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State of the Grid Report

NEW
MEXICO



Energy, Minerals and Natural Resources Department

Energy & Resources | Utilities

May 2025

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Executive Summary

High winds are a key driver of severe outages in New Mexico, especially among a cluster of rural, mountainous counties in the central portion of the state exhibiting low reliability



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:

Windstorms are a key driver of severe outages* in New Mexico

- Windstorms account for 30% of severe outages in the state from 2018-2022
- 16% of customer interruptions from severe outages are not attributable to extreme weather (higher than most of WECC), which is likely attributable to aging infrastructure or frequent human/wildfire interaction
- Rural counties in the central portion of the state experience the highest volume of interruptions per customer

Capital Planning Insights:

- IOU-2 exhibits relatively average spend efficiency compared to other utilities in WECC, and could consider expanding investment to address wildfire and extreme cold
- COOP-2 could expand investment to address wind exposure given that it accounts for over 30% of customer interruptions from severe outages in the service territory

*A severe outage is defined as one in which >50% of customers in a county are out simultaneously, or at least 30,000 customers in a county experience an outage simultaneously, whichever is less

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

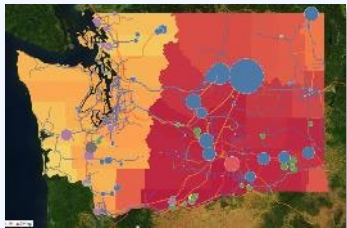
The State of the Grid Report will provide recommendations and insights into most effective **resilience projects, highest risk locations**, and strategies for **improving capital spend efficiency**

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.

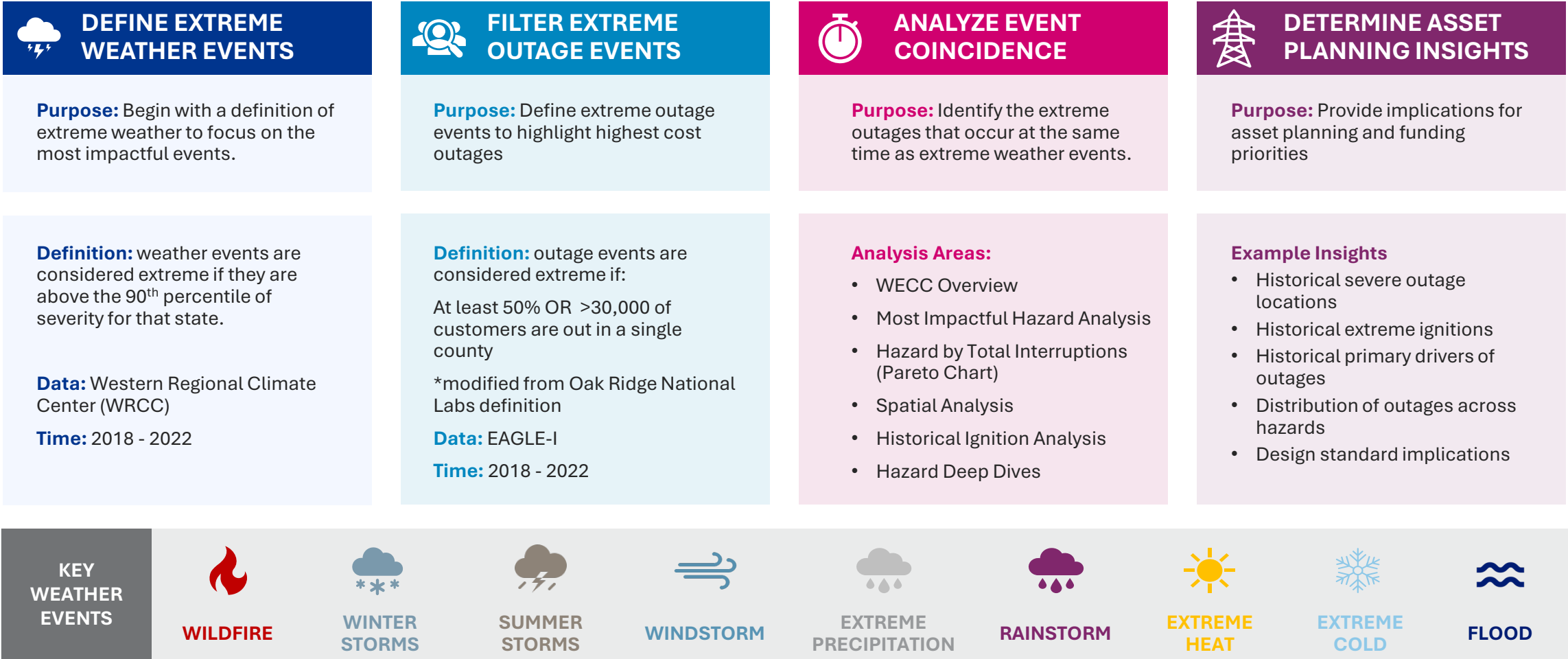
Results will be anonymously compared with other participants to help outline resilience best practices and most effective mitigations.

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



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 90 th percentile)
	EXTREME COLD	Min Temperature
	EXTREME HEAT	Max Temperature
	WILDFIRE	Fire Weather Index (FWI) OR Historical Ignition*
	EXTREME PRECIPITATION	Precipitation

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

WEATHER EVENT
MAPPING
METHODOLOGY

Baringa analyzed 22 years of historical weather data for Colorado to determine 90th percentile weather hazard values across the state. During the mapping process, the algorithm considered whether the weather variables coincident with an outage were above or below the respective 90th percentile value and attributed the outage to a weather event based on the combinations show above. In the case of combinations not explicitly listed (i.e. extreme heat and high wind), the outage was mapped to the hazard deemed more likely to drive an outage (i.e. extreme heat and high wind → windstorm). A full list of mapping combinations can be provided upon request.

*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



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



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

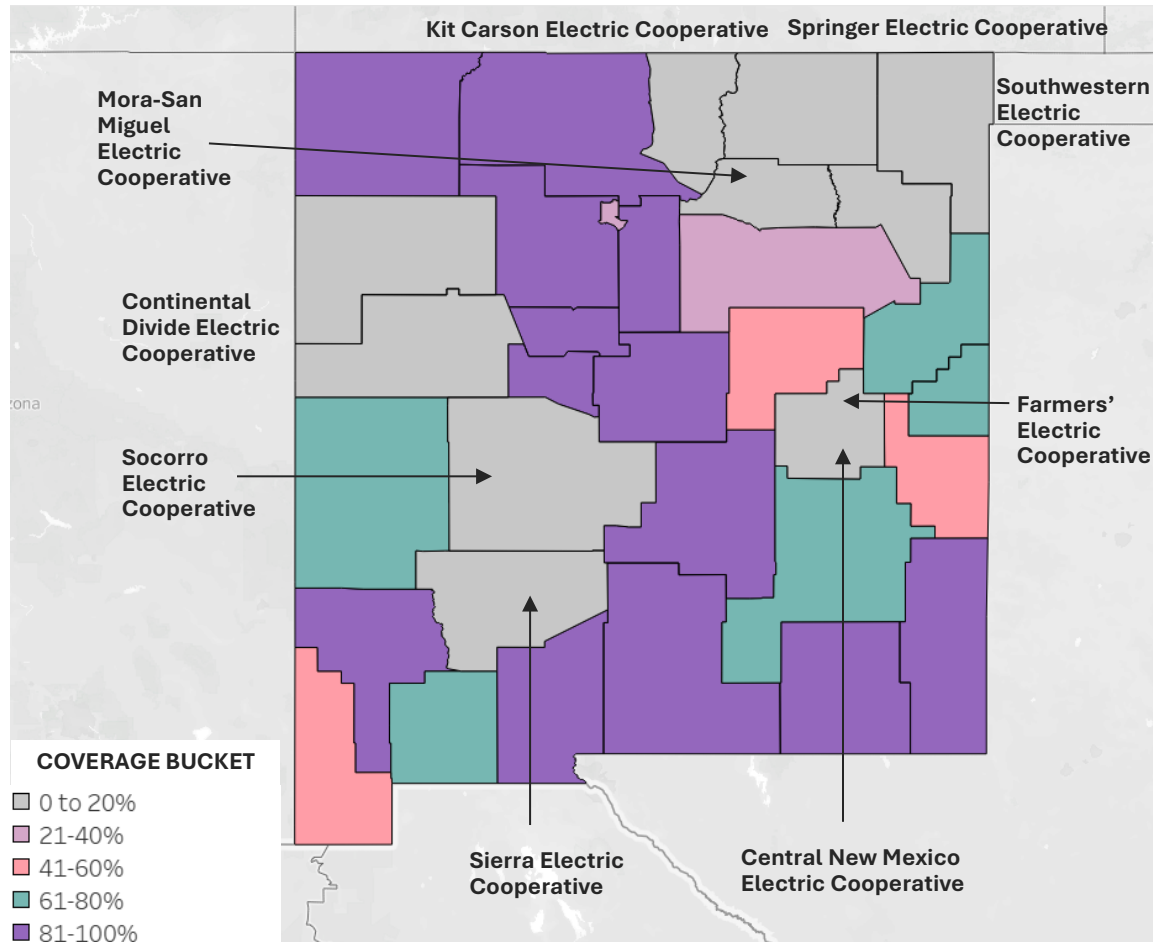
SEVERE OUTAGES | JUSTIFICATION

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

The EAGLE-I dataset provides coverage for 84% of NM customers, but is missing data from smaller cooperatives throughout the state serving less-populated counties

