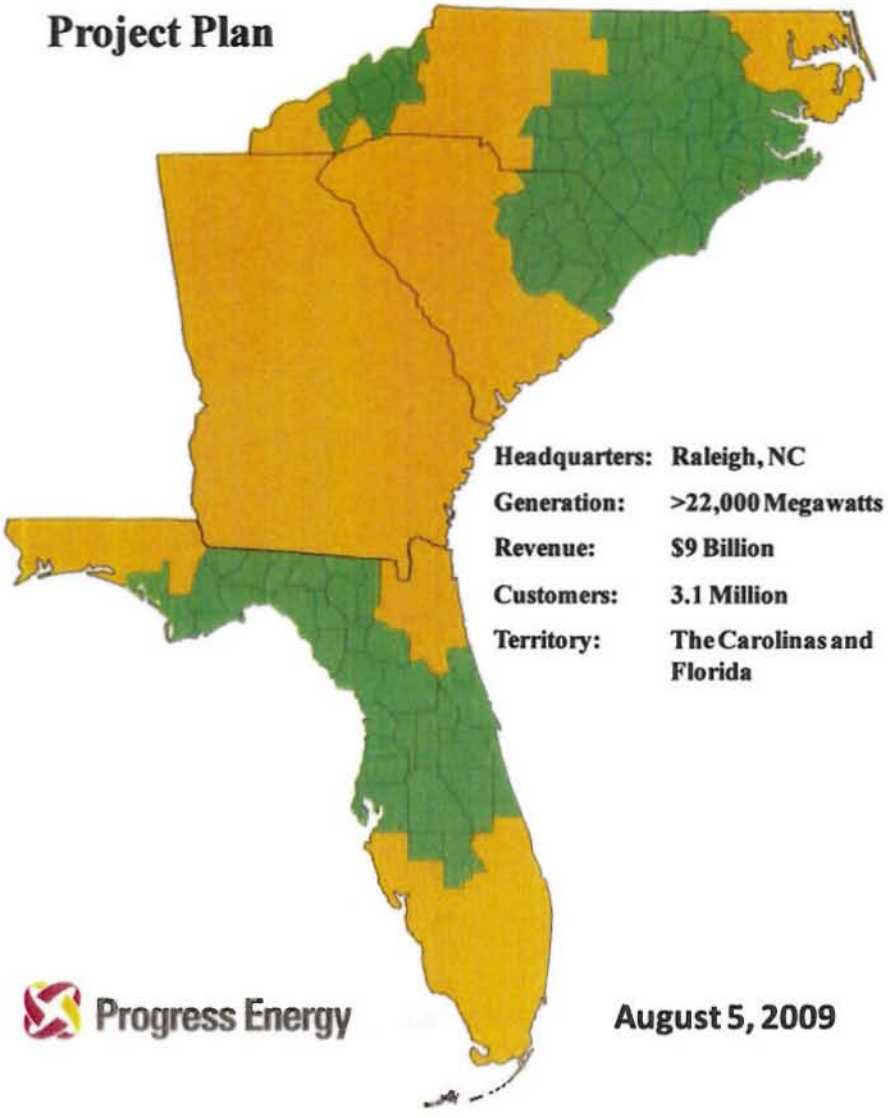
The Optimized Energy Value Chain

Project Plan



Headquarters:	**Raleigh, NC**
Generation:	**>22,000 Megawatts**
Revenue:	**$9 Billion**
Customers:	**3.1 Million**
Territory:	**The Carolinas and Florida**

Progress Energy

August 5, 2009

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1. Project Plan – The Optimized Energy Value Chain

1.1 Project Abstract – Integrated & Crosscutting

Progress Energy's proposal is part of a longer term multi-year investment plan designed to deliver DOE's big picture objectives. This $520M proposal emphasizes green MW delivery through innovative application of today's technology while establishing integrated and crosscutting systems to create capabilities necessary for the grid of tomorrow.

As a multi-state integrated investor owned utility, Progress Energy brings a unique opportunity to accelerate deployment of nearly [redacted] green MW of efficiency and demand response and will optimize the value across our entire enterprise. These investments will also result in accelerating future investments beyond the grant period, delivering nearly [redacted] MW by 2019, maximizing the value of DOE's investment.

This program leverages existing Program/Project Management organizational structures, standards, and disciplines to manage for on-time, on-budget delivery while ensuring benefits realization and includes the following activities and business drivers:

- Transition past demand side investments to Smart Grid compatible infrastructure to preserve, re-purpose and extend benefits
- Deploy AMI infrastructure that establishes a scalable platform for cost effective AMR-AMI migration and positions for dynamic rates
- Deploy grid management functionality that replaces emergency voltage reduction with utility-side demand response capability for routine operational use
- Deploy monitoring capability to critical transmission infrastructure for asset and demand management functionality
- Deploy feeder automation to advance partial restoration capabilities
- Build an advanced analytics engine that forecasts, coordinates and models a comprehensive view of Smart Grid energy and efficiency capabilities

This deployment will be a utility model for efficiency and load shaping representing over [redacted] of Progress Energy's generation capacity. If scaled nationally, this could represent [redacted] MW, reduce [redacted] tons of CO_2 emissions annually, be an important part of meeting Federal RES standards, and produce a present value savings of [redacted] over 10 years based on Cap-and-Trade policies currently being debated[1].

1.2 Project Tasks and Schedules

1.2.1 Project Description

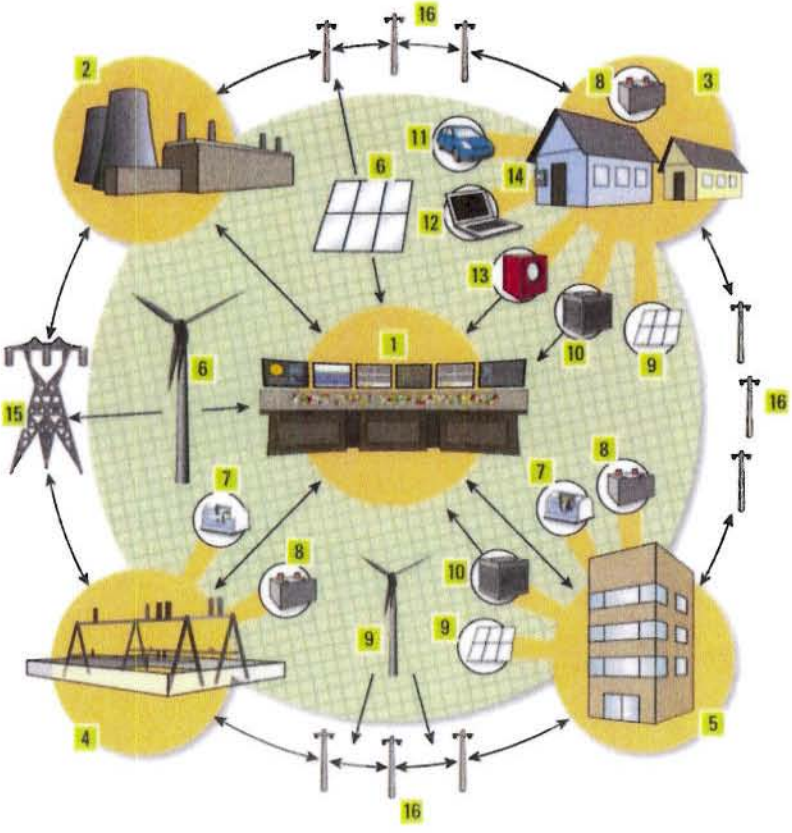
Progress Energy Service Company, LLC, as an agent for Progress Energy Carolinas, Inc. and Progress Energy Florida, Inc. (collectively "Progress Energy") offers this Smart Grid Investment Grant (SGIG) proposal. Progress Energy will leverage the grant as part of a $520M program, with DOE's $200M match representing 38% of the total value to deliver a unique value proposition for DOE. Our overall program,

[1] This is based on applying [redacted] to 2007 EIA/DOE Annual Electric Generator Report figures for total US generating capacity, an assumed emissions rate of [redacted] tons CO_2/MWH, a [redacted]% capacity factor, and a carbon trading value of [redacted] ton.

the Optimized Energy Value Chain (OEVC) will build a green Smart Grid virtual power plant through conservation, efficiency and advanced load shaping technologies. By the end of the grant period the OEVC will enable nearly [redacted]MW of peak load reduction, growing over [redacted]MW by the end of 2015, and producing a present value of fuel savings of $[redacted]M over 10 years.

Progress Energy will be asked during the coming years to provide for continuing growth in customer demand, deal with rising fuel costs, and respond to climate change, while balancing the cost impacts of new generation and renewable energy. This is the "why" behind our SGIG application. In order to adapt in this changing environment, Progress Energy is committed to a long-term Balanced Solution Strategy composed of state of the art plants, energy efficiency, and renewables to meet growing energy needs. The Smart Grid is viewed by the company as a fundamental tool to meet these objectives and is core to enabling expanded demand response and grid efficiency capabilities, and integration of renewables. Our grant proposal will add to elements already underway or scheduled by advancing future projects into the grant window.

Our Smart Grid Vision



1 Command center at Progress Energy
2 Baseload state-of-the-art power plants
3 Residential homes
4 Substations
5 Commercial, industrial and government (CIG) facilities
6 Utility-scale renewable energy generation
7 Distributed traditional generation
8 Distributed energy storage
9 Distributed renewable energy generation
10 Energy-efficient appliances
11 Electric vehicles
12 Real-time customer info
13 Demand-side management programs
14 Smart meters
15 Transmission lines
16 Distribution lines

Figure 1: Progress Energy Smart Grid Vision

Progress Energy, along with our strategic partner, [redacted] developed a multi-year roadmap and investment plan to prioritize Smart Grid project evaluation and implementation. This strategic approach, already in place, maximizes the value for DOE and helps to assure that the right foundational investments are being made. Investments already begun by Progress Energy, and added to by DOE through the SGIG process will position Progress Energy for continued acceleration of Smart Grid investments.

There is a central focus running through our Smart Grid roadmap that is fundamental to our SGIG proposal - maximize Smart Grid green MW, energy efficiency, and load shaping capability now through innovative application of today's technology while establishing foundational capabilities necessary for the grid of tomorrow.

Our Unifying Premise - The Optimized Energy Value Chain

Progress Energy sees a clear unifying premise to our investment strategy. The grid of the future must engage broadly with consumers, reacting to their consumption decisions, accommodating independent alternative supply and energy storage options, while leveraging advanced grid-side efficiency and demand response capabilities. All of these new intelligent capabilities bring value, but also complexity. The grid must be prepared for this evolving complexity and respond dynamically to, and in coordinated fashion with these new capabilities. A holistic analytics-driven engine that coordinates and maximizes the value of the Smart Grid and delivers optimizing capability is required, if we are to maintain and enhance grid stability and reliability.

Grant Plan for Progress

Progress Energy's grant application is framed to quickly advance the OEVC fundamental objectives, position the company for continuing Smart Grid advancement, and create sustainable high-skilled jobs beyond grant completion. This grant will build on Smart Grid efforts already underway or planned and will leverage federal matching funds to increase the breadth and scope of these efforts.

Progress Energy (PGN) is uniquely positioned to leverage its multi-state footprint, (Progress Energy Florida (PEF) and Progress Energy Carolina (PEC)) our proven capabilities and experiences to take the important next steps with Smart Grid for our customers, and most importantly for the industry.

