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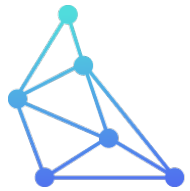
California Indirect Wildfire Risk Analysis

9 June 2026 |California Energy Resource and Reliability Outlook Workshop



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Agenda

- Process Overview
- Findings so far
  - Generation
  - Transmission
- Scenario Identification
- Next Steps

Wildfire Risk Assessment

Objectives: Quantify the impact of wildfires on solar generation and transmission capability. Assess the impact across the state on an economic and engineering basis.

Preliminary Findings:

- Historical data leads to prioritization of transmission system impacts

Process Overview: Wildfire Risk Analysis

High-Level Process Overview

1. Initialization ✓

- Lit Review
- Data Collection

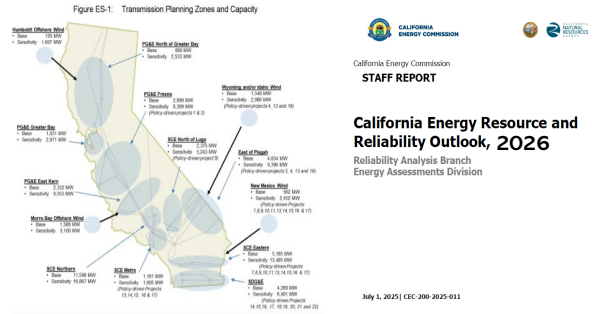
2a. Solar Generation ✓

- Evaluate Smoke Impact on CAISO generation

2b. Transmission ✓

- Evaluate Transmission impacts in times of known fires
- Map PNNL risk data

3. CERRO write-up ✓



4. Evaluate Power Transfer limits

- Define wildfire-informed transfer limits (Thermal, voltage, stability) based on defined scenarios
- Validate via historical data

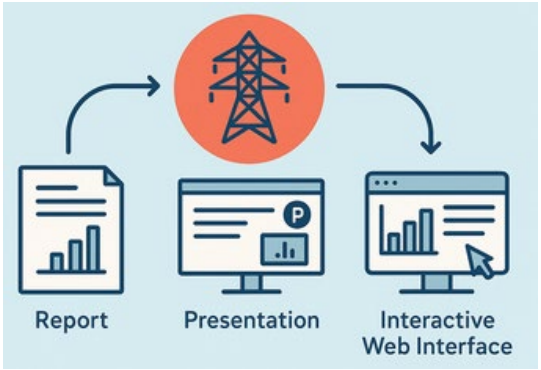
5. Resource Adequacy Stress Test

- Assess zonal RA under wildfire-informed transmission limits

6. Economic Impact Analysis (optional)

- Quantify costs & reliability impacts of lines out of service and transfer limits
- Nodal Production Cost (optional)

7. Multi-purpose reporting



System Risk Findings To Date

Statewide solar generation and transmission risks

Prioritizing Statewide Wildfire Impacts

Minimal impact from smoke on statewide generation leads to prioritization of transmission analyses

• Smoke on a single solar generation site	***Medium impact, but single site***
• “Wiggle” effect from particulate matter	***Medium impact, but single site***
• Smoke across the fleet of solar generators	***Low observed impact***
• Fire perimeter intersecting transmission	***High impact***

Solar Generation is Similar With or Without Fires

Across fire weeks, there was no significant drop in weekly energy factor observed

Site-level impact (literature)

