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

January 7, 2025

MEMORANDUM

TO: **Council Members**

FROM: **Dor Hirsh Bar Gai, Power System Analyst**

SUBJECT: **Approach to Modeling Operational Risks from Wildfires**

BACKGROUND:

Presenter: Dor Hirsh Bar Gai

Summary: Staff will present the approach to modeling the operational risks from wildfires.

Wildfires impact the power system in adverse ways and may pose adequacy challenges as well as influence new resource acquisition decisions. Staff are preparing to capture the operational risk of transmission derating, smoke-induced reduction of solar generation capacity factors, and considerations of the location value of resources due to smoke cover. By embedding the operational risk of wildfires in the modeling and data, the goal is to have "wildfire-informed" planning included in across the scenario modeling.

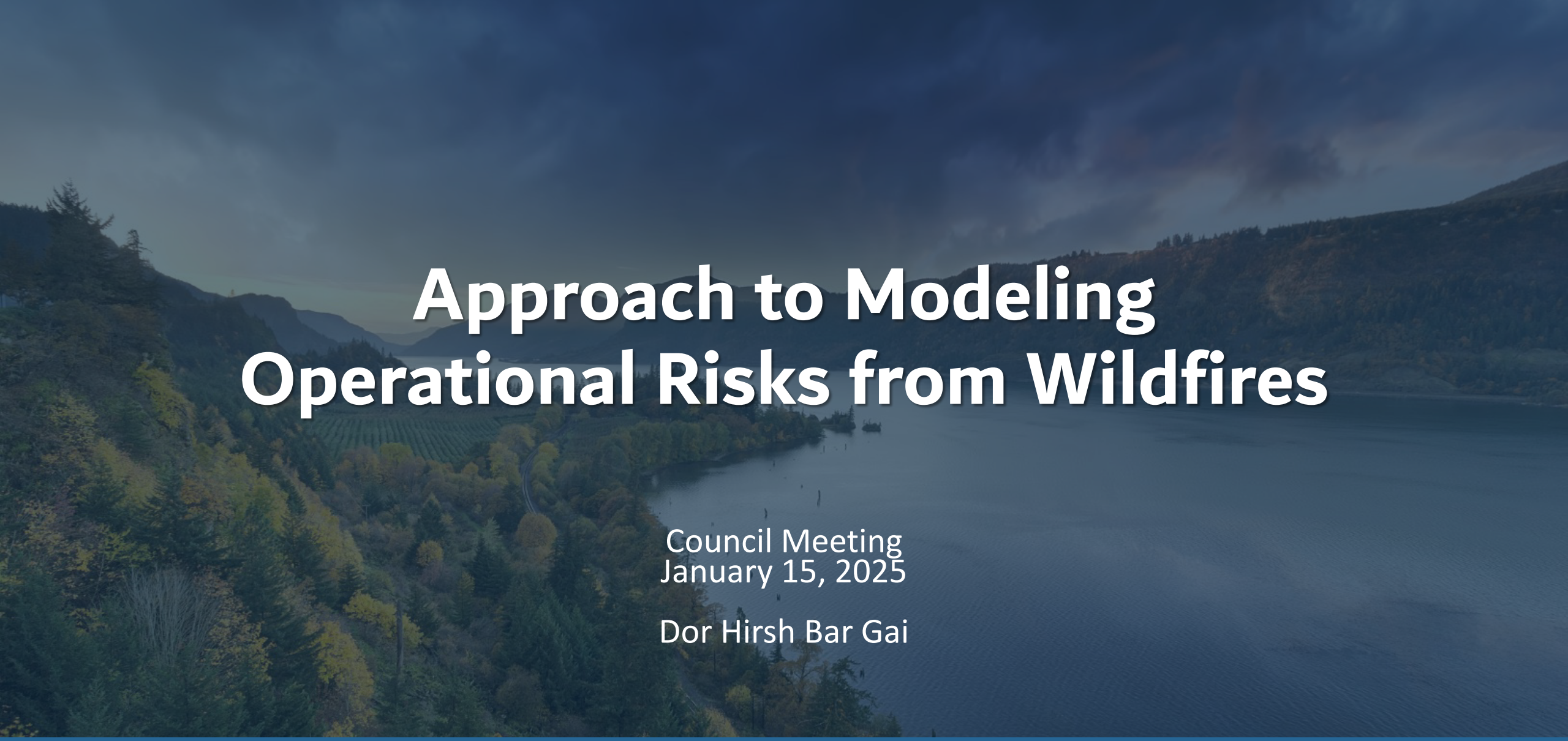
Staff are seeking to finalize this approach to modeling operational risks from wildfires by spring of this year in advance of the needs assessment and scenario modeling. This is an opportunity for members to ask questions and provide insights as we work to finalize an approach.

Relevance: The Council is tasked with planning for an adequate, efficient, economic and reliable power supply. An important element is to represent the existing bulk power system and new resource potential – generation, loads, and transmission –

and risks as best as possible. As recent years experienced several major wildfires in the Pacific Northwest that had significant impacts on the power system, re-evaluating and enhancing the Council's modeling representation of wildfires will help inform a more robust set of recommendations in the Ninth Power Plan.

Workplan: B. Preparation of Tools and Data for the Ninth Power Plan

Background: The previous wildfire representation in Council modeling work (2027 Adequacy Assessment, published January 2023) focused on creating a wildfire scenario that derated specific transmission lines in the region for one week. While the scenario was considered adequate, the tested risk was narrow in scope. Since then, there has been a growing attention to the impact of wildfire smoke that can cause prolonged reductions of solar generation. Through reviewing literature and engaging with utility and regional partners, Council staff set to better understand the impact and modeling of wildfires.



Approach to Modeling Operational Risks from Wildfires

Council Meeting
January 15, 2025

Dor Hirsh Bar Gai

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

Agenda

- High-level review of 2024 wildfire season
- Wildfire operational risks and impacts
- Reminder of wildfire representation in 2027 Adequacy Assessment
- Current thinking on modeling approach
- Proposed next steps

Scope of Wildfire Operational Risks in Power Plan Context:

Impacts to bulk transmission and generation to capture influence on new resource decisions and adequacy

