

Jeffery C. Allen
Chair
Idaho

Ed Schriever
Idaho

Doug Grob
Montana

Mike Milburn
Montana



Northwest Power and Conservation Council

KC Golden
Vice Chair
Washington

Thomas L (Les) Purce
Washington

Ginny Burdick
Oregon

Louie Pitt, Jr.
Oregon

November 7, 2023

MEMORANDUM

TO: Council Members

FROM: Jennifer Light, Director of Power Planning

SUBJECT: Regional Coordination and Summer 2023 Conditions in the Western Grid

BACKGROUND:

Presenters: Elliot Mainzer, President and CEO of California Independent System Operator; Larry Bekkedahl, Senior Vice President of Advanced Energy Delivery at Portland General Electric; Ricky Bustamante, Vice President of System Operations at Bonneville Power Administration; Kathy Anderson, Senior Manager, Transmission and Markets at Idaho Power

Summary: In January 2023, Elliot Mainzer presented to the Council about California's efforts to manage the September 1-10, 2022 heat event. In addition to the resource additions (including storage) and a meaningful amount of demand response, Elliot highlighted the importance of regional coordination and the ability to lean on the Northwest to ensure that the lights stayed on.

This panel will build upon that discussion, bringing in a broader set of examples demonstrating the power of collaboration. The panelists will discuss this past summer's heat event in the Northwest. In this event, it was Northwest utilities, including Portland General Electric, that leveraged demand response and relied on its partnerships with Bonneville Power Administration and our neighbors to the south to ensure system adequacy. The Council will also hear from Kathy Anderson who will share

how broad collaboration has supported Idaho Power's ability to manage the reliability of their system. The goal will be to create a dialogue with the Council, allowing plenty of time to think through how the lessons learned from these events might inform our future power planning efforts here at the Council.

Relevance: Increasing loads, a changing resource mix, and extreme weather events create adequacy and reliability challenges for the power system. The Council has been tracking these events to understand these challenges, as well as the actions taken by entities across the west to ensure the lights stay on. Recent events have highlighted the importance of broad system coordination to leverage the benefits of load and resource diversity. Tracking and understanding these events provides important insights for the Council's power planning function.

Workplan: Track market efforts to inform Council analysis.



Changing Grid Conditions in the West: Summer 2023

Elliot Mainzer
Chief Executive Officer

Northwest Power and Conservation Council
Portland, Oregon

CAISO's Role in the West

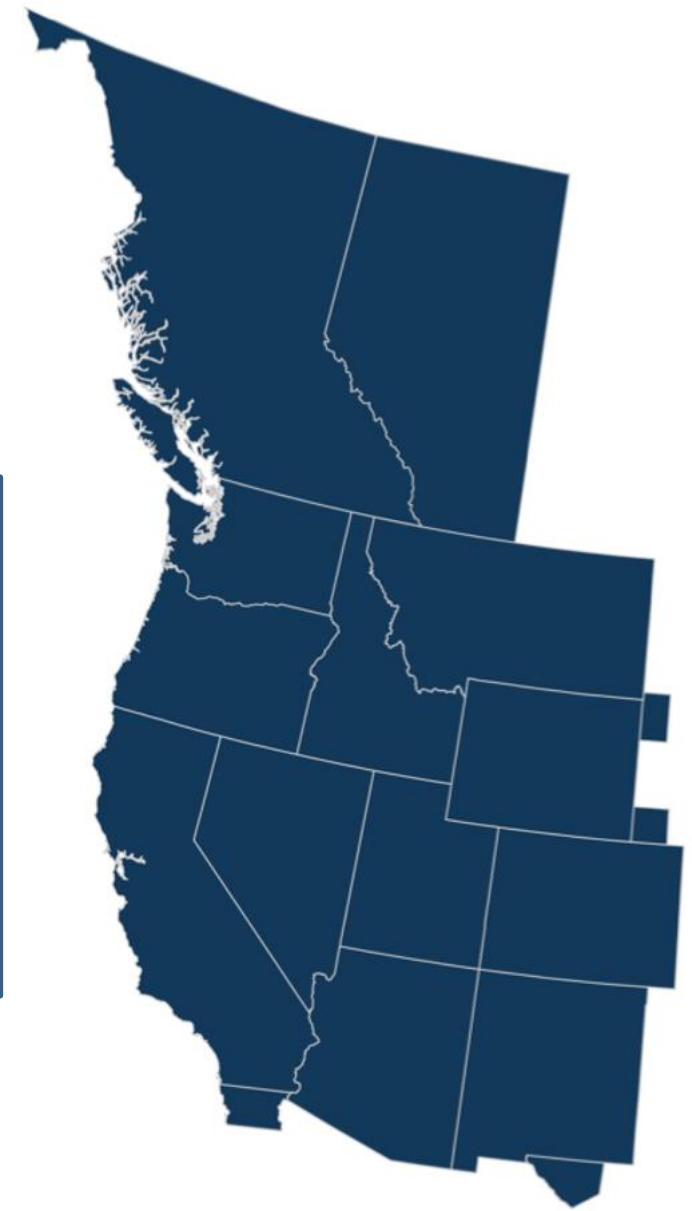
- Operates the Western Energy Imbalance Market (WEIM)
- Serves as Reliability Coordinator (RC West)
- Launching Extended Day-Ahead Market (EDAM)
- Within the CAISO Balancing Authority Area:
 - Maintains reliability; balances supply and demand; maintains operating reserves; manages the flow of energy; oversees the transmission planning process; and operates the wholesale market



WECC-wide: A changing resource mix

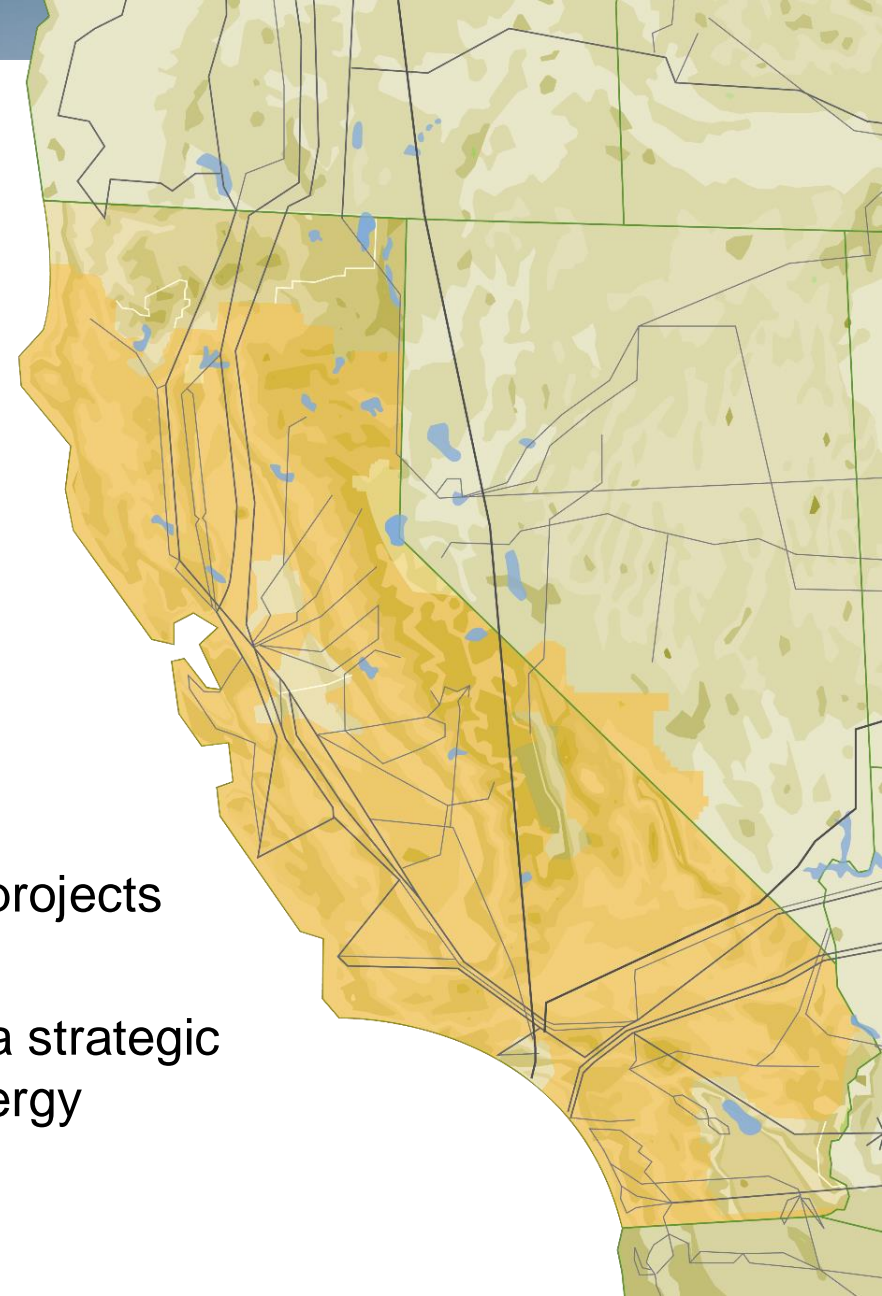
WECC 2023 State of the Interconnection

Resource	5-Year Lookback			Resource	5-Year Lookback		
	2017	2021	% Change		2017	2021	% Change
Coal	37 GW	24 GW	-35%	Coal	206,000 GWh	142,000 GWh	-31%
Natural Gas	101 GW	106 GW	+5%	Natural Gas	221,000 GWh	283,000 GWh	+28%
Wind	23 GW	34 GW	+48%	Wind	55,000 GWh	82,000 GWh	+49%
Solar	16 GW	28 GW	+75%	Solar	38,000 GWh	57,000 GWh	+50%
Hydro	72 GW	73 GW	+1%	Hydro	257,000 GWh	208,000 GWh	-19%
Nuclear	8 GW	8 GW	-	Nuclear	58,000 GWh	57,000 GWh	-2%



Developing adequate capacity and transmission in California to maintain reliability

- **New capacity:**
 - Battery capacity in CA has grown from less than 500 MW in 2020 to more than 6,500 MW today – 10x increase in three years
 - CPUC has ordered 18,800 MW of additional new clean resource procurement to become operational by 2028
- **Transmission:** CAISO's 2022-23 Transmission Plan recommends investment of more than \$7B in the development of 45 transmission projects
- **Strategic Reliability Reserve:** Legislation signed in 2022 created a strategic reliability reserve that can deploy additional supply in the event of energy emergencies to manage net-peak demand

