BTM Solar PV Impact on Regional Power System Planning and Markets

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Load Forecast

LOAD FORECAST

Consumer Behavior

+

Weather Models

+

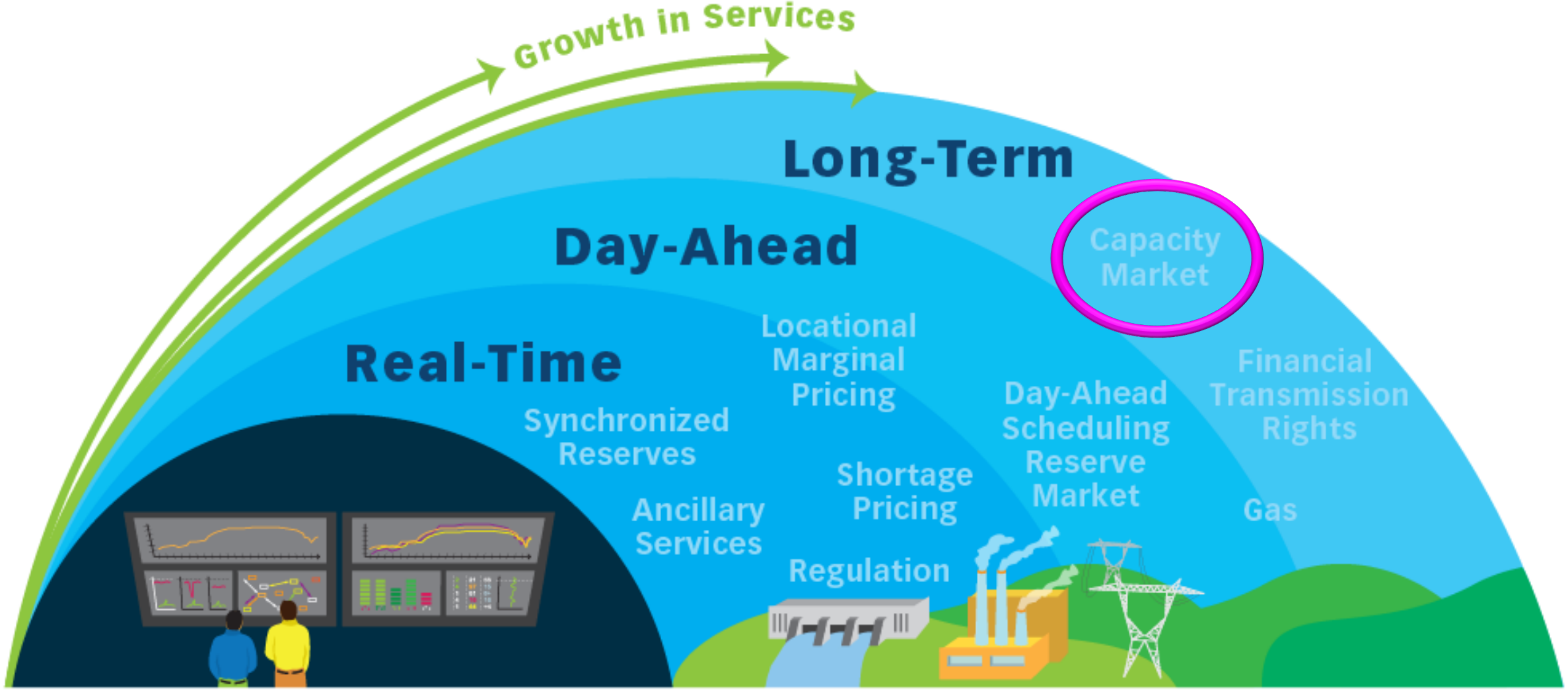
Economics

+

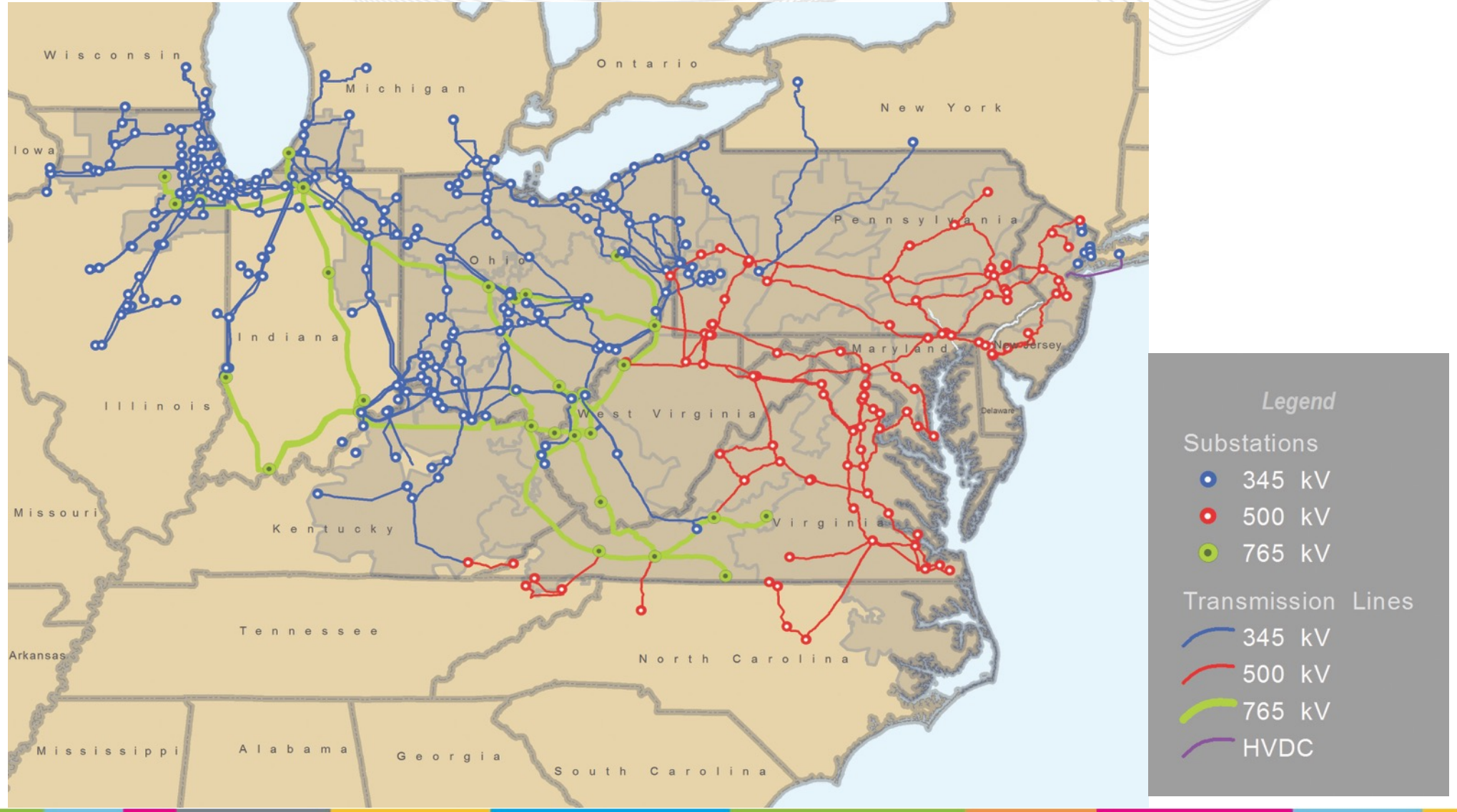
BtM Generation

(behind-the-meter generation)

