Photo Credit: Ocean Power Technologies Inc.

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February 20, 2009

Harnessing the Tides: Marine Power Update 2009

by Marsha W. Johnston, Contributor

California, United States [RenewableEnergyWorld.com]

One hundred and forty-one years ago, the relentless sea off Scotland's coast inspired the following observation from native son and author George MacDonald.

"I climbed the heights above the village, and looked abroad over the Atlantic. What a waste of aimless tossing to and fro! Gray mist above, full of falling rain; gray, wrathful waters underneath, foaming and bursting as billow broke upon billow…they burst on the rocks at the end of it, and rushed in shattered spouts and clouds of spray far into the air over their heads. "Will the time ever come," I thought, when man shall be able to store up even this force for his own ends? Who can tell?"

In the U.S., permitting may be an even bigger hurdle to marine energy deployment than financing. Between 25 and 35 different U.S. federal, state and local regulatory agencies claim some jurisdiction over marine power deployment. In the UK, two agencies handle permitting.

Today, we can certainly say, "Yes, the time *will* come." The only question remaining is how *long* it will be before humankind routinely and widely uses electricity generated from the kinetic power of ocean tides, currents and waves.

If one defines "commercial ocean energy" as several tens of megawatts, the world cannot yet boast a commercial ocean energy installation. Indeed, only two installations of either wave, tidal or in-stream current devices are grid-connected and can generate over 1 megawatt (MW) of power. One is Pelamis Wave Power's 2.25-MW Aguçadoura project off of Portugal's northern coast and the other is Bristol-based Marine Current Turbines' (MCT) SeaGen, a US $20-million commercial-scale tidal-energy project under development in Northern Ireland's turbulent Strangford Narrows.

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In December, SeaGen boasted the first tidal turbine to hit a capacity of 1.2 MW.

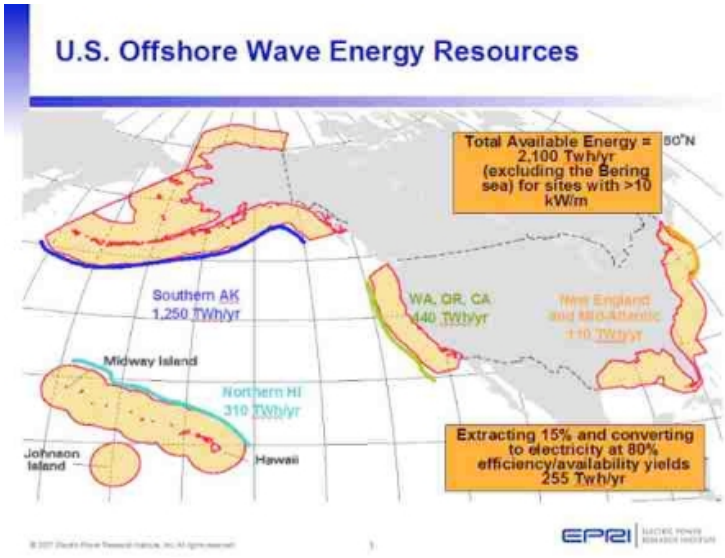
(The biggest exception to commercial ocean energy production is the world's longest running tidal power plant, the 240-MW La Rance, in France. But the plant's barrage technology, which traps water behind a dam and releases it at low tide, has fallen out of favor due to its perceived higher environmental impact than underwater turbines. Nova Scotia has also been operating a 20-MW barrage Tidal Generating Station in the tidal-rich Bay of Fundy since 1984.)

The rest of the world's wave, tidal and current installations, some of which have been in the water as far back as the 1990s, are experimental and prototype units ranging in size from 35 kilowatts (kW) to 400 kW. Because these units operate only intermittently and are not typically connected to any grid, it is not possible to determine their total power generation.

Many of these units are prototype demonstration units for the much bigger installations that are under development and that will begin to realize significant exploitation of the world's ocean energy resource. For example, Ocean Power Technologies Inc. will use the 150-kW PowerBuoy it has been testing since the mid-90s as the "workhorse" for the 270-MW, four-site wave energy plant off California and Oregon coasts that it has partnered with Lockheed Martin to develop, says CEO George Taylor.

And Inverness, Scotland-based WaveGen expects to use 40 units of the 100-kw turbine it just installed off the Island of Islay for a 4-MW farm off of Scotland's Isle of Lewis. Meanwhile, Pelamis says if its 750-kw "sea snake" devices, which were installed last year, make it through the winter, it will put 37 more of them in the water, generating 30 MW.

