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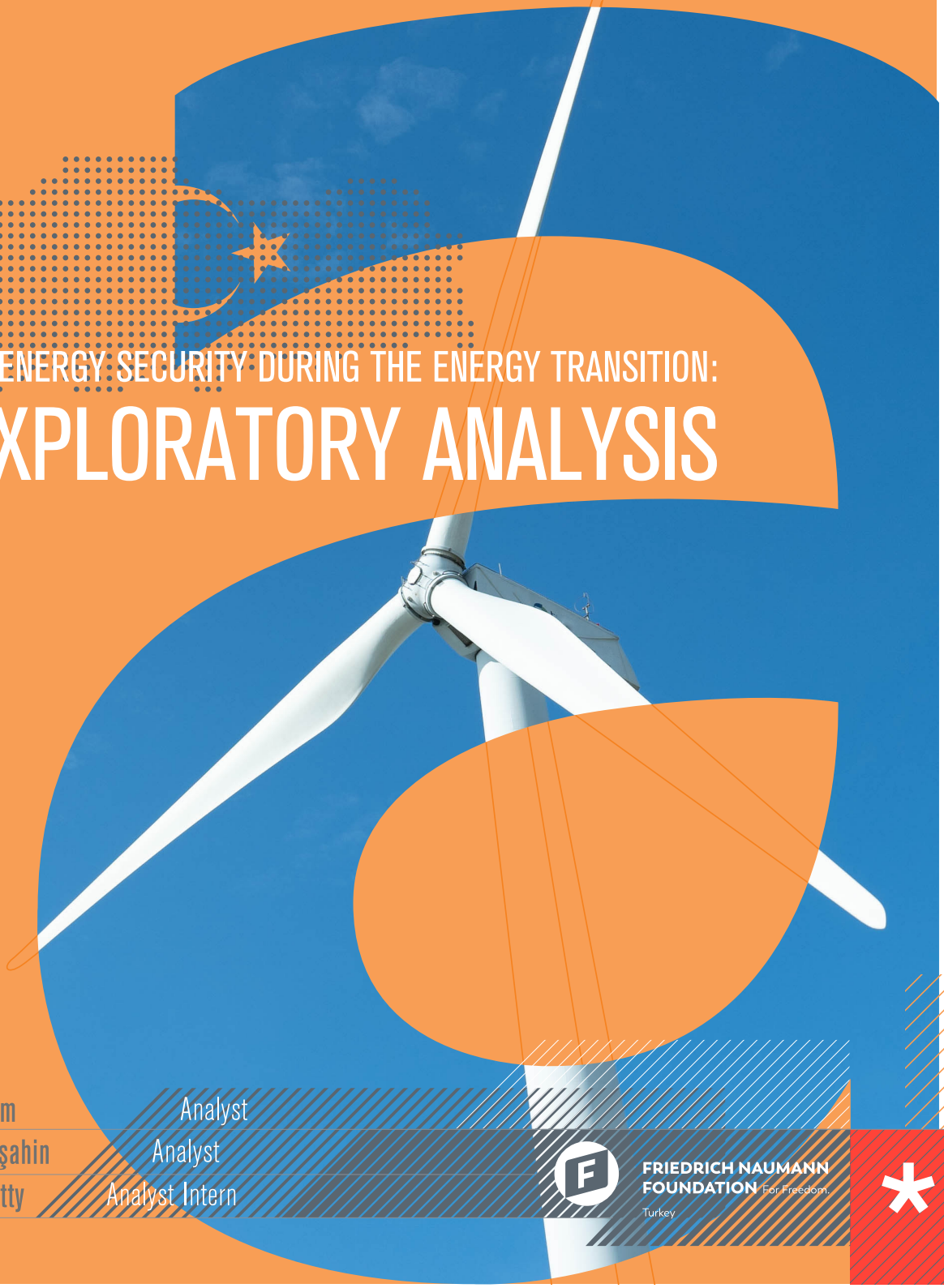
TÜRKİYE'S ENERGY SECURITY DURING THE ENERGY TRANSITION: AN EXPLORATORY ANALYSIS



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TÜRKIYE'S ENERGY SECURITY DURING THE ENERGY TRANSITION: AN EXPLORATORY ANALYSIS

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BACKGROUND AND SUMMARY

Through the last decade, the Turkish economy grew at a yearly average rate of 5.7%[1] accompanied by a total increase of 40.8% in primary energy consumption. Though growth is expected to moderate in the long term[2], the share of value added by manufacturing in GDP has been accelerating since the middle of the decade.[3] The continuation of these trends will lead to higher energy demand which may accentuate energy security vulnerabilities arising from Türkiye's energy import dependency. This is reaffirmed by the IEA reports that illuminate the rapid growth of energy demand and consumption in Türkiye in the last decade, especially on the industrial side.[4] Moreover, the security vulnerability concern is further substantiated by the fact that it currently ranks only second to China in terms of rising energy demand and suffers from an alarmingly high rate of dependency on imports, indexed at 74%, according to the Ministry of Foreign Affairs.[5]

Therefore, it should be an immediate policy objective of the Turkish state to ensure energy supply security. Efforts have been made by the Ministry of Energy Natural Resources to construct an energy strategy aiming to counteract import dependency by focusing on bolstering domestic sources.[6] The policies outlined by this strategy have been devised and executed under the aegis of this ministry, via the Energy Market Regulatory Board and the Ministry of Foreign Affairs.

1 World Bank. "GDP Growth (Annual %) - Türkiye | Data." Accessed October 13, 2022. https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2021&locations=TR&start=2012.

2 OECD. "Türkiye Economic Snapshot - OECD," June 2022. https://www.oecd.org/economy/Türkiye-economic-snapshot/.

3 World Bank. "Manufacturing, Value Added (% of GDP) - Türkiye | Data." Accessed October 13, 2022. https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=TR.

4 IEA. "Türkiye 2021 – Analysis," March 2021. https://www.iea.org/reports/Türkiye-2021.

5 Republic of Türkiye Ministry of Foreign Affairs. "Türkiye's International Energy Strategy." Accessed September 30, 2022. https://www.mfa.gov.tr/Türkiyes-energy-strategy.en.mfa.

6 "2019-2023 Stratejik Planı." T.C. Enerji ve Tabii Kaynaklar Bakanlığı. http://www.sp.gov.tr/upload/xSPStratejikPlan/files/muqpM+Stratejik_Plan_2019-2023.pdf.

At the most basic level, there has been a push towards diversification of energy supply chains. For example, the share of Russian gas as a share of the total imports has declined progressively over the past years, accompanied by an increase in the number of suppliers thanks to increased LNG imports.[7] Moreover, with the new impetus provided by the fight against climate change, and the energy transition, the discourse on energy security has started to be associated with sustainability as well. Indeed, extreme weather and water stress caused by higher temperatures are expected to put additional strain on energy systems.[8] Deployment of clean energy also enhances energy security by diversifying sources domestically. Between 2016 and 2021, Türkiye's installed capacity from clean sources saw a growth of around 50%.[9] Accordingly, the country managed to surpass its 2023 target of having 38% of its power generation from renewables, achieving 44% in 2019.[10]

Nevertheless, Türkiye continues to rely on fossil fuel powered generation for most of its baseload demand. Fossil fuel demand continues to increase alongside that of energy in general, affecting import dependency negatively. While the energy transition will be important in mitigating import dependency and climate change, it cannot be carried out successfully without a robust fossil fuel supply in the process. This means that the geopolitical and economic risks Türkiye is exposed to as a consequence of its reliance on foreign supply will persist to various extents. The invasion of Ukraine and recent riots across Iran is a case in point. The exploitation of domestic fossil fuel reserves will therefore be an integral component of Türkiye's energy security strategy in the near term.

