FINANCIAL INNOVATIONS FOR ENERGY INFRASTRUCTURE

The Grid, Renewables and Beyond

Milken Institute

February 2010

Financial Innovations Labs bring together researchers, policymakers, and business, financial, and professional practitioners for a series of meetings to create market-based solutions to business and public policy challenges. Using real and simulated case studies, Lab participants consider and design alternative capital structures and then apply appropriate financial technologies to them.

This Financial Innovations Lab Report was prepared by Joel Kurtzman, Laura Segafredo, and Brian Vo.

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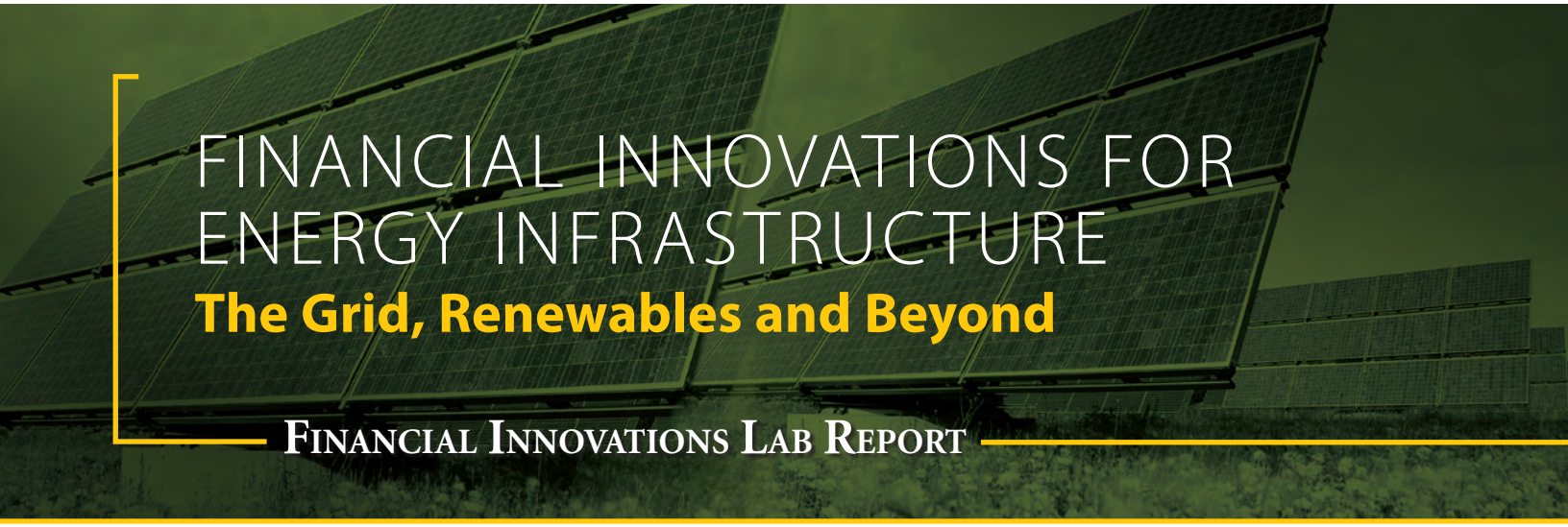

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Financial Innovations Lab Report

Acknowledgments

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The Milken Institute is an independent economic think tank whose mission is to improve the lives and economic conditions of diverse populations in the United States and around the world by helping business and public policy leaders identify and implement innovative ideas for creating broad-based prosperity. We put research to work with the goal of revitalizing regions and finding new ways to generate capital for people with original ideas.

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Upgrading the grid is required for the increased transmission needs of the future. Who will pay for this major undertaking? How will they pay for it?

Introduction

Renewable energies, especially wind and solar, present major generation and consumption challenges because they are most concentrated in areas that are far from the country's population centers.

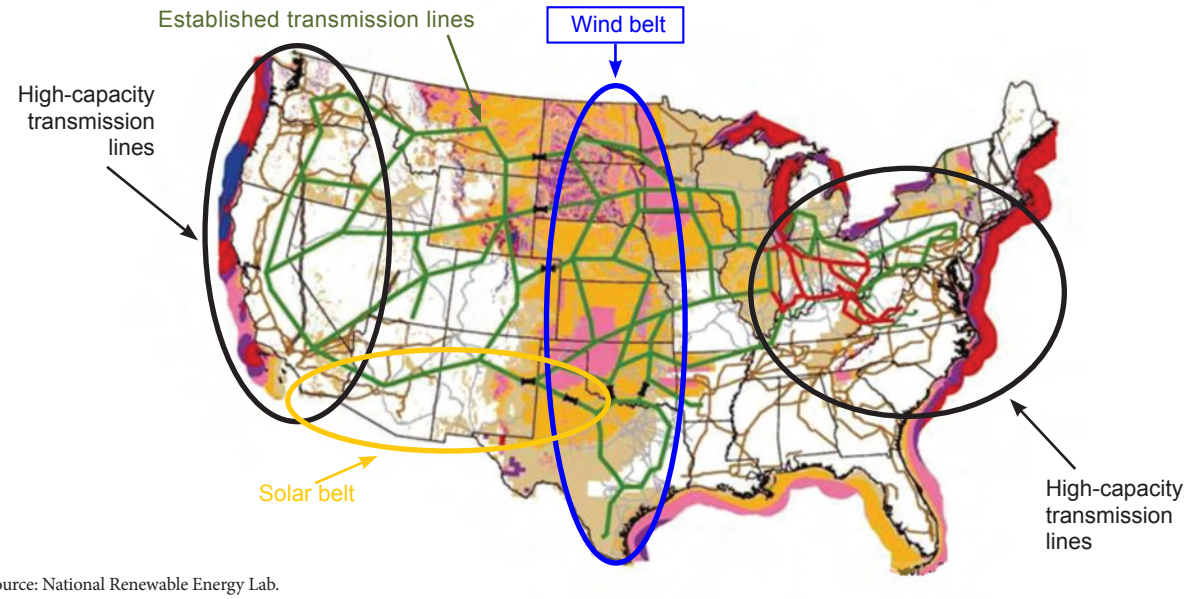
The so-called "wind belt" extends from northern Texas through North Dakota. The solar energy "belt" is concentrated in the deserts of the Southwest. Although there are many other areas with plentiful solar and wind supply, including offshore locations and parts of the East Coast, the greatest concentration of wind and solar power resides in these two belts. In fact, the United States has been called the "Saudi Arabia of wind" because of the corridor from Texas to North Dakota.

Moving that power from the solar and wind belts to the nation's population centers is no easy task. It requires investing in solar and wind farms to harvest the energy and transmitting that energy to where it is needed. To accommodate the high levels of energy that must be transmitted intermittently due to the national day-and-night cycle, weather patterns, and cloud formations, the United States needs to construct a new network of transmission wires, cables, interchanges, computer monitoring and routing protocols, and towers—the components that make up the electric grid.

The intermittency of supply means a new grid must have the ability to either store energy or add supply from conventional sources during peak periods and at other times when warranted.

FIGURE 1

Renewable energy sources require more transmission



Source: National Renewable Energy Lab.

In the short- to mid-term, the nation is likely to draw on several sources, including conventional and renewable supplies, as it moves toward the goals of reducing emissions, improving reliability, and accommodating economic growth, population growth, and wider geographic dispersal. Household and commercial needs aside, even the future of transportation hinges on an updated grid if electric vehicles are to be widely adopted. The nation's energy future depends on investing not only in today's grid, which relies on dated technologies and design, but also in tomorrow's "smart" grid technology.

This next-generation system of interlinked transmission wires, for example, must be capable of moving electricity over hundreds or even thousands of miles. This requires careful monitoring of usage and flow. But new technology can also interact intelligently with the consumer—perhaps switching on and off appliances or heating and cooling systems—to manage the grid's overall load in a manner that is sensitive to needs and price. In addition, new innovations can send more than electricity over the wires. Using sophisticated "multiplexing" technology, the grid can also transmit content. This content can be simple Internet-linked information that alerts a consumer when his washing machine has finished a load or when his oven is done cooking dinner. But it can also be sophisticated content, such as entertainment, information, and data.

As bold and important as these programs are, there are major hurdles to overcome. Upgrading the grid is required for the increased transmission needs of the future. Who will pay for this major undertaking? How will they pay for it? And what financial tools are available to make certain this transformation is timely and sufficient? This was the subject of a Milken Institute Financial Innovations Lab conducted in March 2009. The Laboratory was jointly developed and funded by the Milken Institute and the Office of Energy Policy and New Uses at the U.S. Department of Agriculture.

The American Recovery and Reinvestment Act of 2009 (ARRA) is a dramatic step toward reversing 25 years of declining investment in the grid. The ARRA made $11 billion available for modernizing the grid, including $4.5 billion for smart grid demonstration projects, and gave borrowing authority of $3.25 billion each to the Bonneville Power Administration and Western Area Power Administration to finance the construction of new transmission lines.[1]

The ARRA sent a powerful message that the direction of U.S. transmission policy is changing, a message that was buttressed by President Obama's announcement on October 27, 2009, that $3.4 billion of the ARRA money would be distributed to 100 companies in 49 states in amounts ranging from $400,000 to $200 million and will be matched by $4.7 billion in industry funding.[2] This indicates that, while the ARRA money will not fund the complete restructuring of the nation's grid, it can act as a signal of security to the private sector. The private sector has stepped up to the plate, raising the possibility that the United States will upgrade the grid through the joint efforts of public and private actors.

