**Analysis of Environmental and Energy Policies in Turkey, the European Union and the United States**

.


## ABSTRACT

Energy consumption plays a pivotal role in the development of societies. Sustainable Energy Resources are vital inputs for daily life, and energy and industrial products are essential for economic growth (Ministry of Energy and Natural Resources, 2022). Consequently, those responsible for managing a country's energy sector must ensure the uninterrupted, reliable, timely, clean, and affordable supply of energy, as well as diversify energy sources to enhance energy security.

The concept of "sustainable development" has emerged in response to the need to prevent irreversible environmental damage caused by conventional energy sources and outdated technologies while ensuring access to energy as a fundamental human right under optimal conditions (Pamir, N 2005). Developed societies have transitioned from planning based solely on energy source acquisition and production to a planning approach that carefully considers the energy-economy-ecology balance (3E) while taking into account resource diversity and geopolitical realities (Energy Policies and Global Developments, emo.org.tr).

Turkey remains heavily dependent on energy imports, accounting for approximately 74% of its energy needs (Ministry of Energy and Natural Resources, 2023). The multifaceted nature of Turkey's energy strategy and its energy dependence emphasize the importance of international relations in this field.

U.S. energy policies have global ramifications, particularly in areas such as energy resource utilization, energy trade, and energy independence (Ministry of Energy and Natural Resources, 2022). U.S. energy policies play a significant role in international relations, impacting relationships with other countries, especially in matters related to energy exports and imports.

In Europe, there is uneven progress towards clean electricity, with both successes and challenges in transitioning to a low-carbon energy system. While the European energy sector has taken significant steps towards decarbonization, there has been limited progress in some countries, and much more progress is needed. Achieving a fully decarbonized energy system in Europe requires united efforts and coordination to address the challenges posed by fossil fuel dependence and climate change.



**Keywords:** Energy, Energy Policies, Energy Strategy, Sustainable Development, Energy Security, Renewable Energy, Turkey, United States, European Union, International Relations

## 1. INTRODUCTION

Reducing the use of fossil fuels in electricity generation is a challenging process. The entire world still heavily relies on fossil fuels for electricity production. Increasing the share of renewable energy in power generation offers advantages in various ways, such as reducing CO2 emissions, ensuring grid flexibility, and promoting decentralized electricity production. Many countries today shape their energy strategies and policies to rely more on domestic and renewable sources. Turkey is one of these countries, with effective policies aimed at increasing the use of indigenous resources in electricity generation. Overall, Turkey aims to decrease the use of imported energy sources in electricity production. Over the past 20 years, Turkey has experienced the fastest growth in energy demand among the member countries of the Organization for Economic Cooperation and Development (OECD) (Ministry of Energy and Natural Resources, 2022). During this period, Turkey ranks second globally, after China, in the increase of electricity and natural gas demand. Situated in a region that holds approximately 60% of the world's proven oil and natural gas reserves, Turkey has become one of the largest natural gas and electricity markets in its region.

On the other hand, Turkey is approximately 74% dependent on imported sources to meet its energy demand (Ministry of Energy and Natural Resources, 2022). The multidirectional structure of Turkey's energy strategy and its energy dependency increase the importance of international relations in this field.

Turkey places significant importance on the development of renewable energy sources. According to the National Energy Policy adopted in 2017, increasing the use of local and renewable energy sources is among the top priorities. Turkey has becamethe 5th place in installed capacity in renewable energy in Europe and the 12th place globally. As of September 2023, 53% of the installed capacity in Turkey comes from renewable sources (Ministry of Energy and Natural Resources, 2023).

To meet the growing energy demand and reduce energy dependence and environmental impact, Turkey has decided to utilize nuclear energy in energy production. In this context, the construction of the Akkuyu Nuclear Power Plant (NPP) is currently underway, with the aim of commissioning it in 2024. Energy is one of the most important issues in Turkey-EU relations. Turkey, being in an indispensable position for ensuring Europe's energy security, joined the Energy Community as an observer in 2006, indicating the importance placed on regional energy cooperation.

The goals set by the European Union (EU) for its own energy policy have had both positive and negative impacts on Turkey's energy sector. The reform process initiated by Turkey to align with the EU internal energy market has led to efforts to increase the transparency of Turkey's energy sector, determine prices in a more competitive environment, restructure energy institutions, establish the independent regulatory body EPDK, enhance energy efficiency and savings, invest in the rehabilitation and modernization of energy-related infrastructure, develop a mechanism for emergency stocks, make progress in renewable energy sources, and contribute to reducing loss and leakage rates.

