Disclaimer

This document: (a) is proprietary and confidential to Baringa Services Ltd ("Baringa") and could not be disclosed to or relied upon by any third parties or re-used without Baringa's consent; (b) shall not form part of any contract nor constitute acceptance or an offer capable of acceptance; (c) excludes all conditions and warranties whether express or implied by statute, law or otherwise; (d) places no responsibility or liability on Baringa or its group companies for any inaccuracy, incompleteness or error herein; and (e) is provided in a draft condition "as is" without warranty. Any reliance upon the content shall be at user's own risk and responsibility. If any of these terms is invalid or unenforceable, the continuation in full force and effect of the remainder will not be prejudiced.

This report has been prepared by Baringa Services Ltd or a Baringa group company ("Baringa") specifically for the client named in this report ("Client") for the sole purpose of assisting the consideration of Client or interested investors ("Investors") in the potential transaction named in this report ("Transaction").

This report does not constitute a personal recommendation of Baringa or take into account the particular investment objectives, financial situations, or needs of Client or the Investors in relation to the Transaction. Client and Investors could consider whether the content of this report is suitable for their particular circumstances and, if appropriate, seek their own professional advice and carry out any further necessary investigations before deciding whether or not to proceed with the Transaction. This report could not, under any circumstances, be treated as a document containing complete and accurate information sufficient to make an investment decision. It is the responsibility of the Client and Investors to conduct such due diligence as necessary of any risk factors not identified in this report or which could affect the operation, financial standing and further development prospects of any assets being acquired, charged or sold in the Transaction. Baringa shall not be liable in any way for errors or omissions in information contained in this report based upon publicly available industry data or specific information provided by others (including Client, its affiliates, their advisers, target entity or any third parties). Baringa makes no representations or warranties (express or implied) concerning the accuracy or completeness of the information contained in this report, nor whether such information fully reflects the actual situation described in this report, and all conditions and warranties whether express or implied by statute, law or otherwise are excluded.

Information and data contained in this report is confidential and must not be disclosed to third parties by Client or Investors except as permitted in the relevant Client contract with Baringa or with the written consent of Baringa. This report may not be used in any processes involving the public offering in which shares of stock in a company are sold either privately or on a securities exchange. No part of this Report may be copied, photocopied or duplicated in any form by any means or redistributed (in whole or in part) except as permitted in the relevant Client contract with Baringa or with the written consent of Baringa. Copyright © Baringa Services Ltd 2024. All rights reserved.

State of the Grid Report

MONTANA DEQ MONTANA

Energy & Resources | Utilities

May 2025

Table of contents

 |

Executive Summary

Historically, severe outages in Montana have primarily been driven by wind-related events, making this a priority for additional investment

PROGRAM OBJECTIVE

Help state energy offices and select utilities assess how to use **40101(d) funding** to best strengthen the power grid against extreme weather, by:

- **Assessing** the unique **needs** of each state energy office
- **Analyzing future exposure to extreme weather** in the state, its coincidence with energy assets, and potential impacts
- **Attributing outages to weather events** and commenting on the alignment of utility capital spending with historical exposure
- Outlining a **benefit-cost methodology** to improve asset planning

DELIVERABLE OBJECTIVE

This deliverable seeks to:

- Attribute historical outages in the state to specific weather events and **comment on which events are driving the most customer interruptions in the state**
- Analyze a select utility's capital plan and **assess the alignment between their resilience spending and the weather events driving outages in their service territory**

KEY FINDINGS

Hazard Analysis:

High wind speeds are **the key driver of severe outages*** on the Montana grid

- High wind speeds are coincident with 60% of all customer interruptions from severe outages during 2018-22
- Only 2% of interruptions from severe outages were not coincident with extreme weather, justifying expanded weatherization and resilience-related investments

Capital Planning Insights:

IOU-1 is investing heavily to mitigate wildfire risk, but could **consider whether investments addressing wind should be expanded**

- Purely wind-driven outages account for 40% of customer interruptions from severe outages in IOU-1's service territory
- IOU-1 is generally spending effectively given its relatively low spend per line mile and SAIDI minutes compared to other utilities in WECC

A severe outage is defined as one in which >50% of customers in a county are out simultaneously, or at least 30,0000 customers in a county experience an outage simultaneously, whichever is less

Sources: Found in slide notes

High Cost | Moderate Cost | Low Cost

Despite the importance of wind and wildfire in the West, utilities could bolster their capital alignment with historical & future risk by conducting asset-level vulnerability assessments

STATE OF THE GRID REPORT | FINAL INVESTMENT CONSIDERATIONS

Invest against windstorms: Windstorms are the most widespread and severe cause of extreme outages across WECC in the past 5 years. While utilities are investing some capital against wind risk, the universal elevated exposure requires an increased volume of capital towards mitigations. Given its homogenous exposure, wind upgrades could be pursued as updates to design standards rather than targeted, ad hoc investments like substation upgrades.

Continue existing wildfire mitigations: While wildfire exposure of the past 5 years varies by geography, the cost of ignition remains inordinately high in comparison to other hazards. Therefore, even though ignition probability may be low, the high expected cost, coupled with the expected increase in exposure due to changes in climate, substantiates increased investment in mitigation. Utilities can better justify expensive investments like undergrounding by ensuring upgrades are done on feeders that are exposed to multiple hazards, having a double dividend effect on the investment.

Quantify extreme weather risk in dollars: In order to optimally allocate capital expenditures to buy down the most extreme weather risk for the least amount of dollars, utilities must quantify the cost and benefits of the risk and subsequent investment. The utilities that are most effectively optimizing their plans are implementing asset-level vulnerability assessments, using down downscaled climate projections to predict impacts out to mid-century. Baringa will be expanding on how to conduct such analysis in phase 4 of this project.

ASSET	INVESTMENT	COST	HAZARDS
POLES & STRUCTURES	Pole Reinforcement	M	3
	Pole Upgrades	M	3
	Dead-End Structures	M	2
	Decreased Span	M	2
	Pole Wrapping	L	1
CONDUCTORS	Undergrounding	H	4
	Reconductoring	M	4
	Covered Conductors	M	4
	Hardening/Rebuilds	L	1
SUBSTATIONS	Substation Elevation	H	1
	Control House Remediation	H	1
	Enclosures	H	3
	Reclosers/Switchgear	M	2
	Flood Walls	M	1
	Cooling Mechanisms	M	1
PLANNING TOOLS	Vegetation Management	H	3
	Dynamic Line Rating (DLR)	L	1
	Wildfire Planning Tools	M	1

Project Approach

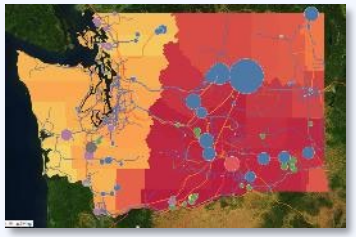
Project Overview

The State of the Grid Report will provide recommendations and insights into most effective **resilience projects**, **highest risk locations**, and strategies for **improving capital spend efficiency**

1 STATE OF THE GRID REPORT | **BENEFITS**

Improved understanding of **how extreme weather impacts outage and ignition rates** in your service territory

DELIVERABLE | **EXTREME WEATHER ANALYSIS**



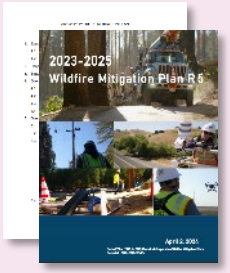
Analyze 5 years of publicly available extreme weather and outage data to **determine which type of events cause the largest outages and ignitions**.

Comment on expected change in outages and ignitions as a function of climate projections.

2 STATE OF THE GRID REPORT | **BENEFITS**

Actionable insights to **improve capital effectiveness** that addresses extreme weather risk

DELIVERABLE | **INVESTMENT PLAN REVIEW**



Review most recent investment plan to determine **effectiveness of normalized capital spend** in mitigating outages and ignitions from extreme weather.

Results will be anonymously compared with other participants to help outline resilience best practices and most effective mitigations.

Baringa is conscious of data privacy and sensitivities and is more than willing to work with your team to address concerns.

Extreme Weather Outage Analysis

Project Overview

Severe outages were mapped to corresponding weather events to better understand which forms of extreme weather are driving customer interruptions and how utilities can respond

DEFINE EXTREME WEATHER EVENTS

Purpose: Begin with a definition of extreme weather to focus on the most impactful events.

Definition: weather events are considered extreme if they are above the 90th percentile of severity for that state.

Data: Western Regional Climate Center (WRCC)

Time: 2018 - 2022

FILTER EXTREME OUTAGE EVENTS

Purpose: Define extreme outage events to highlight highest cost outages

Definition: outage events are considered extreme if:

At least 50% OR >30,000 of customers are out in a single county

*modified from Oak Ridge National Labs definition

Data: EAGLE-I

Time: 2018 - 2022

ANALYZE EVENT COINCIDENCE

Purpose: Identify the extreme outages that occur at the same time as extreme weather events.

Analysis Areas:

- WECC Overview
- Most Impactful Hazard Analysis
- Hazard by Total Interruptions (Pareto Chart)
- Spatial Analysis
- Historical Ignition Analysis
- Hazard Deep Dives

DETERMINE ASSET PLANNING INSIGHTS

Purpose: Provide implications for asset planning and funding priorities

Example Insights

- Historical severe outage locations
- Historical extreme ignitions
- Historical primary drivers of outages
- Distribution of outages across hazards
- Design standard implications

KEY WEATHER EVENTS

WILDFIRE | WINTER STORMS | SUMMER STORMS | WINDSTORM | EXTREME PRECIPITATION | RAINSTORM | EXTREME HEAT | EXTREME COLD | FLOOD

 |

Weather events were mapped to raw data to capture both single hazard and multi-hazard events. Events are considered extreme if the raw data is above the 90th percentile for the state

WEATHER EVENT	PRESENT WEATHER METRICS (Above 90th percentile)
EXTREME COLD	Min Temperature
EXTREME HEAT	Max Temperature
WILDFIRE*	Fire Weather Index (FWI)
EXTREME PRECIPITATION	Precipitation

WEATHER EVENT	PRESENT WEATHER METRICS (Above 90th percentile)
WIND STORM	Wind
RAIN STORM	Wind + Precipitation
SUMMER STORM	Wind + Precipitation + Max Temperature
WINTER STORM	Wind + Precipitation + Min Temperature
FLOODING	Surface Runoff

*Outages occurring within two days of a documented wildfire ignition in the county of origin were also attributed to wildfire, overriding other hazard combinations

Mapping outages to weather events more accurately captures the impact of coincident hazards, avoids double counting outages, and allows for flexible event definitions

Coincident Hazards

- **EXPLANATION:** Mapping to events captures unique threats posed to assets from coincident hazards
- **BENEFIT:** Multiple hazards occurring simultaneously can have different impacts on assets than considering each individually (e.g. coincident wind and snow/ice contributes to line galloping, wind and extreme heat could increase probability of vegetation contact given line sag due to heat).

