

## Harnessing the Power of Renewable Energy: Hydropower

Written by: Randy Bowersox, PE, Hydropower Market Executive, Gannett Fleming

There are many forms of energy, each with its advantages and disadvantages. From water power to solar energy, every option has nuances related to installation, maintenance, and life cycle cost.

Understanding the pros and cons of each type of power infrastructure is essential in building resilient energy solutions that will serve our communities today and into the future.

### What is hydropower?

Hydropower, or hydroelectric power, is energy harnessed by moving water. One of the oldest and cleanest renewable energy sources, the natural movement of flowing water generates power by transforming it from mechanical energy to electrical energy.

### How does hydropower work?

Water + Gravity = Hydropower.

Water stored in a reservoir is potential energy that works similarly to a battery. The more water you have and the farther it has to fall, the more energy you generate. When the water is allowed to run downhill, either in the natural river channel or in a tunnel or pipe, that potential energy is converted into kinetic energy. The moving water hits the turbine and makes it



spin, producing mechanical energy. The generator (connected to the turbine) then converts that mechanical energy into electrical energy, which can be distributed to homes and businesses.

### Is hydropower renewable?

Yes! Hydropower has generated clean, renewable, and reliable power for over 100 years. Mother nature supplies the water and gravity. The water is not “consumed.” It is merely “borrowed” for a fraction of a second to turn the turbine, and then it is released back into the source.

However, “renewable” can be defined differently by different

people and jurisdictions at different times. Every state considers at least some, but not necessarily all, hydroelectric power to be renewable.

For example, the states of Michigan and Missouri don't currently recognize hydropower to be renewable if it requires the construction of new dams, and California and Iowa only consider energy from smaller hydroelectric turbine generators (regardless of the size of the dam) in their renewable definitions, although California intends to count all hydropower eventually. Ohio allows utilities to count hydropower as renewable as long as their facilities are not harmful to fish, wildlife, or water quality. But when you consider the raw inputs and process, the energy created is clean and renewable.

---

## Are dams good or bad?

---

This is a tricky question with many considerations. It is important to recognize that most dams were not built primarily for hydropower purposes, and only 3% of the nation's 80,000 dams currently generate electricity. If you were to get rid of hydropower, most dams would still be needed, as they play a critical role in public safety (flood protection), water supply (for homes and agriculture), recreation, and transportation (locks). In many instances, hydroelectric renewable power is simply an ancillary benefit.

Dams can and do impact the environment, sometimes changing natural flow patterns or interfering with fish and aquatic life. And not all dams are beneficial. Some dams, often built many years ago, are no longer needed or used as intended. In these situations, removing the dam may be the most prudent and responsible action.

Not all hydropower facilities even use dams. There are several ways to generate energy from hydropower:

**Storage Dams:** Moving water flows downward from an elevated reservoir to a lower reservoir or back into the natural river.

**Run of River (ROR):** Dependent on the natural flow of rivers, ROR hydropower diverts a portion of the river water to a turbine. Vulnerable to natural fluctuations in water level, there are more variables related to natural water cycles and their impact on water flow to generate electricity.

**Pumped Storage:** In some situations, the water can be pumped back uphill after it has gone through the turbine and used over and over to make electricity. Pumped storage hydro can even be designed as a "closed loop" system, where there is no connection to any river.

---

## What are the advantages of hydropower?

---

While there is a cost associated with the initial design and construction of a hydropower facility, hydro is a cost-effective and long-term solution that provides many decades of reliable electricity production.

Similarly, as mentioned earlier, implementing a dam-based hydropower solution can help with flood control in low-lying areas, water supply during dry seasons and droughts, and recreational opportunities. Hydropower also plays a critical role in decarbonization and helps to integrate other renewables, such as wind and solar.

When the sun sets (which seems to happen every evening) and the wind stops blowing (a little harder to predict), other electrical generators need to ramp up instantly to compensate for the difference. Hydro is incredibly good at this: being flexible and fast-ramping.

And, if reservoirs are involved, i.e., storage hydro, hydro effectively functions as a large battery, storing power (in the form of potential energy in an upper reservoir) until it is needed.

---

## What are the disadvantages of hydropower?

---

While hydropower and hydroelectric energy are renewable sources, damming a river can affect natural habitats in and around the water source. From a community standpoint, building a dam, as well as a dam failure, can have an impact on surrounding communities and wildlife. 🐟



---

### About the Author

---

Randy Bowersox, PE, is a hydropower market executive with Gannett Fleming. Randy helps clients strategically deploy capital, manage complex (and often aging) assets, maintain perspective, manage risks, and build a positive culture in pursuit of the generation of energy powering our lives.

---

### About the Article

---

This article was written for the online [Gannett Fleming INSIGHTS Blog](#). Founded in 1915, [Gannett Fleming](#) has been a driving force in shaping infrastructure and improving communities in more than 65 countries, specializing in natural resources, transportation, water, power, and facility-related projects. The company embraces sustainability and innovation in projects and internal activities and achieves results while being responsible stewards of the environment. A results-driven firm, Gannett Fleming is consistently ranked in the top one percent of engineering firms worldwide.

Any views and opinions expressed in this article may or may not reflect the views and opinions of the Construction Management Association of America (CMAA). By publishing this piece, CMAA is not expressing endorsement of the individual, the article, or their association, organization, or company.