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Integrated Resource Planning

Economic Research

July 2020

Introduction

- The energy & load forecasts are used to project sales and peak load for 20 years
- The peak load forecast is used to determine how much Generation and Transmission capacity is expected in the future.
- Electric utilities need to have adequate capacity available to meet peak conditions at any point in time.
- The system expansion profile is used to plan for capital expenditures required to meet the future system load.

Introduction (cont.)

- The energy forecast is used to determine the expected energy sales and revenue, usually for two or three years.
- This information is used by the Finance Department to balance cash flow and financial needs, as well as to provide guidance to outside parties.

Energy Model

Energy Forecast Methodology

- **The 2020 Energy Forecast:**
  - Employs monthly and annual methodologies to develop its models.
  - Models are estimated based on an econometric methodology
    - All econometric models are estimated using Ordinary Least Squares (OLS) as a function of weather, economic, and demographic variables. Residential energy sales are estimated using a use per customer (UPC) methodology
  - The final models are selected based on various key statistical measures and professional judgment.
  - Load research data, professional judgment and statistical analysis are employed to estimate sales and demand that don’t lend themselves to econometric modeling.

Example of Energy Forecast Models

Typical simple regression model: $Y = \beta_0 + \beta_1 X + \varepsilon$

<u>New Mexico Residential Use Per Customer Equation</u>

UPC NM= β_0 + β_0 Weather + β_0 LC Non-Farm Employment

<u>New Mexico Residential Customer Equation</u>

CUS NM = β_0 + β_0 LC Population

<u>New Mexico Residential kWh Forecast</u>

Total kWh NM = UPC NM* CUS NM

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NM Energy Forecast Model

- **All of the energy models for NM are econometric models with the exception of street lighting.**
  - Street lighting is forecast to grow at the same rate as total households in Las Cruces.
- **Residential is the only Revenue Class that has a UPC energy model methodology.**
- **All of the energy models for NM use monthly data with the exception of Large C&I which uses annual data.**
- **All of the customer models for NM are econometric models with the exception of Large C&I and Street Lighting.**
  - The non econometric models assume the year ending 2019 customer count to remain constant.

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TX Energy Forecast Model

- **All of the energy models for TX are econometric with the exception of street lighting.**
  - Street lighting is forecast to grow at the same rate as total household in El Paso.
- **Residential is the only Revenue Class that has a UPC energy model methodology.**
- **All of the energy models for TX use monthly data with the exception of Large C&I which uses annual data.**
- **All of the customer models for TX are econometric models with the exception of Large C&I and street lighting.**
  - The non econometric models assume the year ending 2019 customer count to remain constant.

Weather

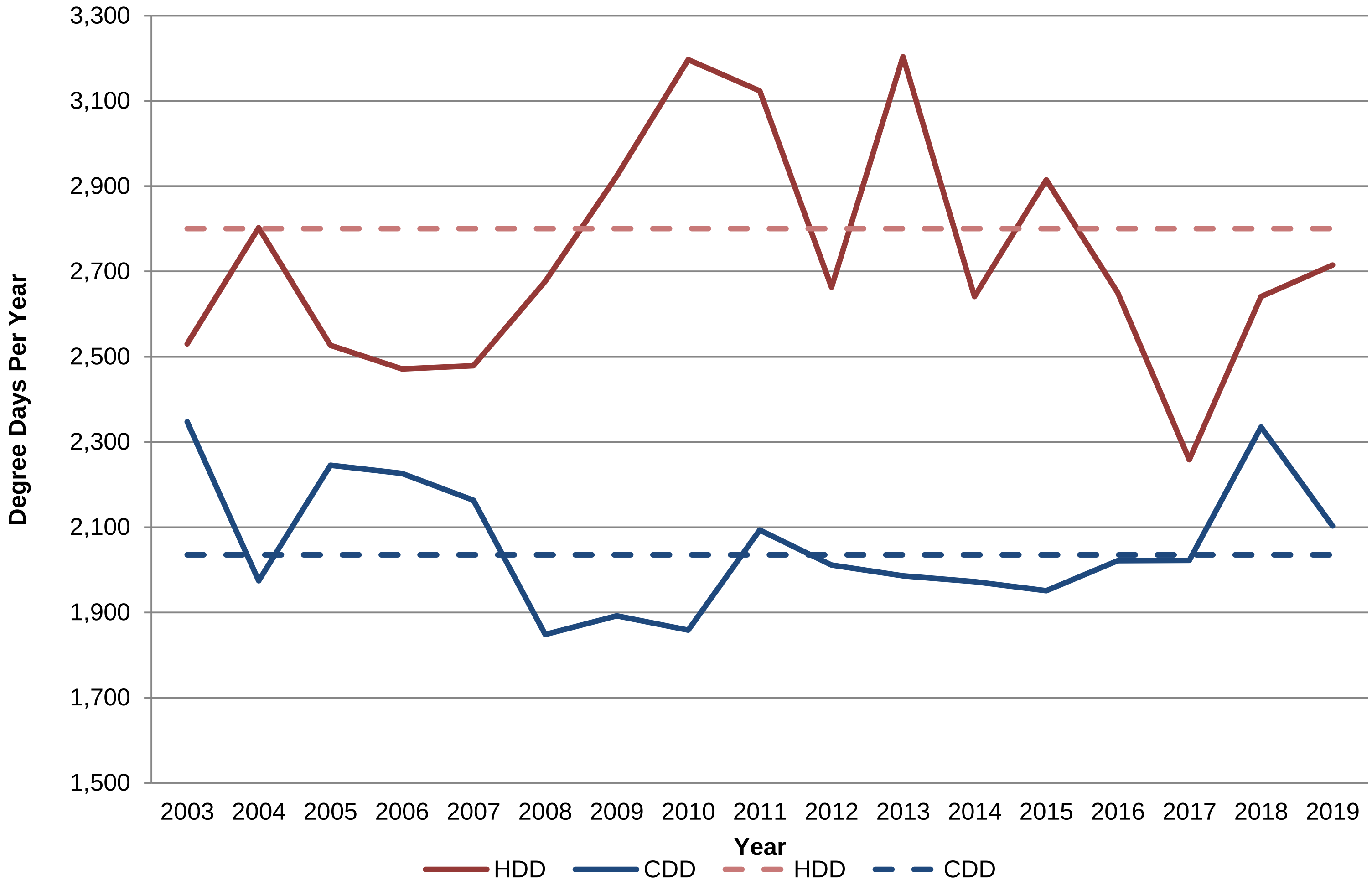
- **Weather in the EPE service territory has been warming over time.**

- **Since weather can sometimes change dramatically from year to year, it is necessary to use the average weather over several years to smooth out the annual variability of weather in the forecasting equation.**

- **For the purpose of generation the energy forecast, then-year average weather for El Paso and Las Cruces is used.**

- **We use HDD’s and CDD’s to analyze weather.**
  - HDD measure the fluctuations in daily average temperature below the designated base temperature (65 degrees Fahrenheit)
  - CDD measures the fluctuations in daily average temperature above the designated base temperature (65 degrees Fahrenheit)

Las Cruces Annual CDD & HDD



Out of Model Adjustments

- **Losses**
- **Rio Grande Electric Cooperative**
- **Energy Efficiency**
- **Distributed Solar Generation**

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Distributed Solar Generation

- Customer-owned solar generation has been rising in our service territory.
- The table below shows the cumulative new distributed generation coincident demand adjustments used in the 2020 Forecast

Distributed Generation Adjustment (2020-2029)			
Year	Demand	Year	Demand
2020	10.7	2025	49.7
2021	21.3	2026	56.7
2022	28.4	2027	63.7
2023	35.6	2028	70.7
2024	42.7	2029	77.6

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Energy and Customer Forecast Summary

Year	Native System Energy (GWh)	Percent Growth	Customers
2019	8,533		428,869
2020	8,679	1.71%	436,042
2021	8,775	1.11%	442,782
2022	8,853	0.89%	449,389
2023	8,925	0.82%	455,934
2024	9,010	0.95%	462,484
2025	9,105	1.06%	469,061
2026	9,209	1.14%	475,635
2027	9,318	1.18%	482,231
2028	9,434	1.24%	488,821
2029	9,561	1.35%	495,400

