Texas Commission on Environmental Quality
New Technology Implementation Grant (NTIG) Program

CPS Energy Solar +Storage Project

Final Implementation Report

for:

New Technology Implementation Grant (NTIG) Program

582-17-70806-2569

Submitted by:

CPS Energy

Project Representative:

Jonathan Tijerina

May 29, 2020

The preparation of this report is based on work funded in part

by the State of Texas

through a Grant from the Texas Commission on Environmental Quality

Table of Contents

Task Deliverable/Final Status Report Overview

This final report signifies that the City of San Antonio, acting by and through City Public Service Board (CPS Energy) hereinafter referred to as CPS Energy, has completed the engineering, procurement and construction (EPC) of a 10 Megawatt (MW) / 10 Megawatt-hour (MWh) lithium-ion battery energy storage system (BESS), AC-coupled with a 5 MW_{ac} solar photovoltaic (PV) facility (the Solar PV) (collectively, the BESS and the Solar PV being referred to as the "Project" or "PV+BESS"), located in San Antonio, Texas. The Project was constructed using Samsung batteries, Power Electronics inverters, Sabre enclosures, the RESolve Energy Management System (EMS) with RES Americas Inc. as the Contractor (the Contractor).

Introduction/Background

Established in 1860, CPS Energy is the nation's largest municipally owned energy utility providing both natural gas and electric services. Serving more than 840,750 electric customers and 352,585 natural gas customers in and around San Antonio, the nation's seventh largest city, as well as portions of adjacent counties. Our customers' combined energy bills rank among the lowest of the nation's 20 largest cities – while generating $7 billion in revenue for the City of San Antonio for more than seven decades. As a trusted and strong Community partner, we continuously focus on job creation, economic development and educational investment. True to our People First philosophy, we are powered by our skilled workforce, whose commitment to the community is demonstrated through our employees' volunteerism in giving back to our city and programs aimed at bringing value to our customers. CPS Energy is among the top public power wind energy buyers in the nation and number one in Texas for solar generation. For more information, visit cpsenergy.com

In 2017, the Texas Commission on Environmental Quality (TCEQ) and Texas Emissions Reduction Plan (TERP) announced the award recipients for their New Technology Implementation Grant (NTIG) Program. The grant supports the implementation of new technologies that will reduce the emissions from facilities and other stationary sources in Texas. CPS Energy was successfully awarded $3 million of the total $3.5 million of grant funds available, to help fund the Project.

The Project was constructed in 2019 on land leased from Southwest Research Institute (SwRI) at 9800 W. Commerce Street, San Antonio, Texas 78227 and consists of a 10 MW / 10 MWh lithium-ion BESS collocated with a 5 MWac solar PV facility. The implementation of the Project allows emission reductions by shifting clean, renewable energy to peak hours when energy demand is the highest, thereby displacing fossil fuel generation. The Project additionally provides emission reduction by supplying frequency regulation to the Electric Reliability Council of Texas (ERCOT) grid. This is an essential service that aids in balancing the state's electric grid by matching supply and demand while maintaining a system frequency of 60 Hertz.

CPS Energy optimized the Project location, technology and provision of services to achieve maximum emission reduction, while providing the greatest economic and operational benefits to our community, customers and the ERCOT grid. The opportunity and lessons learned from the Project will help CPS Energy further integrate renewable energy and achieve a cleaner energy portfolio.

Project Objectives/Technical Approach

The Project will demonstrate how PV+BESS can contribute to a more efficient, resilient, sustainable, and affordable grid. Specific technical objectives included:

- Study the greenhouse gas emission reduction potential of storage and PV+BESS to combat climate change.
- Develop methodology to optimize a storage project (technology, location and dispatch) to maximize the storage value for ratepayers, CPS Energy and the grid
- Apply lessons learned to enhance the current distributed generation (DG) interconnection requirements and process.
- Demonstrate individual services (peak shaving, energy arbitrage and ancillary services) and the compatibility of stacking multiple benefits.
- Develop favorable contract terms and conditions to support future BESS procurement or off-take.
- Explore and consider innovative commercial approaches for energy storage.
- Develop a framework for Project selection criteria and metrics for evaluating the success of the proposed projects and the program.
- Explore hurdles to ownership, operation and adoption.
- Develop internal process for qualification, testing and scheduling of a distribution-connected Resource into the ERCOT Ancillary Services market.
- Develop best practices for integrating storage and PV+BESS into existing control systems.
- Enhance the capability of deploying and controlling multiple distributed, collocated resources.
- Study locational benefits to provide insights into distribution system planning.
- Study the economic potential for distribution-connected storage as it relates to the ERCOT market.

