZE FARMS. IN ADDITION TO TECHNOLOGICAL IMPROVEMENTS, THE ABILITY TO UTILIZE A 10 PERCENT ENERGY INVESTMENT TAX CREDIT IN THE FIRST YEAR OF A DIGESTER'S OPERATION COULD DETERMINE ITS FEASIBILITY FOR SMALL SCALE FARMS.

IN THE MUNICIPAL MARKET, THE PURCHASERS OF ANAEROBIC DIGESTION SYSTEMS FOR MUNICIPAL WASTE TREATMENT PLANTS OFTEN HAVE BEEN TAX EXEMPT INSTITUTIONS. THUS, THE IMPACT OF AN ENERGY INVESTMENT TAX CREDIT IN THOSE SITUATIONS IS NON-EXISTENT. NEVERTHELESS, IN RECENT YEARS, PRIVATELY OWNED FINANCE PARTNERSHIPS HAVE DEVELOPED TO ASSIST MUNICIPALITIES MEET THEIR GROWING FINANCIAL NEEDS. THE PARTNERSHIPS CONSTRUCT WASTE TREATMENT SYSTEMS WITH PRIVATE SECTOR DOLLARS AND LEASE THEM BACK TO MUNICIPALITIES AT REASONABLE RATES. IN THESE TAX LEASE ARRANGEMENTS, THE PARTNERSHIPS WOULD BENEFIT FROM THE TAX CREDITS AND ACCELERATED DEPRECIATION ALLOWANCES ASSOCIATED WITH SUCH AN INVESTMENT. ON THE OTHER HAND, MUNICIPALITIES WOULD OBTAIN A CONVENIENT SOURCE

OF FINANCIAL ASSISTANCE. HERE, THE IMPACT OF AN ENERGY TAX CREDIT ON THESE ARRANGEMENTS WOULD BE SIGNIFICANT.

2. ECONOMIC, ENVIRONMENTAL AND  
POLITICAL SIGNIFICANCE

THE DEVELOPMENT OF THE ANAEROBIC DIGESTION INDUSTRY CAN PROVIDE SIGNIFICANT BENEFITS TO THE UNITED STATES IN TERMS OF ECONOMIC, ENVIRONMENTAL, AND POLITICAL WELFARE.

ECONOMICALLY, THE GROWTH OF THE INDUSTRY SIGNALS BENEFITS BOTH THROUGH THE REVENUES GENERATED FROM DIGESTER SALES AND THROUGH THE POTENTIAL ECONOMIC SALVATION IT MAY PROVIDE FOR THE HARD HIT AGRICULTURAL SECTOR OF THE ECONOMY. ANAEROBIC DIGESTION MAY PROVIDE AN ADDITIONAL CASH CROP THAT COULD PERMIT SURVIVAL FOR MANY MARGINAL FARM OPERATIONS. ADDITIONALLY, THE CREATION OF NEW EMPLOYMENT OPPORTUNITIES FOR OUR NATION'S HARD PRESSED UNEMPLOYED CITIZENS THROUGH A VIBRANT ANAEROBIC DIGESTION INDUSTRY WOULD DECREASE ECONOMIC SUFFERING AND ENHANCE THE FISCAL VITALITY OF THE UNITED STATES.

ENVIRONMENTALLY, ANAEROBIC DIGESTION PROVIDES BENEFITS THROUGH THE PROPER TREATMENT AND DISPOSAL OF AGRICULTURAL AND MUNICIPAL WASTES. THIS TREATMENT IS ESPECIALLY IMPORTANT FOR OPERATIONS CLOSE TO POPULATION CENTERS OR WATER

FACILITIES. IT ELIMINATES NOXIOUS ODORS AND REDUCES THE DANGER OF WATER POLLUTION.

FINALLY, THE POLITICAL IMPLICATIONS OF A VIABLE ANAEROBIC DIGESTION INDUSTRY ARE POTENTIALLY SIGNIFICANT. THE DEGREE TO WHICH OUR AGRICULTURAL SECTOR BECOMES ENERGY SELF-SUFFICIENT MAY WELL GUARANTEE OUR FOOD SUPPLY DURING TIMES OF NATIONAL EMERGENCY IF EXTERNAL ENERGY SOURCES ARE INTERRUPTED OR CUT-OFF.

B. S. 1305

CONGRESS HAS COMMITTED ITSELF TO THE DEVELOPMENT OF RENEWABLE ALTERNATE ENERGY SOURCES THROUGH INCENTIVE-BASED LEGISLATION TO INSURE A STRONG AND CONTINUED INDEPENDENT BASE OF ENERGY FOR THE UNITED STATES. THE ANAEROBIC DIGESTION INDUSTRY, IN ITS RECYCLING OF NONFOSSIL ORGANIC WASTES INTO RENEWABLE ALTERNATE ENERGY, CLEARLY FALLS WITHIN THE INTENDED SCOPE OF THIS COMMITMENT. NEVERTHELESS, THROUGH INADVERTENCE AND DESPITE ITS CLEAR INTENT TO THE CONTRARY, CONGRESS HAS NOT EXPRESSLY ENCOURAGED INVESTMENT INTO THIS INDUSTRY THROUGH ENERGY INVESTMENT TAX INCENTIVE LEGISLATION. THESE CREDITS ARE ESSENTIAL TO THE VITALITY OF THIS NASCENT INDUSTRY.

S.1305 EXPRESSLY WOULD INCLUDE ANAEROBIC DIGESTION EQUIPMENT WITHIN ITS PURVIEW. ITS "METHANE-CONTAINING GAS"

LANGUAGE, EMBODIED IN SECTION 7, ADEQUATELY WOULD COVER THE ANAEROBIC DIGESTION INDUSTRY FOR PURPOSES OF THE CRITICAL ENERGY INVESTMENT TAX CREDIT. WITH ITS EXPRESS INCLUSION IN THIS PROPOSED LEGISLATION, THE ANAEROBIC DIGESTION INDUSTRY WOULD OBTAIN EVEN FURTHER INCREASED TAX BENEFITS THROUGH THE TWO EXTENSIONS OF THE ELIGIBILITY PERIODS FOR THE BIOMASS TAX CREDITS IN SECTIONS 3 AND 4(A) OF S.1305.

S. 1305 WAS INTRODUCED BY SENATOR PACKWOOD ON MAY 17, 1983 ALONG WITH SIX CO-SPONSORS.<sup>1</sup>

AMONG OTHER THINGS, SECTION 7 OF 1305 WOULD AMEND SECTION 48(L)(15)(C)<sup>2</sup> (I.E. "BIOMASS PROPERTY PROVISION") OF THE INTERNAL REVENUE CODE OF 1954 (CODE), AS AMENDED, TO INCLUDE "METHANE-CONTAINING GAS" AS A "QUALIFIED FUEL" FOR PURPOSES OF SECTION 48(L)(3)(A)(III).<sup>3</sup> THUS, "QUALIFIED FUEL" WOULD INCLUDE "METHANE-CONTAINING GAS FOR FUEL OR ELECTRICITY, PRODUCED BY ANAEROBIC DIGESTION FROM NONFOSSIL WASTE MATERIALS AT FARMS OR OTHER AGRICULTURAL FACILITIES, AND AT FACILITIES FOR THE FIRST PROCESSING OF AGRICULTURAL PRODUCTS."<sup>4</sup> AS SUCH, EQUIPMENT (I.E. ANAEROBIC DIGESTER SYSTEMS) FOR CONVERTING AN ALTERNATE SUBSTANCE (I.E. NON-FOSSIL WASTE MATERIALS) INTO "METHANE CONTAINING GAS" (I.E. BIOGAS) WOULD QUALIFY FOR THE 10 PERCENT ENERGY INVESTMENT TAX CREDIT AS ELIGIBLE BIOMASS ENERGY PROPERTY.

SECTION 3 OF S.1305 WOULD AMEND SECTION 46(A)(2)(C)(I) OF THE CODE TO EXTEND THE 10 PERCENT ENERGY INVESTMENT TAX CREDIT FOR QUALIFIED BIOMASS PROPERTY FROM DECEMBER 31, 1985 THROUGH DECEMBER 31, 1990.<sup>5</sup> FURTHER, SECTION 4(A) OF S. 1305 WOULD AMEND SECTION 46(A)(2)(C) OF THE CODE TO INCLUDE A NEW "AFFIRMATIVE COMMITMENTS" PROVISION (I.E. SUBPARAGRAPH (IV)) FOR THIS SPECIFIC PROPERTY.<sup>6</sup>

THROUGH S. 1305'S AFFIRMATIVE COMMITMENTS PROVISION, SENATOR PACKWOOD NOTED IN HIS INTRODUCTORY REMARKS, "BIO-MASS . . . PROJECTS BEGUN BY DECEMBER 31, 1990, WILL CONTINUE TO BE ELIGIBLE FOR TAX CREDITS UNTIL DECEMBER 31, 1995 IF CERTAIN CONDITIONS ARE MET. AFFIRMATIVE COMMITMENTS ASSURE COMPANIES THAT PROJECTS BEGUN BUT NOT COMPLETED BY 1990 WILL CONTINUE TO BE ELIGIBLE FOR TAX INCENTIVES IN 1995."<sup>7</sup> THUS TO DEMONSTRATE THE REQUISITE AFFIRMATIVE COMMITMENTS, A TAXPAYER PROJECT SPONSOR FIRST MUST COMPLETE ALL FEASIBILITY STUDIES AND APPLY FOR ALL ENVIRONMENTAL AND CONSTRUCTION PERMITS BEFORE JANUARY 1, 1991. SECONDLY, A SPONSOR MUST EXECUTE CONTRACTS "FOR AT LEAST 50 PERCENT OF THE REASONABLY ESTIMATED COST OF ALL EQUIPMENT" FOR THE PROJECT OR "AT LEAST 50 PERCENT OF THE REASONABLY ESTIMATED COST FOR ALL EQUIPMENT ESPECIALLY DESIGNED FOR THE PROJECT."<sup>8</sup>

BECAUSE OF THE INCLUSION OF THESE CRITICAL BIOMASS TAX INCENTIVE PROVISIONS, ENERGY CYCLE, INC. ENTHUSIASTICALLY

SUPPORTS S.1305. WE FIRMLY BELIEVE THAT S. 1305 PROMOTES THE LONG-STANDING, CONGRESSIONALLY-CONTEMPLATED PUBLIC POLICY GOALS OF ENCOURAGING THE BROADEST POSSIBLE PROMOTION OF ALTERNATE ENERGY SOURCES. AS SUCH, WE RECOMMEND THAT CONGRESS EXPEDITIOUSLY PASS THIS CRITICAL TAX INCENTIVE MEASURE.

C. ENERGY INVESTMENT TAX CREDITS ON BIOMASS PROPERTY

UNDER THE ENERGY TAX ACT OF 1978, PUB. L. NO. 95-618,<sup>9</sup> CONGRESS ESTABLISHED THROUGH DECEMBER 31, 1982 A 10 PERCENT ENERGY INVESTMENT TAX CREDIT FOR BOILERS, BURNERS, AND RELATED POLLUTION CONTROL AND FUEL HANDLING EQUIPMENT WHICH PRIMARILY UTILIZE FUELS OTHER THAN OIL OR NATURAL GAS (I.E., "ALTERNATE SUBSTANCE").<sup>10</sup> EQUIPMENT EMPLOYED TO CONVERT THESE ALTERNATE SUBSTANCES INTO A "SYNTHETIC LIQUID, GASEOUS, OR SOLID FUEL" ALSO WAS MADE ELIGIBLE FOR THE CREDIT,<sup>11</sup> ALTHOUGH NOT EXPRESSLY MENTIONED, CONGRESS CLEARLY INTENDED PROPERTY USING BIOMASS FUELS TO QUALIFY FOR THE CREDIT AS "ENERGY PROPERTY" WITHIN THE DEFINITION OF "ALTERNATE ENERGY PROPERTY."<sup>12</sup>

UNDER THE WINDFALL PROFITS TAX ACT OF 1980, PUB. L. NO. 96-223,<sup>13</sup> CONGRESS CONTINUED THIS 10 PERCENT ENERGY INVESTMENT TAX CREDIT FOR THIS SPECIFIC PROPERTY AND EXTENDED THE CREDIT'S QUALIFICATION PERIOD THROUGH DECEMBER 31,

1985,<sup>14</sup> IT ALSO EXPRESSLY DESIGNATED A 10 PERCENT ENERGY CREDIT FOR BIOMASS ALTERNATE ENERGY PROPERTY.<sup>15</sup>

IN THE CONFERENCE REPORT TO THE WINDFALL PROFITS TAX ACT, CONGRESS EXPLICITLY OUTLINED THE SCOPE IT INTENDED FOR THE TERM "BIOMASS."<sup>16</sup> THERE, CONGRESS PROVIDED THAT

BIOMASS IS GENERALLY ANY ORGANIC SUBSTANCE OTHER THAN OIL, NATURAL GAS OR COAL, OR PRODUCT OF OIL OR NATURAL GAS OR COAL. FOR THIS PURPOSE, BIOMASS INCLUDES WASTE, SEWAGE, SLUDGE, GRAIN, WOOD, OCEANIC AND TERRESTRIAL CROPS AND CROP RESIDUES AND INCLUDE WASTE PRODUCTS WHICH HAVE A MARKET VALUE. THE CONFEREES ALSO INTEND THAT THE DEFINITION OF BIOMASS DOES NOT EXCLUDE WASTE MATERIALS, SUCH AS MUNICIPAL AND INDUSTRIAL WASTE, WHICH INCLUDE SUCH PROCESSED PRODUCTS OF OIL, NATURAL GAS OR COAL SUCH AS USED PLASTIC CONTAINERS AND ASPHALT SHINGLES.<sup>17</sup>

CLEARLY, ANAEROBIC DIGESTION EQUIPMENT FALLS WITHIN THE CONGRESSIONALLY INTENDED SCOPE OF QUALIFIED BIOMASS PROPERTY.

DESPITE THE INTENT OF CONGRESS SO PLAINLY EXPRESSED IN THE CONFERENCE REPORT, THE STATUTORY LANGUAGE USES THE TERM "QUALIFIED FUEL" INSTEAD OF THE PHRASE "SYNTHETIC LIQUID, GASEOUS, OR SOLID FUEL" TO DEFINE ELIGIBLE BIOMASS ALTERNATE ENERGY CONVERSION EQUIPMENT<sup>18</sup> AND INADVERTENTLY DEFINES "QUALIFIED FUEL" IN A MANNER INCONSISTENT WITH ITS CLEARLY EXPRESSED CONGRESSIONAL INTENT. SPECIFICALLY, CONGRESS DEFINED "QUALIFIED FUEL" AT SECTION 48(1)(15)(C) OF THE CODE AS

- (I) ANY SYNTHETIC SOLID FUEL, AND
- (II) ALCOHOL FOR FUEL PURPOSES IF THE PRIMARY SOURCE OF ENERGY FOR THE FACILITY PRODUCING THE ALCOHOL IS NOT OIL OR NATURAL GAS OR A PRODUCT OF OIL OR NATURAL GAS.<sup>19</sup>

THIS RESTRICTIVE DEFINITION DOES NOT EXPRESSLY INCLUDE METHANE-CONTAINING GAS FOR FUEL OR ELECTRICITY, PRODUCED BY ANAEROBIC DIGESTION FROM NONFOSSIL WASTE MATERIALS. FOR THAT REASON, DESPITE THE CONGRESS' ULTIMATE AIM AS EXPRESSED SO CLEARLY IN THE CONFERENCE REPORT, ANAEROBIC DIGESTION EQUIPMENT CONVERTING AN ALTERNATE SUBSTANCE (I.E., NONFOSSIL ORGANIC WASTES) INTO BIOMASS-DERIVED METHANE-CONTAINING GAS HAS BEEN INTERPRETED AS NOT QUALIFYING FOR THE ENERGY INVESTMENT TAX CREDIT. FORTUNATELY, S.1305 DOES REMOVE THE CONFUSION THAT CURRENTLY SURROUNDS THE ELIGIBILITY OF

ANAEROBIC DIGESTION PROPERTY FOR ENERGY INVESTMENT TAX  
CREDIT PURPOSES.

IN 1982, CONGRESSMAN BEREUTER AND SENATOR MATSUNAGA -- WITH CO-SPONSORS SENATORS WALLOP AND GRASSLEY -- INTRODUCED H.R. 6131 (ON APRIL 21)<sup>20</sup> AND S. 2766 (ON JULY 21),<sup>21</sup> RESPECTIVELY, CONFIRMING WHAT HAS BEEN CONGRESS' INTENTION ALL ALONG -- NAMELY, THAT ANAEROBIC DIGESTION EQUIPMENT BE ELIGIBLE FOR APPROPRIATE TAX CREDITS. THOSE IDENTICALLY-DRAFTED BILLS WOULD HAVE INCLUDED THIS METHANE-CONTAINING GAS AS A QUALIFIED FUEL. SIMILARLY, THEY WOULD HAVE PERMITTED ANAEROBIC DIGESTION EQUIPMENT, PLACED IN SERVICE - AFTER DECEMBER 31, 1982, TO OBTAIN THE 10 PERCENT ENERGY INVESTMENT CREDIT. REGRETABLELY, BECAUSE OF THE PRESS OF OTHER EVENTS, CONGRESS TOOK NO ACTION ON THOSE PROPOSED MEASURES IN 1982.

