What Is Micro-Hydropower?

Flowing and falling water have potential energy. Hydropower comes from converting energy in flowing water by means of a water wheel or through a turbine into useful mechanical power. This power is converted into electricity using an electric generator. Most people in North America understand hydropower as involving big dams and large-scale generating facilities. Micro and small-scale hydropower systems are receiving a great deal of interest as a promising, renewable source of electrical power.

Hydropower technology has been with us for more than a century. Many early mills, mines and towns in Canada built some form of power generation from small hydropower systems in the late 19th and early 20th centuries.

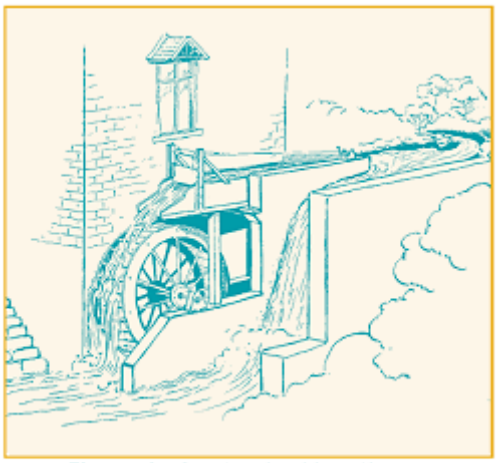

Figure 1. *A waterwheel in action*

Hydropower systems are classified as large, medium, small, mini and micro according to their installed power generation capacity. Electrical power is measured in watts (W), kilowatts (kW) or megawatts (MW). A micro-hydropower system is generally classified as having a generating capacity of less than 100 kW. Systems that have an installation capacity of between 100 kW and 1000 kW (1.0 MW) are referred to as mini-hydro. Small hydro is defined as having a capacity of more than 1.0 MW (1000 kW) and up to 10 MW (10,000 kW) although in Canada small-hydro can be defined by provincial and territorial utilities as having a capacity of less than 30 MW or 50 MW.

Micro-hydro systems have the following components:

- a water turbine that converts the energy of flowing or falling water into mechanical energy that drives a generator, which generates electrical power - this is the heart of a micro and small-scale hydropower system
- a control mechanism to provide stable electrical power (60 Hz)
- electrical powerlines to deliver the power to its destination

Depending on the site, the following may be needed to develop a micro or small-scale hydropower system (see Figure 2):

- an intake to divert a portion of the stream flow from the water course
- a penstock pipeline to carry the water to the powerhouse
- a powerhouse, in which the turbine and generator convert the power of the water into electricity
- a tailrace through which the water is returned back to the river or creek

Many micro and small-scale hydropower systems operate as "run of river" plants, which means that neither a dam or water storage reservoir is built nor is land flooded. Only a portion of the available stream flow at a given time is used to generate power, and this has little environmental impact. The amount of renewable power and energy that can be generated depends on the amount of water flowing per second (the flow rate) and the height from which the water falls (the head).

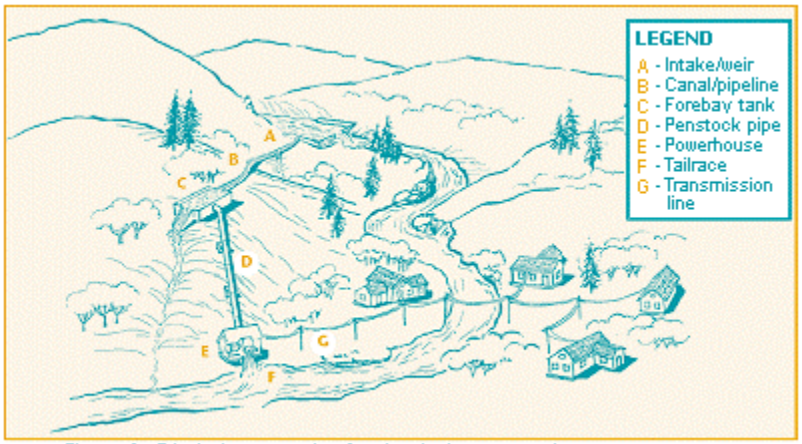

Figure 2. *Principal components of a micro-hydropower system*

Why Micro-Hydropower?

Canada has thousands of rivers and creek that could be used to generate renewable electricity to meet our energy requirements.

Micro and small-scale hydropower systems offer a stable, inflation-proof, economical and renewable source of electricity that uses proven and available technologies. These technologies can produce electricity at competitive rates, and appropriately designed and implemented systems can provide inexpensive energy for many years.

Micro and small-scale hydropower installations have, historically, been cheap to run but expensive to build. This is now changing, with smaller, lighter and more efficient higher-speed turbine equipment, the lower cost electronic speed and load-control systems, and inexpensive plastic penstock pipes. Capital investment in micro and small–scale hydropower is high but their long life, low operating costs make such systems an attractive longer-term investment.

It has been demonstrated that micro and small-scale hydropower plants can produce many times more power and energy than other sources for the same capital investment. Micro and small-scale hydropower system are non-depleting and non-polluting energy sources that have provided reliable power in the past and is the premier renewable energy sources for the future.

Figure 3. *A typical micro-hydropower weir in Cherry Creek, British Columbia*

How to Identify a Potential Site

The best geographical areas for micro-hydropower systems are those where there are steep rivers or creeks flowing year-round, such as in hilly areas with high year-round rainfall. There is micro and small-scale hydropower potential in almost all of Canada's provinces and territories, although most potential is in British Columbia, Newfoundland and Labrador, Ontario and Quebec.

To assess the suitability of a site for a micro or small-scale hydropower system, a pre-feasibility study should be made. This involves surveying the site to determine the water-flow rate and the head through which the water can fall. A knowledgeable micro and small-scale hydropower consultant can assess the renewable energy potential of any creek or river.

Is Micro-Hydropower for You?

Many factors will determine the viability of a micro or small-scale hydropower system:

- local, provincial/territorial and federal legal restrictions on the development of the hydroelectric site and the use of the water
- the amount of power and energy available from the river or creek and its ability to meet energy and power requirements
- the cost of developing the site and operating the system

If planned and designed properly, a micro or small-scale hydropower system has many advantages over most conventional means of electricity generation. Some of the most important advantages are as follows:

- Hydropower systems are inflation-proof because the cost of using the water (the fuel supply) in the river or creek is not likely to increase.
- Hydropower systems can last 30 plus years.
- Smaller projects such as micro-hydro systems can be built relatively quickly.
- As a renewable resource, micro and small-scale hydropower systems promote self-sufficiency because its development occurs on a much smaller scale, and most adverse environmental and social effects of large energy development projects are eliminated.
- Under favourable circumstances, micro and small-scale hydropower is a cost-effective form of renewable energy.

Each micro-hydropower system's cost, approvals, layout and other factors are site-specific and unique in each case.

Figure 4. *A small stream suitable for a micro-hydropower system*