

Renewables Outlook

- Agenda
 - Drivers for Renewables
 - The Changing Generation Landscape
 - Tax Incentives
 - State Renewable Energy Standards
 - Technology / Supply & Demand
 - Customer Considerations
 - Challenges for Renewables
 - Renewables Growth
 - Duke Energy's Current Renewables Portfolio
 - Germany's Lessons
 - Probable Trends for US Renewables

Drivers for Renewables

The Changing Generation Landscape

- Air Regulations
 - Mercury and Air Toxic Standards (MATS)
 - Greenhouse Gas (GHG) Rules – CO2 Reduction by 2030 (Current Court Stay)
 - National Ambient Air Quality Standards (NAAQS) – SO2, Ozone, particulate matter (PM2.5)
- Solid Waste Regulations
 - Coal Combustion Residuals (CCR) Rule
- Water Regulations
 - 316(b) Cooling Water Intake Structure Rules
- Public Utilities Regulatory Policy Act (PURPA)
 - Paying Avoided Cost
- Nuclear is being economically displaced by low Natural Gas Prices
- DOD Micro-grids for Cyber Security Protection
- Customer Demand Micro-grids

Drivers for Renewables (Tax Credits)

Federal Investment Tax Credit (ITC)

Technology	12/31/16	12/31/17	12/31/18	12/31/19	12/31/20	12/31/21	12/31/22	Future Years
PV, Solar Water Heating, Solar Space Heating/Cooling, Solar Process Heat	30%	30%	30%	30%	26%	22%	10%	10%
Hybrid Solar Lighting, Fuel Cells, Small Wind	30%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Large Wind	30%	24%	18%	12%	N/A	N/A	N/A	N/A

Federal Production Tax Credit (if ITC wasn't used)

- Applying the inflation-adjustment factor for the 2016 calendar year, the production tax credit amount is as follows:
 - \$0.023/kWh for wind, closed-loop biomass, geothermal energy resources, and solar systems that have not claimed the Investment Tax Credit
 - For wind facilities commencing construction in 2017, the PTC amount is reduced by 20%
 - For wind facilities commencing construction in 2018, the PTC amount is reduced by 40%
 - For wind facilities commencing construction in 2019, the PTC amount is reduced by 60%

