



Ninth EnerCEE Report

Status of the use of renewable energies in
Hungary, Slovenia and Turkey





About the project

The “Energy Country Profiles” on the enerCEE website provide in-depth information about the energy markets, energy policies and legal frameworks, administration, data on supply and demand, energy-related funds and support mechanisms for renewable energy in 20 CEE- and SEE countries.

Challenges for CEE- and SEE Countries

While quite many CEE- and SEE countries joined the EU about a decade ago, some are still in their negotiation process for EU membership. It is a challenge for the candidate countries to adapt to energy targets and energy regulations as given by the EU to become an EU member state.

Profiles are available for:

Albania
Belarus
Bosnia & Herzegovina
Bulgaria
Croatia
Czech Republic
Estonia
Hungary
Latvia
Lithuania
Macedonia
Moldova
Montenegro
Poland
Romania
Serbia
Slovak Republic
Slovenia
Turkey
Ukraine

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Overview

The ninth comparative enerCEE report looks at the progress in renewable energy deployment in Hungary, Slovenia and Turkey. It presents development plans for decarbonisation and diversification of energy sectors that are often dependent on imports and fossil fuels. Producing energy that does not generate greenhouse gas emissions from fossil fuels and reduces certain types of air pollution is crucial for diversifying the energy supply and reducing dependence on imported fuels. It also contributes to economic development, creates jobs and promotes regional development by providing local governments with the most direct access to renewable energy.¹

2020 & 2021

For all three countries, figures are only available up to 2019. Due to the ongoing health crisis, which took on a global dimension in 2020, all three countries likely experienced a sharp decline in their economies, energy consumption and consequently CO₂ emissions. Publications on large economies show a strong recovery in 2021, with economic recovery accompanied by an increase in energy consumption and CO₂ emissions. Data for these years are expected to be similar for Hungary, Slovenia and Turkey.²

Members & Networks

As EU member states, Hungary and Slovenia are part of the Trans-European Energy Networks (TEN-E), under which the EU supports countries in building better-interconnected energy networks and provides funding for new energy infrastructure.³ Both are also members of ENTSO-E, the European Network of Transmission System Operators for Electricity, and an association for the cooperation of European transmission system operators (TSOs).⁴

Turkey has been connected to the European electricity grid since 2021⁵ and is working with the EU to enable the integration of Turkey's gas and electricity markets into the Union's internal energy market.⁶

Published energy strategies

As EU member states, Hungary and Slovenia have prepared integrated National Energy and Climate Plans (NECP) for the period 2021 to 2030 to achieve the EU's 2030 energy and climate targets.⁷ In 2019, Turkey published its Eleventh Development Plan (2019-2023), in which supply-side targets for 2023 include a reduction in the share of natural gas in electricity generation from 29.9% to 20.7% and an increase in the share of renewable energy sources in electricity generation from 32.5% to 38.8%.⁸

¹ US EPA. Local benefits and resources for renewable energy. (2021, 5 November). <https://www.epa.gov/statelocalenergy/local-renewable-energy-benefits-and-resources>

² Enerdata. (2021). Global Energy Trends - A Return to 2019 Levels. <https://www.enerdata.net/publications/reports-presentations/global-energy-trends-2020-edition-da.pdf>

³ European Commission. Trans-European Networks. (2021, 5 July). Energy - European Commission. https://ec.europa.eu/energy/topics/infrastructure/trans-european-networks-energy_de

⁴ ENTSO-E. ENTSO-E member companies. (2021). <https://www.entsoe.eu/about/inside-entsoe/members/>

⁵ EU Delegation in Turkey. (2021). Connecting Turkey to the EU electricity grid. Connecting Turkey to the EU electricity grid. <https://www.avrupa.info.tr/en/plugging-turkey-eu-electricity-grid-140>

⁶ Patel, S. (2018, December 3). Turkey Joins European Grid. POWER Magazine. <https://www.powermag.com/turkey-joins-european-grid/>

⁷ European Commission National Energy and Climate Plans (NECP) - Energy European Commission. (2021, 21 June). Energy - European Commission. https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en

⁸ The Grand National Assembly of Turkey. (2019, July 18). Resolution No. 1225. Resolution on the Approval of the Eleventh Development Plan. https://www.sbb.gov.tr/wp-content/uploads/2021/12/Eleventh_Development_Plan_2019-2023.pdf



HUNGARY

9.75 M

Population

16.3 \$

GDP/Cap

41,86 GJ

**Per capita energy
consumption**

4.91 t

**Per capita tonnes
of CO₂**

Hungary's NECP (energy and climate plan until 2030) has been updated to include an outlook to 2040 that focuses on clean energy while strengthening energy independence and security. A law passed in June 2020 sets a binding target of achieving net zero emissions by 2050.

In the area of renewable energy, Hungary has set itself the target of achieving a 21% share by 2030, which is considered unambitious by the European Commission.⁹

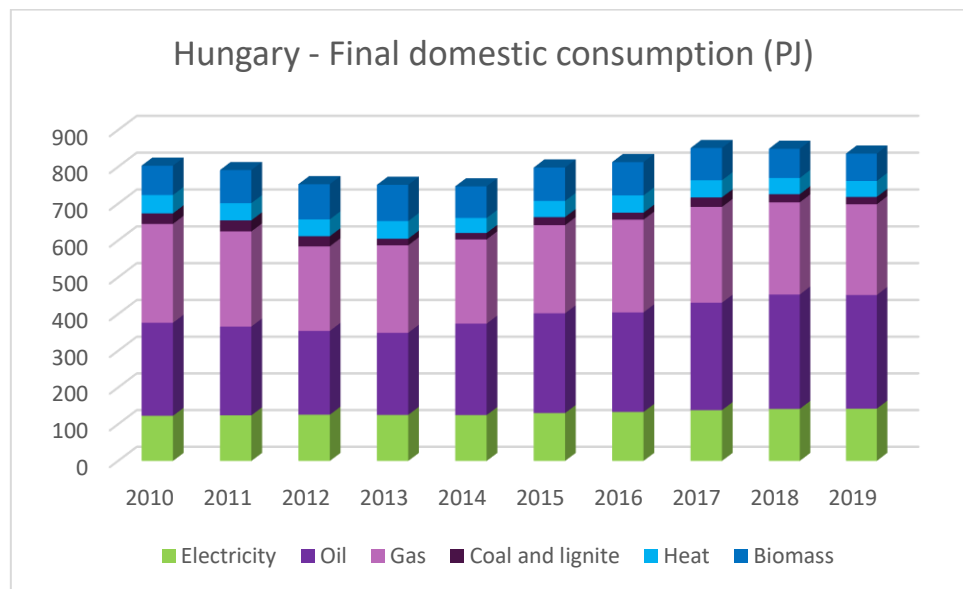
Electricity from renewable sources and the electrification of the end-use sectors are cited as the main drivers to achieve this goal. Hungary is also pursuing a plan to expand its nuclear energy by building two new power plants.¹⁰

⁹ European Commission. (2020a, October 14). Assessment of the Final National Energy and Climate Plan of Hungary. European Commission. https://ec.europa.eu/energy/sites/default/files/documents/staff_working_document_assessment_necp_hungary_en.pdf