Another way of enhancing energy security is the improvement of energy efficiency, which has the potential to yield immediate results. In 2018, Türkiye undertook an energy-efficiency effort to increase energy savings by adopting the National Energy Efficiency Action Plan, which sets out action plans to reduce 14% of primary energy consumption by 2023. The strategy envisaged a plan of action that listed comprehensive measures to affect residential energy consumption, as well as cross-cutting sectors like transportation, industry, and agriculture.[11]

This report attempts to dissect these themes and conduct an exploratory analysis of Türkiye's energy security efforts. It seeks to offer policy recommendations within the framework of Türkiye's energy transition, which is to take place given the country's net-zero pledge by 2053.[12]

7 IEA. "Türkiye 2021 – Analysis," March 2021. https://www.iea.org/reports/Türkiye-2021.
8 WMO. "Climate Change Puts Energy Security at Risk," October 10, 2022. https://public.wmo.int/en/media/press-release/climate-change-puts-energy-security-risk.
9 Ember. "Data Explorer | Open Source Global Electricity Data." Accessed October 13, 2022. https://ember-climate.org/data/data-explorer/.
10 IEA. "Türkiye 2021 – Analysis," March 2021. https://www.iea.org/reports/Türkiye-2021.
11 IEA. "National Energy Efficiency Action Plan 2017-2023 – Policies," January 17, 2022. https://www.iea.org/policies/7964-national-energy-efficiency-action-plan-2017-2023.
12 UNDP. "UNDP Supports Türkiye in Charting a Course to Net Zero by 2053 | United Nations Development Programme," December 2021.

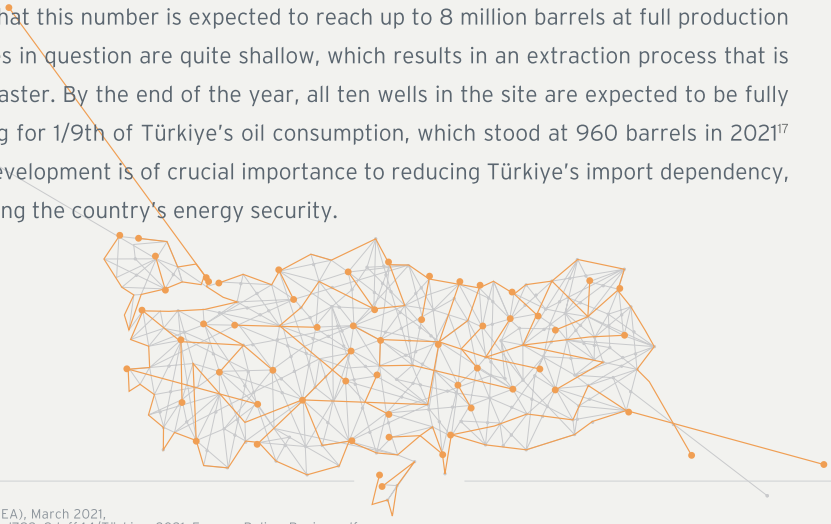
THE SUPPLY SIDE

Past few years yielded positive developments for Türkiye's energy transition, such as Ankara's consequent announcements regarding the discovery of natural gas in the Black Sea. Yet, despite the improvements, Türkiye's energy import dependency on external sources is still extremely high, and challenges to diversifying both fossil fuels and renewable energy sources remain. To explore the availability of supply in the Turkish context, three guiding aspects were chosen; (a) the availability of domestic and imported fossil fuels, and (b) the availability of domestic clean energy.

a) The Availability of Domestic and Imported Fossil Fuels

Although clean energy production more than doubled in the past decade (with significant increases in the use of geothermal, hydro, wind, and solar energy), the Turkish energy mix is still characterized by a heavy reliance on oil and gas.[13] In fact, fossil fuels accounted for 83% of the total primary energy supply (TPES) in 2019. Only 31% of this share was covered by domestic production. Therefore, in its fossil fuel supply, Türkiye is significantly dependent on external sources. Nearly all the gas Ankara uses is imported, domestic oil production covers7% of the demand, and as mentioned above, this figure for domestic coal is just over 40%.[14] At present, Ankara's main supply channels are not solely dependent on Russia, albeit the suppliers are quite limited, and supply chains are alarmingly dependent on fragile states. Türkiye imports around 33% of its crude oil from Russia, 30% from Iraq, and approximately 10% from Kazakhstan.[15] In the past few years, several other countries have also been added to Türkiye's crude oil importers, including Norway, Tunisia, and Turkmenistan.

When looking into the availability of domestic fossil fuel reserves, one needs to study the oil, coal, and gas segments separately. In terms of oil, one of the most important developments has been the recent discovery of oil at the Çukurova field in southern Adana. Although the reserves found on the site will produce a daily average output of 100-120 barrels[16] in the first stages, the Turkish Energy Ministry anticipates that this number is expected to reach up to 8 million barrels at full production capacity. The reserves in question are quite shallow, which results in an extraction process that is cheaper, easier and faster. By the end of the year, all ten wells in the site are expected to be fully functional, accounting for 1/9th of Türkiye's oil consumption, which stood at 960 barrels in 2021[17] (see Graph 1). This development is of crucial importance to reducing Türkiye's import dependency, consequently improving the country's energy security.



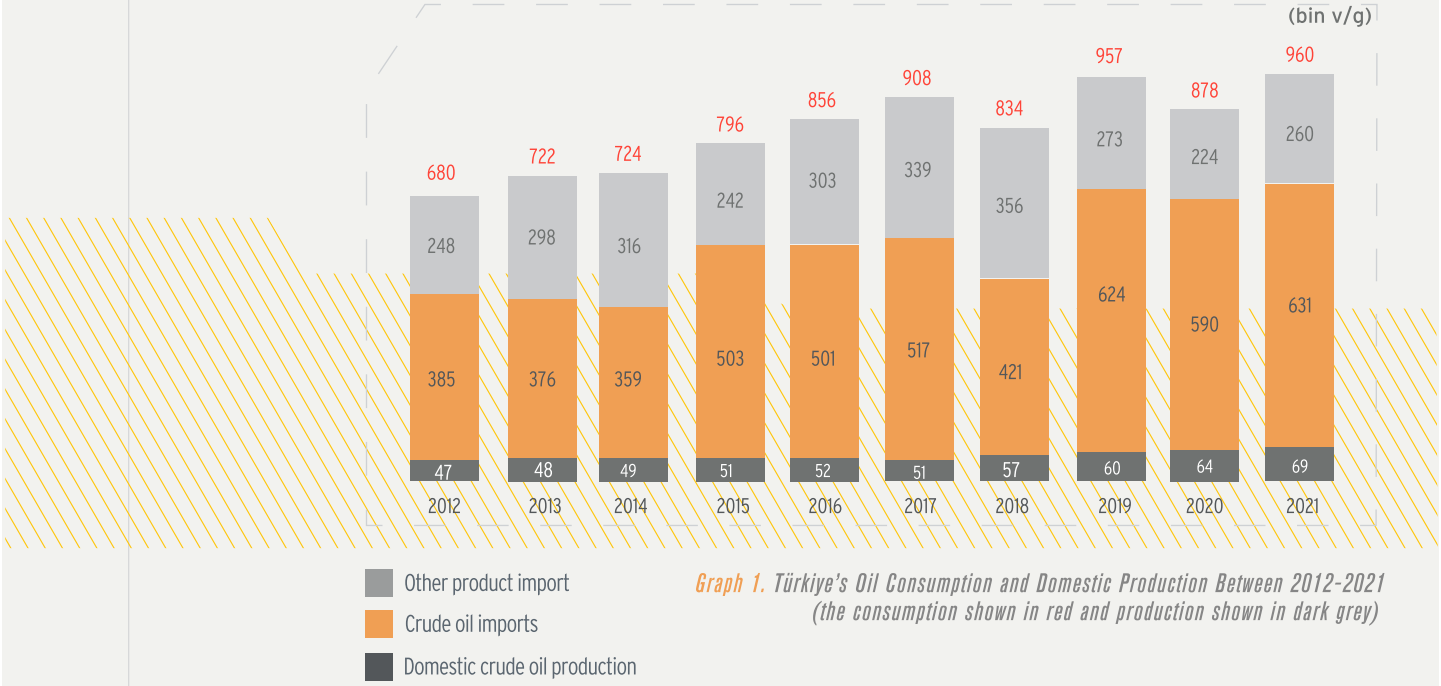
13 "Türkiye 2021: Energy Policy Review", International Energy Agency (IEA), March 2021, https://iea.blob.core.windows.net/assets/cc499a7b-b72a-466c-88de-d792a9daff44/Türkiye_2021_Energy_Policy_Review.pdf

