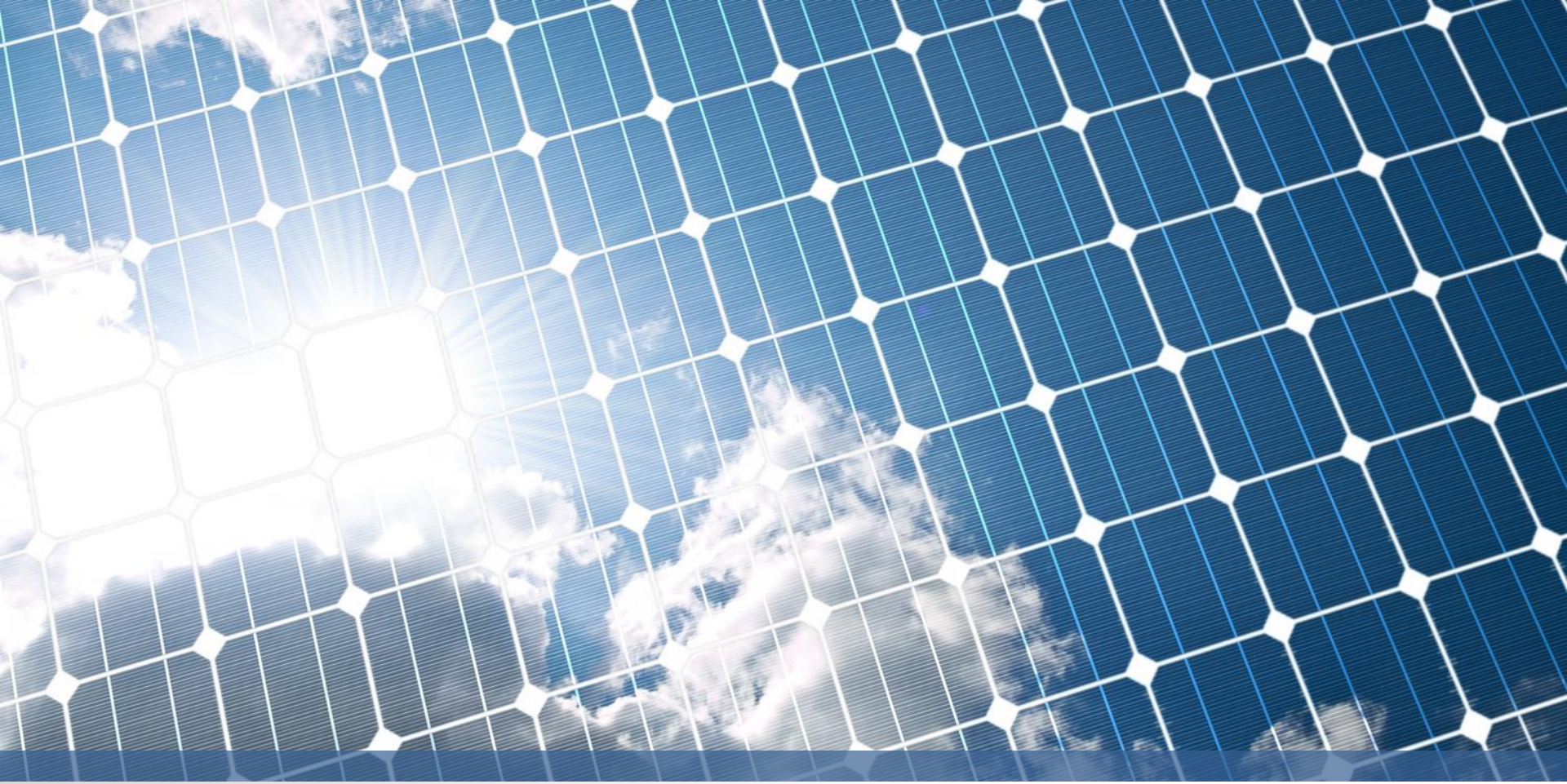
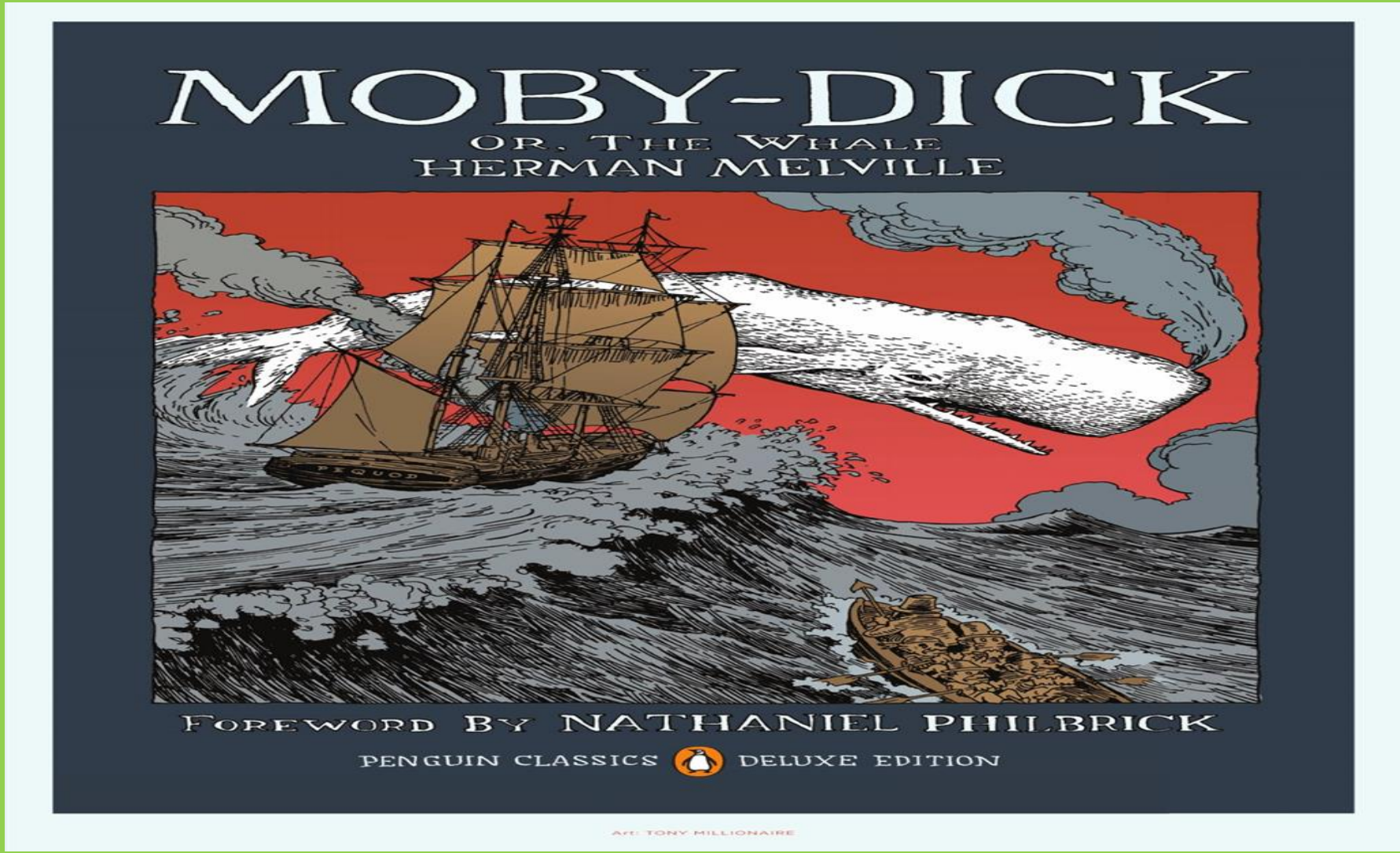
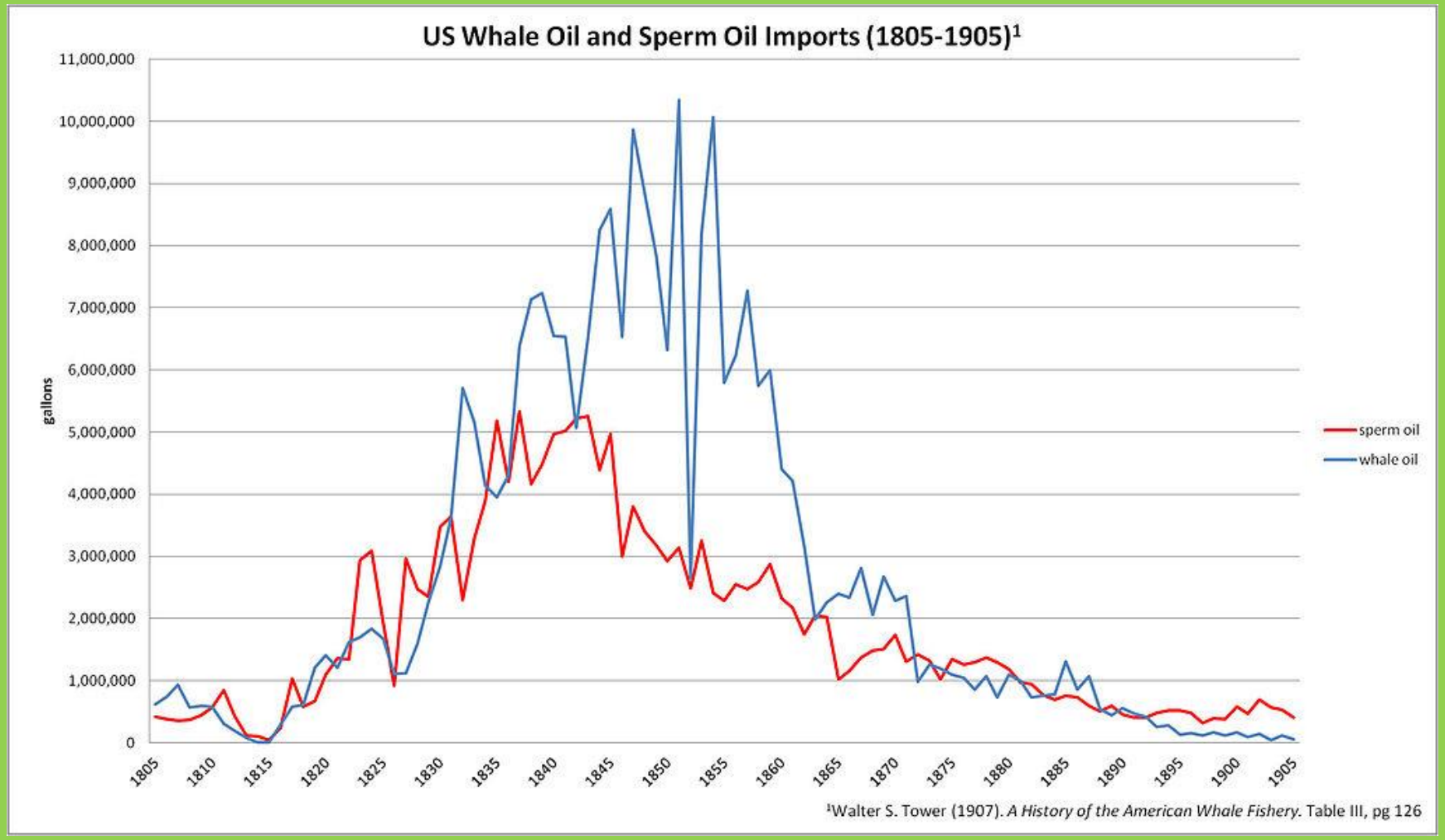


