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2019 IEPR Preliminary
Behind-the-Meter PV Forecast

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Scenario Definitions

❑ **High = High Electricity Demand Case**

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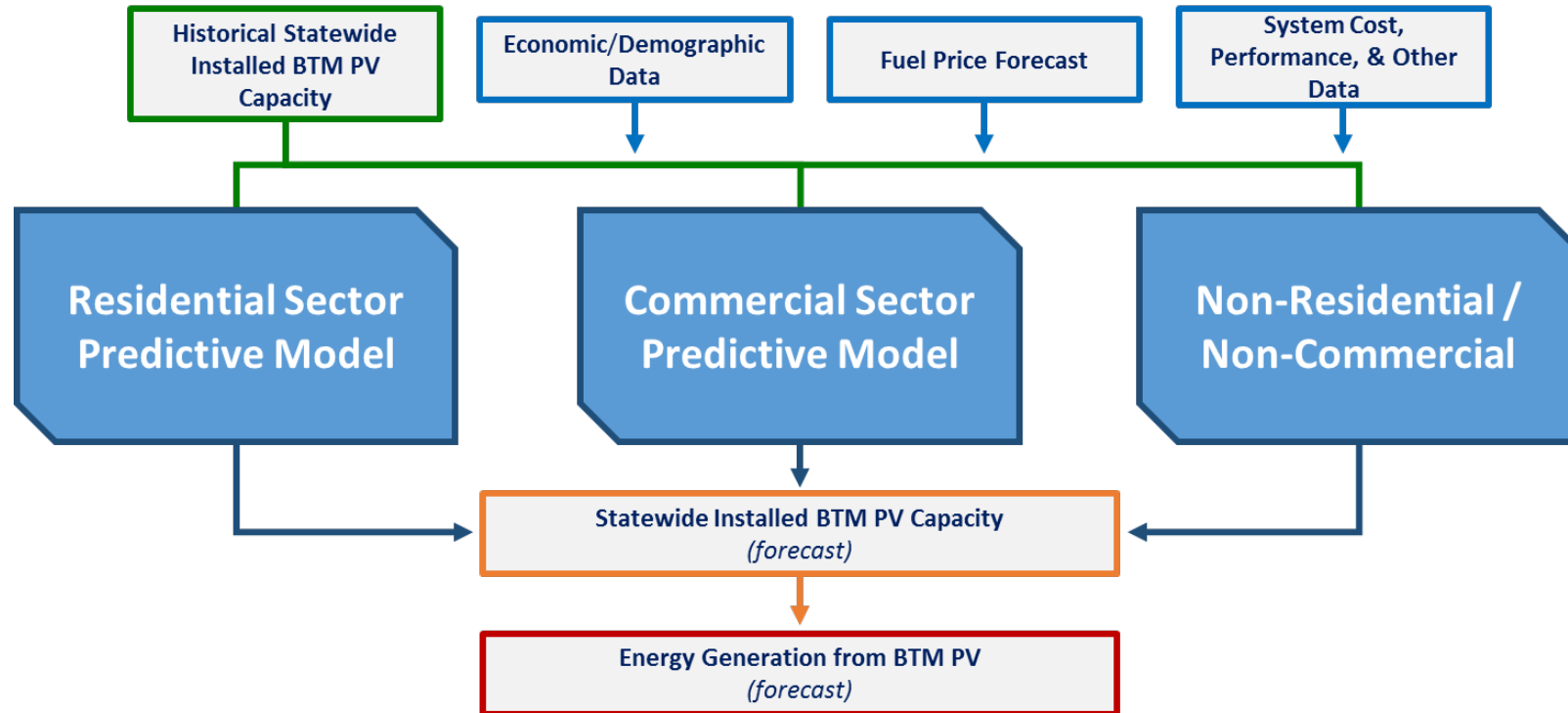- <u>Low</u> PV adoption

❑ **Low = Low Electricity Demand Case**

- Low economic / demographic growth → low growth in building stock
- High electricity rates
- <u>High</u> 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

- A review of 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
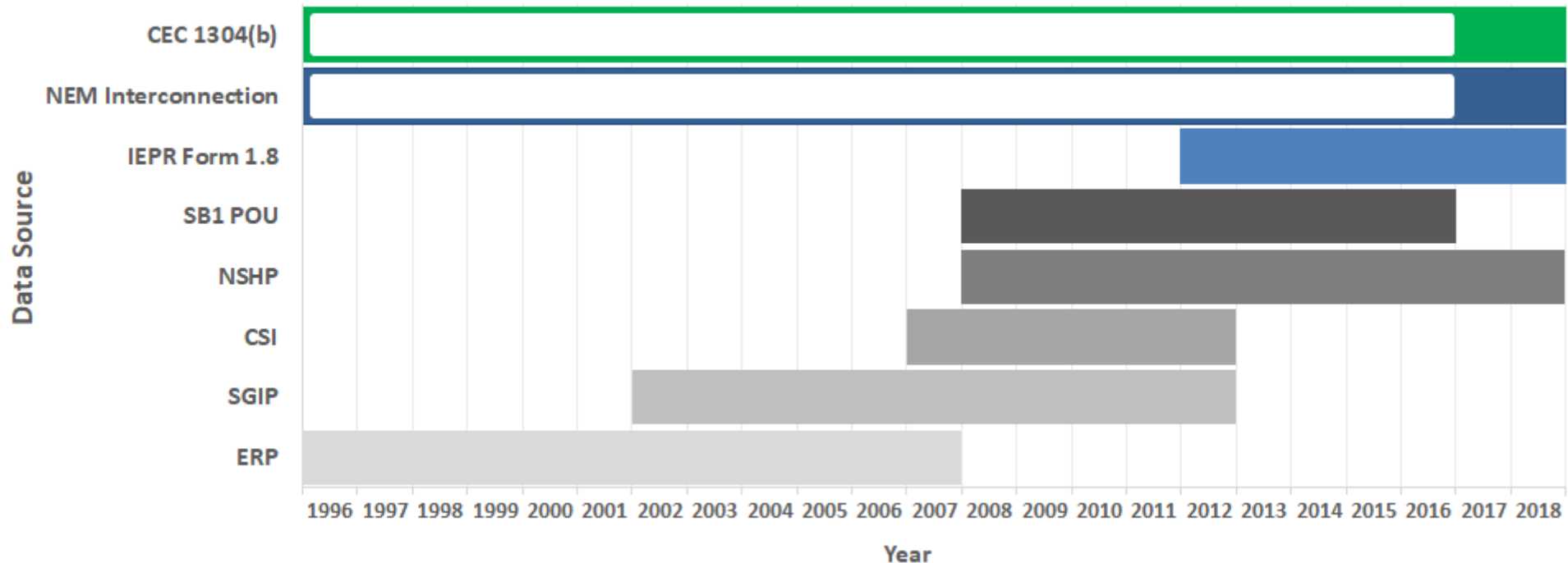
Updated Inputs for 2019 PV Forecast

- PV interconnection data

- Demographic / economic data

- Electricity rates / schedules

- PV system installation costs

Solar PV Interconnection Data

Sources of Historical BTM PV Installation 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

