DRAFT REPORT

Chapter 2 Generation Adequacy
Trends and obstacles confronting greater contribution from generation resources
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Chapter 2. Generation Supply Adequacy

GENERATION TRENDS

During the late 1990's and early 2000's, overall base load generation construction declined as generators were reluctant to commit resources to an unsettled regulatory and developing market based environment. In that same time frame, non-dispatchable or intermittent land-based wind resources began to gain a foothold in mid-western areas. In the U.S. alone, non-dispatchable resources have continued to grow from 7,596 megawatts in 1990 to 23,113 megawatts in 2007. Geothermal has decreased by about 372 megawatts while solar has increased by 184 megawatts and wind by 13,817 megawatts in this same time frame.[2] With this level of capacity, the potential for these resources to contribute to energy supply adequacy has been barely touched. It is estimated that the future potential from such resources is almost unlimited.

Declining Growth Rates

Ten-year generation growth rates have actually declined from a maximum growth rate of 4.08% in the 70's to 1.29% during the 2000-2007 time frame. The net summer capacity ten-year growth rates have declined from a maximum growth rate of 9.22% in the 50's to 3.0% during 2000-2007.(Figure 2-1)[3] While electricity generation growth rates have fallen significantly, capacity growth rates have declined almost twice as much. Generation is not being built at anywhere near historical growth rates and the absence of significant quantities of new generation is a critical concern.

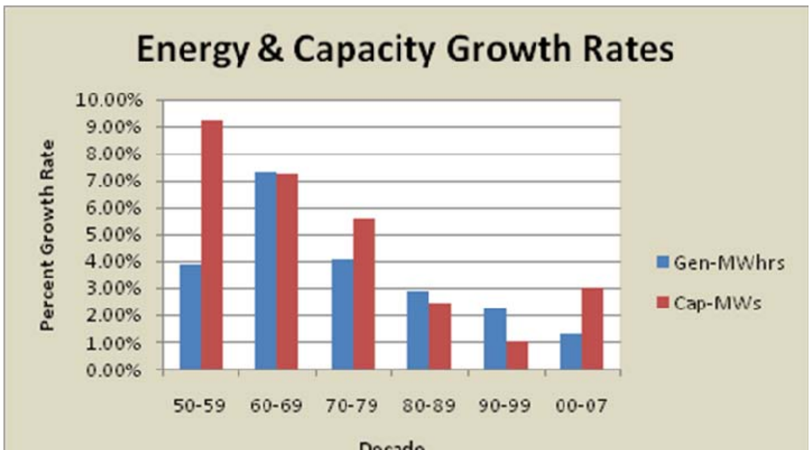

Figure 2-1

[1] Chairman, Director, Maryland Energy Administration
[2] Energy Information Administration, Table 8-11c, http://www.eia.doe.gov/emeu/aer/elect.html
[3] Ibid, Electricity Tables 8.2a, 8.11a and 8.11b

Adequacy of Supply

The North American Electric Reliability Corporation's (NERC's) forward look estimates a peak load growth of 17.7% over the next ten years with only a 12.7% growth in capacity resources. As NERC[4] points out in there most recent Long Term Reliability Assessment report, certain geographic areas face concerns with potentially inadequate generation resource safety margins to meet peak load conditions. Typically expressed as a reserve margin, available unused capacity during peak load conditions has ranged from a high of 20.9% to a low of 14.5%, averaging around 16.9% for the 2000-2006 years.[5] The report cites an approximate 2% improvement in reserve margin this past year, but notes that some areas of the U.S. experienced an actual decline in reserve margins. The Western Electricity Coordinating Council, Rocky Mountain States, New England, Texas, the Southwest and Midwest are areas of concern. California, Arizona, New Mexico, Southern Nevada, Rocky Mountains, New England and Texas all face reserve margins falling below target in the 2009 to 2011 time frame. [6]

As NERC further points out, a major driver of the uncertain or inadequate capacity margins is the industry's relatively recent shorter-term approach to resource planning and acquisition, relying heavily on unspecified, undeveloped, and/or uncommitted resources to meet projected demand. This is a trend made possible by shorter natural gas plant construction times. Shorter term commitments are generally more attractive to investors and load-serving entities alike, as they offer more certainty on potential revenues, demand trends, and the regulatory climate before investments are made.[7]

It should be noted that forecasting capacity growth over the next ten years is not an exact science. In some state jurisdictions that require capacity planning, there may be a level of confidence with new capacity estimates, but in market based regions the forecast accuracy is severely limited. RTO's offer opportunity for all potential generation projects to be reviewed and studied, but a small percentage may actually be built and interconnected. Additionally, with shorter time frames for new gas plants, it is unlikely that plans for these assets extend much beyond a three (3) to four (4) year future timeframe. A forecast declining reserve margin may be more representative of past history than a realistic picture of the futures.

The cost to maintain reliability is no less than the cost of the last new generation plant that was built to meet consumer demand. While NERC cannot order capacity to be built, it can require utilities and/or regional transmission organizations to comply with reliability standards.

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[4] North American Electric Reliability Corporation, 2007 Long-Term Reliability Assessment report, October 2007. In assuring there is sufficient electric capacity to meet load requirements, the North American Electric Reliability Corporation plays the key role. As of June 18, 2007, the U.S. Federal Energy Regulatory Commission (FERC) granted NERC the legal authority to enforce reliability standards with all U.S. owners, operators, and users of the bulk power system, and made compliance with those standards mandatory, as opposed to voluntary. Charged with maintaining the nation's electric reliability, NERC continues to set the reliability standards that must be met to ensure a Loss of Load Expectation (LOLE) of no more than one day in ten years. http://www.nerc.com/files/LTRA2007.pdf,

[5] Energy Information Administration http://www.eia.doe.gov/cneaf/electricity/epa/epat3p2.html , Electricity Table 3.2

[6] North American Electric Reliability Corporation, 2007 Long-Term Reliability Assessment Report, October 2007,pages 10-11

[7] Ibid, page 11

Recognizing capacity shortages as reserve margins have continued to shrink in market based areas, Regional Transmission Organizations have introduced forward capacity markets to provide financial incentive for new capital investments, [8] in effect a premium payment to stimulate new generation and to help maintain reserve margins and adequate reliability. In state regulated environments, vertically integrated utilities are typically charged by state commissions to maintain reliability standards which can include cost recovery for generation to satisfy adequate reserve margins. New generation is one important key to maintaining system reliability.

