TRENDS IN SOLAR PRICING AND STATE POLICIES: A BASELINE FOR CONSUMER ADVOCATES

Sean Gallagher, VP State Affairs
Solar Energy Industries Association

June 1, 2016

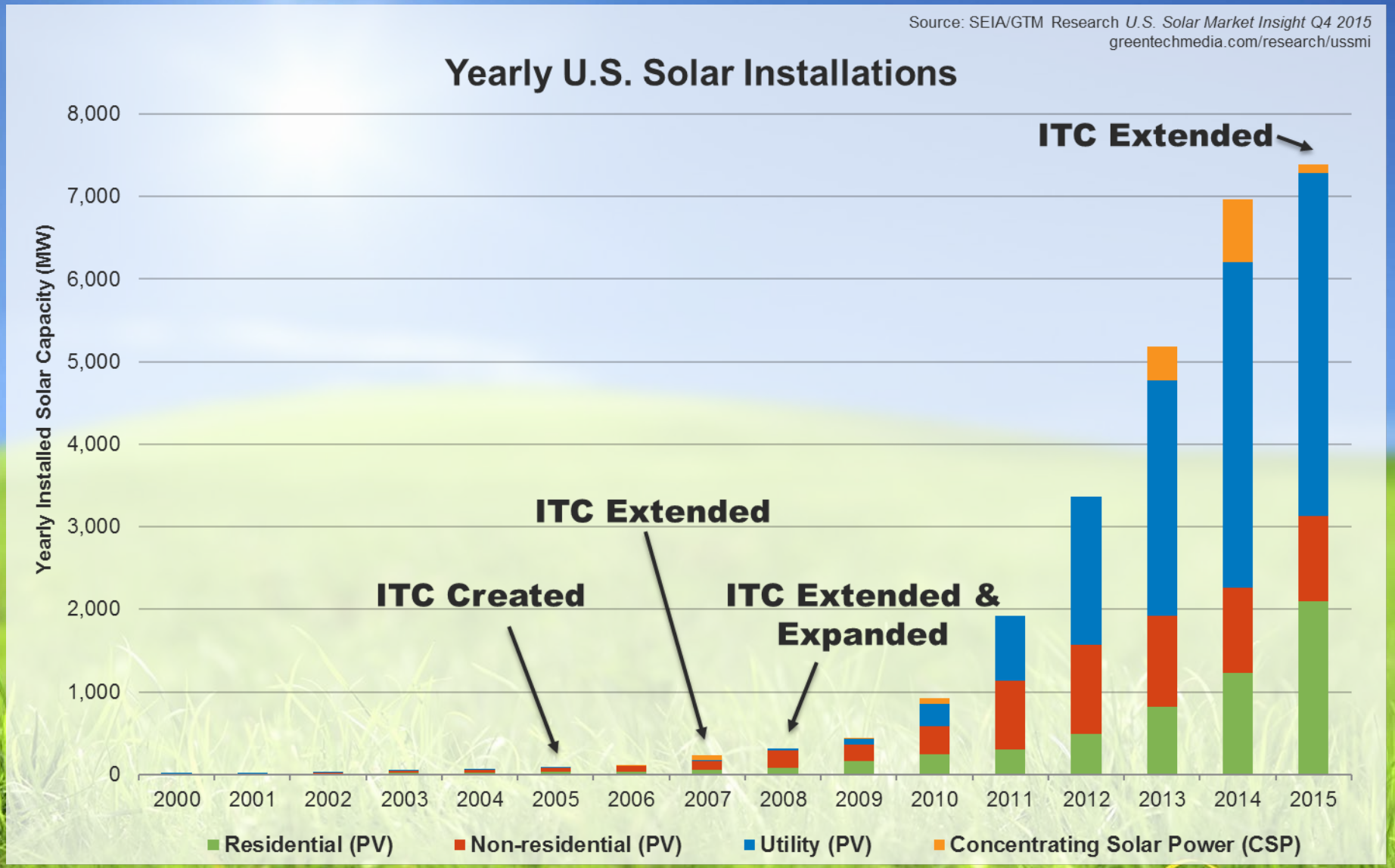
About SEIA

- U.S. National Trade Association for Solar Energy
  - Founded in 1974
  - 1,000 member companies from all 50 states
- Our Mission: Build a strong solar industry to power America
- Our Goal: 100 gigawatts of solar capacity by 2020

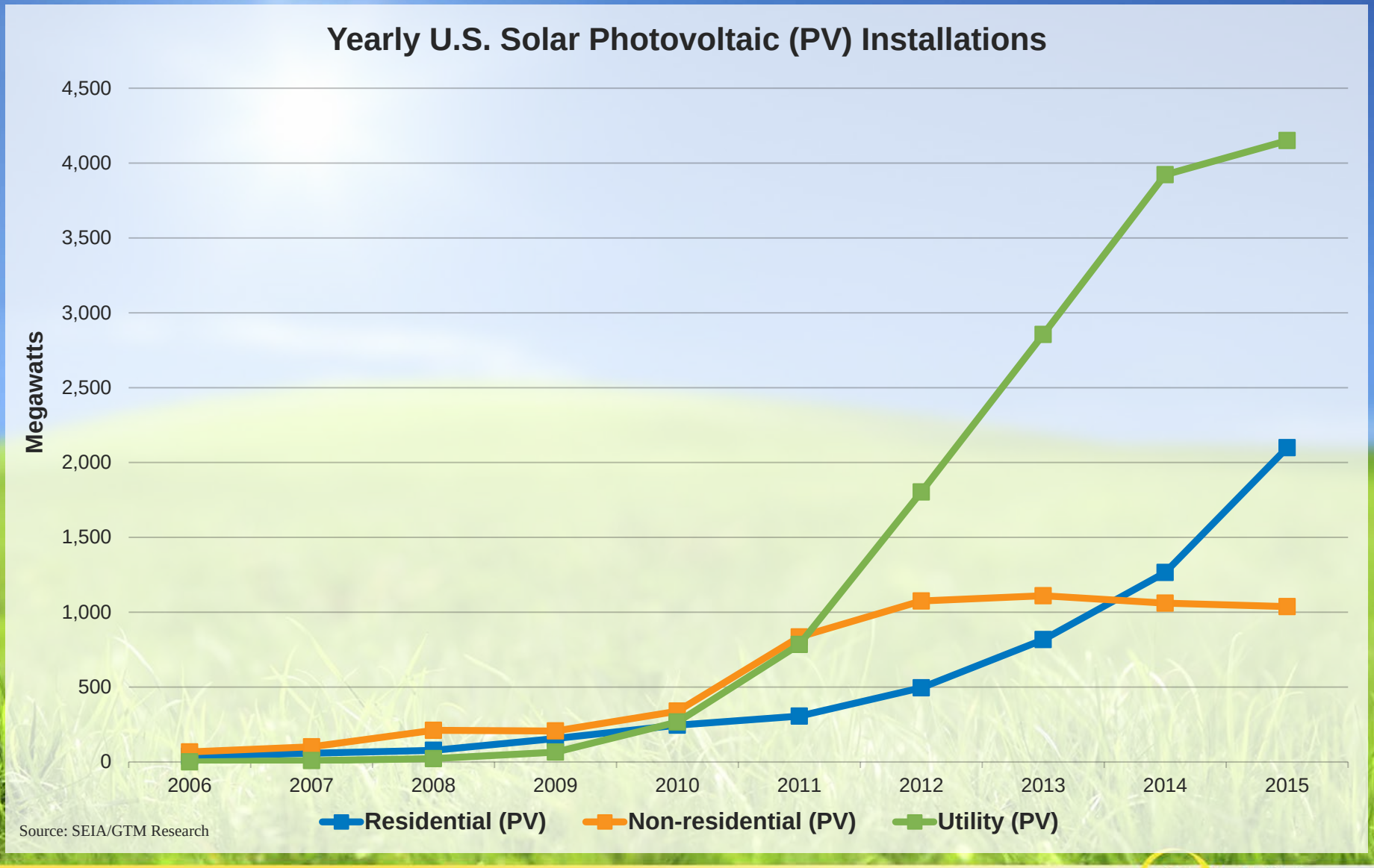
Agenda

- Solar market statistics
- Distributed generation policies and trends
- Utility scale solar policies and trends

