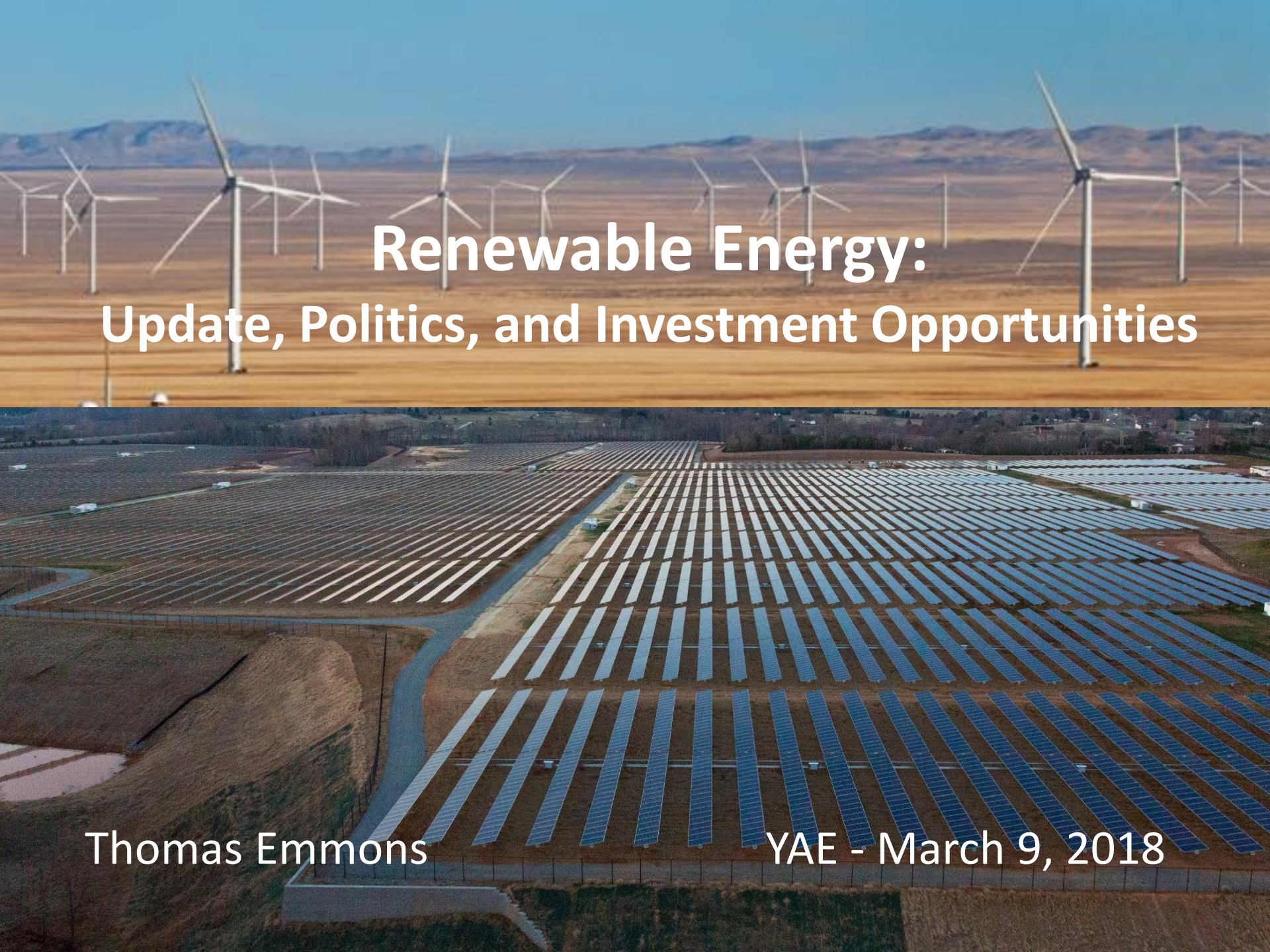


Renewable Energy:
Update, Politics, and Investment Opportunities

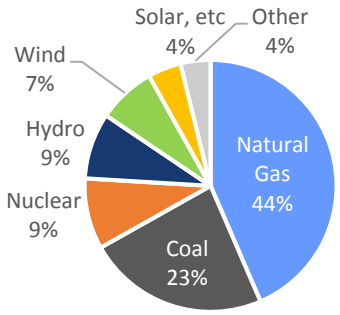
Thomas Emmons

YAE - March 9, 2018

Renewables are Rapidly Replacing Fossil Fuels

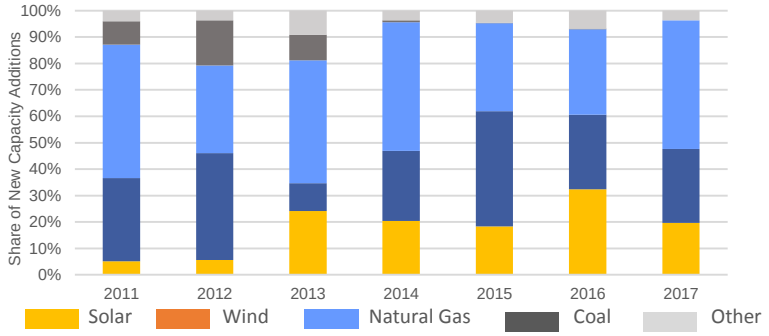
Installed Operating Generating Capacity

- Renewables (wind, solar, biomass, and geothermal) accounted for only ~11% of installed operating generating capacity in the U.S. as of December 2017



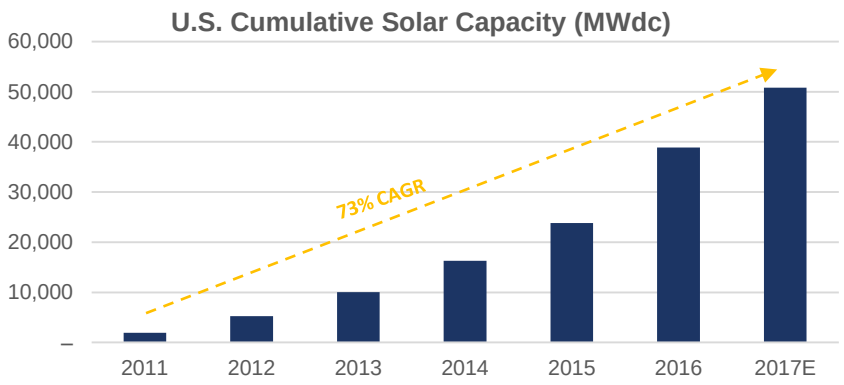
Replacement of Fossil Fuels by Renewables

- Renewables accounted for ~57% of all U.S. new installed capacity from 2015 – 2017



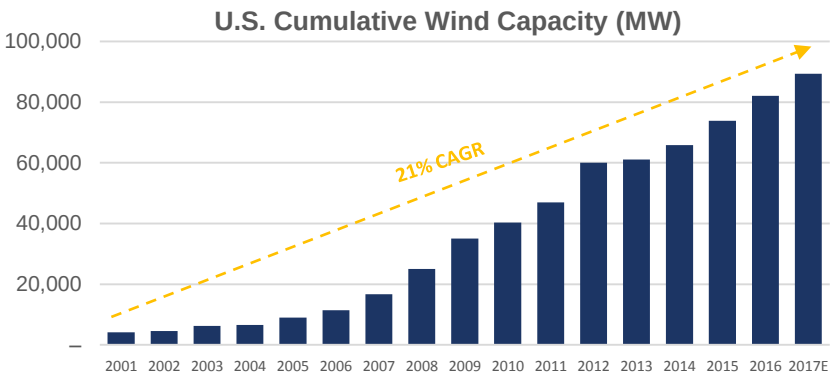
Growth of Solar

- Installations in 2017 down from a record 15 GW in 2016; despite that, 73% CAGR in capacity since 2011