Aging Plants

The generation infrastructure in the U.S. continues to age. Although recent gas and renewable plants have helped to moderate that concern, the U.S. continues to rely on generation capacity reserves that existed in the 1980's and 1990's. As those older units are retired, the development of new generation resources will be essential. In 1995 the average age of utility generation plants was approximately 40 years. As we have added new gas fired generation and renewables, that average age has been reduced to 37 years in 2007. While an improvement over previous years, new generation must continue to come forward to provide for a secure energy future.

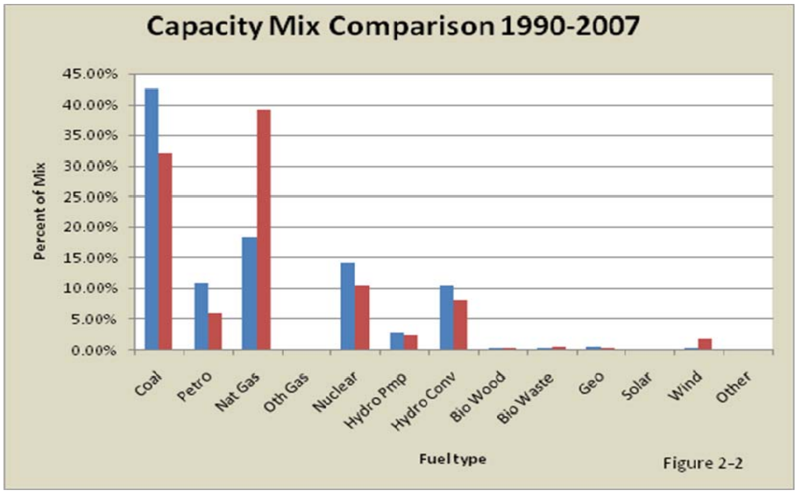

Figure 2-2

Changing Portfolio Mix

In addition to less generation being built in the U.S., the 2007 profile of generation capacity has changed significantly from that of the 1990's. In 1990 the preponderance of capacity was coal at 42.6%, natural gas at18.3%, nuclear at 14.0% and petroleum at 10.8%. By 2007 the generation capacity mix contained significantly less coal and petroleum, a bit less nuclear but over twice as much gas fired capacity. In 2007 coal accounted for 31.9% of capacity; natural gas increased to 39.0%, nuclear decreased to 10.3% and petroleum was cut in half to only 5.9%. While geothermal decreased slightly, bio mass increased, solar increased slightly and wind grew by

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[8] Ibid, , page 10.

over a factor of 8 (Figure 2-2)[9]. In 2007 with the recent addition of less costly and cleaner gas plants, the portfolio percentage of gas fired generation capacity exceeded all other forms.[10]

More Costly Plants

Gas plants, the new generation of choice, are typically in the 200 to 400 Megawatt (MW) size, costing around $700,000 per MW, or roughly $200-$400 million for a plant. In fact, conventional combustion turbine plants can be built for approximately $500,000 per MW or about $150-$200 million for a plant. Conversely a new IGCC plant with carbon sequestration would run over 3.5 times as much or roughly $1.4 billion directly comparable to approximate off-shore wind costs.[11]

The shift in the portfolio mix to cleaner, more costly fuels and more costly renewable generation, coupled with slower demand growth creates a new paradigm in the U.S., - one which favors shorter term, low cost, higher return investments over higher cost, longer term, lower return investments. While that seems to be the approach du jour in both regulated and unregulated U.S. areas, the energy and operating costs, ultimately paid by consumers, may well be higher for low cost plants and lower for high cost plants depending on fuel prices and dispatch times. In dynamic, changing industries without long term policy direction and commitment, investors, whether public or private, will tend to favor the short term approach. The challenge in the generation industry is to attract the longer term base load commitments, insulated as much as possible from changing federal policies to reduce investment risk and financial premiums.

Reliability and Cost Challenges for Renewables

The recent tremendous growth in renewable wind generation, while beneficial, has also created reliability challenges. Wind and solar, often referred to as intermittent resources, are not as controllable as a plant fired by coal, nuclear or gas. Recent experience in Texas, one of the largest wind producing states, demonstrated serious reliability and pricing concerns when large areas of the state experienced high temperatures and low winds for extended periods of time. Lack of generation during peak load periods forced emergency measures and dispatch of higher cost generation. As renewable intermittent resources continue to grow, reserve margins, particularly of controllable plants, become increasingly important.

Renewables are also beginning to face price competition from new transmission lines. In competitive markets with resource choices, energy can be supplied over new transmission facilities or from new renewable generation. Even where renewable generation may be the cost effective solution, the transmission line may be required by regional transmission operator plans to support reliability.

Distributed Generation

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[9] Energy Information Administration http://www.eia.doe.gov/emeu/aer/elect.html, Electricity Tables 8.2a, 8.11a and 8.11b

[10] While gas may now be the largest capacity resource, it does not run as often as base load units. As noted in Chapter 1, coal continues to provide the largest amount of energy.

[11] Ibid, Electricity Table 38

Another factor in providing generation adequacy for the new paradigm will be the role that distributed generation plays in meeting our energy needs. While not necessarily competitive at today's costs for base load generation, it does offer savings when used to reduce peak demands. The Energy Information Administration (EIA) forecasts almost 5,000 MW of this type of capacity by 2010, with assumptions on reduced costs leading to continued growth in this sector of generation.

Short Term Alternatives

There are short term alternatives to increasing generation in the U.S. Adding transmission infrastructure to more effectively use existing capacity and adding new demand response programs to reduce peak load are all viable short term options. But ultimately, increasing demand will have to be met with increased generation resources to keep U.S. lights on.

2010 Trends

If current trends continue, there is a general consensus that:

- U.S. reserve margins will continue to decrease;
- Construction of renewable and distributed resources will continue accelerating;
- Reliability will become more heavily dependent on transmission infrastructure;
- Gas fired generation will continue to dominate new plant growth; and
- Nuclear or coal base load generation, if constructed, will be a much more costly endeavor.

MAJOR OBSTACLES IN THE NEW WORLD

As with most generation technologies, there are obstacles that have limited the development and deployment of these resources. These obstacles range from high level political, economic and environmental concerns to basic technological and physical restrictions, covering a wide range of variables. In general, while these resources have different trends, their obstacles or barriers to greater resource contribution have many common elements, differing mostly in magnitude. This section will address the broader, common obstacles that restrict greater contributions to our energy security.

