MODERNIZING GRID INFRASTRUCTURE THROUGH PEER

A Brief on U.S Federal Energy Policies and the PEER rating system

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OVERVIEW

The United States energy sector is laden with policy-based opportunities to develop a more resilient and sustainable grid system. The U.S. employs ambitious energy policies and programs in response to continually developing challenges to the nation's grid infrastructure. GBCI's Performance Excellence in Electricity Renewal (PEER) program could bridge this gap and help ensure reliable, clean and resilient power to consumers, thereby improving the living standard in communities across the country and positively impacting the nation's economy.

PEER is a rating system that measures and improves power system performance and electricity infrastructure. Policies and programs can require or promote the use of this standardized measure for grid performance to help projects and companies evaluate grid operations. PEER encourages the adoption of reliable, resilient and sustainable practices, and helps utilities solve aging infrastructure, find cost savings, share best practices, build for resiliency and enhance tracking to determine and prevent failures.

PEER can be used to support grid modernization efforts in the U.S. and to enable the energy sector to comprehensively address electricity demand, distribution, resiliency and reliability. It has the potential to help transform the energy and electricity sector and facilitate the construction of modern 21st century infrastructure and, in doing so, reduce emissions, make our communities more resilient, improve safety and security, create thousands of new green jobs and catalyze economic growth at all levels. PEER establishes global best practices, supports programs working toward national goals like the National Action Plan for Energy Efficiency and creates a common language for the electricity consumer, utility companies and other energy professionals. This policy brief details how PEER can complement the work of the U.S. federal government to achieve their targets and holistically support grid modernization in the country.

ENERGY SCENARIO

The United States maintains some of the highest rates of energy consumption among global industrial leaders, accounting for nearly one-fifth of the world energy consumption shares, and the economy is still growing at a marginal rate (BEA projects an average of 3.1 percent real GDP growth), projecting an accompanying increase in energy consumption. Energy consumption rates will likely continue to climb without determined efforts to increase energy efficiency measures. Currently the U.S. is averaging around 95 quadrillion Btu of energy produced per year and this energy is being distributed through a continually degrading electric grid infrastructure in need of renewal.

With such high consumption rates, more focus on energy efficiency is needed to maximize the potential of our current energy systems. In 2017, 77.6 percent of the energy produced in the U.S. came from some form of fossil fuels (natural gas, petroleum or coal), while renewable energy accounted for 12.7 percent of the total energy share – double the renewable energy production levels from 2008 and projected to grow even faster within the next decade. The Energy Information Administration (EIA) projects that energy efficiency across end-use sectors will increase in the next 30 years and those efficiency measures will help to keep energy consumption rates relatively flat.

CURRENT CHALLENGES

Reliability and Resiliency

A sustainable grid system needs to maintain its power supply reliably, even when faced with challenges such as cyberattacks, increased load management and, especially, natural disasters. Take for instance the fact that the U.S. government spent a record amount of money recovering from natural disasters in 2017. Sixteen natural disasters – ranging from hurricanes and wildfires to floods and drought – cost Americans over $306 billion in recovery efforts. These events present unique threats to essential infrastructure, such as hospitals and airports, and thus require increased attention to targeted resilience improvements. The average American customer experienced on average 8 hours of interrupted power supply in 2017, nearly double the time of total interruptions in 2016. Cyberattacks also threaten to destabilize local power supply critical to maintaining essential infrastructure, increasing the need for cybersecurity to protect from new net-based vulnerabilities. Grid reliability and resilience is an increasingly pressing issue to the current energy systems. Aging energy infrastructure is only serving to compound the issue. Utilities in the United States spent over $35 billion in transmission upgrades and maintenance in 2016. The Department of Energy identified significant reliability issues present within U.S. energy infrastructure related to the lack of flexibility and adaptability of traditional grid services – repairing the U.S. electric grid could cost $5 trillion. A modern and sustainable grid system requires an upgraded energy supply system that is more reliable, affordable and resilient to scenarios of extreme stress.