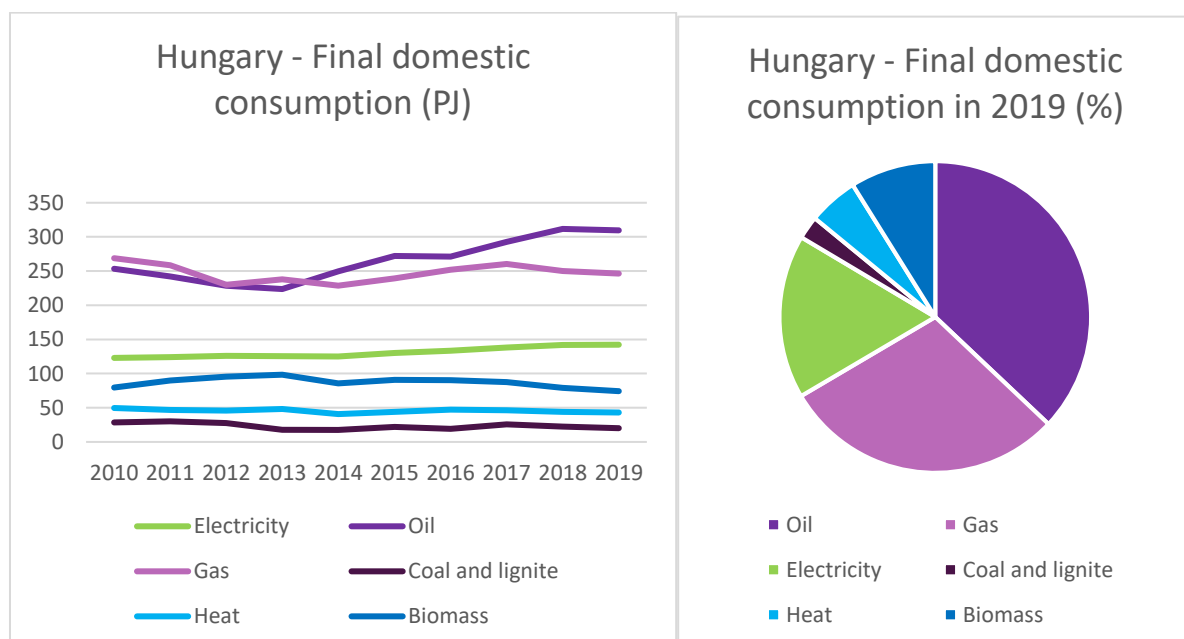
¹⁰ Deák, P., & Simon, P. (2017). Law and Regulation of Renewable Energy in Hungary | CMS Expert Guides. CMS Law.Tax. <https://cms.law/en/int/expert-guides/cms-expert-guide-to-renewable-energy/hungary>



Targets & final energy consumption - % of renewable energies



The strongest increase in final energy consumption is for oil. Since 2016, oil consumption has increased by 4 % of the share of final energy consumption. The share of heat, gas and electricity has remained relatively stable from 2010 to 2019, with slight fluctuations of 1 % up or down in some years. The share of biomass in the mix has decreased by 7 % since 2013, and hard coal and lignite accounted for 2 % of energy consumption again in 2019, as they did before a slight increase in 2017.





