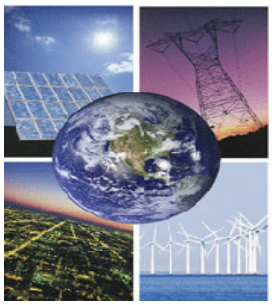

The Role of Transmission in the Clean Energy Economy

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EXECUTIVE SUMMARY

There are varying visions for how transmission should be built to support the expansion of renewable energy in America. The concept of a transmission superhighway is promoted as supporting the development of renewable energy and is touted as being green, efficient and cost-effective. This paper demonstrates that a national transmission superhighway actually can impede renewable development, while yielding expensive and inefficient transmission expansion.

Under this approach, the federal government would plan transmission lines, invoke eminent domain authority to site them, and socialize their cost among a broad group of ratepayers.
A national transmission build-out would cause more expensive projects to be built, enable coal plants to run more often, and hurt local efforts to promote renewable

generation. It also would create a new national bureaucracy and have a chilling effect on the development of new renewable projects while transmission routes are planned and built.

There are more effective and efficient ways to promote renewable energy at a national level, such as placing a price on carbon, establishing a national Renewable Electricity Standard (RES), and offering tax incentives for renewable generation. Policymakers and stakeholders should work together to improve the effectiveness of our existing regional transmission planning systems so that all potential solutions can compete to meet the energy needs of our society.

Introduction

Renewable energy must play an important role in America's energy future. It is beneficial to our national security, can create and sustain a new green manufacturing sector, and is one of our strongest tools to lower greenhouse gas emissions.

An emerging issue is what role electric transmission should play in delivering renewable energy. Transmission is part of the solution for unleashing the potential of renewable power, but it is not a "silver bullet." Questions of how much, where to build, and who should pay for it must be carefully considered. There are two competing visions on the role of transmission in supporting renewables.

The first is a "Support all Solutions" approach, in which transmission enables all renewable energy solutions at all locations to compete on an even playing field, while protecting consumers from unnecessary expense. Key elements of this approach include:

- Creating targeted renewable incentives that are technology neutral, and letting our nation's entrepreneurs determine the most innovative and cost effective solutions. For example, a tax incentive for all types of renewable energy or a penalty for emitting carbon dioxide.
- Requiring all who "plug into" the transmission grid to pay the associated costs on a technology-neutral basis, assuring that transmission investments are cost effective and that the total costs of a renewable resource is clear to both developers and customers.
- Enhancing the existing successful regional planning processes, which already take into account the unique local attributes of each region.
  This approach is the one that the U.S. House of Representatives took in the landmark 2009 American Clean Energy and Security (ACES) Act. ACES establishes a price for carbon through a cap-and-trade program and a market-based incentive for renewable generation through a Renewable Electricity Standard (RES). Many states already successfully have implemented RES requirements that have spurred significant growth in renewable generation.

The alternative vision is the "transmission superhighway" approach, under which government would select preferred renewable technologies and locations and build transmission lines to connect them to areas of high electric demand. This would require the creation of a new federal energy planning bureaucracy that would build lines from the middle of the country to the East and West coasts, where electricity use is concentrated. The federal government plan would invoke eminent domain authority to site the lines and socialize their cost among as broad a group of ratepayers as possible.

This policy approach is premised on the notion that there is a vast renewable resource – including wind in the Midwest and solar in the deserts – that is trapped and needs to get to East and West coast markets. This paper will test that premise.

Several points should be noted at the outset. First, due to a lack of a federal RES and a price on carbon, many renewable resources are undeveloped, particularly in the Midwest, where several states either do not have an RES or have relatively weak ones (Figure 1). In fact, 70 percent of all wind capacity added in the U.S. in 2008 was located in states with RES policies.1 Renewable technologies currently are more expensive than the market will bear, so they will not be developed without adequate public subsidies.

