The Center for Carbon-free Power Integration (CCPI), University of Delaware (UD) welcomes this opportunity to submit comments on the CES and thanks Chairman Bingaman and Senator Murkowski for this opportunity. The UD/CCPI is the leading teaching and research institution in the United States on Offshore Wind Power (www.ceoe.udel.edu/windpower). CCPI conducts leading-edge research in renewable energy including Mechanical Engineering of wind turbines, Meteorology, Public Policy, Composites, Business and Finance, Ocean Policy; and Geospatial and Geotechnical Aspects of Offshore Wind. CCPI leads a US DOE designated University-Industry Wind Consortium, and its researchers have published in leading peer-reviewed journals.

CCPI supports a national CES as detailed in CCPI’s answers to questions 1-6. The CES will promote the important national goals of energy independence and security, technological innovation, and job creation. A national CES also is required because the environmental effects of generation do not stay within state boundaries. The CES should be limited to renewable resources; otherwise, it will disincentivize and have economically punitive effects on the many states that have a renewable-only RPS. The CES also should not preempt laws by states like Delaware that have led on clean energy policies. Preemption would be particularly problematic if the CES were to include electricity generation from technologies such as coal w/CCS or natural gas and would undermine and frustrate well-considered state approaches to promote renewable technologies that emit zero toxic air pollutants or GHGs during operation. Given current prices, natural gas does not need incentives, particularly at the expense of renewables. Nevertheless, if Congress were to include dirtier technologies such as coal w/CCS or natural gas, all technologies should be analyzed according to their life-cycle environmental and human health impacts per kWh of electricity generated. Life-cycle external costs include costs associated with the impacts of underground mining and occupational health, mountaintop mining, fly ash, impacts to aquatic ecosystems, land use, water use, entrainment, transportation, materials and construction of generation facilities, combustion (GHGs, SO2, NOx, PM2.5, and PM10), spent waste, and decommissioning. In sum, if emitting technologies are included in the CES, they should be given credit weighted by their true environmental impact, not on a per energy production unit (that is, not credited solely per MWh).

CCPI, NREL and others have studied in detail the offshore wind resource—this one clean technology is large enough to power all Northeast and Mid-Atlantic electricity needs (including electrifying the vehicle fleet) (Kempton, et al., 2007). Although a CES will help to facilitate offshore wind development, for offshore wind to reach its full potential there are a number of additional steps that Congress should take, which fall into four categories: (i) fiscal/tax policy in the near-term to level the playing field; (ii) amendments to the existing regulatory regime to recognize the differences between offshore wind and offshore oil and gas; (iii) increased research and development to lower capital costs and incentivize US manufacturing and job creation; and (iv) legislation to internalize external costs, including GHGs.
Question 1. What should be the threshold for inclusion in the new program?

Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- How should a federal mandate interact with the 30 existing state electricity standards?

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The federal mandate must not preempt state laws and standards. If on the other hand, the federal mandate is more demanding (requires a higher percentage of similarly qualifying means of electric generation) that a given state’s mandate, that state should be required to meet the federally mandated minimum.

A federal minimum is required because air pollution in the form of, for example, sulfur dioxide, and radioactive releases, does not stay within state boundaries and can affect the health of citizens who reside in neighboring states as well as their environment. In the form of carbon dioxide, air emissions lead to the acidification of the oceans and to climate change, including sea level rise. A federal minimum also promotes important national goals of energy independence, energy security, technological innovation, and job creation.