Total and Incremental Behind-the-Meter PV Capacity by Year
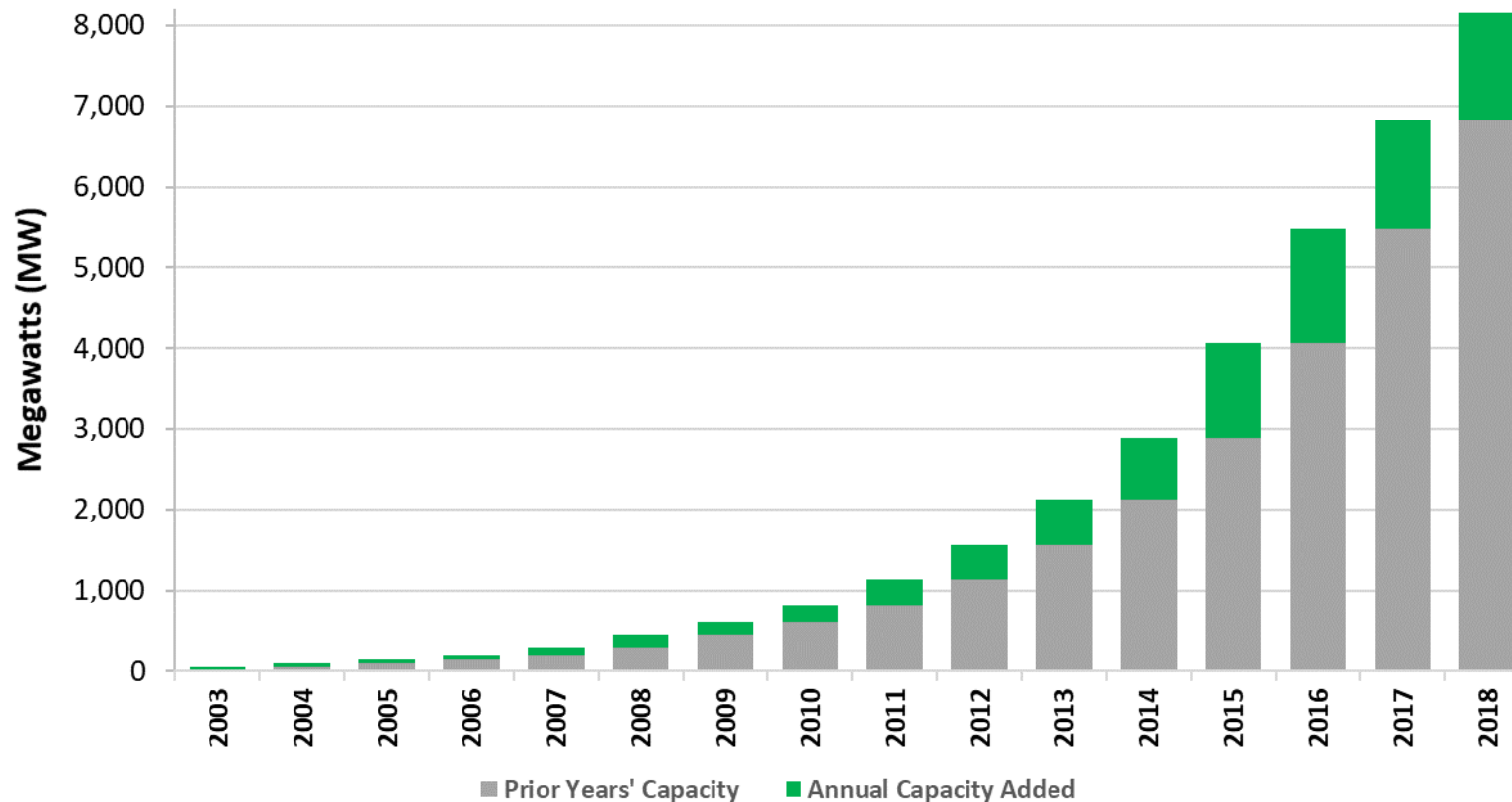
- ~ 8,100 MW total installed capacity

- Maturing PV market
  ~ 1,300-1,400 MW installed annually 2016-18

- Trends in residential and commercial PV

PV Installation Data by Utility

California Electric Utility Service Areas

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
SDG&E	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 %
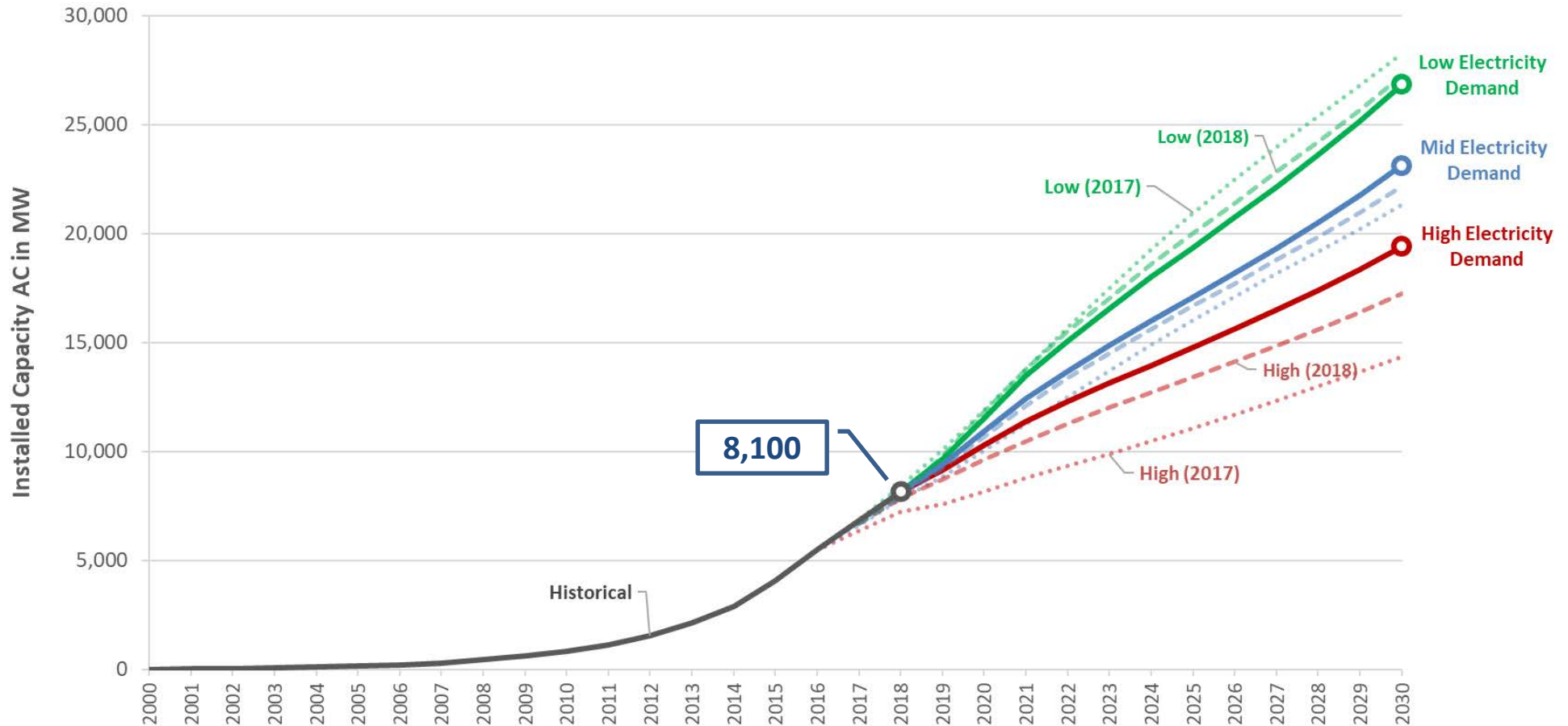
STATEWIDE FORECAST