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



INSIGHTS

The EAGLE-I dataset is missing outage data from a handful of sparsely-populated counties served by electric cooperatives

- These cooperatives may lack sophisticated outage management systems or reporting processes
- The largest data gaps occur in the northeast portion of the state, which happens the least populated

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 84% of customers in the state are covered in the EAGLE-I dataset
- Insights surrounding the volume of customer interruptions in the state will largely 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
 - Northeast Counties: Extreme cold
 - Western Counties: Wind

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

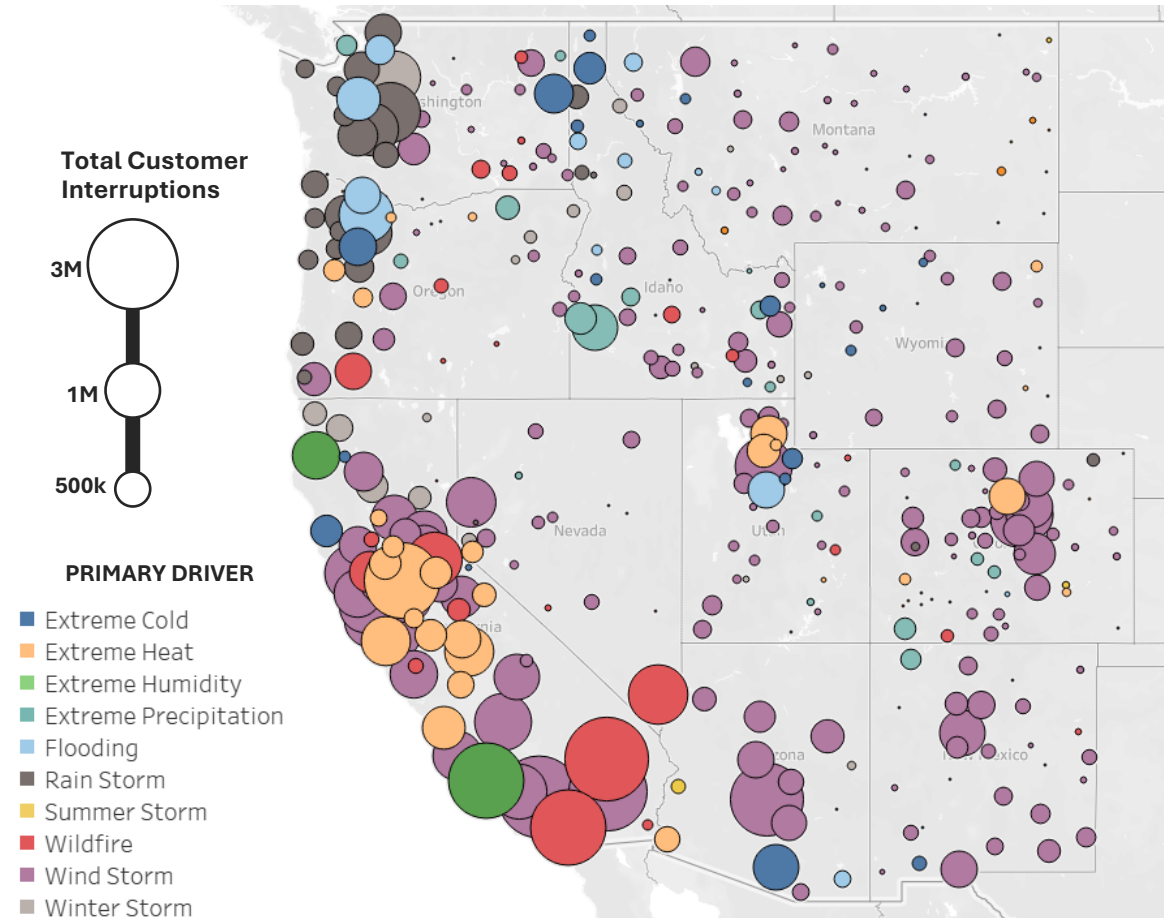
A higher volume of total customer interruptions is generally concentrated along the coast

- More populous counties in CA, WA, and OR drive a higher volume of customer interruptions
- Coastal 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

New Mexico



High winds drive the most frequent and severe power outages in the state, but extreme cold accounts for the most customer interruptions from severe outages

HAZARD INSIGHTS

High winds frequently drive severe outages on the New Mexico grid

- Windstorms are attributable to both high outage minutes and outage events
- High winds account for over 30% of severe outage events and often knock out entire counties, evidenced by a median outage ratio close to one
- Despite leading all events in frequency and severity, windstorms trail extreme cold in total customer interruptions from extreme outages, indicating that wind exposure is generally concentrated in less populous counties

Exposure to wildfire is projected to intensify across the state

- The NM GRR projects increasing wildfire exposure out to mid- and end-century, indicating that it may drive more frequent and severe outages in the future

Extreme cold drives severe outages in more highly populated counties

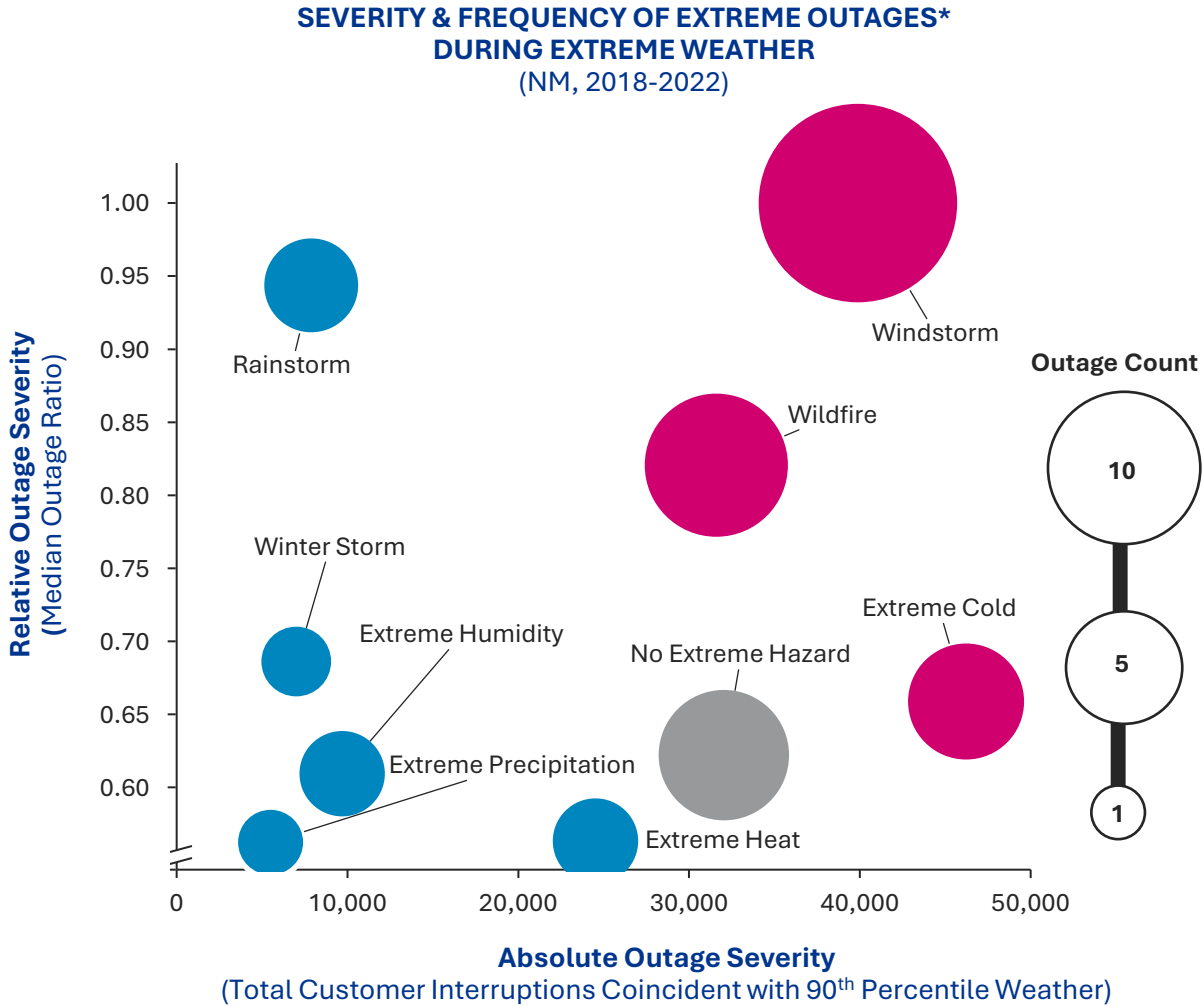
- Extreme cold drives extreme outages that are generally less frequent and severe than those associated with other top hazards, but their high total number of customer interruptions indicates that they occurred in more populated counties