2024 WECC Wildfire Summary

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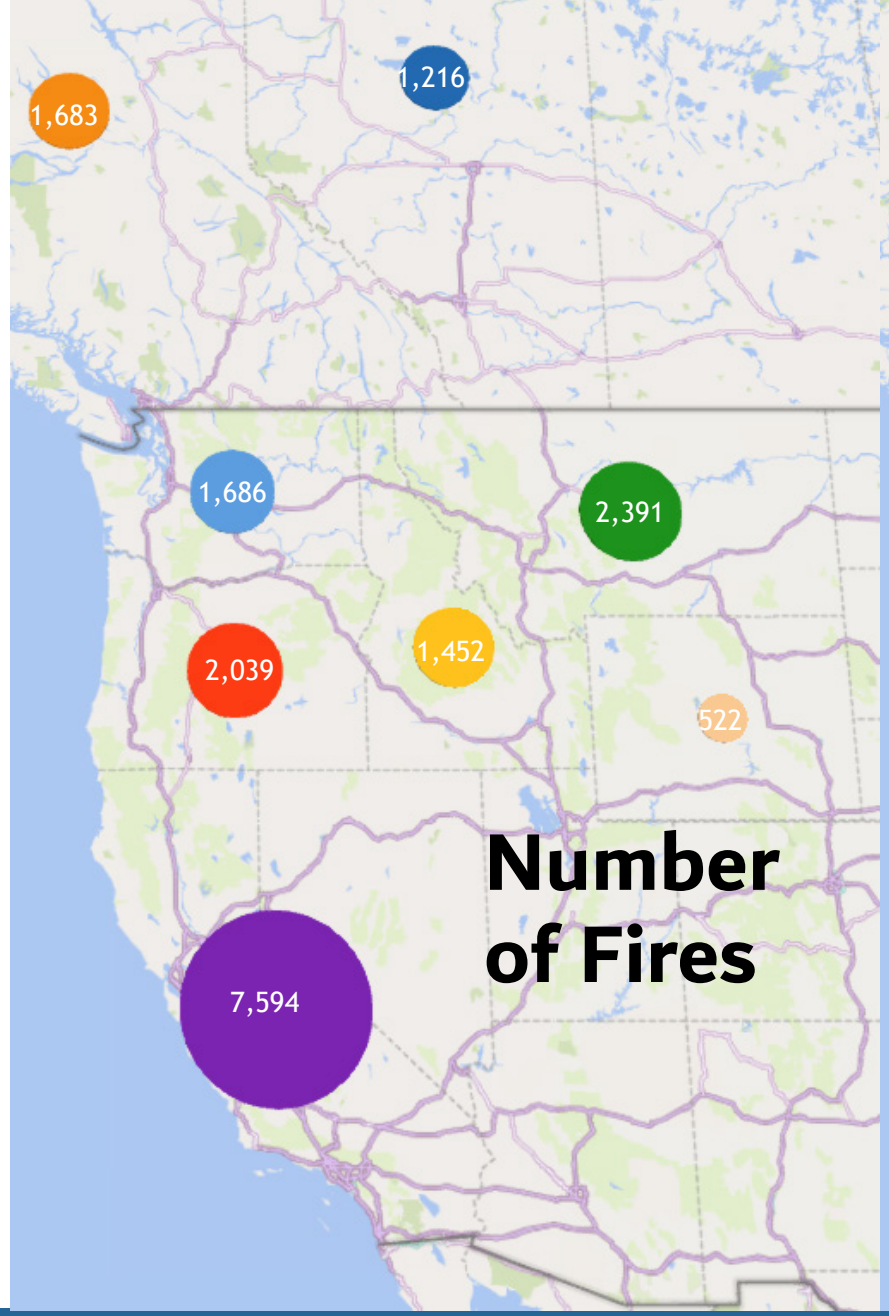
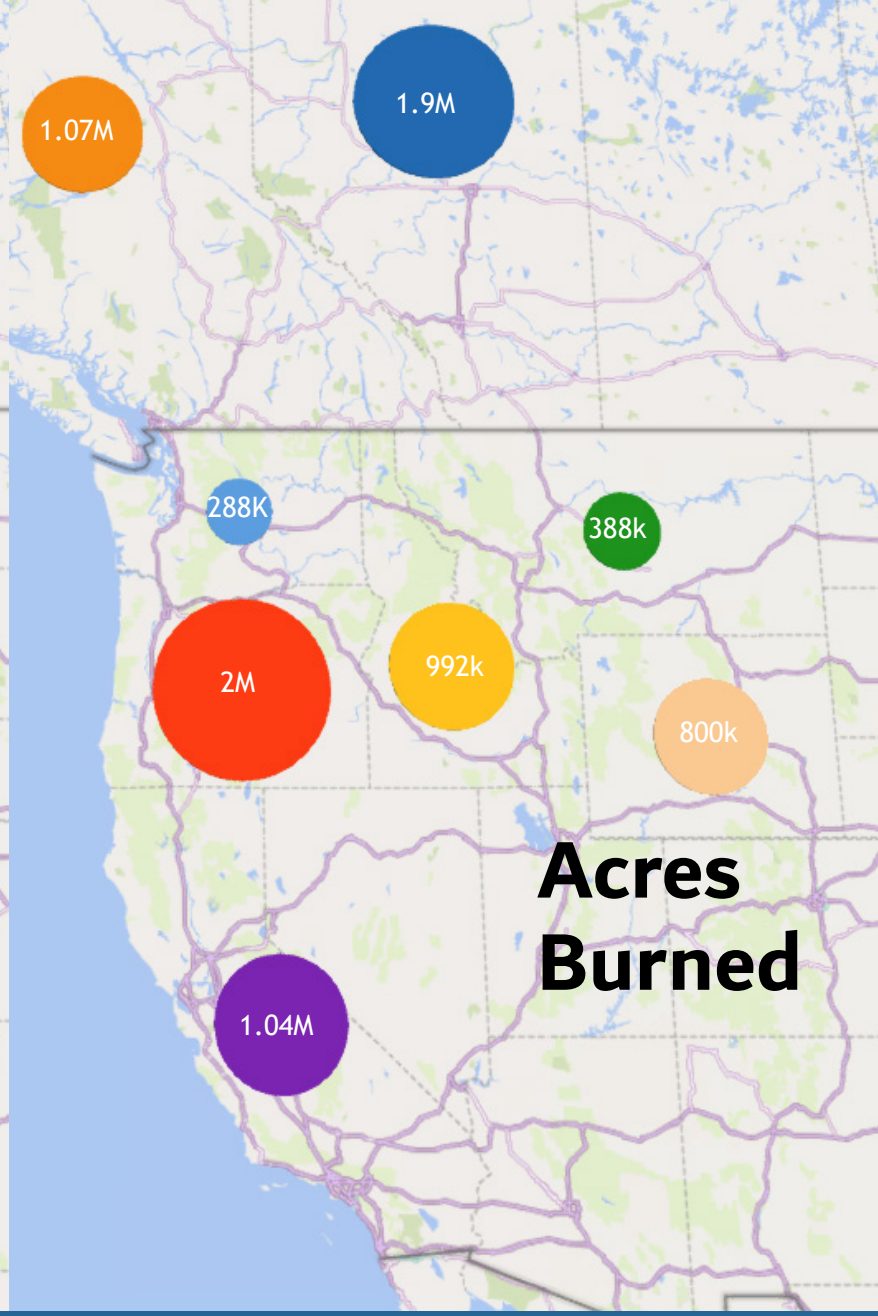
2024 Wildfire Season

- California close to 5-year average
- Washington more than double the 10-year average
- Oregon broke previous record set in 2020, above average
- Idaho was above average
- Montana was below average
- Wyoming had the largest fire season since 1988
- Alberta and British Columbia experiencing large fires

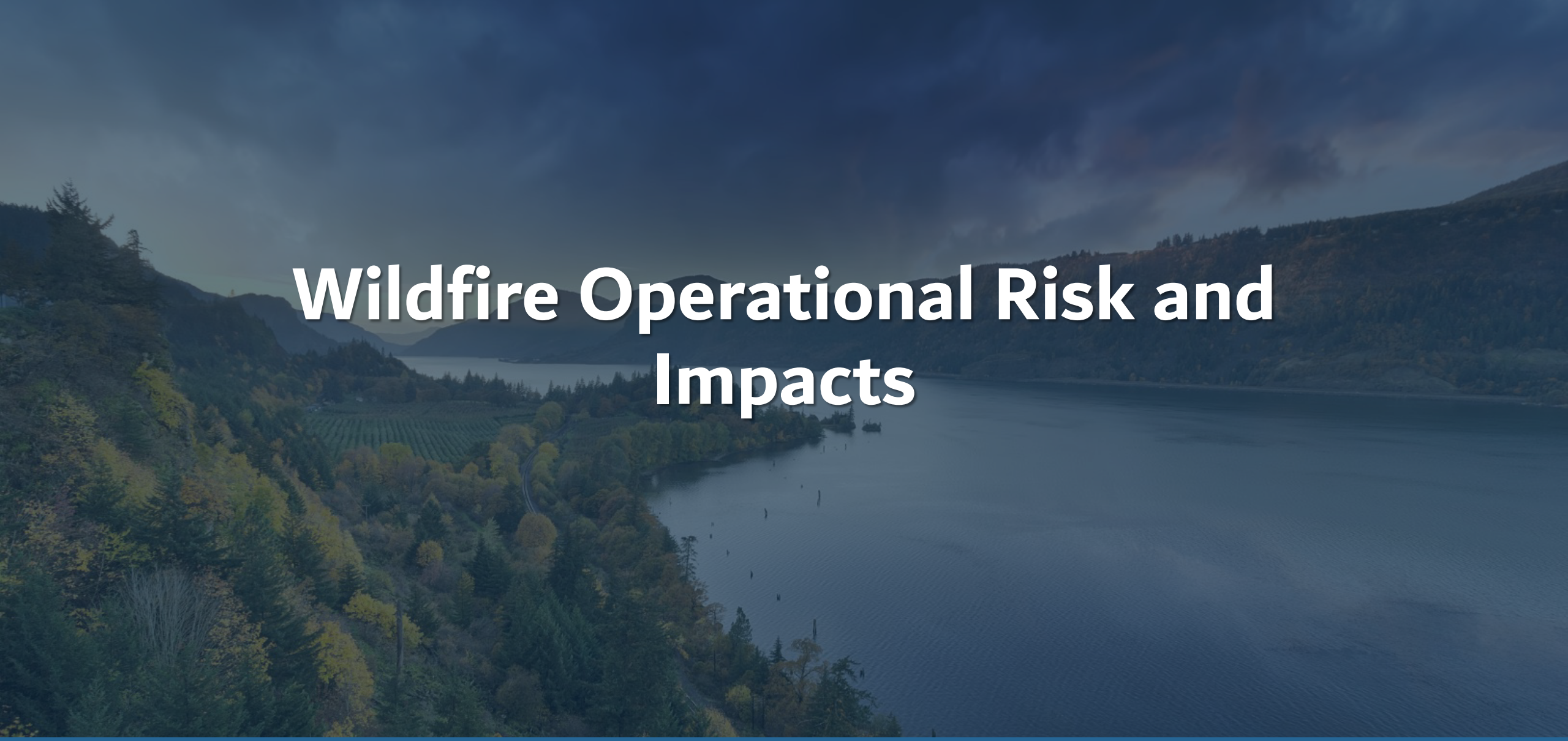




[WECC 2024 Wildfire Summary]
[Idaho 2024 Wildfire Season]
[Montana 2024 Wildfire Season]

