Background

For decades, we have determined resource adequacy by showing that the system has enough generating capacity to meet demand (plus a predetermined planning reserve margin) during peak demand periods. This method of determining resource adequacy has worked in the past because most of the resources used—coal, nuclear, hydro, and natural gas—have fairly dependable fuel sources and can be effectively turned on and off as needed. However, as we replace these dispatchable resources with variable resources such as wind and solar, generating capacity alone is not enough to ensure the reliability of the Bulk Power System. Beyond capacity, we must also look to the system to deliver sufficient energy to meet demand.

This technical session will explore the importance of ensuring that there are sufficient amounts of energy at all times and will focus on the technologies and concepts considered through energy reliability assessment and analysis. Questions that will be answered during this technical session include:

- What is the difference between capacity and energy?
- What time frames should be considered when planning the delivery of sufficient amounts of energy to meet demand requirements?
- What industry efforts are underway to help entities understand the impact of energy limitations in their operational and planning processes?
- What Standards development activities are underway to address the importance of ensuring energy adequacy?
- Do energy adequacy reliability assessments require different tools and data?

Mark Lauby, NERC’s senior vice president and chief engineer, will discuss the importance of energy sufficiency and the efforts of the NERC Energy Reliability Assessment Task Force, including a Standard Authorization Request (SAR) under development focused on ensuring energy delivery from the transforming resource mix.

Matthew Elkins, WECC’s manager of performance analysis and resource adequacy, will also discuss the importance of ensuring energy sufficiency and advanced methods of evaluating resource adequacy in terms of energy.
Ensuring Energy Availability with Energy-Constrained Resources

Mark G. Lauby
Senior Vice President and Chief Engineer
Matthew Elkins
Manager – Performance Analysis & Resource Adequacy
What is the issue?

- Sufficient amounts of energy needed
- Historically, industry ensured energy through capacity and reserve margins (with adjustment to hydro)
- Grid Transformation is resulting in a system with a higher level of energy uncertainty, regardless of fuel type
- The focus needs not to be fuel type, but energy availability
- Widespread, long-duration, extreme temperatures, winds (too high or low), smoke/cloud cover, etc.
- The current tools, rules of thumb, and approaches were not designed to ensure energy availability in a transformed grid
Four Pillars

1. Ensure sufficient **renewable energy** to achieve decarbonization goals
2. Develop sufficient **transmission** to integrate the renewables and transmit/distribute the clean energy
3. Maintain a robust fleet of **balancing resources**
4. Ensure a robust **energy supply chain** for the balancing resources, with sufficient access to stored energy to withstand long-duration, widespread extreme weather events
Energy Availability in 3 Time Frames

• Mid-to-long-term planning (1- to 5-year time frame)
  • Ensure that resources are planned that can provide options to obtain sufficient and flexible energy resources
  • Review tools, rules-of-thumb, and processes to support the need for these energy resources

• Operational planning (1 day to 1 year)
  • Ensure sufficient resources are available and able to provide energy to meet demand and off-set ramping requirements
  • Electrical energy production needs to reflect status of energy availability given the uncertainties

• Operations (0-1 day)
  • Ensure sufficient amounts of capacity, energy, and ramp flexibility are available from available resources
Risk Mitigation Toolkit:
Reliability Guidelines, Reliability Assessments, and Technical Engagement are being used by the ERO to address risks to reliability.
What MUST We Do?

Define Energy Availability Studies
Require Energy Availability Studies
Take action for all time horizons
Energy Availability
Energy Availability

- Base-Load—Highly predictable
- Hydro Storage—Controllable
- Solar—Comparable to base-load but widespread fuel shortages
Hydro Storage

- Highly dependent on the time of year
- Summer months—The distribution is more variable
Highly dependent on the time of year
- Summer months—Tight distribution on the upper end during daylight hours
- Winter months—More uncertainty on the upper end of the distribution
- Highly dependent on the time of year
- Summer months—Low capacity distribution due to less wind
- Winter months—Hard to predict the level of energy compared to capacity
Common underlying risk is the increased use of just-in-time delivery of fuel

