International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume :7, Issue:3-4, Year:2017, pp. 158-177

ANALYSIS OF RENEWABLE ENERGY RESOURCES FROM REGIONAL DEVELOPMENT IN EASTERN ANATOLIA REGION EXAMPLE

Zafer KANBEROĞLU[1,]

İbrahim Halil POLAT[2]

Abstract

One of the most fundamental problems of today's economies is the differences in the regional development. One of the most important instruments for eliminating developmental differences is the energy resources. Energy resources are divided into two parts: renewable and non-renewable. The risk of extinction in resources like non-renewable energy sources such as oil and natural gas has led economic structures to concentrate on the renewable energy sources such as wind and solar energy. In this context, renewable energy sources have become important factors both in macro and regional development. In this study, the role of renewable energy resources in regional development has been analyzed in the case of Eastern Anatolia Region. The empirical findings of the study show that both Turkey and the Eastern Anatolia Region have significant potential in terms of renewable energy resources, but these resources are not sufficiently utilized from.

Key Words: Development, Regional Development, Renewable Energy

JEL Codes: R58, L72, Q43

Introduction

Human has been in productive activities since the beginning of social life. The basic reason of this everlasting purpose is to live under

[1] Assoc. Prof., Department of Economics, Faculty of Economics and Administrative Sciences, Yüzüncü Yıl University, Van, Turkey, zkanberoglu@yyu.edu.tr
[2] PhD Student, Department of Economics, Graduate School of Social Sciences, Atatürk University, Erzurum, Turkey.

the most comfortable conditions. In this context, growth and development have been as the main economical motivation based on an aim to improve the production capacities of society as well as to spend efforts to eliminate differences and inequalities. One of the most important factors for economic growth is the energy which is the main component of production of goods and services. The need for energy has been met with various routes within the historical period. Earlier in this period, man power and animal power were able to meet most of the requirements; however, these means have been insufficient to meet current requirements in progress of time. The human, in search for alternative energy source, discovered fossil fuels like coal and oil which was followed by nuclear energy and consequently, has been able to meet energy requirements by using these sources. However, the mentioned energy sources bear a consumable property which lead societies to find renewable energy sources by also the impact of technological developments. Although the renewable energy sources seem to have a new name, they emerge from utilizing existing sources in the nature. Earlier, the renewable energy was obtained through simple tools and methods, in progress of technological developments, more energy has been able to be produced from these sources. The main reason that drives the human being into these energy sources is not only their being renewable but also their characteristic that protect the living environments. The energy sources in question are called eco-friendly technologies and become as one of the main component of maintainable developments which is dominating conception of development.

Renewable energy sources include hydraulics, solar, biomass, wind, geothermal, wave and hydrogen. Renewable energy sources are also utilized in Turkey as much as it is in the world. Of aforementioned sources, Turkey is one of the few countries in the world, especially in terms of solar energy. When Turkey is evaluated according to the regions, Eastern Anatolia Region stands out as the third sunny region. In this study, renewable energy sources in the Eastern Anatolia Region, constituted the main motivation, the situation on the utilization level and increasing of this level was analyzed.

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An Overview of Economic Development Concept

The financial concern of human has grown along with the growth of desires in size over time and this has led to emergence of the concept of economic development. With emergence of the economic development some semantic shifts have occurred that served different requirements of various societies; and this term has sometimes been with the concepts of industrialization, modernization, progression, growth, development, change, and even also substituted for them (Yavlioğlu,2002:71).

Post-World War II period could be indicated as a major example for this concept. The countries that had attained their independence after World War II, or those who had remained behind in the industrialization race, entered this race quickly; which in turn manifested itself in the development definitions of those countries as the basis for industrialization, and for all development ideas around the concept of industrialization.(Yaylı,2012:15)

Although the concept of development has been dealt with from divergent angles to date, it is generally seen that they keep the development and evolution at a common ground and centralize the human (Yavlioğlu,2002:15). Furthermore, although the definition of development was considered only from an economic standpoint earlier, over time the concept has made its way beyond the economic field; and which has expanded as a concept that include economical change and development of the social and cultural structures of the society besides financial production and national income (Keleş et al.,2005:46). The development view that is common today is the increase in purchasing power of the individuals will trigger the market as result increase the economic activity in the market which can prompt development of national income and individuals' economic status. Namely, the purpose of the economic development is to provide more goods and services to individuals despite the increase in population, thereby elevating the

living standards of the societies (Sarıkaya and Kara,2007:223). When dealing with the development concept, the process of the development should not be considered only in terms of national income and general production levels, but also changes in the social, economic and cultural structures of the society should be considered in this context (Keleş et al.:46).