As a low-lying coastal state, Delaware is particularly susceptible to sea level rise, and the Delaware legislature aggressively responded to the threat of climate change by first enacting a renewable portfolio standard (RPS) in 2007, which called for 20% by 2019. In 2009, Delaware, at the behest of Governor Markell, amended its RPS law and Delaware now requires 25% by 2025. Delaware’s mandate must be met with eligible energy resources: solar photovoltaic or solar thermal energy technologies; wind energy; ocean energy including wave or tidal action, currents, or thermal differences; geothermal energy technologies; fuel cells powered by renewable fuels; combustion of gas from the anaerobic digestion of organic material; hydroelectric facilities (30 MW or less); biomass combustion; or combustion of captured landfill methane. Delaware’s law is also notable for not providing a one-size, fits all approach. Rather, Delaware recognizes that different energy technologies require different incentives given their relative cost and maturity. Delaware includes a specific set aside of 3.5% for solar energy, and provides additional incentives for siting wind energy facilities prior to 2012 and offshore wind energy facilities prior to May 31, 2017. Significantly, Delaware has not included coal with carbon capture and storage (CCS), nuclear energy or natural gas in its RPS.

Through the legislature, the citizens of Delaware have vocalized their desire for renewable and sustainably produced energy by enacting a RPS based solely on the aforementioned clean energy sources. It is important that Congress allow states such as Delaware to maintain their ability to act as laboratories and enact novel mechanisms for their benefit and self-preservation.

Federal preemption is particularly problematic should Congress enact a CES that allows electricity generation from dirtier technologies such as coal with CCS and natural gas to count toward the CES mandate. Indeed, federal preemption under such a regulatory regime would completely undermine and frustrate Delaware’s well-considered approach to promote technologies that are in fact (a) clean as far as the emission of air pollutants, including greenhouse gases (GHG) during operation (importantly, there are no absolutely “clean”
Question 1. What should be the threshold for inclusion in the new program?
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Technologies—all have some negative effects in operation and all result in some life-cycle GHG emissions) and (b) renewable, and thus, do not contribute to the consumption of non-renewable resources, reserving greater amounts of those non-renewable resources to our child and grandchildren and so on. Moreover, if the federal CES is broadened to include non-renewable resources, it will disincentivize and have an economically punitive effect on states, such as Delaware, that have a RPS that includes a more narrowly tailored mandate.

Even if the federal program is written more narrowly to cover only renewable resources, any federal legislation should not preempt more stringent state standards because those state standards can be implemented without conflicting with or undermining the objects of the federal legislation.
Question 2. What resources should qualify as “clean energy”?  
Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- On what basis should qualifying “clean energy” resources be defined? Should the definition of “clean energy” account only for the greenhouse gas emissions of electric generation, or should other environmental issues be accounted for (e.g. particulate matter from biomass combustion, spent fuel from nuclear power, or land use changes for solar panels or wind, etc.)?

Please submit your response HERE. (no page limit)

No energy source is “clean” over its life-cycle (e.g., mining/extraction to construction of the energy-generation technology to transportation of fuels to electricity generation to facility decommissioning). Depending on the technology, these phases result in the emission of greenhouse gases (GHGs), air pollutants, discharges to streams and lakes, water use (with many heating extracted and then discharged water as well), land use, and ecological effects, including habitat destruction and wildlife mortality. “Clean energy” sources should thus be defined using ceilings for life-cycle effects per kWh generated. Moreover, given current prices, natural gas does not need incentives, particularly at the expense of renewables. Nevertheless, if Congress were to include dirtier technologies such as coal w/CCS or natural gas, all technologies should be analyzed according to their life-cycle environmental and human health effects per kWh of electricity generated. Life-cycle external costs include costs associated with the impacts of underground mining and occupational health, mountaintop mining, fly ash, impacts to aquatic ecosystems, land use, water use, entrainment, transportation, materials and construction of generation facilities, combustion (GHGs, SO\textsubscript{2}, NO\textsubscript{x}, PM\textsubscript{2.5}, and PM\textsubscript{10}), spent waste, and decommissioning. While nuclear power and natural gas may reduce the widespread use of coal and thus through replacement decrease aggregate GHG emissions, their other environmental effects must be considered. Further, to provide a level playing ground with other technologies should nuclear energy be included, its inclusion would need to be paired with the repeal of the Price-Anderson Act’s limit on liability for nuclear accidents.

