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An Investigation of the Impact of Government Energy Politics on the Development of Investment in the Renewable Energy Sector in Türkiye (2019-2023)

Haniyeh Hajiloo, Fahri Erenel

Faculty of Business Administration, Istinye Universitesi, Istanbul, Türkiye
Email: 2333325033@stu.istinye.edu.tr

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Abstract

With the depletion of fossil fuel reserves and the rise of environmental concerns, renewable energy has become a strategic policy priority for many countries, including Türkiye. Among the efforts to reduce Türkiye's energy import dependency—which currently stands at 74%—renewable energy-focused projects hold significant importance. Türkiye's installed renewable energy capacity has exhibited a consistently increasing trend over the years. Based on this context, the present study aims to examine Türkiye's renewable energy policies and investigate their role in sectoral development. This study provides a review and critical evaluation of Türkiye's renewable energy policies between 2019 and 2023, focusing on their role in sectoral development. Using a qualitative content analysis approach, academic publications in the fields of management and energy policy, official government reports, and documents from private sector institutions were systematically examined. Sources were selected based on their relevance, credibility, and accessibility within the review period. The findings indicate that supportive policy instruments have promoted investment and awareness in the renewable energy sector. However, various regulatory, infrastructural, and financial challenges are still considered to limit the full utilization of renewable resources. The study emphasizes the need for a holistic and forward-looking policy framework to reduce dependence on fossil fuels, enhance energy security, and align national energy goals with global sustainability commitments.

Keywords

Renewable Energy, Energy Policies, Investment, Job Creation, Financial Incentives

1. Introduction

The rapid depletion of fossil fuels, the need for energy diversification, sustainable development, energy security, and environmental issues related to fossil fuel consumption have increased the focus on renewable energy sources and their growing share in the global energy portfolio. The unequal geographical distribution of energy resources, rising demand, and increasing prices underscore the importance of these sources as viable alternatives to non-renewable energy (Şencan, 2022).

Global warming is one of the most critical environmental challenges that countries must confront, primarily caused by carbon dioxide (CO_2) emissions from fossil fuel consumption. The increasing population and corresponding rise in energy demand necessitate exploring alternative pathways for energy supply from renewable sources. Alongside the annual increase in global energy consumption, environmental challenges play a significant role in the widespread transition to sustainable and renewable energy sources (Kuşkaya & Bilgili, 2020; Şencan, 2022; Yüksel et al., 2023).

The dependency on external sources for energy supply, such as coal and gas, along with environmental pollution and limited fossil fuel reserves, poses critical challenges to the national economy and energy security in Türkiye. Renewable energy is environmentally friendly, and Türkiye possesses substantial potential in this area (Karaaslan & Aydin, 2020).

Currently, both governments and corporations have significantly increased their activities and budgets for the research, development, and supply of renewable energy systems. Large-scale investments in technological advancements have contributed to reducing the costs of renewable energy systems compared to traditional energy systems. Consequently, businesses engaged in renewable energy projects influence various factors, including environmental, social, political, technological, energy, and economic dynamics, while also being affected by government economic policies.

The central research question of this study is to examine the impact of the Republic of Türkiye's renewable energy policies on the development of new energy sectors. If these policies effectively address the issue, they are expected to contribute either directly or indirectly to sector expansion, business development, and economic growth, thereby acting as a significant multiplier effect in these areas.

This study reviews existing reports and previous research on the energy sector and evaluates the government's energy policies through both quantitative and qualitative lenses. The findings are analyzed from a business perspective. The research explores the supply and demand of renewable energy in Türkiye, future energy consumption projections, Türkiye's comparative position in the global renewable energy landscape, and the broader outlook of the energy sector, encompassing public, private, and other domains. In addition, strategic policy documents and the role of renewable energy within these documents are examined, particularly in terms of their influence on investment decisions.

The literature review defines key concepts related to renewable energy and pro-

vides an overview of both global and national developments in the field. It further analyzes renewable energy sources as viable alternatives to fossil fuels and examines international agreements and governmental policies related to renewable energy.

Given these dynamics, this study aims to critically evaluate Türkiye's renewable energy policies between 2019 and 2023 by reviewing policy documents, official reports, and academic studies. The focus is on identifying how national development plans and international obligations shape policy design, and how these policies influence investment trends and business outcomes in the renewable energy sector. Through a qualitative review approach, the study seeks to contribute to the literature by offering an integrated and critical perspective on policy effectiveness.

1.1. Significance of the Study

The potential benefits and impacts of the findings from this research are outlined below:

- It can contribute to evaluating the effectiveness of energy policies in the implementation of renewable energy projects in Türkiye and assist in the development of future policies.
- Investment opportunities and risks in the renewable energy sector, along with related industries, can significantly influence Türkiye's economic future. The findings of this study may help investors better assess potential opportunities and risks in this area.
- Türkiye's energy policies in the renewable energy sector play a crucial role in the country's international relations and collaborations. This research can enhance the understanding of Türkiye's international position in this field and identify opportunities for cooperation.

1.2. Limitations of the Study

This study is constrained by the specific time frame of the sources used, and limited access to certain data may impact the generalizability of the research findings.

2. Research Questions

Previous studies on renewable energy sources and their relationship with economic growth have linked the development of renewable energy projects to economic factors such as investment costs, maintenance costs, return on investment periods, production costs, useful life, and balance costs associated with projects (Albayrak, 2020).

Consequently, the government plays a significant role in the development of renewable energy projects, acting as the driving force behind economic policies based on international agreements and domestic resources outlined in its programs. It is also important to recognize that investments in the renewable energy sector encompass not only the production of electricity, cooling, and heating but also the development of related industries connected to these projects.

The study first examines the role of government energy policies in the develop-

ment of renewable energy projects. To address this question, the period from 2019 to 2023, covered by the 11th Government Development Program, serves as the primary focus.

Furthermore, previous studies applying multivariate decision criteria have identified water, solar, wind, geothermal, and biomass energy sources as the best alternatives to fossil fuels in Türkiye (Karaaslan & Aydin, 2020).

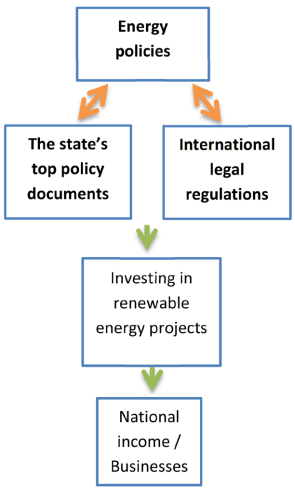
As research has shown, incentive policies, legal regulations, and alignment with international energy policies are among the most significant economic factors to explore (Albayrak, 2020).

In this study, while examining energy policies in the renewable energy sector, we will also discuss international commitments. The following questions will be addressed within this scope:

- Is the priority given to renewable energy projects in the government's vision documents sufficient?
- What is the impact of energy incentive policies on investments in renewable energy projects and related sectors?
- What is the impact of international obligations on investments in renewable energy projects and related sectors?
- What is the impact of investments in renewable energy projects and related sectors on national income and employment?

3. Research Model

The research model refers to the approach of describing a past or present situation as it exists. Two different models can be established under the categories of experimental and survey models. In this study, the "**Survey Model**" was used. The survey model aims to describe and define a condition or situation that existed in the past or exists in the present. This model does not involve any attempt to influence or alter the subject being studied. In the survey model, the descriptive function of science is more prominent; the researcher can directly investigate the subject or refer to previous records related to the topic. In doing so, the researcher may also incorporate personal observations and provide interpretations accordingly (Milliyet, 2021).



