Presentation

PJM solar forecast 2020

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Solar PV forecasting methodology

IHS Markit solar photovoltaics (PV) power forecasting methodology

Analytical framework

The IHS Markit 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 (including renewable portfolio standard [RPS], net energy metering [NEM], community solar, and renewable corporate policies)
- 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 Markit energy analysts include

- Project announcements
- Utility requests for proposal (RFPs), 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 (5–15 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

Key assumptions

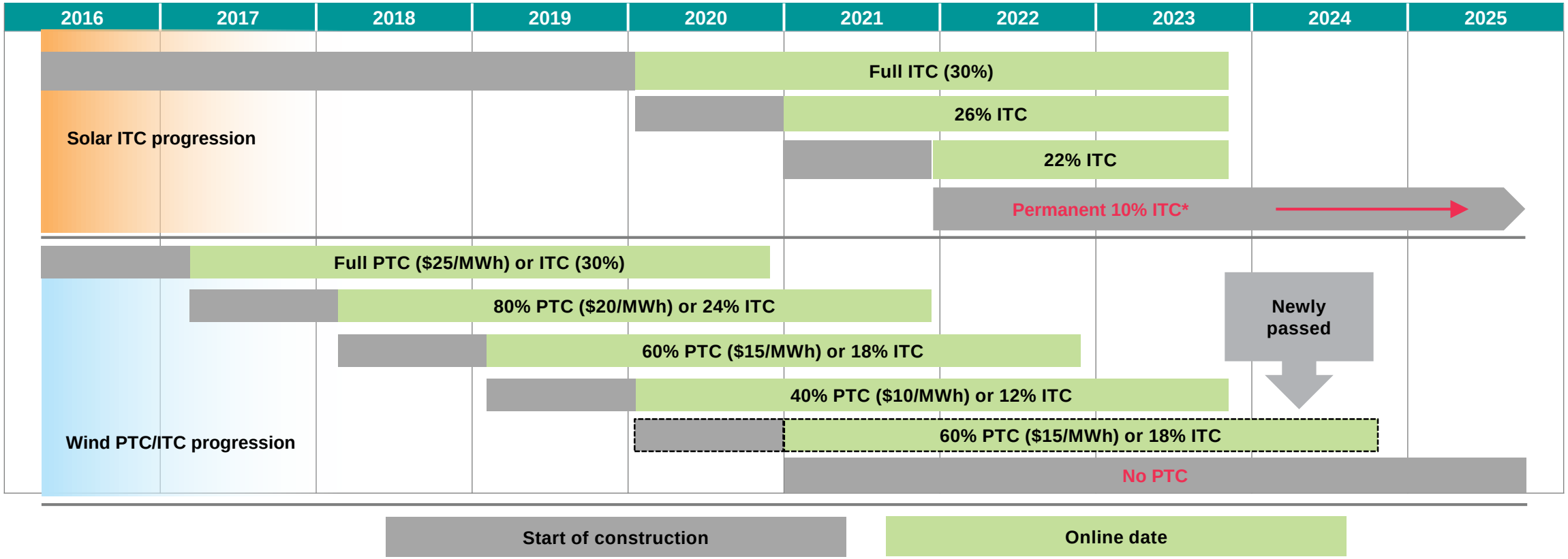
Solar forecast scenario overview			
Assumptions	**Scenario 1: "Extended COVID"**	**Scenario 2: "NEM reform"/ "Base case"**	**Scenario 3: "Lower-cost solar"**
Federal policy support	Current ITC schedule	Current ITC schedule	Extension of the ITC schedule (5 years)
NEM policies and retail rate structures	Over 2025–30, utilities adopt (and regulators approve) delayed changes to NEM and retail rate structures owing to lower distributed solar additions, which result in a more cost-based approach to customer-sited solar compensation (see slide 5); current detailed state NEM policy (see slides 6–8)	From 2020 to 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 5); current detailed state NEM policy (see slides 6–8)	Current retail rate structures and NEM are maintained for three years beyond the reform timeline in Scenario 2; they are then reformed in a similar manner
Solar costs ($/kW)	Solar costs decline by 5–17% in nominal terms from 2020 to 2036 (34–42% in real terms)	Solar costs decline by 5–17% in nominal terms from 2020 to 2036 (34–42% in real terms)	Solar costs decline by 35–40% in nominal terms from 2020 to 2036 (50–55% in real terms), driven by a combination of technology advancements and policy incentives
State policy support	Current RPS policies and state-level incentives are maintained	Current RPS policies and state-level incentives are maintained	Current RPS policies and state-level incentives are maintained
Power demand	Lower power demand in 2020–24 (recovery in the second half of 2020s)	Base-case demand	Base-case demand

Note: ITC = Investment Tax Credit.

Source: IHS Markit

Current ITC schedule

Evolution of tax credits by qualification date and online date



Note: *Investment Tax Credit (ITC) applied to residential taxes terminated for projects that start construction after 2021. PTC = Production Tax Credit.
Source: 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 for all residential customers: lower volumetric (dollars per kilowatt-hour) price in favor of higher
  a) Minimum (fixed) bill charge
  b) Peak-demand (dollars per kilowatt) charge
- Narrowly tailored NEM reform options:
  a) Reduce bill credits for all solar generation exported to the grid in real time (may require new meters)
  b) Add “standby” or similar charges for NEM customers only
- NEM replacement options:
  a) Value-based tariff (adjusted periodically to account for changes in wholesale power markets, transmission and distribution costs, etc.)
  b) Transition toward time-of-use (TOU) pricing for all NEM customers
  c) Competitive process (for example, rolling tenders or RFPs)

RPS and NEM policy assumptions by state

Current RPS policy by state		
State	**RPS target (percentage of retail sales)***	**Solar carve-out percentage of retail sales)*/Distributed carve-outs**
DE	25% by 2025	3.5% by 2025
DC	100% by 2032	2.5% by 2023, 5% by 2032, 10% by 2041
MD	50% by 2030	14.5% by 2030
NJ	50% by 2030*	5.1% by 2021, gradually reduced to 1.1% by 2031
OH	8.5% by 2026	
PA	8% by 2021	0.5% by 2021
WV	-	-
IN	-	-
IL	25% by 2025**	No RPS but required 4 million SRECs by 2030
KY	-	-
MI	15% by 2025***	
NC	12.5% by 2021****	0.2% by 2020****
VA	100% by 2045*****	2,000 MW by 2030
TN	-	-

Note: RPS includes solar carve-outs. *New Jersey RPS target only includes Class I renewable technologies and the solar carve-out. **Illinois solar carve-out requires that 50% of the solar procurements must be from distributed/community solar. RPS mandates at least 75% of the standard come from wind and solar. ***Utilities in Michigan have agreed to 25% by 2030. ****RPS compliance in North Carolina can be achieved through energy efficiency and renewable energy credits (RECs) from any state. *****Phase 1 utilities are required to achieve 14% by 2025, 30% by 2030, 65% by 2040, and 100% by 2050 while Phase II utilities are required to achieve 26% by 2025, 41% by 2030, and 100% by 2045. The primary drivers for solar development include existing Public Utility Regulatory Policies Act (PURPA) policy, planned requests for proposal (RFPs), solar resources, solar costs, and the previous state tax credit.