Additionally, the high level of import dependency in the EU's energy sector, similar to Turkey, should be seen as a separate advantage for Turkey. This situation, which aligns the energy supply security policies of both parties, will also contribute to Turkey's goal of becoming an energy hub in its region. On the other hand, while Turkey's accession to the Kyoto Protocol is considered an important step for environmental protection, it should not be overlooked that it may negatively affect industry in terms of integration, especially given that Turkey has not completed its industrial development (Yorkan, 2009).

The United States, being a central player in the global energy system, attracts close attention to its policies in this field. The announcement by ex President Trump, as part of the "National Security Strategy" declared at the end of 2017, that the goal is to become "energy dominant" globally has drawn the attention of global actors.

The new U.S. administration had expressed this goal as soon as they took office, and efforts continued to make the U.S. an "energy dominant" country. This discourse essentially implied being independent, secure in energy matters, and staying away from global energy conflicts. However, during this period, the U.S. has been notably involved in the midst of global energy struggles. The U.S. aims to maintain its influence in the region and continue its role as a key player in political and economic competitions in the Middle East, Arab countries, and Africa to enhance its interests (Kavaz, 2018).

Another global impact is the transformation of the United States from a long-time energy importer to an energy exporter, especially after the shale gas revolution. As a result, the U.S. aims to play an active role in the world natural gas markets. Efforts are being made to deliver the newly discovered natural gas resources, especially to the EU market. The dependence of EU countries on natural gas from Russia is quite high, prompting these countries to see the U.S. as an alternative supplier to diversify their source countries. The

U.S. also seeks to maintain its influence in the region by exporting LNG to these countries and aims to be a dominant power in the energy markets. The U.S. takes strategic actions to turn the energy dependence of EU countries to its advantage, gaining both political and economic benefits.

In conclusion, critical decisions and actions taken by the U.S. have significant effects on countries worldwide. In the 21st century, where energy is not just a resource but a decisive factor in the economic and political relationships of nations, global energy struggles have turned into a competition to gain more share in the market. As such, the competition among countries with energy resources, those in need of them, and those playing a role in their transfer will continue to intensify.

Turkey's position in energy projects and its geostrategic location, in terms of its impact on EU policies, is a continuously debated topic regarding its beneficial magnitude. The significance of Turkey in many projects has been emphasized, highlighting its proximity to energy routes and its potential to become an energy hub in the near future. Turkey has taken on the role of consistently transferring energy to the European market, elevating its position to a very different level within the decision-making mechanism of EU energy policies. The strategic position of Turkey plays a crucial role in shaping the energy policies that the EU may pursue through Turkey. This process, which influences the future projects and decisions of the Union's energy policy, has propelled Turkey into a critical region.

In this study, attempts have been made to identify the possibilities of transitioning to renewable energy to achieve the net zero carbon goal in all scenarios and studies for Turkey, the United States, and the European Union. The transition to renewable energy for Turkey, European Union, and the United States has been analyzed using the Energy PLAN and SWOT analysis methods to explore their strengths, weaknesses, opportunities, and threats.

## 2. MATERIAL AND METHODS

The study includes comparision of using the EnergyPLAN model and SWOT Analysis. This literature-based study compares studies conducted for Turkey, the European Union, and the United States using the EnergyPLAN model in the context of climate change and green agreements. In this regard, both domestic and international studies, as well as relevant institutional data, have been utilized as source material. To achieve this, information and documents from national and international institutions such as the Ministry of

Environment and Urbanization, EPDK, Ministry of Energy and Natural Resources (ETKB), Turkish Statistical Institute (TUİK), Ministry of Economy, Ministry of Foreign Affairs, International Energy Agency (IEA), IPCC, TEIAS, EÜAS, EPİAŞ, IEA, EMBER, OECD, World Bank, have been extensively utilized, and data from international organizations has been taken into account.

EnergyPLAN is an hourly input/output-based simulation tool used for energy system analysis at the national or regional level. The primary purpose of this model is to assist in the design of regional and national energy system strategies and policies (Lund & Thellufsen, 2019). The model has inputs and outputs. Inputs include renewable energy sources, demands, costs, and installed plant capacities. Outputs include energy balances, fuel consumption, total costs, imports/exports, and annual productions..