The Solar Wars: net-metering, tariffs, grid defection, and the Trump effect

History of electricity in the USA



The beginning of the utility model - 1840



Samuel Kier – The founder of the oil industry

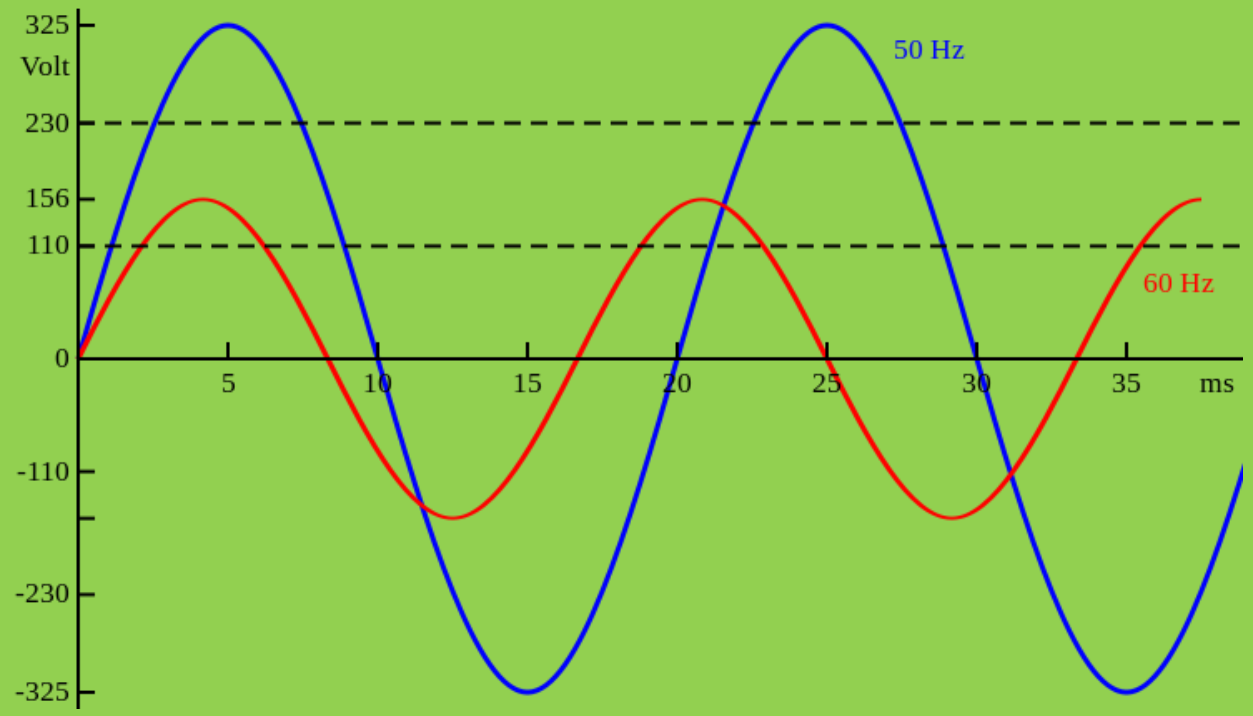
- During the 1840's, Kier's salt wells were becoming fouled with petroleum. Kier simply dumped the useless oil into the nearby Pennsylvania canal, and one day the slick caught fire.
- Kier began experimenting with distilling the oil, and soon after created lamp oil, called Kerosene.
- Between 1850-1870, kerosene lighting started to displace whale oil for lighting, and started the end of the whaling industry.
- During this time, municipalities starting switching to kerosene lighting, and began the more organized modern utility model.
- Even today, a common phase for the purpose of an electric utility is "keep the lights on".

Thomas Edison: modern electric utility - 1879

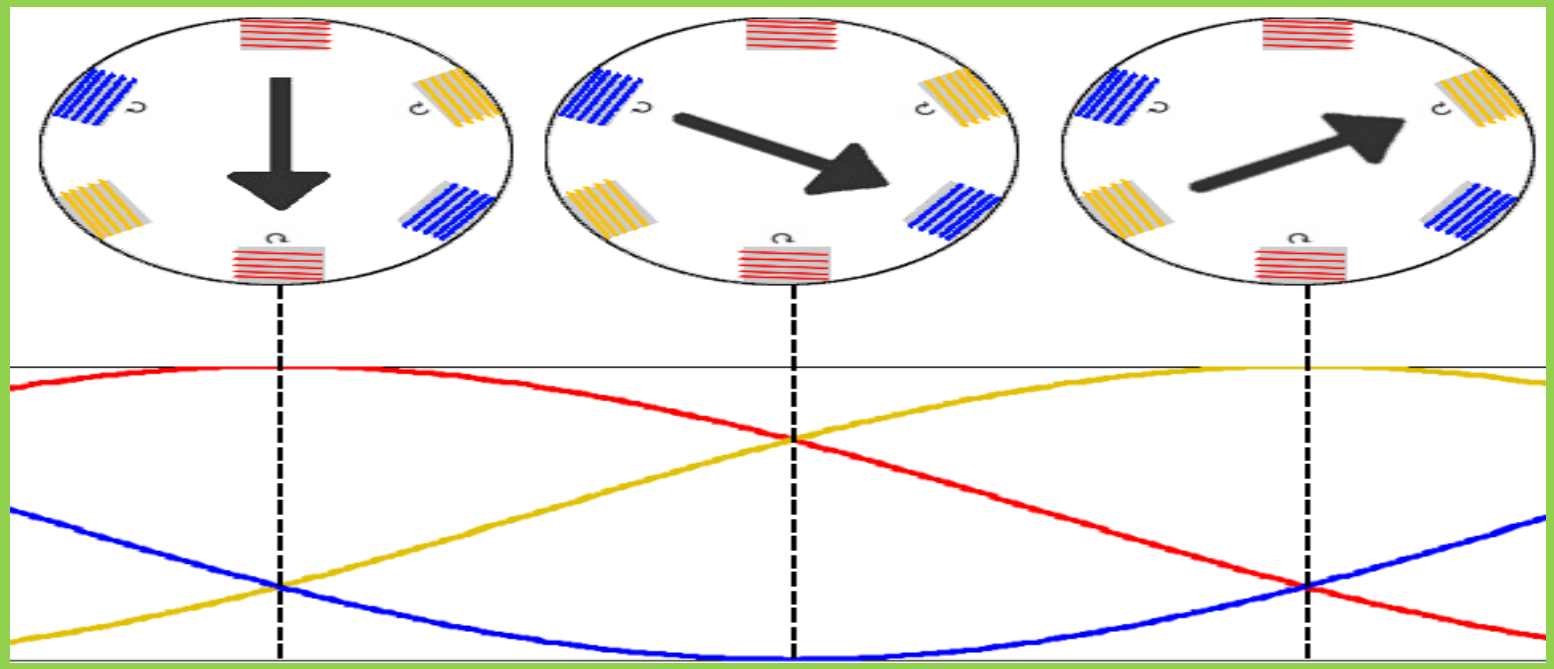
- Patented the first practical incandescent light bulb using carbon filament and striped coils connected to platina contact wires in 1879. Edison then starting working on a method to power these bulbs to create a marketplace.
- In 1882, he developed this system – the Pearl street generation plant in lower Manhattan, NY. These reciprocating steam engines produced direct current – DC power.
- As this new industry was born, entrepreneurs saw a large market for electricity consumption, they sought franchises from municipal governments to build power stations.
- One main obstacle remained – the DC power generated at the relatively low voltage, weakened substantially as it traversed the distribution lines.

War of the currents – AC vs DC 1890's

- Thomas Edison has already started to build out his market, and utility model based on DC electricity.
- George Westinghouse was convicted of another way – AC or alternating current.



Nikola Tesla's Induction Motor - 1887



For induction motors, The supplied AC power to the motor creates a magnetic field that rotates in time with the AC oscillations.