WECC Bulk Electric System (BES)

- Several fires posed adequacy risk for the bulk electric system
  - Effect of fires “left the interconnection one contingency away” from islanding
  - 500kv lines tripping, causing line derates that reduce transfer capacity:
    - Path 66 (COI) was reduced to 0 MW north-to-south and south-to-north
    - Path 65 (PDCI) derated north-to-south
    - As flows change direction, these derates can cause transmission congestion in the east to supply load in the west
  - Post Fire 500kv line tripping
  - Pine Fire triggered remedial action due to transmission loss, dropping 2,000 MW of generation
- Fires peaked in July and August and gradually decreased in September and October
- Smoke impact on solar generation a growing issue to monitor



Wildfire Operational Risk and Impacts

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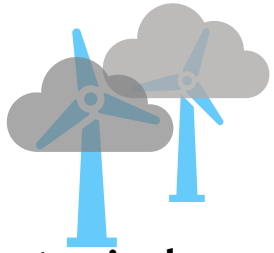
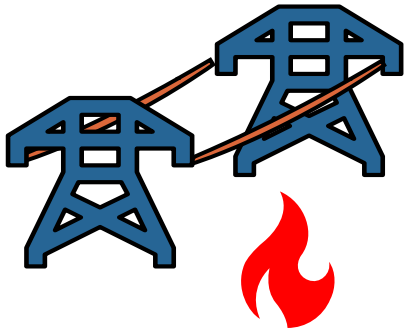
Operational Wildfire Impacts



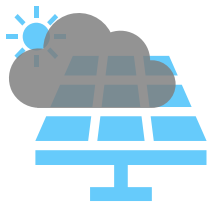
What about wind generation?

Pending further insight



Transmission derating

Transfer capacity reductions

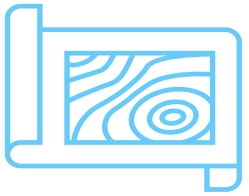


Solar Generation

Smoke-induced capacity factor reduction

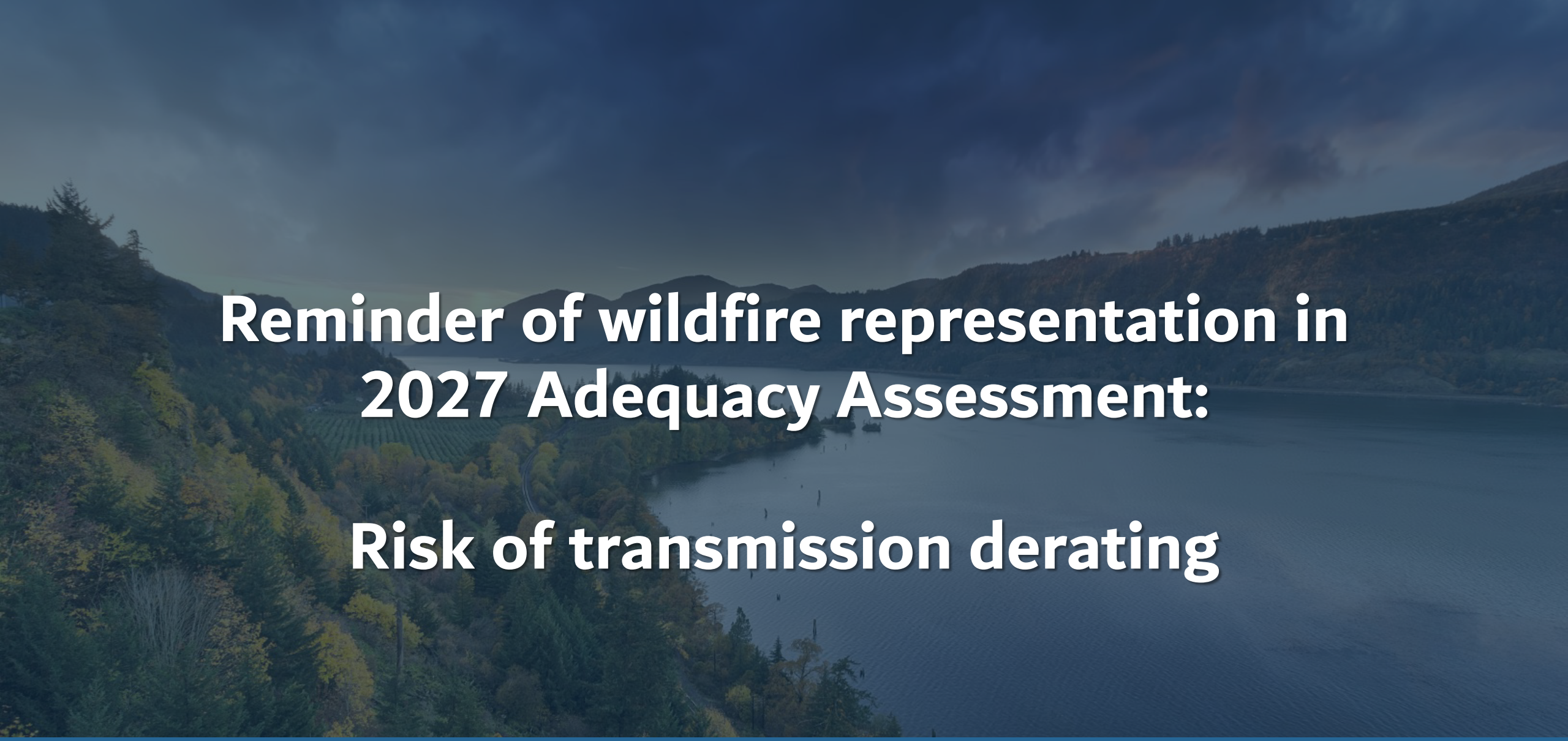
The Wiggle Effect

Sudden generation drops impact frequency stability



Location

Local and downwind impact



Reminder of wildfire representation in 2027 Adequacy Assessment:

Risk of transmission derating

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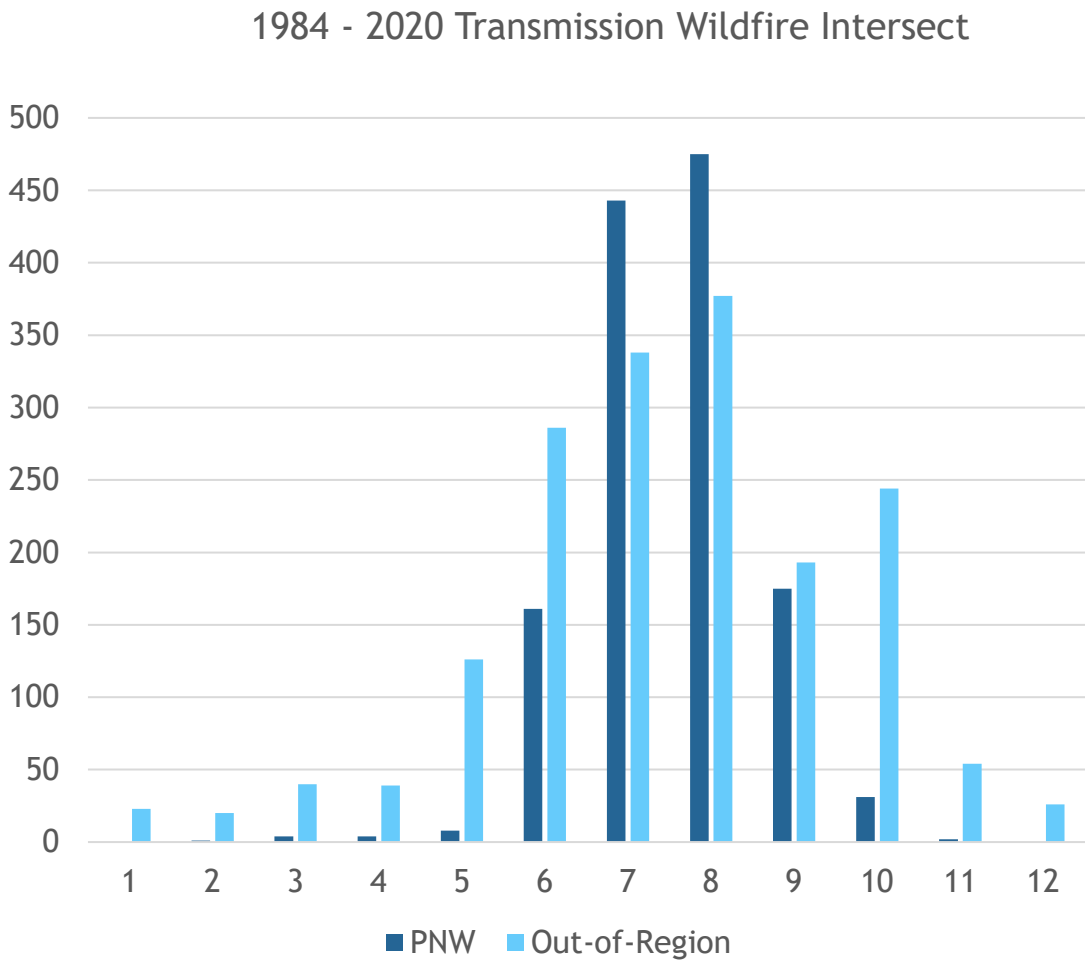
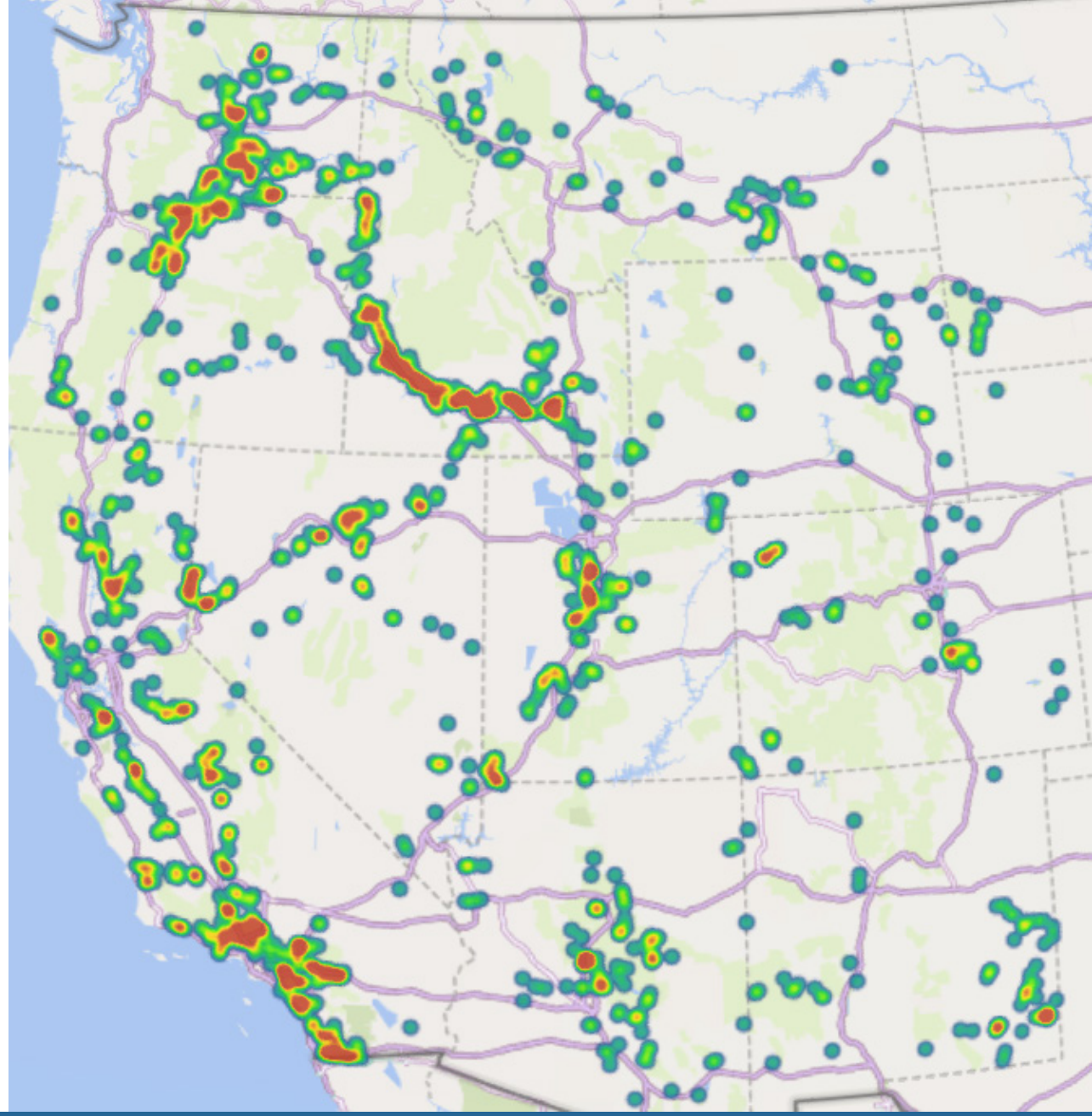
Location & Timing





Shout out to Kris Homel for generous GIS analysis help with MTBS and DHS datasets

Wildfire scenario for 2027 Adequacy Assessment

i. BPA_OR <-> PACW: **5,800 MW capacity**

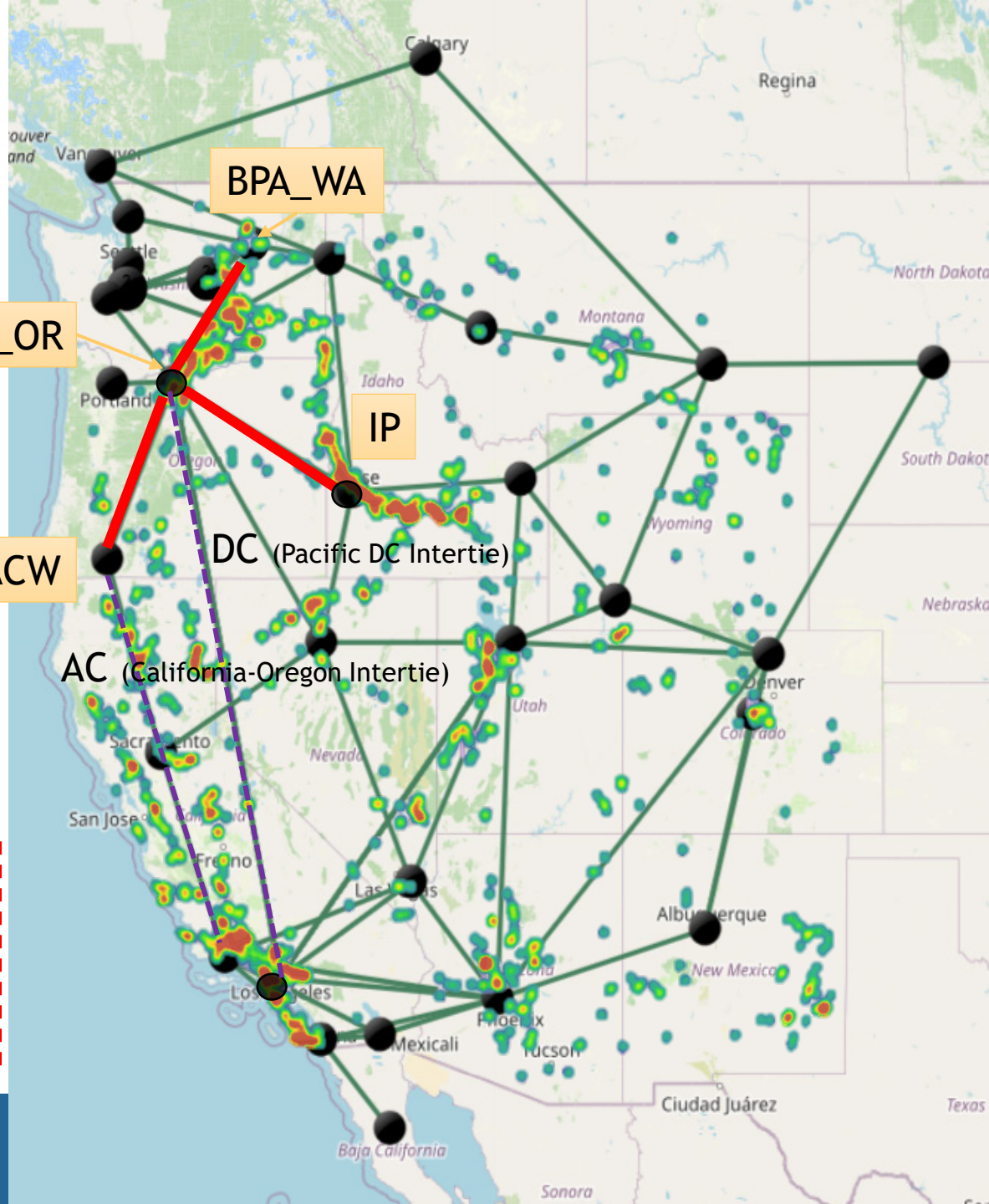
ii. BPA_OR <-> IP: **2,000 MW capacity**

