

***sPower, the Economics of the Solar Market,
and Government Policy***

September 2017



What was done different that helped sPower's success?

- Spotting the opportunity to research clean energy when most investors (PE and venture firms) had given up on clean tech
- Seizing the right business model
- Finding management from outside the industry
- Very conservative capital structure – Initially funded 100% with equity capital
- Keep it simple
- Luck





Devastated Landscape

Greentech Media – *incomplete* list of the solar firms that have left the building – either by closure, bankruptcy, or fire-sale acquisition:

2009 – 2010

Bankrupt, closed

- [Advent Solar](#) (emitter wrap-through Si) acquired by Applied Materials
- [Applied Solar](#) (solar roofing) acquired by Quercus Trust
- [OptiSolar](#) (a-Si on a grand scale) closed
- [Ready Solar](#) (PV installation) acquired by SunEdison
- [Solasta](#) (nano-coaxial solar) closed
- [SV Solar](#) (low-concentration PV) closed
- [Senergen](#) (depositing silane onto free-form metallurgical-grade Si substrates) closed
- [Signet Solar](#) (a-Si) bankrupt
- [Sunfilm](#) (a-Si) bankrupt
- [Wakonda](#) (GaAs) closed

2011

Bankrupt, closed

- [EPV Solar](#) (a-Si) bankrupt
- [Evergreen](#) (drawn Si) bankrupt
- [Solyndra](#) (CIGS) bankrupt
- [SpectraWatt](#) (c-Si) bankrupt
- [Stirling Energy Systems](#) (dish engine) bankrupt
Acquisition, sale
- [Ascent Solar](#) (CIGS) acquired by TFG Radiant
- [Calyxo](#) (CdTe) acquired by Solar Fields from Q.cells
- [HelioVolt](#) (CIGS) [acquired by Korea's SK Innovation](#)
- [National Semiconductor Solar Magic](#) (panel optimizers) exited systems business
- [NetCrystal](#) (silicon on flexible substrate) acquired by Solar Semiconductor
- [Soliant](#) (CPV) acquired by Emcore



Devastated Landscape (cont'd)

2012

Bankrupt, closed

- [Abound Solar](#) (CdTe) bankrupt
- [AQT](#) (CIGS) closed
- [Ampulse](#) (thin silicon) closed
- [Arise Technology](#) (PV modules) bankrupt
- [Azuray](#) (microinverters) closed
- [BP](#) (c-Si panels) exits solar business
- [Centrotherm](#) (PV manufacturing equipment) bankrupt
- [CSG](#) (c-Si on glass) closed by Suntech
- [Day4 Energy](#) (cell interconnects) delisted from TSX exchange
- [ECD](#) (a-Si) bankrupt
- [Energy Innovations](#) (CPV) bankrupt
- [Flexcell](#) (a-Si roll-roll BIPV) closed
- [GlobalWatt](#) (solar) closed
- [GreenVolts](#) (CPV) closed
- [Global Solar Energy](#) (CIGS) closed
- [G24i](#) (DSCs) bankrupt in 2012, re-emerged as G24i Power with new investors
- [Hoku](#) (polysilicon) shut down its Idaho polysilicon production facility
- [Inventux](#) (a-Si) bankrupt
- [Konarka](#) (OSCs) bankrupt
- [Odersun](#) (CIGS) bankrupt
- [Pramac](#) (a-Si panels built with equipment from [Oerlikon](#)) insolvent
- [Pairan](#) (Germany inverters) insolvent
- [Ralos](#) (developer) bankrupt
- [REC Wafer](#) (c-Si) bankrupt
- [Satcon](#) (BoS) bankrupt
- [Schott](#) (c-Si) exits c-Si business
- [Schuco](#) (a-Si) shutting down its a-Si business
- [Sencera](#) (a-Si) closed
- [Siliken](#) (c-Si modules) closed
- [Skyline Solar](#) (LCPV) closed
- [Siemens](#) (CSP, inverters, BOS) divestment from solar
- [Solar Millennium](#) (developer) insolvent
- [Solarhybrid](#) (developer) insolvent
- [Sovello](#) (Q.cells, Evergreen, REC JV) bankrupt
- [SolarDay](#) (c-Si modules) insolvent
- [Solar Power Industries](#) (PV modules) bankrupt
- [Soltecture](#) (CIGS BIPV) bankrupt
- [Sun Concept](#) (developer) bankrupt



Devastated Landscape (cont'd)

