Earth's physical resources: renewable energy.
Wave and tidal energy

Narrator:
The waves that batter Britain's shoreline contain a huge amount of energy in metre of wave front.

David Langston:
Three quarters of the earth is covered in water, and, the oceans actually represent, a large reservoir of stored wind energy, and that's, that's effectively what the wave energy is, and it's a very very concentrated form of energy.

Narrator:
Harnessing that energy could provide all of our electricity needs. But converting the kinetic energy of waves into electrical power is a major engineering challenge.

A Scottish company, Wavegen, has developed a shore-line device called the Limpet, which has been installed on the island of Islay.

David Langston:
It's an oscillating water column, with a wells turbine power take off. Now an oscillating water column uses the wave motion to make water inside a tube oscillate up and down, the air above the water is compressed and decompressed, and it goes out and back in through a turbine.

We commissioned the Limpet plant in November 2000, it provides power into the grid, it's a 500 Kilowatt device.

Narrator:
It will play a crucial part in helping the island community move towards self-sufficiency in energy.

But Wavegen have plans for bigger and better devices -which are at the model testing stage.

David Langston:
At the early stage of development we build numerical models, and we build physical models which we test in our wave tank, so we validate the numerical models, against the physical models in the wave tank, and of course we we, now that we have er a full scale device, we we re able to validate both our numerical models, and our wave tank models.

From the point of view of larger developments, you're looking at offshore floating devices, and that's, that's a lot of our effort is going in to developing floating devices at the moment.

Narrator:
Another Scottish company, Ocean Power Delivery, are actively developing a different way of harnessing wave energy.

It's the Pelamis, or Sea-snake.

Max Carcas:
The way our system works, is erm by means of hydraulics, a hydraulic power take off-system. The reason we've chosen that is, because waves are characterised by er high forces, and relatively low velocities.

Narrator:
They've already completed several series of wave-tank tests using a range of scale models.

Max Carcas:
All wave energy converters work through er the principle of of erm, of being very closely coupled to the hydrostatic forces, that is the the sort of buoyancy versus weight, but what you have to be almost invisible to is the hydrodynamic forces, the things like inertia, drag and slam loads, and that's really the reason our machine looks the way it does, this this sort of long thin pointed structure into the waves erm, to give it er good survivability characteristics, which is one of the most important things for a wave energy machine.

Narrator:
In use, they will have to withstand the force of Atlantic waves peaking at several megawatts of energy per metre. This one-seventh scale model has already been tested at sea. Future offshore wave farms might have some advantages over offshore wind farms.

Max Carcas:
A wind farm consists of a number of wind turbines, a wave farm would consist of a number of wave energy machines, and, for example, a a typical, if that's the right word, twenty five megawatt installation, would consist of of 40 machines, that would occupy about a square kilometre of ocean, and that 4, about 4 times less area than an equivalent wind farm….

Narrator:
The moon's gravitational pull on the ocean creates the tides; another huge source of renewable energy.

This power station on the Rance estuary in Brittany is one of only a few in the world to exploit tidal power.

The ebb and flow of the water drives water turbines to generate as much as 240 megawatts.

In the UK, tidal power could supply up to 20% of current electricity needs.

The long proposed barrage across the Severn estuary could provide 6%, but the very high capital cost means that it’s likely to remain on the drawing board.

So smaller and less costly approaches to harnessing tidal currents are being explored. One solution involves the use of turbines which can be located between the surface and the sea floor.

It's the flow of the tide that's turning the blades of this turbine.

Peter Fraenkel:
The simplest way of describing them is, is as an under water windmill. We've basically got a rotor, which er is submerged in the sea, and as the water flows past, driven by gravity which causes the tides, the rotor turns and drives the generator in much the same way that a windmill rotor turns as the atmosphere flows past it

A current of erm, about four knots or two metres per second, 8 kilowatts per square metre.

Narrator:
The developers are now working on a larger scale prototype that will be fixed to the sea bed off the south coast of England.

Peter Fraenkel:
It's a bit like a very large diameter lamp post stuck in a hole in the sea bed erm, and that of course is isn't going to go anywhere, it can be designed to stay put, er it removes at a stroke all the problems of anchors and cables and all the other things, and it's allowing us to install a

system, which will be rated at a maximum power of three hundred kilowatts, with an eleven metre rotor.

Narrator:
Another approach , called the Stingray, uses an oscillating hydrofoil to capture the energy of ocean currents.

A prototype was tested in Scotland in 2002.

Roger Higman:
Britain's not only got a vast resource in terms of wind, it's also got the best wave power resource in in Europe. Wave power's slightly taking longer to develop than wind power, and I think we're now at exactly the right stage for the Government to press ahead with that, in order to create er, an economic lead for Britain, in job creation from that industry.

John Doddrell:
The UK currently has the lead in those, they're, they're infant developing industries, but we have a technical lead. We want to make the most of that, not to lose it.