5–10% drop

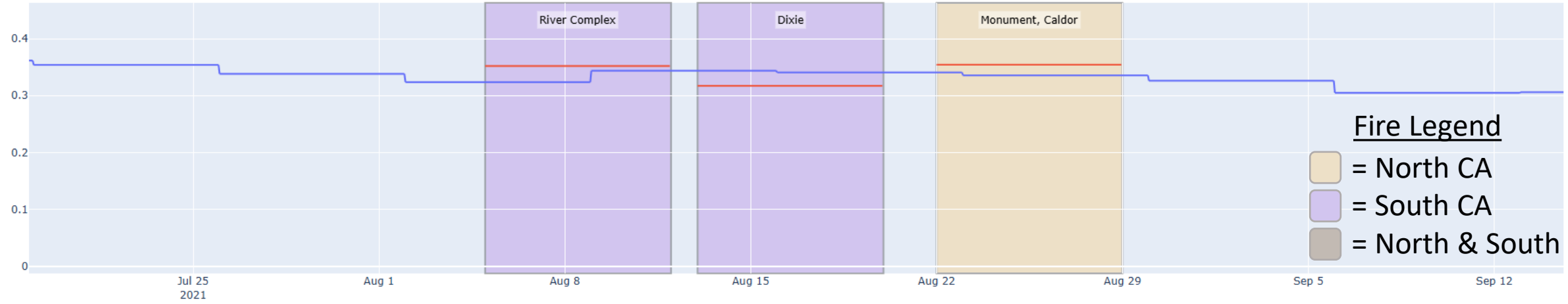
attributable to smoke at a single generation site when a fire is nearby

System-level impact (CAISO)

Negligible

Geographic diversity of the solar fleet mutes the impact across CAISO

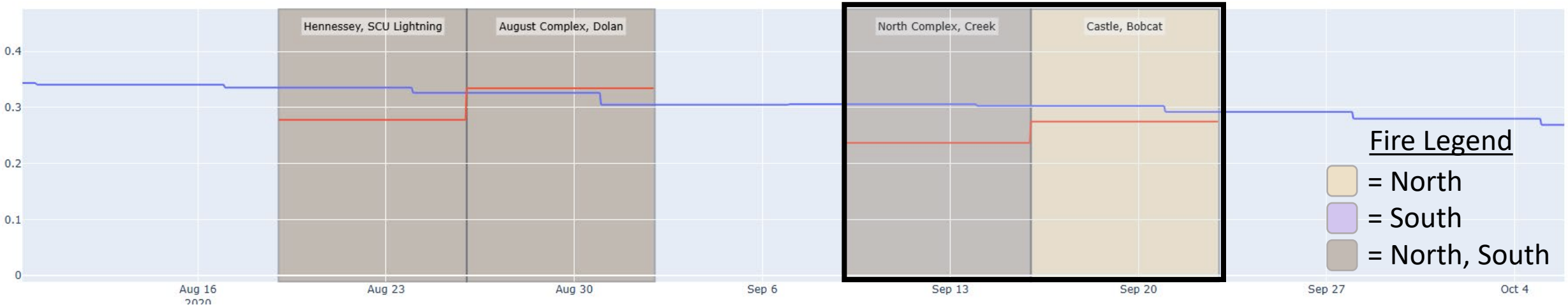
Actual CAISO weekly energy factor vs. average weekly energy factor



Some Evidence of Correlated Energy Reductions

2020 fires affected large parts of the state

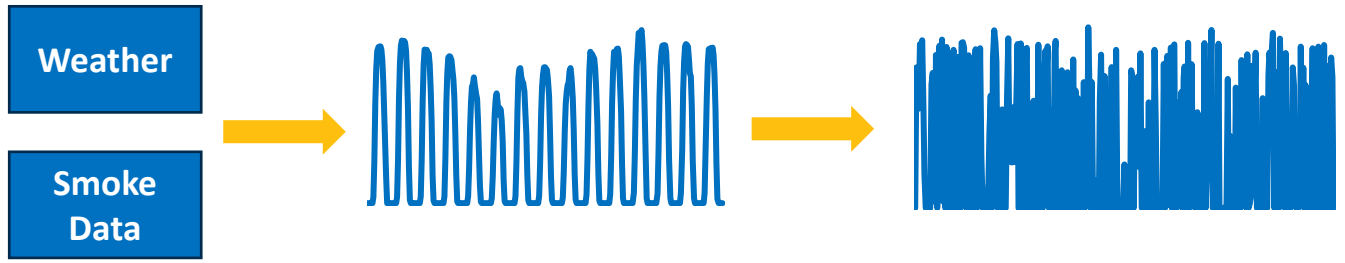
Actual CAISO weekly energy factor vs. average weekly energy factor



