

Chapter 6

The Role of Green Energy Investments in Energy Supply Security



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Abstract Renewable energy sources provide the management and control of energy production. The increase in the share of renewable energy sources in the energy portfolio ensures that the renewable energy obtained from local sources is controlled nationally. Since energy is obtained by using local resources, control can be achieved completely. Ensuring the control of energy resources constitutes a priority step towards ensuring supply security. An important element of energy supply security is to ensure continuity of access to energy while meeting energy needs. If the continuity of access to energy is affected by any political, political, or economic factor and dragged into a negative direction, it is a risk factor for energy supply security. Reducing or eliminating the current risk will be possible by focusing on renewable energy sources. Investments in renewable energy resources will reduce foreign dependency as it will ensure energy supply stability through energy management and control. The fragility of access to energy will decrease. Energy supply security will be ensured by reducing the vulnerability of energy access. In this context, renewable energy investments are a factor that needs to be increased to ensure energy supply security.

Keywords Renewable energy · Green energy · Energy supply · Energy investment

6.1 Introduction

Energy has become one of the most important and indispensable elements of today's world, with its place in every aspect of life in micro and macro dimensions. Energy has a place in many areas from production to transportation, from daily use to health and many more. Energy sources can simply be divided into two classes, renewable energy and non-renewable energy sources. Non-renewable energy sources are also divided into two as fossil fuels and nuclear energy. Energy sources such as natural

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gas, oil, and coal are examples of fossil fuels. These fuels consist of living remains and are formed over a very long time. One of the characteristic features of fossil fuels is that they are not sustainable because they are non-renewable (Dong et al., 2022). In addition, fossil fuels are not available in every region of the world. Another non-renewable energy source is nuclear energy sources. Nuclear energy source is obtained from the atomic nucleus.

There are some advantages and disadvantages of energy resources in terms of production and use. Fossil fuels are one of the most harmful fuels for the environment in terms of their use. Climate change can be mentioned at the beginning of these damages. Fossil fuels cause the global temperature to be above the average, thus causing regional drought or excessive precipitation and frost. Another harm of fossil fuels is the loss of biodiversity. This means the disappearance and extinction of many plant and animal species (Zhang et al., 2022). Another harm caused by fossil fuel consumption is chemical pollution.

Fossil fuels cause the emission of various gases harmful to the environment because of their use. This situation causes air pollution and leads to various social problems. Studies on this subject show that pollution triggers respiratory tract, lung cancer, and cardiovascular diseases. The increase in health problems also increases the expenditures made in this field (Kou et al., 2022). Especially in countries with budget deficits such as Turkey, this situation results in a worsening of the budget. In addition, the increase in health problems is one of the factors that negatively affect the workforce. The damage to the workforce negatively affects production and therefore welfare and income distribution. All these negative situations constitute a social cost that a society must overcome.

Renewable energy resources can be defined as energy resources that remain in a natural cycle and do not decrease as they are consumed. Wind, solar, biomass, hydraulic, tidal wave, and hydrogen are examples of renewable energy sources. The characteristic features of renewable energy sources are that they do not decrease due to consumption, that they are sustainable and environmentally friendly. Renewable energy sources differ from fossil fuels in terms of their production. Countries can produce the energy they need by establishing the necessary facilities from renewable energy sources (Mukhtarov et al., 2022). This is not the case for fossil energy sources. In addition, renewable energy sources can meet the energy needed today without consuming the energy that future generations will need. In this respect, it is also referred to as sustainable energy.

The fact that countries produce their own energy using renewable energy sources is an element that provides political advantage to countries. Especially for countries with high energy dependency, energy resources can be a political handicap. At this point, energy production with renewable energy sources can be a factor that strengthens the hand of countries in international relations. The tension between Russia and Ukraine, which we have witnessed recently, and the worries experienced by European countries at the point of imposing sanctions on Russia can be given as examples.

With the increase in industrialization, energy has become the most important input of production. Another advantage of renewable energy sources is the reduction

of exchange rate risks and the preservation of financial stability. As it is known, foreign currency is used in energy import and export. For this reason, in case of exchange rate shocks, this may adversely affect financial stability and may also burden the economy as inflation. While this situation negatively affects the current account balance for energy-dependent countries, it positively affects the current transactions of the countries that produce the energy they need.

