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Behind-the-Meter Distributed Generation Forecast Results

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Date: November 7, 2024

List of Acronyms and Initialisms

AB – Assembly Bill

ACS – American Community Survey

BTM – Behind-the-Meter

CEC – California Energy Commission

CHP – Combined Heat and Power

CPUC – California Public Utilities Commission

DG – Distributed Generation

dGen – Distributed Generation Market Demand Model

DGStats – California Distributed Generation Statistics

KW – Kilowatt

IEPR – Integrated Energy Policy Report

IOU – Investor-Owned Utility

ITC – Investment Tax Credit

LBNL – Lawrence Berkeley National Laboratory

MW – Megawatt

NBT – Net Billing Tariff

NEM – Net Energy Metering

PV – Photovoltaics

What BTM Distributed Generation Model Forecasts

Technologies

Solar PV

Energy Storage

Other Generation

Such as:

- Fuel Cell CHP
- Gas Turbine
- Wind Turbine

Metrics

Capacity

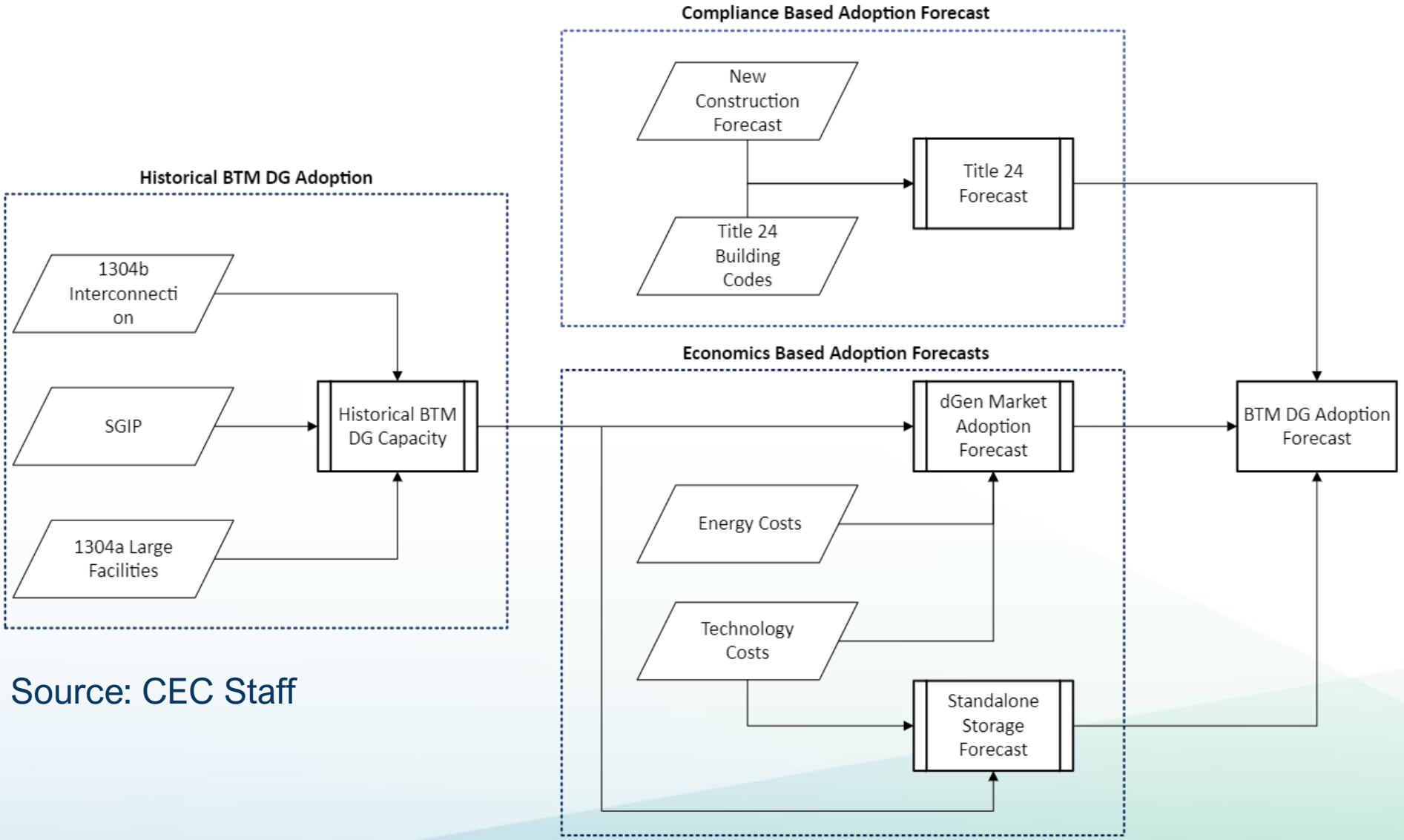
- Future technologies adoption predicted from suite of modelling tools

Energy

- Annual and hourly impacts developed from technologies performance data

Source: CEC Staff

Adoption Modelling Architecture



Source: CEC Staff

Why Forecast BTM Distributed Generation

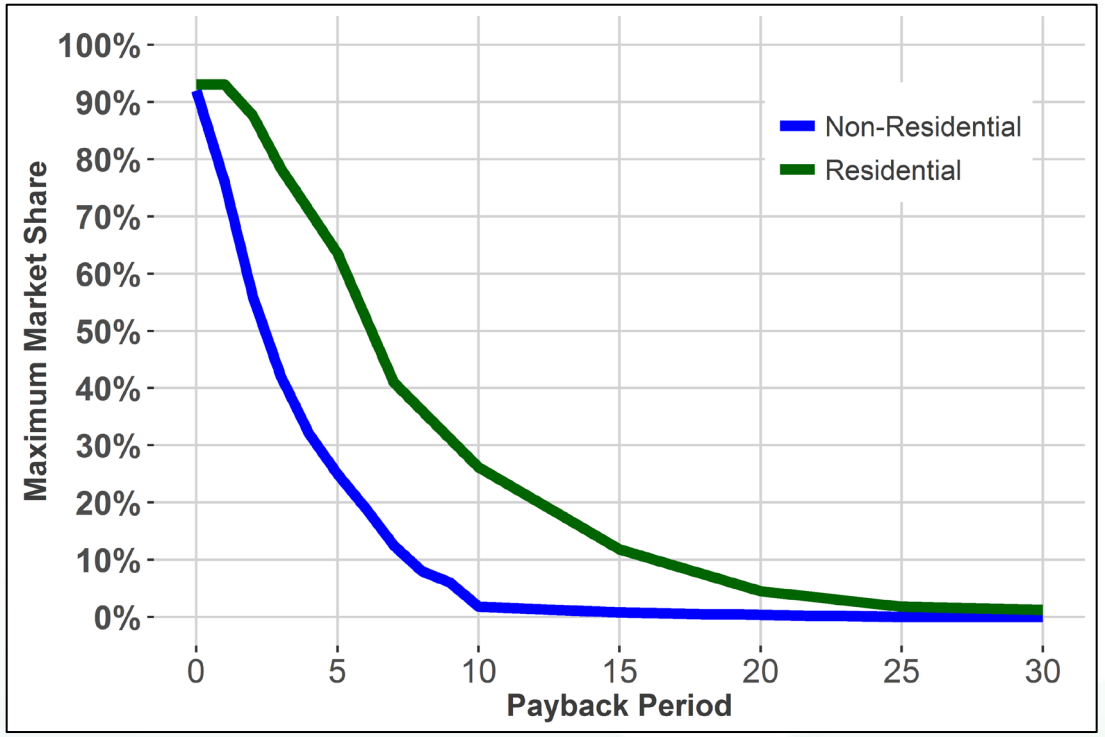
- BTM distributed generation technologies impact electricity demand served by utilities
  - Annually
  - Hourly
- Solar PV generation currently accounts for approximately 10% (and growing) of overall statewide consumption
  - Future adoption will offset a larger amount of electricity demand
- Energy storage adoption affects peak demand
  - Avoids time-of-use rates by dispatching during on-peak period (4-9 pm)

Distributed Generation Forecast Drivers

- BTM capacity forecast is developed using:
  - Interconnection data
  - Factors that influence future adoption, such as:
    - Payback period, which is driven by:
      - System costs
      - Import tariffs (i.e. energy costs)
      - Export tariffs (i.e. NBT vs. NEM)
      - Incentives
    - Title 24 Building Standards

How dGen Models Customer Behavior

- Model uses previously conducted surveys to understand customer willingness to pay at various payback periods
- Market share drops as payback period increases