Natural gas is cleaner than coal, but without carbon capture and storage, it still has the capacity for significant environmental harm, especially considering that natural gas is expected to continue to be a significant share of the total U.S. power-mix over the coming decades. Moreover, the full environmental impact of natural gas is unknown. The EPA has committed to undertake a ‘Hydraulic Fracturing Research’ study to assess the environmental impacts of fracturing liquids on drinking water (EPA, 2011). There also is new concern that hydraulic fracking results in substantial releases of fugitive methane, which is a potent GHG, thus providing little or no benefit over coal. Until the life-cycle effects of natural gas extraction are fully understood, it is prudent to refrain from encouraging this form of energy production.

In sum, if emitting technologies are included in the CES, they should be given credit weighted by their true environmental impact, not on a per energy production unit (that is, not credited solely per MWh).
Question 2. What resources should qualify as “clean energy”?
Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

Question 3. How should the crediting system and timetables be designed?
Submitter’s Name/Affiliation:  J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- What interim targets and timetables should be established to meet the standard’s requirements?

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Interim standards should be established because they provide a market signal to turbine vendors and supply chain firms to ramp up manufacturing of clean energy in response to an assured demand. They likewise will provide a market signal to developers, utilities and other end-users, financial institutions, educational institutions, and workers. Timetables will provide a more orderly switch to clean energy, and will give manufacturers identifiable targets when making investment decisions. Interim targets also will allow monitoring of progress toward the eventual goal. Finally, establishing a clean energy generation facility in 2025 has fewer environmental benefits than one established in 2015, if one makes the reasonable assumption that at the end of its useful life, the clean energy project installed in 2015 will be replaced by another clean energy facility.

Delaware’s renewable portfolio standard (RPS) provides an example of a graduated scheme. Delaware required regulated utilities to generate one (1%) percent renewables in 2007, and requires yearly incremental increases reaching twenty-five (25%) percent in 2025 (Delaware Code, Title 26 § 354). Although the federal scheme need not be as detailed, a stepped approach is preferable to simply setting a final target for the reasons noted. Additionally, the ultimate goal (e.g. 80% by 2035) should be stated as a critical minimum target, not a rigid bar.

It is important to account for the idea that additional clean technologies may be developed in the future, and this legislation should not discourage those efforts with an inflexible mandate. The pace of environmental innovation is mediated not only by scientific and technological breakthroughs and economic and financial incentives, but also by institutional and social factors (Hamdouch and Depret, 2010).

Question 3. How should the crediting system and timetables be designed?
Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- Should partial credits be given for certain technologies, like efficient natural gas and clean coal, as the President has proposed? If partial credits are used, on what basis should the percentage of credit be awarded? Should this be made modifiable over the life of the program?

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Credits should only be granted to technologies that (i) use renewable resources and (ii) do not emit pollutants, including greenhouse gases (GHGs), to the atmosphere. If that is the case, each such technology should be granted equal credit. Allowing other technologies to be included creates a number of complications and those effects must be considered and accounted for in any legislation. First, if a partial credit scheme is adopted, it is necessary to calculate the life-cycle external effects per kWh for each technology, monetize those effects, and then scale based on the “cleanest” qualifying technology. This is not an easy task. Congress and regulators would need to consider GHG emissions (both climate change and ocean acidification effects), health impacts of conventional pollutant emissions, other social disamenities from living near an area of extraction, production or generation, habitat destruction, wildlife mortality, land use, water use, and other ecological effects (such as discharge of cooling water, impoundment of streams, etc.). Take for example, natural gas recovered through hydraulic fracturing. When one considers GHG emissions during that extraction process, natural gas becomes less attractive than oil and almost as bad as coal in terms of GHG emissions (Howarth 2010). Second, it is important to recognize that processes to capture and store carbon (CCS) consume significant energy, and thus, if CCS is included, it will be important not to base the CES on kWh generated, but rather kWh delivered to the grid (this distinction is particularly germane to vertically integrated regulated utilities). Third, CCS is not without risk of GHG escape and thus any credit given to CCS must be discounted. In addition, credits should only be given for CCS that is actually occurring, not the potential for future CCS at a plant.

