C-09: Wawe as an ocen energy harness system

T D K Tennakoon
Oceanography Div., National Aquatic Resources Agency (NARA), Colombo 15)

There are several sustainable alternative energy sources available in the world. Ocean is one of them. Oceans have large energy potentials. Electricity could be produced from Ocean waves, Currents, Tides, Temperature difference in the water column. Salinity difference in the water column, Biomass. Among those the most reliable sources are Tides, Temperature difference (OTEC) and Waves. There are commercial Tidal plants already available in the world. Good results are coming up from experimental level OTEC plants. Wave power plants are being developed, NARA has initiated work on Ocean wave energy potential.

A study was undertaken along the coastal line from Weligama to Palatupana to select suitable sites for further investigations. Three locations were selected as suitable sites for the Oscillating Water Column (OWC) type plant by considering several criteria (coastal morphology, bottom morphology, social needs, wave patterns)-Palatupana, Bundala and Unawatuna. Palatupana point was located inside the Palatupana saltern. This is a rocky point with sharp facing to sea. Bundala point is close to Hambantota and situated inside the Bundala saltern. This point is almost similar to Palatupana. Unawatuna point is a creek in the Rumassala range toward the famous Welle devalaya. Every point was visited monthly to measure beach profiles, wave characters and other parameters. Wave characters were measured by the converted tide gauge. Wave heights and periods were measured during the monsoon every 15 sec every hour and in the intermoonsoonal period, 15 sec every 2 h. Beach profiles were measured only at Palatupana and Bundala using Survey equipment.

Physical model of Unawatuna point was prepared (1:250) scale. It was a 6' x 4' x 1' water tank. The wave producer was located at one end. Three OWC plant models were prepared with different approaching channels (a relationship between inlet and outlet b/B) Waves generated on a

Wave producer come up to the channel. Appearance of the approach channel was the opportunity to concentrate wave energy. Pressure at the inside of the plant will be increased due to the water oscillation (waves). Pressure was measured by the pressure meter. Relationship between approach channel angles and the plant capacity was determined.

The following parameters were measured during the laboratory experiments. h-Wave heights- Wave height measured by specially prepared scale. Three scales were placed in one line parallel to the wave producer. T-Wave period was measured by a stop watch. H-The Oscillation height of the water column (OWC) inside the model was measured by scale as well as pressure meter. The Graphic method as well as computer programs were used for analysing data. To get the relationship between, h-wave height, T-wave period, b/B-relationship between approach channel inlet and outlet widths, H-Oscillation height inside column, the following mathematical calculations were used.

$F=f(pgh, \lambda Td, b/B$.....1.0

where F-Wave force, λ-wave length, p-water density, g-gravity force, b/B- relationship between approaching channel inlet and outlet widths, T-wave period. D-water depth.

After calculations 1.0 could be

$$\frac{F}{pghD^2} = f(h/\lambda, T/\lambda, d/\lambda, bB\lambda, D/\lambda \text{.....2.0}$$

Following steps were taken to find out optimum values:

1.0 Graphs between F and h/λ , F and T/λ in different values of b/B

2.0 Three points from each graph were selected and graphs prepared between F and D/λ ,
F and D/λ , on three different values of b/B.

3.0 Maximum points were selected and N and b/B graph drawn.

The results illustrated that wave force inside the OWC and plant capacity directly depend on the appearance of approaching channel. The maximum plant capacity could be ranged between b/L_1 within - 0.4 - 0.7. The plant maximum output could be ranged between b/B - 0.3-0.6. This combination will increase 20% of plant capacity. These results could be used for the OWC plant designs. The proposed Unawatuna point plant capacity on these results could be during the monsoon season 75KW and inter monsoon season 20KW. For the pilot plant this capacity would be sufficient.

A grant from NARESA is acknowledged