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March 5, 2024

MEMORANDUM

TO: Council Members

FROM: Tomás Morrissey

SUBJECT: Data Center and Chip Fabrication Forecast

BACKGROUND:

Presenters: Amber Riter, Portland General Electric; Mark Symonds, Bonneville Power Administration; Tomás Morrissey, Northwest Power & Conservation Council staff

Summary: Many utilities are forecasting rapid load growth from data centers and semiconductor manufacturing. Amber Riter, PGE, and Mark Symonds, BPA, will discuss their organization's outlook on these sectors. Tomás Morrissey, Council staff, will present a draft Northwest forecast for those sectors.

Relevance: The Council is conducting a resource adequacy assessment this year and data center and chip fabrication loads are an input into the load forecast. Longer term the Council will need to forecast those loads in the ninth power plan as well.

Workplan: A.2.2. Create an updated hourly load forecast to inform the Adequacy Assessment.
B.1.1 Finalize development of new long-term load forecast model and update long-term load forecast.



Industrial Load Growth Trends

Amber Riter, Financial Planning and Forecasting





Portland General Electric

Service Area

- Growing **core urban service area** with population growth supporting services (government, education, restaurants, healthcare, and other services)
- **I-5 corridor** and port access provide opportunity for transportation and warehousing and market access for traditional manufacturing (wood products, food, metals)
- **'Silicon Forest' high tech cluster** includes R&D and component manufacturing. Hillsboro fiber infrastructure provides unique opportunity for continued growth connected to AI expansion, including data center and high-tech development. Companies with operations in PGE's service territory include Intel, Lam Research, Analog Devices, Microchip Technologies, Qorvo, Adobe, DRT, QTS and others
- Residential customers accounted for 37% of retail deliveries in 2023, commercial 34%, industrial 29%
- Strong industrial load growth, 7.5% CAGR from 2018-2023
- Forecast energy deliveries growth of 2% per year through 2027 driven by high-tech industrial customers and stable residential and commercial segments





Overview Oregon Semiconductor Industry

Employment and CHIPS Act

OREGON SEMICONDUCTOR EMPLOYMENT

- In 2022, Oregon had 33,800 semiconductor jobs. 82% of which were in Washington County
- Oregon has 9% of total US semiconductor jobs and 17% of US semiconductor engineering type jobs

OREGON CHIPS ACT

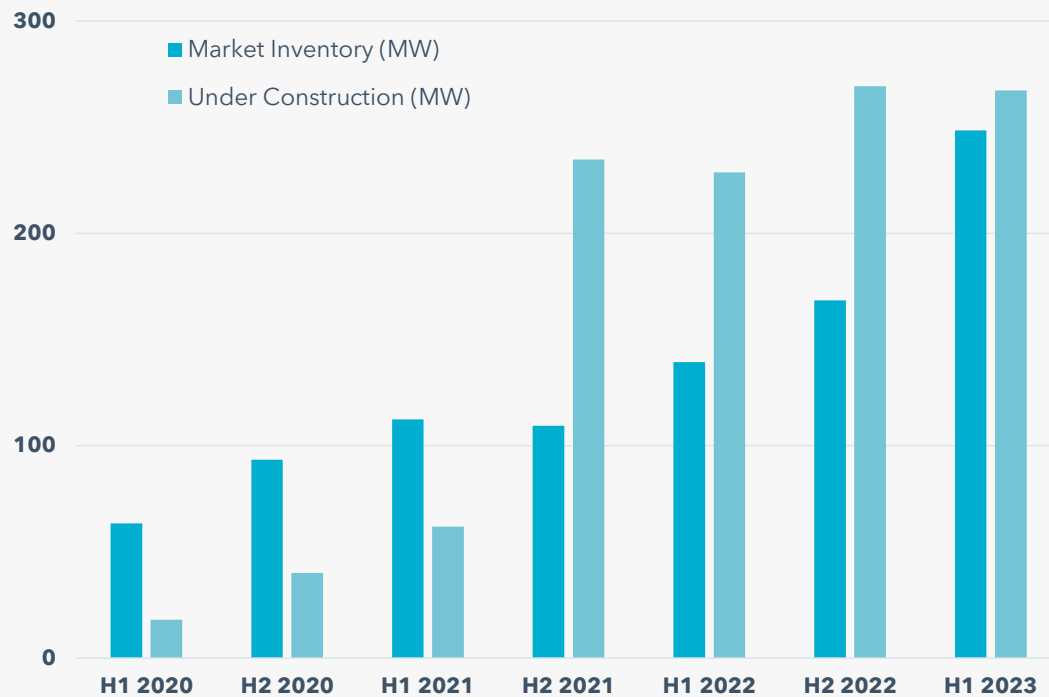
- Dedicated \$190M to support semiconductor businesses looking to expand in Oregon. An additional \$50M was set aside to be allocated in the 2024 legislative session.
 - Over a dozen companies submitted applications
 - The first 3 finalized contracts were announced in January awarded to Microchip, HP and Intel



Overview Data Center

Hillsboro Commercial Market Research

Hillsboro Data Center Market Summary



Data Source: CBRE Group Inc., Biannual Data Center Market Research Report

Why are data centers locating in Hillsboro?

- Transpacific Cable Access
- Clean Energy and Renewable Power Options
- Favorable Climate
- Cost of Living and Education
- Data Center Clustering
- Low Tax Burden

Types of data centers

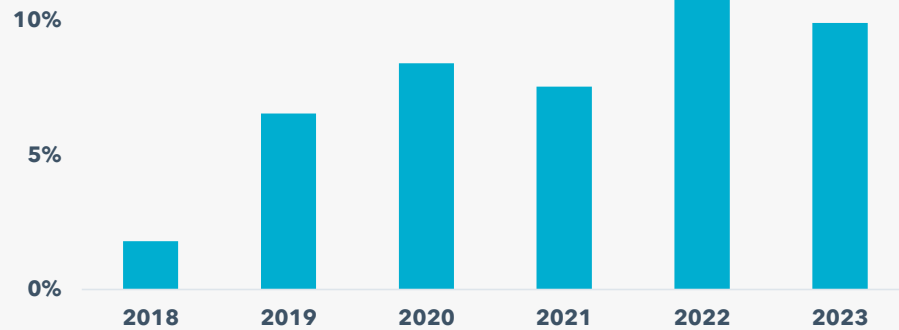
- On Premise or Enterprise: Support that company's business functions
- Colocation: Large facilities that offer data center services to multiple clients in the same facility
- Hyperscale: Large facilities typically owned and operated by the company it supports or colocation provider with a hyperscale client as a tenant

