
# CITY LIGHT 2020 INTEGRATED RESOURCE PLAN:

## DEMAND FORECAST DEEP-DIVE & SCENARIO DISCUSSION

# HIGH-LEVEL INTEGRATED RESOURCE PLAN TIMELINE


Q3/Q4 2019

Q4 2019/ Q1 2020

Q1/Q2 2020

Q3 2020

★ Demand Forecast & Scenarios (12/13)

★ IRP Process & Scenarios (1/10)

★ Resource Adequacy & Climate Change (Feb)

★ Review scenarios and Portfolios (March)

★ Portfolio Results & Review Draft Recommendations (April/May)

# GOALS OF DEEP DIVE

1

## Understand the Baseline Demand Forecast

- Methodology overview

- Walkthrough baseline forecast results

2

## Discussion on scenario planning

- What alternative futures to consider

- Crafting demand scenarios with some illustrative examples

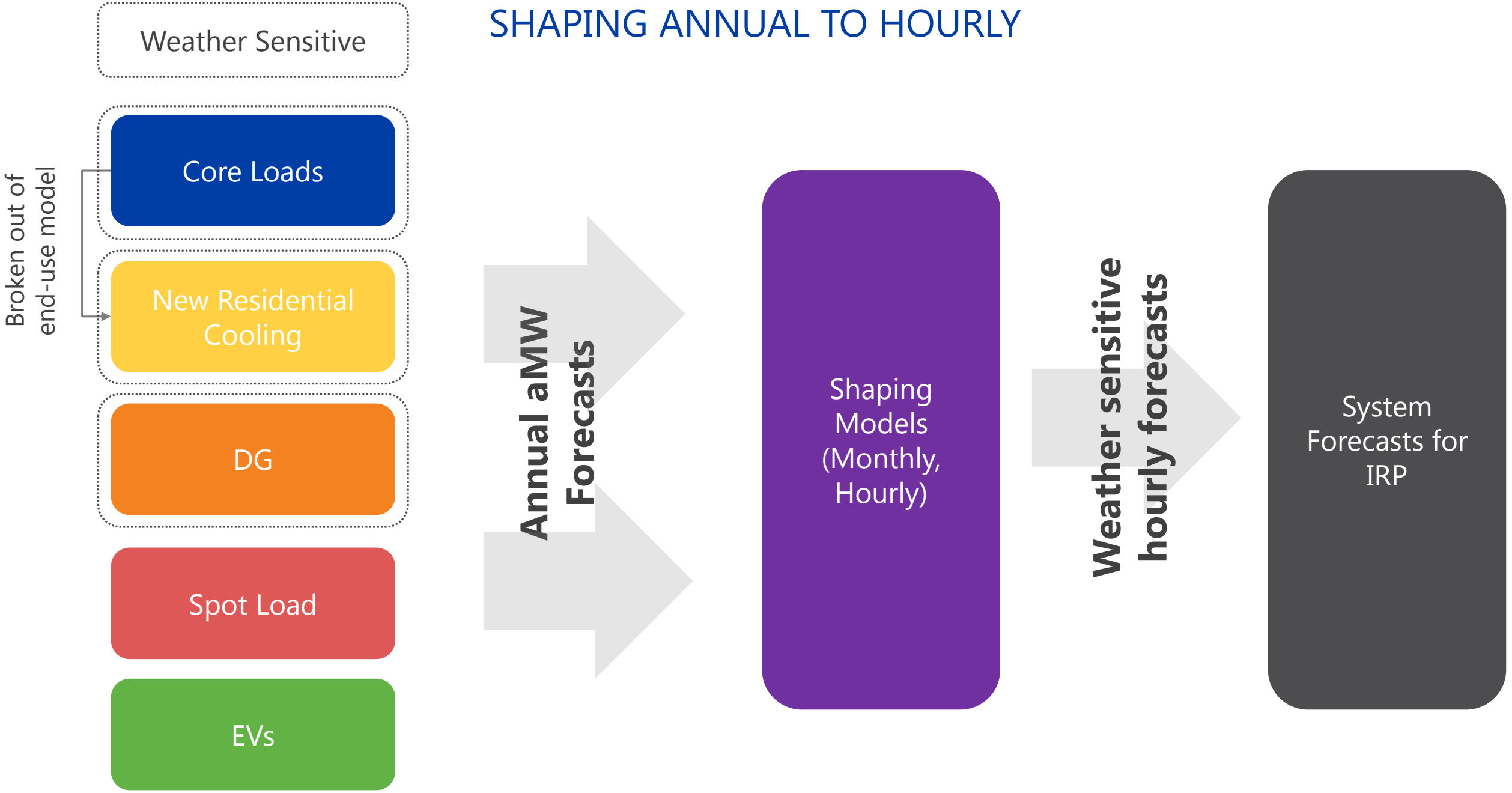
- How to prioritize future development work


# Methodology Overview

# Why did we move from econometric to end-use based demand forecasting?

| | |
|---|---|
| **End-Use Forecast** | **Residential & Commercial delivered sales that includes: economic drivers, stock turnover, codes & standard and naturally occurring efficiency** |
| + | |
| **Adjustments** | **Industrial, electric vehicles, distributed generation & large transit electrification but no programmatic efficiency** |
| + | |
| **Losses + Own Use** | **Gross up from energy delivered at the meter to delivered at the system** |
| = | |
| **System forecast for IRP** | **Annual system load which requires additional shaping** |

# SHAPING ANNUAL TO HOURLY



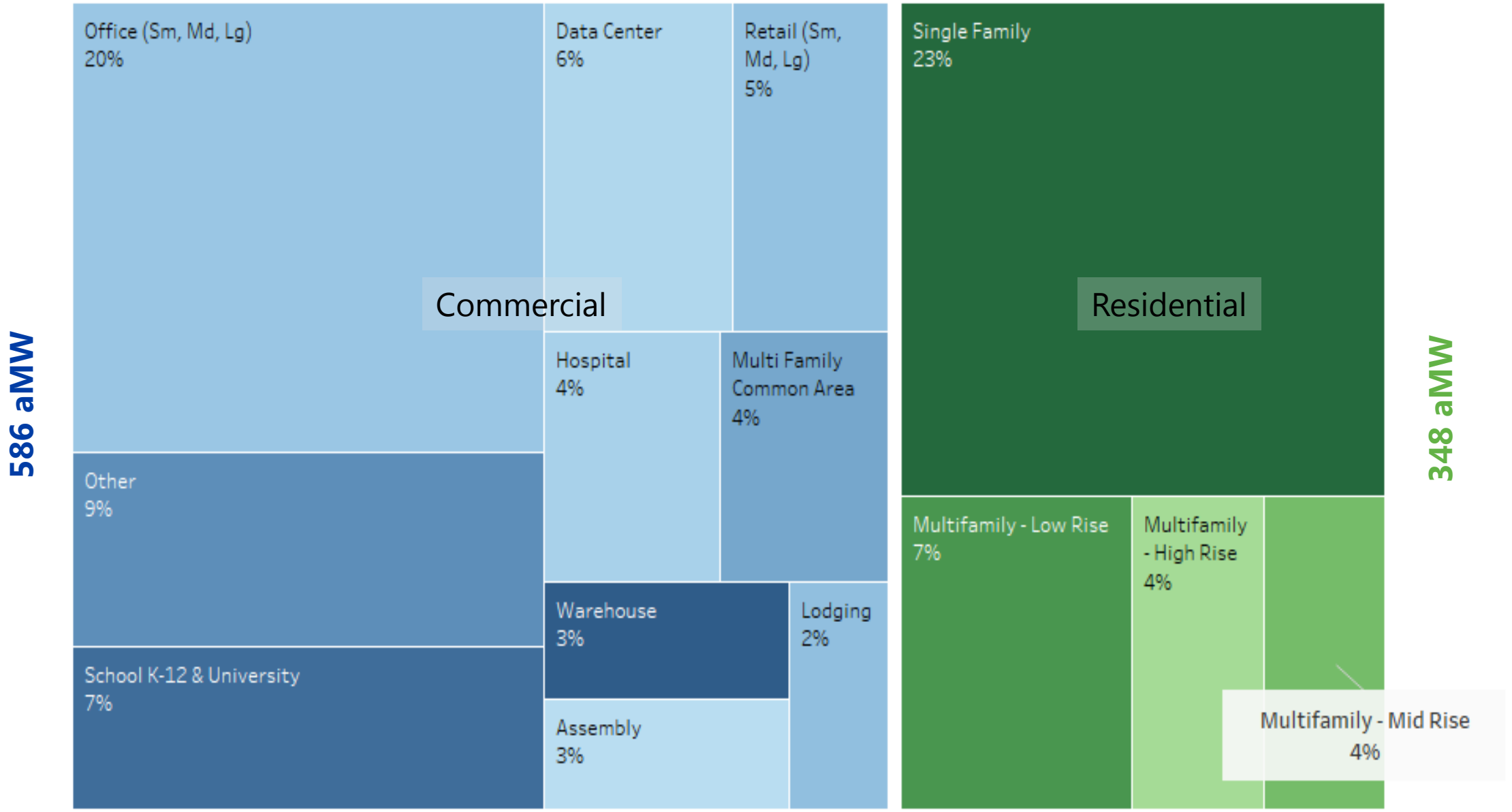
# DEMAND FORECAST DEVELOPMENT WORK

1. Leverage more City Light specific data to better calibrate end-use model
2. Reflect new state and city legislation
3. Incorporate load shape impacts from changes in end-use saturations

# Baseline Forecast

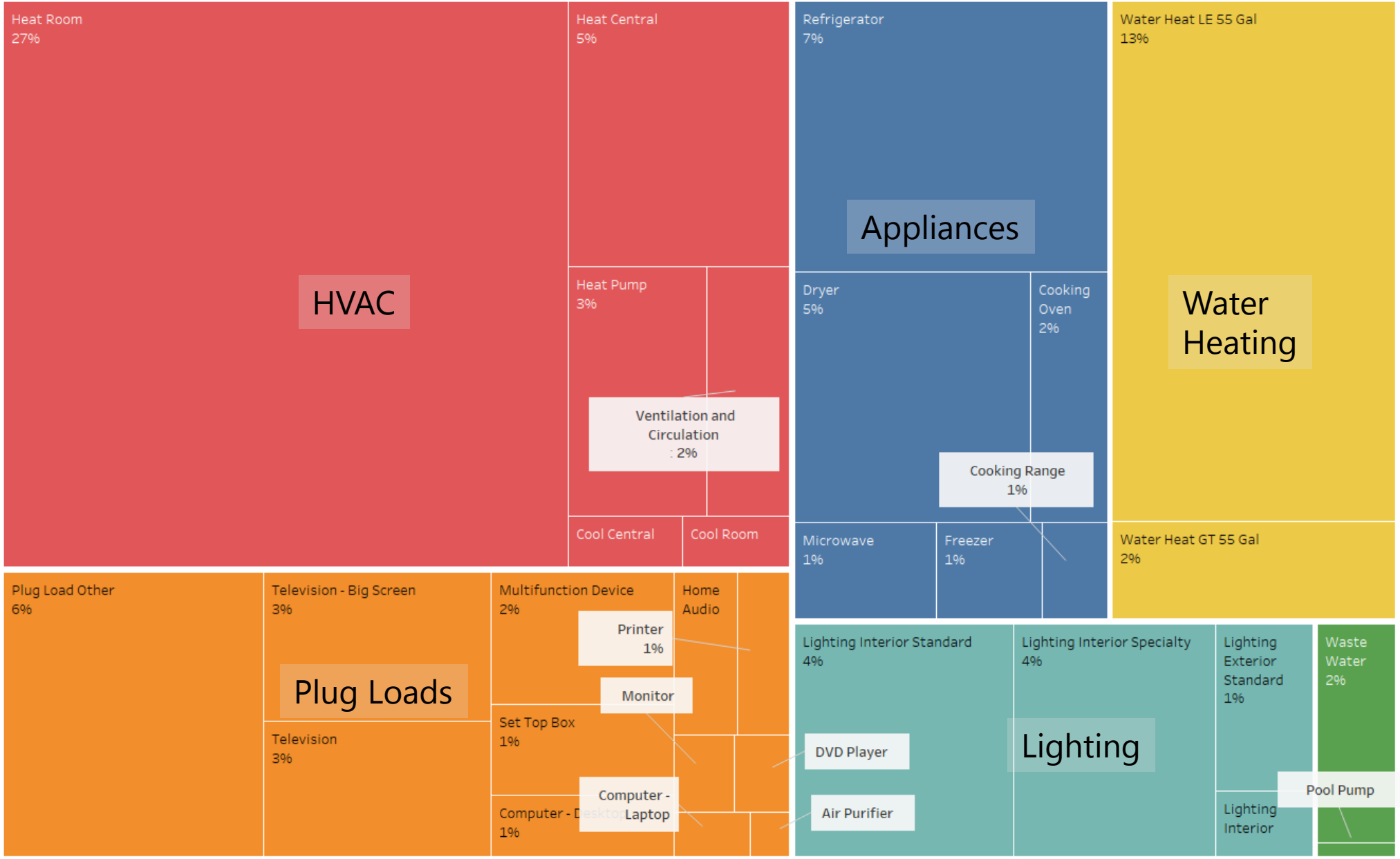
# End-Use Forecast (Annual aMW)

