Vermont Power Sector Update

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Topics

- Orientation of regulated entities and policies
- Regional markets and transmission
- Vermont’s electric system and trends
- Implications for system costs and ratepayer impacts

Regulated Entities and Policies

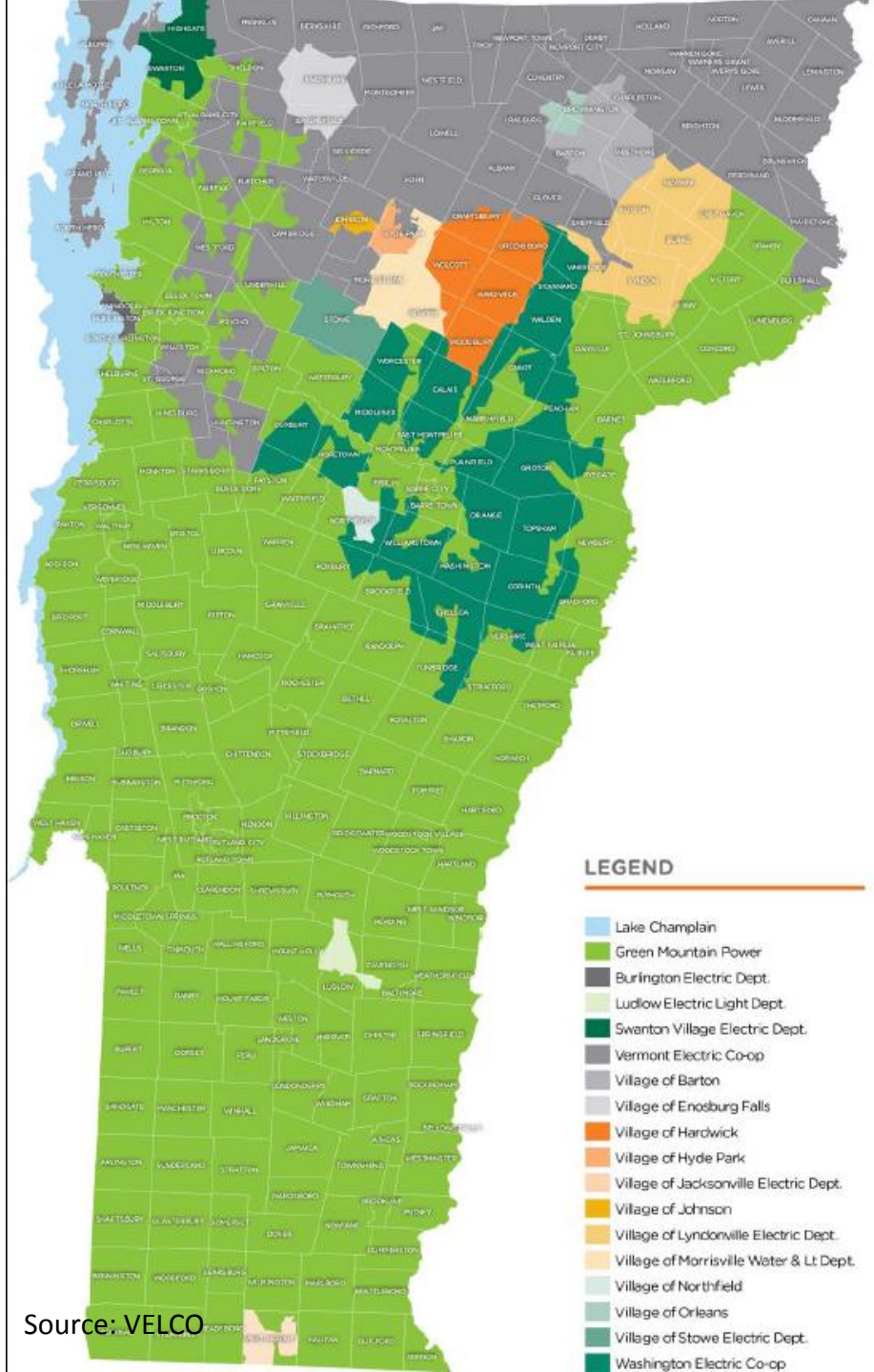
Who is the Public Service Department?

The Public Service Department = represents the interests of the people of the state as a whole

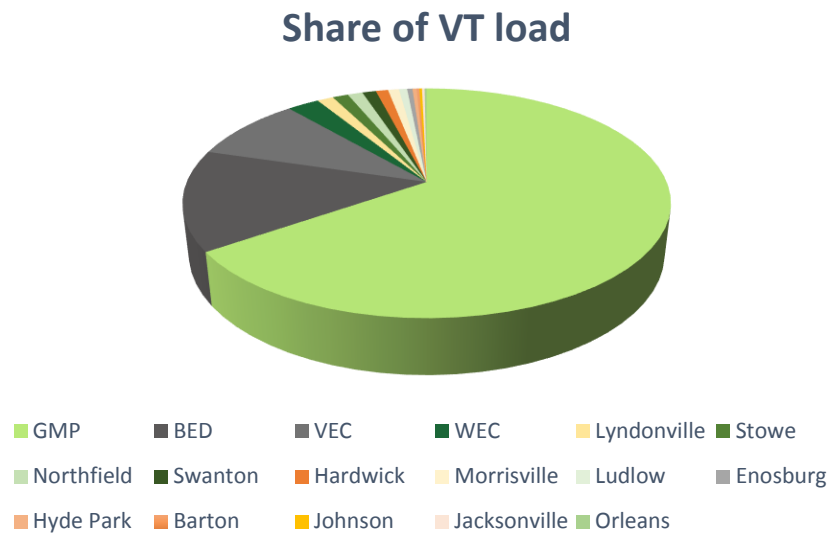
- Represents public interest in utility cases
- Provides long-range planning for the state's energy and telecom needs
- Ensures all Vermonters share in the benefits of modern communications
- Administers federal energy programs
- Resolves utility customer complaints
- Informs public about utility-related matters
- Makes and administers power purchase contracts

Commissioner June E. Tierney

http://publicservice.vermont.gov/



Source: VELCO



Vermont Electric Utilities

- 1 IOU (serving ¾ of VT load or 260,000 customers)
- 2 Coops
- 14 Municipals
- 1 transmission utility (VELCO)

Vermont Renewable Deployment

- 300 MW Solar PV
- 150 MW Wind
- 200 MW In-State Hydro
- 70 MW Biomass
- 8 MW Landfill Gas
- 5 MW Methane Digesters

1000 MW Peak

Energy Efficiency Utilities

- Efficiency Vermont (EVT)
- City of Burlington Electric Department
- Vermont Gas Systems

- Funding source and Responsibilities
  - Responsible for reducing electric and thermal usage
  - Funded by energy efficiency charge on customers' bills

State energy policy

30 V.S.A. § 202a

It is the general policy of the State of Vermont:

(1) To assure, to the greatest extent practicable, that Vermont can meet its energy service needs in a manner that is adequate, reliable, secure, and sustainable; that assures affordability and encourages the State's economic vitality, the efficient use of energy resources, and cost-effective demand-side management; and that is environmentally sound.

(2) To identify and evaluate, on an ongoing basis, resources that will meet Vermont's energy service needs in accordance with the principles of least-cost integrated planning; including efficiency, conservation and load management alternatives, wise use of renewable resources, and environmentally sound energy supply.

Requirements in Statute

Renewable Energy Standard (30 V.S.A. § 8005)

- Total renewable energy (55% growing to 75%)
  - Any size/vintage renewable resource, contract and attribute-based system provided it delivers into New England
- Distributed generation (1% to 10%, carve-out of Tier 1)
  - Under 5 MW, commissioned after 6/30/15, connected to VT distribution
- Energy transformation (2% to 12%, not a carve-out)
  - Fossil fuel reduction

Standard Offer Program (30 V.S.A. § 8005a)

- Long-term contracts for resources 2.2 MW or less, up to 127.5 MW

Net Metering (30 V.S.A. § 8010)

- Compensation based on residential rate with adjustors for siting and RECs

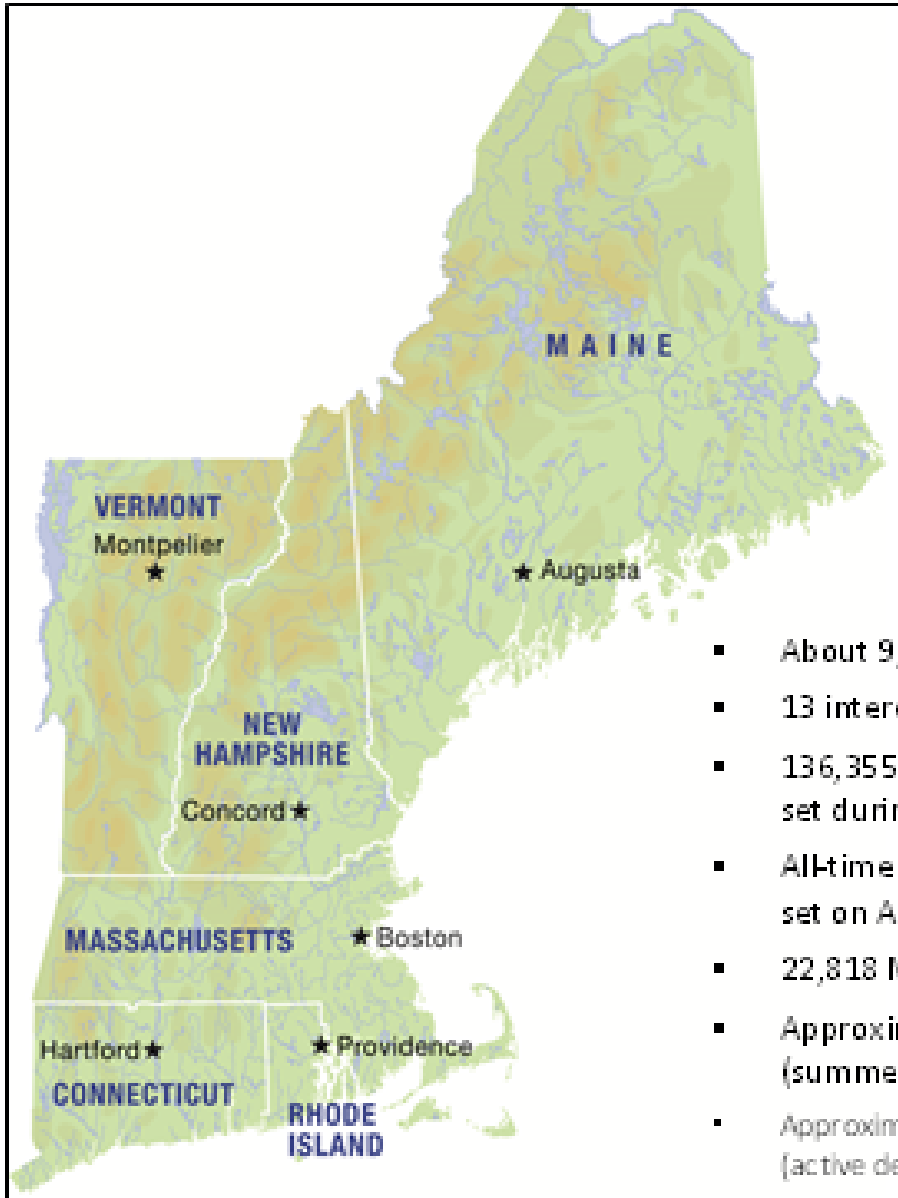
Goals in Statute

- Meet energy needs in a reliable, secure, sustainable, and affordable manner. (30 V.S.A. § 202a)
- Renewable policies that promote economic benefit, efficient use of resources, stable prices, market development, air and water quality, grid stability, climate change mitigation, and diversity of resources. (30 V.S.A. § 8001)
- 25% renewable by 2025. (10 V.S.A. § 580(a))
- 50% GHG emission reduction by 2028, and 75% (if practicable) by 2050. (10 V.S.A. § 578(a))
- Building efficiency – weatherize 25% of housing stock by 2025. (10 VSA. § 581)