Regression Analysis Identified Minimal Causation

Particulate Matter was not a meaningful variable in forecasting solar generation when compared with broader weather

- Shortwave radiation dominates the importance rankings in the regression
- Both wildfire features show little importance (Daily Average/Max Particulate Matter)
  - Permutation importance measures how much a model's score decreases when a feature is randomly shuffled



Original R-Squared: 0.94

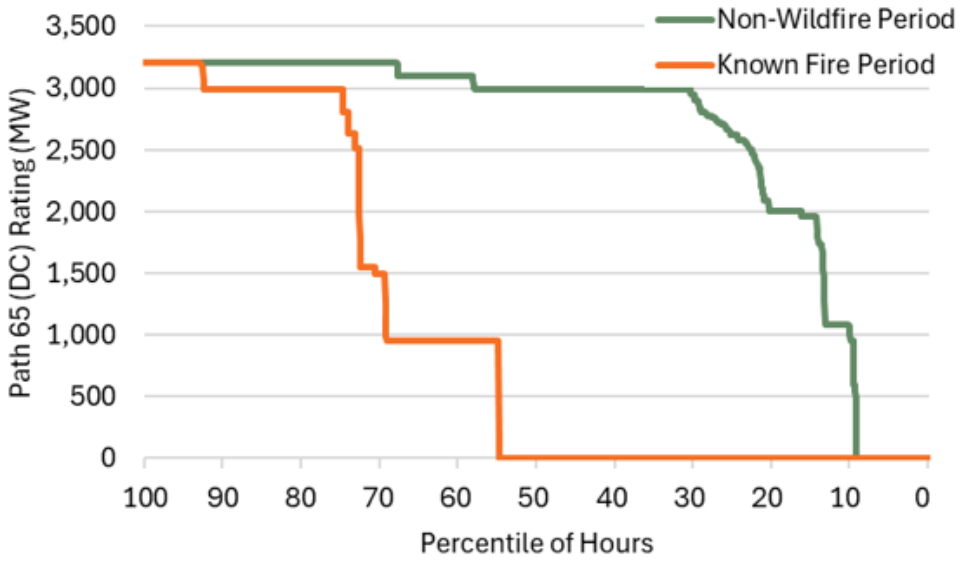
Feature	Importance	R-Squared after Shuffle
Shortwave Radiation	1.76	-0.82
Longwave Radiation	0.06	0.88
Week of Year	0.05	0.89
Temperature	0.03	0.91
Daily Max Particulates	0.02	0.92
Wind Speed	0.02	0.92
Daily Average Particulates	0.01	0.93

