LA100

The Los Angeles 100% Renewable Energy Study

Advisory Group Meeting #11

Virtual Meeting #1

Los Angeles Department of Water & Power

NREL Transforming ENERGY

Advisory Group #11 Materials on LADWP's Website

- Scenario Matrix
- Scenario and Technology Descriptions
- Meeting Timeline
- Modeling Workflow
- AG #11 Presentations (uploaded individually one day prior to presentation)

Agenda

Today (May 14)

- Welcome
- Electricity Demand Projections and Demand Response
- Discussion/Q&A

May 21

- Welcome
- Renewable Options and Trade-offs to Go from 90% to 100% RE
- Discussion/Q&A

May 28

- Welcome
- Local Solar and Storage
- Discussion/Q&A

June 4

- Follow-up Q&A

Tips for Productive Discussions

Let one person speak at a time

Keep phone/computer on mute until ready to speak

Help ensure everyone gets equal time to give input

Type “Hand” in Chat Function to raise hand

Keep input concise so others have time to participate

Also make use of CHAT function

Actively listen to others, seek to understand perspectives

Offer ideas to address questions and concerns raised by others

Hold questions until after presentations


LA100
The Los Angeles 100% Renewable Energy Study
GoToMeeting
Functions
Meeting #11
GoToMeeting
Talking:
Audio
Screen
Webcam
Karla LeComte (me, organizer)
All
All
Invite
Chat
Enter your message
To: Everyone
Send
Record
Meeting ID: 544-477-757
LA DWP
Los Angeles Department of Water & Power
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* How to Mute and Share your Webcam

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LA DWP Los Angeles Department of Water & Power

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*How to Change Your Display Name

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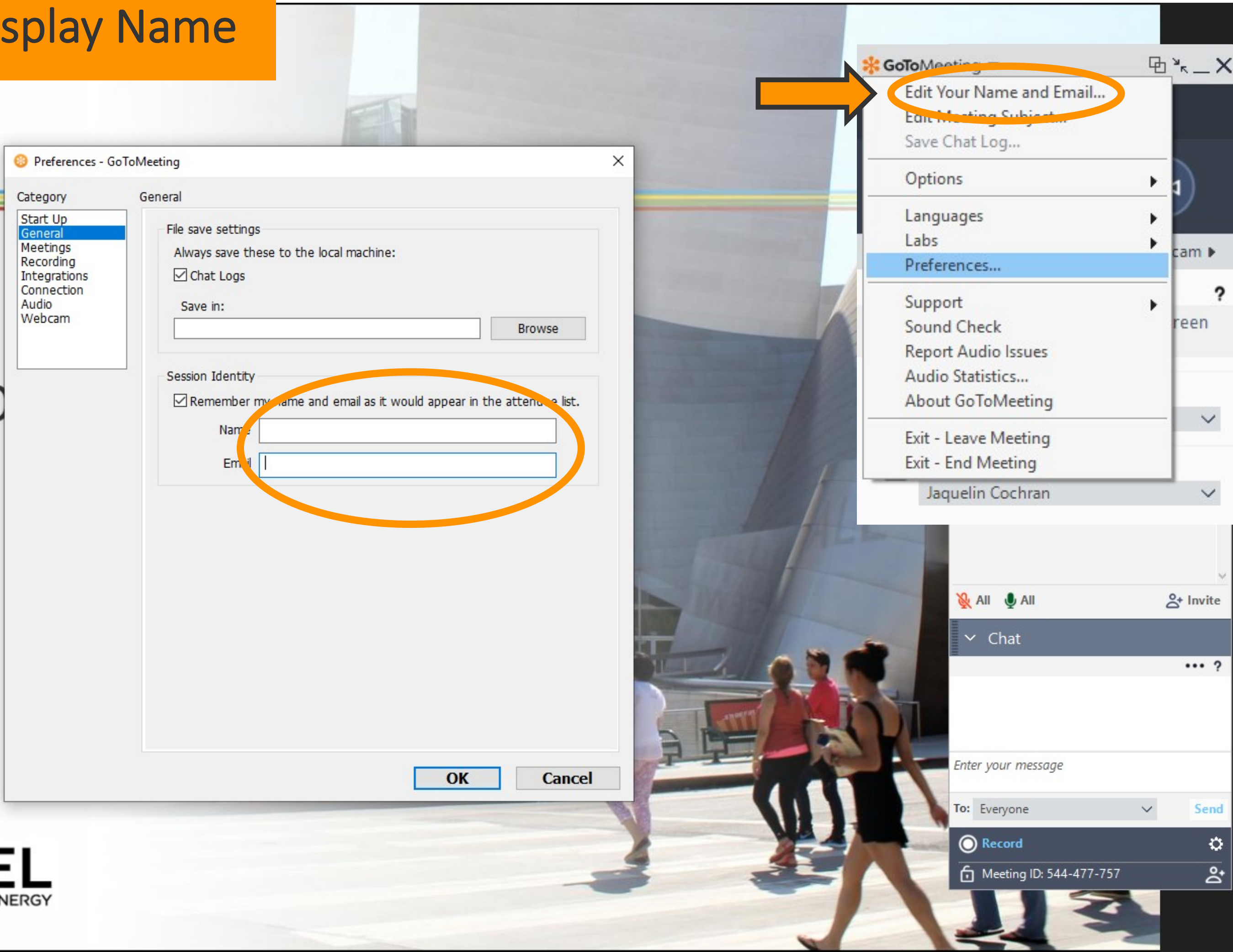

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* Chat Functions

LA100 Updates—May 2020

In response to requests from the Advisory Group, we are adding to the study (without changing the timeline):

1. Greenhouse gas (GHG) emissions from **non-power** sector fuel use changes (buildings, light-duty vehicles)
2. Changes in mortality from air quality
3. Monetization of morbidity, mortality, and GHG benefits
4. Qualitative description of impacts of electrifying medium- and heavy-duty vehicles

Questions? Comments?

LA100
The Los Angeles 100% Renewable Energy Study

Electricity Demand Projections and Demand Response

Elaine T. Hale, Ph.D.

May 14, 2020

LA100 Advisory Group Meeting #11

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Outline

Electricity Demand Projections and Demand Response

- Overview of Load Projections
- Energy Efficiency
- Electrification
- Demand Response
- Discussion/Q&A

LA100 Methodology

Input models

What is electricity demand and customer-driven supply?

- Electricity demand
- Demand response
- Renewable resource analysis
- Customer-driven solar

Main scenario models

What does LADWP build?

- Generation
- Transmission
- Distribution upgrades

Output and validation models

How do we know it's right?

- Load balancing
- Resource adequacy
- Power flow and stability analysis
- Integrated distribution and transmission analysis

Impact models

What are the impacts?

- Economic and workforce analysis
- Environmental analysis

LA100 Methodology—Focus of This Presentation

Input models

What is electricity demand and customer-driven supply?

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Impact models

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- Environmental analysis

Requested Feedback

What information and analysis can we provide on demand projections and demand response assumptions to help inform post-LA100 deliberations on policy (e.g., on building electrification, efficiency, EVs)?

Overview of Results

Moderate, High, and High Load Stress Projections

Electricity Demand Projections

LA100 uses three projections of demand to assess how different demand-side futures affect pathways to meet 100% renewable energy:

Load Projection	Moderate	High	High Stress
Description	Easy, low-hanging-fruit electrification and moderate (above-code) improvements to efficiency and demand response. Significant change, but short of 2019 pLAn[a] goals	Designed to match most of the electrification and efficiency goals set forth in the 2019 pLAn, including 80% light-duty vehicle electrification by 2045	High electrification combined with low energy-efficiency improvements and demand response to presents most challenging load conditions
Energy Efficiency	Moderate	High	Reference
Electrification	Moderate	High	High
Demand Response	Moderate	High	Reference

[a] https://plan.lamayor.org/

What Is and Is Not Included

Included:

Electricity **consumption** in LADWP

Not included:

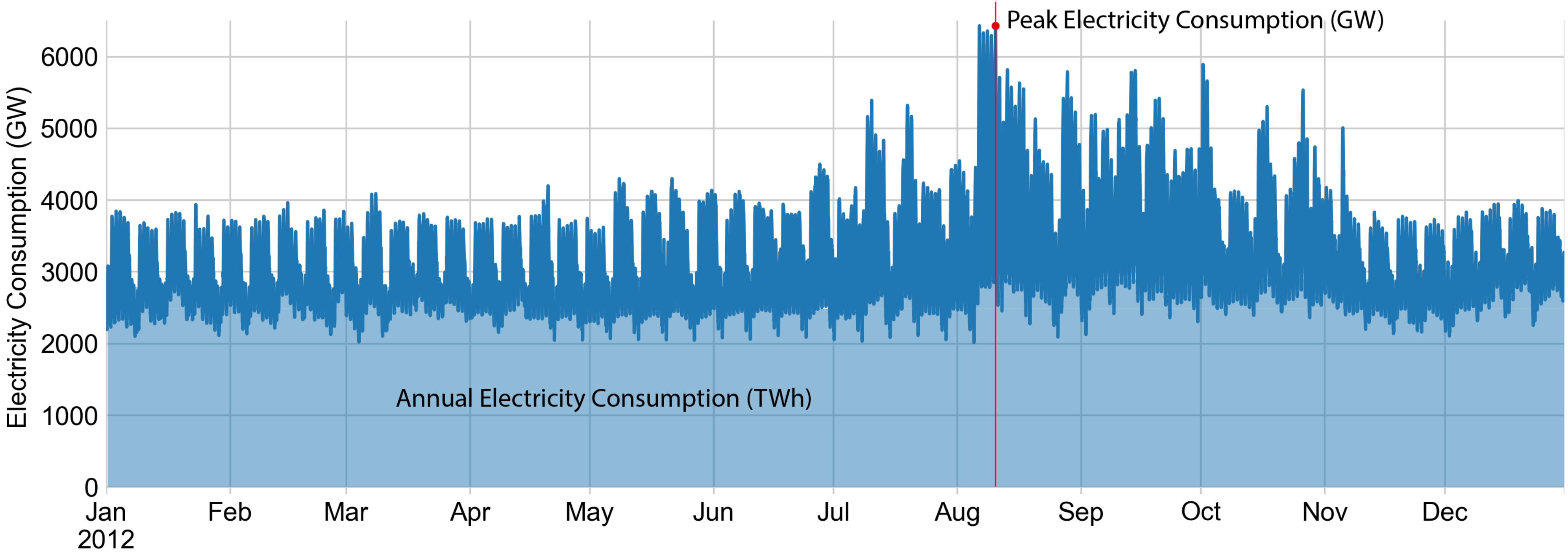
- Distribution, sub-transmission, and transmission losses (~+12%)
- Non-LADWP balancing authority load (i.e., Glendale and Burbank) (~+10%)
- Changes in metered demand/retail sales due to behind-the-meter photovoltaics (PV) or battery energy storage

These changes to load are reflected elsewhere in LA100 modeling

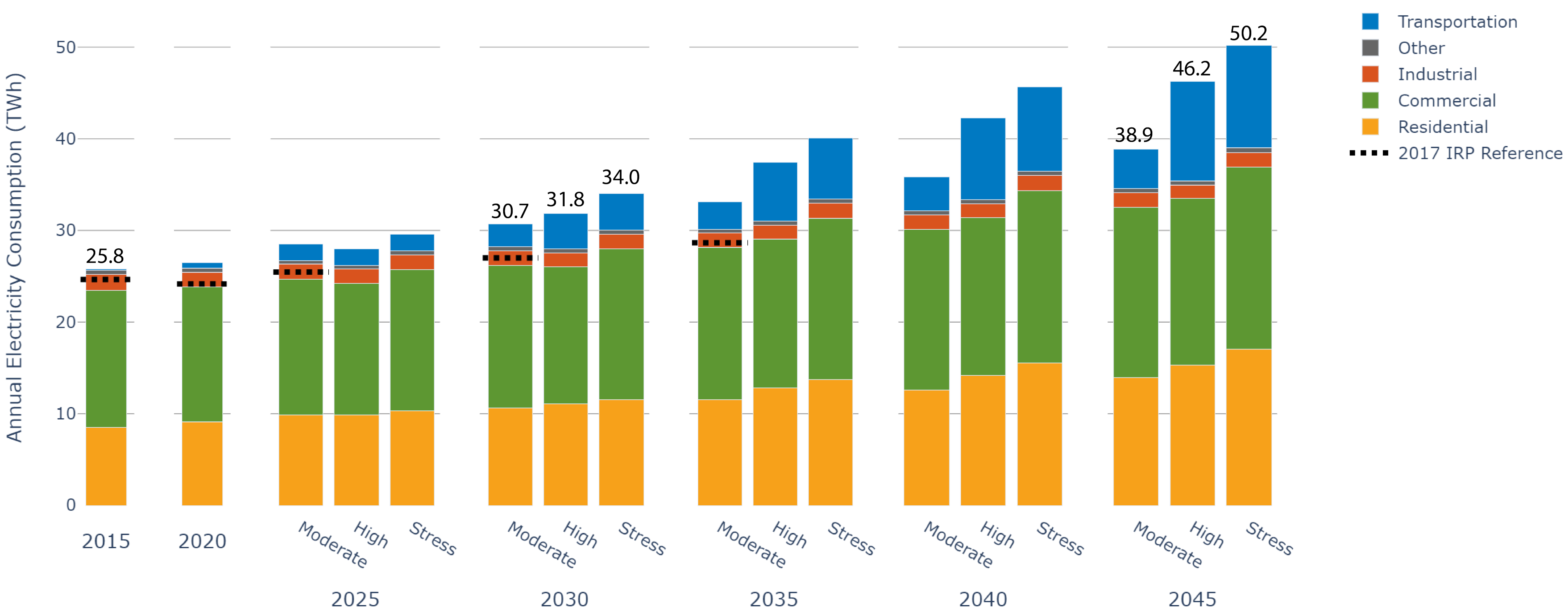
- Impacts of demand response peak load reduction and energy shifting

To be discussed later in the presentation

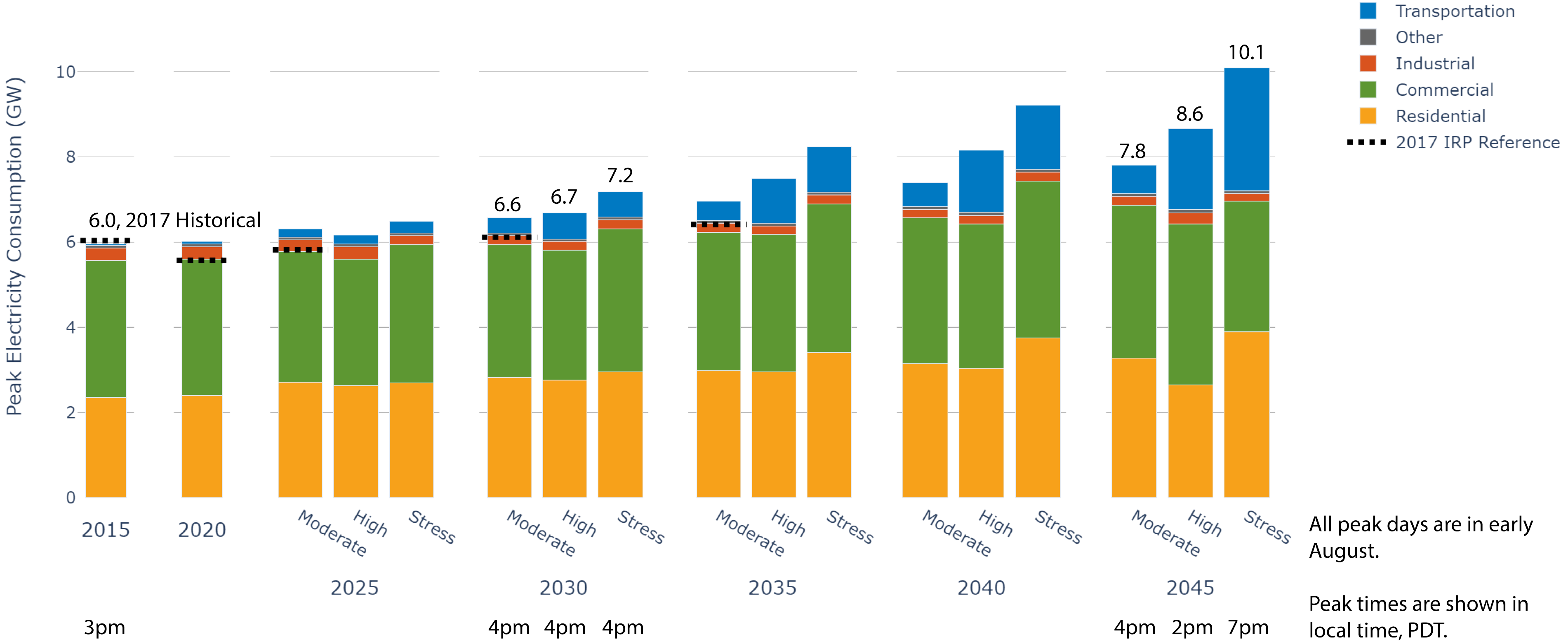
Annual Versus Peak Demand



Annual Electricity Consumption (TWh) by Sector



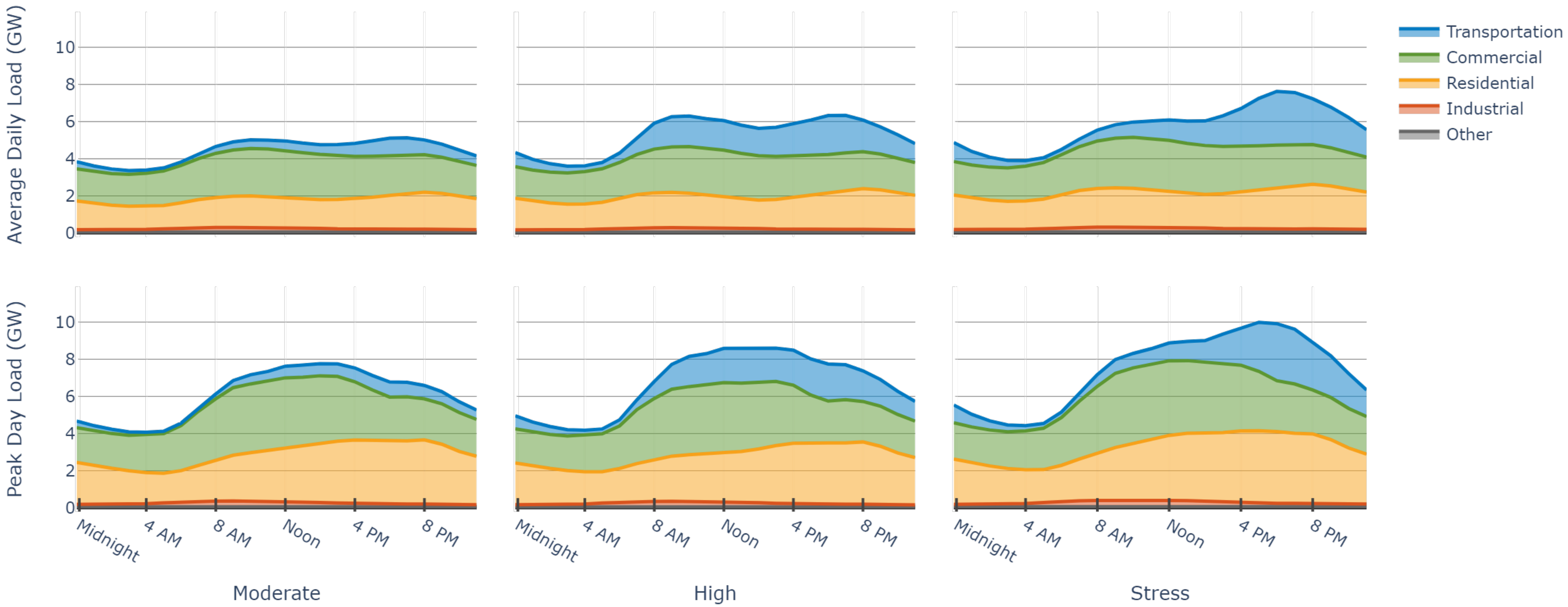
Peak Demand (GW) by Sector



All peak days are in early August.