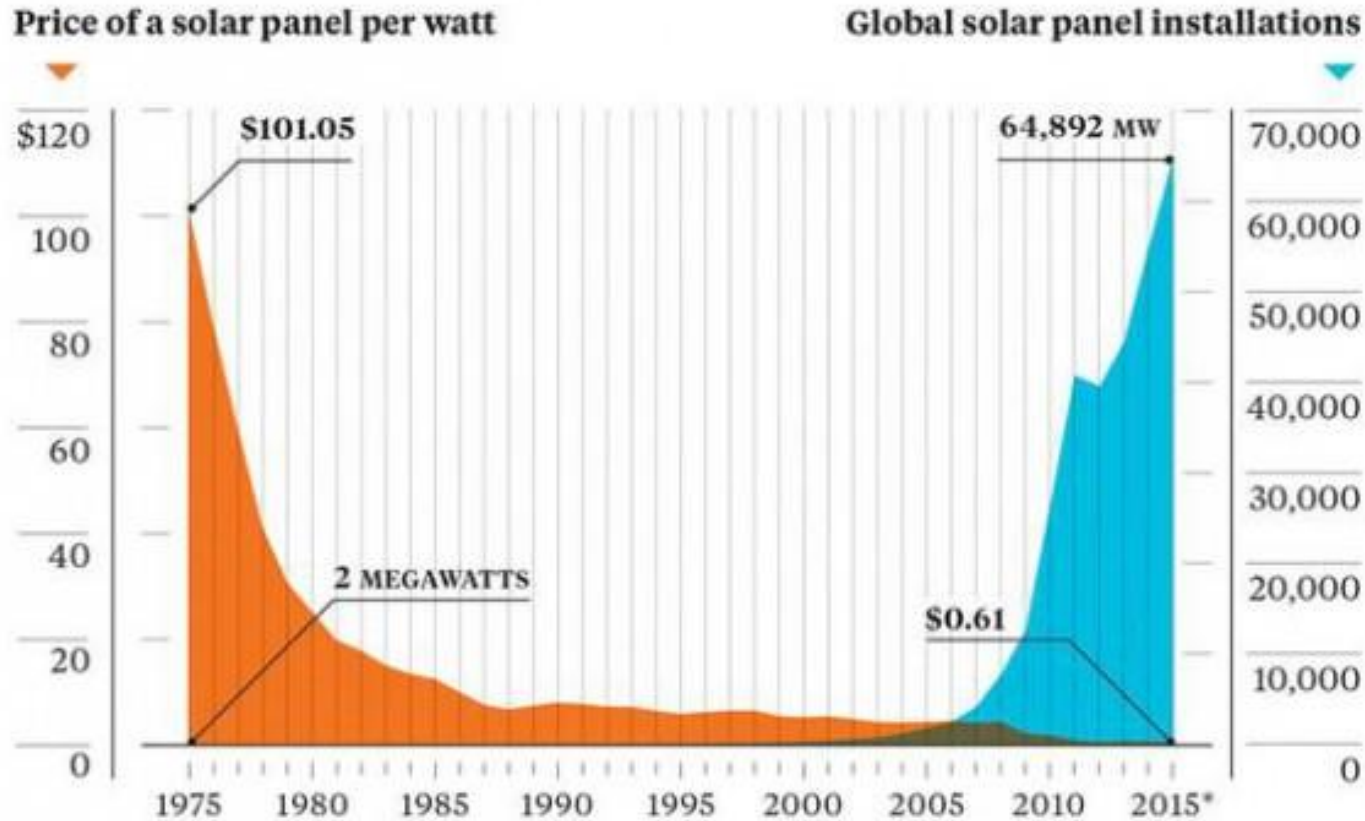
States offer varying Tax Incentives

Drivers for Renewables (State Standards)

29 States and the District of Columbia require Renewable Energy Standards

- For example, North Carolina has a requirement that 12.5% of the states power come from Renewable Sources by 2021
- Ohio has a requirement that 12.5% of the states power come from Renewable Sources by 2027

Drivers for Renewables (Technology/Supply & Demand)



Drivers for Renewables (Customers)

By outpacing policy, technology and customers will ultimately drive the market.



While policy helped jumpstart renewable growth, it has fallen behind the pace of technology and customer demand.

Drivers for Renewables (Customers)

