# IOWA STORED ENERGY PARK "LESSONS FROM IOWA"

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The Iowa Stored Energy Park (ISEP) organization has been developing a Compressed Air Energy Storage (CAES) site for several years. Extensive seismic surveys, several economic feasibility studies, three exploratory wells, and the physical and chemical analysis of core samples from the exploratory wells have all been undertaken to complete our due diligence for this project.

This investigative work has been funded by a combination of entities, including 57 municipal utilities in Iowa, Minnesota, North and South Dakota, the State of Iowa Office of Energy Independence, and the **Energy Storage Program** of the U.S. Department of Energy. Over $8.6 million has been spent to date. Work has been carried out by The Hydrodynamics Group, LLC; Bay Geophysical; Sandia National Laboratories (SNL) in Albuquerque, New Mexico; Gingerich Well Drilling; Grosch Irrigation; Burns & McDonnell; Black & Veatch; RW Beck; and others.

The ISEP CAES facility would use low-cost off-peak electricity to compress air, store the high-pressure air deep underground, and then release the air during high electric demand periods to drive modified combustion turbines for the generation of electricity. This CAES facility is unique when compared to the two other existing CAES operations in the world in that ISEP is intended to use an aquifer for the storage of compressed air while the plants in Huntorf, Germany, and McIntosh, Alabama, each use mined salt domes. Aquifer storage has been used successfully for over 50 years for the storage of natural gas. The ISEP plant could demonstrate the viability of aquifer storage in a CAES operation, thereby providing an analog for facilities that can be constructed in many areas where salt domes or other caverns do not exist.

Initial design concepts determined a 270-MW CAES generation plant, based on existing industry equipment, combined with 200 MW of compression equipment, would be the desired project goal. This set the parameters for cost studies, economic feasibility studies, and geologic formation requirements.

Early searches for a suitable geologic formation in Iowa for the storage of compressed air demonstrated the challenges to be faced. The first site considered had been investigated for the storage of natural gas but experienced excessive leakage of the gas. The Iowa Geological Survey then provided records that showed 20 different dome-shaped geologic structures that might be suitable for storage of compressed gases. Researchers found over half of these were already under lease for natural gas storage. Several were too shallow or were far removed from other needed infrastructures. Two sites looked to be likely candidates.

Seismic tests on the first site selected indicated the lack of a contiguous caprock. Seismic surveys were then taken on a site near Dallas Center, Iowa, and the results looked promising, so a program for further qualification of the structure was commenced. Three exploratory wells were drilled, core samples from the wells were analyzed at SNL, and the results were analyzed with the aid of the Tough2 computer modeling software.

During the geologic study program, economic feasibility studies were also conducted. The most recent study, performed by RW Beck, concluded that ISEP at 270 MW would be cost-effective compared to conventional generation alternatives. It would also support additional wind-generation development in Iowa by consuming excess electricity for compression during lower demand periods when wind turbines might otherwise be curtailed.

The Beck analysis addressed many issues such as construction costs, intrinsic and extrinsic values, ancillary services, renewable integration to the grid, overall grid benefits from storage, and current and future MISO tariff services that will impact ISEP.

The final results from the geologic modeling preformed by The Hydrodynamics Group concluded that the low-permeability conditions in the Mt. Simon

sandstone that was being investigated for the storage of compressed air would prevent the formation of an air bubble adequate for the successful operation of a CAES facility of 270 MW at the Dallas Center site. This led the Board of Trustees of the Iowa Stored Energy Plant Agency to make the painful decision in July 2011 to discontinue the ISEP project.

Although the site geology results were disappointing, much has been learned from the project regarding how to accomplish bulk energy storage and coordinate it with renewable wind resources. Much of these "Lessons from Iowa" are independent of geology or of the storage technology used. Accordingly, documentation of all studies conducted during the due diligence of ISEP is being prepared for presentation on the *www.isepa.com* web site in the near future. It is the intention of the Iowa Stored Energy Plant Agency (ISEPA) Board that the extensive work involved in the ISEP project be available to anyone interested in aquifer CAES technology, or storage technologies of all kinds.

## BIOGRAPHICAL NOTE

Kent Holst is the Development Director for the Iowa Stored Energy Park (ISEP). He has served in this position since the formation of the Iowa Stored Energy Plant Agency (ISEPA) in 2005. Before then he served on the ISEP Committee of the Iowa Association of Municipal Utilities.

Mr. Holst was the General Manager of Traer, Iowa, Municipal Utilities (TMU) for 22 years until his retirement in 2004. Before joining TMU, he was a John Deere farm equipment dealer. He has a B.S. degree in Agricultural Business from Iowa State University.