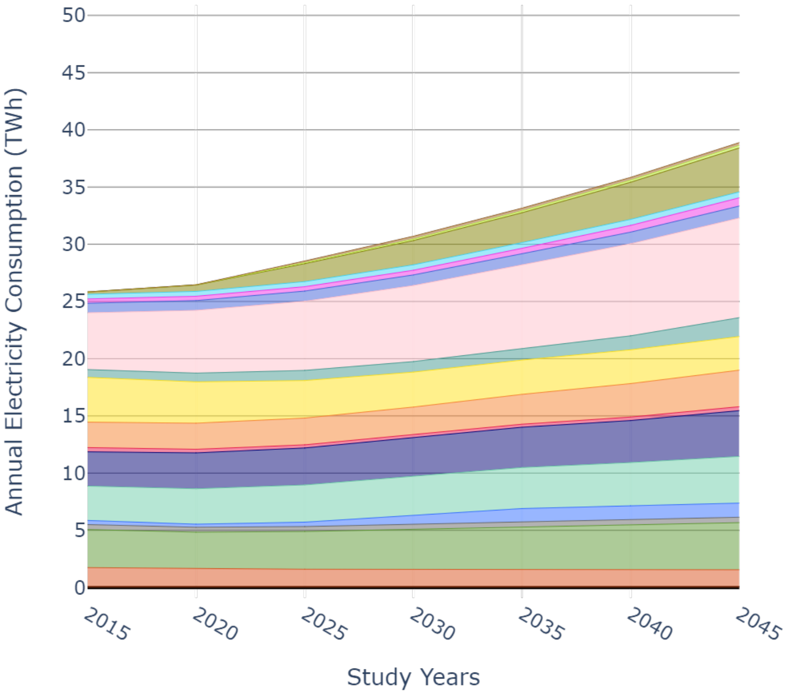
Peak times are shown in local time, PDT.

