HUNTON& WILLIAMS

Renewable Energy Quarterly

June 2009

In This Issue...

Energy Storage Technology: A Way Forward to a Clean Renewable Future

"We talk about the great wind resources and the great solar resources of the United States, and the United States is blessed with enormous resources. But we also have to remember that renewable resources, like wind and solar, are transient — they go up and down. At the level of 2.8 percent — roughly, what we are today, that's okay. But, imagine a world of 15, 25, 30 percent renewable going up and down. That's a bigger problem, a much bigger problem.

"Certainly that's why we need a long-distance transmission system to port the energy, because somewhere in the United States — whether it's the Great Lakes, North Dakota, the Pacific Northwest, Texas, the wind will be blowing, but we don't have large-scale power storage yet. We should start to invest heavily in pumped-hydroelectric storage, we should start to look at compressed air storage, so when the wind blows — because in the Dakotas, there aren't hydro sources, but there is the capability of putting in compressed air storage, bringing that compressed air up, burning it with natural gas to create electricity more efficiently."

Remarks by United States Department of Energy Secretary Steven Chu at the National Clean Energy Project Forum, February 23, 2009

Introduction

Energy Secretary Chu is the latest of a series of energy leaders to regard energy storage technology as a key element in deploying renewable energy more widely. As for renewable energy itself, President Obama is a leader among those who support more renewable energy development as being necessary to engender long-term economic growth, break America's dependence on foreign oil and combat global warming.[1] In a key early speech outlining his plans for the national economy, President Obama called for a doubling of the production of alternative energy over the next three years.[2] Without greater deployment of energy storage technology, however, these aspirations are likely to remain unmet.

---

[1] There are many definitions of renewable energy resources. For example, "The American Clean Energy and Security Act of 2009" (H.R. 2454), which was reported favorably by the House Energy and Commerce Committee on May 21, 2009, contains the following definition for renewable energy resource: "The term 'renewable energy resource' means each of the following: (A) Wind energy; (B) Solar energy; (C) Geothermal energy; (D) Renewable biomass; (E) Biogas derived exclusively from renewable biomass; (F) Biofuels derived exclusively from renewable biomass; (G) Qualified hydropower; and (H) Marine and hydrokinetic renewable energy." Among these renewable energy resources, the ones that tend to be intermittent and therefore would be most aided by energy storage are wind energy, solar energy, geothermal energy and hydrokinetic renewable energy.

[2] *Obama Highlights Need For More Clean-Energy Funding*, CNN.com, March 23, 2009, http://www.cnn.com/2009/POLITICS/03/23/obama.energy (accessed on May 28, 2009) [hereinafter *Obama Highlights Need*].

This article will outline some of the major benefits of energy storage technologies and discuss some of the barriers as well as significant sources of encouragement for their deployment. An appendix, intended as an aid to the reader, will identify leading energy storage technologies with the potential for utility-scale applications and list their key features and some examples.[3]

The Need for Energy Storage

To understand why energy storage technology is vital to building a future where clean renewable energy sources meet significant portions of the nation's electricity needs, consider that the absence of a wide-scale means to store electricity means that electricity generation and load must be in instantaneous balance. Consequently, electric generation capacity has been built to match peak demand. Power plants relying on nuclear fuel, coal or natural gas can generate electricity more or less continuously and are quite capable of responding promptly to fluctuations in demand, including throughout the daily cycle. These plants, either as "base load," "spinning reserve" or "peaking" units, represent approximately 92% of the nation's electric generation capacity.[4] Hydroelectric generation, which is readily dispatchable at certain times of the year, also provides a helpful supplemental resource. Today's set of generation resources generally has provided reliable and affordable electric power. Nevertheless, due to increasing concerns about the environment and, to a lesser extent for electricity, a greater focus on energy security, policymakers and industry leaders want to develop a new portfolio of generation resources.

A move to clean renewable energy sources on a large scale would introduce a new model. To some greater or lesser extent, resources such as wind, solar, geothermal, hydroelectric and hydrokinetic (tidal) energy are all considered to be clean and renewable sources of energy. For the most part, however, these energy sources are not today readily dispatchable because they are frequently affected by time of day or night or changes in weather conditions. The wind and sun are both highly variable energy sources to the point of being considered intermittent, or even "transient" as Energy Secretary Chu described them. First, wind is typically much greater at night (when electric demand is lower), and the wind changes direction and speed on a regular basis, even stopping at any time. Second, the sun generates at most 10 to12 hours a day of power, and this can be affected by clouds. Thus, there must be storage to enable the ready dispatch of renewable generation and a closer matching of the electricity generated by renewable sources with the demand for power.[5]

Benefits of Energy Storage

Energy storage technology can address challenges related to the variable nature of renewable energy sources as well as issues facing the current electric power system.

Price Stability

There is a daily and seasonal variation in demand for electricity. More electricity is consumed during daylight hours than at night, and summer sees an increase in demand for electricity due to the extensive use of air conditioning. In the United States, the typical peak in demand occurs on a hot summer workday when air-conditioning units are demanding enormous quantities of electric power. The price of power naturally peaks during these times of maximum demand. As discussed above, weather-dependent renewable energy sources, such as wind and the sun, have added variability in the amount of energy they produce at any given point in time. By absorbing excess power during low-demand periods and providing an alternative source of power during shortages, energy storage technology can be used to mitigate both demand and supply variability, thereby reducing the frequency and size of fluctuations in pricing and availability, which may deter investment. This would allow for greater economic benefit to power generators because the price of power at peak demand increases, but the cost of production would essentially remain constant. It would benefit customers by providing more generating capacity at the peak. Moreover, when coupled with a "Smart Grid" that could help customers shift their demand from the peak to other times,

[3] *Bottling Electricity: Storage as a Strategic Tool for Managing Variability and Capacity Concerns in the Modern Grid*, a recent report by the Department of Energy's ("DOE") Electricity Advisory Committee (http://www.oe.energy.gov/eac.htm), is a particularly useful reference that outlines the benefits of energy storage technology as well as obstacles to its implementation. *Case Studies: Energy Storage Technologies*, published on the DOE's website (http://www.eere.energy.gov/de/cs_energy_storage.html), also provides helpful background toward better understanding the various energy storage technologies.

[4] "Renewable Energy Trends in Consumption and Electricity," *Renewable Energy Annual*, 2007 Edition, Energy Information Administration, U.S. Department of Energy, http://www.eia.doe.gov/cneaf/solar.renewables/page/rea_data/rea_sum.html (accessed May 28, 2009); *Massive Electricity Storage, An AIChE White Paper*, AIChE, June 2008, http://www.aiche.org/uploadedfiles/About/DepartmentUploads/PDFs/MES%20White%20Paper%20submittal%20to%20GRC%206-2008.pdf [hereinafter, Massive Electricity Storage].

[5] *Massive Electricity Storage, supra*.

energy storage technology utilized by the customer could provide a means to help balance demand and supply and reduce peak prices. The savings could make the "Smart Grid" more attractive to investors and customers.[6]

Efficient Utilization of Generation Facilities and Transmission Infrastructure

Power plants relying upon renewable energy sources often produce substantially less power than their nameplate generation capacity due to the variable nature of their energy sources. The incorporation of energy storage technology into a power project could enable the power plant to operate closer to maximum power and peak efficiency continuously, storing surplus power at off-peak times when production exceeds demand, and releasing it at peak times when demand exceeds production. Energy storage technology also provides a means of capturing energy from renewable sources during times when transmission infrastructure may be subscribed. In this way, energy storage technology can allow more complete utilization of existing generation and transmission assets, thereby enabling power generators to operate more efficiently and making it possible to serve peak demand with a more efficient network of generation and transmission equipment. Last year, the DOE predicted that in order to increase the nation's wind energy to 300 GW, approximately 50 GW of new "peaking plant" gas turbines would be needed to compensate for wind variability.[7] Energy storage technology could eliminate the need for some or all of these new gas turbines.

Reliability and Security of Power Supply

Broad deployment of energy storage technology could provide reliability and security of the nation's power supply in a number of ways, including the following:

- filling the gap created when a power plant goes offline for any reason, including due to time of day or night or changes in weather conditions that make renewable energy unavailable;
- serving as large-scale batteries to aid in getting power plants back online and restoring electricity service in the event of a widespread failure of the grid;[8]
- helping to alleviate spikes or dips in voltage on a power line and regulate AC frequency, which can save power and protect equipment;[9]
- when energy storage is located at a distribution site, enhancing service reliability by enabling the system to respond more quickly and effectively to changes in customer demand; and
- when energy storage is placed at multiple locations along the chain of generation, transmission and distribution, providing protection against sudden disruptions to the system that may occur anywhere in the power system.[10]

Obstacles to Implementation of Energy Storage Technology

The implementation of energy storage technology on a large scale may face a number of obstacles as discussed below.

Financial and Tax Obstacles

Some detractors assert that deploying energy storage technology is more costly than having a generation plant on standby or, in the case of wind generation, than outright curtailment.[11] They also claim that no facility providing reserve power can be rendered economic on payments made for reserve services alone.[12] This issue may simply be one of perspective. If the cost of energy storage is compared with the cost of either a generation facility or a transmission facility, it may not appear to be cost effective. Moreover, if one potential income source created by energy storage is looked at to the exclusion of others, it may appear that the financial benefit of energy storage does not allow for a full cost recov-

---

6 *Bottling Electricity: Storage as a Strategic Tool for Managing Variability and Capacity Concerns in the Modern Grid*, The Electricity Advisory Committee, U.S. Department of Energy, December 2008, http://www.oe.energy.gov/eac.htm [hereinafter, *Bottling Electricity*].

7 *Id*.

8 *Energy Storage Will Raise the Efficiency, Reliability, and Security of the Electricity Transmission Grid*, Richard Baxter, Assistant Director of the Energy Storage Council, http://www.energystoragecouncil.org/EnergyCentral%20Article%20on%20Energy%20Storage.htm (accessed April 18, 2009).

9 *Energy Storage: The Missing Link in the Electricity Value Chain, An ESC White Paper*, Energy Storage Council, May 2002, http://www.energystoragecouncil.org [hereinafter, *The Missing Link*].

10 *Bottling Electricity, supra*.

11 Curtailment today occurs when there is low demand for output of wind turbines or transmission congestion preventing the delivery of all of the wind resources along the line.

12 "Puncturing the Storage Myth," David Milborrow, *Windpower Monthly*, February 2006.

ery. However, energy storage can serve multiple roles and provide multiple benefits. For example, as discussed above, energy storage can enable the arbitraging of the price of electricity, defer the cost of new generation and transmission equipment, and increase reliability and security of the power supply.[13]

Under certain circumstances, incentives for new construction may hinder growth of energy storage. For example, while cost recovery for energy storage technology is not always clear, in most states cost recovery for a new generation or transmission facility is straightforward, making the case for storage more difficult to outline, especially in tough economic times.[14] Further adding to cost concerns, reduced demand for natural gas and comparatively lower costs for fossil fuels today may have dampened investors' current appetite for new energy storage technologies.[15]

The current tax treatment of some energy storage technologies may also pose a challenge to their development. For example, although the generation of wind power is generally eligible for production tax credits ("PTCs"), the use of wind power to compress air in a Compressed Air Energy Storage ("CAES") unit prior to being released and used to generate electricity is not eligible for PTCs. This is because CAES is not included among the technologies that are eligible for PTCs under Section 45 of the Internal Revenue Code. However, there is some political support for making qualifying renewable energy storage facilities, such as CAES facilities, eligible for PTCs, and Senator Robert Menendez (D-NJ), a member of both the Senate Committee on Energy and Natural Resources and the Senate Committee on Finance, has expressed an interest in such a provision.[16] Moreover, in May, Senator Ron Wyden (D-OR) introduced a series of energy initiatives including the Storage Technology Renewable and Green Energy Act of 2009, a measure that would provide investment tax credits for a wide range of energy storage technologies.[17]

[13] *Bottling Electricity, supra*.