Achieving Economic Viability

For new base load or renewable generation to come forward and provide the resources needed to ensure our electric reliability, it will be necessary to demonstrate a solid economic viability. To do this, project developers will have to overcome four principal obstacles.

1. **Achieving maximum return at minimum risk** - All things being equal, investors choose to maximize return and minimize risk. And in response, generation companies have understandably developed similar risk adverse behaviors. The return in the electric industry is mostly inelastic due to state regulation or capped energy market prices. There

is limited commensurate benefit for generators to pursue the higher risk projects with multiple unknowns. The economics and risk factors in today's world have identified gas fired facilities and wind farms as the least risk investments, particularly where the projects have a guaranteed sale contract or can receive regulatory treatment of capital investments. Gas fired facilities are relatively inexpensive to construct, require shorter lead times and have reduced environmental cost exposure. Wind farms have somewhat higher capital costs, but a guaranteed free fuel for the life of the plant. If the goal is to achieve economic viability for large coal or nuclear base load generation, a mechanism must be found that minimizes the business risks associated with such projects. Economic viability for base load generation is dependent on reducing risk factors and increasing potential returns. Financial risk is a key barrier to new generation development.

2. **Overcoming the boom/bust cycle** - Given a risk adverse behavior, generators are reluctant to invest in generation projects until prices are sufficiently high to guarantee an acceptable return. Given that larger generation projects become available in typically large blocks of capacity after lengthy lead times, one can understand why the utility industry seems to have typical boom/bust cycles of investment. A few large projects, coming to fruition in any one year, can satiate the market demand after which it will take increasing shortfalls in generation, raising capacity prices to acceptable investment levels. The construction of smaller gas or wind powered projects can occur much more quickly to take advantage of capacity shortages with higher return on investment. The reality of the boom/bust cycle limits large base load capacity investment opportunity to those times when demand and prices are significantly higher, reinforcing the cyclic investment process. Economic viability of new projects during low demand times will require policies and actions designed to stabilize investment returns and both capacity and energy prices despite swings in consumer demand.

3. **Growing long term contracts –** In changing markets and regulatory environments, there is a great reluctance for purchasers as well as suppliers to enter into long term agreements. With the potential for extreme variations on any number of fronts, it is difficult enough to write a short term contract, let alone one that extends for 20 or more years. Changes to the generation or transmission landscape, environmental requirements, siting and development hurdles, regulatory review and a myriad of other variables can reduce a contract to out-of-market pricing very quickly. However, for generation companies seeking to build new capacity and looking for external financing, long term contracts are essential. In addition, the development of long term contracts would also serve to help dampen the boom/bust cycle by creating more stable returns, not subject to the vagaries of demand and supply pricing. The economic viability of many generation projects is contingent on purchase power agreements and policies that support the negotiation and adoption of long term contracts.

4. **Assuring asset cost recovery –** Investor insecurity related to recouping capital investment costs for a new plant is a definite barrier to economic viability. Whether in an organized market arena or vertically regulated jurisdiction, there are concerns related to asset cost recovery. In organized markets, the generator is left to recover costs through capacity and energy profit payments. Only recently have actual capacity markets been

created and even there, there are market limits on the level and duration of payments. In regulated markets, cost recovery is dependent on the regulatory authority and the determination of prudency with respect to the investment. While a bit more certain and somewhat less risky, the return on investment is also limited.

Another concern is the ever increasing development costs associated with new generation and particularly with new technologies. Generation companies are spending increasing amounts of time and dollars to meet planning, permitting, siting and interconnection requirements in many areas. While the recovery of hard asset costs may not be an issue, the recovery of significant development costs can be more problematic and subject to higher levels of scrutiny. In the case of cost recovery for both hard asset and development costs, regulatory approaches that minimize uncertainty and market rules that provide longer term certainty will help to minimize this barrier.

Facing Political and Regulatory Uncertainty

As noted by the French philosopher Voltaire, "Doubt is not a pleasant condition, but certainty is an absurd one." Although one should never expect absolute certainty, one of the biggest barriers after economic viability is the continuing political and regulatory uncertainty and its impact on potential new generation projects. Federal legislators are unable to produce a comprehensive energy plan or establish long term energy policies. Production tax credits, investment tax credits and grant programs are renewed in small short term increments. A reluctance to deal with climate change, carbon reductions and air quality issues places a thick shroud of fog over generation opportunities that may never see the light of day. Our real challenge may not be how to get generation built, but how to establish a longer term certainty on the critical issues that can help improve the economic viability of generation projects.

There are three (3) distinct uncertainties that impede the progress to secure new generation. They include grants and tax incentives, climate/environmental issues and market or regulatory changes.

1. **Grants and tax incentives –** As of this past month, Congress exited Washington with little or no progress on a comprehensive energy bill. Production tax credits (PTC), set to expire December 31, 2008, are once again on the back burner. Established in 1992, certainty for the PTC has only extended through 1999. According to the Washington Post, the alternative energy industry has learned not to take the tax credit for granted. Wind generation has had its PTC lapse three times – in 1999, 2001 and 2003. According to the American Wind Energy Association, new installed wind capacity declined by 93%, 73% and 77%, during those time frames.[12]

   Concurrent with the expiration of the production tax credit, the investment tax credits for certain renewable facilities are also expiring in December 2008. This is also a critical issue, particularly for the higher cost renewable ventures such as solar. While it is likely that these credits will be re-established in the midst of our current energy crisis, the more important question is how long this credit will be available. Congress appears to think of

[12] Washington Post, "Energy Boost," Anita Huslin, Staff Writer, Monday, April 14, 2008, Page D01

long term as two to three years, while the generation industry thinks in terms of 20 to 30 years - a natural discontinuity that needs resolution.

