Cover Page – TA2-214-E

Project Title: Smart Grid Manholes and Vault Monitoring	
Funding Opportunity: BIL – Grid Resilience and Innovation Partnerships (GRIP)	
Funding Opportunity Number: DE-FOA-0002740	
Topic Area 2: Smart Grid Grants (40107)	
Prime Applicant: Florida Power and Light	**Entity Type**: For-profit
Technical Contact: Benny Pazhayattil Rick Teigland	Email: Benny.pazhayattil@fpl.com; Rick.Teigland@fpl.com Phone: 561-339-2797; 941-316-6298
Business Contact: Ron Critelli	Email: Ron.Critelli@fpl.com Phone: 561-904-3473
Team Member Organizations: Senior/Key Personnel • Florida Power & Light (FPL) - Rick Teigland (Manager Grid Automation) • Eaton – Clarke Clingenpeel (VP) • CNIGuard - Jens Sterum (VP) • Sentient Energy – Bob Karschnia (CEO) • Florida International University – Dr. Arif Sarwat	
Project Location(s): • The planned deployment for this project will be in various locations across FPL's service area.	
Confidentiality Statement: N/A	

1 Project Overview

1.A Background and Introduction

Florida Power & Light (FPL) is a rate-regulated electric utility engaged primarily in the generation, transmission, distribution, and sale of electric energy in Florida. FPL is the largest electric utility in the state of Florida and one of the largest electric utilities in the U.S. The company has more than 28,000 MW of generating capacity, approximately 86,000 circuit miles of transmission and distribution lines, and over 830 substations. FPL provides service to its electric customers through integrated transmission and distribution systems that link its generation facilities to its customers.

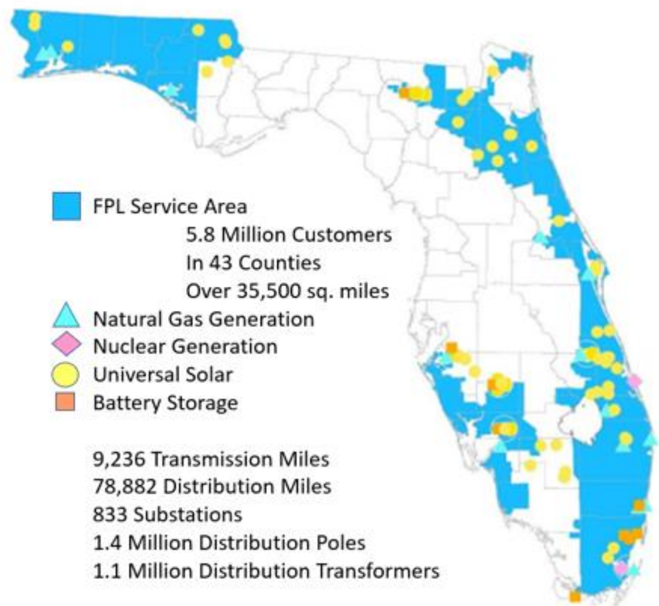


Figure 1: Florida Power & Light Service Area

Commitment to Continuous Improvement of Grid Resiliency. Since 2010, through its Storm Hardening and Storm Protection Programs, FPL has invested more than $2.8 billion to build a more resilient and hardened transmission and distribution grid. These programs include extensive transmission wood pole replacement, substation hardening and flood monitoring, distribution feeder hardening, distribution lateral undergrounding, vegetation management, and in-depth system inspection programs. Going forward, FPL is committed to extending and accelerating these programs with significant additional investments in projects related to grid resiliency, reliability, and grid-edge technology enhancement. These programs are extremely important to achieving FPL's increased resiliency and reduction of total restoration time following major storms and extreme events, while continuing to maintain 1st quartile reliability performance in terms of System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI).

Grid Resiliency Challenges to be Addressed by this Project. Remote monitoring of vaults is not currently a standard utility industry practice. Many vaults have several primary feeder circuits that terminate at switches. These circuits continue to other manhole and vault locations. During outage events, identifying which underground circuit has the damaging fault is time consuming. Providing remote monitoring of these circuits at the switch will identify which switch can be used to isolate the problem, reducing the time to identify the section of cable needing repair. Manholes are underground facilities containing multiple submersible primary feeder circuits that can have a significant impact in outage restoration. Due to the nature of underground facilities, the time to perform fault location and failed equipment identification is greatly

increased compared to the same activities performed for overhead electrical facilities. Additionally, certain manhole locations in FPL's service area, such as the Central Dade area, are constantly flooded throughout the year due to the high-water table causing additional delays due to additional water pumping activities.
Failures to underground electrical infrastructure are typically much lower in count than failures of the overhead system, but a vault transformer failure can be catastrophic requiring a long restoration, and duct cable failures in or between manholes are difficult to locate.

The proposed **Smart Grid Manholes and Vault Monitoring project (MVMP)** will significantly lower the frequency and duration of outages at these locations through the integration of fault locators and manhole monitors in more than 600 vaults and 800 manholes. These Smart Grid monitoring enhancements will also extend the life of underground transformers, enable timely conditional-based maintenance for underground infrastructure, and enable rapid prioritization of outage recovery efforts through real-time monitoring of assets.

Vault Transformer Failures	
Year	**N**
2020	369
2021	366
2022	359

Figure 2 Vault Transformer Failure History

Cable in Duct Failures				
Year	**N (No CI)**	**N (w/ CI)**	**CI**	**CMI**
2020	20	26	18,822	767,986
2021	23	21	9,646	449,139
2022	11	11	11,287	642,245

Figure 3 Cable in Duct (Manhole) Failure History

1.B Project Goal

FPL will implement the **Smart Grid Manhole and Vault Monitoring Project (MVMP**) to accelerate and enhance ongoing resiliency programs to minimize grid impacts from major storms and other environmental events. The MVMP project will significantly improve infrastructure situational awareness through advanced equipment health telemetry and predictive failure analysis.

Specific MVMP technical milestones will include:

- Installation of 370 vault monitoring systems in vaults serving critical infrastructure
- Installation of 600 vault Fault Current Indicators (FCIs) in vaults with manual feeder switches
- Installation of 872 manhole monitoring systems

Resulting MVMP outcomes will include:

- Improved situational awareness to help prevent the likelihood of catastrophic failures due to compromised underground infrastructure
- Reduction in the time to locate faults in a complicated underground system
- Reduced risk for extended outages when system redundancy is impacted
- More efficient and timely system maintenance through condition-based scheduling
- Provide a replicable model of smart grid enhancements for underground infrastructure
- Enhanced system resiliency in Disadvantaged Communities (DACs)

1.C DOE Impact

FPL seeks $30 million in DOE grant funding through the Grid Resiliency and Innovation Partnerships (GRIP) program to accelerate FPL's ongoing investments in projects related to grid resiliency and reliability, and smart grid technology enhancements. Specifically, DOE funding will enable FPL to accelerate deployment of the planned vault and manhole monitoring solutions. FPL has successfully leveraged past federal funding awards through the Smart Grid Investment Grant under the American Recovery and Reinvestment Act of 2009. Through Energy Smart Florida (ESF), FPL installed state-of-the-art smart grid technologies, including smart meters, to improve service to its customers. ESF was an overall investment of $800 million with $200 million cost-share from the U.S. Department of Energy. This investment enabled FPL to accelerate the deployment of smart meters and deploy 7 different new technology devices on the distribution grid related to situational awareness and self-healing capabilities that have now been broadly adopted. Similarly, under the proposed GRIP project, FPL will leverage DOE grant funding to accelerate a widescale deployment of the enhanced vault and manhole monitoring solutions throughout its service territory, including in many areas designated as Disadvantaged Communities (DAC). The proposed project will also reduce the technical and market barriers associated with these technologies and will provide the analyses necessary to promote widespread adoption of these solutions within the utility sector.

