Project DA: Distribution Automation Deployment
In Missouri, Kansas, Arkansas, and Oklahoma.

TECHNICAL VOLUME

BIL Grid Resilience and Innovation Partnerships (GRIP) Program Application by Liberty Utilities Co Central Region d.b.a. Empire District Electric Company

Topic Area 2: Smart Grid Grants

Category	Information
Applicant Organization	The Empire District Electric Company (“Empire”)
Project Locations	This project targets enhancements in multiple areas across Empire’s service territory which primarily consists of southwest Missouri (south of Osceola and west of Marshfield) and also includes portions of southeast Kansas, northeast Oklahoma, and northwest Arkansas.
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Organizations Employing Team Members	Liberty Utilities Service Corp. The Empire District Electric Company
Confidentiality Notes	All charts and graphs contained within the submission are to be treated as confidential material shared exclusively with the DOE and its agents for the purposes of evaluating the company’s proposal.

1. Project Overview

The Empire District Electric Company ("Empire" or "the company") is proud to submit for the Department of Energy's ("DOE") review its full application for the *Project DA: Distribution Automation Deployment in Missouri, Kansas, Arkansas, and Oklahoma*. The project's total estimated cost is $94.98 million, of which $47.49 million is requested from the DOE.

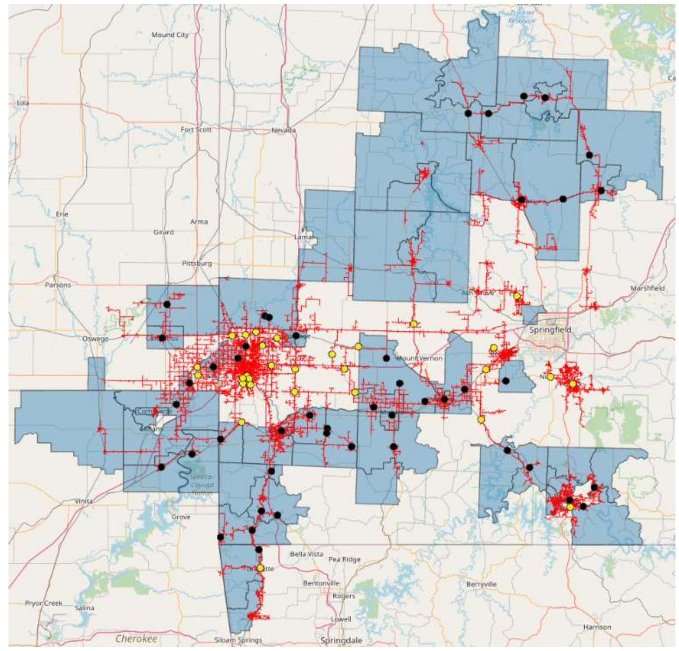

Figure 1: Empire Service Territory, Proposed Locations and DAC boundaries (blue).

1.1 Background

Empire's electric service territory stretches across four state lines to serve approximately 177,000 end-use customers in Missouri, Kansas, Oklahoma, and Arkansas. Empire operates 2,025 MW of thermal and renewable generation, 1,127 miles of transmission and 6,372 miles of distribution line. As Figure 1 illustrates, Empire's service territory consists of two denser load pockets (Joplin and Branson, MO) and much lower-density rural feeders, many of which are radial in nature and present restoration challenges during blue-sky reliability events and outages caused by inclement weather and storms.

This physical and electrical topography landscape lends itself favorably to strategic deployment of decentralized clusters of distribution feeder automation schemes, as Project DA proposes. Circuit automation would also help Empire make the optimal use of 50 MW+ of distributed solar resources connected to its system, which would provide a greater portion of generation mix with improved reliability. As Table 1 shows, the company's reliability enhancing investments are working. However, system average statistics often mask more customer-specific trends that disproportionally impact multiple communities, businesses and public infrastructure assets like water and wastewater facilities. Enhancing their reliability would help address a multitude of socioeconomic issues in these communities.

Table 1:Empire Historical Reliability Statistics (MED-Adjusted)

	2017	2018	2019	2020	2021	2022
SAIDI	113.8	101.47	134.58	97.64	134.17	92.93
SAIFI	1.20	1.12	1.19	0.91	1.20	0.97

Empire is well on its grid modernization journey, having deployed a new generation of Advanced Metering Infrastructure (AMI) in 2021. Aside from time of use billing and reduction of manual meter read expenditures that benefits both customers and the utility, the edge computing capabilities inherent in AMI give Empire's planners a steady and nuanced flow of operating data to help make granular investment decisions. In 2021, the company conducted targeted sectionalization and wildlife cover up on the circuits which AMI data analysis showed as extreme outliers in the number of momentary outages per year. Having confirmed its ability to deploy large and complex grid modernization projects on time and on budget, and then use the resulting data insights to drive important secondary benefits, Empire is capable and ready to take the next step and deploy and integrate the proposed distribution automation devices.

1.2 Project Goal

The project's main *technical development* goal is targeted instrumentation of Empire's distribution grid with 261 new and integration of 49 existing vacuum autorecloser devices (310 total) arranged in 43 clusters and programmed for operation largely autonomous from the company's control room. This in turn translates into a targeted outcome of *advancing a modernized automated distribution system, with reinforced resilience features at the key DA nodes and additional flexibility and capacity to assist electrification and renewables growth*. To enable the installation of new devices and ensure weather resilience, the project will also include upgrading and uprating (in terms of electrical connectivity and mechanical strength, as applicable) of the pole line and conductor segments supporting new installations. The project's ensuing main *community transformation* goal is to improve reliability performance, as measured by outage duration by 33% on the affected feeders, and leverage a concentrated, large-scale, "big bang" investment in new technology as a catalyst for training and upskilling for front-line employees – whether employed by Empire or retained through contractors for installation – in electrical, mechanical, safety-, and telecom-related aspects of Smart Grid devices operation. While Empire's grid stands to attain a new level of performance and technical sophistication, the community members involved in the project's installation and operation would gain or upgrade valuable skills which will be increasingly critical as distribution grids continue to evolve. As described further throughout this document, these two goals are tightly intertwined and are only attainable at the contemplated scale in the event of the project securing the requested funding.

1.3 Community Benefits Plan

While the goals, outcomes, and success factors listed above concentrate on the technical facets of the project, their execution will drive significant impact in the communities it serves. As further discussed in the Community Benefits Plan, Empire's service territory contains a total of 67 census tracts defined as disadvantaged communities (DAC)s by the US Government's Climate and Economic Justice Screening Tool ("CEJST").[1] The DAC-classified communities are home to 98,465 or 56% of all Empire customers, who stand to benefit directly from the forecasted 33% improvement in the Customer Minutes of Interruption on the affected circuits. As planned, project locations would touch 77 unique municipalities, 39 (or 51%) of which include DAC tracts in the boundaries. Looking beyond the DAC threshold, the median score percentile for energy cost vulnerability is between 77th and 81st percentiles across all larger communities in the four states that Empire serves is, while the low-income scores are between 73rd and 83rd percentile. Thresholds issue aside, Empire's host communities are struggling with energy cost burden.

[1] Explore the map - Climate & Economic Justice Screening Tool (geoplatform.gov) Accessed Dec 3, 2022

Given the scale and scope of the proposed project, more than 90,000 crew hours or 44 person years of work would be created or retained by the construction activities alone, with multiple other facilitating and supporting jobs including (a) electrical, civil, and telecommunications engineering and design; (b) local project staging and logistics, including transportation, warehousing, and distribution; (c) site access facilitation jobs like temporary access road construction and brush clearing, (d) project communications and logistics roles; (e) administration, project accounting and others.

As the project progresses, specific opportunities and benefits to the downstream public infrastructure resilience improvements (water / wastewater facilities, hospitals, manufacturing) will also be identified and pursued in collaboration with local stakeholders. To ensure that local resilience impact is maximized and to create additional awareness, education and economic opportunities for local high school students and their schools, the Community Benefits Plan also includes a plan for an integrative in-class program where high school seniors can get exposure to the technical basics and key issues affecting the utilities industry today, including the transformative impact of technological innovation. As a part of the course, the students would complete detailed mapping exercises of their local communities' resilience enablers and key points of vulnerability provisionally called Community Resilience Registries. Empire would use this data in system planning and emergency management activities and would renumerate the students and/or the schools (as appropriate) for the work performed in this regard. While the company has this information available for its larger load centers, centrally kept data is less detailed for many smaller communities, which creates an optimal fit for the proposed crowd-sourced exercise. Provided there is interest, an inter-school competition can be held to identify the most complete and creative approaches to weather resilience data analysis and planning.

