



**Technical Session**  
**January 2024 Winter Storm Impacts**  
**June 11, 2024**

## Background

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In January of 2024, two winter storm events that provided reliability challenges in the Western Interconnection occurred one after the other. During these storms—winter storms Gerri and Heather—entities in the Western Interconnection experienced high demand due to record low temperatures, energy emergencies, low wind conditions affecting generation, transmission congestion, and issues with natural gas supplies. Although there was no subsequent load shedding as confirmed in the [FERC-NERC Regional Review](#), abnormal system conditions and market responses provided valuable lessons that can inform the industry on the threats posed by extreme natural events.

For this technical session, WECC staff will present the overall conditions during these storms and the subsequent reliability challenges with industry representatives.

- Greg Park, Manager of Risk Analysis and Data Services, WECC
- Lane Belsher, Director of Grid & Market Operations, AESO
- Dmitry Kosterev, Senior Transmission Planner, BPA
- Tim Beach, Director of Reliability Coordination, RC West/CAISO

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# Winter Storms Gerri/Heather Western Interconnection Impacts

June 11, 2024

Greg Park, Manager Risk  
Analysis and Data Services

<Public>

# FERC/NERC Performance Review

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- Team was made up of staff from FERC, NERC, and Regional Entities
- WECC participated with two subject matter experts
  - Scott Rowley, Senior Reliability Specialist—Situational Awareness & Infrastructure Security
  - Greg Park, Manager, Risk Analysis & Data Services
- Public presentation to the FERC commission occurred on April 25, 2024  
[April 25, 2024, Open Meeting | Federal Energy Regulatory Commission \(ferc.gov\)](https://www.ferc.gov/open-2024-04-25)

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# FERC/NERC Performance Review

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- The team interviewed all U.S. entities that experienced any level of Energy Emergency Alerts (EEA) in addition to the following:
  - Two PNW entities that experienced emissions-related issues or concerns related to the cold weather.
  - One SW entity that experienced gas delivery constraints during the period.
  - One PNW entity that experienced gas delivery issues.
  - One NE entity that experienced a RAS misoperation—Not necessarily a failure caused by cold weather.
  - Two Western Interconnection RCs

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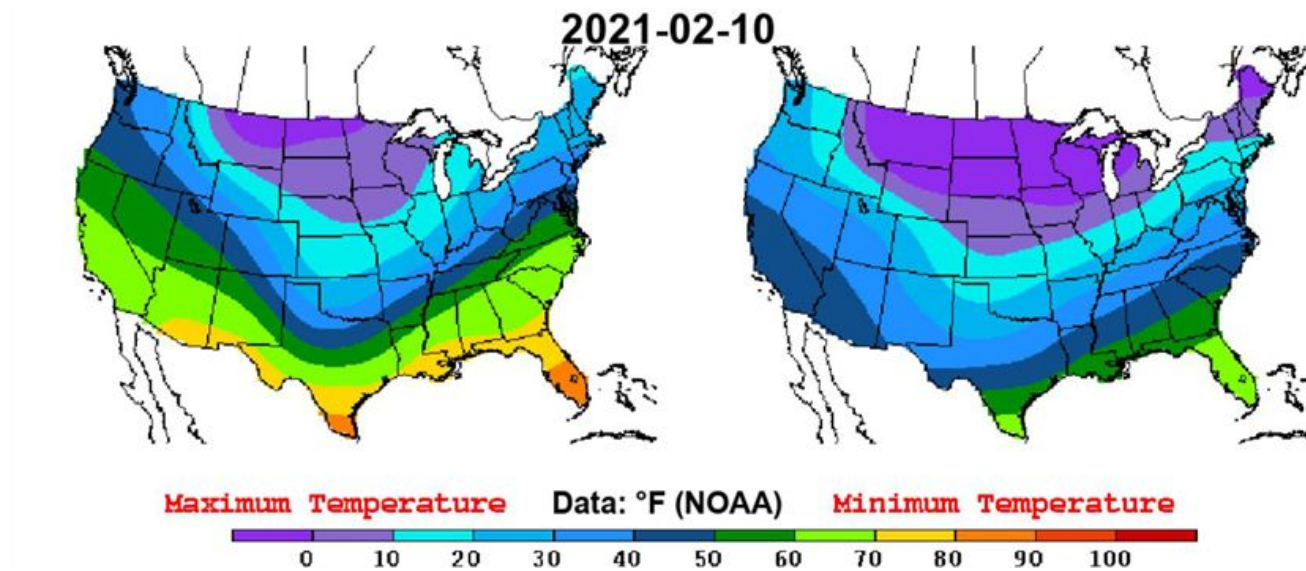
## Western Interconnection Energy Emergency Alerts

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- Entity 1—Four days of EEA 3 (12<sup>th</sup>–15<sup>th</sup> over 17 hours total) **NO Operator-initiated load shed occurred.**
- Entity 2—One day of EEA 3 (13<sup>th</sup>—almost three hours), one day of EEA 1 (14<sup>th</sup>—under one hour) **NO Operator-initiated load shed occurred.**
- Entity 3—Three days of EEA 1 (13<sup>th</sup>, 14<sup>th</sup>, 15<sup>th</sup>—nine hours total).
- Entity 4—One day of EEA 1 (13<sup>th</sup>—almost seven hours total).
- Entity 5—Two days of EEA 1 (13<sup>th</sup> and 14<sup>th</sup>—over 26 hours total).
- Over 63 hours of accumulated time over the four days.

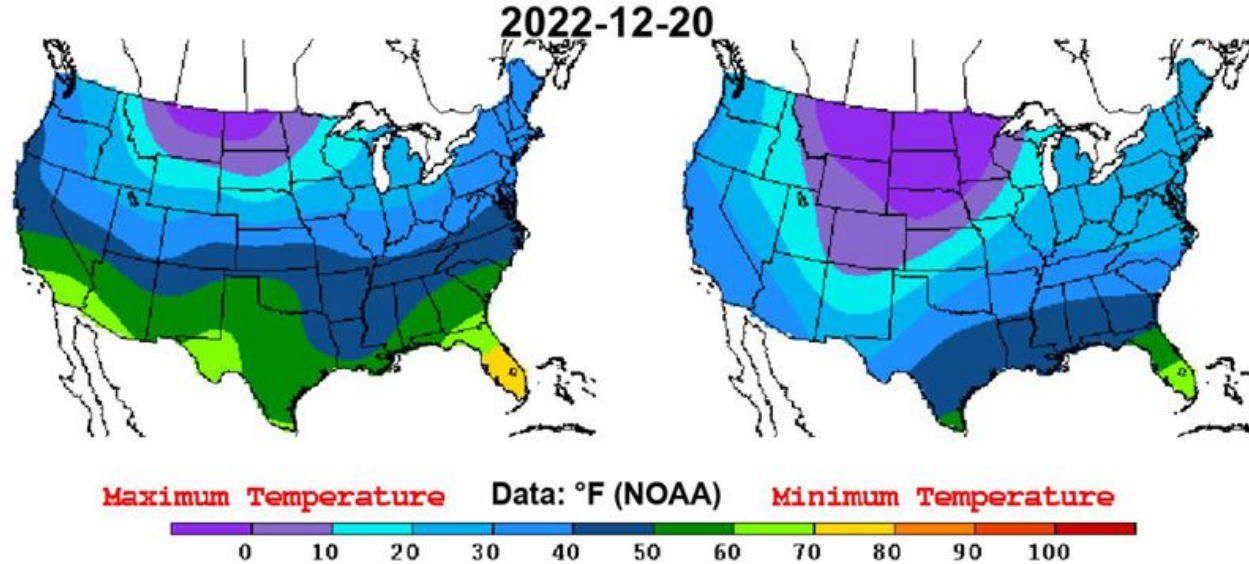
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# Weather—2021 Uri