• A NERC reliability guideline was recently drafted on fuel assurance and fuel-related reliability risk analysis
• Standard development started on unit cold weather preparation
• Standard Authorization Request developed based on the FERC/ERO inquiry for cold weather operations
• Study needed for mid-to-long-term planning horizons impacts
• Can industry agree on a planning and operating design basis that will ensure energy availability?
11 Questions Asked

• Understanding energy availability and, by extension, fuel availability compared to capacity requires consideration of multiple technologies and concepts
• 11 questions asked in the white paper
• Evaluated the 11 questions against the three time frames
Energy Availability and Flexibility for Evolving Resource Mix

- With more renewable energy, primarily with variable supplies of fuel (e.g., sunshine, wind, and water), maintaining a balanced power system will require a more flexible approach to energy availability and capacity adequacy to maintain operational awareness.
- Traditionally, peak-hour capacity can be solved in an isolated case that ignores all other hours, but in a limited energy situation, the use of system resources affects their availability during peak hours.
- Generator flexibility is gaining importance as load ramps begin to stress the existing infrastructure.
- Transmission considerations may be key to address widespread, long duration events.
• Gas Delivery Security
  ▪ Maintaining system balance with energy-constrained resources will require controllability of the remaining fleet, most likely be gas-fired generation.
  ▪ The variability of the renewable resources will change how gas is used, requiring the existing system to serve the changing needs (e.g., larger swings of gas demand due to higher gas generation ramp rates and shorter periods of online time, burning 24 hours of gas in 8 hours instead of 16).
  ▪ Forces external to power system operators may influence gas delivery security such as policies and procedure developments from FERC, NAESB, natural gas pipeline companies, or other entities.
Energy Reliability Assessment Task Force

• Answer the 11 questions asked in the white paper
• Coordinate activities of groups across the RSTC
• Review NERC Reliability Standards for gaps
• Recommend next steps
• Understanding energy assurance, and by extension, fuel/energy availability compared to capacity requires consideration of multiple technologies and concepts
• Evaluate the 11 questions against the three time frames
• Modified the 11 questions to seek out answers
  • Revised to 18 core questions
  • More specific, tactical questions
• Across many of the responses, it was not always clear whether entities were addressing current practices for “capacity” assessments or “energy” assessments

• Unclear what operating entities do with low likelihood, high impact energy assessment results

• Developing forecasts and assumptions for the mid- and long-term assessments is difficult with confidence

• The worse (tightest) conditions could be in the fall or spring seasons with low renewable generation: energy assessments should be performed throughout the year, not just during peak

• There are regional differences that may result in different energy assessment reliability issues
The existing Reliability Standards do not explicitly define or require energy assessments.

A number of the Standards depend on resources to deliver energy but no requirement on ability to deliver.

Little understanding of critical infrastructure interdependencies and the potential impacts on power generation.

As the majority of fuel infrastructure exists beyond a single area, the fuel infrastructure must be modeled on a larger basis.

Consider moving some elements of the NERC Reliability and Security guidelines into NERC’s Reliability Standards.
Do we have energy reserves as the need for them continues to grow?

How much reliance can we give to imports?

Can storage technology be a solution for reserves?
Regional Differences

- Highly dependent on resource portfolio
- More variability in a portfolio, the greater the need for energy reserves
• Define terms: e.g., energy assessment, energy availability, fuel, fuel assurance

• For energy assessments, metrics and observations should be compared to targets or predefined criteria

• Energy assessments should be required and include the appropriate assumptions and scenarios

• Energy assessments must be coordinated between areas to harmonize interchange assumptions

• Extreme event analysis should be included in the assessments

• Requirements for energy assessment should include a clearly defined periodic basis and performed in each of three time frames
Outreach Rollout Plan:

- February 16, 2022—Industry workshop
- March or June 2022—RSTC SAR endorsement
- April or July 2022—Standards Committee SAR acceptance
Questions and Answers