Canton Hydropower Project

The Town of Canton has undertaken the first step in the potential re-development of the Upper and Lower Collins Company Hydroelectric Facilities on the Farmington River in Collinsville and downstream in Avon and Burlington. The project as currently envisioned will be a co-operative effort of Avon, Burlington, and Canton with Canton being the lead community.

To that end, a Preliminary Permit application was filed with the Federal Energy Regulatory Commission (FERC) based upon the surrendered permit of Summit Hydropower. The Preliminary Permit was issued to the Town of Canton by FERC in August 2008 and provides for an exclusive right for a period of three (3) years to determine if the project is the feasible.

The Upper and Lower Collins Company Dams and associated lands are owned by the State of Connecticut and administered by the Department of Environmental Protection (DEP). A short term lease agreement will need to be worked out with the DEP to allow for the initial engineering, structural, mechanical, electrical, geotechnical, fisheries, recreation, cultural, and historical studies. If the project proves feasible and practicable to construct and operate, a long term lease agreement will need to be entered into with the State. Initial consultation with the DEP staff indicates a favorable disposition to allow the Town and its partners to enter into a lease agreement with the State.

There is no currently no useable mechanical or electrical equipment in either of the power houses. While the water turbines were abandoned in-place, the drive shafts were burned off and the electrical generation equipment removed from the power houses.

The civil works of both facilities consisting of the dams, power canals, and foundations are re-usable after refurbishment. The Upper Dam power house and the Lower Dam gate house appear to be re-usable after refurbishment. The Lower Dam brick power house may be a complete loss due to water damage to the brick superstructure.

An analysis of the long term water flow in the Farmington River indicates that it will support a maximum of a one (1) megawatt electrical power plant at each power house consisting of two (2) generator units at each location. However, this power plant size will require permitting by FERC. It is noted that the Summit Power Permit was approved for a 373 kilowatt unit in the Upper power house and a 920 kilowatt unit in the Lower power house.

Preliminary estimates of cost to re-start power production at the Upper and Lower Collins Company Dams is in the $8 to 10 million dollar range depending upon regulatory requirements, extent the civil works need to be modified, fishery requirements, and the actual size of the generators selected for the project.

The completed project, depending upon the installed capacity, will on an average annual basis produce enough electricity to satisfy the demand of 1,200 to 1,600 homes.

Hydropower

Hydropower is a form of solar energy created by the heating of the earth's atmosphere, water, and land by solar radiation that produces the water cycle. For all practical purposes, hydropower is an everlasting, renewable form of energy.

Hydropower is the conversion of potential energy to kinetic energy of a mass of water by falling a vertical distance to produce work in the form of a rotating drive shaft.

Hydropower is a diffuse form of solar energy and it takes many square miles of the earth's surface to develop the water runoff to create practical year round power.

While waterpower has been utilized since ancient times, hydropower as we recognize it today, first developed in the Middle Ages in Europe. This resulted in the phasing out of animal, wind, and human powered machines in favor of hydropower were it was available. The harnessing of the power of the water turbine driven rotating drive shift lead to practical high speed lathes, grinders, drop hammers, weaving looms, spinning jennys, and other machinery that laid the foundation for the Industrial Revolution of the 1700s.

Unlike the United Kingdom at the beginning of the Industrial Revolution, France did not have access to large coal deposits and had to rely on its water resources to generate the energy needed for industrial expansion. Much of the engineering and theoretical work of water turbine design was undertaken in France during the later half of the 1800s. Waterpower is still called "houille blanche" or white coal in France.

It is fairly straightforward to determine the potential hydropower of a brook or river based upon the power equation.

Power Equation:

$P = (Q)(h)(e)/11.8$ in US traditional units

P = Instantaneous power in kilowatts (kW)

Q = design flow through the water turbine in cubic feet per second (cfs)

h = net head in feet (typically 90% of gross head)

e = combined efficiency of turbine and generating equipment (range of 0.7 to 0.9)

11.8 = constant derived form the density of water

It is far more difficult to predict daily, monthly, or annual power production from a brook or river. To do this it requires that the rate of flow and duration of flow be determined for a reasonable long period of time. In Connecticut, the US Geological Survey has measured stream flows for reasonable long periods of time. For example the Farmington River between Unionville and Canton has had flow metering in-place since 1962.

Once this information is collected over a period of years, a flow duration curve may be plotted for individual months or on an annual basis. Flow rates may than be plotted against the % the flow rate is equaled or exceeded.

The final step is to determine the annual energy production estimate based upon the flow duration curve. An estimate is made of the generator size using the power equation and using the energy equation an estimate is made of annual energy output. The two equations are solved several times to balance the size of the generator against the available flows to power it for the maximum energy output. While this can done by hand computation for simple situations, computer programs are available to balance the various variables.