Source: IHS Markit

RPS and NEM policy assumptions by state (continued)

Current RPS and NEM policy by state

State	Utility/territory	NEM cap	NEM system size limits (MW)
DE	All utilities	5% of aggregated customer peak demand (utility can increase the cap)	0.025 (residential), 2 (Delmarva nonresidential), 0.5 (DEC, DEMEC nonresidential)
DC	Potomac Electric Power Co	N/A	1 (single meter), 5 (community renewables)
MD	All utilities	1,500 MW	2 or 200% of customer load
NJ	Investor-owned utilities (IOUs), electric suppliers	None****	100% of customer load
OH	IOUs	N/A	Not to exceed 120% of customer annual average load
PA	IOUs	N/A	0.050 (residential), 3 (nonresidential), 5 (microgrids) (110% of customer's annual load for third-party owned/operated systems)
WV	All utilities	3% of peak demand during previous year	0.025 (residential), 2 (industrial for large IOUs), 0.500 (commercial for large IOUs), 0.050 (C&I for small IOUs)
IN	IOUs	1% of utility's summer peak load	1.5% of utility's summer peak load
IL	IOUs, retail suppliers	5% of utility's peak load in prior year	2
KY	IOUs, electric cooperatives except TVA	1% of utility's peak load in prior year	0.045
MI	All utilities	Average of the previous 5-year peak load	0.15
NC	IOUs, electric suppliers	N/A	2 (residential customer-owned systems), 1 (commercial systems up to 200% of contract demand)
VA	IOUs, electric cooperatives	1% of state's peak load for prior year	0.020 (residential), 1 (nonresidential)
TN	N/A	N/A	N/A

Note: *NEM remuneration is a tariff structure under which the utility pays customers for excess generation, up to a given amount. The most common arrangement is “full retail rate NEM,” in which excess generation is paid the same volumetric price that the customer pays for electricity; so, exports are effectively netted against grid consumption over a given period (typically one year). **NEG over that period is sometimes paid at a lower rate, often based on the utility's avoided cost. ***Total remaining excess kWh at the end of the calendar year (valued at the generation rate) that amounts to greater than $25 will be refunded as a check to the customer, if less than $25 it will be given as a credit. ****While no mandatory cap exists, it as at the discretion of the NJBPU to cap at 5.8% of retail sales. *****TREC = transition renewable energy credits. ******Virtual meter aggregation is limited to the account holder's meters and only those within two miles of the POI.

Source: IHS Markit

RPS and NEM policy assumptions by state (continued)

Current RPS and NEM policy by state

State	NEM remuneration for on-site use or export generation*	NEG remuneration**	Community solar
DE	Retail	Retail	Virtual net metering
DC	Retail	Carries over at retail rate indefinitely, at generation rate for systems over 100 kW***	Virtual net metering
MD	Retail	Credited to customer's next bill at retail rate; reconciled annually in April at the commodity energy supply rate	Pilot program
NJ	Base $152 TREC price ($0.152/kWh), nonresidential rooftop receives full TREC and ground mount receives 60%; residential rooftop, ground mount and carport receive 60%*****	Fixed $152 TREC price ($0.152/kWh)	85% of TREC price ($0.12920/kWh)
OH	Less than retail	Credited to next bill at unbundled generation rate (includes energy component but excludes capacity-related compensation	None
PA	Retail	Credited at retail rate for a year, then any leftover excess is credited at generation and transmission portion of the retail rate, but not the distribution	Virtual meter aggregation******
WV	Retail (credits cannot reduce monthly bills below the fixed monthly charge)	Retail	Virtual net metering
IN	Full retail through 2047 for net metering facilities installed through 2017 and through 2032 for those installed through 2022; 125% of average energy market price for facilities installed after 2022 or 1.5% cap is met.	Full retail through 2047 for net metering facilities installed through 2017 and through 2032 for those installed through 2022; 125% of average energy market price for facilities installed after 2022 or 1.5% cap is met.	None
IL	Retail (TOU for customers paying TOU rates)	Credited to next bill at retail rate, excess at end of year is granted to utility	Virtual net metering
KY	Less than retail	Utility will purchase all electricity produced at the rate set by the PSC, instead of the retail rate	Utility-run program
MI	Less than retail	Less than retail	None
NC	Retail	Carries over at retail rate, granted to utility at beginning of summer billing period	Utility-run program
VA	Retail	Retail	Utility-run program
TN	N/A	Retail	None

Note: *NEM remuneration is a tariff structure under which the utility pays customers for excess generation, up to a given amount. The most common arrangement is “full retail rate NEM,” in which excess generation is paid the same volumetric price that the customer pays for electricity; so, exports are effectively netted against grid consumption over a given period (typically one year). **NEG over that period is sometimes paid at a lower rate, often based on the utility’s avoided cost. ***Total remaining excess kWh at the end of the calendar year (valued at the generation rate) that amounts to greater than $25 will be refunded as a check to the customer, if less than $25 it will be given as a credit. ****While no mandatory cap exists, it as at the discretion of the NJBPU to cap at 5.8% of retail sales. *****TREC = transition renewable energy credits. ******Virtual meter aggregation is limited to the account holder’s meters and only those within two miles of the POI.