The current war ends – AC wins with Tesla

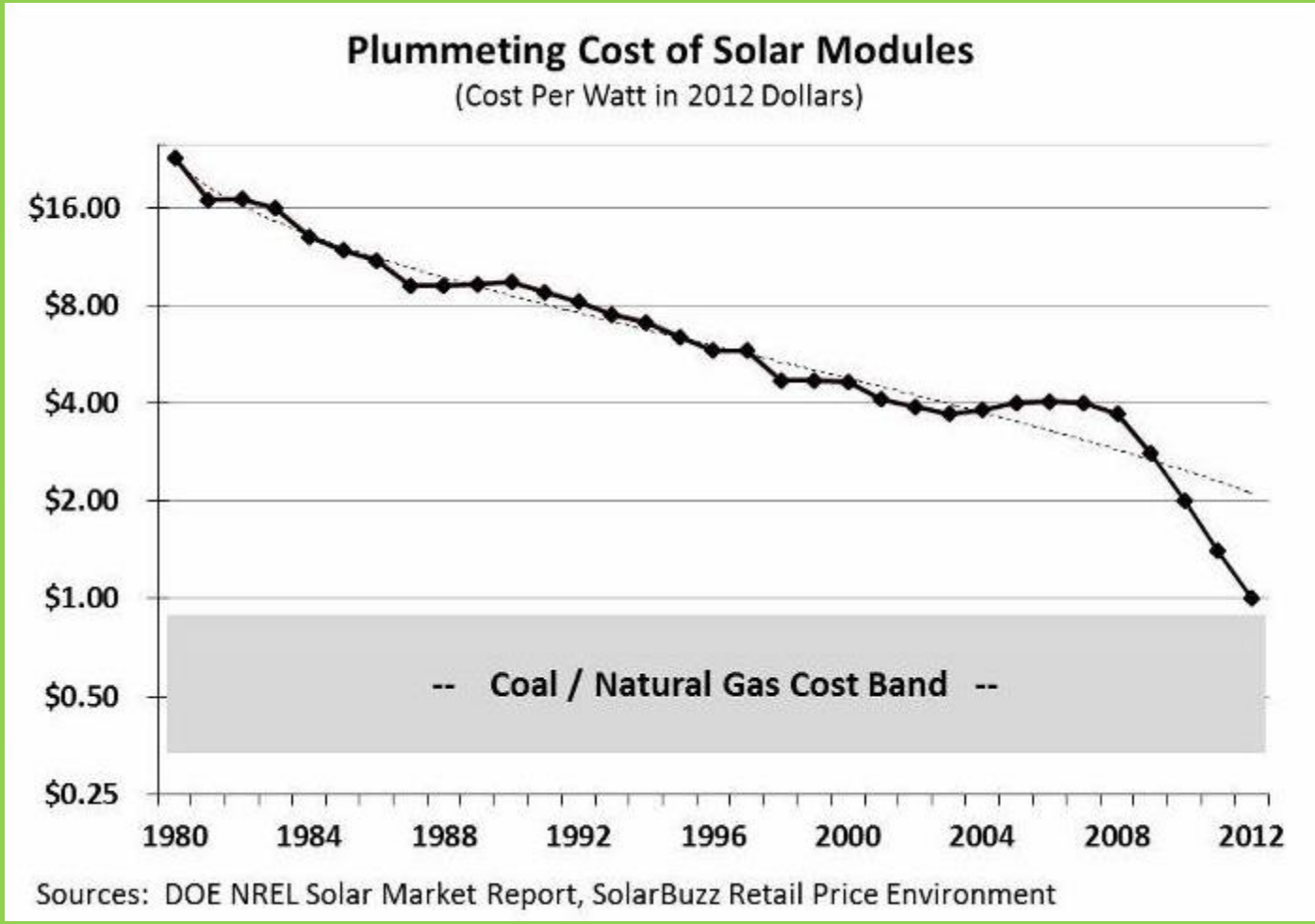
- Nikola Tesla's licensed his patent for the inductive motor and transformer, to Westinghouse in the 1890's. This effectively ended the war.
- The reason being is that AC can now be " transformed" to higher or lower voltage. With DC being one way current flow, and only at 110 volts, the amps(current) needs to be very high to power premises more than 1 mile away.
- It is the current or flow thru an electric resistance the causes line loss. For efficient transport of electricity, one wants very high voltage and low amperage.

The development of the US grid and utilities

- 1882 – Edison's pearl street DC power station
- 1886 - Westinghouse's Niagara Power Plant: AC Era
- 1935 - The Public Utility Holding Company Act of 1935 (PUHCA) was passed by U.S. Congress to facilitate regulation of electric utilities
- Presently we have 3 main forms of electric utilities:
  - Investor owned utilities(IOU's)
  - Electric cooperatives
  - Municipal electric utilities

- Questions? How much do you pay for automotive gasoline?

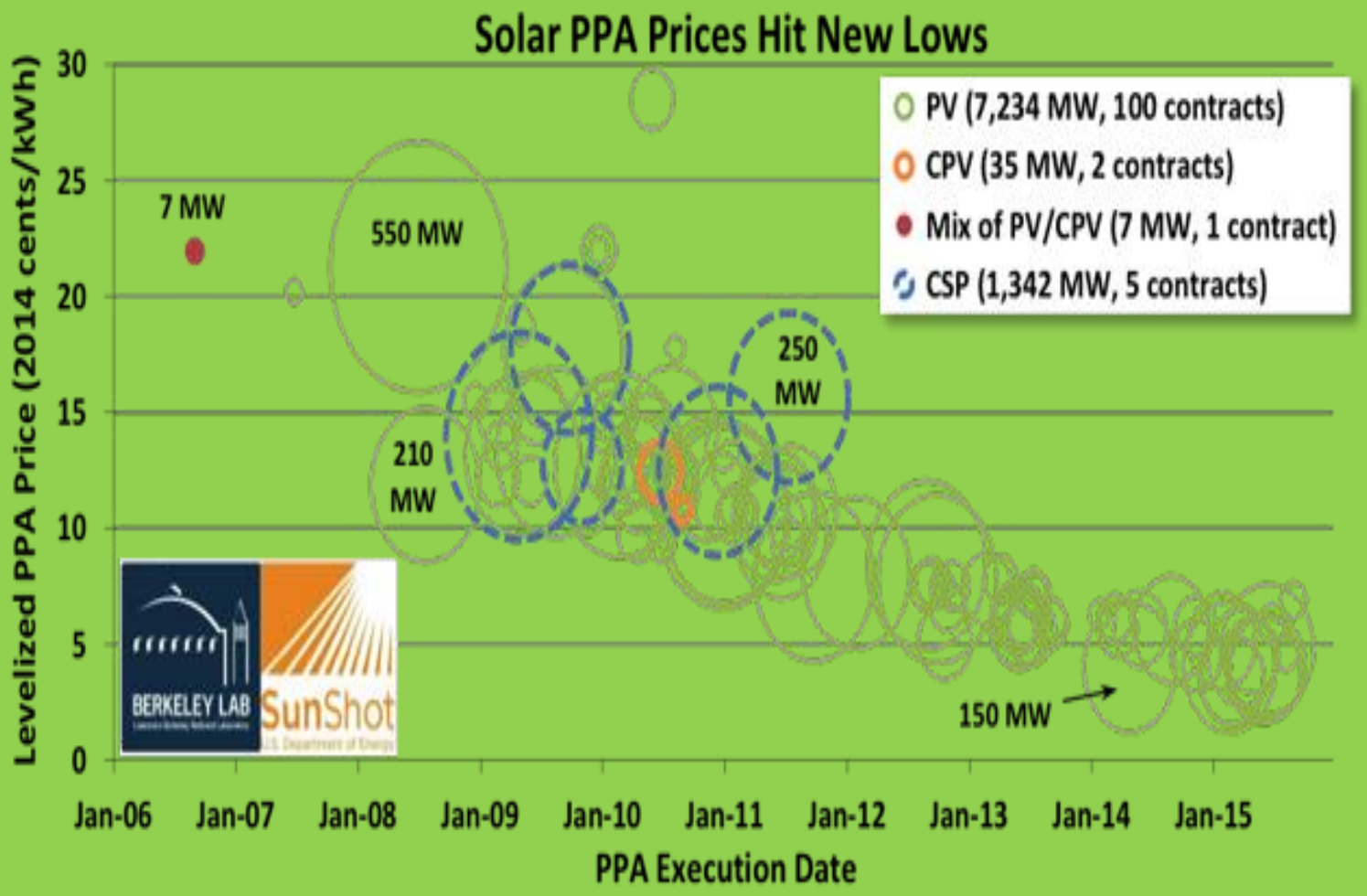
Industry trends – the historical cost of solar



2017 Solar Industry trends

- Herman Zhao, the CFO of JA Solar Holdings stated on Nov. 17th 2016: “we expect the Q4 blended ASP will be roughly low 40s and going to next years we believe half probably will be in - blended base will be high 30s range, in the second half next year probably will be around mid 30s”.
- Guggenheim Securities estimates the selling prices of the First Solar’s S6 modules will fall about 25 percent from current levels to 33 cents a watt, but the cost of producing them will drop 40 percent to 21 cents a watt.