Solar Growth

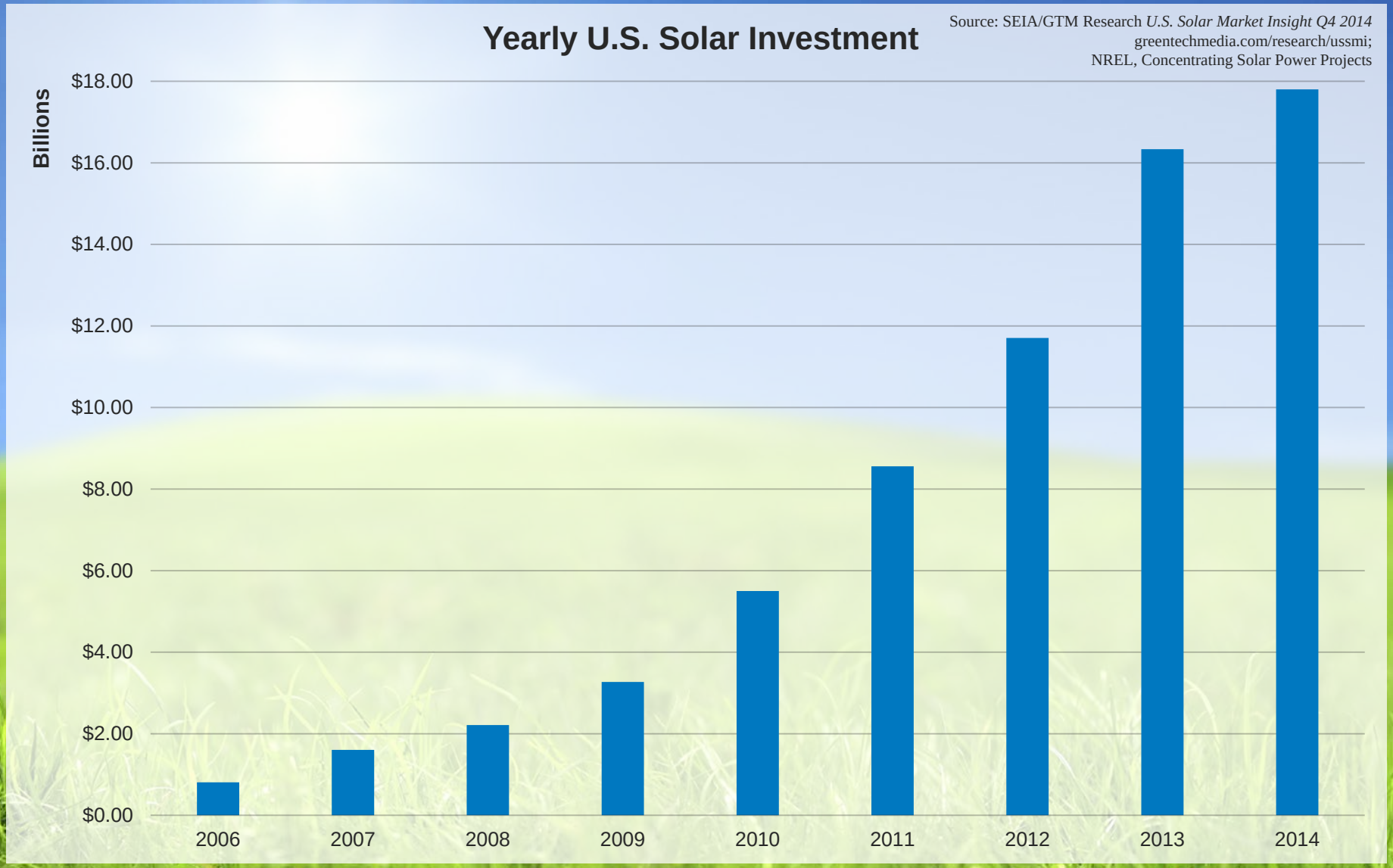


Solar Growth by Market Segment



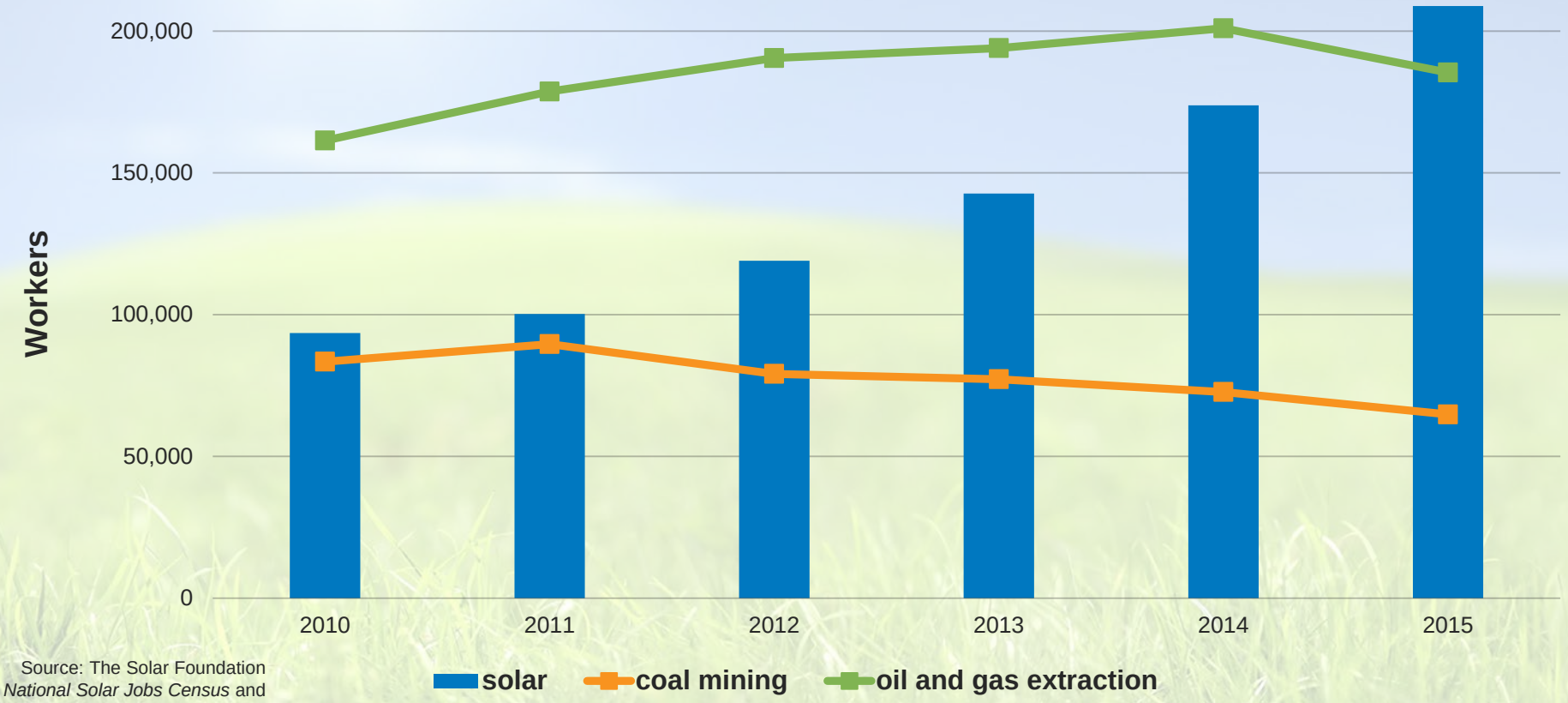
Source: SEIA/GTM Research

Investment in Solar has increased 10x since 2006



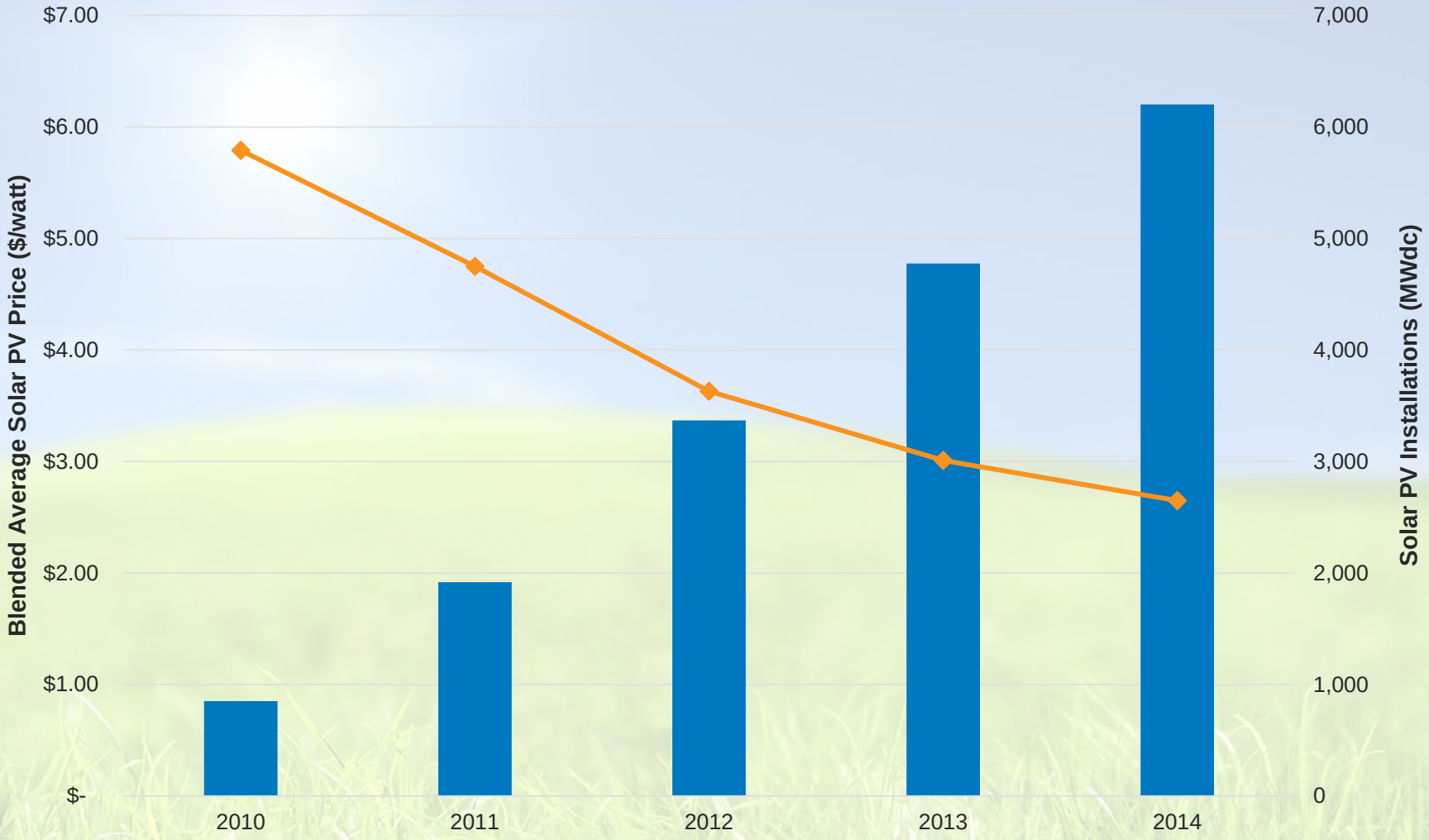
Solar as an Economic Engine

- Nearly 209,000 American workers in solar – more than double the number in 2010 – at more than 8,000 companies



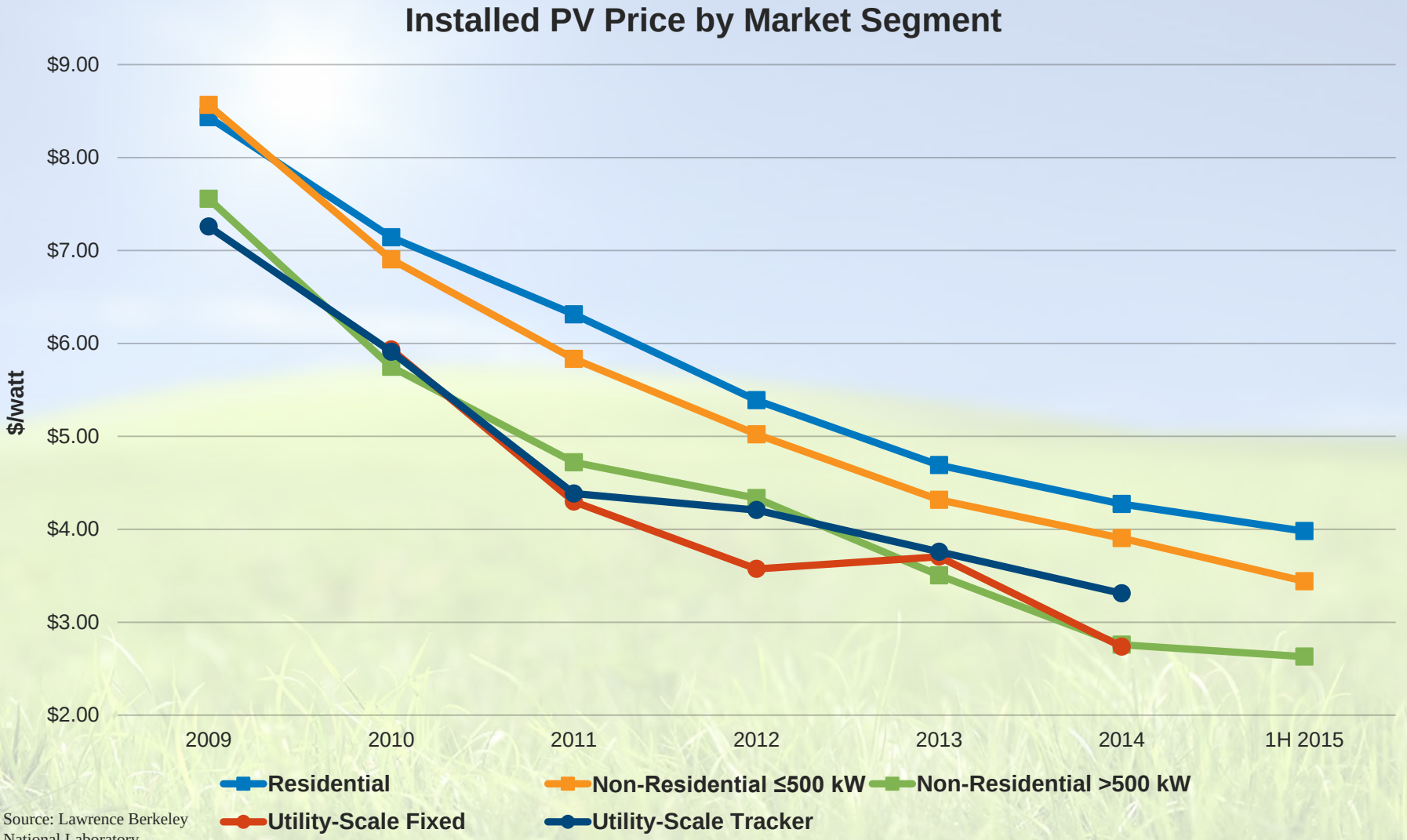
Source: The Solar Foundation *National Solar Jobs Census* and Bureau of Labor Statistics

Growth in Solar led by Falling Prices



Source: SEIA/GTM Research *U.S. Solar Market Insight Q4 2014*
greentechmedia.com/research/ussmi
Lawrence Berkeley National Laboratory, *Tracking the Sun*

