

Project REFORM: Resiliency Enhancement for Fire mitigation and Operational Risk Management (Topic Area 2 – 40107)

Lead Organization

PacifiCorp, a Berkshire Hathaway Energy Company

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Team Member Organizations

Labor Associations: International Brotherhood of Electric Workers (IBEW) Local 57, Local 77, Local 125, and Local 659

Sub-recipients: University of Utah, Pano AI, PSSC Labs, Crater Lake EJATC

Technology Partners: Atmospheric Data Solutions (ADS), Grid Power Solutions, Schweitzer Engineering Lab (SEL), AssurX, Sentient Energy, Technosylva, Texas A&M University

Public, Community, and Educational Partners: Grid Forward, Center for Energy Workforce Development (CEWD), CAL FIRE, Boys and Girls Club of Rogue Valley, City of Grants Pass, College of the Siskiyous, Davis Technical College, Oregon Association of Minority Entrepreneurs (OAME), Oregon Department of Forestry, Oregon Institute of Technology, Rogue Community College, Southwest Tech, Suazo Business Center

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Project Location(s):

California, Idaho, Oregon, Utah, Washington, Wyoming

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1 PROJECT OVERVIEW

1.1 Background

PacifiCorp's Resiliency Enhancement for Fire mitigation and Operational Risk Management (REFORM) project addresses the U.S. Department of Energy's (DOE) Topic Area 2 objectives by bringing together innovative, scalable smart grid technologies for preventing faults that may lead to wildfires, as well as enhancing the situational awareness, controllability, and distribution system flexibility, primarily in rural and disadvantaged communities (DAC). PacifiCorp serves more than 2 million customers across over 144,000 sq. miles of service territory in six western states. The increasingly urgent goals of resilience and wildfire mitigation align PacifiCorp with state priorities to protect citizens of the West facing the devastating impacts of wildland fire. In recent years, wildland fires caused by natural and human-made conditions in the West have burned millions of acres, blanketing the region in smoke, impacting communities like Glide and Santiam Canyon in Oregon and Happy Camp, California (Karuk Tribe) to name a few. The ongoing wildfire risks are particularly devastating to small towns and disadvantaged communities.

Over the past several years, PacifiCorp has invested several hundreds of millions of dollars in asset hardening and control center upgrades to mitigate against the potential risks of wildfire. However, the continuing growth of the wildland-urban interface (WUI), climate change, and a host of other variables require greater focus on smart grid applications to address system reliability and wildfire risk mitigation more holistically. PacifiCorp has established detailed wildfire mitigation plans to predict, protect, and maintain its electrical lines and equipment to minimize the risk of wildfire ignition. PacifiCorp continues to analyze its electric system to develop longer-term strategies that consider the changing climate and increasing wildfire risk, with a continued focus on mitigating Public Safety Power Shutoff (PSPS) impacts to customers.

1.2 Project Goal

Project REFORM focuses on enhancing PacifiCorp control centers' capabilities by establishing a holistic ecosystem of interoperable technologies that significantly enhance situational awareness to reduce or mitigate wildfire occurrences and improve grid flexibility, reliability, and resiliency. REFORM will include a diverse set of innovative, scalable smart grid technologies such as distribution fault anticipation (DFA) devices, advanced relays with wildfire protection features and communicating fault circuit indicators (CFCI) to analyze real-time system health using disturbance and fault data. REFORM will also enhance situational awareness through sophisticated weather forecasting models and wildfire detection network (WDN) AI-enabled cameras. All technology systems will be fully integrated to provide a holistic operational dashboard to control center operators, engineers, field operation crews and emergency operation center personnel. DOE funding will significantly enhance ongoing wildfire mitigation and resiliency improvement efforts and help in development of a comprehensive system-of-systems designed to provide better visibility of grid health and wildfire risks to enable quicker and effective decisions during climate threat conditions. Speed and range are essential in effectively addressing wildfire risk in its

communities in Utah, Idaho, Wyoming, Oregon, Washington, and California. The suite of technologies and their functions are illustrated in Figure 1 below.

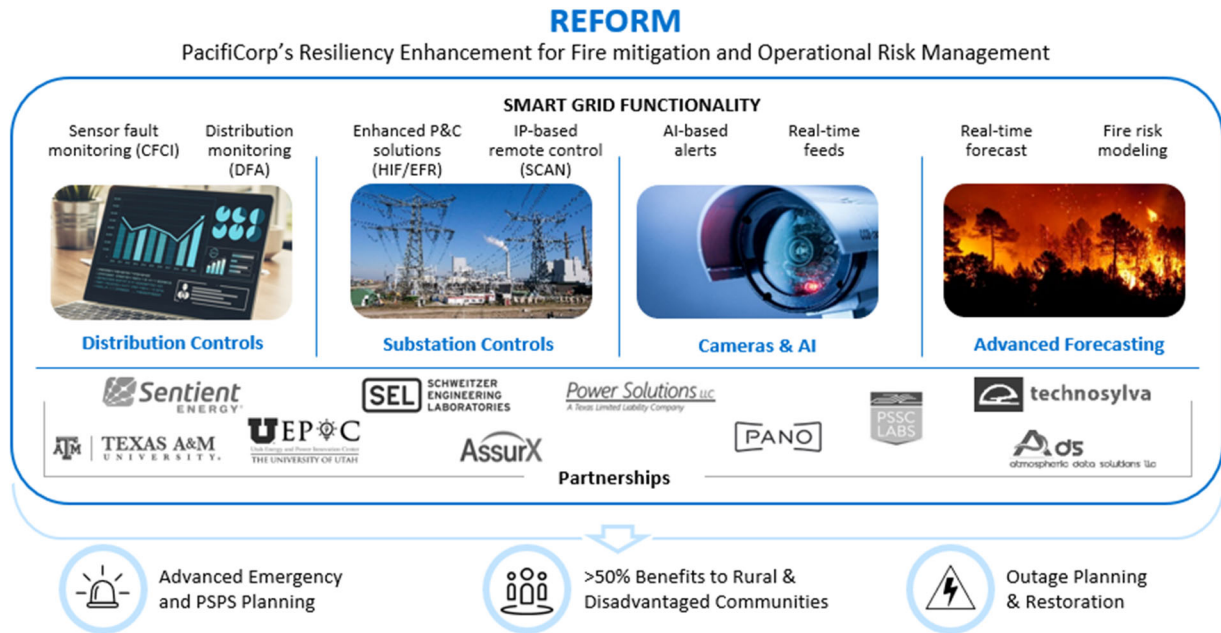


Figure 1—Project REFORM

1.3 DOE Impact

DOE funding will enable the design and deployment of REFORM system elements primarily in DACs and tribal areas and enable operationalization of a unique interoperable technology ecosystem with a unified objective of enhancing situational awareness to reduce or mitigate wildfire occurrences and improve grid reliability, flexibility, and resiliency. The DOE funding will also expand the company's social contract through job skilling and community partnerships. Finally, the DOE funding will enable the company to increase its dialogue, through community benefit agreements, working with community partners to plan for a future that provides affordable, resilient, reliable access to electricity. A detailed breakdown of DOE's contribution to each technology is highlighted in Table 1.

