

Contributions to Management Science

Hasan Dincer
Serhat Yüksel *Editors*

Clean Energy Investments for Zero Emission Projects

An Analysis on How to Reduce
the Carbon Footprint

 Springer

Contributions to Management Science

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The Effect of the Carbon Tax to Minimize Emission



Serhat Yüksel and Alexey Mikhaylov

Abstract Carbon emission refers to the release of carbon gas into the atmosphere. As can be understood from the definition, carbon emissions mainly cause air pollution. Polluted air also threatens the health of living things. As can be seen, carbon emission is a problem that needs to be solved urgently. In this context, many countries are trying to take measures to reduce carbon emissions. Carbon emissions do not only cause air pollution. For example, carbon emissions cause significant problems in the country's economy. First, because of the increase in people getting sick due to air pollution, serious job losses occur in the country. This situation leads to a decrease in the production volume of the country. In addition, the profitability of firms with reduced workforce is likely to decline. As a result, the country's economic growth will be negatively affected. In addition, the increase in the number of patients in the country because of carbon emissions will increase the health expenditures of the country. Finally, carbon emissions cause a decrease in foreign investments in the country. It is obvious that air pollution caused by carbon emissions reduces the quality of life in the country. In this context, there has been an increase in sensitivity to environmental factors worldwide, especially in recent years. This situation makes the carbon emission problem more important. The amount of carbon emission has started to affect the image of countries. In this framework, foreign investors have started to pay attention to environmental pollution issues while choosing the country they will invest in. As can be understood from this, it is obvious that countries that do not take measures to address the carbon emission problem will experience a decrease in their foreign investments soon. Therefore, it is necessary to avoid the carbon emission problem. Carbon emissions can be prevented by legal regulations and sanctions. Sanctions may be imposed on companies that cause carbon emissions. Additional tax may be imposed on nonrenewable energies. Since these types of

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energy pollute the air with carbon emissions, it may be possible to collect a carbon tax. In this way, the cost advantage of nonrenewable energy types will disappear.

1 Introduction

The problem of global warming has become quite dangerous around the world. This situation brings with it many problems. It is obvious that global warming also creates some social and economic problems. Drought caused by global warming adversely affects agricultural production (Yüksel et al., 2020). In other words, there is a significant decrease in the supply of products due to drought. Due to global warming, there is a significant decrease in water resources. If this problem cannot be prevented, the water problem will become very dangerous worldwide. As a result, drought because of global warming causes a decrease in both agricultural production and water resources (Li et al., 2021). This situation also leads to an increase in diseases. Both poor quality nutrition and difficulty in accessing water sources cause people to get sick. If this situation cannot be controlled, there will be an increase in death rates worldwide.

Fossil fuels are mostly preferred in energy use. Fossil fuels consist of resources such as oil, coal, and natural gas. The most important disadvantage of using fossil fuels is carbon emissions. In the process of obtaining energy by burning fossil fuels, a significant amount of carbon gas is formed (Zhou et al., 2020). This situation causes serious air and environmental pollution. Carbon emissions are one of the biggest causes of global warming. The use of fossil fuels is also the most important cause of carbon emissions. In this process, a very serious paradox occurs. In this context, the costs of fossil fuels are much lower than clean energy sources (Karlsson et al., 2021). For this reason, fossil fuels are mostly preferred by investors in energy production. On the other hand, cheap fossil fuels generate carbon emissions. Carbon emission also constitutes the problem of global warming.

In this section, the issues related to the solution of the global warming problem are examined. One of the measures that can be taken to prevent the problem of global warming is the use of renewable energy sources. In renewable energy alternatives, the energy source is supplied from nature (Haiyun et al., 2021). In this process, no carbon gas is released into the atmosphere since fossil fuels are not burned. This situation is considered as one of the biggest advantages of using renewable energy (An et al., 2021). Energy saving has a very important role in solving the global warming problem. Energy saving means reducing the amount of energy used while performing a job.

It is also very important to increase the awareness level of people to solve the global warming problem. Global warming is a very important problem affecting the whole world today. To combat the global warming problem effectively, these negative aspects of this problem must be understood by people (Yüksel et al., 2019). In other words, people need to have a clear understanding of the negative effects of global warming. On the other hand, it is essential to introduce legal

regulations to reduce carbon emissions originating from fossil fuels (Gao, Yang, et al., 2021, Gao, Yue, & Chen, 2021). In addition to the mentioned issues, carbon tax is proposed in this section to deal with the carbon emission problem.