Regional Context:
Vermont as a part of ISO New England

ISO New England

- Regulated by the Federal Energy Regulatory Commission
- Responsible for:
  - Designing and implementing wholesale electricity markets
    - Day-ahead and Real-time Energy Markets, Forward Capacity Market, Ancillary Services
  - Operating the New England transmission system
    - VELCO owns but operation is under the direction of ISO-NE
  - Power system planning to meet federal reliability standards

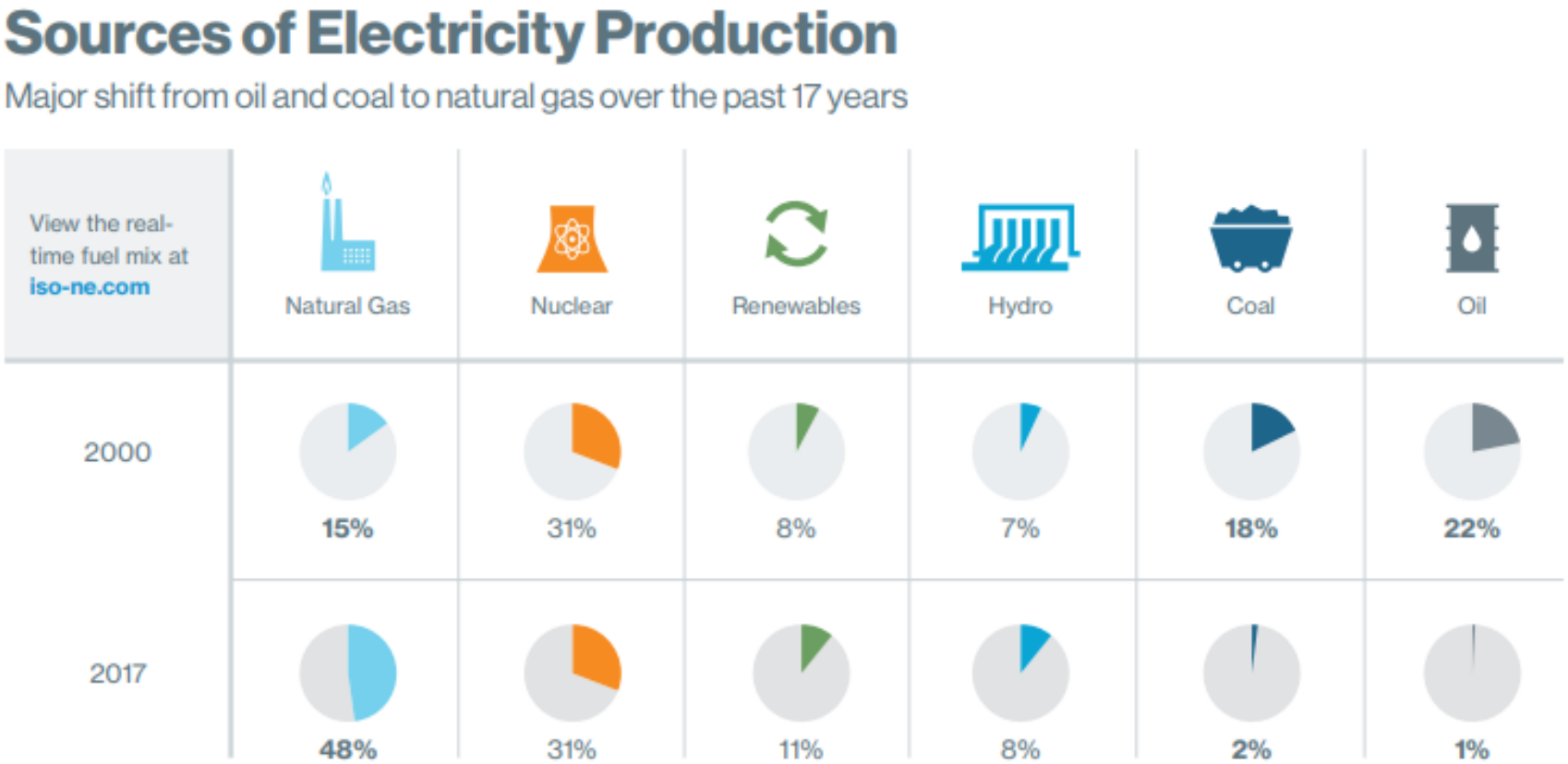


- 7.1 million households and businesses; population 14.7 million
- More than 1,500 generating resources:
  - Approximately 340 resources modeled in the Energy Management System
  - More than 1,200 settlement-only generating resources
  - More than 100,000 grid-connected and behind-the-meter solar PV installations
- Approximately 400 participants in the marketplace (those who generate, buy, sell, transport, and use wholesale electricity and implement demand resources)
- About 9,000 miles of transmission lines
- 13 interconnections to electricity systems in New York and Canada
- 136,355 gigawatt-hours (GWh), all-time annual energy served, set during 2005
- All-time peak demand of 28,130 megawatts (MW), set on August 2, 2006
- 22,818 MW all-time winter peak demand, set on January 15, 2004
- Approximately 30,500 MW of total generating capability for 2017 (summer seasonal claimed capability; SSCC)
- Approximately 2,800 MW of demand resources for 2017 (active demand response and energy efficiency)
- Market value in 2016—$5.4 billion total; $4.1 billion energy market; $1.2 billion capacity market; $0.1 billion ancillary services market
- Approximately $8.35 billion in transmission investment since 2002; approximately $4.0 billion planned

Source: ISO-NE Regional System Plan 2017

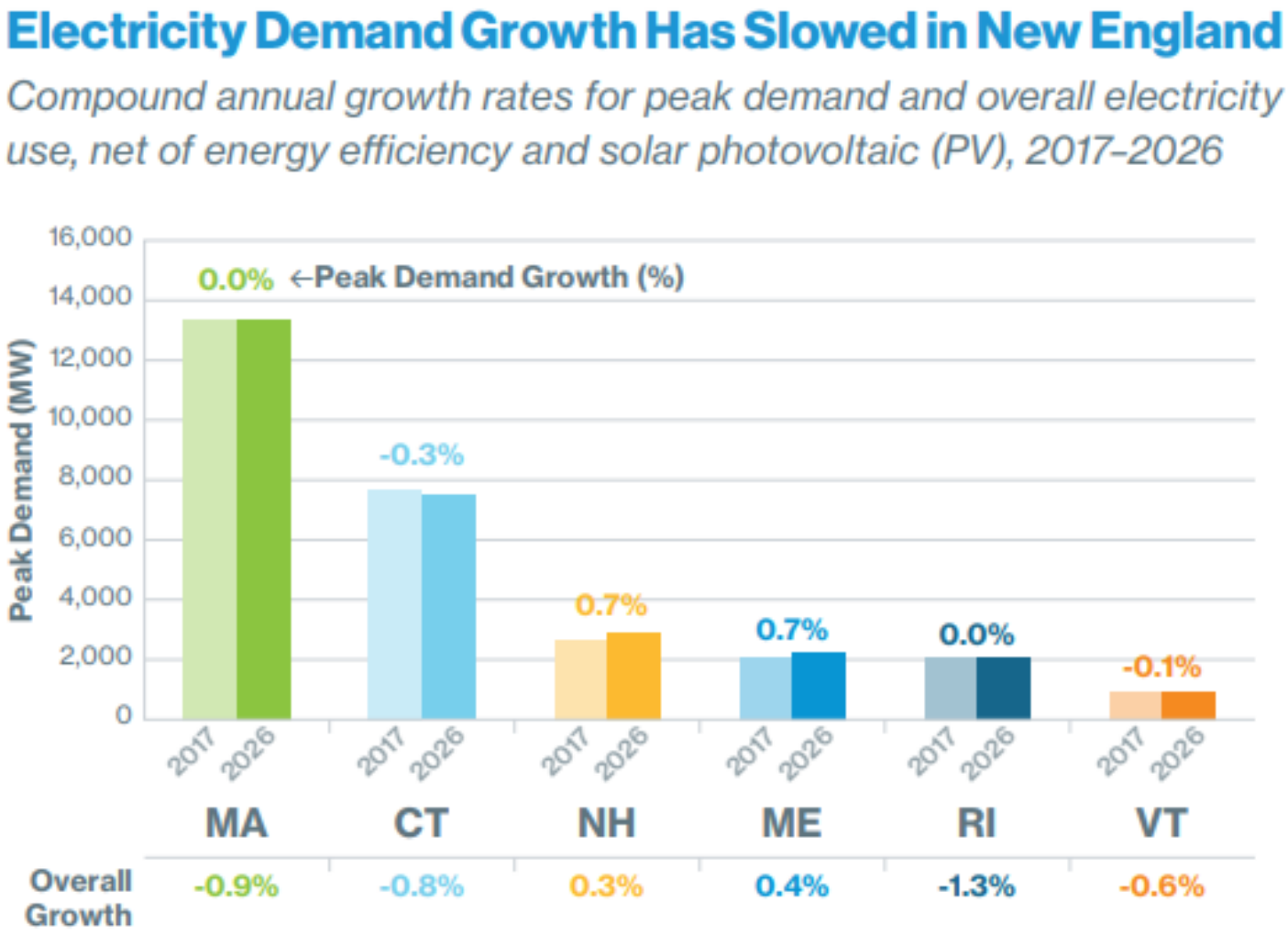
https://www.iso-ne.com/system-planning/system-plans-studies/rsp

Source of New England production cleaner with natural gas and renewables



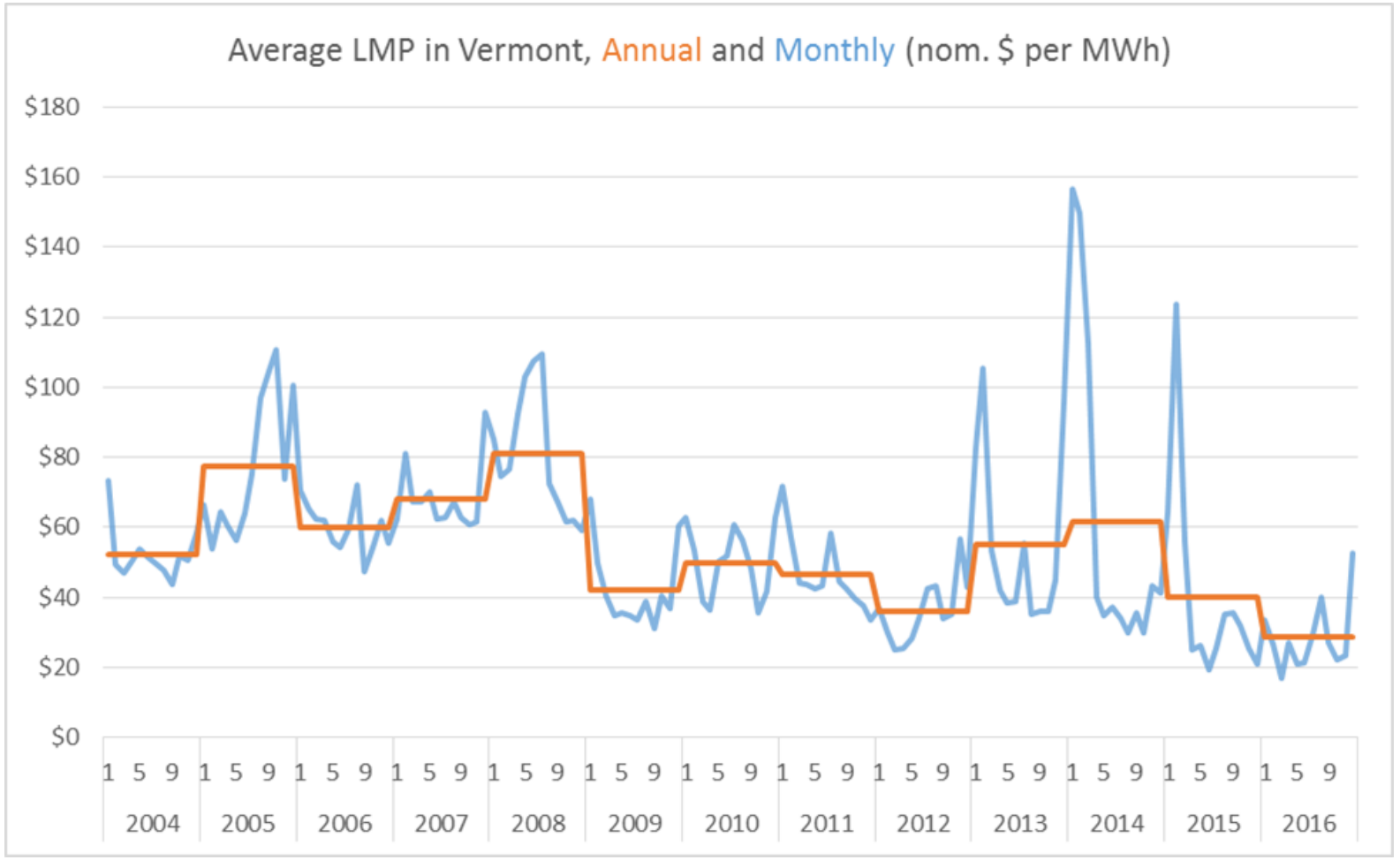
Source: ISO-NE
https://www.iso-ne.com/static-assets/documents/2018/02/ne_power_grid_2017_2018_regional_profile.pdf

