Micro hydro

What is it?


Durweston Mill

Hydro power taps the energy from falling water and has a greater density than other forms of renewable energy. Converting the pressure or kinetic energy of water into electricity through a hydro power turbine is a proven technology that has been practiced worldwide for hundreds of years. During the 1950's when the national grid was established, many small scale hydro plants started to fall into disrepair. However, many of these old weirs and mills are now being renovated as a result of the developing market for renewable electricity.

Micro hydro schemes can be defined as plant of less than 100 kilowatts (kW) and tend to be developed as "run-of river". This means that they don't use reservoirs to store water, but rather just take the flow that is available in the river at any given time. The energy contained in a particular stretch of river depends on the vertical height that the water falls (known as the head) and its flow rate. Low head and high head schemes are possible but require different turbine types. As a general rule, schemes with larger heads require smaller turbines.


Durweston Weir (Keith Wheaton-Green)

Components of the scheme will include an intake and channel which diverts the water from the river into a pipe (known as a penstock) which transfers the water to the powerhouse accommodating the turbine and generator and an outflow which returns the water to the river. There are various layout options depending on the site and its particular head and flow rate (see the British Hydropower Association website).

Micro hydro technology is particularly valid for sites with old water mills as this will help reduce infrastructure costs. Alternatively, hilly areas with spring fed streams or rivers with as little as a 1m head may also be suitable. A rough estimate of the flow rate at a site can be obtained by consulting the National River Flow Archive held by the Centre for Ecology and Hydrology (see more information).

Can I produce all my electricity with this technology?

Yes, if a site has a reasonable head (above 1.5 m) and reliable flow (upwards of 100 litres/sec). In fact the most viable hydro sites are likely to produce much more than a residential house needs. You can either export directly to the grid which will require a convenient connection into the local distribution network or sell the power locally via a private wire. The flow of the water will vary throughout the year but a 10 kW system (for example operating on a 3 m head at 500 l/s) might be able to achieve its full potential for 40-50% of the year. The lower estimate (40%) would enable the production of 35,040 kilowatt hours (kWh) per year, enough electricity for 10 homes.

What does it cost?


Plant room for a 10 kW micro hydro scheme

Suitable micro hydro sites can offer the most cost effective of all renewable resources because plant life is substantially longer than other small-scale renewable technologies. Medium head schemes ranging between 4-20 metres will cost about £3,000-4,000 per kW installed while low heads below 4 m can cost up to £5,000 per kW due to the greater civil works required. Therefore a 10 kW system could cost about £40,000.

Can I get a grant?

The Low Carbon Buildings Programme offers a maximum of £1,000 per kW installed up to a maximum of £5,000 subject to an overall limit of 30% of installation costs.The 10 kW system costing £40,000 could therefore get a grant of £5,000. The installer and the product must be approved and a condition of the grant is that you must already have installed a basic level of energy efficiency measures including wall and loft insulation, adequate heating controls and low energy light bulbs. Community projects should be able to get up to 50% grants from the LCBP and also might be able to top up their grant with Green funds offered by energy utility companies and other support mechanisms.

This fact sheet was produced by the Dorset Energy Group, the body responsible for implementing the Bournemouth, Dorset and Poole Renewable Energy Strategy and Action Plan. The group involves an executive and four working groups with representatives from each of the nine local authorities in Dorset, Dorset Energy Advice Centre, Dorset Agenda 21, and a wide range of other stakeholders.
For general queries regarding this sheet contact Kevin Lindegaard at Dorset County Council on 01305 228530.

What is the economic payback?
It is currently possible to get a pooled price of 8 pence per kWh from electricity suppliers which includes the wholesale price of electricity, Renewable Obligation Certificates (ROCs) and Levy Exemption Certificates (LECs). A 10 kW system producing 35,000 kWh per annum would therefore earn an annual income of £ 2,800 and pay back the £35,000 investment in around 13 years. If all the electricity could be used on-site or sold locally, the payback would be reduced to 7-9 years on current prices.

How much maintenance is required?
Once a scheme is established it requires very little maintenance apart from routine inspections of bearings and other moving parts and an annual service. This might cost £400 - £800 per year for a 10 kW system. However, maintenance for cleaning screens that prevent the ingress of trash can sometimes be time-consuming if automatic cleaners are not installed. After 10 years or so there might be a need to replace seals and bearings and fit a new generator and refurbish sluice gates and screens.