1.4 DOE Funding Impact and Difference

Being a small vertically integrated utility serving low-density economically vulnerable areas, Empire must exercise extreme caution in pacing and prioritizing its investments across all business lines. Absent the offsetting rate impact of the DOE funding, the company could only expect to deploy DA infrastructure at a fraction of the pace and locations proposed in this submission. With DOE support, however, Project DA contemplates a five-year "sprint" that would deploy DA schemes on about 179 circuits – driving in a step improvement to reliability, the ensuing reduction in Customer Interruption Costs for Empire's communities, and cost avoidance from utility expenditures like truck rolls and overtime substantially obviated by DA operation. Without the DOE funding, the need to balance the DA capital with other investment drivers and rate impact management would allow Empire to reach a comparable scale in about two decades.

The DOE funding contribution also substantially improves scale economies obtainable from vendors and contractors given the volume and long-term certainty of the work. The funding contribution also enhances the business case for recloser deployments on some of the sparsely populated, distant feeders. Approximately 20,000 of Empire's customers are served by feeders that are more than 10 miles away from the nearest service center, resulting in longer outage durations and lower restoration order prioritization during wide area outages given low load density. These locations have marginally economic business cases but would avoid sustained interruptions in homes furthest from the operating centers and thus vulnerable to longest outages. With the benefit of the DOE funding, these business cases turn into viable projects, many of which will directly benefit the DAC areas and their residents. Similarly, given the relatively small portion of customer and asset bases located in the three smaller states that Empire serves (KS, OK, AR), the company is not confident that it would be able to advance the DA schemes contemplated in these regions absent the 50% DOE funding contribution – due to the rate impact implications on small rate bases and the opportunity cost of other required work.

A considerably longer-paced deployment without the DOE support would also result in a much slower pace and scale of skills training and process innovation enabled by Smart Grid device introduction. If the company continues its current pace of DA installation, it is feasible that it may not need to fundamentally revisit and redesign in whole all its field operating processes impacted by feeder automation. Similarly, while some crews serving specific areas where autoreclosers gradually appear would need to be trained on how to inspect, maintain, and troubleshoot them, a large-scale Smart Grid technology-related training and upskilling initiative could be reasonably delayed until critical mass of devices is present. Conversely, a large-scale / condensed-timeframe five-year" sprint" for DA deployments across the system would necessitate commensurate scale of change in terms of process redesign and skills training. This would in turn create paid opportunities for acquisition of more advanced skills by local union members and non-union employees in relevant positions, setting the stage for future process innovation and more value-added economic opportunities for project employees and other participants, many of whom are local DAC residents. Finally, enhanced reliability and local system capacity upgrades would also remove significant cost barriers to transportation electrification, and particularly proliferation of public charging stations. While improved reliability would increase potential proponents' confidence in investing in charging stations in less populous locations with fewer system redundancies, upstream system capacity limitations and the need to contribute upfront capital to address them may become insurmountable challenges. To this end, capacity upgrades in the scope of this project would also help reduce the upgrade burden for public charging early movers.

1.5 Natural Resources and Climate Resilience Strategy

Empire confirms that the project will cause no long- or short-term constraints to the communities' access to water or other natural resources. To ensure that the proposed DA installations are resilient to increased mechanical loading from high sustained winds and snow brought by stronger and more frequent storms, Empire will be upgrading impacted line facilities with new and heavier duty pole and conductor equipment. Devices will also operate on a decentralized protocol preprogrammed for each cluster to run largely autonomously. While this is primarily a function of Empire's fiber connectivity challenges in many distant parts of the service area, this operating protocol also has an added benefit of enabling local operation even without constant control room control and visibility (as can happen during storms).

2. Technical Description, Innovation, and Impact.

2.1 Overall Project Description

Project DA targets the deployment of automated vacuum recloser devices (autoreclosers), Fault Location, Isolation and Restoration (FLISR) systems governing their operation, along with renewal and reinforcement of supporting and adjacent pole and conductor assets, sectionalization of the affected circuits, deployment of device-to-device communication modems, and updates to upstream substation capacity and protection schemes. As envisioned by the project, autoreclosers will provide enhanced reliability performance and grid resilience benefits through three mechanisms: (a) fault detection, (b) sectionalization (i.e., use of reclosers as controllable switches), and (c) automatic re-energization. Using the FLISR capabilities, autoreclosers detect faults on electrical lines and automatically de-energize them to minimize potential damage. The devices then test the conductor to check whether the fault persists or if it was momentary. If the fault is momentary, autoreclosers restore power to the electrical line and effectively convert what would otherwise be sustained outages into momentary outages.

Autorecloser benefits are magnified when these devices are deployed in "clusters" – where two or more devices are installed on adjacent sectionalized feeders fed from two different substations, as this enables minimization of the affected area and restoration of service from an alternate path to other feeder segments, depending on configuration. This also narrows down the problem area for response crews to reduce response time and expenditures, or completely avoid truck rolls where transient faults have been cleared. A more detailed description of the project steps and milestones is provided in Section 3 – Workplan.

2.2 Relevance and Outcomes.

Table 2 lists the project Objectives, Targeted Grid and Labor Force Outcomes and Key Success Factors in their delivery, along with description of the core technology elements proposed.

Table 2: End of Project Goals, Outcomes and Key Success Factors

End of Project Goals	Targeted Grid Outcomes	Key Success Factors
1. Deploy 261 new and integrate 49 existing autorecloser schemes using local (decentralized) comms protocols across 179 circuits in 4 states.	**(a)** Enhanced grid flexibility across all major feeder groupings **(b)** 33% CMI improvement on feeders affected. (c) Enhanced outage location precision and response speed by crews.	**(a)** Detailed Design Study confirmation; **(b)** Coordinated deployment planning **(c)** Equipment & labor force availability
2. Upgrade hosting line infrastructure for 310 autorecloser sites to appropriate weight bearing and safety standards for extra poletop equipment.	**(a)** No recordable safety incidents during installation. (b) No physical failures due to support infrastructure post-install.	**(a)** Timely and sequenced completion of supporting infrastructure upgrades to minimize delays of recloser installs.
3. Conduct targeted reconductoring on 34 miles and up to 3 power transformer upgrades to increase system capacity & flexibility around the proposed DA.	**(a)** Added station line carrying capacity to relieve current loading limitations. **(b)** Improved resilience during high-wind and snowstorm events.	**(a)** Load flow studies as a part of the Detailed Design Studies. **(b)** Coordination of timing with pole upgrades (above).
4. Design, test and update requisite operating processes and manuals in collaboration with Local 1474 members.	**(a)** No Human Error-related operations issues during maintenance and restoration after 2 years of operation.	**(a)** Detailed engagement with Line labor force by Engineering and Planning Staff. **(b)** Comprehensive change mgmt. plan.

End of Project Goals	Targeted Grid Outcomes	Key Success Factors
5. Conduct DA-related training and certifications for internal line personnel and external installers if required.	**(a)** Acquisition of advanced technical skills by local line crews and other skilled trades (as relevant) in 4 States.	**(a)** Collaborative development with union leadership and members of course and certification materials.