Tasks

The NTIG Grant Scope of Work included the following Tasks:

- Task 1: Secure Rights to Location
- Task 2: Secure All Necessary Permits to Install Project and Enter into Contract with Supplier
- Task 3: Specific project site preparation
- Task 4: ERCOT Generation Interconnection

- Task 5: Public Relations
- Task 6: Installation of Project
- Task 7: Testing of Final Design
- Task 8: Implementation Reporting
- Task 9: Operating Period

Task 1: Secure Rights to Location

CPS Energy evaluated multiple locations and selected a Project site that would maximize benefits to rate payers, the City of San Antonio and the State of Texas. The Project was constructed on land leased from SwRI at 9800 W. Commerce Street, San Antonio, Texas 78227. The Project location provides the following benefits:

- Emission Reduction. The Project site enables the BESS to achieve the goals and purpose of the TERP and to meet the requirements of the NTIG since San Antonio is an Affected County per the Environmental Protection Agency (EPA) designations for National Ambient Air Quality Standards (NAAQS) for Ozone.
- Proximity to Substation. The Project site is located on the CPS Energy 35 kV distribution system approximately ½ mile away from the SwRI 138kV substation. The existing infrastructure minimized interconnection-related expenses for the Project.
- Data and Research Collaboration with SwRI. CPS Energy is coordinating with SwRI on providing historical data to include battery data, inverter data and solar data to facilitate research and innovation.
- Accessibility. The Project site is within the metropolitan area and close to the airport, providing ease of access for research and education purposes.
- High Visibility. The Project site supports a 360-degree view using surrounding roads and provides drivers on the Highway 151 corridor a 60-second experience of aesthetically-pleasing, clean, solar energy.

The signed Memorandum of Understanding (MOU) and lease agreements between CPS Energy and S were provided to finalize this Task of the Grant Scope of Work.

Task 2: Secure All Necessary Permits to Install Project and Enter into Contract with Supplier

Permits and Site Approvals

CPS Energy and the selected Contractor were required to comply with all environmental and regulatory requirements associated with the construction of the Project. Table 1 shows the environmental survey and permitting project site tasks completed by CPS Energy. Supporting the growth of local companies is critical to the corporate social

responsibility process of CPS Energy. As such, all project site feasibility studies and services were contracted with local firms.

Table 1 - CPS Energy Permit and Site Approvals

• Asbestos-Containing Material / Lead-Based Paint Survey • Cultural Resources Investigation • Boundary and Topographical Surveys • Tree Survey and City of San Antonio Tree Permit • Geotechnical Investigation	• Phase 1 Environmental Site Assessment (ESA) and Drinking Water Sampling • Habitat Evaluation / Karst Survey • Wetlands / Jurisdictional Waters Determination • Zoning Variance Approval • Fire Marshall Approval

Table 2 shows additional permitting activities and approval processes completed by the Contractor:

Table 2 - Contractor Permit and Site Approvals

• Building / Construction permits • Trade Permits • Sign Permits • Electrical Permits	• Stormwater Pollution Prevention Plan (SWPPP) Permit • Temporary Construction Trailer Permit • Dumpsters, Roll-offs and Other Containers

CPSE Energy also conducted technical studies[1] to understand how operation of the PV+BESS system could impact local distribution operations, and to understand the envelope of operation that could be accommodated without creating local adverse effects. The studies produced favorable results.

Supplier Contracting

On January 13, 2017, CPS Energy issued a Request for Proposal (RFP) from experienced, responsible companies to engineer, design, procure, install, test and commission at least 5 MW_{AC} utility-scale solar PV and a 10 MW / 10 MWh BESS.

