Forecasting Long–Range Electricity Demand for the Pacific Northwest

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Northwest **Power** and **Conservation** Council

About the Council

- 1980 Northwest Power Act authorized Idaho, Montana, Oregon, and Washington to create the Northwest Power and Conservation Council

- Responsibilities under the Power Act:
  - Developing a power plan to assure the Northwest has an adequate, efficient, economical and reliable power supply
  - Developing a program to protect, mitigate and enhance fish and wildlife affected by hydroelectric facilities in the basin
  - Informing and involving the public

- Council is kicking off its Ninth Regional Power Plan, seeking to lock in assumptions and inputs over the coming months

The 9th Northwest Power Plan

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The 9th Northwest **Regional Power Plan**

Demand Forecasting & The Power Plan

1. Per the Northwest Power Act, as part of its regional power plan, the Council is required to develop and include "a demand forecast of at least twenty years…."

2. The forecast is used to help evaluate what resources best meet regional needs, with an emphasis on conservation as a resource.
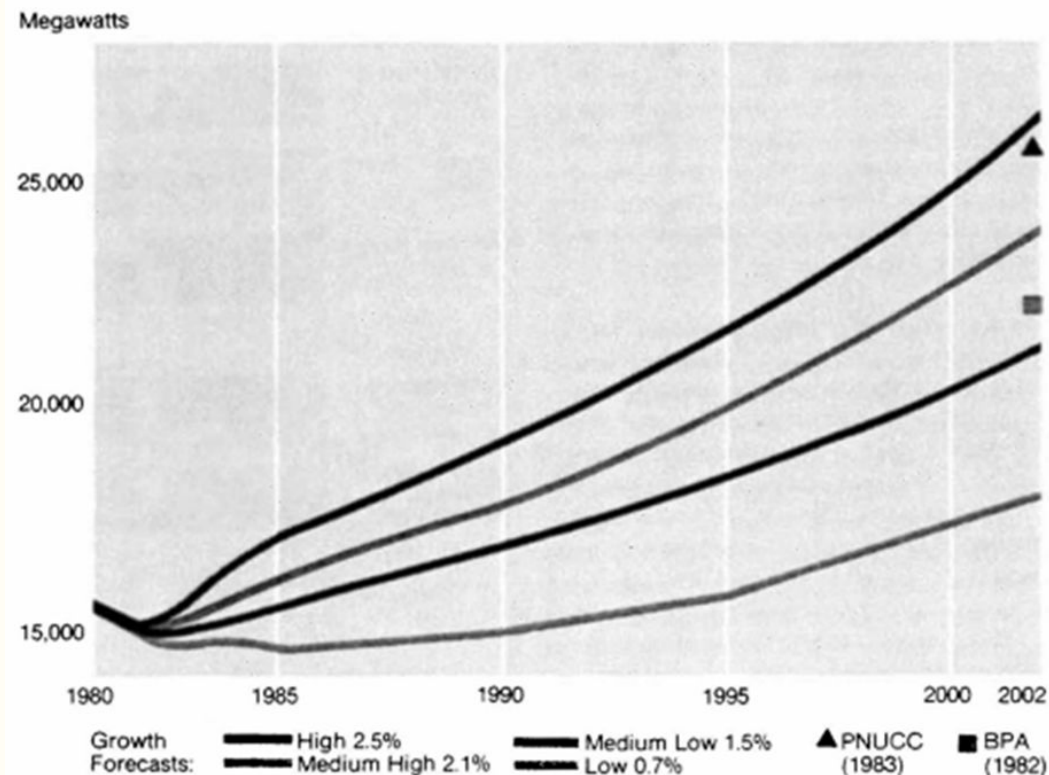
3. The first forecast was published in 1983

Megawatts

Growth Forecasts:	High 2.5%	Medium Low 1.5%	▲ PNUCC (1983)	■ BPA (1982)
	Medium High 2.1%	Low 0.7%		

Figure 4-3.
Summary of Council's Demand Growth Forecasts

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Demand Forecasting & The Power Plan

a forecast is a prediction of a future outcome; it's a way to anticipate future events or conditions from studying historic information and events

Our goal – create an accurate and comprehensive *forecast* of *demand* for electricity in the region – across twenty years
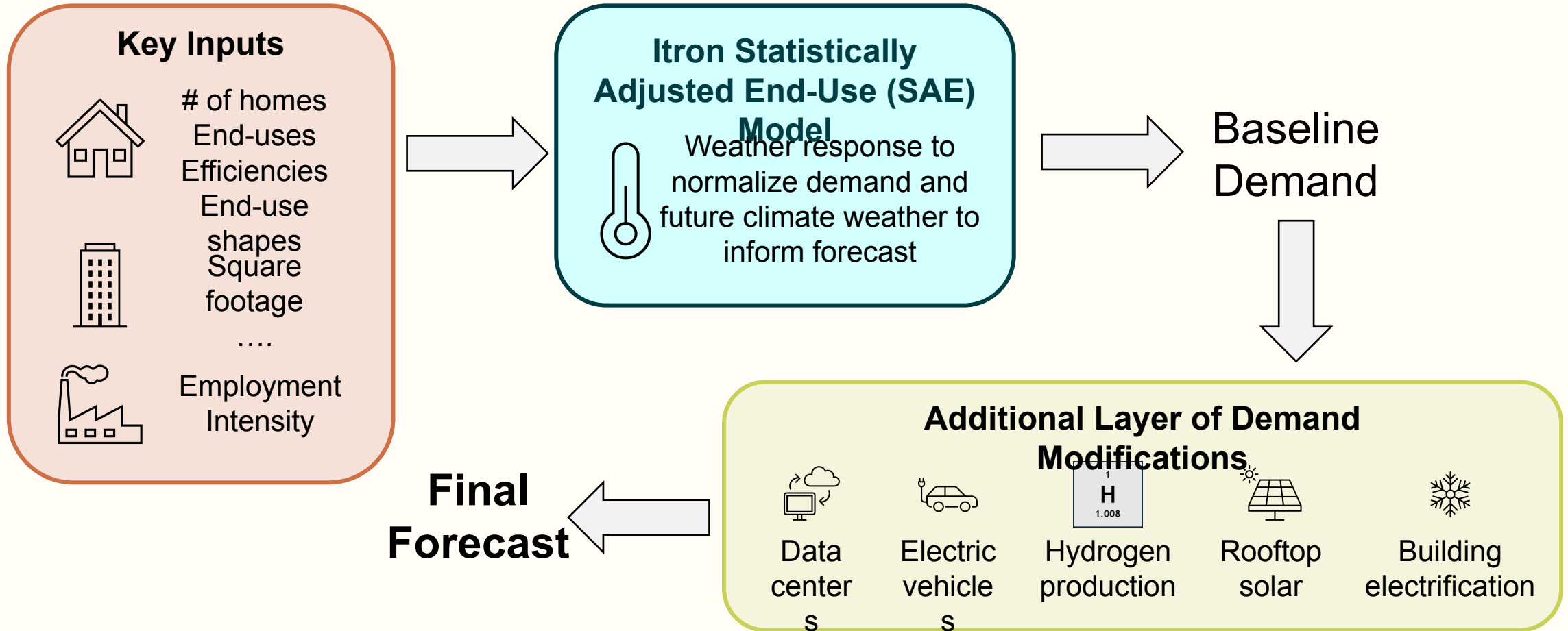
- When we *forecast* – we also want to learn about the region's energy use – to gain an understanding of what might drive changes to future demand

- To do this – we build a *model*

- The demand forecast is an output from the model, which is highly input data driven – and it's getting more complex

A forecast can also act as an input to a decision-making process. In this case, it differs from the tradition concept of a forecast as purely a prediction tool

Our goal – create an actionable set of demand inputs for the power planning models and tools

- Avoid double-counting the effect of energy efficiency potential by freezing efficiency/saturation levels in the model

- Allow the power planning resource model to evaluate cost-effective efficiency levels in context with other options

- Assumed a relatively *unmanaged* electric vehicle charging shape

- At the end of the power plan cycle, the decisions reached for resources such as EE, rooftop solar, and EV charging programs will be fed back into the model and a

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Council's Load Forecasting Approach

Key Inputs

# of homes
End-uses
Efficiencies
End-use shapes
Square footage
....
Employment Intensity

Itron Statistically Adjusted End-Use (SAE) Model
Weather response to normalize demand and future climate weather to inform forecast

Baseline Demand

Additional Layer of Demand Modifications

Data centers | Electric vehicles | Hydrogen production | Rooftop solar | Building electrification