# BASE YEAR (2019) DELIVERED LOAD BY CUSTOMER CLASS & SEGMENT



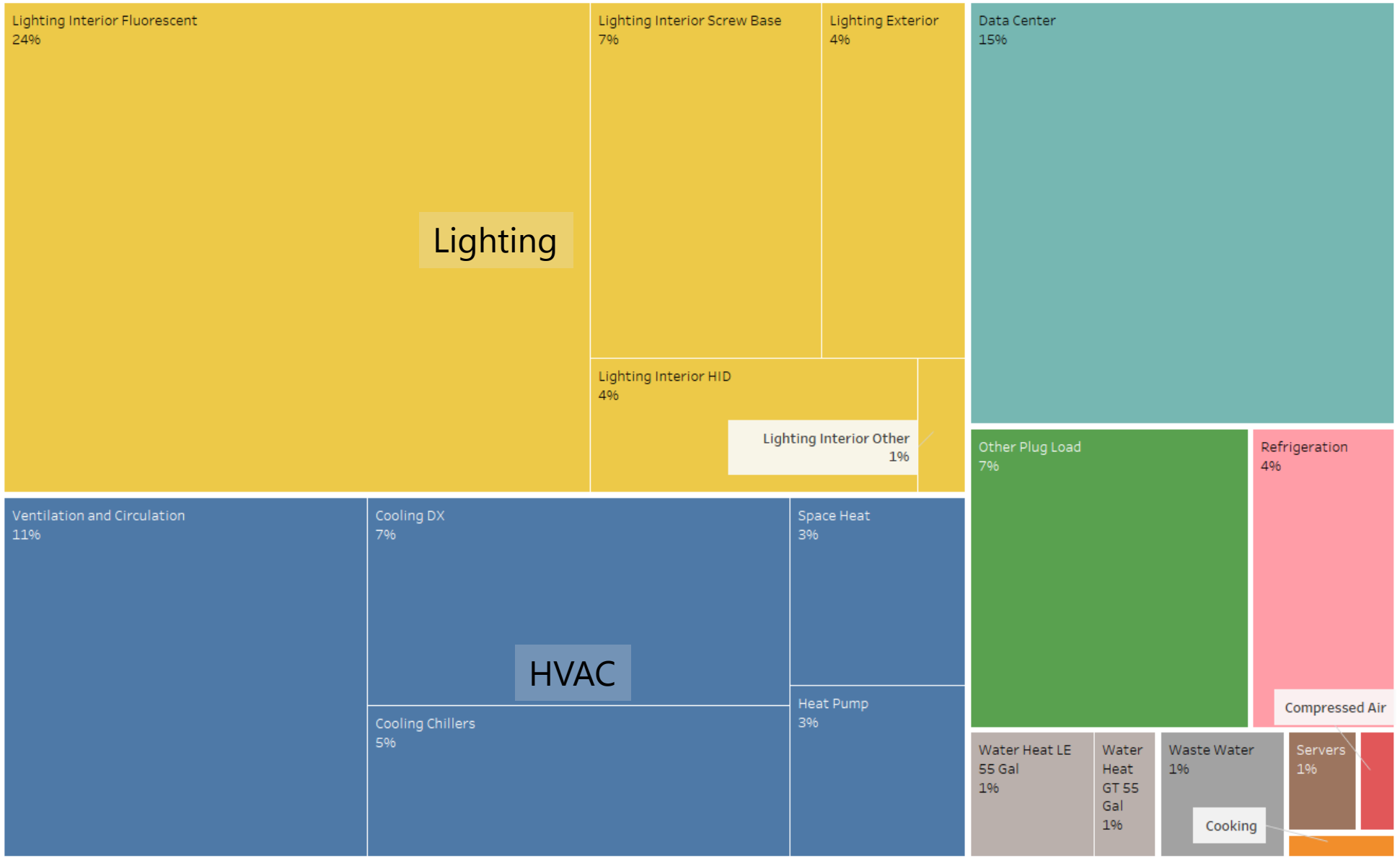
# BASE YEAR (2019) DELIVERED RESIDENTIAL LOAD BY END USE

