

UDC 621.472:662.997

STUDY OF WAVE POWER PLANT ON THE NORTHEAST COAST OF THE ABSHERON PENINSULA

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The article deals with the study of Wells turbine in accordance with the wave energy potential of the northeastern coast of the Absheron Peninsula. Show a methodical approach to determine the main technical parameters of the turbine Wells. In accordance with the procedure were the main parameters of the Wells turbine, including efficiency and productivity.

Keywords: wave energy, Wells turbine, Absheron Peninsula, Caspian Sea coast

Amidst alternative energy sources one of the most perspective field is wave energy. According to its own potential, durability, coverage scale wave energy differs from other renewable energy sources with some positive characteristics. Wave energy can be obtained in two directions so as both hydrodynamic and aerodynamic. For comparison 1 MW hydrodynamic wave energy plant is 4-5 times more expensive than the wind energy plant having the same capacity so, its cost consists of 12-14 million €. At the same time the wave energy device value is more times cheap than mentioned one. In the course of wave energy application some technical and technological difficulties appear. So, waves distinguish due to their direction, amplitude, phase, speed. In such difficult condition regular working of sea wave device and invariable electricity are not easy but optimal variant is able to be defined on the base of several measurement. Thus and so in any external situations the appropriate construction and working details ought to be acted. Averagely wave amplitude increases more than 10 times after each 40-50 years. Taking into consideration these showings, projecting wave energy device construction should be permanent against the permissible load more than 100 times. There's a great deal of potential for using wave energy in the Caspian Sea coastline, mainly Absheron peninsula shore. In the southern coast of Absheron average annual height for sea wave is 1-2 m and in the north-

ern coasts that is 1,5-2,5m. Along the Azerbaijan shoreline of the Caspian Sea average annual height of the wave sometimes consists of 8-10 m [1, 2]. Building and exploitation of devices based on sample construction for this area is advantageous from technical point of view. One of such devices is Wells turbine that having high aerodynamic characteristics, one direction rotation during forward and back wave movement, resistibility in any meteorological situation and being effective energy transformer. All features of the facility are suitable for the natural climate condition on the Caspian Sea. Therefore this makes too great interest in order to apply the plant here. Up today many researches and tests have been done for improving Wells turbine [3, 4]. Thus, to the realized tests and researches mainly on the Northern sea coast so, England, Denmark, Germany and other European countries testing and experimental investigations are being carried out. The main parameters of Wells turbine 3 disproportionate ratios are to be determined due to the following method:

Theses disproportionate ratios are pressure Ψ , curling moment of the device Π and efficiency η and are defined as [3]:

$$\Psi = \frac{\Delta p}{\rho_h \omega^2 r_t^2}$$

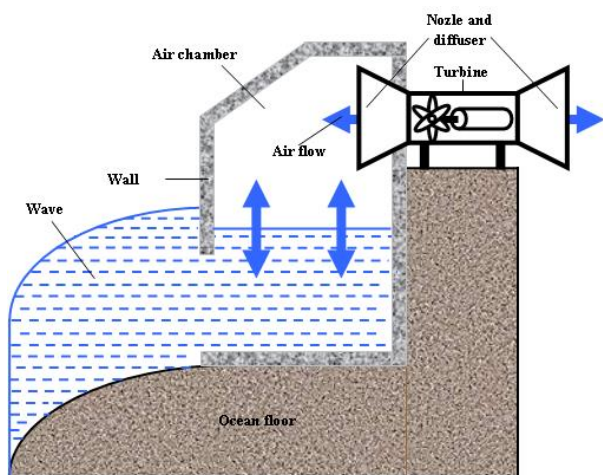


Fig. 1. Principal scheme of Wells turbine

$$\Pi = \frac{T}{\rho_h \omega^2 r_t^5}$$

$$\eta = \frac{T\omega}{\Delta p Q}$$

Here Δp - pressure drop in the turbine; ρ_h - density of the air; ω - turbine rotation speed; r_t - turbine rotor radius; T - turbine curling moment; Q - capacity constant of the air passing through the turbine.

