Committee on Energy Resources and the Environment

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Business Meeting

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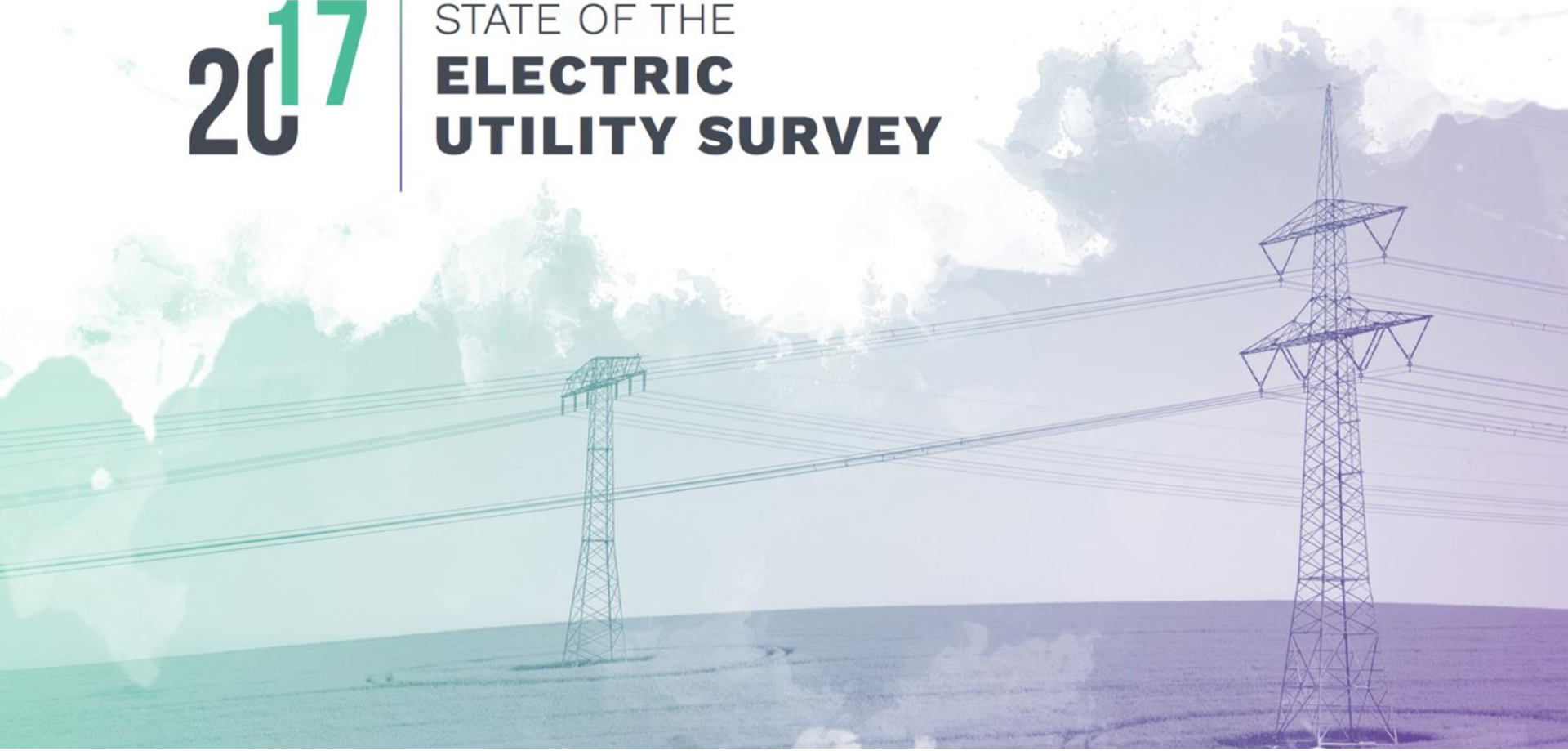
2017 STATE OF THE ELECTRIC UTILITY SURVEY



Demographics

What type of utility employs you?

54%

Investor-owned utility

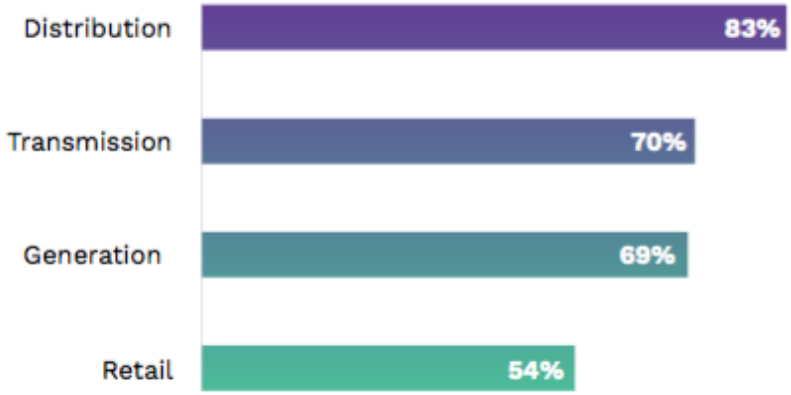
32%

Municipal or public power utility

14%

Electric cooperative

Which services does your regulated utility, co-op or muni provide?



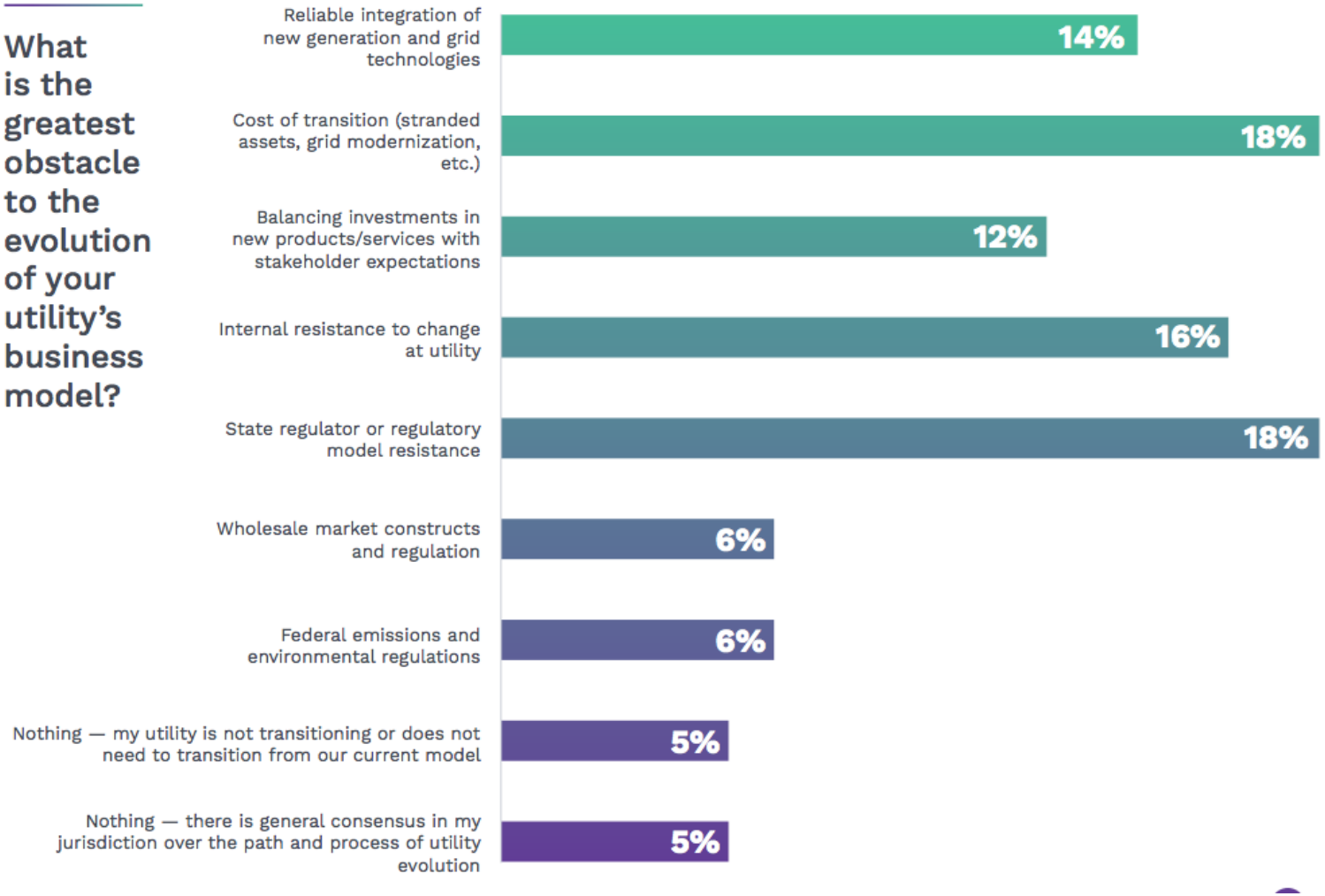
Rate the following power sector issues according to immediate importance to your company.

	Not important at all	Potentially important in the future	Somewhat important today	Important today	Very important today
Physical and/or cyber grid security	3%	7%	17%	**36%**	**36%**
Distributed resource policy (net metering, microgrids, rate basing DERs, etc.)	6%	9%	19%	**33%**	32%
Rate design reform	4%	11%	25%	**31%**	29%
Aging grid infrastructure	4%	13%	22%	**34%**	28%
Reliable integration of renewable and distributed resources	8%	14%	23%	**32%**	28%
State regulatory model reform	7%	18%	16%	27%	**32%**
Aging workforce and worker transition to new technologies	6%	11%	25%	**36%**	21%

Rate the following power sector issues according to immediate importance to your company.

