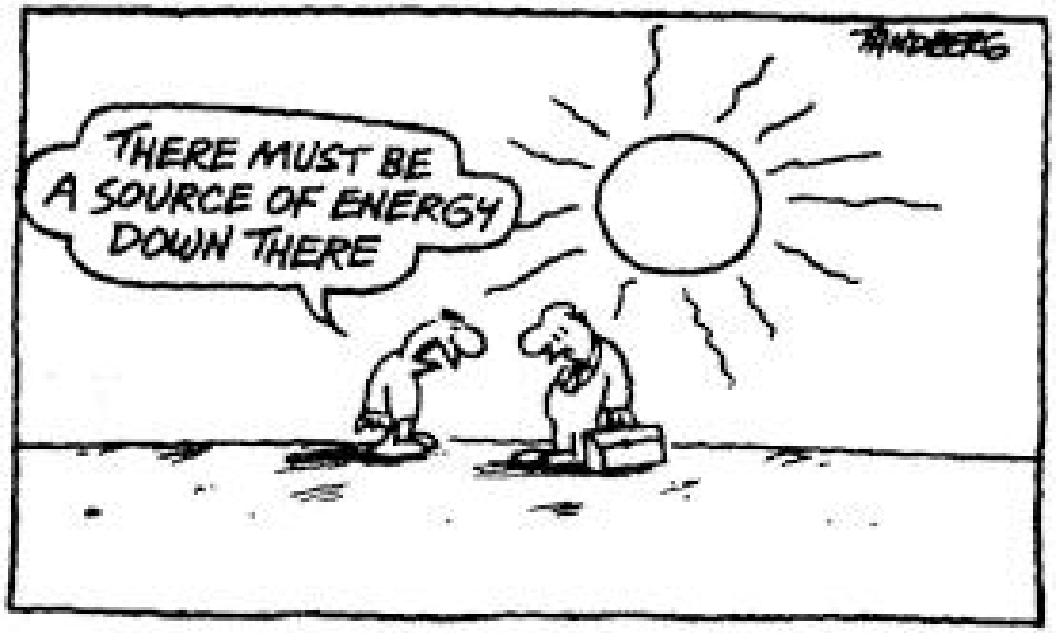
Making Hay While the Sun Shines

Debunking 10 Popular Myths about Solar Energy



Energy
"Lookin' for ~~Love~~ in All the Wrong Places"

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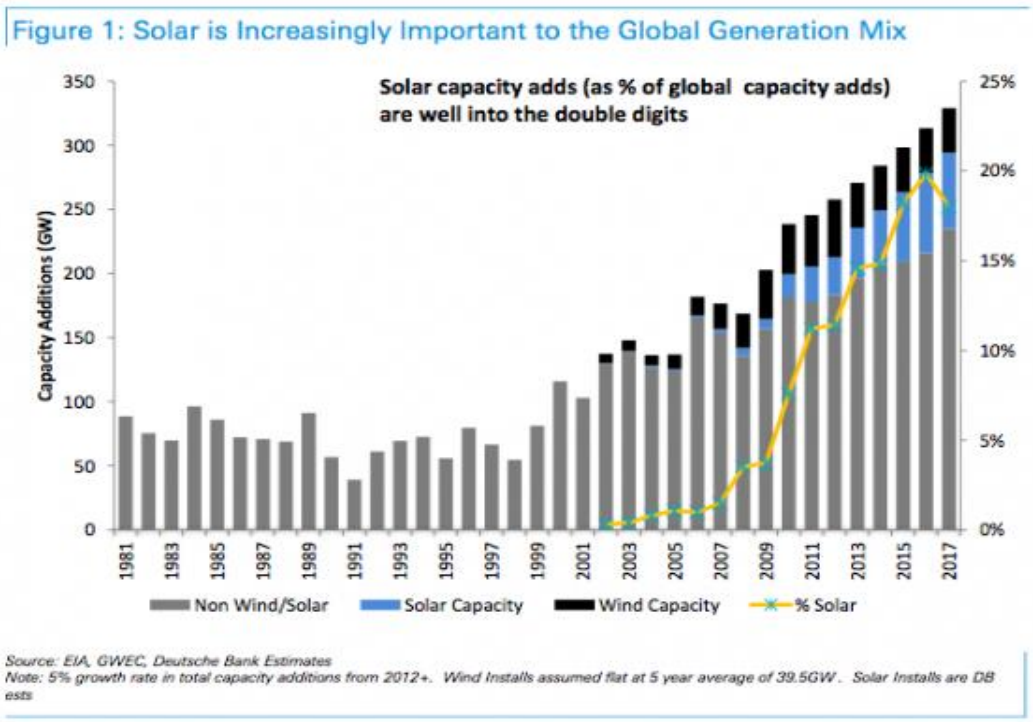
Myth #1: Solar Power Will Be a Small Percentage of New Electricity Generation



