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Abstract

Studying The Achievable Tidal Energy In South Coastal Zones Of Iran

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The energy produced via tide, on the contrary of which, produced by fossil fuels like oil and coal is renewable and everlasting.

On the other hand it has no any environmental pollution.

In this paper, we will concentrate on the potential of achievable tidal energy in south coastal zones of Iran due to head difference during tide.

Using the tidal energy in a small scale has a long history. The tidal mills are symbols of using tidal energies, which from many centuries ago has been customary in some countries.

The French tidal power plant called La Rance build in 1966 with a capacity of 240 MW is the first and the most modern project in achieving energy via tide.

The forces, which are the origin of tides, are mainly from celestial bodies.

They are due to mutual attraction between moon with earth or sun with earth.

The influence of other celestial bodies on tides could be neglected.

According to the Newton law the mutual attractive force between moon and earth or sun and earth can be obtained via the following formula.

$$F = G \frac{M_1 M_2}{L^2} \quad (1)$$

Which

M1 = Mass of moon or sun

M2 = Mass of earth

G = the world attraction constant

L = distance between the centers of moon and earth or sun and earth. As we know from the principals of the movements of moon and earth : First, the movement of moon and earth is periodic.

Second, The tide phenomenon, which we can observe in nature, is periodic.

For analyzing the tide we have to decompose the tidal spectrum.

It is essential to decompose the tidal spectrum (water level against time) into the harmonic components, in order to predict the tide.

The tractive force of tide has a direct relation with water level, on the other hand, we can consider water level as a set of harmonic components in each place. Therefore we can write a similar equation like tractive force of tide for water level.

As the measurement of tide in coastal zones of Iran is strange, and just in a few years ago regular measurements has been done, therefore in an artificial way the tidal levels has been produced by the help of a made software, for this purpose.

The potential energy of tide in a basin with area of S from full water level until the ebb flow, which the water level is the lowest, can be calculated according to this formula.

$$S \int_0^{2H} \rho g Z dZ$$

Which

H is the tidal amplitude

ρ is the water density

g is the gravitational acceleration

Therefore the total achievable potential energy in a tidal period is $4S\rho gH^2$

The average rate of producing energy is $4S\rho gH^2/T$, which T is the period of tide.

Values of tide in a place for 5 years has been calculated and averaged. At the end, the potential energy in a tidal period in watt-hour per square meters has been calculated.

According to available tidal constants which are needed for prediction tide in a place, the potential energy values, as well as potential power for 36 places of south coast of Iran will be presented.

The conclusion is that the Mahshahr port and Shahid Rajace port as well as Laft in Qeshm have a relatively big power in order to obtain energy from tide.