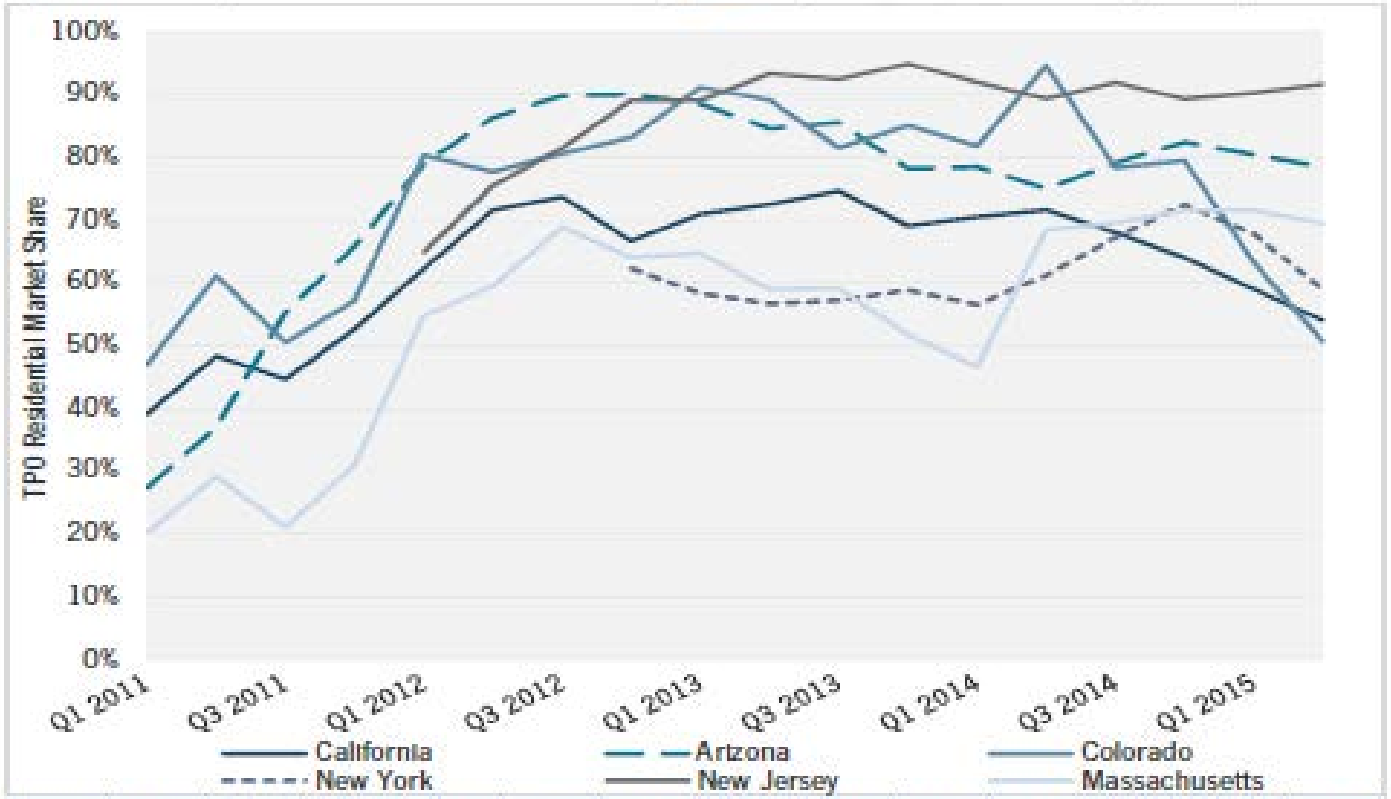
PV Prices fall by 50%+ over last 5 years



Source: Lawrence Berkeley National Laboratory

Residential Third-Party Ownership Broadens Access to Solar

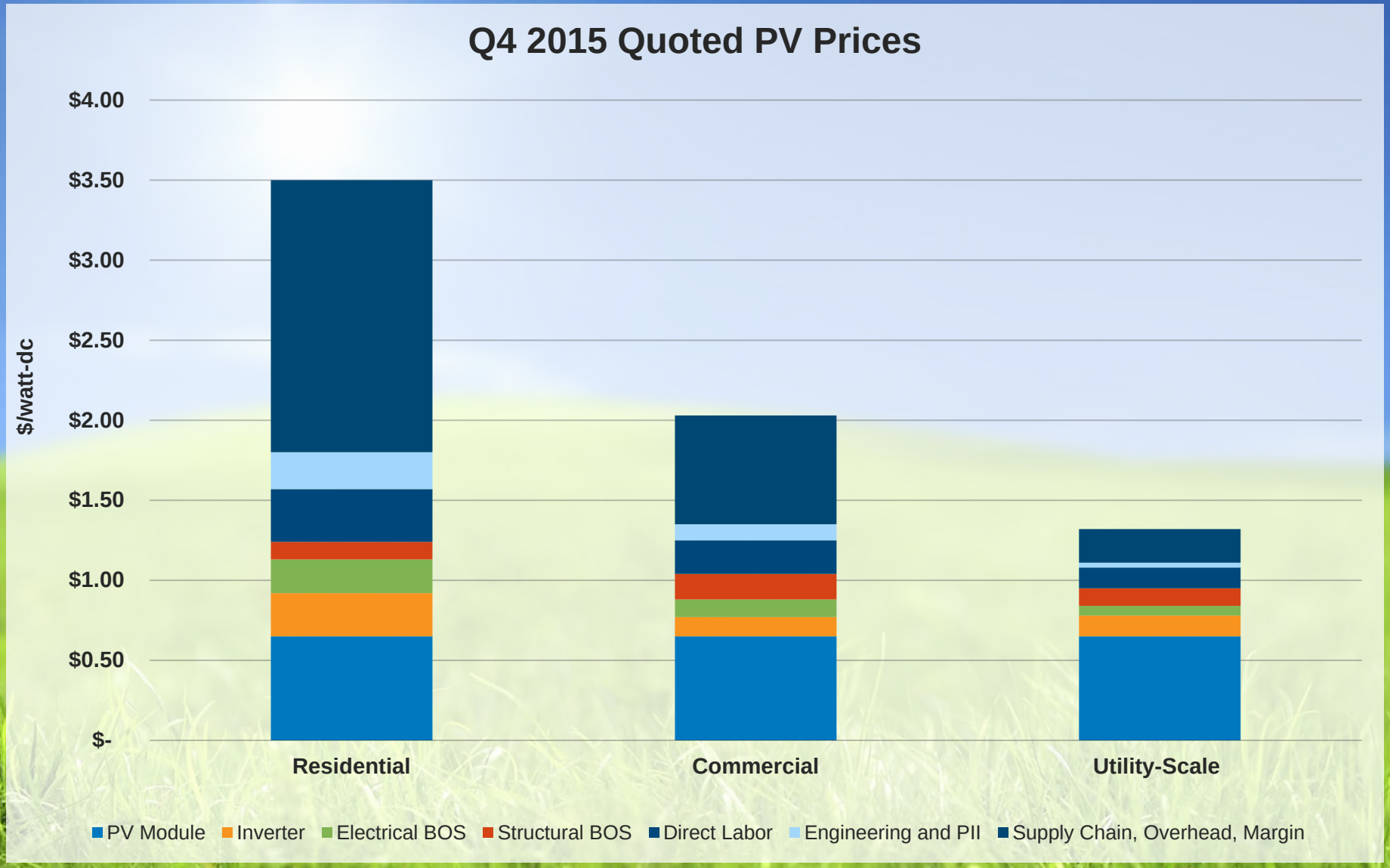
Figure 2.4 Percentage of New Residential Installations Owned by a Third Party in CA, AZ, CO, NY, NJ and MA, Q1 2011-Q2 2015



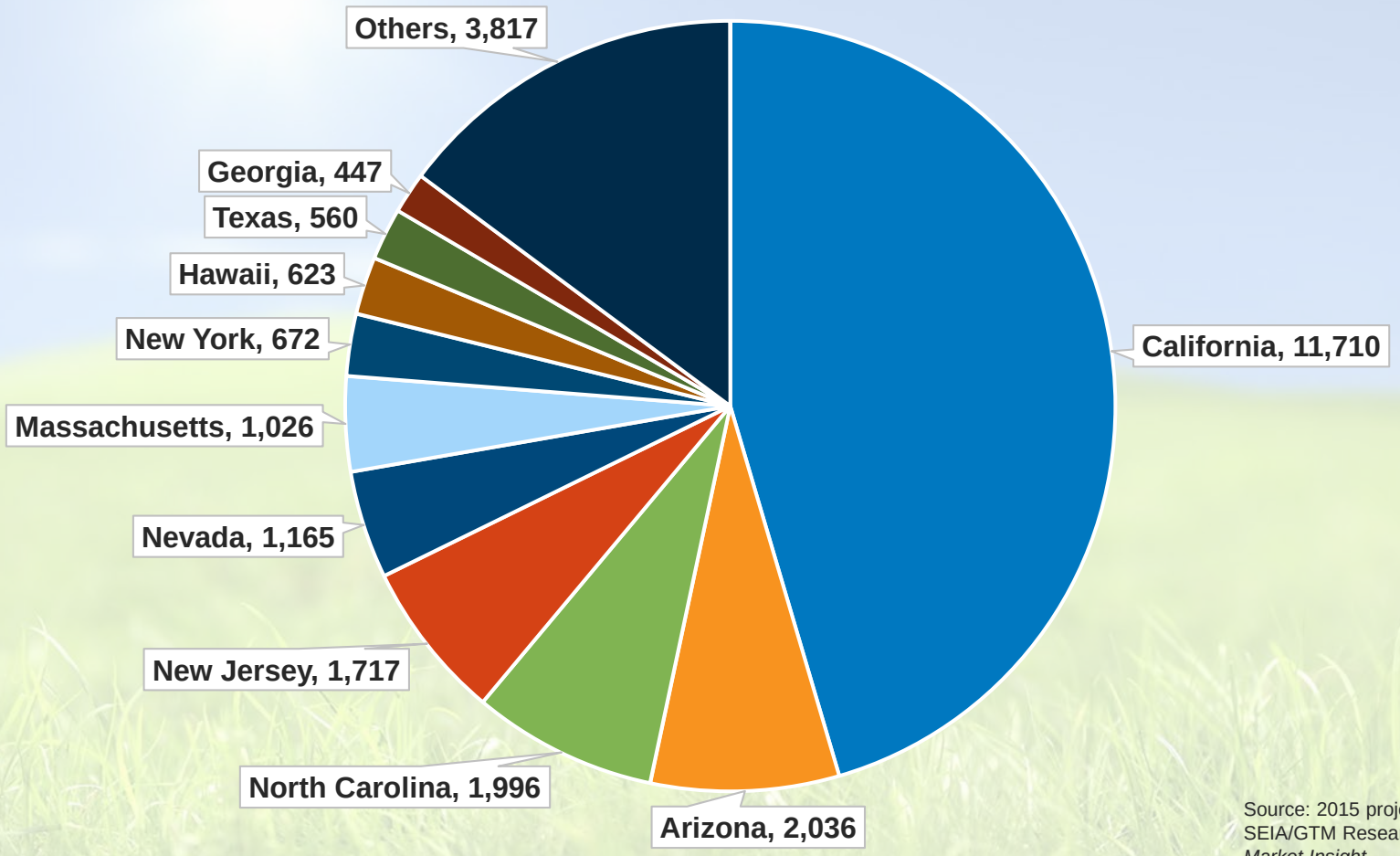
	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
CA	72%	74%	67%	71%	73%	75%	69%	71%	72%	68%	64%	59%	54%
AZ	86%	90%	90%	89%	85%	86%	78%	78%	75%	79%	82%	80%	78%
CO	78%	81%	83%	91%	89%	82%	85%	82%	95%	78%	79%	63%	51%
MA	59%	69%	64%	65%	59%	59%	52%	47%	68%	70%	72%	72%	69%
NJ	75%	81%	89%	89%	93%	92%	95%	92%	89%	92%	89%	90%	92%
NY			62%	58%	57%	57%	59%	57%	61%	67%	72%	68%	59%