2 Social and Economic Problems Caused by Global Warming

The global warming problem has become quite dangerous. The temperature figures around the world are increasing every year. This situation poses a very serious danger to the world. Rising temperatures are upsetting the balance of the world (Zhao et al., 2021). This situation brings with it many problems. For example, a significant increase in temperatures also causes the problem of drought. This puts the lives of living things at risk. In addition, some natural disasters occur with global warming (Yu & Zhang, 2021). For example, the occurrence of floods poses a very serious danger to the inhabitants of the region.

It is obvious that global warming also creates some social and economic problems. Drought caused by global warming adversely affects agricultural production. In this context, there is a significant decrease in the number of products produced (Yüksel et al., 2021). This situation creates an imbalance of supply and demand for products. In other words, there is a significant decrease in the supply of products due to drought. However, the population is increasing worldwide. As a result of this increasing population, the demand for products is increasing (Rehman et al., 2021). As a result, the amount of production becomes unable to meet the demand.

As the demand for the products is higher than the supply, the inflation problem will occur. This will lead to many other problems. High inflation increases the uncertainty in the markets. This situation leads to a decrease in investments throughout the country (Liu et al., 2021). In summary, high inflation disrupts the macroeconomic balances of countries. On the other hand, the occurrence of inflation because of drought brings along some social problems. The quality of life of people who cannot consume some products due to price increases will decrease (Xie et al., 2021). This will lead to a decrease in unhappiness across the country.

Due to global warming, there is a significant decrease in water resources. If this problem cannot be prevented, the water problem will become very dangerous worldwide. Global warming disrupts the balance of nature (Zhou et al., 2021). In this context, there is a serious decrease in the amount of precipitation across the world. Decreased precipitation also causes a decrease in water resources. Therefore, this problem needs to be solved urgently (Nawaz et al., 2021). Otherwise, this problem will threaten the lives of many people around the world.

As a result, drought because of global warming causes a decrease in both agricultural production and water resources. This situation also leads to an increase in diseases (Yu et al., 2019). Both poor quality nutrition and difficulty in accessing water sources cause people to get sick. If this situation cannot be controlled, there

will be an increase in death rates worldwide. As a result, global warming is a problem that puts everyone's life in danger and needs to be solved urgently (Fu et al., 2021).

3 Global Warming and Fossil Fuel Relationship

Energy is an important need for everyone. This applies to both individuals and companies. Individuals need energy while meeting their daily needs. On the other hand, industrial companies also use energy to produce. In other words, energy has become one of the most important raw materials in industrial production (Shang et al., 2021). In summary, energy is an indispensable need for a country. Therefore, this energy need must be met regardless of its price.

This situation can be managed more easily for countries that have their own energy resources. These countries can meet their energy needs with their own means. In other words, these countries are not dependent on other countries for energy supply. On the other hand, if there is not enough energy source within the borders of the country, this situation is very difficult for the countries. As stated before, energy must be supplied regardless of its price (Berger & Wyss, 2021). Therefore, countries that do not have their own reserves have to import the energy they need from abroad.

Fossil fuels are mostly preferred in energy use. Fossil fuels consist of resources such as oil, coal, and natural gas. Fossil fuels can be used if they are available within the borders of the country. In other words, countries do not have a chance to produce fossil fuels themselves. The resources of fossil fuels are decreasing as they are used. As can be understood from here, fossil fuels are examples of nonrenewable energy types (Liu et al., 2020). In summary, the resources of fossil fuels will 1 day come to an end as they are used up.

The biggest advantage of fossil fuels is their low cost. This situation causes investors to turn to this area. This leads to an increase in the use of fossil fuels in energy production. On the other hand, the most important disadvantage of fossil fuel use is carbon emissions. In the process of obtaining energy by burning fossil fuels, a significant amount of carbon gas is formed. This situation causes serious air and environmental pollution. This gas is poisonous and dangerous for living things (Hao et al., 2021). Therefore, in this process, very serious damage is given to the environment while generating energy.