	Not important at all	Potentially important in the future	Somewhat important today	Important today	Very important today
Changing consumer preferences	7%	13%	22%	**36%**	23%
Compliance with state renewable and clean energy mandates	11%	14%	22%	26%	**27%**
Stagnant/negative load growth	12%	17%	**24%**	**24%**	23%
Compliance with federal clean air standards	15%	14%	24%	**26%**	22%
Wholesale market reform	8%	20%	**32%**	26%	14%
Generation retirements and/or stranded assets	14%	18%	**29%**	22%	18%
Fuel policy and costs	10%	22%	**32%**	25%	12%

What is the greatest obstacle to the evolution of your utility's business model?



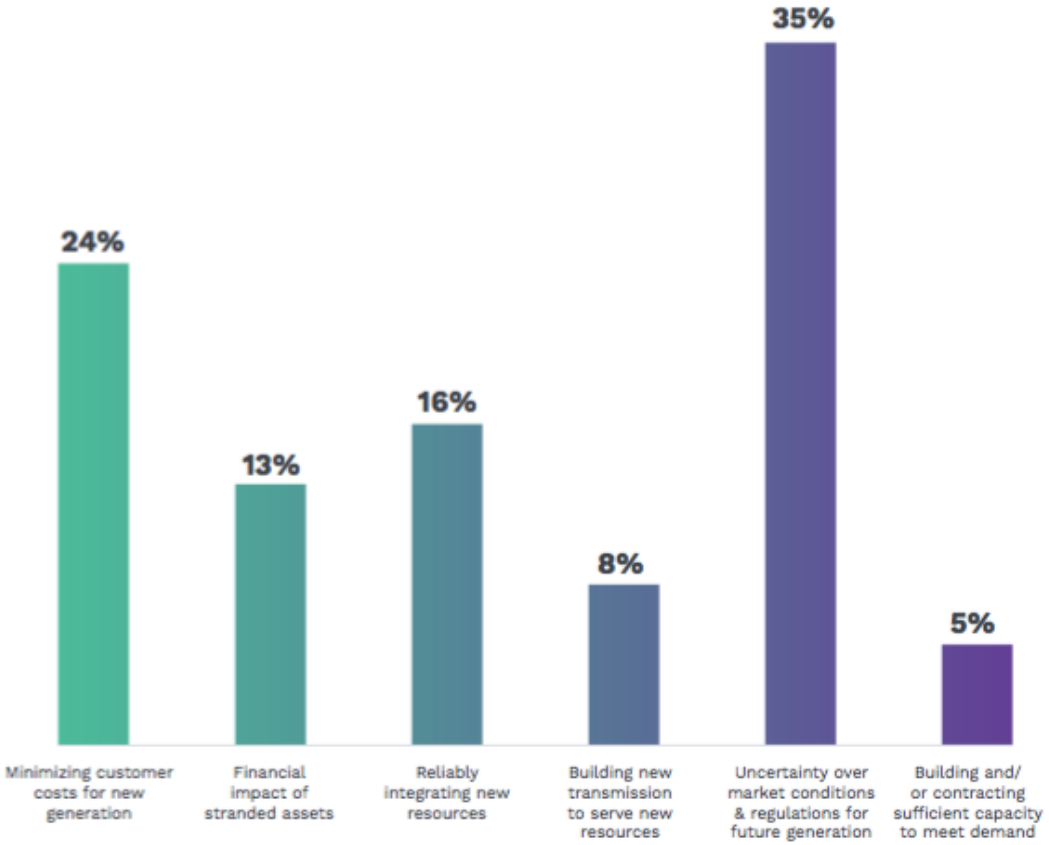
How do you think your utility's power mix will change over the next 10 years?

	Decrease significantly	Decrease moderately	Stay about the same	Increase moderately	Increase significantly
Utility Scale Solar	2%	1%	16%	**43%**	39%
Distributed generation	2%	2%	14%	**50%**	33%
Distributed energy storage	2%	1%	18%	**52%**	27%
Grid-scale energy storage	2%	2%	18%	**49%**	29%
Wind	2%	3%	24%	**48%**	23%
Natural Gas	2%	9%	25%	**42%**	22%
Hydro	2%	4%	**73%**	17%	4%
Biofuels	8%	6%	**61%**	23%	3%
Nuclear	20%	18%	**54%**	4%	4%
Oil	35%	19%	**42%**	3%	1%
Coal	**52%**	27%	18%	2%	2%

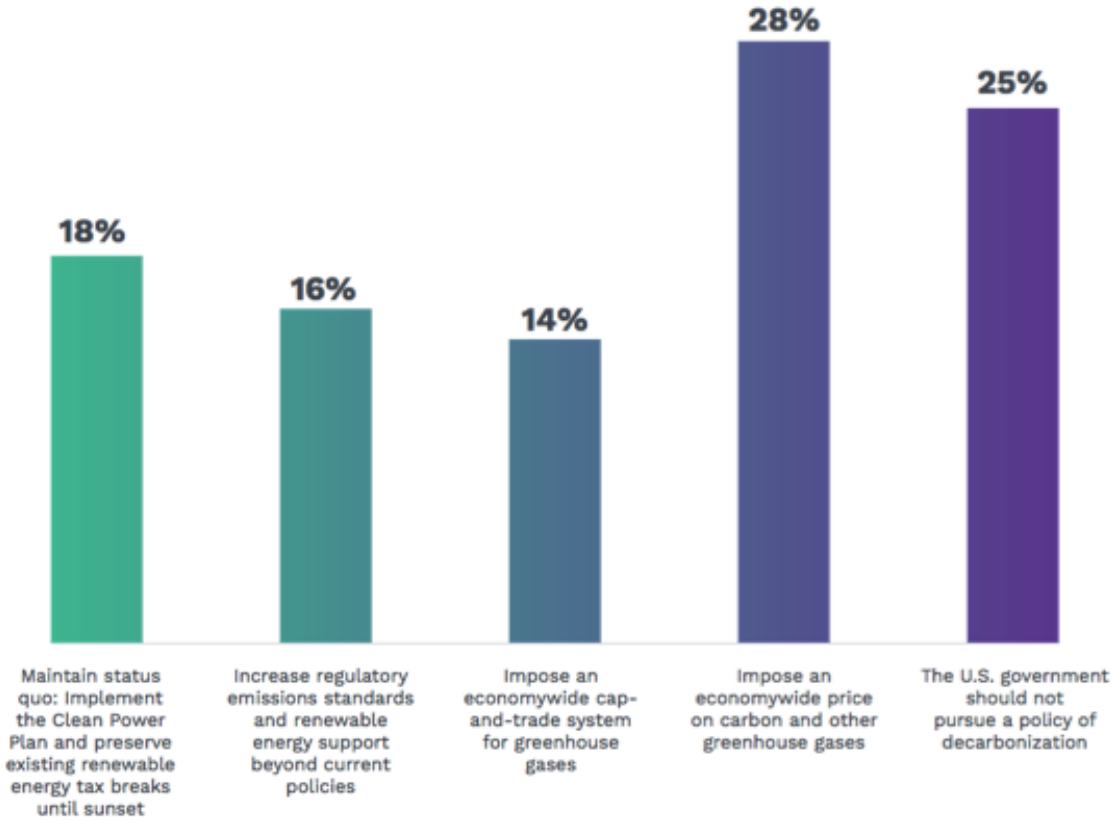
In your opinion, how has the election of Donald Trump affected the outlook for various resources at your utility?

	More negative	About the same	More positive
Utility Scale Solar	35%	**57%**	8%
Distributed generation & storage	22%	**66%**	12%
Grid-scale energy storage	23%	**64%**	13%
Wind	32%	**60%**	8%
Natural Gas	5%	**55%**	41%
Hydro	11%	**80%**	9%
Biofuels	18%	**72%**	10%
Nuclear	6%	**68%**	26%
Oil	7%	**64%**	29%
Coal	7%	45%	**49%**

What's the single greatest challenge associated with your changing fuel mix?



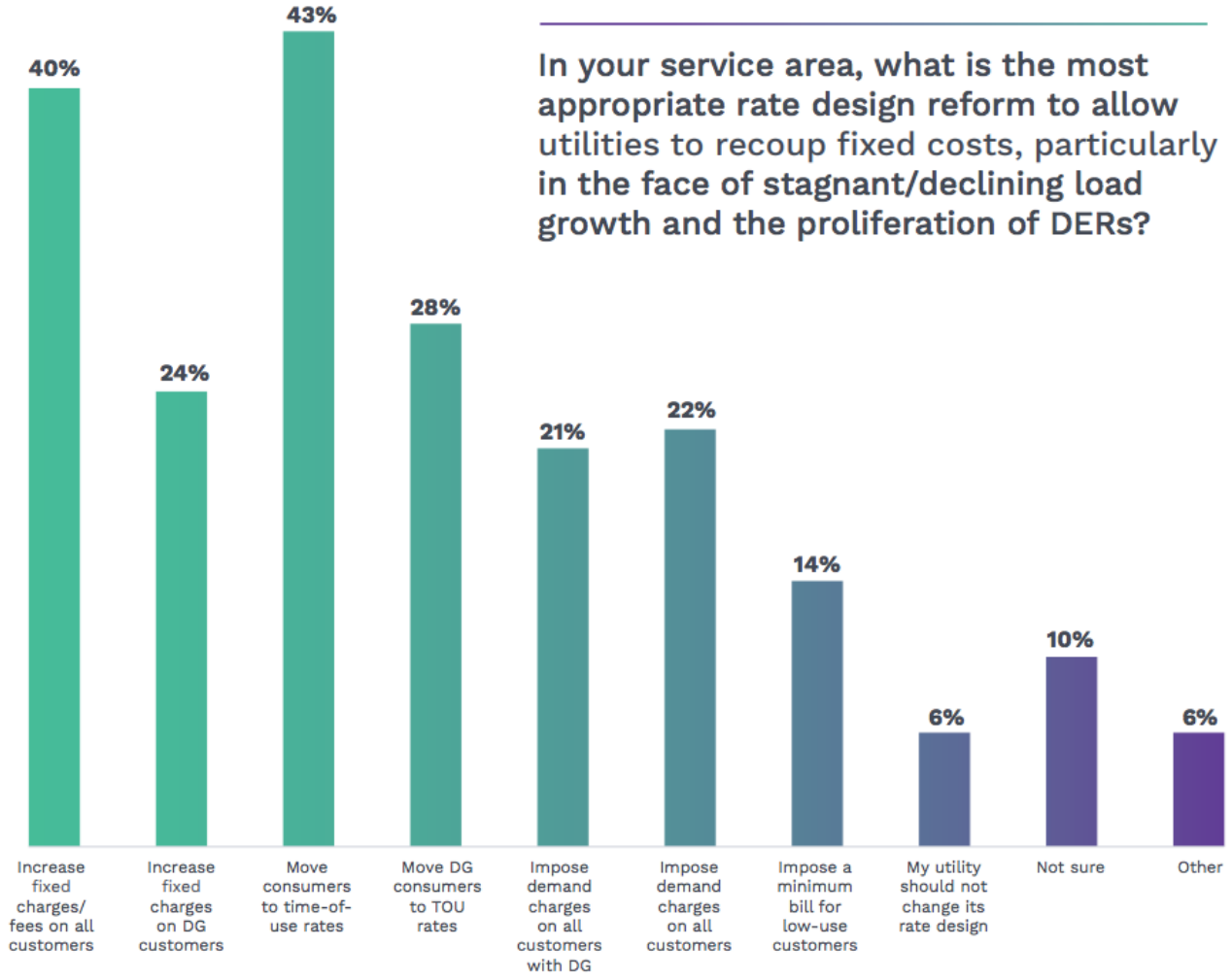
In your opinion, how should the U.S. federal government approach decarbonization policy?