Do I need to get a grid connection?
As with all renewable electricity technologies it is usually best to use the power you produce rather than selling it to an electricity company. However, because micro hydro installations are likely to produce more electricity than is required by a residence, any surplus should be exported to the national grid via an export meter. The property will still be billed for any electricity drawn from the grid (current price is about 12p per kWh) but may also sell the excess back at a lower price. The price varies between buyers, so it is worth shopping around. Alternatively any excess can be sold to other local users via a private wire system.

If a turbine is rated at more than 5kW, the local grid network may need to be strengthened. The cost can vary between £4000 -10,000 depending on the extent of work needed and the distance to the high voltage supply. A scheme must also obtain a "Parallel Connection Agreement" from your local Distribution Network Operator and a "Combined Supply and Purchase Agreement" from an electricity supplier.

Are there any planning issues?
Always check with your local authority and the Environment Agency before starting any development. Planning permission will require various consents and licences including an Environmental Statement and an abstraction licence. Issues that must be addressed include any affects on wildlife, noise impacts, visual appearance, any disruption caused during construction, preservation of any archaeological remains and air and water quality.
The noise produced by the turbine and generator in the powerhouse can be minimised through deploying high quality equipment together with sound insulation of the powerhouse structure. All the components of a hydro scheme have the potential to create a visual intrusion within the landscape, particularly in areas of scenic beauty. However, careful site design, installation and management of all components including surrounding vegetation can limit effects and is often sufficient to screen even the largest components from view.

Plant room of a 500 kW hydro scheme in Cumbria

Special requirements are required by rivers populated by migrating species of fish such as salmon or trout and might dictate the incorporation of a 'fish ladder' so that fish can move up and down the river and avoid the turbine.

What is the potential for this technology in Dorset?
There are many old mill sites in Dorset and as long as their original weirs and leats (or millstream) remain in good condition there is potential to install modern hydro generation equipment. The rivers Stour, Frome, Piddle, Lym, Wey and Wicken Stream in Corfe are all known to have supported water mills in the past and several mill owners have already expressed an interest in developing their properties for the utilization of hydro power.

It is a good idea to get involved with other local mill owners and set up a support group such as the Stour and Vale Hydro Group.

This group has conducted 13 feasibility studies on ex mill sites and the first five are now at a stage where detailed design work is being carried out and license regulations being dealt with. Several projects are expected to be commissioned in 2007. Similar projects are already well established in South Somerset and Mendip districts in Somerset. The headquarters of the British Hydropower Association is also based in Dorset, in Wimborne.

Lordsmead Mill (Keith Wheaton-Green)

Water wheel at Hewish Farm (David White)

The information on this leaflet was correct as of January 2007.

Pros and cons of micro hydro

Pros

- ✓ Schemes generally produce lots of electricity
- ✓ Good paybacks
- ✓ Potential for a high return on investment

Cons

- ✗ Need a fast running or high head water source on your land
- ✗ Expensive and poor grant support
- ✗ May require strengthening of the electricity network
- ✗ Onerous planning hurdles

Micro hydro installers based in the South West
It is best to check that a product and installer are approved by the Low Carbon Buildings Programme. Always get several quotes before committing to an installer.

Company	Telephone	Web address
Hydroplan UK	**01404 548896**	**www.hydroplan.co.uk**
Hydro Generation Ltd	**01398 351112**	**www.hydrogeneration.co.uk**
Pico Energy Ltd	**01884 258566**	**www.picoenergy.co.uk**

More information

British Hydro Power Association	01202 880333	www.british-hydro.org
National River Flow Archive	01305 213500	www.nwl.ac.uk/ih/nrfa/
Environment Agency	08708 506506	www.environment-agency.gov.uk
Low Carbon Buildings Programme	0800 9150990	www.lowcarbonbuildings.org.uk
Energy Saving Trust case studies	0845 1207799	www.est.org.uk/myhome
Dorset Renewable Energy Officer	01305 228530	k.lindegaard@dorsetcc.gov.uk
Micro-hydro technical advice	01305 225279	s.taylor@dorsetcc.gov.uk
Dorset Community Renewables	/	Wheaton-Greens@tiscali.co.uk
Stour Vale Hydro Group (Chair - Stephen Burroughs)	01747 860944	/
Dorset Energy Advice Centre	0800 512012	www.deac.co.uk
Dorset Agenda 21	01305 213721	www.dorsetagenda21.org.uk