Another important federal government policy revolves around loan guarantees for various energy related projects. The Energy Policy Act of 2005 authorized DOE to issue loan guarantees to eligible projects that avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases and employ new or significantly improved technologies. However, such authority is limited by congressional funding approvals. In 2008, Congress authorized $38.5 billion in loan guarantee authority for innovative energy projects. Of the total provided, $18.5 billion is set aside for nuclear power facilities, $2 billion for advanced nuclear facilities for the "Front-end" of the nuclear fuel cycle, $10 billion for renewable and/or energy efficient systems and manufacturing and distributed energy generation/transmission and distribution, $6 billion for coal-based power generation and industrial gasification at retrofitted and new facilities that incorporate carbon capture and sequestration or other beneficial uses of carbon and $2 billion for advanced coal gasification.[13] Needless to say, the dependency on congressional funding puts a short term spin on certainty. It may be available this year, but for those projects, planning to apply for these loans in future years, it may not be there when needed. Once again, the short term nature of policies, needed over longer terms is not always available.

2. **Climate and Environmental Issues -** Carbon reduction and climate change mitigation top the list of environmental uncertainties. Ten (10) Northeast and Mid-Atlantic states and several Western states have already enacted mandatory carbon reduction plans. The Regional Greenhouse Gas Initiative (RGGI) establishes a cap and trade program to reduce carbon emissions 10% by 2019. The Western Climate Initiative, which includes 7 western states and several Canadian Provinces seeks a 15% reduction of carbon emissions below 2005 levels by 2020 by employing a cap and trade program. And lastly, Congress most recently considered the carbon issue with proposals for a carbon tax or national cap and trade program. As of this writing, a national effort remains and uncertainty. The question appears no longer if, but when and how carbon reductions will become mandatory throughout the U.S. However, the uncertainty of program size/goals and whether it will be a tax or cap and trade effort continues to cloud the horizon. The price of carbon emissions may be as little as $5 a ton or much higher, depending on the goals and type of program. Building any type of carbon emitting plant in today's environment automatically adds more cost with uncertainty on how much it may ultimately cost.

   On environmental issues there are also regulatory uncertainties associated with air pollutants, chiefly SO_x, NO_x and mercury. On March 10, 2005 the Environmental Protection Agency (EPA) issued the Clean Air Interstate Rule (CAIR), designed to achieve the largest reduction in air pollution in more than a decade. CAIR established caps for SO_2 and NO_x emissions across 28 eastern states and the District of Columbia. In a closely related action, the EPA also formulated a Clean Air Mercury Rule to further

[13] Department of Energy, Loan Guarantee Program, http://www.lgprogram.energy.gov/

reduce pollution throughout the U.S.[14] While utilities committed to major investments for compliance, others were challenging the rule in court. On July 11, 2008 the District of Columbia Court of Appeals issued an opinion in *State of North Carolina v. Environmental Protection Agency's (EPA) Clean Air Interstate Rule (CAIR) and the associated Federal Implementation Plan*, finding that the program had several "fatal flaws."[15] The Court of Appeals finding basically overturned the CAIR and placed other state environmental issues in question. With Federal clean air requirements unknown and an Administration working through its last few months in office, this uncertainty is likely to remain for at least the next year.

There is also the uncertainty associated with the Environmental Protection Agency's (EPA) approach to the Clean Water Act. Most recently with the overturning of the Clean Water Act, Section 316(b) provisions, generators may be required to replace once through cooling cycles with closed loop cooling towers.[16] The uncertainty on this issue can pose significant costs for new and existing generators and would reduce the capacity of existing resources through added parasitic loads and unit retirements. In a recent special assessment, NERC reported the potential impact of retrofitting once through cooling systems with closed loop cooling systems. Studies projected a 2015 decline in reserve margins from 14.7% to 10.4% when both retirements and cooling system parasitic loads were taken into consideration. That represents an approximate 49,000 megawatt loss of U.S. capacity by 2015.[17]

3. **Market or Regulatory Changes –** While many states continue to regulate vertically integrated utility companies, deregulation and the establishment of Regional Transmission Organizations (RTOs) brought forth a host of uncertainties. As the markets continue to develop, so to do the market rules. And the rules can be significantly different between RTOs. It's not just the differences, but the changing rules landscape that create uncertainty for generation projects. Within the PJM RTO, there were no capacity markets until this past year. The advent of capacity markets opened up a whole new revenue stream for generators for a 4 year forward period, but perhaps at the cost of reduced energy revenues. Further rule changes to permit the entrance of energy efficiency in capacity markets may be creating another competitive challenge to generation companies. Similarly, other RTOs such as the California Independent System Operator and the Midwest Independent System Operator are modifying interconnection cost allocations, a significant cost for new generation. Efforts are being made on both coasts to integrate environmental concerns and to help facilitate the entry of intermittent renewables into the market place. Economic dispatch is being replaced, albeit gradually

[14] Environmental Protection Agency, http://www.epa.gov/cair/

[15] McDermott, Will & Emory, July 15, 2008, http://www.mwe.com/index.cfm/fuseaction/publications.nldetail/objectid/90f784c5-fcbe-4e12-a1b4-39b76e4da002.cfm

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[16] North American Electric Reliability Corporation, 2007 Long-Term Reliability Assessment Report, October 2007,pages 12, 97

[17] North American Electric Reliability Corporation, 2008-2017 NERC Capacity Margins: Retrofit of Once-Through Cooling Systems at Existing Generating Facilities, page 4

with Enviro/Economic dispatch. And while these are all admirable goals, it creates a diversity of uncertainty for those generators willing to tackle a changing and uncertain market environment.

At state levels, the regulation landscape also continues to change. States that fully supported deregulation in the late 90's and have participated in market dynamics are looking at ways to change energy procurement practices and considering long term commitments outside of existing markets. Even where a competitive market may exist, energy procurement is beginning to look at other options, introducing added uncertainty for consideration.

Coping with Construction, Operating and Labor Issues

One Year Commodity Price Increases	
Steel Mill Products	30%
Concrete Products	6%
Copper	10%
Turbines-Gens	8%
Private Industry Labor	3.3%
Electric Power Generation	11.60%

Source: Bureau of Labor Statistics

In today's economic environment, the cost to plan, construct, own and operate a generation station is becoming a much larger obstacle to all companies. The raw materials that go into making up a power plant have seen significant increases in the past year and even more in the past 3 years. Steel has seen the largest increase, followed by copper, generating equipment and concrete. Electric power generation end product price has risen by 11.6% in the past year. General labor costs have increased by approximately 3.3% this past year. When taken together, a $1 billion generation project started in today's environment may well cost $3 billion after eight (8) years of material and labor cost escalations.