Power Equation:

E = (P)(CF)(8760) = Estimated Annual Energy Output

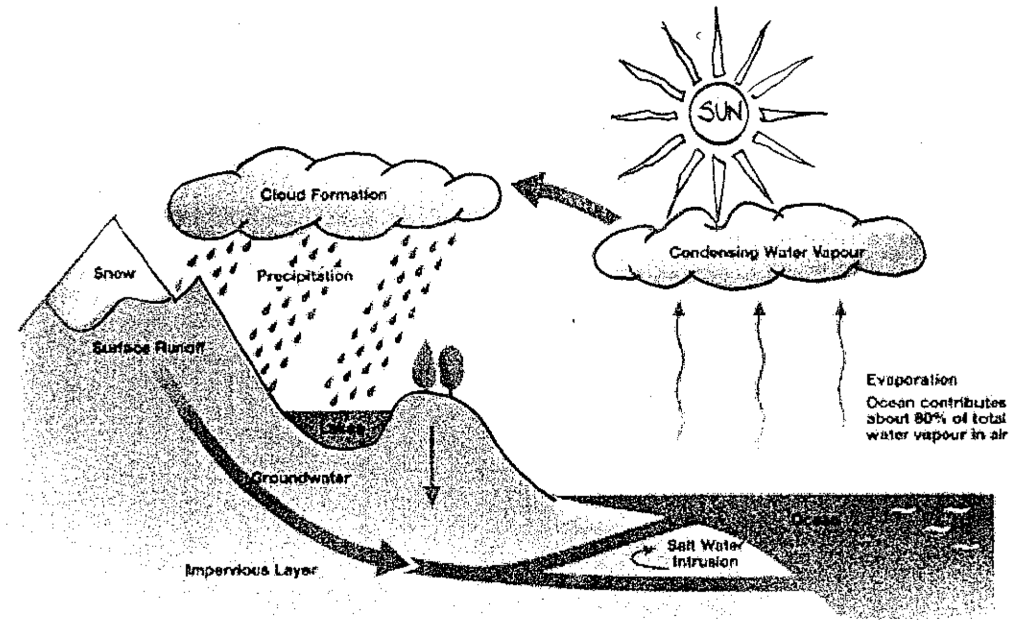
E = kW/year

CF = capacity factor = E/Installed capacity (kW) x 8760 hours/year

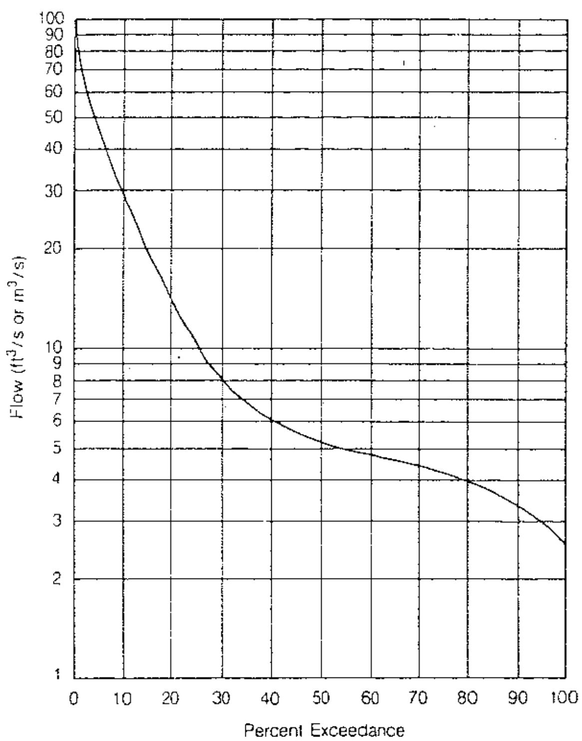
Small low head hydropower facilities became uneconomical for a number of reasons by the late 1950s and early 1960s. The low cost of energy from fossil and nuclear fuels, the high initial construction costs, seasonal variation in water flow, maintenance of aging facilities, loss of the State's manufacturing base to other lower cost locations, long return on investment, and the site specific nature of the resource all contributed to the discontinuance or abandonment of small facilities.

Several times since the early 1970s, interest has peaked in re-starting abandoned or mothballed small hydropower facilities when energy costs have surged for a variety of reasons. Unfortunately, the regulatory climate is such that long delays in permitting have been common and the low return on investment has all but halted development of potential sites for small hydropower facilities.

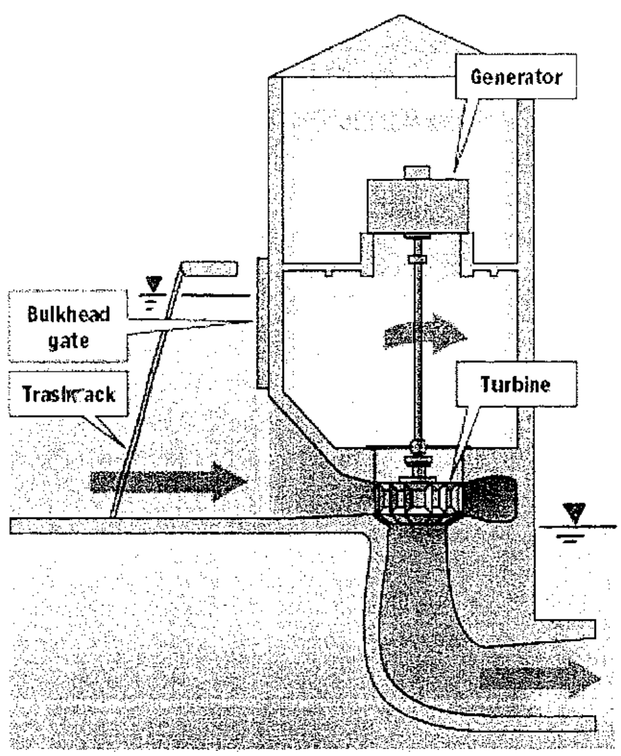
The current interest in providing a non-fossil fuel energy future may be the turning point when small hydropower projects may be constructed to once again provide a renewable energy source with limited environmental impacts.



Water Cycle



Typical Flow Duration Curve



Hydroelectric Generator