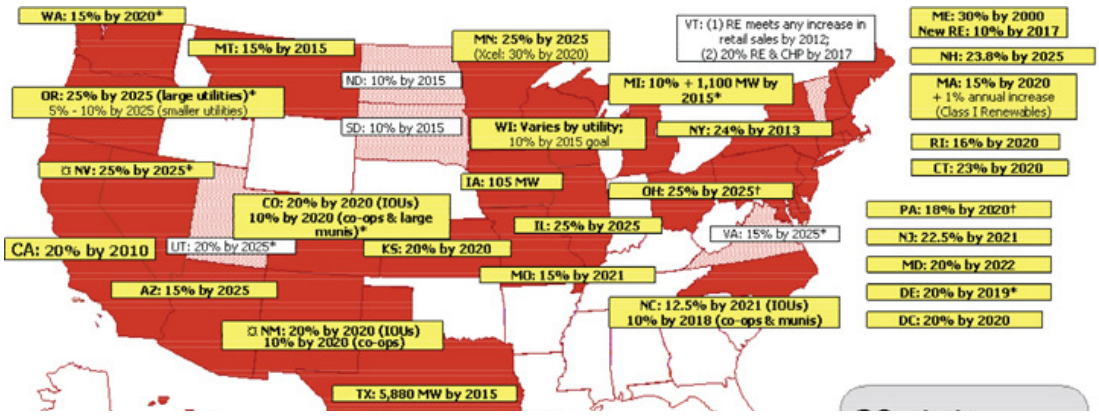

Figure 1 Source: DSIRA

Second, renewable resources, such as wind and sun, exist throughout our nation. The principal advantage of Midwest wind or desert solar is the relative intensity of the resource, which is an economic advantage for developers in those regions. That is, a wind farm that can generate electricity 40 percent of the time (also known as capacity factor) is better than a wind farm that generates electricity 30 percent of the time, all other factors being equal. But all other factors are not equal. If the wind farm operating 40 percent of the time must pay more to move its power long distances to reach a specific market, or if energy prices in that region are lower than in other regions, its economic advantage over the 30 percent wind farm may vanish.

Moreover, the notion that Midwest renewable power must be made deliverable to eastern load centers should be viewed critically. The Midwest has a fair share of load centers and industry, as evidenced by a time-elapsed photo of the U.S. at night (Figure 2), compared to the western part of the country, where there truly are long distances between load centers.

Figure 2

An approach to transmission policy that allows market participants to make fair economic comparisons and invest in the most efficient renewable technologies in the most cost-effective locations is a superior long-term solution. It does not require government to centrally plan new long-haul transmission lines, nor does it require ratepayers to bear the risk and expense of building those lines. Instead, through improved regional transmission planning and policies that send the right price signals to investors, we can promote renewables and other low-carbon energy solutions in the most efficient and cost-effective manner possible.

Background – How Power Plants Connect to the Transmission Grid Today

It is critical to understand how interconnecting new power plants to the transmission grid works today. A common misconception is that certain renewable resources are trapped by a lack of basic transmission infrastructure. But, in reality, existing processes allow any developer to build a power plant, connect to the transmission grid, and get their power to market.

If a developer wants to build a new facility today – whether it's a wind farm or a natural gas-fired plant – the critical transmission-related costs are:

1. Interconnection costs – The owner of the new power plant must pay to interconnect the facility to the existing transmission system. This typically consists of the "lead line" and other transmission equipment that physically connects the plant to the nearest transmission sub-station.
2. System upgrade costs – Under most circumstances, the owner of the new power plant must pay for upgrades to the existing transmission grid that are required to ensure that the grid can reliably deliver the new power under all operating conditions. This cost is determined from a technical analysis of the impacts of delivering power from the new plant.

The interconnection and system upgrade costs are often paid by the generators because the generator is both the cause of the upgrades and the primary beneficiary of the expenses.

But regardless of how high the cost or who pays, the common element in this approach is that the transmission upgrade is not undertaken until there is certainty that the new power plant is being built. In other words, transmission upgrades are done in response to new power supplies or an increase in power use. Alternatively, the "transmission superhighway" approach would build transmission lines before knowing how much new supply will be built or exactly where it will be built, and may even provide for a cost-free "lead line" directly to the plant. The costs of the line would be paid for by ratepayers.

Pitfalls of the "Transmission Superhighway" Approach

At first glance, the idea of building a superhighway of transmission lines to support renewable generation seems appealing. But a closer examination reveals some serious flaws that would result in many undesirable outcomes – higher costs to consumers, project delays, less technological innovation, and added cost and difficulty in reducing greenhouse gas emissions. When taken together, it is an ineffective way to support renewable energy.

The fallacy of "green" transmission – creating expanded pathways for coal-generated electricity: Advocates of the superhighway approach characterize the approach as "green transmission lines," because there may be some number of wind farms connected to the line. The laws of physics and the design of the transmission system make this simplistic characterization inaccurate. The transmission system is a very large, complex network of interconnected high-voltage power lines. As electricity is generated and put into that grid, the laws of physics alone dictate where those electrons go, regardless of the type of plant generating the power.

