# 2019 Preliminary Behind-the-Meter PV Forecast

**Sudhakar Konala**

Demand Analysis Office

Energy Assessments Division

Sudhakar.Konala@energy.ca.gov

# Scenario Definitions

## ❑ High = High Electricity Demand Case

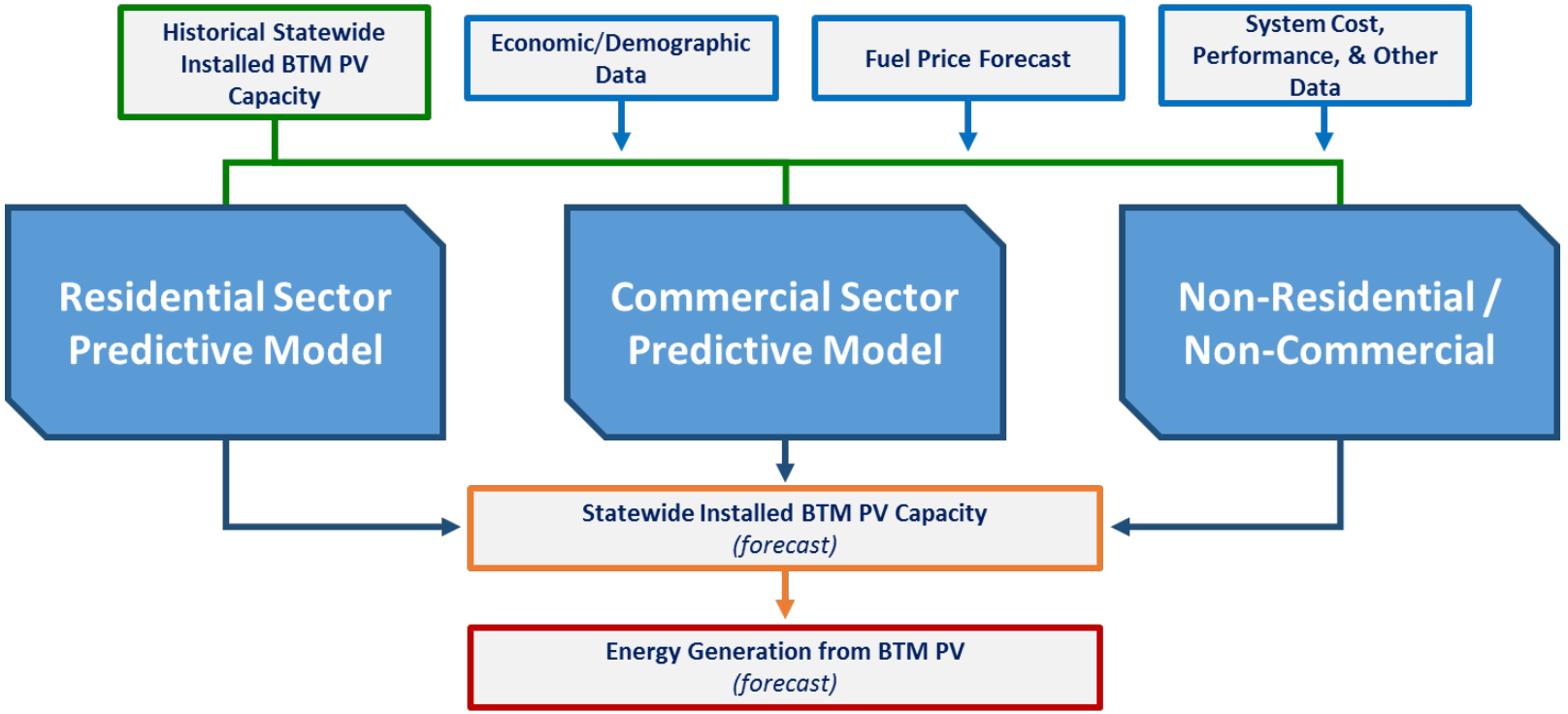
- High economic / demographic growth → high growth in building stock
- Low electricity rates
- Low PV adoption

## ❑ Low = Low Electricity Demand Case

- Low economic / demographic growth → low growth in building stock
- High electricity rates
- High PV adoption

## ❑ Mid = Mid Electricity Demand Case

# Energy Commission PV Model




- Residential and commercial models predict PV penetration based on calculated payback / bill savings.

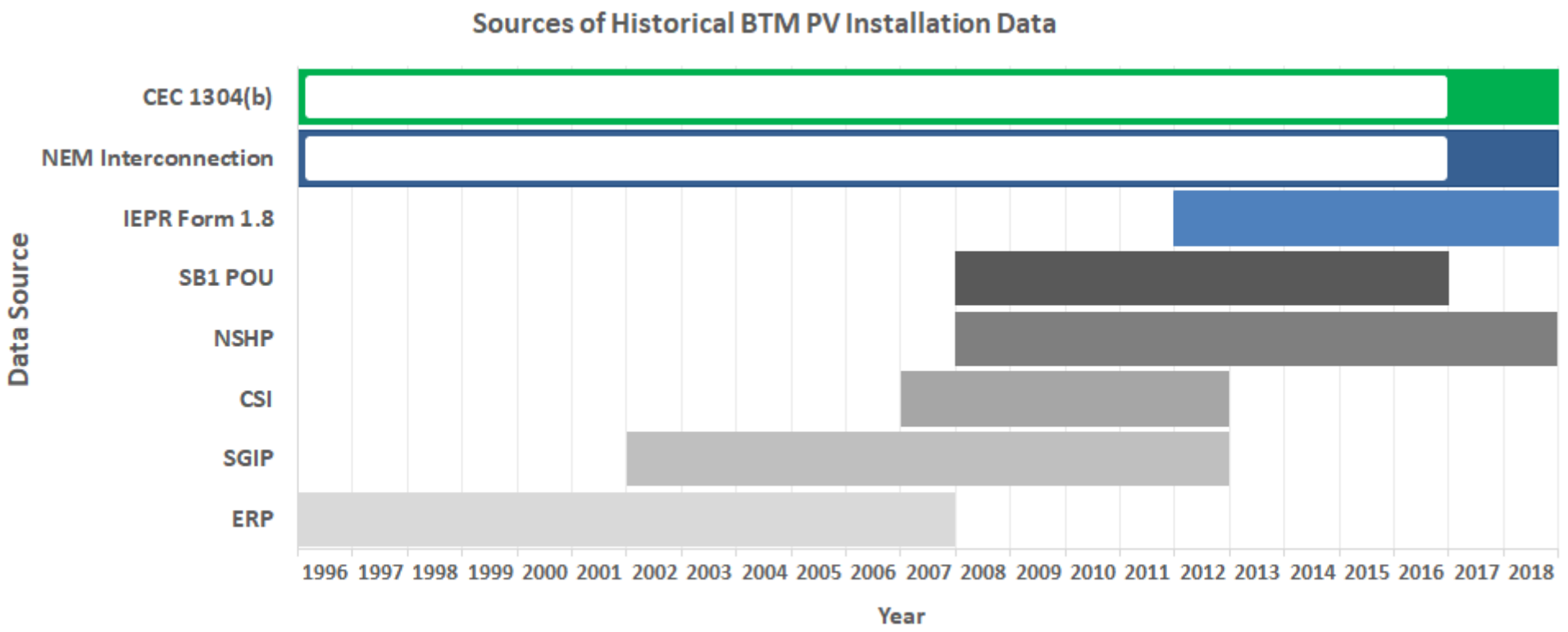
# AAPV Incorporated in Baseline PV Forecast

- Additional achievable photovoltaic (AAPV)
  - Accounted for PV requirements for new homes (2019 Title 24 standards)
  - Baseline forecast: a certain percentage of new homes adopt PV systems
  - AAPV = difference between PV adoptions for new homes due to 2019 Title 24 regulations vs. new home PV adoptions already in baseline forecast
- In 2019, AAPV was incorporated into baseline PV forecast
  - Forecast of PV adoption for new homes now based on regulatory compliance
- AAPV assumptions same as 2017 & 2018 AAPV Forecasts
  - Expected level of compliance (Low = 90%, Mid = 80%, High = 70%)
  - Average PV system size for new homes
- In this presentation, I will restate 2017 & 2018 PV forecasts to include AAPV
  - An “apples” to “apples” comparison

