Enabling EV and DER Adoption Through DERMS, AMI, and Fiber Integration

Technical Volume

Submitted in Response to DE-FOA-0002740
BIL – Grid Resilience and Innovation Partnerships (GRIP)
Assistance Listing Number: 81.254

by

Rappahannock Electric Cooperative (REC)
Open Access Technology International (OATI)
(b) (4) [redacted]
Landis + Gyr (L+G)
The Shpigler Group
Smart Electric Power Alliance (SEPA)

Technical Contact:
Dr. Peter Muhoro (Principal Investigator)
Chief Strategy, Technology, and Innovation Officer
P. O. Box 7388, Fredericksburg, VA 22404
Office: 540-891-5817

Business Contact:
Ms. Rebecca Messerle
Director, Accounting and Internal Controls
P. O. Box 7388, Fredericksburg, VA 22404
Office: 540-891-5887

Table of Contents

1. PROJECT OVERVIEW

1.1 Project Summary

The rapid growth of distributed energy resources (DERs) and electric vehicle (EV) adoption continues throughout Rappahannock Electric Cooperative's (REC) territory. The Cooperative recently launched Vividly Brighter™, a suite of energy products and services that will promote the adoption of DERs and EVs focusing on energy solutions for the future. While these solutions present an opportunity for the member and the Cooperative, how REC manages these resources will help the utility reduce peak power consumption, avoid costly system upgrades, drive resiliency and reliability, and improve the flexibility of the grid. Left unmanaged, DERs can disrupt utility operations and unbalance the grid, but integration presents a major challenge for utilities due to cost, regulatory, and operational challenges. Further, leveraging smart metering data beyond the primary business case of consumption and billing will further allow leveraging advanced metering infrastructure (AMI) to gain operational efficiencies, reliability improvements, better consumer engagement, and effective integration of distributed energy resources. To address both of those upgrades, REC is deploying an effective fiber utility network that connects various nodes and devices for fast and effective data communication that is essential.

REC will deploy a distributed energy resources management system (DERMS) that will be enabled through an advanced metering upgrade from current aging technology and the completion of a fiber utility network that connects all various nodes and devices throughout the REC's service territory. The project will be broken into three areas as shown in Figure 1.

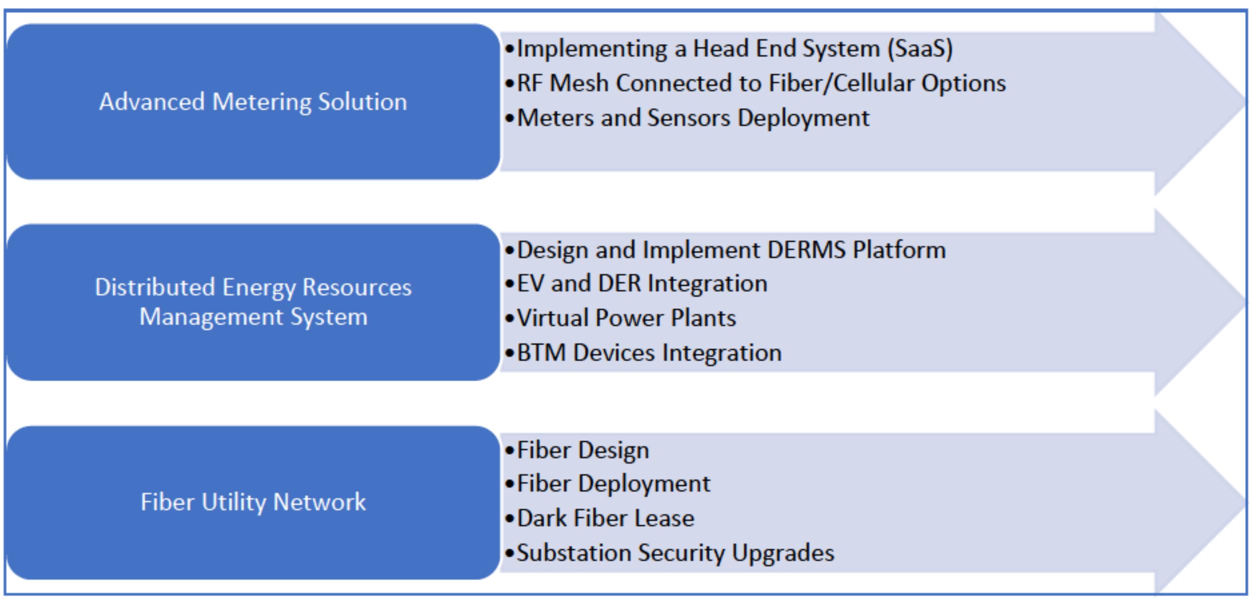

Figure 1: REC Proposed Smart Grid Project

The results of this project will advance REC's capabilities in managing DERs and EVs, providing consumers with more flexibility and ensuring even the most disadvantaged can participate in an equitable energy future that is affordable, reliable, safe, and sustainable.

1.2 Project Tasks

The team will complete the project with six major tasks over a five-year period:

Table 1: Project Tasks and Timeline

Task	Description	Timeline
1.	**Project Management, Planning and Reporting:** The management team with The Shpigler Group will lead Task 1 and exercise management for the project lifetime and coordinate efforts with other partners. REC will be responsible for financial management of all aspects related to the project and will report progress to DOE.	Q1 – Q20
2.	**Design and Engineering:** REC will work with OATI and Landis+Gyr to design and engineer the DERMS and AMI systems to be installed. This will include integration planning with REC's fiber optic network and NISC's iVue enterprise platform. AMI radio frequency collection point locations will be determined using Landis+Gyr's study and integration with fiber.	Q2 – Q3
3.	**Construction and Deployment:** REC will work with all the partners and local contractors to construct and deploy all components of this project.	Q3 – Q20
4.	**Inspection and Verification:** REC will lead the inspection and verification at each phase of completion to ensure systems were installed correctly and working as expected.	Q8 – Q20
5.	**Data Collection, Monitoring, and Analysis:** This task will be managed by the data team and is responsible for monitoring the performance of the system. The Data team will coordinate with all other teams to make any necessary adjustments to optimize performance.	Q8 – Q20
6.	**Outreach and Training:** This task will be managed by the outreach team and is responsible for developing training, marketing, and communication materials. The materials will be presented online and in-person at selected conferences. Metrics will be established for evaluating effectiveness of the outreach.	Q1 – Q20

1.3 Project Locations

REC is a member-owned utility that provides electric service to nearly 180,000 connections in portions of the following 22 Virginia counties: Albemarle, Caroline, Clarke, Culpeper, Essex, Fauquier, Frederick, Goochland, Greene, Hanover, King & Queen, King William, Louisa, Madison, Orange, Page, Rappahannock, Rockingham, Shenandoah, Spotsylvania, Stafford, and Warren. This project will have construction and system modernization impact across REC's entire distribution system, including Small Disadvantaged Community (DAC) areas in the counties of Louisa (51109950201), Culpeper (510479300400/0502/0300), Caroline (51033030100), Essex (51057950600/0700) and the Rappahannock Tribal Designated Statistical Area (8700R) as indicated in the Department of Energy's Disadvantaged Communities Reporter. Figure 2 shows the map of REC's territory.

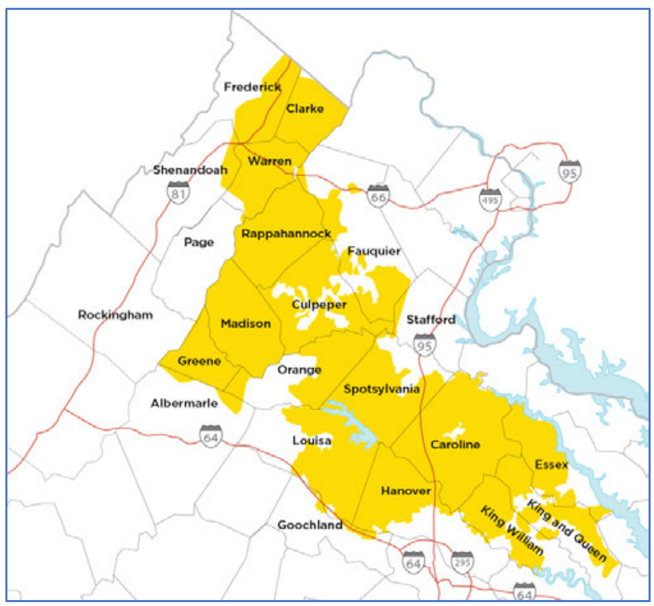

Figure 2: Map of REC Territory

1.4 Project Goals

This project will deploy a distributed energy resources management system (DERMS) that will be enabled through an advanced metering upgrade from current aging technology, and a fiber utility network capable of connecting all nodes and devices throughout Rappahannock Electric Cooperative (REC) service territory. Mass adoption of electric vehicles (EVs) and distributed energy resources (DERs) hinges on the integration of these systems to help the Cooperative manage the electric grid and ensuring reliability. In addressing the impacts of climate change, REC believes that DERs and EVs will contribute largely to the future of energy, thus the Cooperative wants to be prepared for a net zero energy future.