Portland General Electric's Energy Deliveries

Industrial Growth Trends

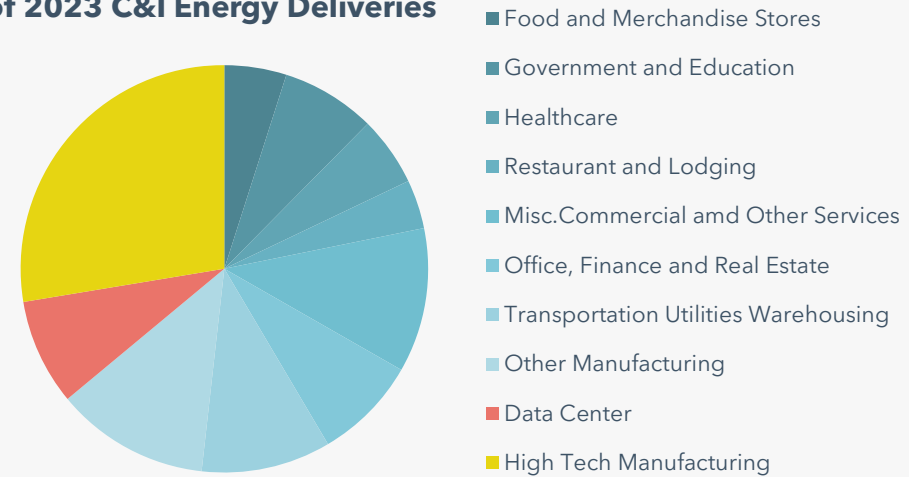


Annual Industrial Energy Deliveries Growth



- PGE has experienced rapid industrial growth in recent years
- Pace of growth for individual large loads can be volatile leading to lumpy year over year growth patterns

Share of 2023 C&I Energy Deliveries



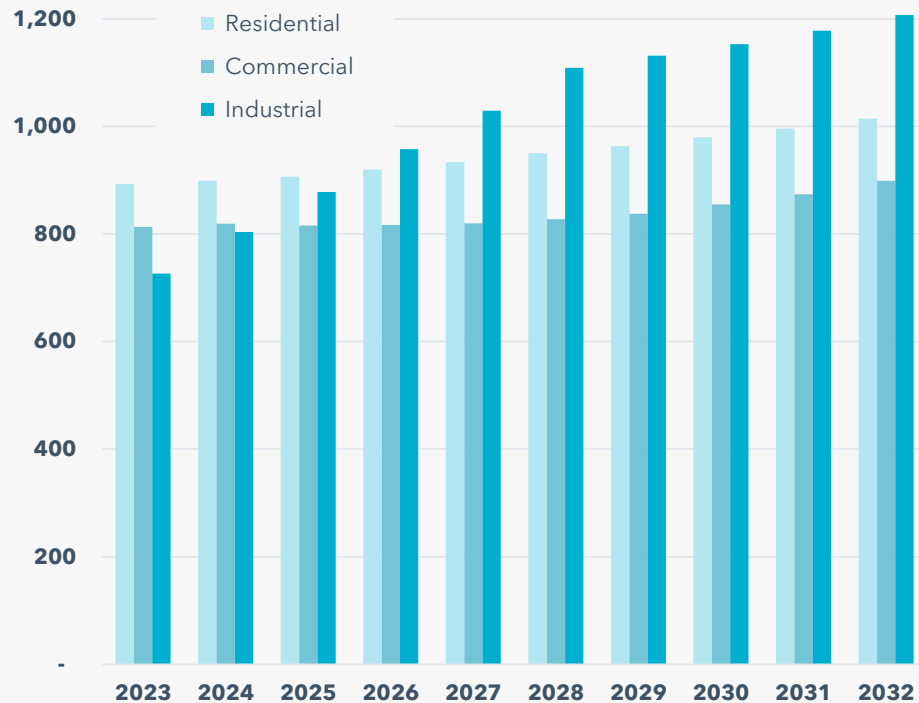
- High tech manufacturing is PGE's largest segment
- Data center energy deliveries are an emerging segment with an increasing share of total deliveries



Portland General Electric's Energy Deliveries

Excluding the impact of electrification and rooftop solar adoption

PGE's CEP/IRP Addendum Load Forecast (in MWa)



20-Yr AAGR (2023-2042)	March 2022	June 2023
Total Energy	1.2%	1.6%
Total Peak	0.8%	1.1%
Residential Energy	0.5%	0.6%
Commercial Energy	0.0%	0.0%
Industrial Energy	3.5%	3.9%

- PGE's 2023 CEP/IRP Addendum presented an updated (increased) load forecast from initial filing. Strong industrial growth from 2021-2023 was a primary driver of that increase
- This forecast reflects the result of the top down, econometric model **prior to** accounting for electrification and rooftop solar