Power generation

Top Renewable



Biomass and waste



Solar

Top non-renewable

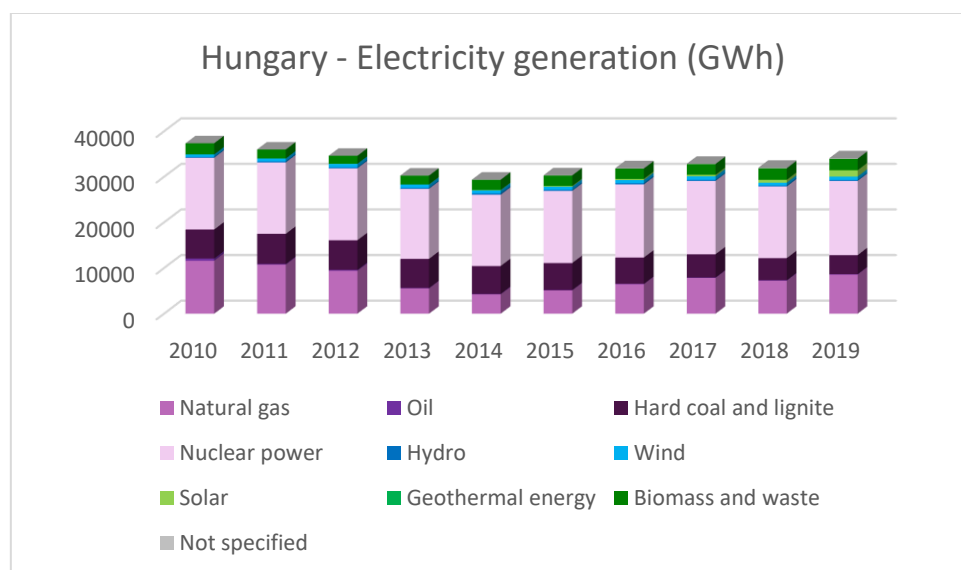


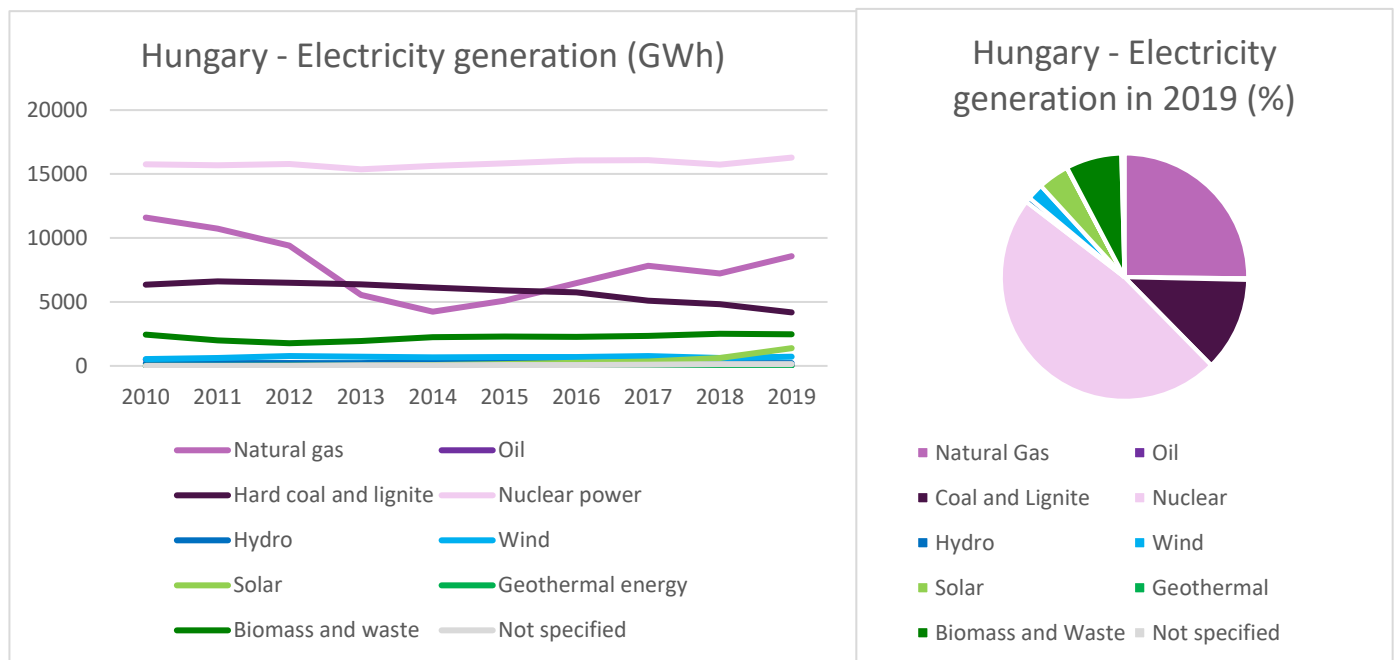
Nuclear power



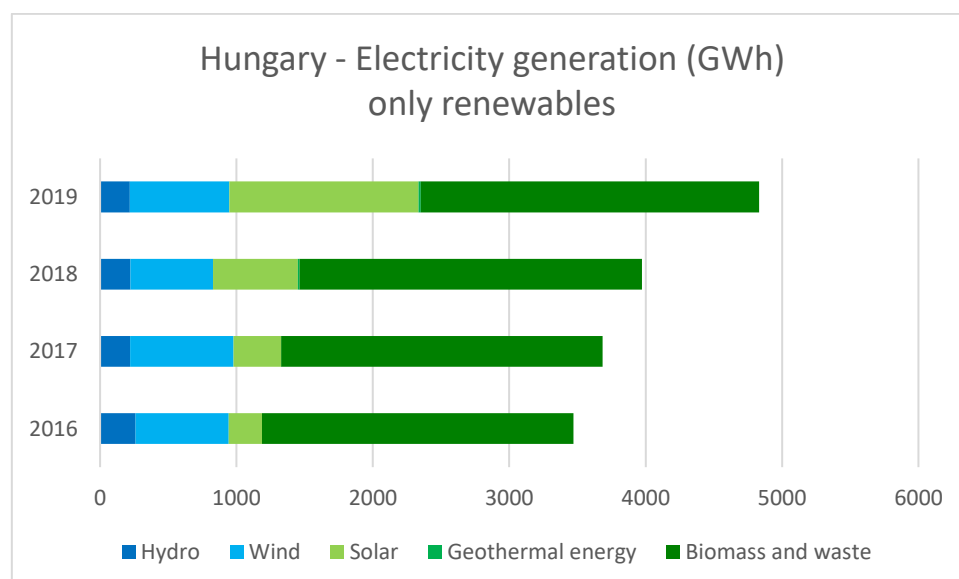
Natural gas

The most important source of electricity generation in Hungary is still nuclear energy, with a relatively stable average of 16 000 GWh per year from 2010 to 2019. Equally, important, but less stable during this decade was the amount of electricity generated by natural gas. While natural gas was the second-largest generator of electricity, with around 8 600 GWh in 2019, its role was even larger a decade earlier. In 2010, 11 600 GWh of electricity was generated by natural gas. This figure fell to almost a third by 2014, only to regain dominance over coal and lignite in 2016. Coal and lignite are third in Hungary's energy mix with 4000 GWh in 2019.





While non-renewable sources dominate the mix, renewable sources have shown a steady increase since 2018. Biomass and waste are Hungary's main renewable sources for electricity generation, with almost 2 500 GWh in 2019, but solar energy has been catching up in recent years. From 2017 to 2018, the amount of electricity generated by solar energy almost doubled. From 2018 to 2019 it doubled even more, finally cracking the 1 000 GWh mark with electricity generation of around 1400 GWh. Electricity production from wind and hydropower has remained relatively stable in recent years, with hydropower accounting for around 220 GWh and wind power around 650 GWh. Geothermal power entered the mix in 2017 and has since increased. However, its volumes remained insignificant at 18 GWh in 2019.





SLOVENIA

2.08 M

Population

25.7 \$

GDP/Cap

137,7 GJ

**Per capita energy
consumption**

6.43 t

**Per capita tonnes
of CO₂**