Progress Energy Smart Grid Roadmap

Figure 2: Progress Energy Smart Grid Roadmap

Grant Project Elements Overview (Scope and Activities)

Re-purpose Emergency Voltage Reduction (VR) to Operational Distribution System Demand Response

This project is an industry leading project for its scope, breadth, and innovative integration, of systems and is designed to replace traditional voltage reduction capability with advanced peak load reduction and efficiency capabilities. Our project known internally as Distribution System Demand Response (DSDR) includes the following systems and capabilities:

- Distribution DSCADA System
- Distribution Management System (DMS)
- VAR Management System (VMS) with two-way digital telecommunications
- Advanced Volt-VAR analysis and optimization capability
- Loss Optimization and efficiency capability
- NIST Roadmap compliant interoperability and cyber-security architecture and infrastructure
- Distribution Feeder Conditioning (load and voltage balancing, voltage regulation, etc.)
- Distribution Automation and real-time sensing/monitoring

This system will deliver grid demand response and efficiency capability through real time unbalanced load flow analysis. The improved modeling and sensing capability of these integrated systems will position us to accomplish demand response while maintaining compliance with voltage delivery quality requirements. This project implements a DMS with real-time state estimation and unbalanced load flow analysis for advanced grid modeling and management capabilities and lays the foundation for reliable integration for customer owned distributed energy resources. The Progress Energy Carolinas project began in 2008 and is on schedule to be completed in 2012, and with SGIG funding the Progress Energy Florida deployment start date will be accelerated from 2013 to 2010. Together these efforts deliver over [redacted] MW of grid side demand response and efficiency capability within the grant period, and will reach nearly [redacted] MW by 2015.

Legacy Direct Load Control (DLC) Program Switch Uplift

Progress Energy Florida is a leader in the nation with over [redacted] percent of its residential customer base enrolled in its EnergyWise direct load control program, producing over [redacted] MW of demand response capability. In our pre-OEVC roadmap, Progress Energy Florida was positioned to begin a multi-year set of investments that would serve to transition and extend this legacy DLC infrastructure for compatibility with the Smart Grid. This older system leverages paging technology for command communications, and the portions of the project within the grant window will transition over [redacted] percent of this capability to Smart Grid-compatible infrastructure accounting for nearly [redacted] MW of value preservation, with full transition completed by the end of 2015.

Targeted Advanced Metering Infrastructure (AMI)

This project will deploy AMI to Progress Energy's remaining manually read meters. This includes commercial demand and non-demand meters, as well as residential time-of-use (TOU). This deployment represents over [redacted] meters across Progress Energy's multi-state footprint and would establish a scalable core communications infrastructure and systems capability. Our pre-OEVC roadmap positioned this deployment to occur in Progress Energy Florida's territory first with the

Progress Energy Carolinas service area following on a later timeline. SGIG funding would accelerate the Progress Energy Carolinas project initiation by two years, from 2012 to 2010. Upon project completion, this infrastructure would allow for broader AMI expansion to residential customers for incremental investments, improving the economics of AMI and representing an important business proof point for the Electric Utility industry. The project scope also includes a residential program development platform that will leverage the AMI backbone to create a statistically valid view across multiple residential customer segments for customer choice offering evaluation.

Condition Based Monitoring/Management (CBM) for Critical Transmission Transformers

This project will install on-line monitoring equipment on key and at-risk transformers throughout the Progress Energy multi-state transmission systems. The equipment will monitor parameters that will allow real-time assessment of asset conditions by Progress Energy and will be installed based on a prioritization of transformers throughout the transmission grid considering their criticality to the system, condition, age, operational history, and resulting risk profile.

The monitoring system consists of a commercially available multi-gas and moisture sensors for the main tank of the transformer, a multi-gas sensor for the tap changer compartment for load tap changing transformers (LTCs), a bushing monitor system, and a communication system for collecting the data and integrating it into the Progress Energy enterprise system. It will be applied to ~~80~~ critical stations upon full deployment.

Feeder Segmentation to Advance Partial Restoration Capabilities

This project will leverage advanced control devices at strategic locations on our feeders and will deploy state of the industry electronic controlled three phase reclosers with integrated sensing capabilities that enable the creation of loop-based feeders that allow for a faster outage restoration times. The waveform oscillography and event data retrieved from these devices will drive Progress Energy to higher levels of fault location accuracy, which is an essential step in support of the migration to automated isolation and partial restoration and eventually micro-gridding capabilities. More importantly they can be integrated into our pre-existing Feeder Monitoring System (FMS) infrastructure for seamless coordination with existing operational processes that have been used for over 10 years to achieve higher levels of reliability and power quality on our system.

Electric Transportation Enablement

Raleigh, NC is designate "Get Ready Now" city by the Rocky Mountain Institute and this project will deploy charging station infrastructure in a targeted manner to enable early adoption of electric transportation. This staged deployment will apply systems and approaches for monitoring and influencing customer charging practices for mitigation of negative impacts.

Analytics Engine for Optimization of the Energy Value Chain (OEVC)

This Progress Energy enterprise project will put in place a scalable advanced analytics engine whose purpose and function will administer the coordination and prioritization of advanced load shaping and efficiency Smart Technologies while integrating and coordinating with grid planning, modeling and forecasting activities. Preparing the grid to integrate renewables and other advanced Smart Grid capabilities is more than connecting them to the grid. It involves having an effective approach for seamlessly coordinating their value within the larger fabric of the grid. This is best accomplished through an advanced analytics engine that models, forecasts, coordinates, prioritizes and creates a view of day-ahead and hour-ahead of a green MW virtual generator made up of broadly dispersed capabilities. This virtual generator will function, work, and appear to grid planners just like a real physical plant at a single location.

In summation, Progress Energy's OEVC Project offers a unique value proposition for DOE. Progress Energy will leverage federal match dollars to bring forward significant elements, allowing DOE's investments in a

much larger $520M program with a **match of 38 percent** delivering nearly [redacted] green MW. Additional investments by Progress Energy beyond the grant period extends the value of DOE participation by expanding the green Smart Grid virtual power plant to over [redacted] MW by the end of 2015, and creating sustainable high-skilled jobs. By 2019 Progress Energy's corporate targets would grow this Smart Grid virtual power plant to nearly [redacted] MW.

Critical Interdependencies and Tasks

Progress Energy's OEVC Project has significant interdependencies and areas of coordination, both within individual grant projects as well as between projects. Some of the more critical areas are listed below:

- Early establishment of critical Information Technologies (IT) architecture strategy including data architecture, data model, system integration and Service Oriented Architecture (SOA) methodologies, information and data bus installations.
- Meter Data Management System (MDMS) selection and installation as a predecessor relationship to AMI meter deployment and the residential program development infrastructure.
- Telecommunications investments needed to support DLC Switch communication, AMI, DSDR, and Feeder Segmentation.
- Process optimization that fully leverages Smart Grid investments to create maximum value.
- Establishment of a thorough change assessment and corresponding Change Management Plan that integrates implications of Smart Grid on operational processes and procedures.

1.2.2 Project Schedule

The project structure incorporates project lifecycle phases, outlined in Figure 3, as directed by Progress Energy's Project Management Center of Excellence (PMCoE) guidelines. Corporate project management procedures and tools are used to mitigate schedule-related risks. Additionally, all Major Capital Projects ($\geq$ $50M) must create an Integrated Project Plan to govern the overall process flow and expectations for managing the project. Each impacted operating business unit is required to integrate their respective project plans and business case analyses for funding approval at each major milestone throughout the project lifecycle.

Initial funding approval is granted by presentation to the Senior Management Committee (SMC). Subsequent funding approval is granted at each major milestone throughout the project lifecycle by presentation to the appropriate member of senior management and other constituents. The nature of OEVC, with a combination of current and accelerated projects, is such that the phases between projects are not highly interrelated. However, there are several program-level planning elements that are shared across projects, such as Project Management Office (PMO) staffing and Integrated Project Plan (IPP) approvals. Additionally, all projects are introducing enhanced Smart Grid capabilities to the system that cannot be fully utilized without the central intelligence and telecommunication infrastructure in place.

The following abbreviated project plan shows how these components, such as DSCADA, DMS, and MDMS, will be brought online to provide the backbone for Smart Grid functionality within the three-year grant period and well beyond. Most projects are completed by early 2012 with a program close scheduled for September 30, 2012.

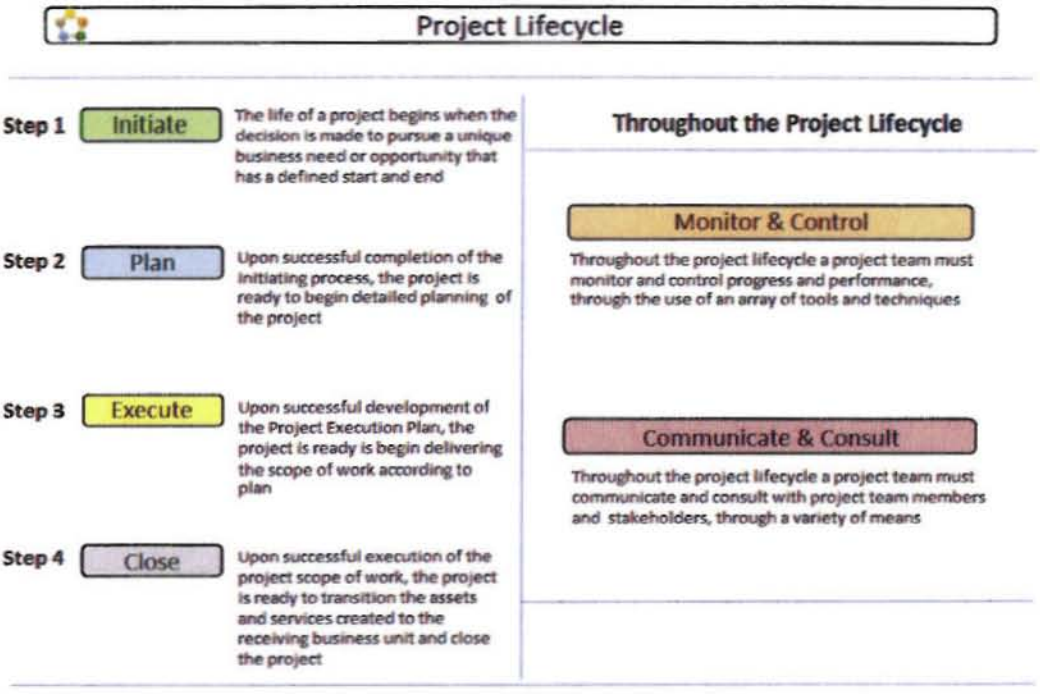


Figure 3: Project Lifecycle

Figure 4: Gant Chart for the OEVC Project

In addition to quarterly progress and financial reports, the Smart Grid PMO will submit to DOE annually a special status report, which will include the performance metrics as outlined in *1.6 Project Costs and Benefits*. Final reports will be submitted to DOE by September 30, 2012.

Major Milestone/Deliverable	Date	
	Plan/Forecast	Actual
Commence Construction *(DSDR - NC)*		1st Qtr 2008
Submit SGIG Application		**08/06/09**
Finalize Project Plan *(Switch Uplift - PEF)*	[redacted]	
[redacted]	[redacted]	
Anticipated Regulatory Filing Date ***(Targeted AMI - PEF; Switch Uplift - PEF)***	[redacted]	
Execute DOE Contract	[redacted]	
Internal IPP Process & Annual DOE Reporting	[redacted]	
Preconstruction Clearances & Permissions *(CBM - PEC/PEF)*	[redacted]	
Release Workplace/Public Charging Station Offering *(PHEV)*	[redacted]	
Anticipated Regulatory Approval ***(Targeted AMI - PEF; Switch Uplift - PEF)***	[redacted]	
Commence Equipment Deployment *(CBM - PEC/PEF)*	[redacted]	
[redacted]	[redacted]	
Release Residential Charging Station Offering *(PHEV)*	[redacted]	
Commence Load Switch Deployment *(Switch Uplift - PEF)*	[redacted]	
Initial Scaled Meter Deployment for End-to-End Testing *(Targeted AMI)*	[redacted]	
First Mass Market Plug-in Vehicles in the Market *(PHEV)*	[redacted]	
Complete Analytics Engine Design	[redacted]	
Internal IPP Process & Annual DOE Reporting	[redacted]	
Release of Production MDMS System *(Targeted AMI)*	[redacted]	
DSCADA Communications Testing *(Feeder Segmentation - PEC)*	[redacted]	
Commence Deployment of Analytics Engine	[redacted]	
Complete Engineering Evaluation of Existing Fleet *(Feeder Segmentation - PEF)*	[redacted]	
Complete DSCADA Deployment *(DSDR less DMS - PEF)*	[redacted]	
Internal IPP Process & Annual DOE Reporting	[redacted]	
Complete FMS and VMS Deployment *(DSDR less DMS - PEF)*	[redacted]	
Project Close *(CBM - PEC/PEF)*	[redacted]	
Execution - Installation/Testing/Commissioning *(Feeder Segmentation - PEC)*	[redacted]	
Project Close *(Feeder Segmentation - PEF)*	[redacted]	
Develop Long-term Smart Charging Solution *(PHEV)*	[redacted]	
SGIG Program Closeout & Final DOE Report	[redacted]	
Project Close *(Switch Uplift - PEF)*	[redacted]	
Complete Feeder Conditioning *(DSDR less DMS - PEF)*	[redacted]	
Internal IPP Process	[redacted]	
Project Close *(DSDR less DMS - PEF)*	[redacted]	

Figure 5: Major Milestones and Deliverables

1.2.3 Regulatory Approval

Progress Energy operates utilities in three states: North Carolina, South Carolina, and Florida. The state regulatory bodies having jurisdiction over our utility operations are the North Carolina Utilities Commission (NCUC), the Public Service Commission of South Carolina (PSCSC), and the Florida Public Service Commission (FPSC).