Regional declining loads and peak



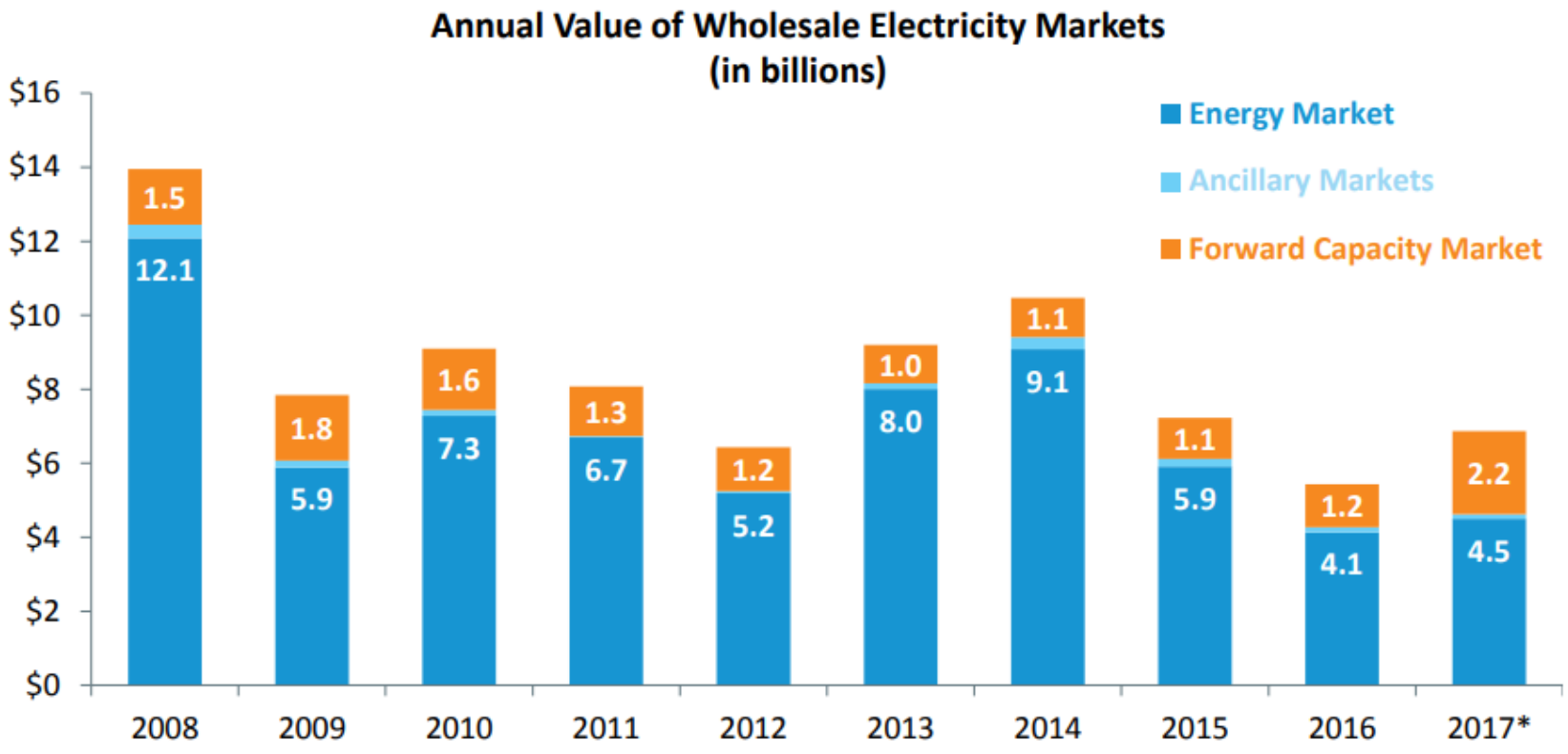
Source: ISO-NE

New England Wholesale Prices Spike in Winter



Source: VT PSD

New England regional market price has been declining



Source: 2016 Report of the Consumer Liaison Group; *2017 data is preliminary and subject to resettlement
Note: Forward Capacity Market values shown are based on auctions held roughly three years prior to each calendar year.

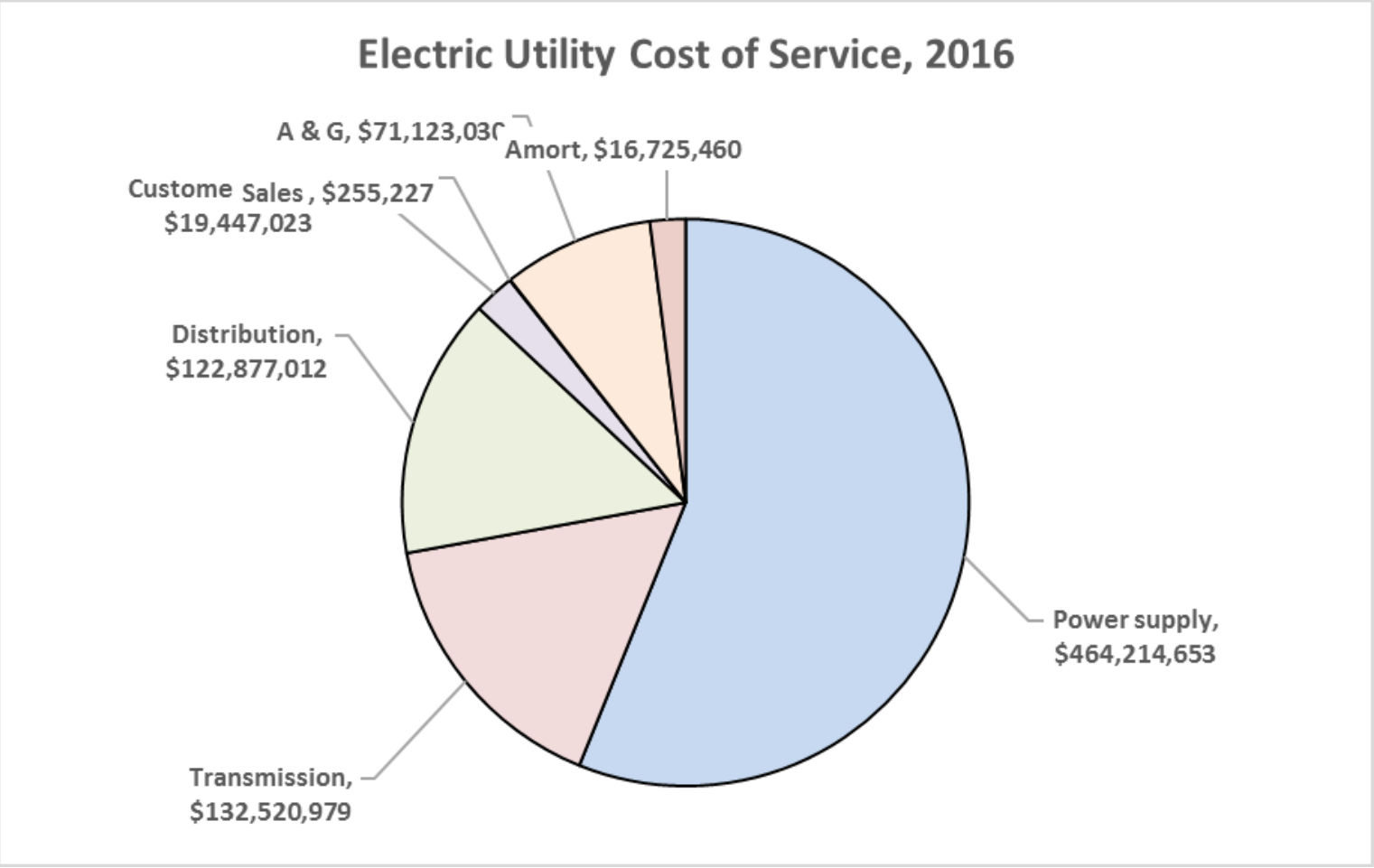
https://www.iso-ne.com/static-assets/documents/2017/01/20170130_stateofgrid2017_presentation_pr.pdf

Vermont utilities are hedged for generation

- ~ 20% of generation from owned units
- Long term contracts
  - System power contracts (e.g., HQ)
  - Unit contingent contracts (mostly weather contingent like wind and solar)
- Standard offer contracts and net metering