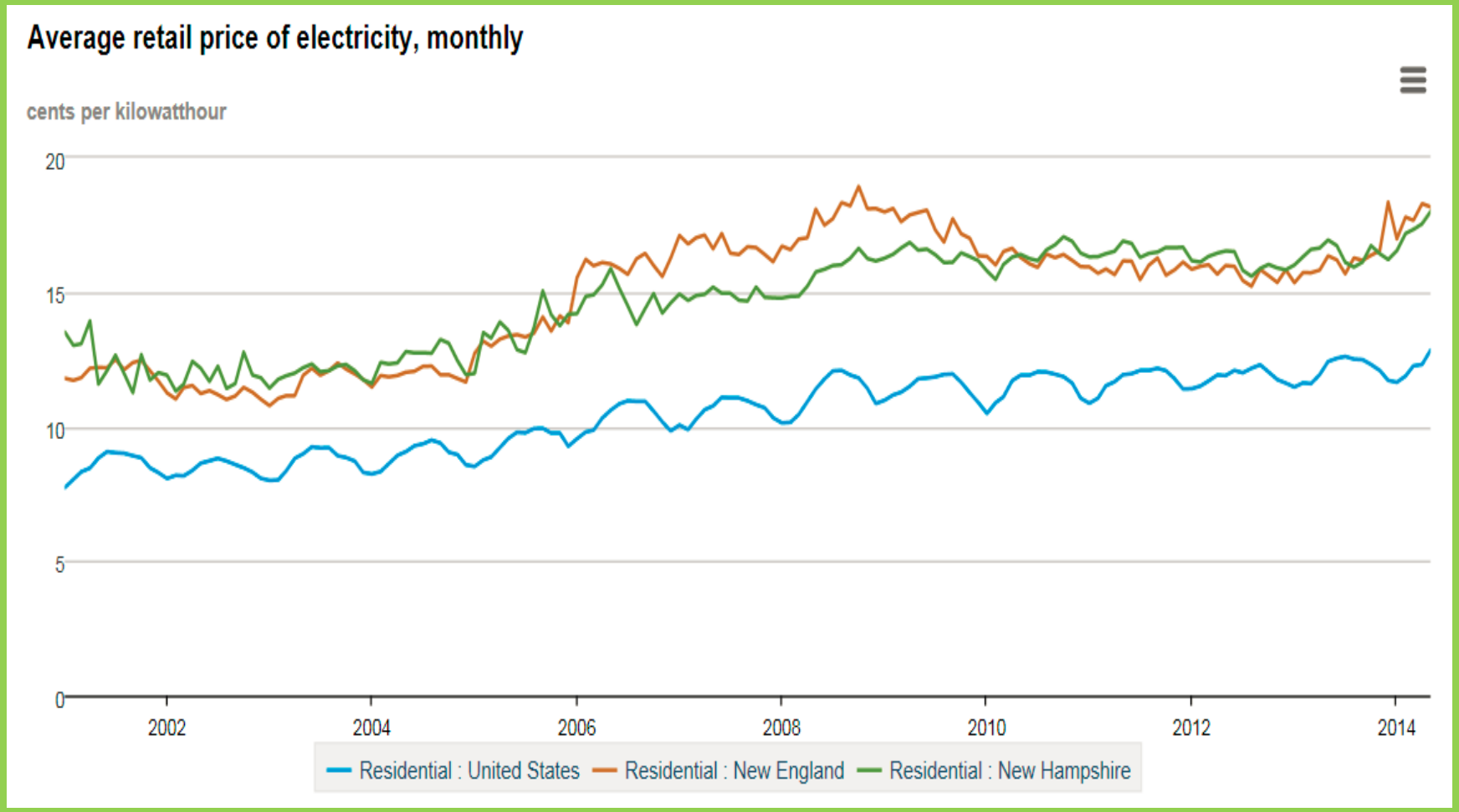
Solar PPA cost per KWH



Recent PPA announcements

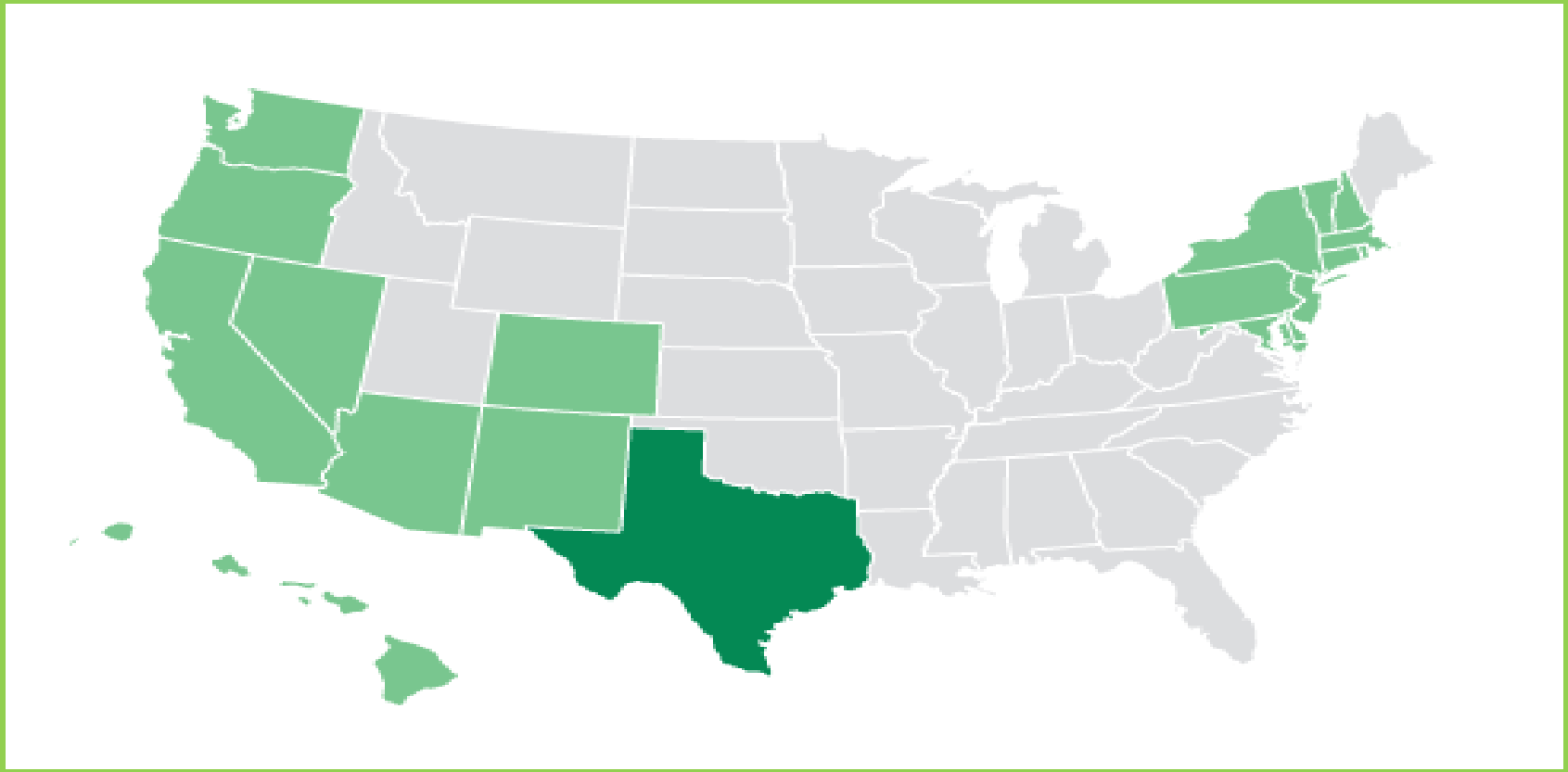
- NV Energy's 2014 PPA for the purchase of the production of SunPower's 100 MW Boulder Solar installation at $0.046 per kwh.
- NV Energy has agreed to a power purchase agreement (PPA) at a $0.0387 per kWh rate for the 100 MW output of First Solar's Playa Solar 2 installation.
- A consortium of the Chinese solar panel maker and project builder JinkoSolar put in a bid to build a large solar panel farm city of Abu Dhabi for a jaw-dropping 2.42 cents per kilowatt hour. This is an unsubsidized bid.