Question 4. How will a CES affect the deployment of specific technologies?
Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- How valuable would clean energy credits have to be in order to facilitate the deployment of individual qualified technologies?

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Clean energy credits should be valued in such a way that they encourage and stimulate capital-intensive facility growth and level the playing field for a given technology. The federal crediting system could be modeled after programs at the state level, such as those instituted in Delaware and New Jersey. Both programs recognize that US developers that wish to deploy US first-generation technologies such as offshore wind require greater incentives than developers of long-established technologies such as land-based wind. To facilitate offshore wind development, Delaware provides a 3.5 renewable energy credits (RECs) for each MWh of electricity generated from offshore wind (Delaware Code Title 26 § 356(c)). New Jersey takes a different approach. NJ has a carve-out for offshore wind power and has adopted technology-specific renewable energy credits known as ORECs (Offshore Renewable Energy Credits). Like a more traditional REC, an OREC is a commodity that must be purchased by an electricity supplier to demonstrate that a certain percentage of its electricity comes from offshore wind projects. However, unlike traditional RECs, whose price is determined by the market, with ORECs, the NJ Board of Public Utilities determines a project-specific OREC price based on a cost flow projections. This ensures that a developer will receive sufficient financial resources to make a given project viable while at the same time ensuring that the developer does not make undue profits, thus protecting ratepayers. N.J.A.C. 14:8-6.

Although no ORECs have yet been awarded given that rules has only recently been established, results of a recent analysis performed by UD and NREL (Levitt, et al, n.d.), suggests that ORECs in the range of $80/MWh will be required after proper offshore wind manufacturing and installation infrastructure has been built up. Moreover, given favorable economic and industry developments, even with no technological advancements, OREC prices of as little as $15 could support certain projects.

Question 5. How should Alternative Compliance Payments, regional costs, and consumer protection be addressed?

Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- **What are the possible uses for potential ACP revenues? Should such revenues be used to support compliance with the standard’s requirements? Should all or a portion of the collected ACP revenues go back to the state from which they were collected? Should ACP revenues be used to mitigate any increased electricity costs to the consumer that may be associated with the CES?**

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ACP revenues should either be returned to the state from which they were collected or dedicated to research and development. Although there are several plausible uses for the ACP revenues, it is important to recognize the economies of scale that can be achieved by dedicating large portions of the revenues to one or two uses, rather than thinly spreading the funds over many varied programs. Those entities making ACPs should not be permitted to pass along ACP costs to ratepayers; rather those costs should be borne by shareholders, etc.

If ACP revenues are returned to the states, states should be required to use the revenues to benefit residential ratepayers and specifically to support one or more of the following programs: (1) energy efficiency; (2) weatherization for low income residents; (3) mitigation of electric rate increases; and/or (4) assistance in the purchase of renewable energy technologies.

Alternately, the funds could be cumulatively dedicated to a research and development fund that would be administered by a federal government agency such as the Department of Energy. The fund could be used to support competitive research grants that focus on understanding and minimizing the environmental, health and social effects of any qualifying technology. The grant program would ‘complete the circle’ as the funds generated from noncompliance would be used to protect natural resources and help render such “clean” technologies even cleaner.
Question 5. How should Alternative Compliance Payments, regional costs, and consumer protection be addressed?
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- Should cost containment measures and other consumer price protections be included in a CES?

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No, cost containment measures or other price protections should not be included in the CES. The status quo presently costs consumers a great deal in terms of habitat destruction, social impacts, health impacts, and climate change. The National Research Council (NRC, 2009) estimates that, on average, 3.2¢/kWh in health costs are not accounted for in the price of coal when one considers only the emission of four criteria air pollutants (SO₂, NOₓ, PM₂.₅, and PM₁₀), with the dirtiest coal plants externalizing 12¢/kWh in health care costs. A more recent peer reviewed study by Paul Epstein, of the Harvard Medical School, and others quantified the life-cycle external costs (including costs associated with the impacts of underground mining and occupational health, mountaintop mining, fly ash, impacts to aquatic ecosystems, transportation, and combustion) of coal (Epstein, et al., 2011). They estimate conservatively the external costs of coal to be 17.8¢/kWh (the lower bound is pegged at 9¢/kWh; the upper bound at 26.89¢/kWh). These external costs suggest that it is prudent to implement policies that help to contain the mining, transport and combustion of coal if one desires to contain costs to consumers rather than instituting a cost containment measure in the CES.