Source: IHS Markit

RPS and NEM policy assumptions by state (continued)

Current RPS and NEM policy by state

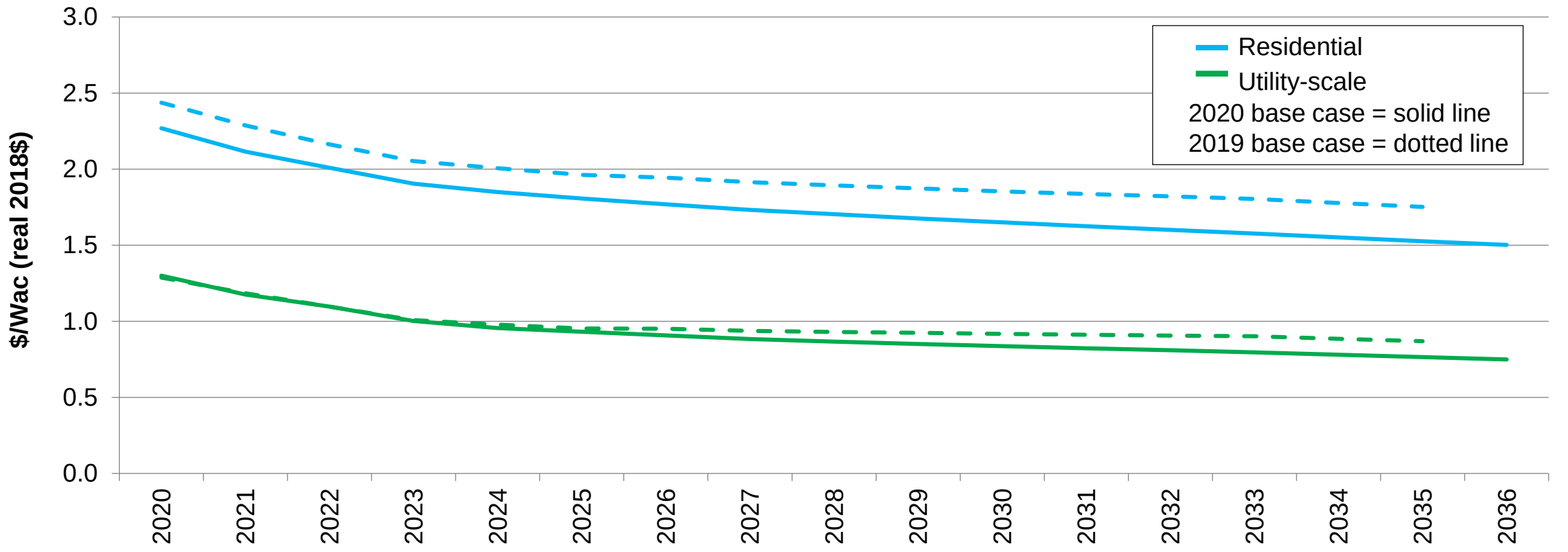
State	Unbundled energy attribute certificates	Virtual power purchasing allowed	Renewable energy offerings from utilities or electric suppliers/green tariff	Production for self-consumption—net metering
DE	Allowed		Retail choice	Up to 2 MW
DC	Allowed		Retail choice	Up to 1 MW
MD	Allowed	Allowed	Retail choice	Up to 2 MW
NJ	Allowed	Allowed	Retail choice	Cannot exceed on-site load
OH	Allowed	Allowed	Retail choice	No size limit
PA	Allowed	Allowed	Retail choice	Up to 3 MW
WV	Allowed	Allowed	-	Up to 2 MW
IN	Allowed	Allowed	Green tariff enabled to guarantee sufficient RECS; does not require new build	No size limit under green tariff
IL	Allowed	Allowed	Retail choice	Up to 2 MW
KY	Voluntary		Green tariff enabled	Up to 45 kW
MI	Allowed		-	Up to 150 kW
NC	Allowed		Green tariff in development	Up to 1 MW
VA	Allowed	Allowed	Green tariff enabled	Up to 1 MW
TN	Voluntary		-	-

Note: Green tariffs only include programs where utilities build new renewables on behalf of corporate customers.