Source: SEIA/GTM *U.S. Solar Market Insight Q2 2015*

Solar PV Price Breakdown



U.S is a 50 state market



Source: 2015 projections from SEIA/GTM Research *U.S. Solar Market Insight*

Moving Beyond Traditional Solar Markets: Distributed Generation (21)

Top 10 DG States by Absolute Growth				
	State	2011-15 DG MW	2016-2020 DG MW	DG Growth
1	California	3,880	13,234	9,353
2	New York	510	2,711	2,201
3	Massachusetts	937	2,256	1,319
4	Maryland	306	1,111	805
5	Connecticut	185	912	727
6	New Jersey	1,132	1,683	551
7	Texas	113	598	486
8	Florida	106	574	468
9	Minnesota	28	472	444

Top 10 DG States by % Growth				
	State	2011-15 DG MW	2016-2020 DG MW	DG % Growth
1	South Carolina	8	172	2097%
2	Minnesota	28	472	1579%
3	Indiana	9	130	1348%
4	Virginia	19	208	1003%
5	Michigan	15	151	936%
6	New Hampshire	23	222	868%
7	District of Columbia	15	136	796%
8	Delaware	32	271	752%
9	Illinois	22	180	731%
10	Vermont	55	399	632%

1	Vermont	87.11	637.61	550.50
2	Delaware	33.56	285.99	252.42
3	California	99.12	338.07	238.94
4	Connecticut	51.58	253.90	202.32
5	Massachusetts	137.84	331.97	194.13
6	District of Columbia	22.63	202.86	180.22
7	Hawaii	322.62	484.18	161.56
8	New Hampshire	17.25	166.94	149.70
9	New Mexico	33.63	179.78	146.14
10	Maryland	50.92	184.91	133.99

Source: SEIA/GTM Research

Moving Beyond Traditional Solar Markets: Utility-Scale (21)

Top 10 Utility-Scale States by Absolute Growth				
	State	2011-15 Utility-Scale MW	2016-2020 Utility-Scale MW	Utility-Scale Growth
1	Texas	394	4,233	3,840
2	California	7,179	10,407	3,229
3	Utah	194	1,466	1,272
4	Nevada	777	1,978	1,201
5	Florida	21	1,173	1,152
6	Georgia	339	1,392	1,054
7	New Mexico	250	1,287	1,037
8	Oregon	26	1,042	1,016
9	Colorado	162	956	794
10	Virginia	2	750	748

Top 10 Utility-Scale States by % Growth				
	State	2011-15 Utility-Scale MW	2016-2020 Utility-Scale MW	Utility-Scale % Growth
1	Washington	0.0	142.4	-
2	Iowa	0.0	68.0	-
3	Louisiana	0.0	33.7	-
4	New Hampshire	0.0	12.5	-
5	Virginia	2.1	750.4	36414%
6	Minnesota	2.3	682.6	29578%
7	Michigan	1.3	333.5	26372%
8	South Carolina	3.7	525.2	14095%
9	Florida	20.9	1,173.0	5511%
10	Oregon	26.3	1,041.8	3861%

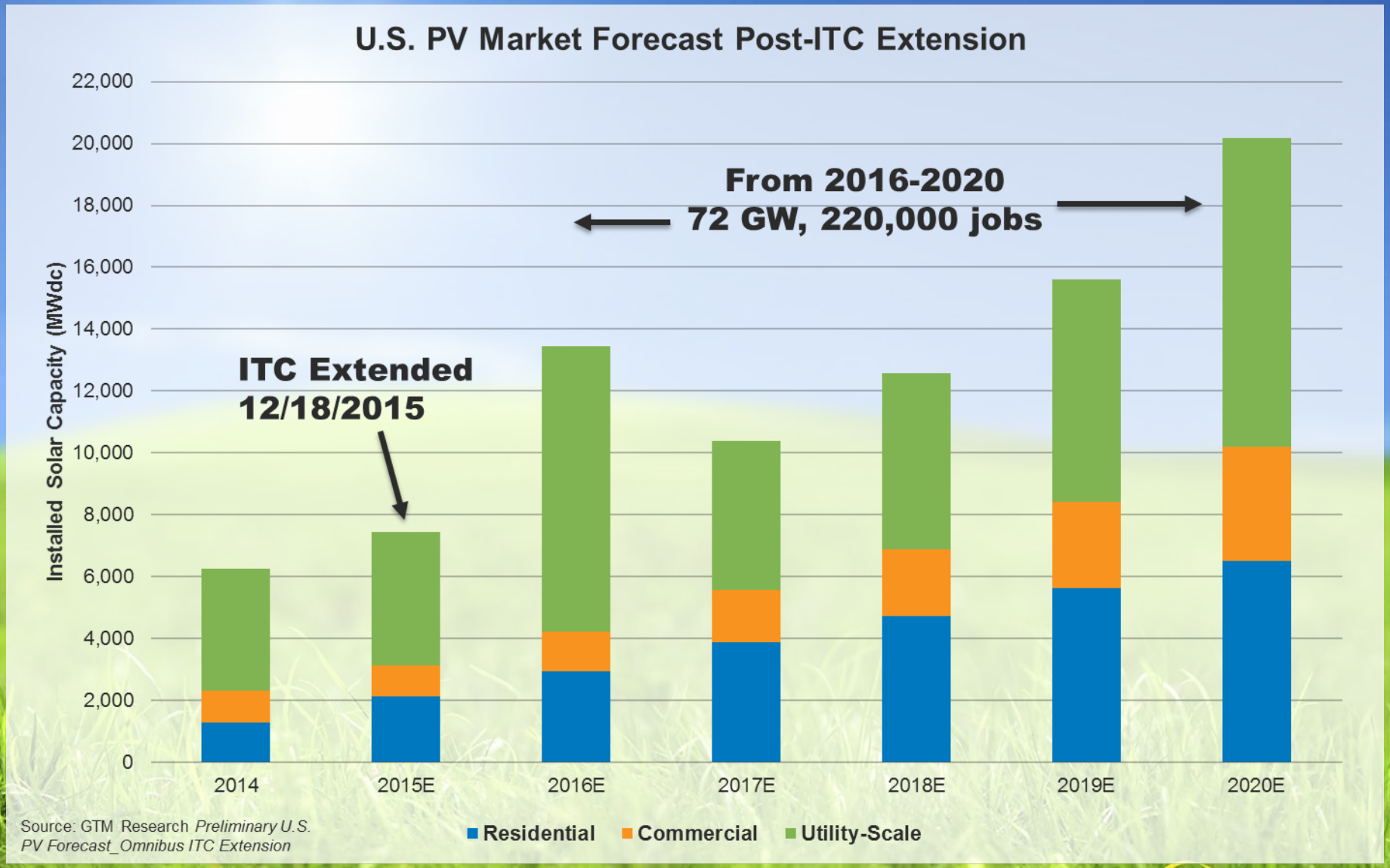
Top 10 Utility-Scale States by Per Capita Growth				
	State	2011-15 watts/person	2016-2020 watts/person	Growth in watts/person
1	New Mexico	119.99	617.30	497.30
2	Utah	64.80	489.22	424.42
3	Nevada	268.73	684.25	415.52
4	Hawaii	38.23	333.57	295.34
5	Oregon	6.53	258.58	252.06
6	Vermont	94.04	286.45	192.42
7	Colorado	29.63	175.15	145.51
8	Texas	14.33	154.11	139.78
9	Minnesota	0.42	124.34	123.93
10	South Carolina	0.76	107.27	106.52

Source: SEIA/GTM Research

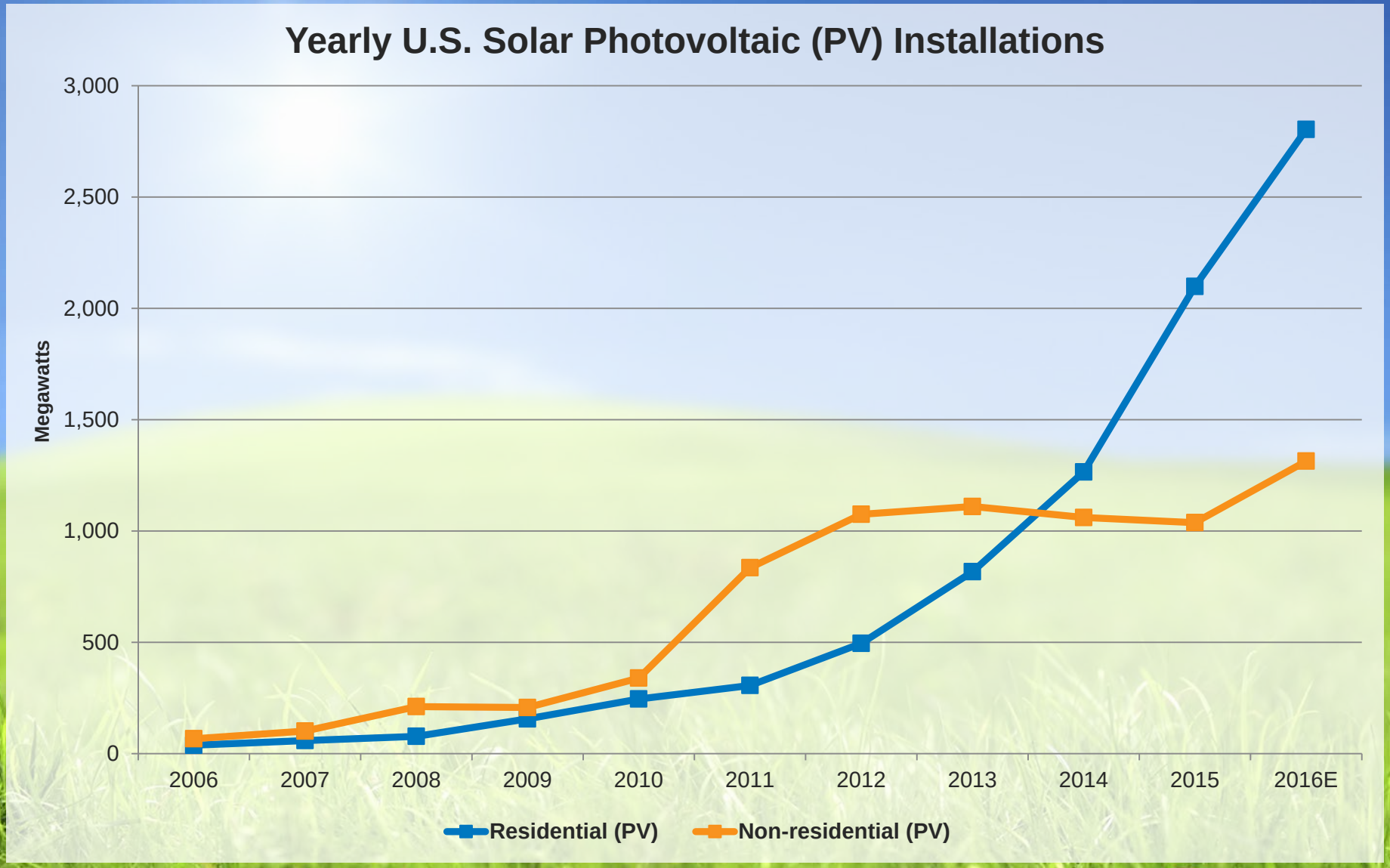
Extending the ITC

- Extended at 30% through the end of 2019
  - Drops to 26% in 2020 and 22% in 2021
  - After 2021, Commercial credit drops to 10%, Residential credit expires
- Commence Construction language added
  - Projects must be placed in service before the end of 2023