Economic Competitiveness

Energy costs accounts for 8% of the total GDP, showing an increasing trend due to the rise of energy prices. These energy costs continue to rise due to lack of adaptive and efficient energy technology. With a larger investment in energy efficiency, the U.S. energy sector could benefit from streamlined and localized grid operations. A more energy-efficient grid can reduce costs, decrease the need for imports (improving energy security) and enhance economic activity by expanding the potential market for energy technology. The smart grid and renewable energy technology market are both burgeoning industrial sectors that could benefit largely from a shift in interest toward clean and efficient energy systems. There also is an increase in supply- and demand-side opportunities for customers to participate in electricity markets. This complicates the distribution system of the traditional energy grid, but also presents a significant opportunity for a more localized energy market that distributes energy more efficiently.

Infrastructure and Efficiency

U.S. energy infrastructure is becoming outdated and is in need of revitalization in many areas. Some emerging trends include moving toward clean energy and alternate distribution methods. This transition, while encouraging, is putting stress on the traditional grid structure, evident through the transmission and distribution loss of 5 percent of total electricity generated.

Retrofitting programs and smart grid technology are presently available but not widely implemented in part due to the required capital investment. Advanced metering infrastructure and other innovative load management tactics, such as interconnected electricity information and control systems, capitalize on prospective energy efficiency measures.

Funds are available to assist entities in their transition to more energy efficient technology options through state and federal programs, but appropriate education and smart investment tactics need to be communicated to ensure maximized utilization of the energy efficiency technology for each individual energy system.

KEY ENERGY POLICIES

Overview

- **Smart Grid Investment Grant:** The Smart Grid Investment Grant (SGIG) program aimed to accelerate the modernization of the nation's electric transmission and distribution systems. A funding of $4.5 billion is allocated to the program to select projects from utilities that work toward grid modernization efforts, smart grid tools and technologies such as interoperability, cyber security and operational efficiency. All these infrastructure requirements are integrated into the PEER program. Hence, the 99 smart grid projects that has received funding as part of SGIG can be tracked, monitored and measured on their performance through PEER.
- **Climate Action Plan:** This plan was presented in 2013 for national and international action to cut the GHG emissions that are the driving cause of climate change and which threaten public health. The plan has three pillars: cut carbon pollution in the United States; prepare the United States for the impacts of climate change; lead international efforts to combat global climate change and prepare for its impacts. The main goal of this plan as it relates to PEER is its mission to implement 10 GW of renewable power on federal lands and 100 MW of renewable power to federally assisted households by 2020.
- **Grid Modernization Initiative:** The GMI is an initiative enacted by the Department of Energy in order to upgrade America's grid infrastructure in order to meet the increasing energy needs of the 21st century.
- **EPA Clean Energy Programs (Combined Heat & Power, Green Power Partnership):** The EPA's clean energy programs are designed to help energy consumers in all sectors, state policy makers and energy providers by providing objective information, creating networks between the public and private sector and providing technical assistance. The EPA also offers recognition to leading organizations that adopt energy efficiency and renewable energy policies and practices. The main two programs featured in this section that relate to PEER are the Combined Heat & Power Partnership and the Green Power Partnership.

Affordable Clean Energy (ACE) Impact

One increasingly important factor to consider when assessing the overall energy scenario in the United States is the impact of the recent approval of the Affordable Clean Energy (ACE) rule, and, consequently, the replacement of the Clean Power Plan (CPP). ACE repeals the goals and incentives set in place by the CPP, and replaces them with more lenient, but also more achievable, goals for the American energy sector. ACE's main program makes coal plant generation more favorable for utilities and existing power plants by incentivizing further coal development, while pledging to increase coal power plant efficiency. This action is regarded as favorable to reducing individual power plant emissions – but projects to increase coal energy generation as a whole – thus increasing overall emissions, especially when compared to the CPP targets. The legislations outlined in this brief are not affected by ACE, but ACE does alter the outlook of the U.S. energy sector.