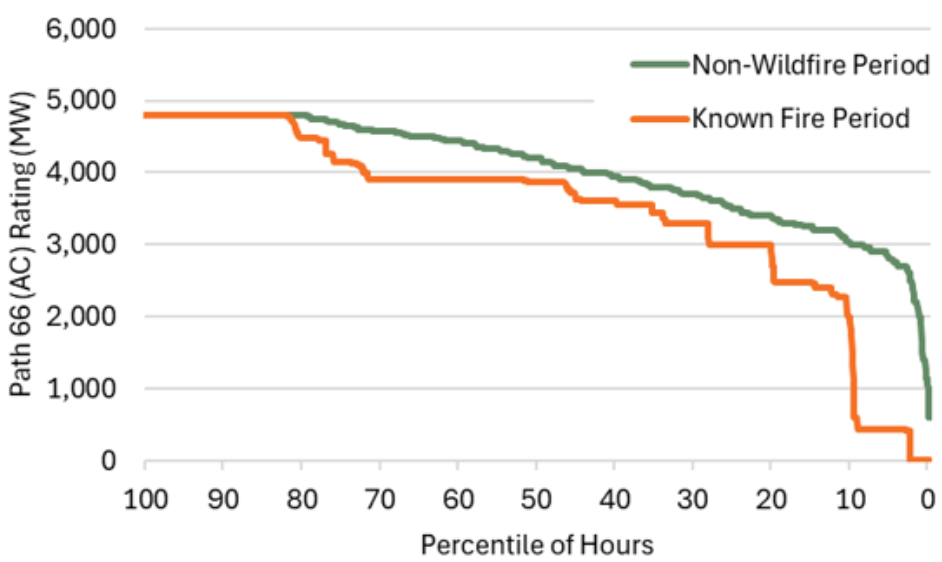
The approach taken is like one outlined in an SNL, EPRI research paper: https://www.sciencedirect.com/science/article/abs/pii/S0306261923006670?fr=RR-2&ref=pdf_download&rr=8f071fb9af3e9b53

Historical Transmission Data: Fires are Relevant

Significant transmission de-rates are aligned with times of wildfire activity[1] on both Path 65 (DC Line into LADWP) and 66 (Oregon<->Northern California).

- Even small fires can be associated with significant de-rates
- Questions remain on how these ratings are determined by utility operations





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1: Wildfire periods were defined as any days when a fire was active in the CAL FIRE data set that intersected with the DC tie. The dataset includes all hours between 2005 and September 2025.

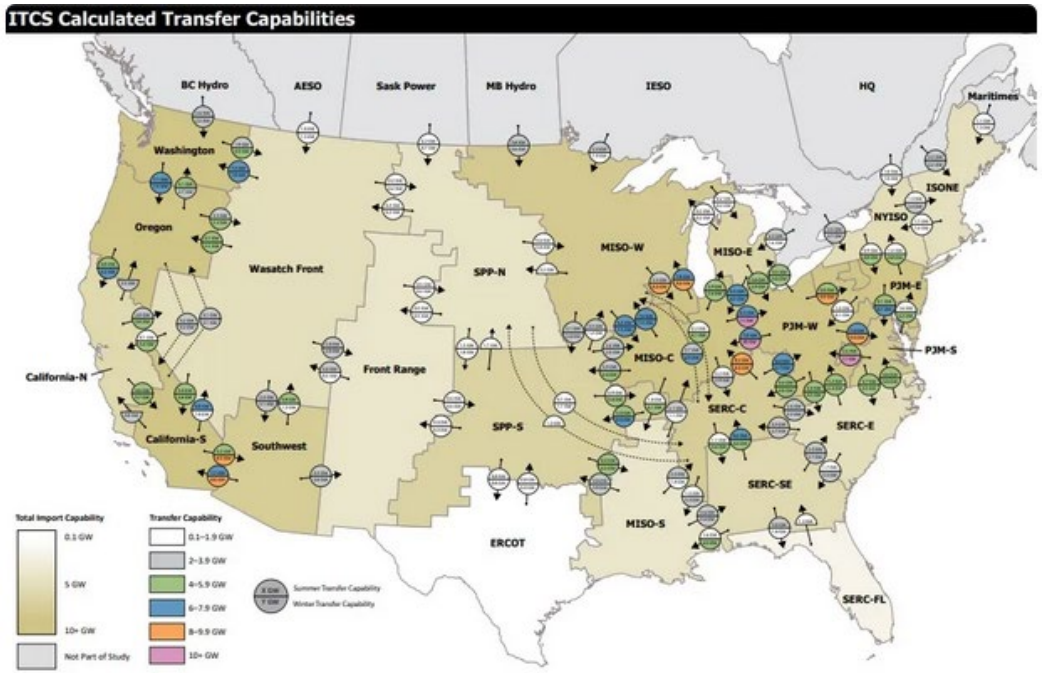
Visualizations by Telos
Data via:
https://transmission.bpa.gov/business/operations/paths/