Source: IHS Markit

PJM solar capital costs

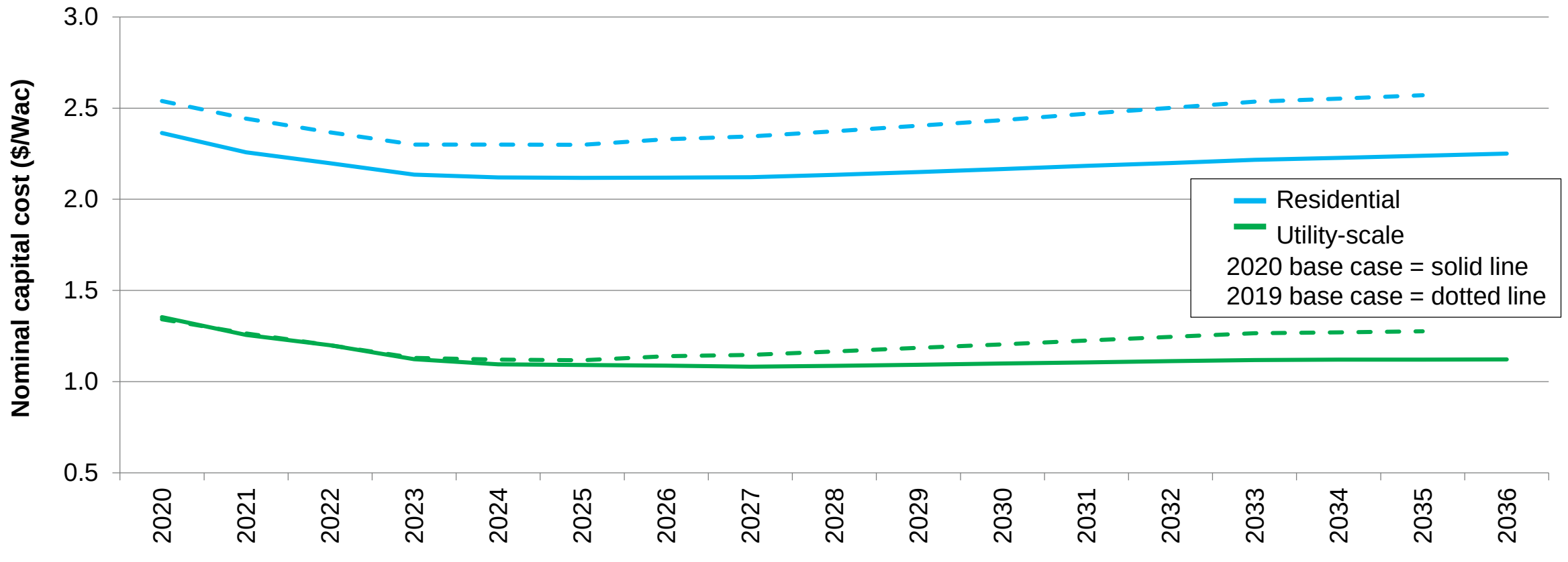
PJM solar capital costs, real



Note: Wac = watt (AC).
Source: IHS Markit

PJM solar capital costs

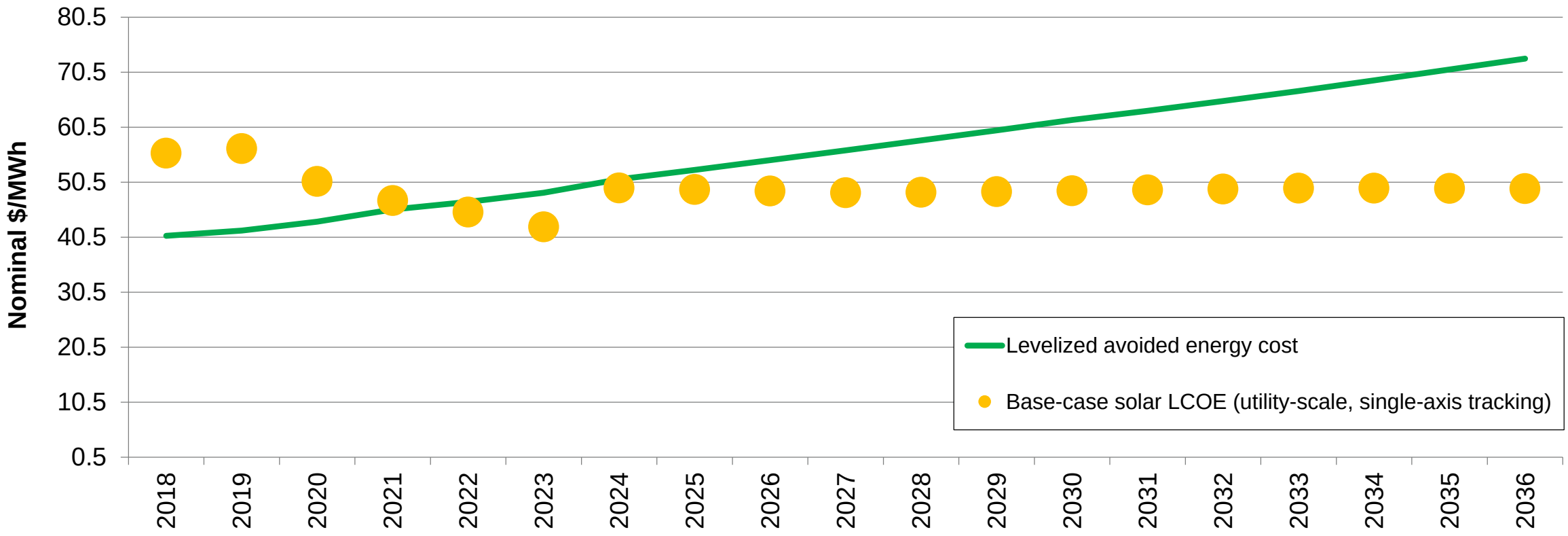
PJM solar costs, nominal



Source: IHS Markit

Utility-scale solar economics

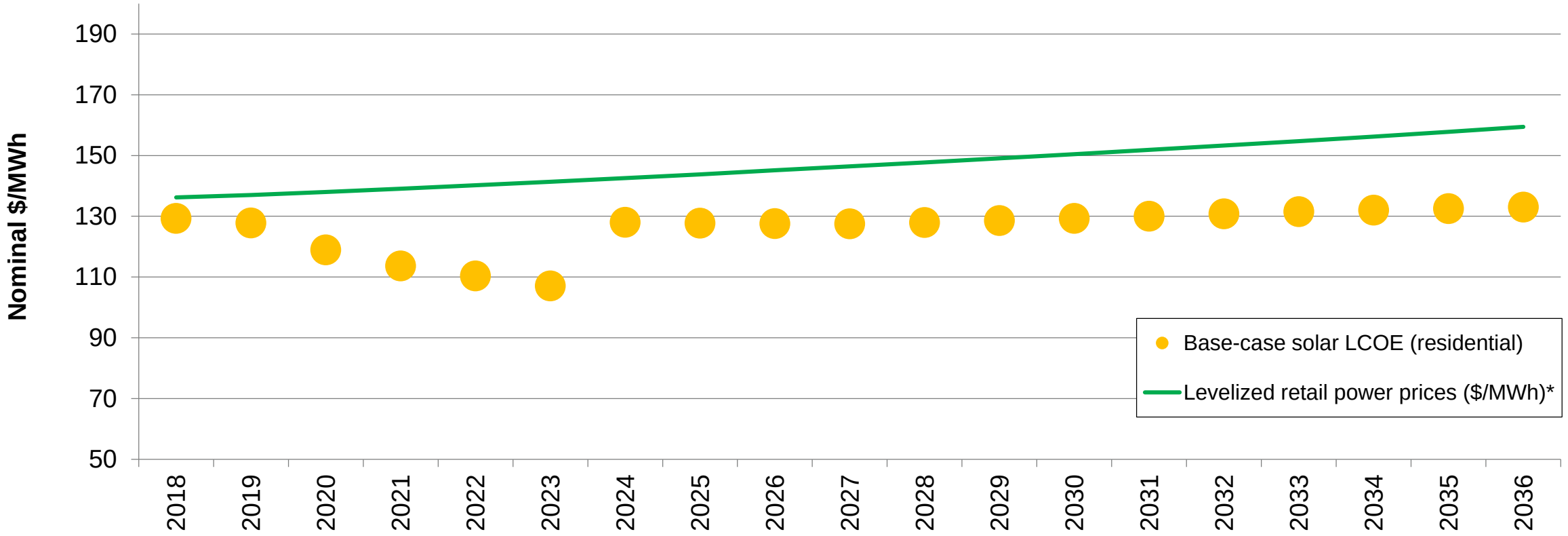
PJM utility solar economics



Note: *Levelized avoided capacity value represents the levelized annual PJM capacity market revenue ($/kW-year) multiplied by a 19% de-rate factor to conservatively account for solar's coincidence with peak load hours.
Source: IHS Markit