# Updated Inputs for 2019 PV Forecast

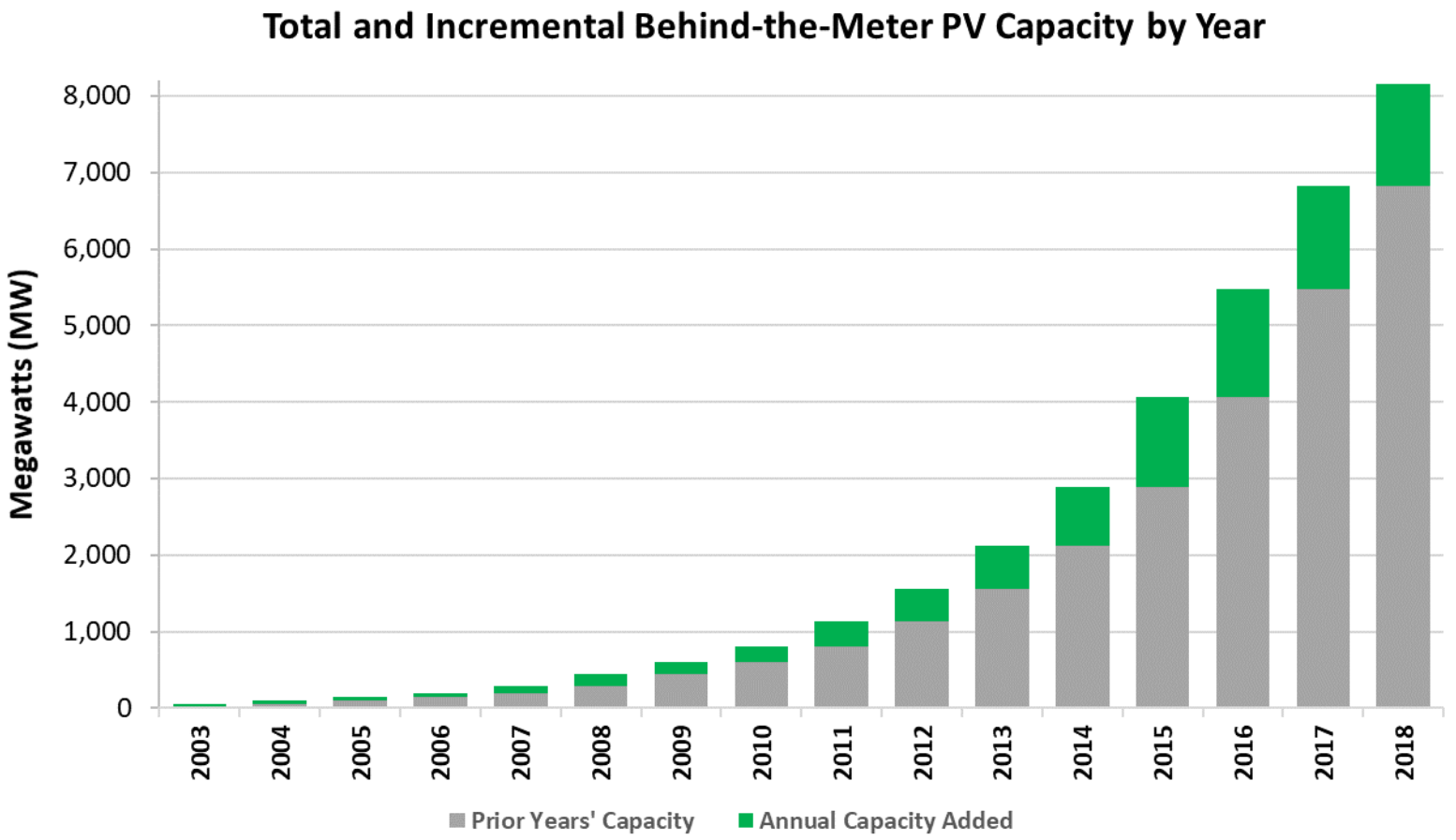
- PV interconnection data
- Demographic / economic data
- Electricity rates / schedules
- PV system installation costs

# Solar PV Interconnection Data




**Sources:** CEC 1304(b) Interconnection Dataset, Net Energy Meeting (NEM) Currently Interconnected Dataset, CEC IEPR Form 1.8, SB1 POU, New Solar Homes Partnership (NSHP), California Solar Initiative (CSI), Self-Generation Incentive Program (SGIP), Emerging Renewables Program (ERP). www.californiadgstats.ca.gov/downloads/

# Historical Statewide PV Installations



# PV Installation Data by Utility

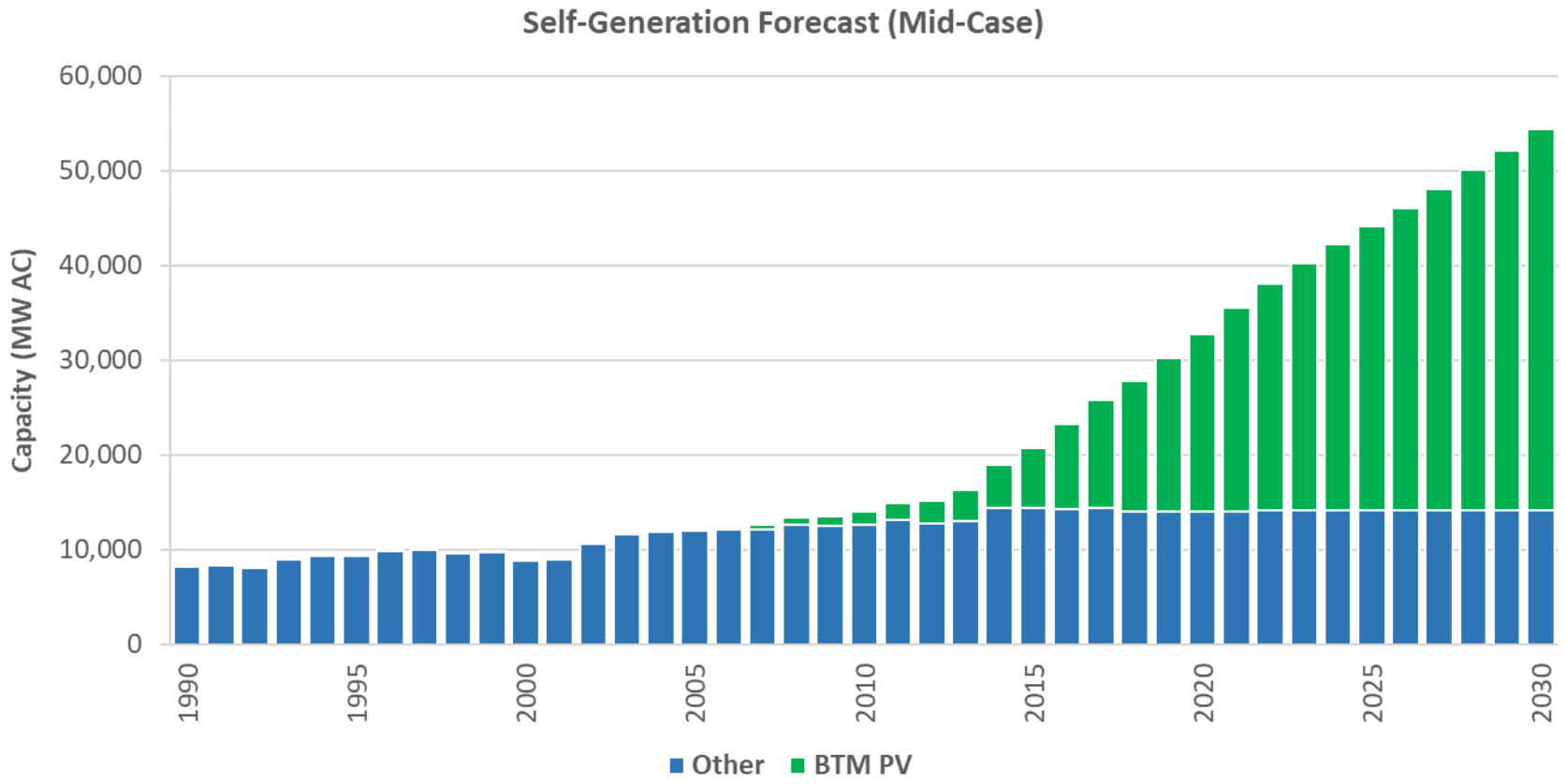

| Utility | Historical PV Data Through… CEDU 2018 | CED 2019 | Capacity (MW) |
|---|---|---|---|
| PG&E | Dec 2017 | Dec 2018 | 3,784 |
| SCE | Dec 2017 | Dec 2018 | 2,496 |
| SDGE | Dec 2017 | Dec 2018 | 1,015 |
| LADWP | Dec 2016 | Dec 2018 | 283 |
| SMUD | Dec 2017 | Dec 2018 | 191 |
| | | | |
| Imperial Irrigation District | Dec 2016 | Dec 2018 | 65.0 |
| Modesto Irrigation District | Dec 2016 | Dec 2018 | 42.7 |
| Turlock Irrigation District | Dec 2016 | Dec 2018 | 37.9 |
| Anaheim, City of | Dec 2016 | Dec 2018 | 30.4 |
| Riverside, City of | Dec 2016 | Dec 2018 | 27.1 |
| Roseville Electric | Dec 2016 | Dec 2018 | 19.5 |
| Glendale Water and Power | Dec 2016 | Dec 2018 | 16.2 |
| Silicon Valley Power | Dec 2016 | Dec 2018 | 14.7 |
| Pasadena Water and Power | Dec 2016 | Dec 2018 | 11.2 |
| Palo Alto, City of | Dec 2016 | Dec 2018 | 10.0 |
| Redding, City of | Dec 2016 | Dec 2018 | 8.6 |
| Moreno Valley Electrical Utility | Dec 2016 | Dec 2018 | 8.1 |
| Burbank Water and Power | Dec 2016 | Dec 2018 | 7.5 |
| Merced Irrigation District | Dec 2016 | Dec 2018 | 6.4 |
| Shasta Lake, City of | Dec 2016 | Dec 2018 | 5.7 |
| Colton, City of | Dec 2016 | Dec 2018 | 5.5 |
| Lodi, City of | Dec 2016 | Dec 2018 | 5.3 |
| Utilities (all other) | Dec 2016 | Dec 2016/18 | |

