Project Title:

Fuel-Free Geologic Compressed Air Energy Storage From Renewable Power

Task # 5 Deliverable Report

For:

New Technology Implementation Grant Program

582-11-13126-3225

Submitted by:
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General Compression, Inc.

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Abstract/Executive Summary

General Compression intends to install a second-generation, commercial 2 MW advanced compressed air energy storage system utilizing a fuel free, near-isothermal compressor/expander at an existing geological salt cavern in West Texas. General Compression additionally plans to install and integrate a 3.0MW or equivalent wind turbine alongside the GCAES™ compressor/expander technology to demonstrate our ability to use wind to provide firm dispatchable power (including peak, intermediate and baseload) and ancillary services to the Texas electrical grid. This project will allow for a minimum of 500 MWh of energy storage at an installed cost of approximately $15/kWh (or $24/kWh including the wind turbine), and will provide the necessary foundation to allow for the wide-scale ramp up to hundreds of thousands of megawatt hours of energy storage throughout Texas.

Introduction / Background

General Compression has developed a near-isothermal compressor/expander module that will allow the construction of utility-scale storage projects from a minimum of 2W to over 1,000 MW in power rating and over 300 hours of storage. The General Compression Advanced Energy Storage ("GCAES") project enables renewable generators to output energy to almost any power curve required by a customer. These modules use electricity as an input, either from intermittent renewable generators such as wind turbines and solar arrays, or from off-peak grid generators. The projects require no fuel to turn the air into power, lowering operating and permitting costs compared to other compressed air energy storage technologies and expanding the number of potential project sites. GCAES units feature a round-trip electrical efficiency of 75% and an installed cost of between $800-$1,000/kW. The projects are targeted at increasing the value of renewables, eliminating curtailment, enhancing transmission utilization, and making dispatchable renewable power available to customers, thus making it possible for renewables to displace coal or natural gas on the grid and significantly reduce total state-wide emissions. Projects can be built in remote areas, allowing renewables to more completely utilize remote transmission lines. General Compression plans to partner with utilities and developers of wind farms, existing underground storage facilities, transmission lines, etc. to develop integrated wind/storage projects. Standalone storage projects can also be built within urban power constraint areas, where peak/off-peak power arbitrage opportunities are highest because of the difficulty of siting new generation and transmission. The compressed air is stored in geologic formations and then expanded on demand to convert it to electric power. Value is created by absorbing power when it is not required by customers and generating power when it is. Unlike conventional compressed air energy storage projects, no fuel is burned when air is expanded and power is generated.

GCAES projects are responsive enough to be eligible in various markets for their ability to provide spinning reserves, capacity, voltage support, frequency regulation, etc. GCAES projects do not have gas line connections, air pollutant or CO2 emissions, radioactive risks, or coal ash containment. They are ideally suited to areas where conventional power projects cannot receive air permits.

Project Objectives / Technical Approach

General Compression has eight operational goals and objectives for this project:

1) Build and install a commercial unit of the General Compression Advanced Energy Storage at a demonstration facility being developed jointly between General Compression and ConocoPhillips.

2) Integrate the GCAES system into an existing cavern formation at the demonstration facility.

3) Build and install approximately 2 to 10 MW of wind turbines at the same site.

4) Integrate electricity generation from the wind turbine into the GCAES system for optimal delivery of wind power to the grid.

5) Provide and maintain energy storage and generation services to supply power to the Texas electrical grid over multiple timeframes.

6) Work with the Bureau of Economic Geology at the University of Texas ("BEG") to develop the test protocol to analyze the function of the GCAES unit and the wind turbine together as a project so that they respond to appropriate market signals.

7) Work with BEG to analyze the further integration of renewables into the electrical grid throughout the state of Texas in order to support the reduction of emissions and create opportunities for existing and future clean energy industry expansion within the state.

8) Reduce emissions by displacing baseload power generated from fossil fuels with renewable resources thus improving overall air quality in the state of Texas.

Tasks

Task 2

Task Statement: The PERFORMING PARTY will identify and obtain all necessary permits to install and operate the GCAES and 3-MW of wind turbine(s) at the specific project site or an adjacent site. ***(from Grant Activities (Scope of Work)***

2.2.1. The PERFORMING PARTY will ensure that all necessary permits cover the years during the project and at least five years after final reimbursement is paid by the TCEQ.