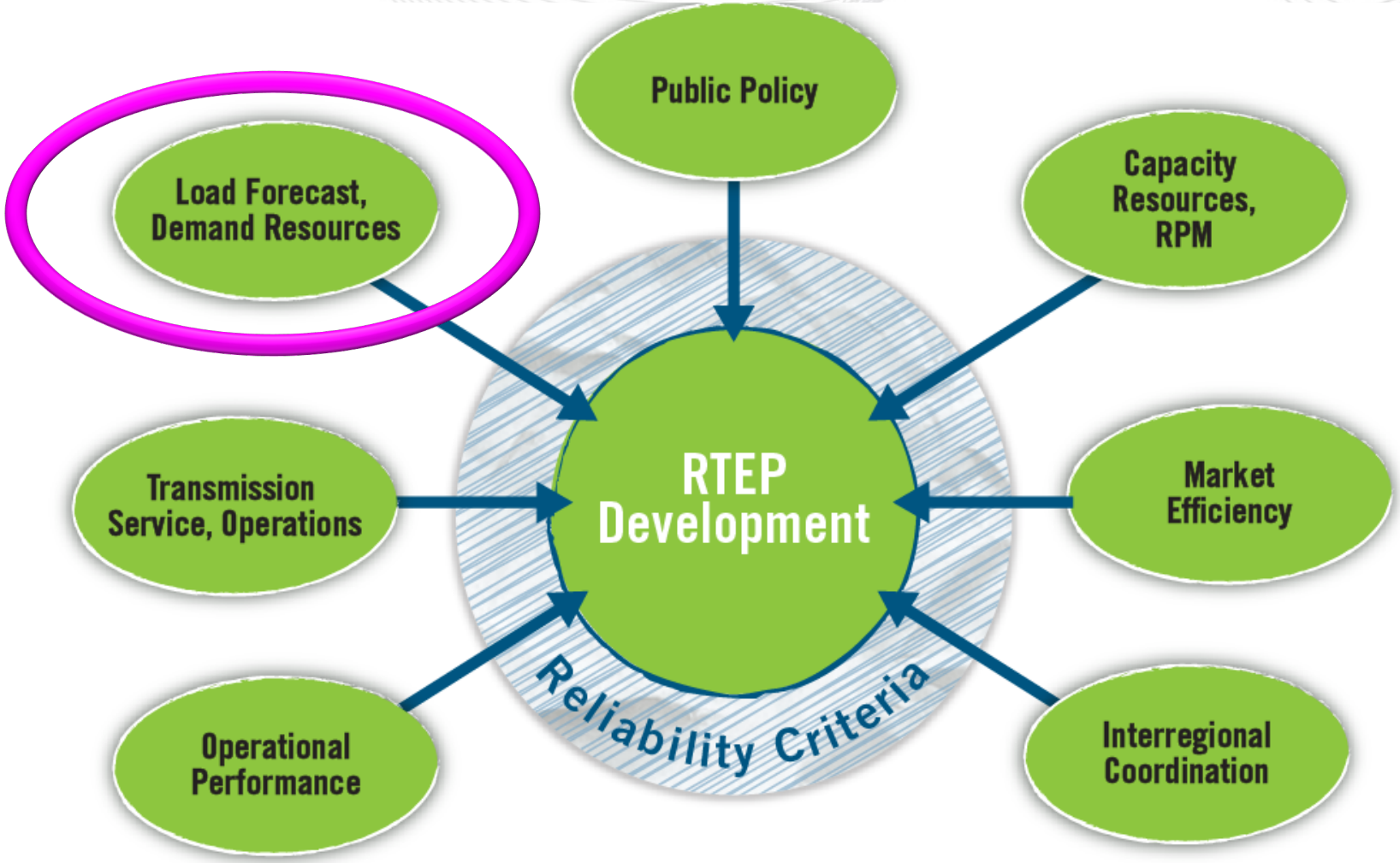
PJM Markets



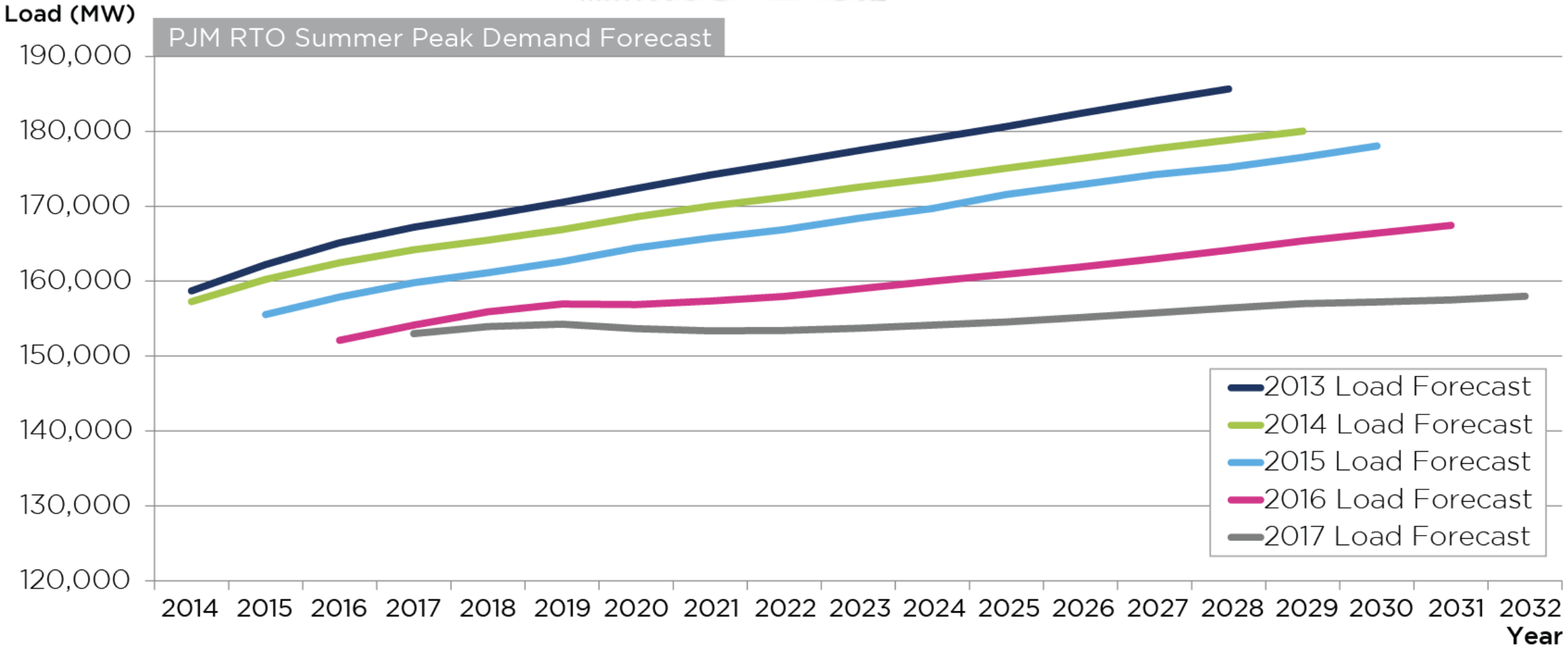
Regional Transmission Expansion Planning