95.5 %

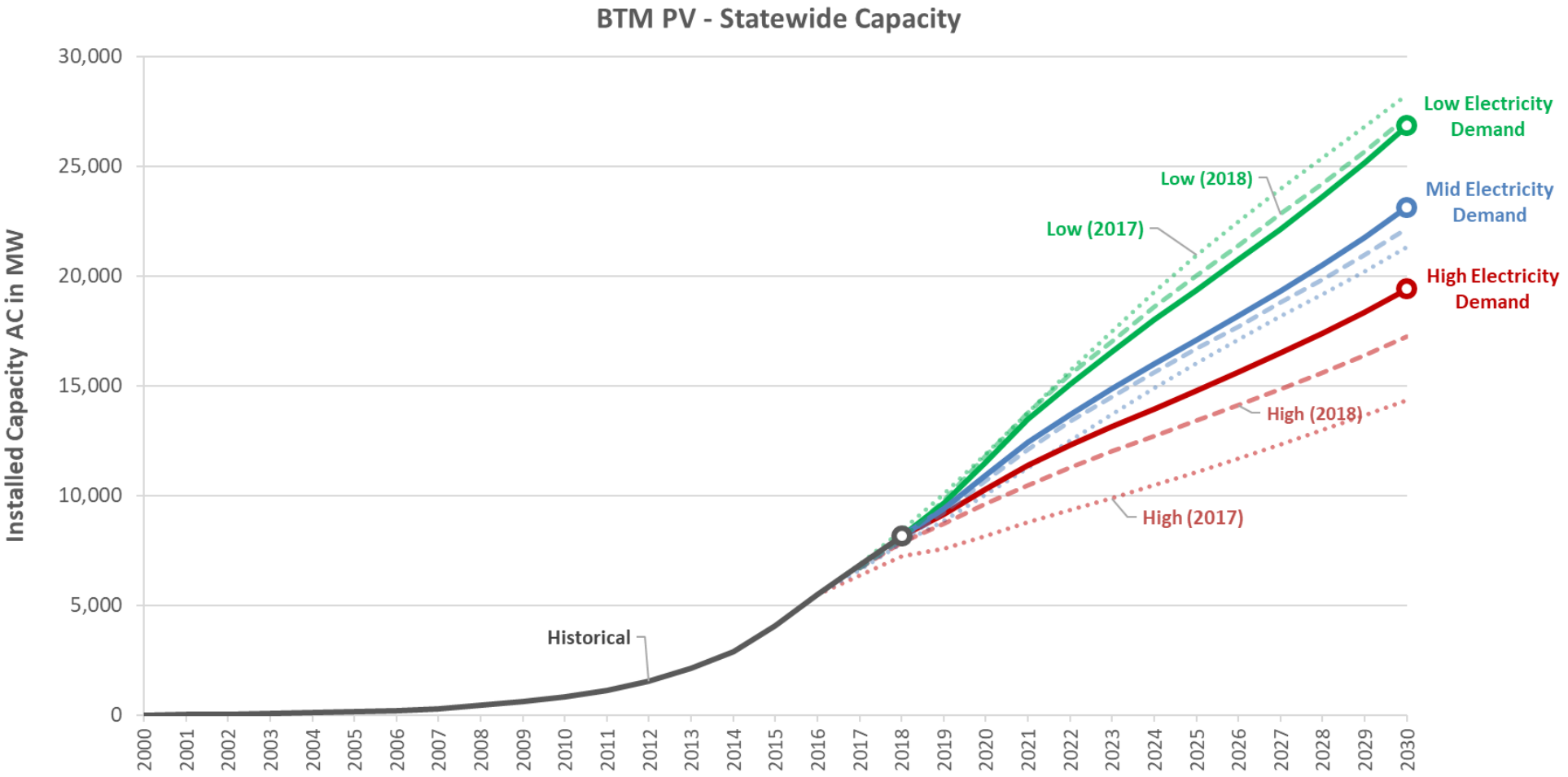
99.5 %

# STATEWIDE FORECAST

# Self-Generation Forecast



# 2019 Preliminary PV Forecast




**NOTE:** For consistency, 2017 and 2018 forecasts are shown with baseline and AAPV forecast results.

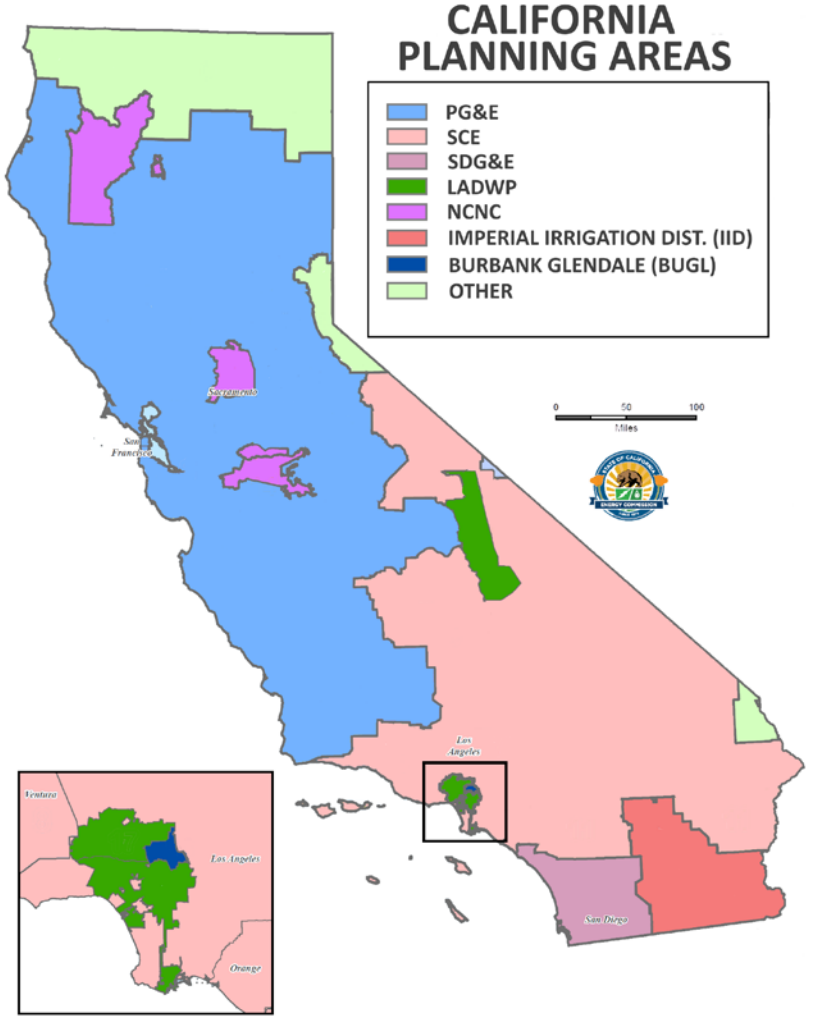
# 2019 Baseline PV Forecast

- Forecast results are shown for 2030

## Capacity (MW)

| Planning Area | High Demand | Mid Demand | Low Demand |
|---|---|---|---|
| PGE | 8,840 | 10,580 | 12,321 |
| SCE | 6,926 | 8,239 | 9,552 |
| SDGE | 2,031 | 2,334 | 2,638 |
| NCNC | 778 | 1,008 | 1,239 |
| LADWP | 552 | 630 | 708 |
| IID | 220 | 263 | 307 |
| BUGL | 49 | 57 | 64 |
| OTHER | 20 | 20 | 20 |
| **Statewide** | 19,415 | 23,132 | 26,849 |
| Δ 2018 IEPR | + 2,171 | - 371 | + 981 |
| Δ 2017 IEPR | + 5,071 | - 1,406 | + 1,833 |

**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.



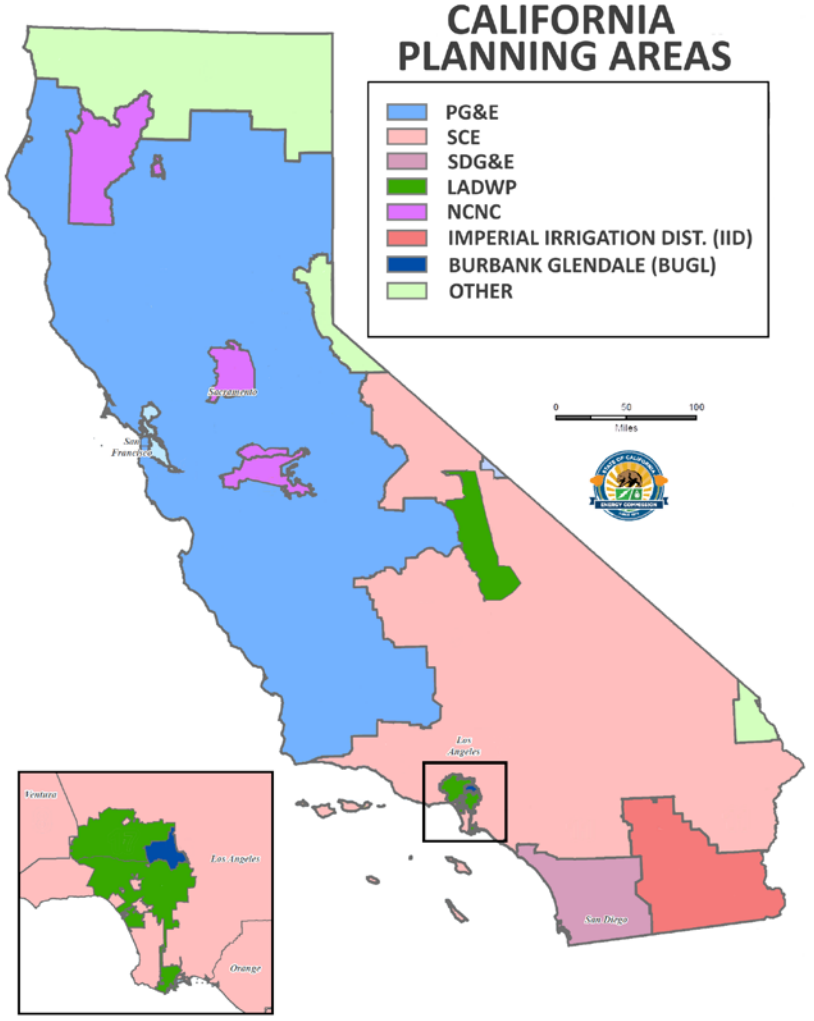
# 2019 Baseline PV Forecast

- Forecast results are shown for 2030

## Energy (GWh)

| Planning Area | High Demand | Mid Demand | Low Demand |
|---|---|---|---|
| PGE | 15,228 | 18,255 | 21,281 |
| SCE | 12,253 | 14,582 | 16,911 |
| SDGE | 3,586 | 4,108 | 4,630 |
| NCNC | 1,328 | 1,727 | 2,126 |
| LADWP | 951 | 1,082 | 1,214 |
| IID | 382 | 456 | 531 |
| BUGL | 84 | 98 | 111 |
| OTHER | 34 | 34 | 34 |
| **Statewide** | 33,847 | 40,342 | 46,837 |
| Δ 2018 IEPR | + 3,750 | - 787 | + 1,620 |
| Δ 2017 IEPR | + 8,853 | - 2,768 | + 3,042 |

