



New  
Direction

# ENERGY SECTOR OF EU-11

IN CONTEXT OF CLIMATE POLICY AND GREEN DEAL

PIELA BUSINESS ENGINEERING

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# New Direction



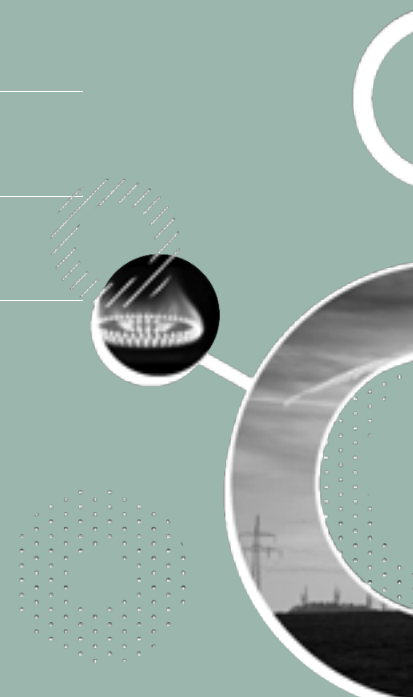
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## 1 Executive summary

The European Union aims to be the leader of the greenhouse gas emissions reduction in the World. Therefore, the Green Deal Strategy under development by the EU is proposing some ambitious greenhouse gas emissions reduction target for the whole EU for 2030 – 50% or even 55% reduction comparing to year 1990. In practice it translates in repeating the half of the reduction level achieved between 1990 and 2020 or more if the 55% target is retained.

The proposed goals have not been yet defined precisely. It is still under discussions how the EU global target will be translated into national targets. Nevertheless, it is obvious that the effort necessary to tackle the challenging targets is considerable and the level of difficulty faced by countries is different depending on their level of economic development and the current situation of their energy sectors.

The challenge is particularly ambitious for EU-11 countries which joined the European Union after 1990. These countries were previously under communist regimes and they had to undergo deep and costly transformation of their economies. Despite 30 years of transformation their GDP per capita level is still lower than the one of the EU-14 countries but it is also increasing faster. It means that there is still high potential for further grow and this grow needs to be properly stimulated among other by investments. Therefore, deviating considerable funds to the energy sector for greenhouse gas emissions reductions projects can harm their economic grow. Currently the GDP produced by EU-11 countries represent only about 10% of the total EU GDP, whereas at the same time the EU-11 countries represents 27% of EU area and 23% of its population. This disproportion points out how more difficult it will be for these countries to meet the Green Deal Strategy targets.

The EU-11 countries are also characterized by high energy intensity of the economy. Despite large reductions achieved over past years, there are still using more energy to produce unit of GDP. In this situation it is hard to expect an increase of energy prices to finance the energy sector transformation. It would severely impact the cost of production of these economies and slow down their economic grow.

It is therefore obvious that the targets proposed under Green Deal Strategy are far more challenging for EU-11 countries than the EU-14 ones. Furthermore, the current situation of EU-11 countries energy sectors is more challenging. Their primary energy production is relying more on greenhouse gas emitting fuels (solid fuels, gas and oil) than the EU-14 member states. The situation is similar in case of electricity production. Therefore, there is for more to transform in the EU-11 energy sector than in the other EU countries.

The situation is therefore extremely challenging for EU-11 countries. Not only their potential to finance the energy transformation is significantly lower due to lower level of economic development and need for further fast development, but also their current energy sector is demanding far more investment to meet the proposed targets. Therefore, there is a need for equalizing the challenge for EU member states and help them to achieve the targets proposed by the European Union.

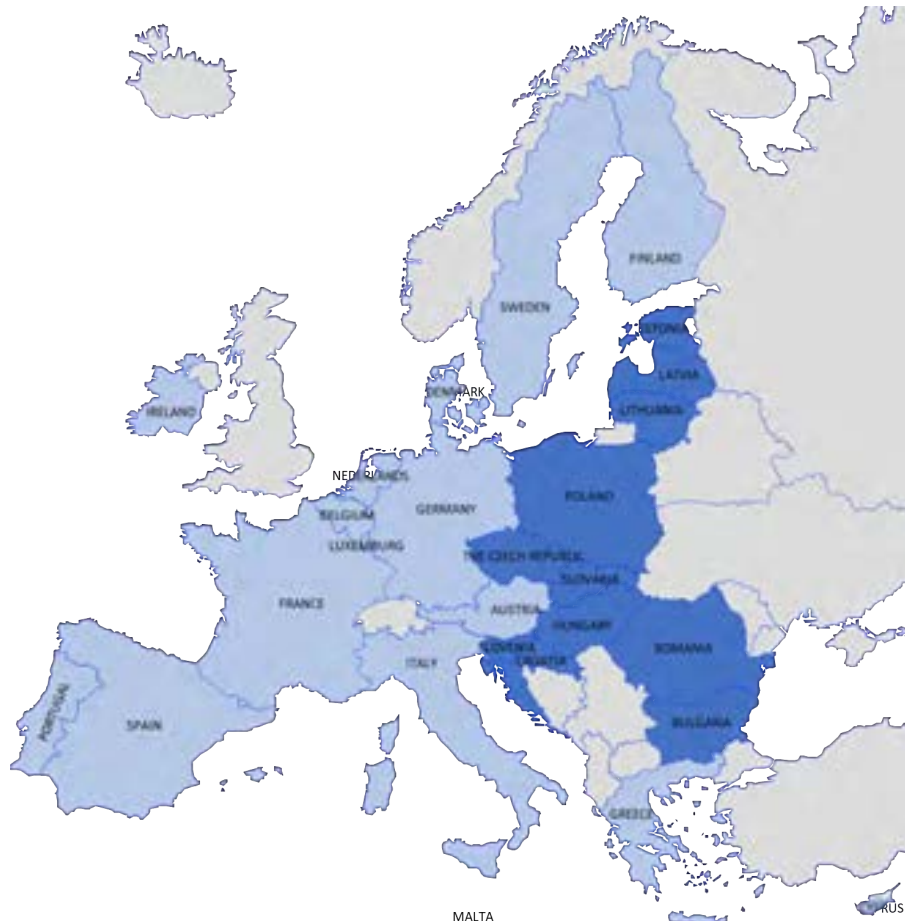


## 2 Energy sector in EU-11 countries

### 2.1 General information

EU-11 is named the group of 11 countries which joined EU after 1990 and which were previously part of the communist countries. The group is composed of Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. The Item 1 and Item 2 summarized the key information about the group.

Item 1: EU map



Source: EU website

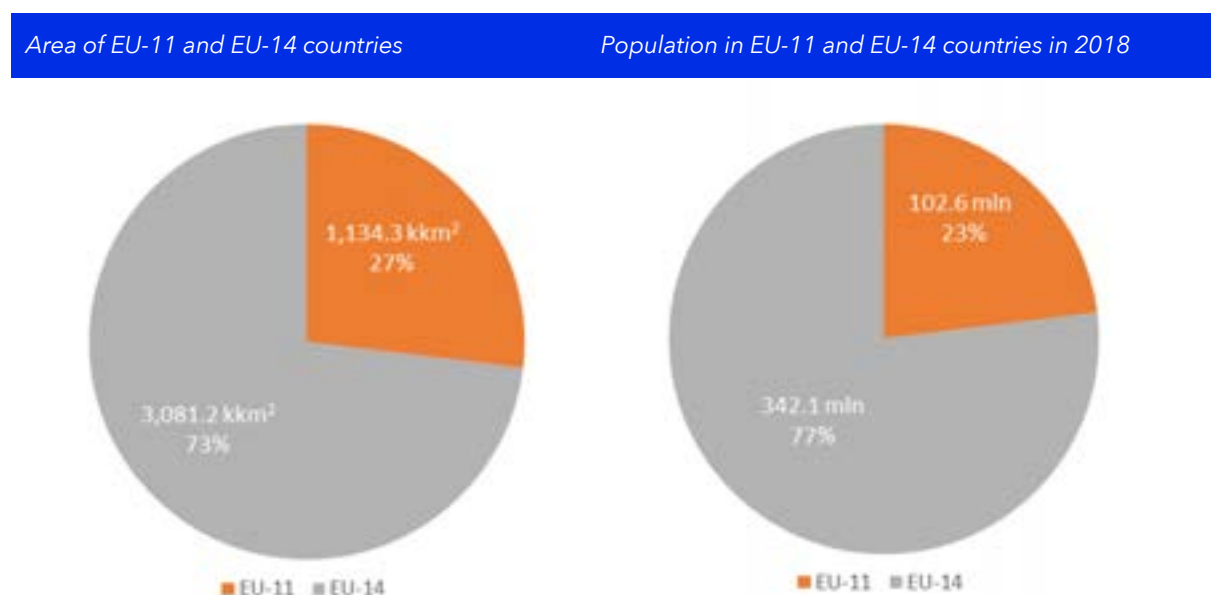
Item 2: EU-11 - key data

Key data	
Population (M)	102.6
GDP per capita (EUR, nominal)	14,446
GDP per capita (EUR, PPS)	22,008
GDP as share of EU-27	10%
Energy intensity of the economy (kgoe per 1,000 EUR)	125.8
Greenhouse gas emissions (Mg per capita)	9.0

Source: Eurostat data for 2018, extracted in 2020

EU-11 countries are 11 of 27 EU member states (about 40% of member states). At the same time, the area of these countries is about 1,134.3 kkm<sup>2</sup> which is only 27% of total EU area. The population of EU-11 is about 102.6 M which is only 23% of EU total population.

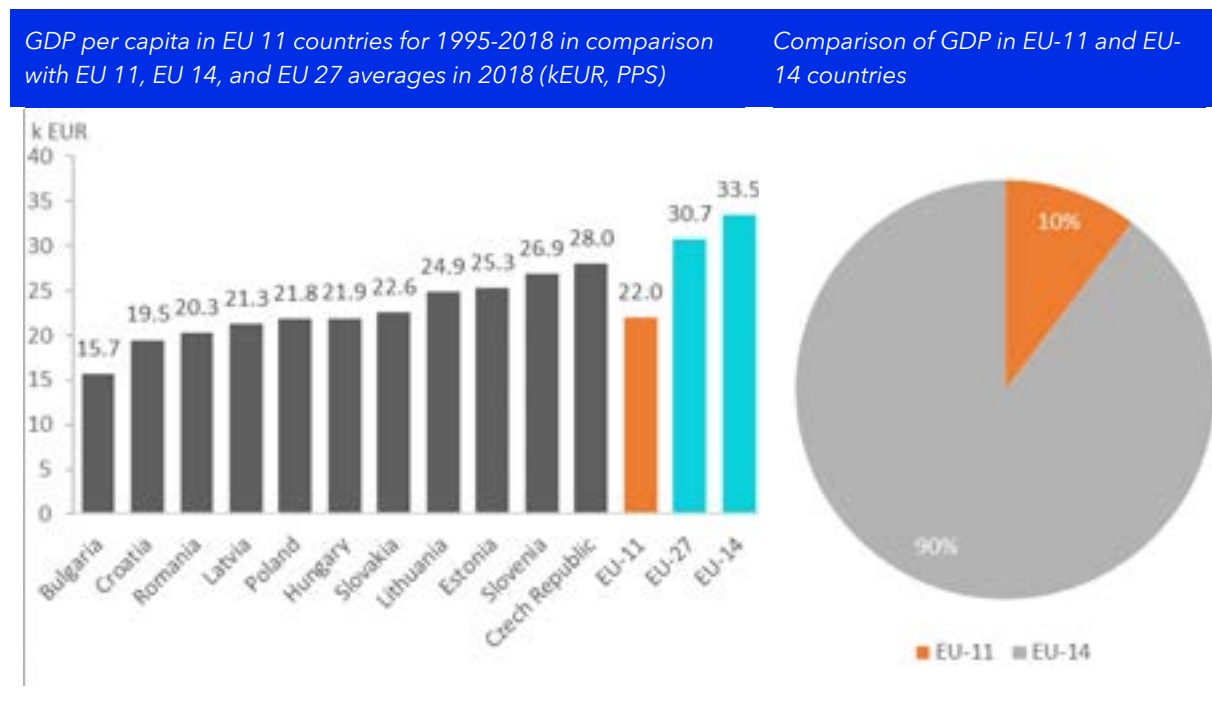
Item 3: Area and population in EU-11 and EU-14 countries



Source: Eurostat data for 2018, extracted in 2020.

The average GDP per capita of EU-11 countries is below EU-27 and EU-14 level. None of EU-11 countries GDP per capita is higher than the average levels for EU-14 and EU-27. In absolute term EU-11 is producing only 10% of EU GDP, compared to 22% of the population which are living there and 27% of total EU area.

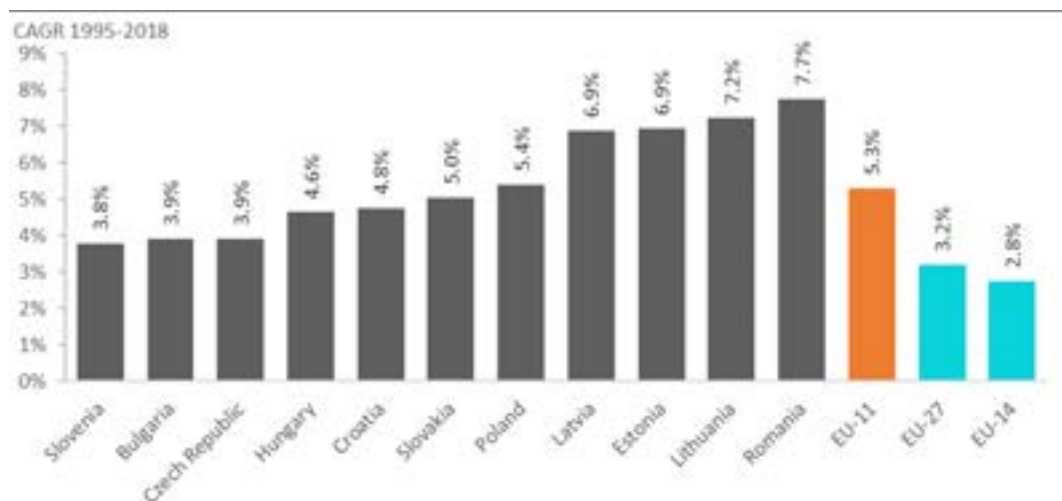
Item 4: GDP per capita in EU-11 countries for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS)



Source: Eurostat data for 2018, extracted in 2020.

