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TECHNOLOGY NEUTRALITY IN ENERGY TAX: ISSUES AND OPTIONS

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TECHNOLOGY NEUTRALITY IN ENERGY TAX: ISSUES AND OPTIONS

THURSDAY, APRIL 23, 2009

U.S. SENATE,
COMMITTEE ON FINANCE,
Washington, DC.

The hearing was convened, pursuant to notice, at 10:10 a.m., in room SD–215, Dirksen Senate Office Building, Hon. Max Baucus (chairman of the committee) presiding.

Present: Senators Bingaman, Lincoln, Wyden, Schumer, Stabenow, Cantwell, Nelson, Carper, Grassley, Snowe, and Bunning.

Also present: Democratic Staff: Bill Dauster, Deputy Staff Director and General Counsel; Cathy Koch, Senior Advisor, Tax and Economics; and Pat Boulisman, Natural Resource Advisor. Republican Staff: Kolan Davis, Staff Director and Chief Counsel; Jim Lyons, Tax Counsel; and Emilia DiSanto, Special Counsel and Chief Investigator.

OPENING STATEMENT OF HON. MAX BAUCUS, A U.S. SENATOR FROM MONTANA, CHAIRMAN, COMMITTEE ON FINANCE

The CHAIRMAN. The hearing will come to order.

Justice Oliver Wendell Holmes wrote: "[T]he best test of truth is the power of the thought to get itself accepted in the competition of the market. . . ."

Today we consider a new thought in the marketplace of ideas about tax incentives. The thought is that, in the creation of energy tax incentives, the government might not pick and choose among different technologies.

The thought is, the government might just set a performance standard, regardless of the technology employed. We can encourage things like reduction of greenhouse gas emissions, improvement in efficiency, or increased energy content. Then we would leave the job of picking the best technology to the competition of the market.

Folks call this sort of incentive "technology neutral."

There are several reasons why a tech-neutral approach to energy tax incentives might make sense.

First, it might well provide more bang for our energy-tax buck. By tying receipt of these credits to a common standard, we may be able to set this level of incentives more efficiently.

Second—and this may come as a surprise to many in the room—sometimes government gets it wrong.

Consider the credit that Congress enacted in 1980 to stimulate oil shale, tar sands, and synthetic fuels from coal. The idea sounded good at the time. But many companies exploited the credits.

Some sprayed coal with chemicals for no reason other than to line their pockets.

Third, a technology-neutral approach might mean that we have to change the tax code less often. Technology is bound to change faster than Congress can act. So there is appeal to instituting a series of incentives that we do not have to update all the time.

We have already taken some steps toward technology neutrality in recent legislation. For example, as part of last year's farm bill, Congress enacted the first-ever credit for cellulosic biofuels. This might sound like a credit that picks a specific technology. But, in fact, we have passed a technology-neutral credit for cellulosic biofuels. Another example is the approach that we took on coal incentives in last year's energy tax bill. We removed the bias toward integrated gasification combined cycle facilities. And we put in its place a requirement that all recipients of clean coal tax credits meet at least a 65-percent standard for capture and storage of carbon dioxide.

This approach sounds sensible. Congress should not pick winners and losers. We should set a level playing field of standards for energy tax incentives. And we should let the marketplace foster competition.

But we need to be aware of pitfalls. For example, a couple of years ago Congress modified the Alternative Fuels Tax Credit. That is a 50-cent-a-gallon credit for a range of alternative fuels, including liquefied petroleum gas, compressed natural gas, liquid coal, and biomass-based fuel.

In modifying the definition of biomass-based fuel, the credit was inadvertently opened to apply to what is called "black liquor." Black liquor is a by-product of the pulp-making process that has been used to power paper mills since the 1930s. Paper companies learned that they could benefit from the Alternative Fuels Credit by mixing a small amount of diesel with the black liquor and then registering with the IRS.

Unless we plug this loophole, the Federal Government is liable for billions in credits for black liquor in 2009 alone, even though the credit was never intended for this fuel. So in this case, a more technology-neutral approach led to a dramatic spike in the use of a credit for an unforseen purpose.

We are working to undo that unintended consequence. But our experience with black liquor suggests that we should exercise caution as we consider a tech-neutral approach. We have to make sure that we write the incentives correctly.

This committee has done a lot of energy tax incentives in recent months. And I am proud of what we have achieved. But as we prepare for the next energy debate, including climate change legislation, it may be time to consider an alternative means of promoting alternative energy.

And so, let us consider a new thought in the marketplace of ideas about tax incentives. Let us see if there is sense in getting the government out of the business of picking and choosing among different technologies. And let us see if technology-neutral incentives

might just be a thought that gets accepted in the marketplace of ideas.*

Senator Grassley?

OPENING STATEMENT OF HON. CHUCK GRASSLEY, A U.S. SENATOR FROM IOWA

Senator GRASSLEY. Thank you, Mr. Chairman.

Hockey players have goals, and soccer players have goals. So, as we look at whether it makes sense to design technology-neutral energy tax incentives, we first need to consider what goals our energy tax policies seek to achieve.

Some of the goals that have been mentioned for energy tax policy are a reduction of dependence upon foreign oil, a reduction in the use of fossil fuels, and reduction in carbon dioxide emissions. Depending on what goal or goals are selected, vastly different results emerge.

For instance, if the only goal in the fuels arena is the reduction of dependence on foreign oil, then of course energy tax incentives that encourage more domestic drilling and oil production are appropriate. However, if the goal is solely a reduction of carbon dioxide emissions or a reduction in the use of fossil fuels, then those same energy tax incentives to encourage more domestic drilling and oil production are inappropriate.

Simplifying the energy tax incentives by creating technology-neutral tax incentives is obviously a noble ambition; however, getting consensus on what the goal should be and what should be used in developing energy tax incentives can be a little like herding cats. Even if lawmakers agree on what goals should be used—and that is a big if—controversial issues arise. For example, whether nuclear energy should qualify for technology-neutral energy tax incentives will certainly be a controversial issue.

Also, the energy tax incentives that the Finance Committee has developed over the years have been extremely successful. For instance, in wind energy in the United States, it has made great advances with the help of the Production Tax Credit, which I first authored in the early 1990s. Or look at the Volumetric Ethanol Tax Credit that was part of the Transportation bill of a few years ago. It has helped the ethanol industry reduce our dependence on foreign oil, improve our national security, and reduce carbon dioxide emissions.

As we move forward now in designing energy tax incentives, we need to be careful not to undo all the good work that this very committee has done. Even the proponents of technology-neutral tax incentives do acknowledge that certain technologies need more assistance in their early stages of development than others. They agree that this justifies a departure from technology-neutral energy tax incentives.

I am interested in hearing the thoughts of the panelists, as well as other people on this issue. I look forward to the discussion.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator.

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*For additional information on this subject, *see also,* "Tax Expenditures for Energy Production and Conservation," Joint Committee on Taxation staff report, April 21, 2009 (JCX–25–09R), *http://www.jct.gov/publications.html?func=startdown&id=3554.*

Now I would like to introduce the panel. Our first witness is Dr. Gilbert Metcalf, professor of economics at Tufts University. Thank you, Dr. Metcalf, for taking the time to come and visit us and tell us your views.

Dr. METCALF. Thank you.

The CHAIRMAN. Next, Dr. David Greene, corporate fellow of Oak Ridge National Laboratory, and a visiting researcher at the University of California at Davis Institute for Transportation Studies. Welcome to you, Dr. Greene.

Dr. GREENE. Thank you.

The CHAIRMAN. You bet.

And finally, Dr. John Urbanchuk, director of the consulting firm, LECG. What does that stand for?

Dr. URBANCHUK. Well, it is an acronym these days, but it used to stand for Law and Economics Consulting Group.

The CHAIRMAN. Thank you. Thank you, gentlemen. Our usual practice is that your statements will be included in the record automatically, and I would ask each of you to speak for about 5 minutes.

So I will start with you, Dr. Metcalf.

STATEMENT OF GILBERT E. METCALF, Ph.D., PROFESSOR OF ECONOMICS, TUFTS UNIVERSITY, MEDFORD, MA

Dr. METCALF. Chairman Baucus, Senator Grassley, members of the committee, thank you for the invitation to testify this morning on the issue of technology neutrality.

I want to make the following points in my testimony today. First, technology neutrality can be defined in a variety of ways. I will primarily focus on technology neutrality in terms of specific policy goals that motivate energy tax policy. Second, efficiency is best achieved by setting taxes on energy sources that have negative externalities associated with their production or consumption. Third, a second-best technology neutrality can be achieved through the use of subsidies, but it is more difficult to do so.

In thinking about technology neutrality today, I want to focus on two externalities in particular. First is the concern with global climate change. Fossil fuel combustion in the United States is responsible for 80 percent of domestic greenhouse gas emissions, thus we should be encouraging a shift from fossil to renewable fuels.

A second concern is our heavy reliance on petroleum products and the dominance of this fuel in the transportation sector. Many have argued that our heavy reliance on oil constrains our foreign policy and makes us vulnerable to macroeconomic shocks when oil prices rise.

Before assessing the concept of technology neutrality, we need to define it. In a general sense, it means that the tax code should not favor one fuel over another after taking into account any positive or negative externalities arising from energy use. While conceptually straightforward, it is more difficult in practice to identify whether certain technologies are advantaged or disadvantaged by the code.

My written testimony describes a number of potential measures. Here, I would just like to focus on a measure in terms of dollars per ton of carbon dioxide not emitted or barrels of oil saved.

The benefit of this approach is that it calibrates the tax code's impact to the policy goals we care about. If the tax subsidy per ton of avoided greenhouse gas emissions from technology X is twice that of reducing emissions from technology Y, then we can say that our policy favors technology X over Y in this dimension.

What about policy distortions? First, let me note that a subsidy-based approach achieves the important goal of adjusting relative prices of polluting and non-polluting energy sources in the right direction. We can provide the right incentive to fuel users choosing between polluting fuel X and clean fuel Y by raising the price of X or lowering the price of Y; a tax or a subsidy can be effective on the margin of choosing among fuel sources where some cause pollution.

This creates a problem, however, on a different margin. Efficiency requires that consumers make decisions taking into account the full cost of using commodities, including any pollution costs. Raising the cost of polluting fuel X raises the overall cost of energy and encourages a reduction in energy consumption. This is efficient. Subsidizing the clean substitute undermines this consumer substitution effect as it leads to a lower cost of energy overall.

Second, subsidies that appear to be technologically neutral may not be neutral at all in the sense of equalizing the subsidy cost per unit of activity that Congress is trying to discourage. Consider the tax credit for hybrid vehicles. Table 5 in my written testimony shows the subsidy cost per gallon of gasoline saved through this credit for a variety of vehicles. The table illustrates a couple of points.

First, the credit per gallon of gasoline saved varies from zero to over $11 per gallon. Second, certain high-mileage vehicles are excluded from the subsidy because they do not use specified technology. Note that the Corolla gets nearly the same mileage as the Tribute hybrid. This is a particularly egregious violation of technology neutrality. The tax credit provides no incentive to make the internal combustion engine more efficient.

Let me discuss two additional design points. The first concerns additionality: does the policy lead to incremental reductions in pollution or simply subsidize activities that would have occurred anyway? As Chairman Baucus has just noted, a good example of this is the Alternative Fuels Mixture Credit. Paper firms are taking the credit for mixing diesel fuel with black liquor, a by-product of paper-making that historically has been used by the industry as a fuel source.

This is troubling on two levels. First, it is highly inefficient if credits are being provided for activities that would have been undertaken in the absence of the subsidy. Moreover, if the tax credit is raising the demand for diesel fuel in order to make the biofuel eligible for the credit, then it is having the perverse effect of raising, rather than lowering, demand for petroleum products.

A second important design issue is the interaction between tax policy and other policies. A simple example here is the interaction with the hybrid vehicle tax credit and CAFE standards. Allowing tax credits for hybrids encourages the production and purchase of high-mileage vehicles. Producing more hybrids relaxes the CAFE

mileage constraint for auto makers and allows them to sell more low-mileage vehicles.

I have identified a number of problems with the current approach. Energy-related subsidies lower, rather than raise, the cost of consuming energy. Much of the subsidy may be inframarginal, and the policy can be undermined through interaction with other policies.

Let me briefly mention alternatives that avoid most, if not all, of these pitfalls. Focusing on our concern with climate change and oil consumption, optimal policies will raise the cost of emitting greenhouse gases and consuming oil. A carbon pricing mechanism—either a carbon fee or a cap-and-trade system—and an oil consumption tax are straightforward ways to achieve these goals.

Both of these approaches address the problems identified above. They ensure that energy consumption internalizes the cost of externalities and achieves a socially efficient mix of energy and non-energy consumption. They avoid problems of inframarginal subsidies and perverse incentives. Finally, they complement, rather than work at cross purposes with, other energy policies.

In conclusion, current energy tax provisions can perhaps be best viewed as a transitional policy until policies such as carbon pricing are put in place. In the meantime, Congress should consider how they might best modify the existing subsidies to achieve true technological neutrality.

This requires measuring the subsidy cost of producing the externality in question. Policies should provide a level playing field in the sense that the subsidy per unit of externality avoided should be comparable across technologies. They should also consider the extent to which true reductions in the externality occur.

This is all very easy to say, but difficult to do. So long as our energy policy is built around providing subsidies for activities we wish to support as opposed to taxing those activities we wish to discourage, we will always face difficult design problems that complicate our efforts to achieve efficient and cost-effective outcomes.

Thank you for the opportunity to testify today.

The CHAIRMAN. Thank you, Dr. Metcalf, very much.

[The prepared statement of Dr. Metcalf appears in the appendix.]

The CHAIRMAN. Dr. Greene, you are next.

STATEMENT OF DAVID GREENE, Ph.D., CORPORATE FELLOW, OAK RIDGE NATIONAL LABORATORY, CENTER FOR TRANSPORTATION ANALYSIS, NATIONAL TRANSPORTATION RESEARCH CENTER, KNOXVILLE, TN

Dr. GREENE. Yes. Good morning, Mr. Chairman, Senators, and distinguished guests. Thank you for inviting me to participate in this hearing.

I will address primarily incentives for energy-efficient and low greenhouse gas-emitting vehicles.

The market system is, and will be, the fundamental mechanism by which we achieve our national energy goals. But markets run into difficulties in several areas. Externalities such as greenhouse gas emissions and the market power of the OPEC cartel are well-known examples.

But markets for energy efficiency have another important flaw: they under-value future energy savings. Here is how. As a rule, car buyers must pay more up front to obtain fuel savings in the future. Most assessments treat the future fuel savings as if they were certain, but they are not. Many key factors are uncertain, especially the future price of gasoline and the fuel economy a vehicle will actually get on the road.

As a result, the fuel savings from increased energy efficiency are not a certain amount, but an uncertain probability distribution. What matters to consumers is the net savings, the future fuel savings minus the up-front costs, a number which is relatively even more uncertain.

Economists have learned over the past 2 decades that consumers are, as a general rule, loss-averse, meaning they weigh the potential for loss more than the potential for gain in evaluating risky choices. Given uncertainty and loss aversion, the market may under-value fuel savings by a factor of two or more relative to the risk-neutral expected value.

Incentives for purchasing energy-efficient low greenhouse gas-emitting vehicles can get around this problem by moving the market signal to the initial purchase of the vehicle. The implications of uncertainty and loss aversion match up almost exactly with the views expressed by manufacturers to the 2002 National Research Council Committee on the CAFE standards. Manufacturers stated that consumers were willing to pay for only technologies which paid back their cost in 2 to 4 years.

But an important exception, which was mentioned by Senator Grassley: I think we can replace our current patchwork of tax incentives for alternative fuels and vehicles, for HEVs, PHEVs, natural gas, electric, flex fuel, E85, fuel economy, et cetera, with the simpler, yet more flexible and more efficient technology-neutral incentive structure.

On the vehicle side, nearly all of our current incentives could be replaced by a unified vehicle incentive system, usually referred to as a "feebate" system. Feebates consist of a graduated rebate for energy-efficient or low greenhouse gas-emitting vehicles and a graduated levy on energy-intensive or high greenhouse gas-emitting vehicles, both relative to a benchmark. The concept is very flexible. Feebate systems can be formulated in an infinite number of ways.

Because the incentive occurs at the purchase of the vehicle, it is not subject to the uncertainty and loss aversion problem, and a feebate rate equivalent to an extra $1 per gallon of gasoline consumed over the life of the vehicle would have more leverage on new vehicle fuel economy than a $2 per gallon tax on gasoline.

Several EU countries have adopted feebate systems for CO_2 emissions in 2008, and I am currently leading a study of potential feebate systems for the State of California on behalf of its Air Resources Board, which is considering such a system.

The U.S. gas guzzler tax is essentially half of a feebate system, but applies only to passenger cars. It is specified in terms of dollar penalties per half MPG step below 22.5 MPG, but the average rate per 100th of a gallon per mile is approximately $1,800. In terms

of dollars per gram of CO_2 per mile, this amounts to approximately $20.

The French have a system they call Bonus/Malus, which is a kind of feebate system. It uses a rate of approximately $1,500 per 100th of a gallon per mile, or $17 per gram of CO_2 per mile. But this rate does not apply to the final step for vehicles below 60 grams of CO_2 per kilometer. That is approximately 100 miles per gallon, better than 100 miles per gallon.

The French government set a much higher value for the lowest-emitting vehicles in order to provide a strong incentive for developing novel technologies, such as PHEVs, EVs, and fuel cell vehicles. Modifying the feebate rate to provide a greater incentive for advanced near-zero emission technologies is one approach to addressing the early barriers to a fundamentally different source of energy for transportation.

In my written testimony I show a series of feebate rates, from $500 to $2,500 per 100th of a gallon per mile, as well as their equivalents in terms of carbon prices per gallon and surcharges for gasoline. But really, as you have already noted, the feebate is attempting to accomplish multiple objectives. Just to overcome the uncertainty/loss aversion effect, a feebate of $1,250 per 100th of a gallon would be justified.

A feebate rate of $2,000 per 100th of a gallon per mile would give a 50 mile-per-gallon vehicle an incentive of $4,000 relative to a 25 mile-per-gallon vehicle. A 100 mile-per-gallon vehicle would receive an incentive of $6,000, assuming a constant rate. These are roughly comparable, I think, to the incentives in effect today, although they are probably not enough to support the early phases of a transition to a completely different energy source, such as hydrogen or electricity.

The market's response to the problems of greenhouse gas emissions and oil dependence is hindered by the inherent uncertainty of future fuel savings and consumers' loss aversion. As a consequence, fiscal incentives for increasing the energy efficiency of motor vehicles and reducing their greenhouse gas emissions can be especially effective policy tools. Most of the existing incentives for energy-efficient, low-emission vehicle technologies could be replaced by a technology-neutral feebate system.

Thank you. I look forward to trying to answer your questions.

The CHAIRMAN. Thank you, Dr. Greene, very much.

[The prepared statement of Dr. Greene appears in the appendix.]

The CHAIRMAN. Dr. Urbanchuk?

STATEMENT OF JOHN M. URBANCHUK, Ph.D., DIRECTOR, LECG, LLC, WAYNE, PA

Dr. URBANCHUK. Well, thank you very much. Good morning, Chairman Baucus, Ranking Member Grassley, members of the committee. I am pleased to be here this morning to discuss the role of the tax code in energy policy and the issue of whether technology-neutral energy incentives, including in the area of fuels, vehicles, electricity and efficiency, should be developed.

Experience both in the U.S. and around the globe has demonstrated that well-crafted tax incentives are an effective means to encourage the production and use of renewable energy. Alternative

sources of energy, specifically renewable forms, have been deemed in the national interest as a way of reducing dependence on imported energy and enhancing national security, improving environmental quality and, importantly in this environment, facilitating economic growth.

As with all tax policy, Congress should conduct prudent oversight to ensure that, over time, various tax incentives continue to reflect the Nation's tax and energy policy goals. As Congress considers both new tax incentives and revisits existing ones, there are three major factors that should be considered when determining the form and structure of an incentive.

The first of these is industry economics. The value of a tax incentive that is designed to encourage the production and use of a particular energy source should be set at responsible levels. Common sense would dictate that the incentive should be structured in a manner that makes an activity economically viable, but does not provide an unintended windfall for recipients. In addition, the value of the incentives should not create perverse incentives that encourage activities counter to responsible energy policy or those that impede achievement of national energy policy goals.

The second factor is innovation in technology development. Energy policy should be structured in a manner that incentivizes and spurs the development of cleaner and more efficient ways to generate and distribute energy. A corollary to this is the role energy tax policy can play in promoting conservation and in helping direct the flow of private investment capital to cleaner and more efficient sources of energy, and to industries with the potential for rapid commercialization.

An additional consideration is the role of energy policy or tax policy in stimulating job creation and economic growth, particularly in nascent industries such as wind and solar and second-generation biofuels. Thus, Congress should consider the potential to develop new technology, promote innovation, and build needed infrastructure when considering energy tax policy.

The third is really the focus of what we are talking about here, and that is technology neutrality. To the degree possible, energy tax incentives should be structured in a manner that treats competing technologies and processes in an equitable fashion. That said, Congress should set parameters, such as requiring various fuels to meet quality standards and specifications established by organizations such as ASTM, that ensure the desired policy goal of an incentive is being met. These three equally important factors should be weighed when Congress considers energy tax policy. However, it is instructive to note that these factors do not exist in isolation; rather, they interact with each other, thereby complicating the job of the policymaker.

The issue of technology neutrality is particularly vexing, especially with regard to the development of alternative fuels. In its purest form, technology-neutral energy tax policy would apply equally to all forms of energy and not give preferential treatment to one energy source over another.

However, national policy, as outlined by the Energy Independence Security Act of 2007 (EISA), mandates the use of 36 billion gallons of renewable fuels by 2022 and provides important research

and development incentives for solar and geothermal sources, as well as for programs aimed at improving energy efficiency and conservation.

On the face of it, the development of energy tax policy that supports these goals would effectively violate the basic premise of technology neutrality by providing favorable tax incentives for renewables such as cellulosic ethanol or advanced biofuel feedstocks, including biomass biodiesel, and the R&D incentives for solar and geothermal.