[14] *Id*.

[15] "Tax Issues Hobbling New Energy Storage Technology," *The Energy Daily*, April 21, 2009.

[16] *Id*.

[17] *Wyden Unveils Energy Agenda to End U.S. Addiction to Foreign Oil*, Press Release of Senator Wyden, May 20, 2009, http://wyden.senate.gov/newsroom/record.cfm?id=313250.

Regulatory Obstacles

There are still few regulations that deal directly with energy storage technology, which can lead to uncertainty surrounding the treatment of investment in energy storage technologies, the recovery of costs, and what regulatory environments will permit energy storage technologies. Also leading to uncertainty is the current debate about whether energy storage technology is a generation or transmission asset. On the one hand, energy storage technology can be used for production levelization and price arbitraging (such as by shifting generation from an off-peak time to a time of peak demand). On the other hand, energy storage technology captures energy that would otherwise be curtailed due to transmission constraints and reserves it for a later time.[18] Nonetheless, with the passage of time and increasing emphasis on deploying energy storage technologies as part of the effort to develop clean renewable energy, these uncertainties are likely to be resolved.

Geographical and Environmental Obstacles

There may be geographical and environmental obstacles to the implementation of some energy storage technologies. For example, identifying suitable sites may prove to be challenging. The number of sites with a source of water and changes in elevation necessary for future pumped-hydroelectric ("pumped-hydro") facilities is limited, and sites with underground caverns suitable for CAES facilities may be difficult to find in suitable volume near to electric loads or existing infrastructure.[19] Even so, there are a large number of potential sites for CAES facilities across the United States, which could be developed in a variety of geological formations, including salt domes, depleted gas fields, abandoned hard rock mines or aquifers. There may also be environmental concerns regarding specific energy storage technologies. For example, because CAES facilities use a mixture of compressed air and natural gas to produce energy, they also produce emissions, including some carbon emissions, notwithstanding that natural gas is regarded as clean among fossil fuels.

Legislative Support for Implementation of Energy Storage Technology

There appears to be substantial public and legislative support for the development of clean renewable energy, and energy storage technology in particular, that may work

[18] *Bottling Electricity, supra*.

[19] *Id*.

to overcome these barriers. Such support includes the following:

- $59 billion has been allocated to new clean energy tax breaks in the American Reinvestment and Recovery Act of 2009;[20]
- State renewable portfolio standards ("RPS") and renewable electricity standards ("RES"), a proposed Federal RES, and the proposed Federal "cap and trade" program all create additional government pressure to adopt clean renewable power generation;[21]
- The Energy Policy Act of 2005 includes energy storage devices among the advanced technologies that Congress encourages the Federal Energy Regulatory Commission ("FERC") to deploy;
- The United States Energy Storage Competitiveness Act of 2007, as part of the Energy Independence and Security Act of 2007, establishes a major new electricity storage program with a range of applications, including electricity transmission and distribution systems, and authorizes funding for the next ten years (2009–2018) in the amount of $50 million per year for a basic research program, $80 million per year for an applied research program, $30 million per year for an energy storage systems demonstration program, and $100 million per year for an energy storage research center program;[22]
- The American Reinvestment and Recovery Act of 2009 allocates $4.5 billion to the Office of Electricity Delivery and Energy Reliability for "expenses necessary for electricity delivery and energy reliability activities to modernize the electric grid, to include … energy storage research, development, demonstration, and deployment …;"[23]
- In support of the above allocation of funds by the American Reinvestment and Recovery Act of 2009, the DOE's National Energy Technology Laboratory ("NETL") has issued a notice of intent to issue a "Funding Opportunity Announcement" intended to support, in part, "Utility-Scale Energy Storage Demonstrations," which are expected to be demonstrations of major utility-scale energy storage installations with application areas that include "wind and photovoltaic (PV) integration, upgrade deferral of transmission and distribution assets, congestion relief, and system regulations";[24]
- President Obama recently announced the creation of a $400 million Advanced Research Projects Agency for Energy ("ARPA-E"), funded by the American Reinvestment and Recovery Act of 2009, which, according to the DOE, will be focused on "transformational energy-related technologies"; and
- The DOE recently announced grants that establish 46 Energy Frontier Research Centers ("EFRC") for the scientific development of advances in various energy-related fields that include electricity storage. Planned funding for these EFRCs totals $777 million.[25]

Conclusion

As evidenced above, there appears to be substantial support for the deployment of energy storage technologies. This support stems from a growing national will to enable a significantly new energy infrastructure that would supply the nation with a major portion of its electricity needs from renewable power. Such a transformation is also said to hold the prospect of new jobs, improvements to the economy, and less dependence on foreign oil and other fossil fuels that may be harmful to the environment. Despite the obstacles to the deployment of energy storage technologies, it has always been true in America that "where there is a will, there is a way." Given the promise of energy storage and the will behind its deployment, these technologies may just be our way forward to a "clean renewable future."

---

[20] *Obama Highlights Need, supra*.

[21] Both the proposed Federal RES and the Federal cap and trade program are included in "The American Clean Energy and Security Act of 2009" (H.R. 2454), which was reported favorably by the House Energy and Commerce Committee on May 21, 2009.

[22] Pub. L. 110-140, Title VI, Subtitle D, Section 641.

[23] Pub. L. 111-005: American Reinvestment and Recovery Act of 2009 Title IV, H.R.1-24.

[24] *Notice of Intent to Issue Funding Opportunity Announcement No.:DE-FOA-0000036*, U.S. Department of Energy, http://www.aceee.org/energy/national/DOE_Industrial_Notice%20of%20Intent_2009.pdf (accessed April 20, 2009).

[25] "Obama Creates New Energy Agency to Boost 'Transformational' Technologies," *The Energy Daily*, April 30, 2009; *Energy Frontier Research Center (EFRC) Awards*, Office of Basic Energy Sciences, U.S. Department of Energy, April 27, 2009, http://www.er.doe.gov/bes/EFRC.html (accessed May 28, 2009).

The Future of Ethanol in the U.S.

The biofuels industry in the U.S. has experienced exponential growth in recent years, due in part to the increase in gasoline prices and federal production incentives. The use of ethanol as a motor fuel in the U.S. has grown at an annual average rate of 25% over the past several years, with U.S. overall production of ethanol hitting 9 billion gallons in 2008. Even with this growth, ethanol still remains a small contributor to the U.S. energy supply, and has come under recent heavy criticism for, among other things, possibly increasing the price of food around the globe and having a smaller-than-expected effect on greenhouse gases. Second-generation cellulosic ethanol has been proclaimed as the green fuel of the future, but it is unclear whether cellulosic ethanol can be produced on a commercially viable scale.

Corn-based Ethanol

Ethanol is traditionally derived from the fermentation of sugars in corn and sugarcane, with corn accounting for 98% of the feedstock for ethanol in the U.S. Corn-based ethanol can be produced in the U.S. on a cost-effective commercial scale. According to the Renewable Fuels Association, there are around 170 biorefineries in production in the U.S., with a vast majority of these projects using corn as the main feedstock.

The process of turning feedstocks into ethanol requires the input of a large amount of water, fertilizer and energy, which critics argue negates any greenhouse gas benefits. Recent studies have found that replacing traditional fossil fuels with ethanol from sugar cane produces a substantial reduction of 80% to 100% in net greenhouse gases.

Corn-based ethanol production has also been the subject of recent criticism, due to the possible link between its production and increased food prices. According to a recent report from the Congressional Budget Office ("CBO"), the increased use of corn-based ethanol as a motor fuel accounted for 10 to 15% of the rise in U.S. food prices between April 2007 and April 2008. This increase in retail food prices is due to higher feed prices for cattle, hogs and poultry. The CBO reports that one-quarter of all corn grown in the U.S. is used to produce corn-based ethanol.

The recent crisis in the financial markets has put a great deal of pressure on ethanol producers, due to shrinking profit margins. Ethanol producers have also had to contend with high volatility in the price of corn over the past several years. Further, due to the contraction of credit in the financial markets, producers in the industry have been unable to obtain sufficient injections of debt or equity to stabilize their operations. As a result, VeraSun Energy Corporation and Aventine Renewable Energy Holdings, Inc., which are among the largest ethanol producers in the U.S., declared bankruptcy in early 2009.

Cellulosic Ethanol

Cellulosic ethanol, a second-generation ethanol, can be created from all types of organic materials. Cellulosic ethanol is made by releasing sugar enzymes from cellulose using enzymes, steam or other processes. These sugars are then fermented to produce ethanol. Cellulosic ethanol may be produced from feedstocks that are not usually used as food, including corn stover (the stalk and leaves after the grain has been harvested), straw, grasses, wood and nonedible plants.

Studies have found that net greenhouse gas emissions from cellulosic ethanol are substantially less than ethanol produced from corn. Recent findings by the Argonne National Laboratory suggest that increased use of cellulosic ethanol, combined with continued use of corn-based ethanol in place of gasoline, in the amounts specified in the Energy Independence and Security Act of 2007 ("EISA") could reduce greenhouse gas emissions by as much as 130 million metric tons of carbon dioxide by 2022. Cellulosic ethanol can reduce greenhouse gas emissions even further if the feedstock comes from wood or perennial grasses, such as switchgrass, grown on non-agricultural land.

Greenhouse gas emissions benefits aside, cellulosic ethanol is currently more expensive to produce than corn ethanol and traditional fossil fuels. According to a recent report from the Scientific Committee on Problems of the Environment, the cost of producing cellulosic ethanol is estimated at $102 per barrel of crude oil equivalent. Thus, at today's crude oil prices of around $62 per barrel, cellulosic ethanol is currently not cost competitive with other forms of energy in the market without the development of new cost-efficient technologies that could drive down the price.

Federal Government Incentives

Increased production of ethanol in recent years has been driven by federal research grants and federal mandates for specific quantities of biofuels in gasoline. The renewable fuel

standard ("RFS") program was established by the Energy Policy Act of 2005 ("EPAct") and was further modified in EISA. EISA requires that an increasing amount of renewable fuels, including advanced biofuels and cellulosic biofuels, be blended into U.S. transportation fuels each year. EISA calls for increasing the standard to 9 billion gallons in 2008, with further incremental increases each year, which culminate in 36 billion gallons of renewable fuel to be produced in the U.S. by 2022. EISA increases the mandate for advanced biofuels, which are fuels derived from cellulose, hemicellulose or lignin, to 6 billion gallons by 2009, with an increase to 21 billion gallons by 2022. EISA also includes a special provision for cellulosic biofuels that mandates the production of 1 million gallons by 2010 and 16 billion gallons by 2022. The Environmental Protection Agency Administrator is given the authority to temporarily waive part of the biofuels mandate, if it were determined that a significant renewable feedstock disruption or other market circumstance might occur.

The American Recovery and Reinvestment Act of 2009 ("ARRA") contains a number of provisions designed to spur growth in biofuels. ARRA extends the production tax credit for qualified biomass projects that are placed in service before January 1, 2014. The bill also permits taxpayers to elect a 30% investment tax credit in place of the production tax credit for biomass projects placed in service after December 31, 2008, and before January 1, 2014. Alternatively, taxpayers are permitted to receive a grant of up to 30% of "qualified facilities," which include biomass projects, from the U.S. Department of Treasury, in lieu of tax credits for projects placed in service (i) in 2009 or 2010 or (ii) after 2010 but before the placed-in-service deadline for the facility, if the construction of the facility began during 2009 or 2010.

