

**Testimony to FERC technical conference regarding reliability of the Bulk-Power System
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Good morning, I am Dr. Peter Balash, Associate Director for Systems Engineering and Analysis and Senior Economist with the Department of Energy's National Energy Technology Laboratory (NETL). I would like to thank the Commission for the opportunity to speak at today's Technical Conference regarding reliability of the Bulk-Power System. NETL has been at the forefront of examining and promoting the reliability of our power system and briefed the Commission in 2015 on the potential for issues with bulk power system reliability due to regulatory and economic pressures against baseload plants.

Since I last briefed the Commission four years ago, many changes have occurred across the bulk power system. Due to regulatory pressure, plentiful supplies of natural gas, and state-level policy interventions, the power system has been in great turmoil for the last decade, with these changes not likely to abate any time soon, but rather increase. It is with great respect that I applaud the electric reliability organization (ERO), regional entities, and all of those engaged in ensuring that the energy we require as a society is reliably available in face of an evolving bulk power system. I would like to share a few perspectives.

Firstly, given the sustained duration of changes that have occurred in the bulk power system, I would ask that the Commission and ERO consider expanding the retrospective duration of the State of Reliability Report (SORR) to a longer period than 5 years to anchor to a point when greater certainty existed. We have seen many times in the research and development space where trending assumptions on a shortened time period obscure larger trends that emerged over longer assessment periods. Expanding the duration of the SORR would be appropriate for the ERO, particularly since its annual Long-Term Reliability Assessment provides a system prospective for the next decade.

Specific to the findings of the 2019 SORR, I would like to comment on Key Findings 1 and 2 which conclude that extreme weather events continue to be leading contributors to transmission, generation, and load loss, and that there were no non-weather related category 3, 4, or 5 events in 2018. It is our perspective that the current and pending ERO Event Analysis Plan underpinning these findings is incomplete. The ERO should expand the plan to include near miss events, as current and pending NERC Event Categories only consider unexpected generation and bulk electric system outages, faults, and misoperations as defining characteristics.

It has become apparent through the public statements of more than one region that the shift from fuel secure assets to weather dependent resources and those with just-in-time fuel delivery are leading the system to incur a higher level of reliability risk, while experiencing increasingly recurring near miss events that could rapidly cascade from a non-event into a category 5 event under the current and

pending ERO Event Analysis Process (EAP).¹ By failing to consider near misses and their triggers, which are primarily driven by fuel security considerations and interdependent infrastructure effects, NERC's EAP fails to capture events that pose a broader risk to system reliability. It is important to acknowledge that incorporating these considerations will increase the already heavy burden placed on the ERO, Regional Entities, regional transmission organizations, and others. However, we believe that it is necessary to ensure continued reliability. Therefore, we ask that the ERO adopt a more proactive posture that documents learnings from near misses rather than remaining in a reactive posture where lessons are only learned and shared after the occurrence of an event.

Overall, the Office of Fossil Energy supports the recommendations identified in the 2019 SORR. We recognize that many of these recommendations were further detailed in NERC's 2018 Long Term Reliability Assessment (LTRA). As the ERO has noted, reliability within many regions of the U.S. bulk electric system (BES) is becoming more vulnerable as the amount of fuel secure generation, namely coal and nuclear power which can sustain long-term supply disruptions, is significantly decreasing. In the Eastern Interconnection (EI), there has been a nearly 28% loss of fuel-secure capacity since 2010, and a 16% decrease in fuel secure capacity as a percentage of total capacity in the same period. While substantial natural gas-fired capacity is coming online, its fuel security is uncertain; relying on just-in-time delivery, with on-site fuel storage options being both expensive and requiring a large footprint to be feasible for extended durations. Much of the remaining generation void has been filled with variable energy resources, such as wind and solar, which offer far less capacity and are limited in their ability for storage to moderate their intermittency.