Self-Generation Forecast

Self-Generation Forecast (Mid-Case)
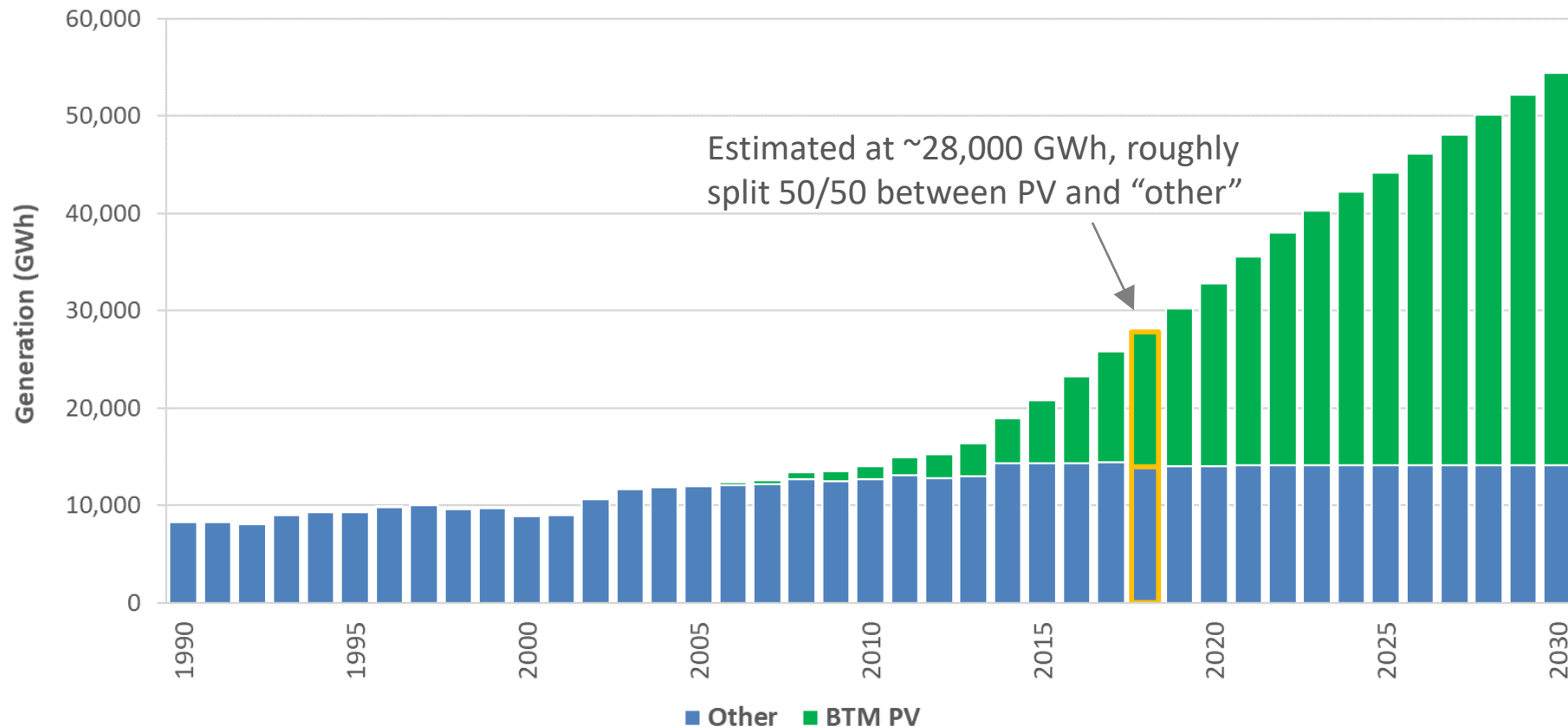
Estimated at ~28,000 GWh, roughly split 50/50 between PV and "other"
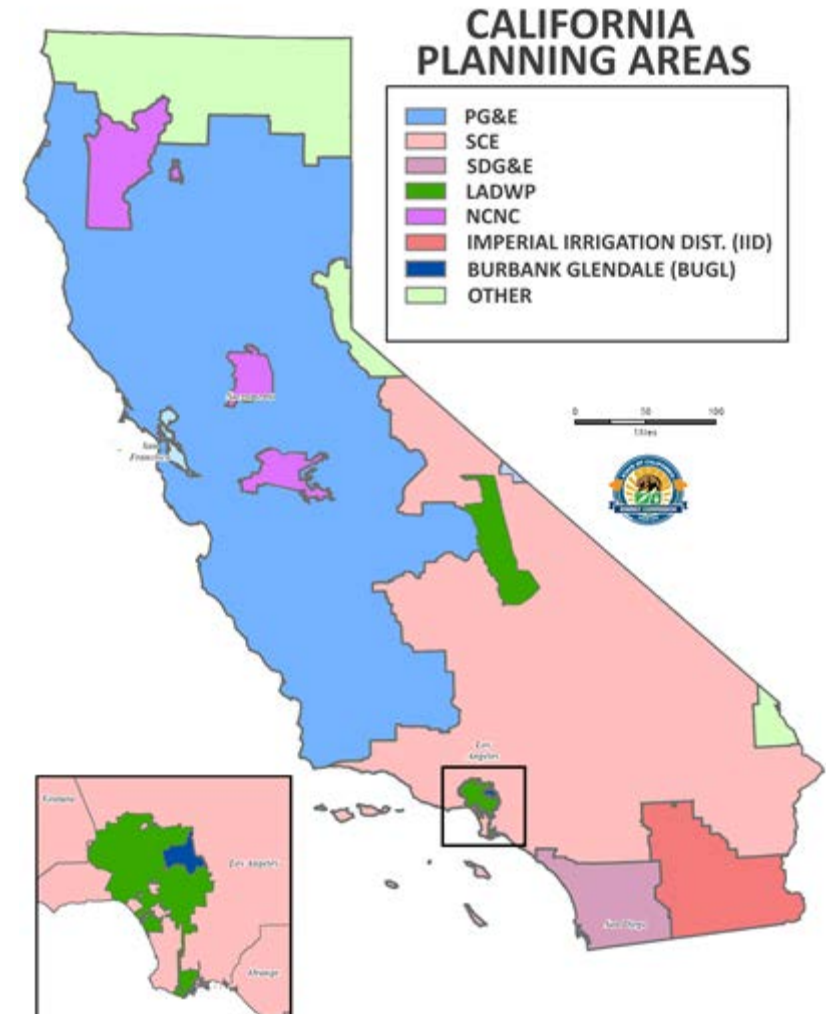
Legend: Other (blue), BTM PV (green)

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	+ 981	- 371
Δ 2017 IEPR	+ 5,071	+ 1,833	- 1,406

NOTE: 2017 and 2018 forecasts include AAPV forecast results.

CALIFORNIA PLANNING AREAS

- PG&E
- SCE
- SDG&E
- LADWP
- NCNC
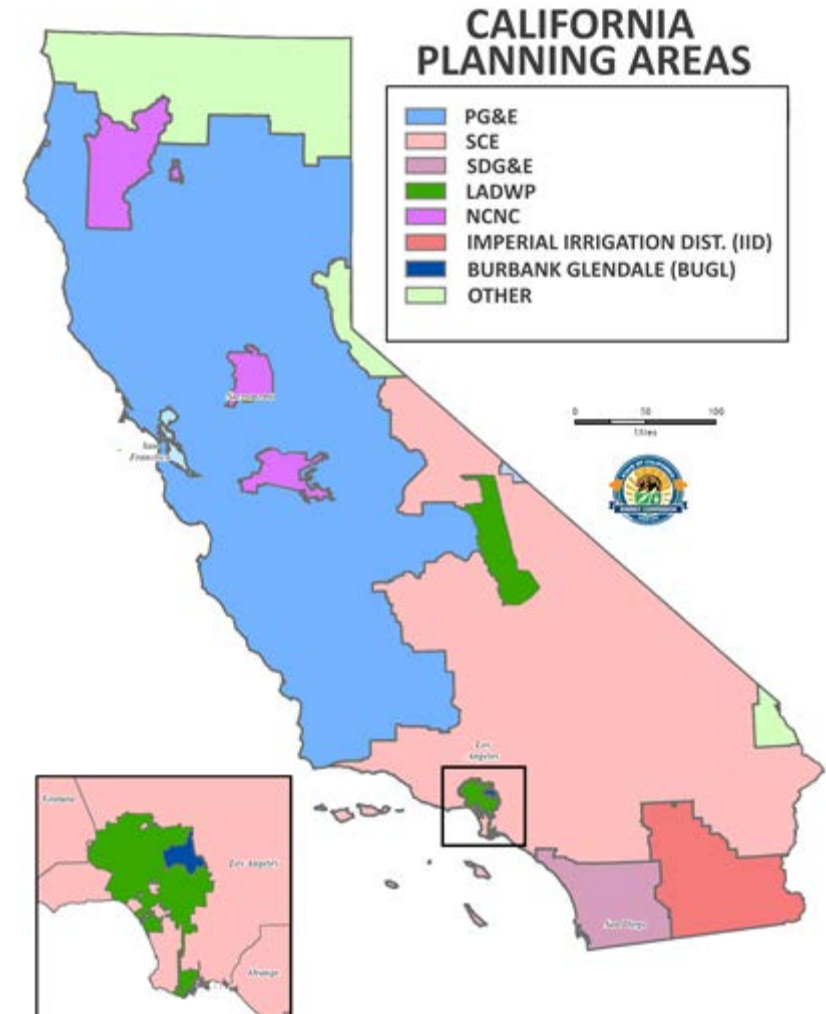- IMPERIAL IRRIGATION DIST. (IID)
- BURBANK GLENDALE (BUGL)
- OTHER

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	+ 1,620	- 787
Δ 2017 IEPR	+ 8,853	+ 3,042	- 2,768

NOTE: 2017 and 2018 forecasts include AAPV forecast results.

