NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Special Report:
Electric Industry Concerns on the

Reliability Impacts of Climate Change Initiatives

to ensure the reliability of the bulk power system

November 2008

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Preface

This special report is part of a series of similar documents the North American Electric Reliability Corporation publishes as part of its assessment efforts on emerging reliability issues. These reports are designed to provide insight into emerging issues whose effects on reliability have not necessarily been studied in depth and thereby spur further study and industry discussion of the topic. Earlier reports studied portions of the Clean Water Act, demand-side management and variable generation. Future reports may focus on issues such as the global rise in demand for energy and equipment, the aging workforce, plug-in hybrid electric vehicles and the growth of the smart grid, and long-term implications of the changing fuel mix.

Importantly, these reports are not intended to provide guidance on or otherwise alter Reliability Standards established by the Electric Reliability Organization. NERC cannot order construction of generation or transmission or adopt enforceable standards that require expansion of these facilities, as that authority is explicitly withheld in the U.S. by Section 215 of the U.S. Federal Power Act[1] *and in Canada by various provisions. In addition, NERC does not herein make any projections or draw any conclusions regarding expected electricity prices or the efficiency of electricity markets.*

The North American Electric Reliability Corporation's (NERC) mission is to ensure the reliability of the bulk power system in North America. To achieve this objective, NERC develops and enforces reliability standards; monitors the bulk power system; assesses and reports on future transmission and generation adequacy; and offers education and certification programs to industry personnel. NERC is a non-profit, self-regulatory organization that relies on the diverse and collective expertise of industry participants that comprise its various committees and sub-groups. It is subject to oversight by governmental authorities in Canada and the United States (U.S.)

[1] http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:h6enr.txt.pdf

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Introduction

"It appears that greenhouse gas issues and electric utility reliability are on a collision course."

Ken Farmer
Director Strategic Planning
Beauregard Electric Cooperative (DeRidder, LA)

The NERC Planning Committee (PC) has identified initiatives currently underway to address climate change and reduce greenhouse gas emissions as among the most important emerging issues facing the reliability of the bulk power system over the coming years.[2] Provisions and requirements implemented through state/provincial-level Renewable Portfolio Standards, regional initiatives, and federal and provincial legislation and regulations, have the potential to influence nearly every aspect of electric industry system planning, design and operation. These climate change initiatives include:

- **State & Provincial Renewable Portfolio Standards:** Renewable Portfolio Standards typically require load-serving entities in a given state to acquire a certain percentage of their energy supply from renewable resources by a target year (for example: 20% by 2020). Twenty-seven U.S. states and three Canadian provinces have some kind of renewable portfolio standard in place (see Figure 1).[3]

- **Other State & Provincial Climate Goals:** All remaining Canadian provinces and six U.S. states have some form of policy in place to address climate change and greenhouse gas emissions, either through specific MW goals for electric generation or other means.

- **Regional Initiatives:** Initiatives such as the Regional Greenhouse Gas Initiative in the Northeast (RGGI) and Western Climate Initiative (WCI) have created multi-state and cross-border partnerships to reduce greenhouse gas emissions on a regional basis.

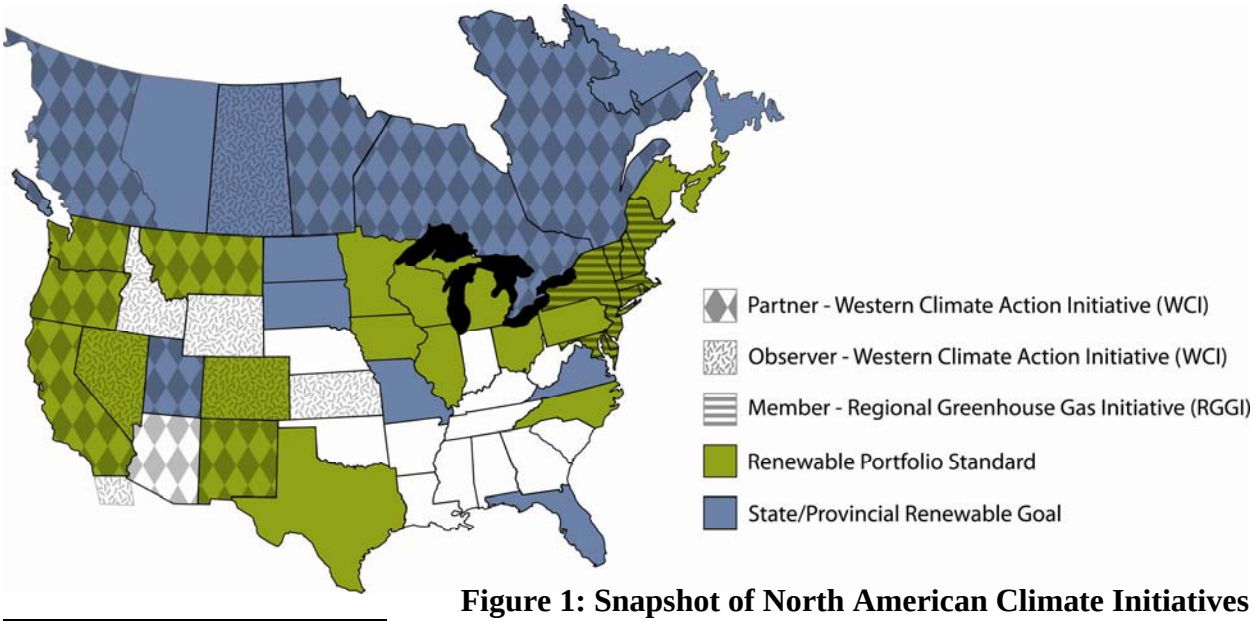


Figure 1: Snapshot of North American Climate Initiatives

[2] Results of the PC's Emerging Issue risk assessment is documented in the *2008 Long-Tem Reliability Assessment*, page 26. Available at: http://www.nerc.com/files/LTRA2008.pdf

[3] Image compiled from several sources: http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm. (Note the Florida Public Service Commission (FPSC) Renewable Portfolio Standard is currently under development), http://www.rggi.org/states, http://www.westernclimateinitiative.org/ewebeditpro/items/O104F19873.PDF

- **U.S. Federal Climate Change Legislation:** The U.S. Senate and House of Representatives are considering various legislative proposals to reduce carbon dioxide (CO_2) emissions.