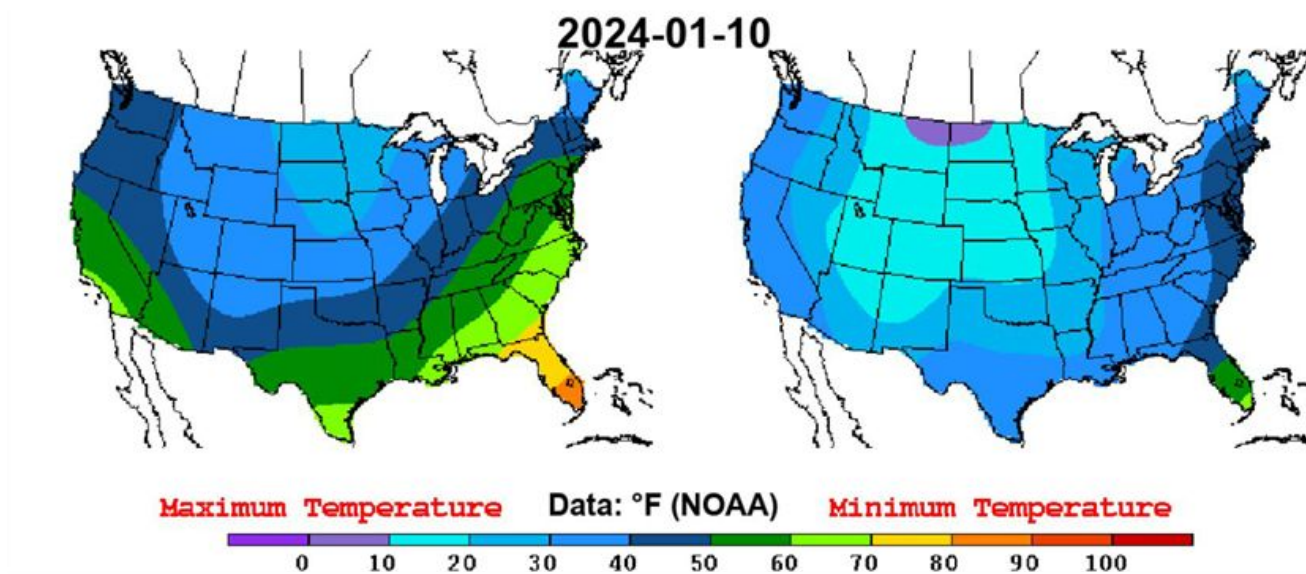
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# Weather—2022 Elliot



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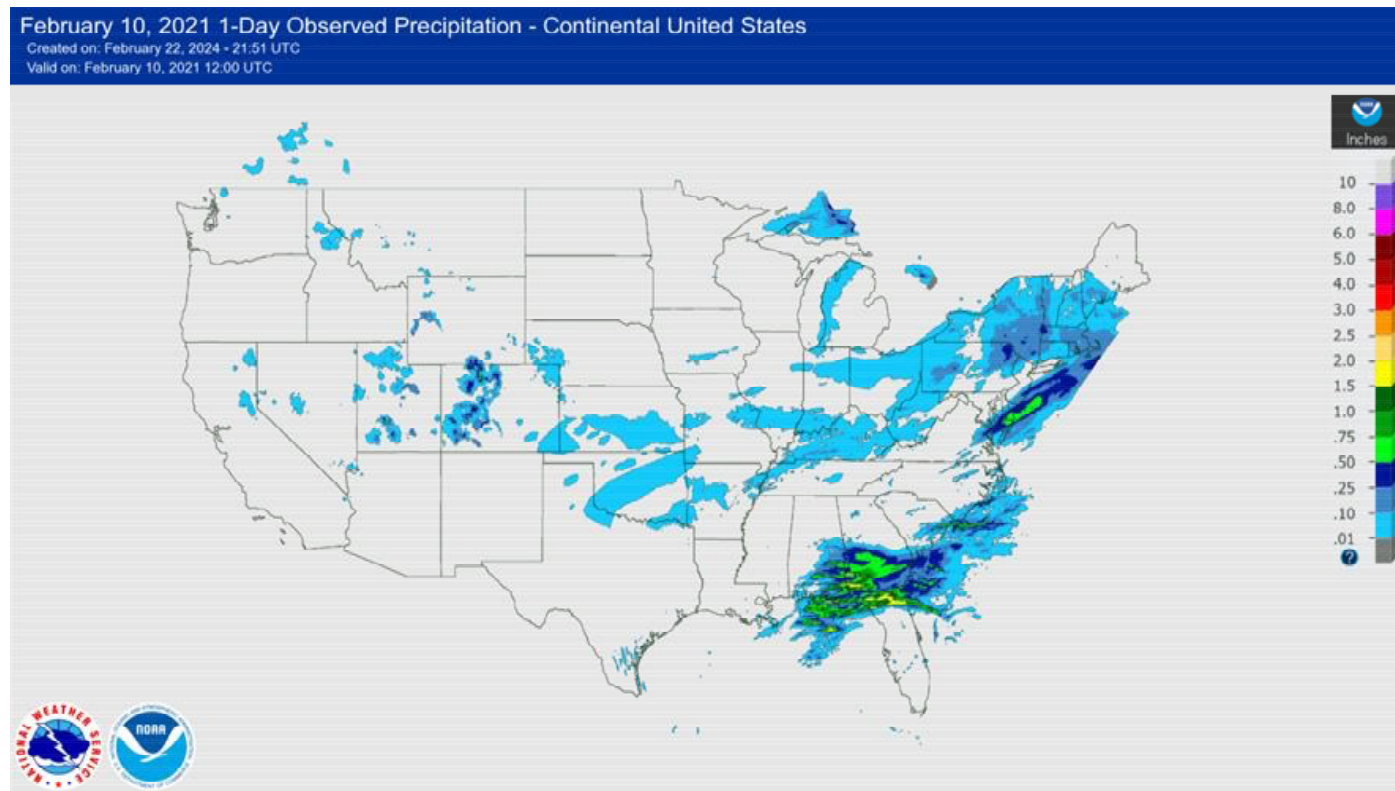
# Weather—2024 Gerri/Heather





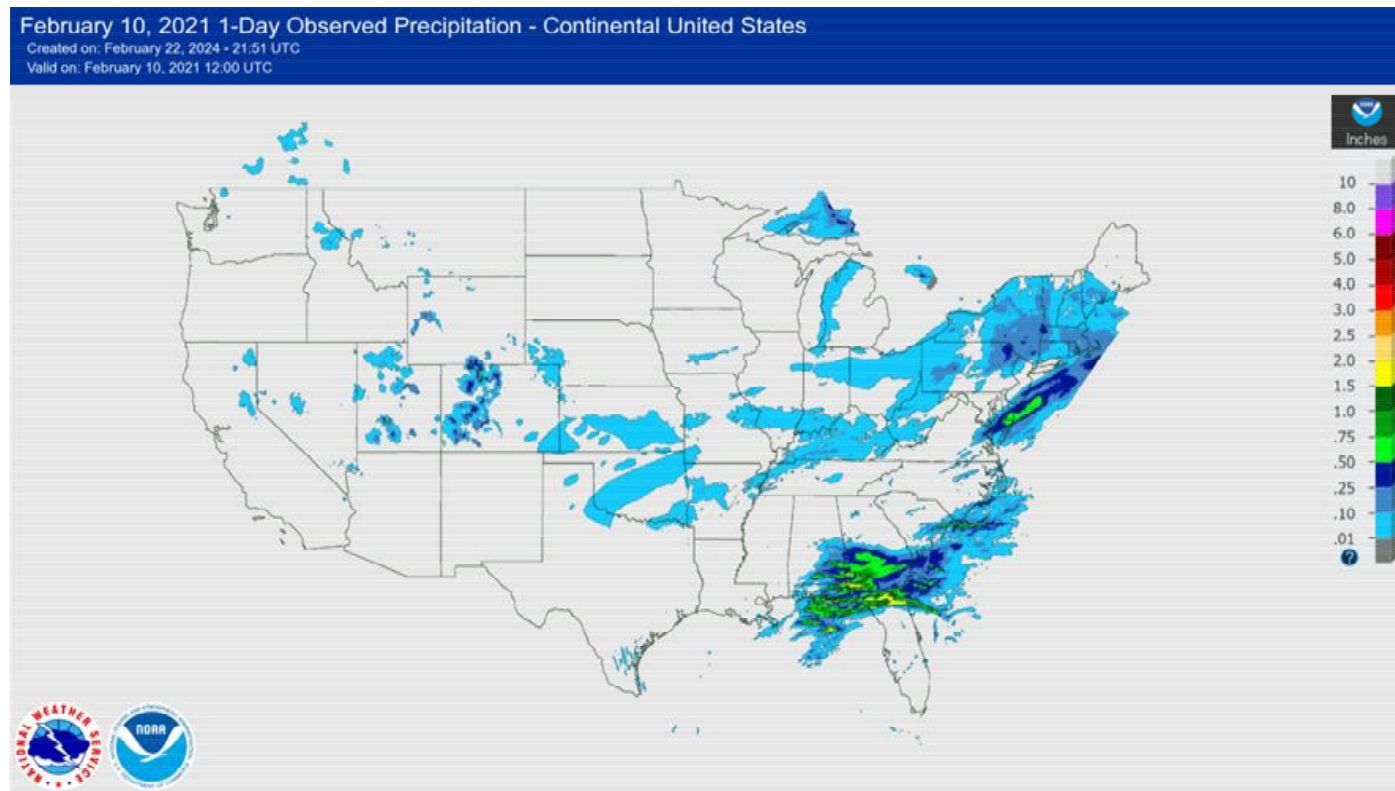
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# Weather—2021 Uri