Customer Considerations

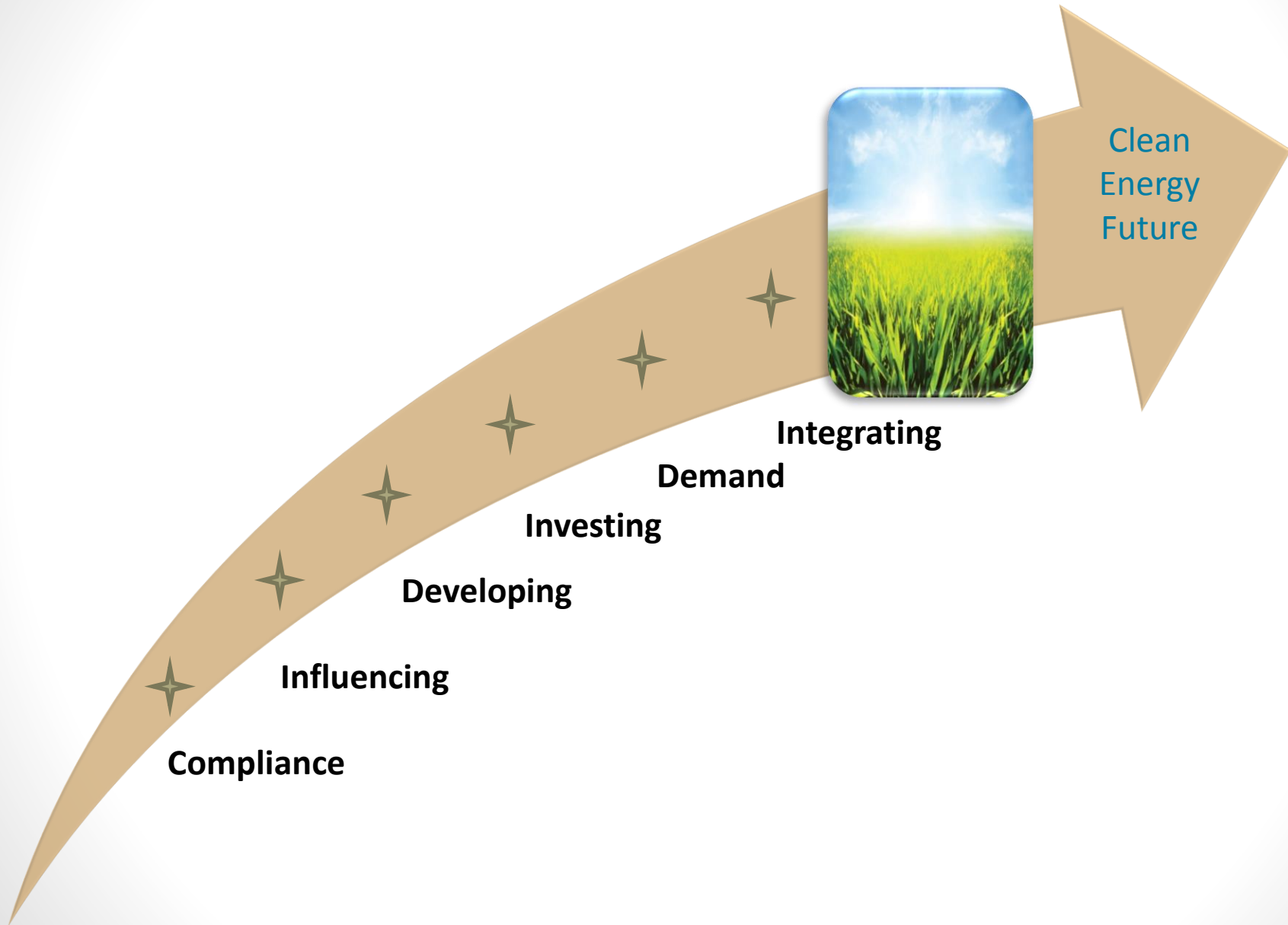
More and more customers are focused on Sustainability and minimizing their environmental footprint.

Google – Powering their Data Center operations with 35% Renewable Energy currently, their goal is for 100% Renewable Energy power

Apple – In 2015, 93% of their Energy Consumption was from Renewable sources, their goal is for 100% Renewable Energy power

