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Behind-the-Meter Distributed Generation Forecast Results

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List of Acronyms and Initialisms

ATB – Annual Technology Baseline

BTM – Behind-the-Meter

CAGR – Compound Annual Growth Rate

CEC – California Energy Commission

DG – Distributed Generation

dGen – Distributed Generation Market Demand Model

DGStats – California Distributed Generation Statistics

IEPR – Integrated Energy Policy Report

ITC – Investment Tax Credit

kW – Kilowatt

kWh – Kilowatt-Hour

MW – Megawatt

NEM – Net Energy Metering

NLR – National Laboratory of the Rockies

PV – Photovoltaics

SGIP – Self-Generation Incentive Program

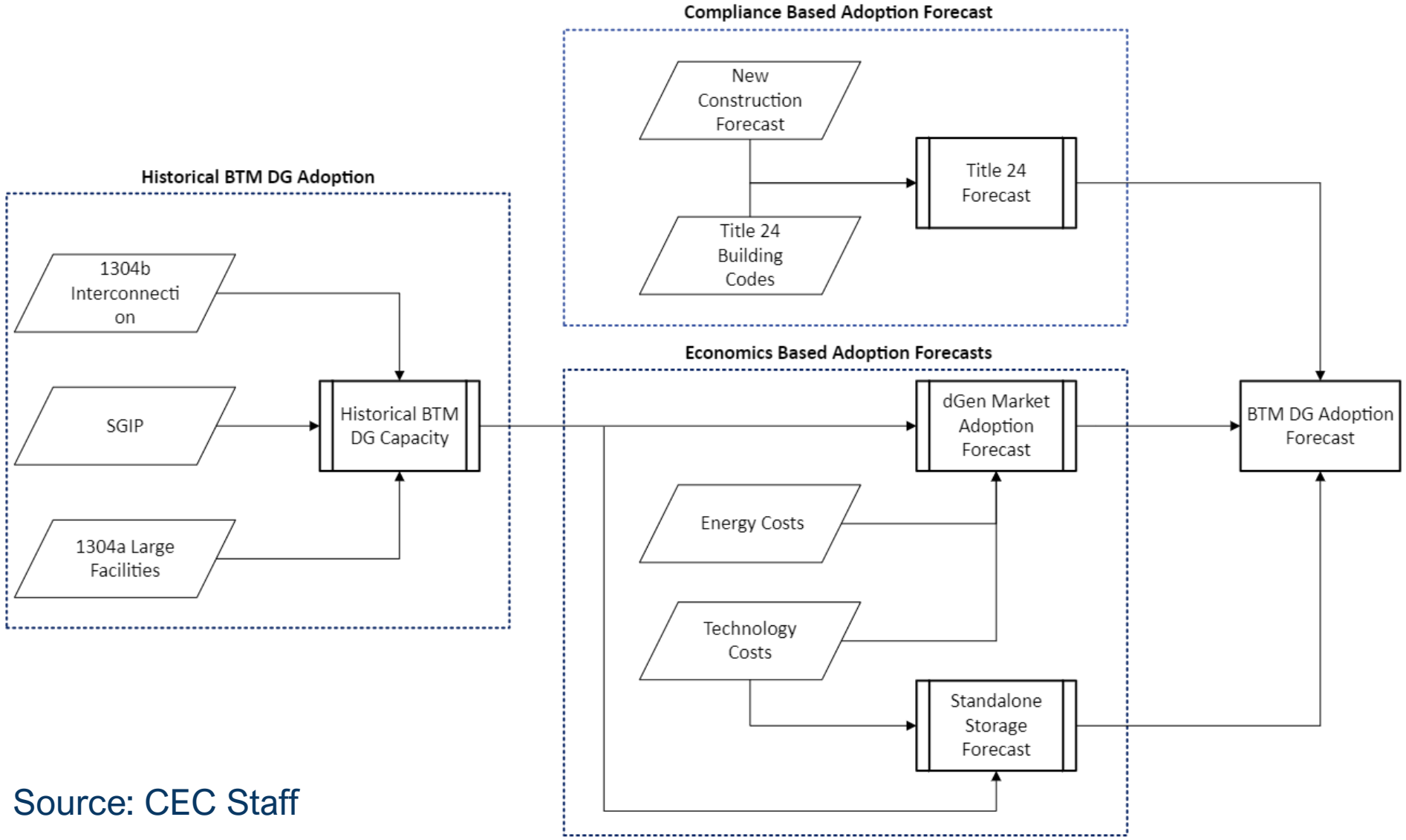
TPO – Third-Party Owned

Forecast Framing

Why Forecast BTM Distributed Generation

- BTM DG technologies affect electricity demand served by utilities
- BTM PV reduces hourly load served by the grid during solar-producing hours
  - Contributes more than 10% of total statewide electricity consumption
- BTM energy storage affects peak demand by dispatching during the on-peak period (generally 4-9 pm) to avoid time-of-use rates

BTM DG Adoption Modelling Architecture



Source: CEC Staff

BTM Distributed Generation Adoption Scenarios

Scenario	CapEx Costs	ITC
Low	Conservative	None
Mid	Moderate	None
High	Advanced	None
~~**Mid Plus ITC**~~	~~Moderate~~	~~Reintroduced in 2030~~

Inputs and Assumptions Updates

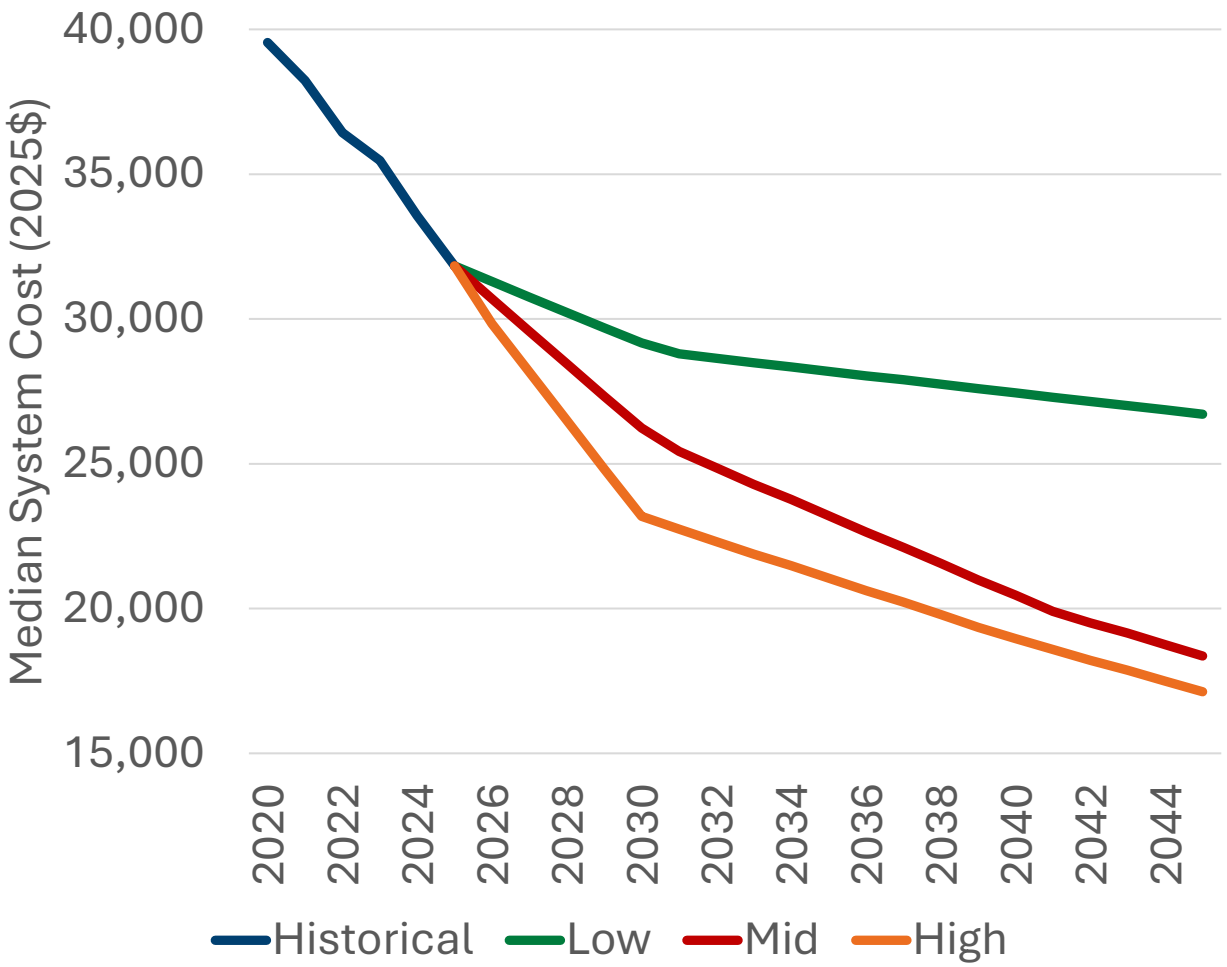
Residential PV + Storage Cost Forecast

- Historical costs from DG Stats interconnected project sites data
- Projections based on 2025 NLR ATB
- Reported costs assumes 5.4 KW of PV and 13.5 KWh battery

Average annual cost reduction across the forecast period:

- Low - 0.8%, Mid - 2.1%, High - 2.3%

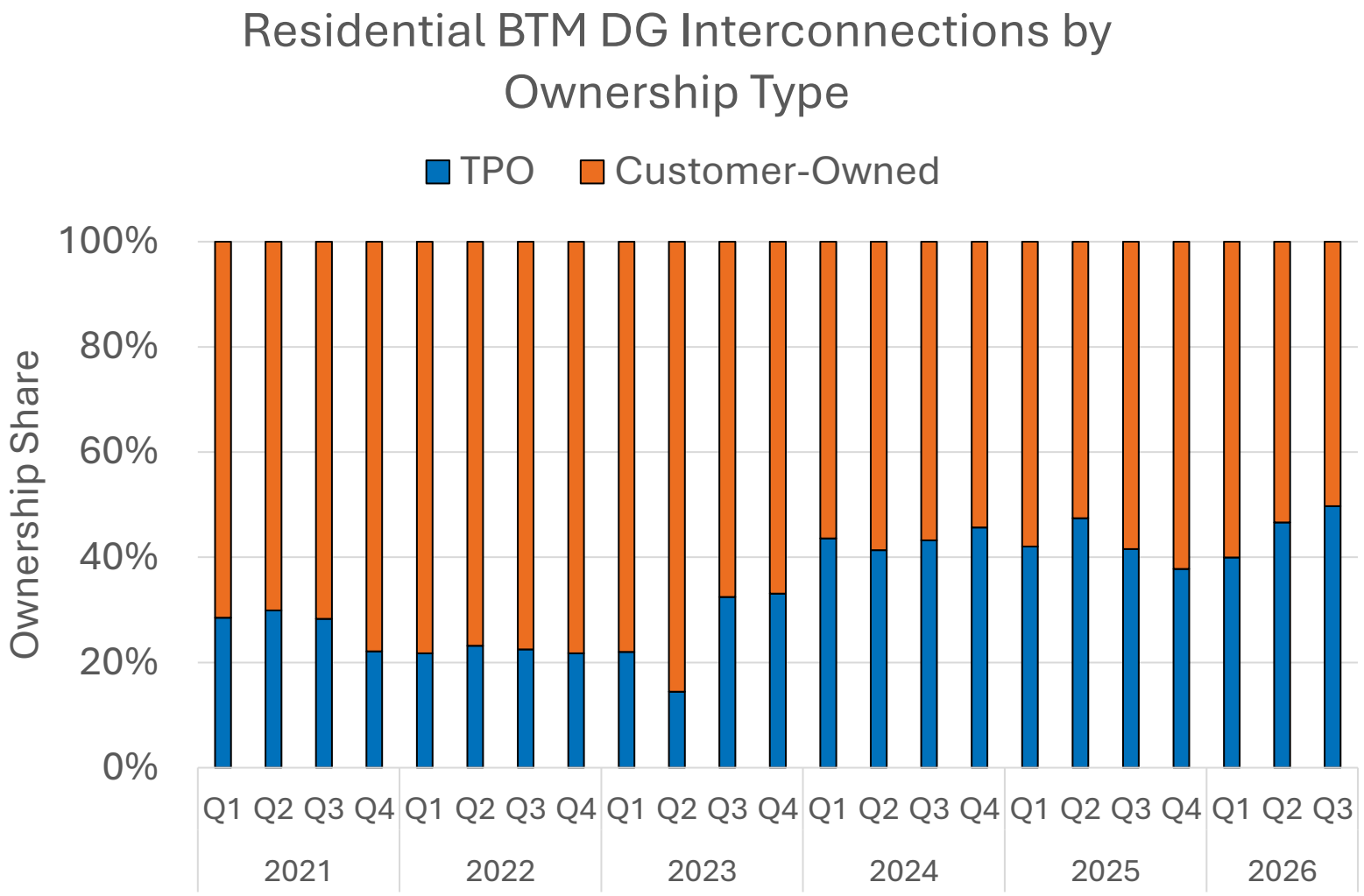
Year	Low	Mid	High
2025	$31,830	$31,830	$31,830
2030	$29,170	$26,230	$23,180
2045	$26,710	$18,360	$17,130



Source: CEC Staff

Third-Party Ownership Update

- Significant growth in TPO residential systems:
  - 28% of installations in 2021
  - 44% through Q3 2026
- dGen model unable to forecast TPO adoption
  - TPO adoption reflected in post-processing update

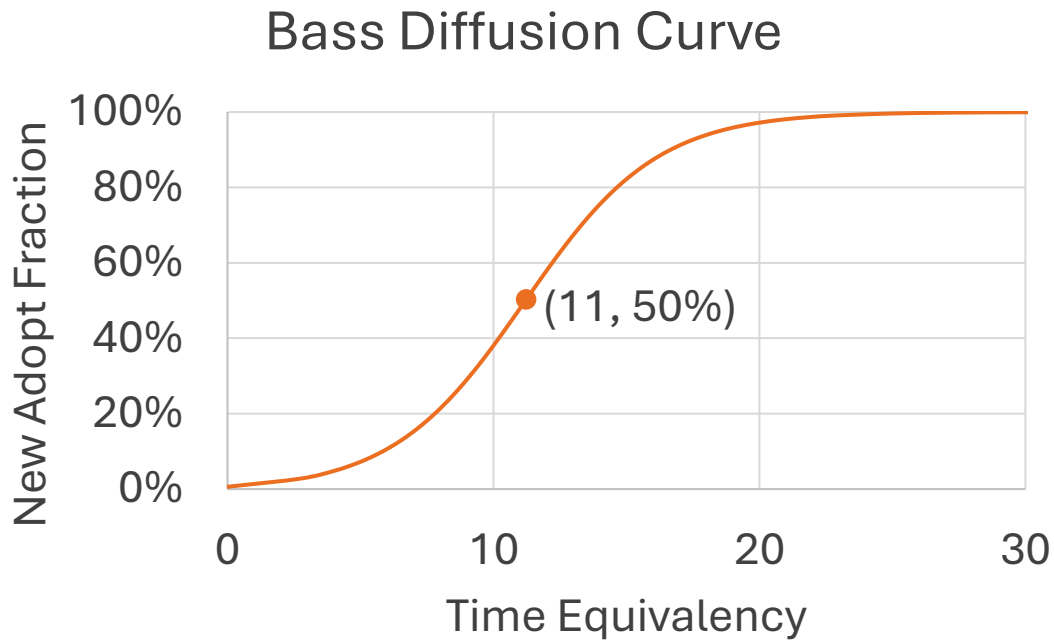


Source: DG Stats Interconnected Projects Dataset

Calculating Adopters

- dGen determines max market share from payback period
- r = last year's market share ÷ max market share
  - r used to determine time equivalency
- Bass diffusion output is new adoption fraction
- Market share = new adoption fraction ∗ max market share
- Δ market share = market share – last year's market share
- Adopters = Δ market share ∗ potential adopters

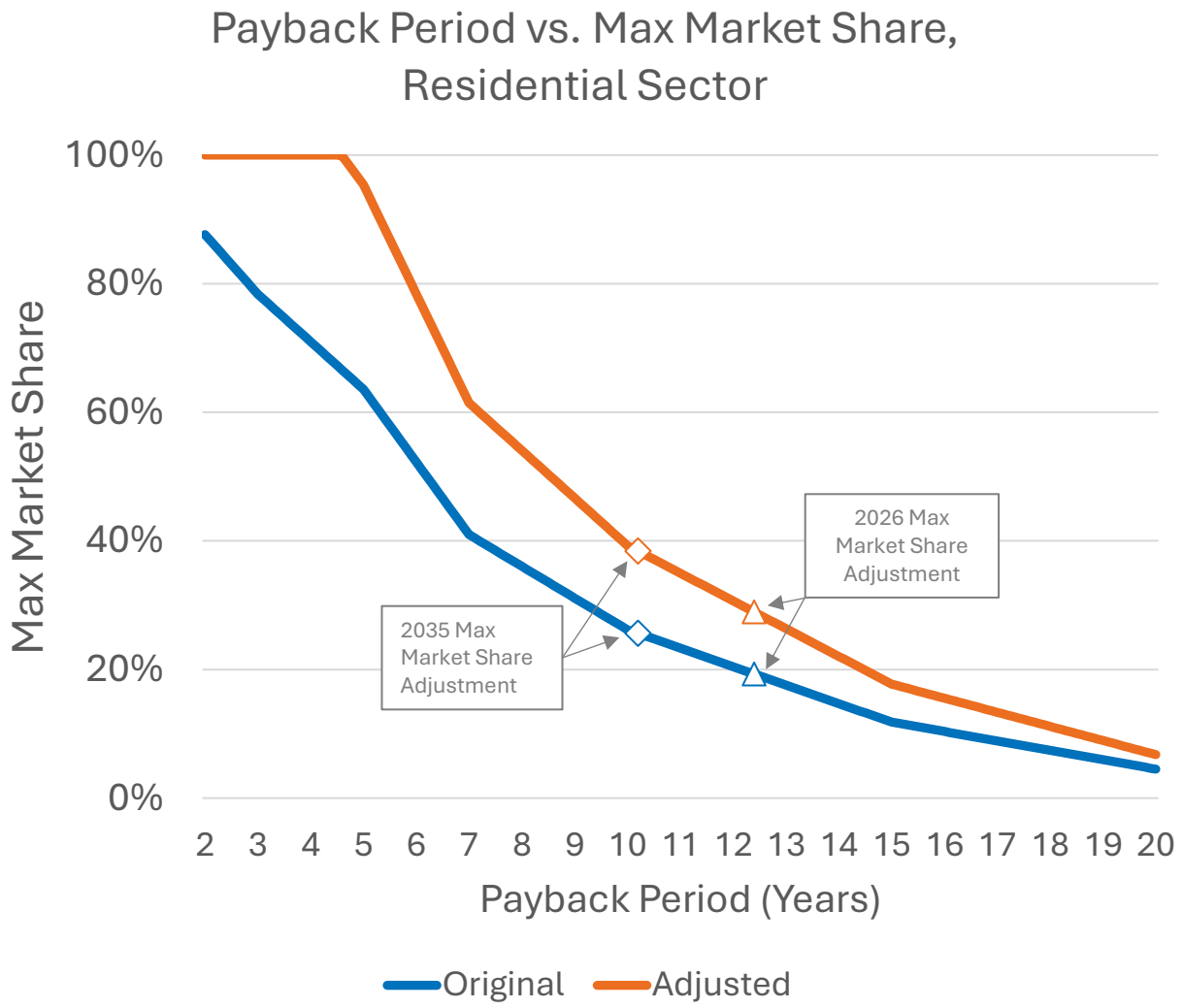
Time equivalency	Bass diffusion
$t = \frac{\ln\left(\frac{1-r}{1+\left(r*\frac{q}{p}\right)}\right)}{-(p+q)}$	$b(t) = \frac{1-e^{(-(p+q)*(t+2))}}{1-\left(\frac{q}{p}\right)e^{(-(p+q)*(t+2))}}$



Source: NLR

Max Market Share Update

- Max market share input adjusted based on BTM DG application data
  - Original values were lower than observed application data
- Data labels are the average forecast payback period for a PV + storage system in 2026 and 2035

