Q1/Q2 2019 Solar Industry Update

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Executive Summary

- In June 2019, the USTR granted an exclusion from the Section 201 solar tariffs for bifacial modules.
- In Q2 2019, Maine and New York joined California, Hawaii, Nevada, Puerto Rico, Washington state, and Washington D.C. in committing to 100% carbon-free electricity.
- In Q1 2019, the United States installed 2.7 GW-DC of PV, the largest amount of solar deployed in Q1 in U.S. history and 10% above Q1 2018.
- SEIA reported that in 2018 the U.S. community solar market installed 543 MW-DC of community solar installations—a 5% reduction, y/y.
- The United States installed approximately 271 MWh (149 MW) of energy storage onto the electric grid in Q1 2019—up 110% y/y.
- Performance of solar companies declined, on average, in Q1 2019, as ASP of modules and cells fell. However, the few companies that reported Q2 2019 earnings indicate an improvement, Q/Q, as global demand has increased and prices have stabilized.
- In the first half of 2019, the United States imported \$1.2 billion in PV modules (4.3 GW) and \$162 million in PV cells (1.1 GW).
- Cell and module prices were relatively flat in Q2 2019, while polysilicon pricing rebounded 6% to \$9.20/kg and multi c-Si wafers fell 5% to \$0.05/W.
- Residential inverter pricing in the United States increased in Q1 19 due to tariffs imposed on Chinese inverters.
- From 2017 to 2018, average battery pack prices dropped 18%.
- Solar stocks have performed significantly better than the rest of the market since the beginning of 2019, outpacing the broader market significantly in Q2.

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 Component Pricing

7 Market Activity

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 Component Pricing

7 Market Activity

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- In Q2 2019, Maine and New York joined California, Hawaii, Nevada, Puerto Rico, Washington state, and Washington D.C. in committing to 100% carbon-free electricity.

Tariff Update (Bifacial Exemption)

- Since the Section 201 tariffs were put in place, the USTR has granted an exclusion to the tariffs for SunPower IBC panels and, in June 2019, for **bifacial modules** (among other changes).
- Chinese-produced solar is also subject to AD/CVD and Section 301 tariffs, which make it cost prohibitive to import modules and cells from China.
 - Currently, most bifacial production capacity is in China.
 - Section 301 tariffs also increase the cost of domestically produced U.S. panels, as many of the components (e.g., glass and frames) are sourced from China.
- It is estimated that manufacturers can switch their monofacial cell and module lines to bifacial production within 1–6 months; however, many suppliers will not shut down production to make the switch, as they are oversold.
 - The impending ITC step-down has caused an increase in U.S. demand.
- There continues to be an undersupply of bifacial modules to the U.S. market (pushing prices up); however, the Section 201 exclusion is expected to ramp up non-Chinese bifacial manufacturing capacity to import into the U.S. market in 2020.

States' Commitments to 50%–100% Carbon-Free Electricity

- In Q2 2019, Maine and New York joined California, Hawaii, Nevada, Puerto Rico, Washington state, and Washington D.C. committing to 100% carbon-free (CF) electricity.
- In 2017, the 17 jurisdictions indicated on the map consumed more than 27% of U.S. electricity.
- All these commitments have target dates between 2030 and 2050.
- Despite the recent increases in renewable and clean standards, they have not yet resulted in an increase in RPS-driven procurement, with the utility-scale markets driven by voluntary and corporate procurement.

Note: CF = carbon free

Sources: 100% Commitments in Cities, Counties, & States, Sierra Club, <https://www.sierraclub.org/ready-for-100/commitments>; www.dsireusa.org, June 2019; League of Conservation Voters; EIA Form 861

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 Component Pricing

7 Market Activity

- The International Renewable Energy Agency (IRENA) reported that from 2017 to 2018 global weighted-average installed costs for CSP fell 28% and global weighted-average capacity factor increased 15%.
- The Global Off-Grid Lighting Association (GOGLA) tracked 7.6 million off-grid solar products with a capacity of 59 MW that sold in 2018 for a value of \$483 million.

