Regulation of Reliability

Gulf Coast Electricity Transmission Summit

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October 16, 2014
Roadmap

- Potential Grid Destabilizers
- Technological Options to Enhance Reliability
- Corresponding Regulatory and Jurisdictional Tensions
Potential Grid Destabilizers
## Destabilizer #1: Extreme Weather Events

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Brief overview</th>
<th>Effect of climate change</th>
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</thead>
<tbody>
<tr>
<td>Wind related damage</td>
<td>▪ Damage can occur across the Gulf Coast region and in areas further inland</td>
<td>▪ Potential increase in wind speed of 1.4-2.9% in 2030 (2.1 - 10.2% in 2100) due to warmer sea surface temperatures</td>
</tr>
<tr>
<td>Sea level rise (gradual)</td>
<td>▪ Key risk is along the coastline</td>
<td>▪ Relative sea level may rise by 5-6 inches in 2030 (2.5 - 5 feet by 2100)²</td>
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<td></td>
<td>▪ The Louisiana gulf coast already experiences significant deltaic land loss/subsidence¹</td>
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<tr>
<td>Storm surge</td>
<td>▪ Risk is along the coastline, linked to hurricane events</td>
<td>▪ Storms can increase the impact of even modest levels of sea level rise</td>
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<tr>
<td></td>
<td></td>
<td>▪ Could lead to more frequent/severe flooding of coastal zones</td>
</tr>
</tbody>
</table>

¹ Estimates for subsidence vary significantly along the coastline; e.g., 8-31 inches per century
² Based on Vermeer and Rahmstorf. “Global sea level linked to global temperature.” 2009.

Source: National Hurricane Center, NOAA, American Geophysical Union (AGU), Union of
View of Gulf Coast Energy assets, 2030

- **Modeling ~ 50,000 oil and gas structures**, including 90,000 miles of pipelines, 2000 offshore platforms and 27,000 wells.
- **Considered over 500,000 miles of T&D, and ~300 generation facilities.**
New Orleans has large water bodies surrounding it today

New Orleans as it is today
By 2100, New Orleans may potentially be surrounded by water.

Area at risk of inundation from 1-meter (3.3 ft) rise in sea level with 1-meter (3.2 ft) relative sea level rise.
Destabilizer #2: Changing Resource Mix

Sources of U.S. electricity generation, 2013

- Coal: 39%
- Natural gas: 27%
- Nuclear: 19%
- Renewable: 13%
- Petroleum: 1%
- Hydro: 52%
- Wind: 32%
- Biomass wood: 8%
- Biomass waste: 4%
- Geothermal: 3%
- Solar: 2%

Source: U.S. Energy Information Administration, Electricity Power Monthly (February 2014). Percentages based on Table 1.1 and 1.1a; preliminary data for 2013.

Note: Sum of components may not equal 100% due to independent rounding.
Increased Intermittent Renewables

- Although nonhydropower renewable generation more than doubles between 2012 and 2040..., [renewable energy's] contribution to U.S. total electricity generation is still just 16 percent.” EIA Annual Energy Outlook 2014
Increased Reliance on Natural Gas

Figure 4-7. Historic trends in natural gas by U.S. region: natural gas consumed to produce electricity

Source: Data from Ventyx Velocity Suite, accessed November 2013.
Load, Wind & Solar Profiles – High Load Case
January 2020

8,000 MW in 2 hours
6,300 MW in 2 hours
13,500 MW in 2 hours

Source: CPUC,
74% of all new generating capacity installed during Q1 2014 was solar.
Installed prices continued their precipitous decline in 2013

Median installed prices fell by $0.7/W (12-15%) from 2012-2013, across the three size ranges shown, and have fallen by an average of $0.5/W (6-8%) annually over the full historical period.

Median prices for systems installed in 2013 (n=50,614):
- $4.7/W (≤10 kW)
- $4.3/W (10-100 kW)
- $3.9/W (>100 kW)

Note: Median installed prices are shown only if 15 or more observations are available for the individual size range.