RTEP Development Drivers



Declining Electricity Demand Growth



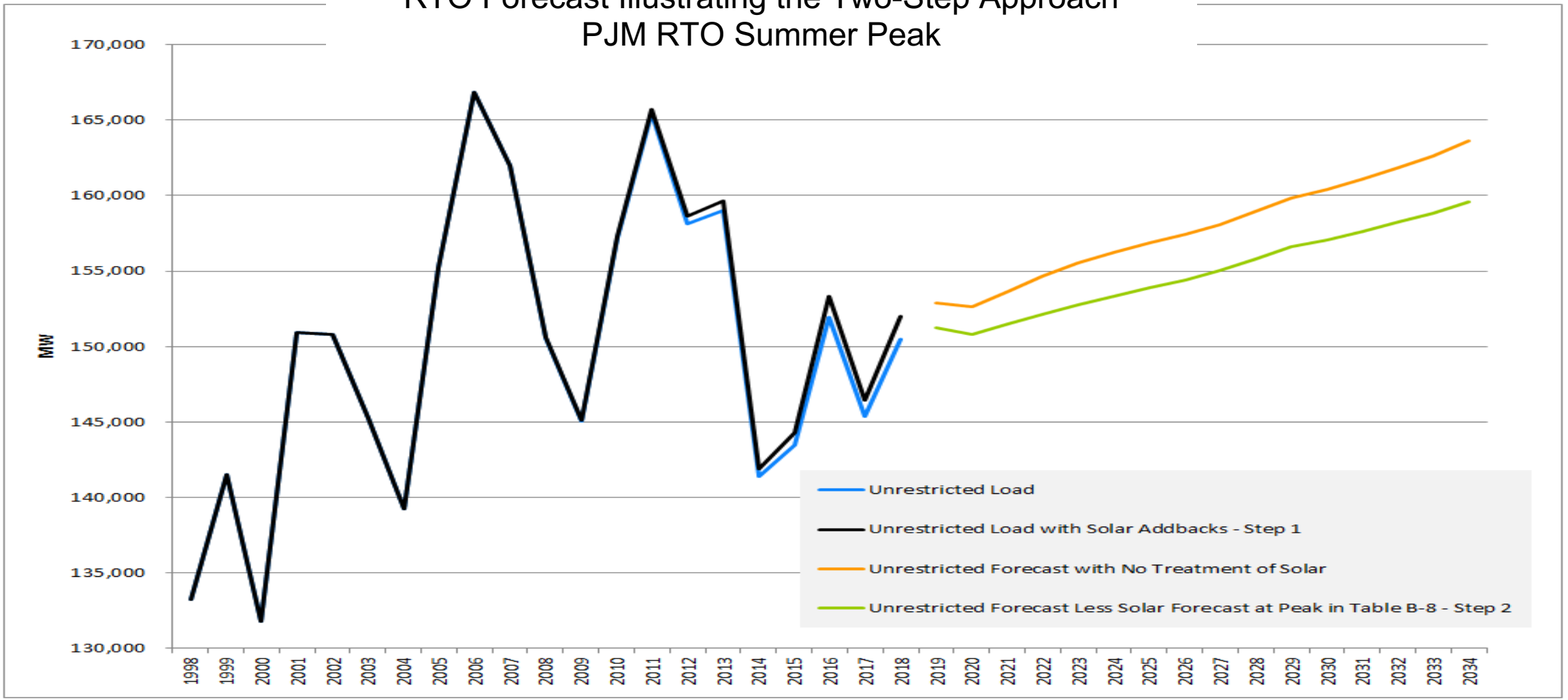
Impact of BTM Solar PV

PJM uses a two-step approach to address distributed solar generation in the load forecast.

- Step 1:
  To account for the historical impacts of distributed solar generation, AWS Truepower back-casts hourly values by transmission zone. These estimates are then added to the unrestricted load used in PJM load models.

- Step 2:
  For forecasted values of distributed solar capacity, PJM contracts with IHS Energy to develop a distributed solar generation forecast specific to the PJM region. PJM then uses the state-level forecast to derive a zonal capacity at peak. Those values are then subtracted from the forecast created with solar addbacks.

Process Overview



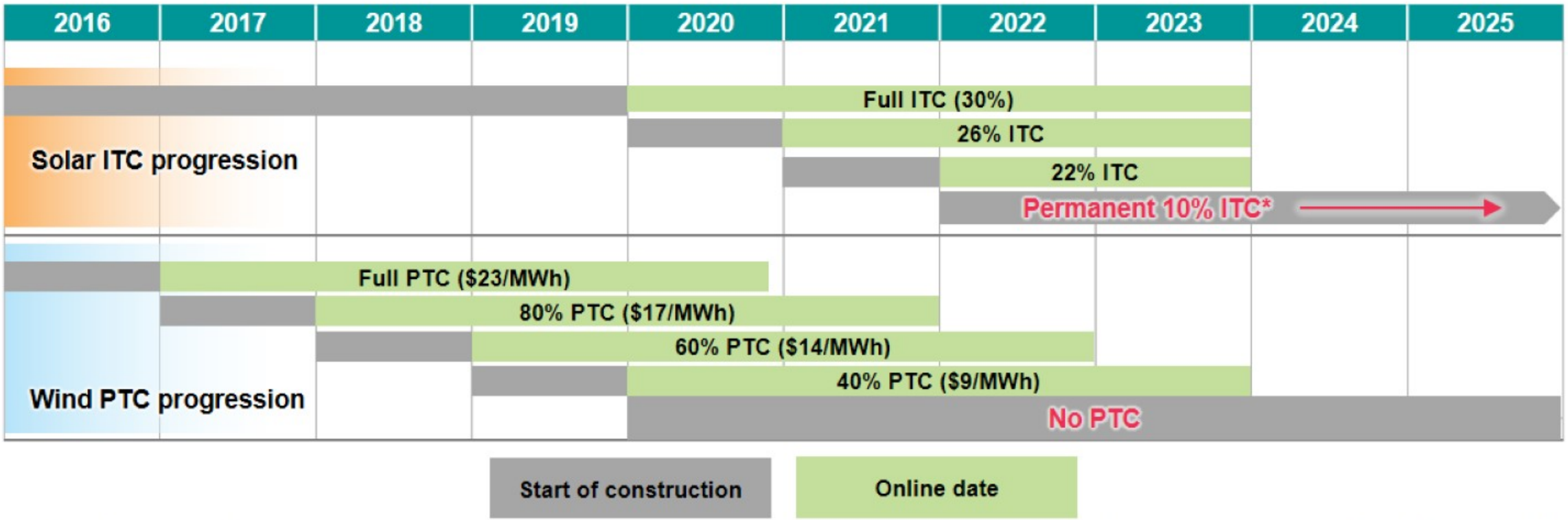
Key assumptions

Solar forecast scenario overview			
Assumptions	**Scenario 1: "NEM continuity"**	**Scenario 2: "NEM reform"**	**Scenario 3: "Lower-cost solar"**
Federal policy support	Current Investment Tax Credit (ITC) schedule (see slide 4)	Current ITC schedule	Current ITC schedule
NEM policies and retail rate structures	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 numerous states to date)	From 2020–25, utilities adopt (and regulators approve) changes to NEM and retail rate structures, resulting in a more cost-based approach to customer-sited solar compensation (see slide 5); current detailed state NEM policy (see slide 6)	Current retail rate structures and NEM are maintained for three years beyond the reform timeline in this scenario; they are then reformed in a similar manner
Solar costs ($/kW)	Solar costs decline by 18–23% in nominal terms from 2018–34 (see slide 8)	Solar costs decline by 18–23% in nominal terms from 2018–34	Solar costs decline by 35–45% in nominal terms from 2018–34, driven by a combination of technology advancements and policy incentives
State policy support	Current RPS policies and state-level incentives maintained (see slide 6)	Current RPS policies and state-level incentives maintained	Current RPS policies and state-level incentives maintained

