HYDROPOWER AND THE GRID

Improving our understanding of hydropower's role in supporting the future electricity grid and in mitigating climate impacts

Hydropower, the largest form of renewable energy storage, has been a longtime contributor to electricity generation around the world. As the transition to net zero carbon emissions unfolds, hydropower—one of the few dispatchable forms of renewable energy—is expected to play an increasingly important role. However, one challenge with conventional hydropower is the multiuse nature of reservoirs. This needs to be balanced with competing uses and ecological impacts.

With a large portion of the hydropower fleet entering Federal Energy Regulatory Commission relicensing negotiations in the next decade, tools are needed to support the effective use of existing resources and evaluate competing needs. RTI International works with hydropower clients, the U.S. Department of Energy (DOE) Water Power Technologies Office, and national labs to build and implement tools to sustainably utilize hydropower. We have implemented multi-objective optimization routines to explore policy alternatives, built an improved Production Cost Modeling/reservoir system modeling framework, tied Capacity Expansion Models with economy-wide modeling to assess the impacts of shifts in different economic sectors, and implemented forecasting and decision-support tools to improve the utilization of hydropower within existing operational constraints. Additionally, we are leading the design of a policy exploration toolbox.

FEATURED PROJECT

Framework Linked Analysis of Streamflow and Hydropower (FLASH)

Client: DOE Water Power Technologies Office
Country: United States
Sector: Hydropower
Related Services: River Basin Operations

Production cost models (PCMs) are used to evaluate how the electricity grid will operate under grid buildout scenarios to assist in addressing energy sector planning questions. Hydropower is expected to play a significant role in providing generation flexibility as the amount of renewable generation on the grid increases and fossil units retire—leaving hydropower as one of the few remaining sources of fully dispatchable generation. However, PCMs typically employ rudimentary representations of hydropower, resulting in uncertainty related to planning assessments that involve high wind and solar penetration.

RTI worked with the National Renewable Energy Laboratory to develop a publicly available co-simulation framework that links the laboratory's Scalable Integrated Infrastructure Planning PCM with RTI's WaterALLOC modeling framework, which utilizes the Modeling and Simulation generalized river basin model. The co-simulation framework allows for realistic representation of reservoir operations and constraints to provide the PCM with improved information about hydropower availability. This framework also aims to increase our understanding of hydropower's capabilities to support the grid, providing improved climate change response tools to evaluate pressing questions surrounding the energy generation system's future transition.

ADDITIONAL HYDROPOWER SERVICES

- Energy-environment tradeoffs
- Forecast-informed reservoir operations
- Reservoir optimization
- Economy-wide impacts modeling
- Food-energy-water nexus evaluation
- Operational decision support tools

RTI INTERNATIONAL | Center for Water Resources

rti.org/cwr
cwr@rti.org

0622