Scenario Definitions

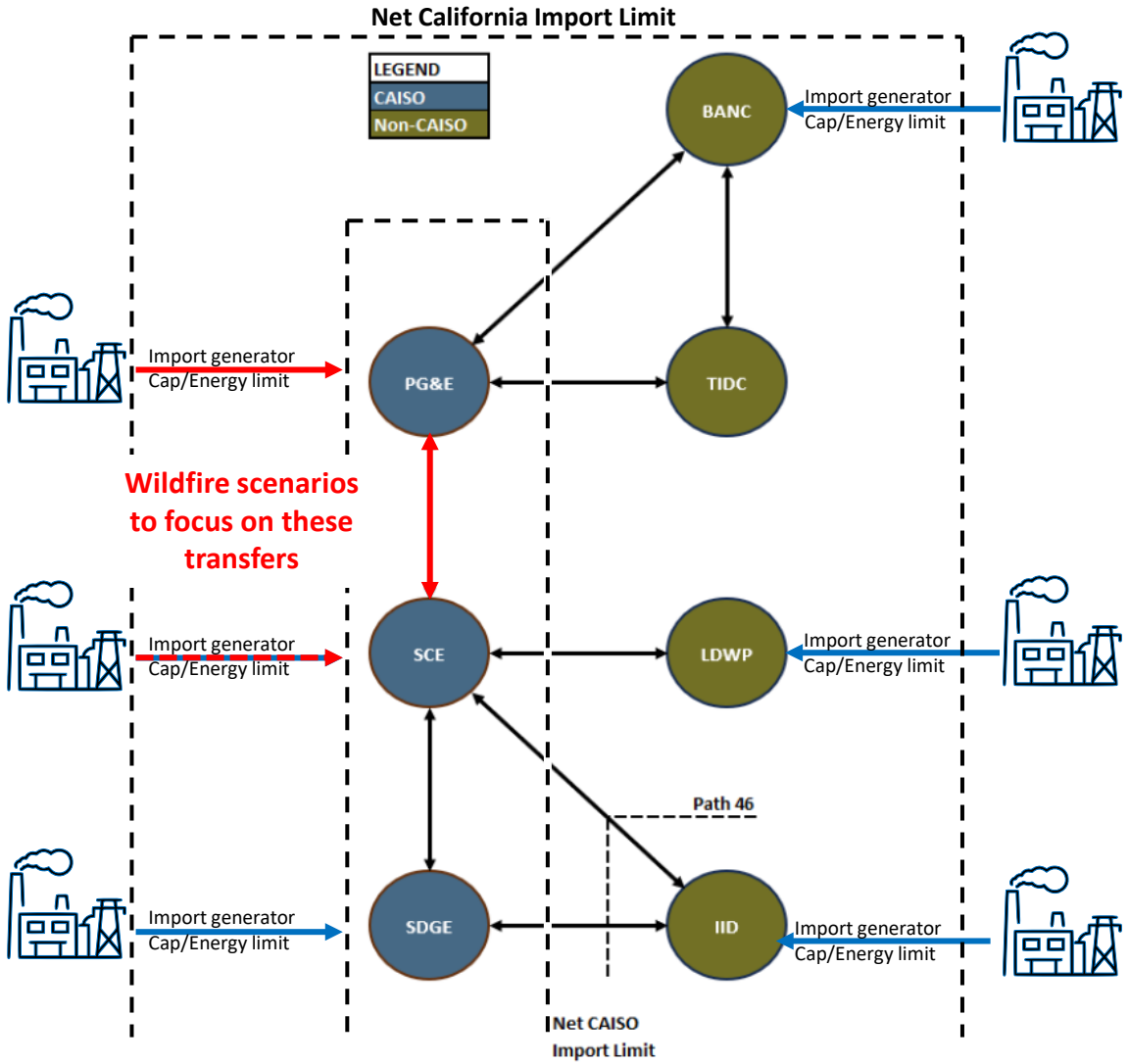
Defining the risk scenarios for additional analysis