Despite lower GDP per capita, EU-11 countries have been developing faster in past 23 years. The average GDP grow rate was CAGR 5.3%, whereas EU-27 and EU-14 averages were CAGR 3.2% and CAGR 2.8% respectively. All EU-11 countries have been developing faster over past 23 years than EU-27 and EU-14 averages.

Item 5: GDP per capita change in EU-11 countries for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in years 1995-2018 (kEUR, PPS)



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The energy intensity of EU-11 economy remains higher than EU-14 and EU-27 averages. Only one country (Romania) is characterized by lower energy intensity than EU-14. At the

same time EU-11 countries have reduced the energy intensity of their economy by a CAGR higher than the average for EU-27 countries.

Item 6: Energy intensity of the economy in EU-11

Energy intensity of the economy in EU-11 countries in 2018 in comparison with EU 11, EU 14, and EU 27 averages, 2018 (kgoe per 1,000 EUR PPS)

Change of energy intensity of the economy in EU-11 countries in 1995-2018 in comparison with EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) – EI\_GDP\_PPS

## Conclusions

- EU-11 countries represent 27% of area, 23% of population but only 10% of total GDP of EU. There is a significant opportunity for further grow of these countries.
- Their GDP per capita is lower than EU-14 and EU-27 averages and it has been increasing for past 23 years faster than GDP per capita of EU-14 and EU-27 countries. Further opportunity of grow exists.
- EU-11 countries have made a significant effort in reducing the energy intensity of economy, more important than EU-27 average decrease of energy intensity. They are still consuming more energy for producing GDP therefore further reductions are possible.
- Further energy intensity reduction in EU-11 countries may be more costly because of the reductions already achieved.

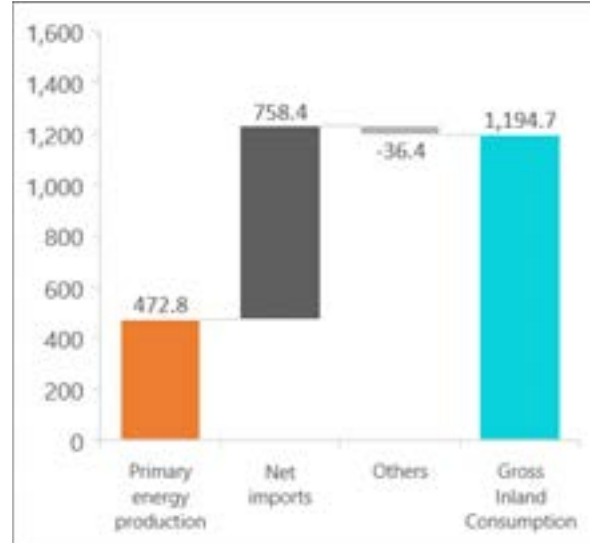
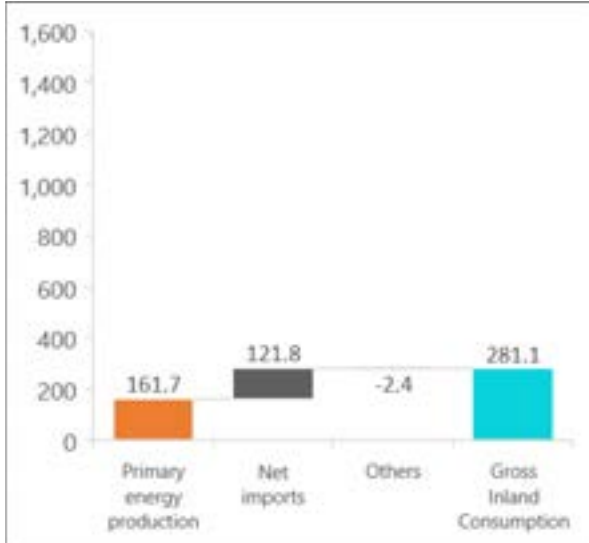
## 2.2 Energy balance of EU-11 countries

The average production of energy in EU-11 countries represent 25% of total EU primary energy production. Net import of energy is lower in EU-11 countries than in EU-14 in absolute terms (121.8 Mtoe versus 764.0 Mtoe) and net import of EU-11 countries represents only 13.7% of EU-14 imports. Gross inland consumption of EU-11 countries remains lower than in EU-11 (only 19%).

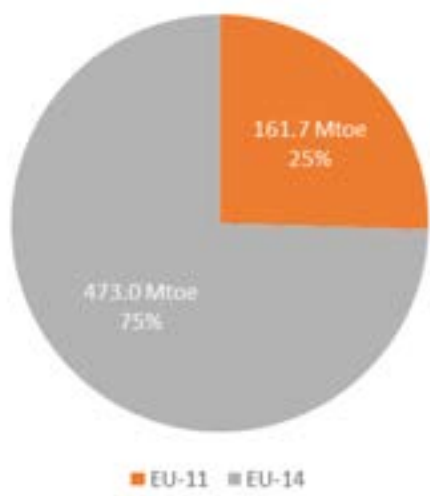
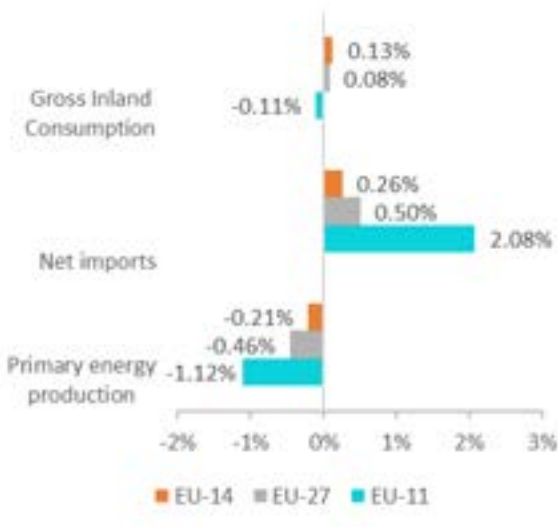
At the same time EU-11 countries are made much more significant efforts in reducing primary energy production and gross inland consumption of energy in years 1995-2018 (see Item 7). Net imports of energy in EU-11 countries have been increasing by CAGR 2.08% in past 23 years whereas EU-14 imports have increased only by CAGR 0.26%.

Item 7: Energy balances of EU-11 and EU-14

Energy balance of EU-11 countries in 2018      Energy balance of EU-14 countries in 2018



Changes in primary energy production, net imports, and gross inland consumption in years 1995-2018 in EU-11, EU-14 and EU-27 countries      Primary energy production in EU in 2018

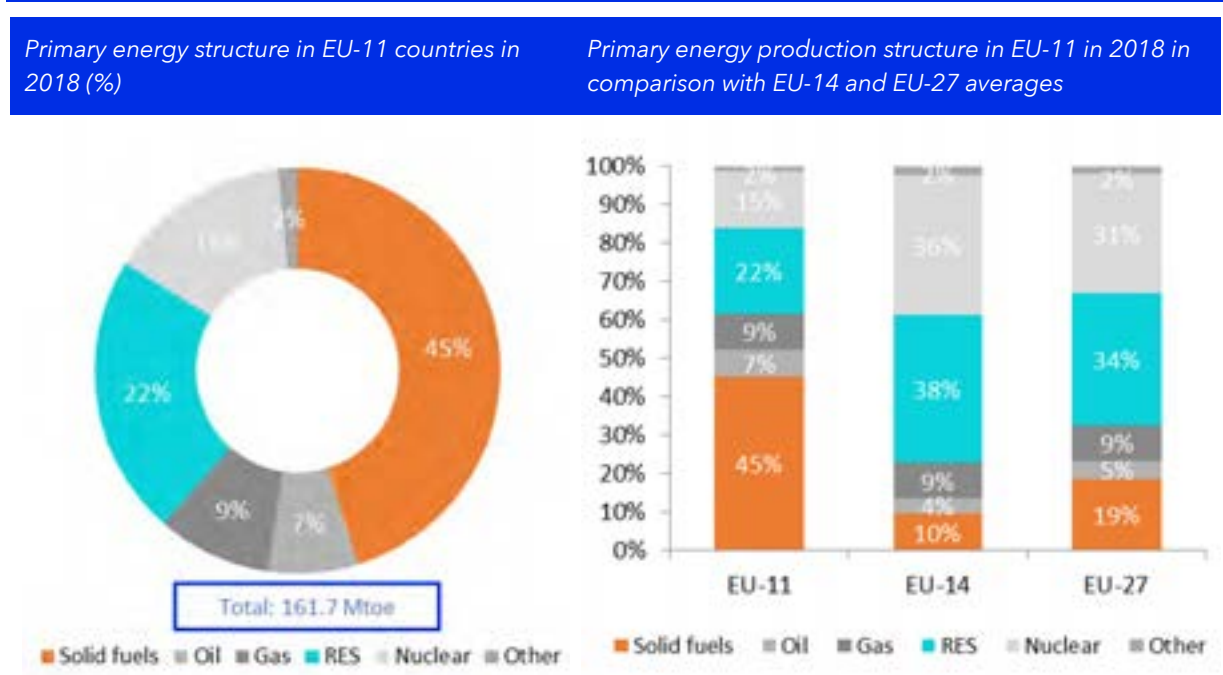


Source: Eurostat data for 2018, extracted in 2020.

### 2.2.1 Primary energy production

The primary energy production structure is dominated in EU-11 countries by solid fuels (45% share). It differs from EU-14 where the solid fuels are limited to 10% of the primary energy production structure. Oil use is lower in EU-14 countries than in EU-11 (respectively 4% versus 7%), but gas share of primary energy production is the same - 9%. EU-14 countries relies more on renewable energy sources (38%) and nuclear energy (36%). In EU-11 countries the share of RES is 22% and the share of nuclear is 15% of the primary energy production.

Item 8: Primary energy structure in EU in 2018



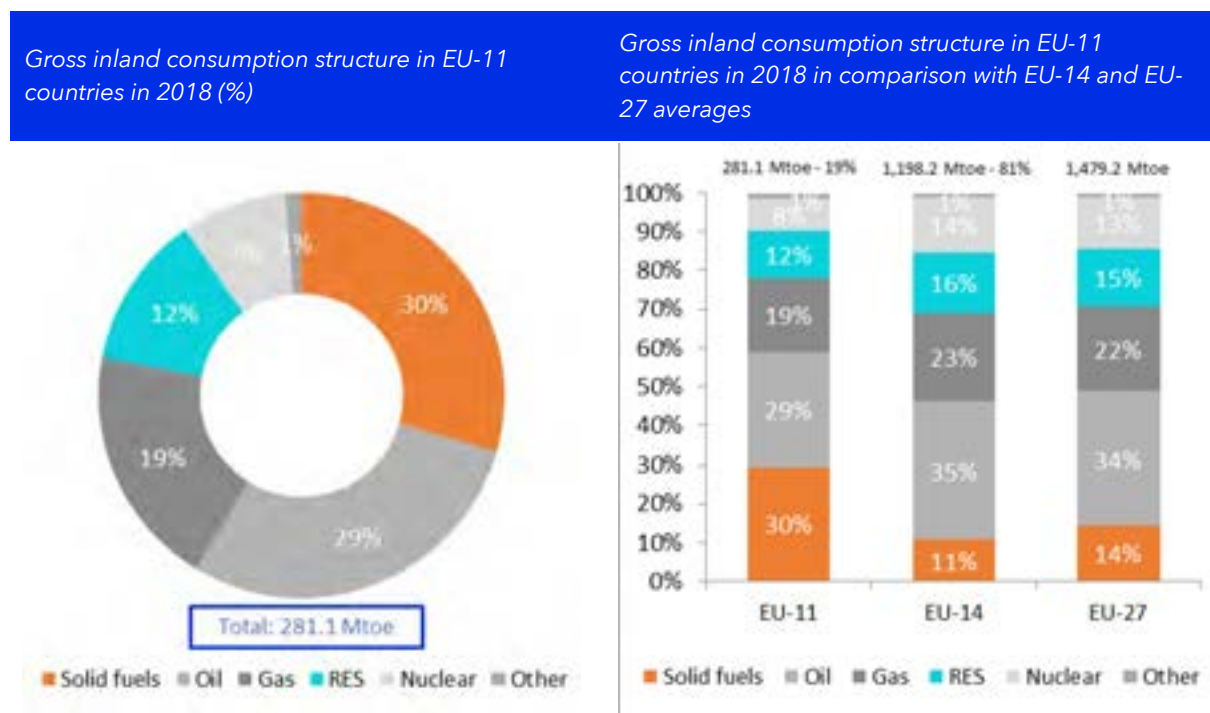
Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

### 2.2.2 Gross inland consumption

Gross inland consumption of energy in EU-11 countries was equal to 281.1 Mtoe in 2018 which represents only 19% of total EU gross inland energy consumption.

Gross inland consumption of energy in EU-11 countries is dominated by solid fuels (30% share). It is almost three times more than in EU-14 countries (11%). The share of oil in EU-11 countries is lower than in EU-14 (29% versus 35%). The share of gas in gross inland energy consumption structure of EU-11 countries is also smaller (19%) than in EU-14 countries (23%). The situation repeats in case of RES (12% in EU-11 versus 16% in EU-14) and nuclear energy (8% in EU-11 versus 14% in EU-14).

Item 9: Gross inland consumption structure in EU-11 countries



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

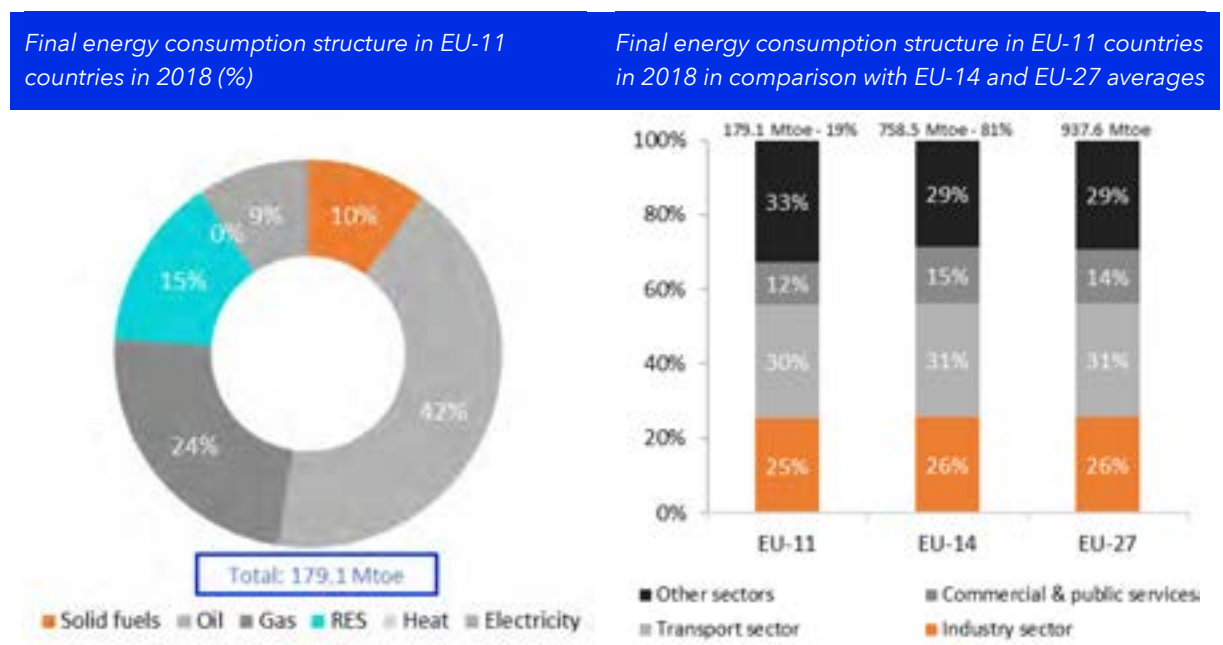
### 2.2.3 Final energy consumption

Final energy consumption in EU-11 countries was about 179.1 Mtoe in 2018. It represents 19% of total final energy consumption of European Union.

