Responses to Senate Questions
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Questions from Senator Domenici

1. SHOULDN'T OTHER CLEAN ENERGY SOURCES BE ELIGIBLE FOR INCLUSION IN A PORTFOLIO STANDARD – STATE OR FEDERAL?

Q. Would you agree with the statement that support for renewables should fit within a much larger public policy objective of:

- diversifying our sources of electric generation;
- reducing environmental impact;
- reducing reliance on oil and natural gas; and
- helping ensure that consumers pay no more than is necessary for their electricity.

If you agree with this statement, shouldn't we also be looking to encourage conservation; customer premises technologies like fuel cells and photovoltaic systems; and inherently clean generation sources like IGCC and nuclear? Should these resources be included as eligible resources under a RPS? If not, why not?

Answer. I would agree that support for renewables should fit with the policy objectives outlined above, along with the objective of increasing use of domestic resources to enhance energy security and economic development, especially in rural areas.

Customer-sited renewable generation, such as fuel cells using renewable fuels and photovoltaic systems, should continue to be eligible in a federal RPS, and continue to be eligible for triple credits, as enacted twice by the Senate. While I would agree that IGCC, advanced nuclear generation, and non-renewable customer sited generation should be encouraged, other mechanisms should be used to encourage these technologies, and they should not be included as eligible resources in an RPS, for the reasons discussed below.

Each of the technologies listed in the question could somewhat reduce reliance on oil and gas. As Dr. Ryan Wiser testified, by reducing the demand for natural gas, they would help reduce its price, as he found that efficiency and renewable energy would do. Dr. Wiser also testified that the price impact from reducing demand is larger in the short-term than it is in the long-term.

Over the long-term, however, the most important economic benefit of the RPS is that it would diversify the fuel sources in our energy portfolio, reducing consumer and industrial energy bills by creating new competitors to the coal, gas and nuclear resources that currently constitute about 90 percent of our fuel sources for electricity. Developing

advanced technologies that use existing fuels is also important, but does not contribute to the objective of diversifying energy sources.

Any new or minimally used fuel whose price is independent of existing fuels would help accomplish that objective. The more that new competitors are available to be rapidly deployed, the less vulnerable our economy is to potential energy supply shortages or interruptions, price spikes, price increases or price manipulation as a result of our current dependence on a limited supply of a limited number of fuels. Renewable resources—including wind, solar, biomass, geothermal, tidal, and wave power—are especially valuable in this respect because they are also domestic, non-interruptible, and non-depletable; because they do not present attractive targets for terrorists; because they avoid the risk of high future environmental and safety regulatory costs; and because they each have the potential for significant expansion as competitors to existing fuels.

Improving the efficiency, the environmental performance, and the safety of technologies that utilize currently dominant fuels is also a very important objective, but accomplishing that objective cannot satisfy the critical national need to develop new competitors to current fuels. Because both objectives—developing new fuel sources, and developing advanced technologies using dominant fuels—are important, one policy, such as the RPS, should not be used to create a zero-sum game where achieving one objective competes with achieving the other objective.

Proposals that would maintain or increase even other subsidies for the dominant resources, and potentially phase out the production tax credit for renewables, compound the concern that including other technologies in the RPS could limit or preclude its effectiveness in developing new competitors. Nuclear generation, for example, continues to receive significant subsidies for fuel enrichment, insurance, security, and waste disposal. A Cato Institute paper found that the insurance subsidy alone conferred by the Price-Anderson Act is worth as much as $3.4 billion per year to the nuclear industry.[1]

Improving energy efficiency is also a critical national objective, but one that should not compete with or displace the need to develop new supply-side competitors to coal, nuclear and gas. The U.S. needs both improved energy efficiency and new supply options. There are many very inexpensive efficiency options that are not being implemented because of market barriers in the electricity industry. Sound energy policy should ensure that those cost-effective efficiency options are implemented without putting them in competition with and compromising the objective of developing new supply options.

The RPS is designed to help emerging renewable technologies cross over the so-called "valley of death" between R&D and commercial deployment. The RPS lets the market place determine winners and losers by creating a national market with competition among new commercially ready technologies to gain critical field installation and operating

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[1] Heyes, Anthony. "Determining the Price of Price-Anderson." *Regulation*, Winter 2002-2003. Available at: <http://www.cato.org/pubs/regulation/regv25n4/v25n4-8.pdf>

experience and achieve initial economies of scale, the RPS helps drive down the costs of the technologies to enable them to increasingly compete with established fuels.

To the extent that Congress wants to utilize competition to meet a standard to further the objectives of developing new renewable energy sources, improve end-use efficiency, or developing advanced technology to utilize today's dominant energy sources, it should create entirely separate standards to meet each of the three objectives. In that way, similar technologies will compete with each other to achieve each of the three objectives, without trading one important objective for another.

Before considering such a competitive mechanism for advanced technologies using today's dominant energy sources, however, we recommend that Congress consider:

- While there are now a number of states that have demonstrated successfully that a renewable standard can work, there is not yet one working state example of an advanced technology standard. Pennsylvania's standard, with a separate tier for non-renewable advanced technologies, is still in the regulatory development phase.
- The RPS creates competition among renewable projects and options because many small projects can compete to fulfill a relatively small piece of the overall load. As Commissioner Richard Morgan pointed out in his oral testimony, it is not clear whether such a mechanism would work effectively with much larger projects. Larger projects would create lumpy additions to utility rates, and are not likely to be financeable using a market-based mechanism such as tradable credits, especially for initial deployment of new technologies.
- We are not aware of any analyses that would help determine appropriate percentages, costs and benefits, or cost cap levels for a standard for advanced technologies.
- To be on a level environmental playing field with renewables, which have very low or zero net carbon emissions, IGCC would have to be coupled with carbon capture and storage.
- An early deployment mechanism, like a portfolio standard, is not a substitute for R&D. Carbon capture and storage still requires significant R&D to determine if it can be effective and economical. Advanced nuclear technologies require considerable R&D to resolve safety, security, waste disposal and economic issues before they are ready to consider for deployment.
- Nothing will foreclose future nuclear options faster and surer than another nuclear accident. The highest nuclear funding priority should be increasing the Nuclear Regulatory Commission's budget for inspection and enforcement.
- While R&D on advanced fossil and nuclear technologies is very important, the paltry sums expended on R&D by the mature energy industries in comparison to other industries[2] suggests that Congress may be perpetuating an unnecessary and expensive expectation and dependence on federal R&D support. While the graph below is from 1995, the R&D situation, particularly in the electricity industry in the wake of

[2] RM Margolis, DM Kammen, "Underinvestment: The Energy Technology and R&D Policy Challenge." 1999 *Science* 285:690-692. http://ist-socrates.berkeley.edu/~rael/Margolis&Kammen-Science-R&D.pdf

restructuring, has become only worse. Congress may want to consider how to induce greater R&D spending by the energy industry itself, rather than simply increasing subsidies for the well-established fossil and nuclear industries.