Taken individually, state, provincial, and regional initiatives may not significantly affect bulk power system reliability. However, as more and more state, provincial, and regional initiatives begin to take effect and federal climate change initiatives are considered in the U.S., there is an increasing need to review the collective impact of these initiatives on the bulk power system and identify effective means to help the electric industry meet these climate change initiatives without degrading system reliability.

The objective of this summary report is to document reliability concerns raised by NERC's stakeholders and identify important objectives that, if met, could help the electric power industry meet the goals of climate change initiatives while maintaining bulk power system reliability. Further, this summary report aims to highlight the potential bulk power system reliability issues associated with the implementation of the climate change initiatives and engage industry stakeholders in developing appropriate plans to ensure reliability in the future.

Gathering Industry Concerns

NERC gathered stakeholder expertise and perspective on how climate change initiatives could affect reliability through a request for input sent out on June 16, 2008.[4] Specifically, industry respondents were asked to identify bulk power system reliability concerns, impacts, or positive developments related to climate change initiatives specific to their geographic location or area of expertise. Respondents had 30 days from June 16, 2008 through July 16, 2008 to provide comments and perspectives. Nearly 100 pages of comments were received, submitted by approximately 50 entities from across all regions and sectors of the electric power industry.[5]

The comments received covered a range of issues including the need for more transmission, environmental dispatching of existing facilities, and technical discussions of the challenges facing operators attempting to integrate variable renewable resources such as wind into their systems.

Reliability Issues & Objectives

In writing this special report, NERC staff sought to highlight key reliability issues raised by multiple respondents whose combined impact and likelihood could most significantly impact the reliability of the bulk power system. These issues are discussed in depth on the following pages and summarized below:

- Broad-scale fuel switching from coal to natural gas and increased dependence on natural gas as a fuel for electric generation may impact reliability.

- Innovative resource planning and implementation mechanisms are needed to ensure the timely development, siting, construction and operation of necessary and appropriate transmission infrastructure to facilitate achieving the goals and objectives of the various climate change initiatives.

- As demand-side resources become an increasingly significant component of the resource mix, effective integration and verification of these resources will be vital to maintaining reliability.

[4] See Appendix for more information on the information gathering approach.

[5] While this document does include a wide range of commentary from many of North America's leading electricity supply and delivery organizations, it is not a statistically significant sample representative of the collective views of the electric power industry as a whole.

- A decision on national climate change legislation is needed.

In order to address these issues, successful, integrated climate change initiatives capable of maintaining reliability must:

- Recognize and address the potential reliability impacts associated with broad-scale fuel-switching from coal to natural gas and the resulting increase in dependence on natural gas as a fuel for electric generation.

- Support innovative resource planning and implementation mechanisms to ensure the adequate development, siting, and construction of transmission infrastructure.

- Support the development and reliable integration of demand-side resources.

- Provide regulatory certainty to the electric industry, clearly articulating requirements and interaction with state, provincial and regional initiatives.

While these objectives will be critical to any successful integrated plan, this list is in no way intended to be exclusive. Further, this report does not attempt to comment on any specific legislative efforts or propose specific solutions to any individual issue. Also, while the costs of new technologies and system upgrades can certainly affect how they are deployed, this report does not consider cost, in itself, to be a barrier to reliability. *Finally, the potential long-term impacts of the recent unprecedented events in global financial markets are not reflected in this special report. NERC will monitor these impacts and reflect them in its future assessments and reports.*

If implemented effectively, climate change initiatives can result in improvements to reliability in North America, bringing new generation technologies to fruition, diversifying the fuel mix, strengthening the transmission system, and encouraging the development of the smart grid.[6] NERC is committed to working closely with industry and policy makers to ensure that the reliability of the bulk power system is maintained as these initiatives progress.

[6] http://www.oe.energy.gov/DocumentsandMedia/EISA_Title_XIII_Smart_Grid.pdf

Fuel Mix

Broad-scale Fuel-switching from Coal to Natural Gas could negatively Impact Reliability