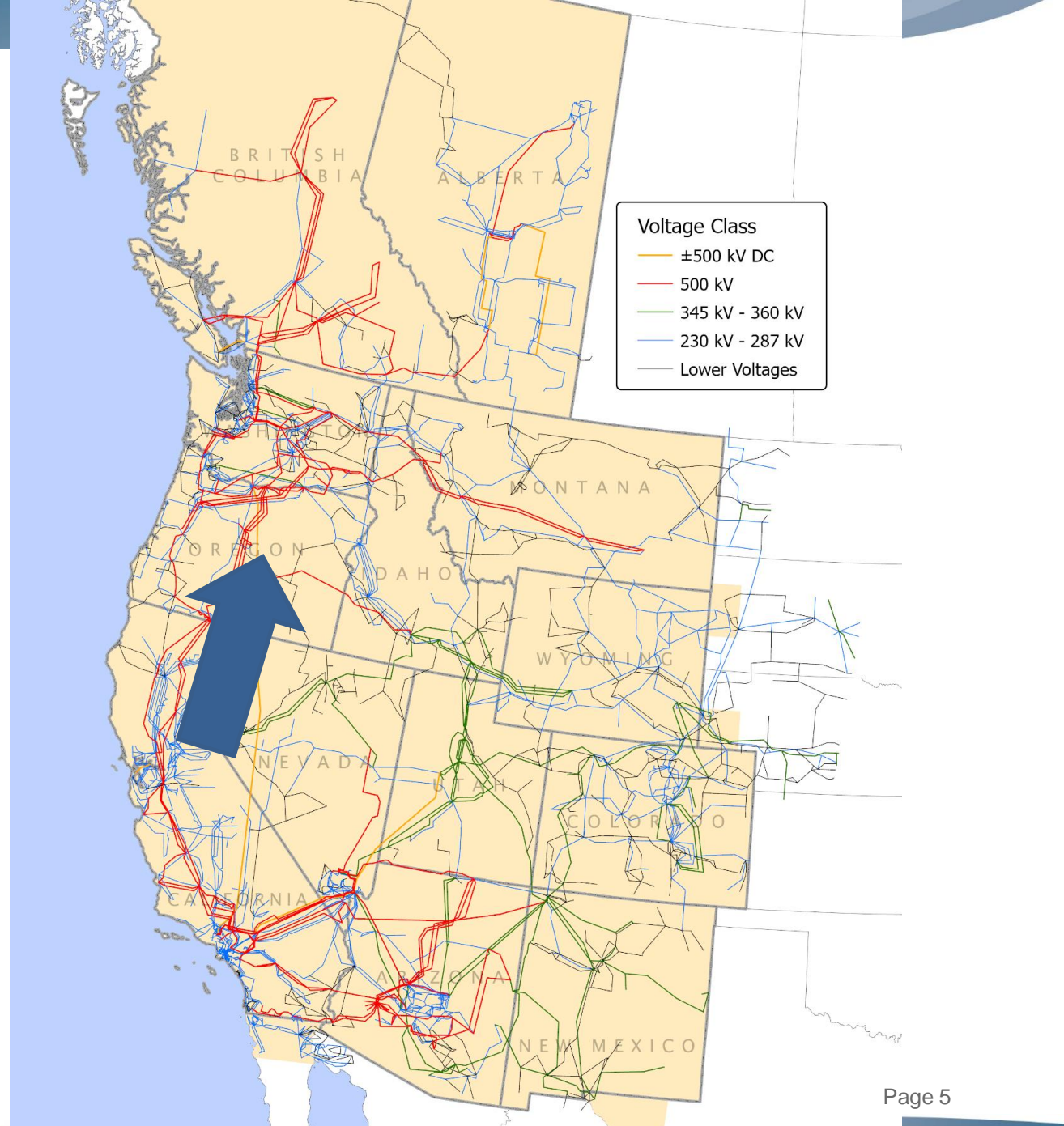


The West helping the West

June 2021



Portland records all-time high temperature of 116, setting new record for third day in a row



The West helping the West

September 2022

RECORD HEAT



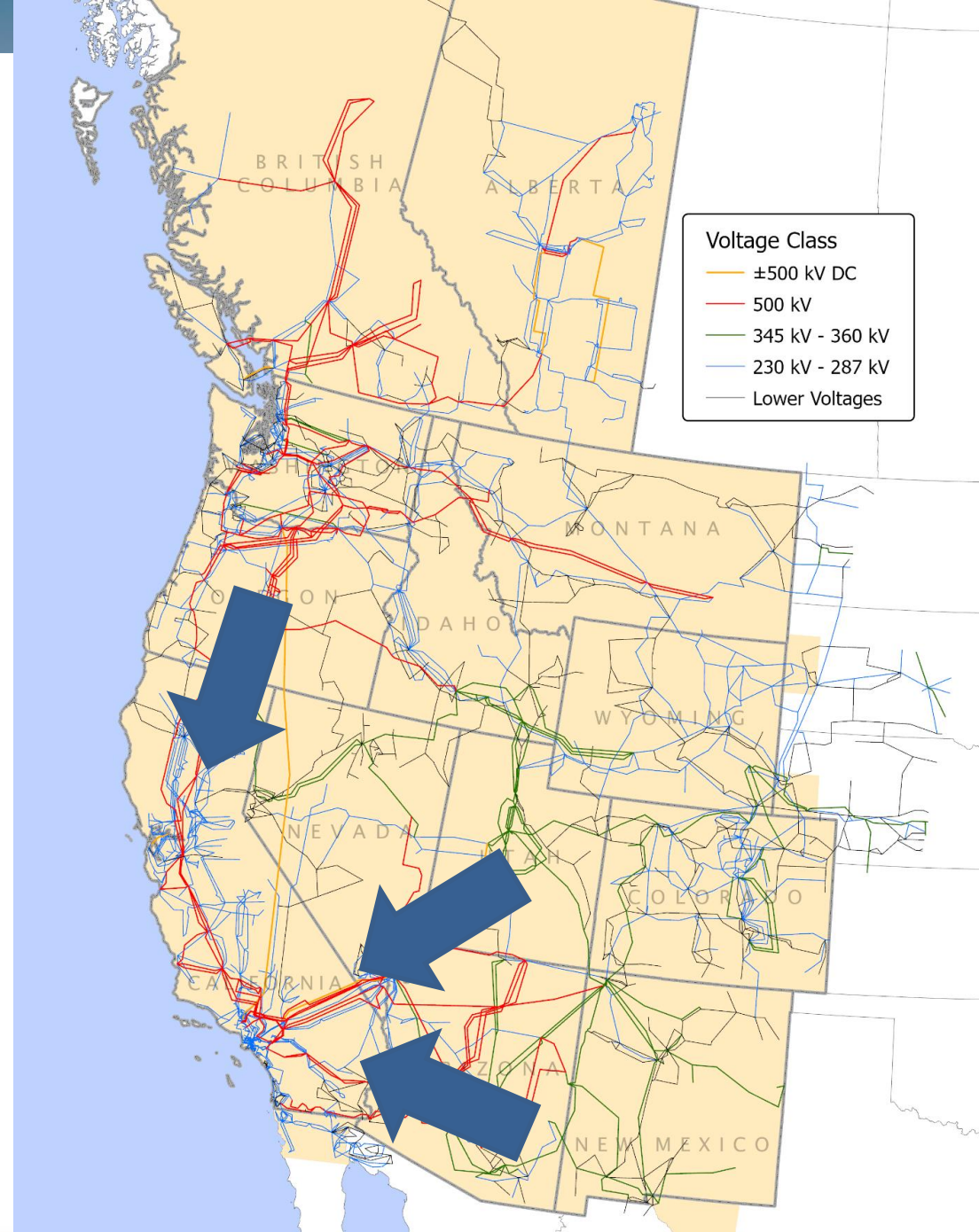
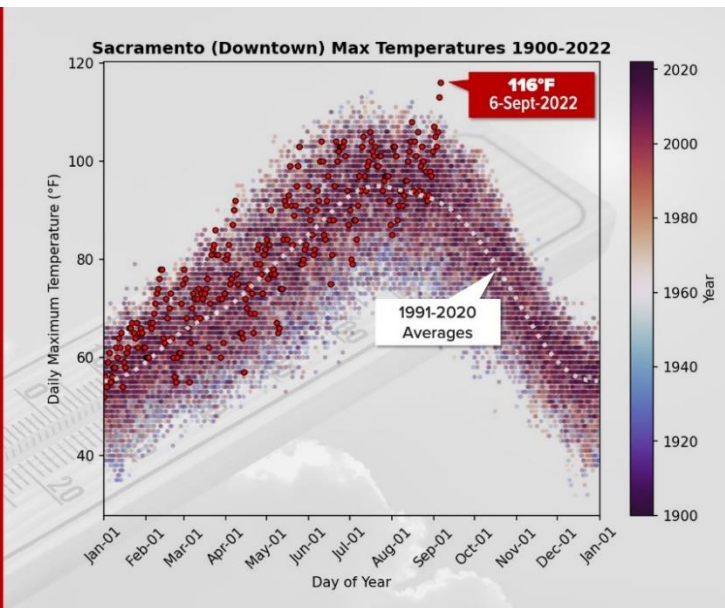
Sacramento, CA

116°F

Tuesday, September 6th, 2022

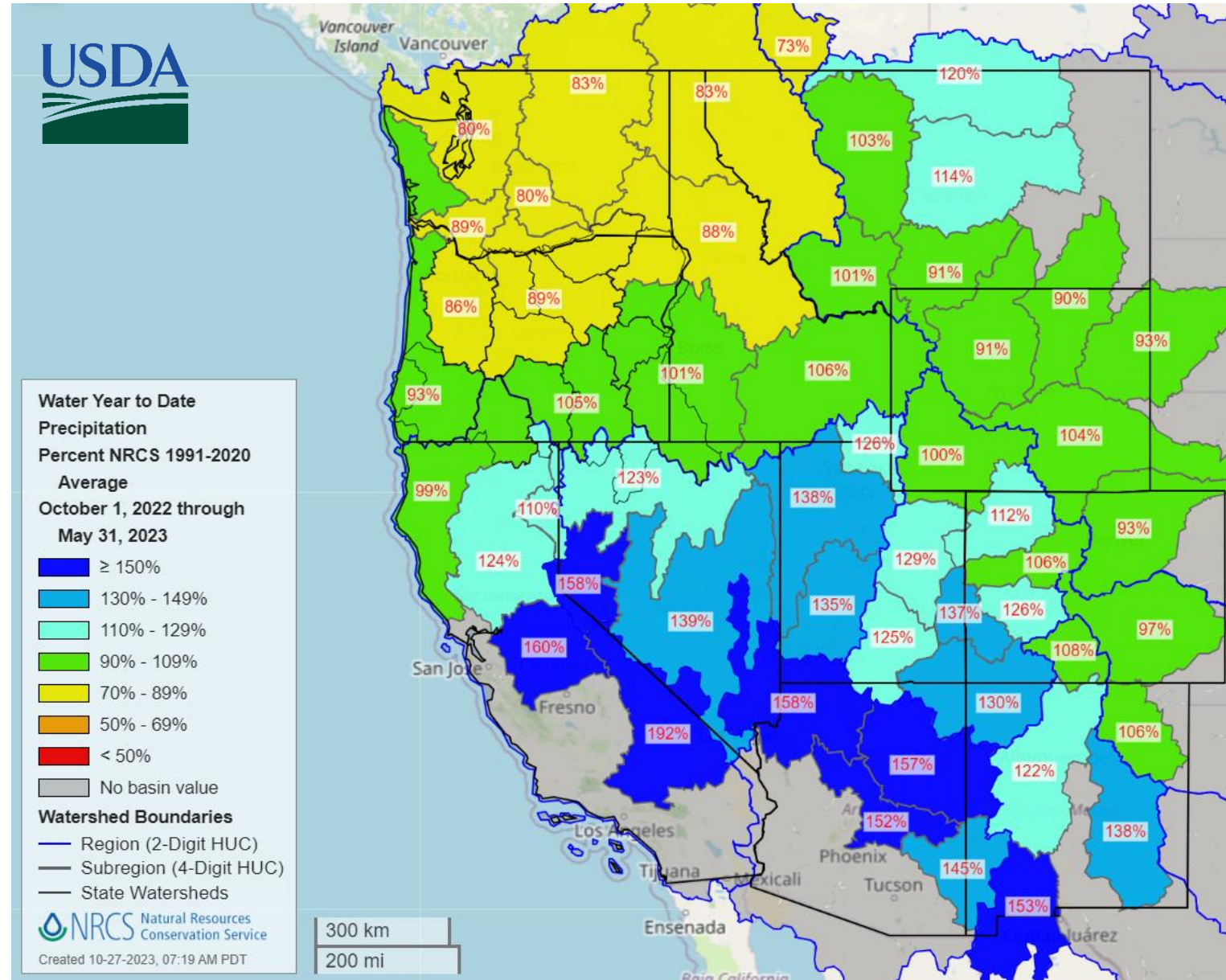
Sacramento/Downtown high of 116 breaks the previous all-time high of 114 set on July 17, 1925

 weather.gov/Sacramento
National Weather Service - Sacramento, CA



Summer 2023

**Precipitation
(% of average):
Oct 1, 2022 through
May 31, 2023**



Source: [USDA - NRCS](#)