**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.



# Contribution of Title 24 Standards

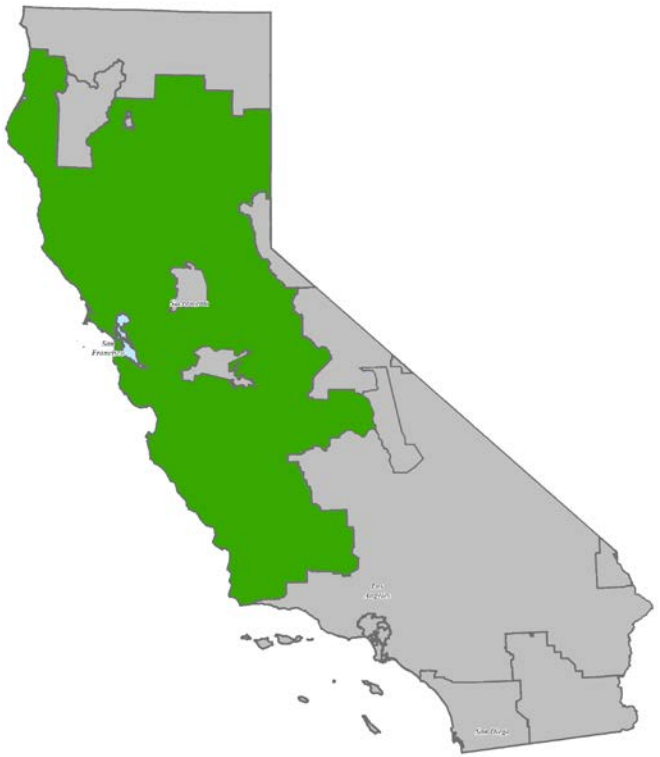
- Contribution of Title 24 building standards to PV adoption in new home construction. (Formerly AAPV forecast)
- Takes effect in 2020.
- Forecast of regulatory compliance.
  - Direct correlation to forecast of new home construction.

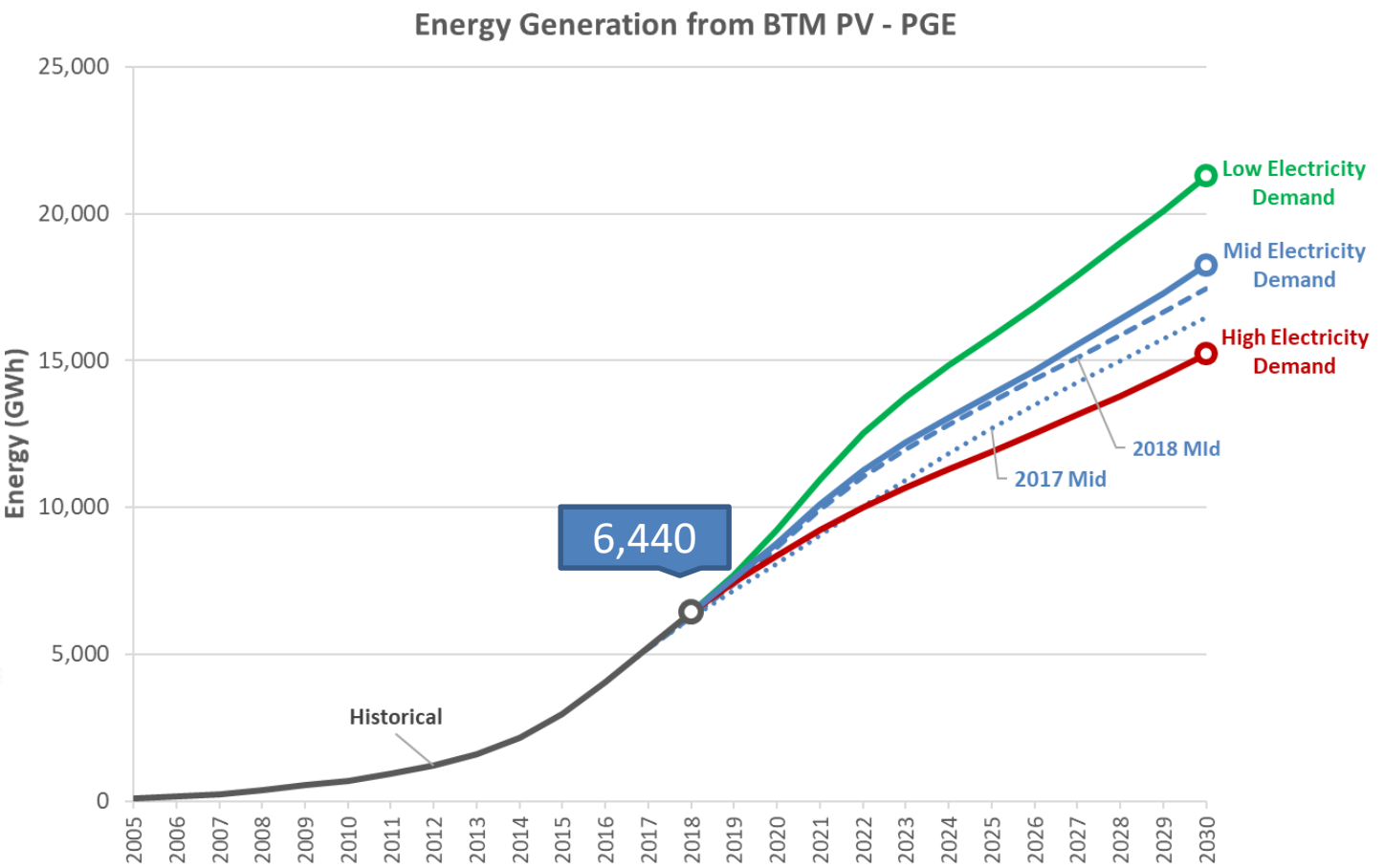
**CAPACITY in MW**

| Scenario | PGE | SCE | SDGE | LADWP | SMUD | OTHER | CED 19 Pre Total | *CEDU 18 Total* |
|---|---|---|---|---|---|---|---|---|
| **High Demand** | 856 | 839 | 144 | 9 | 150 | 137 | 2,135 | *2,290* |
| **Mid Demand** | 770 | 788 | 138 | 10 | 157 | 148 | 2,011 | *1,949* |
| **Low Demand** | 684 | 736 | 132 | 12 | 164 | 158 | 1,887 | *1,607* |