Final Forecast

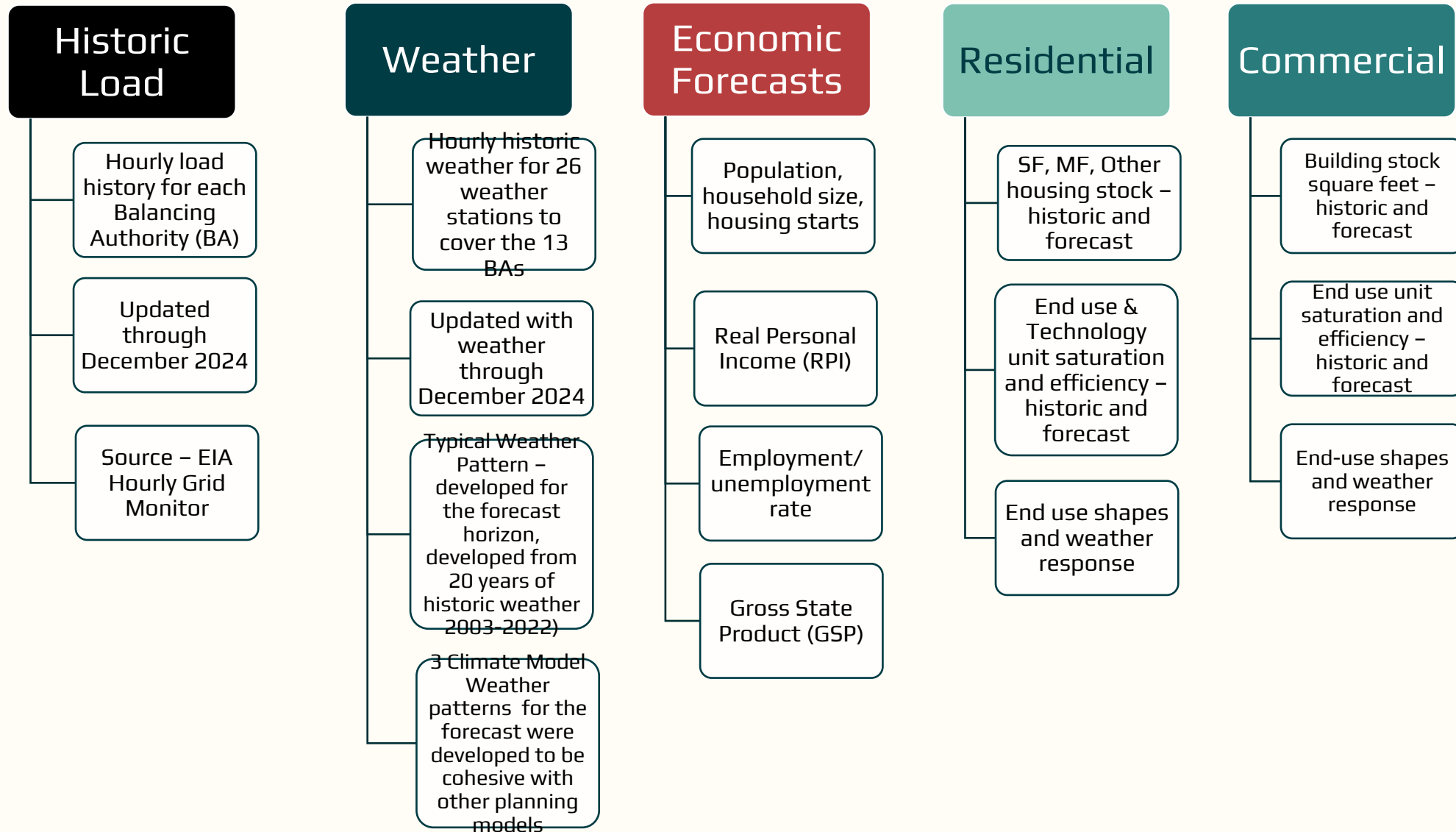# Balancing Authorities

- BPA & 12 BAs
  - Avista
  - Chelan County PUD
  - Douglas County PUD
  - Grant County PUD
  - Idaho Power
  - Northwestern
  - PacifiCorp (East & West)
  - Portland General
  - Puget Sound
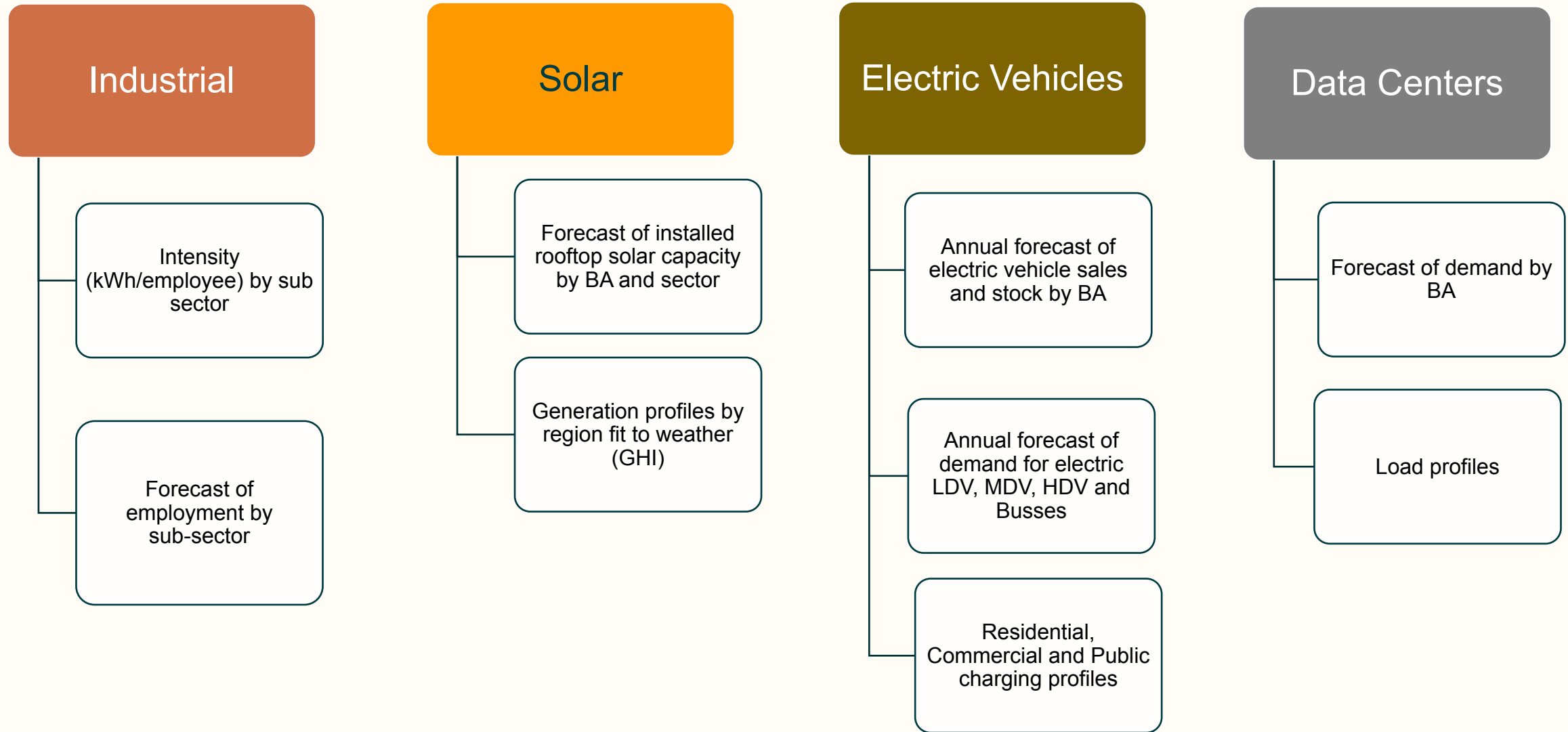 - Seattle City Lights
  - Tacoma Power
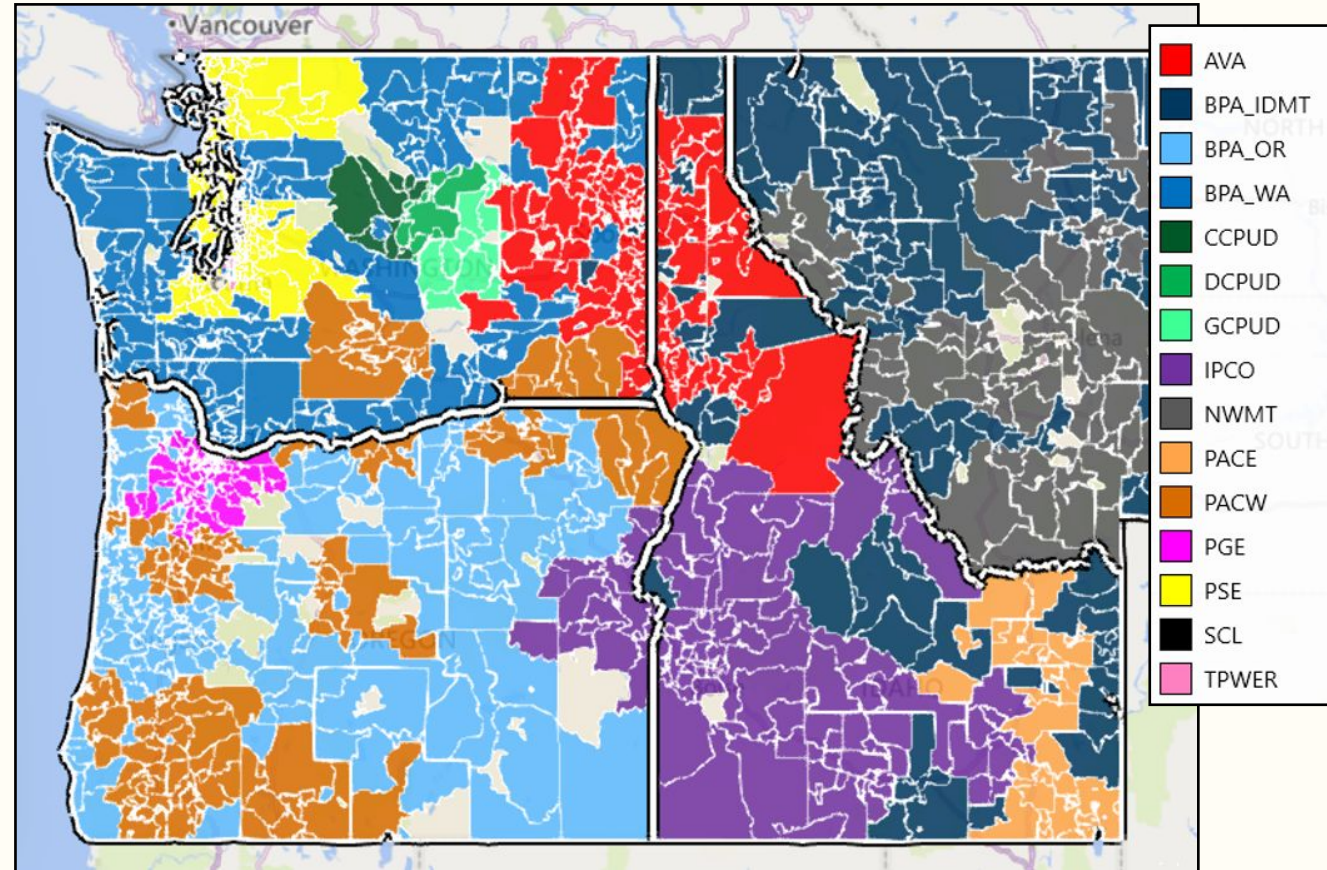
Not an exact representation of BA boundaries. Slight inaccuracies may exist due to overlapping layers