1.5 DOE Impact

With the need to expedite the energy transition, and meet the growing expectations of consumers, DOE funding will help defray the additional costs to complete these projects to return benefits for the grid, the utility, and the consumer in a timely fashion. Without DOE funding, REC runs the risk of being unable to keep pace with these expectations. REC is uniquely positioned due to its proximity to the nation's capital and its diverse and growing service territory to demonstrate the tangible impact of the Administration's historic investment in the clean energy transition. Further, the project partnership with the Smart Electric Power Alliance will provide avenues for stakeholder engagement and dissemination of lessons learned from the project.

2. TECHNICAL DESCRIPTION, INNNOVATION, AND IMPACT

2.1 Project Overview

Background

To enable the clean energy transition, utilities will have to plan for the next generation of advanced metering infrastructure and grid technologies. AMI 1.0, general reference for meters installed in the first two decades of the 21st century, allowed the meter to transmit energy consumption through various dated communications technologies at certain frequencies dependent on the channels. Data from the Smart Grid Investment Grant[1] shows an average savings of $10 per year per meter, which over the life of the meters, nearly 75% of the initial costs could be recovered, with most savings achieved in reduction of service calls. While AMI 1.0 has provided consumers and utilities many benefits, better intelligence and communication will be required to manage the expansion of complex energy-producing and energy-consuming devices in households and businesses. To advance the clean energy transition, AMI 2.0 will be a requirement, especially in managing all distributed energy resources and electric vehicles.

Advanced Metering Solution

Over the years, utilities have utilized AMI to ensure they have the right technology to read and convert energy usage into accurate and timely billing. Advancements in the technology have created opportunities beyond the primary use with opportunities to gain operational efficiencies, reliability improvements, better consumer engagement, and effective integration of DERs.

---

[1] US Department of Energy (DOE), Advanced metering infrastructure and customer systems: Results from the Smart Grid Investment Grant program, September 2016.

REC's advanced metering infrastructure takes the form of a two-way automatic communication system (TWACS), with data exchange occurring via power-line carrier technology (PLC), as shown in Figure 3. REC's TWACS metering system was installed in 2000, expanding on the functionality of its existing PLC system that had been installed in the mid-1980s. REC has conducted multiple meter-replacement and upgrade projects since initial installation. PLC, an older but dependable technology, leverages a utility's electric distribution lines to achieve two-way communication to any meter or other endpoint device connected to the network without the need for additional repeaters or line conditioning equipment. REC's meter data is collected via the TWACS system at local substations and then transmitted to its primary meter-data hub using a proprietary microwave communication network or cell-based technology where possible.

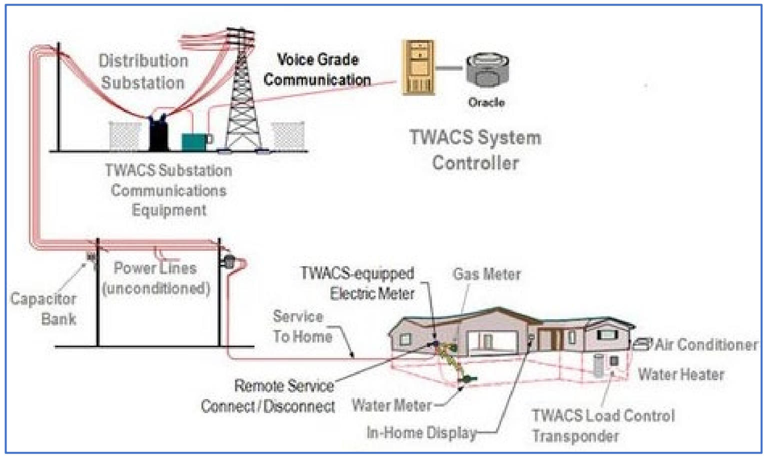

Figure 3: TWACS System Overview

According to data from Frost & Sullivan, by 2026, PLC will have dropped to approximately 0.8% of the market share, with Radio Frequency (RF) Mesh having most of the market share as a communications strategy for metering. Further, from metering/technology partners such as Landis & Gyr, to effectively execute additional use cases in meter use in the future, REC would need to transition from relying on PLC and move to a more advanced technology to meet its needs. Figure 4 illustrates the evolution of AMI in utility use cases, in which the 2nd and 3rd wave would not be possible if reliant upon PLC. For further success, an optical fiber network becomes a critical component to make the transition to a decarbonized energy future. In utilizing the fiber buildout, REC will transition to deploy the RF Mesh solution while migrating off PLC. High speed, sub-minute interval metering solutions will be necessary for the success of the future grid. As consumers look to advance integration of renewables, DER's, and disruptive loads such as high-rate EV charging, and with utilities striving to implement the advanced monitoring, control, and bi-directional systems that will facilitate those desires, older metering technologies will prove ever more ineffective in the modern utility landscape.

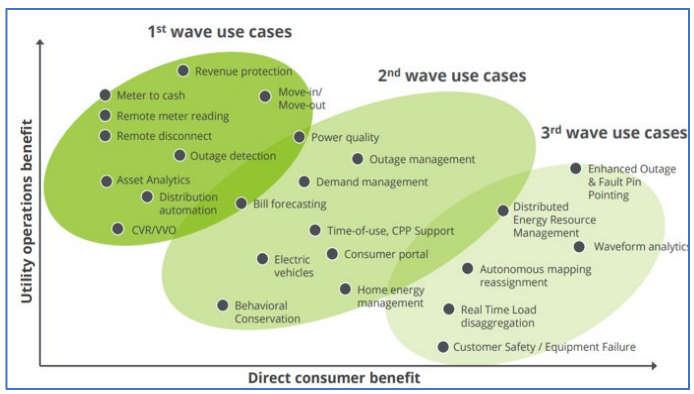

Figure 4: Evolution of AMI in Utility Use Cases

AMI 2.0 is expected to have meters enabled to provide various values. Key areas include improved power quality and resiliency; allowing consumers to analyze their device-level usage; supporting cloud, microgrid, and intelligent automation; improving operational efficiency and enabling data aggregation; enhanced capabilities to measure the value of DERs, integrate EVs, and provide demand side flexibility; and address difficult-to-reach terrain, as well as address cybersecurity and safety needs. Figure 5 is a representation of the value stack from AMI 2.0 enabled meters. These meters will allow consumers to sign up for utility products and services that augment their energy data with personal and regional data, while giving the utility better insight into grid operations and increase reliability.