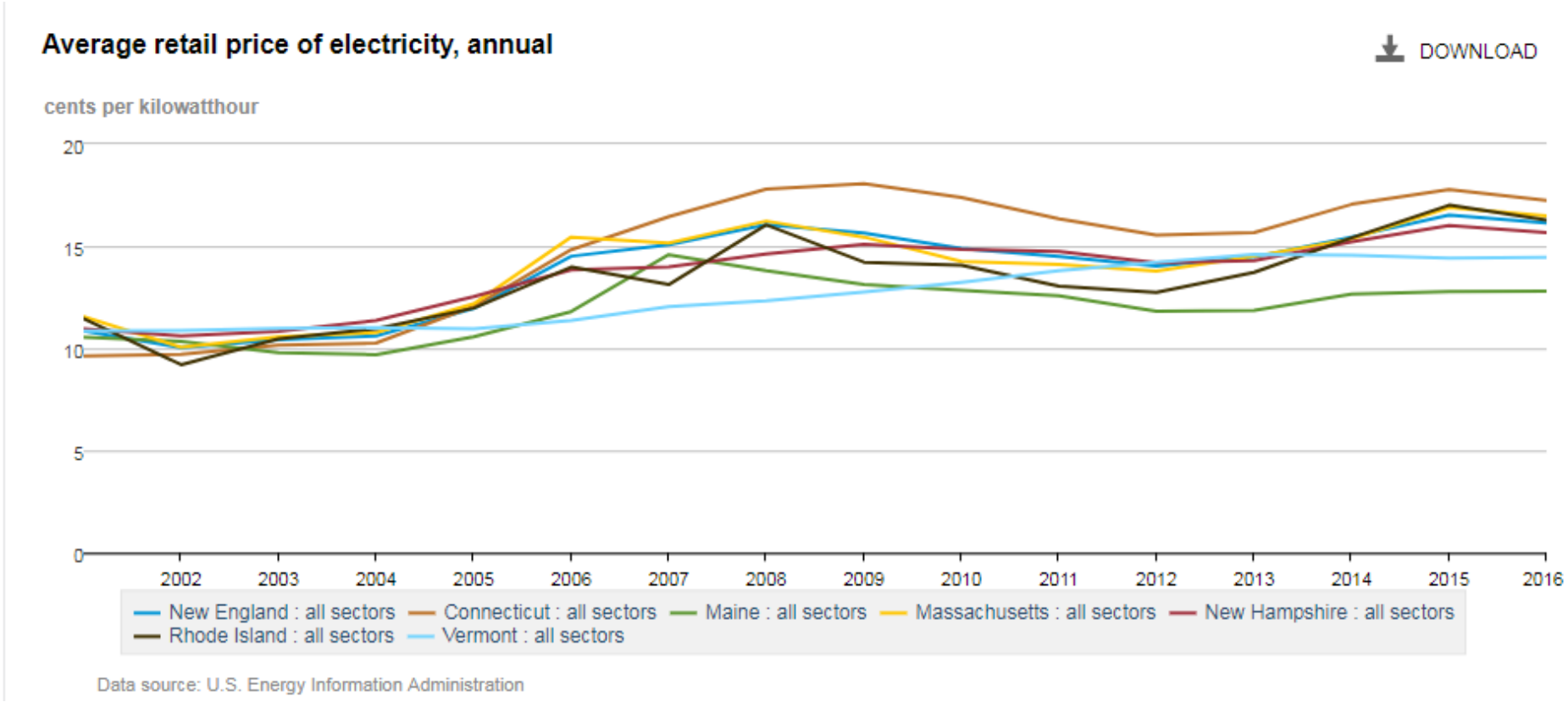
Vermont Electric Prices

Many factors go into customers' electric bills



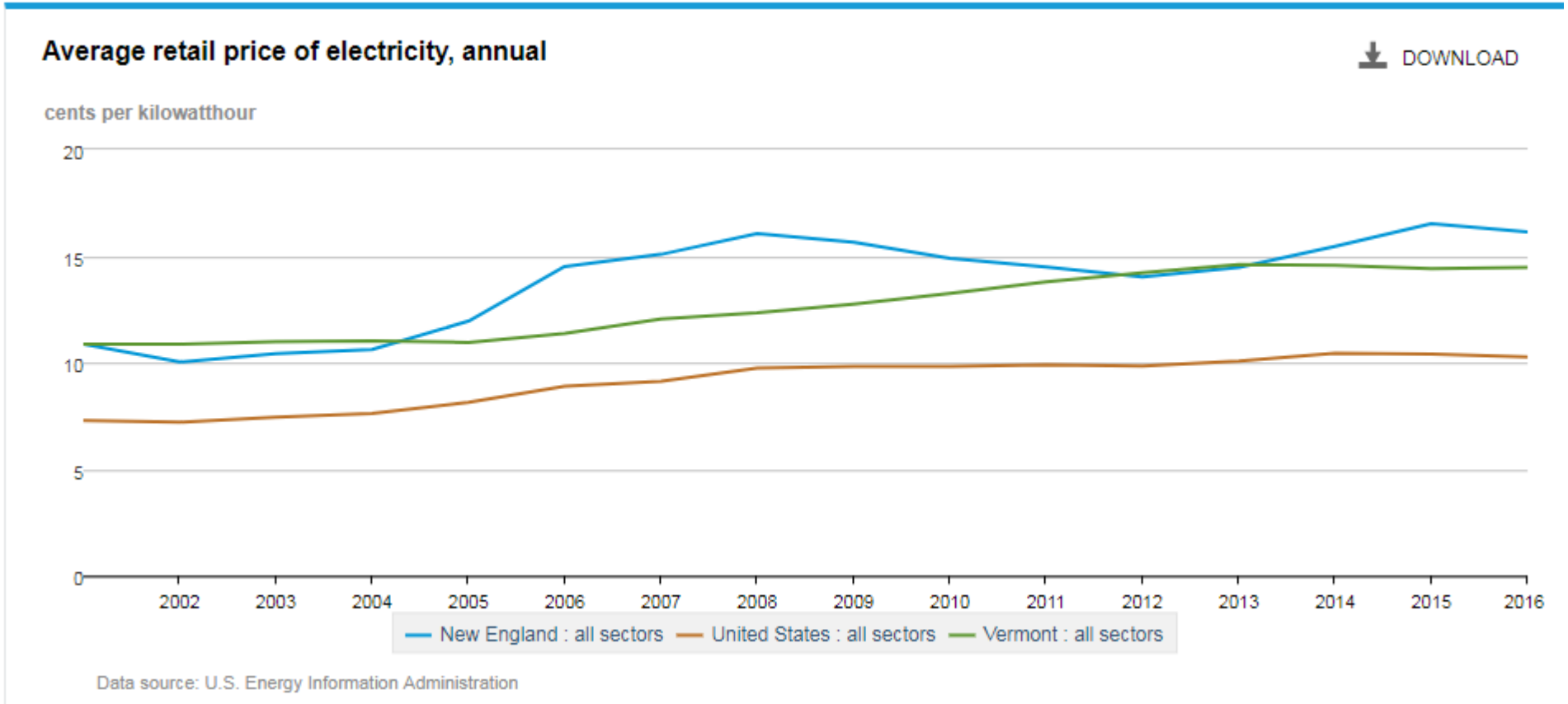
Source: VT PSD

Vermont retail prices are currently low relative to other states in the region, save Maine



Source: EIA.GOV

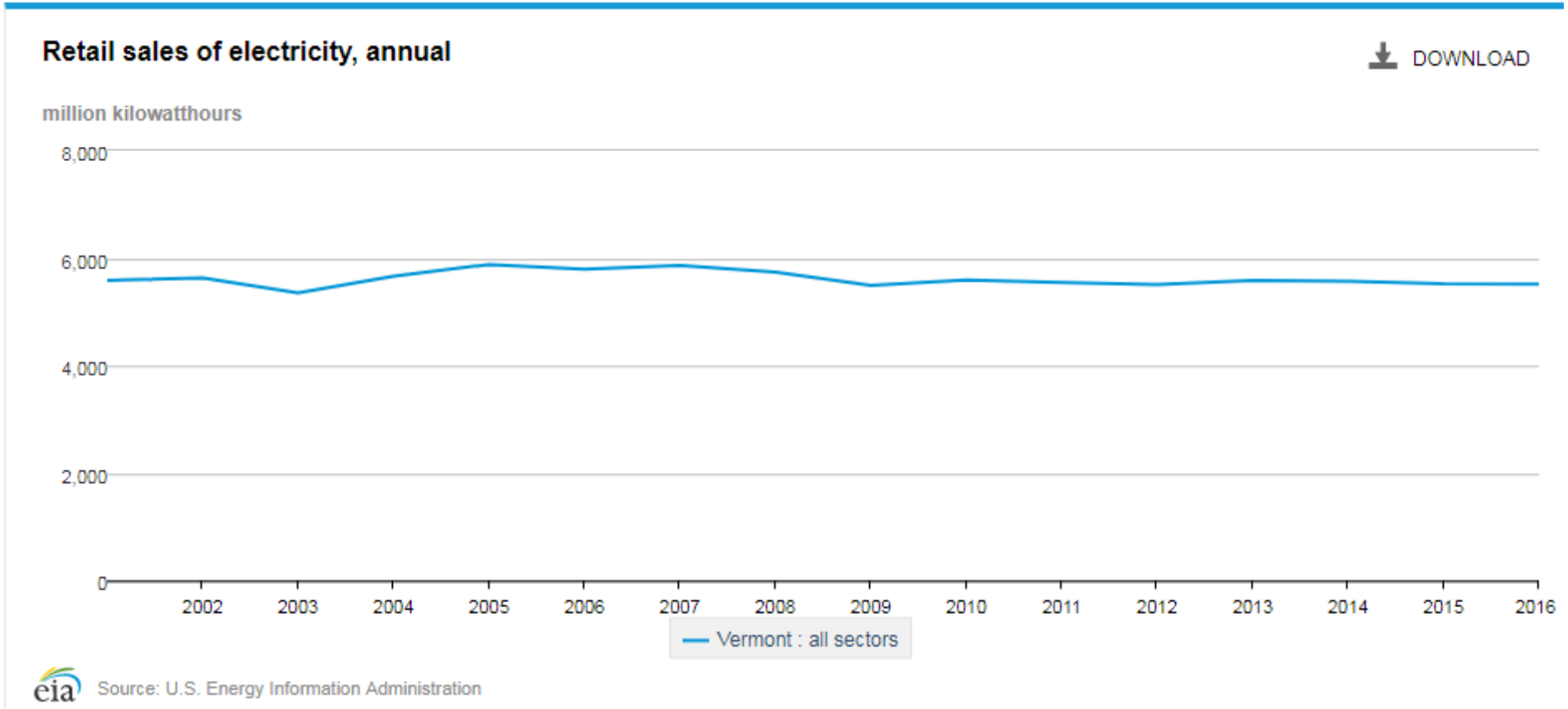
Electricity prices in Vermont are below the region but well above national



Source: EIA.GOV

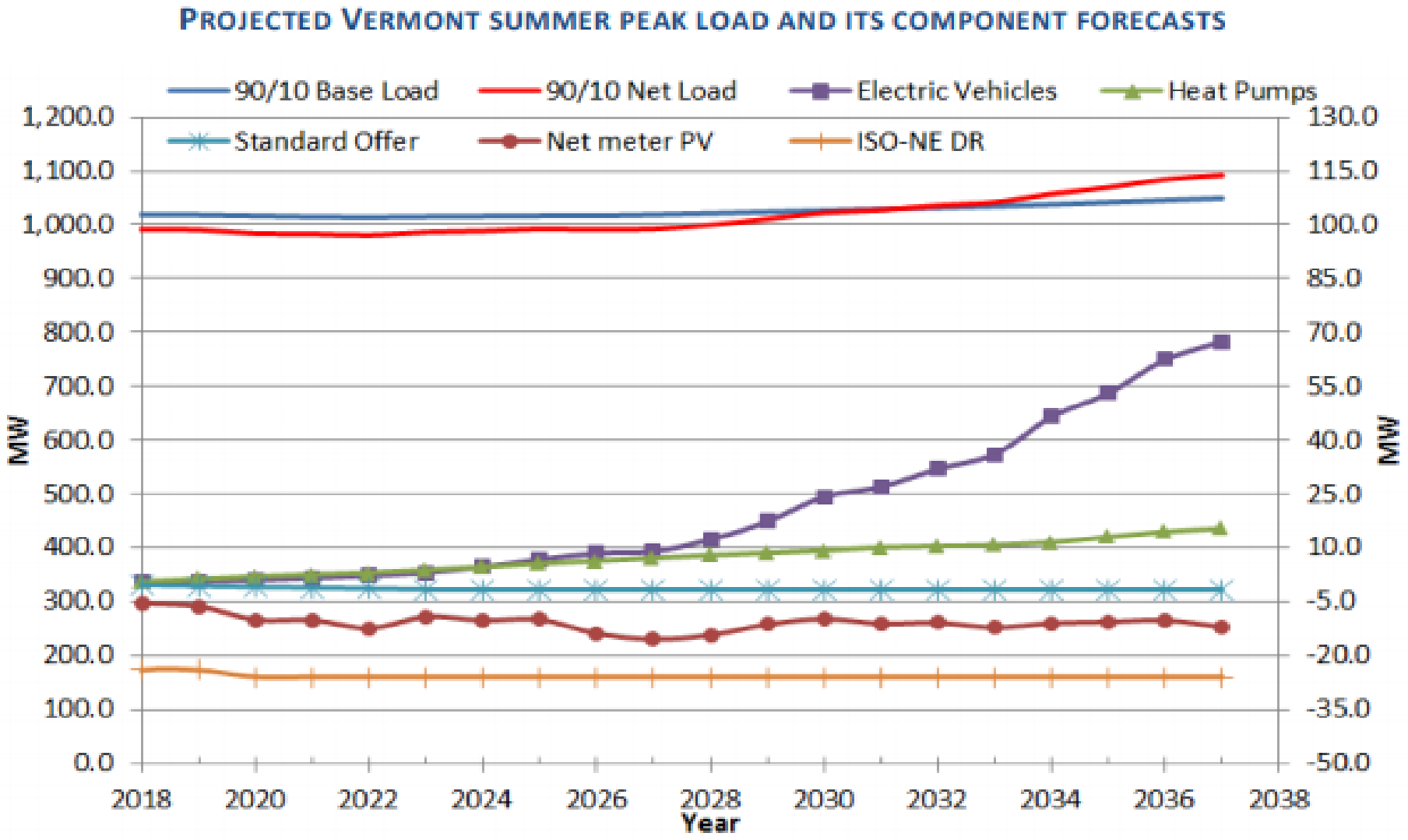
Vermont kWh Sales

Retail sales in Vermont have been flat to declining since 2005…, sales in 2016 below 2001



