Oscillating Water Column

An Oscillating Water Column (OWC) is a shoreline device and consists of an inclined concrete cylinder that uses the natural motion of ocean waves to compress air within the column and drive a turbine, similar to a piston compression cycle. The OWC design usually employs a Wells Turbine which has the unique ability to rotate in the same direction despite the direction of air flow (in the case of both compression and decompression cycles).

The OWC has an interesting design that can be utilized both onshore or in deepwater offshore sites. There are compromises existing between the two designs. Offshore OWC’s can exploit the greater potential of higher waves, but energy would also be lost through shoreline transportation. Also, it is shown that Oscillating Water Columns are optimized when the column is stationary and to anchor a concrete device offshore would imply higher capital costs. It is theorized that shoreline OWC’s are currently the most sensible designs.

The LIMPET (Land Installed Marine Powered Energy Transformer) is a successful OWC project that was constructed on the shores of Islay by Scottish company WAVEGEN. LIMPET (also known as LIMPET 500) built a full scale production plant from the design of a 75 kW model. The actual production plant is rated at 500 kW. This is a good example of how ocean energy can meet local energy needs. The energy resources are analyzed below.

The capacity of LIMPET is estimated at approximately 40%, therefore:

\[ 500 \text{ kW} \times 8760 \text{ (hours/year)} = 4380000 \text{ kWh of electricity can be produced each year from LIMPET, and} \]

\[ 4380000 \text{ kWh} \times 0.40 = 1752000 \text{ kWh of electricity are actually produced annually from LIMPET} \]

\[ 1752000 \text{ kWh} \times \left( \frac{\text{annual household consumption}}{4377 \text{ kWh}} \right) \]

By these calculations and as assumptions, it is estimated that LIMPET can provide sufficient energy for 400 households. Making another assumption of 4 persons per household, LIMPET could fulfill the home energy needs of over one third the population of Islay!

References

http://www.esru.strath.ac.uk/EandE/Web_sites/01-02/RE_info/wavecase.htm