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# Production Cost Modeling Exploratory Scenario Analysis to Inform Future Modeling Efforts

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2019 Integrated Energy Policy Report  
California Energy Commission



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**Date: October 30, 2019**

**Supply Analysis Office, Energy Assessments Division  
California Energy Commission**



# Topics

- IEPR 2019 Base Assumptions
- Exploratory Electricity System Scenarios
  - Low Hydro Scenario
  - Transportation Electrification Scenario
  - Building Electrification Scenario
  - High Electrification Scenario
  - Low Hydro with High Electrification Scenario
  - 2035 Mid Demand Scenario



# Topics

- Select Simulation Results
  - Reserve Margins
  - Natural Gas Demand for Electric Generation
  - GHG Emissions Projections

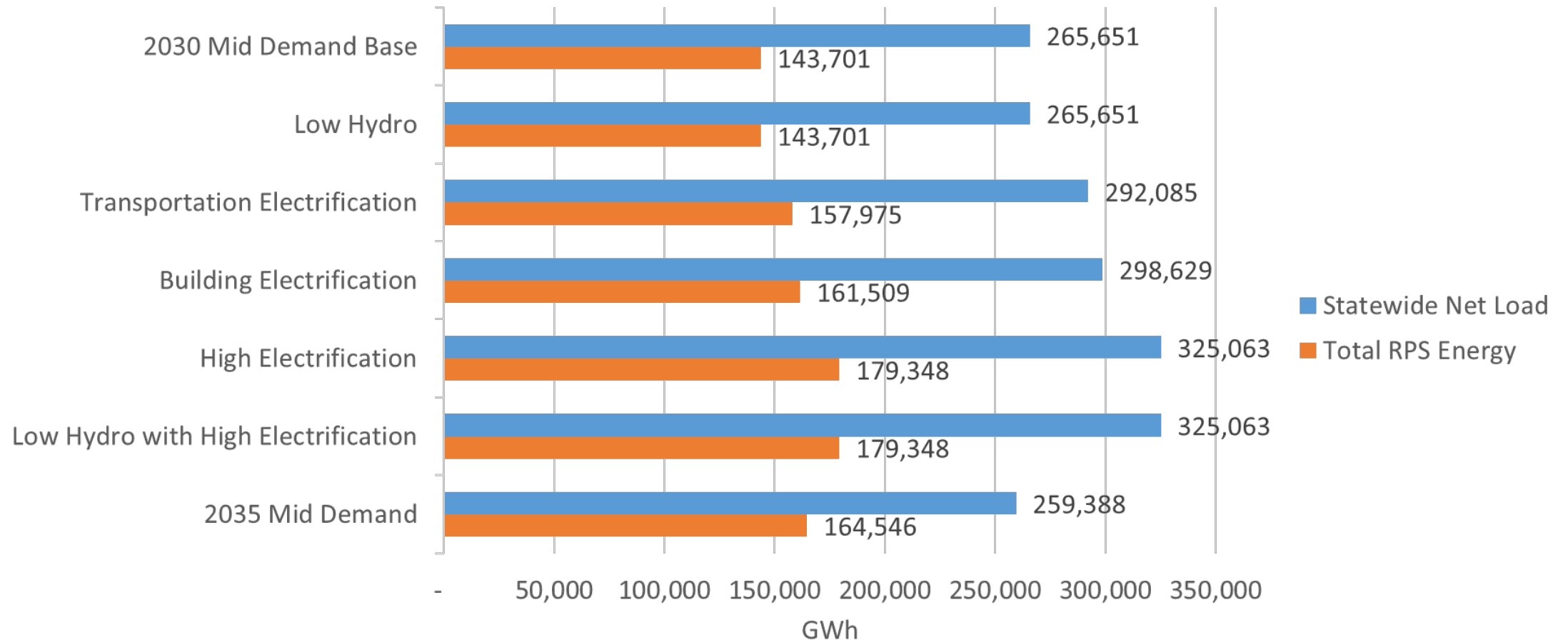


# IEPR 2019 Base Case Assumptions

- 60% RPS by 2030
- 2018 CED Forecast Update 2018-2030
- Existing renewables & planned retirements
- 2,100 MW of additional battery storage
- 75% renewable energy must come from in-state
- WECC-wide RPS policies as of 12/31/2018
- 15-year average hydro profile

