1December 13, 2019

The Electricity Sector of the Past, Present, and Future

South Carolina Public Service Commission

“Utility of the Future” Workshop

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Introductions

The Regulatory Assistance Project (RAP) is a global NGO providing technical and policy assistance to government officials, agency staff, and others on energy and environmental issues.

- Foundation-funded; some contracts
- Non-advocacy; no interventions

Today's Agenda

1. History, Trends, and Challenges facing Regulation and Markets
2. Distributed Resource Capabilities and Value, and Implications for Compensation, Rate Design, and Planning
3. Best Practices in Resource Planning
4. Approaches to Dealing with Misalignments in Traditional Regulation and Markets
5. Process Options for Moving Change Forward

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1 A Very Brief History of Regulation and Trends Shaping the Industry Today

Medieval England Accommodations

- Business “affected with the public interest”
- Prices regulated due to monopoly stature

New Inn, Gloucester, 1454

US Origins: Munn v. Illinois (1877)

- Grain elevators charging monopoly prices to farmers
- Supreme Court ruled “affected with the public interest” and subject to price regulation

Roaring 60's and Scary 70's

- Economic Growth
- Load Growth = more power plants
- Increasing inflation = increasing cost of borrowing $

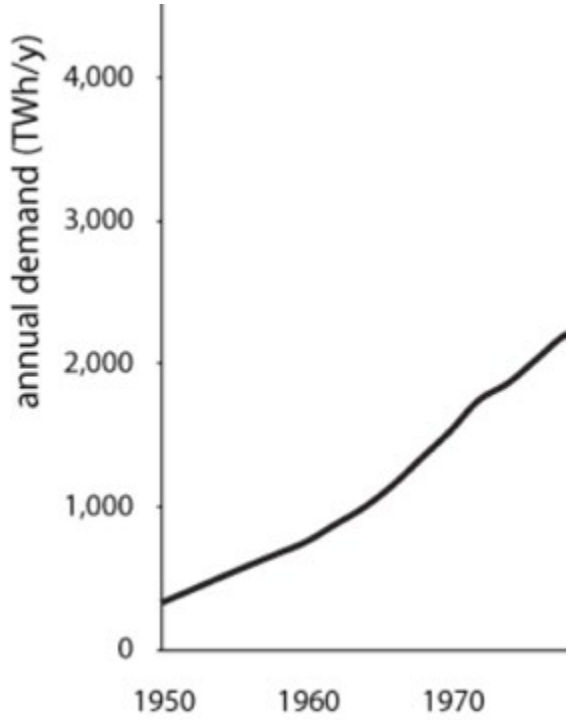
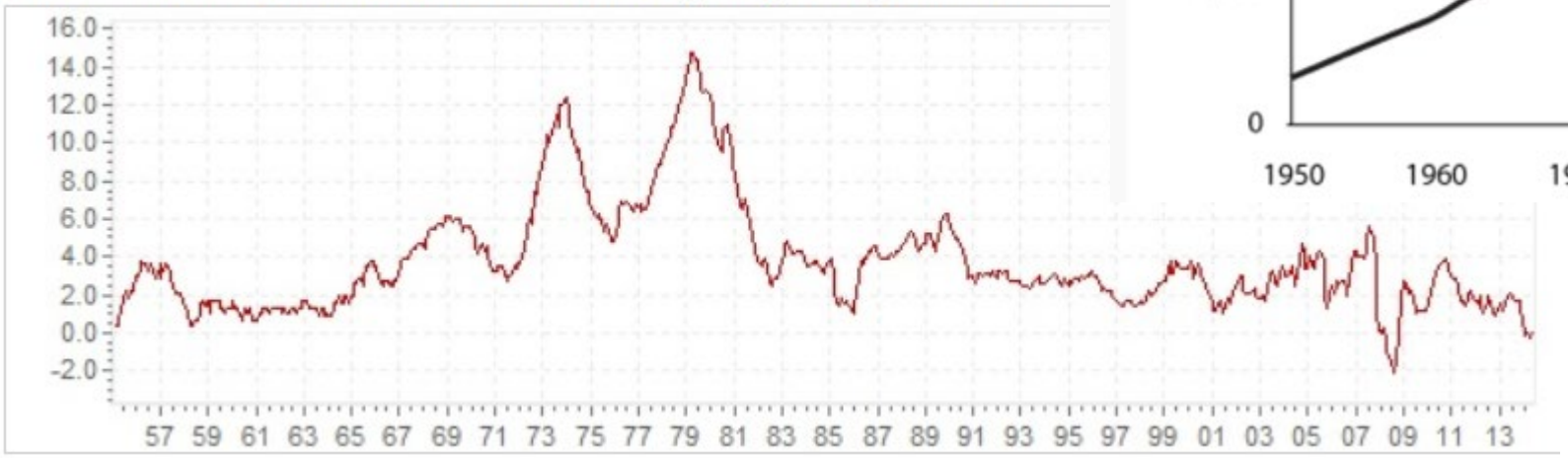


Chart – historic CPI inflation United States (yearly basis) – full term



PURPA: The Public Utility Regulatory Policies Act (1978)

- Requires PUCs to "consider and determine" whether several specific policies should be adopted

Rate Design Standards

- Cost of Service
- Time of Day
- Seasonal
- Interruptible
- Declining Block

Utility Service Standards

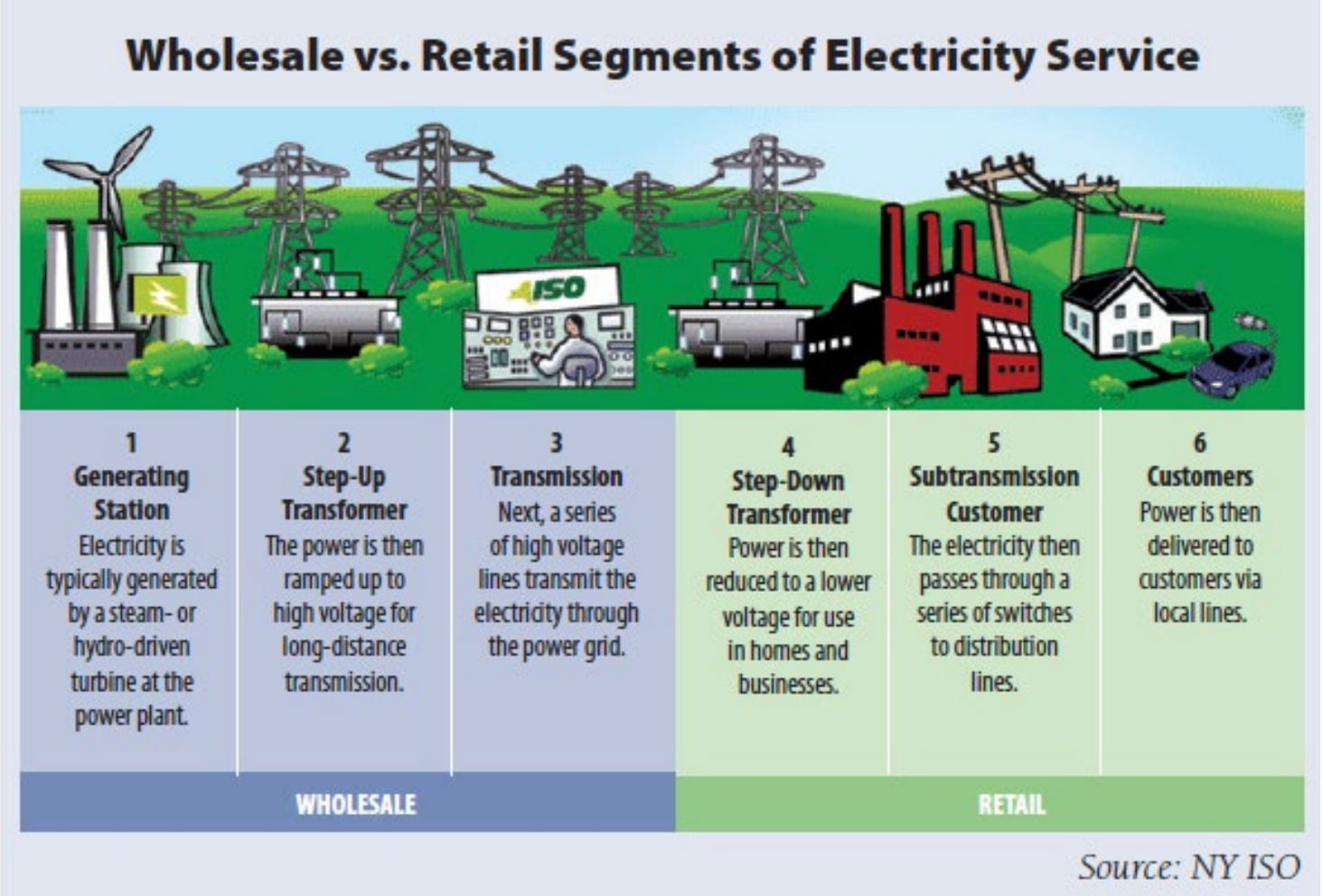
- Master Metering
- Fuel Adjustment Clauses
- Information to Consumers
- Termination of Service

- Avoided Cost for Independent Power Qualifying Facilities
- Idea emerging that competition could help US power sector