How Much Will It Cost?

Estimates of the cost of overhauling the grid or its parts vary widely.

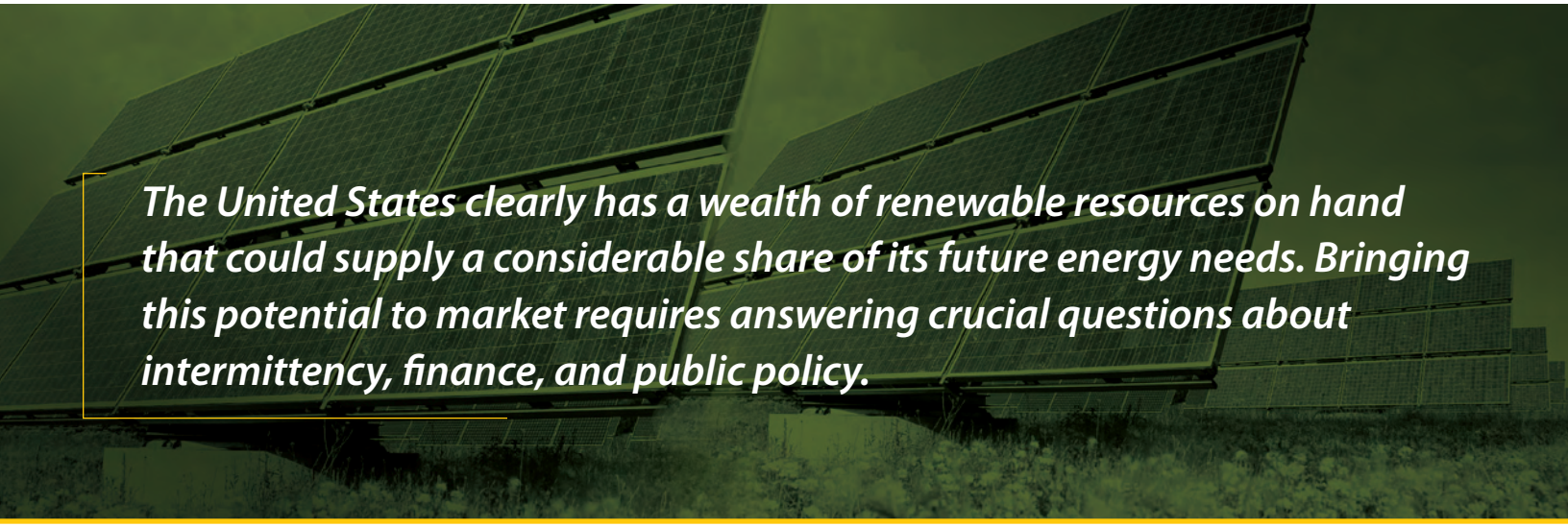
- The Edison Electric Institute, a power industry association, has estimated it would cost $65 billion to upgrade all investor-owned, federally owned and locally owned utilities over 10 to 20 years.[3] Note that this figure includes only utilities, not transmission.
- Former Vice President Al Gore has estimated that creating a unified national smart grid would cost $400 billion over 10 years.[4]
- The Brattle Group has estimated that modernizing the grid would cost $880 billion, including $298 billion for transmission and $582 billion for distribution, by 2030.[5]

The Milken Institute's Role

The cost estimates of overhauling the grid vary widely, but they make it clear that the $11 billion allocated under the ARRA will not get the job done. The investment must be leveraged creatively to provide sufficient capital to upgrade today's grid and develop tomorrow's.

It is the Milken Institute's perspective that upgrading the grid can be accomplished if policy and financial goals are aligned and addressed in tandem. On one hand, the nation's grid policies must be clearly stated and designed for the long term. On the other, the investment and financial communities must see in those policies the opportunity to deploy capital profitably over the long haul.

To explore strategies for policy and investment alignment, the Milken Institute Financial Innovations Lab in March 2009 convened a diverse group of experts in Washington, D.C., including economists, authorities on energy policy, utility operators (privately owned and cooperatives), investors, real estate developers, regulators, representatives from technology and infrastructure companies, researchers, and scholars. Preceded by extensive research and preparation, the daylong discussions were followed by an analysis and synthesis of what took place.



The United States clearly has a wealth of renewable resources on hand that could supply a considerable share of its future energy needs. Bringing this potential to market requires answering crucial questions about intermittency, finance, and public policy.

Part I:

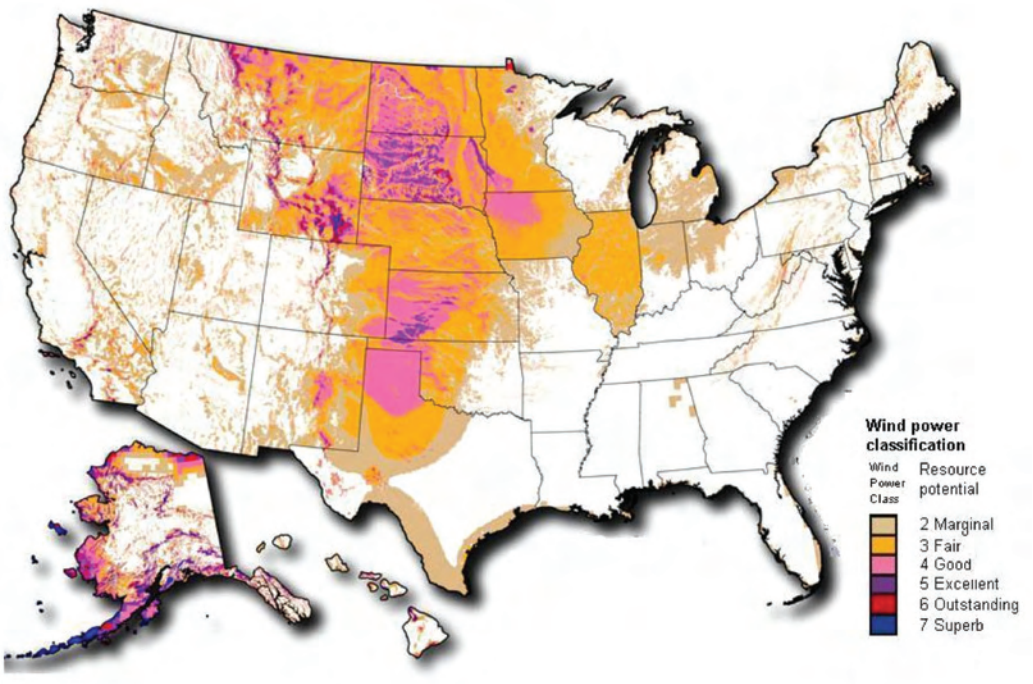
Issues & Perspective

President Obama's administration and Congress support increasing the share of energy derived from renewable sources such as wind, solar, biomass, and geothermal. The administration's goal is for renewable energies to make up 10 percent of total production by 2012 and 25 percent by 2025.[6] The Senate Committee on Energy and Natural Resources cleared a bill in June that would set a national requirement of 15 percent between 2021 and 2039, with some caveats.[7]

Wind power has proven appealing to policymakers and investors alike. A Department of Energy study concluded that wind could provide as much as 20 percent of U.S. electricity generation by 2030[8] with sufficient investment and the right policies in place. As of the writing of this report, an estimated 1.6 percent of U.S. electricity production came from wind power in 2009.[9] The American Wind Energy Association (AWEA) reported that installed wind capacity had reached 31,109 megawatts (MW) in the United States as of June 27, 2009, with construction of new wind capacity in 2007 and 2008 at historically high levels. However, the AWEA also reported that grid transmission capacity was not sufficient to fully utilize the wind power now being developed.[10]

FIGURE 2

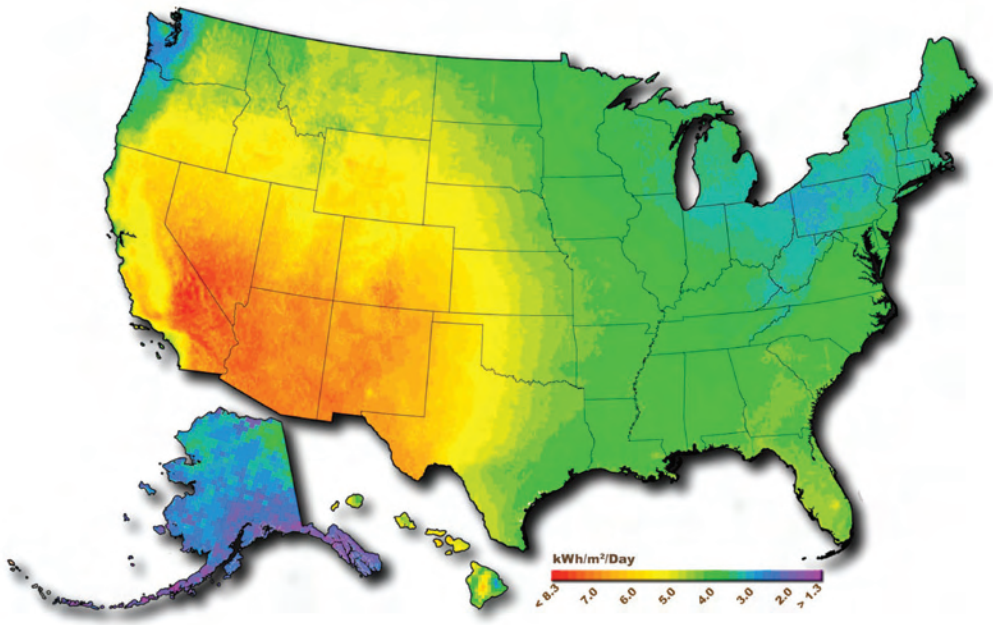
Wind belt wraps around the Midwest



Source: National Renewable Energy Laboratory.