CPS Energy utilizes competitive procurement to purchase solutions and services that have the "best" fit for the utility and customer needs, at the "best" possible terms. The RFP process proved successful and was designed to meet the following criteria:

- The procurement was fair and objective
- The procurement process encouraged robust competitive offerings and creative proposals from market participants
- The procurement process allowed the selection of winning offers based on appropriate evaluation of all relevant price i.e., total cost of ownership and non-

[1] CPS Energy performed an Interconnection Screening Analysis and a detail Distribution-Level Analysis to evaluate the impacts of the planned PV+BESS resource.

price factors e.g., economic development and support of local and diverse businesses.

- The procurement process was completed in an efficient and timely process

Table 3 summarizes the chronology of procurement-related events.

Table 3 - RFP Chronology

RFP Issuance	Jan 2017
Respondent Proposals Received	Mar 2017
Respondent Shortlist and Interviews	Apr 2017
Finalist Selection	May 2017
Contract Negotiations	Jul 2017
Contract Execution	Jun 2018

On June 25, 2018, the CPS Energy Board of Trustees authorized CPS Energy's CEO to execute agreements for the PV+BESS Project to RES Americas Inc. The Contractor was selected as the sole finalist from 22 bids received in response to the RFP.

Equipment Ordering

Long-lead equipment items were procured by the Contractor and delivered to the Project site to include batteries, inverters, transformers, panelboard and switchboard, and Data Acquisition System (DAS).

Figure 1 - Equipment Deliveries

The following deliverables were submitted to finalize this Task of the Grant Scope of Work:

- Copies of permits and zoning variance approvals
- Copies of topographical and boundary surveys
- Copy of conceptual site layout

- Copy of the RFP solicitation package
- Copy of the executed contract with the Contractor
- Photographs of equipment received

Task 3: Specific Project Site Preparation

Project Engineering Review

CPS Energy reviewed the preliminary electrical and civil engineering design packages from the Contractor. Revisions were made as necessary to account for existing and encountered site conditions. Additional drawings were released and revised as the design process progressed. The final Project engineering package was approved prior to construction.

Site Security and Safety

The following security equipment to protect the Project site were installed:

- Card readers inside and outside the building
- Radar system for perimeter protection
- Door contacts for battery equipment
- Barrier fencing with locks
- Camera around the property
- Automated gate configuration
- Installation of regulatory and safety signage

Construction Health and Safety Plan

A Construction Healthy and Safety Plan was prepared to establish the procedures and requirements that would be used to minimize health and safety risks to persons involved with the construction of Project. This plan contained information about the hazards involved in performing the tasks and the specific actions and equipment that will be used to protect persons working at the Project site.

Prior to initiating construction operations, a Pre-Construction Safety and Health Orientation was conducted to address the following topics:

- Employee rights and responsibilities
- The location of approved Project Health and Safety Plan available for review by employees
- First aid and medical facilities
- Emergency response procedures
- Specific Occupational Safety and Health programs or procedures applicable to the construction activities

- General project hazards and the applicable policies and procedures for addressing these hazards
- Construction hazard recognition and the procedures for reporting or correcting unsafe conditions
- Use and maintenance of Personal Protective Equipment (PPE) Procedures for reporting accidents or incidents
- Fire prevention and control
- Alcohol and drug abuse policy
- Disciplinary procedures for safety infractions or violations

A construction Safety Bulletin Board was erected to accommodate the following postings:

1. Project Information Card
2. Appropriate required Occupational Safety and Health Administration (OSHA) and Texas Workers Compensation Posters
3. Appropriate safety posters and safety information signs e.g., PPE requirements

Daily pre-work safety briefings (Tailgate Safety Meetings) for Project site employees was conducted and documented by the Safety Supervisor. The briefings would address the day's planned activities and any pertinent safety and health information the supervisor determines to be applicable and will serve as a daily reminder of safety responsibilities.