# UTILITY / PLANNING AREA FORECASTS

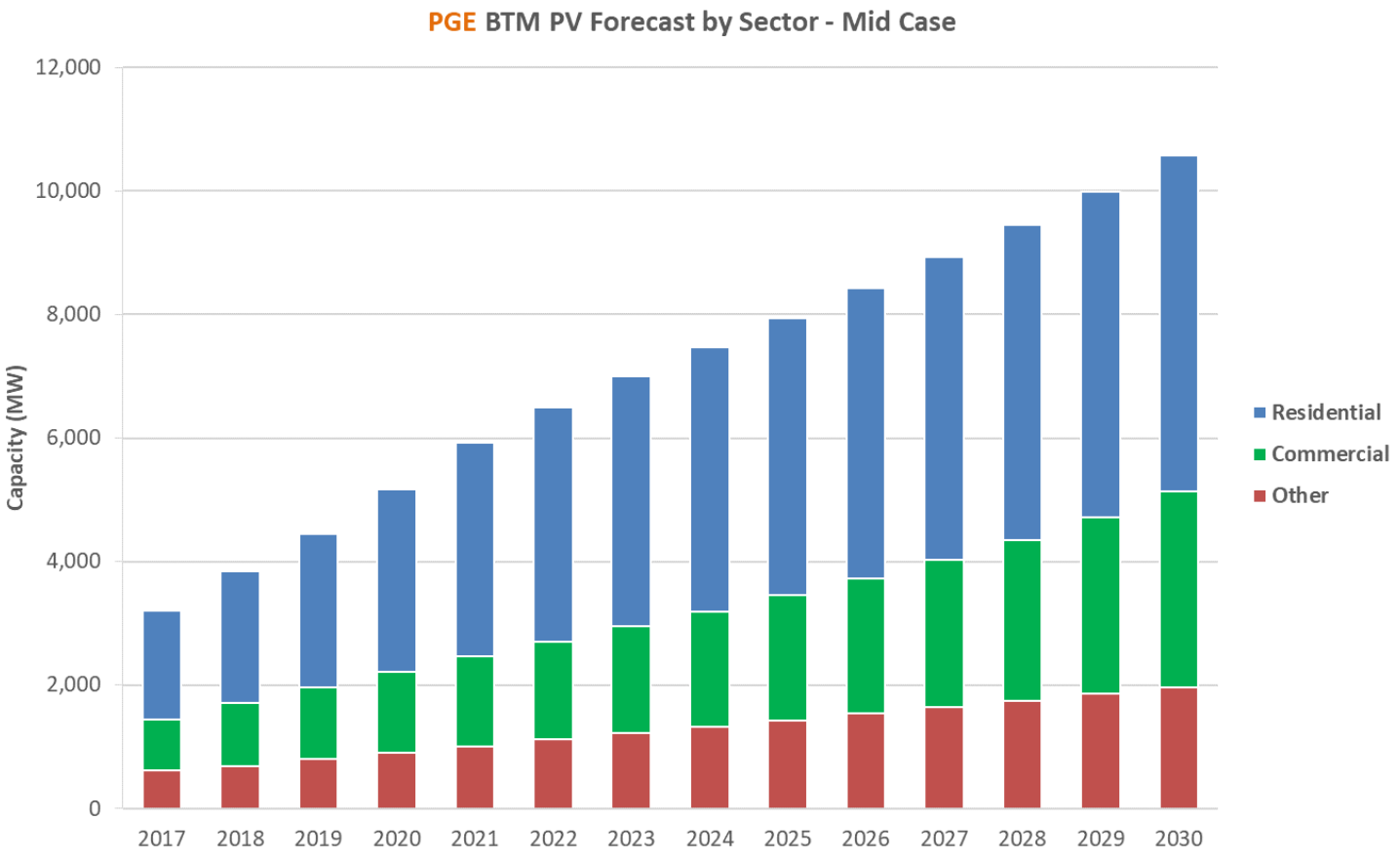
# PGE Baseline Forecast






**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.

# PGE Forecast by Sector



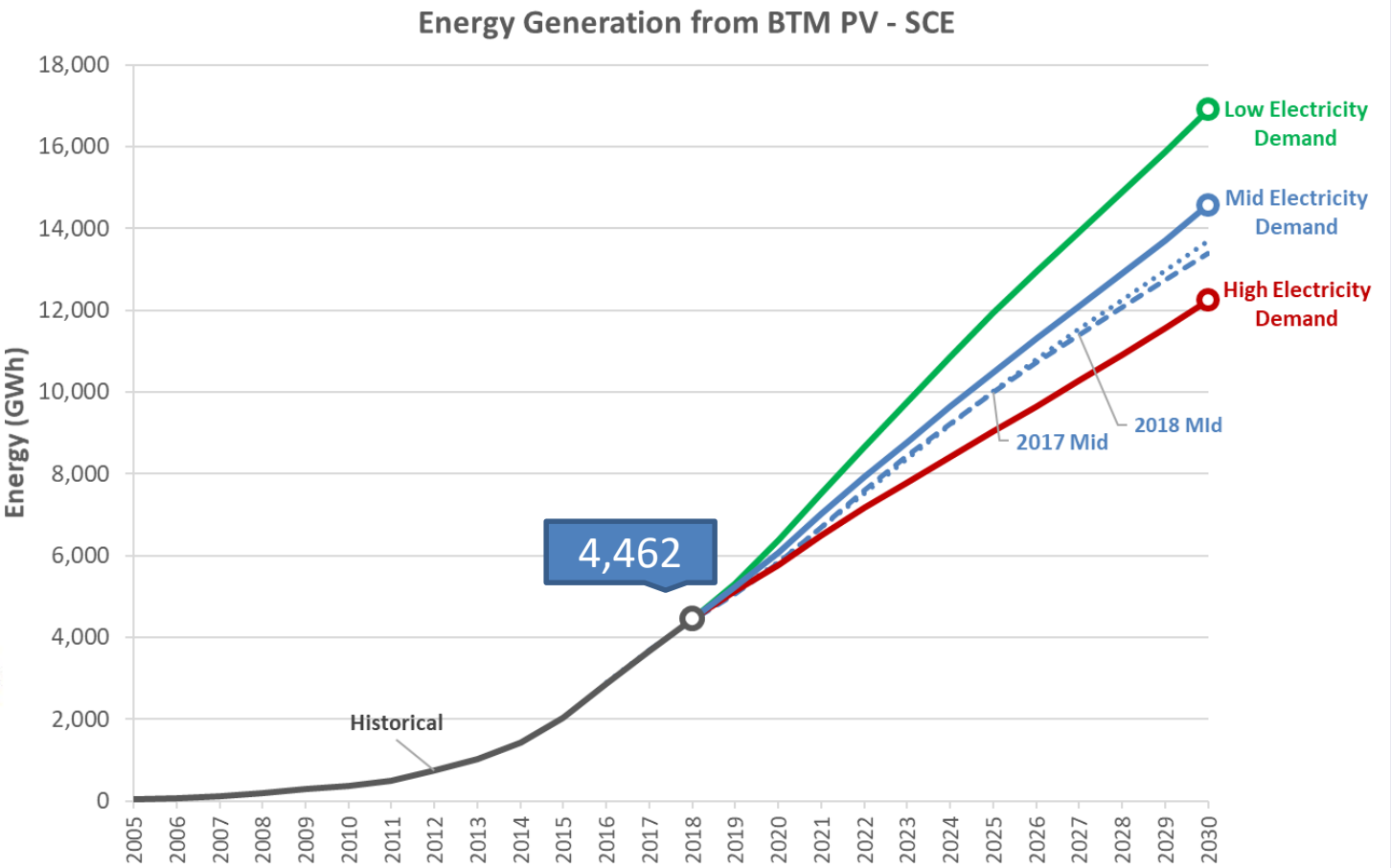

Capacity (MW)

| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 2,125 | 5,437 | 8.1% |
| Commercial | 1,022 | 3,184 | 9.9% |
| Other | 690 | 1,959 | 9.1% |
| Total | 3,837 | 10,580 | 8.8% |

Energy (GWh)

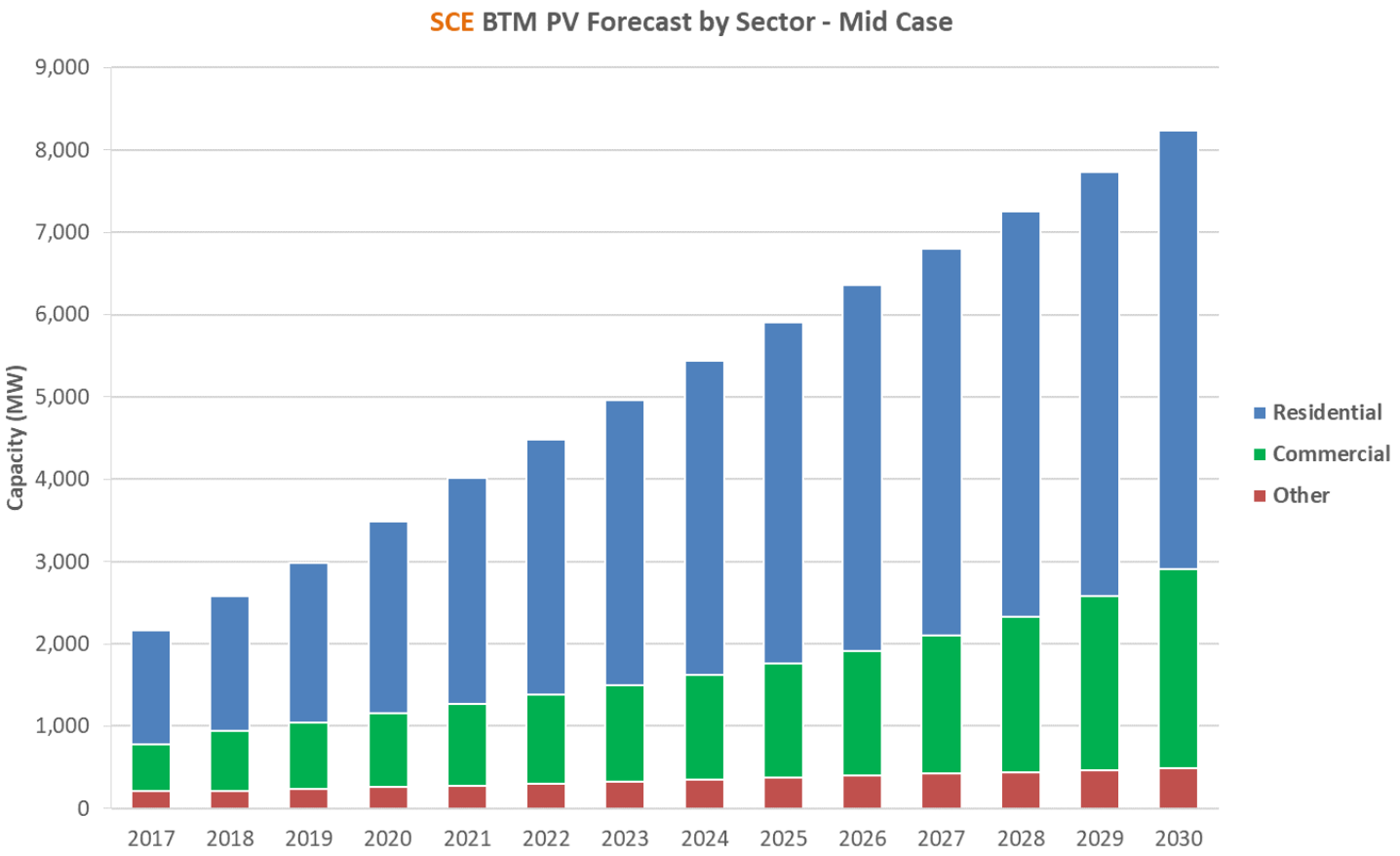
| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 3,562 | 9,451 | 8.5% |
| Commercial | 1,696 | 5,414 | 10.2% |
| Other | 1,182 | 3,389 | 9.2% |
| Total | 6,440 | 18,255 | 9.1% |

