EVALUATION OF THE ECONOMY, POWER WAVE ON THE BEACH TEGAL

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ABSTRACT

Observing power of wave on sea shore Tegal, found by searching for velocity, frequency and height of wave on beach Tegal. The average value of speed is 0.15 m/s, frequency average 0.17 Hz and maximum height average 0.60 m. These data describe coastal condition that the values are too low, to generate electric power from mechanic power of wave.

We have been doing to raise the velocity and height of wave by a method of tapered channel. It can raise up the value of wave height from 0.5 m to 2.2 m. The electricity power of wave from 15.4 Watt/m^2 can be increased becoming 25 – 50 Watt/m^2. Evaluating economically electric power of wave is begun from the value of wave power per m^2 to per 4 m^2. If we need a electric power 100 Watt, the area of sea shore is needed four metres square.

Developing on beach economically by generating the electric power from wave of sea, built in the out area of harbor, so that all fisherman remain to do the effort arrest of fish properly. Base on research result of theory, wave power is function of wave speed that represents linear graph. However in the result of research, wave power is function of wave speed that represents hyperbolic graph. It means wave energy of sea increasing speed of wave. By using method of sharp-pointed channel to catch wave, speed of wave will become higher. Economically, result of wave research to yield the power of wave and frequency of wave. Economic aspect with evaluating energy of wave obtained and the technological aspect with evaluating wave frequency which got.

Keywords : wave power on beach, electric power from wave of sea, blue economic concept on the area of beach.

1. INTRODUCTION

In the beginning we are interested in the economic development of the concept of the blue coastal regions, because this area consists of land and Ocean Beach, there are natural phenomena that occur in the sea; the energy waves reach the coast and windy. The wind is blowing from the land out to sea at night and the wind blows from the sea to the land during the day. The wind blows from high pressure to low pressure. Ocean surface waves is influenced by surface winds. Two natural events that wind and waves, which cause wanted to know about wind energy and wave energy in coastal areas. Research has been carried out, focused on shallow water waves in coastal areas. The purpose of this study, to know the power of the waves to the shore. These data, then used to calculate the electrical power generated from waves of mechanical power. Research findings in the form of electric power value of ocean waves, were evaluated to obtain the blue economy concept in coastal areas.

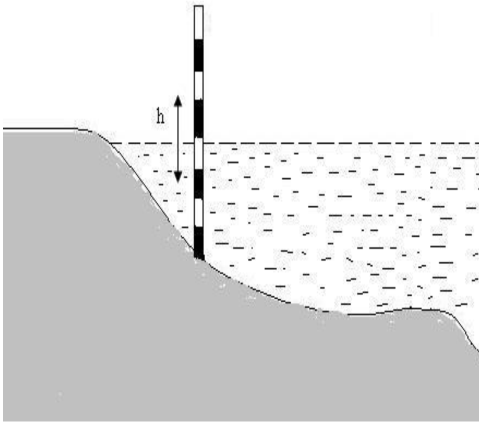
2. RESEARCH METHODS

2.1 Place and time of study

The first study to obtain data waves on the beach Tegal, conducted from June - September 2010 during the hours 11:00 to 13:00 pm. A second study at the beach Tegal, Friday, July 13, 2012 at 14:25 to 15:30 pm. The third research Friday, dated March 1, 2013 at 16:00 to 16:30 pm.

2.2 Frequency and Height of the waves

The first time, we define a point on the sea coast, which is a representative conditions for calculating the frequency and wave height. At that point, placed piles centimeter scale.



Setting up a stopwatch, a pen and study worksheets to record the height and frequency of waves. By using the equation :

$$f = \frac{n}{t}$$

Where: n = number of waves
t = the length of the waves of the powerboats (s)

f = the frequency of the waves.

To change the unit of Hertz became a Rotation Per Menitues:

1 second = $\frac{1}{60}$ minutes

$$f = \frac{n}{t}\, x\, 60 \text{ rpm}$$

$$H = H_{maks} - H_{min}$$

where :

f = frequency waves (Hz)

H = wave height (m)

H_{maks} = peak wave height (m)

H_{min} = height of wave valley (m)

2.3 Speed of Waves

Measurement of wave speed (v) there are two types of rate waves vertically and horizontally the wave speed. The rate of the waves vertically is done by noting the number of waves on a specific time interval and the amplitude of the waves at one point powerboats. The rate of the waves horizontally by measuring the number of waves on a specific time interval and amplitudonya on two points of powerboats. For shallow water, wave speed can also be obtained by measuring the h (the depth of the sea waters where wave propagates). Wave speed calculated using the equation: v = $\sqrt{gh}$, where g is the gravitational acceleration of the Earth.

Determine the speed of the waves at one point, we call vertical speed:

$$v = 2\pi f H$$

2.4 Wave Power

Energy (per unit area) of a sinusoidal wave depends on the density ρ, the gravitational acceleration g and the wave height H (which is equal to twice the amplitude, a):

$$E = \frac{1}{8}\rho g H^2 = \frac{1}{2}\rho g a^2$$

For shallow waters, comparisons h (depth) by λ (sea wavelength),

$\frac{h}{\lambda} < \frac{1}{20}$; the power per square meter of wavefront:

$P = \frac{1}{8} \rho g H^2 v$

P = wave power (W/m^2)

2.5 Tapered Channel

Waves coming at the entrance "tapered channel", fulfilling the law of conservation of mass.