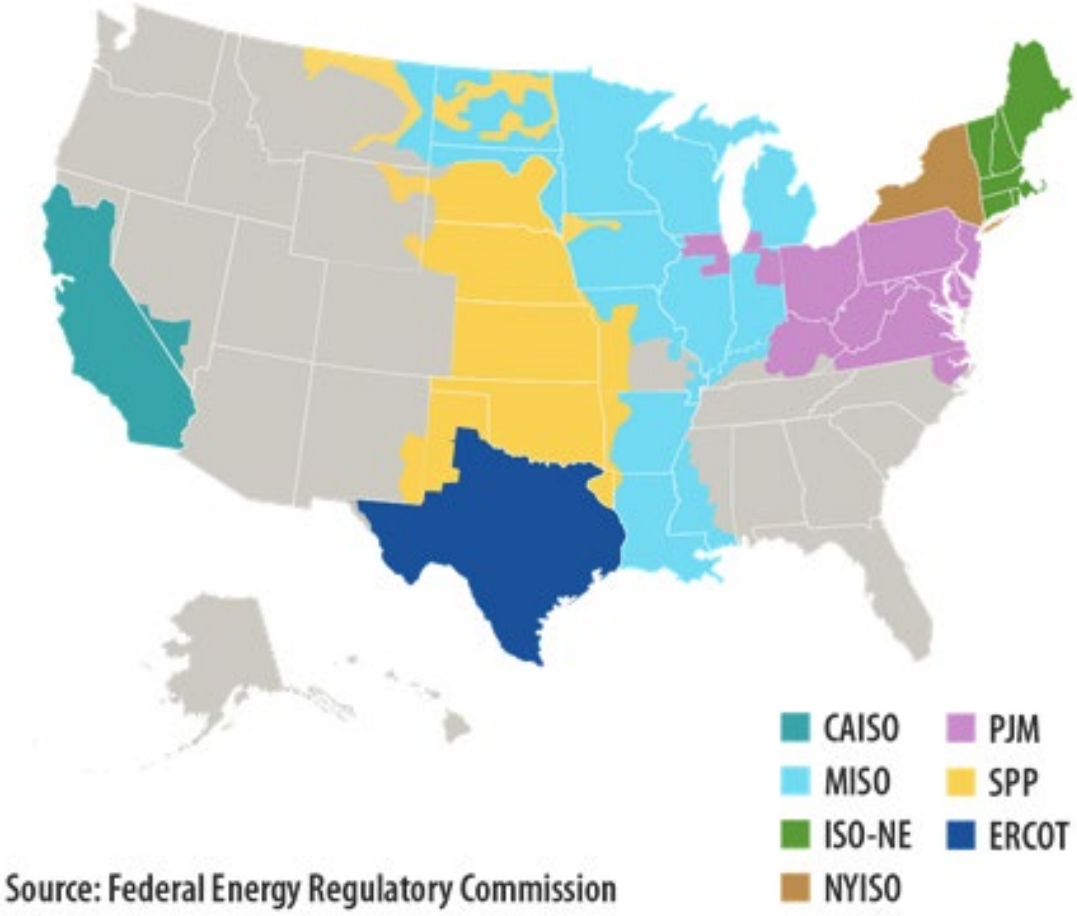
The 80's: Rate Increases, Cost Over-runs, and Abandoned Nukes

- Expensive New Capacity – pollution and safety equipment
- High rates resulted in low load growth
- Three Mile Island incident led to 50 nuclear plant abandonments
- Led large users to demand "direct access" and restructuring

Segments of Electric Service

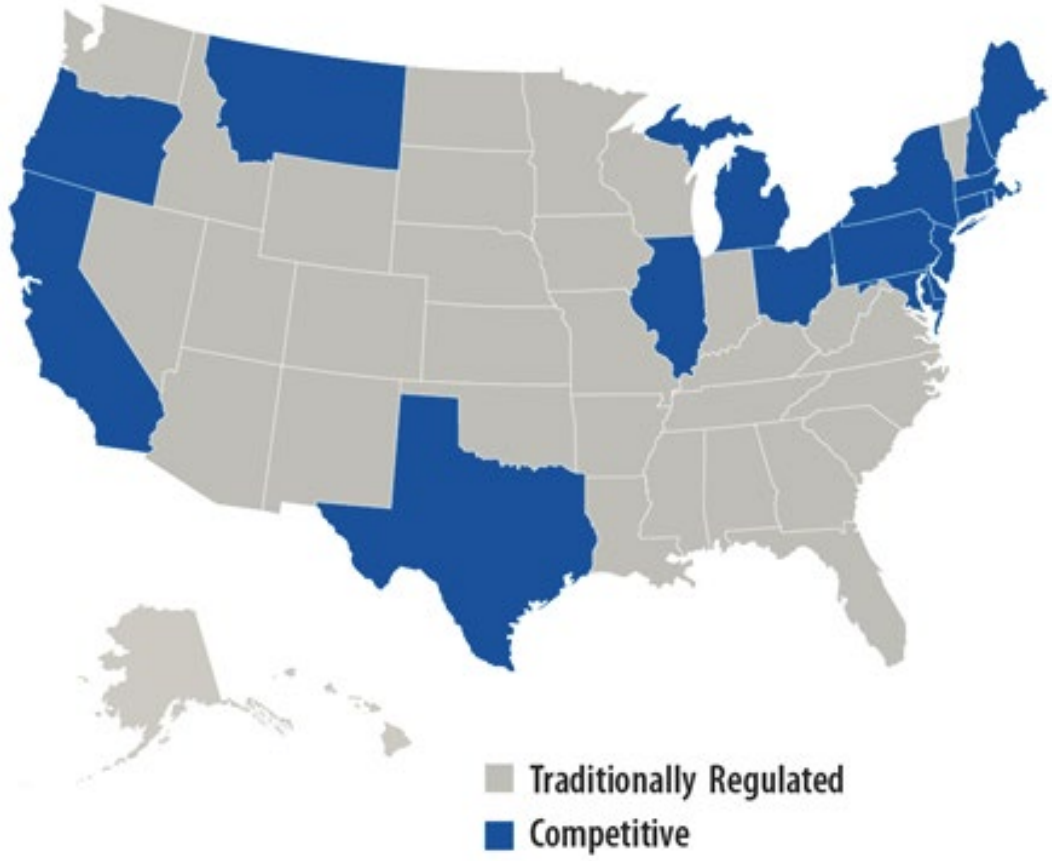


Wholesale Electric Power Markets



Source: FERC, taken from https://www.epa.gov/greenpower/us-electricity-grid-markets

