



*National Association of
State Energy Officials*

NASEO Virtual Roundtable on Electric Grid Sensor Technologies for Resilience and Affordability

April 2, 2024

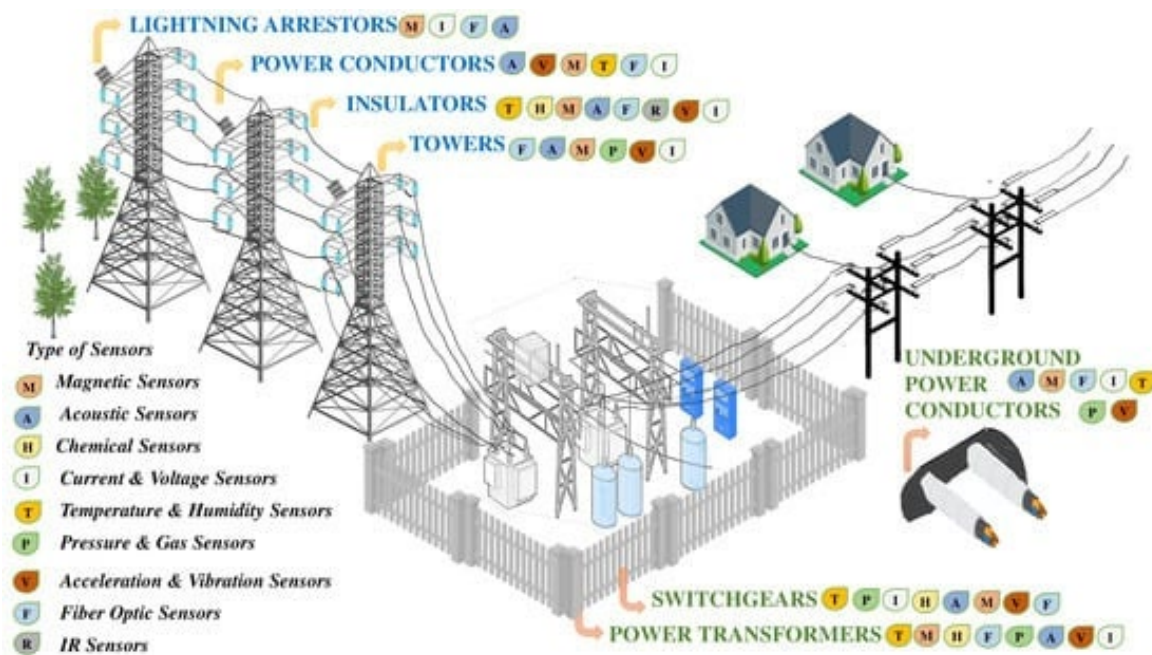
Thank you to the U.S. Department of Energy Office of Electricity for their support of this event.

Welcome and Logistics

Kelsey Jones, Program Director, NASEO

Grid Sensor Introduction

- Challenges:
 - Aging Infrastructure
 - Rise of Distributed Energy Resources
 - Increased Demand
 - Changing Consumer Preferences
 - Increase of Severe Hazards



Agenda and Speakers

Agenda Item	Speaker
Sensors, Machine Learning, and IT Infrastructure	Patricia Hoffman, Principal Deputy Director, Grid Deployment Office, U.S. Department of Energy
Colorado's Advanced Grid Monitoring Grant Program	John Parks, Electricity Markets & Transmission Policy Analyst, Colorado Energy Office
Sentient Energy	Giri Iyer, Vice President, Business Development, Sentient Energy
Using Sensors to Accelerate the Energy Transition	Karthik Rao, Vice President, Client Success, LineVision
Discussion and Q&A	
Facilitated Breakout Discussions	
Report Out and Close	

Sensors, Machine Learning and IT infrastructure

Patricia Hoffman
Principal Deputy Director
Grid Deployment Office
U.S. Department of Energy



Invest in Electric Infrastructure

Strategy:

- ❖ Maintain and invest in critical generation facilities
- ❖ Improve and expand transmission and distribution systems
- ❖ Improve our Nation's resilience

~ \$26 Billion in investment capital

Reduce Financial, Market and Technology Risk

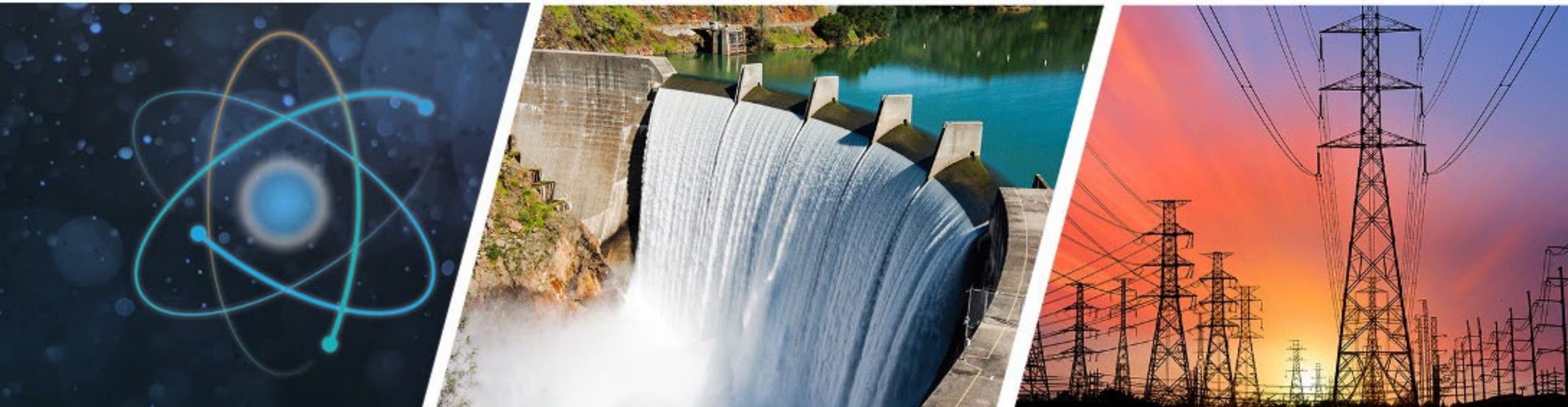
Priorities: Clean Energy Integration and Resilience

