PG&E COMPRESSED AIR ENERGY STORAGE IN CALIFORNIA

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ABSTRACT

The purpose of this presentation is to provide an overview of Pacific Gas and Electric Company's (PG&E's) initiative in evaluating the technical and economic feasibility of compressed air energy storage using porous rock reservoirs in California.

GENERAL

Pacific Gas and Electric Company (PG&E) was awarded funding from the U.S. Department of Energy (DOE), the California Energy Commission (CEC), and the California Public Utilities Commission (CPUC) for the first phase of an initiative to demonstrate the technical and economic viability of advanced, underground compressed air energy storage (CAES) utilizing a porous rock reservoir. Currently, there are two utility-scale CAES facilities operating in the world, and both utilize salt domes for their storage reservoir. Due to the geology in California and many other locations in the United States, such underground storage features are not available. PG&E's CAES project is attempting to be the first commercial CAES plant to utilize porous rock formations, such as depleted gas reservoirs for the air storage.

The work for this initiative began in February 2011 and in its first phase is focused on identification and testing of potential reservoirs in California, preliminary engineering design, and economic analysis of the facility. PG&E proposes to present an overview of the initiative, including a summary of planned project activities, criteria associated with reservoir selection, proposed reservoir testing strategy, technological characteristics under evaluation, proposed system benefits to be evaluated, and potential project challenges. The information provided below provides greater detail on the reservoir selection and testing process.

INITIAL SITE SELECTION

The reservoir identification process includes a variety of components that influence the selection of the appropriate reservoir. An overview of the site selection process will be provided in the poster presentation. Since beginning this initiative, PG&E has evaluated approximately 70 potential sites in California based on technical, environmental, and siting criteria. Specific criteria evaluated include porosity, permeability, size, and pressure characteristics of the reservoir. The proximity to electric and gas transmission and environmental characteristics are significant factors as well. The specific metrics utilized in the evaluation process were re-assessed in the preliminary analysis and are now as follows:

Technical

- Depleted gas reservoirs
- Original production of 4 BCF to 40 BCF
- Permeability greater than 400 MD
- Porosity greater than 15%
- Pressure between 1000 and 1800 psi
- Sand thickness greater than 20 feet
- Low water production characteristics

Environmental/Siting

- Surface and below-ground landowner attributes
- Distance to gas and electric transmission
- Air district requirements
- Proximity to wetlands, flood zones, airports, and scenic highways
- Presence of sensitive species habitat
- Land use

Based on these parameters, fewer than 20 sites remain in the initial site selection process and are being vetted further before determining a short list of project sites. The primary goal of the site selection process of the PG&E CAES project is to select three sites to move into the reservoir testing phase.

RESERVOIR TESTING PLAN

The reservoir testing plan starts off with the drilling of two test wells at each of the three short-listed sites. The core samples will be lab-tested to verify that the reservoir characteristics match the screening criteria from the desktop analysis. Based on the results of the core analyses along with other selection criteria mentioned earlier, one site will be selected for compression testing, which will include establishing an air bubble in the reservoir, followed by monitoring pressure levels and performing flow testing.

SYSTEM BENEFITS/ECONOMICS

Evaluation of proposed system benefits will be a critical activity in identifying the feasibility of CAES in the California market. Such potential benefits that will be evaluated during the first phase of the project include the ability of the potential CAES facility to provide the following: energy during on-peak periods, voltage support, area regulation, and electric supply capacity. Additionally, as part of this analysis, the economic viability of such a facility in California will be assessed based on estimated:

- Facility costs derived from the preliminary engineering design;
- Fixed and variable fuel and non-fuel operations and maintenance costs; and
- Revenue streams associated with the energy, capacity, and ancillary services this facility may provide.

FUTURE WORK

This first phase of the CAES project is scheduled to take place over approximately 4 years. Through the remainder of 2011, the project team will be focused on continued desktop evaluation of the remaining reservoirs. By the end of 2011, the goal is to have completed the desktop analysis and selected the short list of potential project sites. Ongoing throughout the course of the program is the economic analysis of the viability of a CAES plant in the California market.

In 2012 the major activities include the following:

- Site control
- Preliminary plant engineering design
- Commencement of drilling for core samples

In 2013 the major activities include the following:

- Completion of drilling for core samples at three sites
- Commencement of compression testing of one reservoir

In 2014 the major activities include the following:

- Completion of compression testing of one reservoir
- Environmental studies of selected site
- Cost analysis and detailed engineering

BIOGRAPHICAL NOTE

Aparna Narang has over nine years of experience in the energy industry. She is currently the Program Manager for the $50M Compressed Air Energy Storage (CAES) initiative at the Pacific Gas & Electric Company (PG&E). Aparna also led PG&E's wind energy development program, growing that portfolio to over 400 MW of early stage projects. Before joining PG&E, she managed a project development portfolio of over 3,200 MW for Clipper Windpower, and managed construction planning activities for over 300 MW of wind projects at Horizon Wind Energy. She is also a graduate of General Electric's Renewable Energy Leadership Program. Aparna has a Bachelor's of Science in Civil Engineering and Environmental Studies from Tufts University and an MBA from the University of North Carolina at Chapel Hill.