Facts and Forecasts:

- Solar power generated about 15% of all new global electrical capacity in 2014(1)
- Solar power generated about 35% of all new US electrical capacity in 2014(2)

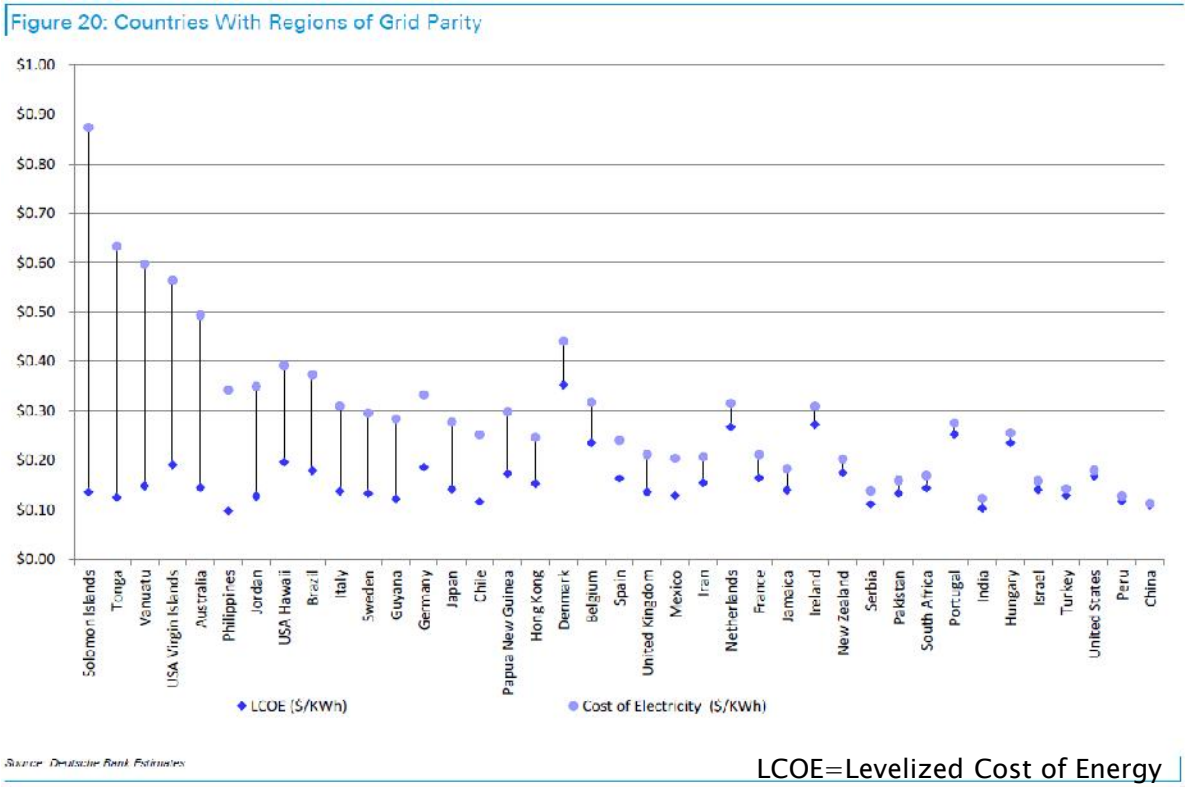
Insights:

- Financial and tax incentives will be required for at least the next two years in some countries before solar-generated electricity can compete with traditional energy sources
- If future peak demand can be met with energy storage rather than generation, solar power as a percentage of total capacity adds could be even larger

(1) Deutsche Bank 2015 Solar Outlook Market Research Paper, January 8, 2015

(2) The U.S. Solar Energy Industry: Powering America, SEIA, January 21, 2015

Myth #2: Solar Power Will Never Offer Competitive Electricity Rates



Facts and Forecasts:

- The unsubsidized LCOE of solar is at grid parity in 29 countries, and in the highest rate regions in an additional 10 countries[1]
- Seven US states were at or below grid parity in 2014. Twenty-eight US states are projected to be at or below grid parity by 2020[2]

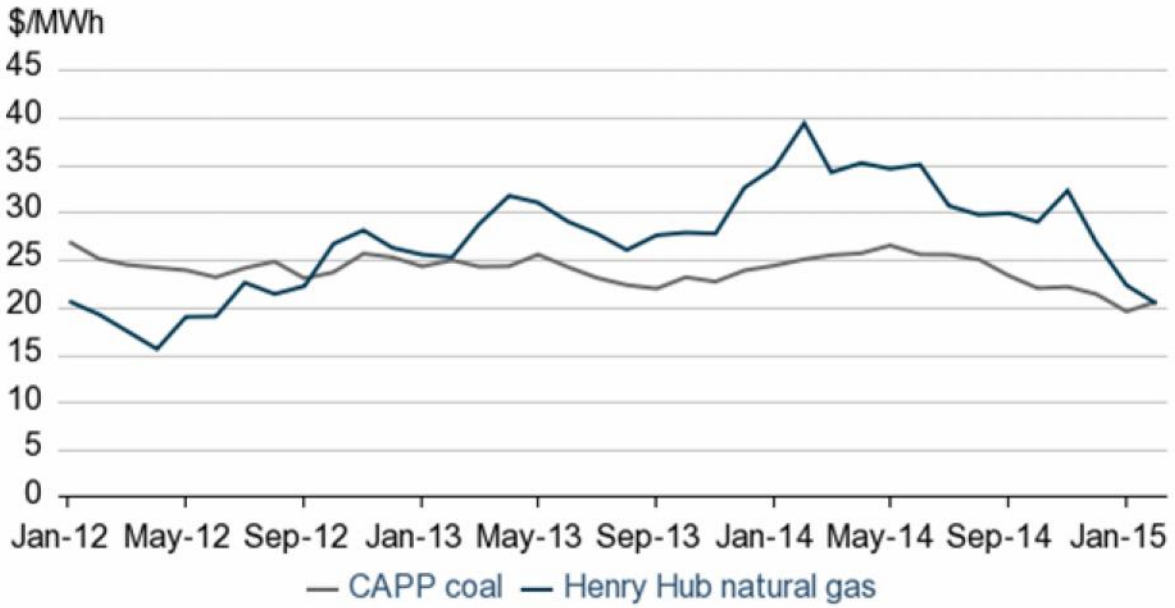
Insights:

- Solar PV power is expected to reach grid parity in 80% of countries in the next two years[3]
- Most recent grid parity analyses are taking into account the intermittent nature of solar generation, and comparing the delta of revenues vs. cost in comparing electricity rates from competing energy sources

(1) Deutsche Bank 2015 Solar Outlook Market Research Paper, January 8, 2015
(2) GTM Research, Solar Tipping Point Presentation, Dec 9,2014
(3) Financing the Future of Energy, University of Cambridge and PwC, March 2015

Myth #3: Plentiful Natural Gas Will Obviate the Need For Solar Energy

Figure 14. Estimated monthly average price for electricity generation



eia Bloomberg

(1) US EIA Short Term Energy Outlook, Market Prices and Uncertainty Report, Feb 10, 2015