The federal government has also provided production subsidies and import tariffs for ethanol. Since 1978, companies that blend ethanol with gasoline receive a tax incentive from the federal government. Today, this incentive amounts to a tax credit of 45 cents for each gallon of ethanol blended into the supply of gasoline. Additionally, a production subsidy for ethanol applies to both domestic and imported ethanol. The U.S. charges importers of ethanol a tariff of 45 cents per gallon and an ad valorem tariff of 2.5% of the value of the imported ethanol. These two tariffs offset the production subsidy for imported ethanol unless the imports arrive duty-free.

In addition to providing tax credits and grants, ARRA expanded the Department of Energy's loan guarantee program that was originally enacted under EPAct. The loan guarantee program now provides $6 billion of loan guarantees for projects such as leading-edge biofuels projects. Leading-edge biofuels projects are likely to become commercial technologies and will produce transportation fuels that substantially reduce life-cycle greenhouse gas emissions compared to other transportation fuels. ARRA also provides an additional $2.6 billion to be spent on renewable energy and energy-efficiency demonstration and deployment activities, including biofuels.

Finally, in the 2008 Farm Bill, the Department of Agriculture was authorized to establish the Biorefinery Assistance Program. This program offers loan guarantees of up to $250 million per project to fund commercial-scale biorefineries and grants for up to 30% of the project cost for demonstration-scale biorefineries that produce advanced biofuels or any fuel that is not corn-based.

Near-Term Prospects

In the absence of a technological breakthrough leading to substantial cost efficiencies, the economic viability of corn-based ethanol is dependent on the price of gasoline, the price of corn and the continuation of federal government incentives. According to the CBO, without current federal government subsidies, the breakeven ratio of the price per gallon of gasoline to the price per bushel of corn is about 0.9. This means that when the price of a gallon of gasoline is

above 90% of the price of a bushel of corn, it is profitable to produce ethanol.

The CBO also found that, without federal government incentives, ethanol producers would have only been profitable once, in 2005. However, the production of ethanol could become more profitable in the future as petroleum becomes more expensive due to lack of supply and corn's yield per acre increases due to new technology. Much of this profitability depends on the continuation of federal policies promoting ethanol, especially the current subsidy of 45 cents per gallon of ethanol produced, but it remains unclear what impact recent criticisms of corn-based ethanol will have on future federal government support.

The Obama administration has advocated cellulosic ethanol as an alternative to corn-based ethanol. During a recent press briefing, President Obama said that it is "important for us to transition to the next generation of biofuels, that we've got to do a much better job of developing cellulosic ethanol, that corn-based ethanol, over time, is not going to provide us with the energy-efficient solutions that are needed." President Obama also appointed vocal cellulosic ethanol supporters to key positions in his administration, namely, Dr. Steven Chu as the Secretary of the Department of Energy and Governor Tom Vilsack as the Secretary of the Department of Agriculture.

Even though the Department of Energy's loan guarantees are limited to $500 million per biofuel project, the expansion of this program to include leading-edge biofuels projects may do a great deal to aid the development of cellulosic ethanol projects. However, it must be noted that, to date, the Department of Energy's loan guarantee program has not been effective, due to underutilization. Indeed, the Department of Energy's loan guarantee program has only funded one project since its enactment under EPAct. On the other hand, the Biorefinery Assistance Program run by the Department of Agriculture has been successful. In January 2009, the program awarded Range Fuels, Inc., a conditional commitment for an $80 million loan guarantee to assist in the construction of a commercial cellulosic ethanol plant in Georgia.

Although it can be reasonably anticipated that federal incentives will help drive the development of cellulosic ethanol, the future of cellulosic ethanol ultimately rests on whether cellulosic ethanol projects can be produced on a commercially viable scale. In what may be viewed as a turning point, major energy corporations, such as Royal Dutch Shell and BP, have recently entered the cellulosic ethanol fray. Royal Dutch Shell announced a new agreement with Codexis to develop super enzymes that will break up starchy feedstock more quickly and on a more cost-effective basis. BP has also partnered with Verenium Corp. to build a full-scale cellulosic ethanol plant in Florida. This plant will likely be among the first full-sized next-generation biofuels refineries in the U.S. and is expected to produce 36 million gallons of cellulosic ethanol a year, starting in 2012.

Ultimately, cellulosic ethanol has a bright future due to the influx of recent investments and continuation of federal government incentives. However, cellulosic ethanol will need technological breakthroughs that lead to substantial cost efficiencies in order to capture a greater share of the U.S. energy market.

Developments in the British and European Biomass and Energy Crop Power Market

From the uplifting words of Barack Obama in his inauguration address to the more mundane wordsmiths of the British statutory draftsmen in the U.K.'s Renewables Obligation Order, it seems like the harnessing of energy from "the soil" or biomass and energy crops is gathering political support and gaining momentum on a global basis.

It is perhaps not appropriate to describe the generation of heat and power from the burning of trees and plants as an emerging industry. However, recent developments in this area and the political need to secure non-fossil-fuel energy sources means that the attention focussed upon biomass and energy crops is now greater than at any time since Bronze Age man started to burn outcrop coal.

Biomass and energy crops can also mean different things to different people. For the purposes of this article, I shall adopt the terminology as used in the draft U.K. Renewables Obligation Order of December 2009, in which biomass is defined as:

> "fuel used in a generating station where at least 90 per cent of its energy content is derived from relevant material (that is to say, material which is, or is derived directly or indirectly from plant matter, animal matter, fungi or algae)."

Energy crops are further defined as meaning:

> "A plant crop planted after 31 December 1989 which is grown primarily for the purpose of being used as a fuel or which is one of the following:
>
> (a) miscanthus giganteus;
>
> (b) salix (also known as short rotation coppice willow);
>
> (c) populus (also known as short rotation coppice poplar)."

In the last 18 months we have seen a proliferation of biomass projects notable for their divergence in scale and technologies.

Located next to the deep-water harbour at Port Talbot in South Wales, the Port Talbot Renewable Energy Plant is notable for its size. Generating 350 MW by the combustion of clean wood chip fuel, the plant is intended to supply enough renewable energy to supply one in every two homes in Wales. The plant has received s36 consent under the U.K.'s Electricity Act and appears to be proceeding to a financial close.

The 73 MW plant developed by the AIM-listed Helius Energy at Stallingborough in Humberside received considerable media attention in September 2008, when it was acquired by RWE Innogy for a purchase price in excess of UK£28 million. The plant was permitted but not built, and the purchase price represented a sum in excess of UK£380,000 per MW.

In the last 18 months we have seen a proliferation of biomass projects notable for their divergence in scale and technologies.

Helius has also reported plans to develop a further 100 MW plant to be located in Avonmouth Docks in the U.K.

At the other end of the scale, a number of developers seem to be developing local and small-scale projects on a portfolio basis.

One such is the Virginia-based renewable energy private equity fund. Intrinergy, which in joint venture with Shanks closed the construction of the Valorbois SMW CHP biomass and wood pellet facility in Belgium in October 2008.

It would therefore appear that two models are emerging in the marketplace: the large-scale power plant owned and developed by long-standing players in the power market or the local plant as part of a portfolio of similar projects developed by entrepreneurs.

Each project has its own challenges, but there is significant commonality between the drivers of such projects and the particular challenges that they face.

The 23, January 2008, Renewables Directive of the EU is looking to create a regulatory framework by which the EU as a whole will generate 20% of its energy needs from renewable sources by 2020. Subject to what happens at COP 15

in Copenhagen this coming December, it may well be that these targets increase post 2020.

In the U.K., the Energy Act 2008 sets out a series of measures that seek, in part, to meet the obligations imposed by the Renewables Directive.

It is clear from the provisions of the Energy Act that biomass and energy crops have been identified as important elements of the U.K.'s meeting its obligations under the Renewables Directive.

As has been widely reported, the Energy Act has introduced a statutory framework by which relevant Secretaries of State can introduce bandings for Renewable Obligation Certificates ("ROCs") favouring different renewable energy sources and emerging technologies utilising those sources.

In summary, the current proposals for ROC banding for biomass and energy crops are as follows:

Co-firing of energy crops	1 ROC
Co-firing of biomass with CHP	1 ROC
Dedicated biomass	1⅓ ROCs
Dedicated biomass with CHP	2 ROCs
Dedicated energy crops with CHP	2 ROCs

Additionally, the Energy Act contains further provisions to encourage, amongst other renewable sources, biomass, particularly:

(a) A feed-in tariff for sub–5 MW plants, thereby giving a guaranteed, certain and easily collectable income for power generation; and

(b) A renewable heat incentive for heat used from a biomass CHP plant.

The U.K.'s provisions are replicated across the EU. Indeed, the U.K. has for some time been behind other EU member states in terms of the support regimes in place. Particularly, the U.K. has been dragging its feet to implement support regimes for heat generated from renewable energy sources. I acted as counsel on a biomass CHP plant in Europe last year where more income was derived from the sale of green certificates for heat than for power.

With support regimes in place, there do, however, remain a number of problems with getting biomass and energy crop power projects closed.

However, the industry is not without its difficulties.

The primary problem with biomass and energy crops is the nature of the feedstock itself.

The large- and small-scale models for biomass power plants clearly demonstrate the challenges being faced by biomass projects.

It is no coincidence that the Port Talbot, Stallingborough and Avonmouth plants are all located in ports. Put simply, the U.K. does not produce the necessary quantities of virgin timber to operate these plants. Accordingly, they require the shipping of significant quantities of materials over long distances.

The Port Talbot plant has been the subject of considerable debate in South Wales, with a certain amount of questions raised about how climate change can be reversed by shipping large quantities of timber from North America.

Whether biomass power plants of 350 MW are politically sustainable remains to be seen. What is clear is that transportation continues to attract the attention of the EU with regard to its emissions and entry into the European Emissions Trading System ("ETS"). Clearly the EU has taken the easy option of including aviation from 2012 within the ETS, but it is surely only a question of time before shipping is also included.

It would be ironic if large-scale biomass became unaffordable because of cost increases caused by the introduction of an emissions cap and trade system for shipping.

Also of concern is the nature of the suppliers of biomass to the power sector. As has been the experience of the biofuels industry with biomass, we have the meeting of two industries, agriculture/forestry and energy, that have not traditionally done business together.

The terms of business that both industries have traditionally traded upon are materially different, and on the supply side, the financial strength of counterparties has raised significant issues.

Those projects that have closed have either not utilised project finance or have required the banks to take a view. On projects I have worked upon, bankers have managed to get themselves comfortable by an independent analysis of the local market. Therefore, they have been able to reach a view that even if the supplier disappears, there will be a significant volume of locally supplied biomass to ensure that the plant

can continue to operate. In reality, it is not sustainable to build a small project some distance from your fuel source.

A number of the traditional commodity houses are starting to look at the biomass/energy crop market to see if there is a role for them in such transactions. Whether the price they seek to extract from taking such a role is detrimental to the project as a whole remains to be seen.

Again, it is no coincidence that the large-scale biomass plants have been designed to use long-established, tried and tested technology - in reality, incineration. In these difficult economic times, raising of debt-finance is hard enough - to seek UK£100 million plus for an emerging technology is impossible.

The 23, January 2008, Renewables Directive of the EU is looking to create a regulatory framework by which the EU as a whole will generate 20% of its energy needs from renewable sources by 2020.