Residential solar economics

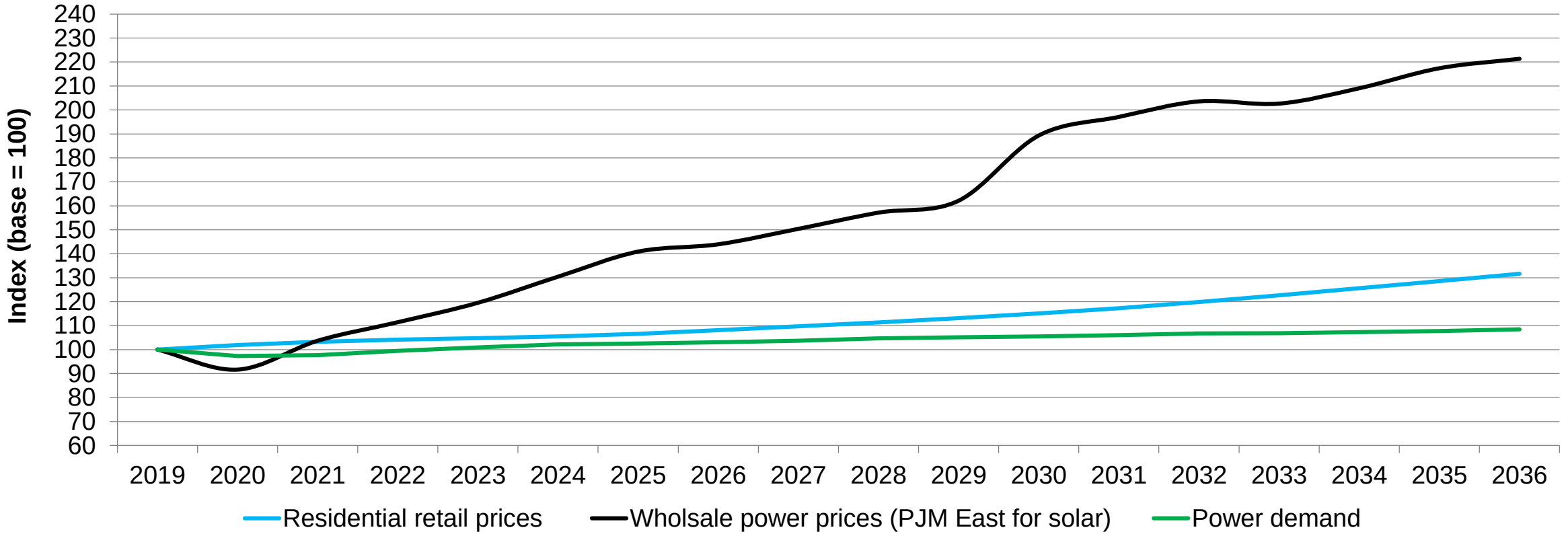
PJM residential solar economics



Note: Average of Maryland, New Jersey, and Pennsylvania residential power prices and average price increase over the last 15 years.
Source: IHS Markit

Key power market assumptions (all scenarios)

Key power market assumptions (all scenarios)*

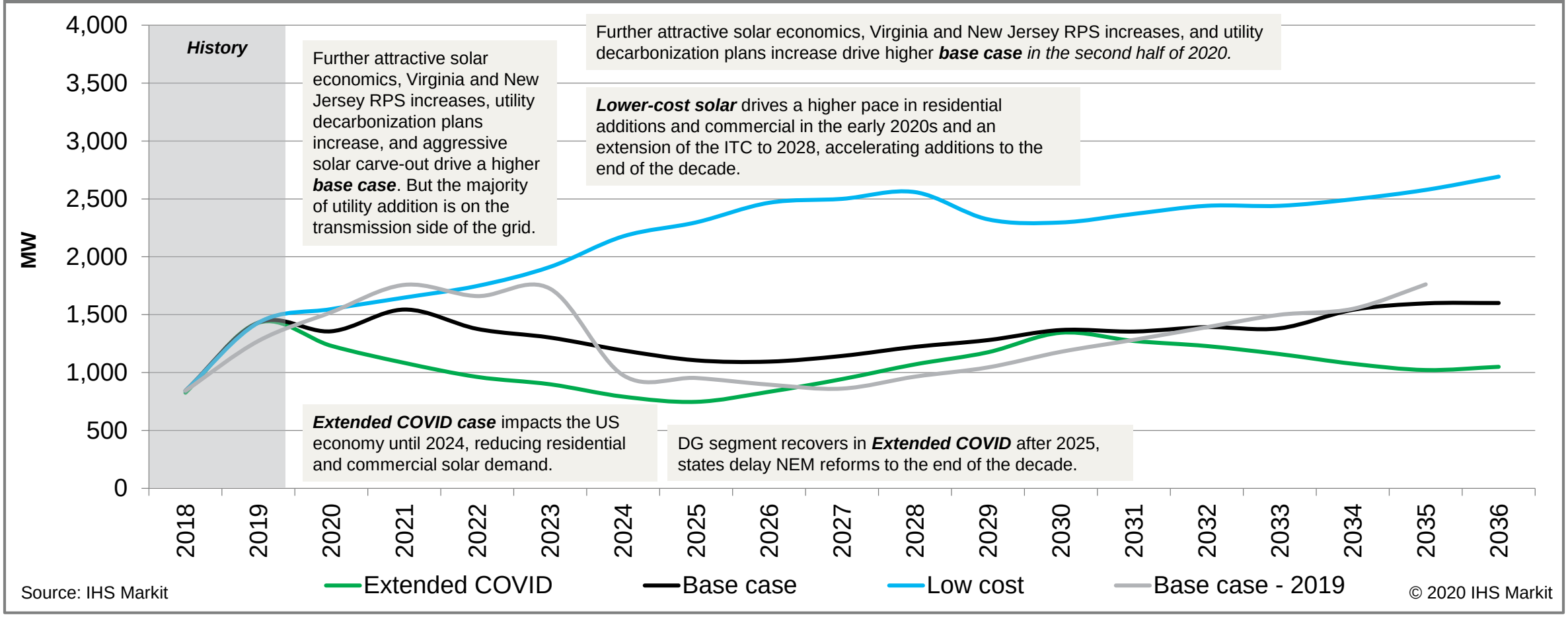


Note: *Extended COVID assumes a lower power demand outlook. Power price growth rates are in nominal terms. Power demand reflects demand at the customer level, including load that is served by behind-the-meter (BTM) solar.