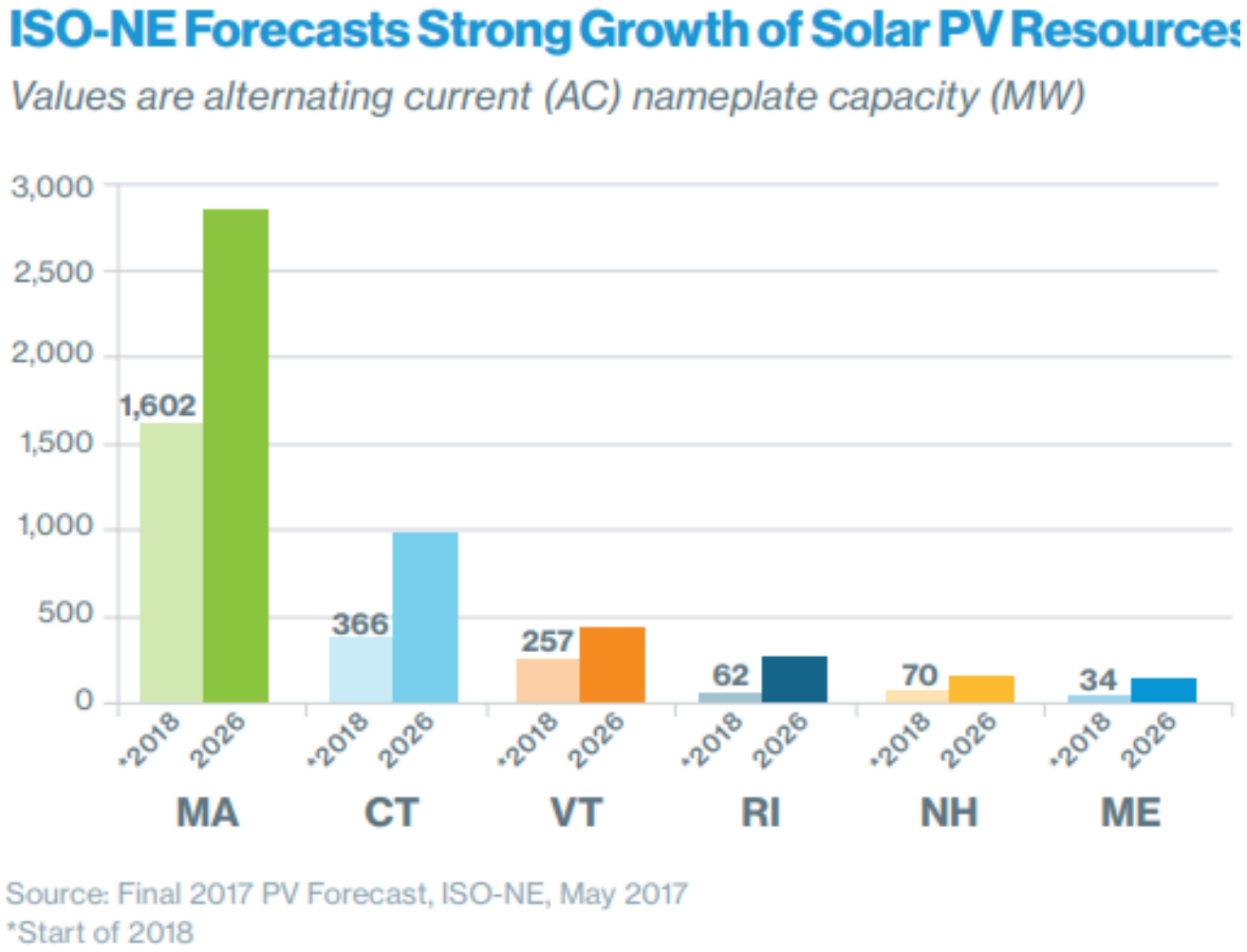
Source:
EIA.GOV

Forecast is for continued flat and below historic levels



Source: VELCO, Draft Long Range Transmission Plan https://www.vermontspc.com/library/document/download/6059/2018Plan_draaft_toVSPC.pdf

Vermont has developed more solar than New Hampshire, Rhode Island and Maine combined



Source: ISO-NE, https://www.iso-ne.com/static-assets/documents/2018/02/ne_power_grid_2017_2018_state_profile.pdf

Policy drivers of sales trends

Down

- Energy efficiency
- Net metering
- Federal appliance standards

Up

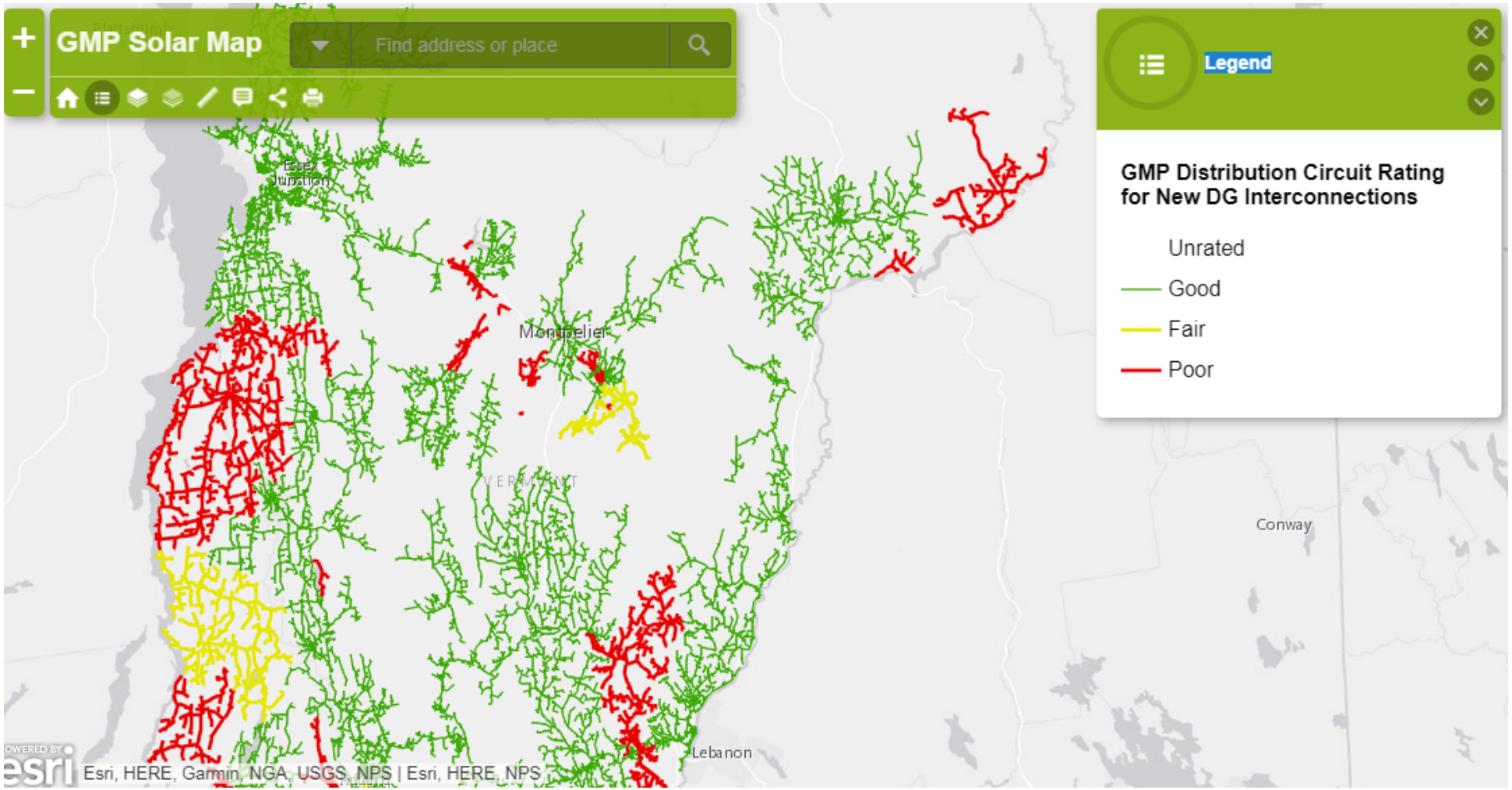
- Beneficial electrification
  - Custom projects (electrifying sugaring operations and saw mills)
  - Electric Vehicles
  - Cold Climate Heat Pumps

Moving Forward

The practical affect of some programs is that there is re-spreading of some costs…

- Average Rates ~ 15 cents/kWh
- Marginal/avoided costs/ratepayer costs/societal costs~
  - Energy 3-4 cents/kWh
  - FCM 1.5 – 2 cents/kWh
  - RNS 1.5 – 2 cents/kWh
  - Carbon at $100/ton ~ $5/MWh or ½ cent per kWh (assumes 10% regional power)
  - T&D – negligible
  - Total avoided ratepayer costs – 6-8 cents per kWh
- Margin lost on sales to be re-spread ~ 7 - 8 cents per kWh

Challenges for integrating solar looking forward…



Challenges associated with export of energy from northern Vermont …

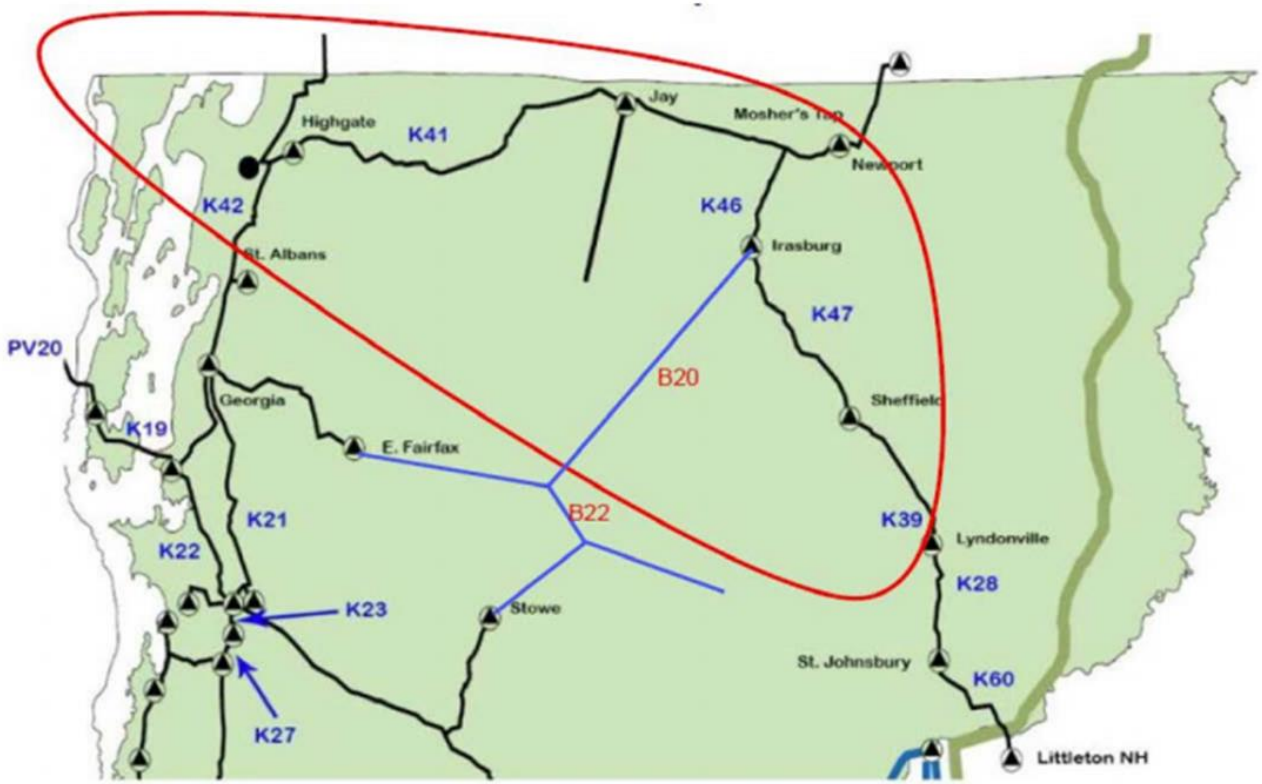


Figure 1: The Sheffield-Highgate Export Interface (SHEI)