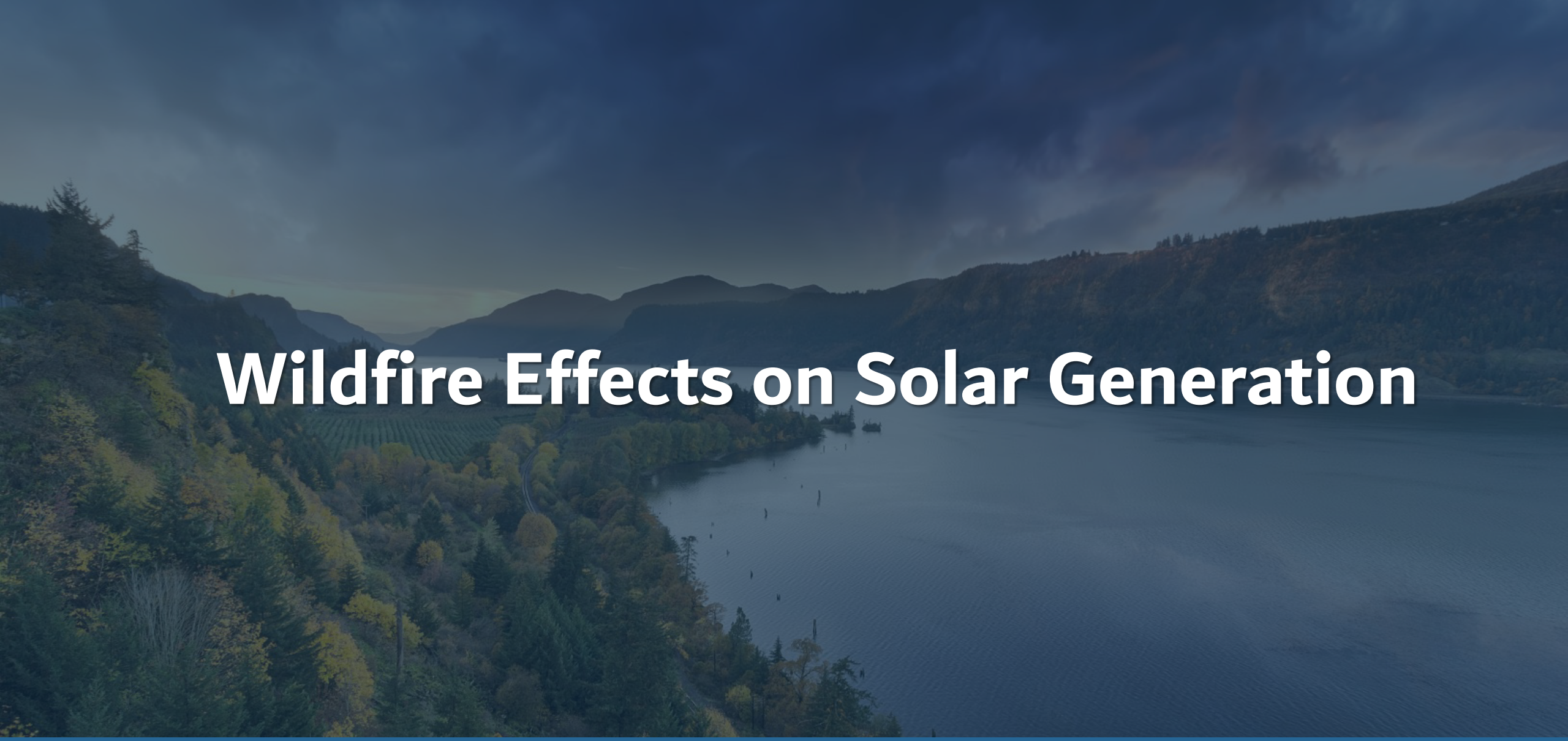
iii. BPA_OR <-> BPA_WA: **7,500 MW capacity**

iv. Wildfire dates:
   i. July 16-23
   ii. 50-90% derating

No observed adequacy impacts, but:

1. Simulated one fire scenario
2. No smoke or other impacts





Wildfire Effects on Solar Generation

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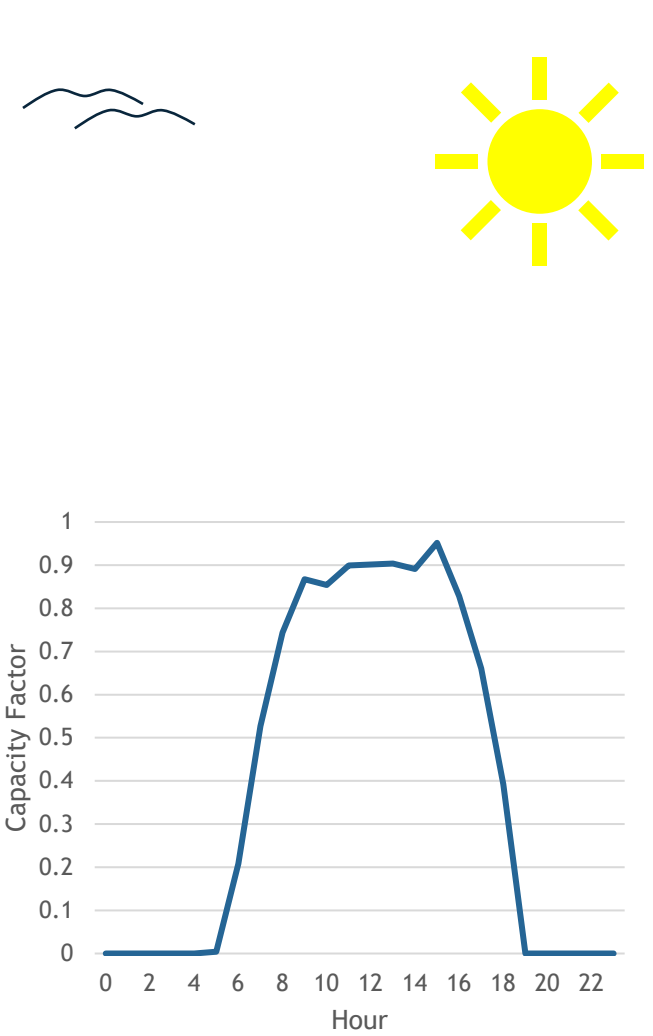
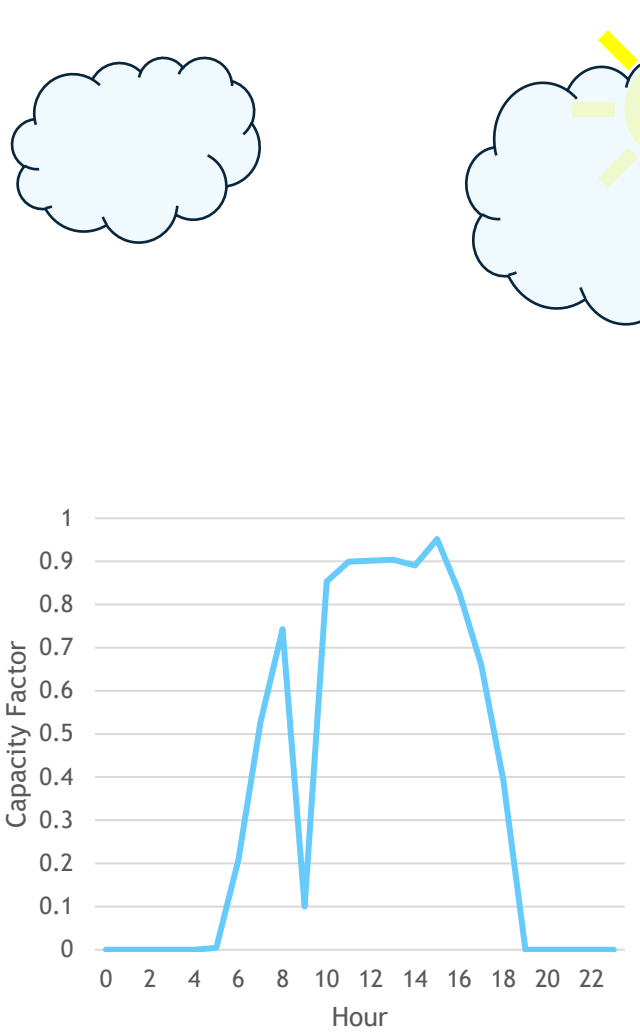
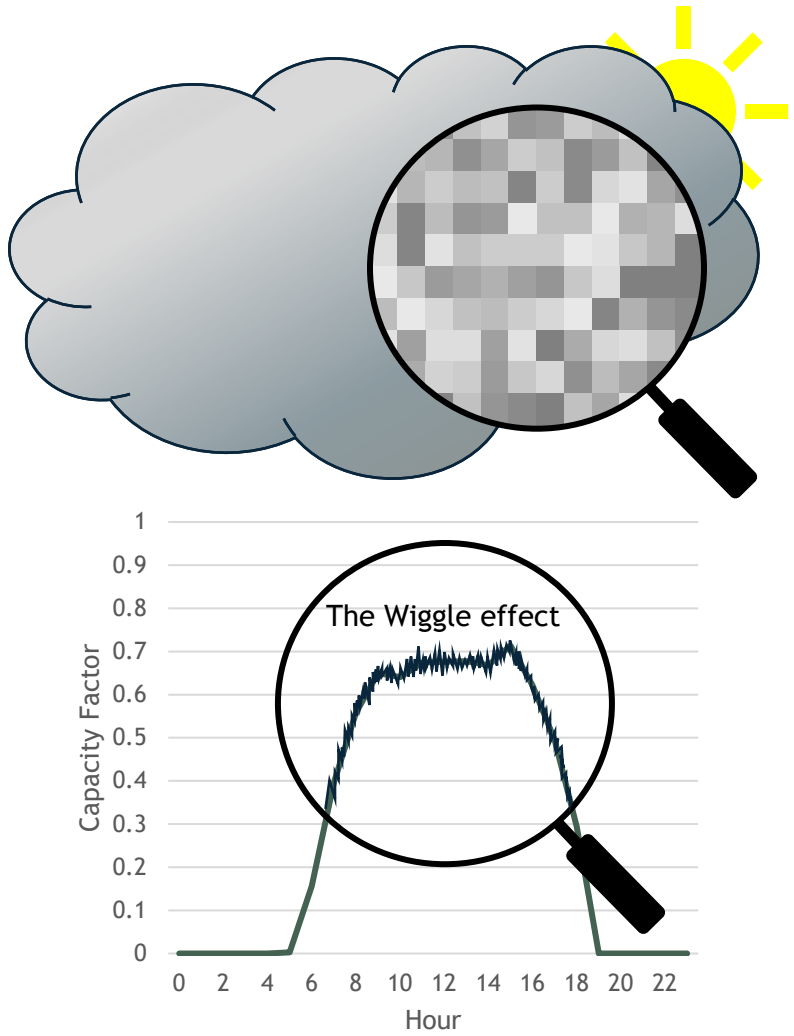
How are clouds different from smoke?