348 aMW

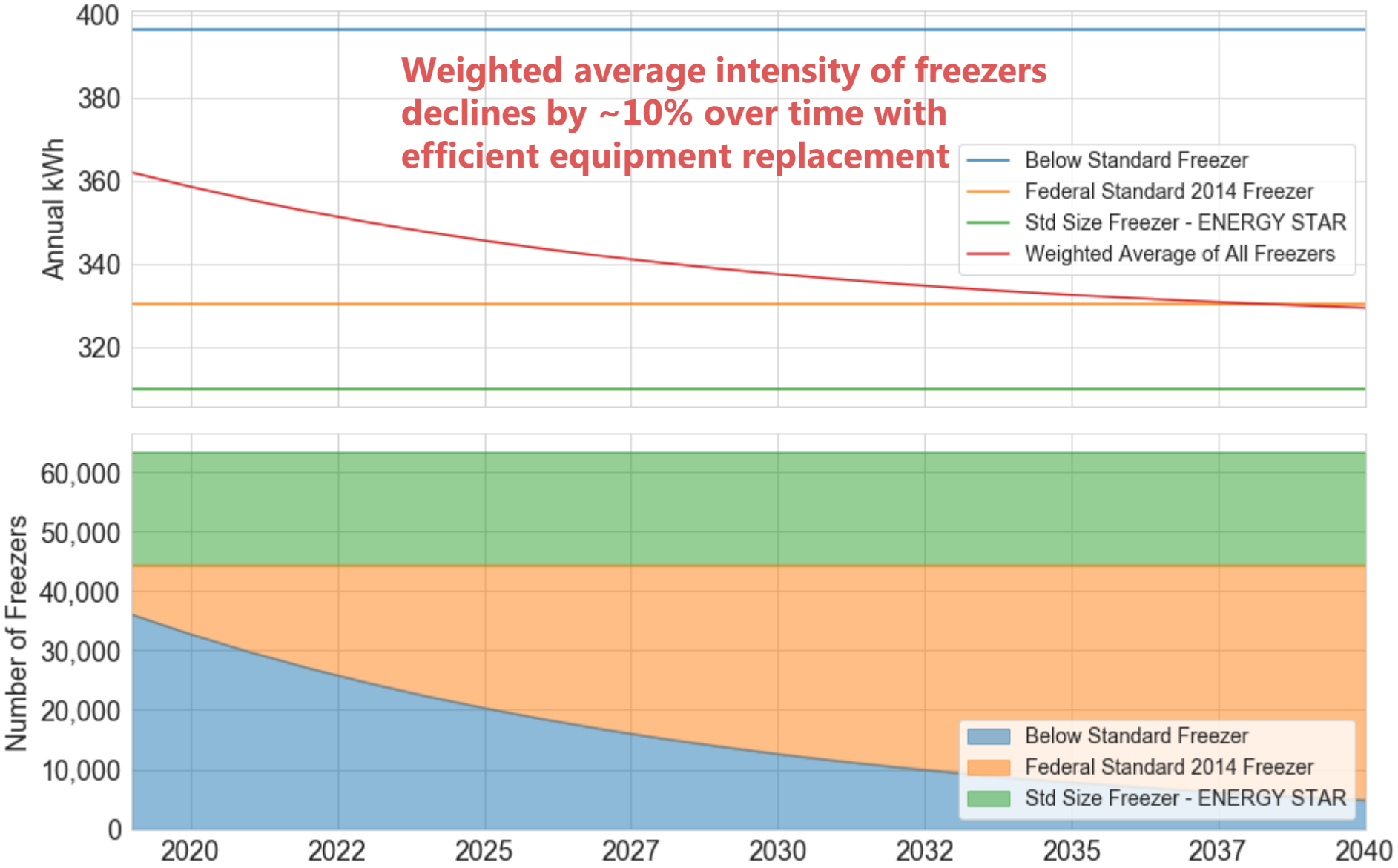


# BASE YEAR (2019) COMMERCIAL DELIVERED LOAD BY END USE

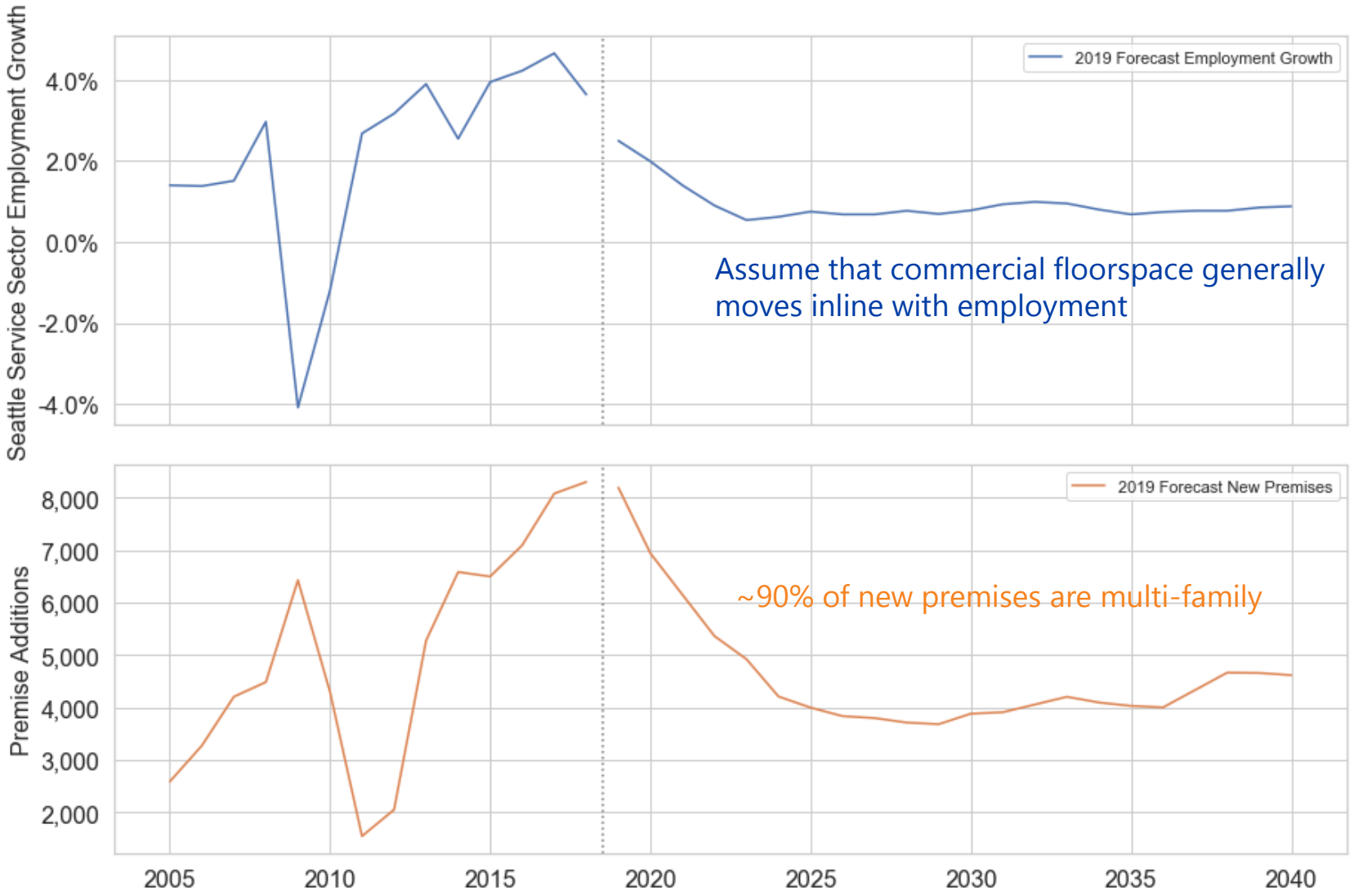
586 aMW



# END-USE STOCK TURNOVER EXAMPLE: RESIDENTIAL SINGLE FAMILY FREEZERS

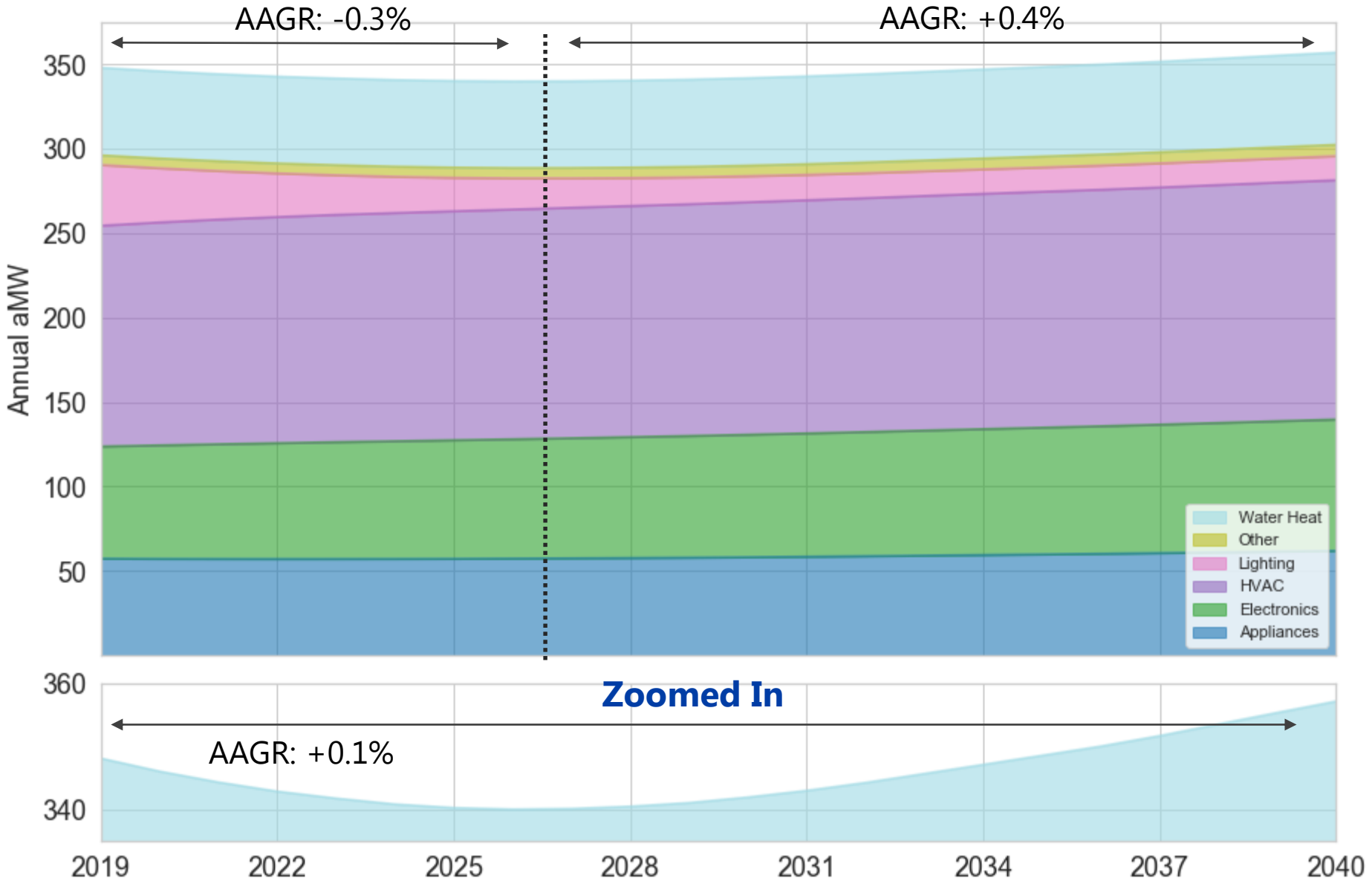


# THE ECONOMY IS COOLING

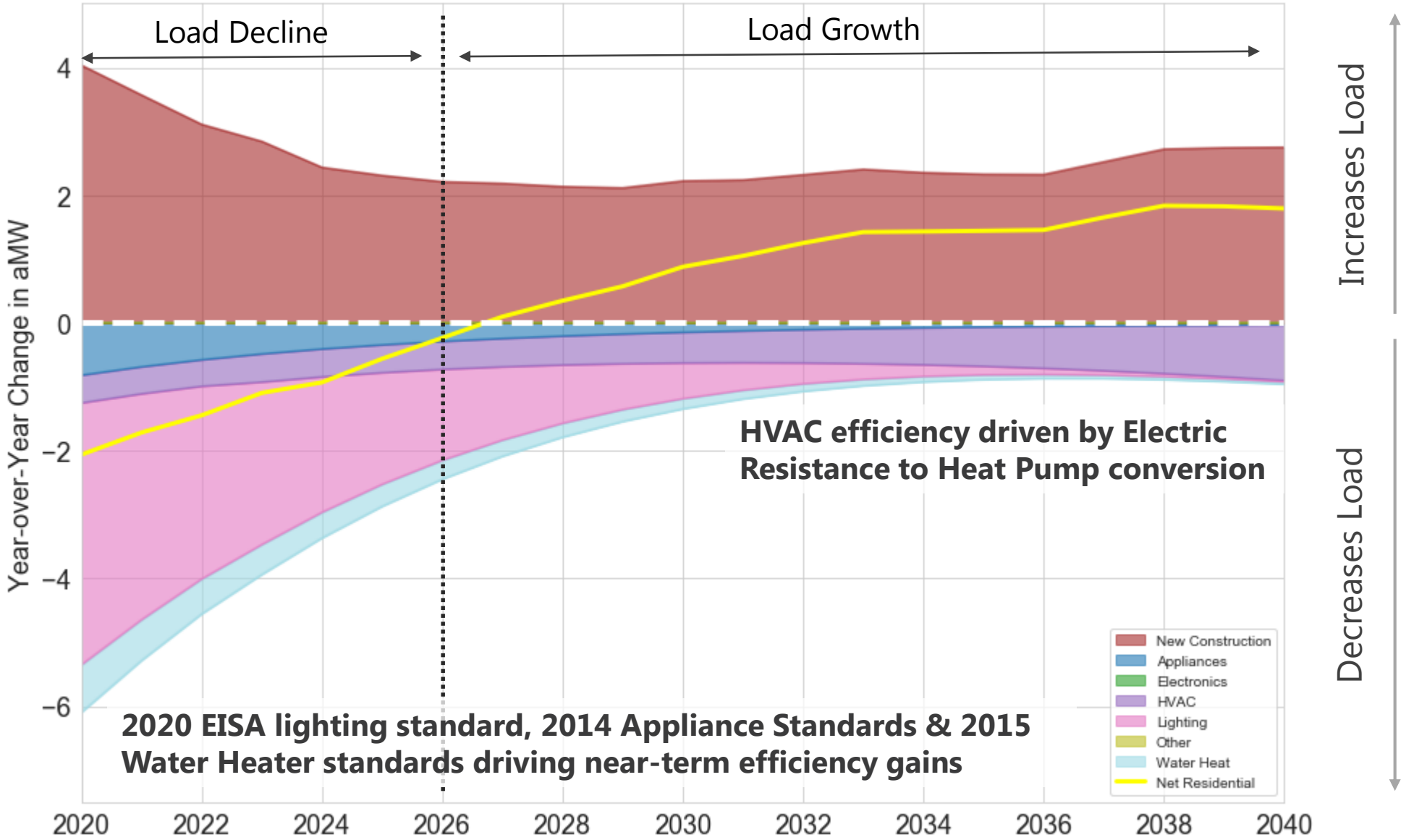



*Employment & Housing Forecast based on IHS Seattle Metro economic forecast

# RESIDENTIAL DELIVERED LOADS



# RESIDENTIAL YEAR-OVER-YEAR CHANGES



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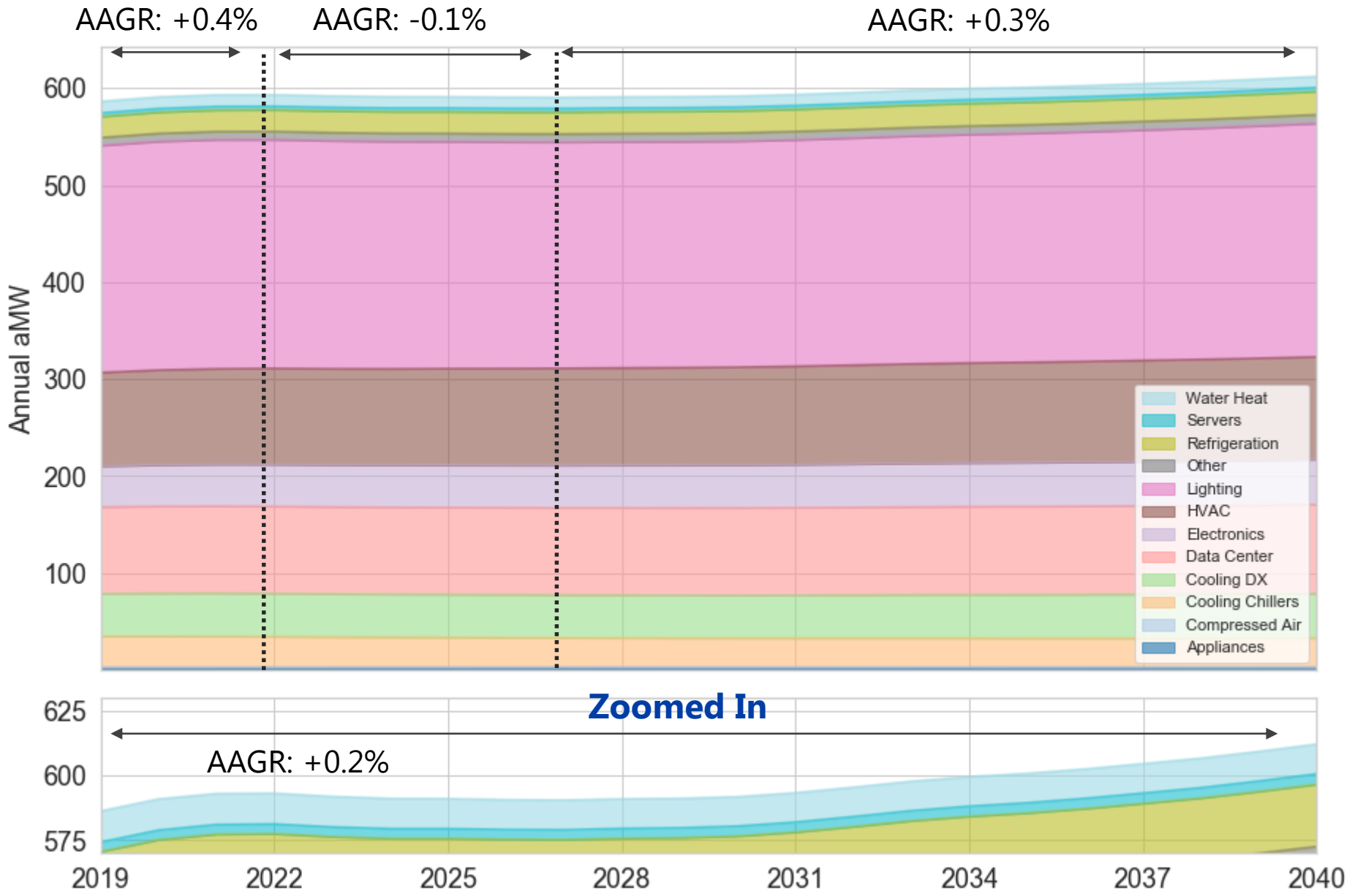

