



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

Operation Phase Annual/Final Status Report

Contract Number: 582-15-53908-1471
Grantee: NRG Texas Power, LLC
Report for the Annual period: 2017 **Date Submitted:** 5/22/2018

Section I. Accomplishments

Provide a bulleted list of operations of the facility during the past year. Include exact numbers and/or estimates.

Since November 1, 2017, the Elbow Creek Battery Storage (ECBS) project:

- Successfully executed over 9,300 deployments supporting grid frequency, estimated 7.2 deployments per hour.
- Discharged 80+ MWhrs to improve and increase grid frequency.
- Charged over to 110 MWhrs, providing load to reduce the grid frequency while simultaneously recharging the battery from renewable power supplied by the Elbow Creek Wind farm.

Section II. Key Events and Issues

Report any key events that occurred during this reporting period. Please include any major project updates that impacted operations.

ERCOT FRRS Frequency Parameters Revision

- On April 19, 2017, ERCOT sent a notice to Market Participants detailing a change to the Fast Responding Regulation Service (FRRS) parameters, most notably, the deployment band triggers and maximum deployments duration. These revised parameters were placed into effect on April 25, 2017. Under the revised parameters, the deployment band triggers were reduced by 0.005Hz for each of the three bands and the maximum deployment was extended from 60 to 90 seconds. Combined, these changes resulted in significantly more deployments for battery systems in ERCOT.

Construction Acceptance

- NRG issued a Notice of Acceptance of Work to Toshiba, covering final construction and commissioning, on October 30, 2017.

Commercial Operational Date

- ECBS was eligible to submit offers in the ERCOT Ancillary Service market effective November 1, 2017.

Sharyland-Oncor Deal

- On November 9, 2017, Sharyland and Oncor closed on a transaction exchanging Sharyland's estimated 54,000 retail distribution customers, including ECBS, for certain Oncor distribution lines in Central and West Texas. The result of this transaction reduced the ECBS interconnection tariff charges.

Report any anticipated or unanticipated problem(s).

- Increased Cycling – The changes in the Fast Responding Regulation Service (FRRS) Parameters causes the ECBS to deploy sooner, longer, and at higher rate of deployment than initially designed. ECBS is able to comply and operate under the revised parameters. The impact of project life, if any, will become more apparent after a full year of operation.
- Cell Heating – The increased cycling has resulted in unanticipated heating of the cells.
- Battery State of Charge Level Indication (SOC) – State of Charging level indication requires resetting periodically to allow for recalibration.
- Deployment Mode – ECBS currently operates in a signal driven mode. In signal driven mode, ECBS responds to an ERCOT deployment signal, via the QSEs Energy Management System. This has resulted in significant signal latency between the need for generation, and receipt of the deployment signal.
- Primary Frequency Response (PFR) – Adherence to ERCOT Nodal Protocols 8.5.1.1(1) & 8.5.2.1(1), and Nodal Operating Guide 2.2.8(1).
- Pro-Rated Regulation Down (RegDn) Awards – FRRS RegDn Day-Ahead Market (DAM) awards, beginning mid-November 2017, became awarded on a pro-rated basis due to an oversupply of market offers.

Proposed Solution(s): Report any possible solution(s) to the anticipated or unanticipated problem(s).

- Increased Cycling – Reduction of deployments within an available operating hour, under the current the Fast Responding Regulation Service (FRRS) parameters, is very unlikely. The only option within NRG's control to reduce increased cycling would be to adjust when ECBS is offered into the market. Due to the cell heating issue, scheduling optimization allows the ECBS batteries to cool, thereby offering some cycling relief for the interim period.
- Cell Heating – Scheduling optimization of ECBS allows the batteries to cool without impacting key hourly deployment periods within a day. NRG is collaborating with Toshiba on various solutions to alleviate the heat generated in cells. Flow distribution vanes were installed to enhance cooling flow to key areas within the container. While this improved the temperature, it did not completely resolve the matter. Toshiba is working on a solution to fully resolve this situation.
- Battery Charge Level – NRG operations periodically resets the batteries, thus allowing the SOC calculation to recalibrate. NRG and Toshiba are working on improving the algorithms that calculate SOC or possibly changing the charging criteria to be based on battery voltage.
- Deployment Mode – Logic is in development to shift ECBS from signal driven mode to autonomous mode. Autonomous Deployment Mode logic is intended to optimize battery response time. In autonomous mode, ECBS will respond instantaneously to grid frequency that is metered at the battery.
- Primary Frequency Response (PFR) – NRG held discussions with ERCOT regarding the requirement, and possible solutions. A solution to incorporate PFR into the ECBS operating software will be implemented to meet the requirement.

Action(s) Conducted and Results: Describe the action(s) taken to resolve the anticipated or unanticipated problem(s). Were the actions successful in resolving the problem?

- An additional inverter was added to resolve inverter heating referenced in the Final Report.

Section III. Provide a summary of the overall state of the facility and grant funded equipment.

- ECBS is generally functioning as designed, with the few exceptions noted in this report.
- Cooling system performance continues to be investigated to identify areas for improvement.
- Numerous electrical connection issues have been identified and resolved.
- ECBS is responding to ERCOT's deployment signals within the prescribed time as required by ERCOT.

Section IV. Goals and Issues for Upcoming Period

Provide a brief description of the project goal(s) you hope to realize during the next reporting period.

- Incorporation of Primary Frequency Response (PFR) requirements.
- Determine the impact of the increased cycling on project life.
- Continue to collaborate with ERCOT to cross reference data telemetry to validate accuracy, discuss current and future protocols that impact ECBS' operation and compliance with ERCOT Protocols and Operating Guides.
- Collaborate with Toshiba to further reduce cell heating.

Dudley D. Zahn

AD

Authorized Official/ Project Representative's Printed name
(blue ink)



Date: 5-22-18

Authorized Official Signature/ Project Representative's name
(blue ink)

NOTE: Please attach any additional information that you feel should be a part of your report.

This form may be submitted via e-mail to your Grant Coordinator or a paper copy may be sent to the following address:

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