2.2.3. Deliverables: The PERFORMING PARTY shall submit copies of the approved permits to the TCEQ upon completion of this task.

Task 2 : deadline from Grant Activities (Scope of Work)

2.2.2. and 2.3.3. Schedule: The PERFORMING PARTY shall complete this task within 4 months of the signed Notice to Proceed Date as issued by the TCEQ. The signed Limited Notice to Proceed was sent to General Compression on July 25, 2011. Therefore, the Task 2 and 3 deadline was November 25, 2011.

Task 2: Details or attachment of additional results/deliverables

(To be added to the other deliverables that were submitted back on November 25, 2011.)

- Determination of No Hazard to Air Navigation approval from The FAA submitted **Confidential/Proprietary: inform applicant & seek AG opinion before releasing**

Task 5 Project objective(s) from Grant Activities (Scope of Work)

The performing party will finalize the GCAES design.

2.5.1. The PERFORMING PARTY will complete the detail design and design release for the GCAES.

2.5.2 The PERFORMING PARTY will confirm the necessary components to build the GCAES.

2.5.3 Schedule: The PERFORMING PARTY shall complete this task within 8 months of the signed Notice to Proceed Date as issued by the TCEQ.

2.5.4 Deliverables: The PERFORMING PARTY shall submit a report to the TCEQ upon completion of this task. This report will include the final design and the necessary components for the GCAES.

2.5.5 Approval to Proceed with Further Tasks: The TCEQ will determine whether additional tasks will be approved and funded depending upon the Performing Party's success in completing Tasks 1 through 5. The PERFORMING PARTY must receive written approval from

the TCEQ to proceed with any further tasks to be eligible for funding under this agreement. The Performing Party will provide evidence of sufficient insurance coverage for this project, as determined by TCEQ, before proceeding with any further tasks.

Task 5: Objectives vs. Results

- System Specification Report for The "Kelvin" GCAES System submitted as ***Confidential/Proprietary: inform applicant & seek AG opinion before releasing***

Task 5 : Deadline from Grant Activities (Scope of Work)

2.5.3 Schedule: The PERFORMING PARTY shall complete this task within 8 months of the signed Notice to Proceed Date as issues by the TCEQ. Therefore, the Task 5 deadline is March 25, 2012.

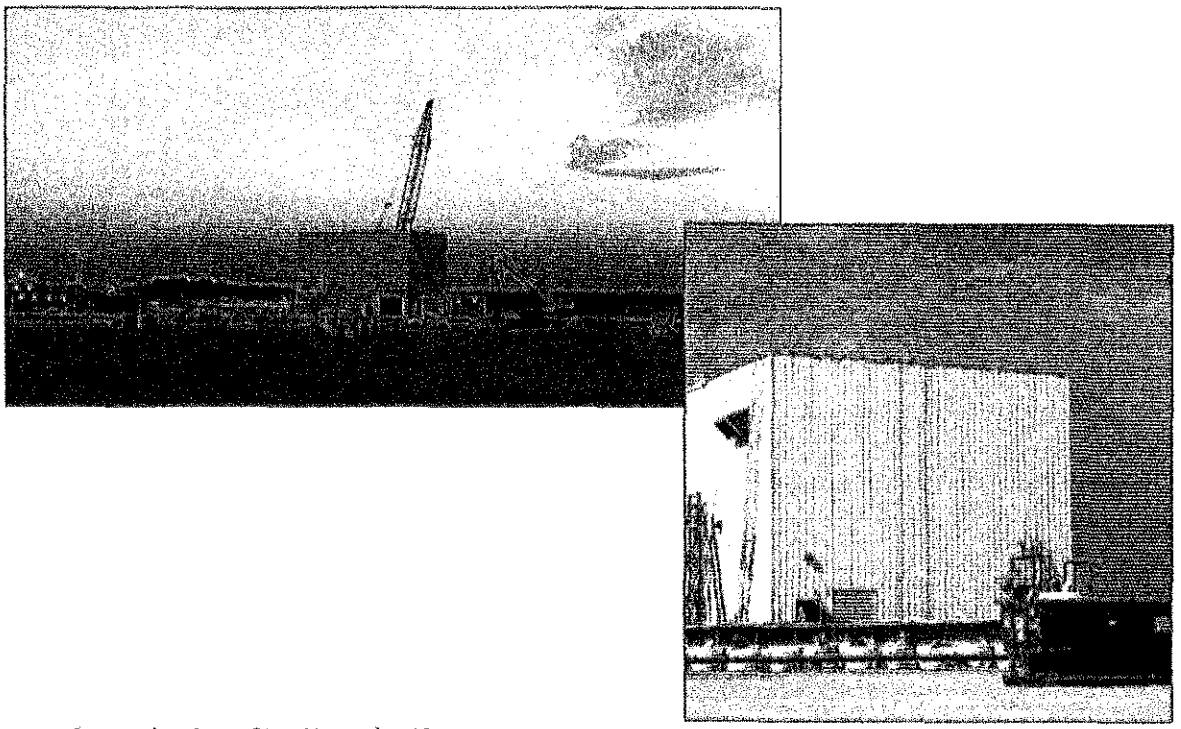
Task 5: Details or attachment of final results/deliverables