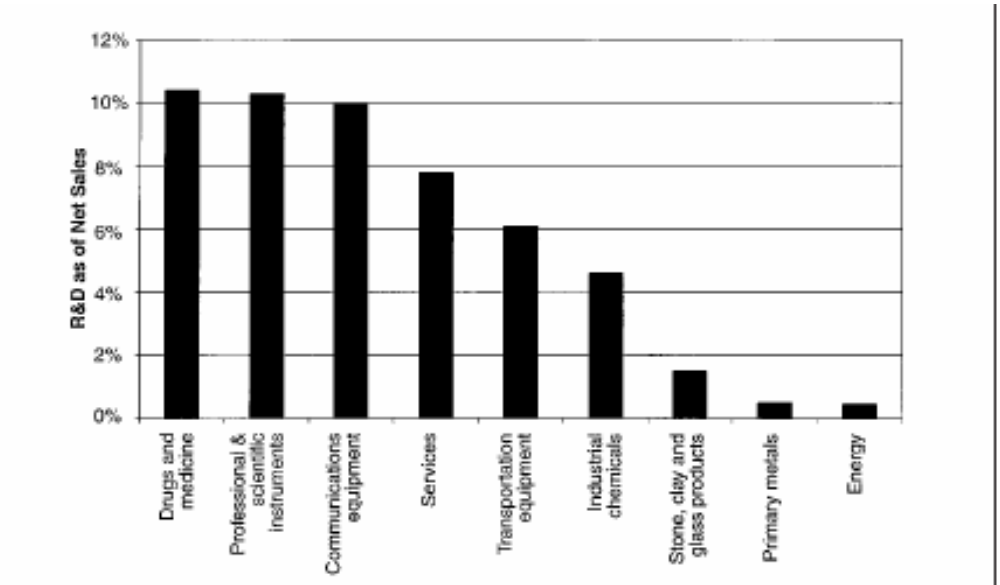


Fig. 3. R&D as a percentage of net sales for selected sectors in the United States in 1995 (*12*). Data for each industrial category, except energy, were drawn directly from (*17*). The data shown include both public and private funding for R&D. Energy R&D as a percentage of net sales was calculated from total (public and private) industrial energy R&D (*17*) and total energy expenditures in the United States (*19*). The energy R&D data in (*17*) are gathered across industrial sectors, that is, they are for industry as a whole. Services include business, health, engineering, and other services. The most recent year that data are available for Communications Equipment is 1990, and for Industrial Chemicals, 1992.

2. <u>ARE HIGHER PRICES IN STORE FOR CONSUMERS WHOSE UTILITIES HAVE LITTLE ABILITY TO GENERATE ELECTRICITY FROM RENEWABLES?</u>

You make a strong "big picture" case for a national RPS citing job creation, manufacturing opportunities, creating fuel diversity among other advantages. However, there are still states and companies that oppose a renewable mandate because they do not have sufficient solar, wind or biomass sources to meet such a mandate and they believe that it will force ratepayers in their jurisdictions to pay higher rates for electricity because credits must be purchased to meet the mandate. How do you respond to those concerns?

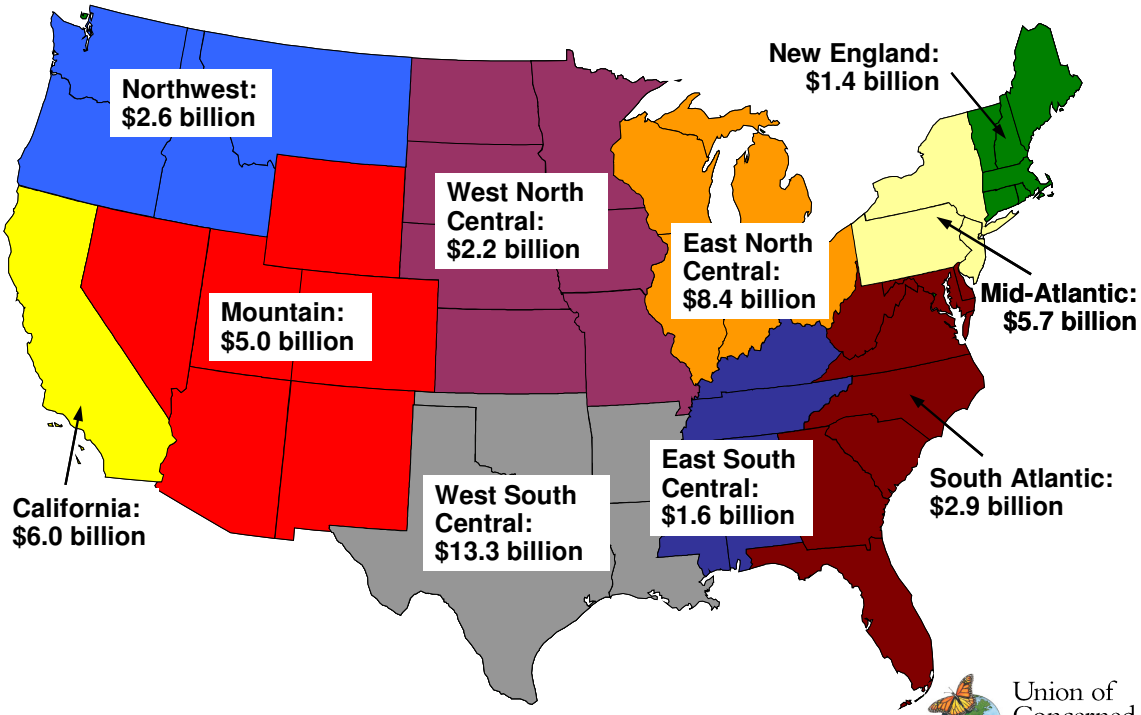
Answer. Thank you. A national renewable electricity standard would not only save money for US consumers as a whole, but would most likely reduce energy bills in every region of the country. The following table illustrates the savings, by census region, from our analyses utilizing the NEMS model, in each of the three scenarios we have run using EIA's 2004 natural gas price projections. The graph shows the definition of the census regions, along with the savings from a 20 percent national RPS, using UCS assumptions.

Cumulative Energy Bill Savings* by U.S. Census Region, 2005-2020, Comparison of National RPS Proposals

Census Region	20 Percent by 2020 RPS		10 Percent by 2020 RPS
	UCS Assumptions	EIA Assumptions	UCS Assumptions
New England	$1.4 billion	$0.7 billion	$1.1 billion
Mid-Atlantic	$5.7 billion	$2.0 billion	$4.0 billion
East North Central	$8.4 billion	$5.3 billion	$6.1 billion
West North Central	$2.2 billion	$1.2 billion	$1.8 billion
South Atlantic	$2.9 billion	$0.1 billion	$4.0 billion
East South Central	$1.6 billion	$0.9 billion	$1.6 billion
West South Central	$13.3 billion	$8.1 billion	$10.5 billion
Mountain	$5.0 billion	$3.1 billion	$2.8 billion
Northwest	$2.6 billion	$1.7 billion	$1.7 billion
California	$6 billion	$4.2 billion	$4.3 billion

* Results are in cumulative net present value 2002$ using a 7 percent real discount rate. Excludes transportation.
Source: UCS, 2005. Based on results from Renewing America's Economy.

Cumulative Energy Bill Savings* by U.S. Census Region, (20 percent by 2020 RPS)



*Results are in cumulative net present value 2002$ using a 7 percent real discount rate. Excludes transportation.
Source: UCS, 2005. Based on results from *Renewing America's Economy*, UCS Assumptions.