Carbon emissions are one of the biggest causes of global warming. The use of fossil fuels is also the most important cause of carbon emissions. In this process, a very serious paradox occurs. Energy is a need that countries must provide. Fossil fuels or clean energy sources can be preferred when supplying energy (Du et al., 2020). In this context, the costs of fossil fuels are much lower than clean energy sources. For this reason, fossil fuels are mostly preferred by investors in energy production. On the other hand, cheap fossil fuels generate carbon emissions. Carbon emission also constitutes the problem of global warming. In summary, fossil fuels will continue to be used if they are cheap, and this will increase the global warming

problem. Therefore, to reduce the global warming problem, first, it is necessary to provide a cost advantage to clean energy sources compared to fossil fuels.

4 How Can Global Warming Be Stopped?

Under this title, the issues related to the solution of the global warming problem will be presented in subtitles.

4.1 Use of Clean Energy

One of the measures that can be taken to prevent the problem of global warming is the use of renewable energy sources. In renewable energy alternatives, the energy source is supplied from nature. For example, electricity is produced by using the blowing power of the wind and the sun's rays. In this process, no carbon gas is released into the atmosphere since fossil fuels are not burned (Ma et al., 2021). This situation is considered as one of the biggest advantages of using renewable energy. Therefore, renewable energy alternatives are energy types that produce clean energy and are environmentally friendly.

Another advantage of renewable energy sources is that countries can produce their own energy. For renewable energy production, there is no need to have reserves such as coal and oil within the borders of the country. Factors such as sun, wind, and river are sufficient to produce electricity with renewable energy alternatives. Therefore, it is possible for these energy projects to be implemented in every country (Dinçer et al., 2022). In this way, countries will be able to produce their own energy. As a result, the dependence of countries on abroad for energy supply will be eliminated.

This will also bring some economic advantages. First, countries that produce their own energy with renewable energy alternatives will not pay other countries for energy supply. Considering that this payment is in foreign currency, the use of renewable energy will significantly reduce the exchange rate risk of countries. In addition to the mentioned issues, energy imports of countries will decrease thanks to the use of renewable energy (Gao, Yang, et al., 2021, Gao, Yue, & Chen, 2021). This will help to manage the current account deficit problem effectively. In this way, the economic fragility of the countries will be eliminated.

Another advantage of using renewable energy is to increase foreign direct investments of countries. Thanks to renewable energy alternatives, the use of clean energy in countries is increasing significantly. This situation affects the image of countries positively. Many foreign investors attach importance to the use of clean energy while choosing the countries they will invest in. Therefore, the use of renewable energy contributes to the increase of foreign investments (Qiu et al., 2020). This will help increase trade between countries. In this way, new job

opportunities will emerge, and this will contribute to reducing the unemployment problem.

As can be seen, the use of renewable energy contributes to the solution of the global warming problem in every sense. In this context, increasing these projects is of vital importance for countries. However, there are some important obstacles to the increase of renewable energy alternatives. First, the installation cost of renewable energy projects is quite high compared to fossil fuels (Wang et al., 2019). This still makes fossil fuels more attractive to investors. Therefore, it would be appropriate to take some measures that can provide cost advantages to renewable energy projects.

Another disadvantage of renewable energy projects is that they involve complex processes. In this context, companies must have technical competence to use these projects effectively. Otherwise, it will not be easy to solve the problems that may occur in the processes. This will lead to customer dissatisfaction. In this context, companies should actively follow current technological developments to increase the effectiveness of renewable energy projects. In this way, technological developments will be able to be adapted to the projects in a timely manner. In addition, there is a serious need for qualified personnel to carry out this process successfully.

4.2 Energy Saving

Energy saving has a very important role in solving the global warming problem. Energy saving means reducing the amount of energy used while performing a job. This situation contributes to the more efficient use of depleted energy resources. Reducing the amount of energy used contributes to reducing the damage to the environment because of energy consumption. This helps to reduce the global warming problem significantly (Sarkar et al., 2021).

In this context, it is possible to talk about some measures for energy saving. For example, the use of energy efficient electronic devices helps this process. Thanks to these tools, much less energy will be used while doing the same work. If this situation is implemented in every house in the country, it will be possible to save very serious energy throughout the country.

In addition to the mentioned point, it is necessary to remove the plugs of unused electrical appliances from the socket. In this way, unnecessary use of electricity will be avoided. Insulation of buildings is also very important in terms of energy efficiency. Less heating will be needed in insulated buildings. This will also contribute to increasing energy savings. It is very important in this process that the doors in houses and workplaces are not kept open unless they are used. In addition, the maintenance of electrical appliances should be done periodically. In this way, it will be possible for these devices to work more effectively and consume much less electricity.