The utility industry is also faced with an aging work force and knowledge loss that they are working hard to overcome. The NERC's *2007 Long-Term Reliability Assessment Report* highlighted the fact that the industry's aging workforce poses a long-term threat to bulk system reliability. In 2007 NERC reported, according to a recent Hay Group Study, that about 40% of senior electrical engineers and shift supervisors in the electricity industry will be eligible to retire in 2009.[18] An informal NERC survey of the industry found that 67% of participants thought there was a high likelihood there would be a reliability risk due to the occurrence of an aging workforce and lack of skilled workers.[19] Both electric and water utilities face the prospect of losing up to 60% of their top management and other key workers by 2010.[20]

Add to this the uncertainty of rising fuel costs. Central Appalachian coal in the past year has gone from $45.00 per short ton, to $85.00 per ton this past spring. Henry Hub spot gas prices

[18] NERC Key Issues: Aging Workforce, http://www.nerc.com/page.php?cid=4|53|55

[19] North American Electric Reliability Corporation, Results of the 2007 Survey of Reliability Issues, October 24, 2007, page 6.

[20] Business Wire, June 18, 2007, http://www.allbusiness.com/services/business-services/4513937-1.html

rose from $7.50 per MMBTU to $12.70 per MMBTU. NYMEX heating oil futures went from $2.00 per gallon to $3.80 per gallon in the past year. Crude oil futures went from $65.00 per barrel to $131.00 per barrel. Rising costs based on inflationary pressures and world wide demand for all resources creates a high level of uncertainty for generation projects.

Adapting to the Need for Green

Climate change and environmental concerns, while not new on the horizon, have recently gained much more support. As new air quality rules are written, generation projects will be expected to comply. And even here, the cost and technology for compliance is continuing to change. What historically was a relatively simple bag house process to eliminate power plant plume particulate has been transformed into a highly technical chemistry designed to minimize not only particulate, but pollutant gases and metal compounds, the cost of which can become an enormous burden for new projects.

Traditional generation creates process waste, no matter whether it's coal ash, spent nuclear fuel rods, cooling water or flue gas particulate. Some wastes, a natural outcome of the generation process, are a critical cost component of the generation process such as spent nuclear fuel storage or carbon dioxide sequestration with extremely high costs. Other wastes have much lower processing costs such as coal ash, or flue gas particulate and provide opportunity for recycling into useful and perhaps environmentally acceptable processes. Another difficulty for new generation projects, outside of the obvious waste disposal issues, is how to plan for the unknown costs related to waste requirements.

Permitting for new generation also creates uncertainties. States continue to try to simplify the permitting process by minimizing agency interfaces, but it still results in multiple agency applications to secure the necessary permits to build new generation. Cities, counties and various state agencies typically each have a process mandated by charter or state law. In addition, the permitting process in all states is becoming more transparent with active participation by state organizations, environmental, political and consumer groups The development permitting process is becoming a negotiation process whereby planned site use, environmental mitigation and infrastructure security are all subject to negotiable change. Add the preferences to use brownfield sites and revised negotiated generation plans can become unrecognizable when compared to original plans.

Interconnecting to the Transmission Grid

The interconnection of new generation to a transmission grid is a series of hurdles, after which the generation company must provide a certain portion of the capital necessary to construct the interconnection facilities – another part of the new generation process with unknown costs. The first hurdle after identification of a potential viable project and possible site would be a request for interconnection study. Depending on the status of regulation and transmission arrangement, this study could be done by the transmission owner or the RTO. The requested study would typically determine deliverability and potential costs for interconnection; however, there can be a significant time lag in the study process due to the multiplicity of requests and the level of technical result required in each study. It is not uncommon for project studies to take well beyond 6 months for completion.

A second hurdle would be a formal interconnection agreement. Passing this hurdle requires a formal contract and may require significant capital commitment for interconnection facilities, depending on the RTO or transmission owner jurisdiction. Once executed, most projects are anticipated to be a viable project and included in future reliability studies. The time from initial application to actual interconnection agreement can take considerable time depending on the process and jurisdiction.

For smaller generation projects that may be behind the meter or for generation at the retail level, there are another series of hurdles that can vary between jurisdictions. Utilities, environmental agencies and state retail regulatory authorities have procedural requirements for interconnection that must be followed prior to the installation of smaller projects. In many cases the complexity of process is disproportionate to the size and type of generation. For small generation developers who work across multi-state areas, the procedural barrier can be a significant concern. In many states, net metering may be an available option for smaller generation projects; however, different limitations by jurisdiction add to the complexity.

While FERC has continued to ensure open access to the transmission gird, the cost of such interconnection continues to vary across the nation. Cost allocation can vary from 100% paid by the generator in PJM, to a 50/50% split used by MISO, to a more recent pricing policy providing 100% refund of interconnection costs.[21]

Interconnection cost allocation can be a significant issue for new generation projects, particularly renewables. These types of plants are typically sited close to fuel sources or in open rural areas. Wind farms need areas where there are consistent wind flows and commercial solar installations need significant open space, neither of which guarantee nearby transmission for interconnection. In Texas, recognizing renewable generation interconnection constraints, Senate Bill 20 laid the groundwork for large transmission lines to accommodate present wind industry needs and to further accelerate the use of wind power in the state. The Texas Public Utilities Commission approved an approximate $5.0 billion dollar transmission investment to move 18,456 megawatts of wind power from West Texas and the Panhandle to metropolitan areas of the state. The cost for this transmission was estimated at $4.00 per month for every Texas rate payer and helped to eliminate the interconnection barriers for wind and solar in Texas.

KEY ISSUES BY GENERATION TYPE

[21] Federal Energy Regulatory Commission, Docket ER08-796, ORDER ACCEPTING TARIFF SHEETS AND REQUIRING COMPLIANCE (Issued August 7, 2008) . The recent revised pricing policy was filed by International Transmission Company, Michigan Electric Transmission Company and ITC Midwest as a mechanism to encourage renewable generation. The generator can receive 100% refund of interconnection costs when a generator has at least a one year contract to serve the ISO's network customers or is designated as a network resource at time of commercial operation. In approving the revised tariff, FERC indicated that a 100 percent reimbursement for network upgrades is just and reasonable, and that different rate proposals can be just and reasonable.

While there are several major generic barriers to generation adequacy, each generation type also comes with its own specific concerns that challenge the development of viable projects. The following nine (9) types of generation projects have specific concerns that will need to be addressed either individually or in generic approaches.