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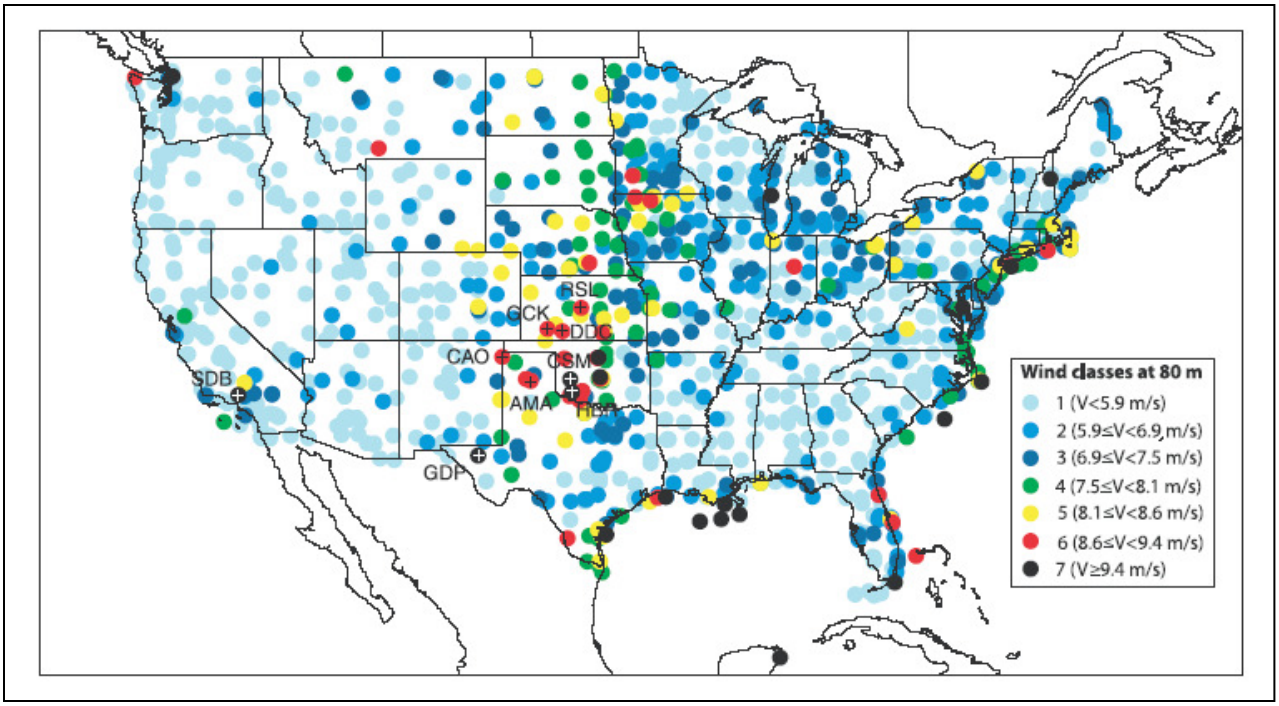
The reasons that all regions can benefit from a national RPS are that a) all regions would see lower natural gas prices for electricity generation as well as for other direct gas consumers b) all regions have some renewable resources, and would likely see an increase in using local resources for generation, c) the national credit trading market

created by a national RPS means that all regions can buy renewable energy credits for the same price, and give utilities negotiating leverage over local renewable generators; and d) by achieving economies of scale, the national RPS will reduce the cost of renewable energy technologies throughout the country.

Additionally, while the Southeast may not have as rich a renewable resource base as some other regions, the dearth of renewable resources in that region has sometimes been exaggerated.

For example, Mr. Bower's testimony for the Southern Company neglected to mention the potential for off-shore wind energy resources. Recent research has found commercially significant wind resources—including the very strongest class 7 winds—off-shore in the Gulf of Mexico and the South Atlantic.[3]



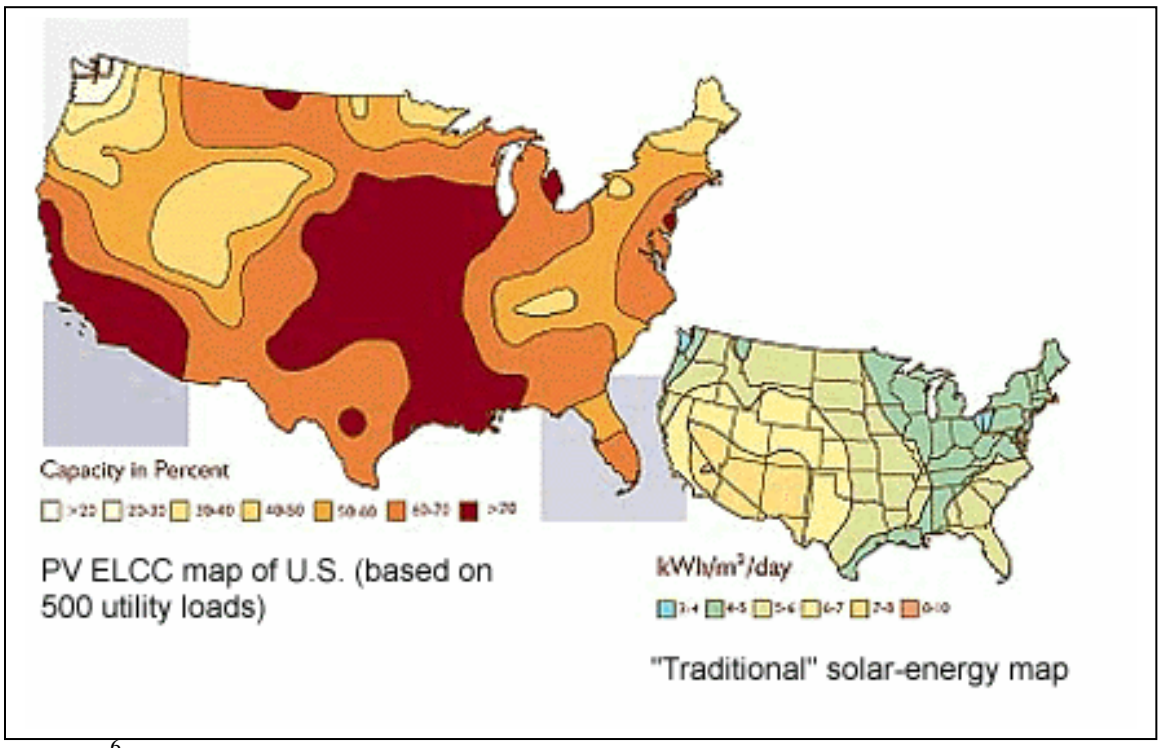
The Southeast also has significant existing hydropower resources. According to the National Hydro Association, the Southeast as the potential to add 2,941 MW of incremental hydropower at existing dams—second only to the Northwest/Rocky Mountain region.[4] Mr. Bower's testimony also neglected other ocean resources, such as

[3] Archer, C. L., and M. Z. Jacobson, *Spatial and temporal distributions of U.S. winds and wind power at 80 m derived from measurements*, J. Geophys. Res., 108(D9), 4289, doi:10.1029/2002JD002076, 2003. Available online at: http://fluid.stanford.edu/~lozej/winds/2002JD002076.pdf.

[4] "Averting Disaster: Keeping the Lights on With Hydropower," National Hydropower Association Issue Brief, Tables 2 and 3. http://www.hydro.org/pubs/lights2.asp?t1=index.asp&n1=Publications

wave and tidal power, which are proving to be increasingly promising.[5] Since incremental hydro, as well as off-shore wind, tidal and wave resources are not included in EIA's NEMS data bases, they are not included in either EIA or UCS analyses. Were these resources included, the analyses would show even greater benefits for the Southeast region.

Mr. Bower's testimony included a map of solar resources intended to demonstrate that such resources in the Southeast pale in comparison to the Southwest. In determining the value of solar energy, however, the effective load carrying capability (ELCC)—which reflects the match between solar output and peak electricity demand—can be more important than the measure of direct solar radiation in a region. The ELCC in most of the Southeast is very high, and in some areas of the Southeast is among the highest in the



country.[6]

Southeast states currently import fossil fuels from other states and countries. Is it more of a problem for Georgia to import some wind energy from, say, the Midwest or Texas than to continue importing coal from Kentucky, Virginia, Wyoming, and Venezuela? Is it more of a problem for Florida to import some renewable energy from neighboring states than to continue importing coal from nine states plus Columbia, Poland, Venezuela and South Africa?[7]

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[5] E.g., Leonard Anderson and Timothy Gardner, "Cities Eye Ocean Waves for Power Supplies," Reuters, Feb 13, 2005. http://www.reuters.com/newsArticle.jhtml?type=businessNews&storyID=7611884

[6] http://www.nrel.gov/ncpv/documents/pv_util.html

[7] http://www.eia.doe.gov/cneaf/coal/quarterly/t28p01.txt

A national RPS will have other benefits for the Southeast and other regions. By giving utilities the option of buying locally produced renewable resources or importing renewable credits from other states, utilities have more leverage over local producers to help keep costs to a minimum. By creating a national market for renewable energy credits, and encouraging development of each renewable technology where it is most cost-effective, a national RPS maximizes learning effects and economies of scale, driving down renewable energy costs. By improving technology faster, the national RPS makes renewable resources in every region cost-effective sooner than they would be without the RPS.