100 GW by 2020 with Extension

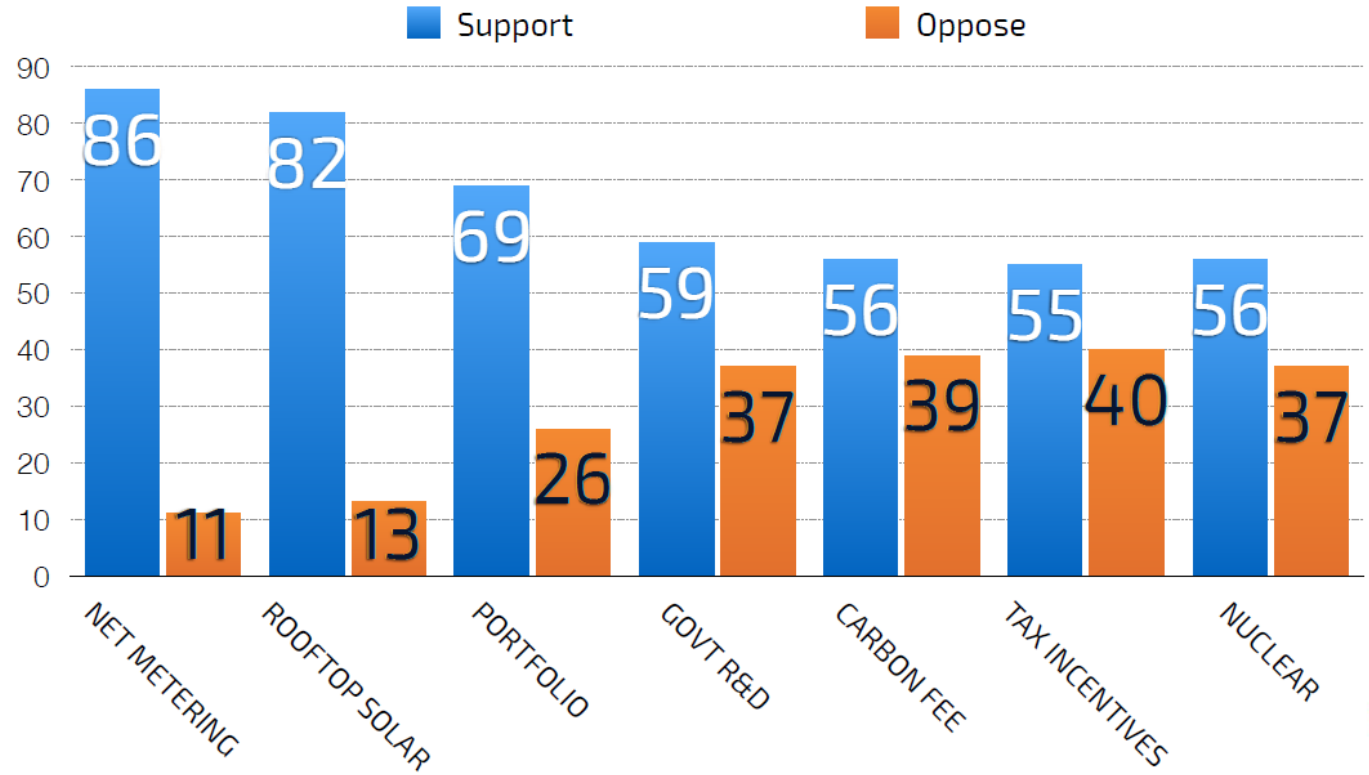


Residential & Commercial (Distributed)



Broad Public Support for Solar

ROOFTOP SOLAR AND NET METERING ARE CLEAR WINNERS (REPUBLICANS)



ECHELON INSIGHTS

NORTH STAR OPINION RESEARCH

QCA PUBLIC OPINION STRATEGIES

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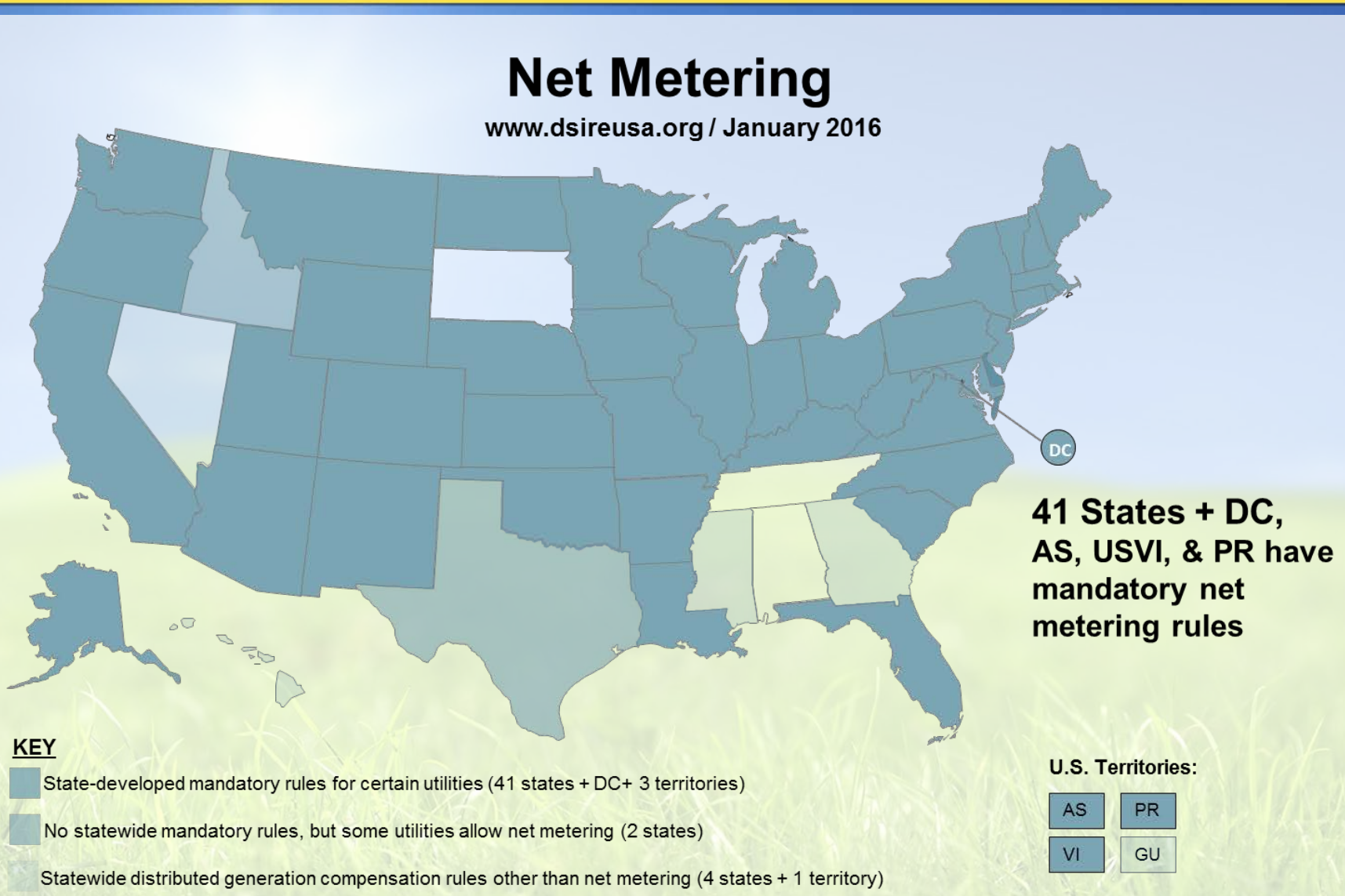
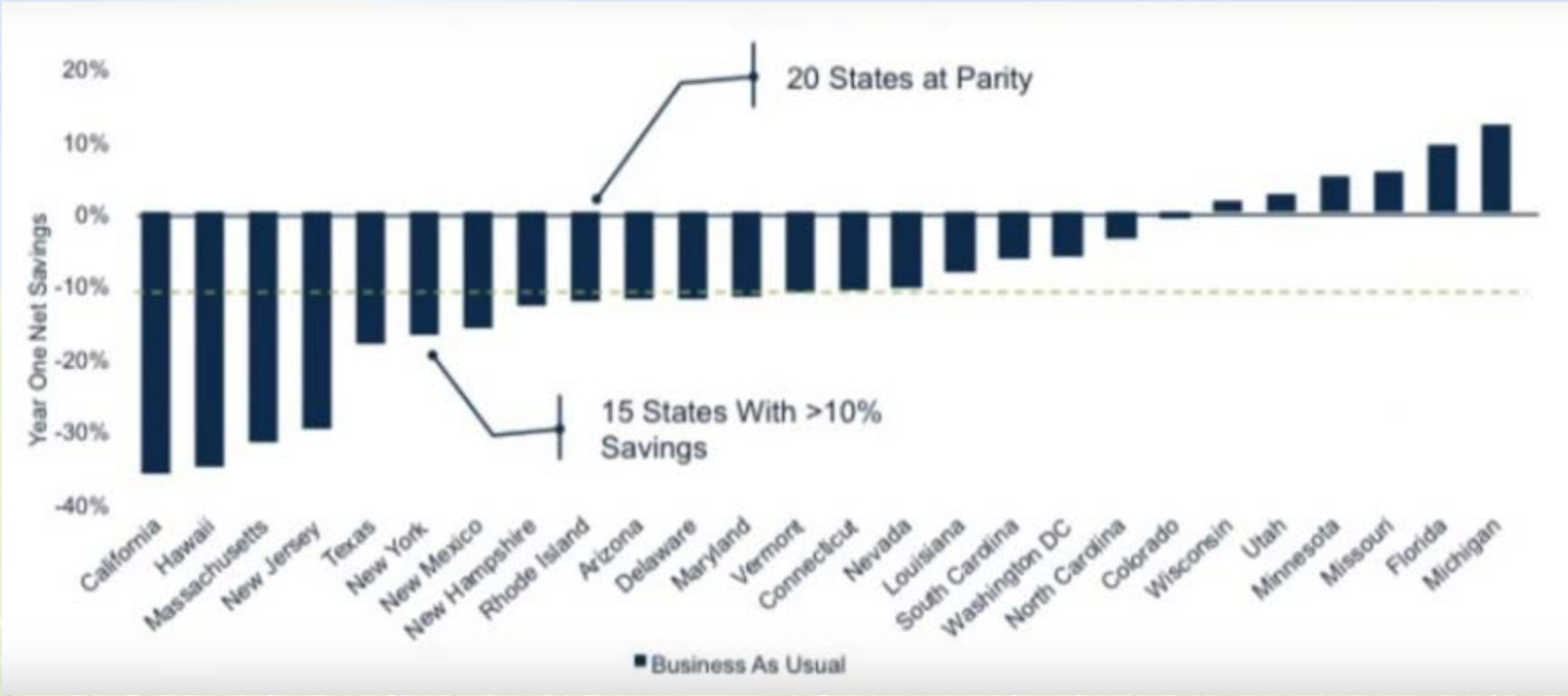
Net Metering