All of the wave, tidal, ocean and river current power around North America that can be practically extracted could together provide 10% of today's electrical consumption in the U.S., says Roger Bedard, ocean energy leader at the Electric Power Research Institute (EPRI) in Palo Alto, CA. He adds that the total water resource could, it is sometimes said, possibly power the world twice over, but a lot of it is out of reach. "Hudson's Bay, off the Arctic Circle, has HUGE tidal power, but it is thousands of miles from where anyone lives. We have HUGE wave resources off Aleutian Islands, but the same problem," he says. *See EPRI's U.S. Offshore Wave Energy Resource Map, below.*



What will be the "magic" year for large-scale ocean energy deployment? Most

developers indicate 2011-2012. Trey Taylor, co-founder and president of Verdant Power, which is moving into the commercial development phase of its 7-year-old Roosevelt Island Tidal Energy project, says the firm aims to have "at least 35 MW" in the water by the end of 2011.

Bedard is more circumspect. "I think it will be 2015 in Europe and 2025 in U.S. for big deployment," he says, adding that the year cited depends entirely on the definition of "big" and "commercial," which he defines as "many tens of megawatts."

Verdant's Taylor expects greater initial success in Canada. "The fundamental difference between Canada and the U.S. is that the underpinning of processes in Canada is collaborative and in the U.S. it is adversarial. It's just the nature of Canadians, collaborating for community good, whereas in the U.S. people are afraid of being sued," he said.

Bedard says the U.S. could catch up to Europe earlier, if the Obama Administration walks its big renewable energy infrastructure investment talk. "But if it's business as usual, it could be later, depending on the economy," he says.

Since the global economy began to melt down last September, many ocean energy companies have had to refocus their investment plans. With venture capital and institutional monies drying or dried up, firms are turning to public funds, strategic partners such as utilities and big engineering firms, and angel investors.

In November, MCT retained London-based Cavendish Corp Finance to seek new financing. Raymond Fagan, the Cavendish partner charged with MCT, said although tidal energy is not as advanced as wind or solar, he has seen a "strong level of interest so far from large engineering-type firms in MCT's leading position." Because MCT holds patents and is delivering power to the grid ahead of its competitors, Fagan thinks Cavendish can bring it together with such strategic partners.

In addition to the economic climate, he notes that the drop in oil and gas prices is further slowing renewable energy investment decisions. "Six to 12 months ago, people were leaping into renewable energy opportunities," he says, adding that the UK government's recent call for marine energy proposals for the enormous Pentland Firth zone north of Scotland will improve Cavendish's chances of getting financing. Though it has yet to make a public announcement, MCT is widely viewed as a prime operator for the zone.

Monies are still available. Witness Pelamis Wave Power's infusion of 5 million pounds sterling in November, which it says it will use for ongoing investment in core R&D and continuing development of its manufacturing processes and facilities.

In the U.S., permitting may be an even bigger hurdle to marine energy deployment than financing. Between 25 and 35 different U.S. federal, state and local regulatory agencies claim some jurisdiction over marine power deployment. In the UK, two agencies handle permitting. Bedard notes however, that streamlining the process in the U.S. may have begun with the recent opening of a new six-month process for licensing pilot marine energy plants.

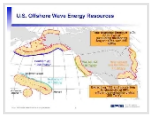
Marine energy experts agree that there are more opportunities for wave power than for tidal, as there are simply fewer exploitable tidal sites. In technology terms, however, tidal turbines have benefited from a quarter century of wind turbine development, says Virginia Tech professor George Hagerman. Despite more widely available wave resource, wave energy developers face the challenge of needing many more devices than do tidal energy developers, and have a higher cabling cost to export the power.

As Christopher Barry, co-chair of the Ocean Renewable Energy panel at the Society of Naval Architects and Marine Engineers, explains: "The major challenge [to ocean energy] is not pure technology, but the side issues of power export and making the technology affordable and survivable."

Marsha Johnston is a freelance writer based in California specializing in renewable

energies, conservation and sustainable development.

Image Gallery (2)



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chandranshu-pandya-159529 February 20, 2009

While wave and tidal stream energy developments may take some time tpo reach commercial viability on a large scale, La Ranche TPS has already proved beyond any doubt that Tidal Barrage Power Stations can be made a major Ocean Energy Resource immediately.

For example, there seems to be no reason to keep on postponing two large projects in Gujarat State, India where potentials of 7000 MW and 900 MW at Cambay basin and Kutch basin respectively are known resources.
Apart from US and Europe, large resources in Asia and Russia are also available for full exploitation.

The earlier these known tidal basd stations are put into practice, the better it is for us.