MOST IMPACTFUL HAZARDS	FUTURE OUTLOOK**	EVENT COUNT	MED. OUTAGE RATIO	TOTAL CUST. INTS.	AVG. CUST. INTS. / EVENT
 Extreme Cold	➡	6	.66	46,219	7,703
 Windstorm	FURTHER RESEARCH NEEDED	17	.97	39,886	2,346
 Wildfire	⬆	9	.82	31,597	3,511

*A severe outage is defined as one in which >50% of customers in a county are out simultaneously, or at least 30,000 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 extreme temperatures, windstorms, and wildfire

OUTAGE INSIGHTS

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

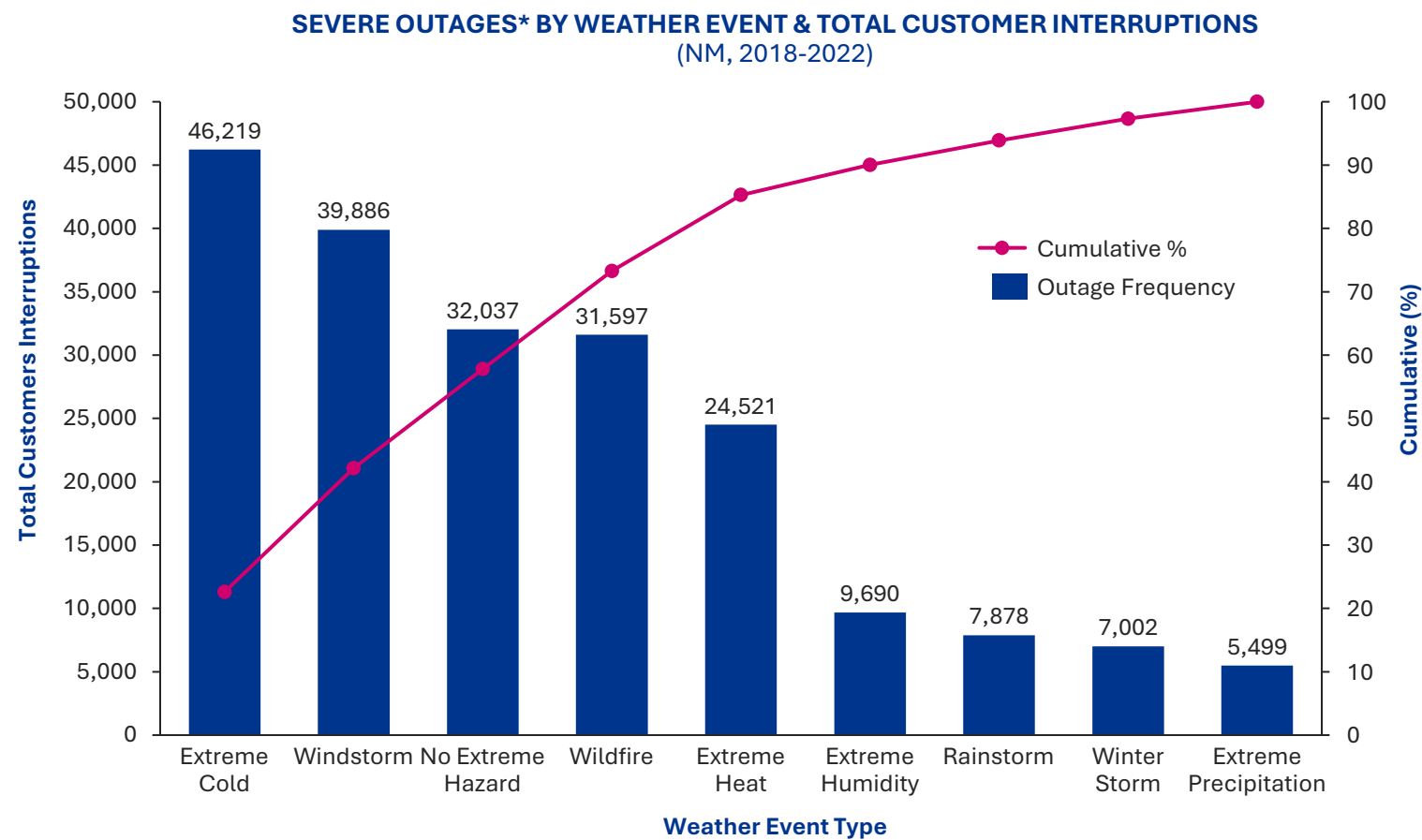
- The top 4 events (extreme temperatures, windstorms, and wildfire) account for about 70% of all customer interruptions resulting from severe outages
- The large gap in customer interruptions between extreme heat and extreme humidity as well as the fact that New Mexico exhibits a denser concentration of interruptions across certain events compared the rest of WECC justifies prioritizing certain hazards on a state level

A significant portion of severe outages are not coincident with extreme weather

- About 16% of customer interruptions from severe outages were not coincident with at least one extreme weather variable, a relatively high percentage compared to other states in WECC
- These outages could be attributable to aging equipment failure, wildlife, human actions, or other similar events, and are generally best addressed through improved inspection and monitoring

Utilities could consider which events impact their climate zone

- Variable climate across the state indicates that local analysis is needed to determine the highest priority events

