

# *ORPC Maine Presentation*

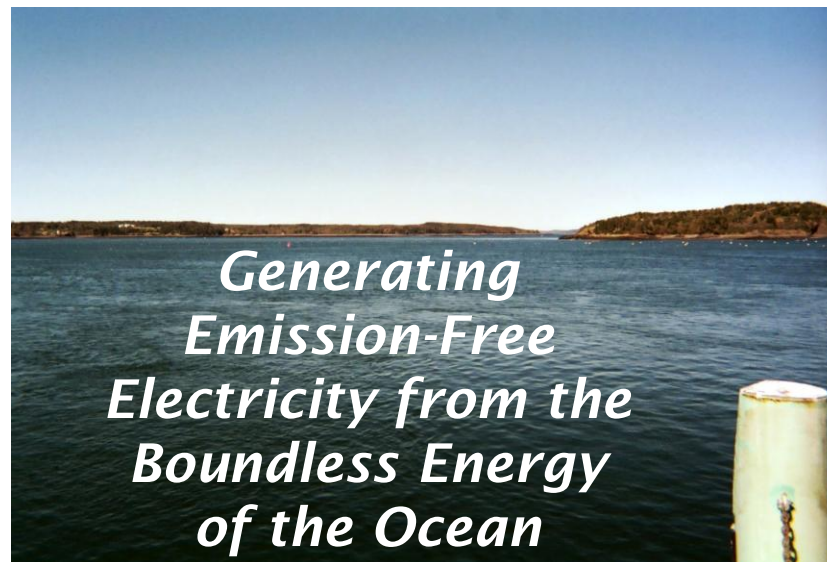
## First Annual Cobscook Bay Conference

March 24, 2007

Eastport, ME



**ocean**renewable power company





## ORPC Background

### Our Mission

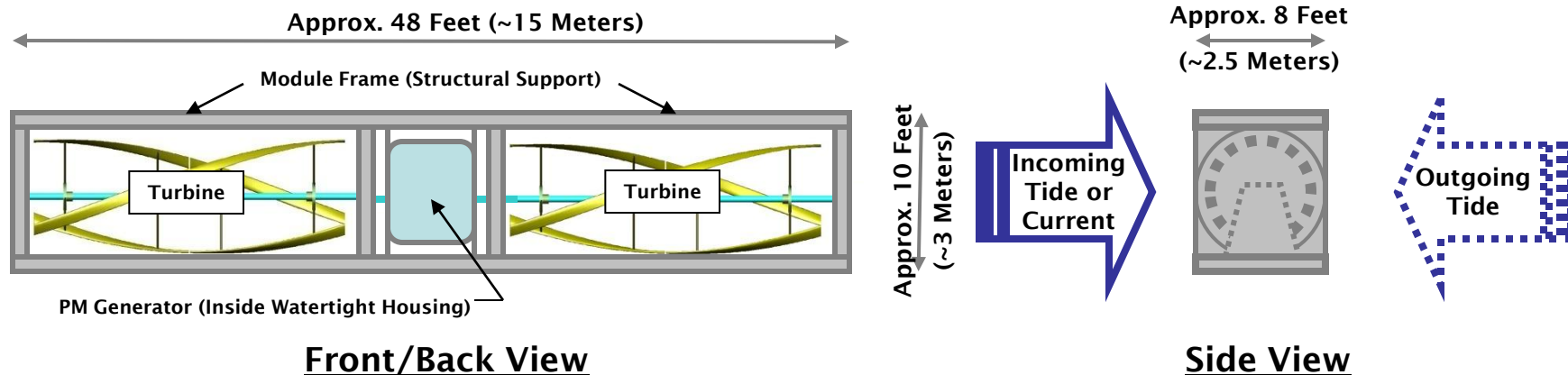
Ocean Renewable Power Company, LLC (ORPC) was founded in 2004 for the purpose of generating reliable, competitive, emission-free electricity from the virtually unlimited energy resources of the oceans. ORPC will accomplish its mission by developing proprietary modular ocean current generation (OCGen™) technology and incorporating it into environmentally superior, financially successful ocean and tidal current generation projects.