The key objective of this program is in line with the PEER Energy efficiency and Environmental (EE) index that plans to reduce the emissions right from the source to the site. The PEER EE index provides a score based on the health of power plants by assessing their emissions (CO2, SOx, NOx, source energy intensity, water consumption intensity and percentage of solid waste recycled) for per unit of power being generated, thus demonstrating the power plants' efficiency.

Grid Modernization Initiative

The U.S. Department of Energy's Grid Modernization Initiative (GMI) focuses on advancing six elements that formulate a modern grid system, including resilience, reliability, security, affordability, flexibility and sustainability. This initiative identifies key technical features that comprise a modern and efficient grid system and uses institutional support to integrate them into the nation's electrical infrastructure.

PEER complements GMI through innovative technical solutions

PEER can assist the efforts of GMI by complementing the technical solutions presented to achieve the vision of a modern grid system. The initiative is looking to achieve their goals through six key technical areas: devices and integrated systems training; sensing and measurements; system operations, power flow and control; design and planning tools; security and resilience; and institutional support. These key technical areas could be supported by the breadth of technological and planning options available through PEER, including:

- Developing a communication network to improve information processing
- Creating better reliability, environmental and operational monitoring systems
- Increased control over transmission flow through Energy Management Systems and Master Controller technology
- Enhancing focus on resiliency through new metrics and standards
- Developing planning tools to promote financial incentives, energy supply choice and demand-side management

PEER provides a common language for energy professionals, businesses and policy-makers to further grid modernization

PEER represents an important opportunity and provides a platform for diverse groups to coalesce toward a common goal. Oftentimes the technical aspects of grid modernization overshadow the developmental prospects in the eyes of policy makers, but PEER can provide a distinguishable metric which multiple parties can utilize to further grid advancements. One major function of GMI is to provide technical and planning support to institutions and organizations in line with the goals of the initiative. PEER can align itself with these organizations, institutions and accompanying utilities to establish a consistent definition for what a sustainable and modern grid system should look like. Ameren Microgrid in Champaign, Illinois is a clear example of how different stakeholders have come together in delivering a technologically advanced microgrid that is PEER-certified. The project is built for Ameren utility by involving industry stakeholders of S&C Electric, Northern Power Systems, Yingli and Caterpillar.

EPA CLEAN ENERGY PROGRAMS

Combined Heat and Power (CHP) Partnership

The Combined Heat and Power (CHP) Partnership is an EPA program that seeks to reduce air pollution and water pollution associated with electric generation. The CHP Partnership is an effective way to increase energy efficiency, increasing fuel use efficiencies of 60 to 80 percent, compared to separate heat and electric power systems, with efficiency rates staying around 45-50 percent. PEER serves as an essential complement to the CHP Partnership because of the proven environmental programs surrounding the improvement of the System Energy Efficiency Coefficient (SEEC). PEER promotes the enhancement of SEEC, which remains right in line with the energy efficiency goals of the EPA's CHP Partnership. PEER's proven ability to foster technological innovation along with this clean energy program's dedication to increasing energy efficiency measures through innovative technological solutions are ideal complements.

Green Power Partnership (GPP)

The Green Power Partnership (GPP) is another initiative of the EPA's Clean Energy Programs. The GPP is a voluntary program that seeks to advance the presence of clean energy sources in the American market and promote the development of renewable electricity sources. Currently, the GPP has over 1,700 operating partners that are providing nearly 55 billion kWh of green power annually. This program offers technical assistance, credible usage benchmarks, market information and public recognition as tools to encourage partners to adopt higher green power usage rates and new entities to become partners. PEER could complement this partnership through advanced efficiency metrics and an increased focus placed on transparency (supply choice and environmental performance disclosure), as well as mirroring the GPP's efforts to increase renewable energy usage through the Green Power and Carbon Offset credit of PEER. Both of these programs could work together to form a holistic energy generation market that values supply-side efficiency and environmental impacts appropriately.