***EnergyPLAN Model Inputs and Outputs***

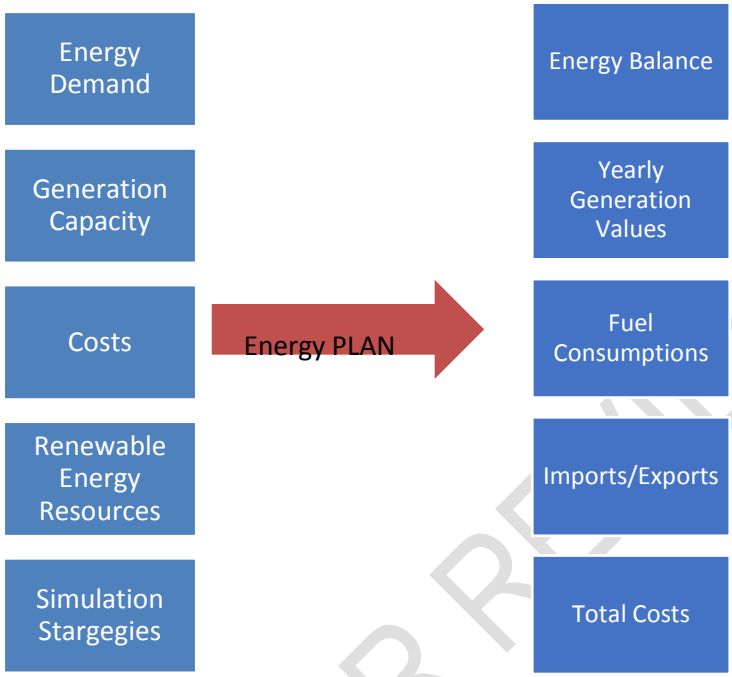


**Figure 1**. EnerjiPLANModel Inputs and Outputs (Özçakır, 2012)

The study evaluated the results obtained with the EnergyPLAN model by collecting information from the literature and comparing them with the outcomes of studies specific to three different regions: the United States, the European Union, and Turkey. Given the diversity of various energy tools available in the analyzed regions concerning the technologies considered and the goals were achieved. The focus of the study was particularly on renewable energy sources, emphasizing their development and future operation. After setting a primary goal, the energy sources were evaluated against each other based on their abilities to achieve this goal.

SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis has been used in this study as a secondary method alongside the EnergyPLAN model to determine the strengths and weaknesses of renewable energy proposed in all studies and models for the transition to long-term carbon-neutral energy production for Turkey, the EU, and the US. The SWOT analysis method was developed by professors from Harvard University, namely Learned, Christensen, Andrews, and Guth, in the 1960s (Ghazinoory, 2011).

SWOT analysis involves examining environmental factors, identifying opportunities crucial for the future of decarbonization, recognizing and taking precautions against activities that could cause threats, revealing strengths, and determining when, under what conditions, and in what environments they might need to be utilized.

In this study, the aim is to achieve a transition to completely renewable energy, as proposed in all scenarios and studies for Turkey, the US, and the EU to reach the net zero carbon target. The applied SWOT analysis examines the transition to completely renewable energy for all mentioned countries in terms of the following:

- Strengths: The advantages and strong aspects that come with the transition to completely renewable energy.
- Weaknesses: The potential weaknesses or obstacles of this transition.
- Threats: Negative factors or risks that may be encountered.
- Opportunities: Positive impacts and opportunities that the transition to completely renewable energy may bring.

This analysis can be utilized to better understand, plan, and optimize each country's energy transformation proces

## 3. RESULTS AND DISCUSSION

### *ENERGYPLAN MODEL STUDY*

When conducting assessments and working on models in the United States, the state system has been prioritized and examined. Each state has three factors specific to them that influence the prediction of targeted emissions:

1. Fuel mix used at the existing power plants: The combination of fuels used to generate energy in the existing power plants in each state.

2. Emission rate of existing fossil fuel power plants: The rate at which emissions occur in the existing fossil fuel power plants in each state.

3. Capacity factor of PV systems in each state: The efficiency and performance factor of photovoltaic (PV) systems in each state.

Taking these factors into account is crucial for a comprehensive evaluation and modeling process in the United States, given the decentralized nature of the energy landscape with each state having its own policies, energy mix, and infrastructure.

For example, while coal-fired power plants in California provide less than 1% of the electricity, in West Virginia, they supply almost all of the generated electricity. Therefore, assuming a higher PV penetration in West Virginia, when compared to states where existing production is supplied from cleaner energy sources, and assuming that local coal production is not transferred elsewhere, it would lead to a proportionally larger reduction in emissions per kWh produced.

Coastal states like California, including those along the Pacific Coast, generate a significant portion of their electricity using natural gas and hydroelectric sources. In contrast, some Eastern states in the Midwest and West Virginia, Indiana, Kentucky, Pennsylvania, and Ohio, typically generate most of their electricity using coal. Higher PV (or other renewables) can replace energy from different power plants depending on the location of new capacity. For example, an increase in electricity generated from PV in West Virginia could replace a larger share of coal-fired production compared to California, where PV could

replace a larger share of natural gas. However, the actual energy produced from renewable sources, and the emissions avoided from displaced fossil units, are also influenced by local weather conditions that vary from state to state. Values from ten geographically distributed states in the U.S., typically generating most of their electricity from coal or natural gas, were analyzed by extracting data from the literature.