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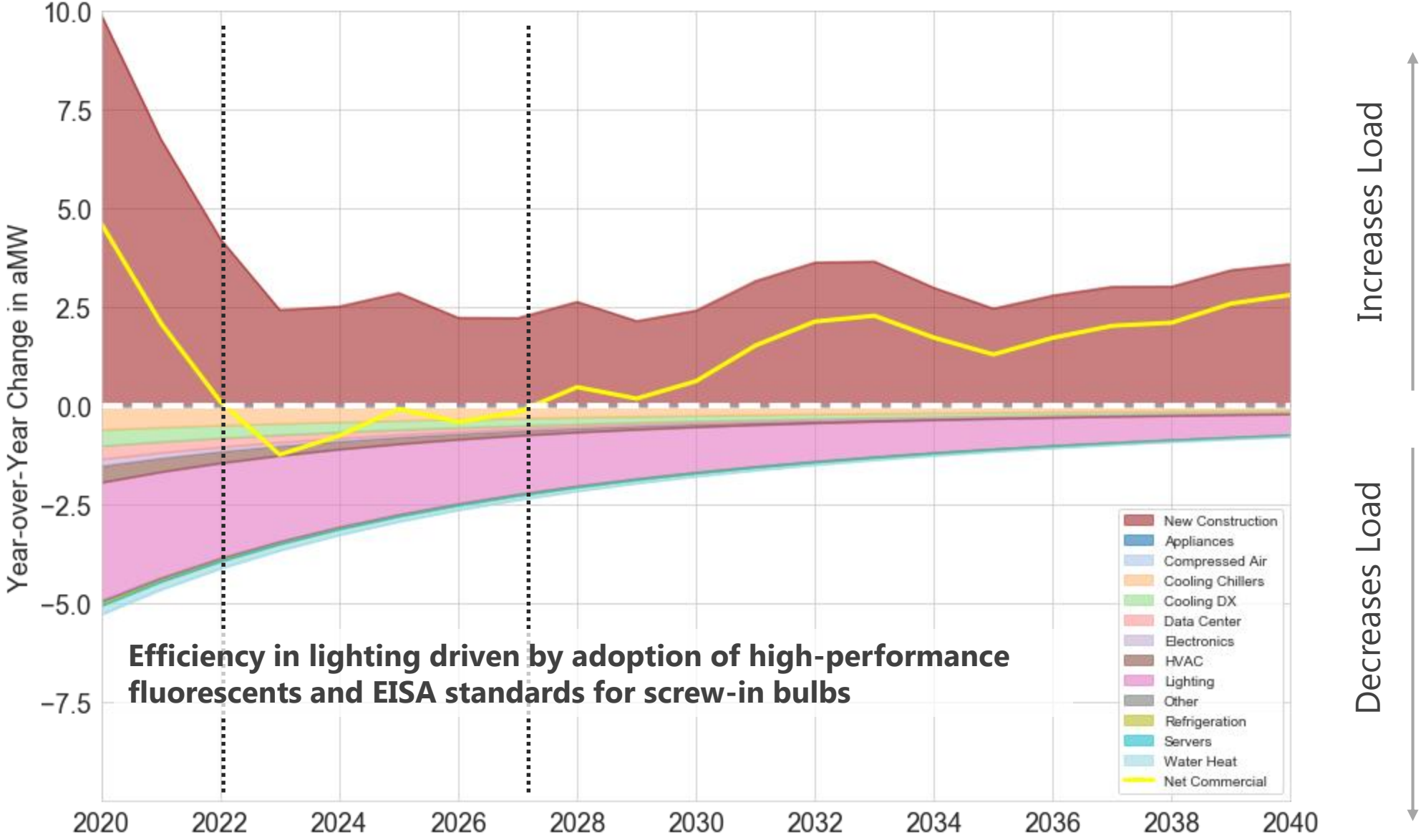
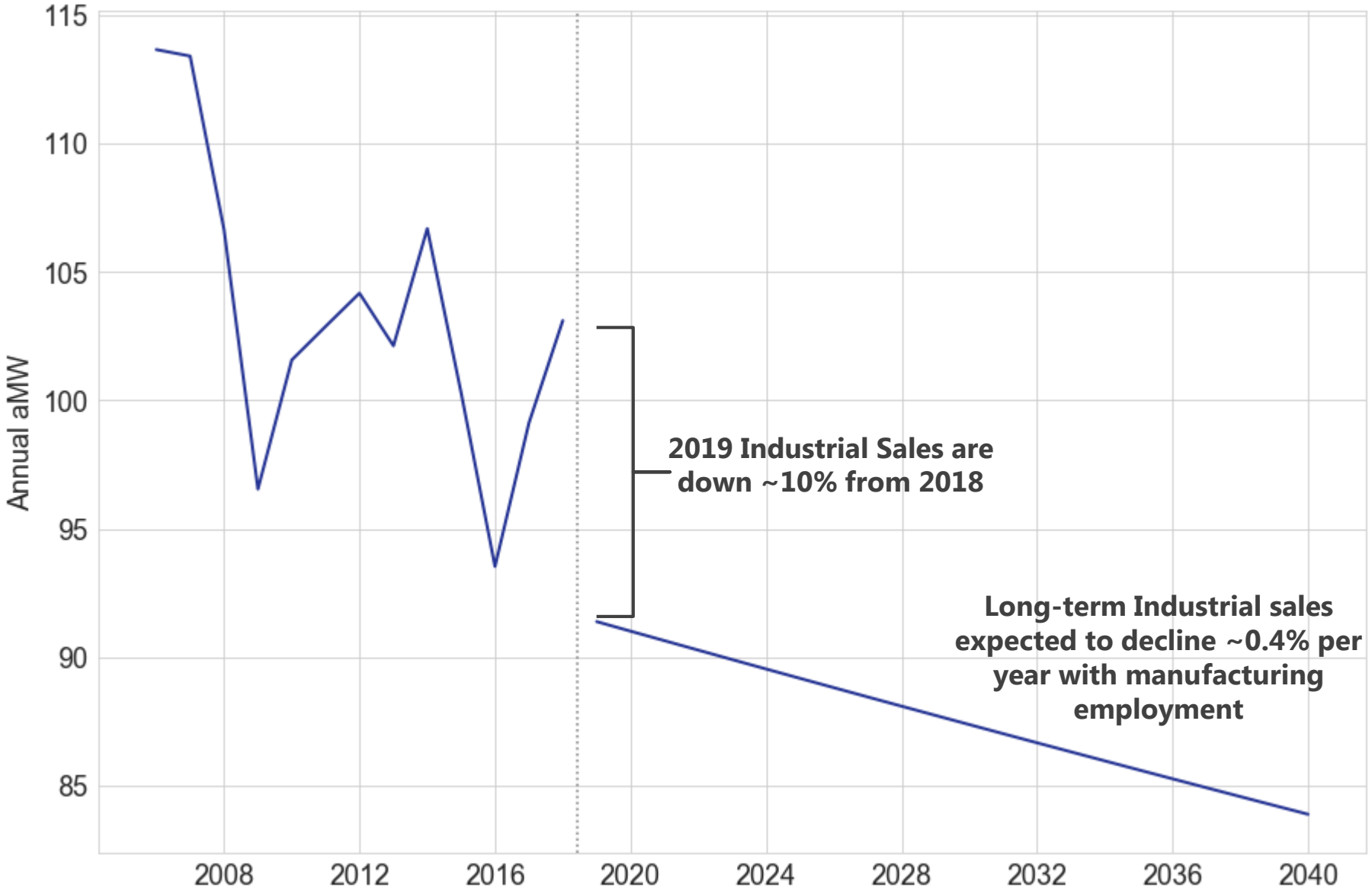