No Double Counting

- **EXPLANATION:** Variable combinations are mapped to specific events
- **BENEFIT:** Ensuring that other hazards are below the 90th percentile isolates the most important hazards. Just looking at one hazards could capture outages that are actually attributable to other hazards.

Flexible Event Definitions

- **EXPLANATION:** Multiple different hazard combinations can be mapped to the same weather event given similar impacts to assets
- **BENEFIT:** Mapping to events allows for historical ignitions and extreme fire weather to be mapped to the same category, as both reflect ignition potential and can be addressed by similar upgrades.

Outages were classified as “severe” if more than 50% of customers OR more 30,000 customers in a given county are out at a single point in time

1 OUTAGE EVENT HANDLING

Define outage events to analyze coincidence with weather events and avoid double counting

METHODOLOGY

1. In a new column, assign “y” if “Customers Out” entry >0 in the data row, “n” if “Customers Out” = 0
2. Assign a unique event number to each string of consecutive “y” entries, separated by at least one “n” entry
3. For each unique event, keep the row with the maximum “Customers Out” value

DATASET | **EAGLE-I**

U.S. DEPARTMENT OF ENERGY

Comprehensive outage dataset from 2014-2022 created through a partnership between Oak Ridge National Lab and the U.S. DOE

OAK RIDGE National Laboratory

Data is collected from utility’s public outage maps and provides 92% coverage of US and Territories

2 SEVERE OUTAGE CLASSIFICATION

Define “severe” outages in order to determine which weather events are coincident with the costliest outages in the state

DEFINITION

At least 50% of customers out in a given county

OR

At least 30,000 customers out in a given county

*whichever is less

SEVERE OUTAGES | **JUSTIFICATION**

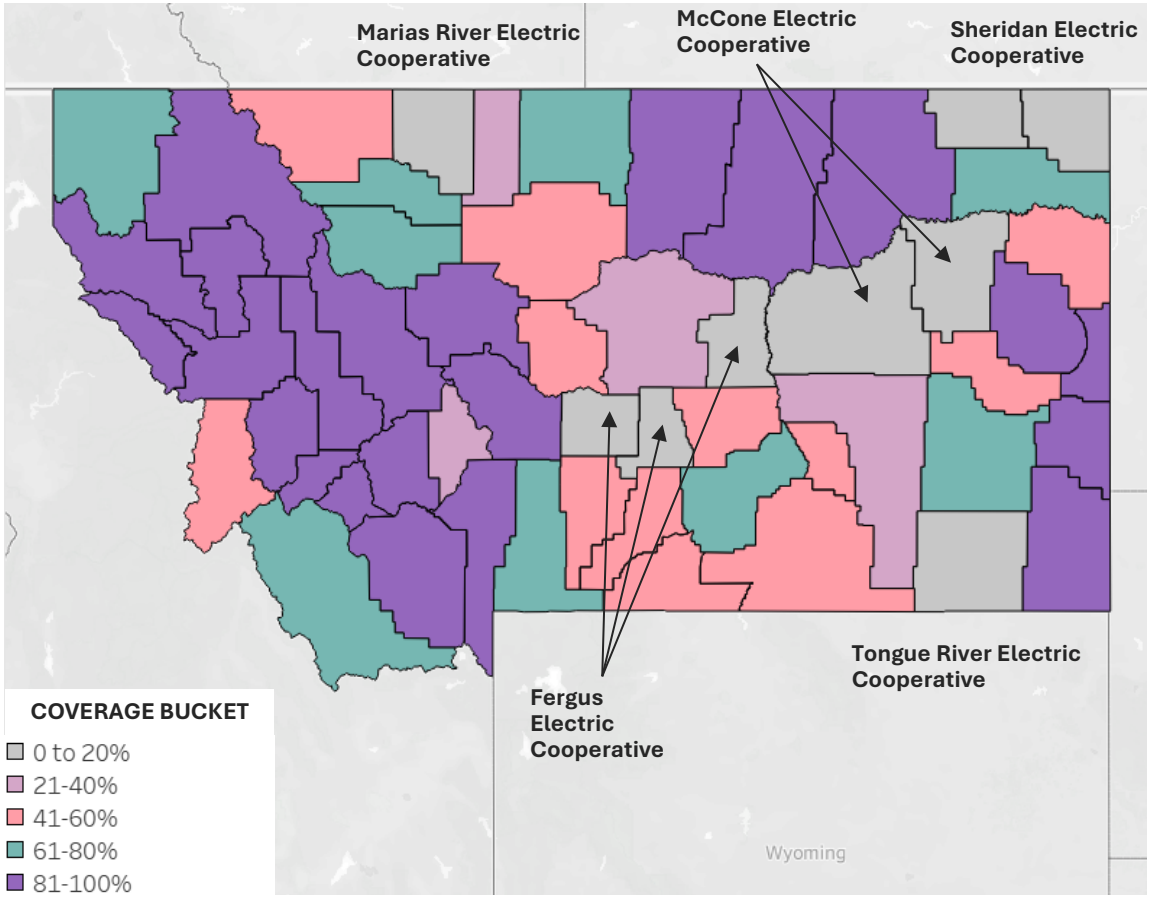
Draws on ORNL’s “Analysis of Historical Power Outages in the United States and the National Risk Index,” in which the researchers determined the 30,000 customer metric as a conservative threshold to isolate extreme, weather-cause events

While ORNL uses a 15% customer outage threshold, we have increased it to 50% for this analysis to focus our insights on how to address the costliest and most severe outages in the state

Baringa

The EAGLE-I dataset provides coverage for 80% of MT customers, but is missing data from smaller cooperatives in the eastern portion of the state

EAGLE-I CUSTOMER COVERAGE (%) (MT, 2018-2022)



INSIGHTS

Outage data generally has better fidelity in the western region of the state than the eastern region

- Outage data is best the highly-populated counties in the western portion of the state that are served by IOUs
- There is a much higher proportion of counties with partial coverage compared to the rest of WECC as many counties are served by a mix of providers that likely have different outage data fidelity

A high volume of customers in the state are covered by the EAGLE-I dataset, indicating that it is still valuable for volumetric analysis

- Over 80% of customers in the state are covered in the EAGLE-I dataset
- Insights surrounding the volume of customer interruptions in the state will be aligned with real world exposure

Additional consideration could be given to the hazards faced by counties without outage data

- The weather events driving outages in counties without data will be underrepresented in this analysis
- While this may not have a large impact on the distribution of the volume of customer interruptions, it could significantly change the distribution of the count of outages associate with different hazards
- Wildfire and extreme heat might be underrepresented in this analysis given their concentration in eastern counties

WECC Summary

Windstorms are often the primary driver of customer interruptions in WECC, especially among smaller counties, but heat, wildfire, and rainstorms drive many interruptions along the coast

INSIGHTS

Windstorms are the most common primary driver of customer interruptions across WECC

- This is especially true among states in the eastern portion of the region such as Montana, Wyoming, and Colorado
- Wind is frequently the primary driver for counties with relatively fewer customer interruptions, indicating that it has an outsize impact on rural communities with radial networks and more overhead line mileage

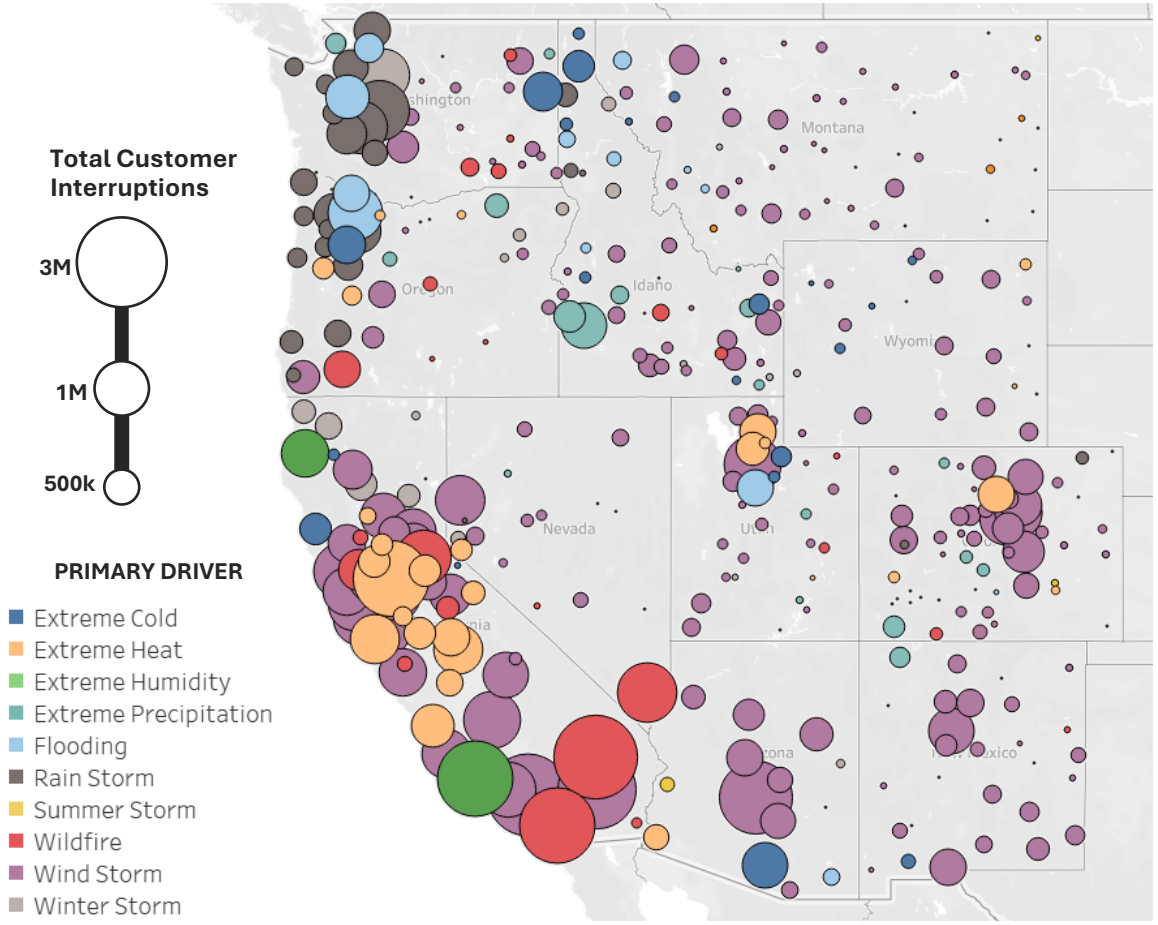
A higher volume of total customer interruptions is generally concentrated along the coast

