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Of the
Senate Finance Committee
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Mr. Chairman, Ranking Member Thomas, and other members of the Subcommittee, thank you very much for the chance to testify about the opportunities associated with combined heat and power (CHP) and recycled energy. My key point is that the nation has an opportunity to lower energy costs and reduce pollution by taking decisive policy action to embrace and reward energy efficiency.

To achieve this goal, I offer two policy recommendations. The first is to have Congress approve an investment tax credit for combined heat and power and waste-energy recovery projects. The more targeted proposal is to provide performance credits that induce energy efficiency of biofuel production facilities. Before discussing those proposals, allow me to briefly review the status quo's inefficiency and the barriers facing clean energy technologies.

The efficiency of today's typical electric power plant is only 33 percent, meaning that large "central station" generators burn three units of fuel to deliver just one unit of electricity, and this has been stagnant since 1960. Much of the wasted energy results from today's centralized utility model in which large generators vent their exhaust heat into the air or water, while other burners are needed at commercial and industrial facilities to produce the heat required for industrial processes and the heating and cooling of buildings. CHP, in contrast, uses one flame to provide both electricity and heat. Put another way, CHP (sometimes known as cogeneration) simultaneously produces useful thermal energy and electricity, achieving efficiencies of 60-90 percent. Indeed, this was the approach taken by Thomas Edison, whose first power plant in Manhattan was 50-percent efficient, almost entirely due to his focus on waste heat recovery. The fact that today's industry is less efficient than the first power plant every built points out the flaws

of our regulatory paradigm, but it also highlights the massive opportunity to lower energy costs and reduce greenhouse gas emissions.

However, the benefits of CHP go beyond simply saving fuel. Because CHP facilities are located close to where power is needed, they help avoid and/or defer investments in new transmission lines, cut line losses, and decrease vulnerability to production outages due to extreme weather, deliverability problems, and terrorism. Analysis done at Carnegie Mellon University has shown that a grid making better use of local power generation would need dramatically less reserve margin, thereby allowing us to serve current power demands with less capital investments.

The U.S. is an international laggard in CHP deployment. Germany, Japan, and China have CHP rates more than twice those in the United States, while Denmark, Netherlands, and Russia are significantly more efficient. Denmark's transition to distributed CHP over the past two decades required no new technologies, but the country simply used smaller applications of the technologies used in central generation and then captured and utilized the wasted energy.

A few U.S. manufacturers have a long history with CHP. The pulp and paper industry, for instance, burns its byproduct wood wastes to produce both electricity and useful steam. Dow Chemical has upgraded its CHP systems to save, compared to a 1994 baseline, 250 trillion BTUs of energy, equal to the annual household energy consumption of New York City or Tokyo. As part of its effort to cut fuel usage and carbon-dioxide emissions, Dow declares that CHP is "significantly more efficient than purchasing power from an outside utility power plant and then separately generating steam."

The potential for capturing wasted energy goes well beyond CHP. The Lawrence Berkeley National Laboratory, in a 2005 report for the U.S. Environmental Protection Agency, examined 19 clean-energy technologies that could produce power from presently wasted energy, ranging from small distributed power systems on farms to large integrated gasifiers at petroleum refineries. In aggregate, these technologies presently generate 10,000 megawatts (MWs) – the approximate output of ten large nuclear plants – but the researchers identified sufficient waste energy for another 96,000 megawatts, enough to provide almost 20 percent of U.S. electricity. This recycling of industrial waste energy would cut carbon dioxide emissions by nearly 400 million metric tons. Fully deploying this total would reduce greenhouse gas emissions from power generation by more than 17 percent **and** reduce total national energy expenditures by a comparable amount, with no reduction in our overall standard of living. Indeed by lowering energy costs, this would put more disposable income in American consumers' pockets. Encourging the greater use of CHP is therefore a GDP-enhancing greenhouse gas reduction strategy.

To understand the substantial potential associated with recycled energy, consider the Mittal Steel facility on the southern tip of Lake Michigan. Occupying several thousand acres of treeless grime, blazing furnaces, and mounds of black coal, the smelter is not where you'd expect signs of an environmental revolution, yet this industrial behemoth is converting its waste heat into

power and demonstrating how energy recycling can tackle the nation's power and greenhouse-gas problems. A long row of 368 ovens that annually produce 1.2 million tons of coke for the blast furnace used to vent the 1,800°F wasted heat into the air. Sixteen heat recovery steam generation boilers now recycle that coke-oven exhaust to produce steam, which powers a 93-megawatt steam turbine generator. The plant also sends roughly 1 million pounds of steam per hour to Mittal's steel plant, eliminating the need to burn natural gas as boiler fuel. This plant annually generates about 770,000 megawatt-hours of clean energy. Combined with the capturing of flare gases at adjacent smelters, such energy recycling in northwest Indiana is producing almost the equivalent of a coal-fired power plant, all without burning any additional fuel or emitting any additional pollution or greenhouse gases. There are two rather remarkable points to make here. The first is that this plant produces fuel-free electricity, as clean as a solar panel but at 1/10th the cost. The second is that there are so many other steel plants in the country that could also deploy this technology, but don't.