Indeed, it is proving to be difficult to raise debt on a small scale for new technologies, but a couple of solutions have emerged:

(a) Build the plant with equity - from a developer's point of view, there is not much point in building single plants. The corporate infrastructure costs of developing a power project are only sustainable if a portfolio is going to be developed. By any analysis, such a portfolio is going to require a significant equity injection. If equity for a portfolio can be raised at an early stage, then the first project can be 100% equity-financed for construction and then refinanced on a traditional debt/equity basis once the technology has been proved to work. Once the technology is proven then the portfolio can be rolled out into the market.

(b) Obtain export credit guarantees. It is a fact of life that most of the technologies used in the biomass industry emanate from Germany or Scandinavia. The wind industry has already seen German and Scandinavian government-backed financial institutions essentially providing performance guarantees for plants manufactured in their own jurisdictions. Given the terms of reference of the institutions concerned, there is no reason why such guarantees could not be provided for biomass technology. Clearly, the attitude of funders would be dramatically different if they were aware of government-backed performance guarantees for the technology concerned.

The final problem emerging for the sector is the availability of debt. With the debt markets remaining very constrained, it is proving extremely difficult to finance projects seen as high risk in terms of fuel supply and technology risk or where a new entrant lacks a long-term relationship with its proposed funders.

Again, a number of practical solutions seem to have emerged in terms of raising debt. These have included the following:

(a) See if you can find a link between your technology supplier and your proposed funder. If you are using German technology, see if you can find a German bank.

(b) Try to raise political supplier/access grant monies to reduce the debt levels.

(c) Do everything that you can to boost the covenant of your fuel supplier, and consider selling it an equity interest in the project - a bank will be attracted to the fuel supplier's having a financial interest in the success of the project.

(d) Locate close to your fuel supply and your off-taker.

Whilst there are clearly challenges facing the biomass/energy crop power sector, this is an area that has, to date, received significant support. With governments around the world identifying climate change and clean technology as a route out of the global financial crisis, it is an area where one can only expect to see more support emerging.

A well-structured project stands every prospect of meeting the expectations of those supporting its development.

Recovery Act Implementation Update

Although the American Recovery and Reinvestment Act of 2009 (the "Recovery Act") was signed into law on February 17, 2009, guidance regarding many of the renewable energy provisions for businesses has still not been issued. Below is a short update regarding issued and pending guidance. Links to various websites are also provided as a resource.

I. Department of Treasury; Internal Revenue Service

Grants in Lieu of Tax Credits

Section 1603 of the Recovery Act provides a 10% or 30% grant for certain renewable energy property. The Department of Treasury had administrative responsibility for the grant program. The Treasury has issued an update that states that Treasury's Office of the Fiscal Assistant Secretary is working closely with the Internal Revenue Service, Treasury's Office of Tax Policy and the Department of Energy "to develop program policies and processes including application forms and instructions, program guidance, reporting and monitoring requirements, and any related agreements." It is currently anticipated that the guidance and application materials will be available for the grant program "by no later than July 2009." For more information, please visit http://www.treas.gov/recovery/docs/Grants_Specified-Energy-Property.pdf. In the meantime, questions regarding the grants can be submitted to: 1603Questions@do.treas.gov.

The Treasury program plan regarding the grant program on http://www.recovery.gov/ provides that the response time from receipt of application to award will be 60 days and that approved applications will receive funding within five days of notification of award. In addition, the program plan provides that awardees will be required to report certain performance data including (a) the name of the recipient entity; (b) the name, a brief description and the location of the project; (c) the number of jobs created and retained; (d) the number of total projects; and (e) the amount of energy produced. All of this data will be made publicly available.

ITC in Lieu of PTC Election

On Friday, June 5th, the Internal Revenue Service (the "Service") released Notice 2009-52 (the "Notice"), which provides the procedures for taxpayers to elect to claim an investment tax credit ("ITC") under Section 48 of the Internal Revenue Code (the "Code) in lieu of production tax credits ("PTC") provided under Section 45 of the Code. The Notice is procedural in nature and does not address substantive questions that may be raised in connection with the ITC election.

Section 1102 of the American Recovery and Reinvestment Act of 2009 provides taxpayers with an election to claim a 30 percent ITC in lieu of PTCs for certain renewable energy facilities (wind, closed-loop biomass, open-loop biomass, geothermal, municipal solid waste, hydropower and marine facilities). The election is available for facilities placed in service after December 31 2008 and before the current placed in service deadline for such facility (January 1, 2013 for wind and January 1, 2014 for all other facilities). The election is irrevocable and no PTCs under Section 45 are allowed once the election is made with respect to a facility. For more information regarding the Notice, please see our Client Alert.

Clean Renewable Energy Bonds

The Internal Revenue Service issued Notice 2009-33, which solicits applications for allocations for the $2.4 billion of New Clean Renewable Energy Bonds that are available to governmental bodies, public power providers and cooperative electric companies for the financing of certain renewable energy facilities. Applications are due by August 4, 2009. A copy of the Notice is available at http://www.irs.gov/pub/irs-drop/n-09-33.pdf.

Qualified Energy Conservation Bonds

The Internal Revenue Service issued Notice 2009-29, which sets forth the amount of Qualified Energy Conservation Bonds ("QECBs") that may be issued by each state and large local government. The total amount of QECBs available for allocation is $3.2 billion. The proceeds of QECBs can be used to finance, among other things, certain renewable energy facilities and demonstration projects. A copy of the Notice is available at http://www.irs.gov/pub/irs-drop/n-09-29.pdf.

General

The latest Department of Treasury developments and information regarding Recovery Act program implementation are available at http://www.treas.gov/recovery/ and http://www.treas.gov/recovery/programs.shtml.

The latest Internal Revenue Service news releases, video, audio and legal guidance regarding the Recovery Act are available at http://www.irs.gov/newsroom/article/0,,id=205018,00.html.

Finally, Senator Max Baucus (D-MT) has released a Finance Committee Tax Summary of the Recovery Act, which provides information regarding Recovery Act implementation and related website links: http://finance.senate.gov/press/Gpress/2009/prg051909h.pdf.

II. DOE Office of Energy Efficiency and Renewable Energy

The Recovery Act designated $16.8 billion to DOE's Office of Energy Efficiency and Renewable Energy ("EERE") to support energy efficiency and renewable energy development divided across the following EERE technology areas and programs.

Applied Research, Development, Demonstration and Deployment

The Recovery Act provided $2.5 billion to EERE for R&D, demonstration and deployment activities. In conference report language, Congress specifically directed that $800 million be used to support biomass programs and $400 million be used to support geothermal technologies. Congress also directed that $50 million be used to support communications and technology standards development. Congress did not, however, provide direction for how the remaining $1.25 billion should be allocated, thus providing EERE discretion to support those programs likely to best achieve the goals of the Recovery Act.

The following outlines EERE's efforts to date with respect to utilizing Recovery Act funds to support R&D, demonstration and deployment activities for various technologies. The latest EERE developments and information regarding Recovery Act program implementation is available at http://www.eere.energy.gov/recovery/.

- **Biomass:** EERE has announced its intent to utilize $786.5 million to accelerate advanced biofuels R&D and to provide additional funding for commercial-scale biorefinery demonstration projects. It will be allocated across four areas:
  - Integrated pilot- and demonstration-scale biorefineries ($480 million)
  - Commercial-scale biorefinery projects ($176.5 million)
  - Fundamental research ($110 million)
  - Ethanol research ($20 million)
- **Wind:** EERE intends to allocate $118 million in Recovery Act funds to the following wind programs and facilities:
  - Wind turbine drivetrain R&D and testing ($45 million)
  - Technology development geared toward improving the quality and use of lighter-weight, advanced materials for turbine blades, towers and other components ($14 million)
  - Wind power R&D for the development of up to three consortia between universities and industry to focus on critical wind energy challenges ($24 million)
  - National Wind Technology Center ($10 million)
  - Massachusetts Wind Technology Testing Center ($25 million)
- **Solar:** EERE has allocated $117.6 million to support the following solar energy programs and research:
  - Photovoltaic technology development ($51.5 million)
  - High penetration solar energy deployment ($40.5 million)
  - Concentrating solar power R&D ($25.6 million)
- **Geothermal:** EERE will provide $350 million to support the following geothermal energy projects, research and studies:
  - Geothermal demonstration projects ($140 million)
  - Enhanced geothermal systems technology R&D ($80 million)
  - Innovative exploration techniques ($100 million)

- National geothermal data system, resource assessment and classification system ($30 million)

- **Energy Efficiency:** The EERE has allocated $256 million toward supporting the following energy efficiency projects and research:
  - Combined heat and power, district energy systems, waste energy recovery systems and efficient industrial equipment ($156 million)
  - Improved energy efficiency for information and communication technology ($50 million)
  - Advanced materials in support of advanced clean energy technologies and energy-intensive processes ($50 million)

- **Fuel Cells:** EERE has awarded $41.9 million to fund 13 projects to deploy fuel cells and help build a consumer base for U.S. fuel cell manufacturers. A state-by-state list of awards is available at http://apps1.eere.energy.gov/news/daily.cfm/hp_news_id=161.

- **National Renewable Energy Laboratory:** DOE's National Renewable Energy Laboratory ("NREL") is slated to receive $106 million for facility construction and upgrades:
  - Research support facility ($68 million)
  - Renewable energy and site infrastructure ($19.2 million)
  - Integrated biorefinery research facility ($13.5 million)

State Energy Program

The Recovery Act provides $3.1 billion to DOE to support the State Energy Program ("SEP"). Federal funds are provided to DOE under the SEP, which in turn allocates funds to the states, first on an equitable basis and then based on population and energy consumption. The grants are intended to help states address their energy priorities and to adopt emerging renewable energy and energy efficiency technologies. Only states are eligible to apply for the federal funding, but funds can be sub-allocated to private entities — generally in the form of grants, revolving loan programs, performance contracting and loan guarantees — to achieve state goals.

Eligible activities are determined on a state-by-state basis as described and identified in a state's "State Energy Plan," which is required to be submitted by each state, and approved by the DOE, in order for a state to receive federal funding. Although specific activities are within the discretion of the state energy offices, the states generally must seek to achieve certain SEP goals and objectives, including improving energy efficiency and reducing greenhouse gas ("GHG") emissions.

States wishing to receive SEP funds were required to submit comprehensive applications to DOE in mid-May outlining program goals and projects to be supported with SEP funds. Additional information on the SEP is available at http://apps1.eere.energy.gov/state_energy_program/.

Energy Efficiency and Conservation Block Grants

The DOE Energy Efficiency and Conservation Block Grant Program ("Block Grant Program") provides federal grants to units of local government, Indian tribes, states and U.S. territories to reduce energy use and fossil fuel emissions, and for improvements in energy efficiency. The Block Grant Program is similar to the SEP, but directs funds toward local units of government, such as cities and counties. Only governmental entities are eligible to apply, but funds received by the entities can then be sub-allocated to private entities to achieve local government goals. The program was established by the Energy Independence and Security Act of 2007 ("EISA"), but had not been funded before now.

Like the SEP, eligible activities are determined by the local government entity as identified in the entity's "Energy Efficiency and Conservation Strategy," which is required to be submitted by the local governmental body, and approved by the DOE, in order to receive federal funding. Although specific activities are within the discretion of the units of local government, projects and activities generally must meet certain Block Grant Program goals and objectives, including reducing fossil fuel emissions, reducing total energy use by local governmental entities and improving energy efficiency.