Slovenia's NECP (energy and climate plan until 2030) envisages a contribution to the EU's 2030 renewable energy target, with a 27 % share of gross final energy consumption by 2030. The European Commission has criticised this plan for lack of ambition; however, it indicates an additional renewable energy potential of up to 29.2 %.¹¹

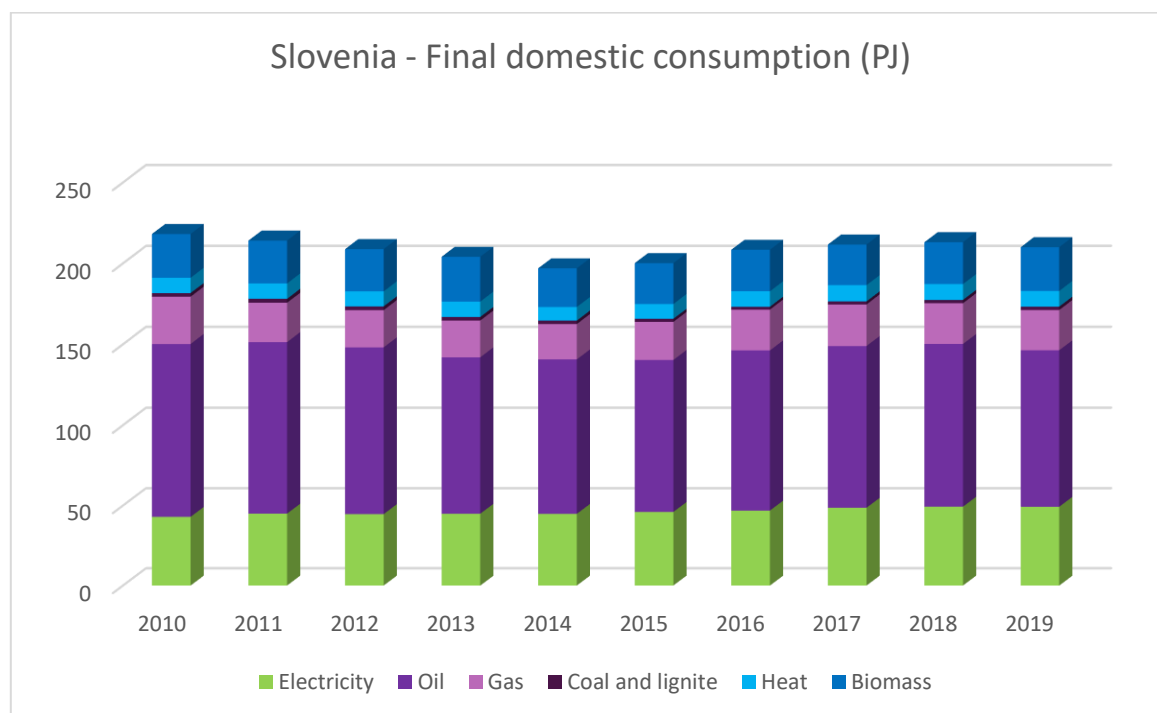
In its national strategy, Slovenia describes difficulties in increasing its share of renewable electricity generation due to environmental constraints - about 35% of its territory is part of Natura 2000. In addition, local communities resist wind power projects and the construction of new hydropower plants.¹²

¹¹ European Commission. (2020b, October 14). Assessment of the Final National Energy and Climate Plan of Slovenia. European Commission. https://energy.ec.europa.eu/system/files/2021-01/staff_working_document_assessment_necp_slovenia_en_0.pdf

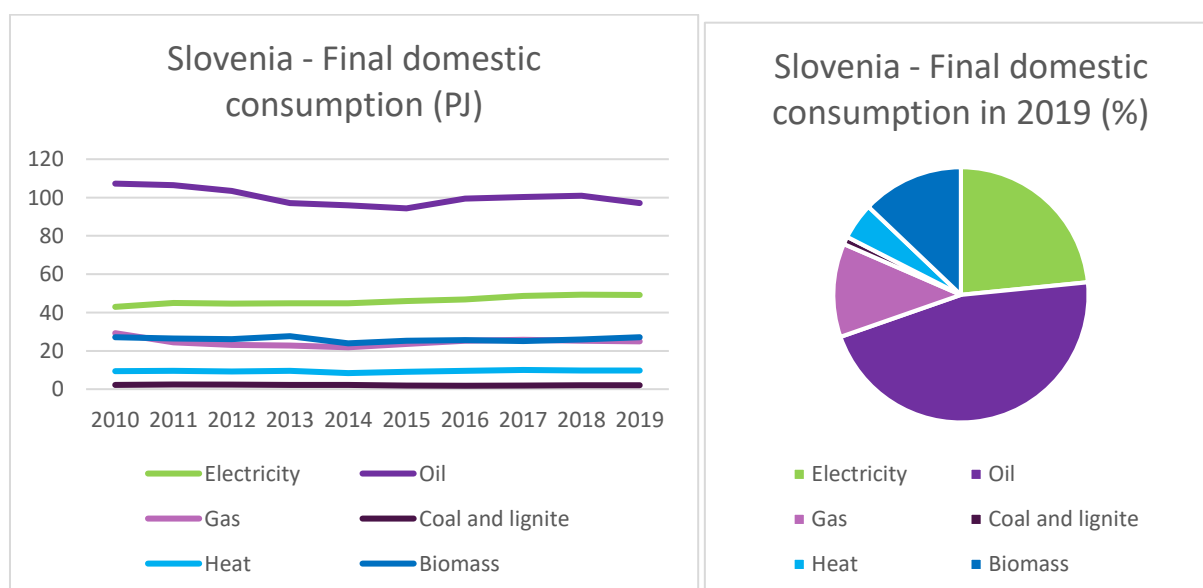
¹² The Republic of Slovenia. (2020, 24 February). INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN OF THE REPUBLIC OF SLOVENIA. National Energy and Climate Plans (NECP). https://ec.europa.eu/energy/sites/default/files/documents/si_final_necp_main_en.pdf
IEA. Turkey - Countries and regions. (2021, 16 December). IEA. <https://www.iea.org/countries/turkey>



Targets & final energy consumption - % of renewable energies



Final energy consumption in Slovenia has increased slightly since 2014. However, the share of oil in the total energy consumption has decreased by 3 %. The shares of all other forms of energy have remained relatively stable. Coal and lignite remain at 1 %, heat remains at 5 %, gas at 12 % and electricity remains at 23 % of the final energy consumption mix, as in previous years. Biomass consumption has increased by 1 %.