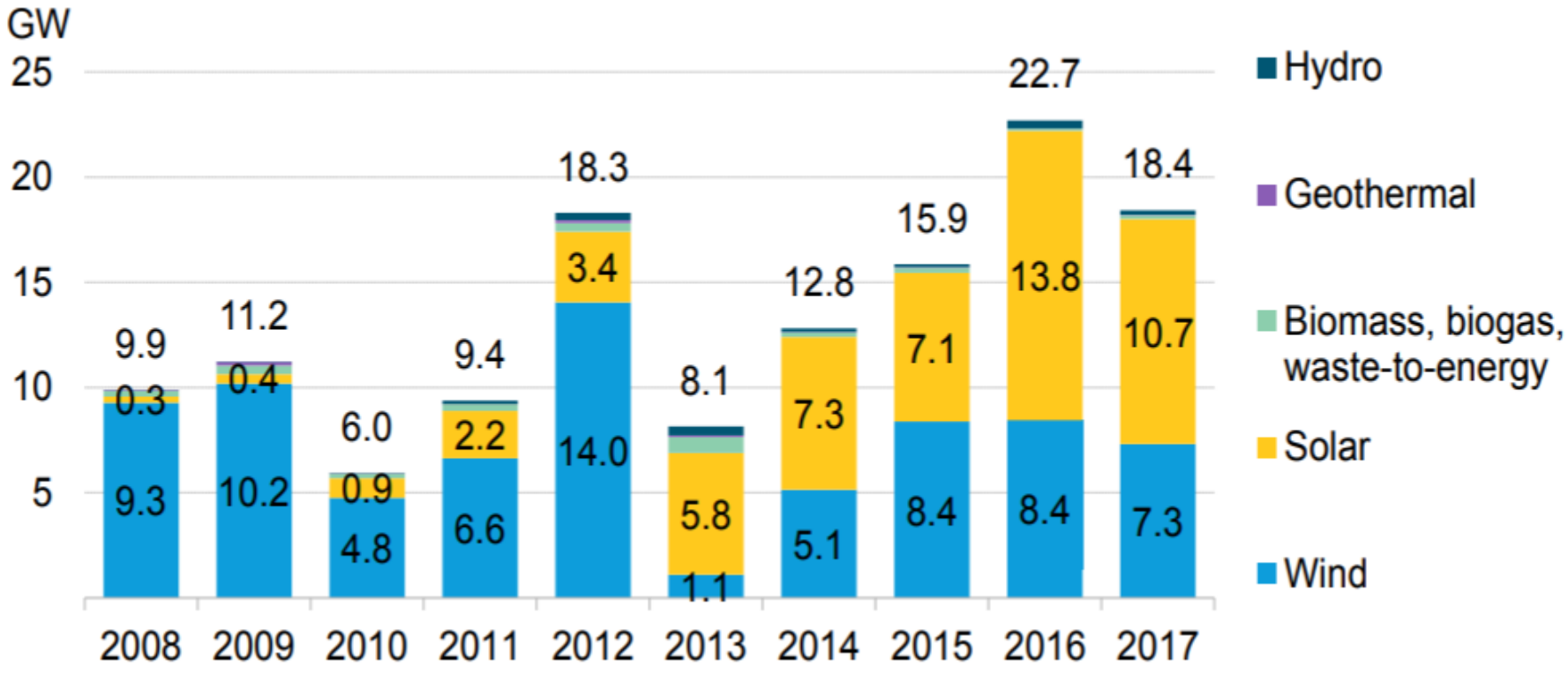
Growth of Wind

- Wind capacity has increased twenty-fold since 2001



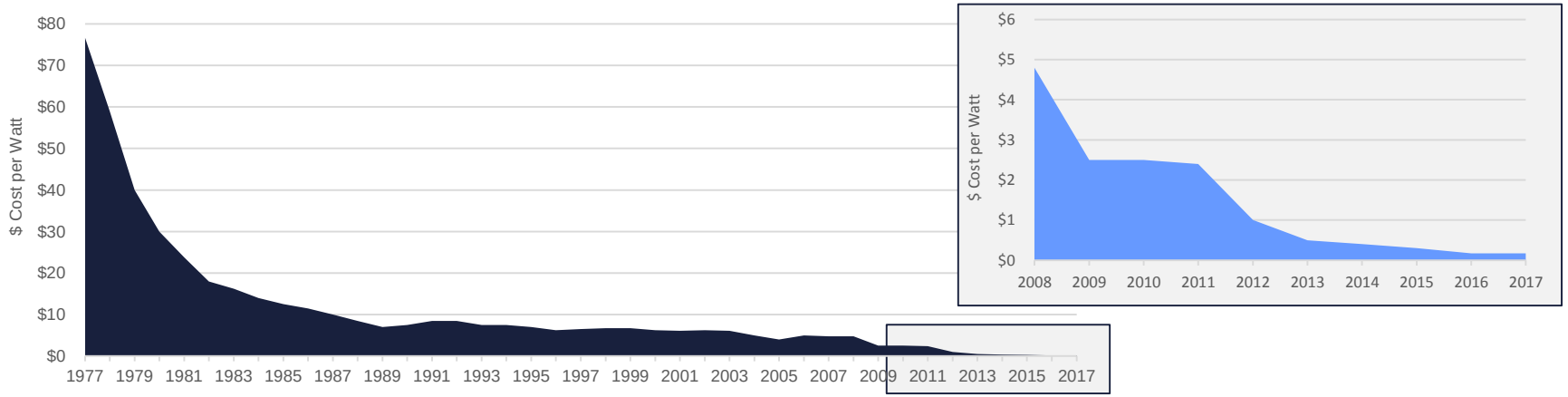
Source: GTM Research, FERC Office of Energy Projects, American Wind Energy Association, Bloomberg New Energy Finance, EIA

Renewable Energy Capacity Built, by Technology

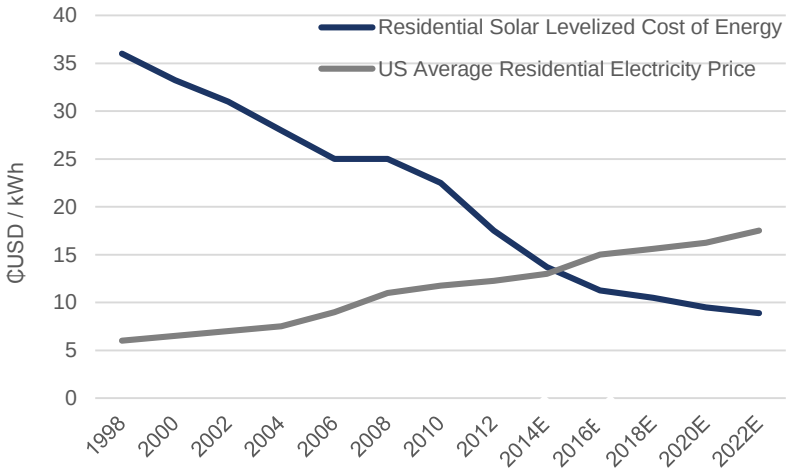


Source: Bloomberg New Energy Finance; Business Council for Sustainable Energy

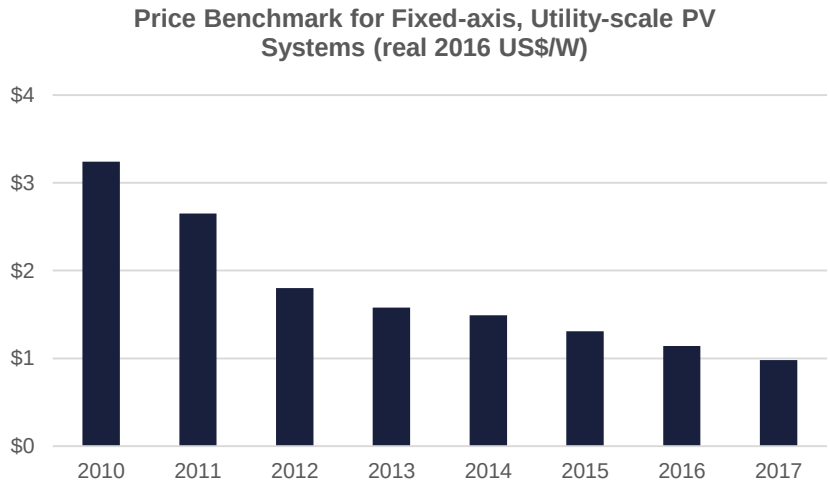
Solar Costs Continue to Fall



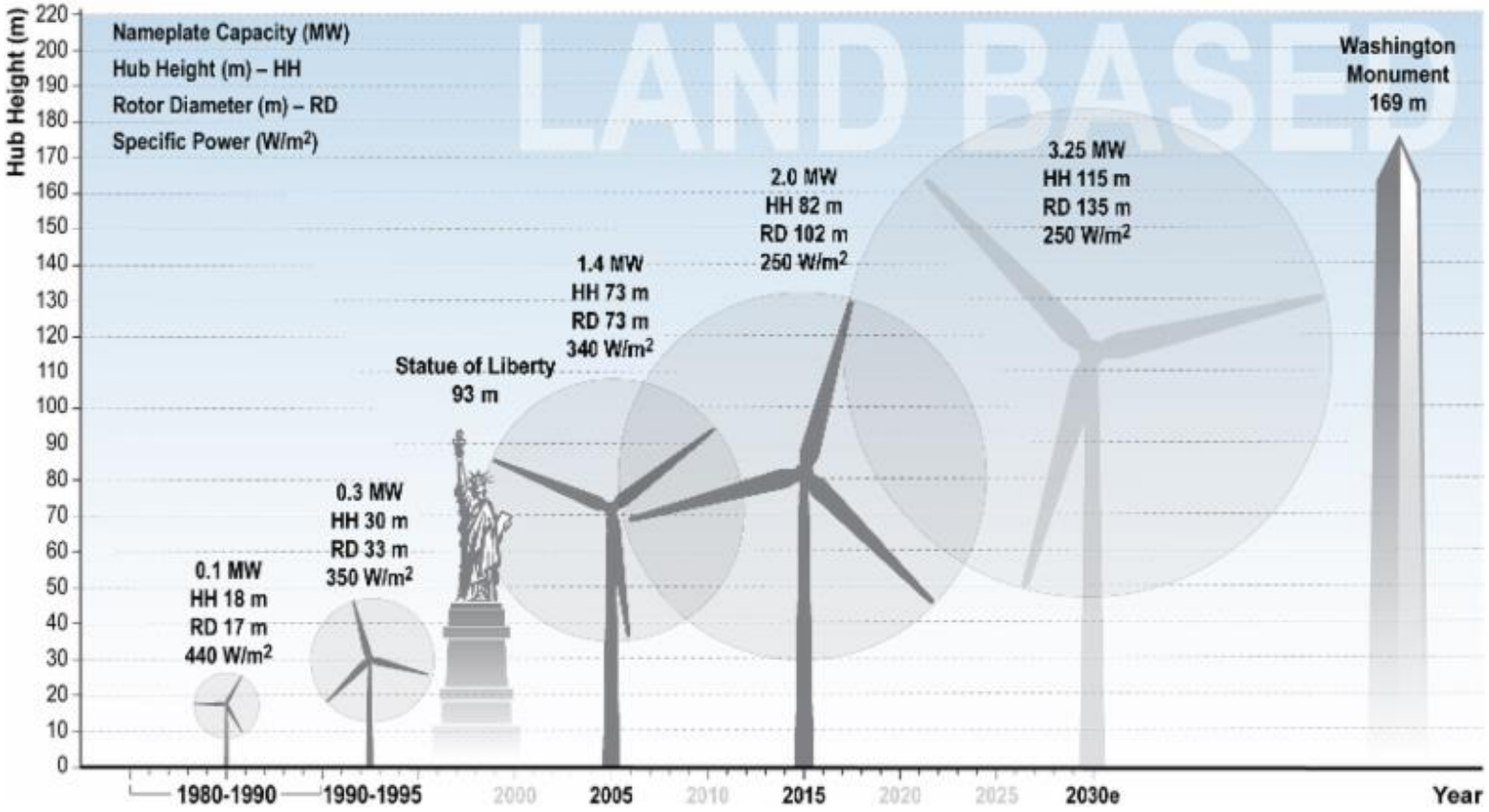
Falling Cost of Solar Systems and Rising Retail Rates