As a result, it is necessary to save energy for the solution of the global warming problem. Energy consumption is one of the biggest causes of the global warming problem. The carbon emission that occurs in the process of energy use causes the

problem of global warming. Therefore, to solve this problem, energy consumption should be reduced. Thanks to the energy saving policies to be implemented, it will be possible to consume less energy, and this will contribute to the solution of the global warming problem.

4.3 Increasing the Consciousness of People

It is also very important to increase the awareness level of people to solve the global warming problem. Global warming is a very important problem affecting the whole world today. If the measures to solve this problem are not taken on time, many new problems will occur. For example, agricultural production will decrease significantly due to drought. This will lead to the problem of scarcity. As a result, many people around the world will face the problem of hunger.

Another problem that will occur because of global warming is the decrease in water resources. Drought occurs due to global warming and the amount of precipitation decreases. This situation causes a significant decrease in water resources. Decreased water resources are a very serious threat to the future of the world. There is a possibility that many epidemics will increase due to insufficient water resources. This means that many people die.

To combat the global warming problem effectively, these negative aspects of this problem must be understood by people. In other words, people need to have a clear understanding of the negative effects of global warming. In this way, people will take precautions against the factors that cause global warming by their own will (Mukhtarov et al., 2022). Therefore, people should be told in detail how dangerous global warming is. By actively using television channels and social media in this process, awareness of the global warming problem can be increased.

4.4 Legal Regulations

One of the main reasons for global warming is the preference of fossil fuels in energy production. The biggest advantage of fossil fuels compared to clean energy sources is their lower costs. This situation causes investors to turn to these projects. Fossil fuels are becoming more attractive to for-profit investors. Considering that the main purpose of enterprises is to make profit, they will not prefer clean energy projects that do not have cost advantages, even if they are more environmentally friendly. This situation constitutes an important obstacle to the solution of the global warming problem.

Considering the abovementioned issues, it is essential to introduce legal regulations to reduce carbon emissions originating from fossil fuels. Otherwise, it will not be possible to reduce the use of fossil fuels. The main reason for this is that it will not be enough to prefer renewable energies just for being environmentally friendly

(Rehman et al., 2021). Therefore, it should be made compulsory to take necessary actions with legal regulations. Penal sanctions to be applied because of noncompliance with the rules will be a deterrent for companies. In this framework, the relevant companies will take the necessary measures to reduce the carbon emission problem.

5 Carbon Tax: As a Solution for Carbon Emission Problem

Carbon emissions cause serious environmental pollution. Therefore, some social and economic problems arise. As a result of carbon gas released into the atmosphere, a significant portion of people become ill. This situation reduces people's quality of life. This situation is considered as an important social problem for countries. In addition, it is obvious that people getting sick create some economic problems. For example, the increase in the number of sick people will result in significant job losses in the country. This situation will adversely affect the amount of industrial production. As a result of the shrinkage of industrial production, some of the companies will not be able to make a profit and this will cause the economy to shrink (Cheng et al., 2021).

Another economic problem caused by the increase in the number of sick people because of carbon emissions is related to the health expenditures of the country. More people getting sick will lead to higher health expenditures. The increase in the government's health expenditures will create a burden on the budget. If these expenditures increase too much, there is a risk that countries will encounter a budget deficit problem. The budget deficit problem makes the economy of a country more fragile. To close the mentioned budget deficit, states may have to borrow money.

It is seen that carbon emissions cause serious problems for the country's economy. In other words, fossil fuels, which are thought to be less costly compared to clean fuels, have additional costs caused by the problems they cause. It is seen that fossil fuels do not actually have a significant cost advantage compared to clean energy investments. The important issue here is that the initial cost of fossil fuels is covered by companies, and the long-term indirect costs incurred are covered by the states (Nong et al., 2021). As a result of the use of fossil fuels, which are cost advantages for companies, extra costs arise for states.

To eliminate this imbalance mentioned above, the carbon tax issue can be considered. In this context, tax is imposed on the amount of carbon emissions created by fuels, especially in the energy and transportation sector. In other words, extra taxes should be levied on companies that generate more carbon emissions in the production process. Because the carbon emissions created by these companies have a significant impact on the state budget. It is thought that this application will significantly reduce the carbon emission problem (Cao et al., 2021). In this way, it will be much easier to reduce the global warming problem.