Table 1—DOE Funding and Technical Elements

Technology	Use for DOE Funding
Communicating Faulted Circuit Indicators (CFCI)	As part of DE-FOA-0001987, PacifiCorp successfully developed, tested, and validated an automated resiliency management system (ARMS) using CFCIs. REFORM project builds upon lessons learned from the pilot projects deployed in 2020-2022 and allows the company to add 2,000+ devices along with an advanced data analytics tool to enhance situational awareness, improve outage restoration time, and provide better fault prediction capabilities.
Microprocessor Relays with Wildfire Protection Features	DOE funding will accelerate the installation of microprocessor relays in areas of high wildfire risk in Utah, Idaho, Oregon, Wyoming, and California. These microprocessor relays will be equipped with advanced wildfire protection features such as high-impedance fault (HIF) detection and elevated fire risk (EFR)

Full Application - Technical Volume – Topic Area 2

Technology	Use for DOE Funding
	settings; the precise deployment will align with specific locations.
Wildfire Detection Network (WDN):Cameras with an AI-Based Ignition Alert System	In 2020, PacifiCorp partnered with the Utah Department of Natural Resources (DNR) to install 14 wildfire detection cameras in Utah. DOE funding through REFORM will allow the company to leverage its experience and expand the company's wildfire detection camera coverage to California and Oregon, prioritized by high-risk fire areas and/or DACs. AI-enabled cameras can support faster, more targeted wildfire responses.
Advanced Forecasting (AF)	DOE funding will expand system features, enhance system processing capabilities and add models that efficiently improve PacifiCorp's weather forecasting and asset risk modelling capabilities. With this funding, PacifiCorp can also expand how it shares weather data with the public on its situational awareness websites (built and maintained by StormGeo), pacificorpweather.com and pacificorpweather.com/maps.
Substation Control Advanced Network (SCAN) and Distribution Fault Anticipation (DFA)	PacifiCorp successfully completed proof-of-concept design and testing of its advanced substation system architecture and integration management system, SCAN, to support enhanced secure communication and data flow between distribution system components such as relays, substation meters, and power quality monitors. DOE funding will allow the company to improve situational awareness by deploying the proven technology architecture at multiple transmission and distribution substations in wildfire risk areas and DACs.
Distribution Resilience Controller (DRC)	DOE funding will support design, testing and deployment of the University of Utah's distribution resiliency controller system at one or more PacifiCorp site(s)
Community Benefits Initiatives	DOE funding will support the creation of a stakeholder advisory board for community engagement and to optimize community initiatives for maximum impact, the Regional Coordination Unit (RCU). Initiatives include expansion of training and pre-apprenticeship programs, focused on DACs and DEIA objectives; training and outreach for diverse supplier development, and to provide on-site energy resiliency and energy efficiency solutions

1.4 Community Benefits Plan

Project REFORM will be implemented in over 200+ locations across PacifiCorp's six-state territory, with over 50% of the benefits directed toward DACs such as those in Grants Pass, Oregon; Yreka, California; and Ogden, Utah. The key direct benefits of the project will be reduced wildfire risk, improved emergency response, and increased energy resiliency. In addition, Project REFORM will partner with local labor unions to ensure installation crews will be represented by local labor unions. Furthermore, PacifiCorp will allocate approximately 10% of federal funding towards directly benefiting DACs through its initiatives – specifically (i) workforce training programs, (ii) improving diversity in its workforce and suppliers, (iii) microgrid and other resiliency initiatives in communities impacted by PSPS events and (iv) energy efficiency programs for reducing energy burden (*please see the Community Benefits Plan for more details*). Federal funds will also be used for an independent, scientific, and data-driven approach to measure its programs' impact and optimize it to maximize community benefits, primarily in the DAC and tribal regions. With this objective, PacifiCorp will establish a stakeholder advisory board (called the Regional Coordination Unit or RCU), led by the University of Utah, to maximize its investments in grid infrastructure and programs for disadvantaged communities.

PacifiCorp does not expect Project REFORM to impact its communities' access to natural resources and tribal cultural resources.

1.5 Climate Resiliency Strategy

PacifiCorp is acutely aware of the need to prioritize grid asset hardening and protection in response to the increasing climate risks. PacifiCorp has recently partnered with Electric Power Research Institute (EPRI) to implement the “Climate READi: Power Common Framework”¹ to apply climate-related information at the asset level, with guidance for specific asset/system vulnerability analyses, thus, enabling the most effective future design and operation of a reliable, resilient, and low-cost power system.

2 TECHNICAL DESCRIPTION, INNOVATION, AND IMPACT

2.1 Relevance and Outcomes

The U.S. Department of Energy’s (DOE) Topic Area 2 focuses on efforts that “deploy and catalyze technology solutions that increase the flexibility, efficiency, reliability, and resilience of the electric power system.” Among the more specific objectives are “preventing faults that may lead to wildfires or other system disturbances.” The increased wildfire risk in PacifiCorp territories requires the grid to be smarter – with better awareness of situational risk, remote visibility of grid conditions, and increasingly agile control center responsiveness. Project REFORM is expected to demonstrate a 5-minute improvement in System Average Interruption Duration Index (SAIDI), a 4x improvement in advanced forecasting capabilities for wildfire risk management, a measurable improvement in wildfire risk metrics, and enable less than 48-hour notification for Public Safety Power Shutoff (PSPS) during wildfire events. REFORM’s technological ecosystem leverages PacifiCorp’s existing grid hardware investments to add data, communications, remote visibility, analytics, and enhance system interoperability. Among these technologies are communicating faulted circuit indicators (CFCI), microprocessor relays with wildfire protection features such as high-impedance fault (HIF) detection and elevated fire risk (EFR) settings, AI-based software solutions for distribution fault anticipation (DFA), distribution resilience controller (DRC), high-performance computing clusters (HPCC) for enhanced advanced forecasting (AF), weather detection network (WDN), and a substation control advanced network (SCAN). All technology systems will be fully integrated to provide a holistic operational dashboard to control center operators, engineers, field operation crews and emergency operation center personnel. REFORM leverages common industry standards and interoperable solutions to establish the next generation of automation, monitoring, and control for enhancing the flexibility and resilience of distribution systems. These systems could be replicated by other utilities against extreme weather and wildfire risk associated with regional drought and climate change. Figure 2 demonstrates how these all work together. A list of individual contributions from these technologies follows.