Power generation

Top Renewable



Hydro



Solar

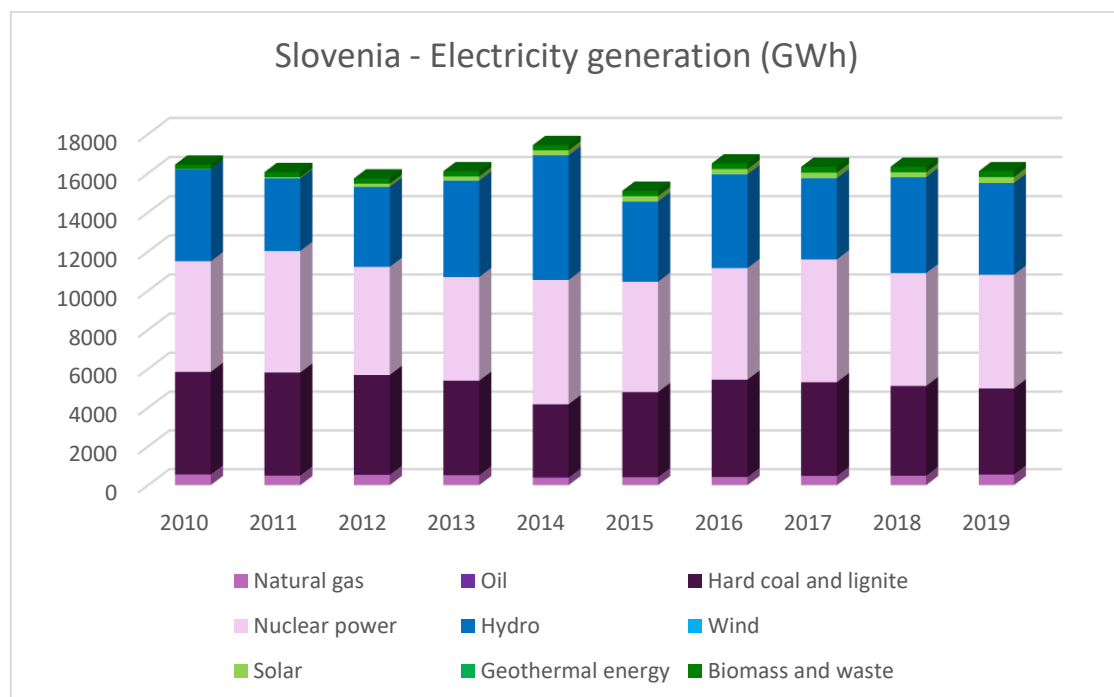
Top non-renewable



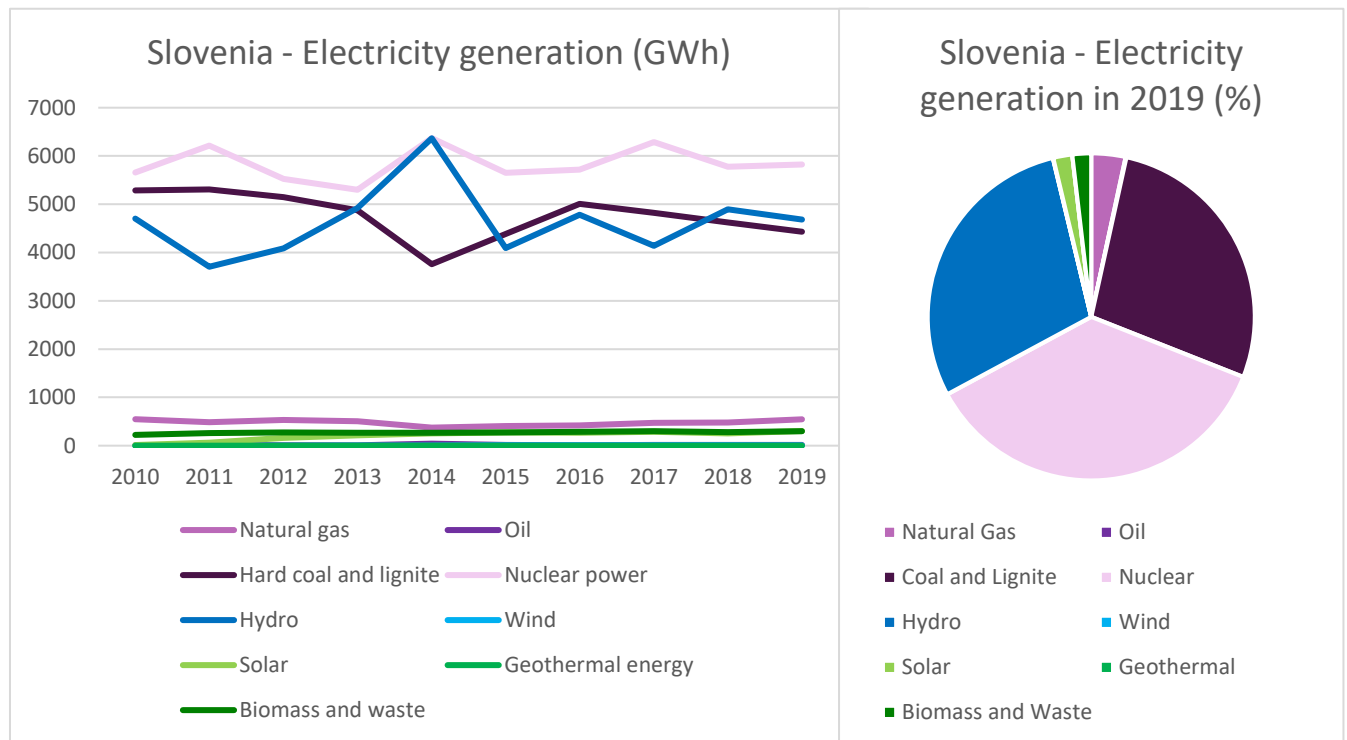
Nuclear power



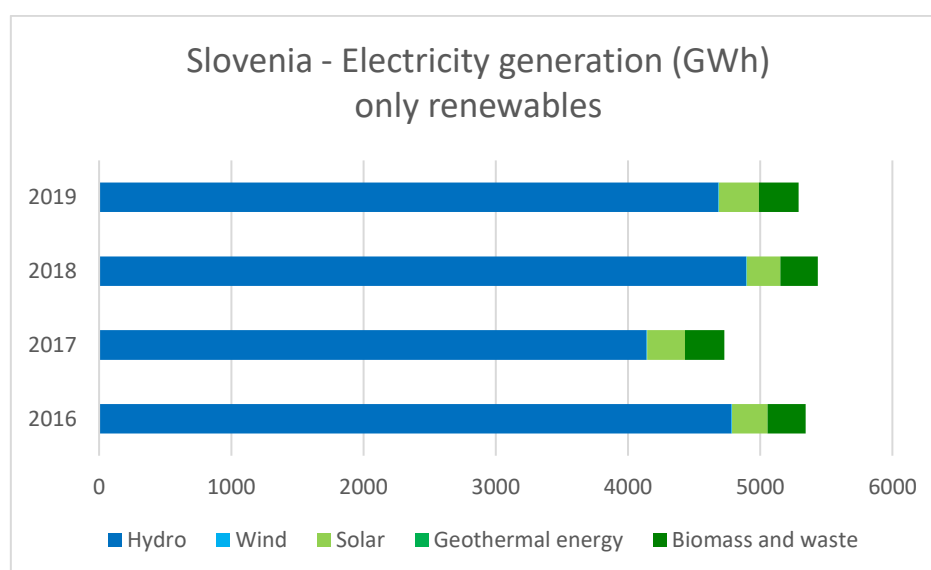
Coal and Lignite

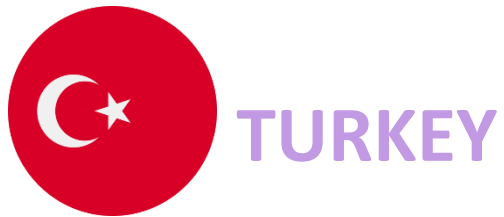


Slovenia's electricity generation can be divided into three main sources: Nuclear, hard coal and lignite, and hydropower. While nuclear energy dominates the mix with 5 800 GWh in 2019, hydropower generation is not far behind with 4 600 GWh in 2019. Hard coal and lignite account for a similar share as hydropower with 4 400 GWh in 2019. For all three, the amount of electricity generated has remained relatively stable from 2010 until 2019, except for a brief sharp increase in hydropower in 2014.



Hydropower is Slovenia's largest renewable energy source, but not the only one. Solar energy, biomass and waste also contribute to the country's energy mix with around 300 GWh each in 2019. While biomass and waste have been producing this amount for many years, solar energy is relatively new to the mix and has shown a relatively stable continuous increase since 2010. Wind power is even younger in the mix, although the amounts of electricity generated are not yet significant.

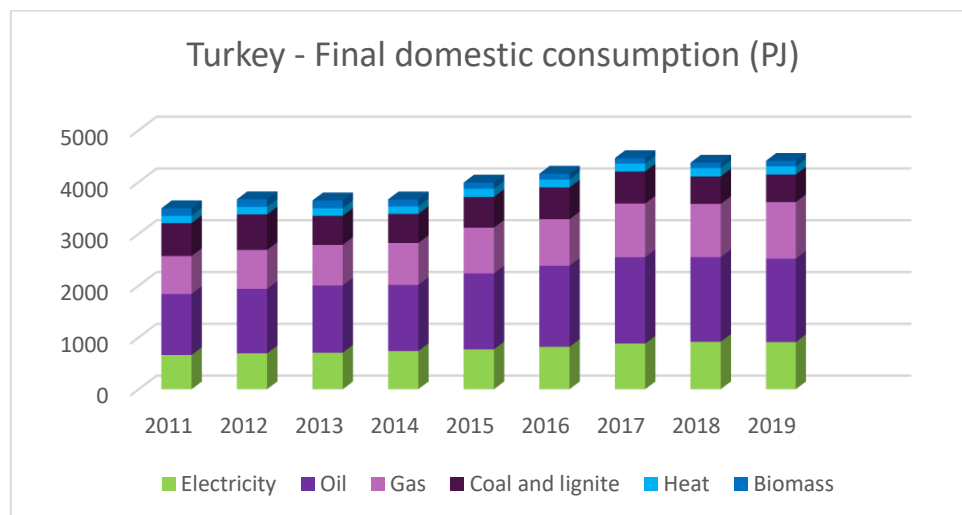


**84.9 M****Population****8.33 \$****GDP/Cap****69,5 GJ****Per capita energy
consumption****4.17 t****Per capita tonnes
of CO₂**

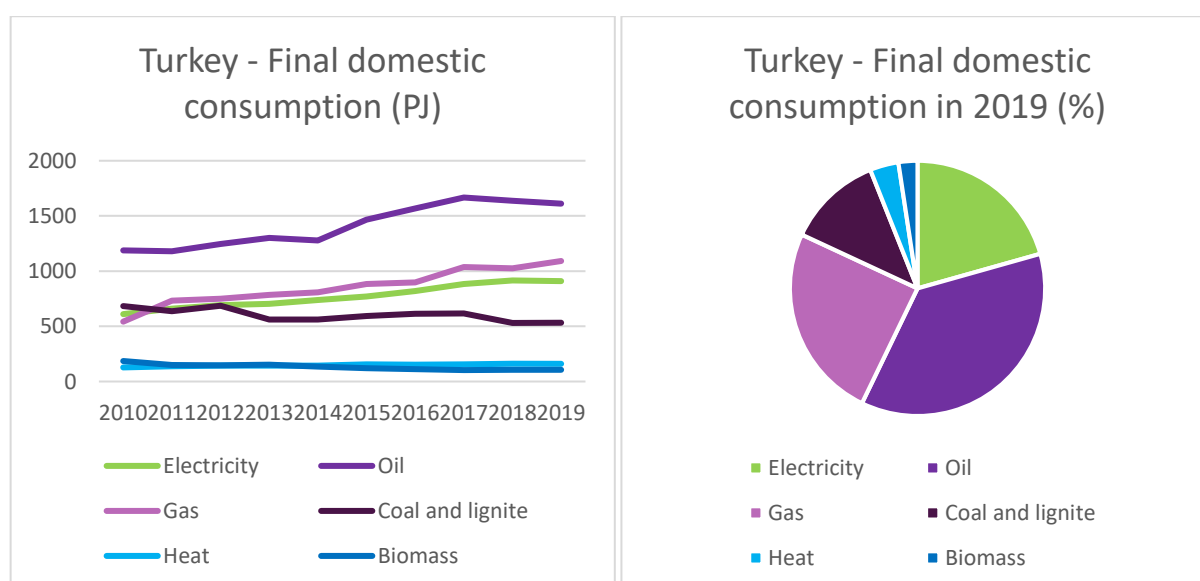
Due to its high dependence on oil and gas imports, Turkey has prioritised energy security as one of the pillars of its energy strategy. Its policies include promoting domestic oil and gas exploration and production, diversifying oil and gas supply sources and related infrastructure, increasing renewable energy production and improving energy efficiency.



Targets & final energy consumption - % of renewable energies



With a population growth of 12.01 million between 2010 and 2020¹³, it is not surprising that the country's final energy consumption has increased. The 3341 PJ of energy consumed has increased to 4417 PJ. The largest increase was in the final consumption of gas. With 1094 PJ of final consumption in 2019, its share has increased by 9% since 2010. The most consumed form of energy continues to be oil, which is increasing in absolute terms due to the overall increase in demand, while its share of around 37 % remains relatively stable. The share of electricity in final energy consumption has increased slightly over the last ten years and now stands at 21 %, while the share of heat remains unchanged at 4 %. A decrease, both in absolute terms and in terms of share, has been recorded in the consumption of biomass and hard coal and lignite, the latter having fallen by 9 % since 2010.