Moreover, Empire submits that as proposed, the project is highly relevant to the goals and objectives of the FOA Topic Area 2 in question for the following reasons captured in Table 3:

Table 3: Alignment of FOA Topic Area 2 Objectives with Key Project Elements

Topic Area 2 FOA Objective	Ways in which Project DA is Relevant and Responsive
1. Increase the capacity of transmission facilities or the capability of the transmission system to reliably transfer increased amounts of electric energy.	**(a)** Increased feeder intertie creates added flexibility and operability for load switching across substations for reasons other than outages (i.e. station loading management) – thus helping defer the timing of station capacity upgrades and/or helping increase transmission system throughput through risk-based substation capacity management. **(b)** Continued advanced instrumentation of Empire's grid with DA technology, following a successful AMI deployment in 2021 forms a logical step towards a future Distribution System Operator (DSO) model where the distributor will have increased control and visibility to optimize grid capacity.
2. Prevent faults that may lead to wildfires or other system disturbances.	**(a)** Autoreclosers allow for quick de-energization of the sections of the system for first responder safety during wildfires or other major weather events. **(b)** Automatic switching capabilities that are at the core of the proposed DA technology and feeder interties installed to deploy them will assist in fault isolation and clearing using modern FLISR technology, reducing the scope and scale of cascading impact of faults and reducing the probability of flashovers and catastrophic equipment failures over a wider area, reducing probability of wildfires. **(c)** Conductor and pole line facility renewal and uprating with equipment more resilient to thermal and mechanical issues. **(d)** Station transformer upgrades reduce the risk of catastrophic unit failures and the associated large-scale fires.
3. Integrate variable renewable energy resources at transmission & distribution levels.	**(a)** DA functionalities, sectionalization and 3 substation upgrades in scope increase the system flexibility to accommodate increased penetration of renewables. **(b)** Outage impact minimization through DA ensures that more of the 50 MW of distributed renewable energy currently installed (and growing) is used across the grid and can be counted upon (when safe) during upstream transmission outage events.
4. Facilitate the aggregation and integration (edge-computing) of electric vehicles and other grid-edge devices or electrified loads.	**(a)** Reliability of supply at home, work and across public charging sites is a prerequisite in driving electrification for transportation and heating. Project DA targets reducing outages on what is a low-density, low-redundancy distribution system. Reducing outage durations by a third on the key circuits impacted (as the project proposes) adds confidence to consumers as they contemplate switching of key enablers of economic and social welfare like heating and transportation to cleaner sources of energy. **(b)** One of the largest areas of interest in Empire's service territory related to EV adoption is school bus electrification. Reliability and station capacity enhancements in the more remote areas can help accelerate adoption of this technology, that can also act as a Demand Response tool and/or a battery for local community resiliency hubs (typically located in schools).

As the detailed exhibits above demonstrate, and as further highlighted in the Workplan, the company's proposal entails a well thought out approach, validated by initial cost benefit analysis estimates from higher order system studies, which puts forth highly specific and measurable outcomes and project features that are well understood and aligned with the objectives that the

DOE prioritizes in this submission. As discussed in the Community Benefits Plan document, the attainment of these outcomes also creates a variety of benefits in an economically vulnerable area that includes multiple DACs, 39 of which would be directly impacted by this project.

2.3 Project Feasibility

As conceived, Project DA leverages mature, well-understood and rigorously field-tested autorecloser and FLISR technology that has been available on the market for at least a decade for the distribution voltages and has transmission system equivalents that have been in use for several decades. In its research on the subject, Empire has confirmed that autorecloser technology has close to ten well-established North American vendors (including ABB, Sweitzer, S&C Electric, Siemens, GW Electric and others) whose equipment installations are deployed across the continent and underwent multiple hardware and software improvements and presents minimal technology- or deployment-related risks for the company, its customers, or the DOE as a funding contributor. Beyond the industry at large, Empire has previously deployed multiple Viper autorecloser devices and FLISR systems on its distribution grid, all of which have been operating as intended, and confirm Empire's ability to install and operate the technology.

To further validate the economic value of the project, Empire undertook a Cost Benefit analysis study in 2021 that identified up to 400 potential deployment locations on 300 circuits, which would yield a combined $100 million Net Present Value on a $30 million device only costs. While the additional costs of labor, materials, IT/OT work and overheads (among others) would reduce these benefits in the fully costed projects, the offsetting impact of a 50% DOE contribution sought, Empire estimates that the fully costed project would still confirm a string case for deployment based on the known and quantifiable benefit elements, further bolstered by the harder to quantify but no less critical strategic benefits, like those that underlie some of the four key Topic Area 2 objectives described in the section above.

Finally, Empire confirms that there are no known constraints in terms of the access to necessary infrastructure or resources. The company owns and operates its distribution system, as well as the upstream transmission system that will require coordinated operation during the installation phase. The company also possesses all necessary easements to modify the distribution infrastructure as required, along with multiple work centers across its service territory to coordinate staging and warehousing. In recent years, Empire leveraged an average of 950,000 hours of unionized labor per year in construction and related activities. The company's head office in Joplin, MO is also located close to critical national east-west and north-south highway corridors, simplifying any transportation logistics. Finally, the company has standing contracts with multiple engineering and design firms, construction contractors who rely on unionized labor, and a strategic supplier sourcing program that maintains contractual relationships with hundreds of vendors in the region and nationwide. Please see the Technical Qualifications and Resources section for the description of the Project Team's qualifications that round out what is an appropriately resourced and well thought out proposal.

2.4 Innovation and Impacts

As noted above, while the technology and associated processes are not new for the electrical industry at large, their proposed widespread adoption through Project DA would constitute a transformative shift for Empire's distribution operations. At this juncture, and with exceptions of recently (and successfully) deployed autorecloser schemes on several Oklahoma and Missouri circuits, the majority of Empire's distribution system relies on manual gang-operated air-break switches. These manual devices have been a standard for distribution system operation for some time, with utilities progressively implementing automatic or remotely operated SCADA schemes to replace and augment their capacity. Gang operated switching requires a crew to be present on site to operate the switch, necessitating truck rolls and radio-based communication between crews in the field and/or the control room. Empire also operates about 20 remotely radio-operated Scada-Mate switches in the Branson area, which were installed in the 1990s due to the heavy summertime traffic in the area which significantly slowed down the response of crews during outage events. Overall, Empire believes that its switching technology landscape largely resembles a typical suburban / rural utility today – with predominantly manual switches and several much smaller populations of newer technologies in specific areas.

As such, the proposed five-year "sprint" to deploy numerous DA devices across the system's key junctures, is set to innovate the way switching is done on Empire's distribution system. The advantages of autorecloser technology over the status quo are:

- *Autonomy of operation* along pre-programmed schemes – leading to avoidance of sustained outages for the bulk of customers that would have been otherwise affected.

- *Immediacy of operation* – the FLISR capabilities enable near-instantaneous reaction that helps limit the amount of damage caused by faults on the electrically adjacent assets.

- *Precision of Outage Location* – sectionalization and automated fault isolation reduce the areas that response crews have to inspect to locate outage cause on faulted segments.

- *Additional System Flexibility* – DA also helps make the system more flexible for capacity-related load transfers that the company may need to undertake during peak days.

- *Reduced Labor Inputs* – automated operation helps avoid additional field switching labor and related coordination tasks, which would have to occur in addition to fault location.

- *Improved Employee and Public Safety* – DA deployment would reduce the number of instances of line staff having to work next to moving traffic on roadside locations.

- *Improved Renewables Utilization* – a more sectionalized grid with automated switching schemes in key places helps maximize the use of distributed renewable energy.

In addition to equipment related innovation, Empire and its employees would also benefit from and directly contribute to the innovation in the operating process dimension. While the gradual installation of DA devices (as has been the case to date) could be accommodated without fundamental process redesign utility-wide, the proposed project scale would require Empire to reassess the completeness, efficiency and consistency of the processes supporting its more modern grid. The company sees the need for this change as an important catalyst for engagement between field, control room, and planning staff that would lead to opportunities for eliminating, reducing, raising, creating, or otherwise transforming the company's processes towards safer or more efficient ways of operation. Similarly, the device operations data collected over time, combined with design-level insights drawn during implementation, are expected to generate additional insights that the company will translate into the next generation of grid modernization investments and/or process enhancements.