As noted in my oral testimony, the Southeast, and every region of the U.S., has more renewable electricity potential than most regions have renewable fuels potential. Anyone who likes a national renewable fuels standard should love a national renewable electricity standard.

3. ARE OTHER FEDERAL INITIATIVES NEEDED TO MAKE A FEDERAL RPS WORK?

Mr. Nogee, the Energy Information Administration estimates that renewables will meet approximately 3.2 percent of the nation's demand for electricity in 2025. If the federal government mandated a 20 percent standard of electricity from renewables by the end of the next decade, what additional federal incentives may be needed to assist the states and electric utilities to meet the mandate?

Answer. It is important to extend the production tax credit for at least five to ten years, whether the RPS is enacted or not. The financial industry needs predictability and stability in a familiar mechanism to continue to invest in renewable energy, and make the forward investments in manufacturing capability and infrastructure needed to sustain continued growth in the renewable energy industry. The PTC should also be tradable, so that it can be utilized by entities that may not have the tax situation needed to take advantage of the current PTC.

The RPS is intended to be sufficient to accomplish the objective of helping the most commercially ready, cost-effective renewable technologies ramp up deployment and reduce costs. It is not sufficient to accomplish all critical objectives for encouraging the development of new renewable technologies. As recommended by PCAST, R&D on renewable technologies should double over five years. National net metering and interconnection standards are necessary to ensure fair treatment of customer-sited renewables. A national system benefit charge that provided matching funds for state programs would provide an incentive for more states to fund such programs, and more resources to ensure diversity within the renewable resource portfolio of each region. Transmission policies and prices are needed that do not unfairly penalize renewables for their unique characteristics, such as variable output. And to the extent that Congress considers support for traditional infrastructure, such as pipelines or transmission, Congress should consider support for transmission initiatives to regions with particularly rich renewable resources. These initiatives are not absolutely necessary for the RPS to work, but they would enable it to produce even more consumer savings, more economic development benefits, and more diversity of fuel sources.

4. ARE EIA'S ESTIMATES OF FUTURE USE OF RENEWABLES TOO PESSIMISTIC?

You suggest in your testimony that EIA uses very pessimistic projections of renewable energy costs. Would you explain for the Committee why you believe those projections to be pessimistic?

Answer. We discuss below thy most analysts believe that EIA's projections for renewable energy costs and performance are pessimistic. Please note, however, that the question in the header, whether EIA's estimates of future use of renewables are too pessimistic, is a different question, that is more difficult to answer. On the one hand, to the extent that EIA's cost projections are pessimistic, EIA's model will tend to underforecast the use of renewables in the reference case. This problem is compounded by pessimistic forecasts of the likely result of state RPS programs. On the other hand, the

NEMS model "builds" the new capacity that is most cost-effective over the life of that capacity. Since most utilities have much shorter planning horizons and payback criteria, particularly since restructuring began, the model will tend to over forecast the extent to which utilities will invest in capital-intensive resources, like renewables, under business as usual.

It is very difficult to know how these tendencies offset each other, and the extent to which EIA's business as usual forecasts of the use of renewables are too high or too low. However, because they utilize pessimistic assumptions about renewable energy costs, we believe that EIA significantly overstates the cost of achieving any given state or federal renewable electricity standard, where the minimum level of renewable use is determined by the standard, not by modeling assumptions.

EIA's projections of renewable energy technology costs and performance are overly pessimistic compared with projections made by the national energy labs, the Electric Power Research Institute, and other renewable energy experts. For example, EIA's cost projections for wind, geothermal, and solar energy technologies are considerably higher than projections recently made by the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) to examine the impact of their renewable energy R&D programs for the FY05 Government Performance Review Act (GPRA).[8]

EIA's projections for wind power in good wind regimes are 1-2 cents/kilowatt-hour higher than the DOE/GPRA projections, as shown in the figure below. EIA also projects that costs for wind will be relatively flat over time, because they assume wind is commercial technology and that modest improvements in performance will be more than offset by higher financing costs. In contrast, DOE/GPRA assumes that wind power will follow the historic trend of continued cost reductions due to increased volumes in manufacturing and research and development that lead to technology advances and improved performance. The figure also shows that the assumptions we used in our most recent national RPS analysis are closer to (but slightly more conservative than) the DOE/GPRA projections.

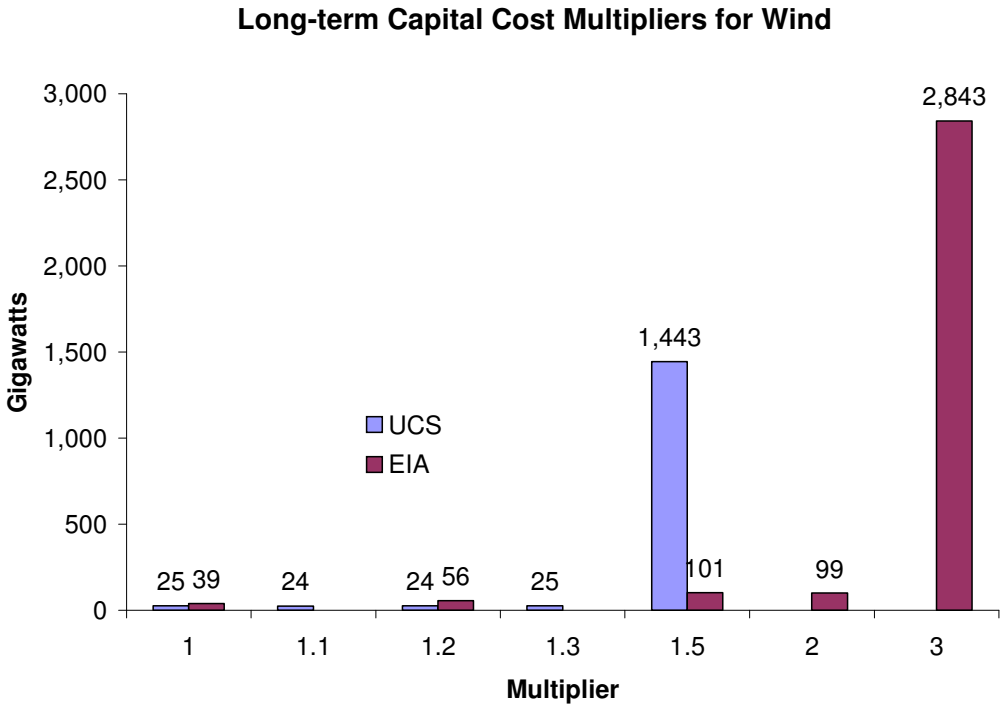
EIA's model has also been criticized for artificially constraining the growth of renewable energy technologies. For example, EIA has assumed that there is an absolute limit on the penetration of wind energy in any region to ensure reliable grid operation. While EIA has raised this limit several times, EIA's maximum penetration limit has been below levels actually achieved in regions in the European Union.[9] Recent European research indicates

[8] GPRA assumptions are online at *www.eere.energy.gov/office_eere/gpra_estimates_fy05.html*. These assumptions are an update to assumptions originally made in NEMS by the Interlaboratory Working Group of the five national energy laboratories in *Scenarios for a Clean Energy Future*. The renewable energy cost and performance assumptions were originally developed by the Electric Power Research Institute (EPRI) and recently updated by the National Renewable Energy Laboratory (NREL) in the *Power Technologies Databook* 2003 and in the GPRA analysis.

[9] EIA set the limit at 12% in the AEO 2001 and AEO 2002 versions of the model, raised to 20% in AEO 2003, and 40% in AEO 2004 along with higher economic penalties at higher levels of penetration.

that there are only economic limits to penetration, as the cost of balancing the system increases at higher wind penetration levels, but no absolute limit.[10]

Analysts have also critiqued EIA's model for applying unfair economic penalties to renewable energy technologies as their penetration increases. For example, EIA increases the capital cost of wind power by up to 200 percent to reflect resource degradation, transmission network upgrades, and competition with other uses (see figure). EIA's applies the highest cost penalty (a 200 percent increase) to over 90 percent of the total class 4-6 wind potential in the U.S. We do not believe there is any empirical support for this severe of an increase.



