



Pacific Northwest
NATIONAL LABORATORY

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NWHA – 2018, Portland - OR

Understanding the Value of Hydropower and Pumped Storage

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DOE Initiatives on Valuation of Pumped Storage and Hydropower

- ▶ In July 2016, the Hydropower Vision Report illustrated some of the challenges and opportunities to expansion of hydropower
- ▶ In January 2017, the Quadrennial Energy Review (QER) Second Installment documented the rising importance of resiliency and stated that traditional methods of valuation are “strained” under the electric system’s technology evolution.
- ▶ In August 2017, the Staff Report to the Secretary on Electricity Markets and Reliability pointed out that along with traditional thermal resources, hydropower plants “provide essential reliability services... critical to system resilience.”



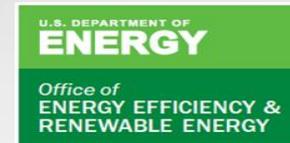
Projects Initiated in FY17-18

- ▶ DOE (WPTO) is initiating a new research strategy around the *value* and *valuation* of hydropower and pumped storage resources
 - Hydropower Value Study
 - Project funding - \$1.5 M
 - Techno-Economic Studies for Valuation of Pumped-Storage Hydropower
 - Project funding - \$3 M
- ▶ The projects are aimed at understanding the full potential of the hydropower fleet, including pumped storage, to contribute to electric grid resiliency and reliability



Hydropower Value Study

- ▶ Study funded by Department of Energy's (DOE's) Water Power Technologies Office (WPTO)
- ▶ Project Team:
 - Argonne National Laboratory (Argonne)
 - Idaho National Laboratory (INL)
 - National Renewable Energy Laboratory (NREL)
 - Oak Ridge National Laboratory (ORNL)
 - **Pacific Northwest National Laboratory (PNNL) – Project Lead**
- ▶ Timeline
 - Start date: January 2018
 - End date: December 2018





Project Overview

- ▶ Motivating questions:
 - How is hydropower currently contributing to grid services?
 - What services/capabilities will be needed by the grid in the future?
 - Can hydropower provide the services based on technical capability and cost?
- ▶ Project intent:
 - Foundational work to understand present hydropower operations trends, future expected changes, and hydropower capabilities analysis
- ▶ Project design:
 - Will involve extensive data collection and analysis on market participation trends, operational practices, and technological capabilities
 - Will not involve design of new market rules, hydro operations models/tools
- ▶ Expected outcomes:
 - Comprehensive understanding of hydropower's evolving value proposition
 - Understanding of high-impact future research needs – research roadmap