- ❖ *Asset Management/Predictive Maintenance*
- ❖ *Planning and Modeling (Grid Management and Optimization)*



- ❖ **Grid Resilience State/Tribal Formula Grants: \$2.3 billion**
- ❖ **Grid Resilience Innovative Partnerships: \$10.5 billion**
- ❖ **Puerto Rico Energy Resilience Fund: \$1 billion**
- ❖ **Civil Nuclear Credit Program: \$6 billion**
- ❖ **Hydro Incentives: \$753 million**
- ❖ **Transmission Facilitation Program: \$2.5 billion**
- ❖ **Transmission Facility Financing: \$2 billion**
- ❖ **Transmission Siting and Economic Development Grants: \$760 million**

[Grid Deployment Office | Department of Energy](#)
www.energy.gov/gdo/grid-deployment-office





Colorado's Advanced Grid Monitoring Grant Program

April 2, 2024



COLORADO
Energy Office

John Parks - gridresiliency@state.co.us
Electricity Markets & Transmission Policy Analyst

Rationale and Partnership Technology Approaches

As Colorado grows hotter and drier due to the impacts of climate change, the state's electric utilities and their customers are vulnerable to the risks of larger and more intense wildfires that threaten more communities, worsen air quality, and increase the frequency of electrical outages across the state.

Approaches to Addressing Wildfire Risk

Integrate Smart Grid Functions to Prevent Wildfires

- SCADA systems
- Adv. Grid Modeling Automation

Anticipate and Mitigate the Impacts of Wildfire on the grid

- Remote HD Cameras
- Adv. Grid Monitoring Automation Software

Increase the Ability to Redirect or Shut Off Power to Minimize Blackouts

- Automatic Reclosers
- Non-Expulsion fuses



Colorado Wildfire Mitigation Technology Partnership

Figure 1: Colorado Partnership Utilities Map and Climate Vulnerability

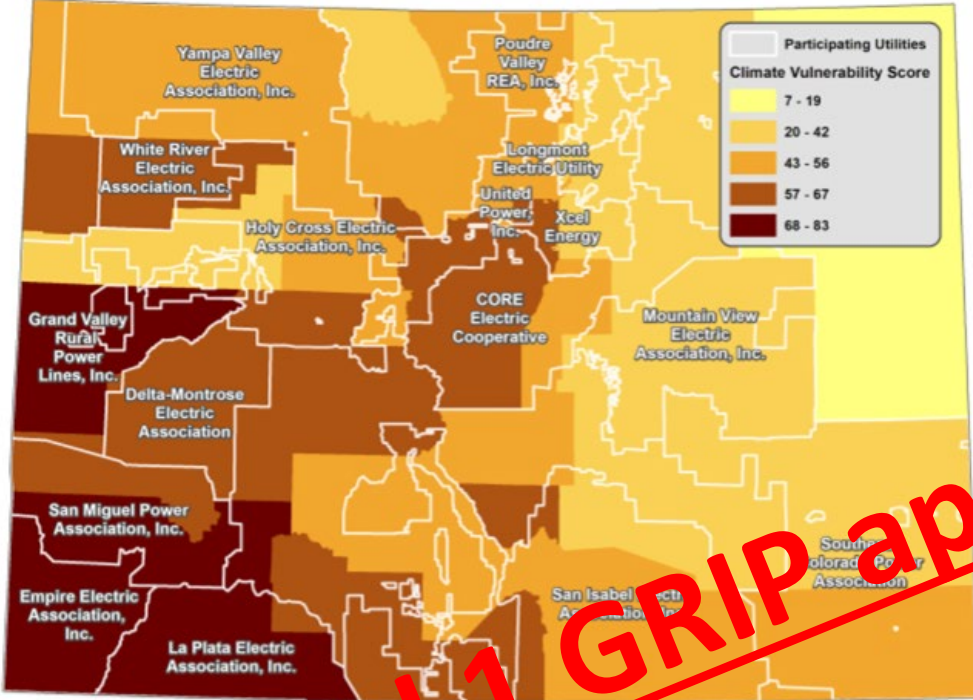


Image courtesy of Laura Petrus; Data source: Colorado EnviroScreen

Since 2021, wildfires caused over \$2 billion in damage in Colorado. The state is proposing a unique and innovative partnership that takes a statewide approach to address multiple aspects of wildfire management across an area that covers roughly 6% of the state, an area where 77% of Colorado residents live and work.