Cost containment measures would simply divert the real costs of fossil fuel generation from the electric bill to society in terms of morbidity (such as asthma, bronchitis, emergency room visits, congestive heart failure) and mortality, lost income and productivity, and higher health care costs. Although electricity rates may increase without a cap, it is critical that those entities that participate in “dirty” energy businesses internalize the social costs of their activities.


Question 6. Are there policies that should be considered to complement a CES?
Submitter’s Name/Affiliation: J. Firestone, et al., Center for Carbon-free Power Integration (CCPI), University of Delaware

- **What are the specific challenges facing individual technologies such as nuclear, natural gas, CCS, on- and offshore wind, solar, efficiency, biomass, and others?**

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Offshore wind technology is mature; reliable wind turbines are available; the offshore wind resource is vast and close to load; and offshore wind energy can be generated with the production of essentially no pollution or greenhouse gases (Kempton et al., 2007). Currently, the offshore wind energy industry faces uncertainties because it is not yet established in the United States. There also is uncertainty over the construction costs and the pricing structure, as well as the regulatory process and public acceptance. The most pressing of its challenges are fiscal, regulatory, and social, rather than technological—it has existed in Europe for two decades.

Due to high capital costs and relative immaturity of offshore wind technology, and the fact that fossil fuel and nuclear power has received decades of subsidies and continue to receive subsidies to this day, offshore wind is not yet cost competitive. As a result of uncertainty, investment rates are inflated. Offshore wind installations have higher capital costs than land-based installations per unit of generating capacity largely because of technological requirements for marine operation and increased costs related to turbine foundations, balance-of-system infrastructure, interconnection, and installation (DOE & DOI, 2011). In addition, the offshore wind industry is struggling to bear the initial costs of infrastructure development, such as vessels for turbine installation, port and harbor upgrades, manufacturing facilities, and workforce training programs (DOE & DOI, 2011).

Though the offshore wind industry has been thriving for twenty years in Europe, and additionally, China has deployed offshore wind turbines, the United States has yet to place a single wind turbine offshore. Indeed, there were no firm national policies for offshore wind development until the passage of the Energy Policy Act of 2005. It took almost four years for the Department of the Interior (DOI)/Minerals Management Service (MMS) to promulgate regulations, which were almost immediately found to create unnecessary and unwarranted regulatory burdens (it takes much longer to permit an offshore wind farm than a coal plant). DOI then reorganized MMS in 2009 after the Deepwater Horizon disaster, creating BOEMRE (which will soon be reorganized again as BOEM). The problems with offshore wind regulation led DOI to launch its “Smart from the Start” Initiative in 2010, which is focused on streamlining permitting, improving transmission accessibility, and establishing wind energy areas (WEAs) (BOEMRE, 2010). With no installed offshore wind turbine facilities in the US and regulatory delay, a stigma for investment has arisen.

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- **Will the enactment of a CES be sufficient for each technology to overcome its individual challenges?**

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No. Although a CES will be of great help and will facilitate development of offshore wind, for offshore wind to reach its full potential, there are a number of additional steps that Congress should take. These actions fall into four categories: (i) fiscal/tax policy in the near-term to level the playing field; (ii) amendments to the regulatory regime to recognize the differences between offshore wind and offshore oil and gas; (iii) increased research and development funding to lower capital costs and incentivize U.S. manufacturing in the middle-term (10-15 years); and (iv) policies to internalize presently unquantified externalities.
Question 6. Are there policies that should be considered to complement a CES? 
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- Are there specific supporting policy options that should be considered for coal, nuclear, natural gas, renewable energy, and efficiency?