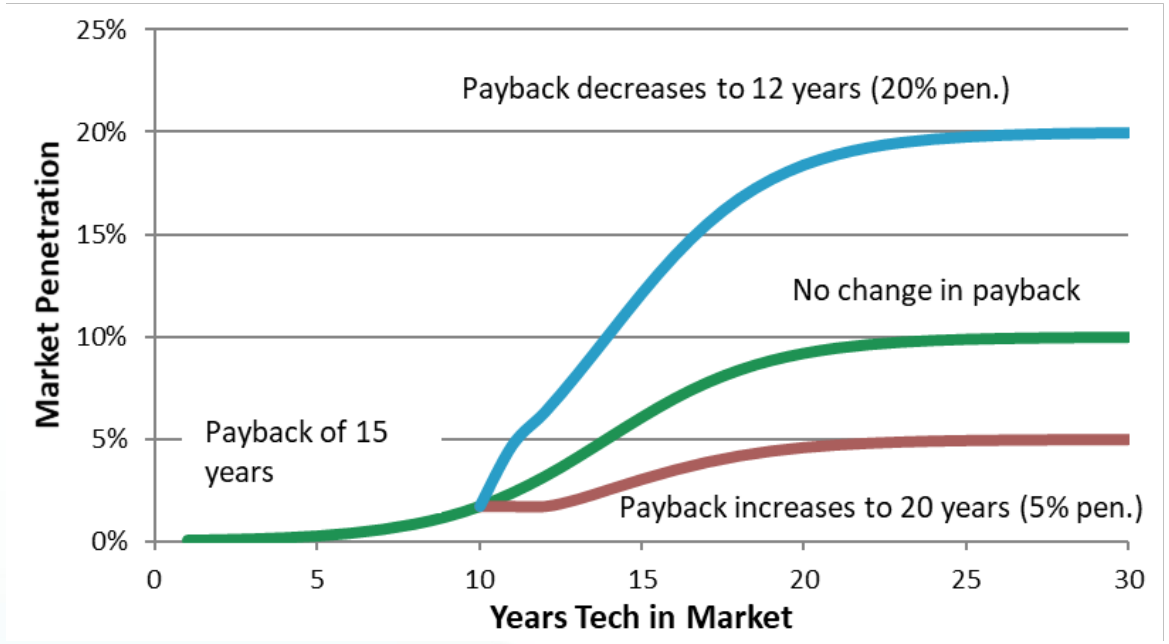


Source: NREL

https://www.sciencedirect.com/science/article/abs/pii/S0301421519301004

How dGen Models Adoption

- dGen relates the payback period to the fraction of consumers that would adopt solar
- Uses the Bass Diffusion model to simulate adoption over time, using the “Maximum Market Share” as the terminal adoption level



Source: NREL

Modelling Updates

Three Distributed Generation Scenarios

Applicability to Each Model

Scenario Lever	dGen	Standalone Storage	Title 24
Total System Load	✓	x	x
CAPEX Costs	✓	✓	x
Investment Tax Credit	✓	✓	x

Source: CEC Staff

Scenario Table

Scenario	CAPEX Costs	Investment Tax Credit
Low	High	Ends in 2034
Mid	Mid	Ends in 2034
High	Low	Extended to 2042

Source: CEC Staff

Changes to Modeling Demographics

- Customers separated by income level and housing tenure (renters vs. owners)
- Over 25% of single-family homes are renter-occupied
  - Assume unable to adopt
- 18% of single-family homeowners are designated low income
  - Less likely to adopt
- Changes in demographic modeling lowers number of potential adopters, reducing forecasted capacity

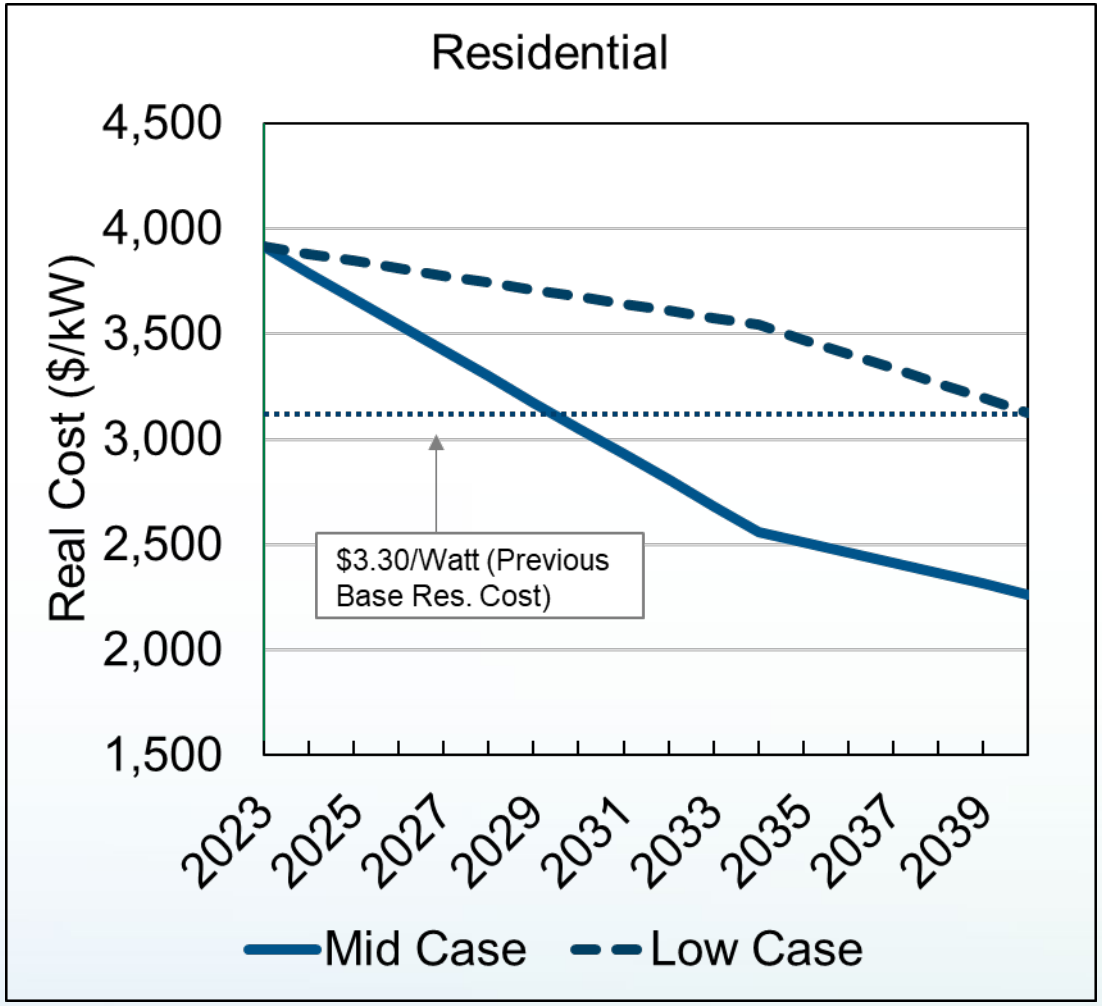
Planning Area	Renters	Owners	Share of Renters
PG&E	824,251	2,420,087	25.4%
SCE	967,857	2,818,161	25.6%
SDG&E	174,355	499,718	25.9%
POUs	188,278	444,863	29.7%
Statewide	2,154,741	6,182,829	25.8%

Source: American Community Survey

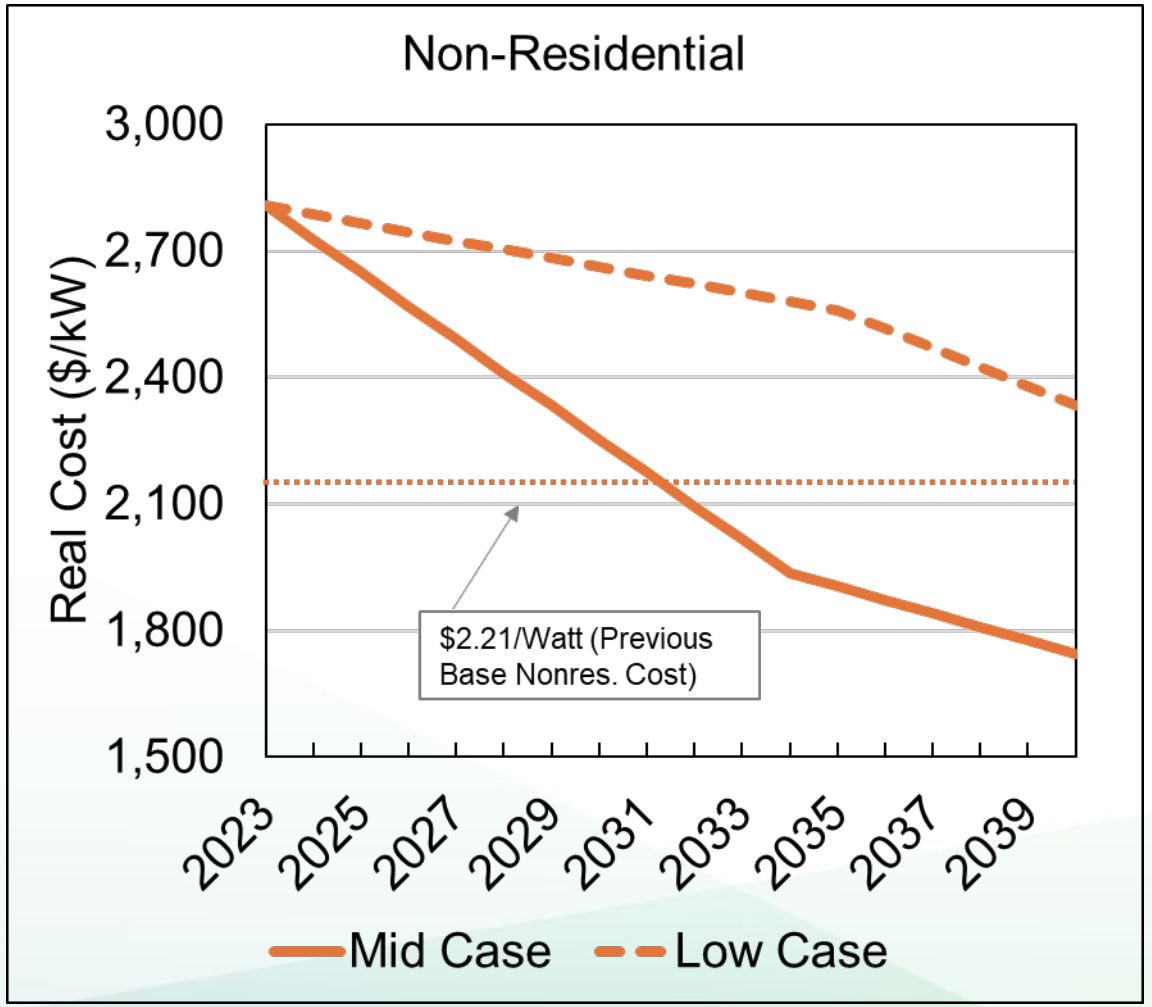
Base Year Technology Costs Updates

- 2024 base year cost derived from DGStats data prepared by LBNL for the Tracking the Sun report
  - Real-world data
  - Incorporates all costs including installation and dealer markup
- 2024 base year cost of standalone PV
  - Residential: $4.04/W
  - Nonresidential: $2.89/W