14 Ibid.

15 "Türkiye 2021: Energy Policy Review", International Energy Agency (IEA), March 2021, https://iea.blob.core.windows.net/assets/cc499a7b-b72a-466c-88de-d792a9daff44/Türkiye_2021_Energy_Policy_Review.pdf

16 Morrow, Sibel. "Türkiye's new oil discovery at Cukurova to yield 8 mln. barrels: Energy Min.", Anadolu Agency Energy, July 7, 2022, https://www.aa.com.tr/en/energy/oil/Türkiye-s-new-oil-discovery-at-cukurova-to-yield-8-mln-barrels-energy-min/35770

17 "2021 Petrol ve Doğal Gaz Sektör Raporu", Türkiye Petrolleri (TP), https://www.tpao.gov.tr/file/2206/2021-petrol-ve-dogal-gaz-sektor-raporu-861629db02eb5624.pdf#page36



Graph 1. Türkiye's Oil Consumption and Domestic Production Between 2012-2021 (the consumption shown in red and production shown in dark grey)

On the side of coal, Türkiye sources 40% of its demand from domestic sources, which is relatively higher compared to oil. In 2021, a significant part of Türkiye's electricity generation came from coal, with 101.89 terawatt-hours per year corresponding to approximately 31% of total generation.[18] Yet, despite its wide use, domestic coal mining in Türkiye presents an environmental tradeoff. While the most abundant type of coal, brown coal, is a secure fossil fuel supply, it is also more polluting than other types of coal. Brown coal in Türkiye is most abundant in the form of lignite.[19] Lignite has a low heating value, and due to its high sulfur and ash content, burning it in coal power plants creates more air pollution.[20] There is an effort at the governmental level to increase lignite extraction, and the import dependency on coal is assessed to pose lower risks as there are many global suppliers with low geopolitical risk. However, the environmental impacts of lignite should be taken into account in the context of energy security.

Currently, the most fragile of Türkiye's fossil fuel energy sources are natural gas. After coal, gas is Ankara's main source of electricity, with a share of 33% of the country's total energy generation.[21] Gas also supplies half of Türkiye's heating requirements. In this segment, Türkiye has been exploring alternative channels (e.g., Kazakhstan) to diversify its gas supply. Though Türkiye has been diversifying away from Russian gas in the past years, 2021 illustrated the continuing dependence on Russia with an import share of almost 45%. Although Türkiye is increasingly becoming a bridge between gas-rich countries and NATO allies, the functioning and maintenance of the TurkStream, the pipeline that carries Russian gas to Europe through Türkiye, depends on

18 EMBER Data Explorer - "Türkiye: electricity generation by source," https://ember-climate.org/data/data-explorer/
19 "Production of lignite in the EU – statistics", Eurostat, July 2021, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Production_of_lignite_in_the_EU_-_statistics
20 "Lignite coal – health effects and recommendations from the health sector", HEAL, December 2018, https://www.env-health.org/wp-content/uploads/2018/12/HEAL-Lignite-Briefing-en_web.pdf
21 EMBER Data Explorer - "Türkiye: electricity generation by source," https://ember-climate.org/data/data-explorer/

Gazprom, the Russian energy giant. So, despite Türkiye's advantageous position as the intermediary provider of gas, this makes the supply increasingly tied to Russia's actions. Especially if Türkiye or Europe should move further away from Russia amid the war in Ukraine, the supply of gas might become a political bargaining chip for Putin, raising concerns about energy security. Although the Turkish deputy energy and natural resources minister announced a new roadmap relying on nuclear and local gas (Black Sea resources) to reduce energy imports, the results of this strategy is still yet to materialize.[22]

All in all, the domestic fossil fuel industry presents opportunities to improve Türkiye's energy security, though geopolitical and environmental risks remain. The exploitation of these sources should therefore only be temporary. Briefly put, the phasing-out period should go hand in hand with the transition process.

b) The Availability of Domestic Clean Energy

In terms of the share of renewable energy sources in Türkiye's electricity generation, there has been a gradual historical increase. Throughout the last decade, the share of electricity generated from renewable sources increased from 2% to 17%, and hydro generation has floated around 16% to 30%.[23] In terms of clean energy, Türkiye mainly generates its electricity from solar, wind, and hydro resources. With the Akkuyu Nuclear Power Plant becoming operational in 2023, nuclear power will also be added to the equation. At present, wind energy is an especially attractive source for many investors due to the country's suitability for wind power generation, as many regions (Aegean, Marmara, and the East Mediterranean) of Türkiye present attractive wind conditions coupled with a high-generation capacity. At present, 65% of the wind turbine parts are produced domestically, with a large extent of external dependency, especially in critical components remains.

Yet, in the wind turbine installment and technological know-how, Türkiye depends on countries such as Denmark for onshore and offshore wind energy and turbine installations. As part of the ongoing cooperation between the two countries, Denmark also said it is open to finding a sub-supplier in Türkiye.[24] In addition, according to the Danish Energy Agency, Denmark will foster strategic cooperation that aims to improve Türkiye's long-term development of a renewable energy system through government-to-government and business-to-business cooperation, with occasional study visits to encourage technological cooperation and the transfer of know-how.[25]

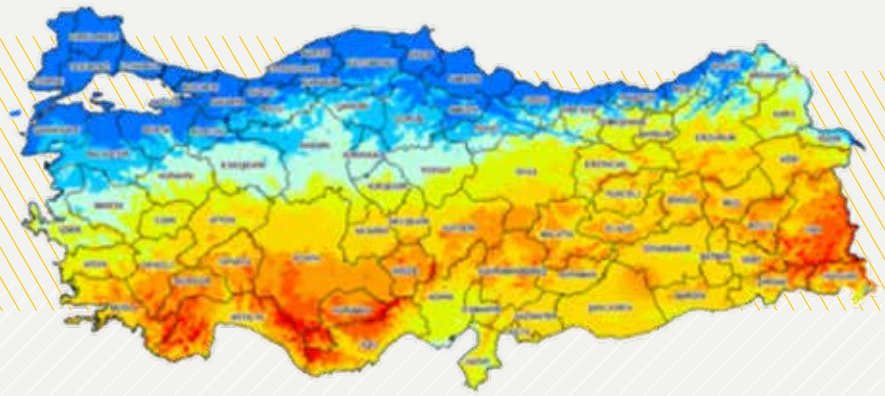
The same holds true for solar energy, with attractive countrywide conditions all-year-around and a consistently high solar irradiation between 1,400 - 2,000 kWh//m2/year. This irradiation value is much higher than in many European countries, making Türkiye an attractive option for solar energy production. However, like wind energy, Turkish solar technologies present a similar bottleneck where external dependency, especially for critical materials and subcomponents, persists.