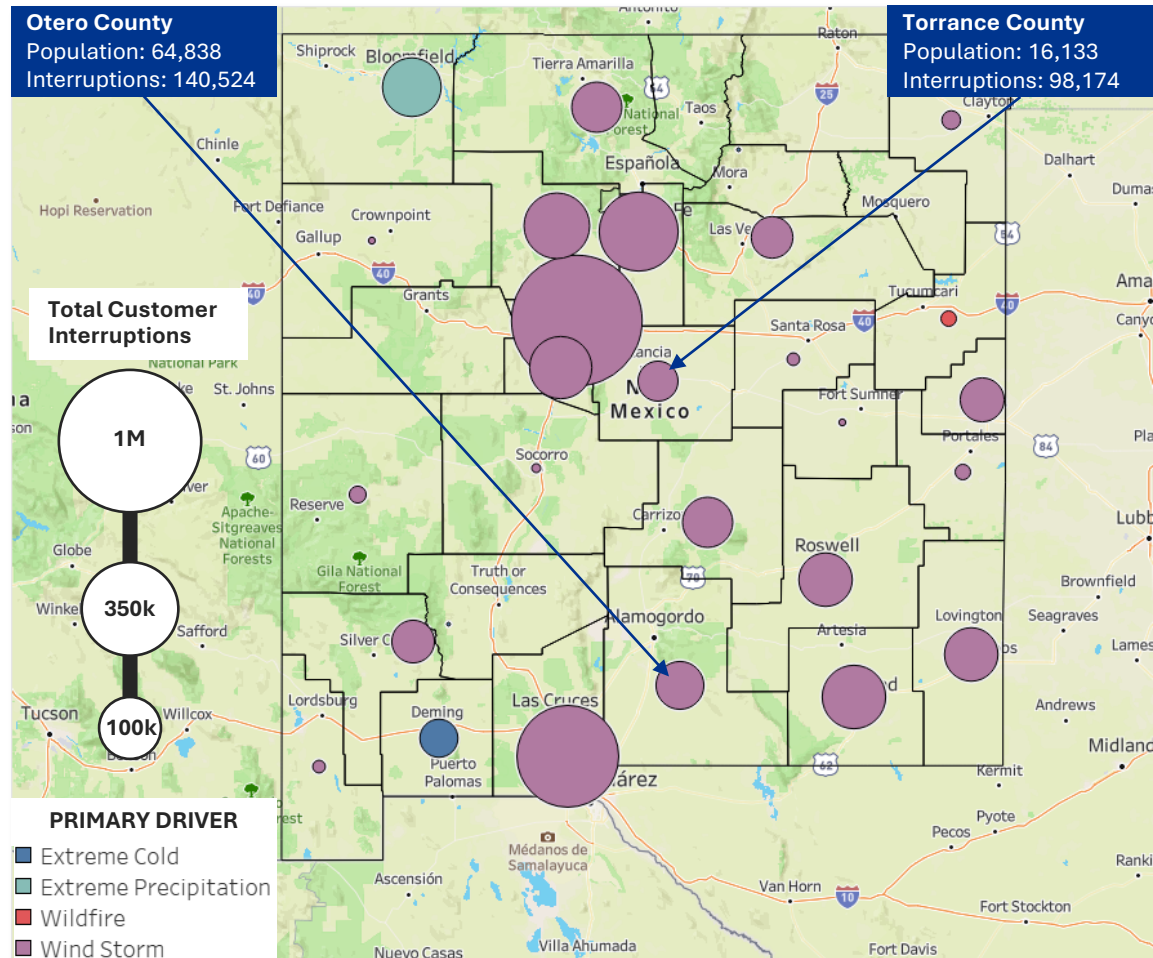


*A severe outage is defined as one in which >50% of customers in a county are out simultaneously, or at least 30,000 customers in a county experience an outage simultaneously, whichever is less



Wind is the primary driver of customer interruptions across the majority of New Mexico, indicating that it could be a priority hazard to address through statewide resilience initiatives

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



INSIGHTS

The highest volume of customer interruptions is concentrated around population centers in Santa Fe and Bernalillo Counties

- While the high number of customers drives high interruption volumes, the area also has relatively denser vegetation than other areas of the state, making it more susceptible to wind-driven outages

High winds are the primary driver of customer interruptions across the state

- This homogeneity indicates that addressing wind exposure could be a priority for statewide resilience programs

Luna County could consider upgrades to address extreme cold

- While surprising that extreme cold is the primary driver of interruptions in Luna County given its desert climate, it could illustrate a lack of preparedness for these types of events

Torrance County experience a relatively high number of interruptions

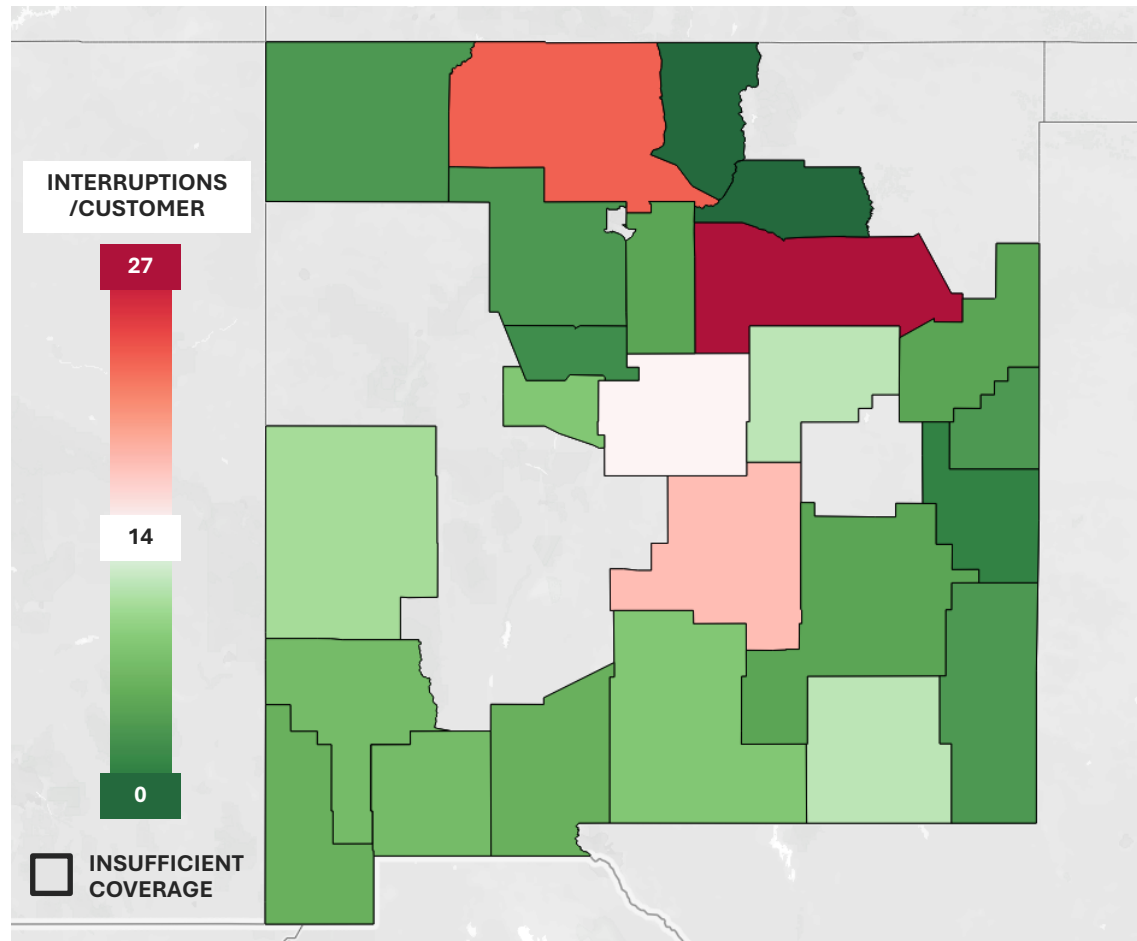
- Torrance County experiences a high volume of customer interruptions given its low population, likely driven by high wind exposure and a high volume of overhead infrastructure

PRIMARY DRIVER METHODOLOGY

- Map weather variable combinations to event definitions (see slide 15)
- 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
- Deem the event with the most coincident interruptions as the “primary driver”

Counties served by cooperatives in the central portion of the state generally experience the highest volume of interruptions per customer

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



INSIGHTS

Rural counties in the central portion of the state tend to experience the greatest number of customer interruptions per capita

- Counties with more customer interruptions per customer tend to be among the least populated in the state, as they likely have a large volume of overhead, radial distribution infrastructure that is particularly vulnerable
- However, the correlation between population density and reliability is weaker than in other states across WECC, meaning asset condition and climate exposure are likely more important drivers of county-level reliability

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

- Wind was identified as the primary driver of customer interruptions in all counties with below average reliability (see slide 24)
- San Miguel and Lincoln Counties also contain large swaths of mountain ranges and forests that could contribute to reliability and restoration issues

Reliability issues span across multiple utility types, but are generally consolidated in the service territories of electric cooperatives