Summer 2023

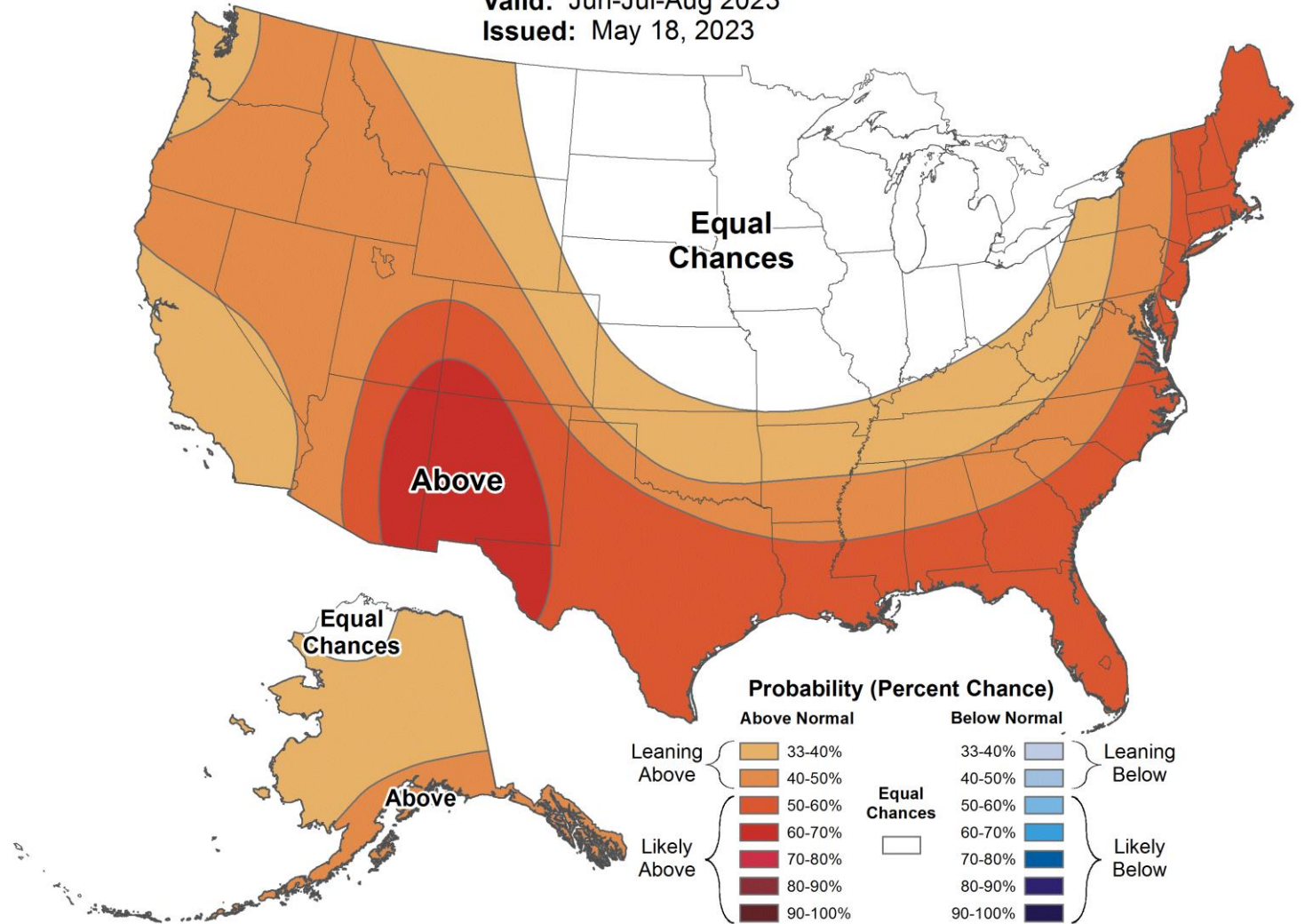


Seasonal Temperature Outlook



Valid: Jun-Jul-Aug 2023
Issued: May 18, 2023

NOAA Summer Forecast:
Above Average in
Desert Southwest



Summer 2023

Phoenix Metro: July heatwave

NWS Phoenix @NWSPhoenix · Follow

We are forecasting record high temperatures over the next 5 days in the Phoenix Metro area. Morning lows will also be near record warm levels. Please be safe during this heatwave!

5 DAY OUTLOOK - PHOENIX METRO

RECORD HEAT CONTINUES

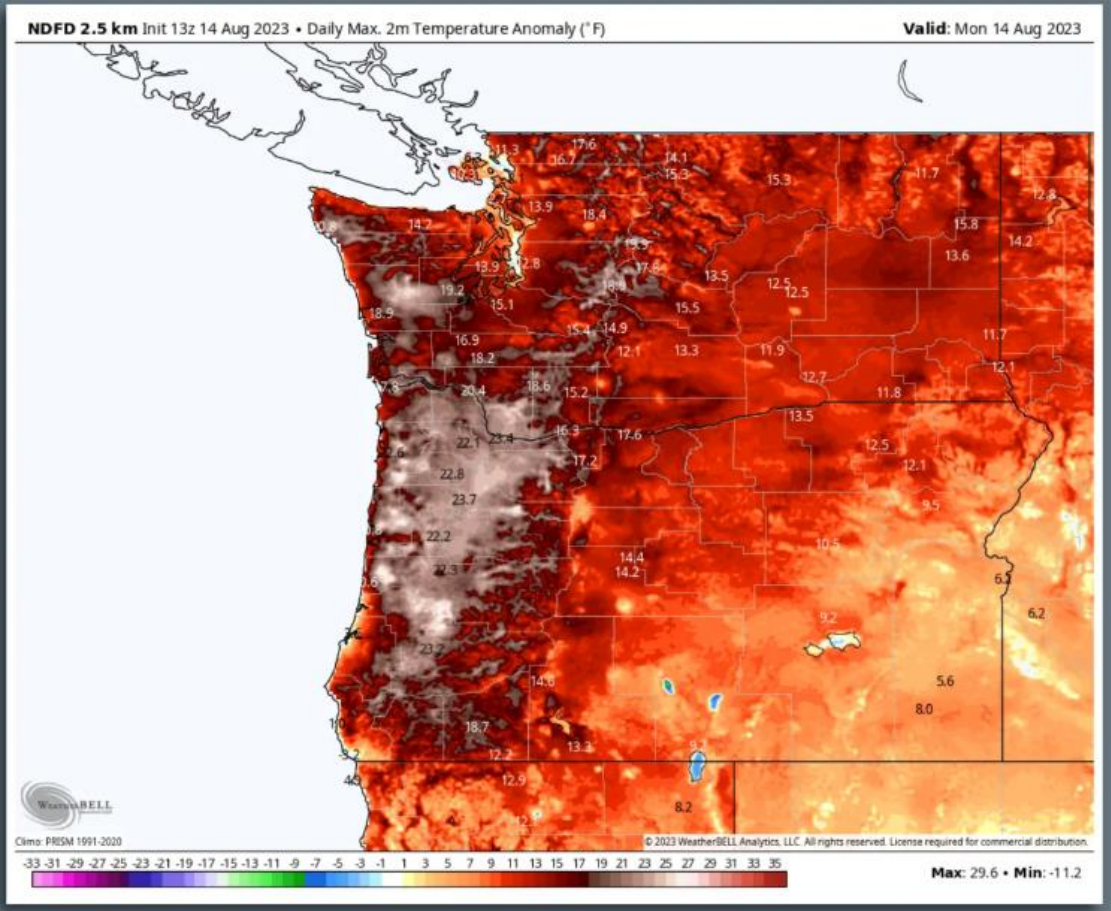
National Weather Service | Phoenix, Arizona

Day	Forecast High	Record High
Saturday	117°F	117°F
Sunday	118°F	118°F
Monday	117°F	116°F
Tuesday	117°F	115°F
Wednesday	116°F	116°F

9:00 PM · Jul 14, 2023

99 ❤️ Reply

Pacific Northwest: Mid-August heatwave



The West helping the West

July-August 2023



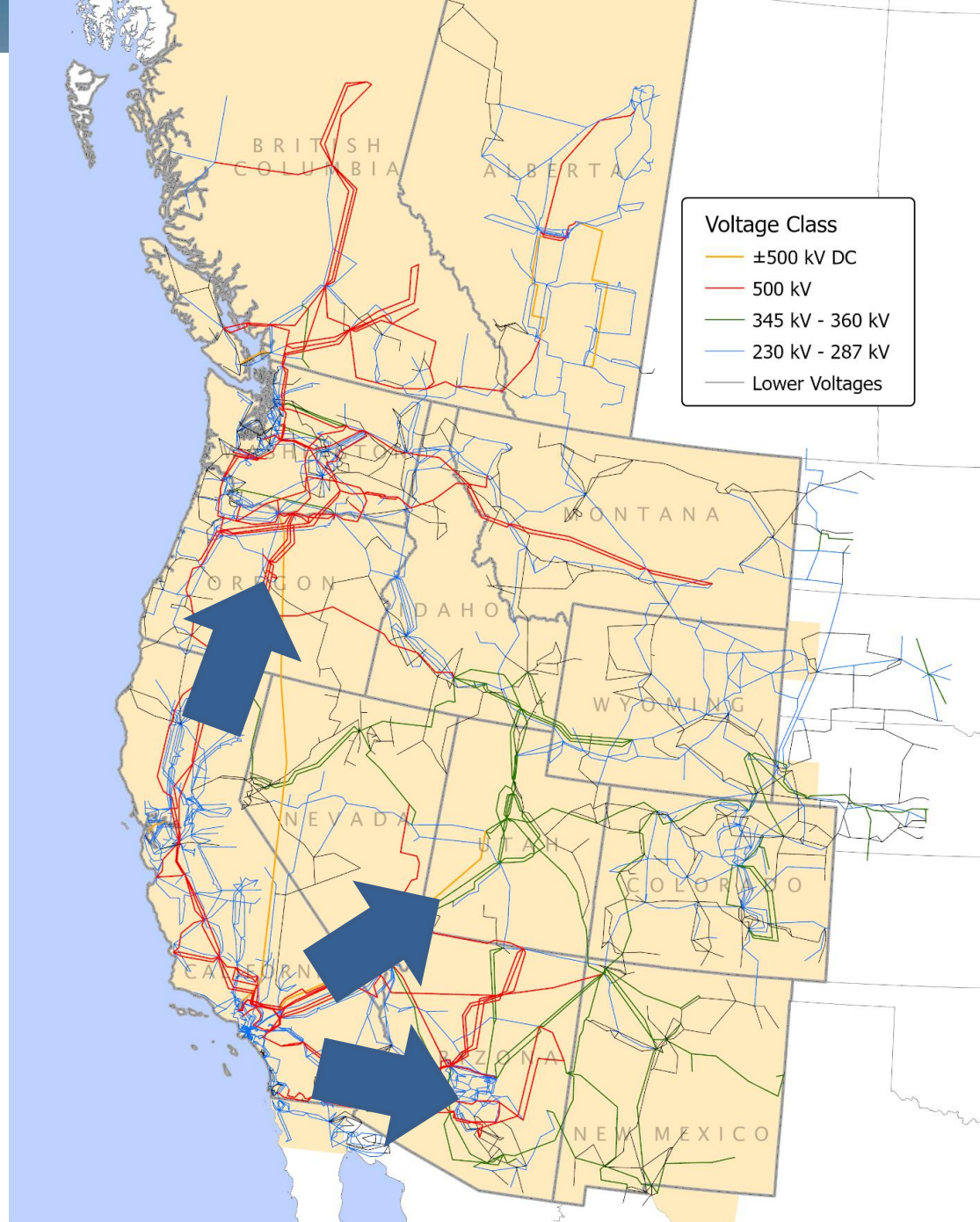
Extreme heat stresses Oregon utilities trying to keep people cool and prevent fires