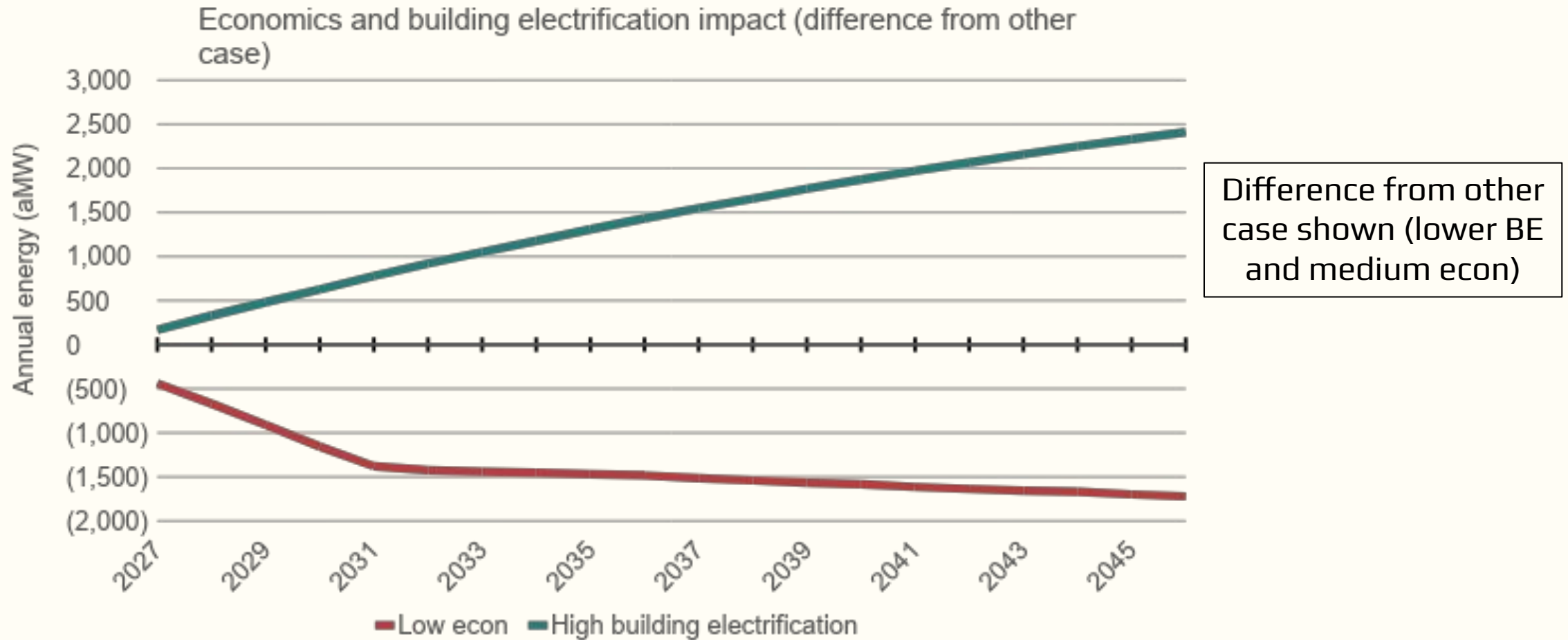Northwest **Power** and **Conservation** Council

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Model Input Data Sets

Historic Load
- Hourly load history for each Balancing Authority (BA)
- Updated through December 2024
- Source – EIA Hourly Grid Monitor

Weather
- Hourly historic weather for 26 weather stations to cover the 13 BAs
- Updated with weather through December 2024
- Typical Weather Pattern – developed for the forecast horizon, developed from 20 years of historic weather 2003-2022)
- 3 Climate Model Weather patterns for the forecast were developed to be cohesive with other planning models

Economic Forecasts
- Population, household size, housing starts
- Real Personal Income (RPI)
- Employment/ unemployment rate
- Gross State Product (GSP)

Residential
- SF, MF, Other housing stock – historic and forecast
- End use & Technology unit saturation and efficiency – historic and forecast
- End use shapes and weather response

Commercial
- Building stock square feet – historic and forecast
- End use unit saturation and efficiency – historic and forecast
- End-use shapes and weather response

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Model Input Data Sets

Industrial
- Intensity (kWh/employee) by sub sector
- Forecast of employment by sub-sector

Solar
- Forecast of installed rooftop solar capacity by BA and sector
- Generation profiles by region fit to weather (GHI)

Electric Vehicles
- Annual forecast of electric vehicle sales and stock by BA
- Annual forecast of demand for electric LDV, MDV, HDV and Busses
- Residential, Commercial and Public charging profiles

Data Centers
- Forecast of demand by BA
- Load profiles

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Forecast pathways

Pathway	What are we testing	Economics	Transportation	Data Center	Building Electrification	Hydrogen
P1	Persistent high growth	Medium	Higher	Higher	Higher	Higher
P2	Persistent low growth	Lower	Lower	Lower	Lower	Lower
P3	Early growth	Medium	Lower	Higher	Lower	Lower
P4	Late growth	Medium	Higher	Medium	Higher	Higher
P5	Mixed bag	Medium	Higher	Medium	Lower	Lower

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Economics and electrification

Economics and building electrification impact (difference from other case)

Difference from other case shown (lower BE and medium econ)

Legend: Low econ — High building electrification

Y-axis: Annual energy (aMW)