Wildfire-Compromised Power Transfer Limits

The team plans to leverage learnings from the NERC ITCS efforts to establish "N-wildfire-1" transfer limits, which are engineering values based on taking lines out of service due to wildfire



CEC Zonal Model Topology



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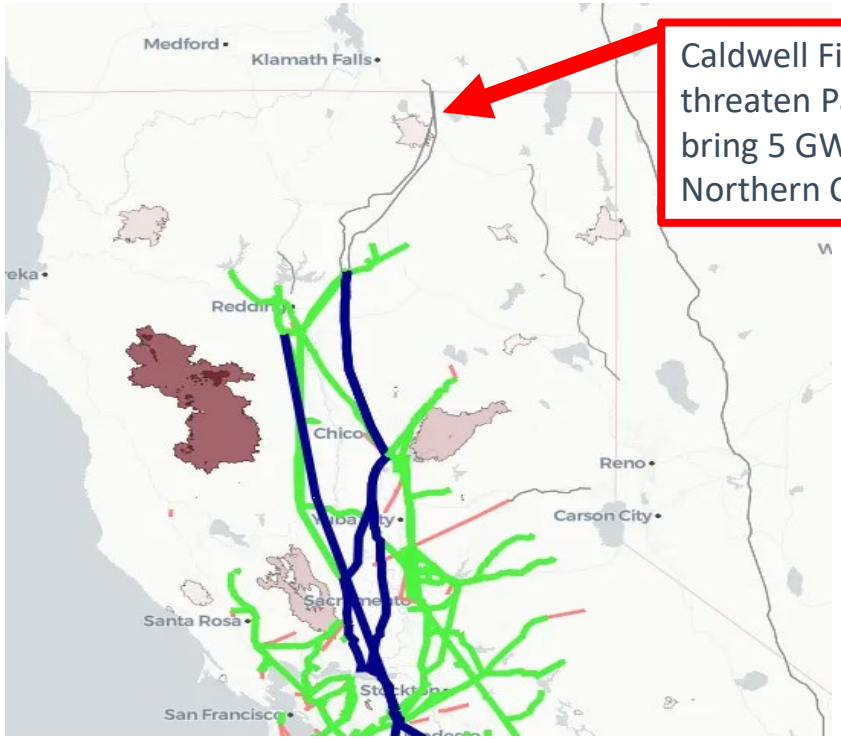
Identified High Priority Wildfire Risk Scenarios

Historical Fires

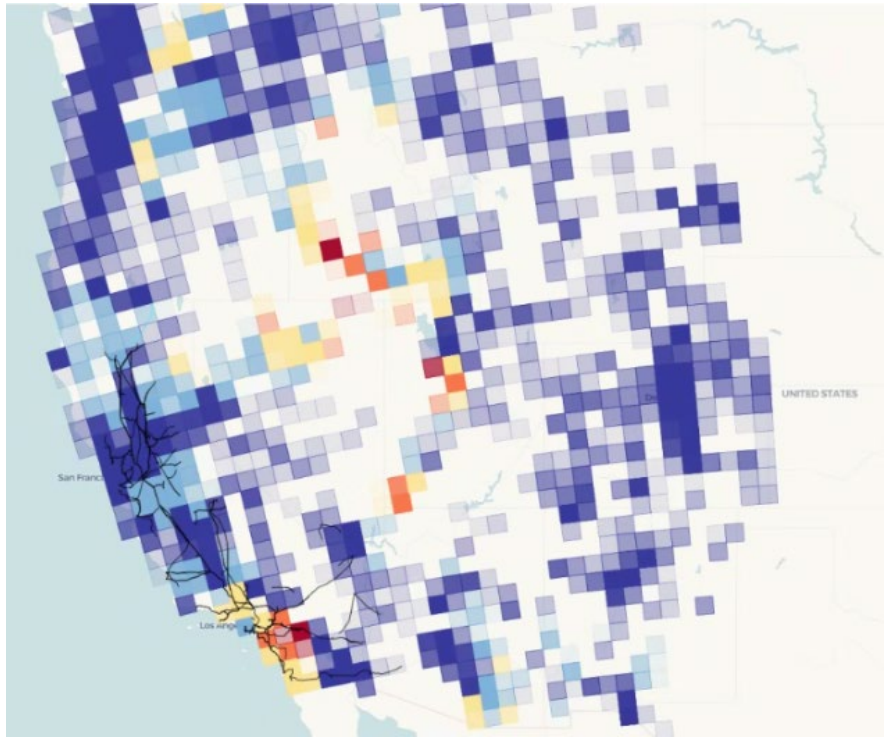
Provide anchor analysis in realistic scenarios, time series, and sanity check power flow derived limits