With DOE funding, FPL will install 370 vaults monitors over a reduced timespan of three years and be able to complete the 600 vault FCI's across the same three-year period. Accelerated installation of the vault monitors will also increase the pace at which critical data is made available to FPL's Smart Grid advanced analytics system, assisting in fault location calculations, power quality analysis, and predictive equipment replacements to avoid and reduce outage times.

DOE funding for the manhole monitoring activities will also have a significant impact on the industry. As there is an increase in converting the existing overhead electric systems to an underground system across the utility industry, the need for a device that can quickly and reliably detect and communicate fault location via technology will become critical. FPL sees this innovative technology as the quickest and most reliable way to identify fault locations occurring on underground cables.

1.D Community Benefits Plan: Job Quality and Equity

Working with community leadership and stakeholder groups, FPL will develop a Community Benefits Agreement specific to this project with each impacted community prior to project initiation. This agreement will formalize FPL's commitment towards achieving specific positive community impacts and minimizing any negative impacts. FPL will collaborate with the International Brotherhood of Electrical Workers (IBEW) and the building trades on project deliverables to ensure its workforce remains aligned, collaborative, and supportive in a manner that enhances access to quality jobs.

FPL works tirelessly to build a diverse pipeline of talent for energy jobs across its service area, including jobs in engineering and within the trades to support project execution and facility operations. FPL has a long and successful history of collaborating with its community and labor partners to provide access to skilled jobs in the clean energy sector.

Planned Activities and Outcomes

Engagement	Workforce	DEIA	Justice40
- Conduct community engagement forums and programs to educate stakeholders on project planning, progress, and impacts and facilitate broad community support. - Collaborate with community leaders and social services agencies to conduct outreach to low- and middle-income neighborhoods in the host communities. - Engage with programs to promote the development of local and regional small businesses and to target minorities, women, and chronically poor communities to promote and subsidize enrollment in technical training programs. - Foster meaningful engagement whereby community concerns and negative project impacts are resolved, and measures are established to mitigate reoccurrence.	- Support a collaborative, clean energy technology curriculum development with Palm Beach State College, Miami Dade College, and Broward College. - Support hiring outreach programs targeting minorities, women, and chronically poor communities to promote and subsidize enrollment in technical training programs. - Engage with Small Business Associations, Chambers of Commerce, and other small business groups to promote the development of local and regional small businesses to serve the clean energy sector.	- Provision of technical and financial support for STEM programs to prepare local and regional youth to enter technical career paths or pursue higher learning in STEM fields. - Establish small business incubators that can leverage local and regional talent and funds to develop new businesses that can serve the needs of the clean energy industry. - Development of performance indicators to establish metrics to allow FPL and the host communities to monitor and track progress towards engagement goals.	- Reduce the impact on home, business, and communities with better use and fault detection of underground electrical infrastructure leading to fewer power outages and disruptions. - Increase in high-quality job creation, the energy job pipeline, and job training for individuals with significant in workforce education and training. - Increase in energy resilience including the reduction of outage frequency and/or duration.

Figure 4 Planned activities and outcomes

1.E Potential Long-Term Constraints on Resources and/or Clean-up Strategy

The installation of the equipment for the MVMP project will be in existing vaults and manholes across the FPL electric grid system. The project will not require any excavation or construction that would have an impact on the environment. This skilled work requires the installation of sensors and the mounting of equipment in and around electrically energized facilities, which will be provided by FPL line crews or contractors. Configuring and commissioning of the equipment will be a combination of on-site and remote programming typically performed by engineers or other technicians.

1.F Climate Resiliency Strategy

As a leader in storm hardening and resiliency for more than 15 years, FPL has shown the willingness and ability to invest and build an electric grid that addresses extreme weather patterns such as those produced by hurricanes, tornadoes, temperature, flooding, and wildfires. The next step in that process is the undergrounding of much of the electric grid, and the MVMP project will provide additional knowledge, experience, and support associated with the type of flexibility and visibility that is currently available on the overhead system to that environment.

In May of 2019, the State of Florida Legislature passed SB 796, legislation that was signed by the Governor in June of the same year, which established the Public Utility Storm Protection Plan. The legislation required that public utilities Storm Protection Plans include resiliency plans that would harden the overhead electric system and underground certain facilities to combat environmental conditions that impact the electric grid and create extended outages for customers. The Storm Protection Plans improve resiliency and reliability by reducing customer outages and costs associated with restoration following major events. FPL filed its initial Storm Protection Plan in 2020.

As recent weather patterns have produced varying temperatures, understanding the loading of FPL's vault transformers is especially important as customers increase their use of electricity for items such as electric vehicle charging. The influx of electric vehicles and other Distributed Energy Resource (DER) technologies, such as roof top solar panels, to the grid will significantly impact system loading and change the way the electric grid is operated and maintained. The sensors to be deployed as part of the Vault monitor project will give the company accurate data of its summer and winter peak loading in the areas served by vault transformers. A better understanding of loads, load flow, and equipment status will provide additional flexibility to perform switching during restoration events to either eliminate outages or reduce the time of restoration when outages do occur.

FPL's goal is to build a resilient electric grid at every level that will withstand storms and other environmental impacts, providing our customers with superior reliability and service. The MVMP project supports this goal, and the DOE funding will enable a more rapid deployment of the vault monitors, vault FCIs, and the manhole sensors.

2 Technical Description, Innovation, and Impact

2.A Relevance and Outcomes

Enhanced Vault Monitoring. Vaults contain critical electrical equipment such as transformers, throwover switches, and feeder circuit switches located in customer-owned commercial/industrial locations. FPL plans to install 370 Vault Monitors to implement automated remote monitoring of transformer health, throwover switches, and condition of the vault itself. This includes 114 Top Critical Infrastructure (CIF) customers. Top CIF customers include community hospitals, police stations, fire stations, water treatment facilities, community emergency operations centers, and high-density residential complexes such as high-rise condominiums with thousands of residents. Vault Monitors include discrete sensors that monitor equipment health and aggregate the data into FPL's data analytics platform. FPL also plans to install Fault Current Indicators (FCIs) on the underground cables connecting to feeder switches in the Vaults. The FCIs use cellular communication technology and will provide the ability to segment the feeder circuits and have remote visibility when an outage has occurred and will reduce the time to patrol and find the fault by 10-20% on average. In addition, the FCIs provide advanced monitoring of load, faults, and disturbances to enable greater situational awareness, preventing outages due to normal equipment failure modes, improving grid resilience, and reliability. In addition, the Vault Monitor data will be aggregated into FPL's Smart Grid advanced analytics system. FPL's Smart Grid advanced analytics reduces the outage duration and outage frequency for its customers by using fault locators, automated switches, and other smart devices. This system will aggregate different Smart Grid sensors to assist in fault location calculations, power quality analysis, and predictive equipment replacements before failures occur.

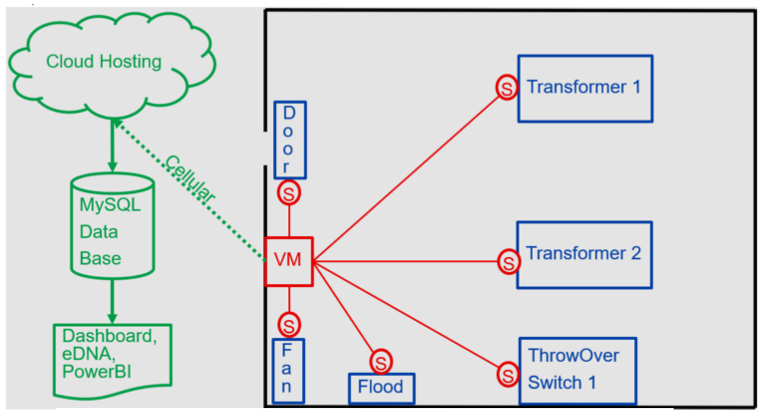


Figure 5 Vault Monitor Block Diagram

By providing real-time situational awareness to operators, these vault monitors will enable FPL to better track loading during winter and summer months, as well as the overall health of its transformers, and will contribute directly to reducing unplanned outages, particularly during extreme weather events. Figure 5 provides a high-level block diagram for the proposed Vault Monitor system to be installed. The blocks in blue represent common equipment found in FPL vaults. The items in red represent the main monitor and individual sensors that will be installed within the vault. The green items represent the communication pathway and endpoint data analytics for users.