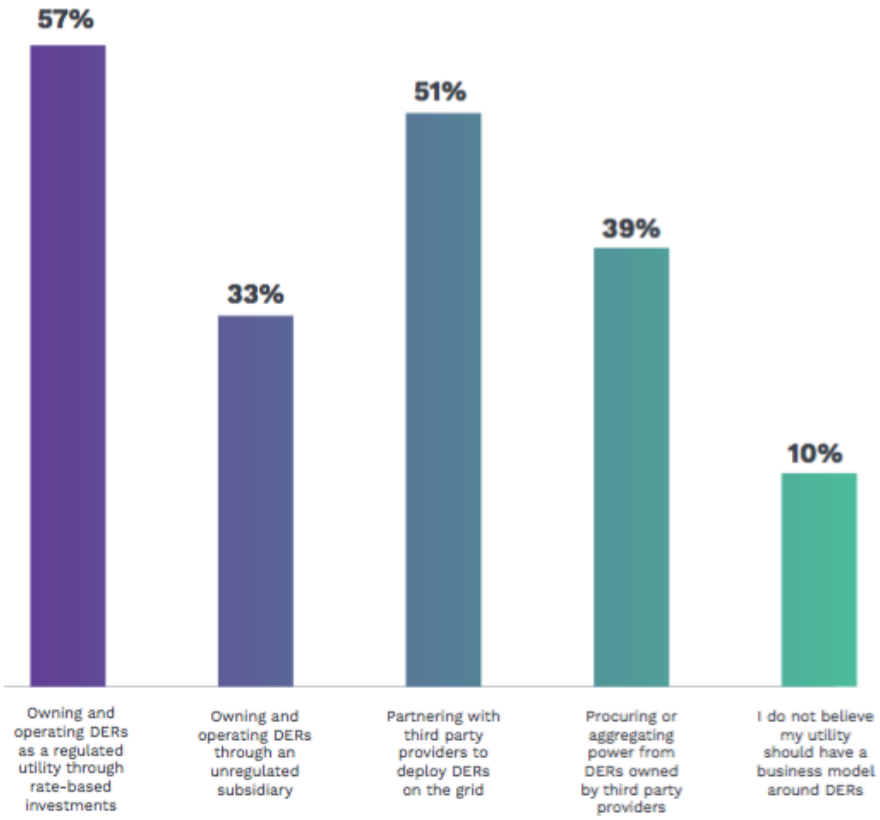
Please indicate your expected outlook for the following distributed resources in your service territory, deployed both by private parties and utilities.

	Decrease significantly	Decrease moderately	Stay about the same	Increase moderately	Increase significantly
Rooftop & other distributed solar	2%	4%	16%	**51%**	27%
Behind-the-meter storage	1%	3%	28%	**51%**	19%
Distributed wind	2%	7%	**59%**	27%	5%
Demand response & demand-side management	2%	3%	21%	**58%**	17%
Combined heat & power	2%	6%	**56%**	31%	5%
Distributed geothermal resources	2%	7%	**74%**	15%	3%
Community shared renewables	2%	3%	29%	**51%**	15%
Smart inverters & other grid communication technologies	2%	1%	15%	**49%**	32%

In your service area, what is the most appropriate rate design reform to allow utilities to recoup fixed costs, particularly in the face of stagnant/declining load growth and the proliferation of DERs?



How do you believe your utility should build a business model around distributed energy resources?



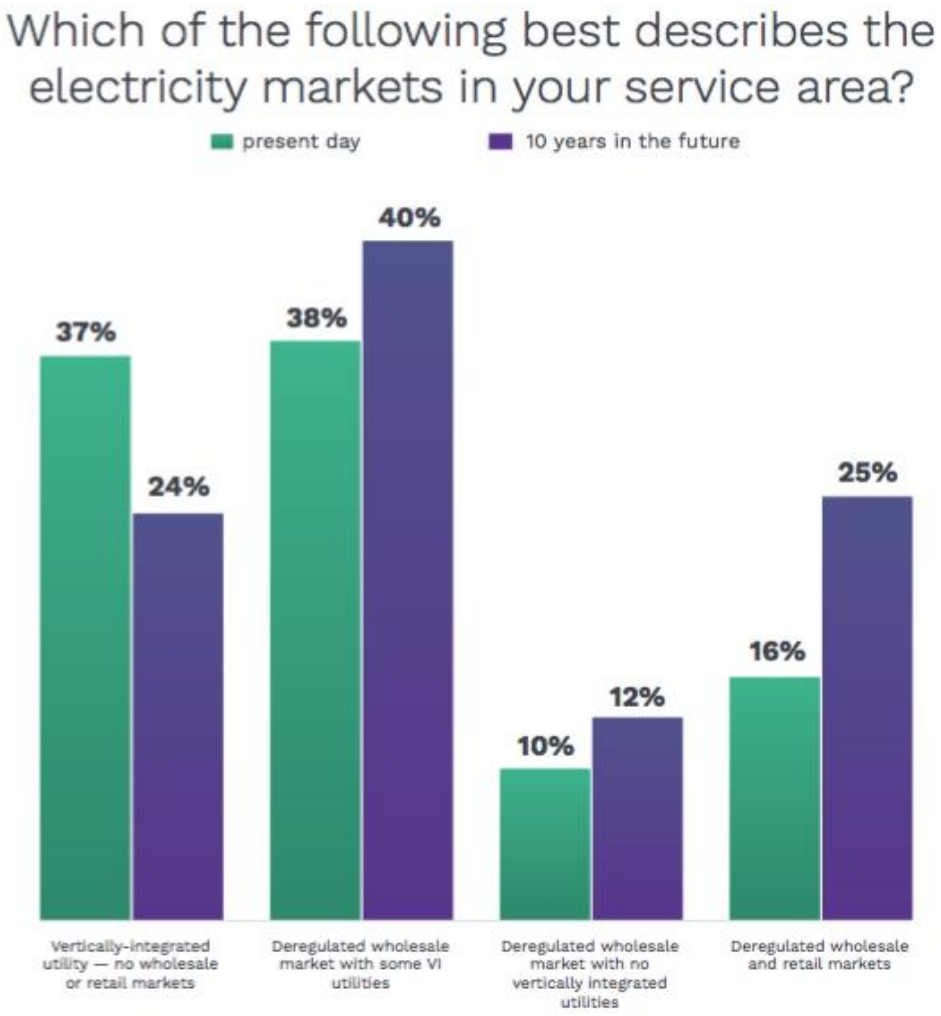
Should utilities be permitted to own and **operate distributed energy resources?**

Yes, regulated utilities should be able to own and rate-base DER investments in all or most circumstances

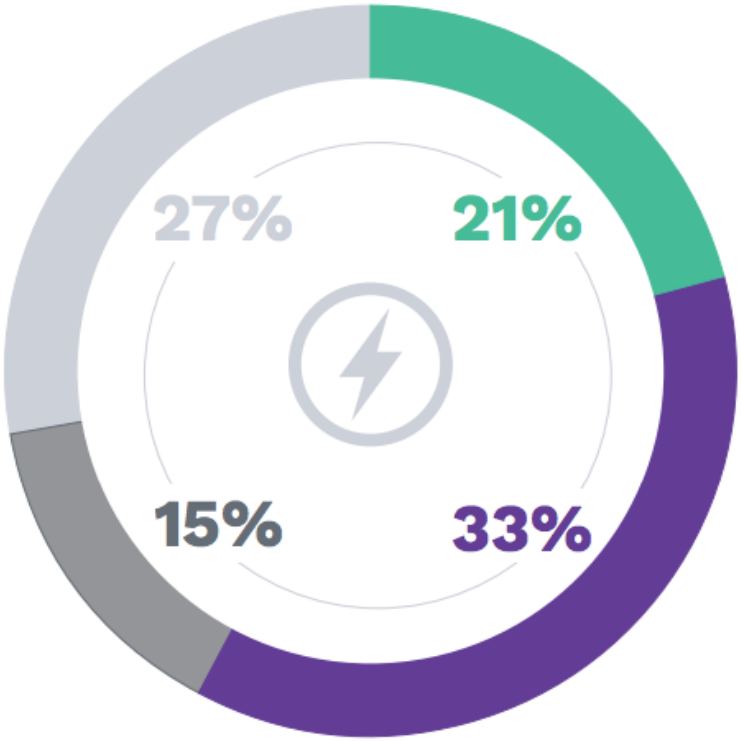
Yes, but only through unregulated subsidiaries