22 Tavsan, Sinan. "Türkiye targets nuclear and local gas to reduce energy imports", Nikkei Asia, April 12, 2022, https://asia.nikkei.com/Editor-s-Picks/Interview/Türkiye-targets-nuclear-and-local-gas-to-reduce-energy-imports

23 "Share of electricity generation from renewable energy and wastes and hydro in Türkiye from 2010 to 2020", Statista, July 22, 2022, https://www.statista.com/statistics/961018/electricity-generation-from-renewable-energy-and-wastes-in-Türkiye/

24 "Turkish and Danish companies cooperate for scaling up clean energy opportunities", Anadolu Agency Energy, October 7, 2022, https://www.aa.com.tr/en/energy/energy-diplomacy/turkish-and-danish-companies-cooperate-for-scaling-up-clean-energy-opportunities/36558

25 "Türkiye and Denmark reach final stage of strategic energy sector cooperation", Anadolu Agency Energy, October 4, 2022, https://www.aa.com.tr/en/energy/general/Türkiye-and-denmark-reach-final-stage-of-strategic-energy-sector-cooperation-/36535



Graph 2. Türkiye's Solar Irradiation Levels by City [26] *(red: highest to blue: lowest)*

The solar panel supply chain rests on a particularly vulnerable and fragile track. It consists of various key materials, the most commonly used / essential ones being crystalline silicon, amorphous silicon, gallium arsenide, and organometallics[27] (soluble platinum), which are all extracted from either unreliable states such as Russia and China or fragile/war-torn countries like Kazakhstan and Ukraine. For the PV batteries, the main component required is lithium-ion. Most of these products, especially silicone, gallium arsenide, and lithium-ion, come from China. On the other hand, Russiais ranked just after China as the second-largest silicon producer.

With such essential components concentrated in the hands of these states, Türkiye, as a NATO ally, needs to boost domestic production and turn to alternatives for the required materials. For example, some countries that share amicable relations with Türkiye, such as South Korea, Japan, and Singapore[28], are all important actors that Ankara might establish alternative, less-risky trade routes. Therefore, without finding these new channels, solar energy, albeit its huge potential, is far from being a secure source of energy for Türkiye at present.

26 Solar Energy Map of Türkiye, https://www.researchgate.net/figure/Solar-Energy-Map-of-Türkiye-26_fig3_337307247

27 Danylenko, Marta. "Photovoltaics: Materials Used and How Their Efficiency and Cost Can Be Improved", Matmatch, May 23, 2018, https://matmatch.com/resources/blog/solar-panels-materials-efficiency-cost/

28 "OEC World - Platinum Clad Metals", 2020, https://oec.world/en/profile/hs/platinum-clad-metals

RUSSIAN INVASION IN UKRAINE COMPLICATES THE RENEWABLE ENERGY SUPPLY CHAIN TOO

These dynamics also lay out the vulnerabilities of renewable energy supplies amid the ongoing Russo - Ukrainian War. Beijing and the Kremlin currently hold a monopoly on some of the abovementioned materials. Still, with the Russian invasion surging with no end in sight, the sanctions imposed on the country will mean that the export of Russian materials will become increasingly harder.

On the other side of the coin, the war-torn country of Ukraine is another vital player in this transition. Most 'noble gasses', including neon and krypton, are crucial in producing semiconductor chips. Besides, they are also indispensable to the production lines of electronic systems, such as automobiles and renewables machinery. Although many countries currently have these materials in stock, as the war prolongs, the renewable energy supply chain will become increasingly fragile, increasing the urgency to find alternative solutions to replace our dependency on fossil fuels .[29]

GLOBALIZATION'S FUTURE AND TÜRKIYE'S POSITIONING IN GLOBAL ENERGY VALUE CHAINS

The need to reconfigure global value chains has gained additional relevance as the pandemic and the invasion of Ukraine demonstrated the shortcomings of globalization in its current form. The impetus to rewire globalization is now shared by developed and developing countries alike.[30] Russia's use of energy supplies as geopolitical leverage was not the first example of its kind. However, it showed clearly that one of the basic tenets of globalization, the idea that trade and mutual co-dependencies would foster healthy relations through a convergence around liberal values, was false. Fueled by this newfound wariness, a new anxiety is starting to take shape with regards to China's proactivity in the clean energy supply chains as well.[31]

The clean energy supply chains are expected to be less commodity-intensive than the fossil fuel ones, and technological competitiveness will certainly play a bigger role.[32] Regardless, China has already made significant progress in capturing clean energy related supply chains. For instance, its share in all the manufacturing stages of solar panels exceeds 80%.[33] The picture is similar on the raw materials front. Cobalt, for example, is a key component of lithium-ion batteries which is key for electric vehicles and energy storage from renewable sources. The Democratic Republic of Congo supplies around 70% of the world's cobalt but Chinese companies own or finance 80% of Congolese industrial cobalt mines.[34]

29 Sharma, Vigya. " Russia and Ukraine are important to the renewables transition. Here's what that means for the climate", March 15, 2022, The Conversation, https://theconversation.com/russia-and-ukraine-are-important-to-the-renewables-transition-heres-what-that-means-for-the-climate-179079

30 Ülgen, Sinan. "The Limits of Convergence and the Road Ahead - Rewiring Globalization." Carnegie Europe, February 17, 2022. https://carnegieeurope.eu/2022/02/17/limits-of-convergence-and-road-ahead-pub-86378.

31 Purdy, Rodrigo Castillo and Caitlin. "China's Role in Supplying Critical Minerals for the Global Energy Transition: What Could the Future Hold?" Brookings (blog), August 1, 2022. https://www.brookings.edu/research/chinas-role-in-supplying-critical-minerals-for-the-global-energy-transition-what-could-the-future-hold/.

32 Lund, Susan, James Manyika, San Francisco, Jonathan Woetzel, Jacques Bughin, Mekala Krishnan, Jeongmin Seong, and Mac Muir. "Globalization in Transition: The Future of Trade and Value Chains," 2019, 144.

33 IEA. "Executive Summary – Solar PV Global Supply Chains – Analysis." Accessed September 29, 2022. https://www.iea.org/reports/solar-pv-global-supply-chains/executive-summary.

34 "Congo's Cobalt Controversy," April 20, 2022. https://globaledge.msu.edu/blog/post/57136/congos-cobalt-controversy.

China itself is the dominant processor of the ore, providing 70% of the global refined supply.[35] Other countries such as the US are therefore exploring new frameworks such as reshoring, nearshoring and 'friendshoring' to improve the resilience of their supply chains and reduce geopolitical risks from potentially adversarial trade partners. Friendshoring is particularly interesting as it entails moving parts of the value chain to allies and other countries sharing similar ideologies and interests.[36] Türkiye is one of the countries that can take advantage of the nearshoring, and potentially friendshoring, due to its proximity to the European market[37], which it already participates in through the customs union.

Securing itself a central place in the reconfigured energy value chains can enhance Turkish energy security through secondary effects of integration. Since 2006, it has been an observer party in the Energy Community comprising of the EU and some of its neighbors.[38] As part of its international energy strategy, Türkiye already has policy objectives aiming "To contribute to regional and global energy security" and "to be a regional trade center in energy.[39] A concrete outcome that aligns with these objectives is the Southern Gas Corridor, which became operational in 2020. This project allows Azerbaijani natural gas from the Caspian Sea to flow to Europe through Georgia and Türkiye.[40] The Trans-Anatolian Natural Gas Pipeline (TANAP) that runs through Türkiye is the longest section of the Corridor with a length of 1,811 kilometers.[41] Türkiye may benefit from establishing such co-dependencies, for example by securing external funding for its energy infrastructure. More importantly, these international projects allow for risk-sharing between Türkiye and its regional partners. Addressing failures or issues on any part of the pipeline becomes the responsibility of all participating countries, enhancing overall energy security.

On the other hand, though natural gas was recently defined as a 'transition fuel' in the EU financial taxonomy, the invasion of Ukraine has also increased skepticism towards relying on this energy source.[42] While this may benefit Türkiye since it facilitates gas flows from sources alternative to Russia, gas may not be as attractive to Europe in the long run especially when the accelerated net zero objectives of European countries are considered. Therefore, extending the aforementioned government strategy to renewables can also be a facet to improving energy security. Becoming a major exporter of renewable energy equipment would not directly benefit Turkish energy security, but the increased competitiveness developed by manufacturing export-grade products can have spillover effects for the domestic deployment of renewables. Indeed, Türkiye is already the first in Europe and the fourth globally in the manufacturing of solar panels[43], and the country has had a positive trade balance in terms of solar panels since 2019.[44]

However, focusing primarily on exports also run the risk of driving domestic prices high, risking a slowdown of domestic renewable proliferation and thus hurting energy security. Moreover, Türkiye

35 Cobalt Institute. "Cobalt Market Report 2021," May 17, 2022. https://www.cobaltinstitute.org/resource/state-of-the-cobalt-market-report-2021/.Atlantic Council. "Transcript: US Treasury Secretary Janet

36 Yellen on the next Steps for Russia Sanctions and 'friend-Shoring' Supply Chains," April 13, 2022. https://www.atlanticcouncil.org/news/transcripts/transcript-us-treasury-secretary-janet-yellen-on-the-next-steps-for-russia-sanctions-and-friend-shoring-supply-chains/.