Tree Removal

Prior to site preparation and grading, select trees were cleared from the Project site. First, a formal tree survey was performed to inventory all trees on the site to capture each location, trunk diameter and tree type. All Significant, Heritage and Historic trees were identified and labeled. Next, a Tree Permit application and detailed Tree Preservation Plan was submitted to the City of San Antonio Development Services Department for review and subsequent approval. CPS Energy's goal was to maintain and preserve as much of the existing tree population as possible. Significant time was allotted to optimizing the Project design and layout to accomplish this task. Trees intended for preservation were marked and fenced prior to grading to protect each tree from root damage or soil compaction.

Site Preparation and Grading

Construction of the Project involved clearing and grubbing of the existing vegetation; grading necessary for the construction of access and service roads and the installation of solar arrays; installation of the inverter stations; construction of underground 34.5 kV collection systems leading to the Project substation; and construction of the Low Voltage (LV) / Medium Voltage (MV) interconnections, energy storage facility, and the aboveground tie line from the Project to the CPS Energy distribution system.

A staging area was utilized to include temporary construction trailers for the management of construction, a parking area, and site security facilities. This area also accommodated the delivery of materials, vehicles, etc. Material delivery for the solar field was ongoing, panels and framing structures were delivered throughout the solar field adjacent to the subunit locations. Temporary staging areas for material laydown including boxes of solar panels, steel, aluminum framing, conduit for underground electrical, transformers, and other project materials were located throughout the Project area. The laydown areas were subsumed by the build-out of the panel array with some exceptions. Materials e.g., boxes of panels, steel and aluminum framing, were laid out between rows of panels and along the access roads.

The Contractor applied water as needed to suppress fugitive dust during grubbing, clearing, grading, trenching, and soil compaction and/or applied a nontoxic soil binding agent to help with soil stabilization during construction. These measures were applied to all active construction areas, unpaved access roads, parking areas and staging areas, as necessary. Dust and debris were also controlled at public access points by limiting traffic speed on unpaved roads and utilizing sweepers and water trucks. All standard engineering practices were applied to minimize soil erosion, minimize grading and vegetation remove and protect neighboring areas.

Point of Interconnection

The point of interconnection (POI) and routing for the Solar PV and BESS was constructed and tested. Prior to construction, CPS Energy worked with the Contractor to coordinate scheduling, scope of work, budget and responsibility for interconnection services including metering, communications, supervisory control and data acquisition (SCADA), site security and accessibility. Figure 2 shows the construction of the POI.

Figure 2 - POI Construction and Final Appearance

Photographic evidence of the site preparation and proof of insurance were provided to finalize this Task of the Grant Scope of Work.

Task 4: ERCOT Generation Interconnection

Any resource that intends to participate in the ERCOT's Security Constrained Economic Dispatch (SCED) or provide ancillary services to the ERCOT system must register undergo qualification testing.

First, CPS Energy had to submit a Generation Interconnection or Change Request (GINR) application.

Second, since CPS Energy was already registered as a Resource Entity (RE) in the ERCOT market, the RARF was then submitted.

The following deliverables were submitted to finalize this Task of the Grant Scope of Work:

- Proof that the ERCOT GINR and RARF were submitted
- Letter of intent to construct and operate a generation resource

Task 5: Public Relations

CPS Energy, SwRI and public officials held a groundbreaking ceremony on October 8, 2018 to celebrate the commencement Project construction. TCEQ Executive Director, Toby Baker, attended and participated in the ceremony.

Figure 3 - Groundbreaking Ceremony

Additionally, CPS Energy has maintained a public webpage[2] for the NTIG Project since awarded. The website URL was provided to finalize this Task of the Grant Scope of Work.

Task 6: Installation of Project

The Contractor managed the installation of all major BESS components. The Project site utilized concrete pier foundations for each of the four battery enclosures with conduit runs between the battery enclosure and the inverter which was installed on a concrete pad. Each battery subsystem is comprised of the battery enclosure, bi-directional inverter, medium voltage transformer, and medium voltage switchgear. Medium voltage transformers were installed at the project site to step up the AC voltage from the inverters to the MV level of the adjacent substation. A series of MV switchgear were also installed to serve as electrical isolations for each of the four battery systems. For auxiliary power, a single auxiliary power transformer was installed near the medium voltage switchgears.