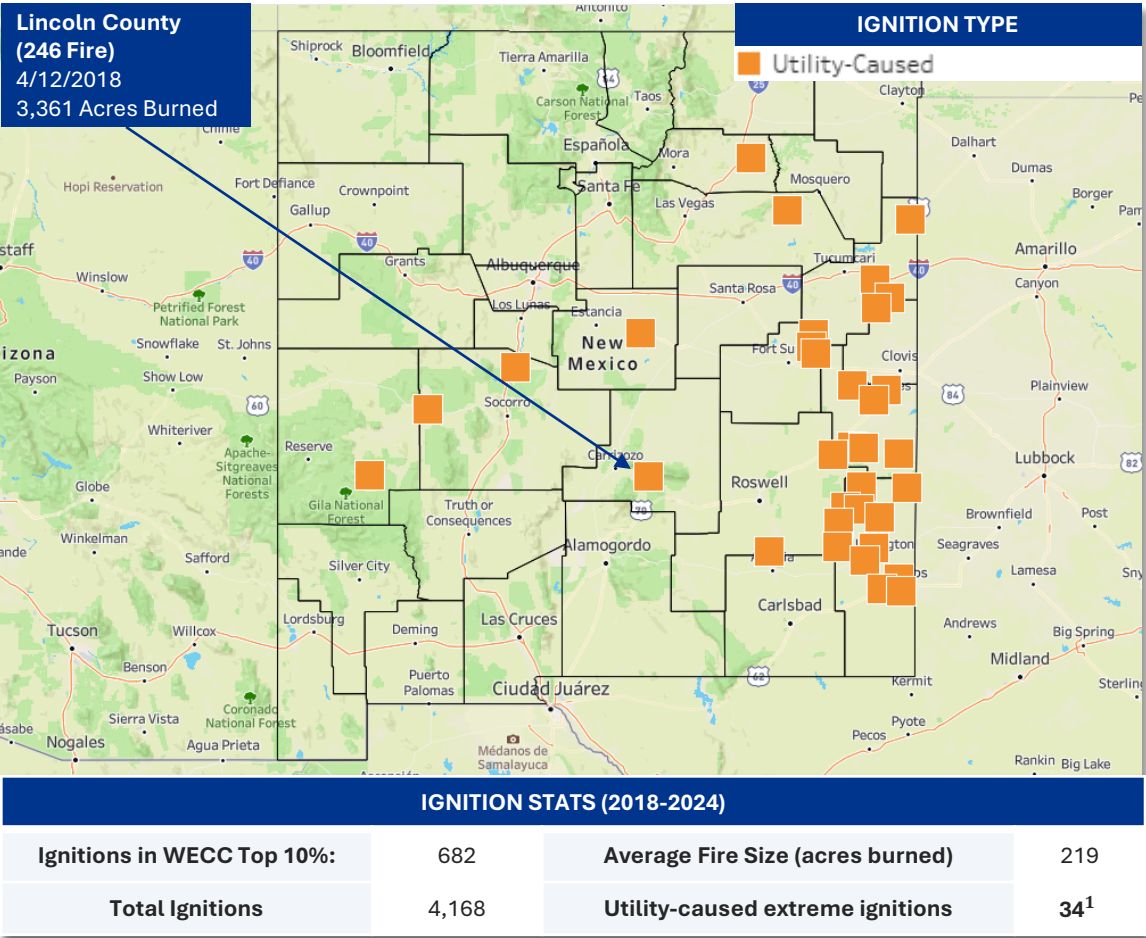
- Many of the least reliable counties are served by a mix of IOUs and coops, making it difficult to determine which utility is contributing more significantly to these issues
- IOUs in the state generally exhibit high reliability given greater resources, a denser customer base (allowing for more underground lines and redundancy), and regulatory scrutiny that could improve spend efficiency

METHODOLOGY

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

Utility-caused ignitions are concentrated in the southeastern portion of the state, prompting close monitoring to ensure that SPS’s WMP is effective in reducing ignition risk

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



INSIGHTS

- Utility-caused ignitions are concentrated in the southeastern portion of the state
- This generally corroborates the exposure noted in the Grid Resilience Report, although the lack of ignitions in the southwest portion of the state, which faces peak statewide fire exposure, is surprising
- Electric providers in Lea and Roosevelt Counties could consider additional wildfire mitigation spending
- The concentration of utility-caused outages in these counties indicates that the assets in this region are particularly prone to ignition and could be upgraded
 - Regulators could monitor whether the actions laid out in newly required Wildfire Mitigation Plans effectively reduce ignitions in this high-risk region

IGNITIONS 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

¹ 5% of extreme ignitions in New Mexico were utility caused, the highest percentage in WECC



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

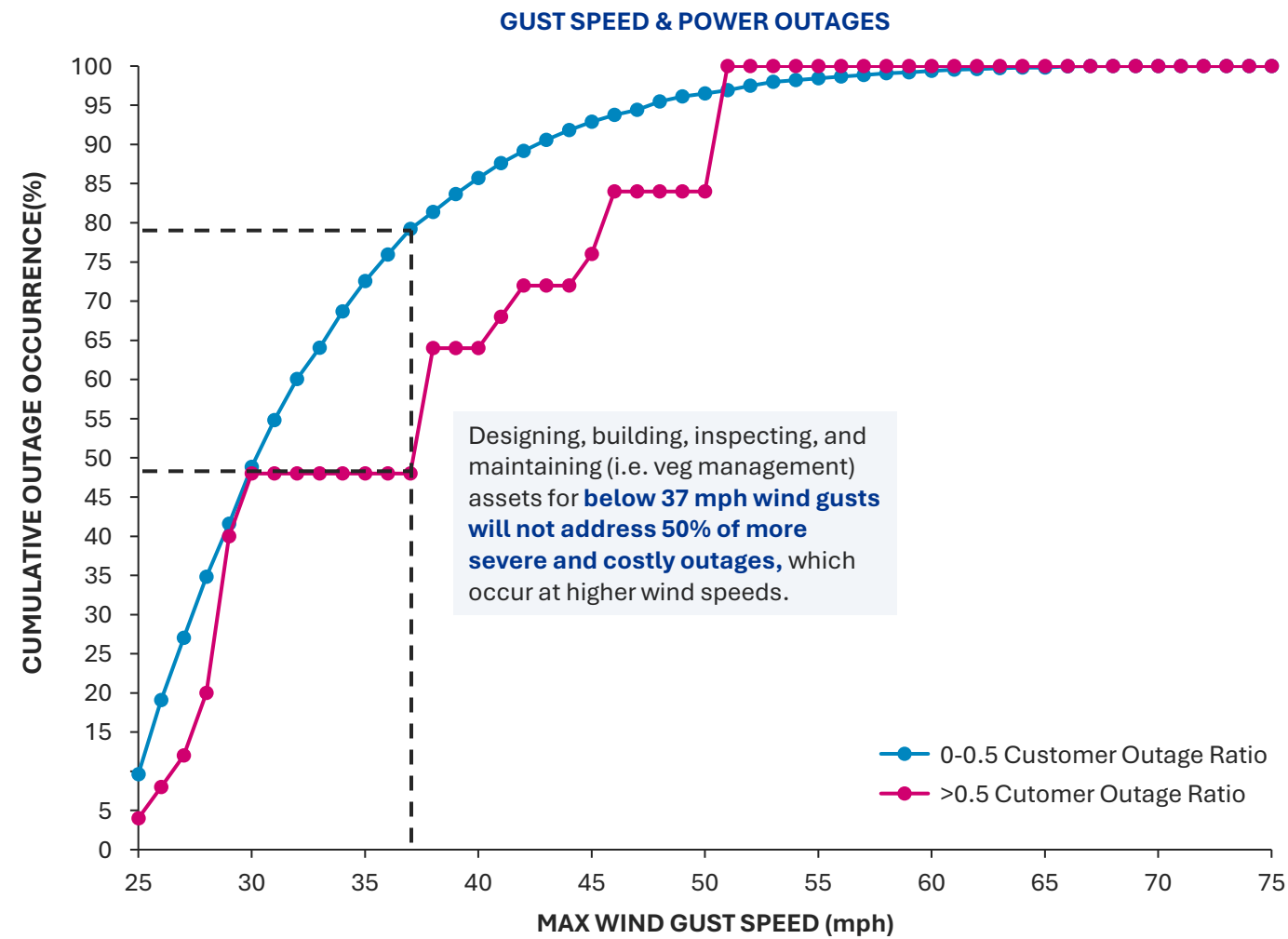
Extreme outages are more likely to be coincident with > 37 mph wind speeds than non-extreme outages

- About 50% of extreme outages are attributable to wind speeds above 37 mph, compared to 20% of non-extreme outages
- 15% of extreme outages occur at exactly 51 mph wind speeds, indicating that there may be a common failure mode that occurs at this threshold

ASSET PLANNING INSIGHTS

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

- Over 95% of non-extreme outages and 85% of extreme outages occur at wind speeds < 50 mph, which are more likely attributable to vegetation contact or aging equipment rather than direct failure
- Outages are coincident with wind speeds up to 75 mph, which could serve as an important threshold for planning and design
- **Low-Cost:** Pole Reinforcement (Trussing, Guy Cables, Concrete Base, etc.), Pole Material Upgrades, Decreased Spans, Vegetation Management
- **High-Cost:** Undergrounding



While extreme cold generally drives generator rather than network outages, many severe outages are concentrated between 13 and 2 °F, indicating an important threshold for planning

