

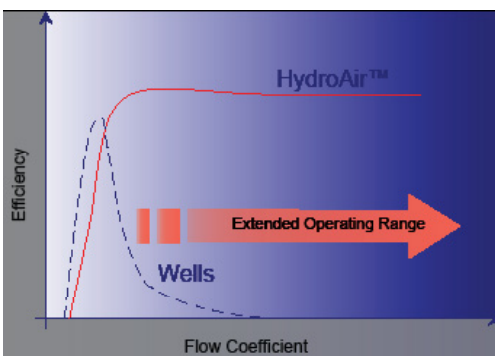
HydroAir™

Variable Radius Turbine

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Dresser-Rand is developing alternative energy sources, including marine renewable (wave) energy.
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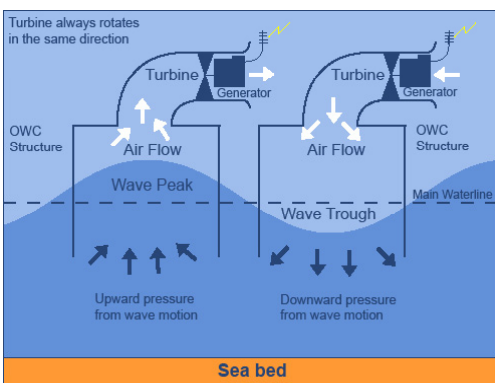
Oscillating Water Column Technology

Oscillating Water Column (OWC) technology is the most successful and extensively studied technology for extracting energy from ocean waves. OWCs can be located on the shoreline, nearshore or offshore. Incoming surface waves induce an oscillating flow of air within the chamber which, in turn, flows backwards and forwards through an air turbine installed in a duct connecting the chamber to the atmosphere. The turbine converts this air movement into electrical energy.



The challenge of OWC technology is to achieve satisfactory efficiency over a wide operating range, considering that the airflow not only varies between zero and 100 percent, but also changes direction (shaft rotation must also be maintained in the same direction).

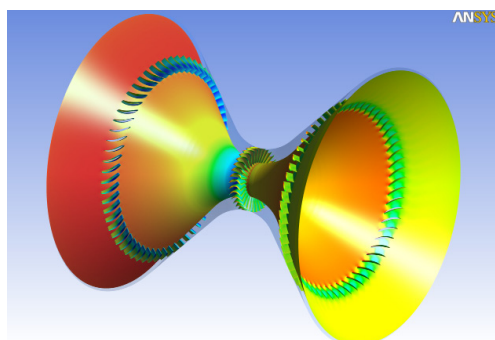
Dresser-Rand has patented a Variable Radius Turbine (VRT) called HydroAir. The turbine is constructed to withstand the rigors of a marine environment using a combination of stainless steel, aluminium and reinforced composites to resist corrosion. In addition, it offers the following benefits when compared to other turbines being used for wave energy capture:



- Above average efficiency
- One moving part - the rotor
- Lower rotational speeds than competing turbines
- Currently designed up to 500 kW
- Wide operating range
- Self-starting
- Reduced noise

The VRT design comprises two sets of static guide vanes located on either side and of a larger diameter than that of the rotor. These vanes are connected by a shaped duct to provide a route for the (inlet/outlet) airflow. Air enters the duct at a relatively low velocity and acquires a swirl motion as it passes through the inlet guide vanes. The air then accelerates as it passes down the narrowing duct towards the turbine rotor. The air drives the rotor, and then decelerates as it travels back through the expanding duct before passing over the outlet guide vanes. The process is repeated (in reverse) for the next wave cycle.

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■ *Oscillating Water Column Device.*



In comparison with both Wells turbines and conventional impulse turbines, the HydroAir turbine solution offers a step-change in efficiency and operating range. The HydroAir turbine achieves its remarkable performance with fixed blade geometry, providing the reliability that is critical to the commercialisation of wave power.

For more information on Dresser-Rand's **HydroAir solutions**, please contact us at the following location:

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www.dresser-rand.com

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Providing Clients With Total OWC-based Solutions

Ocean Energy

Early in 2010, Dresser-Rand and Ocean Energy Ltd signed a developemnt and supply agreement to match the chamber and turbine design for Ocean Energy's wave energy conversion device. The HydroAir package will include the turbine, generator and power electronics and provide a complete Power Take-Off (PTO) solution. By combining their technologies and expertise, Dresser-Rand and Ocean Energy will provide total OWC-based solutions backed by Dresser-Rand's global service network, and clients will gain a high level of confidence in the emerging wave energy market.

Ocean Energy Ltd is a specialised commercial company that develops wave energy technology. The company has spent the last seven years developing and testing its OE Buoy technology. The technology boasts a robust practical design, with one moving part and proven survivability (having withstood more than two years of live sea trials in Atlantic waves). Ocean Energy's location is well suited for its research and development work, as Ireland is centrally located in one of the world's most favourable climates for wave energy power.

Oceanlinx

Oceanlinx is a leading international company in the field of wave energy conversion. The company has developed proprietary technology for extracting energy from ocean waves and converting that energy into electricity or using it to provide desalinated potable grade water from sea water. Oceanlinx has designed and deployed wave energy systems since 1997, to remain at the leading edge of marine renewable technology development.

Oceanlinx has recently deployed the latest version of its technology, the MK3PC, at Port Kembla, south of Sydney, Australia. The unit has been successfully grid connected and is providing consumer quality electricity to Integral Energy, the local energy retailer. The MK3PC is based on the oscillating water column concept and utilizes two different air turbines - the latest version of the proprietary Oceanlinx turbine and the Dresser-Rand VRT. Oceanlinx has worked in cooperation with Dresser-Rand to ensure the successful integration of the VRT into the MK3PC.

Development Partners

Dresser-Rand

Dresser-Rand is among the largest suppliers of rotating equipment solutions to the worldwide oil, gas, petrochemical and process industries. The company operates 12 manufacturing facilities in six countries, and has a service and support network covering more than 140 countries.

Converteam

Converteam is the UK's largest independent supplier of electrical systems to the renewables industry, delivering more than 3GW of power conversion systems annually to wind turbine builders alone. Converteam's offshore and marine experience is not only in merchant and naval vessels and oil and gas platforms, but also as the electrical system supplier to OSPREY and the original LIMPET OWC devices in the 1990s.

Cranfield University

Cranfield's mission to transform knowledge into ingenious solutions in science, technology and management places it at the forefront of some of the world's most practical, cutting-edge projects. Cranfield has a global reputation for inspirational teaching and research, industrial-scale facilities and superior links with industry and commerce. Its areas of expertise are aerospace, automotive and motorsport, defence, engineering, health, management, manufacturing, environment, and water.