What goes into Native System Energy

Components of Native System Energy	MWh
Total Retail Sales	8,042,730
RGEC (Wholesale Sales)	62,560
Energy Efficiency	35,331
Distributed Generation	40,622
Company Use	13,678
Native System Losses	565,450
Native System Energy	8,679,176

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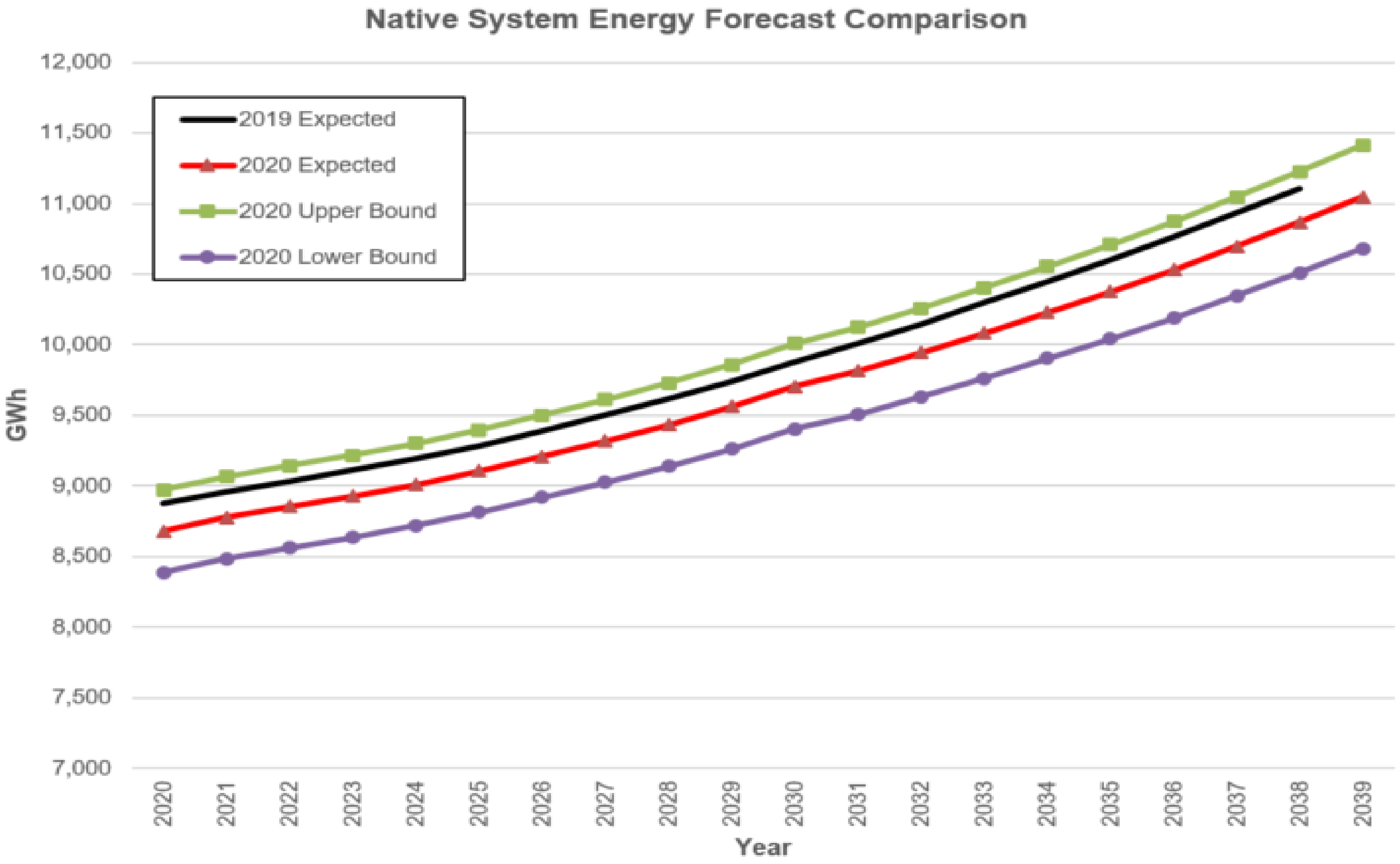
Energy Forecast Comparison



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Energy Forecast Summary

- The table below, shows 10- and 20-year average annual growth rates for the native system energy from the 2019 and 2020 Forecasts.

Native System Energy Growth Rates (CAGR)			
	Historical	2019 Forecast	2020 Forecast
10-Year	1.1%	1.1%	1.1%
20-Year	1.4%	1.3%	1.3%

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Demand Model

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Demand Model

- **Constant System Load Factor (LF) Method**
  - LF = Energy / (demand x Hours)
  - LF = 8,532,859 / (1,985 x 8760) = 0.491

- **Demand is estimated based on the Constant System Load Factor and the Native System Energy forecast**
  - Demand = Energy / (LF x Hours)
  - Demand = 8,760,369 / (0.491 x 8760) = 2,032
    - After adjusting for Distributed Generation and Energy Efficiency our Native System Demand is 2,015

System Load Factor

- **With the exception of 2010, 2012, 2015 and 2018 the system load factor has been declining since 2000.**
- **Historically, annual forecasts used a average system load factor to project demand, given its year to year fluctuations.**
- **In the 2020 forecast, a one-year load factor of 0.491 is used to forecast peak demand. This load factor is obtained from 2019 historical data.**

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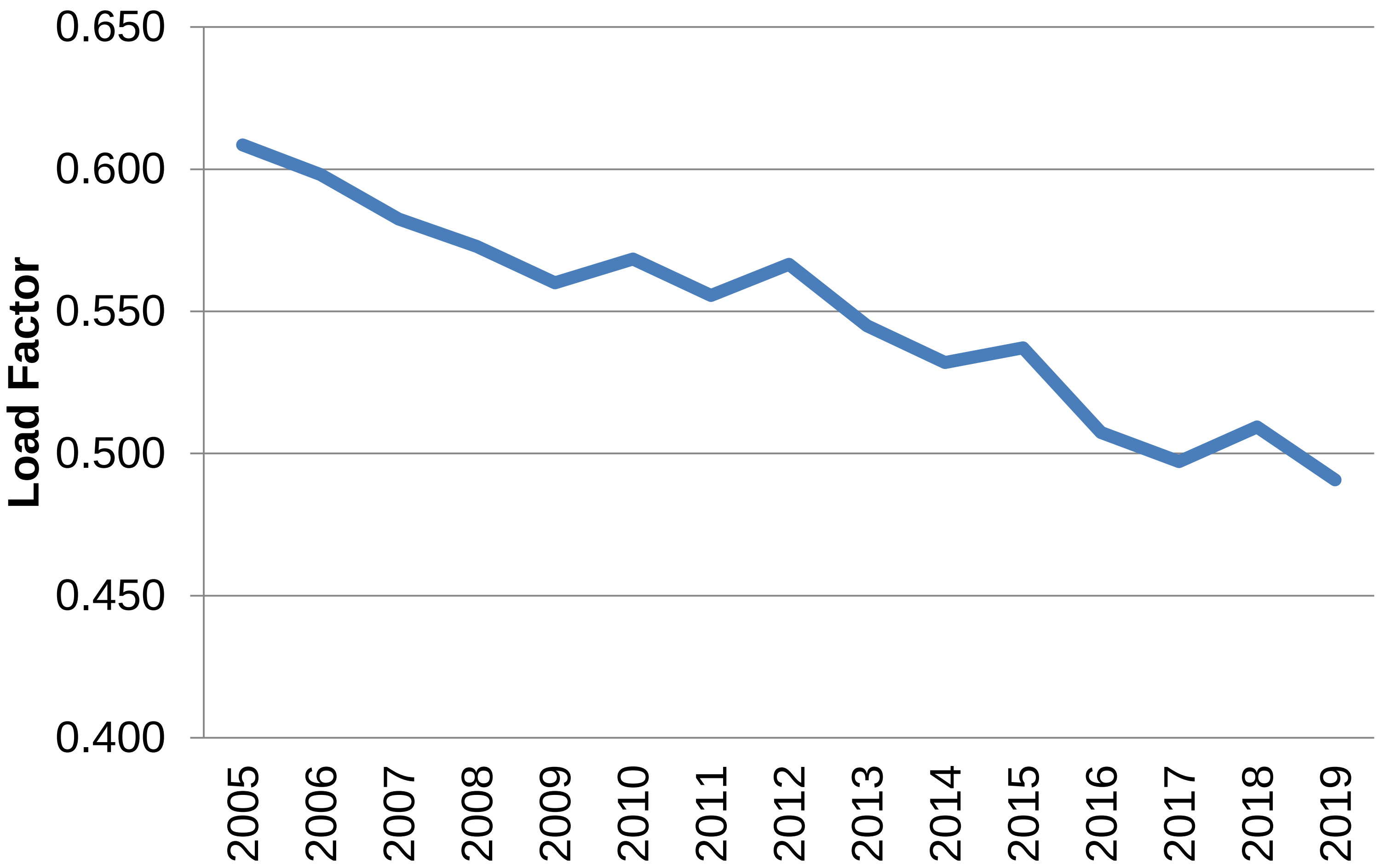
System Load Factor