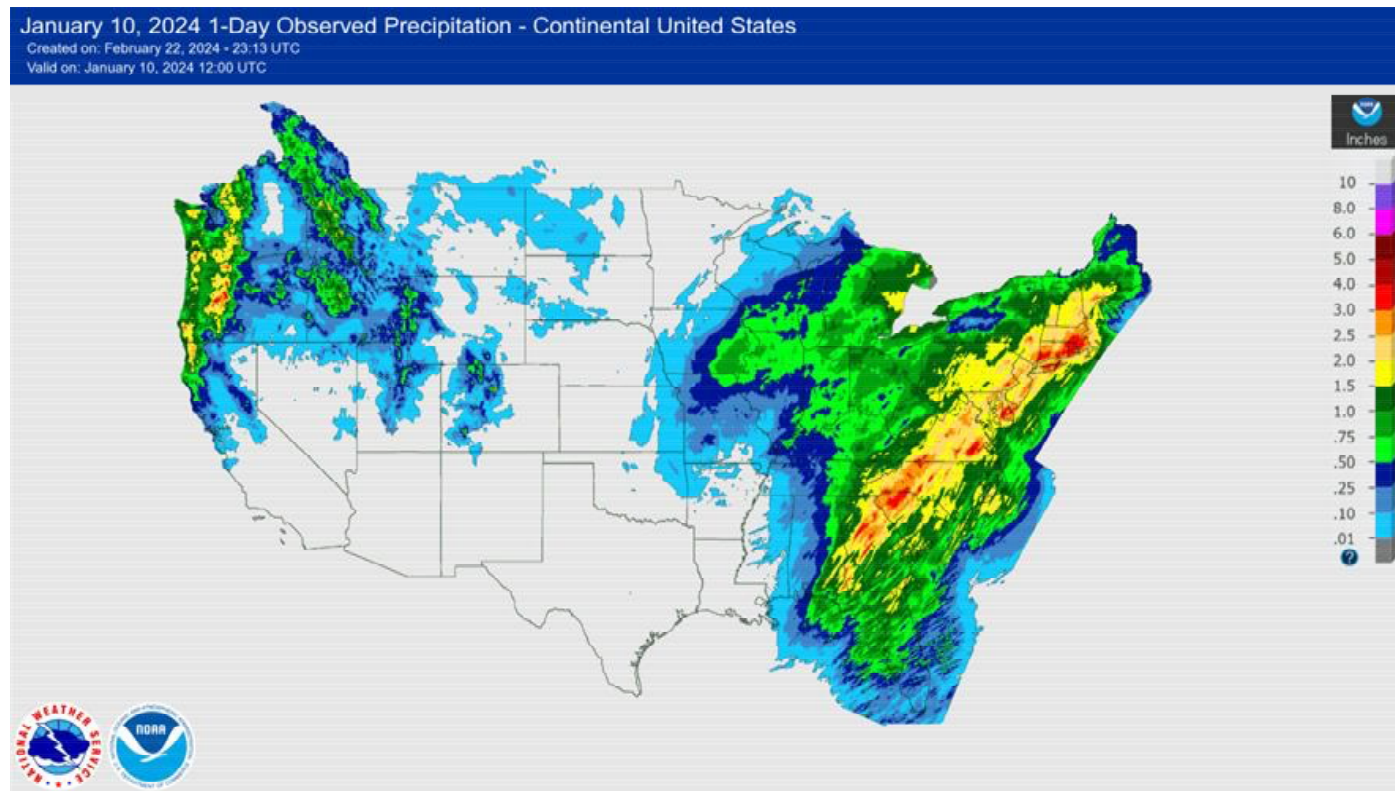
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# Weather—2022 Elliot



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# Weather—2024 Gerri/Heather



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# **AESO – January 2024**

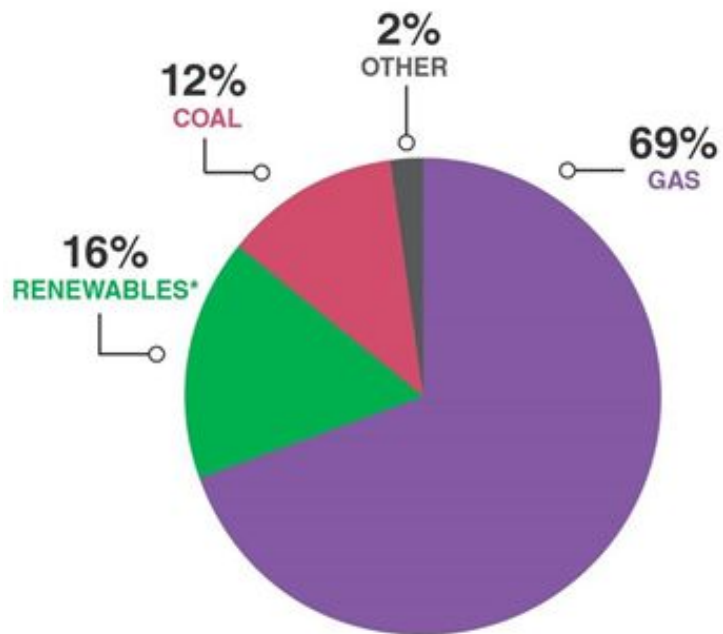
## Winter Extreme Weather

AESO Public

# Alberta Power Overview



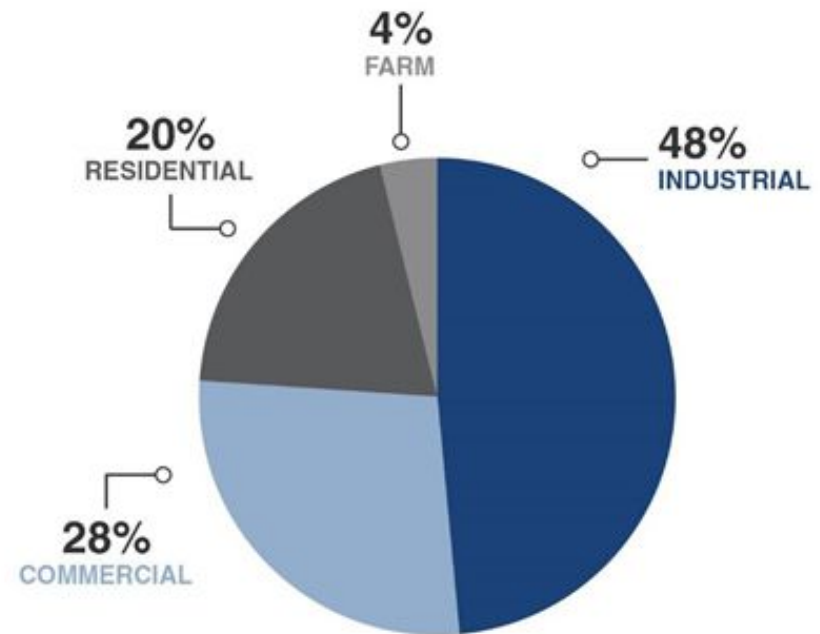
Alberta Generation



Source: AESO Annual Market Statistics Datafile (data as of Dec 31, 2023)

\*Renewables include wind, solar and hydro.