Base Year Cost Change Affects Forecasted Costs for Solar



Source: CEC Staff



Source: CEC Staff

Added Income-Graduated Fixed Charge

- In 2024, the CPUC approved a new Income-Graduated Fixed Charge for all IOU customers
  - Mandated by AB 205 in 2022
  - Goes into effect in late 2025/early 2026
- Fixed charge (~$24/month) on electricity bills
  - Up to $12/month for low-income customers
- Volumetric charges for electricity will be reduced by about $0.05/kWh
  - BTM DG slightly less beneficial

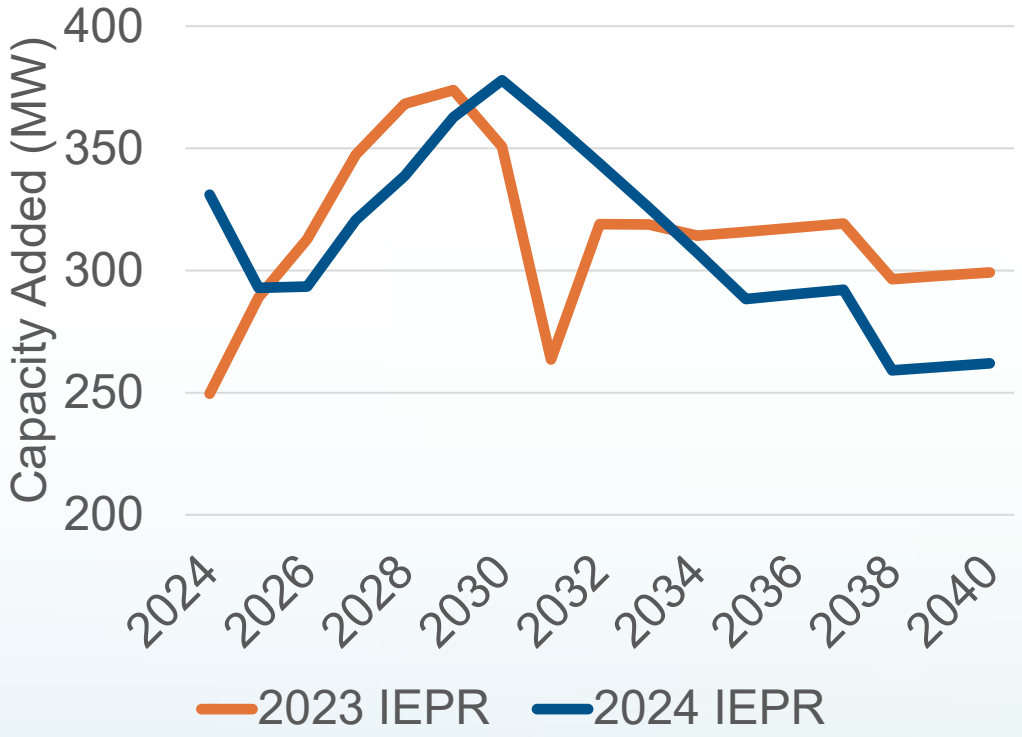
Title 24 Requirement Updates

- CEC's 2025 Building Energy Efficiency Standards go into effect in 2026
- Updates include:
  - Minor adjustment of the watts per square foot requirement by building type and zone
  - Addition of new building types (Events & Exhibits, Sports & Recreation, Religious Worship)
  - Updated housing completion forecast