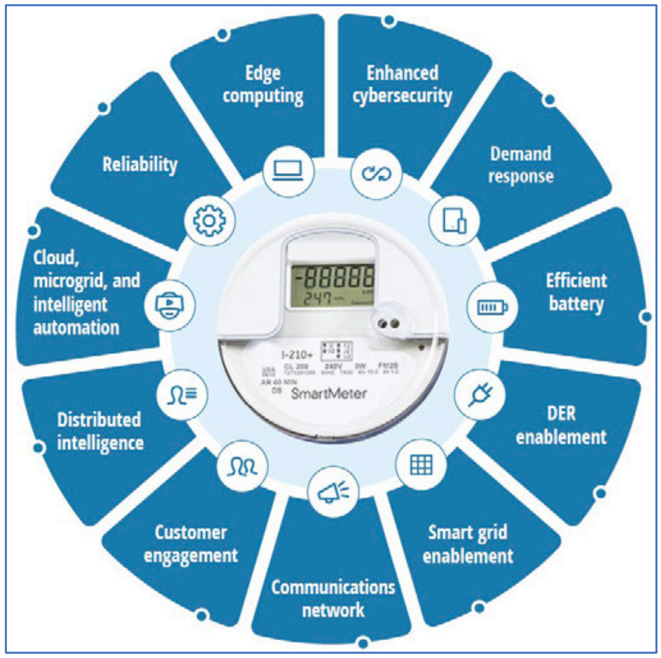

Figure 5: Summary View of Anticipated Capabilities from AMI 2.0 enabled meters (Source; Deloitte)

REC has hundreds of station and distribution electronic reclosers that can be tied into the system to provide real-time current/voltage/power-factor/over-current information. These devices can be leveraged to improve efficiency (load balance to reduce line-loss), service quality (catch power quality issues before they become problems) and reduce restoration time (line-fault data can be interrogated to guide restoration efforts). With additional DERs and EVs, it becomes essential that utilities have a clear representation of directional power flow (both watts and VARs) to safely control and protect the "grid." To effectively operate the future grid, data must be transmitted and received in real time and the utility's response to abnormalities must be automated using algorithms and/or artificial intelligence. Features inherent in advanced SCADA or DERMS system will be critical to future grid stability. The future grid cannot rely solely on human recognition and response because the speed with which an issue must be recognized and mitigated is unachievable from human interaction alone. An optical fiber network is a necessity and will be the conduit for transmitting massive data produced by these devices. REC seeks to modernize its limited-bandwidth power-line carrier technology to meet consumers' expectations for a fully integrated and responsive grid. This transition will take place in stages to get the most useful life out of current technology while moving expediently to the new metering solution, including:

RF Mesh Deployment

Designing an RF mesh system architecture for the whole service territory that utilizes the fiber utility network for the back haul and for those areas that are completely underserved, determining the viability of cellular connectivity. A hybrid architecture is not uncommon, especially for rural utilities. The L+G Gridstream RF is a multi-functional solution supporting advanced multi-energy metering, personal energy management and distribution automation applications. Gridstream residential and commercial metering solutions support up to 5-minute interval data collection, load management, home area networking and outage management applications. It enables enhanced reliability and resiliency, improved billing, meter programming over the air, and revenue protection. Gridstream RF is a true mesh, peer-to-peer network where each endpoint, device and router extends the coverage and reliability of the network. It's also self-healing to provide dynamic routing of messages that automatically adjust for changes to endpoints and the introduction of obstructions such as foliage or new construction.

Revelo Meter

Identify a metering change-out strategy that begins with areas where there are older meters utilizing the PLC technology. The L+G Revelo metering family is the industry's first IoT grid sensing electric metering system benefiting both utilities and their customers. Revelo supports enhanced reliability, safety, and the growing adoption of DERs require more than traditional meter-to-cash capabilities. Revelo is a true grid sensor, providing unprecedented insight and control through industry-leading waveform data technology, offering superior edge computing capabilities, and a greater ability to sample, process, store, and deliver data to the right places in real-time.

REC's long-term strategy is to utilize this architecture as the backbone for enabling the success of the DERMS platform to manage all the grid-edge devices and drive further technologies that move the Cooperative to a clean, resilient, and reliable grid. In addition, this solution allows consumers to enroll in various programs that can yield to further savings. For example, from the SGIG results on demand side management programs, several utilities resulted in around $50 per consumer savings. With additional programs, these savings will increase for the consumers while transitioning to cleaner energy. This advanced metering solution will be critical to grid management in the future and becomes more possible with the capability of fiber connected to all of REC's substations.

Distributed Energy Resources Management System (DERMS)

REC powers a 4,000-square mile territory with nearly 18,000 miles of distribution line. Of the nearly 180,000 connections, the Cooperative has more than 2,000 net metered connections, nearly 2,000 EVs, and manages nearly 30,000 thermostats, air conditioning units, and water heaters combined for demand response. Through its Vividly Brighter™ suite of energy solutions, the Cooperative is anticipating significant growth in more additions of DERs and EVs. In a recent study REC conducted with Burns and McDonnell's 1898 & Co., it was projected that REC could see EV adoption as low as 16,000 (5% penetration) light duty EVs and a high of 93,000 EVs (30% penetration) added throughout the service territory by 2030.

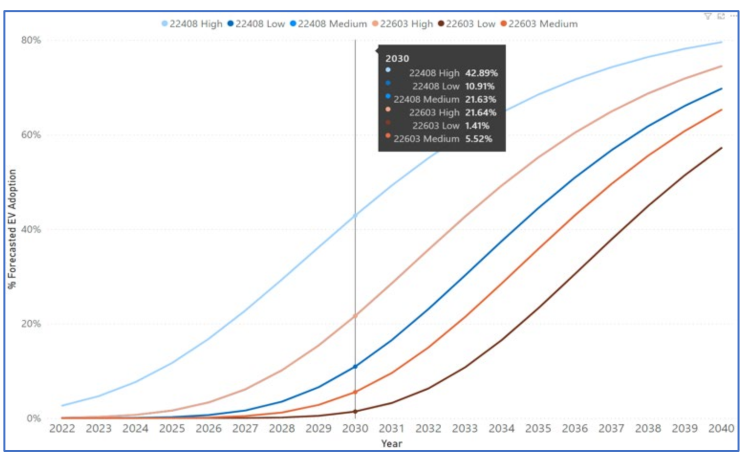

Figure 6: Forecasted EV Adoption in REC Territory

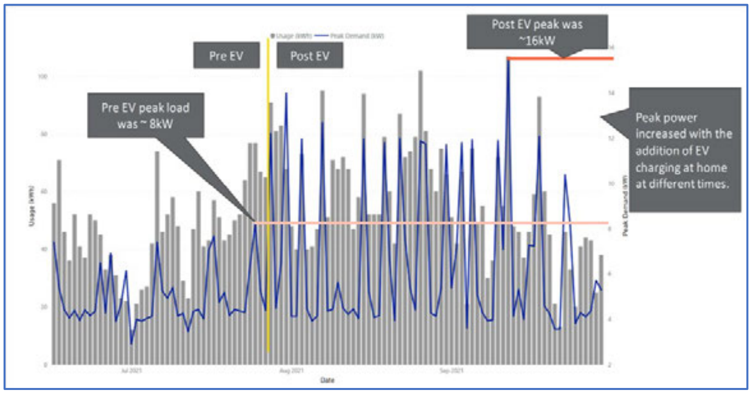

Figure 7: Pre-EV and Post-EV Load Profile

Current data shows that more than 70 percent of charging happens at home. The challenges of how the Cooperative will manage electric grid operations are clearly delineated in a pre-EV and post-EV environment. The role of DERs will become more and more critical to address the post-EV environment. Figure 3 is a good example of a Tesla model 3 with a 7kW level 2 charging at a 2,000 sq. ft. house. Managing the post-EV peak could be addressed through the addition of solar and storage at home, while providing the right rate signal for managed charging, thus shifting that peak to a manageable time.

Virtual Power Plants (VPPs), networks of decentralized power generating units as well as flexible power consumers and storage systems, will also play a key role in a clean energy future. As shown in Figure 8, these clusters of DERs can be aggregated and can participate in the energy markets by scheduling them during anticipated peak periods. Today, REC is aware of approximately 100 MW small scale individual generating units within its service territory, that if aggregated, could provide much needed power during certain peak periods, reducing the need for bulk power provision. A DERMS platform will be a requirement to manage such VPPs.

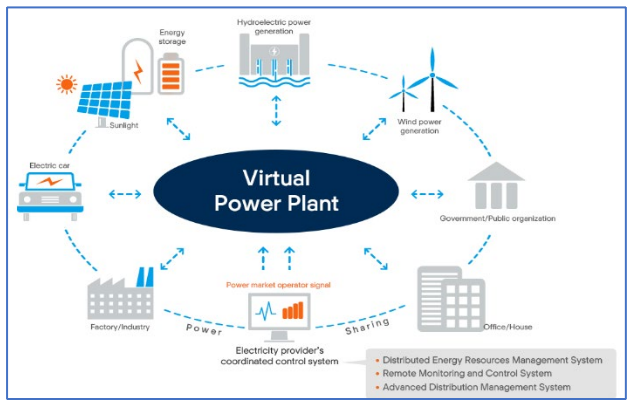

Figure 8: Conceptual Virtual Power Plant

The traditional advanced distribution management systems (ADMS) have supported the grid for a decade, but the functionality for the new paradigms of DERs calls for a modern DERMS platform. New grid challenges that require a better management system include: 1) multi-directional energy flow; 2) various energy sources; 3) real time asset health and integration; 4) DER flexibility and susceptibility; and 5) markets, policy, and regulation, to mention a few. DERMS and ADMS are separate systems but will require each to be aware of and support each other. REC's proposed project will address the missing link and provide the shared model with our ADMS systems that include SCADA, DMS, and OMS, as shown in Figure 9.