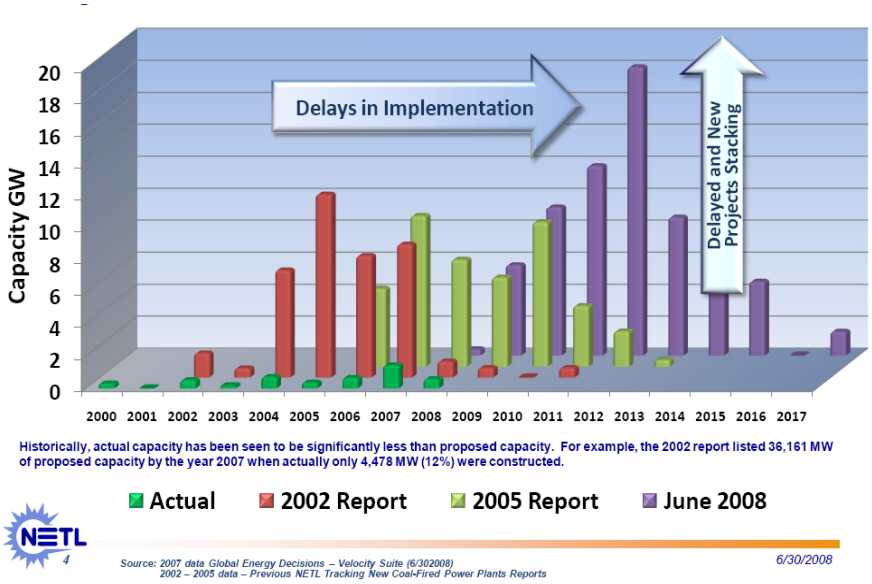
Perhaps the most pervasive issue raised in the comments NERC received was the current trend to replace and displace coal-fired generation with natural gas-fired generation. In their comments, the American Public Power Association has called this "dash to gas" the "most immediate risk to reliability."

Fuel-switching raises a number of reliability issues, from reductions in available generation capacity to natural gas supply security. The timelines established for CO2 reductions will be one of the driving factors determining the extent to which this fuel-switching occurs and any resulting impacts to reliability. "If timetables for reductions are too short, new technologies may not be available to prevent massive fuel switching from coal to natural gas. And, if such fuel switching were to occur quickly, the bulk electric system would be unable to accommodate relocated generating facilities, which, in turn, would have an adverse impact on system reliability," as Dan Steen, VP Environmental, FirstEnergy Service Company in Akron, OH, contributed.[7]

Fuel Switching Already Underway

Natural gas has increasingly been viewed as the "fuel of choice" by the electric industry as natural gas-fired generating plants are typically easier to site, have shorter construction times, and have lower carbon emissions than coal plants. Coal plants, on the other hand, have been facing increasing opposition and delays over the past several years, with over 30,000 MW of coal fired generation canceled or deferred between 2002 to 2007 (see figure) and an additional 3,500 MW cancelled or deferred in the first six months of 2008 (Figure 2).[8]

Figure 2: Past Capacity Announcements vs. Actual Implementation U.S. Coal-fired Generation



The Department of Energy's National Energy Technology Laboratory highlights the differences between past announcements and actual deployment of coal-fired generation in the chart above.[9] As noted in the

[7] For example, see GAO's report, entitled *Economic and Other Implications of Switching from Coal to Natural Gas at the Capitol Power Plant and at Electricity-Generating Units Nationwide*, http://www.gao.gov/new.items/d08601r.pdf
[8] http://www.netl.doe.gov/coal/refshelf/ncp.pdf
[9] http://www.netl.doe.gov/coal/refshelf/ncp.pdf

chart, it appears that delays in implementation are causing projected numbers to continue to rise in the five year planning horizon, while actual implementation continues to lag.
Looking at natural gas-fired generation, NERC's *2008 Long-Term Reliability Assessment* shows an increase of over 20,000 MW of planned natural gas-fired capacity additions over the 2008-2016 period when compared to data submitted just one year ago (Figure 3). While some of this increase can be explained by differences in data collection between the two years, the effect is essentially the same; nearly all of the growth in peak demand in that year will be met by natural gas generation additions.

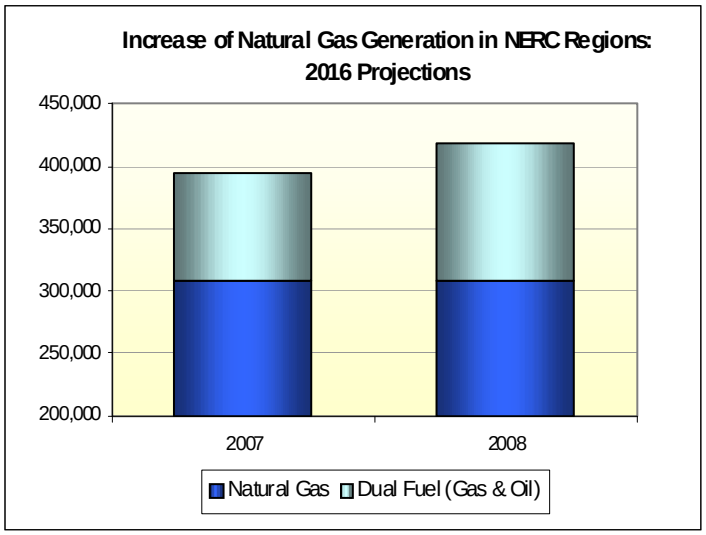


Figure 3: Natural Gas Projections for 2016

Environmental Limitations on Coal Use can Reduce Available Capacity

As a high carbon-emitting fuel, coal will likely continue to face obstacles as climate change initiatives progress. Reliability concerns have escalated with the prospect of early retirements of coal units as carbon constraints may force units out of service earlier than previously expected: "There is a concern with the inappropriate retirement of coal units that are needed for system support which could impact reliability," commented one respondent. "The likely impact of the increased reliance on the transmission system (to import replacement power to make up for the generation that no longer can be generated by coal), especially considering the existing transmission system and constraints in (some regions), will be reflected in reduced reliability within (some states)."

This impact is particularly felt in states such as Mississippi — where coal is the leading fuel for generation.[10] "We are concerned about grid reliability in the next five to ten years because of coal power plant cancellations," commented Pat Williams, Director of Engineering at East Mississippi Electric Power in Meridian, MS.