Source: IHS Markit

Current ITC schedule

Evolution of tax credits by under-construction deadline and online date



Note: PTC = Production Tax Credit. 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

RPS and NEM policy assumptions by state

Current RPS and NEM policy by state

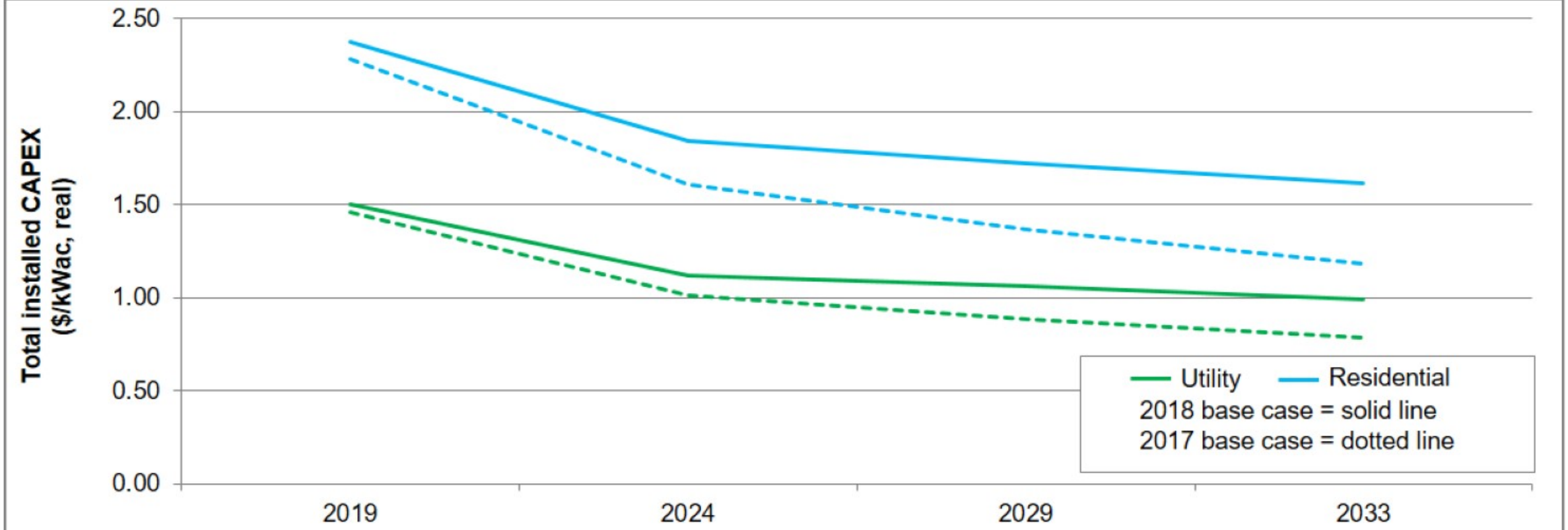
State	RPS target (% of retail sales)*	Solar carve-out (% of retail sales)	NEM cap (% or capacity)	NEM system size limits by segment (MW)
DE	24% by 2026	3.5% by 2026	5% of aggregated customer peak demand (utility can increase the cap)	0.025 (residential), 2 (Delmarva nonresidential), 0.5 (DEC nonresidential)
DC	50% by 2032	5% by 2032	N/A	1 (single meter), 5 (community renewables)
MD	25% by 2020	2.5% by 2020	1,500 MW	2 or 200% of customer load
NJ	50% by 2030**	5.1% by 2021	5.8% of retail sales	100% of customer load
OH	12.5% by 2026	0.5% by 2026	N/A	Not to exceed 120% of customer annual average load
PA	8% by 2021	0.5% by 2021	N/A	0.050 (residential), 3 (nonresidential), 5 (microgrids)
WV	-	-	3% of peak demand during previous year	0.025 (residential), 2 (industrial for large investor-owned utilities [IOUs]), 0.500 (commercial for large IOUs), 0.050 (commercial and industrial for small IOUs)
IN	-	-	1% of utility's summer peak load	1
IL	25% by 2025***	1.5% by 2025****	5% of utility's peak load in prior year	2
KY	-	-	1% of utility peak load in prior year	0.03
MI	35% by 2025****	1% by 2025	0.75% of prior year peak load	0.15
NC	12% by 2021*****	0.2% by 2020****	N/A	1
VA	-	-	1% of state's peak load for prior year	0.020 (residential), 1 (nonresidential)
TN	-	-	N/A	N/A