Average & Peak Day Load Profiles – 2045

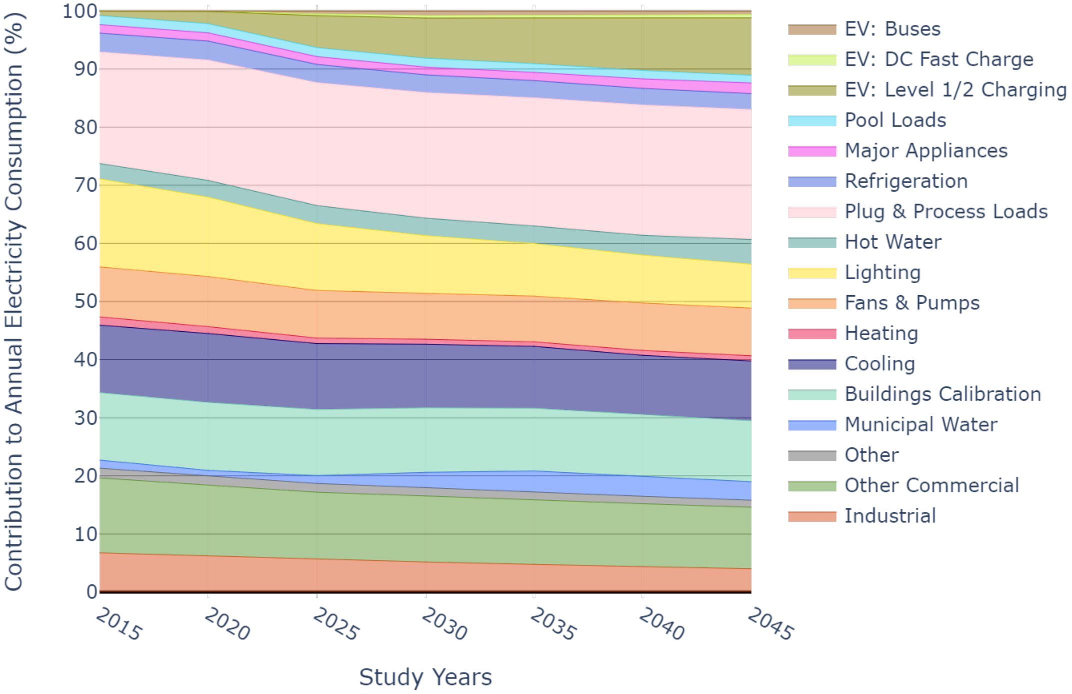


Annual Demand by End Use – Moderate Projection

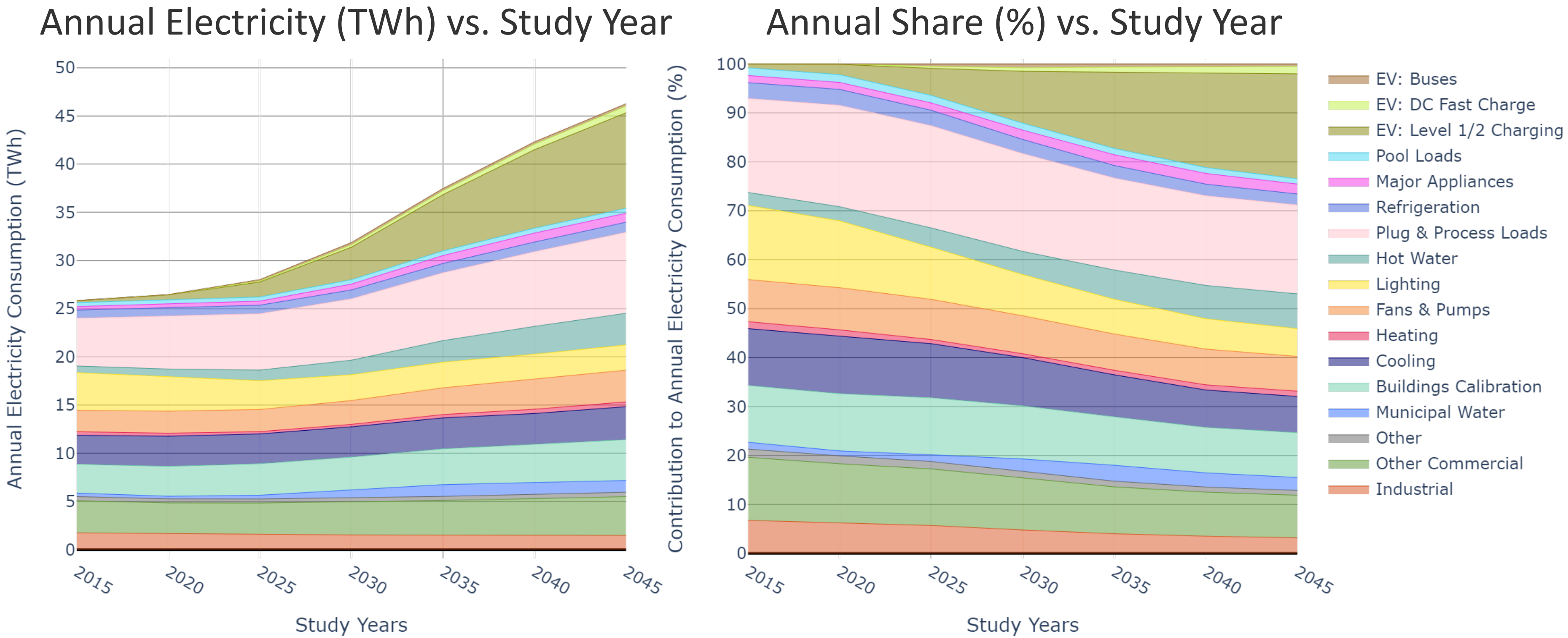
Annual Electricity (TWh) vs. Study Year



Annual Share (%) vs. Study Year

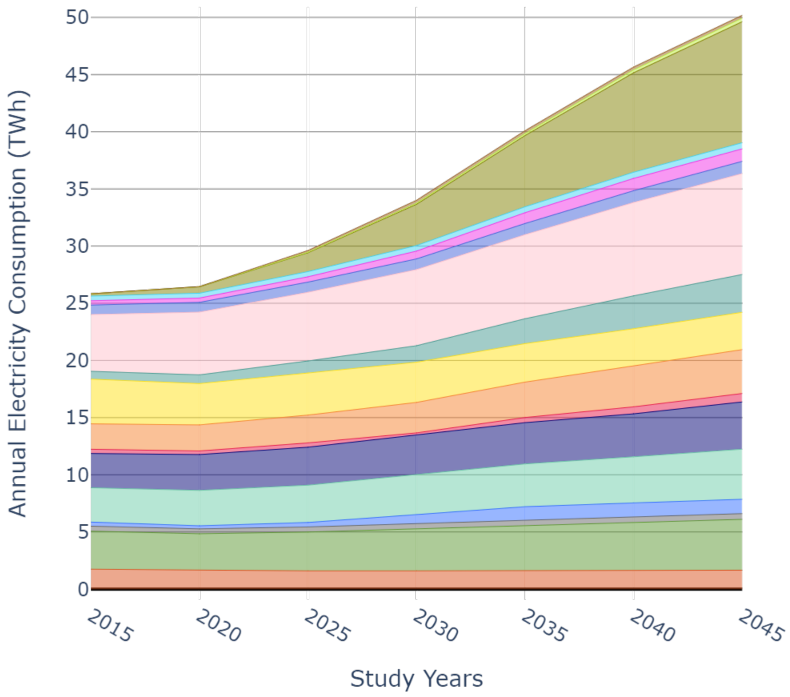


Annual Demand by End Use – High Projection

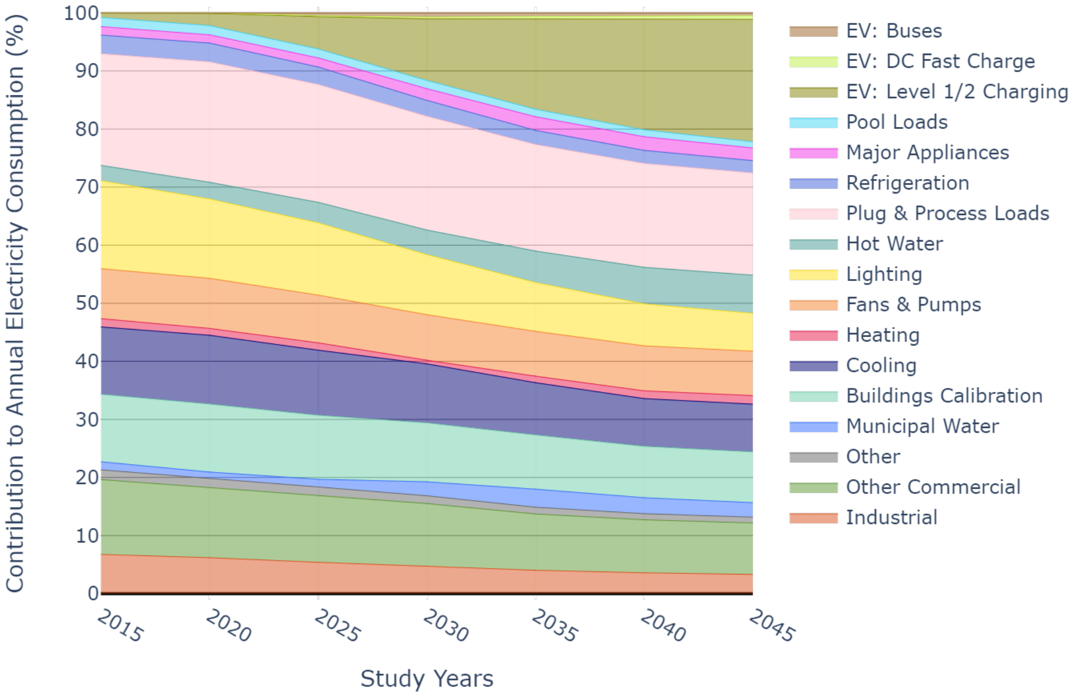


Annual Demand by End Use – Stress Projection

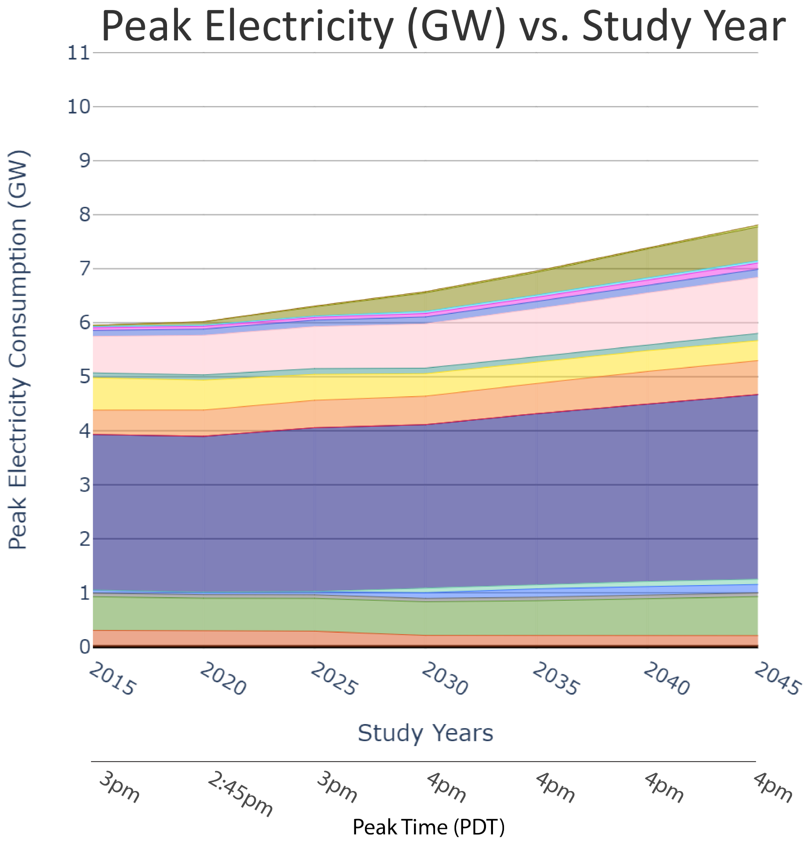
Annual Electricity (TWh) vs. Study Year

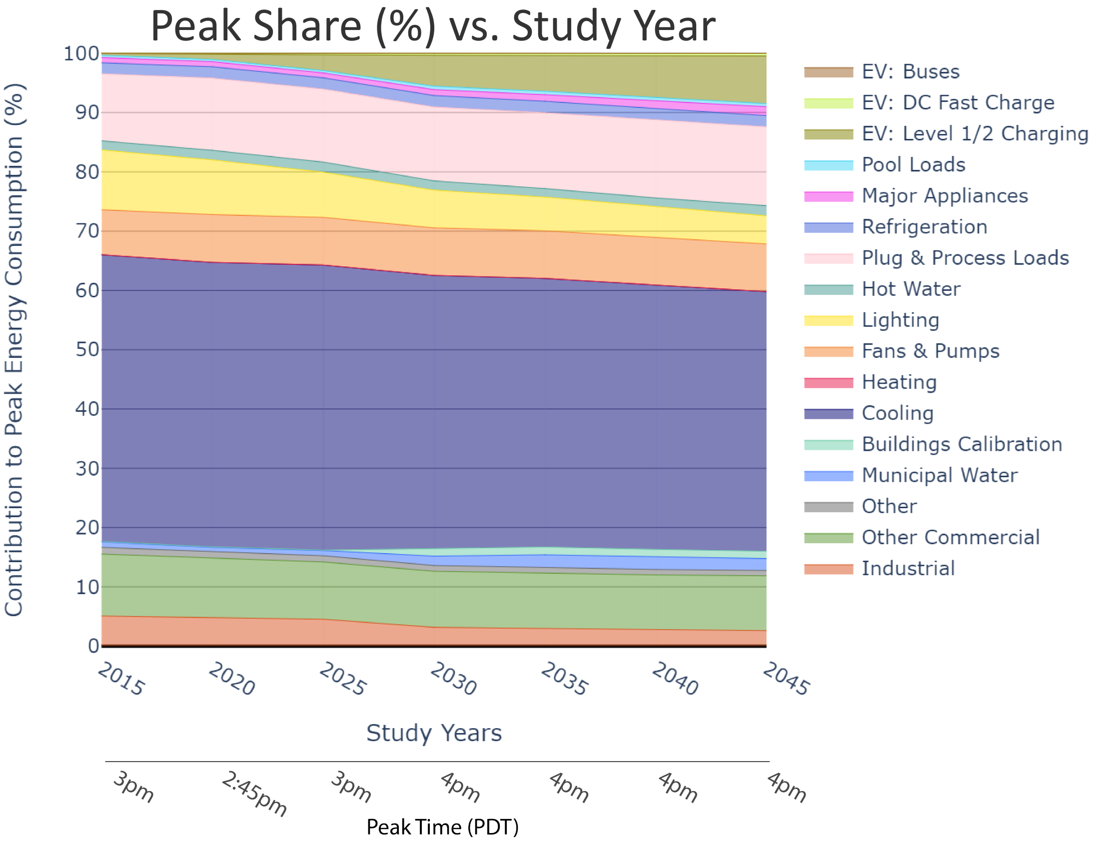


Annual Share (%) vs. Study Year

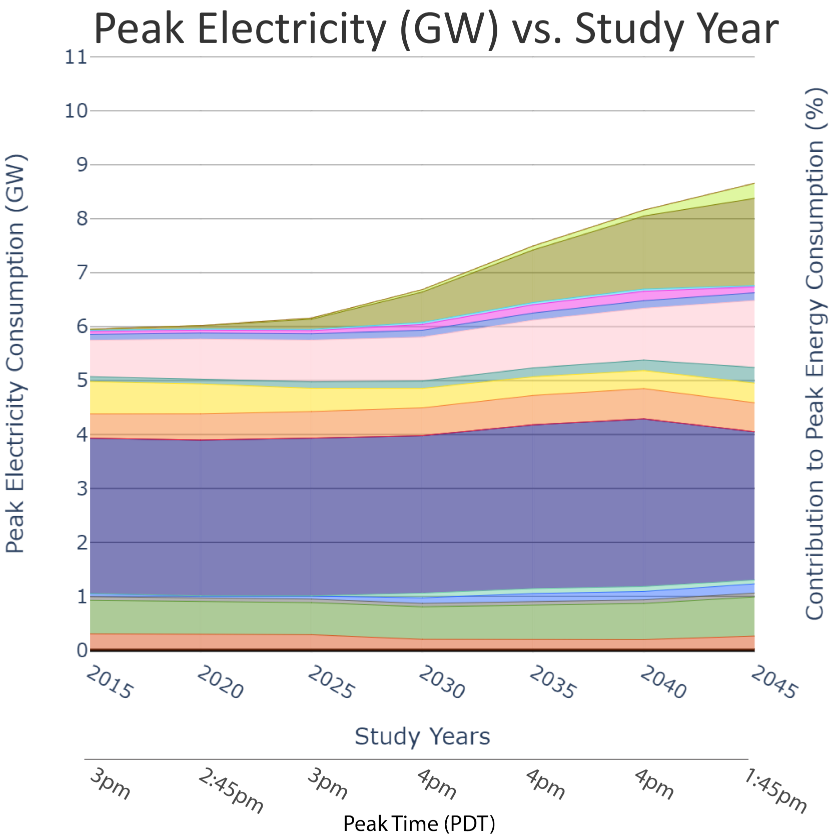


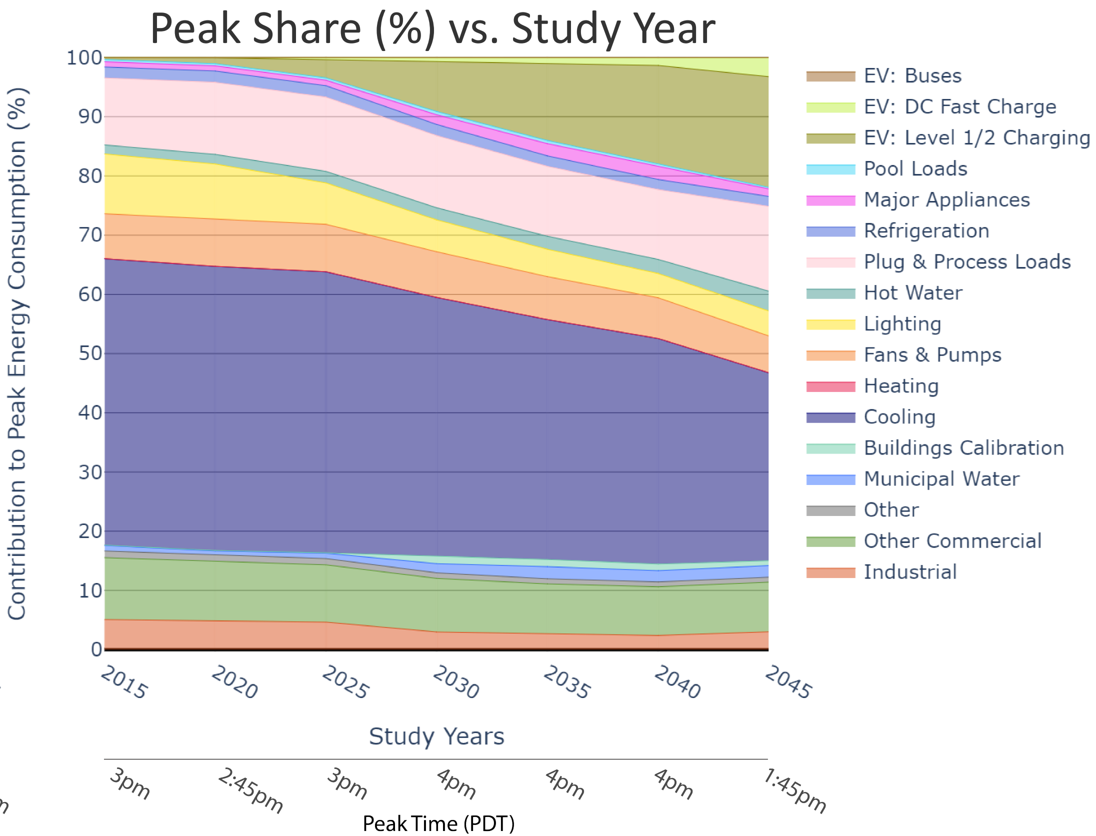
Peak Demand by End Use – Moderate Projection



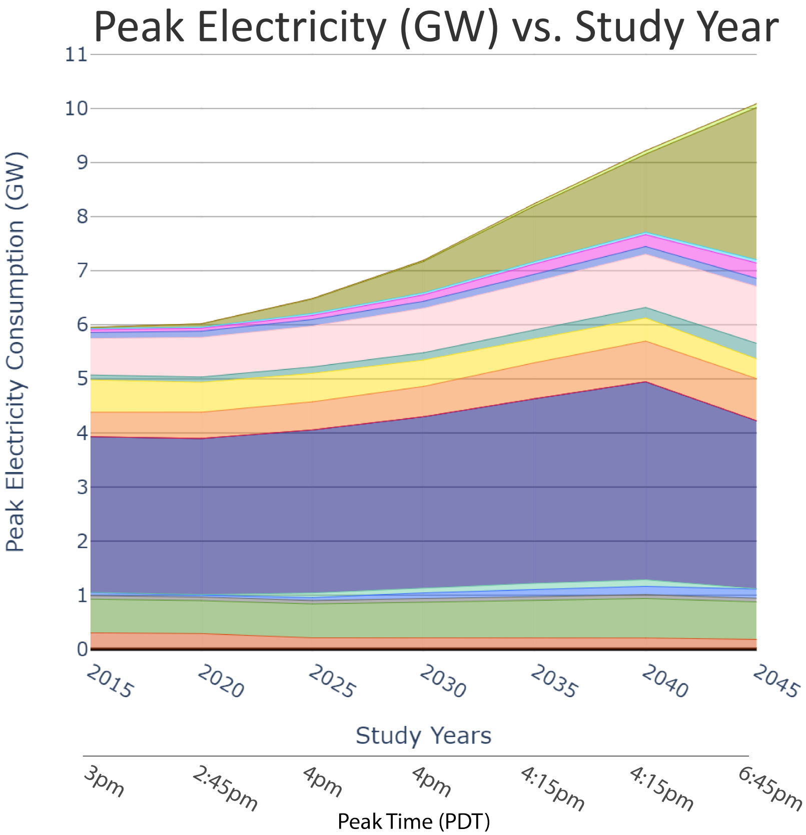


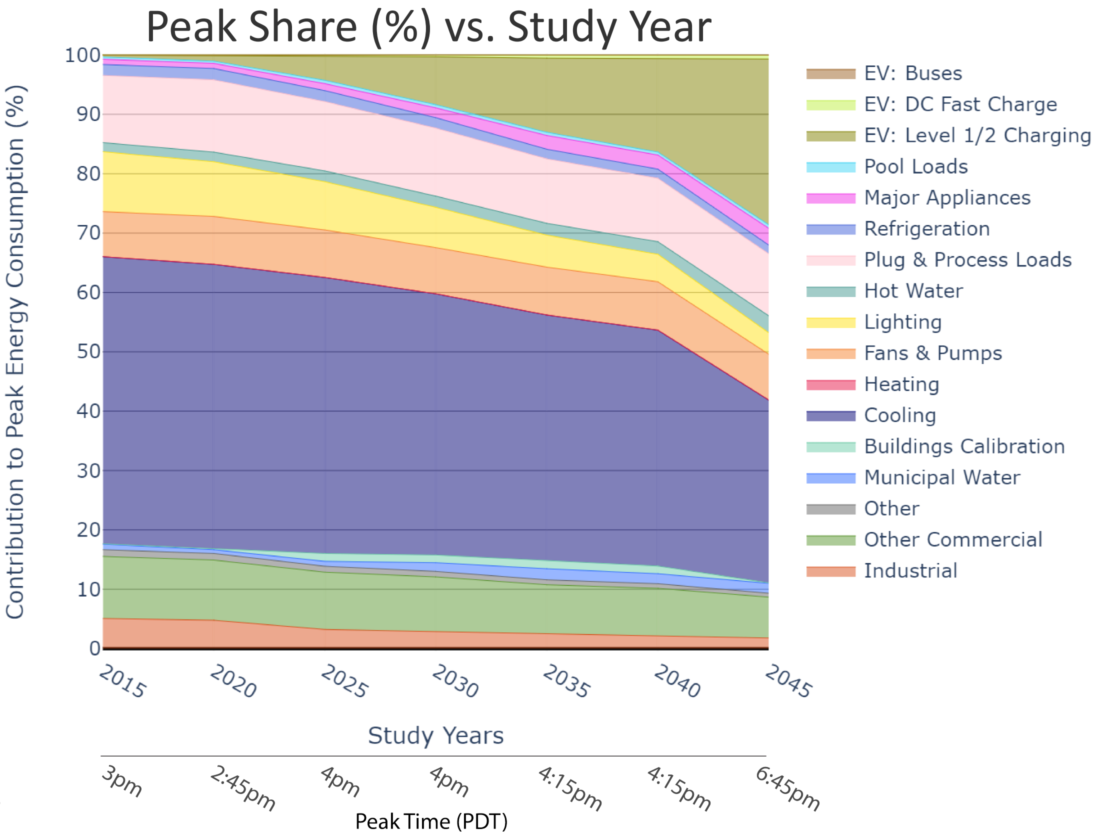
Peak Demand Shares by End Use – High Projection



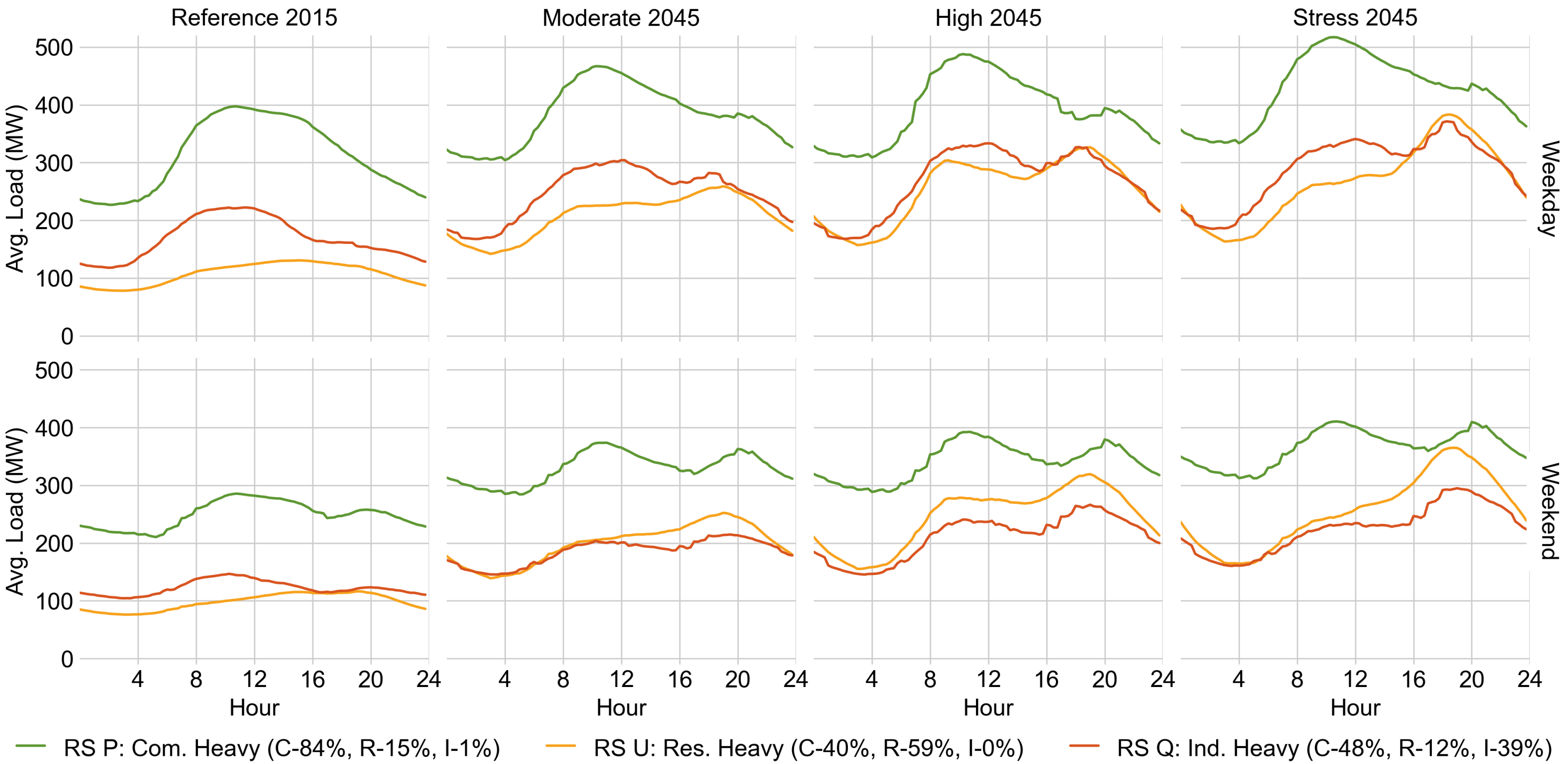


Peak Demand by End Use – Stress Projection





Different Parts of the City Show Different Trends, Depending on Sectoral Split (Com., Res., or Ind.)



Questions?

Up Next:

Energy Efficiency

Electrification

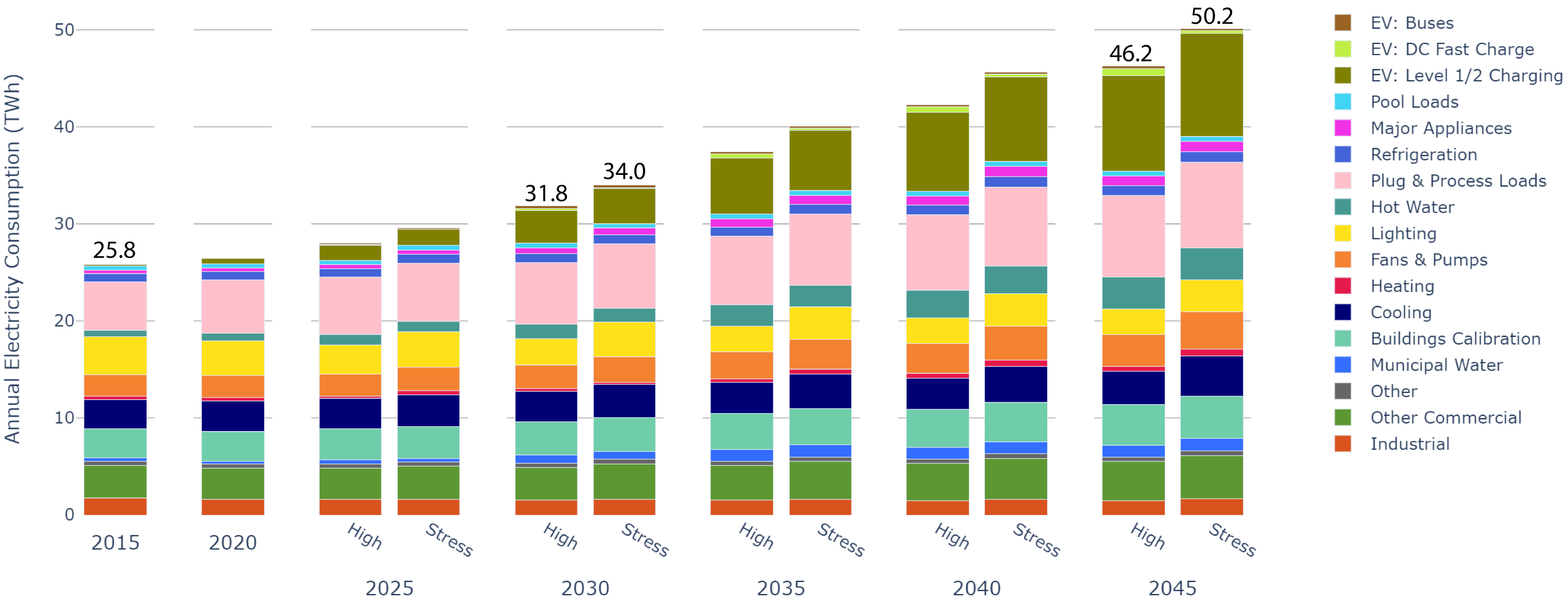
Demand Response

Energy Efficiency

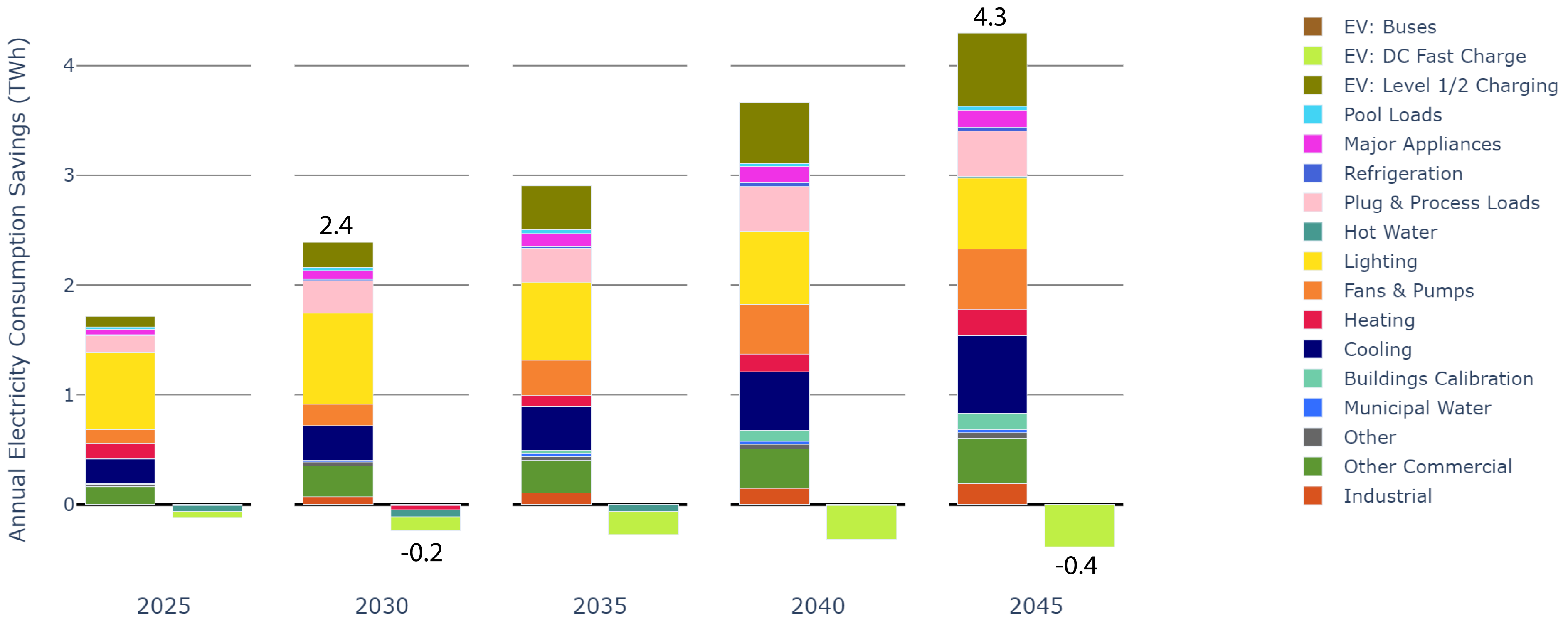
Table of Energy Efficiency Assumptions

Sector	Moderate	High	Stress
Residential Buildings	• Sales shares distributed across efficiency levels	• 100% sales share of highest efficiency models by 2030	• 2017 IRP Efficiency Goals
Commercial Buildings	• 80% adoption of 5-year-ahead Title 24 Code	• 70% adoption of 15-year-ahead Title 24 Code	• 2017 IRP Efficiency Goals
Industrial Premises	• Navigant 2017 and Nextant 2014 – Economic potential	• Navigant 2017 and Nextant 2014 – Maximum achievable	• Navigant 2017 – 80% of commercial market potential
Water System	• Nextant 2014 – 50% of maximum potential for wastewater sector by 2035	• Nextant 2014 – 70% of maximum potential for wastewater sector by 2035	• Nextant 2014 – 30% of maximum potential for wastewater sector by 2035
Transportation	• 75% access to residential, 25% access to workplace charging	• 60% access to residential, 50% access to workplace charging	• 90% access to residential, 15% access to workplace charging