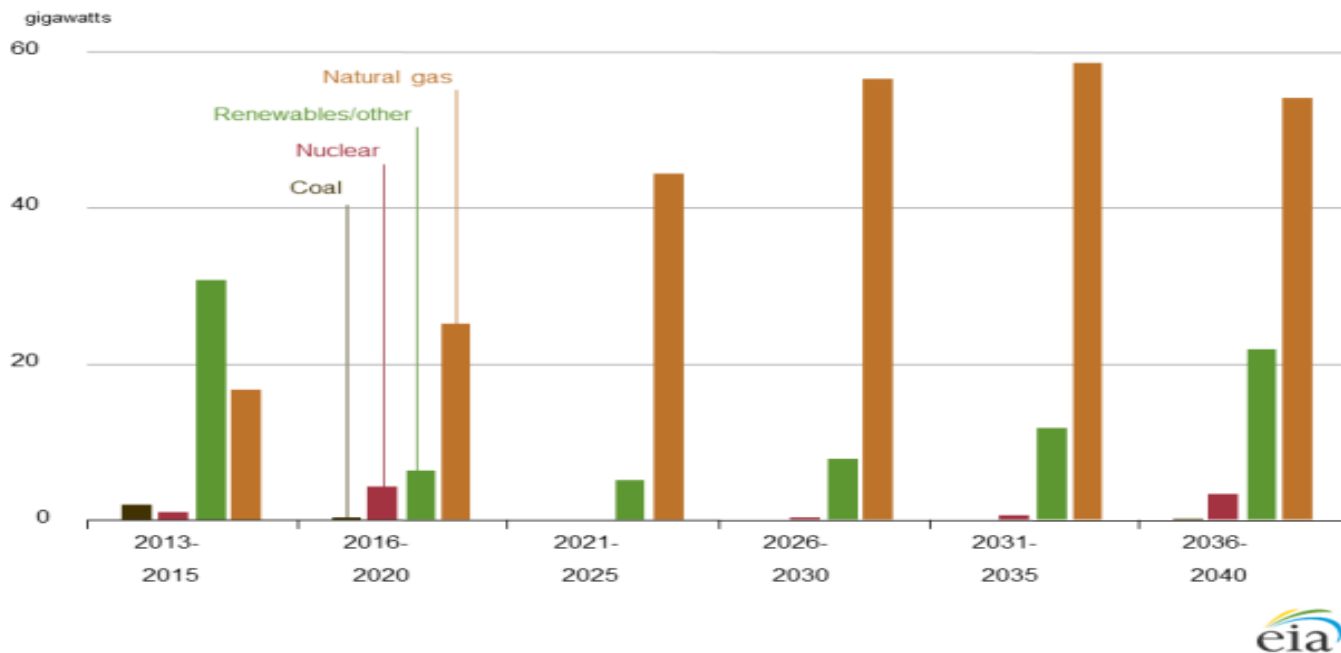
Anheuser-Busch – Uses approximately 3,000 solar panels to help power their Newark, NJ operations (supplies about 5% of their power consumption). In Fairfield, CA, they obtain 15% of their power from solar and wind sources