Power Use in Alberta



Source: Monthly Sales History 2022 ([www.auc.ab.ca/annual-electricity data/](http://www.auc.ab.ca/annual-electricity-data/))

THE FUTURE OF ELECTRICITY

### 3 Interconnections



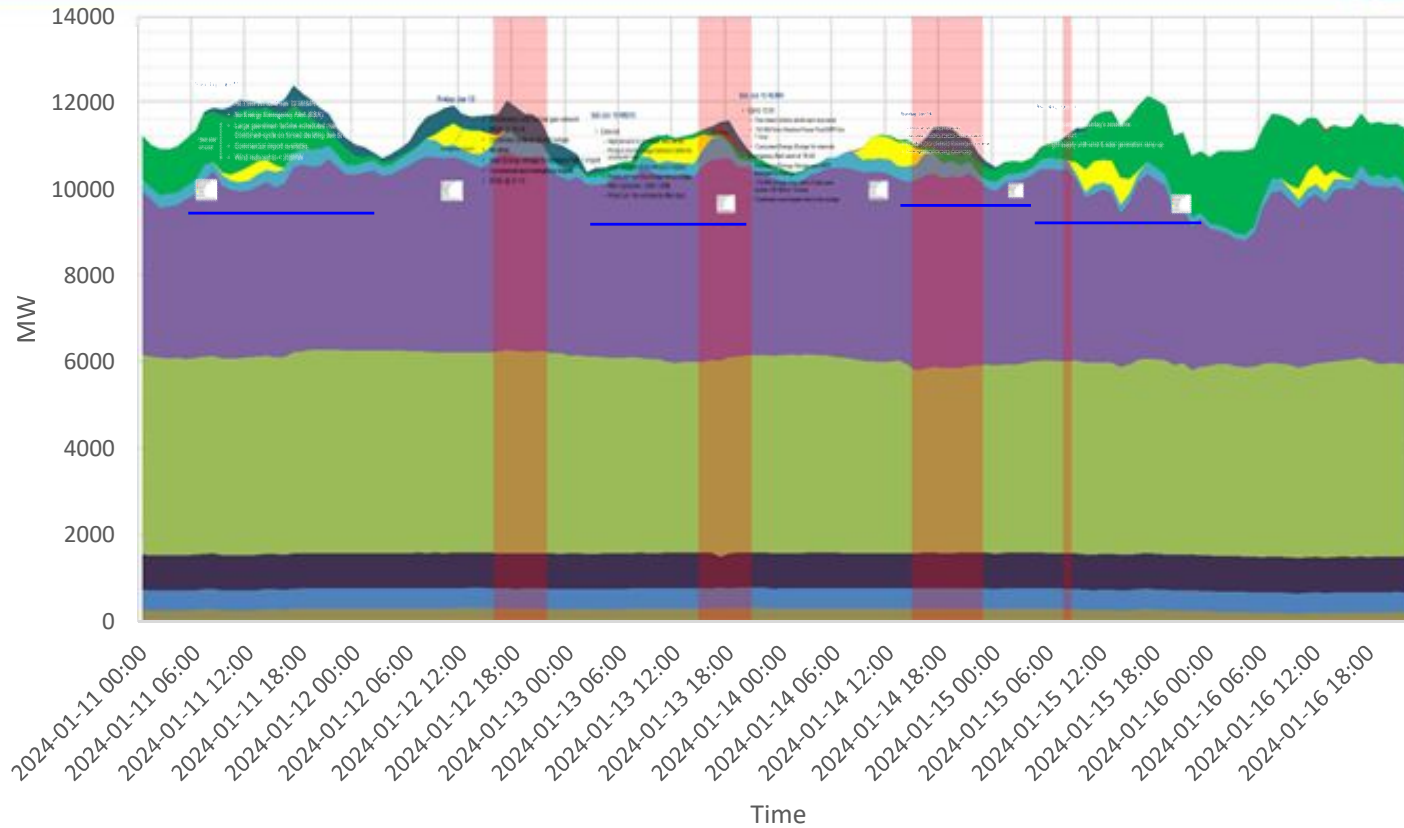
- 800 MW AC tie west to BC
- 300 MW AC tie south to Montana
- 153 MW DC tie east to Saskatchewan





# Timeline

## Supply



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AESO Public



## Thursday Jan 11



~800 MW  
of wind



- All-Time Winter Peak 12,384MW
- No Energy Emergency Alert (EEA)
- Large gas-steam turbine scheduled maintenance; Combined-cycle on forced derating due to icing
- Commercial import available
- Wind reduced to < 200MW

■ Net Imports  
■ Storage  
■ Wind  
■ Solar  
■ Hydro  
■ Dispatchable Gas

THE FUTURE OF ELECTRICITY 

## Friday Jan 12



Emergency import

- Coordination with natural gas network
- EEA3 @ 16:15
- Combined cycle on forced outage
- No wind
- Used Energy storage to increase Path 1 import
- Commercial and emergency import
- EEA0 @ 21:12

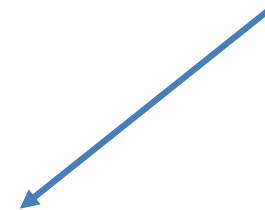


## Sat Jan 13 WECC



- External:
  - High demand in US Pacific NW and BC
  - Planned intertie outage between California and Pacific NW
  - Idaho declared EEA3 AM (and 4 others)
  - Prairie Jackson Gas storage forced outage
  - Mid-C spot price > CDN 1,300\$
  - Priced out = No commercial offers input

No import



## Sat Jan 13 AEMA



- EEA3 15:30
  - Gas steam turbine derate and recovered
  - 150 MW from Western Power Pool(WPP) for 1 hour
  - Consumed Energy Storage for reserves
- Emergency Alert sent at 18:44
  - Exhausting Energy Storage and WPP emergency sharing
  - 170 MW of load drop within 3 mins and further 100 MW in 10 mins
  - Combined cycle tripped due to line outage



THE FUTURE OF ELECTRICITY 

## Sunday Jan 14



- Additional generation outages
- Gas-steam turbine derated and recovered
- Slightly higher wind and more import available
- Prolonged load evening down-ramp

■ Net Imports  
■ Storage  
■ Wind  
■ Solar  
■ Hydro  
■ Dispatchable Gas

THE FUTURE OF ELECTRICITY 

## Monday Jan 15



- Continuation of Sunday's conditions
  - No import
- Tight supply until wind & solar generation ramp up

■ Net Imports  
■ Storage  
■ Wind  
■ Solar  
■ Hydro  
■ Dispatchable Gas

THE FUTURE OF ELECTRICITY 



**Thank You**

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# Overview of Recent Extreme Weather Condition in the Pacific Northwest