Declining Costs to Deliver Projects Globally

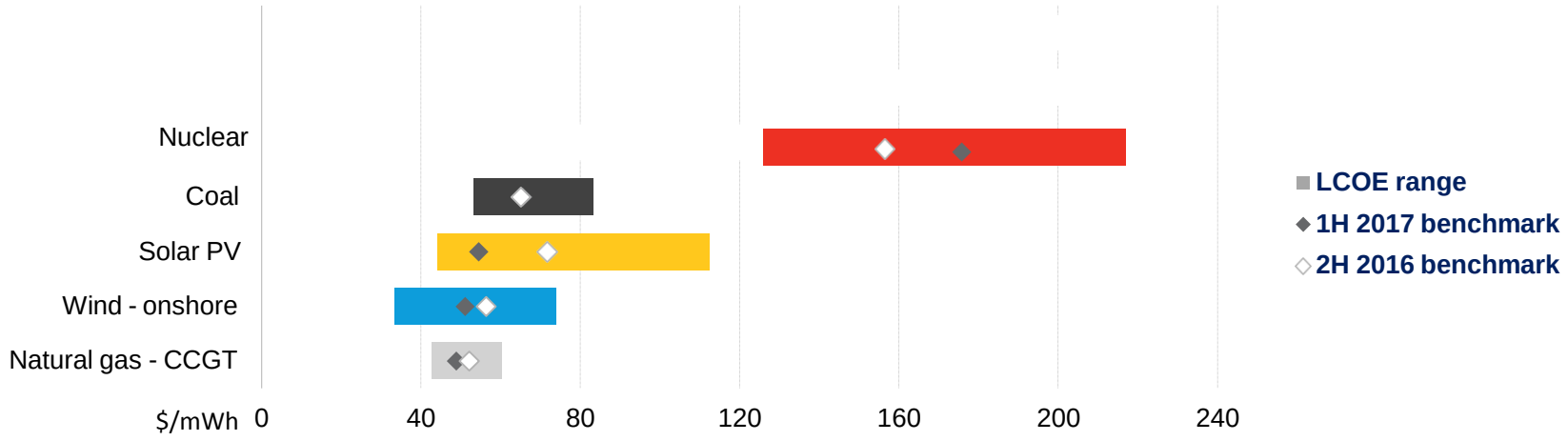


Wind Energy Costs Are Falling



- Bigger, taller turbines
- Improved technology and efficiency
- Lower costs – manufacturing economies

Renewables are Cost Competitive: LCOE Unsubsidized

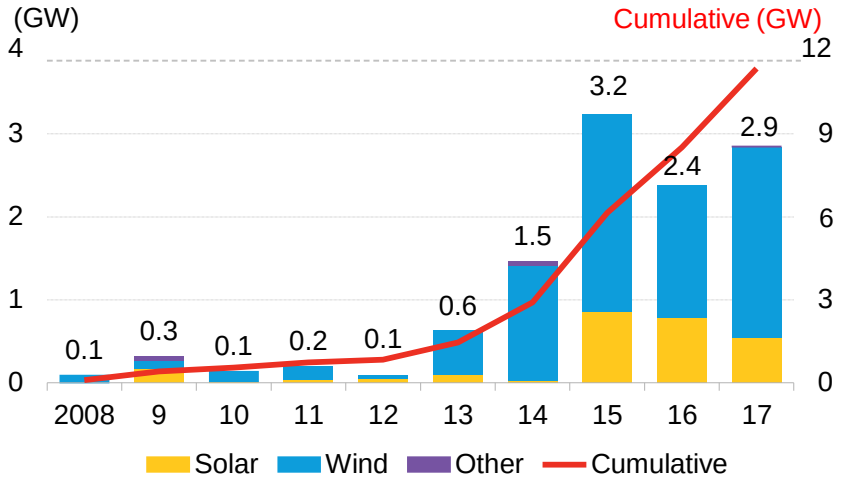


- Solar is now cheaper than coal on a levelized cost of energy (LCOE) basis: $54/MWh vs. $66/MWh. Solar costs continue to fall.
- Onshore wind benchmark is “tied” with CCGT, but with strong wind resources can achieve LCOEs as low as $33/MWh, even cheaper than natural gas($49/MWh).

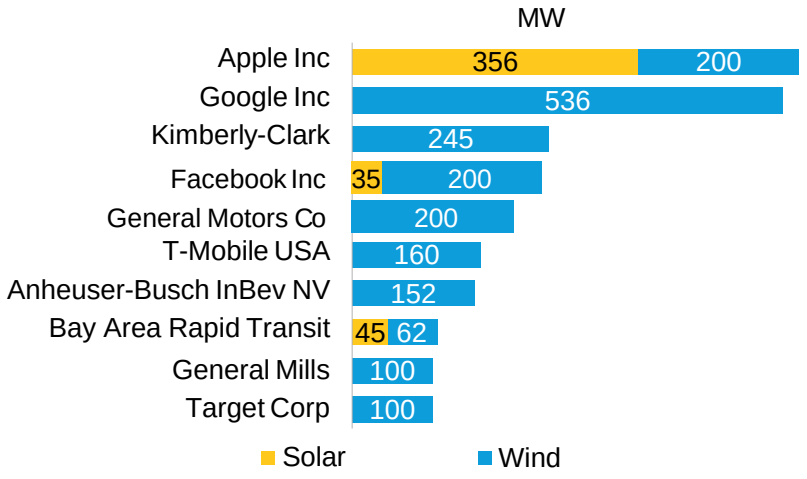
Source: Bloomberg New Energy Finance. Developed in partnership with The Business Council for Sustainable Energy. As of 1H2017.

Corporate Procurement of Renewable Energy

Renewable capacity contracted by corporations, 2017



Largest corporate offtakers, 2017



- Apple contracted 560MW of renewable energy in 2017, more than any other corporation. It signed the largest PPA ever between a corporation and a utility – a 235MW PV plant with NV Energy under the utility's GreenEnergy Rider.
- Google signed PPAs for 536MW, to offset 100% of its global electricity demand. Kimberly-Clark, T-Mobile, General Mills and Cummins all signed their first PPAs in 2017.
- RE100: Corporations pledging to reach 100% renewable energy. Notable names: Ikea, Adobe, BofA, BMW, Bloomberg, Burberry, Citi, Coca-Cola, ClifBar, Danone, Ebay, Facebook, GM, Goldman Sachs, Google, HP, J&J, JPM, Kellogg, LEGO, Mars, Microsoft, Morgan Stanley, Nestle, Nike, P&G, Starbucks, Visa, Walmart, etc.