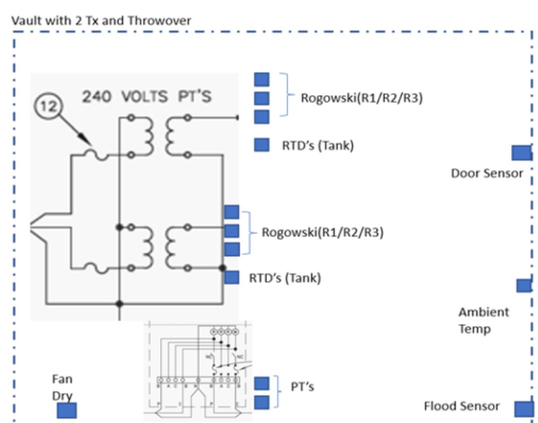


Figure 6 Vault Monitor Sensor Equipment

Figure 6 provides an example of the sensor equipment that will be installed. The Vault Monitor transformer sensor package will be able to monitor currents (via Rogowski coil to make installation easy), voltages (via potential transformers), oil temperature (via Resistance Temperature Detector), and hydrogen. These transformer sensors will provide a holistic health assessment of the vault transformer health. The fan and ambient temperature sensors will work together to indicate whether the vault room has the proper air flow. The door sensor will notify FPL if unauthorized access to the vault has occurred.

The presence of hydrogen in transformer oil has been used as an early indicator for transformer health in the industry for a very long time. For the first time, FPL will be tracking vault transformer health via an H_2 sensor. The H_2 sensor will also provide oil temperature and moisture level within the oil inside the transformer, see Figure 7, which are critical indicators for leaks and transformer load, respectively. FPL uses Dissolved Gas Analysis (DGA) to assess the health of large substation transformers and is the industry standard in transformer asset management. This project aims to bring this technology into the medium voltage vault space which will help to prevent transformer failures for Critical Infrastructure customers.

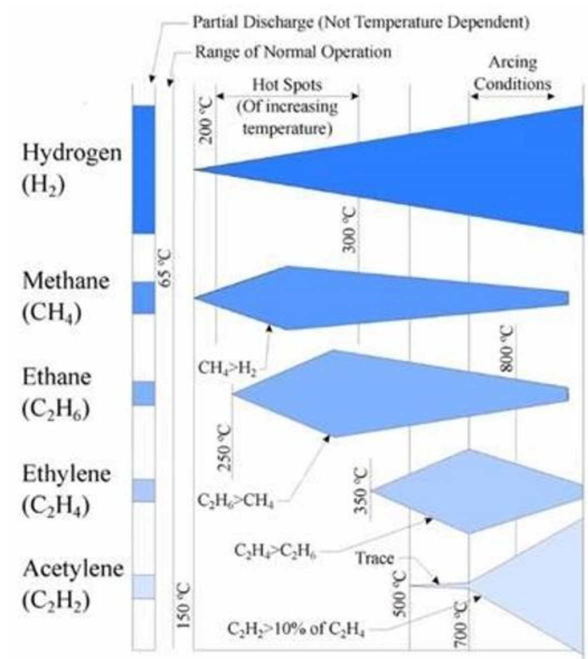


Figure 7 Presence of Hydrogen as temperature increases

As shown in Figure 8, transformers were the leading cause (~50%) of failures inside of vaults. One of main goals of the vault monitor is to reduce the number of transformer failures in vaults.

Sum of N	Year					
Equip	2018	2019	2020	2021	2022	Grand Total
Transformer	301	335	369	366	359	1,730
	325	354	293	219	189	1,380
Other Equipment	98	128	82	55	33	396
Fuse Switch	72	87	61	67	39	326
Cable	71	63	55	60	56	305
Connector	54	42	54	33	43	226
RA Switch	11	11	44	33	18	117
Pothead	34	14	14	20	13	95
Mech for Throwover	8	6	7	40	19	80

Figure 8 A breakdown of cause of failure inside vaults from 2018 to 2022 (The blank row represents instances where the fault cause was not recorded and is considered a proportionate distribution across causes)

Here is an overall summary of the analytics design (sensors data and their strategic necessity):

1. Transformer:
    a. Transformer oil temperature rises when there is excessive current passing through the windings (result of high harmonics from the load side, and the presence of zero sequences current, different categories of fault currents also create momentary overload in raising the winding temperature).

   b. Oil quality in the transformer can be measured with chemical sensors for discharged gas (H2 is a great predictor of faulty transformers as shown in Figure 8).
   c. Rogowski coils on the terminals for measuring the current through each winding will also capture the fault-related notches.
   d. Internal faults within the transformer are also predictable with gas sensors.
2. Throwover switches: Throwover Switch position is important to know which circuit the customer is served from.
3. Fan: Ventilation is critical to monitor to control the temperature in the vault.
4. Flood sensors: Water may enter the vault from the louvered doors and can damage equipment or cause a short circuit. The flood condition inside the vault is measurable by level sensors strategically positioned at different heights.
   Ambient temperature: This is measured by a temperature sensor inside the vault. This will give insight on malfunctioning ventilation fans.

Enhanced Manhole Monitoring. FPL proposes to install 872 Manhole Monitors that will reduce equipment repair times through new technology combining cellular communication and advanced fault current indicators. The CNIGuard Sentir Manhole Monitor is the first product that can monitor both Paper-In-Lead Cable (PILC) and Polymer (EPR/XLPE) cable and transmit this information without local vehicle presence. Existing manhole fault current indicator technology requires a vehicle to be near the manhole to receive cable fault data. The new Manhole Monitor technology will enable faster fault location detection and remote diagnostic data interrogation. Its modular design will enable the company to update equipment as technology changes. This new technology will bring similar reliability benefits found in Overhead Fault Current Indicators to challenging environments in underground manholes. Figure 9 shows the Sentir SX2.1 Manhole Monitor product from CNIGuard.

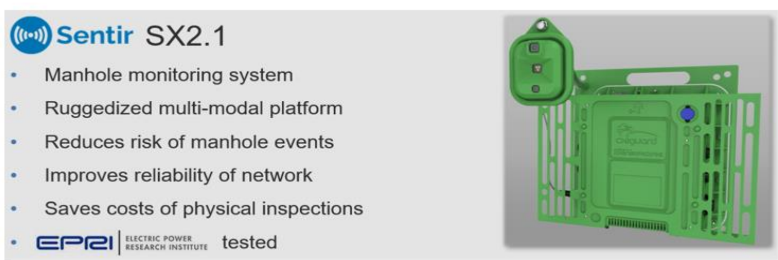


Figure 9 CNIGuard Sentir Manhole Monitor Hardware Platform

Figure 10 provides an example fault scenario and shows the difference in the cable search area (highlighted in red) between the Standard Manhole System and the Enhanced Manhole System with the new Manhole

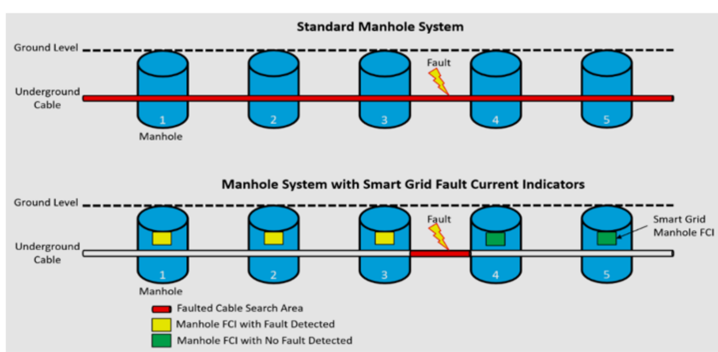


Figure 10 Standard Manhole System vs Proposed Manhole System with Fault

Fault Current Indicator. In the Standard Manhole System configuration, the Fault Cable Search area is the entire underground cable length between all 5 manholes, necessitating dewatering and manual inspection of all 5 locations to locate the damaged section between Manhole 3 and 4. In the case of the Enhanced Manhole System, all manholes are equipped with Manhole Fault Current Indicator devices and the Fault Cable Search area is narrowed to the cable length between Manhole 3 and 4.