Looking ahead to a potential cap-and-trade environment, managing carbon credits and allowances to permit critical coal (and gas) facilities to run will be essential to maintaining reliability. In specific reference to the Regional Greenhouse Gas Initiative (RGGI) in the Northeast, Peter Carney, Lead Environmental Engineer at New York ISO in Rensselaer, NY commented: "Without sufficient

[10] Energy Information Administration, Department of Energy
http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=MS

allowances, generators cannot operate to meet bulk power system electricity needs and also comply with the RGGI program." While it may seem to be only a matter of setting reasonable annual targets, Carney continues by explaining: "The minimum level of allowances needed in New York State will vary from year to year, depending upon a number of factors including, but not limited to, weather conditions and the availability of hydroelectric and nuclear generation. Several situations can be postulated that can result in an insufficient supply of allowances. For example, a loss of a major nuclear plant could translate into a need for an additional 10 million tons per year of CO_2 allowances."

Staff at the Los Angeles Department of Water and Power (LADWP) echoed similar concerns based on experience with another regional emissions control program:

> "While participating in the Regional Clean Air Incentives Market Project (RECLAIM) of the South Coast Air Quality Incentives Market Program, LADWP encountered situations when NO_x credits were extremely limited and difficult to procure, causing LADWP to limit sales to only the most critical times. The reliability problem emerges when all of those sales are exhausted and then the market requires additional supply from generation that LADWP would not be allowed to run. We believe that a future CO_2 market must be properly designed so as to avoid this unintended reliability impact."

The availability of credits can be further complicated by potential economic mechanisms, whereby coal plants "may choose to limit operating hours in order to sell their emission credits as green house gas constraints increase," as Terry Boston, President and CEO of PJM Interconnection in Norristown, PA contributed.

Emerging Coal Technologies

Emerging "clean coal" technologies, including carbon capture and storage and ultra super-critical units, have the potential to become an important part of North America's future generation mix as carbon constraints increase. The successful implementation of a commercial scale fleet of these units could provide a viable path whereby North America's most abundant domestic fuel could be used in a carbon constrained regulatory framework.

The technology in its present form, however, requires further development before it can be relied upon as a significant portion of North America's fuel mix. These technologies must become commercial before 2025 in order to become a viable option. However, a primary concern raised by respondents was the potential auxiliary equipment electrical demands associated with carbon capture and sequestration technologies which are forecast to be roughly 10%-50% of the unit installed capacity: "Research sponsored by APPA indicates that the nation will need to install as much as 320,000 MW of additional generating capacity to meet the parasitic losses associated with CO_2 capture and compression systems at existing coal-fired plants. Parasitic losses associated with retrofitting existing conventional coal-fired plants are as much as 50% of total gross output," commented Allen Mosher, Senior Director of Policy Analysis and Reliability for the American Public Power Association in Washington, DC.

Other potential reliability issues related to "clean coal" technologies identified by the respondents included:

- Higher unit forced outage rates may be experienced due to the additional equipment required to support "clean coal" technologies
- New, non-electric infrastructure, such as advanced communications, coal gasification, pipelines, storage facilities, etc., is needed to deploy this
- Limited engineering talent exists to support these new resources.

Natural Gas Delivery Concerns

As more gas plants are built and existing plants are operated for longer periods, stress on the gas supply and transportation infrastructure is increasingly a source of concern for reliability. "Increased demand for natural gas will put a severe strain on the gas supply infrastructure, which could lead to serious reliability problems," Karl Kohlrus, Supervisor, Electric Planning for City Water, Light, & Power in Springfield, IL contributed.

This is of particular concern in those regions where natural gas is already heavily used for electric generation: "We project that the FRCC region will rely on natural gas fired generation for over 50% (of its generation mix) by 2017," commented Sarah Rogers, President and CEO, of FRCC in Tampa, FL. "We continue to study and monitor the deliverability and reliability of the gas pipeline system and gas supply," Rogers continued.

In the west, where gas storage is extremely limited, similar concerns exist: "An increased dependence on natural gas fired generation may create gas supply deficiencies," submitted Bradley Nickell, Renewable Integration Director at WECC. [11]

"Expecting natural gas generation to displace coal-fired generation is, at best, problematic," concurs a report issued by the Department of Energy. "By 2016, in the absence of 18 GW of currently forecasted new coal-fired plants, the addition of natural gas plants to supplant these kWh would demand 1.4 Tcf/year, or almost all of the presently forecasted liquefied natural gas growth."[12]

An in-depth analysis of this issue can be found in the Emerging Issues section of NERC's *2008 Long-Term Reliability Assessment*[13].

Gas as Base Load Generation

Typically reserved for peaking and intermediate use, a fuel-switching scenario would also require natural gas to more regularly act as a baseload resource. In fact, one respondent characterizes natural gas as "the only viable near-term alternative for new baseload generation."

As generation sources are relocated from coal facilities to new natural gas units along pipeline corridors may require additional transmission infrastructure, "The impacts on the base load generation operation may cause significant changes in regional transmission line flow patterns," commented Terry Boston, President and CEO of PJM. "As the generation mix moves away from coal toward less carbon intensive fuels, the transmission infrastructure may require significant upgrades if the locations of the generation resources change substantially."

[11] The western U.S has only about 5% of the nearly 400 active storage facilities.
[12] Department of Energy. Natural Gas and Electricity Costs and Impacts on Industry (DOE/NETL-2008/1320). Washington, DC. April 28, 2008.
[13] http://www.nerc.com/files/LTRA2008.pdf

Objective

Successful climate change initiatives must recognize and address the potential reliability impacts associated with fuel-switching from coal to natural gas and the resulting increase in dependence on natural gas as a fuel for electric generation.