UNDERSTANDING THE DATA

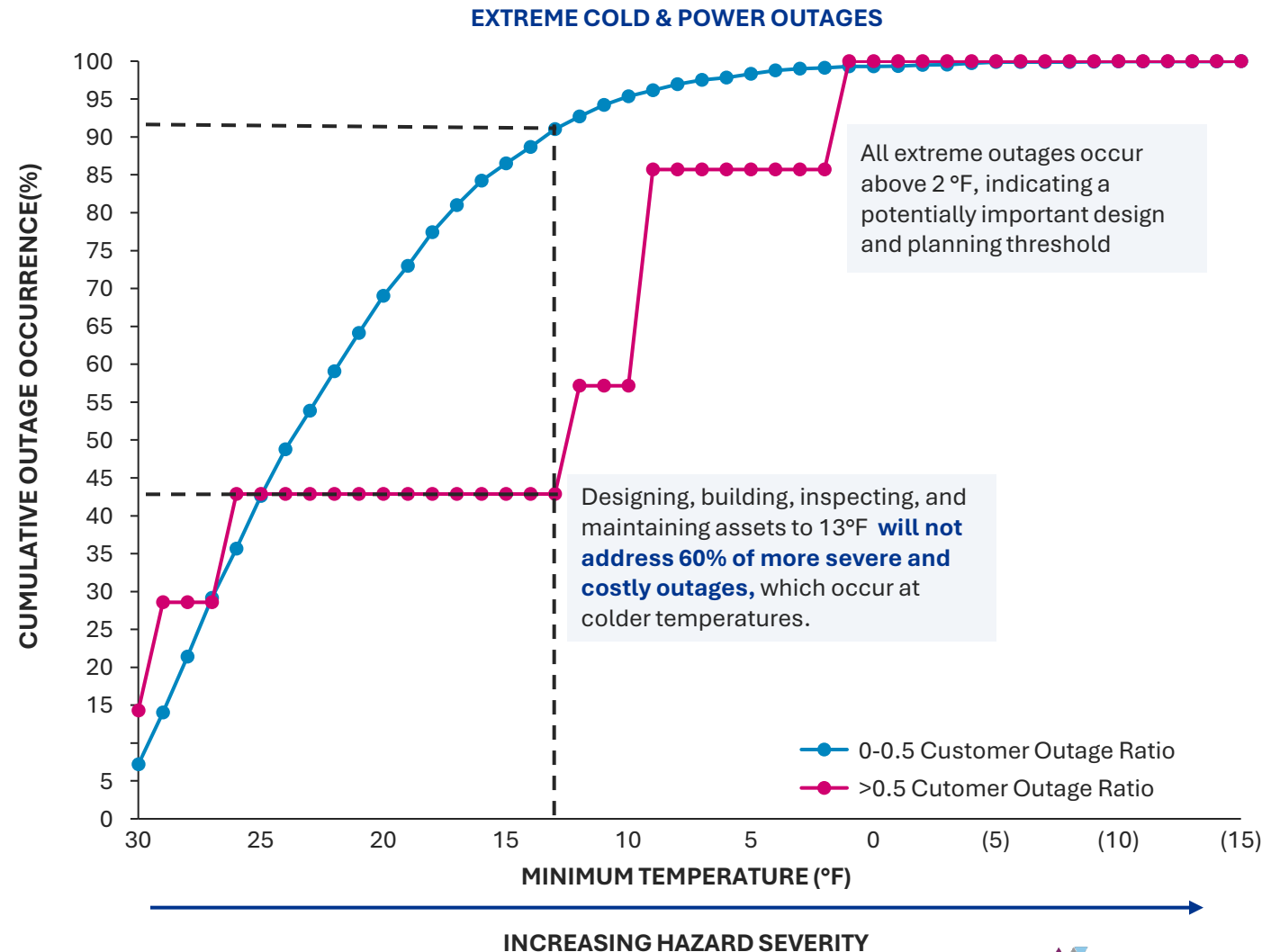
Extreme outages (>50% of customers out) are more likely to be coincident with minimum temperatures below 13°F than non-extreme outages

- About 60% of extreme outages are attributable to minimum temperatures below 13 °F, compared to under 10% of non-extreme outages
- The curves converge at 2 °F, indicating that temperatures rarely fall below these levels across the state

ASSET PLANNING INSIGHTS

Extreme cold without accompanying wind or precipitation is more likely to cause power plant failure than distribution and transmission issues

- Smaller utilities could coordinate with generation owners and update emergency plans to prepare in advance for potential cold-related outages
- Any transmission and distribution system upgrades could target events below 9 °F to address a significant portion of extreme outages
- **Low-Cost:** Contingency planning, monitoring and sensors, demand response, switches and reclosers
- **High-Cost:** Undergrounding, backup power systems, upgrade transformers



Extreme outages demonstrate increasing sensitivity to fire severity, potentially justifying expanded wildfire mitigation expenditures to avoid costly outages and ignition damage

UNDERSTANDING THE DATA

Extreme outages (>50% of customers out) are more likely to be coincident with the most severe wildfires

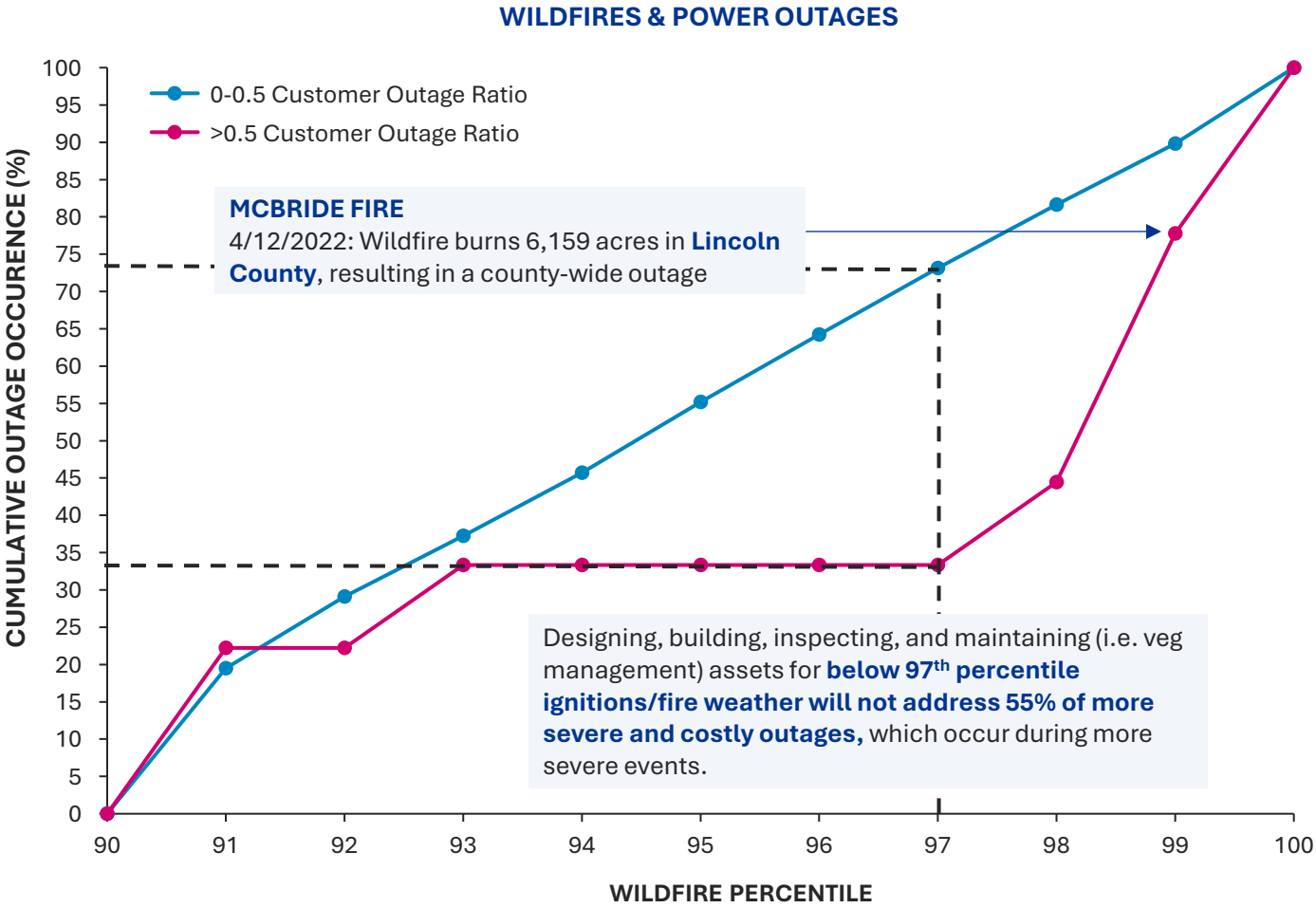
- 55% of extreme outages are coincident with wildfires in the 97th percentile or greater, compared to about 20% of non-extreme outages
- Extreme outages generally show an increasing sensitivity to fire size and FWI, indicating that increasingly severe wildfire events become more likely to drive extreme outages

ASSET PLANNING INSIGHTS

Asset planners could consider the high cost of ignition in addition to the cost of outages when determining the appropriate capital allocation level for wildfire

- **Low-Cost:** Pole upgrades, pole wrapping, vegetation management, switches/reclosers
- **High-Cost:** Undergrounding, reconductoring, covered conductors

HAZARD	FIRE SIZE	FWI
97TH PERCENTILE	1856.2 Acres	87.64



Utility Capital Plan Analysis

Project Overview

Background & Approach

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
Arizona	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

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



MAP RESILIENCE INVESTMENTS TO HAZARDS

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



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

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

TECHNOLOGY, PREDICTION, IMAGING

ASSESSMENT & REPAIR

SYSTEM UPGRADES

... additional spend categories in slide 34

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

TECHNOLOGY, PREDICTION, IMAGING

ASSESSMENT & REPAIR

SYSTEM UPGRADES

... additional spend categories in slide 34

WILDFIRE

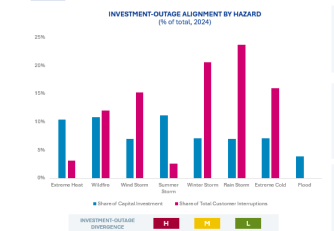
EXTREME HEAT

MAPPED TO 9 SEPARATE EVENTS

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

UTILITY INVESTMENT-OUTAGE ALIGNMENT | COOP-3

While COOP-3 has high coverage of extreme heat events, there is an opportunity to explore targeted resilience investments that address asset failures due to wind and precipitation.