In North Carolina and South Carolina, we have received approval from the NCUC and the PSCSC for the Carolina DSDR project. This project will provide our matching funds investment for Progress Energy Carolinas. The SGIG DOE funds will be applied to projects within Progress Energy Carolinas that have not yet been approved and therefore do not require advance regulatory approval.

Within Progress Energy Florida, we intend to file our Switch Uplift and Commercial AMI projects with the FPSC for approval under our Demand Side Management/Energy Efficiency (DSM/EE) program. These projects have been evaluated using the standard Rate Impact Measure (RIM) cost effectiveness test and have passed this test as prudent investments to meet peak demand reduction targets. We fully expect to receive regulatory approval for these projects, as the FPSC has never rejected a program that passes the RIM cost effectiveness test. These two projects will provide the matching funds investment for Progress Energy Florida. We plan to file these programs as part of our current goals filing process in November 2009 in accordance with the rules of the FPSC. Based on past experience with filing programs of this type, we expect to receive FPSC approval by approximately April 2010.

The SGIG funds will be applied to projects being accelerated within Progress Energy Florida and Carolinas and therefore do not no require regulatory approval.

1.3 Management Plan

1.3.1 Relevance

Progress Energy's investment plan has three strategic objectives and value delivery streams that align with DOE's seven Smart Grid characteristics and the objectives of DOE's Smart Grid Investment Grant. These include grid enablement and optimization, customer enablement, and business transformation based on new Smart Grid capabilities. Progress Energy recognizes the business transformation opportunities across the traditional line of businesses as a result of being a fully integrated utility.

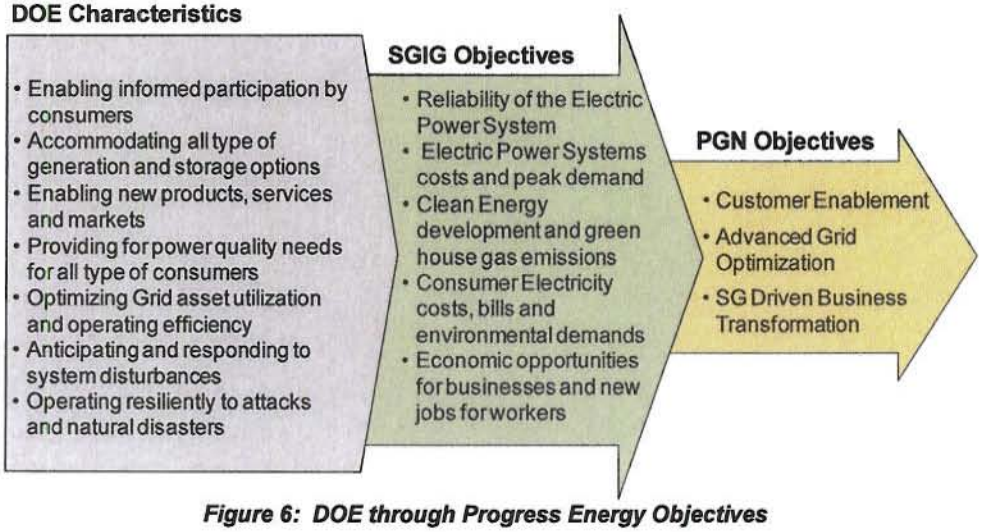


Figure 6: DOE through Progress Energy Objectives

Progress Energy's OEVC Project is focused on maximizing delivery of green MW now through a set of objectives that have influenced Progress Energy's Roadmap for Smart Grid investments and have

served to support both approach and priority for investments. The DOE's SGIG program is designed to advance the deployment of Smart Grid while providing useful and important business proof points around business value. Our project is particularly relevant for three key reasons:

1. It focuses first on maximizing green MW, conservation and efficiency, and load shaping capabilities now via commercially available systems, products, and equipment available in the market place today that have cost effective business benefit to support deployment.

2. It preserves the value of these investments over what will be a multi-year build out of expanding Smart Grid functionality through compliance with interoperability and cyber security methodologies and standards. To preserve value over the longer term, with continued evolution in technology, and to manage the risk of stranded investments, the Smart Grid must be architected in a way that creates modularity, allowing for different generations of technology enabled capability to co-exist and for platforms invested in today to be used and useful for their entire projected asset life.

3. It expands the optimization value of this set of "ready-now" Smart Grid investments by use of an advanced analytics engine that will serve as the holistic point of integration of Smart Grid enabled capabilities with existing grid modeling, planning, and forecasting processes and activities.

This proposed set of projects represents a holistic view of the Smart Grid, advancing customer enablement opportunities, grid side demand response, load shaping, efficiency capability, and the Smart Grid business transformation through the analytics engine along with the larger vision for extended capability towards a green MW virtual power plant. Viewed in this way, Progress Energy's OEVC Grant Proposal is a utility model for efficiency and load shaping capability containing numerous business proof points that address economics as well as stakeholder and regulatory considerations that utilities need to consider. Most importantly, if scaled nationally, this solution could represent [redacted] MW, reduce [redacted] M tons of Green House Gas emissions annually, be an important part of meeting future Federal RES standards, and produce present value savings of $[redacted] based on Cap-and-Trade policies currently being debated[2].

1.3.2 Project Team

The OEVC Project will be managed through the Smart Grid PMO, with Rebecca Harrison as the Program Manager. The SGIG Program utilizes a cross departmental, cross functional organization to oversee a portfolio of projects to achieve operational benefits, advancing Smart Grid development on the Progress Energy electric systems. In Figure 7 is a functional organization chart for the Smart Grid PMO.

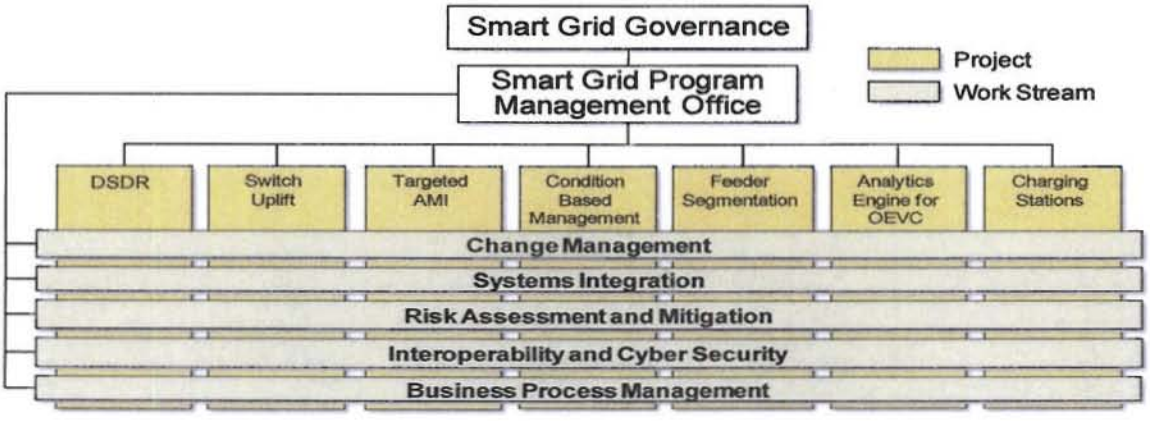


Figure 7: Smart Grid Governance

[2] This is based on applying [redacted]% to 2007 EIA/DOE Annual Electric Generator Report figures for total US generating capacity, an assumed emissions rate of [redacted] tons CO_2/MWH, a [redacted] capacity factor, and a carbon trading value of $[redacted]/ton.

The Smart Grid PMO is responsible for implementation of each of the individual projects, as well as ensuring that the projects integrate effectively into a cohesive set of Smart Grid capabilities. The Program Manager must:

- Ensure that all the disparate systems being installed integrate well to form an enterprise-wide Smart Grid system;
- Adequately assess risks and take necessary mitigation measures;
- Ensure that interoperability and cyber security issues are understood and appropriate actions are taken;
- Optimize Smart Grid-enabled processes to take full advantage of the Smart Grid investments that are being made;
- Employ change management practices that effectively move the organization to new work methods and processes;

Individual projects have their own project team including a subject matter expert and several functional representatives. These teams are responsible to the Program Manager for completing the scope of work on schedule, within budget, and safely.

Governance of the Smart Grid PMO is provided by a Smart Grid Executive Sponsorship Team, Smart Grid Steering Committee, and the VP of the Efficiency & Innovative Technology Department. In Figure 8, a graphical representation of governance organizations is shown.

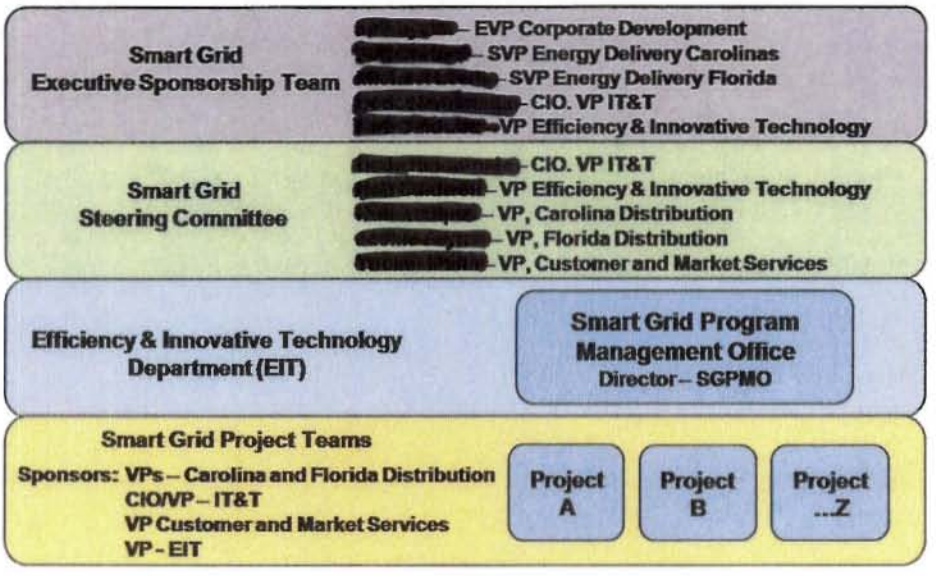


Figure 8: Governance Organizations

The Smart Grid Executive Sponsorship Team has overall responsibility for Smart Grid investments for the company. They assure these investments align with our Balanced Solution strategy and our Enterprise Technology Strategic Plan.

The Smart Grid Steering Committee provides overall governance and strategic guidance and vision for Smart Grid investments. The Steering Committee reviews and approves project plans, key milestones, and budgets; assures project resource allocation; and secures project funding and budget coordination. The Steering Committee reports to Senior Management Executives.

The VP of Efficiency & Innovative Technology (EIT) provides leadership to orchestrate successful delivery of Smart Grid projects, including the identification, prioritization, and sequencing of projects. This involves development of project plans, coordination of long term capital plans, coordination and

management of project teams, management of project risks and project interdependencies. The EIT organization is also responsible for oversight of DSM/EE programs, renewable generation purchases, and emerging technologies, so integration of all these with Smart Grid investments resides in the same organization.