# SCE Baseline Forecast




**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.

# SCE Forecast by Sector



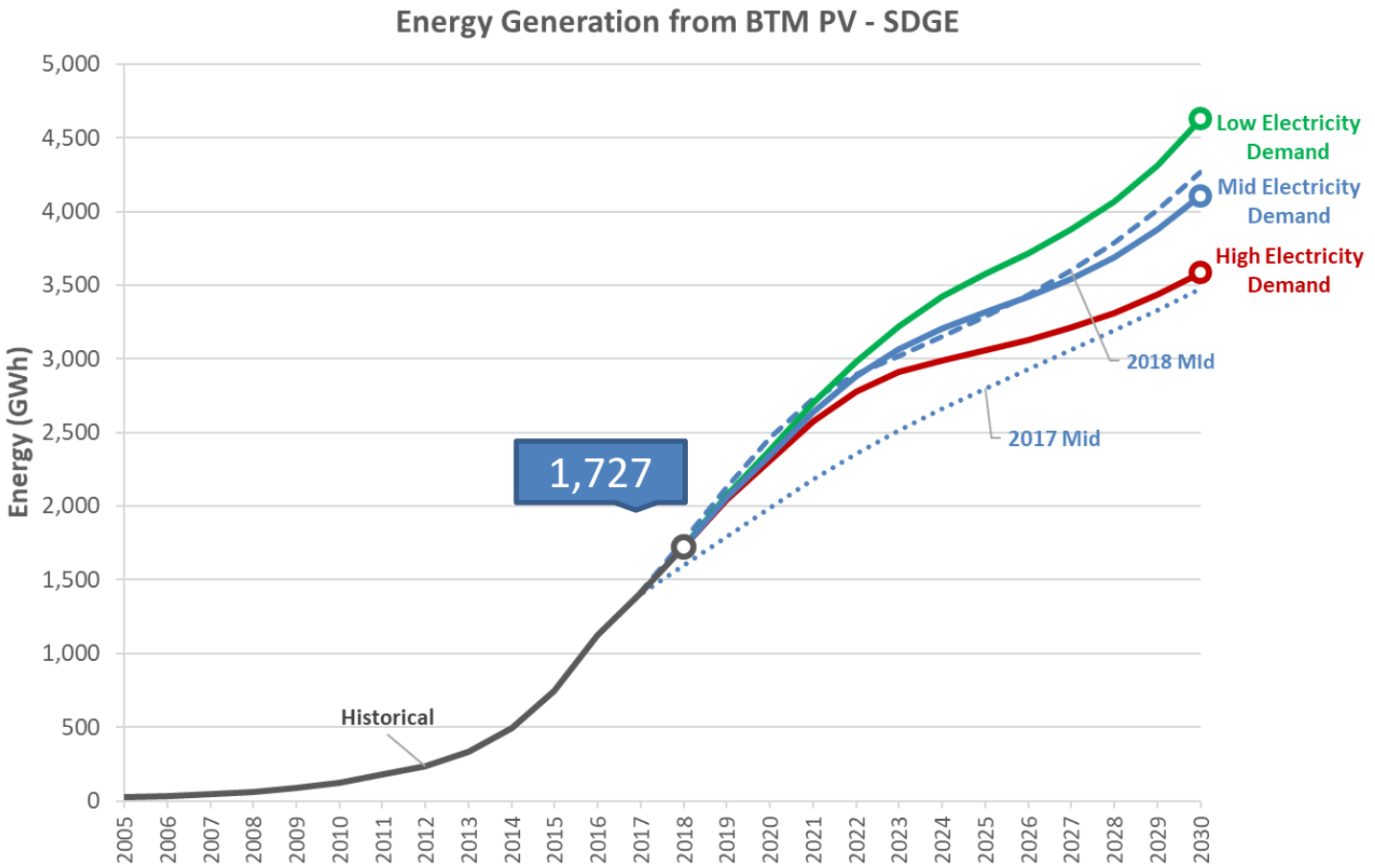

Capacity (MW)

| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 1,648 | 5,333 | 10.3% |
| Commercial | 727 | 2,414 | 10.5% |
| Other | 210 | 493 | 7.4% |
| Total | 2,585 | 8,239 | 10.1% |

Energy (GWh)

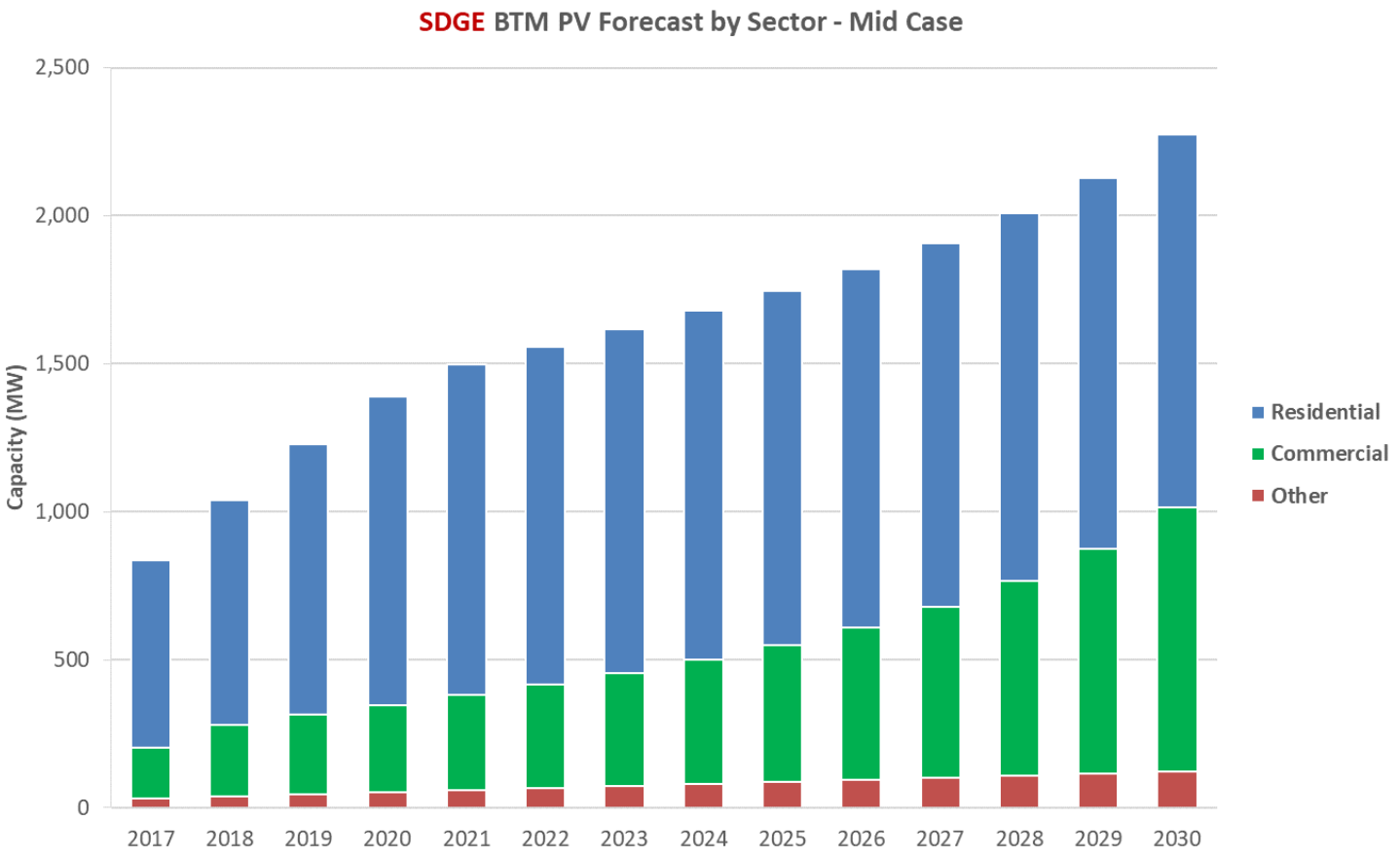
| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 2,855 | 9,540 | 10.6% |
| Commercial | 1,220 | 4,168 | 10.8% |
| Other | 387 | 874 | 7.0% |
| Total | 4,462 | 14,582 | 10.4% |