- More populous counties in CA, WA, and OR drive a higher volume of customer interruptions
- Costal states demonstrate a wider range of primary driving hazards, including wildfire, extreme heat, flooding, and rainstorms

Extreme heat and wildfire are primary drivers of customer interruptions even in northern counties of the state

- While the northern portions of the state generally face less heat and wildfire exposure, these hazards are still driving customer interruptions because grid infrastructure could be less prepared for these events
- Per Baringa's Grid Resilience Reports, heat and wildfire exposure is projected to increase across the region out to mid- and end-century, potentially justifying hardening in historically less-exposed regions where this change will be most dramatic

PRIMARY DRIVER OF CUSTOMER INTERRUPTIONS BY COUNTY
(WECC, 2018-2022)



 |

State Summary

Montana

Legend: Most Impactful Hazard | Tertiary Hazard | No Extreme Hazard

High winds drive the most frequent and impactful power outages in the state, accounting for nearly 60% of all customer interruptions from severe outages across a 5-year period

HAZARD INSIGHTS

High winds frequently drive severe outages on the Montana grid

- Windstorms are attributable to both high outage minutes and outage events
- Top three weather events include wind as a driving hazard, indicating that adaptations addressing wind could be prioritized
- Wind-driven outages account for nearly 60% of all customer interruptions from severe outages across the state from 2018-2022

Exposure to extreme winter and summer storms is projected to intensify

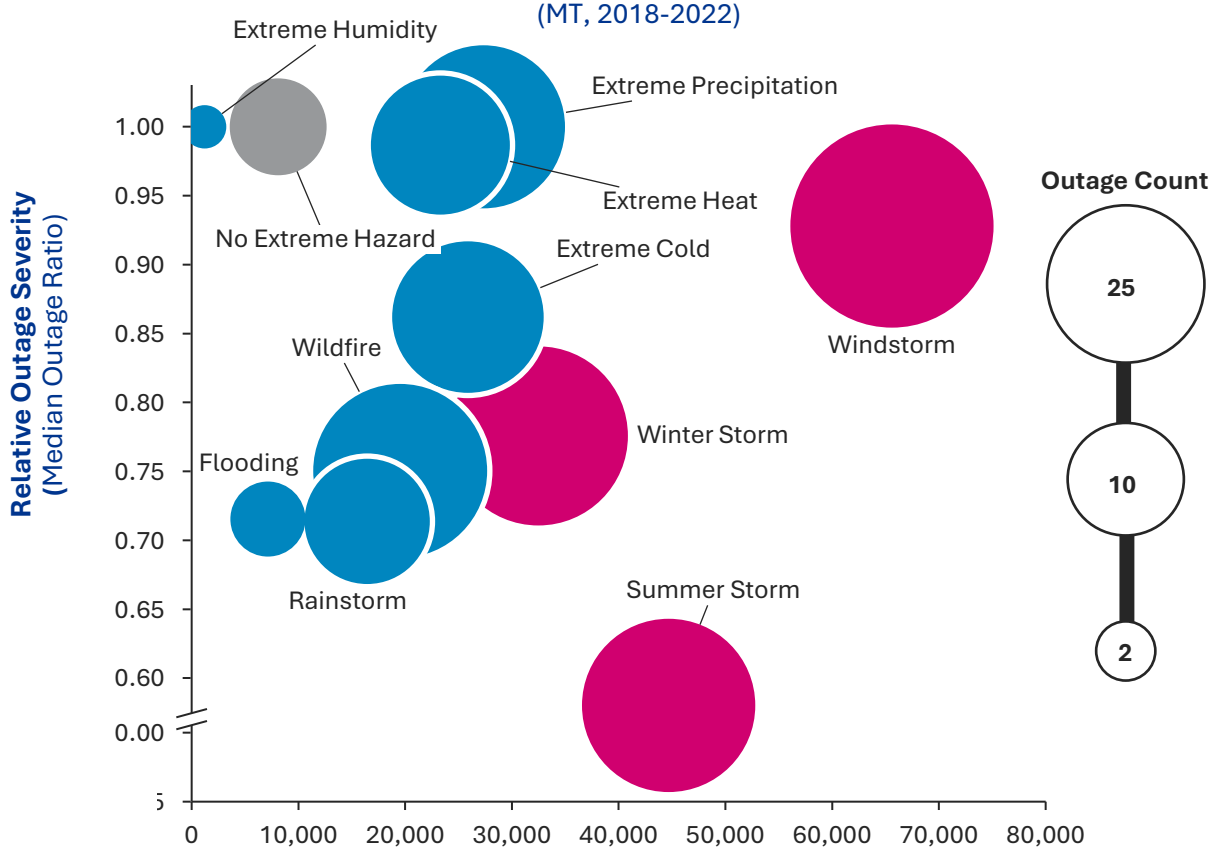
- The MT GRR projects increasing annual precipitation levels, but also prolonged periods of drought across the state in future years, indicating more frequent and severe extreme precipitation events such as winter/summer storms

Extreme wildfire is relatively frequent but accounts for few interruptions

- Wildfire is the third most common event (16), but accounts for fewer customer interruptions given its concentration in less populated counties

MOST IMPACTFUL HAZARDS	FUTURE OUTLOOK**	EVENT COUNT	MED. OUTAGE RATIO	TOTAL CUST. INTS.	AVG. CUST. INTS. / EVENT
Wind Storm	FURTHER RESEARCH NEEDED	22	.93	65,7602	2,982
Summer Storm	↑	16	.58	44,681	2,793
Winter Storm	↑	18	.78	32,478	1,804

SEVERITY & FREQUENCY OF EXTREME OUTAGES* DURING EXTREME WEATHER
(MT, 2018-2022)



*A severe outage is defined as one in which >50% of customers in a county are out simultaneously, or at least 30,0000 customers in a county experience an outage simultaneously, whichever is less
**Future outlook for the hazard severity based on Baringa's Grid Resilience Report, completed as part of phase 2 of this analysis (Insert link to the GRR here)

Source: EAGLE-I, WRCC

 |

The majority of customer interruptions from severe outages are concentrated among a few key weather events, including windstorms, summer storms, and winter storms

OUTAGE INSIGHTS

A handful of hazards drive the majority of severe customer interruptions across the state

- The top 3 events (windstorms, summer storms, and winter storms) account for about 54% of all customer interruptions resulting from severe outages
- MDEQ could consider prioritizing grid resilience funding to projects that address these key weather events, especially since they are driven by similar underlying hazards (wind, rain)

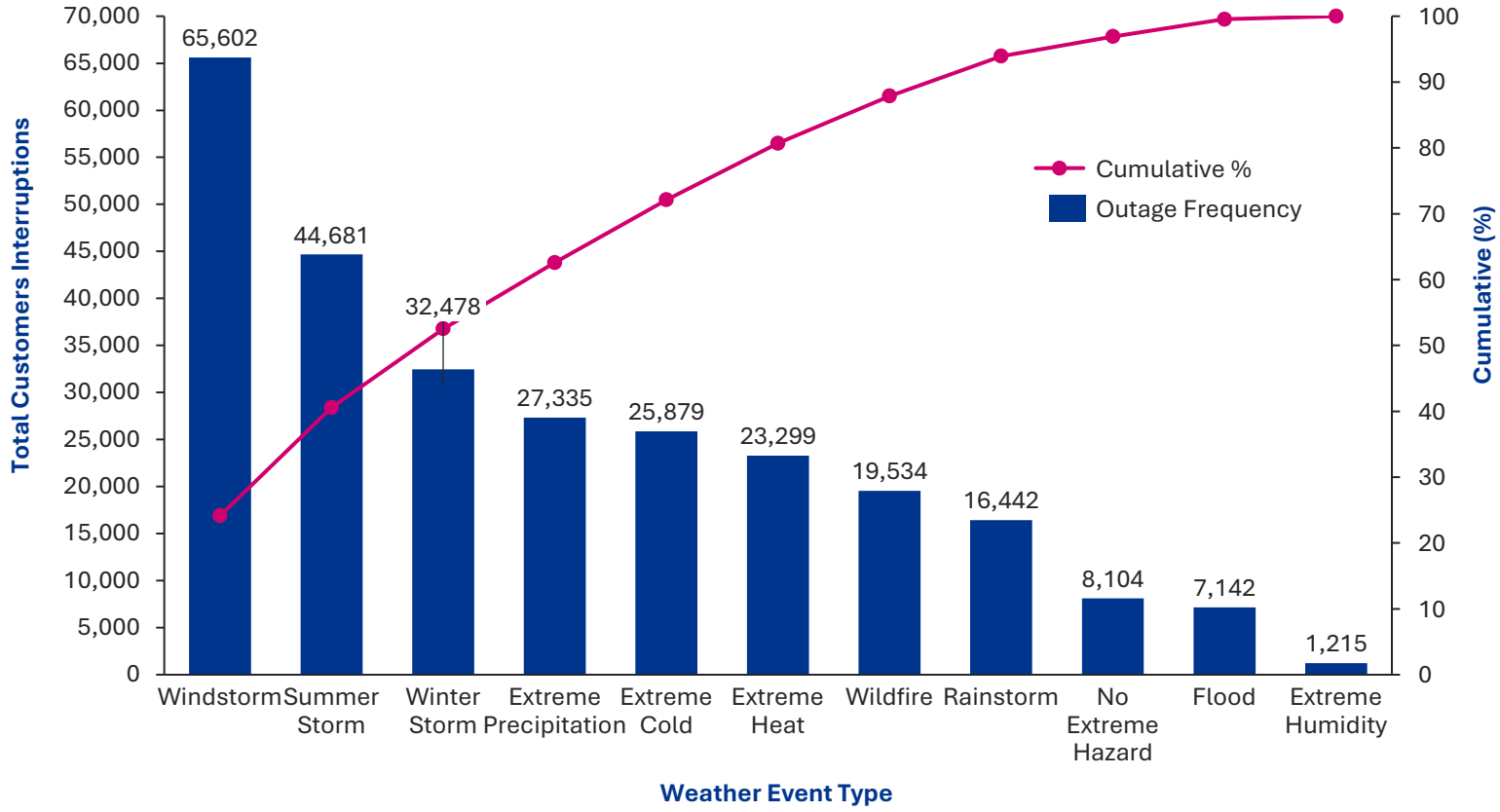
Extreme weather drives a high percentage of severe outages in the state