The key fuel in final energy consumption in EU-11 countries is oil - 42%. The second largest is gas - 24%, followed by renewable energy sources with 15%. The mix is completed by 10% of solid fuels and 9% of electricity in final energy consumption.

The structure of the final energy consumption in EU-11 countries is closed to EU-14 level. Only small differences appear. The share on final energy consumption in industry and transport sector are lower in EU-11 than in EU-14 by 1pp. (25% versus 26% and 30% versus 31% respectively). The use of final energy in commercial and public services is lower in EU-11 than in EU-14 (12% versus 15%) but other sectors (including residential) represents 33% of final energy consumption in EU-11 countries and only 29% in EU-14.

Item 10: Final energy consumption structure in EU-11 countries



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

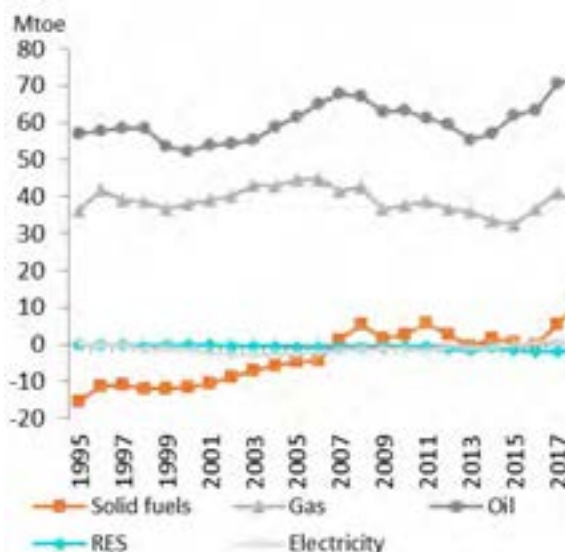
#### 2.2.4 Energy import and import dependency

EU-11 member states imports net 121.6 Mtoe of energy. It represents only 14% of total net energy imports of European Union.

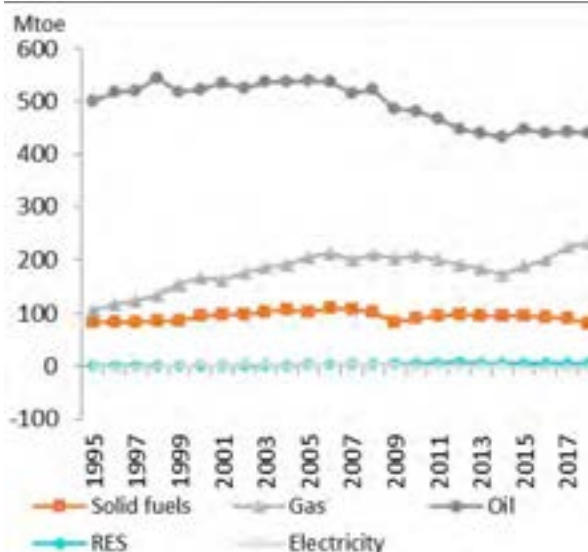
Net import structure is dominated by petroleum products. The share of it in case of EU-11 and EU-14 are very close - 59% and 58% respectively. The second fuel with the highest import share is gas. The difference between EU-11 and EU-14 countries is 1pp (i.e. 31% EU-11 and 30% EU-14). Net import of solid fuels to EU-11 countries is lower than in case of EU-14 countries - 9% versus 11%. The mix was completed by electricity and non-renewable waste.

Item 11: Structure of net import of energy in EU

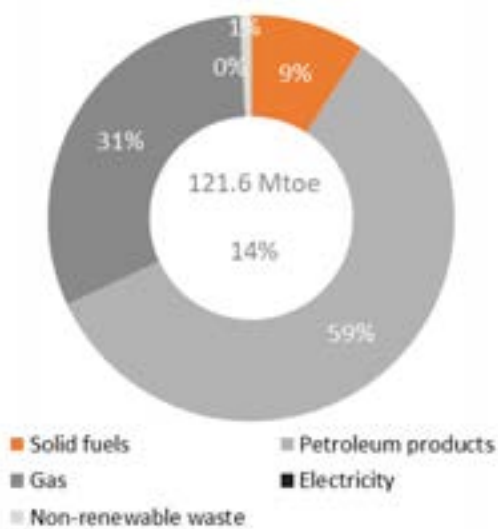
Net import of energy by fuel in in EU-11 1995-2018 (Mtoe)



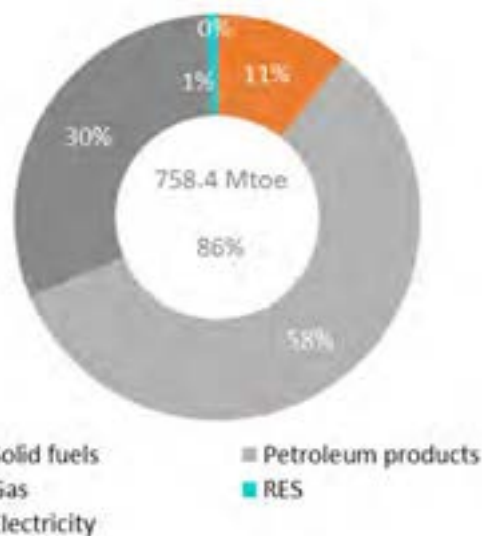
Net import of energy by fuel in in EU-14 1995-2018 (Mtoe)



Net import structure in EU-11 in 2018 (% only fuels for which import is greater than export)



Net import structure in EU-14 in 2018 (% only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)

The evolution of fuels net imports to EU-11 countries over past 23 years shows the increase of oil and solid fuels levels. At the same time the import of gas has remained at similar level. In opposite to this net import of energy to EU-14 countries is characterized by stable solid fuel imports and a decrease of oil imports. Net import of gas to EU-14 increased significantly over past 23 years. It almost doubled.

Solid fuel supplies to EU-11 originates mostly from outside of European Union - 79% whereas the same import of solid fuels to EU-14 is originating from outside EU in 91%.

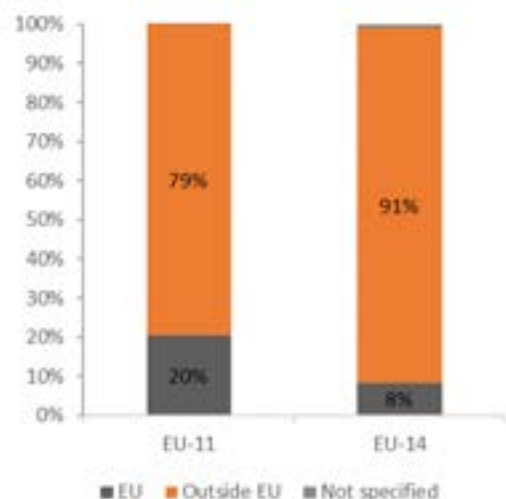
The crude oil import to EU-11 and EU-14 differs only by 1pp. Most of crude oil is imported from outside of EU - 79% in case of EU-11 and 80% in case of EU-14 countries.

EU-11 countries imports more gas from outside EU than EU-14 - 89% versus 78%. It is interesting to notice that 15% of gas imports to EU-14 member states are coming from non-specified sources.

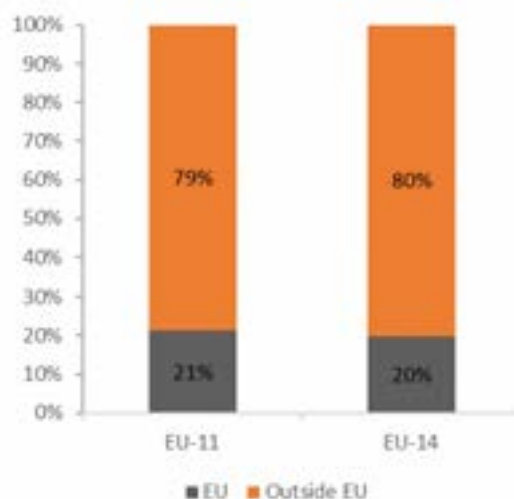
In case of electricity most of import came from EU - 84% for EU-11 countries and 78% for EU-14. EU-11 countries imported 16% of electricity from outside of EU, whereas EU-14 countries imported 23% of electricity from outside of EU.

Item 12: Foreign fuel suppliers

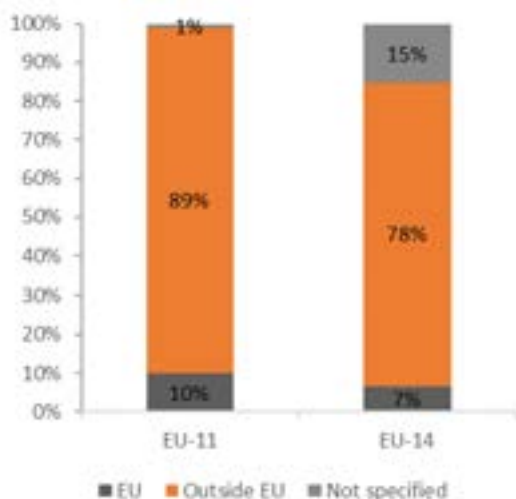
Foreign suppliers of solid fuels in EU-11 and EU-14 in 2018 (%)



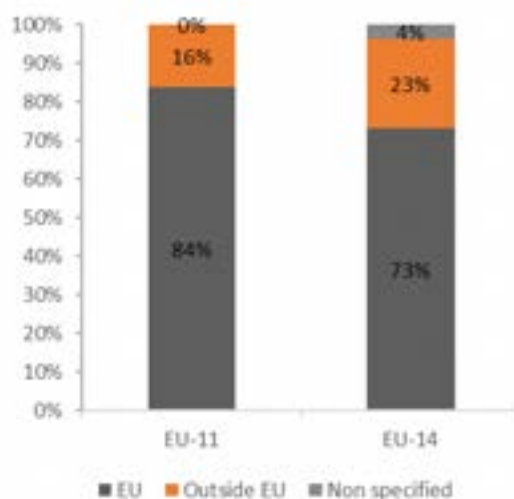
Foreign suppliers of crude oil in EU-11 and EU-14 in 2018 (%)



Foreign suppliers of gas in EU-11 and EU-14 in 2018 (%)



Foreign suppliers of electricity in EU-11 and EU-14 in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

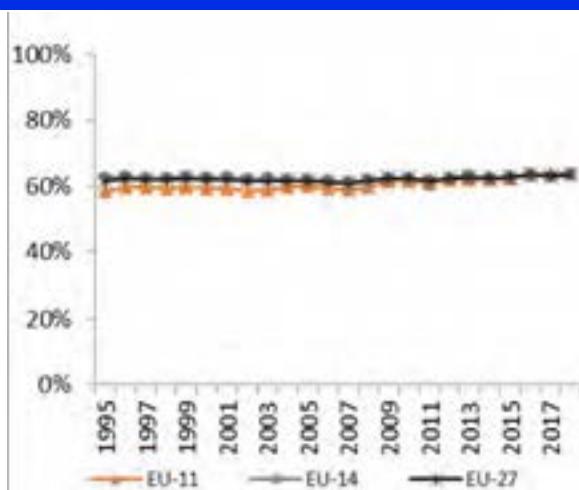
### 2.2.5 Energy intensity

The final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, was lower for EU-14 countries by 4pp. Over past 23 years the ratio for EU-11 countries improved and today the difference between EU-11 and EU-14 countries were close to 0pp.

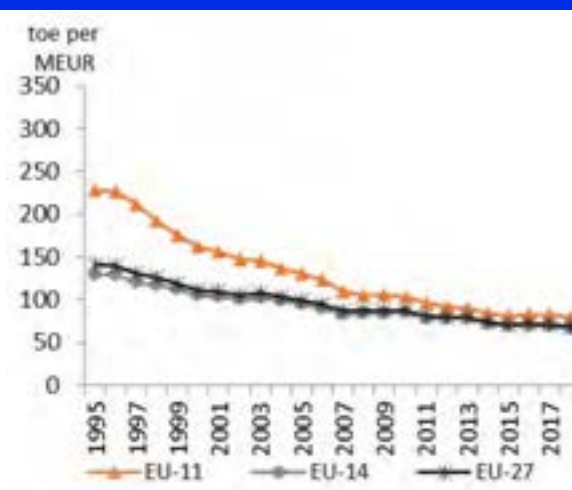
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed in EU-11 countries. When compared to EU-14 ratio one can notice that over past 23 years the difference between EU-11 and EU-14 countries reduced from about 100 toe per MEUR to about 15 toe per MEUR.

