# OCEAN CURRENT POWER GENERATION

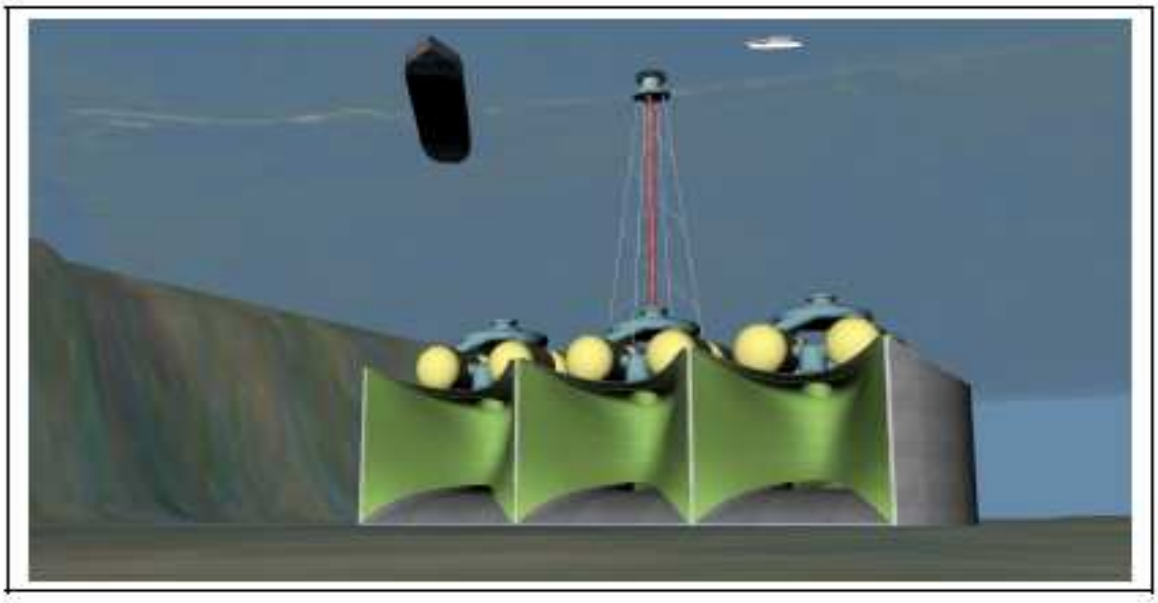


***Fig. 1: View of Ocean Current Generation System (facing)***

Two thirds of the surface of our planet is covered with water, ocean currents can provide virtually unlimited power consistently for the full 8760 hours in the year.

Sea water is 822 times more dense than air (wind) and although tidal and wave power are a huge potential, they are only cyclical in nature with less than 3,000 hours. Furthermore, they are open systems, subject to the harsh marine environment.

OCG is a closed loop system where none of the critical systems are exposed to sea water. Almost the entire OCG comprises a fixed structure and designed for a duty cycle of more than 20 years. Only the closed loop system is designed for a Mean Time Before Replacement (TBR) of 5 years. This component is designed for easy extraction and insertion.

Renewable, zero-emissions based Ocean Power Generation will be an important part of addressing the global warming problem. Ocean current-based power generation has the potential to address a void in current renewable power offerings; the need for large-scale, base load power generation able to replace coal, oil, natural gas-fired, and even nuclear power generation.

Almost all renewable, zero-carbon-emission power generation is non-base load. Wind and solar power can only generate power at its designed loads for 2,000 to 2,500 hours of an 8,760 hour year. The basic OCG is expected to cost about $1.50 per watt to build and deliver design load power for the full 8,760 hours in a year.

Comparative Revenue of 100 MW power generation

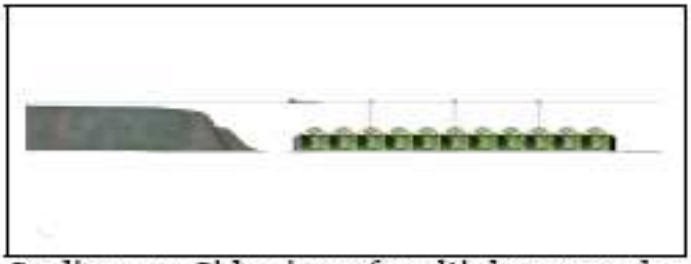
| | Operating Hours Per Year | Yearly Revenue @20 US cents per KW/hr | Yearly Revenue @35US cents per KW/hr |
|---|---|---|---|
| Solar | 2,200 | $ 44 Million | $ 77 Million |
| Wind | 2,000 | $ 40 Million | $ 70 Million |
| Tidal | 1,600 | $ 32 Million | $ 56 Million |
| Ocean Current | 8,760 | $ 175.2 Million | $ 306.6 Million |

A 100MW project is expected to cost about US$150 million with an annual return of about US$ 306 Million. With government grants this amount could be subsidised greatly if not totally.

The OCG is designed to be scaled up to form a long line of Ocean Current generators such as described below.

Initial Computer Fluid Dynamics results show that an OCG with a face of 100m by 100 metres has a potential to generate over 100Mw. This can be enhanced by deploying an OCG in "advantageous" locations. As seen in the artists views below.