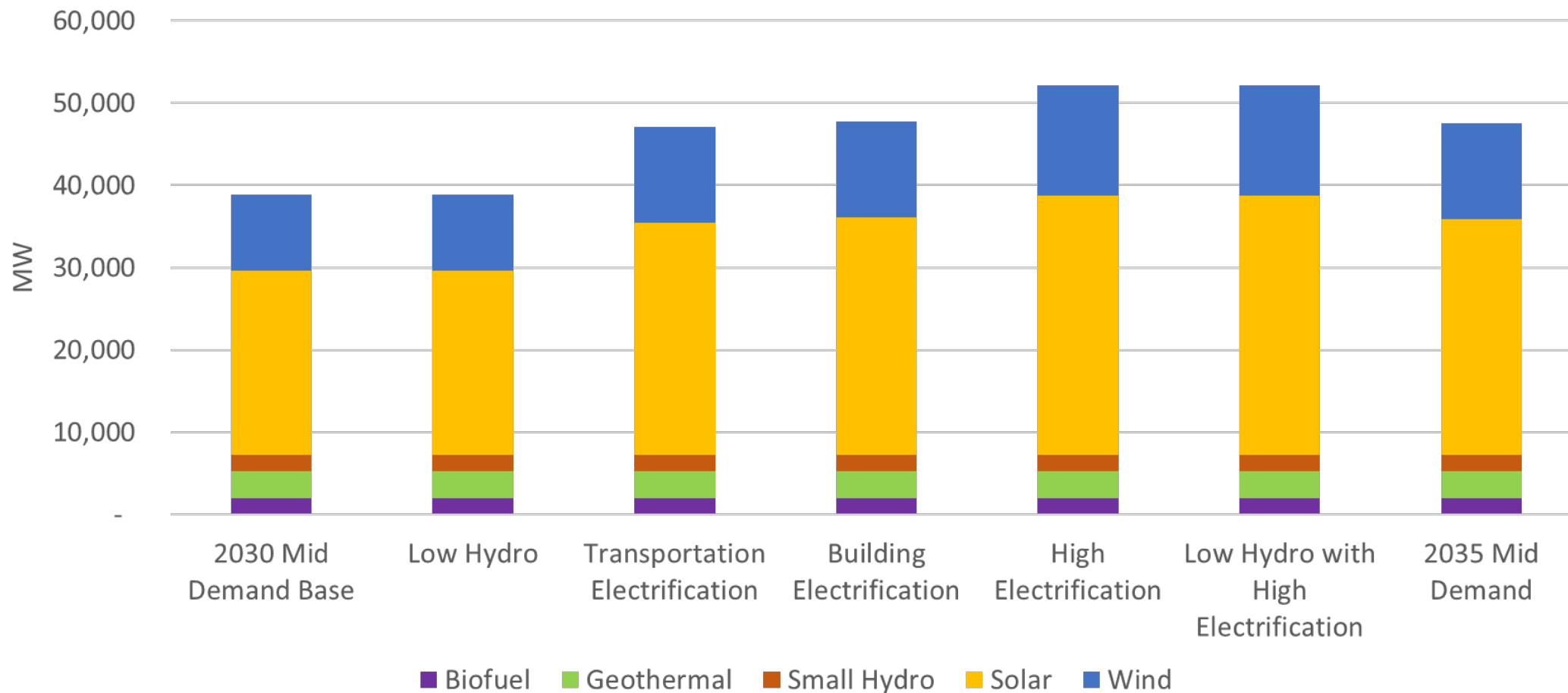


# Exploratory Scenario Assumptions: Statewide Net Energy for Load, RPS Energy





# Total Renewable Capacity by Resource Type





# Assumption Changes

Scenario	RPS Target	Additional	
		Battery Storage	Hydro Profile
2030 Mid Demand Base	60%	0	Average
Low Hydro	60%	0	Low
Transportation Electrification	60%	0	Average
Building Electrification	60%	1,221	Average
High Electrification	60%	0	Average
Low Hydro with High Electrification	60%	0	Low
2035 Mid Demand	70%	0	Average





# Minimum of Reserve Margins

Scenario	Min of RM	Hour of Min RM
2030 Mid Demand Base	15.5%	9/3/30 6:00 PM
Low Hydro	17.3%	8/19/30 7:00 PM
Transportation Electrification	11.0%	9/3/30 6:00 PM
Building Electrification*	15.2%	9/3/30 6:00 PM
High Electrification	10.5%	9/3/30 6:00 PM
Low Hydro with High Electrification	13.8%	7/25/30 8:00 PM
2035 Mid Demand	12.5%	9/13/35 6:00 PM



# Reserve Margins at Maximum Load

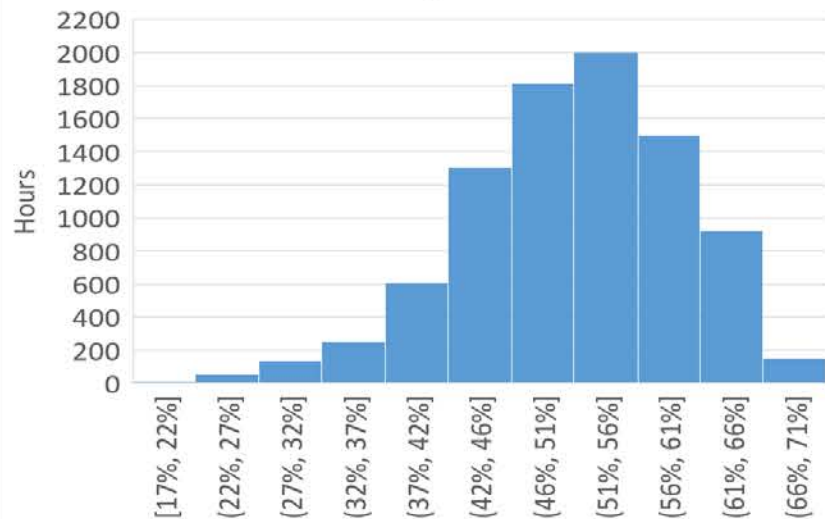
Scenario	RM at Max Load	Max of Load (MW)	Hour of Max Load RM
2030 Mid Demand Base	15.5%	55,511	9/3/30 6:00 PM
Low Hydro	17.9%	55,516	9/3/30 6:00 PM
Transportation Electrification	14.6%	57,931	9/3/30 8:00 PM
Building Electrification*	15.2%	58,345	9/3/30 6:00 PM
High Electrification	10.5%	60,658	9/3/30 6:00 PM
Low Hydro with High Electrification	14.0%	60,651	9/3/30 6:00 PM
2035 Mid Demand	15.9%	55,287	9/3/35 6:00 PM