The model study results indicate a significant reduction in emissions across states with the utilization of renewable capacity. Before conducting any quantitative analysis to explain this diversity, considering that coal-fired power plants have higher emissions than all other energy plants, qualitatively higher CO2, SO2, and NOx avoided emissions in places where the share of coal plants is higher, such as West Virginia, already supports all hypotheses. A sensitivity analysis was conducted to quantitatively investigate the relationship between avoided emissions (g/W) and state-specific factors concerning the transition to renewable energy sources. Assuming a general state profile with an annual demand of 100 TWh and production fuel types being coal and natural gas (Zhai et al., 2012), the EnergyPLAN model was then run with varying factors (the share of coal or gas production), and the results indicated that, generally, in states where the share of coal plants (coal share) is higher, avoided emissions are also higher. Analyzing whether this relationship is linear or nonlinear with a threshold, it was observed that avoided emissions remained almost constant as the coal share increased, but they increased with the coal share after reaching a threshold of around 60%. The explanation for this is that when the share of coal is below 60%, whether it's 50% or 10%, the only fossil fuel replacing PV is natural gas/oil. However, if the share of coal is above 60%, PV will replace a mixture of coal and natural gas/oil. Besides the gas share, it is also crucial to examine how the various emission intensities of existing coal power plants affect the avoided emissions.

Considering the environmental benefits of reducing pollutants, it may still be important for policymakers deciding on PV placement between states to take into account states with high avoided emission potential due to high coal but low solar capacity. The third variable factor influencing the avoided emission rate is the PV capacity factor. The results obtained with the EnergyPLAN model are based on the assumption that the electricity grid is flexible and reliable enough to accommodate all electricity generated from PV.

As part of the EU's goals to reduce greenhouse gas emissions and increase the share of renewable energy, the European energy system is currently undergoing a significant transition (Calzonetti et al., 2004). Traditional fossil fuel-based energy production derived from dispatchable generation units is being replaced by variable renewable electricity and heat sources such as solar and wind, which naturally exhibit fluctuating behavior. The substantial integration of variable renewable energy sources (VRES) poses challenges in terms of matching production and demand due to variability on both sides. Therefore, achieving flexibility and ensuring supply security in energy systems with high penetration of variable renewable energy production requires additional measures (Lukasz, 2018). The European Commission acknowledges that the integration of variable renewable energy sources into the energy system necessitates additional flexibility measures such as rapid-response generation, storage, and demand response.

EnergyPLAN consider all energy sectors. Therefore, the user defines the electricity, cooling, heating, industrial, and transportation sectors, and EnergyPLAN then balances the energy flows between these sectors. It is possible to establish numerous different technologies for each sector, allowing for the exploration of the use of different fuels, efficiencies, and production models. Overall, this enables a detailed inclusion of electricity, heating, and gas networks for the efficient implementation of renewable energy in Europe by 2050 (Lund et al., 2021).

In the literature, values from a baseline scenario for the European energy system in 2050 are used, especially for the European Union, known to formulate highly sensitive policies, particularly regarding climate change. This scenario represents predefined policies in the European energy sector from 2015 to 2050 and, therefore, does not result in achieving European energy goals but serves as a baseline and a reference point for a carbon-neutral European energy system. The system is based on the "A Clean Planet for All" scenarios, specifically the Basic 2050 scenario (EU Commission, 2015).

EnergyPLAN's capability to model energy flows between different sectors, such as excess heat usage, storage, power from heat, power from gas, power from liquid, and electric vehicles, makes it highly suitable for modeling Smart Energy Systems. Additionally, its hourly modeling capabilities enable the matching of energy flows, including the benefits of sector coupling at each hour. The proposed EnergyPLAN model simplifies the European

Energy System as a single energy model. The exposure of countries to geopolitical and economic threats due to fossil fuel dependence is evident in recent national policies of the European Union (EU), which clearly highlight the security risks associated with fossil fuel dependence. Under this new paradigm, not only climate change but also geopolitics accelerates the rapid implementation of renewable energy and the phased removal of fossil fuels.

In response to this new situation, EU national governments have already increased their targets for renewable energy sources. These targets are expected to rise from an average of 55% to 63%, with plans indicating a one-third reduction in fossil fuel usage by 2030. This demonstrates how seriously national governments take the security risks associated with dependence on fossil fuel imports. Decarbonizing heat and industry has also taken into consideration. Five European countries have announced policies related to regulations, energy efficiency in buildings, and clean heating, with a target of distributing 10 million heat pumps in the next five years. Additionally, more effort is needed in certain sectors, such as the transportation sector.