Source: IHS Markit

Distribution/BTM solar PV capacity additions by scenario

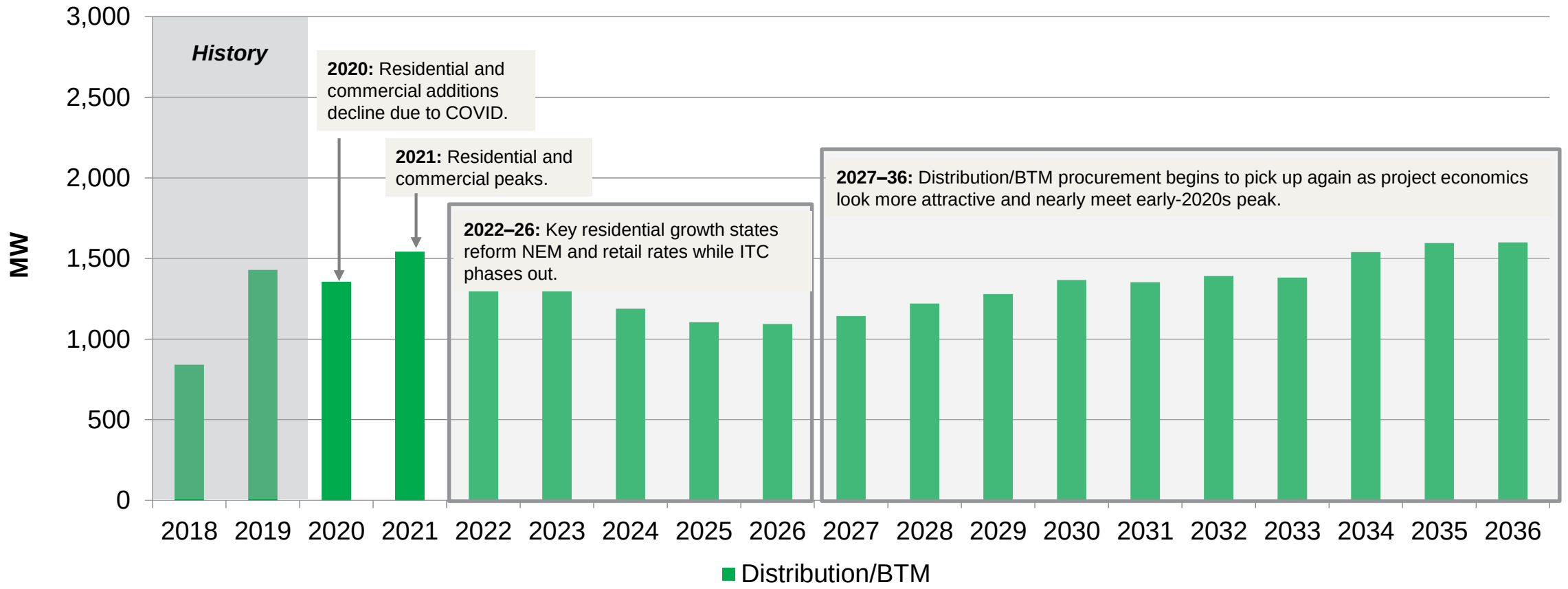
Solar forecasts by scenario



Source: IHS Markit

Distribution/BTM solar PV capacity additions
Scenario 2: NEM reform (base case)

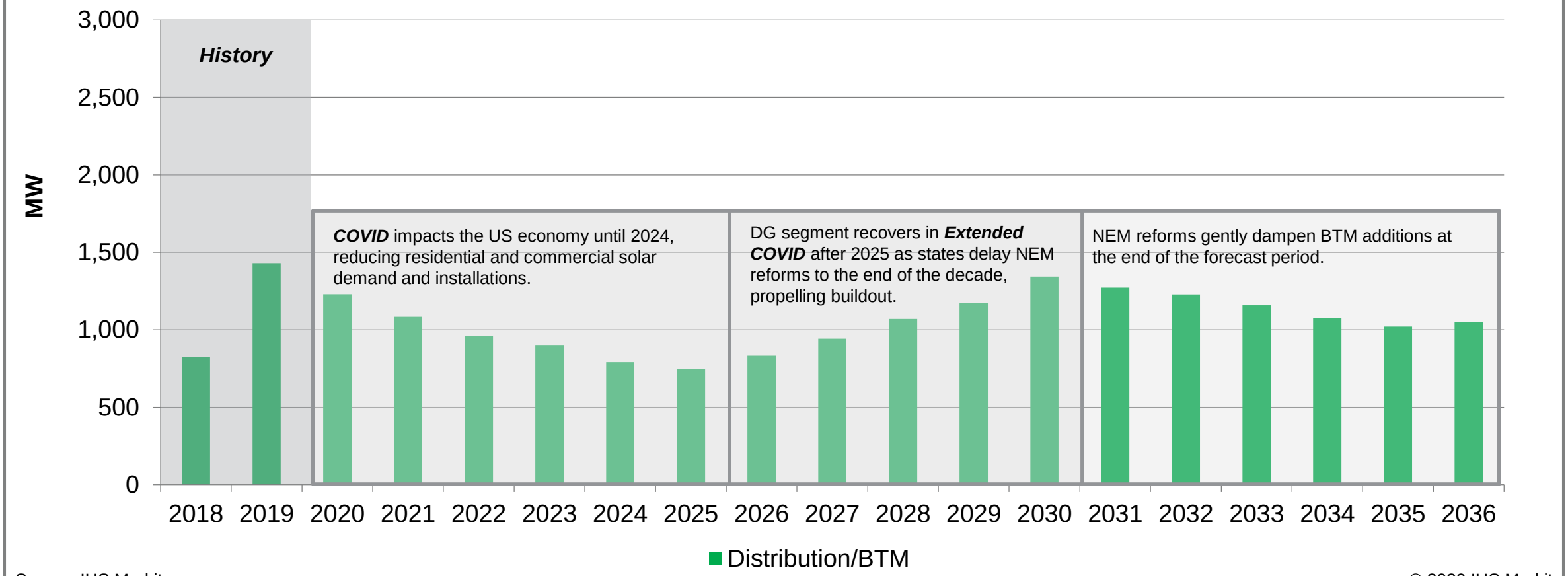
Distribution/BTM solar PV capacity additions