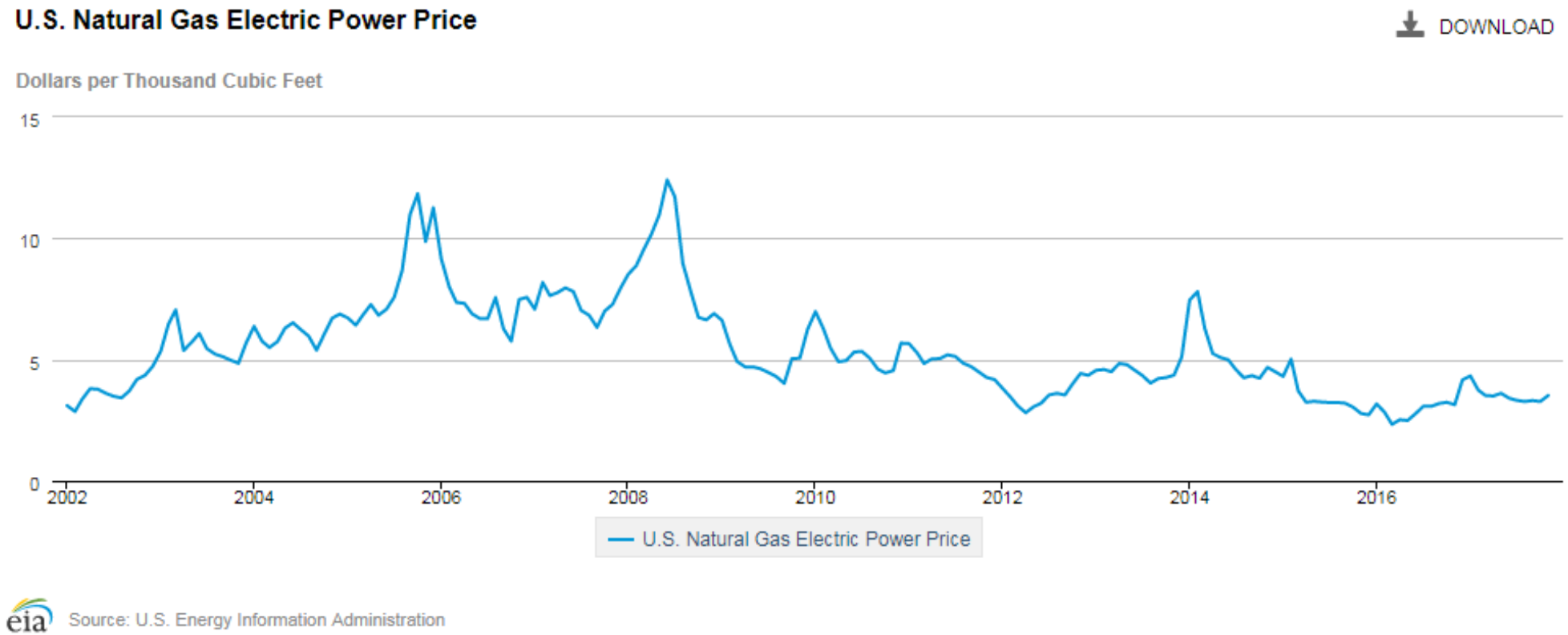
https://www.vermontspc.com/grid-planning/shei-info

System Planning is Increasing in Importance

- Vermont has several planning requirements in place:
  - Integrated Resource Plans are required of utilities
  - VELCO Long-Range Transmission Plan
  - Demand Resources Plan required of energy efficiency utilities
- Location Matters
  - Generation or energy efficiency in a constrained area provides positive value to the individual customer but likely negative value to the system (and to other customers)
  - Beneficial Electrification will have more value in a generation constrained area than elsewhere
- Need to Choreograph Load and Generation (Timing Matters)
  - Utilities electrification efforts should not increase T&D costs
  - Charging an EV after dark doesn’t help ease generation constraints caused by solar generation

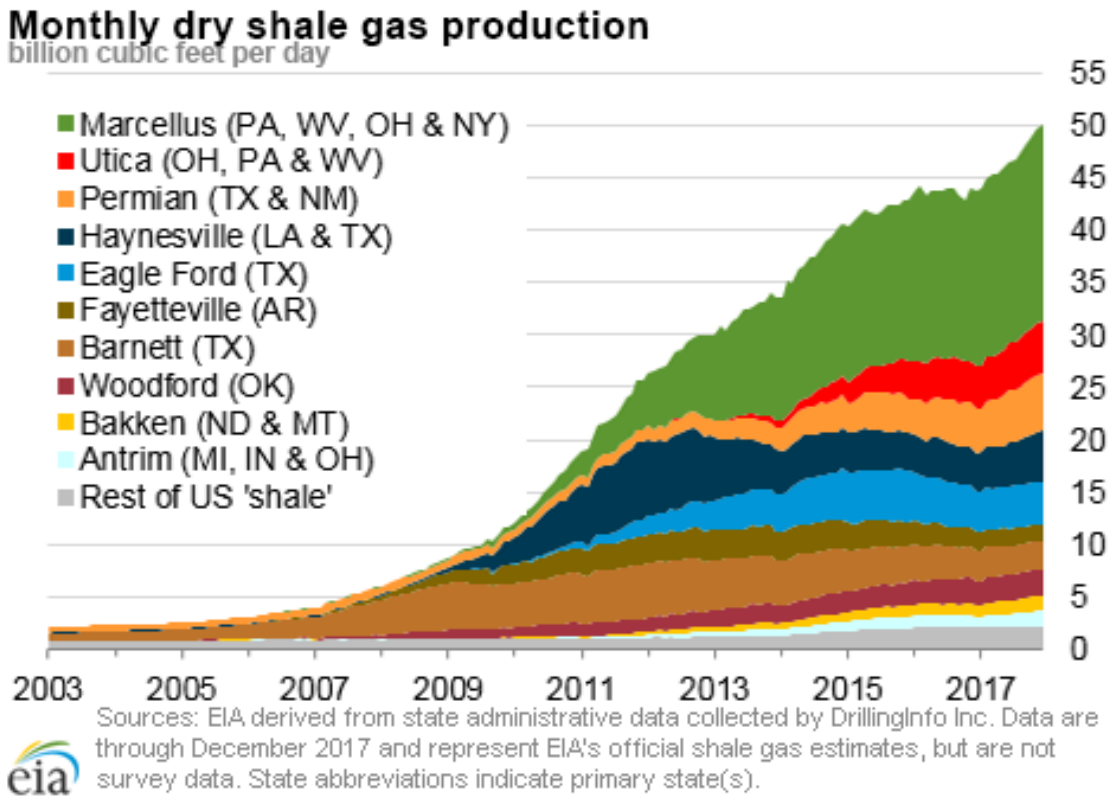
Questions?

National and global trends, declines in wholesale electricity from impacts from shale gas



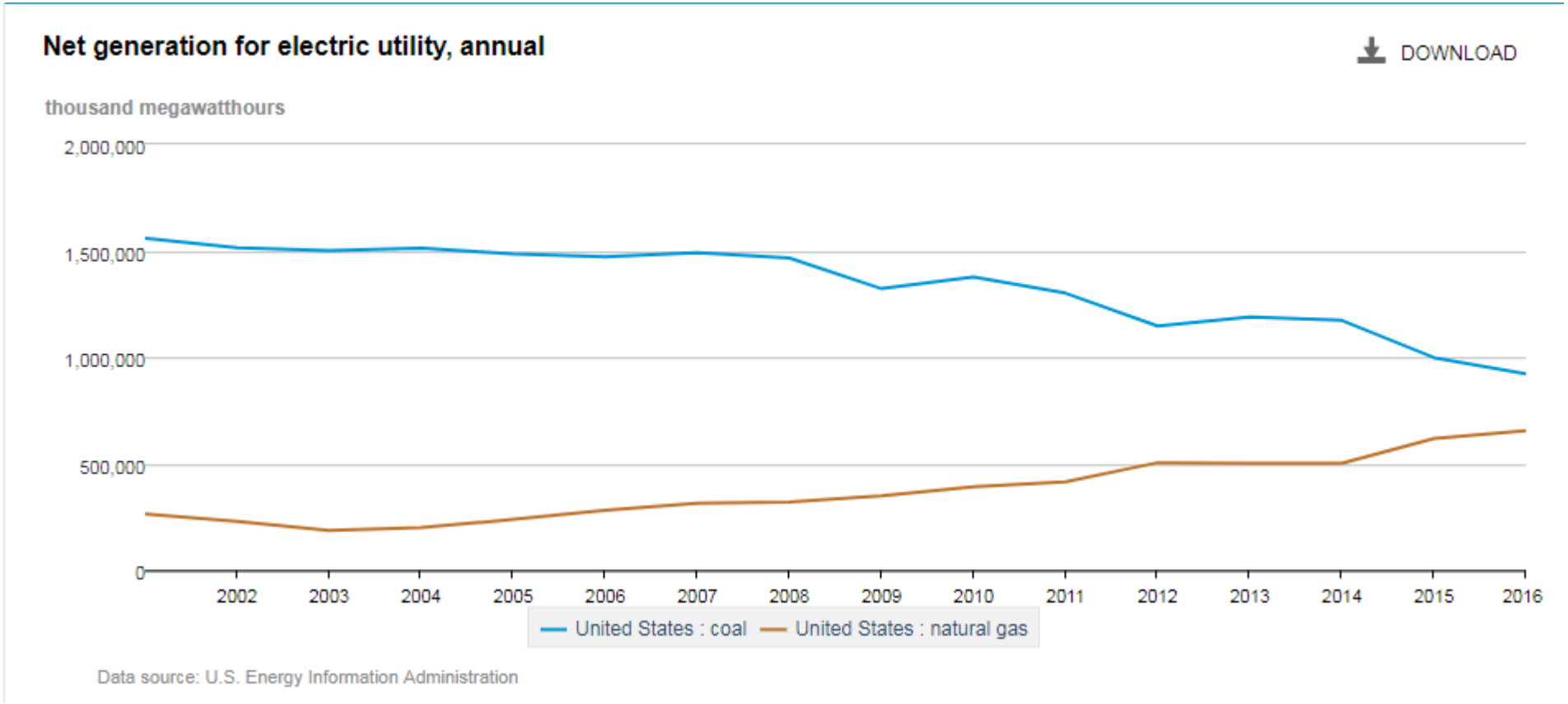
Source: EIA https://www.eia.gov/dnav/ng/hist/n3045us3m.htm