California total peak net import limit assumption = 13,100 MW

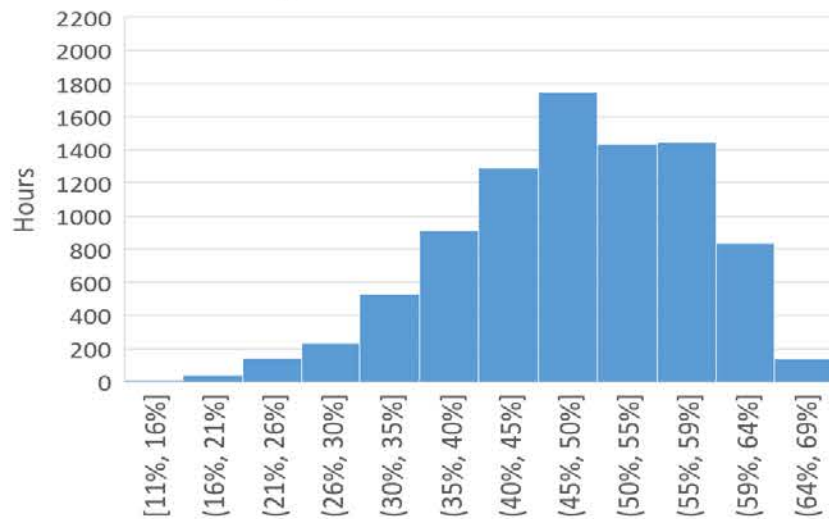


# Reserve Margins

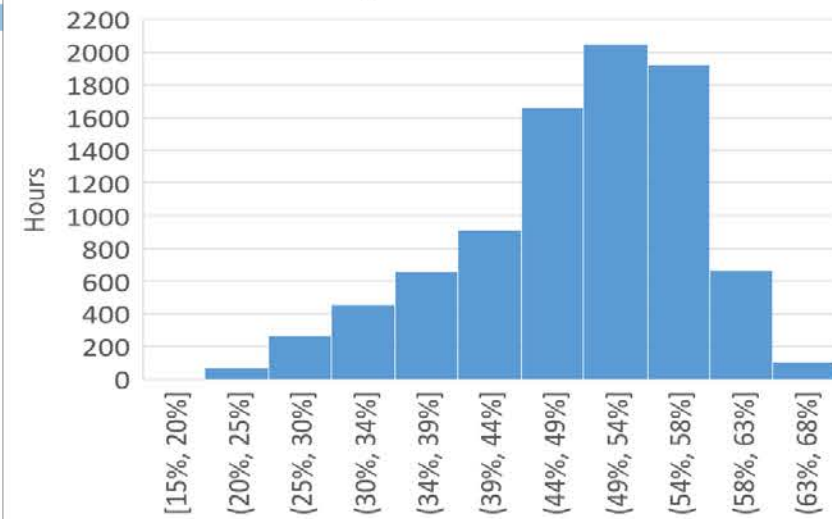
## Low Hydro



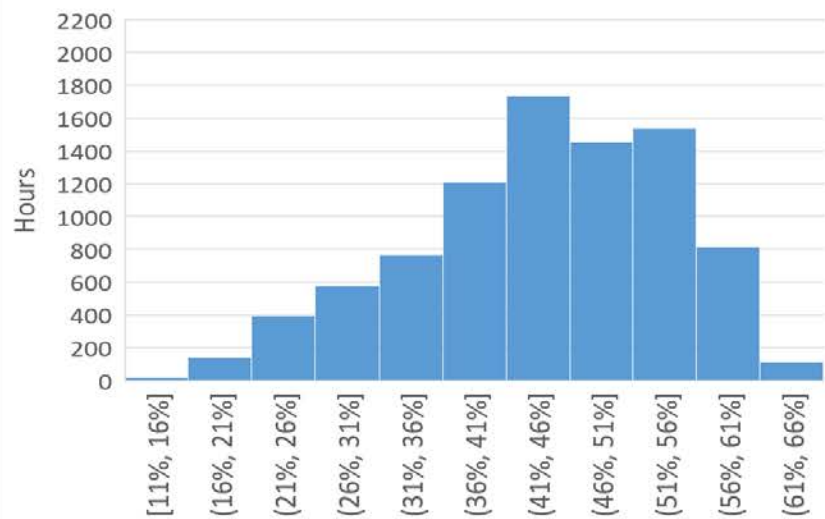
## Transportation Electrification



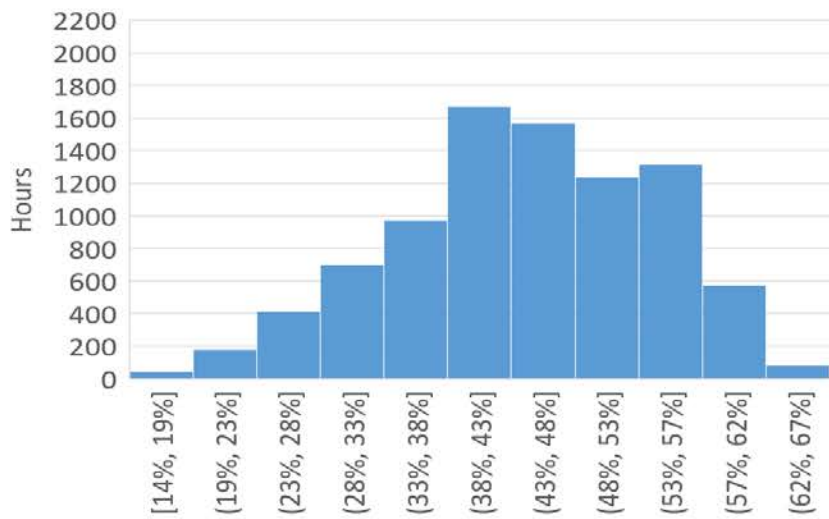