BPA Loads Presentation

NWPCC Power Committee Meeting

March 12, 2024

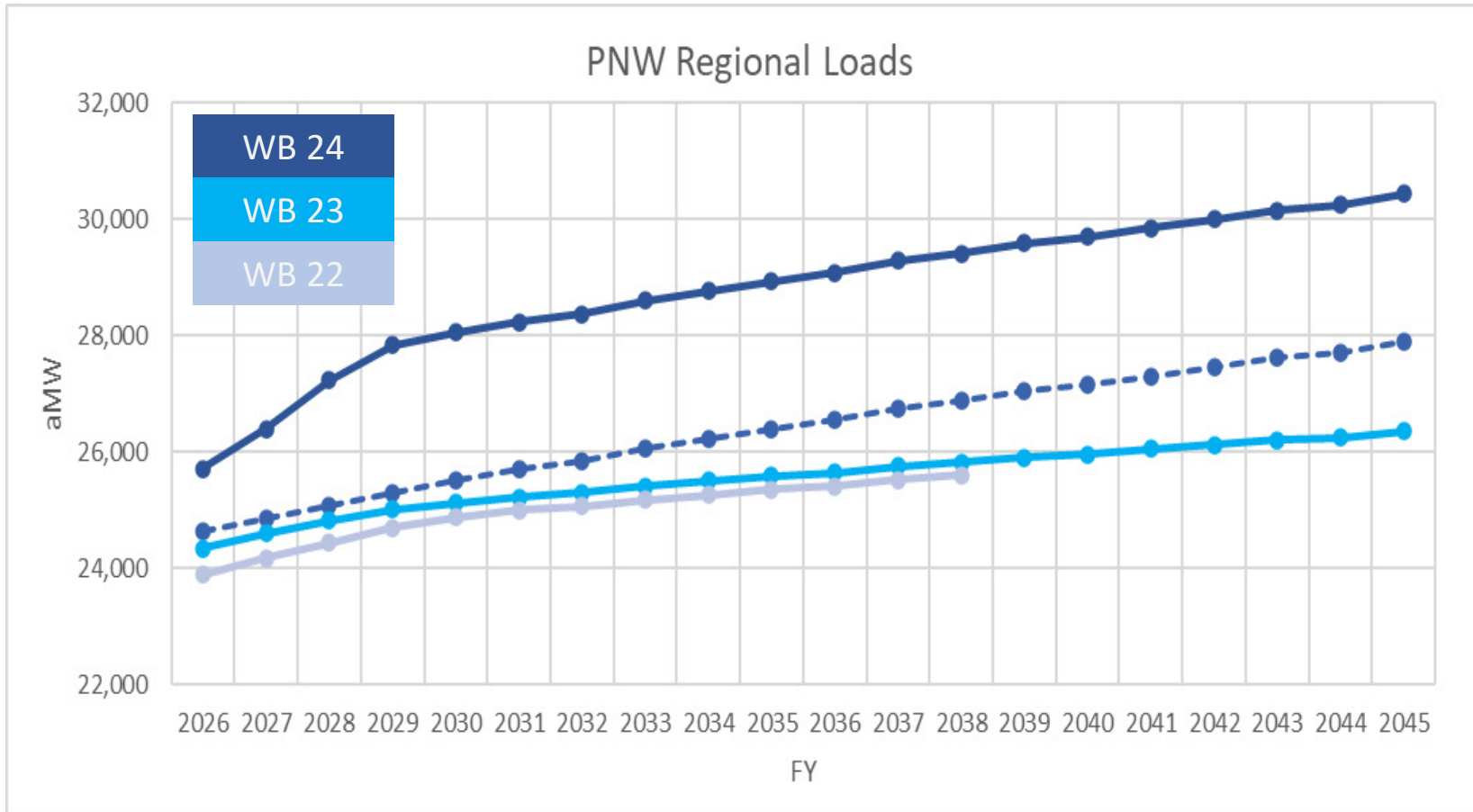


Reminder: Power Planning at BPA



- Each year, BPA publishes the Pacific Northwest Loads and Resources Study – often referred to as the **White Book** - which analyzes BPA's projections of retail loads, contract obligations, contract purchases, and resource capabilities over a 10-year study horizon and describes expected energy and capacity surplus/deficits under varying water conditions.
- On a biennial basis, BPA conducts an IRP-like assessment collectively referred to as the **Resource Program** which examines uncertainty in loads, water supply, natural gas prices, and electricity market prices to develop least-cost portfolios of resources that meet BPA's obligations.
- These processes are voluntarily undertaken to inform acquisition strategies and provide valuable insight into how Bonneville can meet its obligations cost-effectively. They are neither decision documents nor a process required by any external entity.

Pacific Northwest Regional Forecast - Expected



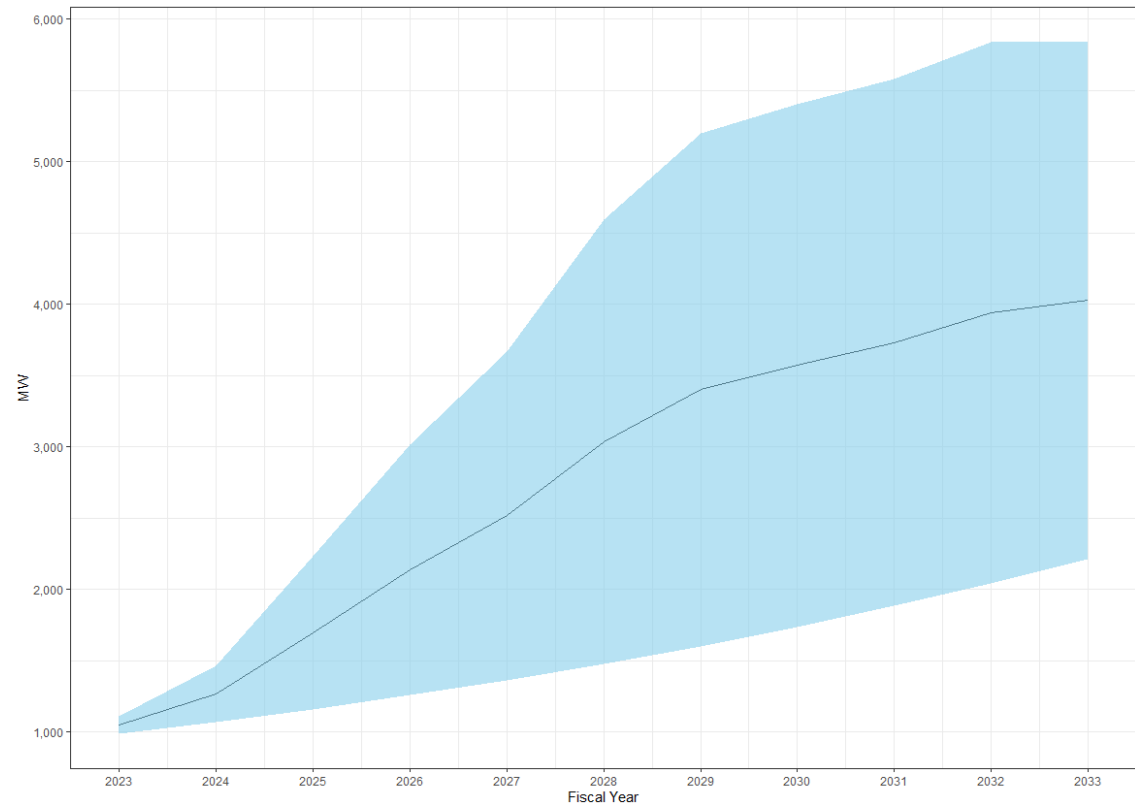
- Expected loads aka White Book (WB) load Forecasts
- Investor-Owned Utilities (IOU) loads included
- The following are not included:
 - Inflation Reduction Act (IRA)
 - Climate Change adjustments
 - Exports

• Significant data center load growth through 2029 driving large changes in the RP24 expected forecast. (Dashed trace represents data center loads removed)