The Block Grant Program funding announcement issued on March 26, 2009 identifies several eligible activities, ranging from distributed energy resource technologies that increase energy efficiency — such as cogeneration systems, combined heat and power systems, and district heating and cooling systems — to technologies that reduce, capture and use methane and other GHGs generated by landfills or similar waste-related sources.

The program application deadline for eligible applicants, including local, tribal and state governments, is June 25,

2009. Additional information on the Block Grant Program is available at http://www.eecbg.energy.gov/.

Weatherization Assistance Program

DOE's Weatherization Assistance Program ("WAP") will distribute $5 billion to the states to reduce energy costs for low-income families through increased home energy efficiency. WAP funds became available to the states in April 2009. Additional information on the WAP is available at http://apps1.eere.energy.gov/wip/weatherization.cfm.

Transportation Programs

- **Advanced Battery Manufacturing Grants ($2 billion):** EERE has issued a solicitation for grants supporting the construction of U.S.-based manufacturing plants to produce batteries and electric drive components. The battery manufacturing program is focused on battery-manufacturing plants, material and component supplier manufacturing plants, and recycling plants to support the development and manufacture of advanced batteries used in advanced vehicles such as electric drive vehicles ("EDVs") and micro-hybrids. The electric drive manufacturing area is focused on production plants for components and subcomponents for use in EDVs.
- **Transportation Electrification ($400 million):** EERE is seeking applications for grants to establish projects to accelerate the market introduction and penetration of advanced EDVs. DOE's goal is for the vehicles and electric technologies to achieve a fast market introduction and reach high-volume production.
- **Alternative-Fueled-Vehicles Pilot Grant Program ($300 million):** EERE issued a solicitation for projects covering a range of commercial technology deployment and educational activities under the Clean Cities Transportation Sector Petroleum Reduction Technologies Program. The goal of the program is to expand the nation's fleet of clean, sustainable vehicles and the supporting infrastructure.

Energy Efficient Appliance Rebate Program and ENERGY STAR®

The Recovery Act provides $300 million to support the appliance rebates and the ENERGY STAR® program, but EERE has not yet announced how this funding will be utilized.

III. DOE Office of Electricity Delivery and Energy Reliability

The Recovery Act allocated $4.5 billion to the DOE Office of Electricity Delivery and Energy Reliability ("OEDER") for activities to modernize the electric grid, including the development of demand response equipment; enhancing security and reliability of energy infrastructure; energy storage research, development, and demonstration and deployment; and the implementation of Smart Grid programs authorized under Title XIII of EISA. Of this funding, Congress directed that $80 million be used to conduct a resource assessment and an analysis of future demand and transmission requirements. Finally, $10 million is to be used to develop and implement Smart Grid interoperability standards.

Smart Grid

OEDER recently took its first steps toward utilizing Recovery Act funds by proposing to launch two Smart Grid programs originally established under Title XIII of EISA: (1) the Smart Grid Investment Grant program; and (2) the Regional Demonstration Initiative, which encompasses Smart Grid demonstrations, complementary synchrophasor demonstration projects and utility-scale energy storage demonstrations. The programs are slated to receive $3.375 billion and $615 million in stimulus funding, respectively. For more on these Smart Grid opportunities, see pages 18-21 herein.

Interconnection-Wide Planning

In addition to Smart Grid, the Recovery Act directs DOE to coordinate with FERC to provide technical assistance to the North American Electric Reliability Corporation ("NERC"), the regional reliability entities, states, and other transmission owners and operators for the formation of interconnection-based transmission plans for the Eastern and Western Interconnections and the Electric Reliability Council of Texas

("ERCOT"). To this end, DOE intends to issue a solicitation seeking applications from potential planning entities to complete interconnection-level studies and planning analyses. DOE likely will choose a single recipient within each interconnection, on a competitive basis, that will be the interconnection planning entity responsible for interconnection-wide analysis and planning, as well as collaborating with additional stakeholders.

IV. DOE Loan Guarantee Program

The Recovery Act established a new, temporary DOE Loan Guarantee intended to support the rapid deployment of (1) renewable energy systems, including incremental hydropower, that generate electricity or thermal energy, and facilities that manufacture related components; (2) electric power transmission systems, including upgrading and reconductoring projects; and (3) leading-edge biofuels projects. The goal of the new program, which supplements the existing loan guarantee program established by the Energy Policy Act of 2005, is to encourage rapid program and project deployment by requiring that commercial technologies commence construction by September 30, 2011.

To date, the new loan guarantee program is not yet up and running, despite the directive of Secretary Chu and the laborious efforts of those in the DOE loan guarantee program office. Progress, however, has been made and it is expected that DOE will issue interim guidance sometime this summer, perhaps by late July, that will outline applicant and project eligibility criteria, as well as financial mechanisms and requirements. Shortly thereafter, applications will be accepted, likely on a rolling basis.

Although nothing is yet set in stone, it is anticipated that there are at least three areas likely to be revised in the implementation of the new program, including:

- **Credit Subsidy Fees:** Under the original program, the amount of these significant up-front costs was too much for many companies to bear. It is expected that the majority of the $6 billion allocated to the new loan guarantee program by the Recovery Act will go toward paying all or a portion of a project's credit subsidy fees.
- **Credit Review Process:** The credit review process for commercial projects is likely to consist of a review by an internal Credit Review Board having delegated authority. Under the existing DOE loan guarantee program, an external credit review was required, which proved burdensome and costly. The commercial lender, however, may have discretion to require a pre-application credit assessment.
- **Application Fees:** Application fees will still be required, but collection of some portion of application and facility fees is likely to be deferred until the closing of the loan.

Additional changes may include shorter applications, a streamlined environmental and National Environmental Policy Act ("NEPA") review, and unlike the existing program regulations, applications are not likely to be scored competitively.

V. DOE Office of Fossil Energy

The Recovery Act allocated $3.4 billion to the DOE Office of Fossil Energy to support various fossil energy-related programs. The Office of Fossil Energy has thus far announced $2.4 billion in funding opportunities, including the following:

- Carbon Capture and Sequestration ("CCS") from industrial sources and innovative concepts for beneficial CO_2 use ($1.52 billion)
- Clean Coal Power Initiative (Round 3) — CCS from coal-fueled power plants ($800 million)
- Site characterization of promising geologic formations for CO_2 storage ($50 million)
- Geologic sequestration training and research ($20 million)

VI. Advanced Research Project Agency – Energy

The Recovery Act established the Advanced Research Projects Agency – Energy ("ARPA-E"), a new organization within DOE created specifically to foster R&D of transformational energy-related technologies. Transformational technologies are those that disrupt the status quo by being significantly better than current technologies. ARPA-E will focus on developing technologies geared toward overcoming the threats posed by climate change and energy security resulting from reliance on fossil fuels.

NEPA Compliance

A time-consuming and often expensive impediment to the development of renewable energy projects is the compliance obligations of NEPA. NEPA requires that before implementing any "major federal actions significantly affecting the human environment" a federal agency must compile an

Environmental Impact Statement ("EIS") that, among other things, considers the environmental impacts of that action and identifies unavoidable environmental impacts. A "major federal action" has been expanded to include most things that a federal agency could prohibit or regulate, including certain instances when a federal agency provides any portion of the financing for a project. The development of a comprehensive EIS is an arduous undertaking that can often take years to complete.

Recognizing that the lengthy NEPA process could frustrate the President's goals of stimulating the beginnings of a new clean energy economy, Congress sought to minimize project delays by including express language in the Recovery Act requiring expedited NEPA reviews. Specifically, the Recovery Act provides that "[a]dequate resources within this bill must be devoted to ensuring that applicable environmental reviews under [NEPA] are completed on an expeditious basis and that the shortest existing applicable process under [NEPA] shall be utilized."

To this end, the White House Council on Environmental Quality ("CEQ") issued guidance on how federal agencies can expedite environmental reviews for projects utilizing Recovery Act funding. In order to comply with NEPA in as efficient a manner as possible, CEQ recommends that federal departments and agencies:

- Ensure proposals that can potentially be categorically excluded from NEPA reviews have been or are being reviewed for extraordinary circumstances;
- Use concise and focused environmental assessments;
- Prepare programmatic analyses in cases in which consolidated analysis of similar, connected or cumulative proposals will facilitate efficient NEPA compliance;
- Review other federal agencies' NEPA analyses and documentation for the project or activity for potential adoption or incorporation by reference; and
- Engage CEQ to address any specific NEPA compliance concerns and issues.

CEQ also advises that departments and agencies address outstanding environmental permitting and compliance issues "as quickly as possible" and that they "proactively comply with all applicable environmental statutes and requirements." In addition, if a department or agency identifies a project or activity that is experiencing substantial delays in completing NEPA reviews, it is to contact CEQ immediately.

The Recovery Act also requires that the President report to Congress every 90 days on the status and progress of projects funded by the Recovery Act with respect to NEPA compliance. To meet this reporting requirement, CEQ has directed Executive Branch departments and agencies to report to CEQ the status and progress of NEPA compliance on all Recovery Act-funded projects and activities. The first two reports to CEQ on the status of NEPA compliance for Recovery Act projects were due on April 9 and April 30, with a report to Congress due by May 18, 2009. The deadline for subsequent reports to Congress is July 15, 2009, and every 90 days thereafter.

EPA Revolving Funds

The Recovery Act provides $6 billion to EPA to support its Clean Water State Revolving Funds program ($4 billion) and its Drinking Water State Revolving Funds program ($2 billion) ("Revolving Funds"). Similar to the DOE's State Energy Program, these funds are allocated directly to the states by EPA based on formulas. The states then have discretion as to how to spend the money.

The Revolving Funds are traditionally intended to support water quality protection projects for wastewater treatment, nonpoint-source pollution control, and watershed and estuary management, as well as drinking water infrastructure needs. The Recovery Act, however, requires that at least 20 percent of each Revolving Fund be available for projects to address "green infrastructure, water and/or energy efficiency improvements, or other projects that involve environmentally innovative activities."

"Green infrastructure" applications and approaches are geared toward reducing, capturing and treating stormwater runoff at its source before it can reach the sewer system and includes projects such as green roofs, downspout disconnections, rain harvesting/gardens, planter boxes and so on. The energy efficiency category is broader in scope and recognizes projects such as anaerobic digesters that produce generation through combined heat and power.

Smart Grid Update:
Recent Federal Agency Efforts to Promote Smart Grid Development

The eventual establishment of a "smart" national transmission grid is expected to create numerous wide-ranging benefits, such as delivering renewable energy to urban load centers, improving energy efficiency, establishing a more reliable and secure transmission grid, reducing harmful emissions and creating green jobs. Congress took a first step toward promoting the Smart Grid in Title XIII of the Energy Independence and Security Act of 2007 ("EISA"). Nevertheless, the development and deployment of Smart Grid standards and technologies have, until recently, been slow and inconsistent. The enactment of the American Recovery and Reinvestment Act of 2009 (the "Recovery Act") has breathed new life into the Smart Grid cause. Although the actual creation of a Smart Grid would necessarily require many years, a number of important post-Recovery Act implementation steps have already been taken by the Department of Energy ("DOE"), the National Institute of Standards and Technology ("NIST") and the Federal Energy Regulatory Commission ("FERC"). This article surveys the measures that the three agencies have taken to lay the foundation for further Smart Grid development. As will become clear, a number of these efforts overlap or are interrelated parts of a major federal push to promote the Smart Grid.

I. DOE's Smart Grid Stimulus Programs

As was reported in the March 2009 edition of the *Renewable Energy Quarterly*, the Recovery Act provided $4.5 billion in stimulus funds to the DOE's Office of Electricity Delivery and Energy Reliability ("OEDER") to, among other things, "modernize the electric grid" and to implement the Smart Grid grant and regional demonstration programs that were originally authorized, but never launched, under the EISA.