Efficiency of pressure drop during Wells turbine action, curling moment and dependence of these showings on the turbine consumption constant has been determined. Taking into consideration maximum, average and minimum indexes of the both pressure changing and curling moment dependences were obtained.

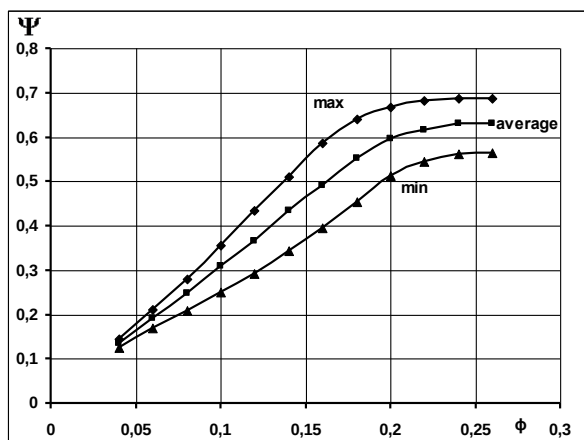


Fig. 2. Dependence of pressure changes from coefficient of discharge in Wells turbine

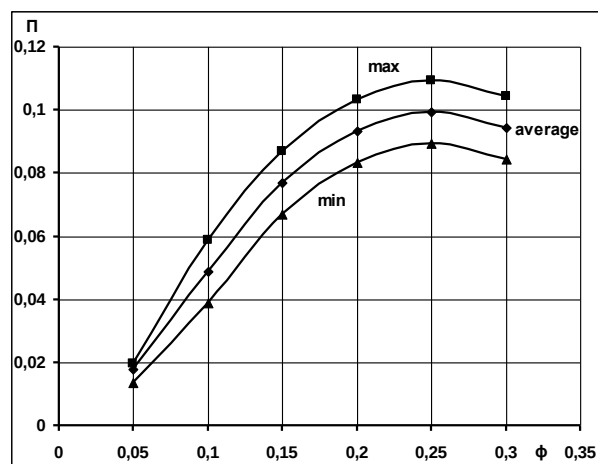


Fig. 3. Dependence of torque shaft from coefficient of discharge in Wells turbine

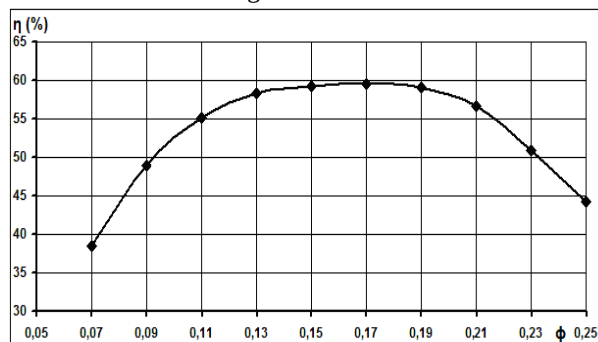


Fig. 4. Dependence of efficiency from coefficient of discharge in Wells turbine

In several natural conditions, depending on none of the season pressure drop in the turbine is difficult to be defined. Naturally stochastic position, so none-stationary regime exists, therefore the average showing is to be taken.

For determining turbine pressure drop the following equation is used [4]:

$$\Delta p = \frac{\Delta p_0}{\rho_h \omega^2 r_t^2}$$

Here, Δp_0 - constant pressure drop happening along the turbine.

Expenditure coefficient and suitable curves to this coefficient are defined by the next equation [5,6]:

$$\phi = \frac{V}{\omega r_t}$$

Here, V - stream speed appearing on the central axe in the turbine is measured by the ratio of the total stream capacity Q speed, cross-section square A_t of the circular canal.

$$V = \frac{Q}{A_t}$$

Due to these calculations, it's possible to say that depending on the air stream speed, pressure drop can be determined.

According to the reference [1] showings dealing with the northern-east coast of Absheron, initially taking into consideration existing technical parameters of Wells turbine with 10 kW powers, by the purpose of efficiency of the device output strength defining following the above method dependences have been obtained.