Turkey is also facing the problems of increasing pollution. The pollution levels are considered higher than that in other OECD countries. Growth and development are the leading issues that considered during the process of improvement and developments of economies after WW II. Growth is defined as the real increases independent of size of population in production capacity or capital which can be quantified. Development, on the other hand, is a term that includes socio-cultural development, such as decline of unemployment, increase of health and quality of life as well as qualitative real increases in the economy within the scope of growth (Çepik,2015:1).

The primary condition to mention the development in a economy of a country is that the increase in production is real and continuous which is an essential requirement to ensure social welfare. This makes the society to meet their needs at higher levels. However, when measuring this case, not nominal but real increases should be taken into account as the increase in purchasing power can be seen in this way (Köklü ve Aziz ,1973:117-119).

Today, when looking at the economic growth and development of developing countries in particular, unfortunately it seems that development is not enough. Despite the fact that the GNP values of these countries progress with a rising trend from year to year, differences in incomes and therefore an increase in population in poverty line point this issue. These problems have given rise to the concept of sustainable development and have caused this concept to gain much more importance.

The development movements supported by industrialization in large scale have increased the urbanization thereby led to destruction in

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ISSN: 1925 – 4423
Volume :7, Issue:3-4, Year:2017, pp. 158-177

natural resources. This emerges as a challenging phenomenon impeding the sustainability of long-term development.

To mention the development and its criterion in Turkey and Eastern Anatolia Region, firstly it is necessary to understand the concepts of development, and that how it is provided in addition to definition of development. In this study the analyses refer to the especially issues of life welfare and unemployment in the Eastern Anatolia Region.

Relationship between the Development and Renewable Energy

Development is as important at the national level as it is at the regional level. Despite the lack of definition about the concept of the region, according to the widely accepted definition, a region is a planning and management unit, which is larger than a city but smaller than a country, with smaller, managerial borders that overlap with the boundaries of the nation's administrative units, but has a participatory governance and budget that can manage those boundaries in terms of interaction, and which is managed locally. (Ağralı,2014:6). Regional development, however, includes activities not only for the development of less developed regions but also comprises all of the activities for the approximation of the development levels of all regions to each other.(Sevinç,2011:36) The main goal of regional development is to minimize disparities among regions in terms of development, thereby improving the minimal living standards in rural areas that more commonly suffer from excessive immigration to larger cities. By achieving this, it is aimed to spread welfare in a more balanced manner throughout the country by increasing competitiveness both within the country and abroad. The components such as ensuring social justice already underlies the regional development besides providing economical prosperity (Günaydın,2013:73).

The concepts of environment and development are on the agenda of the whole world, which cannot be considered independently from each other and also indispensable for the continuity of human being. The relationship between the protection of the environment and development

is now one of the most discussed issues internationally. Energy security and environmental challenges are forcing many countries to find energy alternatives to fossil fuels. Both renewable and nuclear energy sources are believed to provide some solutions to the problems of energy security and environmental degradation. Consequently, many countries have made investments in nuclear and renewable energy in order to reduce the dependence on imported oil, increase the supply of secure energy, minimize the price volatility associated with imported fossil fuels, and reduce greenhouse gas emissions (Nicholas Vs,2010:2225-2260). Renewable sources, such as wind and solar, only constitute a very small part of the total supply. However, the potential is substantial, and in some regions and countries, the share of renewable energy has grown substantially during the last couple of decades (Henrik,2007:912-919).