- About 2% of customer interruptions from severe outages were not coincident with at least one extreme weather variable, a much lower percentage than other states in WECC
- Implies that extreme weather drives an outsized portion of severe outages in MT and system hardening/weatherization should be a priority

Utilities could consider which events impact their climate zone

- Highly variable climate across the state indicates that local analysis is needed to determine the highest priority events
- Regions that face both wind/fire and flood exposure could consider the tradeoffs posed by undergrounding

SEVERE OUTAGES* BY WEATHER EVENT & TOTAL CUSTOMER INTERRUPTIONS
(MT, 2018-2022)

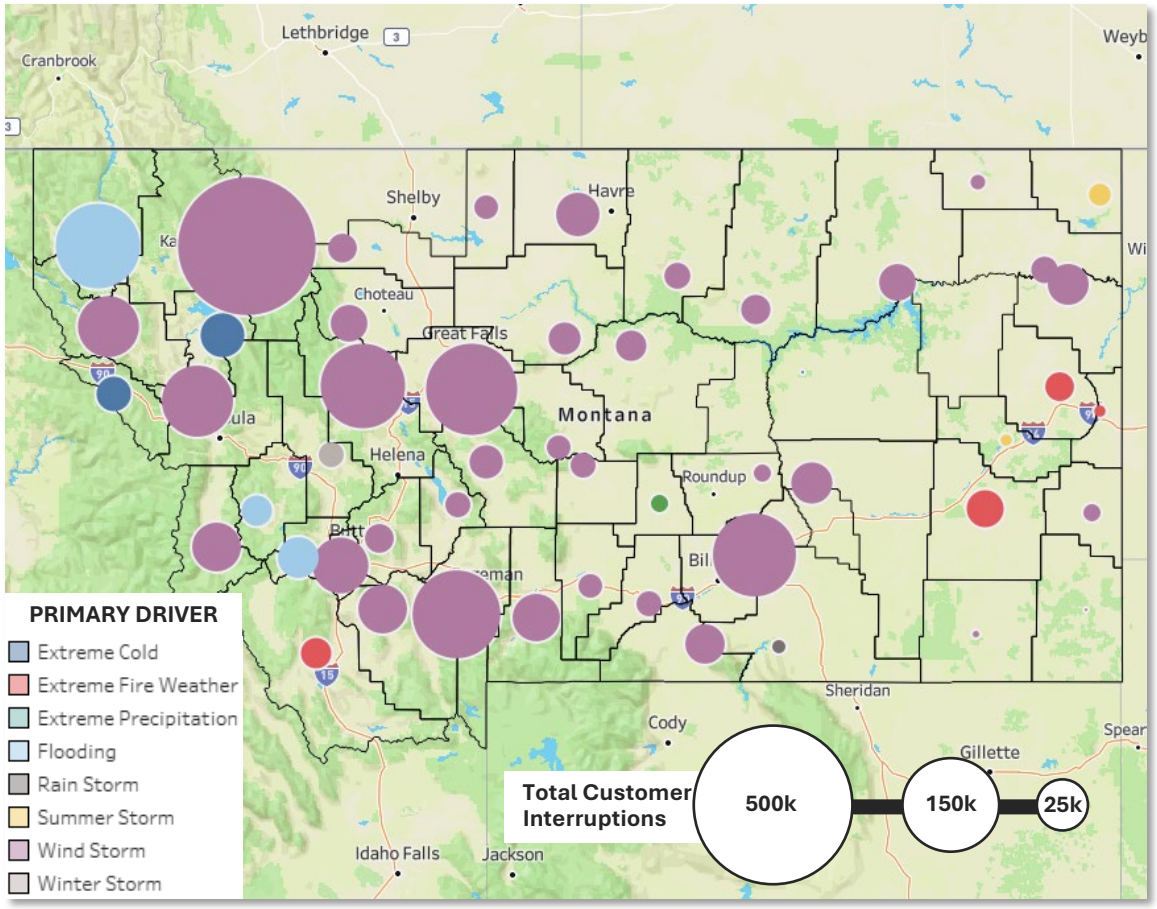


*A severe outage is defined as one in which >50% of customers in a county are out simultaneously, or at least 30,0000 customers in a county experience an outage simultaneously, whichever is less

 |

Wind and flood drive an outsized number of customer interruptions in NW counties, accounting for population, while S counties experience fewer interruptions than expected

PRIMARY DRIVER OF CUSTOMER INTERRUPTIONS BY COUNTY (MT, 2018-2022)



INSIGHTS

The highest volume of customer interruptions is concentrated in western counties

- Highly populated western counties with dense vegetation account for the largest number of customer interruptions, but experience a wider variety of primary hazards than other regions of the state (cold, flood, wind, and precipitation)
- While undergrounding projects would address wind exposure in the region, utilities must consider the tradeoffs given high precipitation and flood exposure

Extreme wildfire drives a high volume of customer interruptions in the southeastern portion of the state

- Substantiates GRR finding that eastern counties are exposed to peak wildfire risk in the state, which is projected to intensify out to mid- and end-century

A pocket of flood, cold, and wind exposure in the NW portion of the state is driving severe outages

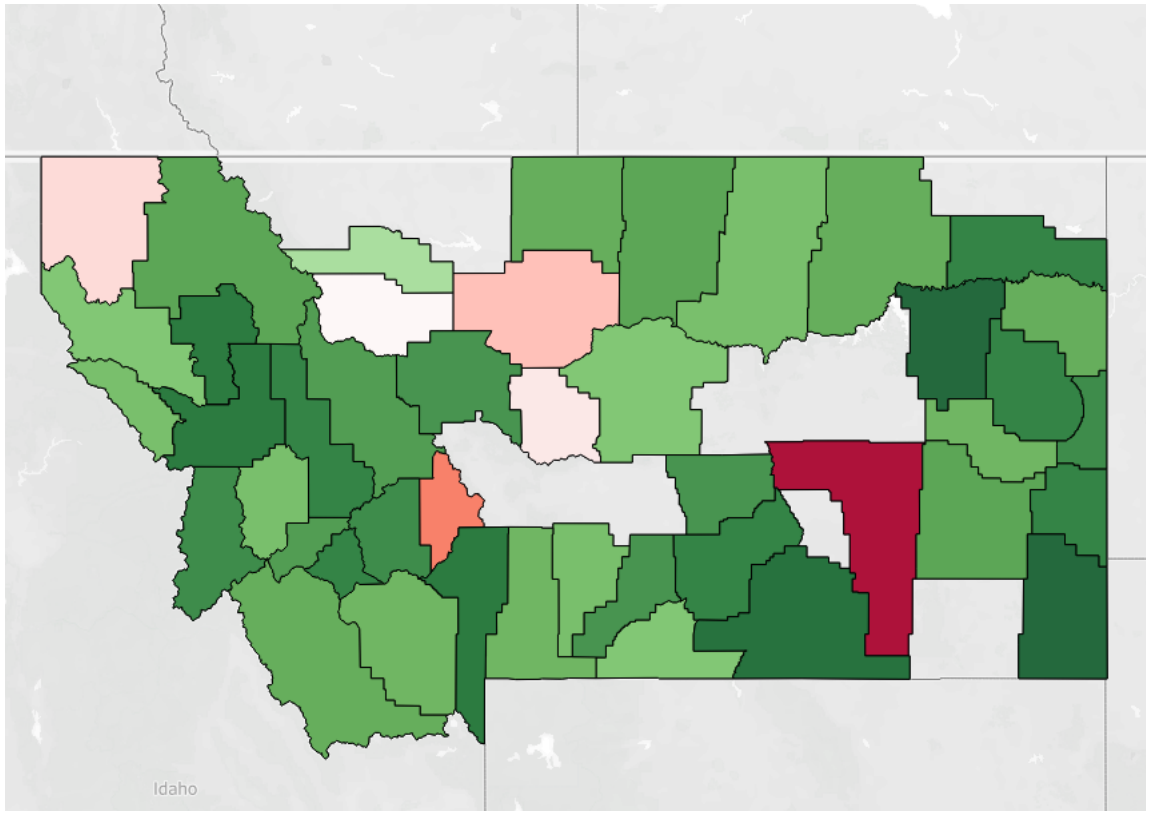
- Prevalence of waterways in Lincoln, Sanders, and Flathead counties contributes to peak state flood exposure
- This flood exposure, combined with cold and wind risk in the NW contributes to an outsized number of customer interruptions with respect to population

PRIMARY DRIVER METHODOLOGY

1. Map weather variable combinations to event definitions (see slide 15)
2. Count the number of total customer interruptions at the county level (> 0 customers out) coincident with 90th percentile or greater weather variables for each of the combinations associated with a weather event
3. Deem the event with the most coincident interruptions as the “primary driver”

Counties with the highest volume of interruptions per customer are spread throughout the state, but are generally located in forested areas and served by rural cooperatives

TOTAL CUSTOMER INTERRUPTIONS PER COVERED CUSTOMER BY COUNTY (MT, 2018-2022)



INSIGHTS

Counties experiencing the greatest number of customer interruptions per capita are spread throughout the state

- Unlike other states in WECC, the most problematic counties from a reliability standpoint are not geographically concentrated or the least populated
- While these counties are not necessarily the least populated in the state, they are still overwhelmingly rural and likely have a high volume of radial, overhead distribution infrastructure that is susceptible to faults
- A high percentage of protected land in Lincoln, Judith Basin, and Chouteau Counties could be contributing to outages as it indicates dense vegetation and can make vegetation management more difficult

High winds generally drive outages across the least reliable sections of the Montana grid

- Wind was identified as the primary driver of customer interruptions in all counties with below average reliability except Lincoln County where it was the second leading driver (see slide 24)

