Scientific Facts on

The potential of tidal energy production

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Context - Tidal energy is a predictable renewable energy source.

What is the potential or this energy source?

This is a faithful summary of the leading report
produced in 2014 by The International Renewable Energy Agency (IRENA):
"IRENA Ocean Energy Technology Brief 3 June 2014 "

The full Digest is available at: https://www.greenfacts.org/en/tidal-energy/

1. What are the technologies used to obtain tidal energy?

There are three categories of tidal energy technologies.

The first category, tidal range technologies use a barrage – a dam or other barrier – to harvest **power from the height difference between high and low tide**. The power is generated through tidal turbines located in the barrage. Their commercial feasibility has been well established and many such projects are currently in operation.

The second category, **tidal current or tidal stream technologies** use turbines that harvest the energy produced by the horizontal movement of the water caused by the tides. Some tidal current or tidal stream technologies in an early developmental stage can also be used to harvest ocean currents. Compared to tidal currents, ocean currents are unidirectional and generally slower but more continuous.

The third category are hybrid applications of tidal range and tidal current technologies that have great potential if their design and deployment can be combined with the planning and design of new infrastructure for coastal zones.

2. What are the advantages and the potential of tidal energy among renewable energy sources?

An advantage of both tidal range and tidal current energy is that they are relatively predictable regular cycles, and are largely unaffected by weather, like solar of wind power can be. However, due to tidal cycles and turbine efficiency, a conventional tidal barrage is producing only 25% of the capacity it would have if it was running continuously. This lead to a high cost of the infrastructure in comparison with power produced.

Worldwide, the tidal resources are considerable and the technically harvestable part of this resource, in areas close to the coast, is estimated by several sources at 1 Terrawatt (TW), the equivalent of the current installed capacity of all hydropower dams in the world. Extensive plans exist for tidal barrage projects and deployment projections for tidal current up to 2020 are in the range of 200 MW.

3. Are these tidal technologies economical competitive?

Cost estimates are projected to decrease with further deployment. Estimates from across a number of European studies for 2020 for current tidal technologies are between EUR 0.17/kWh and EUR 0.23/kWh, although current demonstration projects suggest a cost in the range of EUR 0.25-0.47/kWh. These costs are very site specific and the costs for both tidal range and tidal stream technologies can fall by up to 40% in cases where they are combined and integrated in the design and construction of existing or new infrastructure.

4. What are the barriers and drivers of tidal energy production?

Technological. Improvement in turbine efficiency, in particular innovative reversible turbines for ebb and flood generation, should provide a significant increase in energy yield.

Ecological. The potential for traditional tidal range technology, which closes streams or river arms with dams or in impoundments, is limited due to ecological constraints.

Societal. The installation of tidal range technology leads to several important societal benefits including flood defence and improved water quality.

Industrial. The development of tidal stream technologies has been linked to small and micro enterprises, and there is a lack of cohesion within the industry. However, large turbine manufacturers have entered this emerging sector by becoming involved in the start-up phase.

Financial. The greatest barrier is the relatively high upfront costs related to the developments of the dykes or embankments. Most projects are supported through government funds or by technology developers themselves.

Infrastructural. The lack of infrastructure to transport and distribute the electricity produced can be a problem and in Europe, could benefit from the development of an integrated offshore grid structure to deliver offshore wind to consumers.

Planning and licensing procedures. Coastal communities and those engaged in more traditional marine activities tend to be critical of the impact of tidal technologies. Planning and licensing processes for ocean energy therefore need to be open and comprehensive enough to take these concerns into account.

5. Who is presently developing tidal energy projects?

Leading countries are regions with good tidal resources that have site with a high tidal range (the difference between low and high tide), such as South Korea and Canada at various locations along the Lawrence River. Similarly, tidal range projects are explored in Western Australia. New test sites are planned in Chile, China, New Zealand, Portugal, Spain, and the USA.

Given the financial constraints, in addition to focusing on power generation, a number of new initiatives also focus on water management, flood defence, and the improvement of ecological water quality to enhance the economic and environmental functions around such basins (tourism, fisheries, better flood protection management of protected sites and reducing eutrophication).

Most of these initiatives are typically multi-stakeholder projects, seeking finance from the public as well as private partners.