37 Lund, Susan, James Manyika, San Francisco, Jonathan Woetzel, Jacques Bughin, Mekala Krishnan, Jeongmin Seong, and Mac Muir. "Globalization in Transition: The Future of Trade and Value Chains," 2019, 144.

38 "Energy Community Homepage." Accessed September 30, 2022. https://www.energy-community.org/.

39 Republic of Türkiye Ministry of Foreign Affairs. "Türkiye's International Energy Strategy." Accessed September 30, 2022. https://www.mfa.gov.tr/Türkiyes-energy-strategy.en.mfa.

40 European Commission. "Diversification of Gas Supply Sources and Routes." Accessed September 30, 2022. https://energy.ec.europa.eu/topics/energy-security/diversification-gas-supply-sources-and-routes_en.

41 TANAP. "TANAP Project." Accessed September 30, 2022. https://www.tanap.com/en/tanap-project.

42 Hancock, Alice. "Europe's New Dirty Energy: The 'Unavoidable Evil' of Wartime Fossil Fuels." Financial Times, September 6, 2022.

43 Şahbaz, Yusuf. "Türkiye, Güneş Paneli Üretiminde Avrupa'da Lider Konumda," May 2, 2022. https://www.aa.com.tr/tr/ekonomi/Türkiye-gunes-paneli-uretiminde-avrupada-lider-konumda/2577954.

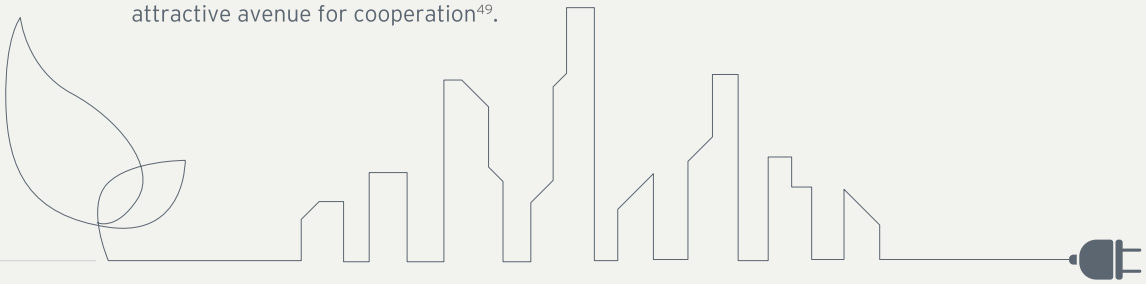
44 PricewaterhouseCoopers. "Türkiye ve Dünyada Güneş Enerjisi Sektörü." PwC, December 2021. https://www.pwc.com.tr/Türkiye-ve-dunyada-gunes-enerjisi-sektoru.

still depends on imports for raw materials and intermediate goods for much of its clean energy products manufacturing.[45] Increased intermediate imports for the sake of higher final goods exports still increases exposure to supply chain risks stemming from import partners. In brief, energy security considerations should not be ignored when designing economic and trade policies that relate to clean energy products.

AVENUES FOR TURKISH - GERMAN COOPERATION IN ENERGY TRANSITION

Vis-a-vis the growing fragility and instability in the main fossil fuel providers, namely Russia and the Gulf States, Türkiye and Germany face similar challenges. Türkiye's new energy plan, its 'net-zero by 2053' target and Europe's desire to improve its efforts regarding clean energy transition combined, the future presents important opportunities for cooperation. German-Turkish economic-trade cooperation is rather intact, and extends into the energy sector. As of June 2021, Germany firms had invested €25 billion in Türkiye's energy sector, employing more than 15,000 people.[46]

In light of Europe's attempt to reduce dependency on fossil fuels from Russia, Türkiye can provide an alternative. The two countries are already working together on various clean energy projects. One remarkable example is the wind power industry, where German firm Enercon will provide (wind) turbines to Türkiye with a 55% share of indigenous production. Green hydrogen is also another segment that provides fruitful opportunities for cooperation, and large Turkish conglomerates such as Sabanci Holding (EnerjiSA) have shown interest in establishing partnerships with Germany in this area to merge strengths in meeting the countries' rising energy needs. This initiative aims to merge Türkiye's geographical advantages with Europe's technical know-how, and was translated into a joint declaration of intent, signed by both parties on October 11 in Berlin[47]. In addition, eight Turkish and international companies and banks recently signed a 811 million USD-worth agreement for Türkiye's largest solar power plant (Karapinar), which will also be Europe's largest solar power plant in one location upon its completion, offering significant opportunities for green energy trade between Türkiye and European nations, including Germany[48]. Acknowledging how solar energy helped the EU avoid almost 30 billion euros in gas imports over 4 months, it is a particularly attractive avenue for cooperation[49].



45 Özenç, Bengisu, Taylan Kurt, and Seçil Gülbudak. "Çevresel Ürünlerin Ticareti Raporu: Dünyada ve Türkiye'de Çevresel Ürünler." SEFIA, July 2022. https://sefia.org/wp-content/uploads/2022/07/sefia-dunyada-ve-Türkiyede-cevresel-urunlerin-ticareti-raporu-v1-min1.pdf.

46 Şengül. "Germany Invests €25 Billion in Turkish Energy Sector, Employing 15,000." Anadolu Agency, June 2, 2021. https://www.aa.com.tr/en/energy/energy-diplomacy/germany-invests-25-billion-in-turkish-energy-sector-employing-15-000/32835.

47 Kivanc Zaimler, October 12, 2022, https://www.linkedin.com/feed/update/urn:li:activity:6985625366405009409/

48 Karabay, Zeynep Beyza. "821 million USD finance deal signed for Türkiye's largest solar power plant", November 30, 2021, Anadolu Agency Energy, https://www.aa.com.tr/en/energy/energy-projects/-812-million-finance-deal-signed-for-Türkiyes-largest-solar-power-plant/34144

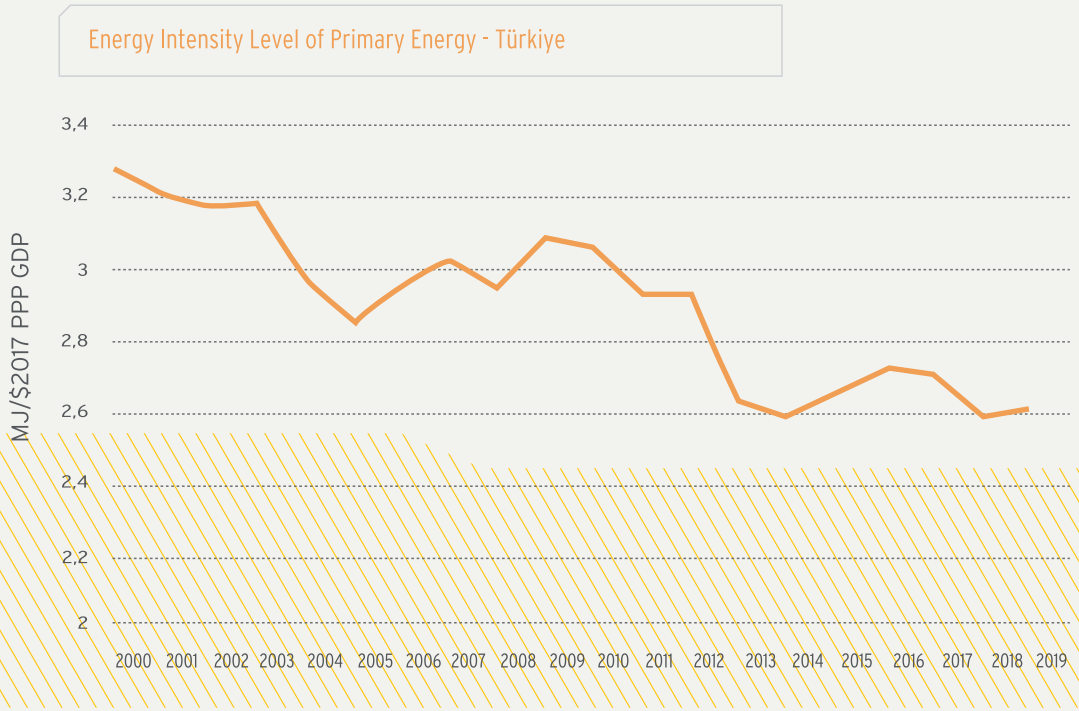
49 Erkul, Nuran. "Solar helps EU avoid 29 billion in gas imports over 4 months", September 8, 2022, Anadolu Agency Energy, https://www.aa.com.tr/en/energy/solar/solar-helps-eu-avoid-29-billion-in-gas-imports-over-4-months/36273