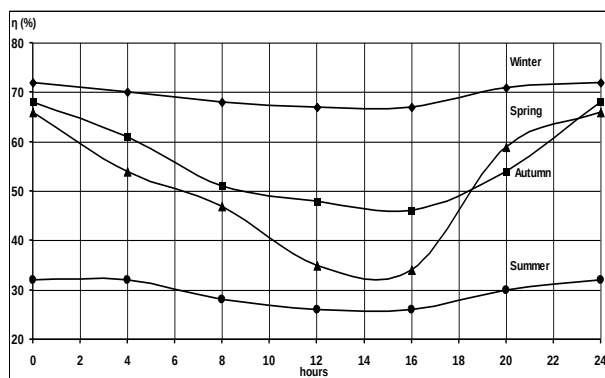


Fig. 5. Dependence of efficiency from daily hours of seasons of Wells turbine

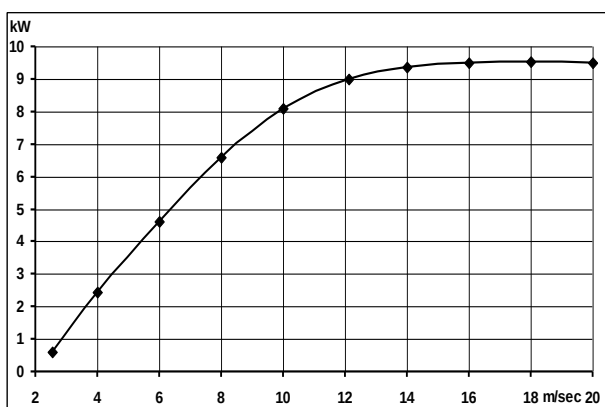


Fig. 6. Dependence of power of Wells turbine speed of air flow

As seen from the fig. 5, the most advantage of Wells turbine efficiency occurs in winter but lest one happens in summer. Autumn and spring seasons' efficiency practically equals.

In comparison with the decreasing windy days amount in spring, strong windy days appear beginning from autumn efficiency is gradually increases.

As seen from fig. 6 depending on the air stream speed happening in nozzle and difusser of Wells turbine, changing curves of the device output strength is shown.

In 0-10 m/sec index of the air stream in nozzle and difusser output strength acts probably rectilineel but in 10-20 m/sec index it is relatively stable.

As the result of the study, we should mention that the highest potential of the Caspian Sea is on the northern-east coast and profitable for Wells turbine by technical and economical point view. Initially as the pilot project devices with 10-20 kW power may be applied in this aerae.

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**ABŞERON YARIMADASININ ŞİMAL-ŞƏRQ SAHİLİNDƏ DƏNİZ DALĞA ENERJİ
QURĞUSUNUN TƏDQIQI****T.Ş.Salavatov, F.F.Məmmədov**

Məqalədə Abşeron yarımadasının şimal-şərq sahilinin dəniz dalğa enerji potensialına uyğun olaraq, Uels turbininin tədqiq edilməsinə baxılır. Uels turbininin əsas texniki göstəricilərinin təyin edilməsi üçün metodiki yanaşma göstərilmişdir. Metodiki yanaşmaya əsasən Uels turbininin əsas parametrləri, o cümlədən səmərəliliyi və məhsuldarlığı təyin edilmişdir.

Açar sözlər: dalğa enerjisi, Uels turbini, Abşeron yarımadası, Xəzər sahili

**ИССЛЕДОВАНИЕ ВОЛНОВОЙ ЭНЕРГЕТИЧЕСКОЙ УСТАНОВКИ НА СЕВЕРО-ВОСТОЧНОМ
ПОБЕРЕЖЬЕ АБШЕРОНСКОГО ПОЛУОСТРОВА****Т.Ш.Салаватов, Ф.Ф.Мамедов**

В статье рассматривается исследование турбины Уэльса в соответствии с волновым энергетическим потенциалом северо-восточного побережья Абшеронского полуострова. Показан методический подход для определения основных технических показателей турбины Уэльса. В соответствии с методикой были определены основные параметры турбины Уэльса, в том числе, эффективность и производительность.

Ключевые слова: энергия волн, турбина Уэльса, Абшеронский полуостров, Каспийское побережье