2024 Forecast Results

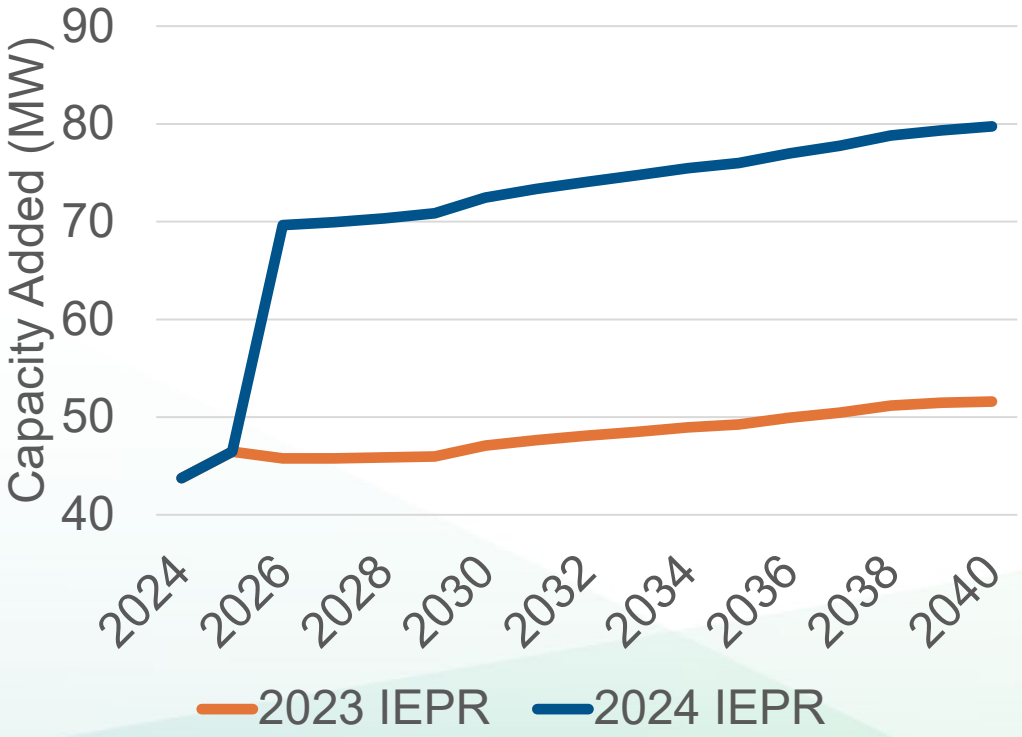
Title 24 PV Forecast Comparison

Residential Forecast



Source: CEC Staff

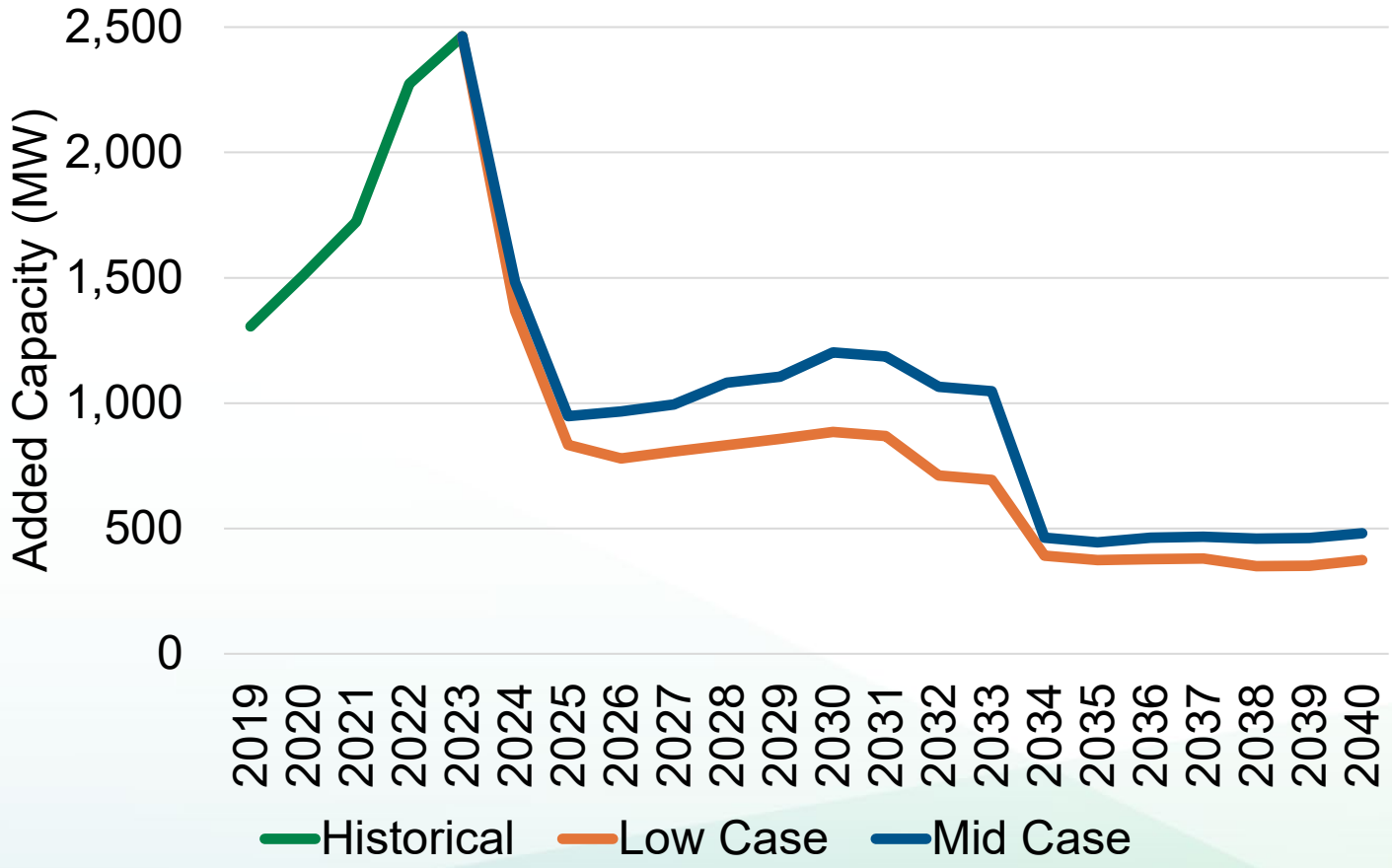
Nonresidential Forecast



Source: CEC Staff

Statewide PV Additions by Case

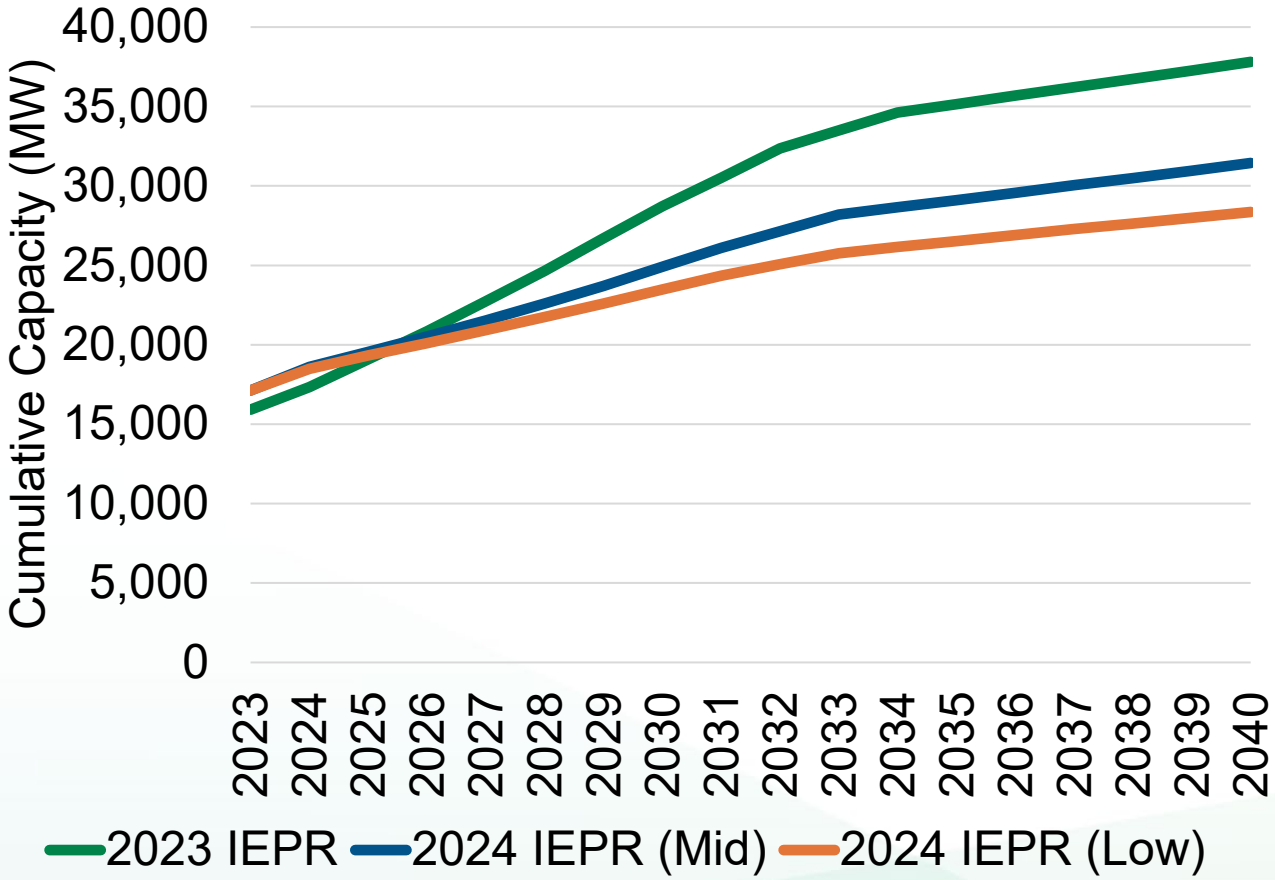
- Lower PV costs lead to higher adoption rates in mid case
- In 2033, mid case additions are 50% greater than in the low case
- Expiration of ITC after 2034 leads to a 50% reduction in PV adoption in both cases



Source: CEC Staff

PV Forecast Update Comparison

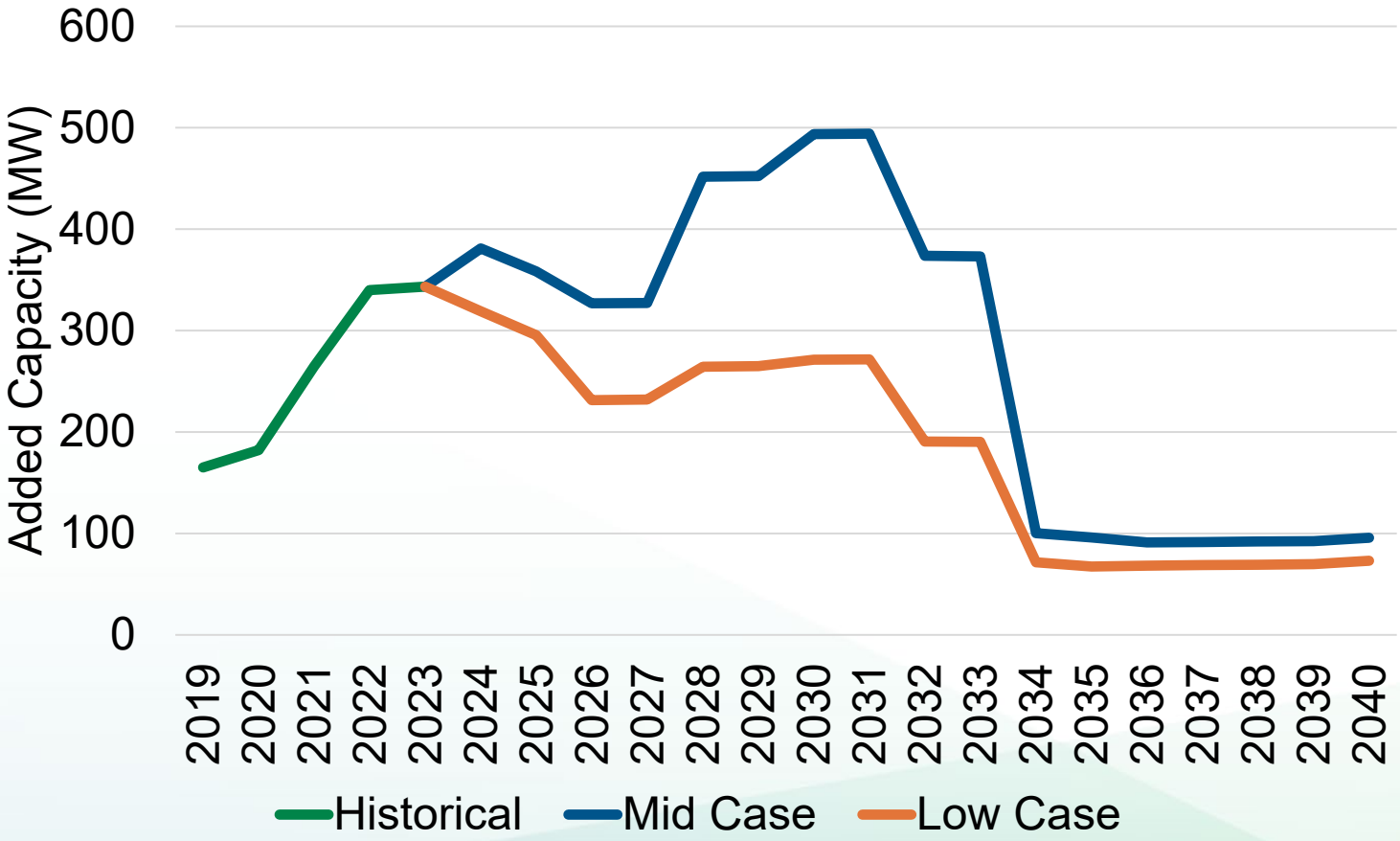
- Lower PV adoption in 2024 IEPR forecasts driven by changes in methodology and inputs:
  - Higher technology cost inputs
  - Single-family home renters modeled as unable to adopt
- In 2040:
  - Mid case is 17%, or 6,400 MW, lower than 2023 forecast
  - Low case is 25%, or 9,500 MW, lower than 2023 forecast