Average retail electric prices

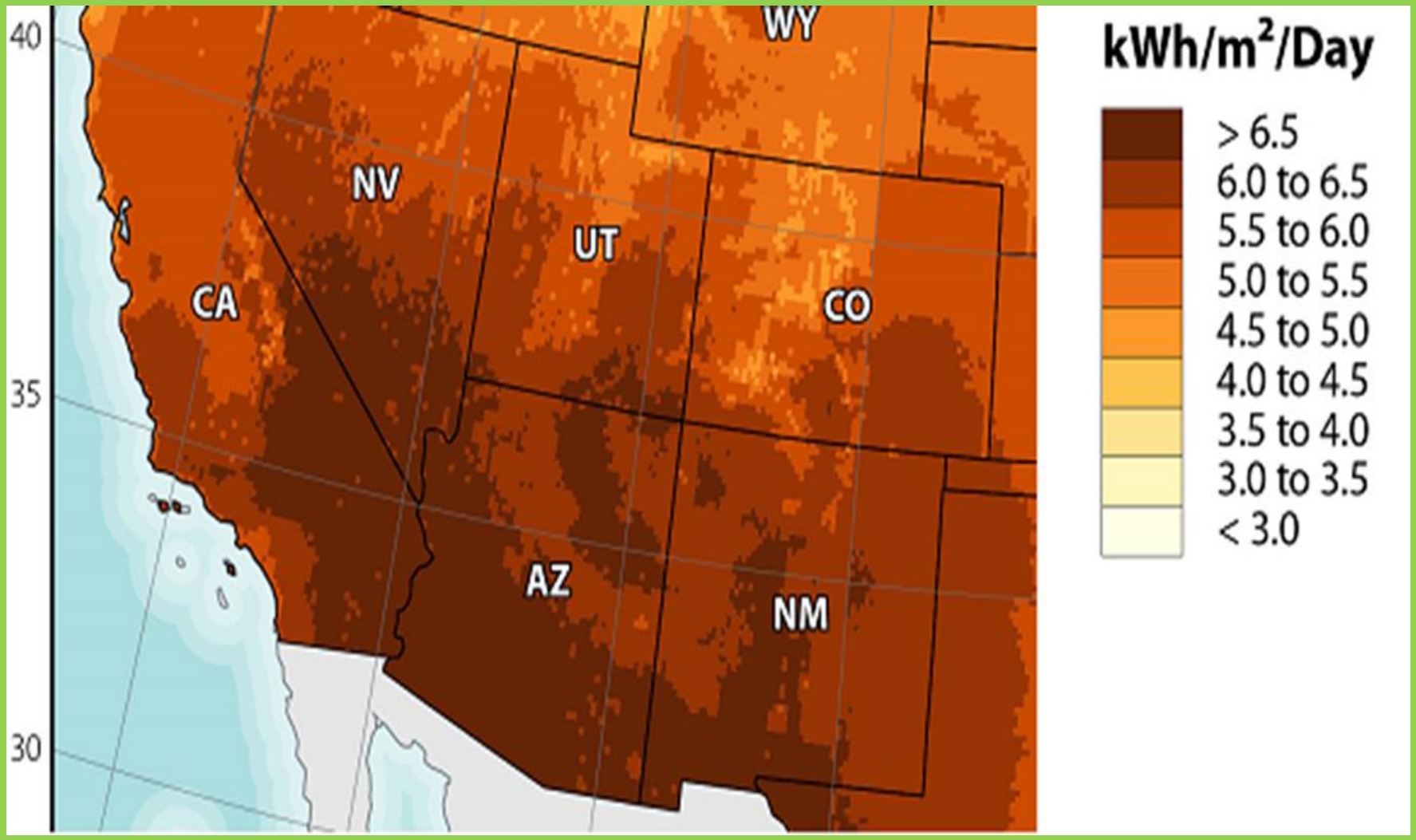


Solar industry state penetration

States with national solar installers



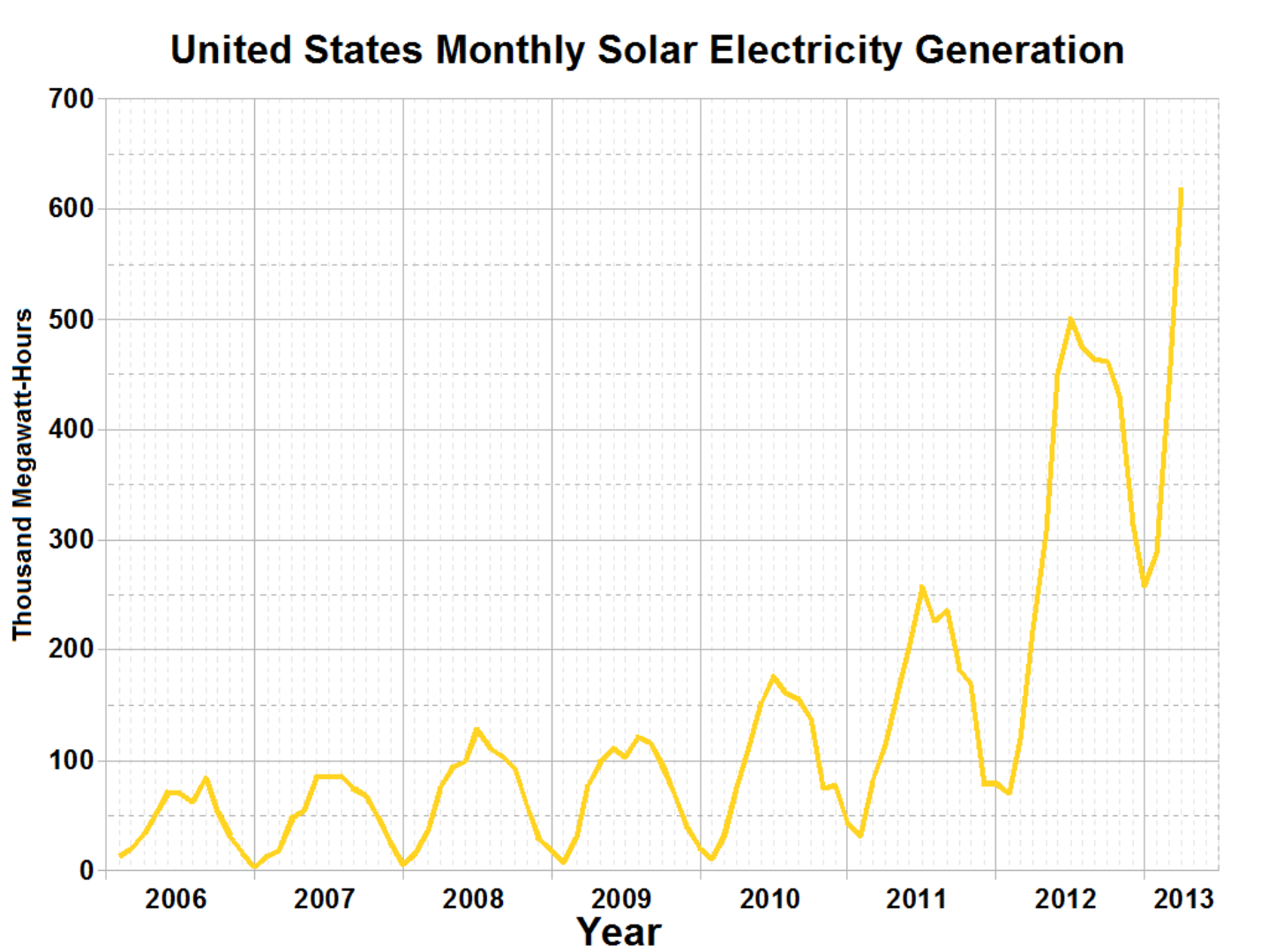
Solar wars resource potential



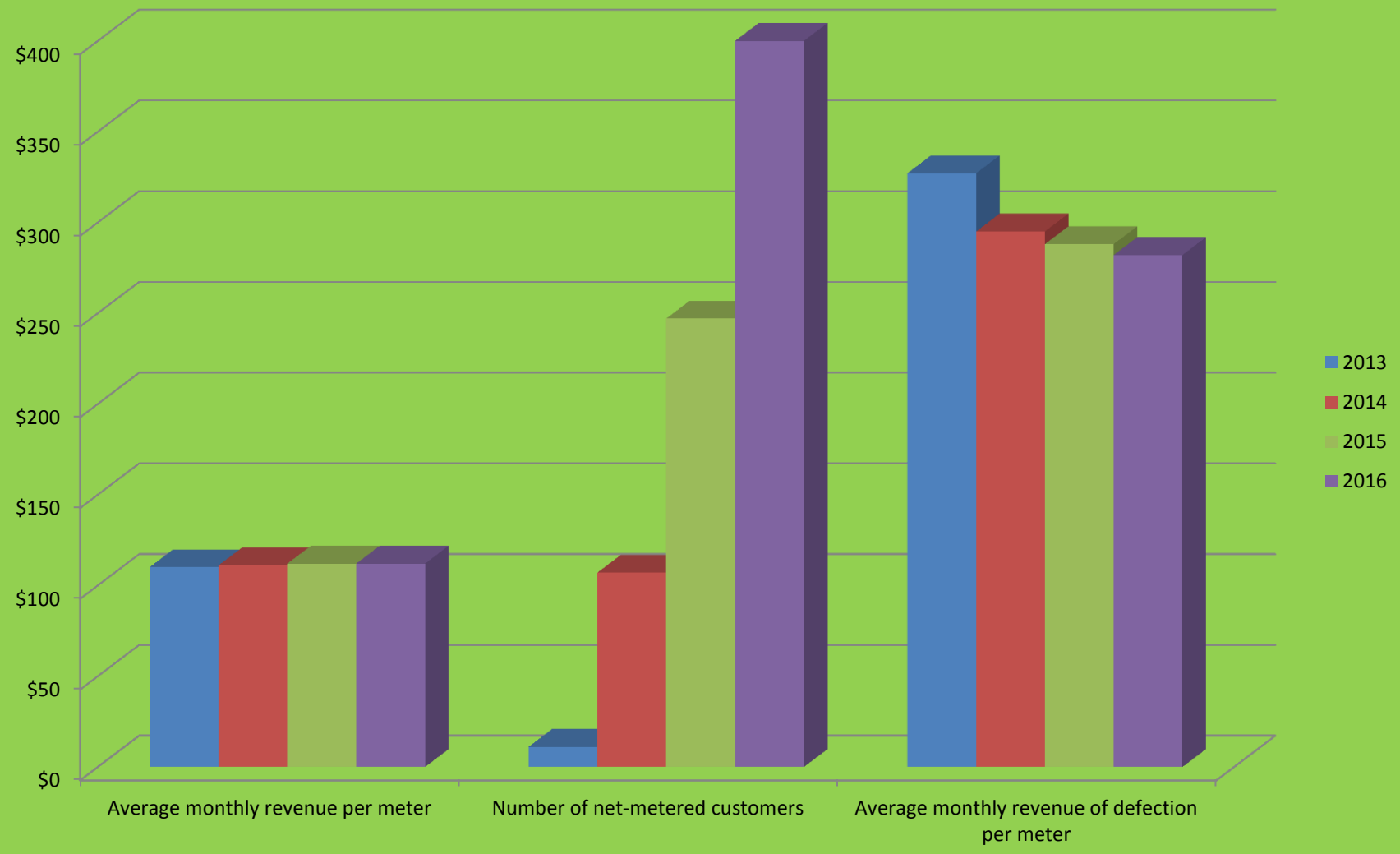
The 1st battle of the solar wars: net-metering

- Utilities are not against solar as this new technology gives them another method to generate electricity, but what utilities dislike is their customers producing their own electricity.
- Net-metering typically occurs between 10 a.m. and 4 p.m. (thought it varies by many factors) when a customer's solar system is producing more electricity than the loads inside the premises. This "extra" energy is sent back through the utility owned meter and into the grid they maintain.
- Starting around 2012 utilities started to get worried about this “load defection”.