2012

Acquisition, fire-sale, restructuring

- [Oelmaier](#) (Germany inverters) insolvent, bought by agricultural supplier Lehner Agrar
- [Q.Cells](#) (c-Si) insolvent, acquired by [South Korea's Hanwha](#)
- [Sharp](#) (a-Si) backing away from a-Si, retiring 160 of its 320 megawatts in Japan
- [Solibro](#) (CIGS) Q-Cells unit acquired by [China's Hanergy](#)
- [Solon](#) (c-Si) acquired by UAE's Microsol
- [Scheuten Solar](#) (BIPV) bankrupt, then acquired by Aikosolar
- [SolFocus](#) (CPV) layoffs, restructuring for sale
- [Sunways](#) (c-Si, inverters) bought by LDK, restructuring to focus on BIPV and storage

2013

Bankrupt, closed, restructured

- [Bosch](#) (c-Si PV module) exits module business
- [Concentrator Optics](#) (CPV) bankrupt
- [Suntech Wuxi](#) (c-Si) bankrupt
- [ISET](#) (CIGS) moving into "microsolar"
- [MiaSolé](#) (CIGS) acquired by [China's Hanergy](#)
- [Nanosolar](#) (CIGS) restructuring for sale
- [Wuerth Solar](#) (installer) business turned over to BayWa