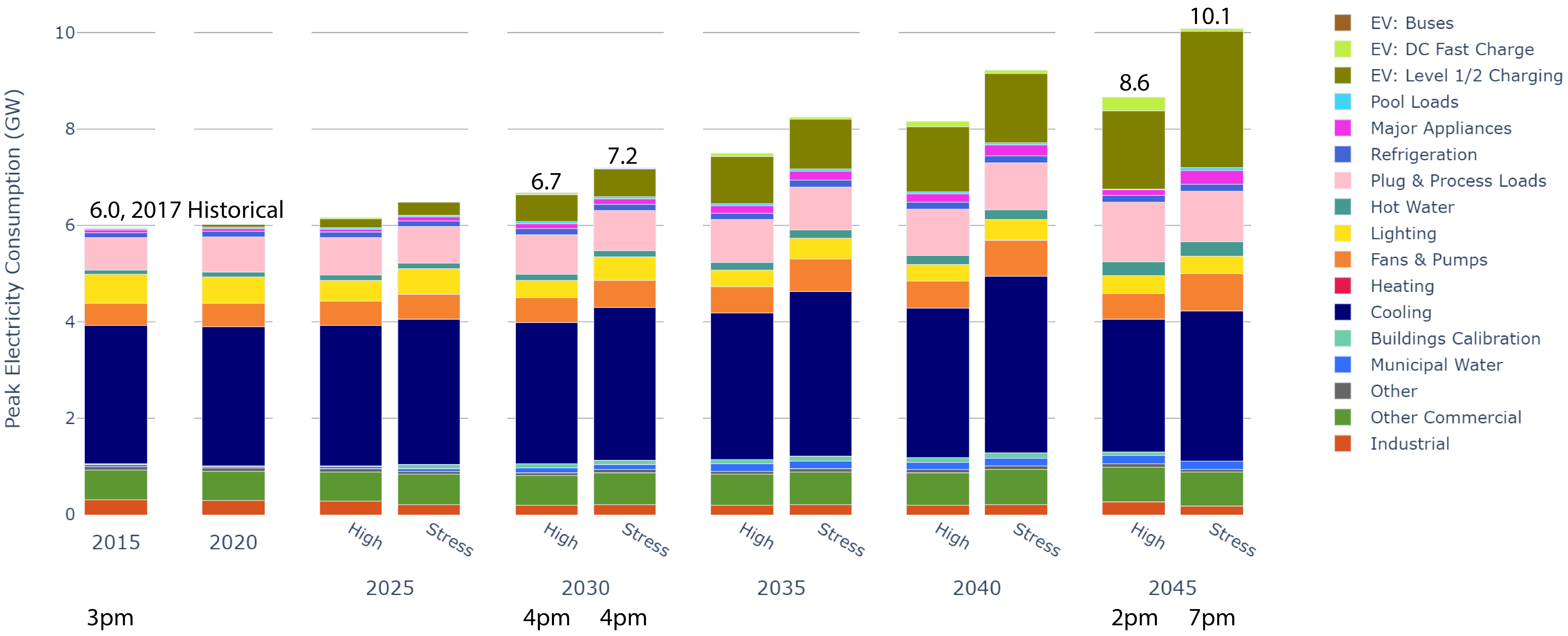
Impact of Efficiency: **Annual Electricity** High and Stress Projections



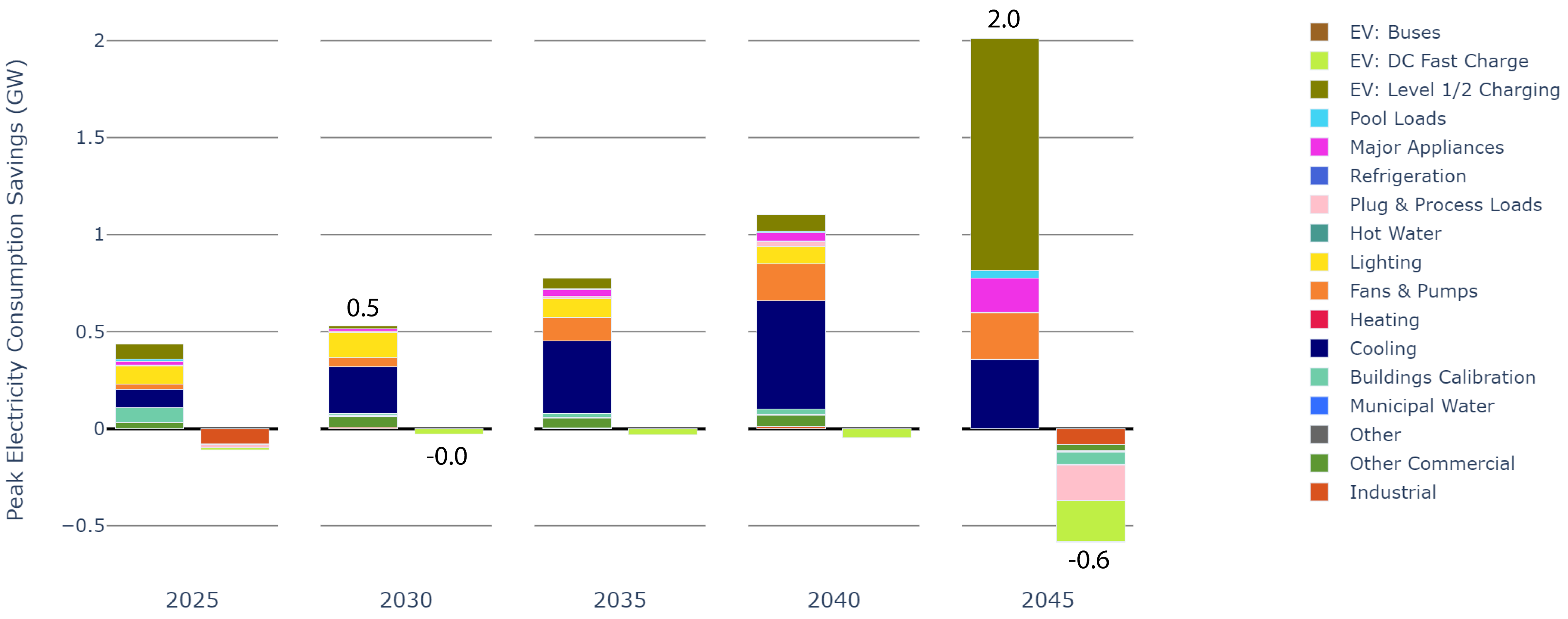
Impact of Efficiency: **Annual Electricity Stress – High Differences**



Impact of Efficiency: **Peak Electricity** High and Stress Projections



Impact of Efficiency: **Peak Electricity Stress – High Differences**



Questions?

Up Next:

Electrification

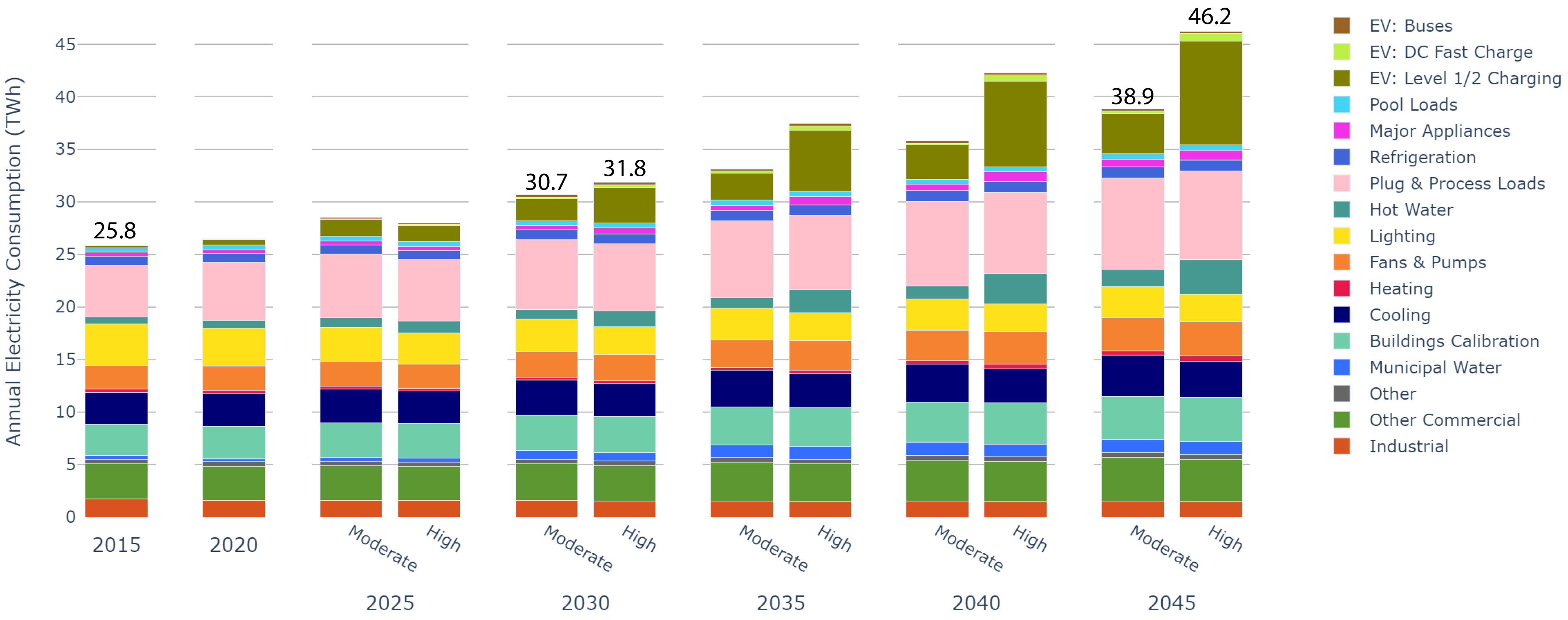
Demand Response

Electrification

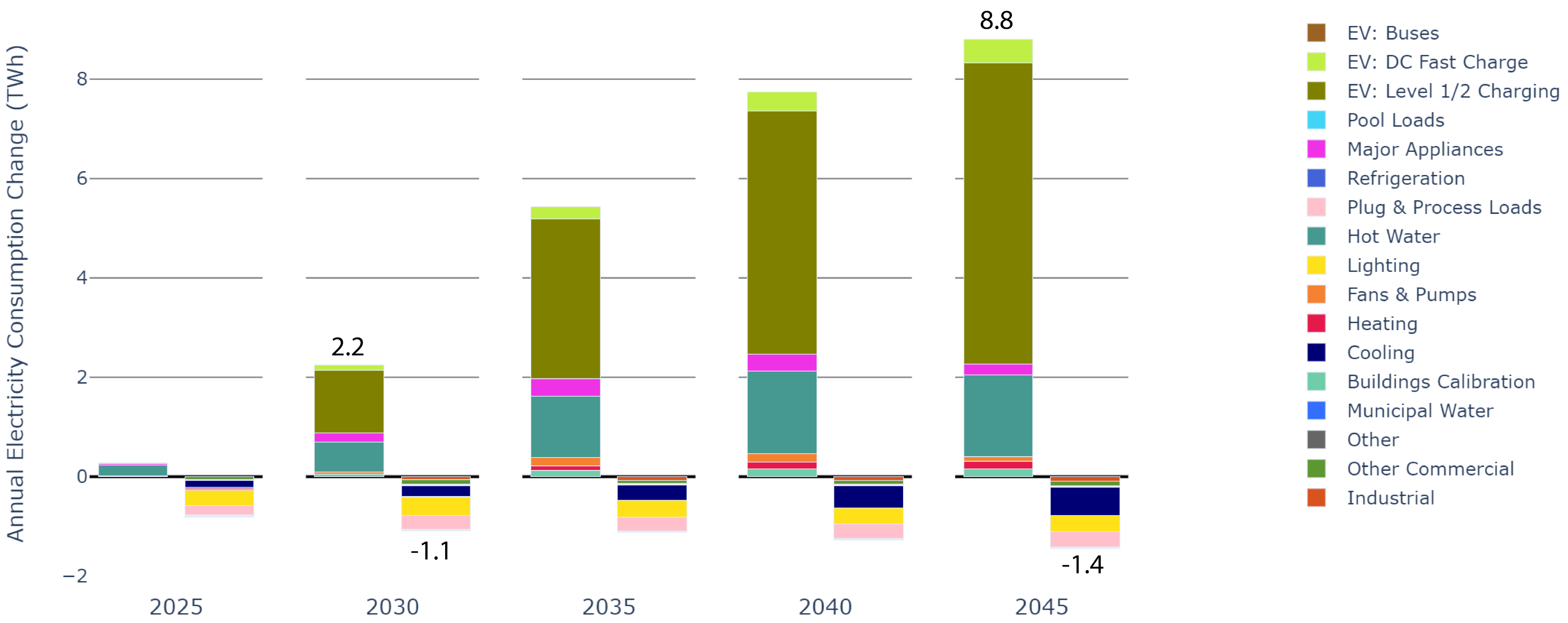
Table of Electrification Assumptions

Sector	Moderate	High	Stress
Residential	• Water and space heating electric sales shares, starting at ~7% and ~26%, increase to 60% and 40% by 2045	• 100% new construction electrification starting in 2030 • 100% electric sales share (HVAC and water heating) by 2030; nearly 100% electric homes by 2050	
Commercial	• By 2045, 43% of water heating and 85% of space heating systems are electrified	• 100% new construction electrification starting in 2030 • 100% electric sales share (HVAC and water heating) by 2030; close to 100% electric buildings by 2050	
Transportation	• 100% bus electrification by 2030 • 30% light-duty vehicle electrification by 2045 • Meet CA 2030 ZEV Goal and continue trajectory (2017 SLTRP “high case”)	• 100% bus electrification by 2030 • 80% light-duty vehicle electrification by 2045	
Industrial	• LA Port – ICF International and E3 reports on CA transportation electrification “In Between” case	• LA Port – ICF International and E3 reports on CA transportation electrification “Aggressive” case	
Water System	• All scenarios maximize local water supply through groundwater replenishment, water recycling (non-potable and indirect potable reuse), and stormwater capture.		