Installation of each battery enclosure included all the necessary cabling, auxiliary equipment and other required infrastructure to support the operations of the battery. This includes the following:

- DC cabling which connects each Samsung M2f rack to the DC bus installed in each rack. Each DC bus connects to a DC disconnect switch which serves as an electrical isolation between the battery system and the inverter.
- Programmable Logic Controller (PLC) which aggregates auxiliary equipment operations and sensory data for proper management of heating, ventilation, and air conditioning (HVAC) and fire suppression systems.

For controls, data acquisition, and telemetry, the Contractor installed a server paired with a robust uninterrupted power supply (UPS) to host the EMS. This equipment was installed in the communication cabinet located at the Project site. This communication cabinet also houses the real-time automation controller (RTAC) which serves as the Distributed Network Protocol 3 (DNP3) gateway device for market telemetry between the BESS and the ERCOT to support market operations.

[2] The webpage is available at: https://www.cpsenergy.com/en/about-us/new-infrastructure/terp.html.

Figure 4 - Installed Project Pictures

Photographic evidence of the site installation was provided to finalize this Task of the Grant Scope of Work.

Task 7: Testing of Final Design

Battery Commission and Testing

The battery system for the Project utilizes Samsung M2F technology and was tested, checked and commissioned by both the Contractor and original equipment

manufacturer (OEM) teams. The battery testing was successfully completed and addressed the following sub tasks/checks:

- Material condition
- Installation verification
- Communication
- Meter and measurement accuracy
- Alarm and protective features

Prior to energization the Contractor's installation team performed the following activities:

- Pre-installation Inspection: Receipt inspection of equipment was conducted to check for defects or missing parts. This equipment included the Samsung modules, racks, switchgears, and racks.
- Installation Checks: Checks for proper installation and grounding of racks, modules and switchgears was performed. Other checks include auxiliary control power, cable and busbar installation, system battery management system (BMS) were completed.
- Voltage and Communication Checks: Proper rack voltage against calibrated multi-meter and communication devices between battery and customer SCADA system were verified.

Upon successful completion of these installation and related checks, the battery OEM team performed the following activities:

- Visual Inspection: Inspection of installed system for proper mounting, fastening and torque of racks and modules, and wiring at the module and switchgear level was performed.
- Rack and System BMS Configuration: Addressing and rack assignment for the system BMS and module count and assignment for the rack BMS was checked.
- Battery System Metered Values: Internal meter data was checked, and measured values were compared against OEM interface for accuracy. These values included rack voltage, current, State of Charge (SOC), cell voltage and temperature.
- SCADA Verification: Point to point testing and verification of battery system metrics with customer SCADA/EMS was performed.
- Alarm and Trip Checks: Alarm/warning reporting and proper fault handling for abnormal conditions actions were checked.
- Measurement Accuracy: The accuracy between bus voltage at switchgear and software reported voltage with a given tolerance of +/- 15% was verified.
- Full Battery Diagnostics: A full system test was performed where each critical parameter was changed through the OEM interface to check for proper reporting and fault handling (faults include cell over/under voltage, cell over/under temperature, charge/discharge overcurrent, communication and fan faults).

Enclosure Commissioning and Testing

The battery enclosures for the Project utilizes structures designed and built by Sabre. These concrete buildings are customized battery enclosures which contain all the necessary thermal management, fire protection/alarm, and sensor equipment necessary for proper and safe BESS operation. The building testing was successfully completed and addressed the following sub tasks/checks:

- Structural
- Fire protection/alarm
- Electrical
- SCADA
- Mechanical

The Contractor installation team in tandem with the OEM engineers completed the following checks of the battery enclosures:

- Structural Inspection and Integrity Checks: Each enclosure was visually inspected for shipping or installation related damages, verification of proper structure anchoring, door operation, and enclosure integrity.
- Fire Alarm and Protection Checks: Proper wiring including functionality verification of installed smoke detectors and fire control panel check were performed.
- Electrical: The enclosure wiring was checked for proper cable management and grounding. All auxiliary AC power cables were verified for proper sizing and terminations. All 24 VDC power supplies, associated cabling, and connections were checked for proper installation. The main DC isolation between the enclosure and the inverter was operated and verified for proper continuity, breaking, and indicating status.
- SCADA: Network connection checks were performed for the enclosure PLC which aggregates many of the auxiliary systems for the enclosure. This includes fire suppression, thermal management, and door sensing equipment. The Modbus interface for the PLC was configured and verified for each enclosure at the project.
- Mechanical: The bulk of the mechanical checks for the enclosure encompassed the HVAC system for each enclosure. This included confirmation of HVAC sequence of operations, proper HVAC controller function, and accuracy of all ambient humidity and temperature sensors within each building. Feedback and safety integration tests for the fire control panel, DC disconnect status, and door alarm statuses concluded the mechanical tests for the enclosure.

Inverter (Power Electronics) Commissioning and Testing

There are 4 inverters installed at the Project. Each inverter, or power conversion system (PCS), is built by Power Electronics and is an outdoor rated enclosure with a nameplate

power rating of 2.5MVA. These inverters accept both the main DC cabling from the battery system and AC cabling from the MV transformer. Each inverter underwent inspections and checks in two phases classified as cold and hot commissioning.

The Contractor installation team successfully completed inspection and verification checks for each inverter installed at the Project site. The de-energized checks, classified as cold commissioning, included the following:

- Equipment Inspection: These inspections encompassed multiple checks including material inspection, internal wiring checks, and power module inspection. The purpose for these checks was to ensure the material integrity of the inverter was intact post-delivery.
- Installation Checks: Once installed and electrically connected, the inverter has its external wiring and ground connections verified for proper wiring orientation and labeling. This includes comparing against project electrical issued for construction (IFC) drawings, verifying correct color coding, polarity/phase rotation, and torque checks.
- Communications: Prior to energization, control power is applied to the inverter which allows the checking of communications between the inverter and site SCADA system.

Energized checks, or hot commissioning, included the following:

- Initial Voltage Checks: These checks ensure that both the DC and AC sources to the inverter are correctly being measured and reported locally to each individual inverter. Each power module within the inverter was checked for proper sensing and calibration of the source voltages.
- Firmware and Settings Verification: The firmware checks verified that each inverter is running on the correct and identical build of software. Each inverter has detailed settings for low voltage ride-through (LVRT), over/under voltage and current tripping, and other protective configurations that were set to the Institute of Electrical and Electronics Engineers (IEEE) 1547 default.
- PCS Alarm and Fault Handling: Each inverter was tested for proper operation during abnormal conditions. This includes removing control power, communications, E-stop initiation, and the simulation of other conditions which cause the inverter to generate alarms and exhibit proper fault handling.
- Power Verification: Upon completion of all cold and hot commissioning checks, the inverters were individually tested for proper bi-directional functionality at low power output levels. The power was increased at step intervals until full power output is reached. At each step power, the inverter was checked for accuracy and measurements as read both locally at the inverter human machine interface (HMI) and remotely on the site SCADA system.

SCADA/Communications Commissioning and Testing

The SCADA and communications portion of the commissioning tests cover all internal point to point communication, grid measurement, data mapping to external entities, and control system testing. This testing can be considered one of the most important tests for a battery system as it ensures proper telemetry, response, and functionality of all components within the project.

The Contractor installation team completed a comprehensive list of tests associated with the SCADA and communications for the Project to include the following:

- Equipment Setup and Configuration Testing: Verification of installed equipment for proper configuration and wiring with adequate and stable power supply (main and backup sources) was performed.
- Point to Point Data Mapping: Proper telemetry of data between the battery and several entities was verified. These entities included CPS Energy, ERCOT and field devices.
- EMS Setup and Configuration: Setup of the power quality meter (PQM) was completed. Numerous tests to verify meter data, accuracy and records was additionally verified.
- Operational Tests: A variety of Project-specific operation tests were completed to include the pushing and pulling of power at a site level, control mode operability and transitioning between modes of operation. The system proportional integral derivative (PID) loop was finely tuned to balance speed of response with accuracy of power setpoints during these power excursion tests.
- Functionality and Interlock Testing: Failure mode testing was performed where communication breaks were initiated between several devices to verify proper and safe response of system.
- Response Time Testing: The speed of response for the system during market operations was tested. The system was triggered based on frequency threshold trips and automatic governor control (AGC) driven triggers where the speed of response is accurately timed and must be below the requirement for the ERCOT Fast Responding Regulation Service (FRRS) ancillary service (< 1 second).