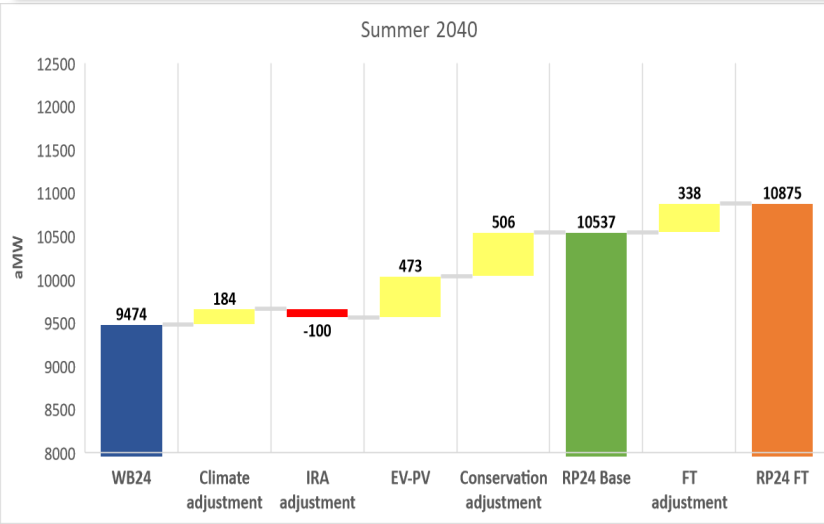
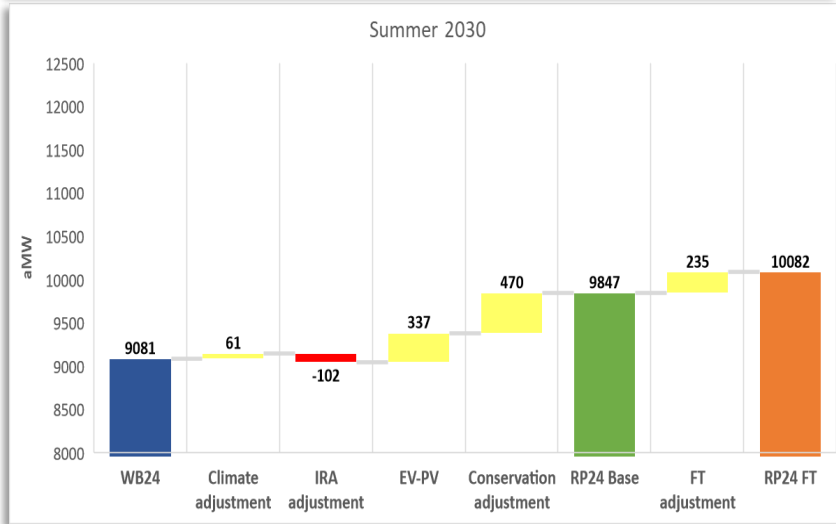
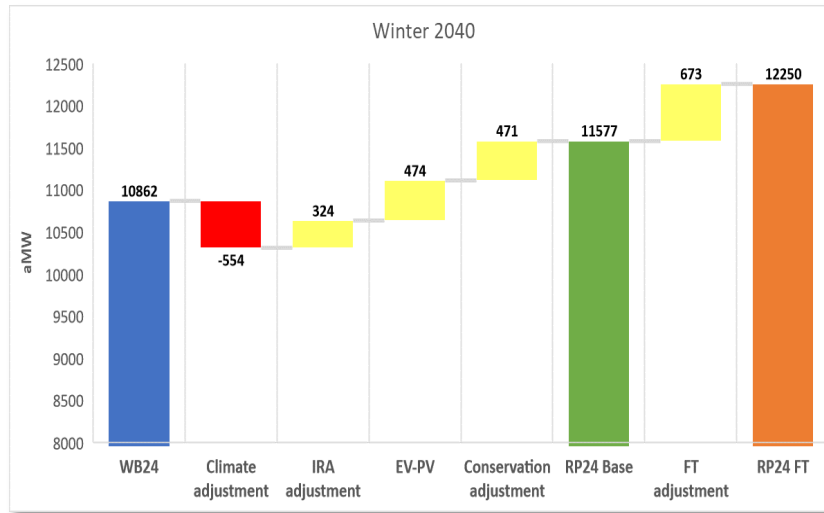
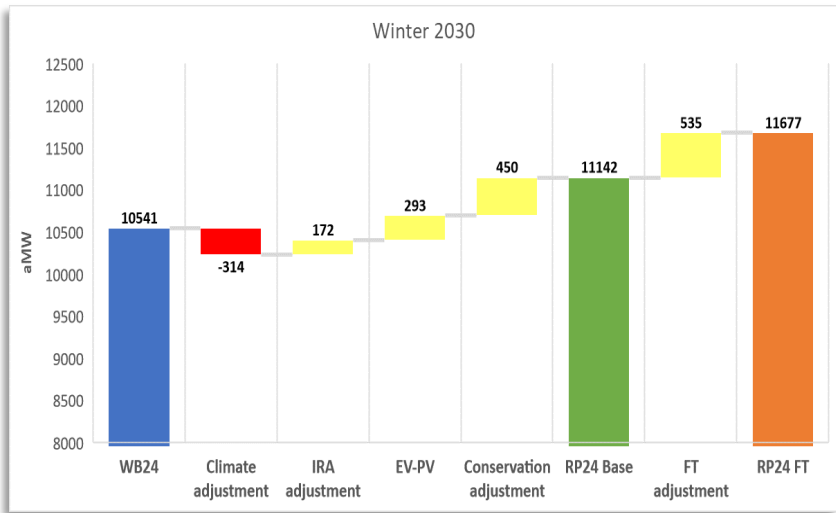
Load Forecast: Assumptions

Data Center Load Growth Assumption

- Shaded area indicate the range of potential data center load for the next 10 years
- Upper-bound is determined by an estimate of demand for FY2024 that includes the bulk of projects that have been reported to Transmission Planning, but may not meet the required confidence threshold for inclusion in the Agency forecast
- The solid line shows the Agency data center load forecast