The principle of fault indicator is as follows:

1. Faulted circuit indicators attach to a conductor, measure the magnetic field, and display an indication of a fault when measurements fall outside normal parameters.
2. When a fault occurs downstream of an FCI, the current through the conductor increases and the FCI senses the increased magnetic field.
3. If the increase in the magnetic field is high enough, the FCI displays a visible indication such as a bright red shape or a lit LED. However, if the fault happens upstream from the device, it doesn't see the overcurrent, and no visual indication appears.
4. By looking at the different FCIs on a circuit, linemen can narrow down the fault location, reduce patrol time, and speed up restoration.

2.B Feasibility

All 3 of the MVMP devices will be installed in existing facilities, either inside a vault or inside a manhole. Rapid deployment of these devices is possible since no new land will be impacted by construction and permits will be minimal and needed only for some road lane closures to provide access to the manholes.

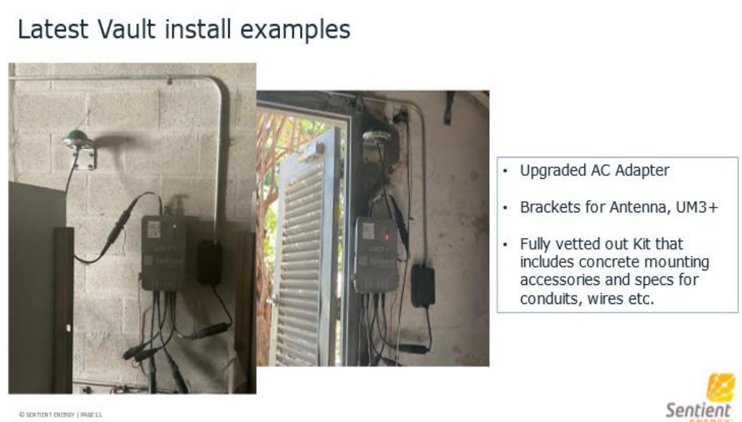


Figure 11 Initial Vault installed Fault Current Indicator

Initial deployment for the new Vault Monitor will begin in the second half of 2023 with bulk deployments to continue in Q1 2024. Once initial deployment is done, training videos can be made to ensure the mass deployment will be efficient. The sensors are "off the shelf" components that have been in the industry for an exceptionally long time with 100s of manufacturers to choose from. This reduces any impact for our supply chain to source the sensors needed for the Vault monitor project. Since the monitor is also a readily available product, supply chain issues will have minimal impact on project execution.

Initial deployment of Sentient's underground FCI began in 2019 for URD cabinet switch gear. The modified design for installation in vaults was piloted successfully in 20 vaults in December 2022 through January 2023, with pictures shown in Figure 11. An additional 10-20 vault locations will be installed in 2023. With DOE funding, this will increase to 200 vault FCI installations per year beginning in 2024 through 2026. Therefore, at this time, there is no technology or implementation risk associated with this proposed project. From the back-end software side, FPL has been using Ample – Grid Analytics System for over a decade. There is a large user base across various functions who rely on the data from this software platform to efficiently run grid operations activities.

Initial deployment for the new Manhole Monitor Fault Current Indicator will begin in the second half of 2023 with bulk deployments estimated to start in Q1 2024. Two early-stage units for this new device type have already been installed and placed in-service at FPL since June 2022. One of these devices has already detected an abnormal event proving out the viability of construction, commissioning, and remote functionality for this new product concept. Figure 12 below shows one of these devices located in downtown Miami.

Figure 12 Early-Stage Manhole Monitor Fault Current

2.C Innovation and Impacts

2.C.1 Innovation and Overall Impacts

Vaults are generally part of the last segment of the electric grid that connects the customer to the grid. Yet, it is a part of the grid that is not monitored. FPL intends to change this philosophy by using off-the-shelf and proven technology.

The incumbent solution for identifying faults in the duct and manhole underground system is a time-consuming manual process. This becomes even more troublesome and a safety concern under inclement weather conditions. Having remote visibility will minimize the safety risk and make the fault-finding process efficient. Following are key innovative aspects of Sentient's UM3+ vault solution:

- High precision and accuracy sensors with continuous monitoring.
- Flexibility to plug and play sensors to monitor 3-6-9-12 phases.
- Flexibility on cable lengths from 8ft. to 50ft. to support installs in space constrained vaults to large vaults.

- Easily integrated within the existing vault space with no need to disturb existing connections or take a customer outage
- Completely remotely programmable sensors with no need for field trips to change setup or calibrate devices.
- Highly scalable Ample – Grid Analytics System to support 50K+ sensors along with out of the box integration with ADMS, SCADA and other systems.
- Field proven product with over 50 million hours of field time.
- Successful pilot of 20+ vault locations.

Additionally, Sentient Energy is innovating further on this UM3+ platform to commercialize a submersible version. A submersible version of the solution can be applied in a “Manhole” location where all components of hardware will likely be submerged most of the time year-round if not all the time. This may provide an additional option along with the CNIGuard solution.

FPL will leverage FIU’s expertise in data and analytics shown in Figure 13 for the MVMP project.

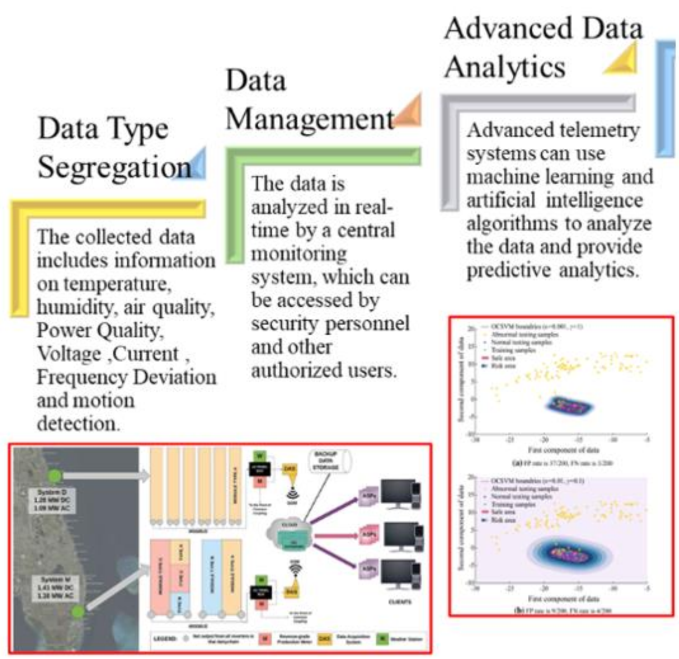


Figure 13 Key areas of focus for this project

<u>Data Type Segregation</u>: The vault monitoring system collects data on temperature, voltage, current, and motion detection. The data is segregated based on the type of information being collected. Segregating the data makes it easier to manage and analyze, allowing for effective decision-making and response to incidents. This ensures the safety and security of valuable assets in the vault.

<u>Data Management:</u> The collected data is analyzed in real-time by a central monitoring system. Real-time analysis allows for quick identification of any issues or anomalies within the vault, allowing for rapid response to any potential threats. The central monitoring system also allows for data management, including the organization, storage, and retrieval of data. This helps to ensure that the data collected is effectively managed and can be easily accessed when needed. Overall, the central monitoring system is a critical component of a vault monitoring system, providing real-time analysis and data management to ensure the safety and security of valuable assets.