FIGURE 3

Southwest has best solar resources



Source: National Renewable Energy Laboratory.

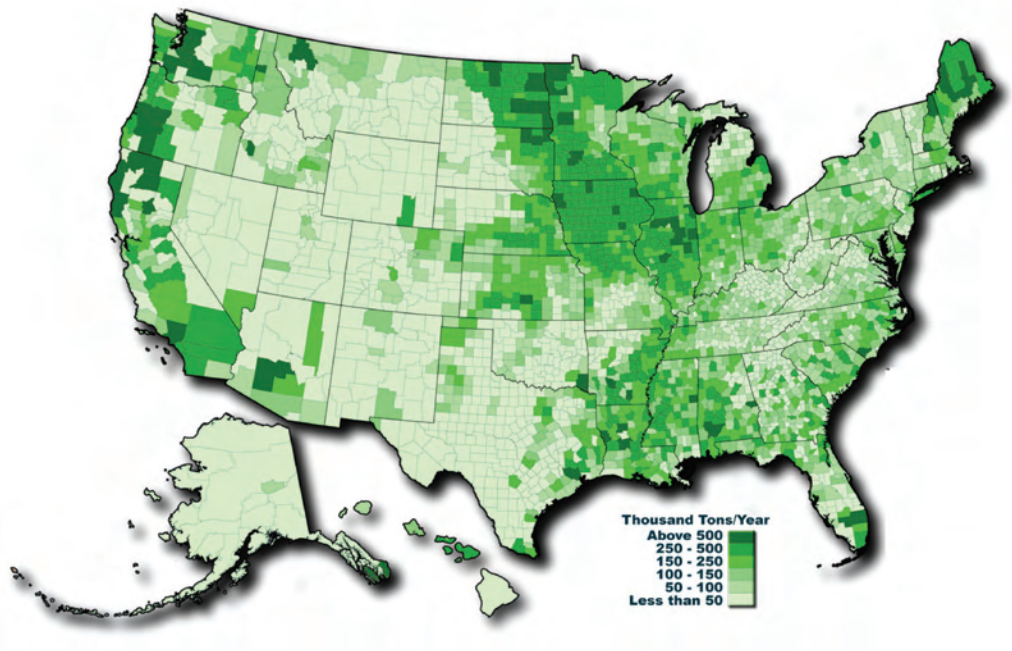
Solar power has also captured the market's attention, attracting $29.6 billion in investment worldwide in 2008,[11] encouraging new competition in upstream markets, and lowering costs for consumers. The price of polysilicon, a key component of solar photovoltaics (PV), fell roughly 30 percent in 2009 due to increased manufacturing capacity and oversupply as new suppliers ramped up production to meet demand.[12]

Anaerobic digestion, the process of turning manure into methane, represents a unique opportunity for livestock farmers. According to Lab participant William Lazarus, a professor at the University of Minnesota, these operations in the United States currently have enough capacity to generate 35 MW of electricity, compared with total U.S. electrical generating capacity of 1.07 million MW. There is potential for growth—the AgSTAR program has estimated that 6,500 large dairy and swine operations could operate profitable biogas systems and provide 802 MW of power[13]—but it still represents a tiny portion of total generation.

Biomass and geothermal technologies have not spurred the level of interest or growth that solar and wind energy have. However, Lab participants said that significant advances have been made in both fields and that both would grow in importance as energy sources in the next several decades.

FIGURE 4

Biomass resources are readily available



Source: National Renewable Energy Laboratory.

"There's a lot more that has to be done than just adding information technology and calling it a smart grid."

Juan Torres, Sandia National Laboratories

The United States clearly has a wealth of renewable resources on hand that could supply a considerable share of its future energy needs. Bringing this potential to market requires answering crucial questions about intermittency, finance, and public policy.

Energy Storage and Smart-Grid Technology

Two technological responses to the issue of intermittency explored at the Lab were increasing energy storage and implementing the smart grid.

Juan Torres, manager of energy systems analysis at Sandia National Laboratories, explained that increased energy storage is the key to better systemwide asset utilization, enhanced reliability, and reduced emissions. The Department of Energy has projects under way in this area, using ultracapacitors, flywheels, and batteries as energy-storage technology. The challenge is that energy storage must comply with the rules of the grid; it must maintain a 60 Hz frequency and have enough capacity to satisfy the loads in case of energy loss on another part of the grid. If storage technologies can meet these requirements, renewable energy could be transformed from an intermittent source into a better-controlled source—but reaching that goal will be expensive.

Torres also covered the opportunities and challenges of implementing a "smart grid." Proponents of smart-grid technology claim that adding computing and communication power to the transmission system will increase its reliability, improve its efficiency, make it less expensive, reduce electricity loss, and enable the grid to accommodate a blend of renewable and conventional sources. As a result, a smart grid would reduce the nation's carbon footprint in a cost-effective way.[14] But Torres was clear about the magnitude of the task: "There's a lot more that has to be done than just adding information technology and calling it a smart grid." A functional smart grid would require not only information technology, such as energy metering in homes, but also new software and management for additional transmission, distribution, and storage

The Finance Challenge

Carol Werner, executive director of the Environmental and Energy Study Institute, laid out the challenges of financing wind projects and, by extension, renewable energy. To finance community wind projects, significant predevelopment and capital costs are incurred up front. Once they are built, however, such projects have low operating expenses. Recent wind projects have been heavily dependent on equity investors to get off the ground, but equity investing activity has dried up in the economic downturn.

Various solutions to the financing challenge were presented by Lab participants. Richard Pietrafesa, managing director of Destiny USA, described how his group financed a development in Syracuse by taking advantage of green bonds, a "payments in lieu of property taxes" program, and other incentives. Nancy Pfund, managing partner of DBL Investors, described the process of securing loan guarantees. These solutions will be explored further in Part II of this report.

Public Policy Hurdles

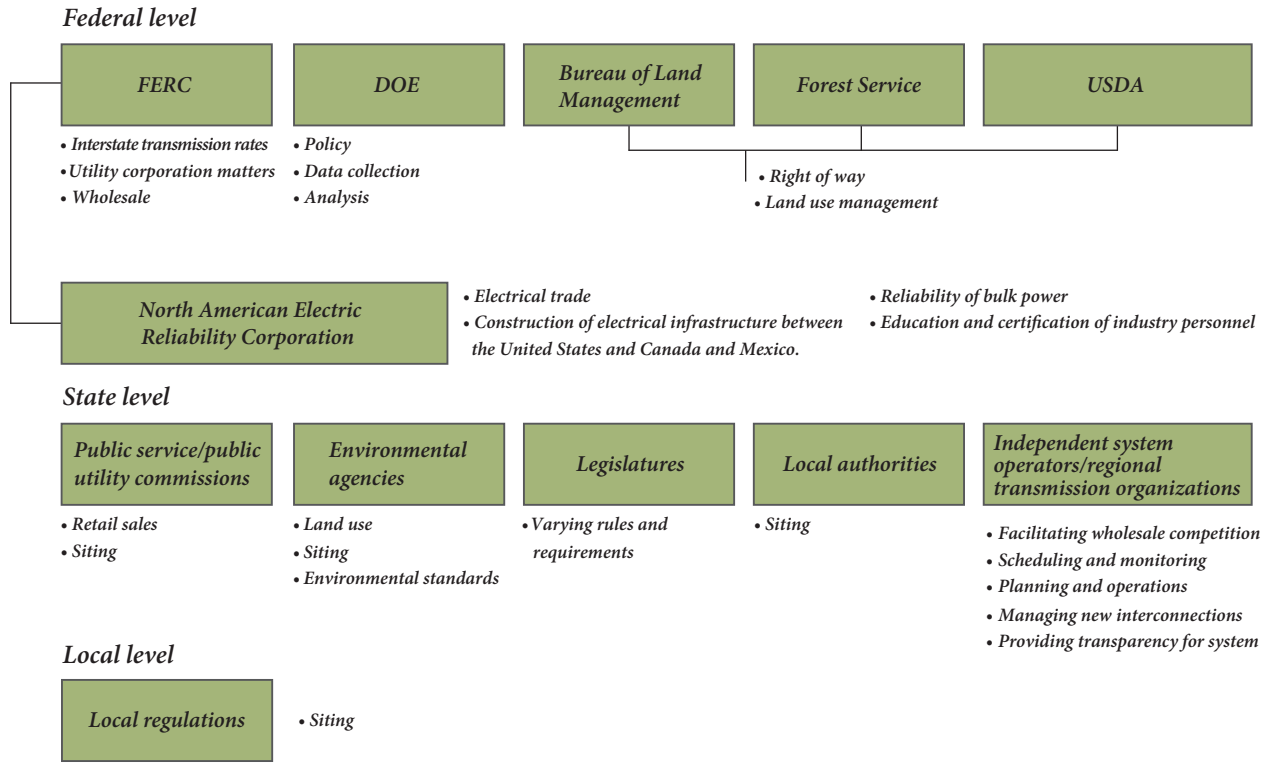
The current institutional framework of electricity regulation is a deterrent to private investing. There are more than 135 regulators of electric transmission, including federal, regional, state, and municipal officials. It is a risk for an investor to get involved in transmission projects, given the many varied regulatory agencies that could put up roadblocks.