The model presented in this study schematically illustrates the research problem and its underlying rationale. It demonstrates how international energy-related commitments—such as global environmental agreements—and national development plans influence the framework of Türkiye's energy policy. These energy policies, in turn, affect both the level and direction of investment in the renewable energy sector. Such investments are among the key determinants of growth or decline for businesses that operate directly in this sector (e.g., renewable energy producers and technology firms) as well as indirectly connected sectors (e.g., supply chains, transportation, and construction). By revealing the causal relationships between structural, policy, and economic variables, the model serves as an analytical foundation for evaluating the effectiveness and coherence of Türkiye's renewable energy policies.

4. Research Methodology

In this study, a qualitative policy review approach was adopted to evaluate the impacts of Türkiye's renewable energy policies between 2019 and 2023. Relevant academic journals were identified through keyword-based searches in scholarly databases such as ScienceDirect, Google Scholar, and ResearchGate. Searches were conducted using the keywords "renewable energy," "energy production and consumption," "energy policies," "renewable energy employment," and "renewable energy investment," each combined with the term "Türkiye." In addition to academic sources, a wide range of publicly accessible institutional websites and portals were reviewed. These included the Presidency of the Republic of Türkiye, the Ministry of Energy and Natural Resources, the Ministry of Foreign Affairs, the Ministry of Interior, and the Turkish Statistical Institute (TURKSTAT). From these sources, policy documents, official reports, and statistical data were collected and used in the analysis process.

A two-stage filtering strategy was followed during the review process. In the first stage, sources were screened based on their titles and abstracts, and articles were categorized according to whether they addressed renewable energy or energy policy in their titles, with particular emphasis on studies specific to Türkiye. In the second stage, the abstracts and conclusions of the articles were examined in greater detail to eliminate irrelevant material. The remaining sources were analyzed thematically, and key insights were extracted through systematic note-taking. In addition to descriptive categorization, the selected materials were critically assessed to identify policy gaps, inconsistencies, and areas where implementation deviated from stated objectives.

It should be noted that this study does not include primary statistical or quantitative analysis. All numerical information used in the analysis was derived from secondary reports and official statistics. Given the qualitative and document-based nature of the research, the findings are interpretive and aim to generate insights rather than provide statistically generalizable results.

5. Energy Types and Their Status in Türkiye

Primary energy includes non-renewable sources such as natural gas, coal, petroleum, and nuclear energy, which consists of uranium and thorium. It also encompasses renewable sources like solar, water, wind, geothermal, biomass, and hydrogen. These energy sources are naturally found in our environment. Secondary energy, on the other hand, refers to energy derived from primary energy sources (FAO, 2024; Kuşkaya & Bilgili, 2020).

With the rise in global warming and greenhouse gas emissions, nearly all countries now support Numerous programs and methods to develop and implement renewable energy projects and energy efficiency initiatives. Each application has distinct impacts, highlighting the diversity of approaches. To promote the production of machinery and equipment for renewable energy generation, support is extended to the manufacturing sector. Additionally, the energy sector receives direct assistance for energy production, while various industries are encouraged to enhance their energy efficiency. Support is also available for energy production and consumption in residential and agricultural sectors.

This research focuses on electricity, and the data analysis is conducted accordingly. To examine the impact of energy policies on renewable energy investments, we analyze Türkiye's electricity market, including electricity production sources, installed power capacity, and future projections for both the public and private sectors.

Türkiye's electricity market comprises several main sections and components, each playing a specific role in energy production, distribution, and consumption. It is believed that energy policies could potentially influence the strategies of these sections. The sections are outlined below:

- Electricity Production: This section discusses various power plants that generate electricity.
- Thermal Power Plants These plants produce electricity using fossil fuels such as coal, oil, and natural gas.
- Hydroelectric Power Plants: These plants generate electricity by harnessing water flow.
- Solar, Wind, and Other Renewable Energy Plants: These plants generate electricity from renewable energy sources.

1) Electricity Transmission: The electricity produced must be transmitted to various regions of the country. This section covers electricity transmission lines and voltage conversion stations that deliver electricity from power plants to distribution centers.

2) Electricity Distribution: This section describes distribution companies that deliver electricity from the transmission network to end consumers, including households, industries, and other entities.

3) Regulatory Bodies and Supervisory Authorities: These entities are responsible for regulating and overseeing the electricity market. In Türkiye, the Energy

Market Regulatory Authority (EPDK) plays a key role in this area.

4) Consumers: This section encompasses all individuals and organizations consuming electricity, including residential, commercial, and industrial users.

5) Energy Services and Information Technologies: This section discusses companies that provide energy services, energy management systems, and information technologies related to the electricity market.

Türkiye's electricity production from fossil energy sources has undergone significant changes since the 1970s, influenced by the introduction of natural gas in the 1980s and shifts in coal and hydroelectric production. The Renewable Energy Sources Support Mechanism (YEKDEM) tariff, introduced in 2010, increased the share of non-hydro renewable energy sources in electricity generation. This led to the establishment of wind and geothermal power plants, followed by solar energy plants shortly thereafter (KPMG, 2024). Despite Türkiye's growing renewable energy production capacity, the government still regards fossil energy sources as a more reliable option (Tanil, 2023).

From 2013 to 2023, Türkiye's electricity production rose from 240,154 GWh[1] to 331,149 GWh, while net consumer demand increased from 246,356 GWh to 335,167 GWh. Excess demand during this period was met through imports. By 2023, the installed capacity for electricity production from all energy sources reached approximately 971,606 GWh. Of the total electricity generation of 331.49 GWh, 140,159 GWh came from renewable energy sources, accounting for 42.33% of total electricity generation.

As illustrated in **Figure 1**, public sector investments have been on a downward trend from 2013 to 2023, while private sector investments have grown. In 2023, the state's share of investment in electricity generation was 13.4%, compared to 86.6% for the private sector.

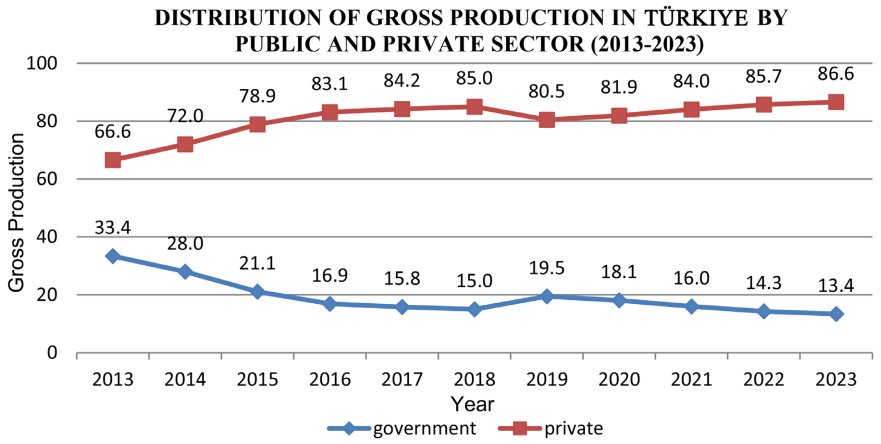


Figure 1. Distribution of Türkiye's gross electricity generation by public and private sectors (2013-2023). Source: http://www.teias.gov.tr/, 2023.

[1]In this research, to make a more accurate and straightforward comparison between installed capacity, actual production, and consumption statistics, the figures presented in different reports have been standardized to the same measurement units.