As you know, the EISA provides a cap of 15 billion gallons of ethanol from corn starch and calls for a billion gallons of biomass biodiesel, and requires the remaining 20 billion gallons of renewable fuels to come from cellulose and other advanced biofuel feedstocks. While we are on track to meet the 15 billion gallons of renewable fuels from traditional green ethanol, the ability to produce the required amount of cellulosic ethanol and biodiesel is, frankly, questionable.

Now, while we have the technology for this, it is going to require the incentives be in place to provide the investment for these new facilities. The economic viability of any alternative fuel or energy source in today's environment of relatively low oil and gasoline prices and reduced demand due to the recession is seriously threatened.

That makes the continuance of existing tax incentives, such as the Volumetric Ethanol Excise Tax Credit (VEETC), Small Ethanol Producer Tax Credit, and Biodiesel Blenders Credit all the more important in helping level the playing field for these alternatives to petroleum-based fuels. These incentives, particularly the ethanol tax incentives which continue through 2010, also play a major role in helping attract the investment capital needed to build and commercialize the second-generation ethanol industry.

As was pointed out earlier, the application of technology-neutral tax policy can, in fact, provide unintended consequences. A great deal has been talked about with regard to the black liquor issue. My written statement goes into more detail. I am not going to spend a lot of time talking about that right now, other than to point out that the paper industry is following a long-standing industry practice and taking advantage of an existing technology neutrality tax incentive, and revoking the industry's eligibility for this incentive would in fact violate the technology neutrality concept.

There are other examples, such as policies that would improve mileage or reduce emissions for vehicles without regard to fuel type, or incentives to develop clean coal and coal-derived technologies. These outcomes may in fact be positive or negative. The key point that I would like to make is that the full range of outcomes and consequences must be evaluated when tax policy is being developed.

Tax incentives have long supported public policies designed to stimulate the development of renewal energy markets and industries both in the U.S. and abroad. Tax incentives are often complementary to other types of renewable energy incentives. They are powerful and highly flexible tools. They can be targeted to encourage specific renewable energy technologies and to impact selected

renewable energy market participants, especially when used in combination with other policy tools.

With that, I thank you very much and look forward to answering questions.

[The prepared statement of Dr. Urbanchuk appears in the appendix.]

The CHAIRMAN. Thank you, gentlemen, very much.

I have an obvious question. Just to be a devil's advocate here, why do we have this Production Tax Credit, for example, and for renewable energy, or on fuels, why even have, say, a biodiesel credit or maybe an ethanol credit, when we have renewable energy standards and we have renewable fuel standards?

Why do those standards, in and of themselves, not provide (A) sufficient incentive, and (B) are they not technology-neutral? Add to that, do they not just add unnecessarily to the cost of the Production Tax Credit because we have an upcoming electricity standard, and add unnecessarily to the cost of, say, the biodiesel and other alternative fuel standards because we have a renewable fuel standard?

So why do we have all these credits? Why do we have all these incentives when technologies are going to be developed anyway due to the renewable electricity standard, as well as renewable fuel standard? They are just adding to the cost to taxpayers because people are getting all these credits and are doing something they would otherwise do if prompted and pushed by the electricity standard or by the fuel standard. Who wants to take a crack at that? Dr. Metcalf, I see you grinning.

Dr. METCALF. I would not claim to be able to explain why we have these credits, but I can certainly note that it does raise the cost to the Federal Government if we have a standard on the one hand and then have a credit on the other. I talked about the issue of additionality. The question is, if we are giving people tax credits for activities that they would already do, either because it is cost-effective for them to do it or because we have another policy in place that says that they have to do it, then this is wasted money in the sense that it is not getting behavioral change.

A good example of that is, we now have Renewable Portfolio Standards coming in place at the State level. California has a 20-percent RPS coming into effect in 2010, and that is driving up the cost of the Production Tax Credit.

The CHAIRMAN. Now, we do not have a national electricity standard yet, but I would expect we may get one.

Dr. METCALF. Right.

The CHAIRMAN. As you say, States have them. Some do.

Anyone else have a similar or different view?

Dr. URBANCHUK. Well, I am going to talk not on the electricity side, but on the renewable fuel side. As was pointed out, we do have the renewable fuel standard of the Energy Independence and Security Act.

The CHAIRMAN. Right.

Dr. URBANCHUK. That provides a requirement to use renewable fuels—the requirement to use renewable fuels, not necessarily to produce renewable fuels.

The CHAIRMAN. Right.

Dr. URBANCHUK. That standard effectively provides a floor for the use of ethanol and biodiesel and promotes the development of second-generation feedstocks. We do not have a series of production incentives or production credits, but rather their incentives. The Excise Tax Credit, the Volumetric Excise Tax Credit, or Blenders Credit really is an incentive to use that and to level the playing field with that alternative made from a domestic biomass source with a very, very well-capitalized and very well-financed petroleum industry.

So essentially what we have is a system that incents or requires the use, but not necessarily the production, provides the incentive to maintain and increase production. I think importantly, as we move forward, in respect to that goal of reducing petroleum, the fossil fuel use, we will develop the technologies that will get us there.

We essentially need those incentives to encourage the development of those new technologies. Similarly, in the issue of other industries, those incentives do provide an important role in channeling private investment capital into industries that will effectively help us achieve socially desirable goals.

The CHAIRMAN. What about the provisions in the President's budget where the President suggests repealing section 199, and also oil depletion, and I think intangible drilling costs, for example. Are those good ideas? Are those incentives for the oil and gas industry that have outlived their usefulness, particularly as we are driving toward—I think most Americans—less reliance on OPEC. Well, that cuts the other way, I guess; it all depends on where you drill. Also, addressing climate change. Yes?

Dr. METCALF. I think they do make good sense, particularly repealing the expensing of intangible drilling costs and percentage depletion. I think the issue here is that we want to be discouraging the consumption of petroleum, and anything that reduces subsidies to petroleum contributes to lower world oil prices and increased consumption of petroleum.

I think this just simply runs counter to our goals of reducing emissions of greenhouse gases and improving energy security. I am not the first person to point this out, but policies that encourage domestic production are our Drill America First policy, and it is not clear that that is a smart idea.

The CHAIRMAN. My time has expired, anyway.

Senator Bingaman, you are next because Senator Grassley is temporarily absent.

Senator BINGAMAN. All right. Thank you all for being here.

Let me ask Dr. Greene about his feebate proposal, which I have admired his work on for several years now. Do I understand that your thought is that a feebate would be an alternative to CAFE, as well as an alternative to a low-carbon fuel standard? I mean, I am just wondering as to your thoughts as to whether we do feebate, plus low-carbon fuel standard, plus CAFE, plus renewable fuel standard, or do we just do feebate?

Dr. GREENE. Yes. I think that is a very good question, Senator. My view is that feebates are, at this point, a system that we do not have a lot of practical experience with around the world. In 2008, about a half-dozen EU countries implemented CO_2-based

feebate systems. I think it probably would not be wise to get rid of our CAFE system right away and implement a feebate system, but rather to first try them both together and, once we gain confidence that the feebate system is working and can replace the CAFE system, then I think that would be a desirable thing to do.

I think we are already in a situation where we are going to have a lot of confusion, as you alluded to. We are going to have greenhouse gas emission standards from the EPA. We are going to have CAFE standards from the National Highway Traffic Safety Administration. So, just as Senator Baucus said, why do we need the renewable fuel standard and incentives, why do we need a CAFE system and a feebate system and a greenhouse gas emission standard at the same time? I think there are some legitimate reasons. Manufacturers complain frequently that consumers are not on board, and consumer demand is not consistent with the CAFE standards. A feebate system helps to match up the consumer demand with the requirements for fuel economy.

Senator BINGAMAN. As I understand what you are working on there in California and what you have advocated for, you would have this feebate system based on greenhouse gas emission performance rather than on any other energy security issue. Could you explain that? Is there a reason why you could not have a couple of different metrics that are performance standards that you are looking at in order to design a feebate system rather than just the one?

Dr. GREENE. There is no inherent reason why you could not have more than one objective. However, obviously, this will complicate the system. In my own view, reducing greenhouse gas emissions and achieving energy independence are mostly consistent goals. The area of conflict, of course, comes when you are talking about coal-to-liquids or something like that that has extra greenhouse gas emissions relative to gasoline. Research that I have done suggests that that conflict is very much exaggerated and that we can do both of these things at the same time.

Senator BINGAMAN. In the case of Europe, you indicated there are some countries there that have implemented a feebate-type system. Have they specified that it relates just to the greenhouse gas emissions?

Dr. GREENE. Yes, primarily. The tax systems for motor vehicles in Europe are unbelievably complicated, and there are taxes on almost everything. But there have been, in the past year, about half a dozen countries adopting systems like feebates, and they do it for carbon dioxide emissions.

Senator BINGAMAN. All right. I will stop with that, Mr. Chairman. Thank you.

The CHAIRMAN. Thank you very much, Senator.

Senator Nelson, you are next.

Senator NELSON. Thank you.

Dr. Metcalf, you state that the current policy can best be viewed as a transitional policy, so I take it you are suggesting that renewable energy and energy conservation incentives will no longer be needed once we have—if we are able to—a cap-and-trade system in place.

Dr. METCALF. I think that we would be able, in the long run, to replace many of the subsidies that we have with carbon pricing, that that would have a lot of the desirable impact that we are looking for. I think that there would continue to be some useful activities in addition to carbon pricing.

One is energy research and development. R&D is a pure public good, and the private market simply does not do enough of it, so we are certainly going to need to be investing more there. I think we also have some market failures and problems in markets that lead to inefficient levels of energy conservation and energy efficiency, so I think there is a place for standards and programs to encourage energy efficiency to complement carbon pricing.

Senator NELSON. But the carbon pricing, if we passed a cap-and-trade, would take care of most of that, with the exceptions that you are talking about.

Dr. METCALF. I think it would make a Production Tax Credit, for example, for renewable energy no longer necessary.

Senator NELSON. All right.

Let me ask any of you all, by the way we have done it with subsidizing specific technologies, there is some discouraging of certain innovation. Let me give you an example. In my State, we are starting to see, because of the heat and humidity in my State, some encouraging signs of algae as a source of a biofuel, generating electricity and so forth. Yet, the current energy tax credits did not see this potential energy source. So how should we restructure the tax incentives so that we do not discourage the innovation?

Dr. METCALF. So, I think a performance-based approach is precisely the way to go. In this era in which we continue to provide Production Tax Credits or excise tax credits for renewable fuels, it should be based on a performance metric, that this is a fuel that is not a fossil-based fuel, it does not release carbon dioxide or other greenhouse gases, and therefore there should be a broad sort of eligibility criteria. That is the reality, that we can never predict what will be happening 20 years from now in terms of new technologies, so we want to try to develop as broad and comprehensive a definition that targets our goals.

Senator NELSON. Mr. Chairman, by the way, if this technology ever were to work, what it does is, you stick algae in plastic tubes, the heat of the sunlight and so forth, and what it does is, it produces ethanol and at the same time absorbs CO_2.

The CHAIRMAN. Right. It is being discussed in Montana as well, and in lots of other States in conjunction with coal-fired power plants. Right?

Senator NELSON. Yes. That is right. Co-locate the algae producing ethanol that absorbs CO_2 next to a coal-fired plant.

The CHAIRMAN. Maybe.

Senator NELSON. Well, this is where we want to get the incentives.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much.

Senator Bunning, you are next.

OPENING STATEMENT OF HON. JIM BUNNING, A U.S. SENATOR FROM KENTUCKY

Senator BUNNING. Thank you, Mr. Chairman.

I am going to make a statement rather than question our witnesses because I think it is interesting we are holding a hearing on technology neutrality and energy policy. I have long said that our tax policy should be goal-oriented and not technology driven. I believe it is wrong to pick winners and losers. Instead, we should consider reasonable goals and let the marketplace find the best way to create efficiencies and decrease emissions.

That is why I was troubled to read the testimony of today's witnesses. There was certainly no neutrality towards one of the most abundant sources of American-made energy called coal. Advanced coal technologies are reducing greenhouse gas emissions and reducing our dependency on foreign oil.

The first time we had an oil crunch was 1974. We were 34 percent dependent on foreign oil. Now we are almost to 70—not quite, 65 percent—dependent on foreign oil. These are the goals that all three of our witnesses seem to share, yet they seem hostile toward the use of innovative coal technology in our energy strategy. It defies logic to me.

Next, the written testimony talks about externalities. In simple terms, the externalities are a bad side effect. For example, some of our witnesses point out that the externalities of energy consumption are pollution and reliance on foreign oil. Then two of our witnesses make the leap of saying that a cap-and-trade, better described as cap-and-tax, is the technology neutrality solution for fixing the externalities of energy consumption.

Nowhere in their highly academic discussion of externalities is there a mention of the devastating externalities of cap-and-trade. Some of those bad side effects are: (1) raiding the pocketbook of American families at a time when families are struggling to survive and stay in their homes; (2) a loss of more American jobs at a time when our economy is shedding millions of jobs; and (3) guaranteeing lower economic growth at a time when our economy is shrinking. Most Americans do not have the luxury of sitting in an ivory tower and ignoring the impact of policies on family budgets and jobs.

If enacted, a cap-and-trade revenue program would institute one of the largest tax increases in American history. It is a tax that everyone under $250,000 included will pay, but few will benefit from the revenue. President Obama says he wants America to be a place that makes things again. It is ironic that his cap-and-trade plan will make it harder and more expensive to manufacture and do business in America. It absolutely makes no sense.

I hope you will have a fair and wide-ranging discussion today about true technology neutrality. True neutrality will lead us to energy independence instead of a prolonged recession.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Senator.

Senator Snowe, you are next.

Senator SNOWE. Thank you, Mr. Chairman.

I want to get to the issue that has been much discussed publicly in recent days regarding the black liquor because I do think it is

important to issue a number of clarifications with respect to this issue. First and foremost, it is a legitimate tax credit. It has been utilized by the industry because it has been certified by the Internal Revenue Service.

The Congress fully intended that this black liquor is a by-product of the pulp process to be considered as part of alternative fuels. In fact, in the 2007 Technical Corrections Act it indicated the provision changes that were referenced in section 6426 from liquid hydrocarbons to liquid fuel for the purposes of Alternative Fuel Excise Tax Credit payment provisions. So, it was fully intended. The industry is using it as was intended.

In fact, it used de minimis fossil fuels, 1/10th of 1 percent compared to other industries that are using a disproportionate amount of fossil fuels—to those who have suggested that somehow it is increasing the use of fossil fuels. This is an industry that got ahead of the curve in using alternative sources of energy, whereas other industries are behind the curve in using alternative energies.

I think the logic stands on its head today when we are thinking, in the midst of the worst economic crisis since the Great Depression, an industry is going to be punished by rescinding this invaluable tax credit for them. An industry that employs 1.2 million people in this country, is one of the top 10 manufacturing employers in 42 States, an industry that did get ahead and became fuel efficient, is now hanging on for survival in this terrible economic crisis through no fault of its own, but rather due to the excessive greed, irresponsible and fraudulent behavior on Wall Street that not only perpetrated financial constraints on access to capital markets so they could not even avail themselves of affordable credit, not to mention the multi-trillions of dollars that we have had to expend as taxpayers in this country to rescue these financial institutions. We just recently enacted a fiscal stimulus plan of $787 billion, expressly for the designed purpose of retaining or saving more than 3 million jobs. Here is an industry that has 1.2 million employees across this country, many of whom are in rural America.

So I think it does stand logic on its head. It up-ends the rationale that supposedly was used for this tax credit to reward those who use existing alternative sources, that already have done it, to create a level playing field between encouraging those who have not used it, have not looked to alternative sources, and those who do to create the fairness involved within an industry so that we are not picking, as many have said, winners and losers. So I do think it is critically important.

This industry—in my State, for example, I have just visited one paper company, Domtar. They made $15 million last year. Their decline occurred during what happened on a national level in the fourth quarter of 2008, as it did with the entire industry, where they lost the equivalent amount in the first few months. So they are going to have to temporarily shut their doors on May 5th. I emphasize "temporary" because that is what we want it to be. This tax credit is a lifeline.

So I am stunned by the amount of criticism that is derived. At a time when we are trying to save jobs, here is an industry using a legitimate tax credit, and they are causing a loophole because they have used this process in the past. Since the 1930s, this proc-

ess has been there. Well, we have had the worst economic crisis since the 1930s, so this is where we stand today. There are going to be 44 mills this year that are going to close their doors for some period of time in 2009. They have already lost $2 billion in the last quarter of this last year in 2008. So I think that that dramatically reflects the dire circumstances which we face. We should be doing everything we can to salvage this industry.

I know, Dr. Urbanchuk, you mentioned in your statement that, if we were to revoke this incentive, that it would violate the technology neutrality factor that you think is one of three factors involved in determining the form and the structure of tax incentives. You also mentioned industry economics as one of the three factors as well. Certainly that would alter the industry if we were to have this incentive revoked this year? I mean, how would that affect the industry economics? Do you think it would be appropriate to revoke this incentive this year?

Dr. URBANCHUK. Well, Senator Snowe, as you pointed out, there are the three factors that I talk about, industry economics, innovation and technology, and of course technology neutrality. Revoking the paper industry's eligibility obviously would violate the neutrality concept we talk about, but moreover, in the environment that we find ourselves in, I think it would be inappropriate to remove that incentive this year given the economic circumstances facing this industry. At the same time, I think it also sends a negative message. If you take a look at the role that tax policy and incentives can play in stimulating investment in new technology, I agree that it would be inappropriate with regard to that.

Senator SNOWE. Thank you.

Thank you, Mr. Chairman. I hope that we will be able to work on this issue in this committee and that we will not be in a bad position, the industry will not be, because it is crucial to their survival and crucial to job creation and salvation in this country at this moment in time. Thank you very much.

The CHAIRMAN. Thank you, Senator. We will take a good look at it. It is controversial, and we will just do the best we can with it.

Senator Stabenow?

Senator STABENOW. Thank you, Mr. Chairman.

I would just associate myself with the concerns that Senator Snowe had raised on that particular issue of importance to northern Michigan, or around Michigan.

Thank you for coming in today. I have a number of thoughts, as you have been speaking. One thing I wanted to point out is that, as we are talking about taxes and as you have talked about taxes for using particular kinds of fuel or technology incentives for—one person indicated using, rather than making.

The incentives are there and maybe we would be using that fuel anyway, maybe we would be developing it anyway. One area of the tax code, where clearly without incentives we are losing ground, is in manufacturing these items. So we may have a tax credit for wind or for solar, but we have lost ground over the last decade in that the manufacturing of those new technologies has gone to other countries because of aggressive manufacturing strategies.

We have taken a major step to help bring that back in the recovery plan with a 30-percent manufacturing tax credit. In my State,

we are literally seeing the difference. We are seeing solar panel plants being announced now, as well as wind, and so on. So I would just first make the point that I think technology neutrality around issues of use or so on is one thing, but we have a specific need to make sure that we are capturing the jobs and the economic development from all of the pieces of alternative energy, and one that we have missed up until very, very recently, has been the jobs. Seventy percent of the jobs in wind come from building the wind turbine. There are 8,000 parts in a large wind turbine. I always like to remind people, we can make every single one of those in Michigan. But the reality is, that is a different kind of tax policy.

Would anyone want to respond to that statement, and would you agree that that is different when we are trying to incentivize particular economic activity, and that manufacturing is something that is important to incentivize?

Dr. GREENE. I would agree with that. I think, on the example you cited of wind, Germany had a very aggressive policy to introduce wind power into their electricity grid and heavily subsidized, essentially, the wind power. As a result, now I think they lead the world in technology and manufacturing of wind power.

So I think, to the extent that we can be innovative like that and establish a lead in manufacturing, not just in creating the technology but in making the technology here, I think this will benefit us in the long run as the world turns more and more to renewable energy and energy sources that do not affect the climate.

Dr. URBANCHUK. I want to also step in on this. A large part of this comes down to, particularly with regard to technology neutrality and the goals you set, whether they are replacing fossil fuels, imported oil, or improving national security, improving environmental quality, reducing carbon footprints, or economic vitality and viability—and that is one of the things that we have talked about. As you may know, an awful lot of work has been directed in the area of biofuels and other renewables.

I continually remind people that this is a manufacturing sector industry, making ethanol or making biodiesel, whether it is from grain or from cellulose, whether you are using coal in a coal-to-liquids process or you are building wind turbines or solar panels, these are economically important manufacturing sector industries that we have grown and can continue to grow, and I believe that that is a legitimate goal that tax policy should play in terms of providing incentives for it. They are not at all divorced from the other goals.

Senator STABENOW. No, I understand.

Dr. URBANCHUK. So we have to keep all those things in perspective.

Dr. METCALF. Senator, the only thing I would add to that is that I think stability of policy is very important. The on-again/off-again nature of Production Tax Credits has led to bottlenecks in production of wind turbines that are costly to industry, so I think that needs to be taken into account also.

Senator STABENOW. Thank you. I know I am out of time, but I cannot relinquish the mike without just indicating that I would hope we would look at other kinds of programs in addition to feebates, such as what has been dubbed a scrapping program that

Germany has, or what's been called "cash for clunkers," which, instead of taxing consumers at a time of tremendous recession and job loss, that we would be focusing on incentives like those that have been done in other countries now, for vehicles to be purchased, turning in older vehicles that are less fuel-efficient for newer fuel-efficient vehicles. There is a way to do that without taxing consumers and adding more cost to the industry.

Thank you, Mr. Chairman.

Dr. GREENE. Could I just comment on that, quickly?

Senator STABENOW. Yes.

The CHAIRMAN. Briefly. Yes. Very briefly.

Dr. GREENE. Yes. I think that one option also is to introduce a feebate system that initially is a net subsidy. In other words, depending on how you structure the benchmark, the feebate system could be revenue-neutral, it can be revenue-generating, or it can be a net subsidy. I think, especially in a time when the economy is suffering, introducing a feebate system that is a net subsidy and then gradually phasing that subsidy out would be even more effective in stimulating new vehicle sales because it subsidizes precisely that: new vehicle purchases.