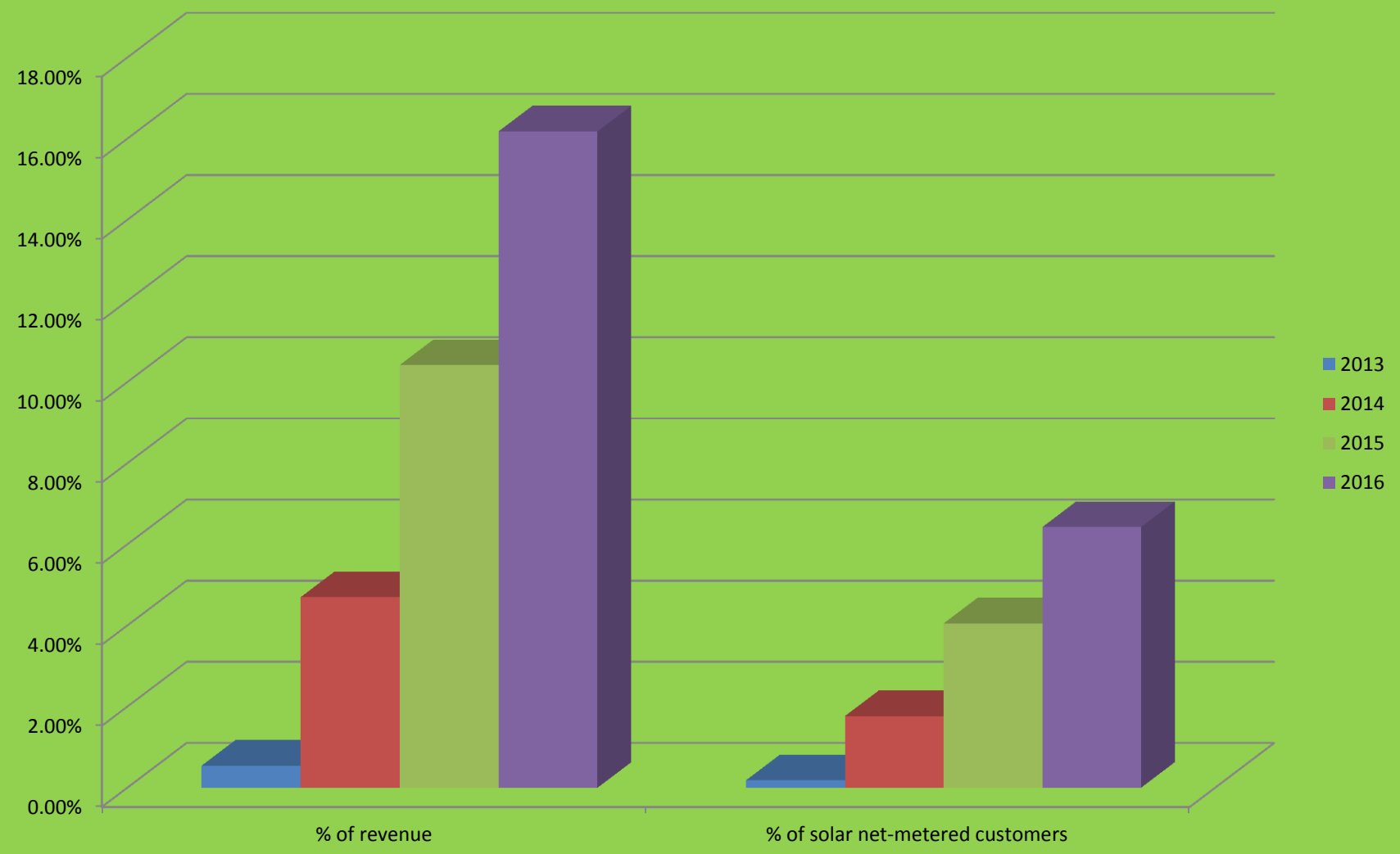
Historical US solar generation



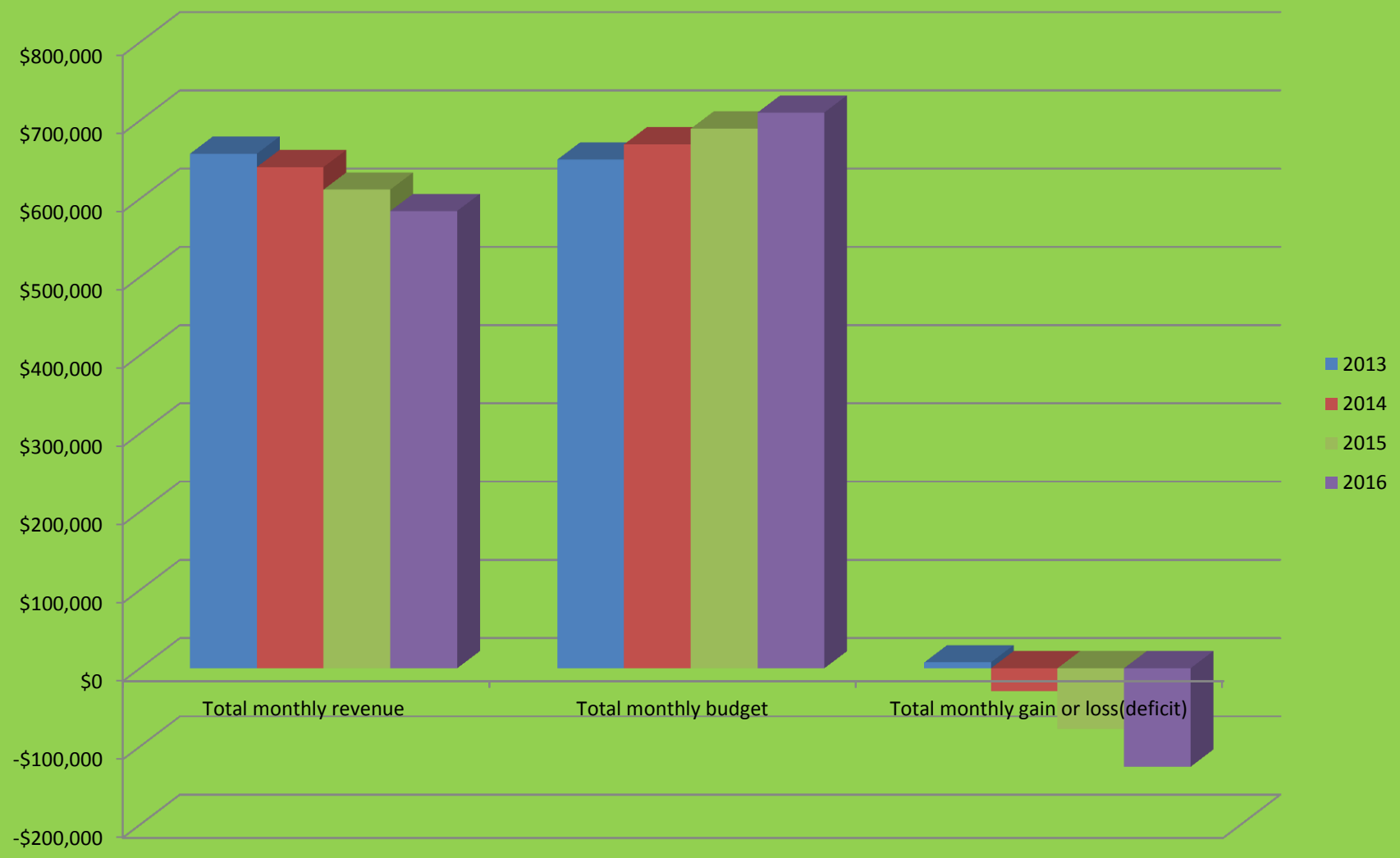
Case study of load defection – small municipal utility



Load defection trends



Revenue impact with load defection



Current state of net-metering

- The first three states to enter into the net-metering battle were California, Arizona, and Nevada due to excellent solar insolation and relatively high electric rates.
- In California, the PUC rejected many of the changes to net-metering, while in Nevada the PUC allowed NV energy to reduce how much they credit consumers bills by 75%.
- Other state that are battling net-metering are: are Arizona, Nevada, Maine, Florida, and Alabama.

Free Market Innovation and Competition

- Next we will see innovation in the energy storage space.
- In most cases, the typical residential solar system only nets back to the grid about 20%-40% of its production.
- To effectively eliminate net-metering back to the grid, you don't need a lot of storage.
- It would be a strange twist of fate if Tesla can use new technology just as the firm's namesake Nikola Tesla's did to decide this battle in energy.
- Smart inverter technology with curtailment control and DC storage will win the net-metering battle.
- With full curtailment control, the premise would never send electricity back to the utility. In this case the owner may not even have to notify the utility when installing this behind the meter solar system.

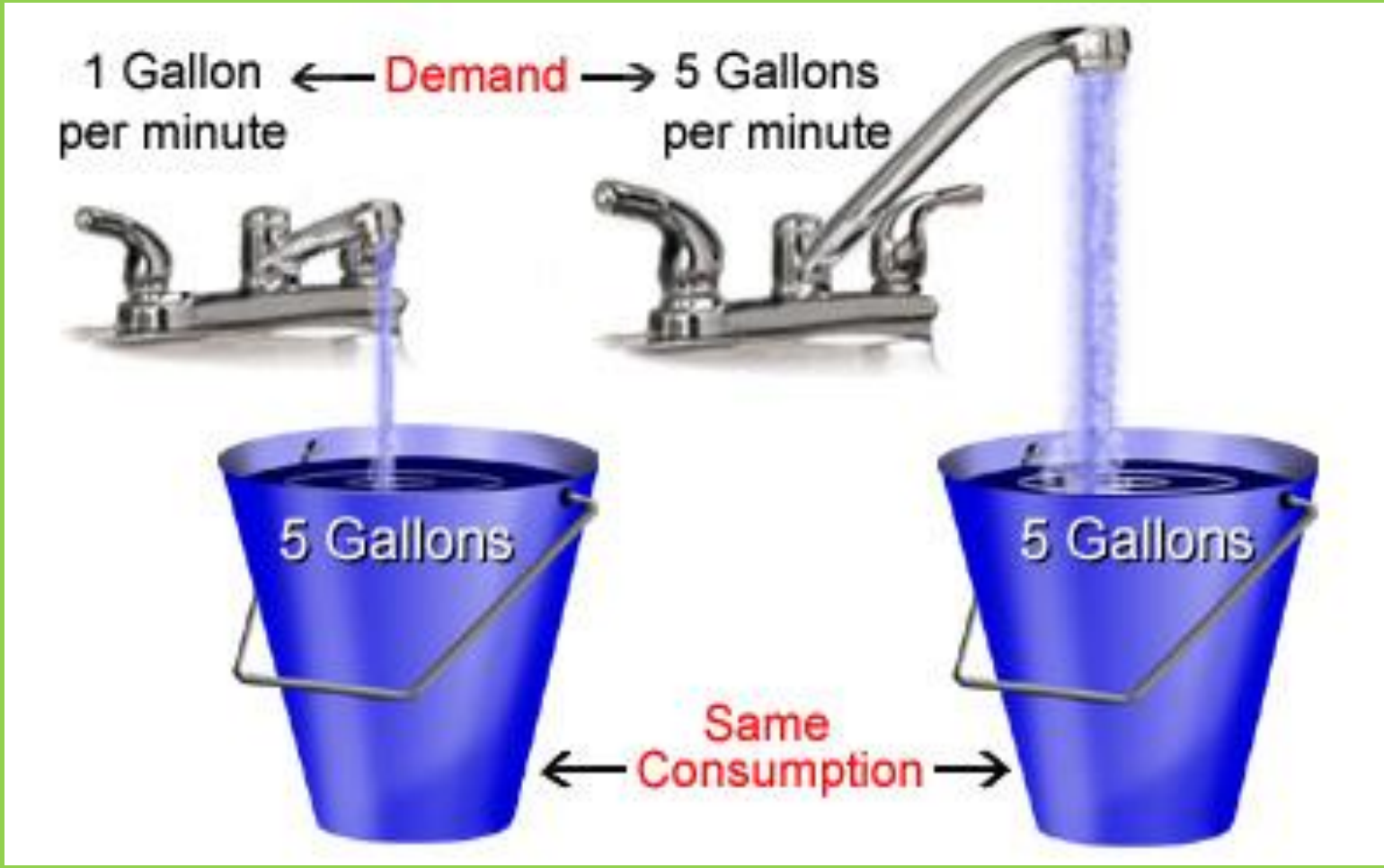
The Tariff Battle: Second Battleground Of The Solar Wars

- Electric tariffs are typically divided into 3 classes of customers: residential, commercial and industrial.
- Electric utilities sell 2 things – power(demand or KW) and consumption(usage in KWH's).
- Residential tariffs are the simplest, usually a small service fee and then a volumetric consumption rate by kwh.
- Commercial and industrial(C&I) customers have a larger service fee, a demand charge(highest 15 minute interval of demand – KW), and a volumetric consumption charge per kwh.