## Building Electrification



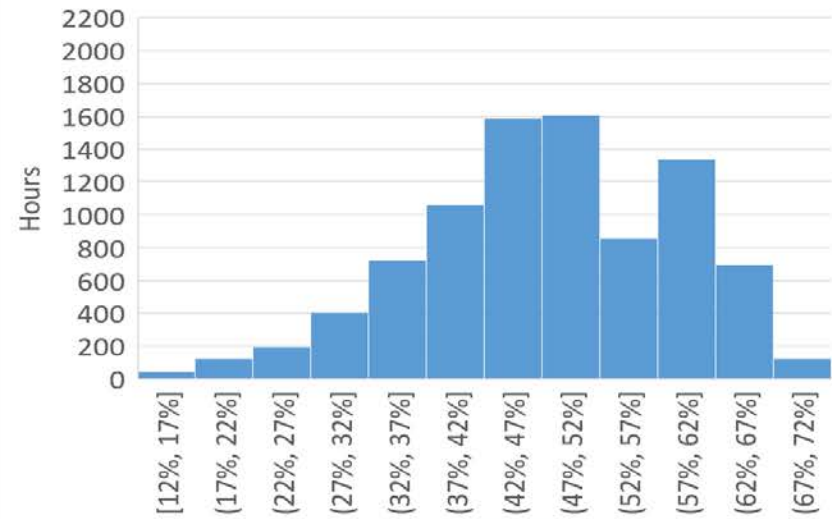
## High Electrification



## Low Hydro with High Electrification

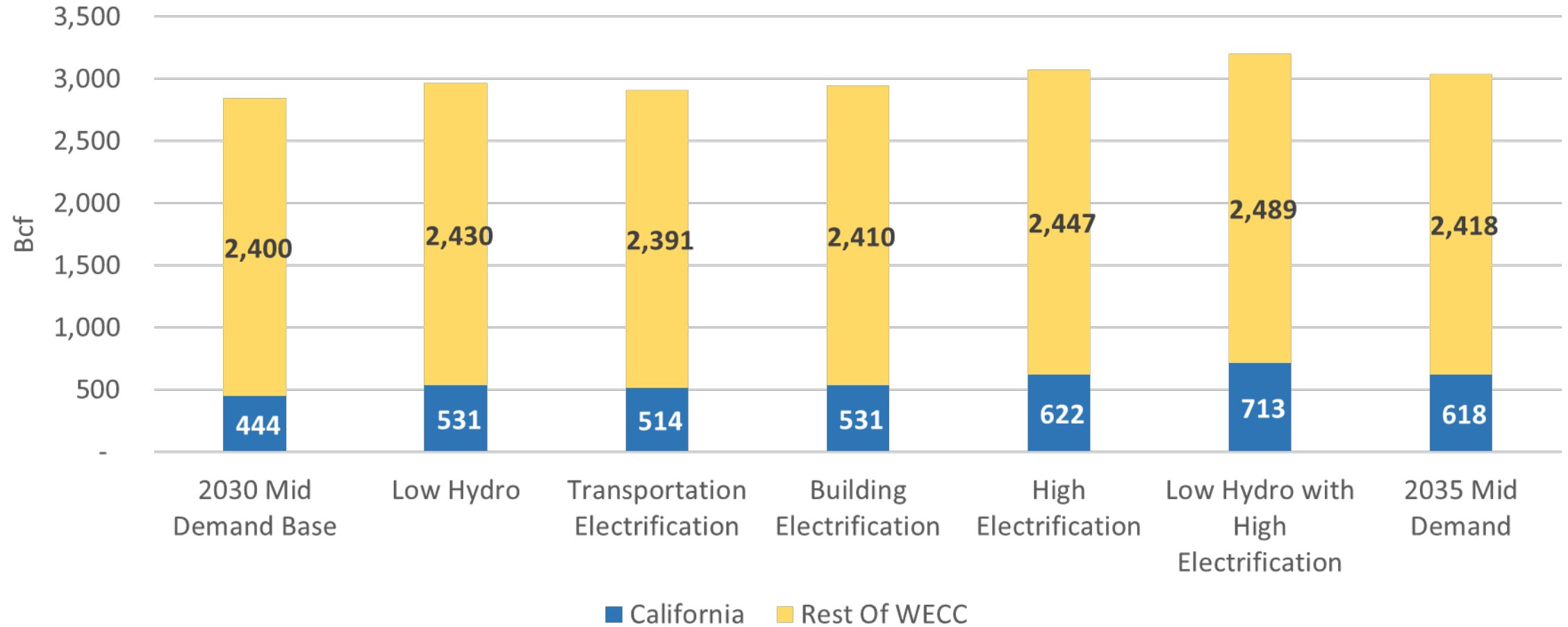


## 2035 Mid Demand





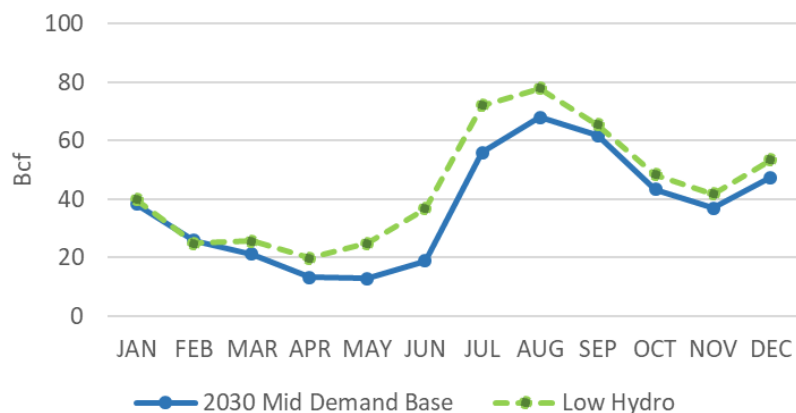
# WECC-Wide Annual Natural Gas Consumption