Transmission and Innovative Planning & Operations

Transmission development and innovative approaches to planning and operations are critical to achieving climate goals and maintaining reliability

"Inadequate attention to the transmission grid will undermine all efforts to address climate change while endangering our electric reliability, and thereby our national security."

Michael Heyeck
Senior Vice President, Transmission
American Electric Power
Columbus, OH

Though often overlooked in the discourse surrounding climate change and greenhouse gas reduction initiatives, adequate investment in transmission infrastructure will be vital to maintaining reliability while implementing climate change initiatives. Transmission lines are the critical link between generation resources and customers: at a very basic level, they are the network over which power flows from generation plants to homes and businesses. But beyond this function, transmission also increases the flexibility and reliability of the grid, allowing operators to effectively accommodate new variable resources (such as wind and solar) into the grid as well as respond to a broad array of system emergencies.

The ability to reduce the carbon emissions of the electric sector hinges on having a robust transmission system. A recent study by the Power Systems Engineering Research Center (PSERC) suggests that: "Regardless of contractual arrangements that are subject to environmental regulation, the ultimate dispatch pattern that will determine the actual emissions is largely dependent on transmission constraints and reliability considerations."[14] California ISO echoes these concerns, naming transmission limitations as the "fundamental obstacle" to achieving the state's environmental objectives and maintaining reliability.

Ensuring a suitable transmission system will require a two-pronged approach: building new infrastructure and changing current planning mechanisms to focus more heavily on interregional and continent-wide planning and operation. For example, cost allocation issues need to be resolved in order to develop meaningful, continent-wide planning processes as this influences how planning is conducted.

Building New Transmission Infrastructure

Existing transmission infrastructure is inadequate to reliably integrate new renewable resources to demand centers.[15] Evidence of this exists today, as "transmission limitations are already imposing significant constraints on wind development, with massive interconnection queue backlogs and forced curtailments of wind."[16] Further, the transmission grid was not designed for the long distance continental transport of power, and will require enormous study to ascertain the best plan to meet potential requirements of climate change initiatives.

[14] Dennis Ray, Executive Director, PSERC
[15] James Hoecker, Counsel, WIRES (Washington, DC)
[16] Michael Goggin, Electric Industry Analyst, American Wind Energy Association (Washington, DC)

Several factors compound the need for new transmission infrastructure. New generation resources under consideration are typically location-constrained — meaning they must be sited in a particular area, such as where the wind blows, the sun shines, or, in the case of clean coal with carbon capture and sequestration, where the infrastructure exists to support them. Nuclear is also typically included in this category, as nuclear facilities generally cannot be located near major population centers.

These types of low or non-emitting resources can require long-distance transmission lines to areas not already served by existing transmission infrastructure, as "areas that are rich in renewables … do not correspond with areas where the transmission system is the strongest."[17] The same applies to a new fleet of nuclear units, according to George Dawe, Director, Federal Energy Policy at Duke Energy Corporation in Charlotte, NC, who writes: "If there is a nuclear buildout, more transmission will need to be added to handle baseload output to regions importing nuclear." Significant transmission siting challenges can arise as longer lines are considered, especially when needed transmission lines cross state or regional boundaries. Cost-allocation of this infrastructure also remains a significant concern of respondents, as these needs can significantly impact the cost competitiveness of renewable energy projects.

While some respondents have suggested vast amounts of transmission development may be needed to support integration of new generation, if they are deployed coupled with other counter- balancing resources, such as demand-side management, the amount of transmission could be reduced. There still is an enormous amount of study needed to settle on the appropriate plan going forward.

The Potential Need for an Extra High Voltage Transmission Overlay

A number of respondents stressed the need for an extra high-voltage transmission backbone, referencing recently completed studies.[18]. As APPA comments, "A major build out of EHV transmission is required to ensure the deliverability of wind and other generation to major regional load centers." Ricky Bittle, Vice President of Planning, Rates, and Dispatching for Arkansas Electric Cooperative Corp. in Little Rock, AR expands on this concept:

> "Most transmission systems have not been designed to operate based on large power transfers. Import and export capabilities only represent a fraction of the actual load within a balancing area. If renewable generation is expected or desired to be integrated into the grid in a manner that can serve multiple load centers, a substantial amount of additional high-voltage transmission must be designed and built to allow that result."

This overlay would serve as a "transmission superhighway,"[19] allowing physically "distant resources to be electrically proximate to load centers."[20] A number of planning studies on such an overlay, notably including those at American Electric Power and Southwest Power Pool, are underway or have already been completed.

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[17] Ricky Bittle, Vice President Planning, Rates, & Dispatching, Arkansas Electric Cooperative Corporation (Little Rock, AR)

[18] For an overview, see pp. 93-100 of http://www.20percentwind.org/

[19] See page 95 http://www.20percentwind.org/

[20] Michael Heyeck, Senior Vice President, Transmission, American Electric Power (Columbus, OH)