<u>Advanced Data Analytics:</u> Machine learning algorithms such as decision tree, random forest, support vector machine, and neural network algorithms are used in advanced telemetry systems to analyze data collected from sensors and devices within the vault. These algorithms help identify patterns and relationships in the data and provide predictive analytics, allowing

for proactive maintenance and response to potential issues. Decision tree algorithm recursively partitions data, random forest combines multiple decision trees, support vector machine finds the optimal boundary that separates different classes, and neural network simulates the function of the human brain. By using these algorithms, the vault monitoring system can predict future events or issues, identify anomalies, and minimize the impact of potential problems. Advanced data analytics with machine learning algorithms is a powerful tool for optimizing the performance and reliability of a vault monitoring system.

2.C.2 Alignment with State, Local, Tribal, Regional, and National Goals

FPL is committed to continuous improvement of grid resilience and has invested significantly in Smart Grid, undergrounding and other grid modernization projects over the past decade. The MVMP project will expand and accelerate FPL's efforts to improve service reliability and system resilience across its service area.

MVMP Impacts on Community and Regional Resilience. Recent planning for undergrounding and line hardening in this region has been accelerated in the wake of major storm events impacting the electric grid. In 2022, Hurricane Ian made landfall as a Category 4 storm knocking out power to approximately 2.2 million customers (more than 38% of FPL customers) leading to an 8-day restoration of 100% of customers that could receive power, further emphasizing the need for the acceleration of FPL's proactive asset hardening and overhead to underground conversion programs. DOE funding will support expansion and acceleration of these plans to expedite the transition to underground lines and upgrading of underground infrastructure through the SULP project; all of which will contribute directly to enhanced local and regional resilience.

MVMP Impacts on Tribal Resiliency. The company's Tribal/Indigenous relations staff supports all FPL projects, including wind, solar, battery energy storage, electric transmission, and natural gas infrastructure. The team works proactively with Tribes to avoid and resolve issues, support Tribal economic and community needs, educate internal personnel and consultants, and help support Tribes' energy development interests. Issue avoidance and resolution is achieved by early, direct Tribal outreach on all projects under development, both for projects on private land where Tribal outreach is voluntary and on projects with a regulatory requirement for Tribal outreach. Staff coordination is conducted with respect and sensitivity to each Tribe's cultural concerns or needs. In 2021, NextEra Energy, FPL's parent company, created a scholarship program for Native American youth, administered by the American Indian Graduate Center. Fifteen scholarships are awarded annually to qualified students in energy, environmental, and cultural resource disciplines. Internal education for FPL's development, environmental and construction teams is vital to its efforts to build strong collaborative relationships with Tribes.

2.C.3 Impact on Reducing Perceived Risk, Further Deployment, and Private Investment

FPL will leverage DOE grant funding to accelerate a widescale deployment of the enhanced vault and manhole monitoring solutions throughout its service territory, including in many areas designated as Disadvantaged Communities (DAC). The proposed project will also reduce the technical and market barriers associated with these technologies and will provide the analyses necessary to promote widespread adoption of these solutions within the utility sector.

The Enhanced Vault Monitoring system uses proven technology widely used in the industry for above-ground substations and transformers. FPL seeks to use this same technology with an innovative approach for improving the resiliency of its underground infrastructure. The approach can be replicated industry-wide since there are no supply chain or technical barriers to adoption. There are many manufacturers for the sensors and monitors that will be incorporated into the enhanced vault monitoring system. System data connectivity can be achieved via cellular, fiber, or radio. This technology flexibility creates a pathway to wider market adoption, and FPL's project will provide a scalable and replicable Smart Grid solution for improved grid resiliency.

The Manhole Monitor Fault Current Indicator device will introduce new technology to the industry by providing a platform that can monitor two distinct types of underground cable while providing remote telemetry for faulted conductor sections. Development risk is mitigated by using the existing Sentir Manhole Monitor platform, which already has over 10,000+ installations, including many for large investor-owned utilities. The combination of technologies utilized in this deployment will encourage the industry to adopt advanced Smart Grid solutions and will enable remote health telemetry for the rapidly expanding underground electrical infrastructure nationwide.

2.C.4 Encouraging and Facilitating Smart Grid Priorities

As shown in Section 2.A Figure 9, faulty transformers were the leading cause of outages inside of vaults. By using an array of sensors, especially the Hydrogen sensor, we can mitigate the risk of an outage. All sensors used for monitoring the vault have 100s of manufacturers. The data path can be cellular, fiber, or radio depending on the utility's preference.

As FPL hardens our electric grid by moving it underground, FPL has been able to decrease the frequency of the outages. The challenge now is to reduce the outage duration since it is harder to see a fault underground versus on an overhead cable. The manhole monitor intends to identify faulty cable and send a signal to the control center to dispatch crews accordingly. The DOE funding will advance the adoption of this technology since other utilities are also moving parts of their grid underground.

Integration of the technology within existing SCADA and smart grid systems will provide accurate visibility into the vault and manhole electric systems, providing additional operational flexibility when it comes to system operations and dealing with the impacts of environmental conditions. A better understanding of loads, load flow, and equipment status will provide additional flexibility to perform switching during restoration events to either eliminate outages or reduce the time of restoration when outages do occur.

2.C.5 Enhancing System Flexibility to Meet Program Objectives

Implementation of the MVMP project puts technology close to or at the grid-edge at a customer's vault. The sensors in the vault will not only identify conditions, but also the severity of the condition. This provides flexibility so that limited, specialized resources can be assigned to the highest priority issues, including a planned replacement of a customer's transformer or equipment as needed.

The vault and manhole FCIs provide fault data for specific sections of underground directly into outage management system for determining the best switching options to the Control Center. This provides flexibility to the Control Center for limiting the amount of time and limiting the number of customers that need to be out during a repair.

Accurate visibility into the system also provides additional operational flexibility when it comes to system operations and dealing with the system impacts driven by weather, customer load, or unexpected events. A better understanding of loads, load flow, and equipment status will provide additional flexibility to perform switching during restoration events to either eliminate outages or reduce the time of restoration when outages do occur. The MVMP project is focused on providing better visibility of resources, to create a flexibility and responses system.

The MVMP project activities directly address DOE's Smart Grid objectives related to deployment of innovative technology solutions that flexibility, efficiency, reliability, and resilience of the electric power system, prevent faults that may lead to extreme weather-related outages or other system disturbances, and facilitate the aggregation and integration (edge-computing) of grid-edge devices and electrified loads.

3 Workplan

3.A Project Objectives

The Smart Grid Manholes and Vault Monitoring program **(MVMP)** consists of the installation of three intelligent device solutions, which will be installed in existing vaults or a manholes. These devices will enhance existing assets with monitoring capability and will not be altering or repairing any public infrastructure. The project will install 370 vault monitors in critical vaults, 600 vault FCIs in all remaining vaults with manual feeder switches, and 872 manhole monitors. All products are designed in America. The complete solution of this equipment combined with the data flow into FPL's data analytics platform will contribute to reducing unplanned outages in the vaults and provide the ability to segment the feeder circuits and have remote visibility when an outage has occurred and can reduce the time to patrol and find the fault by up to 50%.

3.B Technical Scope Summary

The project will install 370 vault monitors in critical vaults, 600 vault FCIs in all remaining vaults with manual feeder switches, and 872 manhole monitors. The critical vault locations will include hospitals, police stations, schools, firehouses, and other critical infrastructure across FPL's service area focusing on disadvantaged communities. The enhanced vault monitoring system uses proven technology widely used in the industry for above-ground substations and transformers. FPL seeks to use this same technology with an innovative approach for improving the resiliency of its underground infrastructure.

Initial deployment for the new Vault Monitor will begin in the second half of 2023 with bulk deployments to continue in Q1 2024. Once initial deployment is done, training videos can be made to ensure the mass deployment will be efficient. The sensors are "off the shelf" components that have been in the industry for an exceptionally long time with 100s of manufacturers to choose from. This reduces any impact for FPL's supply chain to source the sensors needed for the Vault monitor project. Since the monitor is also a readily available product, supply chain issues will have minimal impact on annual goals.