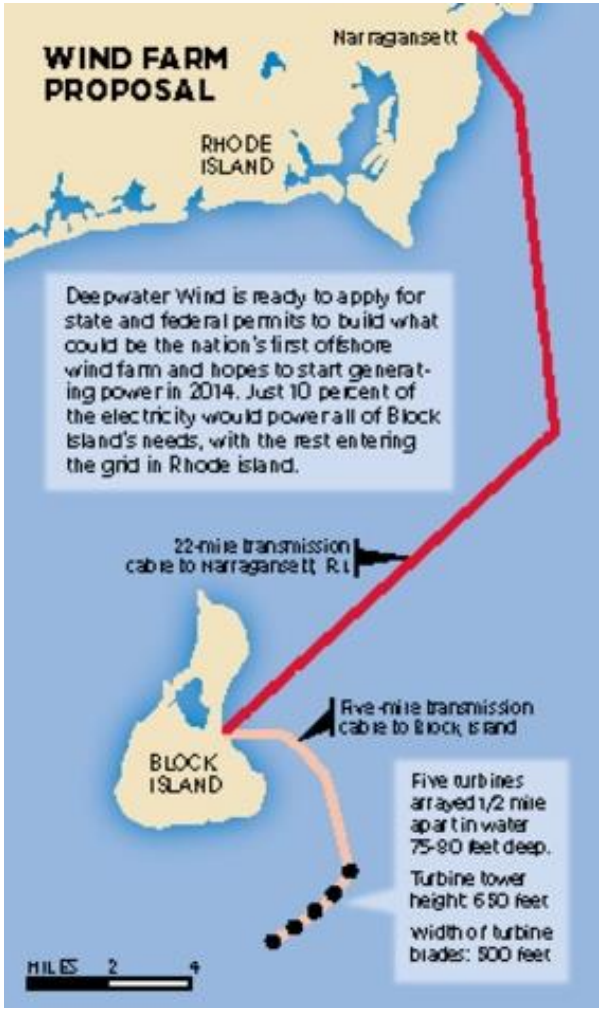
Source: Bloomberg New Energy Finance. Developed in partnership with The Business Council for Sustainable Energy. Note: Charts show offsite PPAs only

Corporate Renewable Energy Users, Largest by State

Walmart: 6
Target: 6
IKEA: 6
Amazon: 4
Google: 4

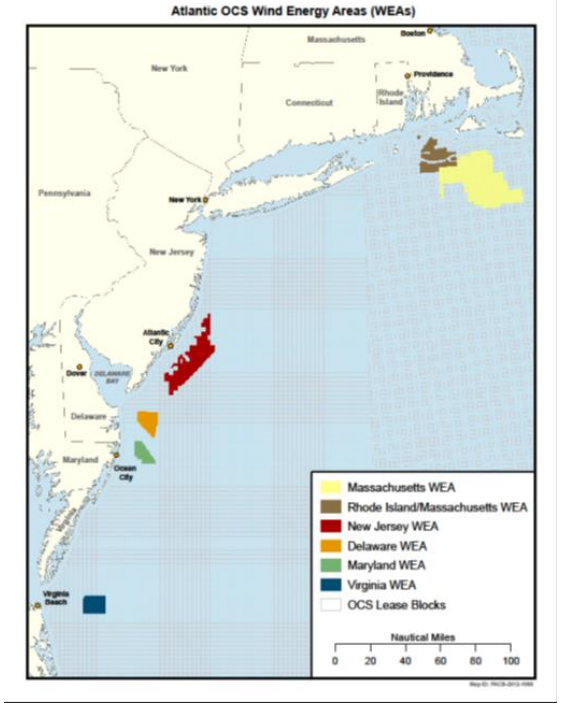
Source: David Gardner and Associates, April 2017

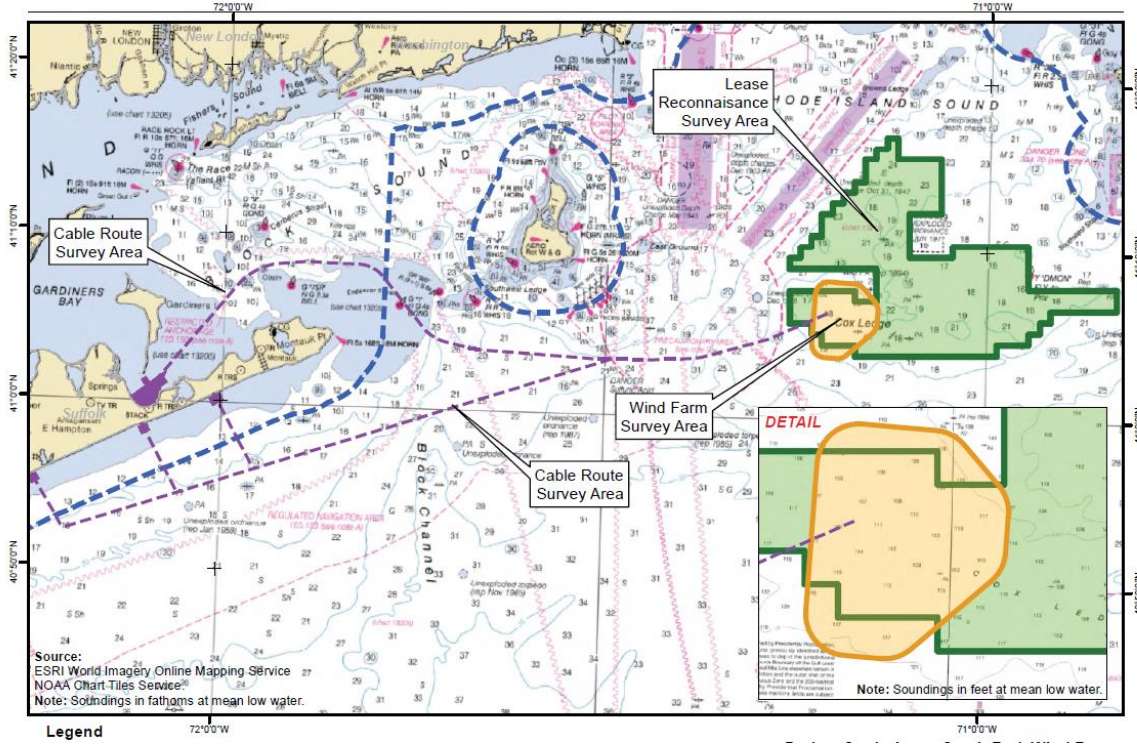
First US Offshore Wind Project – Block Island



More Offshore Wind Projects Coming

- "South Fork", LI, selling to LIPA (developed by Deepwater Wind)
- 90MW, 30 mi east of Montauk, connecting at East Hampton
- NJ: New Gov. Murphy reversed Gov. Christie's stance, calling for 3.5GW by 2030
- NY Masterplan: 800MW by 2020; 2.4GW by 2030;
- MA: goal of 1.6GW by 2027
- Significant economic activity on land, revitalizing ports (Quonset Point, RI)





Next: Floating Offshore Wind Turbines

Hywind Scotland

The world's first commercial floating wind farm

Rotor diameter: 154 metres

Blades: Length 75 metres

Each **turbine** weighs 12 000 tonnes

Turbine height: 253 metres in total. 78 metres below sea surface, 175 from sea surface to wingtip

Suction anchors:15 suction anchors, 16 metres tall, 5 metres in diameter and weighing approx. 300 tonnes each.

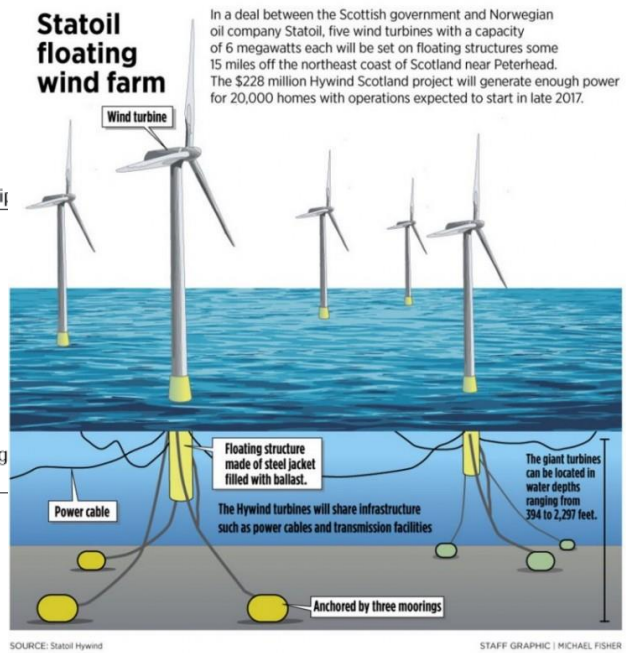
Chains: 2,400 metres long weighing 1,200 tonnes