These points, of course, raise the billion-dollar question: If CHP and energy recycling make such sense, why isn't more being done? The short answer is that local (sometimes called "distributed") generation faces an array of policy barriers created over the past century to advance and protect the centralized model. Our electric regulatory system was crafted in the early part of the 1900s and was quite well designed to electrify the country, but it has become ever more antiquated as technologies have marched forward while the regulatory paradigm has stalled. These outdated regulations now subsidize the most expensive options to serve new power load at the expense of CHP and other energy efficiency measures, and thus they encourage a massive misallocation of private capital.

So what are some of these barriers? Many state public service commissions have approved both fixed and variable backup-power rates that insulate regulated utilities from competition and block the deployment of the most economic ways to serve new load. In 15 states, it is illegal for any company other than the electric utility to sell a kilowatt-hour, effectively preventing the development of an energy outsourcing industry. In every state, it is a felony offense to run a private distribution wire across a public thoroughfare, which causes many clean energy plants to be undersized relative to the total opportunity (since they have no leverage to negotiate a fair price for exported power if the only route to market is through a single company's wire).

A second set of barriers are not explicit per se, but they create an environment that fails to provide full credit to CHP and recycled energy for the system benefits they create. Distributed generation, for instance, reduces the need for transmission and distribution wires, yet it receives no compensation. Doubly efficient CHP that recovers and recycles wasted heat energy also cuts criteria pollutant and greenhouse-gas emissions in half compared to conventional central generation, but it receives no benefit credit under current emissions regulations. (Indeed, efficiency can in some cases be a liability under the input-based emissions standards that are prevalent in most jurisdictions.). Moreover, distributed generation, due to the large number of relatively small units, requires less redundant generation and redundant transmission capacity. The aforementioned Carnegie-Mellon research shows that a system of many local generators with 3-percent to 5-percent redundancy would provide the same system reliability as the current 18-percent

redundancy for large central generators, but local generation again receives no credit for this benefit. This regulatory environment creates a problem familiar to any introductory economics student. The private sector will mobilize rapidly in response to accurate price signals – but if you don't pay for it, they won't come.

Today's playing field, moreover, provides differential advantages to existing or new central generation. Utility rate structures, for instance, guarantee the financial return on all investments in central generation and in the associated wires and transformers, yet distributed generation is not included in rate base and receives no comparable guarantees. The host or third-party power provider bears the total risk of the (much more energy and economically efficient) investment, which makes obtaining capital more expensive or even impossible to obtain. The costs associated with interconnecting central generation plants to the distribution or transmission system also are typically included in rate base and passed on to ratepayers, yet distributed generators pay for the costs to interconnect to the grid.

All of these barriers to efficiency suggest a rather easy prescription for reform. **We need a level playing field.** Unfortunately, 100 years of regulatory precedent is a hard onion to unpeel. That said, there are a few small steps that can be taken to dramatically increase the private sector's deployment of clean, local power technologies. I urge you to approve a 10-percent investment credit for qualified CHP and recycled energy systems up to 50 megawatts. Such a credit would make a crucial difference in the financial feasibility of CHP investments, which would create sizable energy savings, greenhouse gas reductions, job creation, and technology innovation.

Both houses of Congress passed a CHP investment tax credit during the 2005 EPACT process, but the provision was cut in the final conference report, largely because of an inaccurate cost assessment by Treasury. A recent scoring by the Joint Committee on Taxation corrects the prior assessment and highlights the reasonableness of a CHP credit in light of its efficiency, economic, and environmental benefits. I hope the Senate will endorse a bipartisan House provision, H.R. 2001, introduced by Reps. Inslee (D-WA) and Terry (R-NE).

A more targeted incentive – one that induces energy efficiency at biofuel production facilities – also would provide substantial benefits. The Senate Energy and Natural Resources Committee, as you know Mr. Chairman, recently passed a provision to encourage biofuel production. Adding to that provision a performance tax credit for CHP would allow the nation to make even more progress toward energy independence as well as ensure vast improvements in the efficiency of ethanol and biofuel production. If done correctly, biofuel facilities could become the sites of clean base-load electricity generation. Such increased energy efficiency would reduce costs for biofuel producers, cut pollution, increase ethanol's net energy savings, and provide revenue and jobs in rural areas.

If the biofuel industry optimizes its energy islands – its steam and electricity production facilities – it would increase the net fossil savings per gallon of biofuel by 25 percent to

310 percent compared to the lowest-first-cost approach. These gains would destroy for ever any criticism of ethanol's net energy savings. Lawmakers can induce the building of such high-efficiency biofuel plants by offering a production credit of at least 1.5 cents per kilowatt-hour (kWh) for the electricity these efficient facilities generate. I'd be pleased to offer more detailed legislative language associated with this proposal.

In closing, I urge this committee to use the tax tool to help reduce wasted energy and enhance efficiency. Combined heat and power and recycled energy, if given the chance to compete on a level playing field, will provide substantial rewards.