The path forward for the European continent is clear – ensuring energy security by phasing out fossil fuels. Most governments have already taken steps to address this challenge, and many countries are rapidly joining the unified REPowerEU effort by accelerating the transition to renewable energy, increasing energy efficiency, and decarbonizing their economies. These steps are seen as both necessary and beneficial, serving as a guide for countries outside Europe as the impacts of fossil fuel fluctuations continue to spread.

For Turkey,  EnergyPLAN to develop and analyze different scenarios for advanced energy regulation and implementation in the electricity generation processes. Three separate scenarios were created, taking into account the installed power potentials of solar, wind, and both sources combined. In each scenario, capacities were increased by 5%, and suitable solutions were examined. The analysis results indicate that the contribution of wind and solar energy to the economic dimension can be 47% and 41% on the market level, respectively. In this context, the importance of contributing to the country's economy by using wind and solar energy has been emphasized (Bahadır, 2020).

Furthermore, this study examines the low, medium, and high-capacity production demands for 2030 and 2050 in Turkey, along with which energy sources should meet these demands. The study also addresses energy policies and the role of green hydrogen in the energy supply. The year 2023 marks the 100th anniversary of the establishment of the Turkish Republic. Therefore, Turkey has numerous targets to achieve by 2023. In this study, the 2023 energy targets have been taken as a reference to reach the scenario of 50% renewable energy.

***SWOT ANALYSIS STUDY***

SWOT analysis aims to provide a comprehensive overview of the strengths, weaknesses, opportunities, and threats associated with renewable energy sources in the US, EU, and Turkey. It takes into account the unique characteristics and challenges of each region in the context of sustainable energy development.

SWOT analysis is a strategic management tool that involves the examination of various sources, including management, strategic management, diagnostic analysis, and business management. While it is one of several strategic management approaches, SWOT analysis stands out by enabling the identification of the current situation and perceptions in different projects, leading to the formulation of successful plans. This method focuses on determining the Strengths (S) and Weaknesses (W), ultimately evaluating potential Opportunities (O) and Threats (T).

Key Components of SWOT Analysis:

1. Strengths (S):

Internal factors that represent advantages and positive attributes.

Examples: Skilled workforce, strong brand reputation, advanced technology.

2. Weaknesses (W):

Internal factors that represent disadvantages or areas needing improvement.

Examples: Limited financial resources, outdated infrastructure, lack of market presence.

3. Opportunities (O):

External factors that the organization or project could leverage for its benefit.

Examples: Emerging markets, technological advancements, changing consumer trends.

4. Threats (T):

External factors that could pose risks or challenges to the organization or project.

Examples: Regulatory changes, economic downturns, intense competition.

Applying the SWOT analysis to the renewable energy sector allows for a thorough evaluation of its current state and future prospects. This method helps identify the sector's inherent strengths and weaknesses, as well as the external opportunities and threats that could impact its growth and sustainability. The analysis provides a strategic framework for decision-makers to formulate effective plans and navigate challenges in the dynamic renewable energy landscape.

The USA has been a global leader in developing and adopting innovative renewable energy technologies. Abundant solar, wind, and geothermal resources provide a strong foundation for renewable energy projects. In Investment and Financingit Robust financial markets and investment mechanisms support large-scale renewable energy projects. In USA, the lack of consistent federal policies can create uncertainty for renewable energy investors and developers.Remote renewable energy resources face challenges in connecting to the main power grid. USA. Growing demand for clean energy presents opportunities for expanding the renewable energy market in USA.

The European Union has a comprehensive and supportive policy framework for renewable energy adoption. EU countries benefit from collaborative efforts, allowing for shared resources and knowledge in the renewable energy sector. There is a high level of public awareness and support for renewable energy in EU member states. The intermittent nature of some renewable sources poses challenges for maintaining a stable energy supply in EU. Despite substantial progress, some EU countries still rely on energy imports, impacting energy security. In EU ongoing advancements in renewable technologies create opportunities for more efficient and cost-effective solutions.

Turkey has a diverse range of renewable resources, including solar, wind, hydropower, and geothermal. Turkey's geographical location allows it to serve as a bridge between Europe and the Middle East for renewable energy trade.The Turkish government has shown commitment to increasing the share of renewables in the energy mix.. Limited financial resources and reliance on traditional energy sources can hinder substantial investments in renewable in Turkey. Integrating renewable energy into the existing grid

poses technical and logistical challenges. Increasing reliance on domestic renewable sources can enhance energy security and reduce dependence on imports in Turkey.Collaborating with neighboring countries for regional renewable energy projects wıll be a good challenge for Turkey. Turbulence in the global energy market can affect the feasibility of renewable projects.