APS record shattered: Customers' energy use sets new peak twice in two days



Tucson Electric meets demand peak beyond forecast



Stay connected



California ISO



ISO Today
mobile app



California ISO
Daily Briefing



Sign up for
Flex Alerts



Follow us on social media.

Northwest Power and Conservation Council

Larry Bekkedahl

SVP, Advanced Energy Delivery



November 15, 2023

South-to-North flows

New North of Pearl Flowgate

Flows on the COI and PDCI were significantly south-to-north during hot summer days in 2023, a condition that had never before been observed.

This stressed the 230kV infrastructure on PGE's westside, denoted by the new "North of Pearl" flowgate.

**California-Oregon
500kV AC Intertie (COI)**

Pacific DC Intertie (PDCI)

PacifiCorp experiencing similar constraints on their 230kV system between Klamath Falls and Roseburg

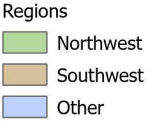
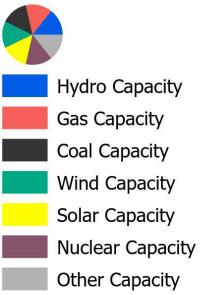
**(Generation from California
and Desert Southwest)**

Google Earth

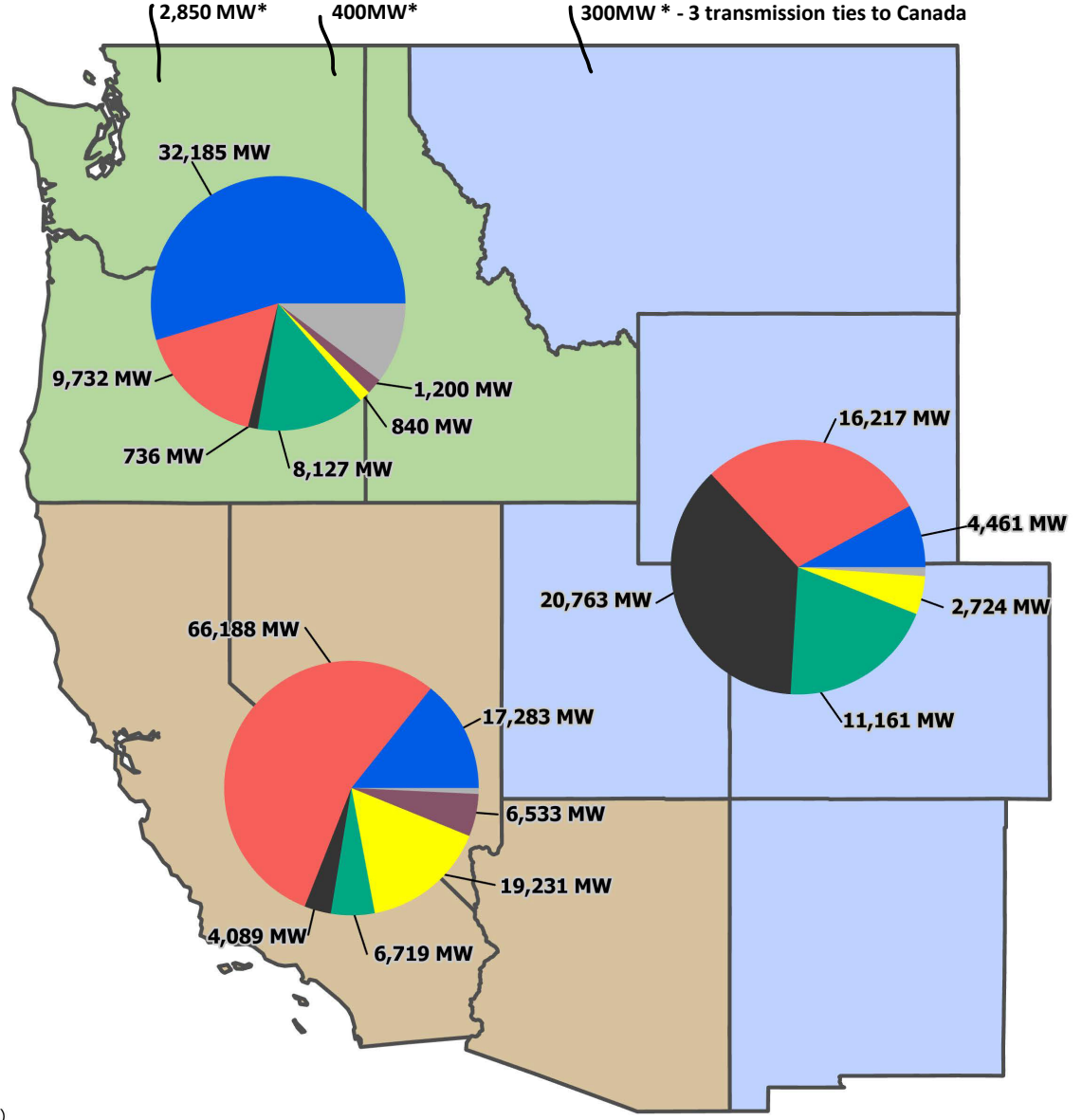
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA

Generation across the west

Regional Generation Capacity (2020)

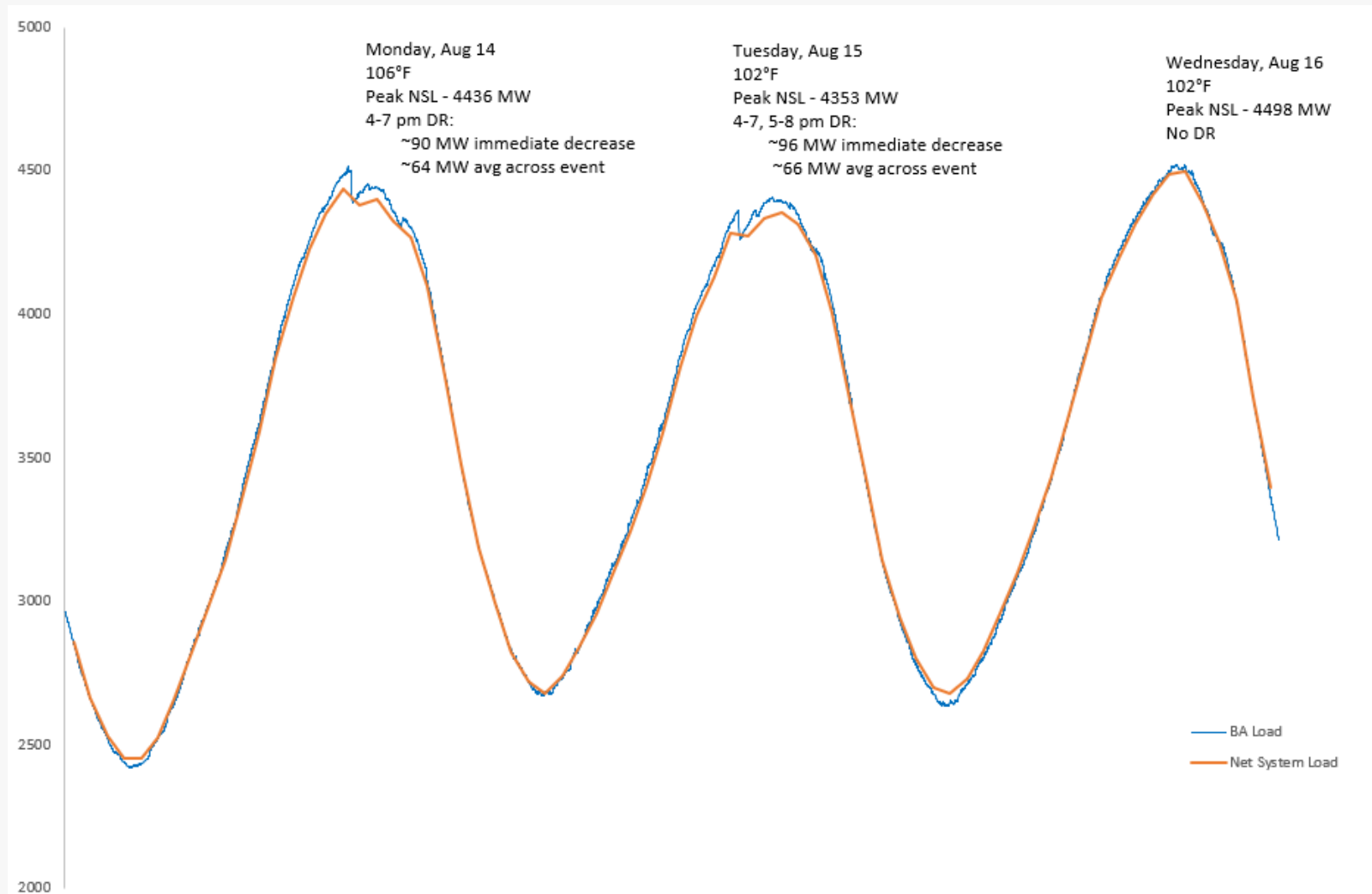


Data Source: EIA Form EIA-860 (2020)



