MEMORANDUM

TO: Duke Energy Corporation Board of Directors

FROM: Kodwo Ghartey-Tagoe, Executive Vice President, Chief Legal Officer and Corporate Secretary

Dhiaa Jamil, Executive Vice President and Chief Operating Officer

Chris Fallon, Senior Vice President and President, Duke Energy Sustainable Solutions

Preston Gillespie, Senior Vice President and Chief Generation Officer

Nelson Peeler, Senior Vice President, Transmission and Fuels Strategy and Policy

SUBJECT: Lessons learned from ERCOT weather event

Background

The failure of the Texas electric and gas infrastructure during the extreme cold period in February affords Duke Energy an invaluable opportunity for learning. At the peak, 48% of ERCOT's generation was unavailable due to a myriad of problems: freezing instrumentation in power plants, loss of gas supply or low gas pipe pressure, snow loading on solar panels and low temperature inverter trips at solar sites and wind turbine blade icing. With virtually no ability to import power, blackouts were widespread and lasted for days. Duke Energy performed a multifaceted assessment to evaluate Duke Energy system's resilience to an extreme cold-weather event similar to the Texas experience. This work was conducted at the direction of the Legal Department because of pending and expected litigation.

Duke Energy Regulated Operations Review

Under the direction of Legal and the Operations Council, a review of applicable processes and procedures was conducted. A review of prior NERC winterization guidance validated our processes are sound and improvement opportunities exist. Twenty-nine follow-up activities were initiated, including: conducting operational vulnerability reviews, improving the enterprise wide annual winter preparedness challenge session, establishing integrated exercises to test processes and procedures, and thoroughly evaluating the risk to our gas supplies.

System Planning Implications

Extensive load forecasting and planning processes ensure resources are adequate. Maintenance outage planning ensures assets are available for normal peak season operation. However, modeling of extreme cold (10 degrees Fahrenheit colder than prior extremes) conducted for Duke Energy Progress and Duke Energy Carolinas indicated significant load-shedding may be necessary to maintain system stability in extreme cold weather conditions. Further modeling is planned for the Florida and Midwest regions, and long-term modeling enhancements are planned to account for increased weather volatility and the changing generation fleet.

Duke Energy Commercial Operations Review

High ERCOT pricing impacted Duke Energy Renewables' resources (625 MW) in Texas. The current estimate of losses is ~$35M, not including any impacts from pending and other potential litigation. Electric generation supply and availability was impacted by icing on wind turbine blades, snow loading on solar panels and low temperature inverter trips at solar sites. Lessons learned include the need for updated Emergency Response Plans for extreme cold-weather events and the evaluation of alternative contracting structures.

Next Steps

The Operations Council will oversee operational improvement activities. Strategic investment opportunities and fuel contracting strategies will be evaluated in a collaborative approach with stakeholders and regulators.

[redacted]

Board of Directors
May 6, 2021

Lessons learned from ERCOT weather event

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Background

- ERCOT Event (Winter Storm Uri)
  - The Electric Reliability Council of Texas (ERCOT) manages power delivery to 26 million Texas customers; ~90% of the state's electric load
  - During the week of February 14, 2021, a polar vortex impacted Texas
    - Single digit lows, 45-50 degrees Fahrenheit below average
    - >74 GW peak forecast versus a typical peak forecast of ~55 GW
  - Generation availability was severely impacted – affected by cold weather-related equipment problems, natural gas availability, solar generation and wind turbine availability
  - Generation availability was exacerbated by the inability to import power
  - At the peak, over 48% of generation was unavailable

- Duke Energy Actions
  - Operations Council Reliability Review
  - System Planning Implications
  - Commercial Operations Review
  - Work was directed by Legal because of pending and expected litigation

Operations Council reliability review

A team was formed to assess Duke Energy's preparation and planning activities, conduct of operations, and fuel supply during an extreme cold-weather event.

Overall, the assessment found processes governing response to extreme cold-weather events are effective and ensure high probability of success to serve the customer. In addition, opportunities to improve reliability during extreme cold-weather events were identified.

Key Improvement Opportunities:

- Conduct additional operational vulnerability reviews
- Conduct integrated exercises to test enterprise processes and procedures
- Evaluate natural gas supplies

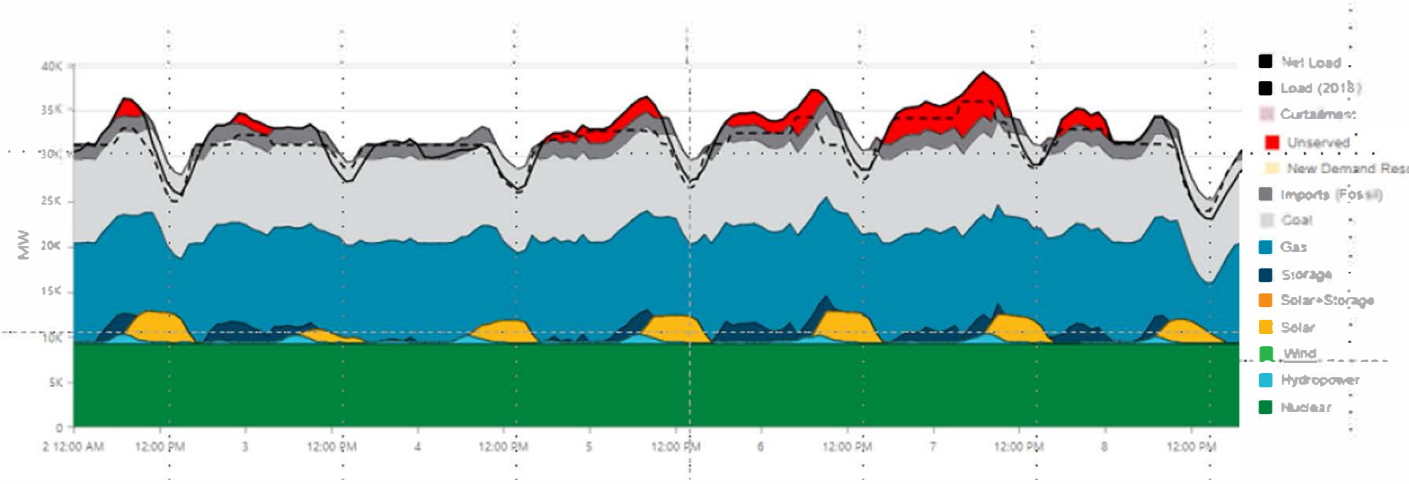
Next Step:

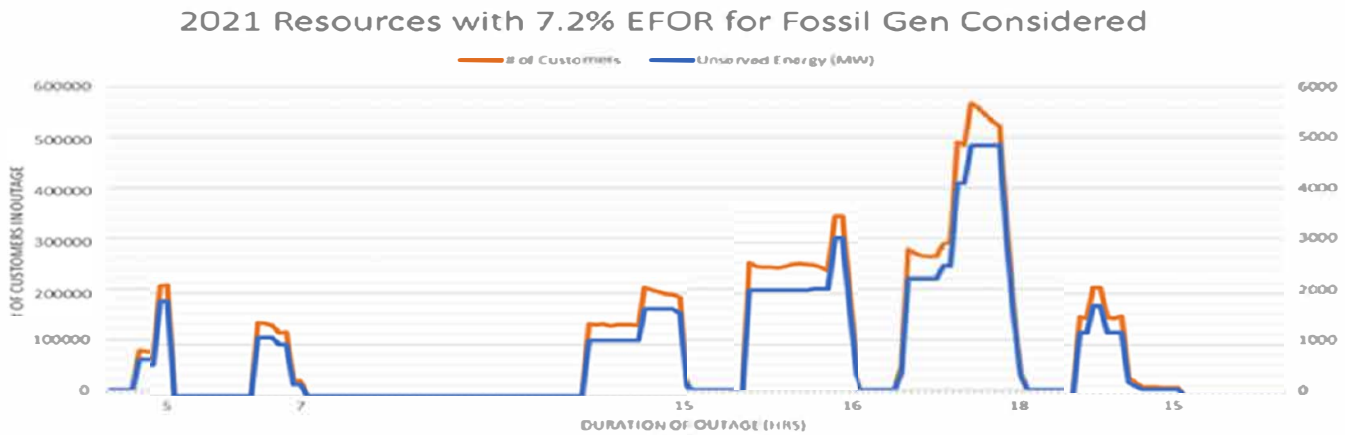
The suite of corrective actions will be monitored to completion by the Operations Council

Key differences in system planning and resource adequacy

ERCOT	DUKE ENERGY
Deregulated market structure does not impose a formal resource adequacy reliability planning standard or reserve margin requirement	Each regulated utility files an Integrated Resource Plan (IRP), which explains how the electric utility will meet the projected peak demand and energy requirements of its customers, including a proposed reserve margin
Latest summer reserve margin is 12.25% and Loss of Load Expectation (LOLE) of 0.5 – 1 event every two years. There is no winter reserve margin requirement.	Planning reserve is 17% and LOLE of 0.1 – 1 event in 10 years
Does not have a capacity market and does not incentivize dual/alternative fuel capabilities	Meets its capacity requirements with a diverse generation mix, including backup/dual fuel capabilities
Very siloed without coordination across generation, fuels and transmission to ensure energy sufficiency	Utilizes coordinated planning of transmission, distribution, generation and fuels for long term, mid-term and near term time horizons

System Stress Model: DEP/DEC, Extreme Cold





- Assumes -10 °F lower than 2018 polar vortex, with cold temps over multiple days during the week
- Key Takeaways
  - Unserved load is ~128,000 GWh and peaks at 4,847 MW
  - Peak is equivalent to ~565,000 customers
  - Approximately 5,200 MW of additional generation required to serve all load at peak (equivalent to 20+ CTs at a cost of $3B+)
  - Typical reserve margin analysis is ineffective due to event duration
  - Planning is required to provide energy sufficiency for all hours, not just capacity for peak periods
  - As variability of load and generation increases, reserve margins will require re-evaluation (likely increasing)

System planning next steps

- Conduct “extreme cold” modeling for Florida and Midwest regions
- Conduct similar stress test for summer modeling in all regions
- Review and update resource adequacy modeling to consider multi-day events and energy sufficiency for all hours to account for changing and increasingly variable generation fleet
- Determine incremental capacity needs to meet load requirements during extreme conditions and evaluate options (additional generation, DSM, etc.)
- Review and update load forecasting procedures to include additional scenarios – extreme weather and corresponding load response
- Validate studies with third-party review – NREL, EPRI, NERC, etc.
- Engage and seek input from stakeholders and regulators
- Ensure follow-up to any required NERC/FERC findings and actions