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Factors in System Load Factor Decline

- **Increasing share of residential sales**
  - Loss of manufacturing load
- **Increasing saturation rate for refrigerated air conditioning**

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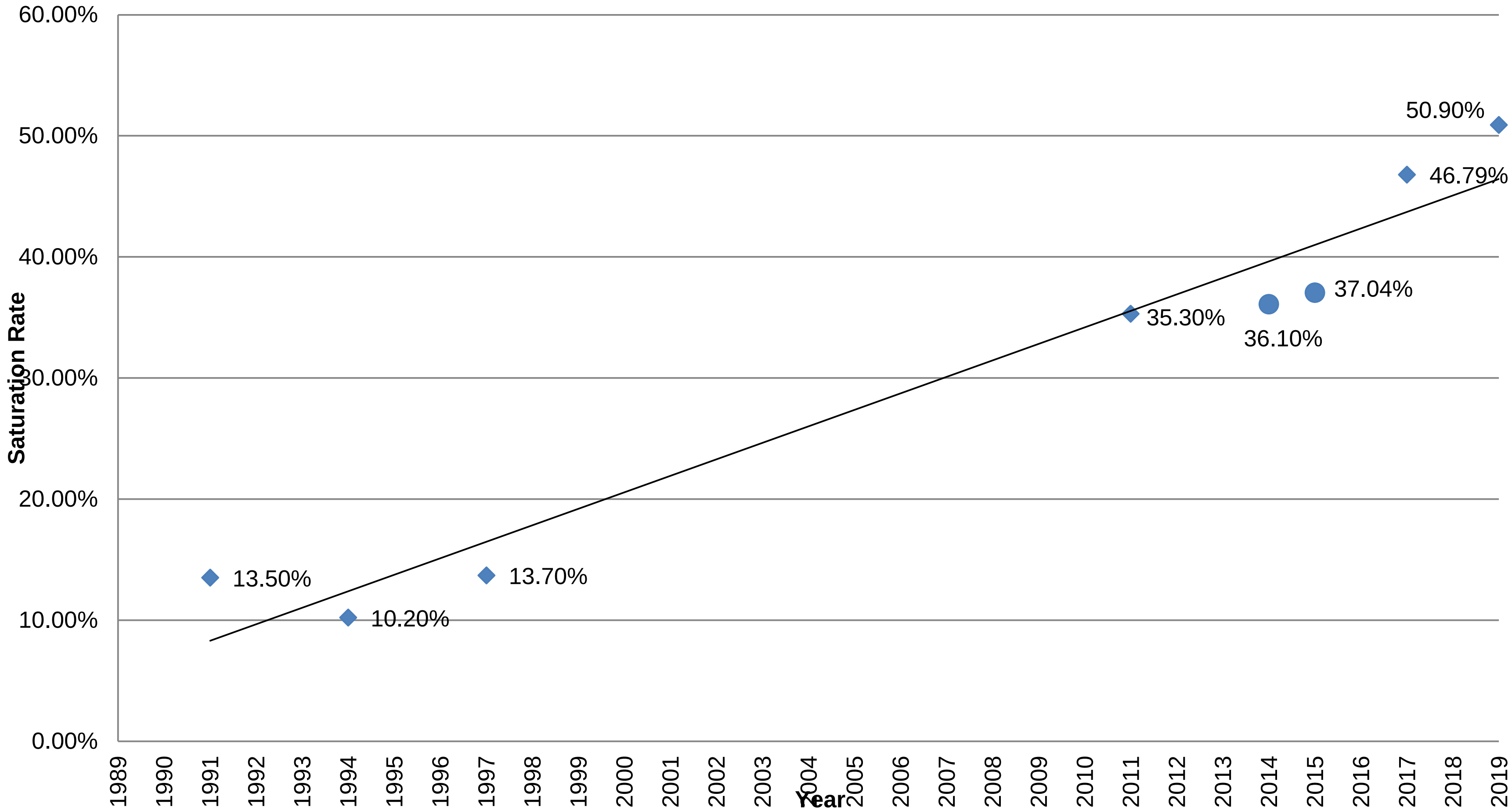
Refrigerated Air Conditioning Saturation Rate



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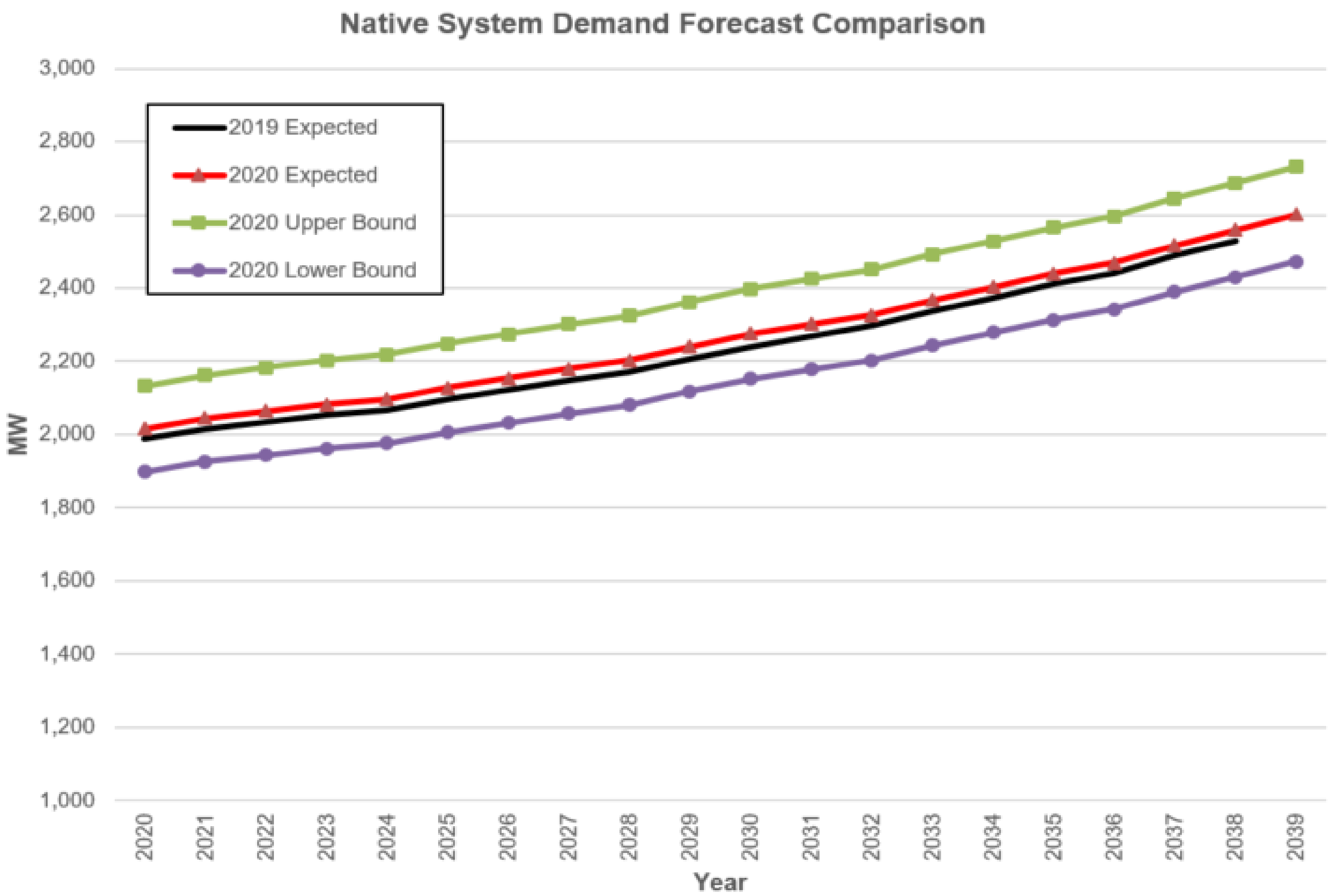
Demand Forecast Summary