6 Conclusion

In this section, the issues related to the solution of the global warming problem are examined. One of the measures that can be taken to prevent the problem of global warming is the use of renewable energy sources. In renewable energy alternatives, the energy source is supplied from nature. In this process, no carbon gas is released into the atmosphere since fossil fuels are not burned. This situation is considered as one of the biggest advantages of using renewable energy. Energy saving has a very important role in solving the global warming problem. Energy saving means reducing the amount of energy used while performing a job.

It is also very important to increase the awareness level of people to solve the global warming problem. Global warming is a very important problem affecting the whole world today. To combat the global warming problem effectively, these negative aspects of this problem must be understood by people. In other words, people need to have a clear understanding of the negative effects of global warming. On the other hand, it is essential to introduce legal regulations to reduce carbon emissions originating from fossil fuels.

In addition to the mentioned issues, carbon tax is proposed in this section to deal with the carbon emission problem. It is seen that fossil fuels do not actually have a significant cost advantage compared to clean energy investments. The important issue here is that the initial cost of fossil fuels is covered by companies, and the long-term indirect costs incurred are covered by the states. As a result of the use of fossil fuels, which are cost advantages for companies, extra costs arise for states.

To eliminate this imbalance, the carbon tax issue can be considered. In this context, tax is imposed on the amount of carbon emissions created by fuels, especially in the energy and transportation sector. In other words, extra taxes should be levied on companies that generate more carbon emissions in the production process. Because the carbon emissions created by these companies have a significant impact on the state budget, it is thought that this application will significantly reduce the carbon emission problem. In this way, it will be much easier to reduce the global warming problem.

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Selecting the Optimal Clean Energy Projects for Emerging Economies



Serkan Eti

Abstract In this study, it is aimed to determine the most accurate renewable energy investment alternative for developing economies. In this context, firstly, a very large-scale literature analysis was made. As a result, four different issues were identified that could have an impact on this decision. Financial analysis contributes to the determination of the efficiency of investments. Another factor to be considered in the selection of the optimal clean energy investment is customer satisfaction. Customer expectations should be taken into consideration when making investment decisions. Technological investments are also very important in this process because renewable energy investments involve complex engineering steps. Additional factor to consider in the selection of the most suitable renewable energy investment is personnel quality. By considering these four different factors, a decision-making model is created to identify the most optimal renewable energy alternative. For this ranking, the MAIRCA method based on expert opinion was preferred. The most optimal renewable energy alternative has been determined as geothermal energy. Secondly, biomass was determined as the most suitable renewable energy type. Geothermal energy and biomass energy types were followed by wind, solar and hydroelectricity energy types, respectively. It has been determined that hydroelectricity energy type is the most unsuitable renewable energy type. Considering the results obtained, it would be appropriate for developing countries to prioritize their geothermal energy investments. In this context, the types of risks encountered in this process should be determined. In addition, actions specific to these risk types need to be taken. This will allow the risks to be managed effectively. In this way, it will be possible to increase the performance of geothermal energy investments. One of the most important risks in geothermal energy investments is the damage of water resources. Otherwise, there will be significant reductions in water resources. This situation will cause some problems especially in agricultural production. Insufficient water resources will lead to a decrease in the production of agricultural products.

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Therefore, it would be appropriate to pay attention to this issue in geothermal energy investments.

1 Introduction

Energy is one of the key factors in human history. Throughout history, energy has been an indispensable concept for people to survive. Energy can be found in different forms such as nuclear energy, chemical energy, electrical energy, heat energy, mechanical energy, and light energy. Depending on the form of energy, its use and importance can vary (Smil, 2004). Energy can be used for many purposes such as heating, lighting, and operating electronic devices. First, electrical energy has serious importance for countries and businesses. As it is the raw material of the industry, it has increased the investments in the countries and increased the profit margin of the energy sector (Dinçer et al., 2019).