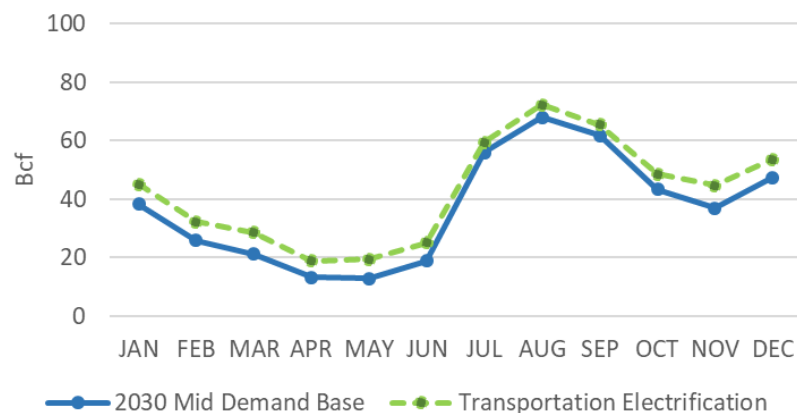


# Monthly Natural Gas Consumption

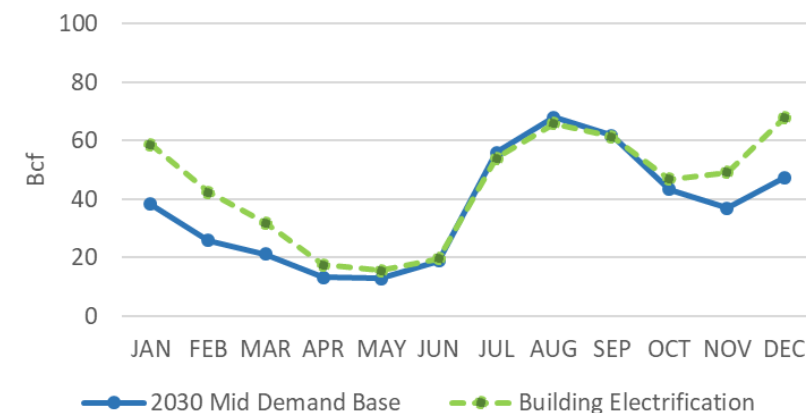
## Low Hydro



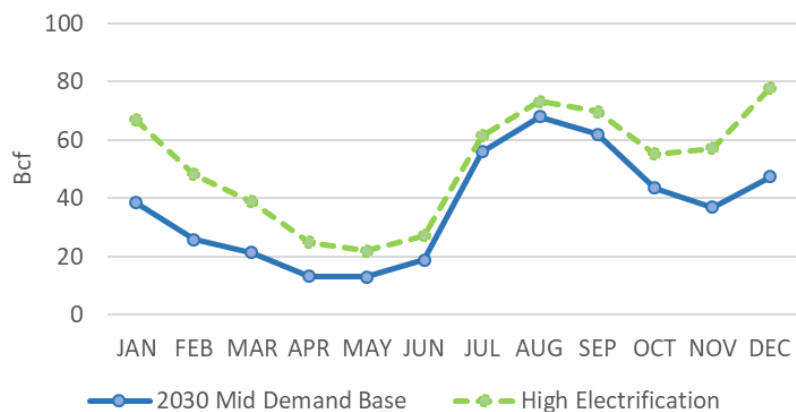
## Transportation Electrification