More Solar = More Risk

Significance of Smoke Impact

- Range of average solar generation reduction of 5-40% [1, 2, 3, 4, 5]
  - During peak daytime hours can be as high as 50%
  - Balancing up reserves expected to increase, NREL CA study saw ~10% generation reduction, but 53-64% reserve increase

- Localized and downwind generation reduction
  - Burned area major driver to increased in Aerosol optimal depth (AOD) increases

- The Wiggle Effect will be a growing risk with increase penetration of solar
  - One research found sudden drops of generation averaging 2.17%

These might not seem significant – but with hundreds or thousands of MW could have a large impact on supply and reserves

Current Thinking on Modeling Approach

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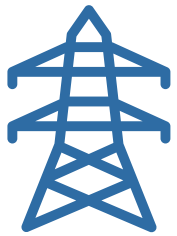
Where we are today

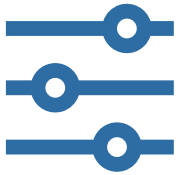
- Explore the use of Public Safety Shutoffs (PSPS) data
  - Derive duration, magnitude, and location of transmission derates
- Explore the operational impact of wildfire smoke
  - Derive estimates to modify the hourly capacity factors
  - Determine changes to balancing up reserves
- Develop a range of profiles - “wildfire years” – to embedded into operational risk assumptions
  - Transition from standalone “wildfire scenario” to “wildfire-informed” planning that are included in all scenarios

What we can model



TRANSMISSION DERATES

We are evaluating WECC aggregate wildfire statistics for 2017-2023 to identify duration and magnitude profiles



MODIFIED CAPACITY FACTORS

We are reviewing reports from national labs, universities, and utilities to estimate appropriate capacity factor changes

INFORMED BALANCING UP RESERVE MARGINS

We are considering our reserve representation in GENESYS and OptGen to capture necessary changes

Options for Transmission Derating Profiles

Focusing on major interconnection paths

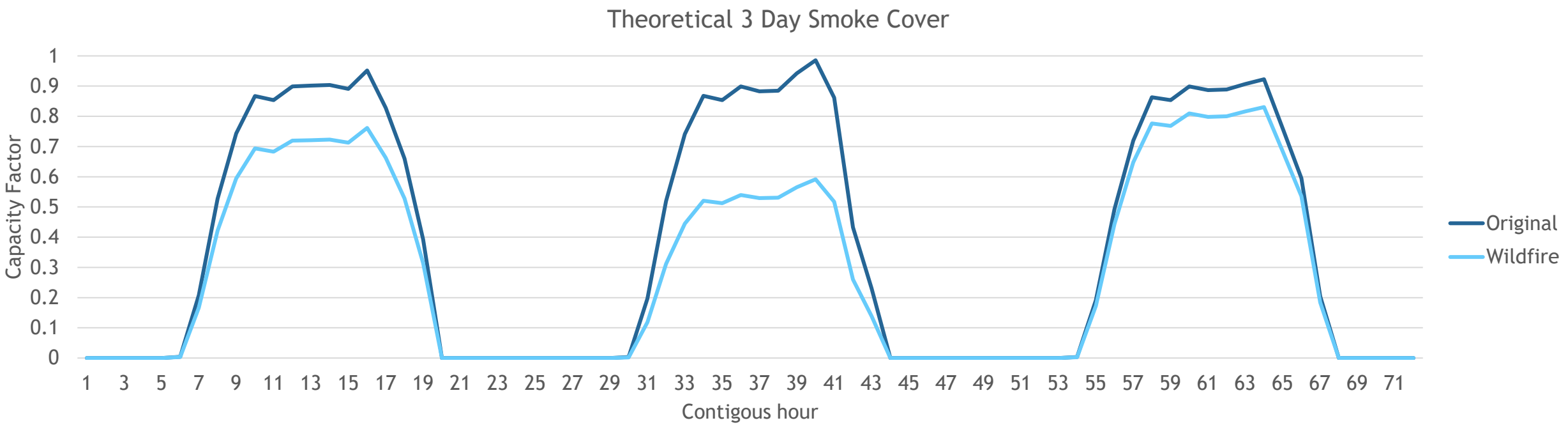
1. Create annual profiles that approximate 2017-2023
2. Assume the worst 1-2 fire years and cycle wildfire events in the appropriate months
3. Combine 2017-2023 WECC data with ArcGIS analysis

Staff suggest options 1 and 2 for greater consideration by Members and Advisory Committees.

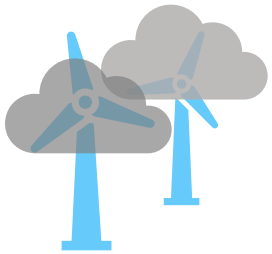
Options for Smoke-modified capacity factors

- Determine distribution of capacity factor reduction range
  - Consider severity? (low, medium, heavy smoke cover)
  - Constant or probability?
    - Varying by time of day?
- Pending incorporation of the Wiggle Effect, apply additional uncertainty?

Engaging with researchers about their findings

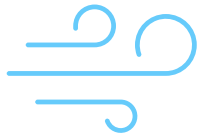


More Information is needed on:



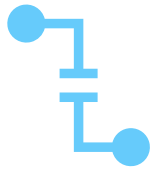
Impact of wildfire smoke on wind generation.

Research suggests reduced wind speeds and soot buildout lowers generation and efficiency