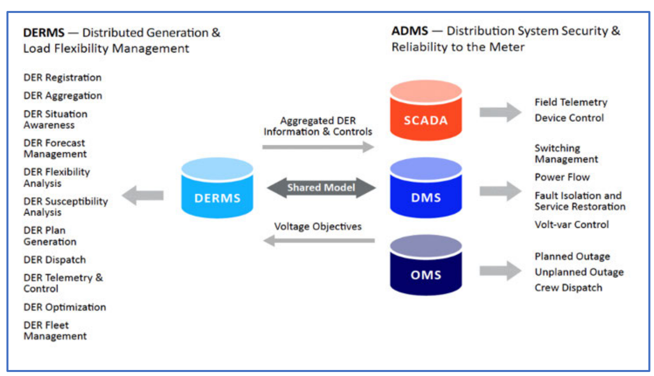

Figure 9: Interconnected Roles of DERMS and ADMS

REC desires to track and manage the full lifecycle of each individual DER, currently known or unknown. From demand response devices to solar PV, energy storage and EVs, DERMS will provide an optimal utilization of resources and ensure fair and equitable utilization of the distribution system for all stakeholders. The challenge of a system of systems that enables a modernized grid ecosystem is that those systems have traditionally not had a unifying theory. Among the markets, DMS/ADMS, microgrids, energy management systems, DERMS is the platform that can help unify. Through this project, REC with its partners will design a DERMS architecture that can address integrating both today's technologies and those of the future, powered by a strong metering system and faster communication provided through a fiber network. Figure 10 shows an example that REC might consider for this integration.

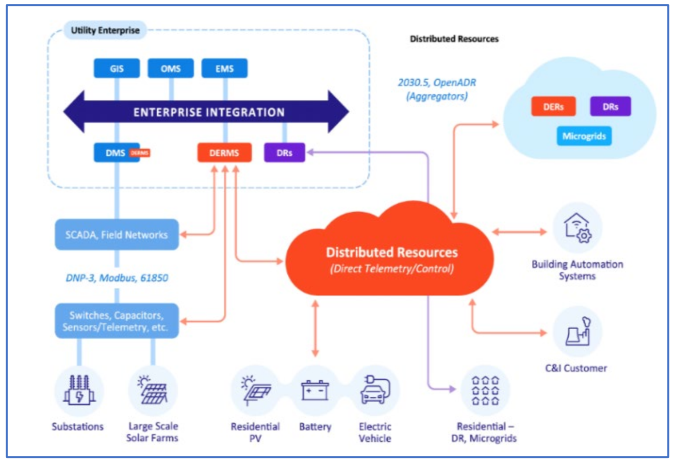

Figure 10: Example of a Utility's Proposed DERMS Architecture

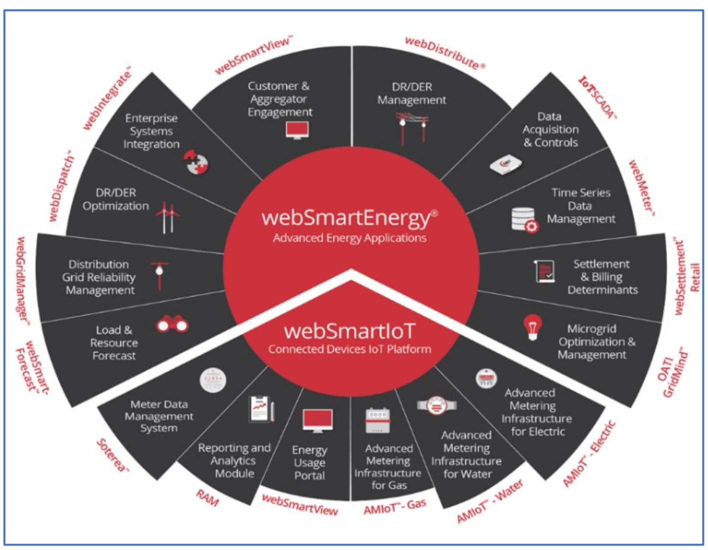

Figure 11: OATI's webSmartIoT Solution

The ideal platform manages the full DR and DER program lifecycle, including modeling and aggregating disparate load and generation resources, forecasting DR/DER capabilities, optimizing, scheduling, dispatching, and controlling DR/DER assets as well as monitoring performance of field assets and their response to control events and instructions. The platform extends grid operators' visibility all the way to the customer side of the meter and grid edge devices and thus allows utilization of these assets in support of grid operations, as shown in Figure 11. The OATI webSmartEnergy portfolio, as an example, is a common platform for both DR and DER management that comprises various application modules that are configured to provide solutions to meet specific use case requirements.

To successfully complete this portion of the overall project, REC is proposing the following tasks:

1. Review existing ADMS architecture and upgrade needed components such as SCADA, OMS, and DMS.
2. Design DERMS architecture that integrates with existing enterprise system.
3. Deploy and implement DERMS platform.
4. Use DERs installed at REC offices to test and report operation of DERMS architecture.

Fiber Utility Network

REC faces challenges of connectivity with the lack of high-speed broadband solutions, primarily due to the low density and long miles of line, across significant portions of its service territory. The Cooperative's reliance on PLC for communication is largely the result of this digital divide. While this technology has worked, a fiber optical network is a necessity due to the amount of data and frequency of transmission required.

(b) (4) [redacted]

Figure 12: REC Fiber Utility Network

In 2019, the REC Board of Directors approved a long-term strategy to install a fiber utility network (FUN), an optical fiber middle-mile network designed to provide high-speed connectivity to REC's critical infrastructure and all its offices, with the capability to lease excess dark fiber for additional utility needs and to third parties for the provision of broadband services. REC's FUN spans a total of 820 miles. As of December 2022, the Cooperative will have completed building 262 miles with the rest projected to be completed by the end of 2024. Figure 12 shows the Cooperative's plan for the fiber buildout connecting all substations and offices and serving as a backhaul for the massive data that devices will be submitting. As of today, REC has been able to lease dark fiber to an ISP that can reach the last mile, allowing the utility another access point and enabling REC to communicate with its meters at the end of the line easier and faster. FUN will also enable various other sensors that can enhance the consumer's energy use to work better while giving the utility better visibility to usage needs.

The FUN project provides more than needed connectivity for system communications. At the point of connecting fiber to the substation, a full security inventory is conducted, and upgrades are being made including installation of new high-definition cameras. As made clear by the PG&E Metcalf substation attack, and the more recent event in North Carolina, substation vulnerability is a significant risk for electric utilities and their stakeholders. REC's planning for future substation security goes beyond the traditional, hardened 7-foot perimeter fences of years past. Escalating threats require more significant measures to ensure resilience for the Cooperative's residential, commercial, industrial and government customers, particularly during a time with increasing costs and expanded lead times for new replacement equipment.

REC is seeking to implement more advanced measures to protect all substations from potential attack, with a focus on preventing the likelihood of an adverse event and limiting the consequences should an adverse event take place. Planned attacks, such as copper theft or shootings, of substations identified as "crucial facilities" are of greater concern and require a more significant investment in physical and digital security features. [redacted] Figure 13 is an example of an individual at a substation. REC would not have been aware of this threat without the capability of cameras that can send notifications to security staff. [redacted]

Figure 13: Unauthorized Person at a Battery Located at a Substation

While progress in the fiber network buildout has been made, supply chain constraints, inflation, and labor shortages have delayed the project. Funding the remainder of the fiber buildout will be critical for REC's success in meeting the Cooperative's overall decarbonization and promotion of DER goals, EV integration, system resilience, and reliability.

2.2 Feasibility

Success of the project in the performance period will include territory-wide deployment of a RF Mesh network; all-system meter replacement, including all new connections to be constructed with the new meters; all substations connected with fiber with additional physical security; and a DERMS platform installed and controlling devices. REC's business case is based on a 10-year timeframe between 2024 to 2033, using 2023 as base year for Net Present Value (NPV) calculations, as shown in Table 2.