As of 2023, the distribution of installed capacity by producers and energy sources is shown in **Table 1**[2]. The highest installed capacity is in thermal and hydroelectric energy sources, with private companies realizing the most electricity generation (TEIAŞ, 2023).

Table 1. Distribution of installed capacity according to producers and energy sources. Source: http://www.teias.gov.tr/, 2023.

	EÜAŞ	PRODUCTION COMPANIES + TRANSFER OF BUSINESS RIGHTS	UNLICENSED	TOTAL
THERMAL	14%	85%	1%	44.9%
HYDRO ELECTRIC	44%	55%	0	28.8%
GEOTHERMAL	0	100%	0	1.5%
WIND	0	11%	89%	10.6%
SUN	19%	68%	13%	14.1%

The Turkish electricity market is currently in a lagging growth phase and is transitioning towards a greener approach focused on reducing carbon emissions in response to rising electricity demand. This development is supported by four key areas:

- Minimal state intervention
- Increased electricity demand due to population growth and infrastructure requirements
- Creation of a nationwide electricity network with a focus on expansion
- Engagement of municipalities and private companies in electricity generation and distribution

A reduction in large investments and changes in new laws have prompted many renewable energy companies to enhance their capacities and convert single-source power plants into hybrid systems (PwC Türkiye, 2023).

Renewable energy sources, including hydropower, wind, solar, geothermal, and biomass, constitute the highest shares of electricity generation in Türkiye. The share of each source from 2012 to 2022 is depicted in **Figure 2** (Irena, 2024).

As **Figure 3**, in 2023, Türkiye's electricity generation comprised 19.6% hydroelectricity, 21.4% natural gas, 36.3% coal, 10.4% wind energy, 5.7% solar energy, 3.4% geothermal energy, and 3.2% from other sources (ETKB, 2024a).

Between 2019 and 2022, Türkiye's hydroelectric power generation capacity increased by more than 100%. The utilization of solar energy, which began in 2014, reached an installed capacity of 6667 MW by 2020. These developments reflect the supportive policies of the Turkish government and its alignment with European Union regulations (Tanil, 2023).

[2]The data of the table is summarized according to the study need.

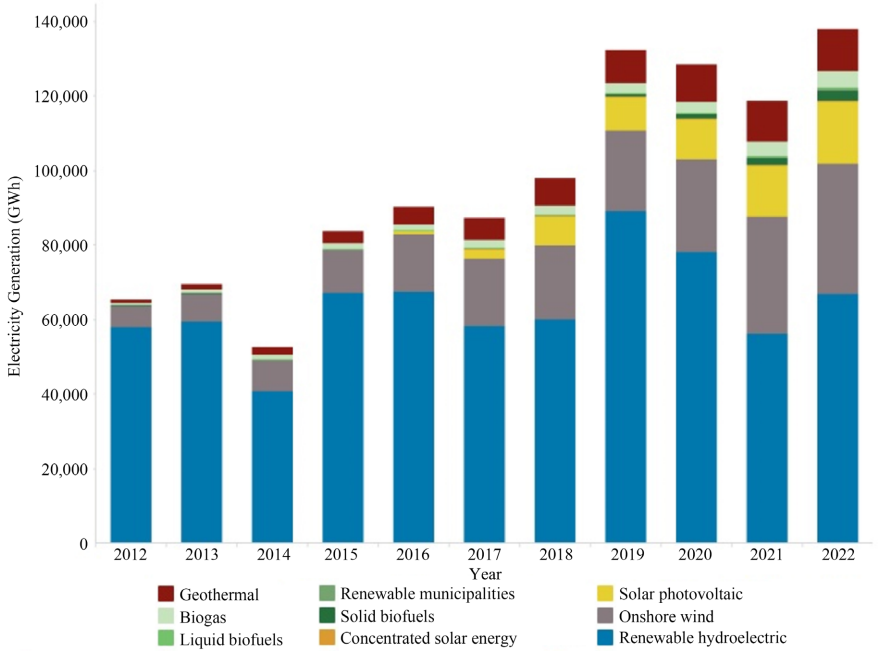


Figure 2. Share of renewable energy sources in electricity generation in Türkiye. Source: http://www.irena.org/, 2024.

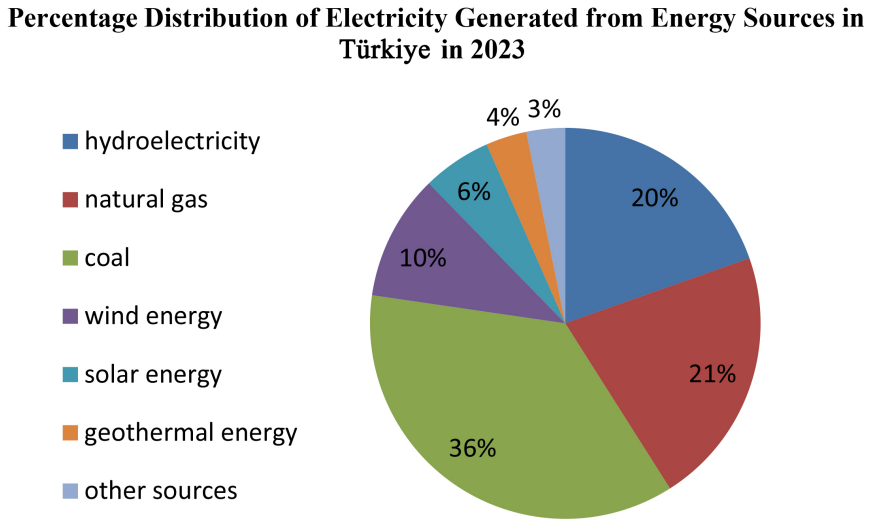


Figure 3. Percentage distribution of electricity generated from energy sources in Türkiye in 2023. Source: http://www.enerji.gov.tr/, 2024.

As of 2022, Türkiye's solar energy capacity stood at 9.5 GW, with a target of increasing it to 52.9 GW by 2035, alongside a battery storage capacity goal of 7.5 GW. Furthermore, a $10 billion investment is planned to establish a "Green Grid" by 2030 and to expand the total installed electricity capacity to 190 GW by 2035, 60 GW of which is expected to come from renewable energy sources (Energy Terminal, 2024).

Wind energy is Türkiye's second-largest renewable energy source. Despite its high potential, its share in electricity generation remains low due to technological

and financial constraints. The number of wind power plants increased from 2312 in 2012 to 7615 in 2019. Law No. 5346 stipulates that the state provides a purchase guarantee for wind energy and projects a capacity increase over a 20-year period (Tanil, 2023).

Biomass energy is derived from biological waste through biochemical (BC) and thermochemical (TC) processes. Its sources include solid materials of plant and animal origin, agricultural and forestry residues, and food industry waste (Albayrak, 2020; Karaaslan & Aydin, 2020). According to data from BEPA, the annual economic energy equivalent of collectable waste in Türkiye is approximately 3.9 Mtoe (ETKB, 2024a).

Between 2019 and 2023, electricity generation capacity from biomass in Türkiye increased from 781 MW to 2001 MW, representing a growth of over 100%. During the same period, electricity generation from biomass sources rose from 3488 GWh to 8072 GWh—an increase of more than 200%. The largest capacity growth was observed in biogas-based sources (IRENA, 2024).