Net Metering

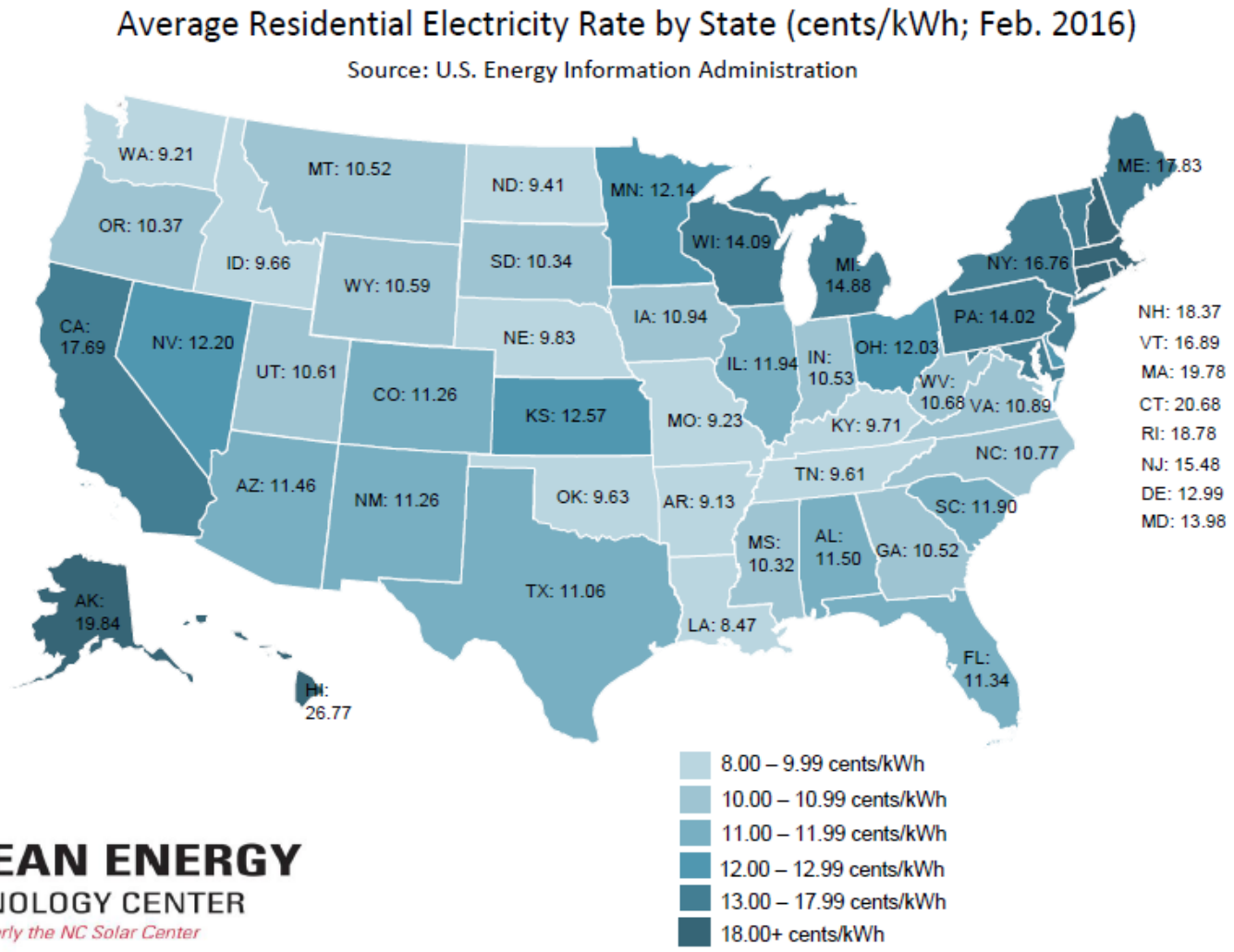
- **Under current NEM rules, distributed generation solar at grid parity in 20 states**



Source: Shayle Kann, GTM Research
U.S. Solar Market Insight Conference
Keynote: *The Future of Solar*

Average Retail Rates

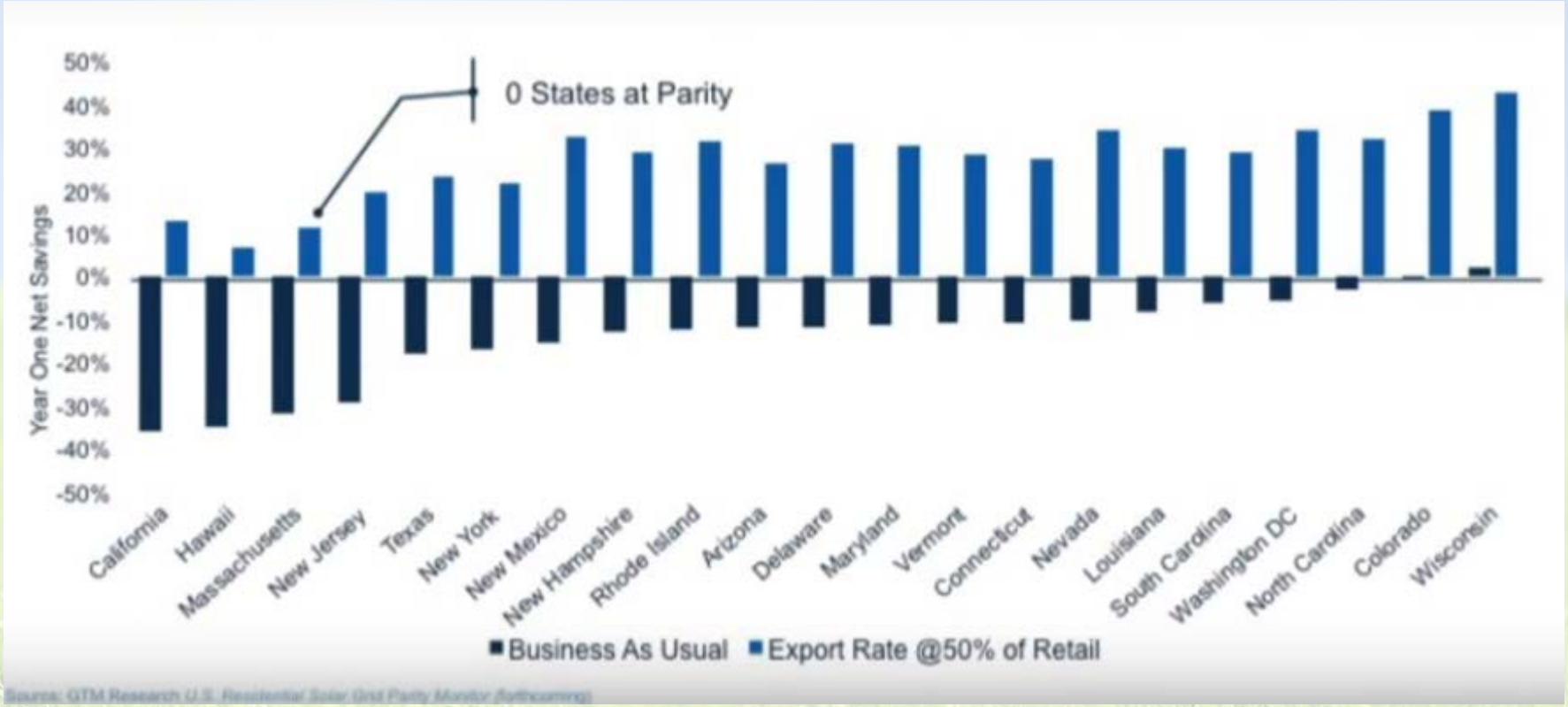
NC STATE UNIVERSITY



NC CLEAN ENERGY TECHNOLOGY CENTER
Formerly the NC Solar Center

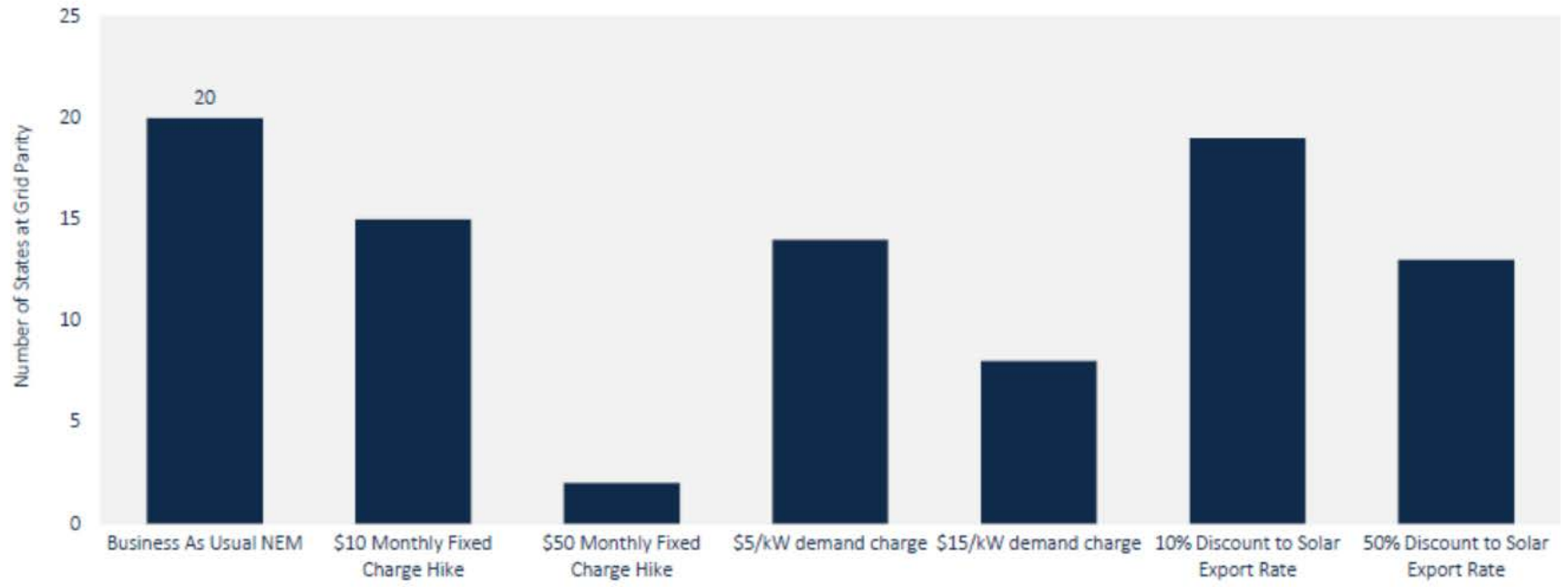
Net Metering

- **If export rate is cut in half, 0 states at grid parity**
- **Nevada outcome looms large, but not emblematic of NEM policy nationally**



Source: Shayle Kann, GTM Research *U.S. Solar Market Insight* Conference Keynote: *The Future of Solar*

Impact of other rate design changes



Executive Summary: U.S. Residential Solar Economic Outlook 2016-2020 gtmresearch 9

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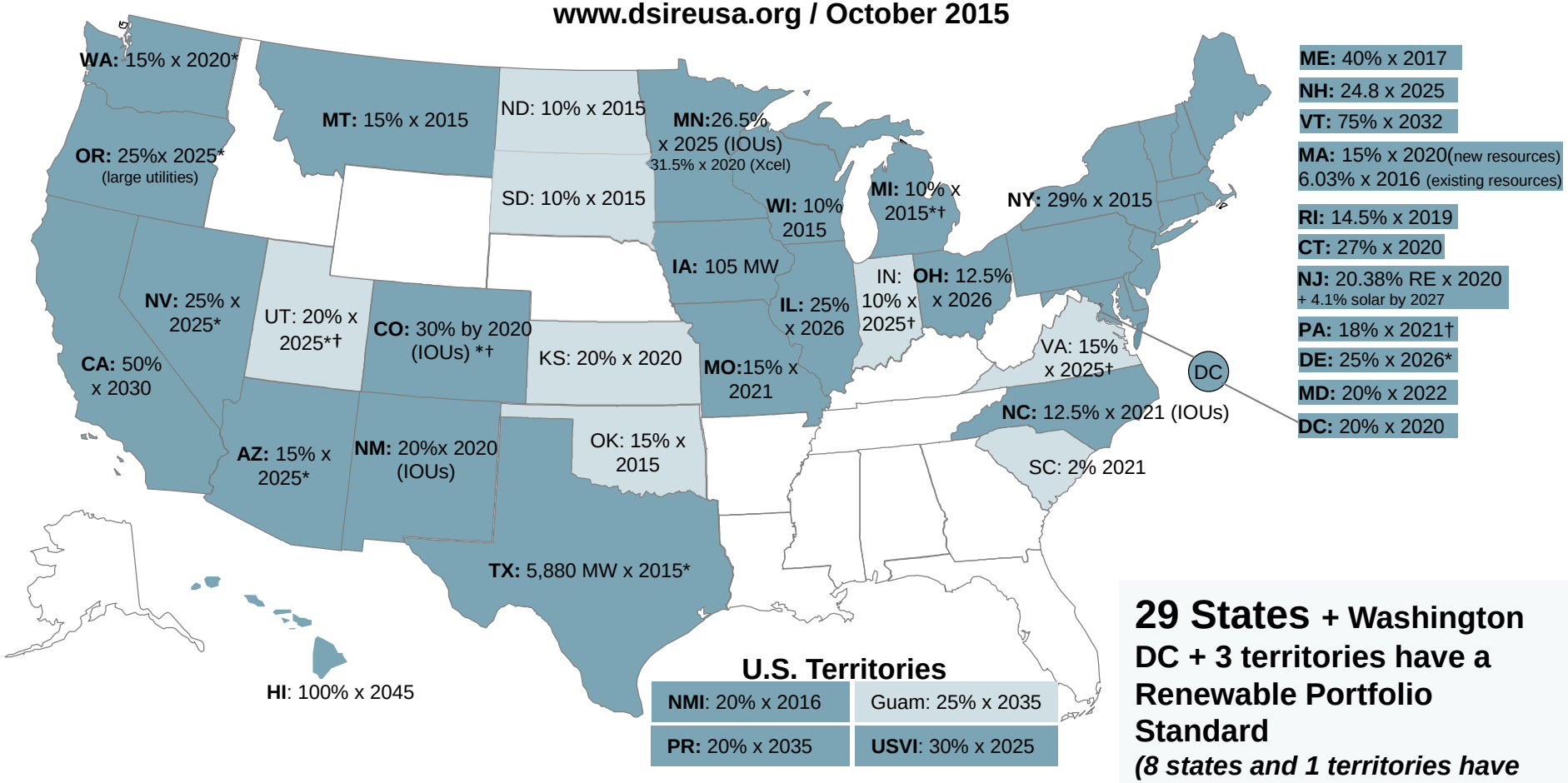
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Renewable Portfolio Standard Policies

www.dsireusa.org / October 2015



ME: 40% x 2017
NH: 24.8 x 2025
VT: 75% x 2032
MA: 15% x 2020(new resources) 6.03% x 2016 (existing resources)
RI: 14.5% x 2019
CT: 27% x 2020
NJ: 20.38% RE x 2020 + 4.1% solar by 2027
PA: 18% x 2021†
DE: 25% x 2026*
MD: 20% x 2022
DC: 20% x 2020