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Yes. First, Congress should amend the Energy Policy Act of 2005 and (a) recognize that electric markets differ from oil and gas markets, and thus eliminate the competition requirement and instead recognize competition for new generation by states, state public utility commissions and end-users such as regulated and municipal utilities; (b) decrease the royalty payments for offshore wind facilities constructed prior to a date certain such as 2020; (c) modify section 8(g) so that revenues are shared with the states for projects that are placed further than six nautical miles from the shore; a more appropriate distance would be between 12 and 20 nautical miles, based on visual effects; (d) clarify that only one site-specific NEPA analysis is required; and (e) place more emphasis on science-based study of the environmental effects of post-constructed wind projects and less on pre-study.

Second, as a capital-intensive endeavor with no fuel costs, finding ways to lower capital costs of offshore wind and incentivizing long-term contracts are key. In the near-term (through 2020), in ascending order of importance, the most beneficial investments are treasury grants, investment tax credit (ITC), and production tax credits (Levitt, et al., n.d.). A 30% initial capital contribution is better for offshore wind development because it can offset the large up-front capital costs. As an uninitiated U.S. industry, offshore wind faces significant uncertainty regarding future production and future profits. Because the national economy has not yet fully rebounded, and the offshore wind industry is still in the US starting blocks, tax credits can be difficult to forecast and do not create the same incentive for investors (ibid). To lower capital costs, we thus strongly support the Treasury Grant program for offshore wind, and secondarily the ITC. The Treasury Grant program and ITC were extremely successful in incentivizing land-based wind. Because of the much longer lead times for offshore wind than land-based wind and the length of time it has taken the federal government to implement the Energy Policy Act, offshore wind has been able to take advantage of these programs. A Treasury Grant/ITC for offshore wind that runs until 2020 would thus place it on a level playing ground with other technologies (it is worth noting that nuclear has a PTC that lasts beyond 2020).

Another important way to lower capital costs is to extend the federal loan guarantee program for offshore wind generation. Loan guarantee programs can be especially important policy drivers in lowering the cost of energy from capital-intensive technologies such as offshore wind. Given that offshore wind has little downside risk—that is, it does not present the risk of catastrophic failure, a loan guarantee program is a win-win-win—enhancing the prospects of development, benefiting consumers through lower prices and cleaner air, and placing virtually no risk on federal taxpayers.
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To facilitate long-term contracts, a feed-in-tariff (FIT), is appropriate. FITs are technology-specific per-kWh rates that oblige regulated utilities to purchase electricity from generators of specified technologies. FITs ensure that developers are being paid a fair price while at the same time ensuring that consumers are not providing a developer with a windfall. FITs have been shown to be the most important drivers of wind energy development in the Europe. FITs will simplify the purchase process, provide revenue certainty to generators, and reduce the cost of financing generating projects (NREL, 2010).

Alternatively, Congress should consider designing the CES, along the lines of what Delaware has done providing set-asides for certain technologies and providing technology-specific credit multipliers as Delaware has done (the UK, which has the most offshore wind generation in the world, uses this approach).

Third, Congress should increase the Department of Energy’s (DOE) research and development budget and provide more funds for training and educating the next generation of energy professionals. R&D will go a long way toward lowering the levelized cost of offshore wind energy. An important component of R&D is the establishment of one or more offshore wind turbine test sites, which will incentivize new wind turbine designs. These actions will help drive down capital costs and facilitate offshore wind becoming cost competitive with fossil fuels in the middle-term (10-15 years). Following the examples of turbine test sites in the U.S. (e.g., at the National Wind Technology Center in Boulder) on land and in Europe offshore, test site development should stimulate manufacturing, port development and ship building. Federal government support for offshore wind turbine test site development will be a wise down-payment for high-paying jobs and economic development in the United States.

Finally, Congress should price externalities such as carbon emissions either through a tax or the establishment of tradable permits programs.