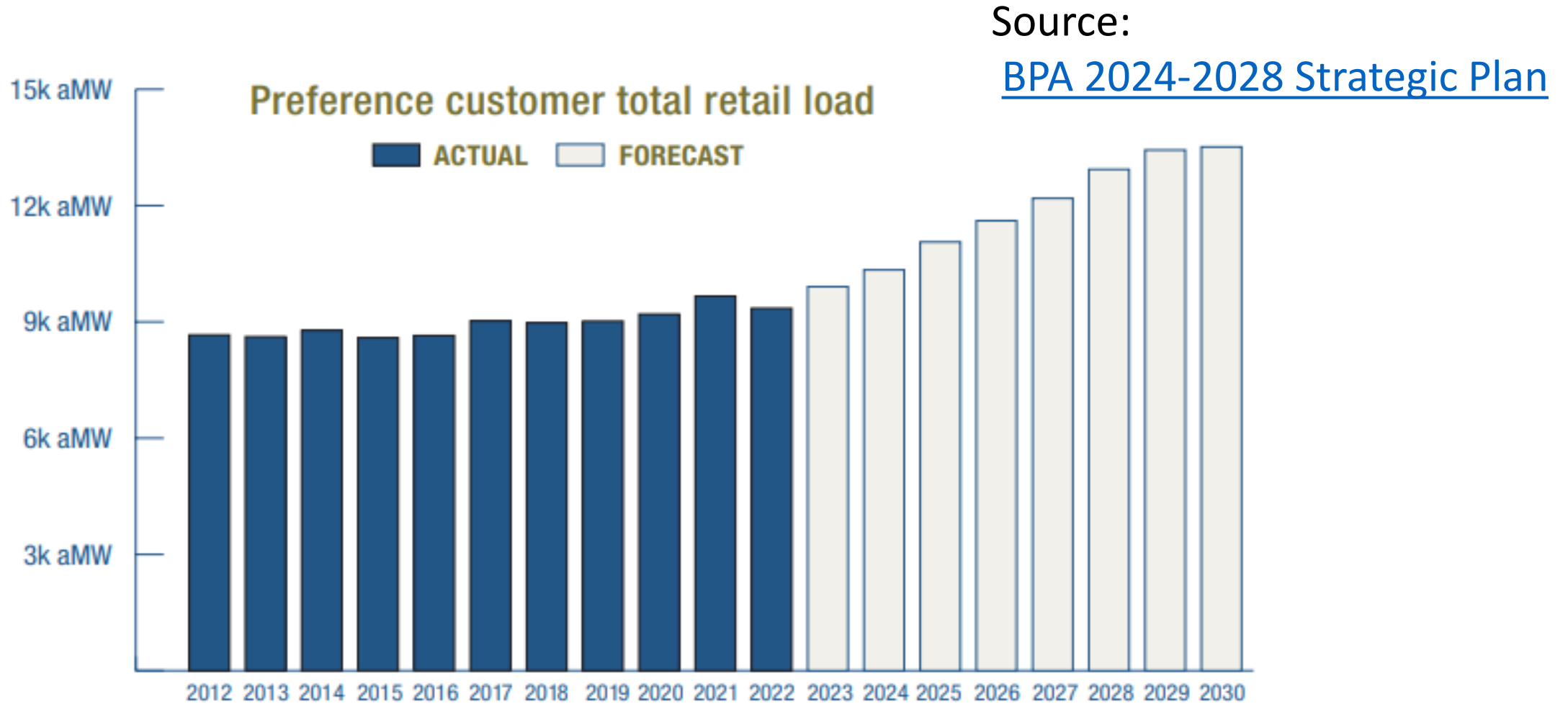


Load Forecast: Conclusions



- The speed of the energy transition is uncertain, but the Fast Transition case illustrates its large potential impact on loads, especially as emission target deadlines loom
- The collection of these impacts has the potential for profound impacts on loads – if, when, how and the extent to which they happen matter

Historic Total Retail Loads (TRL)



