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Original Contribution

POWERING OF WATER PUMPS BY ALTERNATIVE ENERGY SOURCES IN THRACE REGION

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ABSTRACT

Of the 20,000km^2 field in Thrace region 1.24 million hectares are convenient for agriculture and 1.05 million hectares can be irrigated. The main water sources of the region are the Rivers Arda, Meriç and Tunca, as surface and underground waters, with annual capacities of 8.3 billion m^3 and 337.5 million m^3 respectively. A large amount of the water is used for irrigation, drinking, and industrial purposes. A great part of the irrigation is done with irrigation pumps. The total national power generated from upper surface pumping in agriculture is 9750 kW; the yearly energy consumption is approximately 22.4 GW-h; the total power generated from the upper surface irrigation pumps is 11000 kW and the yearly energy consumption is approximately 25.6 GW-h in the irrigation season. The 1500 water wells in Trace region serve as sources for drinking. The total power of these wells is 18 MW, while they consume 130.4 GW-h energy a year. Because of high expenditures in running these pumps, the cost of the crops has consequently risen also; therefore the need for alternative energy sources became necessary. Energies from the wind and sun, with the appropriate pumps, would meet this alternative requirement. This new arrangement would bring down running costs and subsequently costs of agricultural produce.

Key words: Energy, wind, sun, pump, consumption, water

INTRODUCTION

1.05 million ha of the field that is convenient for agriculture in Thrace region can be irrigated. The amount of yearly average rain is 600 mm and this is lower than Turkey's average (1) In Thrace region 149,000 ha of field can be irrigated; this amount being 14 % of the total field, which can be irrigated (2). The sunflower, rice, corn, sugar beet and melon have been farmed in the irrigated field and wheat, barley, onion etc. have been farmed in the field that cannot be irrigated. Grains are not normally irrigated since they grow during seasons when this is not necessary. Though irrigation usually leads to 50% more grain production.

In the city of Edirne, with River Meriç as main water source, rice farming is usually done on an average of 2500 ha field yearly. The rice is a plant that has 1000-1500 mm more water necessity compared to the other plants (2). In the present fields that can be irrigated, 133,500 ha field is being irrigated by the upper surface water; 15500 ha field is being irrigated by underground water (2).

In the region, irrigation is being done by 636 underground water wells except the present 9 dams, 54 ponds (2). Approximately 650 million m^3 water from the upper surface irrigations and 25 million m^3 water from the underground wells are being used in the irrigation season (3). About 70 % of upper surface irrigation water is being done by pumps. 480 million m^3 pumped water is being used for irrigation in a year.

In Thrace Region, water for drinking and industrial purposes comes from the 1400 underground water sources; water for agricultural irrigation does not come from this source. Approximately 300 million m^3 water is being pumped from these wells in a year (4).

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THE WATER PUMPS USED IN THRACE REGION

So far the water pumps are powered by electricity. These pumps generate a total of 53.75 MW, while their annual consumption stands at 205.4 GW-h (5).

The centrifugal pumps have often been used and working intervals of these pumps are longer than the others. These pumps can work at high capacity but with limited output over time. In addition, maintenance of these pumps becomes a significant requirement for minimising energy losses. These conditions hence make it mandatory to source alternative energies, if the projects are to remain on course.

THE POTENTIAL OF ALTERNATIVE ENERGY RESOURCES IN THRACE REGION

The energy production and consumption of a country have a significant impact on its economic development. Resources like coal, petrol and natural gas, which are used to produce electrical energy, have become environmentally unfriendly, thus paving the way for efforts to source alternative energies. The alternative energy resources that are also defined as new and recovery energy resources comprise the following (6):

- The solar energy
- The wind energy
- The hydraulic energy
- The geothermal energy
- The biomass energy (plant and animal waste)
- The sea energy (sea wave, sea heat gradient, sea flows, tide energy)
- The hydrogen energy

The solar energy

Solar energy, which has not been considered until recently, has begun to assume widespread importance. It is now becoming an alternative to the resources like coal, petrol and natural gas. Turkey has a rich potential for solar energy with a 365-hour/month reception of this energy. It has the highest monthly total solar energy in July with 175. 38 kWh/m^2-month (7) (**Table 1**).

Table1. *Monthly Average Solar Energy Potential Of Turkey.*

Month	Monthly total solar energy		Period of time of getting sunlight (hour/month)
	kcal/cm^2 month	kwh/m^2 month	
January	4,45	52,75	103,0
February	5,44	63,27	115,0
March	8,31	96,65	165,0
April	10,51	122,23	197,0
May	13,23	153,86	273,0
June	14,51	168,75	325,0
July	15,08	175,38	365,0
August	13,62	158,40	343,0
September	10,60	123,28	280,0
October	7,73	89,90	214,0
November	5,23	60,82	157,0
December	4,03	46,87	103,0
TOTAL	112,74	1311	2640

From the point of view of period of time of getting sunlight and total solar energy, the richest region is Southeast Anatolia and the Mediterranean comes next. The period of time of getting sunlight in Thrace Region is 1911 hour/year in all. Like the statistic for Turkey, the highest amount of monthly solar energy has been in July with 280.86 hour/month in Thrace Region (8)(**Table 2**).

Table 2. *Monthly Average Periods of Time of Getting Sunlight In Thrace Region.*

Month	Period of time	Month	Period of time
January	48,36	July	280,86
February	71,63	August	253,2
March	110,05	September	213,6
April	163,5	October	141,67
May	218,55	November	93,0
June	248,7	December	67,27

The Wind Energy

Wind energy is increasingly gaining popularity. Wind turbine technology is becoming quite competitive with respect to environmental friendliness and running costs.

Studies by Electricity Works Research Management have determined that Marmara, Aegean and East Mediterranean Shore Regions are areas most favoured by wind energy potential. At present, 15 of the observation stations working in Turkey are in Aegean, Marmara and Thrace Regions (9). To produce the required energy of significant value, the wind velocity must be more than 2,2 m/s in 60 % of year (10)(**Table 3**).

Table 3*. The Average Values of Monthly Wind Velocity In Thrace Region.*

Month	Velocity(m/s)	Month	Velocity(m/s)
January	4,7	July	3,5
February	4,2	August	2,9
March	4,4	September	3,2
April	3,9	October	3,6
May	3,6	November	3,7
June	3,4	December	4,4

In Thrace Region, the average values of monthly wind velocity in the year 2002 placed the yearly average velocity at 3.8 m/s. This shows the potential for producing uninterrupted energy all year round.

CONCLUSION

In Thrace Region, increased irrigation, need for drinking water and growing industries, have caused a concomitant increase in the use of pumps. The consequential high running costs of these machines have rubbed off on the price of agricultural produce. In order to prevent this, pumps used for irrigation must be worked by electrical energy that will be obtained from sun or wind that are alternative energy resources, or must be worked by mechanical energy obtained from wind.

The storage batteries must be charged with sun collectors or wind turbines; the pumps worked by direct current must be worked by batteries. If pumps worked by alternating current will be used, these pumps must be used by changing direct current to alternating current through the use of inverters.

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