The following deliverables were provided to finalize this Task of the Grant Scope of Work:

- The Final Completion Certificate
- A report detailing the testing and commissioning process

Task 8: Implementation Reporting

Quarterly progress reports were submitted in a timely fashion summarizing all aspects of the Project tasks. CPS Energy submitted the following progress reports:

- Q1 / 2017 Progress Report – Submitted April 4, 2017
- Q2 / 2017 Progress Report – Submitted July 7, 2017

- Q3 / 2017 Progress Report – Submitted October 2, 2017
- Q4 / 2017 Progress Report – Submitted January 8, 2018
- Q1 / 2018 Progress Report – Submitted April 4, 2018
- Q2 / 2018 Progress Report – Submitted July 9, 2018
- Q3 / 2018 Progress Report – Submitted October 9, 2018
- Q4 / 2018 Progress Report – Submitted January 10, 2019
- Q1 / 2019 Progress Report – Submitted April 5, 2019
- Q1 / 2019 Progress Report – Submitted July 9, 2019
- Q1 / 2019 Progress Report – Submitted October 8, 2019
- Q1 / 2019 Progress Report – Submitted January 9, 2020
- Q1 / 2020 Progress Report – Submitted April 9, 2020

Task 9: Operational Period

CPS Energy will provide annual operation status reports annually for five years and will submit a final operations report at the conclusions of the five-year period.

Discussion/Observations

Objectives and Results

The overall objective of the NTIG Grant Project was to engineer, procure and construct a 10 MW / 10 MWh lithium-ion BESS to reduce emissions by shifting solar and performing grid services. CPS Energy has successfully met this requirement as well as other technical objectives outlined in this report.

Critical Issues / Technical Goals and Barriers

During the Implementation period, several setbacks and scope revisions were encountered, some of which resulted in delays to the project schedule. CPS Energy described these issues within the quarterly status reports and coordinated with TCEQ to facilitate amendments to the scope of work and Project schedule as needed.

Topic:	In the NTIG application, CPS Energy proposed installation of the project at the Alamo 1 solar facility. Further stakeholder discussion, technical and financial analysis revealed the Project site to be the superior selection. The Grant Scope of Work was amended to reflect the updated location.
Lessons Learned:	Multiple locations should be evaluated for any given Project. Market rules can influence the registration, interconnection and operations of a proposed Resource and must be thoroughly evaluated. Additionally, the location must maximize the storage value to CPS Energy, rate payers and the ERCOT grid.

Topic:	CPS Energy was very specific in the battery sub-chemistry, racking and enclosure specifications in the original Grant Scope of Work. Changes in the technology and cost landscape required re-evaluation of battery module and sub-chemistry selection. Each vendor presented a unique offering e.g., plant layout, number of modules and racks. The Grant Scope of Work was amended to accommodate flexibility of design.
Lessons Learned:	Project technical specifications must enable flexibility of design to account for multiple vendor offerings and the changing industry landscape.

Topic:	Site-specific studies and permitting activities took longer than expected. Several iterations of the Project layout and design had to be considered to maximize tree preservation while maintaining accessibility and overall cost-effectiveness. The Project site was also located in the Highway 151 Gateway Corridor District and was subject to specific zoning standards. A zoning variance application had to be submitted to the City of San Antonio for review and approval which took additional time. Finally, an abandoned gas line was found to intersect the property and additional time was required to locate the easement.
Lessons Learned:	Project ownership influences the scope of work requirements for CPS Energy related to site diligence activities. These additional responsibilities must be clearly defined and managed. Additional time must be allotted to procure the necessary consultant and companies to perform such activities, in addition to the time required to carry out the tasks.