Yüksel, Dinçer, and Yavuz (2023) emphasize that biomass investments carry significant potential for enhancing Türkiye's energy security. Geothermal energy is derived from the extraction of subsurface heat and can be used for direct heating and cooling or for electricity generation. However, medium- or high-temperature resources are required for electricity production. The main advantage of geothermal energy lies in its ability to operate continuously at high capacity throughout the year and at relatively low cost. With sufficient incentives and legal support, this resource could contribute to stable and portable electricity production as well as ancillary services.

Between 2019 and 2022, geothermal capacity increased by 11%, rising from 1515 MW to 1691 MW, while electricity generation rose by 24% during the same period—from 8952 GWh to 11,119 GWh.

In 2019, the highest electricity production from renewable energy sources in Türkiye was provided by hydroelectric power plants. As of 2022, Türkiye ranked 12th in the world and 5th in Europe with an installed capacity of 56 GW. In that year, 64% of the country's electricity demand was met from renewable sources (PwC Türkiye, 2023).

Between 2005 and 2020, Türkiye invested $6.9 billion in renewable energy projects, making it the leading investor among Eurasian countries, ahead of Georgia, Armenia, Azerbaijan, and the Russian Federation (IRENA, 2024).

During the period from 2019 to 2023, a total of 1527 companies invested in capacity expansions amounting to 15,331 MW. While in 2019, 55.63% of investments were directed toward thermal energy sources, the subsequent years saw a shift in the largest share of investments toward renewable energy sources (ETKB, 2024a).

The majority of renewable energy investments in Türkiye are made by the private sector; some companies generate electricity using both renewable and thermal resources. As of 2023, the total installed capacity of 20 private companies op-

erating renewable energy power plants was approximately 15.7 GW, with hydroelectric sources accounting for around 60% of this capacity (PwC Türkiye, 2023). In 2023, energy investments, incentive certificates, fixed investments, and employment increased within the private sector. Fixed investments rose by 91.7% and created 5188 jobs, accounting for 1.5% of total employment across various economic sectors (Economic Report, 2023).

The 10 companies with the highest installed capacity in 2023 are: EÜAŞ, ENKA, Enerjisa Üretim, Cengiz Enerji, Eren Enerji, Çelikler Holding, Limak Enerji, Aydem Enerji, İÇDAŞ, and Bilgin Enerji (Enerji ve Çevre, 2024).

Determining the exact number of jobs created by investments in the renewable energy sector is challenging. However, the National Energy Laboratory in the United States (NREL) recommends a method that categorizes employment into direct, indirect, and induced types for power plants with a capacity of 50 MW. Direct employment refers to those engaged in generation, construction, and maintenance, while indirect employment encompasses jobs in secondary industries. Induced employment refers to jobs created through the income generated by the first two categories. **Table 2** presents employment generated through renewable energy investments in 2016 (Izmir Development Agency, 2021).

Table 2. Employment generated by renewable energy investments. Source: Izmir Development Agency, 2021.

	Employment Numbers			
	Directly	Indirect	Induced	Total
Wind	281	413	172	866
Sun	582	375	273	1230
Hydro (barrage)	1004	239	335	1578
Hydro (Stream)	301	91	117	509
Biomass	180	136	97	413
Geothermal	314	174	91	579

The energy sector employs around 65 million people, with strong growth trends in renewable energy and other clean technologies. By 2030, this distribution is expected to change significantly due to the rapid deployment of new technologies, such as electric vehicles and heat pumps, coupled with trends in renewable energy and energy efficiency. According to the Net-Zero-Emissions (NZE) scenario, employment in the energy sector is projected to increase by about 40%, reaching 90 million people by 2030 and creating 40 million new jobs in clean energy industries. Employment growth in renewable energy is closely aligned with increases in installed capacity, with over 2 million new jobs created in renewable sectors worldwide over the past five years. Since 2012, the renewable energy labor market has expanded by more than 50%, reaching 12.7 million renewable energy-related jobs globally in 2021. The photovoltaic (PV) solar sector accounts for approximately

one-third of these jobs. Currently, photovoltaic and thermal solar technologies, biofuels, hydropower, and wind constitute 90% of total renewable energy employment (IICEC, 2022).

In 2023, China leads the renewable energy sector with 7.1 million jobs. In Türkiye, there are 41,000 jobs in solar PV and 5100 jobs in wind energy (IRENA, 2024). By 2030, the renewable energy sector in Türkiye is expected to create 300,000 new jobs (Temiz Enerji, 2022).

Capitalizing on opportunities in technology and innovation while developing human resources and talent pools to support this growth will be critical success factors for renewable energy expansion. Additionally, fostering human resources through production capabilities and technology utilization, along with creating an innovation ecosystem supported by public, industry, and academic collaborations, will provide long-term advantages for economies with limited fossil resources (IICEC, 2022).

In October 2021, Türkiye signed the Paris Agreement, committing to achieve net-zero carbon emissions by 2053. The Ministry of Energy and Natural Resources has articulated the following targets for Türkiye by 2035 (PwC Türkiye, 2023):

- Installed Power Share in Renewable Energy: This share is expected to reach 65% by 2035 with 53% from solar energy.
- Decreasing Energy Intensity: Energy intensity will decrease by 51% compared to 2000 levels by 2035, similar to rates observed in Germany and France.
- Phased Coal Phase-out: A specific date for phasing out additional coal capacity has not been established.
- International Energy Programs: Key targets for the Ministry of Energy and Natural Resources by 2035 include 52.9 GW of solar energy, 29.6 GW of wind energy, and 7.2 GW of coal energy.

Important targets in the national energy program include reducing dependence on thermal energy after 2030 and increasing the sustainable share of renewable energy in electricity generation. Annual electricity consumption in Türkiye is expected to exceed 500 terawatt hours by 2035, with the industrial and service sectors accounting for more than 50 percent of this consumption. Over the forecast period (2025-2035), the transport sector is identified as the fastest-growing sector in electricity consumption, with an anticipated annual growth rate of 27.8%. The adoption of electric vehicles and the electrification of public transport are seen as decisive factors in achieving this level of electricity consumption (PwC Türkiye, 2023).

6. Research on the Subject

Surewer, Wanoer, and Mandowen (2024) in "Geothermal and Biomass Energy: Technological Innovations and Economic Viability in the Renewable Energy Landscape" state that policy frameworks should prioritize innovation incentives, sustainable biomass management, and grid integration to optimize participation in the energy transition. According to the researchers, the costs associated with in-

vestments in these projects are evaluated based on potential revenue streams from the sale of electricity, renewable energy credits, and the sale of heat for district heating or industrial processes. Geothermal projects have a competitive advantage over fossil fuels in electricity generation due to their low and stable costs and can benefit from tax incentives, grants, and fixed feed-in tariffs. In the field of biomass energy, various fiscal incentives and policy support mechanisms, such as tax credits, grants, subsidies, and feed-in tariffs, can significantly enhance project profitability and attract more investors by reducing risk (Surewer et al., 2024).

Tanil (2023), in his research titled "Analysis of Renewable Energy Policy Development in Türkiye and Poland," concludes that the establishment of effective renewable energy policies has facilitated energy transitions in both countries over the long term, resulting in a more sustainable and cleaner energy mix. Based on his analysis of Türkiye's energy consumption patterns, the author states that fossil fuels remain the largest source of electricity generation in Türkiye. By comparing generation capacity and current operational quantities across various renewable energy sectors, he concludes that the ongoing trend toward fossil fuel consumption may stem from a lack of appropriate financing sources and credit facilities, particularly for small-scale projects, alongside complex bureaucratic procedures related to the permit application process (Tanil, 2023).