Renewable energy system development will make it possible to resolve the current crucial tasks such as improving energy supply reliability and organic fuel economy; solving problems of local energy and water supply; increasing the standard of living and level of employment of the local population; ensuring sustainable development of the remote regions in the desert and mountain zones; implementation of the obligations of the countries with regard to fulfilling the international agreements relating to environmental protection.(Panwar vs,2011:1513-1524)

It is clear that countries must expend their natural sources for maintaining development. But, unfortunately, risks of destruction and environmental abuse arise during this consumption. This situation more frequently appears in especially developing countries. As world population and requirements of people increase, environmental pollution increases and natural sources are more intensely devastated. The balance between world’s resource requirement has begun to terminate and also future of human has begun to be endangered; but the limitations of natural resources and the deterioration of the balances have been ignored frequently until recently (Baykal,2008:9). For these reasons, the press on the inclination towards renewable energy, in other words the green energy, has been becoming more intensive day by day.

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The concepts of renewable energy refers to "the energy source that can exist in the next day, in its own evolution of nature" (Seydioğulları:22). According to another definition, the renewable energy is not based on fossil sources that exists naturally without requiring any extra operations and sources of which are renewed with movement and also it is a kind of ready to use energy in the nature which possess very less harm to environment than other energy resources (Irkçıçatal,2011:3). In particular, their use are tried to be increased from year to year because of the fact that this type of energy is useful in terms of reducing carbon dioxide emission, contributing environmental concerns in the long term and their cleanliness relative to other sources of energy. Such that, it is predicted that this value will rise to 60% in 2030, while it was increased by 5.7% between 1970 and 2002 among the IEA countries (Bayraç,2011:248).

The Role of Renewable Energy in the Development of the Eastern Anatolia Region

Eastern Anatolia Region is the biggest region of our country occupies 21% of the territory of Turkey. In addition, Eastern Anatolia Region is the Turkey's most mountainous region with an average altitude of 2000m and with Turkey's largest river network (Genç,2002:5).

A hard terrestrial climate prevails in the Eastern Anatolia Region, the main causes of which are caused by its high altitude and lacking of the maritime effect. Thus, in the country, summers are short and cool, while winters are long, quite cold and rainy. The steppes form the main plant cover of the region, the forests can be seen in quite high areas and most of them have been destroyed over time, especially due to meet the residential heating requirements (Genç:9).

It should be noted that the use of renewable energy has also very significant mean for Turkey. Despite the fact that today Turkey is a foreign-dependent country in terms of energy supply, it stands out with suitable and advantageous renewable energy potential. Moreover, Turkey's ten-year energy outflow has exceeded $147 billion. In this case,

tendency towards the renewable energy is even more important for Turkey.

Another reason for the use of renewable energy in Turkey is that renewable energy sources possess direct or indirect links to many other sectors. For example, while bio-fuel energy is closely related to the especially agriculture and animal husbandry as well as automotive sector, geothermal energy is closely related to the agriculture, tourism and health sectors. At the same time, the widespread adoption of these practices and the strengthening of the relations between them open ways to new applications and activities among these different sectors.

In connection with the widespread use of bio-fuels, utilization and making benefits from animal and vegetable wastes have gained currency progress has been made on the development of new generation fuels and vehicles suitable for these fuels. When investments to the Eastern Anatolia Region and their potential are taken into the account, a widespread existence of the hydro-electric plants can be seen. Besides, it has potential in terms of bio-fuel, solar energy and geothermal energies and it seems that this potential is utilizable.

The meteorological characteristics and situations of territory is extremely significant in terms of renewable energy. Regarding this fact, meteorological parameters of the provinces within the boundaries of Eastern Anatolian region were established based on the data provided by the General Directorate of State Meteorological Affairs between 1975 and 2015, and these data were averaged according to 12 monthly periods.

Table 1.The difference in annual average number of frost days of provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,04	0,29	0,13	0,01	0,11	0,18	-0,37	0,19	0,09	0,02	0,11	0,19	0,09	0,2

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It can be seen from Table 1 that the highest increase in frost was observed in Ardahan province by 0,29% and the highest decrease was observed in Erzurum province by 0,37%

Table 2. The difference in annual average number of snowy days of provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,15	-0,24	0,14	0,00	0,05	0,05	0,12	-0,08	0,05	-0,29	0,08	0,12	-0,06	0,11

In this table, distributions of snowy days in provinces are shown and considering the result of the values, the highest increase observed in Ağrı province by 0.15%, the highest decrease was observed in Kars by 0.29%.