1. **Biomass** generation tends to be smaller scale plants to minimize the difficulties with storing, handling and transporting large quantities of the necessary fuels. While coal has a heat value of 8,000 – 14,000 BTU per lb., wood and even dried switch grass has around 6,500 – 7,500 BTU per lb., requiring larger quantities of fuel to achieve the same BTU heat input to a generation process. On the opposite end of the spectrum, landfill gas has a 12,000 -13,000 BTU per lb. heat content, making it a renewable fuel of choice where available. While the cost of fuel may be competitive, the quantity to be handled can impose difficulties. Additionally, there is a need to manage a complex fuel cycle from start to finish to ensure consistent availability of fuel and to minimize price instability.

   Principally thought of as a wood burning plant or landfill gas plant, biomass generators are not considered utility scale enterprise. As such, biomass projects typically suffer from higher investment costs and a lack of venture capital for new projects. When and where biomass projects have been successful, there have generally been public policies designed to offer project incentives.

   As with other renewables, interconnection costs and the allocation of such costs can be a barrier to new projects. Since many of the projects are of a smaller size, they are often left to interface with local utilities at retail level distribution voltages. Unless they are willing or can sell energy to the local utility, there can be additional energy wheeling costs for handling the energy injection on the distribution system.

2. **Clean Coal Technologies and/or Integrated Gasification Combined Cycle (IGCC)** plants, no matter how you package them, are still power plants that require coal delivery and storage, produces a flue gas with carbon dioxide and has resulting wastes for disposal. And needless to say, the requirements for carbon capture, land use mitigation and emission controls rapidly increase the costs of such ventures. Along with cost increases on new plants comes reduced generation output as plants siphon off energy to maintain supporting fuel and emission processes. IGCC plants are estimated to use up to 30% of the power generated for support processes. Higher costs and lower outputs will require additional federal support if new IGCC or clean coal ventures are to be viable.

   The desire for carbon capture and/or sequestration will add both cost and technological difficulties. The location of new plants will require transport of fuels to the site and/or transport of emissions to a sequestration location. Mine mouth coal plants may be replaced with strata capture coal plants, depending on which part of the energy cycle is more costly, fuel procurement or emission sequestration. The availability of appropriate sites may well be a significant barrier to new coal generation depending on the type of underground formations that can accept and hold carbon emissions. Such sites may also have transmission interconnection barriers where they are far from existing facilities.

Coal continues to have issues with waste storage and disposal. While there are efforts to recycle ash into useful processes, much of it winds up as landfill in carefully prepared dump sites to limit heavy metal ground water contamination. According to the American Coal Ash Association, the U.S. produced 125 million tons of coal combustion products in 2006. Of that amount, 43% was used beneficially, leaving approximately 70 million tons for disposal.[22].

Although new coal technologies offer significant improvement, public perception has not reduced barriers for these new plants. With the recent rise in coal prices coupled with environmental concerns, renewable generation appears to be the public's preferred solution. And while that solution is not without its own issues, it places new coal technologies at a competitive disadvantage in the quest for new project financing. Renewables may have needed policy incentives to get them started in the 80's and 90's, but coal may need new policy incentives to maintain a self sufficiency base load capability in the U.S.

3. **Geothermal's** principal barrier is finding locations for economical energy production with minimal interconnection costs.[23]. Access to readily available heat sources in the earth often require access to rugged and difficult terrain Once an access point is identified, there are water table concerns, sustainability of heat flows, protected wilderness issues and certainly transmission interconnection availability. Of all the renewable generations, geothermal provides the most challenging siting concerns.

   Other barriers include lower efficiencies of operation due to lower temperature steam and the environmental requirements to deal with a generally corrosive fuel containing some heavy metals. While geothermal plants are relatively clean in comparison to coal plants, there can be some harmful emissions and waste water that requires special disposal processes. Additionally, geothermal plant sizes may be limited by the availability of steam and the geological heat transfer rates at the site.

   Geothermal plants, while environmentally cleaner than fossil fuel base load units, are not an inexpensive proposition. Financing for geothermal plants given the higher cost of facilities and the risk of steam resource losses is an on-going challenge.

4. **Hydroelectric** energy plants have continued to see steady growth. In the U.S. it has grown from 56 gigawatts in 1970 to more than 95 gigawatts in 2007. However, even with this growth, it has dropped to 10% of supply capacity, displaced mostly by the

[22] American Coal Ash Association, http://www.acaa-usa.org/index.cfm

[23] California Energy Quest, http://www.energyquest.ca.gov/story/chapter11.html Geothermal energy is referred to as any energy producing approach that uses the earth's heat or coolness to improve energy efficiency. As an example, ground water heat pumps can be thought of as a geothermal energy product, but for purposes of this paper, geothermal energy will be a generation system that uses the earth's heat to produce electric energy. There are many examples of geothermal plants, particularly in California where there are currently 14 plants in operation

growth of natural gas power plants.[24] Barriers pertinent to new hydro plants are predominantly the environmental and social costs associated with location and the interconnection access. The creation of dams can have major impact on marine animals, forested habitats and in some instances displacement of homes and communities.

Hydropower is also beginning to face a new phase of competition. New technologies such as tidal, wave and river generation facilities are being explored. Competition for financing may become a significant barrier in the face of new developing technologies.

5. **Natural Gas** has had limited barriers to its continued development as evidenced by the recent increases in gas fired capacity. One of the least expensive types of new generation and the quickest to build, natural gas is limited mostly by siting issues and availability of gas. However, there are carbon emission issues that may well slow the development of gas plants. Although a combined cycle gas plant can produce up to 70% less carbon emissions then a conventional coal plant, it still has the cost of its remaining 30% carbon emission to contend with.

   Recent discussions around gas capacity have raised issues with respect to fuel availability. Is there sufficient gas and gas transmission capacity to support the level of plants planned and constructed? While U.S. gas utilization was around 72% in 1997, places like California are beginning to see 100% utilization numbers. Future gas plants may well be dependent on the development of additional LNG supplies and infrastructure.

   There are also new questions with respect to recovering asset costs. Gas fired generation has historically been relatively high on the economic dispatch curve and run for shorter periods of time to meet peak loads. A potential barrier to new entry may also be the ability of gas fired plants to secure enough capacity and energy revenues to recover investment costs.