Özen, İşleyen, and Görür (2023), in their study titled "Investigation of the Relationship between the Use of Selected Energy Types and Agricultural Area Utilized by ARDL Bound Test: The Case of Türkiye," assert that the inability to provide sufficient employment for the rapidly growing population is one of the most significant challenges faced by developing countries. This issue could be addressed through investments in production units that develop renewable energy and expand business areas (Özen et al., 2023).

Şencan (2022), in his research titled "The Place of Türkiye in the World in Renewable Energy and the Evaluation of Incentives Applied," states that according to reports for 2019 and 2020, global energy capacity is projected to reach 3721 GW, reflecting a 50% increase between 2019 and 2024, with 1200 GW of additional installed capacity added during this period. Electricity generation from renewable energy sources has tripled in the last decade, and Türkiye has reached and exceeded its target of 38.8% outlined in the 11th Development Plan (Şencan, 2022).

Alnour and Atik (2022), in their study titled "The Dynamic Effect of Biomass Energy Consumption on Economic Growth and Environmental Quality in Türkiye," examine studies conducted in various countries, including Brazil, India, China, Russia, and South Africa, stating that the impact of biomass consumption on economic growth varies based on different assumptions in each country. They also refer to studies conducted in G7 countries, asserting that biomass energy consumption positively affects economic growth within this group (Alnour & Atik, 2022).

Eygü (2022), in his study titled "The Relationship Between the Use of Renewa-

ble Energy Sources and Economic Growth: Case of Türkiye Between 1995-2020," posits that electrical energy contributes to economic growth. According to the research literature, an analysis of energy consumption and gross domestic product suggests that Türkiye is projected to grow between 5.9% and 7% until 2025. It is also noted that renewable energy policies developed in Türkiye reduce electricity demand. While renewable energy costs negatively impact exports in the short term, they are expected to yield positive and significant effects by offsetting these costs in the long term (Eygü, 2022).

In the study titled "Public Incentives in Renewable Energy and Energy Efficiency and Its Reflections in Türkiye" by Aydoğdu (2021), it is stated that state regulations have improved the renewable energy sector. The research emphasizes that development is possible through private sector investments and that support for this sector is crucial, leading to both national and global changes. Although oil remains the largest source of energy production, it is predicted that rapid developments in renewable energies will occur as energy production costs decrease and energy storage technologies advance (Aydoğdu, 2021).

Kamaci and Akça (2021) highlight that Diyarbakir and Şanliurfa possess significant solar energy potential in Türkiye and can lead in biomass energy while also being well-positioned for wind and geothermal energy. However, the potential of these regions is underutilized. For the Karabük and Zonguldak Bartin regions, only one wind farm with a capacity of 5.22 MW has been commissioned in Zonguldak as of 2021. The total wind energy potential of 269 active wind farms in Türkiye is 9559 MW, with these regions contributing a mere 0.005%. Despite their suitability for biomass energy, as of 2021, there are no biogas, biomass, waste heat, or pyrolytic oil facilities in the Bartin, Karabük, and Zonguldak provinces, nor have there been any geothermal activities in the area. Additionally, their studies indicate that Türkiye is rich in active fault lines due to its location in the Alpine-Himalayan belt, and natural hot water flows along these lines could serve as a source of geothermal energy (Kamaci & Akça, 2021).

Karaaslan and Aydin (2020), in their research on geothermal energy in Türkiye, state that the country is situated in an active tectonic belt, which grants it abundant geothermal resources. There are approximately 1000 geothermal springs in Türkiye, each with different natural outlet forms and temperatures. According to research conducted by the MTA General Directorate, 90% of Türkiye's geothermal resources are low and medium temperature, suitable for direct applications (heating, thermal tourism, various industrial applications, etc.), while the remaining 10% is intended for indirect applications (electricity suitable for power generation). Türkiye began generating electricity from geothermal energy in 1975 with the Kizildere power plant, which has a capacity of 0.5 MW (Karaaslan & Aydin, 2020).

Demirci (2019), in "Financial Development, Renewable Energy, and Economic Performance: Evidence from Türkiye," proposes growth, conservation, feedback, and neutrality hypotheses to examine the relationship between economic growth

and energy consumption. This study concludes, based on statistical analysis, that there is no causal relationship between renewable energy consumption and economic growth, and that any protective or expansionary policy regarding renewable energy use will not impact economic growth (Demirci, 2019).

7. International Agreements

The concentration of natural gas and oil reserves in specific regions, combined with political tensions, has increased the risk of energy crises for many countries. Consequently, renewable energy investments have become a top priority for both policymakers and producers, particularly within the European Union. The 2030 Agenda for Sustainable Development, adopted at the United Nations Sustainable Development Summit on 25 September 2015, comprises 17 goals and 169 targets. To monitor progress toward these goals, a global indicator framework consisting of 231 indicators has been established (Turkiye Istatistik Kurumu, 2024).

Since 1997, Türkiye has become a party to several key international agreements, including the Paris Climate Agreement (2015), the Kyoto Protocol (1997), the EU–Türkiye Renewable Energy Agreement, membership in the International Renewable Energy Agency (IRENA), bilateral and regional energy cooperation agreements, the United Nations Framework Convention on Climate Change (UNFCCC), the European Green Deal, the Sustainable Energy Strategy Agreement, and foreign investment treaties.

The Paris Climate Summit (COP21) was held from 30 November to 12 December 2015 in Paris, with the aim of limiting the global temperature increase to 2˚C above pre-industrial levels, preferably to 1.5˚C. Türkiye became a party to the agreement and committed to taking necessary steps to reduce greenhouse gas emissions and combat climate change. In this context, the expansion of renewable energy use constitutes one of Türkiye's primary strategies (UNFCCC, 2024; mfa.gov.tr, 2024).

In 2009, the European Commission published the Renewable Energy Directive with the aim of establishing a common framework for renewable energy and increasing its use in the electricity and transportation sectors (European Commission, 2024; Tanil, 2023). The directive incorporates the "20-20-20" strategy, which comprises three key targets: a 20% reduction in greenhouse gas emissions compared to 1990 levels, a 20% increase in the share of renewable energy in total energy consumption, and a 20% improvement in energy efficiency (European Commission, 2024).

Türkiye is located in a region that holds approximately 60% of the world's oil and natural gas reserves and has experienced the fastest energy demand growth among OECD countries over the past two decades. It ranks second after China in terms of electricity and natural gas demand growth. As a country heavily reliant on energy imports, Türkiye has gained a prominent position in international energy relations. Due to its strategic role in Europe's energy security, Türkiye became an observer member of the Energy Community in 2006.

Türkiye's international energy strategy includes the diversification of supply routes and sources, contributing to regional and global energy security, becoming a regional energy trade hub, considering social and environmental impacts at all stages of the energy chain, increasing the share of domestic and renewable resources, and integrating nuclear energy into its energy mix (mfa.gov.tr, 2024).

8. Economic Policies

Türkiye's energy transition and policies have been shaped by various international agreements. In 2015, the commitment to reduce greenhouse gas emissions was established through the INDC agreement. By 2021, several measures were implemented, including the Green Deal Action Plan, the Paris Climate Agreement, and the National Green Finance Strategy, which set a net zero emission target by 2053. Additionally, the forthcoming Emission Trading System (ETS), scheduled for completion in 2024, the development of carbon capture, utilization, and storage technologies for coal-fired electricity production, and the National Efficiency Strategy and Optimization Action Plan have collectively led to the adoption of policies for energy resource utilization. Key policies promoting the increased use of renewable energy sources include the carbon tax mechanism, the green certificate mechanism, the Green Deal Action Plan, and the net zero carbon target for 2053 (KPMG, 2024).