U.S. Territories

NMI: 20% x 2016	Guam: 25% x 2035
PR: 20% x 2035	**USVI**: 30% x 2025

29 States + Washington DC + 3 territories have a Renewable Portfolio Standard
(8 states and 1 territories have renewable portfolio goals)

Renewable portfolio standard
Renewable portfolio goal

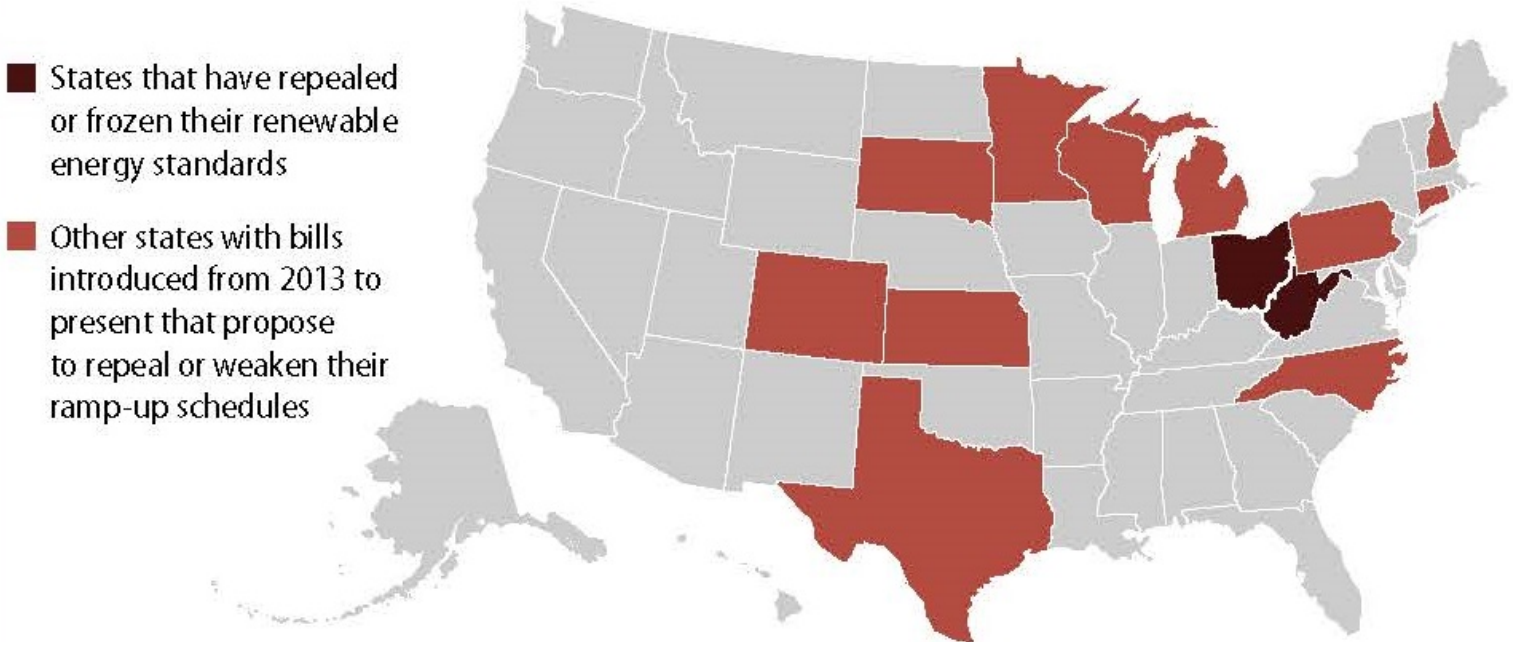
* Extra credit for solar or customer-sited renewables
† Includes non-renewable alternative resources

State RPS – threats since 2013

FIGURE 1

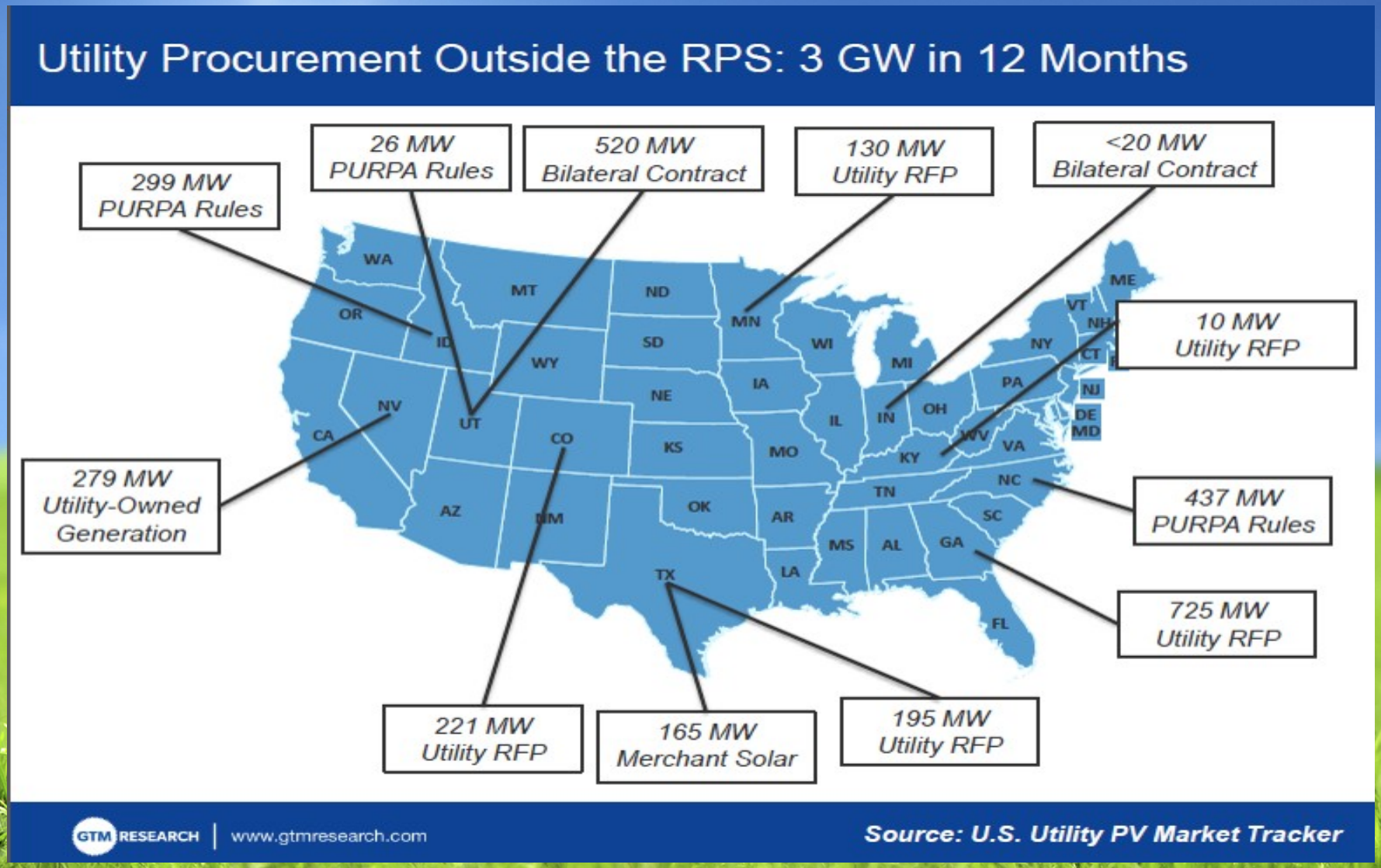
Battles over state-level renewable energy standards

Selected efforts to repeal or weaken ramp-up schedules for renewable energy

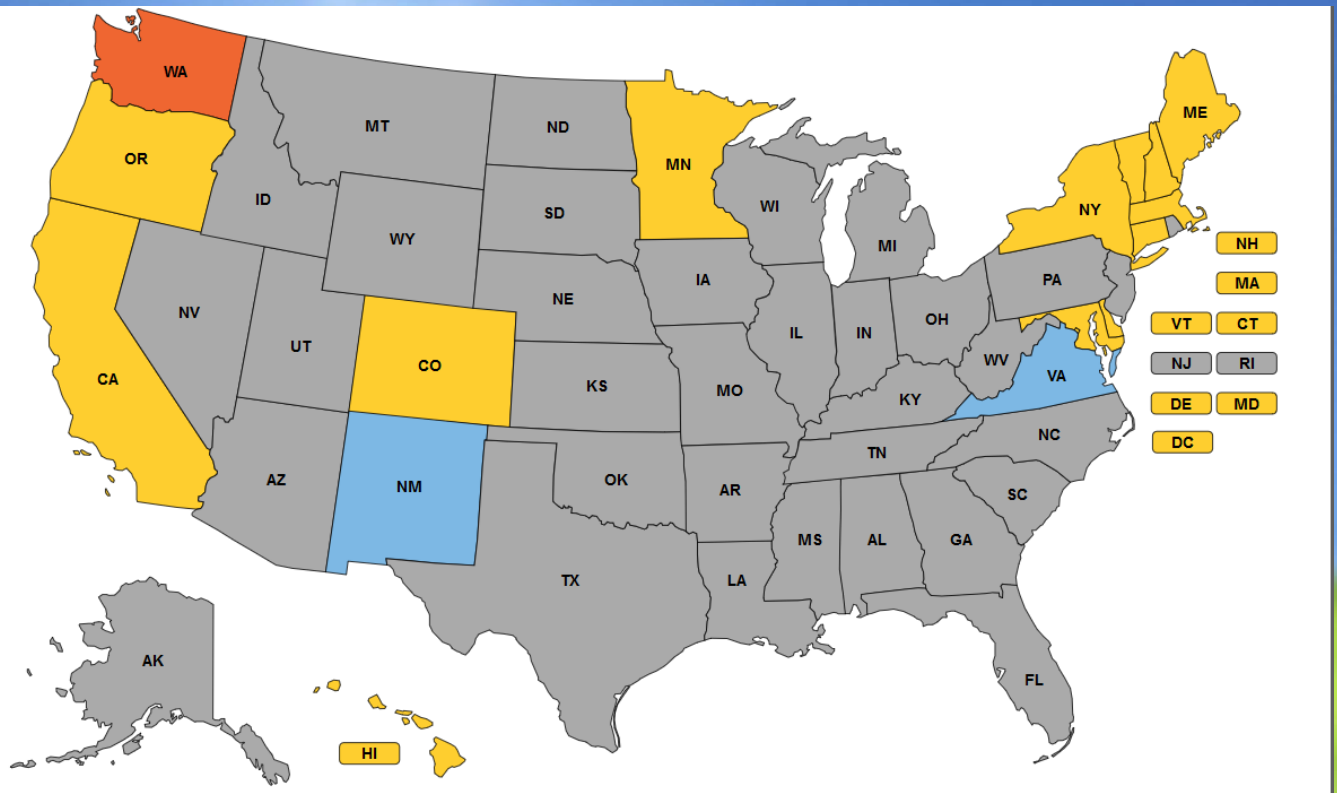


- 13 states have considered repeal or weakening RPS (Source: Center for American Progress report, March 2015)
- Ohio RPS frozen; WV RPS repealed (but included clean coal and old tires)
- Colorado and NC bills to weaken RPS defeated in 2015
- Texas bill to weaken RPS passed state Senate in April, but died in House
- Kansas bill to make RPS voluntary agreed to by AWEA May 2015