On April 16, OEDER took its first steps toward utilizing Recovery Act funds by proposing to initiate (1) a Smart Grid Investment Grant ("SGIG") program and (2) a Regional Demonstration Initiative ("RDI"), which encompasses smart grid demonstrations, complementary synchrophasor demonstration projects and utility-scale energy storage demonstrations. The proposed SGIG program is slated to receive $3.375 billion in stimulus funding, while $615 million would be allocated to support RDI programs. (It appears that the remaining OEDER stimulus funding would seemingly be for non-Smart Grid initiatives.) OEDER intends to implement the programs through a competitive grant process, offering grants to successful applicants to cover up to 50% of total project costs. A cost share requirement of 50% of the total allowable costs for each project is required and must come from non-federal sources.

Consistent with the Recovery Act's purpose of stimulating the economy and creating jobs, it is expected that most of the SGIG and RDI funds will be expended over the next two years. Interested stakeholders submitted comments on the two programs in early May. DOE anticipates issuing final Funding Opportunity Announcements ("FOA") for each program in mid-June and accepting applications under them by July.

Smart Grid Investment Grant Program

DOE originally proposed that the Smart Grid awards would provide competitive matching grants between $500,000 and $20 million to a broad range of potential applicants for "qualifying smart grid investments" that would support or advance one or more "smart grid functions," as defined in EISA. "Qualifying smart grid investments" eligible under the SGIG program include a variety of investments in equipment, software, or other technology that enables transmission and distribution facilities, specialized electricity usage equipment, sensors or metering and control devices, distributed generation, and electric vehicles, *etc*, to perform (or to be integrated into) Smart Grid functions. "Smart grid functions" generally relate to the monitoring, collecting, measuring, sending and receiving of digital information concerning electricity use, prices, storage and so on.

Stakeholder comments on the SGIG program overwhelmingly objected that the proposed $20 million cap on grants was too low to encourage commercial-scale projects or to attract the interest of major companies. In response, DOE recently announced that it would increase the cap on awards to $200 million. It also stated that it would ensure that a "diversity of applications" were funded, "including small projects as well as end-to-end larger projects." Additional details on DOE's plans will not be known until the final FOA is issued.

DOE had previously announced that the SGIG would provide awards for Phasor Measurement Unit ("PMU") technologies ranging between $100,000 and $5 million per project. PMU technologies measure voltage, current and frequency on the

electric power transmission system, which provide the data needed to run analytical operations and gather real-time information on the status of the grid. A critical goal of these grants is to expand the number and coverage of PMUs in each interconnection that feed their output into a network that shares data necessary to detect and mitigate wide-area disturbances. It is unclear to what extent the potential size of these awards will be increased in line with the increase of the maximum award cap to $200 million.

Consistent with the Recovery Act's purpose of stimulating the economy and creating jobs, it is expected that most of the SGIG and RDI funds will be expended over the next two years.

Upon issuance of the final SGIG, currently expected in mid-June, DOE will accept applications on or before three anticipated target dates: July 29, 2009; December 2, 2009; and March 31, 2010. DOE has said that it intends to make all awards by September 30, 2010, but has also been clear that there is no guarantee that funds will remain available beyond the first date.

Regional Demonstration Initiative

In addition to the SGIG program, DOE also intends to support $615 million in Smart Grid regional demonstration projects, synchrophasor technology and utility-scale energy storage projects. The goal of the Smart Grid RDI is to "support regionally unique demonstration projects to quantify smart grid costs, benefits and cost-effectiveness, verify smart grid technology viability, and validate new smart grid business models, at a scale that can be readily adapted and replicated around the country." The initiative is intended to support advanced digital technologies for use in planning and operations of the electric power system and the electricity markets, such as microprocessor-based measurement and control, communications, computing and information. Each demonstration project is to be carried out in cooperation and collaboration with the electric utility that owns the grid facilities. A utility may be either the proposing applicant or a team member. A team approach including utilities, Regional Transmission Organizations and Independent System Operators, and state and municipal governments is encouraged.

DOE originally anticipated making eight to twelve total project awards under this category, ranging between $20 million and $40 million for each project involving investor-owned utilities (six to eight expected projects), and between $5 million and $20 million for each project involving public power utilities, such as electric cooperatives and municipal utilities (two to four expected projects). DOE also originally stated that it would make four to five total project awards for synchrophasor demonstrations, with each receiving between $15 million and $20 million. These projects will be complementary to the Smart Grid projects by installing and networking multiple high-resolution, time-synchronized grid monitoring devices to address local or regional power system issues that pose reliability concerns.

Subsequently, in response to the same kind of criticism that was leveled against its original SGIG proposal, DOE announced that the cap on demonstration projects involving investor-owned utilities would be increased from $40 million to $100 million. It is not yet clear whether the other originally proposed RDI ceilings, or the total number of RDI awards, will be changed. Answers must await the issuance of a final FOA.

Smart Grid Information Clearinghouse

Although not expressly supported by Recovery Act funds, DOE is required under the EISA to establish a Smart Grid Information Clearinghouse (the "Clearinghouse") as a resource to stakeholders that is intended to help advance Smart Grid implementation. In early March, DOE issued a solicitation requesting applications from qualified applicants to develop, populate, manage, and maintain a public Clearinghouse website. The Clearinghouse is envisioned as being the principal repository for public Smart Grid information that will also link other pertinent databases and resources. Through direct sharing and dissemination of information on lessons learned and best practices, DOE intends for the Clearinghouse to facilitate Smart Grid collaboration. It is also intended to serve as a decision support tool for both state and federal regulators, and to serve as a public forum for information outreach to all interested parties including the general public.

II. NIST's Efforts to Develop an Interoperability Framework

The EISA directed the NIST to "coordinate the development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems." The goal is to ensure that software and hardware components from different manufacturers will all work together, thereby avoiding future compatibility problems and stranded investment. Once NIST's efforts have led to "sufficient consensus" among the cooperating entities on interoperability standards, FERC is required to conduct rulemaking proceedings to adopt the standards.

In April, the NIST stated that it would work with stakeholders to define an overarching Smart Grid "architecture" and to identify the highest priority standards needed to support future development.

Before the Recovery Act, the NIST-led effort was generally perceived to have made little progress. Since the Recovery Act, however, the NIST has unveiled ambitious new plans for advancing the effort and has begun to put them into action.

In April, the NIST stated that it would work with stakeholders to define an overarching Smart Grid "architecture" and to identify the highest priority standards needed to support future development. NIST has since held two major stakeholder workshops and enlisted the Electric Power Research Institute ("EPRI") to assist it with both the stakeholder process and the necessary technical work.

In May, the NIST announced that it would include sixteen standards in the first working version of an interoperability standards framework and invited stakeholder comment on them. The NIST acknowledged that many more standards remain to be developed. In particular, it has identified a need for communications standards to support connectivity and data networking as well as cyber-security. Nevertheless, the NIST has committed to completing an "initial slate" of interoperability standards and submitting them to FERC for its review by the end of 2009.

Looking ahead, the NIST has promised to launch a formal partnership to pursue the development of additional standards needed to fill gaps and integrate new technologies. It also intends to establish a testing and certification program to ensure that Smart Grid equipment complies with standards for both interoperability and cyber-security. NIST has indicated that it will initiate the partnership and have a complete testing and certification plan in place by the end of the year.

III. FERC's Smart Grid Initiatives

In March, FERC issued a proposed Smart Grid policy statement and action plan ("Smart Grid Policy"). Industry comments were submitted in May and a final policy statement is pending.

FERC's proposed Smart Grid Policy has three major objectives: (1) to prioritize the development of key interoperability standards of Smart Grid devices and systems; (2) to provide guidance to the electric industry regarding the need for full cyber-security for Smart Grid projects; and (3) to provide an interim rate policy geared toward encouraging utility investment in Smart Grid technologies.

With respect to interoperability, the Smart Grid Policy encouraged the NIST to expedite its efforts and signaled FERC's willingness to insert itself into the NIST process, *e.g.,* by helping to identify when a "sufficient consensus" has been reached or when negotiations on interoperability standards are at an impasse.

The Smart Grid Policy also highlighted several areas that FERC believes need special and immediate attention. Specifically:

- **Cyber-security:** FERC's principal goal is to ensure that interoperability standards and protocols are consistent with the overarching requirements of its reliability standards, including especially the cyber-security requirements of its Critical Infrastructure Protection ("CIP") standards. The Smart Grid Policy identified a number of considerations that FERC expects Smart Grid developers to address, such as the integrity of data communications, the physical protection of Smart Grid devices, and unauthorized-use impacts. Given increased concerns about the grid's vulnerability to cyber-attacks and the substantial amount of media and Congressional attention that these issues have recently received, cyber-security seems certain to remain a paramount concern to

FERC. For the same reasons, any violations of FERC cyber-security rules are likely to elicit a swift and forceful response by FERC's Office of Enforcement.

- **Inter-system Communication and Coordination:** FERC believes that standards for a common framework and software models for communication among all elements of the (FERC-jurisdictional) bulk power system are needed. Specifically, the Smart Grid Policy identifies certain communication standards initiated by EPRI and currently utilized by some utilities for enterprise system integration. FERC cites the EPRI standards as serving as a foundation for developing a complete set of communications standards and sought comment on this approach.
- **Wide-Area Situational Awareness:** The Smart Grid Policy defines wide-area situational awareness as "the visual display of interconnection-wide system conditions in near real time at the reliability coordinator level and above." FERC's goal in this area is to ensure that operators have the equipment and technology needed to effectively monitor and operate their systems as well as to analyze and respond to system conditions and events. Efforts to achieve these goals will require substantial communications and coordination across large regions.
- **Coordination of Bulk Power Systems with New and Emerging Technologies:** FERC hopes to see standards that would help support renewable resources, demand response, and electricity storage to help address bulk power system operational challenges as well as accommodate emerging technologies and electric transportation.

Finally, FERC's "interim rate policy" for Smart Grid projects would allow for "single issue rate filings" by utilities to recover the costs of FERC-jurisdictional Smart Grid deployments.

This is significant because FERC generally does not permit such filings and is clearly intended to incentivize investment. Utilities would be given a rare opportunity to seek rate recovery for Smart Grid investments without having to open all of their rates to review. They would also have a clearer path to returns on their Smart Grid investments, ameliorating the ambiguity about rate recovery (at least at the federal level) that has the potential to impede a Smart Grid build out.

The interim rate policy would remain in place until FERC adopts final interoperability standards from the NIST. FERC proposed to "consider Smart Grid devices and equipment, including those in a Smart Grid pilot or demonstration project, to be used and useful if an applicant makes certain showings…," including how the:

- proposed Smart Grid equipment will maintain compliance with all Commission-approved reliability standards, including CIP standards, such that the reliability and security of the transmission grid will not be adversely affected by the technology deployment;
- possibility of stranded investment in Smart Grid equipment will be minimized by designing for the possibility of later upgrades; and
- Smart Grid deployment information will be shared with DOE's information clearinghouse, mentioned earlier in this article.

The Smart Grid Policy clearly signaled that accelerating the deployment of Smart Grid technologies has become one of FERC's major institutional priorities. This point was recently re-emphasized when FERC established a new Office of Energy Policy and Innovation to formulate policies and regulations in this area.