Transportation

9th Plan transportation electrificaiton forecasts, 2025 to 2046
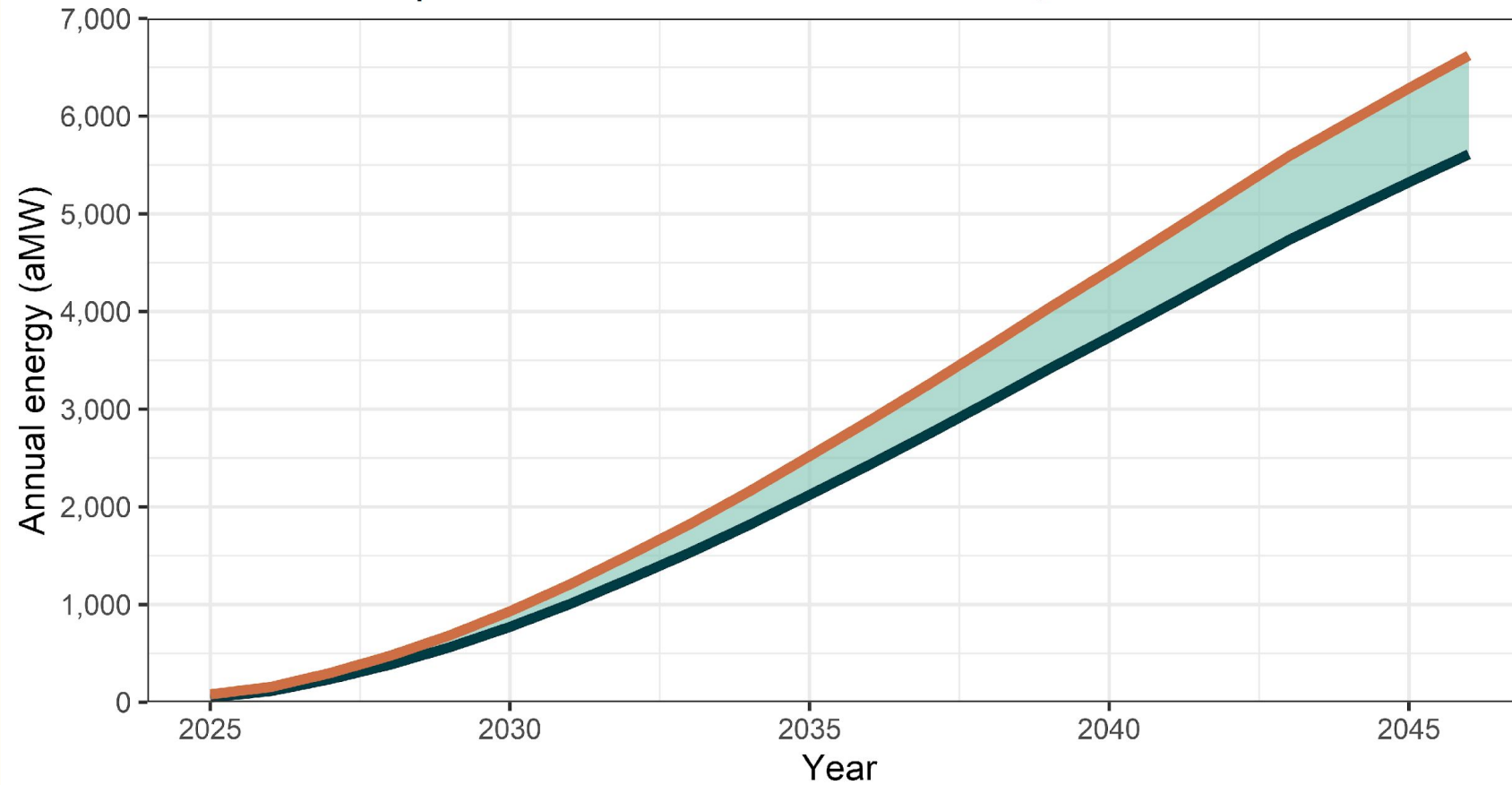
Both forecasts meet Oregon & Washington clean vehicle policy (which in part drives the tight range)

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Tech load forecast (data centers & fabs)

9th Plan tech forecasts, 2025 to 2046
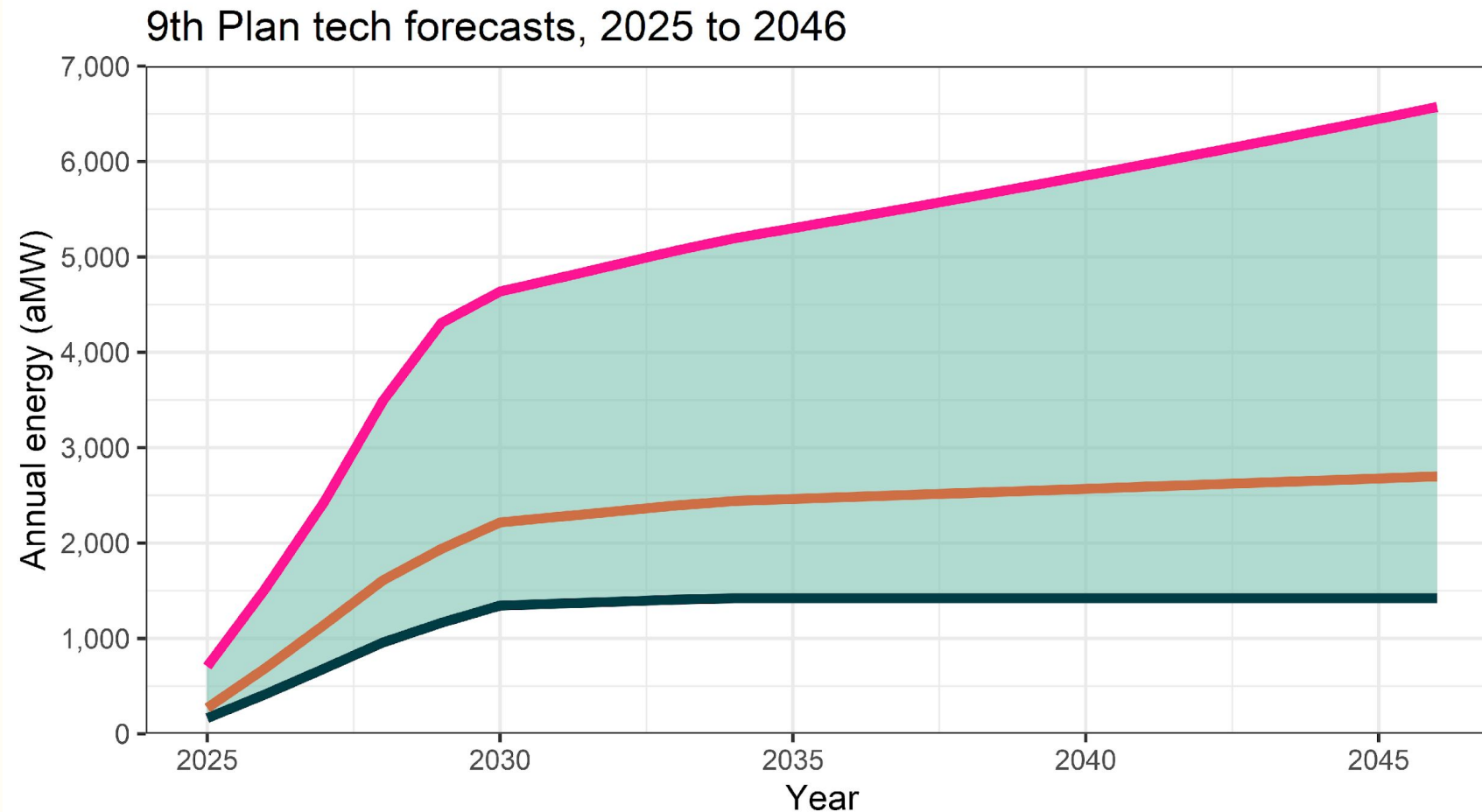
The **high forecast** through 2030 reflects utility and BPA growth expectations