6. **Nuclear** energy planning, if not actual construction, is experiencing a profound new birth with many different generation companies proposing projects. In 2007 the Nuclear Regulatory Commission (NRC) received five (5) applications for new plants. In 2008 the NRC expects to have thirteen (13) new applications.[25] While financing this level of capital expansion may be a barrier for some companies, the boom of new applications is not indicative of that concern. One applicant has noted that it expects to seek Department of Energy loan guarantees with specific financing likely to come from the Federal Financing Bank, a government entity managed by the U.S. Treasury

[24] Union of concerned Scientist, http://www.ucsusa.org/clean_energy/renewable_energy_basics/how-hydroelectric-energy-works.html

[25] Nuclear Regulatory Commission, Expected New Power Plant Applications, August 2008, http://www.nrc.gov/reactors/new-licensing/new-licensing-files/expected-new-rx-applications.pdf

Department.[26] With the potential for federal loan guarantees, pooled insurance plans and carbon emissions looming large, the nuclear energy industry hopes to provide long term stability for U.S. energy resources

A more serious barrier for new nuclear generation is the potential for significant project cost overruns. With continually escalating material and labor costs, a long term, 8-9 year construction project faces significant final cost uncertainty. This easily translates into financial risk and higher premiums for secured loans. And where previous nuclear construction costs suffered major overruns and left developers in serious financial straits, there will be extreme caution around financial commitments to the new nuclear generation projects.

The sheer size and capacity of new nuclear facilities also present challenges for the delivery of energy on the existing transmission grid. 1600 megawatt units will require significant transmission capacity to move energy to markets, but transmission infrastructure costs needed for this type of plant pales in comparison to the cost of the entire plant.

Other barriers to new nuclear plants include the high cost of planning, development, siting, permitting and litigation where necessary. There are high costs of raw materials such as steel, concrete and uranium fuel with world wide demand pushing prices higher daily. And although somewhat diminished at this time, there is the public perception and latent fear of a catastrophic and hazardous event.

Finally, waste disposal and an appropriate mechanism for the long-term storage of spent nuclear fuel await further action. Unlike coal, nuclear waste and storage will be a cost to be born by many future generations.

7. **Oil** fired generation is continuing to decline in the U.S. With environmental concerns, rising prices and international dependency, it is no longer the fuel of choice. The principal barriers to new oil fired generation are the price for fuel, the uncertainty over fuel availability, the cost of carbon emissions and the fact that a perfect oil storm (all variables at highest prices) would leave these projects non-competitive. The long term viability of new oil fired generation is open to question.

8. **Solar** generation, both photovoltaic (PV) and thermal, have significant cost barriers to overcome as a new energy source. PV installations can cost up to 15-20 cents per kilowatt-hour, while concentrated thermal installation could cost 12-15 cents per kilowatt-hour. These costs are currently keeping solar generation limited to those occasions where the environmental benefit of clean energy is the tipping point to pursue the project. While costs for both photovoltaic and thermal are continuing a downward trend, it has been very gradual.

[26] Gazette.Net, Nuclear Financing Scare, August 1, 2008, http://www.gazette.net/stories/080108/businew180449_32355.shtml

A substantial barrier for solar is finding appropriate locations where economies of scale can offer pricing benefits to the developer and where interconnection costs are still manageable. While interconnections need to have the capacity to deliver the maximum output of a solar installation, there are many times during day and night when transmission plant is not utilized. This is true for all intermittent resources that must plan for maximum output, but realistically have lower outputs throughout the day. Under utilized transmission capacity can add cost to this type of project.

9. **Wind** is the new gold rush in energy solutions. According to the American Wind Energy Association, U.S. wind farms now generate more electricity than any other nation in the world and are on track to expand by over 45% this year.[27] A key barrier to continuing wind development is the loss of the production tax credit as previously discussed. Restoration of this credit and higher prices for renewable energy credits are necessary to secure financing for new projects.

   Wind is also an intermittent generation that must pay for high capacity interconnection resources, but typically only uses about 20-30% in daily generation output. Finding locations appropriate for facilities with manageable interconnection costs is also a barrier for new wind efforts. However, states such as Texas are beginning to address this issue with major new transmission installed to prime wind generation sites. Another barrier for wind generation is the availability of turbines, blades and other materials. Heavy new demand in the industry has caused temporary shortages and higher prices.

   Off-shore wind generation is another source of energy with similar barriers. Just recently Delaware announced a contract for the first off-shore wind farm, however, the project required a long term 20 year purchase arrangement and 3 times renewable energy credit multiplier to provide financial viability for the project. Off-shore wind projects are typically twice as expensive as land-based units and operate in a harsh marine environment, requiring additional maintenance and operating costs. Permitting for off-shore facilities is a second barrier and depending on location will generally include both state and federal requirements due to environmental and marine transit issues. The U.S. Minerals Management Service, charged with permit authority, just recently issued its permit requirements for off-shore wind farms in federal waters. However, with off-shore wind farm facilities extending from turbine location to substation landfall, the permitting process will involve almost every interested agency, both federal and state.

   Wind farms, a high growth industry, are rapidly changing the reliability environment of transmission systems. Meeting reliability adequacy requirements with base load and on-call conventionally fueled peaking plants has been the typical approach, but with more wind and solar intermittent resources becoming available, there is a much larger portion of generation resources that are not dispatchable in the historic sense of the word. Numerous large installations in relatively small weather pattern areas can

[27] American Wind Energy Association, http://www.awea.org/

create large voids of generation resources on peak demand days when most needed. Texas experienced this shortfall this past summer when western winds subsided across a large area requiring emergency generation with extremely high energy prices. As this type of resource continues to be developed, reliability organizations will likely have to consider wind availability across multiple plant areas in their single contingency outage studies. Developers, who wish to cluster units for economic advantage, may begin to see new siting barriers created by reliability concerns.

RECOMMENDED DOE ACTIONS

Keeping the lights on, keeping energy affordable and minimizing environmental impacts will be the most challenging requirements for the new Department of Energy administration. Encouraging and managing new generation technologies while removing barriers to their development will require bold new actions that are significantly different than historical efforts. Letting the generation industry stumble along, finding its own way, will likely result in market inefficiencies leading to reliability concerns, higher energy prices and a portfolio of facilities that serves only generator interests. It will be important for DOE to undertake aggressive and timely efforts to address market failures and to promote an optimum mix of generation resources.