## WECC Evaluation of the January 2024 Winter Storms

June 11, 2024

Presented by Dmitry Kosterev, BPA

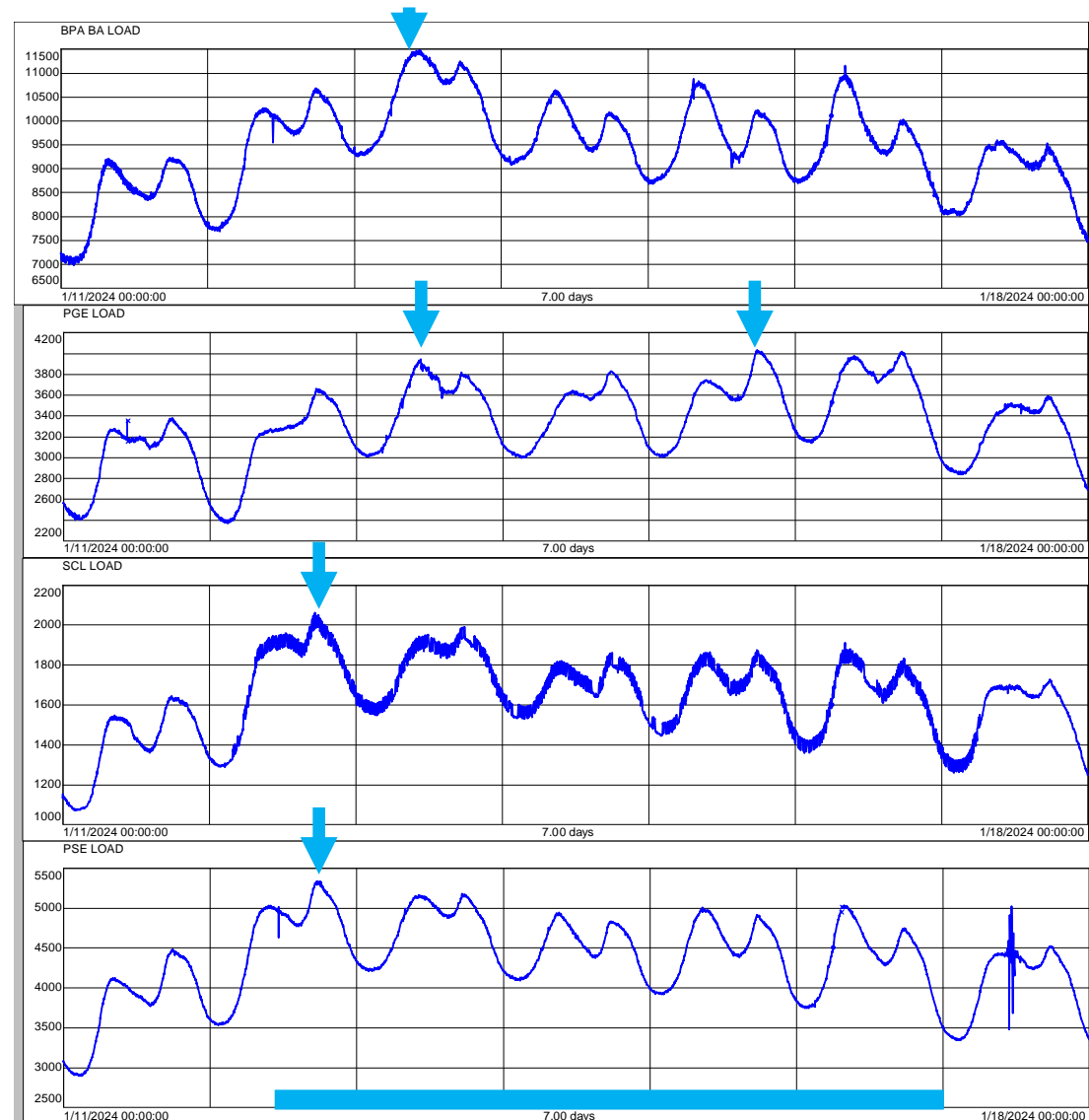


# Northwest Loads

BPA, PSE and SCL experienced record loads, fortunately at different times (pointed by arrows)

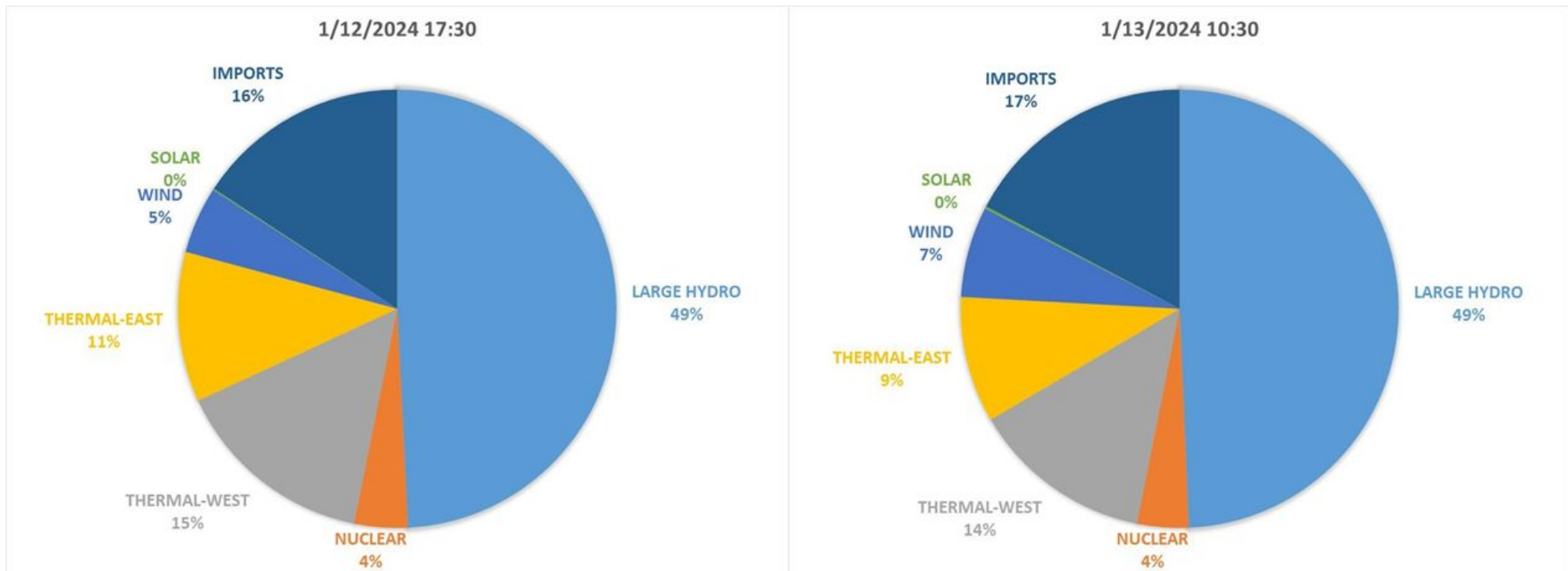
Most of cold snap occurred over the weekend, which helped with net demand

Winter Peak	NW BA Load
January 13, 2024 Cold Snap	31,711
December 22, 2022 Elliott	31,257



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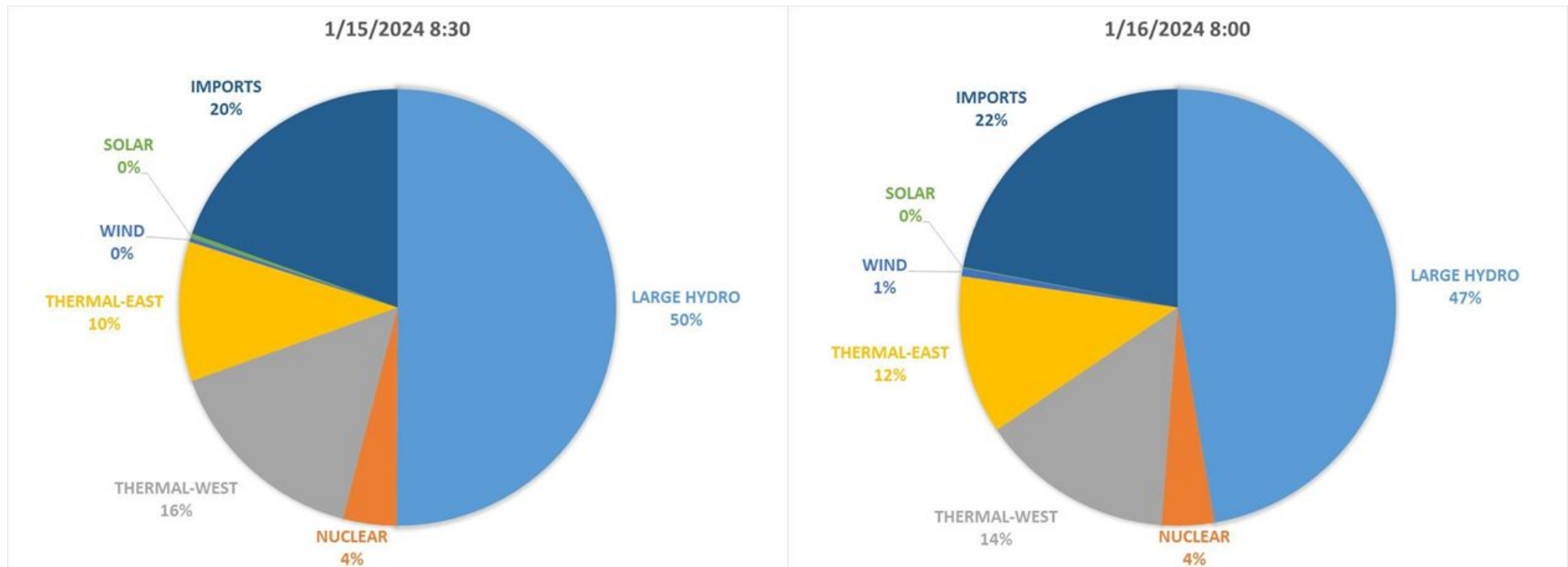
## Generation Mix During Peak Hours (1/2)



Low NW wind and solar generation and high imports during peak loads

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## Generation Mix During Peak Hours (2/2)