Energy is examined in 2 classes according to the source from which it is produced. These are renewable energy and conventional energies. Renewable energy is an energy resource that does not have a finite life and is a type of energy whose source is assumed to be inexhaustible. The energies obtained from sources such as sun, wind, and water are evaluated in this type of energy category. Solar energy, wind energy, hydroenergy, tidal energy, geothermal energy, and biomass energy are subcategories of this type (Fridleifsson, 2001). Fossil fuels are considered conventional energy sources. These energy sources are energies stored underground with accumulations throughout history. They have a limited amount. Energy obtained from sources such as oil and coal can be considered in this context (Du et al., 2020).

As countries around the world face energy resource shortages, there is a need for more sustainable energy sources. In this context, although the trend towards renewable energy sources has increased recently, these energy sources have some difficulties. Chief among these are difficulties such as installation cost and storage (Muruganantham et al., 2017). There are also many studies showings that geographical conditions are an effective factor in the selection of renewable energy (Bao, & Fang, 2013).

Due to such difficulties in the establishment of renewable energy, it is an important problem to determine the type of source to be selected. Such difficulties are considered in determining the optimal energy source over countries in academic studies and field applications (Liu et al., 2021). Similar studies in the literature reveal the selection of the most appropriate energy for countries and businesses. Choosing the most suitable renewable energy source is important because not every country is equal in terms of energy resources and the financial infrastructure to meet the installation costs is limited. If the said energy sources are not selected correctly, energy efficiency will not be in question. This will lead to a longer return on energy investments and an increase in energy-related costs. Thus, the desired efficiency from renewable energy will not be achieved.

Correct planning of energy investments is important in terms of efficiency. In this context, this study aims to determine the most suitable renewable energy project for developing countries. For this purpose, the four criteria that are taken into consideration most in the selection of renewable energy are taken as a basis. Within the framework of these criteria, renewable energy alternatives will be listed with the MAIRCA (Multi-Attributive Ideal–Real Comparative Analysis) method, which is one of the multi-criteria decision-making methods.

2 General Information About Energy Production

The concept of energy is an indispensable raw material for both businesses and countries in daily life. In this context, energy production is of great importance. The basic principle in energy production is to move dynamos with steam power by utilizing heat. The basic structure here is the conversion of kinetic energy by the action of dynamos. Renewable resources such as water, nuclear, and the solar wind can be used for the movement of these dynamos. Apart from such renewable energy sources, fossil fuels have been preferred for a long time. These are the method of obtaining by using underground resources such as oil and coal. Whether renewable or derived from fossil fuels, both types of energy have advantages and disadvantages.

Fossils are the remains of extinct creatures that have survived for many years without deterioration. Fossil fuels are energy sources that result from the decomposition of living remains (animal and plant remains) under the ground for millions of years. The excess of harmful gases that arise during the acquisition of the said energy is one of the biggest disadvantages of such energy sources. In other words, such gases are released into the air as a result of the chemical reaction that occurs in obtaining energy from fossil fuels. Unless correct filtering and precautions are taken, these gases can harm both nature and human health (Zhou & Li, 2018). It has harmful effects on nature such as thinning the ozone layer and causing acid rain. Another disadvantage is that the fossil resources used to obtain these fossil energies are limited (Najafi et al., 2011). One of the advantages of these fuels is their low investment costs (Caineng et al., 2021; Lively, 2021).

Unlike the energy obtained from fossil fuels, renewable energy is environmentally friendly. Its effect on greenhouse gas emissions and other air pollution is minimal. Thus, it can be said that it is harmless to both the environment and human health. In addition, turning unlimited energy sources into electrical energy ensures that it is long term. Another advantage is the promotion of economic development. Research has shown that renewable resources have a significant multiplier effect on countries whose industries can produce and produce energy machinery and equipment based on technological innovations, especially in their exports (Maradin, 2021). Despite these advantages of renewable energy types, there are also disadvantages. These energy resources are completely dependent on geographical location and weather conditions. This can present a significant limitation

and difficulty. But this can be mitigated by quality planning and careful site selection.

Another disadvantage is that they cannot produce as much energy as fossil fuel power plants. To reduce this deficiency, more investments and construction of power plants may be required. Production cost can be shown as the biggest disadvantage of renewable energy. The literature suggests that there is a higher cost to build a renewable power plant compared to fossil power plants (Risto & Aija, 2008). In summary, renewable energy types have disadvantages such as being dependent on weather conditions, low energy production ability, efficiency, and capacity, as well as high investment costs. However, it has benefits such as being harmless to the environment and human health, reducing import dependency, encouraging innovation and economic development, enabling rural development, and reducing energy shortage (Akhtar et al., 2021; Maradin, 2021; Wu et al., 2021).