According to Şencan (2022), state incentives for renewable energy projects in Türkiye are categorized into three main groups: financial, production-based, and other types of incentives. Financial incentives include low-interest, long-term loans, environmental tax exemptions, VAT exemptions, and depreciation benefits. Tax incentives encompass carbon tax exemptions, energy tax relief, exemptions from environmental and property taxes, VAT and customs duty exemptions, tax deduction schemes, and company-specific tax exemptions. Within production-based incentives, the portfolio model stands out; under this model, producers sell energy in exchange for certificates. Other incentives include feed-in tariffs with fixed price guarantees and premium payments. The fixed-tariff system guarantees electricity purchase for a period of 10 - 25 years and covers the difference between the market price and the fixed tariff paid to producers.

State support mechanisms include:

- A fixed tariff guarantee for electricity generated from renewable sources for 10 years,
- Exemption from licensing and sales requirements under Law No. 6446 for unlicensed production,
- Local content support for facilities using at least 51% domestic components,
- An 85% discount on land use and permit fees and a 10-year land use permit,
- Tax, customs, profit, and premium supports for strategic investments,
- VAT and customs duty exemptions for equipment covered by investment incentive certificates,
- Reduced income tax rates,

- VAT refunds for construction costs,
- Interest subsidies on loans with a minimum term of one year,
- Interest-free loans for individuals in rural areas with terms ranging from 3 to 7 years,
- A 2% Special Consumption Tax exemption for domestic biofuels.

The highest feed-in tariff guarantees are provided for solar and biomass energy, followed by geothermal, hydroelectric, and wind power plants. Although Türkiye initially planned to terminate the fixed tariff program in 2020, it extended the program until 30 June 2021, allocating a budget of $570 million for this purpose (Şencan, 2022).

Following the official termination of feed-in tariff guarantees under the Renewable Energy Support Mechanism (YEKDEM) in 2021, the Turkish government shifted toward more competitive and market-oriented policies to support the development of renewable energy. These policies have been designed to enhance efficiency, reduce costs, and align the energy market with global standards. A key objective has been to diversify electricity generation sources and establish a balanced energy portfolio. With the regulation published in the Official Gazette No. 29852 on October 9, 2016, the Renewable Energy Resource Zone (YEKA) model was introduced. This model aims to reduce renewable energy production costs while simultaneously promoting domestic technology production and capacity development. Instead of fixed tariffs, the government began organizing competitive auctions, where producers win contracts by offering the lowest bid prices. Projects utilizing domestically manufactured equipment receive additional support. This approach aims to reduce electricity generation costs, attract foreign investment, promote advanced technologies, and lessen dependency on technology imports.

For large-scale solar and wind projects, special investment zones have been established in high-potential areas, and new investment programs have been launched under the YEKA framework. Furthermore, carbon pricing, the 2053 net-zero carbon pledge, the expansion of distribution and transmission infrastructure, and the deployment of smart grid technologies are among the core components of Türkiye's post-2021 energy policies (ETKB, 2024a).

The 11th Development Plan addresses issues related to renewable energy, which are outlined as follows:

- Increase renewable energy production capacity by expanding the capacities of solar, wind, and geothermal resources.
- Enhance the share of renewable energy to reduce dependence on fossil fuels and energy imports, decrease natural gas and oil consumption, and lower domestic production and import costs.
- Improve energy efficiency in buildings, industries, and transportation, reduce energy losses in the electrical grid, and promote energy conservation at the national level.
- Develop smart grids and new infrastructure to optimize the transmission and

distribution of energy.

- To support the private sector and foreign investments, incentive laws and regulations have been established to promote private sector participation in solar, wind, and other renewable energy projects, thereby attracting foreign investors.
- Provide support for research and development (R & D), increase domestic energy development, boost employment and economic growth through renewable energy, promote the use of renewable energy in transportation and industry, and combat climate change within the framework of the Paris Agreement (Strategy and Budget Presidency, 2019-2023).

The laws and regulations enacted to support and develop investments in renewable energy utilization include various financial, tax, and production supports for electricity producers and manufacturers of facilities in the renewable energy sector. The legislation aimed at developing renewable energy investments is generally categorized into two main groups: Laws and Presidential Decrees. Notable pieces include Law No. 5346, Law No. 5686, and Law No. 6446 approved and brought into force in 2005, 2007, and 2013, respectively along with Presidential Decree No. 7189 issued in 2023.

Law No. 5346, titled "The Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy," constitutes the first legal framework supporting the renewable energy sector in Türkiye. This law established the legal infrastructure for the production and use of renewable energy, introduced a liberalized market mechanism, and aimed to increase the share of these sources in total energy consumption. The first amendment to the law came in 2007 with the enactment of the Energy Efficiency Law No. 5627, which introduced additional incentives for electricity production from renewable energy sources. Under this amendment, a fixed feed-in tariff was applied for electricity produced from such sources, guaranteed for a period of 10 years (for power plants commissioned by the end of 2011). During the same period, planning efforts focused particularly on the establishment of small-scale production facilities, such as cogeneration plants, and procedures were introduced to exempt such projects from company formation and licensing obligations. On January 8, 2011, Law No. 5346 was amended a second time through Law No. 6094. This revision restructured the support mechanism for renewable energy production and aimed to reduce production costs through the adoption of advanced technologies (ETKB, 2024a).

Law No. 5686, titled "Geothermal Resources and Natural Mineral Waters Law," was enacted on June 3, 2007. This law provides the necessary legal framework for the exploration, utilization, and protection of geothermal resources and natural mineral waters. It aims to facilitate the use of these resources in areas such as energy production—particularly electricity—and direct applications such as heating. One of the core elements of the law is the regulation of property rights over these resources. Accordingly, companies and institutions are required to obtain two types of licenses: an exploration license (valid for three years) and an opera-

tion license (valid for up to 30 years).

Amendments made in 2013 sought to increase resource efficiency and ensure alignment with international standards. These revisions simplified the permitting processes, promoted investment, and enhanced transparency and oversight mechanisms in operational activities. The changes were designed to safeguard the resources and prevent unauthorized use. In addition, incentives such as tax reductions and financial support were introduced for small- and medium-scale projects. Projects with low environmental impact were exempted from certain regulatory requirements to enable their more rapid and cost-effective implementation (ETKB, 2024a).

Law No. 6446, titled the "Electricity Market Law," was enacted on March 14, 2013, with the objective of regulating the electricity market, enhancing efficiency in generation, distribution, and consumption, and, in particular, increasing the share of renewable energy sources in electricity production. By establishing the legal infrastructure for a competitive and efficient market structure, the law has directly influenced the use of renewable energy. Within this framework, generation, distribution, and sales activities were unbundled, and private sector investments were actively encouraged. Incentives for resources such as solar, wind, geothermal, and biomass include mechanisms such as feed-in tariffs and grid connection priority. Under this system, companies are obliged to purchase electricity generated from renewable sources at predetermined prices, thereby guaranteeing returns on investment over a specified period.

Amendments introduced in 2016 raised the ceiling on purchase prices, thereby enhancing investor confidence in the sector. Additionally, special incentives were introduced for domestically manufactured equipment, with the aim of reducing import dependency and supporting local industry. The licensing procedures for renewable energy projects were simplified, permitting times shortened, and implementation processes accelerated. Technical regulations were also introduced to facilitate integration with the national electricity grid, thereby aiming to overcome challenges related to sustainability and system integration (ETKB, 2024a).