Table 3. The difference in annual average temperature of soil (5 cm) of provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	-	0,16	0,00	-0,27	-0,13	-2,46	-0,19	-0,08	-0,34	0,21	-0,24	-0,27	0,22	0,01

The highest increase in annual average soil (5 cm in height) temperature was observed in Tunceli province by 0.22%, the highest decrease was observed in Erzincan province by 2.46%.

Table 4. The difference in annual average temperature of soil (10 cm) of provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	1,07	0,10	0,07	-0,04	-0,20	-1,19	-0,24	0,09	-0,21	0,12	-0,22	-0,66	-0,08	0,23

Erzincan province exhibited the highest increase in the annual average soil (10 cm in height) temperature fluctuations by 0.19%; Bitlis province exhibited the highest decrease mean annual soil (10 cm in height) temperature by 1.19%.

Ağrı province exhibited the highest increase in annual average soil (20 cm in height) temperature fluctuations by 1.07%; Erzincan province exhibited the highest decrease mean annual soil (20 cm in height) temperature fluctuation by 1.19%.

Ağrı province exhibited the highest increase in annual average soil (50 cm in height) temperature fluctuations by 0.22%; Ardahan province exhibited the highest decrease mean annual soil (50 cm in height) temperature fluctuation by 0.30%.

Ardahan province exhibited the highest increase in the annual average soil (100 cm in height) temperature fluctuations by 0.12%; Kars province exhibited the highest decrease mean annual soil (100 cm in height) temperature fluctuation by 0.39%.

The percentage of change in the annual average soil temperature in referred provinces with soil height varying between 5 and 100 cm are as stated above. These evaluations prove the annual variations occurred in East Anatolia Region regarding meteorological data.

Table 5. The difference in annual average number of clear days of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	-0,47	-0,68	-0,22	-0,13	0,06	-0,37	-0,31	-0,41	-0,27	-0,03	-0,02	-0,37	-0,02	-0,30

The rates of change in the annual average clear days were shown in the Table 6. The number of clear days provided a decreasing graphic in general. The only increase was observed in Elazığ province with a difference by 0.06% and the highest decrease was observed in Ardahan with a difference by 0.68%

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Table 6. The difference in annual average cloudiness of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,13	0,18	0,03	-0,02	-0,17	0,10	0,07	0,28	0,04	-0,03	-0,01	0,08	-0,04	0,04

The differences in annual average cloudiness of the provinces were shown in the table above. The number of clear days provided an increasing graphic in general. The highest increase was observed in Hakkari province with a difference by 0.28% and the highest decrease was observed in Elazığ with a difference by 0.17%

Table 6. The difference in monthly average sun exposure intensity of the provinces.

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,01	-	0,13	-	-0,08	-0,17	-0,07	-0,01	-0,11	-0,02	-0,11	0,11	-	-0,12

The differences in monthly average sun exposure intensity of the provinces are shown in the table above. The sun exposure intensity provided a decreasing graphic. The highest increase was observed in Bitlis province with a difference by 0.13% and the highest decrease was observed in Elazığ with a difference by 0.17%

Table 7. The difference in annual average sun exposure intensity of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,04	-	0,29	-	-0,10	-0,03	0,03	0,01	-0,05	-0,08	-0,06	0,12	-	-0,06

The sun exposure intensity of the provinces is shown in the table above. The highest increase was observed in Bitlis province with a

difference by 0.29% and the highest decrease was observed in Elazığ with difference by 0.10%.

Table 8. The difference in annual average sun exposure time of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,26	0,37	0,07	0,12	-0,07	0,19	0,36	0,34	0,05	0,02	-0,14	0,12	0,07	0,12

The sun exposure time in the provinces are shown in the table above. The highest increase was observed in Ardahan province with a difference by 0.37% and the highest decrease was observed in Malatya with a difference by 0.14%.

