Energy Storage Systems

Electrochemical Systems
Batteries are available in an increasing number of chemistries, including lead-acid, nickel-cadmium, lithium-ion and sodium/sulfur. Battery systems are inherently modular and have a wide range of applications.

Compressed Air Energy Storage
CAES utilizes off-peak electricity to compress and store air for expansion and generation during high demand, high pricing periods. Large CAES plants require geologically-specific locations and provide benefits similar to a peaking plant.

Flywheels
Flywheel storage employs magnetic levitation to spin a cylinder on a shaft and generate electricity. Kinetic energy is stored when the flywheel’s rotational speed is increased, then converted back to electrical energy with a motor-generator.

WorleyParsons’ Capabilities
- Program Management and Planning
- Economic Analyses and Cost Estimates
- Technology Assessments
- Site Evaluation and Selection
- Feasibility Studies
- Conceptual Design
- Front-end Engineering and Design
- Integration and Interconnection
- Construction Management
- Permitting and Compliance Monitoring
- Reservoir Testing and Analyses

Energy Storage
Energy storage systems can provide beneficial solutions to the challenges faced by renewable power generation grid integration. Ensuring power during periods of high demand, enhancing grid reliability, and smoothing intermittent supply fluctuations are a few of the roles filled by energy storage in the drive towards a more efficient electrical grid.

Applications and Benefits
Energy storage systems are available in a variety of technologies that are optimally selected for predictable benefits as well as the transmission system and electrical generation plant they will support. Electrochemical, compressed air with preferred storage reservoir, and flywheel systems are three of the developed technologies that can be utilized to provide energy time-shifting, electric supply capacity, load following, transmission and distribution upgrade deferral, time-of-use energy cost management, demand charge management, and grid reliability services such as frequency regulation and power quality improvement.

Distributed energy storage can be utilized for a broader range of value propositions. Transmission congestion relief, T&D upgrade deferral, time-of-use energy management, demand charge management, and reliability services, especially voltage support, can profit when located close to loads. In addition, since many storage technologies are inherently modular, they can be deployed and relocated where needed to provide electric capacity expansion and transmission planning flexibility. Benefits such as energy time-shifting and renewables firming can be easily realized when the storage system is located at the generation site.

WorleyParsons provides a full range of services to support the development of energy storage planning and implementation. Our staff will provide assistance with the benefit analysis and technology selection that is optimum for a customer’s project, including consideration of the particular storage applications that provide synergistic advantages to enhance project financial returns.
Experience

**Economic Potential for Energy Storage Technologies**

**CUSTOMER:** COMMISSIONER FOR RENEWABLE ENERGY  
**TIMEFRAME:** 2011 - 2011  
**LOCATION:** SOUTH AUSTRALIA  
**OFFICE:** MELBOURNE, AUSTRALIA

WorleyParsons and Sinclair Knight Merz prepared the Phase 1 feasibility assessment for energy storage technologies in South Australia.

WorleyParsons investigated the large scale storage potential with generation capacities from 50-500 MW, including:

- Capital and Operating costs
- Performance parameters
- Preferred geographic locations
- Existing transmission capabilities
- Benefits from energy trading, network support, and ancillary services

The study provided an overview of viable energy storage solutions and recommendations for their development potential.

**Seneca 150 MW CAES FEED Project**

**CUSTOMER:** NYSEG  
**TIMEFRAME:** 2011 - 2011  
**LOCATION:** NEW YORK, US  
**OFFICE:** READING, PENNSYLVANIA, US

WorleyParsons developed detailed engineering designs for two compressed air energy storage (CAES) technologies in order to generate cost, schedule, and performance forecasts to support a Go/No Go decision for the project.

The CAES project was to be sited on a solution-mined salt formation in New York State. WorleyParsons worked with Parsons Brinkerhoff Energy Storage Services to determine the reservoir capabilities that established the design requirements for WorleyParsons' detailed engineering and cost estimates of two potential CAES technologies.

WorleyParsons also performed transmission system modeling to assess the impacts of the CAES plant operations.

**PG&E 300 MW CAES Feasibility Study**

**CUSTOMER:** PACIFIC GAS & ELECTRIC  
**TIMEFRAME:** 2011 - ONGOING  
**LOCATION:** CALIFORNIA, US  
**OFFICE:** FOLSOM, CALIFORNIA, US

The 300 MW CAES study is a demonstration project funded by the DOE. This project is unique in that it expects to utilize a depleted natural gas reservoir for underground storage.

The plant is expected to generate electricity for extended periods via the stored compressed air. WorleyParsons is providing reservoir analysis, modeling, and geological testing services to develop an understanding of the underground storage boundary conditions and operating parameters.

WorleyParsons is also providing cost estimates, abatement strategies for permitting, and realistic operations analyses for the surface plant.