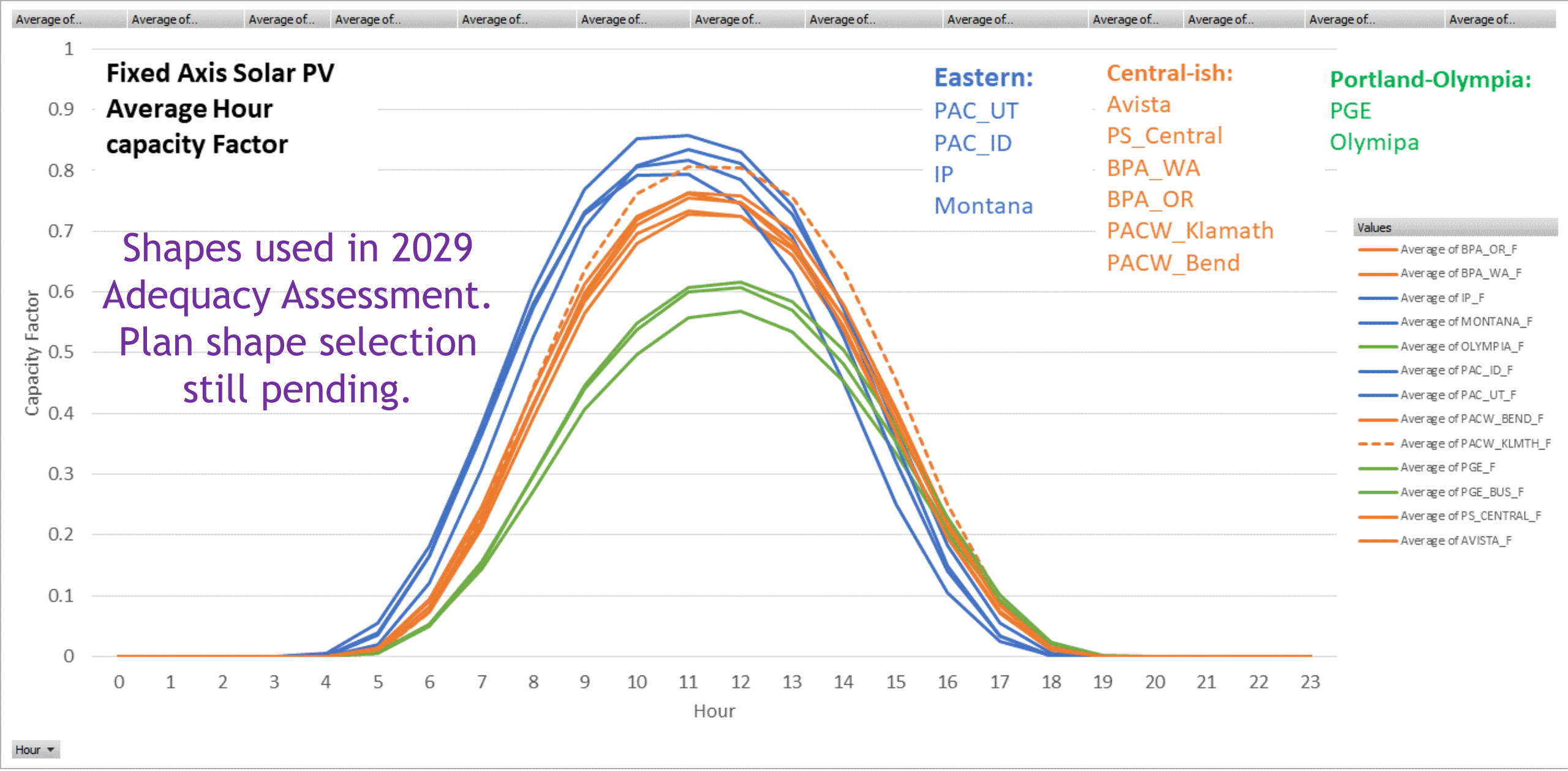
How much “down” is downwind?

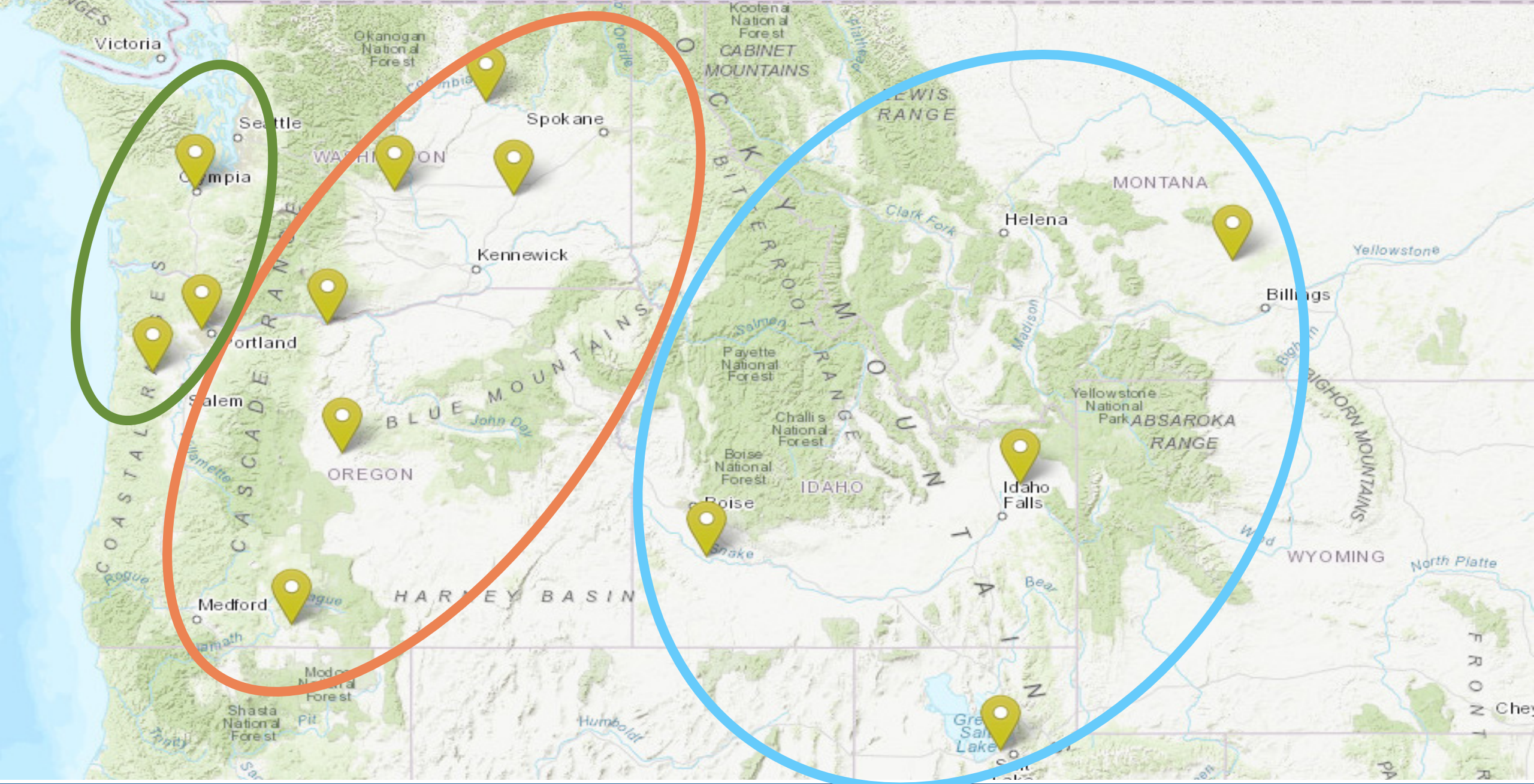
Impact on locational value of resources



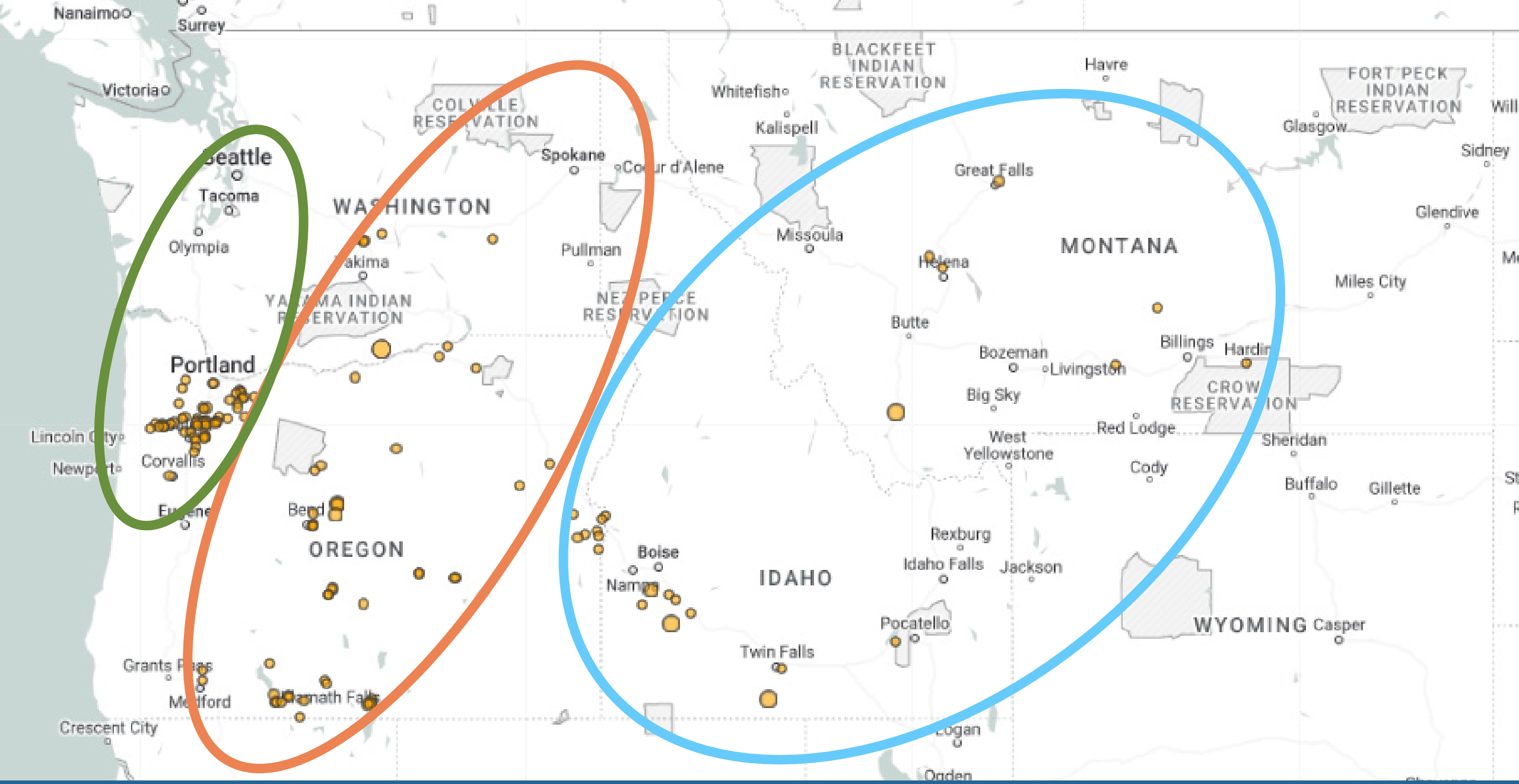
Generator islanding?