The Program Manager has the overall responsibility and authority for planning and executing the SGIG project safely, within budget, and on schedule while in compliance with local, state, and federal laws. Specific responsibilities for the Program Manager include preparation of the project plans, managing the project team for execution of tasks, organizing and reporting project status to the Steering Committee and Executive Sponsorship Team, and managing the interfaces between the stakeholders and within the project team.

One of the tasks already underway is the Progress Energy Carolinas DSDR project. To manage this project's size and complexity, a robust organization was established. In Figure 9, is the organizational chart for the project, which serves as an example of how we organize to manage large projects. Additionally, resumes of key DSDR project team members can be found in Attachment 1.2.1.

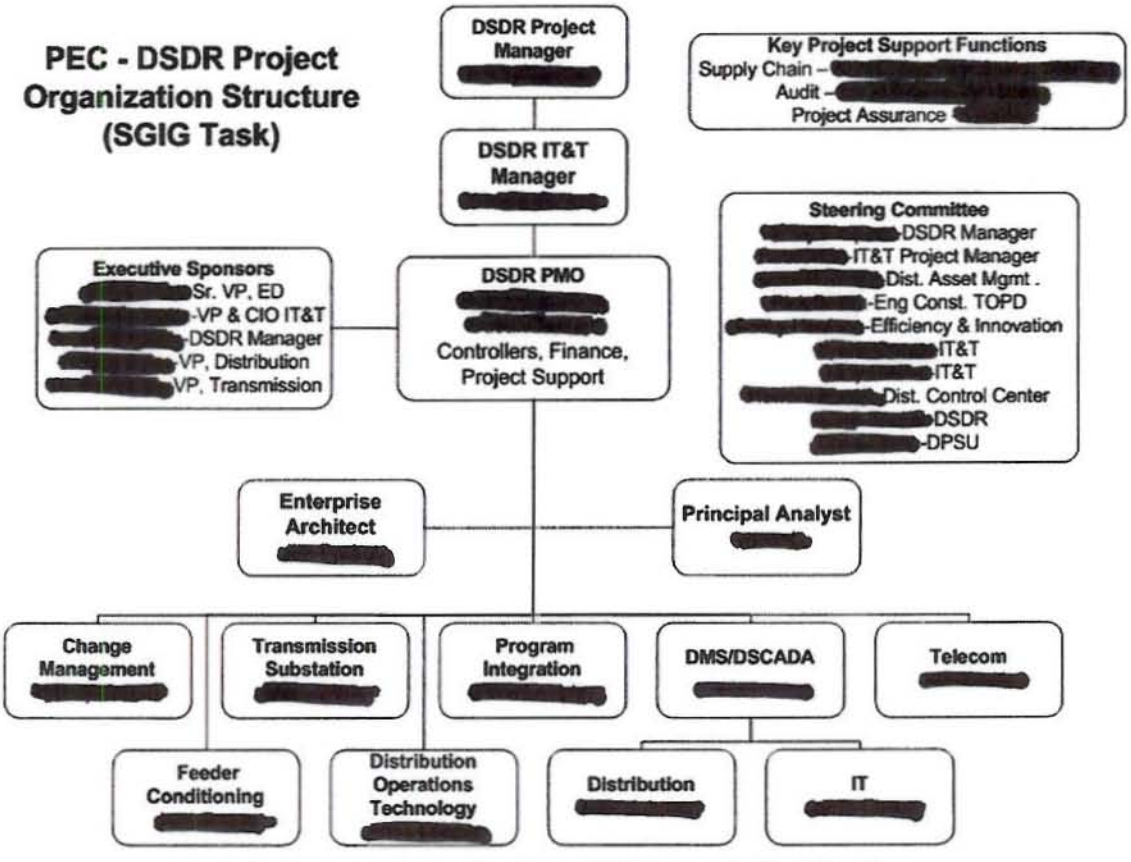


Figure 9: Progress Energy Carolina's DSDR Organization Structure

1.3.3 Project Management

Effective Project Management is a key activity to ensure the successful, on-time and on-budget completion of any project. Progress Energy is partnering with [redacted] to manage the OEVC Project and its associated tasks. [redacted] is able to demonstrate a fully documented project management methodology to minimize risks, and they have a proven track record of successful undertakings.

[redacted]s methodology for developing and delivering solutions, [redacted] was created to harness and structure this vast well of experience and 'know how' to deliver end-to-end best of breed industry solutions. Because the solution [redacted] will implement is built upon both the technical and the industry experience of our global community of practitioners, [redacted] is in a position to minimize project risks based on more predictable results derived from previous projects.

This couples well with Progress Energy's own methodology, refined in our Project Management Center of Excellence (PMCoE). The PMCoE was chartered in May 2008 to achieve the following company-wide initiatives:

- standardize processes, tools, and templates,
- establish a project management career path,
- provide common training & qualification programs,
- adopt best practices from both internal and industry groups.

The PMCoE has quickly evolved into an industry leader, recognized externally and being selected to present at the 2009 PMO Symposium held in Atlanta, GA. The Symposium is sponsored by the Project Management Institute (PMI), the globally recognized project management association.

Roles that will be utilized for the OEVC Project are:

Role	Company	Responsibility
Program Manager	PGN	Ensuring the project utilizes standard templates, processes and tools referenced in the PMCoE. Additionally, will manage periodic status meetings, monitor time management, costs, resources, scheduling, integrate tasks, communicate and monitor and control at the Program level.
PMCoE	PGN	Responsible for periodically assessing the effectiveness of required procedures and providing training, assistance and procedural updates.
Systems Integration (SI) Project Manager	[redacted]/PGN	The SI PM is responsible for managing the systems integration portion of the OEVC Project. While reporting to the PM, they are responsible for a similar set of functions but only applicable to SI.
PMO – Analyst (2)	[redacted]/PGN	PMO analysts will assist the PM in conducting day-to-day business. Additionally, they will take on the project management at the task level and report up.
Organizational Readiness Lead	[redacted]/PGN	Responsible for measuring the current state of Progress Energy from top-level management down to all impacted levels. Additionally, will be responsible for managing key stakeholders and communicating information to Progress Energy as a whole.
Benefits Realization Lead	[redacted]/PGN	Responsible for the measurement and tracking of the OEVC Project to determine impact. Starting with a defined baseline, the BR lead will collect information from across the company to isolate and determine the actual effect of the OEVC Project.
Project Managers	PGN	Each project within OEVC will have an assigned manager who is responsible for managing their respective piece of the OEVC story. Project Managers will be accountable for progress, benefits, schedule, risk and reporting.

Figure 10: Roles for the OEVC Project

[redacted] will initially take on a larger role in managing the OEVC Project, but Progress Energy employees will move into the PMO roles over the course of the project. [redacted] is offering expertise and resource augmentation, though as Progress Energy resources become available and are trained, the [redacted] presence will diminish.

Because of the large size and complexity of the OEVC Project, particular detail has been paid to the management of time. A six-part time management process has been created by the PMCoE and will be the basis of managing this project as represented in Figure 11.

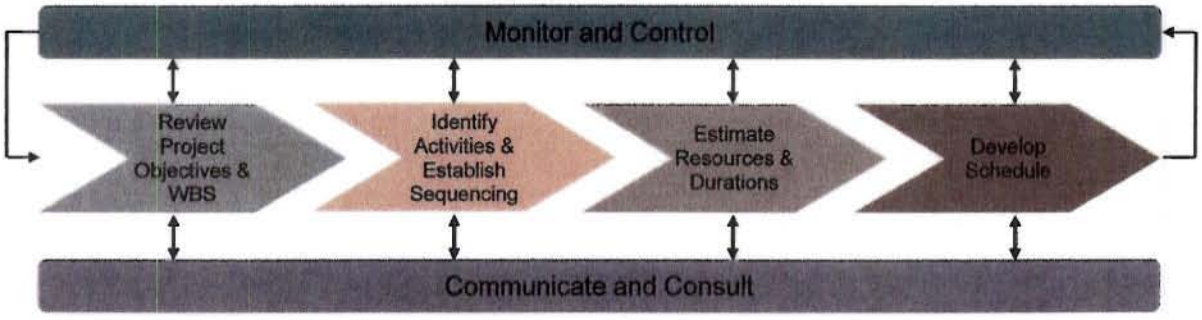


Figure 11: Process for Time Management

The process of developing a schedule is focused on determining the planned start and finish dates of the project activities. Schedule development is an iterative process that requires that duration and resource estimates be reviewed and revised as new information becomes available. Ultimately, the Project Manager approves the schedule and is responsible for managing and organizing tasks and activities. As schedule development progresses and the amount of detail increases, the schedule is grouped and displayed into various schedule levels, such as:

- Level 1: shows the main milestones to complete the project,
- Level 2: shows the scope of work to achieve the milestones,
- Level 3: shows the deliverables to achieve the scope of work,

Schedule development continues throughout the project lifecycle and changes are made as activities are completed, removed, altered and/or added. A number of tools and techniques are available to assist in the development of schedules, including:

- Schedule Network Analysis
- Critical Path Method [CPM]
- Schedule Compression
- What-If Scenario Analysis
- Resource Leveling
- Critical Chain Method
- Use of Project Management Software
- Application of Different Calendars
- Adjustment of Leads and Lags

At a high level, Progress Energy and [redacted] will approach the OEVC Project using the following phases and activities as indicated in Figure 12.

Defining	• D1: Understand objectives and plan defining activities • D2: Define target solution	• D3: Describe overall approach • D4: Shape Project • D5: Assess effectiveness of project plans
Planning	• P1: Build project organizational unit work plans • P2: Build agreement with supplier	• P3: Integrate project organizational unit work plans • P4: Finalize sponsor agreement
Starting	• S1: Initiate phase • S2: Implement project management system • S3: Expand work plans	• S4: Establish technical environment • S5: Obtain staff • S6: Start staff • S7: Start subcontractor
Monitoring	• M1: Track and control progress • M2: Assess estimating basis • M3: Hold internal communication meeting • M4: Audit or review subcontractor • M5: Participate in audit or review	• M6: Reconcile financial data • M7: Report project status • M8: Handle in-scope request • M9: Continuously assess risks • M10: Continuously assess project health
Handling Exceptions	• HE1: Handle issues • HE2: Handle actions • HE3: Analyze situation • HE4: Handle compliance incident	• HE5: Handle change request • HE6: Handle controversial defect • HE7: React to risk occurrence
Closing	• C1: Release staff • C2: Release subcontractor	• C3: Manage end of project

Figure 12: OEVC Project Phases and Activities

1.3.4 Team Qualifications

Background on Progress Energy

- Progress Energy Florida has the single largest Direct Load Control (DLC) program in the US,[3] and has a demonstrated leadership role in energy efficiency capabilities comprised of nearly three decades in customer side load shaping capability.
- Over a decade of experience in industry-leading advanced analytics and Feeder Monitoring System (FMS), Real Time VAR Management/Optimization and Distribution Grid Modeling, integrated to create a system wide fault location and management capability. Progress Energy Carolinas has had an industry-leading advanced fault locating capability for over a decade covering 100 percent of its distribution circuits with a locating accuracy of within two spans for over 80 percent of faults. Its FMS includes event-driven oscillography capture, and its VAR Management System dynamically optimizes VARs and line loss based on line conditions every 15 minutes to deliver a 99 percent power factor on the high side of our distribution substation transformers.
- Demonstrated experience with deploying commercially available platforms in an innovative way, which adds unique value through integrated interoperable data and information sharing. We have a history of discipline and experience with advancing what has broader value to the industry and

[3] Based on the ratio of demand response capabilities to load requirements at system peaks

not what is unique just to Progress Energy. We work with our vendor partners to build these capabilities as part of their standard customer offerings.

- Recent upgrade across the entire multi-state Progress Energy footprint of the Geographic Information System (GIS) platform that leverages an open architecture founded on an Oracle spatial database, which increases interoperability capabilities of this key foundational platform.
- Suite of grid and operations technologies integrated for business capabilities has served to create an experienced and enabled work force, receptive and positioned to embrace and leverage technology.