(2) BP Energy Outlook 2035 Fact Sheet, January 2014

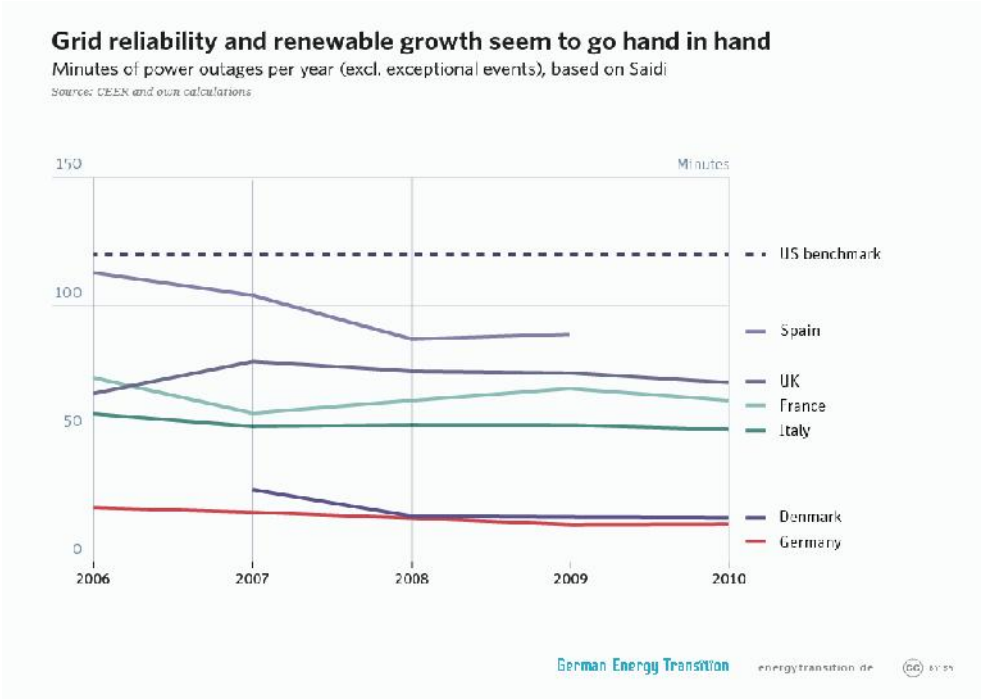
Facts and Forecasts:

- Coal power has been cheaper than natural gas power from Sept 2012 to Jan 2015(1)
- Globally, renewable energy usage will grow 6.4% per year while natural gas usage will grow by only 1.9% per year through 2035(2)

Insights:

- Increasing demand for NG as coal plants are retired could add to price volatility
- Natural gas will be a major source of electricity in the US, but less so worldwide
- Export of LNG from US to other countries where gas prices are higher could add to price volatility

Myth #4: Intermittent Nature of Solar Power Will Soon Severely Impact Grid Reliability



Source: The German Energiewende, energytransition.de

Facts and Forecasts:

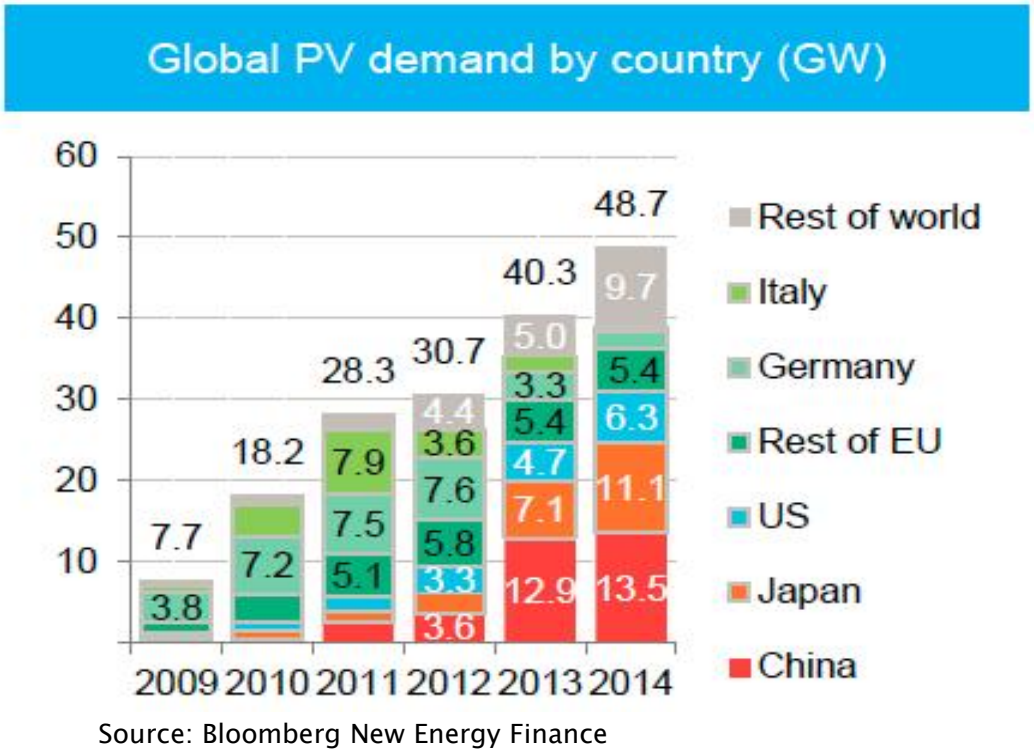
- Germany, with >25% renewable power on average fed to the grid, has an average of 15 minutes of grid outages per year which is among the lowest in the world(1)
- Reactive power in AC transmission systems, not real power, is frequently the bottleneck when it comes to stabilizing the grid(1)