**S. Strengths**

The United States, the European Union (EU), and Turkey, due to their geopolitical positions, have significant potential for most sustainable energy sources. This situation can facilitate the transition to a green economy. Some factors supporting this are:

- Sustainable energy sources mostly consist of resources that do not require advanced technology (except for geothermal energy). This can make the use of sustainable energy sources more accessible.
- The use of sustainable energy sources for electricity generation can reduce the reliance on fossil fuels. This can have positive effects on ecological balance.
- The use of sustainable energy sources can significantly decrease energy imports for all countries. This is an important advantage for energy security.
- Having significant potential for sustainable energy and the long-term usability of energy plants can encourage investors to focus on renewable energy projects.
- Holding the advantage of a rich alternative energy source against externally dependent primary energy sources can provide a shield against the negative effects of energy price fluctuations.
- Sustainable energy sources are a preferred type of energy due to their ease of detection and production, low operating costs, and the quick return on investment.
- Renewable energy can be considered almost limitless because, once used, it naturally reverts to its original state, allowing repeated utilization. Unlike fossil resources such as oil, coal, natural gas, or nuclear energy, it is not limited in supply.
- With few exceptions, renewable energy can be viewed as a cost-free fuel, as it is not subject to the control of oil cartels or multinational corporations. It can be produced independently at levels targeted by countries.

- It is a clean energy type. Although it may cause reasonable levels of damage during manufacturing and installation stages, it generally exhibits an environmentally friendly structure during the energy production phase, causing little to no pollution.
- It plays a significant role in the reduction of CO2 emissions in the fight against climate change.
- A significant portion of the technology required to harness energy from renewable sources is available in today's world. With sufficient investments in some areas, costs will decrease, enabling more practical production of energy from renewable sources.
- Many renewable energy sources are decentralized and typically controlled by smaller energy companies. Therefore, they are less susceptible to threats like sabotage.
- They usually operate quietly and do not contribute to noise pollution.

For these reasons, these countries can play a significant role in transitioning to sustainable energy, bringing along a range of advantages in terms of economy, environment, and energy security

**Weaknesses (W):**

- In many countries, the share of investments in sustainable energy sources remains low within total investments. Despite the low operating costs of renewable energy sources, the initial investment cost is high. Due to the high investment costs and the continuous updating of technologies, investments in renewable energy often require government support. Without consistent support, energy costs may rise, leading to a loss of sector advantages.
- Global variations in seasons, changes in sunlight durations, and alterations in precipitation patterns can adversely affect renewable energy sources due to meteorological events.
- Inadequacy of sustainable energy policies and ineffective implementation of prepared policies and plans.
- The necessity for sustainable energy production facilities to be located close to settlements requires additional measures for the health and welfare of the community, thereby increasing the costs of using sustainable energy sources.

- The production of sustainable energy sources is closely linked to R&D activities. In this regard, the importance given to R&D activities is not at a sufficient level to improve the production of sustainable energy sources.
- The high installation cost of sustainable energy sources, especially in the short term, reflects on the public in the form of higher taxes.
- The relatively low and unqualified education of the current population, especially in Turkey, impedes the increased use of sustainable energy sources.
- Lack of sufficient enlightening and explanatory information regarding the negative impacts of renewable energy on the environment and human health contributes to increased public pressure on power plants.
- The fact that renewable energy investments are mostly made by investors from outside the cities does not contribute to the urban economy at the desired level.
- One of the biggest disadvantages of renewable energy sources is the high cost of infrastructure investments required to meet large-scale demand. Particularly, power plants such as hydroelectric, solar, and wave energy require costly dam construction investments.
- As the use of renewable sources is still in the development stage, specialization is not at sufficient levels. Potential issues exist in areas such as feasibility, durability, and emission reduction within the framework of technical innovations
- Renewable energy technologies and sources currently have a small share in the existing production and consumption potential. However, administrators, major energy companies, and regulatory institutions are working on initiatives to promote the widespread use of alternative sources.
- Another disadvantage of renewable energy sources is their costs. While some technologies are expensive, they may not compete with traditional fuels at comparable levels.
- Some alternative energy sources, such as solar and wind, are not accessible 24 hours a day.
- Many alternative sources require storage for later use, and the process of storing renewable resources is costly and poses challenges.
- Solar and hydroelectric power plants require extensive installation areas. Solar power plants are usually installed in large, open areas. Since allocating efficient lands

for electricity production purposes may cause problems, deserts are often preferred for power plants.