- ❖ ORPC's management team include professionals with extensive experience in development and financing of cogeneration, independent power and renewable energy facilities, and in management of startup companies, technology development, engineering, construction and operations
- ❖ ORPC utilized the extensive technical resources of the U.S. Navy (Naval Surface Warfare Center – Carderock Division) through a Cooperative Research and Development Agreement to assist in technology evaluation and selection and in the development of designs that are robust enough for underwater deployment in the ocean
- ❖ ORPC has retained a core team of highly respected individuals and professional firms in the fields of turbines, generators, power electronics and controls, submersible structures, mooring systems, oceanography, regulatory process, environmental studies and permits, and legal/business counsel
- ❖ ORPC formed ORPC Maine, LLC in 2006 to develop, permit, install and operate tidal energy projects in northern New England and eastern Canada



## The OCGen™ Turbine-Generator Unit (TGU)

*Patent applications in process*

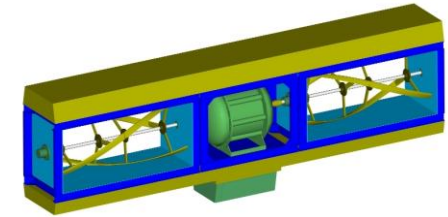
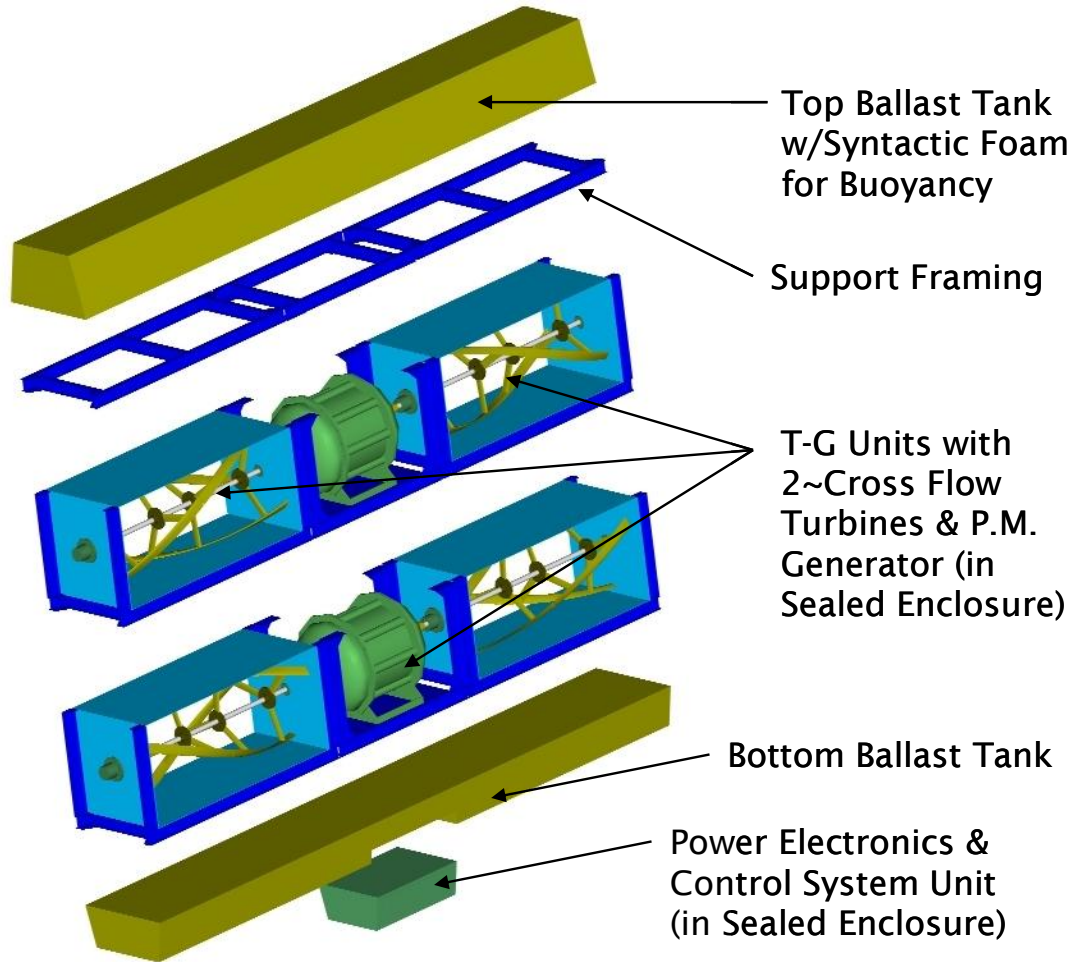


