Micro-hydro in Nepal

Nepal is a small country in the Himalayan mountains between India and Tibet.

In Nepal, approximately 10% of the population has access to electricity from the national grid.

Over the past few years, many villages in the mountainous areas that do not have access to the national grid have installed micro-hydro units.

Pause for thought: How and where is electricity produced in the UK? How is it channelled?

How does Micro-hydro work in Nepal?

The hydro schemes use water from the fast-flowing rivers that thunder down the Himalayan mountains. The water is diverted from the stream or river to drive a water turbine. Often the turbine drive belt is hooked to the drive shaft of a food processing appliance, eg. to mechanically turn the grindstones to mill grain.

The most common use of micro-hydro schemes is for agricultural processes, such as milling grain or de-hulling rice (as in the picture on the right).

Increasingly, there are some micro-hydro schemes which have been designed to produce electricity. In this scheme the water turbine drive belt is connected to a small generator or alternator to produce electricity.

Electrical control

Micro-hydro scheme engineers go through a complicated process to calculate the variation in demand for mechanical and electrical power required from the village throughout the day and night.

Pause for thought: At which times of the day do you think the demand for power is high?

The amount of water available to produce the power is calculated, and a scheme is designed with supply and demand factors in mind.

Because there is no national grid, when the village doesn't use all the power produced by the scheme, there is nowhere for the excess power to go. There are two main ways of avoiding the risk of overloading the system:

- **Restricting the amount of water flowing into the turbine** so the amount of power produced can be reduced. Hydro-electric stations in the UK have complex systems of this type of control. However, they are very expensive and prone to breakdown.

- **Using an Electronic Load Controller (ELC)** An ELC is a box of micro-circuitry, manufactured in Nepal, which can sense how much power is being used in the village at any moment. If there is more power being generated that is needed by the village, the excess power is sent to a "ballast load". This is usually a heavy duty resistive load such as a water heater which acts as a sponge to soak up any extra power, preventing it from overloading the village system. A simpler controller called an Induction Generator Controller (IGC) is also being produced in Nepal which enables electricity to be generated from an electric motor run backwards.

Ghandruk

The village of Ghandruk lies in the Annapurna region of Nepal. It is one of many villages in the region that is generating electricity from the Modi Khola river. The stream is no more than a metre wide in the dry season, but generates enough power for electric lighting for every house in the village and for 20% of the village to cook with electricity.

An appropriate technology?

Micro-hydro schemes ...

- are cheap to run and maintain once they have been set up
- save thousands of women from the drudgery of milling grain by hand
- generate electric light, which improves the quality of life for people
- enable electric cookers to be used, which save trees and time previously spent collecting fuel wood
- allows communities to manage their own power supplies

Find out where micro-hydro is used in the UK to generate electricity.
Do you think micro-hydro is appropriate for the UK?

TASK International work on small-scale electricity generation, including micro-hydro, has increased the need for electronic products in developing countries. Small-scale generation and its associated control gear/appliances are still very experimental. Design and make a product for this exciting area of electronics.

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