



2024 Extreme Natural Events Mitigation Plan

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ENEMPAG: Who We Are

- Extreme Natural Events (ENE) Mitigation Plan Advisory Group
- Formed after RRC Risk Mitigation Decision (Feb. 2024) to “reduce” three ENEs
- Attempted subregion focus



ENE Focus

- ENEMPAG is responsible for identifying and documenting mitigating activities for three risks (and one risk identified for potential exploration of risk reduction); they are:
 1. Large and prolonged heat waves
 2. Cold Weather Preparedness
 3. Wildfire
 4. *Exploratory*: Drought (Aridification)

Advisory Group Members

Anderson, Grace	California Energy Commission	Fuller, Stan	Puget Sound Electric
Anderson, Nathan	GPUD	Hajian, Mahdi	AESO
Ashbaker, Steve	WECC	Hougland, Jon	Lower Valley Energy
Atighechi, Hamid	Powerex	Hydzik, Richard	Avista Corporation
Beach, Tim	RC West/California ISO	Johnson, Colby	Energy Strategies
Brightwell, Chad	Burbank	Landon, Suzanne	ATCO
Brooksby, Scott	WECC	Maxfield, Jake	PacifiCorp
Burchard, Hunter	SNPD	Mignella, Amy	Energy & Utilities Attorney
Butikofer, Tyler	Energy Strategies	Nath, Ram	Siemens
Conway, Kevin	Western Power Pool	Park, Greg	WECC
Dela Cruz, Roderick	Southern California Edison	Parvania, Masood	University of Utah
Dobson-Mack, Gordon	Powerex	Pavard, Curtis	Burbank
Dong, Feng	Siemens	Peters IV, Bert	WECC
Du, Fangfang	PacifiCorp	Poirier Mouallem, Johnne	ATCO
Duran, Gene	Xcel Energy	Vyakaranam, Bharat	PNNL
Fan, Xiaoyuan	PNNL	Williams, David	Avangrid

ENEMPAG Stated Objectives

The ENEMPAG will deliver the first three steps of the Risk Treatment Process contained in the RRC Risk Management Process document, which are:

1. Identify current or potential activities that could mitigate the risk;
2. Evaluate the expected effectiveness of each activity;
3. Determine the expected reduction in risk resulting from each activity;

Current RRC Objectives

The next steps are the remaining Risk Treatment Processes, which are:

4. Deciding whether the expected remaining risk is acceptable for each activity;
5. Selecting the activities to be undertaken;
6. Planning the activities; and
7. Executing and tracking the activities.

Things to Know

- ENEs are complex issues that may take years to evaluate
- Risks would benefit from including specific measures, for example:
 - 1-in-X-year weather event
 - X-degree below Y-facility-rating ambient operating temperature
- Many Mitigating Activity options are not fully formed
- May require efforts to explore the full options and expected effects of activities


Large and Prolonged Heat Waves

- **Condition:** Prolonged heat wave events cause stress on the interconnection as BAs ensure there is enough generation to meet the demand and transmission available to transfer it. The impact can also be more significant depending on the size of the heatwave.
- **Consequence:** As experienced in 2020 and 2022 heatwaves, prolonged high temperatures impact transmission availability and all classes of generation. As the ambient temperature rises, de-rates will occur for transmission and generation thermal ratings, causing a lack of transmission and generation availability.
- **Cause:** Beyond our control

Large and prolonged heat waves

Current Risk Evaluation

RISK PROBABILITY	MATERIALITY (40%)	CONTROLLABILITY (40%)	SPAN (10%)	VELOCITY (10%)	INITIAL RANKING SCORE	INITIAL RANKING
Likely	High	Uncontrollable	>2 Months	< 5 Years	18.8	High

POTENTIAL RISK EVALUATION	
RISK PROBABILITY:	<i>Likely</i>
MATERIALITY (40%):	<i>High</i>  <i>High Moderate</i>
CONTROLLABILITY (40%):	<i>Uncontrollable</i>
SPAN (10%):	<i>> 2 Months</i>
VELOCITY (10%):	<i>< 5 Years</i>
POTENTIAL RANKING SCORE:	<i>17.2 (out of 25)</i>
POTENTIAL RANKING:	<i>High</i>

Heat Wave: Constraints

- States control resource adequacy
- Energy Policy/jurisdictional authority distinctions
- Temperature impact on renewables
- Supply Adequacy and diversity
- Transmission (derates/reduce power transfers) – FERC881 Ambient Adjusted Ratings
- Reserves – Can be used to serve firm demand under specific conditions (WECC-BAL-002-WECC-3)
- Critical Service Categories – Need to focus on critical infrastructure
- Not all demand response devices are being used, nor can they even be used by utilities.
- Consistency of planning scenarios being used across the regions