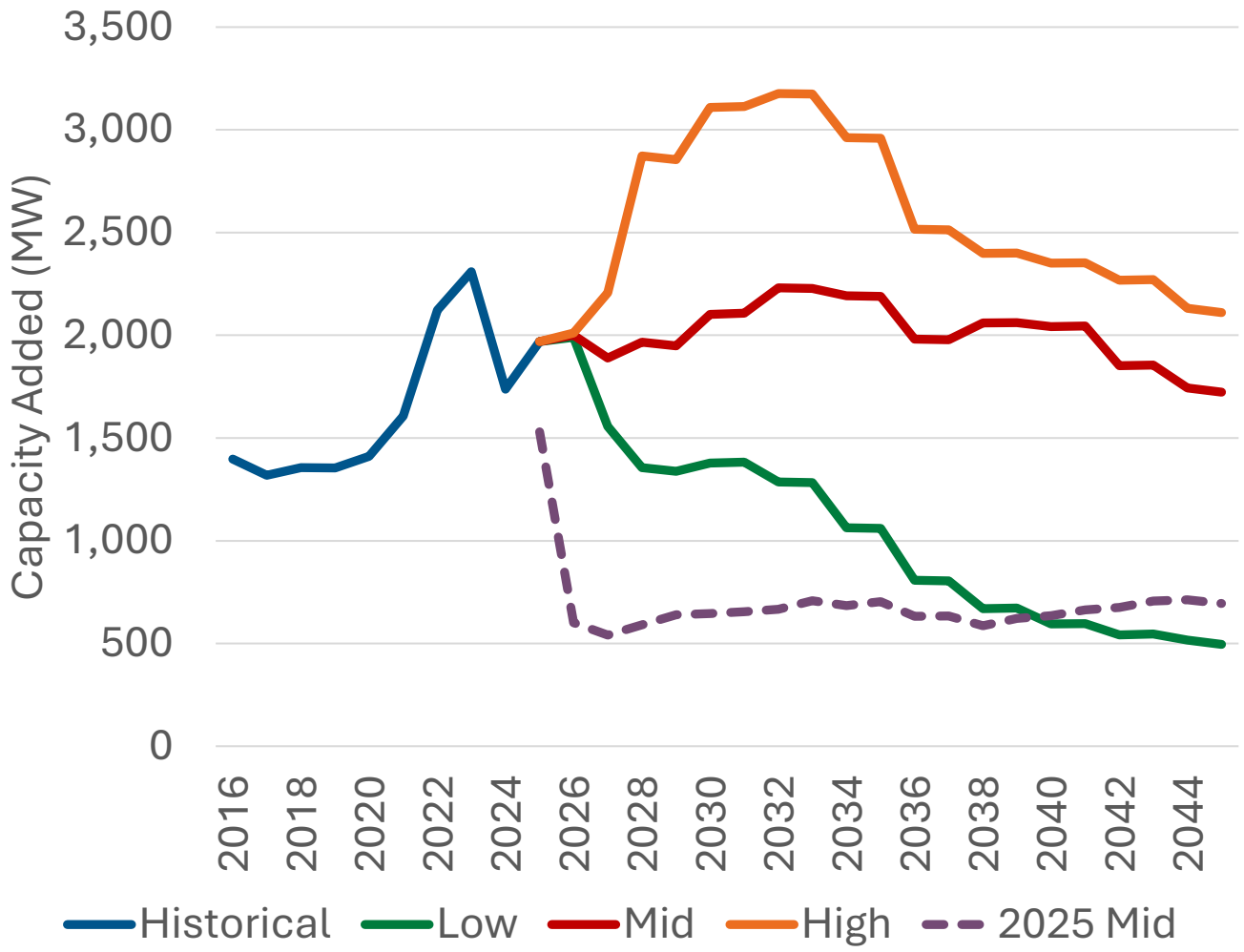


Source: CEC Staff

2026 Forecast Results

Statewide BTM PV Additions

- Mid case: Approximately 2,000 MW of new capacity added annually
- Low case: Annual additions range from 1,000 MW to 1,500 MW through 2035
  - Declines to 500 MW annually by 2045
- High case: Annual additions range from 2,500 MW to 3,000 MW through 2035
  - Declines to 2,000 MW annually by 2045
- 2025 forecast was lower due to:
  - Uncertainty over effect of ITC elimination
  - No forecast adjustment for TPO installations

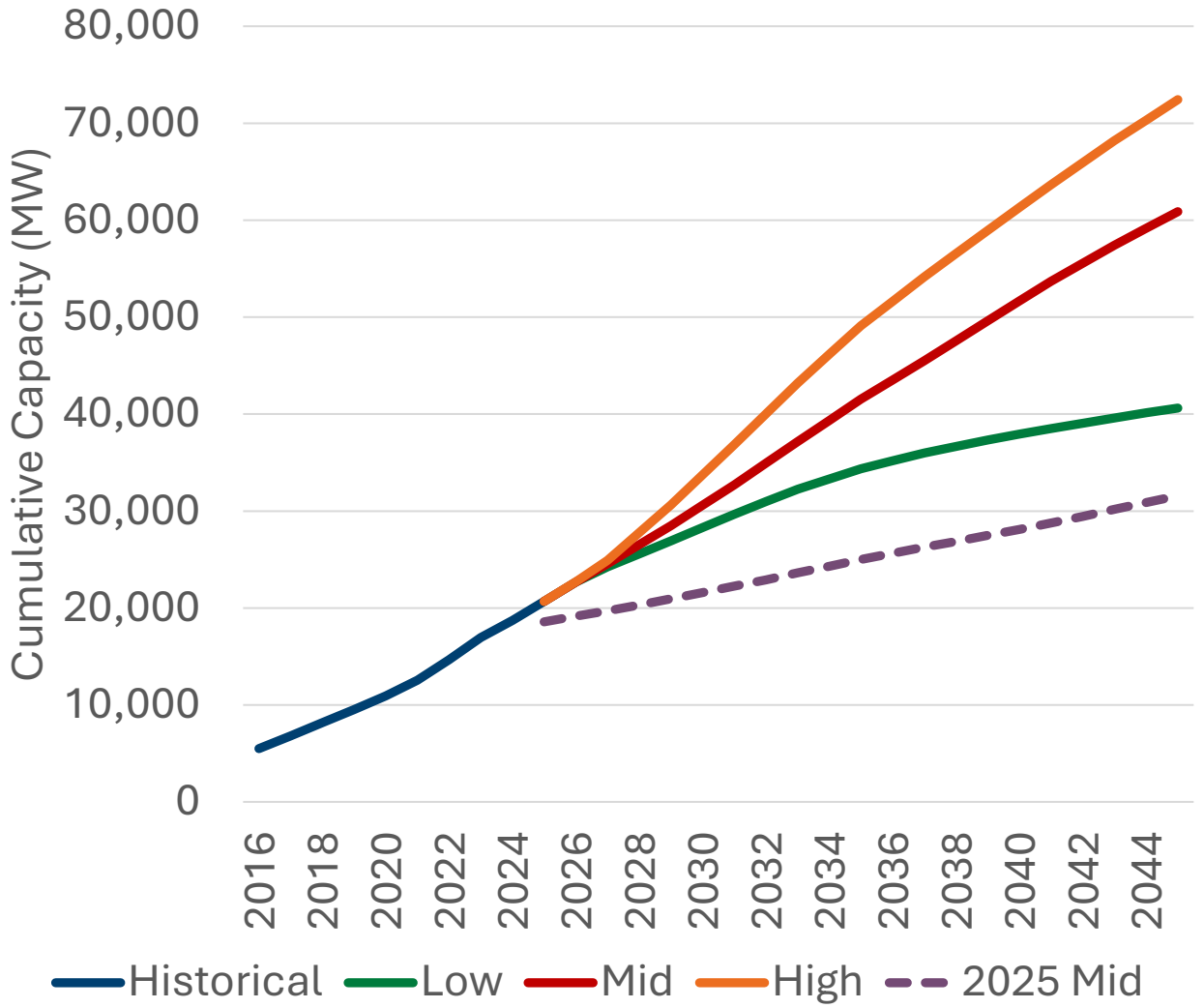


Source: CEC Staff

Statewide Cumulative BTM PV Forecast

- 2025 Capacity: 20,680 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	28,300	30,590	33,730	21,590
2035	34,370	41,540	49,120	25,010
2040	37,920	51,660	61,300	28,120
2045	40,620	60,880	72,440	31,570
CAGR	3.4%	5.6%	6.5%	2.7%



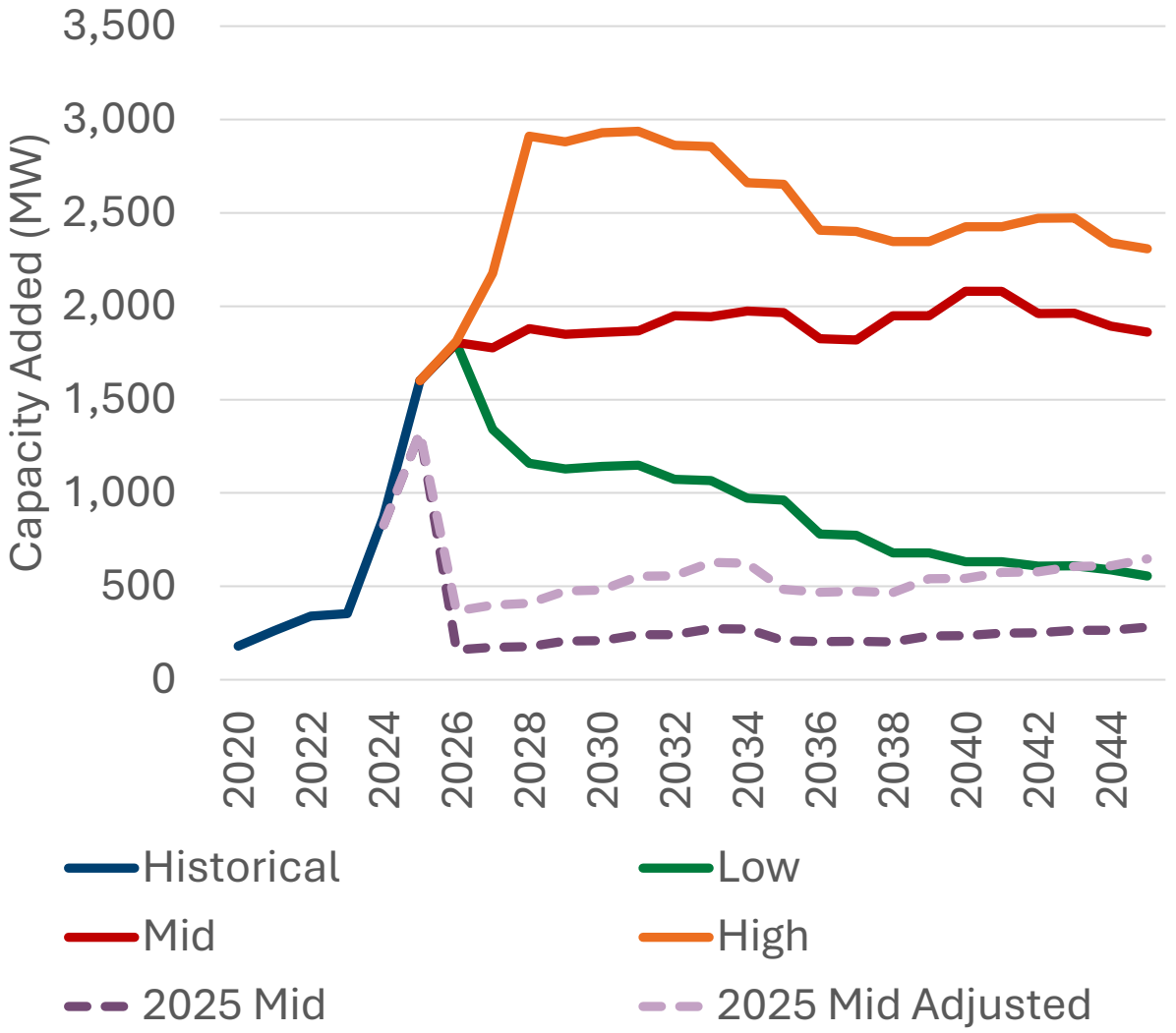
Source: CEC Staff

Statewide BTM Storage Additions

- Mid case: Approximately 1,800-2,000 MW of new capacity added annually
- Low case: Annual additions range from 1,000 MW to 1,300 MW through 2035
- High case: Annual additions near 3,000 MW at peak, average around 2,500 MW
- 2025 forecast was lower due to:
  - Assuming each residential battery has 5KW capacity
  - Lower paired system forecast (PV + Storage)