¹ <https://www.epri.com/research/sectors/readi>

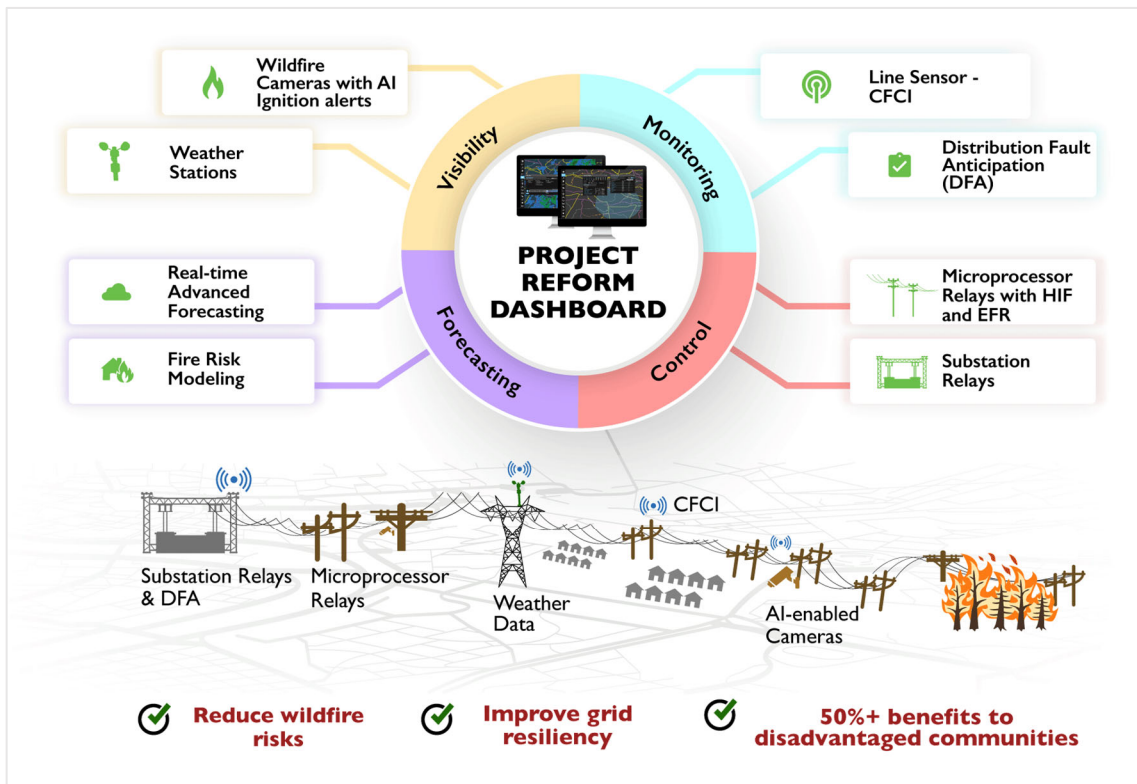


Figure 2 - Project REFORM Technology Overview and Functional Areas

2.1.1 Preventing faults that may lead to wildfires or other system disturbances

Microprocessor relays with wildfire protection features: Design and deployment of advanced microprocessor relays at 40+ sites will include new cutting-edge features such as high-impedance fault (HIF) detection and advanced elevated fire risk (EFR) settings. HIFs are short-circuit faults with currents smaller than those a traditional overcurrent protective relay can detect. The main causes of HIFs are tree branches touching a phase conductor, dirty or failing insulators that cause flashovers between a phase conductor and the ground, or downed conductors. HIF relays trip during such low frequency events, reducing fire risk and preventing a potential spark event. During low-risk seasons, these relays can identify potential faults before a trip, giving line crews time to examine the circuit without interrupting customer service. Relays with EFR settings enable a faster trip shutting off power within a second of contact, dramatically reducing ignition risks. PacifiCorp will deploy HIF detection relays in roughly 40 substations, to detect EFR such that devices are adjusted to trip on contact — deenergizing the line and lowering the risk of a sustained event or possible ignition. During high-fire risk seasons, debris that contact lines can start fires extremely quickly.

Distribution fault anticipation (DFA): DFA is an autonomous, distributed computing system that provides control center operators and engineers with continuous situational awareness of each circuit's condition. It can detect precursors to failures, thereby providing operators and engineers greater ability to assess system health and to take preemptive action to avoid outages and mitigate any fire ignition risks. Project REFORM includes adding DFA technology at five distribution substations across multiple states and establishing robust event investigation

processes to collect data from operating feeders by capturing, documenting, and characterizing signatures indicative of faults and incipient failures.

2.1.2 Improving the visibility of the electrical system to grid operators

Communicating fault circuit indicators (CFCI): With shifting extreme weather and wildfire risk in the western United States, visibility of real-time electrical system parameters is increasingly critical for ensuring system reliability, resiliency, and flexibility. Amid these growing threats, CFCI devices installed on distribution lines substantially improve real-time information exchange and reduce the time spent to locate, isolate, and restore power. This rapid real-time information exchange allows speedier outage response. This project will focus on installing 2,000+ CFCI sensors on approximately 300 distribution circuits in DACs and wildfire risk areas across Utah, Idaho, Wyoming, Oregon, Washington, and California. An advanced data analytics system will proactively monitor system disturbances and alert control center operators to allow field crews to address an issue before a fault event occurs. PacifiCorp expects CFCIs to contribute towards REFORM's goal of 5-minute reduction in SAIDI as well as reduced carbon emissions due to decreased need for line patrols.

2.1.3 Enhancing interoperability and data architecture of systems

Substation control advanced network (SCAN): SCAN will establish a secure, versatile, and scalable remote communications architecture to mission-critical assets at five substations across multiple states, where only point-to-point serial communications exist today. SCAN automatically records the system disturbance history or fault events and sends data to a centralized server for detailed engineering analysis on a near real-time basis. The company expects this system to radically reduce event recovery times by eliminating the need to send trucks and technicians to the site to manually collect data. Additionally, near real-time system disturbance data analysis supports reasonable prediction of future fault events. PacifiCorp expects deployment of SCAN to contribute towards the project's goal of 5-minute reduction in SAIDI as well as reduced carbon emissions due to lesser need for line patrols.

Distribution resilience controller (DRC): DRCs are a critical element in Project REFORM that will seek to integrate multiple sources of data from weather patterns, camera alerts, circuit and substation fault data, and HIF data. If tested successfully, this data integration will allow operators to consider multiple inputs to make the most informed real-time decisions. DRC integration will also allow a level of automation that realizes the full benefits of smart grid technologies. Project REFORM offers PacifiCorp a unique opportunity to explore the powers of this tool and implement it in parallel with the other initiatives described in this application to realize resiliency improvements.

2.1.4 Anticipate and mitigate the impacts of extreme weather

Advanced weather forecasting: To advance quantitative weather pattern assessments and to project wildfire consequences on company assets, customers, and communities, PacifiCorp has partnered with weather forecasting software suppliers Technosylva and Atmospheric Data Solutions (ADS) to implement robust, multi-member weather research forecast (WRF) models that support: (1) production of service territory-wide risk metrics for asset ignition danger and fire susceptibility; (2) real-time simulation of reported/ongoing wildfires to identify assets at risk, time of arrival, etc. to mitigate potential damage through actions like pole wrapping; (3)

development of comprehensive risk analyses for detailed weather and fire information maps to drive operational decisions, like whether and where to initiate a PSPS, vegetation management priorities, grid hardening, and asset maintenance; and (4) fire risk visualization that incorporates socioeconomic vulnerability and egress metrics (e.g., age, disability, fire station proximity, etc.), which supports assessing fire impacts on vulnerable communities. These tools give PacifiCorp advanced warning on the location, timing, and severity of weather and fire-related threats to the grid, which, in turn, allows PacifiCorp to adjust operations to mitigate risks through actions like changing normal system protection and relay settings to EFR settings and initiating PSPS events. Project REFORM will implement HPCCs to enable a 4x improvement in the time required to run the WRF models — thereby significantly enhancing advanced forecasting capabilities for wildfire risk management.

Wildfire detection network (WDN): Project REFORM will partner with sub-recipient Pano AI to deploy a network of artificial intelligent (AI) advanced wildfire detection cameras to provide crucial support to first responders' wildfire-reactive protocols, e.g., by measurably decreasing detection-to-alert times and facilitating more targeted fire response. WDN will enable the advanced forecasting system to produce more accurate weather predictions. Further, PacifiCorp expects these improved predictions will decrease the frequency of instances where customers are warned of potential Public Safety Power Shutoff events less than 48-hours before the event. The WDN aims to notify emergency responders of potential wildfire before 911 calls.

Summarizing, REFORM seeks to transform the grid into a smarter, resilient, and more efficient system. It is expected that the avoidance of a single large wildfire and the damage caused by such an event could pay for the REFORM investments multiple times. While the economic impact of fire resilience is difficult to quantify, PacifiCorp has identified metrics to track other project impacts. Traditional metrics, such as SAIDI and CAIDI, will be combined with new metrics to measure the impact of improved resilience to wildfire risk, and improved emergency response operations, as shown in Table 2 below. All metrics will be tracked with baseline, mid-point and end-of-project quantitative values. As an illustration, we expect project REFORM to make significant improvements to SAIDI. Our baseline SAIDI in 2021 was 340 for the circuits currently scoped. We expect this to improve by 2 minutes by the end of 2026 (mid-point goal), and by 5 minutes by end of 2028 (end-of-project goal). Based on conservative calculations in the ICE calculator², the SAIDI improvements alone result in economic benefits of \$84M over a 10-year period. The economic value of other resilience and efficiency benefits would also be quantified to demonstrate the project impact. Further, these benefits will be tracked in DACs and tribal areas as specified in the Justice40 section of the Community Benefits Plan.

² The Interruption Cost Estimate (ICE) Calculator is an electric reliability planning tool developed by Lawrence Berkeley National Laboratory (LBNL) and Nexant, Inc., accessed December 2022: <https://icecalculator.com/home>

Table 2—Smart Grid Metrics: Project REFORM Impact

Area	Initiative	Proposed Metric	Explanation
Efficiency	Substation Control Advanced Network (SCAN)	SAIDI, customer minutes interrupted (CMI), kg CO ₂ e	Real-time information reduces travel time to substation and improve outage restoration
	Communicating Fault Circuit Indicators (CFCI)	SAIDI, CMI, kg CO ₂ e	Understanding fault locations to reduce patrol time and improve outage restoration
Resilience	Microprocessor relays with wildfire protection features	HIF/EFR trips, EFR deployment frequency	These represent events that could lead to wildfire that were potentially mitigated
	Wildfire Detection Network (WDN)	Number of true positives	Every time a camera alerts first responders of an actual fire
	Advanced Forecasting (AF) system	Runtime in hours	Improve run time of WRF models from 40+ hours to ≤10 hours; accurate, timely forecasts give operators more time to notify customers and communities and reduce asset risk
Reliability	Distribution Fault Anticipation (DFA) and CFCI	SAIDI, CMI	Anticipates faults before they happen to reduce outages
	Microprocessor relays with wildfire protection features	HIF detections before trip	Interface recognizes impedance allowing investigation of interference before a fault
Flexibility	SCAN, CFCI, and DRC	Switching operations	Circuit current data is used to profile line ratings enabling automated switching

To further support industry advancement, REFORM will also supplement PacifiCorp’s ongoing integration with the Outage Data Initiative Nationwide (ODIN) campaign that will support real-time data outage and other grid performance data sharing with the DOE.