Shale gas production in the US…., demand is roughly 75 Bcf/d



Source: EIA

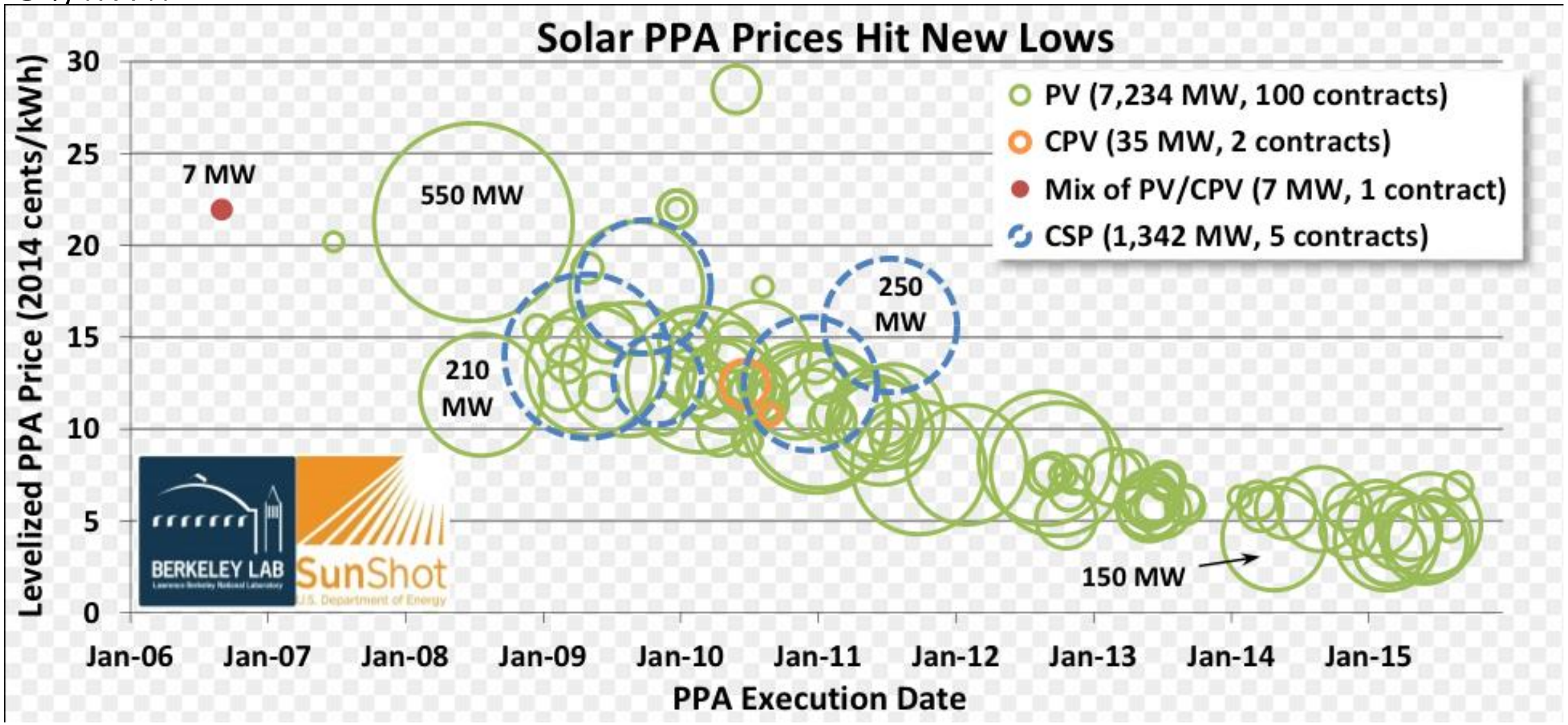
Coal is on the decline, natural gas on the rise



Source: EIA

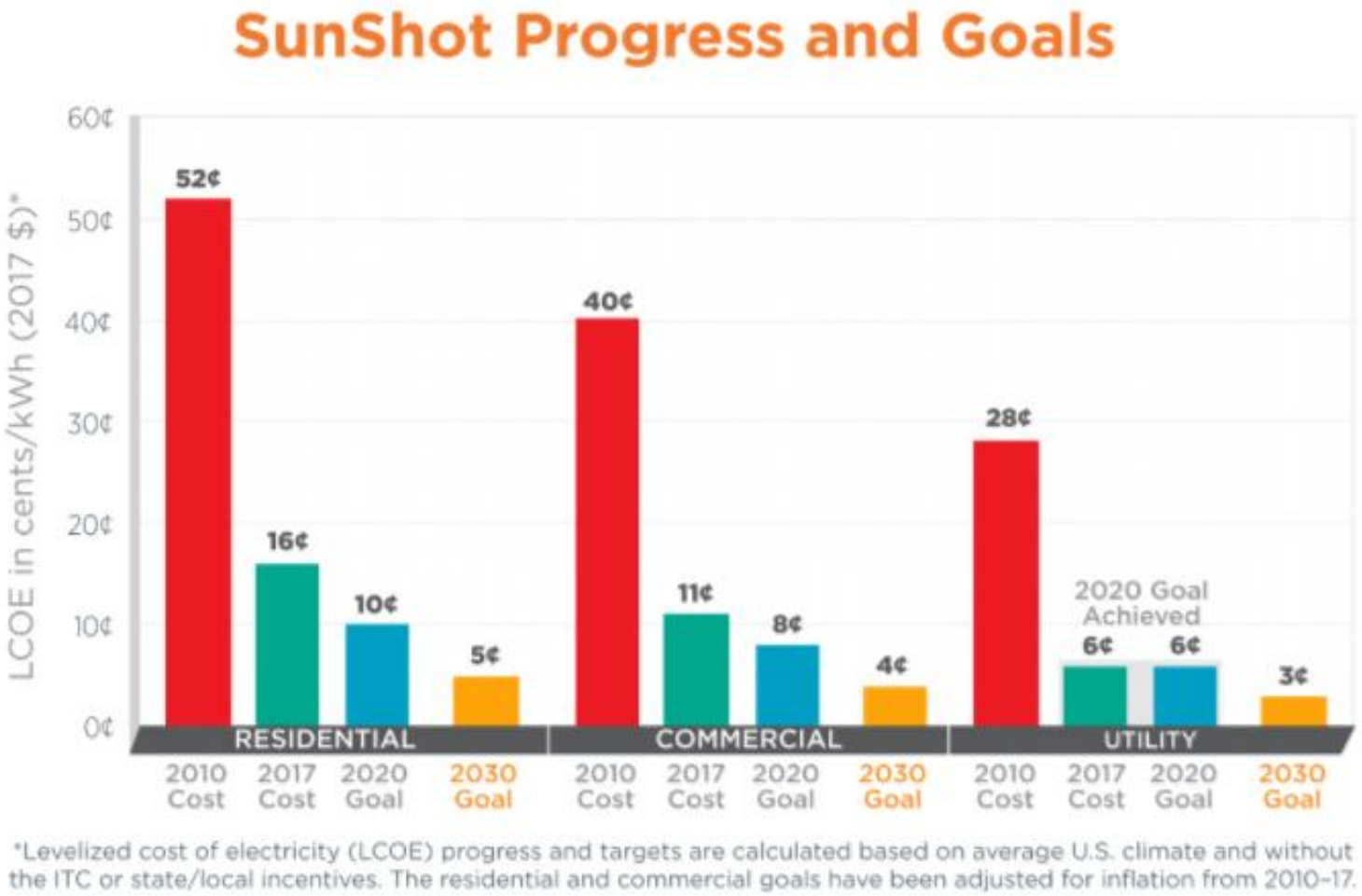
Transmission costs have been on the rise nationally

“Price of Solar Energy in the United States Has Fallen to 5¢/kWh”



Source: LBNL http://newscenter.lbl.gov/2015/09/30/price-of-solar-energy-in-the-united-states-has-fallen-to-5%C2%A2kwh-on-average/

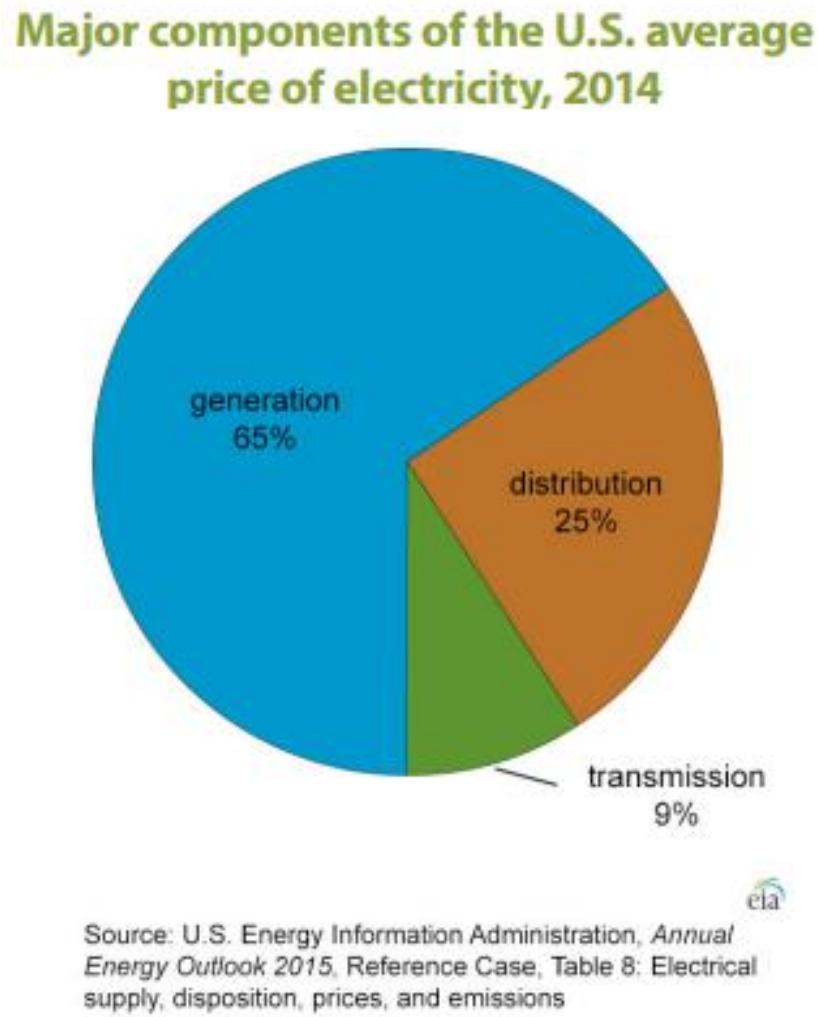
DOE 2020 targets for solar (sans incentives) met in 2017