Model	Nameplate Power (KW)	Nameplate Energy Capacity (KWh)
Tesla Powerwall 2	5	13.5
Tesla Powerwall 3	11.5	13.5

Source: CEC Solar Equipment Lists

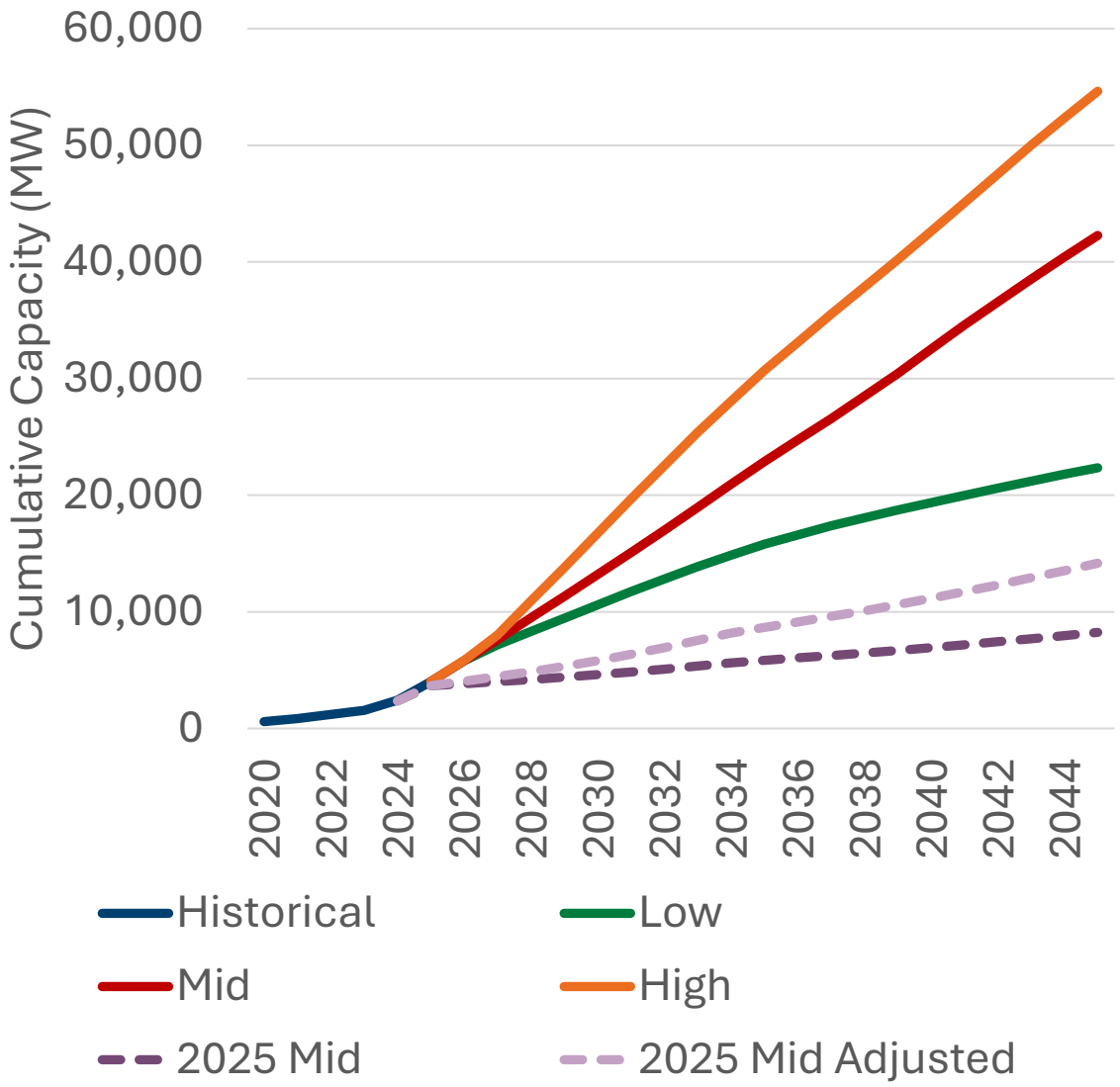


Source: CEC Staff

Statewide Cumulative BTM Storage Forecast

- 2025 Capacity: 4,020 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)	2025 Mid Case Adj. (MW)
2030	10,590	13,190	16,720	4,610	5,810
2035	15,810	22,890	30,690	5,840	8,660
2040	19,360	32,510	42,620	6,930	11,150
2045	22,350	42,270	54,640	8,240	14,170
CAGR	9.0%	12.5%	13.9%	4.1%	7.0%

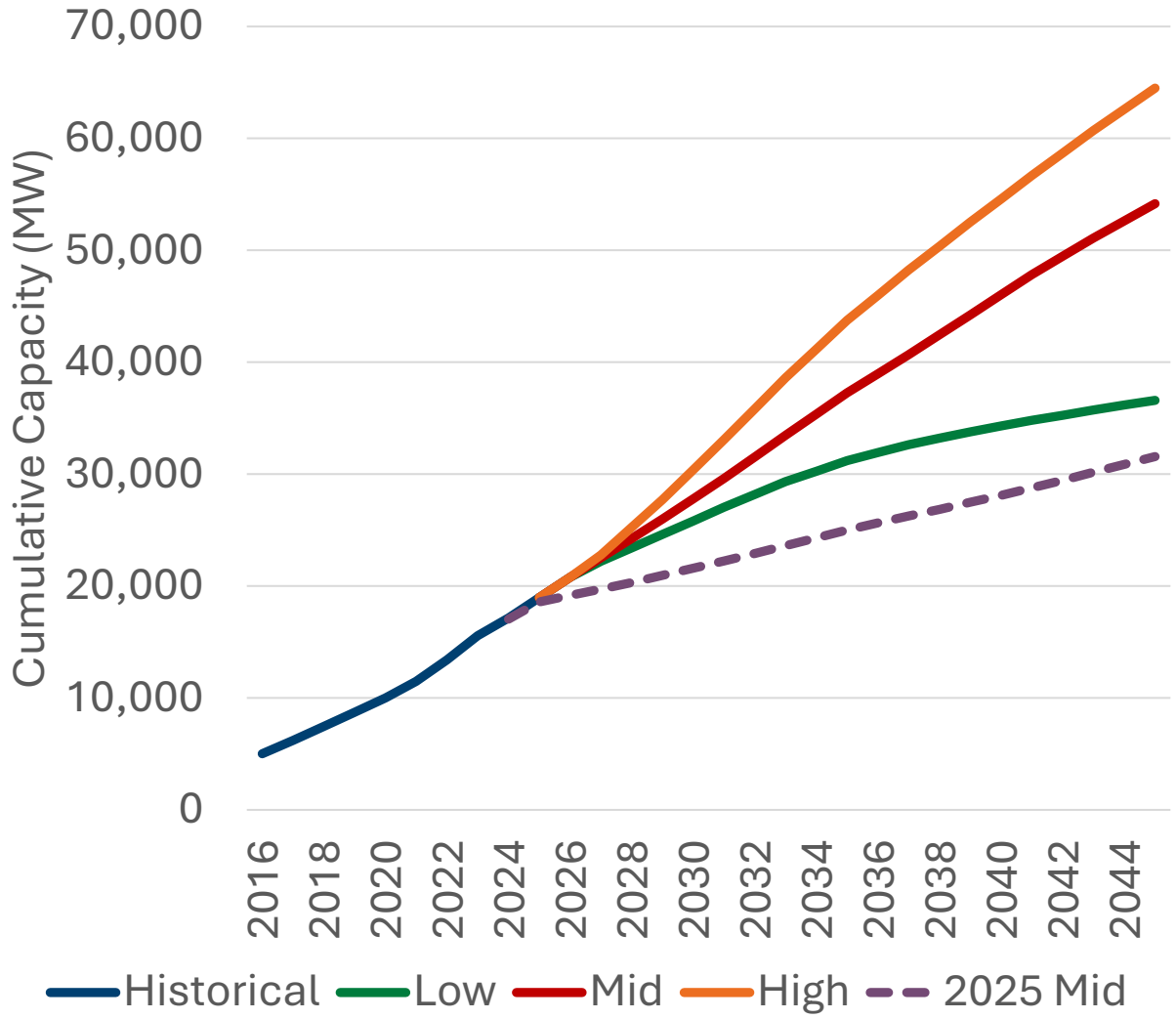


Source: CEC Staff

BTM PV Forecast: CAISO Planning Area

- 2025 Capacity: 18,969 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	25,830	25,990	30,390	20,950
2035	31,210	37,273	43,760	25,010
2040	34,300	46,030	54,600	28,120
2045	36,600	54,170	64,500	31,570
CAGR	3.3%	5.4%	6.3%	2.7%

