Valuation Guidance and Techno-Economic Studies for Pumped Storage Hydropower

Project Summary

Objectives

As an energy storage technology, pumped storage hydropower (PSH) supports various aspects of power system operations. However, determining the value of PSH plants and their many services and contributions to the system has been a challenge. The objective of this U.S. Department of Energy (DOE) funded project is to advance the state of the art in assessing the value of PSH plants and their contributions to the power system. The specific goal is to develop a detailed, step-by-step valuation guidance that PSH developers, plant owners or operators, and other stakeholders can use to assess the value of existing or potential new PSH plants.

The specific goals of this project are: (1) to develop comprehensive and transparent valuation guidance that will support consistent valuation assessments and comparisons of PSH projects or project design alternatives, (2) to test the PSH valuation guidance and its underlying methodology by applying it to two selected PSH projects, and (3) to transfer and disseminate the PSH valuation guidance to the hydropower industry, PSH developers, and other stakeholders.

Technical Approach

To accomplish the goals and objectives of this project, the project team will first develop a draft PSH valuation guidance that accounts for a full range of PSH services and contributions to the grid. The team will then apply the valuation guidance to two proposed PSH projects that were competitively selected by DOE through the Notice of Opportunity for Technical Assistance (NOTA). The project team will engage with NOTA selectees and perform various techno-economic studies to assess different aspects of value of these two projects (Banner Mountain PSH and Goldendale Energy Storage Project). These analyses will serve as the real world test cases for the proposed PSH valuation framework.

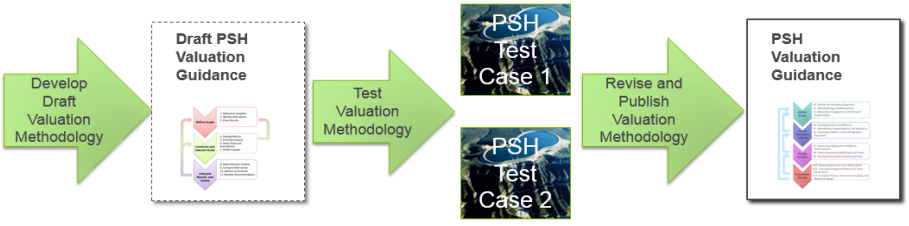

Figure 1: Key Project Activities

The valuation guidance will allow stakeholders to account for PSH costs and benefits over time. It will use a cost-benefit approach to compare the annualized project investment costs to the annual values of expected benefits and revenue streams. In estimating the potential benefits and revenue streams of PSH projects, the analysis will take into account which services

can be provided in parallel, and which are mutually exclusive and cannot be performed at the same time. The methodological approach will allow value streams to be stacked, but some co-optimization may be necessary to avoid double-counting benefits. The guidance for valuation analysis will also include the estimation of so-called system-wide or portfolio benefits PSH plants provide to the power system as a whole.

The techno-economic studies will include a number of different analyses that will be performed by the project team in support of the valuation process and to provide inputs for the valuation framework, specifically the estimated values of different PSH services and contributions. The key techno-economic studies to be carried out for the two selected PSH sites will include the analyses of:

- Value of bulk power capacity and energy arbitrage,
- Value of PSH ancillary services,
- Power system stability benefits,
- PSH impacts on reducing system cycling and ramping costs,
- Reduction of system production costs and other portfolio effects,
- PSH transmission benefits, and
- PSH non-energy benefits.

To develop the PSH valuation guidance, the project team started by identifying the key steps in the PSH valuation process. Figure 2 illustrates the proposed draft structure of the PSH valuation process.

Project Impact

The key product of the study will be step-by-step guidance for valuating PSH projects. Developing valuation guidance that is specifically designed to capture all services and contributions that PSH plants provide to the power system represents a big step forward in understanding the true value this technology brings to the grid.

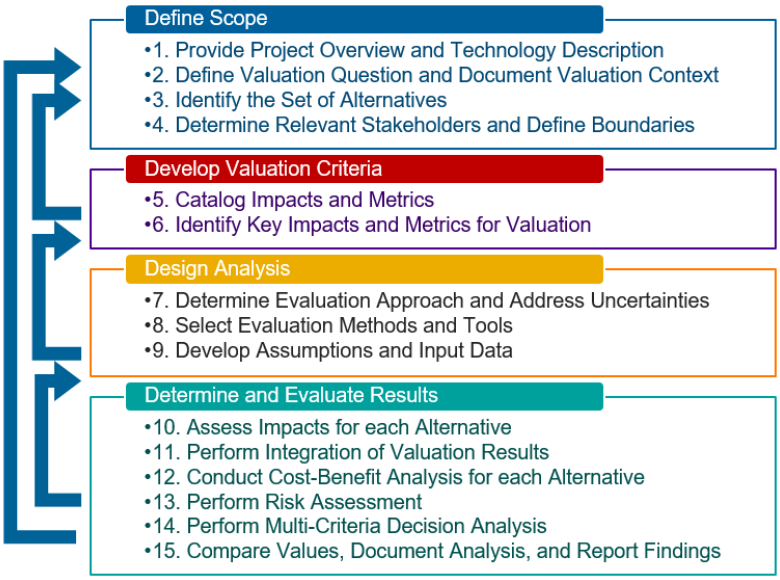

Figure 2: Proposed PSH Valuation Process

Project Team

The project is funded by the DOE's Water Power Technologies Office (WPTO) and carried out through collaboration of five national laboratories. In addition to Argonne National Laboratory, which is the project lead, the project team includes Idaho National Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory. The project team will also closely collaborate with a technical advisory group, which will include prominent experts in the field.

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