Yes, but only in specific instances where the competitive market fails to equitably deploy DERs to all customers and/or fails to serve optimal grid needs

No


Which of the following best describes the electricity markets in your service area?
present day
10 years in the future
37%
24%
38%
40%
10%
12%
16%
25%
Vertically-integrated utility — no wholesale or retail markets
Deregulated wholesale market with some VI utilities
Deregulated wholesale market with no vertically integrated utilities
Deregulated wholesale and retail markets

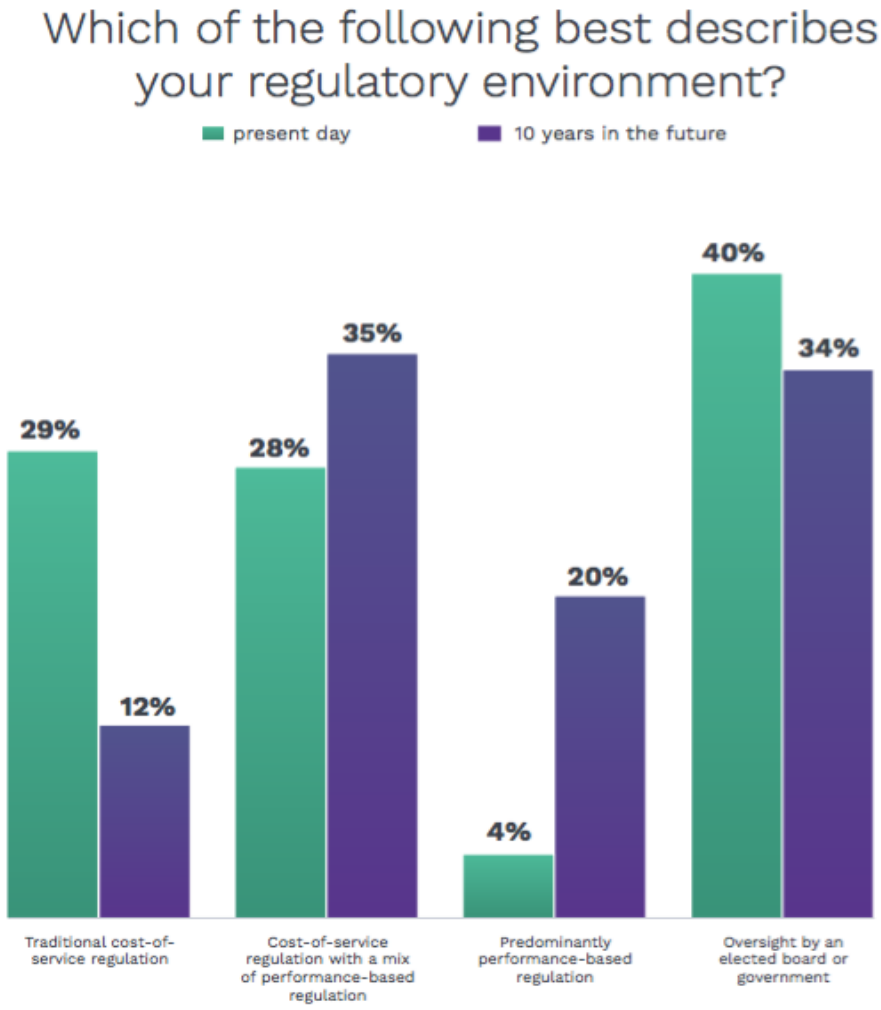
In your opinion, what is the most appropriate electricity market construction in the 21st century?



- Vertically-integrated utility — no wholesale or retail markets
- Deregulated wholesale market with some VI utilities
- Deregulated wholesale market with no vertically integrated utilities
- Deregulated wholesale and retail markets

In your opinion, how should federal and state policymakers respond to the retirement of baseload generation (especially nuclear plants) in the nation's organized markets?

34%	Nothing; allow uneconomic generation to be retired
25%	Devise an around-market mechanism to keep selected plants online (ie, New York's Zero Emission Standard)
23%	Impose an economy-wide carbon tax to support nuclear and let other baseload plants retire
10%	Re-regulate state utility markets to the vertically-integrated model
9%	Increase capacity payments to generators until they are financially viable


Which of the following best describes your regulatory environment?
present day
10 years in the future
29%
12%
28%
35%
4%
20%
40%
34%
Traditional cost-of-service regulation
Cost-of-service regulation with a mix of performance-based regulation
Predominantly performance-based regulation
Oversight by an elected board or government

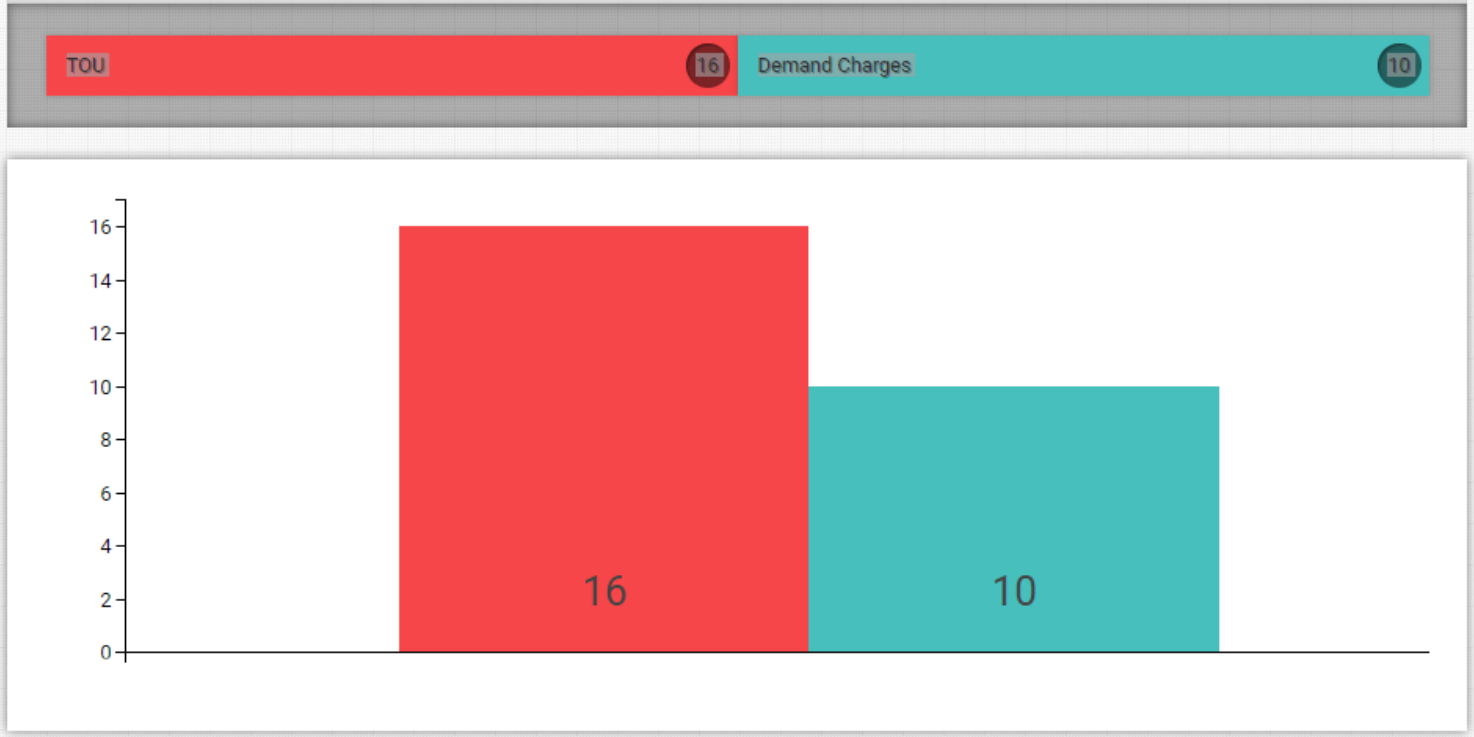
In your opinion, what is the most appropriate utility regulatory model in the 21st century?

42%	Cost-of-service regulation with a mix of performance-based regulation
28%	Predominantly performance-based regulation
17%	Oversight by an elected board or government
8%	Traditional cost-of-service regulation
5%	Other

Please identify the top three difficulties associated with your state regulatory model.