Renewables Structural Market Path



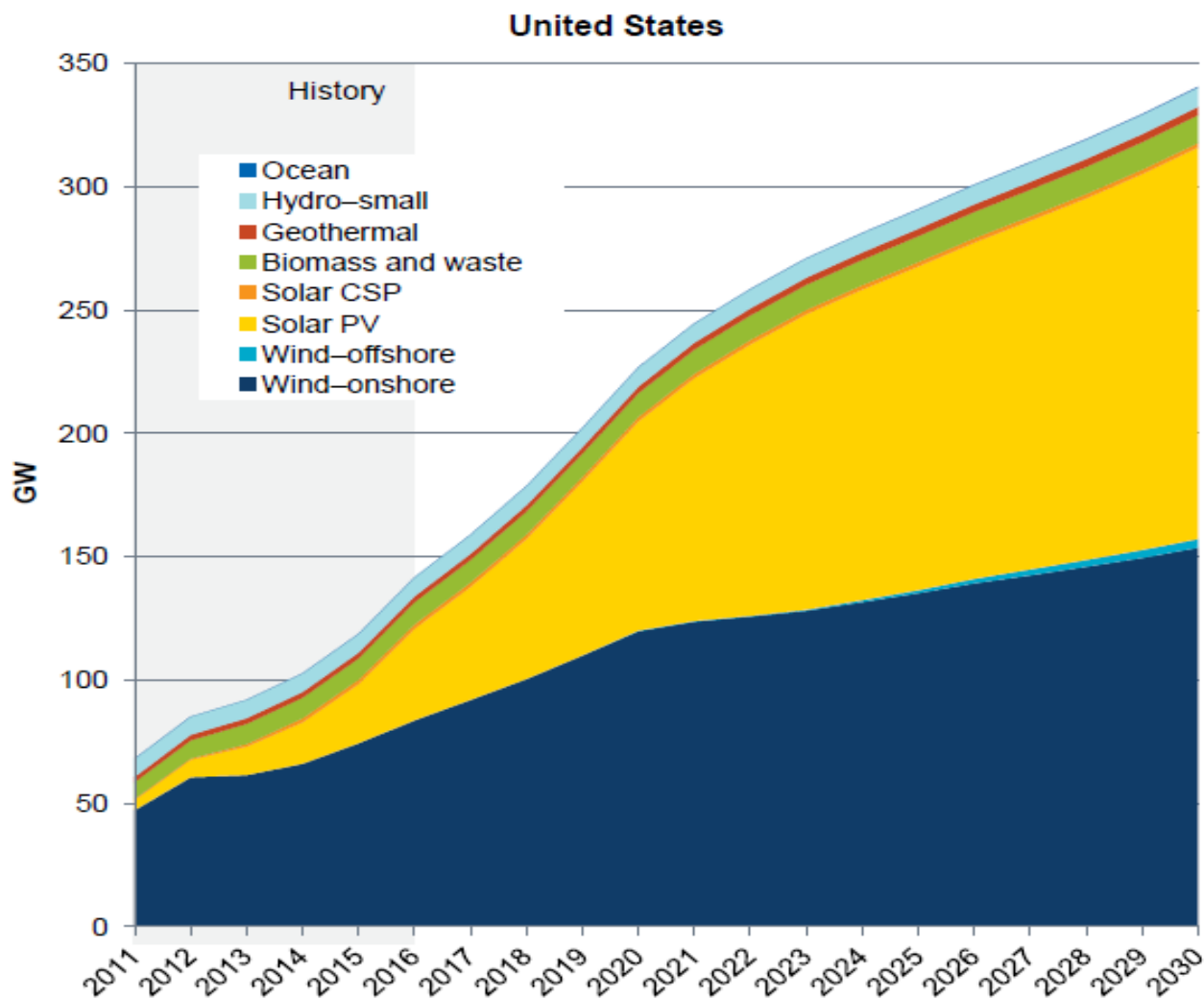
US Renewables Growth

Figure MT-31. Electricity generation capacity additions by fuel type, including combined heat and power, in the Reference case, 2013-40



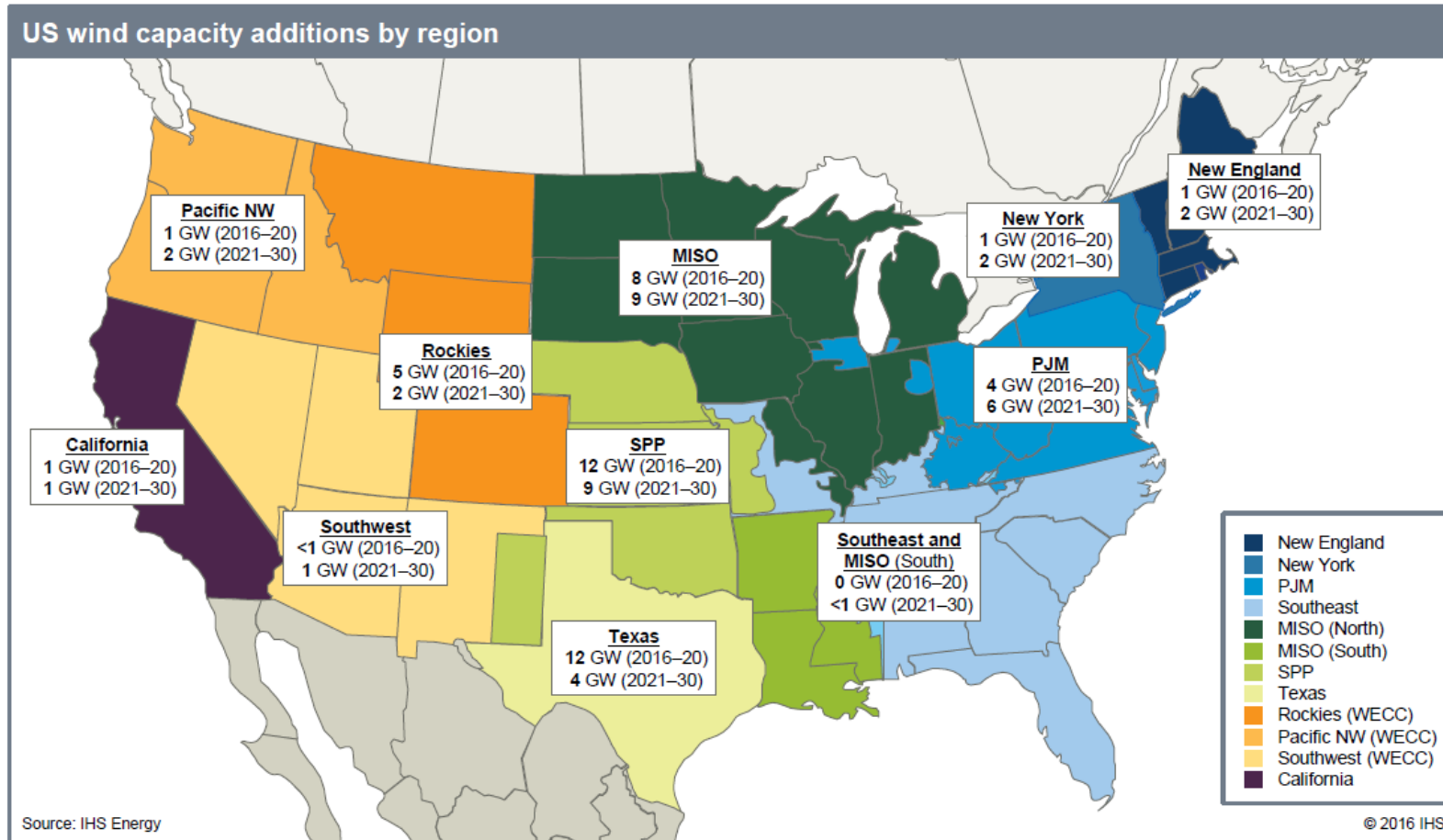
The majority of future demand is predicted to come from two fuel sources: Natural Gas and Renewables