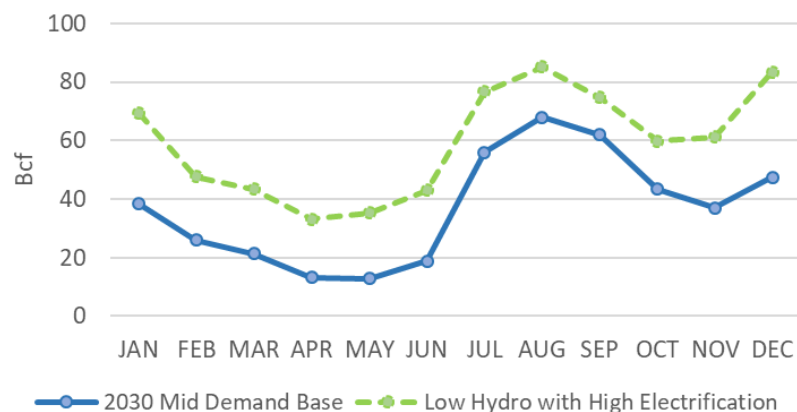
## Building Electrification



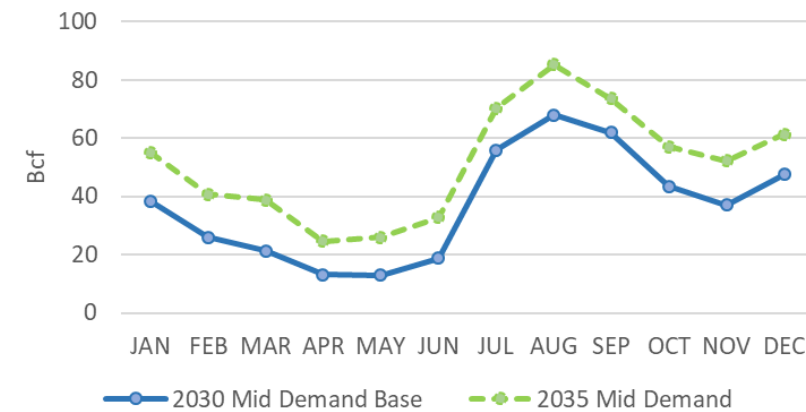
## High Electrification



## Low Hydro with High Electrification

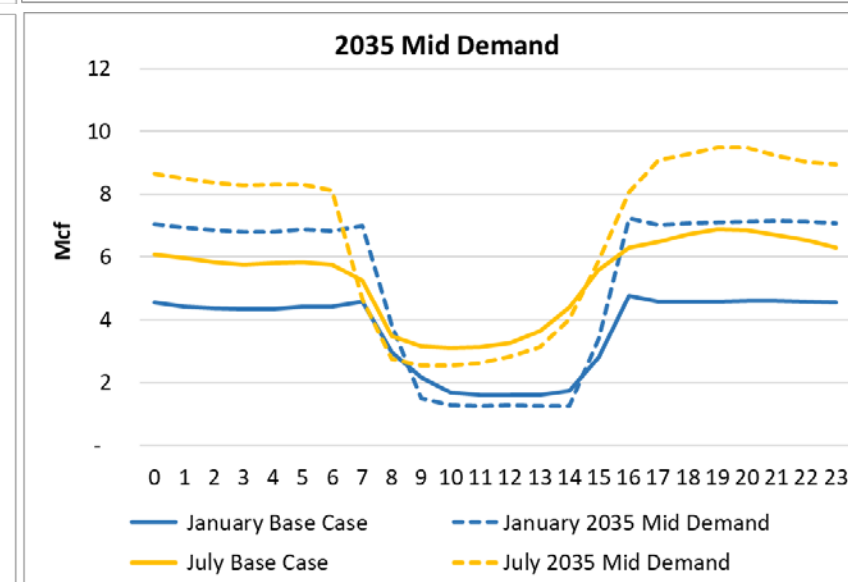