ON MARCH 3, 1983, CONGRESSMEN BEREUTER AND HEFTEL REINTRODUCED CONGRESSMAN BEREUTER'S 1982 MEASURE AS H.R. 1876.<sup>22</sup> ON MAY 19, 1983, TWO DAYS FOLLOWING SENATOR PACKWOOD'S INTRODUCTION OF S. 1305, CONGRESSMAN HEFTEL INTRODUCED S.1305'S COMPANION MEASURE, H.R. 3072.<sup>23</sup> S.1305 AND H.R. 3072 INCLUDE THE ANAEROBIC DIGESTER LANGUAGE OF H.R. 1876 IN SLIGHTLY DIFFERENT WAYS.<sup>24</sup> NONE OF THE OTHER ACTIVE RENEWABLE TAX INCENTIVE MEASURES WOULD COVER THE ANAEROBIC DIGESTION INDUSTRY.<sup>25</sup>

### III. CONCLUSION

THIS SUBCOMMITTEE TODAY HAS THE SPECIAL OPPORTUNITY TO ENTHUSIASTICALLY CONFIRM THE CLEAR AND LONG-STANDING CONGRESSIONAL INTENT TO QUALIFY ANAEROBIC DIGESTION EQUIPMENT FOR THE 10 PERCENT ENERGY INVESTMENT TAX CREDIT AND, THUS, PROMOTE THE PRODUCTION AND DEVELOPMENT OF CRITICAL ALTERNATE ENERGY SOURCES. IT CAN SUPPORT S. 1305 OR H.R. 3072 TO ACCOMPLISH THIS IMPORTANT RESULT.

A TAXPAYER ENGAGED IN AGRICULTURE USUALLY MUST SECURE THIRD-PARTY FINANCING IN ORDER TO INSTALL AN ANAEROBIC DIGESTER SYSTEM. THE APPLICATION OF THE ENERGY CREDIT TO THIS SYSTEM MAKES THIRD-PARTY FINANCING POSSIBLE. WITHOUT THE ENERGY CREDIT, THIS ALTERNATE ENERGY SOURCE WILL NOT BE UTILIZED TO ANY GREAT EXTENT.

THE SHORT TERM EFFECT ON GOVERNMENT REVENUES THROUGH THE USE OF THESE CREDITS BY THE ANAEROBIC DIGESTION INDUSTRY WILL BE MINIMAL. THE AVAILABILITY OF THESE ENERGY CREDITS FOR ANAEROBIC DIGESTER SYSTEMS WILL ENCOURAGE STRONG INVESTMENT INTO THE INDUSTRY. THUS, INVESTMENT-GENERATED INDUSTRY SALES WILL PROVIDE INCREASINGLY SIZABLE LONG-TERM TAXABLE INCOME FOR THE GOVERNMENT'S COFFERS.

THE ECONOMIC, ENVIRONMENTAL AND POLITICAL SIGNIFICANCE OF THE ANAEROBIC DIGESTION INDUSTRY TO THE CITIZENS OF THE UNITED STATES ARGUES IN FAVOR OF THE ENACTMENT OF S. 1305. SIMILARLY, THE IDENTICAL CONGRESSIONAL OVERSIGHT THAT EXCLUDED ANAEROBIC DIGESTION FROM THE ENERGY INVESTMENT TAX CREDIT ALSO EXCLUDED ANOTHER IMPORTANT ALTERNATE ENERGY TECHNOLOGY, I.E. WOOD GASIFICATION, FROM THAT CREDIT. AS SUCH, A TECHNICAL CORRECTION TO THE TAX CODE TO ELIMINATE THE ADVERSE EFFECTS OF THIS OVERSIGHT IS CRITICALLY NECESSARY.

FOOTNOTES

1 THE CO-SPONSORS INCLUDE SENATORS MATSUNAGA, DURENBERGER, MOYNIHAN, BAUCUS, MITCHELL, AND PELL. S. 1305, 98TH CONG., 1ST SESS., 129 CONG. REC. S 6861-6863.

2 SECTION 7 OF S. 1305, 129 CONG. REC., SUPRA AT S 6862, AMENDING 26 U.S.C § 48(L)(15)(C).

3. 26 U.S.C. § 48(L)(3)(A)(III).

4. SECTION 7 OF S. 1305, 129 CONG. REC., SUPRA AT S 6862. IN HIS INTRODUCTORY REMARKS, SENATOR PACKWOOD NOTED THAT THE LANGUAGE "FACILITIES FOR THE FIRST PROCESSING OF AGRICULTURAL PRODUCTS" WOULD INCLUDE AMONG OTHER SIMILAR FACILITIES, "PACKING PLANTS AND CANNERIES." 129 CONG. REC., SUPRA AT S 6861.

5. SECTION 3 OF S. 1305, 129 CONG. REC., SUPRA AT S 6862, AMENDING 26 U.S.C. § 46(A)(2)(C)(I).

6. SECTION 4(A) OF S. 1305, 129 CONG. REC., SUPRA AT S 6862, AMENDING 26 U.S.C. § 46(A)(2)(C)(IV).

7. 129 CONG. REC., SUPRA AT S 6861.

8. SECTION 4(A) OF S. 1305, 129 CONG. REC., SUPRA AT S 6862.

9 26 U.S.C. § 1 NOTE ET SEQ.

10 SECTION 301 OF PUB. L. NO. 95-618 AMENDING 26 U.S.C §§ 46, 48; H.R. CONF. REP. NO. 817, 96TH CONG., 2D SESS. 131-132 (1980) (CRUDE OIL WINDFALL PROFITS TAX ACT OF 1980).

11 SECTION 301 OF PUB. L. NO. 95-618 AMENDING 26 U.S.C. § 48; H.R. CONF. REP. NO. 817, SUPRA.

12 Id.

13 26 U.S.C. § 1 NOTE ET SEQ.

14 SECTION 221 OF PUB. L. NO. 96-223 AMENDING 26 U.S.C. § 46(A)(2)(C)(i); H.R. CONF. REP. NO. 817, SUPRA AT 132.

15 Id.

16 H.R. CONF. REP. NO. 817, SUPRA AT 132.

17 Id.

18 26 U.S.C. § 48(L)(15)(B)(ii).

19 Id. AT § 48(L)(15)(C).

20 H.R. 6131, 97TH CONG., 2D SESS. (1982).

21 S. 2766, 97TH CONG., 2D SESS. (1982).

22 H.R. 1876, 98TH CONG., 1ST SESS. (1983).

23 H.R. 3072, 98TH CONG., 1ST SESS. (1983).

CO-SPONSORS INCLUDE CONGRESSMEN FOWLER, MATSUI, DUNCAN, FLIPPO, FUQUA, UDALL, OTTINGER, FISH, MINETA, CORRADA, JEFFORDS, WYDEN, WILLIAMS, WIRTH, BEDELL, WOLPE, HARKIN, BEREUTER AND LONG; AND CONGRESSWOMEN KENNELLY AND SCHNEIDER.

24 THE "METHANE-CONTAINING GAS" LANGUAGE OF SECTION 201 OF H.R. 3072 IS IDENTICAL TO THAT CONTAINED IN SECTION 7 OF S. 1305, BUT FOR ONE EXCEPTION. H.R. 3072'S LANGUAGE WOULD NOT LIMIT THE FEEDSTOCK FOR PRODUCING "METHANE-CONTAINING GAS" TO NONFOSSIL WASTE MATERIALS "AT FARMS OR OTHER AGRICULTURAL FACILITIES, AND AT FACILITIES FOR THE FIRST PROCESSING OF AGRICULTURAL PRODUCTS."

25 THESE BILLS INCLUDE AS FOLLOWS:

- A. H.R. 1595, 98TH CONG., 1ST SESS. (INTRODUCED BY CONGRESSMAN WIRTH ON FEBRUARY 23, 1983).

- B. S. 616, 98TH CONG., 1ST SESS. (INTRODUCED BY SENATOR DURENBERGER ON FEBRUARY 28, 1983).
- C. S. 617, 98TH CONG., 1ST SESS. (INTRODUCED BY SENATOR STENNIS ON FEBRUARY 28, 1983).
- D. S. 618, 98TH CONG., 1ST SESS. (INTRODUCED BY SENATOR PERCY ON FEBRUARY 28, 1983).
- E. S. 619, 98TH CONG., 1ST SESS. (INTRODUCED BY SENATOR TSONGAS ON MAY 26, 1983).
- F. H.R. 1775, 98TH CONG., 1ST SESS. (INTRODUCED BY CONGRESSMAN FUQUA ON MARCH 2, 1983).
- G. S. 1396, 98TH CONG., 1ST SESS. (INTRODUCED BY SENATOR DOMENICI ON MAY 26, 1983).
- H. H.R. 3283, 98TH CONG., 1ST SESS. (INTRODUCED BY CONGRESSMAN JENKINS ON JUNE 13, 1983).
- I. H.R. 3358, 98TH CONG., 1ST SESS. (INTRODUCED BY CONGRESSMAN SHANNON ON JUNE 16, 1983).

(S. 1237, July 18, 1983)

STATEMENT OF KARL S. LANDSTROM, ATTORNEY-AT-LAW, 510 NORTH EDISON STREET, ARLINGTON, VIRGINIA, 22203, BEFORE THE SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION ON S. 1237, A BILL TO CLARIFY THE DEFINITION OF GEOTHERMAL ENERGY FOR PURPOSES OF CERTAIN INVESTMENT TAX CREDITS

Mr. Chairman, and members of the Committee, my name is Karl S. Landstrom, an attorney-at-law in Arlington, Virginia. My interest in geothermal energy arises from two sources: (1) my former service as Director of the Bureau of Land Management in the Department of the Interior; and (2) my recent service as special counsel for Geothermal Resources International, Inc., of Menlo Park, California.

I wish to commend Senators Symms and McClure for having introduced S. 1237 and also Congressman Hall of Ohio for having sponsored an identical House bill. I have read Congressman Hall's proposed statement on the bill, and I find myself in full agreement with his testimony. Certainly this legislation should become law if the country is fully to have the benefit of geothermal resources having temperatures below the limit of 50 degrees Celsius which has been set by the IRS for purposes of the investment tax credits.

The bill is worthy of enactment from another standpoint: it is an illustration of a perfectly constitutional method by which the Congress can proceed toward correcting an agency-made rule which appears to conflict with legislative intention or otherwise is not in the public interest.

Thank you, Mr. Chairman, for this opportunity to comment on the bill.

XXXXXX

WRITTEN STATEMENT OF  
McDONNELL DOUGLAS ASTRONAUTICS COMPANY

Regarding S. 1305

Submitted to the  
SUBCOMMITTEE ON ENERGY AND AGRICULTURAL TAXATION  
of the  
COMMITTEE ON FINANCE  
UNITED STATES SENATE

August 10, 1983

SUMMARY

McDonnell Douglas Astronautics Company has been actively engaged in the development of solar central receiver technology for the last 10 years. This has involved basic engineering, manufacturing of prototype heliostats, research, and economic and technical analysis aimed at commercializing solar thermal central receiver technology in the United States. Our principal interest has been to develop a market for the commercial use of heliostat hardware (two axis tracking mirrors), a principal component of solar central receiver plants. We believe our interests are typical of solar suppliers for major plants. To illustrate the situation, we will discuss a specific proposed plant.

At the present time, McDonnell Douglas is proposing to construct a 100 megawatt solar central receiver project, Solar-100, in the Lucerne Valley of California on a site owned by Southern California Edison Company (SCE). If SCE and McDonnell Douglas can agree to go forward with this project within the next six months, and the California Public Utilities Commission approves of the various contractual arrangements that need to be reviewed by it, final design and initial construction can commence in 1984. If construction commences in 1984, the first half of the plant is scheduled to come on line by December, 1987, and the second half of the plant will come on line by December, 1991.

The project involves significant risks and costs in commercializing a new technology involving large heliostats, a molten salt heat transfer system, and various other equipment that have not been used before. Because the initial capital costs and risks are very high, and the pay back period as well as the rate of return well below normal corporate hurdles, financing by unaffiliated third parties is not feasible and the project can only be financed by funding from affiliated equipment suppliers. If the energy tax credits are not available, McDonnell Douglas and other affiliated suppliers will not participate in this project. We are considering this investment principally because of our belief that a future market for the purchase of solar central receiver plants by utilities may develop. McDonnell Douglas and the other equipment suppliers to Solar-100 could become the providers of goods and services in that market.

This project alone will create more than 6700 man-years of jobs in the next 35 years and reduce the importation of oil by 800,000 barrels per year at a savings of \$24 million a year (at oil priced at \$30 a barrel). Not only will these jobs and savings accrue if the project is successful, but other jobs and further savings will occur if the technology is commercially demonstrated and the other plants built. Additionally, there are significant opportunities for export of this technology to other countries, further assisting the U.S. balance of payments.

This project is on the drawing boards right now. In the next few months, decisions need to be made and millions of dollars of funds committed to make this project go forward. We cannot commit these funds and make these decisions to go forward without the passage of legislation (either S. 1396 or S. 1305) allowing us to take the energy tax credits for this project.

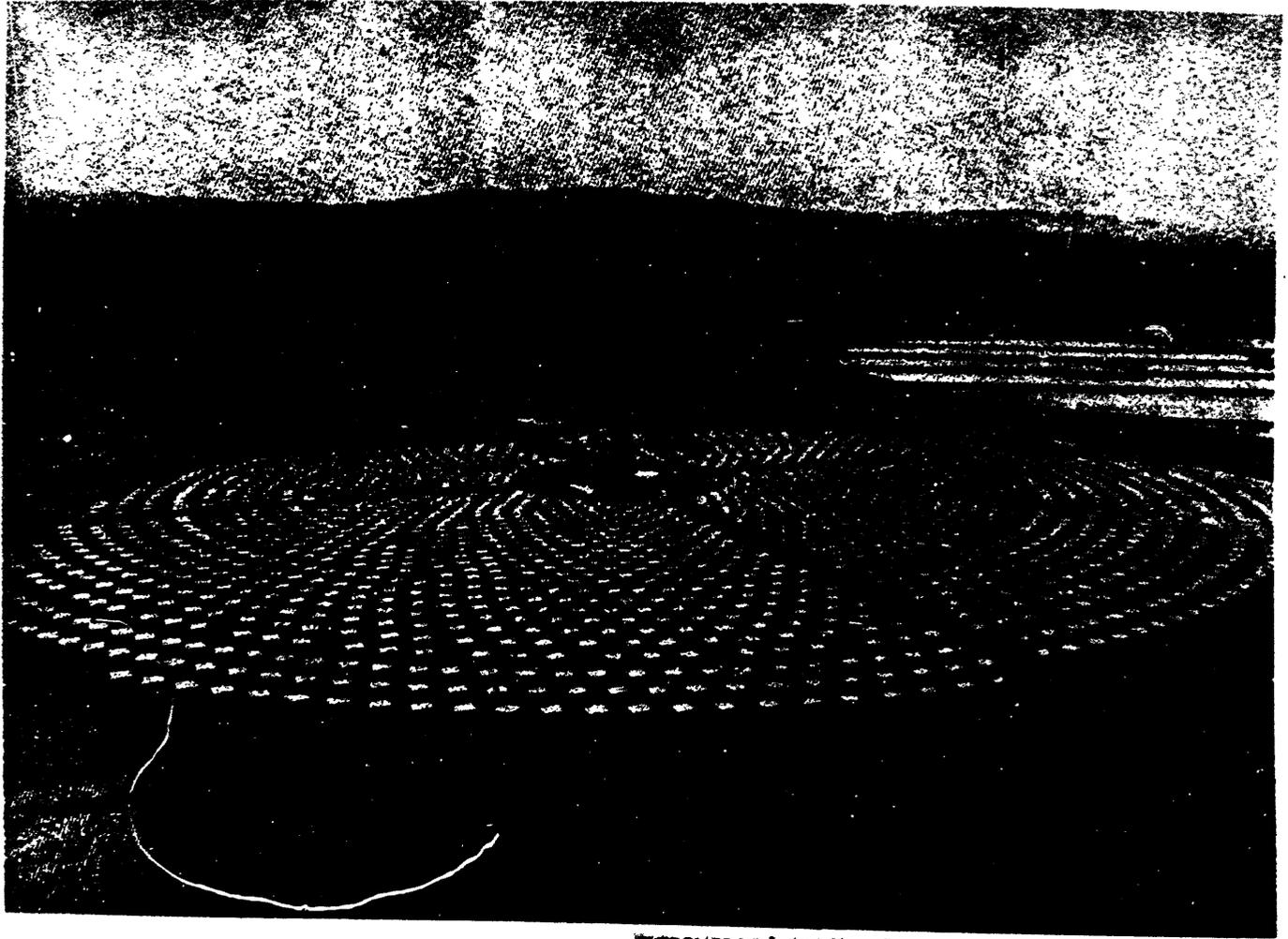
BRIEF HISTORY

The progress to date in the development of solar central receiver technology has been characterized by a cooperative effort by the Federal government, a number of electric utilities, and a number of companies like McDonnell Douglas Astronautics, that have been keenly interested in participating in the development of a market for the equipment that can efficiently use the sun's energy for large scale commercial power production.

Solar One

Through the involvement and support of the Congress and the Department of Energy over the last 10 years, there are several significant events heralding the development of the solar central receiver as a viable energy source for electric generation in the United States. These events culminated on April 12, 1982, when a 10 megawatt solar central receiver pilot plant near Barstow, California, became operational and on November, 1982, when the facility was dedicated. (See attached photo.)

This plant, known as Solar-One, is undergoing a 5-year test program. It is currently the world's largest electric generating station being successfully powered by solar energy.