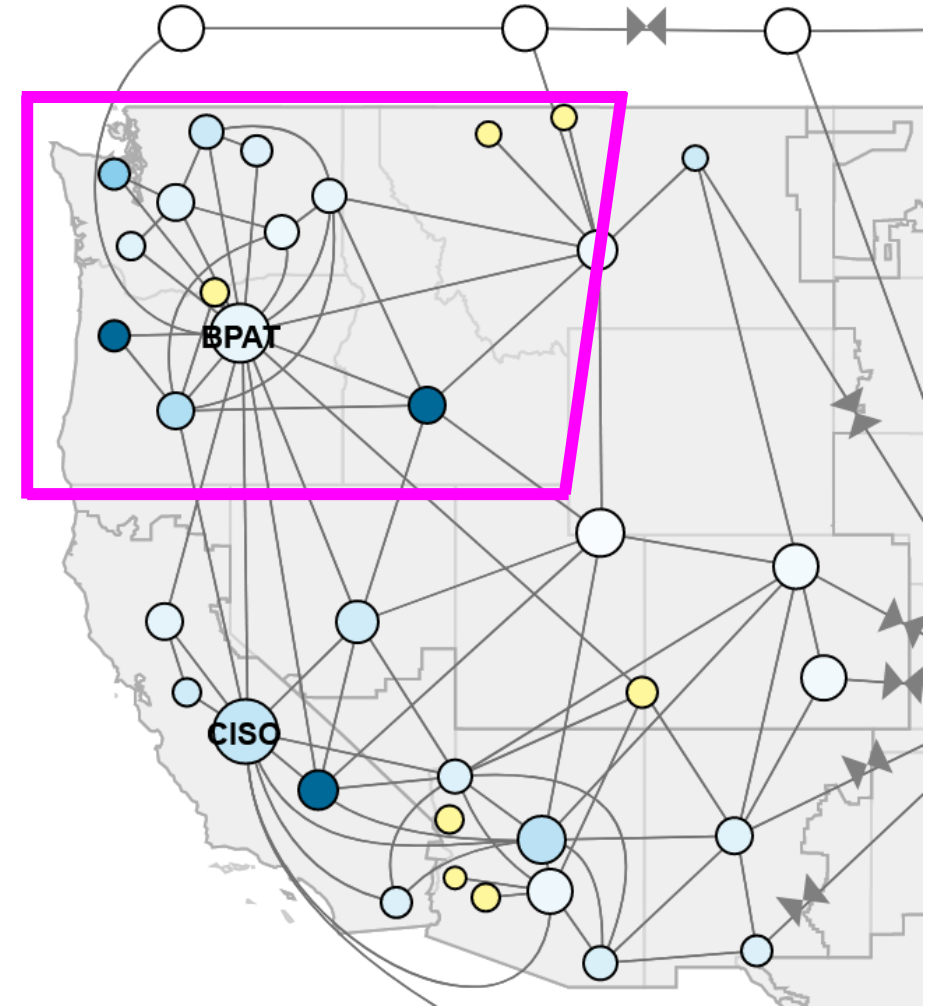
DRAFT

Data centers and chip fabrication load forecast

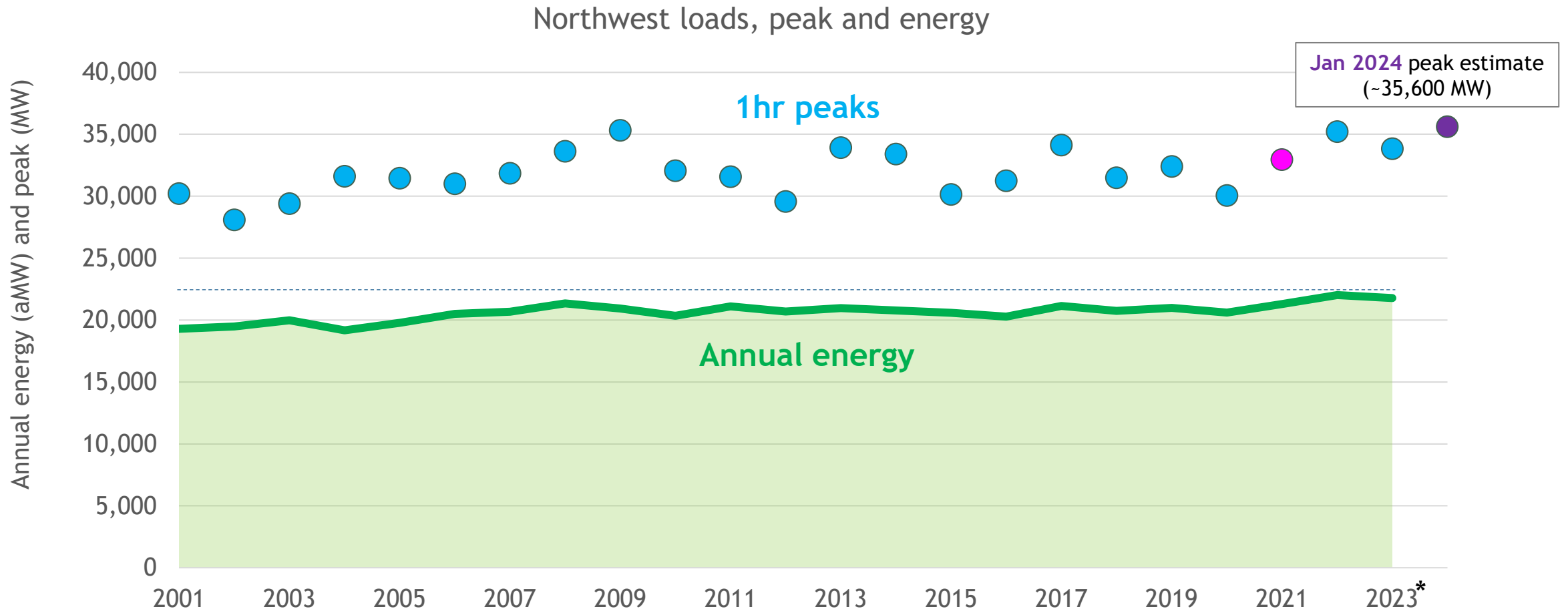
March 2024

The Northwest Region and other background

- The Northwest, as defined by the Power Act, includes load in Idaho, Oregon, Washington, and Western Montana
 - This includes about 33% of the Northwestern Energy balancing area and ~10% of the PacifiCorp East balancing areas
- Today's presentation focuses on the forecast for the 2029 adequacy assessment that will occur later this year



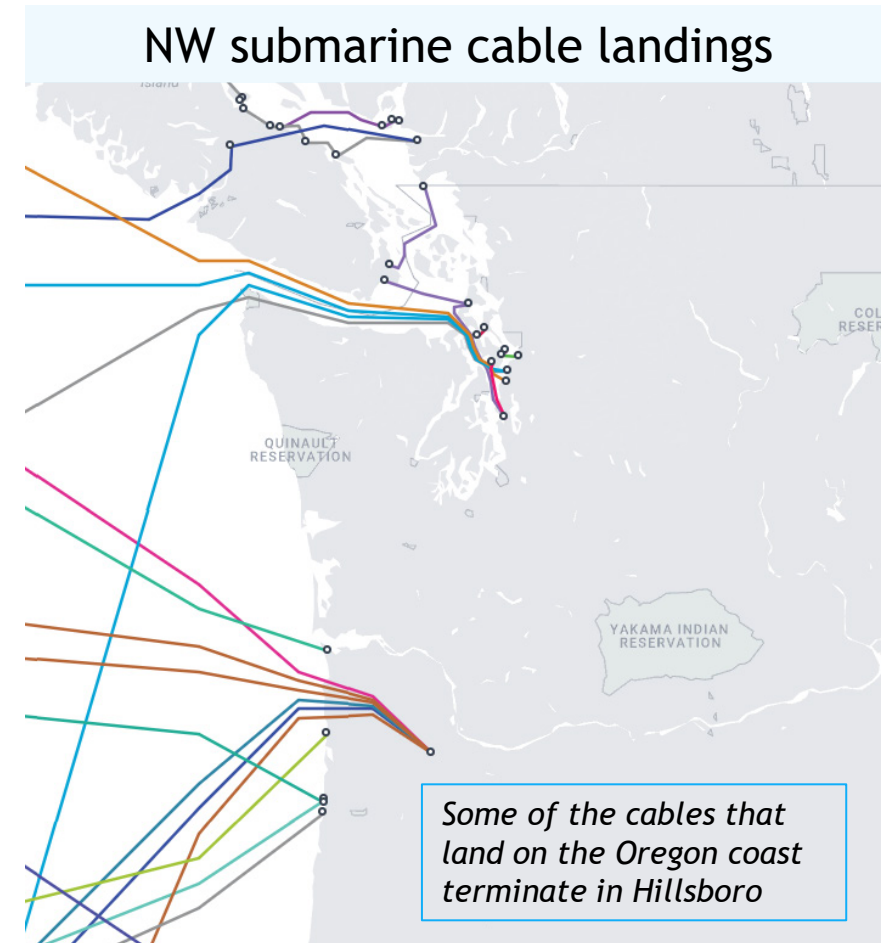
Northwest load growth has been slow since 2001



*2023 data are initial

General data center and fab locations

- **Eastern Oregon**
 - This includes UEC, Northern Wasco PUD, PacifiCorp, and more.
- **Eastern Washington**
 - Mid-C utilities seeing growth, in part from Microsoft.
- **Portland metro area**
 - The Portland area has subsea cables connecting back to Asia. Also forecasting fab load (for example Intel, among others).
- **Boise metro area**
 - Meta has announced a data center in Kuna, Idaho. Micron has announced a fab in Boise.