Source: CEC Staff

Statewide Storage Additions by Case

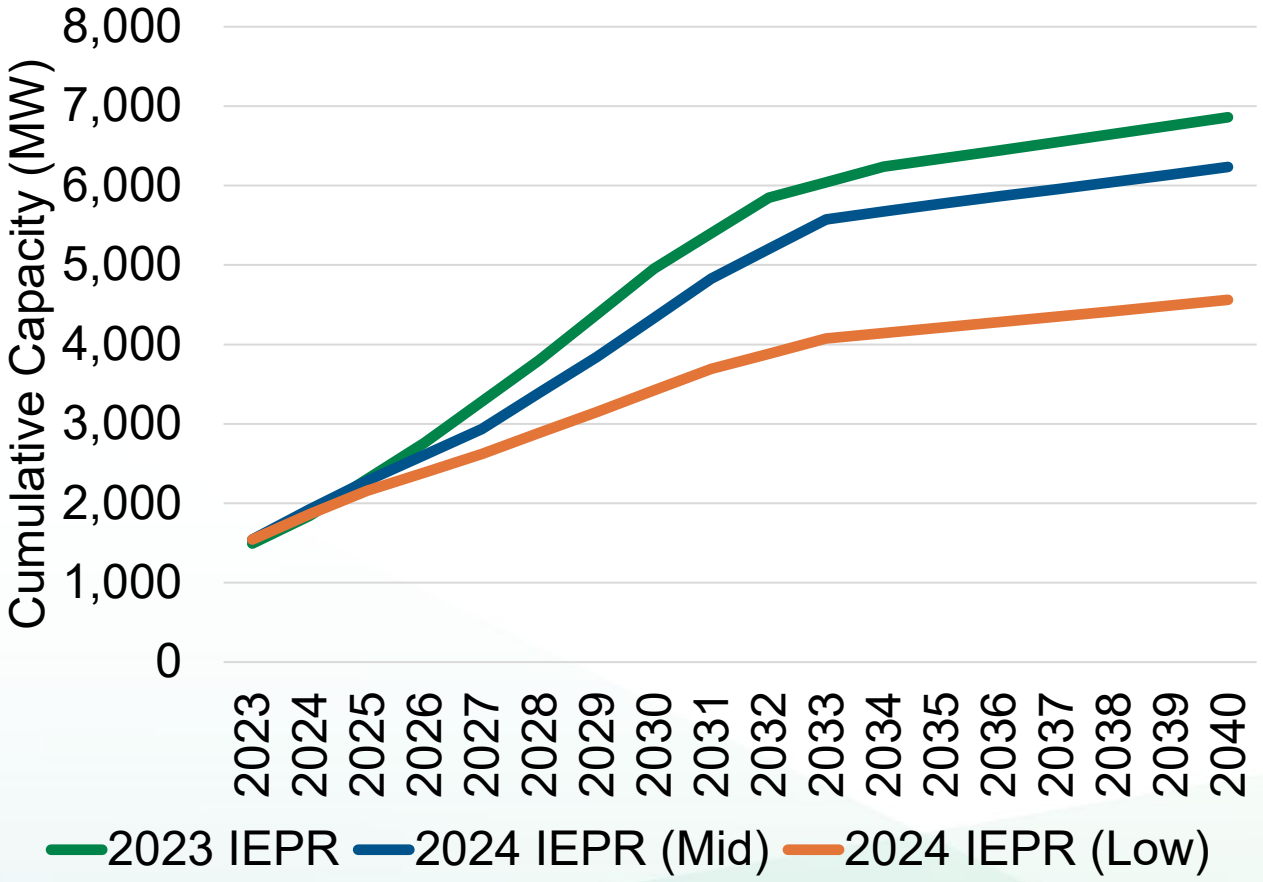
- Like PV, lower storage costs lead to higher adoption in mid case
- In 2033, mid case additions are 95% greater than in the low case
- Expiration of ITC after 2034 leads to an over 50% reduction in PV adoption in both cases



Source: CEC Staff

Storage Forecast Update Comparison

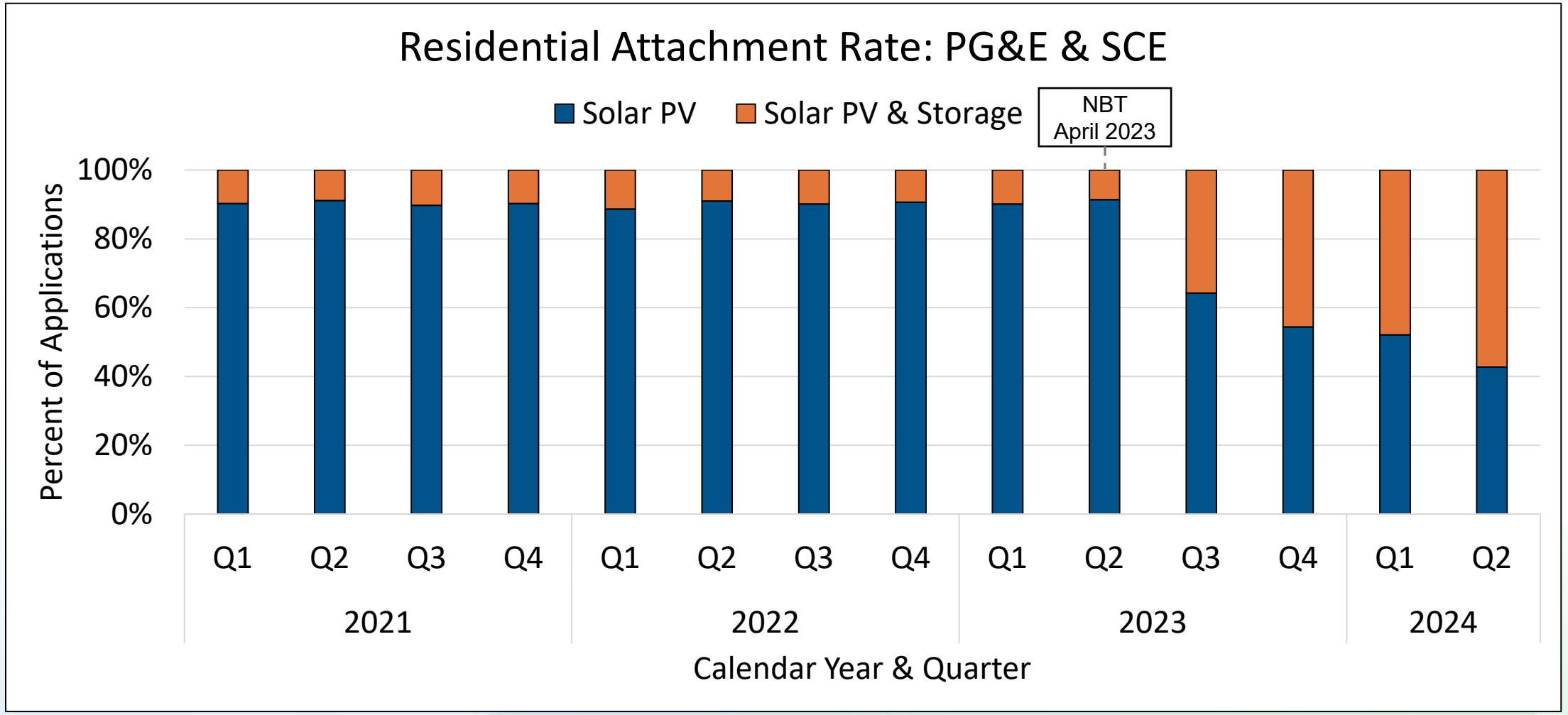
- Lower storage adoption in 2024 IEPR forecasts driven by changes in methodology and inputs:
  - Higher technology cost inputs
  - Single-family home renters modeled as unable to adopt
- In 2040:
  - Mid case is 9%, or 630 MW, lower than 2023 forecast
  - Low case is 34%, or 2,300 MW, lower than the 2023 forecast