Heat Waves: Mitigating Activities Ranked

1. Load forecasting (aligns with cold weather prep)
2. Energy emergency alerts/watch (EEA)
3. Demand-side management (DSM)
4. Retire WECC BAL-002 and go to NERC BAL-002 standards for contingency reserves
5. Restricted maintenance operations (RMO) (no touch day)
6. Storage device capacity management (state of charge)
7. Long-term incentives
8. Weather stations (entity-owned)
9. Microgrids
10. Customer awareness
11. Operator-initiated load shed

Heat Wave Mitigation Plot

Assets				
Controls		Generation	Transmission	Distribution
	Detective	1, 8	1, 8	1, 8
	Preventive	2, 4, 5, 6, 9	2, 9	2, 3, 7, 9, 10
	Corrective			

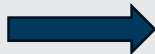
Cold Weather Preparedness

- **Condition:** Applicable Western Interconnection entities may not have adequate plans for winter preparedness.
- **Consequence:** Generation assets are impacted by cold weather and will trip offline if they are not prepared for cold ambient temperatures. Transmission assets can also be impacted due to icing on the lines that will eventually cause them to be derated or forced out of service (e.g., arcing, line sagging)
- **Cause:** Applicable utilities in the Western Interconnection are not implementing best practices learned from recent cold weather events.

Cold Weather Preparedness

Current Risk Evaluation

RISK PROBABILITY	MATERIALITY (40%)	CONTROLLABILITY (40%)	SPAN (10%)	VELOCITY (10%)	INITIAL RANKING SCORE	INITIAL RANKING
Likely	High Moderate	Uncontrollable	>2 Months	< Month	18.0	High

POTENTIAL RISK EVALUATION	
RISK PROBABILITY:	<i>Likely</i>
MATERIALITY (40%):	<i>High Moderate</i>  <i>Moderate</i>
CONTROLLABILITY (40%):	<i>Uncontrollable</i>
SPAN (10%):	<i>> 2 Months</i>
VELOCITY (10%):	<i>< Month</i>
POTENTIAL RANKING SCORE:	<i>16.4 (out of 25)</i>
POTENTIAL RANKING:	<i>High</i>

Cold Weather: Risk Feedback

- Create a newly registered risk to address wet/cold conditions (icing or ice storm preparedness)
 - Icing may occur at higher temperatures (i.e., not extreme cold)
 - Icing may occur with high wind conditions
 - Moisture (humidity, direct rain, atmospheric river, sleet, etc.) creates varied conditions different from ambient temperature

Cold Weather: Constraints

- Energy policy: carbon-free goals
- Supply derates:
 - Natural gas is a competing resource for heating
 - Natural gas and electric interdependency
 - Solar and wind impacts/reduced during extreme cold
 - Curtailment schemes may cut generation off to serve residential heating loads
- Battery energy storage systems (BESS) – Operate in only given thermal ranges
- Undergrounding equipment is high cost
- Transmission constraint management: to potentially allow higher flow (e.g., import) during extreme cold

Cold Weather: Constraints

- Allow generation assets to operate beyond contractual limits (if they can) during extreme cold to manage supply
- Wind chill factors
- Wind drought: Affected by the cold temperatures and atmospheric pressure changes (or hot temperatures)
- Severe winds (preceding or at the initial stage of the extreme cold event)
- Acknowledge grid transformation as a constraint on mitigation efforts
- TPL Standards don't allow load-shed during all icing events

Cold Weather: Mitigating Activities Ranked

1. Load forecasting (aligns with heat wave)
2. Dispatchable generation
3. Weather forecasting accuracy
4. NERC Alerts (Level III, Eight Essential Actions Cold Weather Preparedness)
5. Cold weather reliability standards (EOP, TOP, IRO, TPL, BAL)
6. Public appeals (limit use) / incentives
7. Hardening load (customer preparation)

Cold Weather Mitigation Plot

Assets				
Controls		Generation	Transmission	Distribution
	Detective	1, 3, 4	1, 3, 4	1, 3, 4
	Preventive	2, 4, 5, 6	4, 5	4, 5, 6, 7
	Corrective			

Wildfire

- **Condition:** Wildfires continue to be a risk in the West, creating potential service disruptions and loss of load.
- **Consequence:** Wildfires can impact the electric grid, causing service disruptions to transmission and generation assets by affecting the equipment directly (e.g., fire burning equipment) and indirectly (e.g., smoke causing transmission line arcing, sediment on insulators). Depending on different factors of the fire, like the magnitude or location, the disruptions can be prolonged (e.g., remote areas). In addition, extreme wildfires can create their own climates which can cause unsafe mitigation conditions slowing restoration, or exacerbating its impact and damage caused.
- **Cause:** Lightning and humans are the two main factors that cause wildfires.