Global CSP Cost and Performance 2010–2018

IRENA reported that from 2017 to 2018 global-weighted average installed costs for CSP fell 28% and global weighted-average capacity factor increased 15%.

- One reason for the trend in higher average capacity factor is the increased deployment of storage, which rose, on average, from 3.6 hours in 2010 to 8.3 hours in 2018.
- Additionally, CSP projects commissioned in Spain from 2010 to 2013 were typically sited in areas with DNI in the 2,000–2,200 kWh/m²/year range, while sites with DNI of 2,500–3,000 kWh/m²/year became the norm from 2014 to 2018.

Global CSP LCOE

- The LCOE of new CSP projects fell from between \$0.27/kWh and \$0.48/kWh in 2010 and 2011 to \$0.10-\$0.28/kWh in 2018, as a result of the combination of higher capacity factors and lower installed costs.
 - IRENA reports that no projects have been built without storage since 2014, given that including storage minimizes LCOE.
- Average CSP costs in 2019 should fall further, as several Chinese plants will come online at lower installed costs.
 - Additionally, current auction and PPA data suggest that by 2020, CSP will offer electricity in the \$0.06 to \$0.10/kWh range.
 - In May, Morocco awarded the 800-MW CSP-PV Noor Midelt I project to an EDF consortium at a record low price of \$71/MWh.

Global Off-Grid Solar Market

GOGLA tracked 7.6 million off-grid solar products, with a capacity of 59 MW that sold in 2018 for a value of \$483 million.

- GOGLA estimates they track roughly 30%–80% of total off-grid sales, depending on the product and market.
- 50% of sales in 2018 were in sub-Saharan Africa and 33% were in India.
- GOGLA estimates that the off-grid products sold since July 2010 have improved energy access to over 245 million people.

Global Off-Grid Solar Market (cont.)

Product Size (Watts)	Use	Percent of 2018 Market Volume	Percent of 2018 MW Shipped
0–1.5	Single light only	30%	2%
1.5–3	Single light and mobile charging	42%	13%
3–10	Multiple lights and mobile charging	16%	13%
11–20	Solar home system (SHS), entry level (3–4 lights, mobile charging, powering radio, fan, etc.)	4%	7%
21–49	SHS, basic capacity (above plus power for TV and extended capacity)	3%	15%
50–100	SHS, medium capacity (above but with extended capacities)	3%	23%
100+	SHS, higher capacity (above but with extended capacities)	1%	26%

- In 2018, approximately 88% of global off-grid solar volume but only 29% of megawatts shipped were for lighting products under 10 W.
 - The top-selling off-grid solar product is the single light with mobile charging. It accounted for more than 40% of off-grid product sales worldwide.
- In 2018, solar home systems (SHSs) accounted for approximately 12% of global off-grid solar volume and 71% of the megawatts shipped.
 - Sixty-two percent of the capacity of SHSs in 2018 were sold via a pay-as-you-go (PAYGO) business model, instead of cash, versus 39% for systems under 10 W.

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 Component Pricing

7 Market Activity

- In Q1 2019, the United States installed 2.7 GW-DC of PV—the largest amount of solar deployed in Q1 in U.S. history and 10% above Q1 2018.
- SEIA reported that in 2018 the U.S. community solar market installed 543 MW-DC of community solar installations—a 5% reduction, y/y.
- The United States installed approximately 271 MWh (149 MW) of energy storage onto the electric grid in the first quarter of 2019—up 110% y/y.

U.S. Installation Breakdown

- In Q1 2019, the United States installed 2.7 GW-DC of PV, the largest amount of solar deployed in Q1 in U.S. history and 10% above Q1 2018.
 - Utility-scale deployment in Q2 2019 was the second-highest non-Q4 quarter ever.
 - Additionally, PPA prices have been reported below \$35/MWh in nine states.
 - The residential sector continued to rebound with its third consecutive quarter of more than 600 MW of deployment.