Caldwell Fire (July 2020) could threaten Path 66, which can bring 5 GW of power into Northern Cal.

Research Probabilities

Provided by PNNL, geographic wildfire risk can inform stochastic RA representation



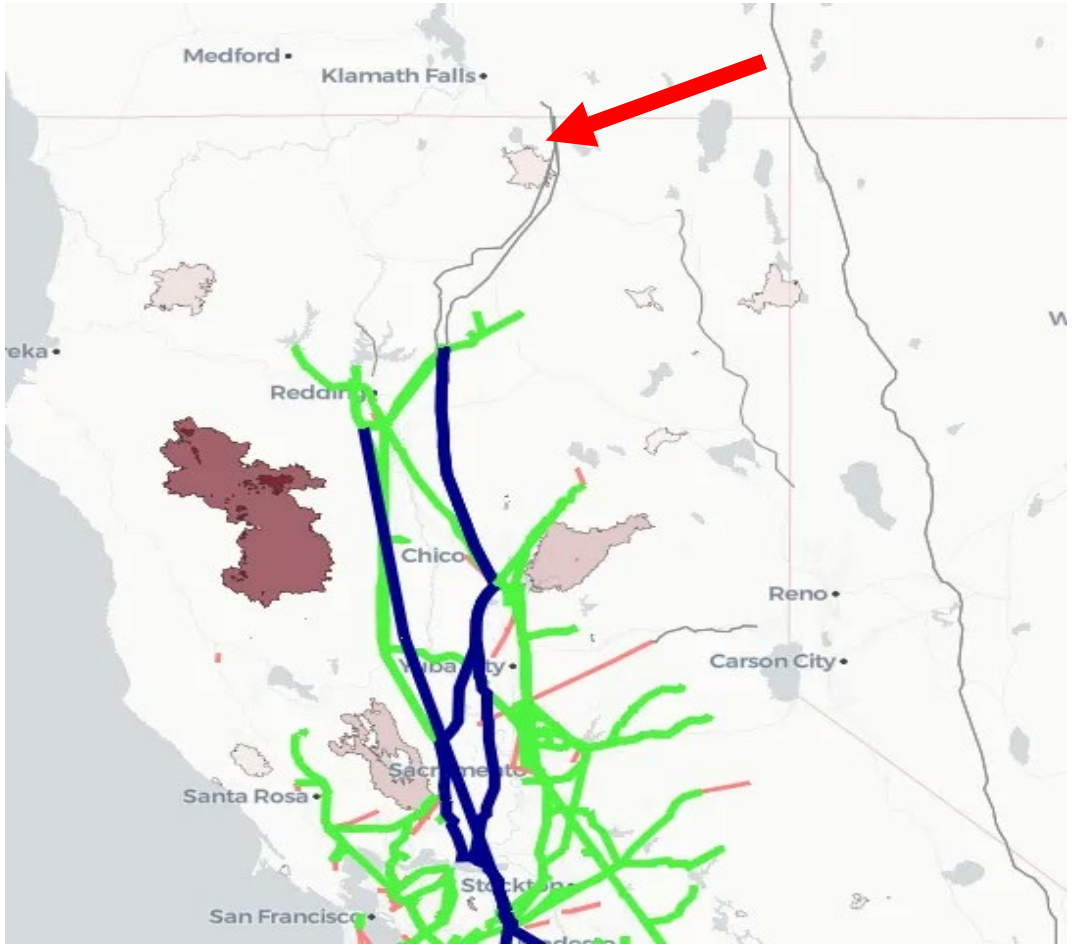
Visualizations by Telos

Data (left) via: https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program/fire-perimeters

Data (right) via: https://doi.org/10.11578/3018229. https://doi.org/10.11578/3018229

Path 66: California–Oregon Intertie

SCENARIO 1



Why This Scenario

The Caldwell Fire (July Complex, 2020) burned near the CA–OR border, threatening the primary import path that supplies ~5 GW to California. Loss of some Path 66 capacity will constrain northern imports during peak summer demand.

Scenario Details

Fire: Caldwell (July Complex) | Jul 22 – Sep 1, 2020 (~80,00 acres)*

Elements "Tripped": One 500 kV line

Normal Limit: 5,100 MW (North to South)

Wildfire-compromised limit: TBD

*Wildfire duration subject to CALFire reporting accuracy

Path 26: North California to South California

SCENARIO 2

Why This Scenario