# Adjustments (Annual aMW)

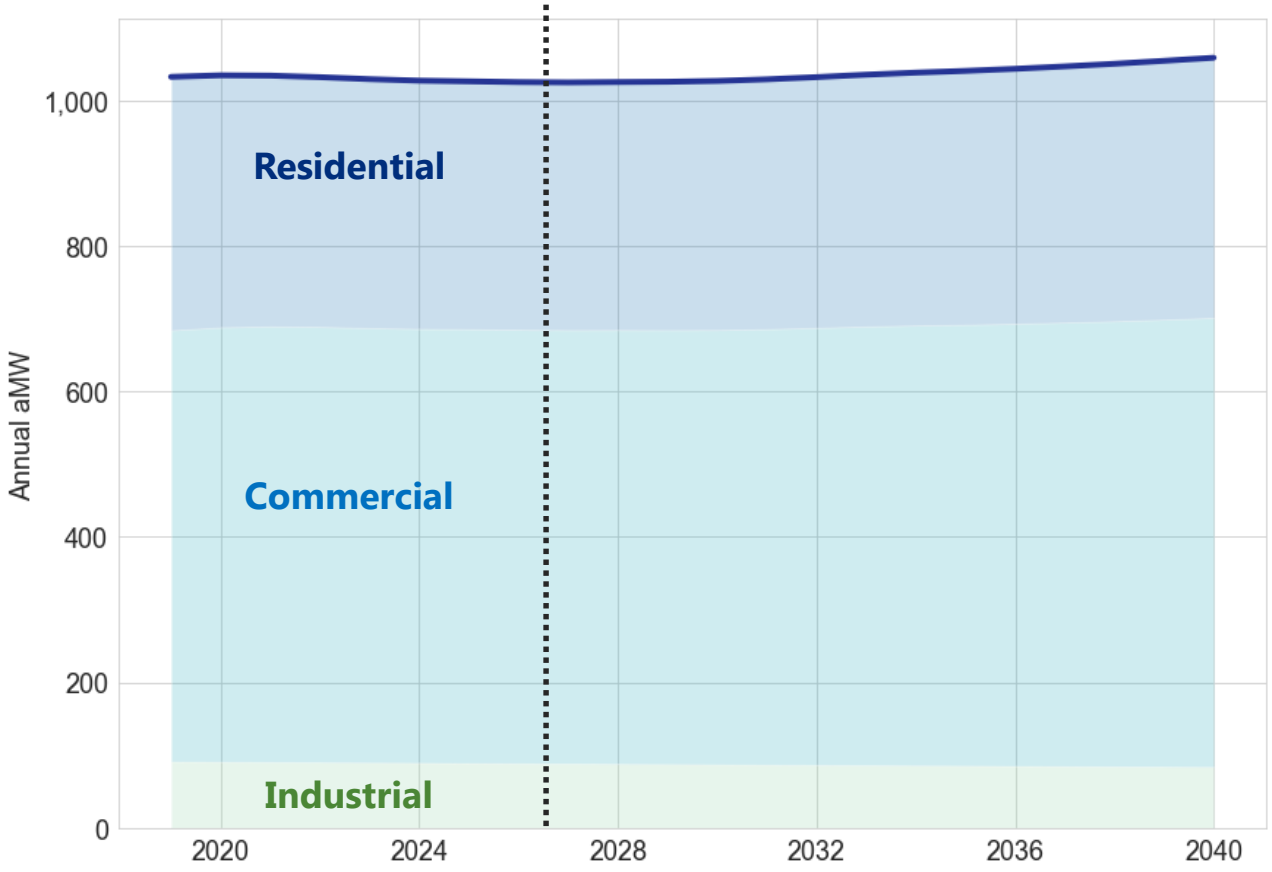
# INDUSTRIAL FORECAST



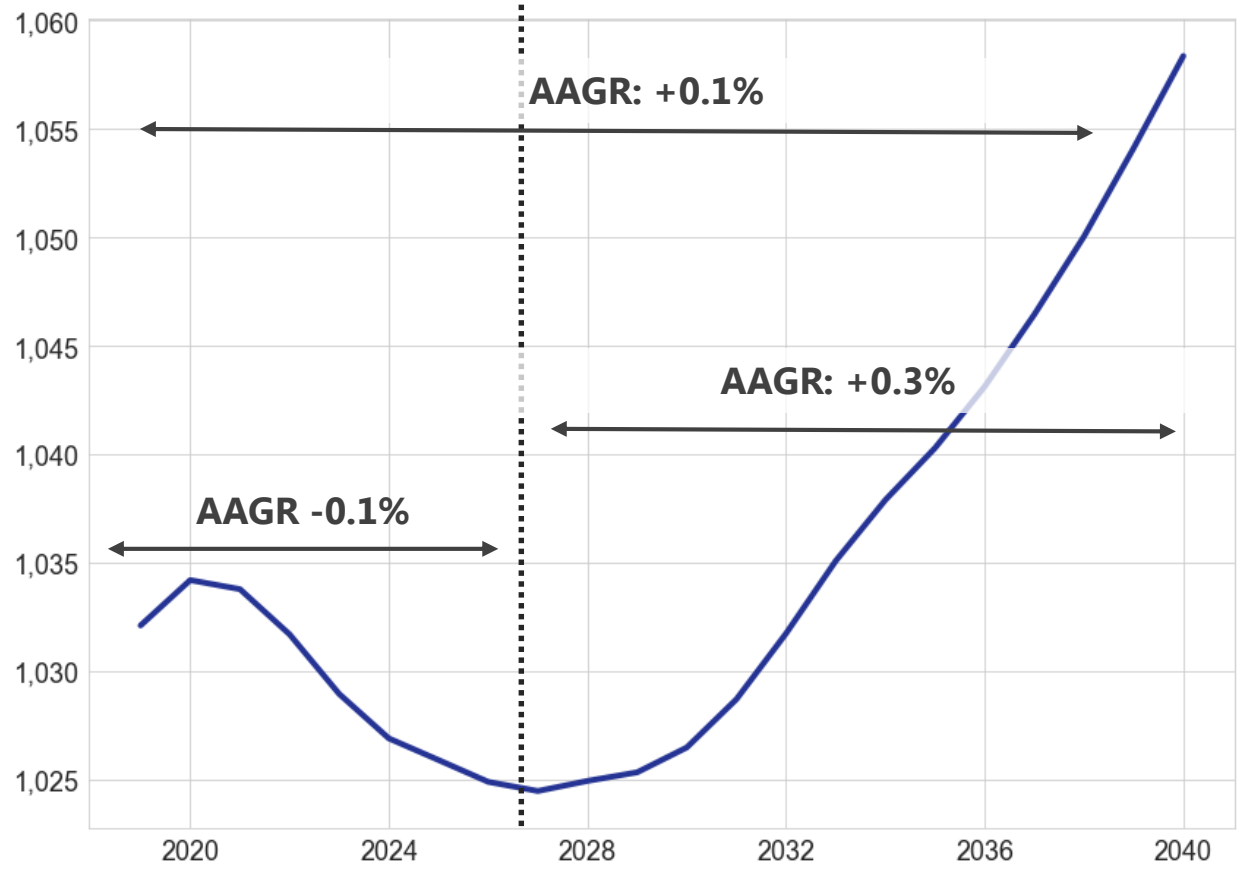

| Industrial Customers |
|---|
| ARDAGH GLASS |
| ASH GROVE CEMENT |
| BOEING |
| CERTAINTEED |
| DARIGOLD INC |
| LAFARGE CORPORATION |
| NUCOR |
| PORT OF SEATTLE |
| STEVEDORING |
| VIGOR |

