

IMPORTANCE OF DEMONSTRATION FACILITIES IN ADVANCING TECHNOLOGY – A FORCE PERSPECTIVE

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Abstract

A marine renewable energy demonstration facility can support informed decision making by developers, regulators, researchers, democratically accountable officials, and the public if it promotes learning about tidal energy development, as opposed to promoting tidal energy development *per se*. But the promoting can be predicated on the belief that tidal energy conversion has the potential to offer safe, clean energy and economic opportunity.

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1. Conditions for success

There are five conditions necessary for viable tidal energy projects:

- 1 A site with an adequate tidal resource
- 2 The suite of technologies necessary to convert marine kinetic energy to electricity and deliver it to market
- 3 A legal regime that creates the right to produce and sell electricity from tides and protects long-term investment in the project
- 4 A price for the electricity that provides a sufficient return on the investment
- 5 Political support (sometimes referred to as “social license” presumably based on confidence the project represents a net environmental and social benefit).

Demonstration facilities have a role in all five.

2. Is there a problem with public funding of demonstration facilities?

Demonstration facilities are often publicly funded, at least initially. There is nothing inherently wrong with this.

The relevance and value, if any, of research is the knowledge acquired, not the source of funds. Publicly funded research is not inherently less worthy than privately funded research. If there is a problem it is that governments cannot always be relied on to see things are researchers and business people do. That is the nature of government – democratic ones at least. Democratic governments respond to a political bottom line – public opinion, which is invariably complex, subjective, fuzzy and shifting. Whatever it is, it is not a financial or academic bottom line. Consequently governments initiate and terminate research for a variety of reasons that have nothing to do with the subject. This can make governments unreliable. But it doesn't make good research bad.

Those who believe everything should be left to markets would do well to consider the words of Henry Ford: “If I had asked people what they wanted, they would have said faster horses.” And of course Niccolo Machiavelli is always a source of useful advice: “(A) disease, at its early stage, is easy to cure but hard to diagnose. At a later stage, it is easy to diagnose, but impossible to cure.”

Machiavelli's musings on disease (which he was actually using as a metaphor for political unrest) applies equally well to innovation. Petroleum was initially sought to replace declining supplies of whale oil as a source of light. Petroleum production preceded the automobile by 25 years. Whale oil would not have spawned the internal combustion engine. As Jared Diamond said in *Guns, Germs, and Steel*, “Invention is the mother of necessity.” At this stage of tidal power development governments are as well placed as anyone to assess its potential commercial and public policy value. So there is no reason for a government not to fund tidal research including a demonstration facility.

There being no reason not for governments not to fund tidal energy research, there are two broad reasons *for* public investment in it: renewable energy is presumptively a public good; (This can be debated but I assume not at ICOE.) and new technology offers not only a new product or service but also economic opportunity for individuals and nations.

The economic opportunities in tidal energy are not confined to turbines any more than value in the petroleum economy is confined to refineries. So, for example, a key factor in tidal energy is that one cannot send in bulldozers and shovels to shape submarine sites. The developer must take them as they are and the very characteristic that makes them valuable makes them difficult and dangerous places to work. So an area of economic opportunity is technologies for finding, characterizing, and monitoring high energy sites and the interaction between turbines and the environment.

3. Why Fundy, why FORCE?

Four times a day on average over 160 billion tonnes of seawater— more than the entire Earth's daily combined flow of freshwater rivers and streams – flows in and out of the Bay of Fundy. The Bay produces the world's highest tides, ranging over 16 vertical metres, and strong tidal currents, exceeding 5 metres/sec (about 10 kts.) at peak surface speed. In the Minas Passage, where FORCE is located, one independent expert estimates up to 7000 megawatts of power, 2500 of which can be extracted without significantly affecting the tides.

Since 1910, there have been four major and numerous minor proposals for large-scale tidal power development in the Fundy. North America's only tidal power station - a barrage with a capacity of 20 megawatts and a daily output of 80-100 megawatt hours – has operated on the Bay since 1984.

4. How does FORCE contribute to the five conditions?

(1) A tidal site

FORCE provides an approved site and infrastructure for turbine developers and researchers near Parrsboro, Nova Scotia. It has a shared observation facility, a 1.6km by 1km submarine Crown lease approved for turbines, a grid connected substation and an established environmental monitoring program. The first of

four 34.5kV submarine cables will be deployed in the fall of 2012.

FORCE is built to support arrays of turbines. Each of its cables is rated for 16MW continuous power and, when all four cables are deployed in 2013, FORCE will be capable of delivering 64MW to the eastern North American grid. It is built this way because FORCE is the premier site in the Bay of Fundy and, when and if the public interest in learning about tidal energy is superseded by the public interest in tidal electricity production, FORCE – a not for profit company – will cease to have a purpose and its infrastructure would be useful for commercial production on terms that would have to be decided at the time. In other words, FORCE is intended to have few if any stranded assets.

(2) The suite of technologies necessary to convert marine kinetic energy to electricity and deliver it to market

Innovation requires collaboration. FORCE is like a co-operative; the Provincial government and the berth holders (selected by the government through open competition) are the owners. The government is the only permanent owner. The berth holders acquire no equity and cease to be members upon ceasing to be actively pursuing technology or project development at FORCE.

FORCE advances innovation and economic opportunity by:

- Attracting world class technologies to Nova Scotia where they engage with local suppliers enabling knowledge transfer and experience in the sector
- Allowing developers to concentrate their resources and efforts on tidal technology innovation
- Creating a hub for developers, researchers, and regulators to learn about tidal energy extraction and the environment and to interact.
- Having berth holders as owners of FORCE which requires competitors to collaborate on the design and construction of the facility. In addition to ensuring the facility is well suited to industry needs, the experience of working together has encouraged collaboration on other common problems such as device deployment technologies and techniques.
- The Provincial government acquires a window on industry leaders.

- Researchers have a site to work and are supported because their work is seen to have real, practical application.

(3) & (4) A legal regime and a price that protects and justifies investment

FORCE has offered advice to government on marine renewable energy legislation and the need for a feed in tariff for turbines at FORCE. It does not argue for a specific amount.

(5) Public and political support

At its root FORCE's role is to support informed decision making by everyone from developers to the members of the general public. As a not for profit, private company with public objects

FORCE helps build regulator, researcher, and ultimately, public confidence by

- Conducting environmental monitoring at and around its site
- Collaborating with and supporting independent academic research at its site with particular regard to marine life
- Conducting its own research on site characterization and monitoring, and the sensors and tools necessary to carry it out; and
- Serving as an honest broker and, we believe, trusted advisor to public policy makers and the public.