Year	Native System Peak Demand (MW)	Percent Growth
2019	1,985	
2020	2,015	1.49%
2021	2,044	1.44%
2022	2,063	0.96%
2023	2,082	0.89%
2024	2,097	0.74%
2025	2,127	1.42%
2026	2,153	1.21%
2027	2,180	1.25%
2028	2,202	1.02%
2029	2,239	1.71%

Demand Forecast Comparison



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Demand Forecast Summary

- **The table below compares 10- and 20- year average growth for the native system demand from the 2019 and 2020 Forecast**

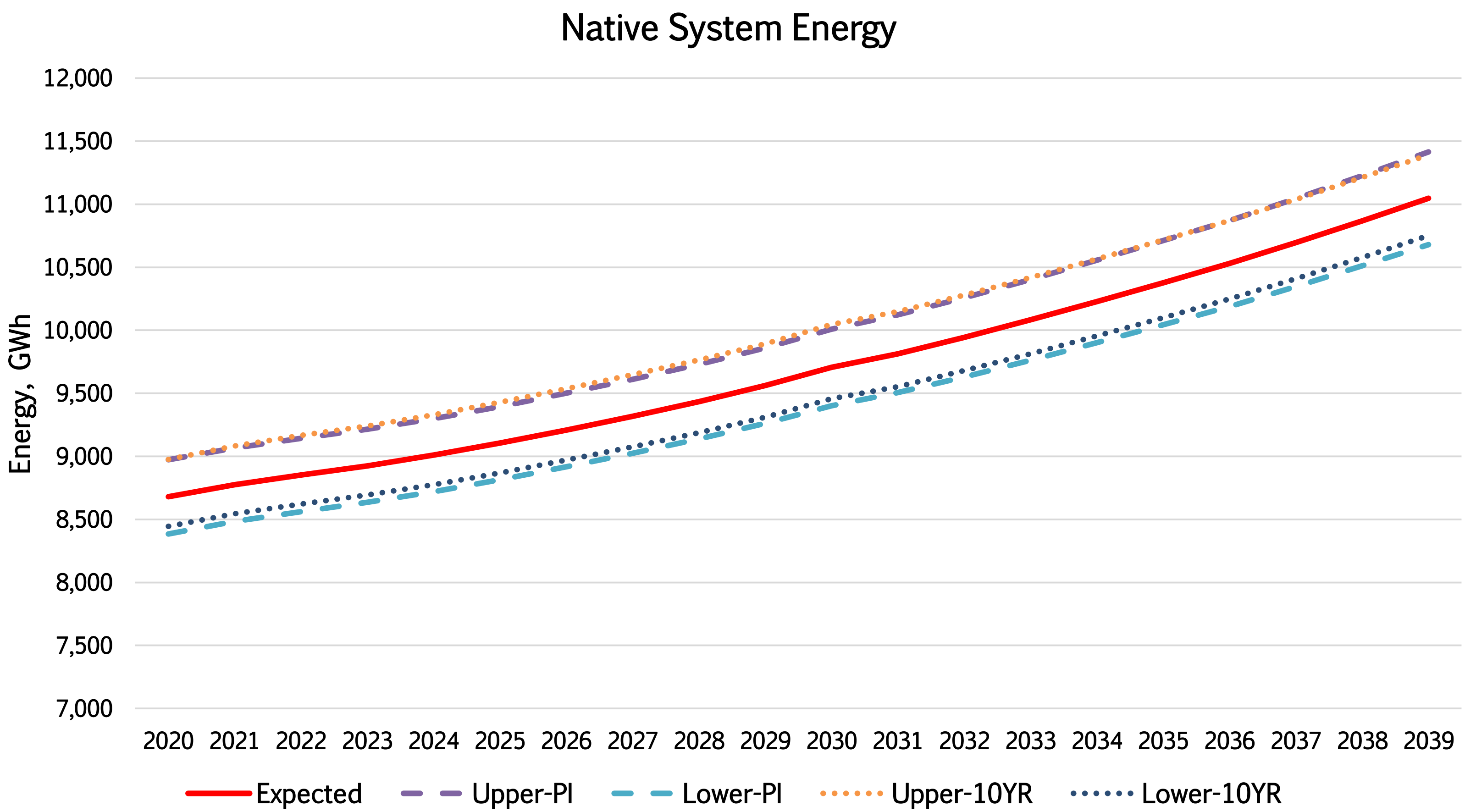
Native System Peak Demand Growth Rates (CAGR)			
	Historical	**2019 Forecast**	**2020 Forecast**
10-Year	2.4%	1.2%	1.2%
20-Year	2.7%	1.4%	1.4%

Extreme Weather Scenarios and Future Model Refinements

Upper and Lower Bands Based on Weather Scenarios

- **Upper and lower bands were constructed around the 2020 long-term native energy and demand from each of the last 20 years as the future weather.**
- **Extreme weather conditions were simulated**
  - Dataset composed of the highest number of HDD or CDD for each month over the last 10 years were used to generate an extreme weather year

Native System Energy



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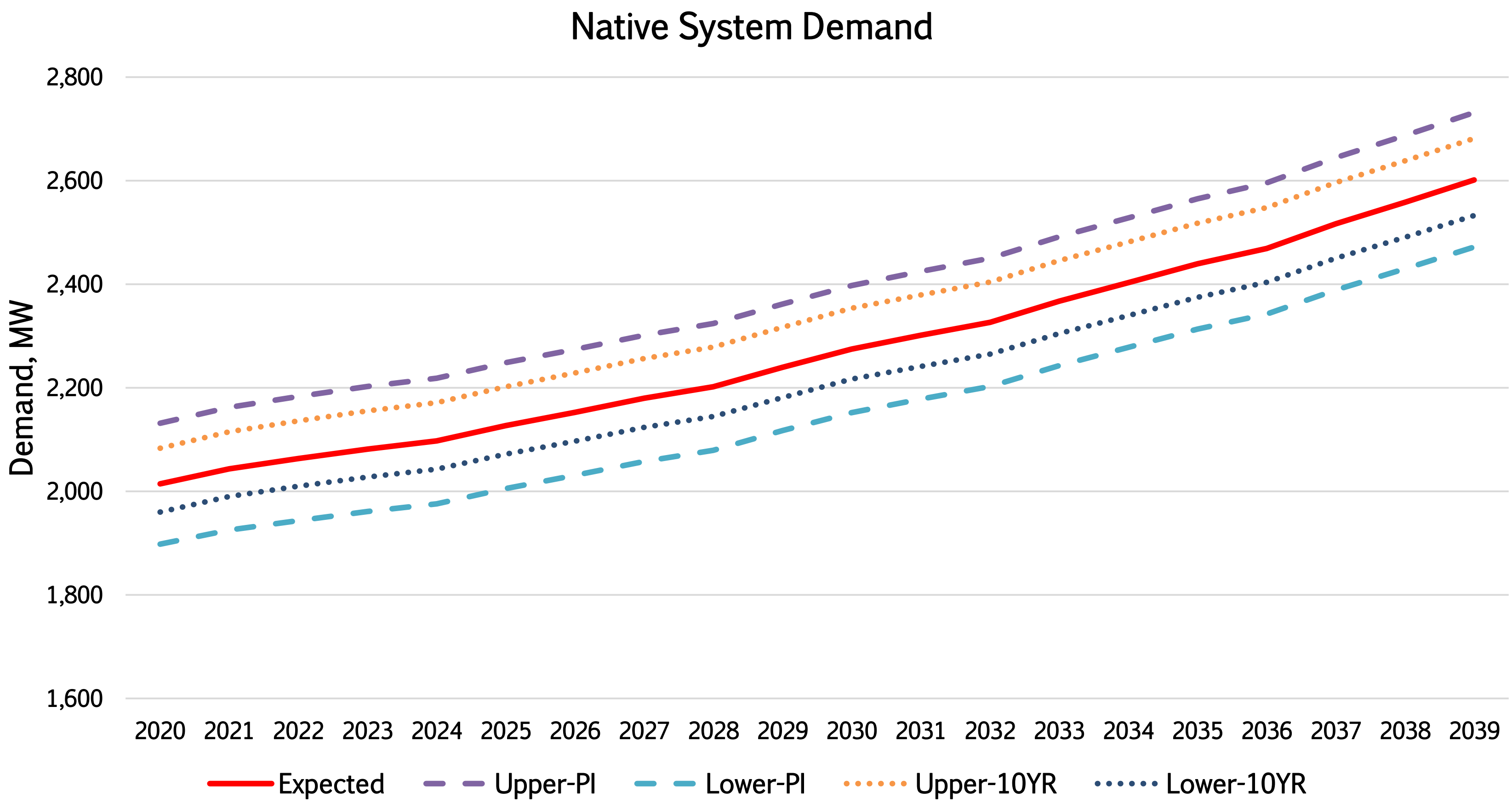
Native System Demand