6.2 Energy Dependence Problem

From the industrial revolution to the present, the use of energy has been increasing its weight by intensifying in every phase of life. From the needs in our daily lives to the most strategic points of the countries as a production factor, the need for energy emerges as an indispensable element. With the developments in information communication technologies, blockchain technology, and robotization, it is seen that energy is now moving towards the point of becoming almost the life itself rather than a necessity. The fact that energy has become so important brings with it some difficulties. Ensuring the demand and supply balance of energy, which is not technologically possible to store yet, emerges as a national security factor for countries. In this context, energy dependency is of vital importance (Yüksel et al., 2022).

Energy dependency is mainly due to the difference between energy demand and energy supply. Although there are different definitions of energy dependence in the literature, to put it simply, it is the situation where the energy deficit, which arises because of the energy demand being higher than the energy production, must be closed. If the required amount of energy cannot be met by national means, the energy deficit must be met by supplying it somehow. This situation also includes many risk factors for countries. The risk of not providing a vital factor gives an idea of how deep the addiction can be (Kostis et al., 2022). It is possible to classify the risks posed by energy dependence under four headings. The risks posed by energy dependence are defined as political risk, economic risk, uncertainty, and security of supply.

Energy dependency makes the country, which must supply the energy deficit, politically dependent on the country from which it supplies energy. Policy makers, who must meet the energy deficit that can have devastating economic and social effects, must follow a moderate and harmonious policy towards the countries from which they import energy in terms of both the future of the country and the course of their political life. With the effect of globalization, which is a pillar of the economic and financial architecture created after the Second World War, it must follow policies close to the country it is dependent on, even in matters not directly related to it (Bhuiyan et al., 2022). Although in the short term, it seems profitable to follow policies close to the country of dependence in the context of the country's economy and social order, since it will destroy the environment for independent policy development and action in the long run, it leaves countries with a problem that is

not easy to get out of on the level of existence-independence. As a result of energy dependence, it is not possible to reject the political and economic demands coming from the energy importing country, even if it is not compatible with national interests. Political instability arises, causing wrong economic decisions to be made.

The need for energy will not only cause problems in political decisions, but also prevent the implementation of the principle of reciprocity in international law. The principle of reciprocity in international law expresses the right to respond in kind to an act, policy, or sanction applied. With the spread of international trade and transnational companies and the globalization of competition, companies have started to act in the international arena from a national basis. Countries may engage in restrictive attitudes and behaviors towards international companies in line with their own interests. Applications such as quotas, legal restrictions, and holding at customs on imported products affect companies negatively, and due to this attitude, they also negatively affect the country where the company is headquartered (Yüksel & Dinçer, 2022). It is especially common in agricultural products. Even though such applications are relatively low in high-tech products, they can be observed in the context of strategic policies and in the name of developing baby industries. The country exposed to such a situation will be affected both economically and socio-politically as the internal market conditions will change. The most deterrent factor when countries resort to such practices is the principle of reciprocity in international law. However, the implementation of the principle of reciprocity becomes very difficult in countries with energy dependence. This situation emerges as a political risk factor.

One of the elements that form the foundations of modern economies is industry. The most important input of the industrial sector is energy. Energy dependence can directly affect industrial production and cause the country's economy to suffer. The decrease in industrial production causes a decrease in the growth and development of the country. Although growth does not mean development, an increase in production and an increase in exports mean an increase in per capita income. The increase in national income per capita will also bring about an increase in the level of welfare. The increase in the welfare level will also contribute to the increase in the level of economic development (Wan et al., 2022). A problem in the supply of energy will reverse the process and cause economic shrinkage, and economic development will decrease with the decrease in the welfare level. Energy dependence causes countries to become dependent on economic growth and development through industrial production. Ensuring the energy deficit while creating an economic policy presents itself as an obstacle that must be overcome to create an effective and efficient policy.

Another economic risk of energy dependence is unemployment. Any negative situation that will occur in industrial production will cause a decrease in production and therefore a decrease in the required workforce. Although the decrease in labor demand will be delayed for a while with the effect of employment contracts and unions, it will show itself as unemployment (Zhao et al., 2022). The deterioration in the labor market will cause social problems. Increasing unemployment is a factor that can have serious social consequences. The economic activities of the unemployed agents will change, and this will affect the entire market. This deterioration in

the balance of the domestic market will not only cause unemployment but also negatively affect other economic factors (Li et al., 2022). In addition, the increase in the unemployment rate may cause deterioration in the budget balance by causing an increase in the payments made within the scope of unemployment benefits and social assistance. As a result of energy dependence, the economic cost of a problem with the country from which energy is supplied can be very heavy.