CALIFORNIA PLANNING AREAS

- PG&E
- SCE
- SDG&E
- LADWP
- NCNC
- IMPERIAL IRRIGATION DIST. (IID)
- BURBANK GLENDALE (BUGL)
- OTHER

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.
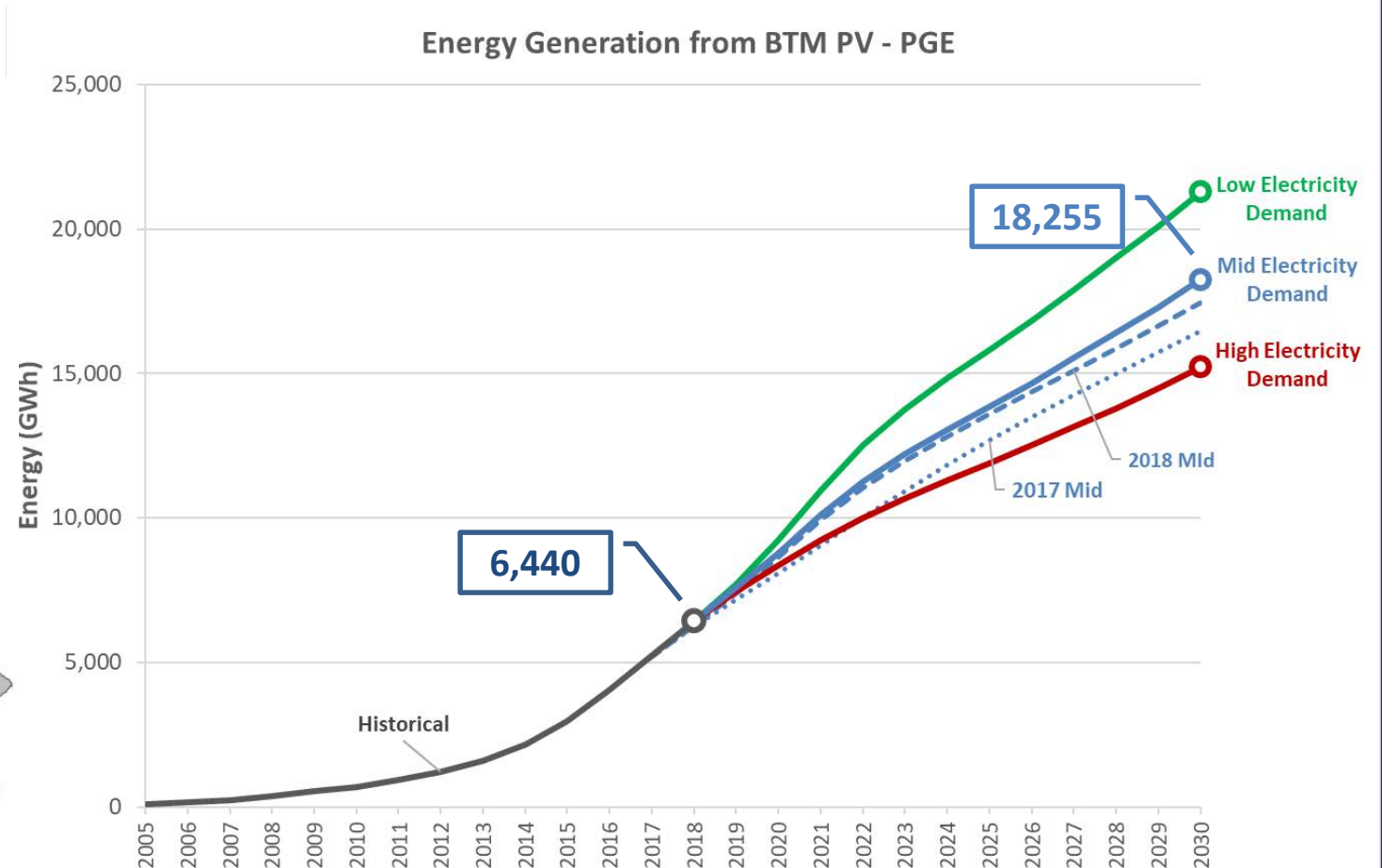 - Direct correlation to forecast of new home construction.
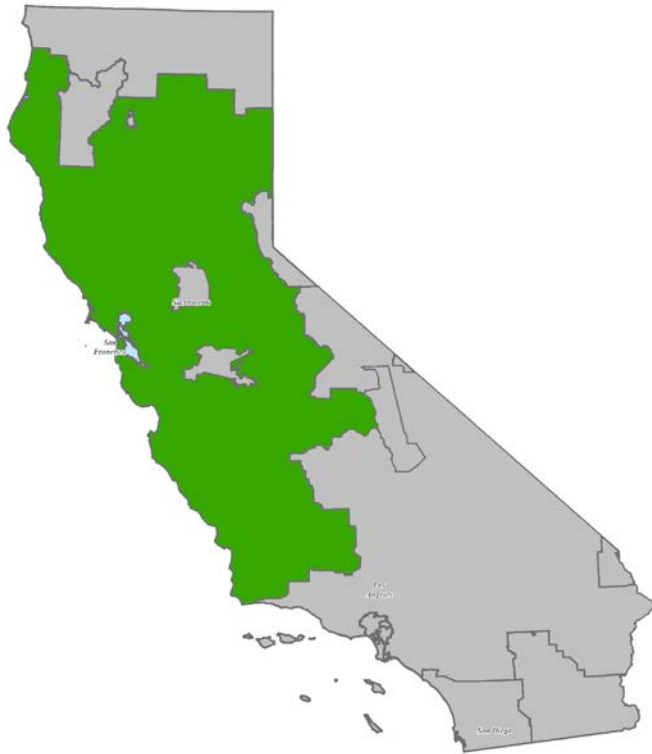
CAPACITY in MW

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

PG&E Baseline Forecast

Energy Generation from BTM PV - PGE
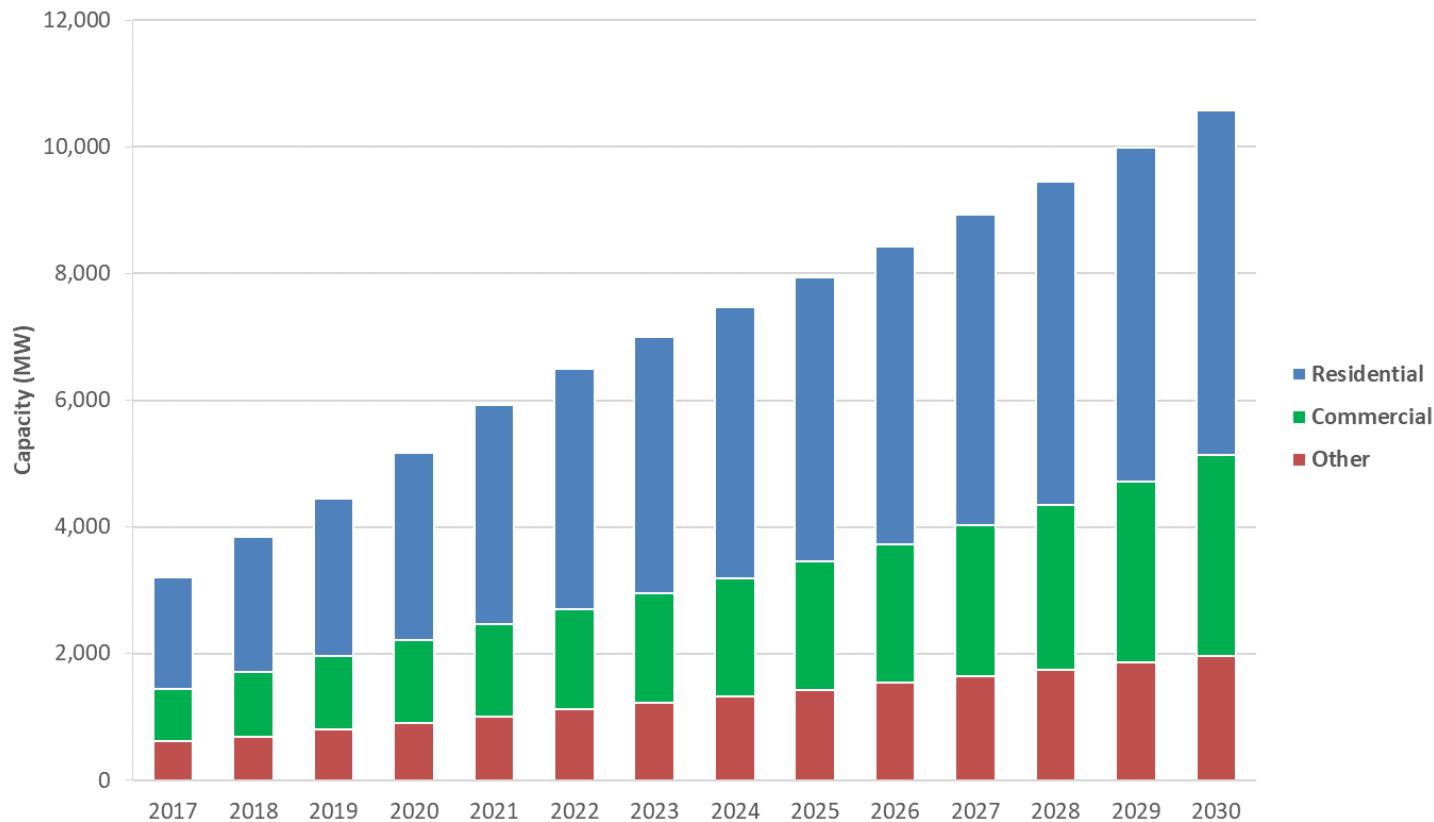
NOTE: 2017 and 2018 forecasts include AAPV forecast results.

