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 Administrations 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 2023 State of the Interconnection**

**WECC-wide: A changing resource mix**

<table>
<thead>
<tr>
<th>5-Year Lookback</th>
<th>2017</th>
<th>2021</th>
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</thead>
<tbody>
<tr>
<td>Coal</td>
<td>37 GW</td>
<td>24 GW</td>
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<tr>
<td>Natural Gas</td>
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<tr>
<td>Hydro</td>
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<td>73 GW</td>
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<tr>
<td>Nuclear</td>
<td>8 GW</td>
<td>8 GW</td>
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<table>
<thead>
<tr>
<th>5-Year Lookback</th>
<th>2017</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>206,000 GWh</td>
<td>142,000 GWh</td>
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<tr>
<td>Natural Gas</td>
<td>221,000 GWh</td>
<td>283,000 GWh</td>
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<tr>
<td>Wind</td>
<td>55,000 GWh</td>
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<td>Solar</td>
<td>38,000 GWh</td>
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<tr>
<td>Hydro</td>
<td>257,000 GWh</td>
<td>208,000 GWh</td>
</tr>
<tr>
<td>Nuclear</td>
<td>58,000 GWh</td>
<td>57,000 GWh</td>
</tr>
</tbody>
</table>

Source: [WECC 2023 SOTI](#)
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
Portland records all-time high temperature of 116, setting new record for third day in a row

June 2021
The West helping the West

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

Source: USDA - NRCS
Summer 2023

NOAA Summer Forecast: Above Average in Desert Southwest

Source: NOAA CPC
Summer 2023

**Phoenix Metro:** July heatwave

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!

**Pacific Northwest:** Mid-August heatwave
The West helping the West

July-August 2023

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

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

Tucson Electric meets demand peak beyond forecast
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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.

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

(Generation from California and Desert Southwest)
Generation across the west
System Load

Aug. 14, 15 & 16

- Monday, Aug 14
  - Peak NSL: 4436 MW
  - 4-7 pm DR:
    - ~90 MW immediate decrease
    - ~54 MW avg across event
- Tuesday, Aug 15
  - Peak NSL: 4353 MW
  - 4-7, 5-8 pm DR:
    - ~96 MW immediate decrease
    - ~68 MW avg across event
- Wednesday, Aug 16
  - Peak NSL: 4498 MW
  - No DR
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)

**State**
- Climate Protection Program
- Clean Fuels Program

**Local**
- Portland Clean Energy Fund

$2 Trillion
Nationwide, over 10 years

$1-2 Billion
Oregon, through 2030

$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)*
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

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)

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

2010s
- Large scale wind integration continues, reached 7 GW, then slowed down
- Anemic load growth

2020s
- Progressive de-carbonization policies
- Accelerated need for carbon-free resources
- Load growth accelerating
- Climate change challenges - extreme temperatures and wildfires

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

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
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
Idaho-Northwest 2021 vs 2023 Heatwave Flow Comparison

Positive values are E-W transfers

Path Flow (MW)

04:00 08:00 12:00 16:00 20:00
NWACI 2021 vs 2023 Heatwave Flow Comparison

Path Flow (MW)

- Blue line: NW AC INTERTIE (2021)
  - Positive values are N-S transfers
- Orange line: NW AC INTERTIE (2023)
  - Positive values are N-S transfers

04:00 08:00 12:00 16:00 20:00
PDX Load and Southern Intertie

- NW AC INTERTIE @IPS: MW (51975)
- DC @CELILLO: MW (53073)
- NET LOAD @PGE: MW (46939)

Dates: 8/14/23, 8/15/23, 8/16/23
FCRPS Generation

- 8/14/23: 4,478
- 8/15/23: 4,392
- 8/16/23: 4,503

(BPA) N.Bonn 230  |  (BPA) Bonn 115  |  (PACW) Swift  |  (PACW) Yale
(PGE) Beaver     |  (PGE) Port West 2 | (PGE) Port West 1 | PGE Net Load
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