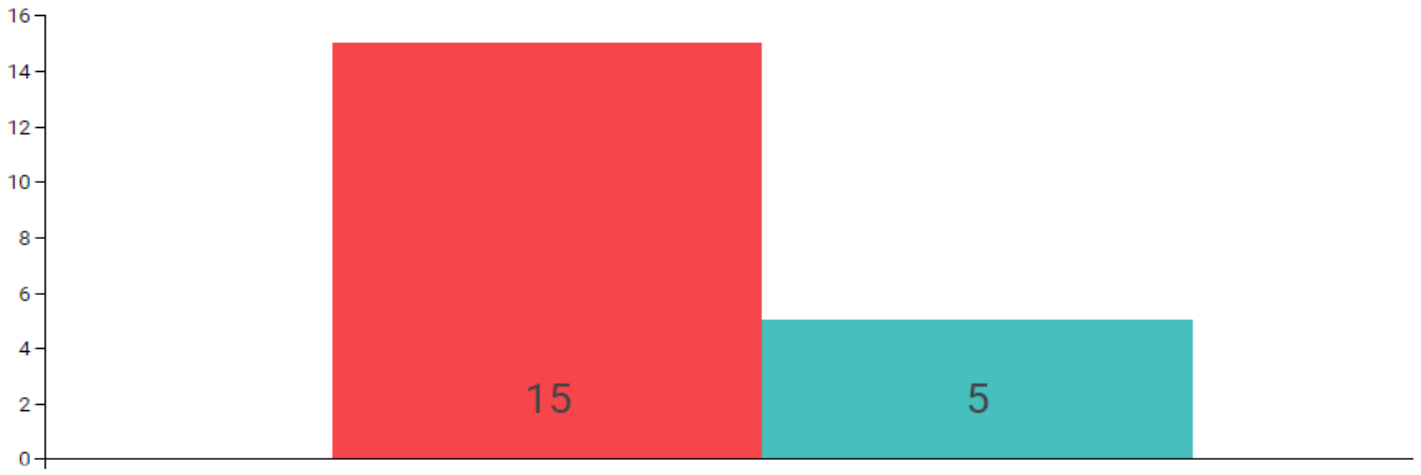
1. **49%** Recovering fixed costs through rate design
2. **43%** Justifying emerging utility investments (energy storage, EV chargers, microgrids, etc.)
3. **41%** Managing distributed resource growth and net metering/value of solar debates
4. **35%** Recovering revenue lost to efficiency and negative load growth
5. **24%** Meeting renewable and other clean energy mandates
6. **20%** Justifying traditional utility investments (wires, poles, etc.) to regulators
7. **16%** Meeting state emission mandates and/or climate standards
8. **16%** Managing stranded utility assets
9. **14%** Meeting performance mandates for efficiency, customer engagement, etc.
10. **9%** Resolving waste issues related to nuclear decommissioning, coal ash, etc.
11. **6%** Other
12. **6%** Obtaining adequate capacity through wholesale power markets

Which rate mechanism is better for equitably recovering the utility's costs for supplying power to public charging stations? ?

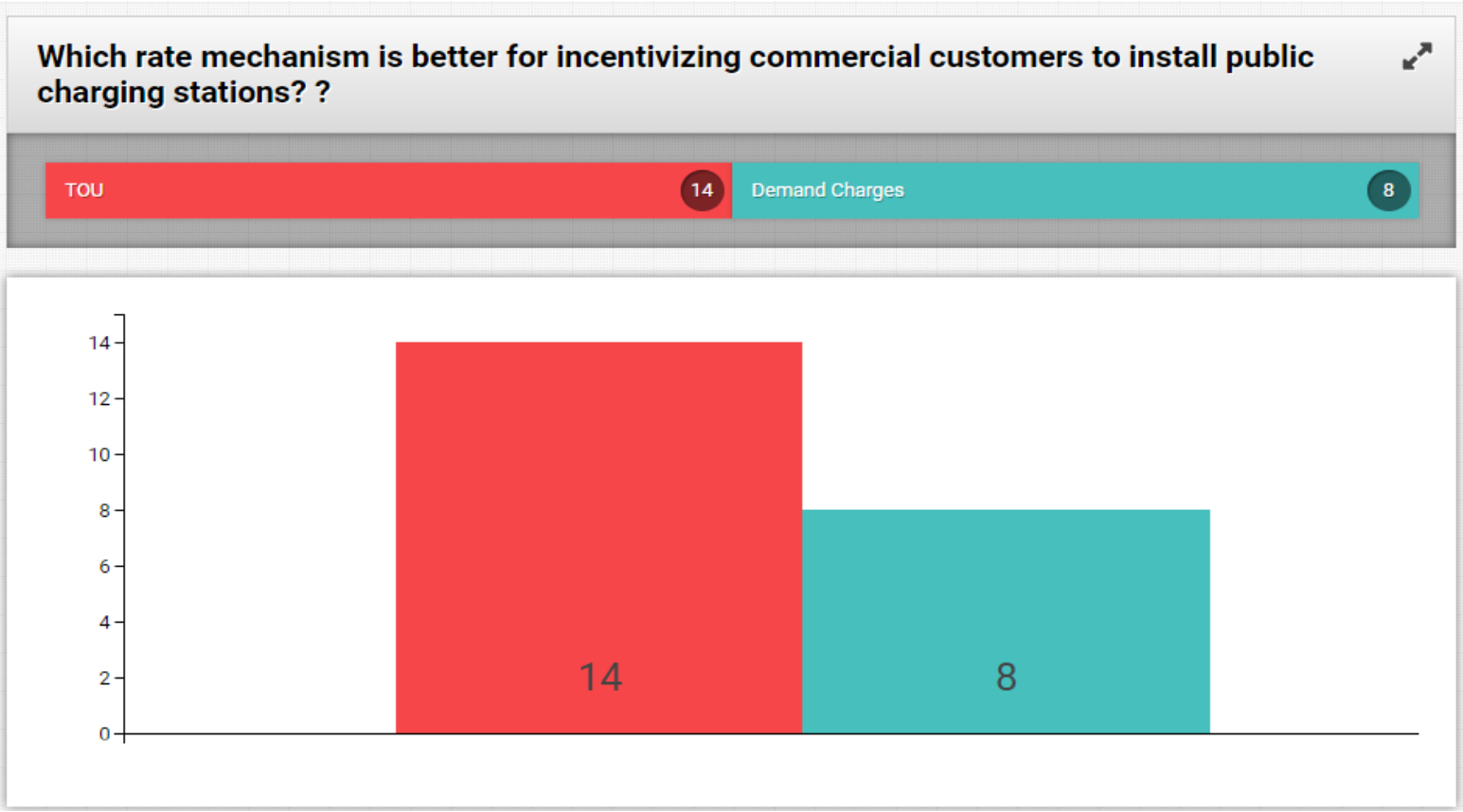


Which rate mechanism is better for equitably recovering the utility's costs for supplying power to public charging stations? ?

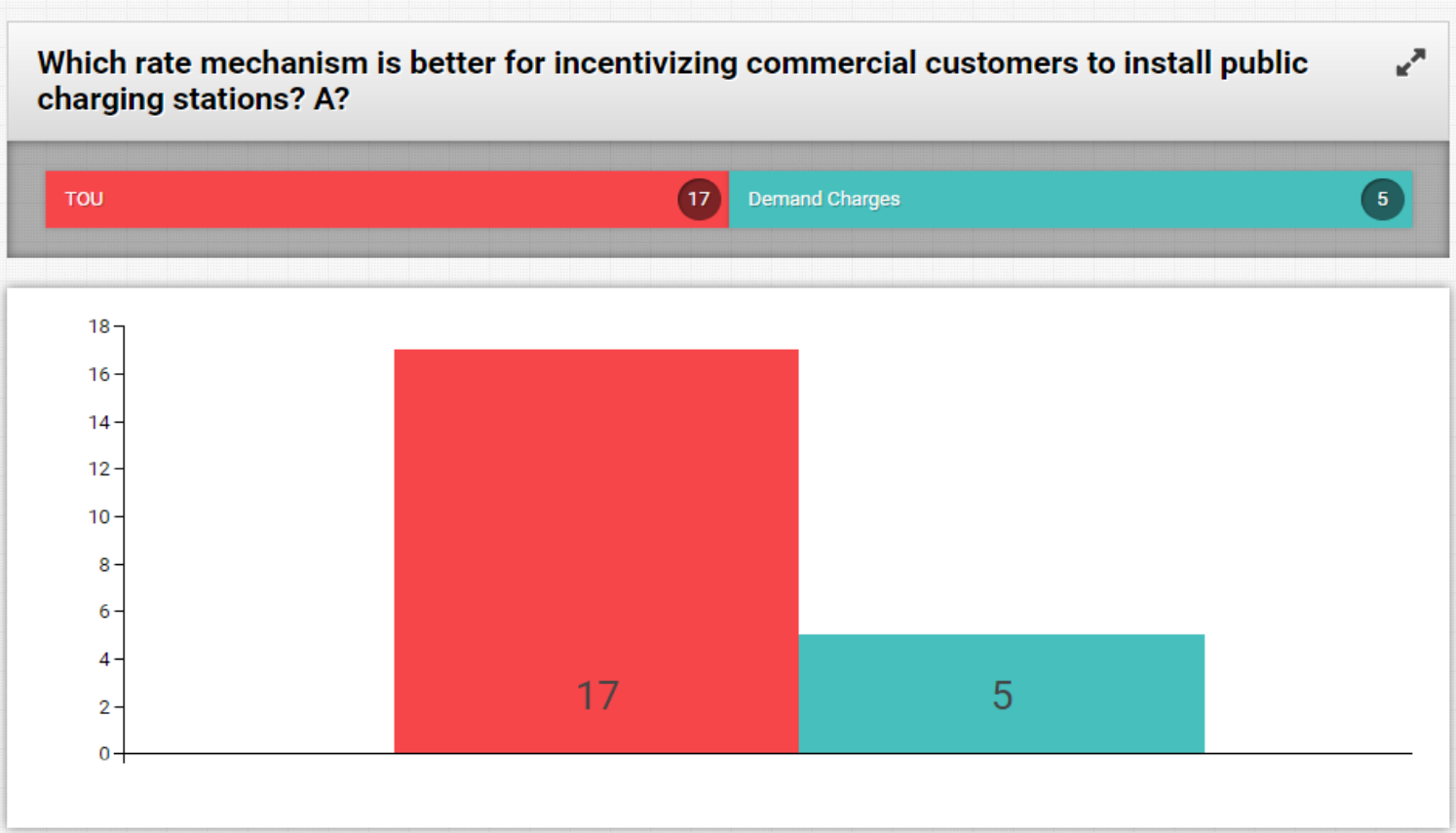
TOU	15
Demand Charges	5



Which rate mechanism is better for incentivizing commercial customers to install public charging stations? ?



Which rate mechanism is better for incentivizing commercial customers to install public charging stations? A?