Source: DOE

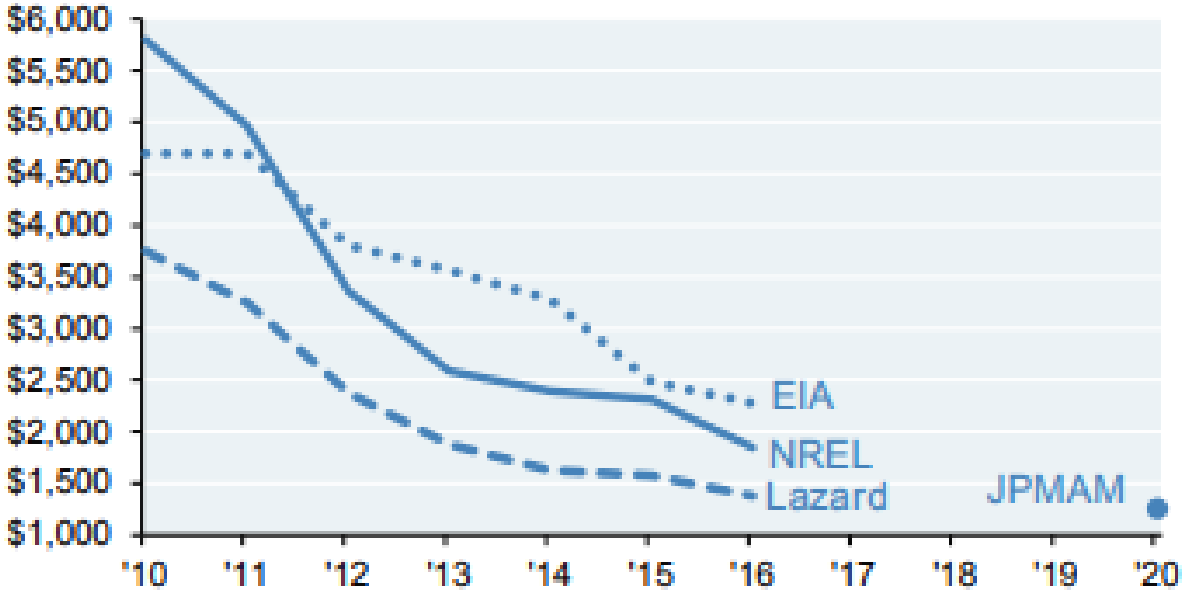
https://www.energy.gov/eere/solar/articles/2020-utility-scale-solar-goal-achieved

Major components of cost of electricity, US



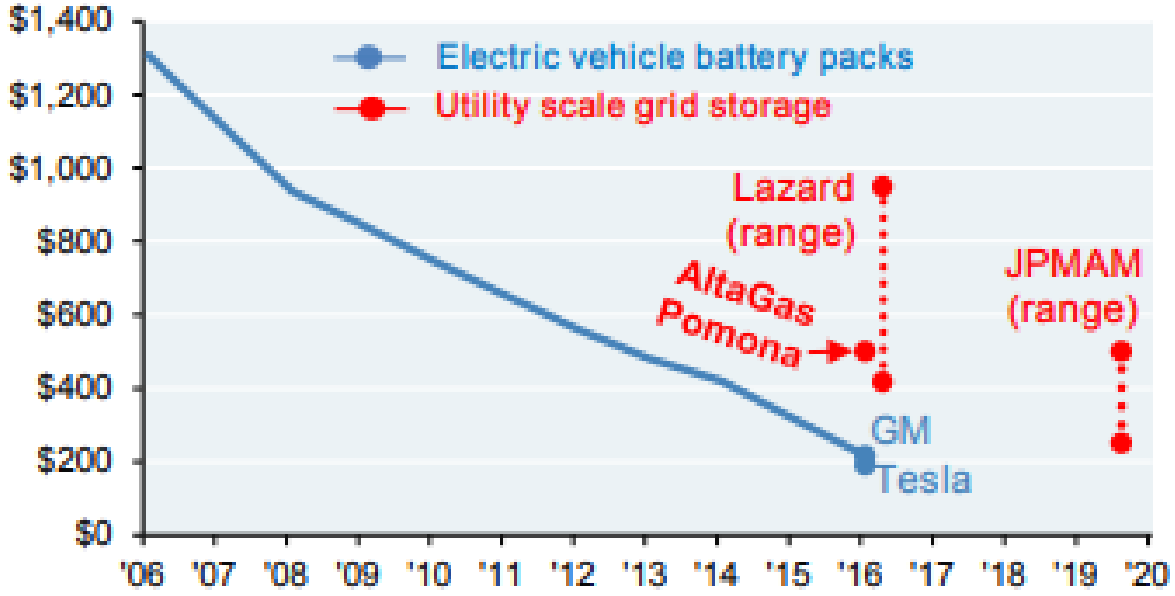
Utility scale solar PV capital cost estimates

US$/kW-AC, assuming 1.3 inverter DC-AC loading ratio



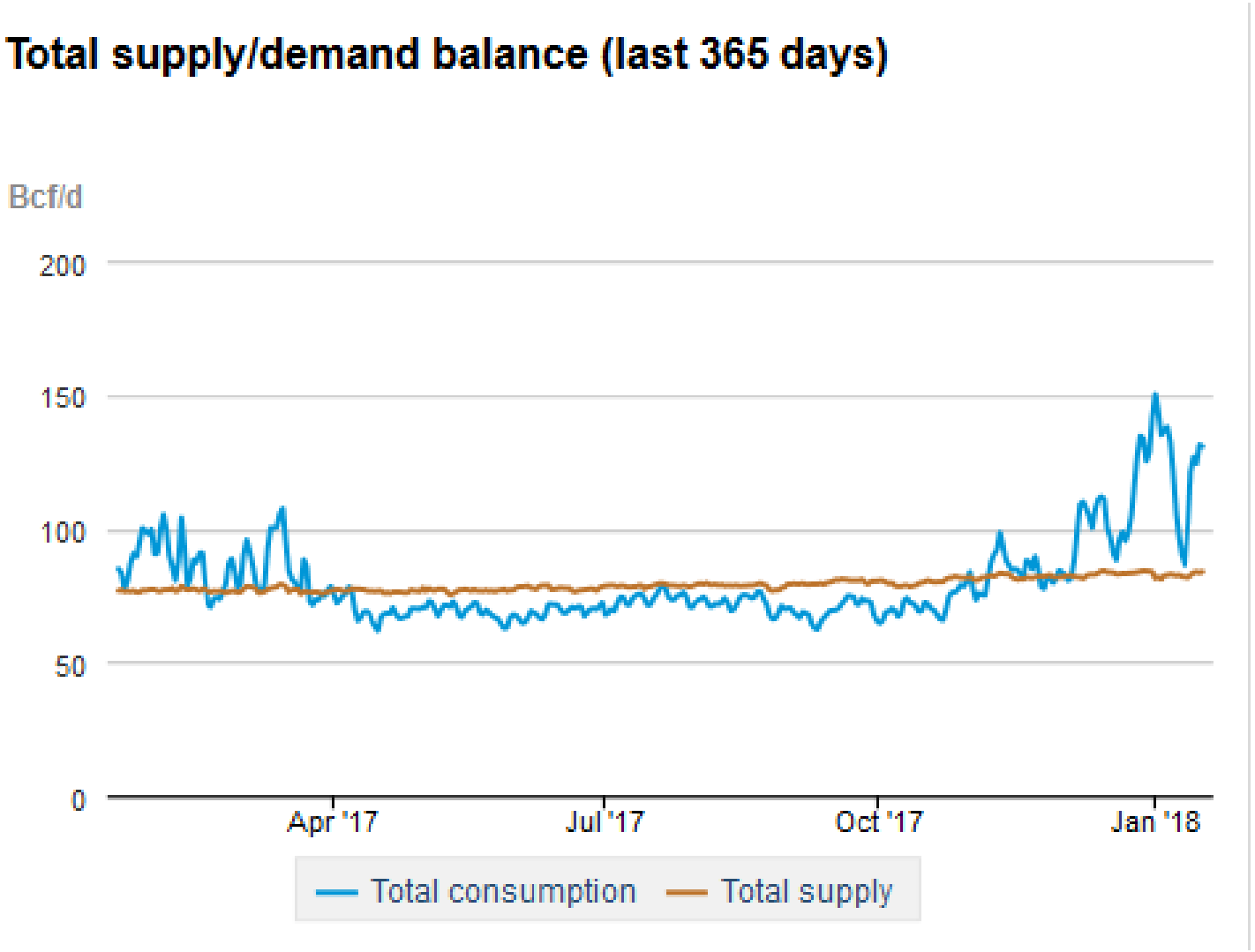
Source: NREL, EIA, Lazard, JPMAM. April 2017.

Lithium ion energy storage costs: EV battery packs vs utility scale grid storage, capital cost per kWh

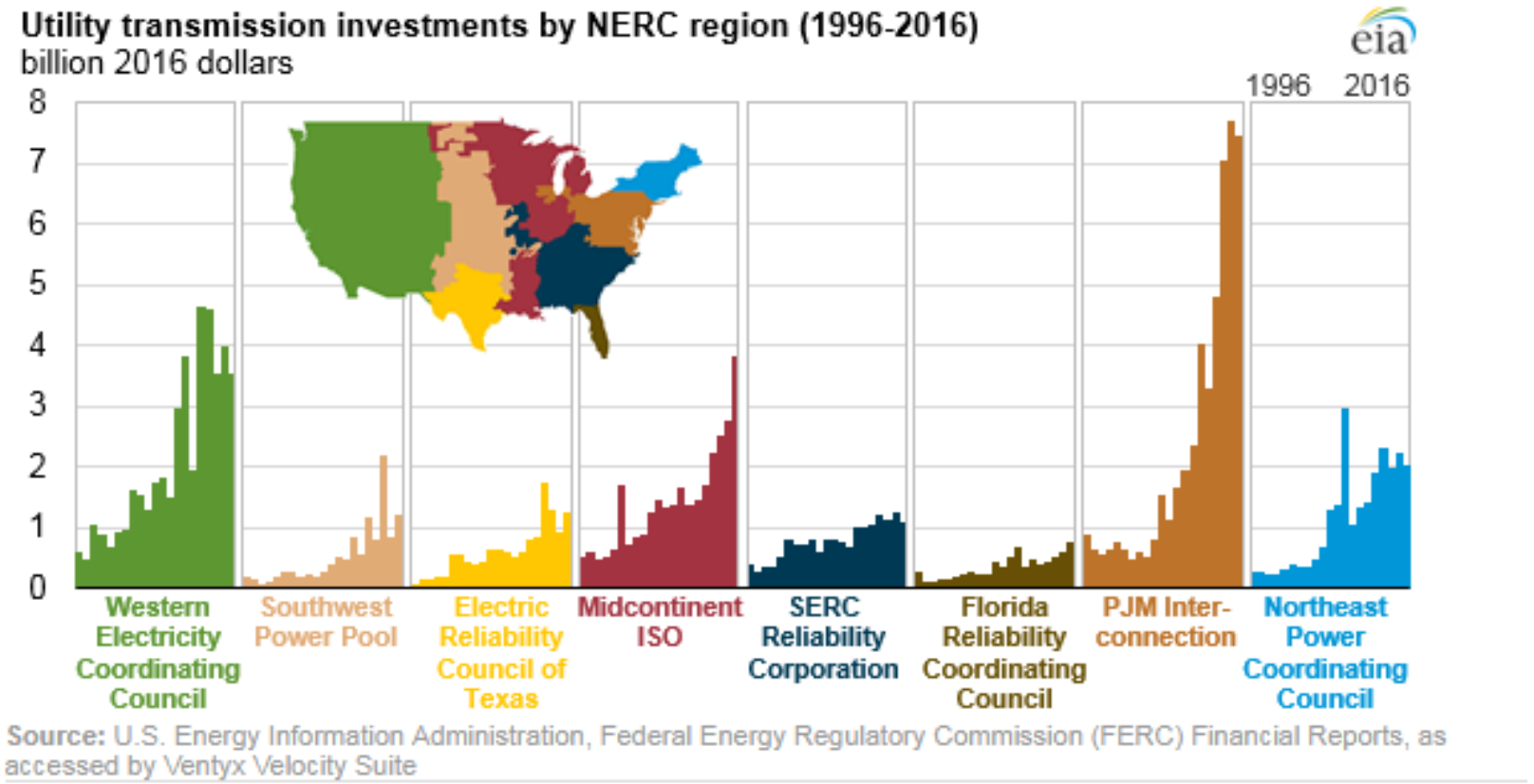


Source: Lazard, Nykvist, et. al., Green Car Reports, Utility Dive. April 2017.

US Demand and Production roughly in balance in recent years at about 75 Bcf/d



Transmission investments have been on the rise regionally and nationally



Source: EIA, https://www.eia.gov/todayinenergy/detail.php?id=34892