Retail Electric Power Markets



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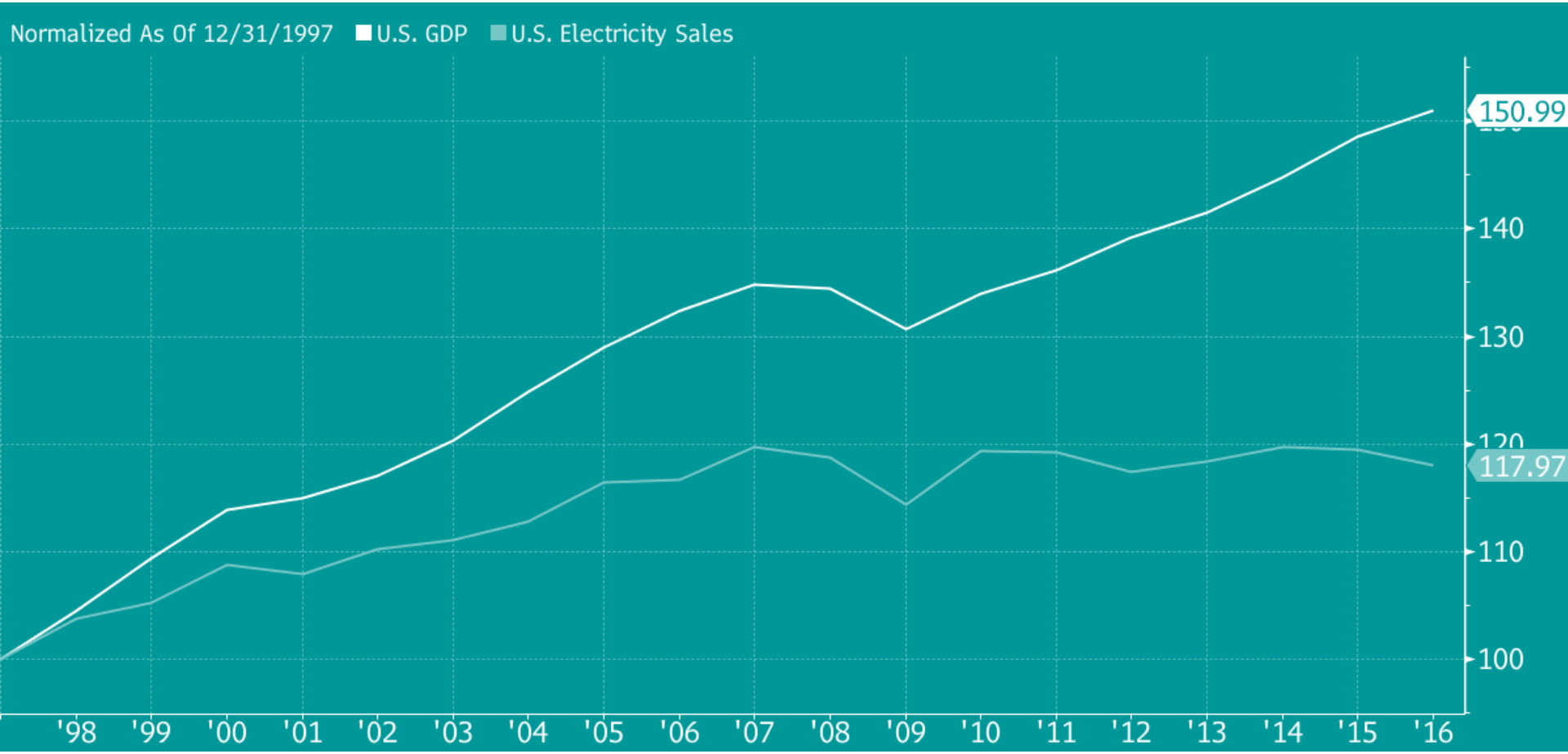
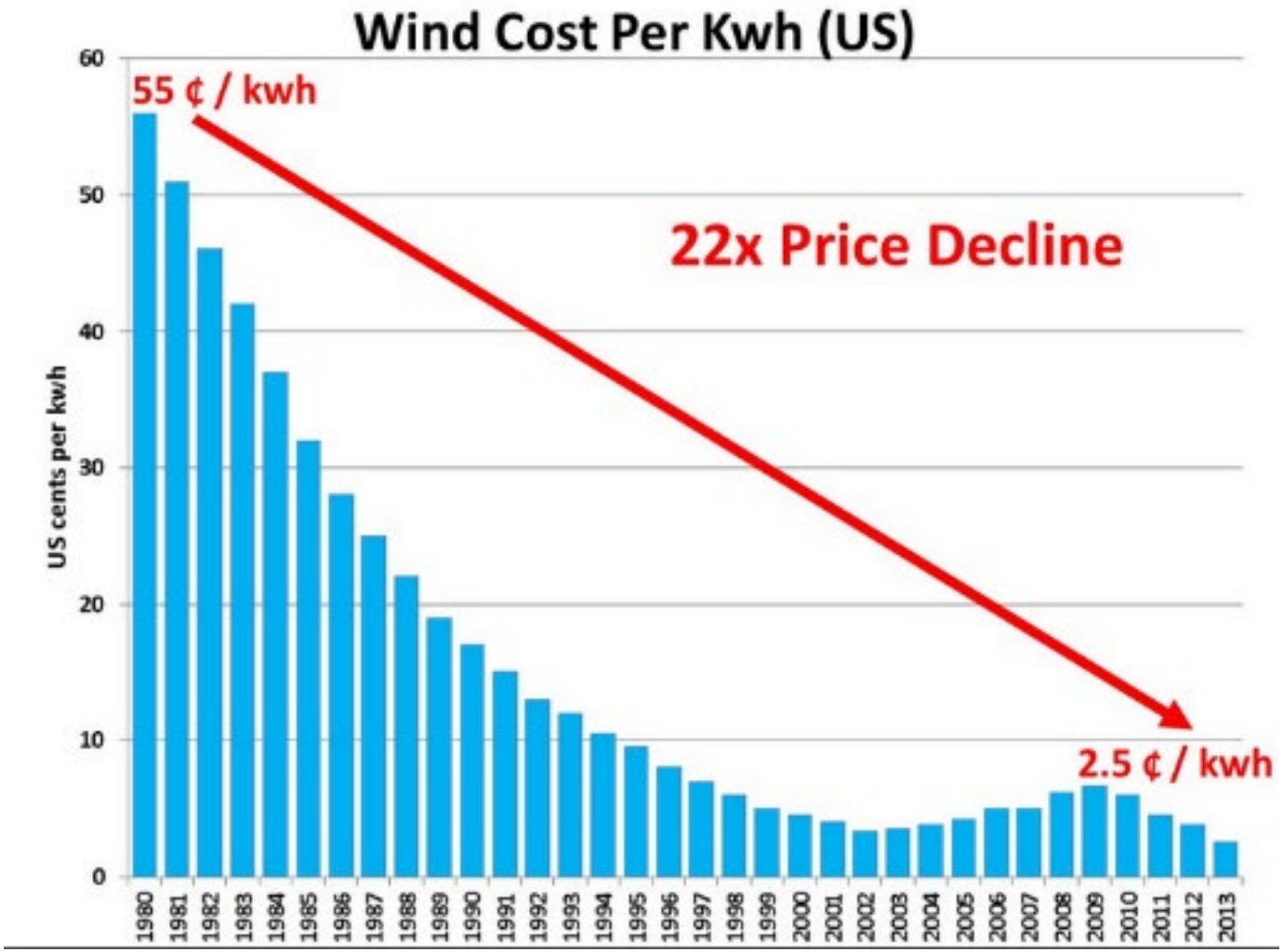
A few more recent developments