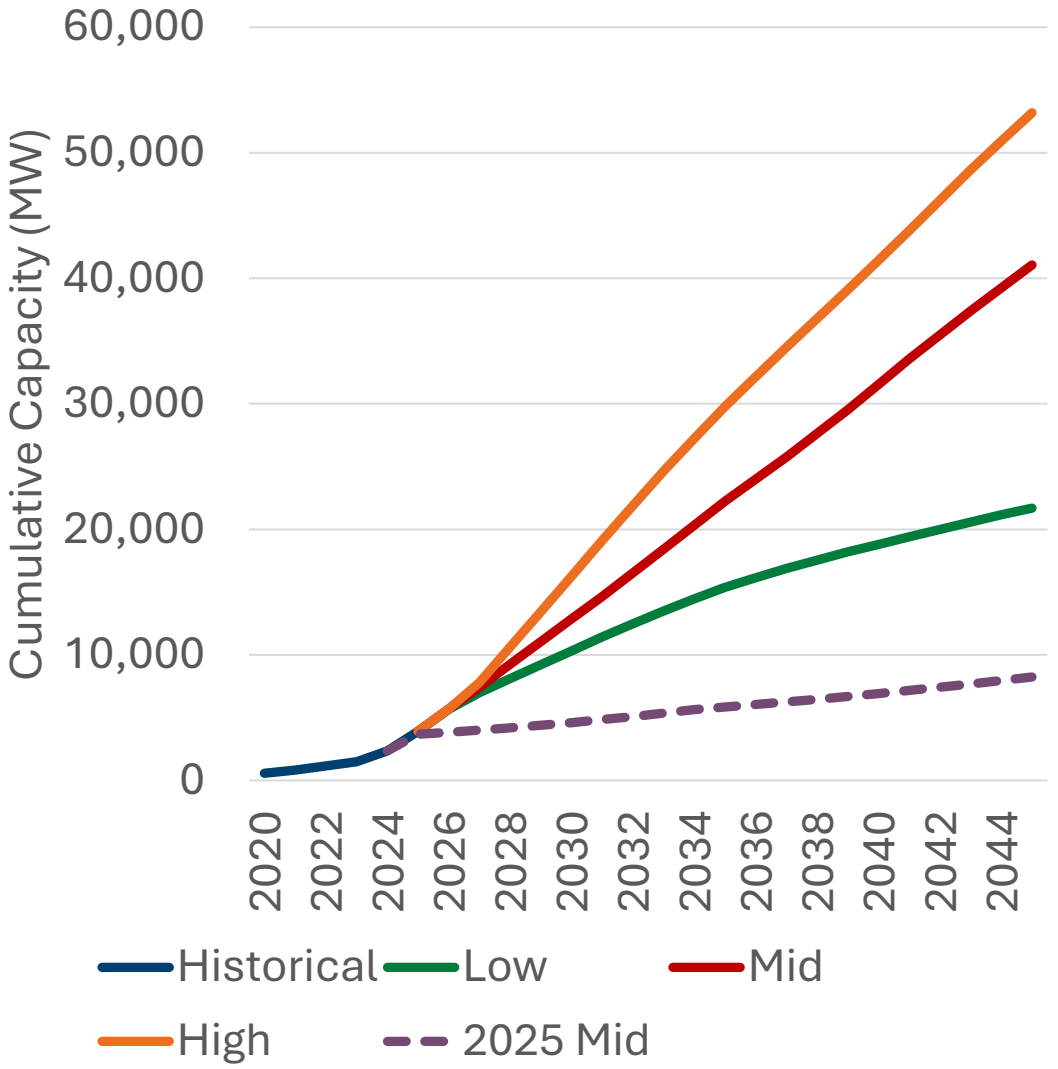


Source: CEC Staff

BTM Storage Forecast: CAISO Planning Area

- 2025 Capacity: 3,914 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)	2025 Mid Case Adj. (MW)
2030	10,320	12,850	16,260	4,610	5,810
2035	15,390	22,230	29,800	5,840	8,660
2040	18,810	31,550	41,440	6,930	11,150
2045	21,690	41,060	53,180	8,240	14,160
CAGR	8.9%	12.4%	13.9%	4.1%	7.0%



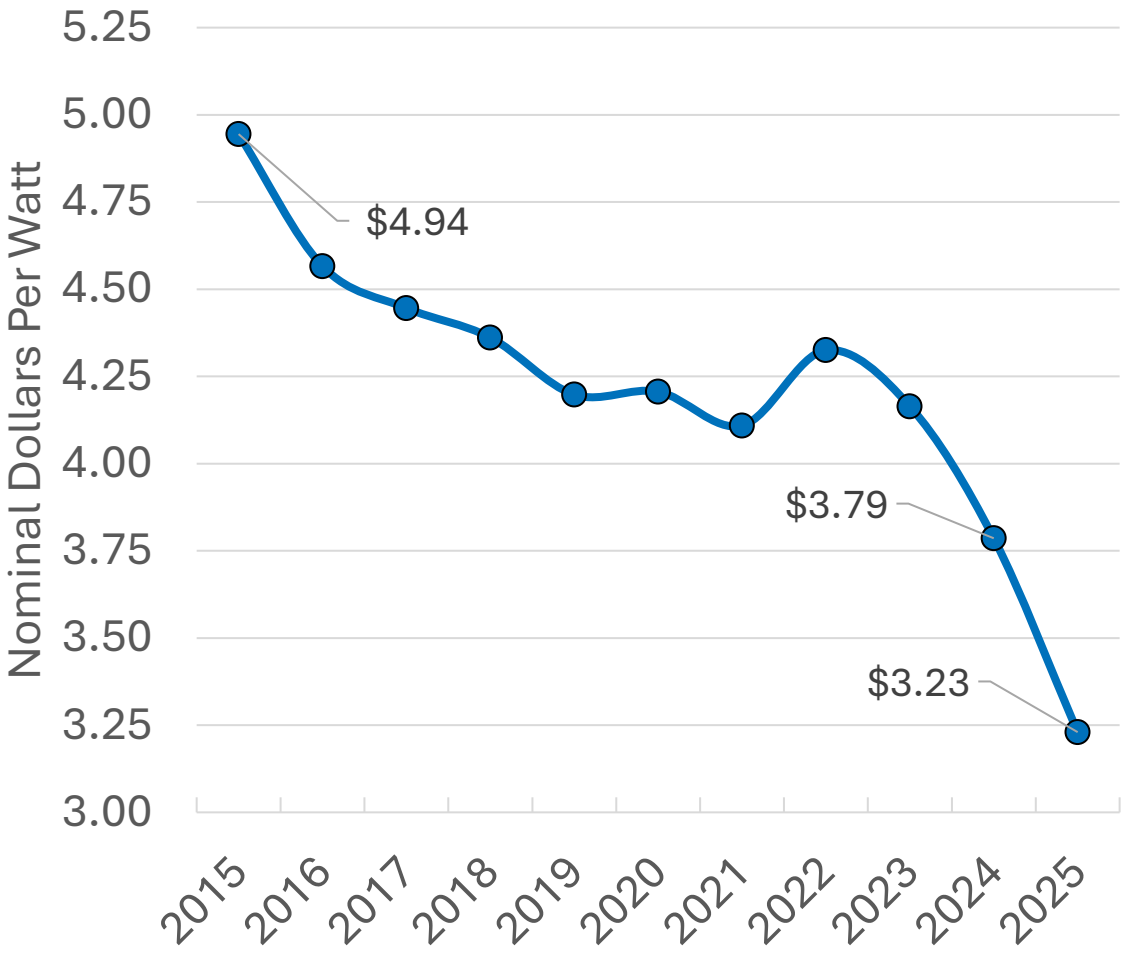
Source: CEC Staff

Thank you!

Questions/Comments: Mark.Palmere@energy.ca.gov

Appendix

Historical Residential PV Installation Cost



Source: CEC Staff analysis of DGStats interconnected project sites data

- Base year technology costs derived from DG Stats program data
  - Average costs decreased by approximately $0.10/Watt per year between 2015 and 2023
  - Average residential PV costs have decreased by over $0.50/Watt in past year

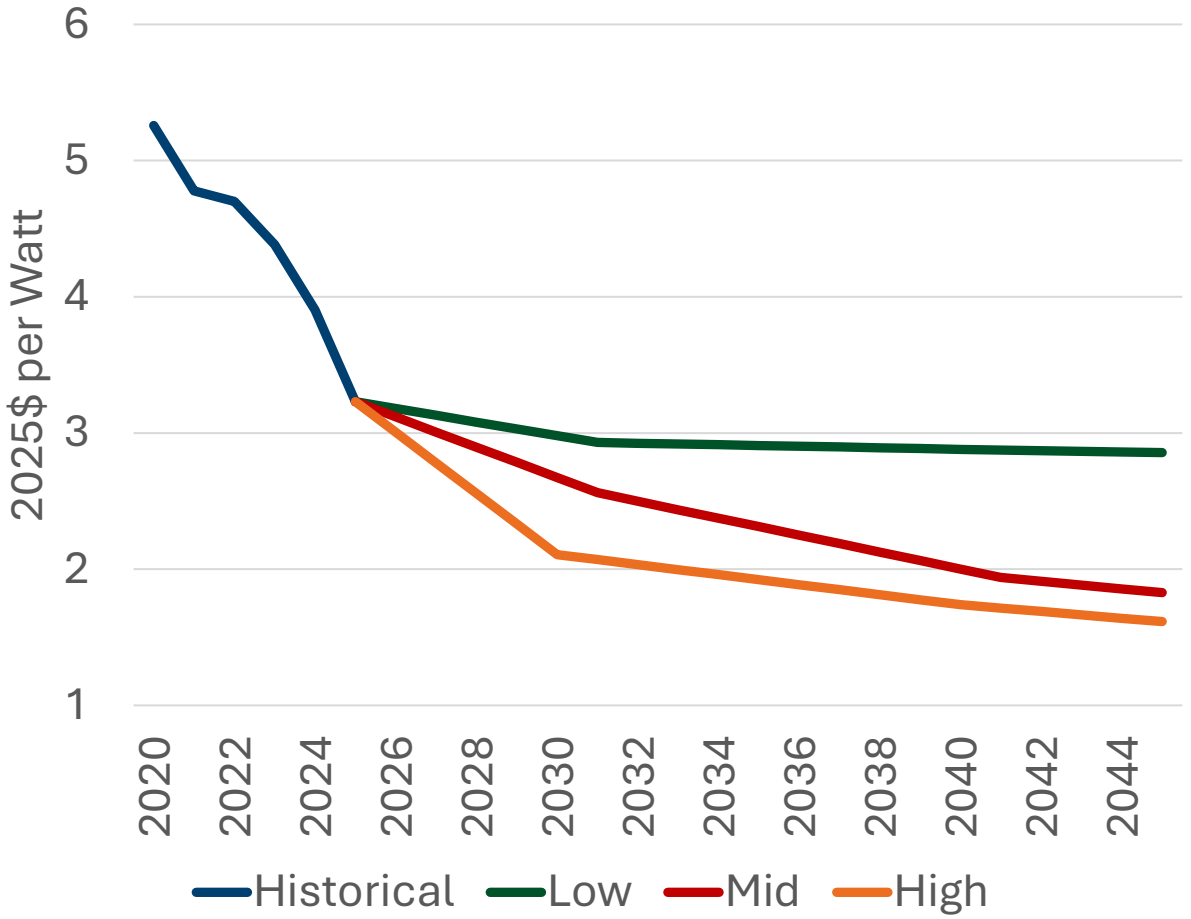
Residential PV Cost Forecast

- Projections based on 2025 NLR ATB

Average annual cost reduction across the forecast period:

- Low - 0.6%
- Mid - 2.2%
- High - 2.5%

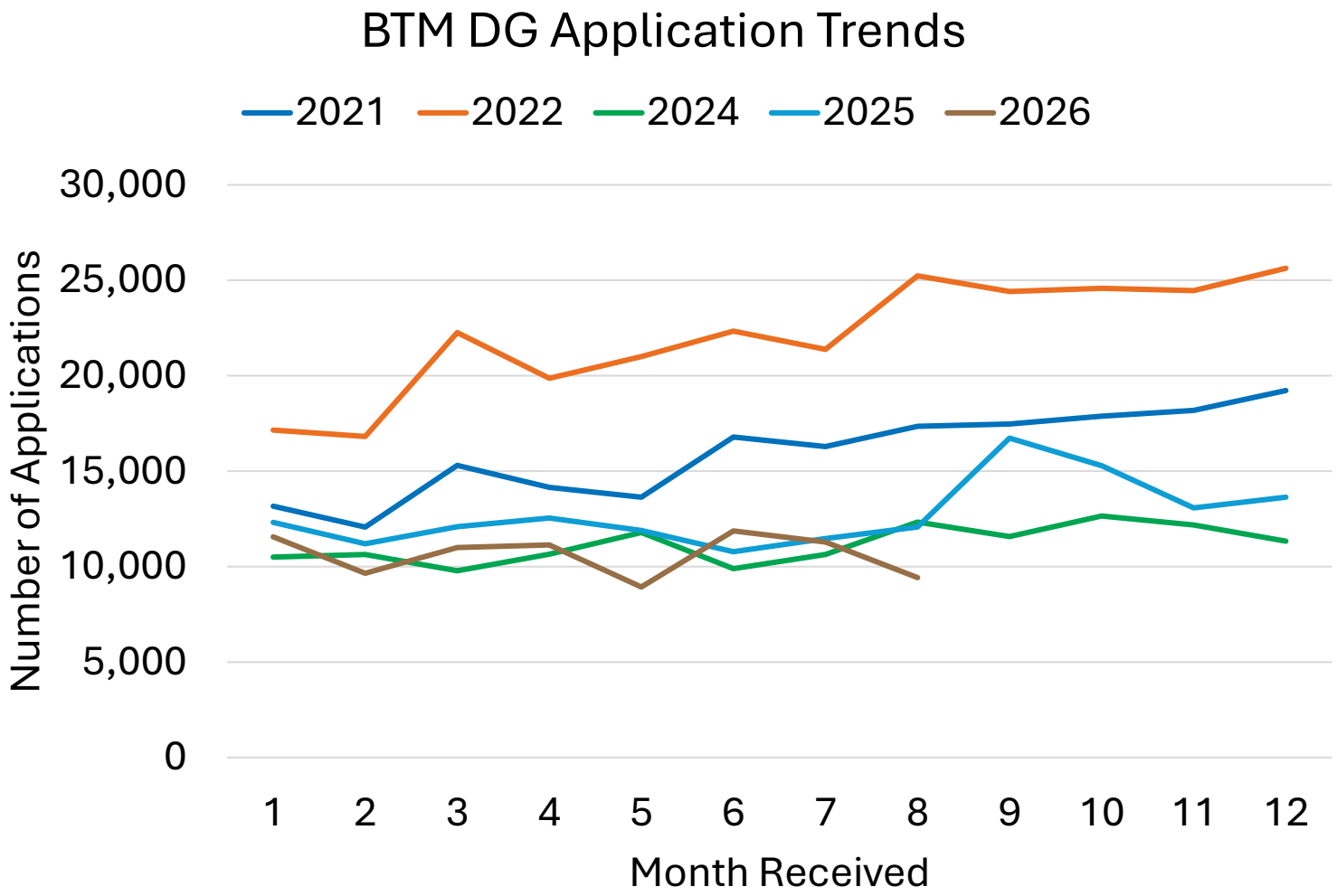
Year	Low	Mid	High
2025	$3.23	$3.23	$3.23
2030	$2.98	$2.67	$2.11
2045	$2.86	$1.83	$1.62



Source: CEC Staff

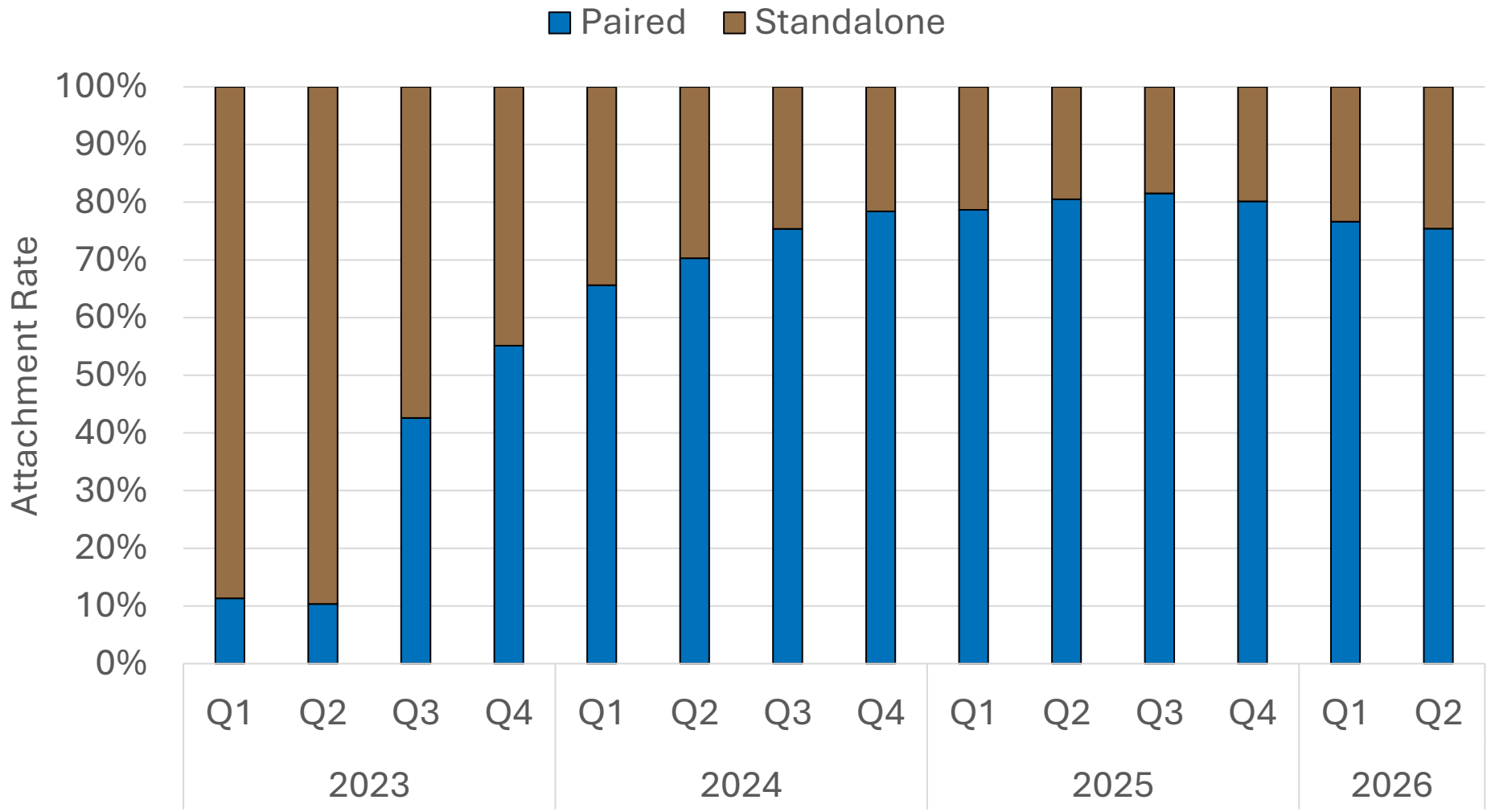
BTM DG Application Trends

Period	2024	2025	2026
Q1	30,915	35,614	32,207
Q2	32,333	35,218	31,935
Q3	34,540	40,274	
Q4	36,159	41,995	



Source: CEC Staff analysis of DG Stats Interconnection Application Dataset

Storage Attachment Rates

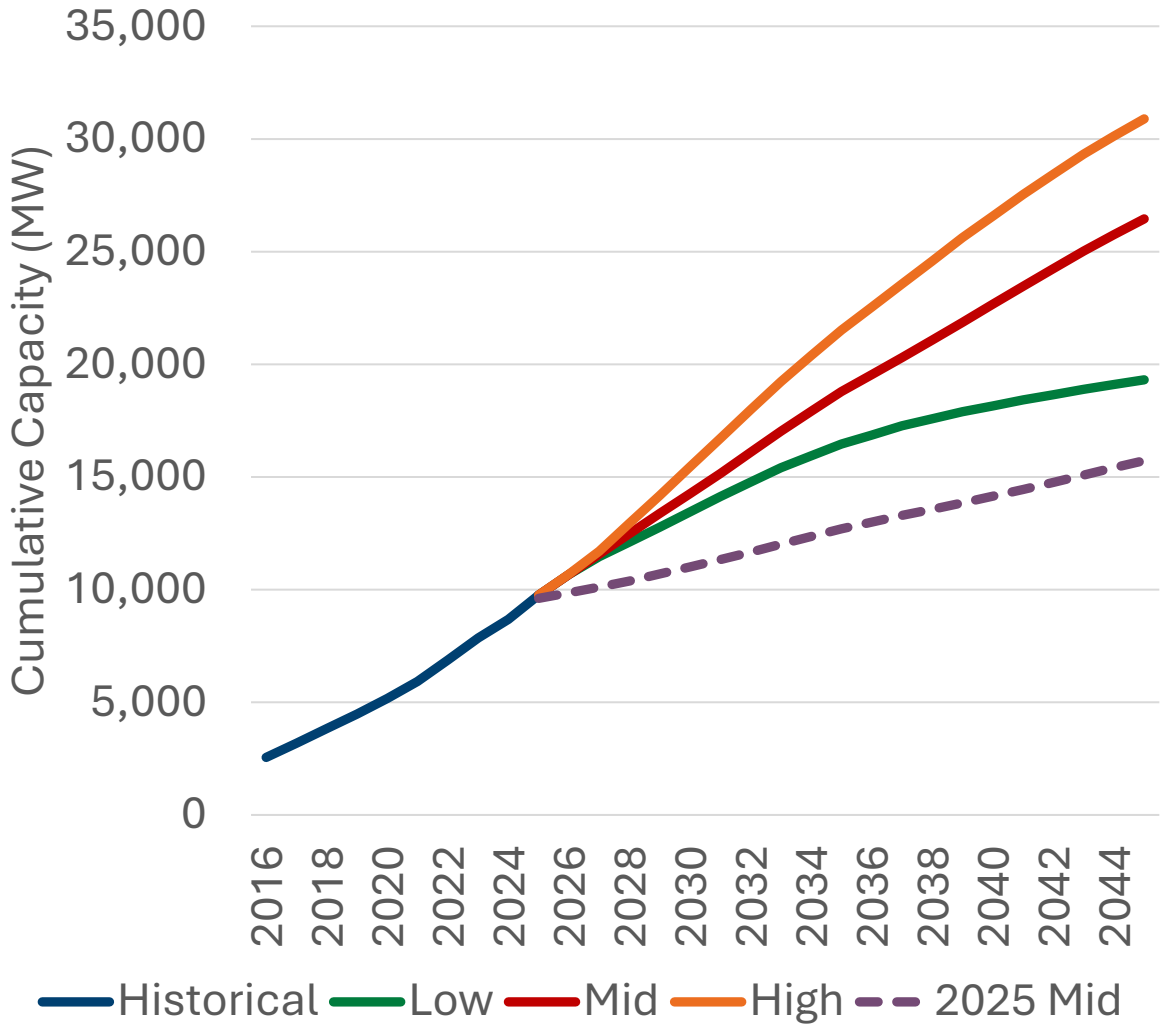


Source: DG Stats Interconnected Projects Dataset

BTM PV Forecast: PG&E Planning Area

- 2025 Capacity: 9,757 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	13,450	14,270	15,450	11,010
2035	16,460	18,780	21,510	12,700
2040	18,160	22,660	26,580	14,140
2045	19,310	26,450	30,890	15,720
CAGR	3.5%	5.1%	5.9%	2.5%