US Renewables Growth



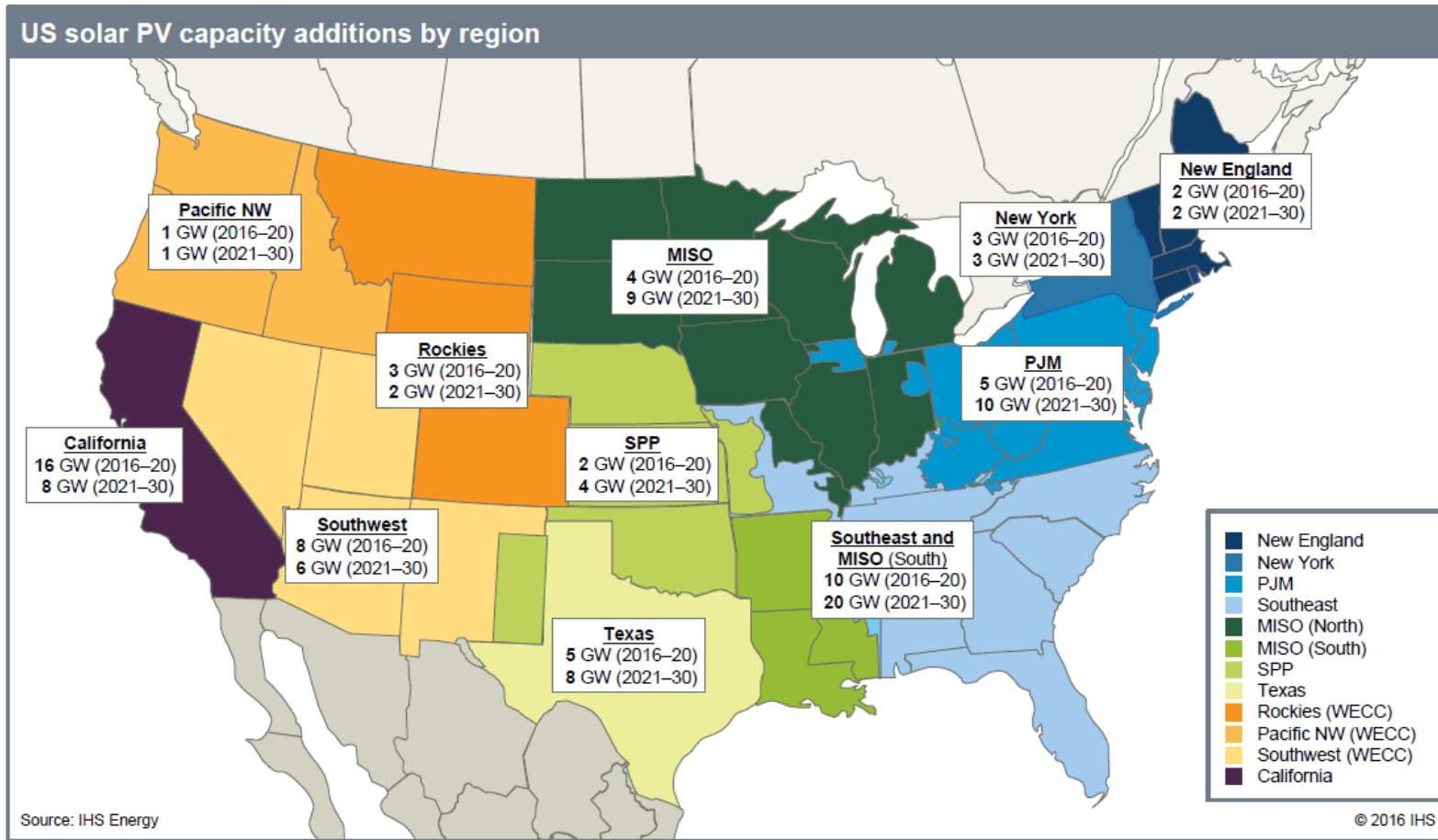
Note: CSP = concentrated solar power.
Source: IHS Energy