Hywind Scotland consist of
5 turbines, 6 mw each -> 30 MW

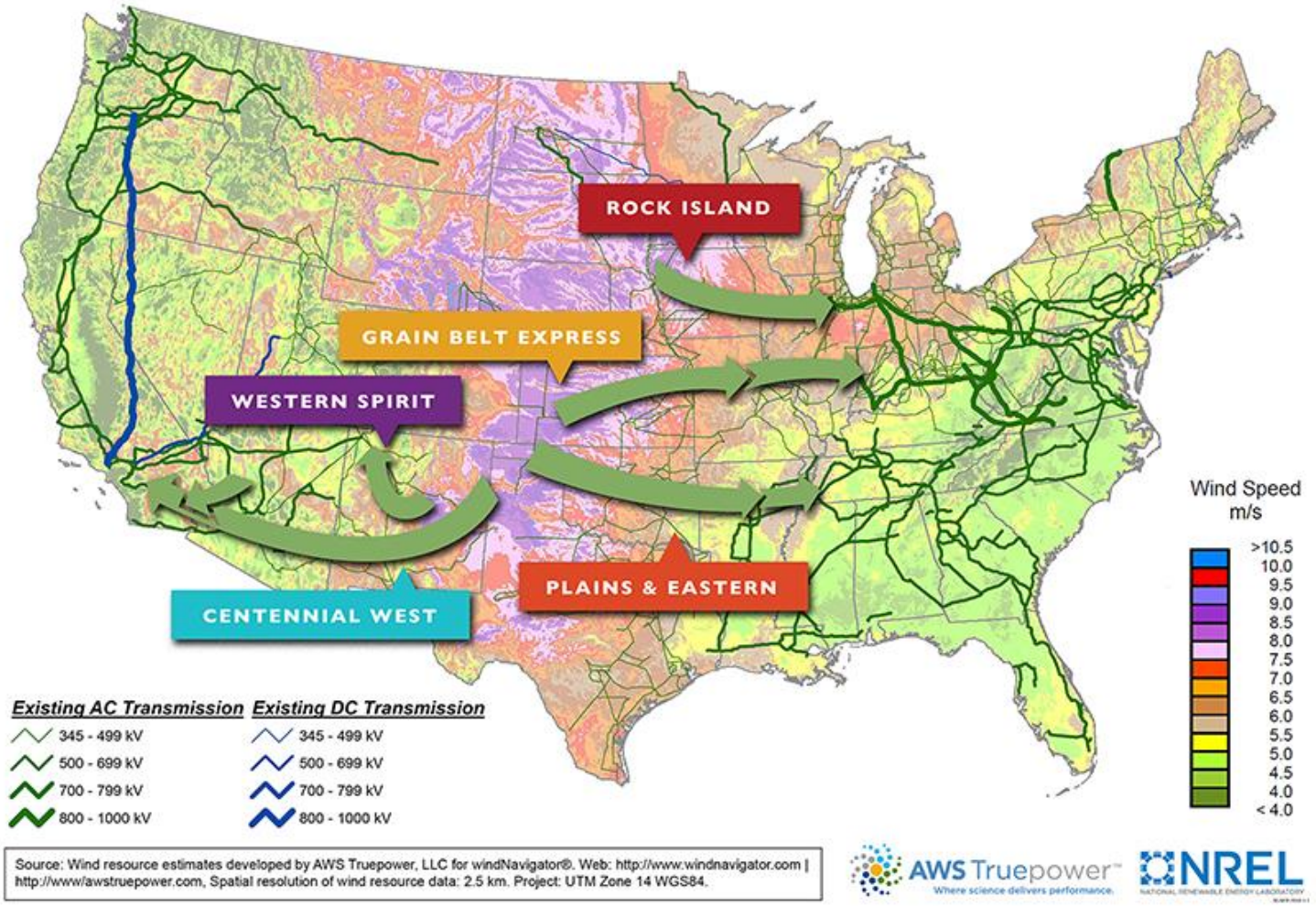
Will supply with renewable energy
20 000 UK households

Masdar
A MUBADALA COMPANY

Statoil

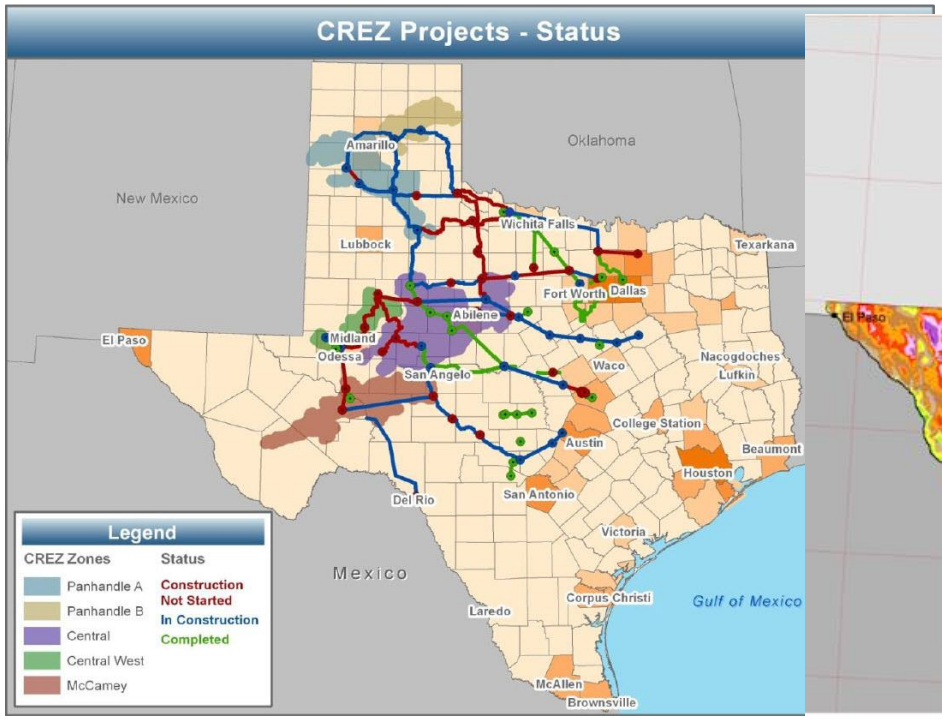


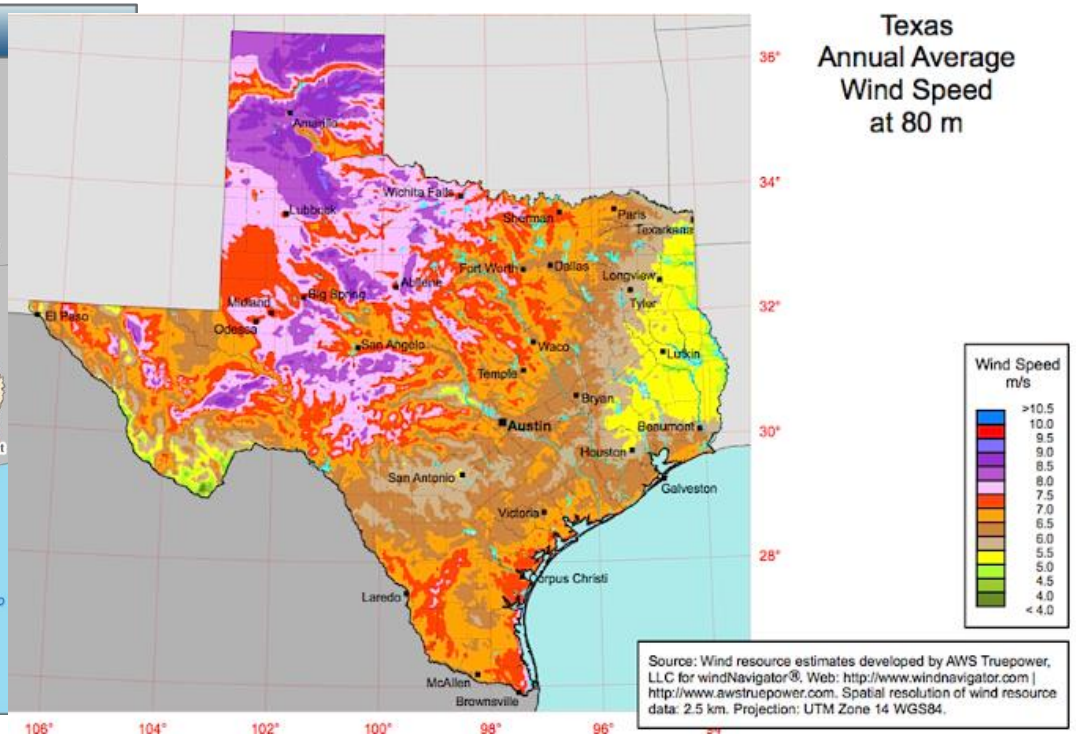
Transmission Projects – Stranded Wind



Transmission Projects – Stranded Wind

Texas CREZ – Captured Stranded Wind





Cost: $8 billion
Distance: 3600 miles
Capacity: 18.5 GW
Completed: 2014

Other Baseload Renewable Energy Sources

- Hydropower
  - Now 9% of load; few new being built
  - Environmental impact
- Geothermal
  - Tapping subsurface heat to generate electricity
  - Mostly in West; base load; small contributor
- Combustion or gasification of organic materials
  - Wood-burning power plants (incl. pelletized wood as coal substitute)
  - Forest management; pine beetle in West/Canada
- Waste to Energy (many types)
  - Methane capture (and pipeline injection, or fuel generator)
    - Anaerobic Digestion (manure, food waste, etc.)
    - Landfill gas
  - MSW/RDF processed to various fuel forms

