Solar PV Capacity Additions Forecast for PJM States: 2018–33

31 October 2017

Thomas Maslin, Associate Director, +1 202 481 9297, tc.maslin@ihsmarkit.com
Copyright notice and disclaimer

© 2017 IHS Markit. All rights reserved. For IHS Markit clients’ use only.

These webinar slides are subject to IHS Markit copyright and are being provided to IHS Markit clients only. You are free to redistribute the slides internally within your organization in the form as made available by IHS Markit provided that all IHS Markit legal notices and markings are displayed. You are not permitted to reproduce, reuse, or otherwise redistribute the slides or any portion of this presentation to anyone outside of your organization without prior written consent of IHS Markit.

This presentation is not to be construed as legal or financial advice, use of or reliance on any content is entirely at your own risk, and to the extent permitted by law, IHS Markit shall not be liable for any errors or omissions or any loss, damage, or expense incurred by you or your organization.
Solar PV Forecasting Methodology

IHS Energy solar PV power forecasting methodology

Analytical framework

The IHS Energy outlook for solar power takes into account multiple drivers and inhibitors that reflect the maturity of the market and its growth potential for solar.

Key components of our framework for assessing market attractiveness for solar are

- State renewable policy
- Regulatory incentives
- Solar resources
- Site approval
- Grid access and offtake

Short-term data points

In the short term (one to four years), our forecast is based primarily on existing policies, the late-stage project pipeline, and status of procurement and equipment orders.

Key data inputs collected and assessed by IHS Energy analysts include

- Project announcements
- Utility requests for proposal, auctions, and tenders
- Existing mandates and incentives
- Project development track record
- Reported costs and pricing
- Supply-chain announcements and equipment orders

Longer-term assumptions

In the longer term (5–25 years), our forecast draws upon rigorous bottom-up research and on economic fundamentals, energy prices, and macroeconomic factors.

Key data inputs and assumptions include

- Policy and regulatory trends
- Power demand growth and capacity retirements
- Annual solar power pricing forecasts
- Power and gas prices
- Transmission and grid infrastructure

Source: IHS Markit

© 2017 IHS Markit
# Key assumptions

## Solar forecast scenario overview

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal policy support</td>
<td>Current ITC schedule (see slide 5)</td>
<td>Current ITC schedule</td>
<td>Current ITC schedule</td>
</tr>
<tr>
<td>Net energy metering (NEM) policies and retail rate structures</td>
<td>Current retail rate structures are maintained, and NEM continues to be offered at full retail rates; existing NEM caps are consistently increased (as they have been in a number of states to date).</td>
<td>From 2020-2025, utilities adopt (and regulators approve) changes to NEM and retail rate structures which result in a more cost-based approach to customer-sited solar compensation. (see slide 6) Current detailed state NEM policy. (see slide 7)</td>
<td>Current retail rate structures and NEM are maintained for 3 years beyond the reform timeline in Scenario 2. They are then reformed in a similar manner.</td>
</tr>
<tr>
<td>Solar costs ($/kW)</td>
<td>Solar costs decline by 18-23% in nominal terms from 2017-2033 (see slide 8)</td>
<td>Solar costs decline by 18-23% in nominal terms from 2017-2033</td>
<td>Solar costs decline by 35-45% in nominal terms from 2017-2033; driven by a combination of technology advancements and policy incentives</td>
</tr>
<tr>
<td>State policy support</td>
<td>Current RPS policies and state-level incentives maintained (see slide 7)</td>
<td>Current RPS policies and state-level incentives maintained</td>
<td>Current RPS policies and state-level incentives maintained</td>
</tr>
</tbody>
</table>

Note: NEM = Net energy metering  
Source: IHS Markit  
© 2017 IHS Markit
Current Investment Tax Credit (ITC) schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Start of Construction</th>
<th>Online Date</th>
<th>Solar ITC Progression</th>
<th>Wind PTC Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td>Full ITC (30%)</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td>26% ITC</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td>22% ITC</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td></td>
<td>Permanent 10% ITC*</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Assumes that solar projects may be completed within two years of qualifying for the tax credit via start of physical construction or “safe harbor” provisions. *ITC applied to residential taxes terminates for projects that start construction after 2021.

Source: IHS Markit

© 2017 IHS Markit
Options for NEM and retail rate reform

IHS Markit will not predict specific changes to state or utility NEM policies or rate structures; however, we assume states will choose from a variety of options that reduce the compensation for customer-sited solar, but still provide sufficient compensation for a moderate pace of additions.

• Holistic rate reform options: lower volumetric ($/kWh) price in favor of higher:
  a) Minimum (fixed) bill charge
  b) Peak demand ($/kW) charge

• Narrowly-tailored NEM reform options:
  a) Add “standby” charge for NEM customers only
  b) Reduce bill credits for all solar generation exported to the grid in real time (may require new meters)

• NEM replacement options:
  a) Value-based tariff (adjusted periodically to account for changes in wholesale power markets and T&D costs)
  b) Competitive process (for example, rolling tenders)
## RPS and NEM policy assumptions by state