The OEVC Project team consists of a number of highly qualified individuals. Highlighted here are the Program Manager and several key individuals in supporting roles. Attachment 1.2.2 contains resumes for these individuals as well as others whose qualifications are representative of OEVC project members.

[redacted] – Program Manager, Director of the Smart Grid Program Management Office

[redacted]

[redacted] – Project Manager of the Distribution System Demand Response Project

[redacted]

[redacted] – Director of Infrastructure & Cyber Security Services

[redacted]

[redacted] – System Architect, Information Technology & Telecommunications

[redacted]

[redacted] – Project Management Center of Excellence

[redacted]

[redacted] – Project Assurance Program Lead

[redacted]

These key leaders will provide Progress Energy with the experience and subject matter expertise necessary to allow us to complete the OEVC Project safely, on schedule, within budget, and with quality results.

1.3.5 Vendor Qualifications

Progress Energy has employed, or will employ, a strong list of vendors for our OEVC Project. Among them are the following and what they will be supplying to the project:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

1.3.6 Organizational Commitment

Progress Energy is proud to have received high rankings in the 2009 J.D. Power and Associates survey of business customer satisfaction: Progress Energy Carolinas is second in the nation and Progress Energy Florida is eighth in the Southeast. This is a testimony to how we are meeting our commitment to providing reliable and affordable electricity to our customers. It is also the result of a history of strategic investments in Generation, Transmission, and Distribution assets.

In the late 1990's, Progress Energy initiated an effort to become one of a few utilities in the country to implement large scale deployment of feeder monitoring equipment for expedited identification of fault locations, resulting in shorter restoration times. More recently, Progress Energy Carolinas became the first utility in the country to undertake a system-wide distribution system investment targeted at achieving approximately [redacted] MW in peak load demand response and 12 MW of enhanced grid efficiency gains. The major capital project, known as DSDR, will serve as the foundation upon which future Smart Grid capabilities will be built. Our Chief Executive Officer (CEO) confirmed Progress Energy's commitment to invest in Smart Grid advancement in a message to our employees, customers, and stakeholders:

> ***Progress Energy's 2008 Annual Report: Message from Our CEO***
> *FORWARD-LOOKING INITIATIVES – "Securing our energy future requires a diverse, balanced strategy to meet the energy needs of a growing population and the emerging federal and state policies to reduce carbon emissions and climate change. Progress Energy's strategy includes aggressive energy efficiency and innovative alternative energy (such as solar and biomass projects), as well as state-of-the-art power plants to provide needed large-scale generating capacity. It's a portfolio approach that leverages advances in nuclear plants and transformational technologies such as the Smart Grid and plug-in electric vehicles... At Progress Energy, we must lay the groundwork now to make sure we're ready to meet our service areas' energy needs a decade ahead. In this down economy, we reduced our 2009 capital spending plan by about $250 million, but we continue to fund our critical capital projects. It's important for us to keep making strategic investments that will produce value for our customers and investors."*

[redacted]
Chairman, President and Chief Executive Officer
March 2009

A recent corporate realignment also demonstrates the company's focus on Smart Grid technology to help us achieve the "balanced solution" of energy efficiency, alternative energy resources, and state of the art plants. The realignment has created a single organization that spans both operating companies, Progress Energy Carolinas and Progress Energy Florida, in order to achieve increased collaboration and coordination in the planning, development and implementation of the balanced solution. With years of management experience, most recently serving as the President and CEO of Progress Energy Florida, [redacted] has been tapped to lead this new organization.

Progress Energy's OEVC Letter of Commitment (Attachment 2.2)
"Smart Grid advancements are critical in enabling our system to maximize demand side management and energy efficiency benefits by enabling active participation by our consumers, enhance power quality and reliability, optimizing grid assets and efficiency, and adapt to growth in distributed generation assets, including renewable generation resources and energy storage. To this end, Progress Energy has developed a Smart Grid roadmap representing our long-term vision of how the advanced functionalities will be integrated... The potential to accelerate many of the long-range Smart Grid roadmap initiatives through SGIG is of interest to Progress Energy because of the significant benefits that it represents for the company and our customers... assuming mutually agreeable terms, we are committed to making available the finances and resources necessary to successfully complete the scope of work outlined in our grant application."

[redacted]
EVP, Corporate Development Group
August 2009

In this role, [redacted] is providing leadership and support for the Smart Grid Program Management Office, which is led by [redacted]. The following organizational chart, as represented in Figure 13, indicates the management reporting structure providing governance for this project.

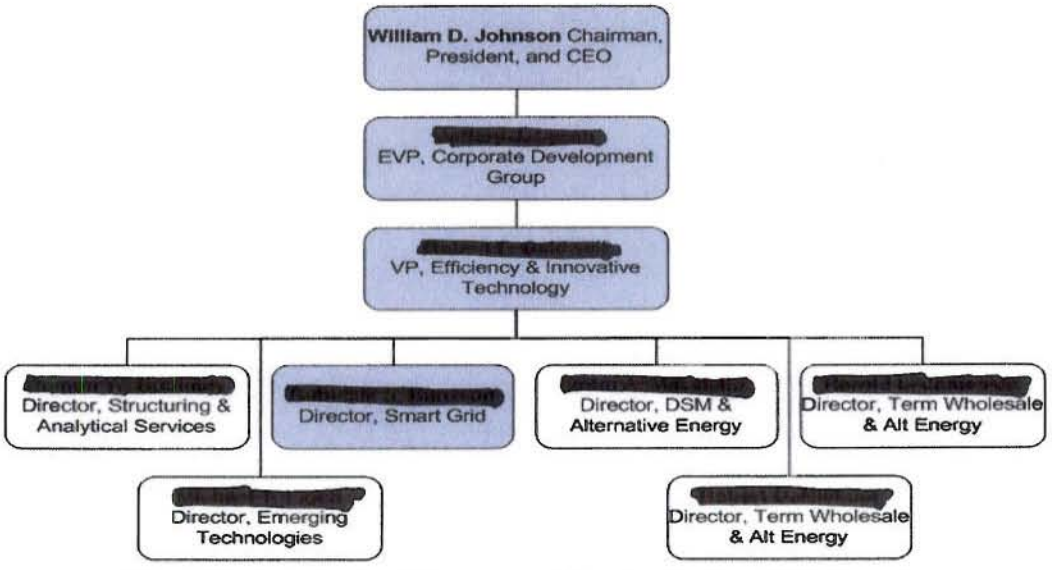


Figure 13: Organizational Management Structure for Smart Grid Projects

1.3.7 Risk Identification and Mitigation

Aligned with PMBOK® methodology, Progress Energy's PMCoE has established a risk management process standard by which all tasks of considerable size and complexity must comply. All projects and all tasks will adhere to this process, as outlined below, throughout the project lifecycle.

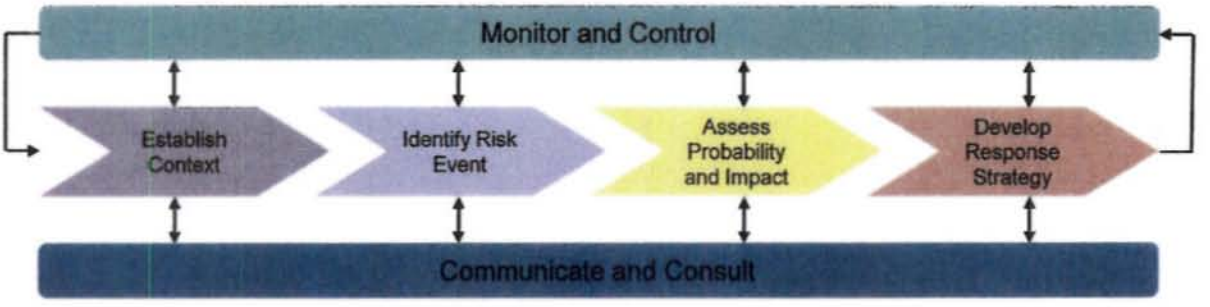


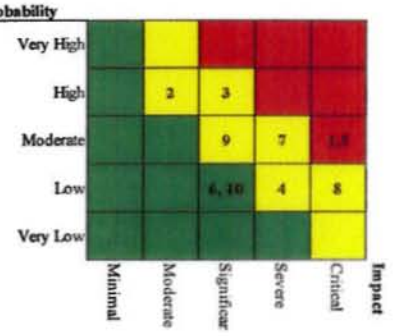
Figure 14: Process for Risk Identification and Mitigation

1. Establish context by clearly defining cost, schedule, quality, and compliance objectives,
2. Identify risk events by reviewing internal/external factors, preliminary scope, and assumptions and constraints,
3. Assess individual risk events using Progress Energy's standard probability and impact scales,
4. Develop a risk response strategy for each risk event,
5. Complete PMCoE's risk register tool to collect information and to facilitate the monitoring and control of project risk,
6. Utilize a risk matrix tool to summarize the status of each risk event, provide a visual tool for communicating to key stakeholders, and determine what degree of management involvement the project team requires to address a risk event.

Large, strategic project risks warrant additional rigor and communication to ensure the corporation has a comprehensive perspective of the uncertainties representing the biggest threat to on-time, on-budget project delivery. Additional requirements to be applied to the key strategic risks, potentially influencing project success, include 1) monetization of quality and schedule impacts and calculation of the expected monetary value (EMV) for both project- and enterprise-level risks as a measure of risk exposure, 2) pre- and post-response strategy probability and impact assessments including identification of risk triggers, 3) pooling of risks for analysis of pre- and post-response risk analysis, 4) risk trending and tracking of EMV by month with comparisons to contingency reserves, and 5) creation and upkeep of a project-specific Risk Management Plan.

Context for this project is discussed in detail in the Project Tasks & Schedules (1.2) and Project Costs and Benefits (1.6) sections. Figure16, which was populated from the risk register tool, provides a summary of identified key risks and corresponding abridged response strategies, while the risk matrix tool in Figure 15 provides a graphical representation and assessment metrics. In accordance with Funding Opportunity Announcement (FOA) guidance, each risk event is segmented into one of four risk pools – Technical, Financial, Regulatory, and Institutional. In general, PGN will leverage internal procedures (including the IPP approval process and DOE Earned Value Management System (EVMS) Gold Standard principles), stakeholder involvement, extensive technology evaluation, and continuous regulatory engagement to help mitigate all risk types.

Level	Likelihood of Occurrence
Very High	>89%
High	66-89%
Moderate	34-65%
Low	11-33%
Very Low	<10%



Risk Level

HIGH	Target unachievable. Mgmt attention required.
MODERATE	Target achievement uncertain. Mgmt. attention may be needed.
LOW	Target achievement certain. Minimum oversight needed.

Impact:

Category / Level	Cost	Schedule	Quality	Compliance
Minimal	<2%	No slip	No reduction	Project compliant
Moderate	≥2 & <5%	Slip occurs, but has little or no impact on project	Quality reduced, but has little or no impact on project	Local/State/Federal warning or Near Miss
Significant	≥5 & <10%	Slip occurs, Significant impact on project	Quality reduced, Significant impact on project	Local/State/Federal violations or Recordable/Lost Time Indicent
Severe	≥10 & <15%	Slip occurs, Noticeable impact on enterprise	Quality reduced, Noticeable impact on the enterprise	Local/State/Federal stoppage or Fatality
Critical	≥15%	Unacceptable slip occurs	Unacceptable reduction in quality	Local/State/Federal stoppage or Fatality

Figure 15: Risk Matrix

Figure 16: Summary of Key Risk Events and Response Strategies

1.3.8 Multiple Applications for Recovery Act Funds

Progress Energy Carolinas is a sub-award partner under two different applications for the Transportation Electrification Grant, DE-FOA-0000028, each with different lead organizations.

1. "Sustainable Transportation Education Programs" was submitted by the North Carolina Solar Center. This grant application targets education and outreach for electrified vehicles. As a partner, Progress Energy Carolinas has committed to leverage 100 percent cost share expenditure in the amount of [redacted] during the three-year period of the grant. These expenses include brochures, vehicle wraps, vehicle displays, employee time for education related events, and funding for an Electric Vehicle challenge. There are no significant sub-contractors involved, and no federal funds were requested by Progress Energy.