¹³ World Bank. WDI - Home page. (2021). World Bank. <https://datatopics.worldbank.org/world-development-indicators/>



Power generation

Top Renewable



Hydro



Wind

Top non-renewable

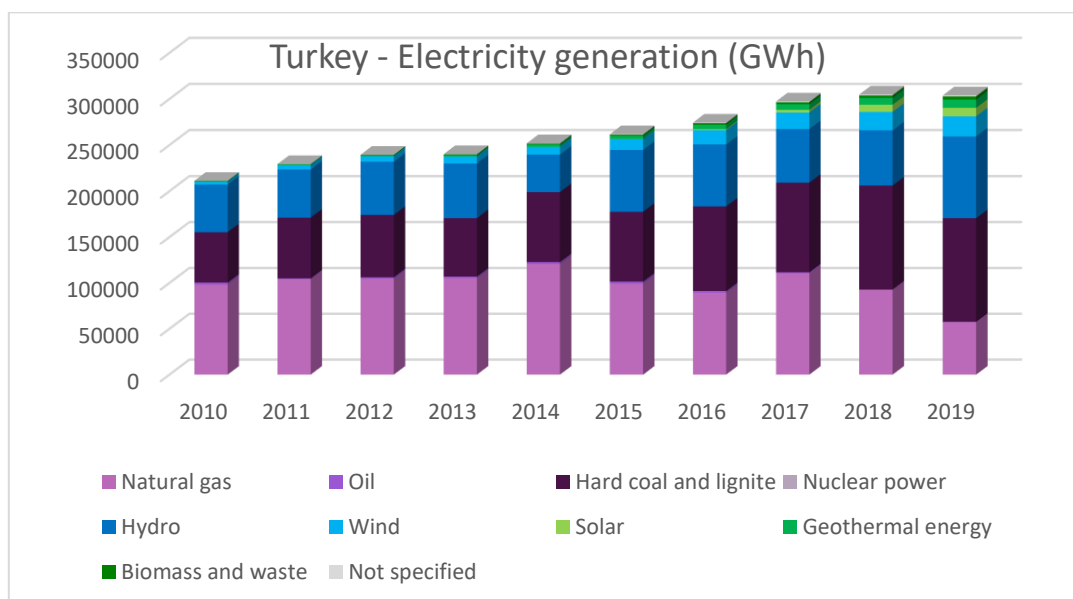


Coal and Lignite



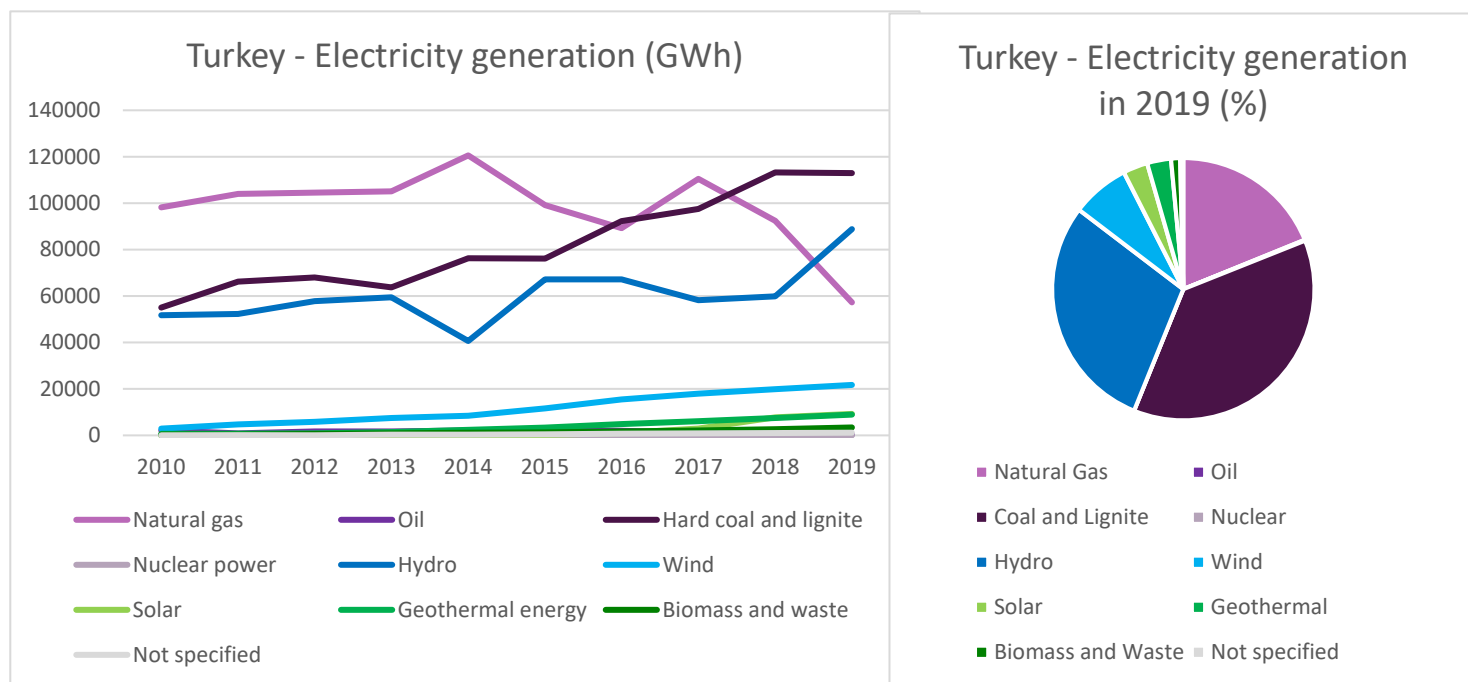
Natural Gas

In 2019, the largest share of Turkey's electricity generation came from coal and lignite, at 113 000 GWh. The second-largest share of the mix came from hydropower generation, which amounted to 89 000 GWh in 2019. Natural gas also accounted for a significant share with 75 000 GWh.

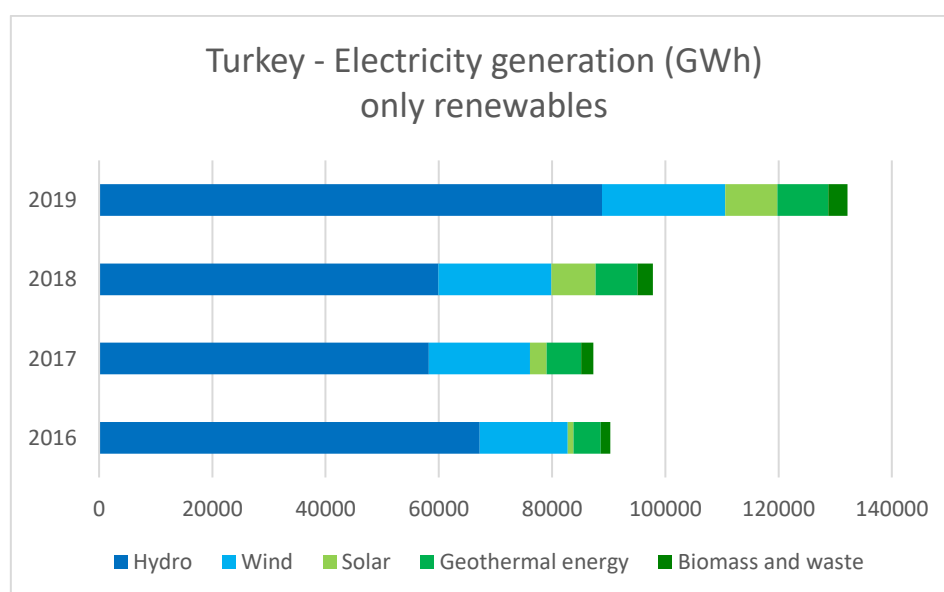


The use of coal and lignite is not being phased out; on the contrary, as the country's energy demand has grown, the use of coal and lignite for electricity generation has almost doubled between 2010 and 2019, supported by energy security measures. Turkey has also expanded its gas supply options through new pipelines, LNG terminals and larger storage facilities. Currently, the country has no nuclear power plants; however, three are planned and one is scheduled to come on stream in 2023.¹⁴

¹⁴ IEA. Turkey - Countries and Regions. (2021, 16 December). IEA. <https://www.iea.org/countries/turkey>