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Future Load Considerations

- **Growth in:**
  - Distributed Generation
  - Battery Technology
  - Electric Vehicles
  - Energy Efficiency (UPC reductions)
- **Changes to rate design/offerings**
  - Three part rates
    - Fixed charges
    - Demand charges
    - Time varying energy charges
  - Critical Peak Pricing
  - Demand Response
- **Statutory Change**
- **Externalities**
  - COVID-19 Pandemic
  - Weather
  - Energy vs Demand impact

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Future Model Refinements

- **Keep improving Distributed Generation Model**
  - Sampling points
  - System Sizes

- **Incorporate forecasted electric vehicle load**
- **Study Changes to rate design/offerings**
- **AMI**

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Electric Vehicle Impact

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Light-Duty Battery Electric Vehicle Impact

- ***<u>Energy Impacts</u>***
  - **Estimates indicate a single light-duty BEV could consume an average of 3,767 kWh per year.**
  - **Equivalent to half (47%) of the average annual energy consumption of a residential customer in EPE's service territory,**
  - **Residential customers who own a BEV increase their average annual energy consumption by 47%.**
- ***<u>Demand Impacts</u>***
  - **Light-Duty BEV charging can create demand spikes between 1.2 and 19.2 kW per vehicle.**
  - **Compared to average residential non-coincident demand, light-duty BEV charging demand can be between 0.25 and up to 4 times higher per vehicle.**

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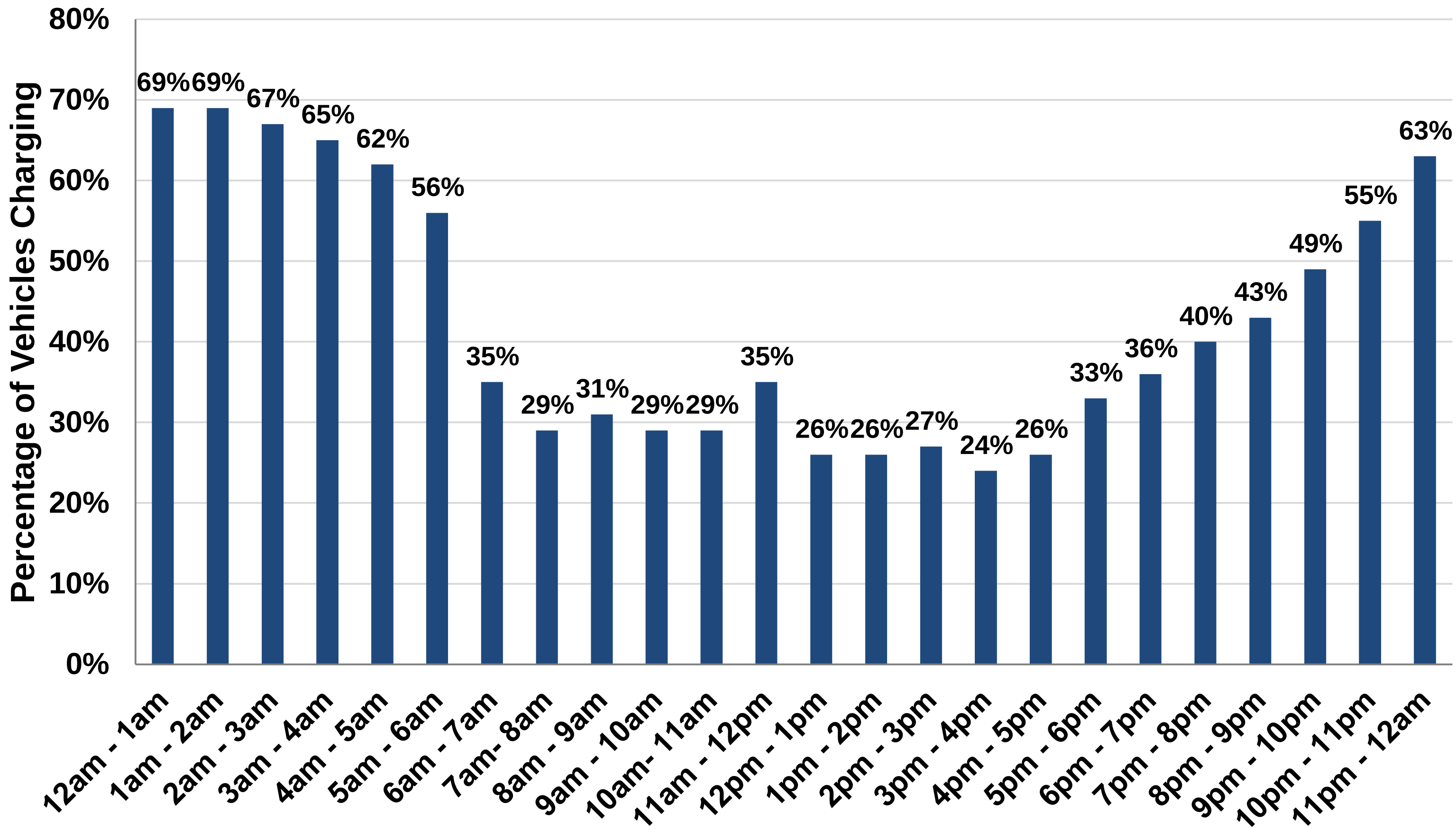
Typical Charging Demand Profile for Residential Customers



California Energy Commission, 2015-2017 California Vehicle Survey, May 2018, CEC-200-2018-006.
(Additional information: www.energy.ca.gov/data-reports/surveys/california-vehicle-survey)