The **mid forecast** through 2030 is a continuation of recent trends

The **low forecast** through 2030 has a slowing of recent trends

Post 2030 growth at a fixed rate depending on forecast

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Non power system hydrogen

9th Plan non-power hydrogen forecast, 2025 to 2046

Annual energy (aMW) vs Year
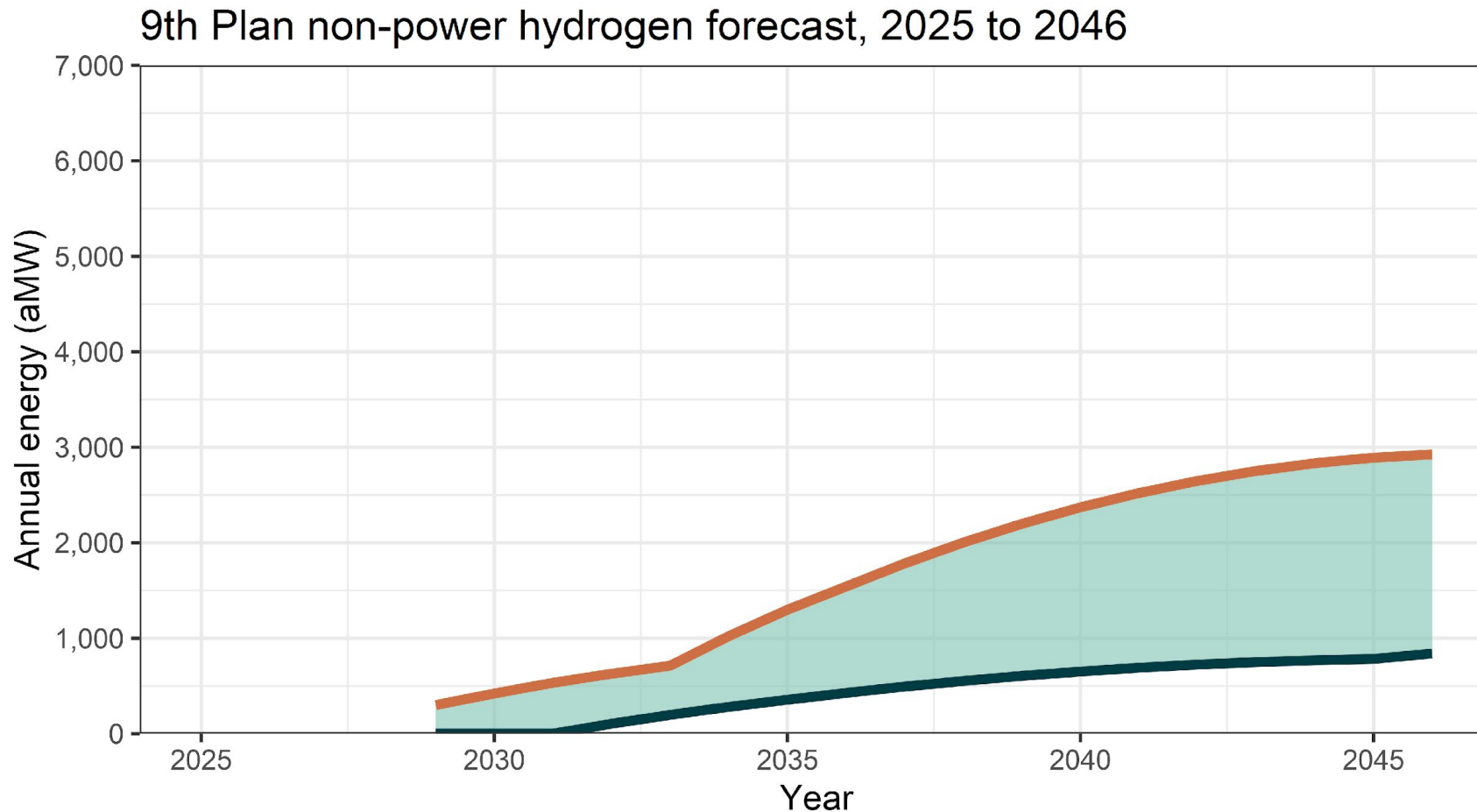
The **high forecast** represents the Northwest reaching an assigned portion of a 2023 DOE report by 2050 (with half of the hydrogen needed coming from electricity)

The **low forecast** is roughly based on a delayed version of the PNW Hydrogen hub, with continued growth after hub completion

All together

9th Plan load layers, 2025 to 2046
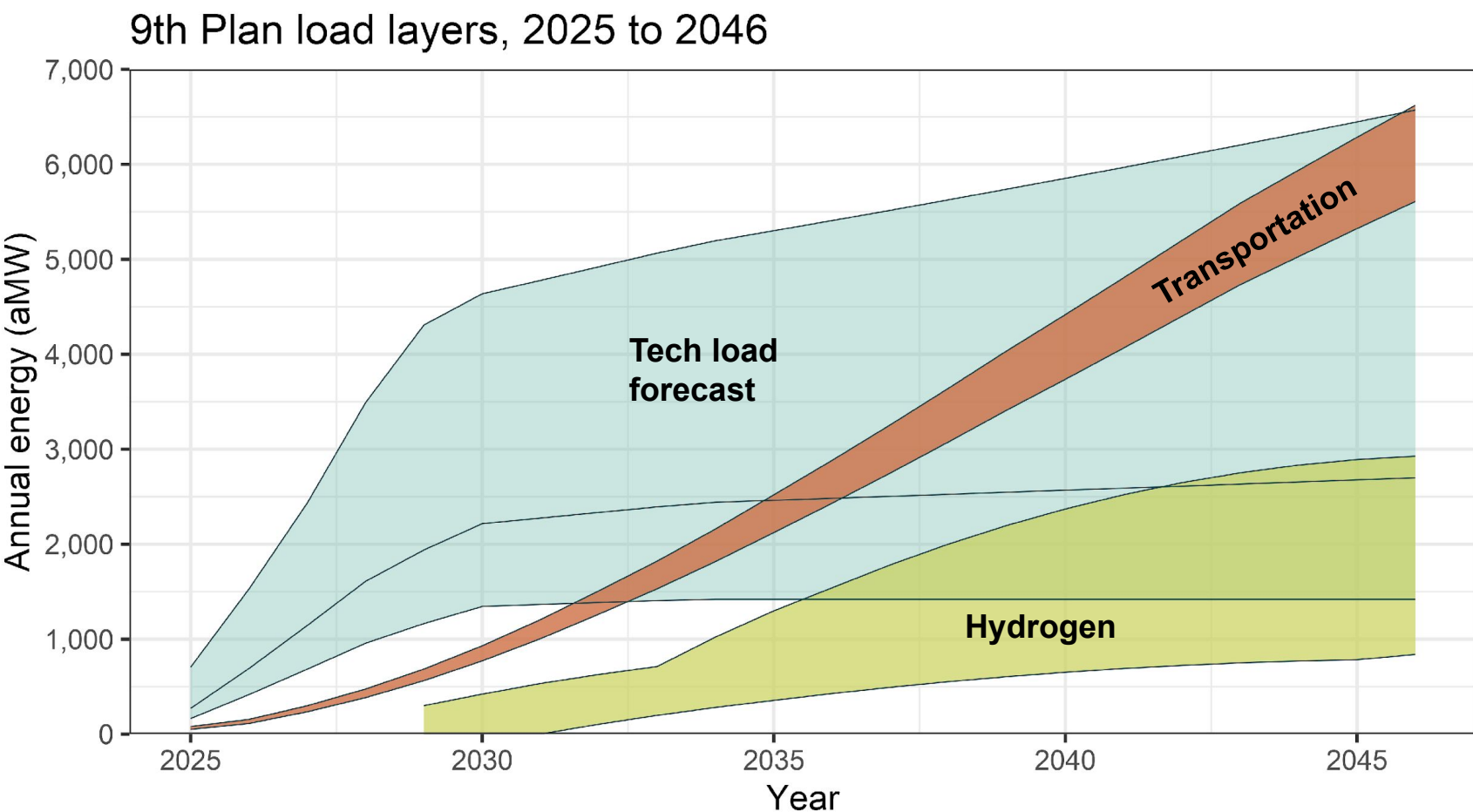
Tech and transportation electrification can reach similar levels by 2046

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Results

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Regional Demand Forecast

1. Strong demand growth is expected – energy and peak

2. All sectors see some level of growth

3. Primary Residential and Commercial growth driver is demand from electric vehicles

4. Data Centers, Electric Vehicles, Building Electrification and Hydrogen Production – primary growth drivers overall

Average Annual Growth Rate %
(2027 - 2046)