Initial deployment of Sentient's underground Vault FCI began in late 2022 with 20 vaults completed by January 2023. An additional 10-20 vault locations will be installed in 2023. With DOE funding, this will increase to 200 vault FCI installations per year beginning in 2024 through 2026.

Initial deployment for the new Manhole Monitor Fault Current Indicator will begin in the second half of 2023 with bulk deployments estimated to start in Q1 2024. Two early-stage units for this new device type have already been installed and placed in-service at FPL since June 2022. One of these devices has already detected an abnormal event proving out the viability of construction, commissioning, and remote functionality for this new product concept.

3.C WBS and Task Description Summary

Task 1.0: Project Management and Planning

Subtask 1.1 – Project Management Plan (PMP):

Within 30 days of award, FPL will submit a Project Management Plan (PMP) to the designated Federal Project Officer (FPO) and not proceed beyond Task 1.0 until the PMP has been accepted by the FPO.

The PMP shall be revised and resubmitted as often as necessary, throughout the project, to capture any major/significant changes to the planned approach, budget, key personnel, and major resources.

FPL will manage and direct the project in accordance with the accepted PMP to meet all technical, schedule, and budget objectives and requirements. FPL will coordinate activities to effectively accomplish the work. FPL will ensure that project plans, results, and decisions are appropriately documented, and that project reporting and briefing requirements are satisfied.

Subtask 1.2: National Environmental Policy Act (NEPA) Compliance

As required, the Recipient shall provide the documentation necessary for NEPA compliance.

Subtask 1.3: Continuation Briefing(s):

FPL will brief DOE on a quarterly basis (or as agreed upon) to explain the plans, progress, and results of the technical effort. Internal, weekly, quarterly, semiannual, and annual reports and meetings will be key to the success of all key shareholders involved. Communication and reporting among teams will ensure both short-term and long-term challenges are met and overall success for MVMP. The briefing shall also describe performance relative to project success criteria, milestones, and the Go/No-Go Decision point that are documented in the Project Management Plan (PMP).

Task 2.0 - (Training and Bid)

Subtask 2.1 - Bid

Help documents will be prepared and sent to local contractors for bids. During this phase of the process, FPL will identify any part of the installation that is not clear. Understand the cost of installation.

Subtask 2.2 - Training

Once bids have been awarded, educating the contractors about the best work practices and safe work practices will be of high priority to have a smooth and safe deployment. Training will also include the use of the vendor software to verify sensors are working properly and the data is going all the way to the vendor portal.

Subtask 2.2.1 – Milestone Bid & Training Completion

Task 3.0 - Initial Deployment

An Initial Deployment is in place to verify contractors have been trained thoroughly, understand and mitigate any unforeseen supply chain roadblocks, optimize the process for mass deployment, get feedback from contractors for process improvement, and guide everyone involved to desirable outcomes.

Task 4.0 - Bulk Deployment

In this phase of the project, all questions have been addressed and the process streamlined for smooth and safe deployment.

Subtask 4.1 - Prioritization

Review list of planned vaults and manholes to determine priority, grouping geographically for more efficient deployment.

Subtask 4.2 - Site Inspection

Perform a site inspection to verify the specific equipment needed including the length of sensor cables and identify space for mounting equipment.

Subtask 4.3 - Order Materials

Some of the major materials have very long lead times and need to be ordered up to a year in advance. Quantities of regular materials can be ordered after the site inspection.

Subtask 4.4 - Create Work Request and Complete Design

Work Orders are used to capture the detailed design and specific materials and labor needed to complete the installation and provide a mechanism for proper approvals. The

Work Management System (WMS) allows for scheduling of the work to specific contractors for installation.

Subtask 4.5 - Release Material

All materials are requested through the WMS system and delivered to the required contractor's site for installation. Verification of dry storage is needed to ensure the electronics are protected prior to installation.

Subtask 4.6 - Complete Field Installations

Installations will take place at the specified vaults and manholes for each sensor type and ensuring the monitor is powered.

Subtask 4.6.1 – Milestone Device Installations

Subtask 4.7 - Provision and Commission Sensors into SCADA and other Systems

Some of the monitors can be configured remotely once communication is established. This will match the physical location to the specific monitors, so the back-office data systems are properly mapped.

Subtask 4.7.1 – Milestone Device Communication & System Integration

Subtask 4.8 - Develop Smart Grid Manhole and Vault Monitoring System

The key objectives for the analytics design is to enhance Smart Grid data analytics, to create the ability for rapid and focused fault isolation, to reduce repair times, and to improve critical infrastructure resilience.

Subtask 4.8.1 – Data Analytics Integration

Subtask 4.9 - Track Reliability Metrics

Implement Artificial Intelligence and Machine Learning tools to conduct analysis impacting disadvantaged communities' resiliency and reliability metrics.

Subtask 4.10 - K-12 STEM Classroom Makeover Grants

Grants provide transformational learning opportunities for Black students in a classroom setting. Funds are available to address needs in infrastructure, technology, or resources to advance the STEM curriculum and increase exposure of STEM education and careers to Black Students.

Subtask 4.11 - 4-8 FPL Energy Curriculum Integration

FPL's program will provide deeper understanding of energy concepts with a robust curriculum for fourth, fifth, and sixth grades covering energy standards in science, English language arts, and math. As a next step, FPL expects to expand the FPL Energy Curriculum Integration to seventh and eighth grades.

Subtask 4.12 - K-12 Innovative Technology School Sponsorship Program

FPL provides scholarship opportunities to reward FIRST® students whose experience has inspired their interest in an engineering or information management career.

Subtask 4.13 - Community Based Organization/STEM Enrichment Scholarships

FPL provides scholarship programs through the Southeastern Consortium for Minorities in Engineering (SECME), the American Association of Blacks in Energy (AABE), and the United Negro College Fund (UNCF).

3.D Milestone Summary

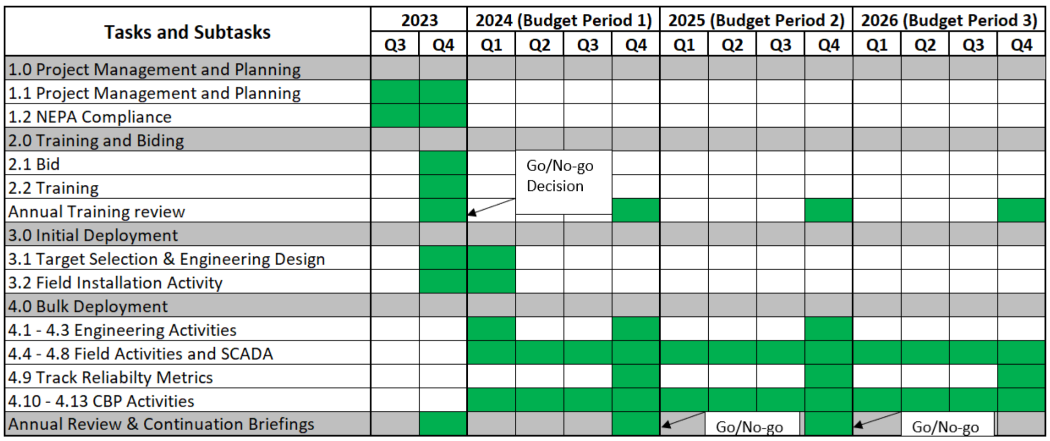


Figure 14 GANTT chart for FPL Vault Monitor and Manhole Monitor Project (MVMP)

The project will install 370 vault monitors in critical vaults, 600 vault FCIs in all remaining vaults with manual feeder switches, and 872 manhole monitors. The critical vault locations will include hospitals, police stations, schools, firehouses, and other critical infrastructure across our service territory focusing on disadvantaged communities. The initial deployment has a goal of 10 vault monitors, 10 manhole monitors with necessary vault FCI(s) by the end of Q1 2024. The goal of initial deployment is to understand and optimize coordination and processes as needed. Bulk deployment will start in the beginning of Q2 2024 and extend to the end of 2026.