### Key Design Features

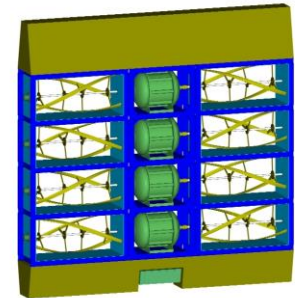
- ★ Generating capacity of approx. 180 kilowatts in a 6 knot current (varies with current speed)
- ★ Unique proprietary turbine rotates in one direction only, regardless of current flow direction
- ★ Two cross flow turbines drive a permanent magnet generator on a single shaft
- ★ OCGen™ TGU can be shop fabricated and shipped to project sites
- ★ TGU are “stacked” (horizontally or vertically) and incorporated into OCGen™ modules that contain the ballast/buoyancy tanks and power electronics and control system (plug & play)
- ★ Assembled OCGen™ modules are deployed in arrays comprised of tens to hundreds of modules
- ★ OCGen™ modules are held into position underwater using a deep sea mooring system
- ★ A power and control cable connects each OCGen™ module to an underwater transmission line that interconnects with an on-shore substation
- ★ OCGen module operations are monitored and controlled from on-shore computers
- ★ OCGen™ modules are brought to the water surface for inspection and maintenance



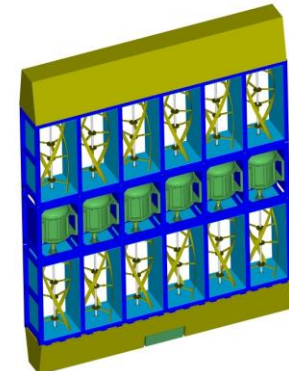
# OCGen™ Module Assembly & Configurations



Single-T-G Unit Prototype Configuration



4 T-G Unit Horizontal Configuration

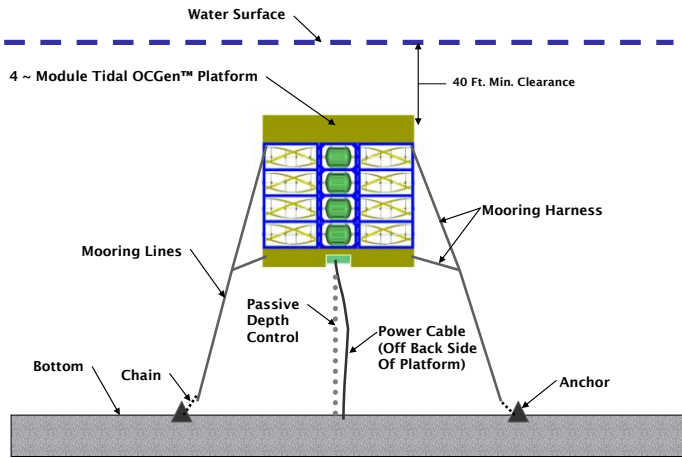


6 T-G Unit Vertical Configuration

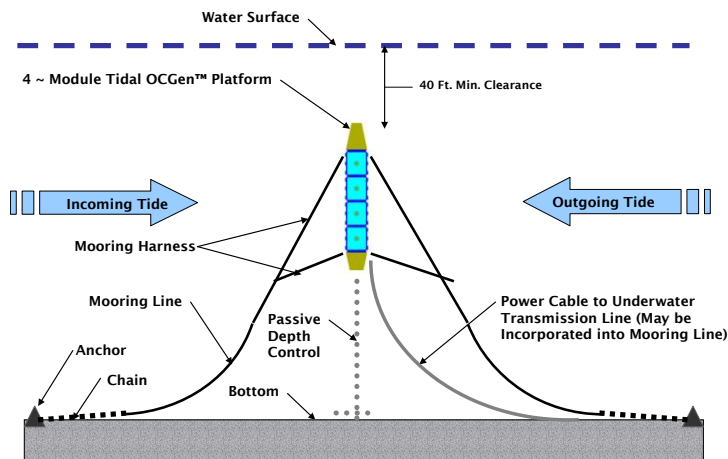


# OCGen™ Module Deployment Concept

## 4 TGU Horizontal Configuration Shown



**Front Elevation**



**Side Elevation**

### Assembly and Deployment Sequence

- ▶ TGU's are manufactured and shipped to the on-shore assembly and deployment facility
- ▶ The TGU's are connected in a stacked configuration (4-module horizontal assembly shown) and the ballast/buoyancy tanks and the power electronics/control system unit are then attached to complete the module assembly
- ▶ The power and control leads from the TGU's on each module are connected to the power electronics/control system unit on that module
- ▶ The underwater transmission line, power and control cables and mooring systems (anchors and mooring lines) are installed
- ▶ The assembled OCGen™ modules are towed (floating in a horizontal position) to the site
- ▶ The mooring lines and power and control cables are connected to the OCGen™ modules
- ▶ For each module, the ballast tanks are flooded (bottom tank first) and the module is lowered into its operating position