2.2 Feasibility

PacifiCorp has worked with the technology partners and successfully completed proof-of-concept or pilot installations of the various technologies proposed as part of Project REFORM. These efforts firmly established individual initiative benefits and helped PacifiCorp clarify best practices and familiarity with technical limitations. Furthermore, all the initiatives in REFORM will take place predominantly on existing PacifiCorp assets — mitigating any risks associated with siting and permitting. Lastly, PacifiCorp has established material and services contracts with applicable technology partners and REFORM’s goals and, wherever applicable, the project’s timeline aligns with supplier’s anticipated product delivery lead times. The most critical of these suppliers have provided letters of commitment to support the execution of Project REFORM. Technology-specific feasibility details are described below.

Communicating faulted circuit indicators: The deployment extends PacifiCorp’s successful 2020-2022 pilot project as part of DE-FOA-0001987. CFCI sensors will be placed on conductors at various intervals in a circuit. The locations are determined based on engineering analysis and geographical data of the terrain. Line crews used for installation will be internal or external contractors and are fully trained and available to undertake this task. The process of installing sensors on these lines is quick - only taking two journey linemen less than 10 minutes per device.

No lines will be de-energized during the installation process. Due to the ease of installation, access to infrastructure, equipment, and workforce is not a concern for this initiative.

Microprocessor Relays with Wildfire Protection features: PacifiCorp plans to install SEL's advanced microprocessor relays for enhancing grid operations under climate-risk conditions—a technology PacifiCorp has significant experience operating and troubleshooting and which integrates well with existing infrastructure. These advanced relays also come with EFR settings that allow operators to adjust system automation based on wildfire risk. The installation of these technologies, potentially coupled with circuit breaker and switchgear addition, is a routine process. To address labor shortages, these installations will be implemented in phases with the goal of retaining a smaller, fully trained workforce that is capable to complete projects in an efficient manner.

Wildfire detection network: PacifiCorp has successfully installed and integrated 14 wildfire detection cameras in Utah beginning in 2020 to evaluate the usefulness of the technology. PacifiCorp will partner with Pano AI, one of the application sub-recipients and a proven supplier of wildfire detection cameras systems and artificially intelligent advanced wildfire detection software, to expand its camera program by installing a network of eight additional cameras and implementing smart AI and data analytics. During the 2022 Oregon fire season, Pano AI cameras spotted the following fires ahead of dispatch alerts in the Allgeier Structure Fire, Hagg Lake Fire, and McIver State Park Fire (September) and the Firwood Structure Fire (October). Pano's technology has been in use by other utilities and agencies in five U.S. states and two states in Australia. Pano AI has relationships with tower owners and maintains the ability to construct its own towers to ensure successful installation of camera systems. Additionally, CAL FIRE operates fire watchtowers at three of the scoped locations; it has provided a letter of commitment to provide necessary support to ensure success of the program. Pano AI will supply training modules to all camera system users.

Advanced forecasting (AF): The AF and situational awareness tools provided by the vendors identified in this project have become essential for the safe and reliable grid operation. The identified vendors have significant experience providing these tools to utilities worldwide and has committed to working with PacifiCorp to ensure a smooth integration. PacifiCorp's meteorology team will be leading implementation of these technology systems and will transition to using high-speed advanced forecasts in place of older prediction models. Sub-recipient PSSC Labs and other technology partners such as ADS and Technosylva have existing contracts with PacifiCorp and have committed to providing required technical support.

Substation control and automation network with distribution fault anticipation: PacifiCorp has evaluated SCAN and DFA systems through proof-of-concept design, testing and early deployment. During these efforts, PacifiCorp ensured that the technology protected data and was cybersecure. The system is now being deployed in two substations and workforce training is being conducted. The substations proposed as part of REFORM have been examined to identify the financial and technical feasibility of installation. PacifiCorp has worked with Schweitzer Engineering Laboratories, Power Solutions LLC and AssurX to ensure the equipment needed for upgrades will be available. Further, the proposed timelines have considered PacifiCorp's internal workforce availability to design, install, commission, and maintain these systems.

Distribution resilience controller: PacifiCorp has a strong relationship with REFORM’s sub-recipient University of Utah and their sub-vendor Grid Elevated, whose patent pending technology will start at the bench scale as part of this project and will be engineered to match the requirements of PacifiCorp infrastructure. For past several years, PacifiCorp has successfully partnered with University of Utah on multiple DOE awards (DE-FOA-0002206; DE-FOA-0002420) and delivered or is in the process of delivering all its project objectives.

In closing, PacifiCorp strongly believes in the comprehensive viability and feasibility of REFORM. Project initiatives have proven, significant value in increasing grid reliability, resiliency, situational awareness, and advanced wildfire detection to improve responses before, during, or after major weather events. These are prudent investments in the best interest of PacifiCorp customers; the company expects regulatory commission support and is confident of meeting its cost share commitments. Lastly, PacifiCorp has thoroughly examined project implementation strategies, utilized historical experience, and worked closely with vendors to ensure that it is well-equipped to successfully execute Project REFORM’s proposed goals and objectives.

2.3 Innovation and Impacts

Project REFORM is a forward-thinking and data-driven project that leverages cutting-edge technologies and insights to tackle some of the most pressing challenges facing the US utility industry today. REFORM is based on an innovative data-driven approach – although some of the proposed solutions have been proven at a small-scale, large-scale deployment of such a holistic interoperable system has rarely been undertaken in the US utility industry. With a system approach towards solving grid disruption issues, REFORM concurrently implements multiple, innovative smart grid initiatives to establish a holistic technology ecosystem to enhance the operational flexibility, agility, and situational awareness for control center operators—in short, the whole is greater than its parts.

REFORM’s direct and indirect positive impacts reach far beyond PacifiCorp and its customers to support other customers, other communities, the utility industry, and its suppliers. As a larger utility operating in a region facing high fire risk, PacifiCorp is uniquely positioned to act as a frontrunner in new technology adoption. With DOE assistance, the company can demonstrate the effectiveness and viability of emerging wildfire mitigation technologies, drive private sector investment, and be a force multiplier to improve regional situational awareness, wildfire response time, and system reliability. DOE funding will expand the company’s investment in cutting-edge technologies and further help these technologies mature—mitigating the broad risk of misapplication of expensive, untested tools. As the technologies mature, manufacturing efficiencies and probable supplier competition can reduce costs, thereby supporting scaled deployment by a wide range of utilities, especially smaller utilities struggling to respond to extreme weather impacts.

Immediate industry impact—sharing lessons learned with peer utilities: As a subsidiary of Berkshire Hathaway Energy (BHE), PacifiCorp shares critical lessons learned with other BHE affiliates, including MidAmerican Energy Company and NV Energy. PacifiCorp will work with its partner Grid Forward on an annual symposium to share lessons learned from funded federal projects related to wildfire mitigation. As part of the regional coordination workgroup focused on wildfire technology, PacifiCorp will share lessons learned with other workgroup members

including Portland General Electric, Idaho Power, Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, Bear Valley Electric, and Liberty Utilities. PacifiCorp also shares lessons learned, as mandated by California's Office of Energy Infrastructure Safety through publicly available annual filings. Finally, PacifiCorp will coordinate with Edison Electric Institute to share best practices with its extensive member utilities.