*Scaling up: View of multiple units from above ocean*



*Scaling up: Side view of multiple arrayed units.*

**Ocean Current Generation: Base load Renewable Power**

Ocean currents flow over a vast area of our planet. Two thirds of our planet is covered by ocean and its currents flow over vast tracks of ocean. For example, currents off the coasts of China, Japan, Korea, South America, British Columbia and Nova Scotia, Canada, Africa, Portugal, Spain, Ireland, the UK, Norway, and Australia could produce enough electricity from ocean current-based power generation for each of those regions.

Much of today's environmentally friendly (green) technology utilizes solar, wind, wave and tidal energy to produce electricity. These forms of energy are cyclical in nature which means that electricity created from these methods require alternative generators to work when the source is not present. Therefore for every megawatt of electricity of wind, solar, tidal, wave energy produced, another 2 megawatts of electricity must be generated with traditional methods for the hours where the sun or wind is insufficient to produce electricity.

Ocean current-based power generation operates all the time, providing "base load" electricity suitable to replace coal, oil, nuclear, and natural gas-fired power generation capacity.

## Ocean Currents as Base load Power Source

Ocean currents are a constant form of energy offering a potential source of power 24 hours a day, 365 days a year. That is 8,760 hours a year of constant energy as compared to 3,000 hours a year for wind generation and 2500 hours for solar photo-voltaic generation. Not only are capital costs recovered much faster by OCG but there is no need for backup power generation and redundant capacity which makes solar and wind energy less attractive in the macro cost equation.

As a rough guide, the density of air is about 0.00125 kg/m3 and the density of seawater is about 1,028kg/m3. Therefore, sea water has 822 times the density of air and is a non-compressible medium.

Ocean currents can be focused by natural and/or man-made channels to increase its useful energy

## Ocean Current Generation System

OCG Solutions:

The OCG system has no high pressure differential between the inner working cavities and the outside sea, even at depths exceeding 2,000. OCG has no thick pressure hulls and costly precision structures.

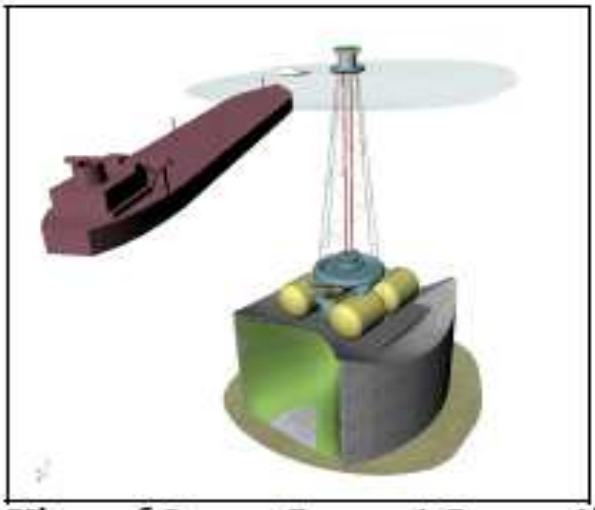
The OCG has no water proof seals that make it difficult to keep the device water tight as seals wear quickly especially if there are rotating bodies.

OCG has no critical parts exposed to seawater and is self cleaning in the course of its normal function. Therefore micro organisms and marine growth cannot clog up the

OCG.

The OCG has no appendages or apparatus that can be compromised or deformed such as turbine blades or other such shape critical moving parts in contact with sea water.

The critical functioning component of OCG is a self contained unit which is designed to be recoverable and can rise to the surface for attention if needed. However there should be no need for such recovery in its 20 year life cycle.



***View of Ocean Current Generation System (from ocean surface)***

## Why a Closed Circuit Generator?

Problem: Underwater devices tend to require a great deal of maintenance due to the corrosive nature of sea water and the accumulation of marine life on the surfaces of submerged devices, especially on any appendages.
OCG Solution: All components that are sensitive to sea water corrosion and/or marine life growth are encapsulated in a closed circuit system. This means that all the sensitive components such as the turbine blades, gear mechanisms, valves, rotating gimbals are in a distilled water environment with additives to maximize the efficiency of the system. Therefore, sensitive components that require precision engineering are at high risk of gross deterioration when exposed to salt water corrosion or marine growth and could result in premature malfunction will function efficiently for far longer without the need for costly maintenance.
The ocean current generator has no sensitive mechanical moving parts that are exposed to sea water other than other than the in-flow port and the out-flow ports which are cleaned with each cycle and they are not sensitive to maintaining critical shape.

Description of OCG:
This invention would be positioned to best face an ocean current, the area fronting the ocean current is called the face. The head is the distance between the top of the OCG and the surface.

The OCG includes an apparatus for generating power, comprising
- first, an open unit arranged to permit sea water to flow through it, and
- second, a closed unit which in use is substantially filled with a second fluid, arranged so that in use the flow of the first fluid through the first unit drives the flow of the second fluid within the second unit; the apparatus also includes a turbine to be driven by the flow of the second fluid within the second unit.

Scientific Principles:

The principles are well established. However survey of potential sites and there are special characteristics specific to each country deploying an OCG. A commercial OCG must be specifically built deployed to take into account the sea bottom, temperature, flow characteristics of the ocean current, salinity, etc.

Patent Process:

A patent has been filed in Singapore, UK and PCT. UK patent application is in the examination stage.