Another risk of energy dependence is uncertainty. The deepening of financial markets, the transformation in the instruments used, and the expectations of economic agents are very effective on countries and the policies they implement. One of the most important triggers of economic dynamics is expectations. Uncertainty in the economy may cause the behavior of agents and the balance to change. Possible problems arising from energy dependence will be an indicator that markets, which price the possibilities in advance, will consider in their expectations. The resulting perception affects the economic variables and has negative consequences on the country's economy (Dinçer et al., 2022). Energy dependency will create the opinion that the country's economy is fragile. It will have a negative impact on direct investors as well as on financial markets. Country risk premiums will increase and direct investments to the country will decrease. The most obvious indicator of the negative externality created by energy dependence is the risk of uncertainty.

The negative externality of energy dependence in the context of uncertainty is not only on perceptions, but also directly affects concrete economic indicators. Problems that may occur in energy flow for any reason can directly affect production. The decrease in production is reflected to the domestic and foreign markets as changes in prices. Changes in prices cause inflation and negatively affect the country's economy. The increase in inflation has a direct impact on the consumption and investment decisions of economic agents. In addition to inflation, the inability to import energy in local currency brings exchange rate uncertainty. Currency fluctuations can cause very difficult conditions to be compensated for those who have foreign currency debt. Exchange rate fluctuations can cause damage to the society with inflation. Problems may occur in the current account balance due to the use of a currency other than the local currency in trade. The foreign exchange deficit, which occurs outside of national possibilities, poses a risk as a situation that needs to be closed somehow (Haiyun et al., 2021). The problem that will occur in the current balance creates a risk regarding the budget and the whole planning of the country. Policy makers, who must act with the sensitivity of a surgeon in the economic system where all elements are interconnected, have to reduce the uncertainty environment as much as possible in order to carry both economic welfare and social factors in a balanced way. Energy dependence causes an environment of uncertainty.

Energy dependence is also an important risk factor in terms of supply security. In some periods, energy importing countries may impose various restrictions on energy exports due to both their internal dynamics and external reasons. Sometimes the elimination of the destruction in the energy transportation channels, sometimes the maintenance and repair works, and sometimes the obstacles to energy export due to unpredictable reasons pose a serious problem for energy importing countries. The interruption of the energy they export because of such events occurring in the

internal dynamics of energy-exporting countries creates a supply security risk for energy importing countries. In addition to internal dynamics, there may also be problems caused by external dynamics (Yuan et al., 2021). The cost of a problem that will occur at the point of energy supply can be very heavy for energy importing countries. Energy supply security is a strategic issue for all countries. The supply security risk of energy dependence is an important risk factor that cannot be ignored.

6.3 The Role of Renewable Energy Investments in Energy Supply Security

Energy refers to the physical ability to do work. It is the thing that occurs because of the change in matter and provides the opportunity to do work. Energy is needed in all the work we do in our daily life. Resources that produce energy using certain techniques are also called energy resources. Although energy sources are diverse, they have become more diverse with the development of technology. Especially with the increase in environmental problems and the importance of the concept of sustainability, the search for different energy sources has become inevitable. In this context, there is a need to classify energy sources (Zhou et al., 2021). It is important to make the classification correctly so that policy makers can take a more active role. Energy sources are divided into two as renewable energy sources and non-renewable energy sources.

Non-renewable energy sources are energy sources that are depleted as they are used and cannot renew themselves. These resources are found in certain proportions and amounts on earth. When they are used for energy production, they cannot be recycled and reused. They are not sustainable. They harm the environment and cause global warming. They cause serious negative externalities while meeting their energy needs. Today, non-renewable energy sources are widely used in energy supply. The most important reason for this is that it is cheap and does not require new technological investments. It is more stable than renewable energy sources. Non-renewable energy sources are fossil fuels and nuclear energy (Meng et al., 2021). Fossil fuels are the energy source formed by the death of living organisms and their decay by being in an oxygen-free environment for many years. Fossil fuels contain high levels of carbon. When they are burned, they release a high amount of carbon to the nature together with energy and harm the environment. Coal, oil, and natural gas are some of the fossil resources. Nuclear energy is the energy obtained from the nucleus of the atom. Energy is obtained by splitting atoms. It causes the release of heavy radioactive substances. These substances can cause devastating effects on living things that will last for generations.