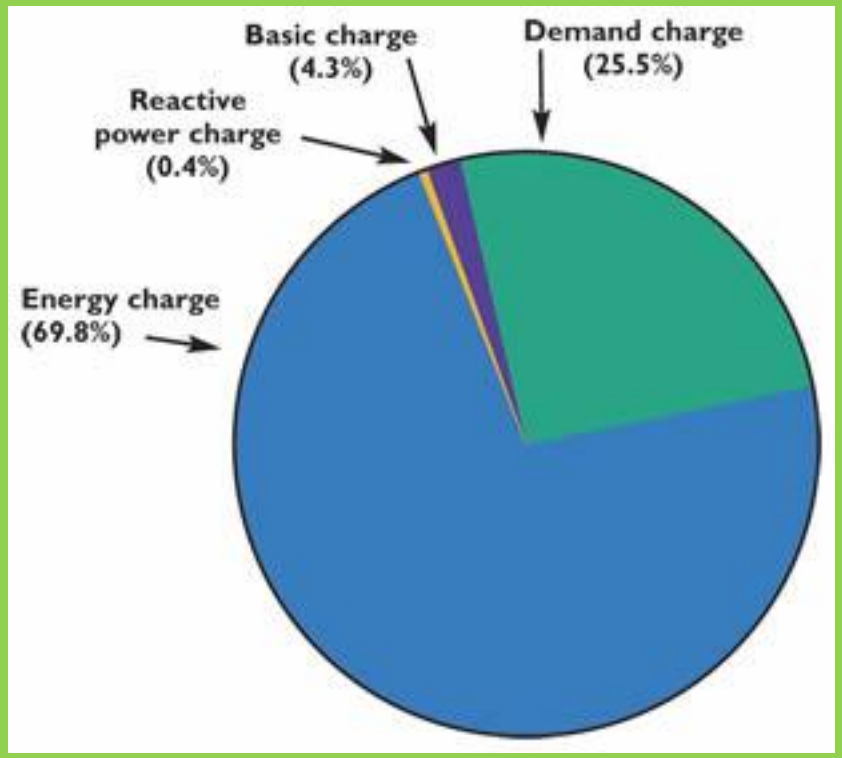
Tariff dynamics

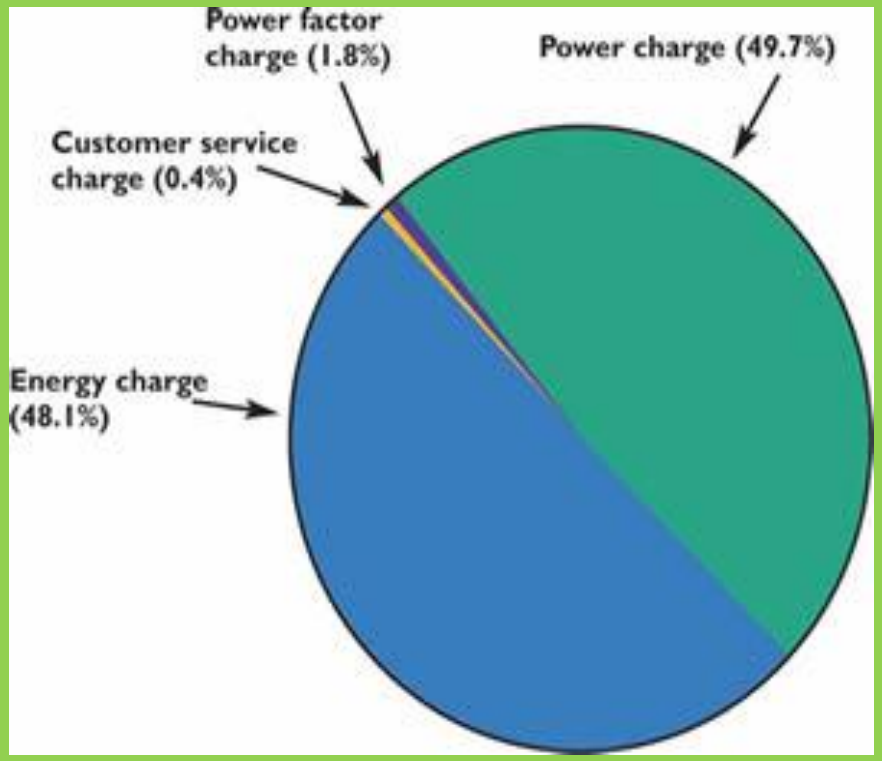
- Summer vs winter rates – summer rates higher.
- Block or tiered billing – the upper tiers much more expensive.
- Demand charges now can be over 50% of a customers bill.
- The tariff battle will focus on the demand charge and tiered billing.
- In California in 2015, the utilities changed the tiered billing structure on residential customers. They reduced the tiers from 4 to 2. The utilities did this since the very high tier 3 and tier 4 billing rates were incentivizing customers to go solar.
- More recently, Rocky Mountain Power - Utah's electric utility - filed for a residential demand charge. Demand charges are really nothing more than another service fee or facility charge that can't be lowered significantly with energy efficiency or on-site solar alone.

Power vs consumption – demand charge



demand charges over time





Higher demand charges has been the trend. Over 50% of a commercial customers bill can be the demand charge.

Sample CO commercial tariff schedule

LARGE GENERAL SERVICE – SECONDARY
ELECTRIC

RATE DESIGNATION – LGS-S
RATE CODE – CO720/CO878/CO888/CO889 T

Effective In:	All territory served.
Classification:	Commercial, Industrial and Institutional customers.
Availability:	Available to customers whose actual demand is greater than fifty (50) kW but less than or equal to fourteen hundred (1400) kW. Available for electric service at secondary voltage levels, as herein defined, supplied through one (1) metering point. This rate is also available for customers served at higher voltage levels but not electing to own, operate and maintain distribution facilities beyond Company's point of delivery. No resale permitted.
Character of Service:	Alternating current, 60 Hertz, at any one standard voltage available for the service required.
Monthly Rate:	Customer Charge: Per customer, per month ..... $66.75 Demand Charge: All kW of billing demand, per kW ..... $26.81 Energy Charge per kWh: For the first 200 kWh's per actual kW ..... $0.00710 For all over 200 kWh's per actual kW $0.00432
Payment and Late Payment Charge:	Bills for electric service are due and payable within fifteen (15) days from date of bill. Any amounts not paid on or before the due date of the bill shall be subject to a late payment charge set forth in the Company's rules and regulations.
Minimum Charge:	The monthly minimum charge shall be the customer charge plus the billing demand charge subject to the special terms and conditions hereinafter set forth.
Energy Cost Adjustment:	This schedule is subject to the energy cost adjustment.
Tax/Fee Adjustment:	This schedule is subject to the tax/fee adjustment.

Advice Letter No. 732	Decision or Authority No. C16-1140	
Signature of Issuing Officer /s/ Fredric C. Stoffel	Issue Date December 21, 2016	
Title Director-Regulatory	Effective Date January 1, 2017	

The final battleground: grid defection

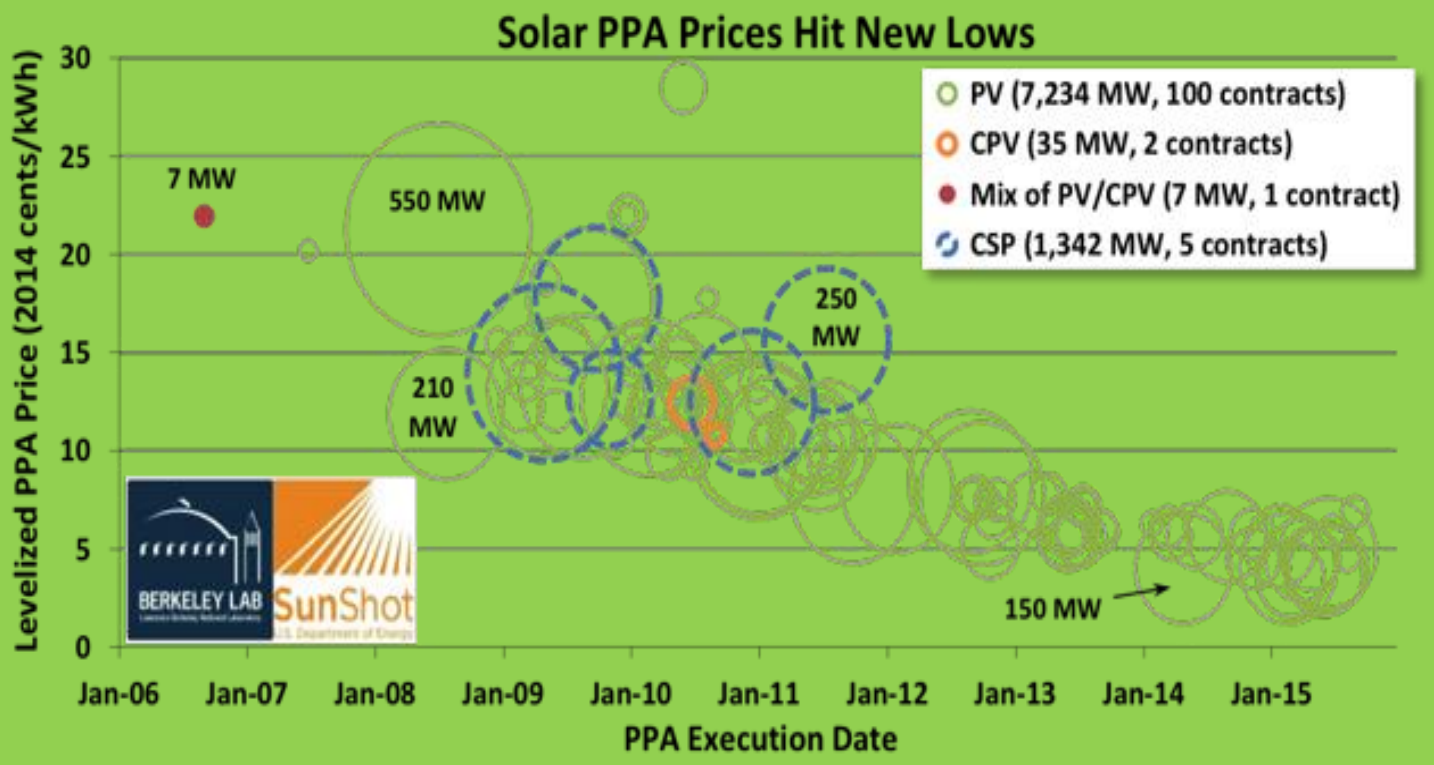
- Ambitious plans by MGM Resorts, Wynn, and Las Vegas Sands are overshadowed by an ongoing battle with regulators and the state's biggest utility NV energy.