Presidential Decree No. 7189, published on 19 April 2021, addresses the management of energy and natural resources, as well as infrastructure projects. This decree is part of Türkiye's efforts to enhance performance in the energy sector and advance infrastructure development initiatives. It incorporates changes in legal and administrative frameworks aimed at increasing efficiency, developing infrastructure, and strengthening energy security. The innovations in law and regulation include significant measures for infrastructure development, investment promotion, improved management of natural resources, and increased efficiency (ETKB, 2024a).

The Unlicensed Electricity Generation Law allows natural and legal persons to generate electricity without the requirement to obtain a license or establish a company, within the framework of the Regulation on Unlicensed Electricity Generation. This regulation offers various models aimed at enhancing efficiency and re-

ducing costs in the electricity market:

Self-Consumption Model: Consumers meet their electricity needs from a generation facility located near the point of consumption, thereby contributing to the reduction of transmission and distribution costs.

Security and Small-Scale Generation Facilities: The widespread deployment of small-scale generation facilities supports electricity supply security while reducing dependence on large-scale energy sources.

Distributed Generation: Generating electricity at different points across the grid reduces transmission and distribution costs as well as energy losses, thereby improving infrastructure efficiency (ETKB, 2024b).

As of the regulatory amendment made on February 24, 2022, unlicensed solar (GES) and wind (RES) energy investments in Türkiye began to be supported without regional profit-based incentives (Dünya Gazetesi, 2022). The country's renewable energy legislation aims to establish balance within the energy portfolio, reduce costs, promote domestic production, and enhance human resource capacity (ETKB, 2024a). Within this framework, the approved Regulation on Unlicensed Electricity Generation has adopted the objectives of increasing employment in secondary industries and reducing energy costs. Similarly, the regulation published in the Official Gazette on May 28, 2021 introduced protective measures for domestic manufacturers producing renewable energy equipment (İGMD, 2024).

Türkiye's investment incentive system has been shaped by the "Decision on State Aids in Investments" No. 2012/3305. According to this decision, renewable energy investments are included in the general incentive scheme, providing investors with only VAT and customs duty exemptions (Dünya Gazetesi, 2022). During the 2019-2023 period, the Turkish Electricity Transmission Corporation (TEIAŞ) designated 2500 kilometers of transmission lines and 32 transformer substations to integrate new renewable energy generation into the grid and tendered these assets for user access (TEIAŞ, 2019-2023).

As part of the ongoing privatization process initiated in 2002, all electricity distribution assets and 78% of generation assets were transferred to the private sector. This process generated a total revenue of $23 billion, and approximately $100 billion in public-private sector investment has been made. Within this framework, the Istanbul Energy Exchange (EXIST) was established in 2013 to manage and operate liberalized energy markets (invest.gov.tr, 2024).

9. Future Perspectives

Türkiye's official future energy roadmap aims to reduce external dependence on energy and incorporate nuclear power into its renewable energy portfolio. Key objectives include increasing natural gas storage capacity, enhancing competitiveness in export markets, transitioning to sustainable and low-carbon transportation systems, achieving high energy performance in public, commercial, and residential buildings through renewable energy, and investing in next-generation autonomous vehicles and railway systems.

The national energy program is grounded in three key factors: population growth, economic expansion, and fuel prices. It aims for renewable energy to account for 58.4% of electricity production by 2035, with nuclear energy comprising 29.3% by 2053. Tenders for renewable energy resource areas will continue, and the development of offshore projects will be supported. Additionally, plans include the installation of energy storage systems to enhance grid reliability. The strengthening of hydroelectric power plants, the enhancement of grid flexibility, and the safe disposal of nuclear waste are essential components (KPMG, 2024).

Achieving a net zero-carbon economy by 2053 is a long and challenging journey. Establishing renewable energy policies for the medium and long term is critically important. To facilitate rapid investments, it is necessary to develop a comprehensive roadmap that includes clear objectives and plans for the short, medium, and long term (SHURA, 2023).

Furthermore, the 12th Development Plan, which will be implemented between 2024 and 2028, appears to emphasize renewable energy more than the previous plan. The main issues related to renewable energy outlined in the 12th Development Plan are as follows:

- Increase the share of renewable energy in electricity production; expand wind energy capacity by 2028; increase solar energy capacity and promote the nationwide installation of solar panels; advance projects for both large- and small-scale solar power plants; enhance the utilization of geothermal energy.
- Reduce reliance on energy imports; implement programs to improve energy efficiency technologies in industry, agriculture, and transportation; minimize energy losses in the electricity grid; and promote energy conservation in both residential and commercial sectors.
- Develop smart electricity grids to bolster technology development and infrastructure investments; invest in initiatives that enhance the integration of renewable energy into the grid; commit resources to energy storage solutions using advanced batteries and emerging technologies; and support research and innovation projects in clean energy.
- Support the private sector and incentivize investments in large-scale renewable projects by providing financial backing for major initiatives, such as solar and wind power plants, as well as for small-scale, decentralized renewable energy projects like residential and commercial solar panel installations.
- Reduce carbon emissions and facilitate adaptation to climate change by promoting domestic energy resources and encouraging participation in international and regional projects (Strategy and Budget Presidency, 2024-2028).

10. Findings

To ensure energy security and reduce dependence on fossil fuels, Türkiye has made international commitments to implement sustainable development programs in the energy and environmental sectors. This has resulted in a prioritization of renewable energy usage and an increase in investments. Consequently, the govern-

ment included provisions in the 11th Development Plan—implemented from 2019 to 2023—that aimed to deploy as many support policies as possible. However, the period from 2019 to 2023 has presented unique conditions for energy production and consumption in Türkiye and globally. The emergence of the COVID-19 pandemic in 2019 led to a decrease in energy consumption, while significant changes occurred in the global energy sector by 2023. Growing public awareness of pollution reduction and the climate crisis, combined with energy security concerns stemming from the Russia–Ukraine conflict, has prompted European countries to adopt ambitious targets for reducing fossil fuel dependency and achieving net zero emissions.

Türkiye, serving as a strategic transit route for fossil fuels and energy resources transported from producer countries to consumer nations in Europe—and also one of Europe's largest export markets—has undergone significant transformations in alignment with the European Union's policy frameworks.

Research indicates that, in response to international commitments aimed at reducing carbon emissions and enhancing energy security, Türkiye has incorporated renewable energy sources into its planning. The government is following a corresponding roadmap in its medium- and long-term development programs.

This study examines energy policies, international commitments, renewable energy sources, and the amount of electricity generated from these sources. The analysis reveals that, regarding the current state of renewable energy sources, hydroelectric power holds the largest share in electricity production, with renewable energy sources accounting for approximately half of the total electricity demand. Statistics further show that, after hydroelectric power, wind energy has the largest installed capacity; however, this source faces technological shortcomings and financial constraints. Therefore, it is recommended that the government support increased capacities in the wind energy sector to enhance electricity production from this source.

Solar energy plays a crucial role among clean energy sources. However, its relatively low production compared to existing capacity indicates that support policies in this sector need to be. While electricity generation from solar energy is easier and more cost-effective for small-scale producers, the low installed capacity and production levels suggest that these resources are not receiving adequate support.