2.4.1 Alignment with State, Tribal, Regional and National Resilience and Decarbonization Goals

The project's alignment with national resilience and decarbonization goals is addressed in the Relevance and Outcomes section of this submission. Improved Resilience is a key priority identified in Missouri's 2015 Comprehensive State Energy Plan, Arkansas 2013 Energy Assurance Plan, and Oklahoma's 2021 State Energy and Environment Plan (which remain these States' latest to date). Empire is not aware of a state energy plan for Kansas. All three energy plans of Empire's home states describe above-ground electricity distribution as an area of high vulnerability to wind, earthquakes, physical attacks, wildfires and snow and advocate for investments in grid hardening and smart grid solutions that help reduce the impact of these events. In their ability to significantly reduce the duration of outages affecting customers that would otherwise experience power failures, DA devices help advance resilience system-wide.

Importantly, the flexibility inherent in the sectionalization and automation of circuits can also make Empire's system more resilient to what is normally thought as good weather – or rather when it turns extreme. In the summer of 2022, Empire's service area underwent an extended heat spell between late June and early September with consistent temperatures staying in high 90s and low 100s with virtually no meaningful breaks. As a result, multiple distribution station transformers were running at or beyond normal rated capacity and would have benefitted from greater flexibility for load transfers. While the system avoided major issues, creating additional safeguards from premature degradation and failure of station equipment via sectionalization and intertie automation is another resilience enhancing dimension that the project brings.

The fact that they can be deployed in virtually autonomous schemes in any suitable corner of the grid also makes them highly modular and suitable for both larger and smaller parts of Empire's expansive distribution network. As stated above, this is critical for the company's goal of enabling reliability enhancements not only in the denser parts of its territory where feeder interties are more widely available, but also in the distant areas where opportunities for redundancies are sparser and outage response times are longer. As such, DA technology may also be seen as a means of increasing equity of access to more reliable service irrespective of one's address. This is particularly important for the subset of the contemplated project locations with NPVs that are only marginally positive. The presence of DOE funding will significantly strengthen these business cases and turn them into viable projects by reducing the perceived risk of project deployment in vulnerable locations. Although outage avoidance in these less dense locations may not drive down system-wide reliability metrics, their impact will be transformative for smaller communities. Specifically, enhanced reliability in these more distant areas may position them as more fruitful grounds for additional commercial private sector investments, including agriculture, manufacturing and processing, or hospitality. Based on the feedback from Empire's Business and Community Development (BCD) Team who will drive forward the proposed Community Development Plan, capacity and reliability of supply are among the chief concerns from organizations seeking to establish new facilities in the region. Similarly, working in tandem with Empire's four-pronged Transportation Electrification Pilot Program that offers residential, commercial, school bus, and public charging EV programs, the company expects that improved reliability and capacity constraints relief in more distant corners of its service territory is a key enabler for future deployment of public EV charging beyond major highway corridors.

Moreover, considering that the project proposes the same types of devices to be installed in four neighboring states, it also advances regional resilience by making the benefits of a modernized grid available to its customers in different jurisdictions. While none of its host state energy plans dedicate significant attention to decarbonization goals, as descried earlier, Empire believes that its ability to increase flexibility of load transfers between substations and reduce the impact of outages, DA deployment can help promote better utilization and further deployment of distributed renewables in the company's service territory.

2.4.2 The Project's Effect on Encouraging Development of Priority Smart Grid Functions

Table 3 above contains a detailed articulation of the company's position as to the manner and extent that the facets of Project DA align with the priority Smart Grid functions identified in FOA section 1.B. for Topic Area 2. In addition to these points of alignment already articulated, the company is confident that the proposed large-scale deployment of DA schemes will set the stage for the subsequent horizon of its grid modernization journey. With real-time consumption measurement and edge computing capabilities available following its 2021 AMI investment, the company now finds itself in a better position to deploy the DA devices to the areas where more granular data confirms they will have the greatest benefit.

Similarly, with the compounding benefit of AMI and DA capabilities, Empire will be well positioned to invest more effort into exploring more advanced ways of transmission station capacity constraints mitigation through more flexible switching protocols, risk-based capacity planning, managed EV charging, and other forms of demand response programs. While these elements can and would develop in the absence of a DOE-funded major DA project, an enhanced reliability and Smart Grid-driven operating practices updated throughout the utility value chain would serve as critical enablers and catalysts of further progress. While much of it is a function of physical devices and data flows, the company is also clear in its conviction that the culture of innovation plays an equally important role. For this reason, it sees the scale of the contemplated investment itself as a key gravitational force that empowers utility personnel to address complex questions that ultimately lead to procedural and programmatic breakthroughs, which are in turn shared with customers.

2.4.3 The Project's Effect on System Flexibility to Meet Program Objectives

As previously discussed at several junctures of this submission (including Table 3), the sectionalization and automation of switching associated with DA would have a material impact on the flexibility of Empire's grid. Given that today's system largely relies on manual switching for load transfers and partial outage restorations, DA investments would constitute a step improvement in grid flexibility. The key parameters of added grid flexibility are:

- Near-instantaneous outage response on automated feeder clusters.
- Improved optionality for short-term load transfers with redundant path enhancement.
- Increased opportunities to optimize station capacity expansion scale and timing.
- Increased system capacity in critical areas through conductor upgrade / uprating.

3. Workplan

3.1 Project Objectives and End of Project Goals

Please see Table 3 for detailed articulation of the SMART end or project goals that the company proposes for this project. As a brief summary, Empire proposes 5 core categories of end of project goals / objectives chief among which is installation or integration of 310 autoreclosers across 43 clusters in 4 states, along with associated host line facility hardening and conductor capacity expansion. A key outcome of the proposed project is a reduction in Customer Minutes of Interruption of 33% on the affected circuits. Please refer to Table 3 for more detailed information, including that pertaining to other goals. Empire notes that absent a more concerted effort, it is impractical to set SMART targets for the number of workshops and process design changes, since process redesign may in fact lead to process consolidation and/or establishment of net new processes, while the number of workshops would not necessarily be indicative of their quality – whether the targeted number is large or small. It is the company's hope that these considerations highlight the rigor that it has approached the preparation of the project plan with. Summarized in a single sentence, the end of project goal is to *advance a modernized automated distribution system, with reinforced resilience features at the key DA nodes and additional flexibility and capacity to assist electrification and renewables growth*.

3.2 Buy America Requirements

Empire is keenly aware of the impact that its work program has on the socioeconomic prosperity within its service territory, the broader region and nationwide. To maximize its impact, the company attempts to procure domestic materials and supplies wherever economic and advantageous for itself and its customers. To this end, Empire is supportive of the Buy America objectives. At this juncture, the company has not selected any specific vendors for the autorecloser / FLISR technology and telecom elements, while it regularly procures the common utility infrastructure like poles, crossarms and conductor for its regular utility operations. The company submits that it intends to make the Buy America policy conformance a key priority in its procurement decisions for all construction materials and implements, and upon preliminary discussions with internal supply chain professionals, has confirmed that all major project equipment and materials components are available from U.S.-based suppliers.

3.3 Technical Scope Summary

The project will deploy automated power restoration devices to approximately 179 supply circuits by installing or further integarting 310 DA devices, 33.5 miles of line upgrades and 3 power transformer replacements. The work is divided up into five one-year performance periods with clusters of DA devices getting put into service each year to allow customers to begin deriving benefits increasingly throughout the project as shown in Table 4.

Table 4: Performance Periods Technical Scope Accomplishments Summary

Milestone	Performance Period					Total
	Period 1	Period 2	Period 3	Period 4	Period 5	
DA Devices (# reclosures)	31	75	78	74	52	310
Conductor Upgrades (cct. miles)	3.5	10	7	7	6	33.5
Power Transformer Replacement	0	0	1	1	1	3

Empire will review project progress and planning assumptions at the end of each performance period. The project team will incorporate any changes in assumptions and emerging conditions into a revised project plan to determine the impact on project scope, budget, schedule, and deliverables. The revised project plan will then get assessed to make a "Go/No-go" decision on whether, and to what extent the project should proceed.

