BIZCOMMUNITY

How floating turbines could harness the awesome power of the tides

By Ross Jennings

1 Sep 2015

The world's tides contain enough energy to power the entire UK's electricity consumption. And, since it effectively harnesses the moon's constant and predictable gravitational pull, tidal power overcomes one of renewable energy's classic problems - the fact you never know quite how much sun, wind or rain to expect. Now, underwater windmills positioned just below the ocean surface could be a major breakthrough for tidal power.

Costly technology and inaccessible locations have thus far held things back. Large, heavy and expensive turbines mounted on the seabed have been developed, but these are aimed at commercial scale developments. Tidal power needs its equivalent of the rooftop solar panel.

Imagine then a wind turbine, but underwater, and not fixed to the seabed - these so-called "mobile floating turbines" are a cheaper and more adaptable alternative to big, fixed developments. Most floating turbines look something like this:

This 'Evopod' partly floats on the surface, but some other designs are entirely submerged.Ocean Flow Energy Ltd, CC BY

They're placed whereever tidal flows will be strongest, and are then loosely tethered to (but not built on) the seabed. Cables take power generated by the turbines down to the seabed and along to the shore.

Why floating beats fixing

Floating turbines are able to capture energy from the fastest-flowing water, which tends to be just below surface. At the bottom, where the water bumps against the seabed, things slow down and the flow is less smooth. Turbines floating in the right place could generate significantly more energy than those stuck to the sea bed.

The UK has some of the world's best tides.NASA

Tidal currents also shift direction roughly every six hours, therefore an optimal turbine would take advantage of these two-way flows. Floating turbines can freely rotate in the changing tide, eliminating the need for costly and complex mechanical yawing systems used by bed-mounted turbines.

Floating is cheaper

Deploying large, heavy turbines on the bed requires expensive specialised vessels and docks. Even routine maintenance is costly.

Bed-mounted turbines can be big and bulky.

In contrast, floating turbines can be towed to a site and installed very quickly at a fraction of the cost. Internal machinery can be positioned above the waterline allowing instant access for routine maintenance and minimal waterproofing costs.

Since they're relatively cheap to set up and operate, floating turbines are suited for a wider market, not just utility companies. Industries close to the coast could invest in a floating turbine to reduce their electricity bill, in much the same way as they are currently doing with solar or wind technologies. You can even "plug in" multiple turbines by sharing mooring points.

While bed-mounted turbines aren't visible from the surface, most floating turbine designs would be visible and could interfere with shipping lanes or be exposed to floating debris.

Floating turbines could be best suited to sheltered tidal environments such as estuaries, since storm waves could interfere with their power output and operation.

Floating turbine designs

Numerous floating turbine designs exist, utilising a variety of interesting innovations.

Some have a hull which floats on the surface while the turbines operate underwater, as in the case of Scotrenewable's SR2000 which claims to be the "largest and most powerful tidal turbine in the world". Its 64m long hull and 16m diameter turbine blades are designed to last for 20 years.

The smaller SR250 being lifted out for routine maintenance

Other floating designs include a modular design for easy transportation and assembly anywhere in the world, or a specially-streamlined turbine moored to a swivelled connector, for use in rough seas.

Bought a desert island? Need electricity? Look no further than the BlueTEC Modular.

Some "floating" tidal turbines actually bob somewhere just below the surface. In one design a "hinge" on the sea bed is attached to a semi-submerged platform that can fit up to 36 turbines, which can freely rotate into the flow. Developer Black Rock considers lots of independent and inexpensive turbines positioned to catch the optimum tidal flow a better configuration than a single larger turbine.

The Black Rock Tidal Power TRITON S36 in use.

Floating turbines demonstrate the continued effort towards exploiting the vast tidal energy resource. The sector is growing ever closer to commercial scale arrays using bed-mounted turbines, but floating turbines could increase development opportunities further.

ABOUT THE AUTHOR

Ross Jennings is a PhD Student in Renewable Energy at University of Hull.