In contrast, we assumed a maximum capital cost increase of 50 percent as the penetration of wind increases to 30 percent of a region's electricity. This includes a 20 percent cost increase for integrating wind into the broader electricity system based on a recent analysis for PacifiCorp's Integrated Resource Plan and a 30 percent increase for additional siting and transmission costs based on estimates from wind developers, utilities, and other studies. PacifiCorp's wind integration cost estimate is at the high end of the range of studies that have been completed to date for several utilities.[11]

EIA also does not include several advanced renewable energy technologies that could be economically viable over the next 20 years. Perhaps, most importantly, they do not

[10] Söder, L. (2004) 'On limits for wind power generation', *Int. J. Global Energy Issues*, Vol. 21, No. 3, pp.243-254.

[11] A more complete description of the assumptions we changed in NEMS for our most recent national RPS analysis is available at: http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1504.

include class 3 or offshore wind potential. DOE goal is to develop a low wind speed turbine that is capable of producing electricity for 3 cents/kilowatt-hour by 2012 in class 4 wind areas, without incentives or transmission costs. This low wind speed turbine would also increase the competitiveness of class 3 wind areas, which are available in nearly every state in the US and are often located close to load centers. Wind development is already occurring in class 3 areas in a few places in the Midwestern and Eastern US and in Europe countries like Germany and Denmark. Several European countries are also aggressively pursuing offshore wind development. In addition, EIA does not include potential from enhanced geothermal systems, wave and tidal power, and incremental hydropower expansion at existing dams, and advanced biomass crops that can produce significantly greater yields than today. These resources and technologies could make a contribution to long-term U.S. electricity needs.

EIA has also consistently underestimated natural gas prices over the past decade. The impacts of their gas forecasts are discussed in response to Senator Salazar's question #2.

5. DOES A TRADITIONAL RPS – LIMITED TO SOLAR, WIND AND BIOMASS -- IMPOSE EXCESSIVE COSTS ON UTILITIES AND THEIR CUSTOMERS?

According to the Electric Power Research Institute, impacts of RPSs can be significant, especially for those companies that depend on coal and other fossil fuels to supply the power delivered to their customers. For example, under a 10% renewable portfolio standard, a large utility with 20,000 megawatts of generation delivering 140,000 gigawatt hours per year of power to customers would need to replace up to 14,000 gigawatt hours per year with renewable energy. If wind was the only economical choice, it would be necessary to build and operate or purchase power from 5000 to 7000 megawatts of wind generation, depending on the wind resource strength. Thus, a single utility's wind energy requirement would approximately double the installed wind capacity in the United States today. This example could also require an investment of about $5 to $7 billion in wind facilities; and an additional investment in transmission and control facilities, which would be required to integrate the intermittent wind generation into the grid. Other significant issues include public acceptance, land use, and noise, visual, and avian impacts.

Do you think EPRI's example accurately describes what could happen under a limited traditional RPS?

Answer. Detailed studies by the EIA and by UCS show that a traditional national RPS would not impose costs, let alone excessive costs, on utilities and their customers, but results in savings on both natural gas and electricity bills.

With respect to the hypothetical EPRI example, it is first important to note that a 20,000 MW utility would be a very large utility, equivalent to a utility covering the entire New England region, or the entire state of California.

While the EPRI assumptions might apply in an extreme case, EPRI uses conservative assumptions that exaggerate the amount of wind development that would typically be required to meet the traditional RPS outlined in their example. First, EPRI assumes that the 20,000 MW of capacity belonging to the utility would be operating at an 80 percent load factor. This load factor is considerably higher than the average would likely be for a large utility that has a portfolio with both a mix of electric generation technologies, and baseload and peaking plants. As a result, the overall amount of renewable generation required to meet the standard is high.

Second, the EPRI example assumes that the utility has no existing renewable energy resources that could be used to either meet its requirement (wind, bioenergy, solar) or reduce its baseload (hydroelectric). And utilities in all regions would have the opportunity to import renewable energy credits from other regions.

Third, EPRI assumes that wind resources would be the only renewable energy technology developed by the utility. However, our analyses and EIA find that wind would likely constitute 57 to 66 percent of the renewables developed to meet a national 10 percent RPS, with the remaining development coming from bioenergy, geothermal, landfill gas, and solar technologies. In regions with above-average wind resources, which would also mean having a large number of above-average wind sites, the percentages would be higher.

Fourth, EPRI assumes that the wind resources developed would have a capacity factor ranging from just 23 percent to 32 percent. Both EIA and the National Renewable Energy Laboratory assume that wind capacity factors, particularly in areas with class 4 to 6 wind speeds, would range from 35 percent to 45 percent. The more pessimistic capacity factors assumed by EPRI result in greater amounts of wind development needed to meet the requirement.

With more realistic assumptions, UCS finds that a utility with a 20,000 MW portfolio would need 1,500 MW to 2,300 MW of wind, either in that utility's territory or somewhere else in the US from which it would import credits, to meet a 10% national RPS. An additional 800 MW to 1,000 MW of other renewable energy sources would be needed to fulfill the utility's RPS requirement. This also conservatively assumes that the utility has no existing renewable energy development that could be used to meet the RPS.

The investment needed to meet these targets depends greatly on projections of renewable technology costs. Using EIA projections, they would remain close to $1,000/kW. As discussed in question 4, however, we believe those projections are very pessimistic. (EPRI itself, in its Technical Assessment Guide, uses much more optimistic projections of future wind costs than EIA, however.) Some additional investment in transmission and control facilities would be required. These investments are included in the EIA and UCS analyses that find that there would still be net consumer savings from the RPS.

Finally, after all is said and done, the EPRI publication quoted in the question recommends: “Consider Support of Federal RPS: Proactively Develop Resource Definitions and Standards.” (p. 4-6)

Public acceptance. Public acceptance is an issue that affects all energy technologies, including coal fuel cycle and power plant siting; gas plants, pipelines, storage facilities and LNG terminals; nuclear power plants and waste storage facilities, and renewables. In some regions, like the northeast, it is difficult to build any type of energy facility. The public acceptance of wind has varied by region, state and specific locality. In general, areas that have been less accepting of other energy facilities, like the northeast, have been less accepting of wind as well.

If the public in the hypothetical utility territory did not accept the full amount of wind needed to meet the full requirement in the in the hypothetical utility territory, the utility would have the choice of either utilizing other locally available renewable resources or of importing wind or other renewable energy credits from regions where public acceptance is higher.