Senator STABENOW. Thank you.

The CHAIRMAN. Senator Carper?

Senator CARPER. Thanks, Mr. Chairman.

To our witnesses, welcome. I am sorry I missed your testimony. I have three simultaneous hearings going on, and it is tough to be in three places at once. I am one of those people who is in favor of cloning humans so we can go to all the hearings. [Laughter.]

People would say, boy, it is remarkable, how he gets around. But anyway, I could not be here when you testified, so I am going to ask you each to just take maybe a minute apiece and give us, again, your take-aways, your principal take-aways for us, and then I have a couple of specific questions. Take it away.

Dr. URBANCHUK. Well, what I have outlined is that there are three factors that have to be taken into consideration with regard to developing energy tax policy, one being industry economics, the other being technology and innovation and the role that it plays, and then the issue of technology neutrality.

With regard to the last issue of technology neutrality, it is incumbent upon policymakers to think through carefully all of the potential outcomes and how they interrelate to both the industry's economic situation and the impact on technology and development, keeping in mind that it is very difficult—it is impossible—to figure out where we are going to be 20, 30 years hence in terms of technology. So you want to have policies that provide adequate incentives for the development of new technologies that, on the face of things today, may not appear to be viable but very, very clearly might as we move through time.

Senator CARPER. All right. Thank you.

Please?

Dr. GREENE. Yes. I think, to summarize my testimony, I pointed out that there is a problem in the market for motor vehicle efficiency in that future fuel savings are an uncertain factor and consumers are loss-averse, so, when they look at the fact that more money has to be paid up front to buy a more efficient vehicle and

the fact that the future fuel savings are uncertain, they weigh the potential for loss more than for gain. This results in a very serious under-valuing of future fuel savings. A feebate system, which is a graduated tax on inefficient vehicles and subsidy for efficient vehicles, puts the incidence right on the purchase decision, so it gets around that problem.

Such a system could replace most, if not all, of the current subsides we now have for cleaner and more efficient vehicles. I think that was the gist of what I said.

Senator CARPER. All right. Thank you.

Dr. METCALF. I think the main take-away point I would leave you with is that technology neutrality really needs to be defined in terms of specific policy goals, environmental and national policy goals. So thinking about climate change and greenhouse gas emissions, we want to make sure that our policies lead to an equal subsidy per ton of CO_2 reduced. This is hard to do with subsidies. It is hard to do with a subsidy-based program.

To give you one quick example, the Production Tax Credit for wind and geothermal, it is 2 cents per kilowatt hour, 2.1 cents per kilowatt hour currently. That looks like technology neutrality. However, if geothermal is, to a large extent, replacing coal-fired power while wind is replacing natural gas, then it actually turns out that the subsidy per ton of CO_2 is higher for wind than for geothermal. So it makes it difficult to have a truly technologically neutral policy through the subsidy system.

Senator CARPER. All right. Thank you.

I sit on another panel called Environment and Public Works. We are going to have an opportunity later this year to hopefully mark up and report out climate change legislation. I am an advocate of a cap-and-trade approach.

I believe, one thing that intrigues me—I studied a little bit of economics at Ohio State—very little—and a little more at University of Delaware in a graduate program. But one of the things that has intrigued me as Governor, and here in this role is, how do you harness market forces to incentivize the kind of behavior that we seek in our society? I think cap-and-trade does that pretty well. Some of my colleagues talk about a tax on carbon. I think most of the people who talk about that being a better option probably would not vote for one. So, we will see where we end up.

But my question is, since we currently do not have a price on carbon, and dirty fossil fuels are often cheaper, or appear to be cheaper than clean energy, many of the energy tax incentives try to level the playing field, as you know, making clean energy either competitive or cheaper than dirty fossil fuel energy.

Let me just ask, would putting a price on carbon through an economy-wide greenhouse gas tax, a cap-and-trade approach, make these tax incentives obsolete?

Dr. METCALF. I think in large measure it would. If we put a significant price and a stable price that is growing over time so that it sends a consistent and stable signal to industry that the United States is serious about carbon pricing, we can do this through a cap-and-trade system or a carbon fee. We can do it either way. It really will have the incentive effects, in a technologically neutral way, to reduce emissions, including the potential for coal if this

makes carbon capture and sequestration viable. So, I think this really is the most efficient way to proceed.

Senator CARPER. Thank you.

Dr. GREENE. If I could. While I agree it is the most efficient and it is a cornerstone of climate policy, I think that it is not enough for the transportation sector for the reasons that I have outlined in my testimony. I also want to agree that we will not seriously meet the kind of goals we seem to be setting for climate change without carbon capture and storage. With carbon capture and storage, then we can use our coal.

Senator CARPER. All right. Thank you.

The last panelist, please.

Dr. URBANCHUK. Well, I do not have too much more to add to that. I think it is very important to keep in mind that, as we look at the development of the technologies, particularly with regard to coal and the use of coal—I am a Pennsylvanian, so we have a little bit of coal as well. It has tremendous potential. I think the evaluation of that potential, in the light of today, is probably unfair, and really we need the incentives to develop the storage and sequestration technologies that make it much more acceptable from a carbon perspective.

Senator CARPER. Yes. All right.

The CHAIRMAN. Thank you very much.

Senator CARPER. Thanks so much.

The CHAIRMAN. Next is Senator Cantwell. You were skipped earlier when you were not here.

Senator CANTWELL. Thank you, Mr. Chairman. Sorry, I had to step out to give testimony at another hearing. Thank you for having this important hearing and for our witnesses. I know that part of this is about reform of the tax code as it relates to these alternative renewable resources and looking at parity. So, I firmly believe that we need to move forward on that.

In 2007, I introduced a bill that would provide parity for a Production Tax Credit for energy- or heat-generating technologies certified to be carbon-neutral. So when we are having this discussion—I am certainly no expert on technology—but it seems to me a carbon-neutral standard by the Energy Department certification would be a way that we could stimulate those new energies without picking winners and losers.

But I actually have a more specific question for Dr. Urbanchuk about the biodiesel credit and your testimony. I have been a strong supporter of the credit; obviously it expires at the end of the year. In particular, I have been working on legislation to change that to a production credit from the blender credit that it is today.

I obviously think we have come some distance in this development of the industry, but we obviously need to go a lot further. So I wondered if you would expand on your testimony as to why you think a production credit, as opposed to a blender credit, would be a more positive way to go.

Dr. URBANCHUK. Well, there are two aspects to your question. The first is, as you point out, the existing Blender Credit expires at the end of this year. I believe a multi-year credit is far preferable to a single-year credit, particularly with regard to the message that that sends to the investment community and to people

involved in producing that. The reduction of risk is an important aspect.

The transformation from an excise credit to a production credit, I think, has a couple of key benefits. One, obviously, it would simplify the administration of the system for the government, for the IRS. It would also simplify the system from the perspective of taxpayers as well.

So, there, I think there are important economies to be gained by those two things. I think the other factor is, and this is tied again to current issues, while Congress appropriately shut down the splash-and-dash loophole for biodiesel by its very formal blender's credit, it enhances the exploitation for future transshipment schemes for biodiesel, and that creates obvious trade problems.

A production incentive, on the other hand, would focus the incentive on the U.S. industry and, if properly structured, would stop those transshipment issues. I think they are important aspects to that as well.

Senator CANTWELL. It just makes it simpler, right?

Dr. URBANCHUK. Simpler and more efficient from an administration perspective.

Senator CANTWELL. We could continue with the blender credit and then try to address and close loopholes, or we could try to get it correct from a production perspective and be more specific as to whom we are giving the credit to and the types of uses.

Dr. URBANCHUK. That is correct.

Senator CANTWELL. Dr. Greene, did you have any comment about the subject you were discussing with my colleague Senator Carper about, if you had an Energy Department carbon-neutral credit—I mean, in trying to reach parity, basically the Department of Energy would certify which of those energy solutions were carbon-neutral, or the carbon-neutral standard. Do you think that is a way we could go in trying to get a parity law?

Dr. GREENE. I am not clear exactly what the carbon-neutral standard would be. In other words——

Senator CANTWELL. It would be a way for the department to certify that these resources can be used for a production credit for any energy- or heat-generating technology certified to be carbon-neutral.

Dr. GREENE. I think this is probably not my area of expertise.

Senator CANTWELL. All right. All right.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator.

Senator Lincoln?

Senator LINCOLN. Thank you, Mr. Chairman. I appreciate you bringing us together today. This is a good discussion, and one we need to have.

I would like to just take one moment, however, to address an issue that I think has already come up this morning, and it was the use of alternative fuel credits by the paper industry. I noticed, Dr. Urbanchuk, in your testimony you noted that some were outraged over the fact that the industry is receiving this incentive.

Although they might not have been the original intended beneficiary of the Alternative Fuel Credit, and I think that is probably still to be determined, I do hope that the committee will be cau-

tious as we tread forward—treading lightly hopefully—to avoid any unnecessary rhetoric that exists out there in that industry.

The Finance Committee has a history of support for incentivizing conservation in the use of renewable energy in the forest products industry, which is important to our State. In fact, in December of 2007 the committee's energy package included a repeal of the Third Party Sale rule for the section 45 Renewable Electricity Credit so that the industry could use the advance, and for the on-site production in the use of renewable electricity from biomass, which is an important, certainly, feedstock that will have to be, I think, a part of the equation in terms of moving to renewable fuels and renewable energy.

So it was unfortunate that energy package did not become law, but the committee was right to do so then, and we need to continue working to encourage and reward the use of biomass for renewable energy, because I do think, as I said, it has, certainly, a role to play. So I know I joined last night in introducing a proposal, along with Senator Roberts and Senator Snowe, that would allow electricity from biomass to be used on-site to qualify for that section 45 credit, which I think is going to be important.

Many places are doing that now, and giving them the credit to continue to do that and to be competitive, I think, is critical. I know that, according to the American Forest and Paper Association, in 2005, the industry produced 28.5 million megawatt hours of biomass-based electricity, which avoided the use of more than 200 million barrels of oil.

So as we look at what we are trying to do, which is to replace some of those carbon-emitting fossil fuels, I hope that we will certainly be hopeful and objective about that. So, I appreciate that, Mr. Chairman. I want to move forward on that and certainly look at how we can do it fairly, and I trust your judgment, and certainly your leadership, to help us get through that. So, thank you.

Just to touch back on what my colleague Senator Cantwell mentioned, that biodiesel credit is critically important. Dr. Urbanchuk, I want to thank you for your comments—I was not here, unfortunately, earlier—but your comments on biodiesel. My biodiesel producers back in the State would say "hallelujah and amen, brother" to everything you said about the short-term nature of our biodiesel policies. I think that is really critical for us to recognize, talking about the frame or the length of these incentives.

Predictability is everything. In this economy, being able to seek out the capital that you need, to make the investments to move in a relatively new industry, it is essential to have some predictability in terms of what you can expect in those incentives in the tax code.

You talked about a multi-year extension. Do you have any length of time that you would put on there? Just multi-year?

Dr. URBANCHUK. No, I have not thought about it in terms of a specific time period.

Senator LINCOLN. A length of time.

Dr. URBANCHUK. I do, however, think that a multi-year incentive as opposed to single individual years that have to be reauthorized every year really does help from a significant perspective, in terms of reducing risk and providing the assurance that we are serious about moving toward those stated policy goals of reducing use of

fossil fuels and imported petroleum, improving national security, improving environmental quality, and improving our economic sector as well.

Senator LINCOLN. Well, thank you. I appreciate it. I do not know what the magic number is, but I definitely know predictability is not something we are used to exercising or dishing out in the U.S. Senate. So, I hope we will change and look towards the real difference we can make in the economy and the job creation, and more importantly, the environment.

Dr. Metcalf, you said that the "existing structure for hybrid vehicle credits is an egregious violation of tech neutrality, and a clear example of inefficient allocation of resources across fuel savings' capital investments." I completely agree. It does not make a whole lot of sense to me to have a per-manufacturer cap on a credit that excludes good high-mileage hybrids from the credit simply because people want to buy them.

So, I also think we need to stop trying to fool ourselves into thinking that the combustion engine is going to go away. I think anything we can do to improve what we are doing now is going to make a great deal of sense, as well as making the investment in newer technologies.

If you were to take a look at the vehicle credits and decide to keep them in some of the same form, what should that credit look like? Did somebody already ask this?

Dr. METCALF. I think the simplest way to do it is a benchmark miles-per-gallon if you want to stay with a credit approach as opposed to the feebate, which I think has a lot to say for it, and provide a credit for any vehicle that exceeds that.

Could I make a comment on the black liquor? I am sorry Senator Snowe has left. Because I feel like black liquor is being tarnished a bit here today. It is a good example of where a credit is being provided for something that we value and think is an important activity, but it is an example where we may not be getting additional activity because of the credit. I do not think we need limit this to black liquor.

I think when oil and gas prices were very high, a lot of wind facilities that were going in would have gone in with or without the Production Tax Credit. So this issue of additionality is not just one that is an issue for the paper industry and black liquor, so I think it really is important not to focus on that but to think more broadly about using tax dollars wisely to get the biggest bang for the buck.

Senator LINCOLN. I think so, too. I think it is important to recognize some of what Senator Carper mentioned, and that is that, when you start talking about cap-and-trade, those credits are going to have to have value. To have that value, you have to make that kind of investment. If they do not have value, then you are not going to have the subsequent activities that you need to have because people are not going to use them.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator Wyden, you are next.

Senator WYDEN. Thank you very much, Mr. Chairman. This has been an excellent hearing, and good witnesses.

It seems to me that the current system of tax credits just defies common sense. You look, for example, at wind. I think virtually ev-

erybody on the committee supports wind, but wind works where the wind is blowing. We have certain areas in eastern Oregon, for example, where that is very much a part of our future. But one of the reasons Senator Lincoln, I, and a number of colleagues are interested in biomass is that it is something you can use everywhere.

You can use it wherever it is, and you do not need the wind to blow. I think Senator Lincoln has put it very well in terms of the biomass potential in terms of using that sawdust, in effect, to heat a plant. I think we can go much, much further than that. You look at the amount of wood waste that is on the floor of these plants, and you are not just going to heat the plant, you are going to heat the entire town that way. So, we very much need your input in terms of getting this parity standard.

Dr. Greene, tell me a little bit more about how particularly we get a fair shake for these half-credit technologies. It is almost like what you need is a pay-for-performance kind of standard. I know Dr. Greene and Dr. Metcalf have been interested in that. I would be interested in your thinking on that.

Dr. GREENE. Yes. I completely agree with Professor Metcalf about the hybrid vehicle incentives we have in place now. I do think that a feebate system, whether it is——

Senator WYDEN. I have not gotten to feebates yet. You are going to get feebates in just a quick second.

Dr. GREENE. Later.

Senator WYDEN. But tell me, particularly using the biomass issue, how we could have a pay-for-performance kind of approach there, because it seems to me you are going to get real results there if you look at something along the lines of what biomass's potential is.

Dr. GREENE. Well, I think you will get this with a carbon cap-and-trade system, and I will let Professor Metcalf elaborate on that.

Senator WYDEN. Professor Metcalf?

Dr. METCALF. Again, we want the biggest bang for the Federal dollar that we spend on this. We want to make sure that we are subsidizing activities, that the subsidy leads to new activity that would not already take place. I think this is difficult. If we are thinking open-loop biomass, for example, do we know how much activity would occur in the absence of a credit, and then how much we get because of the credit? I think these are tough measurement problems.

A performance-based standard certainly starts from the proposition that we want to reward all carbon-free activity and we want to try to make that as general a definition as possible, so, if we ask DOE to provide definitions for carbon-free technology and then allow all such technologies that pass that test to get the credit, then I think that is a great approach to take.

Senator WYDEN. I will follow that up with you because I think these half-credit technologies, in particular—it is almost like you say to yourself, what has evolved in terms of Federal policy is who has the best lobbyist and who can figure out how to fan out across the Capitol and wend their way through the lobbying system rather than what is most effective. So, we are going to follow that up with you.

Now on to the feebate question for you, Dr. Greene. The theory here, of course, is what I have been interested in with the Oil Save proposals, a technology neutrality tax credit for fuel-efficient vehicles so as to provide consumer tax incentives for the purchase of more fuel-efficient cars and light trucks. The idea would be to tie the credit to how much better their fuel mileage was compared to CAFE.

Would something like this not be, again, another practical way to use the tax code to wring more fuel efficiency out of the system we have as opposed to, I think, continuing these debates about CAFE and just battling to raise the standards a little bit at a time?

Dr. GREENE. Well, I think we discussed earlier the possibility that you could replace the CAFE system eventually with a kind of a feebate system, an incentive system. I think that is likely to be true, but we do not have much experience with these systems yet, so I think for the time being it is useful to have both of them at the same time. So, I think that is very similar to what you are proposing.

Senator WYDEN. Any information you can give us—and I know my time is up, and I appreciate the chairman—on how you would actually, in the transition, go forward with both retaining CAFE and beginning transition to something like a feebate, sort of a step-by-step path to how you would do it, that would be very helpful.

Mr. Chairman, thank you.

The CHAIRMAN. Thank you, Senator, very much.

Joint Tax has prepared lots of material. One I am looking at right now is a pamphlet that compares selected energy production tax credits. It lists them and then has the statutory credit amount in 2008. The next column is the credit amount stated in dollars-per-million British thermal units of heat energy. On this list there are six. Wind power is at the top in terms of efficiency, 72 cents per million Btu of heat energy.

In geothermal, it calculates to be the same, 72 cents. Open-loop biomass is actually cheaper, it is 34 cents, at 1 cent per kilowatt hour incentive. Advanced nuclear is about 61 cents. They are all pretty close. But then you get down to ethanol, and it is at a current 45 cents per gallon. The credit amount in dollars per million Btu is almost $6. Biodiesel, for all its popularity, at least in my State of Montana, has current incentives of $1 per gallon, and it costs $8.45 per million Btu.

So I wonder if maybe, Dr. Metcalf, you could just comment on that in terms of what it says and what you think its implications are, and what, if anything, we should do about that.

Dr. METCALF. That is a great question, Senator. I think it is a really important way to be thinking about technology neutrality.

So this table provides a credit amount in dollars per million Btus, and it is very high for ethanol and biodiesel, which would suggest that these are relatively inefficient.

I think the problem goes beyond the numbers in this table. For example, if you look at the top two numbers, wind and geothermal, it appears that we have technology neutrality between those two sources, but in fact we do not if geothermal is really replacing coal-fired power while wind is replacing gas, because we are paying

more per ton of CO_2 reduction for wind, because we are replacing a less carbon-intensive fuel.

On the ethanol, I have done some research elsewhere that looked at the interaction between our mandates for ethanol and the excise tax credits. I tried to be as generous as I could towards ethanol in terms of carbon reductions and energy consumption. I was finding that the cost of reducing a ton of CO_2 through the excise tax exemption for ethanol is about $1,700 a ton of CO_2. This is about 80 times higher than the current price of permits in the European Union's emission trading scheme. It is just a huge cost. In terms of oil savings, it is about $150 to $200 per barrel of oil saved, so it is a very inefficient and expensive way to get savings.

The CHAIRMAN. Dr. Greene, do you have a thought on that same subject?

Dr. GREENE. Well, I agree with that. I think the problem with corn-based and starch-based ethanol production is that the fuel cycle greenhouse gas reductions are relatively small, and there may not be any at all. So with that kind of relatively poor leverage, subsidizing ethanol is relatively expensive.

I think we have, over the years, subsidized ethanol primarily as our security policy to reduce our dependence on oil. There again, it is a more expensive policy than, say, improving fuel economy.

The CHAIRMAN. There are lots of facts. It is really interesting. It is not quite so much the case. You see a lot of wheat producers who moved out of wheat and started to produce corn, because a lot of corn is going to produce not just feed, but ethanol. That drove up the price of wheat because there is much less wheat being produced in certain parts of the country. So we get a lot of side effects whenever we try to rifle-shot a particular incentive for credit. But as you know, ethanol enjoys a lot of popularity in the Congress.

I will let you, Dr. Urbanchuk, speak as well. Go ahead.

Dr. URBANCHUK. Well, I just wanted to point out that what we are finding is that a lot of the science behind the calculation of the carbon footprint of ethanol and biodiesel is imperfect. I think there is still a substantial amount of discussion about the baselines from which those calculations are made. So I recognize the numbers; I take them with a grain of salt.

Similarly, with regard to some of the other indirect effects, such as land use, as you know there is some substitution of land between corn, soybeans, and wheat, but relatively little when it comes to corn and wheat. There is some substitution, but they have to be looked at in a global context. I suspect that the impacts of grain prices that we have seen over the last year or so are very, very complex.

The CHAIRMAN. Very complex.

Dr. URBANCHUK. And are due to far more other factors than just the increase in ethanol.

The last point is the other important role that the current incentives played with regard to starch-based ethanol. As you know, we are capped at 15 billion gallons of starch-based ethanol by 2015, with the additional 21 billion gallons to come from bio-based biomass, biodiesel, and advanced bio-feedstocks, including cellulose. If you do not have a healthy grain-based ethanol system and one that provides for profitability, you are never going to get to that next

section. So I think the future development of biomass feedstocks for alternative fuel production really is contingent on the kinds of incentives that we have today.

The CHAIRMAN. Well, I thank you all very much. I am going to have to conclude this hearing, but you have been very helpful here. I also thank Joint Tax for the pamphlet that they produced for today's hearing. I think we are all agreed that technology neutrality is a good goal. Congress's incentives, energy incentives, are just too much spread over the lot. As we all know, too, it is difficult, very difficult. But I think it is a worthy goal, anyway, and we should do our very best to pursue it. So, thank you very much.

The hearing is adjourned.

[Whereupon, at 11:43 a.m., the hearing was concluded.]

APPENDIX

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

Hearing Statement of Senator Max Baucus (D-Mont.)
Regarding Technology Neutrality in Energy Tax

Justice Oliver Wendell Holmes wrote: "[T]he best test of truth is the power of the thought to get itself accepted in the competition of the market . . . ."