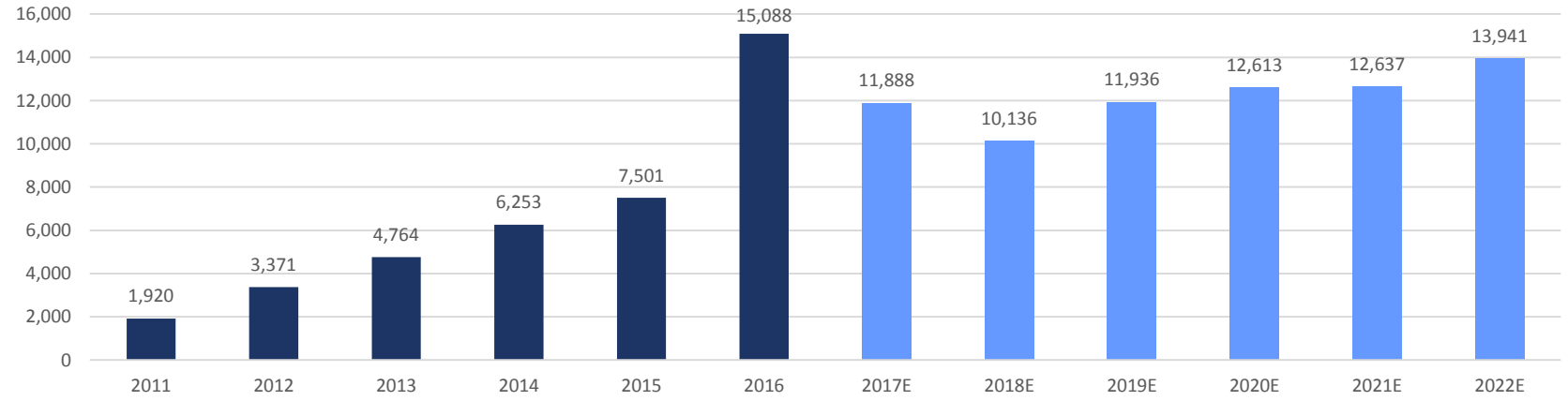
Politics: Federal Tax Incentives - Supporting Renewables

- ❑ Wind:
- 2.3c/kWh production tax credit (PTC)
- Since 1992 (escalated with inflation)
- ❑ Solar:
- 30% investment tax credit (ITC)
- Since 2005
- ❑ Benefit: attracted large cash investors (~40% of project cost) into generation projects, who received tax shelter in lieu of cash. (JPMorgan Chase has been a large US “tax investor”.)
- ❑ Extended in 2015 for 4 years, phasing out by 2021
- ❑ Early House versions of the Tax Cut and Jobs Act of Dec 2017 included changes to the phase-out, but it was ultimately left intact.

Tariffs on Imported Solar Cells and Modules

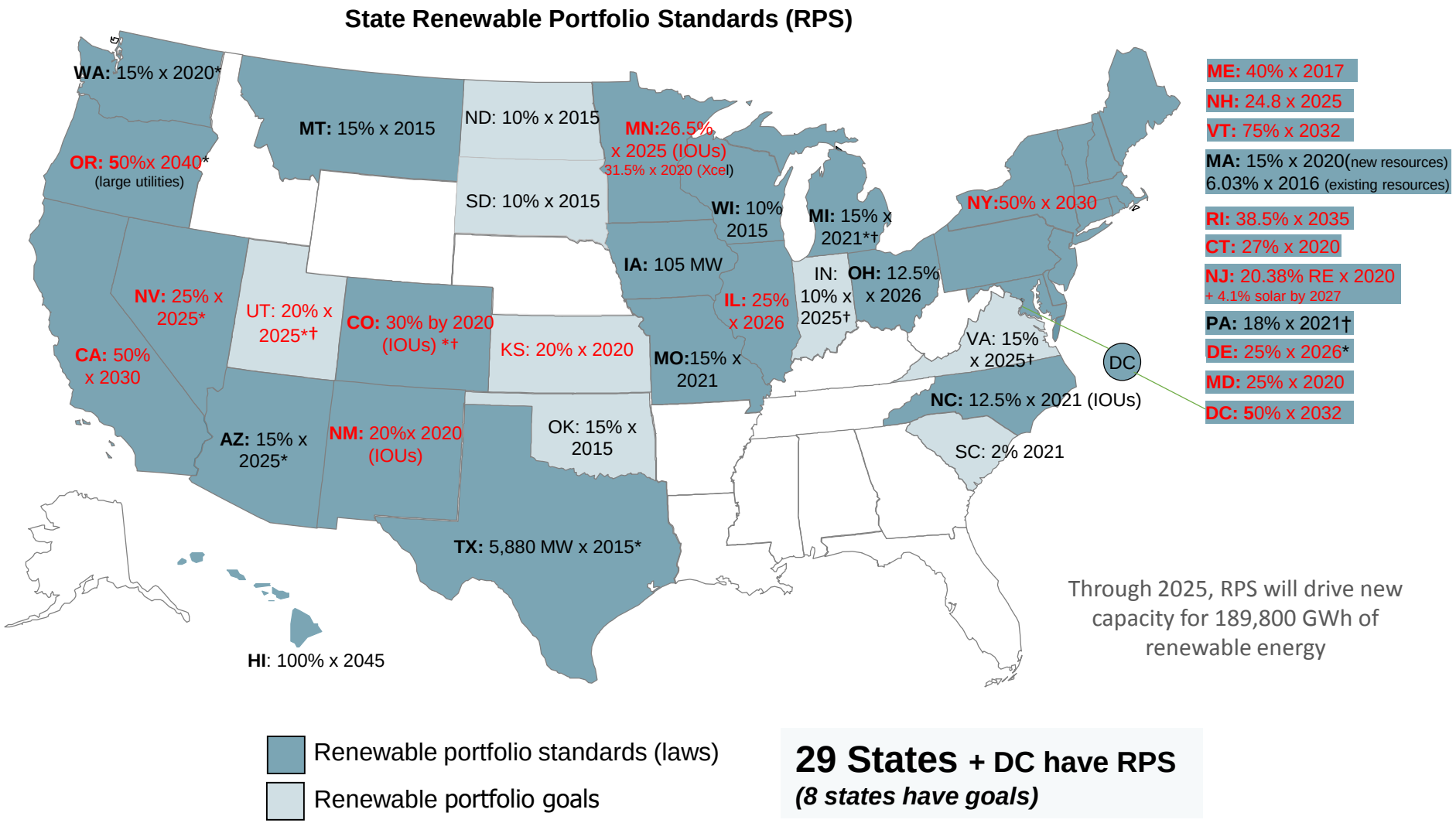
- 4-year tariff on imported PV solar cells and modules, from all countries
- Consensus: a minor, temporary, politically-motivated cost increase for the solar industry
- Tariff Schedule over 4 years: 30%, 25%, 20%, 15%
  - First 2.5GW of imports each year are exempt from tariffs (~20% of imports)
  - Many developers have stockpiled components for the next 1-2 years
- Increases solar TOTAL installation costs by ~5-10% (as cells/modules are a fraction of the costs)
- Tariff is MUCH lower than plaintiffs requested (their ask would have doubled the cost)
- Only 1000 people employed in manufacturing solar cells/modules vs. ~250,000 in total US solar (installers, services, etc.)
- Hurts the larger installation businesses more than helped the small US manufacturing businesses
- Will it bring jobs? TBD: Days later, Jinko Solar (China) announced a $410mm deal with Jacksonville FL to build a factory there.

Historical and Forecast U.S. Solar Installations (MWdc)



Source: GTM Research, Bloomberg New Energy Finance

State Policies Driving Renewables Adoption



Through 2025, RPS will drive new capacity for 189,800 GWh of renewable energy

Renewable portfolio standards (laws)