Wildfire

Current Risk Evaluation

RISK PROBABILITY	MATERIALITY (40%)	CONTROLLABILITY (40%)	SPAN (10%)	VELOCITY (10%)	INITIAL RANKING SCORE	INITIAL RANKING
Likely	High Moderate	Uncontrollable	1-2 Months	< Month	17.6	High

POTENTIAL RISK EVALUATION

RISK PROBABILITY:	<i>Likely</i> → <i>Likely</i>
MATERIALITY (40%):	<i>High Moderate</i> → <i>Moderate</i>
CONTROLLABILITY (40%):	<i>Uncontrollable</i>
SPAN (10%):	<i>1 - 2 Months</i>
VELOCITY (10%):	<i>< Month</i>
POTENTIAL RANKING SCORE:	<i>16.0 (out of 25)</i>
POTENTIAL RANKING:	<i>High</i>

Wildfire: Constraints

- Limited control of wildfires
- Post-fire erosion, burn scars, and watershed changes can adversely affect system performance and asset access
- Ash plugging filters / increasing issues
- State & federal involvement can complicate coordination
- Regulations
- Bringing all utilities to the coordination effort (water, gas, power) to develop plans
- Cost (may be offset by state/government money FEMA)
 - Wildfire insurance issues
 - Utilities experiencing a lot of wildfires downgraded in credit ratings
 - When a corridor is identified that could be impacted by WF, entities must reconsider construction or rebuilding

Wildfire: Constraints Cont.

- Supply chain
- Aging infrastructure/performance level variation
- Vegetation management policy may restrict what an entity can perform for maintenance
 - Reputational Risk for doing the right thing (i.e., vegetation management, tree trimming, and/or removal pushback from public and regulatory policies)
- Limitation of satellite imagery (can't see through smoke)
- Animal- and human-caused
- Fire management strategies (historically) may have relied on transmission fire breaks where they should not have

Wildfire: Mitigating Activities Ranked

1. Vegetation management
2. Position the grid to be more resilient / grid hardening
3. Formal wildfire mitigation program covering grid expansion and grid resiliency
4. Public safety power shutoff (PSPS)
5. Designate high-fire-risk areas and determine the installation of other routes
6. Coordinating: multi-entity engagement. Including fire departments
7. Use of drones (equipment inspecting; fire detection)
8. Satellite imagery (fuel loading; hazard tree inventory)
9. System hardening (fire-resistant)
10. Islanding operations to consider voltage and frequency control
11. Machine learning: improved accuracy of weather forecasting and models

Wildfire Mitigation Plot

Assets				
Controls		Generation	Transmission	Distribution
	Detective		1, 5, 7, 8, 10, 11	1, 5, 7, 8, 10, 11
	Preventive		2, 3, 4, 6	2, 3, 4, 6, 9
	Corrective			

Exploratory: Drought (Aridification)


- **Condition:** Severe and extended drought conditions
- **Consequence:** Reduction in the availability of some hydro resources in the West and limiting the cooling capacity of thermal generation.
- **Cause:**

Drought (Aridification)

Current Risk Evaluation

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CONTROLLABILITY (40%):	<i>Uncontrollable</i>
SPAN (10%):	<i>> 2 Months</i>
VELOCITY (10%):	<i>< 5 Years</i>
POTENTIAL RANKING SCORE:	<i>15.6 (out of 25)</i>
POTENTIAL RANKING:	<i>High</i>

Drought: Constraints

- Aquifer drops degrade infrastructure
- Floodplain changes due to drought
- Constraint conditions can run for multiple years
- Increased seismic activity can result from the massive loss of groundwater experienced since the western drought began
- The comprehensive nature of the problem may not be understood
- Drought could disrupt electricity systems that depend heavily on hydropower, potentially increasing generation from fossil fuel sources
- Communications of availability of hydro generation

Drought: Constraints

- Hydro plants provide operating reserves and Blackstart services for some utilities
- Water diversion to food/drinking resources, including fish operations
- Dynamics of aridification on wind resources. Microburst extremes
- Increasing wear on spinning resources as a backup
- Increased wildfire risk, increasing tinder
- The U.S. may have maxed on reservoirs

Drought: Mitigating Activities Ranked

1. Planning long-term (Study the resource mix to understand hydro vs. non-hydro)
2. Encourage/support the coordinated hydro operations (e.g., Mid-Columbia)
3. Conservation needs. Improved water-management practice
4. Resource diversity: solar collectors, shifting to non-hydro resources
5. Tracking: hydro mapping
6. Enhanced grid flexibility. Ability to transfer energy between water basins
7. Increased water storage
8. Consider materials more resilient to drought, cold, etc. Consider throughout design/planning
9. Real-time predictive AI models that enable hydro operators to plan drought events

Drought Mitigation Plot

Assets				
Controls		Generation	Transmission	Distribution
	Detective	1, 2, 5, 7, 8, 9		
	Preventive	3, 4, 6		
	Corrective			

Next Steps Discussion

- Webinars / deep-dive sessions
- Determine RRC-specific actions
- Plan and execute



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