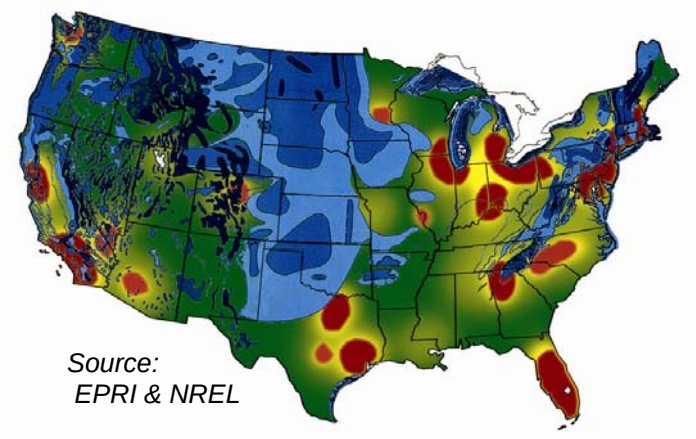
Ancillary Services

It is important to note that the need for new transmission infrastructure is not limited to lines alone. A number of respondents highlighted the need for reactive power and voltage support as longer transmission lines and more variable generation are added to the system. As Don Neumeyer, Engineer at the Public Service Commission of Wisconsin in Madison, WI explains, these new resources may require a change in traditional planning and new technologies to support reactive power at the transmission level:

> "A large penetration of wind generation with a significant distance requirement for delivery or generation off-set will cause the voltage to drop. The amount, location, and type of reactive sources must be analyzed to prevent voltage collapse under varying real-time generation scenarios. Control devices such as the dynamic Var technology or even multiple DC lines are devices and techniques under consideration to deliver renewable energy at greater distances."

National and Regional Climate Goals Require New Approach to System Planning

Changes in the regulatory framework from state/provincial, regional and national climate policies will require a new approach to system planning processes. Even varying state and provincial renewable portfolio standards already in place, though only applicable to these smaller jurisdictions, can significantly impact regional and interregional transactions. As Dawe at Duke Energy highlights in his comments: "Certain regions may not have enough renewable resources in their region to meet state imposed targets. This will likely lead to more constraints across interfaces as companies try to meet targets by importing resources." Therefore, "the success of climate change initiatives will depend on successful and aggressive regional planning," as James Hoecker, Counsel for WIRES in Washington, DC comments.



Source: EPRI & NREL

Figure 4: Wind Availability Compared to Demand Centers

Note:

- Blue indicates areas with high wind potential,
- Brown indicates large demand centers, and
- Green indicates areas with little wind potential and smaller demand centers

As national or international targets are considered, the need for broader planning mechanisms becomes self-evident. As suggested in Figure 4, "with the exception of Texas, less than seven percent of the United States' population inhabits the top ten states for wind potential."[21] As a result, many of the resource plans currently under consideration to reduce carbon emissions involve large transfers of wind power from the Midwest to population centers on the east and west coasts.[22]

[21] Michael Heyeck, Senior Vice President, Transmission, American Electric Power (Columbus, OH)

[22] A number of respondents from the Midwest expressed concern that "The demand for renewable resources in the Midwest will likely exceed the renewable resources that can be brought to market. The transmission planning needs to account for the significant demand of Midwest renewables that exists in the Midwest," as Tom Smies, Director of Generation Planning, for Wisconsin Public Service Corp. explains.

The transmission grid was not designed for the long distance continental transport of power. Designing and building the infrastructure required to facilitate such large power transfers over long distances is "not a trivial design," explains Neumeyer of the Wisconsin PSC. "The power flows to multiple energy markets require careful analysis to balance the annual energy requirements with many time sensitive operational power responses," he continues. "The basic problem is how to re-design and operate a new bulk transmission system under a different energy delivery scenario. The new transmission planning, design, and operation must consider several concepts simultaneously," including Locational Marginal Price of energy in real-time across multiple RTO's, allowing load serving entities equal access to "greener" energy portfolios, and delivering non-dispatchable energy (as opposed to capacity) across many states and RTO's.

These considerations require significant expansion of traditional planning practices, which have typically focused on serving most demand in a given balancing area from generation within that same balancing area.[23] Heyeck of AEP suggests in his comments that "EHV transmission planning must start at the regional level, quickly becoming multi-regional in nature, stretching across vast portions of the continent." A number of multi-regional planning efforts are already making this vision a reality, notably including the Joint Coordinated System Study Plan currently being jointly developed by many of North America's major RTO's, ISO's and power pools.

Re-evaluating the current organization of the bulk power system may also be required to support this new energy delivery scenario. Minimum unit commitment issues resulting from an influx of wind can be mitigated by expanding balancing areas to include more load centers, thereby increasing the amount of load available to serve. Expanded balancing areas can also make additional ancillary services available to operators. "A number of studies have documented that larger balancing areas make it easier to integrate large amounts of wind energy," comments Goggin of AWEA. "Larger balancing areas provide more opportunity for excess generation in one region to be offset by shortfalls in generation in another region. This effect is true even for systems without wind energy," he continues.

Objective

Successful climate change initiatives must support innovative resource planning and implementation mechanisms to ensure the development, siting, and construction of necessary transmission infrastructure including the development of appropriate operating procedures to facilitate achieving the goals and objectives of the various climate change initiatives.

[23] Ricky Bittle, Vice President Planning, Rates, & Dispatching, Arkansas Electric Cooperative Corporation (Little Rock, AR)

Demand-Side Resources

Demand-side Resources are a Critical Component of Resource Mix

As highlighted in the key findings of NERC's *2008 Long-Term Reliability Assessment*, demand-side resources continue to play an important role in supporting the reliability of the bulk power system. Growing use of these resources to meet daily capacity requirements, as well as their critical role in supporting the integration of variable renewable resources, will only increase their importance as climate change initiatives progress.