System Load

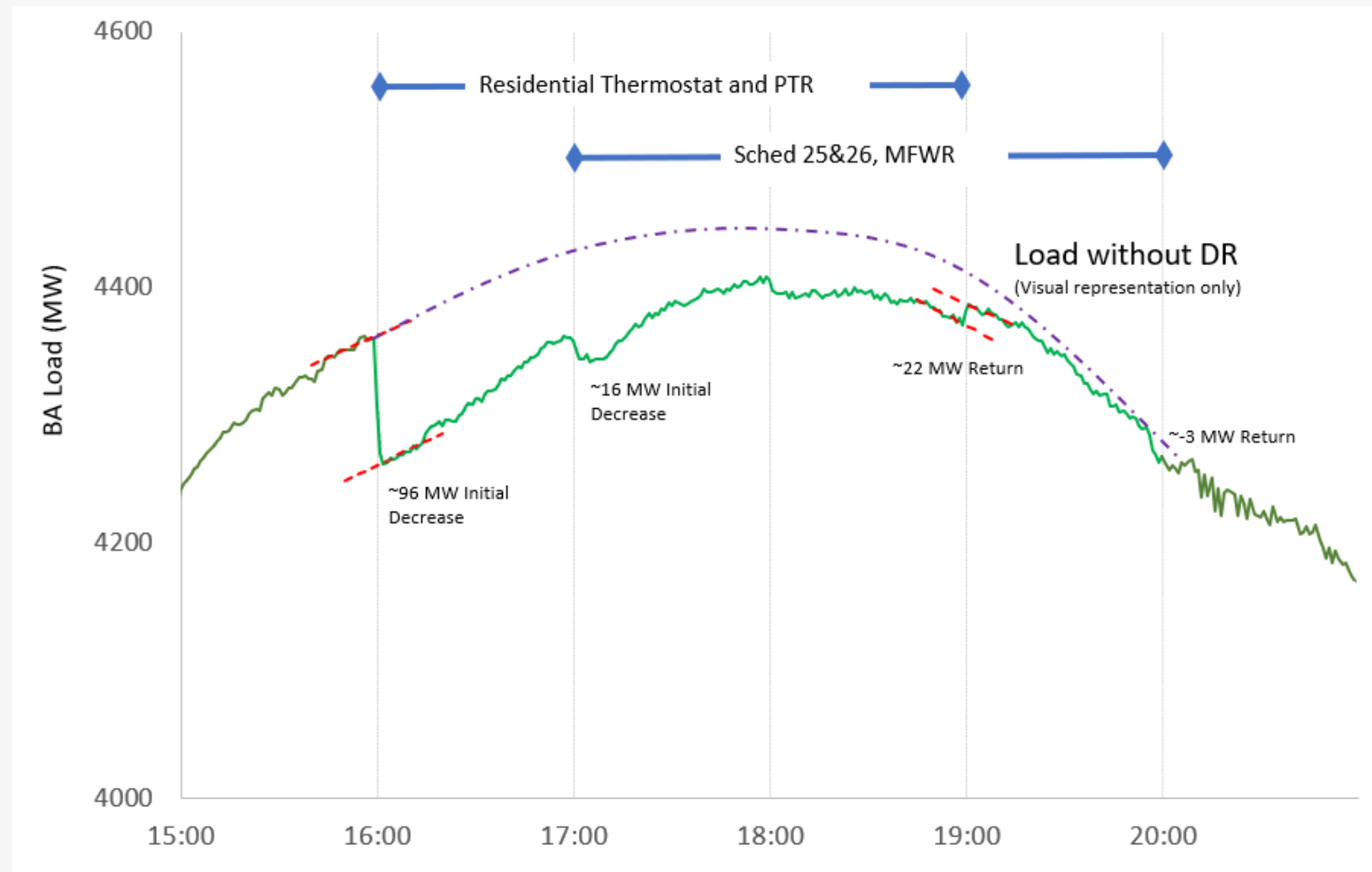
Aug. 14, 15 & 16



System Load

Tuesday, Aug. 15

16:00-20:00



Federal, State & Local Funds

Related to energy, infrastructure and advanced manufacturing

Federal

- Bipartisan Infrastructure Law/ Infrastructure Investment & Jobs Act (BIL/IIJA) (\$1.2 trillion)
- Inflation Reduction Act (\$579 billion)
- CHIPS & Science Act (\$280 billion)

\$2 Trillion

Nationwide, over 10 years

State

- Climate Protection Program
- Clean Fuels Program

\$1-2 Billion

Oregon, through 2030

Local

- Portland Clean Energy Fund

\$750 Million

Portland, next 5 years

CTWS & PGE Regional 500 kV Transmission Innovative Partnership

Topic Area 3: Innovative Partnerships

Grant Award: \$250,000,000

Project Cost: \$613,953,472 (Single Circuit)

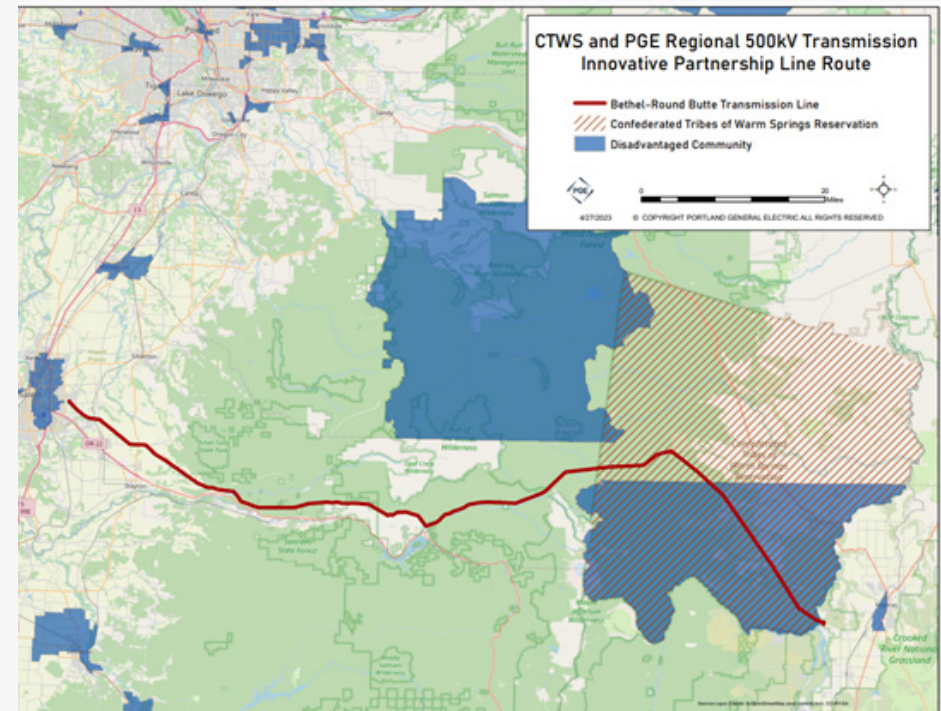
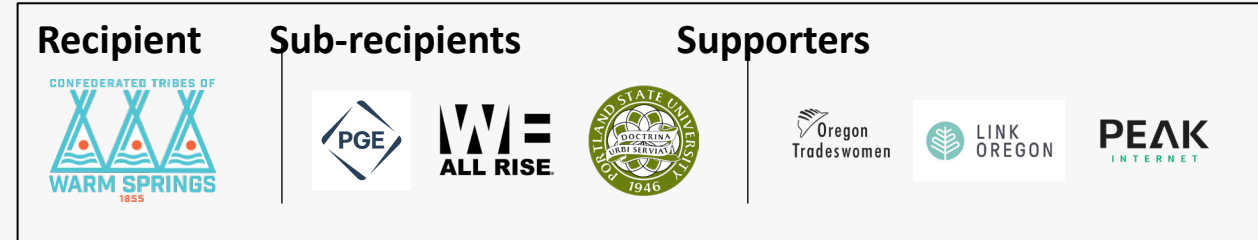
Scope

Create additional transmission capacity (230kV to 500kV) on the existing Bethel-Round Butte Transmission line to unlock moving large amounts of renewable energy from **east of the Cascades**, including those on the Warm Springs Reservation, to **PGE's load centers**. Install **high capacity fiber** optic cables for greater communications resiliency and partner to bring broadband to underserved communities.

Benefits

- Access to affordable and reliable clean energy
- Create Tribal social and economic benefits, including job creation
- Align with state decarbonization mandates
- Improved communications reliability/broadband access
- Workforce development & job creation

Duration: 8 years (start date TBD)



Accelerating and Deploying Grid Edge Computing

Topic Area 2: Grid Flexibility aka “Smart Grid Grants”

Grant Award: \$50,000,000

Project Cost: \$108,402,842

Scope

PGE will deploy **~90K smart grid chips** capable of enabling grid-edge computing (~10% of distribution system). PGE will also build **advanced analytics models** to support real-time decisions and predict pre-outage conditions.

Benefits

- Real-time edge visibility & hosting capacity insights
- Clean energy acceleration (through distributed energy resource (DER) integration & optimization)
- More reliable and clean energy for disadvantaged communities (DACs) (40% deployment in DACs)
- Workforce development

Duration: 5 years *(start date TBD)*

Sub-recipients



VertueLab

Contractors



Wheatridge Grid Forming Inverter Research & Demonstration

Grant Award: \$4,575,000
Project Cost: \$9,895,394

Overview

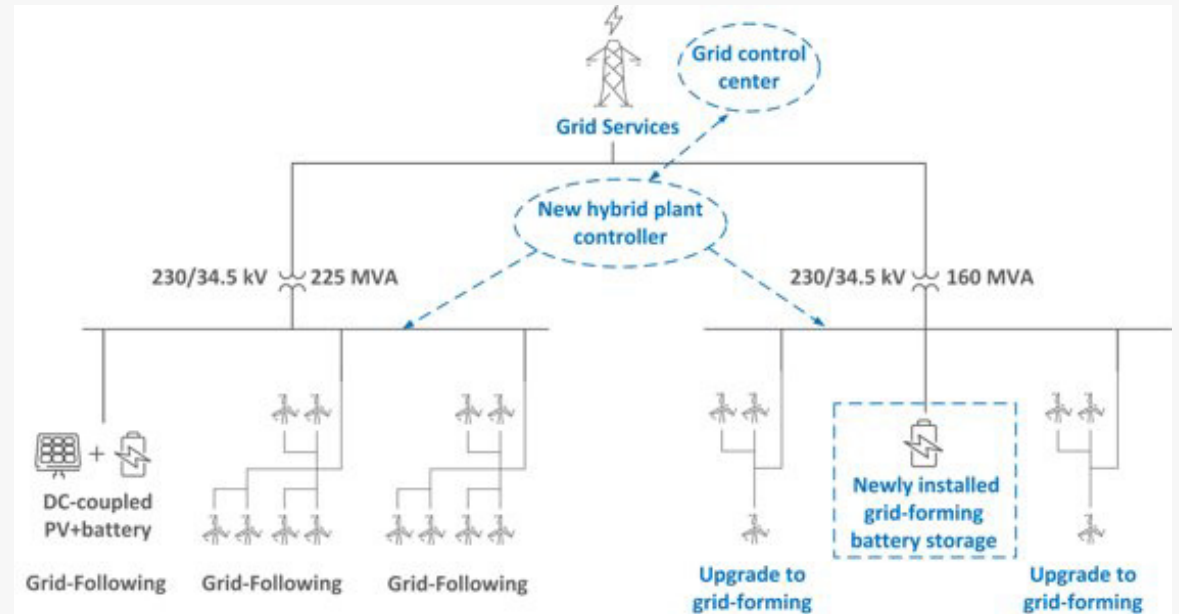
This research project will demonstrate **grid-forming inverters** at the Wheatridge Renewable Energy Facility in Oregon, North America's first energy center to **combine wind, solar, and energy storage systems in one location**. If successful, this will be the first bulk power system-connected grid-forming hybrid power plant in the United States and will encourage utilities to consider including grid-forming capabilities in their own interconnection requirements.