THE ROLE OF ENERGY EFFICIENCY AND TECHNOLOGY FOR ENERGY SECURITY

(a) Energy Efficiency

Energy efficiency has once again become a key policy topic following the increased state-level awareness on climate change and the intensification of energy security concerns following the Russian invasion of Ukraine. When thinking about energy security, what usually dominated the debate has been supply security in its most basic sense: Where the fossil supplies come from and how diversified the sources are. However, energy efficiency is also intimately tied to supply security. As the IEA states: "The only energy source that cannot be interrupted is the energy that is not used".[50] What's more, although new power plants, both fossil and clean, take years to build and deploy, increasing energy efficiency has immediate positive effects on energy security.[51]

Achieving the most economically and socially while using the least amount of energy should therefore be a component when formulating an energy security strategy. This theme holds additional relevance in the context of the energy transition due to the intermittency of most renewable energy sources, at least in the absence of cost-effective energy storage techniques.



Graph 3. Energy Intensity Level of Primary Energy - Türkiye [52]

50 IEA. "Energy Security – Multiple Benefits of Energy Efficiency – Analysis." Accessed October 3, 2022. https://www.iea.org/reports/multiple-benefits-of-energy-efficiency/energy-security.

51 WWF. "Energy Efficiency: An Overlooked Solution to the Energy Crisis," May 2022. https://wwf.panda.org/wwf_news/?5538966/energy-efficiency-solution.

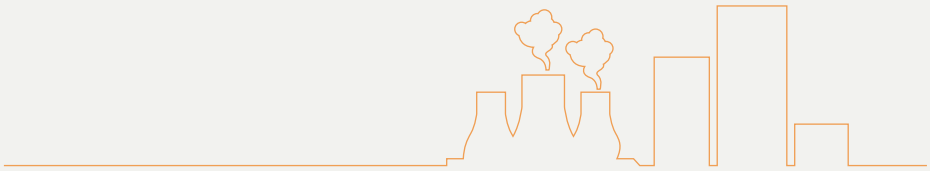
52 World Bank. "Energy Intensity Level of Primary Energy (MJ/$2017 PPP GDP) - Türkiye | Data." Accessed October 3, 2022. https://data.worldbank.org/indicator/EG.EGY.PRIM.PP.KD?locations=TR&name_desc=false.

Despite Türkiye's rapid industrialization, urbanization and overall economic growth in the last two decades, the primary energy intensity of GDP has been declining. Indeed, Türkiye's energy intensity is among the lowest in IEA members. However, its economic development has not yet decoupled significantly from energy consumption. The country also has a track record of energy efficiency policies starting with the Energy Efficiency Law in 2007. The most recent step taken has been the National Energy Efficiency Action Plan (NEEAP) that came into force in 2018 with setting targets for 2023.[53] The plan's estimated result has been a decrease of 14% in primary energy consumption over five years. Since it expires in 2023, a renewal of the plan is also on the agenda as of September 2022.[54] Türkiye's energy efficiency policies mirror those of the EU, and their implementation has been supported by multilateral organizations such as the EBRD. Türkiye also participates in cooperation programs on energy efficiency with countries such as Denmark, Germany and Japan.[55]

Though Türkiye has demonstrated political willingness to pursue energy efficiency goals, there is room for improvement for the design and implementation of such policies. For one, Türkiye still does not have a dedicated governmental energy efficiency agency. Building the institutional capacity for the pursuit of its stated efficiency goals would render Türkiye proactive and flexible in this sphere. Moreover, the role of energy efficiency should be contextualized within a broader energy security and climate strategy. Revising efficiency standards and subsidy schemes for coal and gas power plants may also benefit efforts at improving energy efficiency. In addition to focusing on programs such as public and residential building insulation and industrial energy efficiency investments, public awareness should be built around energy conservation. Though policies targeting energy demand are always politically risky, sufficient institutional capacity and state-level coordination may help push Türkiye's energy efficiency policies further so that a more tangible impact is experienced.

(b) Technology

We have already established the importance of domestic renewable energy capacity in ensuring energy security in its own section. To recapitulate, transitioning to clean sources of energy improves the energy security of countries that are dependent on fossil fuel imports. In addition to the environmental motive for reaching net-zero, energy security and independence have become the drivers of the energy transition for some countries in the wake of Ukraine's invasion. The EU's REPowerEU plan explicitly includes energy independence from Russia as a goal for accelerating the deployment of clean energy.[56] It is unlikely that the idea of focusing on clean energy for the sake of energy independence will be limited to European countries in the long run.



53 T.C. Enerji ve Tabii Kaynaklar Bakanlığı. "Ulusal Enerji Verimliliği Eylem Planı." Accessed October 3, 2022. https://enerji.gov.tr/bilgi-merkezi-enerji-verimliligi-ulusal-enerji-verimliligi-eylem-plani.