Source: G. Barbose, Lawrence Berkeley National Laboratory, Tracking the Sun V
<table>
<thead>
<tr>
<th>Category</th>
<th>Rule</th>
<th>Impacts</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Cross-State Air Pollution Rule (CSAPR)</td>
<td>Establishes pollution caps for SO₂, annual NOₓ, and seasonal NOₓ for 28 states in the eastern half of the U.S. to reduce transported pollution that significantly affects downwind nonattainment and maintenance problems with National Ambient Air Quality Standards (NAAQS). Following vacatur of the rule by the Court of Appeals, it is not clear how the rule will be revised or when a new regulation will go into effect. Per the Court’s order, EPA’s 2005 Clean Air Interstate Rule (CAIR) remains in place.</td>
<td>Finalized 7.6.2011 supplemental rule finalized 12.15.2011; technical revisions finalized 2.7.2012 and 6.5.2012; stayed on 12.30.2011 and vacated 8.21.2012 by U.S. Court of Appeals, D.C. Circuit; vacatur reversed by the Supreme Court 4.29.2014, remanded to the D.C. Circuit.</td>
</tr>
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<td></td>
<td>Clean Power Plan for Existing Power Plants</td>
<td>Requires state plans with enforceable measures to limit CO₂ emissions from existing fossil fuel-fired power plants and sets rate-based emissions goals for each state.</td>
<td>Proposed rule released 6.2.2014; published in Federal Register for comment on 6.18.2014; final rule expected 6.1.2015</td>
</tr>
<tr>
<td></td>
<td>Carbon Pollution Standards for Modified and Reconstructed Power Plants</td>
<td>Establishes national limits for CO₂ emissions from modified or reconstructed fossil fuel-fired plants.</td>
<td>Proposed rule released 6.2.2014</td>
</tr>
<tr>
<td>Waste</td>
<td>Coal Combustion Residuals (CCR) Rule</td>
<td>Regulates disposal of coal combustion wastes (e.g., fly ash, bottom ash, boiler slag, flue gas desulfurization materials) in existing and new landfills and surface impoundments. Addresses risks from leaching of contaminants to groundwater from disposal units and risks from fugitive dust.</td>
<td>Proposed options for the rule released 6.21.2010. Final rule expected 12.19.2014 (required by October 29, 2013 court memorandum)</td>
</tr>
<tr>
<td>Water</td>
<td>CWA §316(b) – Cooling Water Intake</td>
<td>Establishes national standards for impingement mortality and a process for establishing site-specific impingement mortality levels for fish, wildlife, and other aquatic organisms.</td>
<td>Finalized 5.19.2014.</td>
</tr>
</tbody>
</table>
Renewable Portfolio Standard Policies

www.dsireusa.org / March 2013

29 states + Washington DC and 2 territories have Renewable Portfolio Standards.
Environmental Protection Agency

40 CFR Part 60
Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule
<table>
<thead>
<tr>
<th>Building Block</th>
<th>Value Allocated in Goal-Setting Formula</th>
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<tr>
<td>Make fossil fuel power plants more efficient</td>
<td>Average heat rate improvement of 6% for coal steam electric generating units (EGUs)</td>
</tr>
<tr>
<td>• Improve equipment and processes to get as much electricity as possible from each unit of fuel.</td>
<td></td>
</tr>
<tr>
<td>• Using less fossil fuel to create the same amount of electricity means less carbon pollution.</td>
<td></td>
</tr>
<tr>
<td>Use low-emitting power sources more</td>
<td>Dispatch to existing and under-construction natural gas combined cycle (NGCC) units to up to 70% capacity factor</td>
</tr>
<tr>
<td>• Using lower-emitting power plants more frequently to meet demand means less carbon pollution.</td>
<td></td>
</tr>
<tr>
<td>Use more zero- and low-emitting power sources</td>
<td>Dispatch to new clean generation, including new nuclear generation under construction, moderate deployment of new renewable generation, and continued use of existing nuclear generation</td>
</tr>
<tr>
<td>• Expand renewable generating capacity, which is consistent with current trends.</td>
<td></td>
</tr>
<tr>
<td>• Using more renewable sources, including solar and wind, and low-emitting nuclear facilities, means less carbon pollution.</td>
<td></td>
</tr>
<tr>
<td>Use electricity more efficiently</td>
<td>Increase demand-side energy efficiency to 1.5% annually</td>
</tr>
<tr>
<td>• Reducing demand on power plants is a proven, low-cost way to reduce emissions, which will save consumers and businesses money and mean less carbon pollution.</td>
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</tbody>
</table>
Destabilizer #3: Increased Penetration of DG