This physical reality results in an unintended consequence of building large superhighways of transmission lines that go far beyond delivering green power to the grid. It will provide access not just to renewable resources, but to all power plants in the surrounding region where the lines are built. For the Midwest Independent System Operator (MISO) market region, which currently generates more than 75 percent of its power from coal,2 coal plants also will gain new, additional access to eastern markets and higher prices. So, instead of Midwest renewable energy competing against Midwest coal-fueled electricity, both coal and green energy will travel along these new lines to more easterly markets and replace eastern renewables and eastern power generated with cleaner, but more expensive, natural gas, which is more prominent in the East. Greenhouse gas emission reduction targets will be more difficult to achieve, and it will put upward pressure on emission prices.

Hiding costs and encouraging expensive and inefficient solutions: Another serious flaw in the superhighway approach is the market impact of socializing the cost of transmission. The cost allocation methodology that assigns interconnection and upgrade costs to power suppliers ensures that the transmission built is only what is necessary for new suppliers to reliably deliver energy to the transmission grid. However, once that cost burden is shifted entirely onto captive consumers, that self-imposed cost control is removed. Transmission projects may be proposed with little, if any, economic justification.

The impact of transmission on the total cost of a renewable energy resource can be significant. A recent study by Lawrence Berkeley National Laboratory, conducted with funding from the Department of Energy3, looked at the cost of 40 transmission projects undertaken to support the interconnection of renewable energy. The unit cost of transmission for these projects varied from $0/MWh to $79/MWh. This variability is much greater than the variability of wind projects based on the amount of time each can generate power; a Midwestern wind farm that generates power 40 percent of the time may cost around $60/MWh, while an eastern wind farm that generates power 30 percent of the time may cost $86/MWh, a difference of only $26/MWh. (Figure 3)

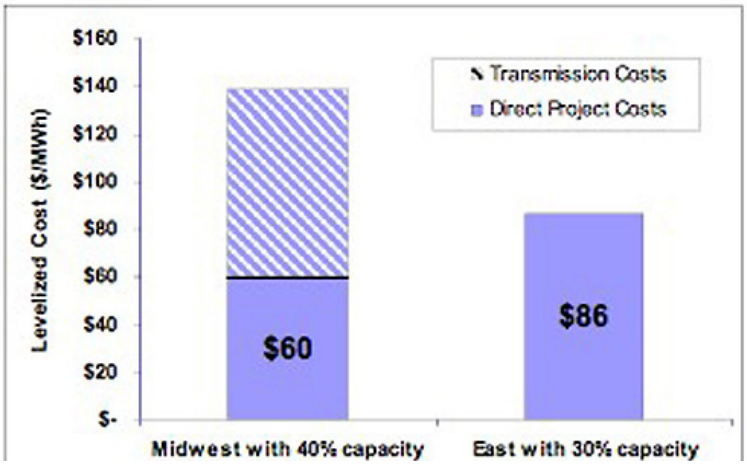

Figure 3

So, depending on the transmission cost, even the best resource areas ultimately can become very expensive. As an example, a somewhat typical, large project in PJM4, a 350 MW wind farm requires just under $3 million in transmission upgrades to interconnect to the grid. The transmission cost that this project needs to recover is about $0.50/MWh.

And under current PJM interconnection rules, the wind farm owner, not customers, is responsible for the interconnection costs. But under the superhighway approach, renewable developers in PJM (or New York or New England) could be put at a severe competitive disadvantage to Midwest developers, even though their total cost may be much lower.

Disadvantaging local renewable solutions: Subsidizing Midwest renewable resources would result in the redirection of investment funding away from eastern regional resources, and would deter green economic development in those regions. Due to the potential regional impacts on eastern renewable markets, 10 governors from the Northeast and Mid-Atlantic regions recently voiced their concerns to congressional leaders.5 Among their concerns: “It would hinder our efforts to meet regional renewable energy goals with regional resources” and “It would have a negative consequence for consumers, regional energy sufficiency, and the environment.” These governors understand the economic and environmental pitfalls of the superhighway approach, and already are taking aggressive action to develop their own regional renewable resources: off-shore wind in states such as New Jersey, Delaware, Rhode Island and Massachusetts; on-shore wind in New York, New Hampshire and Maine; biomass development throughout New England; and regionally imported renewable energy from Canada’s eastern providences.