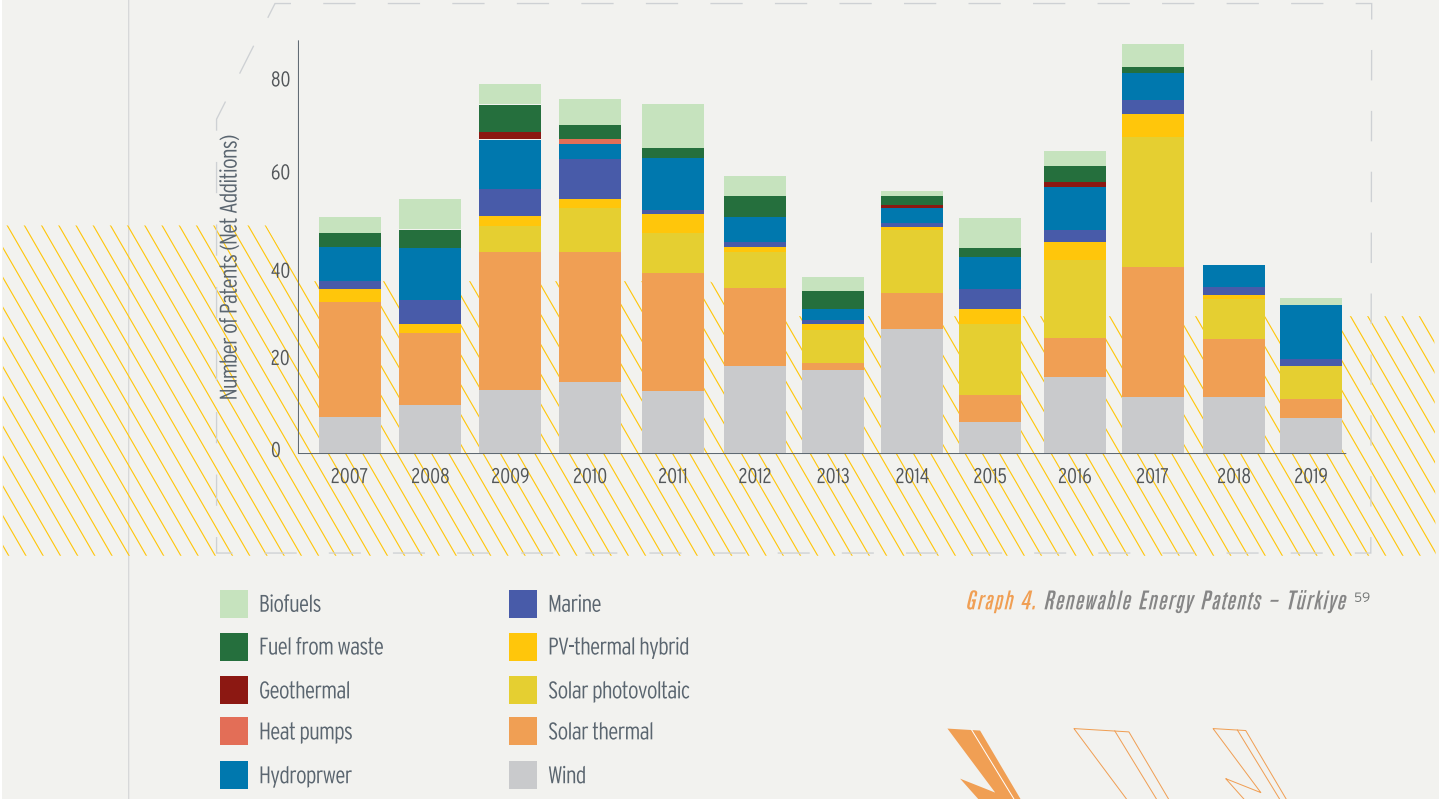
54 Ekonomist. "Ulusal Enerji Verimliliği Eylem Planı Yenileniyor - Ekonomist," September 2022. https://www.ekonomist.com.tr/enerji/ulusal-enerji-verimliligi-eylem-plani-yenileniyor.html.

55 IEA. "Türkiye 2021 – Analysis," March 2021. https://www.iea.org/reports/Türkiye-2021.

56 European Commission - European Commission. "REPowerEU: Affordable, Secure and Sustainable Energy for Europe." Text. Accessed October 4, 2022. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en.

A significant feature of clean energy, and of renewables in particular, is the role of technology in its development and adoption. From higher efficiency solar panels to fusion-powered nuclear plants, technological solutions are gaining traction in clean energy as opposed to the mainly resource-based functioning of fossil fuels. Granted, innovations such as fracking and liquification of natural gas have also contributed to energy security for some countries. However, the current efforts at developing clean energy technologies have become so central that the international competition now almost resembles the Cold War-era space race.[57]

Technology's key role in enabling clean energy also makes it an essential factor to consider in the context of energy security. Türkiye's domestic and renewable energy push motivated by reducing import dependency has thus far has lacked an explicit technological dimension. Türkiye's lag in this area is also reflected in its patent data; in 2020 for example, Türkiye had 0.005 renewable energy patent additions per 10,000 people as compared to Spain's 0.031 and South Africa's 0.007.[58] Including a technological focus for clean energy in its energy security strategy would therefore be a natural step for Türkiye.



Graph 4. Renewable Energy Patents – Türkiye [59]

57 Hook, Leslie, and Henry Sanderson. "How the Race for Renewable Energy Is Reshaping Global Politics." Financial Times, February 4, 2021.

58 IRENA. "Patents Evolution," December 2021. https://www.irena.org/Statistics/View-Data-by-Topic/Innovation-and-Technology/Patents-Evolution.

59 Ibid.

A good case study on this theme would be the negative example of Akkuyu Nuclear Power Plant. Diversifying its energy sources is obviously a net benefit for Türkiye's energy security. Moreover, including nuclear in its energy mix will bring with it environmental benefits by providing a clean source of generation. However, the Akkuyu project also contains serious drawbacks that hinder energy security. Firstly, the project will be owned and operated by the Russian Rosatom which will sell the generated electricity to Türkiye. Therefore, in effect, Türkiye will continue to be dependent on Russian energy even if it will be generated in Türkiye geographically.[60] The outlook is also dire in terms of technology transfer. Though there is a provision on this in the agreement between Türkiye and Russia as mentioned by the Turkish Energy Minister's statements[61], the technology transfer is not guaranteed to materialize. The agreement does not provide details on how the transfer will take place, and the lack of purchase guarantees from Turkish companies on the part of Rosatom means Turkish companies may not be involved in the technologically sophisticated aspects of the construction.[62]

Though it is likely that political considerations preclude Türkiye from fully pursuing a technology transfer agenda in its nuclear ambitions, there are countries that can be taken an example in case such hurdles are overcame. South Korea, for instance, made technological self-reliance an integral part of its nuclear energy strategy, and successfully developed domestic capabilities by cooperating with foreign partners.[63] In the future, Türkiye should also prioritize technological self-reliance so that one dependency is not replaced with other in the pursuit of energy transition.

POLICY RECOMMENDATIONS AND SUGGESTED AREAS OF FOCUS

Türkiye needs a dedicated and multi-layered energy security strategy. As of now, ensuring energy supply security is taken as one of the main components of the Turkish international energy strategy as formulated by the Ministry of Foreign Affairs.[64] One might argue that this strategy, together with the actions of the Ministry of Energy and Natural Resources and the Energy Market Regulatory Authority already form the necessary framework. However, we believe that energy security should become an explicit pillar for policy in the operations of these governmental bodies. This is mainly because the country's reorientation towards a domestic manufacturing-driven exports based economic model[65] necessitates it. Between January and August 2022, Türkiye's exports have increased by 19.1% year-on-year, showing that the new model did result in more exports. However, the increase in imports was 40.7% resulting in a widening trade and current account deficit.[66]

60 Doğru, Seyide. "Akkuyu Nükleer Güç Santrali ve Enerji Bağımlılığımız." ThinkTech - STM, July 2018. https://thinktech.stm.com.tr/akkuyu-nukleer-guc-santrali-ve-enerji-bagimliligimiz.

61 Milliyet. "Bakanlık'tan Akkuyu Nükleer Santrali açıklaması: Çözüm için girişimlerde bulunuldu," July 2022. https://www.milliyet.com.tr/ekonomi/bakanliktan-akkuyu-nukleer-santrali-aciklamasi-cozum-icin-girisimlerde-bulunuldu-6800811.

62 Doğru, Seyide. "Akkuyu Nükleer Güç Santrali ve Enerji Bağımlılığımız." ThinkTech - STM, July 2018. https://thinktech.stm.com.tr/akkuyu-nukleer-guc-santrali-ve-enerji-bagimliligimiz.

63 Ahn, J. H., and K. I. Han. "Korean Experience in Self-Reliance for Nuclear Power Technology (a Case Study in the Republic of Korea)." Taejon, Republic of Korea: NSSS Engineering & Development, 2000. https://www.osti.gov/etdeweb/servlets/purl/20116559.

64 The Republic of Türkiye Ministry of Foreign Affairs. "Türkiye's International Energy Strategy." Accessed October 11, 2022. https://www.mfa.gov.tr/Türkiye_nin-enerji-stratejisi.tr.mfa.

65 Cakir, Merve Ozlem, and Zeynep Cetinkaya. "Hazine ve Maliye Bakanı Nebati: Yüksek Büyüme, Düşük Cari Açık. Modelimizin Temeli Bu," December 2021. https://www.aa.com.tr/tr/ekonomi/hazine-ve-maliye-bakani-nebati-yuksek-buyume-dusuk-cari-acik-modelimizin-temeli-bu/2453934.