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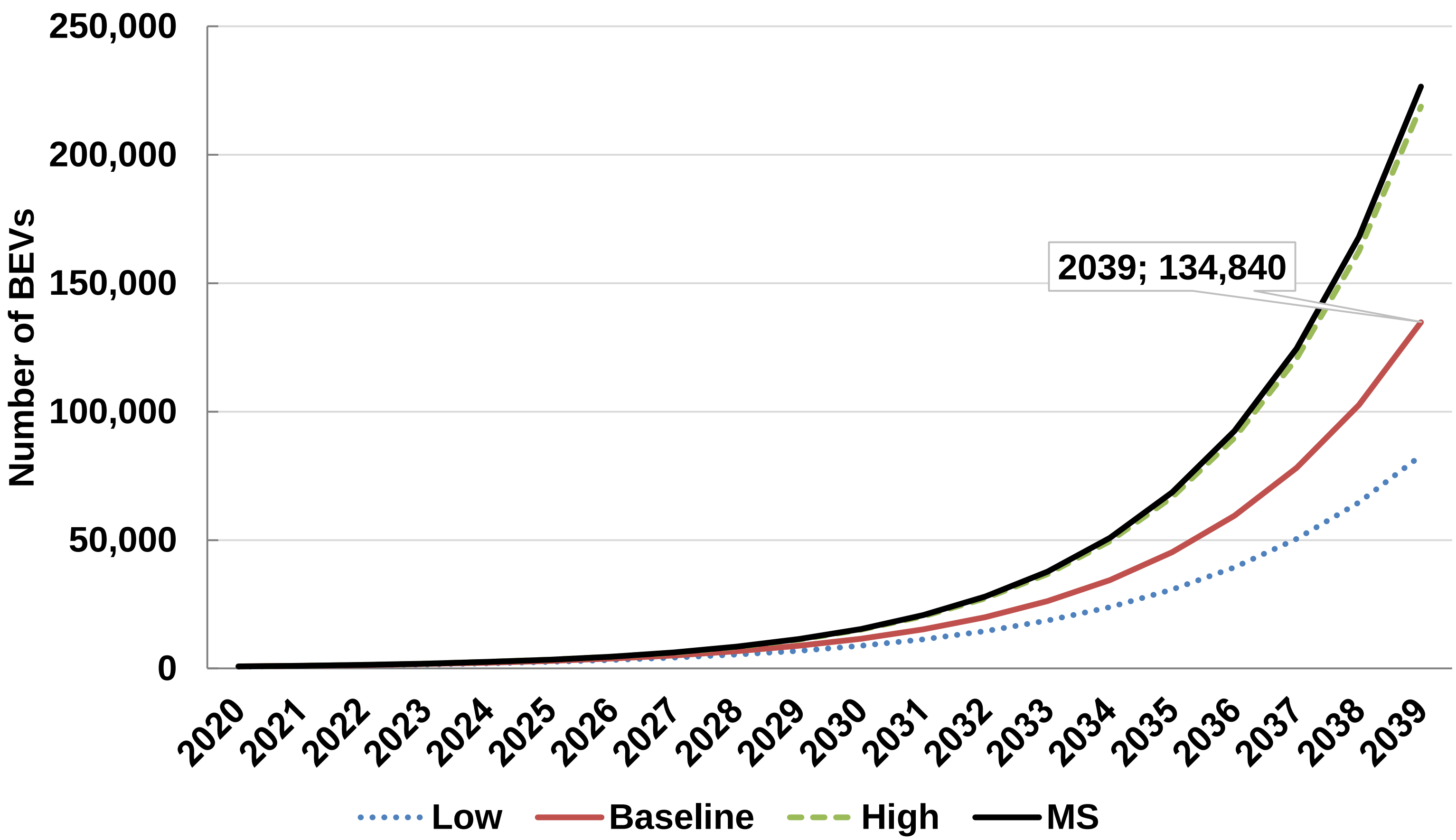
Light-Duty Battery Electric Vehicle Forecast



MS: Morgan Stanley

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Light-Duty Battery Electric Vehicles

Year	No. of Vehicles	Demand * (MW)	Energy ** (MWh)
2020	754	5	1,470
2021	991	7	1,931
2022	1,302	9	2,537
2023	1,711	12	3,333
2024	2,248	16	4,379
2025	2,953	21	5,753
2026	3,880	28	7,558
2027	5,098	37	9,930
2028	6,697	48	13,046
2029	8,799	63	17,141

* Forecasted Maximum Non-Coincident Peak Demand considering 7.2 kW level-2 charger
** Forecasted Energy considering average yearly commute

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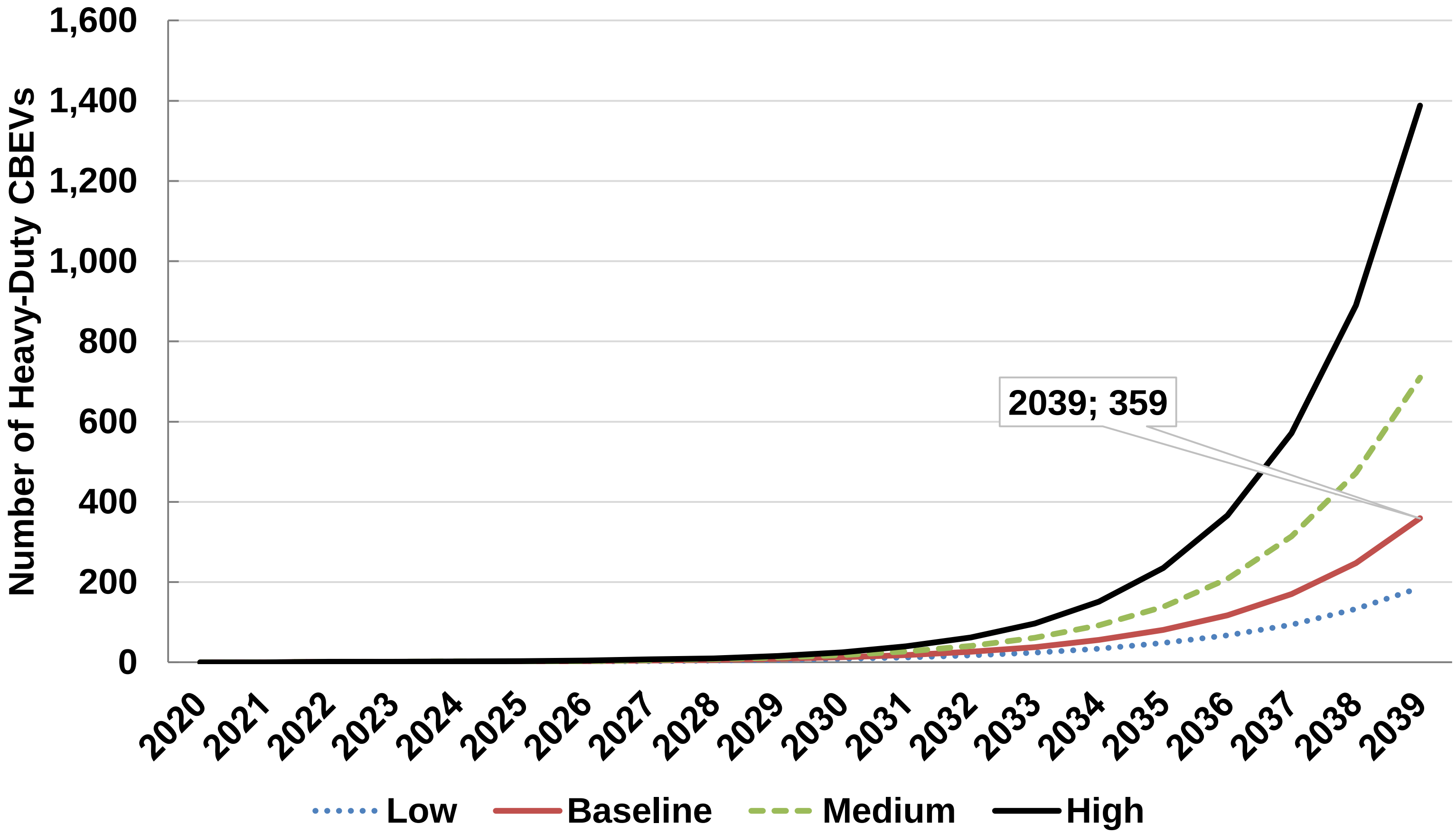
Heavy-Duty Commercial Battery Electric Vehicle Impact

- ***Energy Impacts***
- **Estimates indicate a single heavy-duty CBEV could consume an average of 131,778 kWh per year.**
- **Equivalent average annual energy consumption of 17 residential customers or 2 small commercial customers in EPE’s service territory.**
- **Compared to light-duty BEVs, heavy-duty CBEV energy consumption is on average 35 times greater.**
- ***Demand Impacts***
- **Heavy-duty CBEV charging can create demand spikes as high as 2 MW per vehicle.**
- **Compared to light-duty BEVs, charging demand can be between 2-17 times higher per vehicle.**

