How Hydropower Works

Each hydropower project is unique. The equipment and design reflect when it was built, the landscape and the geologic character of the location.

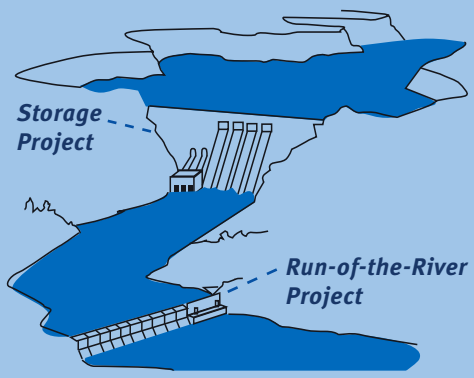
And like our homes, equipment and designs are regularly updated. Hundreds of millions of dollars have been invested since the 1990s to replace turbines and rewind generators. These investments are used to help projects generate more power, use less water to generate the same amount of power, improve water quality and/or increase juvenile fish passage downstream.

From a power generation perspective, the other big difference between projects is "run-of-the-river" vs. "storage" projects. Run-of-the-river projects allow water to pass through a facility at about the same rate the river naturally flows.

Storage projects have a reservoir, sometimes called a lake, behind the dam. By "storing" water, operators can adjust the river's natural water flow to meet one or more needs. For instance, releasing water when more electricity is needed, capturing runoff to assist with flood control and supporting irrigation.

Storage between May and July also helps equalize river runoff over the course of the year. In fact, in the Northwest 60 percent of runoff occurs during this time. By storing water in U.S. and Canadian reservoirs, it can be released for power, irrigation and other needs when supply is less plentiful during the late summer, fall and winter months.