Renewable energy is self-renewing and environmentally friendly energy. We can classify renewable energy sources as solar energy, wind energy, geothermal energy, biomass energy, hydroelectric energy, wave energy, and hydrogen energy. Solar energy is the energy obtained by using the rays coming from the sun. Throughout

history, the sun has been used for different purposes (Levenda et al., 2021). The sun was used in determining the time, war technologies, and some other fields. The sun not only illuminates our world, but also has effects both sociologically and physically. Sun rays are an important source of energy. When we say solar energy as a renewable energy source, it is meant to convert the rays from the sun into electrical energy through thermal and photovoltaic systems. In photovoltaic systems, it is done by means of photovoltaic batteries placed on the solar panel. Electricity is obtained through batteries by taking the sun's rays. In thermal systems, the sun's rays are first converted into heat. Heat energy is converted into electrical energy (Sebestyén, 2021). It is possible to store solar energy with certain methods. Studies have shown that solar energy can be stored for years.

The sun's rays heat different regions at different levels according to the position of our world, the difference in distance and the angle of incidence of the rays. Pressure differences due to temperature differences cause the formation of winds. These winds are also a source of energy, as are the sun's rays. Wind turbines are used to convert winds into energy. Kinetic energy is obtained because of the movement of wind turbines by the effect of the wind. Kinetic energy is converted to mechanical energy and mechanical energy is converted to electrical energy (Panagopoulos, 2021). The process is completed with the conversion of wind into electrical energy. The blowing speed and duration of the winds affect the energy obtained. Wind turbines, also called wind vane, are divided into two as horizontal axis wind turbines and vertical axis wind turbines.

Heat accumulation takes place on the earth due to both the sun and other reasons. The heat accumulated in the earth's crust is called geothermal. It was created by combining the words *geo* meaning earth and *thermal* meaning heat. There are temperature and pressure differences at various levels of the earth's crust. Hot water, steam, and gases collected in the earth's crust form geothermal fluids. The energy created by geothermal fluids is called geothermal energy. It is an environmentally friendly energy source. Combustion method is not used. It produces zero carbon emissions (Pietrzak et al., 2021). It is very easy to use because it does not carry any risk factors. It is an energy source with a very high efficiency and does not require a large facility area. Energy and electricity are obtained by separating the fluids obtained from the drilled wells. Geothermal energy is one of the renewable energy sources.

Biomass energy, one of the renewable energy sources, is an energy source whose importance is increasing day by day as the fourth largest energy source among existing energy sources. Biomass is expressed as the total mass of living organisms belonging to a species or a community of various species in a certain period. It is also considered as organic carbon. Biomass is converted into energy by going through various processes. Biomass is burned (decomposed) into energy and then into electricity (Opeyemi, 2021). Energy is obtained by burning biomass in biomass power plants. Although there are different processes, motion energy is obtained by performing the rotation process with the gas, which is basically separated because of burning the biomass. This energy is then converted into electrical energy. While

some of the generated electrical energy is used in the facility, the remaining portion is sent to the grid.

Another renewable energy source is hydroelectric energy. It is defined as the energy obtained from running water. The potential energy of water is used by converting it to kinetic energy and kinetic energy to electrical energy. This process we are talking about is carried out in hydroelectric power plants. In order to benefit from hydroelectric energy more efficiently, it is necessary to pay attention to the climate structure of the region where the power plant will be established and the speed of the flowing water. The hydroelectric power plant also creates a positive externality socially and economically in the region where it is built (Ivanovski et al., 2021). The prevention of floods, the creation of irrigation channels, the improvement of the quality of life, the development of fisheries, and the creation of recreational facilities are some of the positive externalities we can count. Hydroelectric power plants are long-lasting. The size of the hydroelectric power plant varies according to the amount of energy needed or the conditions of the region.

Wave energy, one of the renewable energy sources, is the energy obtained by utilizing the waves that occur in the seas and oceans. Waves occur in the seas and oceans due to earthquakes, tides, and winds. Wave energy is obtained from the wave surface or below the wave surface. Energy is provided through wave energy conversion systems. Hydrogen energy is another renewable energy source. Hydrogen is the most abundant element on earth. It is an odorless, light, and non-toxic substance, but it is not a source of energy (Gernaat et al., 2021). To be used as an energy source, it must go through various transformations. With hydrogen energy systems, energy is obtained from hydrogen.