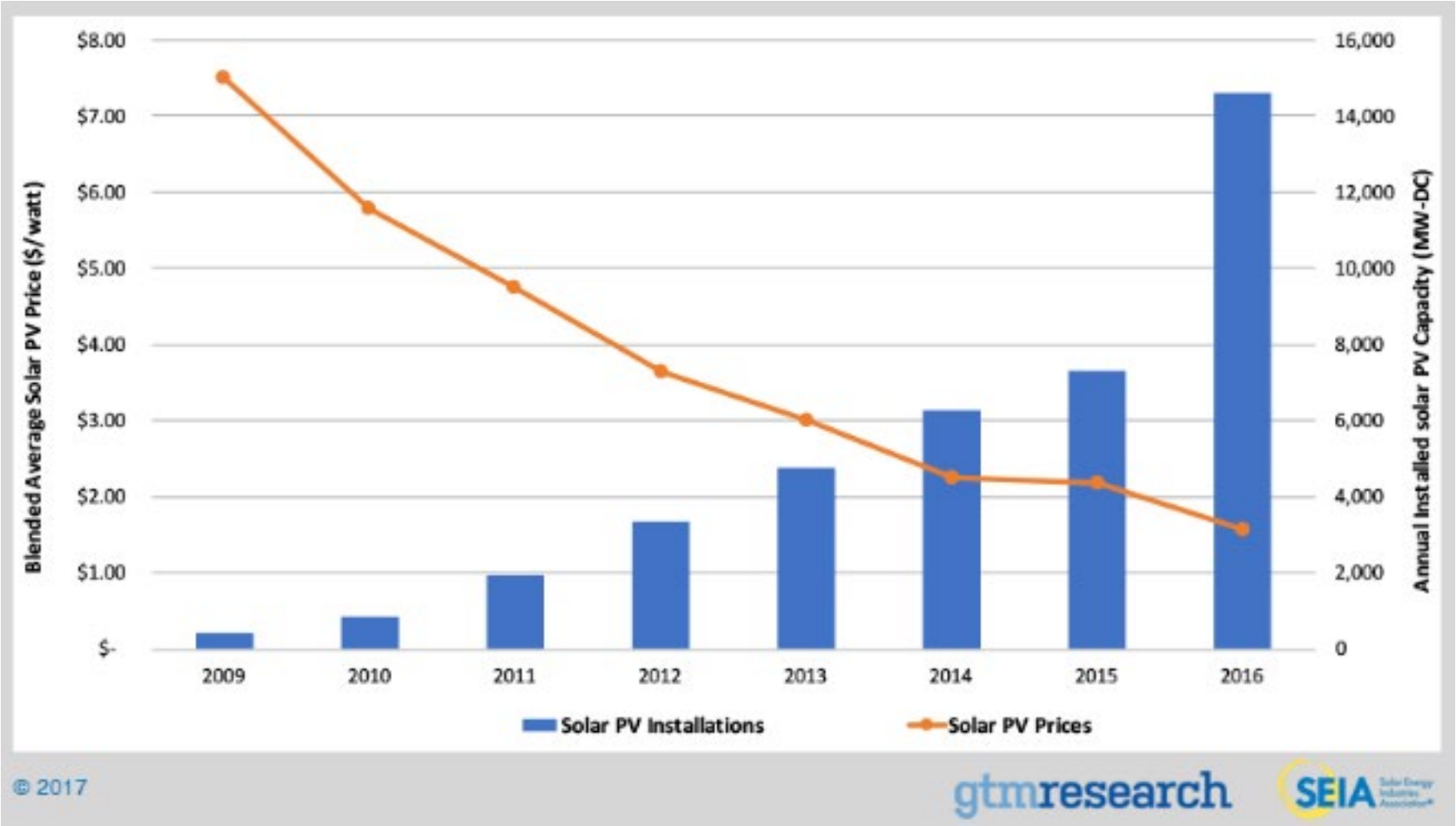


Source: Bloomberg New Energy Finance

Wind Costs Dropped a Decade Ago

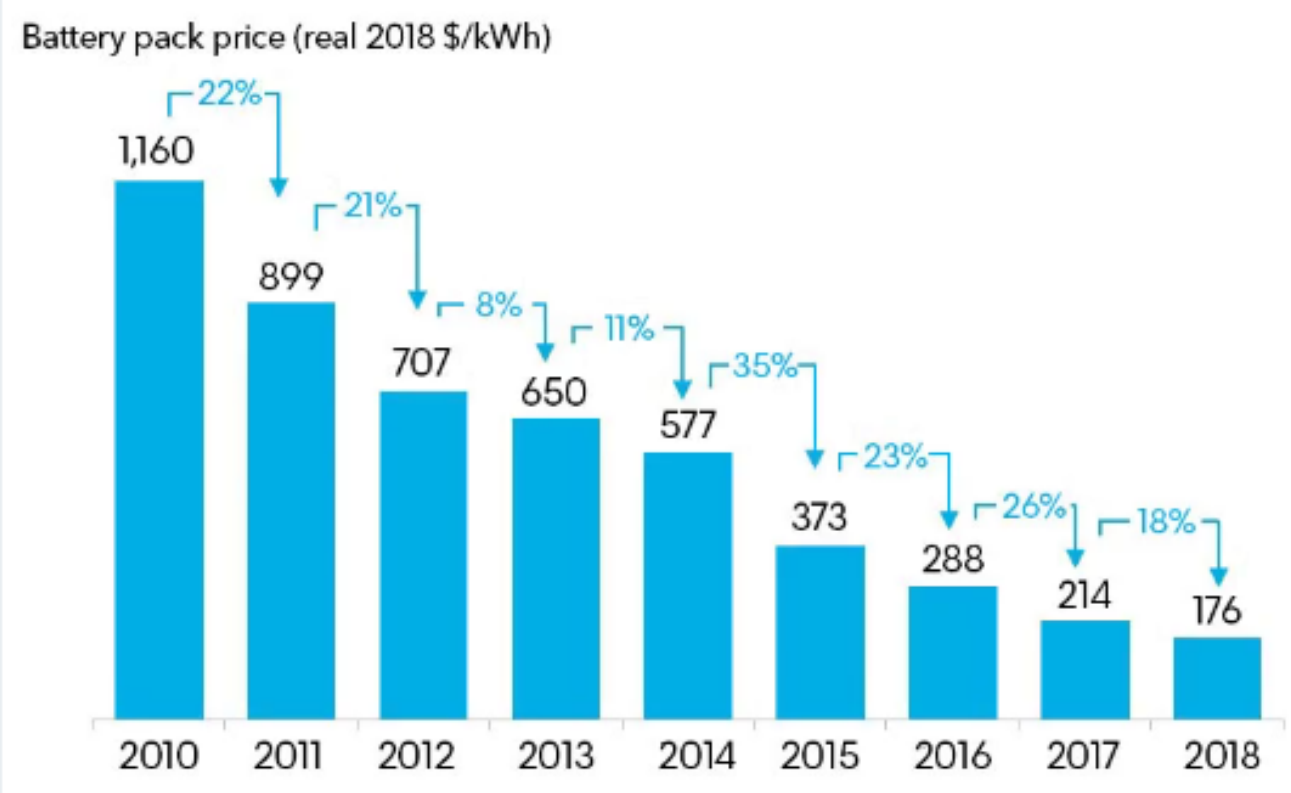


Solar Is Following Close Behind



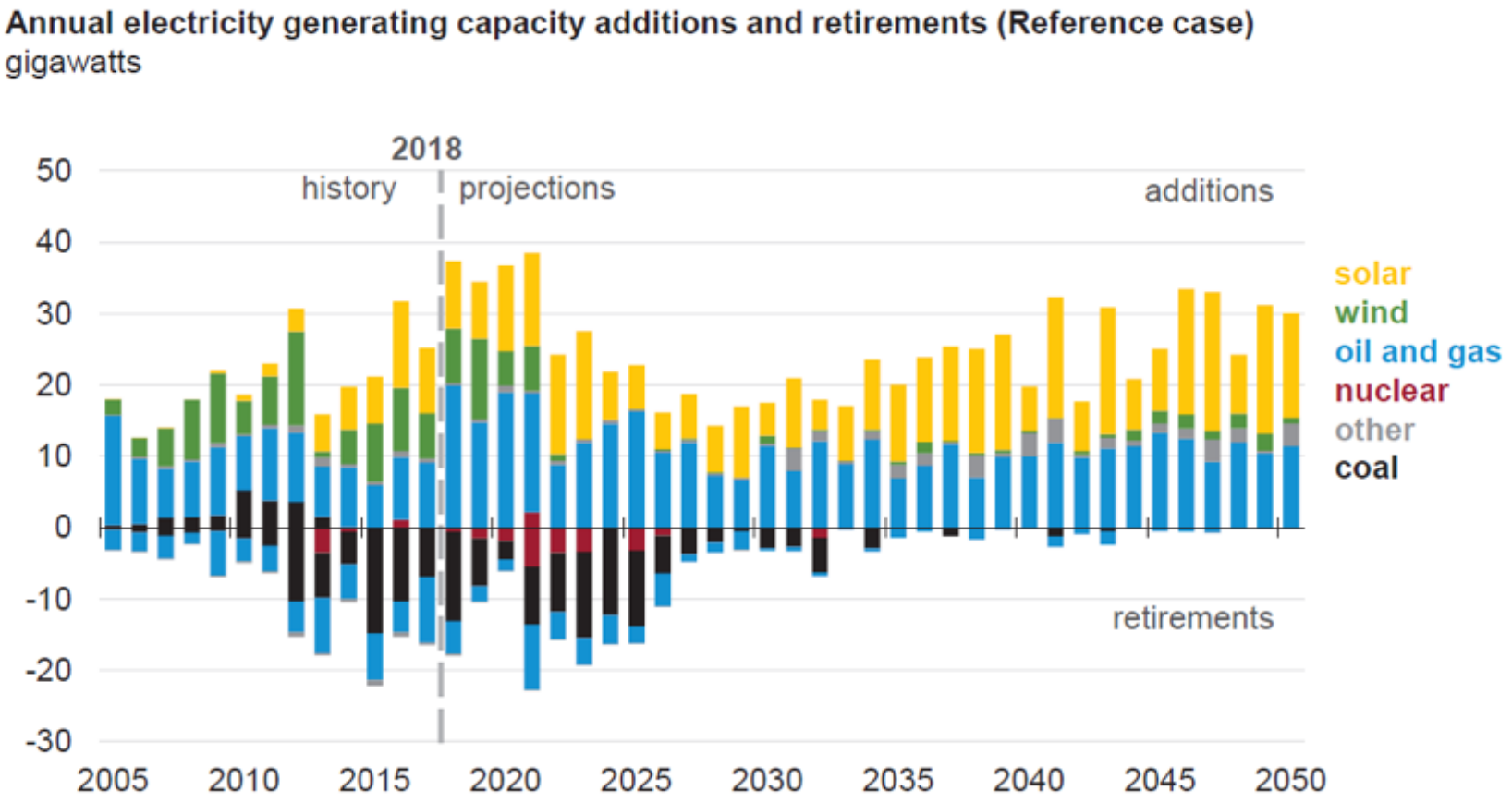
Source: Solar Energy Industry Association

Batteries, too



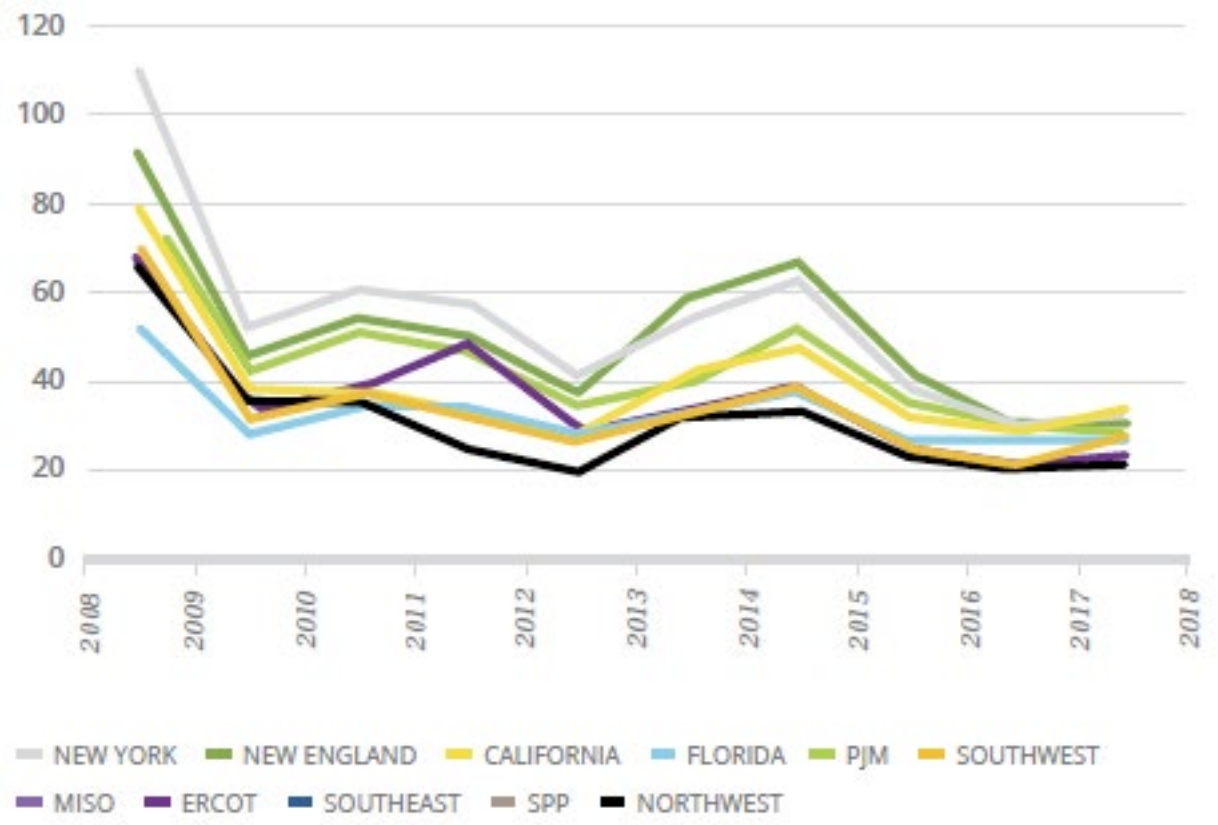
Source: Bloomberg NEF. Data adjusted to be in real 2018 dollars.