# CORE LOADS BY CUSTOMER CLASS

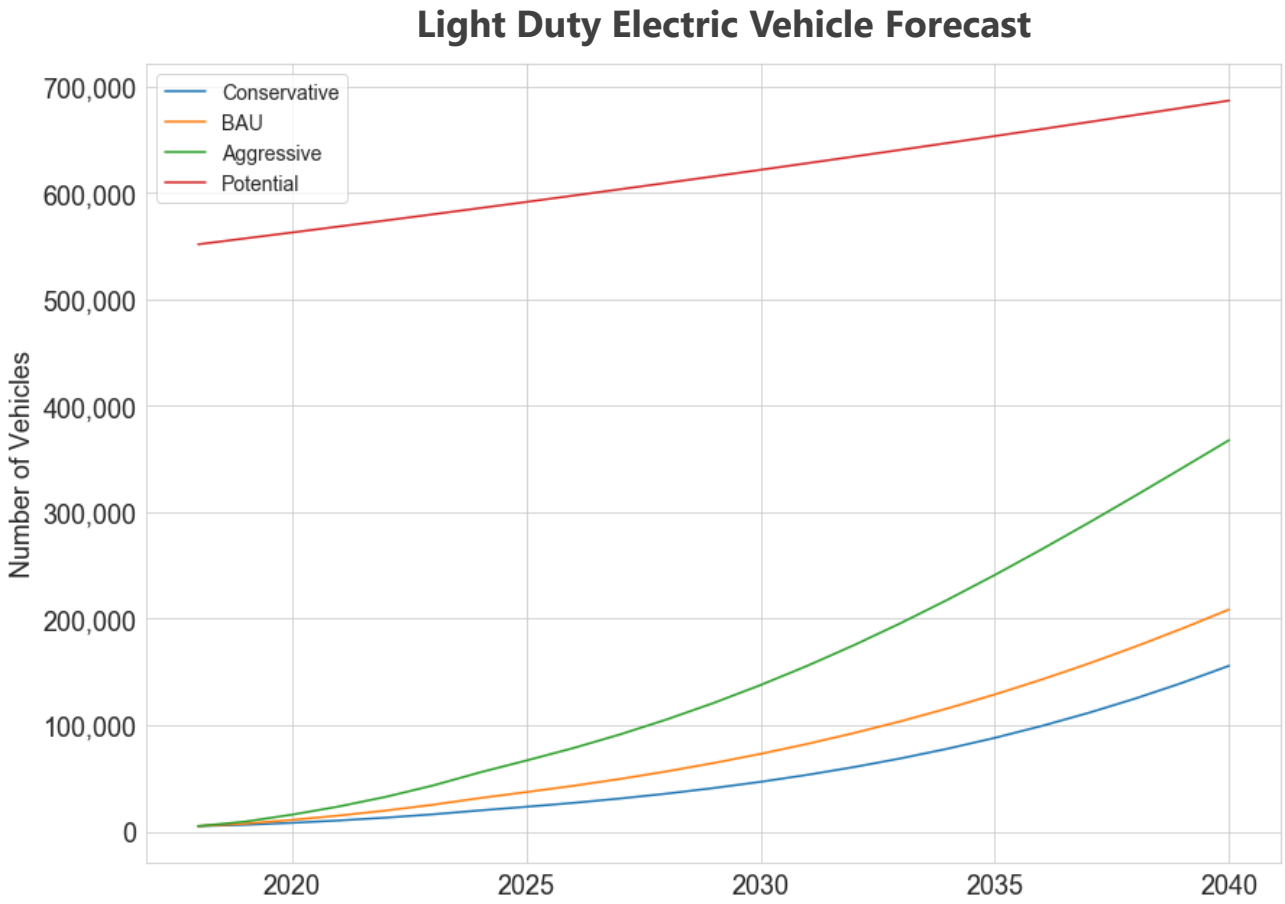
## Zoomed Out

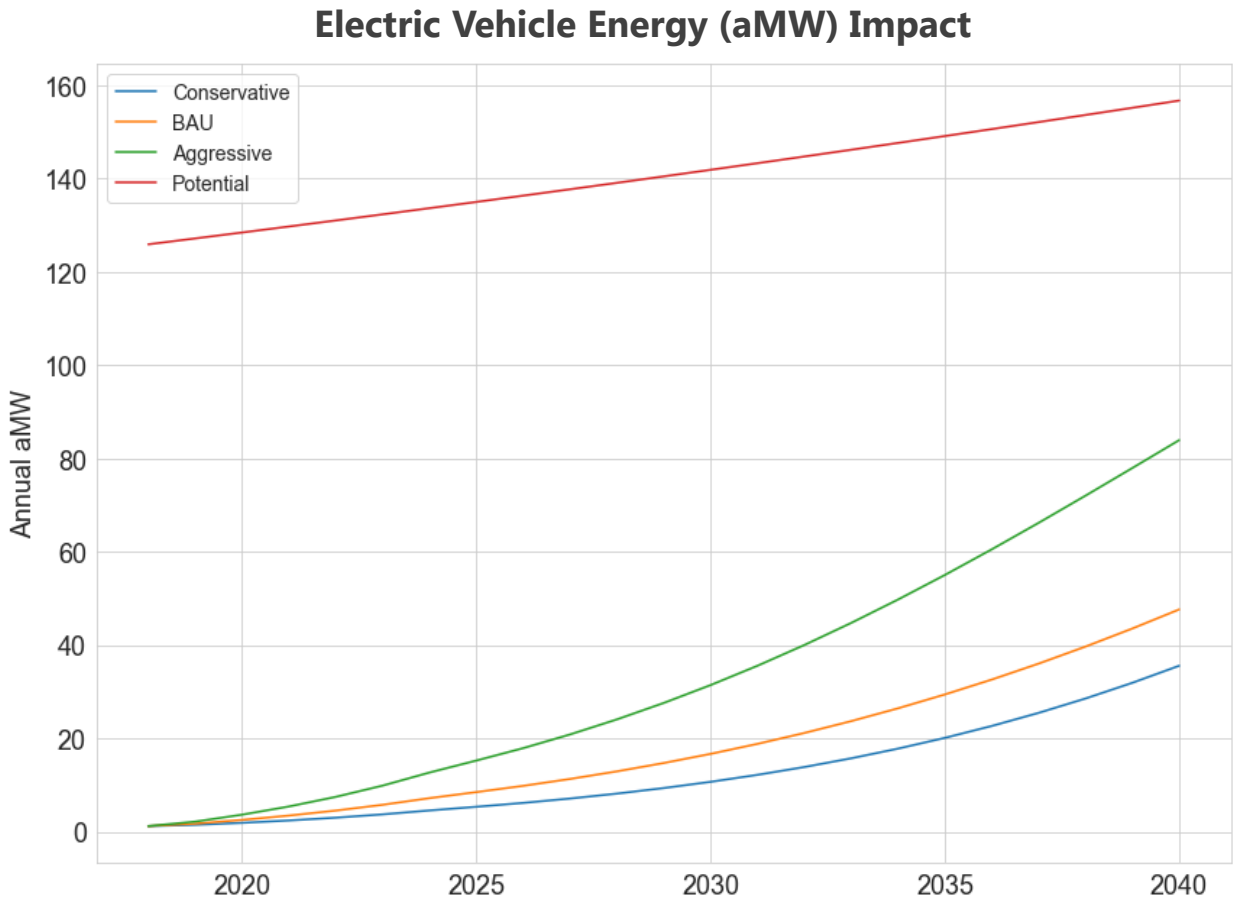



## Zoomed In



# ELECTRIC VEHICLES FORECAST

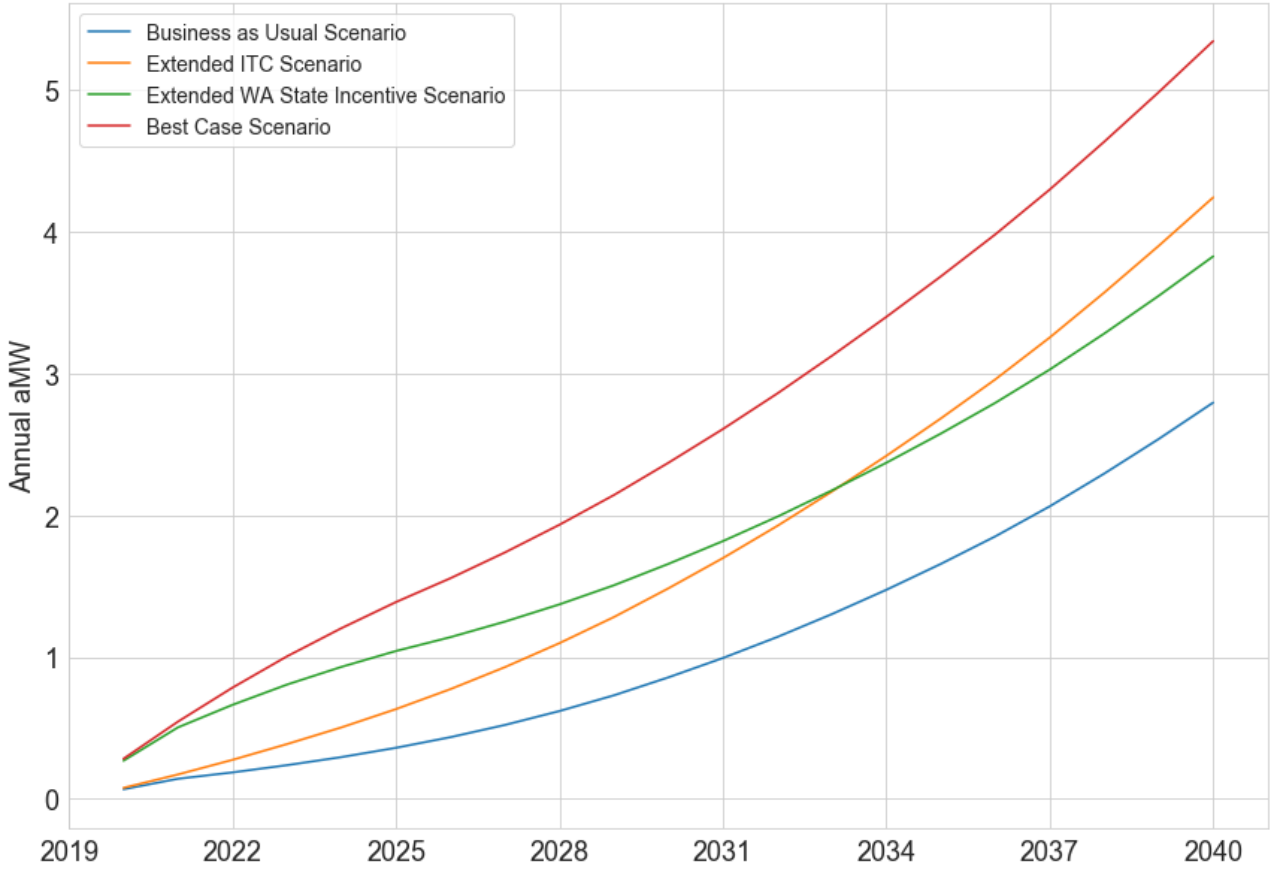


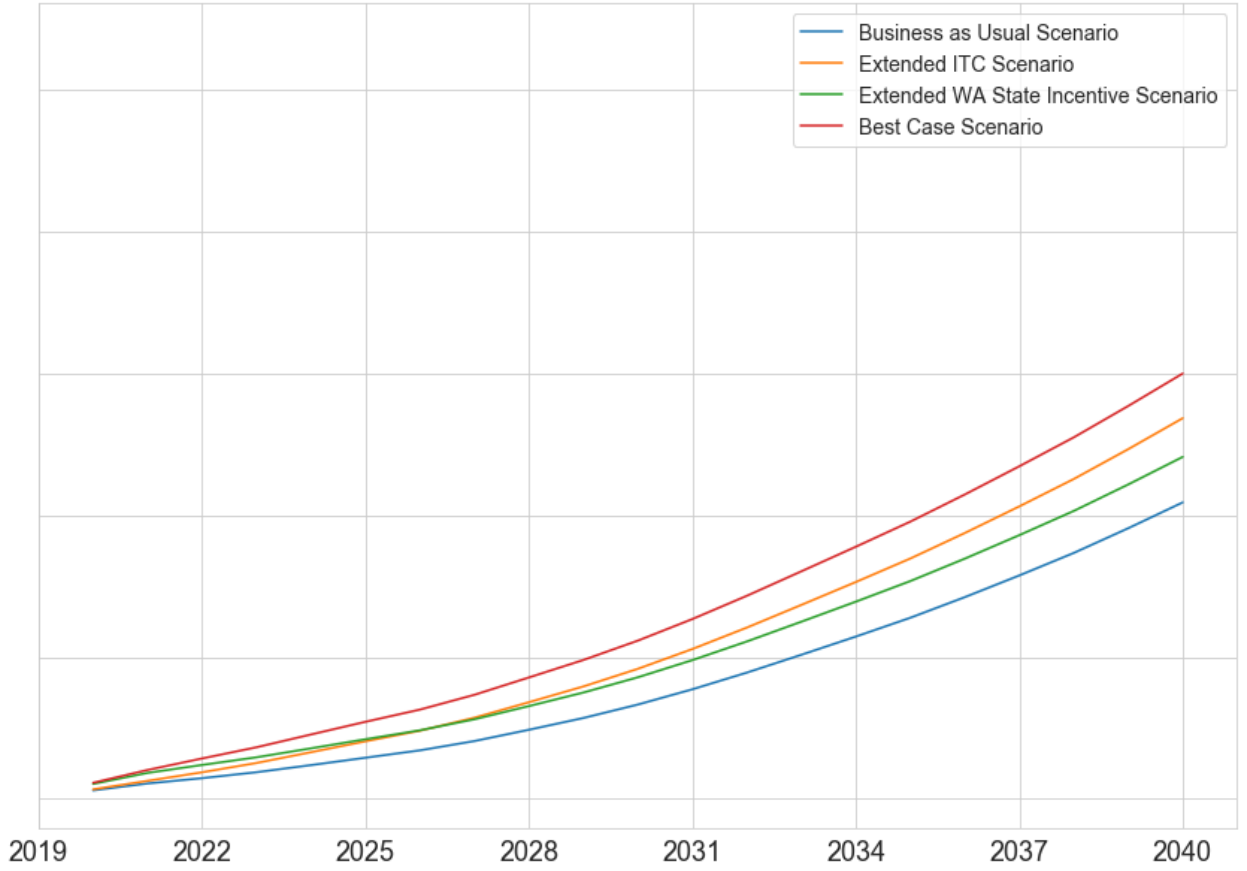

**Same forecasts used for RMI study. We adopt BAU for the baseline forecast.**

# DISTRIBUTED GENERATION

## Residential Expected Generation (aMW)

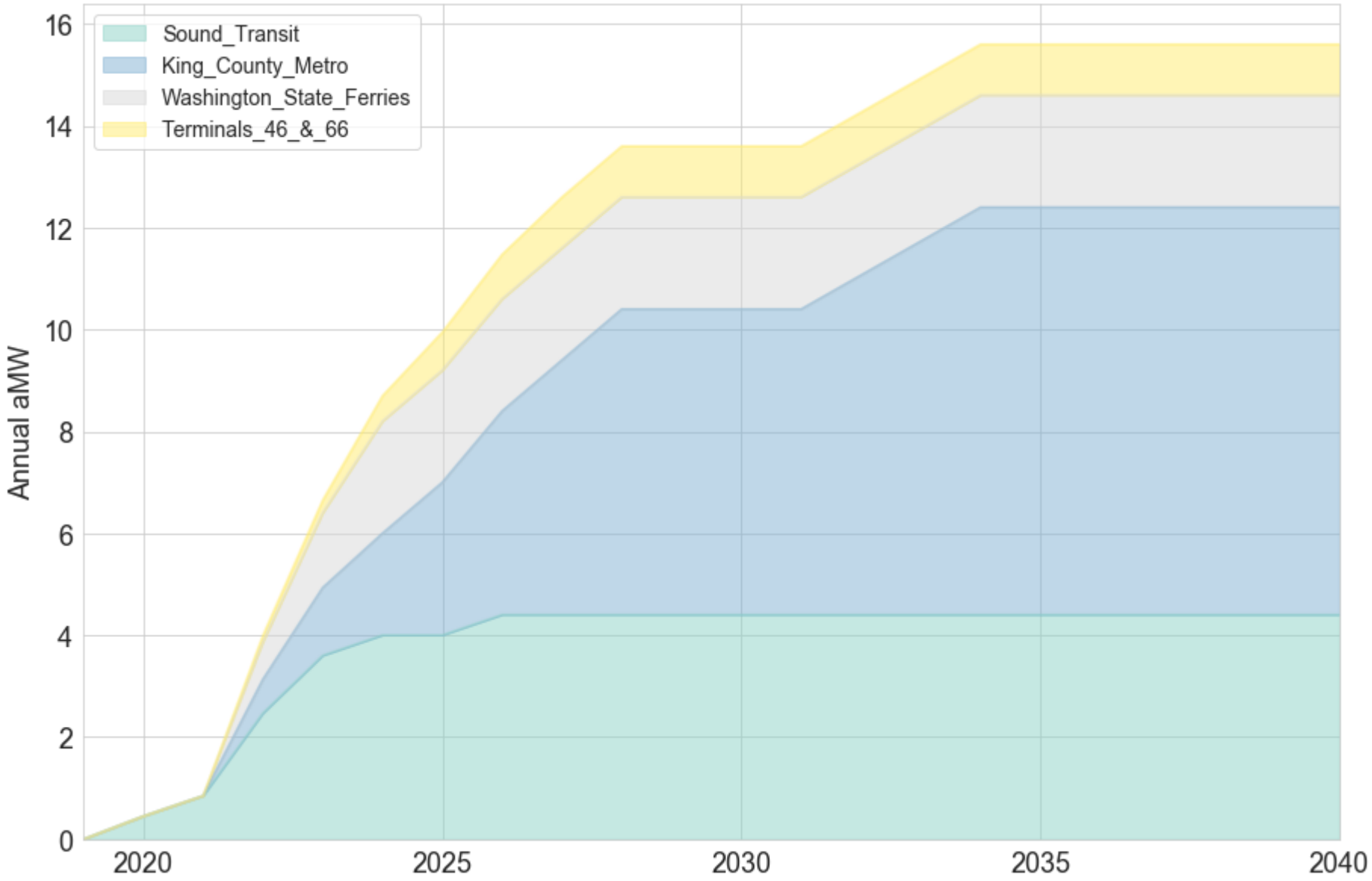



## Commercial Expected Generation (aMW)




**From 2020 Cadmus Solar PV Potential Study. We adopt Extended WA Incentive for the baseline forecast.**

# LARGE TRANSIT ELECTRIFICATION



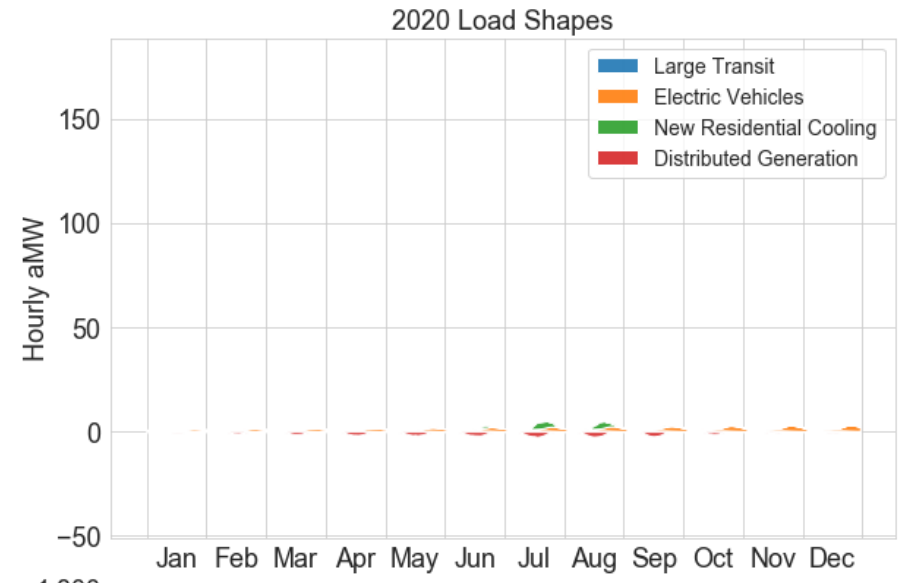
# Apply Shapings (Annual to Hourly) and Weather Sensitivities