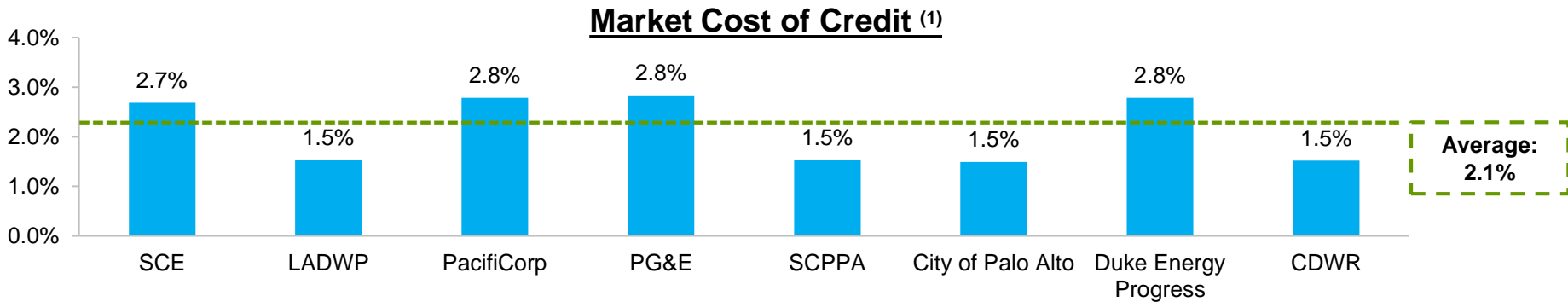


Quality Cash Flows



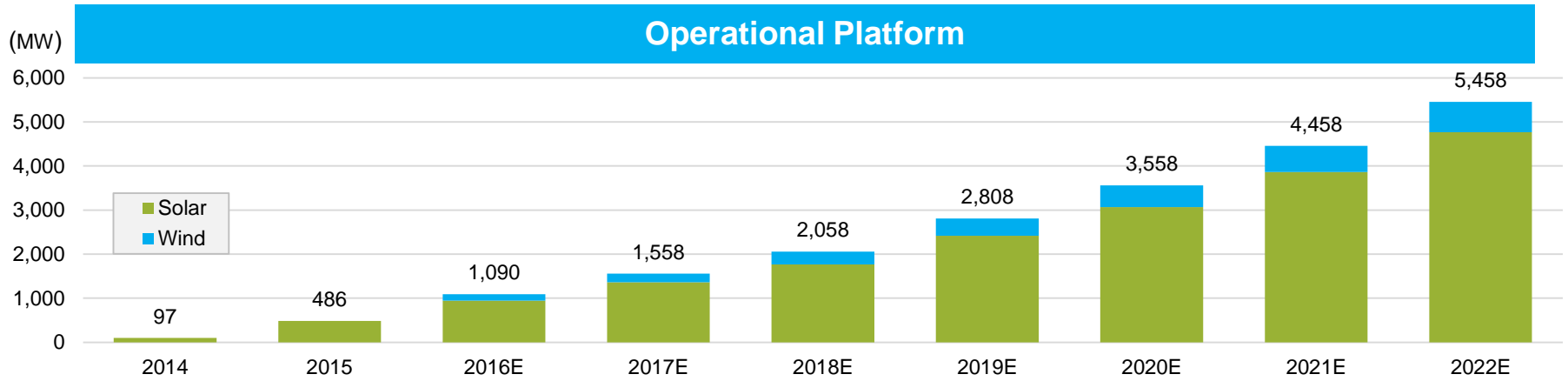
**Total /
Wtd. Avg.**

Portfolio Composition	Off-take MW	233 MW	183 MW	142 MW	129 MW	121 MW	110 MW	109 MW	106 MW	1,135 MW
	% of Portfolio	~18%	~14%	~11%	~10%	~9%	~8%	~8%	~8%	~87%

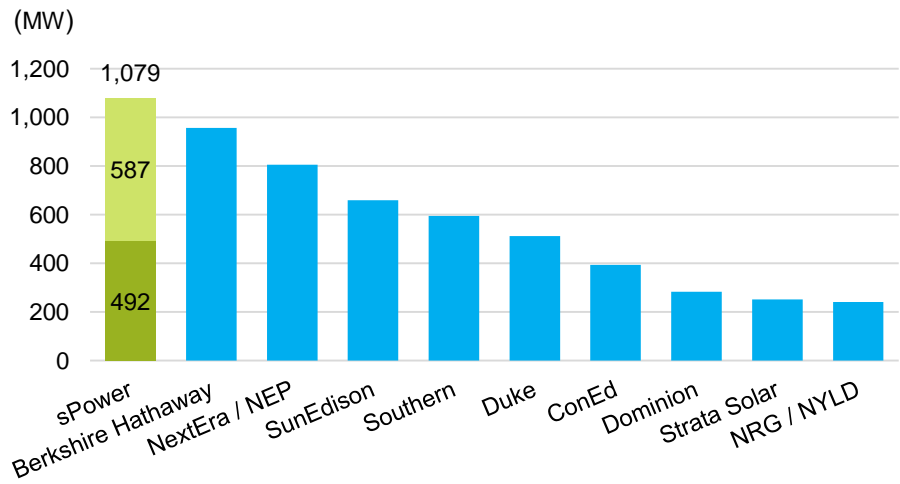




sPower Historical Growth



US Solar PV Assets Brought Online (Since 2014) ⁽²⁾



1. Includes ~29 MW which reached COD prior to 2014.
 2. Source: SNL, company filings, company websites and investor presentations.
 3. Reflects contracted US solar projects currently under construction or near-construction.



Future Demand for Utility Scale Solar & Wind: 3 Main Business Drivers

1. Corporate Demand:

- 50 gigawatts with Fortune 500 companies over next 5 years
- Leaders: Amazon, Google, Apple, Johnson & Johnson, Microsoft, Wal-Mart, IBM, Intel

2. State Renewable Portfolio Standards (RPS) & Other State Incentives:

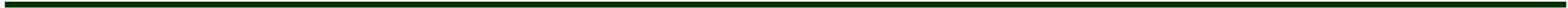
- 80 + gigawatts over next decade

3. China Investment & Cost Curve Implications:

- sPower buildout costs went from \$2 mw/hour to about \$1 and heading to .85 - .90 in just 3 years!
- China plans to spend \$350 billion on clean energy over the next 4 years and create 13 million jobs = much lower costs

Near Term Issue:

- Suniva Trade Tariff case



Corporate and Industrial Market

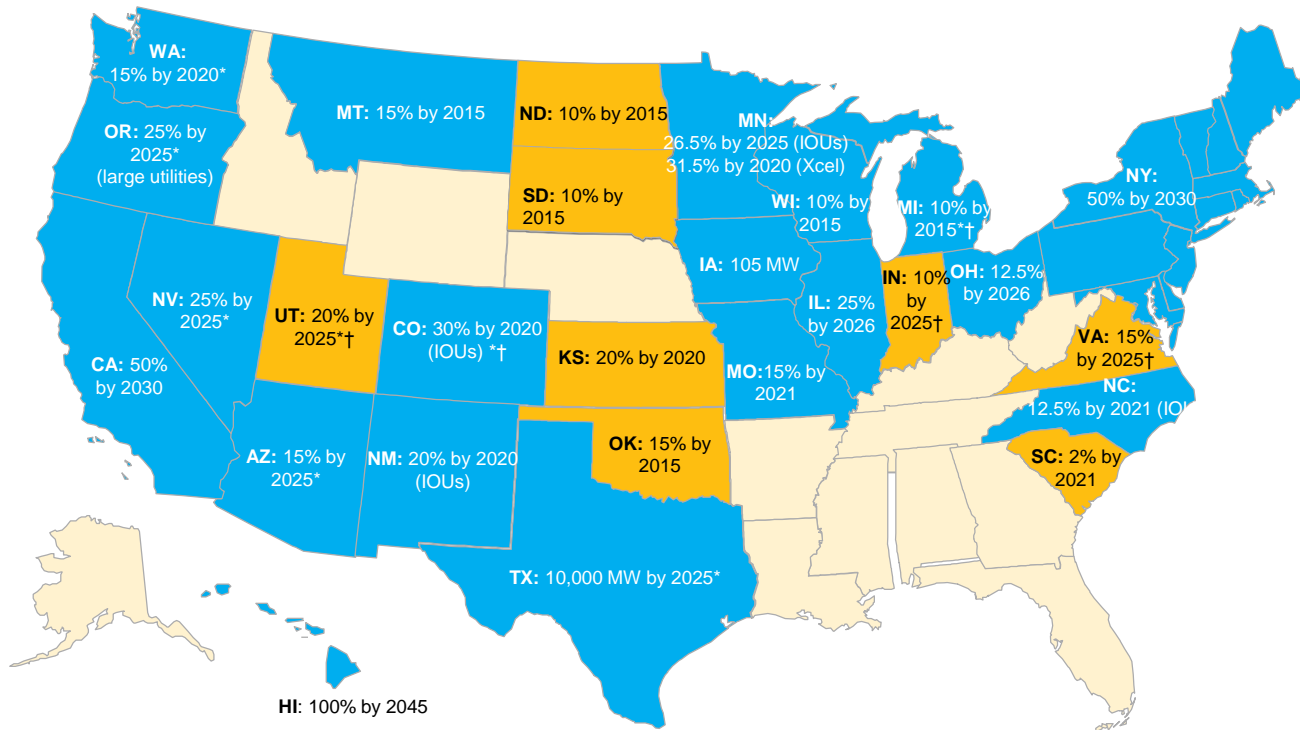
Largest Market Opportunity For Renewables – 60 GW of Renewables by 2023

58 COMPANIES BUYING 60 GW OF RENEWABLES BY 2023





Renewable Portfolio Standards Driving Growth



- Renewable portfolio standard
- Renewable portfolio goal
- * Extra credit for solar or customer-sited renewables
- † Includes non-renewable alternative resources

29 States + Washington, D.C. + 3 Territories have a Renewable Portfolio Standard (8 states and 1 territory have renewable portfolio goals)

Source: National Conference of State Legislatures (NCSL).
1. Renewable energy.



Solar Cost Curve

Declining Solar Construction Costs ⁽¹⁾

(\$ / Watt)



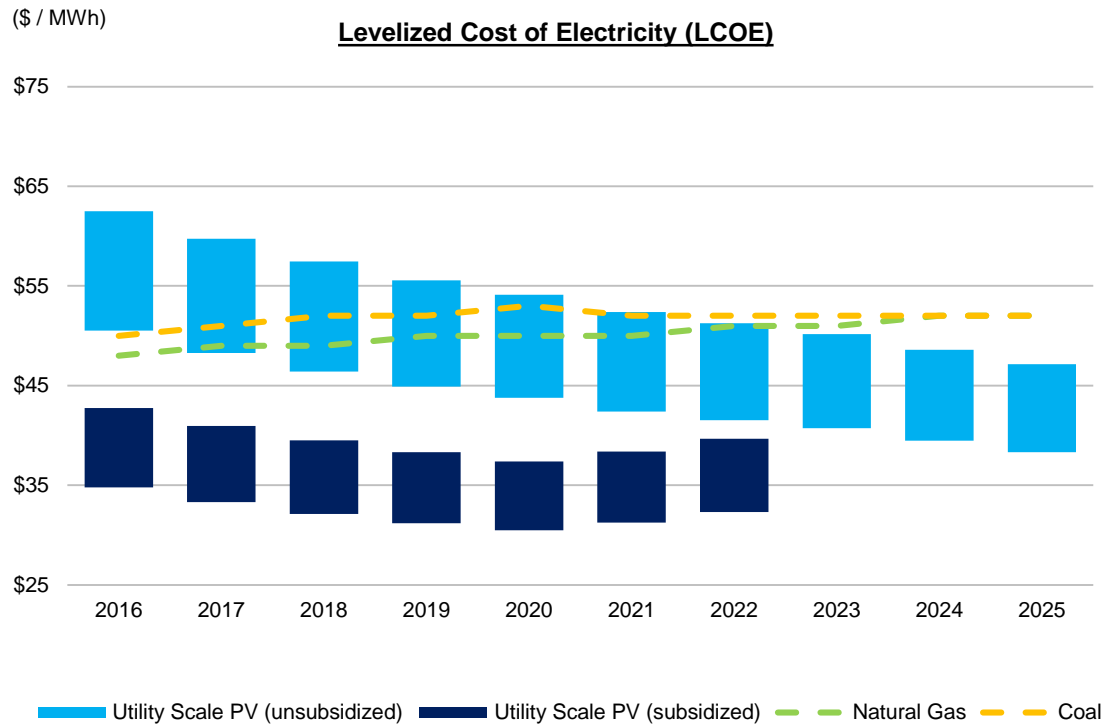
1. Source: National Renewable Energy Lab.
2. Bloomberg New Energy Finance (BNEF).
3. Based on tracking projects in high solar resource states (AZ, CA, NV, NM, TX).