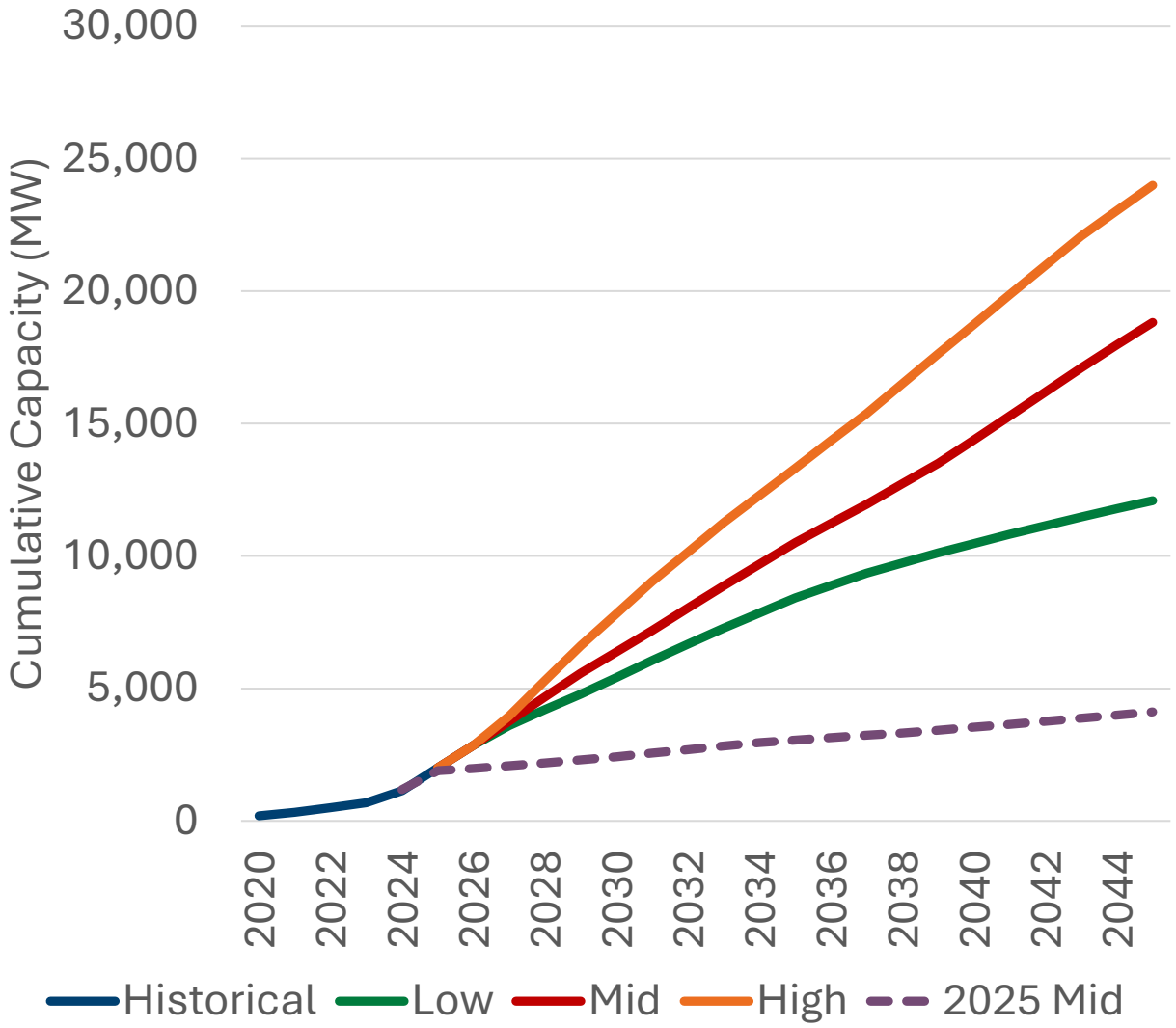


Source: CEC Staff

BTM Storage Forecast: PG&E Planning Area

- 2025 Capacity: 2,002 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	5,410	6,380	7,820	2,420
2035	8,410	10,500	13,320	3,050
2040	10,470	14,390	18,740	3,530
2045	12,090	18,820	23,990	4,120
CAGR	9.4%	11.9%	13.2%	4.0%

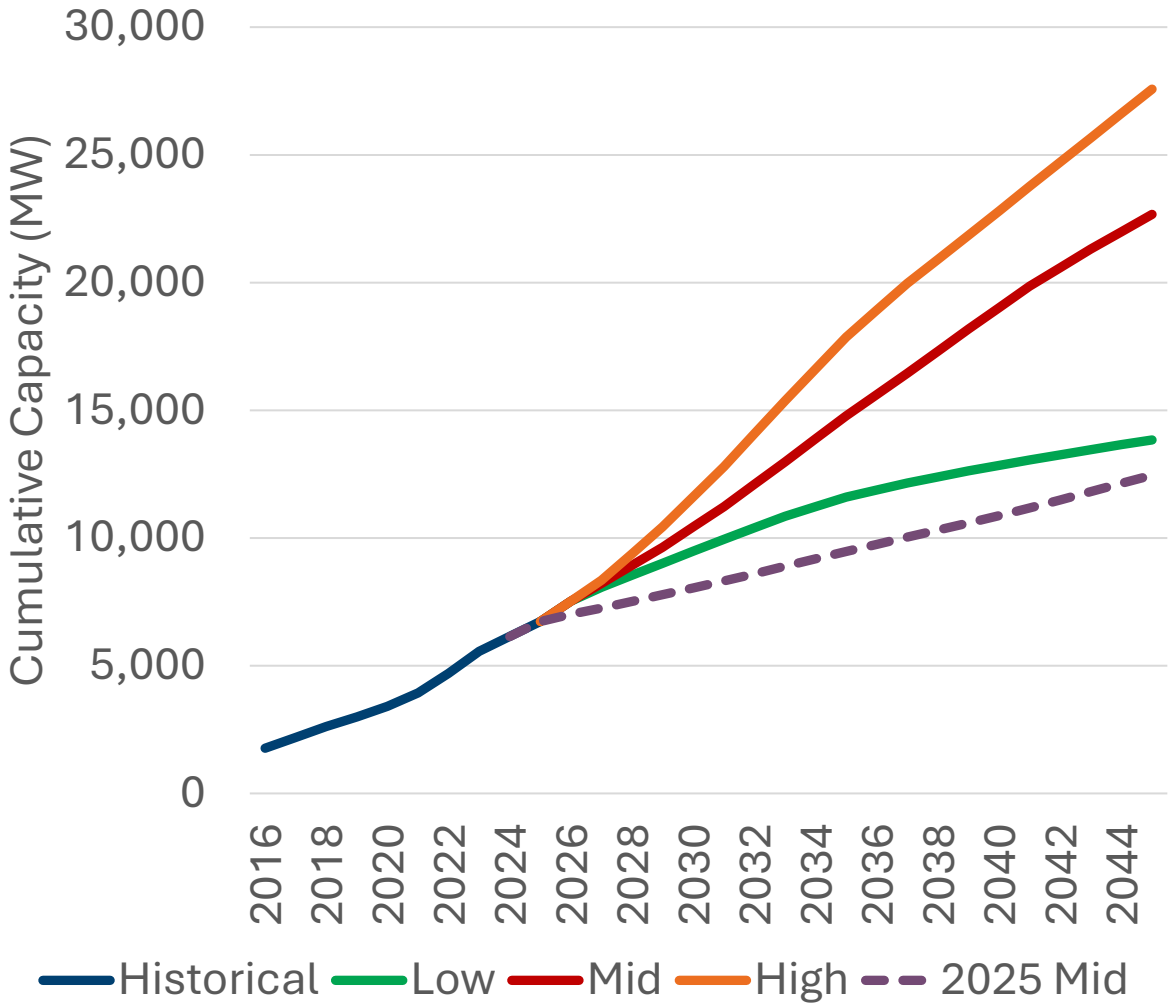


Source: CEC Staff

BTM PV Forecast: SCE Planning Area

- 2025 Capacity: 6,730 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	9,480	10,430	11,610	8,050
2035	11,600	14,780	17,870	9,470
2040	12,840	19,020	22,810	10,880
2045	13,840	22,670	27,570	12,460
CAGR	3.7%	6.3%	7.3%	3.1%