A number of respondents highlighted a primary benefit of demand-side resources: "when effectively verified, (demand-side resources) can be used to defer capital investments or even be equivalent to new supply."[24] Luke O'Dwyer, Senior Engineer at Salt River Project in Phoenix, AZ echoes this thought in his comments, when he writes "Climate concerns have resulted in increased efforts and attention for DSM programs at SRP. This could be viewed as a positive factor on power system reliability resulting in less necessary generation and transmission." However, he continues to note, "At SRP, with a 4% annual growth in electric demand, increased DSM activity can help slow the demand growth, but new sources of generation are still required."

An additional benefit of demand-side resources is their ability to complement the variability of intermittent resources such as wind power and provide operational flexibility during the sharp down-ramps that can occur as output declines. Goggin of AWEA highlights this in his comments, stating that "Flexible resources ease the integration of all low-carbon generation technologies with limited dispatchability, particularly those with variable output." He adds "Smart grid technology offers significant potential for electric load to be dispatched just as generators are dispatched today."

As a result of these benefits, several respondents emphasized the importance of demand response to future reliability. Brent Ingerigtson, Senior Policy Analyst at E.On US in Louisville, KY encourages NERC to treat demand management as a base load resource in his comments, when he writes: "Using demand management only in times of system emergency and then only for ancillary services is insufficient. Products such as demand management and load control have much shorter lead times and will provide increased efficiency gains that may delay the need for significant new generation (of any form) and/or enhance the eventual entry of renewable energy facilities," he continues. Michael Winka, Director, Office of Clean Energy for the New Jersey Board of Public Utilities in Newark, NJ concurs, offering a regulatory perspective that suggests the future development of what he calls an Energy Efficiency Portfolio Standard (EEPS) that requires an increased percentage of EE and DR similar to an RPS.[25]

Renewed focus on demand response and energy efficiency is one of the most compelling reliability benefits of climate change initiatives when developed as part of a broader resource portfolio. In his comments, Jeffrey Williams, Director, Climate Consulting for Entergy Services in New Orleans, LA states "Mandatory greenhouse gas regulations at the federal level will trigger technology innovation throughout the economy and change the way we manage our resources, including investments in clean technologies that increase efficiency, reduce energy demand, and reduce greenhouse gas emissions."

[24] Nelson Yip, Policy Advisor, ConEdison (New York, NY)

[25] Paul Giancaterino, Chief, Division of Reliability and Security for the New Jersey Board of Public Utilities in Newark, NJ

Significant opportunities for further increasing available demand-side resources also exist as transmission and distribution networks are upgraded to smarter grids. As Hoecker of WIRES comments: "By expanding the high voltage 'backbone' network and ensuring that it becomes a 'smart grid,' we can empower consumers to control their own carbon footprint, enable companies to make optimal use of existing assets, and turn the grid into a driver of energy efficiency and demand response."

As these programs are developed, however, more rigorous measurement and verification of demand-side resources and a better understanding of actual performance will be needed at the system planning level, as Nelson Yip of ConEdison in New York, NY contributes: "Rigorous measurement and verification protocols are need to mitigate concerns regarding uncertainty in the planning process about the levels of achievable DSM." NERC's ongoing efforts to support research and data collection in these areas include the development of a Demand Response Availability Data System, similar to its existing Generator and Transmission Availability Databases.

Objective

Successful climate change initiatives must support the development and reliable integration of demand-side resources.

National Climate Change Legislation

A Decision on National Climate Change Legislation is Needed in the United States

The emerging "patchwork" approach to carbon reductions and renewable resource integration at the state, provincial and regional level emerged as a source of concern for a number of respondents. This concern has also been echoed by the industry in response to draft legislation. For example, in a letter to Senators Lieberman and Warner in reference to the S.2191 bill, National Rural Electric Cooperative Association CEO Glenn English urges lawmakers to "provide regulatory certainty" at a national level, highlighting "different reduction requirements, emission permits, and other compliance obligations" as challenges to effective policies.

One thing is made clear by the responses to NERC's request for comments: legislative and regulatory uncertainty is problematic: "This uncertainty makes it difficult to determine the potential impact and risks associated with GHG emissions; to make effective, strategic capital investment decisions; and to project our costs, revenues, and profits. A clear national policy on global climate change is needed for our industry to plan for the future," as Dan Steen, VP Environmental, FirstEnergy Service Company of Akron, OH comments. For, "while deliberations on climate change must consider economic and reliability factors, the uncertainty associated with the outcome of protracted deliberations is the most problematic issue," as Bob Kahn, President and CEO of ERCOT in Austin, TX stated.

Regulatory certainty is critical to the development of adequate new resources. Without it, planned generation and transmission projects could be deferred or cancelled, capacity margins would therefore decline, and system reliability would be negatively affected. As Nicholas Brown, President and CEO, Southwest Power Pool in Little Rock, AR contributes: "Our industry desperately needs national leadership on allocating costs for the expansion of the bulk transmission system. We have planned regionally and inter-regionally for over a decade, but ideas remain on paper due to lack of needed cost allocation."

As national policies are delayed, actions to specifically address imminent state or regional requirements must be taken, potentially at the expense of longer-term goals not yet defined. As discussed in the transmission section of this document, "provincial approaches to planning, stopping at state or RTO boundaries, will not achieve the renewables objectives of our nation, nor will they preserve our electric grid reliability."[26]

But "actions currently being taken at the state level are already having a material effect on the electric generation and transmission investment decisions," commented Bradley Nickell, Renewable Integration Director at the Western Electricity Coordinating Council. Indeed, a number of responses, such as the following contributed by Larry Meyer, Load Forecast Policy Analyst at BC Hydro (Vancouver, BC), highlighted the influence of current climate initiatives on ongoing resource decisions at utilities across North America: "Since (British Columbia's Clean Energy Target) was established in 2002, all new energy acquired has been BC Clean: alternative energy technologies that result in a net environmental improvement relative to existing energy production."