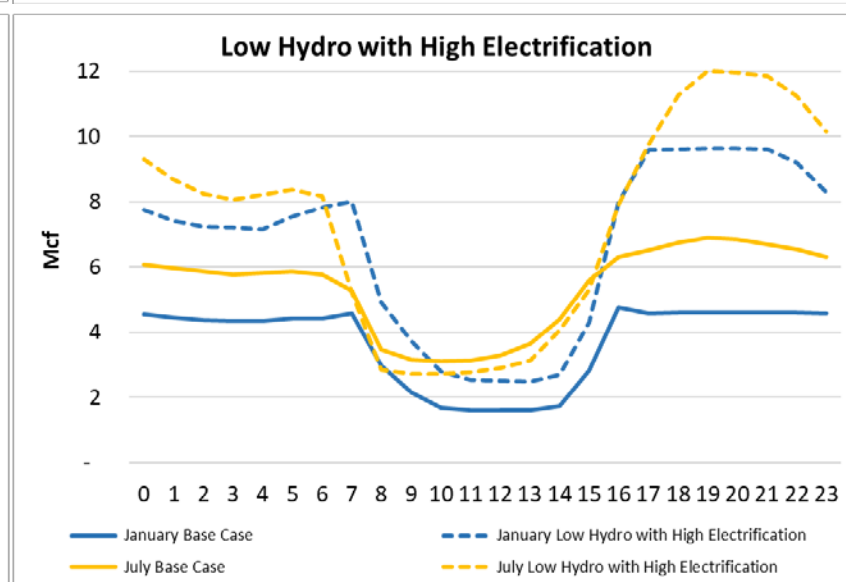
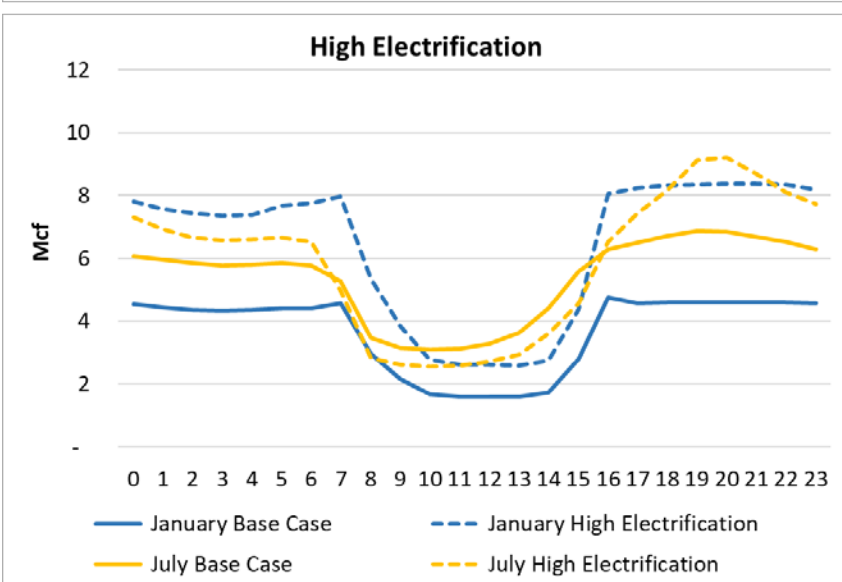
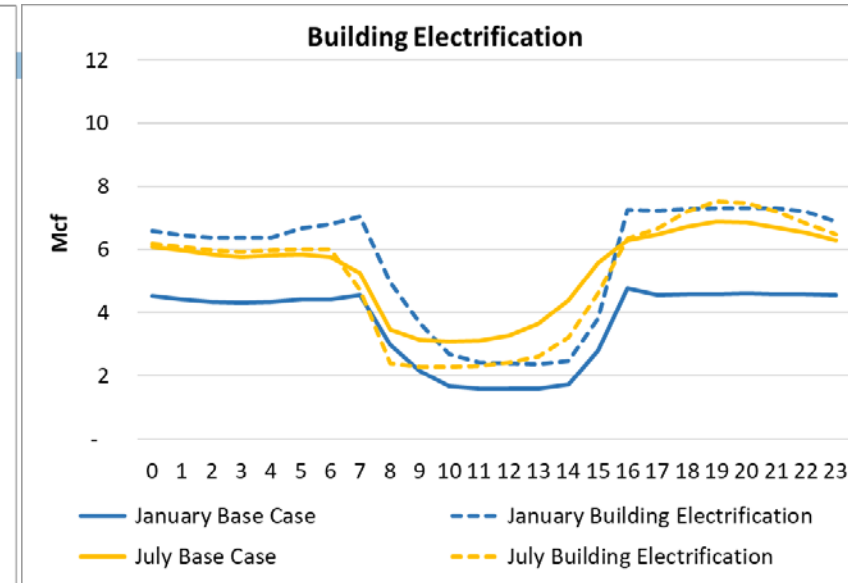
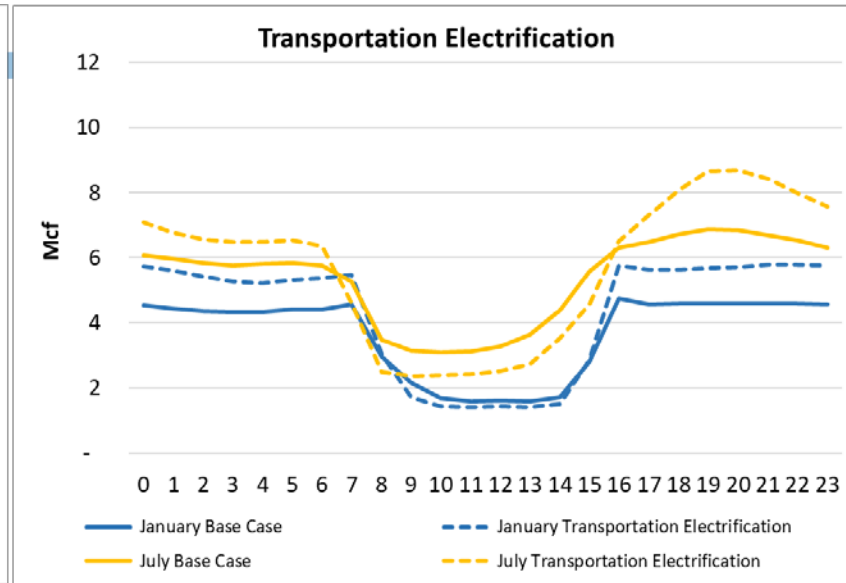
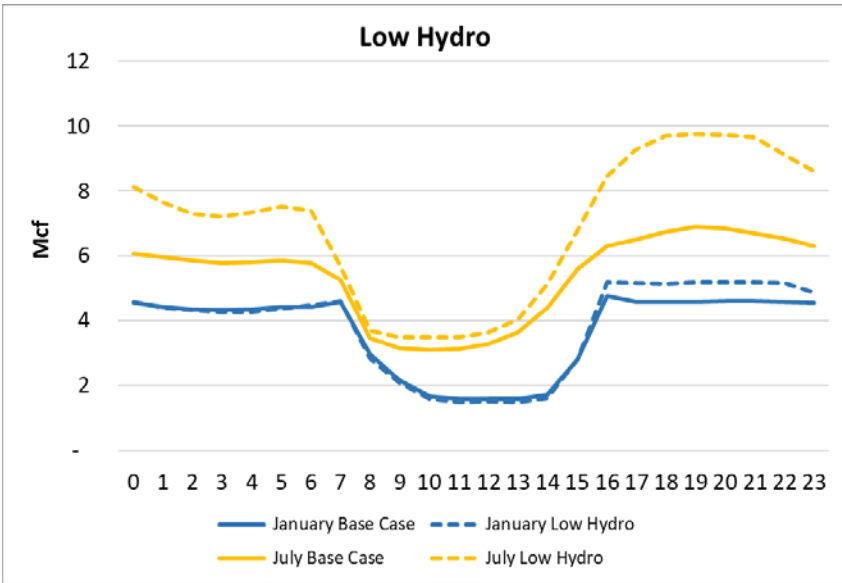