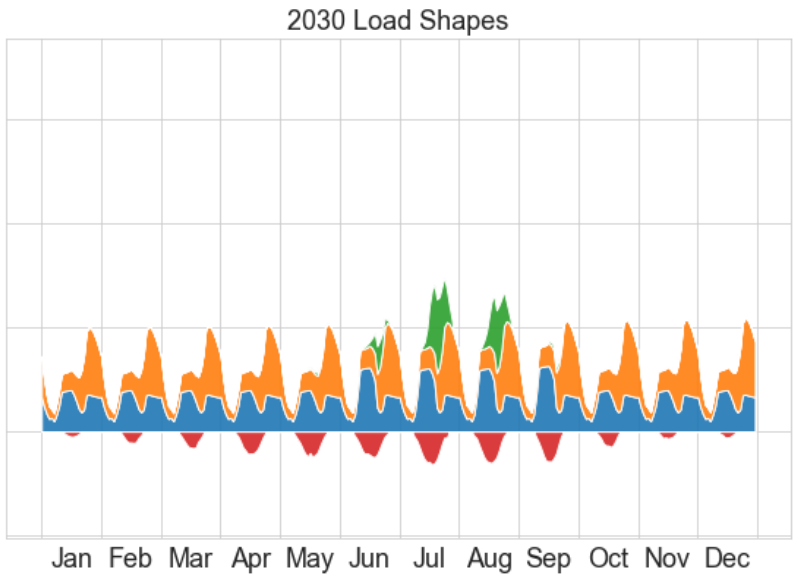
| Annual Forecast Component | Shaping Model Description |
|---|---|
| Core Loads (RES + COM + IND) | Hourly level model fit to historical system load data that accounts for weather, day of week effects and holidays |
| Solar | NREL System Advisor Model (SAM) |
| New Residential Cooling | Residential building simulation model: Simplified Energy Enthalpy Model (SEEM) |
| Electric Vehicles | DOE EV Project data for Washington State |
| Large Transit | Engineering studies |

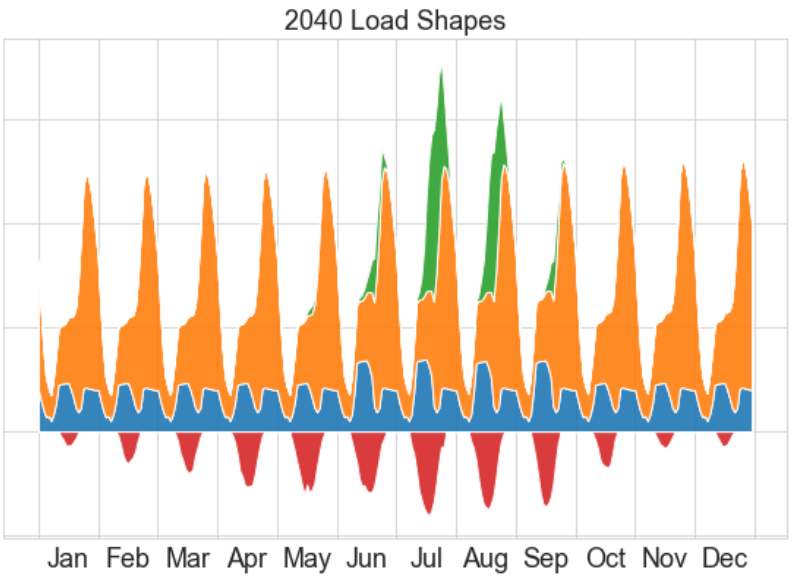
Broken out of end-use model

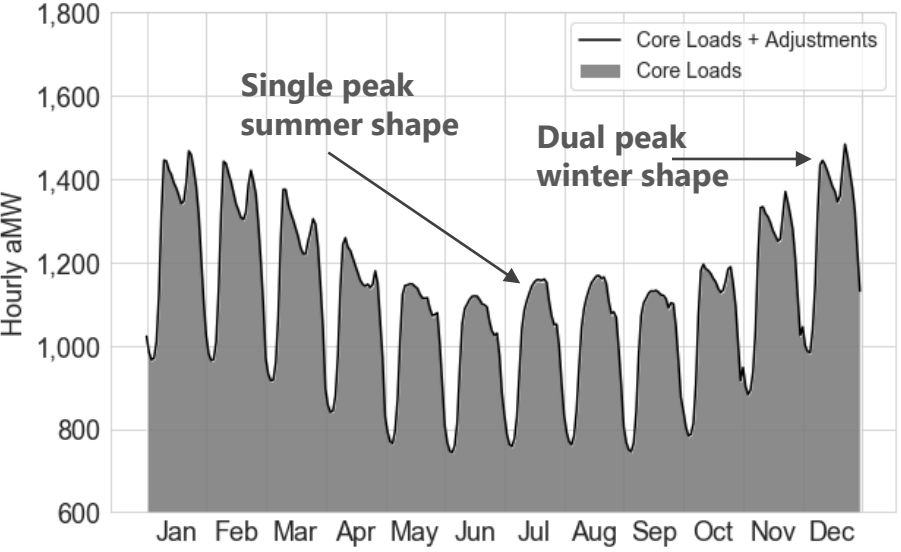
**Weather Sensitive Shapes**

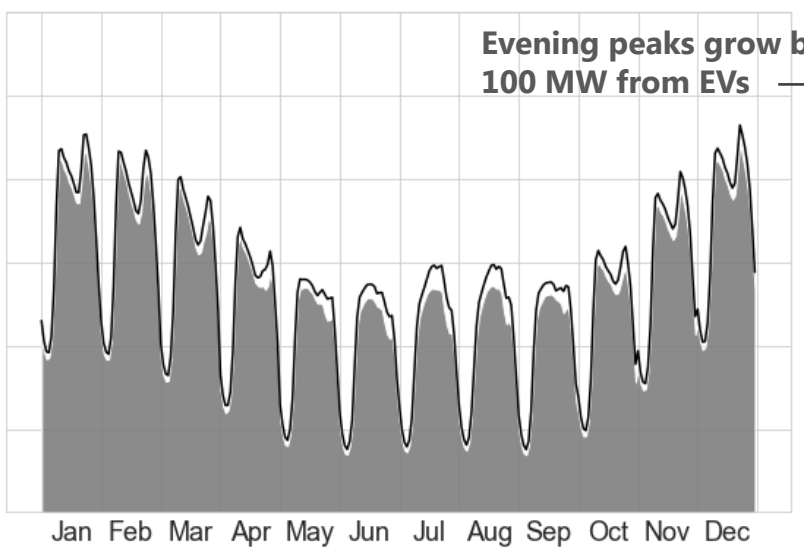
# TYPICAL WEEKDAY 24 HR NON-COINCIDENT LOAD SHAPES