2. "Strategy to Accelerate U.S. Transition to Electric Vehicles" was submitted by General Motors. This grant application is focused on electric charging infrastructure. Progress Energy Carolinas is a sub-award partner and has committed to a cost share of [redacted] million, or [redacted] percent of the total $[redacted] million sub-project total. Key elements of the project include deployment of charging infrastructure,

vehicle performance and charging monitoring, and program development for a charging station offering. Key sub-partners of Progress Energy Carolinas include National Renewable Energy Laboratory (NREL) and NC State's Advanced Transportation Energy Center.

[redacted]

1.4 Technical Approach to Enabling Smart Grid Functions

Progress Energy's Optimized Energy Value Chain grant proposal outlines a series of investments that includes customer enablement, advanced grid optimization, and business transformation through integration of Smart Grid value into grid modeling, planning and forecasting processes. This proposal represents a portfolio of Smart Grid investments that advance the Smart Grid on all its fronts. Progress Energy's technical approach to delivering Smart Grid functions focuses on assessing what can be done NOW using available technologies to advance the Smart Grid and deliver value through innovation rather than invention. Our plan positions Progress Energy to partner with industry leading suppliers to develop marketable systems in areas where our background and experience add subject matter expertise. Additionally, the SGIG proposal seeks to advance Smart Grid business transformation through interoperability and systems integration that ensures information exchange across business silos. This model is at the heart of our technical approach, and core to the business proof points we believe will add value to the electric utility industry and the nation. Key background on the approach is described below.

1.4.1 Progress Energy's Qualifying Investments & Installation on the Grid

- DLC Switch Uplift project will replace existing DLC switches at customer premises transitioning legacy capability to Smart Grid compatible infrastructure. New switches will be digital, addressable, and be equipped with legacy communications capability along with interoperable and cyber secure protocols like [redacted] to create an adaptable and flexible infrastructure. These investments will create compatibility with AMI or other yet-to-emerge two-way communications options, and will preserve and extend this capability into the future. By being uniquely addressable, they will also position the company to increase the delivered value by harnessing the capability for localized grid constraint issues or for the customer's premise-level objectives. This would effectively re-purpose the capability by adding additional use cases for activation. This investment occurs in Progress Energy Florida, with the [redacted]

- Targeted AMI infrastructure including MDMS, integration for outage detection and notification, and customer awareness through development of web-portal infrastructure. This will involve meter installation at customer premises, telecommunications for backhaul, systems, and application integration for outage detection and awareness information.

- DSDR and grid-side conservation and efficiency optimization capabilities enabled through the DMS, DSCADA infrastructure, advanced telecommunications investments, advanced sensors, advanced distribution automation to distribution regulators and capacitors. This will involve distributed intelligence and control capability throughout the feeder as well as systems and systems integration to create real-time modeling and state estimation capability.

- Feeder segmentation enabled by investments in advanced fault sensor and control capability on Distribution feeders to advance partial restoration. This will be installed in a distributed manner across our Carolina feeders where loop feeder connections are feasible, and will involve extending DSCADA control points and interfaces with DMS and Outage Management System (OMS) and our fault management process. Communications to these devices will leverage a secure high speed peer to

peer[redacted] MHz spread spectrum radio network and [redacted] based protocol that is being implemented as part of the DSDR project overviewed previously, and represents just one example of the synergistic value of the scope of Progress Energy's grant proposal.

- Real-time monitoring of critical transmission transformer infrastructure for CBM functionality. This will involve the installation of sensors and monitoring software at numerous transmission substations throughout out regional footprint and integration with existing Transmission SCADA systems. Equipment includes a gas and moisture monitoring system currently installed at more than 800 utilities since it became commercially available in 2004, and a bushing monitoring system commercially available since 2002 with installations at over 150 utilities worldwide. This program is a first phase deployment to capture and demonstrate business proof points and positions Progress Energy for additional expansion.
- PHEV charging infrastructure to prepare the grid for electric transportation options. This will involve installing charging stations in a targeted manner to enable early adoption of electric transportation options. This project will evaluate systems and approaches for monitoring and influencing customer charging practices to mitigate negative impacts to distribution assets, system peaks, and to produce specifications for options leveraging PHEV's for load shaping activities.
- Implement an industry leading analytics engine OEVC. In its initial phase, this analytics engine will coordinate with the DMS and the DLC Load Management System to create an integrated view of efficiency and load shaping capability across the enterprise for interface with Resource Planning and our Energy Control Center's Energy Management System (EMS) for Progress Energy Florida and Progress Energy Carolinas as part of grid planning and forecasting processes. In addition, these systems will be coordinated to be engaged on a more targeted basis in support of critical transmission transformer assets described above in CBM, adding an additional use case for these capabilities. Under this scenario, demand response capabilities would be engaged to "de-congest" critical transmission infrastructure. In our work with [redacted] our strategic partner, we have identified over 10 additional use cases beyond N-1 contingency scenarios for expanded value. Figure 17 overviews our long term vision for this analytics engine that is analogous to an "economic dispatch engine" for distribution Smart Grid load shaping and efficiency capabilities. It will enable these assets to engage and interact with traditional grid stability organizations, structures, and processes.

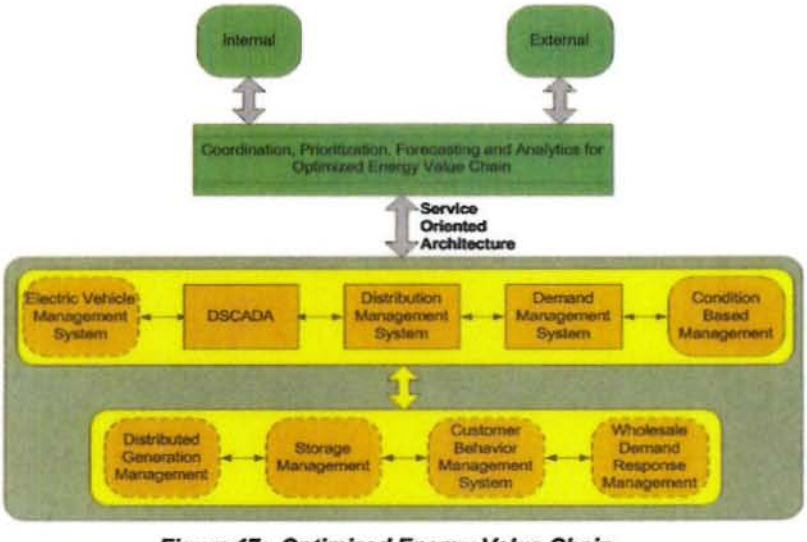


Figure 17: Optimized Energy Value Chain

1.4.2 Progress Energy's Operational View

As stated earlier, Progress Energy sees a clear unifying premise to our investment strategy. The grid of the future must engage broadly with consumers, reacting to their consumption decisions, accommodating independent alternative supply and energy storage options, while leveraging advanced grid-side efficiency and demand response capabilities. All of these new intelligent capabilities bring value, but also complexity. The grid must be prepared for this evolving complexity and respond dynamically to, and in coordinated fashion with these new capabilities. A holistic analytics-driven engine that coordinates and maximizes the value of the Smart Grid and delivers optimizing capability is required, if we are to maintain and enhance grid stability and reliability.

The value of this "combined view" of Smart Grid capability is achieved via integration with existing and future grid planning, command and control processes. This includes season, week, day, hour ahead modeling and forecasting of these capabilities for this dispersed green MW virtual power plant. At its fullest potential, the Smart Grid represents end-to-end optimization of the energy value chain, from the power plant down to the consumer's end use devices, and it enables the grid to dynamically respond in a coordinated and complementary fashion. These new Smart Grid functions and capabilities will be made up of many independent and disparate components that individually may be small in size but in aggregate are significant and material.

1.4.3 Progress Energy Plans for Extending Installation & Value of SGIG Investments

Progress Energy will leverage its multi-year roadmap and investment plan discussed earlier to guide investment priority around Smart Grid project evaluation and implementation. Our proposal meets DOE's desired objectives in fast tracking key elements of the Smart Grid, and serves to establish a scalable platform that will lead to a broader deployment of Smart Grid functionality. Within the grant period we expect to create a green virtual power plant of nearly [redacted] MW of capability and will achieve over ~~1600~~ MW by 2015 and currently have a corporate target of nearly [redacted] MW by 2019.

1.4.4 Scalable Infrastructure for Cost Optimized AMI Deployment via Customer Choice

Progress Energy's Roadmap of investment offers a unique value to DOE and essential business proof points for the industry around how to more economically deploy AMI infrastructure in an existing AMR environment. This investment would allow for broader targeted AMI expansion to residential customers, improving the economics of AMI and represents an important business proof point for the electric utility industry. The deployment plan laid out in this proposal helps to address two critical concerns and obstacles to AMI: the upfront cost, and customer readiness and ability to engage across all economic and demographic segments. This scalable infrastructure demonstrates its versatility by:

- Allowing for scaling into AMI based on customer choice around a portfolio of enabled offerings targeted to customer needs and preferences, with each option bringing conservation and efficiency, as well as load shaping value. This makes the investment more cost effective- where customers lead through self-selection. We believe this is a preferable model for moving customers to dynamic pricing over a coercive big-bang approach with limited options over customer offerings.
- Positioning the utility to better partner with key stakeholders and regulators for a sustainable approach for transitioning from flat to tiered and dynamic rates through education and a set of stratified offerings. This portfolio of offerings would offer load-shaping and conservation value, and a broad mix of ways for the customer to engage and participate with the utility to the advantage of both. This is especially important in addressing concerns that remain around Smart Grid technologies inadvertently disadvantaging some customers or customer segments.

1.4.5 Enabling Smart Grid Functions, Customer Awareness from Targeted AMI

Progress Energy will be implementing outage and restoration notifications through systems integration between the MDMS, CIS, and Outage Management System platforms. These notifications will be provided to customers through text messaging, interactive voice response, and e-mails. Additionally, a scalable web-portal infrastructure will be implemented that will provide energy usage, demand information, and provide for consumer awareness and education.

1.4.6 Leveraging Smart Grid Investments for Asset Management

Progress Energy's OEVC Project proposal also has a CBM project that will install on-line monitoring equipment on key and at-risk transformers throughout the Progress Energy multi-state transmission systems. The system will monitor parameters that will allow real-time assessment of asset conditions by Progress Energy and will be installed based on a prioritization of transformers throughout the transmission grid considering their criticality to the system, condition, age, operational history and resulting risk profile. Transformers have been selected as a result of a Pareto view of root cause for past transformer issues.

The Feeder Segmentation Project is designed to build on our industry-leading fault analytics, location, and management capability. We currently leverage advanced sensing at the distribution substation for oscillography capture and data that feeds to our Feeder Monitoring System, is automatically integrated into our Outage Management System and is then dispatched to our restoration crews via our short-cycle mobile work management platform. The end result is a predicted fault location with an accuracy rate of over[redacted] within[redacted]spans of the actual fault location for all backbone feeder events. To transition into partial restoration and micro-gridding capability, these capabilities must be expanded and extended. Enabling these capabilities will improve asset performance as measured by industry metrics of SAIDI and CAIDI.

1.4.7 Leveraging Smart Grid Investments for System Conditions Optimization

Progress Energy's proposal is first and foremost about positioning advanced Smart Grid capabilities as investments that can be leveraged to support System Conditions Optimization. Our advanced analytics engine that will create an integrated view of the various green MW capabilities enabled by the Smart Grid will be architected to coordinate engaging these capabilities based on numerous overlapping control schemas such as system demand, transmission constraint issues, distribution substation or feeders or localized grid problems. The grant proposal includes investments to build this foundational analytics engine, and will create a prioritization and coordination schema for grid side DSDR and new Smart Grid capable Direct Load Control. This will be leveraged to extend the value delivered by adding control analytics in order to decongest transmission assets (identified through CBM component of the grant proposal and TSCADA sensing and monitoring around load conditions).