STORAGE VS. RUN-OF-THE-RIVER

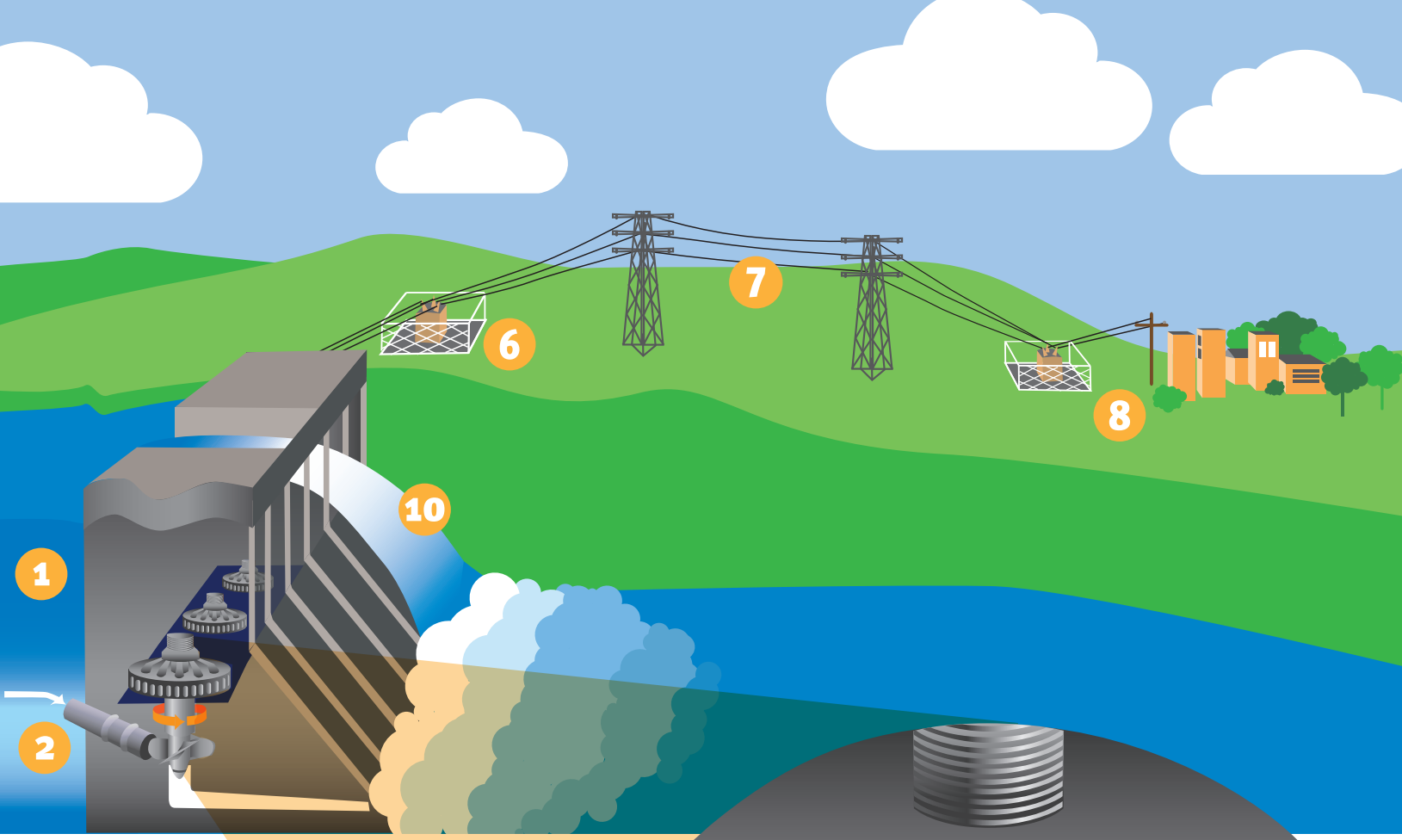


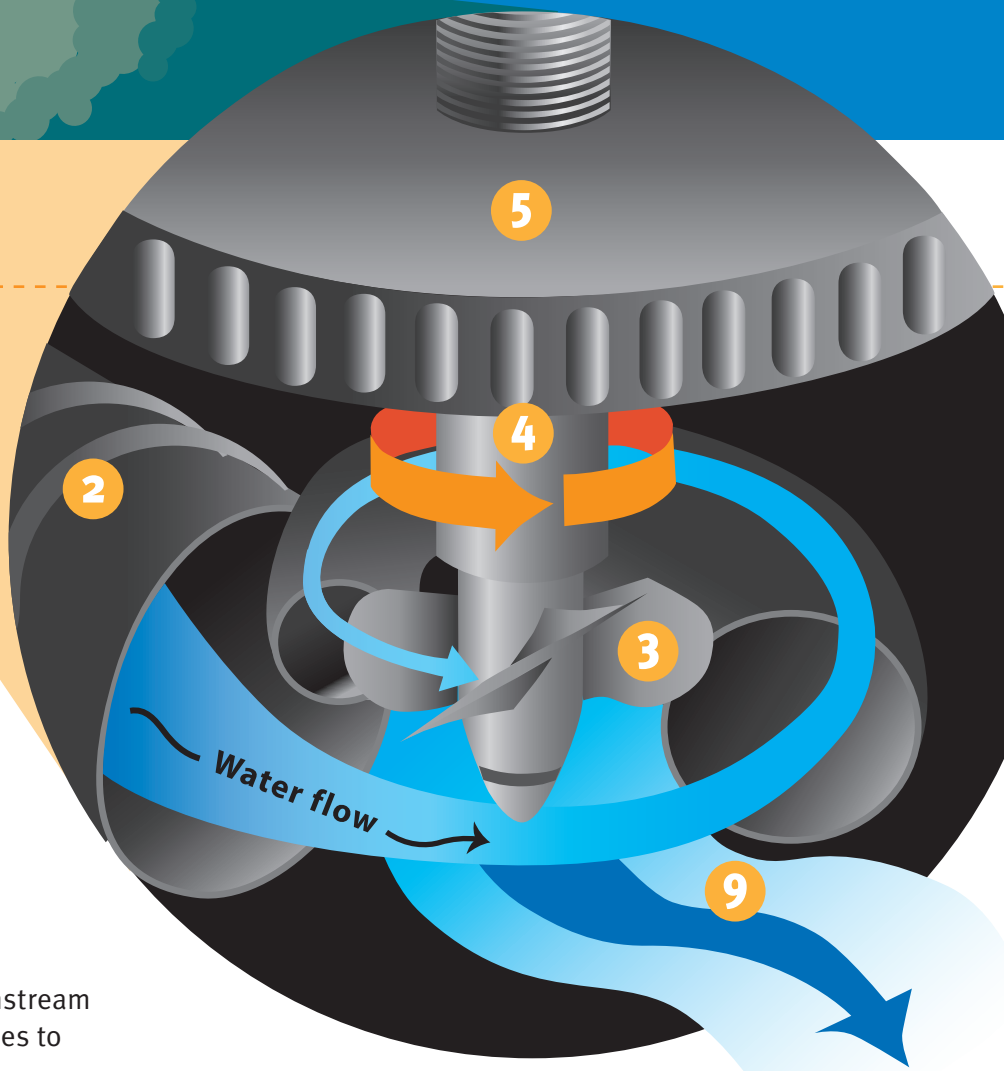
In the Northwest, 60 percent of runoff occurs from May through July. Storage projects allow water to be released when supply is less plentiful during the late summer, fall and winter months. Spring water is helpful in meeting flows for fish, irrigation and flood control needs. It also enables intermittent resources such as wind and solar to be used on the power grid.

Run-of-the-river projects allow water to pass through a project at about the same rate the river naturally flows. Some run-of-the-river dams include the flexibility to reserve some river flows for release during hours when power is most needed. This hydropower flexibility provides critical support to wind, solar power and other variable sources of energy that are becoming more prominent on the power grid.

Take a Walk through a Hydroelectric Project

1. **WATER** from a river or reservoir flows into a penstock.
2. The **PENSTOCK**, a large pipe above or below ground, is commonly used to direct the water flow.
3. **TURBINE BLADES** are pushed by the force of water exiting the penstock, causing them to transfer the energy of falling water to rotate the shaft.
4. The **SHAFT** connects the turbine to the generator, turning at the same speed as the turbine.
5. Inside the **GENERATOR**, the spinning shaft turns electromagnets (called a rotor) inside a stationary ring of copper (called a stator), moving electrons to produce electricity.
6. **STEP UP TRANSFORMERS** increase the voltage of electricity produced by the generator.





7 **TRANSMISSION LINES** carry high voltage electricity to substations in our communities.

8 At **SUBSTATIONS** (which house step down transformers), the voltage is decreased. Electricity is then distributed to homes and businesses.

9 **WATER FLOW** used to turn the turbines returns to the river.

10 **SPILLWAYS** release water downstream that is not directed to the turbines to generate electricity.