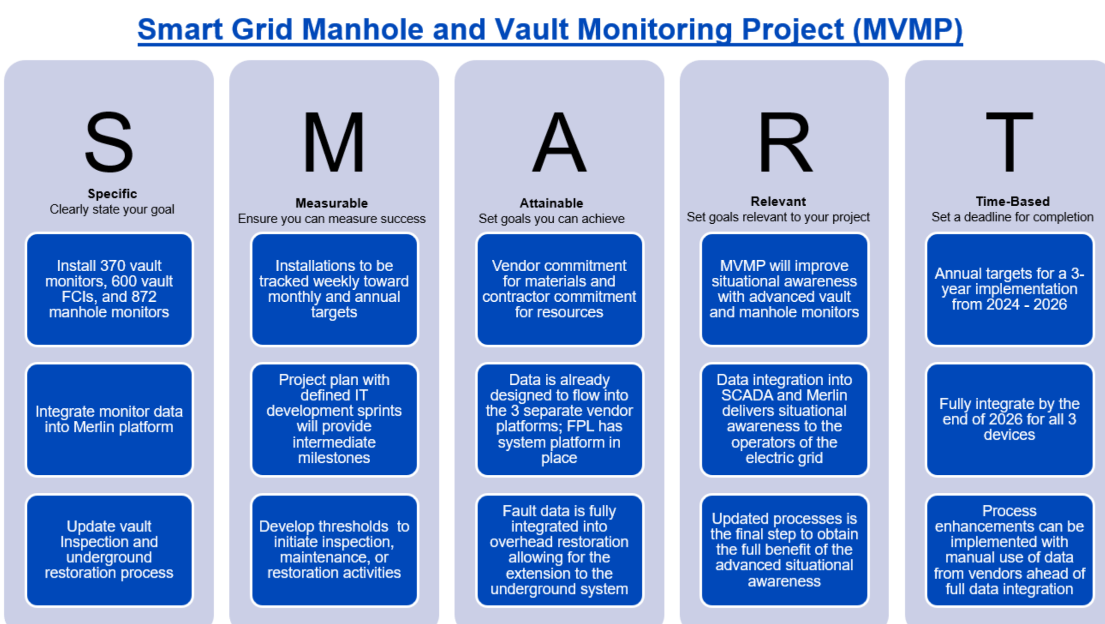
Budget Period, Schedule	WBS	Milestone	Means of Verification
2023	2.2.1	Bid & Training	A winning bid must be selected at this point. MVMP can only move forward with the help of qualified contractors. Training completed ahead of initial installations
BP1, 2024	4.6.1	Complete field installations	Vault Monitor - 115; Manhole Monitor - 146; Vault FCI - 200
	4.7.1	Provision and commission sensors into SCADA and other systems	Field devices communicating and system integration at 50%
BP2, 2025	4.6.1	Complete field installations	Vault Monitor - 145; Manhole Monitor - 363; Vault FCI - 200
	4.7.1	Provision and commission sensors into SCADA and other systems	Field devices communicating and system integration at 100%
BP3, 2026	4.6.1	Complete field installations	Vault Monitor - 110; Manhole Monitor - 363; Vault FCI - 200
	4.8.1	Data Analytics Integration	Incorporation of data is required to verify data quality to ensure future installation success.

3.E Go/No-Go Decision Points

Decision Points	Title	Criteria	Verification
Q4 2023	Training & Bid	Successful and complete bid process. Completion of Training procedures and training contractors.	A winning bid must be selected at this point. MVMP can only move forward with the help of qualified contractors. Training completed ahead of initial installations
Q4 2024	Bulk Deployment	Successful completion of initial year deployment. Planning and engineering completed for next phases. 50% incorporation of data monitoring into FPL systems.	Work requests for 2024 and 2025 projects completed to avoid delays in deployment, installations, and possible supply chain issues. Incorporation of data is required to verify data quality to ensure future installation success.
Q5 2025	FPL Data Analytics	Successful completion of initial year deployment. Planning and engineering completed for final phase. 100% incorporation of data monitoring into FPL systems.	Work requests for 2024 and 2025 projects completed to avoid delays in deployment, installations, and possible supply chain issues. Incorporation of data is required to verify data quality to ensure future installation success.

3.F End of Project Goal

The end of the project goal would be the successful implementation of the equipment and systems outlined in this scope of work . The installation of 370 vault monitors in critical vaults, 600 vault FCIs in all remaining vaults with manual feeder switches, and 872 manhole monitors. This also includes the data infrastructure and integration of the data into FPL's existing systems for operations visibility and control, and data analytics that are an integral part of the Smart



Grid Manholes and Vault Monitoring Program to show the potential for system improvements in the area of resiliency and reliability for the customers.

3.G Project Schedule

Refer to Figure 14 (Gantt Chart) in 3.D for Project schedule.

3.H Project Management

FPL has successfully leveraged past federal funding awards through the Smart Grid Investment Grant under the American Recovery and Reinvestment Act of 2009. Through Energy Smart Florida (ESF), FPL installed state-of-the-art smart grid technologies, including smart meters, to improve service to its customers. ESF was an overall investment of $800 million with $200 million cost-share from the U.S. Department of Energy. FPL's proven track record on managing and executing large scale projects will be vital for the successful execution of MVMP while the economy is grappling with labor shortages and supply chain challenges.

As with any big project, picking the right person for the right job is crucial for the success of the project. One of FPL's core philosophies is "Safety First." Every member listed or otherwise will always have a Safety-First mindset in their role. The list below covers the key positions and the responsibilities.

Project Position Title	Project Position Description
FPL Project Lead	Responsible for the overall MVMP project and the single point contact with the DOE for the periodic briefings
FPL Smart Grid Manager	Responsible for securing the contract resources for executing the MVMP project, supporting the workplan, bidding and creating work packages
FPL Project Analyst	Responsible for the financial aspects of the MVMP project and maintaining the DOE support documentation
FPL Design Project Manager	Responsible for securing the MVMP design resources and providing oversight for the designs
FPL Reliability Analyst	Responsible for determining the reliability benefits of the MVMP project and support the DOE briefings
FPL Product Engineer (SME)	Responsible for providing the technical solution for the MVMP project support the training of the contractors and the FPL teams responsible for ongoing support and maintenance
Community Benefits Program Manager	Responsible for engaging community leaders and developing a Community Benefits Agreement and supporting the DOE briefings
FPL Production Lead (2)	Responsible for installation oversight, including verification the devices are installed as intended, validating the hours worked by the installation contractors
FPL Grid Automation Engineer	Responsible for the overall integration of the data into FPL systems and developing the IT requirements, supporting the tracking and training

FPL will be using contractors with proven track records, and most should have experience providing services on the FPL system. MVMP primarily uses three distinct technologies with each being executed by teams with experience in the corresponding area of electrical line work. Vault monitors can be installed by contractors that are trained in medium and low voltage electric grid construction and maintenance. Fault current indicators will be installed by crews FPL has relied on since 2009 for similar work. FPL has had great success in the past installing and managing similar products, and the risk of labor shortages and supply chain issues are low. Lastly, manhole monitors will be installed by specialized contractors with a history of working with this type of work in this environment. FPL has strong relationships with the proposed contractors, contracting with them for outage restoration and scheduled maintenance involving manholes and equipment. FPL foresees that this project will require additional contractor personnel and will support the hiring and training of these skilled workers.

Quality assurance will be a paramount piece of the MVMP project. To provide accurate, repeatable, reliable, and consistently available data for the project strict standards of installation and data will have to be maintained. FPL will be leveraging two groups in this area, the FPL Power Delivery Diagnostic Center (PDDC) and Dr. Sarwat's team at Florida International University. As MVMP is commissioned at each site, verification of the data will be part of the project requirements. The contractors will be required to verify data accuracy and availability with the PDDC. As data becomes available, the FIU team will be monitoring the data to provide real time health statistics of the vault and research new ways to predict faults from the available data.
Clear and effective communication will be imperative for all the teams involved with the project. Key team members listed as part of this project are all part of the same department at FPL with an organization structure similar to other fortune 500 companies. Weekly, quarterly, semiannual, and annual reports and meetings will be key to the success of all parties involved. Communication and reporting among teams will ensure both short term and long-term challenges are met and overall success for MVMP.