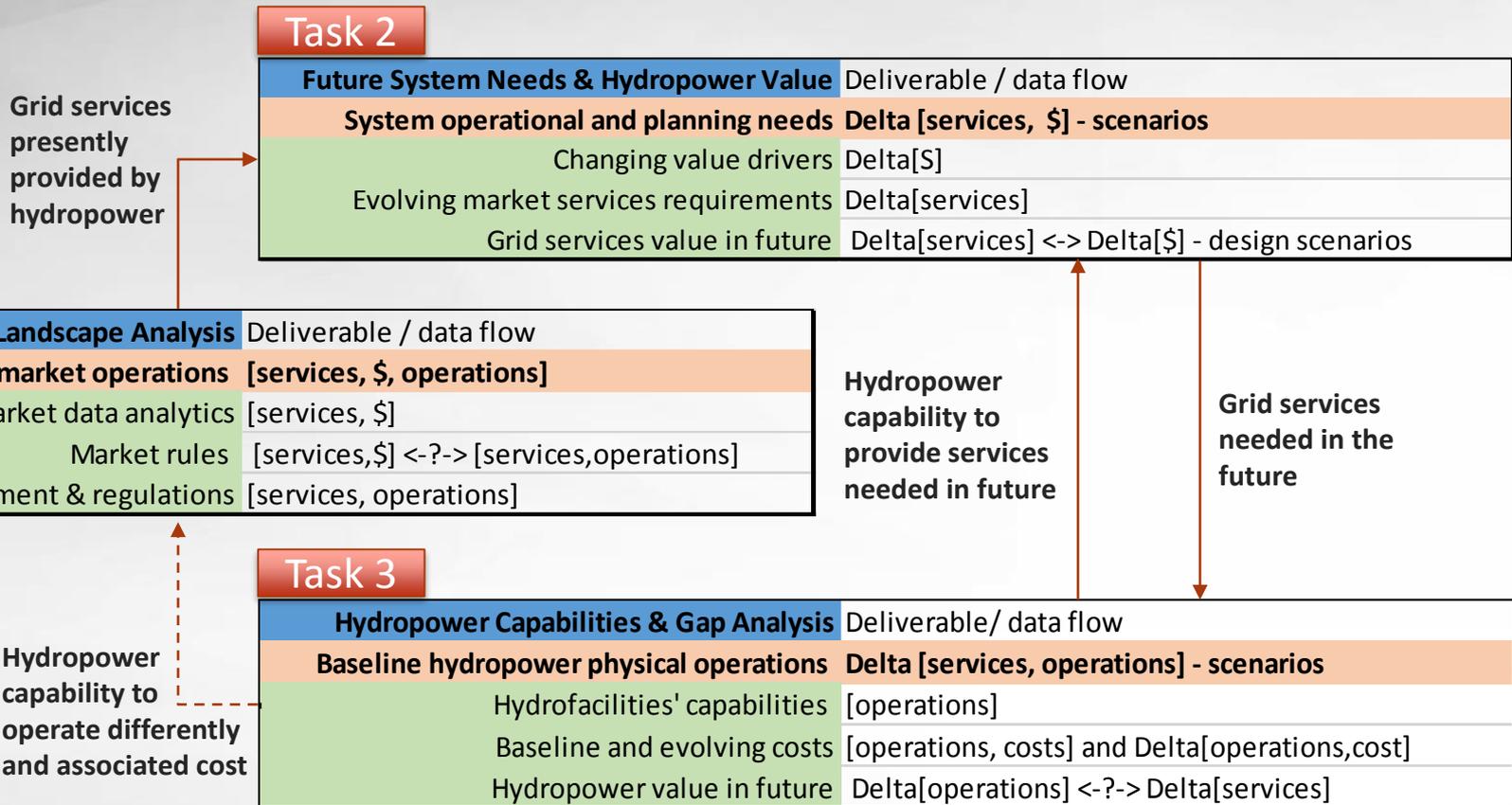
Project Tasks:

- ▶ Task 1 – Current landscape review
 - Market participation trends in different regions
 - Correlation analysis with other system variables, such renewables
 - Market participation rules and procedures in different regions
 - Estimation of value from services not presently monetized, such as inertia
 - Case studies on water management practices, and their impact on operations

- ▶ Task 2 – Future system needs & hydropower value
 - Future power system scenarios and resulting value drivers for hydropower
 - Hydropower value proposition in future based on system needs

- ▶ Task 3 – Hydropower capabilities & gap analysis
 - Comparison of current power system and hydro operations timelines
 - Baseline capabilities of existing units, facilities, and systems
 - Cost analysis to operate hydro facilities differently to provide future grid services

Task Structure and Information Flow





Industry Outreach

- ▶ Project specific engagement:
 - Identify, collect, and analyze hydropower operations data as it relates to provision of grid services
 - Identify present and future regulatory and market issues affecting operations and value access
 - Document water management practices and their impacts on dispatch
 - Analyze and validate the study results and propose refinements

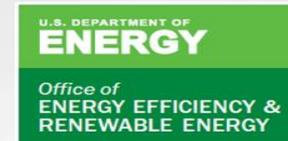
- ▶ Long-term strategic engagement:
 - Help identify the highest value research topics to help shape DOE's research agenda in the future

- ▶ Outreach activities:
 - Technical Advisory Group (TAG) participation in reviews and workshops



Techno-Economic Studies for Valuation of Pumped-Storage Hydropower

- ▶ Study funded by Department of Energy's (DOE's) Water Power Technologies Office (WPTO)
- ▶ Initiated by Congressional budget language setting aside \$3M for the analysis of value of PSH at two sites in areas with high RE generation
- ▶ Project Team:
 - Argonne National Laboratory (Argonne) (Project Lead)
 - Idaho National Laboratory (INL)
 - National Renewable Energy Laboratory (NREL)
 - Oak Ridge National Laboratory (ORNL)
 - Pacific Northwest National Laboratory (PNNL)





Project goals and objectives

Objective: Advance the state-of-the-art in the assessment of value of PSH plants and their role and contributions to the grid

Specific goals:

1. Develop a comprehensive, replicable, and transparent valuation methodology (framework, guidance, or process) that will allow for consistent valuation assessments and comparisons of PSH projects
2. Test the PSH valuation methodology by applying it to two PSH projects
3. Transfer and disseminate the PSH valuation methodology to the hydropower industry, PSH developers, and other stakeholders

Contact



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