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

Legend: Blue = Capital Investment, Red = Total Customer Interruptions

Legend: Blue = Public Power, Green = Cooperative, Red = IOU

Legend: Green = L, Yellow = M, Red = H

INVESTMENT-OUTAGE DIVERGENCE

Legend: Green = L, Yellow = M, Red = H

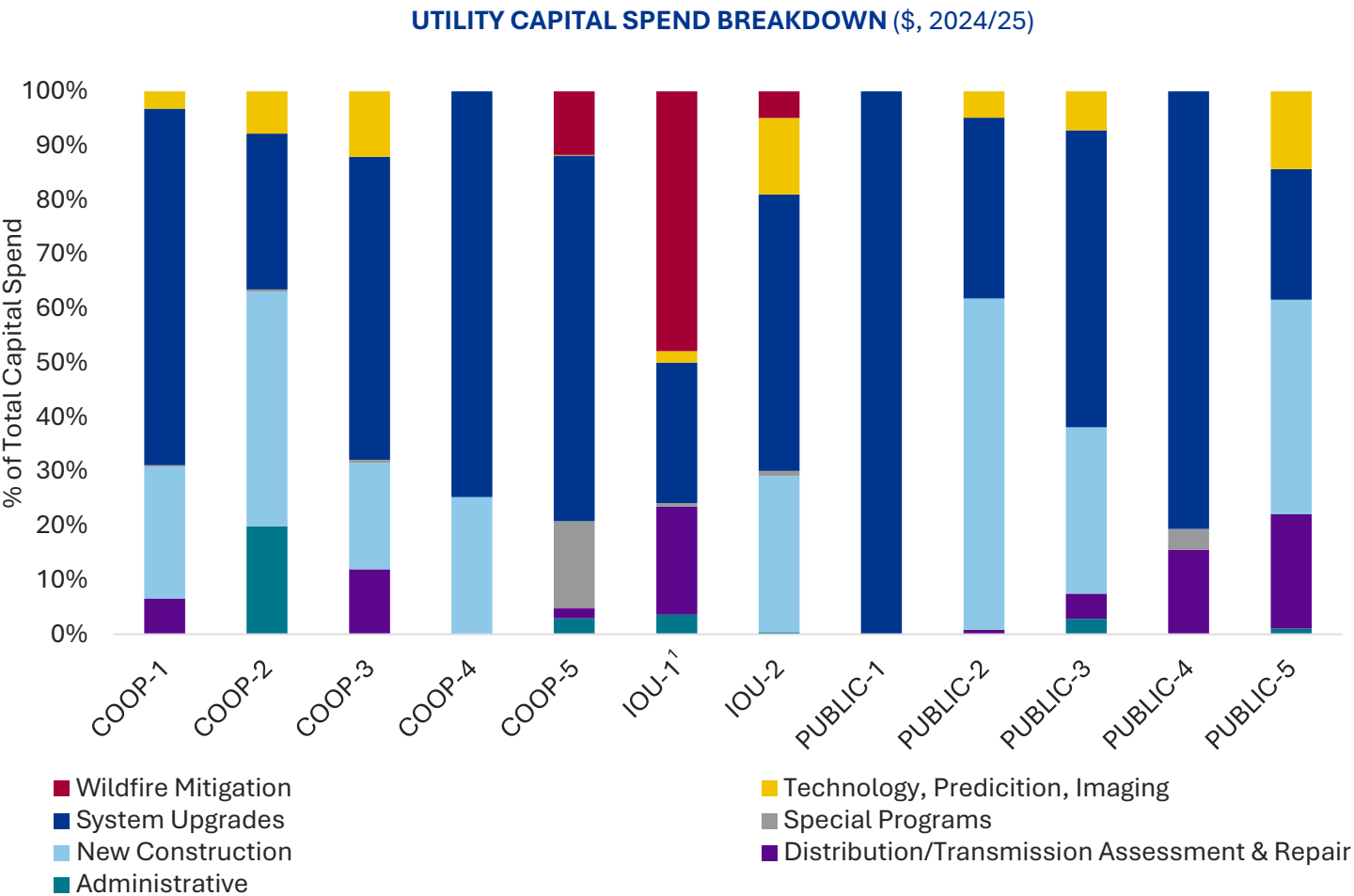
The level of capital spend addressing each weather event is compared to the share of customer interruptions it drives

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 that are explicitly allocated towards wildfire mitigation.

Capital Plan Review

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



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

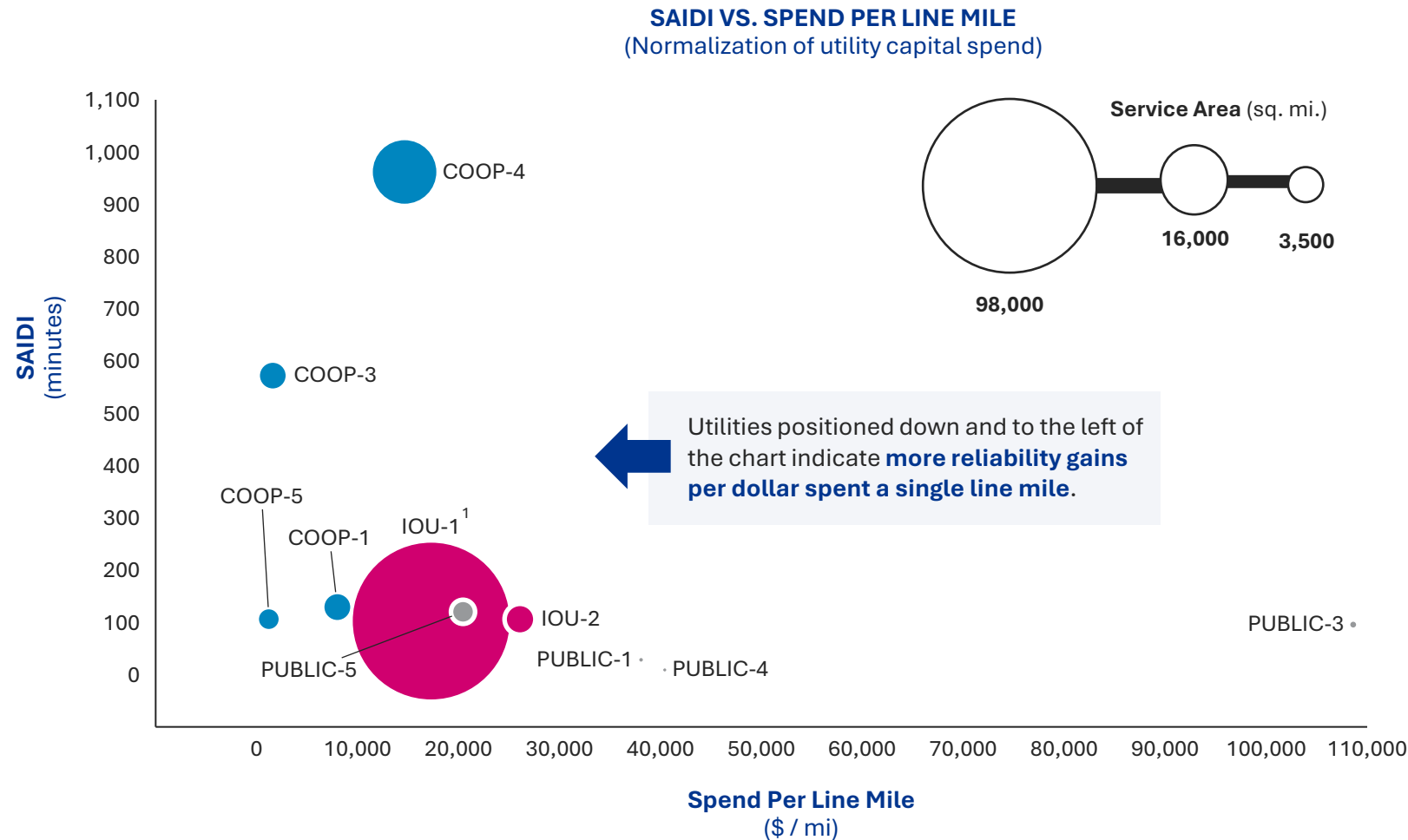
- Public power entities spend significant sums on both system upgrades and new construction and often have extensive undergrounding programs