Furthermore, in the deployment of various incentives, public policy has sent confusing and even contradictory messages to firms investing in renewable energy projects. For example, before the ARRA, renewable energy production tax credits (PTC) and renewable energy production incentives (REPI) were renewed on an annual basis, reducing the ability of investors to make meaningful judgments regarding how long these benefits would last and, as a result, increasing investors' risk. With the passage of the ARRA, renewable energy providers have been given a clearer view of future regulations: REPI benefits were allocated

The current institutional framework of electricity regulation is a deterrent to private investing. There are more than 135 regulators of electric transmission, including federal, regional, state, and municipal officials.

FIGURE 5

Who regulates wholesale and retail transmission?



Sources: Milken Institute.

through 2026,[15] PTCs for wind were extended by three years, and the Solar Investment Tax Credit was extended for eight years.[16]

At the Lab, Richard O'Neill, chief economic adviser with the Federal Energy Regulatory Commission (FERC), explained some of the inefficiencies of energy regulation. For one, "people get incentivized to do things they want to do anyway," he said. O'Neill described how an incentive for full recovery would be granted to utilities trying out a technology that would improve their return on equity—something they would have done whether or not full recovery was granted in the first place. The solution, O' Neill said, is to focus on "how [to] clear up the regulatory signals, because that's much more important than any incentive or anything else you could do."

Hunter Hunt, president of Hunt Power L.P. and Sharyland Utilities L.P., agreed with the need for a clearer regulatory model. Recounting his experience in Texas, Hunt described how working with fewer regulators has facilitated the building of transmission lines in a state where "in general, [people are] used to land rights, used to people crossing their property with gas pipelines, water. These are all things that are second nature to a lot of Texans." He agreed with O'Neill that making regulation clear and removing barriers to entry would be more effective than incentives.

The Financial Innovations Lab

The Milken Institute Financial Innovations Lab drew upon these and other observations to develop solutions for breaking the gridlock that prevents investors and policymakers from moving forward. During the Lab, teams of participants examined funding-gap scenarios and solutions for specific financial, technological, and regulatory challenges inherent in the enormous task of upgrading the nation's transmission grid.

The first panel, "Scope of the Problem: Transferring Renewable Power," gave an overview of the issues faced by renewable energy providers in transferring energy to users through an antiquated grid. Panelists discussed the lack of investment in the grid and how demand would likely affect electricity infrastructure in coming years.

The second session, "Technology Solutions Sets," illustrated technology that has the best chance of meeting the nation's future energy needs, as well as supporting infrastructure and storage. Lab participants detailed the strengths and weaknesses of solar, wind, and geothermal energies. Energy efficiency was also examined as a solution on its own.

The third session, "Financial Solutions Sets," demonstrated the ways in which investors have managed to finance renewable energy and transmission projects.

In "Regulatory Next Steps," participants discussed current laws and regulations along with ways to cut red tape. Solutions presented included a sustainability standard, taxing industry to support it, reconsidering the sheer number of regulators, and exploring the possibility of a single regulator or regulatory quarterback.

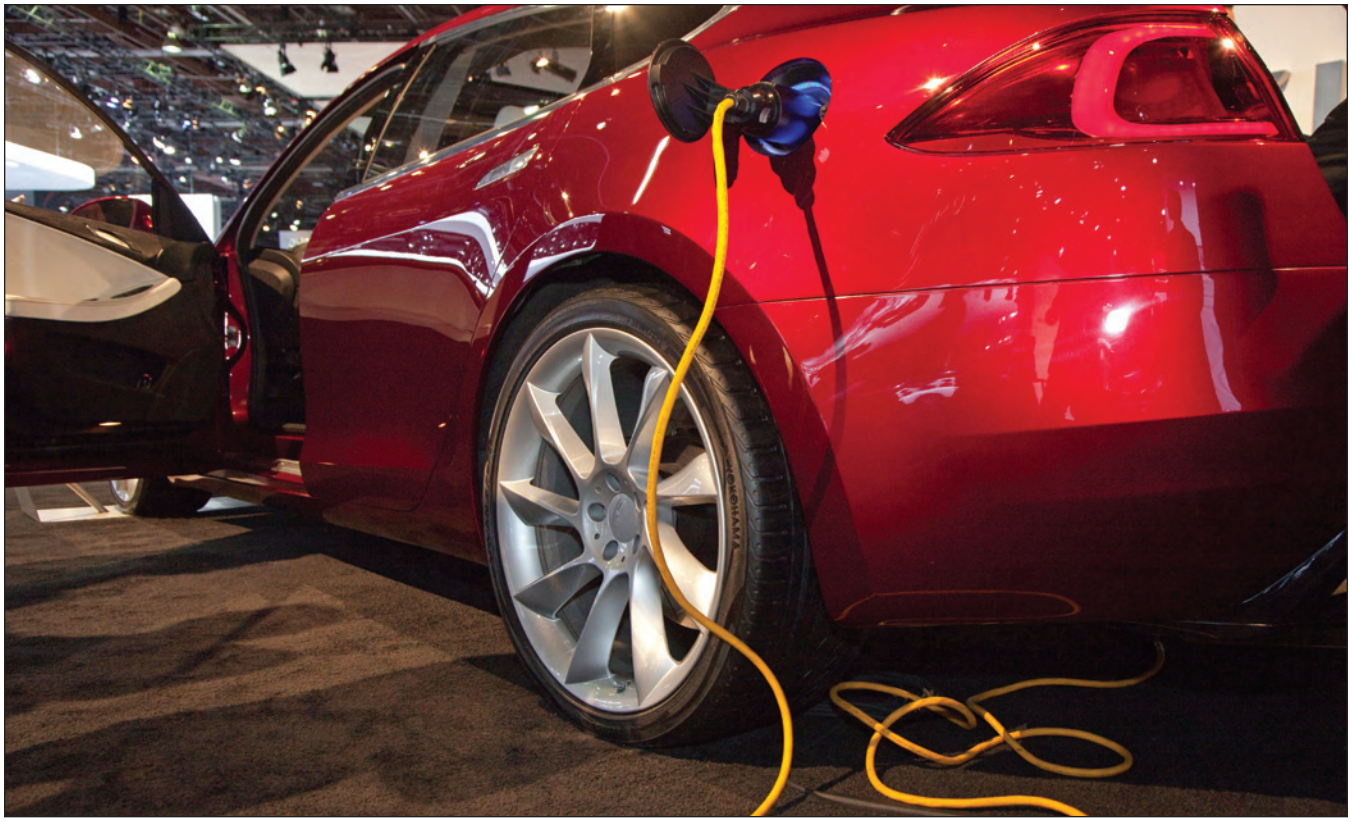
These four sessions laid considerable groundwork for solutions that could be undertaken by policymakers and financiers. Part II of this report details proposed steps that could give significant momentum to the forward-thinking agencies, innovators, and investors who seek to transform the nation's transmission infrastructure.

Lab participants discussed a variety of ways to upgrade the nation's electric grid. The most promising of these fell into two categories: policy and financial solutions.

To motivate private investors, the government needs to simplify regulatory procedures and adopt innovative finance models that decrease political risks for investors while upholding reasonable government oversight.

Part II:

Financial Innovations for Electric Grid Development



Policy Solutions

Solution 1	*Define and implement national sustainability standards*

Newer and more comprehensive approaches to energy and environmental policy are needed to address today's pressing energy challenges in more efficient and cost-effective ways. One solution could be national sustainability standards that integrate climate change prevention and other environmental objectives into the nation's energy production system. Such standards could be modeled on the Greenhouse Gas Emissions Performance Standards issued by the California Public Utilities Commission, as legislated by California Senate Bill 1368; these standards strive to meet long-term climate goals by setting facility-based emissions standards.[17]

Sustainability standards are agreed-upon economic and technical criteria by which the production, transportation, and processing of energy can be assessed for environmental, social, and other values. The concept of sustainability standards has been widely applied in the biofuels space by a number of countries and intergovernmental organizations. The Inter-American Development Bank already applies sustainability-standard screens to all the projects it finances in the energy, infrastructure, water, environmental, and building sectors, as does the International Finance Corporation.

A sustainability program can only be effective if the proposed framework is not excessively complicated and if impacts and actions are measurable and verifiable. A recent report by the University of California, Davis, recommends basing sustainability requirements on these principles, among others:[18]

- Adopt a long-term view, in accordance with climate change legislation.
- Begin with simple requirements and methods and gradually expand the scope.
- Establish a performance-based system that encourages innovation, rewards practices exceeding a minimum standard, and has clear measures of compliance and methods of enforcement.
- Consult continuously with stakeholders.