Table 9. The difference in annual average relative humidity of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,08	0,02	-0,07	0,01	0,01	-0,04	-0,01	0,03	0,18	0,03	0,06	-0,07	-0,01	0,00

The annual average relative humidity in the provinces is shown in the table above. Presence humidity and high value of relative humidity effect cloudiness and therefore sun energy potential. The highest increase was observed in Iğdır province with a difference by 0.18% and the highest decrease was observed in Malatya and Muş provinces with a difference by 0.07%.

Table 10. The difference in annual average sun exposure intensity of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum
Averages	-0,042	-	-0,034	0,089	-0,030	-0,142	0,131

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Provinces	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	-0,0007	0,002	0,034	-0,033	0,029	-0,059	-0,063

The sun exposure intensity of the provinces are shown in the table above. The highest increase was observed in Erzurum province with a difference by 0.13%, and the highest decrease was observed in Erzincan province with a difference by 0.142%.

Table 11. The difference in annual average sun exposure time of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum
Averages	-0,006	-	-0,150	-0,040	-0,043	-0,179	-0,029

Provinces	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	-0,005	-0,023	-0,065	-0,040	0,084	-0,025	-0,033

The sun exposure time of the provinces are shown in the table above. The highest increase was observed in Bitlis province with a difference by 0.150% and the highest decrease was observed in Erzincan province with a difference by 0.179%.

These rates of change in studied parameters bear significance especially in terms of solar energy. To utilize solar energy, sunny and clear days generates potential and it can be seen from this table that this potential has been diminished for Eastern Anatolia Region over years. According to Figure 19 and Table 10 in the section regarding solar energy, Eastern Anatolia Region does not possess a powerful potential.

Table 12. The difference in annual average atmospheric pressure of the provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum
Averages	0,0007	0,0007	-0,0005	-0,0006	-0,014	0,0003	-0,0143

Provinces	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	-0,0004	0,0006	0,0007	-0,00473	0,0009	-0,0004	-0,0006

The difference in annual average atmospheric pressure of the provinces is shown in the Table above. The highest increase in pressure rate was observed in Muş province with a difference by 0.0009% and the highest decrease was observed in Erzurum province with a difference by 0.0143%. This difference that observed in Erzurum province pronouncedly stands out when compared with other provinces in the Eastern Anatolia Region. It can be observed that seasonal changes have no impact on the pressure changes, the differences in Erzurum and Elazığ provinces maintained their nakedness in all months and seasons of the year.

Table 13. The Differences in Percentage of average wınd speed in provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,48	0,10	0,34	0,41	-0,50	0,13	-0,06	0,06	0,00	0,22	-1,45	0,24	0,15	-0,12

The difference in average annual wind speed of the provinces is seen in the Table above. The highest increase in speed rate was observed in Ağrı province with a difference by 0.48% and the highest decrease was observed in Malatya province with a difference by 1.45%.

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Table 14.The Differences in Percentage of average temperature days change according to provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	0,04	0,09	-0,12	0,06	-0,09	0,16	-0,02	-0,06	0,14	-0,03	-0,19	0,52	0,22	-0,17

The rate of change in the temperature of the provinces is seen in the Table above. The highest increase in wind speed rate was observed in Muş province with a difference by 0.52% and the highest decrease was observed in Van province with a difference by 0.17%.

Pressure differences has a significant role in terms of solar energy, this is an persistent energy till the pressure difference between the zones are equilibrated. As can be seen from the Table 5, the energy of wind power intensity is approximately 24 W/m^2 and this value is seen in the highest degree in west and south regions of Turkey. Eastern Anatolia Region is one of the poorest regions with regard to wind energy, of which mean power is measured to be 13,19 W/m2 per 10m2.