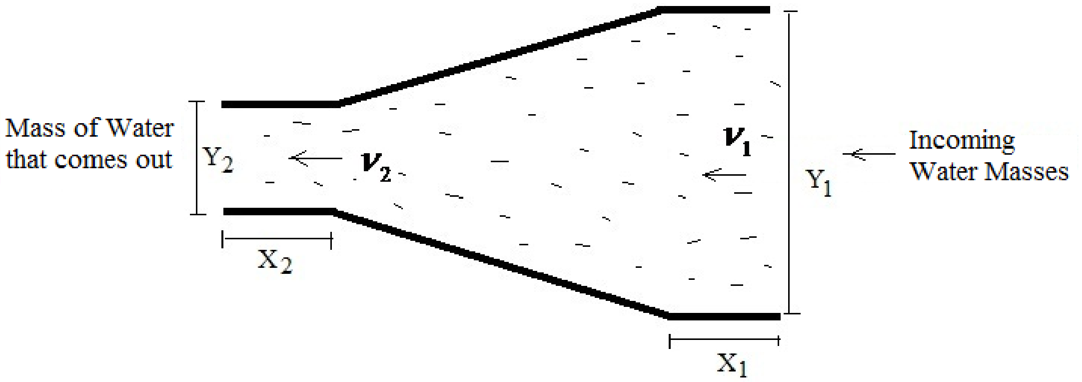
Σ incoming water masses = Σ water mass exit

$\rho = \frac{m}{V} \rightarrow m = \rho.V$

V = A.h

A = X.Y

ρ = the density of liquid (kg/m^3),
m = liquid mass (kg),
V = liquid volume (m^3).
A = cross-sectional area = length (X) times width (Y) "tapered channel" (m^2), h = wave height (m).



3. RESEARCH RESULTS

Economic evaluation of electric power using a shallow water wave formulation:

$$P = \frac{1}{8} \rho g H^2 \sqrt{gh} = \frac{1}{8} \rho g H^2 v$$

where :
H = wave height (m)
h = depths of ocean waters (m).
Assumptions : ρ = 1026 kg/m^3, g = 9.81 m/s^2, 1 kWh = Rp. 793; if the cost of usage per day 8 hours, then to 240 hours a month, so the cost of 1 month of use 1 kWh of Rp. 190320.
Calculation of wave energy usage fee per month, using the formula:

$$P = \frac{W}{t}$$

W = P.t
where :
P = wave power (kW)
t = time usage (hours)
W = wave energy (kWh)

Table 3.1 Wave Energy Consumption Cost per Month

Nu.	H (m)	v (m/s)	P (kW/km)	Cost of sales per month
1	0.3	0.2	22.6	Rp 4,310,059.99
2	0.4	0.3	60.4	Rp 11,493,493.32
3	0.5	1.2	377.4	Rp 71,834,333.22
4	1	1.5	1887.2	Rp 359,171,666.10
5	1.5	2	5661.6	Rp 1,077,514,998.30
6	2	2.5	12581.3	Rp 2,394,477,774.00
7	3	3	33969.6	Rp 6,465,089,989.80

For ocean areas with an area of 1 square kilometer, if we take the assumption of no state grain waves. 1 in Table 5.1, the energy of ocean waves to generate electricity:

P = 22.6 kW/km

If a set of wave power plant to cost Rp. 5,000,000.00 (five million dollars), then for 1000 sets of wave power plant will cost Rp. 5,000,000,000.00 (five billion rupiahs). While the selling price per 1 kWh electricity is Rp. 793.00 (seven hundred and thirty three rupiahs). Thus in point 1 Table 5.1, the selling price of electrical energy of 22.6 kW / km multiplied by Rp. 793.00, has a sale value per hour is Rp. 17921.8 kWh / km. If the daily electrical energy consumption an average of 8 hours, then for one month is Rp 4,310,059.99. For the year amounted to Rp. 51,614,784.00.

Table 3.2 Sales Price Wave Energy Use by Theory of Oceanography

NO.	H (m)	E	v (m/s)	P (kW/km)	Making prices	Selling price / year	N (year)
1	0.3	113.2	0.2	22.6	Rp 5,000,000,000	Rp 51,614,784	96.87
2	0.4	201.3	0.3	60.4	Rp 5,000,000,000	Rp 137,943,936	36.25
3	0.5	314.5	1.2	377.4	Rp 5,000,000,000	Rp 861,921,216	5.80
4	1	1258.1	1.5	1887.2	Rp 5,000,000,000	Rp 4,310,062,848	1.16
5	1.5	2830.8	2	5661.6	Rp 5,000,000,000	Rp 12,930,188,544	0.39
6	2	5032.5	2.5	12581.3	Rp 5,000,000,000	Rp 28,733,676,192	
7	3	11323.2	3	33969.6	Rp 5,000,000,000	Rp 77,581,131,264	