Smaller peer utilities have been following PacifiCorp's wildfire mitigation program. As REFORM evolves, PacifiCorp expects to set precedents for peer investment in advanced fire modeling software solutions, like those offered by Technosylva and ADS, either in partnership with PacifiCorp or independently. DOE funding may allow PacifiCorp to pursue supplier agreements to provide data and forecasting to municipalities and cooperatives operating within the forecast territory. These agreements reduce financial barriers for smaller utilities helping them leverage the expensive technologies scoped in this application.

Collaboration with technology providers and research institutions: Through partnership with roughly 10 world-class technology providers, public partners and educational institutes, PacifiCorp expects REFORM's integration and application of technologies and centralized management tools to lead the industry. Successful implementation will enable other utilities to establish similar enhanced situational awareness systems and data analytics tools. For instance, PacifiCorp will share valuable project/technology insight at various local, national, and international industry standards committees, technical workgroups and conferences on relay engineering, line monitoring, system resiliency, etc. PacifiCorp is also an active participant in the Oregon Wildfire Detection Camera Interoperability Committee, whose mission is to establish cross jurisdictional/cross-governmental communications and cooperation to identify/implement advanced wildfire detection best practices across the emergency operations ecosystem in Oregon; namely, in relation to implementation of a statewide network of wildfire detection cameras. Lastly, several forecasting software suppliers use machine learning to produce models. PacifiCorp hopes that by using these platforms, the company's data could be used to improve supplier technologies further.

Extended industry impact: As more users prove the effectiveness of technologies, it enables greater adoption. Within a span of a few years, a new, essential technological sector dedicated to wildfire mitigation has begun to emerge. Continued support for wildfire mitigation technologies will be essential to their long-term success and broad implementation. Most importantly, as REFORM brings different modules together, it creates a system greater than the sum of individual parts. PacifiCorp plans to partner with multiple universities to address the challenge of synthesizing data from these individual components. REFORM offers a unique opportunity to confront these issues, which limit adoption of smart grid technologies for many utilities. Overall, the project's collaborative, systemic approach provides essential support for the maturation and creation of an ecosystem to support continued investment in the technology.

2.4 Project Support for State and Local Resilience and Energy Plans

Improved energy resilience: REFORM will reduce the need for sustained, widespread power outages, which have a tremendous impact on the economies and productivity of our communities. While California has had a longer experience with PSPS, Oregon is also experiencing increasing wildfire risk and a rise in PSPS events.² Sparsely populated areas, which make up a

large portion of our service territory, tend to put more pressure on customer rates due to the higher cost of upgrades associated with larger area. REFORM will prioritize deployment of these critical smart grid technologies for improved resiliency in DACs and rural communities.

Reduced risk of extreme weather events and wildfires: REFORM will support efforts to reduce the severity of wildfire impact, which has been identified as one of the communities' top priorities; it will also prioritize deployment in communities at the greatest risk of impact from extreme weather events. For example, Grants Pass, Oregon, ranks in the 96th percentile of wildfire risk while simultaneously having the circuits with the most sustained outages. While PacifiCorp cannot guarantee specific outcomes around natural disasters, the company expects REFORM to measurably reduce wildfire risks caused by utility equipment, and to significantly improve response to wildfire risk events.

The increasing wildfire threat is reflected in PacifiCorp territories' state resilience plans and policies. As outlined in both the California and Oregon Wildfire Mitigation Plans,⁵ PacifiCorp aims to notify its customers, communities, and first responders at least 48 hours in advance of a de-energization/PSPS event. REFORM will improve PacifiCorp's advance notice period in other territories and improve precision of these notifications for customers. PacifiCorp plans to incorporate REFORM information and updates into its existing, robust community engagement strategy related to wildfire mitigation and PSPS preparedness.

Skilling and workforce development for clean energy jobs: Several territories in PacifiCorp's service area include rural and tribal communities with high rates of unemployment (Crescent City and Scott Bar, California, in the 95th percentile). PacifiCorp is partnering with several schools for training programs. Specifically, Crater Lake Electrical Joint Apprenticeship and Training Center, a Project REFORM sub-recipient, will commit to creating a pipeline of 100 graduate pre-apprentices during the project period. PacifiCorp will leverage our current work with "Stronger Together" partnership, a pre-apprentice talent development program with the IBEW to expand apprenticeship and training programs targeted at DACs.

3 WORKPLAN

3.1 Project Objectives

REFORM intends to establish an ecosystem of interoperable technologies that significantly enhance situational awareness to reduce/mitigate wildfire occurrences and improve grid flexibility, reliability, and resiliency. PacifiCorp expects REFORM to exponentially increase its capability to holistically view system health using disturbance and fault data from various sources and to improve situational awareness via advanced weather modeling and wildfire detection systems that support more accurate wildfire risk forecasts and more effective wildfire-reactive protocols. Project objectives will be accomplished by designing the program based on input from diverse stakeholders and adapting it based on measured continuous assessment.

All of REFORM's elements involve the construction and alteration of utility infrastructure in the United States. As a for-profit entity, PacifiCorp is exempt from the Buy America requirement. Company-wide, PacifiCorp is making efforts to develop local vendors wherever the industry has traditionally relied on foreign sourced components. Project REFORM will continue these efforts.

3.2 Technical Scope Summary

The work would be implemented across five budget periods that correspond to the years 2024-2028. **Budget Period 1 (BP1)** is generally dedicated to overall planning and design in coordination with strategic partners. **BP2** is generally focused on material procurement, engineering design and installation of equipment, and initial implementation of software and analytics systems. **BP 3** is generally aimed at expanding equipment rollout and data collection and synthesis. **BP 4** is generally focused on installation, testing, data validation, and obtaining stakeholder feedback. **BP 5** is generally committed to system integration, reporting and extensive outreach and education across the region, and establishing processes to continue maintenance of the various systems.

3.3 Work Breakdown Structure and Task Description Summary

Task 1.0 – Project Management and Planning for each Budget Period – Submit PMP to/receive approval from DOE PM (1.1). Provide necessary documentation for NEPA compliance (1.2). Revise and resubmit cybersecurity plan (1.3). Provide Continuation briefings and all necessary reports (1.4).

BUDGET PERIOD 1

Task 2.0: Engineering Scoping – Complete scoping analysis for Oregon cameras (2.1); complete relay engineering scoping for sites 1-6 (2.2); conduct CFCI engineering analysis (2.3).

Task 3.0: Permitting and Procurement – Obtain permits required for WDN in California (3.1); order materials required for relay installations at sites 1-6 (3.2).

Task 4.0: Engineering, Design, and Initial Build – Complete infrastructure design for advanced forecasting (AF) system (4.1); Develop system architecture for DRC testing and deployment (4.2); Integrate ODIN with outage management system (OMS) (4.3). Design review for relay sites 7-12 in California and Oregon (4.4).

Task 5.0: Installation and Testing – Install two cameras in California and train end users (5.1); Implement software for cameras (5.2); Complete installation of relays at sites 1-6 (5.3).

BUDGET PERIOD 2

Task 6.0: Engineering Scoping – Complete engineering scoping for all SCAN site locations (6.1); Complete engineering scoping for relay installations at sites 7-12 and 31-40 (6.2).

Task 7.0: Permitting and Procurement – Obtain permits for wildfire camera installation in Oregon (7.1); Order relay and CFCI equipment for sites 7-12 in California and Oregon (7.2).

Task 8.0: Engineering, Design, and Initial Build – Complete design reviews for all SCAN sites (8.1); Design review for relay sites 7-12 in California and Oregon (8.2).

Task 9.0: Installation and Testing – Install six cameras in Oregon (9.1); Setup DRC testbed at University of Utah (9.2); Build IT infrastructure for AF system (9.3); Complete installation of CFCIs at all locations (9.4). Complete installation of relays 7-12 (9.5)

Task 10.0: System Integration and Reporting – Integrate camera data for end-user access (10.1).

BUDGET PERIOD 3

Task 11.0: Engineering Scoping – Complete scope of work for relays at sites 13-30 (11.1)

Task 12.0: Permitting and Procurement – Order relay equipment and obtain permits for sites 13-40 (12.1).