PG&E Forecast by Sector

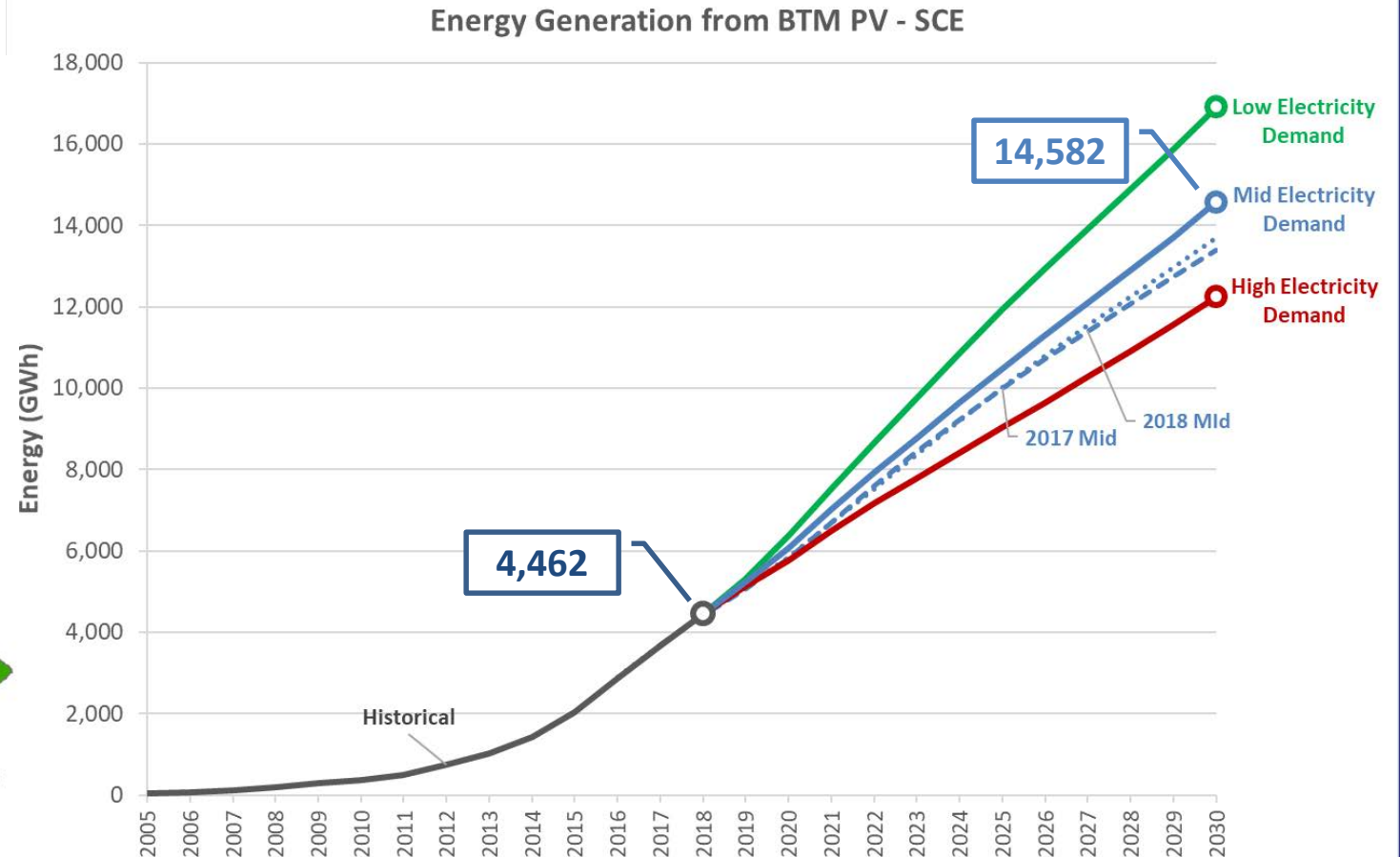PGE BTM PV Forecast by Sector - Mid Case

Capacity (MW)

Sector	2018	2030	CAGR
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	CAGR
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

Energy Generation from BTM PV - SCE

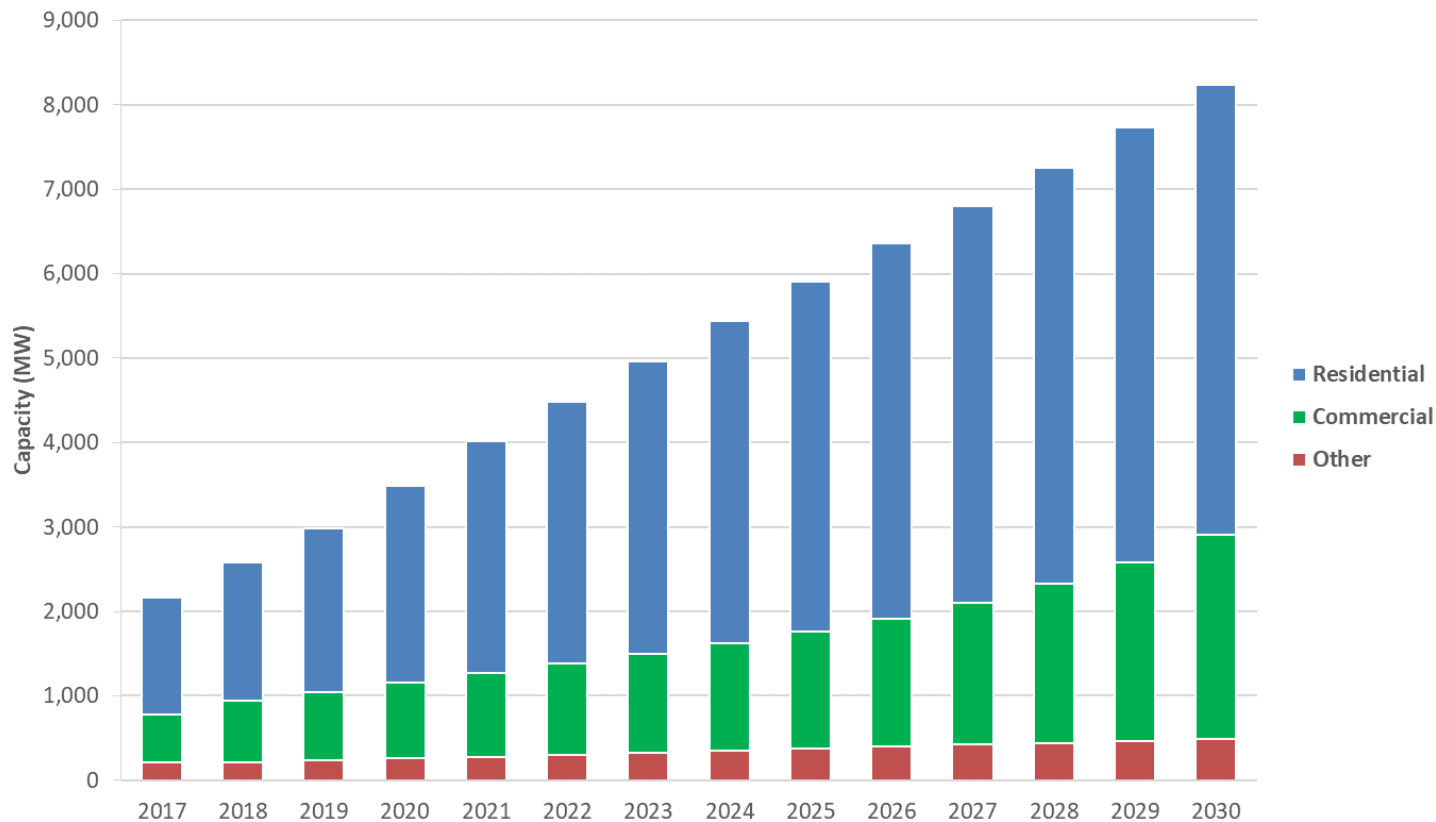NOTE: 2017 and 2018 forecasts include AAPV forecast results.