Topic:	In 2018, President Trump imposed a 30 percent tariff on solar panel imports from China under Section 201 of the Trade Act of 1974. This resulted in extended contract negotiations and delays to the Project schedule.
Lessons Learned:	Our country's political climate can create disruptions to the procurement process. The point of origin on all equipment must be thoroughly investigated during the procurement process.

Topic:	Contract negotiations with the initial vendor selected proved unsuccessful. Despite good faith efforts, significant gaps in contract terms could not be resolved. The contract negotiations process had to be restarted with the second ranked vendor.
Lessons Learned:	Two finalists should be selected when pursuing contract negotiations in case of any contingency that necessitates switching vendors.

Topic:	The original Grant Scope of Work planned to house the BESS inside the building on the SwRI property. New codes, standards and regulations (CSR) for 2018 editions modified the Maximum Allowable Quantities (MAQ) of specific battery technologies housed indoors. IFC chapter 12 and NFPA-1 chapter 51 limit the MAQ to 600 kWh. If a site exceeds or is planned to exceed these MAQ, the facility will need to be classified as a high hazard occupancy and be subjected to increased physical and operational criteria

	and allowed uses for the building. Because the Project site building had a multi-purpose usage, it was appropriate to keep the BESS outdoors. The Grant Scope of Work was amended to use a containerized BESS approach.
Lessons Learned:	Pending CSR changes and resulting impacts must be closely monitored. Local Authorities Having Jurisdiction (AHJ), e.g., the Fire Marshall should review and approve the Project design prior to procurement.

Topic:	The ERCOT Resource registration process takes considerable time and is dependent on project specifications e.g., point of interconnection voltage, asset size and intended services.
Lessons Learned:	Communication must be established with the appropriate personnel at ERCOT early in the project lifecycle to identify requirements, milestones and overall timeline. A progressive approach may be warranted in the future e.g., filing for a Settlement Only Distributed Generation (SODG) registration to begin solar shifting, then work on registration for ancillary service capability. Smaller project sizes or behind-the-meter interconnections should additionally be explored as it relates to registration requirements, interconnection process and cost.

Topic:	The functionality, response time and usability of each vendor's EMS can vary significantly.
Lessons Learned:	More detailed evaluation of the EMS is necessary to understand the capabilities of the system and perhaps any limitations. This should be done during the procurement process and should be considered in the selection criteria.

Topic:	The development of interconnection best practices takes time and practice.
Lessons Learned:	The increased volume of interconnection requests and the evolving market for distributed energy resources (DERs) requires revisions to legacy interconnection agreements. Identification of specific technical requirements and best practices streamline and automate interconnection process. CPS Energy will continue to evaluate and adjust interconnection standards for similar systems to include metering, balance of plant, plant controller and protections requirements.

Topic:	The planning, ownership and operation of a BESS can span several utility departments.
Lessons Learned:	Roles and responsibilities across multiple departments must be identified as it relates to project management, operation and maintenance. Transition plans must be designed and implemented.

Topic:	New resources should account for the provision of a welcome center.
Lessons Learned:	A welcome center is important to educate Project visitors. The design and cost of a welcome center should be included in the procurement process to ensure adequate funding.

Scope for Future Work

The PV+BESS Project provided valuable insights on how battery storage can positively contribute to the CPS Energy ***Flexible Path***. The ***Flexible Path*** is a strategic approach to thoughtfully discover, explore and implement new power generation solutions over the next 20 years and beyond. The ***Flexible Path*** is an over-arching strategy to transform the CPS Energy generation fleet to lower and non-emitting resources, while balancing security, safety, reliability, resilience, the environment and affordability.

Summary/Conclusions

The engineering, procurement and construction of the NTIG project has been completed. CPS Energy plans to submit annual operation status reports for the five subsequent years, followed by a final operation report in the year 2025.

Acknowledgments

CPS Energy would like to acknowledge the following parties that helped make the Project a success:

- Texas Commission on Environmental Quality NTIG team for support and collaboration during the Project
- Southwest Research Institute for Project hosting with ongoing data and research collaboration
- The City of San Antonio for support and collaboration
- The CPS Energy team for their vision, procurement and Project management
- Fractal Energy Storage Consultants for consulting and advisory services
- RES Americas for their role in engineering, construction and commissioning the Project