Item 13: Final energy consumption in EU-11 in relation to selected indicators

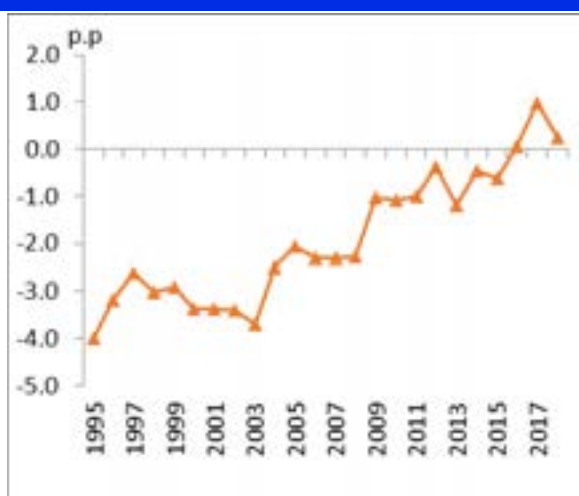
Final energy consumption to gross inland consumption ratio in EU-11, EU-14 and EU-27 countries in 1995-2018 (%)



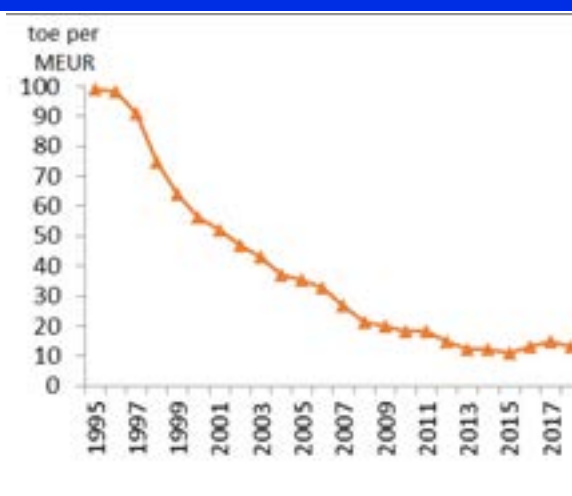
Final energy consumption to gross domestic product ratio in EU-11 in 1995-2018 in comparison with EU-14 and EU-27 averages (toe per M EUR)



Difference between final energy consumption to gross inland consumption ratio for EU-11 and EU-14 countries in 1995-2018



Difference between final energy consumption to gross domestic product ratio for EU-11 and EU-14 countries in 1995-2018 (toe per M EUR)

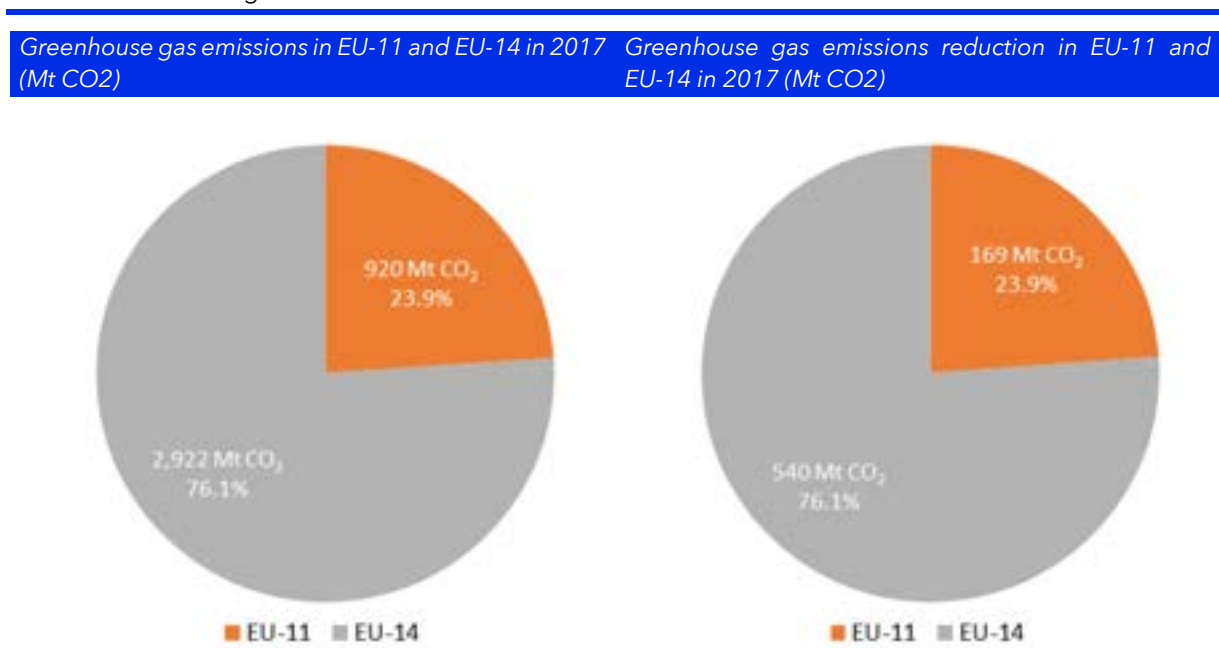


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

## 2.2.6 Greenhouse gas emissions

Greenhouse gas emissions generated by EU-11 countries amounted to 920 Mt CO<sub>2</sub> in 2017. It represented about 23.9% of EU-11 and EU-14 countries emissions. The reduction of greenhouse gas emissions achieved by EU-11 and EU-14 in years 1995-2017 is proportional to the share of emission. EU-11 countries have reduced the emission by 169 Mt CO<sub>2</sub> which represents 23.9% of total reduction generated by EU-11 and EU-14 countries. Respective greenhouse gas emission reduction in years 1990-2017 is characterized by the fact that 43.2% of total reduction is attributed to EU-11 countries versus only 23.9% in the period of 1995-2017.

Item 14: Greenhouse gas emissions in EU-11 and EU-14



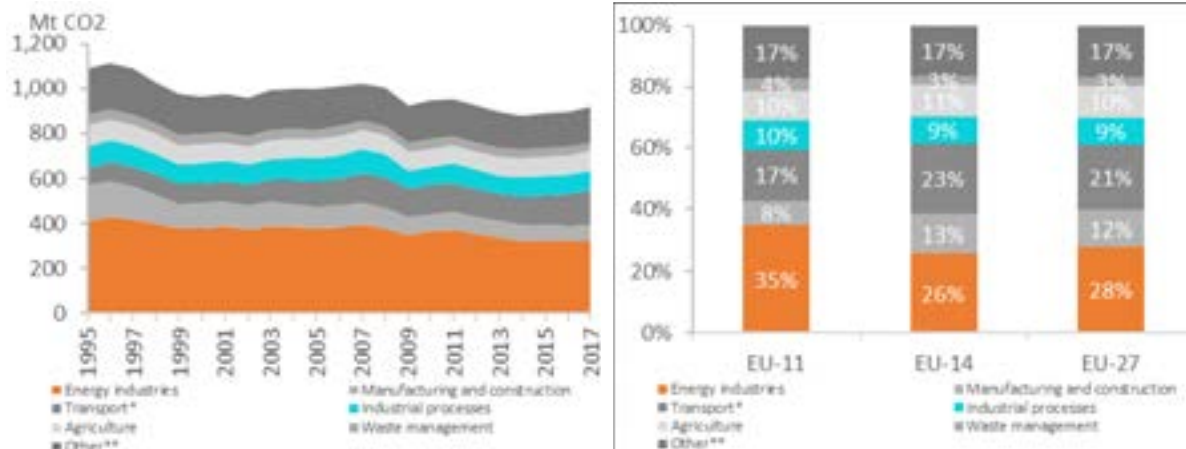
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - values for EU-11, EU-14 and EU-27 recalculated by the Author; Greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O in CO<sub>2</sub> equivalent, CH<sub>4</sub> in CO<sub>2</sub> equivalent, HFC in CO<sub>2</sub> equivalent, PFC in CO<sub>2</sub> equivalent, SF<sub>6</sub> in CO<sub>2</sub> equivalent, NF<sub>3</sub> in CO<sub>2</sub> equivalent) - GHG. The percentages of GHG emission and reduction show the share of EU-11 in the sum of EU-11 and EU-14 and respectively for EU-14.

The greenhouse gas emissions were reduced in EU-11 countries mostly in energy industries and manufacturing and construction. At the same time the emissions from transport doubled over past 23 years. The emissions structure in EU-11 was still dominated by energy industry emissions - 35%. It was more than in case of EU-14 countries - 26%. The share of emissions from manufacturing and construction and transport were still lower in EU-11 countries than in EU-14 (8% versus 13% and 17% versus 23% respectively). The share of emissions from industrial processes, agriculture and waste management were similar in EU-11 and in EU-14 countries (1pp of difference).

The average greenhouse gas emission for EU-11 is above EU-14 and EU-27 levels. Only 4 out of 11 countries had a lower level of GHG emissions than EU-14 average. At the same time, the CAGR of greenhouse gas emissions in EU-11 countries were lower than in EU-14 by a half (0.5% versus 1.1%). Only one country of EU-11 achieved a higher GHG emission reduction than EU-14 average, it is Romania.

Item 15: Greenhouse gas emissions in EU-11

Greenhouse gas emissions in EU-11 by sectors in 1995-2017 (Mt CO<sub>2</sub>) Greenhouse gas emissions in EU-11 by sectors in 2017 in comparison with EU-14 and EU-27 averages (%)



Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO<sub>2</sub> (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO<sub>2</sub> emissions (memo item). Greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O in CO<sub>2</sub> equivalent, CH<sub>4</sub> in CO<sub>2</sub> equivalent, HFC in CO<sub>2</sub> equivalent, PFC in CO<sub>2</sub> equivalent, SF<sub>6</sub> in CO<sub>2</sub> equivalent, NF<sub>3</sub> in CO<sub>2</sub> equivalent) - GHG

Item 16: Greenhouse gas emissions in EU-11 and EU-27

Greenhouse gas emissions per capita in EU-11 in 2017 in comparison with EU-14 and EU-27 averages

Change in greenhouse gas emissions per capita in EU-11 in 2017 in comparison with EU-14 and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - values for EU-11, EU-14 and EU-27 recalculated by the Author; Greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O in CO<sub>2</sub> equivalent, CH<sub>4</sub> in CO<sub>2</sub> equivalent, HFC in CO<sub>2</sub> equivalent, PFC in CO<sub>2</sub> equivalent, SF<sub>6</sub> in CO<sub>2</sub> equivalent, NF<sub>3</sub> in CO<sub>2</sub> equivalent) - GHG

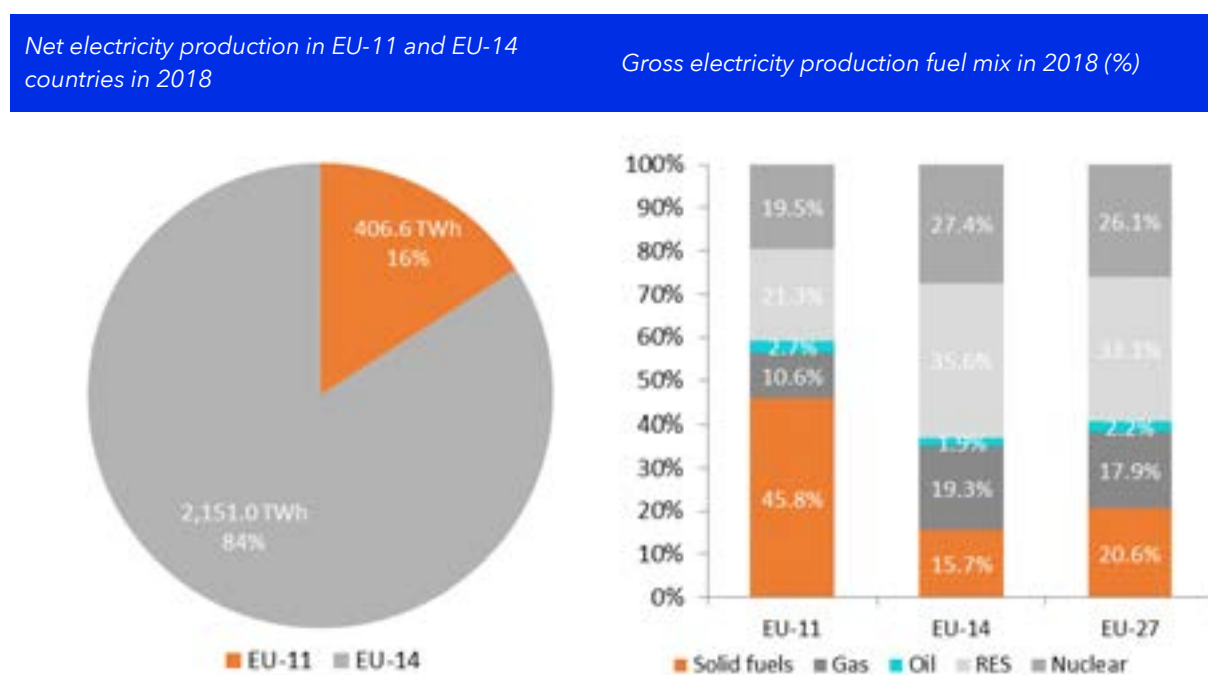
## Conclusions

- EU-11 countries represents 25% of primary energy production, 13.7% of its import and 19% of gross inland consumption of EU-11 and EU-14 countries.
- The primary energy production and gross inland consumption in EU-11 are dominated by greenhouse gas emitting fuels (solid fuels, gas, and oil) which is not the case in EU-14.
- The import of oil and solid fuels to EU-11 countries have been increasing. The import to EU-14 has been increasing only in case of gas whereas oil import has decreased.
- Both final energy consumption to gross inland energy production ratio and final energy consumption to GDP ratio of EU-11 countries have been approaching the values for EU-14.
- EU-11 countries are responsible for 23.9% of greenhouse gas emissions in total of EU-11 and EU-14. Emission of GHG per capita is higher in EU-11 countries and its CAGR 1995-2018 is lower than EU-14 countries.

### 2.3 Overview of the electricity sector

Net electricity production in EU-11 countries was equal to 406.6 TWh. It represents 16% of net electricity production in EU-11 and EU-14. Gross electricity production is dominated by solid fuels in EU-11 countries (45.8% of production) which is much higher than the average for EU-14 and equals to 15.7%. The share of gas in EU-11 production mix is lower than in EU-14 countries (10.5% versus 19.3%) but the share of oil is higher (2.7% versus 1.9%). The share of renewable energy sources is lower in the production mix in EU-11 than in EU-14 (21.3% versus 35.6%). The share of nuclear is also lower in EU-11 - 19.5% versus 27.4% in EU-14.

Item 17: Net electricity production and gross electricity production fuel mix in EU-11



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

The production of electricity was increasing in EU-11 countries slower than in EU-14 (0.5% versus 1.0% CAGR 1995-2018). At the same time, it is important that the average of EU-11 was highly affected by the shutdown of Ignalina Nuclear Power Plant.