- As of 2011, 4 gigawatts (GW) of distributed capacity had been installed in the United States.
- The amount of distributed capacity is expected to increase to approximately 9 GW by 2016, and to as much as 20 GW by 2020.
Technological Options to Enhance Reliability
Option 1: Expand and/or upgrade Transmission

- Increase system flexibility
- Mitigate congestion and deliverability constraints
- Address “n-1” and above contingencies
Option 2: Firm Intermittent Renewable Generators
Option 3: Capitalize on Distributed Technological Innovation

- Demand Response
- DG
- Microgrids
Evolving Reliability Responsibilities

**Historic**
- Utilities

**Modern**
- Utilities
- NERC (as electric reliability organization per EPAct 2005)
- FERC (as approver of NERC reliability standards)
- Balancing Authorities
- Transmission Operators
- Distribution Providers
- Generators
Corresponding Regulatory and Jurisdictional Tensions
Option 1: Expand and/or upgrade Transmission

- Transmission Planning
- Transmission Siting
- Transmission Cost Recovery
- Transfer of Transmission Assets
## Evolving Transmission Responsibilities

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<tr>
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<th>Then...</th>
<th>Now...</th>
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<tr>
<td>Transmission Planning</td>
<td>State</td>
<td>RTOs, transcos, state/local (FERC Orders 890 and 1000)</td>
</tr>
<tr>
<td>Transmission Siting</td>
<td>State</td>
<td>State plus Section 216 Federal Backstop Authority</td>
</tr>
<tr>
<td>Transmission Cost Recovery</td>
<td>Federal (FPA § 201(b))</td>
<td>Federal (FPA § 201(b)) plus State for bundled retail transmission</td>
</tr>
<tr>
<td>Transfer of Transmission Assets</td>
<td>Federal and State</td>
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## Can Create Federalism Tensions

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<tr>
<th></th>
<th>Now...</th>
<th>Tensions...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Planning</td>
<td>RTOs, merchant, state/local (FERC Order 890 and 1000)</td>
<td>No uniformity across multiple jurisdictions on competitive bid process and more interstate lines</td>
</tr>
<tr>
<td>Transmission Siting</td>
<td>State plus Section 216 Federal Backstop Authority</td>
<td>Single state can block approval of interstate transmission</td>
</tr>
<tr>
<td>Transmission Cost Recovery</td>
<td>Federal (FPA § 201(b)) plus State for bundled retail transmission</td>
<td>Cost allocation issues</td>
</tr>
<tr>
<td>Transfer of Transmission Assets</td>
<td>Federal and State</td>
<td>States reluctant to lose jurisdiction over transmission assets to FERC and cost concerns</td>
</tr>
</tbody>
</table>
May Mean Evolving Federalism Relationships

- Preemption
- Process Preemption
- Enhance Backstop Authority
- Cooperative Federalism
- Regional - Interstate Compacts
Section 1221(a) of the Energy Policy Act of 2005, codified at 16 U.S.C. 824p(a), directs the Secretary of Energy to conduct an electric transmission congestion study every three years.