U.S. PV Installations by Market Segment

Q1 2019 U.S. PV Installations by Region (2.7 MW-DC)

- Some of the larger residential markets have still slowed due to high customer acquisition costs caused by these markets moving past early adopters; however, the U.S. residential market has become more geographically diverse, with 29% of Q1 2019 residential installations coming outside the top-ten cumulative markets.
- Reform in California and Massachusetts—historically, two of the largest markets—is hampering the non-residential U.S. PV market.
 - California is transitioning to new time-of-use rates, and Massachusetts’ new incentive program (SMART) has slowed development as interconnection approval is taking longer than expected.

Community Solar Landscape

As of April 2019, 20 states and Washington D.C. had adopted community solar policies, with Connecticut and New Jersey enacting legislation in 2018 and Utah enacting legislation in 2019.

- SEPA reports that at least seven of these states have provisions that incentivize LMI participation.
- In Q2 2019, Nevada and South Carolina enacted legislation that will encourage community solar development.
- Forty-three states have at least one community solar project online, with SEIA reporting 1,387 cumulative megawatts installed through 2018.

Annual Community Solar Additions

- SEIA reported that in 2018 the U.S. community solar market installed 543 MW-DC of community solar installations, a 5% reduction, y/y.
- At the end of 2018, seventy-seven percent of the cumulative installed community solar capacity was in the leading five states, with Minnesota representing 39%.
 - Eighty-five percent of the community solar capacity installed in 2018 was in the leading five states, with Minnesota representing 55%.
- Wood Mackenzie expects significant growth from a new wave of states that have adopted community solar mandates, starting in 2020, including Illinois, Maryland, New Jersey, and New York.

Tesla, Vivint Solar, and Sunrun Residential Market Share

- Despite the usual Q1 installation dip, Sunrun and Vivint experienced 28% and 13% increases in sales in Q1 2019, y/y.
- Tesla sales are down 39% over the same period to their lowest quarterly installation levels since 2013.
 - Tesla sales declined another 38% in Q2 2019, to 29 MW. Tesla states it is reorganizing its retrofit business.
 - Tesla continues to focus on direct sales, while well over 80% of Vivint and Sunrun sales still come from leases or PPAs.
- Despite lackluster PV sales, Tesla Powerwall system sales continue to ramp, with over 1 GWh installed in the past year.
 - Sunrun now offers its Brightbox storage solution service in nine states and Puerto Rico.
 - Wood Mackenzie expects 7% of all distributed PV systems in 2019 to include storage.

U.S. Energy Storage Breakdown

- The United States installed approximately 271 MWh (149 MW) of energy storage onto the electric grid in the first quarter of 2019—up 110% y/y, buoyed by the largest non-residential deployment quarter and the second-largest residential deployment quarter on record, with California and Hawaii leading the way.
 - Battery supply constraints that hampered the U.S. market in 2018 began to ease in 2019 and were expected to have been fully resolved by the end of H1 2019.

- Note:** projects deployed on the utility side of the meter are classified as front-of-the-meter regardless of size.
- Sources:** Wood Mackenzie Power & Renewables and Energy Storage Association, "[U.S. Energy Storage Monitor](#)."
- In Q1 2019, 75% of front-of-the-meter systems were installed in New York and New Jersey and had shorter than an hour of storage (bucking the trend toward longer duration).
 - In Q1 2019, New York opened its Storage Bridge Incentive Program, which will support at least 1.8 GWh; it also adjusted its VDER program to provide more revenue certainty to storage projects.
 - Florida appears to be a growth market as customers seek resiliency from hurricanes; additionally, Florida Power and Light announced a 409-MW storage procurement.

Q1 2019 U.S. Energy Storage Installations by Region (271 MWh)

- 1 State and Federal Updates

- 2 Global Solar Deployment

- 3 U.S. PV Deployment

- 4 PV System Pricing**

- 5 Global Manufacturing

- 6 Component Pricing

- 7 Market Activity

Based on preliminary reported data for H1 2019, the median reported PV system price in California, Massachusetts, and New York dropped 2% to 7%, depending on system size, though significant price variation remains.