Benefits

- First time that the grid-forming inverters, including both wind and battery storage, are connected to the US bulk power system - **which could accelerate adoption of renewables**
- Workforce development through PSU internship program (minority serving institution)
- DE&I commitments to all recipients and sub-recipients

Duration: 3 years

Sub-recipients



What is a grid forming inverter (GFI)?
GFIs are used to convert direct current (DC) electricity from renewable sources to alternating current (AC) electricity. They have the capability to restart the grid independently and can enhance use of renewable energy.

Pacific Northwest Hydrogen Hub

Boardman Node

Grant Award: Up to \$1B (for PWN consortium)
Expected for Boardman Node: \$200,000,000 (\$10M for PGE)

Overview

Spans Washington, Oregon, and Montana, and plans to produce **clean hydrogen exclusively via electrolysis**. The use of electrolyzers will play a key role in driving down electrolyzer costs, making the **technology more accessible** to other producers, and reducing the cost of hydrogen production.

Benefits of PNW Consortium Hub

- Remove approximately 1 million metric tons per year of CO2 emissions
- Priority hiring programs for former coal industry workers & job creation
- Investment in worker training
- Clean hydrogen production tax credits for PGE
- Support reliability with carbon-free capacity resource

Duration: Anticipated to be 9 years (start date TBD)

Recipient



Sub-recipients (Boardman Node)



What is a hydrogen electrolyzer?

A hydrogen electrolyzer is a device that uses electricity to split water into hydrogen and oxygen. The hydrogen gas can be used for various purposes, such as fuel, energy storage, or industrial processes.



The Evolving Grid

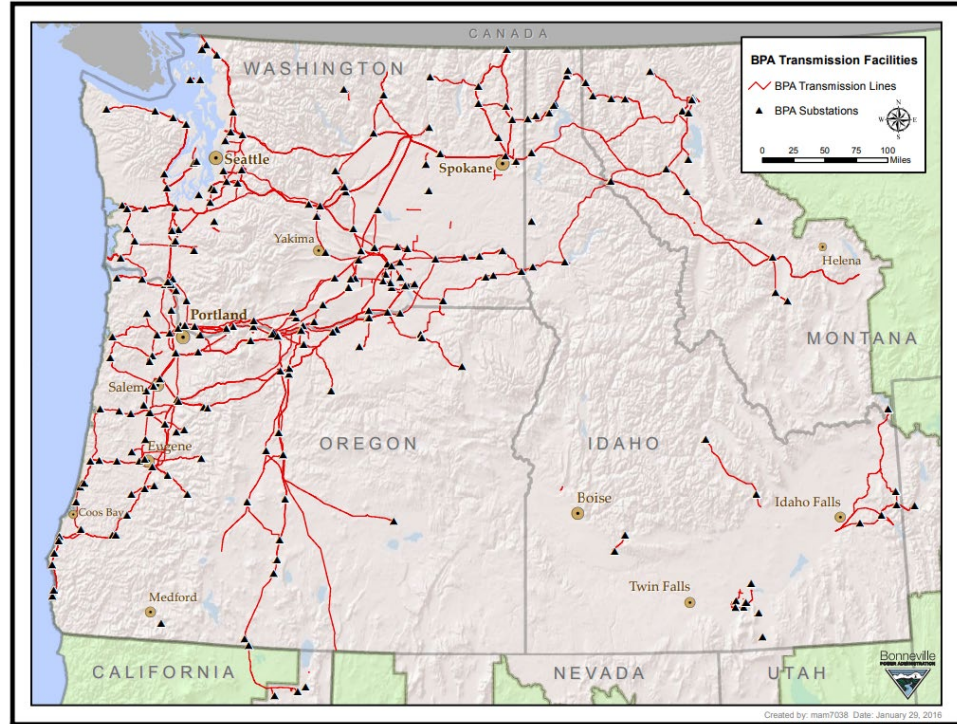
Summer Operations Update

Ricky Bustamante
Acting Vice-President, Transmission System Operations
Bonneville Power Administration
November 15, 2023



BPA Infrastructure

- BPA markets power from 31 Federal hydro plants, the Columbia Generating Station Nuclear Plant, and several small non-Federal power plants.
- BPA owns no power generators.
- About 80% of the power BPA sells is hydroelectric.
- BPA accounts for about 28% of the electric power consumed within the PNW and over 50% of power consumed in WA.
- BPA owns and operates 15,000+ circuit miles of transmission lines, about 75% of transmission in its service territory
- BPA owns and operates 3500+ miles of fiber optic network
- BPA transmission serves over 300 customers



Rapidly Evolving NW Landscape

2000s

- California Energy Crisis, shutdown of aluminum industry
- Addition of 5.5 GW of natural gas plants in the NW
- Start of large scale wind integration



BPA Grand Coulee – Bell 500 kV
 BPA Schultz – Wautoma 500 kV
 BPA John Day, Rock Creek, Shepherd Flats,
 Central Ferry wind hubs

2010s

- Large scale wind integration continues, reached 7 GW, then slowed down
- Anemic load growth



BPA Bakeoven 500 kV series capacitors
 BPA Central Ferry – Lower Monumental 500 kV
 BPA McNary – John Day 500 kV
 BPA Big Eddy – Knight 500 kV
 Pacific HVDC Intertie Celilo upgrade

2020s

- Progressive de-carbonization policies
- Accelerated need for carbon-free resources
- Load growth accelerating
- Climate change challenges - extreme temperatures and wildfires



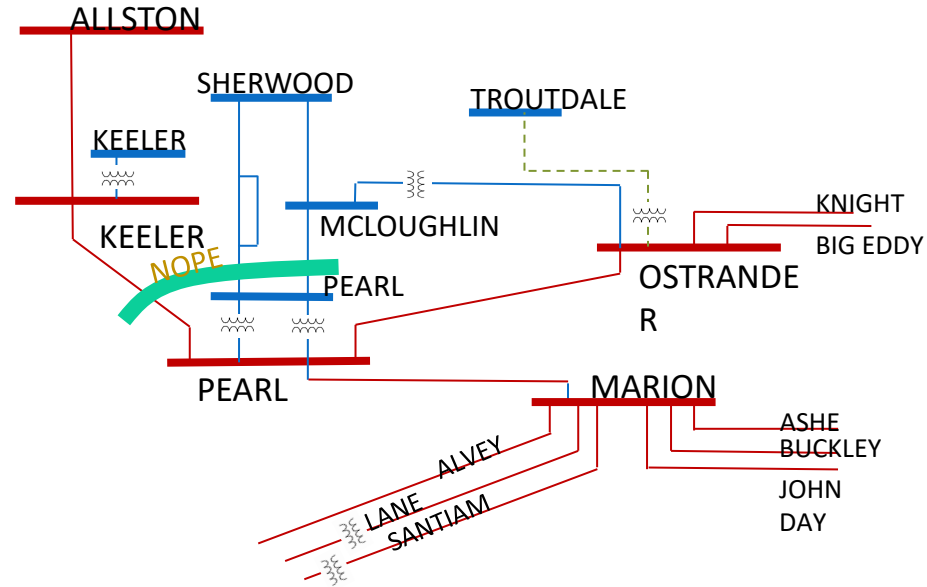
August 2023 - Operating Plan

Going into the weekend Operating Plan

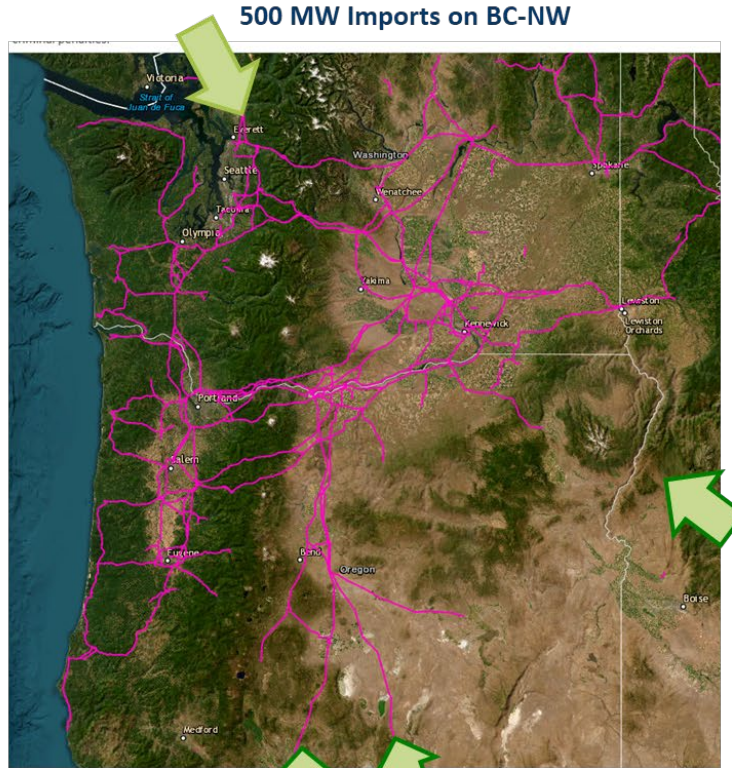
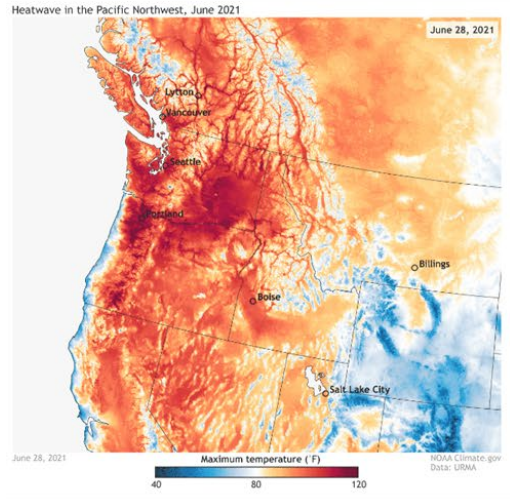
1. Sectionalize BPA's System
2. Sectionalize PGE's System
3. Place a TCOR on NWACI S>N if unscheduled flows
4. Increase Generation North of Portland

Notable outages:

- McNary – Ross #1 345kV line
 - construction tower rebuild/upgrade.
- Troutdale 500/230 Bank 1
 - Transformer failure in 2022



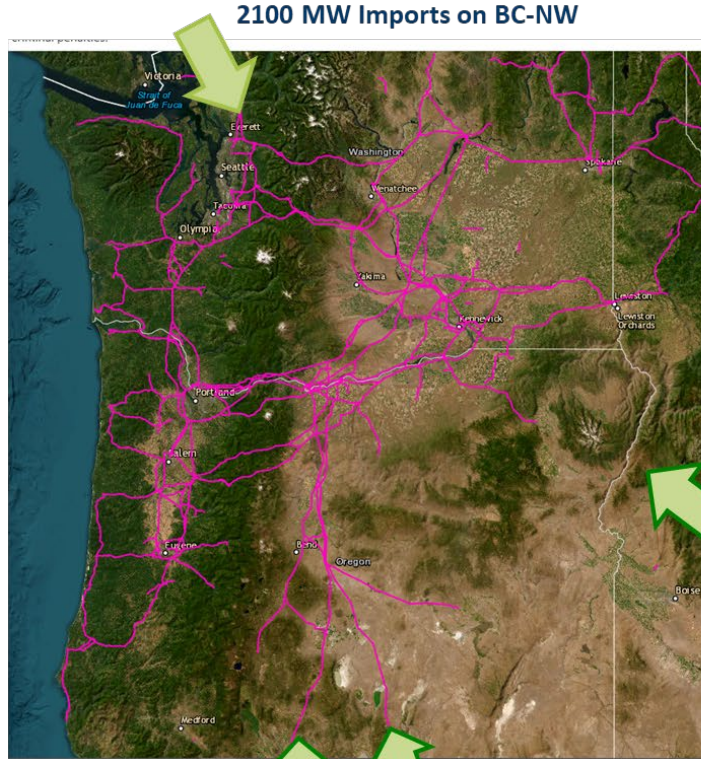
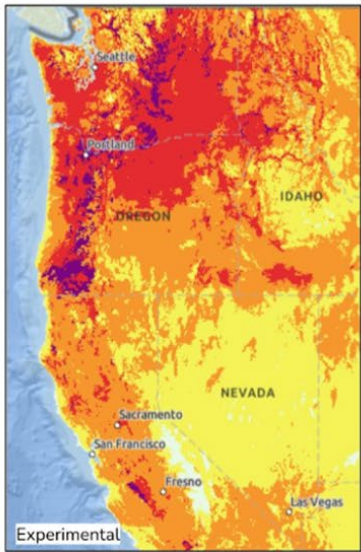
June 28, 2021