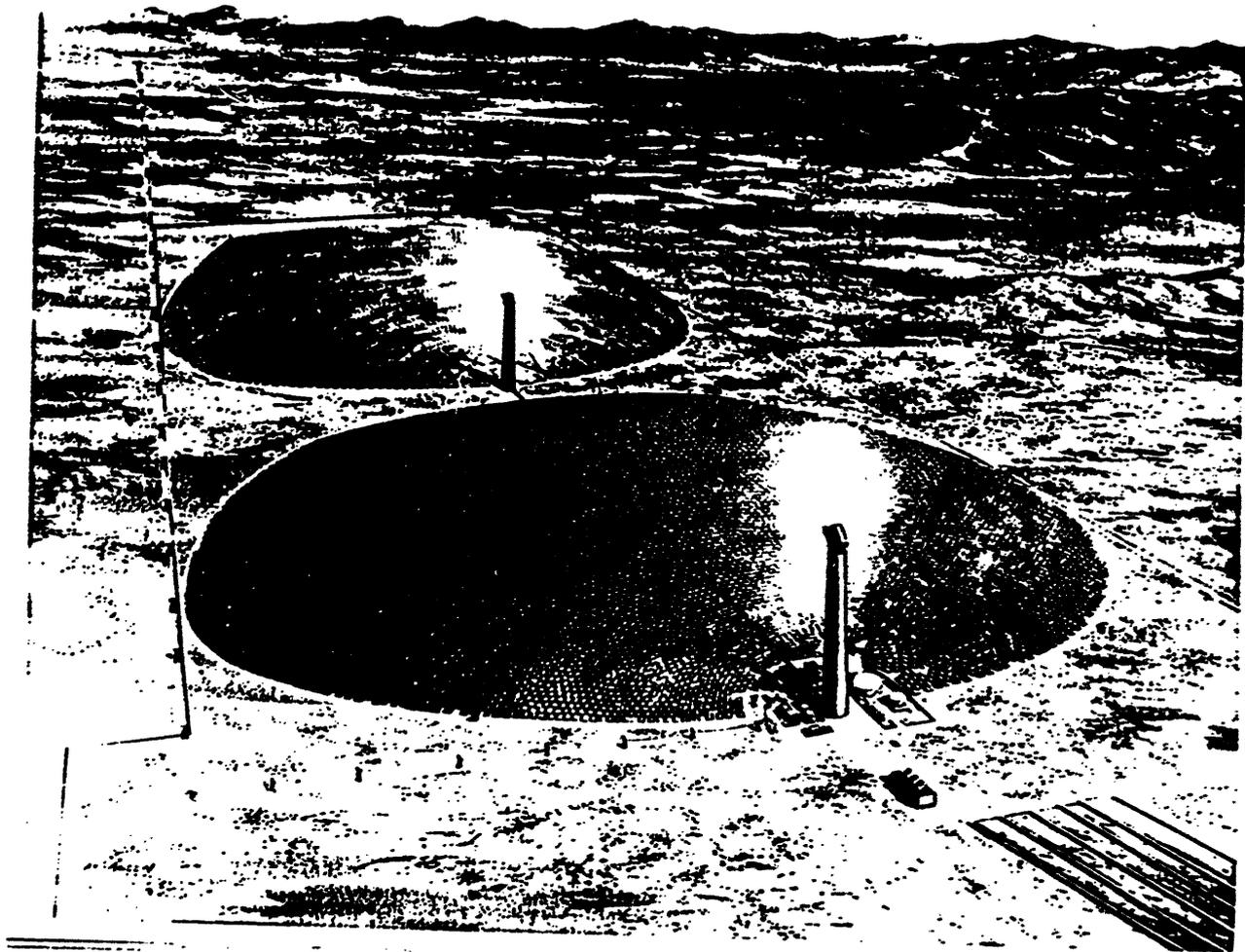
ENERGY PROGRAMS

Solar-100

Last year, as a follow up to the research and development that has been invested in Solar-One and the expertise gained thereunder, Southern California Edison requested proposals from private industry for the development of the first commercial scale solar central receiver plant at SCE's Lucerne Valley site in California's Mohave Desert. Four companies, including McDonnell Douglas Astronautics, responded to the SCE request and expressed confidence in the technologies that are available and optimism that financing can be worked out.

Southern California Edison has been a utility leader in demonstrating interest in renewable energy resources generally, with a commitment to develop as part of its power generating facilities, 2100 megawatts of renewable energy resources by the early 1990's. Of this amount, 890 megawatts have been designated to come from solar energy. In addition, there is strong interest among other utilities in the Southwest to participate in more than 49 follow-on, 100 megawatt, central receiver plants for capacity additions by the year 2000.

Pursuant to a more recent request of SCE for offers to build a solar central receiver power plant at this site, we have submitted an offer to SCE on June 10, 1983, and hope to begin negotiations with SCE in the next few weeks. Attached to this statement is a design concept illustration of our proposal.



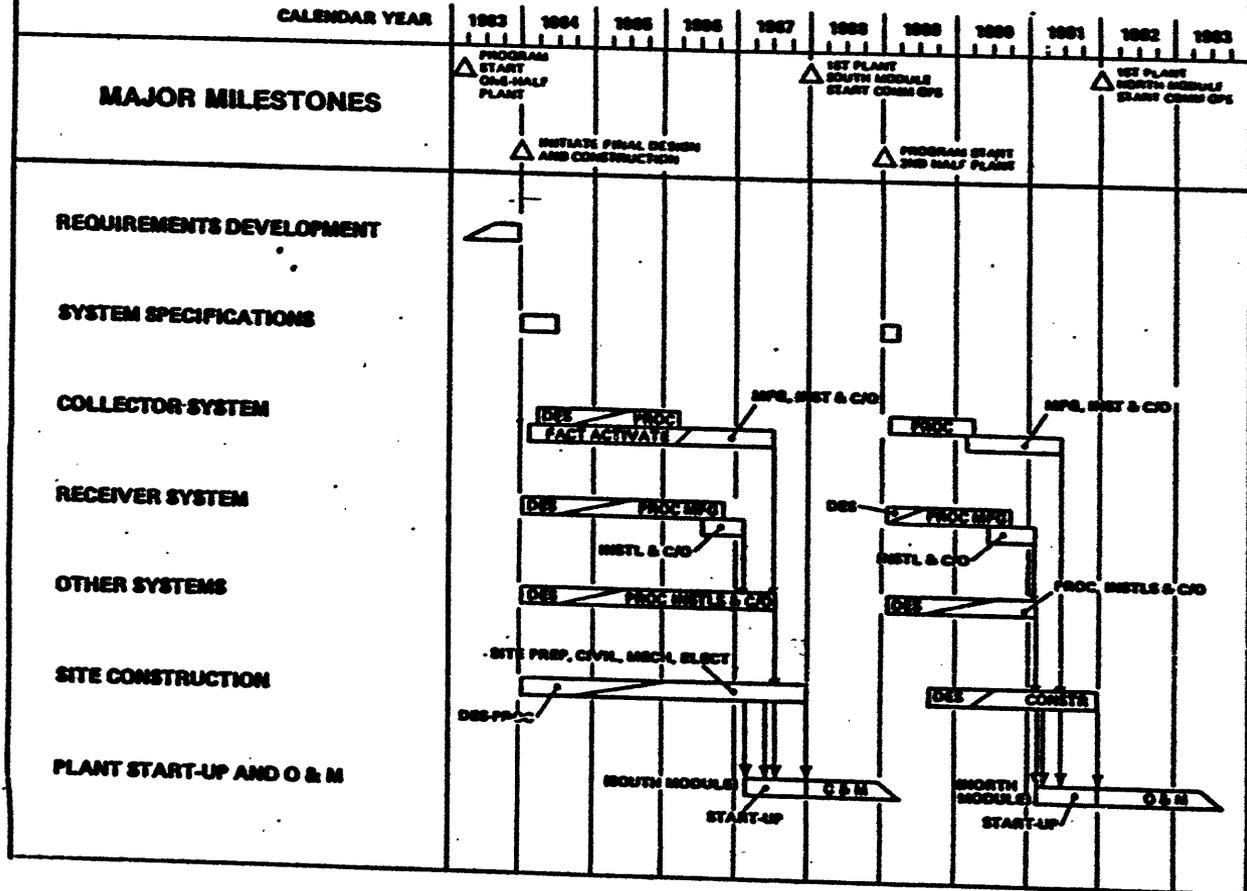
SOLAR-100 PROGRAM SUMMARY SCHEDULE

A schedule summarizing the major milestones in the development of Solar-100 is also attached to this statement. Even if we are able to initiate final design and begin construction of the plant in early 1984, the first half of the plant will not become operational until early 1988. The final design, site preparation, civil, mechanical and electrical work will take approximately four years to complete. Following check out of this facility, the second half of the plant will not come on line until late 1991 or early 1992, if initiated in 1989. Therefore, the complete Solar-100 plant will take approximately eight years to bring on line, from the beginning of the final design and construction to the placing in service of the last of the 10,000 heliostats and other associated equipment.

Enactment of either S. 1396 or S. 1305 would allow us to receive the energy tax credits for energy property placed in service prior to the end of 1992. The schedule for completion of the Solar-100 project demonstrates the importance of extending the availability of the energy tax credit in order to allow investors in this project to receive the benefits of the credit.

# SOLAR 100 PROGRAM SUMMARY SCHEDULE (FIRST PLANT)

VF28771



PROJECT REVENUE IMPACT

The project costs to build this commercial demonstration plant are going to be in the hundreds of millions of dollars. SCE has told us that it would buy energy from an independent power producer which would own the plant, rather than own the entire plant itself. Hence, the required capital investment must come from non-utility sources like ourselves if the project is to go forward.

We estimate that over the eight-year construction life of the full Solar-100 Project, there will be approximately \$80 million in energy tax credits available to project sponsors. We also estimate that there will be tax revenues generated to the Treasury, both during this construction period and over the 30-year life of the plant, of between \$800 million and \$2.5 billion. At \$30 a barrel, this solar plant will displace the need to import \$24 million worth of foreign oil a year into the United States.

The energy tax credits would appear to us to be a worthwhile investment by the Congress to foster this technology. The returns to the U.S. Treasury over the life of the project are far greater than the amount of the credits. Without the credits, our analysis shows that returns to project participants are reduced by 32% and funding and credit support levels will be increased by 20%. This makes the funding of the project unacceptable to ourselves and others who would like to

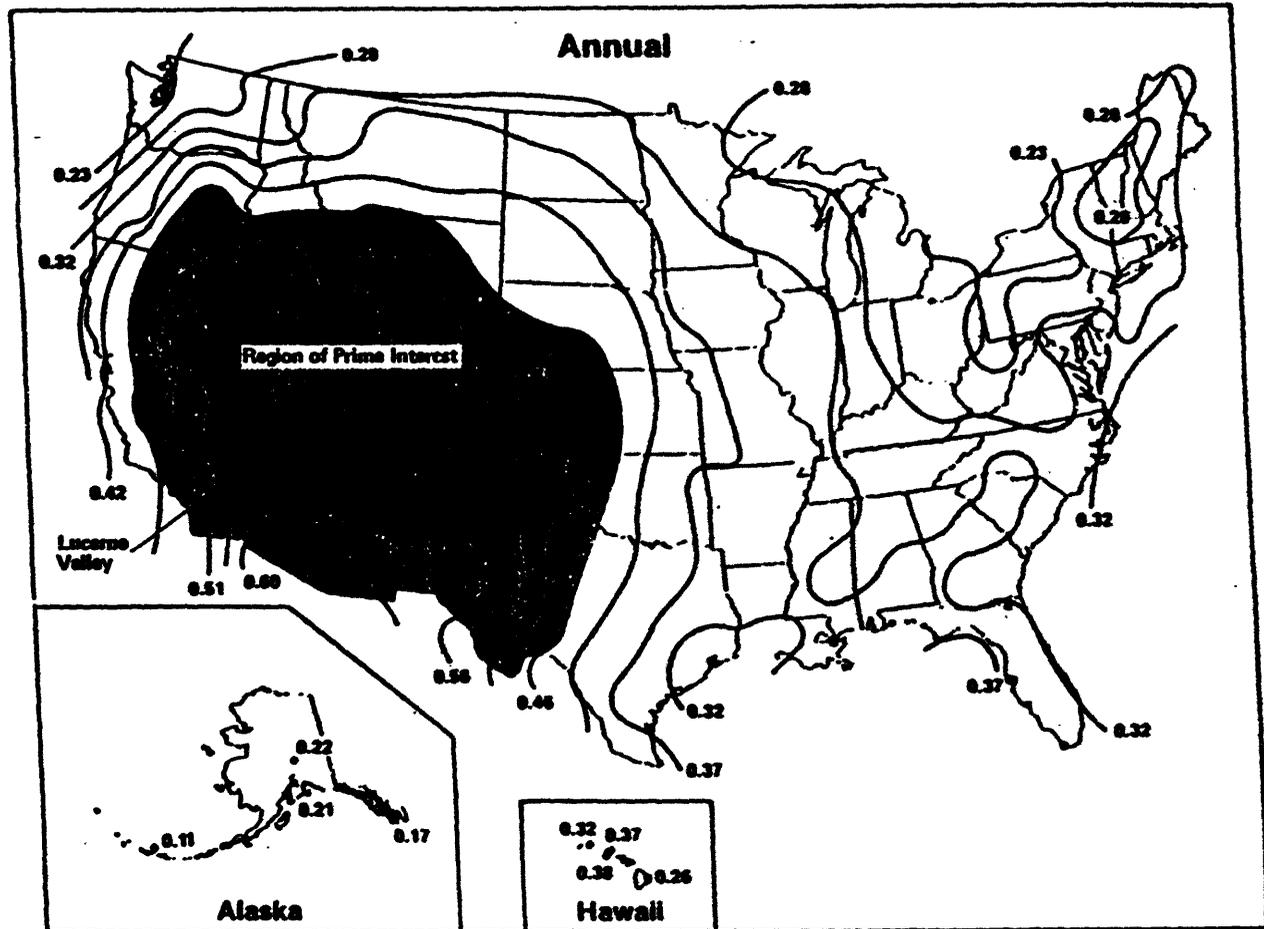
go forward with us. Additionally, without the credits, the payback period is an unacceptably long 17 years.

#### PROSPECTS FOR COMMERCIAL DEPLOYMENT OF THIS TECHNOLOGY

If this project proves to be a commercial success, we believe that we could build as many as six plants by the year 2002, and 35 plants in California alone by the year 2020. In order for the Committee to appreciate where other future plants may be sited, we are attaching a solar insolation map. This map identifies the regions of prime interest for utilization of solar central receiver technology. Stretching from Texas in the East to California in the west and as far north as the southern half of Idaho and Wyoming, there are vast quantities of available land and sunlight for development of solar central receiver electric generating plants throughout the western United States.

#### JOB IMPACT

The jobs created by the development and deployment of this technology are not limited to the Lucerne Valley site. Attached to this statement is an abbreviated list of the potential industrial and engineering firms which may be involved with us in the design and construction of this project. Over 400 firms, both large and small, are potential suppliers of goods and services to this project and, although



**Yearly Average Direct Normal Irradiance  $I$  (in  $\text{kW}/\text{m}^2$ ) During Daylight Hours for the United States.**  
 Reference: SERI/TR-631-716

# JOBS RESULT FROM A NEW TAX-PAYING, EXPORTING INDUSTRY BENEFITING MANY STATES

VGC7704-1

<u>PRODUCT</u>	<u>APPROXIMATE DOLLAR VALUE (1983 10<sup>6</sup> \$)</u>	<u>POTENTIAL U. S. SUPPLIERS</u>	<u>SUPPLIER LOCATION</u>
<b>HELIOSTATS</b>			
LAMINATE MIRRORS	20	BIRNBAUMER BUCHHEIM INDUSTRIES VAN HUFFEL TUBE BINKLEY WESTERN GEAR	CHANDLER, AZ REEDLEY, CA WARREN, OH WARRENTON, MO EVERETT, WA
ROLL FORMED BEAMS	12		
MAIN BEAM DRIVE HOUSING } PEDestal	8 8		
LINEAR ACTUATORS	4	ACE BUNLER	ANAHEIM, CA
HARMONIC DRIVE	8	DUFF-MORTON	CHARLOTTE, NC
HELICAL GEAR SET	15	USM CORP	WAKEFIELD, MA
MOTORS	1	ILLINOIS TOOL WORKS	CHICAGO, IL
BEARINGS/BUSHINGS	3	EMERSON ELECTRIC	ST. LOUIS, MO
MICRO PROCESSOR	-	MCGILL	VALPARAISO, IN
CONTROLLER COMPONENTS	-	SARGENT INDUSTRIES	BARBANK, CA
FACTORY EQUIPMENT	8	DIVERSE CANDIDATES ITT CANNON F. JOE LAMB CO. DOLLAR ELECTRIC MCDONNELL DOUGLAS	SANTA ANA, CA WARRER, MI MADISON HEIGHTS, MI SOUTHGATE/LUCERNE VALLEY, CA
ASSEMBLY RECEIVER	82 26	FOSTER WHEELER ROCKETDYNE	DANVILLE, NY CANOGA PARK, CA
STEAM GENERATOR	8	FOSTER WHEELER BARCOCK & WILCOX	MOUNTAINTOP, PA BARBERTON, OH
PLANT CONTROLS COMPUTERS	0.5	DIGITAL EQUIPMENT MODCOMP HEWLETT PACKARD	BOSTON, MA FT. LAUDERDALE, FL PALO ALTO, CA
PROCESS CONTROL	5	BECKMAN LEEDS & NORTHROP FORNEY FOXBORO	FULLERTON, CA NORTH WALES, PA HOUSTON, TX FOXBORO, MA
SALT TANKS	10	PITTSBURGH DES MOINES	PITTSBURGH, PA
KNO <sub>3</sub> /NH <sub>4</sub> NO <sub>3</sub> SALT	25	VERTAC CHEMICAL OLM CHEMICAL OLM CHEMICAL	VICKSBURG, MI LAKE CHARLES, LA STAMFORD, CT
SALT M. KEUP SYSTEM	3	GENERAL ELECTRIC	LYNN, MA
TURBINE	12		
OTHER PROCESS EQUIPMENT	33	DIVERSE CANDIDATES	
CONSTRUCTION MATERIALS AND EQUIPMENT	81	DIVERSE CANDIDATES	

669

the project will be located in California, these firms are located throughout the United States.

In terms of jobs in plant operations and the manufacturing and construction sectors of the economy directly related to the project, we estimate that the first plant will result in 6700 man-years of employment. If this technology proves commercially viable, we will have created an industry employing thousands of U.S. workers well into the 21st century. Instead of importing foreign oil, this project will result in the employment of hundreds, if not thousands, of U.S. workers to help make our nation become self-sufficient in its energy needs.