## 2035 Mid Demand





# Average Hourly Natural Gas Use





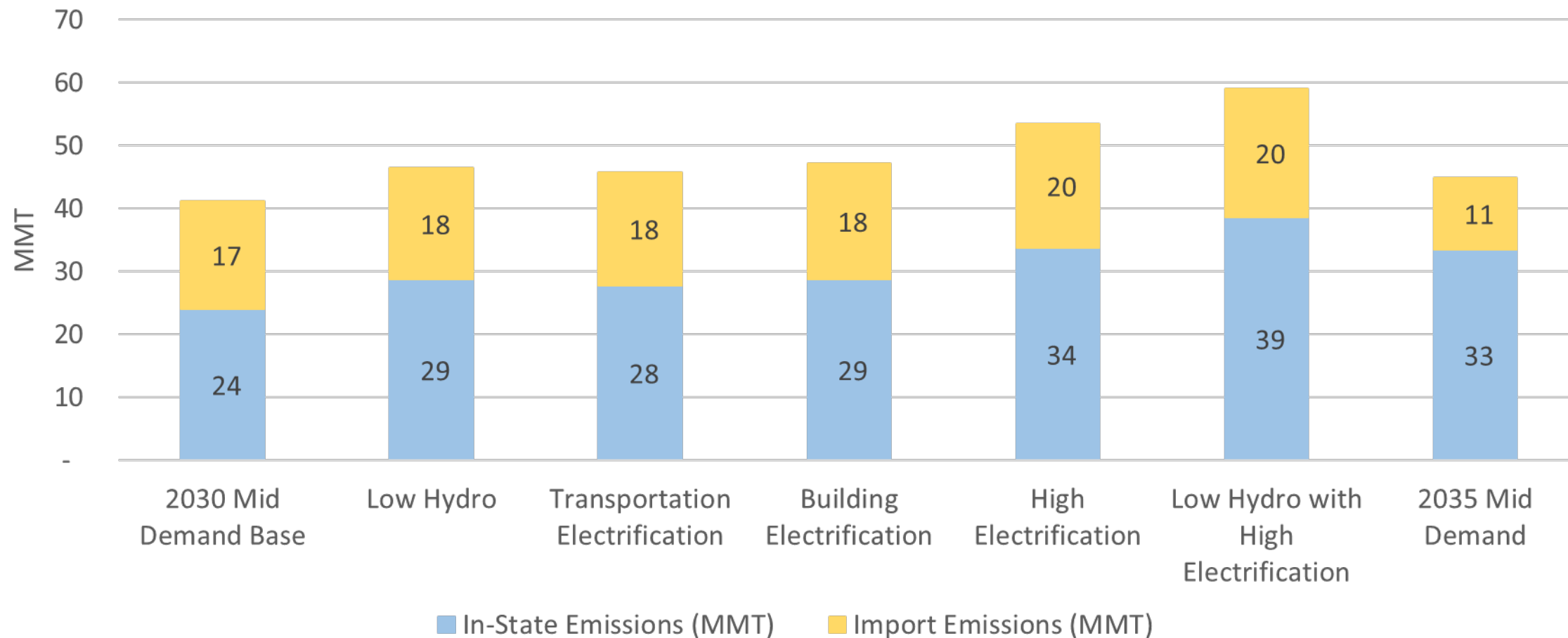


# California Emission Intensity

Scenario	Emission Intensity (MMT/MWh)
2030 Mid Demand Base	0.15
Low Hydro	0.17
Transportation Electrification	0.15
Building Electrification	0.15
High Electrification	0.16
Low Hydro with High Electrification	0.17
2035 Mid Demand	0.16



# California Emissions







# Net Imports to California

Scenario	Percent of Net Imports Meeting Total CA Load
2030 Mid Base	54%
Low Hydro	50%
Transportation Electrification	46%
Building Electrification	46%
High Electrification	44%
Low Hydro with High Electrification	41%
2035 Base Case	23%



# Thank You

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Questions and Comments:

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