Table 2: AMI Project Primary Capital Deployment

Parameter		**Value**	
Timeline		2024 – 2033 (10 years)	
Base Year (discounting to)		2023	
Meter Deployment	**Year**	**Meters**	**Share %**
	2024	15,000	8.3 %
	2025	45,000	33.3 %
	2026	45,000	58.3 %
	2027	45,000	83.3 %
	2028	23,000	96.1 %
	Total	173,000	96.1 %

The strategies that will be executed to achieve the project outcomes are cost effective with estimates of benefits an NPV of $24.32 over a 10-year period. The benefits beyond the 10-year window provide a positive NPV accounting for the terminal value. In addition, the project eliminates 50,715 tons of CO_2 and saves 386,956,324 minutes of outage time. While difficult to quantify other benefits such as the reductions in emissions, increased renewable energy, or a cleaner environment, it is believed that this project is feasible and will return many community benefits. This project will create great benefits and outcomes, as outlined in section 2.3.

2.3 Relevance and Outcomes

This project has numerous grid-benefiting outcomes:

Outcome 1: Maximize energy efficiency and reduce peak demand – With the updated meters, consumers will be able to use enhanced data to make behavioral changes to reduce and more effectively manage their energy usage. For example, with data disaggregation, consumers can see which devices consume the most and connect their usage with utility-driven programs and incentives. In addition, they can sign up for more demand side management programs, helping to reduce the utility peak.

Outcome 2: Reduce energy use and emissions in buildings – While new buildings can be built very efficiently, older buildings often tend to consumer more energy and have higher emissions. The outcomes of this project will help provide granular data to building owners through energy audits that identify opportunities for creating efficiencies and reducing energy use.

Outcome 3: Reduce energy use and emissions in transportation – The transition from internal combustion engines to electric vehicles presents a great opportunity to reduce the use of fossil fuel to power vehicles as well as emissions reduction. Capabilities of this project will become a strong enabler of the EV transition, allowing drivers the flexibility to charge whenever they need to, while maintaining grid reliability.

Outcome 4: Accelerate the deployment of renewable energy and DERs – AMI will enable real-time pricing and compensation for DERs. EVs and DERS have the potential to impact the grid depending on the size and timing of the electricity demand. With the AMI and DERMS, better insight can help promote more cleaner technologies that can provides better insight to the utility and can dispatch resources as needed.

Outcome 5: Promote VPPs for load management – With additional DERs, further adoption of EVs, and the need to utilize VPPs, managing of all those devices with bi-directional communications, a DERMs platform will be required by each utility for control, planning, outage restorations, and enhancing resiliency. VPPs will not only help reduce peak demand due to high costs, but it will also facilitate more localized generation and use of storage systems, reducing the need for additional fossil fuel generation, further leading to a decarbonized electric grid.

Outcome 6: Grid and infrastructure modernization – Automation of the grid, a necessity for the future, will only be achievable with a robust fiber network connecting many sensors and devices and transmitting data when and to where it is needed. Any meters that can provide more granular data will give the utility clearer insight of grid operations, helping planners understand what upgrades are needed on the system for better reliability and resiliency. A fiber network enables better and faster decision making by the utility, from having ready access massive data sets detailing the performance of various grid elements.

Outcome 7: Expansion of more equitable programs – Granular meter data will allow equitable adoption of all utility programs by the consumer as they can participate in specific rate-driven programs that require that level of data granularity. For example, managed EV charging with incentive rates requires more sophisticated metering, which also enables asset deferral for some upgrades, benefitting consumers in the form of avoided costs.

Outcome 8: Expand the clean energy transition – To achieve clean energy transition goals, the combination of technologies proposed will be critical to enable a path to a cleaner energy future.

2.4 Regional and National Resilience, Decarbonization, and Other Energy Goals

Improvements in reliability and resiliency, and capability to manage DERs and EVs on the grid are directly tied to customer satisfaction. REC aims to significantly improve its communities' experience by providing ways that consumers can integrate those resources while minimizing the occurrence of and impact of disruptive events. In recent years, REC's consumers have been significantly impacted by several major storms including hurricanes, snowstorms and the June 2012 straight-line windstorm. Since 2003, REC has applied for and received $26,650,000 in FEMA reimbursements for system recovery following numerous declared disasters. During the most recent major weather event, Winter Storm Frida which struck the Cooperative in January 2022, damage totaled over $20 million dollars and over a week for restoration efforts. The local communities would benefit significantly from having DERs that can be up and running during such storms and as they wait for restoration efforts to be completed. The project will enhance the resiliency of REC's entire electric system and ensure electricity is available to consumers when it is needed the most, now and into the future.

2.5 Information Dissemination and Replicability

The Smart Electric Power Alliance as a partner will assist the project in the creation and transfer of knowledge to the broader energy industry. This will accelerate the deployment of similar technologies and accelerate the clean energy transition. Publications from the project will be widely disseminated through various channels.

3. WORK PLAN

3.1 Project Objectives

The purpose of the technical work plan is to outline how the work will be executed in sufficient detail to arrive at a clear understanding of what will be done, when, and how. This will be the basis for the Project Management Plan (PMP), which is the first major deliverable of the project. In developing this work plan, REC has provided as much detail as possible at this early stage.

3.2 Organization of Project Team

The project will be executed using a team/charter approach that is well established at REC. In a team/charter management system, the work is divided among several teams, each with a specific and largely distinct role. Each team has a designated lead responsible for organizing and managing the team, delivering the team's products, coordinating with other teams, and participating in project management as part of the project management team. The basic organizing element for each team is its "Charter," which will define the role and specific responsibilities of each team and how its work contributes to the overall project. At the outset of the project, we will hold a management team meeting to review the definition and scope of teams. The charters are internal project documents, not deliverables, but the Project Management Plan is an explanation of the allocation of work to teams and the teams' charters with a coordinated list and schedule of milestones, deliverables, go/no go decisions, and progress reports. The teams will be as follows:

Project Management and Planning: The management team is responsible for the project team, and will: structure the work, coordinate the team charters, monitor progress, adjust the plan as necessary, administer the project financially, and perform appropriate reporting. The management team is also responsible for monitoring all spending, managing cost share, invoicing DOE, assuring compliance with all Federal rules and regulations, managing all contractual matters, and providing all non-technical reporting. REC will be the lead and will assign a project manager to the project, as well as receive support from The Shpigler Group.

Design and Engineering: The engineering team is responsible for the system design, engineering, planning, and optimization. This team will also provide technical support throughout the project. REC engineering will be the lead with support from L+G.

Construction and Deployment: The construction and deployment team is responsible for construction of fiber, installation of substation security, and meter changes. REC will be the lead overseeing all contractors performing the work.

Inspection and Verification: The inspection and verification team will inspect and ensure the integrated project meets its system-level requirements. REC and The Shpigler Group with lead this task with support from vendors.

Data Collection, Monitoring, and Analysis: The data team will be responsible for the deployment of the DERMS platform, data collection, and analysis. This team is responsible for making sure any anomalies in the system output are caught and that the engineering team has enough information to optimize the system. REC will be the team lead with support from L+G and OATI.

Outreach: The outreach team will be responsible for all the outreach and training components as well as communications regarding the project and dissemination of results beyond the rest of the team. SEPA will be the lead.

3.3 Task Breakdown and Go/No-Go Decisions

Task 1 – Project Management, Planning and Reporting (Q1 – Q20): The management team with The Shpigler Group will lead Task 1 and exercise management for the project lifetime and coordinate efforts with other partners. REC will be responsible for financial management of all aspects related to the project and will report progress to DOE.

Subtask 1.1 – Develop Project Management Plan: REC in coordination with DOE will develop a PMP that will be updated annually, or as needed, to reflect project changes. The PMP will include roles, tasks, milestones, deliverables, and a communications plan.

Subtask 1.2 – National Environmental Policy Act (NEPA) Compliance: REC will provide the documentation necessary for any NEPA compliance required.

Subtask 1.3 – Cybersecurity Plan: REC will work with all partners to ensure a cybersecurity plan is developed, addressing both IT and OT requirements and delivered to DOE.

Subtask 1.4 – Monitor Progress and Milestones: REC in coordination with The Shpigler Group will actively work with all project teams including all subcontractors to manage task execution, monitor progress against milestones and deliverables, evaluate risks and execute mitigation strategies, if needed. REC will also coordinate with DOE on a quarterly basis to make sure project goals and objectives are executed as expected.