#### FOREIGN COMPETITION

There are six operating central receiver solar facilities in the world today. The list is as follows:

#### OPERATING CR SOLAR FACILITIES

<u>Central Receivers</u>	<u>Size MWe</u>	<u>Operational</u>
Barstow Solar One	10	4/82
ARCO Enhanced Oil Recovery	1	1982
IEA, Almeria, Spain	0.5	9/81
Sunshine Project, Japan	1	9/81
Eurelios, Italy	1	6/81
Themis, France	2.5	8/82

As you can see, many of our foreign allies and trading partners are actively engaged in the development of this technology. Importantly, our foreign competitors are receiving significant governmental assistance in their efforts. As of today, with the assistance and foresight of the Congress and the Department of Energy, we are the world's leader in developing solar thermal energy. To maintain this lead and open up opportunities to compete effectively against foreign competition in world markets for the sale of these powerplants, we need to commercialize this technology as quickly as possible. We cannot afford to delay or cancel the initiation of promising projects, such as Solar-100, by reason of the expiration of the energy tax credits.

**RISKS AND BENEFITS ATTENDING THE  
DEVELOPMENT OF SOLAR THERMAL TECHNOLOGY**

It is important for the Committee to understand the nature of the risks and benefits involved in developing this technology on a commercial basis. To date, the Federal government has invested more than \$140 million in Solar-One to prove the technical feasibility of the basic design for solar central receiver power plants. To move from this research and development phase to the commercial demonstration phase, some additional large scale subsystem development is required.

The thermal storage system in a solar central receiver plant must have the capability of efficiently storing heat energy. In our proposal to SCE for Solar-100, we have designed

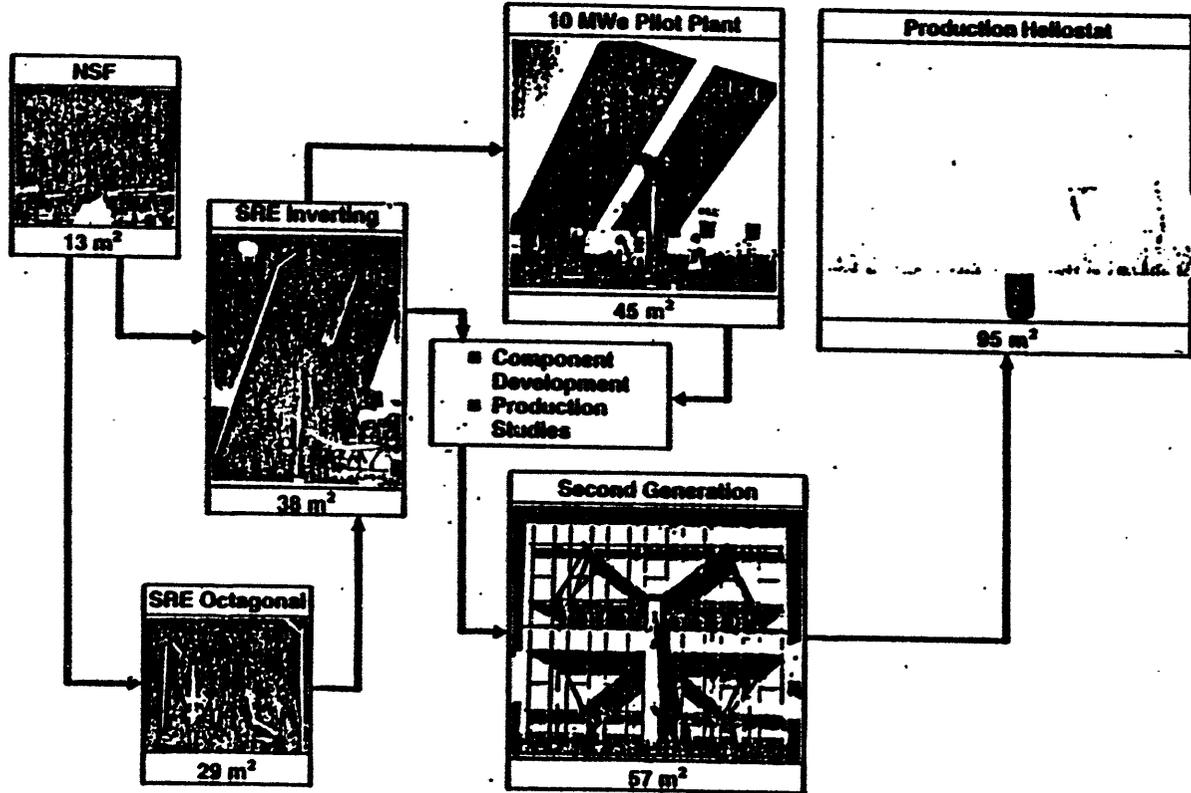
a molten salt energy transfer and heat storage system which, would allow approximately 8 hours of energy to be stored. This would permit the power plant to operate at night and during cloud transients, without significant losses in efficiency. It would also allow excess energy to be stored for later use by the power plant.

Additionally, the heliostats or computer-controlled, sun-tracking mirrors will be dramatically enlarged to achieve commercial scale economics. Research and development in heliostat technology has taken place over more than ten years, starting with 13 square meter mirrors pioneered by McDonnell Douglas for the National Science Foundation. For these reasons and many others, Solar-100 is able to utilize technology advances, but it also involves technical risks. We are optimistic, however, that they can be dealt with successfully.

Our desire to participate in this project and assist in the commercialization of this technology stems from our belief that solar thermal technology can be an economically competitive energy source for the nation's utilities in the decades ahead. Jobs are created for U.S. workers, and foreign oil displaced, thereby improving our balance of payments. Significant environmental benefits are achieved through deployment of the non-polluting, clean source of electric power generation. In that no combustion process is involved, there are no air or water pollution or residual solid wastes disposition concerns.

# MDC HELIOSTAT DEVELOPMENT

VFU8074-1



We would prefer to be solar power plant suppliers as opposed to owners and operators of solar power plants, but we recognize that to commercialize this technology and make purchases of these plants acceptable to utility planners, we have to take significant risks on this first commercial demonstration plant. McDonnell Douglas and other industrial concerns are willing to invest significant funds in developing this technology. We cannot afford to do so without the availability of the energy tax credits.

#### CONCLUSION

The solar central receiver technology which McDonnell Douglas and others are trying to develop is a first of its kind, high risk, high initial cost technology which, if demonstrated, will provide significant benefits to the U.S. economy. Because of the low return on investment and the long pay back period, funding by disinterested third parties is not available and the funds and credit support required for the project must come from project participants who stand to benefit if the technology meets performance specifications and utilities become willing to purchase future solar thermal plants. The willingness and ability of participants to proceed is stretched to the limit with the energy tax credit available -- without the energy tax credit, this project will not go forward.

The Committee is urged to favorably consider S. 1396 and S. 1305. Without enactment of legislation which will extend the duration of the energy tax credits for solar, we cannot proceed.

Statement on Senate Bill S. 1237, July 18, 1983

National Water Well Association  
Worthington, Ohio 43085

The National Water Well Association has been involved with research on and promotion of the use of water source heat pumps coupled to water wells and closed earth-coupled heat exchangers since 1975. There is no need to repeat the entire body of evidence demonstrating the value of ground water heat pump technology in energy conservation and environmental protection, but it is worthwhile to restate the main points and references.

Both heat pump use and ground water use in space conditioning are old technologies, dating back to the advent of practical refrigeration and modern water well construction methods. Wells for air conditioning urban hotels, theatres and stores in urban areas were very common until replaced by compressor air conditioning, fueled by cheap fuel, in the 1960s. Water source air conditioners have been common in Florida for decades. With the advent of modern air-to-air heat pumps, both heating and cooling could be accomplished using a compressor cycle. AAHPs however have always been hampered by the physical limitations of air as a heat source/sink.

Water source heat pumps coupled to wells or downhole heat exchangers married a simple, effective heating and cooling technology to a heat source/sink capable of providing really outstanding performance. The ground water in any locality has a nearly constant temperature, allowing the heat pump to operate at optimal efficiency no matter what the air temperature would be. Consequently, efficiencies of water source heat pumps could double compared to conventional air-to-air heat pumps, and provide three to five times the heat per kilowatt of electricity consumed compared to simple electric resistance heating.

In the larger scale, the use of ground water heat pumps provides a means of heating and cooling at total fuel to work efficiency superior to burning precious fossil fuels, which are better used as petrochemical stock and motor fuel. Electricity can be generated from anything, including solar energy and municipal trash.

Ground water heat pumps themselves can be used anywhere in the U.S. Where water quality or quantity problems limit the use of more efficient direct-use ground water heat pumps, earth-coupled heat pumps employing heat exchangers in deep boreholes can be used. Both types of systems can and should be constructed to protect drinking water supply aquifer quality according to state regulations by qualified installers.

While primarily a rural and suburban energy choice to date due to the need for drilled boreholes and water wells, urban areas can benefit as well. A return to earth coupled air conditioning in urban areas would significantly lower the elevated air temperatures aggravated by air conditioner heat exchanger discharge. This heat would be dissipated instead in the vast ground water reservoir below. Because water has such a favorable specific heat, ground water temperatures would rise only slowly and return to ambient conditions in the off season.

Another consideration is the initial costs of these systems. There is still a need for a tax incentive to spread low-temperature geothermal technology, since the initial cost of a ground water or earth-coupled heat pump unit and its wells is higher than fossil fuel or electrical equipment. This has limited to a degree the replacement of old, inefficient furnaces and heat pumps.

However, the ground water heat pump installation costs much less, is more certain in its performance, costs less to maintain and works for more people than solar heating systems. A \$4000 tax incentive would do far more good in the long run financing a heat pump.

Environmentally, widespread use of ground water heat pumps would slow the need for additional power plant capability, especially where air conditioning loads require excess peak capacity. Studies have shown that the thermal impact of heat pumps on aquifers is minimal and the pollution impact insignificant or nonexistent.

For further technical information, we refer the members to other testimony and to two research projects completed by NMWA on ground water heat pump technology:

DOE/CS/20060-5120 (Department of Energy). Ground Water Heat Pumps: An examination of the hydrogeologic, environmental, legal and economic factors affecting their use. 1980.

and

U.S. EPA Grant No. R806465-02. Computer Simulation to Assess the Environmental Impact of Residential Ground Water Geothermal Heat Pump Utilization. 1982. (not yet released by U.S. EPA officials)

The National Water Well Association staff and membership wish to thank Mr. Hall, his staff and Mr. Symms for their interest and support of the spread of this very timely, energy-saving, environmentally-sound technology.



HOLLAND PLANT  
 341 EAST 7TH ST.  
 HOLLAND, MICHIGAN 49423  
 AREA CODE 616-396-3101

July 27, 1983

Mr. Roderick A. DeArment  
 Chief Counsel  
 Committee on Finance  
 Room SD-219 Dirksen Senate Office Building  
 Washington, D. C. 20510

RE: (S.1237, July 18, 1983)

Dear Mr. DeArment:

We wish to go on record as strongly supporting S.1237 and HR 2927 which would eliminate the temperature requirements imposed by the Internal Revenue Service on the heat source of geothermal equipment eligible for tax credit.

It is rather clear that the intent of the Energy Tax Act of 1978 was to allow tax credits to individuals and businesses who installed energy consuming devices that were both highly efficient and would reduce this nation's dependency on fossil fuels. There is no question that the achievement of this goal is vital to the long term survival of our country or that ground water heat pumps will be a significant contributor towards that end.

As a major manufacturer of this equipment, we are well qualified to support the preceding statement:

- ° Due to the continual absorption of solar energy into the earth's crust, our abundant ground water aquifers (from 50 to 500+ feet deep), remain at a constant temperature year around. This temperature decreases as one goes from south to north due to the decreasing amount of solar energy available. (See attached map, figure 1). The important factor is that in any given location, this water temperature remains constant year around.

**Mammoth**

TOTAL ENVIRONMENTAL AIR CONTROL

- ° The water source heat pump is a refrigeration system and there is a serious misconception that a refrigeration system can cool only. Before going any further, this misconception must be clarified by a brief description of the refrigerant cycle:
  - A. Any refrigeration system starts with a pump (the compressor) that takes a low temperature, low pressure gas and compresses it to a high temperature (160 - 200° F), high pressure gas.
  - B. This gas is then cooled down (condensed) into a mixture of low temperature gas and liquid. To do this, the heat of the gas must be dissipated (or exchanged) into some cooler medium, such as water or air.
  - C. The cool gas is put thru an expansion or metering device, at which point it becomes a very cold (below 0° F) liquid,
  - D. Which is then evaporated to a low pressure, low temperature gas by absorbing heat from some medium such as warmer air or water.
  - E. This low temperature, low pressure gas then re-enters the compressor (pump) to start the cycle all over again.
- ° A water source heat pump, following the above sequence would, indeed, be cooling; cooling the hot gas by exchanging the heat to water and evaporating the liquid refrigerant by absorbing heat from the warmer house air. By reversing this cycle and putting the hot gas thru the "indoor" exchanger first, the refrigerant gas is cooled by dissipating it's heat into cooler house air and the cold liquid evaporated by absorbing heat from the warmer water. It is a well established fact that heat can be absorbed from or dissipated to a liquid much more rapidly (and therefore more efficiently) than to a gas, such as air.

- With water source equipment, whether it is heating or cooling, one side of the heat exchange cycle is absorbing from or dissipating to a constant temperature liquid and can, as a result, attain efficiencies that are not subject to seasonal changes and are far higher than conventional heating or cooling equipment.
- The only fuel consumed by a ground water heat pump is electricity. The common measure of the efficiency of any electrically driven equipment is the ratio of input watts to output watts called "coefficient of performance", (COP). Electric resistance heating systems common in the '60's had, and still have, a maximum COP of 1.0, (i.e. 1 watt output for every watt input). As a result of research and development in the industry, water source heat pumps are readily available today having COP's between three and four, (i.e. 3 to 4 watts output for each watt input). Another way to state this is that the amount of electric power required to heat one home with electric resistance heat would heat 3 to 4 homes using ground water heat pumps.
- By going through the same exercise and comparing the cost of watts to that of therms for oil, natural gas or LP gas, it has been conclusively shown that ground water heat pumps are the most efficient means of heating or cooling a home today and at the same time result in the lowest level of fossil fuel consumption possible.
- The natural question at this point would be: "With all this going for ground water heat pumps, why should there be any tax credit to encourage installation?"

The answer is twofold:

1. The Consumer's confidence level in ground water applications of water source heat pumps is low. Though the water source heat pump has been a viable product, for over 35 years (widely used in the deep south), it has only been during the last four years that equipment has been available that effectively operates at water

temperatures down to the 40°F required for the extreme northern tier of states. The relative "newness" of such equipment, both in the eyes of the installing contractors and the end user, has resulted in relatively low consumer confidence and the obvious need for broad based public education about the product and its advantages. We have found successful installations one of the best means of building consumer confidence and the tax credit will most certainly speed this process.

2. The "first costs" of a ground water heat pump system are often greater than that of conventional heating systems even though "life cycle savings" will result in return on investment in five years or less. Be it a system for a new home or the replacement of an existing system, it is relatively easy to document savings over conventional heating or air source cooling systems that justify the investment in a water source heat pump system. Even though today's average consumer is far more energy conscious, they tend to be uncomfortable with a higher first cost of a system which is technically more complex and, in their eyes, relatively new and unproven.

The availability of a tax credit from the Federal Government will help immeasurable in getting the consumer over this initial "hurdle".

In our struggle towards energy independence, ground water heat pumps will play a very important role. Passage of S.1237 would encourage the general

public to install ground water heat pump systems, not only by giving an energy tax credit but also by indicating that the United States government recognizes this type of equipment as a viable energy conservation device.

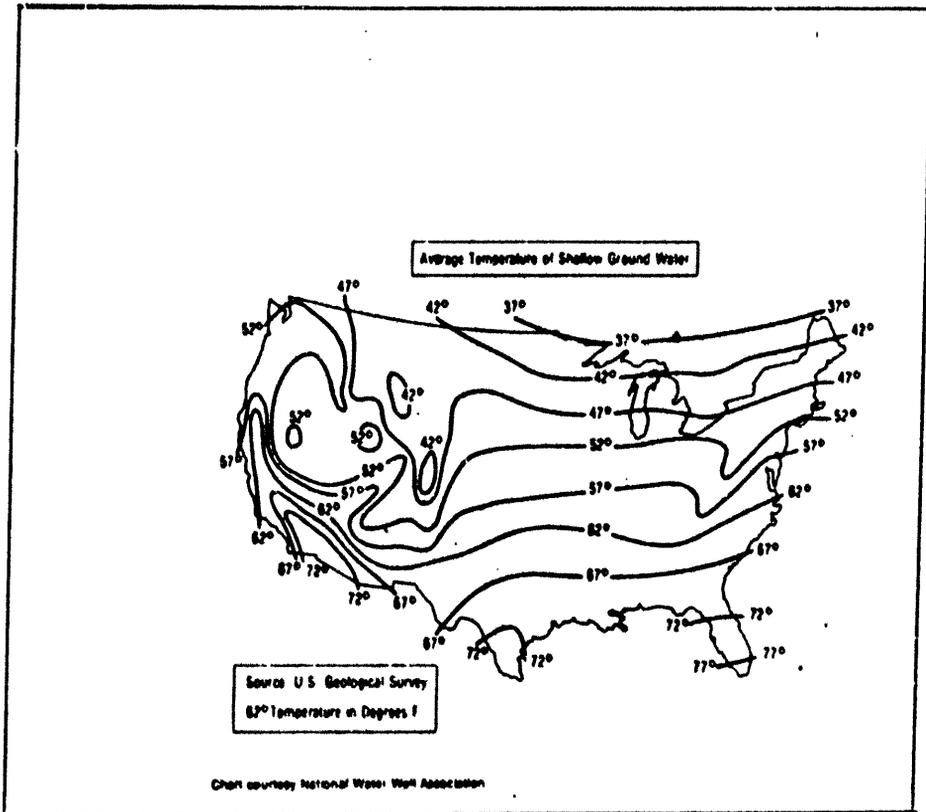
We strongly support S.1237 and urge it be approved.