Changes in Generation Mix



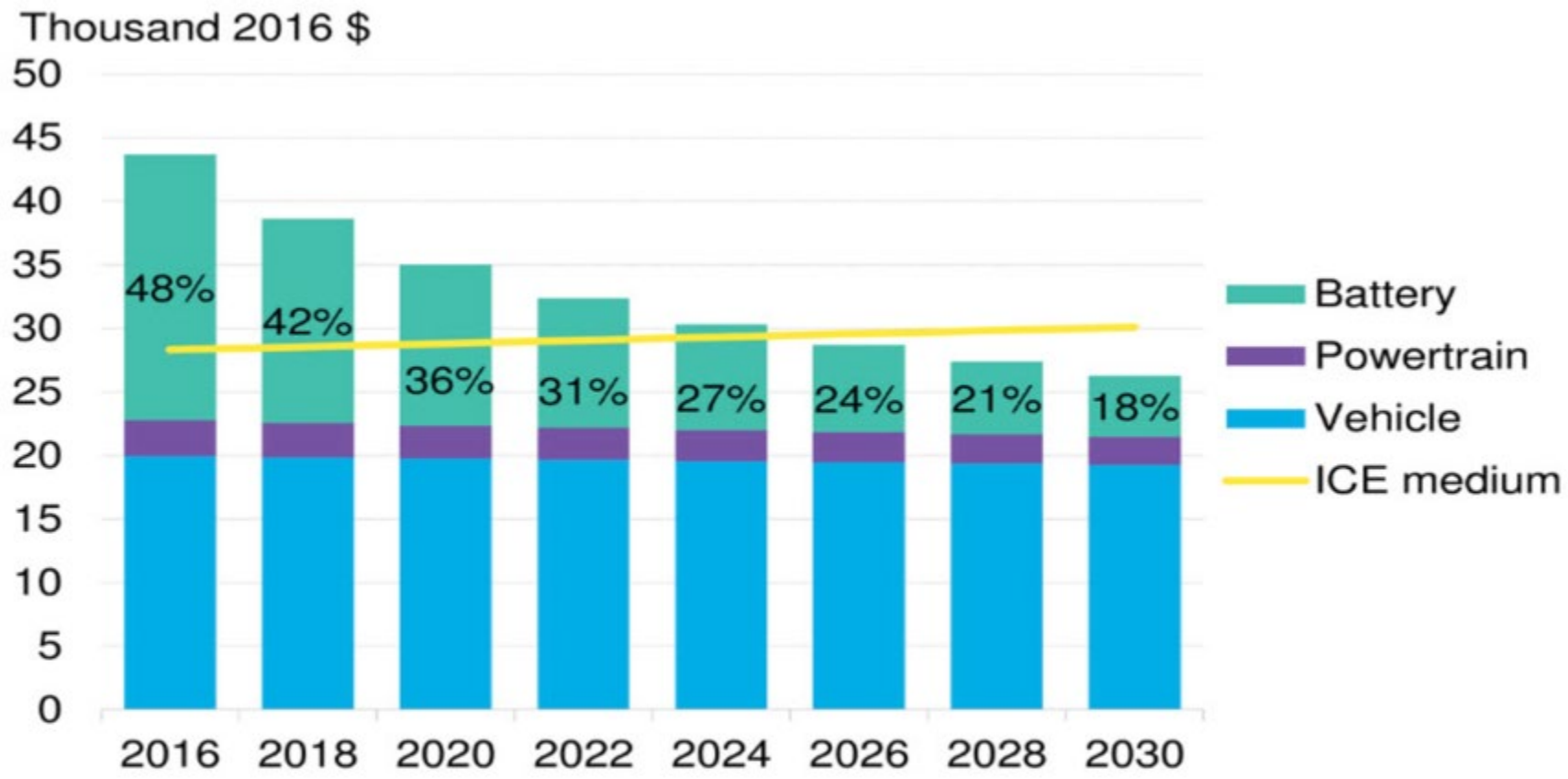
Energy Information Administration, Annual Energy Outlook 2019

Wholesale Power Prices ($/MWh – real 2017)



Source: BNEF, 2018. Image taken from Goggin, et al, "Customer Focused and Clean: Power Markets for the Future. Wind Solar Alliance. November 2018.