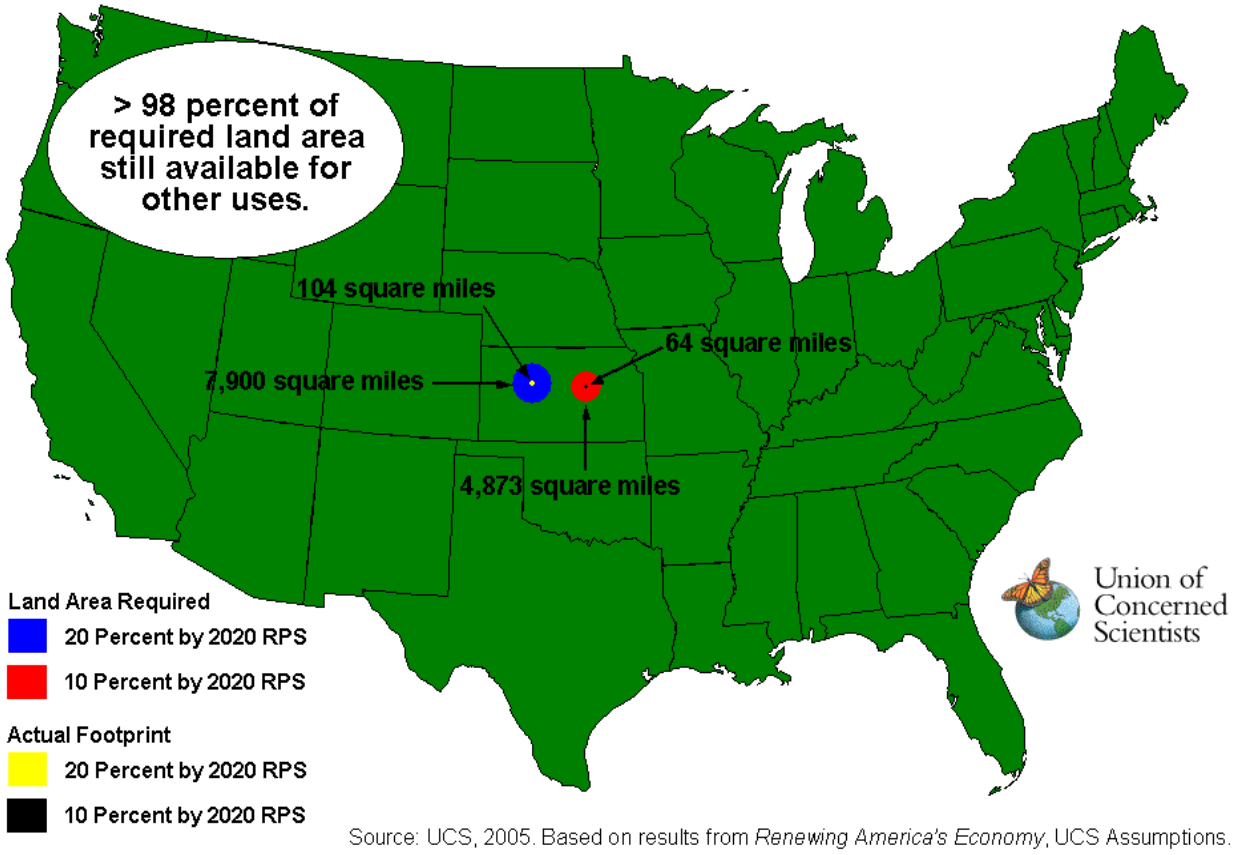
Land use. In a recent analysis, UCS examined the amount and types of renewable energy resources that would be developed under both a 10 percent and 20 percent by 2020 national RPS. We used the National Energy Modeling System (NEMS), developed and maintained by the U.S. Department of Energy's Energy Information Administration (EIA), and examined the range of costs and benefits for each RPS proposal using EIA projections of renewable energy costs and performance, and using UCS projections for renewable energy costs and performance. The UCS assumptions are close to (but somewhat more conservative than) projections from the Department of Energy's national labs.

Table 1. Comparison of Wind Results, National RPS Proposals

	20 Percent by 2020 RPS		10 Percent by 2020 RPS	
	UCS Assumptions	**EIA Assumptions**	**UCS Assumptions**	**EIA Assumptions**
Total wind power capacity (MW)	132,990	105,480	82,036	56,015
Estimated number of wind turbines*	88,660	70,320	54,691	37,343
Land area requirement**				
Square miles	7,900	6,266	4,873	3,327
Acres	5,055,776	4,009,950	3,118,703	2,129,482
Circle of radius = (miles)	50.1	44.7	39.4	32.6
Percent of contiguous U.S. land area	0.26%	0.21%	0.16%	0.11%
Actual Footprint***				
Square miles	104	82	64	44
Acres	66,495	52,740	41,018	28,008
Circle of radius = (miles)	5.75	5.11	4.51	3.74
Percent of contiguous U.S. land area	0.003%	0.003%	0.002%	0.001%

* Assumes average wind turbine size of 1.5 MW.
** Assumes wind power development land density of 6.5 MW per square kilometer, based on U.S. EIA documentation for the *Annual Energy Outlook 2004*.
*** Actual footprint includes wind turbines, transmission tie-ins, and access roads. Source: Personal communication with Tom Gray, American Wind Energy Association, 3/10/2005, and based on input from wind power developers.

Figure 1. Land Area Requirement for Wind Power Development Under a National Renewable Electricity Standard



Source: UCS, 2005. Based on results from *Renewing America's Economy*, UCS Assumptions.

In all four scenarios, wind power plays a dominant role in the renewable energy mix. Table 1 lists the total wind power capacity by 2020 under both the 10 percent and 20 percent RPS for each set of assumptions. Table 1 also lists the estimated number of wind turbines needed to reach these capacity levels, the amount of land needed to build these turbines, and the actual footprint (including turbines, transmission line tie-ins, and access roads) of the wind development. Only a small fraction of the contiguous United State's land area—ranging between approximately 0.11 percent and 0.26 percent—would be required for the level of wind development that could occur as a result of a national RPS. The actual footprint would be far less based on current experience, with more than 98 percent of the land area required for a wind facility still available for other uses such as farming and ranching. Figure 1 (see Appendix) illustrates the land area requirements for wind power development under a national RPS compared to the land area of the 48 contiguous states.

The results presented above do not account for the potential of offshore wind power development in the United States, as EIA does not currently include offshore wind resources in NEMS. The U.S. National Renewable Energy Laboratory (NREL) estimates the total offshore wind resource potential to be 908,000 MW (excluding the Gulf of Mexico, Alaska and Hawaii, and Great Lakes).[12] To the extent that offshore wind resources can be developed, the amount of land-based area required for wind development under a national RPS would be reduced.

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[12] Musial, W., *Overview: Potential for Offshore Wind Energy in the Northeast*, Offshore Wind Energy Collaborative Workshop February 10-11, 2005. National Renewable Energy Laboratory. Available online at http://www.mtpc.org/renewableenergy/Owec_pdfs/OWEC-%20Musial.pdf.

Additionally, the land use area of fossil plants are often underestimated when the entire fuel cycle, including extraction, refining, transport, generation and waste disposal. At least one study calculates the lifetime fuel-cycle land-use impacts of a coal plant as exceeding the land use of the comparable generation from wind turbines.[13] Because almost the entire fuel cycle impacts (except manufacturing) for a wind plant are in one location, however, whereas the fuel cycle impacts of a fossil fuel plant are spread over a number of different locations far from each other, the apparent impact of wind energy can be higher. Also, because the wind resource also tends to be higher on ridgelines, the overall visual impact of wind can be higher. Those impacts need to be balanced against the overall impacts of other energy sources, of course.

Avian impacts. There have been significant impacts on raptors at the Altamont, CA wind facility, and unexpected impacts with bats at a few Mid-Atlantic wind farms. Extensive research and mitigation efforts are underway at these sites. The avian impacts of wind energy facilities at most sites, and overall in the industry are very small, especially in comparison with other human sources of bird mortality, such as vehicle collisions, tall buildings, cell phone towers, transmission lines, and house cats. On average, there are 2.3 bird deaths per turbine per year, and that number has been decreasing with more experience and larger turbines. Overall, wind facilities today are responsible for approximately one of every 30,000 bird fatalities from human causes. The fossil fuel cycle also cause enormous impacts on wildlife.

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

6. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth – the "incremental basis" approach." The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Answer. As noted above in question 1, we do not support making different resources eligible for the RPS.

[13] Paul Brophy, "Environmental Advantages to the Utilization of Geothermal Energy," *Renewable Energy*, Vol 10:2/3, Table 3, pp. 374, (1997).

We do not support setting the target level for an RPS based on new load growth, as opposed to the traditional approach of a percentage of overall sales. The objectives of more diversity of fuel supplies, lower environmental impacts, more domestic energy sources and choices, are important in areas where load is growing slowly, or even not at all, as well as for areas in which load is growing quickly. The impact of an RPS based on total sales is already scaled to an extent to be higher in territories where load is growing more quickly.