In terms of biomass and geothermal energy, the studies reviewed in this research reveal that, despite regional incentives aimed at developing projects in these areas, investment has been insufficient. Investing in biomass energy sources could significantly enhance energy security. Geothermal projects, with their lower costs, have a competitive advantage; thus, increased incentive support could make it more feasible to maximize the capacity of these resources. Therefore, ensuring accurate investment decisions, reducing risks, and maximizing potential benefits in geothermal projects is critical for energy security, environmental sustainability, and economic development. Geothermal energy projects are generally considered

financially attractive due to their long-term income stability, which arises from predictable operating costs and minimal fuel price fluctuations. Additionally, policy and regulatory frameworks that mitigate risks associated with policy changes and create a supportive environment can further encourage investment in geothermal projects.

Financial aid, subsidies, fixed guaranteed tariffs, and tax credits are examples of incentives that can support biomass and geothermal resources. Economically, renewable energy sources not only enhance energy security but also help address employment challenges.

Despite the government's commitment to renewable energy and advancements in energy supply aimed at improving energy security and establishing a sustainable energy portfolio, fossil fuels including gas remain the largest source of electricity production. This persistence may result from funding deficiencies or the complex bureaucracy involved in obtaining permits. However, statistics from the International Energy Agency indicate that Türkiye has implemented numerous effective measures to meet its international obligations and has even surpassed its medium-term targets. Furthermore, research suggests that reducing energy production costs and leveraging emerging technologies could rapidly advance the renewable energy sector.

Small-scale production facilities play a vital role in securing demand and enhancing the national economy, while the distributed generation approach helps reduce transmission and distribution costs, as well as energy losses in the electrical grid. The Unlicensed Electricity Generation Law aims to support renewable energy and simplify the electricity production process for small producers. This law also improves the management of electricity sources and pricing. Furthermore, under the Green Deal Action Plan, the provision of green financing for investments in "electricity generation from renewable energy sources" and "energy optimization" makes such investments more attractive.

Extending the duration of tariff guarantees could increase interest from both domestic and foreign investors. The lack of a specific tax incentive mechanism to promote investments in renewable energy and facilitate access to general tax incentives is considered a shortcoming. To significantly boost the share of renewable energy in the overall energy portfolio, it is crucial to enhance the incentive system and address its deficiencies.

Mandatory installation of photovoltaic systems on the roofs of public buildings, standard portfolio incentives requiring electricity to be sourced from renewable energy, and the provision of property tax reductions or exemptions for buildings equipped with renewable energy systems—along with measures to boost share prices, encourage the widespread use of domestic machinery and equipment, accelerate research and development to reduce reliance on imported technology, and implement a carbon tax—are all seen as incentives that can support investment in the renewable energy sector and contribute to economic development.

The enacted laws are viewed as a turning point in Türkiye's energy policies. By

providing financial support, reducing administrative obstacles, and adapting to new technologies, these laws focus on strengthening the foundations of sustainable development and increasing the share of renewable energy.

By introducing detailed regulations for permit acquisition that protect the environment and natural resources while facilitating the use of geothermal resources and mineral waters, the operating process has been systematized. Additionally, enhancing investment opportunities in the renewable energy sector, creating a stable legal environment, and providing financial incentives have established a solid foundation for the development of renewable energy projects.

In Türkiye, the strategic document on supply security and the electricity market serves as a roadmap for achieving a sustainable energy supply, enhancing efficiency, and fostering a competitive energy market. By emphasizing the diversification of energy sources, reducing dependence on imports, and increasing the share of renewable energy, this document guides Türkiye in meeting its objectives for energy security, sustainable development, and environmental protection.

The 11th and 12th Development Plans, which outline the formulation of energy policies and the approval and amendment of related legislation, exhibit some key differences. The 11th Plan focuses on increasing the share of renewable energy in the sustainable energy portfolio, while the 12th Plan aims to optimize efficiency, facilitate the structural transformation of industry, and reduce dependence on fossil fuels. It is anticipated that policies based on the 12th Development Plan, along with the approved laws, will address the shortcomings of previous legislation and promote the growth of employment and businesses related to renewable energy projects.

From an investment and employment perspective, fixed investment increased by 91.7% in 2023, resulting in the employment of 5188 individuals. However, this indicates that the rate of employment growth is lower relative to the growth in investment. When examining global statistics and employment increases in countries such as China, India, and the United States, it becomes evident that Türkiye's comparatively modest employment growth may be due to the underutilization of renewable energy sources. Furthermore, the projection of generating 300,000 jobs in Türkiye's renewable energy sector by 2030 appears inadequate when compared to global statistics, particularly in the context of achieving energy policy targets.

The European Renewable Energy Directive is designed to combat climate change and enhance energy security in Europe. As Türkiye prioritizes sustainable development and improving its citizens' quality of life through its environmental and energy policies, these strategies align with the European Union's objectives for sustainable growth and environmental protection. Overall, Türkiye participates in all international agreements related to renewable energy to ensure energy security and reduce greenhouse gas emissions.

11. Conclusion

This study sought to answer the following questions, with the findings presented

in detail. In summary, the question "Is the prioritization of renewable energy projects in the government's strategic vision documents sufficient?" was generally answered in the affirmative. For the question "What is the impact of energy incentive policies on investments in renewable energy projects and related sectors?", it was found that although the impact is not rapid, it is positive. Regarding the question "What is the effect of international obligations on investments in renewable energy projects and related sectors?", the impact was found to be substantial. As for the question "What is the effect of investments in renewable energy projects and related sectors on national income and employment?", the impact was identified as increasingly significant.

The key components of Türkiye's national strategic objectives and energy policies are defined as energy saving and efficiency, ensuring energy supply security, reducing foreign dependency, protecting the environment, and effectively combating climate change. Within Türkiye's energy policy, reducing the country's high dependency on imported oil and natural gas is a priority, and diversification of primary energy sources is targeted. In this context, greater utilization of lignite and other domestic resources, increasing the share of renewable energy sources, and incorporating nuclear energy into electricity generation is considered necessary.

Energy has become an indispensable component of modern industry and the service sector. The accessibility, cost, and environmental impacts of energy have brought renewable energy concepts to the forefront at both national and international levels, garnering widespread support. This support is critical for achieving renewable energy targets, enhancing energy efficiency, and promoting the development and dissemination of new technologies.

In Türkiye, the persistent reliance on conventional energy sources highlights the need for greater flexibility and adaptability in its energy policies. Despite the development of renewable energy plants, the growth rate of investments in this sector appears insufficient to meet the medium-term objectives outlined in national energy plans. Therefore, reforms that provide incentives and support for electricity production are essential, along with a clear need for legislative changes to facilitate the implementation of energy storage systems.

While both geothermal and biomass energies provide renewable alternatives to fossil fuels, but their economic sustainability is affected by factors such as technological advancements, resource accessibility, operating costs, and regulatory support. Strategic policy interventions, technological innovations, and evolving market dynamics shape the economic landscape, directing the sustainable energy transition and bolstering global energy security.

Overall, there is a significant lack of innovative and creative business models that facilitate the production and distribution of energy from renewable sources. Introducing regulations designed to support these business models could effectively advance renewable energy projects and, ultimately, achieve broader economic and environmental objectives.

One of the most significant economic value-added contributions of renewable energy sources is the employment they generate. The renewable energy sector, which interacts directly and indirectly with many industries throughout the process, from equipment manufacturing to electricity generation, is among the emerging sectors in Türkiye in terms of the employment it creates and is expected to create.

Conflicts of Interest

We, the authors of this article, confirm that we have adhered to ethical research principles and have refrained from any form of academic misconduct, including plagiarism, data fabrication, simultaneous submission, duplicate publication, or any other unethical practices.

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