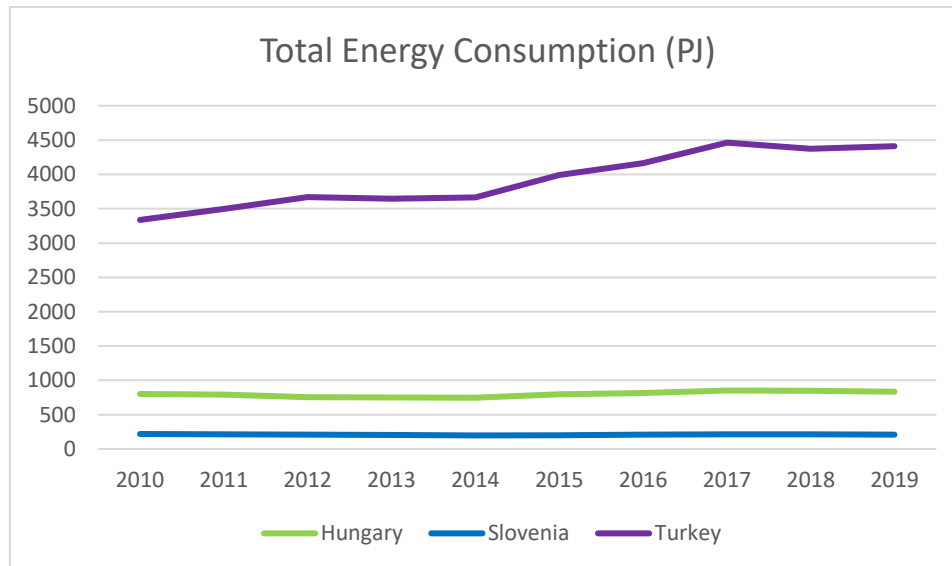


While non-renewable sources of electricity generation are increasing in Turkey, the share of renewable energy is also rising. Hydropower is the largest source of renewable energy, but electricity generation from wind power is steadily increasing. In 2019, 22 000 GWh was generated by wind power in Turkey, almost ten times the amount in 2010. An equally large increase is seen in most other renewables, with biomass and waste increasing from 350 GWh in 2010 to 2700 in 2019 and geothermal from 650 GWh in 2010 to 7 400 GWh in 2019.

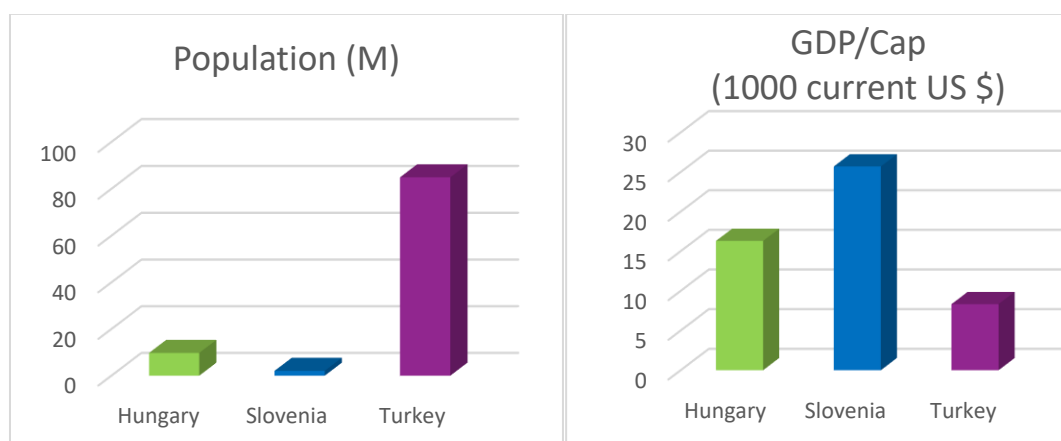


Summary and comparison

The three countries studied in this report differ in GDP and energy consumption. Therefore, comparison in absolute numbers can be misleading, as seen in the Graph below.



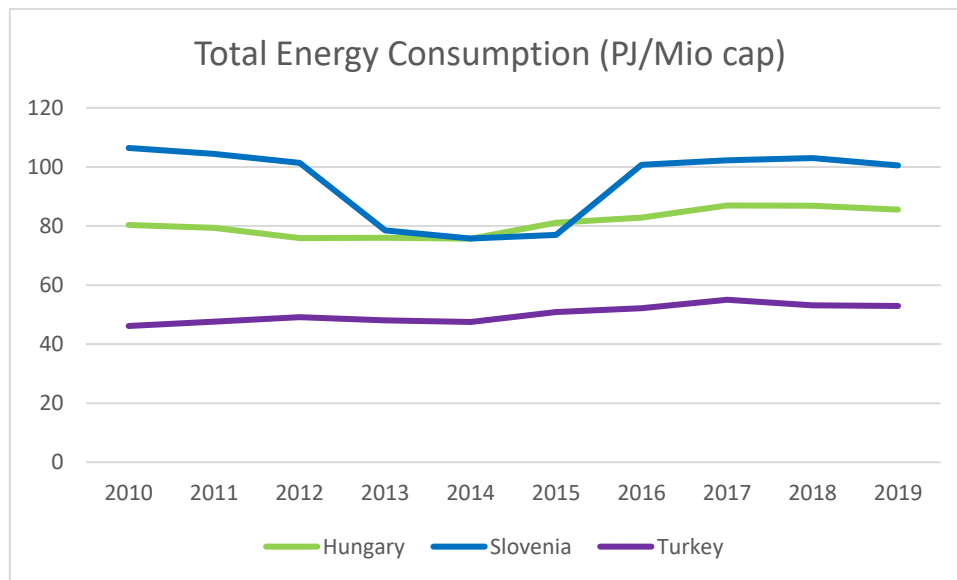
Turkey's final energy consumption in 2019 is almost 18 times that of Slovenia, but once the energy consumption is divided by the country's population, it is Slovenia that comes out on top. This is unsurprising, considering Slovenia's economic performance exceeds the other two compared countries. In the following chapter, both a division per million inhabitants as well as per capita are presented to ensure a meaningful comparison.



Comparison: per million inhabitants and GDP

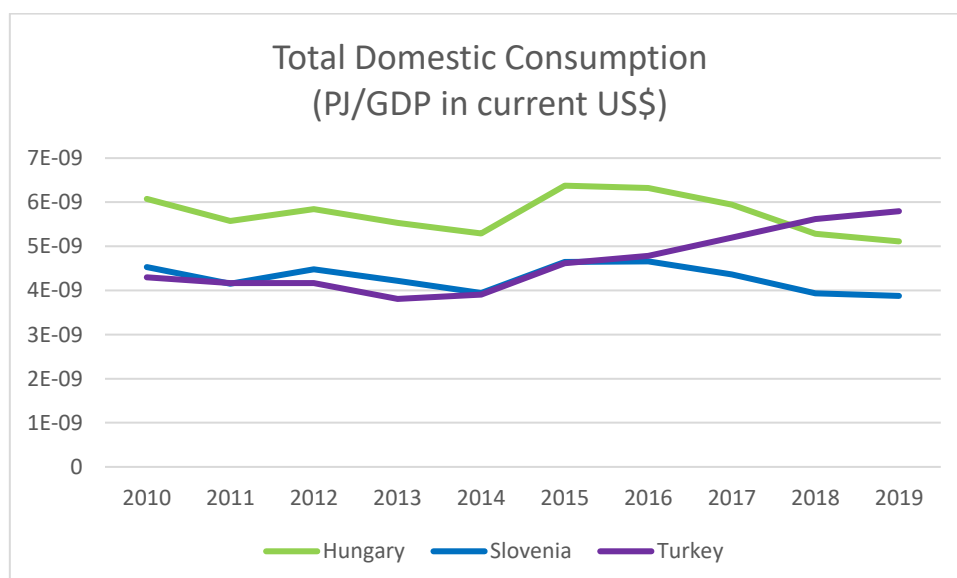
The following Graphs, visualise the total energy consumption of the three countries per Million inhabitants and by the country's GDP.

The 2012 to 2016 dip in Slovenia's energy consumption is due to a slight increase in population and a slight decrease in overall energy consumption.



Dividing the consumed energy by the country's economic performance, it becomes visible that Hungary and Slovenia have managed to lower their energy consumption concerning their GDP since 2015. The GDP of both countries has been somewhat steady while Turkey's GDP has taken a steady dive since 2013. Despite the decreasing economic performance of the country, energy consumption has increased. This leads to the steadily rising consumption of PJ per GDP as shown in the graph below.

