What the DOE Study Should Address

Since 2010, more than 100,000 megawatts (MW) of coal-fired electric generating capacity in 43 states have either retired or announced plans to retire.[i] These retirements represent one-third of the nation's coal fleet. In addition, 12,000 MW of nuclear generating capacity in ten states have retired or announced retirement since 2013.[ii] Together, coal and nuclear retirements represent over 25 percent of the nation's traditional baseload electricity resources.

In April, Energy Secretary Perry requested a study by DOE to determine whether the retirement of baseload electricity resources is affecting the reliability and resilience of the electric grid. It is important that the DOE study explain the distinction between reliability and resilience; call for resilience analysis and the establishment of uniform resilience criteria; evaluate the risks associated with over-reliance on natural gas to generate electricity; accurately characterize the role of EPA policies in causing coal retirements; and include correct information on subsidies.

The distinction between reliability and resilience.

Resilience is not the same as reliability.[iii] A *reliable* electric system minimizes the likelihood of disruptive electricity outages. A *resilient* system acknowledges that outages will occur, prepares to deal with them, and is able to restore service quickly. In other words, a reliable system is not necessarily a resilient system.

According to PJM, resilience "... relates to preparing for, operating through and recovering from a high-impact, low-frequency event."[iv] (Low probability but highly disruptive events are sometimes referred to as black swans.) NERC says that "... system resiliency is becoming an enhanced yardstick for reliability."[v] Concerns about grid *resilience* have increased for a number of reasons, especially the retirement of a large

amount of coal-fired and nuclear generating capacity and the increasing reliance on natural gas and renewables.

The DOE study should identify attributes that strengthen grid resilience (e.g., on-site fuel supplies, firm fuel contracts, and black start capability[vi]) and attributes that can diminish grid resilience (e.g., just-in-time fuel delivery, fuel storage disruptions, pipeline outages, interruptible fuel contracts, and over-reliance on any one fuel type.) In addition, the study should make the case for policy changes by FERC and grid operators that value attributes that strengthen grid resilience.

The need for resilience analysis and resilience criteria.

To our knowledge, PJM is the only organization that has done comprehensive analysis to determine the appropriate mix of electricity resources needed to maintain grid resilience.[vii] For example, the PJM analysis showed that the 13-state region would likely need significant coal-fired generating capacity to ensure that its grid is resilient against Polar Vortex conditions. Also, PJM pointed out that "... criteria for resilience are not explicitly defined or quantified today."

The DOE study should (1) urge grid operators to undertake resilience analyses to evaluate all high impact, low frequency events that threaten grid resilience and (2) promote the establishment and use of uniform resilience criteria.

The risks associated with natural gas.

Some argue that the operational characteristics of natural gas production, transmission, and distribution make the natural gas network reliable and resilient.[viii] However, according to NERC, "as growth in natural gas demand increases from the electric sector, pipeline transportation constraints, storage limitation, and contingencies on gas infrastructure will have a greater impact on gas-fired generation. Overdependence on a single fuel type increases the risk of common-mode or single-point-of-failure disruptions ..."[ix] The natural gas outage at Aliso Canyon is a recent example of how a major gas outage can threaten grid resilience and reliability.[x]

In addition, even an arguably operationally reliable and resilient natural gas system does not ensure that natural gas can always be

delivered to power plants, especially during serious disturbances, such as extreme weather and infrastructure disruptions. One quarter of the natural gas used last year by power plants in the nation's eight power pools was delivered under *interruptible* contracts. Interruptible gas transportation represented 61 percent of natural gas delivered to power plants in NYISO (New York), 57 percent in ISONE (New England), 47 percent in MISO, and 35 percent in PJM.[xi] Under interruptible service, the gas pipeline or supplier can generally cease delivering gas with short or no notice.

The DOE study should provide a comprehensive evaluation of the risks (e.g., interruptible contracts, single points of disruption, just-in-time fuel delivery) associated with the increasing reliance on natural gas for electricity generation and the effect of those risks on the reliability and resilience of the electric grid.

Acknowledge the major role of EPA policies in causing coal retirements.

EPA regulations and policies have played a *major* role in three-fourths of coal retirements, so far.[xii] ACCCE provided information to DOE showing that three fourths of coal retirements have been attributed, at least in part, to EPA regulations and policies. Nonetheless, a leaked draft of the DOE report suggests that EPA actions have played a *minor* role.[xiii] Repeating this mistake in the final report could lead to even more retirements by understating EPA's influence over energy policy.

The DOE study should recognize the major role that EPA regulations and policies have played in causing coal retirements.

Provide better information on subsidies.

Subsidies, especially for renewables, are distorting wholesale electricity markets. Nonetheless, the leaked draft of the DOE report states that coal has been one of "the largest energy subsidy beneficiaries." This is clearly incorrect and could lead to more bad policy decisions. For example, a 2016 study by the University of Texas shows that over four years coal receives less federal subsidies than any other energy source. According to the study, renewables receive $40.3 billion, oil and gas $18.4 billion, nuclear $5.6 billion, and coal $5.3 billion.[xiv]

[i] ACCCE, "Retirement of Coal-Fired Generating Units as of June 17, 2017."
[ii] EIA, Today in Energy, "Three Mile Island is the latest nuclear plant to announce retirement plans," June 13, 2017; Nuclear Energy Institute, "US Nuclear Operating Plant Basic Information."
[iii] NAS, "Enhancing the Resilience of the Nation's Electricity System," 2017.
[iv] PJM Interconnection, "PJM's Evolving Resource Mix and System Reliability," March 30, 2017.
[v] North American Electric Reliability Corporation, Remarks of Mark Lauby, Senior Vice President and Chief Reliability Officer, FERC Reliability Technical Conference, Panel III: The Potential for Long-term and Large-Scale Disruptions to the Bulk Power System, June 22, 2017.
[vi] Most generating units need electricity from an external source to start after they have shut down. A unit that is black-start capable can start independent of a grid electrical source and therefore supply electricity to the grid so that other sources can start up. Typically, diesel generators, hydroelectric units, small natural gas combustion turbines, as well as batteries, can be black-start capable.
[vii] PJM Interconnection, PJM's Evolving Resource Mix and System Reliability, March 30, 2017.
[viii] For example, see "Natural Gas Systems: Reliable & Resilient," Natural Gas Council, July 2017: "The physical operations of natural gas production, transmission and distribution make the system inherently reliable and resilient." (page 6)
[ix] North American Electric Reliability Corporation, "Short-Term Special Assessment, Operational Risk Assessment with High Penetration of Natural Gas-Fired Generation," May 2016.
[x] In October 2015, a gas leak was detected at the Aliso Canyon natural gas storage facility in Southern California. Aliso Canyon is a critical component of the gas system in the Los Angeles Basin. It is one of the largest natural gas storage facilities in the U.S. and is essential in providing a reliable gas supply to 18 large power plants with approximately 9,800 MW of capacity in the Los Angeles Basin. After the leak was detected, a moratorium on injections into the facility was instituted until all wells were tested.
[xi] Energy Ventures Analysis, Inc., Memo to ACCCE, May 2017.
[xii] ACCCE, "Retirement of Coal-Fired Electric Generating Units, as of June 17, 2017."
[xiii] DOE, "Electric Power System, Markets and Reliability Study, Interim Draft Report," July 2017.
[xiv] Energy Institute of the University of Texas at Austin, "Federal Financial Support for Electricity Generation Technologies," November 2016. The study included energy expenditures for 2010, 2013, 2016 (projected) and 2019 (projected).