System Pricing from Select States

From H1 2018 to H1 2019, the median reported PV system price in California, Massachusetts, and New York:

- Fell 2% to \$4.17/W for systems from 2.5 kW to 10 kW
- Fell 3% to \$3.52/W for systems from 10 kW to 100 kW
- Fell 7% to \$2.69/W for systems from 100 kW to 500 kW
- Fell 6% to \$1.93/W for systems from 500 kW to 5 MW.

Preliminary H1 2019 MW: CA (177 MW), MA (33 MW), NY (143 MW)

Note: System prices above \$10/W and below \$1/W were removed from the data set.

Sources: CA NEM database (03/31/19); MA SREC program (07/01/19); NYSEDA (06/30/19).

System Pricing from Select States, 2018

- In addition to price differences based on system size, there is also variation between states and within individual markets.

- The median price of a small system in New York was about 5% less than the median price in California.
- In H1 2019, the 20th and 80th percentile preliminary prices in California for a small system were \$3.42/W and \$5.21/W respectively.

Preliminary H1 2019 MW: CA (177 MW), MA (33 MW), NY (143 MW)

Note: System prices above \$10/W and below \$1/W were removed from the data set.

Sources: CA NEM database (03/31/19); MA SREC program (07/01/19); NYSERDA (06/30/19).

Vivint Solar and Sunrun Cost and Value

- For the past two years, Vivint Solar and Sunrun total system costs remained relatively flat.
 - The average price of Sunrun's cash sales is approximately the same as their costs.

Sources: Corporate filings.

- In Q1 2019, totals costs for Vivint- and Sunrun-built systems were approximately \$3.5/W.
- Sunrun still reports a PV system value of approximately \$4.5/W.

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 Component Pricing

7 Market Activity

- Performance of solar companies declined, on average, in Q1 2019, as ASP of modules and cells fell. However, the few companies that have reported Q2 2019 earnings indicate an improvement, Q/Q, as global demand has increased and prices have stabilized.
- In the first half of 2019, the United States imported \$1.2 billion in PV modules (4.3 GW) and \$162 million in PV cells (1.1 GW).
 - Most of the imports come from a few countries in Asia.

PV Manufacturers' Margins

Line represents the median, with error bars representing 80th and 20th percentiles for the following companies in Q1 2019: Canadian Solar, First Solar, Hareon Solar, HT-SAAE, Jinko Solar, LONGi, Motech Industries, Neo Solar Power, ReneSola, and SunPower. When they are available, margin data from Hanwha Q Cells, JA Solar, Trina, and Yingli are also included from Q1 2010 to Q3 2018.

- Performance of solar companies declined, on average, in Q1 2019, as ASP of modules and cells fell.
- However, the few companies that have reported Q2 2019 earnings indicate an improvement, Q/Q, as global demand has increased and prices have stabilized.
 - China announced in July that it will subsidize almost 23 GW of PV to be connected in 2019, bringing total 2019 Chinese demand to ~40 GW and stability to the global market.
 - The surging U.S. market, caused in part by the expiring 30% ITC, has U.S. companies performing well, with SunPower reporting its first profitable quarter in four years.

Module and Cell Import Data

While module and cell imports into the United States fluctuate over time, PV module import value has dropped to a historically low level since implementation of the Section 201 tariffs; PV cell value has been increasing.

Import value has increased since the start of the tariffs in February 2018, despite the continued downward trajectory in module price. Q2 2019 was likely a near historical peak in terms of import quantity (MWs).

- In the first half of 2019, the United States imported \$1.9 billion in PV modules (5.9 GW), an increase over 2018 values.
 - A portion of that growth came from increases in thin-film module imports from Malaysia and Vietnam, growing from 0.6 GW in H2 2018 to 1.0 GW in H1 2019.
- In the first half of 2019, the United States imported \$162 million in PV cells (1.1 GW) —an increase of 605% and 35% of first half of 2017 and 2018 respectively.