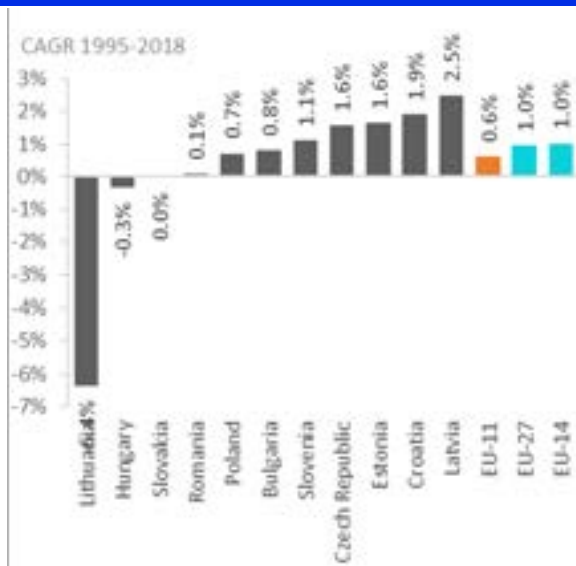
The final consumption of electricity is increasing faster in EU-11 than in EU-14 (1.7% versus 0.6%). It is interesting when compared to lower growth of electricity production in EU-11 versus EU-14. All EU-11 countries final electricity consumption is growing faster than EU-14 average.

The final electricity consumption per capita is lower in EU-11 countries than in EU-14 (0.3 toe per capita versus 0.4 toe per capita). Only one country (Slovenia) is characterized by higher final electricity consumption than EU-14 average.

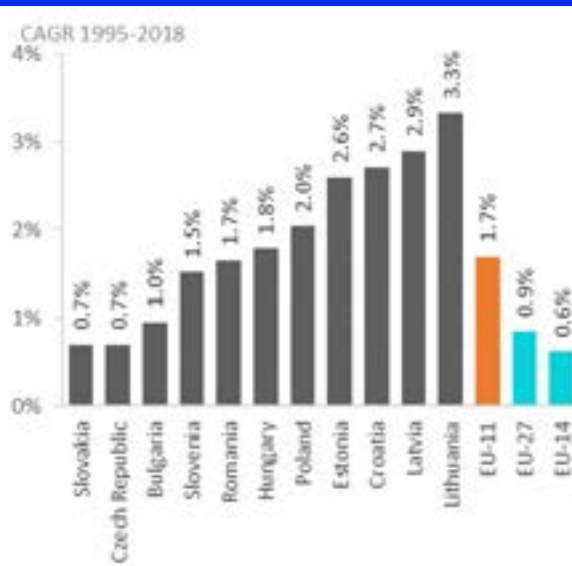
The structure of electricity consumption in EU-11 is characterized by higher share of industry use (40.9% versus 37.6%) and lower share of residential use (25.6% versus 28.5%). Shares of transport and commercial sectors are similar.

Item 18: Growth of net electricity production and final energy consumption in EU-11 countries

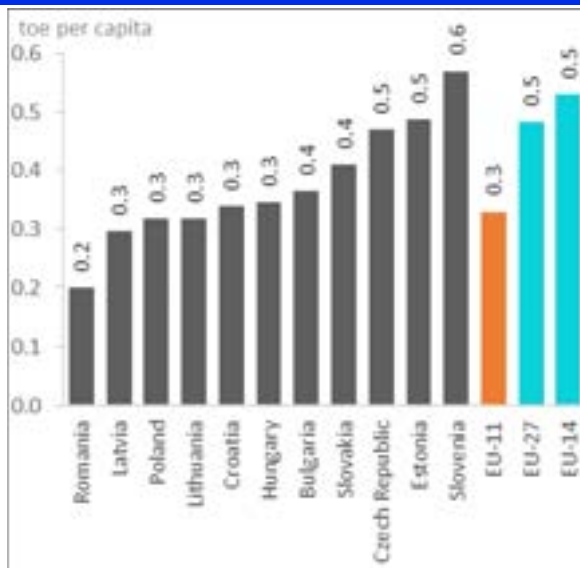
Growth of net electricity production in EU-11 countries in 1995-2018 in comparison with EU-14 and EU-27 countries



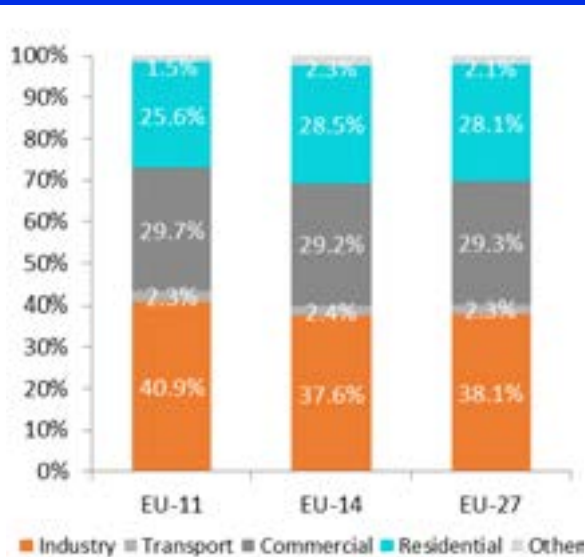
Growth of final consumption of electricity in EU-11 countries in 1995-2018 in comparison with EU-14 and EU-27 countries



Final consumption of electricity per capita in EU-11 in 2018 in comparison with EU-11 and EU-27 (toe per capita)



Final consumption of electricity in EU-11 by sectors in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## Conclusions

- EU-11 countries represented 16% of electricity production in EU-11 and EU-14 countries altogether.
- Most of electricity was generated from greenhouse gas emitting fuels (solid fuels, gas, and oil) – 59.1% versus 36.9% in EU-14.
- The electricity production was growing slower in EU-11 than the final consumption. The opposite situation was in EU-14 countries.

## 2.4 Overview of the heat sector

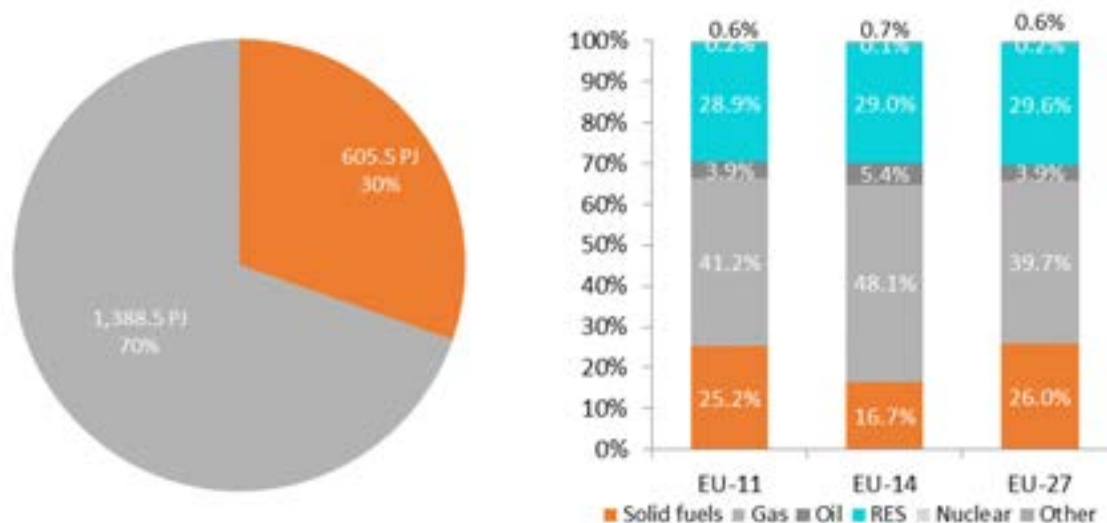
Net heat production in EU-11 countries was equal to 605.5 PJ. It represents about 30% of total EU-11 and EU-14 heat production.

Most heat is produced from gas in EU-11 countries but its share in gross heat production is lower than in EU-14 (41.2% versus 48.1%). At the same time, the share of solid fuels is higher in EU-11 than in EU-14 – 25.2% versus 16.7%. Share of oil is lower in EU-11 than in EU-14 (3.9% versus 5.4%) but the share of renewable energy sources is almost equal (28.9% and 29.0%).

Item 19: Net heat production and gross heat production fuel mix in EU-11

Net heat production in EU-11 in 1995-2018 (Mtoe)

Gross heat production fuel mix in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

The production of heat in EU-11 countries is decreasing. The CAGR for years 1995-2018 is equal to -1.9%, whereas it is increasing in EU-14 countries at CAGR 0.3%.

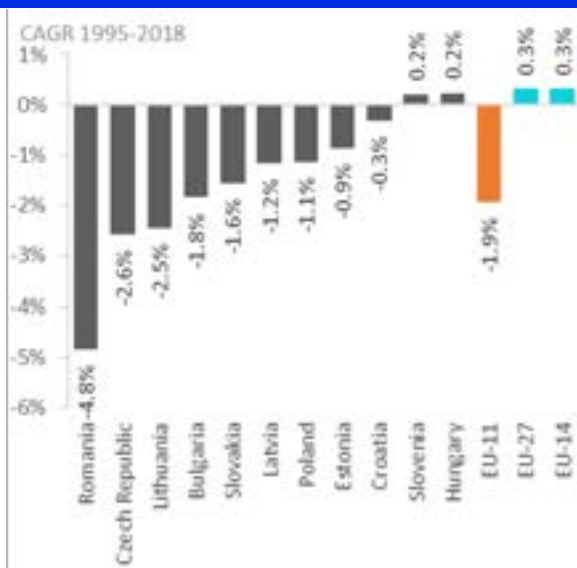
The consumption of heat is also dropping in EU-11 countries by -2.4% CAGR 1995-2018. The use of heat in EU-14 countries is increasing by 1.5%.

Despite the changes the final consumption of heat per capita in EU-11 countries remain higher than in EU-14 countries (0.13 toe per capita versus 0.10 toe per capita).

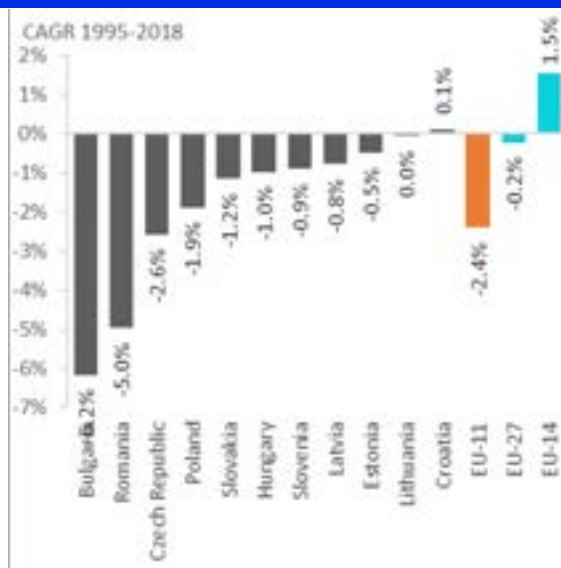
The final consumption of heat in EU-11 countries is dominated by residential sector in the same way as in EU-14 but the share of this use in EU-11 countries is 60.5% and 40.1% in EU-14. The share of heat use in industry and commercial sector are lower in EU-11 countries - 19.7% versus 37.9% and 19.3% versus 21.3%. The residential and industry sectors consume the same amount of heat in EU-14 countries whereas the residential sector is three times bigger than the industrial one in EU-11.

Item 20: Growth of net heat production and final heat consumption in EU-11 countries

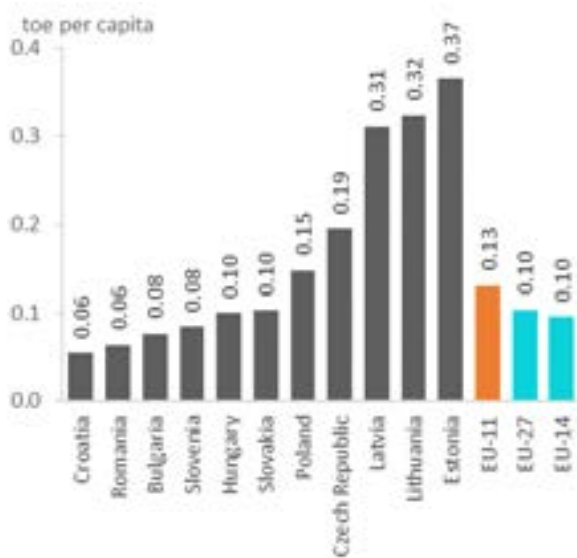
Growth of net heat production in EU-11 countries in 1995-2018 in comparison with EU-14 and EU-27 countries



Growth of final consumption of heat in EU-11 countries in 1995-2018 in comparison with EU-14 and EU-27 countries



Final consumption of heat per capita in EU-11 in 2018 in comparison with EU-11 and EU-27 (toe per capita)



Final consumption of heat in EU-11 by sectors in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## Conclusions

- EU-11 countries represents 30% of heat production in EU-11 and EU-14 countries altogether.
- Heat production and consumption were decreasing in EU-11 countries whereas it was increasing in EU-14.
- The residential sector was three times bigger than the industrial one in EU-11 countries whereas in EU-14 it was almost the same consumption.

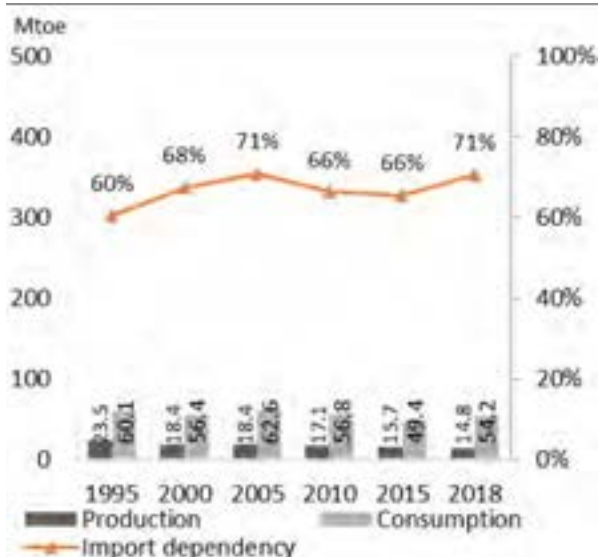
## 2.5 Overview of gas sector

EU-11 countries have produced about 14.8 Mtoe of natural gas in 2018. At the same time the consumption reached the level of 54.2 Mtoe. It means import dependence of 71% on average of EU-11 countries.