- Wind farms can create negative visual impacts. Proper alignment of a large number of turbines placed at frequent intervals is crucial to creating a suitable composition.
- Another negative impact of wind turbines is the disturbing noise they generate. In addition to the noise produced by the mechanical system, the turbine blades also contribute to this effect. However, advancements in technology have significantly mitigated the noise problem of the existing system.
- Wind farms established in natural habitats or migration routes can lead to bird deaths and cause interference with television, radio, and communication systems in the vicinity. Therefore, when constructing wind energy systems, suitable geographical regions should be carefully selected.

**Opportunities (O):**

- The problem of energy dependence is expected to decrease with the widespread use of sustainable energy sources, consequently accelerating the transition to a green economy.
- The installation of facilities for sustainable energy sources will create employment opportunities, contributing to the reduction of existing unemployment.
- Increasing the use of sustainable energy sources and formulating incentive policies will not only have economic impacts but also foster development in both environmental and sociological aspects.
- The global context highlighting energy dependence in discussions will increase the importance of education, policies, and incentives for sustainable energy sources.
- Growing awareness among individuals towards sustainability.

Threats (T):

- Increasing dependence on external sources due to the inability to source certain inputs domestically for the installation of sustainable energy source facilities.
- Potential financial challenges in the financing of sustainable energy projects.
- The mismatch between current energy supply and demand, with a significant portion of energy being imported from foreign countries. Failure to increase the use of sustainable energy sources and neglecting their importance may perpetuate energy dependence, posing economic and political risks for all countries.

- Economic constraints in countries with low-income populations, such as Turkey, may delay the transition to sustainable energy sources.
- Renewable energy sources are highly susceptible to natural events such as rainfall, wind, and drought. Rapid and continuous climate changes in many countries' geographies can lead to disruptions in renewable energy production.
- In countries with fertile agricultural land, the large surface areas of hydraulic dams can lead to rapid evaporation, impacting the ecosystem and causing salination of surrounding agricultural fields, resulting in agricultural economic losses.

## 4. CONCLUSION

In conclusion, Turkey's energy policies aim to enhance energy security, promote environmental sustainability, and support economic growth. These policies play a significant role in shaping the future development of the energy sector and have substantial national and international impacts on Turkey's energy strategy.

As a result of the growth in renewable energy, it is anticipated that the coal-fired production capacity in the United States will sharply decrease to approximately 50% of current levels (around 200 GW) by 2030, followed by a more gradual decline. It is estimated that by 2050, there will be coal-fired capacity between 23 GW and 103 GW.

The energy consumption in the United States is expected to continue increasing until 2050, with electricity playing a much larger role. Total energy consumption, including electricity usage and related losses, is projected to increase by up to 15% from 2022 to 2050. The rise in energy consumption will lead to improvements in end-user and electricity sector technologies and efficiency, as well as a decrease in the costs of zero-carbon production technologies. This, in turn, will result in cheaper electricity supply and increased electrification at the end-user level. The share of electricity in the residential and transportation sectors will increase, especially as cooling demand rises and electric vehicles gain a larger market share.

International demand for oil and natural gas affects the domestic production of the United States, regardless of whether domestic consumption increases or decreases. While the consumption of petroleum products in the United States remains relatively stable, the dynamics of international trade will influence the domestic production of other liquids, such as natural gas and oil.

Recent national policies in the European Union (EU) clearly highlight the security risks associated with fossil fuel dependence. Under this new paradigm, renewable energy is being rapidly implemented, and the phased removal of fossil fuels is accelerating not only due to climate change concerns but also geopolitical considerations. EU member states have already increased their targets for renewable energy, with these targets expected to rise from an average of 55% to 63%, and plans for a one-third reduction in fossil fuel usage by 2030. This indicates how seriously national governments take the security risks associated with fossil fuel import dependence.

The decarbonization of heat and industry has also received attention. Five European countries have announced policies related to regulations, energy efficiency in buildings, and clean heat, targeting the distribution of 10 million heat pumps within the next five years. However, additional efforts are needed in some sectors, such as the transportation industry.

The future path for the European continent is clearly seen—energy security in Europe can be ensured by gradually eliminating fossil fuels. Many governments have already taken steps towards this challenge, and numerous countries are rapidly joining the united REPowerEU effort by accelerating the transition to renewable energy, increasing energy efficiency, and decarbonizing their economies. These steps are deemed necessary and beneficial, and as the impacts of fossil fuel fluctuations spread further, Europe serves as a guide not only for itself but also for countries beyond its borders.

.