U.S. Wind Growth by Region



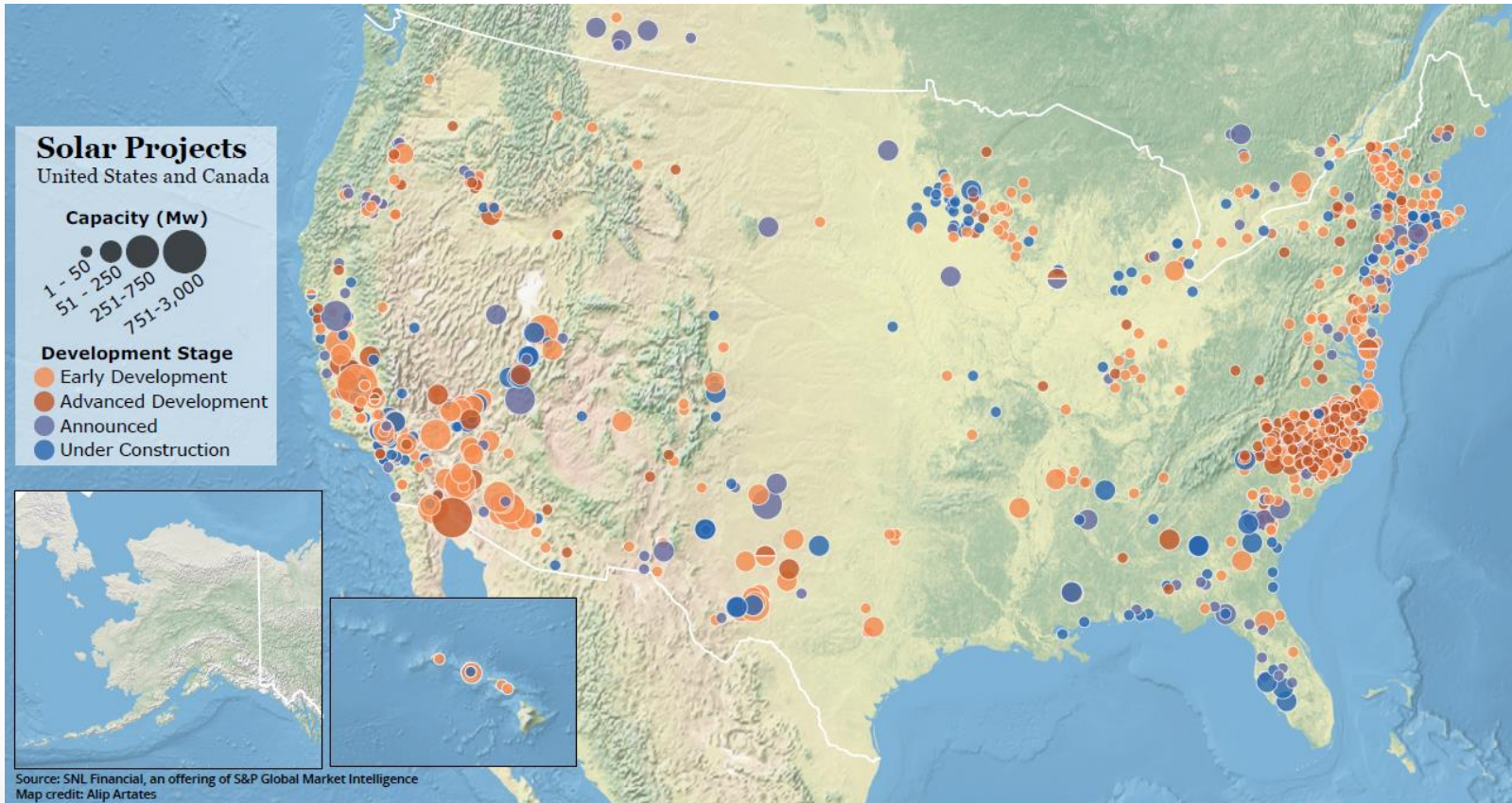
IHS Forecasts 80,000 MW of new wind from 2016-2030