In Table 3.1 obtained in item 1-3. wave height 0.3 m - 0.5 m. If this study used methods tapered channel. the data obtained in Table 3.3 point 2. from a height of 0.5 m to 2.2 m height. We note that the power generated in Table 3.2:

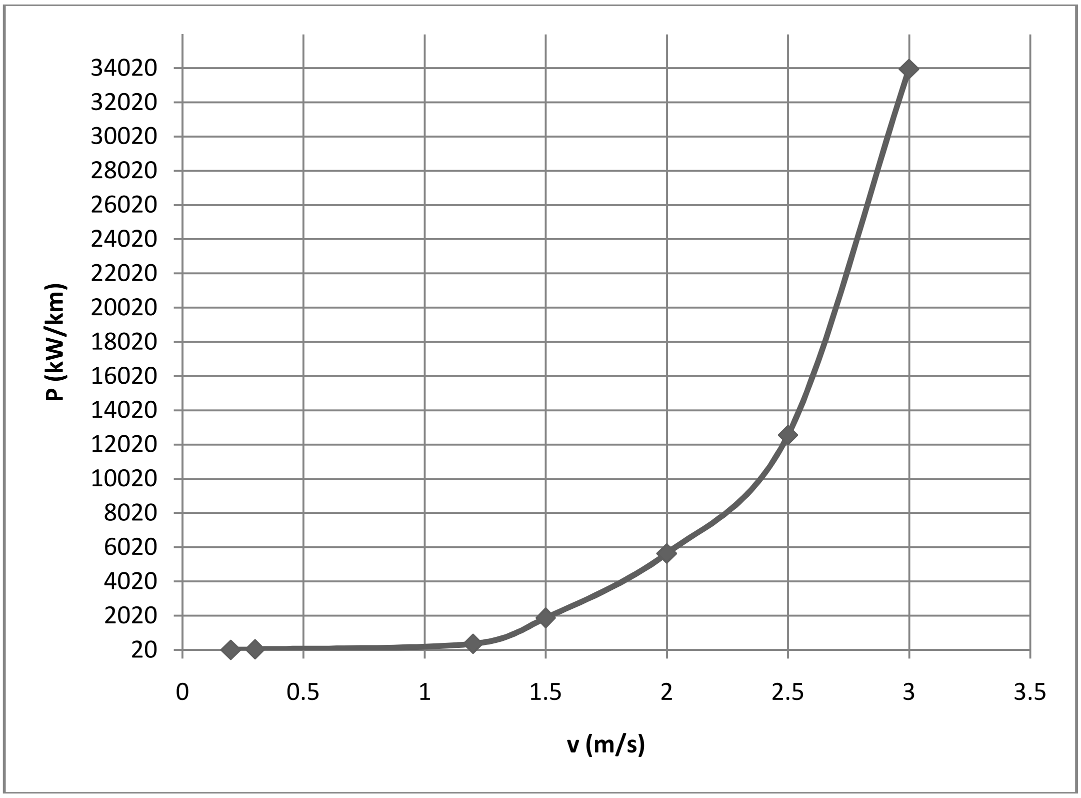
H(m)	v (m/s)	P (kW/km)	Making prices	Selling price / year	N (year)
1	1.5	1887.2	Rp 5,000,000,000	Rp 4,310,062,848	1.16
1.5	2	5661.6	Rp 5,000,000,000	Rp 12,930,188,544	0.39
2	2.5	12581.3	Rp 5,000,000,000	Rp 28,733,676,192	

Tabel 3.3

WAVE HEIGHT DATA ESTIMATES

USING TAPERED CHANNEL

NO	X_1 (m)	Y_1 (m)	H_1 (m)	X_2 (m)	Y_2 (m)	H_2 (m)
1	0.5	2	0.55	0.5	0.5	2.2
2	0.5	2	0.54	0.5	0.5	2.2
3	0.5	2	0.62	0.5	0.5	2.5
4	0.5	2	0.49	0.5	0.5	2.0
5	0.5	2	0.58	0.5	0.5	2.3
6	0.5	2	0.64	0.5	0.5	2.6
7	0.5	2	0.65	0.5	0.5	2.6
8	0.5	2	0.7	0.5	0.5	2.8
			0.6			2.4



4. CONCLUSION

1) Power wave formulation is based on the speed of the wave function. a linear graph. which means the energy of the waves increased in a linear wave speed. Obtained in studies on the rate of wave power wave is a function of hyperbole. This means following the formulation of wind power which is a function of the cube of the wind speed.
2) Two factors are used in the evaluation of the economic and technological power of the waves and the frequency of the waves. are the two parameters to be used in planning for marine energy conversion devices to electrical energy.
3) Based on the concept of math and physics calculations using the Tapered Channel. 0.5 m high waves can be 2.2 m.
4) Electrical energy can be obtained from wave energy (wave energy) with the provision of power and frequency of waves capable of moving equipment and dynamo with rpm (rotations per minute) is sufficient to obtain electricity.

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