SCE Forecast by Sector

SCE BTM PV Forecast by Sector - Mid Case

Capacity (MW)

Sector	2018	2030	CAGR
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	CAGR
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%

SDG&E Baseline Forecast

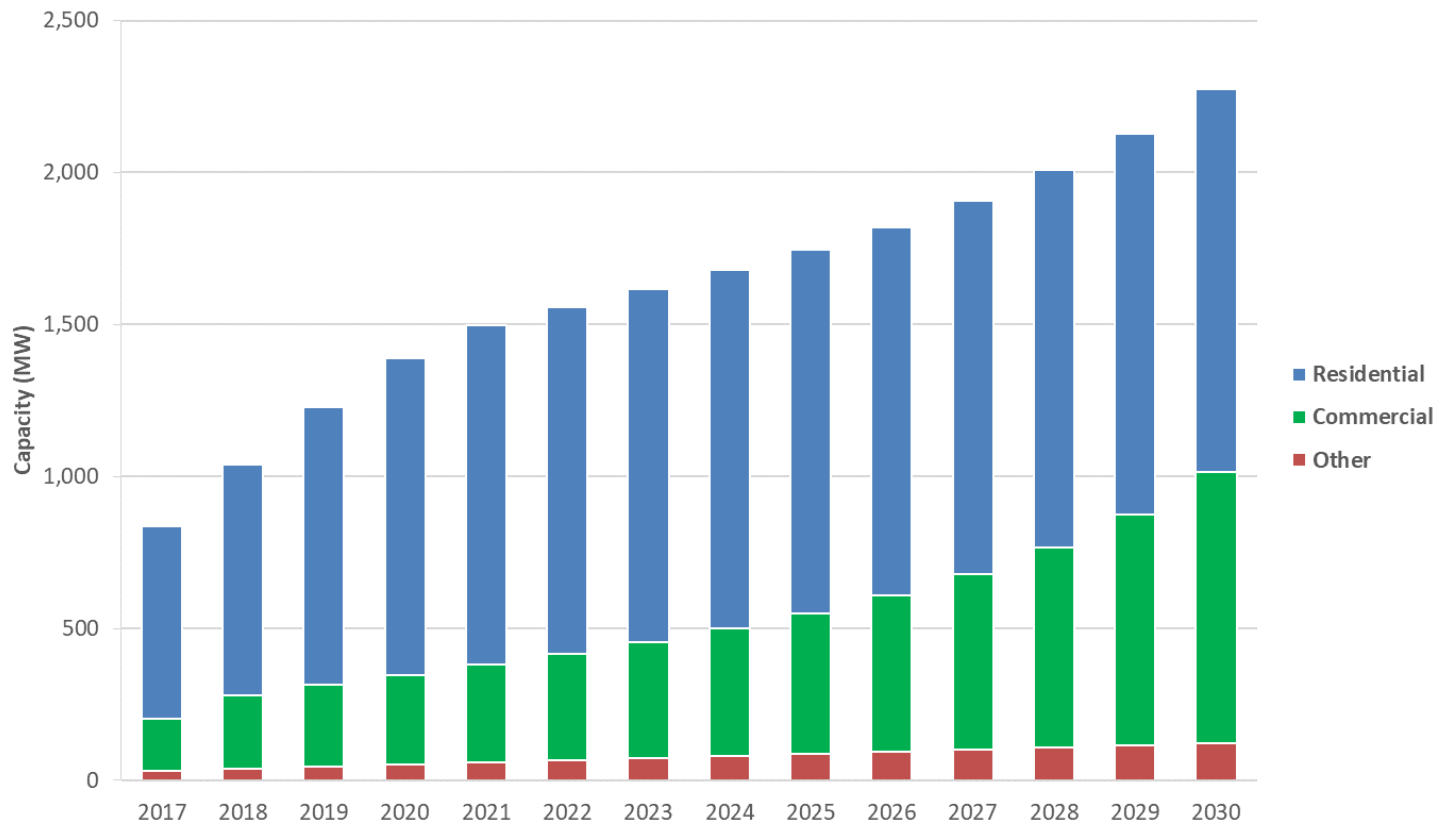Energy Generation from BTM PV - SDGE
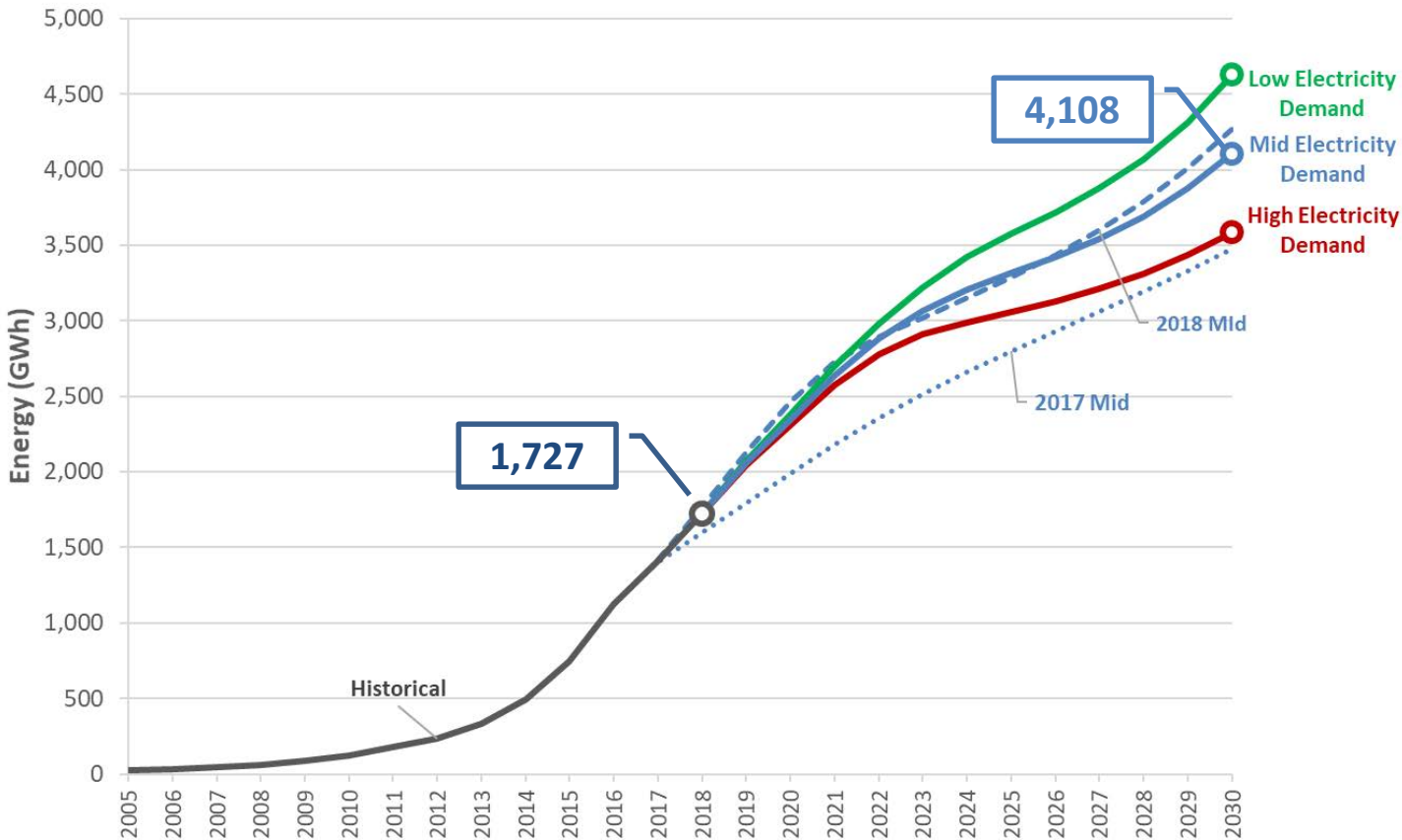
NOTE: 2017 and 2018 forecasts include AAPV forecast results.