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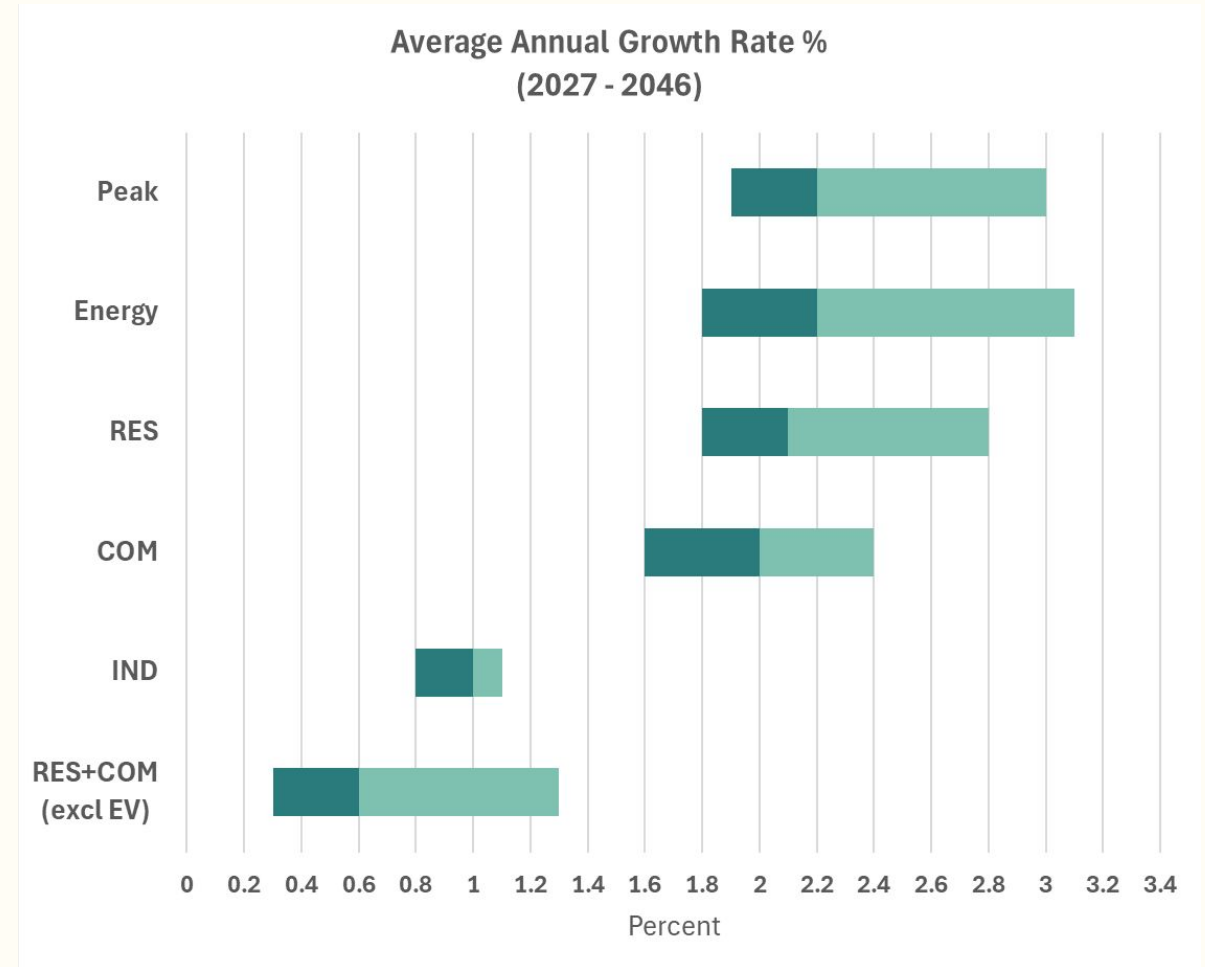
Energy and Peaks

- **Historic and Forecast Range for annual regional peaks (MW)**

- **Historic and forecast range for regional annual energy (aMW) *excludes H2**

- **Weather – Climate A**

Energy (aMW) & Peaks (MW)

Legend: ■ Forecast Energy Range ■ Forecast Peak Range ○ Historic Energy ○ Historic Peak

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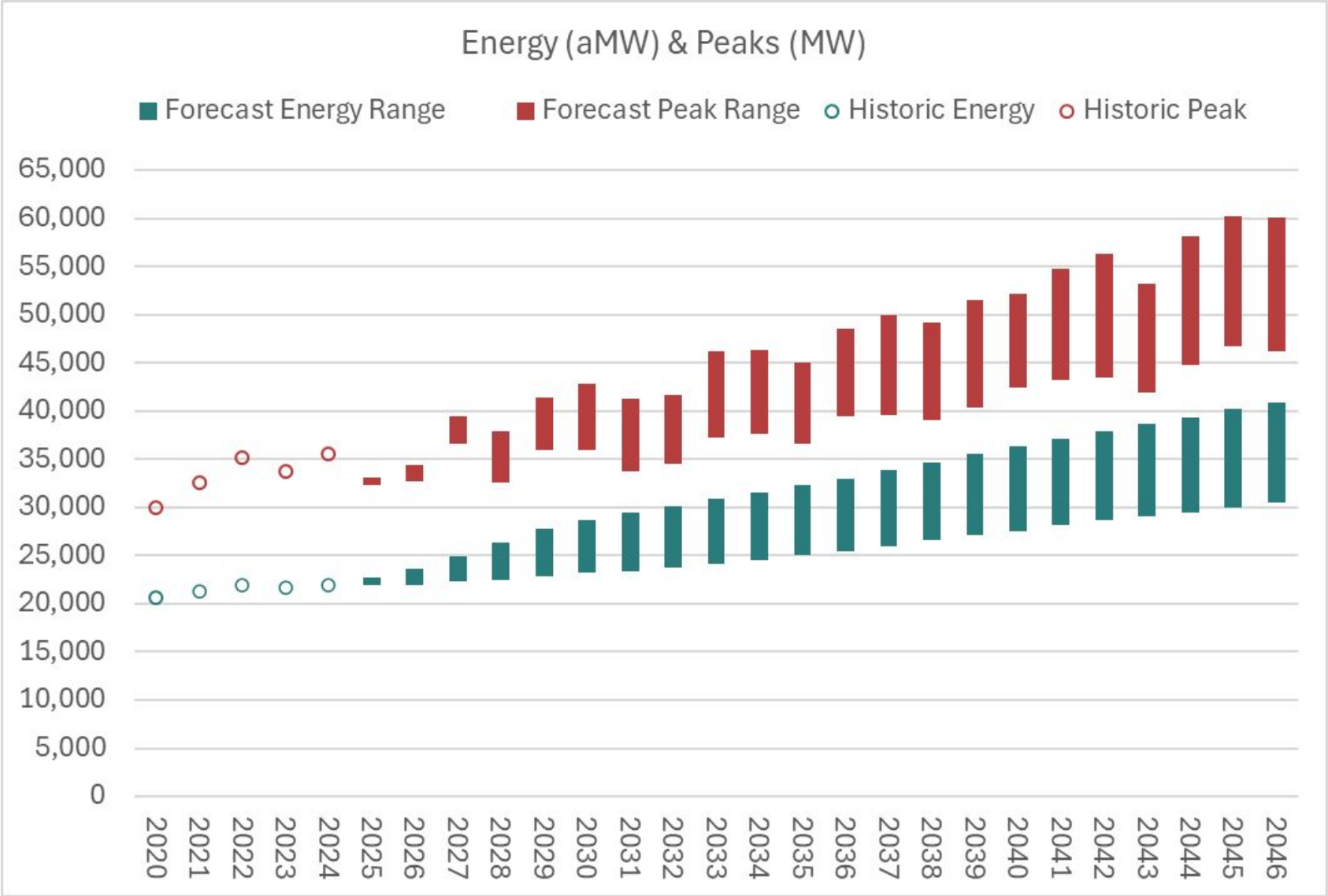
Peak Demand

- The forecast model produces an hourly demand for each of the 13 Balancing Authorities across the 20-year planning horizon

- We also calculate a system-wide coincident peak broken out by demand component
  - Baseline (residential/commercial/industrial) on peak
  - Rooftop solar and EE on peak
  - Electric Vehicle charging on peak
  - Data Center demand
  - Building Electrification (RES and COM) on peak

- Average annual growth rates across all futures range from 1.9 % to 3.0 %

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Regional Peak

- Seasonal
  - There is a mix of winter and summer peaking Balancing Authorities however historically the region is winter peaking
  - The forecast is showing some occasional summer peaks creeping in

- Time of Day
  - Winter peaks can switch between morning or evening
  - Summer peaks are in late afternoon/early evening

- Weather
  - The baseline sector (Residential, Commercial, Industrial) peak is temperature sensitive and peaks in very cold or very hot weather
  - Additional building electrification end uses are weather sensitive and contribute to peak

- Electric Vehicle demand is not weather sensitive but is time-sensitive and is projected to grow significantly

- Data Centers have a relatively flat load profile that simply raises the floor of the entire demand level