Note: DEC = Delaware Electric Cooperative. *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 that at least 75% of the standard come from wind and solar. ****Utilities in Michigan have more ambitious renewable goals. *****RPS compliance in North Carolina can be achieved through energy efficiency and renewable energy credits (RECs) from any state. The primary drivers for solar development include the existing Public Utility Regulatory Policies Act, planned RFPs, solar resources, solar costs, and the previous state tax credit.

Source: IHS Markit

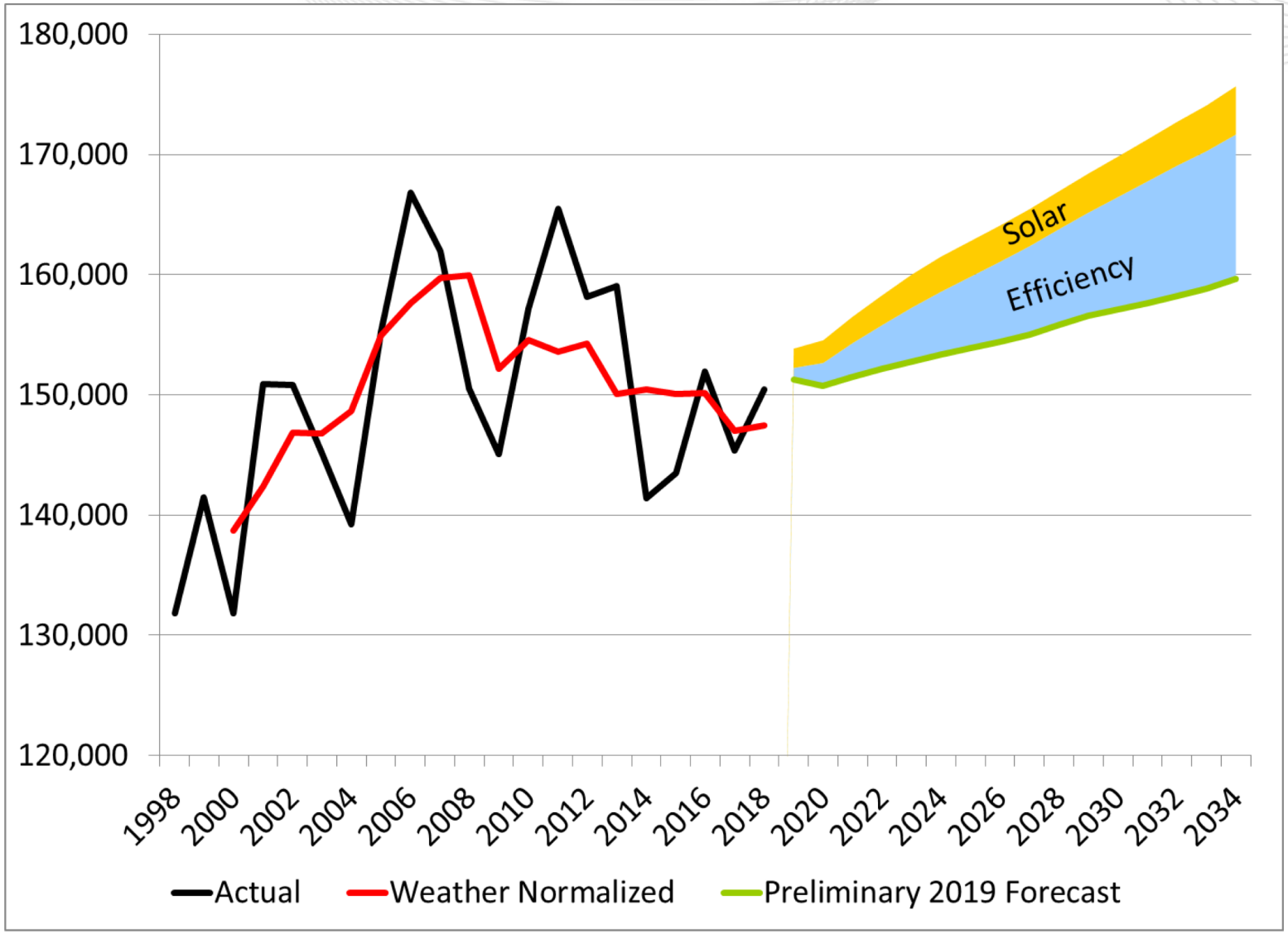
PJM solar costs ($/kWac, real)