3 The Importance of Clean Energy Investments

Many numerical models are considered when making investment decisions (Eti, 2021). Whether it is fossil fuels or renewable energy types, both types have their advantages and disadvantages. Today, it is possible to see that countries and businesses are moving away from the types of energy obtained from fossil fuels and turning to more renewable energy sources. The main reasons for this are its environmental friendliness, and it is minimally affected by energy price fluctuations (Yuan et al., 2021). Generally, it is aimed to stabilize the costs arising from energy prices in production enterprises. Businesses and countries can produce their energy with renewable energy. Thanks to this, external dependency is reduced, and it can strengthen its hands in price policy. In addition, it is environmentally friendly because it does not emit carbon emissions and does not release other air pollution-causing gases into nature. One of the reasons for preferring renewable energy is the employment provided by these facilities in countries (Li et al., 2021). Establishing renewable energy power plants and facilities instead of importing energy will contribute significantly to the employment of the country. Thus, domestic and national energy production will be provided while contributing to employment. Another benefit is its contribution to the image of the country. It has been shown by studies that renewable energy is stimulating economic development (Baloch et al., 2022; Felice et al., 2021; Maradin, 2021).

Investments in renewable energy sources have benefits for the country, the environment, and people. Therefore, investments in renewable energy facilities are important. With these investments, serious contributions will be made to both the employment of the country and the economic independence of the country (Li et al., 2021). Studies in the literature have shown that renewable energy investments have a positive effect on economic growth and employment (Azretbergenova et al., 2021; Baş & Ersin, 2021; Eyuboglu & Uzar, 2021; Kirikkaleli et al., 2021; Zhe et al., 2021). In addition to the financial contributions of renewable energy investments,

there are also benefits in terms of country image. It is both an indicator of economic development and can be seen as an indicator of independence (Hussain et al., 2021; Wang et al., 2022).

Renewable energy investments, such as energy investments from fossil fuels, also have disadvantages. The cost in the facility or power plant is one of these disadvantages. The high cost of this makes investors hesitant (Dinçer et al., 2021; Karatop et al., 2021). Besides the high initial cost, renewable energy sources may not have a stable efficiency due to climate instability. This may prolong the return on costs (Sendstad et al., 2022). Investors may therefore abstain due to the uncertainty of the return on their investments. In addition, the storage of energy to be obtained from renewable energy sources is a separate problem. Storage units to be established for this also create costs. Energy obtained from renewable energy sources must be stored before distribution. The facility to be established for the storage of energy also creates additional costs (Meng et al., 2021).

After the cost of establishing renewable energy sources, fixed costs can also be an effective factor in investment decisions. Maintenance and repair costs and difficulties of renewable power plants are also included in the literature as a disadvantage. It can be difficult to find spare parts and equipped personnel for maintenance and repair. Such difficulties can be effective in making the renewable energy decision (Babatunde et al., 2020; Kan et al., 2020). Another disadvantage of renewable energy is that technical competence is required. Personnel working for fossil fuels may not generally be expected to be qualified. Academic success is not expected in the employment of personnel to work in coal mines and similar places. However, this is the opposite in renewable energy production facilities. The personnel who will work here must be experts and equipped. In addition to personnel, technical products and materials are also required. These two technical requirements increase fixed costs. In this case, it is considered a negative criterion in making investment decisions (Li et al., 2020).

4 An Evaluation for Emerging Economies

The MAIRCA method is a multi-criteria decision-making method that was first introduced to the literature in 2014. The method in question provides the ranking of alternatives with the help of determined criteria and weights like the TOPSIS method (Pamučar et al., 2014). The basis of the MAIRCA method lies in determining the gap between ideal and empirical evaluations. The sum of the gaps for each criterion is calculated and evaluated for each observed alternative. The highest ranked alternative is treated as the alternative with the lowest value for total clearance. The alternative with the lowest total gap is interpreted as having values closest to the ideal estimates (Chatterjee et al., 2018; Gigovic et al., 2016).

Many criteria affect renewable energy investments. The advantages and disadvantages of renewable energy sources can affect these decisions. In this context, it is important to consider these criteria carefully to obtain maximum efficiency from