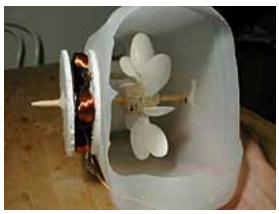

DSEN Factsheet 2: Micro Hydro – Sowton Mill

INTRODUCTION

Hydropower exploits the completely natural process of the 'hydrological cycle'. Unlike most of the other renewables, hydropower is a major contributor of world energy, in the form of large hydro electric dams. There are many large hydro dam structures in the world; in the UK much of the large hydro is concentrated in Scotland (The Galloway Hydroelectric scheme on the river Dee). In larger rivers (Tamar) run of river systems can be installed, this is covered in a separate case study.

Here we are concerned with the small scale, 'micro hydro' resources. Hydro-power systems convert potential energy stored in water held at height to kinetic energy (or the energy used in movement) to turn a turbine to produce electricity. A micro hydro plant is below 100kW. Improvements in small turbine and generator technology mean that micro hydro schemes are an attractive means of producing electricity. Useful power may be produced from even a small stream. The likely range is from a few hundred watts (possibly for use with batteries) for domestic schemes, to a minimum 25kW for commercial schemes.

Energy from the sun warms the oceans where water evaporates to form clouds which the wind then blows over land. The water vapour falls as rain on high ground, some of the rain is absorbed by plants to either become plant material or be transpired as water vapour again. Some rain soaks into the ground to issue as 'springs' elsewhere and some runs off to form streams and rivers which flow back to the sea. The whole process is powered by the sun and is infinitely repeated. Flowing water has energy in it by virtue of its mass and the fact that gravity accelerates the water as it flows downhill. The power contained in flowing water can be expressed by;

Power = Mass x **Height through which it falls** x **Gravity** x **Efficiency**

To get the power output in kilowatts (kW), mass is measured in (Q)cubic meters per second (m^3/s), height (H) is measured in meters (m), gravity is a numerical constant (9.8 m/s^2), efficiency is a numerical constant for a particular turbine and generator set.

SOWTON MILL

Sowton Mill is an historic mill on the River Teign. The mill stopped operating as a corn mill many years ago, but retained the leat and tailrace which used to carry the water to and from a water wheel. In the early 1980's the owner decided to build a micro hydropower system to generate enough electricity for the three nearby dwellings and sell the surplus to the national grid.

HOW IT WORKS

The water is diverted away from the natural river course by a weir about 500 metres upstream. The leat carries the water from the weir to the turbine inlet screen (just beyond the bridge in the picture). The screen filters out debris that would otherwise cause damage to the turbine, and prevents the ingress of fish.

From the screen a 1 metre diameter concrete pipe takes the water into the purpose built turbine house. This is about the size of a small garage and is screened by plants in a corner of the garden. Water passes through the turbine and down into the original mill tailrace from where it returns to the river.

A controller monitors the water level and regulates the turbine power output so that minimum water levels are maintained. In the event of a power cut the turbine disconnects, and reconnects automatically when grid power is restored. Sowton Mill stands on the Teign River in Devon and has been using hydro power for over 400 years, initially to mill corn and from the 1950's to generate electricity. In the eighties, the Ossberger crossflow turbine was installed a few yards further down river, enabling an improved head of 4 meters that increased output fivefold. The water flow is now controlled automatically but in the early days, the owner's were out in all weathers to man the sluice gates.

MAINTENANCE

The owner is very happy with the system. It has been running now for 16 years with hardly any problems, just an occasional bearing to replace or branch to remove which has floated down the leat.

TECHNICAL DETAILS

Turbine type	**Ossberger crossflow, rated flow rate 850 l s^{-1}**
Speed increaser	**Flat belt and pulley system**
Generator type	**Three-phase asynchronous, exited by the grid**
Site hydraulic head	**4 metres.**
Maximum power output	**28kW**
Annual energy capture	**132,000kWh.**

GENERAL COST PROFILE

The cost of a small scale hydropower development will be very site specific and will depend on factors such as the hydraulic head, amount of civil works required, ease of grid connection etc. However, as a general guide the installed cost of a small scale hydropower development will be between £1,000 - £3,000 per installed kW.

Example:

A 10kW site may cost between £10,000 and £30,000 to install. The annual electricity generated would be of the order of 50,000kWh. At a sale price of 6p/kWh this would equate to an income of about £3,000 per year, with a small maintenance budget for periodic part replacement.

VISITING SOWTON MILL

Sonia Newton manages the business side of the hydro generation and the 5 acres of gardens and orchards surrounding the mill that contain a great variety of flora. The gardens can be visited throughout the year and the mill itself is let for holidays. If you are interested in visiting the hydro scheme, the gardens or staying at the mill, call 01647 252263.

FUTURE DEVELOPMENTS

In recent years, interest in the development of small-scale hydropower schemes has increased, largely in response to Government initiatives encouraging the greater use of renewable energy sources (the term "small-scale" applies to developments of less than 5 Megawatts generating capacity). Understandably, developers are eager to take best advantage of the opportunities offered by Government policy. This has resulted in increasing pressures upon the Environment Agency and planning authorities, together the main regulators for hydropower proposals, to grant the necessary permissions, consents, and licences.

FURTHER INFORMATION

To find out more about micro hydro visit the Regen South West website at:
http://www.regensw.co.uk/technology/hydroelectricity-faq.asp

Grants are available to domestic householders and communities to carry out renewable energy projects such as micro hydro through the DTi's Low Carbon Buildings Programme. Find out more about this at:
http://www.est.org.uk/housingbuildings/funding/lowcarbonbuildings/ or telephone 0800 915 7722.

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