



E³A: Micro-hydropower for the Home, Farm or Ranch

Steps in the Micro-hydro Series

Understanding Micro-hydro

Site Assessment

Equipment and Installer Selection and Costs

Regulations

Understanding micro-hydro

The generation of electricity from falling water is generally divided into three categories:

- Large hydro: Greater than 20 megawatts (MW) of capacity
- Small hydro: From 100 kilowatts (kW) to 20 MW capacity
- Micro-hydro: Under 100 kW capacity

Micro-hydro involves a large range of system sizes, from a 50-watt system powering an electric fence to a 100-kW system selling electricity to a utility. Like other renewable energy technologies, micro-hydro can be used with a grid-connected or an off-grid, battery-based system. This module focuses on micro-hydro systems that are designed to offset energy consumption in a home, farm or ranch, not the sale of electricity for profit. If you have an interest in larger systems designed to sell electricity, contact your local extension office or electric cooperative for more information.

Micro-hydropower resources are divided into two categories: low-head and high-head systems. Head is a measure of the vertical distance that water falls. A low-head system is generally considered anything between 3 and 40 feet high. The higher the head, the greater the available energy, so low-head systems generally require more available water flow than high-head systems to generate the same amount of energy. The difference will be discussed further in the *Site Assessment* guide.

Hydroelectric systems are further categorized as impoundment or run-of-the-river systems. Impoundment systems store water for the hydroelectric system. Larger systems typically use this method, because flow can be regulated and maintained more consistently throughout the year. Unless an impoundment already exists, such as for irrigation, most micro-hydro systems are run-of-the-river, where water is diverted from a body of water. Run-of-the-river systems typically cause less of a disturbance to wildlife habitat, fish passage, water flow and water quality than impoundment systems.

Components of a micro-hydro system

Hydroelectric systems are designed to extract energy from falling water, regardless of the size of the installation. The figure on the right shows the basic components of a system. The intake is typically shielded with a trash rack, weir or forebay to prevent debris from entering the pipeline. The pipeline, or penstock, carries water under pressure to the turbine, where the energy of the flowing water is converted to electricity. The turbine for a micro-hydro system operates similarly to a wind generator. The raw AC power flows to an inverter that converts it to standard 110- or 220-volt, 60-hertz electricity that would be used for a variety of electrical loads.

Applications of Micro-hydropower

Only a lucky few farmers, ranchers or homeowners will have access to a quality micro-hydro resource. Hydroelectric resources are more site-specific than solar or even wind energy. Naturally flowing streams, irrigation ditches and existing pipelines are the most suitable locations for a micro-hydro system. For those with access to flowing water, micro-hydropower is often the least costly source of renewable energy. More information on site assessment, selecting equipment, regulatory considerations, cost and incentives is available in the following sections.

References

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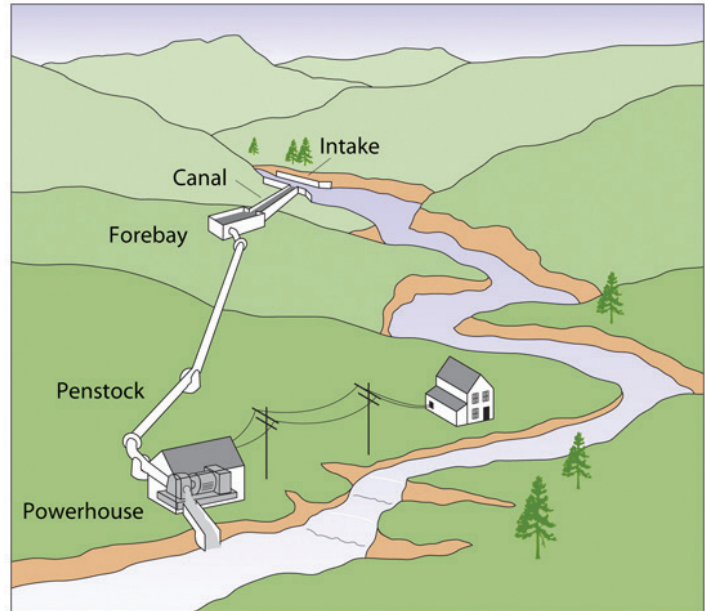


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A typical hydroelectric system.

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