3.3.1 WBS & Task Description Summary

Project DA is supported by a project plan to ensure successful attainment of the goals and deliverables. The plan not only covers the work of designing and building the core systems and infrastructure, but also considers changes to operational processes, engagement of stakeholders and training to ensure successful completion of the scope of work and sustained benefits. The plan consists of the following tasks described in more detail below:

1. Project Management & Planning
2. Change Management
3. Risk Management
4. Work Execution

1.0 Project Management & Planning

1.1 Project Management: A robust project management process will be employed applying "Plan, Do, Check, Act" principles with short interval controls to ensure the team completes the entire scope of work on time and on budget. Decisions, work assignments and action responsibilities will be documented to ensure clarity of direction and accountability of project team members. Additionally, a rigorous change order process will be used to ensure appropriate approvals and scope changes get tracked. Progress meetings will be held at least monthly to ensure the various studies and site preparation involved are proceeding as expected and staged implementation of the Engineering / Procurement / Construction (EPC) aspects of the project are on track. Specific updates on change management and risk management effectiveness will also get reviewed to identify and resolve emerging risks.

1.2 National Energy Policy Act (NEPA) Compliance: The project team will ensure strict compliance with NEPA and provide all documentation required. A dedicated workshop will be held post-award to identify and rectify any potential gaps.

1.3 Cybersecurity Plan (CSP): The project team will create and submit to the DOE a plan for identifying and mitigating all cybersecurity risks associated with telecom infrastructure and operating systems integration deployed through the project. The plan will be grounded in Empire's internal cybersecurity policy and strategy documents and will incorporate any early direction from the DOE on the content, structure, or conformance to any specific provisions as raised during early post-award discussions. A cybersecurity liaison will be integrated into Project Status Report Meetings and the plan will get updated as changing conditions dictate.

2.0 Change Management

Successful project completion requires the support and buy-in of all stakeholders impacted by the project. Stakeholders would include Empire staff and senior management, customers, contractors, labor organizations, regulatory bodies, other utilities, etc. A technically oriented stakeholder engagement plan will be employed to build on the Community Benefits Plan to ensure all stakeholders understand the purpose and scope of the project, impact it might have on them and a provide a chance for questions and discussion. This will also include detailed technical workshops to ensure that the operating processes impacted by the large-scale deployment of Smart Grid infrastructure are reviewed and updated as necessary, with the associated training planned and actioned out as necessary. Nadler and Tushman's Congruence Model framework for change management is expected to be employed to structure and facilitate the change management activities (the "Inputs → Task – Individual – Formal Organization – Informal Organization → Outputs" framework devised to effect comprehensive organizational change). The key advantage of this approach is the degree of attention it pays to the informal organization (i.e. attitudes, norms, commonly held beliefs that have impact on execution of tasks by individuals – sometimes in spite the presence of formal rules that may dictate the contrary.

3.0 Risk Management

All projects incur inherent risks that could threaten the successful completion of the project. Baseline risks that apply to all projects will be mapped and tracked (safety of workers and the public, environmental, customer service and financial) as well as risks specific to this type of project (supply chain delays, labor disruptions, extreme weather, etc.). The project team has created a risk management plan that identifies all risks and determines risk severity by assessing the probability and impact of each risk. Corresponding mitigation actions in accordance with the risk severity will be identified and undertaken to ensure risks will not jeopardize the project. Table 5 provides a summary of Top 5 risks identified at this juncture.

Table 5: Top Project Risks Registry

Category	Risk Description	Probability	Impact	Mitigation Strategy
Budgetary	The scope of circuit and/or station upgrade costs due to load flow study or other design findings.	Medium	Significant	Identify alternate placement locations with comparative reliability benefits.

Category	Risk Description	Probability	Impact	Mitigation Strategy
Security	Cybersecurity breaches on telecom equipment affect grid operation integrity or sensitive data.	Low	Critical	Implement a Cybersecurity Plan industry best practices and company policies.
Economy	Escalating labor and material costs due to inflation reduce the number of unit accomplishments feasible.	Medium	Moderate	Utilize strategic sourcing practices and leverage project multi-year nature and certainty for pricing to drive lower pricing & flexibility.
Regulatory	Conflicting requirements between objectives and evaluation criteria of State regulators (for costs to be recovered in rates) and the DOE.	Low	Significant	Ensure early and thorough engagement with state authorities to align on expectations and avoid unmet expectations.
Scheduling	Construction delays dur to the effects of extreme weather events.	Low	Moderate	Reschedule the order of deployment of site locations to allow for impact mitigation.

4.0 Work Execution

Work execution is divided into five performance periods of 12 months each. Performance period milestones were selected to ensure customers experience project benefits as soon as possible. More specifically, milestones represent the deployment of operational DA device clusters that will deliver project benefits in an incremental manner. Each performance period will also include ongoing activities associated with project management, change management and risk management as described in sections 1.0 to 3.0 above.

4.1 Process Impact Study: Empire already has a moderate degree of distribution automation devices in operation. However, the significant increase in numbers and sophistication of DA devices brought about by this project may necessitate changes to existing processes and perhaps introduce new processes. All operational processes potentially impacted will get reviewed to ensure the equipment gets seamlessly transitioned into operation and continues to function properly throughout its lifecycle. Processes for review would include but are not limited to: field safety practices, outage response, system repair, work management, control center operation, equipment maintenance practices, vendor support contracts, etc. The final stage of the process review effort is to train all affected staff and contractors prior to go-live.

4.2 Station and System Capacity Study: The automated power restoration provided by this project requires interconnected stations have sufficient capacity to back feed power to each other during outage restoration. Consequently, back feed requirements for all power restoration scenarios must be determined and compared with station loading during peak loading periods to ensure power restoration doesn't overload the station used to restore power. Similar to the station capacity study, main supply circuits used to back feed power during outage restoration must be studied as well to ensure sufficient capacity for all restoration scenarios.

4.3 Engineering & Design: DA deployment has 3 main elements: autoreclosers, system upgrades and communication & control systems, each with required engineering and design work.

4.3.1 Autoreclosers: Engineering includes equipment specification development, system connection design, determination of device settings and programming. This work is highly technical and involves such elements as protection coordination analysis, specification for device voltage, current and Basic Impulse Level (BIL) ratings, etc.

4.3.2 Distribution System Upgrades: The installation DA devices will often necessitate system upgrades. In some cases, the upgrade just requires moving existing assets on a pole to accommodate the new DA device or perhaps the pole is at end of life and must be replaced to avoid putting the new DA device at risk. In other cases, distribution system line capacity upgrades are required to allow DA devices to change supply routing and restore power. All these upgrades require engineering studies to determine such parameters as guy tensioning, wind and ice load resiliency and fuse ratings. Designs must detail the required materials, resources and equipment before construction can be planned and executed.

4.4.3 Communication and Control Systems: DA devices work together automatically to disconnect failed distribution system components and re-configure supply routes to restore power. These devices assess fault conditions and communicate with one another to determine the required device operations for automated power restoration. In addition, system operators in control centers must be informed of this new supply routing for consideration in ongoing operating analysis and decisions. The systems required to allow this communication are generally wireless and must be engineered to ensure signal propagation reliability and penetration, adequate data transfer rates and proper signal interference tolerances. In addition, power re-routing control room annunciation must be incorporated into the existing Empire Electric System Control & Data Acquisition (SCADA) systems which requires IT interfaces.

4.4.4 Power Transformers: Some power transformers at supply stations may not have sufficient capacity to back feed power to another station for power restoration. The installation of cooling fans can address a very moderate transformer capacity shortfall, but in most cases the transformer will require upgrade. Ordering a replacement station transformer requires the creation of elaborate specifications to ensure it has the characteristics required for all operating conditions and to allow maintenance tasks. Some of the characteristics for consideration are: gauges and annunciation, tap changers, oil sampling ports, type of dielectric design, primary and secondary bushing types, etc. In addition, the transformer site may require upgrading to accommodate the new transformer for such issues as oil spill containment capacity, site ground grid, fire suppression systems, SCADA interface, cable management systems, etc.

4.5 Procurement: Materials, equipment and resources have to be procured before construction can begin. The procurement process will proceed according to established company practices and policies. As part of the process, vendors will declare delivery times which will be used by project schedulers to update project plans. Purchase Orders will get issued to successful vendors at the conclusion of this process.

4.6 Construction and System Development: Once designs are completed and materials, resources and equipment procured, work packages can be issued to crews for construction. In addition, engineers and IT professionals can begin installing and programming comms and control systems.