National sustainability standards would make different renewable energy projects, energy-efficiency initiatives, and transmission-network developments directly comparable in terms of social and environmental costs and benefits. Clearly ranking the "sustainability value" of different proposals would simplify the creation of incentives for projects, presenting a much clearer market signal to potential investors as well as making financing easier to obtain for such projects. Moreover, a system of national sustainability standards could be instrumental in solving permitting and siting issues for transmission and generation projects by moving the best ones up the queue. The FERC could, in turn, adapt its rules of system balancing and network access to favor such developments. In fact, a national framework of sustainability standards would be "resource neutral" in that it would not be biased in favor of specific energy sources.

A national sustainability standards program could be articulated at the state level in a variety of ways. States would be free to decide whether they prefer to comply with national standards by applying quantity-based mechanisms (e.g., renewable portfolio standards) or price-based mechanisms (e.g., feed-in tariffs, through which renewable energy producers can sell units of electricity at a fixed price into the grid). The federal government may use such standards as a way to impose a floor in terms of sustainability compliance to individual states, while leaving states that wish to exceed these standards free to do so.

"Having some kind of mechanism that embeds the climate change objectives and the other environmental objectives with the energy system transformation for sustainability standard perhaps is a useful approach to examine. So I think this actually entails a much different way of regulating the system if we look at it from a sustainability performance standard, as opposed to some of the more prescriptive standards over time," said Professor Bryan Jenkins of the University of California, Davis.

It is important to recognize that defining sustainability objectives and performance standards is an extremely difficult task, as is the translation of such objectives into law. Nevertheless, implementing these sustainability standards on a national scale has the potential to resolve many of the issues that hinder development of renewable energies and slow our nation's transition to a more climate-friendly energy system.

ACTION ITEM:

- The Environmental Protection Agency, the Department of Energy, and FERC should take the lead in initiating the process of setting up a clear matrix of standards and rankings.

SOLUTION 2

Shift toward a "one-stop-shopping" regulatory model

The existing regulatory regime for the electricity industry is overly complex and extremely fragmented, with overlapping jurisdictions whose responsibilities are unclear. The "balkanization" of the grid and, hence, of the regulatory interface, adds high political risk and disincentives to socially beneficial investments.

Texas, which grants the final say in regulatory matters to the Electric Reliability Council of Texas (ERCOT), is in a much better position to arbitrate among different stakeholders, adopt a longer-term perspective, and push for more ambitious renewable portfolio standards and network investments. Similarly, some very successful companies, such as Detroit-based ITC Transmission, have built their entire business model on concentrating exclusively on the FERC-regulated segment, carefully avoiding state regulators' jurisdictions and thus reducing their regulatory risk exposure.

The call for an easier-to-navigate regulatory system that can cut permitting times and is less susceptible to capture by different industry segments is virtually unanimous. The consensus in the industry is that the natural gas model, established by the Federal Power Act of 1935, is a clearly superior example of transmission because it gave FERC exclusive authority over the siting of natural gas infrastructure. Electricity transmission, on the other hand, was not completely brought under federal jurisdiction. This represents a major obstacle today, as there are many issues that only FERC is in a position to address, especially when it comes to moving renewable energy across long distances.

One proposal described during the Financial Innovations Lab was altering electricity regulation to more closely resemble how highways are regulated. This would enable high-voltage electricity transmission lines to be constructed with less red tape. Nevertheless, the highway model is a radical departure from the status quo and would need to be mandated by Congress. As of this writing, two bills propose increased responsibility and authority for FERC: HR 2454, the American Clean Energy and Security Act of 2009,[19] and the American Clean Energy Leadership Act.[20]

Another possible solution that gained support among Lab participants was the creation of a single regulatory portal for the industry. This would be a monumental shift away from the current system's large number of permitting and regulatory bodies to a one-stop-shopping model used by many developing countries to encourage investments. The different aspects of regulation (e.g., land use, safety, and finance) would be bundled together in a single office, standardized procedures would be put in place, timelines would be exact, the regulatory risk would become more predictable, and the long-term visibility of regulation would be enhanced. As a result, transparency and regulatory certainty would improve. Using a football metaphor, investors could finally count on a quarterback to move their projects downfield and shift risk away from market investments.

"[Utilities] want distributed [generation], and they're figuring out how to make money on it for solar and wind," said Pfund, of DBL Investors. "But they build plants, and so central solar has a huge role in their future, and they're starting to finance it. But what they really want is … a quarterback. … When the Arizona PUC … goes after the California PUC to undo a transmission line that would have made a lot of sense because of regional disputes and petty state issues, they want FERC or someone to quarterback and kind of

say let's get to the goal line here. So I think that this notion that we can do this without some federal hammer or oversight and get to the kind of scale that we want is a delusion."

ACTION ITEM:

- Investigate the feasibility of a single regulatory portal by drawing on the experience of countries like Singapore that have already adopted such practices.

Solution 3	*Designate "competitive renewable energy zones"/empowerment zones*

As is often the case with rivers, lakes, and forests, energy resources are oblivious to state borders. To maximize the efficient use of resources that straddle state lines, some form of coordination among different "sovereign" entities is needed. Such coordination rarely if ever takes place today, and conflicts between states over where to build generation and transmission infrastructure are routine. As a result, large pools of wind and solar resources go untapped.

Several Lab participants urged the federal government to take a more proactive stand. A relatively easy solution would be to combine features of "competitive renewable energy zones" (CREZ) and federal empowerment zones. This would provide renewable energy developers with powerful incentives to invest in resource-rich areas while ensuring that the appropriate transmission infrastructure would be in place to deliver the electricity to consumers.

The CREZ model was pioneered in Texas to comply with the state's stringent renewable portfolio standard and make the abundant wind of West Texas and the Panhandle available to the rest of the state. State legislation in 2005 required that the best areas be designated CREZs and that an electric transmission infrastructure be constructed to move energy from the zones to the market. The Public Utility Commission of Texas (PUCT) voted in 2007 to designate eight zones as the best sites for construction of new power lines for the more than 20,000 MW of proposed wind generation. ERCOT, the state's transmission operator, is charged with collecting wind data and nominating CREZs based on transmission cost calculations.

This approach can easily be applied throughout the United States. The Energy Policy Act of 2005 gave FERC "backstop" siting authority on "national interest electric transmission corridors" (NIETC) designated by the DOE in areas with severe transmission system congestion. The pending climate legislation could extend that authority to include environmental objectives in the evaluation of potential NIETCs.

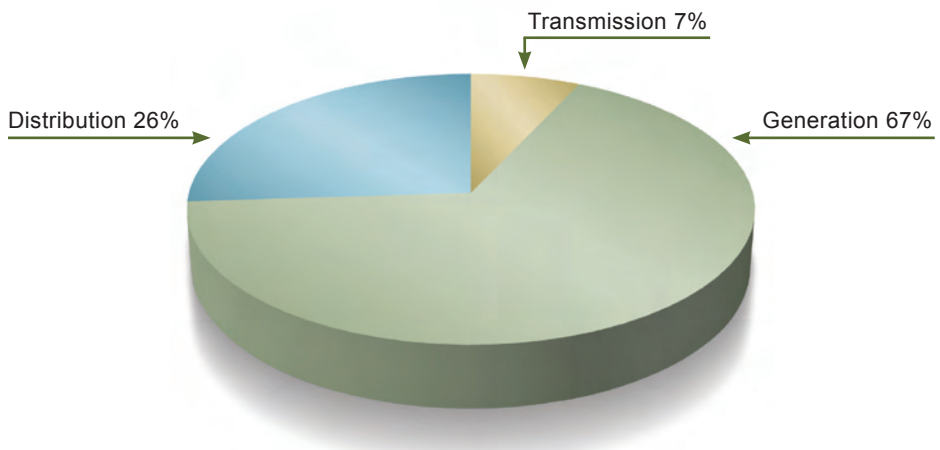
The CREZ model was pioneered in Texas to comply with the state's stringent renewable portfolio standard and make the abundant wind of West Texas and the Panhandle available to the rest of the state.

Creating competitive renewable energy zones involves a three-step procedure:

- Identify the best resource zones nationwide.
- Develop a transmission master plan.
- Open potential transmission projects up to the competitive bidding process, and start building transmission lines. All potential investors (utilities, rural players, developers of renewable energy projects, transmission-only companies, etc.) should be invited to participate.

FIGURE 6

Major components of average U.S. electricity price



Sources: Energy Information Administration, "Electricity Explained: Factors Affecting Electricity Prices."

Texas will pay for these investments by increasing the rates consumers pay. This is fair because all customers benefit to some degree from enhancements to the grid, and it makes economic sense because their share of transmission costs is relatively small—7 cents to the dollar on average.[21] Eventually, the availability of such "cheap" resources will push down the price of electricity on wholesale markets and have a positive impact on CO_2 emissions. A recent study by the Oak Ridge National Laboratory[22] shows that existing wind capacity saved Texans $476 million in 2006, and an estimated 2,342 MW of additional wind capacity that year provided similar savings. The study also estimates that new wind generating capacity will reduce customer payments to generators by $221 million to a total of $1.278 billion per year and curtail CO_2 emissions statewide by 5 percent.