Sincerely,



Thomas P. Warner

Plant Manager, Mammoth Division, Lear Siegler, Inc.



STATEMENT OF  
PAUL J. LIENAU, DIRECTOR  
Geo-Heat Center  
Oregon Institute of Technology  
Klamath Falls, Oregon

The non-availability of geothermal tax credits for geothermal resources below 50°C (112°F) has been and continues to be a serious impediment to a major energy source that can help the United States move toward energy independence.

There are two reasons why low temperature geothermal water is an excellent energy source for the heat pump operation of a residential dwelling. First, the average temperature of shallow ground water ranges from about 4°C (39°F) along our northern boundary to about 24°C (75°F) in southern Florida. These temperatures fall within a ground water source heat pump's efficient operating limits. Second, unlike air or surface water, the temperature of ground water varies little if at all, regardless of surface extremes. Therefore, when utilized in conjunction with a heat pump system for interior building temperature control, the constant temperature characteristics of low temperature geothermal water makes it an ideal source of energy.

Heat pumps also lend themselves to district heating concepts. The geothermal water would be the common factor in a district heating concept. Heat pumps and/or peaking boilers can be used to increase the water temperature during the coldest days of the year. This would allow for reduced investment and operating cost.

The passage of S.1237 is important for the development of a source of energy directly beneath our feet. Widespread use of ground water source heat pumps will permit our nation to considerably reduce it's consumption of fossil fuels and electricity.



**RALOS SOLAR ENTERPRISES, INC.**  
SOLAR • GEOTHERMAL • HEATING & COOLING SYSTEMS

12400 TROY RD. ST. RT. 41 • NEW CARLISLE, OHIO 45344  
TELEPHONE 513-845-3470

RE: S. 1237, July 18, 1983

Mr. Roderick A DeArment  
Chief Counsel  
Committee on Finance  
Room SD-219, Dirksen Senate Office Building  
Washington, D.C. 20510

Dear Sirs,

I am writing to you concerning bill S-1237, which allows groundwater heat pumps to qualify for residential and commercial geothermal energy tax credits.

I have done extensive studies concerning the present geothermal interpretation of IRS and would like to share with you this information.

As you know, IRS's interpretation of geothermal is a well head temperature of 122°F. This interpretation in fact alleviates the vast majority of the people of this country from ever qualifying for the geothermal tax credit.

Temperatures of 122°F can only be found west of the Mississippi, which eliminates that part of the country where over half the population is contained.

Furthermore, those areas which do contain geysers, or temperatures of 122°F, in most cases are state parks, national parks or Indian reservations.

Also, the cost to tap temperatures of 122°F, when it is available is beyond the scope of the average person.

Furthermore, the original bill states geothermal energy for the purpose of heating or cooling a dwelling or providing hot water. In order to use 122°F as the temperature requirement, you eliminate the ability of cooling, which in parts of this country is a more expensive cost than heating.

Overall, through my studies I have come to the conclusion that by having a temperature requirement of 122°F that 99% of the people of this country would never qualify for a geothermal tax credit. This leaves 1% of the people who might live near an active volcano or geyser and who have the monetary resources to qualify for this credit. However, the savings they would realize would never justify the expense of such a project.

In all sincerity I do not believe that it was congress' intent to pass a bill that would only benefit, at the most, 1% of the people and then at a cost that would not make sense for someone to invest in.

The definition of geothermal energy property includes equipment that distributes the natural heat in rocks or water.

Natural, by definition, means normal. It is not normal for there to be 122°F temperatures. If it was normal, then far more of this country would experience this temperature, and in fact very little of the United States has ground temperature of 122°F. Therefore, this must be considered unnatural, which is the opposite of the law, which again states, geothermal is natural heat stored in rocks or water.

Also, I believe that the most important item to consider is the true intent of the law, which was to eliminate, as much as possible, the dependency on fossil fuels, especially oil. The geothermal groundwater heat pump has done this better than any other renewable energy source we now have on the market, at a price that the average person can afford.

I can provide you with over 300 names of people who have purchased geothermal groundwater heat pump systems in the last three years, and in most cases against oil heat, are experiencing savings between 50%-70%.

The average household uses in excess of 1,000 gallons of oil per year for heating purposes. My company alone has replaced the use of over 300,000 gallons of oil by putting in groundwater heat pump systems.

Although today there may be a glut of oil, there cannot be anyone who truly believes that the oil situation will not worsen over the next few years.

Also, it should be remembered that the reason that we now have a glut of oil is the we have conserved and used much less because of such systems as a groundwater heat pump, but how long will we have a glut if we stop such efforts of conservation.

I believe it to be in the best interest of this country, its people, and even the people of the world, to allow groundwater heat pumps to be considered as tax creditable under the geothermal laws. The reasons for this statement are many, but I will list just a few of the major ones:

1. Groundwater heat pumps are using the natural heat of the ground, which is a renewable energy source in the true meaning of renewable.
2. Groundwater heat pumps are replacing conventional fossil fuel systems, especially oil heat.
3. By using less fossil fuels, especially oil, this country has less dependency of foreign governments supplying us with their fuels.
4. By using less oil there will be less world demand, and therefore oil prices will stabilize, allowing all governments to work on stabilizing their economies.
5. Failure to continue to conserve on fossil fuels will once again bring back runaway inflation, high unemployment and worldwide recession. This is because prices will rise on fossil fuels as demand begins to rise.
6. Remember, according to every expert in the world, we do not have a never ending supply of gas, oil, or even coal. Someday our offspring will be faced with a world of no fossil fuels. We cannot stop the supplies of fossil fuels being used up, but we can greatly delay the day this happens.

In conclusion, I wish to state that you have an opportunity to correct a situation that I believe will be shown, someday, as a very big mistake made by IRS. I do employ you to take this opportunity to correct that situation and make groundwater heat pumps tax creditable under the renewable energy tax credits.

I do thank you for your patience in reading this letter and do hope I have given you enough information to aid in your decision process. If I can be of any further help, please feel free to write or call me.

Sincerely,

*Briggs Moore*  
Briggs Moore



Renewable Fuels Association  
499 S. Capitol Street, Suite 420  
Washington, D.C. 20003  
(202) 484-9320

David E. Hallberg  
President/Chief Executive Officer

TESTIMONY OF DAVID E. HALLBERG  
PRESIDENT, RENEWABLE FUELS ASSOCIATION

Thank you, Mr. Chairman. On behalf of the renewable fuels industry, I first want to thank you for this opportunity to make known our support for S. 1305, the Renewable Energy Tax Incentive Act of 1983. The RFA is a non-profit trade association based in Washington, D.C., which counts among its membership firms involved in a wide range of renewable fuels technologies, among them fuel ethanol, anaerobic digestion, and biomass.

S. 1305's extension of the existing 10 percent investment tax credit afforded the technologies cited above until December 31, 1990, is critically needed if these technologies are to continue making progress toward construction of commercial production facilities. In recognition of the Committee's severe time constraints, I would like to very briefly focus on five general considerations that the Committee will have to balance in making a decision on this legislation. They are: (1) Net Cost: Is this a wise investment, or unnecessary expenditure, as far as the taxpayer is concerned?; (2) Uniqueness: Do renewable energy technologies offer more than a dollar for dollar return, or should they be treated the same as other types of investments?; (3) Contribution Potential to the Nation's Energy Security: How much of a contribution to U.S. energy security objectives can these technologies make if the credits are extended?; (4) Technological Advancement Potential: Do these credits represent temporary assistance needed to bridge an initial cost gap, or will these renewable technologies remain chronically uncompetitive for many years?; and (5) Need: If the credits are not extended, what will happen to the renewable fuels industry?

(1) Net Cost: A Consideration of Externalities. At a time of concern over excessive budget deficits, the Congress faces difficult decision about where to draw the line in extending federal support, whether it be in the form of direct outlays or tax expenditures. Renewable energy technologies are not alone in claiming that a "holistic" view of their costs and benefits would show that the passage of S. 1305 would be a cost-effective investment for the country, and taxpayer. However, due to the unique nature of U.S. payments for imported oil, and the many hidden costs associated with the outflow of dollars for such oil, the renewable energy technologies' argument for "net benefits" stands on a more solid foundation than most.

Simply put, renewable energy technologies require the assistance of "preferential tax policy" because they are not yet competitive with conventional fuels in the marketplace. However, it is increasingly evident that the cost of conventional fuels--whether it be at the pump, on the meter, or otherwise delivered to the final consumer--is frequently understated, simply because the "externality costs" have not been fully quantified. Therefore, because the cost of a Rapid Deployment Force, or a nuclear waste disposal program, or miners' health and safety assistance may be borne by taxpayers in other parts of the Federal budget, and not consumers purchasing the end energy product, renewable technologies are forced to gain a foothold in the marketplace initially through the assistance of favorable tax policy. It should be emphasized that all of the conventional fuels have generously benefited from the same treatment during the history of their development.

An example that occurs in the fuel ethanol industry might be useful in

illustrating this point further. This fiscal year, the Department of Agriculture will spend over \$21 billion in crop price support programs, and another \$12 billion on the Payment-in-Kind program to induce farmers to idle acreage. These multi-billion dollar payments have been necessitated by the lack of sufficient outlets for U.S. farmers' prodigious production. Already, in just five short years of commercial development, the fuel ethanol industry has proven itself capable of providing sufficient new demand for feedgrains that the taxpayer has already been spared hundreds of millions of dollars in reduced outlays for deficiency and storage payments alone. In addition, fuel ethanol as a 10 percent additive to gasoline has positive emissions and environmental effects, reduces the need for lead in gasoline by increasing octane, and will "back out" more than 10 million barrels of imported gasoline-equivalent in 1983 alone, thus reducing U.S. oil import payments by several hundreds of millions of dollars. All of these have significant direct and indirect benefits to the U.S. Treasury that far outweigh the cost of fuel ethanol's tax expenditures, but the marketplace does not attribute the savings to ethanol "at the pump". The tax incentives are therefore necessary, and a wise investment for the nation as a whole.

(2) Uniqueness: The "Bushel of Apples vs. Barrel of Oil" Argument. It is frequently argued that it makes no difference to the nation whether investors put their money in an alternative energy facility or a shopping center or a widget plant. According to this argument, when all is said and done, the number of jobs will be created, the same amount and quality of "ripple effects" will be generated, and the net impact on the economy will be a "wash".

However, closer examination makes this contention very dubious. No less an expert than Sheik Yamani, Saudi Arabia's oil minister, noted that "Oil is not an ordinary commodity like tea or coffee. It is a strategic commodity." There is an obvious difference between a "barrel of oil and a bushel of apples", best demonstrated by the fact that the U.S. will spend tens of billions of dollars on a Rapid Deployment Force over the next several years, primarily to keep the Persian Gulf oil supply lanes open. The 1973 and 1979 "spikes" in oil prices have been conclusively shown to be prime culprits in the ensuing inflationary and recessionary cycles that have gripped the U.S. economy. In short, there are few more legitimate purposes of "tax incentives" policy than to catalyze the development of a vigorous U.S. alternative fuels industry. A dollar invested to "back out" oil imports has a much higher value to the U.S. than a dollar invested in most other activities.

(3) Contribution Potential. Alternative energy technologies, particularly renewable energy technologies, have been criticized by detractors as making insignificant contributions to U.S. energy supplies. However, there is a growing awareness that, in the future, there will be no panacea, no one or two major "quad contributors" capable of replacing the oil and natural gas contributions alone. It is also important to remember that the 1973 and 1979 oil supply interruptions only involved a few percentage points-reduction in total U.S. oil supplies.

When viewed in this perspective, it is clear that renewable energy technologies do represent a sizeable potential contribution to U.S. energy needs, in the relatively near- as well as long-term. Again using the fuel ethanol industry as a specific case in point, in just four short years, U.S. production and use has grown from virtually zero to over 4 percent of the total gasoline market penetrated by 10 percent ethanol blends---over 10 million barrels of fuel ethanol in 1983 alone! Relative to other energy alternatives, renewable energy technologies have short construction lead times, reduced capital requirements,

benign environmental impacts, increased job creation effects, and dispersed energy security benefits. Given the right set of signals to project sponsors and investors, the renewable energy technologies can make a substantial "quad-equivalent" contribution to U.S. energy needs by 1990.

(4) Technological Advancement Potential: The Evidence Against The "Chronically Uncompetitive" Charge. Despite the many uncertainties confronted by project developers in the fledgling stages of growth, the renewable energy technologies have made some dramatic strides toward cost reduction and improved competitiveness with conventional fuels. In fact, there is mounting evidence that the existence of tax incentives that have stimulated commercial penetration by the various technologies have actually served to bring about increased private sector R & D spending. In recent testimony before two House energy subcommittees, CBO Director Alice Rivlin stated that "stimulating private research through tax incentives is an important part of energy research and development policy."

Again, the fuel ethanol industry's experience provides a worthwhile illustration. Due to the existence of tax incentives that have provided efficient producers an opportunity to compete in the marketplace, considerable sums of private sector R & D dollars have been spent to advance technology in all dimensions of the industry: production and conversion of feedstock; energy efficiencies; improved utilization of the high protein and CO<sub>2</sub> co-products; and expanded end uses for the fuel ethanol itself. Dramatic examples of improvements, such as 1/6 the energy requirements to produce a gallon of anhydrous ethanol as compared to that of five years ago, and the use of more efficient enzymes in fermentation, underscore the fact that ethanol prices have narrowed the price differential from gasoline by as much as 70 cents per gallon since 1979. While much of this narrowing is attributable to price increases in gasoline, the trend is nevertheless valid: renewable technologies' improvements promise to stabilize or reduce their products' costs, while the depletable conventional fuels will inexorably rise.

(5) Need for the Credits. A final consideration is to determine the need for the credits out past 1985. If the renewable energy technologies' credits are not extended, to what extent will the commercialization of the various technologies be retarded or stopped altogether?

To answer this question, one must consider two sub-questions: first, why hasn't there been more response to the credits in the past few years if their existence is so crucial?; and second, who are the likely participants in the financing of "Phase II" renewable energy projects?

The answer to the first is quite clear. Due to the numerous threats and challenges to the status of the incentives--ranging from the 1981 "at risk rule" proposal to last year's outright repeal attempt--the financial community has never had the full opportunity to bring prospective investors "up the learning curve" and raise the needed funds. Only recently has there been the sort of relative stability requisite to allow the marketing of these projects to the equity investor. As Mr. John H. Cassidy, Vice President of E.F. Hutton & Company Inc. noted in recent testimony before your Committee on S. 1396, the New Energy Corporation of Indiana fuel ethanol project \$32 million equity package completed at the end of last year would never have been sold without the credits. He

stated: "Without the energy tax credits available to the equity investor which represented 24% of his expected return in the first three years of the project, this deal could not have been sold nor would we have seriously considered bringing it to the public for sale."

With regard to the second question---who are the likely participants in the future financing of renewable fuels projects?--it is clear that the majority of these "first of a kind", project financing deals will be done through third-party financing, and not supported by the balance sheet of a large, established company. Numerous studies have been completed recently that document the inability to secure this financing without the credits' existence (e.g., the Booz Allen & Hamilton May 1983 analysis). The Office of Technology Assessment, in a June 1983 analysis of "U.S. Industrial Energy Use", found that "energy investment tax credits directed at energy production, such as cogeneration by third parties, would be effective. In this case, energy would be the principal product produced by the investment."

Finally, to those who maintain that OPEC's back has been broken and that the need for energy alternatives has been pushed far into the future, the recent testimony of J. Erich Evered, Director of DOE's Energy Information Administration, is worth reading. Citing the projections of world oil price rises by 1990, he said: "This implies that the date at which the various technologies now under development would become attractive may be delayed by the recent declines in the world oil price...but it does not mean that the long-term attractiveness of alternative sources of energy has changed."

Obviously, investments in alternative energy projects--just like other substantial investments--cannot be turned "on and off like a light switch". The Congress has wisely triggered a significant private sector investment in the energy technologies that will be needed in the not-so-distant future, and it is in the interests of both taxpayers and consumers to see that these investments are optimized by the extension of the tax credits.

CONCLUSION. Consequently, Mr. Chairman, we would respectfully urge the earliest enactment of S. 1305. Because the planning requirements of project sponsors, financial packagers, and investors dictate that the failure to enact this extension would "freeze" the development of projects with longer than two year lead times until the extension is enacted (which covers nearly every new project not in advanced stages of planning at this moment), it is also very important that the Congress enact this extension before the end of the current session.

Careful consideration reveals that the extension is justified when one considers the benefits conveyed by renewable fuels technologies on the basis of: (1) net cost; (2) uniqueness; (3) contribution to the U.S. energy security; (4) technological advancement potential; and (5) need for the credits.



# SOESI Solar Systems

July 18th 1983

**COST EFFECTIVE EQUIPMENT FOR  
COOLING, HEATING, HOT WATER  
AND POOL HEATING**

Hon. Tony Hall,  
1009 Longworth House Office building,  
Washington, D.C. 20515

(S. 1237, July 18, 1983)

Dear Congressman Hall,

The following information regards the impact of Ground Water Heat Pumps upon the cost of utilities for the American Homeowners, and the ultimate reduction in power consumption. Questions will be posed as to why, when such savings in dollars and power consumption are available, this industry has been discriminated against by Government failure to include it in the energy tax credit program.

With the constant rise of power costs and with no relief from this continually increasing cost in sight, it has become more important than ever before to consider means which reduce power consumption by major amounts.

At all levels of our industry and in government it has been recognized for some time that the Geothermal Ground Water Heat Pump System is the most efficient mechanical means of heating and cooling.

Such systems are not new in basic concept to our industry. Commercial operations have used water cooled systems for forty years or more. What is new is the feasibility of application of these systems for the homeowner.

Twenty years ago we were pioneers in this field in America and with the steadily rising costs of utilities, our penetration of this market has been increasing.

Manufactured By

**"SOLAR ORIENTED" ENVIRONMENTAL SYSTEMS, INC.**  
10639 S. W. 185th Terrace · Miami, Florida 33187 · Phone (305) 233-0711  
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We believe our equipment to be state of the art with Energy Efficiencies Ratios, E.E.R.'s and co-efficients of performance, C.O.P.'s representing increases of 60% to 150% over conventional 'hi efficiency' products.