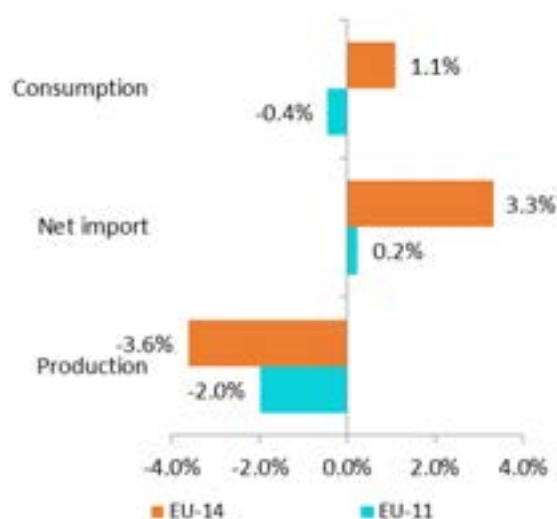
The level of production has dropped over past 23 years by 2.0% which is lower compared to the drop in EU-14 countries - 3.6%. At the same time the consumption of gas has decreased in EU-11 countries by 0.4% whereas it has increased in EU-14. The import has also been growing faster in EU-14 countries (3.3%) than in EU-11 - 0.2%.

Item 21: Gas sector in EU-11 countries

Gas production, gross consumption and import dependence in EU-11 in 1995-2018 (Mtoe)



Changes in gas production, consumption and import in EU-11 and EU-14 countries in 1995-2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

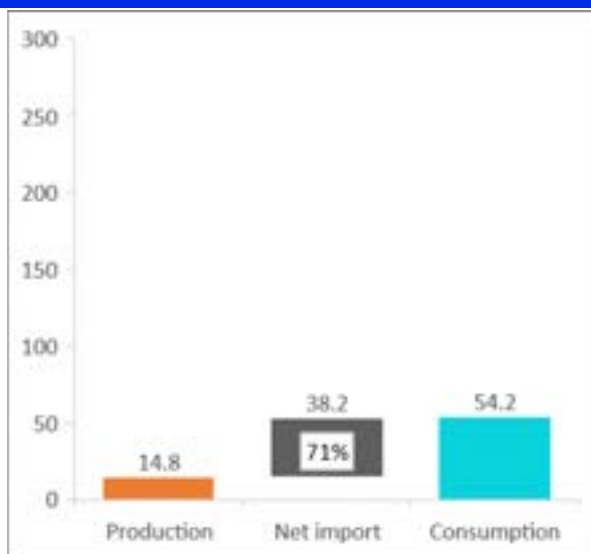
Gas production in EU-11 represents 25% of total EU-11 and EU-14 production. The consumption represents only 17% of total EU-11 and EU-14 consumption altogether. Therefore, the share of production in EU-11 is higher whereas the share of consumption is lower than in EU-14 countries. Consequently, net import to EU-11 represents only 14% of total import to EU-11 and EU-14 countries. The import dependency of EU-11 countries is lower - only 71% compared to 86% of EU-14 countries.

The final consumption of gas in EU-11 countries is lower than in EU-14. The average value for EU-11 is 0.32 toe per capita and it is 0.49 toe per capita in EU-14 countries. Only three EU-11 countries reached EU-14 level and only one exceeded it (Hungary).

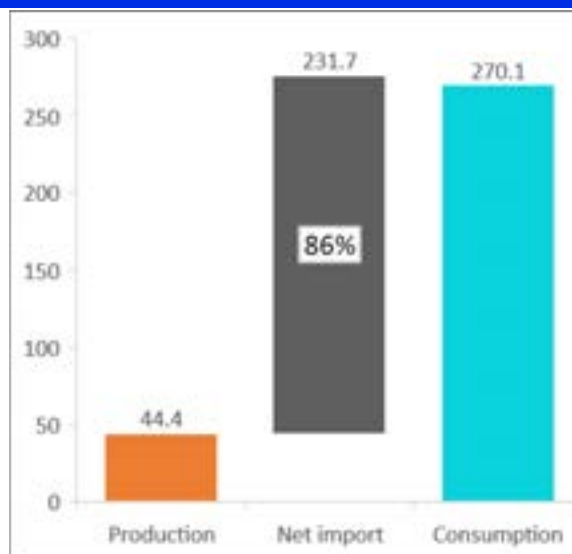
Gas consumption structure is similar in EU-11 and EU-14 countries. The use is dominated by industry (39% and 37.1% in EU-11 and EU-14 countries respectively) and residential sector (39.6% and 39.1% in EU-11 and EU-14 countries respectively). The share of gas use in transport is higher in EU-11 countries (3.2% versus 1.5%) but the same value for commercial sector is lower - 16.7% versus 20.5%.

Item 22: Final consumption of gas per capita in EU-11 countries

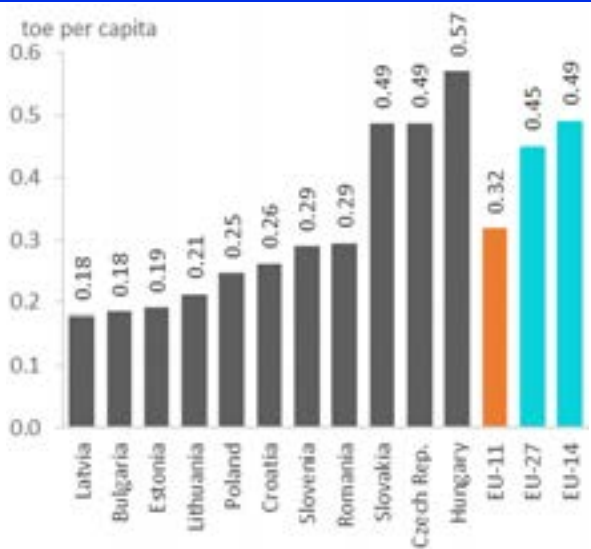
EU-11 countries gas balance and import dependency in 2018



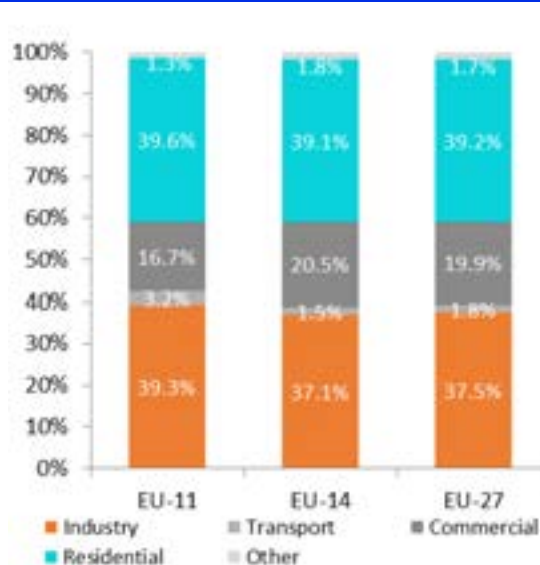
EU-14 countries gas balance and import dependency in 2018



Final consumption of gas per capita in EU-11 countries in 2018 and in EU-11, EU-15 and EU-27 averages (toe per capita)



Gas final consumption by sectors in EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

**Conclusions**

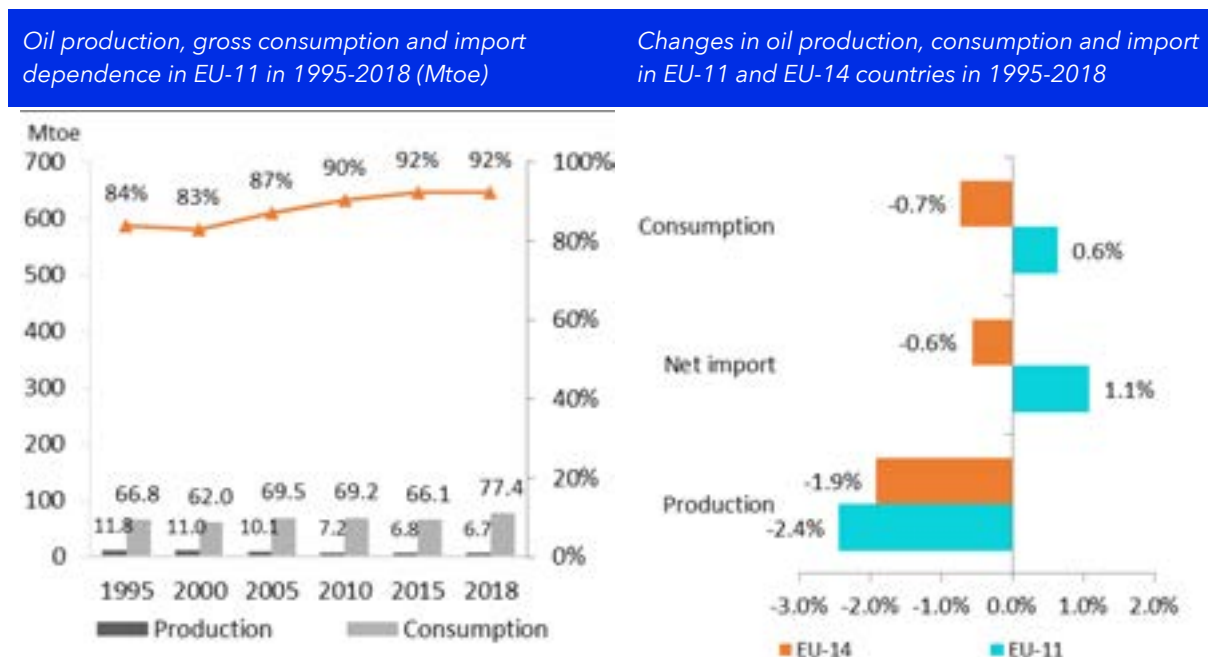
- EU-11 countries represents 25% of gas production, 17% of gas consumption and 14% of gas import in EU-11 and EU-14 countries altogether.
- Gas use structure is similar in both EU-11 and EU-14 countries.

- Gas consumption was decreasing in EU-11 countries whereas it was increasing in EU-14.

## 2.6 Overview of the oil sector

Oil production in EU-11 countries in 2018 was 6.7 Mtoe and the consumption was 77.4 Mtoe. Production of oil dropped over past 23 years in EU-11 by 2.4% whereas in EU-14 countries it dropped by 1.9% only. At the same time, the consumption of oil and its import increased in EU-11 countries (respectively 0.6% and 1.1%). In EU-14 countries the import and consumption of oil decreased.

Item 23: Oil sector in EU-11 countries



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO.

The production of oil in EU-11 countries represent 27% of total production in EU-11 and EU-14 countries altogether. The share of net import to EU-11 countries was lower - 14% of total import went to EU-11 countries. EU-11 member states were responsible only for 15% of total consumption of oil in EU-11 and EU-14 countries altogether.

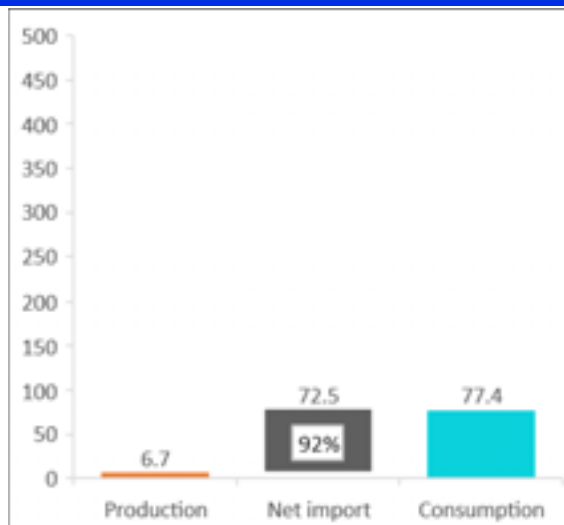
Oil import dependency of EU-11 countries is lower than in EU-14 - 92% versus 95%.

The consumption of oil per capita in EU-11 countries remains lower than the average of EU-14. Only one country (Slovenia) is characterized by higher final oil consumption than EU-14 average.

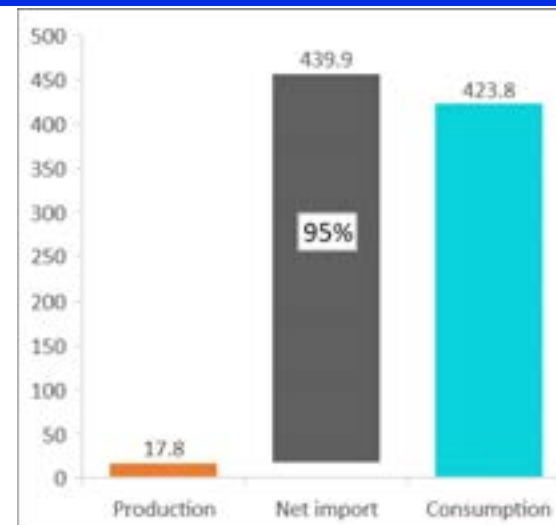
The oil consumption structure of EU-11 countries is dominated by transport, but its share is even higher than in EU-14 countries (82.7% versus 74.7%). In opposite EU-11 countries share of gas in other sectors is lower than the one for EU-14 countries.

Item 24: Final consumption of oil per capita in EU-11 countries

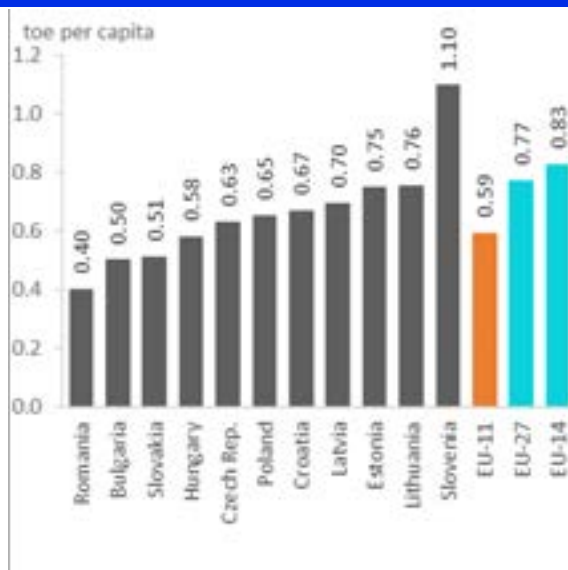
EU-11 countries oil balance and import dependency in 2018



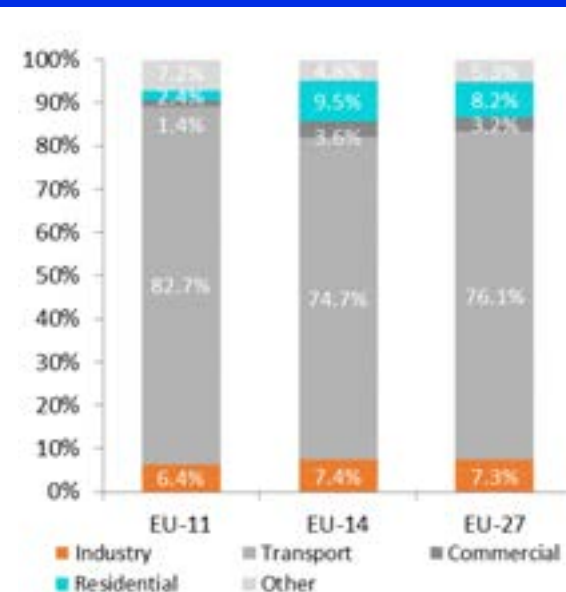
EU-14 countries oil balance and import dependency in 2018



Final consumption of oil per capita in EU-11 countries in 2018 and in EU-11, EU-15 and EU-27 averages (toe per capita)



Oil final consumption by sectors in EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## Conclusions

- EU-11 countries represents 27% of oil production, 15% of oil consumption and 14% of oil import in EU-11 and EU-14 countries altogether.
- Oil production was decreasing in EU-11 and EU-14 countries whereas the consumption and net import were increasing in EU-11 countries but decreasing in EU-14.
- Oil consumption per capita was lower in EU-11 countries than EU-14 average.