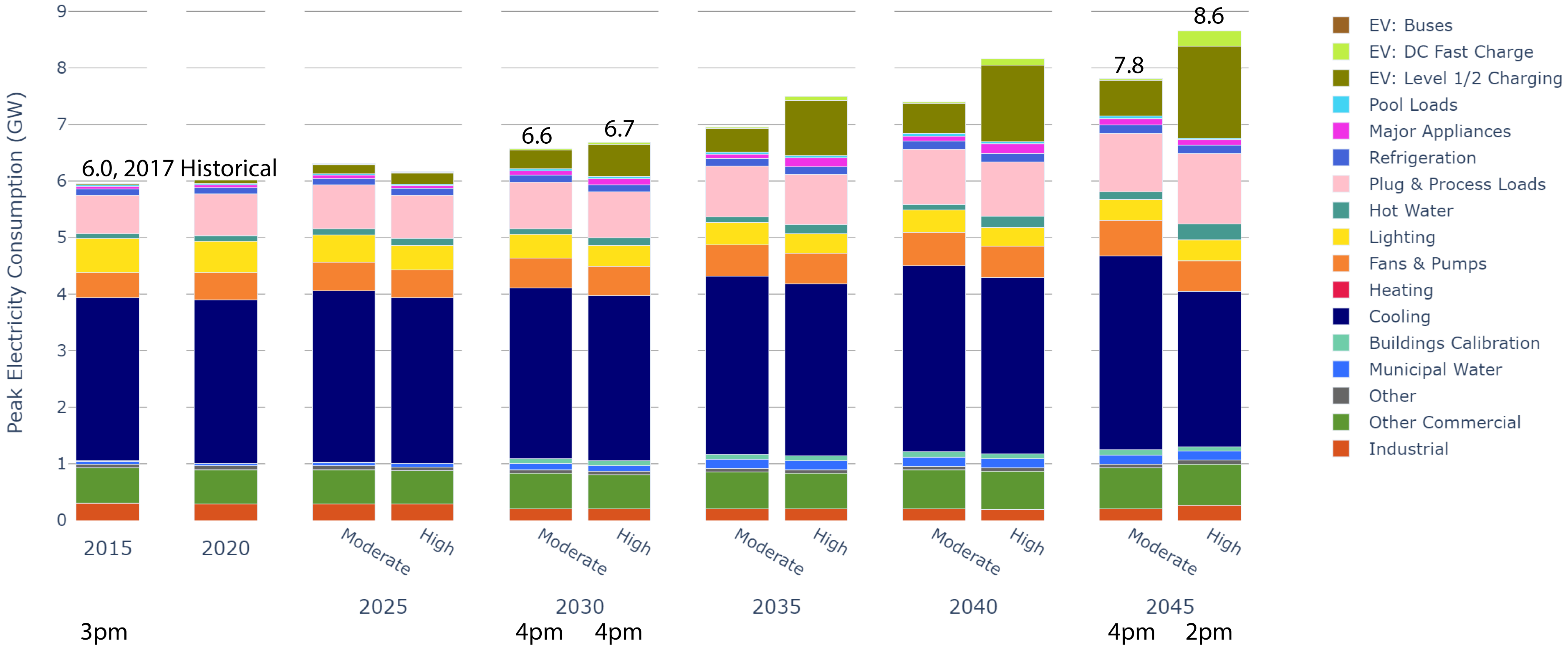
Impact of Electrification & Efficiency: **Annual Electricity** Moderate and High Projections



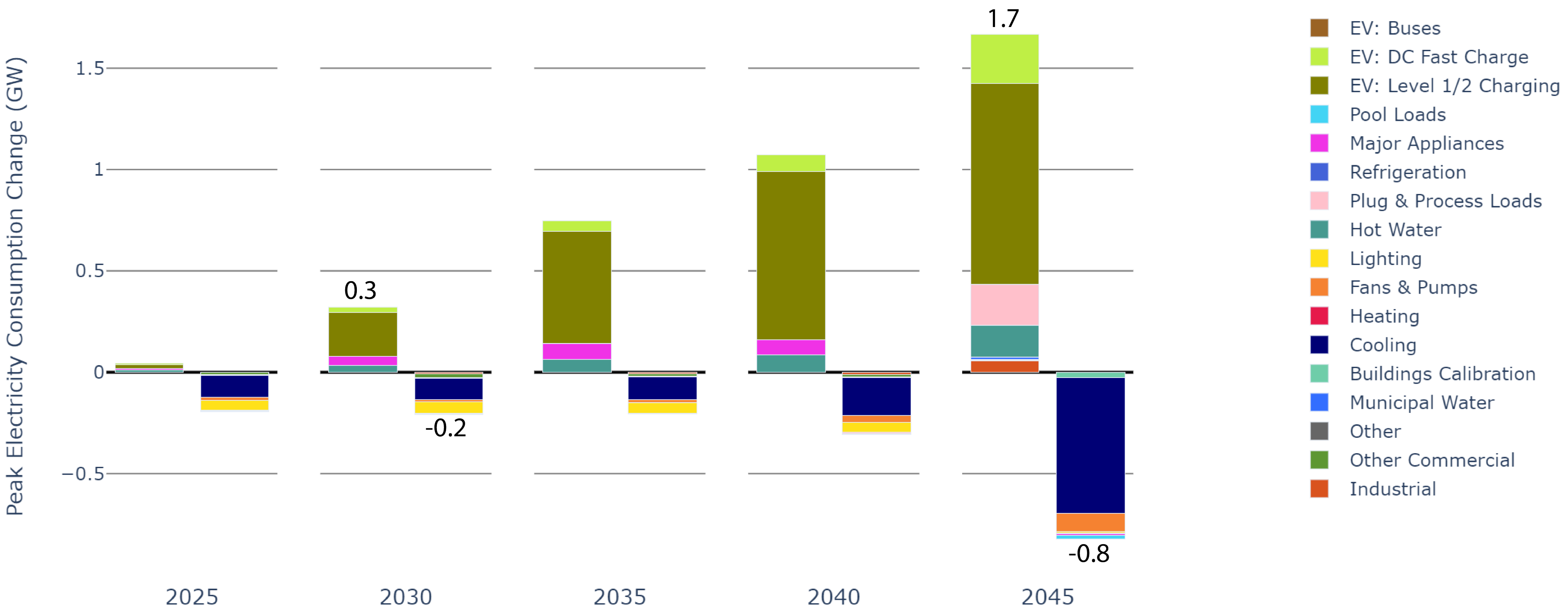
Impact of Electrification & Efficiency: **Annual Electricity** High – Moderate Differences



Impact of Electrification & Efficiency: **Peak Electricity** Moderate and High Projections



Impact of Electrification & Efficiency: **Peak Electricity High – Moderate Differences**



Questions?

Up Next:

Demand Response

Demand Response

Demand Response Programs

Interruptible Load

- Commercial, Institutional & Industrial (CII, modeled on current program)

Energy-shifting

- Scheduled electric vehicle charging
- Scheduled water system operations

- Residential
  - cooling
  - hot water
  - heating
  - refrigeration
  - schedulable appliances
  - pool pumps
- Commercial
  - cooling
  - heating
  - hot water
  - refrigeration

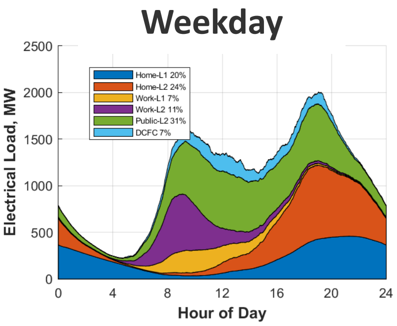
Demand Response Assumptions and Methods, 1 of 2

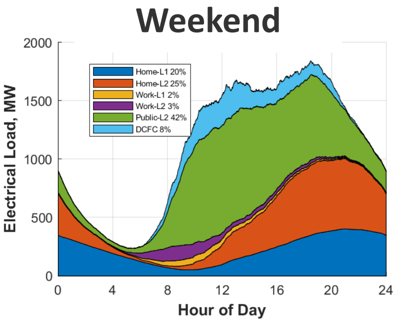
- **Interruptible load** – Load shed up to 4 h/day, 48 h/year (e.g., 4 hour load shed on top-12 peak days)
- **Water system scheduling** – Half of water system load shiftable up to 12 hours in High Projection, 2035 and later only
- **Residential and commercial end-use shifting** – Participating fraction of end-use can be shifted, subject to
  - Shifting windows
  - Times of day by which all service in the previous period must be delivered

Demand Response Assumptions and Methods, 2 of 2

- **Electric vehicle schedulable load** – Dynamic model of shiftability is assembled from min-delay and max-delay profiles

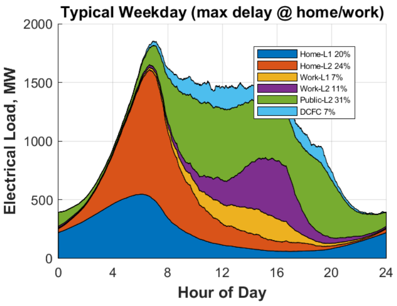
Min-delay (Baseline) profile

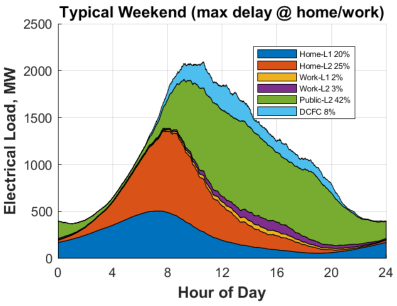




*Charging **proceeds as quickly as possible** as soon as you plug your car in.*

Max-delay profile

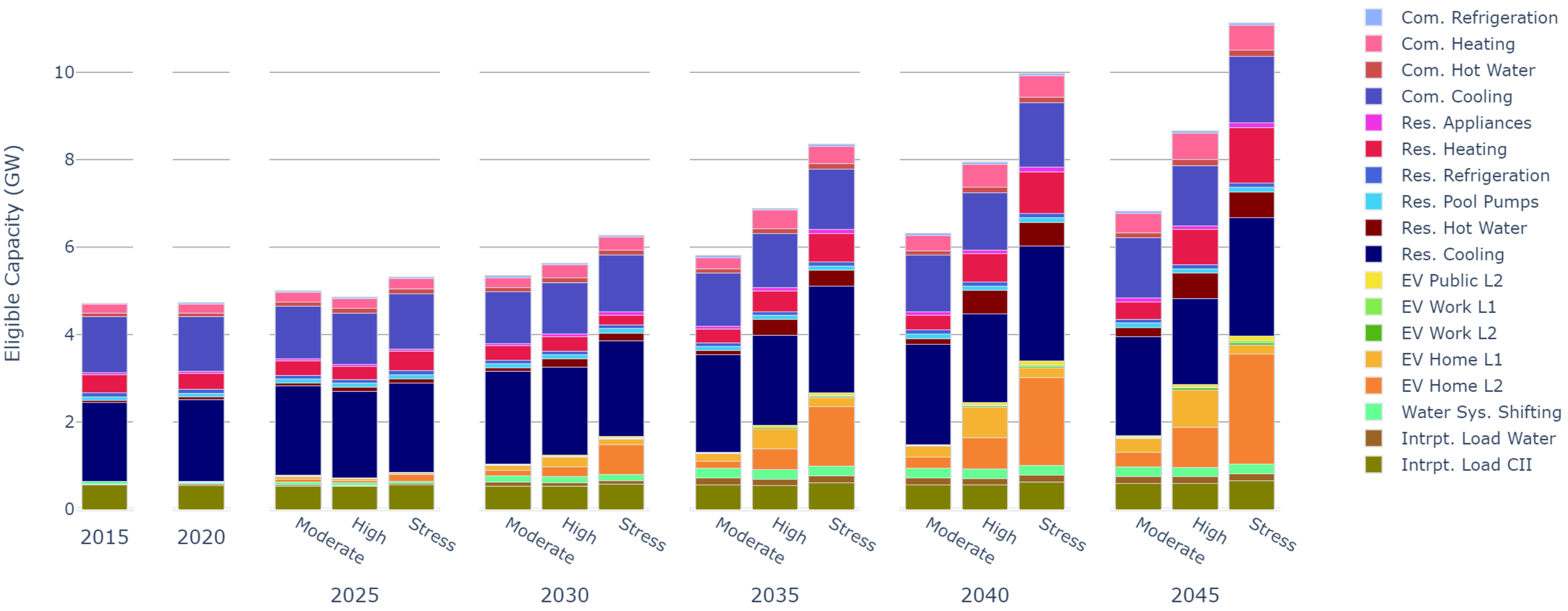




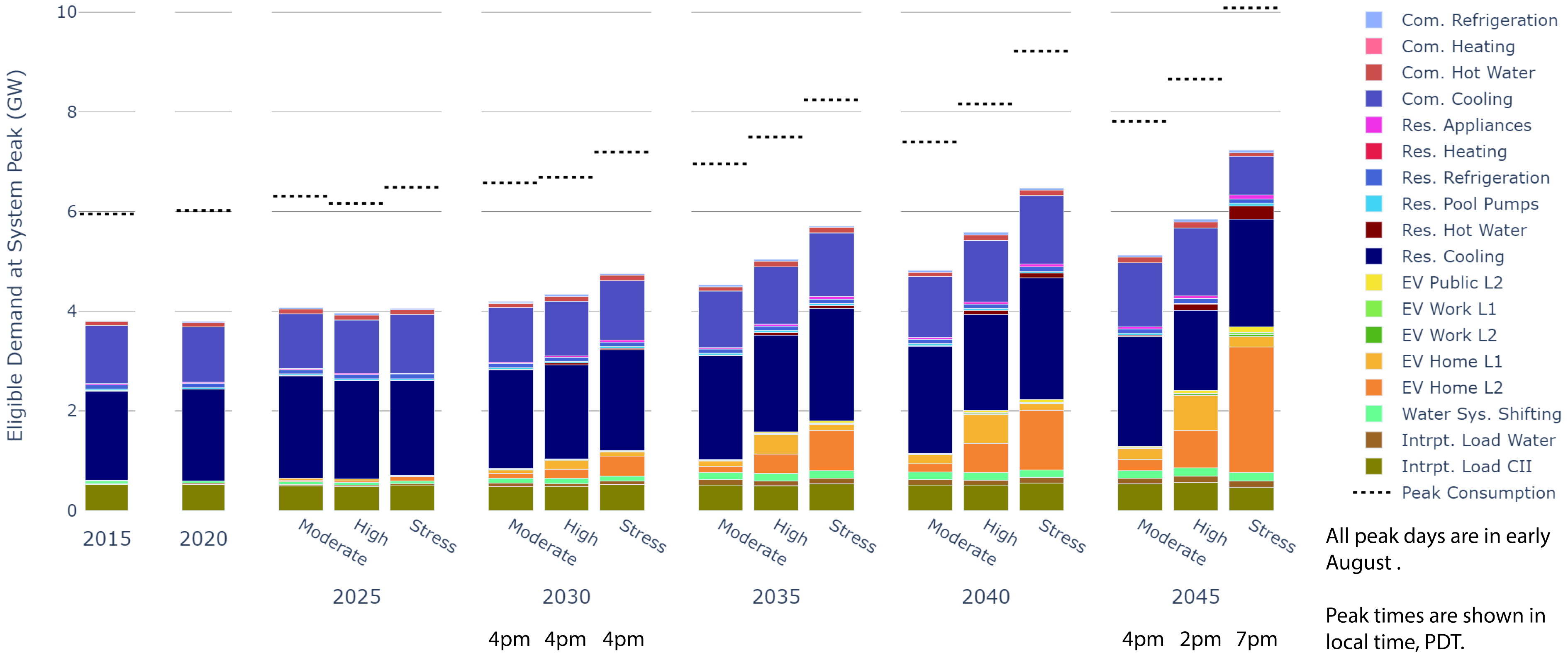
*Charging is **delayed as long as possible** while ensuring you have sufficient charge for your next trip.*

Only L1 and L2 charging is considered shiftable

Demand Response Eligibility: End-use peak demand, non-coincident with system



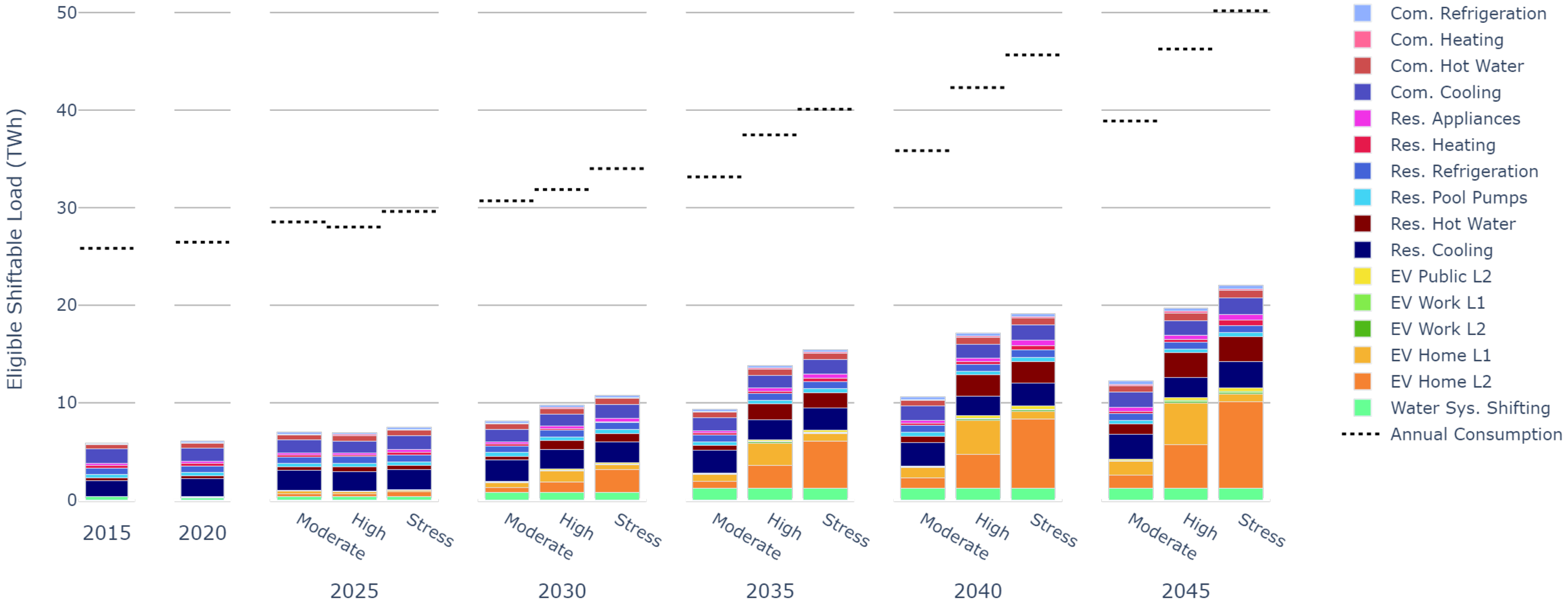
Demand Response Eligibility:
End-use demand at time of system peak



All peak days are in early August .

Peak times are shown in local time, PDT.