4.7 Commissioning and Final Testing: Commissioning tests on all DA system components must get performed to ensure no installation oversights and/or component defects exist. Some components will also require programming and calibration before they are ready for service. With commissioning of all DA system components complete, the overall system must undergo rigorous testing to ensure it functions properly under all operational scenarios before "go live" and project deliverables are realized.

4.8 Performance Period Approach: As described in the introduction to section 4.0, work execution will occur incrementally, so benefits get increasingly realized throughout the project. As such, clusters of DA devices will get designed, constructed and put into service according to the planned milestones of each performance period. Early performance periods contain more planning, engineering and procurement activities while later periods contain more construction and commissioning & testing activities.

3.3.2 Milestone Summary

Milestones for the project have been set for each performance period and each quarter to allow tracking of project progress. In most cases quarterly milestones will represent completion of activities while performance period (annual) milestones will represent technical achievements in the project. Technical achievements will mainly represent the completion of a key project stage.

1.0 Quarterly Milestone Description

Quarterly Project Meetings: Quarterly project meetings will be held to assess the completion of activities schedule for the quarter in question.

2.0 Performance Period Milestones (See also Table 6).

2.1 Project Studies: Performance period milestones may represent the completion of a study that determines key parameters for proceeding with the rest of the project. For this milestone, a report will be completed concurrent with field work describing the findings of the study that will guide other elements of the project. For example, the distribution loading study will identify the scope of each circuit upgrade necessary to achieve project deliverables. This information will guide the Engineering & Design work for each circuit upgrade stage in the project.

2.2 Engineering and Design: Completion of engineering & design milestones will be a construction package that details all aspects of the implementation stage in question to allow the procurement of materials and equipment as well as installation, construction, testing, commissioning and putting the equipment into service.

2.3 Issue Purchase Order: orders required to procure all necessary materials and equipment for each construction stage must get issued with sufficient lead time to allow installation and construction to begin on schedule.

2.4 Install / Construct / Energize: completion of this milestone requires that all aspects of a particular work package for a stage in the project have been completed and have been put into service in the case of circuit upgrades or are ready for testing and commissioning in the case of DA devices and telecom systems. A 50/50 internal - contractor labor force split is assumed.

2.5 Test/Commission/Go-Live: this milestone will require that the DA devices and communications are fully functional and has become part of the distribution system operation. Verification will be done by an entity other than the one responsible for completing the milestone to ensure an objective assessment of completion. In all cases a tangible product is required to complete milestones whether it be a report, design drawings, purchase orders, field installations or functioning DA clusters.

Table 6: Performance Period Milestone Summary

Milestone	Performance Period					Deliverable
	One	Two	Three	Four	Five	
Phase 1: Studies						
Process Impact	X					Report
Station capacity	X					Report
Distribution system loading	X					Report
Phase 2: 31 DA devices						
Engineering & Design	X					Construction Work Pkg
Issue Purchase Orders	X					PO issued
Install /construct	X					Work Pkg scope constructed
Test/Commission/go-live		X				In service
Phase 3: upgrade 3.5 miles of circuits						
Engineering & Design	X					Construction Work Pkg
Issue Purchase Orders	X					PO issued
Install /construct/Energize	X					In service
Phase 4: 75 DA devices						
Engineering & Design	X					Construction Work Pkg
Issue Purchase Orders	X					PO issued
Install /construct		X				Work Pkg scope constructed
Test/Commission/go-live		X				In service
Phase 5: upgrade 10 miles of circuits						
Engineering & Design	X					Construction Work Pkg
Issue Purchase Orders	X					PO issued
Install /construct/Energize		X				In service
Stage E: 78 DA devices						
Engineering & Design		X				Construction Work Pkg
Issue Purchase Orders		X				PO issued
Install /construct			X			Work Pkg scope constructed
Test/Commission/go-live			X			In service
Stage F: upgrade 7 miles of circuits						
Engineering & Design		X				Construction Work Pkg
Issue Purchase Orders		X				PO issued
Install /construct/Energize			X			In service
Phase 6: 74 DA devices						
Engineering & Design			X			Construction Work Pkg
Issue Purchase Orders			X			PO issued
Install /construct				X		Work Pkg scope constructed
Test/Commission/go-live				X		In service
Phase 7: upgrade 7 miles of circuits						
Engineering & Design			X			Construction Work Pkg
Issue Purchase Orders			X			PO issued

Install /construct/Energize				X		In service
Stage I: 3 power transformers						
Engineering & Design	X	X	X			1 designed in PP 3, 4, 5 each
Issue Purchase Orders	X	X	X			1 ordered in PP 3, 4, 5 each
Install /construct			X	X	X	1 installed in PP 3, 4, 5 each
Test/Commission/energize			X	X	X	1 in service in PP 3, 4, 5 each
Phase 8: 52 DA devices						
Engineering & Design				X		Construction Work Pkg
Issue Purchase Orders				X		PO issued
Install /construct					X	Work Pkg scope constructed
Test/Commission/go-live					X	In service
Phase 9: upgrade 6 miles of circuits						
Engineering & Design				X		Construction Work Pkg
Issue Purchase Orders				X		PO issued
Install /construct/Energize					X	In service

3.4 GO/NO-GO Decision Points

Empire will review progress and planning assumptions at the end of each performance period *as applicable to specific work sites / clusters (not overall project)*. Review elements include:

Table 7: GO/NO-GO Decision Points

GO-NO-GO Decision Points	Periods of Relevance
a) station capacity confirmed to allow automated power restoration	1, 2
b) distribution capacity confirmed to allow automated power restoration	All
c) labor and equipment availability confirmed as planned	All
d) amount of distribution line upgrades required consistent w. assumptions	All
e) automated power restoration concept functioning as designed	All
f) site access and environmental approvals, local stakeholder acceptance	All
g) key budget assumptions in line with design output	All
h) site scheduling assumptions in line with project timeline	All
i) requests for scope change within / outside risk tolerances	1, 2
j) supply chain ability and lead times to provide necessary materials and equipment	All

3.5 Project Schedule

Figure 2 on the following page showcases the project schedule, as envisioned by the team at this juncture. Included in the schedule are the milestones and annual decision points as to the project's continued path and assumptions, expected to be tied to the annual Performance Period Reporting Meetings with the DOE staff. Empire notes that the project is based on the current assumptions gearing the number of devices, scope and scale of requisite distribution system upgrades to enable DA (see WBS and Milestone sections for further discussion on these items). The schedule is also grounded in the normal construction practices for Empire, where distribution construction work is carried out year-round. The project assumes calendar year performance periods with a tentative start of January 1, 2024. Changes to core assumptions due to factors outlined in prior sections would necessitate changes to the schedule as well.