Note: cell data uses HTS codes: 8541406030, 8541406025; module data uses codes: 8541406015, 8541406020, 8541406035. The U.S. started tracking MWs, in addition to dollar value at the beginning of 2018. While we do not have definitive imported MW statistics in 2017 and 2018, if we were to divide peak monthly dollar value in 2016 and 2017, by U.S. ASP reported on slide 33, we would arrive at peak imported MWs between 1.5 GW – 1.7 GW per month.

Sources: Imports, by value and MW: U.S. International Trade Commission, 2019.

Module and Cell Import Data by Region

In the first half of 2019, Malaysia, Vietnam, South Korea, and Thailand represented nearly 85% of PV *module* imports into the United States.

- In total, 93% of imports came from Asian countries, though a very small percentage came from China.

H1 2019 U.S. Module Imports by Region (5.9 GW)

Note: cell data uses HTS codes: 8541406030, 8541406025; module data uses codes: 8541406015, 8541406020, 8541406035

Sources: Imports, by value and MW: U.S. International Trade Commission, 2019.

In the first half of 2019, South Korea, Taiwan, Vietnam, and Japan represented over 80% of PV *cell* imports into the United States.

- In total, 99.7% of imports came from Asian countries, though a very small percentage came from China.

H1 2019 U.S. Cell Imports by Region (1.1 GW)

Cell Import Data by Tariff

There is a 2.5 GW quota (from February 7, 2019 through February 6, 2020), exempting the first 2.5 GW of imported c-Si PV cells, subject to the 201 tariff.

- In the first 6 months, approximately 150 MW of cells, subject to the quota, have come in per month, however in May, June, and July this increased to 200 MW.
- If PV cell imports stay at current import levels for the rest of the year, they will fall just short of the 2.5-GW quota by the end of the term.
 - However, a significant amount of c-Si module assembly was completed in the first half of 2019, more than doubling the U.S. capacity to around 5 GW. Approximately 400 MW of cells per month would be needed to run these plants at full capacity – or double what is currently being imported.
- If the c-Si module assembly plants were operating at the announced full capacity, they would hit the cap in November.
- Some cells (e.g. bifacial cells, SunPower IBC) are exempt; however, they may not be used until the PV cell cap is hit.

Note: cell data uses HTS codes 8541406025

Sources: Imports, by MW: U.S. International Trade Commission, 2019; U.S. Customs and Protection Commodity Status Reports.

H1 2019 Module Imports by Tariff

In the first six months of 2019, the majority of panels imported into the U.S. have reported duties from the Section 201 tariffs.

- However, a significant amount of modules are either not subject to the 201 tariffs or have been exempted from the tariffs.
 - Most of these panels (1.6 GW) use non c-Si thin-film technology, and therefore Section 201 does not apply.
 - Another 0.9 GW use c-Si technology but have been exempted from the tariff because of country of origin (developing countries like India, Indonesia and Turkey) or module technology (SunPower IBC panels from Mexico and Malaysia).
 - Turkey and India lost their exemptions in May and June of this year, respectively.
 - 0.4 GW of c-Si exempt modules were reportedly imported from South Korea. It is unclear how these panels received exemptions.
 - Approximately 0.2 GW of c-Si modules, subject to Section 201, was imported, however not duty was reported. It is unclear why this happened as well.

Note: module data uses codes: 8541406015, 8541406020, 8541406035. We assume all modules not subject to 201 tariffs are reported under, “Free under HS Chapters 1-98” or “Entered into U.S. Virgin Islands,” with exemptions coming from HTS code 8541406015, and technologies not applicable reported under HTS code 854140603. We assume all panels subject to Section 201 duties have been reported under, “Dutiable- HS chapter 99.”

Sources: Imports, by MW: U.S. International Trade Commission, 2019.

California Distributed PV Installations by Technology

- From 2003 to 2016, most California distributed PV systems installed multi c-Si panels; however, since 2017, mono-c-Si has captured an increasing share.
- The reason for this shift can be explained by the narrowing in price between the two technologies, with mono c-Si still retaining an efficiency premium.