SDG&E Forecast by Sector

SDGE BTM PV Forecast by Sector - Mid Case

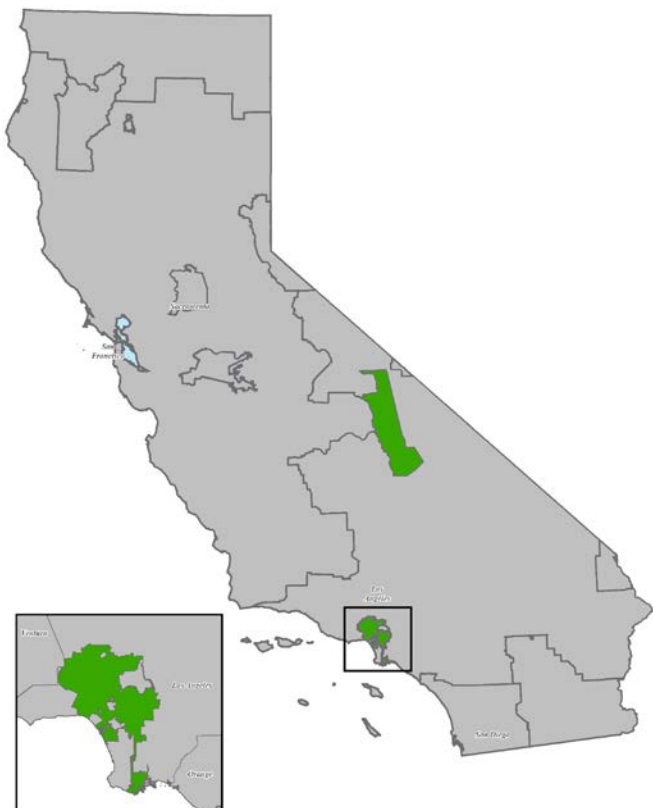

Capacity (MW)

Sector	2018	2030	CAGR
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	CAGR
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

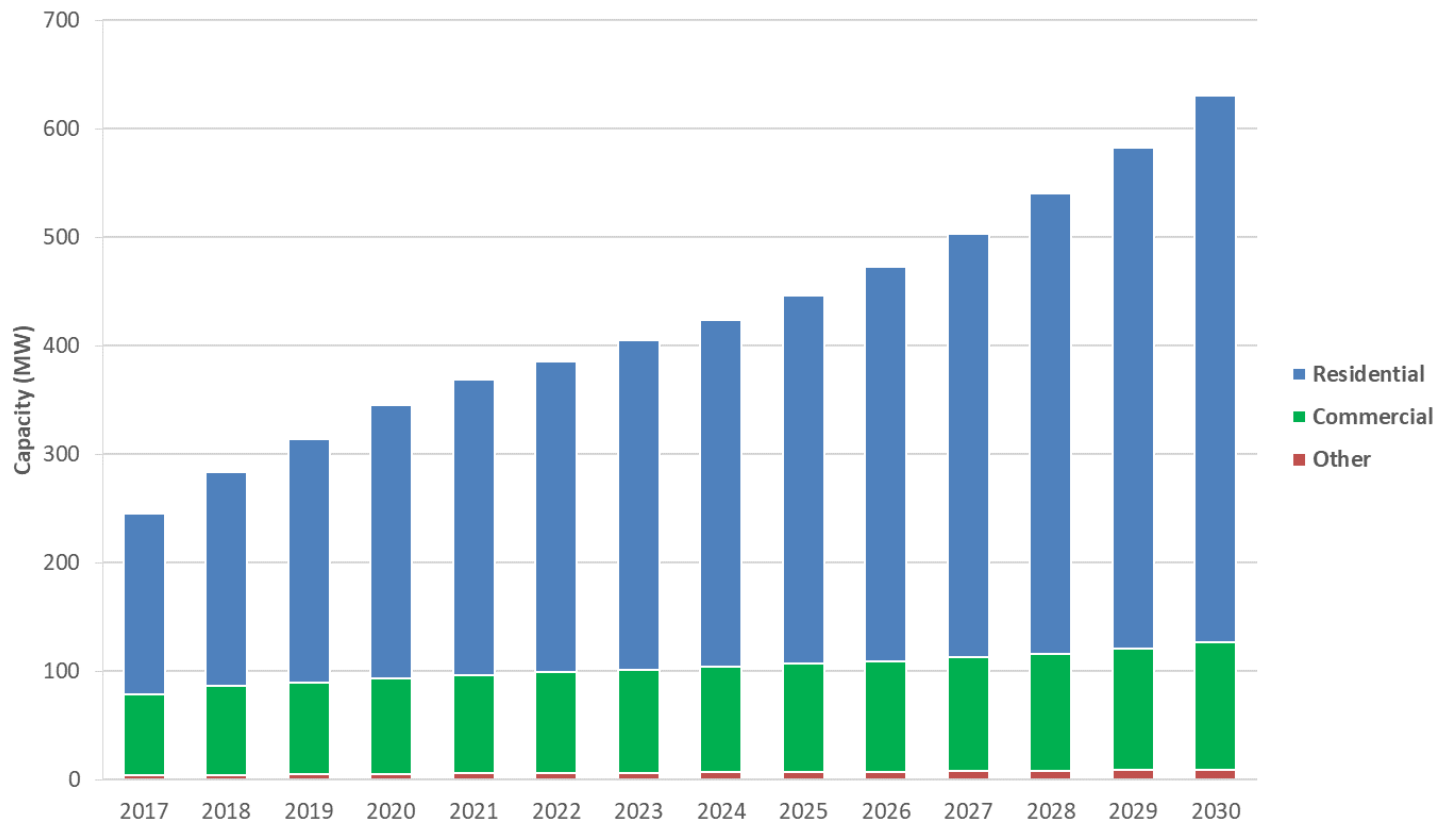Energy Generation from BTM PV - LADWP
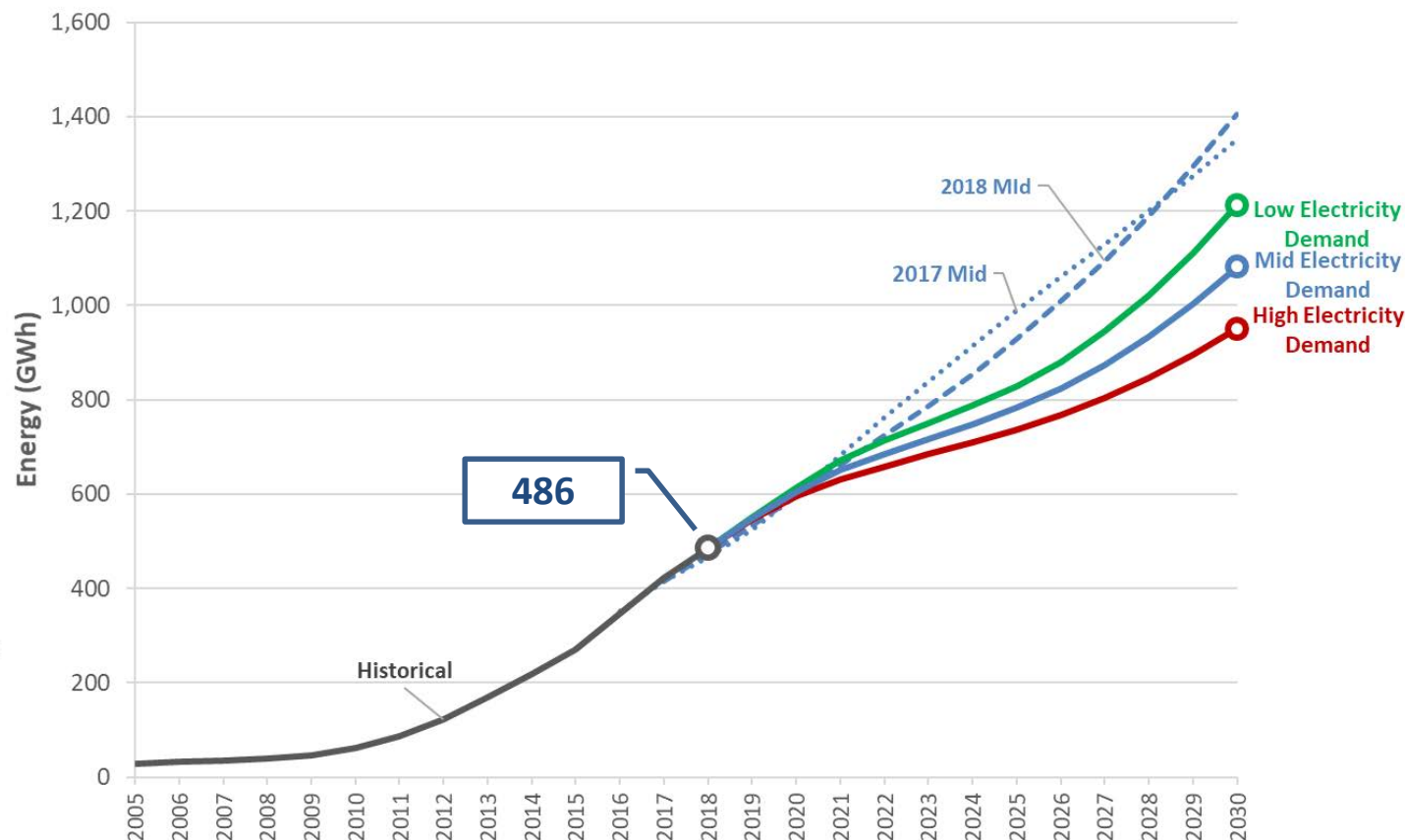
NOTE: 2017 and 2018 forecasts include AAPV forecast results.