Task 13.0: Engineering Design, and Initial Build – Perform engineering design and cost estimation for relay installations at sites 13-40 (13.1).

Task 14.0: Installation and Testing – Develop beta version of WRF ensembles for AF tool (14.1); complete relay installations at sites 13-40 (14.2); initiate SCAN installations at substations (14.3).

Task 15.0: System Integration and Reporting – Establish lessons learned and best practices for CFCI installations and operations (15.1); solicit stakeholder feedback on wildfire cameras and evaluate true positives (15.2).

BUDGET PERIOD 4

Task 16.0: Installation and Testing – Test final WRF ensembles to ensure that AF models run as designed (16.1); coordinate with substation crews and networking teams to complete SCAN installation and ensure DFA runs as expected (16.2).

Task 17.0: System Integration and Reporting – Develop WDN implementation report, solicit stakeholder feedback on AF interface (17.1); create metrics to track HIF and EFR effectiveness (17.2).

BUDGET PERIOD 5

Task 18.0: System Integration and Reporting – Report on stakeholder feedback from AF (18.1); create a report that leverages metric develop to analyze faults and track grid improvements (SCAN/DFA, CFCI and advanced relays) (18.2); install DRC at applicable site(s)(18.3); develop a report that identifies lessons learned, best practices and overall project results (18.4); conduct necessary personnel training for system maintenance, software patching and firmware updates (18.5).

Budget Period 5 End of Project (EOP) Goals:

- **EOP 5A:** 100% End-to-end connectivity from control center to all SCAN sites
- **EOP 5B:** Control center to have visibility to real-time data from >90% CFCI sites installed
- **EOP 5C:** Emergency responders and PacifiCorp Emergency Management teams can control eight new wildfire detection cameras in Oregon and California
- **EOP 5D:** AF infrastructure can run multi-member WRF ensembles in less than or equal to 10 hours
- **EOP 5E:** Complete deployment of advanced microprocessor relays at least 30 sites. All sites to have HIF detection capabilities that recognize low-impedance contacts and EFR settings tailored for high-fire risk situations
- **EOP 5F:** Reduce diverse employee turnover rates to at or below current levels
- **EOP 5G:** Complete training for 100 graduate pre-apprentices by the end of 2028
- **EOP 5H:** Report on lessons learned and best practices

3.4 Work Milestones and Milestone Verification

Full Application - Technical Volume – Topic Area 2

Table 3 below provides the key milestones per budget period, including SMART and Go-No-Go milestones, and the milestones related to implementation of the Community Benefits Plan. The table also provides details of how the milestone achievement would be verified.

Table 3—DOE Funding and Technical Elements

No.	Milestone Description	Milestone Verification	Period
1.1	Submit PMP each budget period	Submit PMP to/receive approval from DOE PM	BP1-BP5, Q4
Budget Period 1			
M1	Map all CFCI site locations	Publish GIS map w. final device type/locations	Q1
M2	Complete ODIN integration	Document connectivity of data model	Q2
M3	Complete infrastructure design for AF system	List of all necessary equipment specs	Q3
GNG1	Integrate 2 wildfire camera system in California with AI based ignition risk alarms activated	Verify site data is integrated and accessible on software platform	Q4
Budget Period 2			
M1	Complete testing of DRC controller	Publish technical design and outcomes	Q1
M2	Installed 6 cameras and integrated with control center	End users have access to camera feeds and receive notifications	Q2
M3	Build IT infrastructure for AF system	Ensure IT infrastructure meets initial design	Q3
GNG2	All 2,000+ CFCI devices are installed and fully integrated with control center	Completed testing and commission forms and operators confirm devices communicate	Q4
Budget Period 3			
M1	Integrate data from relays 7-12	Publish testing and commissioning forms	Q1
M2	Obtain feedback from wildfire detection network stakeholders in CA and OR	Requested survey/interview from end users in CA and OR	Q2
M3	Create a report that illustrates CFCI effectiveness	Report with data outage data and relevant metrics for circuits with CFCI	Q3
GNG3	Improve run time of WRF models from 40+ hours to ≤10 hours for AF	Computer cluster runs as expected with real-time forecasting data output in ≤10 hours	Q4
Budget Period 4			
M1	Integrate relay data with control center	Testing and commissioning forms for California and Oregon relay installations	Q1
M2	Create metric to track HIF and EFR trips	Submit metric for operations evaluation	Q1
M3	Complete all SCAN installations	Publish testing and commissioning forms	Q3
GNG4	Operationalize relays at 40+ sites and SCAN system at five sites	Report confirming end-to-end connectivity for all sites	Q4
Budget Period 5			
M1	Obtain stakeholder feedback for integrated AF and camera systems	Survey results from interview from end users in CA and OR	Q1
M2	Report on SCAN/DFA, CFCI, and advanced relay fault analysis findings	Report with fault analysis finding and SAIDI improvement metrics	Q3
M3	Install DRC at applicable site(s)	Publish lessons learned/best practices report	Q3
M4	REFORM lessons learned and best practices	Full lessons learned and best practices report	Q4
Community Benefits			

No.	Milestone Description	Milestone Verification	Period
M1	U of U conducts first RCU meeting	Meeting notes that include attendance	BP1-Q2
M2	Track 100% of supplier invitations/DBE status	List of supplier invitations (include if DBEs)	BP1-Q3
M3	Complete 10 resilience DAC org. feasibility studies	Submit feasibility study reports to?	BP2-Q3
M4	Distribute 75% allocated workforce dev. funds	Receive report from workforce partners	BP3-Q1
M5	Reduce diverse employee turnover to ≤ current rates	Internal reporting	BP5-Q4
M6	Renegotiate 6 CBAs expiring during the project	Six CBAs extend beyond 2028	BP5-Q1
M7	Complete training for 100 graduate pre-apprentices	Graduation data	BP5-Q2
M8	Create best practices and lessons learned report	Provide report to upper management and key stakeholders	BP5-Q4

3.5 Project Schedule

The task numbers in the Gantt Chart below correlate to the tasks and subtasks outlined in the WBS found in Section 3.3, and in the SOPO.docx.

Table 4—REFORM Gantt Chart

Item		BP1				BP2				BP3				BP4				BP5			
Task 1.0 Project Management Plan																					
1.1	Maintain PMP each budget period																				
1.2	Manage and report on all activities																				
1.3	Reports, presentations, tracking																				
1.4	Technical updates, review meetings																				
Task 1 Milestones																					
M1.1	Submit PMP each budget period				X				X				X			X	X				
Budget Period 1																					
Task 2 – Engineering Scoping																					
2.1	Analyze locations for cameras																				
2.2	Scope relay installs at sites 1-6 (OR/CA)																				
2.3	Determine CFCI type & locations																				
Task 3 - Permitting/Procurement																					
3.1	Request permits for cameras in CA																				
3.2	Release PO for relay equipment																				
Task 4 - Engineering Design and Build																					
4.1	Develop plan for AF architecture																				

Full Application - Technical Volume – Topic Area 2

Item		BP1			BP2			BP3			BP4			BP5		
4.2	Develop plan for DRC architecture															
4.3	Integrate ODIN with outage management system (OMS)															
4.4	Design review - relay sites 1-6															
Task 5 – Installation & Testing																
5.1	Install 2 cameras: CA															
5.2	Implement software for cameras															
5.3	Install relays (sites 1-6)															
Budget Period 1 Milestones																
M1	Map all CFCI site locations	X														
M2	Complete ODIN integration		X													
M3	Complete AF infrastructure design			X												
GNG 1	Integrate 2 wildfire camera system in CA w. AI based ignition risk alarms activated				X											
Budget Period 2																
Task 6 – Engineering Scoping																
6.1	Develop scope for SCAN system															
6.2	Scope relay installs, sites 7-12 & 31-40															
Task 7 - Permitting/Procurement																
7.1	Request permits for cameras in OR															
7.2	Release PO for CFCI & relay equipment															
Task 8 - Engineering Design and Build																
8.1	Design review for SCAN sites															
8.2	Design review - relay sites 7-12															
Task 9 – Installation & Testing																
9.1	Install 6 cameras: OR															
9.2	Setup DRC testbed at U of U															
9.3	Build IT infrastructure for AF															
9.4	Install all CFCIs															
9.5	Install relays (sites 7-12)															

