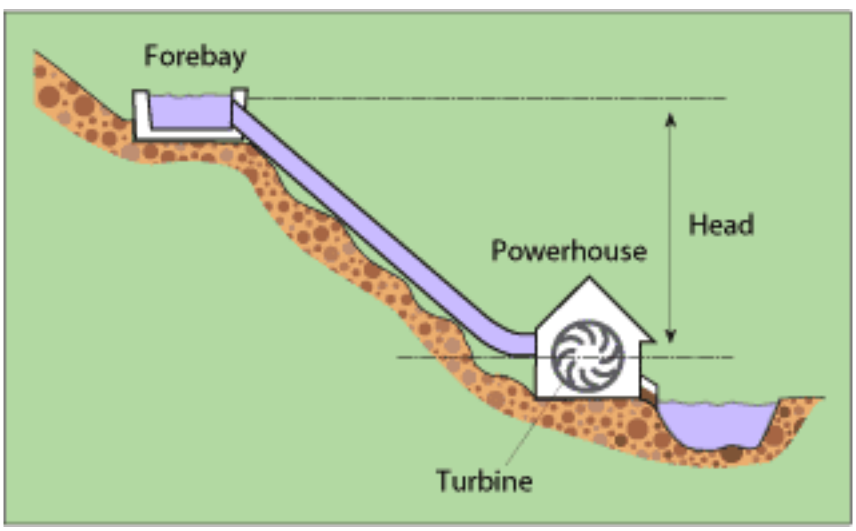
Micro-hydropower Systems

Micro-hydropower systems usually generate up to 100 kilowatts (kW) of electricity. Most of the hydropower systems used by homeowners and small business owners, including farmers and ranchers, would qualify as microhydropower systems. In fact, a 10-kilowatt microhydropower system generally can provide enough power for a large home, a small resort, or farm.

How A Microhydropower System Works

Hydropower systems use the energy in flowing water to produce electricity or mechanical energy. Although there are several ways to harness the moving water to produce energy, run-of-the-river systems, which do not require large storage reservoirs, are often used for microhydropower systems.

For run-of-the-river microhydropower systems, a portion of a river's water is diverted to a water conveyance—channel, pipeline, or pressurized pipeline (penstock)—that delivers it to a turbine or waterwheel. The moving water rotates the wheel or turbine, which spins a shaft. The motion of the shaft can be used for mechanical processes, such as pumping water, or it can be used to power an alternator or generator to generate electricity.
A microhydropower system can be connected to an electric distribution system (grid-connected), or it can stand alone (off-grid).



Evaluating a Potential Microhydropower Site

To build a microhydropower system, you need access to flowing water on your property. A sufficient quantity of falling water must be available, which usually, but not always, means that hilly or mountainous sites are best. Other considerations for a potential microhydropower site include its power output, economics, permits, and water rights.

Power Output
To see if a microhydropower system would be feasible, you'll want to determine the amount of power that you can obtain from the flowing water on your site. This involves determining these two things:

* Head—the vertical distance the water falls
* Flow—the quantity of water falling.

Once you've calculated the head and flow, then you can use a simple equation to estimate the power output for a system with 53% efficiency, which is representative of most microhydropower systems.

Multiply net head (the vertical distance available after subtracting losses from pipe friction) by flow (use U.S. gallons per minute) divided by 10. That will give you the system's output in watts (W).
The equation looks this:

Head x (Flow/10) = Watts

To help make a microhydropower system more feasible, it's a good idea to make every effort to reduce your electricity usage.

In creek turbine. Photo from www.homepower.com

Economics

If you determine from your estimated power output that a microhydropower system would be feasible, then you can determine whether it economically makes sense.
Add up all the estimated costs of developing and maintaining the site over the expected life of your equipment, and divide the amount by the system's capacity in watts. This will tell you how much the system will cost in dollars per watt. Then you can compare that to the cost of utility-provided power or other alternative power sources.

Whatever the upfront costs, a hydroelectric system will typically last a long time and, in many cases, maintenance is not expensive. In addition, sometimes there are a variety of financial incentives available on the state, utility, and federal level for investments in renewable energy systems. They include income tax credits, property tax exemptions, state sales tax exemption, loan programs, and special grant programs, among others.

Permits and Water Rights

When deciding whether to install a microhydropower system on your property, you also want to know your local permit requirements and water rights.
Whether your system will be grid-connected or stand-alone will affect what requirements you must follow. If your microhydropower system will have minimal impact on the environment, and you aren't planning to sell power to a utility, there's a good chance that the process you must go through to obtain a permit won't be too complex. On Tribal lands, contact your tribal environmental or planning department, to make sure you aren't going to run into trouble.

Which System Should you Get?

Commercially available turbines and generators are usually sold as a package. Do-it-yourself systems require careful matching of a generator with the turbine horsepower and speed. Homemade turbines are relatively simple to create, but tend to wear out at a faster rate than commercially designed ones.

Many systems also use an inverter to convert the low-voltage direct current (DC) electricity produced by the system into 120 or 240 volts of alternating current (AC) electricity. (Alternatively, you can buy household appliances that run on DC electricity.) Whether a microhydropower system will be grid-connected or stand-alone will determine many of its balance of system components.

For example, some stand-alone systems use batteries to store the electricity generated by the system. However, because hydropower resources tend to be more seasonal in nature than wind or solar resources, batteries may not always be practical for microhydropower systems. If you do use batteries, they should be located as close to the turbine as possible because it is difficult to transmit low-voltage power over long distances.

Online Parts and Do-It-Yourself Resources:
www.backwoodssolar.com
www.microhydropower.com
http://www.builditsolar.com/Projects/Hydro/hydro.htm

For Trainings, more information, or consulting services, contact us at energy@sustainablenations.org