Reliability issues are generally concentrated among rural electric cooperatives

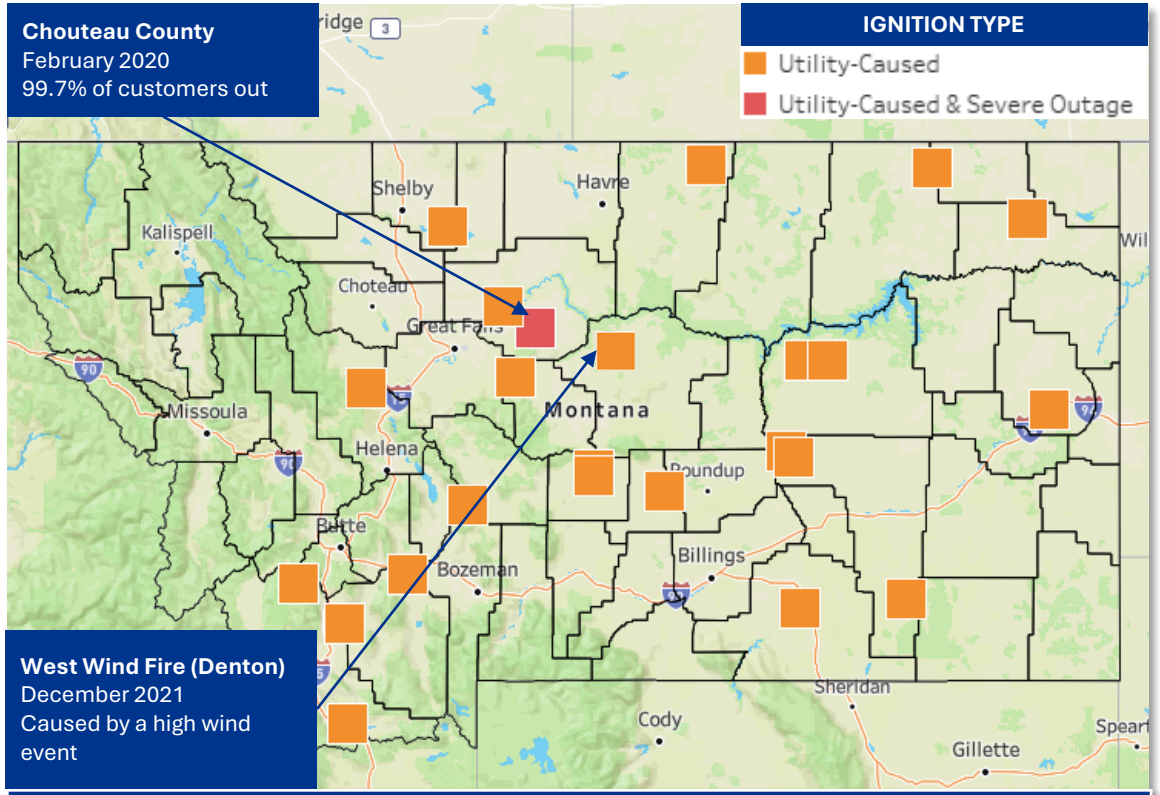
- Counties with the highest volume of interruptions per customer are generally served by rural electric cooperatives, while IOUs serve the most reliable portions of the state
  - Coops generally serve rural areas, leading to vegetation issues and a higher volume of vulnerable overhead Dx infrastructure
  - These organizations may be under resourced and are not subject to a regulatory scrutiny that may enhance spend effectiveness

METHODOLOGY

1. Calculate the total number of customer interruptions that occur in a particular county, ensuring outage events are not double counted
2. Divide this number by EAGLE-I's "covered customers" metric for the county

While extreme, utility-caused ignitions are relatively evenly distributed, wildfire mitigation efforts could be expanded in central/western counties, specifically Chouteau and Beaverhead

UTILITY-CAUSED, TOP 10% IGNITIONS BY ACRES BURNED (MT, 2018-2022)



IGNITION STATS (2018-2024)			
Ignitions in WECC Top 10%:	1,256	**Average Fire Size (acres burned)**	243
Total Ignitions	8,345	**Utility-caused extreme ignitions**	23

INSIGHTS

Historical ignitions are relatively evenly distributed throughout the state, aside from a pocket of low exposure in the NW corner of the state

- Generally corroborates the exposure noted in the Grid Resilience Report, although Beaverhead County experiences more ignitions than expected

Central and Central-West counties could expand wildfire mitigation efforts

- While wind is likely the primary driver of outages in the central/central-west counties, relatively frequent ignitions could justify expanded investment to mitigate wildfire exposure
- **A utility-caused ignition led to an outage for nearly 100% of customers in Chouteau County on February 2nd, 2020**, prompting consideration of whether sufficient investment has been made since this event to reduce the probability of future catastrophic ignitions in the area

IGNTIONS METHODOLOGY

- Historical ignition data was collected from the FPA-FOD and the WFIGS Interagency Fire Perimeter Database
- We filtered out the **top 10% of ignitions by fire size across states in WECC**
- The map at left depicts these top 10% ignitions that also **listed "Power generation/transmission/distribution" as their NWCG cause code**
- The red boxes denote top 10% utility-caused ignitions that were also coincident with a severe outage in the ignition county within 2 days of the discovery date

Extreme outages are generally attributable to higher wind speeds, but a high coincidence of outages with low wind speeds indicates vegetation contact could be a key driver

UNDERSTANDING THE DATA

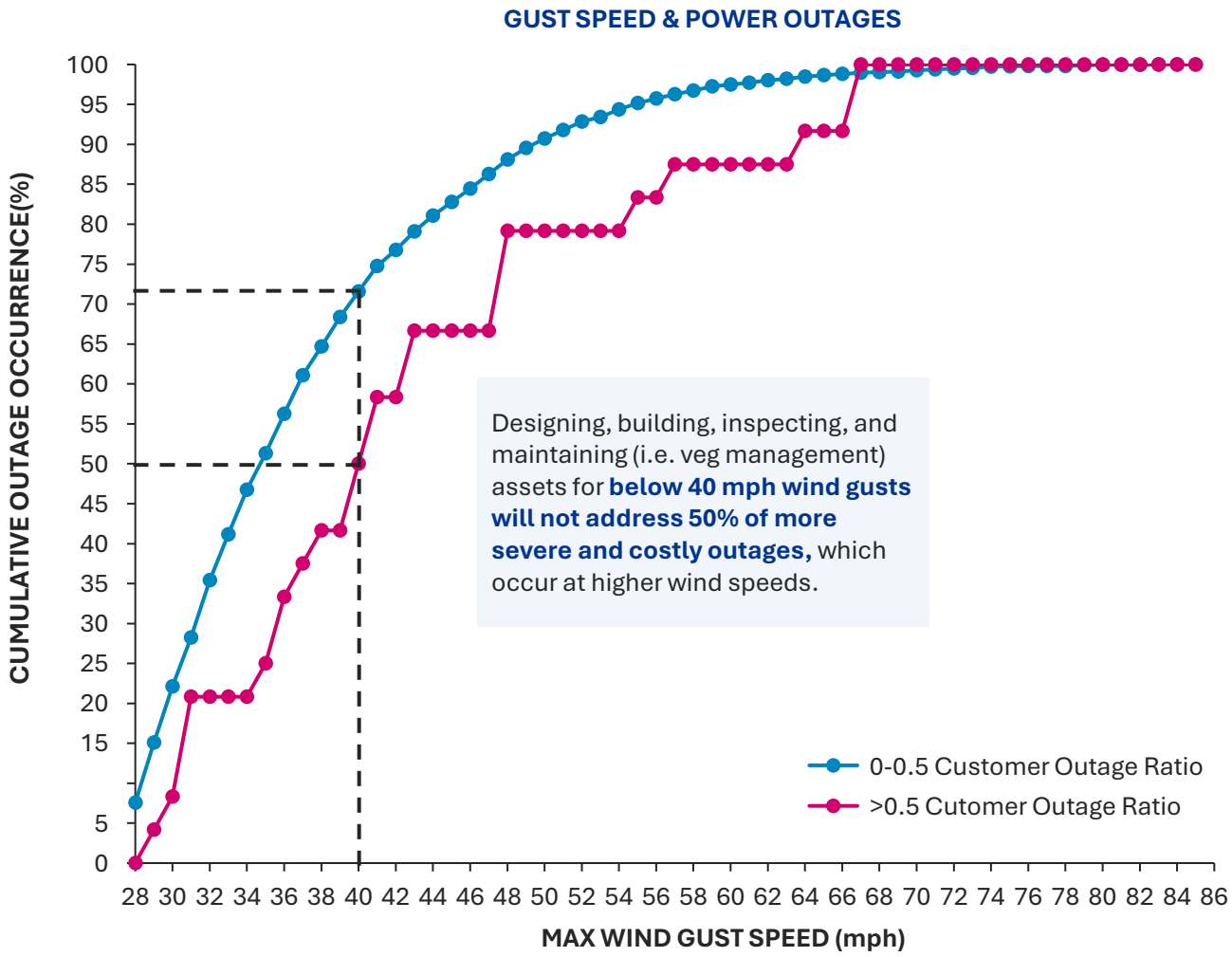
Extreme outages (>50% of customers out) are more likely to be coincident with >40 mph wind speeds than non-extreme outages

- About 50% of extreme outages are attributable to wind speeds above 40 mph, compared to just 30% of non-extreme outages
- The gap between the curves indicates that extreme outages are generally more likely to be coincident with higher wind speeds than non-extreme outages

ASSET PLANNING INSIGHTS

Prioritizing vegetation management and active inspection could address a significant portion of wind-driven outages

- Almost 80% of extreme outages and 90% of non-extreme outages occur at wind speeds < 50 mph, which are more likely attributable to vegetation contact or aging equipment rather than direct failure
- Designing to 67 mph wind speeds would historically address most extreme outages, including those caused by direct failure
- **Low-Cost:** Pole Reinforcement (Trussing, Guy Cables, Concrete Base, etc.), Pole Material Upgrades, Decreased Spans, Vegetation Management
- **High-Cost:** Undergrounding



 |

Designing and inspecting assets above the 99th percentile summer storm event could be necessary to address the most severe and costly outages

UNDERSTANDING THE DATA

Extreme outages (>50% of customers out) are more likely to be coincident with more severe summer storms