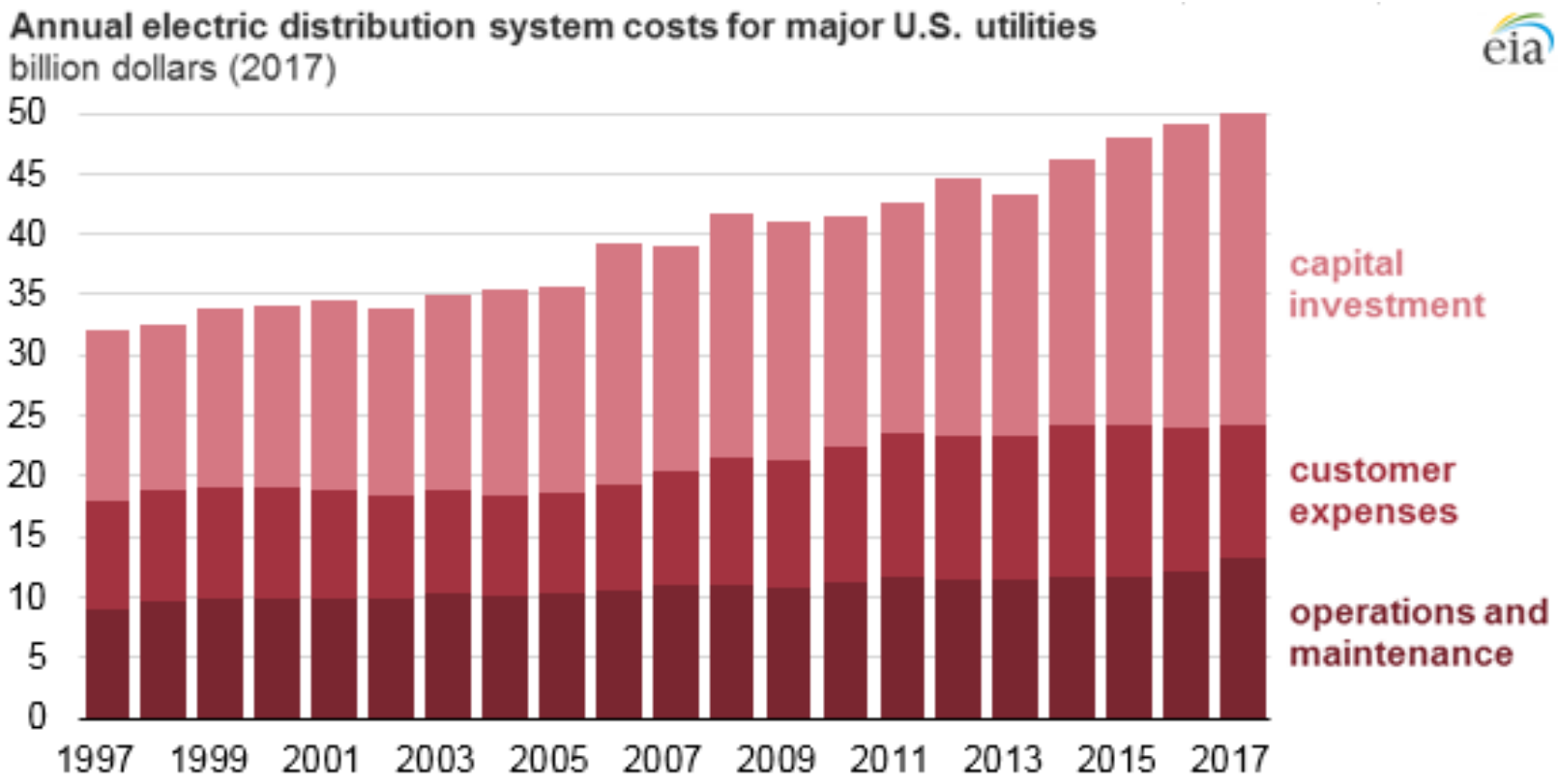
EVs Soon to Reach Price Parity



Source: Bloomberg New Energy Finance

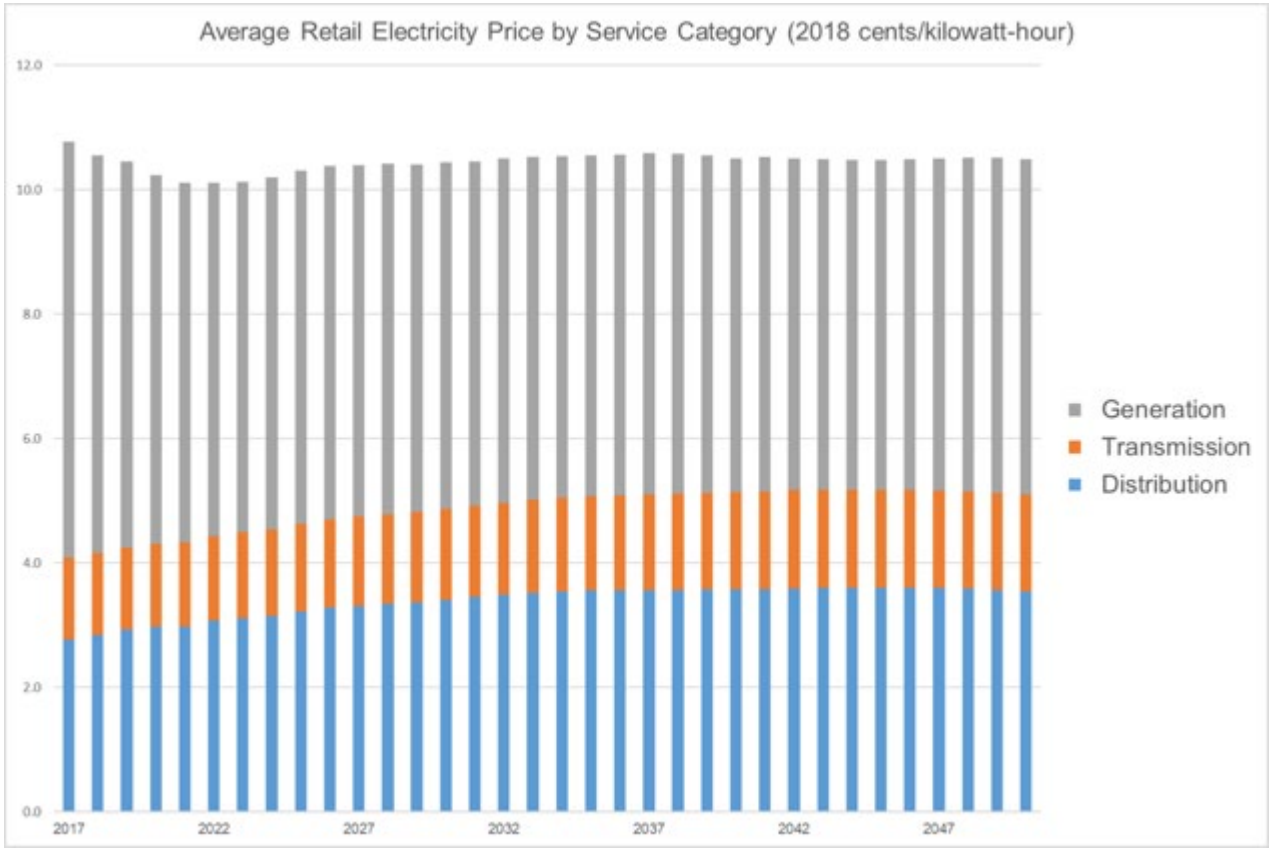
Note: Estimated pre-tax retail prices

Distribution System Costs are Rising Steadily



Source: U.S. Energy Information Administration (EIA), Federal Energy Regulatory Commission (FERC) Financial Reports, as accessed by Ventyx Velocity Suite

Distribution Share of Retail Bills is Large and Projected to Grow



2017: 25.8%

2030: 32.7%

2040: 34.0%

Data Source: EIA Annual Energy Outlook 2019

New Power Sector Realities

- Clean = cheap; pressure on legacy assets
- Information technology: new value and new risks
- Shrinking demand, rising peaks, and aging infrastructure
- The rise of distributed energy resources
- The rise of customer choices
- New natural and manmade threats


KNIGHT
WHAT DOES THE FUTURE HOLD?

2 Challenges to Regulatory and Market Paradigms

Key Points

- Traditional utility regulation is under stress due to changing industry circumstances
- Existing utility incentives and market structures may be at odds with some public interest goals
- Regulatory tools exist to help address challenges

Shortcomings of Traditional Cost of Service/Rate of Return Regulation and Rate Design

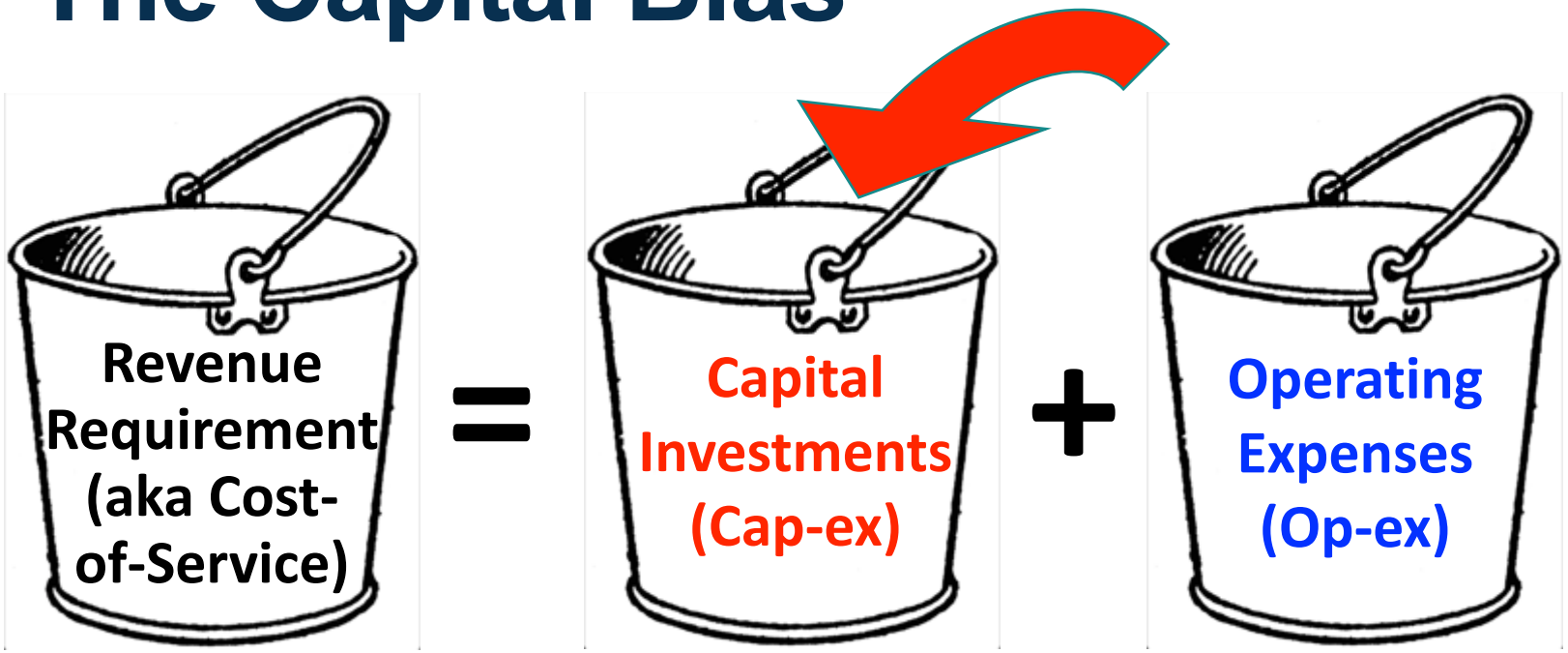
- Capital Bias (including the “Averch-Johnson Effect”)
- Throughput Incentive
- Regulatory Lag
- Regulatory Capture
- Challenges to Markets / Market Structures

Averch-Johnson effect

The tendency to over-invest capital to increase profit

- Results from revenue requirement calculation
- Bias for capital investments over other possible solutions
- “Gold plating”

Utility Revenue Requirement: "The Capital Bias"



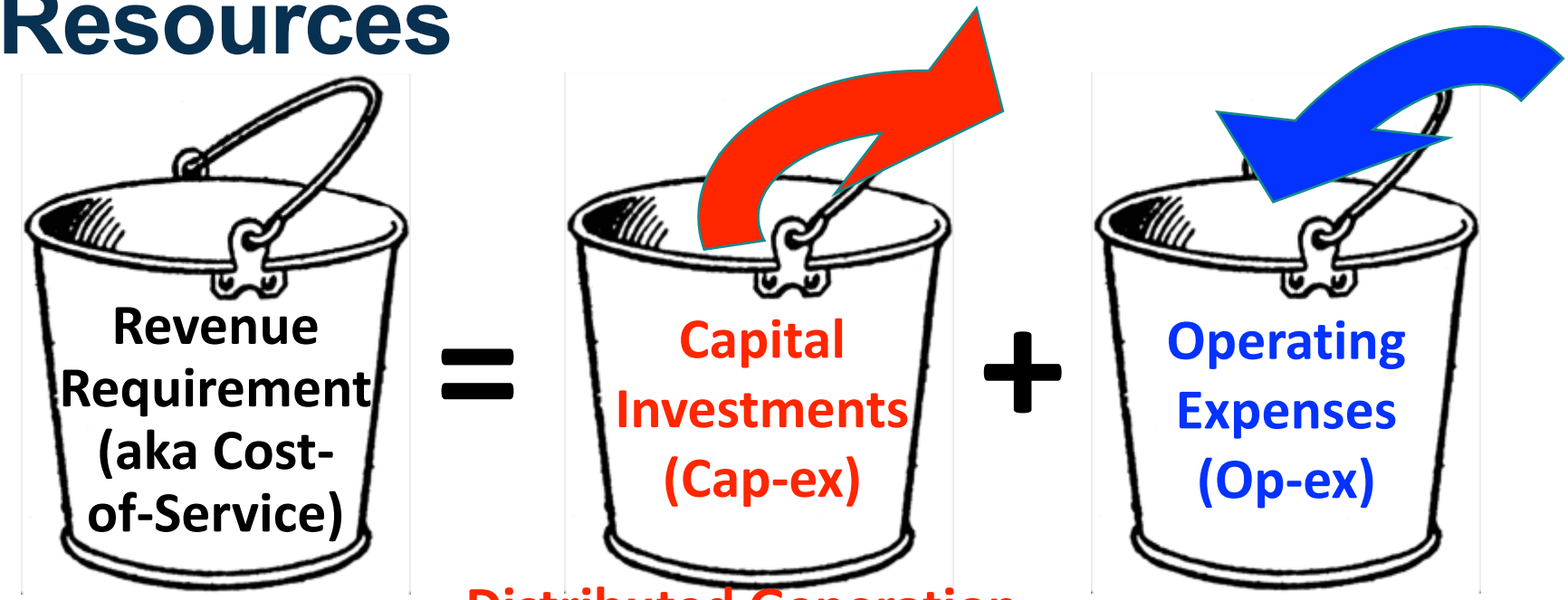
"Rate Base" x Rate-of-Return
(Interest on Shareholders' "Loan")

