ORPC Overview

Ocean Renewable Power Company (ORPC) is a developer of both technology and projects

- Founded in 2004, ORPC is a New England based developer of technology and projects that convert tidal, river and deep water ocean currents into emission-free electricity.
- Proprietary ocean current generation (OCGen™) technology.
- Demonstrated the technical feasibility of the core component of OCGen™ technology, the Turbine-Generator Unit (TGU), in April 2008.
- Project sites in three of the world’s most promising tidal energy resources (Western Passage & Cobscook Bay, ME and Cook Inlet, AK).
- Planning a tidal and a river deployment of the commercial TGU in the summer and fall of 2009 (pending funding).

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What is Tidal Energy?

Tidal Energy is derived from the reversing current movement of ocean waters caused by the interacting gravitational effects of the sun and moon resulting in predictable current flows.

- The amount of energy that can be extracted from tidal currents is directly proportional to the cube of the current speed.
- The maximum current speed occurs in areas where there is a significant rise and fall in the tides and the water is "funneled" through islands and inlets that constrict the flow and increase the water speed.
- The coast of Maine and the entire Bay of Fundy, as well as coastal Alaska have significant tidal energy resource.

Tidal Energy Conversions Technologies

TIDAL BARRAGES (Dams):
- Designed to operate like conventional hydropower facilities.
- Installation of turbines at the inlet/outlet of the barrage allowing water to flow through the turbine.
- Require very large capital investments.
- Long construction time.

Primary Advantage: Proven technology with off-the-shelf equipment.

Primary Disadvantage: Impounding tidal areas can cause significant negative environmental impacts.
Tidal Energy Conversions Technologies (Cont.)

TIDAL IN-STREAM CONVERSION (TISEC):

- Designed to capture kinetic motion (speed) of tidal currents and convert it to electricity.
- Devices are comprised of rotor blades in combination with a generator.
- TISEC devices are deployed in open waters with sufficient current flows to generate electricity without the need for a barrage.

Primary Advantage: Holds the promise of being the most environmentally benign method of power generation.

Primary Disadvantage: TISEC technology is still in the development phase.

What Makes a Good Tidal Energy Site?

Site Specifications ➔

- Substantial tidal current velocity – peaking at 6 knots (3 m/s) or greater.
- Sufficient depth and width (bathymetry) to provide for deployment of multiple units and allow for adequate clearance.
- Reasonable proximity to the electricity grid (substation) or remote power system.
- Not a highly sensitive area with respect to endangered species/fishing.
- Community support for tidal power development.
ORPC Site Locations

ORPC is developing projects in some of the world’s strongest water currents:

- Tidal – Western Passage & Cobscook Bay, ME (Bay of Fundy) and Cook Inlet, AK
- River – Alaska (Nenana) and Northern New England
- Deep Water Ocean Current – the Florida Current

Permitting

Tidal energy project permitting controlled by FERC

- Typically, a 3-stage process: Preliminary Permit → Pilot Project License → Operating License
- All Federal and State Agencies under the FERC Umbrella

In Maine, 9 FERC Preliminary Permits have been issued and 4 are pending.
Permitting Challenges

Major Challenges include:

- Tidal energy resources have not been characterized – agencies know very little about what species exist and when (background data)
- Technology is evolving so little firm data is available on the potential environmental impacts
- FERC permitting process was developed for traditional hydro – being streamlined for TISEC devices but not there yet
- The fight over “bottom space” – conflicts over use of submerged lands
- Local support – Federal control over local resource

Project Development (Permitting) Strategy

All Development is Local!

- Formed regional development companies - ORPC Alaska, ORPC Florida, and ORPC Maine - in 2006.
- Regional development teams formed through strategic relationships with leading regional firms, individuals and contractors.
- Developed open and collaborative relationships with local community officials, citizens and stakeholders, Federal and State agencies, regional economic development organizations and other key organizations and individuals.
- Commitment to maximize involvement of local contractors, suppliers and professional service providers to the extent practical and competitive.
Importance of Community Support

- Community support is critical to successful project development
  - must be developed early and constantly reinforced.
- Collaborative efforts between ORPC and local entities include,
  but not limited to:
  - City officials
  - Local citizens and stakeholders
  - Universities and Research Centers
  - Local associations including fishermen, pilots, etc.
  - Local Port Authority and Coast Guard

Alaska Development Status

- Sites: Tidal energy site in Cook Inlet near Anchorage and river project site near Nenana.
- FERC Permit Status: Preliminary Permit obtained and Pilot Project License in process for Cook Inlet – Preliminary Permit in notice period for Nenana river site.
- Community Support: Letter of Intent with Matanuska-Susitna Borough (Port McKenzie) for Cook Inlet - Working with the full support of Nenana officials and Alaska Energy Authority and in partnership with Yukon River Inter Tribal Watershed Council for Nenana river project
- Planning to test it’s the OCGen™ TGU in Nenana in summer 2009 and a tidal OCGen™ module in Cook Inlet in 2011.
Maine Development Status

- Sites: Tidal energy sites in Western Passage and Cobscook Bay near Eastport and river project site near Woodland.
- FERC Permit Status: Preliminary Permit obtained and Pilot Project License in process for Western Passage and Cobscook Bay – river project site under evaluation.
- Community Support: Memorandum of Understanding executed with City of Eastport for Western Passage and Cobscook Bay – local support enhanced by the prototype TGU demonstration project that pumped a significant amount of money into the local economy. (At the peak of construction, ORPC employed over 30 local people.)
- Planning major testing projects of the commercial TGU in Western Passage and Cobscook Bay in summer of 2009 and in Woodland river site in fall of 2009 – first tidal OCGen™ module to be deployed in Western Passage in fall of 2010.

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TGU Demonstration Project
Summary of Results

The Technical Feasibility of the TGU has been demonstrated!

- The Turbine Generator Unit (TGU) design feasibility has been confirmed.
- The TGU self-starts (under load) in current speeds under 2 knots and generates electricity continuously and in direct proportion to current speed until current speeds fall below 1 knot.
- The TGU has been stress tested in current speeds up to 8 knots with no excessive vibration or deflection
- The prototype TGU met or exceeded expectations in 10 out of 12 criteria

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A Simple and Rugged Underwater Workhorse

Patent applications filed

Incoming (Flood) Current

Varies with application – 48 to 92 Feet Typical

Varies – 6.5 to 13 Feet Typical

Tidal OCGen™ Module Configurations

Vertical (4x1) Configuration

Horizontal (2x2) Configuration

1 MW Peak Generating Capacity in a 6-Knot Current

ORPC Proprietary Permanent Magnet Underwater Generator

ORPC Proprietary Advanced Cross Flow (ADCF) Turbines

ORPC Proprietary Permanent Magnet Underwater Generator

ORPC Proprietary Advanced Cross Flow (ADCF) Turbines

TGU Modular Structural Frame

Vertical (4x1) Configuration

Horizontal (2x2) Configuration

1 MW Peak Generating Capacity in a 6-Knot Current

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Lessons Learned and Still Learning

- There is no clear path to obtaining permits
- Permitting complicated by lack of information (data) and development status of technology
- Agencies generally favorable towards tidal energy development but have concerns that must be addressed
- Local community and regional support are critical to success
- Funding (or lack thereof) impedes progress
- Murphy is alive and well so, if you don’t have a sense of humor, you better develop one!!!