Heavy-Duty Commercial Battery Electric Vehicle Forecast



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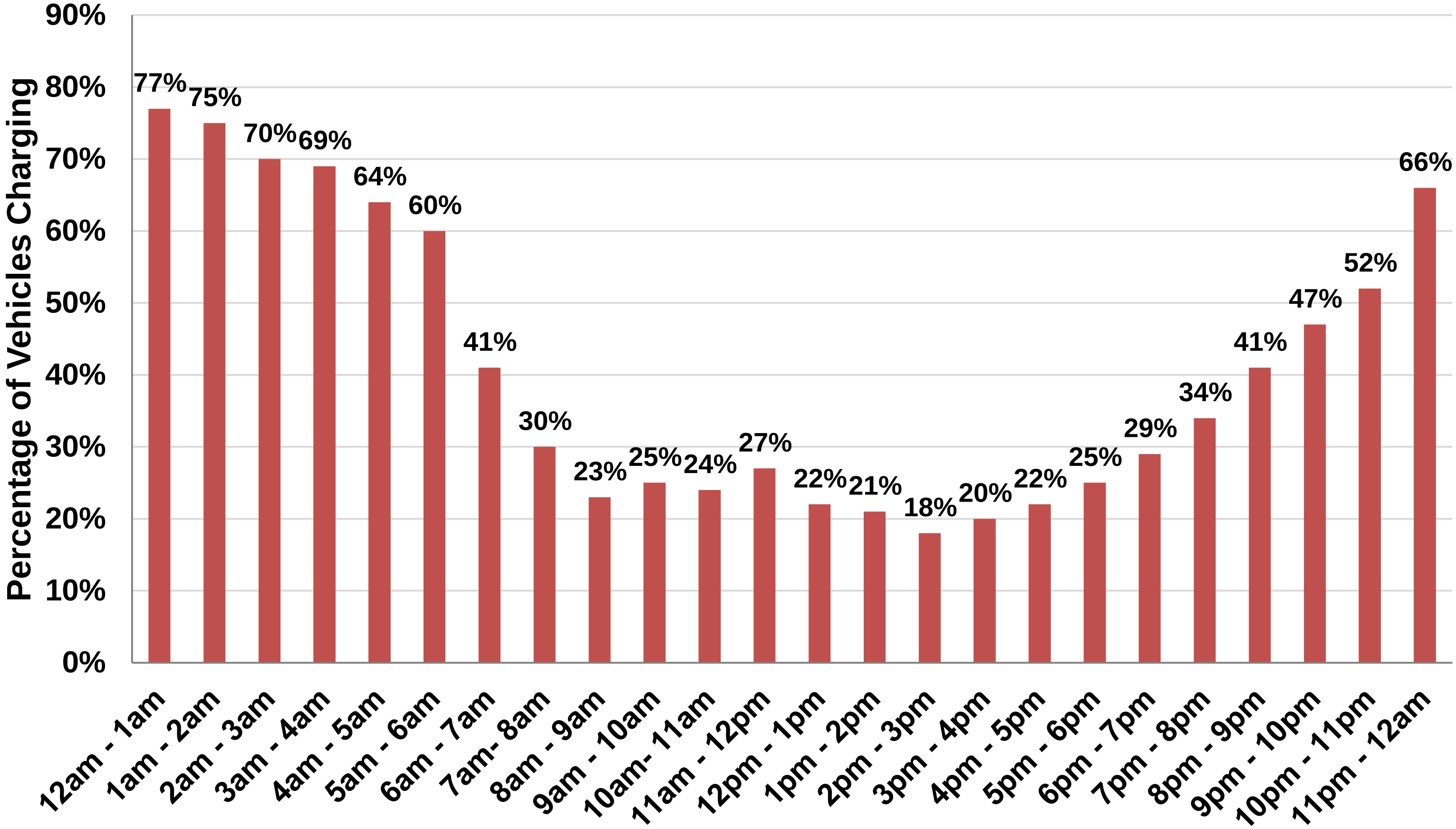
Heavy-Duty Commercial Battery Electric Vehicles

Year	No. of Vehicles	Demand * (MW)	Energy ** (MWh)
2020	0	0.0	0
2021	0	0.0	0
2022	1	0.1	132
2023	1	0.1	132
2024	1	0.1	132
2025	2	0.2	264
2026	3	0.4	395
2027	4	0.5	527
2028	6	0.7	791
2029	9	1.1	1,186

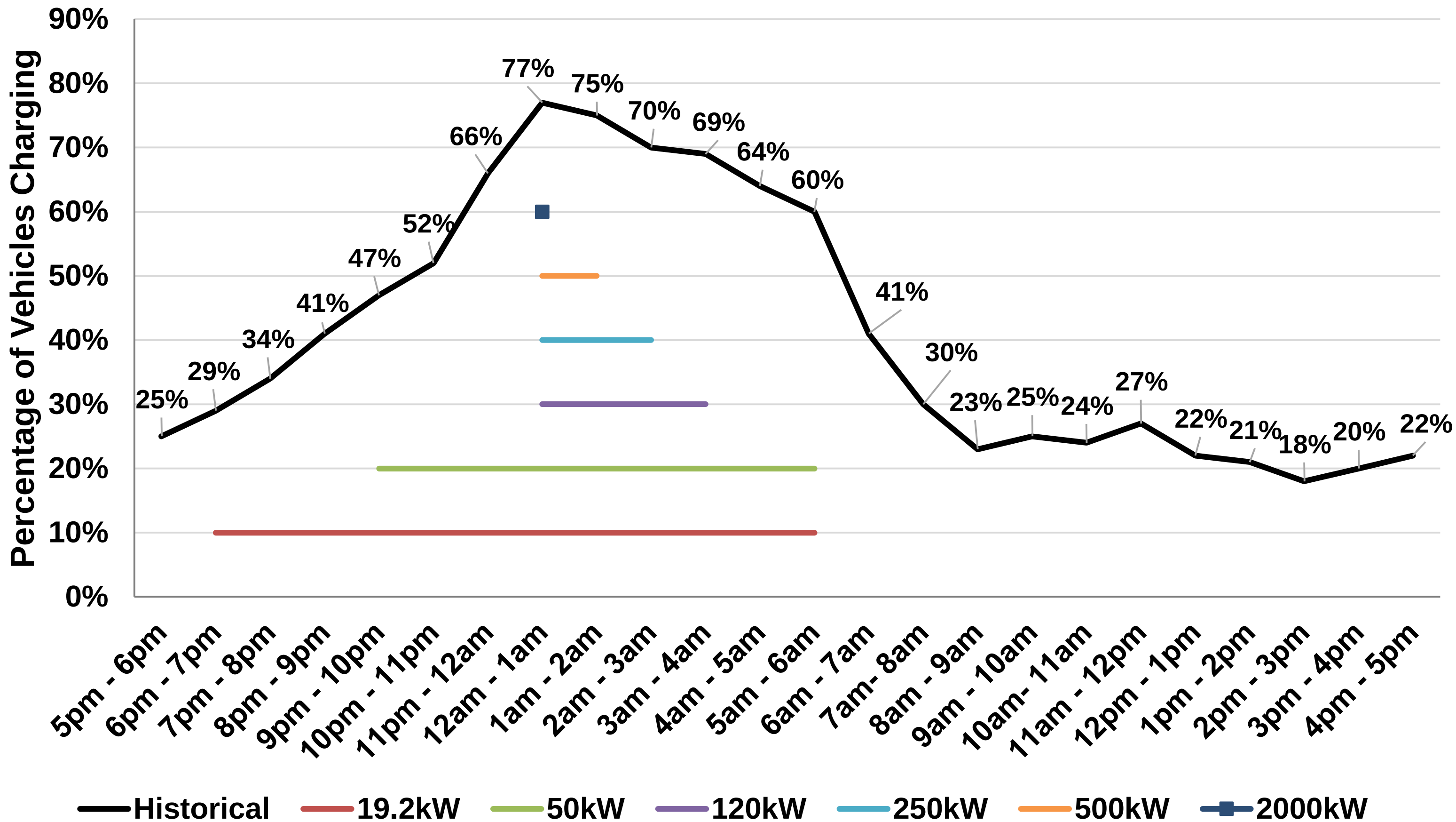
* Forecasted Maximum Non-Coincident Peak Demand considering 120 kW DCFC
** Forecasted Energy considering average yearly commute

Typical Charging Demand Profile for Commercial Customers



California Energy Commission, 2015-2017 California Vehicle Survey, May 2018, CEC-200-2018-006.
(Additional information: www.energy.ca.gov/data-reports/surveys/california-vehicle-survey)

Typical Charging Demand Profile for Heavy-Duty Commercial Customers with Different Chargers