# SDGE Baseline Forecast




**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.

# SDGE Forecast by Sector



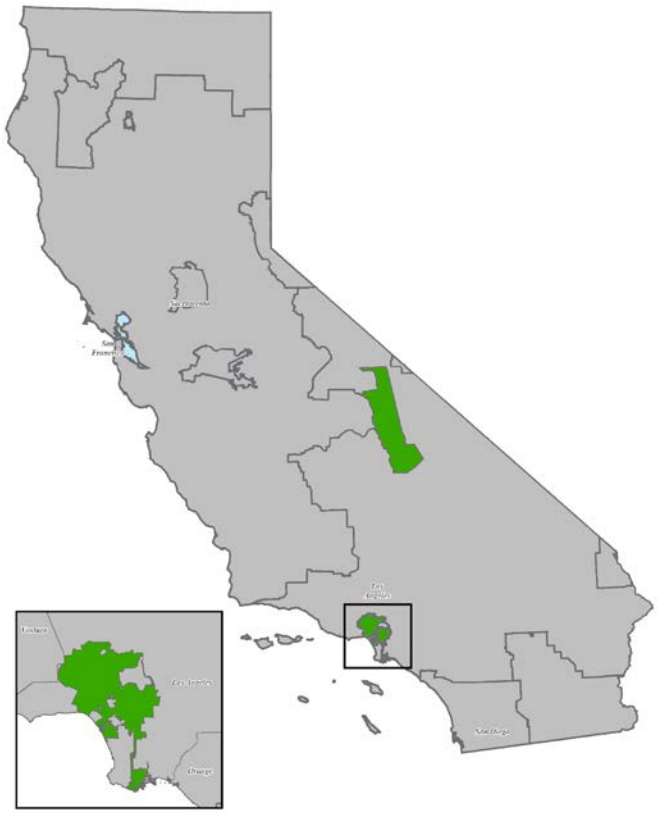

Capacity (MW)

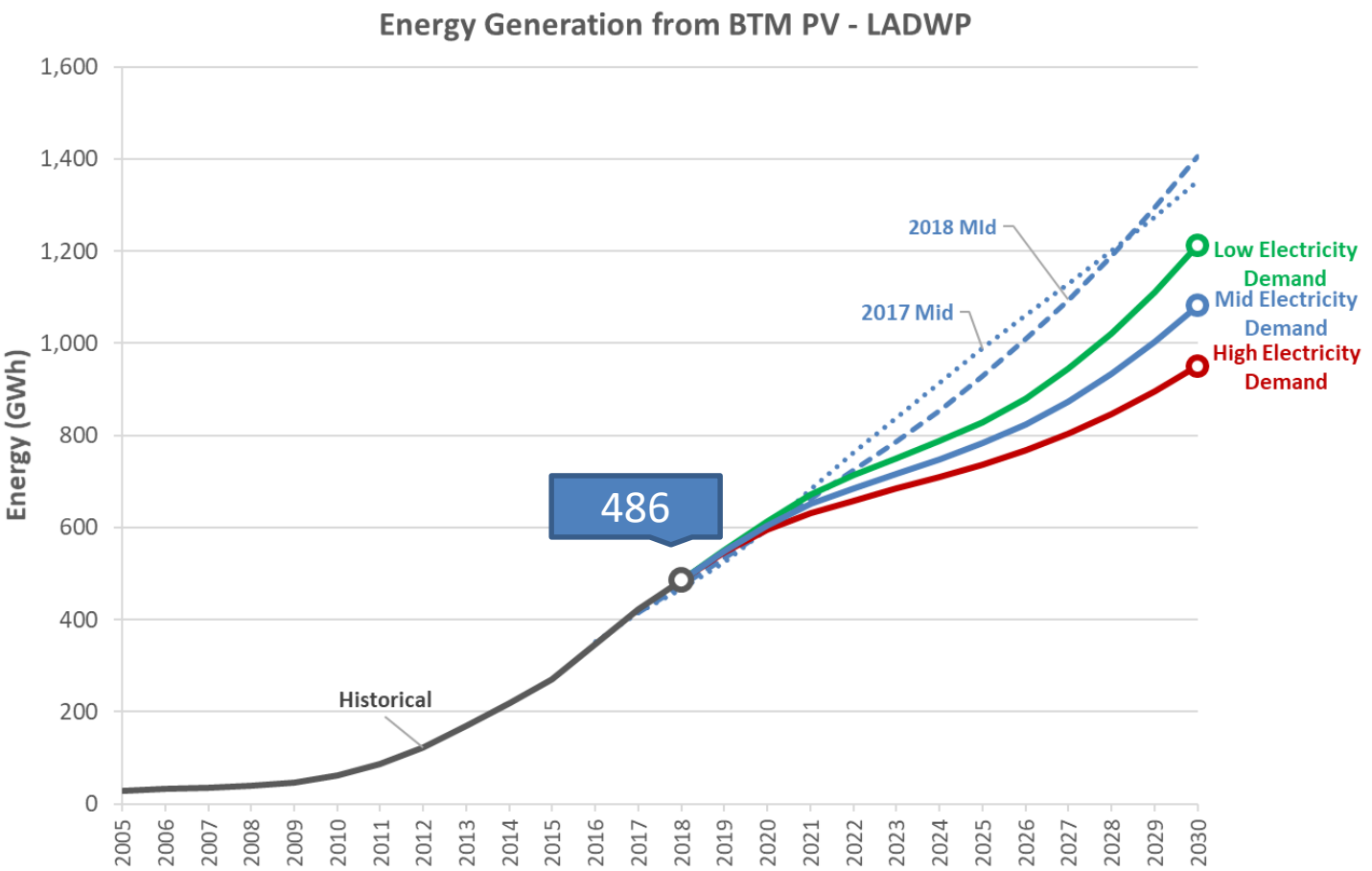
| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 760 | 1,262 | 4.3% |
| Commercial | 241 | 890 | 11.5% |
| Other | 39 | 123 | 10.1% |
| Total | 1,040 | 2,275 | 6.7% |

Energy (GWh)

| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 1,305 | 2,625 | 6.0% |
| Commercial | 362 | 1,352 | 11.6% |
| Other | 60 | 131 | 6.8% |
| Total | 1,727 | 4,108 | 7.5% |