Source: CEC Staff

Historical Solar Attachment Rates

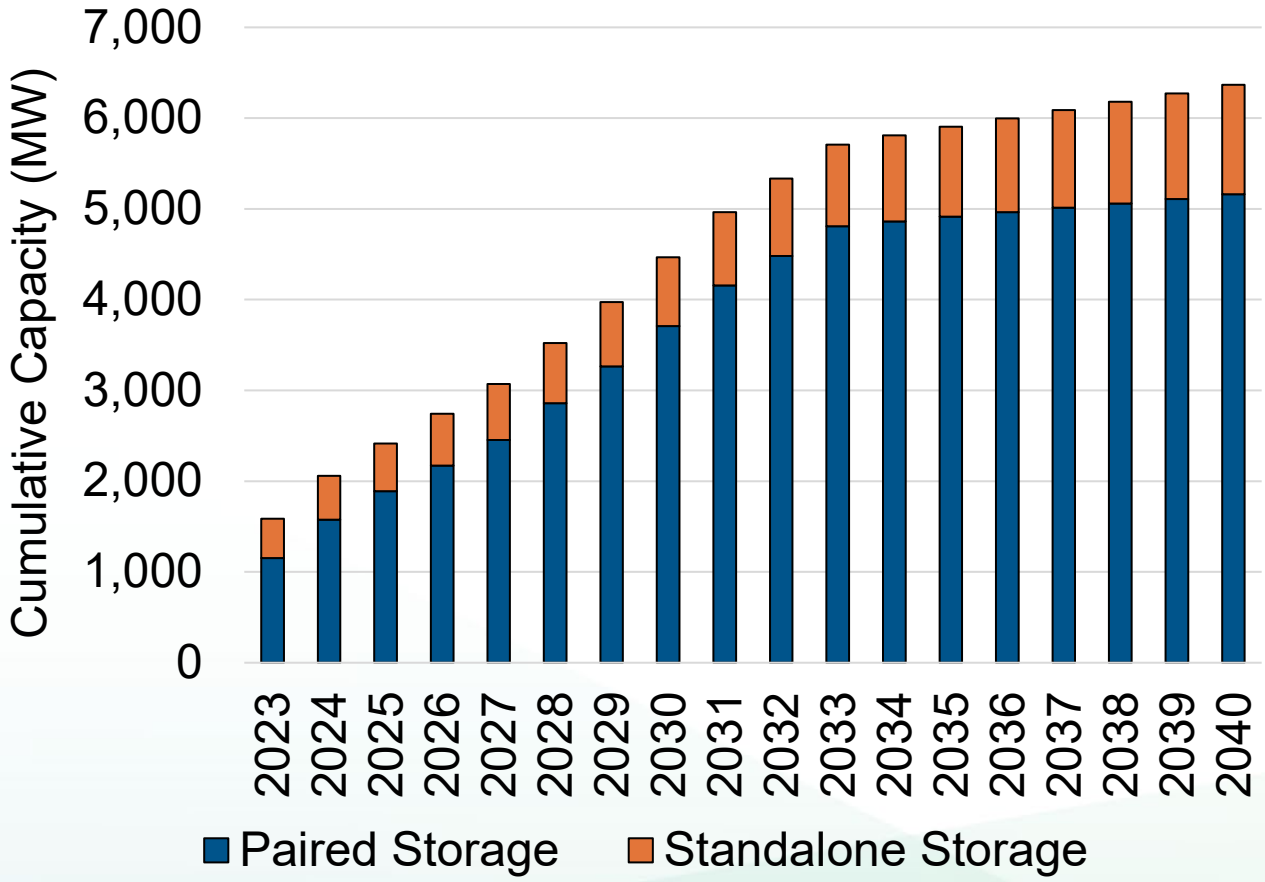
Includes NEM and NBT systems



Source: CEC Staff

Mid Case Storage Forecast by Configuration

- Over 70% of storage installations are currently paired with a PV system
- 16% of storage capacity added between 2024 and 2040 is standalone
- Standalone storage is forecast to have increased growth until ITC expires after 2034



Source: CEC Staff

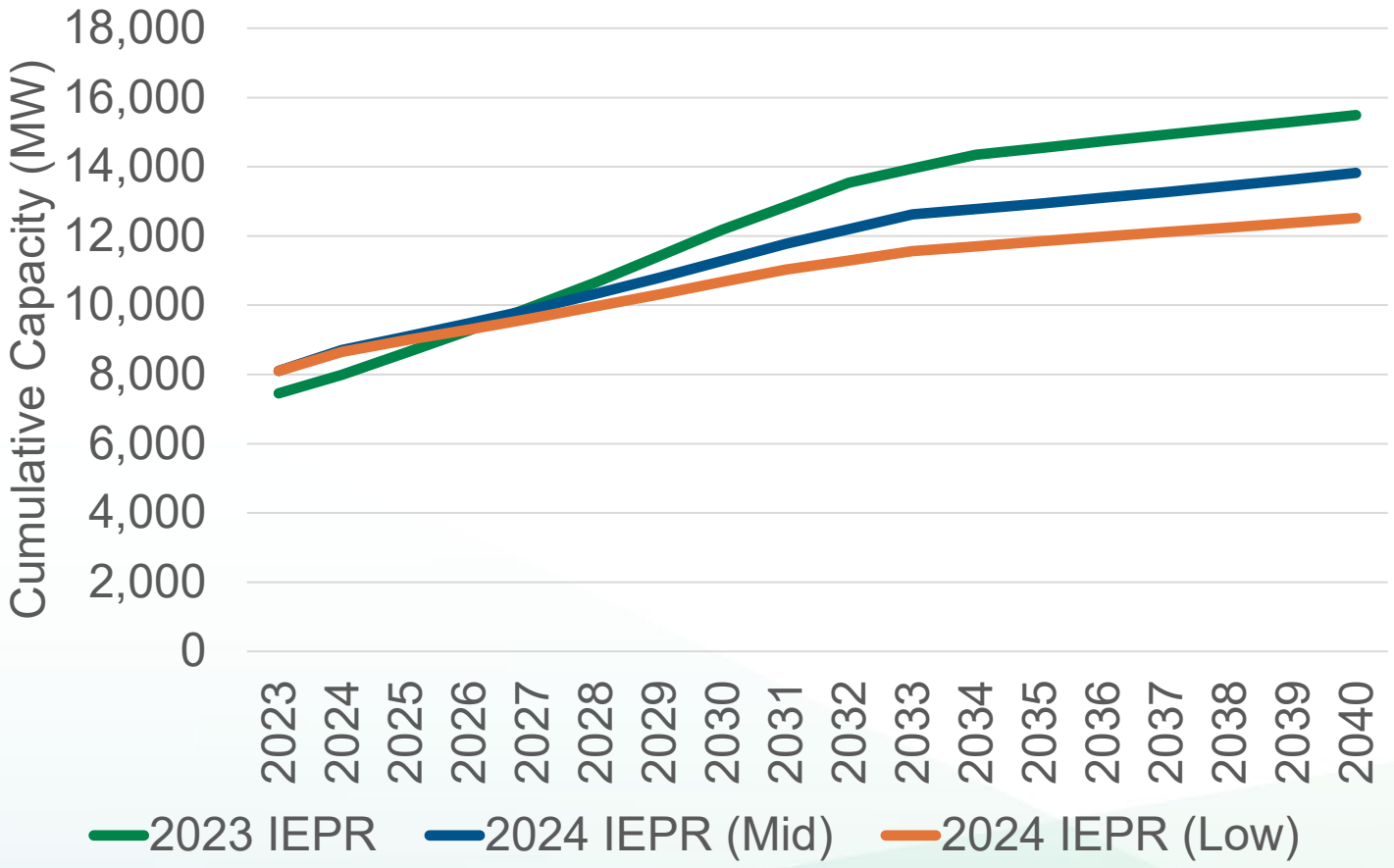
Thank You!

Supplemental Slides

PV Forecast Comparison: PG&E Planning Area

- In 2040:
  - Mid case is 11%, or 1,700 MW, lower than the 2023 forecast
  - Low case is 19%, or 3,000 MW, lower than the 2023 forecast

	Capacity (MW)		
Year	2023 IEPR	2024 IEPR (Mid)	2024 IEPR (Low)
2023	7,454	8,103	8,103
2025	8,625	9,091	8,985
2030	12,182	11,283	10,670
2035	14,540	12,929	11,840
2040	15,492	13,823	12,518