Source: IHS Markit

Distribution/BTM solar PV capacity additions
Scenario 1: Extended COVID

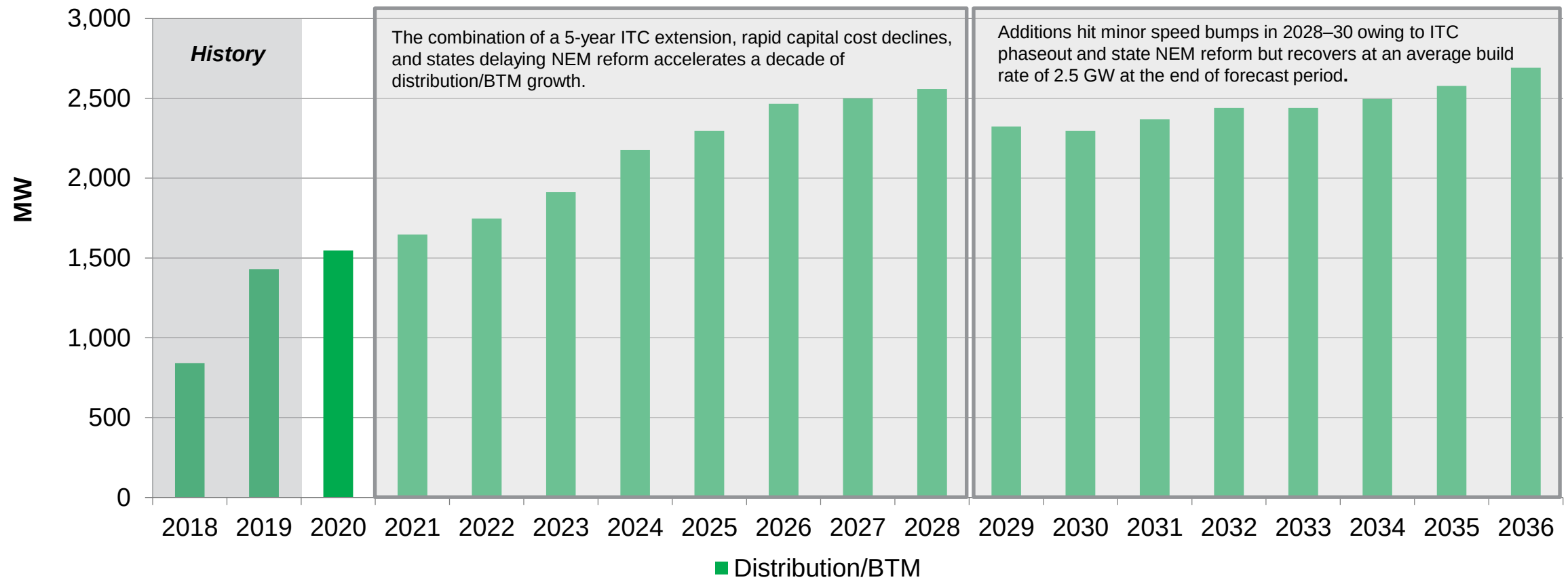
Distribution/BTM solar PV capacity additions



Source: IHS Markit

Distribution/BTM solar PV capacity additions
Scenario 3: Lower-cost solar

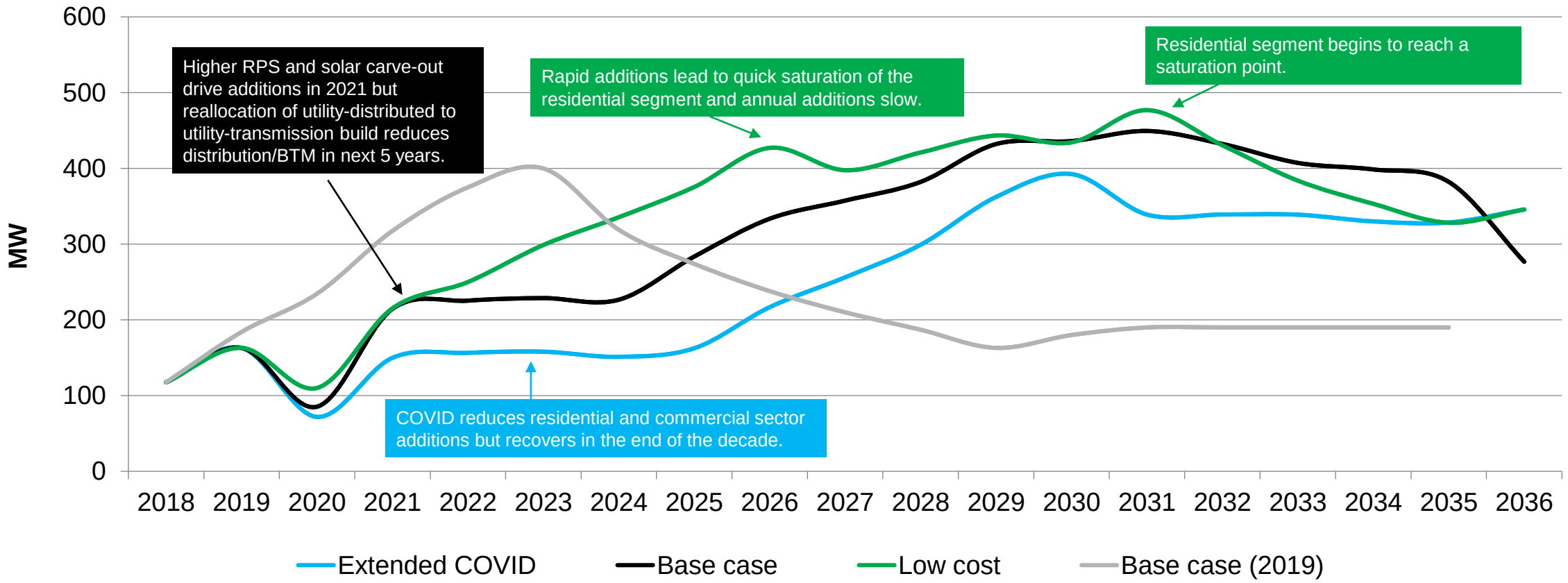
Distribution/BTM solar PV capacity additions