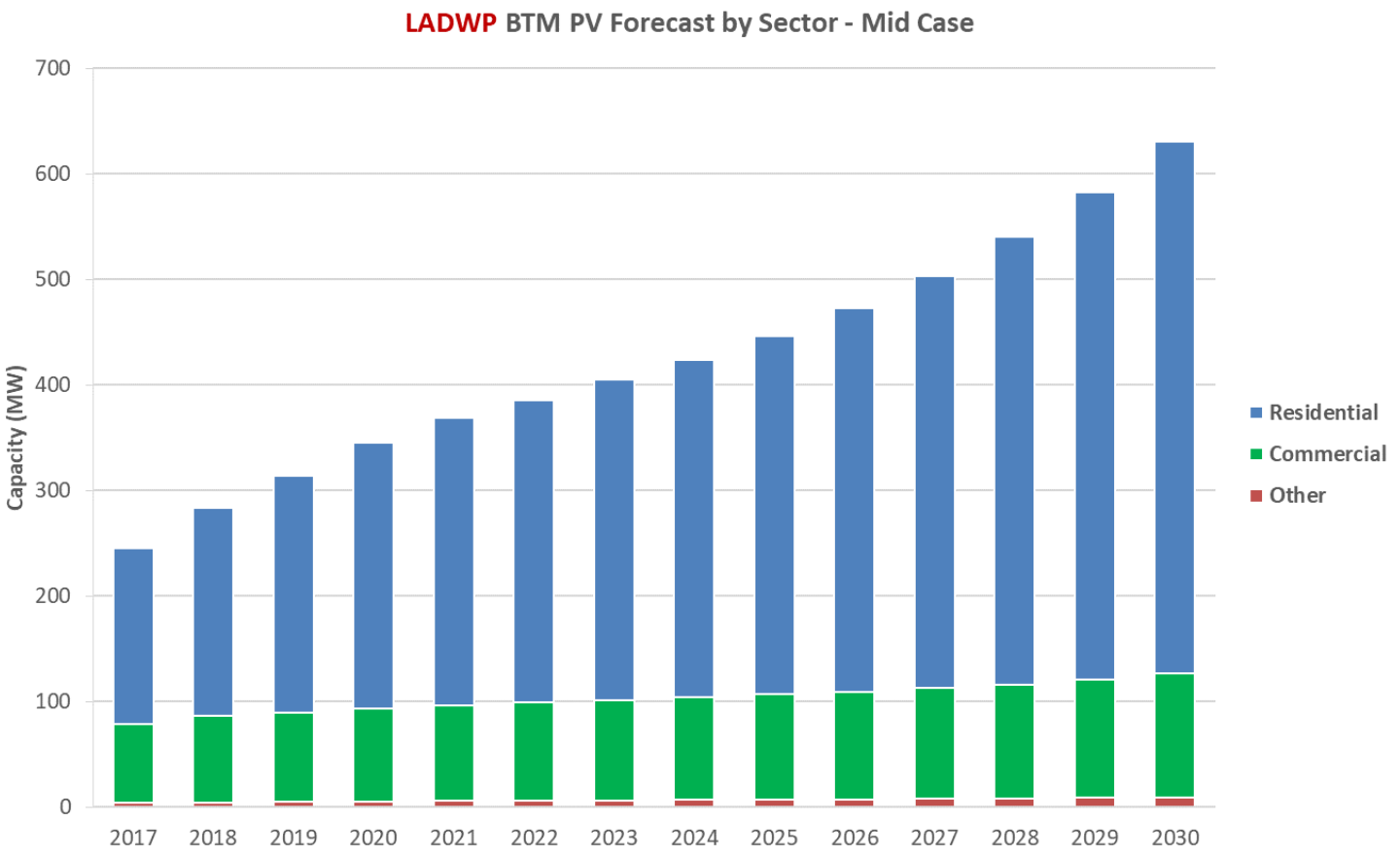
# LADWP Baseline Forecast






**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.

# LADWP Forecast by Sector



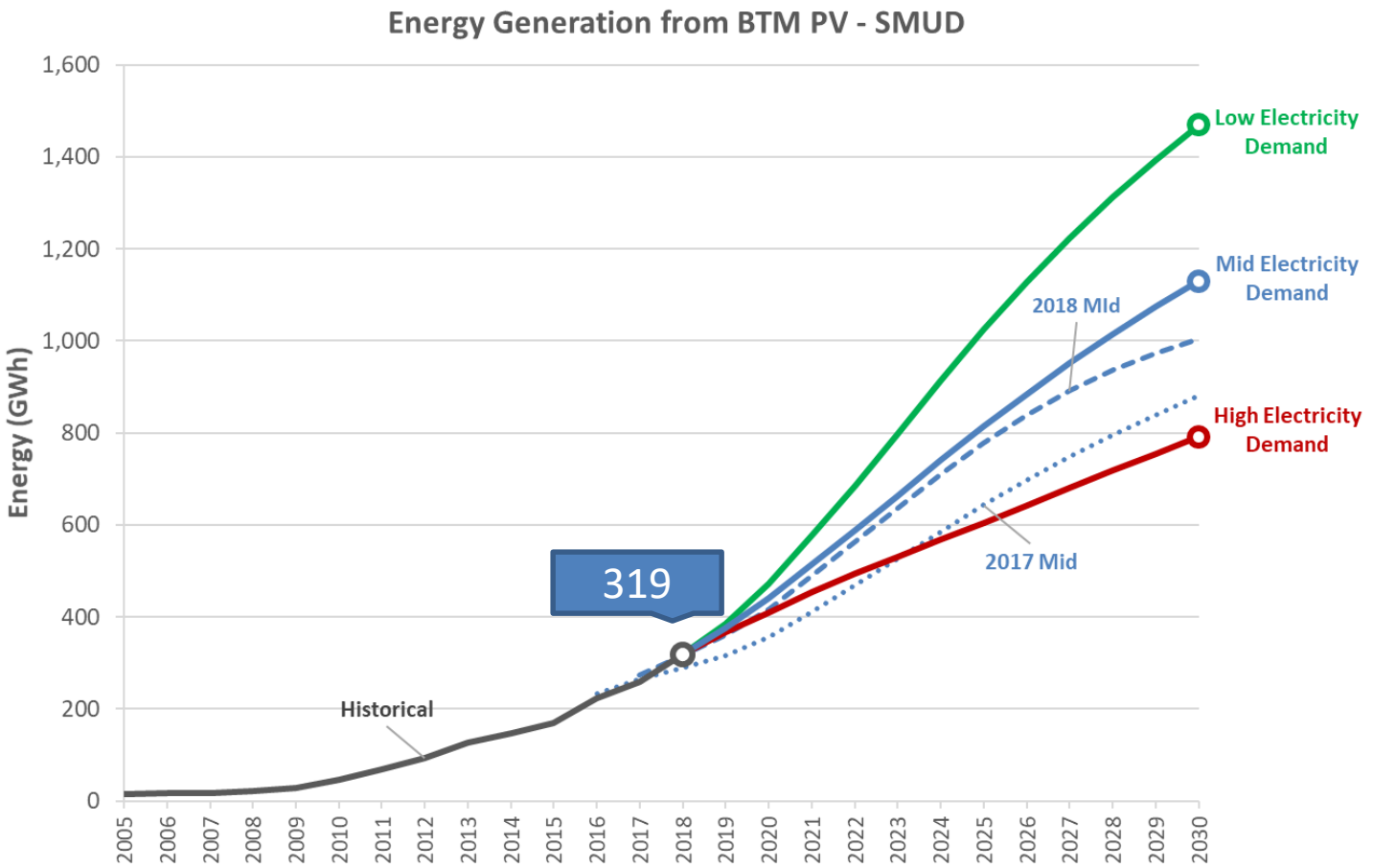

Capacity (MW)

| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 197 | 504 | 8.1% |
| Commercial | 81 | 117 | 3.1% |
| Other | 5 | 9 | 5.5% |
| Total | 283 | 630 | 6.9% |

Energy (GWh)

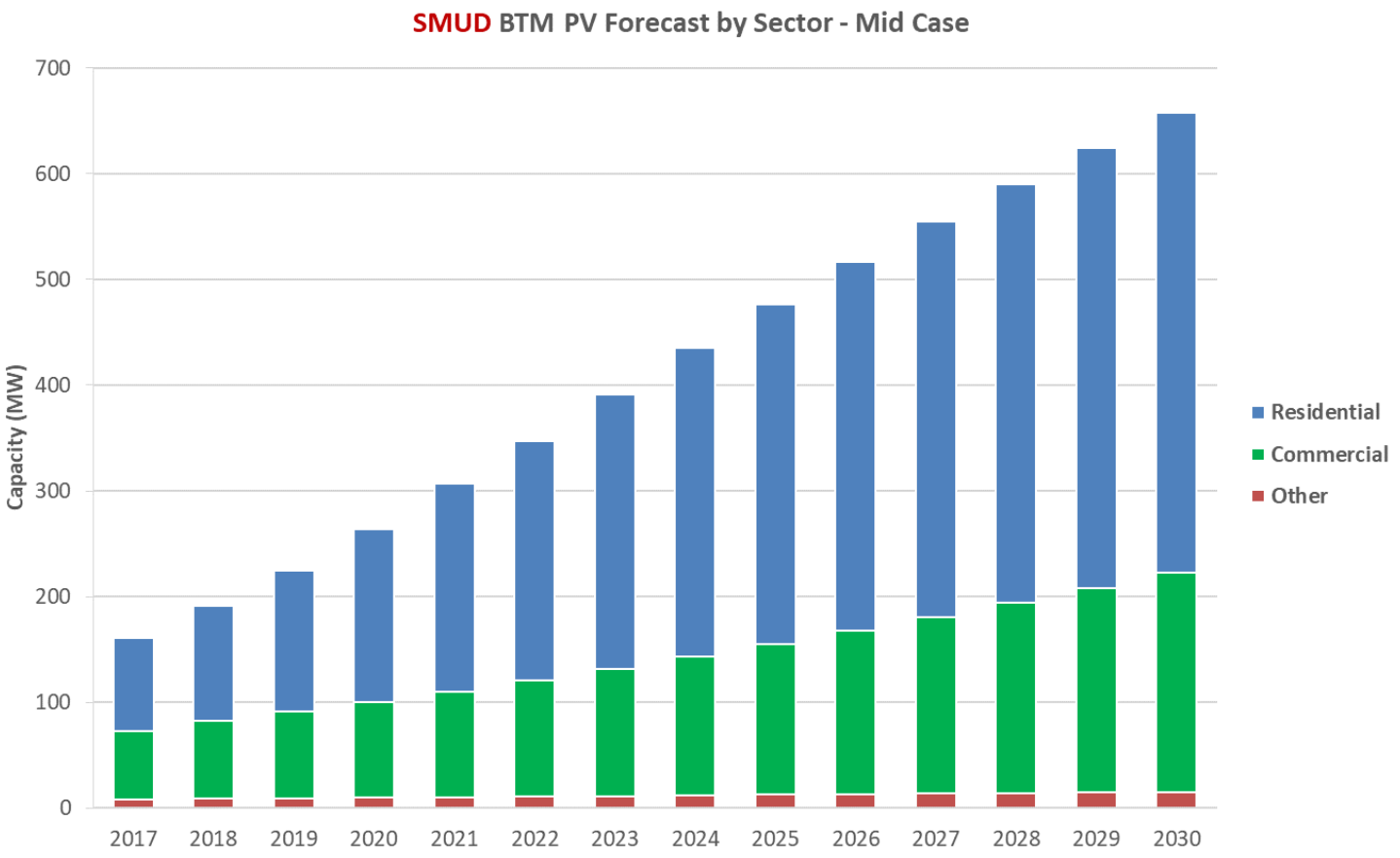
| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 336 | 866 | 8.2% |
| Commercial | 142 | 201 | 2.9% |
| Other | 9 | 16 | 5.3% |
| Total | 486 | 1,082 | 6.9% |

# SMUD Baseline Forecast




**NOTE:** 2017 and 2018 forecasts include AAPV forecast results.

# SMUD Forecast by Sector




Capacity (MW)

| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 109 | 435 | 12.2% |
| Commercial | 74 | 208 | 9.0% |
| Other | 9 | 15 | 4.6% |
| Total | 191 | 658 | 10.8% |

Energy (GWh)

| Sector | 2018 | 2030 | % |
|---|---|---|---|
| Residential | 180 | 752 | 12.7% |
| Commercial | 124 | 353 | 9.1% |
| Other | 15 | 26 | 4.5% |
| Total | 319 | 1,131 | 11.1% |

# BTM PV / SELF-GENERATION FORECAST ROADMAP

# Planned Updates

## 2019 Revised Forecast

- Energy storage
  1. Energy storage profiles
  2. Storage adoption modeling changes
  - Emerging forecast topics workshop in late September

- Update model inputs
  - Demographic forecasts, electricity price forecasts.

## 2019 Revised Forecast / 2020 update

- Explore updating PV generation profiles
  - Incorporate newly available system orientation data

# Long Term Planning

## Energy Commission PV Model

**CED 2019 Prelim Forecast**
*DAO staff runs CEC model*

**CED 2019 Revised Forecast**
*DAO staff runs CEC model*

**CEDU 2020 Forecast**
*DAO staff runs CEC model*

## dGen Model

**CED 2019 Prelim Forecast**
*NREL staff runs dGen → PV results delivered to CEC*

*NREL completes dGen modeling work.*

**CED 2019 Revised Forecast**
*NREL staff runs dGen → PV results delivered to CEC*
*- dGen contract term completed*

*NREL open sources dGen using U.S. DOE funding.*

***~Oct 2020:** NREL transfers dGen to Energy Commission*

**CED 2021 Forecast**
*DAO staff runs dGen*