Subtask 1.5 – Monitor Project Budget: REC's finance group will continually monitor and manage project costs against the approved budget, prepare invoices and any other financial records per DOE guidance and processes. REC will also ensure that the project cost share is expended proportionally per invoice.

Subtask 1.6 – DOE Reporting: REC project management team will prepare and submit quarterly progress reports and required financial reports. The team will also produce a final project report to be submitted to DOE at the end of the fifth year of the project.

Task 1 Milestones

M1.1: Completed Project Management Plan
M1.2: Completed Cybersecurity Plan

Task 1 Deliverables

D1.1: Project Management Plan
D1.2: NEPA Compliance
D1.3: Cybersecurity Plan
D1.4: Quarterly Reports
D1.5: Annual Reports
D1.6: Final Project Report

Task 1 Go/No-Go Decisions

G1.1: Project Management Plan
G1.2: Annual Review

Task 2 – Design and Engineering (Q2 – Q3): REC will work with OATI and Landis+Gyr to design and engineer the DERMS and AMI systems to be installed. This will include integration planning with REC's fiber optic network and NISC's iVue enterprise management platform. AMI radio frequency collection point locations will be determined using Landis+Gyr's study and integration with fiber.

Subtask 2.1 – Develop System and Operational Requirements: REC will work with OATI, L+G, and [redacted] to identify and develop all the system and operational requirements for the project.

Subtask 2.2 – Complete Propagation Study for AMI/RF Mesh: REC will work with L+G to complete a propagation study ensuring locations of all RF receivers are determined.

Subtask 2.3 – Identify DER Locations for DERMS Integration: REC will identify locations of DERs to integrate them as a pilot into the DERMS platform.

Subtask 2.4 – Develop Meter Change Out and Decommissioning Plans: REC, with L+G, will develop plans for the meter change out as well as how we decommission the existing meters.

Task 2 Milestones

M2.1: Completed System and Operational Requirements
M2.2: Completed Propagation Study
M2.3: Completed Meter Change Out and Decommissioning Plan

Task 2 Deliverables

D2.1: Propagation Study
D2.2: Meter Change Out and Decommissioning Plan

Task 2 Go/No-Go Decisions

G2.1: System Design Feasibility

G2.2: Review of Plans

Task 3 – Construction and Deployment (Q3 – Q20): REC will work with all the partners and local contractors to construct and deploy all components of this project.

Subtask 3.1 – Installation Planning: REC will execute all contracts with stakeholders involved in the construction and deployment stage, ensuring they meet all policies and standards, including safety. REC will also procure all the required equipment.

Subtask 3.2 – Fiber Installation: REC will continue to work with [redacted] to finish the remaining 300 miles of fiber installation. (b) (4) [redacted]

Subtask 3.3 – AMI/RF Mesh Installation: REC will work with L+G to install the AMI/RF Mesh network territory wide.

Subtask 3.4 – Meter Changeout: REC will use local contractors to begin the meter changeout.

Subtask 3.5 – DERMS Deployment: REC will work with OATI to deploy the DERMS platform. With the identified DER locations, the platform will test the management of those devices and integration with the SCADA system.

Subtask 3.6 – System Integration and Testing: For each of the Task 3 items, REC will work with each partner to ensure all systems are integrated with NISC, the enterprise system, and perform testing.

Task 3 Milestones

M3.1: Procurement and Installation Planning Completed

M3.2: Equipment Installed and Testing and Walk-Through Completed

Task 3 Deliverables

D3.1: Installation Completion Report per Phase

Task 3 Go/No-Go Decisions

G3.1: Successful Installation per Phase

Task 4 – Inspection and Verification (Q8 – Q20): REC will lead the inspection and verification at each phase of completion to ensure systems were installed correctly and working as expected.

Subtask 4.1 – Utility Inspection: REC will inspect all installed systems to verify proper labeling, proper disconnects, and access to equipment. All installations will be verified to confirm they meet the latest version of the National Electrical Safety Codes and meet current UL certification. This task includes responsibility for making sure the proper utility meter is installed.

Subtask 4.2 – Perform DERMS/AMI Deployment Readiness and Functionality: REC, with all partners, will conduct a deployment readiness and functionality test to ensure system turnover is successful.

Subtask 4.3 – Cybersecurity Plan Test: REC will conduct at tabletop exercise to ensure that the plan works as intended.

Subtask 4.4 – User Training: REC will work with all partners to ensure each user is trained on each of the installed systems.

Subtask 4.5 – Final System Turnover: Once all inspections and verifications have been conducted; REC will verify to see if there are any other immediate changes needed. At this point, documentation will be provided for the full system prior to the system turnover.

Task 4 Milestones

M4.1: Successful Utility Inspection

M4.2: DERMS/AMI Deployment and Functionality Passed

M4.3: Cybersecurity Plan Testing Complete and Successful

M4.4: User Training Complete

Task 4 Deliverables

D4.1: System Turnover Report

Task 5: - Data Collection, Monitoring, and Analysis (Q8 – Q20): This task will be managed by the data team and is responsible for monitoring the performance of the system. The data team will coordinate with all other teams to make any necessary adjustments to optimize performance.

Subtask 5.1 – Data Collection and Analysis: The data team will initially model the ideal system performance based on theoretical models. The team will collect data throughout the project and analyze and provide reports.

Subtask 5.2 – System Optimization: On a quarterly basis, the data team will provide a complete review of the data analyzed and provide recommendations on any adjustments that may be needed to improve the functionality of the system.

Task 5 Milestones

M5.1: System Optimized Based on Data Analysis

Task 5 Deliverables

D5.1: Quarterly Data Report

D5.2: Annual System Report

Task 6: Outreach and Training (Q1 – Q20): This task will be managed by the outreach team and is responsible for developing training, marketing, and communication materials. The materials will be presented online and in-person at selected conferences. Metrics will be established for evaluating effectiveness of the outreach.

Subtask 6.1 – Define Audience & Content: The team will first define the target audience which will include co-op directors, management, technical staff, member-services staff, utility industry peers, and vendors. The team will develop the material needed to address the audience mentioned.

Subtask 6.2 – Analyze & Select Outreach Channels: The team has access to several different channels which are used for outreach, including magazines, conferences, topic-specific webinars, and other reports. The team will also publish peer reviewed papers on the outcomes of the project. The outreach task will also include quarterly newsletters that highlight functionality of the system and challenges faced.

Subtask 6.3 – Schedule: The schedule for outreach and training will be developed concurrently with the audience/content development subtask and will be designed to reach the widest range of interested parties.

Subtask 6.4 – Execute Outreach: Outreach will continue over the entire 5 years.

Task 6 Milestones

M6.1: Audience and Content Defined

M6.2: Schedule Completed

M6.3: Training and Outreach Executed

Task 6 Deliverables

D6.1: Outreach and Training Plan

3.4 High Level Quarterly Schedule and Detailed Project Execution Plan

Table 3 shows a high-level quarterly schedule with the milestones, deliverables, and go/no-go decision points. Table 4 is a GANTT chart showing the project execution plan.

Table 3: High Level Quarterly Schedule

Enabling EV and DER Adoption Through DERMS, AMI, and Fiber Integration

Rappahannock Electric Cooperative

Milestones, Deliverables, and Go/No-Go Decisions	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
Task 1 -Project Management, Planning and Reporting	M1.1				D1.5				D1.5				D1.5				D1.5				D1.6
	M1.2																				
	D1.1																				
	D1.2																				
	D1.3																				
	D1.4	D1.4	D1.4	D1.4		D1.4	D1.4	D1.4		D1.4	D1.4	D1.4		D1.4	D1.4	D1.4		D1.4	D1.4	D1.4	
	G1.1				G1.2				G1.2				G1.2				G1.2				G1.2
Task 2 - Design and Engineering		M2.1	M2.3																		
		M2.2	D2.2																		
		D2.1	G2.2																		
		G2.1																			
Task 3 - Construction and Deployment			M3.1		D3.1				D3.1				D3.1				D3.1				D3.1
				M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	M3.2	
					G3.1				G3.1				G3.1				G3.1				G3.1
Task 4 - Inspection and Verification								M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	M4.1	
								M4.2											D4.1	D4.1	
								M4.3													
								M4.4													
Task 5 - Data Collection, Monitoring, and Analysis								M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	M5.1	
									D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	D5.1	
													D5.2				D5.2				D5.2
Task 6 - Outreach and Training	M6.1	M6.2	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3	M6.3
		D6.1																			