Pre-determining winners and locking out new, innovative, cost-effective renewable options: Another unintended consequence of this superhighway build-out would be the risk of “stranded assets,” which are investments that are not fully utilized but still continue to be paid for by consumers. The superhighway concept is based on the assumption that desert solar and Midwestern wind are the central solution to expanding renewable electric generation. Transmission lines would be built well in advance of the Midwestern wind farms, with the expectation that they will all, in fact, be built and the lines fully utilized. But as renewable technology evolves, it is easy to envision several alternatives:

- The cost of solar panels continues to drop at a rate that soon becomes competitive with retail electric prices.6 Within a few years, solar energy could be on par with retail energy prices on both the East and West coasts, around 15¢/kwh (Figure 4). Deployment of this locally distributed renewable energy source would reduce the need for transmission lines from remote locations.

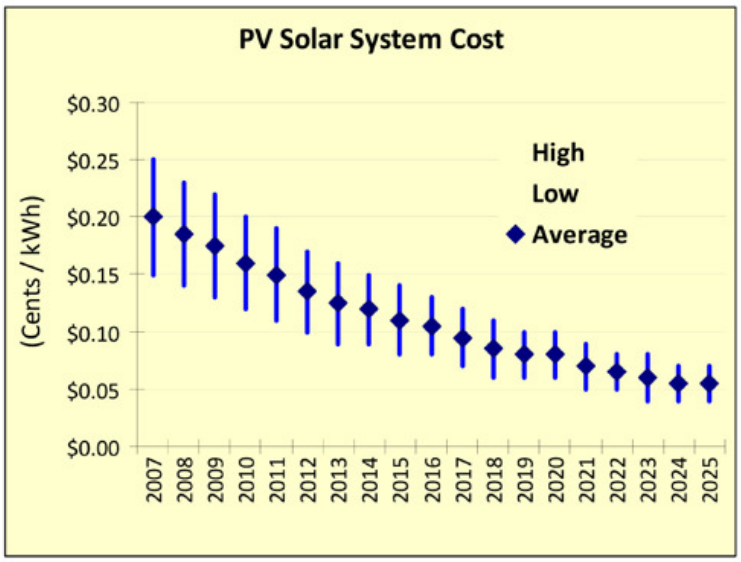

Figure 4

- Storage technologies become commercially accepted and economically viable, with the ability to “firm up” intermittent wind resources so that they can be utilized when demand is greater. This would greatly reduce the need for transmission, as off-peak wind power could be stored for use during times of higher demand.
- Advances in biomass or geothermal technology would expand the potential for locally generated, firm, renewable energy, thus reducing the need for intermittent, off-peak renewable energy. These firm sources of renewable energy can deliver two to three

times the amount of clean energy for each megawatt of capacity installed.

The superhighway approach puts these alternate solutions, all of which require minimal transmission, at a competitive disadvantage to Midwest wind resources. Developers of more cost-effective innovations could find it tougher to find investors under this approach.

Uncertainty during planning, siting and building – stopping development in its tracks: Advocates of the superhighway approach have argued that a new "top down" renewable transmission planning authority is necessary to get new resources developed and operating. But a new layer of government transmission planning may easily result in more delays, rather than acceleration, of renewable development.

From the viewpoint of a renewable resource developer, projects in early development right now almost certainly will be put on hold waiting for the outcome of the renewable transmission planning process. Where developers currently have clear rules on interconnection costs and can determine their own economics, the new process holds out the potential of the "gold ring" of fully funded interconnections and upgrades. No developer will spend investment capital on interconnecting his site if he can wait and see if the transmission planners decide to build a line in proximity to their project. Additionally, once selected, project developers will need to wait for these large, multi-state lines to be completed to interconnect with them. These lines likely will take four to eight years to go into operation. As time goes by, it is likely that the only renewable resources that are developed will be ones in proximity to renewable transmission lines, regardless of the economics of the project, simply because all will wait for the free interconnection.

From the viewpoint of the regional transmission planners, this new layer of planning adds complexity, not certainty, to the process. Currently, regional planners must ensure above all that reliability is maintained as the grid is expanded. A new top layer of government planning from an entity that focuses on renewable resources, not reliability, will complicate the job of the regional planners, adding bureaucratic delays and requiring further integration of information and continual coordination with the resource planners to ensure that all goals can be met concurrently.