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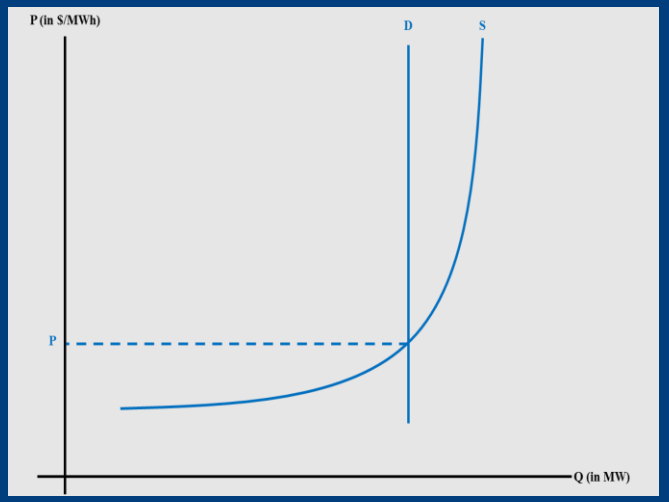
Electricity Markets, Reliability, and the Evolving U.S. Power System



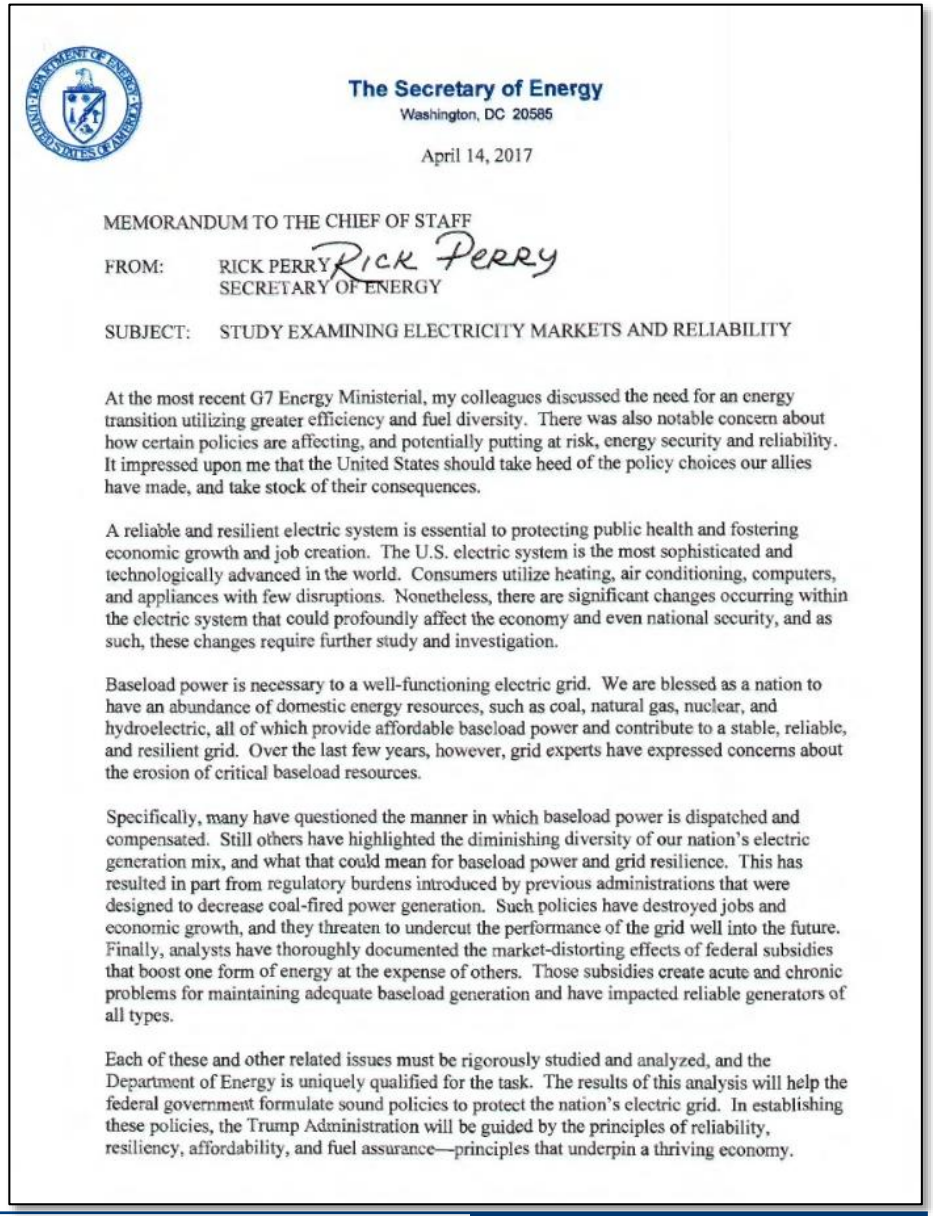
Paul Hibbard

NARUC Summer Policy Summit
San Diego
July 2017

Context

- **Recent attention by federal officials (DOE Secretary Perry, EPA Administrator Pruitt) regarding financial pressure on and retirements of certain coal-fired and nuclear generating units**

- **Questions about retirement drivers and the implications for electric system reliability**



The Secretary of Energy
Washington, DC 20585

April 14, 2017

MEMORANDUM TO THE CHIEF OF STAFF

FROM: RICK PERRY *Rick Perry*
SECRETARY OF ENERGY

SUBJECT: STUDY EXAMINING ELECTRICITY MARKETS AND RELIABILITY

At the most recent G7 Energy Ministerial, my colleagues discussed the need for an energy transition utilizing greater efficiency and fuel diversity. There was also notable concern about how certain policies are affecting, and potentially putting at risk, energy security and reliability. It impressed upon me that the United States should take heed of the policy choices our allies have made, and take stock of their consequences.

A reliable and resilient electric system is essential to protecting public health and fostering economic growth and job creation. The U.S. electric system is the most sophisticated and technologically advanced in the world. Consumers utilize heating, air conditioning, computers, and appliances with few disruptions. Nonetheless, there are significant changes occurring within the electric system that could profoundly affect the economy and even national security, and as such, these changes require further study and investigation.

Baseload power is necessary to a well-functioning electric grid. We are blessed as a nation to have an abundance of domestic energy resources, such as coal, natural gas, nuclear, and hydroelectric, all of which provide affordable baseload power and contribute to a stable, reliable, and resilient grid. Over the last few years, however, grid experts have expressed concerns about the erosion of critical baseload resources.

Specifically, many have questioned the manner in which baseload power is dispatched and compensated. Still others have highlighted the diminishing diversity of our nation's electric generation mix, and what that could mean for baseload power and grid resilience. This has resulted in part from regulatory burdens introduced by previous administrations that were designed to decrease coal-fired power generation. Such policies have destroyed jobs and economic growth, and they threaten to undercut the performance of the grid well into the future. Finally, analysts have thoroughly documented the market-distorting effects of federal subsidies that boost one form of energy at the expense of others. Those subsidies create acute and chronic problems for maintaining adequate baseload generation and have impacted reliable generators of all types.

Each of these and other related issues must be rigorously studied and analyzed, and the Department of Energy is uniquely qualified for the task. The results of this analysis will help the federal government formulate sound policies to protect the nation's electric grid. In establishing these policies, the Trump Administration will be guided by the principles of reliability, resiliency, affordability, and fuel assurance—principles that underpin a thriving economy.

Two Questions

- **What are the primary drivers of the transition underway in the electric industry?**

- **Is the transition to a different mix of generating resources adversely affecting power system reliability?**

Industry Transition – What?

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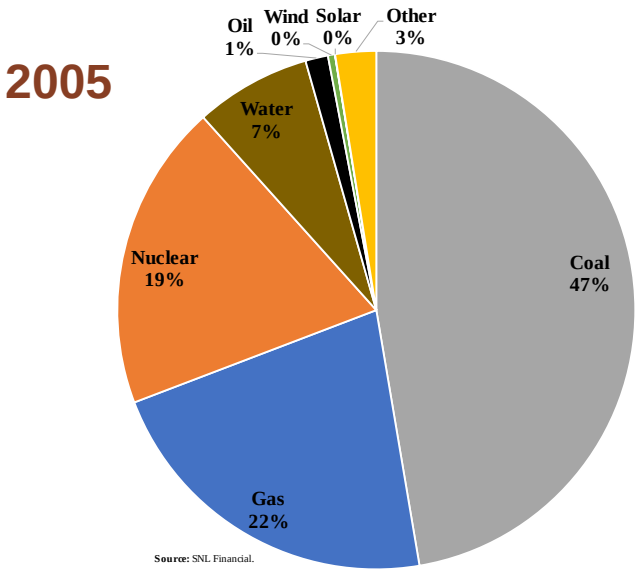
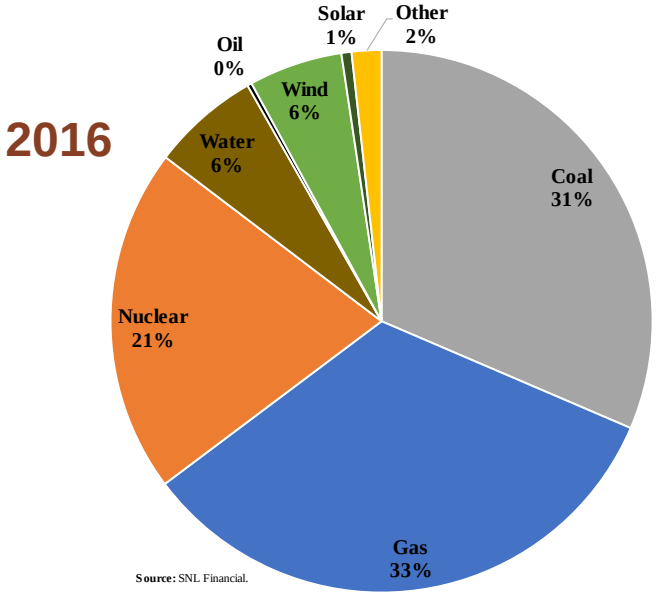
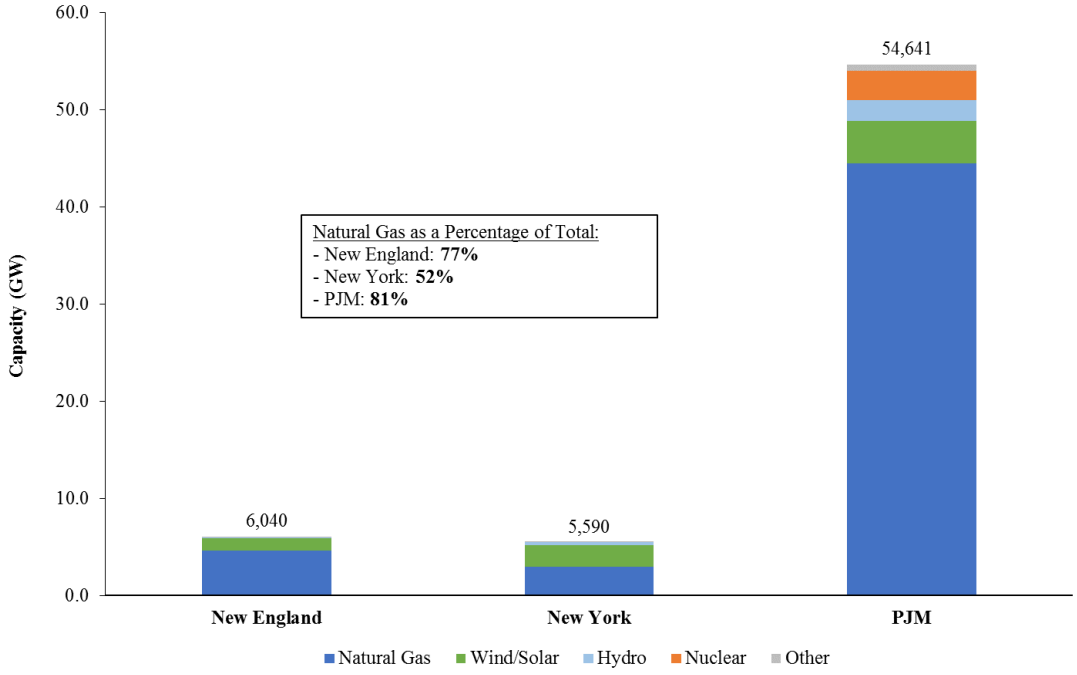