The Powerhouse Fire (2013) struck a critical double-circuit corridor linking PG&E and SCE territory. Path 26 is the primary internal transfer path between Northern and Southern California. Multiple fires have affected this area since 2009.

Scenario Details

Fire: Powerhouse | May 30 – Dec 13, 2013* (~30,000 acres)*

Elements "Tripped": Two 500 kV lines

Normal Limit: 4,000 MW (North to South),
3,000 MW (South to North)

Wildfire-compromised limit: TBD

*Wildfire duration subject to CALFire reporting accuracy

Next Steps

Wildfire Risk Analysis Process Overview

Next steps – Better understanding the potential risks

1. Initialization ✓

- Lit Review
- Data Collection

2a. Solar Generation ✓

- Evaluate Smoke Impact on CAISO generation

2b. Transmission ✓

- Evaluate Transmission impacts in times of known fires
- Map PNNL risk data

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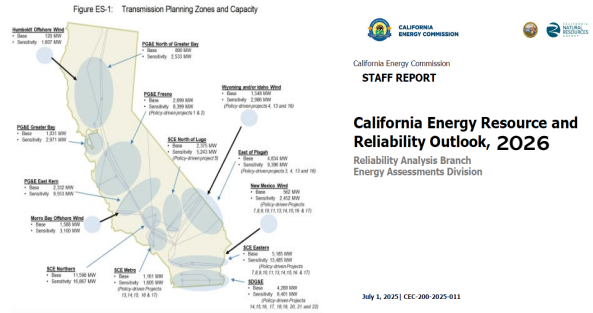

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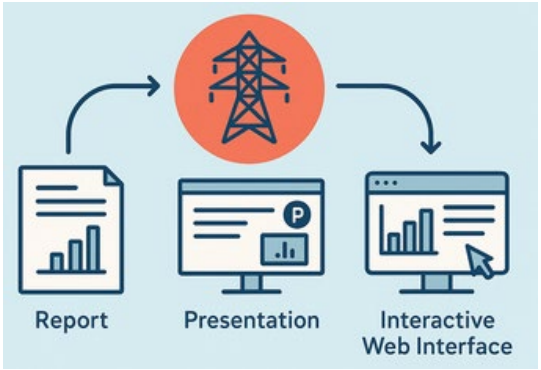

Thank You

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