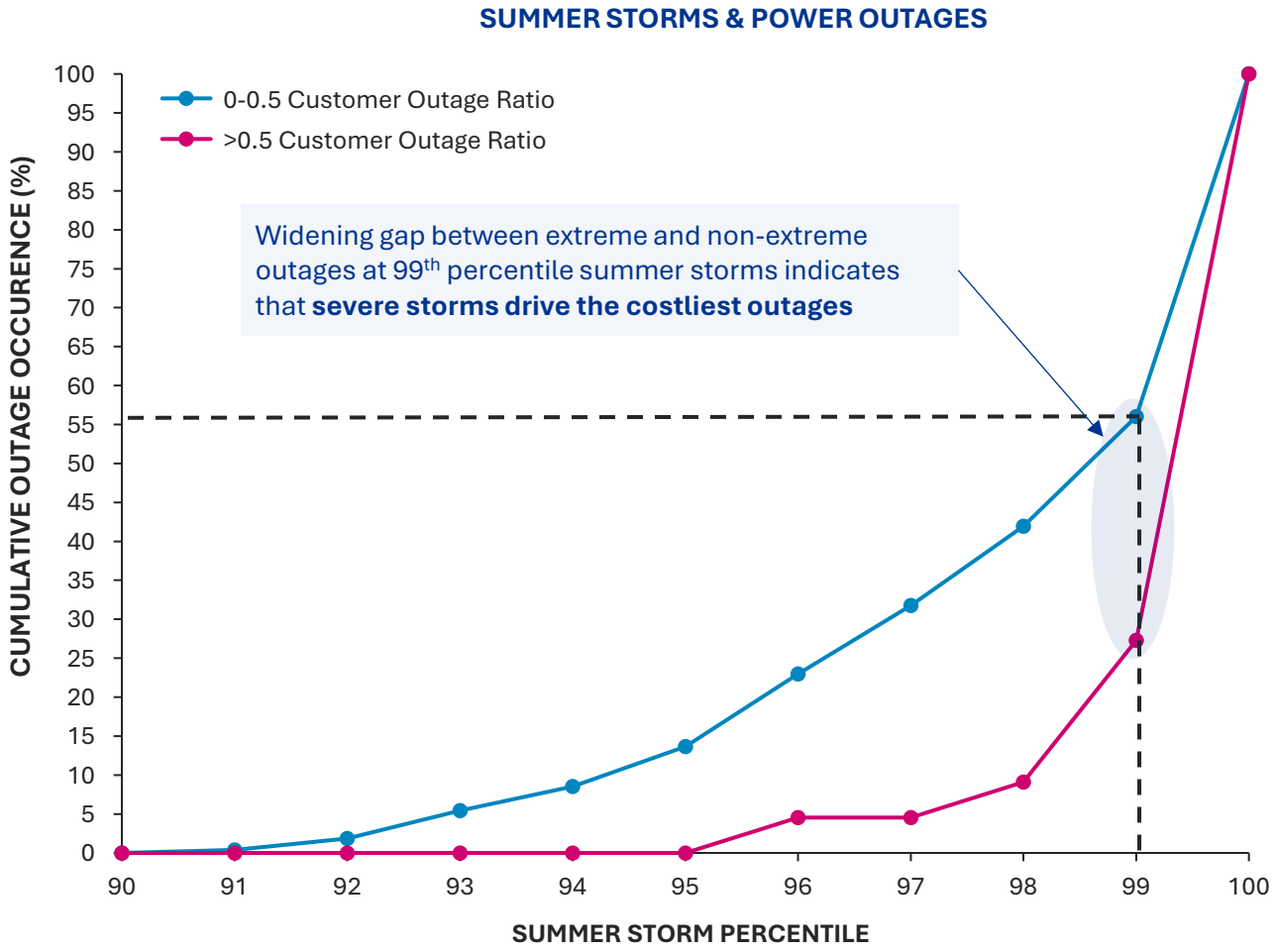
- Over 70% of extreme outages are coincident with summer storms in the 99th percentile or greater, compared to about 45% of non-extreme outages
- The gap at the 99th percentile widens to > 30% when wind is excluded from the percentile mapping, indicating that extreme heat is a key driver of the most extreme summer storms

ASSET PLANNING INSIGHTS

Designing and inspecting assets above the 99th percentile could be necessary to address the majority of extreme outages

- **Low-Cost:** Pole Reinforcement (Trussing, Guy Cables, Concrete Base, etc.), Pole Material Upgrades, Decreased Spans, Vegetation Management
- **High-Cost:** Undergrounding, Transformer Upgrades, Substation Cooling

HAZARD	PRECIP	GUST SPEED	MAX TEMP
99TH PERCENTILE	0.05 (in.)	45 (mph)	89°F



 |

Extreme outages are concentrated above the 99th percentile weather hazards, indicating that designing assets above this threshold is necessary to address the costliest outages

UNDERSTANDING THE DATA

Extreme outages (>50% of customers out) are more likely to be coincident with more severe winter storms

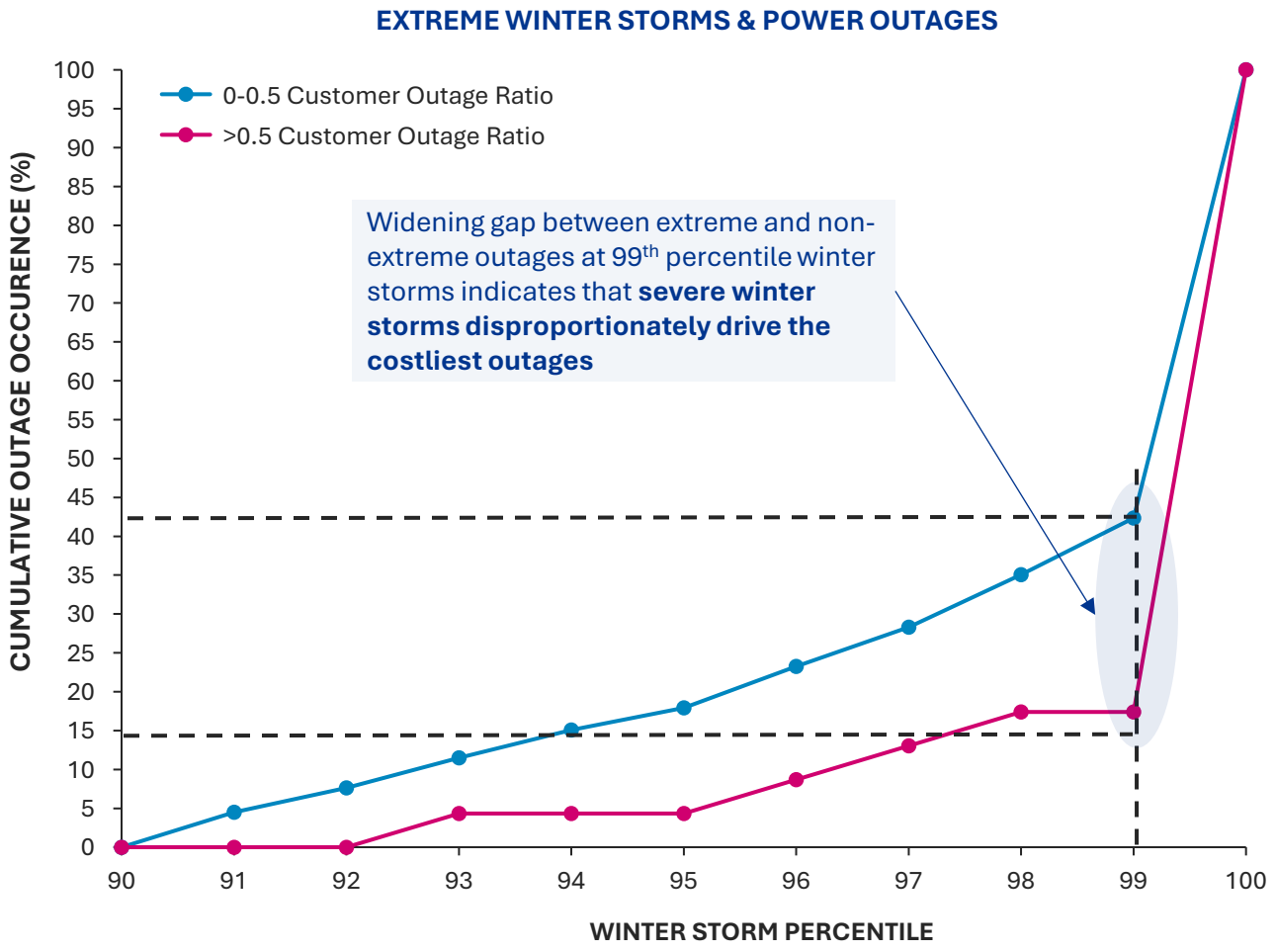
- >80% of extreme outages are coincident with winter storms in the 99th percentile or greater, compared to about 60% of non-extreme outages
- The gap between the curves at the 99th percentile shrinks to <10% when wind or precipitation are excluded from the percentile mapping, indicating both are key drivers of extreme outages

ASSET PLANNING INSIGHTS

Utilities could consider pole reinforcement or undergrounding to address snow and ice loading, line galloping, and high wind speeds associated with winter storms

- **Low-Cost:** Pole Reinforcement (Trussing, Guy Cables, Concrete Base, etc.), Pole Material Upgrades, Decreased Spans, Vegetation Management, Covered Conductors
- **High-Cost:** Undergrounding

HAZARD	PRECIP	GUST SPEED	MIN TEMP
99TH PERCENTILE	0.05 (in.)	45 (mph)	-2°F



 |

Utility Capital Plan Analysis

Project Overview

Background & Approach

Severe outages were mapped to corresponding weather events to better understand which forms of extreme weather are driving customer interruptions and how utilities can respond

ANALYZE 2024 UTILITY CAPITAL PLANS

Purpose: Review projects listed in capital plans and categorize into standardized buckets of utility spending

CAPITAL PLAN	
Project	**$(k)**
Undergrounding	900
Reconductoring	75
Substation Upgrade	500

- TECHNOLOGY, PREDICTION, IMAGING
- ASSESSMENT & REPAIR
- VEGETATION MANAGEMENT
- ... additional spend categories in slide 33

Individual projects in utility capital plans are **mapped to standardized buckets in order to compare spend between utilities**

MAP RESILIENCE INVESTMENTS TO HAZARDS

Purpose: Determine which types of investments mitigate or adapt the utility network to certain extreme weather events

- TECHNOLOGY, PREDICTION, IMAGING
- ASSESSMENT & REPAIR
- VEGETATION MANAGEMENT
- ... additional spend categories in slide 33

WILDFIRE

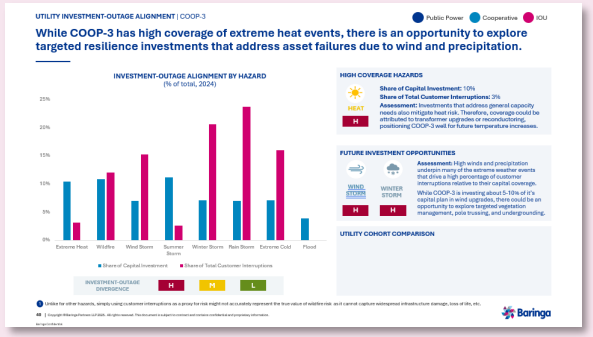
EXTREME HEAT

MAPPED TO 9 SEPARATE EVENTS

Project categories are ascribed a value as to generally how effective they are at **addressing each extreme weather variable**.