66 T.C. Ticaret Bakanlığı. "2022 Yılı Temmuz Ayı Dış Ticaret Verileri," August 2022. https://ticaret.gov.tr/haberler/2022-yili-temmuz-ayi-dis-ticaret-verileri.

Looking closer, it is possible to see that the volume of energy supply imports has risen by 134.5% between January and September.[67] This is clearly caused by the global energy crisis, yet to ascribe temporariness to this situation may be wrong. Underinvestment in energy during the pandemic, more ambitious climate targets and the subsequent volatility expected during the energy transition may mean that relatively high energy prices are here to stay.[68] When Türkiye's geopolitical conundrums with its energy suppliers such as Russia and Iran are considered, the need to domesticize and secure energy production gains additional relevance.[69] Moreover, measures such as the EU's Carbon Border Adjustment Mechanism pose additional risks for Türkiye's fossil energy-intensive exports.[70]

In short, Türkiye has missed its chance at manufacturing-heavy exports-oriented growth that was pursued by many countries (most notably China) during a time of cheap energy prices and low environmental concerns. To take advantage of the shifting trends in globalization and apply this policy successfully, Türkiye will have to prioritize energy security as part of its economic and foreign policy in an environment of volatile prices and climate emergency.

To summarize the analysis and recommendations made throughout this paper: In the short term, increasing efforts at improving energy efficiency is necessary. Continuing cooperation with international partners such as UNFCCC, EBRD and the World Bank may be beneficial in this context. Looking forwards, accelerating the deployment of clean energy sources, and incentivizing the adoption of ancillary methods such as hybrid power plants and battery storage technologies will prove to be important. The energy transition will not happen in a day, and replacing imported fossil resources with domestic ones can also benefit energy security during this period. Electrification too is an area where special attention should be accorded since that is also a way of replacing the imported energy for heating and transportation with domestically generated electricity. For long term energy security, in recognition of the technology-driven nature of clean energy, the necessary education, technological infrastructure and R&D investments should start now.

As a final note, while this report was being finalized, the deputy minister of energy and natural resources Alparslan Bayraktar has stated that the government will soon announce a new energy roadmap. His statement indicates that reducing import dependence will be a central objective of the roadmap.[71] Moreover, he touched on almost all areas this report also mentions such as the net-zero target, the role of renewables in energy security and energy efficiency. Hopefully this new strategy will be aligned with the energy security needs outlined in this paper.

67 T.C. Ticaret Bakanlığı. "Eylül Ayı Dış Ticaret İstatistik Tabloları - En Fazla İthalat Yapılan 20 Fasıl," October 2022. https://ticaret.gov.tr/istatistikler/bakanlik-istatistikleri/dis-ticaret-istatistikleri/eylul-ayi-dis-ticaret-istatistik-tablolari.

68 Bordoff, Jason, and Meghan L. O'Sullivan. "Green Upheaval," June 8, 2022. https://www.foreignaffairs.com/articles/world/2021-11-30/geopolitics-energy-green-upheaval.

69 Yildirim, Azem. "Natural Gas Crisis: Türkiye's Wake-up Call." EDAM, January 2022. https://edam.org.tr/wp-content/uploads/2022/02/220210-NaturalGasCrisis.pdf.

70 Ulgen, Sinan, Azem Yildirim, and Mehves Selamoglu. "Modernizing the Türkiye-EU Customs Union: The Digital Agenda and the Green Deal." EDAM, February 2022. https://edam.org.tr/en/modernizing-the-Türkiye-eu-customs-union-the-digital-agenda-and-the-green-deal/.

71 Erkul Kaya, Nuran, and Firdevs Yuksel. "Enerji ve Tabii Kaynaklar Bakan Yardımcısı Bayraktar: Enerjide Yeni Yol Haritamızı Yakında Paylaşacağız," October 11, 2022. https://www.aa.com.tr/tr/ekonomi/enerji-ve-tabii-kaynaklar-bakan-yardimcisi-bayraktar-enerjide-yeni-yol-haritamizi-yakinda-paylasacagiz/2708282.

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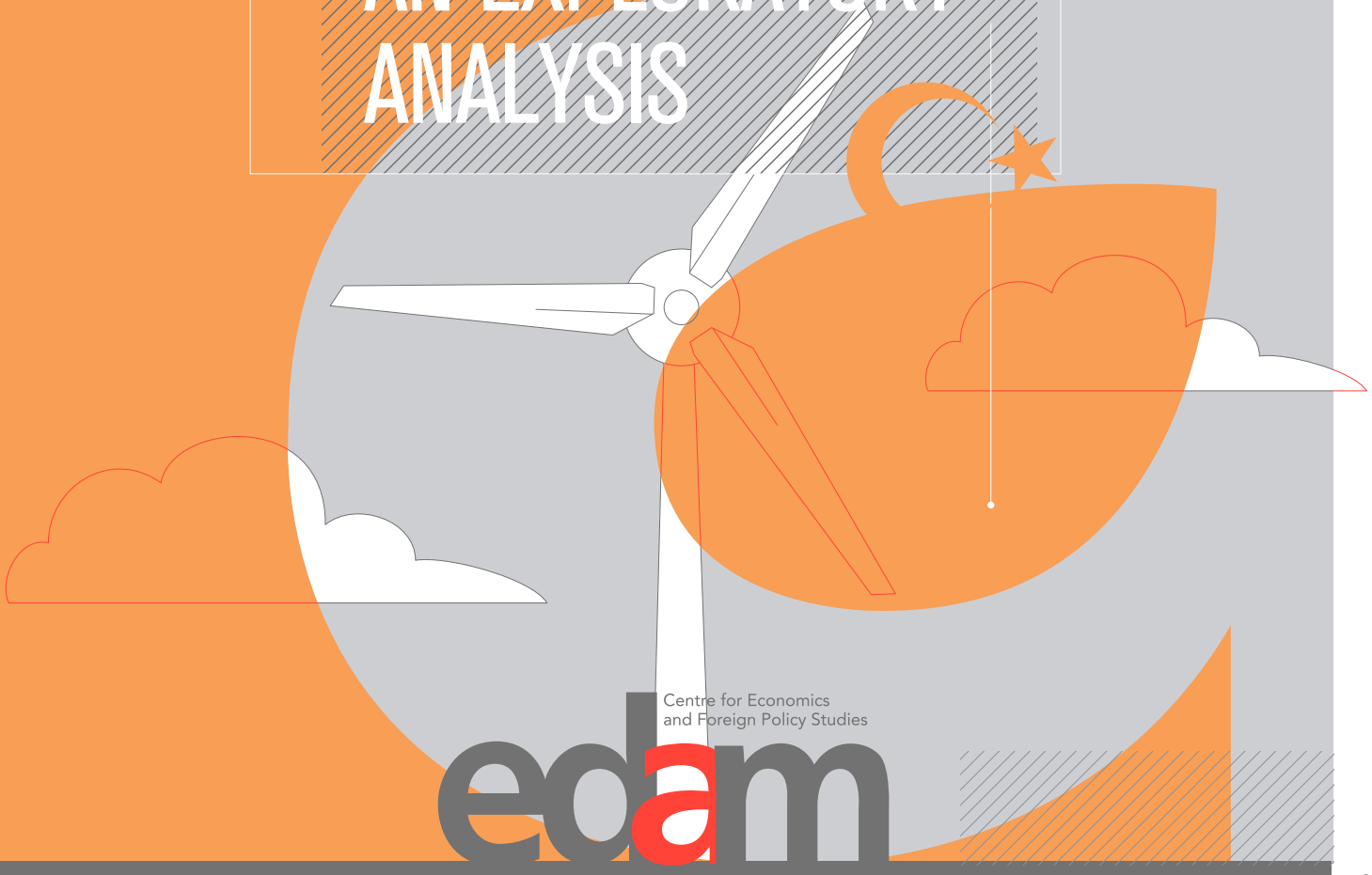
TÜRKİYE'S ENERGY SECURITY DURING THE ENERGY TRANSITION: AN EXPLORATORY ANALYSIS



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