1.5 Technical Approach to Interoperability and Cyber Security

1.5.1 Interoperability

The Smart Grid initiative will drive requirements for greater connectivity, integration, data management and analysis capabilities. Advances in technology are driving change so that a "plug-and-play" approach can be taken. For example, device vendors are now supporting the IP protocol so devices can "plug" into a common IP network. Similarly, industry efforts at data standards, such as the Common Information Model (CIM), are moving toward a future in which applications can plug into a common integration "bus." Advances such as these will enable vastly greater agility in adopting new business practices that require new or modified applications or infrastructure.

The OEVC needs a flexible but resilient architecture in which to produce the results needed for advanced grid optimization, customer enablement and the resultant business transformation. This architecture is based on service oriented architecture (SOA) with utilization of multiple service buses to ensure delivery

of data to the applications when the data is needed. The first bus handles the delivery of field data to the processing applications. Once the processing applications are finished with the data, the optimization application pulls the data from the federated analytics bus and provides the information to continually update algorithms that are part of the optimization scheme. As the optimization applications have completed the updates, the processed data is served to the utility enterprise service bus that delivers the data to the management applications responsible for governance and regulatory reporting. This architecture in Figure 18 allows for the best-in-breed application to utilize all of the data required to move the OEVC into reality.

Figure 18: Enterprise, Analytics and Operations Bus Architecture

Information exchange interfaces for communicating automation devices and systems

The core infrastructure planned for the Smart Metering System will consist of AMI Smart Meters and a Meter Data Management System (MDMS) interconnected by an AMI Collection Engine that resides in the field. The Smart Meters will not only be leveraged as a conventional smart electricity meter, but also as the entry point to the customers' network (premise network) and as an endpoint sensor for the Outage Detection system. The MDMS will gather and maintain usage, status and power quality information from across the PGN service territory. Interfaces are architected between the MDMS and the Outage Management System (OMS), the Customer Information System (CIS) and the Direct Load Control system (DLC).

The premises can consist of consumption-side Energy Management System (EMS), Programmable Communicating Thermostats (PCT), and direct load control. Through an interface between the MDMS and the CIS, the billing system will leverage time phased electric usage data to calculate the customers' bill per the agreed rate plan. Through the same interfaces, the AMI Smart Meter will be aware of the current electric rate.

The DLC system will take inputs from an optimization algorithm and will send curtailment requests to specific appliances or devices during times of peak demand. During other times, through the Distribution Management System (DMS), the system may utilize line devices to manage the active and reactive power flowing over the distribution grid.

Meanwhile, the OMS will be notified of localized outages reported by AMI Smart Meters through the MDMS. Similarly, the DMS can also notify the OMS of sensed faults on the distribution feeder or circuit level. The OMS can then act to locate and isolate the fault on the grid and alert dispatchers of the outage and send a repair crew to the fault location.

The Asset Management System will take inputs from the DMS and Distribution SCADA systems for both preventative maintenance and asset condition monitoring.

New and existing interface specifications

While point solutions address specific local objectives, typically they lack the underlying standards-based components to enable system-wide integration. The lack of adherence to specific standards leaves parts of the overall solution (e.g., applications) to exist within a non-integrated model. The successful implementation of a solution is dependent on the utilization of standards as it facilitates seamless integration. The utilization of industry standards is critical to Progress Energy's solution and is an important principal when assessing strategic and tactical technology solutions.

Progress Energy uses its Software Development Lifecycle Methodology (SDLC) standards for interface development and implementation. SDLC is formed from the many standards that currently exist in the industry. In addition, all solutions must comply with open standard protocols in order to transmit and receive data across networks. The Progress Energy Semantic Model uses [redacted] as the base model and adds company specific fields only where necessary for compatibility to legacy systems. This is the basis for all messages created by and from the system.

[redacted]

Risk mitigation for failure and device upgrade scenarios

A Business Impact Analysis is performed on Smart Grid projects to reduce or eliminate single points of failure and to mitigate risk of device failure. Load control devices are architected to return to a predictable state in the event of control signal loss. In addition, a loss risk assessment is performed for key components and equipment such as capacitor banks, voltage regulators, RTUs, gateways, communication links and equipment power sources. These assessments are designed to identify areas that will require redundancy or special accommodation to mitigate impacts to device or communication failures or even power outages.

[redacted]

[redacted]

Compatibility with NIST's emerging smart grid framework for standards and protocols

Progress Energy continues to be an active participant in all relevant industry groups (e.g. EEI, NIST and GridWise) and standards development organizations (e.g. NERC, IEEE). This conscious business decision aims to ensure awareness and positive influence of the standards and requirements. Standards are a significant concern for Progress Energy because of our strong commitment to providing reliable bulk electric power. Our proactive involvement has provided early warning of changes that need to be accounted for in relevant solutions. For example, the NERC CIP project team performed an analysis of FERC Order 706 in Jan 2008 and immediately worked to address the direction of the forthcoming NERC CIP standards in advance of CIP Draft 3. Also, Progress Energy began leveraging drafts of the DHS Procurement Language document and ANSI/ISA-99.02.01-2009 Security for Industrial Automation and Control Systems Standard as they were being developed.

Progress Energy has demonstrated a strong commitment to the development of the NIST Interim Roadmap for the Smart Grid by participating in all of the formal workshops, reviewing and providing input on the development of roadmap articles, and participation in the Cyber Security Coordination Task Group. Our direct involvement has translated into Distribution System Demand Response project architecture updates through regular engagement of project team architects and directly based on the material from the NIST Roadmap initiative. The information and standards from the NIST Roadmap initiative are already being used in design, planning and requirements development for upcoming Smart Grid initiatives like commercial and targeted AMI. Progress Energy requires compatibility with NERC CIP 002-009, ANSI C12.19 DNP3, IEC 61850 and IEC 61968 for all new devices, systems and tools.

1.5.2 Cyber Security

Progress Energy's fundamental approach to cyber security leverages a [redacted] including the principles [redacted] Cyber security threats continue to increase in number, complexity and level of impact. At the same time, business needs are driving requirements for increasing access and interoperability across enterprise applications, process computing environments, enterprise networks, and the Internet.

Progress Energy's corporate strategy embraces and integrates cyber security risk management methodologies and philosophy in our processes, ways of doing business, initiatives and in maintaining regulatory compliance.

Cyber security risks

Rather than attempting to make a defined architecture secure, Progress Energy chooses to architect cyber security into the solution beginning at the concept stage. This ensures that major architectural decisions are influenced by the requirement to be secure and resilient. As part of the plan, ongoing cyber security evaluations are to be performed during the design and procurement, installation and commissioning, and the ongoing maintenance and support phases of the project. The strategies used at each project phase include these security-related activities:

- [redacted]
- [redacted]
- [redacted]
- [redacted]

- [redacted]

An important consideration in developing a cyber security strategy is to continually update and maintain the security framework as technology and standards evolve. Specific areas include:

- Network Intrusion Detection/Prevention and Monitoring –affects the confidentiality, integrity and availability of information and control components for the grid.
- Vulnerability Management – identification and verification of risk remediation is integrated into business processes and procedures.
- Key Management and Cryptography – procedures and solutions enabling cryptographic mechanisms employed for security, accountability, non-repudiation and data integrity.
- Cyber Security Incident Response – provide emergency incident response procedures for any newly discovered or derived attack scenarios.
- Customer Privacy – ability to secure data and components that may not be under the full control of the utility.
- Operational Security – scalable and tightly integrated with business and utility operations.
- Natural Disasters – tactics to manage security risks after natural disasters such as fire, flood or hurricanes.
- Application Vulnerabilities – minimize the risk to the confidentiality, availability and integrity of the Smart Grid data through the Software Development Lifecycle Methodology (SDLM).

Cyber Security Criteria used for vendor and device selection

Vendor and device selection is a critical part of the process to ensure secure, reliable solutions. During the Request for Information and Request for Proposal (RFI/RFP) processes we evaluate respondents using a comprehensive assessment process to produce consistent results. This process was amended in 2007 to include new requirements for the selection of all new equipment and systems.

There are multiple industry standards that serve as inputs for the deployment lifecycle such as DHS Cyber Security Procurement Language, the NERC CIP Cyber Security Standards, as well as international standards, such as IEC. Other inputs include legislative and regulatory requirements as well as corporate policies and standards. These requirements are then turned into component functional models and specifications which form a basis of the criteria for making specific product and device selections. Based upon cyber security risk assessments, the selection criteria are prioritized and weighted to provide the best technology and product/device selection. Other non-technical requirements include vendor stability, vendor support, adherence to industry and global standards, and lastly vendor knowledge of legislative/regulatory requirements and controls. In addition to our own training, expertise and experience, we utilize the following sources:

- DHS – Cyber Security Procurement Language for Control Systems
- NERC CIP 002-009
- ISO/IEC 27002 – Information technology — Security techniques — Code of practice for information security management.

- IEEE-1686 – IEEE Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities
- ANSI/ISA-99.02.01-2009 Security for Industrial Automation and Control Systems: Establishing an Industrial Automation and Control Systems Security Program

Progress Energy requires all potential RFI respondents to produce executive summaries of any third party testing. Progress Energy plans and conducts technical security assessments using numerous vulnerability assessment tools during proof of concept initiatives and at multiple phases during the design and implementation of solutions.

Progress Energy actively supports the work identified in the NIST-EPRI Interim Roadmap initiative aimed to implement a Testing and Certification Framework. We see this as a vital step toward industry improvements with the solution providers. The Information System Acquisition, Development and Maintenance section of ISO 27002, A Code of Practice for Information Security Management, will be used to ensure the selection processes include appropriate control points and objectives.

Relevant cyber security standards will continue to evolve as new technologies are introduced

Progress Energy utilizes cyber security standards at the security governance and technology components level. Cyber security standards and best practices, such as those propagated by NERC CIP Cyber Security Standards and AMI-SEC form the basis of Progress Energy's business and cyber security policies. Other widely accepted industry standards such as ISO 27002 and the Sarbanes-Oxley (SOX) Act of 2002, are being used to ensure the inclusion of appropriate control objectives and control points in Progress Energy's security governance policies.

[redacted]

Progress Energy has made significant investments in technologies that are used to enforce and maintain its cyber security policies based on relevant standards and leveraging industry best practices. These technology investments give Progress Energy the ability to manage and evolve the cyber security policies development life-cycle, enforce policies at the technology components level, monitor compliance to policies, and report compliance measurements to management.

Progress Energy implements policy decision points and policy enforcement points in a [redacted] approach to ensure that only authorized services are consumed. Compliance reporting allows Progress Energy management to review overall compliance posture and provide auditors and security professionals with the ability to drill-down into details surrounding particular security compliance events. Progress Energy's approach provides the flexibility to quickly adapt its cyber security policies to changes in regulations, standards and industry practices. It also supports documentation requests by independent, third-party testers.

Regardless of perspective, the Smart Grid project will account for change on multiple levels, including Methodology, Architecture, Software, and Hardware:

- Methodology – Accounts for and expects emerging security standards to enforce security
- Architecture - [redacted] with inherent adaptability
- Software and Hardware – Selected for scalability, [redacted] reuse, and [redacted] orchestration

Also, in addition to the *Initial Smart Grid Interoperability Standards Framework Release 1.0*, the following list of standards and works are being leveraged to provide interoperability and cyber security requirements for our Smart Grid initiatives. These standards and works are utilized by project teams, operational staff and others to ensure interoperability, reliability and security of Smart Grid Solutions:

- DHS Cyber Security Procurement Language for Control Systems provides information and specific examples of procurement language text to assist the control systems community, both owners and integrators, in establishing sufficient control systems security controls within contract relationships to ensure an acceptable level of risk.
- ISO/IEC 17799/27002 – Information technology — Security techniques — Code of practice for information security management.
- IEEE-1686 – IEEE Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities
- ANSI/ISA-99.02.01-2009 Security for Industrial Automation and Control Systems: Establishing an Industrial Automation and Control Systems Security Program
- IEEE-1613 – Standard Environmental and Testing Requirements for Communications Devices in Electric Power Substations.