Table 4: Detailed Project Execution Plan

Enabling EV and DER Adoption Through DERMS, AMI, and Fiber Integration

Rappahannock Electric Cooperative

TASKS AND SUBTASKS	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
Task 1 -Project Management, Planning and Reporting																					
1.1 Develop Project Management Plan	■																				
1.2 National Environmental Policy Act (NEPA) Compliance	■																				
1.3 Cybersecurity Plan	■																				
1.4 Monitor Progress and Milestones	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
1.5 Monitor Project Budget	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
1.6 DOE Reporting (quarterly and annual)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Task 2 - Design and Engineering																					
2.1 Develop System and Operational Requirements		■																			
2.2 Complete Propagation Study for AMI/RF Mesh		■																			
2.3 Identify DER Locations for DERMS Integration			■																		
2.4 Develop Meter Change Out and Decommissioning Plans			■																		
Construction and Deployment																					
3.1 Installation Planning			■	■																	
3.2 Fiber Installation			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3.3 AMI/RF Mesh Installation				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3.4 Meter Changeout					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3.5 DERMS Deployment					■	■															
3.6 System Integration and Testing						■	■														
Inspection and Verification																					
4.1 Utility Inspection								■	■	■	■	■	■	■	■	■	■	■	■	■	
4.2 Perform DERMS/AMI Deployment Readiness and Functionality Test								■													
4.3 Cybersecurity Plan Test								■													
4.4 User Training								■													
4.5 Final System Turnover																			■	■	
Data Collection, Monitoring, and Analysis																					
5.1 Data Collection and Analysis								■	■	■	■	■	■	■	■	■	■	■	■	■	
5.2 System Optimization								■	■	■	■	■	■	■	■	■	■	■	■	■	
Outreach and Training																					
6.1 Define Audience & Content	■																				
6.2 Analyze & Select Vendor Outreach Channels	■																				
6.3 Schedule Outreach		■																			
6.4 Execute Outreach			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

3.5 Risks and Mitigation Strategies

Rappahannock Electric Cooperative maintains an enterprise risk management program with a Board-approved risk management policy, quarterly risk committee meetings, and semi-annual program updates. Projects undergo a risk assessment prior to review and approval by the Cooperative's executive team. REC uses an enterprise risk management platform, Fusion Risk Management, to register, track, and report risks and monitor associated controls. Table 6 illustrates the key risks and mitigation strategies for this project:

Table 5: Risks and Mitigation Strategies

Risk/Challenge	Mitigation Strategy
Technology	REC has chosen to work with global leaders in AMI, smart metering, distributed energy resource management systems, and electric system project management with successful, field-proven experience working with some of the world's largest investor-owned utilities to America's smallest cooperatives.
Supply	Supply chain risk is monitored regularly by all affected REC departments and was critical in vendor selection. At the time of application, REC's vendors have expressed confidence in the feasibility to install 30,000 – 50,000 meters per year across the service territory.
Third-party/vendor risk	Selected partners and vendors have significant experience and resources
Environmental	Currently deployed meters incompatible with project systems will be sold for re-use or disposed of by a third-party in an environmentally responsible manner. REC expects to sell its existing power line carrier meters for re-use or recycling following removal.
Inability to meet DOE expectations at review intervals	A well-structured project management plan developed by consultants and project managers with significant experience in DERMS, AMI, and other utility system integration and deployment

3.6 Team Communications

REC and its partners will operate using Microsoft Teams as the primary collaborative tool. REC also uses Microsoft Project and Sensei IQ to handle project and portfolio management, both of which interface with Teams. Together, these tools allow for document and artifact management, business insights and decision support, enterprise resource management, benefits realization, and reporting to stakeholders.

4. TECHNICAL QUALIFICATIONS AND RESOURCES

4.1 Project Partners

Rappahannock Electric Cooperative

Located in parts of 22 counties in Virginia, REC is one of the largest electric distribution cooperatives in the U.S. Currently, the co-op serves nearly 180,000 connections covering an area roughly 4,000 square miles with 18,000 miles of line. Uniquely positioned, the co-op territory is a major transportation hub with intersections of interstates 95, 66, 81, and 64, and centrally located between Washington, D.C. and Richmond, VA. In 2022, the co-op distributed 3.9 billion kilowatt-hours (kWh), with annual growth of nearly 3,500 additional meters. Safety and reliability are a high priority with continuous work to improve the System Average Interruption Duration Index (SAIDI) which topped at 210 minutes.

REC primarily purchases its electricity from Old Dominion Electric Cooperative (ODEC), a wholesale power supplier in VA. ODEC is committed to reducing its GHG emissions overtime, seeking to achieve a 50% reduction (from 2005 levels) in its carbon intensity (tons of CO_2/MWh) by 2030, and achieving a net zero GHG emissions by 2050. In addition, REC also purchases a small portion of its electricity from the Southeastern Power Administration, adding hydropower to its portfolio, and from Morgan Stanley Energy Partners.

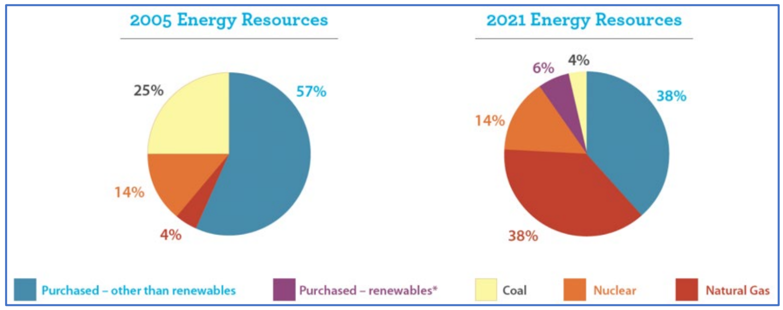

Figure 14: ODEC Energy Resources

Open Access Technology International (OATI) - DERMS

As the leading provider of grid reliability and smart grid solutions and services to the power industry, OATI offers extensive subject area experience, and research and development capabilities, covering transmission, generation, distribution, and energy market operations, as well as integration of renewable and distributed energy resources. OATI experts are actively involved in various industry forums addressing the emerging needs of the power industry. OATI has introduced innovative and pioneering solutions connecting generation, transmission, and demand-side resources to the wholesale energy markets, allowing utilities and market participants to optimize their power supply management efforts, manage the reliability needs of the grid, and fully harness the economic and social value of their assets. OATI's mission critical solutions are in use by over 2,200 power industry entities, including ISO/RTOs, Balancing Areas, Reliability Coordinators, utilities, distribution grid operators, municipalities, and others.

[redacted]

Landis+Gyr (L+G) – RF Mesh and AMI

For more than 125 years, Landis+Gyr has been an industry leader in energy management solutions. Using our advanced metering infrastructure and other cutting-edge smart grid technologies, we've helped utility companies all over the globe improve their operations, protect their assets, lower their operating costs and provide better customer service. With a focus on quality, reliability, and innovation Landis+Gyr's portfolio of products and services can help you do the same and modernize your smart grid for the future. At Landis+Gyr, we create a greener tomorrow through leading smart metering, grid edge intelligence and smart infrastructure technology. As partners, we empower customers and consumers to utilize resources in a more informed and sustainable way. Together, we manage energy better. Today, Landis+Gyr's integrated products and services are paving the way for the next generation of energy management solutions. For instance, we provide smart grid applications, demand-management technologies, data analytics, and renewables integration – a comprehensive portfolio that can help both utilities and consumers realize the full potential of the smart grid.

The Shpigler Group – Project Management

Founded in 2001, The Shpigler Group serves as a strategy management consulting firm, specializing in transitional analysis for clients in the energy sector. While traditional analysis may still work for companies involved in static industries, the dynamic changes occurring within the energy sector that feature extensive automation advances and new customer approaches suggest that traditional analysis and business approaches are simply no longer good enough. The Shpigler Group has extensive experience in the area of utility planning and operations, including a great deal of work in reliability improvement planning, new technology application and system analysis. Furthermore, The Shpigler Group has extensive experience in advanced technology infrastructure and working with utilities to develop optimal deployment strategies. They have managed large scale projects and worked with over 250 utilities over the past 21 years.