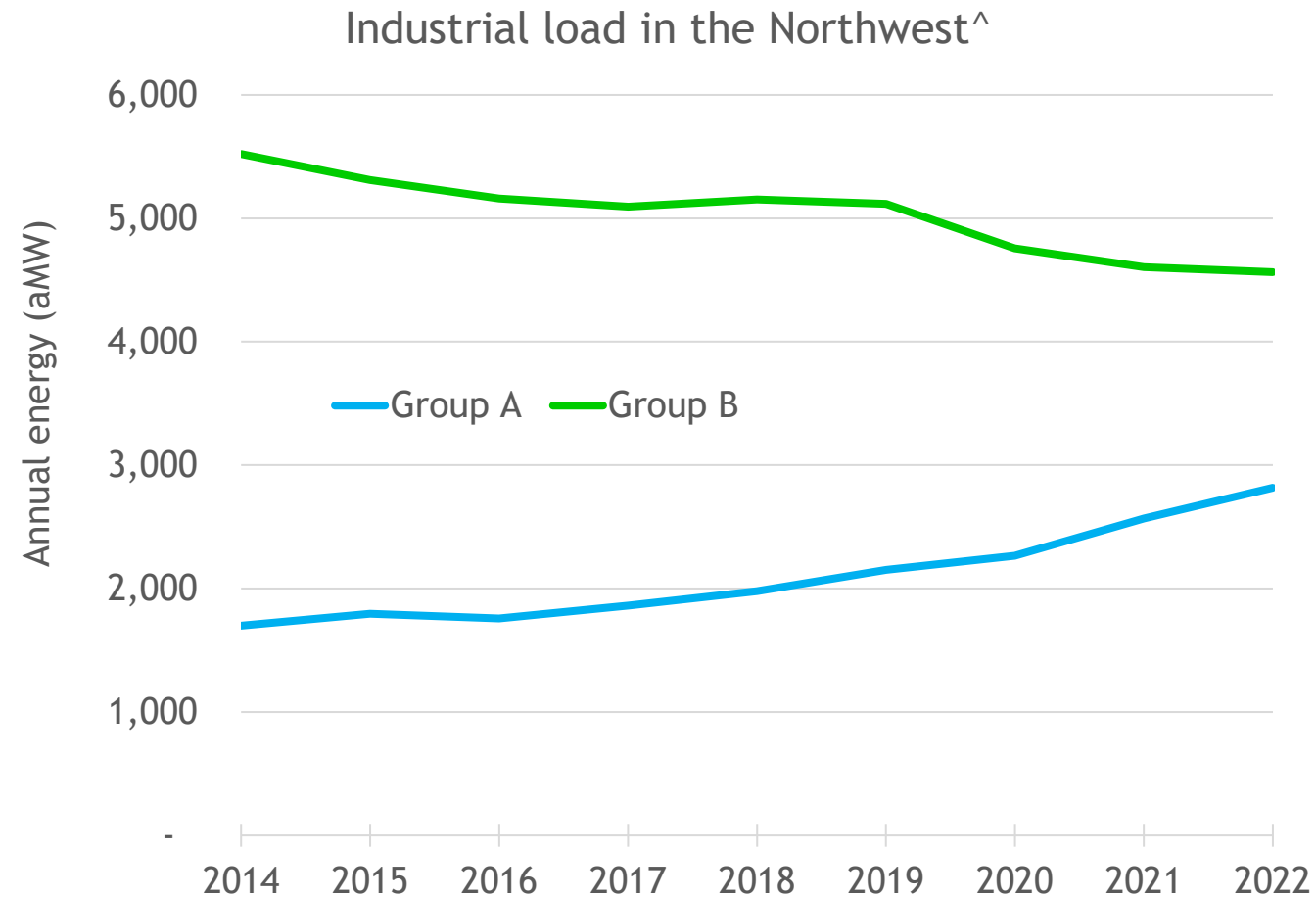


Creating a forecast

- This forecast uses three input sources:
 - a) Historical industrial or commercial sales trends (gathered from EIA form 861)
 - b) Utility data center growth projections (typically from IRPs)
 - c) Review of announced projects (mostly news stories and press releases)
- There is also some analyst adjustment in the forecast
- The result is a range of forecasts, none of which are a reference case
 - Considerable uncertainty given the load ranges in utility planning documents
 - Data centers can be challenging to get information on

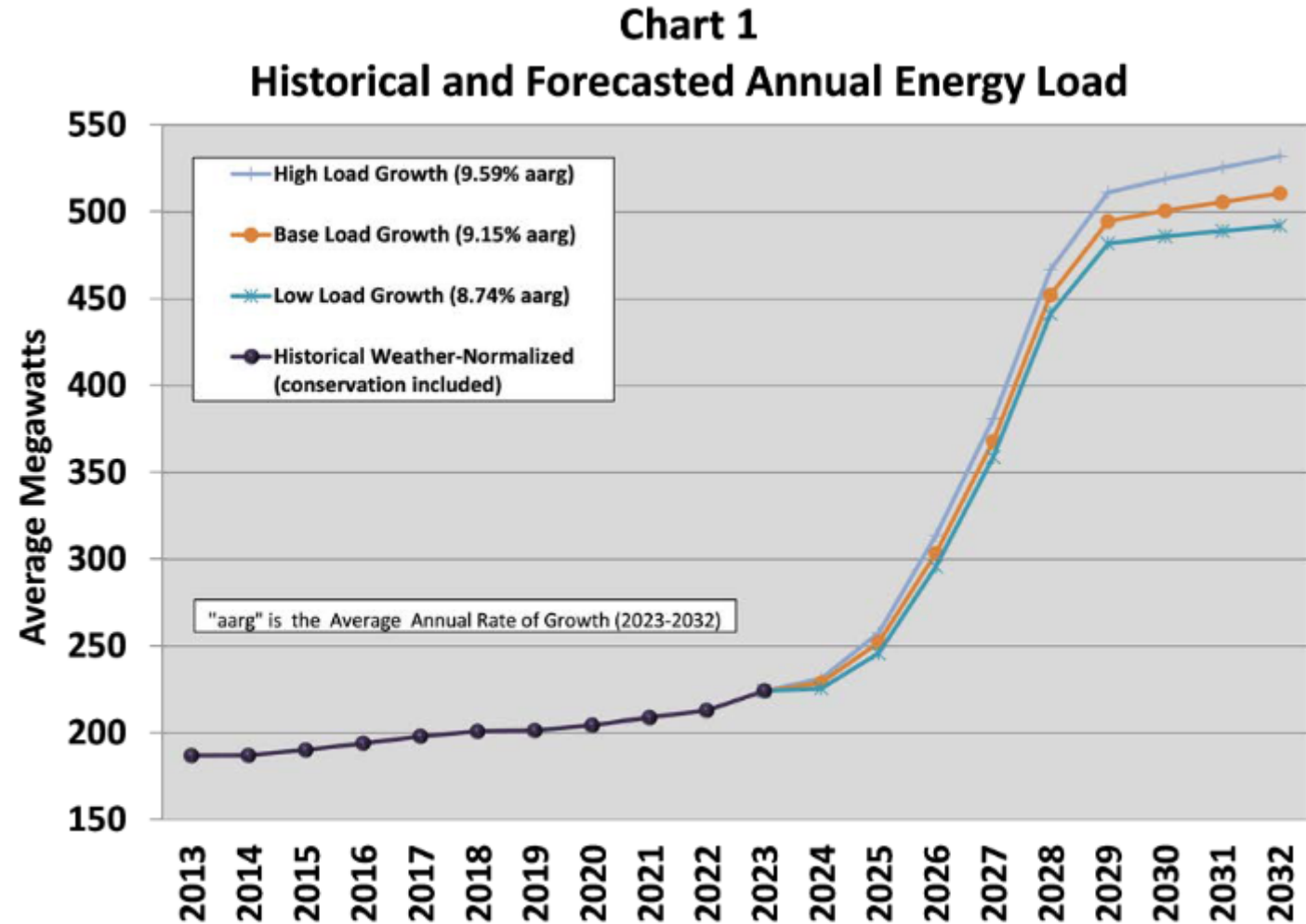
Historical trends example

- Group A is PGE, Grant, Douglas, UEC, Northern Wasco PUD, and PacifiCorp in Oregon*
- Group B is the remaining Northwest (some of the load loss is from aluminum shutdowns)
- We are assuming most of the industrial growth is from data centers and fabs