BENEFITS OF PEER

PEER helps electricity leaders, professionals, operators and energy stakeholders:

- Bring transparency and create a common language for consumers, utilities, operators and energy stakeholders
- Define key performance metrics, benchmark against industry standards and verify measurable outcomes
- Demonstrate competitive advantage and comparative differentiation
- Build a comprehensive continuous improvement process based on industry best practices to maximize returns and minimize risks, thereby increasing trust, credibility and customer satisfaction

CASE STUDIES

Chattanooga Electric Power Board

In 2015, the Electric Power Board (EPB) of Chattanooga, Tennessee became the first PEER-certified municipal utility in the world. The EPB system was put to the test in 2012, when two major storms knocked out power throughout most of Chattanooga. With electricity infrastructure improvements, power was restored to most of the system within hours instead of days. As part of the PEER process, the city identified opportunities for sustained improvement through undergrounding, improving the generation mix and encouraging ongoing customer engagement. This decreased Chattanooga EPB's outages to 83.5 minutes per year, which is half of the state average and approximately a third of the national average, demonstrating PEER's capability to bolster grid reliability. These strategies have helped the Chattanooga EPB provide further value to customers, raise awareness of their accomplishments to date and support additional investments.

NYU Langone Medical Campus

This PEER Platinum medical campus made headlines through its dedicated improvements to reliability and resilience. After Hurricane Sandy, the NYU Langone medical campus experienced delayed blackouts and power shortages. In response, NYU Langone installed a more resilient power infrastructure using a combined heat and power plant with emergency generators and boilers. Their critical electrical infrastructure was elevated to prevent damage from a 500-year flood event and they also undergrounded 100 percent of their electric cables. Sensitive equipment such as CT scan and X-ray machines are well protected with power quality monitoring and mitigating systems in place. All these measures help in ensuring better and continued operations and safety to the patients who depend on them. All such infrastructure improvements made by NYU Langone helped them to achieve the first PEER Platinum certification for a medical campus. The management team responsible for the transition to climate resilience cited PEER's support in enabling them to assess the quality of their work, identify areas for improvement and benchmark their progress against other global campuses.

Ameren Microgrid

Located in Champaign, Illinois, the Ameren Microgrid is the first PEER Gold certified microgrid in the world. Ameren achieved this in 2018 by experimenting with new smart grid technologies and investing in reliability to produce and deliver energy more efficiently. Microgrids are the emerging energy ecosystem that provide practical answers through a local, interconnected energy system within clearly defined electrical boundaries, incorporating loads, decentralized energy resources, battery storage systems and control capabilities. Ameren Microgrid implemented distributed energy resources of 363 MWh on-site renewable energy generation, constituting one wind turbine of 100 kW generation capacity, solar power generation of 125 kW and two natural gas generators with a generation capacity of 500 kW each. 100 percent of the microgrid's project loads are provided with an alternate power supply, with seamless transfer controls and an outage management system is in place for all loads.

CONCLUSION

Communities all over the world must modernize their electricity infrastructure in order to meet the dual challenges presented by climate change: 1) to mitigate climate change to the extent we still can, and 2) to begin adapting to its inevitable effects through resiliency efforts. PEER provides direction and identifies new opportunities for improvement of America's aging energy infrastructure through more resilient and efficient upgrades. PEER has the potential to accelerate the transformation of the power and energy market, help reduce vulnerabilities and damage to grid infrastructure as a result of extreme weather events and promote clean and efficient energy production and distribution.

PEER is administered by Green Business Certification Inc. (GBCI), the premier organization independently recognizing excellence in green business industry performance and practice globally. Through PEER, GBCI puts forth a comprehensive framework for the assessment of power supply performance and works to transform cities, utilities, campuses and transit systems through its 36 global parameters. Learn more at peer.gbci.org.