Partners

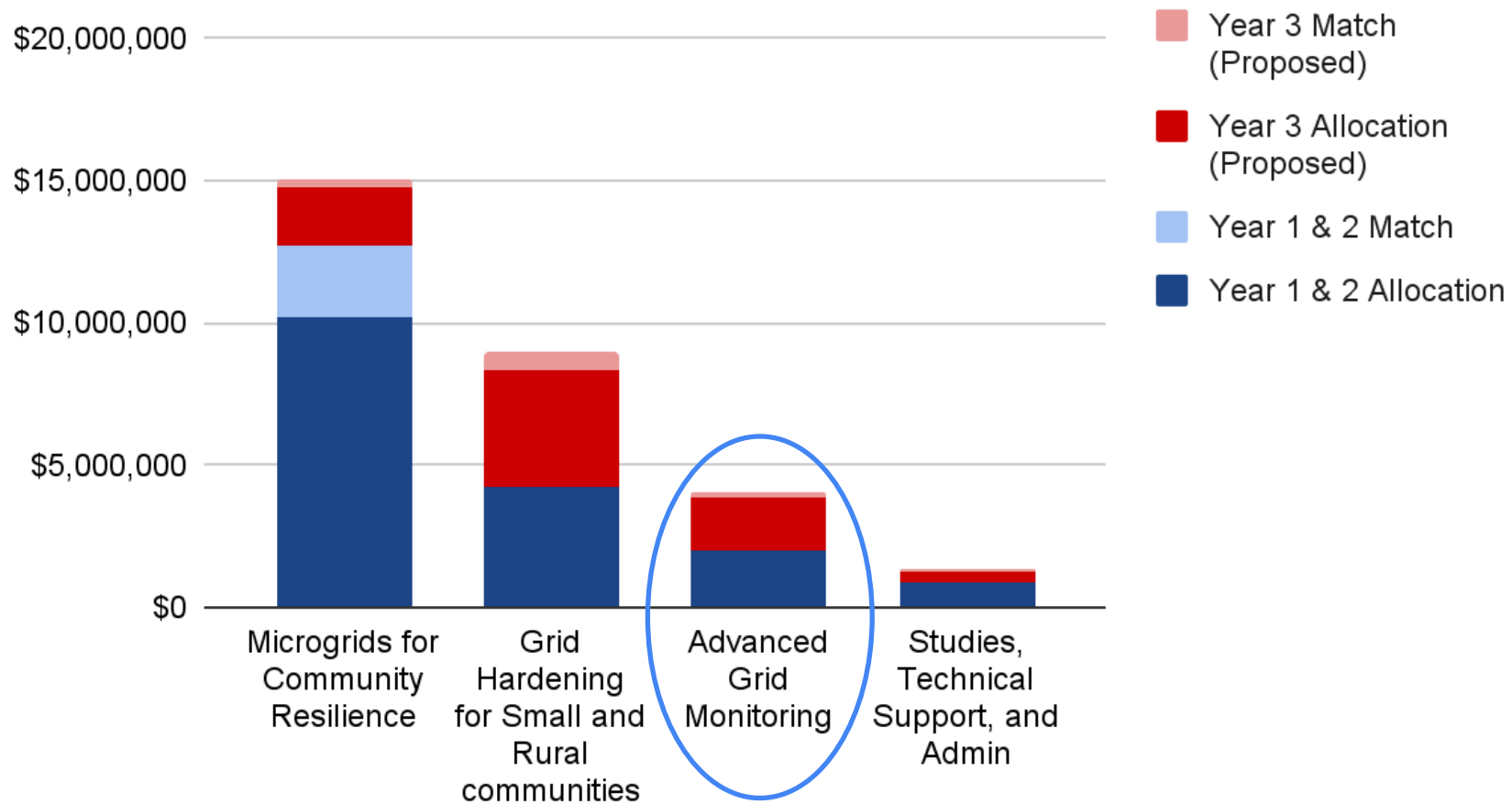
- 14 rural electric cooperatives
- 1 investor owned utility
- 1 municipal provider
- 4 state agencies (including Colorado Energy Office)

Round 1 GRIP application - NOT Awarded



Total Colorado IJA Grid Resiliency 40101d Allocations

Overview of 40101d Funding



Advanced Grid Monitoring Grants

Up to \$500,000 per grant (4 available at this level)

Match:

- One third local match (2022 utility sales < 4 million MWh)
- 100% cost match for Colorado's largest utilities
(2022 sales > 4 million MWh)
- Cost match can be cash, in-kind, or a combination of the two

Timeline:

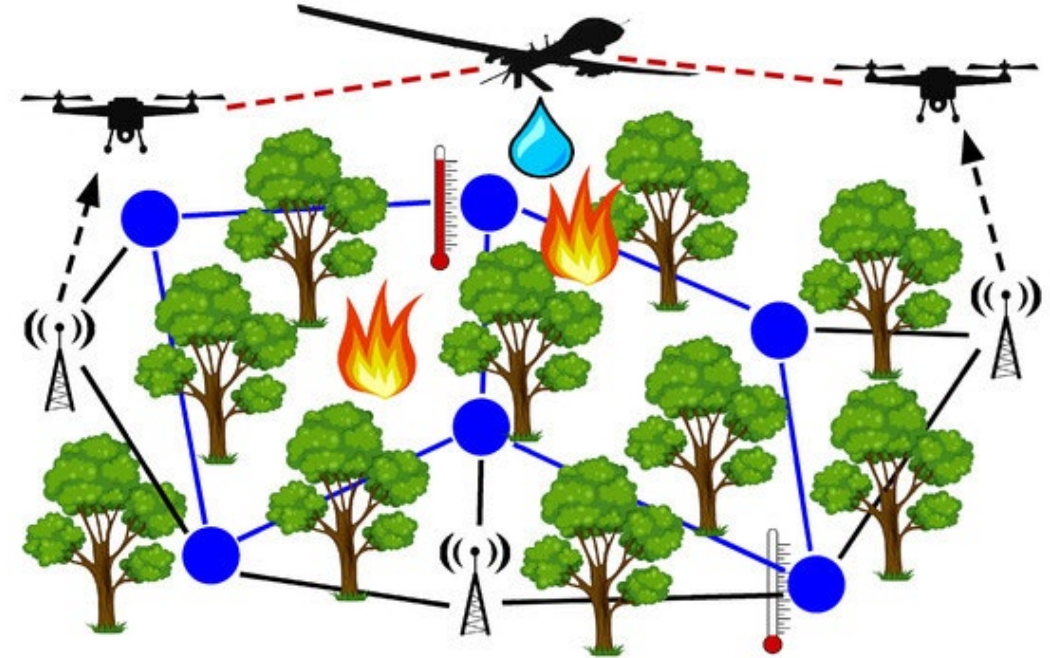
- Early Fall: Grant window open
- Late Fall: Grants due
- Winter: Award announcements

Advanced Grid Monitoring Grants - Uses

Eligible entities: all Colorado utilities

Eligible uses:

1. Fire monitoring & prevention technologies
2. Advanced Vegetation and fuel-load management, using LiDAR, satellites, AI, or other information technology
3. Distribution pole sensors
4. Smart meters (advanced metering infrastructure, or AMI)
5. Grid modeling
6. Studies to identify where best to strategically locate weather stations, HD cameras, and other grid monitoring technologies