An optimal scenario, from the perspective of minimizing energy bills, minimizing environmental impacts, and maximizing fuel diversity, would be to utilize energy efficiency to offset all load growth (or perhaps even reduce energy demand) and still utilize an RPS to diversify fuel sources. A scenario in which energy use continues to grow, and an RPS is used to meet some of the load growth, is likely to lead to continued growth in emissions, especially carbon emissions. Such a scenario is incompatible with United States obligations under the Rio Treat signed by President H.W. Bush and with the need to reduce carbon emissions to stabilize carbon concentrations in the atmosphere.

7. If there was a National Power Generation Diversirty Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. In a federal RPS, credits retired to meet state RPS programs should count towards fulfillment of any federal obligations. Likewise, in a state accepting alternative compliance payments to meet a state credit obligation, the state alternative compliance payments should count towards fulfillment of the same number of federal credit obligations.

8. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversirty Standard, what kinds of resources should be included?

As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. Eligible resources should only include renewable resources, as in the two previous renewable portfolio standards that were approved by the Senate.

9. Should there be different levels of credit for different classes of resources?

As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. We continue to support providing multiple credits to renewable facilities sited in customer facilities. Such distributed generation projects face additional market barriers not faced by bulk power renewables, and generally require more support to be implemented.

10. What should the States' roles be in determining what resources are assigned to what tiers and how much credit each should receive?

As noted in question one, we do not support a national power generation diversity standard. Congress could consider a separate tier for renewable distributed generation facilities, as some states have done. That option would provide greater certainty that such facilities would be built than providing credit multipliers would, although at potentially higher cost.

11. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversirty Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

As noted in question one, we do not support a national power generation diversity standard. We do not think that storage technologies should receive credit in a renewable portfolio standard. At least with RPS' of 20 percent or lower, it should not be necessary to add storage for either reliability or economic reasons. Developers already have to pay any ancillary service costs imposed by their facilities, which should be cost-based charges developed by independent system operators. Eventually, it may be economic for projects to propose storage as an alternative, or to consider adding system storage, but this is not an issue for the near future. Of course, we support continued R&D for advanced storage technologies, as they will eventually be needed to facilitate higher penetration levels of variable output technologies.

12. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

    What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

    Under a traditional RPS, a supplier has the option of purchasing renewable energy credits from generators, either under long-term contracts or in spot purchases, or of building and owning eligible generation facilities, and using the credits they generate for compliance, or of purchasing credits from the Government at a fixed price. The supplier thus already has the option of investing the developing new renewable resources.

    If the question is whether the supplier should receive credit according to dollars invested, rather than according to the megawatt hour output of the eligible facility, I would respond in the negative. In order to create as level a playing field as possible among the potential developers of renewables, all should receive credits annually according to the output of the facility. Awarding credits according to investment is a particularly weak concept, because it would reward non-performing or poorly performing projects. Awarding credits according to facility output is not only fairer, it rewards and incentivizes good facility performance.

    With respect to the purchase of credits from the Government, I would not agree that this option does nothing for diversity. The Government should recycle the funds from alternative compliance into the development of renewable facilities, either through purchasing credits in the market to resell as needed, or by auctioning funds to potential developers, or by distributing the money to state renewable energy funds in the state served by the supplier.

13. If there was a National Power Generation Diversirty Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. With respect to tax credits and the RPS, please see the response to question #3 above.

Questions from Senator Talent

1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

While new transmission lines and upgrades would be needed to deliver wind power from remote locations to load centers under a national renewable portfolio standard, this situation is not unique to renewable energy or the RPS. Other resources, particularly new coal plants and many natural gas plants, will also need new transmission lines and upgrades.

As discussed above, our national RPS analysis increased the capital cost of wind by up to 50 percent as the penetration of wind increases to 30 percent of regional electricity use to account for the costs of new transmission lines and upgrades and for integrating wind into the electricity system. An additional cost is also applied to interconnect wind to the existing electricity system. These costs are applied on top of a generic cost that EIA applies to all new generation for expanding the transmission system.

Our analysis conservatively allocates 100 percent of the additional capital costs for new bulk transmission lines and upgrades to wind. In reality, other resources (both new and existing power plants) will likely use these lines to transmit power to electricity consumers and should therefore share in the cost of paying for them.

The answer to the question of who pays for new transmission for wind and other resources is likely to vary by region. FERC has been using this approach in trying to implement its standard market design (SMD). For example, the Midwest Independent System Operator (MISO) is developing a methodology that they are planning to file with FERC in May that will likely be a combination of: 1) everyone within the MISO footprint paying for higher voltage "highway" type transmission facilities (345 or 500 kV) that have broader regional grid benefits and 2) specific load paying for lower voltage transmission facilities (115kV) that supply load serving needs. ERCOT is proposing to spread the costs of new transmission to all ratepayers. These approaches provide a

relatively equitable approach for allocating costs for new lines to wind and other resources.

In contrast, we do not support proposals requiring "participant funding" of transmission upgrades, which could severely restrict the growth of wind power for years. It would doom hope of building major new power lines, as developers of 50-100 MW wind projects with six month lead times could not hope to finance a $500 million, 1,000+ MW transmission line with a six-year or more lead time needed to export wind from a windy region. It would also create higher transmission costs for developers of all new projects, but especially for variable output resources like wind. In addition, it would undermine efforts to improve electricity reliability, making it difficult and more expensive to site transmission, expand and improve the grid, and finance new power plants.

We also believe that fair transmission rules are needed to level the playing field for wind power and other renewable resources. This includes eliminating unfair imbalance penalties, allowing for scheduling flexibility, removing multiple charges for transmitting wind over long distances (i.e. pancaked rates), using methods that recognizes the full capacity value of wind, and developing broader regional transmission organizations to optimize dispatch and grid expansion. A recent FERC staff briefing paper shows that effective transmission charges for wind generators under current transmission rules are more than twice as high as high as natural gas combined cycle plants in some parts of the country.[14] The FERC paper, along with papers from AWEA and the National Wind Coordinating Committee, identify some solutions to this problem.[15]

2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

As discussed extensively in response to Chairman Domenici's first question, nuclear energy and coal gasification should not be factored into a national portfolio standard.

3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

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[14] *Assessing the State of Wind Energy in Wholesale Electricity Markets*, FERC Staff Briefing Paper, Docket No. AD-04-13-000, November 2004.

[15] National Wind Coordinating Committee, Transmission Planning Principles, February 2004, http://www.nationalwind.org/publications/transmission/Transmission_Planning_Principles.pdf. Christopher Ellison, et. al., *A Review and Update Regarding the 2000 AWEA Transmission Access Priority Issues Report*, December 2002, online at http://www.awea.org/policy/documents/Transmissionwhitepaper12-2002.pdf.

Mr. O'Shaughnessy did not present or cited any specific analyses to back up his claims. Costs for transmission, meeting capacity requirements, balancing and load following costs, and economic dispatch are all already included in the analyses using EIA's NEMS model discussed in my testimony that find that an RPS of 10% by 2020 or 20% by 2020 will reduce both natural gas and electricity bills. As discussed in response to Chairman Domenici's Question 4 above, we believe that EIA's cost assumptions are generally quite pessimistic in these categories.

4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

As discussed in response to Chairman Domenici's Question #6 above, we do not believe it would be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet new load growth.

Questions from Senator Salazar

- Mr. Nogee, I am very interested in the economic benefits of renewable power. The Union of Concerned Scientists has recently released a report stating that if only 10% of our energy demands came from renewable sources, this would create 91,000 new jobs and would save industrial, business, and home energy consumers

$28.1 billion dollars. Would you please comment on how new American jobs are created and how the country could save money by investing in renewable energy?

Answer. New jobs are created by investment in renewable energy in several ways. First, there are direct jobs in manufacturing renewable energy technologies, as well as in installing and operating them. The Renewable Energy Policy Project has performed a number of analyses breaking down the specific types of jobs created by renewable energy investments and where they will likely be located.[16] Secondly, jobs are created when the renewable energy workers spend their additional income, supplying them with goods and services. Third, jobs are created when energy bill savings are spent in the economy. Our jobs analysis calculates the net jobs created by all three such types of spending.