The result to the consumer is considerable savings by virtue of reducing energy usage from 30% to 80%. The overall picture is that power consumption in the America Home for heating, cooling and domestic hot water represents 70% of the total utility costs, that ultimate savings is in the 35 - 40% area in warm climate zones and 40 - 60% in cold climate zones. There is no other single piece of equipment for the home owner that could be responsible for as great a savings as these systems offer.

That these systems cost more is not surprising. The additional cost of \$2-5000.00 per average installation, when compared to conventional and less efficient systems, has had the natural result of deterring sales in this highly competitive industry. The fact that such additional costs are usually amortized by the savings developed in the first two years has caused many whose cash position allows, to make the decision to move to these more efficient methods.

Obviously, however, those who are not in such a position or those not quite capable of making a value judgement of such a sophisticated nature, are not willing or able to make the financial commitment and thereby develop the savings in dollars and power consumption.

We believe that in light of the tax considerations that are offered through energy tax credits, solar tax credits and the like, that savings of the magnitude offered by Geothermal Systems for cooling and heating cannot justifiably be ignored. The purpose, as we understand it, of these aforementioned credits is to encourage the consumer to purchase more efficient equipment and thereby reduce our National consumption of power, ease the burdens being placed on power utilities in areas of rapid population growth, and lastly to provide additional funds for the purchase of consumer goods, these funds to be developed

*from savings in utility costs. If this understanding is correct, then it becomes apparent that tax considerations for the water cooled heat pump systems should be of the highest priority to enhance these basic goals.*

*By virtue of the law of diminishing returns, we believe that conventional cooling and heating equipment has reached, for all practical purposes, its design limits. The time has arrived to move onto the next generation of equipment. No single effort could have the impact of our Governments endorsement of the facts of efficiency, already known and proven as regards the Ground Water Heat Pump by offering incentives to install such equipment.*

*Such an action would encourage the ultimate consumer to look again, or for the first time, at this industry's projections of savings available.*

*Such an action would encourage the contracting portion of our industry to move off of dead center in light of the consumers' new interest.*

*Such an action would cause manufacturers to devote greater numbers of dollars for R & D to develop better and more efficient equipment to satisfy this new interest being shown by the consumer.*

*Such an action would be in concert with our understanding of Congressional responsibility to encourage the development, manufacturing, and sale of products to improve life standards, reduce costs, and conserve natural resources vital to the safety, health, and well being of our citizenry.*

*Continued discrimination against the ground water heat pump industry would not be in the interest of the American Public and would be evidence of the lack of information by our Congressional Representatives, regarding the impact of such advancements upon our greater purpose of energy conservation.*

Our Government has already recognized that energy conservation is a vital national concern. There are many areas that Governmental action has caused industries to alter products to bring about greater conservation and has also encouraged the consumer to buy products which achieve these objectives.

This encouragement offered in the form of tax credits for the Solar Hot Water Heater has had the result of developing consumer interest to a degree not possible without such endorsement. The net advantage of energy conservation from this program does not exceed 10% of total domestic energy consumption, and yet considered to be quite effective. The net advantage from a similar program for the Ground Water Heat Pump industry would be three to eight times greater and result in 35 - 80% savings in energy costs to the consumer and 35 - 80% reductions in energy consumption.

If we were to isolate the various areas of our nation we would better understand the impact of Geothermal Systems upon energy conservation. For example, in the northern states where fuel oil is the major source of heating, the average home consumes 1000 gallons or 32 barrels of oil annually. Ten thousand such homes would consume 320,000 barrels of oil. The savings here would be 220-240,000 barrels of oil each year. One million such homes would mean a savings in excess of 22 million barrels of oil and yet this represents only a small percentage of the homes in such states. Such a goal is attainable in a very few years.

These facts are worthy of studied consideration. Our Congress has shown the courage to act in behalf of the greater long term advantage for the American people.

We believe such action is called for here.

Respectfully,

  
Robert DiGiacomo,  
Vice President

<b>TETCO</b>	<b>THERMAL ENERGY TRANSFER CORPORATION</b>
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*Manufacturers of Ground Water Source Heating and Cooling Equipment*

July 28, 1983

Mr. Roderich A. DeArment  
Chief Counsel  
Committee on Finance  
Room SD-219 Dirksen Senate Office Building  
Washington, DC 20510

RE: S.1237, July 18, 1983

Dear Mr. DeArment,

Thank you for the opportunity to respond to a request for statements regarding the S.1237 proposal for energy credits for low temperature Geothermal heating and cooling systems. I have supported the concept of tax credits for energy saving devices and feel that water source (low temperature geothermal) heating and cooling systems have been unfairly excluded from their rightful position as a very useful energy saving system.

As the attached utility company testimonials of monitored applications indicate, the savings can result in a 60 to 70% power reduction for heating, and when direct well water cooling is used, an energy reduction of up to 80% can result.

Where water is available and can be easily returned back to the aquifer from which it came, I can see no better means for conserving our valuable fossil resources than the use of a low temperature Geothermal system.

Even in areas where water is in short supply the concept is very successful using closed loop earth coupled heat exchangers to store and retrieve the heating and cooling energy with the earth. What better way could there possible be than to store the summers heat within the ground and then retrieve it through the winter for heating purposes, while then chilling the earth in preparation for the summer cooling season. This type and scale for thermal storage in the earth has not been practical for direct solar applications but it is ideal with the water source heat pump and ground coupled systems. The operation of such a system on my own home in Columbus, Ohio has resulted in a 40% savings versus natural gas heat and a 75% savings for air conditioning. With energy conservation figures like these I sincerely hope that the Senate will not take the same closed minded approach to energy conservation that the IRS appears to represent.

Sincerely,

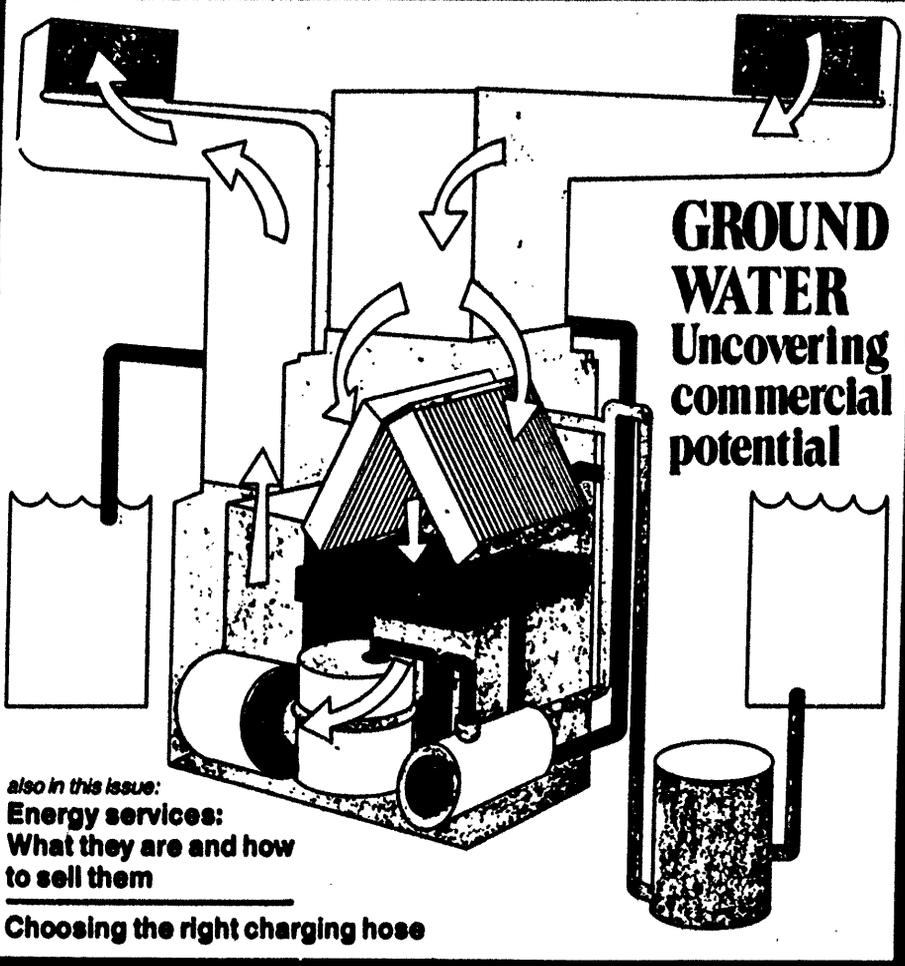


Jeff Persons  
Hydrogeologist

JP:at

SALES and MARKETING: 9650 Liberty Rd., Drawer C, Powell, Ohio 43065 614/431-1324  
ADMINISTRATION and MANUFACTURING: 378 W. Orlentangy St., Drawer C, Powell, Ohio 43065 614/889-6654

# Contracting Business



derstood problems, as opposed to taking on new problems.

However, Asbjornson continues, "The information needed to solve these new problems is readily available. Hvac contractors already understand the machine side of the system, and water side data is there for the asking — from well drillers and from the Water Well Association."

Figure 3 indicates a typical division of labor between a mechanical systems contractor and a well driller. The schematic shows that neither man has to take responsibility for any part of the system falling beyond the realm of his primary expertise.

But to sell ground water systems effectively, each man should understand what the other is doing, so they can function as a cohesive unit. In line with this, Dexheimer has compiled a list of questions either type of contractor could use to initiate a dialogue with his brethren on either the machine or water side of the system.

He suggests mechanical systems people ask well drillers:

- In what ways do you treat return and supply wells differently?
- How do you test a well?
- What type of screens do you put in the well for a geothermal heat pump system?
- How do you size the submersible well pump?
- What is your approach to pressure tank sizing?
- How do you size the water lines?
- How deep and far apart do you run the water lines?
- Do you use galvanized pipe or fittings in the water supply system?
- Do you use ball valves?
- Where do you go for advice on wells and water supply systems?

Conversely, Dexheimer indicates hvac people should be prepared to answer the following questions from well drillers:

- How do you calculate a structure's heat loss or gain?
- Do you try to size the heat pump to provide the entire heating load?
- Do you provide some sort of emergency heat for your customers?
- Do you use insulated ducts?
- What static pressure do you design your ductwork to?
- Describe your water piping layout for a geothermal heat pump.

## AN EXEMPLARY RETROFIT

The Butler Rural Electric Cooperative, Inc., Hamilton, Ohio, is housed in a 6,600 sq ft building having a calculated heat loss of 190,000 Btuh. Until November 1980, the entire building was heated and cooled by a 100 kw electric boiler and a 30-ton chiller operating in conjunction with a water-to-air heat exchanger.

During the '79-'80 fiscal year, Butler Electric paid \$4,500 for the maintenance contract on its heating/cooling equipment. During '81, that same contract, because of the equipment's age, was pegged at \$13,000, so the Butler people decided to change to ground water heat pumps.

In March 1980, Butler drilled a 156-ft, 6-in. casing test well into a sand and gravel formation. The company did its own pump test for 90-1/2 hr, pumping at the rate of 62.1 gpm, even though the projected ground water heat pump system would need only 47 gpm to

operate. At the end of the test, the well's static level was back to its 125 ft in under two minutes.

Favorably impressed by this preliminary test, Butler expanded the specifications for its comfort conditioning system, and drilled a second well 300 ft from the first, to allow enough space to prevent a water temperature change, and to permit possible future expansion. The second well was 158 ft deep, and it produced 65 gpm for 168 hr during its test period. This well's static level returned to its original 119 ft in one minute.

The buy decision was made. The company installed five pressure tanks, each having a 40-60 ib operating range. These pressure tanks supplied four 4-ton TETCO ground water heat pumps.

The accompanying table shows that Butler Rural Electric was able to pay 2/3 less for heating and cooling in '80-'81 than it had to pay in '79-'80.

Heating	1979-80 Old equipment 100 kw boiler 30 ton chiller*	1980-81 New equipment 4-4 ton ground water heat pumps and well pumps**
Degree Days 79-80	6,340	
Degree Days 80-81	6,045	
Total kwh to heat and cool	117,556	38,502
Average kwh per month	9,796	3,042
Average kwh per day	322	100
Total cost per year	6,347.87	\$2,190.12
	Avg. @ .054/kwh	Avg. @ .08/kwh
Average cost per month	\$528.99	\$182.51
Average cost per day	\$17.39	\$6.00
Average cost per sq ft	\$,981	\$,332
Total kwh to heat area	71,415	28,663
Total cost to heat area	\$3,856.41	\$1,400.88
Avg. cost per sq ft to heat area	\$,534	\$,242
Total kwh to cool area	46,140	9,819
Total cost to cool area	\$2,491.56	\$689.14
Avg. cost per sq ft to cool area	\$,377	\$,088

\* Thermostat settings on old equipment—winter 65°; summer 78°

\*\* Thermostat settings on new equipment—winter 74°; summer 74°

- Where do you go for advice about geothermal heat pump systems?

Once the mechanical systems contractor and the well driller know what each other is doing, they can, together, pursue a mutually profitable new market.

### Where the system will work

The map in fig. 4 plots the average ground water temperatures throughout the continental United States, as determined by the Department of Energy's Well Temperature Survey. Giv-

en that manufacturers generally base ground water heat pump performance tables on a supply water temperature range of around 50-70F, the map indicates that, at least in theory, a ground water system could work just about any place in the country.

The heat exchange capability of the geologic formation is one of the variables you have to consider. Bud Heiss, hydrogeologist with the Thermal Energy Transfer Co. (TETCO) of Powell, Ohio, notes that "When you put a well into sand and gravel deposits situated

**TETCO****THERMAL ENERGY  
TRANSFER CORPORATION***Manufacturers of Ground Water Source Heating and Cooling Equipment.*

**BEDFORD** - A recently introduced system which extracts heat from well, spring or pond water to provide low-cost heat for buildings will be among displays and demonstrations at the open house of Bedford Rural Electric Cooperative, just east of Bedford, March 17-18 from 2-8 p.m.

Called a geothermal heat extractor, the system can extract heat from water as cold as 37 degrees, and at the average local ground water temperature of 47 to 54 degrees, removes 8 to 12 degrees. Jim Clark, REC energy conservationist, said the system runs through five gallons of water per minute and extracted heat is then used to heat a freon gas to 50 degrees.

That gas is then compressed until it reaches a temperature of 100 degrees, after which the hot gas circulates through a system of coils, providing heat which is blown through a system of hot air registers. "It's not a really hot air

systems," Clark notes, "but it's a very consistent heat."

After heat has been extracted from the original water supply, the cold water is discharged into another well or pond within 100 feet of the source well so that it returns to the same ground water table.

#### Huge Savings

While the system does need electricity to operate its motors, the total amount of energy required is significantly less than in traditional systems. Thus savings in both energy and money in comparison with oil or traditional electric systems range from 60 to 70 percent.

Clark said a test unit placed in a Rainsburg home last winter saved the owners \$1,300, and savings during this year's more severe winter should be significantly greater.

The REC's modern 7,000-square-foot building also

uses the system, and heating costs this year are expected to total just \$375. Clark said the system costs about \$2,500 to install, plus the cost of establishing a second well or other water discharge area. A well which pumps 10 gallons of water per minute, not an excessive amount, is sufficient to operate the system, he said.

Invented in the late 1940s, the system was largely ignored, Clark said, because of the low cost of fossil fuels. But with today's costs and shortages, the geothermal heat extractor becomes an attractive alternative, and units are being manufactured by several companies.

Engineers today are working on a closed loop system which would reuse the same water, eliminating the need for a discharge area, and on a system for heating domestic hot water.

Also, Clark said, for about \$1,500 an air conditioning unit is available for the system which will air condition an average home for just pennies a day. As an example, a system in the Rainsburg test home cooled the home during the three hottest months of last summer for a total of \$20 in electricity. Clark said he anticipates a bill of about \$100 for cooling the REC offices next summer.

#### Other Demonstrations

In addition to the geothermal heat extractor, Clark said, next week's open house will include building tours, a look at REC's computer system and engineering department, and a safety demonstration of hot line precautions.

#### BITS & PIECES

**GIRL SCOUT** Sherry Crissey of Troop 141 from Manns Choice won first place in her troop and service unit's bake-off contest. She is now eligible to compete in the Sectional bake-off. Sherry took first place last year in all three events.



**JIM CLARK, REC ENERGY CONSERVATIONIST,** displays the geothermal heat extractor which will be shown during REC's Open House March 17-18.