Insights:

- Using Volt-VAR control to manage voltage levels and reactive power can have a significant impact on distribution network stability(2)
- Innovative utility-scale inverter designs can help avoid grid instability for the next few years. More grid lines with intelligent monitoring and control will be needed in the future as distributed solar plants proliferate.

(1) The German Energiewende, energytransition.de
(2) Electric Power Research Institute Smart Grid Demonstration Initiative, January 2015

Myth #5: Most Solar Deployments are in Europe Due to Generous Feed-in-Tariffs



Source: Bloomberg New Energy Finance

Facts and Forecasts:

- In 2014, China, Japan and US deployed more solar than Europe[1]
- Rest of the World (ROW) countries deployed about 20% of the total of 48.7GW of solar deployed in 2014[1]

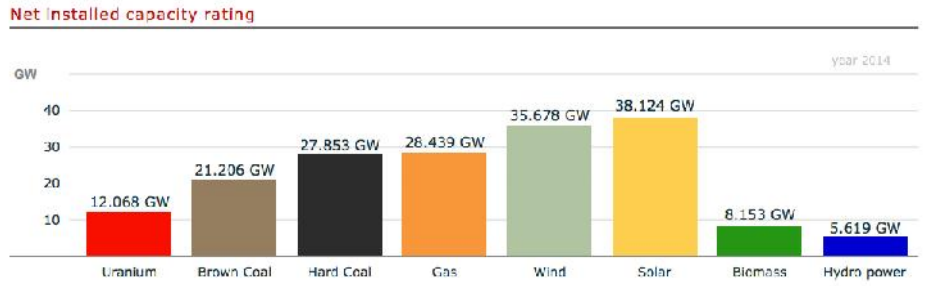
Insights:

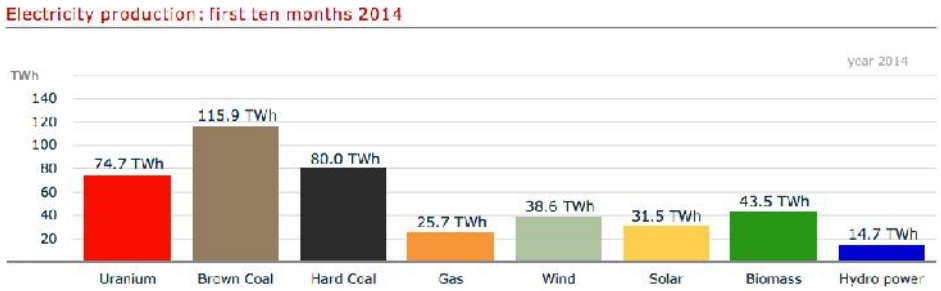
- Latin America is expected to deploy 2GW of solar in 2015, most without use of subsidies[2]
- China could surpass Germany in 2015 for the most cumulative installed solar power capacity
- California could lead the world in 2015 with 10% of annual power generation coming from solar
- India, UK, Chile and Middle Eastern countries are solar growth area

(1) Bloomberg New Energy Finance Sustainable Energy in America 2015 Factbook, February 2015

(2) GTM Research Latin America PV Playbook, July 2014

Myth #6: A Major Share of Germany's Electricity Production Is Generated by Solar





Source: Fraunhofer Institute for Solar Energy Systems

Facts and Forecasts:

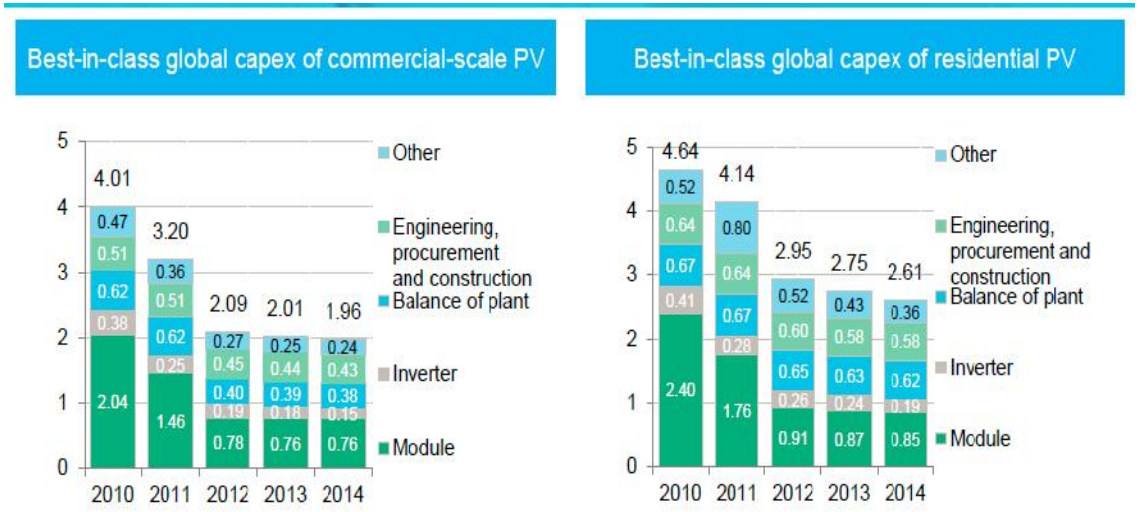
- Despite solar comprising >20% of net installed capacity in 2014, <8% of Germany's electricity was produced by solar power(1)
- Coal produced >45% of the electricity generated in Germany in 2014(1)

Insights:

- PV-generated residential energy in Germany costs about $0.15 Euro/kWh while energy from the grid costs about $0.30 Euro/kWh
- Excess PV-generated residential energy in Germany is sold back to the grid at a current FIT of about $0.13 Euro/kWh
- Use of energy storage systems in conjunction with PV could increase the amount of electricity used by residences from about 30% to 60%

(1) Electricity Production from Solar and Wind in Germany in 2014, Fraunhofer Institute, December 29, 2014

Myth #7: Only Chinese Module Suppliers Benefit from Growth of Solar Industry



Facts and Forecasts:

- Module costs currently represent <40% of total residential and commercial solar installation costs(1)
- More than 50% of total residential and commercial solar installation costs are incurred locally(1)

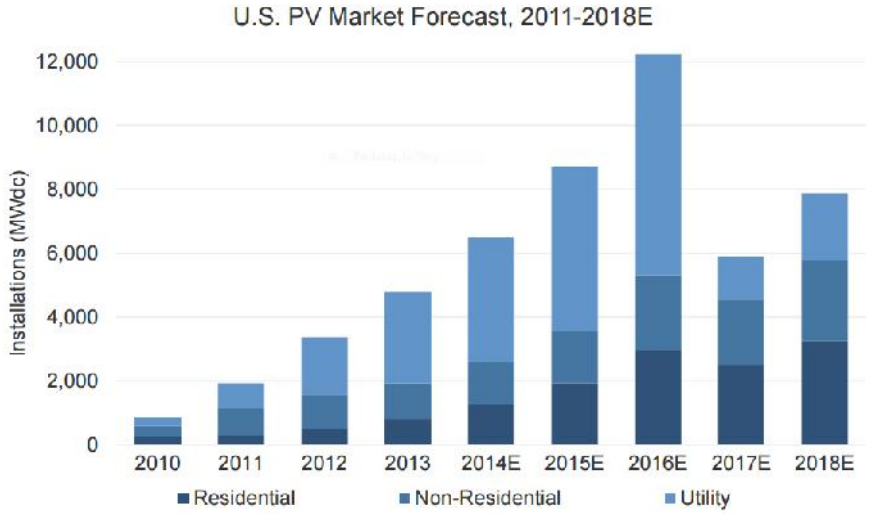
Insights:

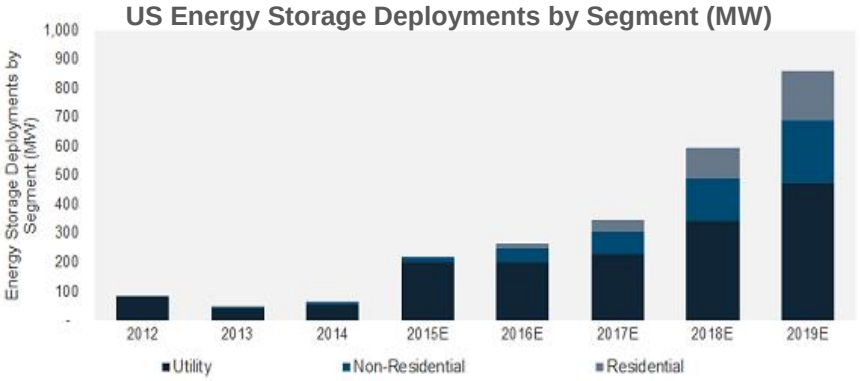
- Nearly 174,000 workers are employed in the US solar industry, nearly double the number from 2011
- Solar now employs more US workers than the coal mining industry
- Solar added 50% more US workers in 2014 than the number of new workers for the oil and gas pipeline construction and for the crude petroleum and natural gas extraction industries combined

(1) Bloomberg New Energy Finance Sustainable Energy in America 2015 Factbook, February 2015

Source: Bloomberg New Energy Finance

Myth #8: Energy Storage Will Be Crucial for Near-Term US Solar Energy Expansion





Souce: GTM Research

Facts and Forecasts:

- New solar energy storage deployments in US in 2018 are forecast to be <10% of new solar PV capacity installed(1)
- Net-metered residential and commercial solar, now available in 43 states, represented about 40% of the total solar capacity installed in the US in 2013, but about 99% of the total installations(2)

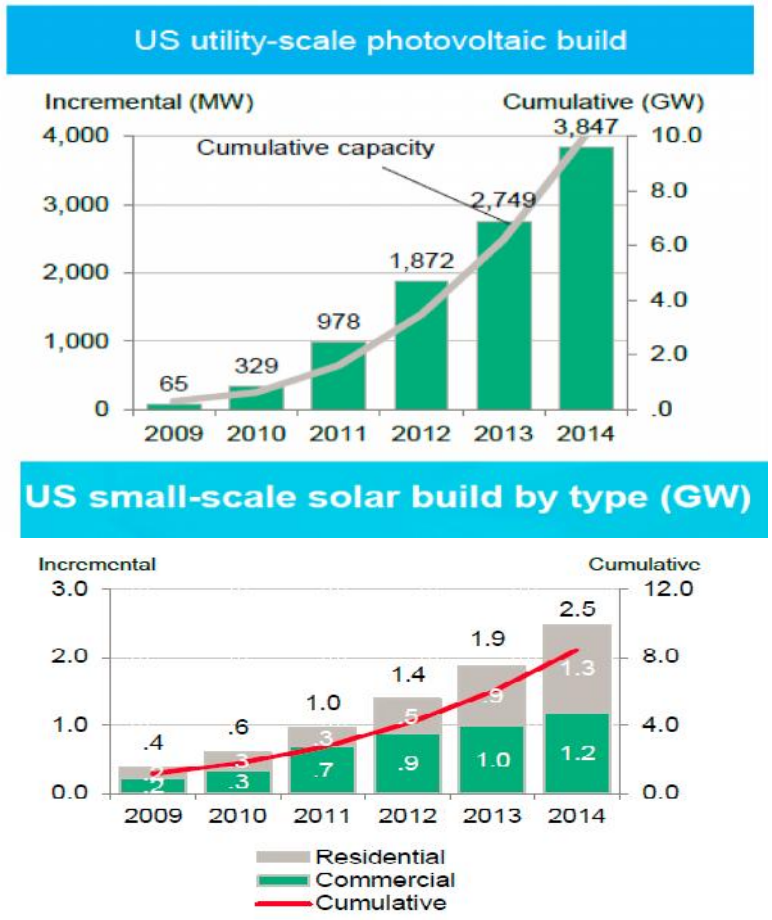
Insights:

- In the short-term, declining solar costs, net metering, and simplified interconnection procedures will spur the growth of US solar usage
- Relaxation of regional power import/export rules could help as much as energy storage to spur solar growth

(1) GTM Research, SEIA Solar Focus, November 2014

(2) LLBL Tracking the Sun VII, September 2014

Myth #9: Utility-Scale Projects Will be the Major Source of US Solar Energy



(1) Bloomberg New Energy Finance Sustainable Energy in America 2015 Factbook, February 2015