ASSESS INVESTMENTS-EXPOSURE ALIGNMENT

Purpose: Normalize spend across relevant utility metrics and determine the degree to which capital allocation aligns with historical extreme weather exposure



INVESTMENT-OUTAGE DIVERGENCE: L | M | H

The level of capital spend addressing each **weather event is compared to the share of customer interruptions it drives**

 |

Public Power Cooperative IOU

We have a total of 12 utilities across WECC participating in this analysis, 5 public power, 5 cooperatives, 2 investor-owned utilities

STATE	UQID
California	PUBLIC-1
Colorado	PUBLIC-2
Washington	PUBLIC-3
Nevada	PUBLIC-4
Washington	PUBLIC-5

STATE	UQID
Colorado	COOP-1
New Mexico	COOP-2
Oregon	COOP-3
Utah	COOP-4
Wyoming	COOP-5

STATE	UQID
Montana	IOU-1
New Mexico	IOU-2

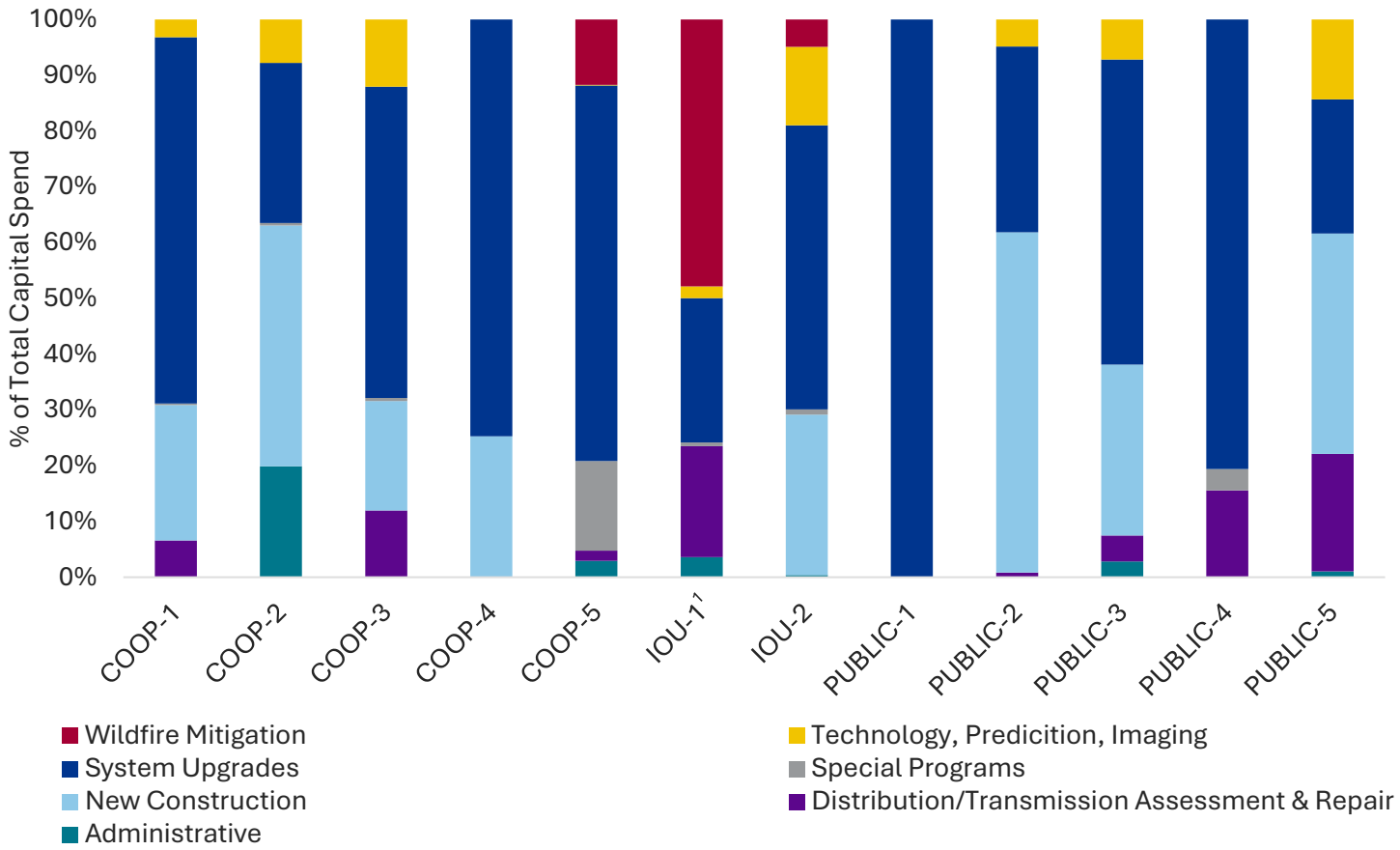
Individual projects and line items within the capital plans were mapped to larger buckets to allow for standardized comparison across utilities

	CATEGORY	DEFINITION	SUBCATEGORIES
	TECHNOLOGY, PREDICTION, IMAGING	Investments in analysis and tools that improve asset management, asset planning, and operational efficiencies.	Modeling, Remote Sensing, Mapping
	ASSESSMENT & REPAIR	Investments needed to repair or replace damaged or end-of-life distribution equipment like-for-like.	Like-for-like equipment replacement
	SPECIAL PROGRAMS	Investments needed for non-traditional capital and other unique projects.	Demand Response/VPP, Wildfire Training Environmental/Ecological Protection
	SYSTEM UPGRADES	Investments in existing assets that improve the capacity, reliability, resilience, etc. of the system.	Transformer Capacity Upgrades, Pole Replacement/Reinforcement, Reconductoring Undergrounding, Voltage/Phase Upgrades
	NEW CONSTRUCTION	Investments in brand new assets and equipment.	New Lines, New Substations, New Customer Interconnection
	ADMINISTRATIVE	Investments in supporting infrastructure and processes for capital planning and operations.	Fleet, Building Remodeling, Travel, Education, Salaries
	WILDFIRE MITIGATION	Investments in system upgrades, adaptations, mitigations, that lower the likelihood of wildfire ignition and prevent damage to assets.	Investments explicitly earmarked for wildfire protection

Capital Plan Review

Cooperatives' and public power entities' highest categories include system upgrades and new construction, while IOUs generally spend more on wildfire mitigation

UTILITY CAPITAL SPEND BREAKDOWN ($, 2024/25)



ALL UTILITIES

- System upgrades make up a significant portion of capital spending across all utility types, indicating that resilience is a key focus area
- Many utilities are also spending substantially on new construction, increasing capacity to serve new customers and large loads
    - This corroborates recent data showing new transmission and distribution expenditures driving the bulk of utility spending increases in recent rate cases

COOPS

- Cooperatives typically prioritize system upgrades in their capital allocation, demonstrating a prevalence of aging equipment and focus on resilience

PUBLIC POWER

- Public power entities spend significant sums on both system upgrades and new construction and often have extensive undergrounding programs

IOUs

- Generally spend more on wildfire mitigation given the commonplace requirement to file Wildfire Mitigation Plans (WMPs) with the PUCs

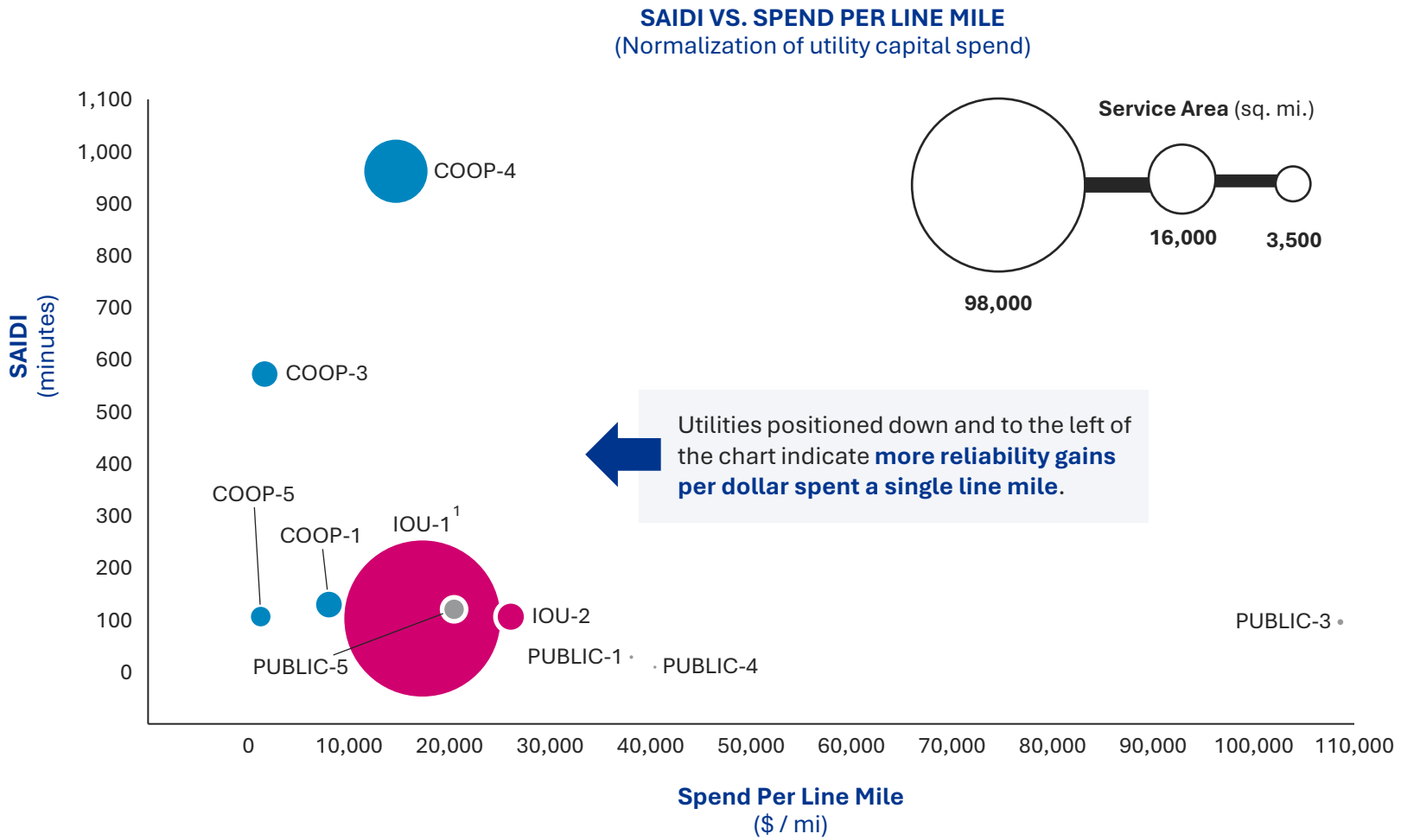
1 IOU-1 provided their Wildfire Mitigation Plan rather than their exhaustive capital plan, resulting in a high percentage of wildfire mitigation spending

U.S. EIA, FERC

 |

Public Power Cooperative IOU

Cooperatives spend less per line mile, while public power entities are generally more reliable; IOUs fall somewhere in between these two utility types on the spend vs. reliability matrix



INSIGHTS

COOPS

- Cooperatives typically spend less per line mile, indicating lower overall spend given their medium-sized service territories
- Wide range of reliability could be driven by different levels of spend effectiveness or extreme weather exposure

PUBLIC POWER

- Public power entities have higher reliability given their smaller territories and higher percentage of underground equipment
- Less area and more expensive upgrades indicate high spend per line mile, though entities that are outliers could be spending less effectively

IOUs

- IOUs see both high reliability and relatively low spend per mile
- Being subject to strict oversight from a state regulator could improve IOUs' reliability and spend effectiveness
- Given their larger service territories and customer counts, IOUs could benefit from economies of scale that increase spend effectiveness (i.e. admin, procurement, etc.)