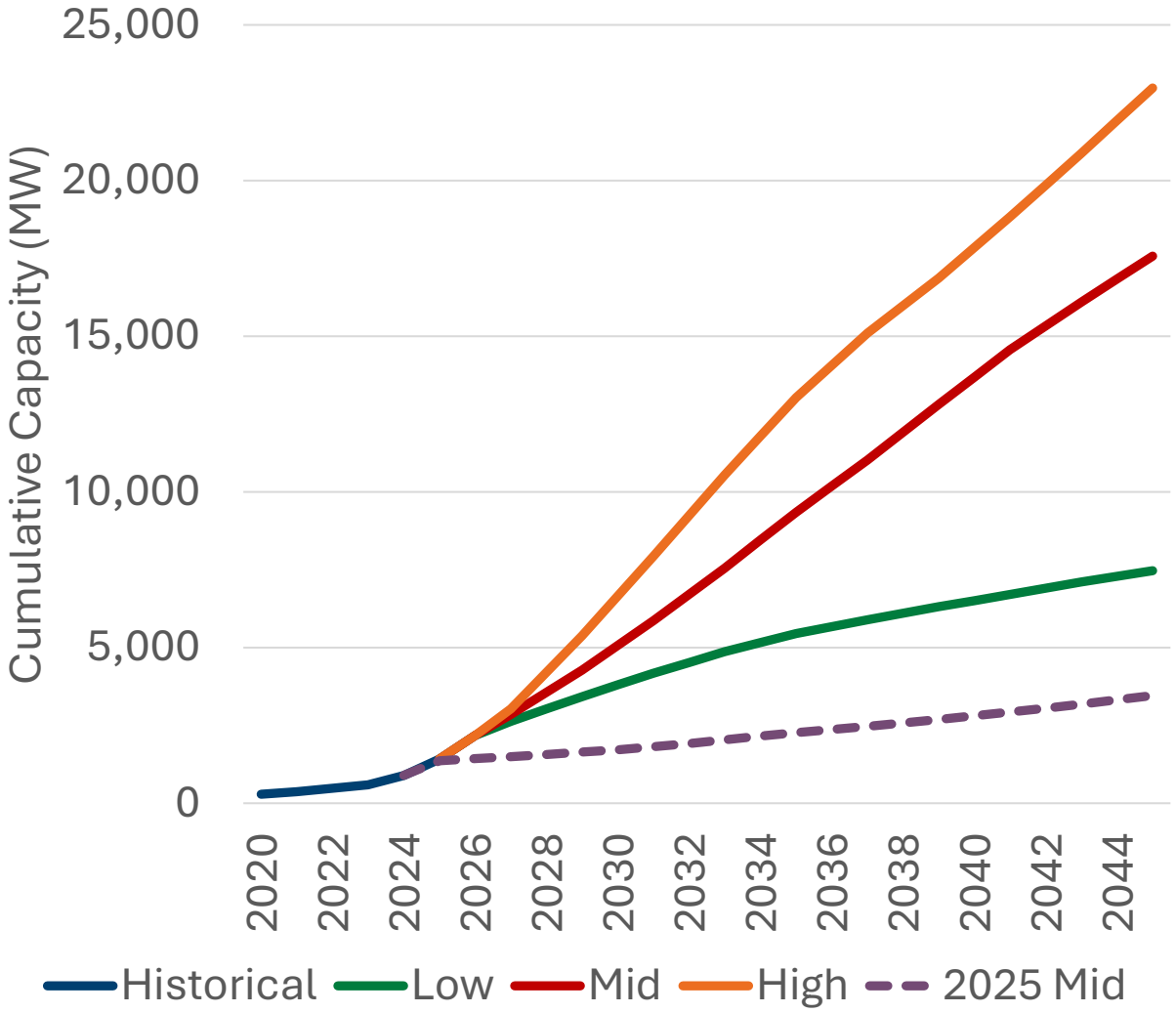


Source: CEC Staff

BTM Storage Forecast: SCE Planning Area

- 2025 Capacity: 1,418 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	3,800	5,070	6,660	1,720
2035	5,450	9,340	13,030	2,260
2040	6,510	13,680	17,850	2,810
2045	7,470	17,570	22,970	3,460
CAGR	8.7%	13.4%	14.9%	4.7%

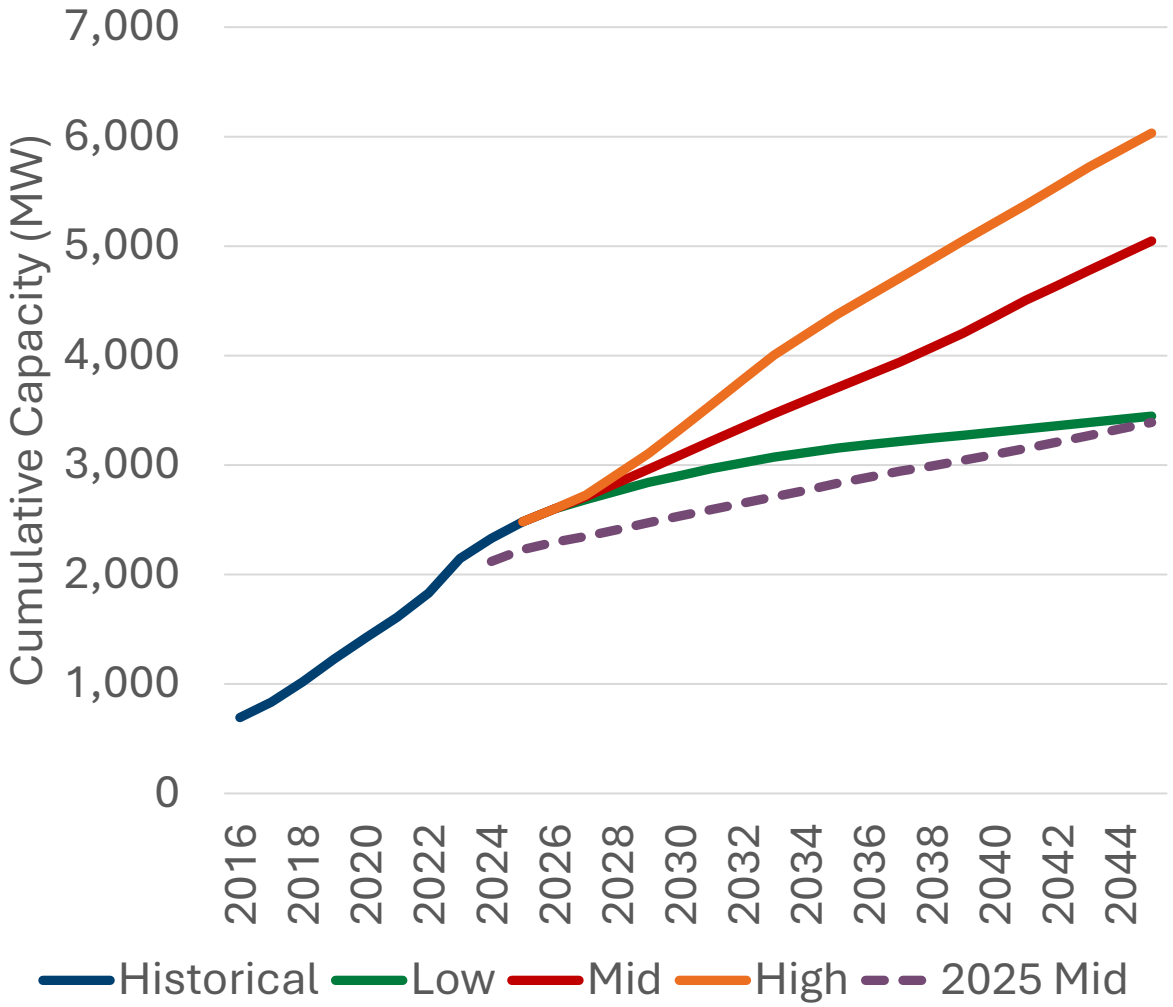


Source: CEC Staff

BTM PV Forecast: SDG&E Planning Area

- 2025 Capacity: 2,482 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	2,900	3,090	3,330	2,540
2035	3,160	3,710	4,380	2,830
2040	3,300	4,350	5,210	3,100
2045	3,450	5,050	6,030	3,390
CAGR	1.7%	3.6%	4.5%	2.1%

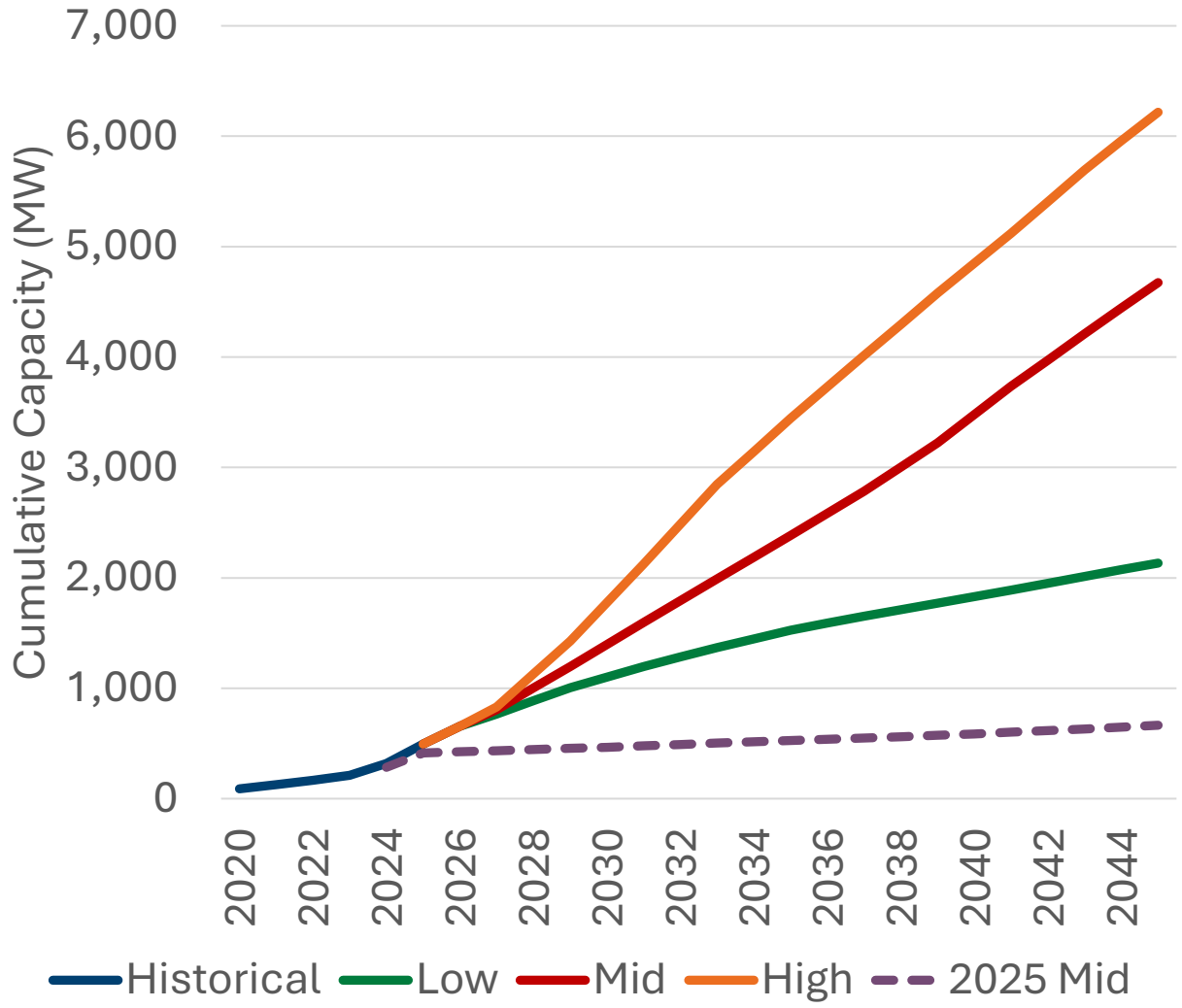


Source: CEC Staff

BTM Storage Forecast: SDG&E Planning Area

- 2025 Capacity: 495 MW

Year	Low Case (MW)	Mid Case (MW)	High Case (MW)	2025 Mid Case (MW)
2030	1,100	1,400	1,780	470
2035	1,520	2,380	3,440	530
2040	1,830	3,480	4,850	590
2045	2,130	4,670	6,220	670
CAGR	7.6%	11.9%	13.5%	2.4%



Source: CEC Staff