Source: IHS Markit

Maryland solar PV distribution/BTM capacity additions by scenario

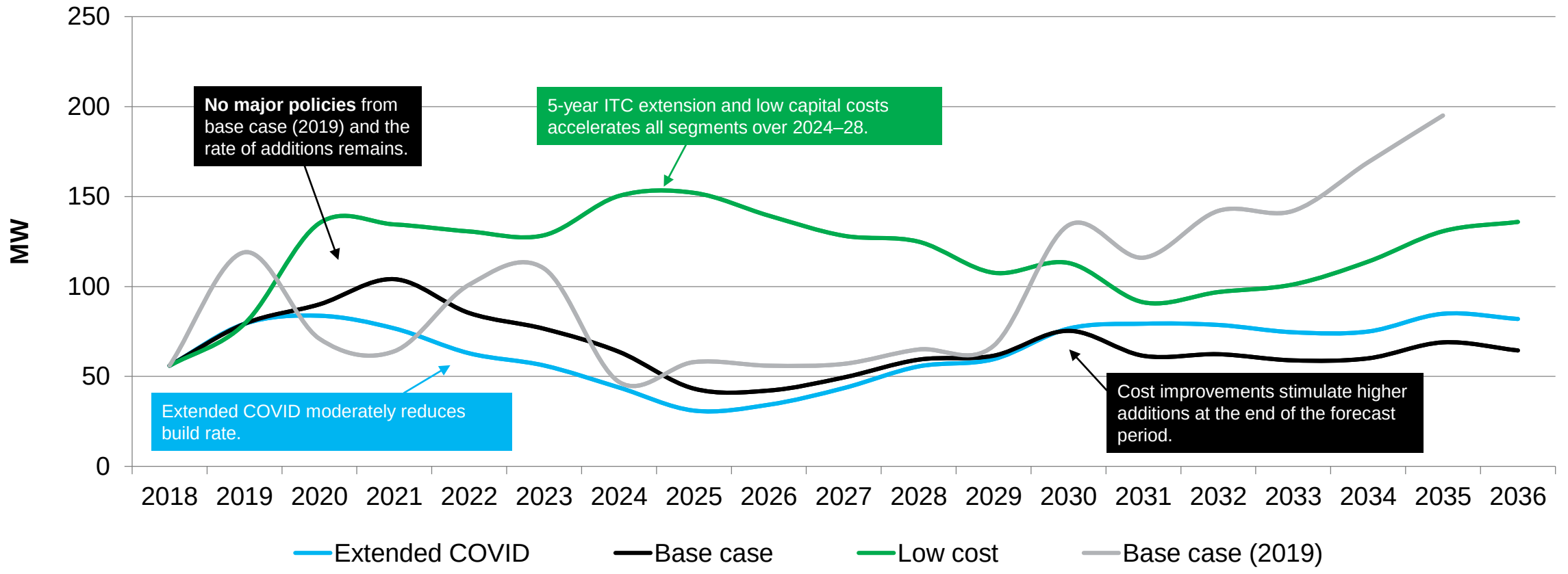
Maryland solar capacity additions by scenario



Source: IHS Markit

Pennsylvania solar PV distribution/BTM capacity additions by scenario

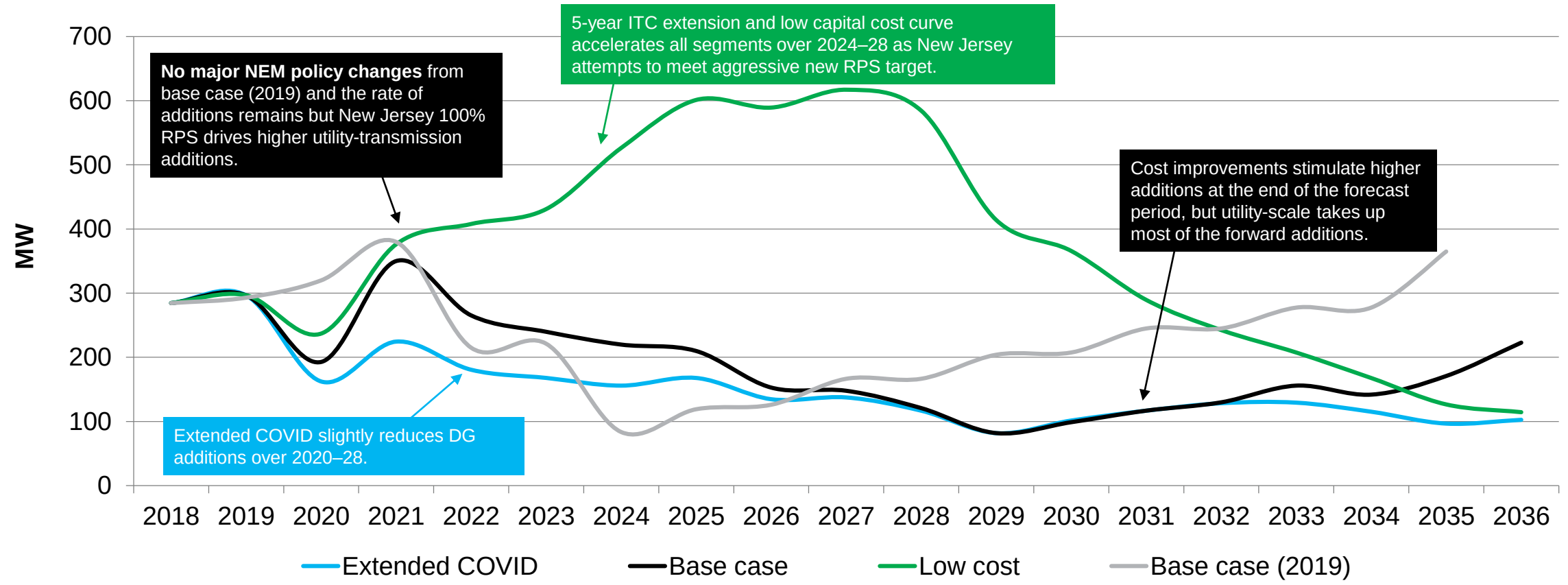
Pennsylvania solar capacity additions by scenario



Source: IHS Markit

New Jersey solar PV distribution/BTM capacity additions by scenario

New Jersey solar capacity additions by scenario



Source: IHS Markit

Conclusions (Scenario 2: Base case)

- New state RPS and technology carve-outs (such as New Jersey and Virginia) stimulate further solar in all segments, particularly residential in the near term.
- State full NEM policies bolster BTM growth in the next few years, making up the majority of solar capacity additions.
- IHS Markit expects states to reform NEM policies in 2020–25, dampening further additions.
- States and utilities continue to announce aggressive renewables procurement goals or decarbonization plans.
- Utility-scale solar economics become attractive just as the ITC starts to phase out but surges at the end of the forecast period.
- A few states will hit a “saturation” point in the forecast period as the low-hanging residential solar sites are gobbled up.

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