Transmission is not the key to wind development: With some Midwest wind resource locations being remote from customers or existing transmission lines, some wind advocates claim that requiring developers to pay for the high cost of transmission access would all but kill future wind development in the Midwest. But recent studies contradict these claims. The same Lawrence Berkeley National Laboratory study cited earlier indicated that the cost of transmission access is not an "overwhelming" cost driver for wind developers, consisting of about 15 percent of the total investment cost of a project. The report also suggests that the unit cost of transmission need not increase dramatically at higher levels of wind penetration.

Expanding FERC's role beyond reliability: The superhighway approach changes what has been a primary focus of the Federal Energy Regulatory Commission (FERC), maintaining the reliability of the grid, and puts it into the unfamiliar and uncertain new role of deciding what types of power plants to build, and where and when to build them. This is a profound increase in the level of federal intervention into the energy sector. Where FERC once championed competitive markets as the most effective way to ensure adequate and least-cost energy to consumers, under the superhighway proposal, they would instead attempt to decide which supply resources, in which regions, should get preferential treatment in accessing the grid.

Strengths of the Support All Solutions Approach

The Support all Solutions approach can help achieve our renewable energy goals while minimizing costs and preventing the unintended consequences of the superhighway approach. There are four main components to this approach: direct incentives, enhanced regional planning, cost controls, and ensuring the reliability of the grid.

Providing more effective and efficient incentives: By establishing distinct price signals for both greenhouse gas emissions and renewable energy, market players will receive the most direct incentives needed to spur renewable development. First, putting a price on the emission of greenhouse gases through a national cap and trade system will boost investment – not only in renewable resources, but also to other innovative solutions for lowering carbon emissions.

Second, an RES is an important complement to putting a price on carbon. While a carbon price will drive investment toward the lowest-cost carbon reduction solutions, an RES will specifically require the development of a minimum amount of renewable electric generation. This obligation is usually imposed on electric utilities and/or other companies that sell power to end users (commonly referred to as Load Serving Entities or LSEs).

The strength of the RES is that it gives LSEs various competitive options on how to fulfill the renewable energy obligation, in which transmission plays a supporting role rather than a primary one. The first option is for the LSE to build its own renewable generation. The second option is to purchase the output of a renewable facility directly from a developer. And the third option is simply to purchase tradable renewable energy certificates. In whatever way this mandate is fulfilled, the transmission costs of each renewable energy solution will be considered by investors, which means investment will

renewable energy solution will be considered by investors, which means investment will be driven toward the most cost-effective renewable technologies in the most cost-effective locations.

Finally, if a price on carbon and an RES are not adequate to move the market, further targeted tax incentives such as a continuation of Production Tax Credit (PTC) or Investment Tax Credit (ITC) should be used to facilitate renewable energy development.

The direct incentives approach also helps limit cost risks to consumers. The incentives only are paid to projects after they are completed, so consumers pay only for successful, operating projects. Consumers will not pay for poor investment decisions, nor will they inadvertently support investments that may work against the policy goals for which they are intended.

Enhanced regional transmission planning: Transmission planning is a critical and complex component of our nation's energy infrastructure. It requires an accurate assessment of both current and likely future conditions and the reliability of our grid is dependent upon its success. There has been much discussion about the need to overhaul the current transmission planning paradigm; to broaden its scope and refocus its goals. It is important to first evaluate what is working and what is not, rather than starting from scratch. We should build on established, successful regional planning principles rather than replace or encumber the existing planning process with a new bureaucracy.

FERC already has demonstrated that it has the willingness and tools to adapt current planning processes where appropriate and necessary to promote renewable generation, while still protecting consumers from overpaying for transmission. An example of this is Tehachapi project. The Tehachapi Mountain region in California (Figure 5) has plentiful wind resources, but is located more than 100 miles from Los Angeles in a remote area that lacks transmission infrastructure.

Developers seeking to take advantage of this wind resource faced significant costs to bring the energy to market.

Figure 5

Under California generator interconnection rules, generators of any type are required to pay for the facilities to interconnect their projects to the grid and to make their output deliverable, which for this region would have been significant because of the need for extensive transmission to the area.

Yet, despite California's long-standing commitment to renewable development, local authorities determined that it was not reasonable to saddle customers with all of the interconnection costs.

In cooperation with the local utilities and the state of California, FERC approved a process that fixed the problem for both customers and the wind developers. FERC authorized the California transmission owners to build the amount of transmission that was reasonably necessary, which was to be defined by a study, to enable the Tehachapi region to be fully developed. The transmission will be built and initially financed by customers, but generators who build in the Tehachapi region are required to reimburse customers for the transmission over time once they have gone on-line.