DOE has recognized the need for bold new actions, most recently in its 20% Wind Energy by 2030 Report. As DOE notes, "The 20% Wind Scenario is not likely to be realized in a business-as-usual future. Achieving this scenario would involve a major national commitment to clean, domestic energy sources with minimal emissions of GHGs and other environmental pollutants.[28] It is policies such as this that will need to be supported by bold new actions.

What are the recommended actions that DOE should consider? The Energy Advisory Committee has identified seven (7) key actions to enhance generation development for DOE consideration.

1. REDUCE THE FINANCIAL RISK FACED BY NEW GENERATION DEVELOPERS.

The most significant barrier to new generation is establishing the financial viability of proposed projects. DOE needs to support policies, programs and legislation that minimizes the risk of cost recovery and maximizes available returns. Some new suggestions for consideration include the following:

- Generation developer cost recovery insurance pools whereby new projects may subscribe and qualify for partial cost recovery insurance. Such insurance pool

[28] Department of Energy, 20% Wind Energy by 2030 Report, http://www.20percentwind.org/default.aspx

would be limited to generation projects that employ new or enhanced technologies and have substantial planning and development costs.

- Continue to provide financial grants for new and enhanced technologies and expand grant programs to support planning and development of new generation projects that demonstrate clean and/or renewable and environmental benefits.

- Ensure the continuation of funding and availability of federal loan guarantees for new energy technologies.

- Initiate, expand or support the creation of an energy development credit market whereby generation developers may market planning and development credit instruments (non-asset backed securities) to finance generation planning and development costs. A higher risk credit market, the return on investment could be direct repayment of principal and interest after commercial operation or rollover for project stock options.

- In markets where generation is not being built, consider the adoption of a new capacity pricing option that limits existing generation payments to cost plus reasonable return on investment and provides new generation with multi-year stimulus payments.

2. PROMOTE POLICIES, PROCESSES AND LEGISLATION THAT INCREASES CERTAINTY OVER THIRTY YEARS.

Long term in the generation industry is considered the 30-40 year life of a plant asset and yet the political environment discusses and occasionally produces legislative changes every few years. The conflict between the need for longer term consistency and short term reactions creates huge uncertainties for new generation and new technology development. Recent legislative discussions around Production Tax Credits and a possible Carbon program are examples of a clear, uncertain message to generation developers. The most recent National Governors Association Policy statement, NR-18, Section 18.1.3, further supports the need for longer term certainty and is a good source for additional recommendations. More specific suggestions include:

- Advocate the continuation and establishment of production tax credits and the expansion of investment tax credits for a much longer term to provide additional financial certainty for new generation projects.

- Promote the use of long-term contracts through preferential grants and loans for new technologies that agree to seek long term output contracts.

3. ADVOCATE POLICIES, PROCESSES AND LEGISLATION THAT PROMOTES NEW TRANSMISSION, SUPPORTS DEVELOPMENT OF A HIGH CAPACITY

TRANSMISSION SYSTEM AND FAIRLY ALLOCATES TRANSMISSION INTERCONNECTION COSTS.

A basic barrier to all generation investment is the interconnection infrastructure needed to provide energy to the transmission grid. Investment in transmission facilities, particularly for renewables located in rural or remote areas, can be a significant part of the overall investment. Investment in the nation's transmission system is essential so that the electricity generated throughout the U.S. can be delivered to urban centers that need the increased supply. Actions that DOE should consider include:

- Support the development of new transmission facilities that enhance the bulk energy flows and provide for major resource interconnections across the U.S.
- Advocate a fair and equitable interconnection cost allocation process that balances costs and benefits and is appropriate for the regional transmission managing entity.

4. PROMOTE AN IMPROVED PLANNING PROCESSES THAT EXPEDITES GENERATION FACILITY STUDIES, INTERCONNECTION AGREEMENTS AND CONSIDERS GENERATION SOLUTIONS FOR RELIABILITY.

Generation queues in market based areas have a significant number of projects awaiting the facility studies which identify preliminary interconnection requirements and costs. Delays in the review process add uncertainty to projects and impact viability. Actions to enhance and improve that process include:

- Advocate improved and faster interconnection study processes to provide more accurate and timely information for generation developers.
- Consider a national review of generation planning processes in cooperation with NERC and other interested agencies.
- Promote a planning and review process that recognizes the need to view larger electric load balancing areas and to confirm that region reliability is supported by the existing diversity of generation sources, including intermittent generation.
- Consider providing transmission owners and RTOs the ability to secure new cost based generation to maintain system reliability when it becomes the most cost effective solution to help mitigate congestion and maintain reliability.
- Promote greater regional coordination and planning, consider re-establishing regional offices and providing grants to support regional energy planning efforts.

5. ADVOCATE IMPROVED AND LONGER TERM CERTAINTY FOR AIR AND WATER QUALITY ENVIRONMENTAL REQUIREMENTS INCLUDING CARBON EMISSIONS

- Advocate the adoption of a long term national carbon policy, air quality rules and waste disposal that supports the development of new generation technologies and adds longer term environmental certainty for all generation companies.

- Adopt policies that try to harmonize the need for new energy resources with the environmental limitations imposed by legislative action.

- Support the adoption of new air and water quality standards that maintain environmental requirements and create longer term certainty.

6. CONTINUE SUPPORTING NEW TECHNOLOGY DEVELOPMENT AND MAINTAIN OR IMPROVE DOE GRANT AND/OR LOAN GUARANTY PROGRAMS.

The development of new generation technologies depends on innovation and development. Securing our energy independence requires support for new research and development efforts. DOE needs to continue and enhance its support for new generation technologies.

- Adopt a long term funding plan that provides for a stable level of support for new generation programs and technologies and creates certainty of direction and purpose.

- Support efforts to make efficient cost-effective technology advancements and improved manufacturing processes in generation equipment.

7. SUPPORT THE DEVELOPMENT AND EXPANSION OF DISTRIBUTED, RENEWABLE GENERATION.

With the demise of integrated resource planning in some energy markets and with regional transmission organizations focused on transmission reliability, not all potential solutions to keeping the lights on are necessarily reviewed and incorporated in regional plans.

- Support revisions to regional planning processes that permit RTOs to examine other cost effective options and to solicit both generation and energy efficiency responses as appropriate.

- Explore the potential for distributed, renewable generation to supplant transmission solutions.

- Consider supporting a national renewable portfolio standard to encourage energy independence.