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Region-wide Peak (MW) Demand - Mixed Bag CI_A
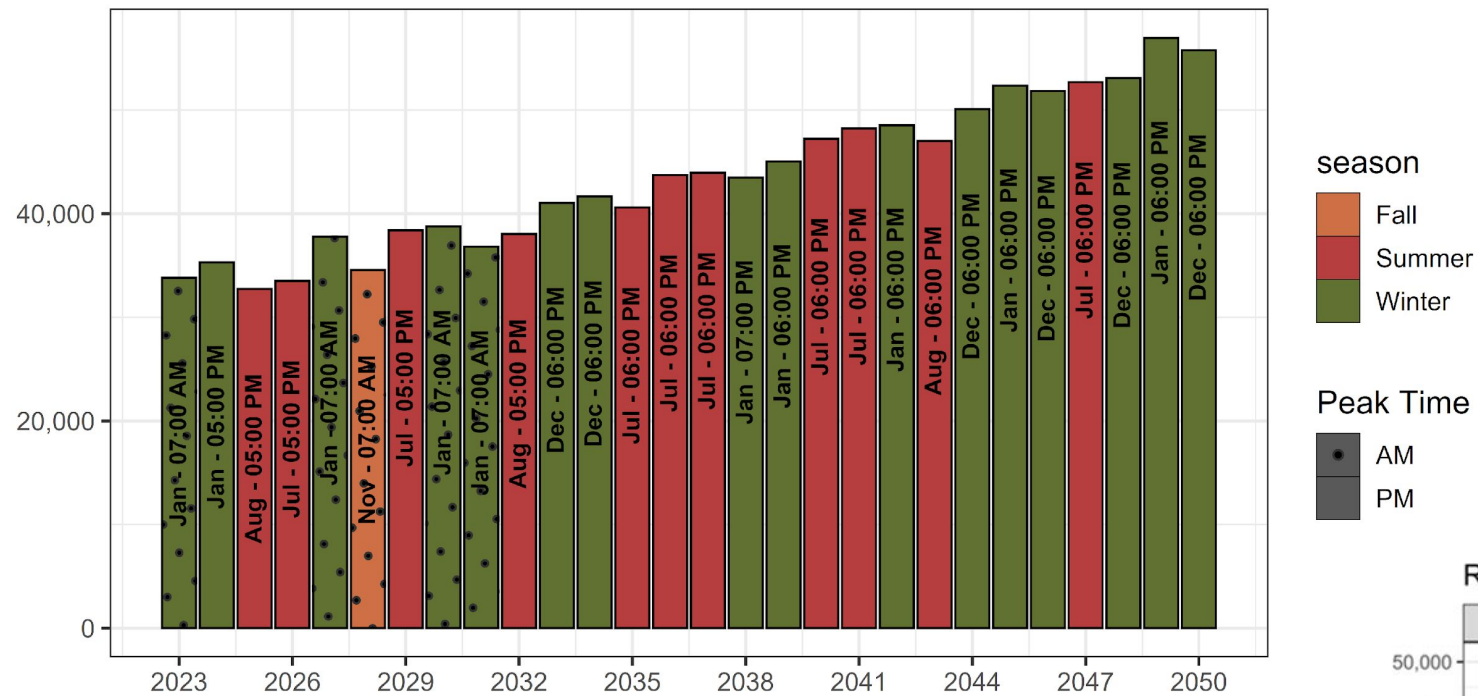
Region-wide Hourly Energy Demand Forecast - Midway_ClimateA
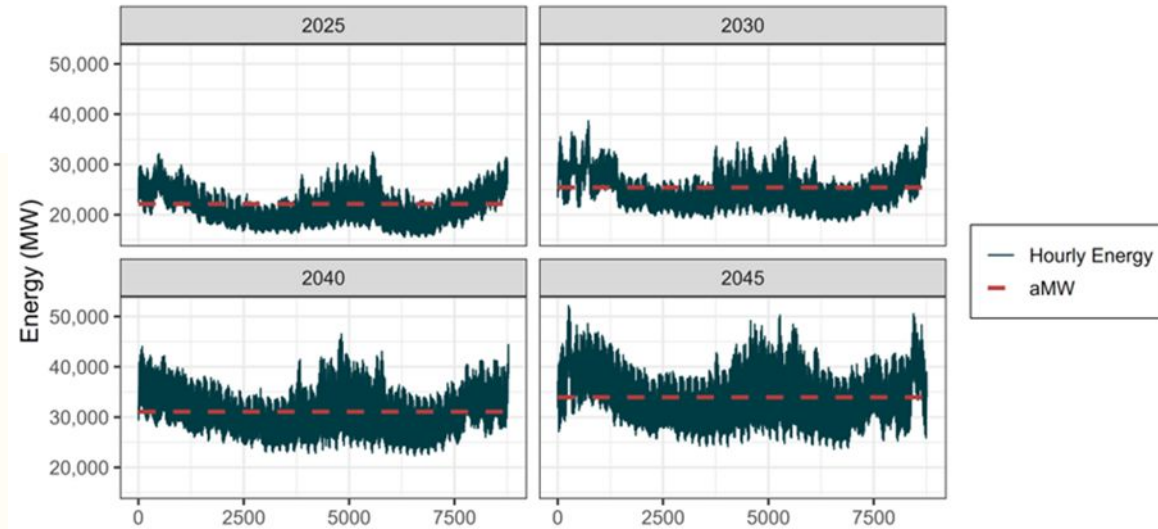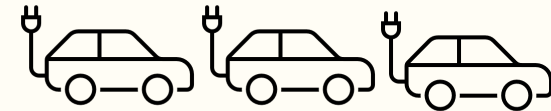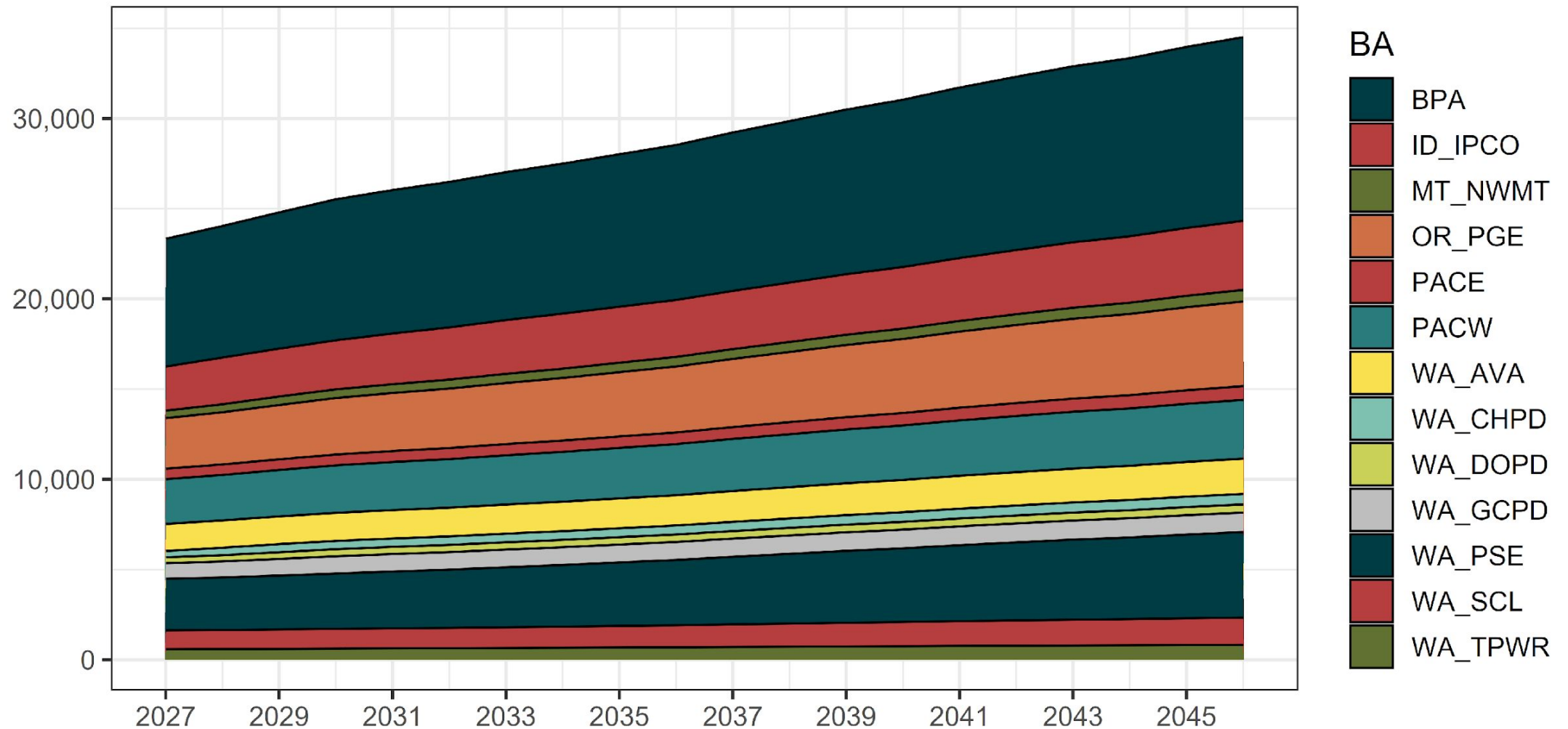
High Growth with Climate A weather

PEAK (MW)