**REFERENCES**

Askeland, B, Kauko,P Braekken,A. Energy system modeling of a future zero-emission neighborhood with seasonal thermal energy storage. 2023 9th International Conference on Smart Energy Systems

Bahadır, I. Creation and analysis of electricity production scenarios for long-term energy planning. 2020 Master's Thesis. Capital University.

Communication from the Commission to the European parliament and the council European Energy Security Strategy 2014. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330 . Access: 09.09.2023

COP28, IRENA and GRA (2023), Tripling renewable power and doubling energy efficiency by 2030: Crucial steps towards 1.5°C, International Renewable Energy Agency, Abu Dhabi.

Deloitte. https://www2.deloitte.com/tr/tr/pages/energy-and-resources/solutions/renewable-energy.html24.10.2023,

EIA 2015. https://www.iea.org/reports/world-energy-outlook-2015. Access: 19.09.2023

EIA 2023. https://www.eia.gov/outlooks/aeo/ Access: 24.09.2023,

EIA 2020 (http://www.eia.gov/state/). Access: 15.09.2023

Ember 2022. Global Electricity Review 2022 - Ember Climatehttps://ember-climate.org/insights/research/global-electricity-review-2022/ access date 15-11-2023

ENERDATA https://yearbook.enerdata.net/ Access Date, 15-11-2023

Ministry of Energy and Natural Resources, 2022).

Energy and Natural Resources Ministry. (2020). Information Center, Energy. Retrieved from: https://enerji.gov.tr/bilgi-merkezi-enerji-elektrik

EPA 2022. (http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html). Access: 15.09.2023

EMRA 2020. https://www.epdk.gov.tr/Detay/Icerik/4-10402/2020-yili-sektor-raporlari. Access date.15.11.2023

EMRA. [http://www.mfa.gov.tr/yenilenen-enerji] (Access Date: 19.03.2022).

Ghazinoory, S. Abdi, M. Azadegan-Mehr. M. Swot Methodology: A State-Of-The-Art Review For The Past, A Framework For The Future. J.Bus. Econ. Manag., 12 (2011),

H Lund, PA Østergaard, D Connolly, BV Mathiesen, Smart energy and smart energy systems Energy 137, 556-565.2017

https://enerji.gov.tr/bilgi-merkezi-enerji-gunes Access Date: 19.03.2022

https://enerji.gov.tr/bilgi-merkezi-enerji-hydrolik Access Date: 19.03.2022

https://enerji.gov.tr/bilgi-merkezi-enerji-geothermal Access Date: 19.03.2022

https://enerji.gov.tr/bilgi-merkezi-enerji-nukleer-enerji Access Date: 19.03.2022

https://enerji.gov.tr/bilgi-merkezi-enerji-ruzgar Access Date: 19.03.2022

https://enerji.gov.tr/eigm-yenilenen-enerji-uretim-faaliyetleri-yeka-modeli

https://enerji.gov.tr/eigm-yenilenen-enerji-uretim-faaliyetleri-yeka-modeli

https://www.climate-transparency.org/g20-climate-performance/the-climate-transparency-report-2020. : 24.10.2023,

Kavaz İ.2018 Recent Energy Policies of the USA within the Scope of Global Markets. Seta Perspective Magazine. issue:185 January 2018

Lukasz , K., 2018. In-Depth Analysis In Support Of The Commission Communıcation Com(2018) 773, European Economic and Social Committee. Belgium.

Lund H, Mathiesen BV, Karlsson K. The IDA Climate Plan 2050. The Danish Society of Engineers and Aalborg University, 2009. Available from: http://ida.dk/News/Dagsordener/Klima/Klimaplan2050/Sider/Klimaplan2050.aspx .

Lund, H., Østergaard, P. A., Connolly, D., & Mathiesen, B. V. (2017). Smart energy and smart energy systems. Energy, 137, 556-565.

National Security Strategy of the United States of America", White House, https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf) Access Date : 17.03.2022

Pamir, N. (2005). Energy Needs and Strategies of the USA, EU, Russia and China. What Should Turkey's Energy Strategy Be? Symposium (26-27 January 2006). Military Academy Press, Istanbul.Renewable and Sustainable Energy Reviews 15 (9), 2017 4491-4497

TEİAŞ 2022 Activity report.

TMMOB 2022. https://www.tmmob.org.tr/yayin/akp-iktidarinin-enerji-karnesi-enerjide-son-20-yi. 09-08-2023

Yılmaz, M. (2012). Turkey's energy potential and the importance of renewable energy sources in terms of electrical energy production. Ankara University Journal of Environmental Sciences, 4 (2)

Yorkan, A.2009Energy Policy of the European Union and its Effects on Turkey. Bilge Strategy, Volume 1, Issue 1, 2009