$1 x 10% = $1.10

Pass-Through,
No Rate-of-Return

$1 = $1

Utility Revenue Requirement: Discourages Distributed Energy Resources



Both reduce kWh sales => raises rates

Distributed Generation = less need for cap-ex = lower earnings

Energy Efficiency = more op-ex & less need for cap-ex

Throughput incentive

Increased sales lead to increased utility profit

- True when load is served with existing facilities, thus costs are fixed
- Creates incentive to resist measures that reduce sales

Is something wrong with the throughput incentive?

- Many reasons why utility sales might go up or down, but what should the utility motivation be?

Our current model: Sales ↑ Revenue ↑ …. Sales ↓ Revenue ↓

- Public interest appears to be in conflict with throughput incentive
  - Energy Efficiency (EE), Distributed Generation (DG), other policies reduce sales
- Also, may not be a sustainable business model in a world of flat or declining load

Regulatory Lag

- Time between when utility costs change and the point when customer rates change
  - Utility concern that higher costs wait until after a rate case. Earned return < allowed return
  - Some consumer advocates may favor lag to keep costs from hitting rates
  - Often means there are reconciliation mechanisms in place, which have their own issues
- In today's environment, regulatory lag may inhibit ability of utilities and commissions to respond to technological innovation and capture opportunities for customers

Regulatory Capture

- Elected Commissions
  - Only the utilities have a large vested interest in the outcome.
    - One approach (AZ): Campaign contribution limits
- Appointed Commissions
  - Utilities have undue influence over Governor
    - Other interests need to focus effort
- Can manifest in different ways, important to keep antennae up for utility attempts

Ratemaking Outside of Rate Cases: Examples of Tariff Riders

- Fuel Cost Adjustments
- Infrastructure Cost Recovery
- Energy Efficiency Programs
- Decoupling
- Performance Incentive Mechanisms
- City Fees
- State Tax

Tariff Riders: Fuel and Purchased Power

- Complex mechanisms, tracking a wide variety of costs
  - Fuel cost; short term purchased power, all purchased power, all power costs
- Dollar-for-dollar vs. formulaic flow-through to rates
- Criticized for removing incentive for utilities to contain fuel costs

Tariff Riders: Infrastructure Cost Recovery

- Older transmission & distribution (T&D) assets wear out, new ones cost more
- No new revenue to go with the new cost
- Can lead a Commission to approve a tracker for new investment in infrastructure between rate cases
- What types of infrastructure investments make sense for a rider?

What's wrong with infrastructure recovery mechanisms?

- Investments that rise in price flow through to rates immediately
  - E.g., grid modernization costs
- Investments and other costs that decline in price do not
  - E.g., cost reductions due to improved outage identification and prevention, lower line losses, lower billing costs, and lower peak demand
- "Single Issue Ratemaking"

Benefit Charges for Cost-Effective Energy Efficiency

- System Benefit Charge – dedicated funding source for cost-effective EE
- All electric consumers eligible to participate
- Utility allowed to recover all expenditures for EE
- Helps address EE market failure

Evolution of Wholesale Markets

Markets in the past

- Dominated by large, inflexible central station power plants
- Few wind and solar generators
- Predictable demand
- Excessive operating reserves

Markets in the future

- Low cost natural gas
- Near-zero energy cost of renewables
- State policy goals around clean energy
- Non-discriminatory access to markets
- Need for flexibility

Wholesale Price Effects of 40-50% Wind & Solar

(Wind: 30% wind & 10+% solar | Balanced: 20% wind & 20% solar | Solar: 30% solar & 10+% wind)

For more info, see: http://eta-publications.lbl.gov/sites/default/files/report_pdf_0.pdf and http://eta-publications.lbl.gov/sites/default/files/presentation_pdf.pdf

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Impacts in 2030 relative to baseline with 2016 wind & solar shares	Southwest Power Pool 2016: 18% wind & 0% solar			NYISO (New York) 2016: 3% wind & 1% solar			CAISO (California) 2016: 7% wind & 14% solar			ERCOT (Texas) 2016: 16% wind & 1% solar		
	Wind	Balanced	Solar	Wind	Balanced	Solar	Wind	Balanced	Solar	Wind	Balanced	Solar
Lower Average Prices [$/MWh]	-19%	-21%	-27%	-37%	-38%	-39%	-25%	-23%	-27%	-25%	-17%	-15%

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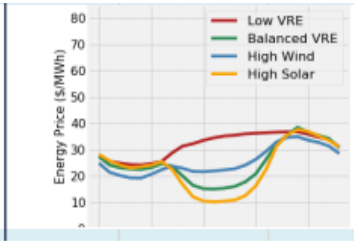

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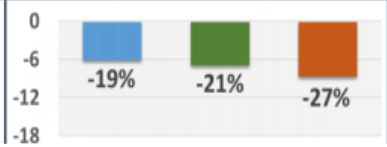
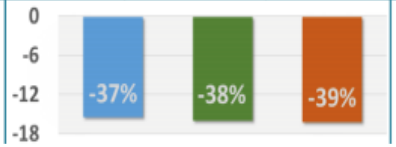
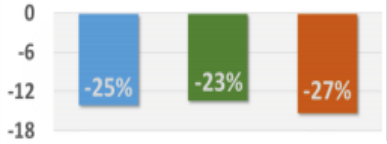
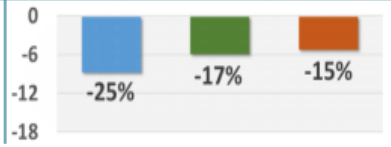
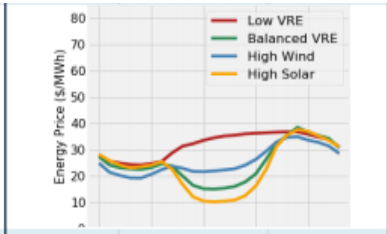
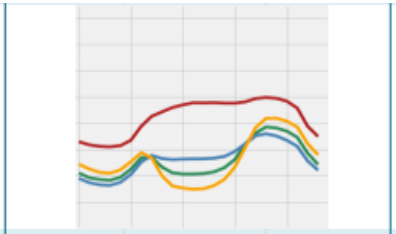
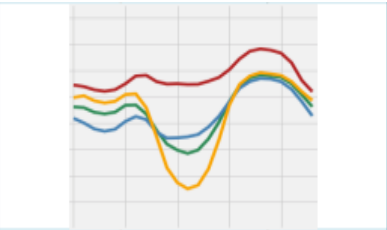
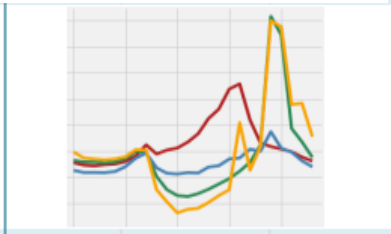
Lower Average Prices [$/MWh]												
Changes in Diurnal Price Profile red baseline shows 2016 wind & solar shares												
More Price Variability	1.8x	2.1x	2.5x	2.1x	2.3x	2.5x	3.0x	2.9x	3.4x	1x	4.7x	6.6x