Taking specific resources offline close to wildfire?


Fixed Axis Solar PV
Average Hour
capacity Factor
Shapes used in 2029 Adequacy Assessment. Plan shape selection still pending.
Eastern:
PAC_UT
PAC_ID
IP
Montana
Central-ish:
Avista
PS_Central
BPA_WA
BPA_OR
PACW_Klamath
PACW_Bend
Portland-Olympia:
PGE
Olympia
Capacity Factor
Hour
Values
Average of BPA_OR_F
Average of BPA_WA_F
Average of IP_F
Average of MONTANA_F
Average of OLYMPIA_F
Average of PAC_ID_F
Average of PAC_UT_F
Average of PACW_BEND_F
Average of PACW_KLMTH_F
Average of PGE_F
Average of PGE_BUS_F
Average of PS_CENTRAL_F
Average of AVISTA_F



Potential groupings of representative solar capacity factor stations

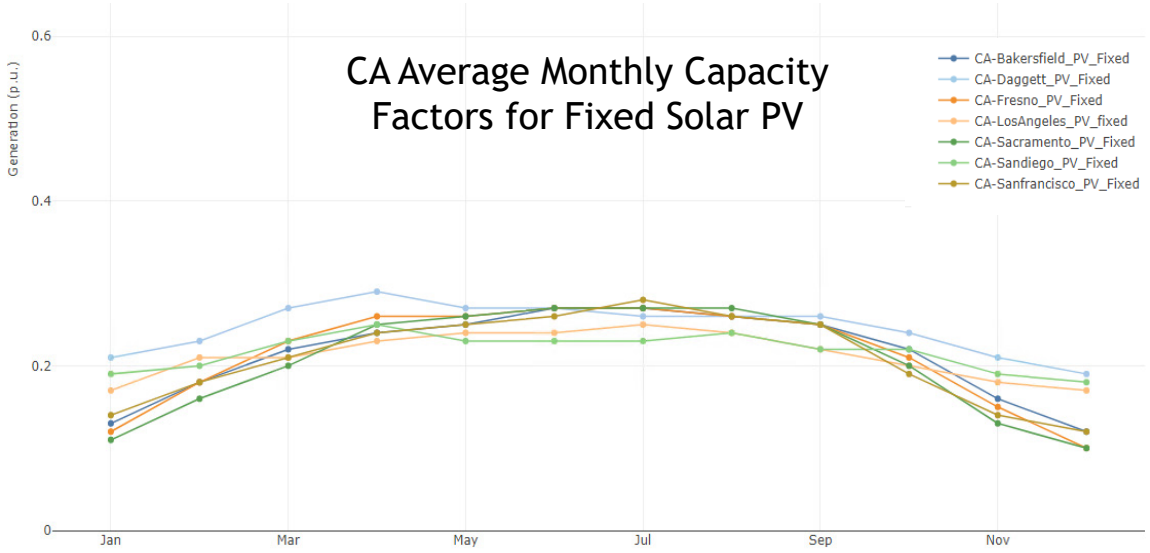


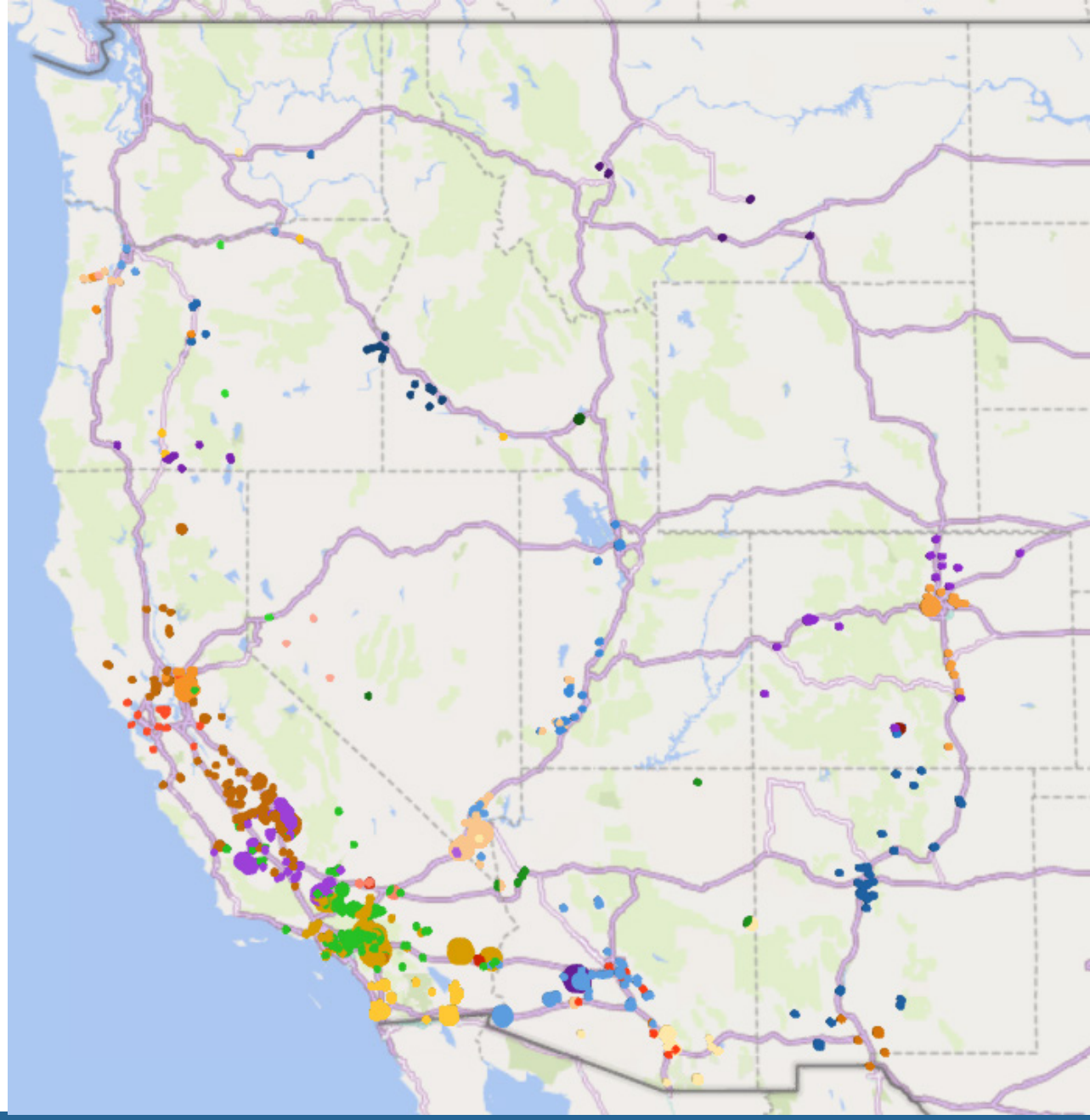
Existing solar projects throughout the region

Out-of-Region Solar Shapes?

- Important to consider as out-of-region resources influence market dynamics

- Staff is considering a similar approach to clustering shapes as conducted for in-region shapes





Proposed Next Steps

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Next Steps

- Follow up with BPA, utilities, and research groups in January
- Schedule wildfire multi-advisory committee session for February
- Data development:
  - Map transmission lines to focus on
  - Determine spatial shape representation and clustering
  - Establish transmission derate statistics and smoke-modified capacity factors
  - Avoid the risk of double-counting impacts
- Seeking to finalize approach in March/April timeframe

Questions?

Dor Hirsh Bar Gai
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Appendix

Existing Solar and Wind