COLORADO
Energy Office

Sentient Energy

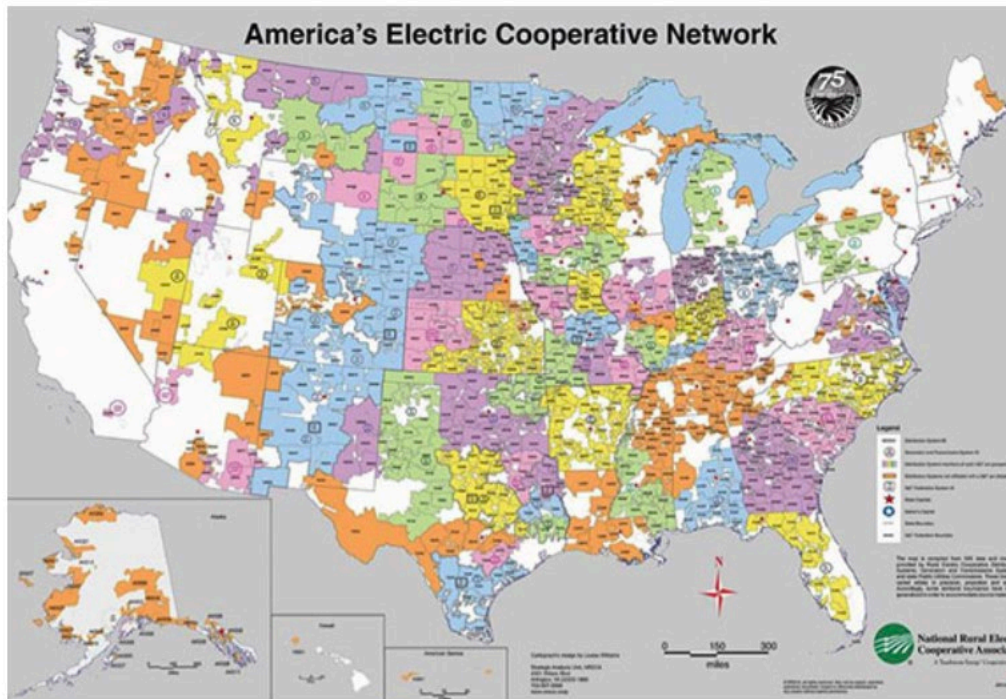
Presentation to NASEO



Major US territories now at risk for wildfire and other climate driven events

HISTORICALLY UNDER-INSTRUMENTED GRID – ESTIMATED at ~70,000 feeders (1/3rd of US grid is here)

ILLUSTRATIVE MAP OF US ELECTRIC UTILITIES

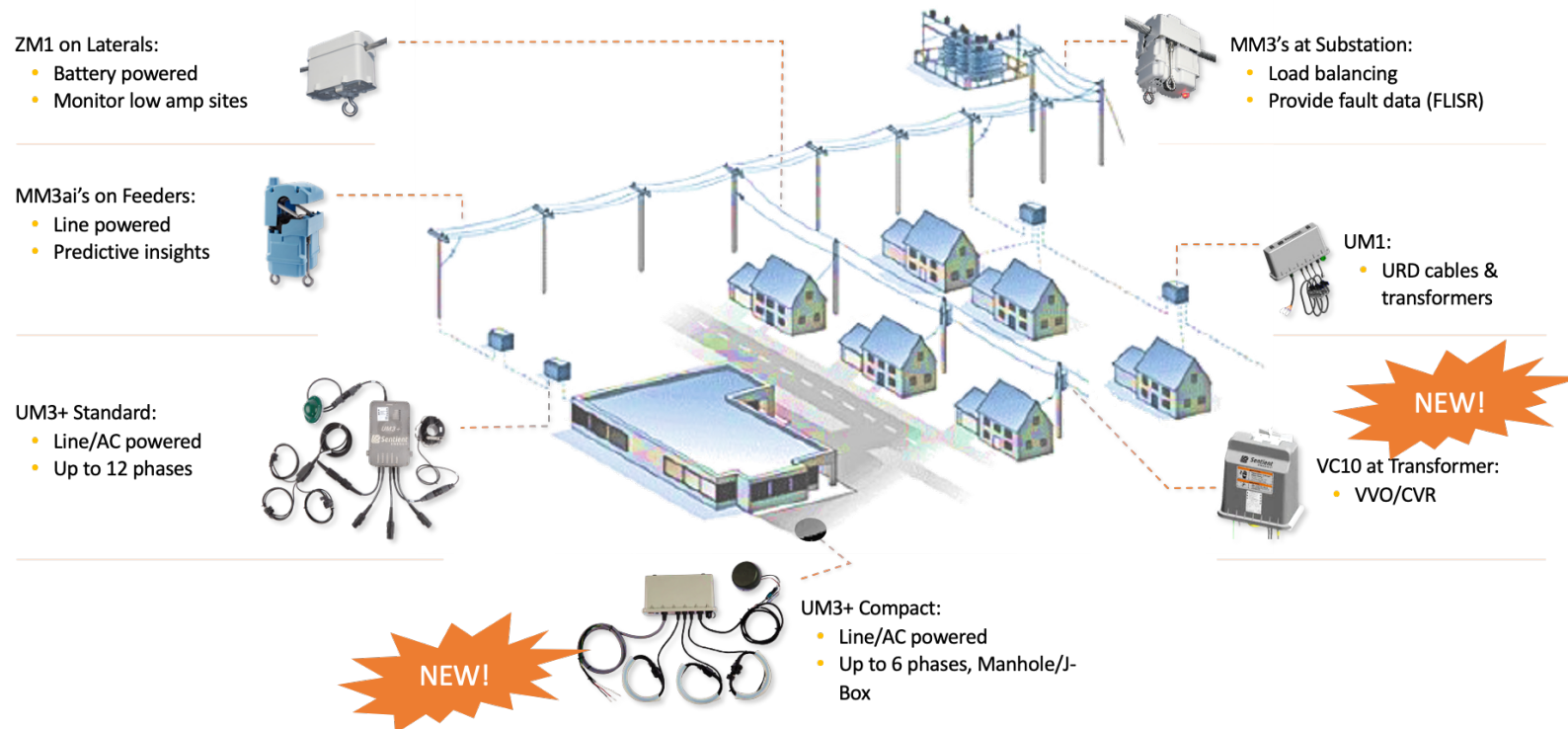


<https://www.electriccooporganizing.org/rec101>

KEY RELEVANT BACKGROUND

- Significant IJA money going to non-investor owned entities; estimate \$9B out of \$14B
- 50% of the nation's geographical landmass and about 45M meters (~100M population)
- 2900 municipalities and electric cooperatives part of the electricity provider landscape
- Combination of rural, remote and pristine areas with many indigenous Indian nations
- Most, if not all entities are outside the purview of NASEO
- Many of these utilities have real energy justice challenges
- They have a real need for leapfrog innovation- FAST TIME TO VALUE