At the national level, cost allocation becomes more contentious but could be solved by some form of cost socialization. New legislation is unlikely to be necessary; FERC has authority to order its own cost-allocation scheme if the cost-allocation proposals of regional planning authorities concerning specific interstate transmission projects are not submitted or are rejected by FERC.

Where appropriate, the designation of CREZs may be complemented by the creation of federal empowerment zones. Empowerment zones are highly distressed urban or rural communities made eligible for a combination of grants, tax credits for businesses, bonding authority, and other benefits by the Empowerment Zone Program established in 1994. The program was scheduled to end on December 31, 2009, but may be revived under some

form of sustainable development agenda. Currently, qualifying businesses are eligible for employment credits, low-cost loans through empowerment zone facility bonds, increased Section 179 tax deductions, partial exclusion of capital gains taxes upon the sale of certain assets, and other incentives.[23] The employment credit also gives businesses an incentive to hire individuals who live in an empowerment zone.

Some Lab participants, including Destiny USA and BrightSource, were able to set up creative financing structures by making use of a number of advantages reserved for investors in empowerment zones. Given that these are state-run initiatives that do not rely on the federal budget, the combination of CREZs and empowerment zones has the potential to become a true breakthrough in the shift toward building a more sustainable national energy system without more federal funding.

"I think people in Texas would say, with all due respect and deference to folks in D.C., let us continue to innovate on a smaller scale, and … I think the CREZ is a great case in point," said Hunt, of Hunt Power and Sharyland Utilities. "You have two or three other CREZ-type initiatives going on, one in California. We will make mistakes, obviously, but I do think you pick up what you lose in regulatory uncertainty. And I think the key thing is to eliminate the overlap. You do pick up an innovation because different people can try different things."

ACTION ITEM:

- Study the impact of designating federal CREZs and empowerment zones. What could be the cost allocation/cost recovery mechanism?

Financial Solutions

Solution 4	*Make more creative use of existing tax credits and loan guarantees*

Tax credits, when used too liberally, remove a valuable stream of government revenue. Some incentives, such as tax credit bonds, are also more costly to the government than regular financing, and administrative costs are higher because of enforcement and compliance costs.

The traditional financing instruments used to increase renewable energy supply in the United States today are tax credits and loan guarantees. Provided by the government, they are offered as inducements to encourage activity in specific sectors of the market. Tax credits decrease the tax burden on businesses by reducing taxes directly. Loan guarantees encourage lenders to finance projects because they guarantee repayment of a percentage of the debt if the borrower defaults. While both government inducements have proven effective at encouraging more renewables, notably in wind and solar equipment manufacturing, these instruments are somewhat costly and inefficient in their current iterations.

Tax credits, when used too liberally, remove a valuable stream of government revenue. Some incentives, such as tax credit bonds, are also more costly to the government than regular financing, and administrative costs are higher because of enforcement and compliance costs.[24] Tax credits are also imperfect because of the frequency with which they must be renewed. Because administrations change and the makeup of Congress shifts, producer and consumer tax credits are always at risk of not being renewed, which puts larger projects with longer building phases at a significant disadvantage compared to smaller projects that can be built quickly.

Loan guarantees, if handed to risky projects, subject the government to exposure commensurate with the proportion of the loan that is guaranteed. Because loan guarantees are highly dependent on a lender's willingness to use them, loan guarantee terms need to be comprehensible to lenders. The inherent risk-shifting of a loan guarantee from lenders and borrowers to the government would also attract less-cautious players to the market and, at a certain level, could increase the default rate if less-qualified participants are not filtered out.

The funding used for tax credits and loan guarantees could be deployed in more effective ways, according to Pfund, of DBL Investors, and Pietrafesa, of Destiny USA.

Pietrafesa explained how Destiny USA, a multi-use development in Syracuse, New York, partnered with the government to finance the project without tax credits. Instead, the project leveraged payments in lieu of property taxes (PILOT). The PILOT transferred a tax lien from the municipality to the bondholders. The rest of the funding came from such programs as New York state's Brownfield Program; New York state's Empire Zone program, which refunded property taxes, among other benefits; a New York state marketing fund; and federal "green bonds."

DBL Investors has had its own issues with traditional finance. For its investment in Tesla Motors, DBL secured both auto industry-related loans and traditional loan guarantees. In the case of BrightSource Energy, a solar energy producer, the legislative language of tax credits needed to be addressed head-on by the industry. The ARRA, in one early iteration, designated tax breaks to solar projects that would finish by 2010. The 2010 end date, while accessible to smaller projects, was prohibitive to larger-scale solar projects because of the longer construction time required. Extensive lobbying persuaded lawmakers to reshape the legislation to allow large producers to benefit. Pfund discussed the necessity of fighting for equitable deployment of incentives for large and small producers alike and said renewable energy and industry experts needed to launch a powerful effort to educate policymakers.

If a subcommittee in Congress had adequate expertise in scaling issues between large and small projects, it could try to tailor future legislation to give potential applicants equal opportunity to incentives.

Another alternative to financing through traditional government measures would be to aggregate smaller projects into a portfolio that could be more easily funded. A group of smaller projects with similar technology, equity levels, and other characteristics would prove more attractive to lenders, who would stand to gain more from investing in a larger collection of uniform projects and would be spared the time required to investigate each project individually. To do this, standards need to be established. Lab participants saw Farmer Mac and the U.S. Department of Agriculture as natural choices for aggregators.

ACTION ITEMS:

- Establish a working group of innovative financiers, and compile a list of financial techniques used by such financiers as an industry resource.
- Establish an equity of scale subcommittee in Congress.

Solution 5	***Allow grid operators to use innovative business models like REITs***

The ARRA includes significant spending and tax cuts designed to improve the nation's infrastructure, including the grid. But this public funding is only a fraction of what will be needed in the coming years to modernize the grid. Private investment is necessary to bridge the gap, and one effective strategy could be applying real estate investment trust (REIT) models to infrastructure financing.

A REIT is a designation that reduces or eliminates corporate income taxes for a corporation investing in real estate. In return, REITs are required to distribute 90 percent of their income, which may be taxable, to their investors. The REIT model was designed to provide a structure for investments in real estate similar to what mutual funds provide for investments in stocks.

REITs have successfully attracted wide sources of capital to real estate. Subject to compliance with a number of asset and income requirements designed to ensure an almost exclusive focus on ownership and operation of real estate, REITs have the benefit of being treated as corporations under the Internal Revenue Code (IRC) without the corresponding burden of paying entity-level

federal income taxes to the extent that they pay out dividends from their net income.

To use REITs to invest in infrastructure, the infrastructure assets must be characterized as real estate under the IRC. As the REIT market has developed, the Internal Revenue Service (IRS) has concluded that certain infrastructure such as railroad tracks and broadcasting and cell-phone towers may constitute REIT assets. In a private 2007 ruling (PLR 200725015), the IRS also concluded that an electricity transmission and distribution system and the rental payments from the use of such systems could be eligible to be part of a REIT.[25]

In view of the government's focus on infrastructure improvement, REITs should be considered as vehicles to efficiently finance and sustain electricity infrastructure projects on a tax-advantaged basis. Further, REITs could be considered as vehicles to fund internal growth and the acquisition of infrastructure companies by master limited partnerships, which could contribute assets to a REIT subsidiary for that purpose. This subsidiary would then execute an offering of shares to raise the necessary capital.

REITs have the potential to become a magnet for earnings-oriented investors such as pension funds, insurance companies, mutual fund companies, banks, and individual investors. The virtue of this structure is that it has the potential to make new sources of capital available for investment in transmission and distribution systems at a time when the aging grid cries out for modernization.

It is still unclear whether a utility's local regulators would be willing to approve this disposition, knowing that it would transfer all regulatory jurisdiction of the transmission system to FERC.[26] At least one precedent exists in Texas, where Sharyland Utilities was allowed by the Public Utility Commission of Texas to operate under a REIT structure, said Kirk Baker, of Sharyland Utilities.

"In 2008, the Public Utility Commission of Texas approved our structure; it took about a year," Baker said. "To say that this is an industry that does not embrace innovation is an understatement. Nonetheless, we will do this.… The federal government has made a determination that a REIT may either pay its tax to the federal government or pay its tax to its owners. Therefore, it will not be a highly levered vehicle. It will look much more stable investment-grade than an existing utility that might be highly levered. That's our story. We would think that REIT will do for the electric transmission and distribution space what master limited partnerships did for pipelines."

Despite these difficulties, it is questionable whether traditional sources of utility capital outside of the transmission and distribution REITs can cover the projected massive need for investments in electricity grid upgrades and expansion. The REIT model may also prove to be an extremely interesting paradigm of merchant/cooperative hybrid arrangement that may be used by rural cooperatives to keep financial returns within their community. Finally, the REIT model lends itself to being combined with additional revenue-generating ventures such as leasing transmission towers or other vertical assets to mobile telecommunication companies.

In sum, the ability of REITs to invest in electricity-transmission assets would provide potential investors with a great opportunity to invest in a tax-efficient manner while improving the nation's electricity infrastructure and presenting one-of-a-kind development possibilities to rural communities.