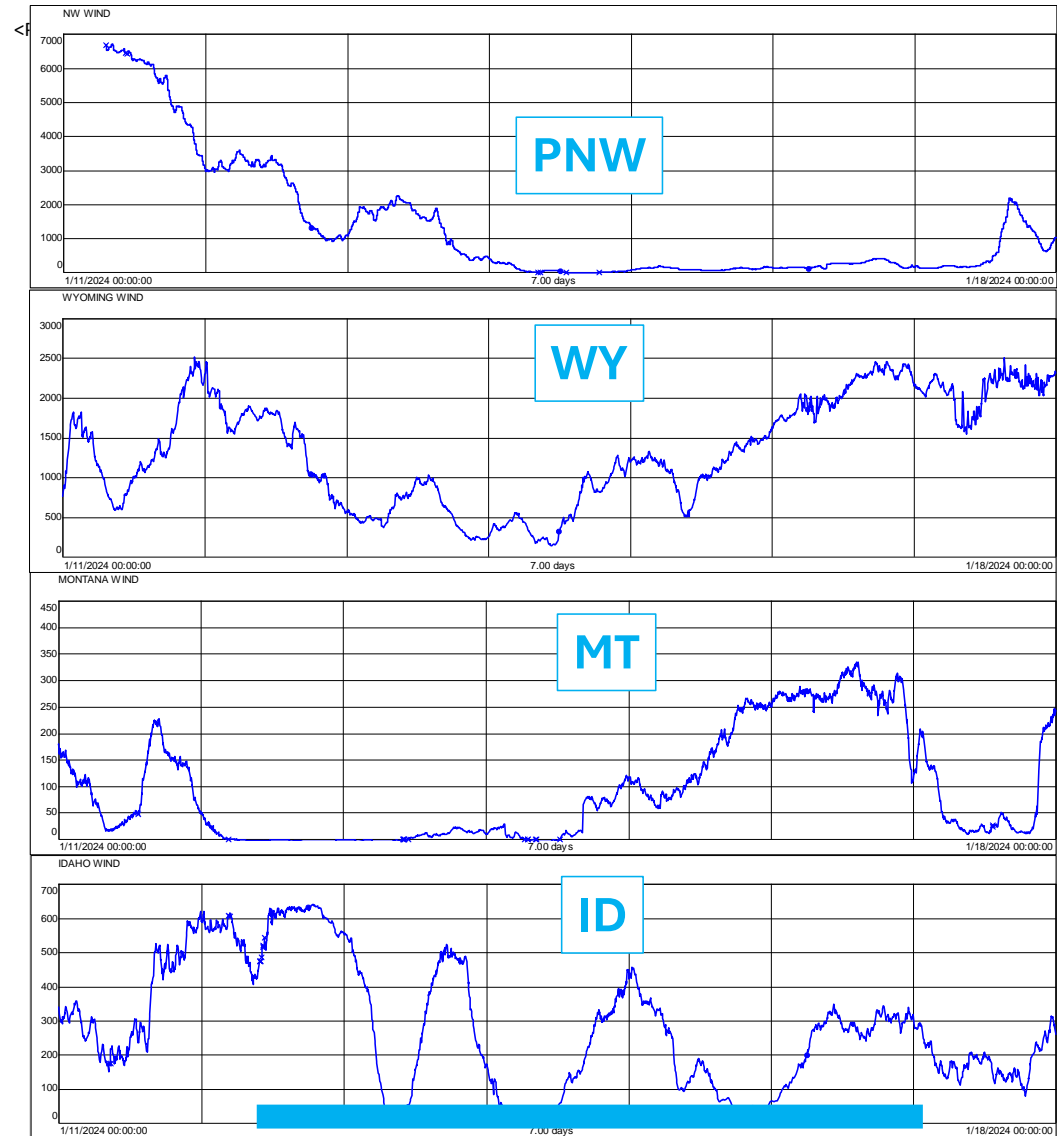


Low NW wind and solar generation and high imports during peak loads

## Wind

Northwest land-based wind generation reduced to zero as extreme cold temperatures settled across the region

There was some diversity in wind across Western states, but there were periods of very low wind generation across the wide area



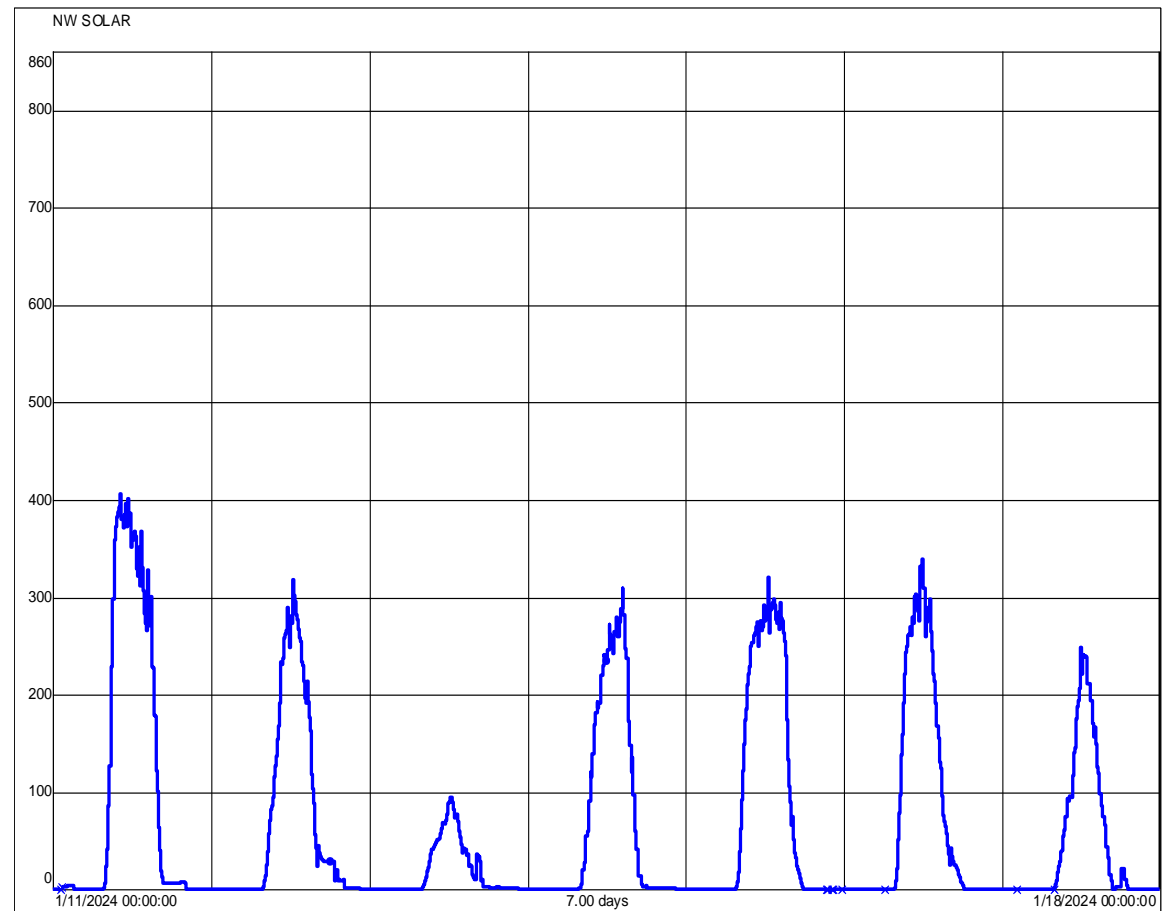
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## NW Solar

Northwest solar power plants  
operated at very low capacity  
factor during the winter storm

The plot is sum of solar generation in  
Avista, Avangrid, BPA, PacifiCorp  
West and PSE Balancing Authorities