Smart Electric Power Alliance (SEPA) – Outreach

The Solar Electric Power Alliance (SEPA) is an organization that envisions a carbon-free energy system that is safe, affordable, reliable, resilient, and equitable. SEPA has a very specific role in the journey towards carbon-free. SEPA's mission is to accelerate the electric power industry's transformation to a modern energy future through education, research, standards, and collaboration and has a over 1,100 members comprised of utilities, technology solution providers, regulators, and other stakeholders. SEPA's areas of expertise include unbiased research and analysis, convening and facilitation, report development and writing, and results distribution and promotion.

4.2 Project Team

Peter Muhoro, Ph.D., Chief Strategy, Technology, and Innovation Officer
Project Role: Principal Investigator and Executive Leadership
Dr. Muhoro is an accomplished electric utility executive with nearly 20 years of experience in the energy industry. He is responsible for developing and monitoring long-term strategies related to the Cooperative's technology systems, new service offerings to the membership and business planning. Strategies developed under his leadership will include a technology strategy that addresses not only the Cooperative's needs of today, but more importantly, the information, distributed generation, clean energy, emerging technologies and advanced electrification needs of tomorrow. Over the course of his career, Dr. Muhoro held several positions working for and with electric cooperatives. He served as the Chief Strategy Officer at Pedernales Electric Cooperative, the largest distribution electric cooperative in the U.S. Prior to that he was an Advisor at the Cooperative Research Network, the technology research arm of the National Rural

Electric Cooperative Association. He has been a principal investigator, technical lead, and program manager on several grant funded projects including the NRECA flagship program Solar Utility Network Deployment Acceleration (SUNDA) that was DOE funded. He has previously launched several small businesses focused on energy analysis, bottom of the pyramid issues, and poverty reduction through efficient electrification. He serves on the boards of the Smart Electric Power Alliance, GridWise Alliance, Utilities Technology Council, VA Renewable Energy Alliance, as well as other advisory committees.

John Arp, P.E., Chief Engineering and Grid Operations Officer
Project Role: Executive Leadership and Design, Engineering, and Construction Oversight
Mr. Arp is REC's Chief Engineering and Grid Operations Officer. In this role, he oversees system planning, engineering and technical services, ensuring the successful implementation of the Cooperative's strategic plan. Previously, John served as the Cooperative's Western Regional Managing Director, where his key responsibilities included providing leadership for the regional design, operations, and construction teams and coordinating with directors and supervisors during outage restoration events. John holds a Bachelor of Science in electrical engineering from Tennessee Technological University and is a licensed professional engineer in Virginia and Pennsylvania. John brings 23 years of experience in the electric utility industry. Prior to joining REC, he worked 13 years for Allegheny Energy (becoming First Energy in 2012) as an electrical system planning engineer supporting field operations and construction.

Christopher Stoia, P.E., Managing Director - Engineering and Power Supply
Project Role: Technical Advisor and Engineering Management
Mr. Stoia is responsible for the REC's engineering department in all aspects of planning, coordination, protection, construction and maintenance of the Cooperative's electrical system as well as the Cooperative's apparatus and metering. This includes all distribution, transmission, substation and environmental needs, as well as wholesale power, revenue, transmission and distribution capital and all generation and interconnection matters. Further, Stoia is responsible for: REC's power supply contracts, billing and purchases; Rural Utilities Services (RUS) approval, planning and construction of the Cooperative's construction work plan and long range plan; managing major storms/outages by establishing meetings to assess the Cooperative's progress and formulate plans to address storm requirements; representing the Cooperative on engineering, generation and wholesale power matters internally as well as with the Rural Utility Service, Dominion Energy, First Energy, Old Dominion Electric Cooperative, PJM and other Cooperatives.

Jason Satterwhite, Managing Director – Regional Operations
Project Role: Construction Management
Mr. Satterwhite serves as the primary managerial representative for construction and maintenance activities. Satterwhite exercises managerial responsibility for engineering, operations, and construction and for the technical and operational & construction services.

[redacted] *– Director – Energy Solutions and Clean Energy*
Project Role: DERMS, DER and EV Management

[redacted]

Rebecca Messerle, Director – Accounting and Internal Controls
Project Role: Administration of Financial Tasks
Ms. Messerle oversees the Cooperative's accounting staff, directing staff in various audits and organizational projects including the Internal Control Assessment and Depreciation Study. She coordinates the annual financial statement audit, tax returns, and Form 7 submissions, as well as maintaining and communicating Generally Accepted Accounting Principles (GAAP), and internal control guidelines. Rebecca represents REC on the NISC Large Utility Committee (LUC) and was recently appointed to the National Society of Accountants for Cooperatives (NSAC) Electric Cooperative Chapter (ECC) board.

Larry Andrews, CTP, Chief Administrative and Finance Officer
Project Role: Executive Leadership and Administrative, Financial, and Regulatory, Oversight
Mr. Andrews leads the Cooperative's interests in finance and accounting, human resources, safety, risk, operational support services, facilities, and procurement. Andrews has more than 30 years of leadership experience in electric Cooperative finance and accounting, as well as the banking industry. Andrews is a certified treasury professional (CTP) as administered by the Association for Financial Professionals.

Tracey Steiner, JD, Chief Engagement and Consumer Officer
Project Role: Executive Leadership and Communication and Engagement Oversight
Tracey provids executive leadership in the Cooperative’s marketing and communications programs, assuring the Association’s voice of its membership resonated across the nation. Tracey’s experience includes functioning as Senior Corporate Counsel at NRECA. She also advised the Touchstone Energy Cooperative board and staff, helping to grow and further the brand which now serves more than 700 co-ops. For nearly a decade, Tracey served as NRECA’s Senior Vice President of Education, Training and Events.

John Hewa, P.E., Dr. Eng., President and Chief Executive Officer
Project Role: Executive Leadership and Oversight
Dr. Hewa has more than 20 years of leadership experience in the electric utility industry with an emphasis in technology and management of public and Cooperative power utilities. His experience also spans technical and executive roles managing electric, water, wastewater, and wireless and fiber optic telecommunications systems. Hewa serves on various board including the Virginia Chamber of Commerce, the Fredericksburg Regional Alliance, and Fredericksburg Regional Chamber of Commerce. He has previously served on the Board of Directors of the U.S. Energy Storage Association as well as the Smart Electric Power Alliance. Hewa holds a Bachelor of Science in electrical engineering and a Master of Science in engineering management from the University of Tennessee. He also earned his Doctor of Engineering at George Washington

University focusing on engineering management, researching and modeling energy storage for electric cooperatives in the PJM structured wholesale electricity market. Hewa is a registered professional engineer.

4.3 Prior Experience

The team has prior experience in managing DOE funded projects. Dr. Peter Muhoro will serve as REC's principal investigator on this project. He has experience with several DOE-funded projects, including NRECA's Achieving Cooperative Community Equitable Solar Sources (ACCESS), Solar Utility Network Deployment Acceleration (SUNDA), GEARED, and Pedernales Electric Cooperative's solar demonstration project funded by the Texas Department of Environmental Quality. Rebecca Messerle, Director of Accounting and Internal Control, has experience as the financial lead for a DOE SGIG $31 million grant. Tasks included monthly report submission to DOE for payment, quarterly reporting required by DOE, compiling data for the yearly single audits, and cost verification audit performed by DOE independent auditors. REC's project management consultant for this project, The Shpigler Group, has proven experience managing utility projects across North America with a client list that includes American Electric Power, BC Hydro (Canada), Burbank Power and Water, Duke Energy, Florida Power and Light, Pacific Gas and Electric, Southern California Edison, Toronto Hydro (Canada), and Xcel Energy. Their experience includes several AMI and DERMS implementations and upgrades, including experience with REC's selected vendors OATI and L+G. The Shpigler Group specializes in carbon reduction modeling, development of key performance indicators, and facilitating benefits realization. OATI and L+G have extensive experience in deploying such projects funded through grants. SEPA brings a breadth of experience in grant funded work and boasts over 100,000 contacts in the energy industry.

4.4 Equipment and Supply Chain

As a USDA RUS borrower, the "Buy American" provision of the Rural Electrification Act of 1936 (RE Act) requires, to the extent practicable and the cost of which is not unreasonable, that RUS Borrowers use loan funds only for such manufactured articles, materials, and supplies as have been manufactured in the United States or in any eligible country, substantially all from articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States or any eligible country. Supply chain risk is monitored regularly by all affected REC departments and was critical in vendor selection. At the time of application, REC's vendors have expressed confidence in the feasibility to install 30,000 – 50,000 meters per year across the service territory.