Today we consider a new thought in the marketplace of ideas about tax incentives. The thought is that, in the creation of energy tax incentives, the government might not pick and choose among different technologies.

The thought is: The government might just set a performance standard, regardless of the technology employed. We could encourage things like reduction in greenhouse gas emissions, improvement in efficiency, or increased energy content. And then we would leave the job of picking the best technology to the competition of the market.

Folks call this sort of incentive structure "technology neutral."

There are several reasons why a tech-neutral approach to energy tax incentives might make sense.

First, it might well provide more bang for our energy-tax buck. By tying receipt of these credits to a common standard, we may be able to set the level of incentives more efficiently.

Second — and this may come as a surprise to many in the room — sometimes government gets it wrong.

Consider the credit that Congress enacted in 1980 to stimulate oil shale, tar sands, and synthetic fuels from coal. The idea sounded good at the time. But many companies exploited the credit. Some sprayed coal with chemicals for no reason other than to line their pockets.

Third, a technology-neutral approach might mean that we have to change the tax code less often. Technology is bound to change faster than Congress can act. So there's appeal to instituting a series of incentives that we don't have to update all the time.

We've already taken some steps toward technology neutrality in recent legislation.

For example, as part of last year's farm bill, Congress enacted the first-ever credit for cellulosic biofuels. Now this might sound like credit that picks a specific technology. But in fact, we passed a technology-neutral credit for cellulosic biofuels.

Another example is the approach that we took on coal incentives in last year's energy-tax bill. We removed the bias toward integrated gasification combined cycle facilities. And we put in its place a requirement that all recipients of clean coal tax credits meet at least a 65 percent standard for capture and storage of carbon dioxide.

This approach sounds sensible. Congress should not pick winners and losers. We should set a level playing field of standards for energy tax incentives. And we should let the marketplace foster competition.

But we need to beware of pitfalls.

For example, a couple years ago, Congress modified the alternative fuels tax credit. That's a 50-cent-a-gallon credit for a range of alternative fuels, including liquefied petroleum gas, compressed natural gas, liquid coal, and biomass-based fuel.

In modifying the definition of biomass-based fuel, the credit was inadvertently opened to apply to what is called "black liquor." Black liquor is a byproduct of the pulp-making process that has been used to power paper mills since the 1930s.

Paper companies learned that they could benefit from the alternative fuels credit by mixing a small amount of diesel with their black liquor, and then registering with IRS.

Unless we plug this loophole, the Federal Government is liable for billions in credits for black liquor in 2009 alone, even though the credit was never intended for this fuel.

So in this case, a more technology-neutral approach led to a dramatic spike in the use of the credit for an unforeseen purpose.

We are working to undo that unintended consequence. But our experience with black liquor suggests that we should exercise caution as we consider a tech-neutral approach. We have to make sure that we write the incentives correctly.

This committee has done a lot on energy tax incentives in recent months. And I'm proud of what we've achieved. But as we prepare for the next energy debate, including climate-change legislation, it may be time to consider an alternative means of promoting alternative energy.

And so, let us consider a new thought in the marketplace of ideas about tax incentives. Let us see if there is sense in getting the government out of the business of picking and choosing among different technologies. And let us see if technology-neutral incentives might just be a thought that gets accepted in the marketplace of ideas.

United States Senate *Sen. Chuck Grassley · Iowa*
Committee on Finance *Ranking Member*

Statement of Sen. Chuck Grassley
Finance Committee Hearing, Technology Neutrality in Energy Tax: Issues and Options
Thursday, April 23, 2009

As hockey and soccer players know, it's important to have goals. As we look at whether it makes sense to design technology-neutral energy tax incentives, we first need to consider what goals our energy tax policies seek to achieve. Some of the goals that have been mentioned for energy tax policy are a reduction in dependence on foreign oil, a reduction in the use of fossil fuels, and a reduction in carbon dioxide emissions. Depending on what goal or goals are selected, vastly different results emerge. For instance, if the only goal in the fuels arena is a reduction in dependence on foreign oil, then energy tax incentives that encourage more domestic drilling and oil production are appropriate. However, if the goal is solely a reduction in carbon dioxide emissions or a reduction in the use of fossil fuels, then those same energy tax incentives to encourage more domestic drilling and oil production are inappropriate.

Simplifying the energy-tax incentives by creating technology-neutral tax incentives is a noble ambition. However, getting consensus on what goals should be used in developing energy tax incentives can be a little like herding cats. Even if lawmakers agree on what goals should be used, which is a big "if", controversial issues arise. For example, whether nuclear energy should qualify for technology-neutral energy tax incentives would certainly be a controversial issue.

Also, the energy tax incentives that the Finance Committee has developed over the years have been extremely successful. For instance, the wind industry in the United States has made great advances with the help of the production tax credit, which I first authored in the early nineties.

Similarly, VEETC has helped the ethanol industry to reduce our dependence on foreign oil, improve our national security, and reduce carbon-dioxide emissions.

As we move forward in designing energy-tax incentives, we need to be careful not to undo all the good work that this committee has done. Even the proponents of technology-neutral tax incentives acknowledge that certain technologies need more assistance in their early stages of development than others. They agree that this justifies a departure from technology-neutral energy tax incentives. I am interested in hearing the thoughts of this panel on these important energy-tax issues.

Testimony to the
United States Senate Finance Committee

TECHNOLOGY-NEUTRAL INCENTIVES FOR ENERGY-EFFICIENT LOW GREENHOUSE GAS EMITTING VEHICLES

by

Dr. David L. Greene
Visiting Scholar
Institute for Transportation Studies, University of California at Davis
Corporate Fellow
Oak Ridge National Laboratory

10:00 a.m., Thursday, April 23, 2009
Dirksen Senate Office Building, Room 215
Washington, DC

Good morning Mr. Chairman, Senators and distinguished guests. Thank you for the opportunity to offer my views on the pros and cons of technology-neutral energy and environmental incentives. I will confine my remarks to the area I know best, which is the transportation sector, addressing primarily incentives for energy efficient and low greenhouse gas (GHG) emitting vehicles.

For most energy and environmental policy goals, performance-based, technology-neutral incentives (and standards) are superior to those that target a specific technology. Performance-based incentives allow the widest scope for innovation, and permit market forces the greatest latitude to select and implement cost-effective solutions. Because of our limited ability to foresee technological solutions that are possible but do not yet exist, it is almost always more effective and economical to specify the energy or environmental objective rather than a specific means of achieving it. Well designed fiscal incentives provide a clear and consistent signal to the market to make continuing progress toward energy goals. In certain cases they can even correct limitations of the marketplace.

Performance can be measured in different ways: e.g., energy use, petroleum consumption, or GHG emissions.[1] The choice could be important because some fuels that would help reduce petroleum dependence (e.g., coal-derived gasoline) would increase full fuel cycle GHG emissions unless by-product carbon dioxide (CO_2) were captured and sequestered. Choosing GHG emissions as a metric however, would substantially benefit energy security since the preponderance of measures for reducing GHG emissions from transportation vehicles will also reduce oil dependence.

[1] Of course many other measures of merit are possible, as are combinations of measures.

Why Vehicle Incentives Can Help Achieve Energy Goals

The market system is the fundamental mechanism by which we will achieve our national energy goals. However, markets run into difficulties in several areas. Emissions of GHGs from the combustion of fossil fuels are a near-perfect example of a public good externality that requires public policy solutions. At the center of our oil security problem is the monopoly influence of the OPEC cartel. The nationally owned oil companies controlling four out of five barrels of the world's proved reserves and well over half of the world's ultimately recoverable resources of conventional oil create oil price shocks, inflate world oil prices and in the process appropriate hundreds of billions of dollars of wealth from oil consuming economies. By my estimates, oil dependence cost our economy between $700 and $800 billion dollars in 2008. The market problem here is not externalities but monopoly power, and fiscal policies alone are not likely to solve the problem (Leiby, 2007).

Markets for energy efficiency in general, and the market for automotive fuel economy in particular, also have important limitations. As a general rule, more efficient automotive technologies cost more and deliver benefits in the form of future fuel savings. The estimated cost of increasing the fuel economy of an average U.S. passenger car based on the 2002 National Research Council (NRC) fuel economy study is illustrated by the red dotted line in Figure 1. The expected present value of future fuel savings is shown as a solid gray line. Of greatest interest to the consumer is the difference between the two, the expected net present value. This increases to a maximum of about $400 at 35 miles per gallon (MPG), the point at which the marginal cost of increasing fuel economy exactly equals the marginal value of expected fuel savings. Figure 1 reflects private costs only; motor fuel taxes are included but no values are attached to reducing GHG emissions or oil dependence.

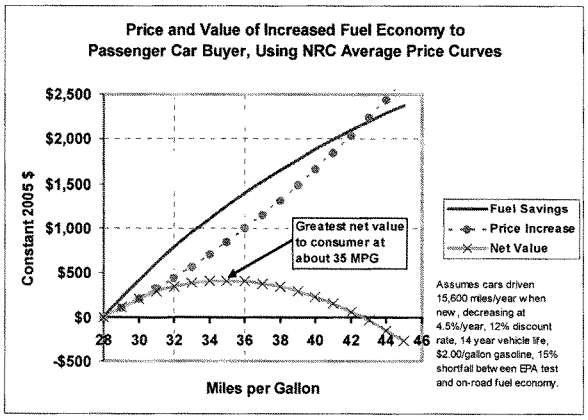

Figure 1. Illustrative Private Cost and Expected Benefit of Increasing Passenger Car Fuel Economy. (Greene, German and Delucchi, 2009)

Figure 1 represents future fuel savings as a known quantity. However, consumers view future fuel savings as uncertain due to ambiguity about future energy prices, the validity of official fuel economy estimates, vehicle life expectancies, future vehicle travel and other factors. When the uncertainty about future payoffs is considered, the net value of increasing fuel economy at each higher fuel economy level becomes a probability distribution, as shown in Figure 2. As Figure 2 shows, if fuel prices are low and the vehicle's rated fuel economy is not realized, the consumer might actually lose money despite the expected gain of $405.

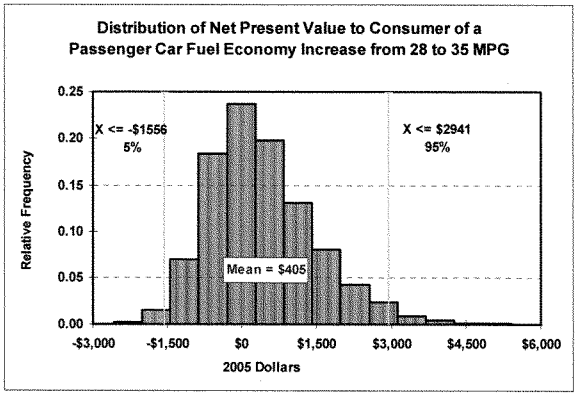

Figure 2. Distribution of Net Present Value to Consumer of an Increase in Passenger Car Fuel Economy from 28 to 35 MPG. (Greene, German and Delucchi, 2009)

Nobel prize-winning economic research conducted over the past three decades has established that, in general, consumers are loss-averse. That is, they weight potential losses from a risky bet more heavily than potential gains. When the inherent loss-aversion of typical consumers is taken into account, technologies that are cost-effective in terms of their expected payoff appear to be too risky. Using the same data and assumptions of the 2002 NRC study of the CAFE standards (NRC, 2002) but applying a typical loss-aversion function (Tversky and Kahneman, 1992) changes the perceived value of the fuel economy bet from an expected net gain of $405 to a perceived loss equal to -$32 (Figure 3).

The implications of uncertainty and loss-aversion match up almost exactly with the views expressed to the 2002 NRC committee by auto manufacturers, who stated that consumers were willing to pay only for technologies which paid back their cost in 2 to 4 years. If one assumes that consumers value future fuel savings using a simple 3-year payback rule, future fuel savings are undervalued by a factor of 2, or more. Again using the same cost data and assumptions of the 2002 NRC report, we find an expected value of fuel economy improvement of almost zero from 28 to 35 MPG (Figure 4). The undervaluing of energy efficiency (relative to expected savings) due to uncertainty and loss-aversion is very likely pervasive, affecting not only automobiles but all energy using consumer durable goods. It also almost certainly discourages appropriate levels of investment in energy efficiency research and development.

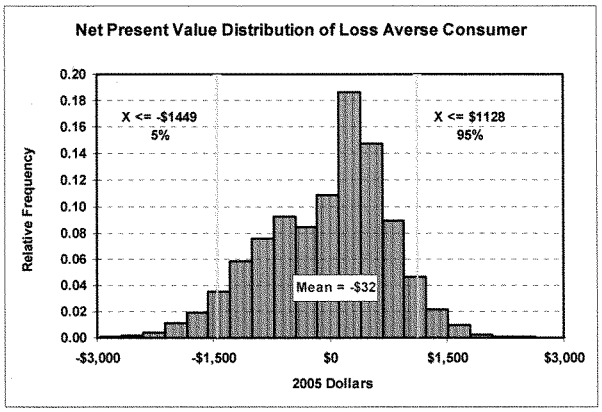

Figure 3. Perceived Value Distribution of the 25% Increase in Passenger Car Fuel Economy for a Loss-Averse Consumer. (Greene, German and Delucchi, 2009)

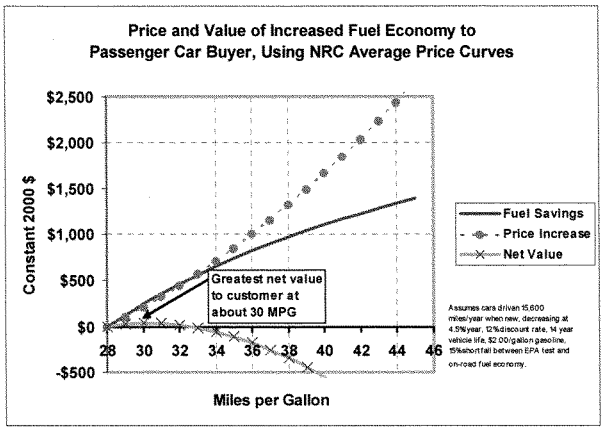

Figure 4. Private Cost and Expected Benefit of Increasing Passenger Car Fuel Economy Using a Simple 3-Year Payback Rule. (Greene, German and Delucchi, 2009)

The phenomenon of uncertainty and loss-aversion in the market for fuel economy does not constitute a market failure in the usual sense. Rather it exacerbates the market failures of environmental externalities and oil market monopolization and its energy security consequences. It weakens the market response to fuel price signals, such as a tax on gasoline. At the same time it creates an opportunity for public policy to achieve a greater response than would be possible with externality pricing alone through the use of regulations or fiscal incentives to promote vehicle efficiency and GHG mitigation.

Examples of Successful Technology-Neutral Policies in Transportation

Motor vehicle emissions standards established by the State of California and the U.S. Environmental Protection Agency pursuant to the Clean Air Act, set performance goals for criteria pollutants but did not specify the technologies that should be used to achieve them. The motor vehicle industry responded with unanticipated technologies, such as the three-way catalyst, multi-point fuel injection and computerized control of combustion that reduced emissions by orders of magnitude. A passenger car meeting California's SULEV standard in 2005 emitted one one-thousandth (0.001) of the smog-producing hydrocarbons of a passenger car manufactured in 1960 (Sakai, 2009).

The federal Corporate Average Fuel Economy standards likewise did not specify the technologies manufacturers should use to nearly double passenger car fuel economy over 1975 levels by 1985, and to increase light truck fuel economy by more than 50% (Figure 5). Manufacturers responded with a range of technological solutions, from front wheel drive and lighter-weight unibody designs to reduced engine friction and 4- and 5-speed transmissions.

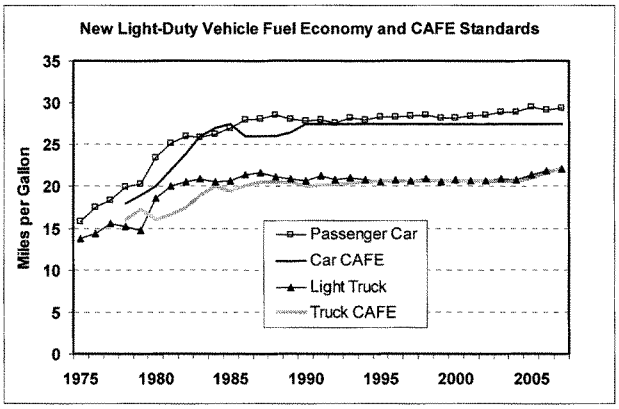

Figure 5. New Passenger Car and Light Truck Fuel Economy and Standards. Source: U.S. EPA (2008) "Light-Duty Automotive Technology and Fuel Economy Trends: 1975-2008.

Improvements in new vehicle fuel economy gradually increased the fuel economy of the on-road fleet by more than 50%, as the vehicle stock turned over (Figure 6). The result was a clear decoupling of vehicle travel and energy use, beginning at about the same time the standards took effect in 1978 (Figure 7). U.S. motorists are today consuming on the order of 75 billion gallons less fuel each year than they would have had fuel use continued to increase in direct proportion to vehicle travel.

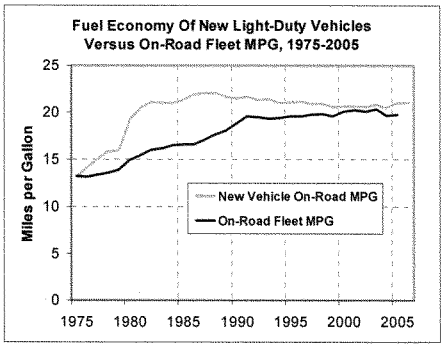

Figure 6. Fuel Economy of New Light-duty Vehicles & On-Road Fleet MPG, 1975-2007
Sources: U.S. EPA (2008), table 1, and U.S. DOT/FHWA (2007),
Highway Statistics 2007, table VM-1.

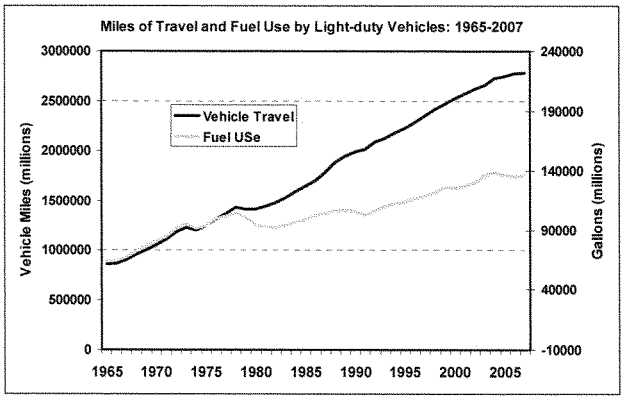

Figure 7. Light-duty Vehicle Travel and Fuel Use: 1965-2007
Source: U.S. DOT/FHWA (2007), *Highway Statistics 2007* and earlier, table VM-1.

On the fuel side, California's clean fuel standards were initially pegged to the lower emission performance of methanol in comparison to gasoline. Fortunately, the standards were formulated in terms of pollutant emission requirements rather than picking methanol as the winning fuel. Energy companies responded by inventing reformulated gasolines that achieved the same environmental goals at lower cost.

Examples of technology-neutral fiscal incentives in the transport sector are scarcer.[2] Although it is a flawed policy, the U.S. gas-guzzler tax is nonetheless technology neutral, and appears to have had a powerful impact. The policy is flawed, in my view, because it applies only to passenger cars and not light trucks, and because it provides only for taxes on energy-intensive vehicles but no incentives for energy efficient vehicles. Still, it appears that the gas-guzzler tax convinced manufacturers to improve the fuel economy of larger passenger cars such that no mass-market passenger car has had to pay the tax (Greene et al., 2005).

New Options: Feebates and Carbon Prices

Can we replace our current patchwork of tax incentives for alternative fuels and vehicles (incentives for HEVs, PHEVs, natural gas, electric, flex-fuel, E85, for fuel economy, etc.) with a simpler yet more flexible and more efficient, technology-neutral incentive structure? The answer, I think, is a qualified yes. On the vehicle side, it should be possible to replace nearly all of our current incentives with a more effective unified vehicle incentive system, usually referred to as a "feebate" system. On the fuel side we can create a system for pricing carbon, whether it is a carbon tax or carbon cap-and-trade system. Both policies are technology neutral and can provide appropriate incentives for improving energy efficiency and de-carbonizing transportation's energy sources.

Feebates consist of a graduated rebate for energy efficient or low-GHG-emitting vehicles and a graduated levy on energy intensive or high-GHG-emitting vehicles, relative to a benchmark. The concept is very flexible: feebate systems can be formulated in an infinite number of ways. The simplest and perhaps most efficient, is to set a constant rate of rebate or tax per unit of petroleum use or GHG emissions per mile. A constant rate is economically efficient, in that it values every gallon of fuel saved or ton of GHGs mitigated equally.

The benchmark determines which vehicles pay a fee and which receive a rebate. It can be as simple as a single point for all vehicles or as complex as the reformed CAFE footprint function. Feebate systems can be designed to be revenue neutral, in which the fees finance the rebates, revenue enhancing or a net subsidy. At times when a stimulus to the automotive industry could benefit the entire economy, feebates could be structured as mainly or entirely a rebate system for energy efficient, low GHG emitting vehicles. By using an attribute-based benchmarking system, such as the NHTSA now uses in its reformed CAFE standards, equitable impacts on manufacturers could be designed into the system.

Regardless of where the benchmark is set, the feebate rate provides the market signal to automobile manufacturers to adopt advanced technology up to the point where the marginal cost equals the marginal value of fuel saved plus the marginal improvement in the feebate. The extra incentive of the feebate can be used to correct the market limitation described above. A feebate rate equivalent to an extra $1 per gallon of gasoline consumed over the life of a vehicle would have more leverage on new vehicle fuel economy than a $2 per gallon tax on gasoline.