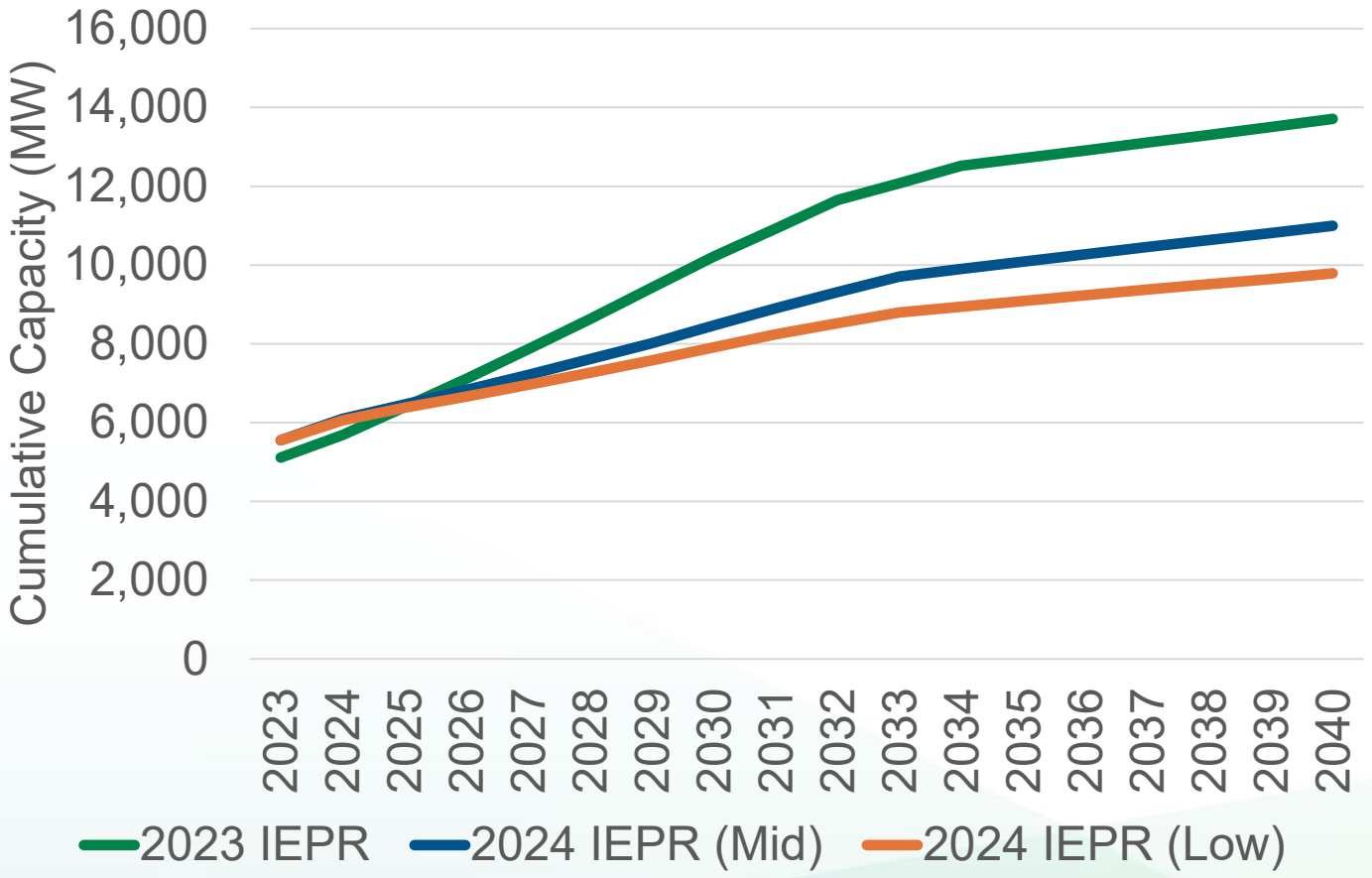


Source: CEC Staff

PV Forecast Comparison: SCE Planning Area

- In 2040:
  - Mid case is 20%, or 2,700 MW, lower than the 2023 forecast
  - Low case is 28%, or 3,900 MW, lower than the 2023 forecast

	Capacity (MW)		
Year	2023 IEPR	2024 IEPR (Mid)	2024 IEPR (Low)
2023	5,112	5,552	5,552
2025	6,397	6,462	6,376
2030	10,212	8,464	7,914
2035	12,713	10,088	9,088
2040	13,710	10,996	9,789

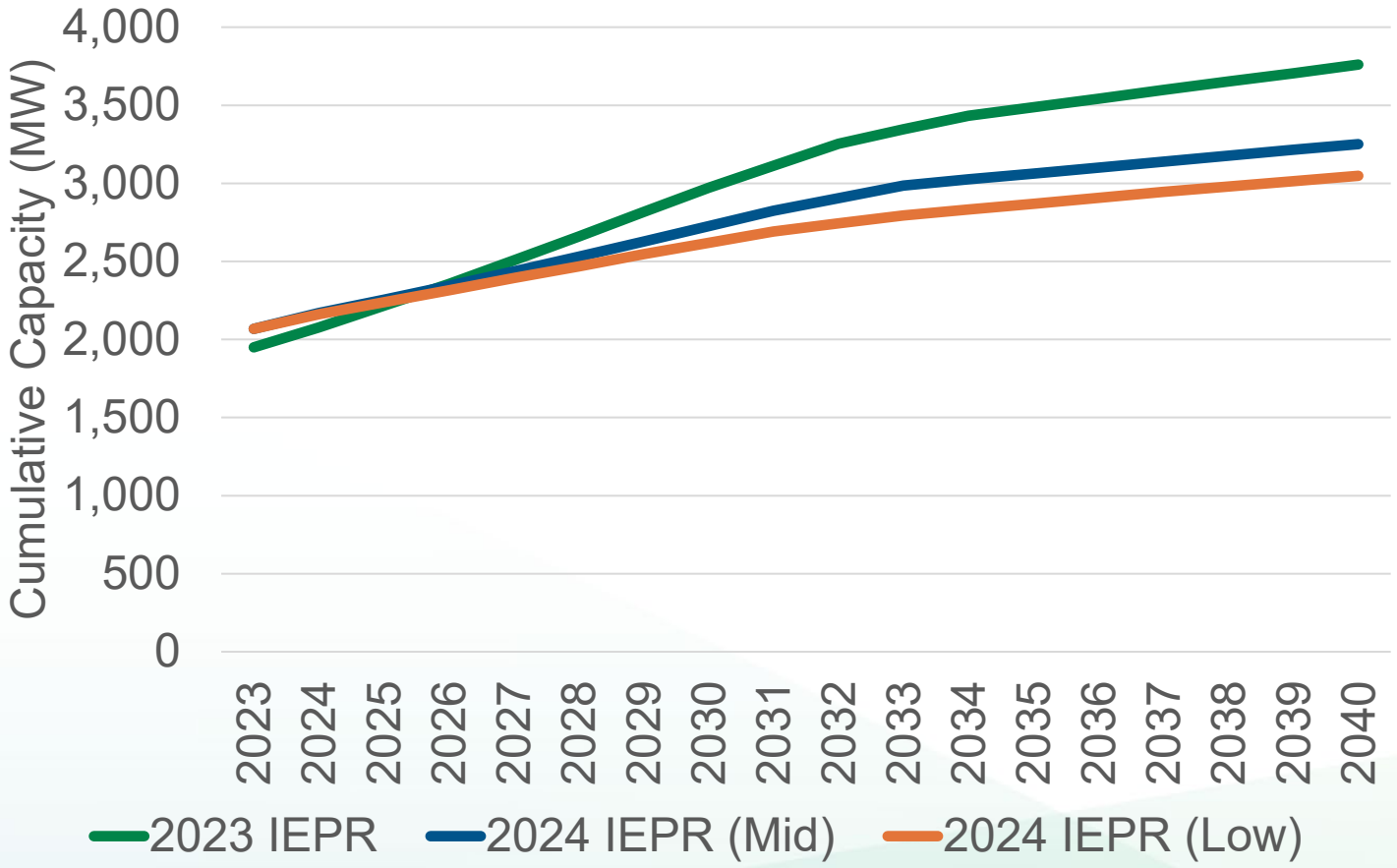


Source: CEC Staff

PV Forecast Comparison: SDG&E Planning Area

- In 2040:
  - Mid case is 14%, or 510 MW, lower than the 2023 forecast
  - Low case is 19%, or 710 MW, lower than the 2023 forecast

	Capacity (MW)		
Year	2023 IEPR	2024 IEPR (Mid)	2024 IEPR (Low)
2023	1,950	2,068	2,068
2025	2,217	2,255	2,238
2030	2,972	2,726	2,619
2035	3,487	3,062	2,869
2040	3,760	3,251	3,048

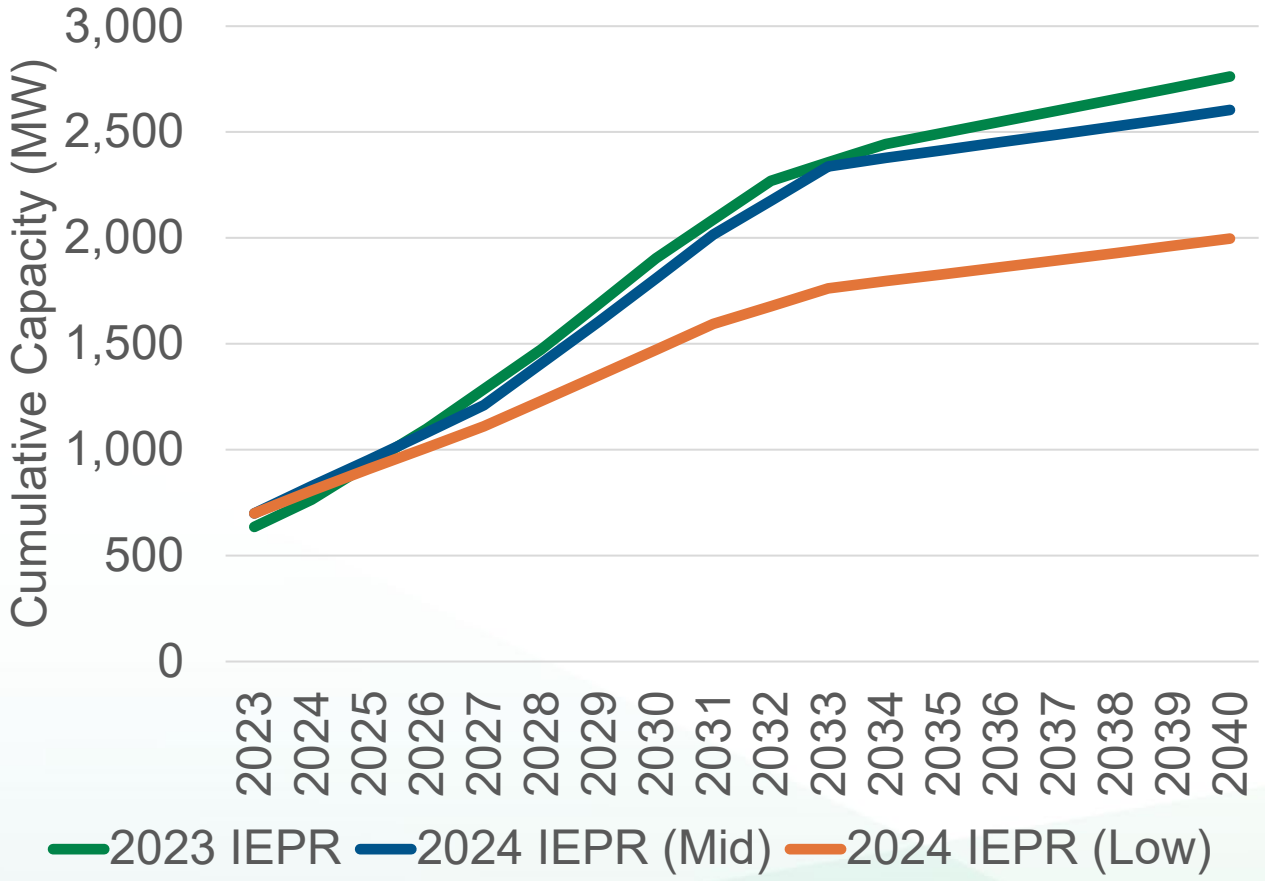


Source: CEC Staff

Storage Forecast Comparison: PG&E Planning Area

- In 2040:
  - Mid case is 6%, or 160 MW, lower than the 2023 forecast
  - Low case is 28%, or 770 MW, lower than the 2023 forecast