Historical: California Energy Commission, 2015-2017 California Vehicle Survey, May 2018, CEC-200-2018-006. (Additional information: www.energy.ca.gov/data-reports/surveys/california-vehicle-survey)

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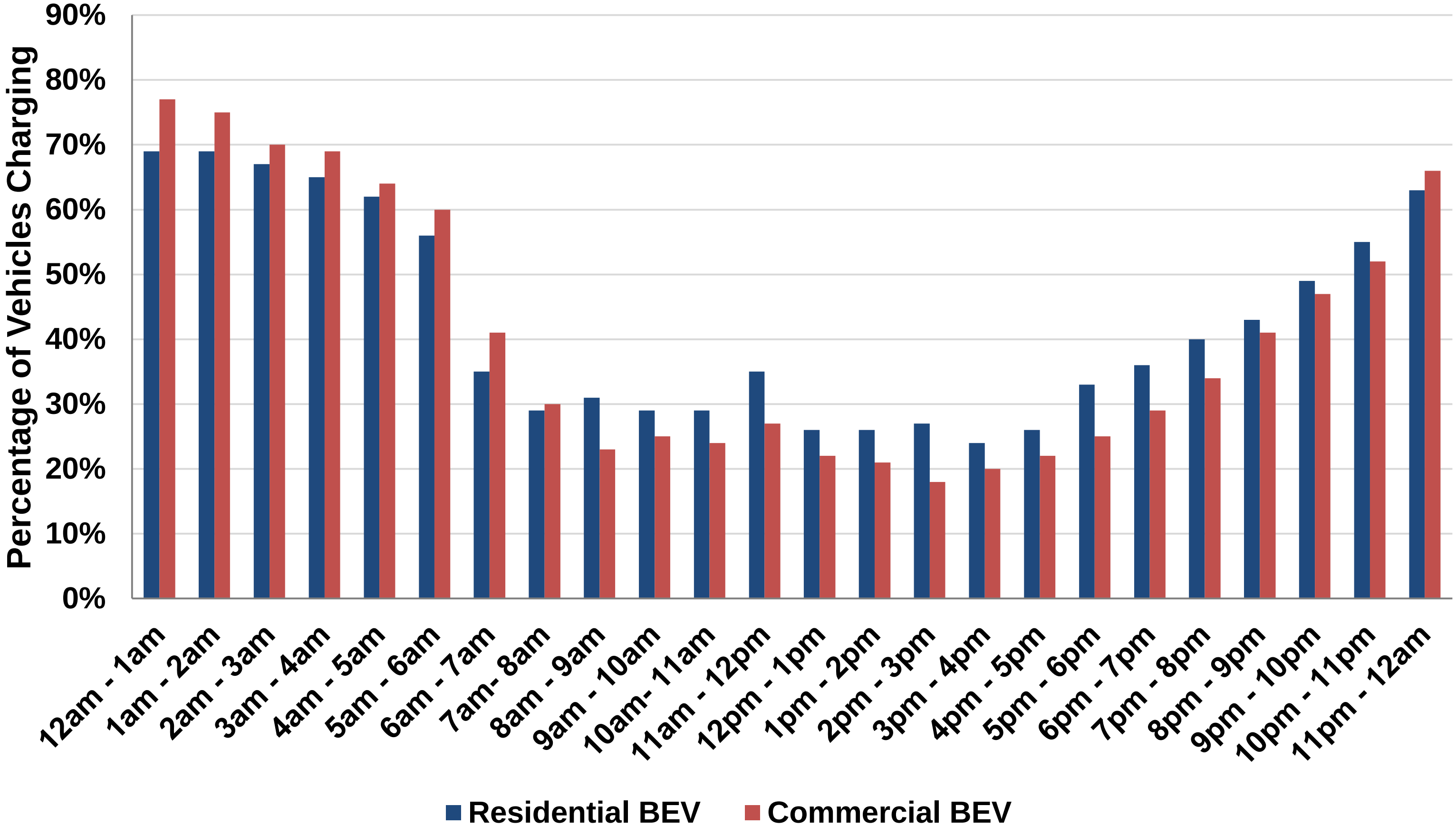
Commercial Vs Residential Typical Charging Demand Profile



California Energy Commission, 2015-2017 California Vehicle Survey, May 2018, CEC-200-2018-006.
(Additional information: www.energy.ca.gov/data-reports/surveys/california-vehicle-survey)

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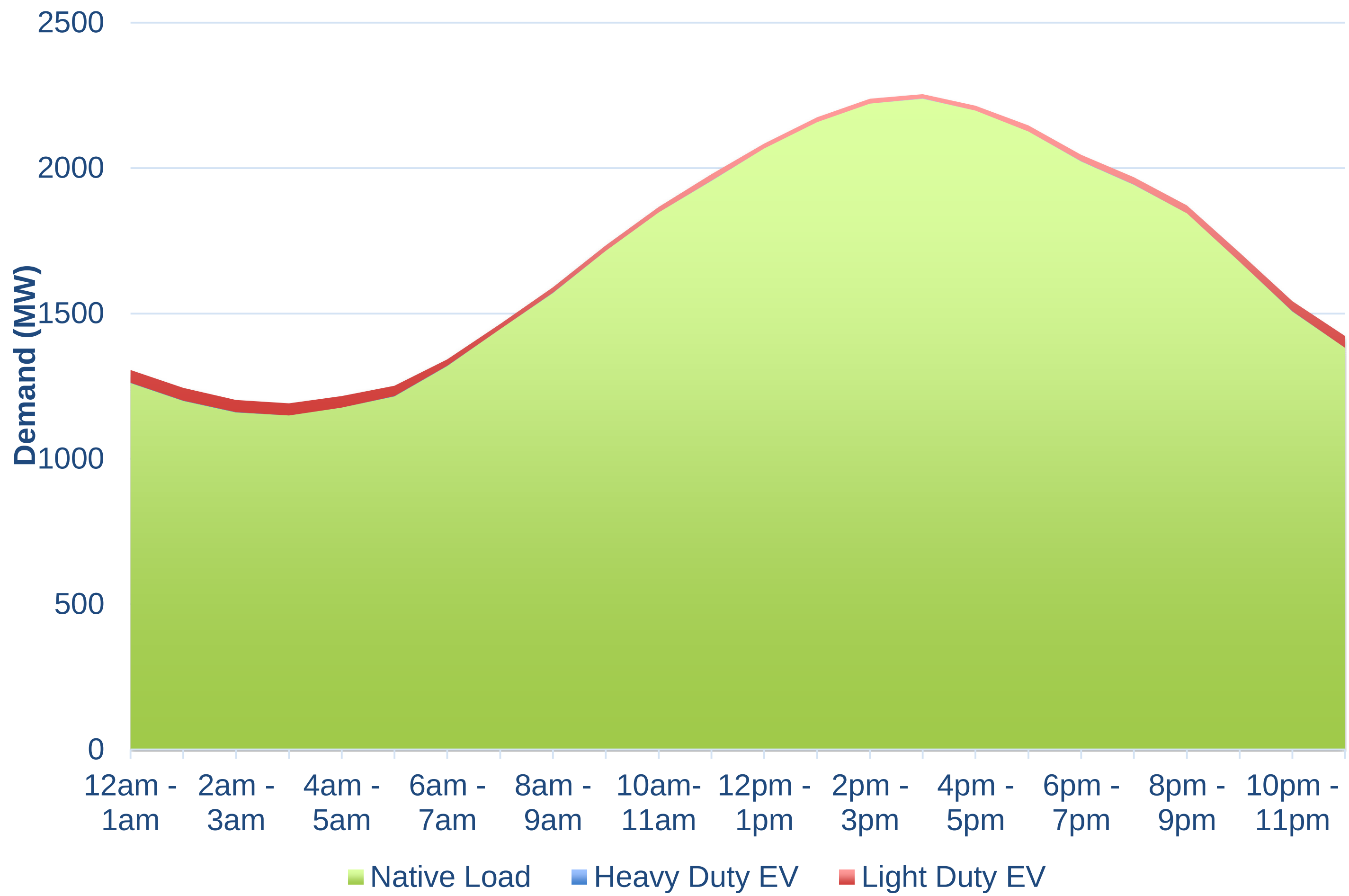
Summer Day in June 2029



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