[2] Certainly the federal excise taxes on motor fuels can be seen as a technology-neutral incentive to increase fuel economy, although their primary intent is to serve as a user fee to fund the highway system. By taxing the energy for transportation motor fuel taxes are effectively a tax on the amount of physical work done by transportation vehicles since, for constant energy efficiency, work done is directly related to energy use.

Feebates differ from fuel economy standards in that as long as they are in effect they provide a continuing incentive to develop and apply new technology to improve fuel economy. Fuel economy standards must be periodically raised to stimulate continuous improvement. History indicates that this can be a significant problem. As Figure 5 shows, U.S. fuel economy standards were not significantly increased for more than two decades.

Unlike fuel economy standards, feebates also create an economic incentive for consumers to choose more efficient, lower GHG emitting vehicles. The strength and nature of the market signal, however, depends on precisely how the feebate benchmark is defined. A single benchmark for all light-duty vehicles will not only encourage consumers to select the more lower emitting vehicles within a size class but will also shift sales from larger to smaller vehicle classes. If the benchmark is defined as a footprint function, like the one used in the reformed CAFE system, there could be no incentive to choose smaller vehicles.

It is not yet clear, however, how best to use feebates as a complement or replacement for fuel economy or GHG standards. In theory, standards guarantee performance but not cost, while fiscal policies can assure cost but not performance. If we were omniscient, we could accomplish the same result with either policy. However, because there is very limited experience with feebate systems, it is not clear how much of the potential of technology to increase fuel economy or reduce GHG emissions would be traded-off by consumers and manufacturers for increased horsepower or size, or other energy-consuming features. These are trade-offs that fuel economy standards do not allow. More real-world experience with feebate systems will be accumulated in the next few years as the impacts of feebate-like systems implemented by France, the Netherlands, Spain and Sweden become known (Fulton, 2009). In addition, the Universities of California at Davis and Berkeley are conducting a comprehensive assessment of alternative feebate systems for California for the state's Air Resources Board. The study should provide useful insights about these and other practical issues.

The centerpiece of any climate policy should be establishing a meaningful way to price GHG emissions. It is well known that this can be done via a carbon tax or a carbon cap-and-trade system. There are pluses and minuses for either approach. I do not have a strong preference, however, if pressed I would give the edge to carbon cap-and-trade. Cap-and-trade will undoubtedly be more complex to administer but has the advantage that long term targets can be set, and long-term thinking is needed if we are to successfully cope with climate change. Transportation fuels should definitely be included in any carbon cap-and-trade system. Pricing carbon is not a replacement for efficiency standards but a useful complementary policy. A price on carbon will encourage energy companies to seek out ways to reduce the carbon content of the energy they supply to the transportation sector. It will also tend to increase the price of fuel, offsetting to a degree the small amount of increased driving that would otherwise be induced by increased vehicle efficiency (Small and Van Dender, 2007). Pricing carbon, however, is no panacea for transportation's energy problems. \$50/tonCO_2 amounts to approximately \$0.50 per gallon of gasoline. Given the tendency of the market to undervalue future fuel savings, this is not nearly enough to stimulate the kinds of changes needed in our transportation system.[3]

[3] This does not reflect the value of reducing oil dependence, which would justify a higher levy on petroleum fuels. However, as noted above, the nation's oil dependence problem is not an externality in the technical sense. Imposing a tax on oil, though helpful, is not a sufficient solution to the problem (Greene, 2009).

How Large Should Incentives Be?

Incentives can be designed to reduce GHG emissions, reduce oil dependence, correct the fuel economy market limitation caused by uncertainty and loss aversion, or any combination of the three. To date, the subject of an optimal feebate rate has not been rigorously analyzed in this broad context. Rates established in past policies provide at least a few reference points. Feebate rates that follow from different carbon prices, oil security premiums and market corrections are then presented.

The U.S. gas-guzzler tax is specified in terms of dollar penalties per half MPG step below 22.5 MPG. Translated to gallons per mile, the average rate per 0.01 gallons per mile is approximately $1,800 (Figure 8). In terms of dollars per gram of CO_2 per mile, this amounts to approximately $20.

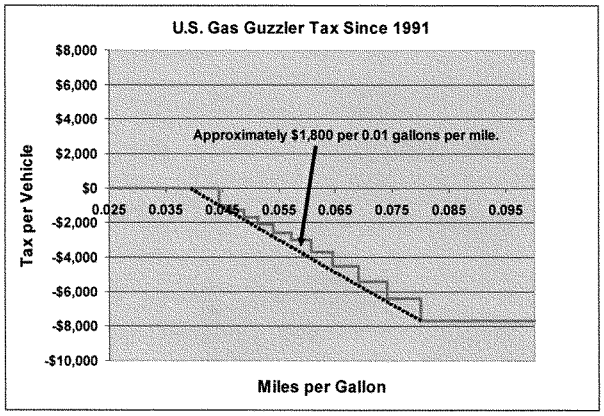

Figure 8. U.S. Gas-Guzzler Tax as an Fuel Efficiency Incentive Rate.

France's Bonus/Malus system corresponds to a rate of approximately $1,500 per 0.01 gallons per mile, or approximately $17 per gCO_2/mi (Figure 9). This rate does not apply to the final step for vehicles below $60gCO_2$/km. The intention of the French government in setting a much higher incentive for the lowest emitting vehicles was to provide a strong incentive for developing advanced technologies such as PHEVs, EVs and FCVs. As noted above, such additional incentives are likely to be necessary during the early phase of a transition to a fundamentally different energy source for motor vehicles, such as hydrogen or electricity. Modifying a feebate rate curve to provide a greater incentive for advanced, near-zero-emission technologies is one approach to addressing the early barriers to a fundamentally different source of energy for transportation.

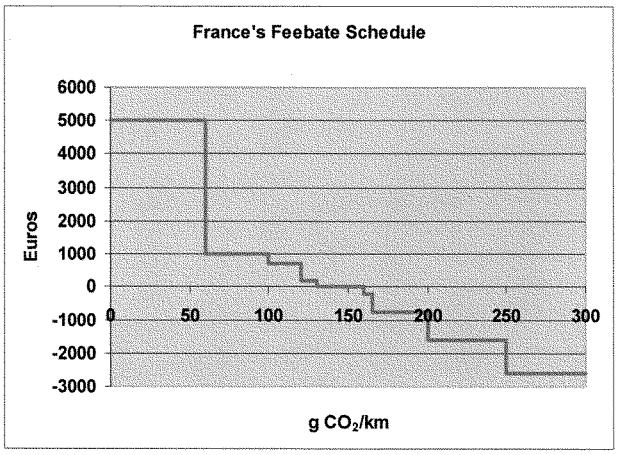

Figure 9. France's Bonus/Malus GHG Incentive System.

While existing feebate-like systems provide useful reference points, it is more valuable for policy-making purposes to relate alternative feebate rates to equivalent carbon prices or oil consumption premiums. Table 1 shows a series of feebate rates from $1,500 per 0.01 gallon per mile to $2,500 per 0.01 gallon per mile and their equivalents in terms of carbon prices and per gallon surcharges on gasoline. Key assumptions used in the calculations are provided in a footnote to the table. A feebate rate of $500 per 0.01 gallon per mile equates to a charge of $0.47 per gallon of gasoline consumed over the life of the vehicle. If interpreted as a tax on CO_2 emissions, it equates to $5.69 per gCO_2/mile or $53 per metric ton of CO_2. Because the feebate system has 2.5 times the leverage on vehicle fuel economy as a gasoline tax, a gas tax of $1.18 per gallon would be needed to equal the impact of the $500 feebate rate.

The numbers in Table 1 assume that the full weight of the feebate is attributed to either an equivalent gasoline tax or a carbon price. More appropriately it should be shared between these objectives. Thus a $2,000 feebate rate could be interpreted as a $1/gal. gasoline tax and $100/$tCO_2$ carbon price. However, neither calculation reflects the role of the feebate system in overcoming the problem of uncertainty and loss aversion. Given the undervaluing of future fuel savings by 2.5, a feebate equivalent to $1.20/gal. would be needed just to overcome the uncertainty/loss-aversion effect. This may explain why the United States and France chose feebate rates in the vicinity of $1,500-$2,000 per 0.01 gallon per mile.

Table 1. Alternative Feebate Rates and Their Equivalencies in Terms of Externality Costs, Oil Consumption Premiums and Correcting the Uncertainty Loss-Aversion Problem

Feebate Rate $/0.01gal/mi	Equivalent $ per Lifetime PV Gal. $/gal	Feebate Rate $/gCO$_2$/mi	Equivalent Carbon Price $/tCO$_2$	Gasoline Tax of Equal Impact $/gallon
$500	$0.47	$5.69	$53	$1.18
$1,000	$0.93	$11.38	$106	$2.36
$1,500	$1.40	$17.07	$159	$3.54
$2,000	$1.87	$22.76	$212	$4.72
$2,500	$2.33	$28.45	$266	$5.90

Assumes vehicle is driven 15,000 miles per year when new, declining at 4% per year, over a lifetime of 14 years. Future dollars are discounted at 7%/year.

Concluding Observations

The market's response to the problems of GHG emissions and oil dependence is not only hindered by the market failures of externalities and monopoly power but by the inherent uncertainty of future fuel savings and consumers' loss-averse behavior. As a consequence, fiscal incentives for increasing the energy efficiency of motor vehicles and reducing their GHG emissions can be especially effective policy tools. Technology neutral incentives have the dual advantages of allowing the greatest scope for innovation and harnessing market forces to select the most economically efficient solutions. As long as the incentives are in place they will provide a continuing incentive for firms to develop and implement, and for consumers to choose more energy efficient and lower emission vehicle technologies. Most, if not all of the existing incentives for energy efficient, low-emission vehicles technologies could be replaced by a consistent, economically efficient, technology neutral incentive system, such as feebates. What remains unclear at this point is how a comprehensive system of fiscal incentives should relate to a regulatory system targeting the same energy goals.

Feebate rates on the order of $1,000 to $2,000 per 0.01 gallons per mile and carbon prices in the vicinity of $50 per ton of CO_2 would very like be sufficient to stimulate research, development and implementation of advanced technologies and fuels that are not disruptive of the predominant petroleum fuel and internal combustion engine transportation system. Such economic incentives would probably not be adequate to initiate a sustainable transition to radically different energy sources for transportation, such as hydrogen or electricity. Hydrogen, in particular, will require a completely new energy supply infrastructure as well as entirely new propulsion systems for vehicles. Studies of what may be required for a transition to hydrogen vehicles (NRC, 2008; Greene et al., 2008) have concluded that even when the technological hurdles have been overcome, initiating a sustainable transition may require on the order of $50 billion in subsidies to achieve learning-by-doing and economies of scale in vehicle production, and to provide sufficient fuel availability and diversity of vehicle choice to overcome the inertia of the petroleum-fueled, internal combustion engine system. During this early transition phase, which could easily last a decade, additional incentives especially for vehicles, are likely to be required. Such incentives could be provided as a special case or by modifying a feebate schedule to provide extra, temporary incentives for the lowest emission vehicles.

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Senate Finance Committee
Technology Neutrality in Energy Tax: Issues and Options
Questions for the Record for David Greene

Senator Baucus

(1) In your testimony you proposed a "feebate," consisting of a graduated rebate for efficient vehicles and a graduated levy on less-efficient ones, relative to a benchmark. How can this policy be written so that it doesn't disadvantage drivers whose occupation or geography requires them to drive a less-efficient vehicle?

By using the NHTSA's footprint curves to define a different benchmark for each vehicle, a feebate system can be designed that does not disadvantage drivers whose occupation or geography requires them to drive a larger vehicle. The benchmark of the feebate system determines which vehicles receive a rebate and which pay a fee. The feebate rate determines the incentive to manufacturers to use advanced technology to improve fuel economy, and the incentive to consumers to purchase more efficient vehicles. If there is a single benchmark for all vehicles, there will be an incentive for consumers to buy smaller, lighter and less powerful vehicles. Making a vehicle's benchmark a function of its footprint (or other attribute), could insure that feebates do not disadvantage drivers who need larger vehicles.

A single footprint-based function might not be sufficient to address the needs of those drivers who require especially high-power vehicles, for example for routine towing or hauling of heavy loads. This problem could be addressed by defining a class of working vehicles, based on power and capacity, and by applying a different benchmark function to those vehicles. As long as the feebate rate is the same, a two-tiered system will provide the same incentive for manufacturers to adopt advanced technology to improve the fuel economy of all vehicles.

Analyses of the long-run impacts of feebate systems show that 90%, or more, of their fuel economy or greenhouse gas emissions reduction benefit comes from technological and design changes made by manufacturers, not from changes in the mix of vehicles sold. For feebates systems with footprint benchmarking, almost all of the benefit will come from technology and design; there will be very little impact on consumers' choice of vehicles.

(2) (For Dr. Greene and Dr. Metcalf) Which areas are most ripe for a tech-neutral approach in energy-tax? Given that there are carbon-related standards in the areas of vehicles (CAFE) and fuels (EPA is in the process of calculating lifecycle emissions of each fuel relative to gasoline or diesel fuel), does it make sense to start here? What about other areas, such as electricity and energy efficiency?

A carbon tax, or carbon cap-and-trade system should be the cornerstone of climate change policy, in my opinion. In the electricity generating sector, putting a price on carbon will be an effective policy for evoking a creative market response. In other sectors, such as transportation,

pricing carbon will be helpful but not adequate, for reasons I explained in my testimony and in greater detail elsewhere (Greene, German and Delucchi, 2009). In general, markets that determine the energy efficiency of energy-using consumer durable goods, and perhaps all energy-using durable goods (e.g., automobiles, refrigerators, HVAC) are likely to require efficiency standards or efficiency taxes or both in order to stimulate an appropriate market response. I doubt that it would make sense to establish technology-neutral taxes (like feebates) for all energy using goods. However, it might make sense to extend the concept of feebates to major energy using durables, like new homes (based on square feet and climate region), retrofitted HVAC systems, and motor vehicles.

My research team at the University of California at Davis is currently analyzing the impacts of feebates as a complement to or replacement for fuel economy and greenhouse gas emissions standards. We should have more definitive answers in a few months. However, feebates accomplish some things that fuel economy standards do not. First, they provide a continuing economic incentive to manufacturers not only to implement but to research and develop new energy efficient or low greenhouse gas technologies. Once a standard is met, there is no incentive to go further. With feebates, there is a consistent financial incentive to make continuous improvements. Second, feebates can help align market forces with regulatory mandates. A perennial complaint of the automobile manufacturers is that regulatory standards require them to design products whose efficiency is often out of step with consumer demand. Feebates help align price signals and regulatory mandates. They do this by bringing the consumer into the equation. With feebates, consumers have an additional financial incentive to seek out the more efficient makes and models. Finally, once the effectiveness of feebates has been established, it may be possible to eliminate fuel economy or greenhouse gas emissions standards for vehicles and replace them with market-based feebates.

Senator Grassley

(1) (For all panelists) Coming up with technology neutral tax incentives first requires a decision as to what goal or goals lawmakers seek to achieve. Regarding fuels, some of the goals that have been mentioned by various members of the panel are a reduction in dependence on foreign oil, a reduction in the use of fossil fuels, and a reduction in carbon dioxide emissions. I'll ask this question first to Dr. Urbanchuk and then open it up to the other members of the panel. The type of technology-neutral energy tax incentives that are appropriate depends largely on the goal or combination of goals that lawmakers seek to achieve, don't they?

Yes. The concept of technology neutrality requires a performance measure, or measures, against which all technologies can be rated objectively. Rating technologies on multiple metrics is not a new concept for regulatory standards. For example, motor vehicles must meet technology-neutral emissions standards for hydrocarbons, oxides of nitrogen, carbon monoxide, particulates and, soon, greenhouse gas emissions. It is entirely possible to define technology-neutral taxes based on multiple performance measures. Taking the feebate system I described in my

testimony as an example, one could define a feebate for greenhouse gas emissions and another for petroleum consumption. (I elaborate on this below in my response to Senator Bingaman's first question to me.) Each goal could have its own rate and benchmark(s), and the rebate or fee assigned to a vehicle could be the sum of the two. A vehicle that achieved low greenhouse gas emissions and did not use petroleum fuel would receive a rebate on both counts. A vehicle with average greenhouse gas emissions but no petroleum use would get credit for reducing petroleum dependence.

There is a trade-off between simplicity and comprehensiveness: the more factors considered, the more complex the system. Still, a system including both oil dependence and greenhouse gas emissions would not be difficult to design or implement.

Senator Bingaman

(1) Is there a way to combine the two performance standards, both greenhouse gas emissions and energy security, perhaps through a multiplier?

It is feasible to combine more than one performance standard in a feebate system by, in effect, adding together two feebate systems. I will give a simple example to illustrate the concept. In the example I will consider only the energy security and greenhouse gas mitigation objectives and ignore for the moment the question of inefficiency in the market for fuel economy. Let the first system be intended to reflect a carbon price of $50 per ton of CO_2. According to my written testimony, this would be equivalent to a feebate rate of approximately $5/gram CO_2 per mile. A vehicle's feebate (FB) is determined by multiplying the rate times the difference between the vehicle's CO_2 emissions (E, measured in grams per mile) and the benchmark (E_o, which could be a function of the vehicle's size, as noted in my answer to Senator Baucus' question). In equation form, this would be the following.

$$FB_{GHG} = \$5(E - E_o)$$

Let the second feebate be intended to reflect an oil consumption premium of $1 per gallon. This corresponds to a feebate rate of approximately $1,000 per 0.01 gallons of petroleum fuel consumed per mile. In equation form, this would be the following, where G is the vehicle's fuel consumption in gallons of petroleum per mile and G_o is the benchmark (again, possibly a function of the vehicle's footprint or some other attribute).

$$FB_{Oil} = \$1{,}000(G - G_o)$$

The combined feebate reflecting both performance standards would be the sum of the two feebates.

$$FB = FB_{GHG} + FB_{Oil} = \$5(E - E_o) + \$1{,}000(G - G_o)$$

The above example does not include a correction for the inefficiency of the market for fuel economy but that can be added easily.

The combined feebate gives independent incentives for both objectives. An improvement in the energy efficiency of a gasoline vehicle would benefit both measures, as would converting to a low-carbon, domestically produced biofuel.

(2) Is it correct to think of feebates as a technology-neutral tool for maximizing number of miles traveled per unit of fossil fuel? Is this an alternative to a low carbon fuel standard, which seeks to regulate the fuel rather than the miles traveled?

A feebate system based solely on fossil fuel consumption would, in effect, be a technology-neutral tool for maximizing miles per unit of fossil fuel. Such a feebate system would not be a substitute for a low carbon fuels standard because the vehicle manufacturer and vehicle buyer do not control the carbon content of motor fuels, and because a standard based solely on fossil fuel consumption will not fully reflect differences in the carbon content of fuels.

(3) How would you suggest transitioning to a feebate system? Should we implement the "bate" portion and phase-in the "fee"?

While there are many things to consider when phasing in a new policy like feebates, I think three are most important. First, this is a new policy and despite our best attempts to analyze its impacts, there could be surprises. One might hope that feebates would work so well that we would no longer need fuel economy or GHG standards. However, it will take time and success to prove that. Flexibility to adjust to surprises should be built into the system. Feebate rates should be adjusted over time for inflation, and for possible changes in the value of the goals (e.g., greenhouse gas mitigation and oil security).

Second, there is a good argument to be made that a feebate system should be implemented quickly so that consumers do not postpone some purchases to gain a rebate and advance others to avoid a fee.

Third, if a feebate system is implemented quickly, manufacturers will not have time to redesign their vehicles to make the best of it. In part, the importance of this will be reduced by the necessity of redesigning vehicles to meet higher fuel economy standards. Nonetheless, my analyses indicate that it would be a good idea to implement a feebate system so that it initially provides, on net, a subsidy to car purchasers, and then transition to a revenue neutral system. Providing an initial subsidy would be an especially good idea in the face of a recession. This could be done by adjusting the benchmark so that most vehicles get a subsidy or by providing only the subsidy first and then phasing-in the fee.

Senator Enzi

(1) In your judgment, what level would the fee or tax need to be to influence consumers to move away from less fuel efficient vehicles?

My research indicates that new car buyers undervalue discounted lifetime fuel savings by about a factor of 2.5. Given this, a feebate rate of between $1,000 and $1,500 would be required to move the market to where it would be if car buyers fully valued lifetime fuel savings. This alone would provide a very substantial incentive for consumers to move toward more fuel efficient vehicles. Higher feebate rates could be justified by the external costs of greenhouse gas emissions or by oil consumption premiums.

As I note in my answer to Senator Baucus' first question to me, the effect of a feebate system on consumers' choices of sizes of vehicles will depend on how the feebate system, in particular the benchmarks, are designed. If a single benchmark were used for all vehicles, this would create a significant incentive for consumers to purchases smaller vehicles. If a vehicle's benchmark depended on its footprint, then there would not necessarily be any incentive to purchase a smaller vehicle; the incentive to consumers would be to purchase the more efficient vehicles of any given size, while the incentive to manufacturers would be to increase the efficiencies of vehicles of all sizes.

(2) What feebates seem to ignore is that different vehicles are purchased for different reasons in different parts of the county. It seems like your proposal would punish my constituents for their way of life. Wyoming is one of the most beautiful states in the nation and we care deeply about the environment. But my constituents are farmers and ranchers and the weather in Wyoming is harsh in the winter. We need larger vehicles for work to tow and haul. We need four wheel drive vehicles to get around in the winter. And, sometimes, we need vehicles that work where there aren't always roads. If I understand the feebate system you're proposing, I'm guessing that the vehicles we need in Wyoming are not the vehicles that would be eligible for rebates. Why should I support a program that forces my constituents to pay a fee for the vehicles they need to live in Wyoming? Why should my constituents have to subsidize small cars for urban and suburban commuters?