Utility growth projection example

- Some utilities are forecasting steep upcoming load growth
- This example is from Chelan's 2023 IRP, which notes that high-density loads, "typically server farms", are projected to grow rapidly
- These forecasts are checked against project announcements (see next slide)



Project announcements

From Wenatchee World (2023): “The Chelan County PUD took a big step on an \$86 million Malaga substation... Microsoft has already paid for “costs associated with the substation...” **The metal-enclosed capacitors will help power 360 megawatts to Microsoft’s data center...”**

From OPB (2023): “Amazon is going to greatly expand its presence in Morrow County. **The tech giant already has four huge data centers there. With the recent approval from the Port of Morrow, they will now be able to build six more data centers. They’ll get an estimated \$1 billion in tax breaks”**

Meta’s Kuna Data Center

The Kuna Data Center will be part of Meta’s global infrastructure that brings our technologies and services to life.

\$800M+

Data center investment in Idaho

~100

Operational jobs supported once completed

1,000

Skilled trade workers on site at peak construction

We prioritize sustainability



Meta will be water positive in 2030, where we restore more water than we consume.



Meta’s supported project is adding 200MW of new renewable energy in Idaho.



Our global operations, including our data centers and offices, are supported by 100% renewable energy and have reached net zero emissions.



Meta’s global fleet of data centers support our technologies that empower more than 3 billion people around the world to share ideas, offer support and make a difference.

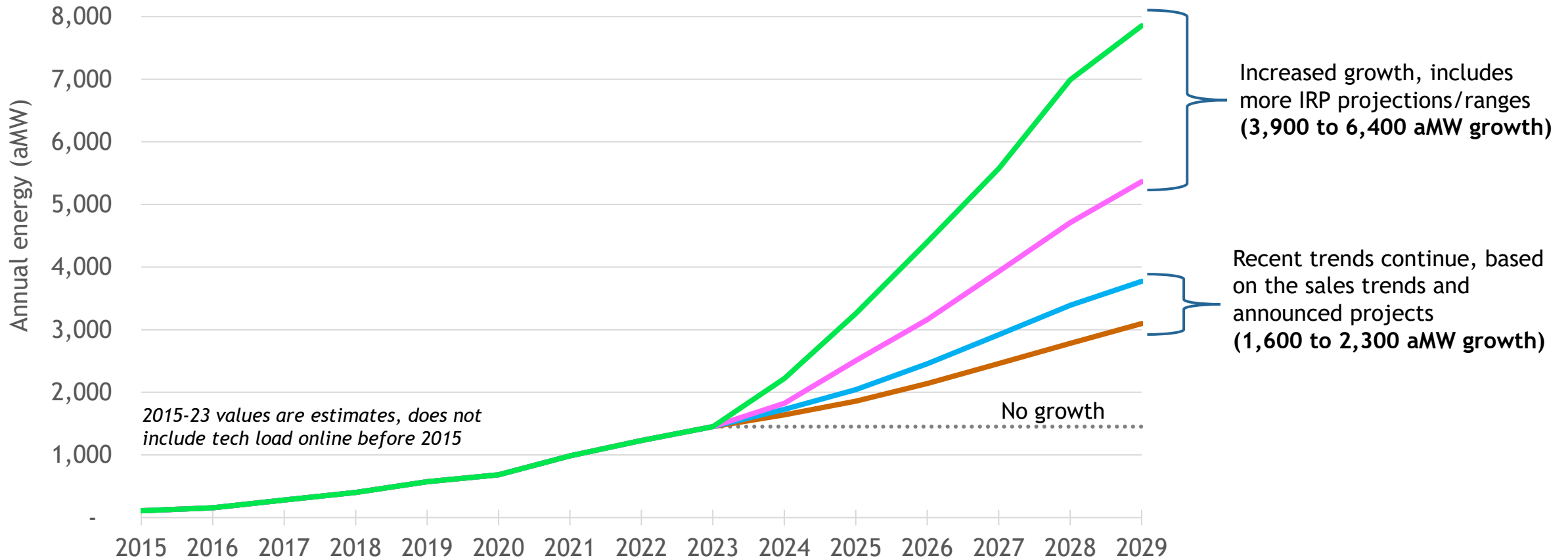
datacenters.atmeta.com

Meta



Draft tech load forecast to 2029

Draft data center & chip fabrication load backcast and forecast



Big open questions

- The role of energy efficiency and demand response at data centers
 - We will dig into this more for the 9th Plan
- What resources will serve this new load?
 - Some data centers are working with utilities to build new renewables
 - Some data centers may build their own resources
 - Some data centers behave like more traditional customers
- What about transmission and distribution?
 - What are the T&D system limits to load growth, and how quickly, and at what cost, can those limits be changed?
 - Some customers are paying for system upgrades directly

Next steps

- Extend the forecast past 2029
 - Forecast currently goes to 2029, the year of the next adequacy assessment
 - The Ninth Plan needs a forecast through 2045+
- Talk to the Council Demand Forecasting Advisory Committee
- Continue to talk to utilities and others about data center and chip fabrication growth potential
- Continue to dig into energy efficiency and demand response at data centers

An aerial, sepia-toned photograph of a large, winding lake or reservoir. The water is a light, milky color. Several large, dark, forested islands and peninsulas are scattered throughout the water. On the left side, a road or railway line curves along the shoreline. The background shows rolling hills under a sky filled with large, white clouds. The overall scene is a wide, panoramic view of a natural landscape.

Questions?

Extra slides

More projects in the news

From Reuters (2022): “Micron Technology Inc... will break ground for a \$15 billion factory in Boise, Idaho...”

From Energy News Data (2023): “Powerex will deliver firm, carbon-free energy to Microsoft's new data center complex in Douglas County, Washington... the two companies will bring more renewable capacity on line... starting with a 200-MW wind project that has an expected on-line date of December 2024... **The data centers will consume 180 MW at full buildout...**”

From Hillsboro NewsTime (2023): “A new data center company with plans to build in Hillsboro has cleared a large regulatory hurdle... The company earlier this year announced its plans for a 108-megawatt data center campus to be built in the North Hillsboro Industrial Zone, so the annexation into city limits clears the way for those plans.”