Full Application - Technical Volume – Topic Area 2

Item		BP1				BP2				BP3				BP4				BP5			
Task 10 – System Integration																					
10.1	Connect to 6 cameras in OR																				
Budget Period 2 Milestones																					
M1	Complete testing of DRC controller						X														
M2	6 cameras installed/ integrated w. control center							X													
M3	AF IT infrastructure deployed/ functional								X												
GNG 2	All 2,000 CFCIs installed/integrated with control center									X											
Budget Period 3																					
Task 11 – Engineering Scoping																					
11.1	Scope relay installs for sites 13-30																				
Task 12 - Permitting/Procurement																					
12.1	Release relay equip PO for sites 13-40; obtain permits																				
Task 13 - Engineering Design and Build																					
13.1	Design review for relay sites 13-40																				
Task 14 – Installation & Testing																					
14.1	Develop AF model beta version																				
14.2	Install relays at sites 13-40																				
14.3	Install SCAN system at substations																				
Task 15 – System Integration																					
15.1	Evaluate CFCI performance																				
15.2	Evaluate cameras; solicit feedback																				
Budget Period 3 Milestones																					
M1	Integrate data from relays 7-12									X											
M2	Obtain WDN stakeholder feedback										X										
M3	Create CFCI effectiveness report											X									
GNG 3	WRF models run in ≤10 hours for AF												X								
Budget Period 4																					
Task 16 - Installation and Testing																					
16.1	Integrate and test final WRF ensembles																				

Full Application - Technical Volume – Topic Area 2

Item		BP1				BP2				BP3				BP4				BP5			
16.2	SCAN testing																				
Task 17 - System Integration and Reporting																					
17.1	Develop WDN implementation report and solicit feedback																				
17.2	Develop tracking metrics for relays																				
Budget Period 4 Milestones																					
M1	Integrate relay data with control center																		x		
M2	Create metric to track HIF and EFR trips																		x		
M3	Complete all SCAN installations																			x	
GNG 4	Operationalize 5 SCAN/40+ relay sites																				x
Budget Period 5																					
Task 18 - System Integration and Reporting																					
18.1	Generate AF stakeholder report																				
18.2	Assess SCAN/DFA, CFCI, advanced relay impact																				
18.3	Install DRC																				
18.4	Report on REFORM																				
18.5	Personnel training																				
Budget Period 5 Milestones																					
M1	Obtain stakeholder feedback: integrated AF & WDN systems																		x		
M2	Report on fault analysis findings																			x	
M3	Install DRC at applicable site(s)																			x	
M4	REFORM lessons learned and best practices																				x
Community Benefit Milestones																					
M1	U of U conducts first RCU meeting		x																		
M2	Track 100% of supplier invitations for DBE status			x																	
M3	Complete 10 feasibility studies for DAC organizations							x													
M4	Distribute 75% of allocated work-force dev. funds									x											

Full Application - Technical Volume – Topic Area 2

Item		BP1				BP2				BP3				BP4				BP5			
M5	Reduce diverse employee turnover to ≤ current rates																				x
M6	Renegotiate 6 CBAs expiring by 2028																	x			
M7	Complete training for 100 graduate pre-apprentices																		x		
M8	Create best practices/lessons learned report																				x

Work towards community benefits will be executed continuously throughout the project lifetime. Therefore, the Gantt Chart above only reflects the milestones that are part of these efforts.

3.6 Project Management

The leadership structure and lead contact for each partner organized by category is shown in Section 4.1. PacifiCorp will manage the overall program, coordinate all project funding, create and execute contracts with participants. PacifiCorp will schedule regular check-ins with the project team, monitor sub-awardee progress toward completion, perform regular risk assessment, and generally follow industry best practices in managing this project. PacifiCorp plans to organize an in-person full team kick-off meeting, followed by quarterly stakeholder workshops to keep the team well informed and coordinated. PacifiCorp will lead development of all quarterly, annual, and preliminary and final progress reports and ensure timely submission to the DOE. Any project changes or modifications will be coordinated by PacifiCorp and submitted to DOE for approval. Additionally, University of Utah will conduct Assessments on the program to measure the effectiveness and to track the impacts on **DEIA** and **Justice 40** populations. University of Utah will house, maintain and document all the data related to these activities.

3.7 Access to Equipment and Facilities

A majority of REFORM initiatives will be completed on existing PacifiCorp assets. The primary exception is the WDN cameras planned for installation on partner infrastructure or on private property. Proposed locations include watchtowers owned and operated by the U.S. Forest Service, cell towers owned by private operators, PacifiCorp telecom towers and sites that may be bare earth on private property. To maximize camera effectiveness and allow camera analysis to cover a few miles, a 50-foot tower would be built on any bare-earth sites selected. Pano AI will hire subcontractors to construct these.

3.8 Risks and mitigations

Supply chain: Supply chain delays and CFCIs orders represent the largest project risk. Leveraging its deep vendor relationships, PacifiCorp will work closely with suppliers to ensure availability of critical components. This may involve negotiating contracts that guarantee delivery dates or collaborating with suppliers to identify potential bottlenecks and develop contingency plans.

Inclement weather: To mitigate the impact of seasonal weather patterns, project schedules and milestones will be developed to account for potential delays or disruptions that may be caused by inclement weather, both in winter and summer. In addition to targeting construction activities

to minimize weather-related risks, project schedules will also include contingencies or buffers to account for potential delays caused by inclement weather

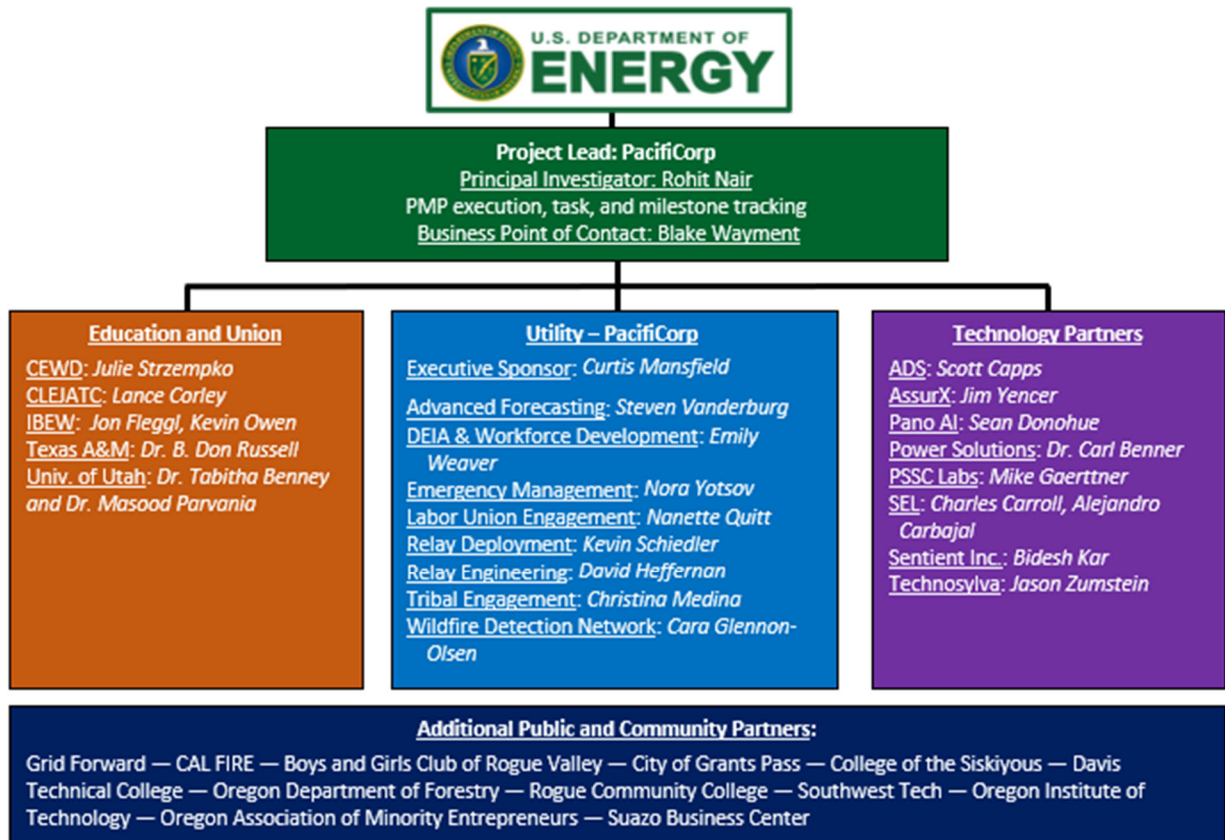
Workforce: PacifiCorp has informed its partners of REFORM’s schedule and the labor unions have confirmed their support to deliver the project goals. By leveraging its long list of contractors, PacifiCorp can quickly identify potential partners with the necessary skills and experience to deliver high-quality work. This reduces the risk of delays or cost overruns due to a lack of internal resources. PacifiCorp will ensure clear communication throughout the project; workforce availability concerns will be addressed in a timely and effective manner.