This is a very good question because the impacts of a feebate system depend very much on how it is designed. As I explain in my answer to Senator Baucus's first question, a feebate system can be designed with a single benchmark fuel economy (or greenhouse gas emission rate) for all vehicles. In that case, your assessment of the implications for larger, more powerful vehicles would be correct. All, or nearly all, would pay fees. On the other hand, it is possible to design a feebate system by basing benchmarks on vehicle attributes. In my answer to Senator Baucus, I suggest a design in which each vehicle has a benchmark that is a function of its footprint: the bigger the footprint, the lower the benchmark fuel economy. I also suggest that it is possible to divide vehicles into two classes based on their intended uses. The CAFE standards already make such distinctions and there is no reason why they could not be incorporated into a feebate system.

However, there is a justification to base fees and rebates on absolute emissions, rather than emissions relative to other vehicles of the same size. This, for example, would be the consequence of a carbon tax or a carbon cap-and-trade system. Every ton of CO_2 has the same effect on the global climate regardless of which vehicle emitted it. It is therefore economically efficient to base fees and rebates on absolute emissions. Of course, economic efficiency is not the only goal of policy; equity is a legitimate concern as well.

(3) (For all panelists) In response to questions from the Committee, you mentioned support for continuing the use of coal as an energy source. Because coal provides more than half of our nation's electricity generation, I am pleased to hear you support its continued use. Because none of your written testimony focused on the continued need for coal, I would appreciate if you could elaborate further on this matter.

I have just completed an assessment of the importance of advanced technology for meeting our national energy goals for greenhouse gas mitigation and oil dependence. One of the conclusions of that assessment is that it will be very difficult, if not impossible, for us to achieve reductions in carbon dioxide emissions from energy use of 50% to 70% by 2050 if we are not able to capture carbon dioxide emissions from fossil fuel combustion and sequester them. This appears to be an essential technology for meeting our climate goals. If we can capture and sequester carbon from fossil fuel combustion, then coal becomes a very low greenhouse gas source of energy for electricity generation and a possible source of liquid fuels for transportation that can help reduce our dependence on oil. I am not an expert on carbon capture and storage. However, those who are (for example, Howard Herzog of MIT) tell me that carbon capture and storage is very likely to be feasible, however, we must establish that it is extremely reliable and that we can accurately predict the performance of storage reservoirs over periods of hundreds of years. Scientists and engineers believe this is very likely but we must demonstrate and validate this technology. In my opinion, the highest priority of our climate change policy should be to demonstrate the feasibility and reliability of carbon capture and storage as quickly as possible. Once we have done that, not only our nation but the world can continue to use coal environmentally responsibly.

TESTIMONY

Statement of
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Technology Neutrality in Energy Tax: Issues and Options

before the
Committee on Finance
U.S. Senate

April 23, 2009

Chairman Baucus, Senator Grassley, and Members of the Committee, thank you for the invitation to testify this morning on the issue of technology neutrality in the treatment of energy in the tax system. I make the following points in my testimony today.

- Energy policy is shaped in important ways by the federal tax system. While taxes are one instrument of tax policy, subsidies in the form of accelerated depreciation, percentage depletion, production tax credits and investment tax credits are more commonly used instruments in the tax code.
- Technology neutrality can be defined in a variety of ways. It can be defined in terms of the effective tax rate on new investments in the sector, in terms of the levelized cost of power from new investments or in terms of specific policy goals that motivate energy tax incentives.
- Efficiency is best achieved by setting taxes on energy sources that have negative externalities associated with their production or consumption. Similarly technological neutrality is most easily achieved through the use of taxes.
- A second-best technological neutrality can be achieved through the use of subsidies but it is more difficult to do so. In particular it is very difficult to level the playing field across different non-polluting energy sources through the use of subsidies.

I. Background

Federal taxes specifically related to energy production or consumption are dominated by the federal motor fuels excise tax for the Highway Trust Fund. This 18.3¢ per gallon tax collected just under $40 billion in Fiscal Year 2006. In contrast taxes on coal to fund the Black Lung Disability Trust Fund collected $639 million in FY 2006 and the Leaking Underground Storage Tank tax collected $226 million in that year.[1]

The tax code has become an important instrument for energy policy over the past decade. Tax provisions for accelerated depreciation, percentage depletion, deductions and tax credits are different tools for reducing the cost of producing energy. The Energy Information Administration recently released a report detailing federal financial interventions in energy markets and notes that expenditures through the tax system account for nearly two-thirds of all federal support (see Table 1 below).[2]

Subsidies through the tax code play an especially important role in supporting fossil fuel and renewable energy production. They play a smaller role in supporting nuclear power production though this could change over the next decade. Production tax credits for new nuclear power production put in place in the Energy Policy Act of 2005 could significantly increase federal tax expenditures for this source of electricity.

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[1] Statistics taken from the Budget of the United States (2009), Historical Tables, Table 2.4. See Metcalf, Gilbert E. 2007. Federal Tax Policy towards Energy. *Tax Policy and the Economy* 21:145-184 for further discussion of the federal taxes on energy along with a comparison and contrast with other countries.

[2] Energy Information Administration. 2008. *Federal Financial Interventions and Subsidies in Energy Markets 2007*. Washington, DC: EIA SR/CNEAF/2008-01.

Table 1. Federal Support for Energy: FY 2007 ($ Millions)

Fuel	Tax Expenditures	Total	Share of Total
Coal*	2,660	3,302	81%
Natural Gas and Petroleum Liquids	2,090	2,149	97%
Nuclear	199	1,267	16%
Renewable Energy	3,970	4,875	81%
Electricity (not fuel specific)	735	1,235	60%
End Use and Conservation	790	3,754	21%
Total	10,444	16,582	63%

Source: Table ES-1, Energy Information Administration. 2008. *Federal Financial Interventions and Subsidies in Energy Markets 2007*. Washington, DC: EIA SR/CNEAF/2008-01.

* - The 2007 tax expenditure for coal includes the credit for producing fuels from a non-conventional source in the amount of $2,370 million. Subsequent legislation has eliminated this tax expenditure for coal.

The role of tax policy has increased significantly over the past decade. EIA documents that total federal subsidies and support for energy have roughly doubled between 1999 and 2007 (in year 2007 dollars). Over this period, tax expenditures have more than tripled from $3.2 billion in real terms to $10.4 billion.

As of 2007, EIA documented thirty seven tax expenditures related to energy production and consumption. The number of incentives in the tax code makes it difficult to assess their relative effectiveness and the extent to which they favor certain types of fuels over other fuels. I turn to this issue next.

But before doing so I wish to discuss *why* the federal tax system should intervene in energy markets through either taxes or subsidies. Economic theory provides clear prescriptions for situations where interventions through the tax code can improve social welfare. Externalities provide the most relevant rationale for the energy sector. If the production or consumption of energy has as a by-product the creation of an externality (e.g. pollution) then social welfare can be improved through government intervention. One way to do this is by taxing the externality. Thus a tax on the sulfur content of fossil fuels, for example, would be an efficient response to acid rain damages arising from fossil fuel consumption for electricity generation. This is an example of a Pigouvian tax.[3] It "internalizes the externality" by forcing firms to take into account the social costs of pollution by raising their private costs by the amount of the social damages that are

[3] Named for the economist Arthur C. Pigou, an early proponent of this policy instrument in Pigou, Arthur C. 1938. *The Economics of Welfare*. London: Weidenfeld and Nicolson. A comparable approach – and the one taken to address acid rain – is to create a cap-and-trade system for SO_2. Either approach puts a price on emissions of SO_2 and provides the appropriate price signal to electric utilities to reduce emissions.

generated by the pollutant. This approach implicitly makes clear that pollution generating activities have social benefits as well as costs. Optimal policy must balance those costs against the benefits; the tax is an efficient means of effecting that balance.

Rather than taxing activities that create negative externalities, we can provide subsidies to activities that are substitutes for externality generating activities. Put simply, if fuel X generates pollution damages while fuel Y does not, we can raise the price of fuel X relative to fuel Y to reflect the social damages from burning fuel X or we can reduce the price of fuel Y. Either approach encourages firms to use less of fuel X and more of fuel Y. This is the essential approach taken through federal energy tax policy. In large measure, we subsidize energy activities that we would like to encourage rather than tax activities that we would like to discourage.

What are the externalities that are of significant concern that drive federal tax policy towards energy? I would argue that two dominate the agenda. First is the concern with global climate change arising from increasing concentrations of greenhouse gases in the atmosphere. Fossil fuel combustion in the United States was responsible for eighty percent of domestic greenhouse gas emissions in 2007.[4] Any policy to reduce U.S. greenhouse gas emissions must have as a key element incentives to shift from fossil to renewable fuels consumption.

A second concern is our heavy reliance on petroleum products and the dominance of this fuel in the transportation sector. In 2007 seventy percent of petroleum products were used by the transportation sector. Conversely, petroleum accounted for over 95 percent of the fuel used in this sector. Our reliance on petroleum makes us vulnerable to economic dislocations from sharply rising oil prices or supply disruptions. Table 2 illustrates our increasing reliance on oil over the past few decades. Oil imports have risen from just over 40 percent of total US supply to nearly 60 percent in 2007. The EIA Annual Energy Outlook does not project any significant decline in this share over the next few decades under current policy. Many have argued that our heavy reliance on oil constrains our foreign policy, drives up our military costs, and makes us vulnerable to macroeconomic shocks when oil prices rise as they did over the past few years.[5]

Energy production and consumption are associated with negative externalities in addition to climate change and oil dependence. I do not focus on those here because many of these negative externalities are currently addressed through regulatory means. For example, the Acid Rain Program run by the Environmental Protection Agency has been a highly cost-effective response to the damages from releasing sulfur dioxide in fossil fuel electric generation units. Moreover the current set of energy subsidies is arguably focused to a large extent on reducing greenhouse gas emissions and reducing

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[4] See Environmental Protection Agency. 2009. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2007*. Washington, DC: Environmental Protection Agency, EPA 430-R-09-004.

[5] On the first point, see Deutch, John, and James Schlesinger. 2006. National Security Consequences of U.S. Oil Dependency Washington, DC: Council on Foreign Relations Task Force Report No. 58. On the macroeconomic impact of oil shocks, see – among other sources – Hamilton, James. 2009. Causes and Consequences of the Oil Shock of 2007-2008. Washington, DC: Brookings Institution.

our consumption of oil. For the purposes of this testimony I will take as given that going forward tax policy will be predominantly concerned with these two issues and that any assessment of energy tax policy must consider, among other things, the degree to which policy reduces greenhouse gas emissions or our reliance on petroleum products.

Table 2. US Oil Dependence				
	1990	2000	2007	2030
Net oil imports as percent of total US Supply	42.2	52.9	58.2	55.5
World Oil Price (2007 $/BBL)	38	35	72	60
World Crude Production (million BBD)	65.5	74.9	81.5	102.9
OPEC Share (percent)	38.3	42.9	43.2	46.4
US Petroleum Consumption (million BBD)	17	19.7	20.7	22.8
US Share of World Production (percent)	26.0	26.3	25.4	22.2
Oil Intensity (1,000 BTUs/GDP) $2000	4.7	3.9	3.4	2.2
Oil Intensity (Value of oil as a percent of GDP)	2.6	2.0	3.6	1.9
Source: BP Statistical Review of World Energy (2008), EIA Annual Energy Review (2008), EIA Annual Energy Outlook (2008), EIA International Energy Outlook (2008)				

II. What Does Technology Neutrality Mean?

This hearing is concerned with technology neutrality in energy production. Before assessing this concept we need to define it. In a general sense technology neutrality means that our tax code does not favor one fuel over another. With this as our definition our tax code is not technology neutral nor should it be. To the extent that certain energy sources create negative externalities we want to ensure that the tax code (or federal policy more generally) takes into account the pollution arising from energy production or consumption. We can modify the definition to mean that the tax code should not favor one fuel over another after taking into account any positive or negative externalities arising from the production or consumption of energy.

While conceptually straightforward, it is more difficult in practice to identify whether certain energy technologies are advantaged or disadvantaged by the tax code. We cannot observe what the mix of energy technologies and fuels would be in the absence of a technology neutral tax system. Moreover efforts to measure the impact of changes in the tax code on energy production and consumption are made more difficult by the fact that changes in energy tax provisions often occur at the same time as (or soon after) significant changes in energy prices or supply.

One approach to quantify the impact of the tax system on energy investment is the construction of *effective tax rates*. An effective tax rate is a summary measure of the various provisions in the tax code that affect investment in new capital. Specifically, it compares the before-tax return to the difference between the before- and after-tax return. The before-tax return is the return an investment must earn in order to cover its cost, pay the required return to investors, and pay taxes on the project. The after-tax return is the return that savers (the source of funds for investment) expect to receive after taxes are

paid on marginal investments. Thus, if savers are prepared to accept seven percent on an investment after tax and the project must earn ten percent in order to cover depreciation, taxes, and required payments to investors, the effective tax rate is 30 percent $\left(\frac{10-7}{10}\right)$.

Effective tax rates focus on the marginal cost of funding investments rather than on project cost. In particular, they focus on the cost of a break-even investment. Because they summarize the many provisions of the tax code that affect the returns on capital investment, effective tax rates are frequently used to consider how the tax system affects capital investment. This is a particularly salient issue given the capital investment needs of energy infrastructure in the United States.

Table 3 reports estimates of effective tax rates on new energy investment assuming the tax rules in place in 2007.[6]

Table 3. Effective Tax Rates on New Energy Investment

	Current Law	No Tax Credits	Economic Depreciation
	(1)	(2)	(3)
1. Electric Utilities			
Generation			
Nuclear	-99.5%	32.4%	-49.4%
Coal (PC)	38.9%	38.9%	39.3%
Coal (IGCC)	-11.6%	38.9%	-10.3%
Gas	34.4%	34.4%	39.3%
Wind	-163.8%	12.8%	-13.7%
Solar Thermal	-244.7%	12.8%	-26.5%
2. Petroleum			
Oil Drilling (non-integrated firms)	-13.5%	-13.5%	39.3%
Oil Drilling (integrated firms)	15.2%	15.2%	39.3%
Refining	19.1%	19.1%	39.3%
3. Natural Gas			
Gathering Pipelines	15.4%	15.4%	39.3%
Other Pipelines	27.0%	27.0%	39.3%

Source: Table 2, Metcalf, Gilbert E. 2009. Taxing Energy in the United States: Which Fuels Does the Tax Code Favor? New York: The Manhattan Institute. PC stand for pulverized coal and IGCC for integrated gasification combined cycle.

Table 3 illustrates that new energy capital investments for many fuels can have large and negative effective tax rates. An effective tax rate of -100 percent, for example, means that the return an investment must earn prior to paying taxes need only be half as large as the return investors require since the tax code will provide sufficiently generous tax treatment that the project return increases to the investor's required return. The table

[6] This analysis comes from Metcalf, Gilbert E. 2009. *Taxing Energy in the United States: Which Fuels Does the Tax Code Favor?* New York: The Manhattan Institute.

also illustrates that tax credits for certain new electricity generating units are the predominant source of the tax benefits for these technologies.[7]

Another way to report subsidies in the tax code is the subsides per BTU of energy or MWh of electricity generation. Table 4 reports data from the EIA study discussed above.

Table 4. Subsidies per Unit of Energy Production in 2007

	Energy	Electricity
	$/billion BTUs	$/MWh
Coal	113	0.14
Refined Coal*		29.94
Natural Gas and Petroleum Liquids	63	0.22
Nuclear	24	0.25
Renewable Energy	584	2.01

Source: Energy Information Administration. 2008. *Federal Financial Interventions and Subsidies in Energy Markets 2007.* Washington, DC: EIA SR/CNEAF/2008-01.

* - The 2007 tax expenditure for coal includes the credit for producing fuels from a non-conventional source in the amount of $2,370 million. Subsequent legislation has eliminated this tax expenditure for coal.

The first column reports the total tax subsidy for energy per billion BTUs of production. I have combined refined coal and coal here given data availability. The subsidy for coal is roughly double that of natural gas and petroleum liquids and roughly five times that of the subsidy for nuclear power.[8] In contrast, the subsidy per billion BTUs of renewable energy is nearly $600. The second column restricts attention to subsidies for fuels used in the production of electricity. Here I've broken out refined coal given data on electricity generation with refined coal. The subsidy per megawatt hour of electricity production is highest for refined coal and lowest for other coal.

Measuring subsidies per dollar of production is problematic for a number of reasons. Table 4 measures the average subsidy but provides no information about the subsidy's effect on the use of this fuel. It may be that production of a particular form of energy would occur in the absence of any subsidy directed at that fuel source. Second, the subsidy doesn't take into account differences in the quality of fuels. On an energy

[7] A similar approach that focuses on the cost of producing electricity is to report the levelized cost of a project. This is the constant revenue per kWh of electricity generation that a project must earn over its life to cover its costs. One can compare levelized cost measures with under different tax assumptions to see how the tax code affects the cost of a project. This is the approach taken in Metcalf, Gilbert E. 2007. Federal Tax Policy towards Energy. *Tax Policy and the Economy* 21:145-184

[8] Note that no developer has yet made use of the production tax credits for new nuclear power plants.

content basis, natural gas is nearly five times the cost of coal. Thus while the subsidy to regular coal used in the production of electricity is roughly two-thirds that of natural gas on a MWh basis, the coal subsidy is more beneficial per dollar of spending on coal. Third, the subsidy is not related to any externality that may be driving energy policy. Whether the subsidy for renewable energy is high or low depends on the benefits that come about from the reduction in our use of that fuel. We cannot say anything about that by focusing on a subsidy per unit of energy.

A final way to measure subsidies is per ton of carbon dioxide emissions that is not emitted or barrel of oil that is not consumed. The benefit of this approach is that it calibrates the measure of the tax code's impact to the policy goals we care about (reducing greenhouse gas emissions and oil consumption). If the tax subsidy per ton of avoided greenhouse gas emissions from technology X is twice that of reducing emissions from technology Y then we can say that our tax policy favors technology X over Y on this dimension.

This definition of technology neutrality is not the same as efficiency in abatement of pollution. The latter requires that the marginal cost of pollution abatement be equalized across energy sources. Unless subsidies are designed in terms of a payment per unit of pollution reduced it is difficult if not impossible to achieve economic efficiency across fuel types. Moreover, as I discuss below, even if subsidies are constructed in this fashion, it is difficult to disentangle true emission reductions from reductions that would have taken place in the absence of the tax subsidy.

III. Achieving Technology Neutrality Through a Subsidy Based Policy

Using subsidies within the tax system to achieve energy policy goals has been a time honored custom throughout the history of the U.S. income tax. It is important, however, to recognize the limitations of subsidies in achieving efficient outcomes. Congress may decide that the political benefit of a subsidy based approach outweighs the efficiency costs but it should be aware of the drawbacks of this approach so as to use the instrument as efficiently as possible.

First note that a subsidy based approach achieves the important goal of adjusting relative prices of polluting and non-polluting energy sources in the right direction. If fuel source X causes pollution that is equal to 10 percent of its cost then we can provide the right incentive to fuel users choosing between fuel sources X and Y by raising the price of X by 10 percent or by lowering the cost of fuel source Y by 1/(1.10) or 9.1 percent. Either way the relative cost of fuel source X to Y is now ten percent higher than it was prior to the implementation of new energy policy. Either a tax or a subsidy can be effective on the margin of choosing among fuel sources where some sources cause pollution.

This creates a problem, however, on a different margin. Efficiency requires that consumers make decisions taking into account the full cost of using commodities – including the pollution costs associated with using energy. Raising the cost of the

polluting fuel source X raises the overall cost of energy use and encourages a reduction in energy consumption. More precisely, consumers shift away from consuming energy to consuming other goods. This substitution is driven by the higher overall cost of energy. Subsidizing the clean substitute undermines this consumer substitution effect as it leads to a lower cost of energy overall. Consumers do not reduce energy consumption as much as they would under a cost-raising policy.

Second, subsidies that appear to be technologically neutral may not be neutral at all in the sense of equalizing the subsidy cost per unit of activity that Congress is trying to discourage. Consider the tax credit for hybrid vehicles put in place in the Energy Policy Act of 2005. The credit ranges from zero to $3,000 per vehicle depending on whether the vehicle meets the specific hybrid criteria and on how many vehicles have been sold. The credit phases out as the vehicle hits certain sales targets over time. Table 5 shows the subsidy cost per gallon of gasoline saved through this credit for a number of vehicles. The tax credit is for model 2009 vehicles. I measure the savings relative to a vehicle that gets 20 miles per gallon assuming the vehicle is driven the average number of miles currently driven by private vehicles in the United States.

Table 5. Hybrid Vehicle Tax Credit
Model 2009 Values

Vehicle	MPG	Hybrid Vehicle Tax Credit	Annualized Value of Credit	Annual Gasoline Savings (Gallons)	Tax Credit per Gallon of Gasoline Saved
Chrysler Aspen Hybrid	21	$2,200	$347	30	$11.68
Ford Escape Hybrid (2WD)	32	$3,000	$474	234	$2.02
Mazda Tribute Hybrid (2WD)	32	$3,000	$474	234	$2.02
Nissan Altima Hybrid	34	$2,350	$371	257	$1.44
Toyota Corolla	31	$0	$0	222	$0
Toyota Prius	46	$0	$0	353	$0

Source: Author's calculations of savings relative to a vehicle that gets 20 miles per gallon and is driven 12,485 miles per year. Vehicles are assumed to be driven for ten years and savings are annualized with a ten percent discount rate.

The table illustrates several points. First, the tax credit per gallon of gasoline saved varies from zero to over $11 per gallon. Second, certain hybrid vehicles that get high mileage are excluded from the credit because they have been successful in the market place. Third, certain high mileage vehicles are excluded from the subsidy because they do not use specified technology. Note that the Corolla gets nearly the same mileage as the Tribute Hybrid. This is the most egregious violation of technology neutrality. The tax credit provides no incentive to tinker with the internal combustion

engine to achieve increases in vehicle efficiency despite the many opportunities that exist to make the internal combustion engine more efficient. Our tax policy should provide the same incentives to improve mileage regardless of the technology put in place. Only in this way is true technology neutrality achieved.