Y-axis scale is maximum generation  
observed in June 2023

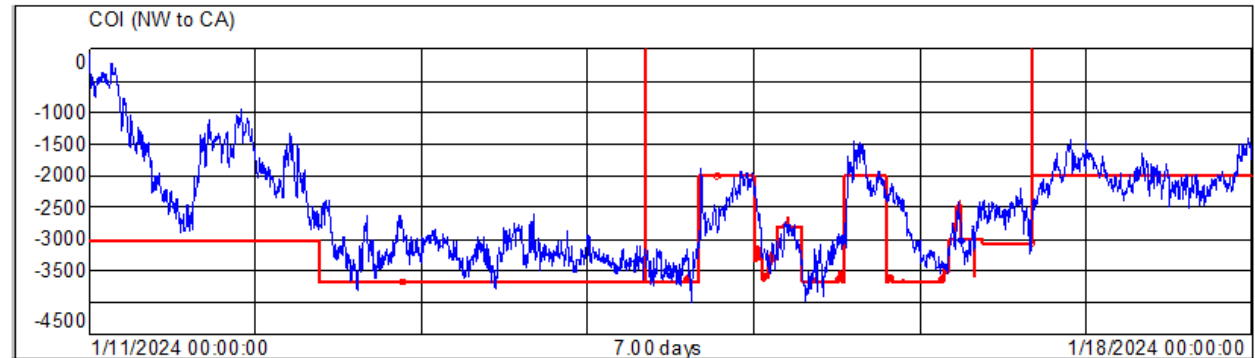


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## NW Imports

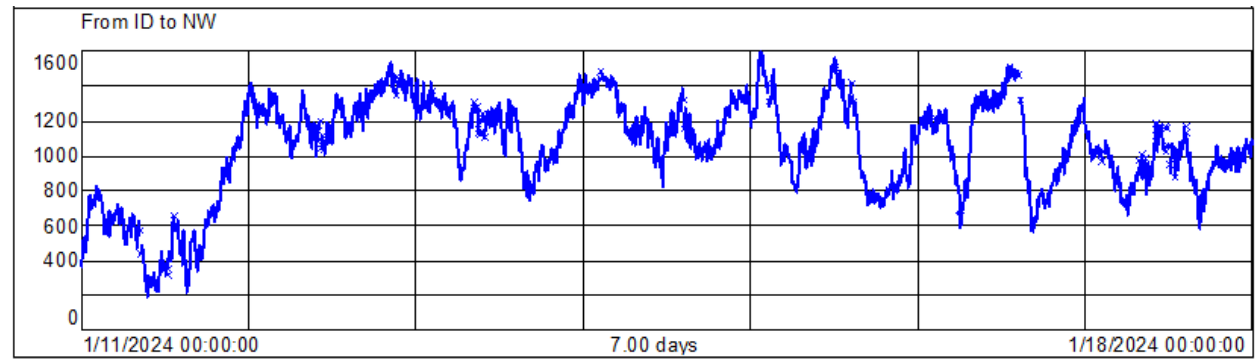
### California:

- COI was importing close to its limit during the cold snap
- COI TTC de-rates due to line outages
- Pacific HVDC intertie was down due to AC network constraints in LA basin

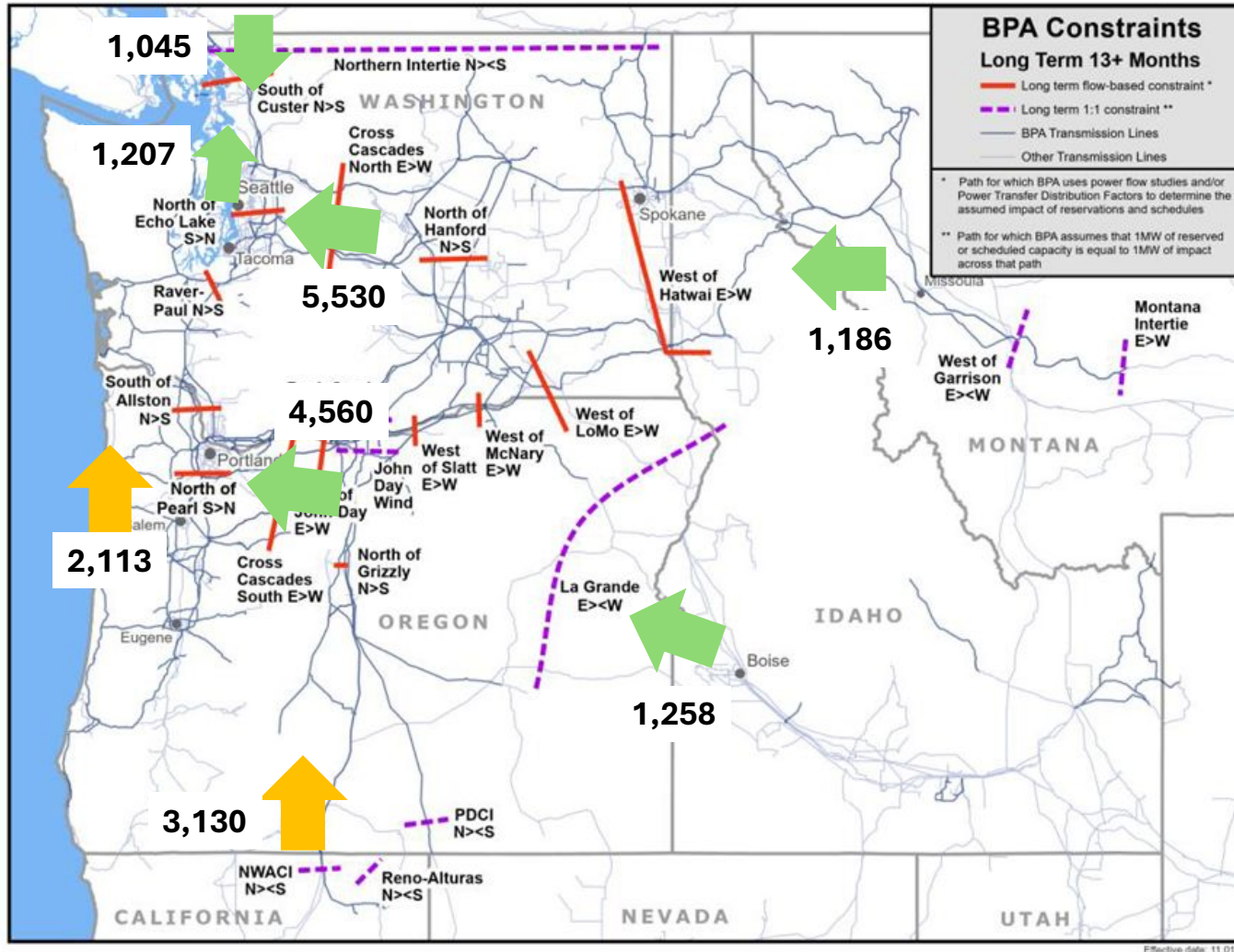


### Idaho-Northwest:

- Strong imports from Idaho through the entire event



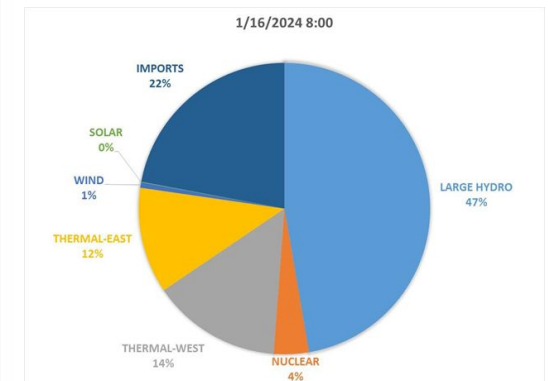
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Snapshot at 8:00 on January 16

