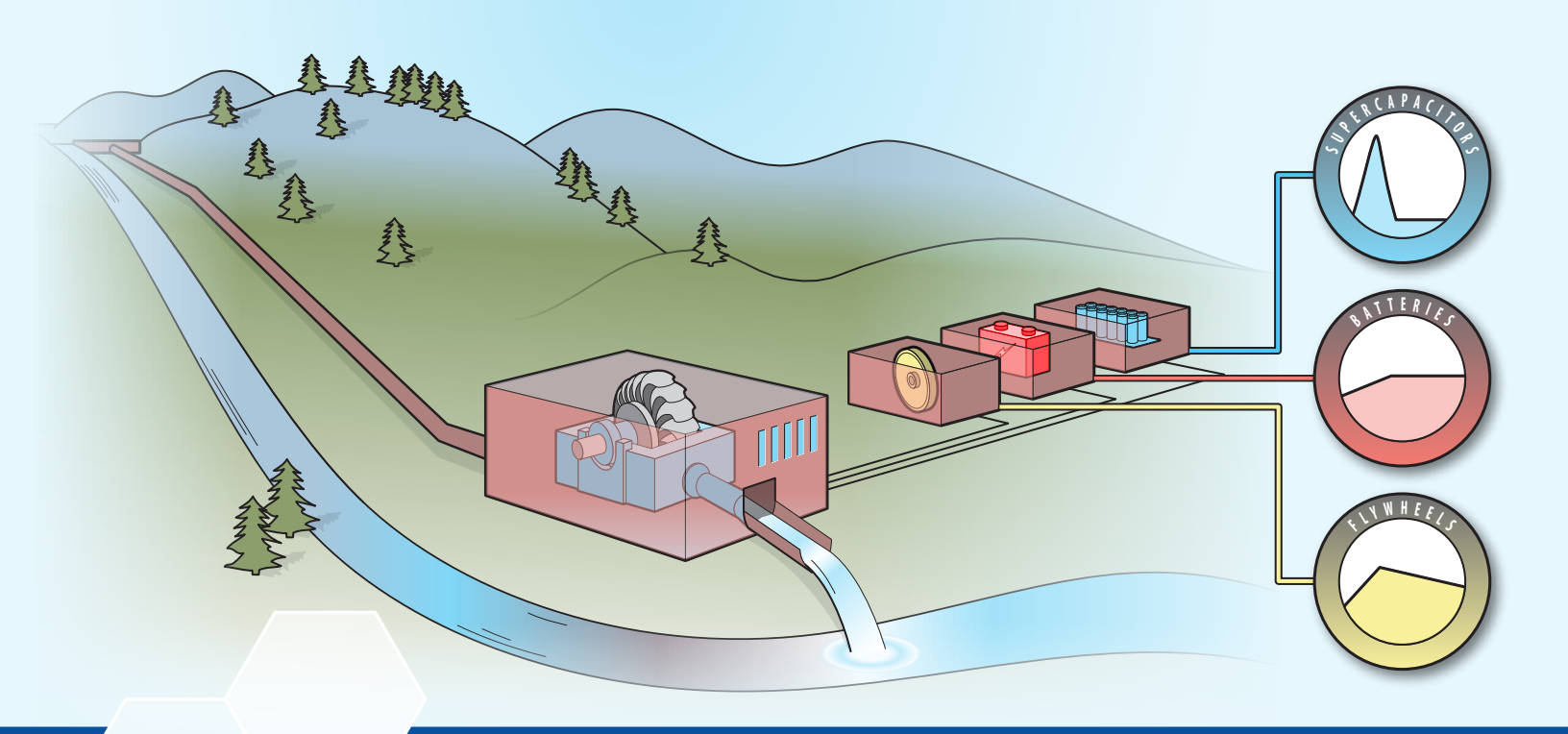

Integrating hydropower and energy storage

How run-of-river hydro can offer power-balancing solutions

Idaho National Laboratory is leading a research effort evaluating the ability of run-of-river hydropower to provide grid balancing through integration with an energy storage system.

Hydropower has long been the nation's largest source of renewable electricity, providing energy storage and essential services to the electric grid. While wind and solar generation have gained a greater presence on the grid, they are "variable renewables," meaning their output changes frequently throughout the day. Such variability has heightened the need for flexible generation. As a result, generation resources that ensure reliable balance between supply and demand have become more valuable. The U.S. Department of Energy's (DOE) Water Power Technologies Office (WPTO) is leading research to modernize hydropower — America's first renewable electricity resource — to meet these current and future electrical grid needs.

THE BALANCING ROLE OF HYDROPOWER

Hydropower is well-suited to balance grid supply and demand. Typically, hydropower includes a reservoir, which enables a hydropower operator to hold water in reserve when it is not needed or to generate at a higher capacity when it is needed. Hydropower can therefore generate less electricity when the wind is blowing or the sun is out, and more when conditions change.

By contrast, "run-of-river" (ROR) hydropower has little if any inherent storage capacity with which to balance the grid because it doesn't include a reservoir. Instead, a portion of a river is channeled into the hydropower plant. Therefore, the amount of electricity generated varies with the flow of the river.

There are approximately 38 gigawatts of ROR hydropower infrastructure in the United States, according to the Energy Information Administration. On its own, this infrastructure is seasonally intermittent as river levels rise and fall.

Due to new developments in energy storage, however, WPTO has identified the potential for ROR hydropower backed with energy storage to offer stable generation and the flexibility to respond quickly to changes in energy supply and demand. This capability is increasingly valuable as the share of wind and solar energy generation continues to increase.

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Idaho Falls Power, a collaborator on the project, has four ROR power plants on the Snake River. Here, a diversion dam directs much of the water toward a nearby hydro plant. (Photo courtesy Idaho Falls Power)

INTEGRATED IS ELEVATING THE ROLE OF RUN-OF-RIVER HYDROPOWER

Idaho National Laboratory is leading WPTO's *Integrated* project, a research effort evaluating the ability of ROR hydropower to provide grid balancing through integration with energy storage systems, including batteries, flywheels and supercapacitors. In essence, an energy storage system can act as a virtual reservoir, making it possible for a ROR hydropower plant to adjust the amount of power it puts on the grid, filling the same balancing role as conventional hydropower.

Phase I of the Integrated project has confirmed the concept that combined ROR hydropower and energy storage systems can perform like reservoir-based hydropower.

One test case also demonstrated the potential for the technology to increase ROR hydropower revenue by 12 to 16 percent due to the additional services that the ROR plants could provide the grid. These services included the ability to be compensated for helping regulate grid frequency—stabilizing the grid when, for example, demand spikes or a transformer faults.

Phase II of the project will provide practical demonstration and guidance to industry on design and utilization of integrated hydropower and energy storage (IHES) systems for providing essential reliability services and increasing grid resilience.

The first use case will focus on enabling distribution-level black start services using integrated run-of-river hydropower plants and ultracapacitors. This will be accomplished through a field demonstration at Idaho Falls Power in the Spring of 2020.

A second use case will be identified through partnership with industry. These two use cases will help inform and refine the ultimate deliverable of industry guidance for assessing, sizing and optimizing hydropower and energy storage systems.

FOR MORE INFORMATION

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