The hybrid vehicle tax credit is a clear example of inefficient allocation of resources across fuel saving capital investments. It is not the only example, however. Inefficient allocations can occur even when policies appear to be technology neutral. Consider the production tax credit for electricity generated from renewable sources. Currently the tax credit is worth 2.1¢ per kWh for electricity over the first ten years of the plant's life.[9] This policy appears to be technology neutral (assuming all renewable technologies are made eligible for the credit). Renewable in this context means carbon-free. But consider Table 6 which compares the production tax credit for wind with that for geothermal energy.

Table 6. Production Tax Credit

Renewable Source	PTC	Capacity Factor	Subsidy per ton CO_2
Geothermal	$ 0.021	73%	$ 7.74
Wind	$ 0.021	27%	$ 12.28

Source: Author's calculations. Capacity factor based on electricity generation in 2006. CO_2 emissions avoided assume geothermal replaces coal fired base load capacity while wind replaces natural gas shoulder or peaking capacity. Coal and natural gas emissions based on EIA estimates

The subsidy per ton of carbon dioxide avoided critically depends on which power source is displaced by the new renewable capacity addition. Geothermal power, for example, has a capacity factor of over 70 percent – meaning that it is producing power on average for 70 percent of the year – while wind's capacity factor is less than 30 percent.[10] Geothermal power is more likely to displace base load coal units than natural gas while the opposite is true for wind. Under the assumption that geothermal displaces coal and wind displaces natural gas, the subsidy for the former is $7.74 per ton of carbon dioxide avoided while the subsidy for wind is $12.28 per ton. The difference arises because coal emits on average one ton of CO_2 per MWh of electricity generation while natural gas emits on average roughly two-thirds of a ton of CO_2 per MWh.

The point here is not whether geothermal displaces coal and wind natural gas (or even whether the displaced fuel is constant over time). Rather the point is that a technology neutral policy focused on reducing greenhouse gas emissions should favor technologies that are more likely to displace coal than natural gas. The current new technology credits do not take this into account.

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[9] Certain sources (e.g. municipal solid waste and open loop biomass) are eligible for a tax credit at half this rate.

[10] The capacity factor for wind depends importantly on location and turbine design. Capacity factors as high as 40 percent are not out of the question. But even at higher capacity factors the point of this example is unaffected.

In summary, the current set of subsidies to encourage reductions in petroleum consumption and greenhouse gas emissions have two drawbacks. First, they generate a distortion on the margin between energy consumption and consumption of other non-energy commodities. Second, they generate distortions among the externality-reducing technologies in a way that raises the cost of achieving our policy goals.

IV. Design Issues

In addition to the pricing issues discussed above, the current set of energy tax initiatives have other issues that could fruitfully be addressed by lawmakers. The first issue is that of stability and clarity in the policy. The historic pattern of two-year authorization cycles for production tax credits has created great uncertainty in the wind industry and led to boom and bust cycles that raise the cost of renewable energy investment.[11] Greater certainty over the production tax credit would smooth out investment and reduce bottlenecks in turbine manufacture that delay projects and raise costs. A related issue is the ability to use tax benefits. One casualty of the current financial crisis is the reduced tax appetite of firms that historically have invested in wind and other renewable projects. The provision of a rebate option in the American Recovery and Reinvestment Act of 2009 addresses this concern.

A second key design issue is that of additionality. Does the policy lead to incremental reductions in pollution or simply subsidies for emission reducing activities that would have occurred in the absence of the policy? A good example of this is the $.50 per gallon alternative fuels mixture credit. This credit is intended to encourage the addition of biodiesel and other biomass based fuels to petroleum to reduce petroleum use. Recently it has emerged that many paper firms are taking the credit for mixing diesel fuel with black liquor, a biomass by-product of paper making that historically has been used by the industry as a fuel source for their boilers. Controversy has arisen over whether paper firms are adding diesel fuel to black liquor purely for the purpose of claiming the tax credit biodiesel mixture tax credit.[12] This is troubling on two levels. First, it may be highly inefficient if credits are being provided for inframarginal activities. This is a common problem with any subsidy. We want to provide the incentive to firms that would not have undertaken the desirable activity in the absence of the subsidy. But we don't want to provide the subsidy to firms that would have undertaken the activity regardless of the subsidy. But the example from the paper industry is troubling beyond the inframarginal nature of the subsidy. If the tax credit is raising the demand for diesel fuel in order to make the biofuel eligible for the credit, then it is having the perverse effect of raising rather than lowering demand for petroleum products.[13]

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[11] The American Recovery and Reinvestment Act of 2009 extends the production tax credit (PTC) for wind through 2012 and allows PTC qualified facilities to opt for a 30 percent investment tax credit or a cash rebate. These options are described in greater detail in Bolinger, Mark, Ryan Wiser, Karlynn Cory, and Ted James. 2009. *PTC, ITC, or Cash Grant?* Berkeley: Lawrence Berkeley National Laboratory LBNL-1642E.

[12] See Mouawad, Jad, and Clifford Krauss. 2009. Lawmakers May Limit Paper Mills' Windfall. *New York Times*, April 18, 2009.

[13] The perverse impact of policy is not limited to the biodiesel mixing tax credit. Research by Holland, Hughes, and Knittel suggest that low carbon fuel standards may have the perverse effect of increasing net

A third important design issue is the interaction between tax policy and other policies. A simple example here is the interaction of the hybrid vehicle tax credit and the Corporate Average Fuel Economy (CAFE) standards. Allowing tax credits for hybrids encourages the production and purchase of high mileage vehicles. But CAFE sets minimum fleet mileage standards for automakers. Producing more hybrid vehicles relaxes the CAFE mileage constraint for automakers and allows them to sell more low mileage vehicles.[14] One possible policy response to this would be to exclude credit receiving hybrids from the fleet for purposes of meeting CAFE standards. Alternatively one could eliminate the credit and simply let CAFE be the driving incentive for hybrid production.

V. A Better Approach

I have identified a number of problems with the current approach. Energy related tax subsidies lower rather than raise the cost of consuming energy. Much of the subsidy may be inframarginal. And the policy can be undermined through interaction with other energy policies. Here I wish to briefly mention policies that avoid most if not all of these pitfalls.

Assuming our concern is with climate change and oil consumption, optimal policies will raise the cost of emitting greenhouse gases and oil consumption.[15] One approach to discourage greenhouse gas emissions is through a carbon pricing mechanism.[16] One approach is through a carbon fee. Elsewhere I describe a proposal to price carbon emissions in a way that meets targets for emission caps over a control period (say from 2012 through 2050) to ensure that environmental goals are met while achieving price stability.[17]

A simple and efficient way to reduce oil consumption is to implement an oil consumption tax. Because of the volatility of oil prices and occasional spikes as we saw last year, I proposed (along with a colleague) a variable oil consumption tax that phases

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carbon emissions. See Holland, Stephen P., Jonathan E. Hughes, and Christopher R. Knittel. 2009. Greenhouse Gas Reductions under Low Carbon Fuel Standards? *The American Economic Journal: Economic Policy* 1 (1):106-146.

[14] Alternatively and equivalently, it leads to the substitution of hybrid vehicles for other high mileage vehicles that in the absence of hybrids the automakers market primarily to meet CAFE fleet standards.

[15] Clearly there is overlap between policies that discourage oil consumption and greenhouse gas emissions. But policies can also work at cross purposes. A desire to reduce oil consumption could lead to increased coal consumption (and greenhouse gas emissions) if plug-in cars are a key part of the strategy to reduce oil consumption. Hence it is desirable to have multiple policy instruments in the face of multiple policy goals.

[16] I use the term carbon price as this is the common terminology despite the fact that the price can extend to gases beyond carbon dioxide.

[17] See Metcalf, Gilbert E. *Reacting to Greenhouse Gas Emissions: A Carbon Tax to Meet Emission Targets*, Tufts Department of Economics Working Paper 2009-03. For a detailed description on how to implement a carbon fee see Metcalf, Gilbert E., and David Weisbach. forthcoming. The Design of a Carbon Tax. *Harvard Environmental Law Review*.

out as oil prices rise.[18] An oil consumption tax is preferable to an increase in the gasoline tax since it targets all oil consumption rather than the portion targeted to motor vehicles. But an increase in the gasoline tax in lieu of an oil consumption tax would go a long way towards improving efficiency.[19]

Both of these approaches address the problems addressed above. They ensure that energy consumption internalizes the costs of externalities associated with its production or consumption and achieves the socially efficient mix of energy and non-energy consumption. Second, they avoid problems of inframarginal subsidies or perverse incentives. Third, they complement rather than work at cross purposes with other federal energy policies.

VI. Conclusion

Current energy tax policy can perhaps be best viewed as a transitional policy until policies such as carbon pricing (whether through a carbon fee or a cap-and-trade system) are put in place along with consideration of an oil consumption tax or increase in the gas tax. In the meantime, Congress should consider how they might best modify the existing subsidies in the tax system to achieve true technology neutrality.

True technology neutrality requires measuring the subsidy cost of reducing the externality in question. Here I have focused on reducing greenhouse gas emissions and oil consumption. Policies should provide a level playing field in the sense that the subsidy per unit of externality avoided should be comparable across technologies. They should also consider the extent to which true reductions in the externality occur and avoid unintended consequences. This is all very easy to say but difficult to do. But so long as our energy policy is built around providing subsidies for activities we wish to support as opposed to taxing those activities we wish to discourage, we will always face difficult design problems that complicate our efforts to achieve efficient and cost effective outcomes.

Thank you for the opportunity to testify today.

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[18] See Bordoff, Jason and Gilbert E. Metcalf, *Breaking The Boom-Bust Oil Cycle*, The New Republic Blog (The Vine), Jan. 6, 2009. Available at http://blogs.tnr.com/tnr/blogs/environmentandenergy/archive/2009/01/06/breaking-the-boom-bust-oil-cycle.aspx.

[19] Research finds that the optimal tax on gasoline in the United States falls far short of the unpriced social cost of its use. See Parry, Ian, and Kenneth A. Small. 2005. Does Britain or the United States Have the Right Gasoline Tax? *American Economic Review* 95:1276-1289.

Senate Finance Committee
Technology Neutrality in Energy Tax: Issues and Options
Questions for the Record

Responses by
Dr. Gilbert E. Metcalf
Department of Economics
Tufts University

Senator Baucus

(1) Which areas are most ripe for a tech-neutral approach in energy-tax? Given that there are carbon-related standards in the areas of vehicles (CAFE) and fuels (EPA is in the process of calculating lifecycle emissions of each fuel relative to gasoline or diesel fuel), does it make sense to start here? What about other areas, such as electricity and energy efficiency?

The most direct approach towards tech neutrality would be to replace many of the current tax benefits with a carbon price (either through a cap and trade system or a carbon fee) to address climate change and to enact an oil consumption charge per barrel of oil.

Achieving tech neutrality with subsidies requires that we define the goals we wish to achieve. Reducing oil consumption and reducing greenhouse gas emissions are two important goals. While some policies may be complimentary in helping reach both these goals, other policies may help achieve one goal while making it more difficult to achieve the other goal (e.g. coal to liquids to replace petroleum fuels).

Limiting attention to subsidies, let me note the following:

Replacing the current hybrid vehicle tax credit either with a feebate or with a credit for all new vehicle purchases that attain mileage ratings above a set level regardless of engine type or hybrid nature is one promising approach. The threshold for receiving the credit could vary by vehicle type (e.g. light trucks could have a different standard than passenger cars). The credit could be stepped or a linear function of the difference between the vehicle's mileage rating and the base level. Thus if 22 mpg were set for a vehicle class, one approach would be to provide a given amount of credit per miles by which the vehicle rating exceeds 22 mpg.

Focusing on our concern with global warming, energy efficiency credits should be tied to emission reductions. Thus differential energy efficiency credits based on the heat source (oil versus gas versus electricity) would be desirable although it adds to the complexity of the initiative.

Senator Grassley

(1) Coming up with technology neutral tax incentives first requires a decision as to what goal or goals lawmakers seek to achieve. Regarding fuels, some of the goals that have been mentioned by various members of the panel are a reduction in dependence on foreign oil, a reduction in the use of fossil fuels, and a reduction in carbon dioxide emissions. I'll ask this question first to Dr. Urbanchuk and then open it up to the other members of the panel. The type of technology-neutral energy tax incentives that are appropriate depends largely on the goal or combination of goals that lawmakers seek to achieve, don't they?

That is correct and a point that I emphasized in my testimony before the Committee. If our goal is to reduce petroleum consumption per mile driven then a feebate or credit for mileage above a baseline makes more sense than the current tax credit for hybrids. If our goal is to reduce greenhouse gas emissions, then an appropriate policy would shift us away from coal dependence (or shift us to the use of coal with carbon capture and storage).

Unfortunately none of the current policies are truly tech neutral as I note in my testimony. It is very difficult to design tech neutral subsidies. Even apparently neutral subsidies like the production tax credit for renewable electricity generation falls short of tech neutrality since it does not take into account the fossil fuel that it is replacing. Carbon pricing avoids this problem.

Similarly subsidies for ethanol production should take into account the net energy and carbon reductions that they achieve over their entire production cycle. This would provide an additional stimulus to second generation biofuel production and ensure that corn is reserved for its highest value use.

Senator Bingaman

(1) You advocate for incorporating negative externalities (such as pollutants) into price by increasing the price of the polluter, rather than our traditional approach of reducing the price of the non-polluting alternative, through a tax subsidy. If we were to incorporate negative externalities into cost, can we do so in a manner that is not regressive – that is, so that it does not disparately impact consumers who are least able to afford the extra cost?

Yes, we can. I have written a number of papers that demonstrate the ability to implement carbon pricing in a distributionally neutral manner. Let me refer you to a paper I wrote for the Hamilton Project at Brookings on this topic, *An Equitable Tax Reform to Address Global Climate Change,* available at http://www.brookings.edu/papers/2007/10carbontax_metcalf.aspx . The paper notes that combining regressive carbon pricing with a progressive rebate of the revenues ensures distributional neutrality.

My paper discussed a capped rebate of payroll taxes (similar to the approach currently taken with the Making Work Pay tax credit). It can be combined with a carbon bonus to Social Security

recipients and a carbon adder for food stamp recipients to ensure maximum coverage. One could also provide a carbon dividend to each household based on family size rather than tie the rebate to current programs. Either approach can be designed to meet distributional goals.

Senator Enzi

(1) Your testimony discusses negative externalities associated with fuel sources. It states, "If the production or consumption of energy has as a by-product the creation of an externality (e.g. pollution) then social welfare can be improved though government intervention." While many proponents of a cap and trade system focus on externalities like pollution, it seems to me that they do not focus on the tremendous economic costs of implementing such a system and the relative lack of a benefit if the United States attempts to do it alone. Do you have concerns that a cap and trade system will have a negative economic impact, particularly on lower income individuals?

We can hold harmless most households – and in particular low income households – through well designed rebates of revenue from a carbon pricing program. I have written a number of papers that demonstrate the ability to implement carbon pricing in a distributionally neutral manner. Let me refer you to a paper I wrote for the Hamilton Project at Brookings on this topic, *An Equitable Tax Reform to Address Global Climate Change,* available at http://www.brookings.edu/papers/2007/10carbontax_metcalf.aspx . The paper notes that combining regressive carbon pricing with a progressive rebate of the revenues ensures distributional neutrality.

My paper discussed a capped rebate of payroll taxes (similar to the approach currently taken with the Making Work Pay tax credit). It can be combined with a carbon bonus to Social Security recipients and a carbon adder for food stamp recipients to ensure maximum coverage. One could also provide a carbon dividend to each household based on family size rather than tie the rebate to current programs. Either approach can be designed to meet distributional goals.

(2) Do you believe that the United States could be at an economic disadvantage if countries like China and India are not involved in a climate change program?

I believe that any carbon pricing program should have border adjustments included (perhaps implemented with some lag to give major developing countries an opportunity to develop their own carbon pricing programs). This is important for competitiveness reasons and also because it is imperative that major developing countries become part of a global partnership to reduce emissions given the expected rate of growth of emissions in those countries. Put simply the world cannot solve the climate problem without the participation of China, India, and other major developing countries.

(3) (For all panelists) In response to questions from the Committee, you mentioned support for continuing the use of coal as an energy source. Because coal provides more than half of our nation's electricity generation, I am pleased to hear you support its continued use.

Because none of your written testimony focused on the continued need for coal, I would appreciate if you could elaborate further on this matter.

The United States sits on vast reserves of coal. It is a valuable resource and we cannot expect that we will not want to avail ourselves of it. But we must do so in a way that is not environmentally harmful. Significant research is needed on carbon capture and sequestration and rapid funding of demonstration projects *at scale* to identify all of the bottlenecks to rolling out this technology as quickly as possible. Research should also focus on socioeconomic obstacles, regulatory hurdles, and insurance and liability issues associated with long-term storage of carbon dioxide. This is an area where prompt action by Congress could be most valuable.

Senate Finance Committee

Hearing on the Tax Code's Role in Energy Policy

Testimony of

John M. Urbanchuk

Director, LECG LLC

April 23, 2009

Good morning, Chairman Baucus, Ranking Member Grassley, and Members of the Committee. My name is John M. Urbanchuk. I am a Director at LECG LLC, a global expert services consulting firm, where I specialize in agriculture and the economics of alternative fuels with particular emphasis on biofuels. I am pleased to be here this morning to discuss the role of the tax code in energy policy and whether technology-neutral energy incentives, including in the areas of fuels, vehicles, electricity, and efficiency, should be developed.

Optimal Structure for Energy Incentives:

Experience, both in the U.S. and around the globe, has demonstrated that well crafted tax incentives are an effective means to encourage the production and use of renewable energy. Alternative sources of energy, specifically renewable forms, have been deemed in the national interest as a way of reducing dependence on imported energy and enhancing national security; improving environmental quality; and facilitating economic growth.

As with all tax policy, Congress should conduct prudent oversight to ensure that over time, various tax incentives continue to reflect the nation's tax and energy policy goals. As Congress

considers both new tax incentives and revisits existing ones, there are ***three major factors*** that should be considered when determining the form and structure of an incentive.

Industry Economics

The value of a tax incentive that is designed to encourage the production and use of a particular energy source should be set at responsible levels. Common sense dictates that the incentive should be structured in a manner that makes an activity economically viable but does not provide an unintended windfall for recipients. In addition, the value of the incentive should not create perverse incentives that encourage activities counter to responsible energy policy, or those that impede achievement of national energy policy goals.

Innovation and Technology Development:

Energy tax policy should be structured in a manner that incentivizes and spurs the development of cleaner and more efficient ways to generate and distribute energy. A corollary to this is the role energy tax policy can play in promoting conservation and in helping direct the flow of private investment capital to cleaner and more efficient sources of energy, and industries with the potential for rapid commercialization. An additional consideration is the role of energy tax policy on stimulating job creation and economic growth, particularly in nascent industries such as wind and solar, and second generation biofuels. Thus, Congress should consider the potential to develop new technology, promote innovation and build needed infrastructure when considering energy tax policy.

Technology Neutrality:

To the degree possible, energy tax incentives should be structured in a manner that treats competing technologies and processes in an equitable fashion. That said, Congress should set parameters, such as requiring various fuels to meet quality standards and specifications established by ASTM International, that ensure the desired policy goal of an incentive is being met.

These three equally important factors should be weighed when Congress considers energy tax policy. It is instructive to note that these three factors do not exist in isolation. Rather they interact with each other, thereby complicating the job of the policy maker.

A Technology-Neutral Tax Policy Would Counteract Existing Energy Policy

The issue of technology neutrality is particularly vexing, especially with regard to the development of alternative fuels. In its purest form a technology neutral energy tax policy would apply equally to all forms of energy and not give preferential treatment to one energy source over another. However, national policy as outlined by the Energy Independence and Security Act of 2007 (EPAC07), mandates the use of 36 billion gallons of renewable fuels by 2022 and provides important research and development incentives for solar and geothermal sources as well as for programs aimed at improving energy efficiency and conservation.

The development of energy tax policy that supports the national goals embodied by EPAC07 would effectively violate the basic premise of technology neutrality by providing favorable tax incentives for renewables such as cellulosic ethanol, advanced biofuel feedstocks including biomass biodiesel, solar, and geothermal. Specifically, EPAC07 establishes a cap of 15 billion

gallons of ethanol from corn starch, calls for one billion gallons of biomass biodiesel, and requires the remaining 20 billion gallons of renewable fuels to come from cellulose and other advanced biofuel feedstocks. While we are on track to meet the 15 billion gallons of renewable fuels from traditional corn ethanol, the ability to produce the required amount of cellulose ethanol and biodiesel is, frankly, questionable.

The technology exists to process ethanol from cellulose feedstocks. However, commercialization of cellulosic ethanol remains a question of economics. While operating costs for cellulosic ethanol are expected to be lower than for corn ethanol, the capital investment necessary to build cellulosic ethanol facilities remain about five times that of grain-based facilities. The economic viability of any alternative fuel or energy source in today's environment of relatively low oil and gasoline prices and reduced demand as a result of recession is seriously threatened. This makes the continuance of existing tax incentives such as the Volumetric Ethanol Excise Tax Credit (VEETC), the Small Ethanol Producer Tax Credit and the biodiesel blenders excise tax credit all the more important in helping level the playing field for these alternatives to petroleum based fuels. The ethanol tax incentives, which continue through 2010, also play a major role in helping attract the investment capital needed to build and commercialize the second-generation (cellulose) ethanol industry.

The biodiesel tax incentive is scheduled to expire at the end of this year. In its absence the price of biodiesel will be significantly higher than petroleum diesel, further reducing demand and making it nearly impossible for biodiesel plants to produce fuel at a profit. Thus, it is safe to assume that if the biodiesel tax incentive lapses, biodiesel production in the U.S. will halt or at a minimum be severely curtailed, and the energy security, environmental, and job creation benefits that the nation realizes from biodiesel production will be lost.

Further, the short-term nature of the incentive under current law inadvertently sends the signal to the marketplace that the federal commitment to biodiesel is tenuous. At a time when market conditions are less than ideal and investor confidence is strained, the temporary nature of the incentive undermines overall confidence in the stability of the industry. A multi-year extension of a reformed tax incentive that is structured in a manner to promote a stable, viable domestic industry would address this situation and allow the U.S. to reap the multiple long-term benefits associated with the enhanced production and use of biodiesel.