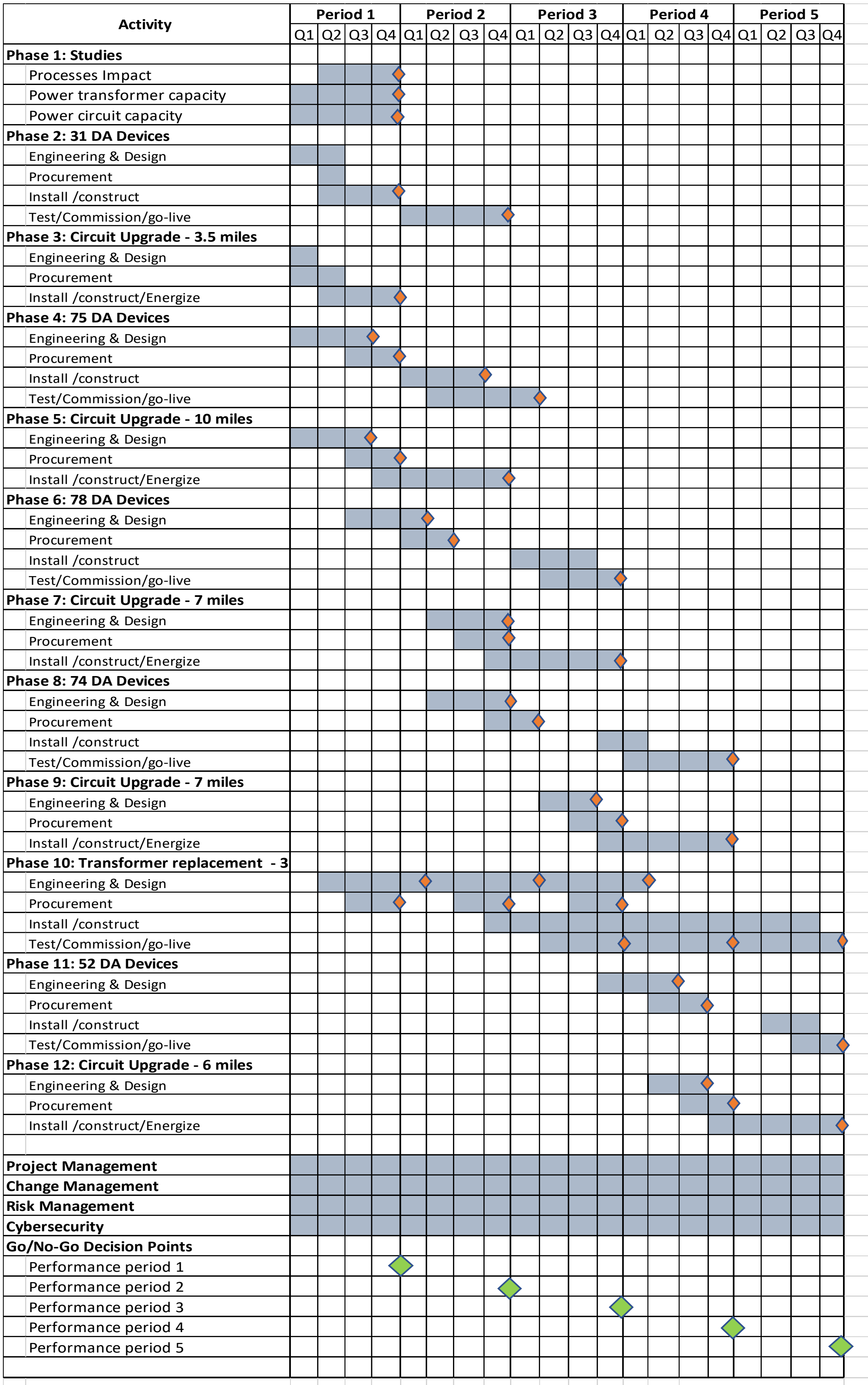

Figure 2: Project Schedule

4. Technical Qualifications and Resources

As the following passages demonstrate, Empire is well positioned to undertake the proposed project using its existing resources. While a number of these would be required to be temporarily supplanted with underfill resources for the duration of the project to continue their regular responsibilities, the company is confident that it can achieve an appropriate balance should the GRIP grant be awarded to the company.

4.1 Project Team's Qualifications

The following table provides the listing of core project team members and lists their specific qualifications, educational background, company role and contemplated project that would position them to deliver a successful project.

Table 8: Core Project Team Members and Relevant Skills and Experience

Name & Education	Project Accountabilities & (Company Title)	Years of Sector Experience	Unique Skills Relevant to Project Success
Sam McGarrah *B.S., M.S. Electrical Engineering, PE*	Project Manager and Engineering Lead, Safety Officer *(Director, System Performance)*	29	Reliability improvement planning and analysis. Asset management, control room operations, capital construction and maintenance staff oversight, vegetation management, community relations. Experience leading cross functional teams. Direct experience with DA projects.
Tim Wilson *B. S. Mathematics, M.S. Project Management*	Executive Sponsor *(VP, Electrical Operations)*	24	Integrated Planning oversight, Utility strategy development and implementation. Strategic planning, cross-functional / cross-departmental leadership. Experience in oversight of major wind project construction and coal plant retirement.
Jeffery Westfall *Highschool Diploma*	Organized Labor Liaison and Sr. Line Operations SME *(Senior Director, T&D)*	30	Extensive hands-on experience with line work under normal and emergency response conditions. Leadership progression from line crew member to a Senior Ops leader.
Joshua Clements *B.S. Mechanical Engineering*	Project Planning Lead, East *(Manager, System Reliability)*	22	Outage Management System (OMS) implementation, reliability planning. Experience with implementation of DA (autoreclosers). Experience as a Standards Engineer.
Kendra Nixon *BA, General Studies*	Project Planning Lead, West *(Manager, Engineering Business)*	10	Extensive Engineering and Business Analysis (including value-based project prioritization) experience for Generation, Transmission and Distribution. Knowledge of AutoCAD, PowerPlan, Procore software.
Michael Fobair *Associates Degree Computer Systems Technology.*	Project Analytics and Operations Technology Lead *(Program Manager, GIS Ops)*	21	Extensive GIS analytics expertise as applied to utility construction planning or reliability analysis. Experience with developing and implementing mobile technology solutions for operations crews.
Drew Landoll *B.S. Civil Engineering, P.E.*	Design and Construction Lead *(Sr. Director, Engineering & Project Management)*	16	Generation. Transmission, and Distribution Planning, Design and Construction Project Management. Environmental Analysis Expertise. Contractor procurement and management.
Shawn Pingleton *B.S. Business Administration*	Community Engagement and Economic Development Lead *(Director, Customer Solutions)*	29	Extensive knowledge of business and community organizations in the Empire service territory from leading the local Business and Community Development group for over a decade. Economic Development Certification.

As a group, the project team possess a combined skillset and experience that covers all facets of electric transmission and distribution planning, design, asset management analytics, reliability planning and forecasting, field operations, emergency response and power restoration, maintenance and capital design and construction. In recent years, Empire's capital investment program had an annual throughput volume of more than $300 million per year, with the individuals comprising the project team playing pivotal roles in the planning, design, work execution and community and regulator engagement. Importantly, multiple team members and sponsors (most notably Messrs. Westfall and Wilson) have significant experience in labor relations -both in the context of internal utility work and contracted third-party EPC work execution, which predominantly relies on organized labor as well. This expertise will be critical in developing a detailed Labor Engagement Plan that would begin initial formulation upon the project's invitation to proceed to the full application and would be further developed once project selection was confirmed.

4.2 Empire's Relevant Previous Work Efforts Demonstrating Similar Risk and Complexity

Of special relevance to the project are Empire's successful planning and delivery of four major multi-year Generation and T&D infrastructure renewal and enhancement projects that were led and/or supported by many of the team members. These initiatives were:

- *Operation Toughen Up* – a major multi-year transmission and distribution system hardening initiatives that spanned nearly a decade and included upgrades to both line and station infrastructure.
- *Advanced Metering Infrastructure Project* – a recently completed major project that deployed over 170,000 AMI meters across Empire's service territory, along with the sophisticated communication mesh network of devices.
- *Customer Savings Plan* – early retirement of a 200-MW Asbury coal-powered GS and addition of 600 MW of wind generation projects in and around the company's service territory, utilizing tax equity financing to deliver additional customer value.
- *Aging Assets Initiative* – a multi-year asset renewal program targeting removals and upgrades of aged and/or functionally obsolete substation equipment (such as oil-based circuit breakers) to reduce system failure probability and/or impact.

Taken together, these investment programs amount to hundreds of millions of dollars of carefully planned and expertly executed projects, including the logistically complex and technically innovative AMI meter and network deployment and the Customer Savings Plan which were both executed to plan and budget during the COVID-19 pandemic that has challenged supply chains and external approvals processes in an unprecedented way. Having accomplished these complex and risky projects, team members are well suited for the challenging work proposed.

Project Team members also have a proven track record of supporting projects that seek to expand the company's toolkit for assisting their customers in implementing innovative technologies that are becoming increasingly commonplace in the electric industry. For instance, Mr. McGarrah and Mr. Westfall have been involved in the development and implementation support of Empire's Transportation Electrification Application that is comprised of five sub-programs (Residential Charging, Public Charging, Commercial Fleet Charging, School Bus Charging, and Non-Road EV Incentive). The Residential, Public, Commercial, and School Bus charging programs all entail a Time-of-Use based rate schedules with pronounced separation of commodity rates between Peak, Mid-Peak, and Off-Peak to encourage optimal system utilization. Customers are also able to finance the cost of their Behind-the-Meter charging infrastructure on their electric bill – using the company's transparent and regularly reviewed and updated cost of capital parameters to manage the upfront purchase costs.