[26] Michael Heyeck, Senior Vice President, Transmission, American Electric Power (Columbus, OH)

Diversified Resources, Achievable Timelines

"From a reliability perspective, any regulatory requirements cannot and should not be imposed faster than new technologies can be developed and deployed to support alternative resources," Vicky Sullivan, Climate Strategy Manager for Southern Company in Birmingham, AL comments. Planning, permitting, and construction of new resources will take time and aggressive goals aimed at accelerating this timeline may not be achievable.

If implemented properly, climate change initiatives can result in great improvements for reliability in North America, bringing new generation technologies to market, diversifying the fuel mix, strengthening the transmission system, and encouraging the development of the smart grid. Donald McCloskey, Director of Environmental Strategy and Policy for the Public Service Enterprise Group in Newark, NJ, emphasizes these potential improvements in his comments, citing benefits such as upgrading and/or retrofitting aging generation and transmission infrastructure with clean and more efficient technologies and the research, development, and deployment of new advanced metering and transmission technologies that will support a more resilient and reliable electric delivery system.

It is true, however, that "all generation resources and demand-response/energy efficiency initiatives will be needed to meet growing demand in a reliable fashion," as Brown of Southwest Power Pool states in his comments. A broad resource portfolio needed to address climate change initiatives was highlighted by a number of respondents referencing EPRI's[27] recently completed "prism" analysis.

Objective

Successful climate change initiatives must provide regulatory certainty to the electric industry, clearly articulating requirements and interaction with state, provincial and regional initiatives.

[27] http://my.epri.com/portal/server.pt/gateway/PTARGS_0_2_1630_277_848_43/http%3B/myepri10%3B80/EPRIDocumentAccess/popup.aspx/000000000001015461

Appendix: Information Gathering for this Report

To obtain industry input on the reliability impacts of climate change initiatives, NERC sent out the following letter to industry stakeholders via e-mail in June, 2008.

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

June 16, 2008

Industry Stakeholders,

As the organization tasked with ensuring the reliability of the bulk power system in North America, we continually strive to keep abreast of emerging issues and trends that may affect reliability. As key issues are identified, they are highlighted in our seasonal and annual long-term reliability assessments through ongoing work with the Planning Committee and its Reliability Assessment Subcommittee.

This year, green house gas reductions, including deliberations on climate change initiatives, were ranked by these two groups as the number one "emerging issue" for consideration in our 2008 long-term reliability assessment. As part of our efforts to gather as much stakeholder expertise and perspective as possible on how these issues could affect reliability, we are requesting your help to identify bulk power system reliability concerns, impacts, or positive developments related to climate change initiatives specific to your geographic location or area of expertise.

We plan to compile and summarize the responses into a set of target issues, which we will then present to our stakeholders, Members Representatives Committee, and ultimately the Board of Trustees for inclusion in our 2008 Long-Term Reliability Assessment to be issued in October.

We encourage you to forward this request on to others who may have interests in the subject. For systematic compilation, we request that all information be submitted by **Wednesday, July 16th** via NERC's website at the location below:

https://www.nerc.net/nercsurvey/Survey.aspx?s=9357126fc23347da945450ab8d232f12

Please feel free to contact Mark Lauby, Manager of Reliability Assessments, at 609.452.8060 or, via email, at mark.lauby@nerc.net for further discussion, questions, or concerns. Thank you for your contributions to this important effort.

Sincerely,

Rick Sergel
President & CEO

116-390 Village Blvd.
Princeton, NJ 08540
609.452.8060 | www.nerc.com

Information gathering was carried out using a web-based tool, inviting each respondent to identify up to 10 separate reliability impacts of Climate Change Initiatives. The tool is outlined below:

Emerging Issues: Climate Change Initiatives

As the organization tasked with ensuring the reliability of the bulk power system in North America, we continually strive to keep abreast of emerging issues and trends that may affect reliability. As key issues are identified, they are highlighted in our seasonal and annual long-term reliability assessments through ongoing work with the Planning Committee and its Reliability Assessment Subcommittee.

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This form includes space for entering up to ten (10) separate issues. We ask that each distinct issue be submitted separately, please do not combine issues into one section. We also ask that responders prioritize issues based on level of importance if possible, and submit the most important issue first. To input another issue, please be sure to check "yes" on the last question of this page and hit "Submit Issue."

Unfortunately, this form cannot be saved and re-accessed. We apologize for any inconvenience this may cause. We recommend creating responses in a word processing software package (such as Microsoft Word) and pasting final responses into the form. This will allow for easy editing and commenting and will reduce the chances of data loss due to session inactivity or connection issues.

Please contact Cheri Thompson at 609.452.8060 or via email at cheri.thompson@nerc.net with any technical issues or questions. All other inquiries should be directed to Mark Lauby at 609.452.8060 or via email at mark.lauby@nerc.net.

Please provide your contact information:

Name
Title
Organization
Address
City
State/Province
Postal Code
Country
Phone
E-mail Address

*Would you like your response to remain anonymous?
Yes, I would. / No, it's ok to attribute my comments.

*Sector(s) Represented:

*Title of Issue:

*Description:

*Is your organization currently conducting any studies on this issue? If so, please describe:

Would your organization be willing to share the results of these studies with NERC? (if applicable) Non-disclosure agreements may be arranged.
Yes/No

Do you have an additional issue you would like to submit during this session (up to 10)?
Yes/No

* Questions marked with a * required responses.