Moving forward, in addition to the certainty provided by a multi-year extension, the biodiesel tax incentive can be reformed in a manner that will improve the form and function of the incentive. Specifically, changing the blenders excise tax credit to a production excise tax credit would improve administration of the credit for both taxpayers and the Treasury; help eliminate unintended abuses of the credit; and focus the incentive on the development of a domestic industry that is meeting the nation's energy needs.

Technology-Neutral Tax Policy Can Provide Unintended Consequences

Providing a technology-neutral tax policy can result in outcomes that provide an unintended windfall for recipients and create perverse incentives that encourages activities counter to responsible energy policy. Perhaps the most notable example of such an unintended consequence is the current outrage over "black liquor". The 2005 highway bill created a subsidy that provided a 50-cents-per-gallon tax credit for blending alternative fuels with traditional fossil fuels. In 2007 the law was later expanded to include other alternative fuels that would qualify for the credit as well as allowing "non-mobile" entities to qualify. This allowed the pulp and paper industry to claim the credit for blending a byproduct known as "black liquor," (already used as a

fuel in plants) with a small amount of petroleum diesel. This has invoked the ire of environmental groups who claim that this use of the credit is actually encouraging the use of fossil fuels, and has increased the cost of the credit. The paper industry is only following long-standing industry practices and taking advantage of an existing technology-neutral tax incentive. Revoking the paper industry's eligibility for this incentive would violate the technology-neutrality concept.

Other examples of unintended consequences resulting from technology-neutral tax policies would include incentives to improve mileage or reduce emissions without regard to fuel type and incentives for the development of "clean coal" and coal-derived transportation fuels. The requirement to improve mileage without regard to fuel type could work to the disadvantage of flex-fuel vehicles that use renewable fuels, and end up increasing the use of petroleum based motor fuels compared to a policy that incented the use of renewable fuels. Incentives for coal could increase coal production and use, with the consequent environmental considerations.

These outcomes may be positive or negative, depending on the viewpoint of the interest group involved. The key point is that the full range of outcomes and consequences must be evaluated when tax policy is being developed.

Conclusion

Tax incentives have long supported public policies designed to stimulate the development of renewable energy markets and industries both in the U.S. and globally. Tax incentives are often complementary to other types of renewable energy incentive programs. They are powerful and highly flexible policy tools that can be targeted to encourage specific renewable energy

technologies and to impact selected renewable energy market participants, especially when used in combination with other policy tools

The design of tax incentives deserves careful attention. The three equally important factors of industry economics, innovation and technology development, and technology-neutrality should be weighed when Congress considers energy tax policy. It is important that tax policy be consistent with and supportive of national energy policy goals and objectives and that careful thought be given to the full range of potential outcomes.

AGC

Statement for the Record

by AGC Flat Glass North America

Committee on Finance – April 23, 2009 Hearing

Technology Neutrality in Energy Tax: Issues and Options

AGC Flat Glass North America (AGC Flat Glass) would like to thank the Committee for their attention to the importance of technology neutrality in energy tax policy as this is an issue of consequence to our company. AGC Flat Glass, like all other glass companies, is in the process of dealing with the unintended negative consequences of technology specific language in the American Recovery and Reinvestment Act (ARRA) which dictates a unique and limited type of glass in order for windows to be eligible for the $1,500 replacement window tax credit.

The ARRA modified the tax credit for windows established in the Energy Policy Act of 2005 by increasing the amount of the available tax credit from 10 percent to 30 percent, modifying the cap from $200[1] to $1,500[2] per existing home, establishing a specific efficiency standard for windows and extending the timeframe by one year[3].

To qualify for the tax credit under the ARRA, windows must now have a U-factor and Solar Heat Gain Coefficient (SHGC) less than or equal to 0.30. SHGC refers to the amount of solar heat that is admitted through a window. It is expressed as a number between 0 and 1. The lower a window's SHGC, the less solar heat it lets into a room. According to the Department of Energy (DOE), different SHGC levels are necessary to provide the optimum energy savings across various climates. For example, a higher SHGC will allow more solar heat into a home which helps alleviate energy use in colder climates. In warm climates, a lower SHGC blocks solar heat alleviating air conditioning energy usage.

The windows criteria set by Congress, rather than specifying an energy savings goal or technology neutral standards, prescribed glass qualities that were assumed would help achieve the country's energy savings goals[4]. Instead, the prescriptive criteria set in ARRA actually will

[1] Applicable specifically to windows.

[2] The $1,500 is an aggregate cap applicable to windows and other qualified energy efficiency improvements such as doors, skylights, heat pumps and water heaters after February 17, 2009, and before January 1, 2011.

[3] The tax credit applies to property placed in service after February 17, 2009, and prior to January 1, 2011.

[4] The updated 2010 Energy Star Criteria were not available when Congress enacted ARRA.

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not achieve the highest possible amount of energy savings in certain climates, will cost homeowners in certain climates who purchase qualifying windows more money on utilities to keep their homes comfortable, and will cost jobs within the glass manufacturing industry. Specifically, the new tax credit will encourage northern homeowners to buy windows which will not save the maximum amount of energy for their climate; cool-climate homeowners will spend more to purchase windows which save less energy than less expensive windows which are more suitable for their climate; the consumer will pay more money to heat their homes and use more energy to heat those homes increasing carbon emissions; and jobs will be lost at glass manufacturing companies which produce energy efficient glass for cool-climate windows.

The DOE, with input from interested stakeholders such as glass and window manufacturers and energy efficiency organizations, worked for over a year to determine whether or not allowing more solar heat into northern homes through windows would save energy. In depth studies by DOE labs and private researchers have concluded that in order to save the maximum amount of energy, northern climates should capitalize on passive solar heat by installing windows with a higher SHGC. According to the DOE, there are significant differences in what SHGC provides the lowest energy cost for households based on the regional climate. In fact, on April 7, 2009, the DOE's Energy Star program published final Energy Star criteria to take effect in January 2010 which set regional SHGC rates based on climate. These criteria were developed through a process which included scientific research, public meetings, comment periods, and reviews of comments by experts at the DOE.

The ARRA tax credit, which requires that windows have a U-factor and SHGC less than or equal to 0.30, is at odds with the updated Energy Star criteria. This new SHGC standard unfortunately does not take into account the significant work by the DOE to update the Energy Star criteria to attain the highest possible gain for residents nationwide. As a result, the vast number of new window purchases will be the narrow slice of the replacement window market that qualifies for the ARRA tax credit, regardless of whether those windows are the most energy efficient choice for a particular home. The significant evidence supporting windows with a higher SHGC in the north (even in advance of the 2010 Energy Star Criteria) has resulted in significant research and development investment by glass companies to diversify their product lines. This effort has been significantly undercut because consumers are most immediately focused on purchasing windows that are eligible for the enhanced federal tax credit. In many cases, these are the only windows consumers are interested in buying today and all they care about is getting the tax credit regardless of the impact on the overall energy performance of their home.

Proposed Modification

The Federal government through the DOE has established energy efficiency criteria that allow the greatest possible savings by homeowners when purchasing replacement windows. It would be more appropriate for federal energy policy and tax policy to support one another by having the replacement window tax credit correspond to the newly published 2010 Energy Star Criteria. The coordinated approach will best serve consumers by ensuring that windows that provide the greatest possible energy savings for that climate are available for purchase and eligible for the corresponding tax credit. This is a far preferred approach to providing a tax incentive to purchase windows that, for many consumers, are going to increase their energy consumption

rather than reduce it. The DOE is taking the lead in trying to drive greater energy performance and savings in homes across the country and using these newly published criteria to govern window replacements eligible for the new tax credit will help jump start this energy savings effort in 2009 even before the new 2010 Energy Star Criteria become effective.

Thank you again for your attention to this important issue. If AGC Flat Glass North America can be of any assistance to you, please do not hesitate to contact me.

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STATEMENT

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Technology Neutrality in Energy Tax: Issues and Options

Committee on Finance

U.S. Senate

April 23, 2009

Chairman Baucus, Senator Grassley, and Members of the Committee, thank you for the opportunity to submit this statement on the necessity of technology neutrality in energy tax incentives. Arthur J. Gallagher ("Gallagher") is a global insurance brokerage firm based in Illinois. In recent years, Gallagher has invested in emerging energy technologies, including "The Chem-Mod™ Solution", a clean coal technology, and C-Quest, a carbon capture and sequestration technology. Each investment was made on the premise that federal tax incentives would aid in the development of a marketplace for and the deployment of these technologies.

Chem-Mod is a sorbent-based, multi-pollutant control technology that substantially reduces mercury, sulfur dioxide, nitrogen oxide, heavy and light metals, and chlorides. Simply put, the technology works by capturing harmful emission contaminants and permanently binding the contaminants in stable chemical bonds in the fly ash. The by-product is non-leaching and can be recycled for commercial use by the cement industry and others. This technology has been commercially tested at 8 full-scale coal-fired power plants and is now in the preparatory stages for commercial deployment at 3 utility companies across the country using various types of coal. Despite the early success of Chem-Mod, there remains no requirement in federal law for coal-fired plants to utilize this or any other technology to achieve these emission reductions. As a result, market-based incentive must exist for this technology to be deployed on a broad scale.

Gallagher's investment in Chem-Mod was initially spurred by a tax credit that was included in Section 45 of the Internal Revenue Code. The provision was added to the Code in 2004 and recently extended for one additional year in the Emergency Economic Stimulus Act of 2008. Known as the "refined coal" tax credit, it was intended to be technology neutral in application, emphasizing emission reduction goals rather than any particular means of achieving those goals. To qualify for the credit, the taxpayer must certify that the refined coal: (1) is a liquid, gaseous, or solid fuel produced from coal (including lignite) or high carbon fly ash, including such fuel used as a feedstock; (2) is sold with the reasonable expectation that it will be used for the purpose of producing steam, and (3) results (when used in the production of steam) in a qualified emission reduction. A "qualified emission reduction" is defined as a reduction of at least 20 percent of the emissions of nitrogen oxide and at least 40 percent of the emissions of either sulfur dioxide or mercury released when burning refined coal....as compared to the emissions released when burning the feedstock coal or comparable coal predominantly available in the marketplace as of January 1, 2003.[1]

Importantly, in the case of the refined coal credit, the statute does not prescribe any particular process or method for achieving the emission reductions necessary to qualify for the credit. For example, Chem-Mod will use a chemical process to capture the emissions and by products from the coal. Other technologies will treat the coal itself and still others will process waste coal. This is precisely the objective of a technology neutral incentive. Unfortunately, in the case of this credit, the objective and the outcome are two different stories.

As this panel has experienced in the past, without cooperation from Treasury, even a well intended technology neutral incentive runs the risk of becoming a no-technology incentive. Since a statute cannot anticipate all of the matters on which taxpayers need certainty, it is the Treasury Department's responsibility to provide the necessary guidance. In the case of refined coal technologies, as with all emission reduction technologies, taxpayers need very specific guidance on how to measure and certify emission reductions that are necessary to qualify for the credit.

To this end, Gallagher, and others in the industry have been in communication with Treasury Department officials for nearly three years in an effort to expedite such guidance. Unfortunately, after five years on the books, we remain without authoritative guidance from the Department, despite numerous taxpayer requests and multiple inquiries and letters from members of the congressional committees of jurisdiction. Further, in talks with Treasury, we learned that they may ultimately interpret the statute to exclude certain technologies, despite those technologies meeting the relevant emission reduction goals. This, in Gallagher's view, and in the view of many others in the industry, would be a disastrous result.

While Gallagher remains confident that the Chem-Mod Solution will in fact qualify for the credit as the statute was intended and written, the views indicated by Treasury have had a chilling effect on our partners who must invest millions of dollars to prepare their plants for use of a technology that the law does not yet require them to use. Thus, without prompt guidance in 2009, taxpayers will have to abandon projects due to their inability to achieve a statutorily-mandated year end placed in service date. Additionally, should unfavorable non technology-

[1] 26 USC § 45(c)(7)(C)

neutral guidance ultimately be published, the objective of the Congress will be thwarted and a real opportunity for substantial emission reductions at coal-fired plants will be lost.

Just as well intended technology neutral tax incentives can face challenges post-enactment, we must also remain vigilant in ensuring that incentives are properly designed when considered by this panel and the Congress. Drafting legislation that emphasizes certain technologies over others poses the risk of incentivizing technologies that match tax incentives rather than those that are the best product of scientific discovery and market innovation.

Gallagher, in addition to Chem-Mod, has invested in a carbon capture and sequestration technology called C-Quest. C-Quest is a newly developed technology that is able to chemically capture and sequester carbon created during the burning of all fossil fuels. This new technology offers a superior solution for carbon capture and sequestration while reducing the economic impact often associated with such technologies. C-Quest is currently in phase four testing for optimization at the Energy and Environmental Research Center (EERC) in North Dakota. In its most recent testing phase, C-Quest captured more than 90% of carbon through the use of chemical capture and sequestration. Equal if not improved results are expected from ongoing tests. C-Quest also achieved capture rates of 99% for SO2 and 90% for mercury.

C-Quest is superior to other carbon capture technologies for the following two reasons. First, other available technologies require disposal of captured carbon dioxide in secure geological spaces. Such disposal is an unproven option given U.S. geology, and it is exorbitant in cost. C-Quest, on the other hand, produces a non-hazardous, landfill-able by-product. That by-product can be used in commercial production of concrete, wall-board, and other products.

Second, C-Quest is more efficient. C-Quest can be used with scrubbers currently under design and permitting for Clean Air Act compliance. Further, minor retro-fits may make C-Quest compatible with existing scrubbers. This in turn provides an opportunity for deployment among existing plants who may not otherwise be able to retrofit for carbon capture. The net effect is a tool providing efficient carbon capture while insulating the rate payer from unnecessary cost increases associated with expensive retro-fits.

There is no doubt that carbon capture and sequestration is a national priority. However, it is guaranteed to be a costly endeavor. Until last year, there was no federal financial incentive in place for the utilities to use or consider using carbon capture and sequestration technologies. However, as you know, the "Emergency Economic Stabilization Act of 2008" included a provision, adding at Section 45Q of the Internal Revenue Code, a new carbon dioxide sequestration tax credit. Providing financial incentives while the technologies are being perfected is good public policy whereas requiring utilization of these technologies before they are perfected could cause a number of unintended consequences, not the least of which is unnecessary rate hikes shouldered by consumers. Gallagher commends this committee for its work on a carbon dioxide sequestration incentive.

That said Gallagher is concerned that the credit was not drafted in a technology neutral manner. As stated above, while a tax credit has the potential to spur wide spread research, development and deployment of emerging technologies, we should be careful that such

incentives do not overly incentivize early development technologies that may not, in the end, be ideal. A properly crafted tax incentive should consider all existing and future technologies capable of achieving the threshold goals established by Congress. In this instance, the goal of the Congress and the country is to minimize carbon dioxide emissions.

Unfortunately, as it stands, the Section 45Q tax credit is designed to provide incentives only for technologies that capture and then sequester carbon dioxide in a "secure geological storage". The definition of "secure geological storage" includes, "storage at deep saline formations and unminable coal seams", but does not appear to contemplate technologies that may not require such storage, as is the case with C-Quest. In the end, this incentive, as drafted, is not technology neutral. It runs the risk of encouraging inefficient investment in technologies that are costly and less efficient. While Gallagher supports the notion that secure geologic storage is one necessary method of disposing of carbon dioxide, it does not support the notion that this is the only method.

Again, Gallagher thanks this committee for the opportunity to provide a statement for the record, and we look forward to a continued dialogue on this important issue. The future of clean energy and energy independence will require a strong working relationship between the public and private sectors. Gallagher looks forward to continuing in its part to bring innovative energy solutions to the marketplace. Thanks you.

May 6, 2009

The Honorable Max Baucus
Chairman
Senate Finance Committee
United States Senate
Washington, DC 20510

The Honorable Charles Grassley
Ranking Member
Senate Finance Committee
United States Senate
Washington, DC 20510

Chairman Baucus and Ranking Member Grassley:

Recently, your committee held a hearing titled "Technology Neutrality in Energy Tax: Issues and Options." As a part of this hearing, the concept of feebates for vehicle purchases was discussed by panelists and members of the committee.

As the committee considers policy choices for tax and energy policy, we urge you to keep in mind the critical transformation that the auto industry faces. Automakers are committed to doing our part to reduce greenhouse gas emissions from the vehicles we sell and from our assembly plants. We understand that our economic vitality continues to depend on innovation, and we plan to be ahead of the curve. Two key elements that show the Alliance's commitment to transformation include our support for an economy-wide greenhouse gas emissions reduction program and our support for the 2007 energy bill that will raise CAFE standards by at least 40% by 2020.

While automakers supported this historic increase in CAFE, we believe that feebates are a step in the wrong direction. Feebate programs have taken a number of forms over the years, but the concern is that by and large they would raise costs for many new vehicle purchasers and harm businesses and families without providing meaningful benefits to consumers. Furthermore, with U.S. auto sales still down nearly 35% from last year, the additional cost of a new feebate system could further dampen car and truck sales.

There are better ways than a feebate program to encourage purchases of the many fuel-efficient and advanced technology vehicles on sale today. Tax incentive programs for advanced technology vehicles are already in effect at the federal level and in many states to boost the purchase of advanced technology vehicles.

BMW Group • Chrysler LLC • Ford Motor Company • General Motors • Jaguar Land Rover Mazda • Mercedes-Benz • Mitsubishi Motors • Porsche • Toyota • Volkswagen

1401 Eye Street, NW, Suite 900, Washington, DC 20005-6562 • Phone 202.326.5500 • Fax 202.326.5567 • www.autoalliance.org

A few key points to consider on feebates include:

Feebates Would Harm Businesses and Consumers Who Don't Have the Option to Downsize

By raising the costs of many popular utility and work-related vehicles, feebates will raise the cost of doing business for small businesses, trades people, farmers and others who are dependent on light duty trucks for their livelihoods. In addition, fees imposed on minivans and SUVs will especially burden large families --who need vehicles with enough room for carpooling, sporting equipment, several child safety seats or family vacations.

Fuel-Efficiency is Already Being Addressed -- Today and in the Future

Auto manufacturers fully support the new fuel economy (CAFE) standards included in the Energy Independence and Security Act of 2007 (EISA). That new legislation will result in increasing CAFE standards to at least 35 mpg by 2020, a 40% increase in fuel economy over current law. The EISA puts automakers on track to reduce CO2 emissions from new autos by at least 30% by 2020. Automakers sell nearly 200 models that achieve more than 30 MPG on the highway, according to EPA estimates. More than 70 models of advanced technology and alternative fuel vehicles (including hybrids, clean diesel and ethanol-powered autos) were on sale in 2007-more than five times the 12 models consumers were able to choose from in 2000.

Feebates Raise Public Policy Concerns

Feebates pick "winners" and "losers" among automakers by setting arbitrary fuel economy numbers that determine which vehicles receive a rebate and which vehicles are taxed. A vehicle just slightly below the line could suffer in the marketplace even though the difference in fuel economy would be minimal. Feebate proposals also would have unintended consequences. Certain vehicles will be more costly due to feebates, causing consumers to hold on to older, less fuel-efficient autos longer. This will have adverse impacts on vehicle emissions – contrary to the original purposes of the "feebate" program. Finally, feebate programs don't address vehicle miles traveled (VMT), which is clearly one of the most important factors in overall fuel consumption.

Revenue Neutrality: Canada's Failed Feebate Program

Under Canada's failed two-year program, achieving revenue neutrality proved to be an insurmountable obstacle. Attempts to achieve revenue neutrality resulted in having to regularly re-set the fuel economy target (known as the "pivot point"), creating uncertainty for automakers and consumers alike. In several cases, cars missed getting rebates by fractions of miles per gallon. The revenue problems and logistical difficulties led to the program's demise and today only the tax remains.

Consumer Incentives are Better Ways to Influence Consumer Choice

Governments can be proactive on the climate change issue - as it relates to the transportation sector- by incentivizing the purchase and use of alternative fuel and advanced technology vehicles. A vehicle scrappage program designed to encourage consumers to turn-in older, less fuel efficient vehicles and purchase new, more efficient vehicles, would stimulate new vehicle sales while also getting older vehicles off the roads. There are many other effective ways to influence consumer choice, such as allowing advanced technology vehicle owners to:

-- Drive solo in carpool lanes and free on toll roads.
-- Park for free at parking meters and at airports.
-- Obtain premium parking access (close to front doors) in large lots and garages.
-- Enjoy reduced frequency of emissions checks.
-- Use express lines at DMV.

Automakers are a key player in the transition to a new way of using energy and new energy sources require that we collaborate with government and other industries like never before. Thank you for considering our thoughts on these important issues.

Sincerely,

Dave McCurdy
President & CEO

Copy:

The Honorable John Rockefeller
The Honorable Kent Conrad
The Honorable Jeff Bingaman
The Honorable John Kerry
The Honorable Blanche Lincoln
The Honorable Ron Wyden
The Honorable Charles Schumer
The Honorable Debbie Stabenow
The Honorable Maria Cantwell
The Honorable Bill Nelson
The Honorable Robert Menendez
The Honorable Thomas Carper
The Honorable Orrin Hatch
The Honorable Olympia Snowe
The Honorable Jon Kyl
The Honorable Jim Bunning
The Honorable Mike Crapo
The Honorable Pat Roberts
The Honorable John Ensign
The Honorable Mike Enzi
The Honorable John Cornyn

JOHN AND BETHANNA KORTIE

April 22, 2009

Senate Committee on Finance
Attn. Editorial and Document Section
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Washington, DC 20510-6200b

RE: Hearing on April 23, 2009

Dear Sir or Madam:

We want to urge you to not put an energy tax in place. The American public is already taxed to the hilt and that is part of the problem with our economy right now. A further tax would make it much more difficult for the average taxpayer to simply pay their bills. Please vote against an energy tax.

Sincerely,

John and Bethanna Kortie

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○