The Residential program also includes a pilot for capturing of the EV charger consumption data using charger-embedded measurement equipment – rather than requiring customers to pay for an expensive second revenue-grade meter. The Public Charging program works with proponents to identify the sites that optimize charger coverage across the company's service territory and seeks to offset their costs with the help of NEVI Grants and other available funding. The Non-Road EV incentive program targets companies that operate forklifts / lift trucks, refrigeration truck upgrades to use electricity rather diesel for the freezer source of power consumption, and truck stop plug-in facilities that enable cabin device powering by electricity instead of diesel.

Beyond EV charging, Team Members (Messrs. McGarrah, Fobair, Landoll, Clements and Ms. Nixon) are in the early stages of implementing a hybrid risk-based and condition-based transmission and distribution system renewal and expansion prioritization model that utilizes the following key variables to develop optimized investment scenarios:

- Age- and condition-based Weibull failure probability curves for core T&D Assets.
- Connectivity-based prioritization using the CYME model information.
- Customer Interruption Cost (CIC) Estimates using the DOE-Sponsored ICE Calculator.

To ensure that the CIC inputs reflect the present local conditions and the economics of outage impact relevant to its customer base, Empire is collaborating with Berkeley Labs and Resource Innovations Inc., along with the other two Investor-Owned Utilities in Missouri on an updated Value of Lost Load (VOLL) Study expected to be completed in early 2025.

Project Team members are also frequently involved as Subject Matter Experts supporting the innovative efforts of their peers in their Liberty group of companies affiliates Granite State Electric (New Hampshire) and CalPeco Electric California). These collaborative efforts include a Behind-The-Meter residential storage pilot program in New Hampshire, aimed at providing extra resilience and reducing the coincident system peak through storage device aggregation, and the Sagehen Microgrid in the Lake Tahoe area of California, that seeks to defer the need for distribution system renewal and reduce the risk of forest fires of a distribution feeder that traverses a forested area to serve a single customer – a remote Berkeley University research facility. Using solar power and battery system, the Sagehen microgrid enables the company to de-energize the aged feeder line during the summer season, thus pacing its natural degradation and reducing the risk of forest fires.

Across these projects and programs, Empire's team members are tackling some of the most pressing issues in the electricity sector today and are among the nation's leaders in advancing this work in the lower-density rural parts of the country. The Project Team is confident that the DOE’s approval of Project DA would be seen as a significant vote of confidence of the company’s direction, resulting in the expansion of the scope of this innovative work that Empire balances with its core mandate of maintaining and improving safe, reliable, and economic operation of the electricity system that serves some of the most economically vulnerable communities in the Unites States.

4.3 Key Team Member Time Commitments

Should Empire be successful in securing the requested grant award, the company will immediately proceed with planning and organizational management tasks required to ensure that the key project team members have sufficient capacity to make Project DA’s success their key priority. At this juncture, Empire expects the Project Manager, Mr. McGarrah , and the Project Planning Leads – East and West (Ms. Nixon and Mr. Clements) to be seconded to the project on a full time basis for at least the first annual Performance Period, and have availability buffer of no less than 50% for the remainder of the project. To accomplish this, these individuals’ core roles would be underfilled with a combination of internal and external staffing augmentation. The company also expects that Mr. Pingleton (Community Engagement and Economic Development Lead), will dedicate no less than 30% of his capacity to the tasks and priorities outlined in the Community Development Plan. The remaining team members will be expected to spend between 5%-25% of their regular annual working hours dedicated to Project DA.

4.4 Project Team’s Existing Equipment and Facilities

As a vertically integrated electric utility operating across four States, Empire possesses the fleet, facilities, and IT and OT (OMS, SCADA, CYME Connectivity) infrastructure required to support the project in its planning, design and execution phases. Empire operates 12 operating centers across its electric service territory, which can accommodate the project team’s requirements in terms of training, workshop and meeting space, staging and warehousing (See Figure 3).

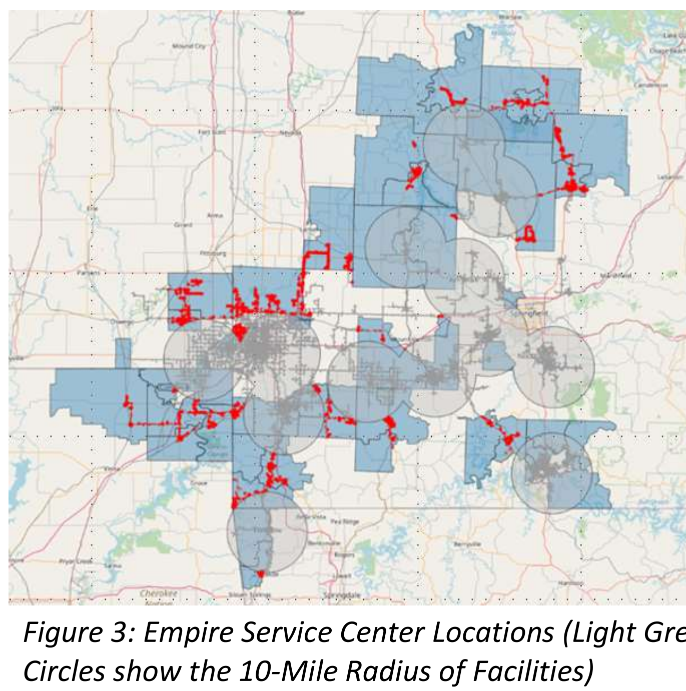

Figure 3: Empire Service Center Locations (Light Grey Circles show the 10-Mile Radius of Facilities)

Empire also has access to a cadre of internal supply chain professionals and industry leading market intelligence and supplier management tools and services. Empire typically prefers for the EPC contractors to be involved in planning and procuring the materials for their project delivery. However, in doing so the companies can exercise Empire’s buying power as an affiliate of 20+ other Liberty Utilities electric, gas and water companies across the United States.

Equipment and machinery required for Empire's distribution construction or maintenance projects is sourced in accordance with company's standard practices and involves either use of the company's internal fleet units, or rental of specialized equipment and purchase of smaller implements as needed. The types of equipment expected to be used in project DA includes: light duty vehicles (supervisory and crew transportation); bucket trucks; dump trucks (for access road construction); cranes and excavators; line stringing machinery; digger derricks (with augers or core barrels depending on terrain); vegetation clearing and mulching equipment; standard safety implements to accommodate live line work,.

The company obtains access to the majority of this specialized equipment through its EPC contractors, who supply it along with construction labor and other service. Because the project's scope of construction work involves the types of activities that Empire conducts on a regular basis, the company is confident that it will have no difficulties obtaining necessary equipment or the associated services. Moreover, and subject to the standards and operating practices update exercises to incorporate Smart Grid devices, the company is confident that its existing policies, practices, and equipment access are sufficiently robust to secure a positive project outcome. Empire also owns and operates all the distribution line and station infrastructure subject to planned renewal and enhancement work and owns easement rights that will permit it to access the areas. Finally, the company's Environment and Compliance professionals will be available to conduct detailed assessments as required and coordinate the obtaining of necessary permits.

5. Additional Comments Pertaining to Application Requirements

Duplicative Funding
Empire confirms that it is not a recipient of any active awards of other federal funds that would be duplicative or overlapping of the funds requested from the DOE in this application

The ODIN Reliability Reporting Initiative
Having learned of the ODIN program through the review of the GRIP Program FOA, Empire has carefully reviewed the information available on the initiative and has reached out to the organizers to learn more. Moreover, the company currently finds itself amidst an Outage Management System (OMS) upgrade project that will deploy a platform that supports the ODIN initiative. Considering this fact, the company has also reached out to its vendor to learn more about the logistical steps associated with this initiative, and its congruence with the current and future states of Empire's outage data collection and reporting processes. Empire expects to evaluate the net benefit of participation in the ODIN program after the ongoing upgrades to the OMS baseline AMI functionalities are fully integrated.

This concludes the technical volume of Empire's submission for Project DA. The company thanks the DOE for its time in reviewing its application package and looks forward to the completion of the grant application review process.