- System Specification Report for The "Kelvin" GCAES System submitted as ***Confidential/Proprietary: inform applicant & seek AG opinion before releasing***

  ASP Unit 2 "Kelvin" design and GCAES system comprises of a nominal 9MW module consisting of a single electric motor generator, rated at 13MW, 20 hydraulic prime movers and four 2.25MW compressor/expander vessel stacks powered by a common hydraulic system. Each pod can be combined with others to deliver a significant project rating in discreet 9 MW increments. Storage is performed by compressing atmospheric air in a near-isothermal manner, and discharging at high pressure to solution-mined salt storage geology.

- Gaines TX Demonstration Site pictures (below)

General Compression Demonstration Project, Gaines TX



Images taken August 31 and September 12

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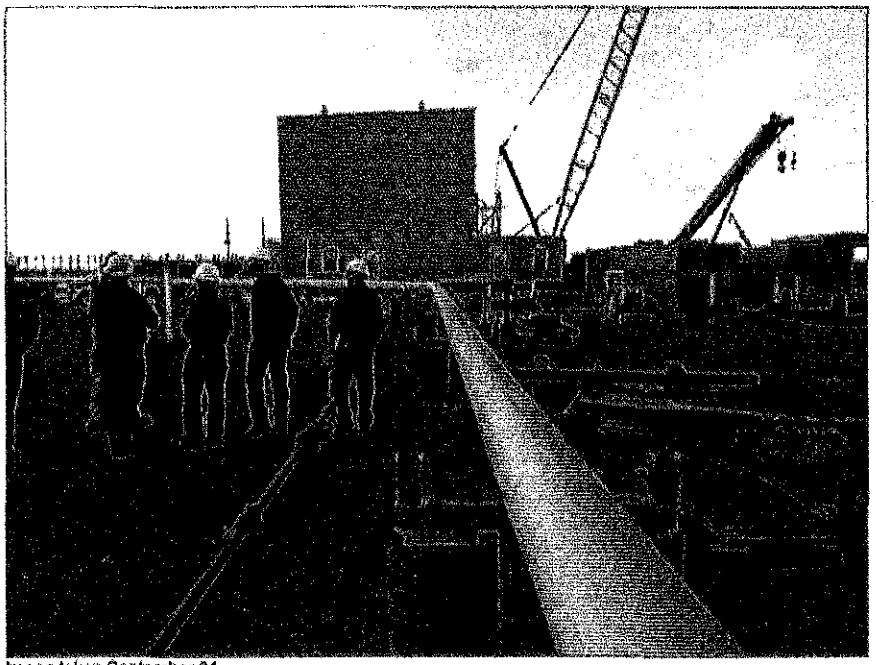

Image taken September 21

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Image taken September 19

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Task 5: Technical and commercial viability of the proposed approach

N/A

Task 5: Scope for future work

N/A

Task 5: Intellectual Properties/Publications/Presentations

Summary/Conclusions

We are moving forward with completing Task 4 and 6 objectives.

END OF TASK 5 REPORT