Solar panels on the roof of the Mandalay Bay convention center. Three of Nevada's largest casino companies have announced renewable energy plans. Photograph: MGM Resorts

March 2016 interview with the Guardian

- “They need to maintain the grid. You cannot let these utilities go bankrupt or else every business in the city dies,” said Bill Ellard”.
- “It’s complex because it’s not just electricity,” he said. “It’s natural gas, wind, coal, smart grid, big data, oil – it’s all connected. We’re at this next change point where wind and solar [battery] storage and smart software are going to start to replace all those energy sources.”.
- “This is what I call a death spiral for utilities,” said Ellard. “They make it hard to go solar because once you defect from them, that affects revenue. Then they increase rates on everybody else, forcing them to defect.”.

Power Purchase Agreements - PPA's



[Lawrence Berkeley National Laboratory (Berkeley Lab) 2015]

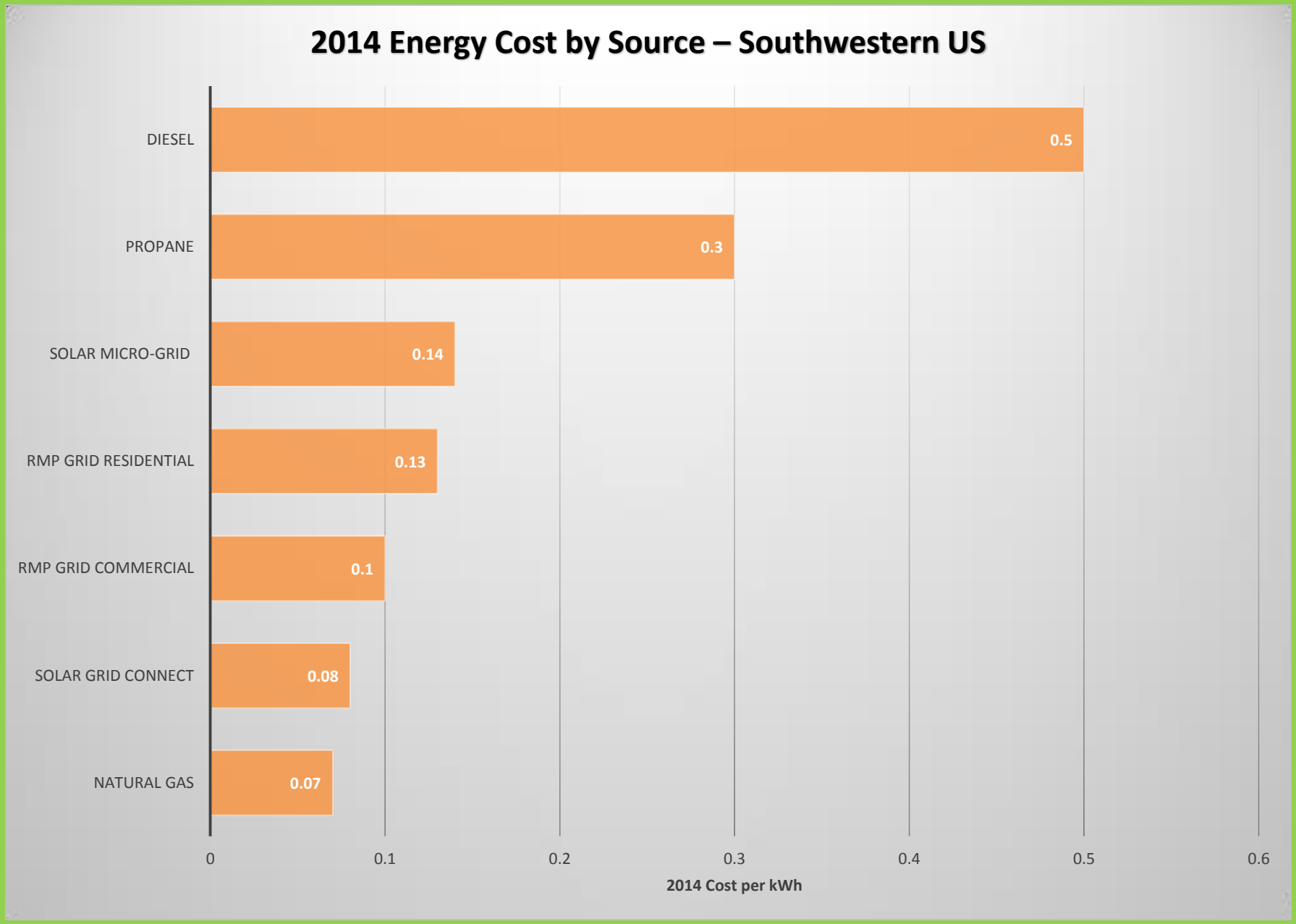
Las Vegas casinos leave the grid

- MGM Resorts is leaving NV Energy, paying nearly $87 million as an exit fee for the right to purchase its electricity elsewhere. They're joined by Wynn Resorts, which operates the Wynn and Encore and will pay approximately $17 million to exit.
- Switch, a large data storage company, previously applied to leave NV Energy with plans to contract for a large solar array. The PUC denied the application, and Switch was eventually convinced to partner with NV Energy on the solar array.
- Now, Switch says NV Energy engaged in deceptive practices and wants a Nevada court to rescind the settlement and allow Switch to exit.
- Sustainability has become a real factor for corporations across the US. Questions?

The 3 ways of being green

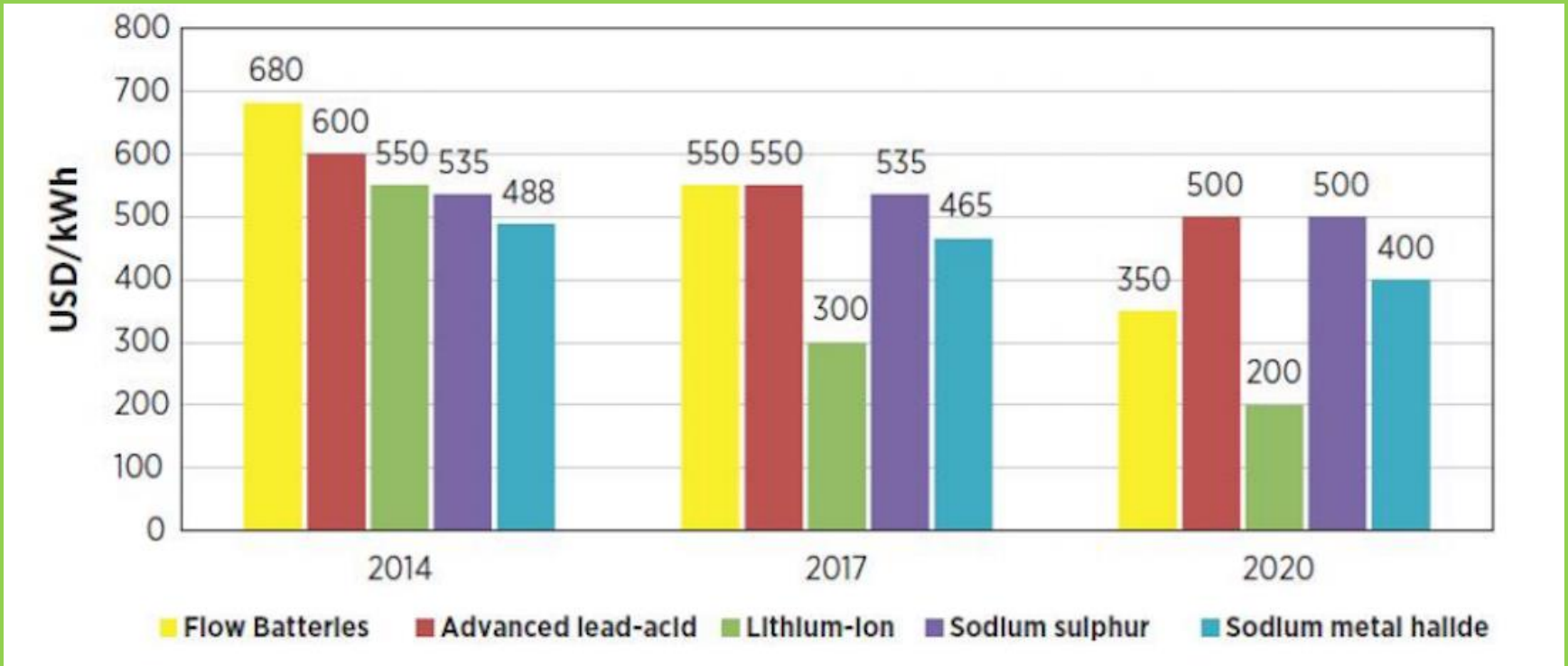
1. Lower pollution footprint
2. Increased cash flow and EBITDA
3. Increased multiple on EBITDA due to increased cash flows, and lower future compliance costs

- The economic case is simple – replace higher power generation cost with cheaper, cleaner generation. Replace 50 cents per kwh diesel generation, with 5-15 cents per kwh smart solar grid generation.
- The economic trends for using Distributed Energy Resources(DERs) are compelling, and will become even more compelling in the future as the installed cost of solar keeps decreasing, and the cost of coal, diesel, natural gas and electricity keep rising.



U.S. Energy Information Administration
(EIA), ESP llc

Battery pricing trends



Jeff Evanson, head of Tesla's investor relations group, dialed into the conference call to take issue with Bereisa's assumptions and estimates.
More importantly, he said the battery-pack cost of the Model S today is less than $190 per kwh.

2017 trends and innovations

- The combination of extremely low solar power pricing, falling battery pricing, and high demand charges will encourage more commercial entities to do what MGM did in Las Vegas - leave the grid.
- Innovation will be the key, with not just cheaper options, but more elegant and innovative options.
- Currently, we do not see residential customers defecting from the grid. This may change in the future if utilities try and eliminate self generation options for this customer base.

The Trump effect on the solar industry

- Chaos theory
- Federal ITC reduction
- Increased access to natural gas drilling
- Weakened EPA regulations
- Denial of climate change
- Individual states control utilities and air quality
- Cross state air pollution litigation
- Positive solar economic trends
- America first concept - jobs

Questions and answers

Links and references

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- http://www.citylab.com/tech/2016/10/why-las-vegas-casinos-are-gambling-on-solar/502649/

Appendix - References

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- http://www.bloomberg.com/news/articles/2015-07-07/buffett-scores-cheapest-electricity-rate-with-nevada-solar-farms
- http://energysolutionpartner.com/wp-content/uploads/2012/06/Municipal-Utility-Examples-Incorporating-Distributed-Generation.pdf
- http://www.nrel.gov/docs/fy15osti/63510.pdf
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