Example of a comprehensive suite of analytics → SaaS → sensors portfolio

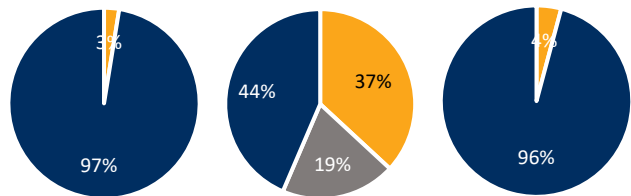
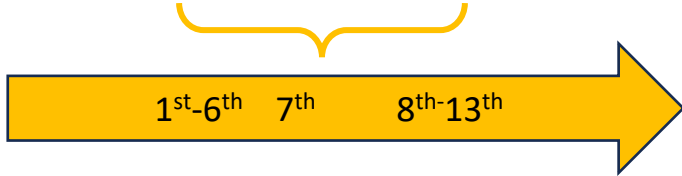


We estimate that 88% of US electric utilities are <16,000 meters in size (EIA 2021 data)

- Safety now as important as grid reliability
- Fastest way to instrument grid is to deploy grid sensor
- No need to take a planned outage for installation
- Sensors deploy in minutes/not years
- Software live within a hour
- Fast time-to-value
- Breakeven on investments is often <12 months
- Average 16K meter utility 100% deployed in 2 weeks

Outage Avoidance (Vegetation Use Case)

← 66 days →



Alert day
-1 week

Alert Day

Alert Day
+1 week

- Precursor anomalies identified
- Escalated to Alert
- Notification sent to customer with likely location

Operational Anomalies Other



- Field investigation identified burnt pine tree branches



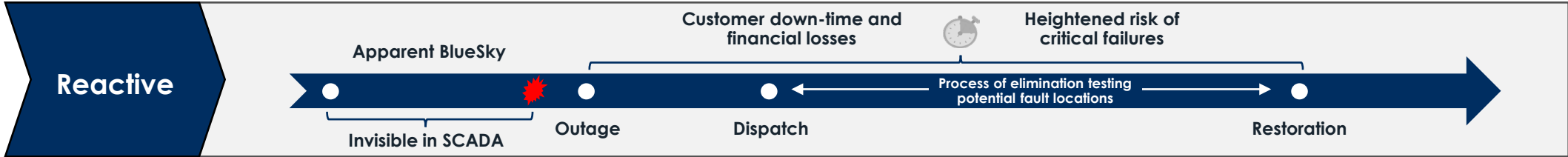
- Tree trimming work completed

Outage avoided!
48 customers;
\$21,000 CMI savings

Sentient Solutions Transform Utility Grid Management

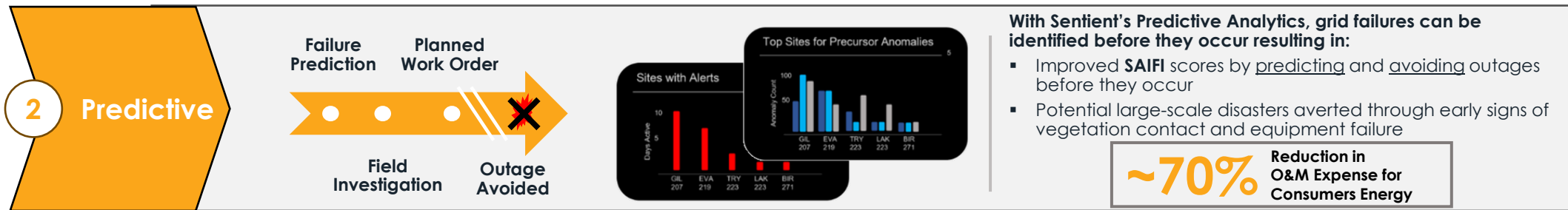
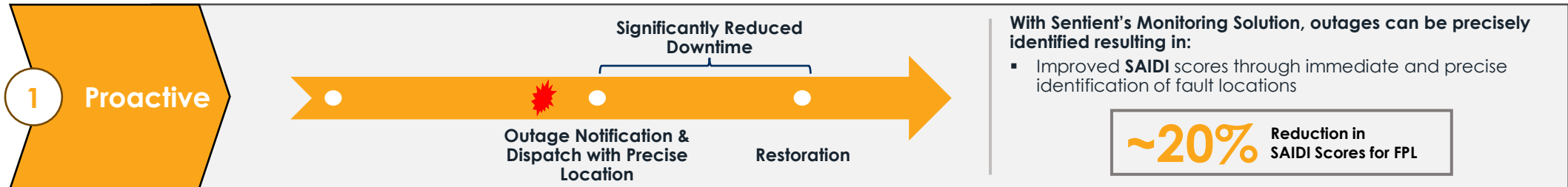
Sentient's solutions enable utilities to quickly locate outages and predictively prevent future outages

Business as Usual:



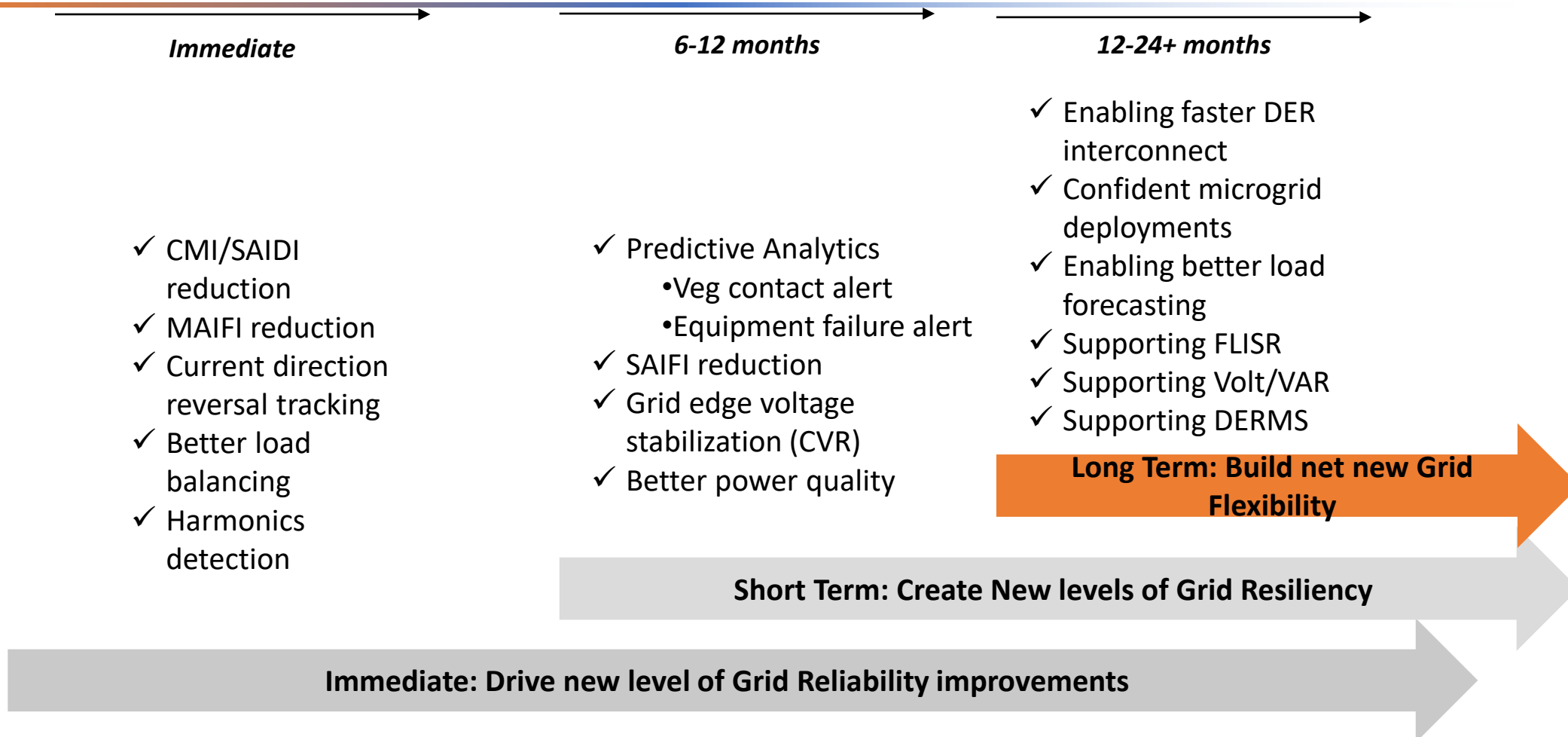
Sentient's Solutions:

Providing a road map for utilities to modernize their distribution grids with Sentient's Grid Analytics System and Grid Edge Control



The benefit of preventing outages before they occur is enormous, as are the consequences to the public of continuing with the status quo

Fast Time-to-Value at Scale



How is Sentient Energy working with the states?

- Currently in various stages of collaboration with Iowa, Virginia, Tennessee, Colorado, Nevada, Minnesota, California, etc.
- Actively working with National Labs like Oakridge, Sandia, LLNL, etc.
- We are supporting Outage Data initiative Network (ODIN) with pre-failure alerts
- Actively seeking State Energy office and NASEO pulling us in
- We are open to collaborating with other technology providers- examples; substation-based cameras for remote monitoring and hydrogen sensors for transformer overloading for DER/EV
- We have a grant submission template ready for submission and use for IJA formula grants and offer FREE grant writing services to the States and associated utilities
- We encourage a State-level submission, not one utility at a time

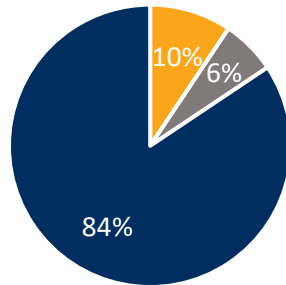
Back Up slides



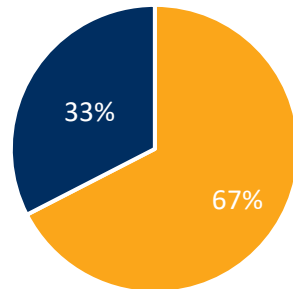
Outage Mitigation (Equipment Use Case)



Operational Anomalies Other

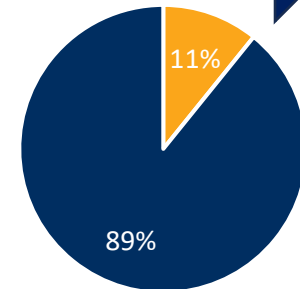


Before Escalation

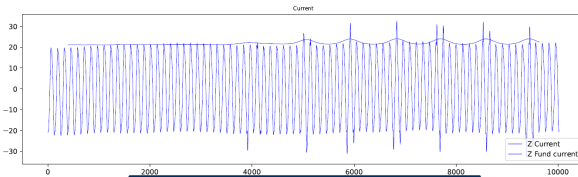


Escalated Days

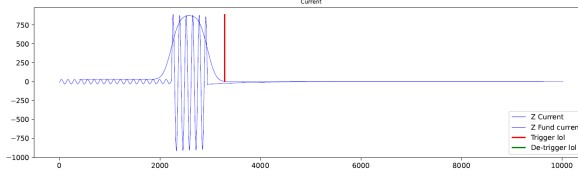
23rd Watch
 30th Warning
 5th Alert
 6th Investigation; can't find problem
 12th Alert w locations; **found cracked porcelain fuse cutout**