Table 15. The Differences in Percentage of average rainy days change according to provinces

Provinces	Ağrı	Ardahan	Bitlis	Bingöl	Elazığ	Erzincan	Erzurum	Hakkari	Iğdır	Kars	Malatya	Muş	Tunceli	Van
Averages	-0,07	-0,47	-0,55	-0,24	-0,11	-0,11	0,04	-0,81	-0,37	-0,40	-0,51	-0,04	-0,16	-0,58

The difference in the rate of average precipitation of the provinces is shown in the Table above. The highest increase in precipitation was observed in Erzurum province with a difference by 0.04% and the highest decrease was observed in Hakkari province with a difference by 0.81%. (Kırtıloğlu etc)

As can be seen, there is a general downward trend in the total number of rainy days. Especially in the Eastern Anatolia Region, the decrease of the precipitation with a value of less than 10 mm trigger the curve of decreasing of precipitation, because the rains with 10 mm constitute the most of the rainy days. While there are a decrease in the number of rainy days, no decrease in the ratio of the precipitation is seen, the main reason of this is that the number rains ≤10 mm is reduced, but there is some increase in the heavy rains (25-50 mm).

These seasonal changes provide information on choosing the most suitable and efficient renewable energy type can be used in Eastern Anatolia Region. For example, investment in solar energy would not be productive, but hydroelectric plants would be utilized more efficiently thanks to the amount of the precipitation and height of the region.

The rainiest seasons are winter and spring in Eastern Anatoli Region. The number of rainy days and rate of the rain are close to each other in both seasons, despite the fact that there is decrease in these values in two seasons; an increase in these values is observed in autumn. In addition, hydroelectric power is the commonly used renewable energy resource with a significant potential. The region provides a very rich resource for the hydroelectric potential. Although this potential isn't completely benefited from, a significant amount of hydroelectric power plants (HPP) in the country are established in the Eastern Anatolia Region.

When distribution of the HPPs with production license according to regions since 2011 is examined, there are 737 HPPs in total and 130 HPPs corresponding to 17,6% of the total HPPs in Turkey are located in Eastern Anatolia Region.

When distribution of the active HPPs according to regions since 2011 is examined, there are 212 HPPs in total and 34 HPPs corresponding to 16% of the total HPPs in Turkey are located in Eastern Anatolia Region.

When distribution of the HPPs in construction according to regions since 2011 is examined, there are 525 HPPs in total and 96 HPPs

corresponding to 18.3% of the total HPPs in Turkey are located in Eastern Anatolia Region. Erzurum is the 6th the province in Turkey with 32 HPPs having production license.

Examining the temperature conditions an increase in the both mean temperature value, and in the minimum and maximum values can be observed. The main reason for this effect is the rise in the emission of greenhouse gases. With respect to this issue, development of new technologies and renewable energy potentials is a quite important factor. The encouragement of common and intensive use of the bio-fuel energy will have positive impact on this issue.

Conclusion

Currently, energy represents a global meaning that affects and shapes international economic, political, social and military fields at a serious level. A significant part of the world energy claim is met by the fossil resources with limited reserves such as oil, natural gas, coal. According to the International Energy Agency (IEA), it is predicted that oil, coal, and natural gas resources will run out after 35 to 40, 220 and 65 years, respectively.

Global population growth and urbanization accompanying the industrialization which increases in requirements for energy, thus the detrimental effect of fossil fuels and exhaust gas on the environment and the risk of nuclear energy promote the inclination towards the alternative energy resources before consuming up the fossil oil reserves. A serious search for cheap, clean, safe, reachable and also maintainable natural resources and therefore growth in development has taken place and this generated new market. In addition, the attempts for reducing ever-increasing cost of imported energy in the global energy market also play an important factor in tendency to renewable energy resources.

Renewable energy, on the other hand, is a system that will reverse these negative developments and reduce negative factors. Although the importance of these systems has not been understood for a long time,

there has been an awareness of the whole world, especially at the end of the 20th century, and serious work has been initiated on this subject. The use of renewable energy and the degree of the size of current technology that has been attained till now, also seem very promising for the future.

Considering the renewable energy potential of Turkey, it can be seen that different potentials come to the forefront in different regions.

Eastern Anatolia Region, which is a source of motivation for this study, is particularly rich in terms of hydroelectric and bio-fuel opportunities within these regions. Increasing renewable energy sources in the region will make a major contribution to solving the fundamental problems of the region, such as employment, energy transmission and migration. It will also have a domino effect in solving other basic problems such as increasing employment, improving welfare, increasing education level.

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