Demand Response Eligibility: Shiftable end-use demand



Residential Participation

Participation rate assumptions from California Demand Response Potential Study

- Level of automation
- Level of marketing
- Incentive level

Incentive level chosen by

- Computing kW/participant
- Capping $/kW-yr based on capacity prices
- Projection and end-use considerations

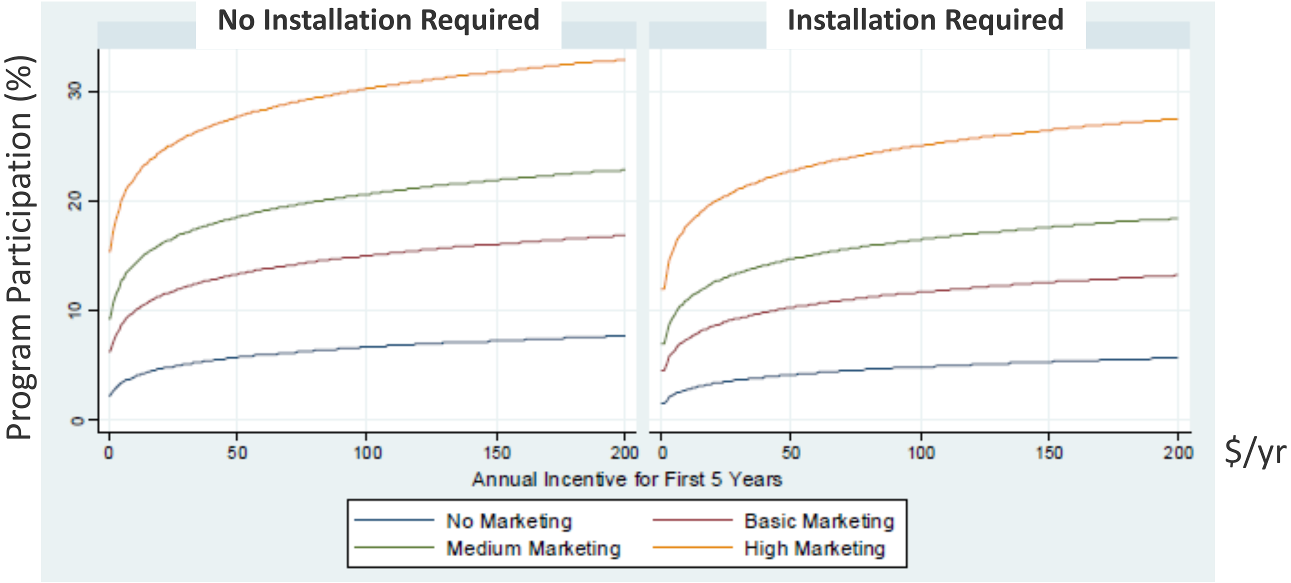
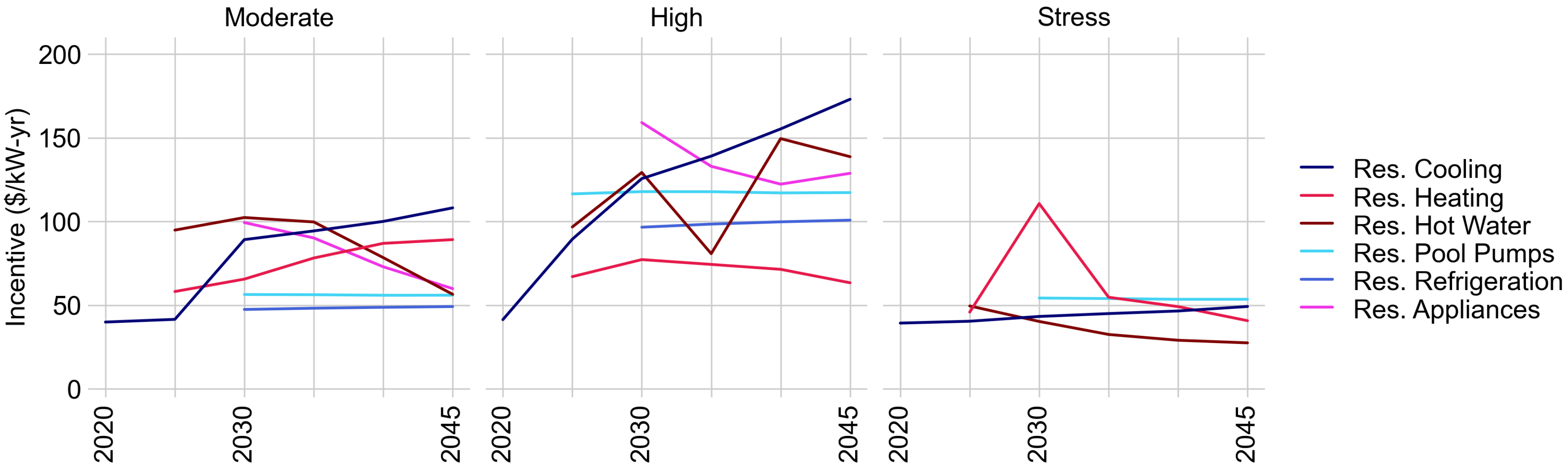


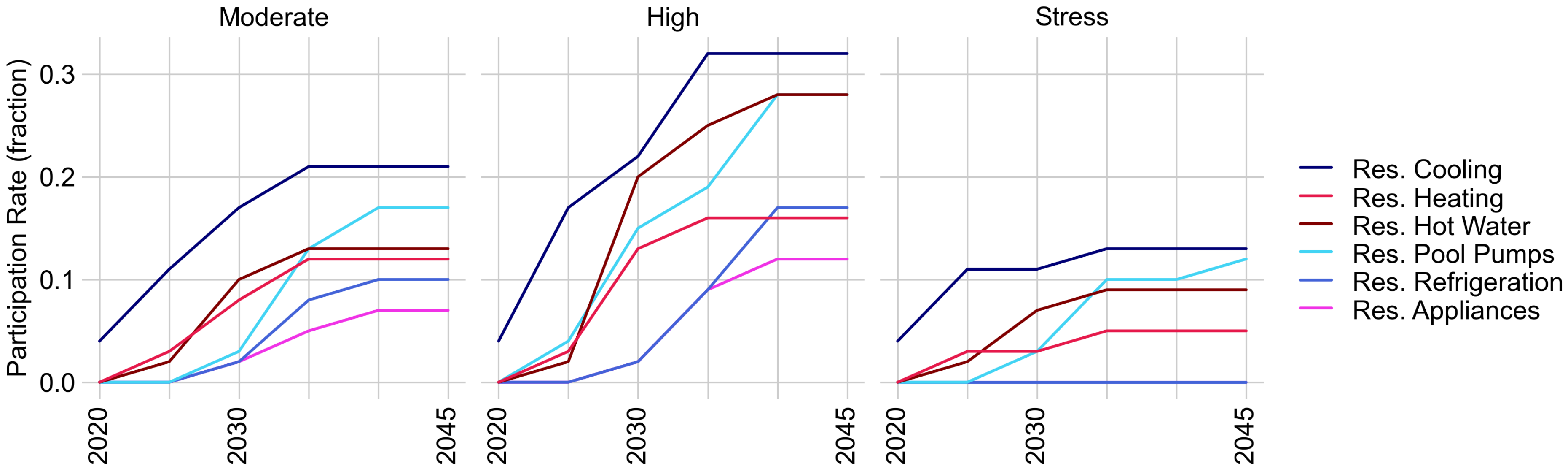
Figure F-5: Achievable Residential Participation Rates by Incentive and Marketing Level (Alstone et al. 2017)

Residential Incentive Levels ($/kW-yr)



Ratio of end-use coincident peak load to number of appliances is computed from building energy models. This lets us transform $/participant-yr to $/kW-yr.

Residential Participation Rates



Residential refrigeration and appliances are excluded in the Stress Projection, because the size of the loads is insufficient to support much incentive (only $6/participant-year in the High Projection).

Commercial Participation

Participation rate assumptions from California Demand Response Potential Study

- Level of automation
- Level of marketing
- Incentive level

Incentive level chosen by

- Computing kW/participant
- Capping $/kW-yr based on RPM capacity prices
- Projection and end-use considerations

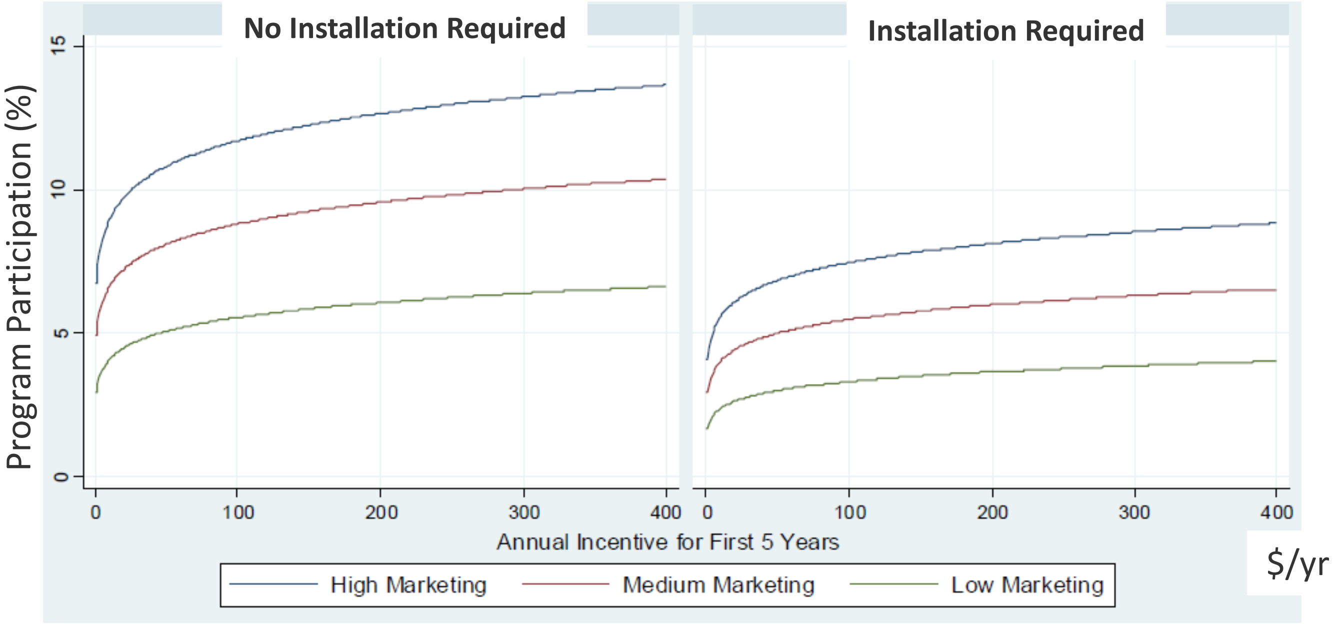
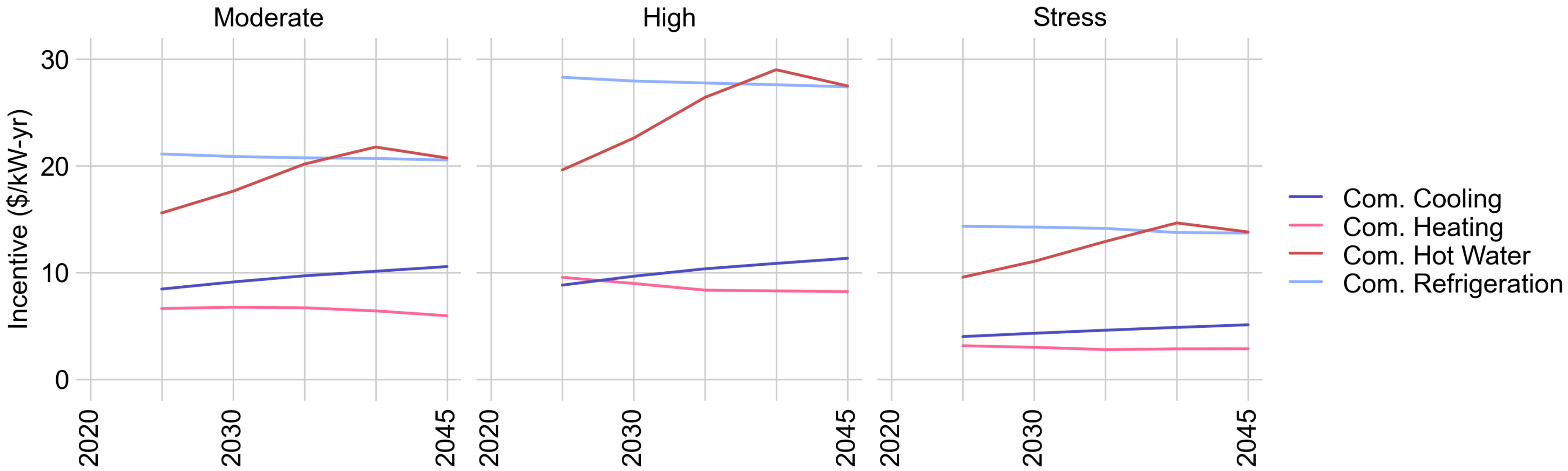


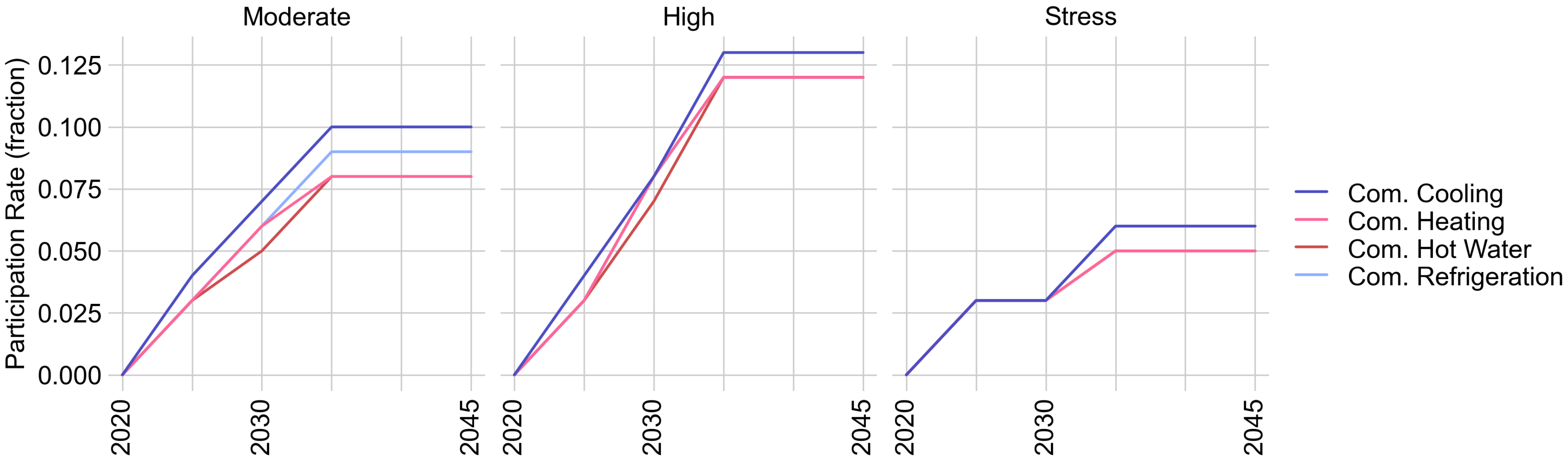
Figure F-6: Achievable Small and Medium Business Participation Rates by Incentive and Marketing Level (Alstone et al. 2017)

Commercial Incentive Levels ($/kW-yr)



Ratio of end-use coincident peak load to number of appliances is computed from building energy models. This lets us transform $/participant-yr to $/kW-yr.

Commercial Participation Rates



The small and medium businesses participation model in the California Demand Response Potential Study shows much lower participation compared to residential customers.

Electric Vehicle Participation

- Participation rates using residential model (Alstone et al. 2017)
- Incentive level converted using kW/vehicle per charger type
- Choose higher \$/participant-year for L2 compared to L1 because of higher kW/vehicle

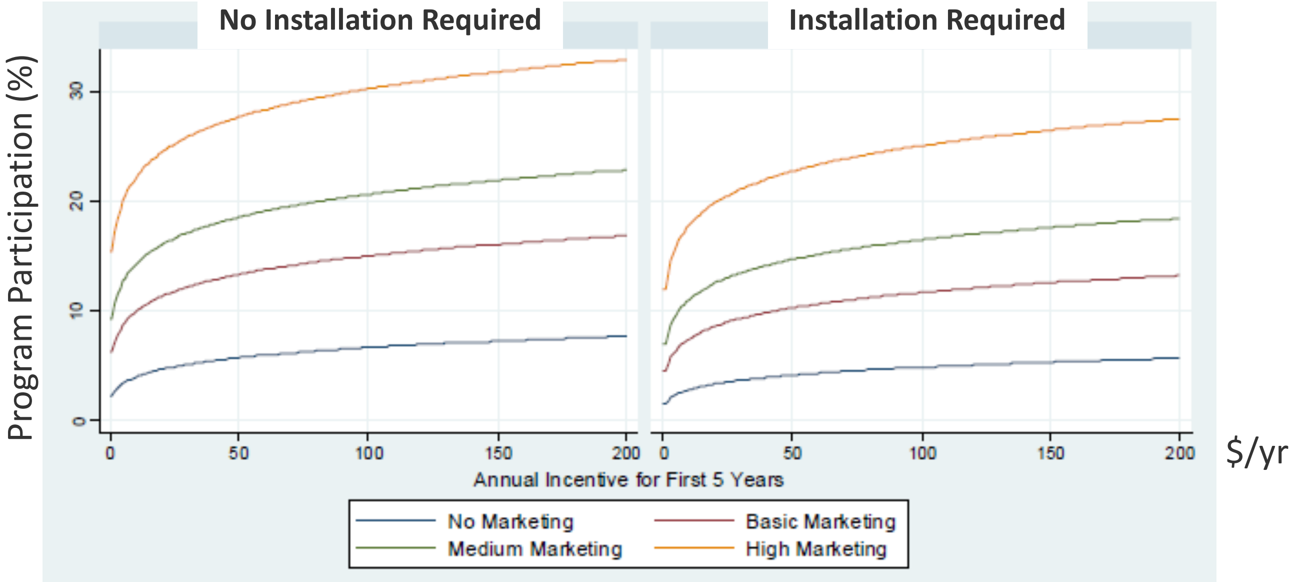
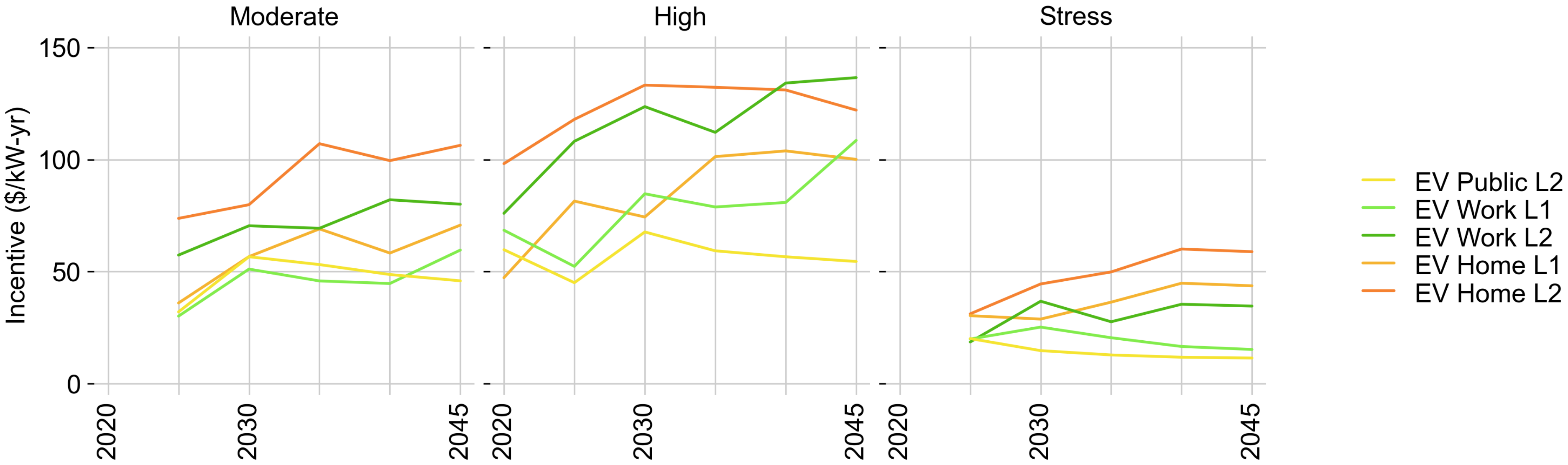
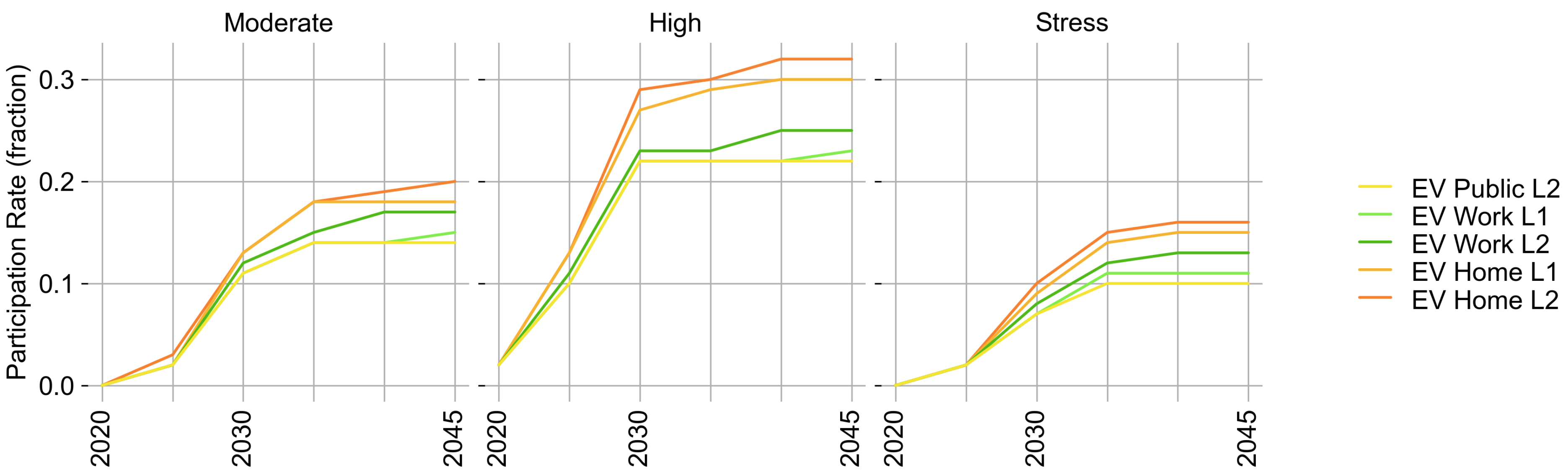