## 2.7 Overview of current EU climate policy in EU-11 countries

Europe 2020 strategy targets on climate and energy and on the post-2020 climate and energy framework. It is known as the '20-20-20' targets. Europe 2020 strategy's three climate and energy targets are interrelated and mutually support one another:

- A 20% reduction in GHG emissions compared with 1990 levels;
- A 20% share of renewable energy in gross final energy consumption; and
- A 20% cut in energy consumption compared to a 2020 business-as-usual projection.

In 2014, European Council agreed on a post-2020 climate and energy framework. The 2030 Climate and Energy Policy Framework includes three targets for 2030:

- at least 40% cut in GHG emissions (from 1990 levels),
- at least 27% share for renewable energy; and
- further improvements in energy efficiency (compared to a projected business-as-usual scenario for 2030).

In 2018, the revised Renewable energy directive and amending Directive on Energy Efficiency increased the ambition of the latter two targets for renewable energy and energy efficiency. Current targets for 2030 are:

- at least 40% cut in GHG emissions (from 1990 levels),
- minimum 32% share for renewable energy; and
- at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030).

*Item 25: Summary of EU-28 targets for 2020 and 2030*

	EU-28 2020 targets	EU-28 2030 targets
Greenhouse gas emissions	20% reduction from 1990 levels (14% reduction from 2005 level)	at least 40% reduction from 1990 levels
Share of energy from renewables	20% energy from renewables	minimum 32% share for renewable energy
Improvement in energy efficiency	20% improvement in energy efficiency	at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)

Source: EU website

### 2.7.1 Greenhouse gas emissions

The greenhouse gas emission reduction targets are summarized in Item 26.

Item 26: Summary of greenhouse gas emissions targets for EU-28 for 2020 and 2030

	EU-28 2020	EU-28 2030
Greenhouse gas emissions	20% reduction from 1990 levels (14% reduction from 2005 level)	40% reduction from 1990 levels
Greenhouse gas emissions in ETS	21% reduction from 2005	43% by 2030 compared to 2005
National emission reduction targets in No-ETS - Effort Sharing Decision (ESD)	From -20% to +20% depending on country, reduction of at least 10% in total EU emissions from the non-EU ETS sectors compared with 2005 levels	-
National emission reduction targets in No-ETS - Effort Sharing Regulation (ESR)	-	0% to -40% compared to 2005 levels depending on the country reduce emissions by 30% compared with 2005

Source: EU website

The achievement of greenhouse gas emissions EU wide target of 20% reduction from 1990 levels to 2020 is based on two elements:

- EU wide target of 21% reduction in EU ETS sectors from 2005 levels.
- National emission reduction targets in Non-ETS sectors defined in Effort Sharing Decision (ESD).

The target for EU ETS sectors was set for the whole EU and there were no targets for countries. In 2017 the emission of greenhouse gas for EU-28 has been reported at the level of 78.34 comparing to the target for 2020 of 80. (emissions are measured to the reference year 1990 emissions).

In case of non-ETS sectors specific targets were agreed for countries based on Effort Sharing Decision. They are listed in table Item 27.

The achievement of greenhouse gas emissions EU wide target of 40% reduction from 1990 levels to 2030 is based on two elements:

- EU wide target of 43% reduction in EU ETS sectors from 2005 levels.
- National emission reduction targets in Non-ETS sectors defined in Effort Sharing Regulations (ESR).

The target for EU ETS sectors set for the whole European Union and there are no targets for countries. In case of non-ETS sectors specific targets were agreed for countries based on Effort Sharing Regulations. They are listed in table Item 27.

Item 27: Summary of national targets for greenhouse gas emissions targets for 2020 and 2030 compared with 2005 levels

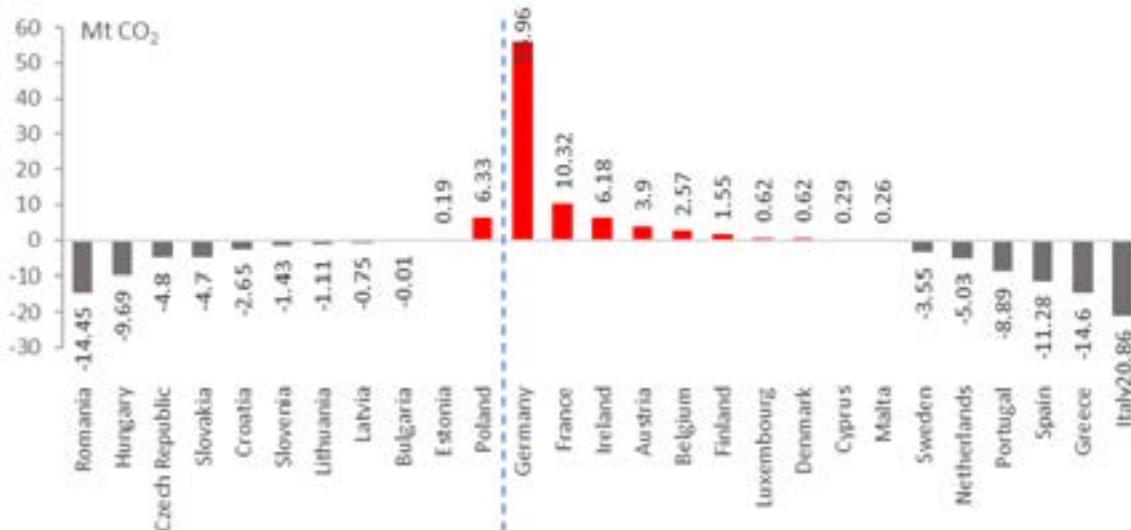
Country	ESD - 2020 targets	ESR - 2030 targets
Belgium	-15%	-35%
Bulgaria	20%	0%
Czechia	9%	-14%
Denmark	-20%	-39%
Germany	-14%	-38%
Estonia	11%	-13%
Ireland	-20%	-30%
Greece	-4%	-16%
Spain	-10%	-26%
France	-14%	-37%
Croatia	11%	-7%
Italy	-13%	-33%
Cyprus	-5%	-24%
Latvia	17%	-6%
Lithuania	15%	-9%
Luxembourg	-20%	-40%
Hungary	10%	-7%
Malta	5%	-19%
Netherlands	-16%	-36%
Austria	-16%	-36%
Poland	14%	-7%
Portugal	1%	-17%
Romania	19%	-2%
Slovenia	4%	-15%
Slovakia	13%	-12%
Finland	-16%	-39%
Sweden	-17%	-40%
United Kingdom	-16%	-37%

Source: EU website

Most of EU-11 countries were below their respective targets for greenhouse gas emissions levels in ESD mechanism. Only two countries were above the limit - Poland and Estonia. In case of EU-14 ten countries remained above their targets.

Item 28: Difference between GHG emissions in 2017 and targets for European Union countries

Difference between GHG emissions in 2017 and targets for European Union countries for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

Currently information about country specific targets for 2030 in ESR mechanism were communicated as percentages of 2005 levels only. The absolute values are still under discussion.

### 2.7.2 Renewable energy sources

The second target climate change and energy target of Europe 2020 strategy has the objective of renewable energy reaching a 20% share of gross final energy consumption by 2020. Gross final energy consumption comprises the energy supplied to final consumers for all energy uses and the consumption of electricity and heat by the energy sector for electricity and heat production, including losses of electricity and heat in distribution and transmission. The recast Renewable Energy Directive<sup>1</sup> adopted in 2018 set a new EU-level target: by 2030, the renewable energy share should reach at least 32%. (see Item 29)

*Item 29: Summary of EU-28 targets regarding share of renewable sources in gross final consumption of energy in 2020 and 2030*

	EU-28 2020 targets	EU-28 2030 targets
Share of energy from renewables	20% energy from renewables	minimum 32% share for renewable energy
EU wide target	20% share of gross final energy consumption	32% share of gross final energy consumption
National targets	From 10% to 49% of gross final consumption	Not yet available

Source: EU website

Share of renewable energy in gross final consumption for EU-27 countries was 18.9% in 2018. Comparing to the target of 20% for 2020 one can conclude that there was high chance to achieve the target.

<sup>1</sup> Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.

Country specific targets for share of energy from renewable energy sources in gross final consumption of energy in 2005 and 2020 were set. (see Item 30).

Item 30: National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2020

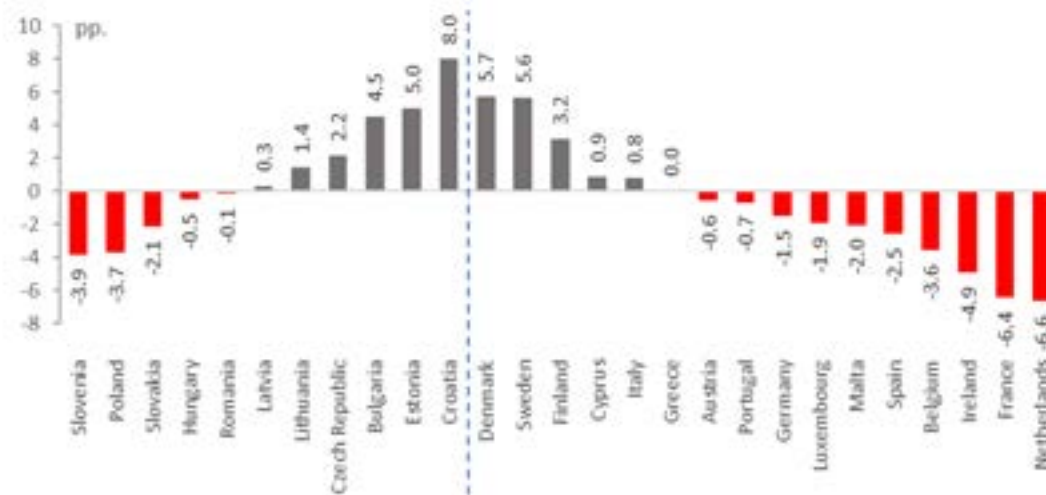
	Share of energy from renewable sources in gross final consumption of energy, 2005	Target for share of energy from renewable sources in gross final consumption of energy, 2020
Belgium	2,2%	13%
Bulgaria	9,4%	16%
Czech Republic	6,1%	13%
Denmark	17,0%	30%
Germany	5,8%	18%
Estonia	18,0%	25%
Ireland	3,1%	16%
Greece	6,9%	18%
Spain	8,7%	20%
France	10,3%	23%
Croatia	-	20%
Italy	5,2%	17%
Cyprus	2,9%	13%
Latvia	32,6%	40%
Lithuania	15,0%	23%
Luxembourg	0,9%	11%
Hungary	4,3%	13%
Malta	0,0%	10%
Netherlands	2,4%	14%
Austria	23,3%	34%
Poland	7,2%	15%
Portugal	20,5%	31%
Romania	17,8%	24%
Slovenia	16,0%	25%
Slovak Republic	6,7%	14%
Finland	28,5%	38%
Sweden	39,8%	49%
United Kingdom	1,3%	15%

Source: EU website. DIRECTIVE 2009/28/EC OF EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

Six of EU-11 countries reached the target of share of renewable energy in the energy mix in 2020, set by EU. In case of EU-14 only six countries reached their respective targets.

Item 31: Difference between target and current share of energy from renewable energy sources in gross final energy consumption in EU countries

Difference between current (2018) share of energy from renewable energy sources in gross final energy consumption and targets for 2020 in EU countries



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

Country specific targets for share of energy from renewable energy sources in gross final consumption of energy in 2030 are still under development.

### 2.7.3 Energy efficiency

In 2012, under the Energy Efficiency Directive 2012/27/EU<sup>2</sup>, EU set a 20% energy efficiency target by 2020 (when compared to the projected use of energy in 2020). In concrete terms, this means lowering EU's final energy consumption to no more than 1,086 million tonnes of oil equivalent (Mtoe) and primary energy consumption to no more than 1,483 Mtoe.

To achieve targets, EU countries were required to set their own indicative national energy efficiency targets.

In December 2018, the revised Energy Efficiency Directive<sup>3</sup> entered into force (amending Directive EU (2018/2002) updating some specific provisions and introducing new elements. Above all, it establishes a headline EU energy efficiency target for 2030 of at least 32.5% (compared to projections), with a clause for a possible upwards revision by 2023. The 32.5 % target for 2030 translates into final energy consumption of 956 Mtoe and/or primary energy consumption of 1,273 Mtoe in EU-28 (Item. 32).

<sup>2</sup> Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency

<sup>3</sup> Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency.

Item 32: Summary of energy efficiency EU-28 targets for 2020 and 2030

	EU-28 2020 targets	EU-28 2030 targets
Improvement in energy efficiency	20% improvement in energy efficiency	at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)
Primary energy consumption	< 1,483 Mtoe	< 1,273 Mtoe (< 1,128 Mtoe EU-27)
Final energy consumption	< 1,086 Mtoe	< 956 Mtoe (<846 Mtoe EU-27)

Source: EU website

The reported primary energy production for 2018 is equal to 1,375.7 Mtoe. Compare to the primary energy consumption target for 2020 for EU-28 countries it can conclude that the target will be achieved. An effort is necessary to meet EU-28 target for 2030.

The reported final energy consumption for 2018 is equal to 989.4 Mtoe. Compare to the primary energy consumption target for 2020 for EU-28 countries one can conclude that the target will be achieved. An effort is necessary to meet EU-28 target for 2030.

The country specific targets for primary and final energy consumption for 2020 are listed in Item 33. Specific country targets for 2030 are not available yet.