- Globally, mono c-Si is also increasing its market share, with the trend to P-type mono PERC continuing, though not to the same proportion as the California distributed market.
 - Forty-five percent of 2018 global PV shipments were mono c-Si—up from 31% in 2016.
 - ITRPV, a working group of PV manufacturers across the supply chain, predicts that mono c-Si will grow to almost 90% of the global market in 10 years (and bifacial c-Si will grow to 60% of the global market).

U.S. PV Manufacturing Update

- Seraphim Solar USA Manufacturing is being sued for trademark infringement, as reported by Solar Power World.
 - Three other lawsuits have been filed for breach of contract in past year, in three different states.
 - Solar Power World reports no evidence of planned 340-MW capacity expansion and concludes it is unlikely to occur.
- A major SHJ cell fab is planned for North America, as reported by PV-Tech.
 - Meyer Burger received a \$100 million equipment order.
- WTO ruled the United States did not properly provide evidence needed for AD/CVD tariffs in 2012/2015 and ordered rates to be decreased.
 - The United States failed to comply as recently as the time of reporting by PV-Tech.
- The U.S. proposed tariffs on finished steel products (as opposed to raw steel in Section 232 tariffs), as reported by PV Magazine
 - A tariff may impact PV racking producers more than Section 232
 - The scope of the tariff is focused on Mexico and China, and the final ruling is scheduled for November 19, 2019.

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 **Component Pricing**

7 Market Activity

- Cell and module prices were relatively flat in Q2 2019, while polysilicon pricing rebounded 6% to \$9.20/kg and multi c-Si wafers fell 5% to \$0.05/W.
- In Q1 2019, U.S. module prices continued to fall, dropping to their lowest recorded levels, but they were still trading at a significant premium over the global module ASP.
- Residential inverter pricing in the United States increased in Q1 19 due to tariffs imposed on Chinese inverters.
- From 2010 to 2018, average battery pack prices dropped 85%.
 - From 2017 to 2018, alone, prices dropped 18%.

PV Value Chain Spot Pricing

- Cell and module prices were relatively flat in Q2 2019, while polysilicon pricing rebounded 6% to \$9.20/kg and multi c-Si wafers fell 5% to \$0.05/W.
- However, y/y, component pricing is down 20%–33%.

Source: BNEF Solar Spot Price Index (07/31/19).

Kilogram to Watt conversion: 4.78 grams per watt (2016); 4.73 grams per watt (2017, 2018, 2019), from Cowen & Co. (05/11/17); Deutsche Bank (07/19/17).

Module Average Selling Price: Global versus United States

In Q1 2019, U.S. module prices continued to fall, dropping to their lowest recorded levels, but they were still trading at a significant premium over the global module ASP.

- Multi c-Si and Mono c-Si modules sold in the United States in Q1 2019 were 23% and 27% lower in price than modules sold in the United States in Q1 2018, respectively, but they were 57% and 43% higher in price than the global average.

Inverter Pricing

- Residential inverter pricing in the United States increased in Q1 19 due to tariffs imposed on Chinese inverters.
 - Many of the larger-scale inverters are manufactured outside China and so were less impacted.
- Inverter manufacturers are adjusting their supply to mitigate the impact of the tariff.
 - In June 2019, Enphase commenced microinverter shipments from Mexico.

Average Lithium-ion Battery Pack Price (2012–2018)

Note: The data in this chart has been adjusted to be in real 2018 dollars.

Source: BloombergNEF

- From 2010 to 2018, average battery pack prices dropped 85%.
 - From 2017 to 2018, alone, prices dropped 18%.
- BNEF expects that in 2019 the lower end of pricing could fall below \$100/kWh.
- Energy storage projects require more equipment and material than a battery pack for their systems.
 - BNEF estimates that in 2018 utility-scale battery racks cost \$204/kWh and residential battery packs cost \$385/kWh.
 - BNEF also projects that battery rack pricing will reach \$68/kWh by 2030 and \$38/kWh by 2050.