It is for these reasons that the Commission, the ERO, Regional Entities, and others must develop a plan to make sure there is a balance of fuel-secure generation to maintain reliability in line with the recommendations in both the 2019 SORR and 2018 LTRA. We are all familiar with the tenuous situation in the Northeast where the supply of electricity is vulnerable due to limited pipeline capacity; state-level moratoria on pipeline expansion; coal and nuclear plants closings; foreign LNG import reliance; and environmental operating restrictions. Since no relief to their constraints appears to be forthcoming, the operators in these regions are relying on "virtual pipelines", *i.e.*, transporting LNG by rail and truck, at a much higher cost to consumers. Developing even a fraction of the fuel security provided by coal and nuclear resources for natural gas increases generation costs significantly. According to a NETL analysis, above ground natural gas storage of compressed natural gas and atmospheric natural gas storage for only a single day would increase the costs of a 500 MW natural gas combined cycle unit by nearly \$2 /MWh (at 85% CF over 20 years), and increase the footprint considerably.² Adding on-site liquefied natural gas storage is likewise problematic, due to supporting infrastructure requirements.

According to the latest NERC SORR (June 2019), during extreme winter weather, natural gas generation outages spike above coal outages (nuclear becomes more efficient during extreme cold due to the drop in inlet cooling water temperature). In the New York Independent System Operator (NYISO) and ISO

¹Gordon van Welie (ISONE) 2/20/2019 - <https://www.bostonherald.com/2019/02/20/natural-gas-moratoriums-around-state-due-to-lack-of-pipelines/>; *See also*, <https://www.usnews.com/news/best-states/texas/articles/2019-05-08/texas-power-grid-manager-expects-to-avoid-summer-blackouts>;

CAISO Ancillary Service Scarcity Events Increasing, 5/15/2019, CAISO 2018 Annual Report on Market Issues & Performance - <http://www.caiso.com/market/Pages/MarketMonitoring/AnnualQuarterlyReports/Default.aspx>

² NETL Report (2017) – Ensuring Reliable Natural Gas-Fired Power Generation with Fuel Contracts and Storage - <https://www.osti.gov/servlets/purl/1417306>

New England (ISO-NE) regions, this presents a real reliability issue as the amount of fuel secure generation in these regions has been dramatically reduced by coal and nuclear retirements. The lack of pipeline capacity and alternate resources led operators in the Northeast to burn significant oil for power during repeated cold weather events including the 2014 Polar Vortex and the 2018 Bomb Cyclone, with many plants running out or nearly out of oil and increasing short-term emissions to rates higher than those of controlled coal-fired units.

FERC and state public utility commissions moved away from regulated and toward more open markets with the goal of providing lower cost electric power. A fundamental principle of FERC-regulated markets is fuel neutrality. However, since those changes began in the 1990s, other policy goals have emerged, sometimes at odds with the concept of open and competitive markets, including Renewable Portfolio Standards (RPS) and federal tax credits for wind and solar generation. This has led to an inherent conflict in having policies that elevate competitive markets while incent certain types of generation using out of market policies. State mandated RPSs drive the amount of renewable generating capacity within states without the check and balance of reliability. The RPS in many states include must-take agreements that incent renewable capacity additions and de-incent fuel secure capacity. This leads to market distortions, and even as the cost of renewable generation has decreased, the price of electricity has continued to rise as there has been an increase in out-of-market reliability and must-run generator payments, as well as paying for resilient reserves in the fleet and transmission network upgrades and additions.

We are encouraged by the ERO and the Commission's recognition of the importance of a need to ensure fuel security and the recognition of uncertainties that accompany increasing levels of variable energy production and infrastructure interdependency. We encourage the Commission to recognize the spirit of the 2017 DOE NOPR and construct a viable fuel-security framework that will ensure that the nation's bulk power system remains operable and resilient in the face of predictable events. We are concerned, however, of a reluctance to implement the changes necessary to ensure reliability is maintained in face of these uncertainties. We call on all parties to work together to encourage the ERO to proactively engage stakeholders and policy makers to ensure that reliability is maintained and negative trends are arrested before events occur due to inadequate resources.

I would like to note that the perspectives I have offered are not critiques of the ERO, the Commission, or any entity represented here today, but suggestions offered for their consideration. I would like to offer to work with NERC and others to see the continued success of the ERO and implementation of SORR and LTRA recommendations. Thank you for the opportunity to appear before you today, and if there are any questions, I would be happy to address them.