LADWP Forecast by Sector

LADWP BTM PV Forecast by Sector - Mid Case

Capacity (MW)

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

SMUD Baseline Forecast

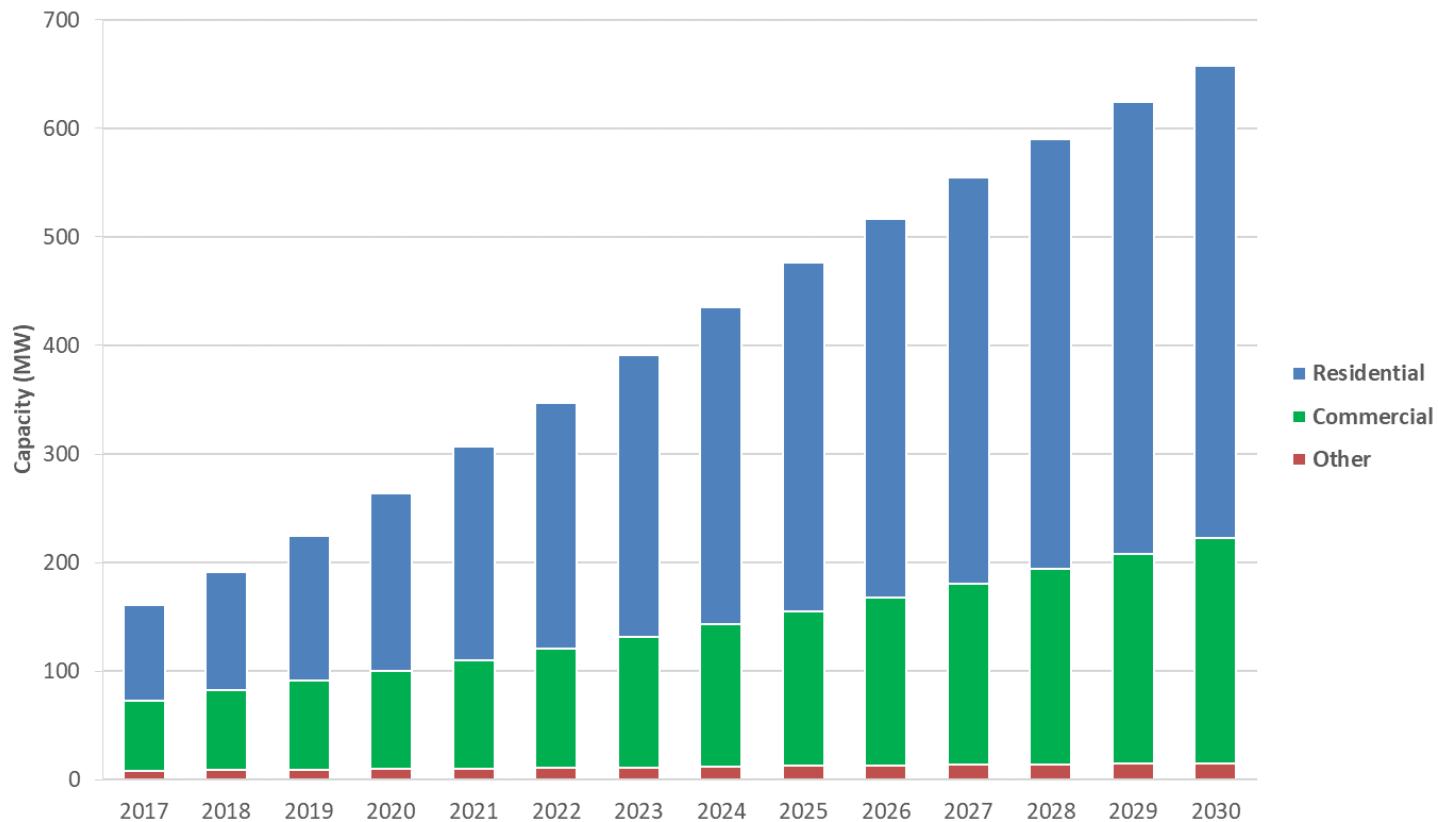Energy Generation from BTM PV - SMUD
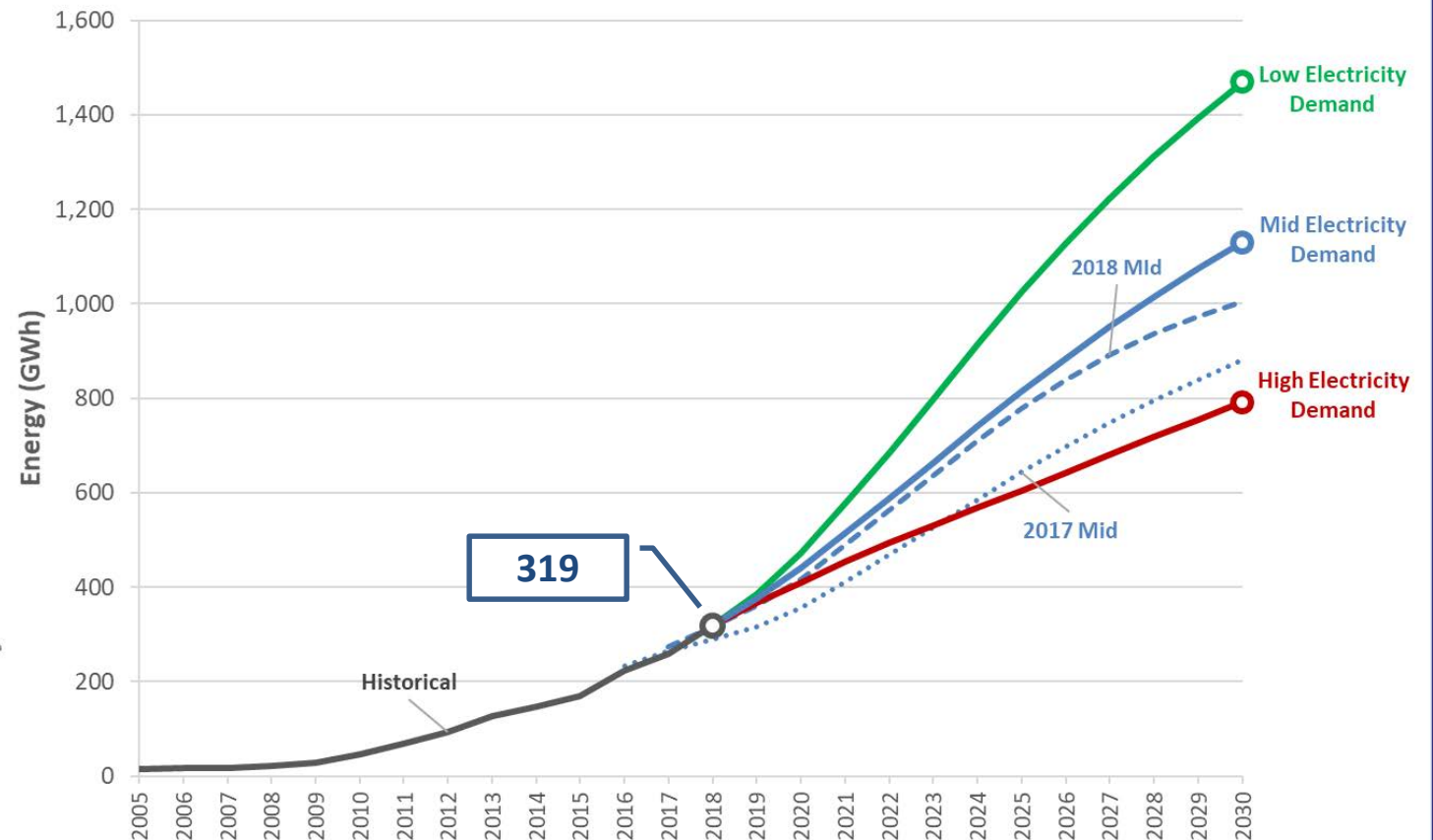
NOTE: 2017 and 2018 forecasts include AAPV forecast results.

SMUD Forecast by Sector

SMUD BTM PV Forecast by Sector - Mid Case

Capacity (MW)

Sector	2018	2030	CAGR
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	CAGR
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	dGen Model

CED 2019 Prelim Forecast
DAO staff runs CEC model

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

NREL completes dGen modeling work.

CED 2019 Revised Forecast
DAO staff runs CEC model

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.

CEDU 2020 Forecast
DAO staff runs CEC model

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

CED 2021 Forecast
DAO staff runs dGen