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

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

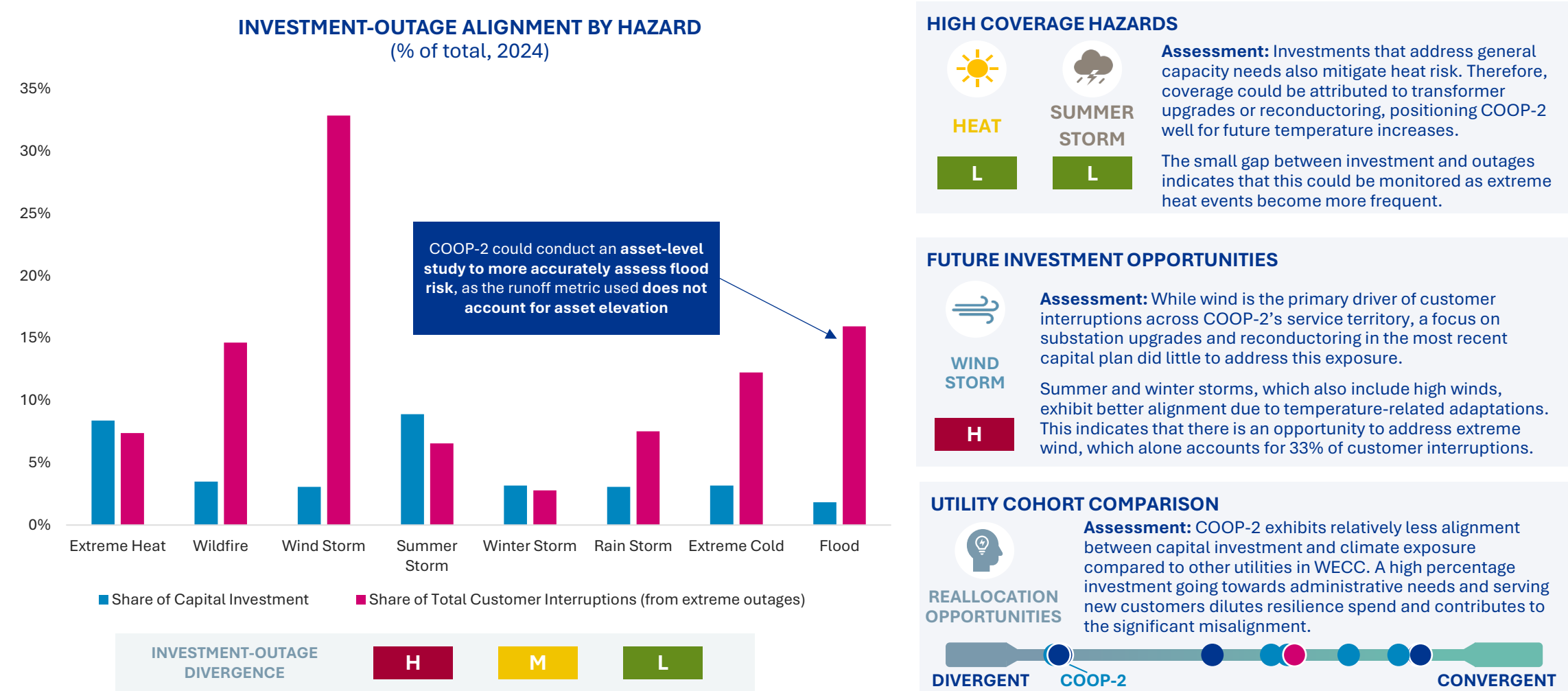
IOUs

- 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.)

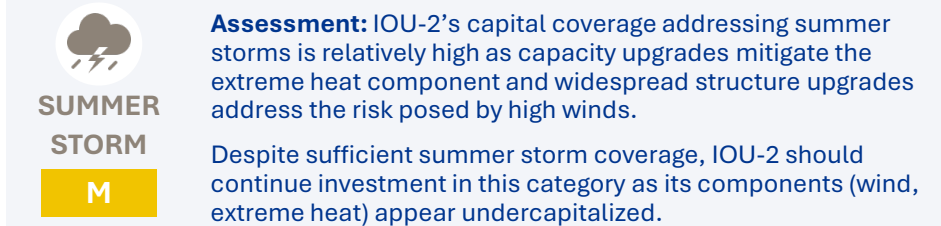
¹ An estimate of IOU-1's total capital spend was considered in this view, not just Wildfire Mitigation Plan spending

Utility Investment-Outage Alignment

While COOP-2 is well-positioned to weather increasing extreme heat exposure, there is significant opportunity to increase investment in adaptations to mitigate wind exposure



HIGH COVERAGE HAZARDS



WILDFIRE

EXTREME COLD

H

H

Assessment: 100-2 could consider expanding investment addressing wildfire given escalating exposure across its service territory out to end-customer as well as the high cost of ignition damage and liability that layers on top of the VOLL from outages.

Physical line loading from snow and ice could be addressed through pole replacement, decreasing spans, or undergrounding key Tx and Dx lines.

Assessment: IOU-2's capital expenditures are generally better aligned with historical climate exposure than other WECC utilities, but opportunities for improvement remain. The utility could consider conducting an asset-level risk assessment using future weather data to clarify future exposure, especially considering its service territory spans multiple climate zones.

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Utility Benchmark Analysis

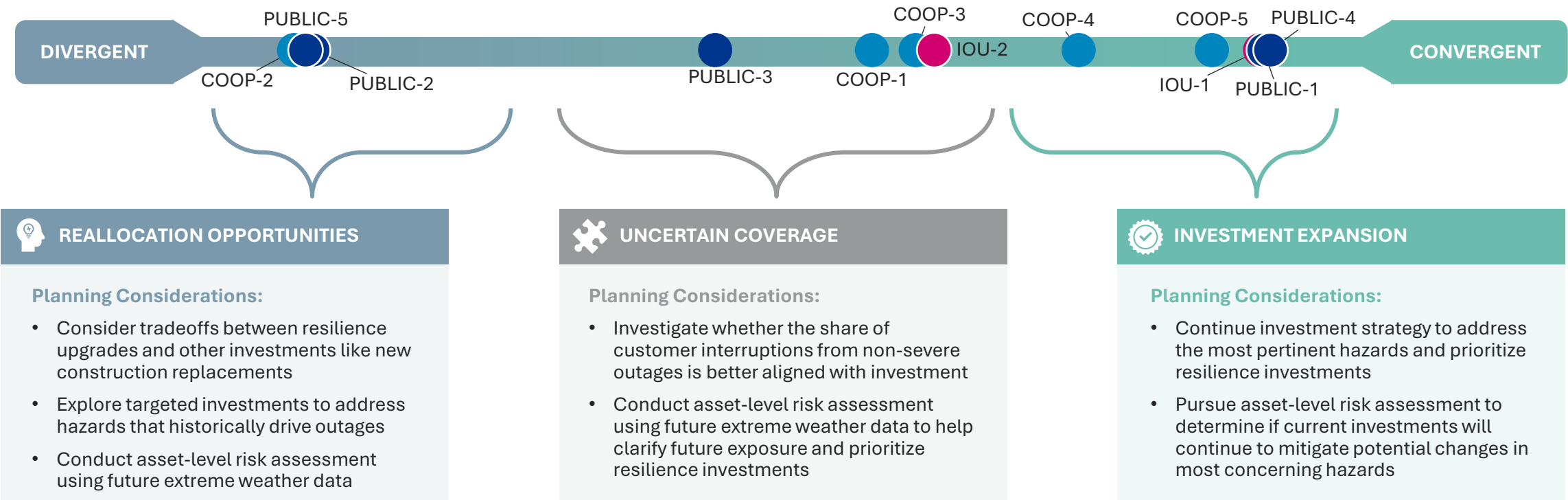
Utilities with convergent coverage are investing in upgrades that address hazards that have been historically responsible for the most severe outages in their service territory

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



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