1 State and Federal Updates

2 Global Solar Deployment

3 U.S. PV Deployment

4 PV System Pricing

5 Global Manufacturing

6 Component Pricing

7 Market Activity

- In the first seven months of 2019, SREC markets reacted strongly to legislation affecting state RPSs, particularly in Massachusetts, Ohio, and Pennsylvania.
- Solar stocks have performed significantly better than the rest of the market since the beginning of 2019, outpacing the broader market significantly in Q2.

SREC Pricing

- In the first seven months of 2019, SREC markets reacted strongly to legislation affecting state RPSs.
- In April 2019, Maryland doubled its RPS to 50%, and it increased the solar carve out to 5.5% in 2019 and 14.5% to 2028; additionally, the Pennsylvania governor came out in support of legislation that would increase the state's solar carve-out from 0.5% by 2021 to 10% by 2030 (and would increase the total RPS from 8% to 30%).

- In July, the Ohio governor signed legislation that lowers the state's RPS from 12.5% to 8.5%, eliminates the solar carveout beginning in 2020, and provides subsidies to two nuclear plants and two coal-fired plants (through additional ratepayer charges).
 - Ohio SREC pricing had increased in the beginning of the year due to certain Ohio projects allowance to sell into the Pennsylvania market, which spiked in price.

Lower-Priced Markets

Higher-Priced Markets

Stock Market Activity

- Solar stocks have performed significantly better than the rest of the market since the beginning of 2019, outpacing the broader market significantly in Q2.

Source: Stock market: Yahoo Finance (08/04/19); Greentech Media (07/26/19).

- At the end of July, SunPower and Enphase reported Q2 2019 results that beat analyst expectations due to strong U.S. market growth.
 - Small-scale installations of solar panels have rebounded after a two-year slowdown.
- In July 2019, Sunnova, a residential PV service provider, became the first major U.S. solar company to go public since Sunrun in 2015.
 - It is currently trading below its IPO and is well below the price range it put out earlier in the month. Many attribute this poor performance to a memo Sunrun put out that questioned its cost and conversion numbers.

2019 Stock Performance (Jan. 1 - Jul. 31)

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List of Acronyms and Abbreviations

• AC	alternating current	• MWh	megawatt-hour
• AD	anti-dumping	• NEM	net energy metering
• ASP	average selling price	• PERC	passivated emitter and rear cell
• B	billion	• PPA	power purchase agreement
• BNEF	Bloomberg New Energy Finance	• PSC	public service commission
• CF	carbon free	• PV	photovoltaic
• CSP	concentrating solar power	• Q	quarter
• c-Si	crystalline silicon	• RE	renewable energy
• CVD	countervailing duty	• RPS	renewable portfolio standards
• DC	direct current	• S&P	Standard and Poor's
• DNI	direct normal irradiance	• SEIA	Solar Energy Industries Association
• DG	distributed generation	• SG&A	sales, general, and administrative
• EIA	U.S. Energy Information Administration	• SHJ	silicon heterojunction
• ETF	exchange traded fund	• SHS	solar home system
• G&A	general and administrative	• SEPA	Smart Electric Power Alliance
• GW	gigawatt	• SMART	Solar Massachusetts Renewable Target (SMART)
• IBC	interdigitated back contact	• SREC	solar renewable energy certificate
• IPO	initial public offering	• TAN	Invesco Solar ETF
• IRENA	International Renewable Energy Agency	• TEP	Tucson Electric Power
• ITC	investment tax credit	• USD	U.S. dollars
• ITRPV	International Technology Roadmap for Photovoltaic	• USTR	United States Trade Representative
• kg	kilogram	• VDER	value of distributed energy resources
• kW	kilowatt	• W	watt
• LCOE	levelized cost of energy	• WTO	World Trade Organization
• LMI	low and moderate income	• y/y	year over year
• m ²	meter-squared	• YTD	year to date
• MM	million		
• MW	megawatt		