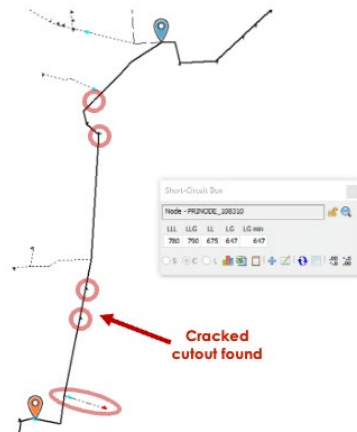
After Repairs



Precursor Anomalies

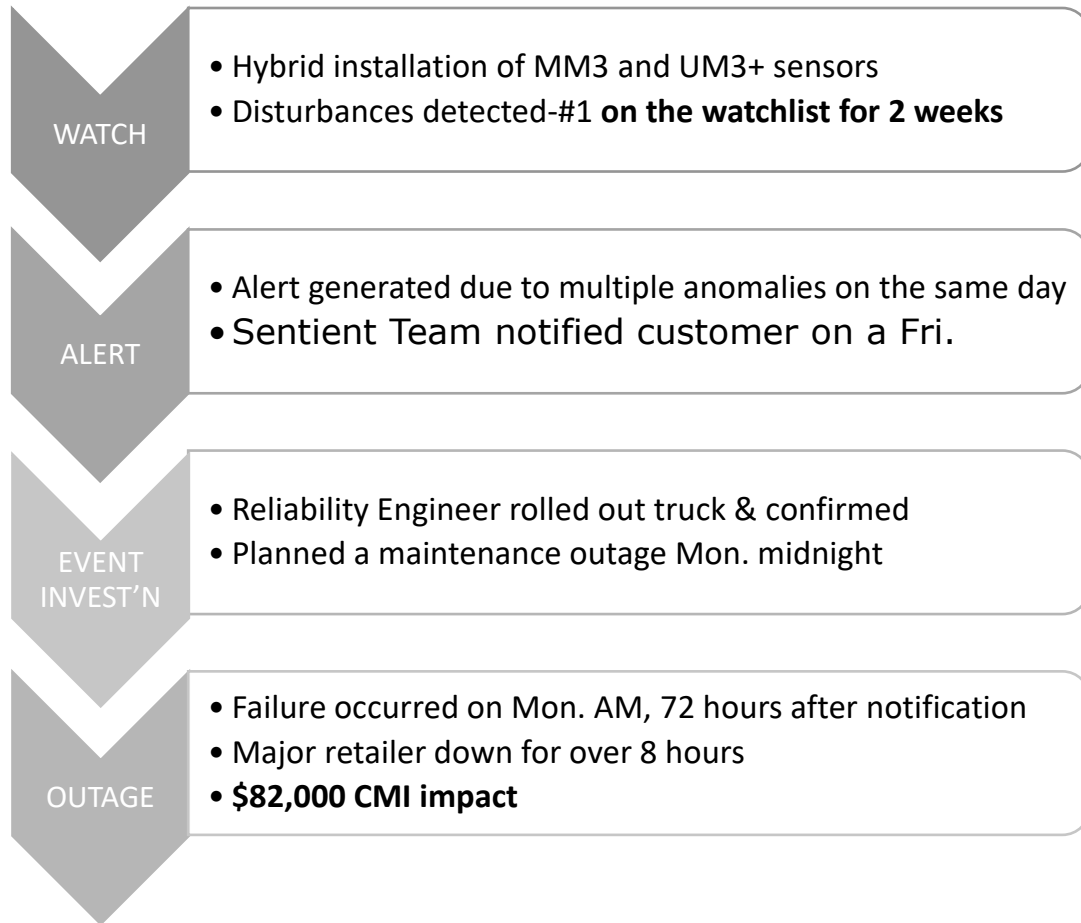


Fault Resulting in Recloser Operation

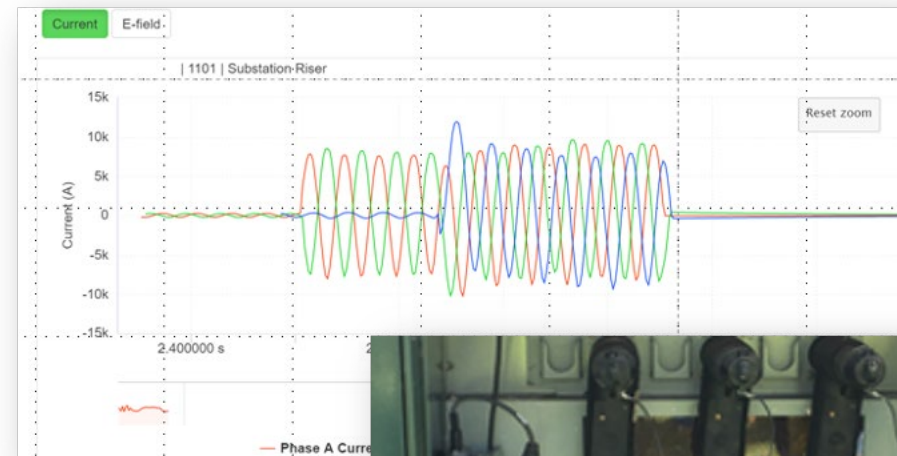


Outage avoided!
 138 Customers
 \$61,893 CMI saving

We have predicted U/G circuit failure as well



Switch Cabinet Use Case





Sentient Energy
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770-402-1085



Using Sensors to Accelerate the Energy Transition



Karthik Rao
VP, Client Success



Grid Challenges



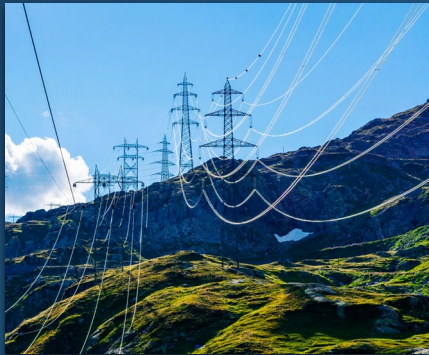
Grid Expansion

100% growth in capacity needed by 2035. **+2 TW** of projects stuck in the interconnection queue.



Intensifying Climate Risk

\$90B+ in economic losses from Texas' 2021 storm



Aging Infrastructure

50% of lines are at or near the end of useful life.



Serving Load Growth

Electrification of everything requires more capacity to serve your customers.

Lack of Visibility

99.9% of all transmission lines have no monitoring beyond the substation

LineVision LUX Sensor



Complete Visibility

- > Optical sensor monitors all phases
- > Data transmitted wirelessly to LineVision platform
- > Self-powered using solar PV

Easily Deployed

- > Sensors strategically placed every 2-3 miles
- > Install completed using basic hand tools
- > **No outages and no live-line work**