9550 LIBERTY RD., DRAWER C, POWELL, OHIO 43085 614/431-1324

**TETCO****THERMAL ENERGY  
TRANSFER CORPORATION***Manufacturers of Ground Water Source Heating and Cooling Equipment*TETCO APPLICATION

BEDFORD RURAL ELECTRIC COOPERATIVE INC.  
P.O. BOX 335  
BEDFORD, PA 15522

JAMES D. CLARK, ENERGY CONSERVATIONIST

CONSTRUCTION:

AREA: 7,000 sq. ft. heated and cooled with TETCO System  
INSULATION: R-42 to R-55 ceiling  
R-12 to R-23 walls  
R-19 to R-23 floor slab and crawl space  
windows: double pane toward south; triple pane toward north

WATER SUPPLY: Gravity feed from 2,500 gallon spring house holding tank

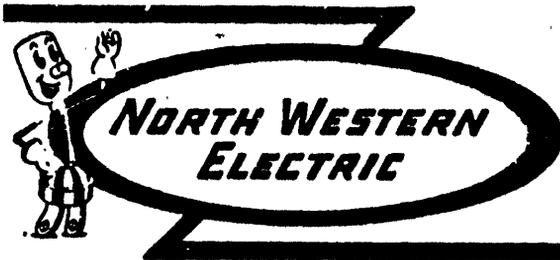
TETCO EQUIPMENT: two TETCO HECWE-050-C Heat Extractors  
three TETCO HEEWA-02 Cooling Coils

ENERGY USE: Including blower watts

Oct. 1981	1167 kwh	at \$.0306/kwh	= \$ 35.71		Total Heating
Nov. 1981	3429 kwh	at \$.0306/kwh	= \$104.84		18,094 kwh
Dec. 1981	2778 kwh	at \$.0306/kwh	= \$ 85.01		\$586.18
Jan. 1982	4704 kwh	at \$.0306/kwh	= \$143.94		
Feb. 1982	2393 kwh	at \$.0306/kwh	= \$ 86.15		
March 1982	2123 kwh	at \$.036/kwh	= \$ 76.43		
April 1982	1357 kwh	at \$.036/kwh	= \$ 48.85		
May 1982	146 kwh	at \$.036/kwh	= \$ 5.25	--HEAT	

May 1982	133 kwh	at \$.036/kwh	= \$ 4.79	--COOLING	
June 1982	123 kwh	at \$.036/kwh	= \$ 4.43		Total Cooling
July 1982	726 kwh	at \$.036/kwh	= \$ 26.14		1,735 kwh
Aug. 1982	526 kwh	at \$.036/kwh	= \$ 18.94		\$62.47
Sept. 1982	227 kwh	at \$.036/kwh	= \$ 8.17		

SALES and MARKETING: 9550 Liberty Rd., Drawer C, Powell, Ohio 43065 614/431-1324  
ADMINISTRATION and MANUFACTURING: 378 W. Olentangy St., Drawer C, Powell, Ohio 43065 614/889-6654



P. O. BOX 391  
 BRYAN, OHIO 43508  
 Phone (419) - 838 - 5081

a consumer owned power system serving northwestern Ohio

May 13, 1981

To Whom It May Concern:

North Western Electric Cooperative is an electric distribution cooperative serving approximately 4200 members in the northwestern corner of Ohio. In 1980, the cooperative constructed new headquarter facilities which consist of 6700 square feet of office space. Various systems of heating and cooling this space were investigated. Due to the adequate ground water supply of the area, and the apparent efficiency of the system, TETCO geothermal heat pumps were installed.

Three units, 50,000 B.T.U.'s each, were installed to condition the facilities. These pumps extract water at an average temperature of 52° year-round from a 6" well 153' deep. Water is then discharged back into the ground through another 6" well 153' deep located approximately 250' in distance.

Located below are the results of the operation of these units since moving into the facilities in July of 1980:

	<u>1980</u>					<u>1981</u>			
	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>
KWH Usage	590	390	1319	2030	3170	3680	2860	2380	1100

The office facilities have been very comfortable, with no drafts, no sensation of sound, and the temperature is very constant from summer to winter.

The actual installation of the unit was done by Roth Electric of Archbold, Ohio. Their workmanship and concern for the operation of the project has been excellent. We at North Western Electric have undertaken a program of promoting the installation of geothermal systems to our members. We believe these systems to be a very economical means of heating and cooling residences, as well as keeping with the spirit of conserving energy.

We would highly recommend the TETCO geothermal system for commercial as well as residential application.

Sincerely,

*Lyle D. Brigle*  
 Lyle D. Brigle  
 Manager - Engineer

LDR/kjb

**ANALYSIS OF HEATING & COOLING  
NORTH WESTERN ELECTRIC HEADQUARTER OFFICE FACILITIES (6,700 sq. ft.)**

	<u>NORTH END</u>		<u>LOBBY AREA</u>		<u>ENG. &amp; LINEMEN'S ROOM</u>		<u>TOTAL PUMP</u>	<u>MONTHLY TOTAL K.W.H.</u>
	<u>#1 TETCO SYSTEM</u>	<u>#1 AUX. HEAT</u>	<u>#2 TETCO SYSTEM</u>	<u>#2 AUX. HEAT</u>	<u>#3 TETCO SYSTEM</u>	<u>#3 AUX. HEAT</u>		
Aug-80	90	0	170	0	70	0	260	590
Sept-80	60	0	130	0	20	0	180	390
Oct-80	210	0	710	0	230	0	160	1,310
Nov-80	490	0	1,040	0	280	0	220	2,030
Dec-80	790	0	1,670	0	360	0	340	3,160
Jan-81	790	0	1,910	0	540	0	410	3,650
Feb-81	760	0	1,380	0	440	0	310	2,890
Mar-81	690	0	1,170	0	250	0	270	2,380
Apr-81	450	0	390	0	130	0	130	1,100
May-81	310	0	370	0	110	0	170	960
June-81	190	0	180	0	0	0	240	610
July-81	170	0	240	0	30	0	320	760
Aug-81	180	0	210	0	50	0	320	760
Sept-81	240	0	260	0	10	0	210	720
Oct-81	340	0	240	0	170	0	90	840
Nov-81	530	0	640	0	430	0	200	1,800
Dec-81	470	0	1,890	0	510	0	360	3,230
<b>TOTAL 81</b>	<b>5,120</b>	<b>0</b>	<b>8,880</b>	<b>0</b>	<b>2,670</b>	<b>0</b>	<b>3,030</b>	<b>19,700</b>

**Well  
water  
can  
heat**



**& cool your home**

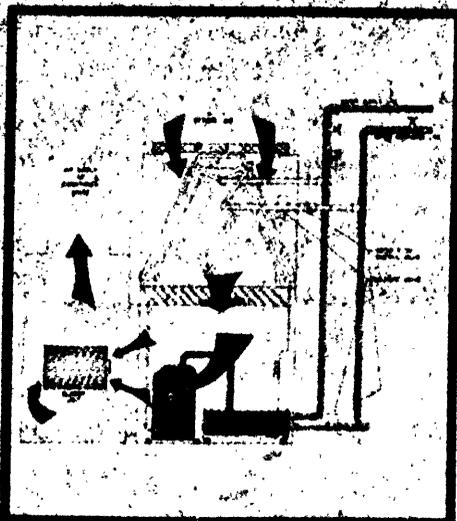
**Virgil Herriott's Geothermal Heat Extractor  
cost an average of \$1.30 to operate a day!**



The TETCO Geothermal Heat Extractor is the most exciting innovation to hit the heating and cooling industry in years. Using a readily available, renewable, and free natural resource as energy, the Heat Extractor can heat most homes more efficiently than any other type of system. Rising energy costs will make the initial investment of the Geothermal Heat Extractor even more financially beneficial in years to come. Read on for documented proof that you can really use well water to heat and cool your home. Be sure to see the TETCO Geothermal Heat Extractor demonstrator unit operate at your nearest dealer.

**THERMAL ENERGY TRANSFER CORPORATION**

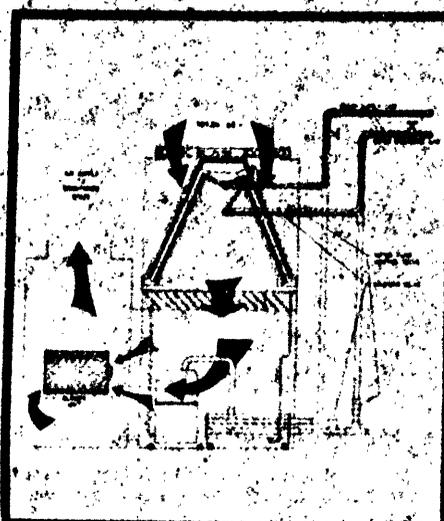
# How it works!



## Heating cycle

The TETCO Geothermal Heat Extractor absorbs heat from well water and turns it into usable high temperature heat for domestic heating purposes. Water from a well flows through tubes located inside a water to refrigerant heat exchanger. Surrounding the water tubes is a container filled with extremely cold refrigerant. This cold refrigerant then enters a compressor where it is put under pressure to about 245 pounds per square inch, increasing its temperature to about 100 degrees Fahrenheit. The hot refrigerant circulates through a refrigerant to air heat exchanger. Air, circulated by a blower, is heated as it flows past the refrigerant to air heat exchanger and is then distributed throughout the entire home. As the hot refrigerant flows through the refrigerant to air heat exchanger, it cools and condenses to a liquid state. The expansion device (capillary tube) acts as a refrigerant flow restrictor. As the liquid refrigerant leaves the capillary tube, its temperature and pressure are reduced to about 33 degrees. The cold refrigerant now enters the water to refrigerant heat exchanger and the process repeats itself.

The TETCO Geothermal Cooling Coil air-conditions by circulating cold well water through a large finned coil. Warm air passing across the fins is cooled as it transfers its heat to the colder water. No compressor is used in this direct cooling process and the only electricity consumed is for the operation of a blower



## Cooling cycle

unit and a well pump. The TETCO Geothermal Cooling Coil is ideal for use where water temperatures of 55 degrees Fahrenheit and lower provide excellent air-conditioning by both cooling and dehumidifying the air.



The Andersen home near Valley Springs contains 1,248 square feet and is heated and cooled for \$1.16 a day — using water.

## Geothermal:

*some members find using underground water has drastically cut heating and cooling costs*

When winter winds blow and snow clogged roads make it impossible for the fuel oil truck to get through, Denis Andersen doesn't worry. His rural Valley Springs home is heated using water — for an average cost of \$1.16 a day.

Nearly two years ago Andersen installed a geothermal heat extractor to heat and cool his rural Valley Springs home. His heating system and home were featured in the September, 1981 issue of the *Sioux Valley Magazine*. Since then, however, the Andersen's have gone through another heating season, the latest, the bitter cold winter of 1981. We decided to return to see if using underground water as a primary source for heating and cooling the Andersen home was working out as he planned. It is. During the past 22 months Andersen has heated and cooled his home for only \$1.16 a day!

Andersen said he decided on the geothermal unit after visiting with Sioux Valley Electric personnel. He and his wife had just arranged to purchase a 1,248 square foot Lampert house, to move on the farmstead, to replace the mobile home that was no longer adequate to meet their growing families needs. "We were looking for a heating and cooling unit that would give us low operating costs the year around," said Andersen. "After looking over all the possibilities, we decided to buy the geothermal unit."

One factor which made it easier for the Andersen's

to make up their mind was the need for a new well. The old well was shallow and not dependable. So with a new well already in the plans, it provided the opportunity to consider a geothermal unit. A geothermal heat extractor needs a minimum of five gallons per minute. Andersen's 240-foot deep well produces over eight gallons per minute. During the summer months the water that flows from the well is at 63 degrees. During the winter months the water is a consistent 62 degrees, cooling to 50 to 51 degrees only in early spring when the frost goes down.

The geothermal heat extractor uses the 62-degree water as the main source of heat. The unit absorbs heat from the water and turns it into usable high temperature heat for heating purposes. Water from the well flows through tubes located inside a heat exchanger. A refrigerant in the exchanger is 32 degrees and has the ability to absorb heat from the water. The refrigerant then passes through a compressor which raises its pressure and temperature to about 180 degrees Fahrenheit. Air, circulated by a blower, is heated as it flows past the refrigerant coils and is then distributed throughout the home. Andersen says he keeps the temperature inside his home between 68 and 70 degrees during the winter months. At night they turn the thermostat down to about 62 degrees. In the summer they keep the air conditioner set at around 75 degrees. The air conditioning cycle of the geother-

mal unit does not require the compressor to operate. The water pump and blower operate, again using the temperature of the water as the cooling source.

Water taken from the deep well first goes into a 30 gallon pressure tank and then runs through Andersens' geothermal unit. After running through the unit, the water is discharged into the old well, which is about 100 feet deep. Because the old well cannot absorb the entire discharge the overflow goes into a 2,000 gallon water supply tank which he uses to water cattle. A water line from the supply tank to a nearby pond takes care of any excess water. Discharged water from the well and pond is absorbed through the ground, rewarmed and reused — making it a clean and renewable energy source at very little cost.

The experiences of Denis Andersen and his geothermal heat extractor are fairly similar to several other Sioux Valley Electric members who have installed such units. Sioux Valley monitors several installations throughout the cooperative's service area. It has been found that wherever there is a dependable and adequate source of water, the geothermal concept can be utilized to slash home heating and cooling costs, many times cutting those costs in half.

Data obtained at the cooperative indicate savings of between 50 and 80 percent over the more traditional fossil fuel heating systems and air to air heat pumps.

"I'm glad we went this way," said Andersen,



The Andersens, Denis, Janet, Erin, Brian and Brooke.

"especially when it comes to paying the bill. It's really worked good."

(For further information about geothermal heat extractors contact your local heating and air conditioning specialist or Sioux Valley Electric.)

Denis Andersen, operating information  
TETCO Geothermal Heat Extractor  
Dec. 4, 1980 - Oct. 4, 1982 (22 months, 669 days)

Meter readings	12/4/80	10/4/82		
Heat extractor	1200	10650	=	9500 KWH
Supplemental heat & blower	240	2790	=	2550 KWH
Well pump	0000	3300	=	3300 KWH
Water	0167050	1787133	=	1580483 gallons

15,500 KWH at .05	=	\$775.00
\$775.00/669 days	=	\$1.16 a day
\$775.00/22 months	=	\$35.23 a month
1,580,483/669	=	2,376 gallons a day
1,580,483/22	=	72,243 gallons per month

8 GPM Flow rate  
4.95 hours per day, average running time  
23 KWH/day average  
706 KWH/month average



**STATEMENT OF THE  
WATER SYSTEMS COUNCIL  
IN SUPPORT OF S. 1237**

(To be included in the printed record of hearings on S. 1237, held by the Subcommittee on Energy and Agricultural Taxation on July 18, 1983.)

The Water Systems Council (WSC), a trade association formed to promote the growth of the nation's private water supply industry, hereby offers this statement in support of S. 1237, a bill to clarify the Internal Revenue Service (IRS) definitions of geothermal energy for the purposes of residential and business investment energy tax credits.

The 22 American companies\* who comprise the regular membership of the WSC manufacture more than 96 percent of the domestic and farm pumping equipment produced annually in the United States. WSC's "Supplier Associate Members" include manufacturers of components sold to the water pump industry, such as motors, switches, tanks, seals, air controls, gauges and cables. Our "Allied Interest Associates" include suppliers of related water-using products, such as well castings, piping, and items used in sewage treatment and septic systems. Members of our Pitless Adapter Division, manufacturers of pitless well adapters, protect public health by setting high standards for design, manufacture and installation of adapters and units as part of the complete water system.

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\* See Exhibit A for the names and addresses of WSC members.

As such, WSC is vitally interested in legislative developments concerning energy-saving devices such as groundwater heat pumps. These pumps operate according to the same basic principles as these at work in a refrigerator. When used in conjunction with a heat pump, groundwater can serve both as a heat source (for heating) and as a heat sink (for cooling). The tapping of such "geothermal" energy through heat pumps yields substantial energy efficiencies and cost savings, for although the heat pump is operated by electricity, the actual heating or cooling energy in a geothermal system is free and almost unlimited.

WSC strongly supports S. 1237 as a timely piece of legislation that would lift several ill-advised restrictions on the development of geothermal energy resources throughout the United States. First, the bill would amend I.R.C. §613(e)(3) and overrule Revenue Ruling 81-304 which limit energy tax credit eligibility to its conception of "geothermal" energy systems, defined by the IRS as those systems having access to groundwater with temperatures above 50° Celsius (122° Fahrenheit). With this restrictive definition of "geothermal" energy, the IRS has effectively removed large areas of the country, particularly in the East and Midwest, from the incentive program designed by Congress to spur development of alternative energy sources such as lower-temperature groundwater. Nationally, the U.S. Geological Service has estimated that 5,496 megawatts of beneficial heat are currently available from known geothermal resource sites with water temperatures below the 50° C standard set by the IRS. It has

been estimated that water source heat pumps can operate extremely efficiently even at groundwater temperatures as low as 4° C. Moreover, the IRS definition stands contrary to commonly-accepted scientific definitions of "geothermal" energy. For instance, the Geothermal Resource and Energy Committee of the American Society of Testing and Materials (ASTM) has issued a proposed definition for geothermal energy that would cover the use of water with earth temperatures as low as 38° F.

Second, S. 1237 also would liberalize the present approach taken by the IRS in its implementing regulations which limit the use of tax credits for geothermal energy equipment to that which uses "geothermal energy exclusively". (See I.R.S. Reg. 1.48-9(c)-(10)(iv)). Consequently, alternative energy equipment that uses energy derived from a geothermal source and a non-geothermal source (i.e., "peaking" equipment) is currently ineligible for the energy tax credit. The "exclusively geothermal" rule thus discourages the development of innovative hybrid alternative energy systems. However, S. 1237 removes many of these disincentives by retaining the residence and investment tax credits for hybrid systems, while discouraging "sham" attempts to claim the tax credits through its requirement that the hybrid system contain a specific percentage of geothermal equipment in order to qualify for the credit.

By eliminating these disincentives through the passage of S. 1237, the Congress would save thousands of American families substantial sums of money on their energy bills, while increasing

American self-sufficiency in energy production. The National Water Well Association has estimated that a water heat pump system, properly installed, can pay for itself in two to four years. If a well must be drilled, the time period expands to four to eight years. Energy savings beyond this period can be dramatic. Water source heat pumps are extremely efficient and can reduce energy consumption and thus, energy costs, by as much as two-thirds. For instance, the Mahonet Valley Company, a heating, ventilating and air conditioning company in Oreana, Illinois, conducted a 1981 study of a ground water heat pump installation in a 2,800 square foot house located near Decatur, Illinois. The results of that study indicated that for the 1980-1981 heating season, the costs of heating the house ranged from an actual low of \$173.43 for a geothermal heat pump to an estimated high of \$621.60 for the equivalent number of BTUs produced by No. 2 fuel oil. (See Exhibit B, Pg. 2, Table 2).

Increased use of heat pumps to tap our geothermal energy would also improve the efficiency of the nation's electricity generation and distribution system. Using groundwater, a heat pump heats three to five times as efficiently as a fossil fuel system, and uses from 20 to 60 percent less energy for heating than the air-source heat pump. Increased reliance on this readily available domestic energy source would reduce the strain on the nation's electric utility systems, while mitigating the capital investment and environmental problems associated with developing new electrical-generating facilities. By one estimate, 85

percent of the homes in the Northeast and Midwest regions could replace their fossil fuel heating and electrical cooling systems with purely geothermal or hybrid geothermal systems.