ACTION ITEMS:

- Seek federal approval of the REIT model as a nationally sanctioned financing practice, usable in all states, as approved by FERC.
- Explore the viability of expanded cooperative models for transmission companies.

Solution 6

Establish a revolving fund for green transmission investment projects

Today's troubled financial climate bears striking similarities to the aftermath of the 1987 stock market crash, which triggered one of the most innovative ideas in infrastructure finance: state revolving funds. Grants are given to states, which use the money to provide low-interest loans for construction of infrastructure. The money that borrowers repay is then loaned to the next borrower, so the fund perpetuates itself. States may provide loans to individuals, nonprofit organizations, and commercial enterprises.

Today's troubled financial climate bears striking similarities to the aftermath of the 1987 stock market crash, which triggered one of the most innovative ideas in infrastructure finance: state revolving funds.

The original purpose of state revolving fund (SRF) programs, established by the federal Water Quality Act of 1987, was to provide financial assistance for municipal sewage and water-pollution programs. The intention was to supplant the traditional matching grant program with a method of sustainable finance. The revolving fund concept has served as a model for several other programs, with its scope being broadened over time. Revolving funds are being used, for example, in the Environmental Protection Agency's Brownfields Program,[27] and New Jersey[28] and Indiana's SRFs (among several other states') are the largest source of financing for their wastewater and drinking water infrastructure loans.[29]

Combining a revolving fund and traditional infrastructure financing could prove an extremely effective strategy for leveraging the $11 billion appropriated by the ARRA. A revolving fund model would offer enhanced security and a subsidized borrowing rate for green transmission projects.

In the traditional SRF model, government grants and state matches can serve as equity contributions for local projects that are capitalized with bond proceeds. Leveraging these assets provides additional loan-funding capacity. States could use these revolving funds to finance projects directly through loans or as a credit enhancement for issuing bonds.

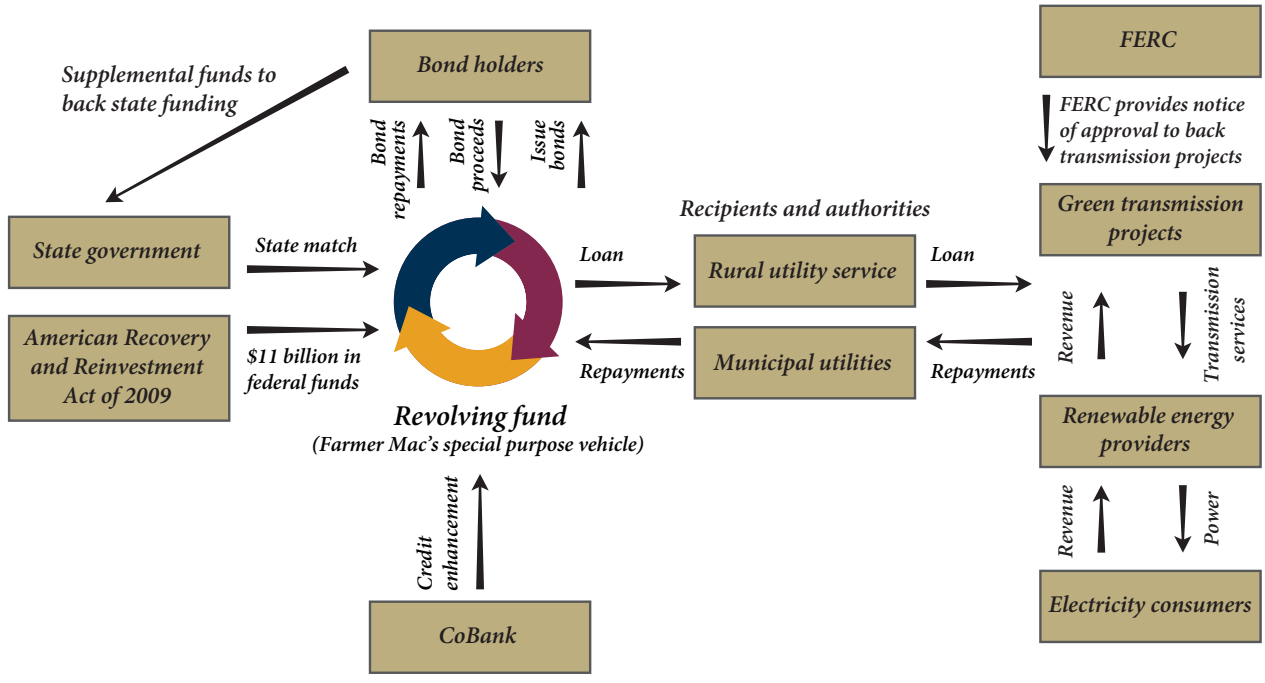
In the model we envision, the funding would come from a combination of ARRA money and matching state contributions. The revolving fund could be a special purpose vehicle created by Farmer Mac, or Farmer Mac itself because of its ability to issue debt securities. CoBank, a co-op bank that provides services for rural clients, could provide credit enhancement when necessary. This would be especially useful in the event tax-exempt bonds were issued to supplement or replace state contributions to the fund.

Transmission has the potential to be an appealing investment, offering limited profit but a guaranteed return in a regulated environment. During the downturn, infrastructure as an asset class has emerged as a port in the storm, attracting continued investor interest. Although debt capital markets have experienced unprecedented volatility since August 2007, interest rates remain low by historical standards.

As illustrated in figure 7, the fund would make loans (enhanced by CoBank) to a rural utility service, municipal utilities, and similar entities, which would in turn fund the green transmission projects they deem most worthy. Priority should be given to projects that provide the greatest economic and environmental benefits to rural communities. A notice of approval provided by the FERC would increase the credibility of such projects and reduce the risks for investors and bondholders. The cash flow model of a transmission company, regardless of its ownership or control structure, is rather straightforward: It makes money by transporting electricity through its network. Provided that the funded transmission projects are carefully selected, the mechanism should allow for loans to be repaid rather quickly. A fast payback means higher turnover and increased leverage for the initial capital endowment.

In conjunction with the federal incentives already in place (see sidebar), the revolving fund model could prove to be an effective solution to the gridlock that hampers the much-needed shift to greener energy sources. In other words, sustainable development can be achieved through sustainable finance.

FIGURE 7 *Revolving fund model for funding green transmission projects*



Sources: Milken Institute.

Federal Incentives for Renewable Energy

Production Tax Credit (PTC)
Provides an inflation-adjusted tax credit for electricity produced from renewable energy resources.

Renewable Energy Production Incentive (REPI)
Provides incentive payments for electricity produced and sold by new qualifying renewable energy generation facilities. REPI-eligible facilities are those owned by state and local government entities and not-for-profit electric cooperatives.

Clean Renewable Energy Bonds (CREBs)
Can be issued to finance the development of renewable energy-related projects. CREBs are based on a "tax credit bond" that currently exists in the tax code. Municipal utilities, tribal governments, and electric cooperatives are qualified to issue the bonds. The CREB provides the issuer with interest-free loans for financing qualified energy projects, and the federal government pays a tax credit to the bondholder in lieu of the issuer paying interest to the bondholder.[30]

ACTION ITEMS:

- Examine the potential of a revolving fund model for green transmission projects.
- Consider expanding Farmer Mac's authority to administer the revolving fund.
- Adjust the role of CoBank to enhance credit to the revolving fund model.
- Determine eligibility requirements for green transmission projects.
- Explore how CREBs could be used in addition to green transmission bonds.

Conclusion

To enhance energy security and address concerns about global warming, the United States needs to take concrete steps toward improving the penetration of renewables in its energy supply. To do that, more investment in transmission infrastructure is needed to create the capacity to deliver renewable energy to population centers, many of which are located far away from the most favorable solar and wind sites.

The financing of the transmission system is a monumental task that will require creative financial thinking to succeed. Leveraging the ARRA's $11 billion by a factor of 6 to 80 will not be a simple task.

Simultaneously, government agencies and regulators need to become more flexible and exercise greater authority to push projects through the pipeline. Discussion in the Financial Innovations Lab indicated that a powerful source of funding could be unlocked by inducing private capital into public infrastructure, if the process is administered responsibly. To motivate private investors to move in this direction, the government needs to simplify regulatory procedures and adopt innovative finance models that decrease political risks for investors while upholding reasonable government oversight, all in a clear and transparent manner.

Three options for new regulatory models are presented in this report. Creating national sustainability standards would streamline the decision-making process for all projects. Under the guidance of such standards, determining the best course of action among varied choices becomes an established practice with clear guidelines, eliminating time wasted on squabbling and legal challenges. A "one-stop shop" for regulation would limit the time projects spend in the pipeline and give investors one clear authority to turn to for assurances that they are meeting regulatory requirements. Expanded use of Competitive Renewable Energy Zones would actively designate locations for investment, a welcome sign to investors. All of these regulatory actions require compromise and coordination between agencies and levels of government to succeed.

Two proposed financial innovations that can be quickly acted upon are presented here as well: using REIT structures and developing a revolving fund model that can be applied to green transmission. These two financial tools would have a significant impact on the deployment of capital by having the government provide investors with assurances and guarantees. The REIT model presents sizeable incentives for transmission construction on a tax-advantaged basis, while the revolving fund model provides a pathway toward self-sustaining funding.