Conclusion

The DOE, NIST, and FERC have all taken major steps since the President signed the Recovery Act to further the implementation of the Smart Grid. The extent to which their efforts have overlapped, and even been coordinated with each other, is striking and suggests the extent to which the Smart Grid is a major Obama administration priority. For example, FERC has supported (and perhaps helped to stimulate) the acceleration of the NIST stakeholder process while encouraging that process to focus on areas of special concern to FERC. FERC also appears to be collaborating with DOE on the development of its Smart Grid funding programs. Most notably, in March, FERC and the National Association of Regulatory Utility Commissioners made joint recommendations to DOE regarding how those programs should be structured. Many of those suggestions seem likely to be adopted.

In short, notwithstanding, the magnitude of the technical and political challenges, and the years of effort that will be required to make it a reality, it is clear that the federal government has committed to Smart Grid development in a major way and that various federal agencies are going to be focusing their attention on Smart Grid development for years to come.

Industry Happenings

Recovery Act Funding Demonstrates Commitment to Geothermal Energy and Solar Energy Projects

On May 27, 2009, President Obama announced over $467 million from the American Reinvestment and Recovery Act to expand and accelerate the development, deployment, and use of geothermal and solar energy throughout the United States. The bulk of this funding, $350 million, is being directed to various sectors of the geothermal industry, a significant increase from previous commitments to geothermal energy development. The funding will support demonstration projects incorporating cutting-edge technologies ($140 million); research of Enhanced Geothermal Systems Technology ($80 million); innovative exploration techniques ($100 million); and the development of the National Geothermal Data System ($30 million). The $117.6 million remaining will be dedicated to the solar energy industry and its development of photovoltaic technology, research and solar energy deployment. The funding announcement represents a substantial down payment that will help the geothermal and solar industries overcome technical barriers, demonstrate new technologies and provide support for clean energy jobs for years to come.

EBRD Facilitates Renewable Energy Investment in Eastern Europe

Encouraged by reported reductions in carbon emissions realized over the past three years, the European Bank for Reconstruction and Development (EBRD) is stepping up its efforts to tackle Eastern Europe's legacy of endemic energy wastage. EBRD plans to invest up to €5 billion in sustainable energy projects in Eastern Europe over the next three years, an investment that is expected to attract cofinancing of up to €10 billion. This commitment increases EBRD's prior investments of €3 billion under its Sustainable Energy Initiative launched three years ago.

The Sustainable Energy Initiative focused initially on fostering large-scale industrial and infrastructure energy efficiencies, developing renewables and fostering the development of the carbon market. EBRD plans to continue this work over the next three years while adding additional types of investments, including energy efficiencies in buildings and the transportation sector, climate-change mitigation, stationary use of biomass, and climate change adaptation. The Bank is also seeking to develop new financial products to support these goals.

Recently announced initiatives include: (1) a €70 million loan to Plinacro, the Croatian state-owned gas transmission operator to acquire a gas-storage company; (2) a €15 million loan to the United Bulgarian Bank to finance small renewable energy projects and energy efficiency; and (3) €90 million in financing to Irkutsk Oil Company, an independent Siberian energy company, to restructure debt and cut gas flaring at an East Siberian oil field.

DOE Loan Guarantee Opportunities Become a Reality

Demonstrating its desire to accelerate the disbursement of clean-energy loans, the U.S. Department of Energy ("DOE") announced a "conditional commitment" to award a $535 million federal loan guarantee to California-based solar start-up Solyndra on March 20, 2009. Once finalized the guaranteed loan is expected to provide debt financing for approximately 73% of the project costs and will allow Solyndra to expand its solar panel manufacturing capacity. If it is finalized, the Solyndra guarantee would be the first to be approved by the DOE since guarantees for "innovative" renewable energy projects were first authorized by the 2005 Energy Policy Act. It also appears to mark the beginning of a wave of loan guarantees triggered by the enactment of the American Recovery and Reinvestment Act ("ARRA"). Beyond sparking new activity under the previously dormant Energy Policy Act loan guarantee program, the ARRA also established a temporary loan guarantee program appropriating $6 billion to support loan guarantees for commercially available renewable energy systems, leading-edge biofuel projects and electric power transmission projects. The deployment of these loans must be complete by late 2011 and DOE has said that it plans to release 70% of the funds authorized by the ARRA by the end of next year.

Sunny Forecasts for New York's Renewable Energy Goals — Large-Scale Photovoltaic Projects Underway

As evidenced by recent photovoltaic project commitments, New York State is banking on solar energy for the realization of two related aspirations: to meet its own renewable energy goals and to become a national leader in solar energy productions. New York State's goal to receive 45% of its electricity through renewable sources by 2015 is aggressive, but over the past month equally aggressive requests for photovoltaic (PV) proposals have been issued by two of the State's Energy Authorities. On April 22, the Long Island

Power Authority announced a 50 MW project (contracts have already been awarded to BP Solar (36.9 MW) and enXco (13.1 MW)). The New York Power Authority followed suit in May with its Request for Expression of Interest for the installation of up to 100 MW of PV capacity; the deadline for receipt of proposals is July 7. Combined, these projects represent 150 MW of installed photovoltaic capacity, positioning New York to rank second in the nation when it comes to the production of solar energy.

The American Clean Energy Security Act Passes the House Energy and Commerce Committee

After weeks of intensive debate, the House Energy and Commerce Committee approved the American Clean Energy and Security Act (Act) by a vote of 33-25 on May 21. The bill proposes to cut greenhouse gas (GHG) emissions by an estimated 17% below 2005 levels by 2020, and about 80% by 2050, while promoting renewable energy and energy efficiency.

The extensive deliberations to pass the bill out of the House Energy and Commerce Committee resulted in several significant amendments to the original text of the proposed Act, particularly with respect to its international strength in the wake of the highly anticipated negotiations at the December 2009 Fifteenth Conference of the Parties (COP) in Copenhagen. In addition to lowering U.S. goals for GHG emissions cuts from 20% to 17%, for example, critics claim the amended legislation also falls short of what is needed for international clean technology cooperation and international adaptation assistance. In addition, although the EU expects all industrialized countries to cut GHGs an average 30% over 30 years, the Act calls for a 5% cut by American industry during the period. The revised draft also provides that, in a proposed cap-and-trade system, the majority of allowances will be allocated to the electricity sector and energy-intensive industries, which has created some controversy.

Nonetheless, many are still optimistic about the passage of a strong climate and energy bill. Those who have given the proposed bill a vote of confidence attribute that confidence, in part, to its similarities to the Global Warming Solutions Act (AB 32), enacted and signed by California Governor Arnold Schwarzenegger in 2006. AB 32 established California as a leader in U.S. GHG emissions mitigation during a period when the Federal government resisted action; it serves as "umbrella" legislation to coordinate statewide climate and renewable energy programs, with the California Air Resources Board (CARB) acting as lead agency.

Akin to AB 32, the Act is structured as comprehensive climate and energy legislation, contemplating regional, national and international trading of carbon credits through a cap-and-trade program, renewable energy deployment by way of mandatory Renewable Portfolio Standards (RPS), as well as GHG mitigation beyond cap-and-trade and renewable energy, such as energy conservation and promotion of Smart Grid development and "green" buildings. Some of the programs and GHG mitigation measures being tested and implemented under AB 32 may provide valuable lessons to the Federal government in shaping a federal climate bill, passing it through the House and the Senate, and during regulatory implementation by relevant federal agencies.

The bill is expected to go to the full House before the August Congressional recess. It likely will not go to the Senate until September, at the earliest.

The American Council On Renewable Energy (ACORE) Hosts REFF-Wall Street – June 23-24, 2009

On June 23-24, 2009, ACORE will host the REFF-Wall Street conference, bringing together over 250 companies and their delegates and the top financial and investment leaders in America for two days of intensive discussions and presentations. As the businesses of renewable energy begin to ramp up, ACORE's programs and committees are delivering much-needed education, leadership and outreach to its over 600 members, including Hunton & Williams.

In early 2009, ACORE put on the well-attended Renewable Energy Technology Conference and Exhibition (RETECH). 2008 saw ACORE producing WIREC 2008, winning the Skoll Award for Social Entrepreneurship, putting on a webcast of the Phase II event in the Cannon Office Building that was viewed by over 4,800 people and carrying out the core business to make renewable energy successful in America.

ACORE is bringing research, solutions and education about renewable energy into the mainstream with a multitude of programs and initiatives — all working to strengthen understanding of new finance, new technologies, and to support members' renewable energy businesses.

For more information about joining ACORE, go to: http://www.acore.org

Hunton In The News

General Counsel and Managing Partners Collaborate on Diversity

Hunton & Williams' managing partner, Wally Martinez, has assumed a national role in the newly established Leadership Council on Legal Diversity, an organization comprised of law firm managing partners and chief corporate legal officers dedicated to improving diversity across the legal profession. He will serve as vice chair of the council's 19-member board, which includes representatives from both Fortune 500 companies and leading law firms. The council's work will advance the 2004 Call to Action, a document signed by general counsel from some of the nation's largest companies that called for a greater commitment to diversity within legal departments.

Hunton & Williams' Climate Change and Green Practices Highlighted by Managing Partner Magazine

Rob Marsh, energy lawyer with the London office, spoke with *Managing Partner magazine* on the firm's efforts to reduce its carbon footprints in the UK and internationally, and on the firm's commitment to demonstrating its green credentials to its clients. The article, which featured a cover story article on carbon sustainability in the legal sector, also referenced H&W's green project initiatives as well as the firm's involvement in policy making on carbon reduction and climate change in the United States.

Hunton & Williams Sponsors Carbon Expo

For the third successive year Hunton & Williams was a gold sponsor of the Carbon Expo this year held in Barcelona from 27 - 29 May. Carbon Expo is the largest annual event for the global carbon markets. Despite the continued global economic difficulties, numbers at the event held up well, with nearly 4000 people attending. Representatives of the Climate Change teams from the London, Los Angeles and Washington, DC offices all attended, with partners Scott Burton, John Deacon and Bill Wehrum all speaking at official Expo events.

Hunton & Williams LLP Latin American Practice Recognized by Chambers

Hunton & Williams LLP is proud to announce the firm received the Chambers USA Award of Excellence: Latin American Investment. The USA Award of Excellence reflects the significant achievements over the past 12 months of the firm's Latin America practice, which is led by Fernando Alonso. Hunton & Williams was also recognized by Chambers Global as having one of the top five Latin America practices.

The Miami office serves as the center of the firm's Latin America practice, both as a gateway for the firm's representation of clients doing business in Latin America and as the hub for services offered to Latin American clients in the United States and Europe. Our Latin America practice group comprises more than 50 lawyers, with diverse cultural backgrounds and Spanish and Portuguese language fluency. The Hunton & Williams Latin America practice group focuses on several main areas of the law, including M&A, banking and finance, capital markets, private equity, project finance, and litigation and ADR.