Comment 1 of 8

adrian-akau-36758 February 23, 2009

Happy Buoys

We need more buoys for our oceans,
Converting the wave's rocking motion,
Anyone can see that the energy will be,
Sufficient for many of our needs,
Bobbing around in the ocean,
While feeding the grid with its potion,
Of strong 'lectricity, just wait and see,
Satisfaction for our energy needs.

adrianakau2aol.com

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r-t-55471 February 25, 2009

Wow, this is one of the MUCH better articles at this site.

Korea is starting a tidal program that uses submerged turbines (but no dams). Allegedly, a "1MW pilot plant would be installed by March 2009".
http://www.inhabitat.com/2008/03/19/worlds-largest-tidal-power-project-coming-by-2015/

This site might be of interest. An exhaustive collection of links to technology and companies in the tidal energy field.
http://peswiki.com/energy/Directory:Tidal_Power

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patrick-takahashi-150741 February 25, 2009

One ocean option you missed, or neglected, is ocean thermal energy conversion. Yes, when I helped draft the legislation in 1979 for OTEC, we predicted 10,000 MW by 1999, and ten years henceforth from that date, there is still zero MW of this technology. However, Lockheed Martin has begun the process of designing and operating a 100 MW facility for Honolulu (in stages), and all indications are they are only a couple of years away from the first prototype. ClimateWire took a recent look at

http://coolerchoice.com/2009/02/13/is-'ocean-thermal'-power-ready-for-its-day-in-the-sun/

I do worry that the current price of oil must be testing their patience. Go to

http://www.huffingtonpost.com/patrick-takahashi/the-coming-of-otec_b_145634.html

for another update. Four months ago, the New York Times reported on LM's efforts at

http://www.nytimes.com/external/gigaom/2008/10/08/08gigaom-lockheed-set-to-tap-ocean-thermal-energy-with-doe-11501.html

The beauty of OTEC is that, in addition to electricity, you have the potential of various co-products: next generation fisheries, marine biomass plantations for biofuels, freshwater and environmental remediation. My Huffington Post article on the Blue Revolution explains the concept at

http://www.huffingtonpost.com/patrick-takahashi/blue-revolution_b_166977.html

Finally, my book on Simple Solutions for Planet Earth (http://simplesolutionsbook1.com) reviews those marine energy systems you mentioned. Unfortunately, every wave power device I have visited, has in time self-destructed. I explain why in my publication. I pray for the Pelamis Portugal adventure. Yet, every little bit of non fossil electricity helps, and I am, actually, a rather strong supporter of most of these ocean energy systems. Thanks for bringing me up to date.

Comment 4 of 8

r-t-55471 February 25, 2009

Pat,

I too thot OTEC might be useful in some areas. It appears not to be. Your sources are not the best for discrimination (my apologies, but they seem biased to me). The market is the final testing place. Sadly, there are those who wish to skew the market with subsidies and other financial mechanisms that distort prices.

Still, there may be some future yet. As importing fuel becomes more costly the benefit of fixed-cost energy becomes more apparent (like an insurance policy). The advances in technology help tremendously, but the sea is a harsh mistress.

In general humans do not look too far into the future and when they do they want the solution today. Almost always they want someone else to pay for the solution, whether it works or not.

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david-king-45455 February 26, 2009

It may interest readers to know that New Zealand has approved an initial tidal flow unit for outside Kaipara harbour, being appealed against by fishing interests at present. Also a tidal flow unit has application for permit in Cook Strait

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chris-moore-140158 February 26, 2009

It seems to me most likely that only close-to-shore projects (including barrages) are going to be viable in the near/medium term, as the issues and costs associated with a) tethering, and b) grid connection will take a considerable time to resolve. The UK has massive wind and ocean energy resources, but is unable properly to exploit these due to lack of infrastructure - the implementation of which requires planning consents, etc., so don't hold your breath! I have been associated in the past few years with certain proposed ocean power technologies, some of which comprised sizeable units (up to 7MWe), but needed to be located at depths and distances from shore which would have made the projects unviable due to the connection costs (not to mention the insurance costs...)

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albert-piccioni-169767 February 27, 2009

an application for patent has been filed for an installation to harness tidal waters.each installation will put out a minimum of 2 mw with 10 mw the norm.it features no submerged spinning blades or turbines,no barrages to be built,is environmentaly friendly,and should not interfere with navigation nor pose a danger to marine life.
does not require anchors as we know them and withstand the harshest marine environment.this installatiton will use localy available manpower and materials.A design of very low miantainance.built close to shore will overcome the technical aspects with its expense of hooking up to the local grid.

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