Solar Cost Curve (cont'd)

Unsubsidized Cost of Utility Scale Solar Approaching Parity ⁽¹⁾



Question: The incremental China benefit?

1. Bloomberg New Energy Finance (BNEF).
 2. Based on tracking projects in high solar resource states (AZ, CA, NV, NM, TX).



Clean Energy: The “Jobs Story”

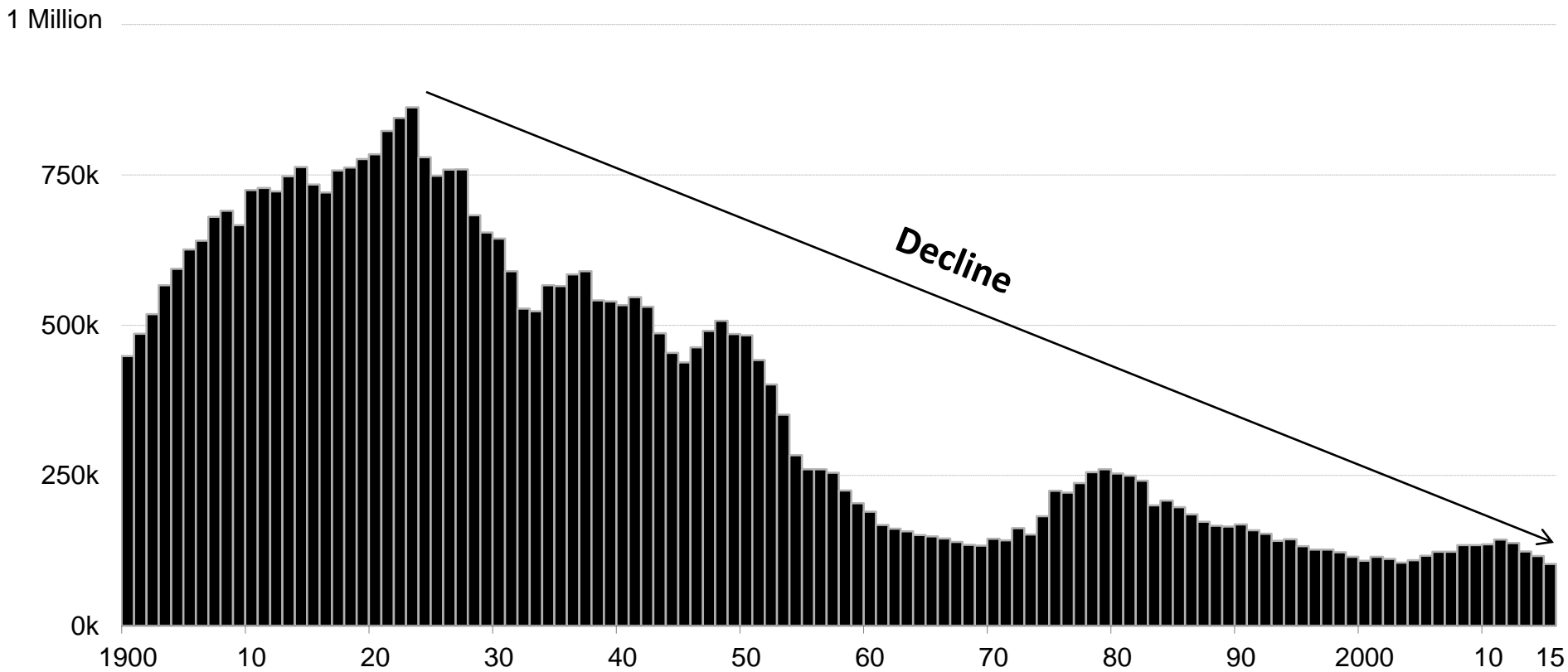
- sPower’s projects employed nearly 3,000 American workers last year. Jobs that didn’t exist a few years ago. Skilled jobs and the majority are union jobs (e.g. International Brotherhood of Electrical Workers 2.5 million labor hours for first gigawatt)
- 3 million + Americans employed in clean energy/ energy efficiency & growing 5% + = 150,000 new jobs each year
- Opportunity to increase by multiples due to 3 major business drivers
- Note: Only 50,000 coal miners in our nation (see graph)