1000 MW Imports on NWACI

500 MW Imports on PDCI

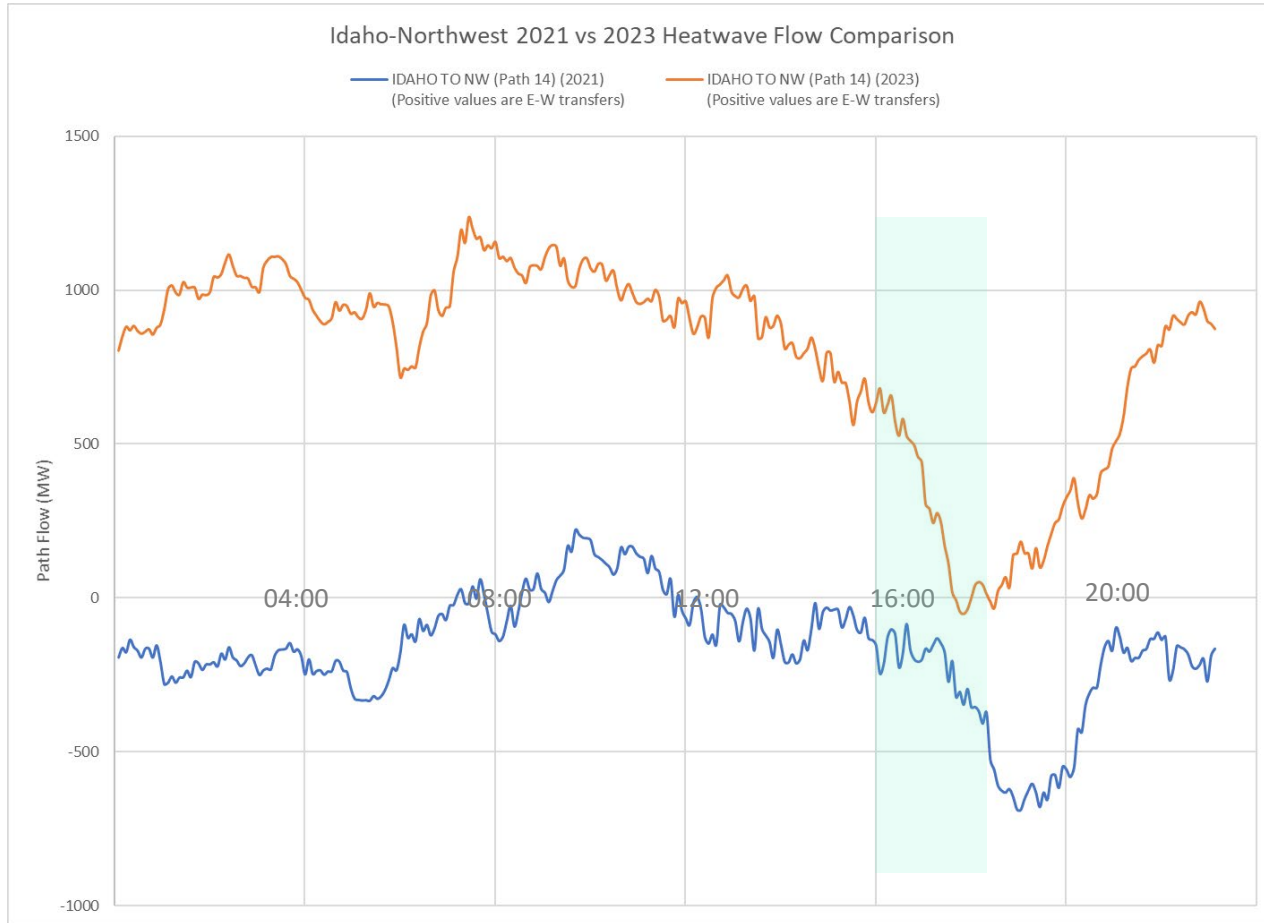
August 14, 2023



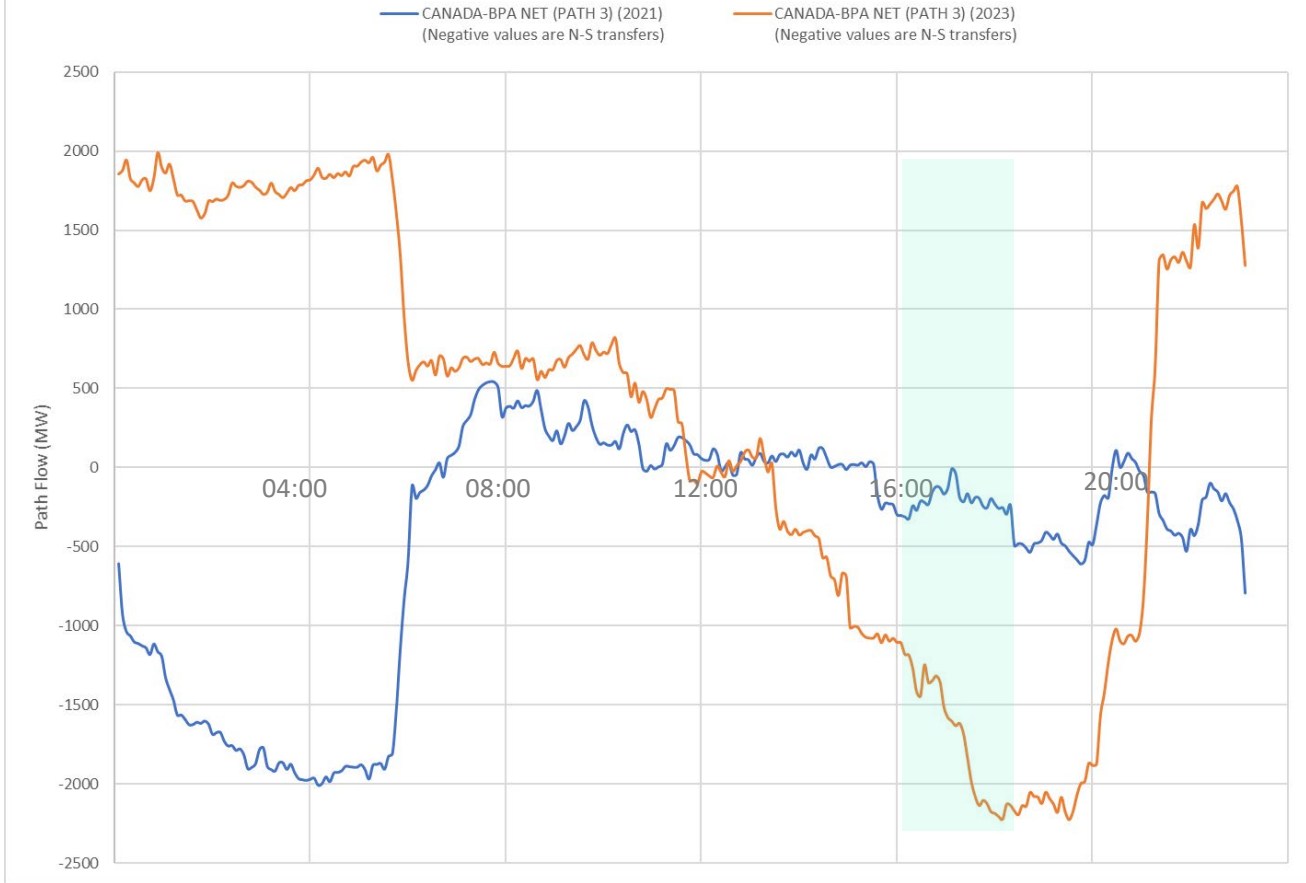
1200 MW Imports on NWACI

300 MW Imports on PDCI

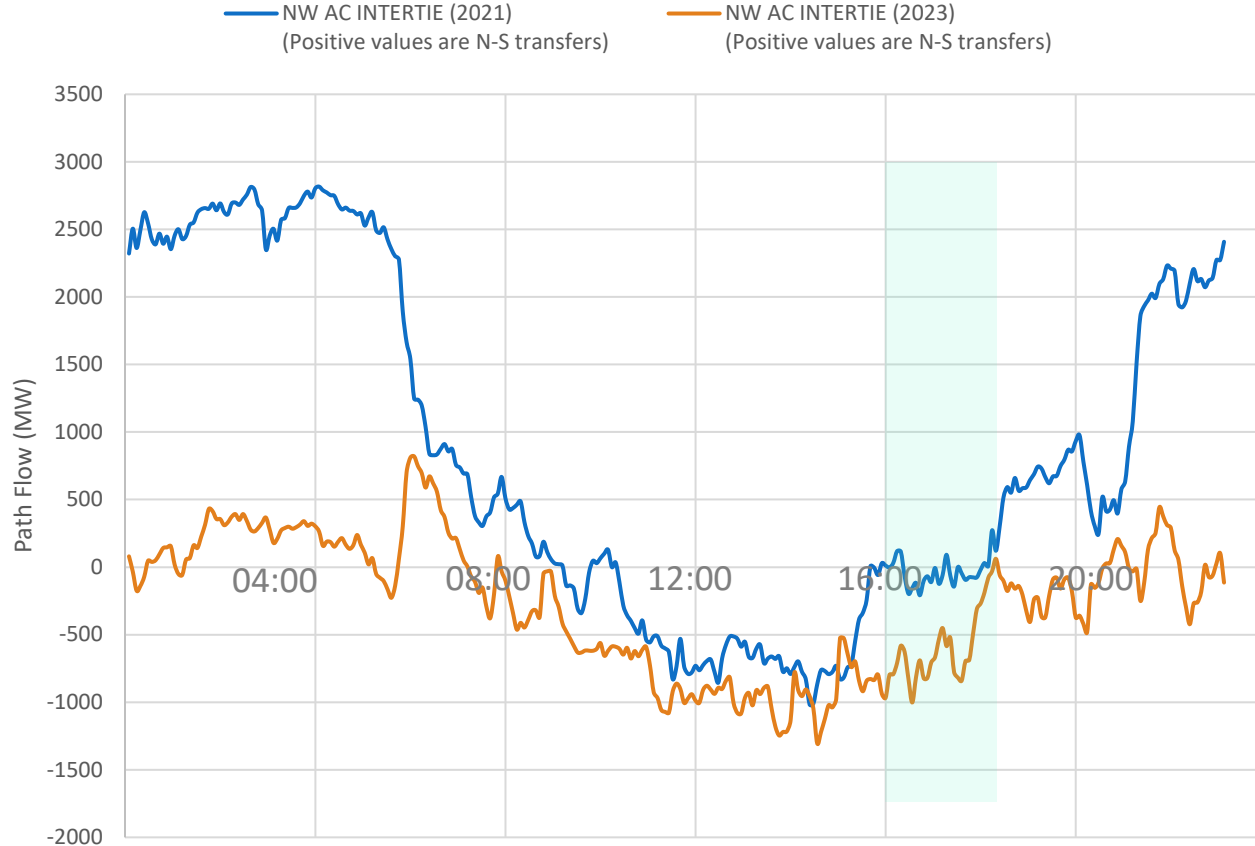
0 MW Imports on Idaho-NW



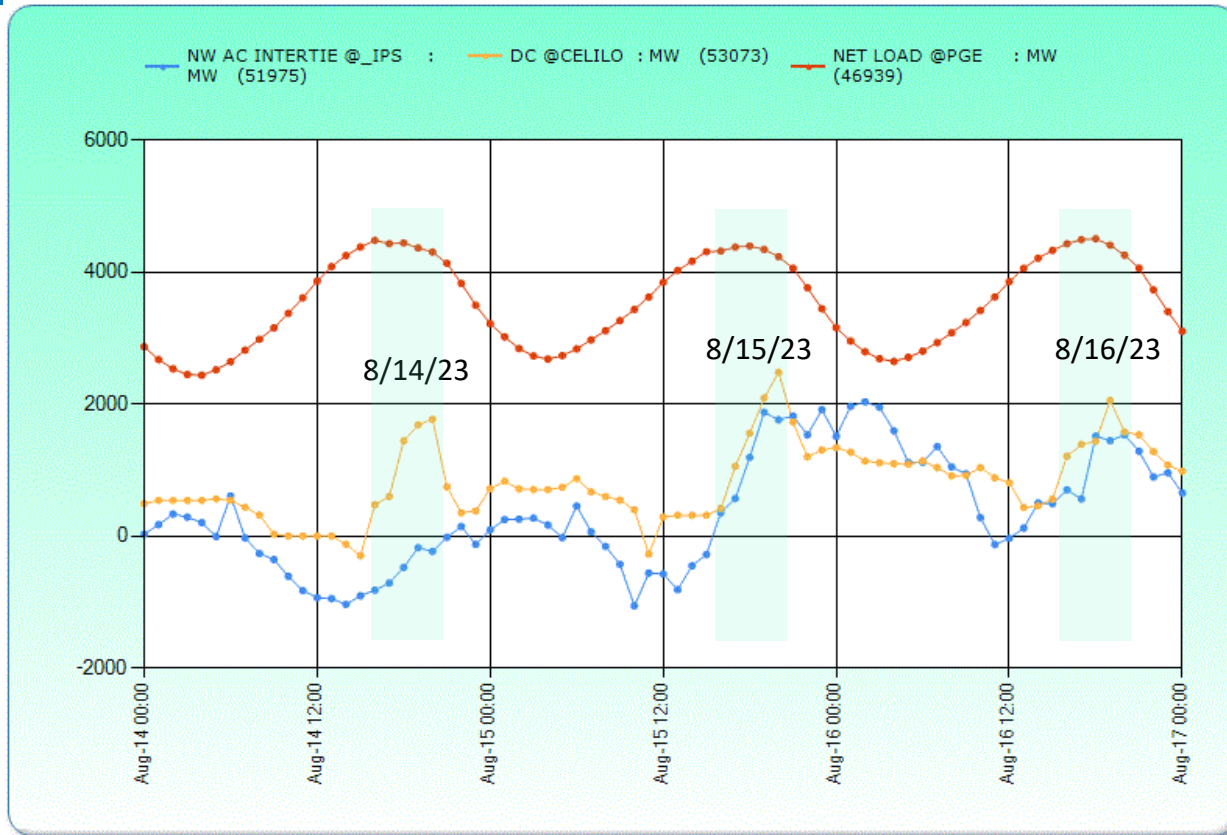
Canada-BPA NET (PATH 3) 2021 vs 2023 Heatwave Flow Comparison



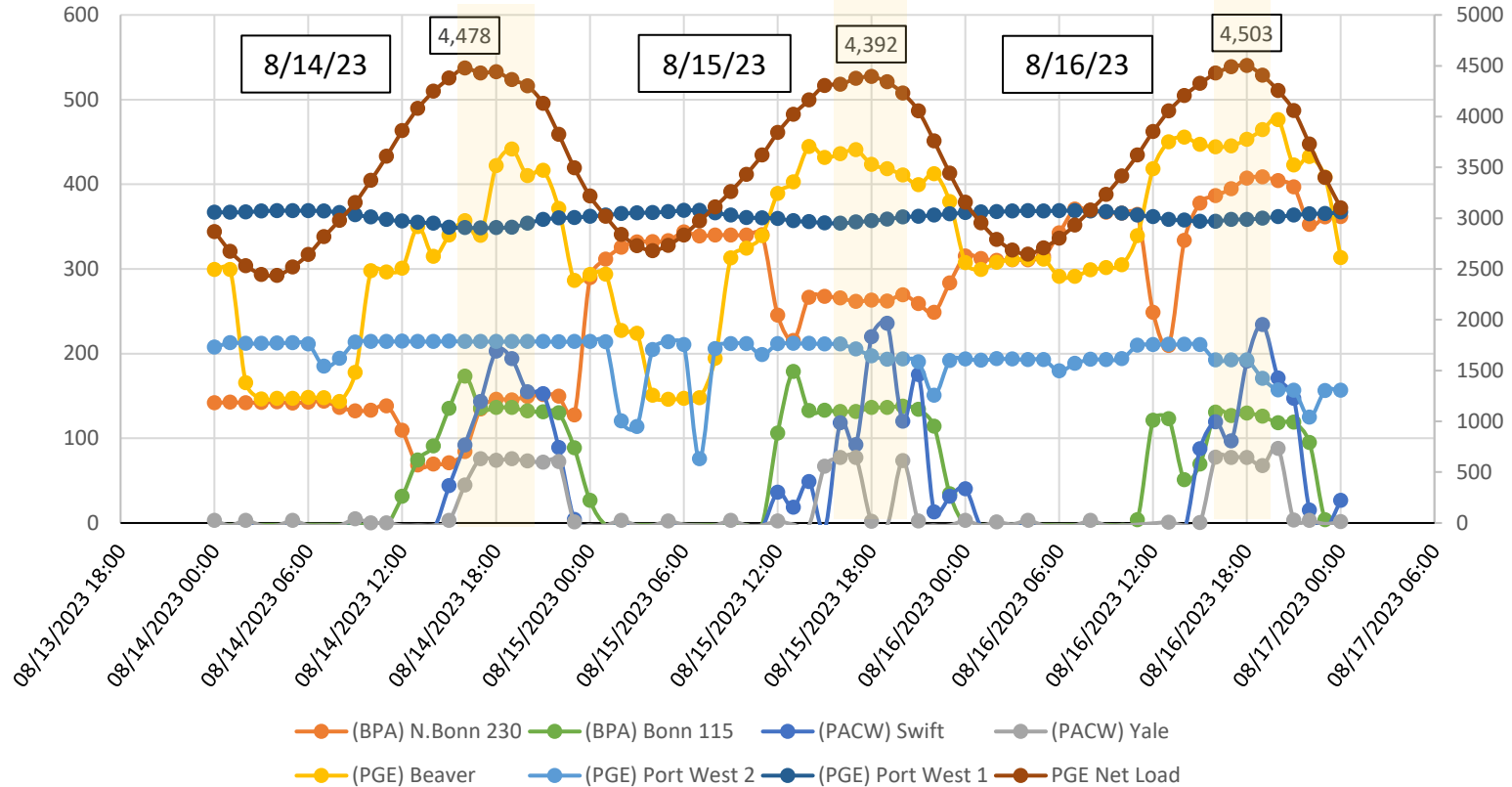
NWACI 2021 vs 2023 Heatwave Flow Comparison



PDX Load and Southern Intertie



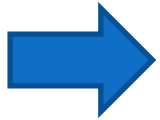
FCRPS Generation



Studies

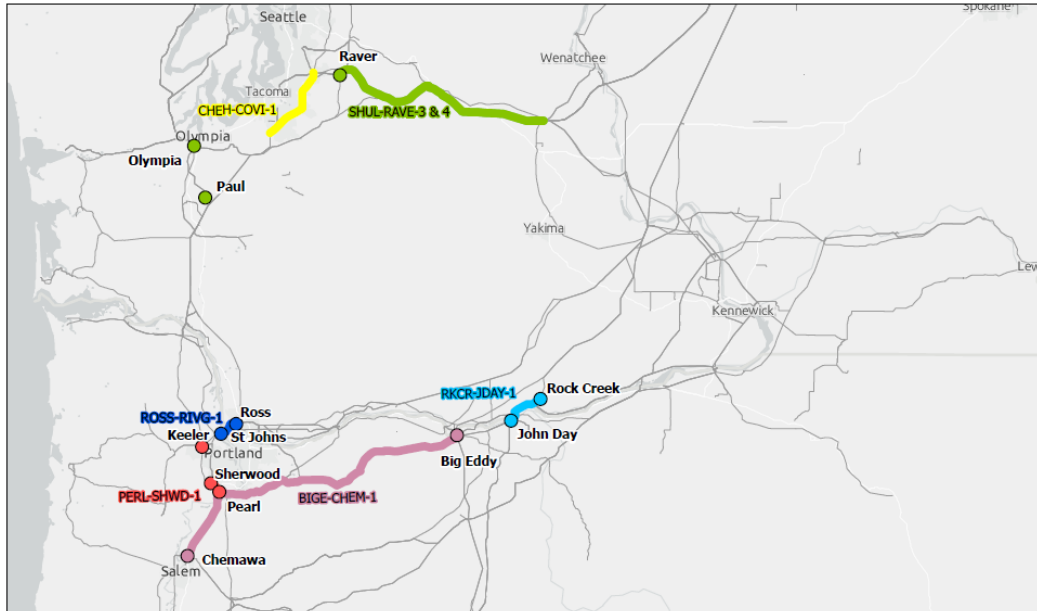
2020s

- Progressive de-carbonization policies
- Accelerated need for carbon-free resources
- Load growth accelerating
- Climate change challenges - extreme temperatures and wildfires



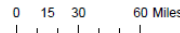
- BPA is one of the main forces behind inter-regional planning efforts to increase region's access to diverse resources.
 - Montana and Wyoming Wind
 - Desert Southwest solar
 - Off-shore wind
- BPA is active in many regional efforts including convening the Western Transmission Expansion Coalition, decarbonization, and extreme weather studies.
- BPA Announced \$2.2B Evolving Grid Project Portfolio

Evolving Grid Projects



Tier 1 Projects

- Cross Cascades North: Schultz-Raver Reconductor+
- Raver Paul: Chehalis-Cowlitz Tap 230kV Rebuild
- South of Allston: Ross-Rivergate 230kV Rebuild
- Cross Cascades South: Big Eddy-Chemawa 500kV Rebuild
- South of Knight: Rock Creek-John Day Upgrade
- Portland Area



Date: 5/10/2023



Thank you