Figure F-5: Achievable Residential Participation Rates by Incentive and Marketing Level (Alstone et al. 2017)

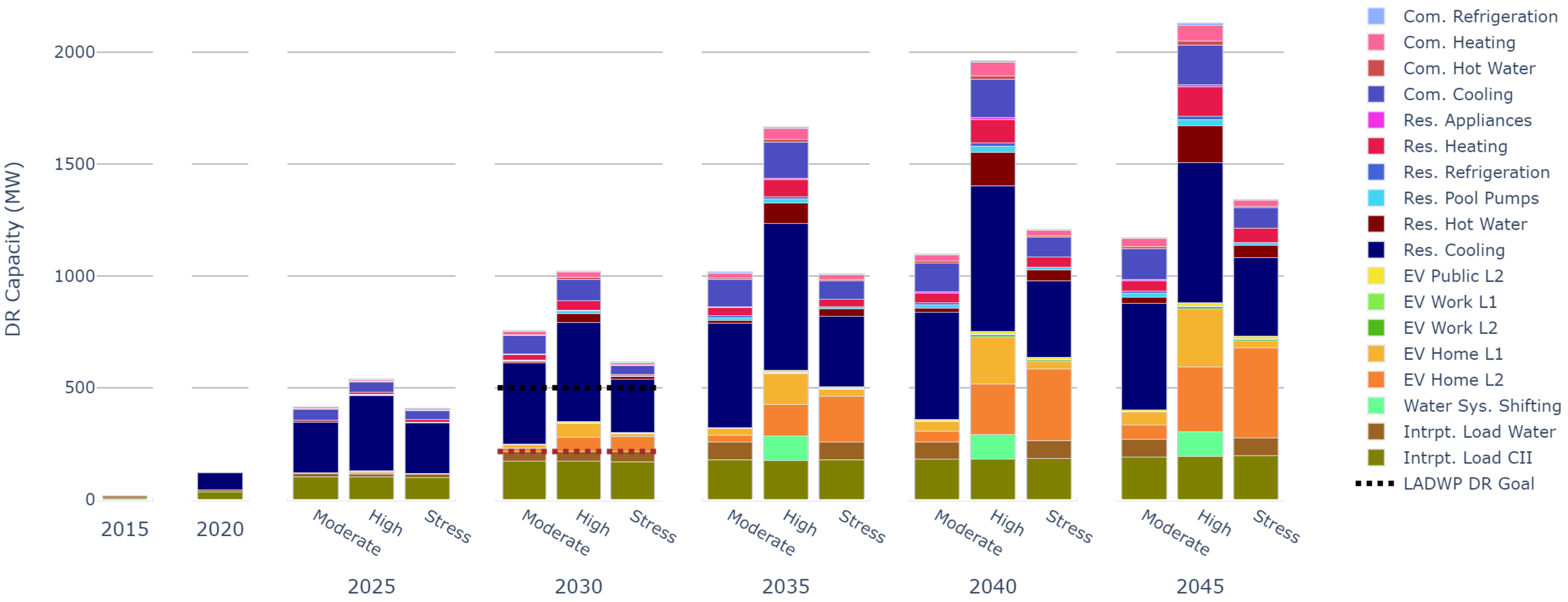
Electric Vehicle Incentive Levels ($/kW-yr)



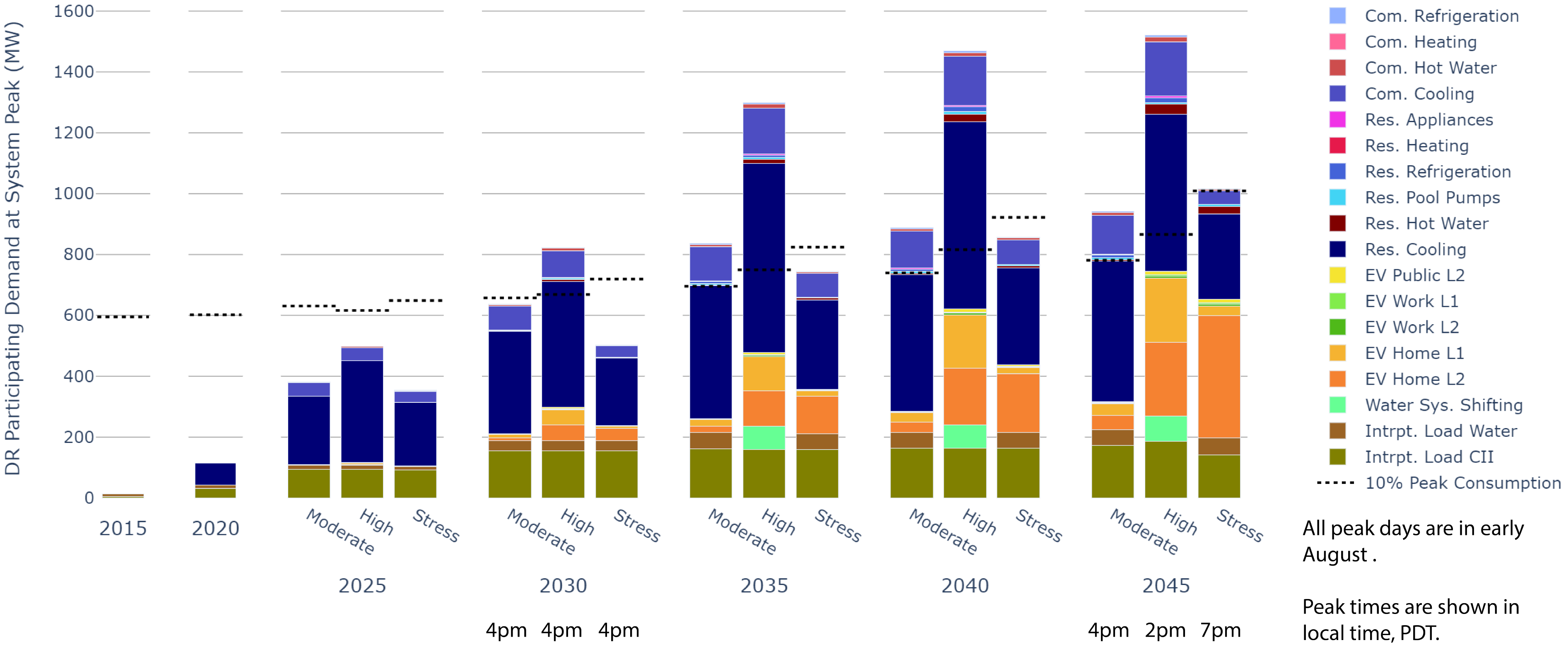
Electric Vehicle Participation Rates



Total Demand Response Capacity: End-use peak demand, non-coincident with system



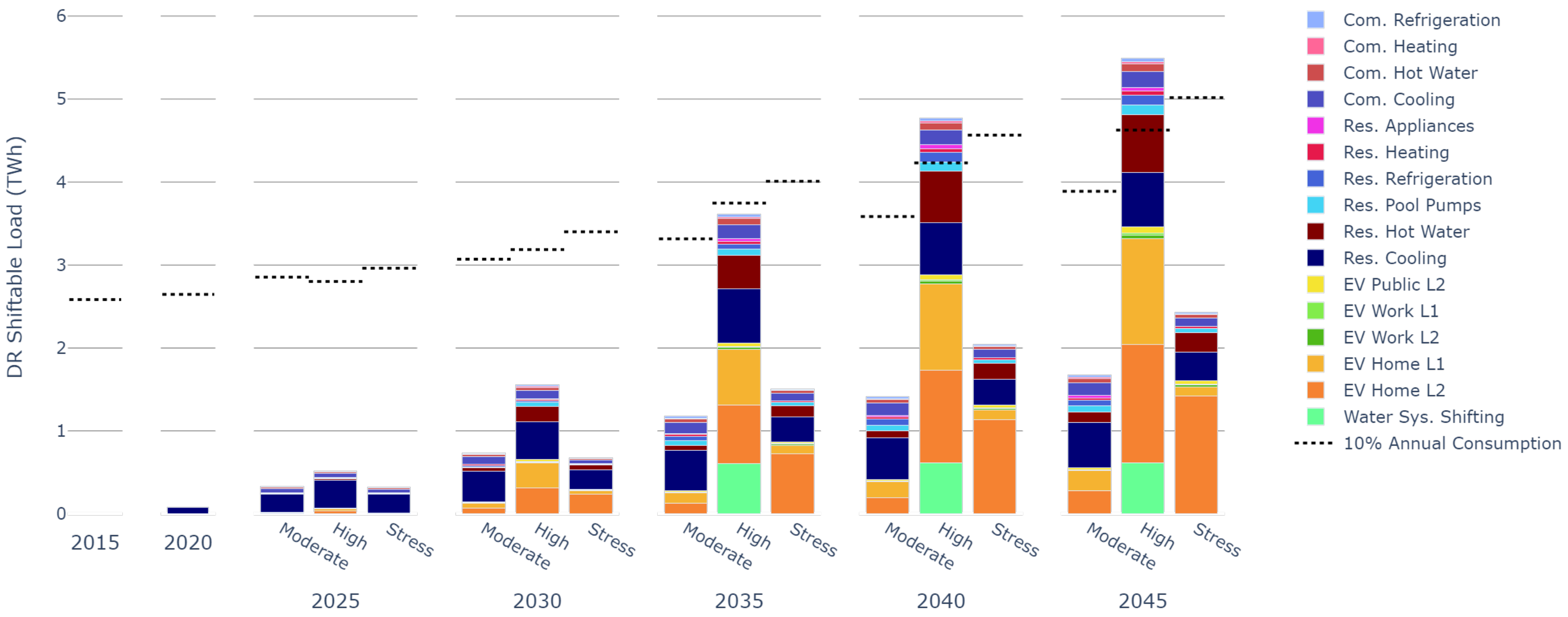
Total Demand Response Capacity: End-use demand at time of system peak



All peak days are in early August .

Peak times are shown in local time, PDT.

Total Demand Response Capacity: Shiftable end-use demand



Conclusion

- LA100 load projections are highly resolved descriptions of demand-side change driven by economic growth, energy efficiency and electrification.
- All three projections include significant transportation electrification (e.g., 30% or 80% of the light-duty fleet by 2045) that influences the amount and timing of system demand.
- High electrification and demand response could unlock over 10% peak demand savings and the potential to shift about 10% of load to better align with available supply.

Discussion/Q&A

The Los Angeles 100% Renewable Energy Study

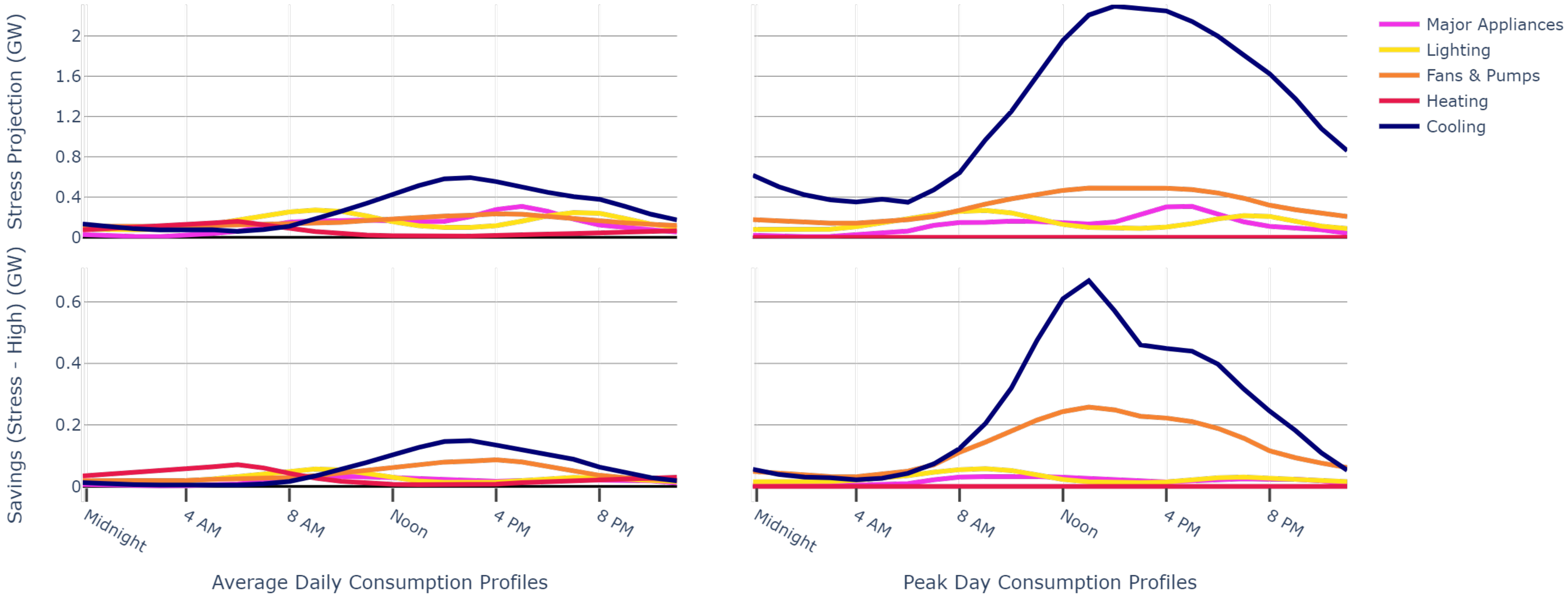
Additional Slides

The Los Angeles 100% Renewable Energy Study

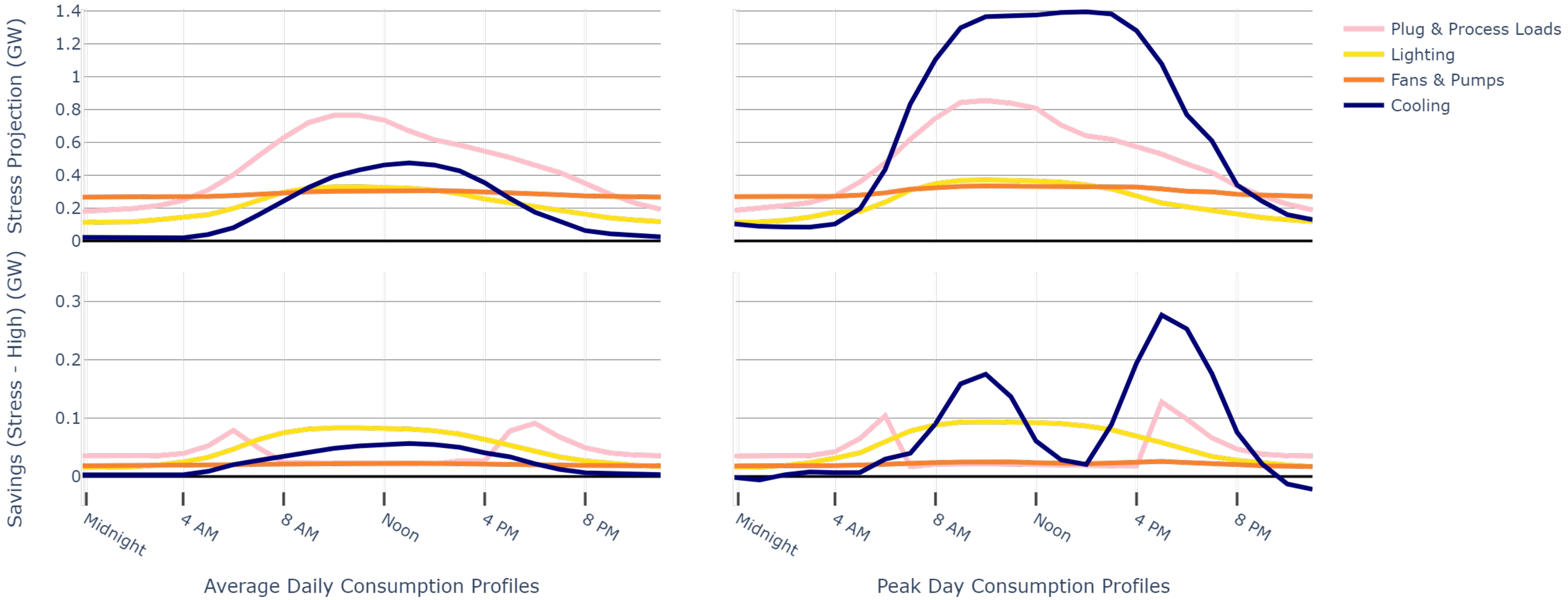
Table of Overall Assumptions

Sector	Methodology	Growth
Residential Buildings	• Detailed engineering models of representative buildings • Geo-located via optimized downscaling • No early replacements—standard equipment lifetimes and commercial renovation rates	• Population-based
Commercial Buildings		• Dodge Metropolitan Construction Insight (through 2022) extrapolated to 2045
Transportation	• Assumptions about EV adoption, fleet mix, and charging availability • Charging profile simulation based on California Household Travel Survey	• AEO vehicle projections scaled down to LADWP
Industrial Premises	• LADWP billing and AMI data supplemented with data from region-specific studies	• LADWP 2017 Retail Sales Forecast • LAX passenger-miles forecast • LA Port tons of cargo forecast
Water System	• By-process analysis of LADWP's water system • Report data layered in to reflect current directions and goals	• LADWP 2015 Urban Water Management Plan • Preference for local water supply