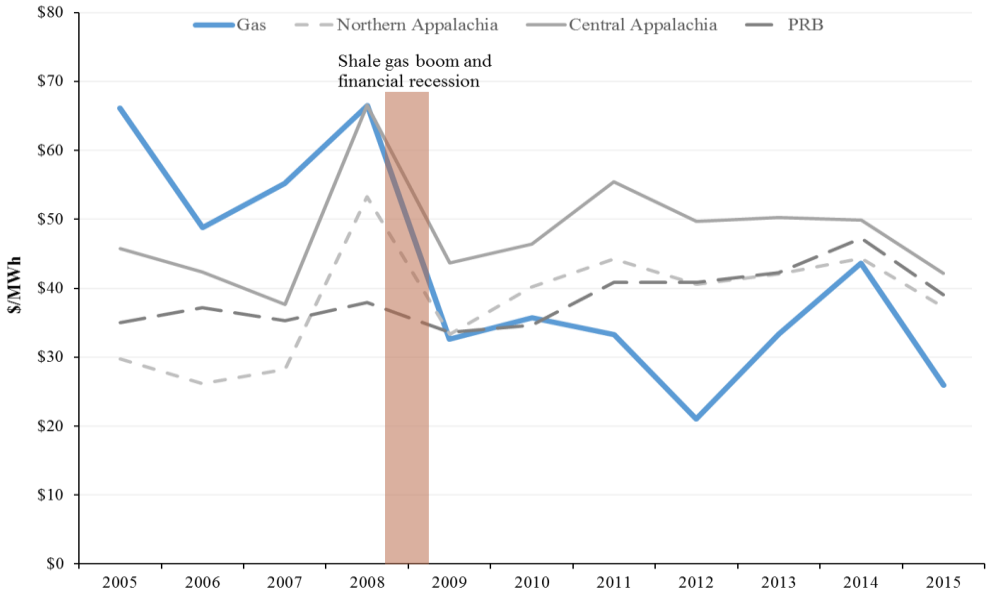
- **Result: a more diverse resource mix**
  - Coal: from about half to about a third
  - Gas: from about a fifth to about a third
  - Renewables: from negligible to 7%
  - The rest about the same
- **Looking forward: more of the same**
  - Natural gas, renewables dominate market interest
  - Economics of displacement have not changed



Notes:
[1] Fuel type Other includes Biomass, Petroleum Fuels, and Other Fuels as classified by SNL Financial.
[2] Wind and Solar Capacity represent the assumed capacity contribution amount, discounted to 30% of nameplate capacity.

Source: SNL Financial.

Industry Transition – Why?

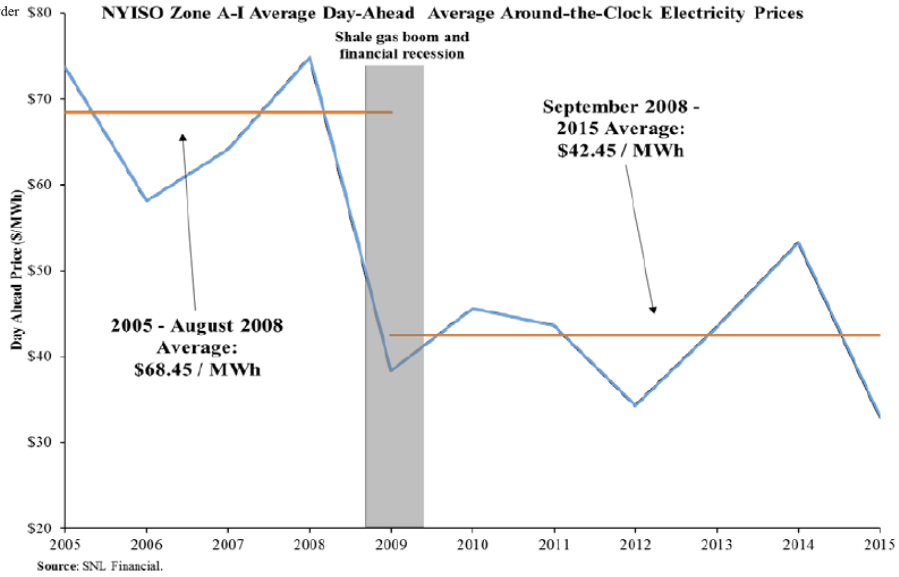


Notes: Gas prices are based on Transco Zone 6 NY prices. Coal prices are a simple average of Northern Appalachia, Central Appalachia, and Powder River Basin coal spot prices, with transportation costs estimated by the EIA
Sources: SNL Financial and EIA.

- **Gas prices plummeted (primary driver)**
  - Existing underutilized gas-fired generating capacity increased output
  - New efficient gas-fired capacity added
  - Increases gas generation at the expense of other sources

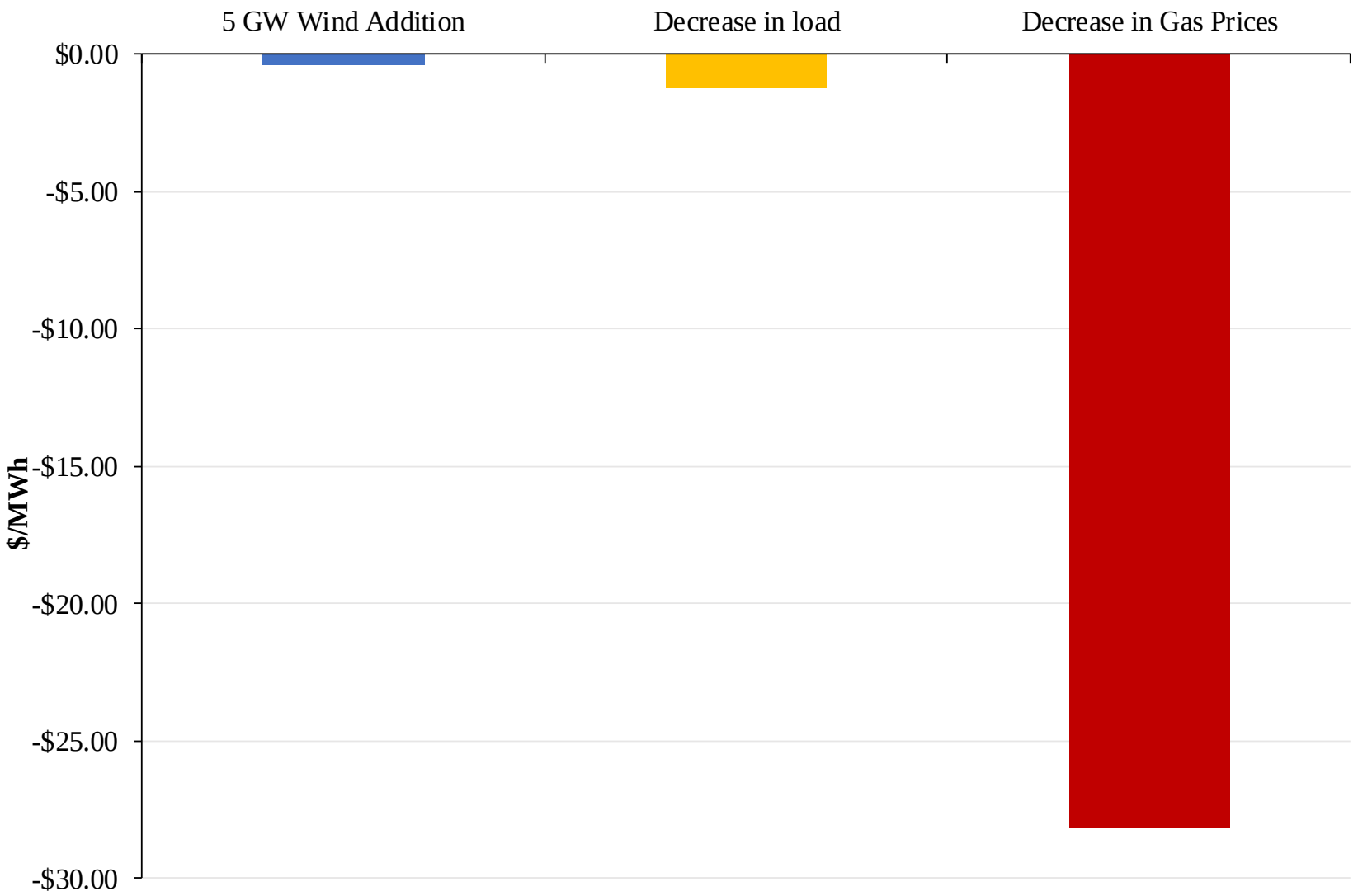
- **Electricity prices followed**
  - Gas on the margin very often, in many market regions
  - Lower prices result in lower revenues for *all* generators
  - Rendering least efficient generation uneconomic

