

# Micro-hydro Power Basics

## Key Points

- Produces no pollution in operation
- Uses the energy in falling water
- Water is returned to the river afterwards
- Installations can have a very long lifetime

## How does it work?

Hydro power works by using falling water to drive a turbine, which generates electricity. The amount of energy produced by a hydro power scheme depends on how far the water is falling and the flow rate (i.e. how much water is flowing past each second).

Micro hydro power systems usually have a water intake above a weir or dam. Some of the water flowing along a river is re-directed into the intake which screens for debris and fish to prevent them entering the turbine. From the intake water leads into a channel or pipe (called the penstock) where it falls down through one or more turbines. The water passing through the turbines, generates electricity and is returned to the river afterwards (see diagram to the right).

## How much energy can it generate?

Hydro projects are generally categorised in terms of energy production as follows: -

- Large hydro - Over 5MW (5000 kW)
- Small hydro - Under 5MW
- Micro hydro - Under 100kW

The amount of energy that can be generated from a hydro site is determined by two factors:

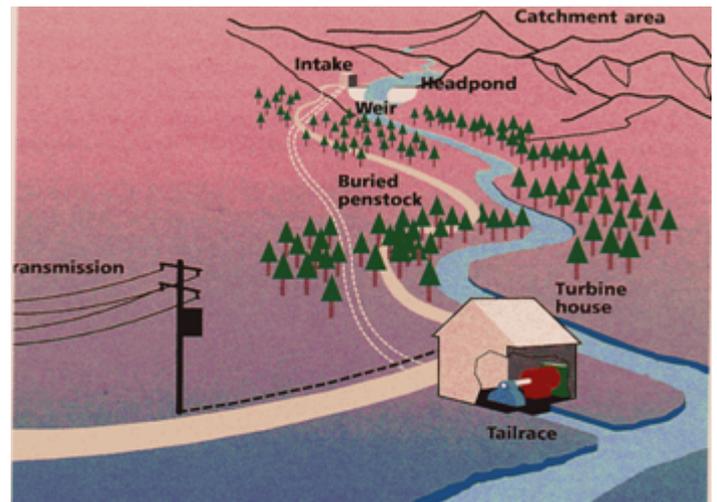
- The flow rate of the water
- The distance the water falls (called the head).

If correctly sited hydro power provides a fairly steady reliable renewable energy source as its output is only effected by seasonal changes in the river's flow rate. Seasonal variation is an important factor, it would not usually be economic to have a hydro system offline in the summer months due to a lack of water.

## Why is it important?

Small scale hydro power can provide clean, safe energy. Hydro power produces no pollution in operation and does not produce carbon dioxide so it does not contribute to climate change.

Large hydro-electric dams can provide very large quantities of energy but generally have serious environmental consequences such as flooding large areas of land and displacing populations. Micro hydro (less than 100 kW) power systems are seen as a cleaner and safer alternative.



*A layout for a 'run of the river hydro system', the intake can be quite close to the turbine if the head is significant (i.e. a sudden drop like a waterfall), or larger distances as depicted!*

## What does it look like?

The turbine and the majority of the machinery for small hydro power systems can be hidden in a small building by the side of the river. This may be designed in a traditional style to blend in with the surroundings.



Similarly pipes can be buried, reducing any visual impact that they might have .

*Turbine and generating equipment can be housed in a small building*

# Micro hydro power—Basics

## How much will it cost?

It is difficult to generalise the cost of hydro systems as every site is different, whilst generating and turbine equipment may be similar, the lengths of pipes and civil works can be quite different.

The initial capital cost of a scheme is quite high (normally in the region of £3000-£5000 per kW capacity for the smaller systems).

However once the plant is in place, it should generate free electricity (apart from maintenance costs) for decades. Only the turbine itself would need to be replaced, every 15-50 years. In general, higher output hydro sites tend to have a lower cost per kW capacity.

## Environmental effects

As mentioned previously hydro schemes produce electricity without releasing carbon dioxide, which contributes to climate change, they also should not release any other pollutants into the local environment.

Whilst larger hydro systems involve substantial construction work micro hydro power schemes do not involve this level of construction, some construction work is required to install the pipes to and from the turbine. As noted earlier, careful design can conceal the hydropower plant and pipes.

The environmental impacts associated with construction and possible alterations to the river environment should be minimal for a micro hydro power project if the scheme is well designed. Nevertheless, sites should still be chosen carefully.

Water used to run the turbine is returned to the river and is aerated by passing through the turbine. This means that the turbine can actually improve water quality in the watercourse. Fish screens are fitted to the water inlet for the hydro power turbine to prevent them entering the turbine and avoid injury to aquatic life.

## Where should it be sited?

As noted earlier the key criteria determining the output of a hydro project are a high flow rate and a large drop in water level (or "head" as it is known). However hydro power can also be produced at "low-head sites" where the drop is less than 3 metres.

Environmental criteria are also very important in deciding whether a site is suitable for hydro power.

The following permissions are usually needed to run a hydro power project:

- Planning permission from the local authority
- A water abstraction license from the Environment Agency
- A "Works in Rivers" consent

One way to identify sites for small hydro power projects is to look for old water mill sites (or place names including the word "mill"). Usually the highest cost in Hydro power development is the building work needed to house the turbine appropriately and redirect water from the river through the turbine, old mill sites may have some of the building work in place already.

Although it is possible to use existing waterwheels to generate electricity it can be expensive and inefficient due to gearing required to get from the low revolutions per minute (rpm) of the waterwheel to the much higher rpm required by the electricity generator.

Where a hydro power site is to be connected to the national grid, distance from a possible grid connection point also needs to be considered.



*A potential low head site, where existing structures could be utilised.*

## Further Information

- British Hydropower Association  
[www.british-hydro.org](http://www.british-hydro.org)  
Tel: 01202 886622
- Centre for Alternative Technology  
[www.cat.org.uk](http://www.cat.org.uk)  
Tel: 01654 705981
- National Energy Foundation  
[www.greenenergy.org.uk](http://www.greenenergy.org.uk)  
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## References

- (1) Hydro power scheme layout - DTI renewables.