## Advantages of OCGen™ Technology

### Competitive Advantages of OCGen™ Technology Include:

1. Lower cost to build (shop fabricated T-G units), install and maintain
2. Simpler, more robust power train
3. Slower turbine tip speed resulting in reduced “wear and tear”, noise, vibration and lower potential for impacts on sea life
4. Turbine rotation in one direction only, regardless of direction of the current flow - no equipment repositioning needed in tidal currents
5. Only one moving part – turbines and generator rotate on a single shaft
6. No gears, thereby eliminating the leading cause of failure for axial flow (windmill-type) turbines
7. Very low vertical profile and many “stackable” configurations – highly adaptable to a variety of project site conditions
8. No impact on the surface of the water (except during brief installation and maintenance periods) – eliminates interference with commercial shipping and recreational boating and *no visibility (view shed) issues*
9. Minimal impact on the bottom of the water body because mooring systems (anchors) are used to hold them in place – no pilings or foundations
10. “Smart” submersible features allow OCGen™ modules to be “told” to submerge and come to the surface for deployment, maintenance or emergency situations



## ORPC Maine Project Sites

In support of its project development efforts, ORPC Maine is evaluating potential sites in Western Passage and Cobscook Bay for development of commercial scale tidal energy projects using ORPC's OCGen™ module technology. ORPC Maine applied to the Federal Energy Regulatory Commission (FERC) for Preliminary Permits for site areas in both waterways. ORPC intends to work with local community officials and stakeholders, as well as state agencies, to conduct studies and evaluations to identify the most feasible and acceptable sites for installation of tidal energy project(s).





## ORPC Maine Team

**ORPC Maine has retained a highly competent team of Maine-based professionals and firms to lead our efforts in Maine. ORPC has also developed key affiliations with leading Maine organizations.**

- ◆ **Nathaniel “Sandy” Paige – provides management and project development expertise (Hallowell, ME)**
- ◆ **Devine Tarbell & Associates (Mary McCann, Project Manager) – provides experience and expertise in environmental studies and permitting as well as FERC licensing (Portland)**
- ◆ **Pierce Atwood – a leading New England law firm that provides essential legal and business advice (Portland)**
- ◆ **Jim Sysko, P.E. – a Maine Professional Engineer with 30 years experience in design and construction of Maine projects, including prior demonstration projects utilizing the Gorlov Helical Turbine (Bethel)**
- ◆ **University of Maine, School of Oceanography - Dr. Huijie Xue (Orono)**
- ◆ **Maine Technology Institute (Gardiner)**
- ◆ **Maine’s Marine Technology Center (Eastport)**

**ORPC Maine won a Development Award from the Maine Technology Institute, which in addition to funding, provided an MTI “seal of approval” for the OCGen™ technology and the ORPC Maine business plan.**

**ORPC Maine continues to look for mutually beneficial relationships with Maine organizations and individuals to help fulfill the ORPC mission.**





## ORPC Development Plan

ORPC's development and commercialization plan will be executed in 3 phases:

1. **1/3 Scale Turbine-Generator Unit (TGU) Demonstration Project**
  - ✓ “Proof of Concept” for the core component of the OCGen™ technology
  - ✓ Collect data for final design and detailed engineering
2. **Full-Scale OCGen™ Module Prototype Project**
  - ✓ Full-Size Single TGU OCGen™ Prototype Module, including ballast/buoyancy equipment, submersed power electronics and control system package and mooring system
  - ✓ Power generated will be transmitted to a buoy where it will be metered and dissipated (no FERC license needed)
  - ✓ All important environmental and operating parameters will be monitored and data will be collected and analyzed
  - ✓ Deployed approximately 18 months after completion of the 1/3-scale TGU demo project and operated for 12 to 18 months
  - ✓ FERC licensing process will be initiated
3. **1st Commercial OCGen™ Project**
  - ✓ FERC licensing and financing completed and project installation within 12 months of completion of prototype project (2011)



## 1/3-Scale TGU Demonstration Project

**ORPC plans to complete a 1/3-scale TGU demonstration project by the end of 2007 at a site in Western Passage or Cobscook Bay. The 1/3-scale TGU demo project will consist of the following elements:**

- **ORPC will consult with Eastport area individuals and groups to determine the best location for the 1/3-scale TGU demo project**
- **The TGU will be 1/3 the size of a commercial OCGen™ unit**
- **Initial tests of the new ORPC proprietary cross-flow turbine will be conducted and data collected**
- **An evaluation of the ORPC turbine vs. Gorlov Helical Turbine will be performed and the preferred turbine technology will be selected**
- **A 1/3-scale ORPC proprietary focused flux permanent magnet generator will be manufactured**
- **Key components will be manufactured and shipped to Eastport**
- **The 1/3-scale TGU will be fabricated and assembled at Maine's Marine Technology Center in Eastport**
- **All required permits and approvals will be obtained**
- **The 1/3-scale TGU will be mounted below a barge or floating platform and deployed at the selected site for a period of 3 to 4 weeks**
- **Results will be disseminated to the Eastport community**