If the region is fully developed, the transmission customers will have acted to finance, but will not ultimately be responsible for the cost of the transmission into this region. In the end, FERC fashioned a creative, but cost-effective, solution that is helping renewables get built, while giving some protection to consumers. This solution represents a shared cost risk between customers and developers; if the region is not fully developed, customers could be responsible for any excess transmission capacity. But this solution demonstrates how FERC can use its existing authority to craft transmission solutions without having to overhaul the transmission planning process.

Limiting costs for consumers: The Support all Solutions approach does not seek to shift the burden of transmission costs entirely onto the shoulders of consumers. Currently, most regions operated by independent system operators require competitive developers of any type of power plant to pay part, or all, of the costs to interconnect their facility to the transmission grid. In simpler terms, developers must take into account the cost of moving the energy from their plant to the consumer, just as any other manufacturer must do, and it also provides a clear and complete price signal to customers who may wish to purchase that power. This non-discriminatory model helps to ensure that consumers can make fair comparisons for buying power and do not overpay for transmission service.

This model also helps to ensure that the most cost-effective transmission upgrades are made when new power plants are added to a region. Developers generally only want

to be assured that they can reliably deliver energy to the grid and compete fairly on price. On rare occasions, a plant owner may want to ensure that its power is deliverable to a specific point, such as a specific city or another part of the country. In such cases, the plant owner must pay an additional charge for that access. It is the owner's decision to weigh that cost against the additional revenue received.

In the Midwest, customers have begun to push back on cost allocation methodologies that are not aligned with benefits. The Midwest Independent System Operator recently has proposed a change to its generator interconnection policies that, if approved, would require power plant developers to pay for at least 90 percent of the interconnection costs of their projects. The current cost allocation formula, which requires local customers to pay for 50 percent of the interconnection costs, simply is becoming too expensive for customers to shoulder. Few of them are buying the wind power being generated in their region, but they are paying for the transmission to have that power shipped to others.

What else is needed?: The Support all Solutions approach builds on the many strengths of existing transmission planning principles and laws designed to move the nation toward a greener energy industry. But to fully and cost-effectively utilize the transmission system in achieving our renewable energy goals, several improvements are needed:

- Existing regional transmission planning is not perfect. Rather than allowing each region to conduct its planning process independently using its own timeline, the regional planning processes should include a mandatory coordination phase to allow the planners in the contiguous regions to work together and identify efficiencies across their separate plans.
- Strong and consistent "green" price signals will give renewable developers the confidence and stability they need to commit long-term investment capital to renewable generation. Stable renewable energy certificate prices and carbon prices and long-term renewable tax incentives all will support the market.
- There currently is a patchwork of cost allocation methodologies throughout the nation, many of which are bogged down in litigation. Consistent and certain cost allocation principles will break through the log jam and give all stakeholders the information they need to make informed decisions regarding renewable energy development. Principles should be based upon the idea that all beneficiaries (both customers and renewable resource developers) should pay for transmission lines that benefit them.

In Summary

It is critical for Congress to get the transmission issue right. The distinctions between the alternate approaches to transmission policy are stark. The superhighway approach would cost billions of dollars of ratepayers' money to provide for incentives to specific renewable resources in specific locations, resulting in many unintended consequences. These inefficient incentives will distort the energy market. The Support all Solutions approach leverages the existing strengths of our transmission grid and entrepreneurial economy. It pays for success on a level competitive playing field, while improving upon well-functioning transmission planning regimes. And it maintains the best role for transmission: that of the enabler of innovative solutions rather than the arbiter of them.

What's your view? Please let us know at Opinion@PSEG.com.

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End Notes

[1]DOE/LLBL 2008 Wind Technologies Market Report, page 44.

[2]State of the Market report 2008, Midwest ISO.

[3]LBNL-1471E "The Cost of Transmission for Wind Energy: A Review of Transmission Planning Studies", February 2009.

[4]PJM project is the Fowler Ridge project, Q01, a 350 MW wind farm.

[5]Letter from the governors of Massachusetts, Rhode Island, Delaware, Maine, Maryland, New Hampshire, New Jersey, New York, Vermont and Virginia, dated May 4, 2009 to Senators Reid and McConnell, Speaker Pelosi and Representative Boehner.

[6]Data taken from Clean Edge report "Utility Solar Assessment Study" 2008.