Project Risk Mitigation. FPL has established an initial risk register which identifies, prioritizes, and develops strategies to deal with risks associated with implementation of the MVMP project. A summary of the primary risks and related mitigation factors are noted below. The project risk register will be updated during project initiation and as needed during subsequent phases.

Risk Category	Mitigation Factors
Labor Constraints – potential labor shortages may impact the pace and scale of the proposed activities, particularly related to the construction activities.	FPL will leverage an existing robust network of contractors with extensive FPL project experience to lock-in project labor commitments and long-term agreements well in advance of installation activities.
Financial – substantial investment will be required to satisfy cost-share requirements and execute the various project activities.	FPL's size, credit standing, and available liquidity will enable FPL to conduct the project on balance sheet with no obligation to obtain external financing.
Supply Chain – ongoing industry and global supply chain constraints could lead to delays in project execution. Portions	FPL has been actively adjusting its processes to respond to recent global supply chain constraints. To further mitigate

of the project schedule will be driven by long-lead material procurement. With existing supply chain constraints, lead times have been greatly increased for many electric distribution components with some extending over a year before material will be received.	schedule risk, FPL has implemented enhanced material and labor procurement programs to provide more flexibility in management of critical-path supply chain constraints through streamlined funding and procurement processes. Additionally, FPL will enter long-term agreements with the project technology vendors to obtain priority access to inventory.
Permitting–project activities may require Federal, State, and County level permits, including NEPA reviews, all of which will impact schedule.	FPL has a wealth of experience securing environmental and land permits including state and federal jurisdictions.
Stakeholder Acceptance – policy makers, labor organizations and communities may not be adequately informed about planned FPL project activities.	Combined with the engagement activities described in our Community Benefits Plan, FPL will provide clear and concise messaging to state and local governments as well as community and labor leaders to ensure all project stakeholders are informed of project activities, progress, and impacts.
Technology and Innovation – Vault Monitor and Manhole Monitor Fault Current Indicator innovations may not perform as anticipated.	FPL considers the technology risk to be low and is collaborating closely with the project technology vendors to ensure seamless integration with FPL's underground infrastructure. The vault monitoring technology solution has previously been successfully deployed on a commercial scale.

4 Technical Qualifications and Resources

4.A Team Qualifications and Expertise

FPL will engage an experienced management team for the MVMP project. Rick Teigland will serve as the Principal Investigator and overall Project Manager. Mr. Teigland has over 34 years of electrical industry experience with various engineering and leadership roles and over 13 years of specific project management with the deployment of Smart Grid devices in the distribution system. Benny Pazhayattil is the technical expert for the smart grid devices that will be deployed with the MVMP project. Mr. Pazhayattil has over 11 years of experience in the utility industry with various engineering roles including the diagnostic center and as the transformer subject matter expert. Overall project leadership and business guidance will be provided by Mr. Ron Critelli, Vice President of Power Delivery Real Zero. Mr. Critelli has over 36 years of industry experience within the transmission and distribution construction, operations, and maintenance area, he has served in numerous engineering and leadership roles. These key employees will be supported by FPL's Power Delivery team that has the resources, ability, and experience of implementing similar technologies and systems across the electric grid.

Sentient Energy has been a strategic partner with FPL since 2009. The company employs 97 people and is headquartered in Frisco, TX with an additional office in Milpitas, CA. As part of the Energy Smart Florida project when the development of the communicating overhead line sensor was underway, FPL piloted the initial Beta version. This followed with a significant deployment of over 3,800 of the MM2 model overhead fault current indicators in Miami-Dade County. The partnership continued with a more advanced MM3 overhead line sensor deployed beginning in 2014 and continues today. A battery-operated design, known as the ZM1, was deployed beginning in 2018 for lower amperage locations not covered by the MM3 model. As overhead deployment continued, the need for a similar solution for the underground system was identified and Sentient designed and delivered the UM3+, the first underground FCI, in 2019 for installation in underground residential developments (URD) feeder cabinets. This design was modified for use in vault applications to address the needs outlined in this project to bring fault location to the duct and manhole underground system.

CNIGuard has worked previously with FPL in 2019 to provide health diagnostics for electrical equipment feeding the Hard Rock stadium in preparation for the 2020 Super Bowl event. This collaboration included the installation and monitoring of 12 Sentir Manhole Monitors around the site. The new technology used for the proposed Manhole Monitor Fault Current Indicator Smart Grid Device borrows from the same platform utilized in the 2019 Hard Rock Stadium deployment.

FPL has an extensive teaming partnership with FIU that goes back to the implementation of Energy Smart Florida (ESF) in 2010. During this time, FPL and FIU have forged a close relationship through the Energy, Power, Sustainability & Intelligence Partnership (EPSi). This joint initiative has the objective of conducting research on the impact of renewable energy sources in reliability, stability, and other pertinent issues of the distribution network. Examples of FPL and FIU collaboration efforts are listed below: -

- Artificial Intelligence based Storage Integrated Smart Grid Stability and Reliability
- Advanced research on Integrating Emerging and Existing Systems
- Smart Grid System testing and verification
- Workforce Retooling for Non-Engineers

4.B Equipment and Facilities

FPL has access to the necessary equipment and facilities to implement the proposed project throughout FPL's service area. FPL will leverage existing team assets to rapidly deploy the MVMP projects. The projects will be conducted entirely in the established ROW. Many of the accelerated activities are extensions of existing FPL programs to implement Smart Grid solutions and enhance grid resiliency. FPL has a well-established network of construction contractors that can participate in a competitive procurement process to support rapid implementation of the MVMP project. FPL has already conducted outreach with our technology vendors and potential local and regional contracting partners to share the scope and timeline for the anticipated work.

4.C Prior Work and Demonstrated Innovations

FPL has extensive experience with the implementation of major projects with similar tasks, risk, and complexity as the project described above. The power delivery team has successfully designed, engineered, constructed, and maintained system wide initiatives across the state of Florida that continue to improve resiliency and reliability for more than 5.8 million customers. The project team will work to mitigate possible risk that may be associated with material and supply chain limitations across the industry.

FPL has deployed significant investments to reduce the likelihood of outages resulting from extreme weather and natural disasters. These investments are categorized as Smart Grid investments in tools and technologies to increase operational efficiency, Feeder Hardening investments to withstand significant impacts from hurricanes, and Lateral Undergrounding investments for overhead-to-underground conversion projects. The table below depicts past and planned investments by year and category in millions.

Category	2019	2020	2021	2022	2023	2024	2025	2026
Smart Grid	$ 149	$ 194	$ 204	$ 145	$ 117	$ 243	$ 254	$ 163
Feeder Hardening	$ 583	$ 695	$ 715	$ 838	$ 689	$ 687	$ 544	$ 200
Lateral Underground	$ 63	$ 129	$ 248	$ 375	$ 523	$ 629	$ 758	$ 889
Total	**$ 795**	**$ 1,018**	**$ 1,167**	**$ 1,358**	**$ 1,329**	**$ 1,559**	**$ 1,557**	**$ 1,252**

4.D Time Commitment of Key Team Members

Below is the estimated number of annual hours for key FPL personnel that will be involved with the smart grid Manhole and Vault Monitoring Project.

Position Title	Year 1 Hours	Year 2 Hours	Year 3 Hours
FPL Project Lead	1040	1040	1040
FPL Smart Grid Manager	728	416	416
FPL Project Analyst	1040	1040	1040
FPL Design Project Manager	832	832	832
FPL Reliability Analyst	104	104	104
FPL Product Engineer (SME)	416	416	416
Community Benefits Program Manager	1040	2080	2080
FPL Production Lead (2)	4160	4160	4160
FPL Grid Automation Engineer	416	416	416