Cyber Security standards and best practices will continue to evolve as new technologies are introduced

Progress Energy employs both internal and third party threat assessments to test and validate the security and communication configurations of Smart Grid hardware and software solutions. Third party assessments are performed annually, while high risk items are scrutinized more frequently utilizing numerous COTS vulnerability assessment tools. Assessment results are documented, including the remediation of findings and reported to the highest levels of the company.

Progress Energy is committed to utilizing the ISO 17799/27002 framework in mapping security controls, determining gaps, defining initiatives and in maintaining regulatory compliance. This official corporate strategy and approach allows Progress Energy to continue to focus on the fundamentals in our cyber security programs and solutions.

In addition, strong, proactive involvement in numerous industry associations, regulatory groups and cyber security organizations is another way Progress Energy remains actively involved and knowledgeable in many specialized areas related to cyber security protection. The following items highlight this commitment within our industry:

- National Institute of Standards and Technology (NIST) - Smart Grid Cyber Security Coordination Task Group (CSCTG) – Progress Energy has actively participated in all of the workshops to date and is committed to continue with this initiative through its completion.
- Edison Electric Institute Security Committee – Cyber Security Subcommittee collaboration on various security topics e.g. NERC CIP, Smart Grid, Physical, CFATS, Aurora follow up, other key topics.
- GridWise Architecture Council Interoperability and Cyber Security Workgroup
- National SCADA Test Bed Advisory Team
- South Eastern Reliability Corporation (SERC) Cyber Advisory Group, Critical Infrastructure Protection Committee (CIPC) & Executive Committee
- Energy Sector Control Systems Working Group (ESCSWG) – responsible for the i.e. Roadmap, the Roadmap to Secure Control Systems in the Electric Sector including outreach and awareness of our peers and vendors.
- Florida Reliability Coordinating Council, Inc.
- North American Electric Reliability Corporation (NERC) CIPC

1.6 Project Costs and Benefits

Cost data is detailed in SF-424A and the budget justification attachments. Below is a breakdown of the projects and costs in the 2010-2012 time period:

Project	MM$
Distribution Side Demand Response (DSDR)	[redacted]
Direct Load Control Switch Uplift	[redacted]
Feeder Segmentation	[redacted]
Condition Based Monitoring (CBM)	[redacted]
Targeted AMI Meters	[redacted]
OEVC	[redacted]
Electric Transportation	[redacted]
Indirect Costs	[redacted]
TOTAL	**$520**

Progress Energy Contribution	**$320 MM**	**62%**
DOE SGIG Contribution	**$200 MM**	**38%**

Progress Energy's Smart Grid Proposal offers a detailed and measurable plan that integrates smart grid technology into its system. This will result in

- Improved system efficiencies that reduce costs to consumers
- Enhanced monitoring of equipment and automation that increases system reliability
- Better monitoring and equipment enhancements that improve power quality
- Lower fuel consumption which results in lower emissions

Additionally, Progress Energy's plan allows for the implementation of Smart Grid technology in a cross cutting fashion that will allow for the evaluation of the synergistic benefits of deploying Smart Grid devices across the energy value chain. The data collection process and lessons learned from Progress Energy's Smart Grid proposal will offer significant learning opportunities for the nation's electric providers.

Benefit	Sources of Benefit	Estimated Impact
Lower electricity cost	• Avoided generation • Reduced peak demand • Reduced transformer capital and inventory costs • Reduced fuel consumption from improved system efficiencies	• [redacted]

[4] *Avoided capacity value is calculated using the economic carrying charge of a combustion turbine multiplied by the avoided MW of peak demand.*

[5] *This amount is present valued at [redacted]% for the ten years of 2010 to 2019.*

Benefit	Sources of Benefit	Estimated Impact
Lower T&D losses	• Reduced fuel consumption from improved system efficiencies • Optimize power factor in real time • Optimize configuration of distribution grid	• [redacted]
Lower O&M costs	• Improved transformer monitoring • System automation reduces O&M • Reduced meter reading costs • Reduced time making manual switches • Lower device maintenance	• [redacted]
Greater transmission capability	• Optimizing grid increases flexibility of generation and transmission assets • Improved transformer monitoring allows for greater transformer capability without adding transformers • Improved VAR management • Reduced outage exposure	• [redacted]
Reduced power interruptions	• Proactive monitoring prevents interruptions • Pre-fault detection • Reduced voltage sags • Fewer unplanned outages	• [redacted]
Better power quality	• Increased visibility of power quality through monitoring • Holistic operations to ensure power quality • Data logging by AMI • Reduced voltage sags • Improved fault locating • I2T exposure reduction	• [redacted]
Lower GHG/carbon emissions	• Reduced emissions from improved system efficiencies • Reduced catastrophic transformer failures result in fewer spills	• [redacted]
Reduced oil consumption	• Reduced fuel consumption from improved system efficiencies • Reduced catastrophic transformer failures • Reduced oil filled equipment	• [redacted]

Figure 19: Benefits and Impacts

Progress Energy selects Smart Grid projects based on the relative project costs compared to the corresponding benefits. This determination is primarily done using the TRC test (Total Resource Cost) and the RIM test (Rate Impact Measure) methodologies. These methodologies speak to the issue of whether or not a stakeholder is better off given a particular investment. This would factor in the cost of new assets and O&M expense as well as the revenue requirement of replaced assets and avoided O&M expense.

The TRC test divides benefits (generation, T&D, Fuel and O&M) by costs (participant and program costs). A ratio is greater than 1.0 means that implementing the program will produce lower total resource costs. The RIM test is also a ratio that divides benefits (generation, T&D, Fuel and O&M) by costs (program costs, incentives and lost revenues). A ratio is greater than 1.0 means that implementing the program will produce lower average electric rates than building supply side resources.

Information linking the benefit, their source of the benefit and the data collected are summarized using the format of Table 6 from the FOA (Summary of benefits, the sources of those benefits and the data which the grant Recipient can expect to report).

Benefit Category	Benefit	Source of Benefit	Information Reported by Project
Economic	Lower Electric Costs	• Reduction in Peak Demand • Avoided Generation • Lower Fuel Consumption and Expense • Avoided Meter purchases • Deferred Transformer Expense • Lower Transformer inventory costs • Increased transmission capability without adding additional transformers	• Hourly load data by substation and feeder • Hourly voltage data by substation and feeder • Meter cost savings • Transformer additions budget • Transformer inventory budget • Use of load control commends by Energy Control Center
	Lower T&D Costs	• System optimization reduces losses	• Distribution losses by feeder
	Lower O&M Costs	• System automation • Reduced transformer maintenance • Fewer catastrophic transformer failures • Reduced generation • Line and Service requirements reduced	• Activity based O&M expense • O&M Savings • Hardware maintenance • Reduced line and service switching costs • Reduced oil based recloser costs
Reliability and Power Quality	Improved Reliability	• Improved fault locating	• SAIDI • CAIDI • SAIFI
	Improved Power Quality	• Flattening of voltage profile • Automation of distribution system provides for better voltage management • Fewer severe sags due to unplanned transformer failures	• Hourly voltage data by substation and feeder • Voltage at various nodes on distribution system • SAIDI • MAIFI
Environmental	Reduced Emissions	• Reduction in Peak Demand • Avoided Generation • Lower Fuel Consumption • Reduction in vehicle mileage	• Fuel Consumption

Benefit Category	Benefit	Source of Benefit	Information Reported by Project
	Reduced Oil use	• Lower Fuel Consumption • Reduction in number of oil filled devices • Fewer oil spills from catastrophic transformer failures	• Fuel Consumption • Oil filled three phase recloser failure incidents • Environmental cleanup and regulatory costs
Energy Security	Reduce Fuel Consumption	• Lower Fuel consumption	• Fuel consumption

Figure 20: Benefit Information Reported by Project

1.7 Assumptions and Conditions

Progress Energy key assumptions and conditions in applying for grant:

- Progress Energy has outstanding first mortgage bonds secured by a first priority lien under its mortgage indentures. Accordingly, Progress Energy will be able to proceed with this proposal only with explicit permission from DOE to preserve and protect such first priority liens on any property or equipment that may be acquired or used in connection with this proposal.
- Progress Energy will maintain title to any property or equipment acquired under the proposal. Progress Energy will continue to utilize all such property or equipment in support of the DOE objectives beyond the end of DOE's involvement in the project, and throughout its useful life for the purposes specified in the proposal until it has no "fair market value". Progress Energy will request that DOE grant it unconditional title to all property acquired under this proposal, and will request DOE confirmation that, under these assumptions, no fair market value will be attributed to the property or equipment for purposes of requiring compensation to the Federal Government upon project completion.
- Progress Energy intends to comply with all reporting and other compliance requirements mandated by the American Recovery and Reinvestment Act for the proposal, including the requirement under the Davis-Bacon Act (DBA) that laborers or mechanics be paid wages at rates not less than those prevailing on projects of a character similar in the locality. Progress Energy will report those wages on a weekly basis as required by the DBA, but will request Department of Labor approval to conform DBA and other requirements to existing Progress Energy employment practices, including approval to continue paying wages on a bi-weekly basis consistent with its payment frequency for other employees.
- The allocation of any intellectual property rights to the Federal Government must be satisfactory to Progress Energy or its subcontractors that develop such intellectual property rights.

Any failure to obtain satisfactory regulatory approvals, waivers or confirmations as outlined above, material negative accounting or tax consequences, or conditions or requirements for the SGIG application that otherwise would conflict with significant Progress Energy corporate policies or objectives would jeopardize the ability of Progress Energy to accept an SGIG grant or to proceed with this proposal.

2.2 Letters of Organizational Commitment

Progress Energy

[redacted]
Executive Vice President
Corporate Development
Progress Energy, Inc.

August 4, 2009

United States Department of Energy (DOE)
1000 Independence Av, SW
Washington, DC 20585

RE: Support for Smart Grid Investment Stimulus Grant

To Whom It May Concern:

Building upon a history of providing customers reliable and affordable electricity, Progress Energy continues to position itself to meet the challenges of finding a "balanced solution" to meeting future energy needs of our customers: energy efficiency, alternative energy resources, and state of the art plants. Our industry is facing a transformative era, and Progress Energy must make resource decisions that comply with new public policies, minimize costs to our customers and create shareholder value for our investors. We view Smart Grid as being a key component to successfully achieve this objective.

Building a Smart Grid is critical to maximizing demand side management and energy efficiency benefits by enabling active participation by our consumers, enhancing power quality and reliability, optimizing grid assets and efficiency, and adapting to growth in distributed generation assets, including renewable generation resources and energy storage. To pull it all together, Progress Energy has developed a Smart Grid roadmap representing our long-term vision of how the advanced functionalities will be integrated. Our first investment in Smart Grid is our Distribution System Demand Response (DSDR) project, which ultimately represents approximately [redacted] MW of peak load demand response, 7 MW of enhanced grid efficiency gains and also provides a portion of our spinning reserves. This project serves as the foundation upon which future Smart Grid capabilities will be built.

Recently, I was named the Executive Vice President of the Corporate Development Group, reporting directly to Progress Energy Chairman, President and CEO, Bill Johnson. Corporate Development is a new business group responsible for implementing our balanced solution strategy to meet our customers' future energy needs through energy efficiency, renewable energy resources and state-of-the-art power plants. My group is charged with increasing collaboration and coordination in the planning, development and implementation of our balanced solution strategy.

The potential to accelerate many of the long-range Smart Grid roadmap initiatives through SGIG is of interest to Progress Energy because of the significant benefits that it represents for

P.O. Box 1551
Raleigh, NC 27602
[redacted]

the company and our customers. Our success with DSDR thus far demonstrates that Progress Energy has the skill sets and corporate governance necessary to manage projects of this magnitude. Assuming mutually agreeable terms, we are committed to making available the finances and resources necessary to successfully complete the scope of work outlined in our grant application.

Sincerely,

[redacted]

2.3 List of other applications for Recovery Act funds

PROGRESS ENERGY CAROLINAS, INC.

Transportation Electrification Grant (DE-FOA-0000028):

1) "Sustainable Transportation Education Programs" submitted by North Carolina Solar Center

2) "Strategy to Accelerate U.S. Transition to Electric Vehicles" submitted by General Motors