PJM solar costs

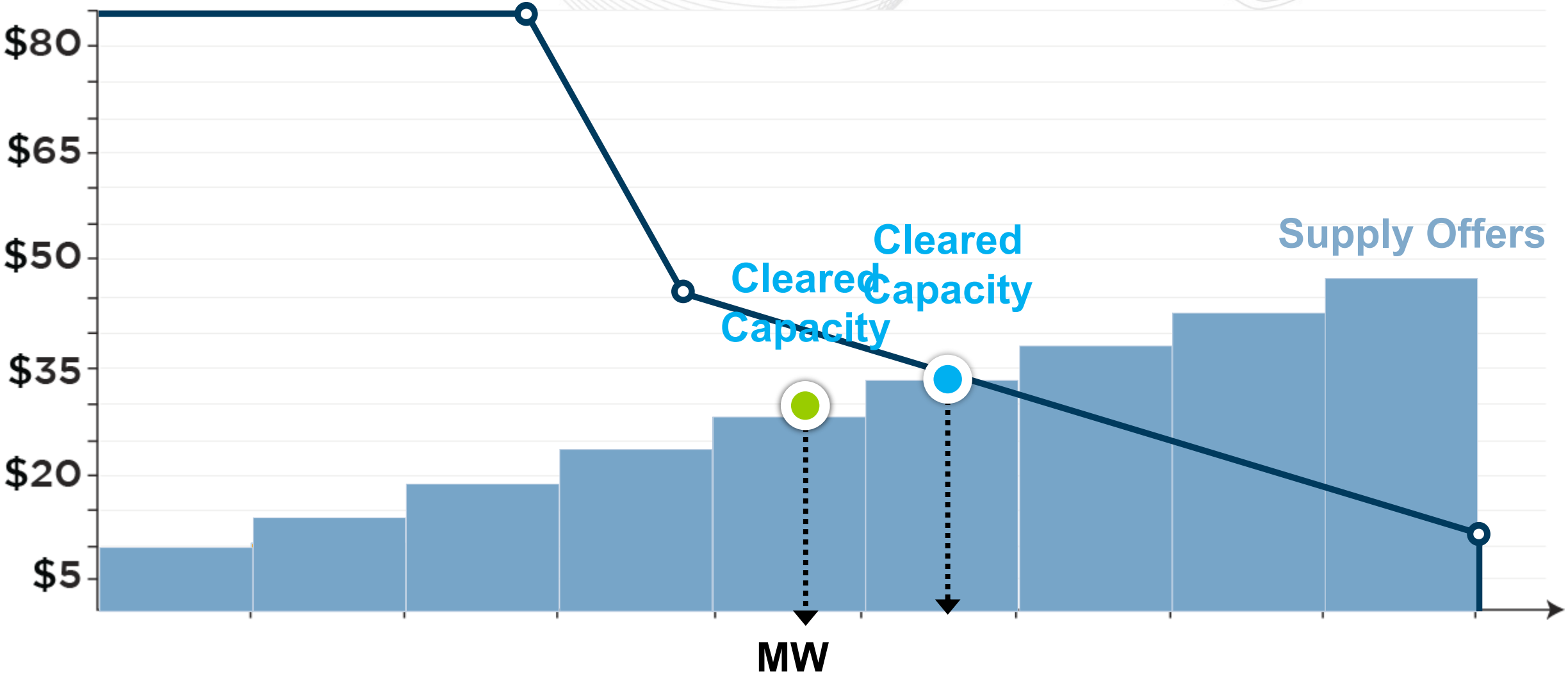


Notes: Utiliy-scale cost represents a project with single-axis tracking technology larger than 5 MW
Source: IHS Markit

PRELIMINARY - PJM RTO Summer Peak Forecast



Capacity Market Example: Effect of BTM Solar Shifts Demand Curve to the Left



Many more details….

PJM Load Analysis Subcommittee