Marine Energy

Highlights

- **PROCESS AND TECHNOLOGY STATUS** – Ocean energy encompasses a number of very different technologies that exploit a diverse range of marine energy sources including: Wind-driven waves; Tidal ranges (tidal barrage); Tidal stream (marine currents); Marine thermal energy (conversion), OTEC; and Salinity gradients. Technologies to exploit OTEC and salinity gradients are not addressed in this overview as they presently have a lower level of R&D focus worldwide. Most ocean energy technologies consist of new concepts under demonstration. Power generation from tidal-range barrages is the most known and proven marine technology that has been working reliably in a small number of power plants with a combined capacity of about 500 MW (including the 254-MWe Sihwa tidal barrage in South Korea). Marine wave and tidal stream technologies are in a stage of development similar to that of the wind industry in the 1980s, and commercial systems could become available between 2015 and 2025 (SEI, 2005).

- **Wave power** – Wave power generation is based on the exploitation of the wind-driven wave energy. The best wave conditions for wave power are found at higher latitudes (away from the equator), with typical conditions of a deepwater power density of 60–70 kW/m of wave crest length declining to 20 kW/m near the shore (Figure 1). About 2% of the world’s 800,000 km of coastline exceeds a power density of 30 kW/m, with a technical potential of about 500 GW based on a conversion efficiency of 40%. The United States alone holds a technical potential of approximately 100 GW (PG&E, 2009), the United Kingdom has an estimated potential may be well below the technical potential (IPCC, 2007). There is a variety of wave energy technologies, resulting from the different ways in which energy can be absorbed from the waves, and depending on plant location (shoreline, near-shore, offshore) and water depth. A recent review (Falcão, 2008) identified about 100 projects with various working principles and different levels of development. On the basis of the working principle wave energy projects can be grouped as: a) Oscillating Water Column (OWC) systems, which use a pneumatic chamber and air turbines (Figure 2), and include onshore plants (e.g. Pico Plant in Azores, www.pico-owc.net and Limpet), near-shore plants (e.g. Mutriku, ...

Fig 1 - Global Wave Energy Flux Distribution (Hagerman, 2005)