

Harnessing the Great British weather



Environmental issues are becoming more and more important as time ticks on; not least the fact that supplies of fossil fuels, which supply most of the energy to our homes, are running out. So the quest to make renewable energy more popular is vital.

There are three main sources of renewable energy - wind, water and sun. The obvious advantage of all three is that no fuel is needed. This means there's no fear of air pollution, acid rain, greenhouse gases or other wastes associated with burning coal, oil or gas. Nuclear energy poses its own problems of safety.

However, one of the main disadvantages is variable power. It's not always sunny in England and, believe it or not, it's not always windy.

Some people argue that alternative energy harms the environment. After all, if you mess with the tidal patterns of an ocean then you're messing with Mother Nature.

Blowing a gale

Wind power isn't new. For centuries it's been used to turn machinery, grind grain and power the sails of ships.

Nowadays advanced wind turbines, called aerogenerators, are used to capture the wind and generate electricity. They come in all sizes and often have a much greater power output than the old style windmill. However, the power output varies because wind speed varies.

Also, they must withstand the other forces of nature. An efficient wind turbine should keep turning when there are changes in temperature, when it rains and when the direction of the wind changes. These factors are all part of the design considerations.

Let's look at wind direction. For a wind turbine to be most effective it needs to be facing into the wind. The wind should blow directly onto the propeller

blades. So some sort of mechanism that moves the turbine so it faces the wind would be great.

The type of propeller used is important. Should there be one, two, three or four blades? Or should there be even more? And what shape should the blades be?

The whole purpose of a wind turbine is to produce energy. So it seems obvious that when designing a wind turbine you test to make sure it produces enough. It would be pointless spending thousands of pounds on a huge turbine that could only power a light bulb, but should be able to produce lots of energy. If you only want to power a single light bulb, then you only need a little turbine. In other words, there should be some relationship between the size of the turbine and its energy output.



Catching a few rays

You've probably seen a solar panel. Many calculators are powered by them. They convert solar energy - energy from the sun - into electricity.

Solar panels are usually made from a number of solar cells. They have to be resistant to various forms of corrosion. A small cell on a calculator should be pretty tough; it's likely to be thrown around in someone's school bag. If it's hard enough it won't scratch and its performance won't be affected.

If solar cells are to work outdoors they need to be resistant to wind and rain. The actual solar cells have to be made from particular materials; usually thin layers of a semiconductor called silicon. If they were scratched it might effect the performance, so they're often covered with glass for protection. Glass is very hard, which means it has a high scratch resistance.

There are other types of solar panels, too. They convert energy from the sun into heat energy. Some have water trickling through that's heated directly by the sun. You might spot these sorts of panels on south-facing roofs of buildings.

Storing energy

Using power from the wind and the sun is dependent on weather conditions. And we all know that Britain's weather is somewhat unreliable. On a clear summer day, Britain receives almost as much energy from the sun as Africa. But how many clear sunny days do we have each year? Not many!

So energy has to be stored somewhere. The most common way is to use a battery store. The electrical energy is stored in a number of batteries set up in parallel - it's the same principle as when you plug your mobile phone into the mains to recharge it.

Often the system has a charge regulator as well. It protects the batteries from overcharging by 'dumping' excess energy, usually as heat. Overcharging batteries shortens their life span.

Another way to try to combat the irregular British weather is to make a system that uses both wind turbines and solar panels to harness energy.

The tide turns

Two-thirds of the Earth's surface is covered with constantly moving water. That's a lot of energy waiting to be harnessed.

There are three major ways of using energy from this water. Probably the most common is a hydroelectric dam. Basically, dams are built to create large reservoirs. A channel is then built for the water to flow down into another lake, turning a turbine in a generator as it goes - the power from the water is converted into electricity.

Another form of water-power is the tide. As we all know, tides rise and fall every day. So large barrages can be built to trap the tide as it rises. Then, when it's time for the tide to go out again, it's released into the sea through turbines. This generates electricity. The largest tidal power station in the world is at La Rance in France - it's 750 metres long and can generate 240 megawatts of power.

Finally, there's the power of the waves. Waves have both kinetic energy (because they're moving) and potential energy (because of their height).

There are many design considerations when making water turbines, dams and barrages. Obviously the materials need to be made waterproof, perhaps with particular finishes. They're also subject to corrosion - especially if the water is salt water, which makes metals rust very quickly.

And dams have to be strong - a lake full of water weighs a lot!



Did you know?

In less than one hour as much solar energy arrives on the planet as the entire world population uses in one year!

And in only three weeks the Earth will receive an amount of solar energy equivalent to the entire, as yet untapped, fossil fuel reserve.

Sainsbury's keep it green



More and more large companies are switching to alternative energy.

This Sainsbury's supermarket in Greenwich, London, uses both solar panels and wind turbines to power the store.