Appendix: Leading Energy Storage Technologies

Pumped-Hydroelectric Storage

Key Features

- A large-scale energy storage technology (can deliver above 31 MW of energy in single-unit sizes and deliver energy over a period of several hours);[26]
- More than 100 facilities built around the world;
- The largest facility can produce over one gigawatt of electricity for days;[27]
- It is the most commercially established form of energy storage technology;
- At off-peak times when demand for energy is low, water is pumped from a lower-level reservoir to an upper-level reservoir and stored. Then when energy is needed, stored water is released down to the lower-level reservoir, passing through hydraulic turbines to generate electrical power;
- It may be used to meet peak demand needs or to provide emergency power injection to the grid when a power plant unexpectedly drops offline; and
- Facilities have the ability to provide the electrical power grid with a large amount of power in a very short period of time as they require only minutes to ramp up to full production; but [28]
- Drawbacks are long construction times and high capital costs.[29]

Examples

- Xcel Energy Cabin Creek built a facility in 1967 in the Colorado Rocky Mountains near Georgetown, Colorado, which has two units (each with a nameplate generation capacity of 150 MW). It is designed to use surplus power at night to pump water uphill to a reservoir located 10,018 feet above sea level and then release it back down when energy is needed; and
- A 1080 MW facility in Northfield, Massachusetts (capable of storing 5.6 billion gallons of water and providing 10 hours of continuous generation) began operating in 1972, drawing water from the Connecticut River and pumping it up into a 300-acre reservoir located 800 feet above the river.[30]

Compressed Air Energy Storage

Key Features

- It is a large-scale energy storage technology (can deliver above 31 MW of energy in single-unit sizes and deliver energy over a period of several hours);
- It is second only to pumped-hydro storage in terms of installed capacity;[31]
- It uses excess grid power to store energy in the form of compressed air in an underground reservoir typically more than 1,500 feet below ground (such as a salt dome, depleted gas field, abandoned hard rock mine or aquifer);
- Power generated at off-peak times is used to pressurize air into the underground reservoir and, when energy is needed, this compressed air is then released using the help of a heat source (such as biomass, geothermal energy or concentrated solar thermal energy) and used to power a turbine or generator; and[32]
- Compared with conventional turbines that rely on combustion, CAES facilities have the capability to start up in half the time, use only 30 to 40% of the natural gas, and function efficiently down to low loads.[33]

Examples

- A 110 MW plant (capable of generating 110 MW of power for 26 continuous hours) utilizing natural gas-powered compressors to store air in a mined-out salt

---

[26] *Bottling Electricity, supra*.

[27] "The Renewable Electron Economy Part VII: Stationary Energy Storage…Key to the Renewable Grid," Michael Hoexter, *Green Thoughts*, October 7, 2007 [hereinafter, *Renewable Electron Economy*].

[28] *Case Studies: Energy Storage Technologies*, U.S. Department of Energy, http://www.eere.energy.gov/de/cs_energy_storage.html (accessed April 18, 2009) [hereinafter, *Case Studies*].

[29] *Technologies: Pumped Hydro Storage*, Energy Storage Association, http://www.electricitystorage.org/tech/technologies_technologies_pumpedhydro.htm (accessed April 18, 2009).

[30] *Case Studies, supra*.

[31] *Bottling Electricity, supra*.

[32] *Renewable Electron Economy, supra*.

[33] *Case Studies, supra*.

dome was built in McIntosh, Alabama in 1991 by the Alabama Electric Cooperative;[34]

- Public Service Enterprise Group Global LLC recently formed a joint venture with Michael Nakhamkin, a pioneer of energy storage technology, to promote, license and support the development of CAES technology; and
- General Compression, Inc. reportedly is developing a wind turbine that has an integrated air compressor.[35]

Batteries

General

Batteries with potential for utility-scale applications include lead-acid batteries, sodium-sulfur ("NaS") batteries and lithium-ion ("Li-ion") batteries. Key features of these battery technologies include the following:

- They are made up of two electrodes separated by an electrolyte. Ions from the first electrode get released into the solution and deposit oxides on the second electrode, and the reversing of this electrical charge through the system recharges the battery; and
- They can serve as a backup power source and can be used for support of the electrical power grid.[36]

Lead-Acid Batteries

Key Features

- The oldest and most developed battery technology;[37]
- The most commonly used form of energy storage technology, although primarily used for relatively small-scale applications;
- Often used as part of a backup power system for data and communication centers, as well as substations and power plants;[38] and
- Some evidence indicates that lead-acid batteries could be used by electric utilities in lieu of fossil fuels for the regulation of voltage and line frequency, and even that lead-acid batteries could be used to store wind and solar energy;[39] but
- Certain testing for utility-scale applications has concluded that the economics and life cycle characteristics of lead-acid batteries may not lend themselves to the daily cycling necessary for utility-scale applications.[40]

Example

- Lead-acid batteries have been used in a few commercial and large-scale energy management applications, including a 40 MWh system in Chino, California, built in 1988.[41]

NaS Batteries

Key Features

- History of use in Japanese utilities and is being used in America today;
- Some evidence that it is more powerful and efficient than the lead-acid battery;[42]
- High-temperature battery that operates above 250°C and uses molten materials to serve as the positive and negative elements of the battery; and
- There is hope that the NaS battery may one day be widely used to support renewable energy sources.[43]

---

[34] "Storing Energy From the Wind in Compressed-Air Reservoirs," Daniel Pendick, *New Scientist*, September 29, 2007 [hereinafter, *Storing Energy from the Wind*].

[35] "Energy Storage Coming to a Power Grid Near You," Martin LaMonica, *Green Tech – CNET News*, June 27, 2008 [hereinafter, *CNET News*].

[36] *Case Studies, supra*.

[37] *Technologies: Lead-Acid Battery*, Energy Storage Association, http://www.electricitystorage.org/tech/technologies_technologies_leadacid.htm (accessed April 18, 2009) [hereinafter, *Lead-Acid Battery*].

[38] "Energy Storage Breakthroughs: An Evolving Technology For Managing the Grid," Michael W. Howard and Haresh Kameth, *EnergyBiz Magazine*, July/August 2007; *Bottling Electricity, supra*.

[39] *Renewable Electron Economy, supra*.

[40] *Bottling Electricity, supra*.

[41] *Lead-Acid Battery, supra*.

[42] *Renewable Electron Economy, supra*.

[43] "New Battery Packs Powerful Punch," Paul Davidson, *USA Today*, July 4, 2007, http://www.usatoday.com/money/industries/energy/2007-07-04-sodium-battery_N.htm.

Examples

- The largest NaS battery installation reportedly is a 34 MW, 245 MWh unit in northern Japan that is used for wind stabilization;[44]
- Utilities in the United States have installed 9 MW in NaS battery storage technology for applications that include peak shaving, backup power and firming wind capacity;[45] and
- A NaS battery system that operates at 1.2 MW for seven hours of storage was installed at an American Electric Power facility near Charleston, West Virginia in 2006 and is being used to reduce peak loads for improved distribution service.[46]

Li-ion Batteries

Key Features

- Successfully used in transportation applications; however it is not yet known whether it has economic utility-scale applications other than to provide ancillary services to independent system operators ("ISOs");[47] and
- The main challenge in making large-scale Li-ion batteries is the high cost of production (above $600/kWh).[48]

Flow Batteries

Key Features

- The most well-known type of flow battery is the vanadium redox battery ("VRB");
- Stores electrolytes in tanks that are connected to a power input/output unit and has a potential output of at least 10 MW extending multiple hours;
- Can be paired with wind farms for the levelization of output or can be used as uninterruptible power supplies;[49] and
- A single-flow battery system may be able to store more than 100 MWh of energy.[50]

Examples

- A start-up company, Deeya Energy, says it is in the process of developing a flow battery that can provide between 2 kW and 2 MW of electricity for 2 to 24 hours for grid backup power or the support of wind and solar power. It is claimed that this particular battery will be much less expensive than comparably sized lead-acid, Li-ion or nickel-metal hydride batteries and also cheaper than fuel cells;[51] and
- VRB Power is said to be in the process of testing a prototype system in Florida that can deliver 5 kW of power for four hours.[52]

Fuel Cells

Key Features

- Converts hydrogen or other fuels into electricity without combustion using a reversible electrochemical reaction between two electrolytes;
- Given that scale for a fuel cell facility is primarily based on tank size, has the potential to become a large-scale energy storage technology; and
- Energy Secretary Chu announced in April that the DOE is making $41.9 million available from the American Reinvestment and Recovery Act of 2009 for the development of fuel cells for emergency backup and material handling applications, and others have agreed to provide $72.4 million in complementary funding.[53]

Example

- 120 MW regenerative fuel cell facility began operation by the Tennessee Valley Authority in 2003.

Superconducting Magnetic Energy Storage

Key Features

- Stores energy in the magnetic field created by the flow of direct current in a cryogenically cooled superconducting material;

---

44 *Technologies: NaS*, Energy Storage Association, http://www.electricitystorage.org/tech/technologies_technologies_nas.htm (accessed April 18, 2009).

45 *Id.*

46 *Massive Electricity Storage, supra.*

47 *Bottling Electricity, supra.*

48 *Technologies: Li-ion*, Energy Storage Association, http://www.electricitystorage.org/tech/technologies_technologies_liion.htm (accessed April 18, 2009).

49 *Renewable Electron Economy, supra.*

50 *Storing Energy From the Wind, supra.*

51 *CNET News, supra.*

52 *Id.*

53 "DOE Doles Out $42 Million for Fuel Cells," *The Energy Daily*, April 17, 2009.

- Size of the facilities can meet up to 3 MW of power demand; and
- SMES facilities are used to resolve power quality problems and short-term power outages, such as may occur when switching between a power grid and backup supply of power, and they are also used to support the electrical power grid.[54]

Example

- Wisconsin Public Service Company installed six systems at substations along its 200-mile, 115-kV Northern Loop transmission line, which allowed the Northern Loop transmission line to maintain power quality during a system fault and after a lightning strike.[55]

Flywheels

Key Features

- Stores energy by accelerating the speed of a rotor and maintaining the energy in the system as inertial energy; energy gets stored in the rotor in proportion to its momentum and gets released as the rotor slows down;
- Achieved commercial success in the power quality and reliability market by delivering power in the range of 150 kW–1 MW;[56]
- Easily able to respond to spikes and dips in power and can deliver peak power to facilities that briefly need a very high level of power;[57]
- A single flywheel energy storage system may be able to store up to 150 kWh as kinetic energy;[58]
- Forty 25 kW / 25 kWh wheels can store 1 MW of power for one hour in a relatively small area;[59] and
- Although currently in use, is still considered in its infancy.[60]

Examples

- Beacon Power Corp. contracted with American Electric Power to construct a 1MW flywheel-based energy storage and frequency regulation facility in Groveport, Ohio;
- Beacon plans to construct a flywheel-based energy storage facility in Stephentown, New York; and
- Beacon interconnected a 1 MW flywheel project with ISO New England as part of a pilot program.[61]

---

54 *Case Studies, supra*.

55 *Id*.

56 *The Missing Link, supra*.

57 *Renewable Electron Economy, supra*.

58 *Storing Energy From the Wind, supra*.

59 *Technologies: Flywheels*, Energy Storage Association, http://www.electricitystorage.org/tech/technologies_technologies_flywheels.htm (accessed April 18, 2009).

60 *Case Studies, supra*.

61 "Beacon Power Building Energy Storage Facility at AEP Site," *The Energy Daily*, February 24, 2009.

Hunton & Williams Renewable Energy Quarterly
Issue 4, June 2009

Contributors

Hunton & Williams LLP

200 Park Avenue
New York, New York 10166
(212) 309-1000

1900 K Street NW
Washington, DC 20006
(202) 955-1500

575 Market Street, Suite 3700
San Francisco, California 94105
(415) 975-3700

700 Louisiana Street
Houston, Texas 77002
(713) 229-5700

951 East Byrd Street
Richmond, Virginia 23219
(804) 788-8200

1111 Brickell Avenue, Suite 2500
Miami, Florida 33131
(305) 810-2500

30 St. Mary Axe
London EC3A 8EP
+44 (0)20 7220 5700

1 South Sathorn Road
Thungmahamek, Sathorn
Bangkok 10120 Thailand
+66 2 645 88 00

550 South Hope Street
Los Angeles, California 90071
(213) 532-2000