The Financial Innovations Lab convened by the USDA and the Milken Institute elicited practical solutions aimed at increasing investment in the nation's electric grid, all drawn from the research and the considerable experience of Lab participants. It is the hope of everyone present that these remedies will be implemented in an effort to fight climate change, promote energy security, and enhance the long-term economic growth of the nation's rural areas.

Appendix I

Financial Innovations Lab Participants

(Affiliations at time of Lab)

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Appendix II

Literature Review

AUTHOR(S)	TITLE	PURPOSE	RESULTS	IMPLICATIONS
Smart Grid				
U.S. Department of Energy	The Smart Grid: An Introduction	Details the purpose and functionality of a smart grid	The report points out the necessity of having a smart grid due to stresses on the system as demand increases in coming years. Definitions of the smart grid are given and future possibilities detailed. The necessity of a better grid is made clear in terms of financial losses in tech sectors due to rolling blackouts and the overall age of existing infrastructure. Electric utilities devote a low percentage of revenue to R&D compared to that of agriculture, durable goods, and others. The smart grid technology is described as a collection of advanced metering, visualization technology, distributed generation, and real-time response. The smart grid demonstrates a lot of potential because of the trend toward customer engagement and increased environmental sensibilities. Pilot programs using smart grid technologies are being implemented in the Distribution Management Platform in Hawaii and Perfect Power program at the Illinois Institute of Technology.	Smart grid technology has a real chance to change the electricity structure. It has already achieved success on a limited scale, and this could possibly be replicated. It may limit the expansion necessary to the grid.
Financial/Financing				
Joel Makower	Clean Energy Trends 2008	What short-term and long-term growth can we expect from clean energy?	Clean Edge, which has been tracking the growth of clean-energy markets since 2000, reported a 40 percent increase in revenue growth for solar photovoltaics, wind, biofuels, and fuel cells in 2007, up from $55 billion in 2006 to $77.3 billion in 2007. For the first time, three of these areas were generating revenue in excess of $20 billion apiece, with wind exceeding $30 billion. New global investments in energy technologies—including venture capital, project finance, public markets, and research and development—have expanded by 60 percent, from $92.6 billion in 2006 to $148.4 billion in 2007, according to research firm New Energy Finance.	In the long run, clean energy investment will be healthy and will continue to grow. In the short term, the recession will slow that trend.

AUTHOR(S)	TITLE	PURPOSE	RESULTS	IMPLICATIONS
Financial Innovations				
William W. Hogan	Electricity Market Structure and Infrastructure	Explores the creation of electricity market design and regulation to support efficient investment in infrastructure.	A key challenge for electricity market design and regulation is to support efficient investment in infrastructure. Outside the organized markets, FERC faces the continuing challenge of implementing and enforcing the principles of open access. Inside the organized markets, the continuing problem is to design rules and regulatory policies that support competitive wholesale electricity markets. A key requirement is to relate any proposed solution to the larger framework and to ask for alternatives that better support or are complementary to the market design. The alternative is to frame every problem in its own terms and design ad hoc regulatory fixes that accumulate to undermine market incentives. A workable regulatory and market framework is an essential tool for anticipating unintended consequences and acting in time.	Addresses and outlines the key challenges to electricity market design. Regulation remains complex, and the road forward will be complicated. This is a strong piece extolling the virtues of a good regulatory framework, which the U.S. does not have in electricity.
National Renewable Energy Laboratory, K.S. Cory, B.G. Swezey	Renewable Portfolio Standards in the States: Balancing Goals and Implementation Strategies	How can RPS policies help or hinder a state's energy goals?	In the end, a successful RPS policy is one that meets a particular state's policy goals. States may enact an RPS with any number of policy goals in mind, such as fuel diversity, economic development, electricity price stability, environmental benefits, and others. However, policymakers should keep in mind that the pursuit of some goals, such as maximizing in-state development, could come at the expense of other goals, such as minimizing the cost impacts of an RPS.	Example of nuanced approaches necessary for states to examine as they shoot for increased renewables usage. These factors will have an effect on how susceptible the market is to new renewable/clean energy in the region.
Lawrence Berkeley National Lab, John P. Harper, Birch Tree Capital LLC; Matthew D. Karcher, Deacon Harbor Financial L.P.; Mark Bolinger, Lawrence Berkeley National Laboratory	Wind Project Financing Structures: A Review & Comparative Analysis	In what ways can wind projects be financed, and what are their structures?	• Corporate • Strategic investor flip • Institutional investor flip • Pay as you go • Cash leveraged • Cash and Production Tax Credit leveraged • Back leveraged	There are varied means of financing alternative energy products. The structures detailed in this document demonstrate a number of approaches and are helpful in describing methods that work.

AUTHOR(S)	TITLE	PURPOSE	RESULTS	IMPLICATIONS
Regulation				
North American Energy Working Group	North America - Regulation of International Electricity Trade	What bodies regulate electricity?	• National Energy Board - Canada • Department of Energy - United States • Energy Regulatory Commission - Mexico	A useful spreadsheet detailing what authority is given to North American electricity regulators.
Federal Energy Regulatory Commission	Energy Policy Act of 2005 (EPAct) Supplemental Electric Transmission Siting Authority	Describes the DOE's new power in siting and regulations	• Department of Energy issues national congestion study (August 2006). • Based on the study results, DOE may designate any geographic area experiencing capacity constraints or congestion that adversely affects consumers as a National Interest Electric Transmission Corridor. • DOE designates first such national corridors (October 5, 2007). • Under certain circumstances, FERC may issue construction permits for electric transmission facilities located in national corridors.	With the increase in DOE's authority, it might be expected that this trend will continue and allow the grid to be regulated more rapidly.
Geothermal				
Massachusetts Institute of Technology	The Future of Geothermal Energy	How feasible is increasing geothermal installations in the United States?	Positive correlation between the development of new EGS fields and continued declines in delivered costs of energy. Installed capacity of EGS could reach 100,000 MWe within 50 years, with leveled energy costs at parity with market prices after 11 years. It is projected that the total cost, including costs for research, development, demonstration, and deployment, required to reach this level of EGS generation capacity ranges from approximately $600 million to $900 million with an absorbed cost of $200 million to $350 million. EGS power lacks a demonstration of its capability at the present time, which can be improved over time with research monies.	Geothermal energy could be a viable energy source in the future but is inadequate at its current level. Bringing geothermal up to scale as a major producer of energy will require a long-term investment.
Biomass				
William F. Lazarus	Farm Based Anaerobic Digesters as an Energy and Odor Control Technology	What role can anaerobic digesters play in America's energy future?	Anaerobic digesters are an innovative technology with a double-sided effect: reducing greenhouse-gas emissions as well as reducing the impact of animal waste on air quality and sanitation.	Anaerobic digesters can play a role in waste sequestration and energy production. The United States has lagged behind the Europeans on this and can do better.

AUTHOR(S)	TITLE	PURPOSE	RESULTS	IMPLICATIONS
Solar				
National Renewable Energy Laboratory, Sarah Kurtz, Jerry Olson, John Geisz, Daniel Friedman, William McMahon, Aaron Ptak, Mark Wanlass, Alan Kibbler, Charlene Kramer, Scott Ward, Anna Duda, Michelle Young, Jeff Carapella	High-efficiency Solar Cells for Large-Scale Electricity Generation & Design Considerations for the Related Optics	What is the efficacy of using high-efficiency solar cells from a cost-benefit perspective?	• Photovoltaic industry is doubling every two years. • Using concentration may help the solar industry grow even faster. • Multijunction cells provide the path to high efficiency: > 40% and still increasing. • The optical designs are varied and the requirements differ for solar thermal and photovoltaics.	The solar industry is growing robustly. The best technology has not come to the fore yet, but it is clear that solar will be a major player in the future of renewable energy.
Wind				
U.S. Department of Energy	20 Percent Wind by 2030	How feasible is increasing wind capacity in the U.S.?	There are significant costs, challenges, and impacts associated with the 20 percent wind scenario presented in this report. There are also substantial positive impacts from wind power expansion on the scale and pace the report describes that are not likely to be realized in a business-as-usual future. Achieving this scenario would involve a major national commitment to clean, domestic energy sources with minimal emissions of greenhouse gases and other environmental pollutants.	Wind is a viable energy source with lots of benefits. It is feasible to power a large portion of America's grid with this technology.
Costs				
National Rural Electric Cooperative Association	Electricity Capacity: Stressed Over the Next Decade: Will We Have Enough to Meet Consumer Needs?	What are the issues that face electricity consumers, particularly rural consumers?	NRECA predicts that electricity demand growth will be an increasingly urgent topic, as adding 75 million new Americans by 2030 will stress the grid. Rural users will be hurt the most due to energy-intensive agriculture and an aging population moving to rural areas. There is also an over-reliance on natural gas (supplied by other nations). Efficiency will not be enough to offset the increased demand. Since coal is off the table and nuclear and renewables are insufficient, this paper draws a bleak picture. The one solid recommendation is to modernize electricity infrastructure.	Electricity reliability is a real concern, especially in rural regions. This points out the need for electrical grid improvement and how those who oppose its creation may be contributing to their own hardship down the line.

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