Draft issued in August, and public comment period ends on Monday.
Option 2: Firm Intermittent Renewable Generators

What Energy Storage Provides

End-Use
- Power Quality/Reliability
- Peak Load Reduction
- Distributed Generation & Smart Grid Support

Renewable Penetration
- Reduced Variability
- Ramp rate control
- Load time shifting
- Reserves
- Dispatchability

Transmission and Distribution
- Line and Transformer Deferral
- Stability
- Voltage/Frequency Regulation

Generation
- Spinning Reserve
- Capacity Deferral
- Voltage/Frequency Regulation
- Load Leveling
Jurisdictional Issues

**FERC**
- Regulates wholesale electricity market operations.
- Sets rules for ISO and Regional Transmission Organization (RTO) operations/procurement rules.
- Influences participation of energy storage and demand response in transmission grid operation and sale of ancillary services in wholesale markets.

**ISO**
- Manages electric transmission in a geographic region, ensures access for all.
- Buys ancillary services to balance supply and demand on its transmission system.
- Establishes rules for procurement of resources (e.g. ancillary services, spinning reserves) to help maintain transmission grid stability.

**PUC**
- Regulates utilities' energy and capacity acquisition, management and operations.
- Sets retail electric rates, assesses cost-recovery and prudence of resource acquisition and operations. Can affect use, acquisition and mode of payment for energy storage at distribution level.
Cost Recovery Issues

- The map below shows information on the electric industry restructuring. Click on a State for details.
- Restructuring means that a monopoly system of electric utilities has been replaced with competing sellers.

Electricity Restructuring by State

Source: Energy Information Administration
May Mean More Focus on Flexibility

- Address cross-subsidization of value
- Adjust market design
- Be willing to shed adherence to strict categories
Option 3: Capitalize on Distributed Technological Innovation

- Demand Response
- DG
- Microgrids
FERC Order 745

134 FERC ¶ 61,187
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 35

[Docket No. RM10-17-000; Order No. 745]

Demand Response Compensation in Organized Wholesale Energy Markets

(Issued March 15, 2011)

AGENCY: Federal Energy Regulatory Commission.

ACTION: Final Rule.

SUMMARY: In this Final Rule, the Federal Energy Regulatory Commission (Commission) amends its regulations under the Federal Power Act to ensure that when a demand response resource participating in an organized wholesale energy market administered by a Regional Transmission Organization (RTO) or Independent System
D.C. Circuit Struck Down Order 745

United States Court of Appeals
FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued September 23, 2013 Decided May 23, 2014

No. 11-1486

ELECTRIC POWER SUPPLY ASSOCIATION,
PETITIONER

v.

FEDERAL ENERGY REGULATORY COMMISSION,
RESPONDENT

MADISON GAS AND ELECTRIC COMPANY, ET AL.,
INTERVENORS

Consolidated with 11-1489, 12-1088, 12-1091, 12-1093

On Petitions for Review of Orders of the
Federal Energy Regulatory Commission
FIGURE: U.S. Demand Response Forecast, With and Without FERC Order 745, 2014-2023

Source: U.S. Demand Response Markets Outlook 2014
May mean we need to reassess categories

- Take a functional approach to jurisdiction
- Gather more information
  - RTOs/ISOs are working with states, utilities and NESCOE to forecast growth of DG/PV resulting from state policies
  - Need to understand: amount, type, location, and timing
Summary: Reliability in Perspective

**Historic**
- Vertically integrated utility in charge of reliability
- Generally intrastate transmission
- Preference for incumbents
- Simpler system

**Modern**
- Multiple stakeholders in charge of reliability
- More interstate transmission
- Creation of non-discriminatory RTOs/ISOs, competitive bids, and removal of ROFR
- Complex system with need to facilitate coordination and establish clear decision-makers
Conclusions

- Tensions can result in underinvestment in technologies needed to “keep the lights on”

- Key Principles:
  - Explore evolving federalism relationships
  - Focus on flexibility
  - Be willing to reassess categorical determinations
Thank you

- Comments or questions?

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