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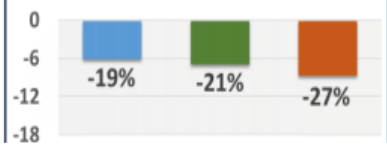
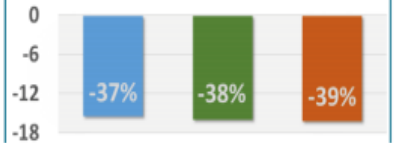
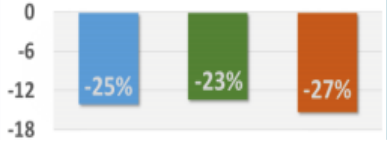
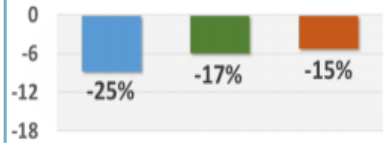
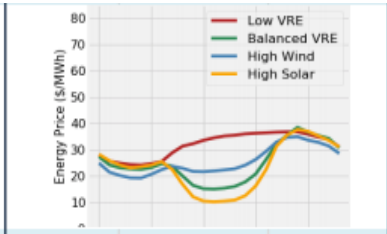
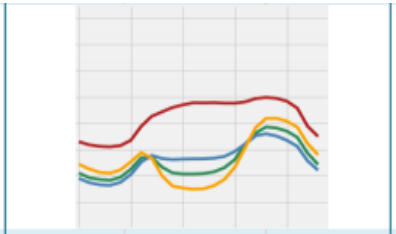
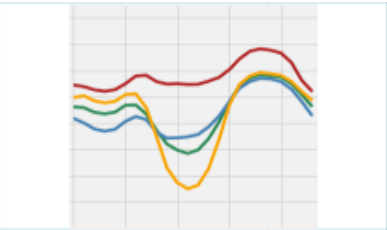
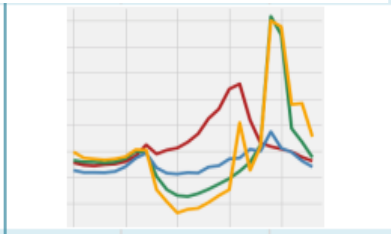
Lower Average Prices [$/MWh]												
Changes in Diurnal Price Profile red baseline shows 2016 wind & solar shares												
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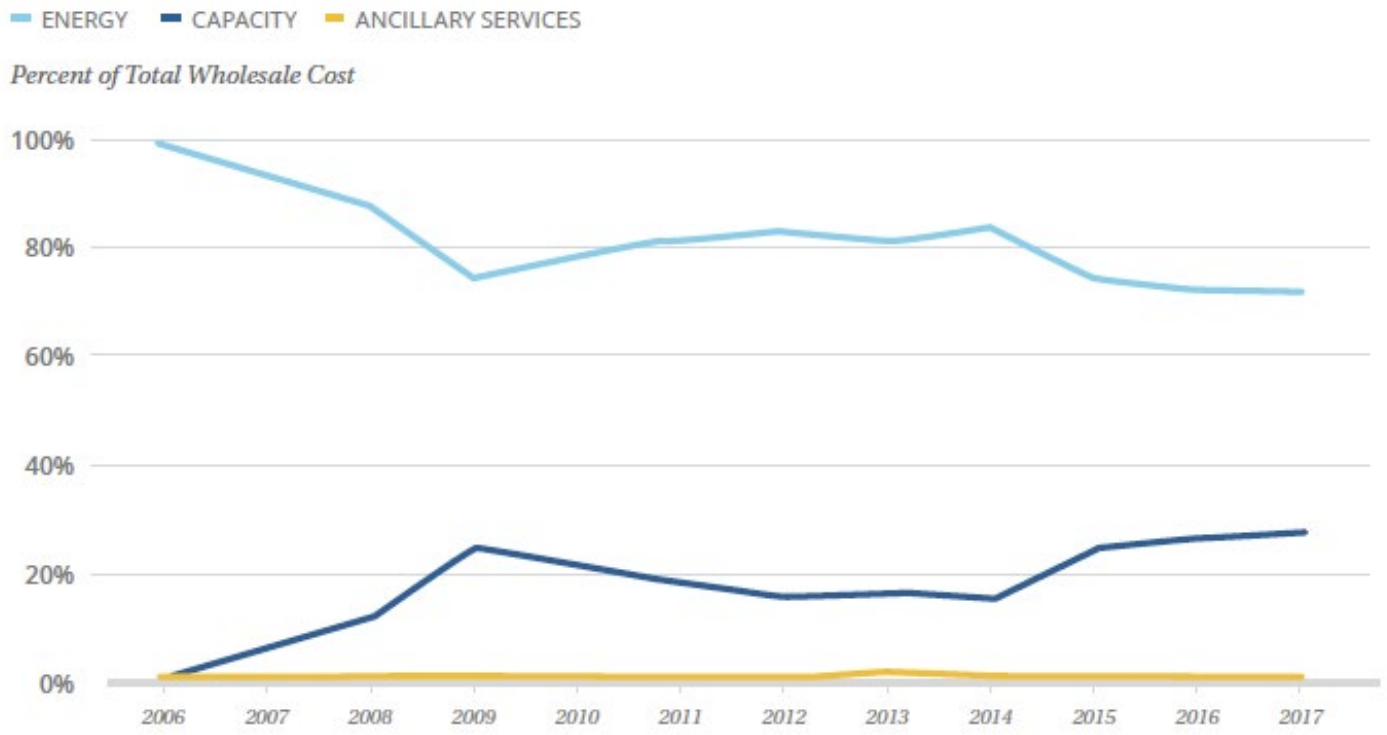
Change in Timing of Top Net-Load Hours	Shift from 4pm to 7pm			Shift from 3pm to 5-7pm			No further shift 7pm			Shift from 3pm to 6-8pm		

For more info, see: http://eta-publications.lbl.gov/sites/default/files/report_pdf_0.pdf and http://eta-publications.lbl.gov/sites/default/files/presentation_pdf.pdf

Challenges with Capacity Markets

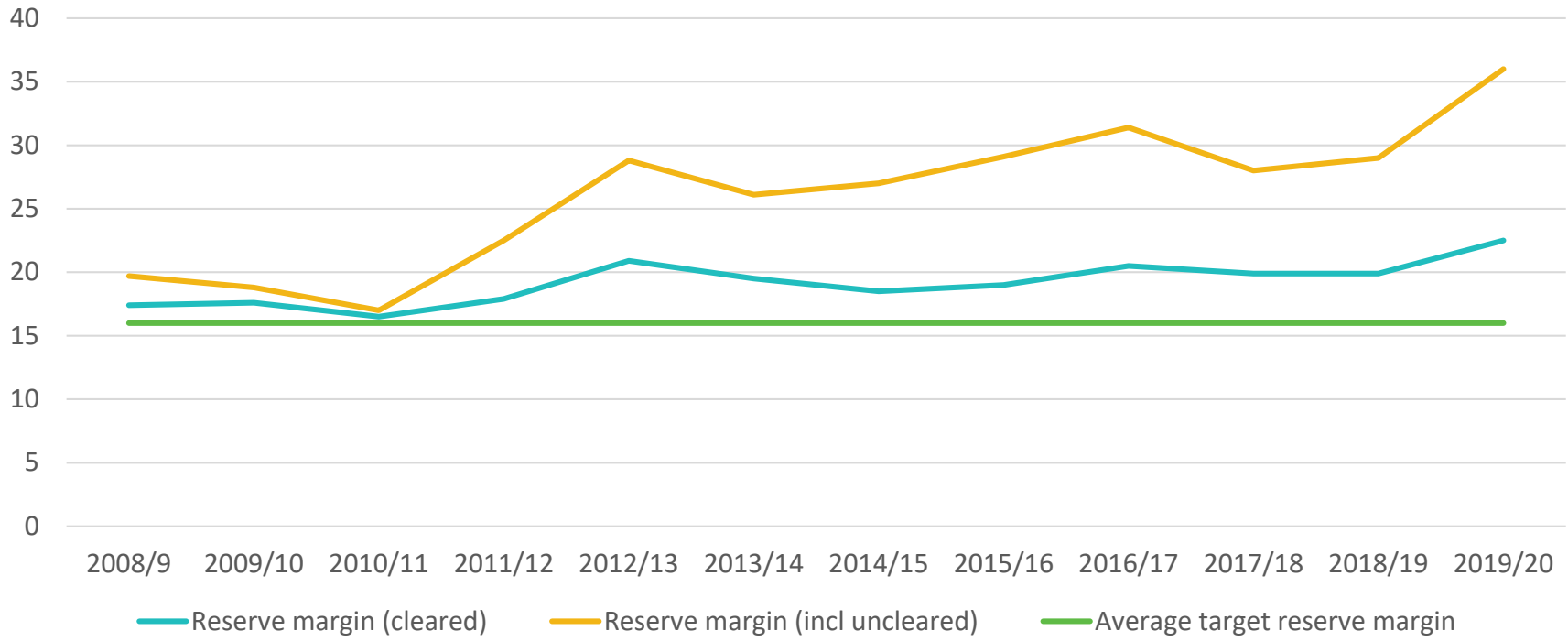
Energy, capacity and ancillary services as shares of total PJM market revenues



Data from PJM, 2017. Image from Goggin, et al, "Customer Focused and Clean: Power Markets for the Future. Wind Solar Alliance. November 2018.

Challenges with Capacity Markets

PJM Reserve Margin Expansion since adoption of capacity market



Source: PJM data, compiled by J. Chen, Nicholas Institute for Environmental Policy Solutions, Duke University.

Preview of tools we will discuss today

- Rate design
- Resource Planning and Distribution System Planning
- Decoupling
- Performance-based Regulation
- Competition

Questions to Consider

- What are the most relevant trends and challenges shaping the electricity sector in South Carolina?
- How do existing regulatory structures need to adapt? What new regulatory structures are needed?
- What can regulators do to put accurate, actionable information/data about energy use into the hands of energy users?
- What opportunities does the PSC have to provide expert opinions and advice on the future of energy policy in South Carolina?
- How can the PSC harness the knowledge of stakeholders to address some of the challenges and changes?