Source: Bloomberg New Energy Finance

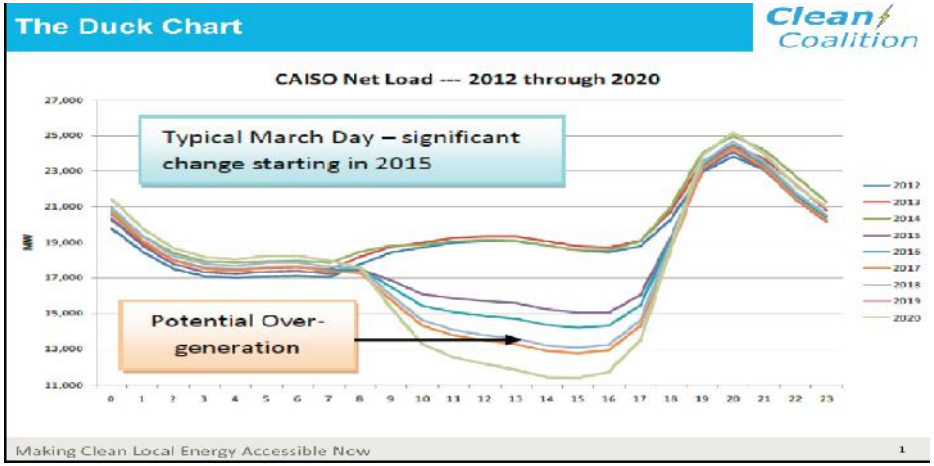
Facts and Forecasts:

- Despite attractive 30% investment tax credit (ITC), cumulative utility-scale solar capacity in US is only 2GW more than residential and commercial solar capacity (1)
- NRG Home Solar, Solar City, and Vivint secured more than $100M each in tax-equity investments for residential installations in 2014(1)

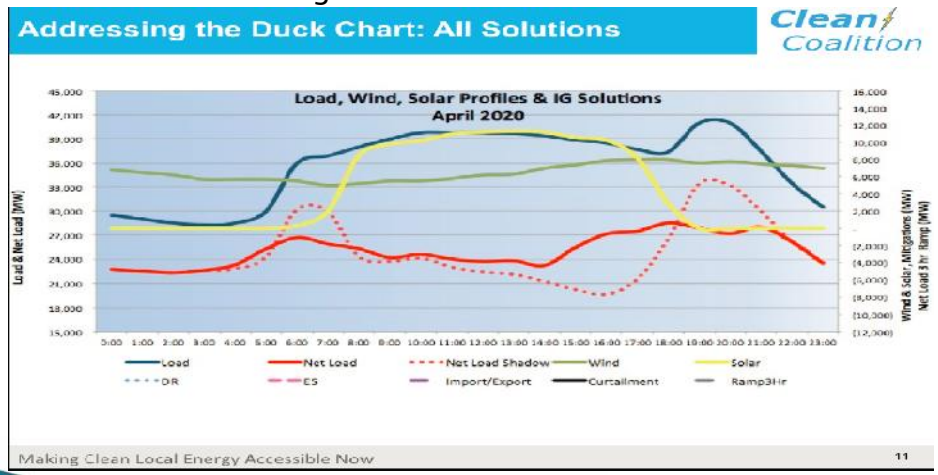
Insights:

- Reduction in Investment Tax Credit in 2017 from 30% to 10% could discourage some utility-scale and large commercial solar projects
- Apple, Google, Wal-Mart, and Prologis are making significant investments in commercial solar energy projects because solar power lowers their OPEX, and reflects their corporate culture and brand identity

Myth #10: California's "Duck Curve" Illustrates the Need for More Peaker Plants



Duck Curve=Increasing solar generation plus non-dispatchable base power (nuclear+less flexible gas) can create more supply than demand starting in 2018



(1) Clean Coalition Renewables Integration White Paper, May 2013

Facts and Forecasts:

- CA Independent System Operator (CAISO) projects potential over generation during peak solar periods starting approximately 2018[1]
- Largest load ramp occurs 2 hours before the sun comes up, and 2 hours after the sun goes down requiring either "fill-in" generation, or demand management or curtailment [1]

Insights:

- In lieu of new gas peaker plants, anticipated load ramping can be addressed by a combination of:
  - Expansion of Energy Imbalance Markets to enable power import and export between grid operating authorities
  - Demand response programs
  - Intelligent inverters and grid technology
  - Battery and power-to-gas energy storage

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For an annotated version of this presentation or for further details on the topic, contact Mort.Cohen@RevGenGroup.com