LineRate

Dynamic Line Ratings



LineAware

Reduced Operational Risk



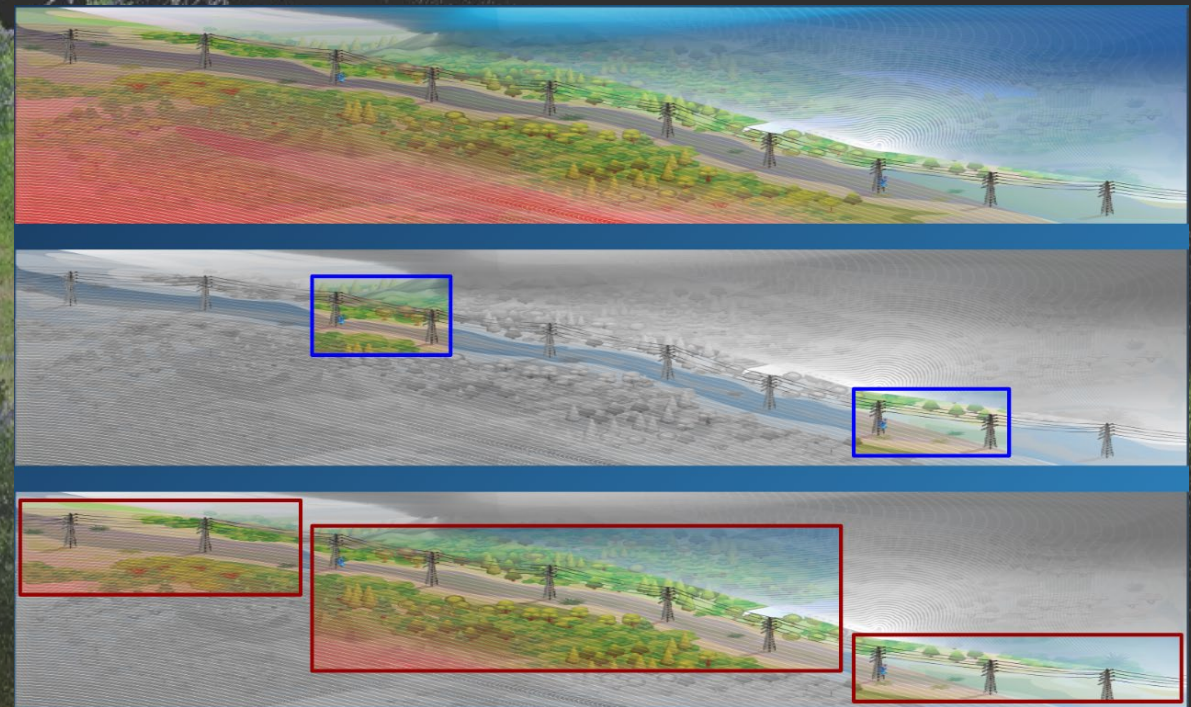
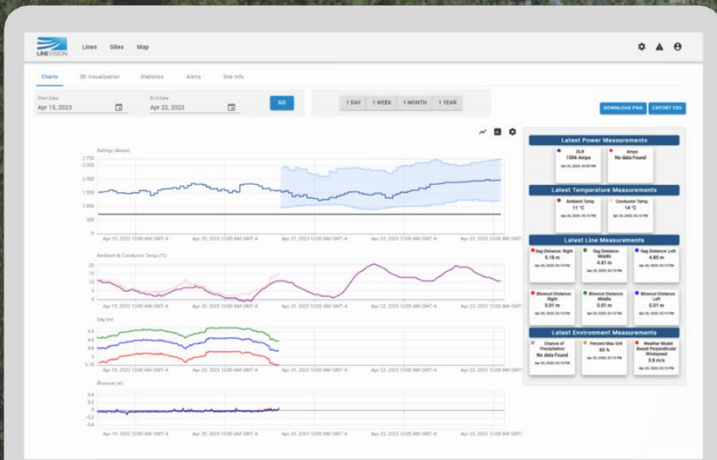
LineHealth

Informed Asset Management

LineVision is a new model for expanding grid capacity with sensors and analytics












Dynamic Line Ratings

- Increase transmission capacity by providing Operators with real-time understanding of conductor conditions
- Model the impact of wind cooling using Computational Fluid Dynamics and sensor validation





LineVision Global Footprint Projects

LineVision is a **Trusted Partner**



> NYSERDA funded CLCPA project to deploy DLR in upstate NY. **Unlocking transmission capacity and integrating renewables.**

Integrating Renewables



> Installation **on critical sections of NYES 54-mile line.** Ensuring the new transmission lines are operating at maximum efficiency and capacity.

Reliability & Resilience



> DLR deployed to reduce OSW curtailments in UK. **Reduced congestion costs by £14M/yr.**

Reducing Congestion



> Expected **20-55% capacity increases** from DLR, providing grid flexibility for critical C&I load integration.

Enabling Electrification



Regulatory Momentum for GETs

Department of Energy



GRIP Program -40101(c), 40107, 40103b
- DLR, monitoring & control technologies

Formula Resilience Grants - 40101d
- Funding to States to improve grid resilience (monitoring & control technologies)

Transmission Facilitation Program - Sec 40106
- Priority funding to projects with GETs

Transmission Needs Study
- GETs highlighted in Final Report

DOE GETs FOA \$8.4 million
- Increasing Utilization and Reliability of Electric Infrastructure with GETs

Federal Energy Regulatory Commission



Transmission Line Ratings NOI on DLR [AD22-5-000]
- Inquiry for a possible mandate on DLR

Transmission Planning & Cost Allocation NOPR [RM21-17]
- Require transmission providers to consider GET's (DLR & APFC) in regional transmission planning

Transmission Incentives Policy [RM20-10-000; AD19-19-000]
- Addresses the requirement of FPA 219(b)(3) to "encourage deployment of transmission technologies... to increase the capacity and efficiency of existing transmission facilities"

Transmission Planning & Cost Management [AD22-8; AD21-15]
- Ensure sufficient transparency into & cost effectiveness of local and regional transmission planning decisions

State Engagement

Legislative Efforts

- Increase in [legislation](#) to encourage or incentivize GETs
- 9 states considering legislation

Massachusetts: Study & Report

- Convened [Clean Energy Transmission Working Group](#)
- Robust engagement on Grid Enhancing Technologies, including DLR
- Final Report to Legislature December 2023

New York: Demonstration Funding

- [NYSERDA - Avangrid Challenge](#)
- Part of NYSERDA's Future Grid Challenge Program
- Secured funding for DLR deployment on 2 lines



Thank you.

 LineVisionInc.com

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Discussion and Q&A

Breakout Questions

- How is your state incorporating sensors into short- and long-term grid planning?
- Are you engaging investor-and-consumer owned utilities on this topic? Or other third parties?
- Is your state running any programs to support RD&D of grid sensor technologies?
- What are the strongest use cases for grid sensors in your state?
- What challenges have you encountered?
- What additional questions do you have about grid sensors and the benefits/challenges?
- What technical assistance/ resources do you need from DOE or NASEO?

Thank you!