There are various reasons for turning to renewable energy sources, which we mentioned above. One of the biggest problems of our world, perhaps the most important, is undoubtedly limited resources. While meeting our energy needs, renewable energy aims to turn to resources that can renew themselves and do not harm the environment instead of limited resources. The use of renewable energy sources is an important element for a sustainable system, as it will not cause any scarcity problems. Although conventional energy, which is widely used today, is sufficient to meet the needs of current generations, it causes serious concerns about meeting the needs of future generations. Developments in information and communication technologies in our age, population growth, and lifestyles increase our demand for energy. With the changing conditions, the possibility of accessing and using energy gains new dimensions. Our energy approach needs to be reviewed in the light of all these. We need to consider environmental and social factors not only to transfer resources to future generations, but also to leave livable conditions.

6.4 Conclusion

Renewable energy is basically a structure built on two columns. It is based on two foundations. They are sustainable and environmentally friendly. As with all elements of the sustainability concept, the concept of green energy is an approach that basically prevents the unlimited use of resources that future generations will need and aims not to deprive humanity of energy resources in the future while meeting our own needs. The fact that energy resources are renewable means that resource consumption and relatively waste of resources come to an end. The problem of scarcity comes to an end with renewable resources and the obstacle to energy shortage is eliminated. Sustainable and predictable energy needs can be supplied from renewable energy sources. The energy supply problem may come to an end for both our world and future generations.

Another element of renewable energy is that it is environmentally friendly. Renewable energy aims to meet our energy needs without harming the environment. The effects of global warming are felt more intensely every day. The damage caused by fossil fuels to the environment has reached an irreparable level. Carbon emissions, greenhouse gases, and other harmful things can be prevented by the renewable energy approach. While meeting the energy needs, it does not harm the ecological system and the risks are reduced to the lowest level. Climate change causes serious problems. The renewable energy approach focuses on increasing energy efficiency. Technological developments that will increase efficiency are an important element of the renewable energy approach. Developments in the field of energy technology will enable us to reach safe and long-lasting energy. Increasing energy efficiency will ensure that the need for energy is met with less resources. In this way, possible damage to the environment will be reduced.

Renewable energy has both positive and negative aspects. The most important negative side of renewable energy is its high investment costs. Whichever renewable energy source will be preferred for access to renewable energy, appropriate investments should be made in suitable regions. The high cost of the investments needed is the most important obstacle to renewable energy. Although the costs are high, the long-term gains will bring a return beyond the costs. Renewable energy sources will make a positive contribution to ensuring energy supply security. When the cost of the risks posed by the energy supply security is compared with the investment cost, it will undoubtedly be profitable to invest. Investments made in renewable energy resources will ensure energy supply security with energy diversity, management of energy production, and sustainability of access to energy.

The more effective and active use of renewable energy sources is important in terms of creating energy diversity. Renewable energy sources can be used together with non-renewable energy sources to meet the energy needs. Increasing the share of renewable energy use in energy supply and consumption will provide energy diversification and support the security of energy supply. It is necessary to increase the use of renewable energy in order to diversify energy sources and meet energy needs in different ways. The increase in renewable energy supply and consumption

will be possible by increasing the investment in renewable energy sources. Reducing the problem of access to energy with energy diversity will increase the security of energy supply. Increasing energy supply security is also a strategic issue of vital national importance. It is aimed to increase the investments made in renewable energy sources with various supports. Investors are tried to be directed to renewable energy investments by developing policies in order to increase energy diversity and increase renewable energy sources.

Another factor to be created by the increase in renewable energy investments is sustainability. As a constant need, energy appears in every moment of both economic and social life. The resources and methods used in energy supply must be sustainable. Perhaps the energy need can be met today from unsustainable sources, but it will not be possible to meet the energy need in the coming years. Renewable energy sources are sustainable as they are not scarce and can be renewed. In this respect, it will support the provision of energy supply security. Renewable energy sources are not only sustainable in terms of resources, but also a sustainable energy source as a method used in obtaining energy. Just being sustainable is not enough. If the method used to access the energy source is not sustainable, it will not be possible to use it continuously due to the negative externality that will arise. Such a situation will also create an energy supply risk. Negative externality will disappear as it is obtained through renewable clean and environmentally friendly methods. Investments in renewable energy sources will ensure energy supply security with this dimension.

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