2030 PEAK

2045 PEAK
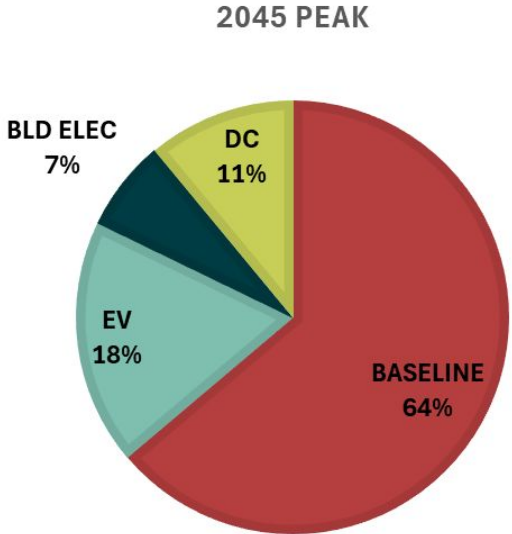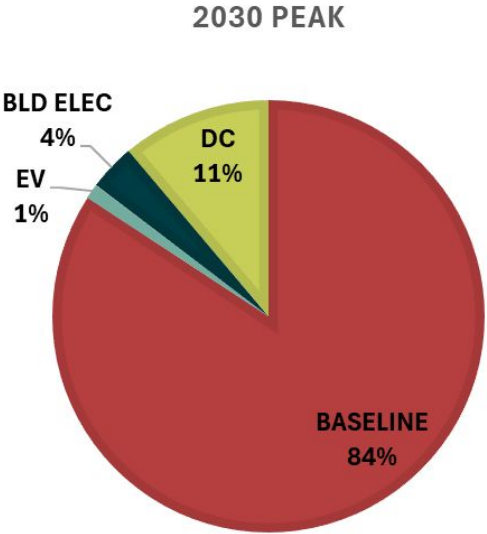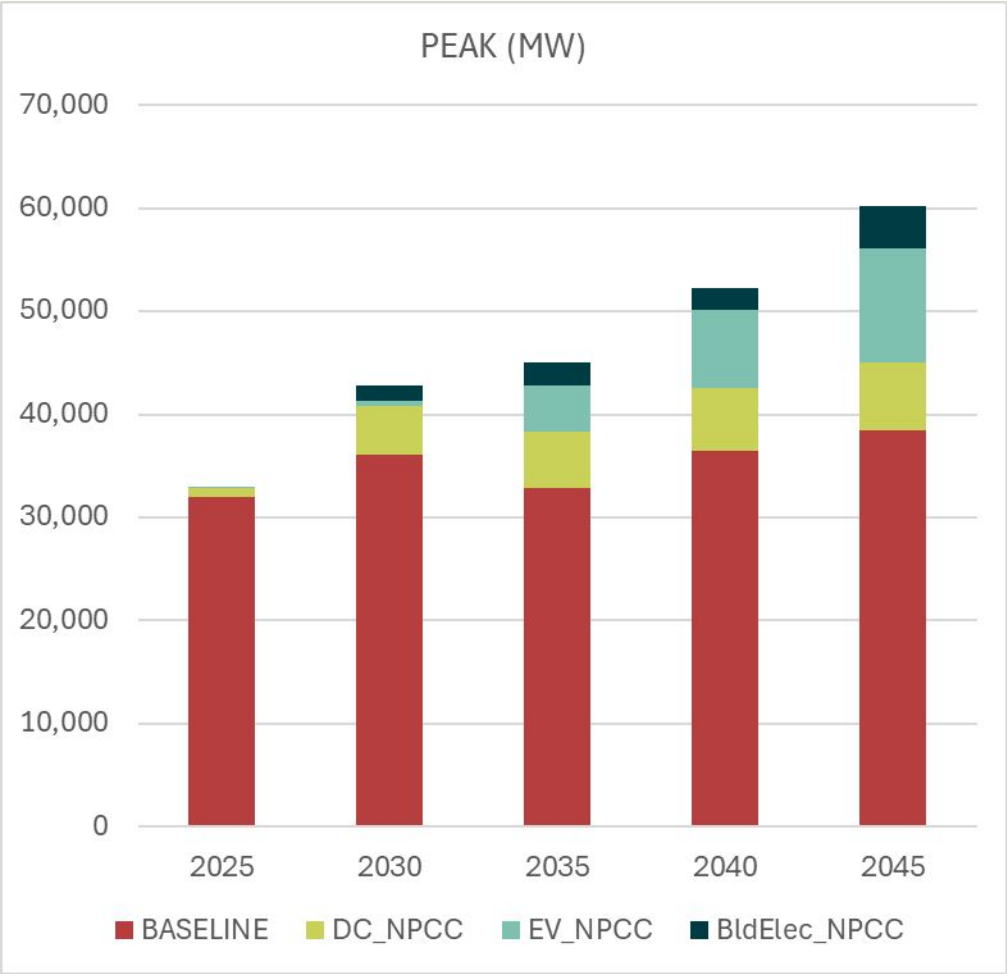
Region-wide Energy (aMW) Demand - MixedBag_CL_A
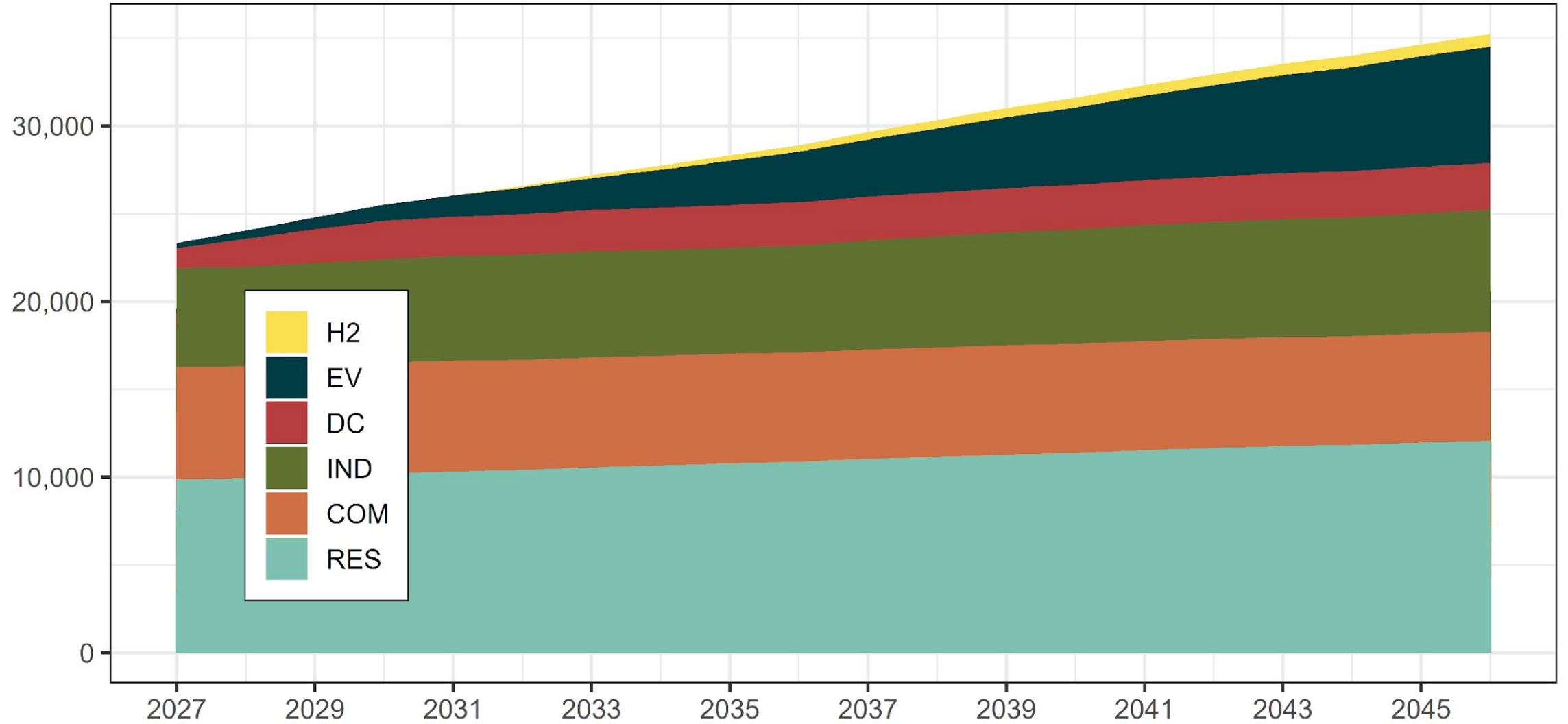
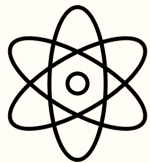Region-wide Energy (aMW) Demand - MixedBag_CL_A

"It's tough to make predictions. Especially about the future."

– Hall of Fame Catcher Yogi Berra

or possibly...

– Hall of Fame Physicist Niels Bohr

Thanks for listening today!

- We will be making data sets and results available on the <u>Ninth Plan Elements and Inputs webpage</u>

- Comments, concerns, questions – please reach out to me:

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