Renewable Energy Program

North Dakota Industrial Commission

MARCH 2010
APPLICATION ADDENDUM

SUBMITTED IN RESPONSE TO THE INQUIREIS POSED BY THE NDIC REC

Project Title:
BULK ENERGY STORAGE FOR NORTH DAKOTA WIND ENERGY INTEGRATION

Applicant:
DAKOTA SALTS, LLC

Principle Investigator(s):
DAKOTA SALTS, LLC &
ELECTRIC POWER AND RESEARCH INSTITUTE
SCHLUMBERGER, TETRA TECH

Duration of Project:
8 MONTHS

Clarification Point #1: Concerning Total Value Proposition

The qualified investigation by the world's foremost leading experts in Bulk Energy Storage and Compressed Air Energy Storage for the purpose of fostering North Dakota's renewable energy initiative is in direct alignment with the NDIC Renewable Energy Council's (REC) Mission Statement, "to promote growth of North Dakota's renewable energy industries through research, development, marketing, and education."

The proposed feasibility study and initial value proposition for CAES depends on projected hourly electricity charging costs, projected hourly fuel costs, generator mix, transmission constraints, and new generation installations.

The 'Total value proposition' for CAES may be difficult to capture, beyond simple project economics, because the CAES system provides many services and inter-related value streams, including items above, and others such as frequency regulation, spinning reserve service, black start capability, synchronous condensing, and reduction in transmission adaptation costs, all of which lend to increased renewable investment as stated by the NDIC REC Goals and Purposes. In greater detail, the following REC Goals and Purposes are directly addressed for the immediate purpose of providing the reviewing committee additional consideration, concerning the 'Total value proposition'.

Goals & Purposes

1. Promote efficient, economic and environmentally sound development and use of North Dakota's vast renewable energy resources, particularly in the areas of wind energy, biofuels (ethanol & biodiesel), and biomass.

   CAES is possible in North Dakota because of its unique resources; both sub-surface (salt) and surface (wind). This places North Dakota in a regionally advantageous position that most other states do not have.

2. Create jobs related to the production and utilization of North Dakota's renewable energy resources.

   Wind penetration levels in North Dakota currently approximate four percent (4.0%). As additional wind power is brought to the grid, transmission and reliability complexities become more and more apparent to the principle power providers since wind competes for transmission space with traditional base load power. As wind penetration levels increase, unless competitive transmission issues are addressed via Bulk Energy Storage, wind investments will meet greater resistance as wind penetration levels increase.

3. Ensure economic stability, growth and opportunity in the renewable energy industry.

4. Encourage and promote the use of new technologies and ideas that will have a positive economic and environmental impact on renewable energy development and production in North Dakota.

CAES is the foremost emergent leading bulk energy storage technology complimentary to traditional renewables. Although CAES is a proven model and has been providing low emission power efficiently for over 30 years, it has been vastly under-considered as a result of minimal drivers. CAES and wind are a natural fit.

5. Promote public awareness of the benefits and opportunities provided by North Dakota's renewable energy industries.

   CAES implementation in North Dakota would not only create state awareness, but would draw national and international attention.

6. Add wealth for landowners and agriculture producers to build and maintain a robust rural economy.

   The proper geological setting for CAES in subsurface salts is in North West North Dakota, whereby, North Dakota's rural setting may benefit from the realization of large scale utility investment.

Clarification Point #2: Concerning Current Research Activity and Published Literature

The Electric Power and Research Institute (EPRI) is the world's foremost leader, expert, and published expert in the realm of Compressed Air Energy Storage. Electric Power Research Institute (EPRI) is an independent, non-profit company performing research, development and demonstration in the electricity sector for the benefit of the public. They focus on a broad array of collaborative Research and Development programs focused on the many specific technology challenges of helping our members provide society with reliable, affordable, and environmentally responsible electricity, including emerging technologies to increase the penetration and availability of renewables. EPRI is funded by membership participation in its research activities. Members represent more than 90% of the electricity generated and delivered in the U.S. International participation extends to 40 countries. This opportunity provides the engagement of EPRI, for the direct purpose of North Dakota Renewable growth.

EPRI is currently involved in full-scale advanced CAES demonstration projects (plant engineering, construction & observation) involving 15+ utilities. EPRI CAES engineering lead on ARRA Stimulus applications awarded to 2 US utilities (involving $55 Million of $60 Million Possible), and is involved with additional utilities on confidential projects. They have focused development in Ohio, California, Colorado, Texas, New York, Iowa as well as European countries. EPRI initiated and lead the development effort for original US CAES plant in McIntosh Alabama, acted as owners, representative & CAES specific technical lead for the Alabama Electric Co-op through its construction. For over 20 years, EPRI has lead the development of advanced CAES cycles with numerous patents awarded and remains the lead in RD&D on Adiabatic No-Fuel and Low-Fuel CAES and alternative advanced fuel based cycles. EPRI has appointed their project director concerning Adiabatic No-Fuel and Low Fuel CAES and alternative advanced fuel based efforts to the North Dakota Proposition.

Clarification Point #3: Concerning the CO_2 Footprint of CAES, and its susceptibility to Natural Gas Price Variations

In terms of natural gas market volatility, CAES utilizes 60% less fuel than any competitive advanced combustion turbine technologies. This provides significantly less vulnerability to variations in fuel costs and an operating cost hedge against such variations since fuel consumption is a much smaller component to the operating cost of CAES than a traditional, gas fired, and combustion turbine. Provided North Dakota's salt storage capabilities, a simultaneous gas storage cavern would provide a further hedging against gas volatility. A third possibility is the syn-gas plant in Beulah, providing an additional potential fuel source. Because CAES utilizes 60% less fuel than a traditional combustion turbine, the CO2 emissions are less than any competitive turbine technology (which are currently being employed to adjust to ramp-up and ramp-down cycles as a result of wind variability).

Clarification Point #4: Concerning the Transmission Considerations of North Dakota and CAES

When the wind is not blowing, there is excess transmission not being used, and there is typically CO2 being emitted by traditional base load power generation. When the wind does not blow, CAES discharges, thereby increasing the overall transmission usage factor, while simultaneously reducing CO2 emissions associated with traditional base load power generation.