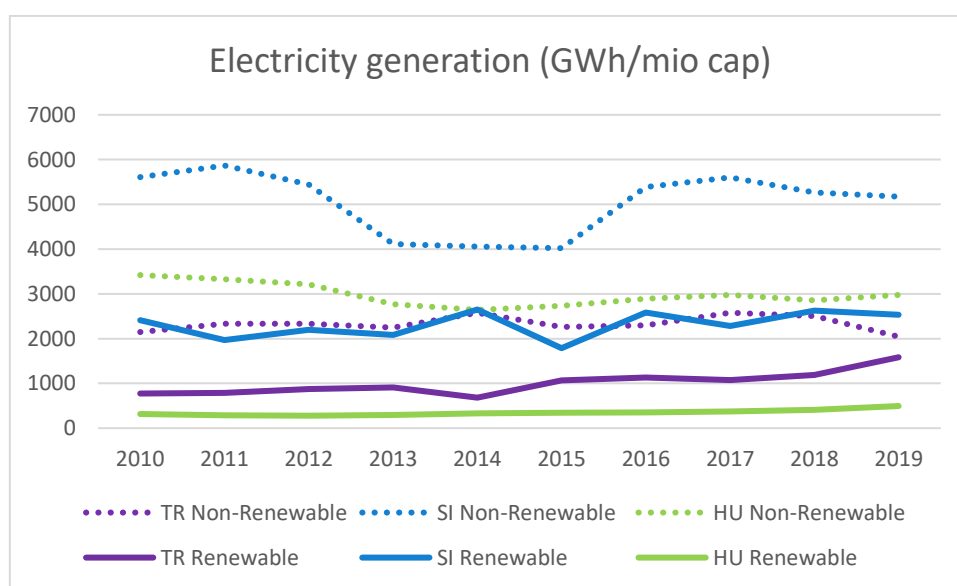
Reasons for decreasing these figures as is done in the case of Slovenia and Hungary can be a focus on the implementation of energy-efficient practices.



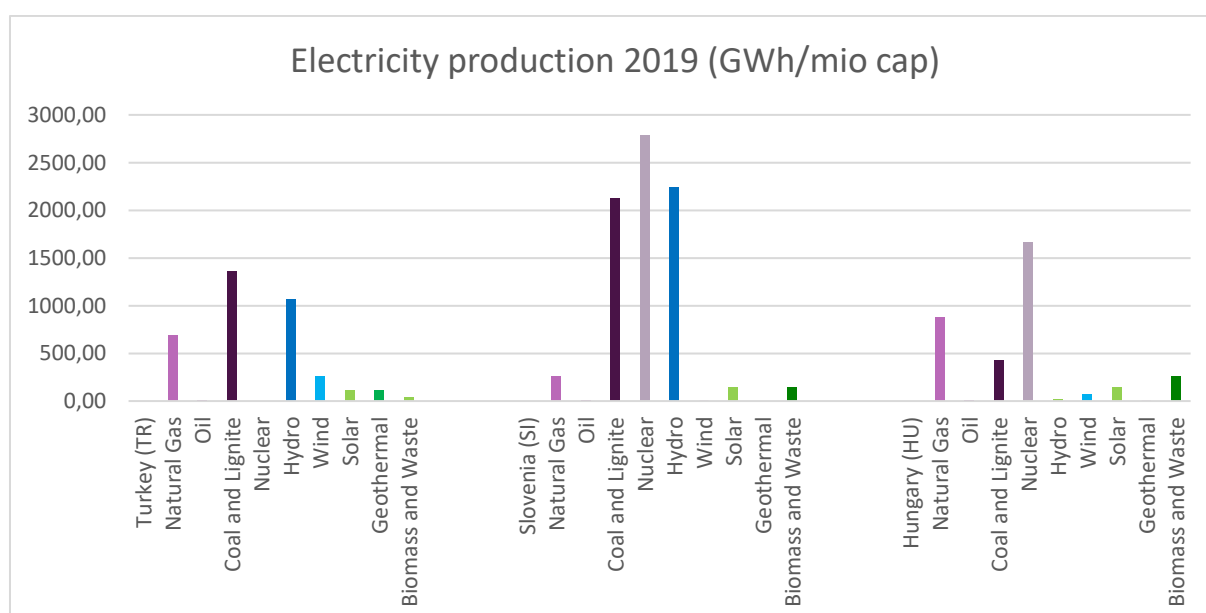
Renewable vs. non-renewable

In all three countries, non-renewable forms of energy exceed the share of renewable energy sources in the energy mix. However, the per capita consumption of renewable energy in Turkey has decreased in 2019, while the consumption of renewable sources has increased. In Hungary, there is a very slight increase in renewable energy sources and a decrease in non-renewable energy sources between 2010 and 2019, although hardly significant. Slovenia's consumption of renewable and non-renewable energy sources fluctuated in the decade in question but stabilised from 2017 onwards.

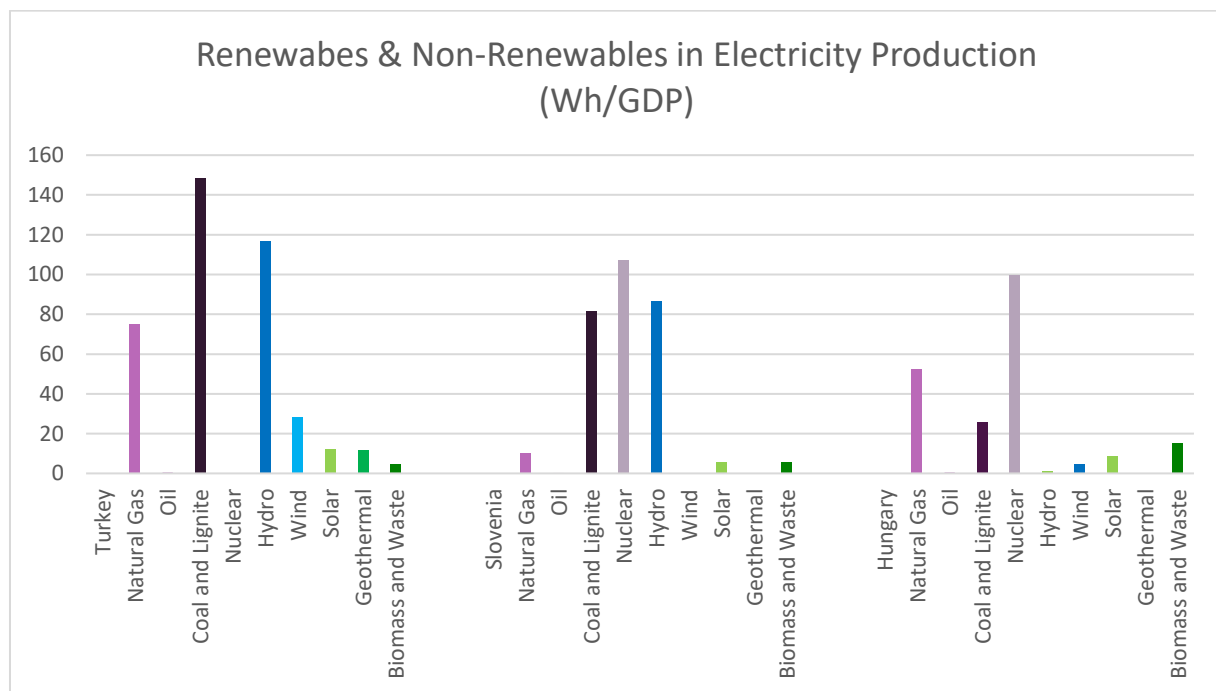
A very similar picture emerges for energy production:



In terms of electricity generation, there are significant differences between countries in the forms of renewable and non-renewable sources they rely on.



While Slovenia and Hungary rely heavily on their nuclear power plants, Turkey generates most of its electricity from hard coal and lignite. Slovenia also generates a significant amount of electricity from hard coal and lignite and in parallel with Turkey, relies heavily on hydropower as a renewable energy source. Hungary relies more on gas than on hard coal and lignite for electricity generation but is still lagging in establishing dominant renewable forms of electricity generation.



The strongest relative increase in the use of renewable is power generation can be seen in Turkey. Since 2018, the Percentage of renewables being used in Power generation has increased sharply and steadily.