Figure 14: Change in Electricity Prices in NY



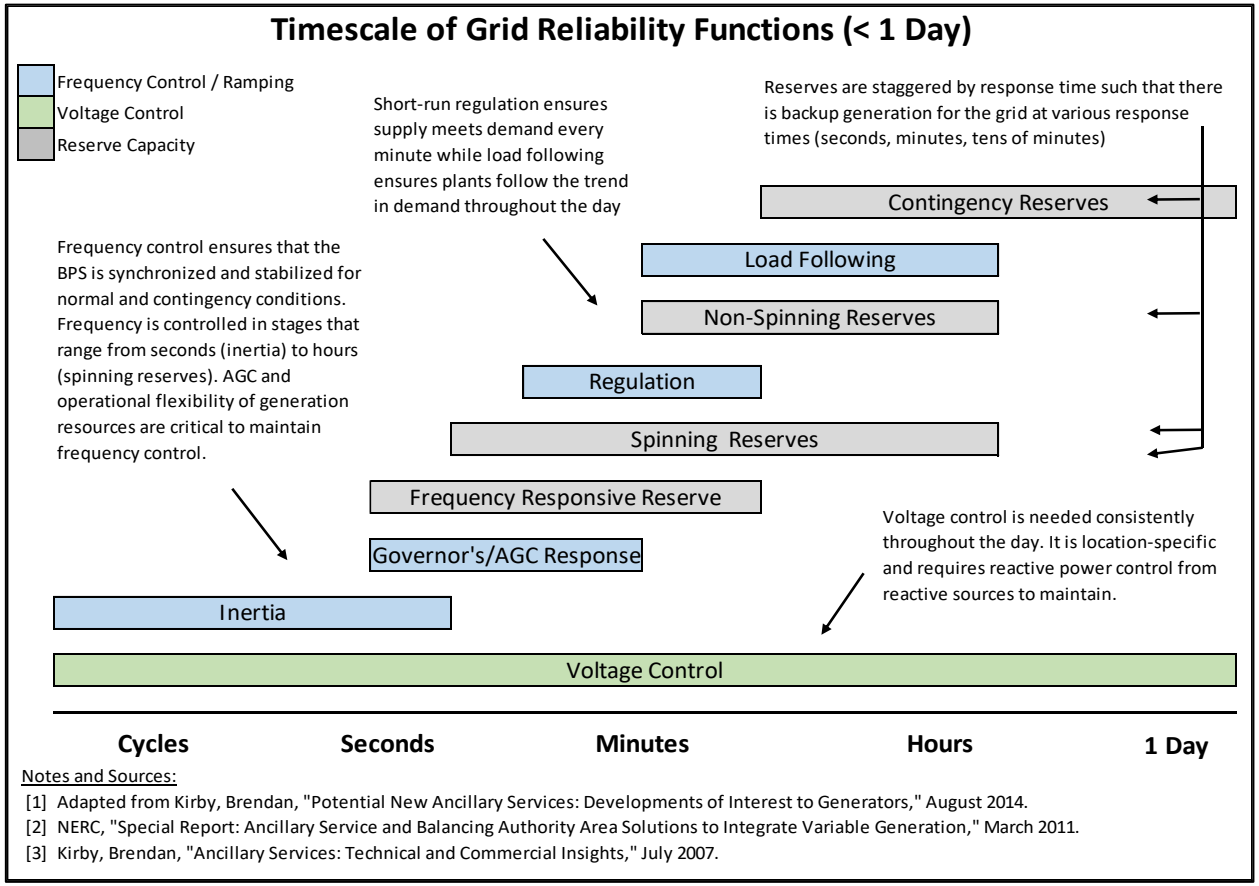
Source: SNL Financial.

Relative Impacts of Factors (Illustrative)



Note: Impact of wind addition demonstrates impact of adding 5 GW of wind to all of PJM on marginal electricity price for all of PJM. Decrease in gas price shown between 2005-2008 and 2009-2015 periods in PJM East.
Source: SNL Financial.

- **Essential Reliability Services (ERS)**
  - Needed to preserve reliability, and provided by various technologies
  - Terms like "baseload" are old-fashioned, no practical meaning from a reliability perspective
  - ERS Include
    - Frequency response
    - Voltage support
    - Reserves, load-following capability
    - Black start capability
  - Critical: ability of *the mix* of resources on the system to provide sufficient ERS
  - Many different resources offer different kinds of ERS



Technology Reliability Attributes

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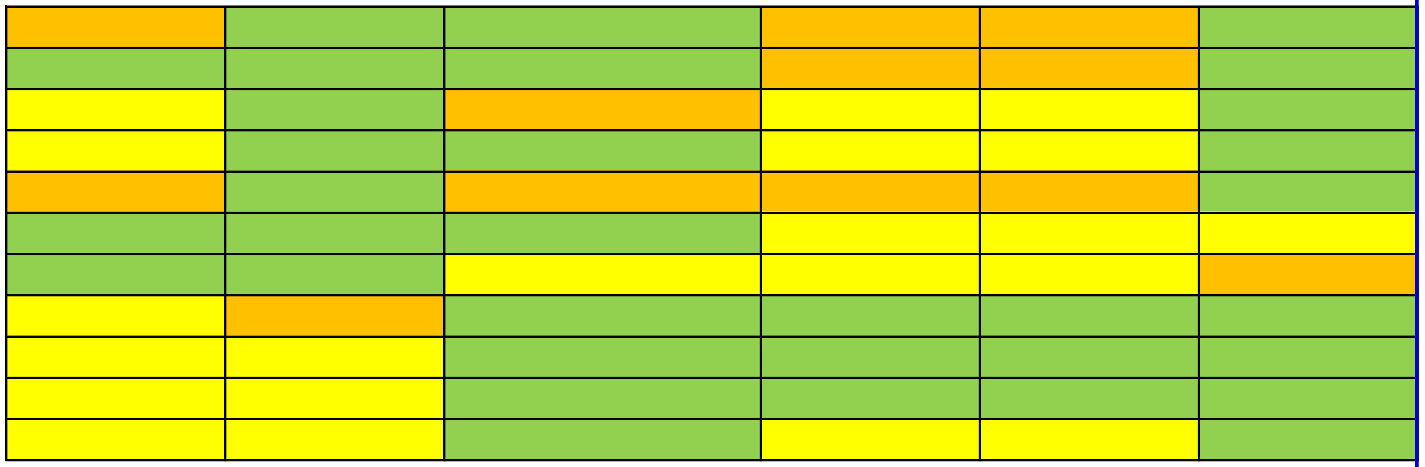
Comparison of Flexibility and Reliability Attributes of Power Generating Technologies

	Nuclear	Coal	Gas	Wind	Solar	Hydro
Construction Duration (Years)[1]	6	6	3	3	1	3
Heat Rate (Btu/kWh)[1]	10,452	10,062	6,682 (CC) - 10,033 (CT)			
Planned Outage Rate (%)[1]	6%	12%	5% (CT) - 6% (CC)	0.6%[2]	2%[2]	1.9%[2]
Forced Outage Rate (%)[1]	4%	8%	3% (CT) - 4% (CC)	5%[2]	0%[2]	5%[2]
Minimum Load (%)[1]	100%	50%	0%			



Notes and Sources:

[1] "2016 Annual Technology Baseline," NREL, 2016. A base year of 2014 is provided for all results.

[2] "Cost Report: Cost and Performance Data for Power Generation Technologies," NREL, February 2012.

[3] "PJM's Evolving Resource Mix and System Reliability," PJM, March 30, 2017.

Full Capability
Partial Capability
No Capability

- **Our Conclusions: Markets**
  - **Market Forces are Driving the Change in the Generation Mix, to the Benefit of Consumers**
    - By far, the dominant driver of financial/economic pressures on generating units that depend upon revenues in RTO markets: low natural gas prices
    - Consumers are benefitting from low gas prices (and the resulting lower wholesale electricity prices)
    - Other, lesser drivers: flat demand and the introduction of renewable generation
    - With few exceptions, the retirement of older, less efficient generating assets is a natural outcome of efficient market operations

- **Our Conclusions: Reliability**
  - **The Transition Underway in the Electric Resource Mix is Not Harming Reliability**
    - Many types of resources on the system have a variety of attributes that provide essential reliability services
    - What matters is the portfolio of attributes available to grid operators
    - "Baseload" is not a useful word to define generating resources with different attributes relevant for reliability
  - **Other recent evaluations find system reliability trending upward; no degradation of reliability from changing resource mix**
    - NERC notes a need to continue to study integration of variable resources
    - NERC finds that reliability is the same or improving along several key reliability metrics (see NERC, State of Reliability 2016, May 2016)
    - Studies by PJM and others on the changing resource mix indicate the system is handling transitions well

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Report available at the following link:

http://www.analysisgroup.com/news-and-events/news/analysis-group-report-finds-that-the-transition-underway-in-the-us-power-system-is-not-harming-reliability/

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