<table>
<thead>
<tr>
<th>State</th>
<th>RPS target (% of retail sales)*</th>
<th>Solar carve-out (% of retail sales)</th>
<th>NEM Cap (% or capacity)</th>
<th>NEM System Size Limits by Segment (MW)</th>
<th>NEM Remuneration**</th>
<th>NEG Remuneration**</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>24% by 2026</td>
<td>3.5% by 2026</td>
<td>5% of aggregated customer peak demand</td>
<td>Residential: 0.025 MW</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-residential (Delmarva): 2 MW, Non-residential: (DEC): 0.5 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td>50% by 2032</td>
<td>5% by 2032</td>
<td>N/A</td>
<td>1.00</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>MD</td>
<td>25% by 2020</td>
<td>2.5% by 2020</td>
<td>1500 MW</td>
<td>2.00</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>NJ</td>
<td>21.98% by 2028***</td>
<td>4.1% by 2028</td>
<td>2.9% of retail sales</td>
<td>100% of customer load</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>OH</td>
<td>12.5% by 2026</td>
<td>0.5% by 2026</td>
<td>N/A</td>
<td>Not specified, must be sized to fit customer load</td>
<td>Full retail rate</td>
<td>Less than retail</td>
</tr>
<tr>
<td>PA</td>
<td>8% by 2021</td>
<td>0.5% by 2021</td>
<td>N/A</td>
<td>Residential: 0.050 MW</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>WV</td>
<td>-</td>
<td>-</td>
<td>3% of peak demand during previous year</td>
<td>Residential: 0.025 MW, Industrial (for large IUOs): 2 MW Commercial (for large IUOs): 0.5 MW</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>IN</td>
<td>-</td>
<td>-</td>
<td>1% of utility's summer peak load</td>
<td>1.00</td>
<td>Less than retail after 2022</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>IL</td>
<td>25% by 2026</td>
<td>1.5% by 2026</td>
<td>5% of utility's peak load in prior year</td>
<td>2.00</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>KY</td>
<td>-</td>
<td>-</td>
<td>1% of utility peak load in prior year</td>
<td>0.03</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>MI</td>
<td>35% by 2025</td>
<td>1% by 2025</td>
<td>0.75% of prior year peak load</td>
<td>0.15</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>NC</td>
<td>12% by 2021****</td>
<td>0.2% by 2020</td>
<td>N/A</td>
<td>1.00</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>VA</td>
<td>15% by 2025 (voluntary target)</td>
<td>-</td>
<td>1% of state's peak load for prior year</td>
<td>Residential: 0.020 MW</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
<tr>
<td>TN</td>
<td>-</td>
<td>-</td>
<td>N/A</td>
<td>N/A</td>
<td>Full retail rate</td>
<td>Full retail rate</td>
</tr>
</tbody>
</table>

Note: *RPS includes solar carve-outs ** NEM remuneration is a tariff structure under which the utility pays customers for excess generation, up to a given amount. NEG is the total amount of excess generation minus the total amount of energy consumed from the grid over a given period *** New Jersey RPS target only includes Class I renewable technologies and the solar carve-out.**** RPS compliance in NC can be achieved through energy efficiency and Renewable Energy Credits (RECs) from any state. The primary drivers for solar development include the current state PURPA policy, planned RFPs, solar resources, solar costs and the previous state tax credit.

Source: IHS Markit © 2017 IHS Markit™. All Rights Reserved.
Solar cost

Solar costs in PJM

Notes: Utility-scale cost represents a project with single-axis tracking technology larger than 5 MW
Source: IHS Markit

© 2017 IHS Markit
Key power market assumptions (all scenarios)

Power price and demand growth (PJM average)

Notes: Power price growth rates are in nominal terms. Power demand reflects demand at the customer level, including load that is served by behind-the-meter solar.
Source: IHS Markit
© 2017 IHS Markit
Capacity additions by scenario

Source: IHS Markit
Solar PV capacity additions by segment: Scenario 2: “NEM reform”

PJM annual solar PV capacity additions by segment: Scenario 2

- **2017-2020:** Residential solar additions rise as project cost decline.
- **2021-23:** Key residential growth states reform NEM and retail rates.
- **2024:** ITC drops down to 10%.
- **2021–23:** Key residential growth states reform NEM and retail rates.
- **2027–32:** Utility-scale and distribution / BTM procurement begins to pick up again as project economics look more attractive.

Source: IHS Markit

© 2017 IHS Markit
Solar PV capacity additions by segment: Scenario 1: “Policy continuity”

PJM annual solar PV capacity additions by segment: Scenario 1

- **2018–23**: With the ITC and no NEM reform, residential solar grows at a healthy pace.
- **2024**: ITC drops down to 10%, hitting all segments.
- **2026-2033**: With full retail NEM still in place, residential springs back growing rapidly in states with low solar penetration.

Source: IHS Markit

© 2017 IHS Markit
Solar PV capacity additions by segment: Scenario 3: “Lower cost solar”

2018–23: Solar in all segments is more attractive, but grows especially quickly in residential.

2024–26: ITC drops down to 10%; residential growth sputters with NEM in place for a few more years.

2027–32: Utility-scale solar procurement begins a resurgence, both at the transmission and distribution level.

Source: IHS Markit

© 2017 IHS Markit
Maryland solar PV capacity additions by scenario and segment

Capacity additions by scenario

Source: IHS Markit
Pennsylvania solar PV capacity additions by scenario and segment

Capacity additions by scenario

Source: IHS Markit

© 2017 IHS Markit
New Jersey solar PV capacity additions by scenario and segment

Capacity additions by scenario

Source: IHS Markit

© 2017 IHS Markit