Renewable portfolio goals

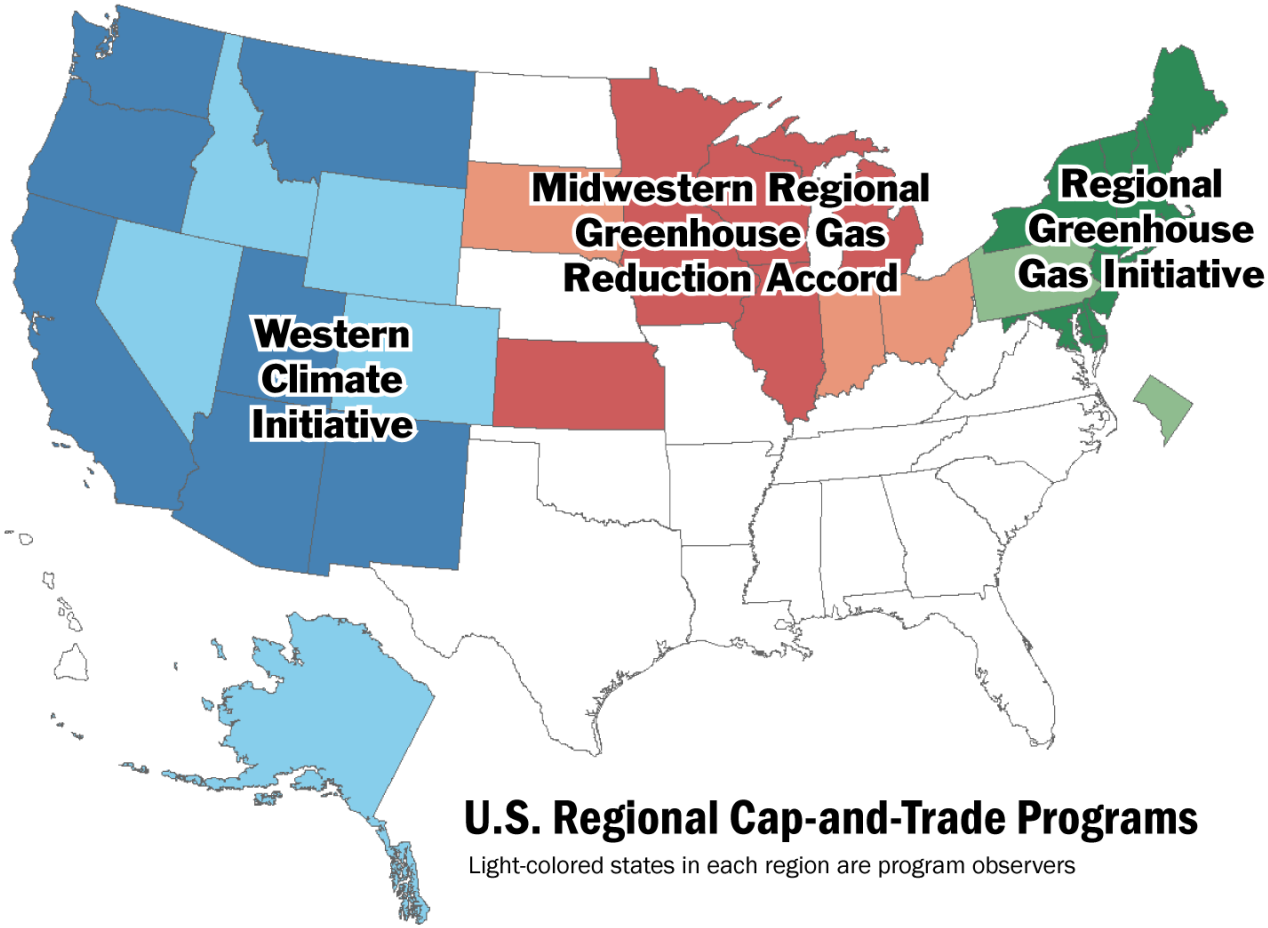
29 States + DC have RPS

(8 states have goals)

Other State/Local Programs

- Net energy metering (NEM)
  - Encourages rooftop/distributed solar
  - Consumers can effectively sell power back to utility at retail/wholesale rate
  - “Behind the meter” – meter runs backward if generation > consumption
  - Mandatory in 38 states + DC
  - +9 states either allow NEM, or have related rules
- Community Solar in 16 states
  - Facilitates larger projects; subscribers enjoy bill credits (like NEM)
- Targeted incentives/mandates – push state goal/problem
  - Solar
  - Offshore wind
  - CA - dairy manure
  - NC - swine manure
- Carbon Tax: WA legislation introduced, but not passed
- Cap and Trade
  - CA – only state with its own
  - RGGI – regional states’ alliance
  - Western Climate Initiative – regional states’ alliance

Regional Cap and Trade Alliances



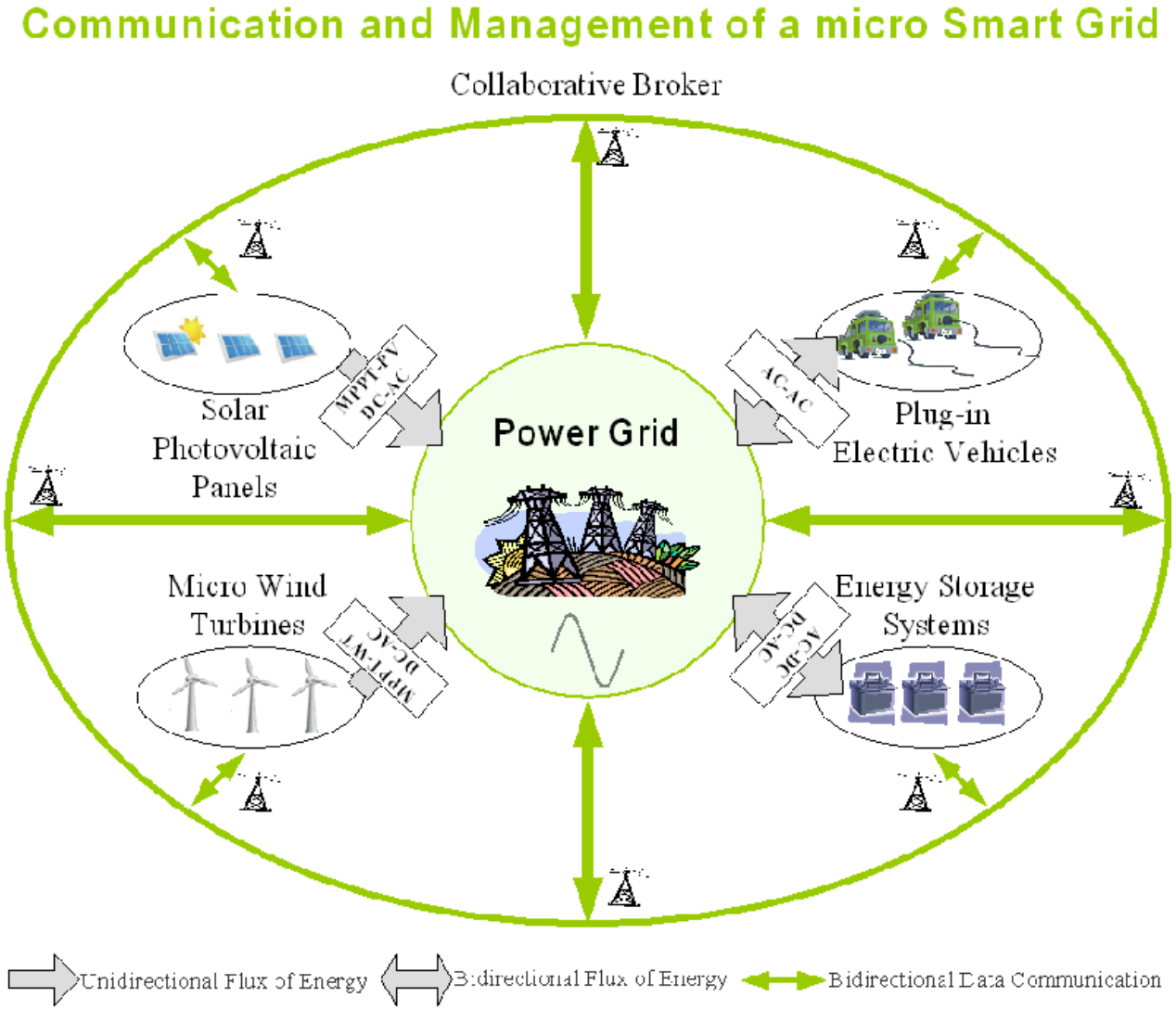
DC Political Stances – What Effect?

Clean Power Plan (Obama's GHG reduction targets for each state)

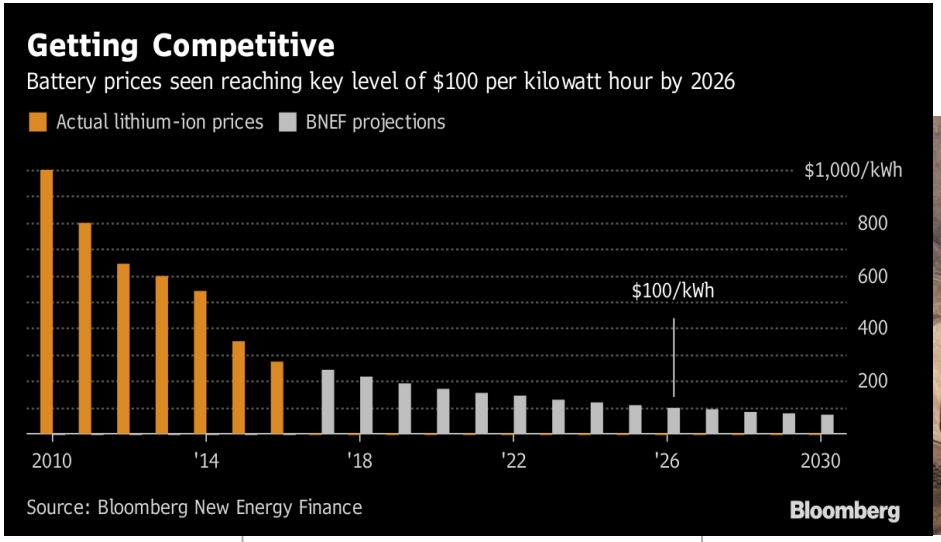
- Not being implemented by EPA
- Renewables grew rapidly without it
- Many states looking medium/long term, and reducing GHG anyway
- Opportunity loss: removes some pressure, impetus, urgency
- Federal vacuum is rousing/energizing state activists

- COP21 (Paris Accord)
  - US announced withdrawal
  - US cannot withdraw until Nov 2020
  - Sparked the formation of the US Climate Alliance, 16 states pledging to meet the goals of COP21 and Climate Action Plan
  - Sparked the formation of "America's Pledge" and "We Are Still In," initiatives led and financed by Michael Bloomberg to represent American states, cities, businesses, and universities (over 1/3 of population/GDP) in fulfilling COP21, in lieu of the Federal Government.
    - Bloomberg Foundation replaced the $15mm US contribution to the UN, and will finance the reporting requirement.
    - Michael Bloomberg appointed UN Special Envoy for Climate Action