Renewable energy technologies tend to create more jobs than fossil fuel technologies because they are capital-intensive. Almost all the money for renewable energy is spent on manufacturing equipment, installing it and maintaining it. With biomass, money is spent on fuel, but usually from sources that are within 50 miles of a biomass plant, because it is too expensive to transport biomass electricity fuels for long distances. Renewables thus avoid the need to export cash to import fuel from other states, regions, or countries, keeping the money circulating in the local economy, creating more local jobs.

A renewable standard saves consumers money in several ways. First, some renewable sources, especially wind energy at good sites, is now less expensive than natural gas or coal-fired power plants over the expected lifetimes of the plants. But in an increasingly competitive industry, utilities are reluctant to invest in capital-intensive renewable energy facilities that have long payback periods, even if they eventually pay for themselves. Second, by reducing the demand for fossil fuels, and creating new competitors for the dominant fuel sources, renewables help reduce the price of fossil fuels and restrain the ability of fossil fuel prices to increase in the future. Natural gas therefore costs less for electricity generation, as well as for other purposes, thus benefiting both electricity and natural gas customers. Third, renewable standards will reduce the cost of renewable energy technologies, by creating competition among renewable sources and projects to meet the standard, and by creating economies of scale in manufacturing, installation, operation and maintenance. As small manufactured technologies, renewables are much more susceptible to such economies than are large power plant construction projects.

- Mr. Nogee, I note with some interest that your organization has run an economic model using the EIA's forecast natural gas prices and found that a 20% renewable

[16] Virinder Singh, The Work that Goes Into Renewable Energy, Renewable Energy Policy Project, November 2001. http://repp.org/articles/static/1/binaries/LABOR_FINAL_REV.pdf George Sterzinger and Matt Svrcek, *Wind Turbine Development: Location of Economic Activity*. Renewable Energy Policy Project, Washington, DC., September 2004. http://repp.org/articles/static/1/binaries/WindLocator.pdf George Sterzinger and Matt Svrcek, *Solar PV Development: Location of Economic Activity*, Renewable Energy Policy Project, Washington, DC., January 2005. http://repp.org/articles/static/1/binaries/SolarLocator.pdf

portfolio by 2020 would save consumers money and reduce the price of electricity and gas. This is even more fascinating if we take into account the fact that EIA forecast prices are unrealistically low. For example, the EIA projects a barrel of oil to be about $35 this year when in fact the cost of oil is above $53 dollars today. Have you examined the benefits of a renewable portfolio if oil is at 50 or even just 40 dollars per barrel? If not, how much improvement do you think we would see?

Answer. We have not examined alternative oil price forecasts, because outside of a few regions, very little oil is used for electricity generation any more. Oil prices tend to be correlated with natural gas prices, however. As illustrated below, EIA has increased its 20-year natural gas price projection, as published in *Annual Energy Outlook* (AEO), each of the last nine years to conform to new data. EIA and other state and federal agencies regularly use these forecasts to evaluate the costs and benefits of proposed energy policies. Companies also use EIA projections to evaluate long-term investment and technology decisions.

Low natural gas prices make investments in energy efficiency and renewable energy appear more expensive than they really are. For example, a 2001 EIA analysis projected that a national renewable electricity standard of 20 percent by 2020 consumers would cost consumers $14 billion on their energy bills by 2020. By comparison, a 2004 UCS analysis of a 20 percent standard using EIA's assumptions and model projected that consumers would save nearly $27 billion on total energy bills by 2020. EIA has changed a number of its assumptions between 2001 and 2004, however, most of the difference in energy bill savings is due to changes in natural gas prices.

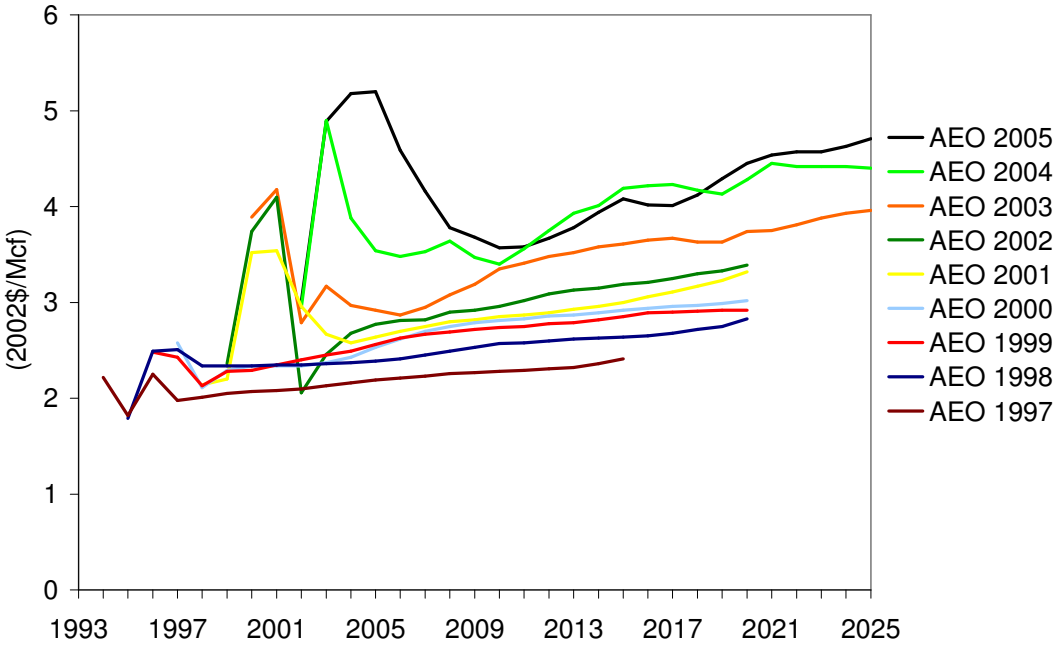
EIA now projects that natural gas prices will come down to the $3.50 range over the next five years or so, before gradually increasing again. However, it is also possible that gas prices will remain at current levels. The mid-term price declines are in part premised on opening new sources of supply, like LNG terminals. New LNG terminals could be delayed or canceled however, as a result of public opposition or other factors, which would tend to keep gas prices high.

While EIA has steadily increased its long-term gas forecasts, it's most recent projection in *Annual Energy Outlook 2005* (released in December 2004) is still well below where NYMEX natural gas futures contracts were trading at the time EIA finalized its gas price forecast. According to a recent analysis by Lawrence Berkeley National Lab, NYMEX futures prices are $1.11 per million Btu higher than the AEO 2005 reference case over the next six years.[17] This is the largest spread between EIA and the futures market that LBL has seen over the past five years. They go on to say that one would have to pay this

[17] Mark Bolinger and Ryan Wiser, Berkeley Lab, "Comparison of AEO 2005 Natural Gas Price Forecast to NYMEX Futures Prices," Memorandum, December 13, 2004.

premium "in order to lock in natural gas prices over the coming six years to replicate the price stability provided intrinsically by fixed-price renewable generation. Fixed-price renewables obviously need not bear this added cost, and moreover can provide price stability for terms well in excess of six years."

EIA Projections for Wellhead Natural Gas Prices, 1997-2005 ($2002/Mcf)



Source: EIA, Annual Energy Outlook, 1997-2005.

Finally, almost all fuel forecasts project relatively smooth average price trajectories for all fuels, while in reality, gas and oil prices are subject to large short-term fluctuations as a result of many factors, such as weather, storage conditions, temporary supply disruptions, price manipulation and other factors. These conditions have led to many periodic, temporary spikes in gas prices that will certainly continue in the future. By locking in fixed prices over an extended period of time, renewables avoid excess costs imposed by short-term volatility and price spikes, which are not reflected in either our or EIA analyses.