Clean Energy: The “Jobs Story” (cont'd)

- US coal mines employ fewer than 60,000 workers today
- Industry has been in decline for past 100 years





New State Momentum

- **Hawaii:** 100% clean energy
- **California:** new bill for 100% clean energy by 2045 – 6th largest economy in the world
- **CA/NY:** commit to exceed “Clean Power Plan”
- **9 State Regional Greenhouse Gas Initiative (RGGI) Announcement**
- **Red & Blue:** Large projected non-RPS growth in red & blue states: TX, NC, GA, UT, CA





Utility Positive Behavior: Seeing the Future

- FPL building 600 megawatts of solar in Florida
- XCEL says 200 megawatts of new solar and 450 megawatts of new wind are cheaper than coal & gas
 - “This is the first time we have seen, purely on a price basis, solar projects made a cut – without considering carbon costs or a need to comply with a renewable standard – strictly on an economic basis.”

David Eves, President of Xcel
 - “Economics are driving what’s happening in the industry. We’re looking at prices in the low teens to low 20’s in dollars/mwh. That beats gas, even at today’s prices. I like to say we backed up the truck because the fuel of tomorrow is on sale today.”

Ben Fowke, CEO of Xcel
- “We are committed to continuing our path of moving to a clean energy economy, notwithstanding President Trump’s announcement about withdrawing from the global climate pact. Our future is driven by renewables due to the lowering costs.”

Nick Akins, CEO of AEP

 - AEP proposes to build \$4.5 billion wind farm in Oklahoma that will create nearly 10,000 jobs



Utility Negative Behavior: Fighting PURPA

PURPA: Requires utilities to buy clean energy when it is equal or cheaper than building a new plant

Duke Energy: Recently introduced new interconnection obstacles to slow PURPA clean energy projects in North Carolina

Montana: The largest state utility lobbied successfully to suspend new PURPA clean energy projects now that they are cost competitive with fossil fuel fired electricity

- To further kill solar, the Montana PUC is “limiting solar to projects that have 5 years of contractual pricing”





A Glimpse Into the Future: The Nevada Story

- 2015 - Nevada Power kills rooftop solar: December 2015 – Nevada slashes utility payments to rooftop solar owners
- 2016-2017 - Grassroots fight:
 - Thousands of solar workers, energy advocates, customers, MGM resorts, Tesla, ballot initiative, etc.
 - Election fight – Joe Heck anti solar vs. Catherine Cortez pro solar – Cortez won
 - 2017 legislative session – 11 energy bills passed, including reinstatement of rooftop solar payments
 - Governor signs bill to reinstate net metering payments
 - New 40% RPS standard approved by legislature (vetoed by Governor)



A Glimpse Into the Future: The AES Story

AES is a fortune 200 global power company with \$14 billion in revenues and 19,000 employees

February 24, 2017: AES announces plans to buy sPower, our nation's largest private solar utility, for \$1.6 billion

March 21, 2017: AES announces plans to shut 3 gigawatts of coal fired electric plants in Ohio!

July 1, 2017: AES announces it is shifting to renewables and natural gas

July 11, 2017: AES announces joint venture with Siemens to create global energy storage venture

July 18, 2017: AES announces plan to divest \$1 billion Philippine coal fired electric plant



Conclusion

- Dramatic acceleration of clean energy
- Driven by:
 - China led cost curve decline
 - Corporate America's energy buying
 - State & local led initiatives (e.g. RPS)
 - Job creation
 - Fortune 500 energy companies morphing to be clean energy leaders





Q & A