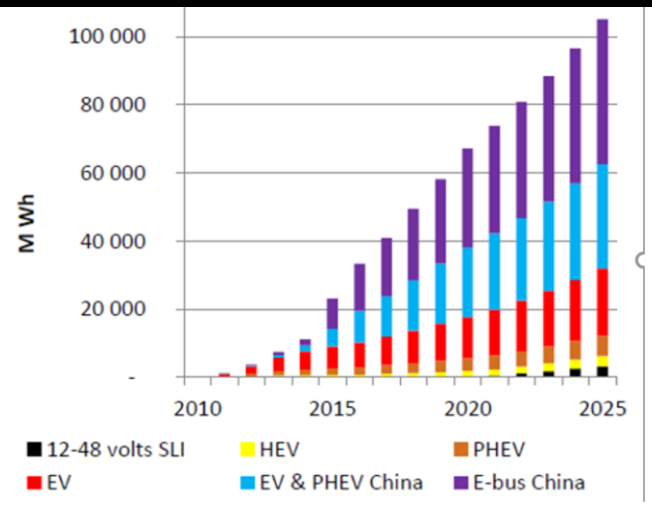
Integration: Renewables, EV, and Battery Storage

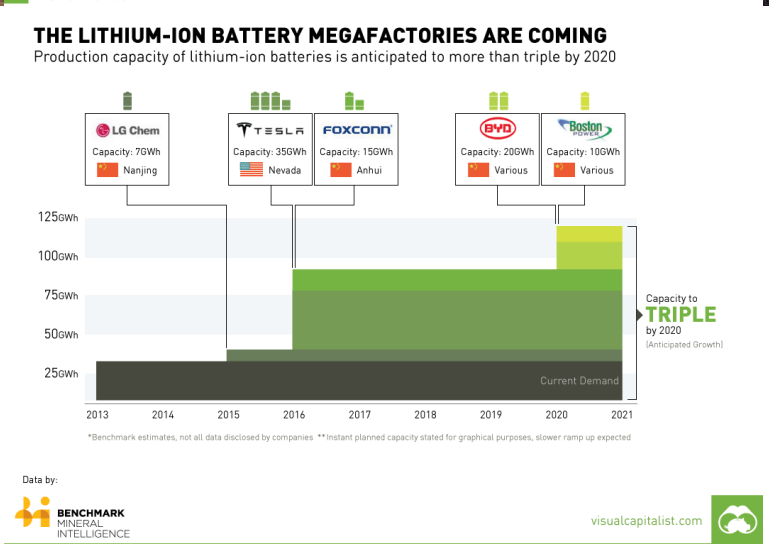


Battery Storage is Here, Growing, Getting Cheaper



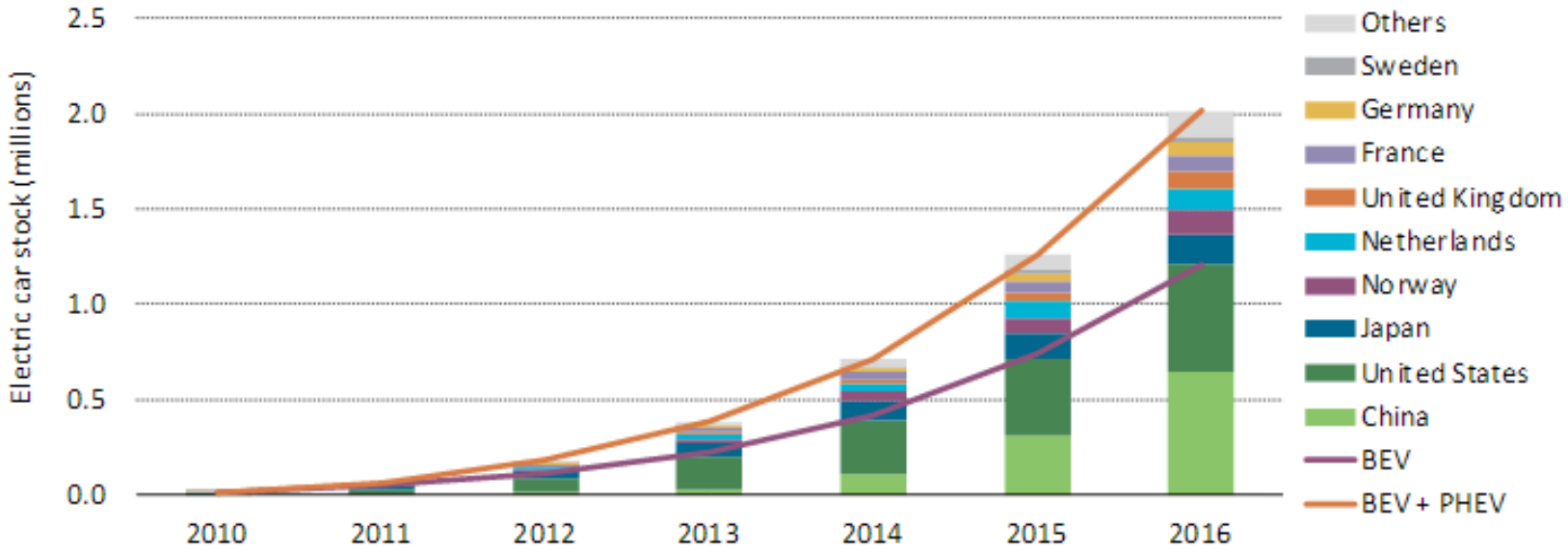
Tesla Gigafactory in NV - $5bn, 5.5mm sf, JV with Panasonic, 6500 jobs; 150 GWh/yr



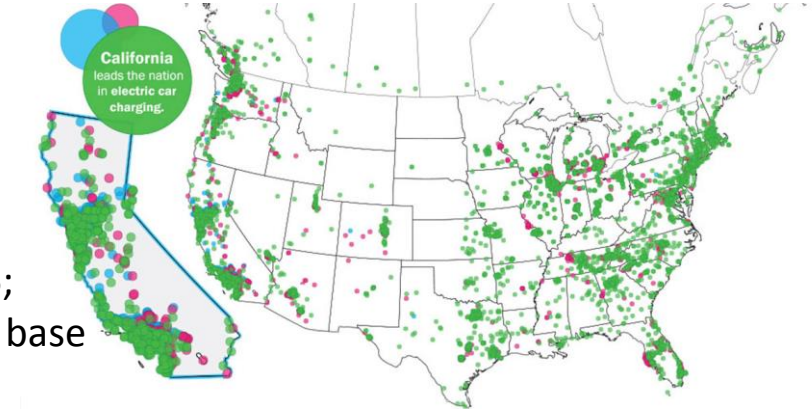


Tesla building a 129 mWh battery in Australia (3x next largest)

Electric Vehicle Adoption is Fast Growing



US: 2016 – 159k (0.9% US car sales)
US: 2017 – 200k (1.2% US car sales) up 26%
CA: from 10,000 EV to 300,000 EV in 5 yrs
CA target: 1.5mm EV by 2015; 5mm EV by 2030
CA: 15,000 EV chargers now; need 250,000 by 2025;
SCE/PG&E/SDG&E asking for $1bn over 5yrs in rate base



Summary - Types of Investment Opportunities

- Overall
  - Many start-ups, optimistic forecasts; new management teams
  - Volatile, faddish, competitive, missed targets
- Developer Public Equity
  - A few public, including some Canadian; several ETFs
  - Most are private, PE/infra fund backed
- Manufacturers/Installers Public Equity
  - Competitive, commoditized
  - Chinese/US PV mfgrs; EU/US/Chinese wind mfgrs; US installers; GE/Siemens
- Yieldco Public Equity
  - Building a portfolio of cash-generating assets – market became competitive, stock prices fell, and it became harder to find accretive investments
  - A few successes, others languished, or were distress-sold to private equity.
- Private Equity Investments
  - Via funds and fund co-investments – equity/infra (primarily institutional)
  - Examples: Blackrock, LS, DESRI, GIP (a few pure RE, many mixed energy/infra)
- Debt
  - Private debt dominated by banks/insurance companies – direct, not funds
  - Public debt – rare due to non-investment-grade credits
  - Mezzanine debt (2nd lien/holding co. project-based) - via funds

Equity in Developers

SunEdison (bankrupt)

Transalta Renewables $1.4bn

- Most US developers are private, PE backed.
- Some are integrated with funds.
- Several active/listed in Canada

Innergex $1.4bn

Northland $2.9bn

Illustrations only, not investment recommendations.

Equity in Solar Installers

Vivent

- Competitive
- Hard to differentiate
- Vendor finance driven

Sunrun

Illustrations only, not investment recommendations.

Equity in Yieldcos

Pattern (PEGI $1.7bn)

8point3 ($1.0bn) (sold)

TerraForm Global ($.9bn) (sold)

Brookfield ($5.5bn)

Nextera Energy Partners ($2bn)

TerraForm Power ($1.7bn) (sold)

A few successful. Many victims of: few accretive assets, market distrust, low stock price, inability to grow. Several sold in distress to PE funds.

Illustrations only, not investment recommendations.

ETFs

Guggenheim Solar ETF

First Trust Global Wind Energy ETF

Illustrations only, not investment recommendations.

Equity in Equipment Manufacturers

SunPower
$1.0bn

Jinko Solar
$0.6bn

FirstSolar
$7.1bn

Vestas
$15bn

Canadian Solar
$0.9bn

Siemens
$109bn
(not pure-play)

Hanwha Q Cells
$0.7bn

Goldwind
$1bn

Illustrations only, not investment recommendations.

Tesla Equity

Illustration only, not investment an recommendation.