U.S. Solar Growth by Region



IHS Forecasts 135,000 MW of new solar from 2016-2030

U.S. & Canada Solar Projects



Challenges for Renewables

- Grid Stability
 - The current Grid wasn't designed for multiple intermittent small scale generators
- Net Metering/PUPRA
 - Several States require Utilities to pay small scale generators the "retail rate" for power produced
- Farmland (Utility Scale Projects)
 - Many landowners can get 12 times as much income from Solar Leasing than from Farmer Leasing
- Not in my Back Yard

Duke Energy's Renewable's Investment (excluding Hydro)

Duke Energy Renewables and Distributed Energy Technology

- **\$5.8 billion** invested
- **20** wind projects
- **60** solar facilities in operation in more than a **dozen** states
- More than **3000MW** of generating capacity
- **1,830MW** operating for third party

Duke Energy's Current Generation Portfolio (Regulated & Non-Regulated)

Duke Energy Solar, Wind and Battery Storage Portfolio



Duke Energy Renewables and Regulated Assets
 ©2017 Duke Energy Corporation 170052 2/17

Germany's Lessons

- Grid Stability (geographically, Montana is the size of Germany)
 - Germany has overcome their Grid Stability issues – 38% of their power is from Renewables
 - It takes significant planning (planned for 6 months for a solar eclipse) and deploying new technology (upgraded their grid)
- Net Metering or Generation
 - Germany's early policy was to pay full retail rate and many entrepreneur's took advantage of this generous offer. Power prices climbed by 50% in 7 years.
 - Germany later revised their policy and it is not as economically lucrative now and power prices are stabilizing
- Urbanization
 - Many urban areas have solar panels and micro-grids have been set up where the home owners and businesses buy and sell power (trade)

Probable Trends US Renewables

- Grid Stability
 - The US must overcome Grid Stability issues – today about 7% of US Power comes from Wind (6%) / Solar Sources (1%)
 - It can be done, Germany provides an example
- Net Metering/PURPA
 - The US needs to solve the Net Metering and PURPA issue that is fair and balanced for Utilities and the Wind/Solar industry
- Battery Technology
 - Increases in Battery Technology will help to drive Wind/Solar development and Micro-grids
- Urbanization
 - In my opinion, there will be a move toward urbanization of Solar (smaller scale) and associated micro-grids
- Technology
 - Remember when everyone had a phone in their home, payphones were on every corner, and no one had a cell phone?