High imports from California, Idaho, Montana and BC

High South to North flows on the I5 corridor



# Unplanned Transmission and Generation Outages

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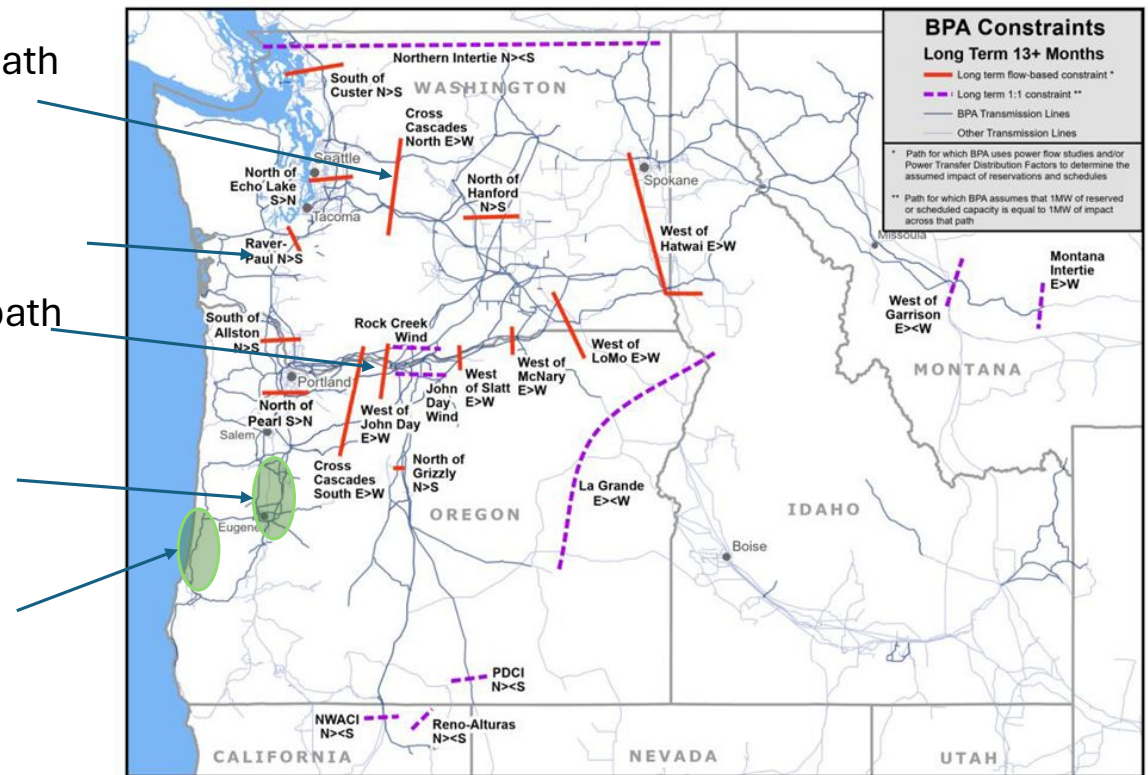
A 500-kV line in Cross-Cascades North path was out of service for about 6 hours

A natural gas plant out for over 6 hours

A 500-kV line in Cross-Cascades South path was out of service for about 2 days

Multiple line outages in Eugene and Willamette Valley area, localized power outages

Multiple line outages on Oregon Coast, localized power outages



**Exceptional work by BPA crews to restore lines and power service to NW customers**



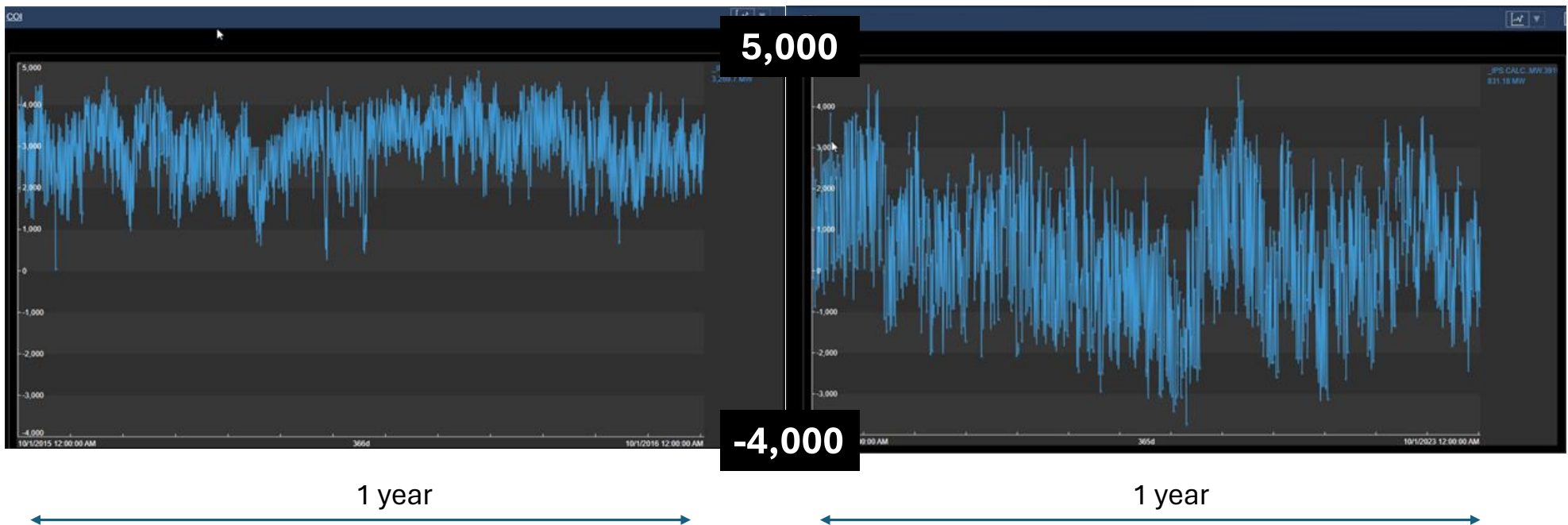
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# Increase in South to North Flows on Southern Intertie

## California-Oregon Intertie Flows

2016

2023





# WECC Board Meeting RC West Winter Storm Heather Review

Tim Beach, Director, Reliability Coordination - RC West  
June 11<sup>th</sup> 2024

# Operations update

January 13-15<sup>th</sup> cold weather event.

- **Cold weather over a holiday weekend increased demand in the Northwest above available resources.** The Pacific Northwest and Rocky Mountain States experienced severe winter weather on the weekend of Jan. 13-15, with extreme cold, snow and high winds. Temperatures fell to 15 degrees in Portland and Seattle, 10 degrees in Boise and minus 10 degrees in Spokane.
- **Grid conditions were strained, and at least six Balancing Authority areas in the Pacific Northwest issued energy emergency alerts.** The alerts ranged from EEA1 for most BAAs to EEA3 in at least one case. Four EEA-Watches were requested and declared. The EEA declarations were required to access emergency energy.





Date / Level	EEA-Watch	EEA-1	EEA-2	EEA-3
January 13	2	3		1
January 14	2	3		
January 15		1		
total	4	7	0	1

# Operations update

- Other issues during the cold weather period
  - Jackson Prairie NG storage facility went off line outage
  - Congestion on Path 80
  - S/N limit on PDCI due to forced outage
  - Forced outage in Southern Oregon further constrained energy transfer
- Lessons Learned
  - During system conditions the RC's hold a early morning call with the TOP/BA operating desks.
    - ✓ Changing time of conference call, adding specific script items.
  - RC West needs visibility or coordination into Natural Gas network in the PNW
    - ✓ RC West added to the Northwest Pipeline Mutual Assistance call
  - WIEM, Assistance Energy Transfer (AET) function
    - ✓ CAISO planning outreach of AET process and potential training
  - Develop Daily System RC West status indicator
    - ✓ Implement mid June

# RC West Daily Condition Status

The purpose of the Daily Condition Status is to provide visual status representation.

<b>RC West Condition Status Legend</b>	
RED - Existing condition poses risk to BPS reliability or Firm Load	
ORANGE - Existing or Emerging condition may present risk to BPS reliability OR Firm LOAD	
YELLOW - Conditions warrant elevated monitoring of potential threats to BPS reliability or Firm load	
GREEN - Conditions do not indicate an elevated risk or abnormal threat to BPS reliability	

## Day 7 to Day 4 weather coordination-

D4-D7 status triggers are used to forecast extreme weather conditions. Purple or Pink composite weather score triggers conditions yellow.

No Actions	GMS notification for potential extreme weather conditions	Criteria not selectable- No actions	Criteria not selectable- No actions

<u>Value</u>		<u>Percentile</u>	<u>Temperature Impact</u>
1		Within normal range	None
-2	2	80%	Moderate
-3	3	90%	High
-4	4	95%	Major
-5	5	98%	Extreme

## Day 3 to Day 0 weather coordination-

D3-D0 status triggers are used to forecast extreme weather conditions.

Pink/Purple trigger condition orange. Dark Blue/Red trigger condition yellow.

No Actions	Grid Messaging Syste4m Posting abnormal weather conditions	Posting and Notification: GMS Posting for extreme weather conditions	Criteria not selectable- No actions
		Initiate RC- BA/TOP daily conference call	

<u>Value</u>		<u>Percentile</u>	<u>Temperature Impact</u>
<b>1</b>		Within normal range	None
<b>-2</b>	<b>2</b>	80%	Moderate
<b>-3</b>	<b>3</b>	90%	High
<b>-4</b>	<b>4</b>	95%	Major
<b>-5</b>	<b>5</b>	98%	Extreme