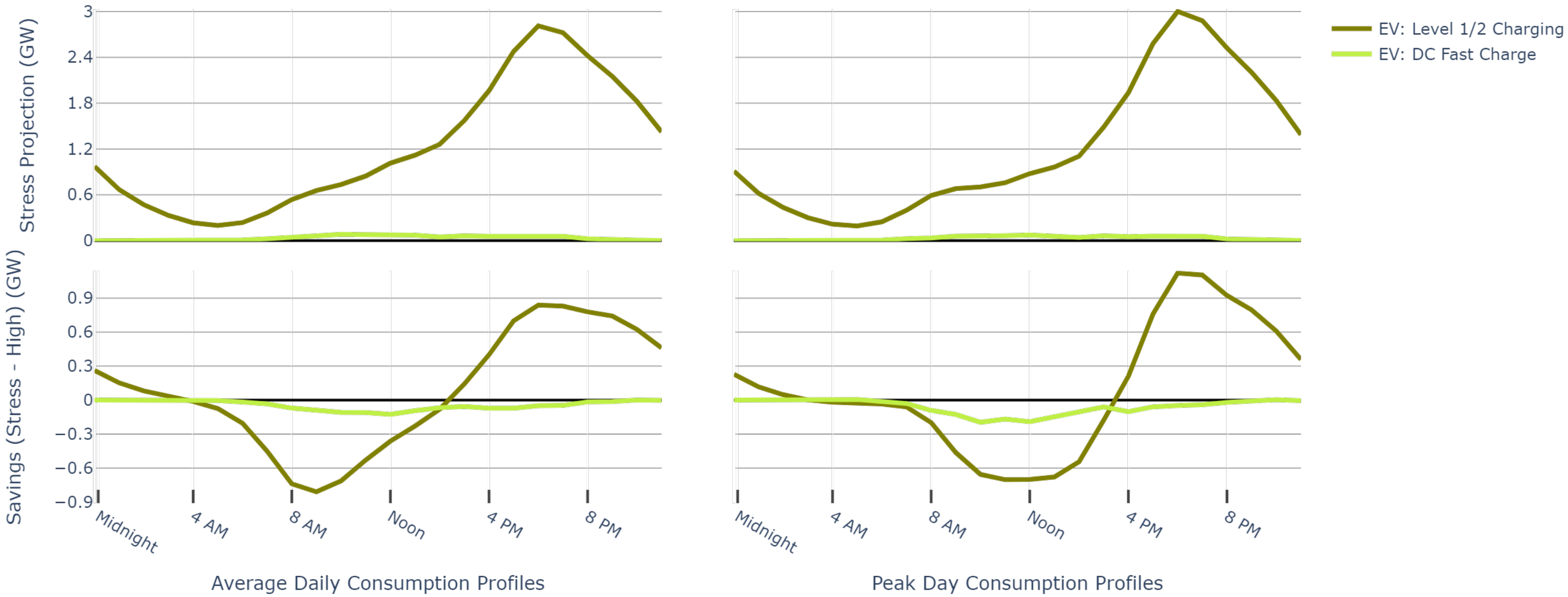
Impact of Efficiency: End-Use Load Shapes Residential, Stress & Stress - High



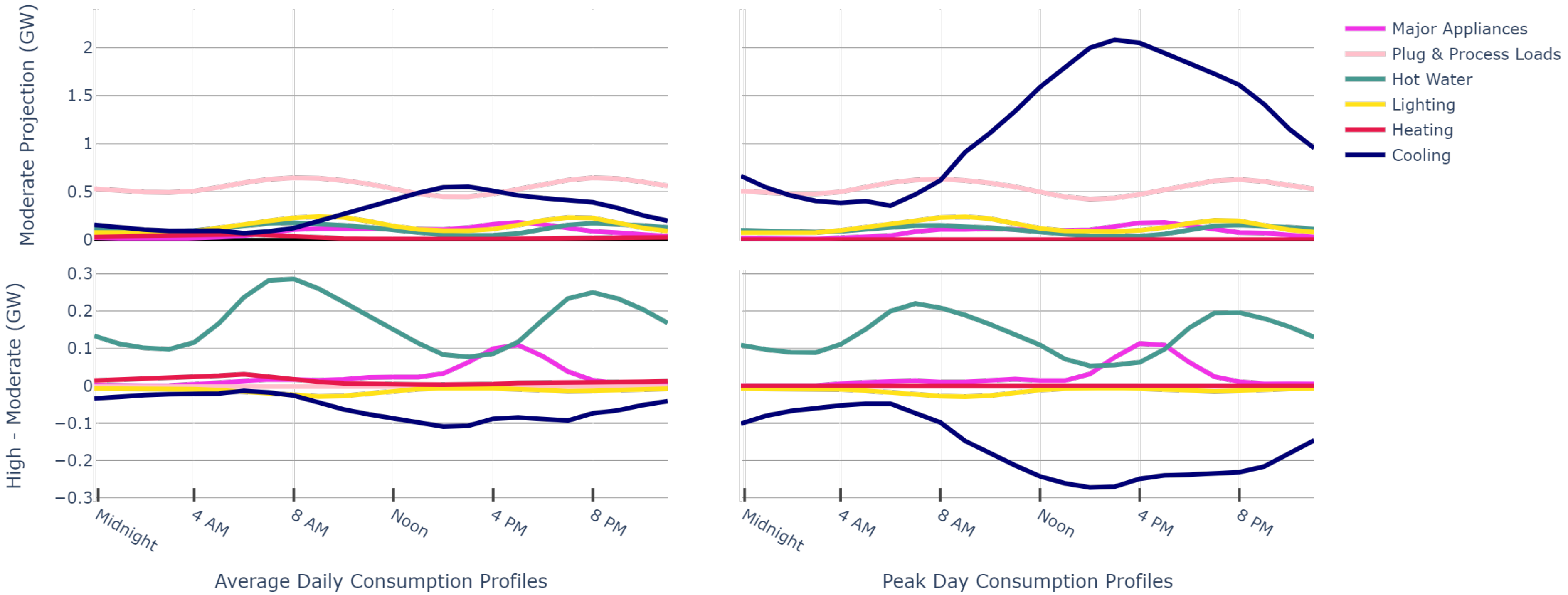
Impact of Efficiency: End-Use Load Shapes Commercial, Stress & Stress - High



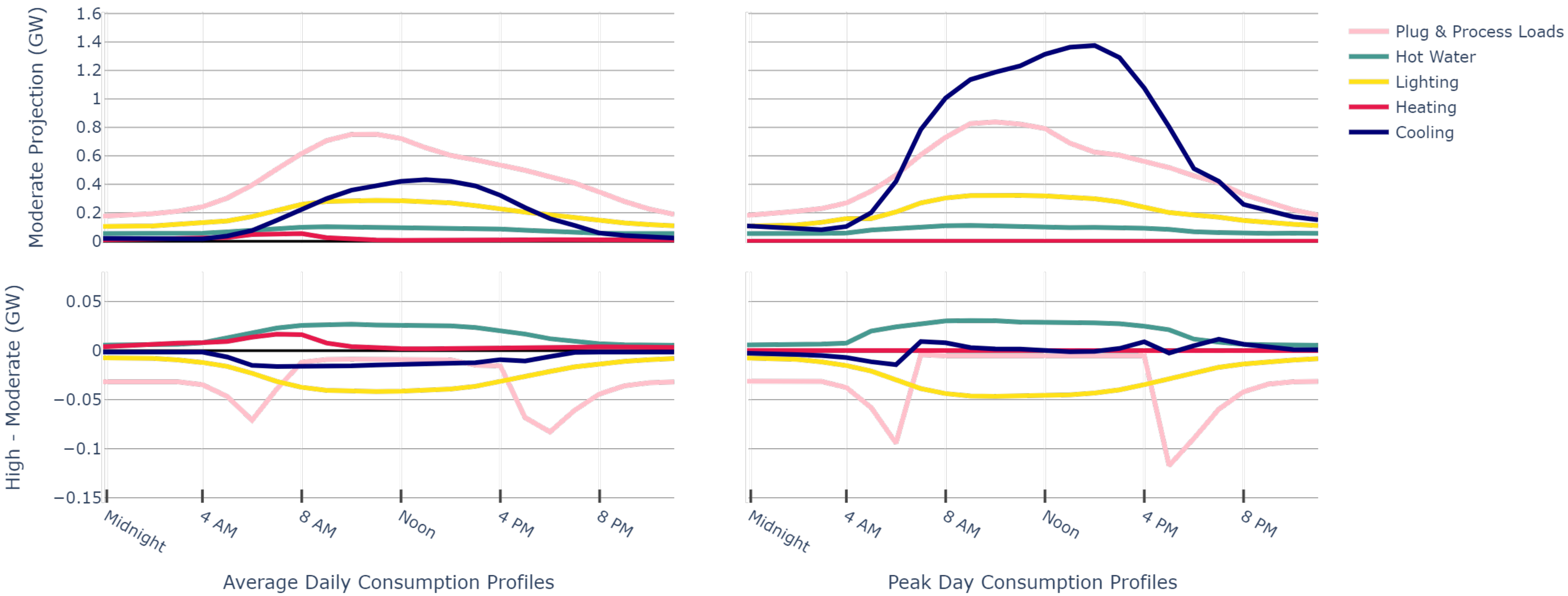
Impact of Charging Assumptions: End-Use Load Shapes Electric Vehicle Charging, Stress & Stress - High



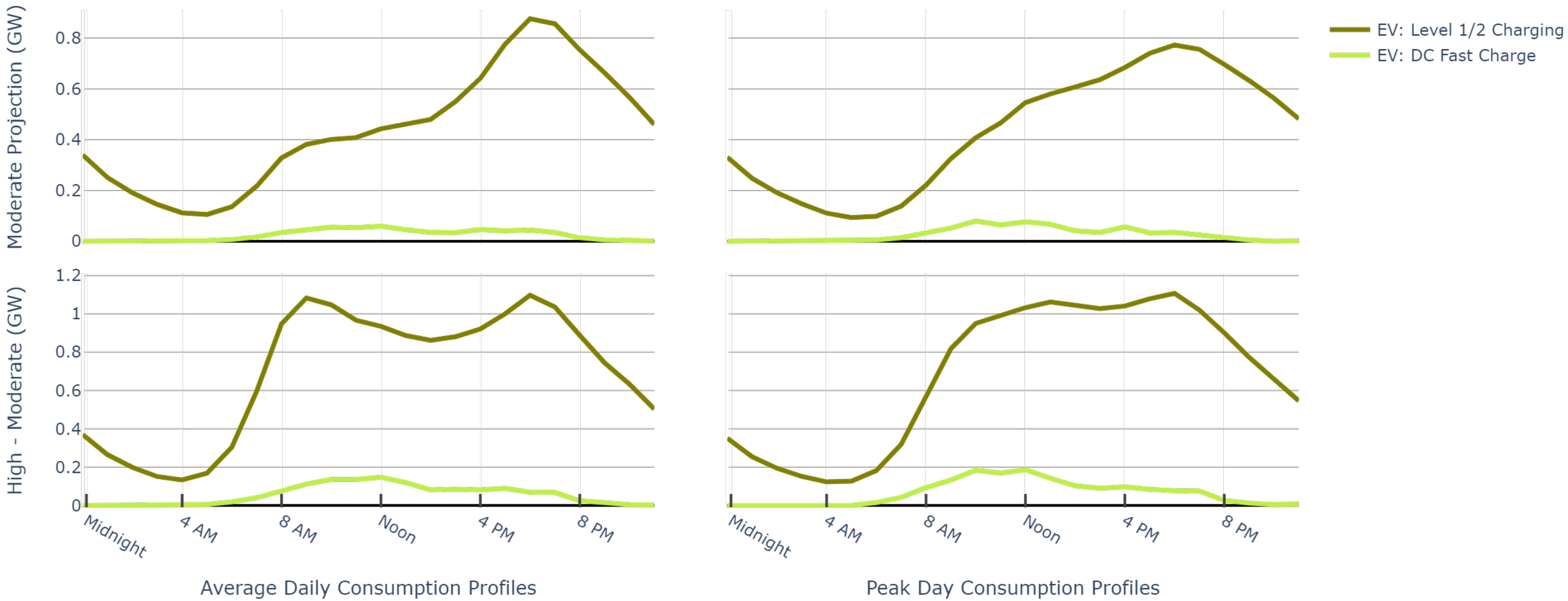
Electrification and Efficiency: End-Use Load Shapes Residential, Moderate & High - Moderate



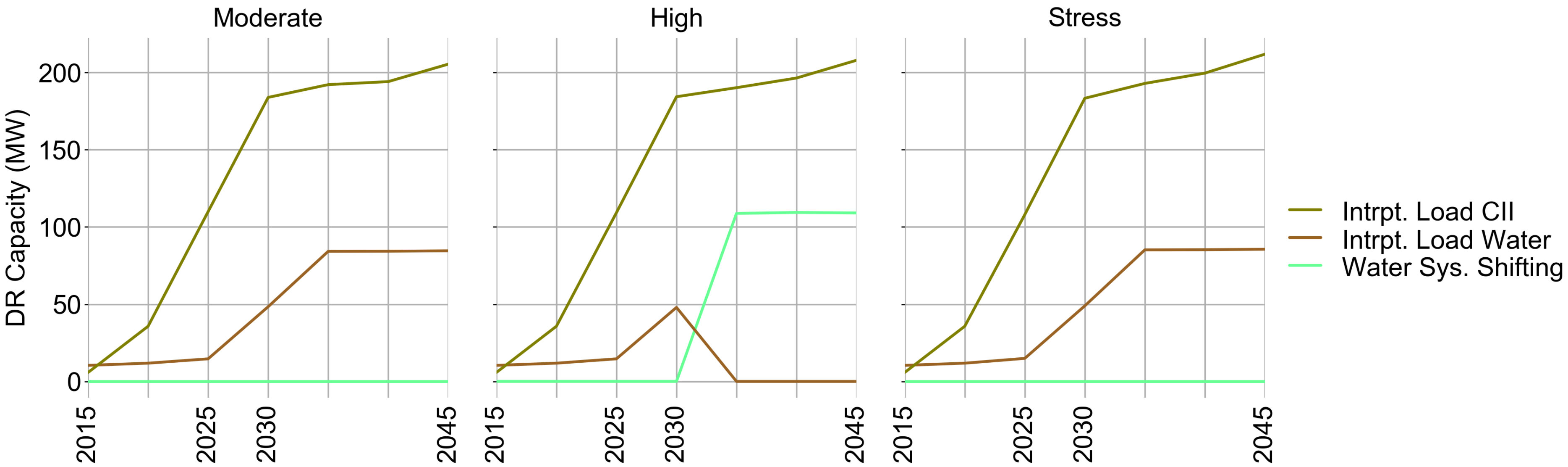
Electrification and Efficiency: End-Use Load Shapes Commercial, Moderate & High - Moderate



Electrification: End-Use Shapes
Electric Vehicle Charging, Moderate & High - Moderate

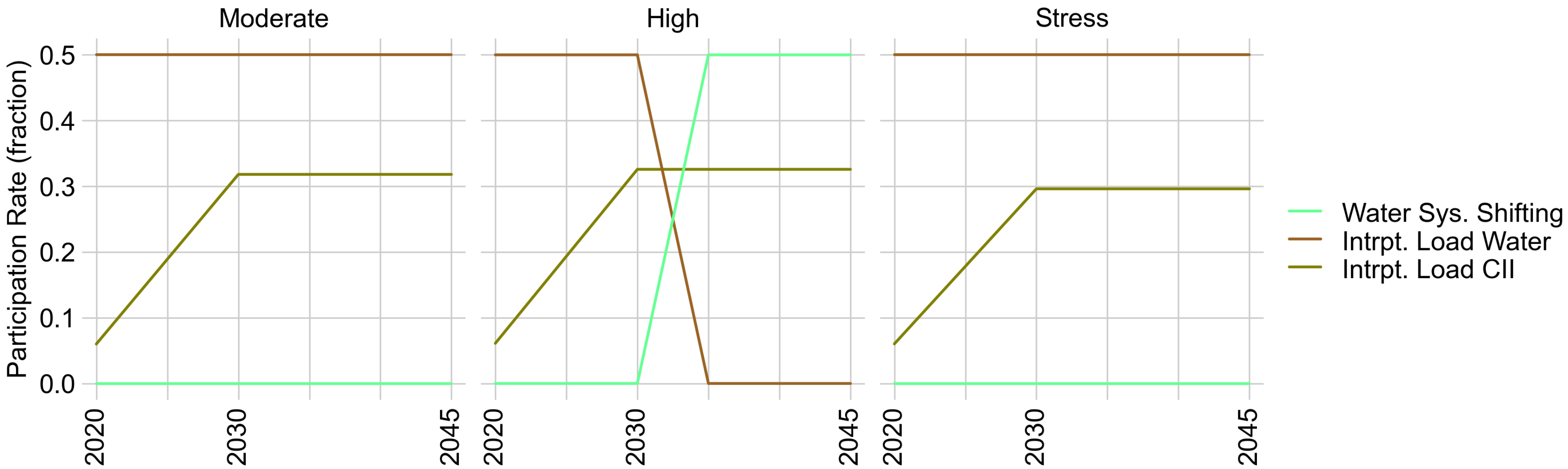


Commercial, Industrial, and Institutional (CII) Capacity



- All scenarios start with 50% of water system pumping loads as interruptible load
- All scenarios have 215 MW total interruptible load in 2030
- Non-water system interruptible load post-2030 is constant proportion of large C&I agents' peak
- In the High Projection only, 50% of all water system loads (incl. pumping) become **shiftable** in 2035

CII Participation Rates



Participation rates for non-water loads were estimated by partitioning out large customers (peak load > 500 kW) and assuming that the resource is approximately 20% of those customers' coincident peak.