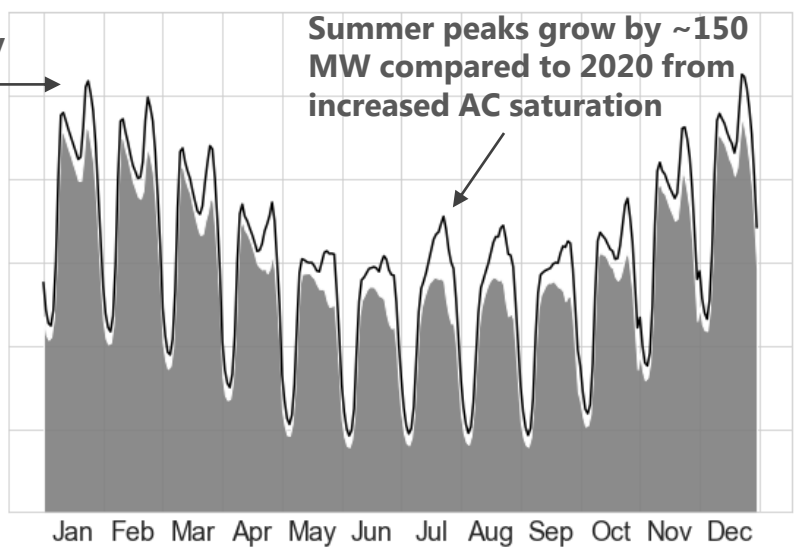


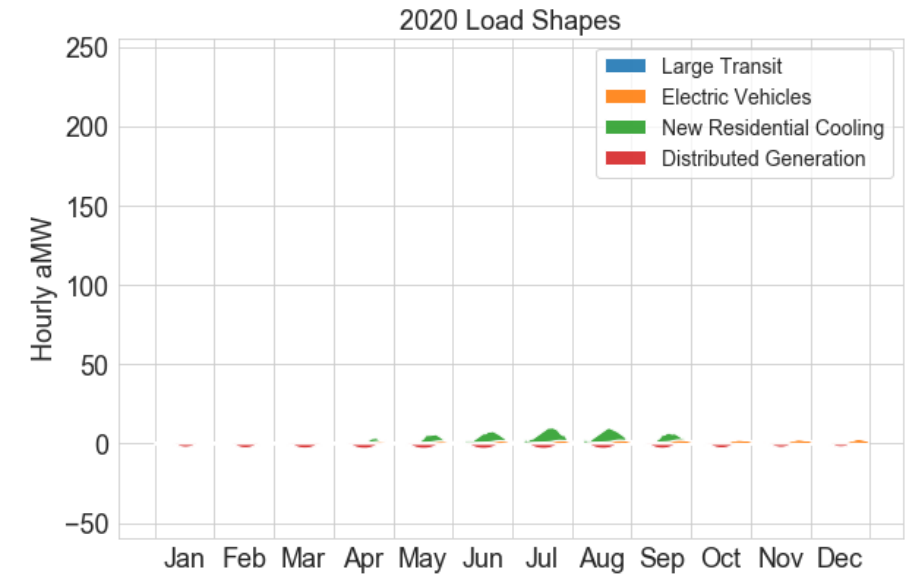



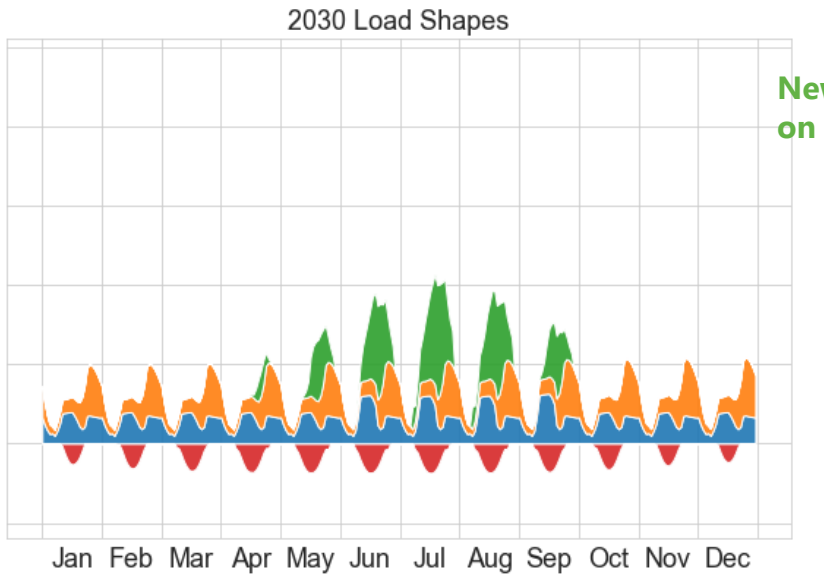



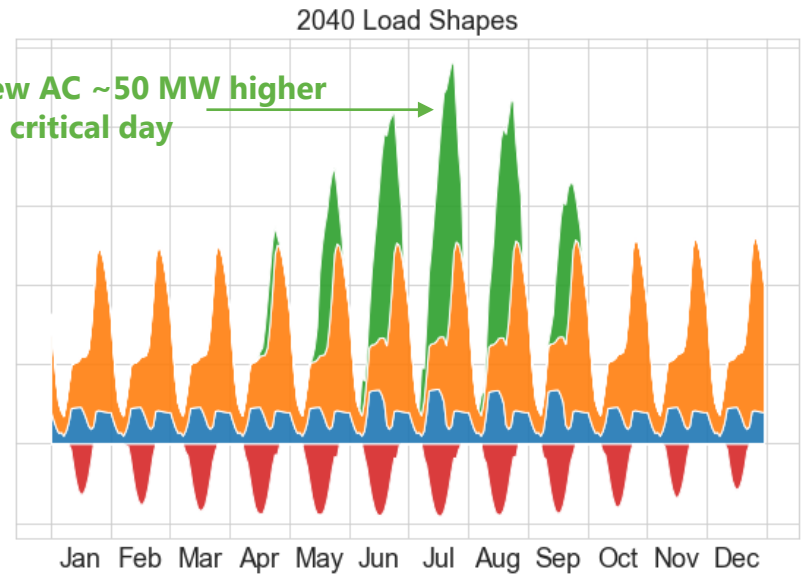



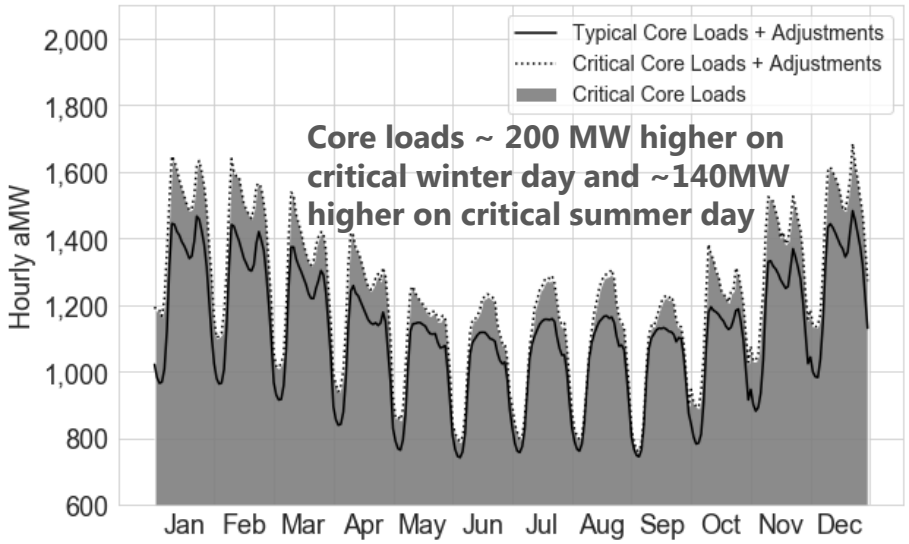



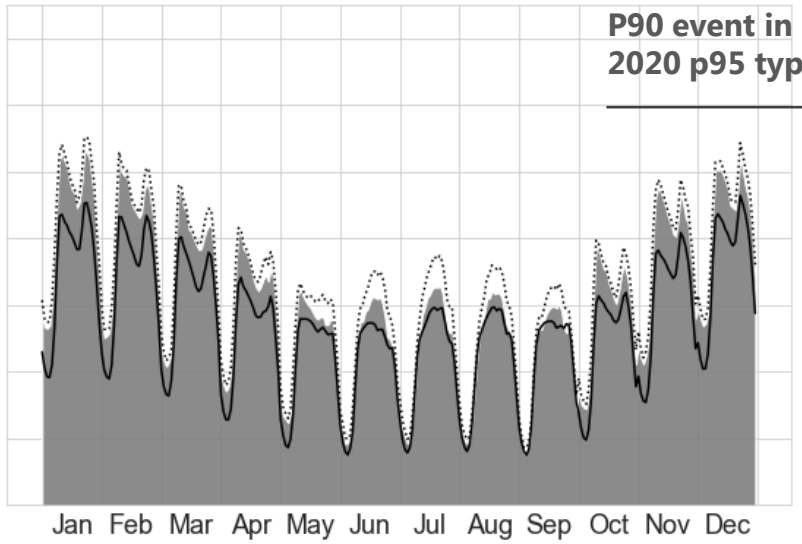
# CRITICAL WEEKDAY NON-COINCIDENT 24 HR LOAD SHAPES

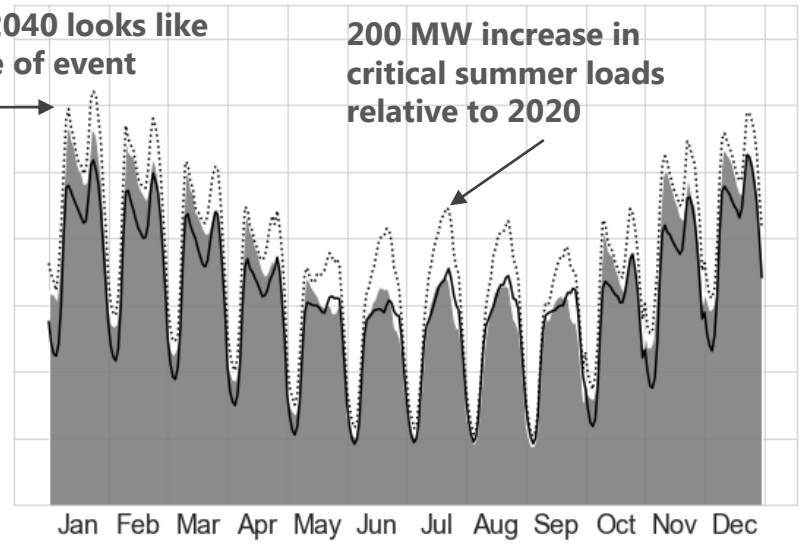


# Demand Scenarios

# What are they key themes to consider for demand scenarios?

## Policies & Regulation

- Taxes & incentives
- CETA, Clean Buildings Act, OSE Benchmarking…etc
- Deep decarbonization proposals

## Market Transformations

- Energy as a service
- Micro grids & consumer aggregators
- Large customer exits

## The Economy

- Will Seattle continue to boom?
- Could Seattle have a struggling economy?

## Technology Adoption

- Equipment efficiency improvements
- Load from new end-uses
- Equipment adoption under electrification

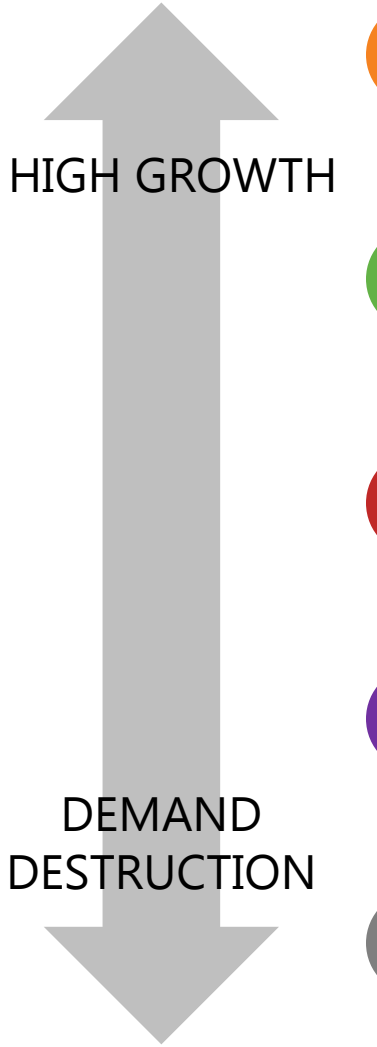
## Climate Change

- Which GCM scenarios to use
- Weather data coverage
- Socioeconomic impacts

## What Else?

# EXAMPLE SCENARIOS






1. **All buildings electrify with high EV adoption**
2. **New buildings electrify with high EV adoption**
3. **Sustained economic growth**
4. **Deep recession with slow recovery**
5. **Energy as a service, microgrids & customer aggregation**

# CRAFTING THE SCENARIO: ALL BUILDINGS ELECTRIFY WITH HIGH EV ADOPTION

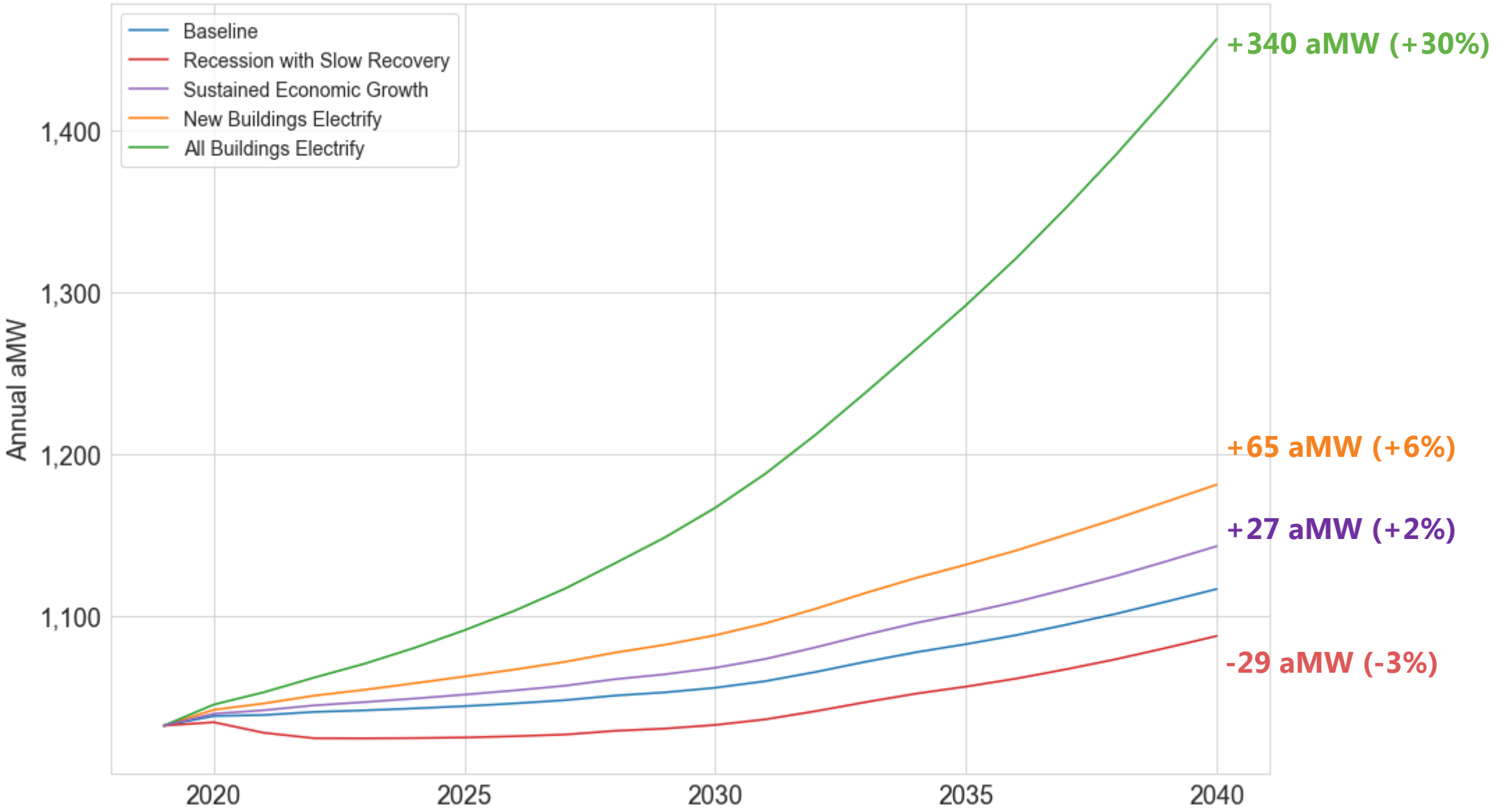


1 **All buildings electrify with high EV adoption:**

- **No new natural gas in all new construction**
- **Existing building stock is converted to 100% electric**
  - **Rate of conversion is non-linear (backloaded)**
    - **Assume high efficiency heat pump conversion for Residential**
    - **Commercial based on existing end-use equipment assumptions**
- **High EV adoption scenario from RMI Study**

# EXAMPLE SCENARIO RESULTS





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Seattle City Light