Software and IT: Software systems on wildfire mitigation are relatively new to the industry and are evolving rapidly. This is unsurprising, wildfire mitigation software development is responding to the urgent need for effective tools to manage wildfire risks. PacifiCorp has proactively identified technology partners with a track record of superior implementation and support. To select other potential vendors, PacifiCorp will, with due diligence, evaluate their experience, capabilities, and track records in delivering successful projects.

Quality control: PacifiCorp adheres to the DOE’s Human Performance Improvement (HPI) Handbook, which provides a systematic approach to improving performance, reducing errors, and mitigating organizational weaknesses. PacifiCorp will use HPI tools such as cross-checking, pre- and post-job review, and an emphasis on communication to detect error-likely situations.

4 TECHNICAL QUALIFICATIONS AND RESOURCES

4.1 Project Team



PacifiCorp (Role: Manage the overall program, coordinate all project funding, create and execute participant contracts): PacifiCorp is the largest grid operator in the western United States with over 16,000 miles of high voltage transmission lines serving 1.9 million customers in six states. PacifiCorp is comprised of two business units: Pacific Power and Rocky Mountain Power. The Principal Investigator, Mr. Rohit Nair, joined PacifiCorp in 2011 and has successfully been involved in multiple DOE awards, including DE-EE0007997, DE-EE0009782, DE-FOA-0002206, DE-FOA-0001987, and DE-EE0009224 for a combined \$25+ million.

International Brotherhood of Electrical Workers (IBEW) (Role: Lead Labor union partner for the project) - Founded in 1891, IBEW is a labor union that represents approximately 775,000 workers and retirees in the electrical industry in the United States, Canada, Guam, Panama, Puerto Rico, and the US Virgin Islands; in particular electricians, or inside wiremen, in the construction industry and lineworkers and other employees of public utilities. The union also represents some workers in the computer, telecommunications, and broadcasting industries, and other fields related to electrical work. IBEW Local 57 in Utah; Local 77 in Washington, and locals 125 and 659 have worked extensively with PacifiCorp in the targeted DACs and wildfire risk areas.

Pano AI (Pano) (subrecipient) (Role: Installation and integration of AI-enabled cameras) - Pano combines advanced hardware, artificial intelligence, and software in a single integrated enterprise solution making it an industry leader in early wildfire detection and intelligence that has been deployed across six U.S. and two Australian states. Pano has extensive experience in all phases of installation including desktop analysis, site auditing and licensing, hardware manufacturing, installation, calibration, and software configuration.

PSSC Labs (subrecipient) (Role: Weather prediction systems) - PSSC Labs has been a leader in the high performance computing solutions for meteorological analysis since its inception in 1989 — offering increasingly robust hardware solutions to support critical wildland fire mitigation. Since its inception, PSSC Labs has become the partner of choice for utilities worldwide.

Crater Lake Electrical Joint Apprenticeship Training Center CLEJATC (subrecipient) (Role: Train graduate pre-apprentices) - Located in Medford, Oregon, nonprofit CLEJATC is a long-time partner of PacifiCorp and IBEW Local 659. Established in 1967, CLEJATC provides the training/education of electrical apprentices, journey electricians, and others; its training center is a registered electrical construction industry apprenticeship program with approved standards in Oregon and California. Doing business as the Crater Lake Electrical Training Center, the CLTC has steadily grown and improved since its inception. The CLTC is currently based out of an 11,655 sq. ft. facility in Central Point, OR, fitted with all the tools, equipment, material, staff, and expertise needed to turn out quality electricians for the industry.

University of Utah (U of U) (subrecipient) (Role: Community engagement framework, and distribution resilience controller technology) - The U of U team, led by Drs. Parvania and Benney, will leverage a deep regional network to create community task forces for independent, unbiased benefit program management. The team leads have years of experience as educators and authors of many peer-reviewed articles and books on topics including system governance, wildfire risk mitigation, AI, distribution system planning, etc. Professor Parvania has served as principal investigator for several grid resilience and security projects.

Atmospheric Data Solutions (ADS) (Role: High-resolution ensemble numerical weather modeling solution for AF) - ADS has been a leader in the numerical weather and wildfire potential modeling space since its inception in 2015, offering increasingly robust weather modeling data solutions to support critical wildland fire mitigation. Since 2015, ADS has become the partner of choice for major investor-owned utilities and other agencies within the western United States.

Center for Energy Workforce Development (CEWD) (Role: DEIA outreach to workers from nontraditional and historically marginalized communities) - CEWD, started in 2006, is a nonprofit consortium of energy companies (over 120 energy companies), contractors, associations, unions, educators, and business partners collaborating to ensure a skilled, diverse workforce pipeline to meet future industry needs.

Schweitzer Engineering Labs (SEL) (Role: Supplier and technical support services for advanced microprocessor relay technologies) - SEL is a 100% employee-owned company that has spent decades developing transformative technologies for critical infrastructure. Since 1984, SEL has been at the forefront of relay technology research and implementation that has revolutionized the electric grid.

Technosylva (Role: Supplier for Multi-member ensemble models for AF): Technosylva has led the wildfire science and technology industry since its inception in 1997 — offering increasingly robust data to support wildland fire mitigation. Technosylva has become a worldwide partner of choice for utilities and emergency responders; its tools have supported response to over 20,000 wildfires annually.

Grid Forward (Role: Share learnings and lessons with industry) - Grid Forward, founded in 2010 as Smart Grid Oregon, is a non-profit trade association dedicated to promoting and accelerating innovation on the regional electric system. The organization has over 70 regional members representing regional utilities, advanced technology providers, major energy users, higher education, government agencies, non-profits and other grid development stakeholders.

AssurX (Role: Support design of compliance management system for SCAN) - AssurX has decades of expertise in creating innovative, quality management and regulatory compliance software. They created the first 100% web-based quality tracking application and now offers industry-leading comprehensive enterprise quality management and regulatory compliance solutions.

Power Solutions, LLC (Role: Supplier of DFA monitors and software) - Power Solutions LLC provides cutting-edge DFA power monitoring products and services. Its proprietary software analytics, developed at Texas A&M University with collaboration from the Electric Power Research Institute and over a dozen utilities. DFA has been demonstrated at over 20 utilities over the past 15 years.

Sentient Energy (Role: Supplier of CFCI devices and analytics software) - Founded in 2009, Sentient Energy provides innovative overhead/underground circuit monitoring and analytics, including CFCIs and our Ample™ Grid Analytics Systems. Sentient has proven utility-based expertise in detection of pre-failure line disturbances and reduced outage duration.

Texas A&M University (Role: Data science support for real-time monitoring of circuit faults): Research by Texas A&M's Power System Automation Laboratory over the last 20 years has developed transformational technologies for real-time monitoring of electric utility circuits for incipient failure conditions. These failure conditions are often linked to wildfire ignition. The lab offers decades of experience and extensive archived data on faults and failure mechanisms that can cause wildfires.