The bill would also strengthen America's independence from foreign oil sources. The 1970's witnessed repeated disruptions of our oil supplies, with commensurate rises in oil prices. In 1981, imported oil provided over 37 percent of our nation's total petroleum supplies. It has been estimated that, for every one million homes equipped with ground water geothermal heat pumps, the country would save an additional 25 million barrels of imported oil annually. (See Exhibit C, page 2). Furthermore, no foreign nation could ever "embargo" or hold hostage the energy found in America's own topsoil, nor would it have the ability to raise the price of geothermal energy located beneath our own homes.

Moreover, the tax credits provided by S. 1237 would spur production of heat pumps and related equipment, as well as the development of new geothermal-related technologies. These incentives would provide new jobs for thousands of skilled American workers, such as electricians, plumbers, sheet metal workers, drillers, technicians and assembly personnel. Many of these jobs would be concentrated in the nation's industrial heartland of the East and Midwest, areas that have been hardest hit by the recent economic recession and rapid technological change in blue-collar industries.

Accordingly, the Water Systems Council extends its wholehearted support to S. 1237, legislation that, while strengthening America's energy independence, would, through the development of cost-efficient environmentally-sound alternative energy systems, aid those sections of the country most reliant upon imported oil and hardest hit by the recent economic recession.

EXHIBIT AWATER SYSTEMS COUNCIL MEMBERSRegular Members

BAKER MANUFACTURING COMPANY  
133 Enterprise Street  
Evansville, Wisconsin 53536  
(608) 882-5100

BERKELEY PUMP COMPANY  
Division of Transamerica  
Delaval, Inc.  
829 Bancroft Way  
Berkeley, California 94710  
(415) 843-9400

BURKS PUMPS - DECATUR PUMP COMPANY  
P.O. Box 431  
1434 North 22nd Street  
Decatur, Illinois 62525  
(217) 429-2591

CRANE CO., U.S.A., DEMING DIV.  
5555 Commercial Blvd.  
Winter Haven, Florida 33880  
(813) 967-1137

DEMPSTER INDUSTRIES INC.  
P.O. Box 848  
Beatrice, Nebraska 68310  
(402) 223-4026

FAIRBANKS MORSE PUMP DIV.  
COLT INDUSTRIES OPERATING CORP.  
3601 Fairbanks Avenue  
Kansas City, Kansas 66110  
(913) 371-5000

GOULDS PUMPS, INC.  
240 Fall Street  
Seneca Falls, New York 13148  
(315) 568-2811

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 Whitewater, Wisconsin 53190  
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by Kevin McCray

## One year of heat pump performance

The Mahomet Valley Company, heating, ventilating and air conditioning contractors in Oreana, Illinois, recently completed a one-year study of a ground water heat pump installation done by the company in a 2,880 square foot, two-story, four-bedroom house with basement located near Decatur, Illinois.

Walls in the house are of two-by-six construction and are fully insulated. The ceiling has an R-38 insulation factor, while the windows are thermopane and doors are of insulated core construction. The basement is also insulated. Mahomet Valley Company determined the structure's heating load to be 32,116 Btuh and the cooling load to be 28,748 Btuh. The winter design conditions in the area were 0°F outside and 70° inside. Summer design conditions were 95°F outside and 75°F inside. The average heating degree days were determined to be 5,429. Decatur is situated at approximately 40° latitude and its temperature range is regarded as medium.

Ground water for the heat pump and domestic needs was supplied from a 5-inch diameter, 140-foot deep well with 8 feet of well screen in an unconsolidated formation. The well was within 50 feet of the house. Static water level in the well was measured to be 53 feet. A 1½ horsepower submersible well pump capable of filling a pressure tank in 45 seconds was used. The return well for the project was 4-inches in diameter, 128 feet deep with 8 feet of screen and an 80-foot drop pipe. Ground water temperatures varied from 54 to 55°F. Quality tests showed the ground water to be 20 grains hard, two parts per million.

A National GeoThermal Model 34 vertical heat pump capable of pro-



The test house used by Mahomet Valley Co. in Decatur, Illinois.

ducing 1,250 cfm of air volume was selected for the installation. The 3-ton unit's heating capacity was rated at 35,500 Btuh, while cooling was 33,000 Btuh. The unit, at its best efficiency, required eight gallons of water per minute. Water usage was manually controlled to different levels to measure performance. While eight was the most efficient, the unit adequately performed at six. Five was considered borderline.

Ductwork in the house was designed for a .08 inch static pressure and was completely insulated, with the exception of branches found in the conditioned basement.

In cooperation with the Illinois Power Company, time of day recording devices and meters were installed separately to the submersible well pump and the ground water heat pump. Additional equipment was in-

stalled to measure and record the balance of the structure's electric demands.

Pressure and temperature gauges were also installed on both incoming and outgoing water lines.

The accompanying tables illustrate the performance of the Decatur test house heat pump during a mild winter, as determined by Mahomet Valley Company.

Mahomet Valley reached several conclusions from their year-long study. The heat pump consumed 1.18 kwh per heating degree day and 4.4 per cooling degree day. Each additional gallon per minute of water flowing through the unit increased electric consumption by .1 to .2 kwh per operating hour. The 3-ton system consumed about 4.2 kwh of electricity per operating hour, with the blower using about 10 percent of the total

Decatur Test House  
1980-1981 Results

Table 1.

Month	Heat Pump kwh	Well Pump kwh	Compressor Hours (1)	Water Used Gallons (2)	Degree Days (3)
October '80	144	32	41.8	12,540	395
November	509	114	142.9	61,590	675
December	892	232	258.3	140,644	1028
January '81	1124	294	329.8	178,092	1193
February	848	217	249.2	129,366	906
March	655	162	192.8	82,380	647
April	198	63	60.8	29,184	181
May	225	72	70.8	34,032	184
Heating Season total	4595	1186	1346.4	667,828	4909
June	319	100	105.2	50,496	88
July	381	120	129.1	61,968	152
August	284	96	96.0	46,080	55
September	50	25	16.5	7,920	12
Cooling Season total	1034	341	346.8	166,464	307
Annual total	5629	1527	1693.2	834,292	

(1) Maximum operation was 17.9 hours per day using 60+16 kwh and 9666 gallons of water.

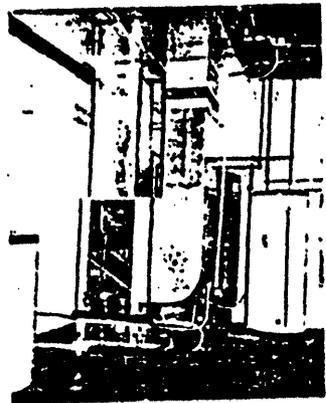
(2) Water usage changed from 5 gpm, to 9, to 6, to 8.

(3) Thermostat set on 70°F, heating and 75°F, cooling.

Table 2. Comparison with Other Fuels  
1980-1981 Heating Season

Heating Load	Units/47,124 Million Btu	Cost/ Unit	Fuel Cost
#2 Fuel Oil	518 gal. <sup>(1)</sup>	\$1.20/gal.	\$621.60
Propane	740 gal. <sup>(2)</sup>	.75/gal.	555.00
Electric Resistance	13,811 kwh <sup>(3)</sup>	.03/kwh	414.33
Air-to-Air Heat Pump	8,124 kwh <sup>(4)</sup>	.03/kwh	243.72
Natural Gas	673 therms <sup>(5)</sup>	.35/therm	235.55
Geothermal Heat Pump	5,781 kwh <sup>(6)</sup>	.03/kwh	173.43

Notes: <sup>(1)</sup> Seasonal C.O.P. of .65.  
<sup>(2)</sup> Seasonal C.O.P. of .70.  
<sup>(3)</sup> C.O.P. of 1.0.  
<sup>(4)</sup> Seasonal C.O.P. of 1.7.  
<sup>(5)</sup> Actual Test Results.



The National GeoThermal Model 34 ground water heat pump in place.

Table 3.

Comparison at Various Rates  
1980-1981 Heating Season

KWH	Electric Rate \$/KWH	Total \$
5781	\$.027	\$156.09
5781	.035	202.34
5781	.040	231.24
5781	.050	289.05
5781	.060	346.86
5781	.070	404.67
5781	.080	462.48

Table 4.

Comparison at Various Rates  
June-September 1981

KWH	Electric Rate \$/KWH	Total \$
1 375	\$.035	\$ 48.13
1 375	.040	55.00
1 375	.050	68.75
1 375	.060	82.50
1 375	.070	96.25
1 375	.080	110.00

Comparison with Conventional Systems  
June-September 1981

Table 5.

Cooling Method	Units (kwh)	Cost/unit	Fuel Cost
Air conditioner	1,719 <sup>1)</sup>	\$0.06/kwh	\$103.14
Ground water heat pump	1,375 <sup>2)</sup>	.06/kwh	82.50
Percent saved	25%		20.64

<sup>1)</sup> EER of 8.

<sup>2)</sup> Actual results of an EER of 10.

system operating cost, the submersible well pump about 20 percent and the ground water heat pump unit itself about 70 percent. The company found that the unit was capable of maintaining 74°F within the house during the heating season without the use of supplemental heat.

The test house experience gave the company several bits of insight for future ground water heat pump installations.

They found that galvanized nipples and fittings in the line leaving the pressure tank quickly corroded and therefore appropriate noncorrosive materials should be used. If a flow con-

trol valve is required, it probably should be placed in the return line and buried outside of the structure due to excessive noise, Mahomet Valley Company determined. The water valve should be sized so as to prevent its amperage draw from burning out the heat anticipator on the thermostat. Large, low static pressure ductwork will provide an efficient, quiet system. Only small amounts of additional humidity were required in the test house during the winter, and the system adequately dehumidified in the summer. For guaranteed comfort in the event of an unforeseen problem, the company suggests that

electric and/or wood heat be available.

For further details on this project contact: Don Dexheimer, Mahomet Valley Company, 23 Wilber Court, Oreana, IL 62554.

*Kenn McCray is editor of Ground Water Heat Pump Journal.*

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## Literature

### American Air Filter water source heat pumps

Vertical, horizontal, console and roof-mounted water source heat pumps for residential and commercial applications are described in six, two-color, multi-page catalogs. Information covers comprehensive product descriptions, model types, capacities, ratings, specifications, dimensions, graphs and charts, illustrations, drawings and photographs.

Circle card no. 10

### New cutting tool catalog

A new 16-page, 2-color catalog containing product information and unit prices for the Champion Twist Drill Corporation's enlarged line of over 2,000 industrial grade cutting tools was recently announced.

In the catalog is an explanation of a new concept in cutting tool distribution called the "Champion Tool Bank." To use the "bank" a regular customer is given a special toll free hotline telephone number that will give him access to an inventory of 40,000 different cutting tools that can be quoted and shipped within 48 hours.

Also in the catalog are Champion's Brute drills, screw machine drills, taper shank drills, single and double end sheeters, extra long drills, pilot drills, silver and deming drills, steel sleeves and sockets, drifts, drill sets, carbide tipped masonry drills, rotary hammer drills, percussor drills, masonry core drills, extension shanks, taper shank adapters, carbon and high speed steel taps, dies and die nuts, taps and die sets, bridge and car reamers, high speed counter sinks, taper pin reamers and carbide circular saw blades.

Circle card no. 12

### Comfort-Aire heat pump literature

Comfort-Aire offers a complete line of water-to-air packaged heat pumps for residential use. Capacities of two through five tons are featured in this brochure. The water source may be a well or other large body of

water that maintains a temperature of a relatively constant 45° or higher.

Units are constructed with copper-tube, aluminum fin indoor coil, co-axial condenser with steel outer tubing and cupro-nickel inner tube. Water piping can be made from three sides with the Comfort-Aire unit. Other features are high and low pressure safety controls, high and low pressure service valves, reversing valve and special valves for installation of accessory of water valves to control water flow, if needed.

Circle card no. 13

### Packard Press announces publication of Homeowner's Energy Tax Guide

With another cold winter upon them, consumers' thoughts have turned once again to the high costs of heating their homes—and to ways of making their homes more energy-efficient.

As an answer to this problem, Packard Press has prepared a sourcebook for consumers which contains all the information they need to know to apply for their income tax rebates. The Homeowner's Energy Tax Guide is a 40-page, fully illustrated, step-by-step guide to claiming the tax rebates while encouraging consumers to join in the fight for America's energy independence.

Packard will provide a sample copy of the Homeowner's Energy Tax Guide, as well as an illustrated brochure on the marketing programs, to any company representative.

Circle card no. 15

### Brochure features Andco Rotary Posi-Tork actuators

A new brochure from Andco Actuator Products Inc. features technical information on the company's Series QR and QRG Posi-Tork Electric Rotary Actuator.

The new Andco Rotary Posi-Tork Actuators can be used in a wide variety of material handling and other rotary applications. They are available as weatherproof or dust-ignition proof

in a compact, rugged unit designed to be maintenance free.

Features of the new Posi-Tork Rotary Actuators include: internal, heavy-duty gear-driven position switch, thrust limit switch, optional gear-driven potentiometer, simple, low-cost mounting and installation.

The standard models of the Andco Rotary Posi-Tork Actuators are available with breakaway torques ranging from 16 lbs. to 760 lbs., running torque from 9 lbs. to 400 lbs., and speeds ranging from 4.6 RPM to 62 RPM.

Circle card no. 11

### Lear Siegler's Mammoth Division heat pumps

Thirteen models of vertical, horizontal and console ground water heat pumps ranging in cooling capacities from 6.6 to 144 Mbtuh, and heating capacities from 8.4 to 174 Mbtuh are described in one, two-color, 20-page brochure, one, four-color eight-page brochure and four-color, six-page foldout. Information includes complete product descriptions, model types and capacities, dimensional data, specifications, photographs, schematics and associated technical material.

Circle card no. 14

### York Triton heat pump units featured

Well water and vertical closed-loop heat pumps are described in a multi-page technical guide. Information includes comprehensive product description, model types, applications, specifications, photographs, drawings, charts, heating and cooling capacities, physical data, wiring data, schematics and associated technical data.

Circle card no. 16



# Ground Water Source Heat Pump Fact Sheet

**Introduction** Our government is spending vast sums of money to develop exotic synthetic sources of energy rather than taking coverage of the natural systems built into the earth that utilize solar and geothermal energy. The ground water source heat pump utilizes this energy more perfectly than any other system that has the potential for saving incredible quantities of fossil fuel.

The importance of the ground water source heat pump to this country's energy situation cannot be overstressed. So far, solar energy has proven extremely costly. Similarly, the direct application of high temperature geothermal energy has proven costly and geographically limited. The ground water source heat pump is our most promising alternative to these limited technologies. It is efficient, economical and adaptable to a wide geographic range.

**Operation** Ground water heat pump systems utilize energy found in shallow ground waters normally occurring within 50-200 feet of the earth's surface. The potential energy within these easily accessible waters is a combination of both geothermal and solar energy. Ground water is heated by the geothermal gradient leading from the earth's center to the earth's surface. In addition, the sun provides a portion of the heat energy of shallow ground waters. The sun heats water falling on the earth's surface; this water then infiltrates the crust of the earth and moves down the water table. Shallow underground water is the perfect marriage of solar and geothermal energy.

A recent study by the National Water Well Association for the Department of Energy demonstrates that temperatures of shallow ground water are slightly higher than mean air temperatures. These higher water temperatures are a result of geothermal heating within the earth.

Ground water energy can be tapped from shallow ground water reservoirs at costs varying from 1¢ per thousand gallons, per 100 ft. of lift, to 6¢ per thousand gallons per 100 ft. of lift. A home heated with energy from the water would rarely use more than 70,000 gallons of water in the coldest months of winter. It would cost less than \$5.00 per month to bring the water to the surface where heat is extracted by simple refrigeration systems known as ground water source heat pumps. The refrigeration system cycle extracts the heat from the water by use of Freon. A compressor in the refrigeration loop increases the temperature and pressure of the Freon gas, amplifying its thermal energy. This energy is expelled to the return air which is then delivered to the conditioned space by a conventional air circulation system. The cost of the electrical energy used to run the compressor and the air handling device rarely exceeds \$35.00 per month.

The water returns underground slightly cooler (approximately 10 degrees) than the temperature at which it was extracted. It is reheated to the ambient ground water temperature within a few feet of the well as it absorbs geothermal energy from the earth as well as solar energy from the surface of the earth. Thus, the system is totally renewable. There is no net change in ground water temperature over time. The small quantities of heat extracted from the water are continually replaced by the reservoir of heat available in the system and by the continuous input of heat energy from the sun and the earth. This results in an absence of negative environmental impacts.

STATE OF MICHIGAN



JAMES J. BLANCHARD, Governor

## DEPARTMENT OF COMMERCE

RALPH J. GERSON, Director

ENERGY ADMINISTRATION  
P.O. Box 30228  
Lansing, MI 48900

August 1, 1983

Mr. Roderick A. DeArment  
Chief Counsel  
Committee on Finance  
Dirksen Senate Office Bldg., Room SD-219  
Washington, D.C. 20510

Dear Mr. DeArment:

RE: S. 1237, July 18, 1983, Hearing

I am writing with comments on S. 1237. For your reference, the hearing date was July 18, 1983.

I continue to have reservations about extending federal tax credits to include water source heat pumps.

First, tax dollars should be used to promote the most cost-effective energy saving technologies. In most cases, individuals would save more energy by investing in insulation, weatherstripping, and heating plant modifications than by purchasing a water source heat pump. As such, it might be better to promote these technologies than spend money on a subsidy for water source heat pumps.

Second, I am concerned that greater use of water source heat pumps may increase the rate of ground water depletion. I would not like to see us conserve energy at the expense of available drinking water.

Thank you for providing us with an opportunity to comment.

Sincerely,

A handwritten signature in cursive script that reads "Joann E. Neuroth".

Joann E. Neuroth  
Director

○