Industry Trends: Non-RPS Procurement



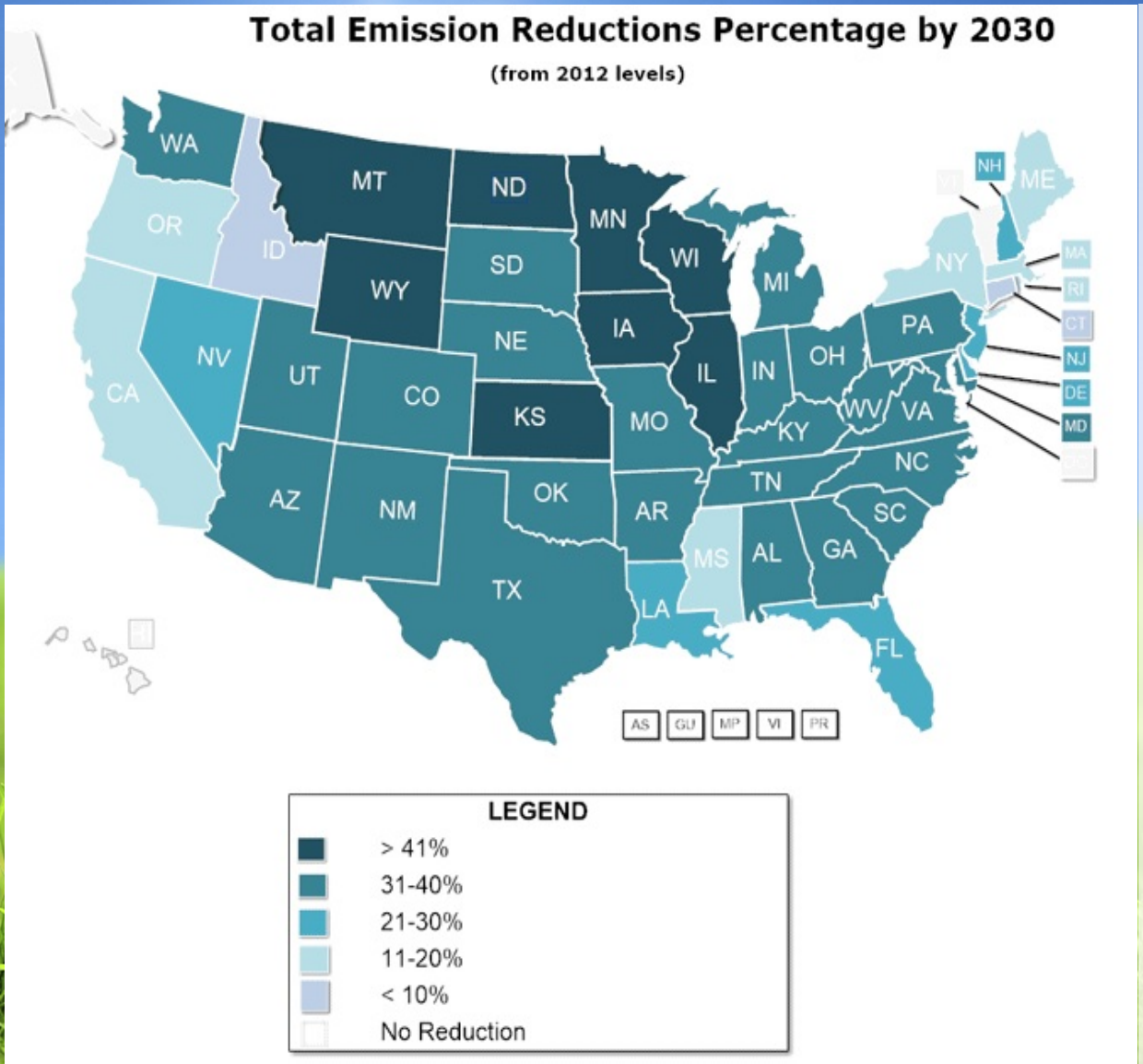
Industry Trends: Community Solar



- 13 states & DC have adopted shared or community solar programs
- Expands solar access to more customers
  - Multi-family
  - Shaded roof
  - Low & moderate income
  - Poor credit
- Multiple business models, including utility ownership

Source: http://www.sharedrenewables.org/community-energy-projects/

Clean Power Plan - Opportunity



- CPP will drive 20 GW of additional capacity by 2030
- SEIA is focused on Southeast & Midwest
  - State targets > 35%
  - States planning SIPs
  - Open new markets
  - Cross over with other SEIA policy priorities
  - Regional approach allows efficient use of resources
- CPP Mechanisms could include:
  - RPS expansions (CA, IL, MI)
  - IRP (GA, CO)
  - Other utility RFP (TN, VA)
  - Utility ownership (AL)
  - Community Solar (MN, CO)

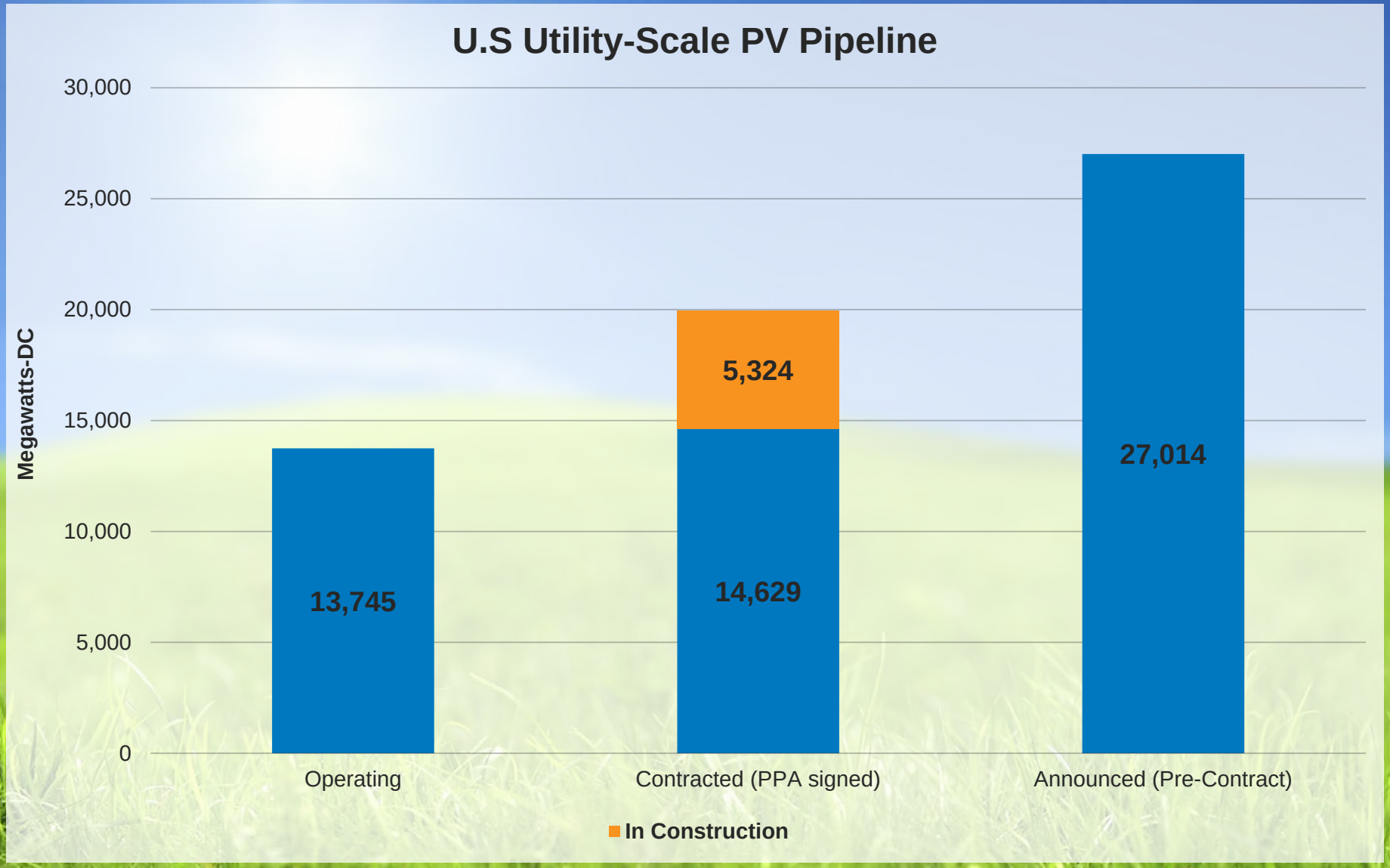
Changing Policy Landscape – Utility Scale Solar

- Not just RPS any more – though RPS remains big driver
- USP gains acceptance from Utilities as prices fall and utility holding companies gain experience owning & operating large solar plants
  - PPA pricing reported below $40/MWh
  - Utilities owning solar projects include:
    - Southern, Dominion, Mid-American, Duke
- Clean Power Plan and other economic and regulatory challenges to the aging coal fleet presents near term opportunities in the South.
- PURPA & voluntary markets
  - PURPA in NC
  - Voluntary programs by municipal utilities in Texas
  - Alabama (500 MW)
  - Virginia (400 MW)
  - Tennessee (800 – 3,800 MW)
  - Arkansas (~100 MW)
  - South Carolina (~100 MW)
  - Georgia Power IRP
- In slightly longer term Texas comes into play in a big way
  - ERCOT projects 13,000 MW solar

Changing Policy Landscape – Utility Scale Solar

- Corporate buyers present new market in some states
  - Kaiser virtual PPA in CA
  - Apple and Google projects in NC, VA
  - Switch in NV
  - Utilities in mature markets increasingly look to offload procurement obligations to other entities (e.g. PG&E, “even with 50% RPS, expect minimal procurement”)
- Grid Integration and Transmission present challenges that will increase with penetration
  - Reduced capacity values with increasing solar penetration
  - California “duck curve”
  - Long distance transmission projects remain subject to multiple layers of state, federal and local regulation, with no end in sight
  - Grid-scale storage development remains nascent

Utility Scale



Industry Trends: Solar Plus Storage

- SEIA views storage as an enabling technology, for both the utility-scale and distributed generation markets
  - Storage and related advanced electronics enable solar projects to provide grid services to utilities, mitigates integration of variable resources, increases value to grid
- Solar-plus-storage deployments totaled 4 MWdc in 2014, but GTM Research expects them to grow to 22 MWdc in 2015 and reach 769 MWdc by 2020.
- California is expected to be the biggest solar-plus-storage market, with 422 MWdc installed in 2020 alone.
- In dollar terms, GTM expects the market to grow to $246 million in 2015 and $643 million in 2016. By 2020, the annual U.S. solar-plus-storage market will be $3.1 billion.
- State storage incentive programs/proceedings
  - California 1,300 MW by 2024
  - NJ FY 2016 incentive program
  - MA considering incentives for storage

Thank You