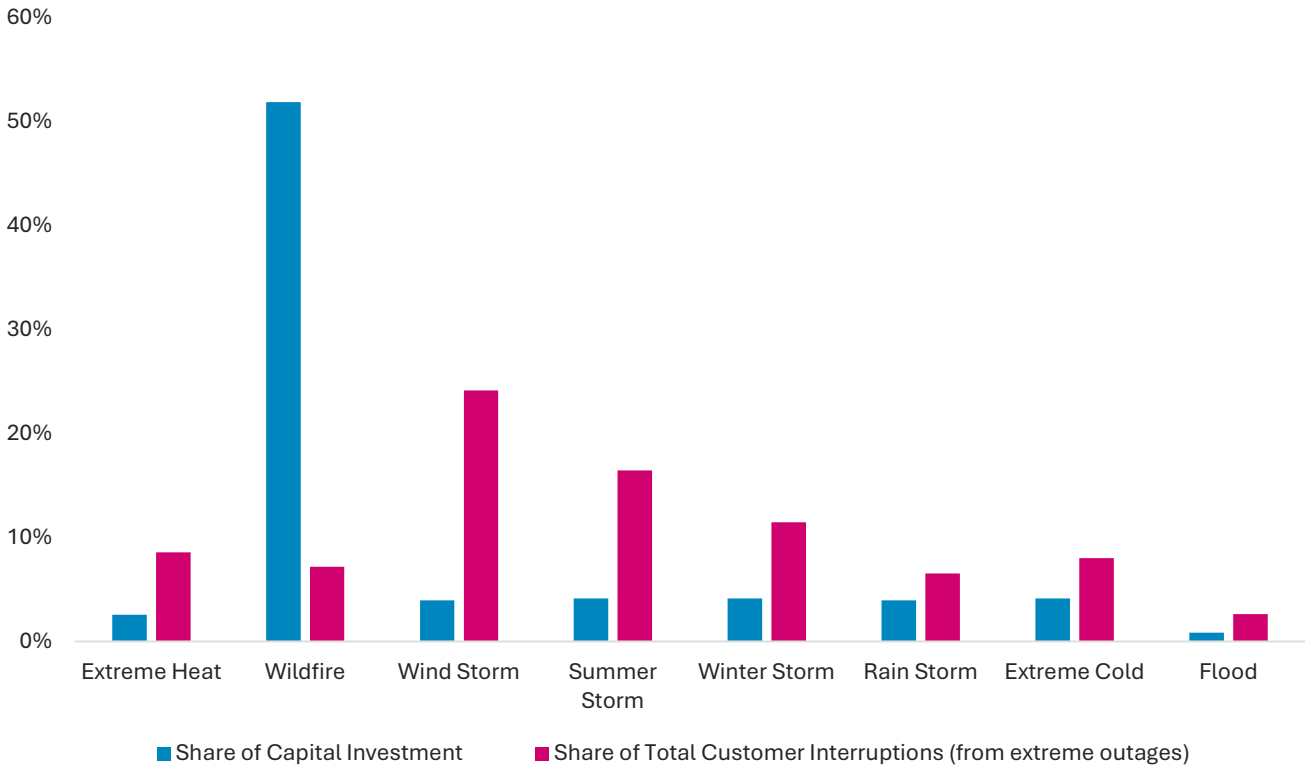
1 An estimate of IOU-1's total capital spend was considered in this view, not just Wildfire Mitigation Plan spending

Utility Investment-Outage Alignment

Public Power Cooperative IOU

IOU-1's could assess whether the rest of its capital plan outside of the Wildfire Mitigation Plan is adequately addressing wind and summer storms

INVESTMENT-OUTAGE ALIGNMENT BY HAZARD
(% of total, 2024)



INVESTMENT-OUTAGE DIVERGENCE: H M L

HIGH COVERAGE HAZARDS

WILDFIRE

H

Assessment: Given this analysis was based on IOU-1's Wildfire Mitigation Plan, the high percentage of capital coverage addressing wildfire was to be expected.

Dividing wildfire spend by the estimated total capital spend yields about 7-8% capital investment, demonstrating better alignment with outages. "Over investment" in wildfire could also be justified by the high cost of utility-caused ignition, allowing the utility to buy down more risk per dollar of investment.

FUTURE INVESTMENT OPPORTUNITIES

WIND STORM — M

SUMMER STORM — M

Assessment: Windstorms and summer storms account for over 40% of customer interruptions from extreme outages across IOU-1's service territory.

IOU-1 could assess whether these hazards are adequately addressed in the full capital plan. A relatively even distribution of outages across hazards could make adaptations that address multiple hazards simultaneously more attractive.

UTILITY COHORT COMPARISON

INVESTMENT EXPANSION

Assessment: IOU-1's heavy spending on wildfire makes up for underinvestment across other hazards, demonstrating above average alignment across utilities in WECC. The utility could consider conducting an asset-level risk assessment using future weather data to clarify future exposure and ensure the rest of its capital plan is effectively allocated.

1 Unlike for other hazards, simply using customer interruptions as a proxy for risk might not accurately represent the true value of wildfire risk as it cannot capture widespread infrastructure damage, loss of life, etc.

 |

Utility Benchmark Analysis

Public Power Cooperative IOU

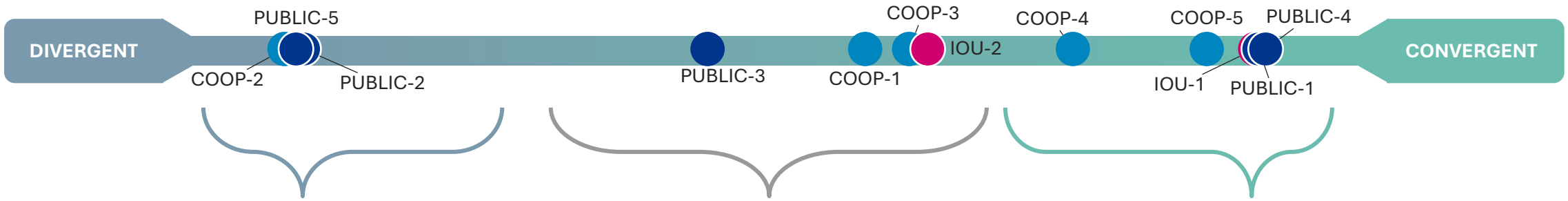
Utilities with convergent coverage are investing in upgrades that address hazards that have been historically responsible for the most severe outages in their service territory

RANKING OVERALL UTILITY COVERAGE OF EXTREME WEATHER EXPOSURE GIVEN CAPITAL INVESTMENTS

Utility Comparison Chart

Utilities that are **DIVERGENT** see a lower proportion of their capital plan cover the hazards that historically drive outages

Utilities that are **CONVERGENT** see a higher proportion of their capital plan cover the hazards that historically drive outages



REALLOCATION OPPORTUNITIES

Planning Considerations:

- Consider tradeoffs between resilience upgrades and other investments like new construction replacements
- Explore targeted investments to address hazards that historically drive outages
- Conduct asset-level risk assessment using future extreme weather data

UNCERTAIN COVERAGE

Planning Considerations:

- Investigate whether the share of customer interruptions from non-severe outages is better aligned with investment
- Conduct asset-level risk assessment using future extreme weather data to help clarify future exposure and prioritize resilience investments

INVESTMENT EXPANSION

Planning Considerations:

- Continue investment strategy to address the most pertinent hazards and prioritize resilience investments
- Pursue asset-level risk assessment to determine if current investments will continue to mitigate potential changes in most concerning hazards

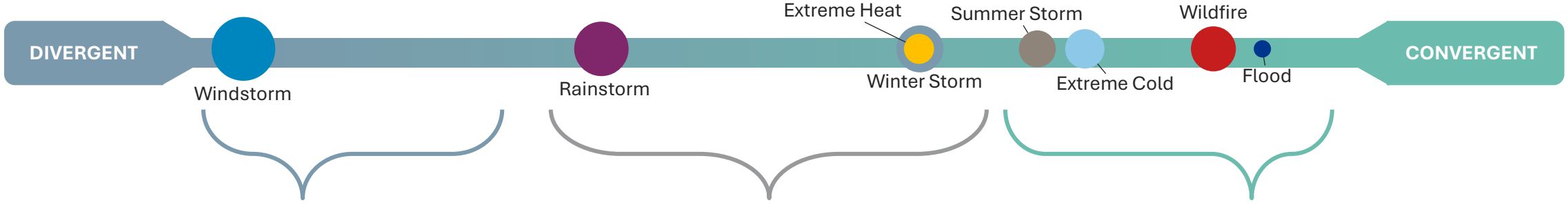
Utilities in WECC generally underinvest in windstorms given their widespread severity over utility service territories. Wildfire remains a highlight hazard for continued investment.

RANKING OVERALL UTILITY COVERAGE OF EXTREME WEATHER EXPOSURE GIVEN CAPITAL INVESTMENTS

Hazard Comparison Chart

Hazards that are **DIVERGENT** see a lower proportion of utility capital investments allocated towards them relative to exposure

Hazards that are **CONVERGENT** see a higher proportion of utility capital investments allocated towards them relative to exposure



REALLOCATION OPPORTUNITIES

Planning Considerations:

- Across WECC, windstorms are the primary driver of extreme outages
- While a large portion of capital spend is focused on wildfire and capacity upgrades, utilities could focus on targeted investments like vegetation management and pole reinforcements

UNCERTAIN COVERAGE

Planning Considerations:

- WECC sees high exposure to extreme heat. This is an opportunity for utilities to solve for both resilience and load growth challenges through capacity investments
- Rainstorms and winter storms include extreme wind, reinforcing the need for increased investment in things like pole reinforcement, vegetation management.

INVESTMENT EXPANSION

Planning Considerations:

- Continue investing in wildfire mitigations given high exposure and high cost of ignitions historically
- Unlike wind, extreme cold and summer storms are only issues in particular climate zones, meaning that overall investment sufficiently covers the limited exposure across WECC