	Capacity (MW)		
Year	2023 IEPR	2024 IEPR (Mid)	2024 IEPR (Low)
2023	636	699	699
2025	932	951	910
2030	1,903	1,809	1,472
2035	2,496	2,415	1,829
2040	2,762	2,604	1,997

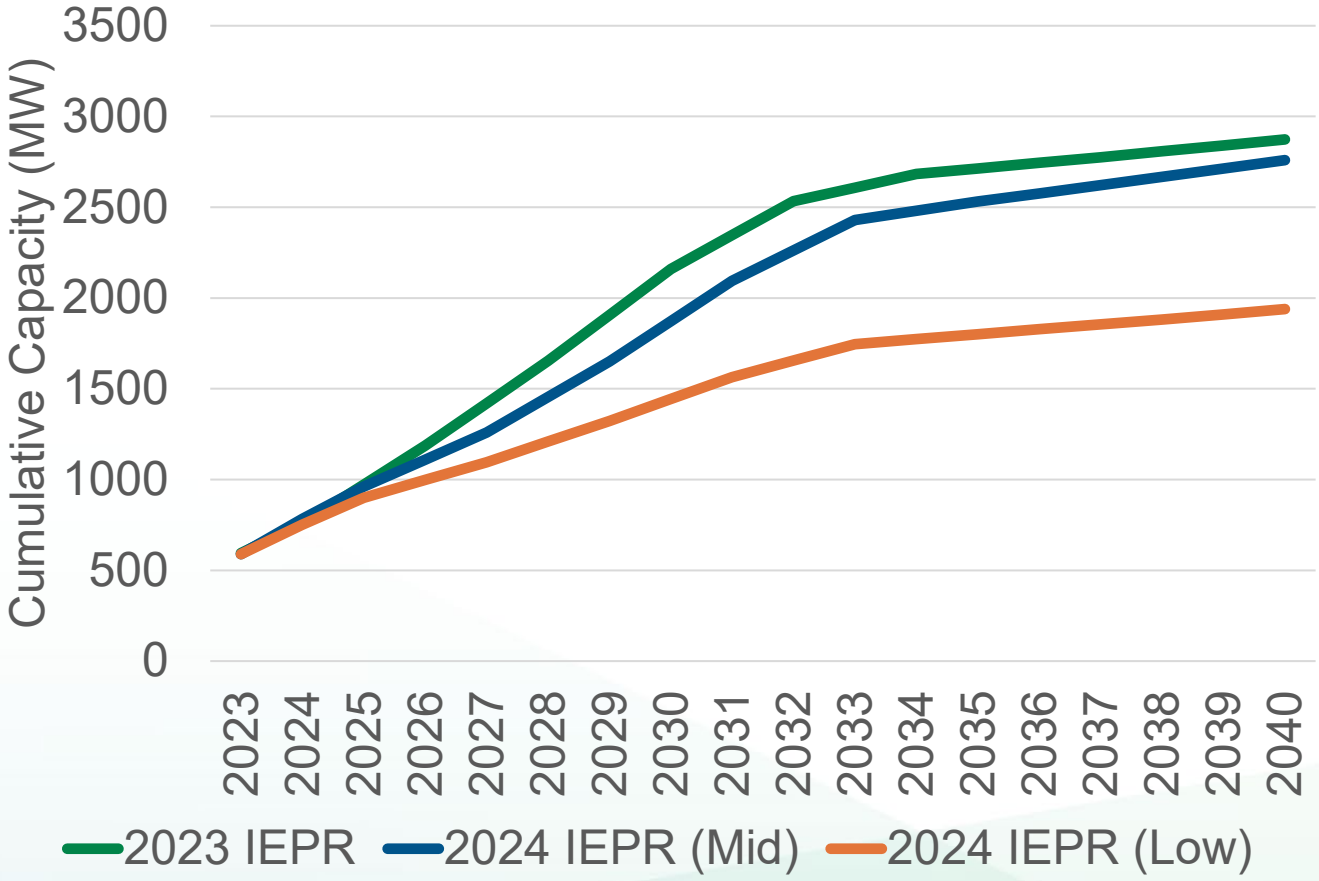


Source: CEC Staff

Storage Forecast Comparison: SCE Planning Area

- In 2040:
  - Mid case is 4%, or 110 MW, lower than the 2023 forecast
  - Low case is 33%, or 940 MW, lower than the 2023 forecast

	Capacity (MW)		
Year	2023 IEPR	2024 IEPR (Mid)	2024 IEPR (Low)
2023	595	589	589
2025	972	961	899
2030	2,161	1,873	1,444
2035	2,713	2,531	1,801
2040	2,874	2,760	1,939

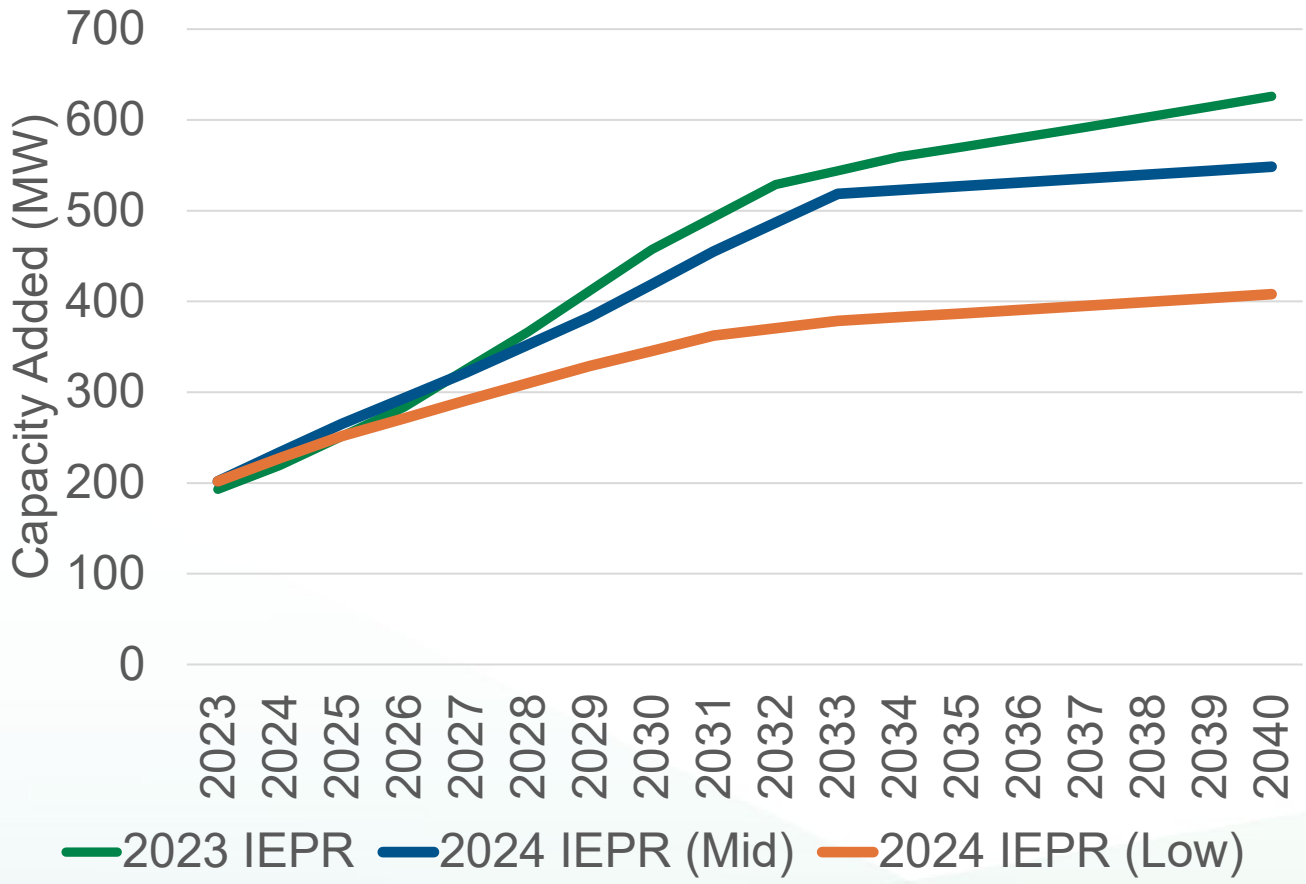


Source: CEC Staff

Storage Forecast Comparison: SDG&E Planning Area

- In 2040:
  - Mid case is 12%, or 80 MW, lower than the 2023 forecast
  - Low case is 35%, or 220 MW, lower than the 2023 forecast

	Capacity (MW)		
Year	2023 IEPR	2024 IEPR (Mid)	2024 IEPR (Low)
2023	193	202	202
2025	251	265	252
2030	457	419	345
2035	570	527	387
2040	626	548	408



Source: CEC Staff