WHY AREN'T WE BUILDING NEW GRID-SCALE ENERGY STORAGE PROJECTS? THE CASE FOR PUMPED STORAE

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While many forms of energy storage are in various stages of development and commercial deployment, pumped storage hydropower is the most widely used energy storage application, with over 127,000 megawatts (MW) installed worldwide, representing over 99% of the existing installed electric energy storage capacity. It is observed from the existing 22,000 MW of U.S.-based pumped storage that the real value of this technology has gone from balancing peak/off-peak demand periods to enabling the overall power system to operate more reliably and efficiently. Worldwide, wind power has increased from approximately 15,400 MW in 2000 to over 145,000 MW in 2010 [1], and with numerous societal pressures and policies promoting the use of green energy, the penetration of wind resources is only expected to increase. The result of this growth in a naturally variable energy source will be the need for rapidly responding, flexible generation sources combined with fast and ultra-fast response or energy storage to instantaneously balance electrical generation and load.

A relatively new design for pumped storage projects is to develop both the upper and lower reservoir off of a main stem river system, thereby eliminating any aquatic and fishery impacts of the project. These projects are typically termed "closed loop" pumped storage, because after the initial filling of the reservoirs, the only water requirement to operate the projects is the occasional makeup water required to offset evaporation or seepage losses. These designs have greatly reduced potential environmental impacts of pumped storage projects by avoiding controversies related to endangered or protected and other aquatic species.

New variable-speed pumped turbine projects (also called adjustable speed) recently constructed in Japan and Europe have demonstrated yet another degree of new operating capabilities, flexibility of operation, and improved efficiency. This technological advancement may provide the greatest ancillary benefit to grid operators in the United States, as current pumped storage plants do not provide regulation in the pumping mode because the pumping power is fixed (i.e., a project must pump in "blocks" of power). However, variable-speed pumped storage units are able to modulate input pumping power and provide significant quantities of frequency regulation, including both incremental and decremental reserves.

Considering these advantages, the question of why pumped storage or grid-scale energy storage projects are not being developed at a pace similar to renewable generation is compelling. As an answer, legislative, regulatory, and financial obstacles exist that are restricting such development of any grid-scale energy storage project, including pumped storage hydropower. The inability to easily and confidently quantify and value the ancillary benefits of pumped storage makes long-term revenue contracts extremely difficult, combined with challenges in obtaining approvals from regional transmission authorities, and the current regulatory environment has stymied many potential projects.

This paper will discuss recent regulatory and technological developments for pumped storage hydropower and the concepts presented in the National Hydropower Association's August 22, 2011, filing to the Federal Energy Regulatory Commission (FERC) in response to their Notice of Intent for ancillary services for energy storage technologies. Several actions were recommended in the FERC filing that could increase the potential for development for grid-scale energy storage technologies like pumped storage by providing opportunities for long-term revenue streams. These include adapting the current Avista restriction to allow energy storage technologies to participate in the ancillary services market more robustly and developing a new energy storage asset class, similar to the gas storage model already adopted by the FERC.

REFERENCE

[1] U.S. Energy Information Administration (EIA), International Energy Annual Report, September 2011, http://www.eia.gov/forecasts/ieo/pdf/0484(2011).pdf.

BIOGRAPHICAL NOTE

Conference presenter: Michael Manwaring has more than 15 years of experience in the renewable energy field, primarily in the hydropower and pumped storage arena. He has planned, developed, and managed a variety of hydropower and water resources projects, from 50 megawatts (MW) to 1,300 MW. Mr. Manwaring currently serves as Chair of the National Hydropower Association's Pumped Storage Development Council, an organization representing over 60 member companies from the utility, merchant operators, equipment suppliers, and the consultant industry. He also previously served as Chair of the Northwest Hydroelectric Association Small & Low Impact Hydro Committee. Mr. Manwaring has presented on behalf of the hydropower and bulk energy storage industries to the U.S. Department of Energy, Federal Energy Regulatory Commission, various energy commissions, and other regulatory entities.