Item 33: Summary of country specific energy efficiency targets for 2020

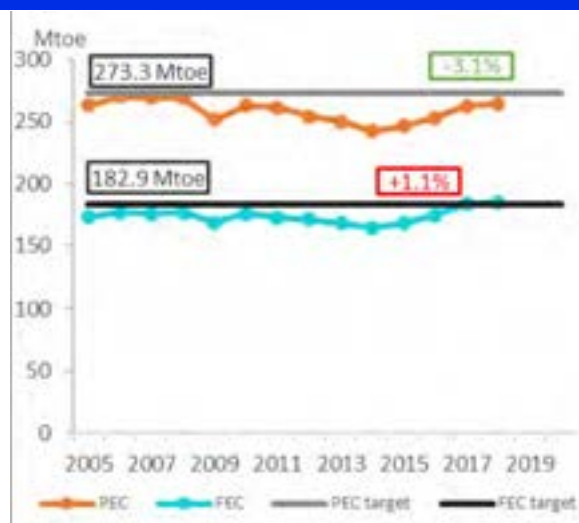
EU Member State	Absolute level of energy consumption in 2020 [Mtoe] as notified from Member States in 2013, in the NEEAP 2014, Annual Reports or in separate notifications to European Commission in 2015 and 2016	
	Primary energy consumption	Final energy consumption
Austria	31,5	25,1
Belgium	43,7	32,5
Bulgaria	16,9	8,6
Croatia	11,15	7
Cyprus	2,2	1,8
Czech Republic	39,6	25,3
Denmark	17,4	14,4
Estonia	6,5	2,8
Finland	35,9	26,7
France	219,9	131,4
Germany	276,6	194,3
Greece	24,7	18,4
Hungary	24,1	14,4
Ireland	13,9	11,7
Italy	158	124
Latvia	5,4	4,5
Lithuania	6,5	4,3
Luxembourg	4,5	4,2
Malta	0,7	0,5
Netherlands	60,7	52,2
Poland	96,4	71,6
Portugal	22,5	17,4
Romania	43	30,3
Slovakia	16,4	9
Slovenia	7,3	5,1
Spain	119,8	80,1
Sweden	43,4	30,3
United Kingdom	177,6	129,2
Sum of indicative targets EU-28	1,528.3	1077.1
Sum of indicative targets EU-27*	1,348.7	947.9

Source: EU website \* - recalculated by the Author

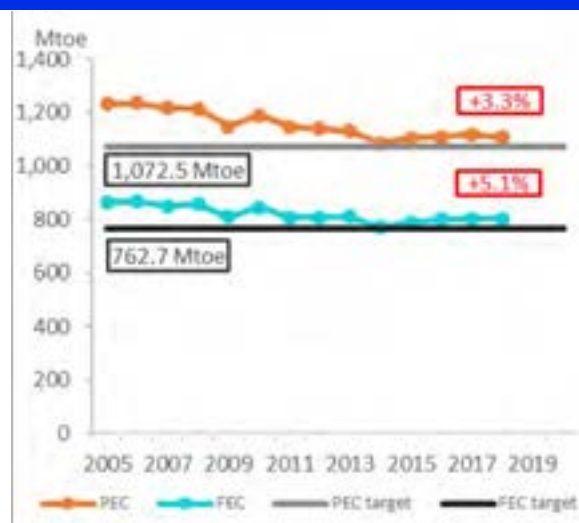
The primary energy production in EU-11 countries was below target of 273.3 Mtoe by -3.1% whereas EU-14 countries were above their common target of 1,072.5 Mtoe by +3.3%. In case of final energy consumption EU-11 member states and EU-14 were both above the targets - +1.1% for EU-11 countries and +5.1% for EU-14. One should remember that the targets for EU-11 and EU-14 are for illustration purposes. The binding targets were set for EU as a whole and for specific countries.

Item 34: Energy efficiency target data for EU-11 countries

Primary energy consumption and final energy consumption in EU-11 countries in 2005-2018 and targets for 2020



Primary energy consumption and final energy consumption in EU-14 countries in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030) (PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

Country specific targets for 2030 in energy efficiency improvements have not been communicated yet.

## Conclusions

- EU wide targets of greenhouse gas emissions reduction, energy efficiency improvements and increase of share of renewable energy sources were achieved in 2017/2018 results. The final check will be performed based on 2020 data.
- Country specific targets in all three areas were not achieved in all the countries based on 2018 data. It relates to both EU-11 and EU-14 countries.
- EU wide targets of greenhouse gas emissions reduction, energy efficiency improvements and increase of share of renewable energy sources for 2030 are still to be achieved.
- The country specific targets for 2030 have not been fully communicated yet.

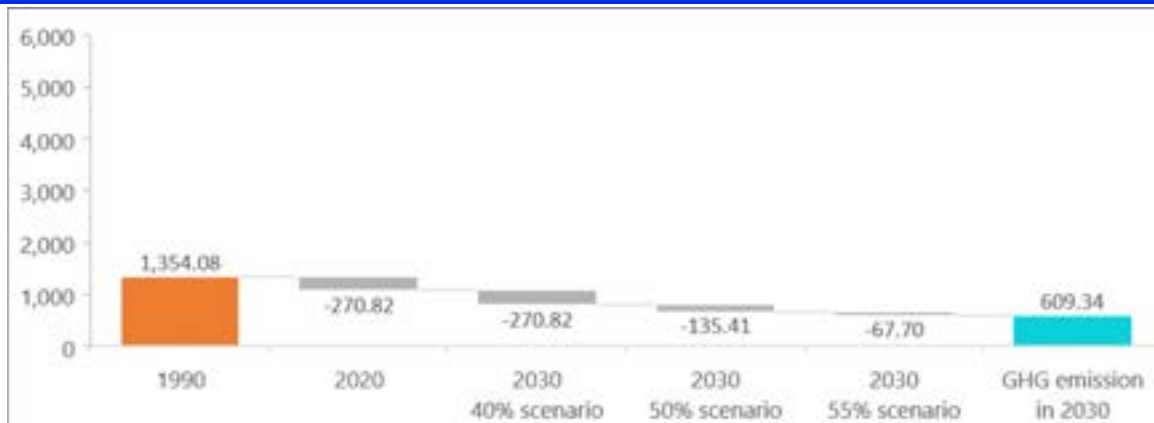
## 2.8 Overview of up-to-date information regarding “Green Deal”

At the current stage of discussions regarding European Green Deal only partial information is available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of “Climate Law”. Assuming EU-11 countries greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 270.82 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 270.82 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 135.41 Mt CO<sub>2</sub> emission decrease is needed, or 203.11 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by EU-11 countries up to 2030 could be higher than the one planned for 2020.

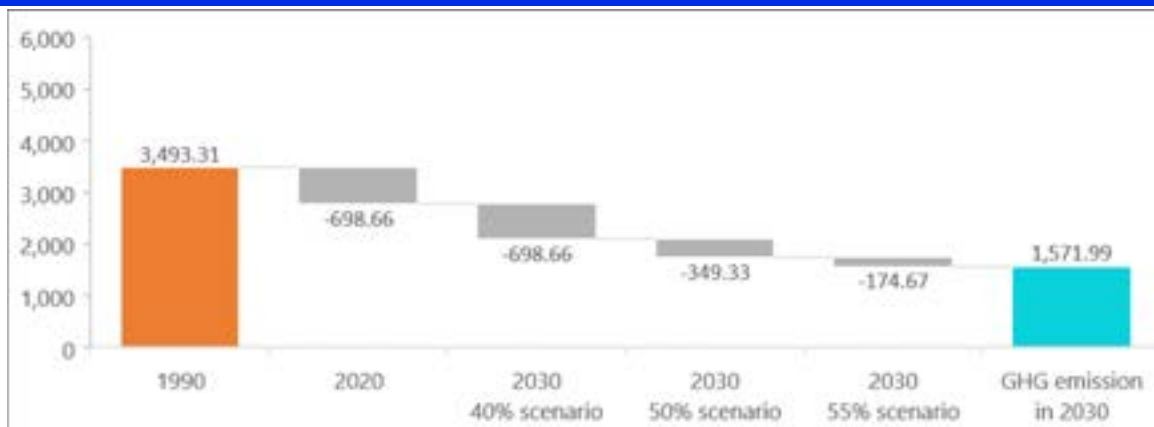
The reduction levels for EU-14 are proportional to the level of greenhouse gas emissions in 1990, as the percentages are the same.

Item 35: Estimation regarding greenhouse gas emissions in EU-11 and EU-14 under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in EU-11 under different scenarios (Mt CO<sub>2</sub>)



Estimation regarding greenhouse gas emissions in EU-14 under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintained, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

Assuming the above scenario becomes binding it means the countries producing 10% of GDP must provide 28% of greenhouse gas emission reduction.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is neither available nor possible to estimate.

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## **Conclusions**

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- Very few information is available up to date about the details of the Green Deal Strategy. Especially there is no information about country specific targets. Any estimations are based on assumptions and guesses.
  - It is reasonable to assume that EU-11 countries representing 10% of EU GDP will have to make much bigger effort to reach the ambitious targets than EU-14 countries. Clear balance between countries with proper consideration of their specific economic, social and political situation in setting the targets is needed, as well as equitable mechanism to balance the burden associated with the effort to achieve ambitious targets in greenhouse gas reduction, energy efficiency improvement and increase of share of renewable energy in the energy mix.
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НАРОДНО СЪБРАНИЕ

## 3 Bulgaria

### 3.1 General information

Bulgaria is the third largest country within EU-11 group in terms of total country area and represents 9.8% of the area. At the same time, it is the 10<sup>th</sup> country in EU-27 with 2.6% of the area. It represents 6.9% of EU-11 population and 1.6% of EU-27 population, but only 4.0% of its total nominal GDP of EU-11 and 0.4% of EU-27. Despite the robust economic growth in 1995-2018 period, in 2018 Bulgarian GDP per capita amounted only to 51% of the whole EU average.

Item 36: Bulgaria - key data



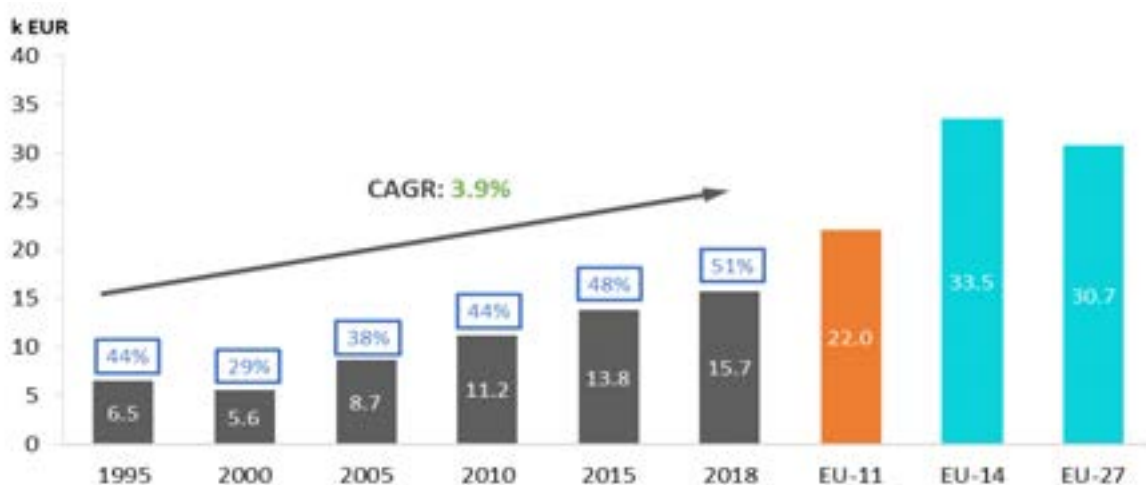
#### Key data

Population (M)	7.1
GDP per capita (EUR, nominal)	7,980
GDP per capita (EUR, PPS)	15,720
GDP as share of EU-11	4.0%
GDP as share of EU-27	0.4%
Energy intensity of the economy (kgoe per 1,000 EUR)	174.9
Greenhouse gas emissions (Mg per capita)	8.7

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 3.9% Bulgarian economy considerably grew in the period of 1995-2018 (see Item 37). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 47% and 51% of the respective averages) – if purchasing power is taken into consideration.

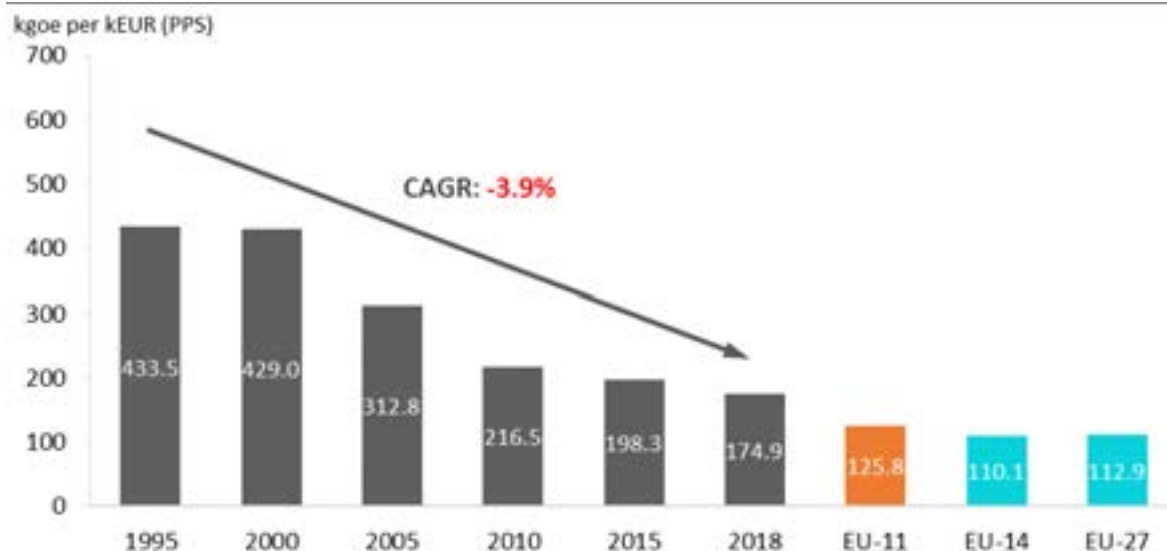
Item 37: GDP per capita in Bulgaria for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Bulgaria GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita – Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Bulgarian economy can be considered as a very energy intensive one, despite a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 258.6 kgoe per 1,000 EUR PPS, i.e. it was reduced by almost half. In EU-14 and EU-27 average values are 1.6 and 1.5 times respectively lower and in EU-11 average is still 1.4 times lower than in Bulgaria.

Item 38: Energy intensity of the economy in Bulgaria in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) – EI\_GDP\_PPS

### 3.2 Energy balance of Bulgaria

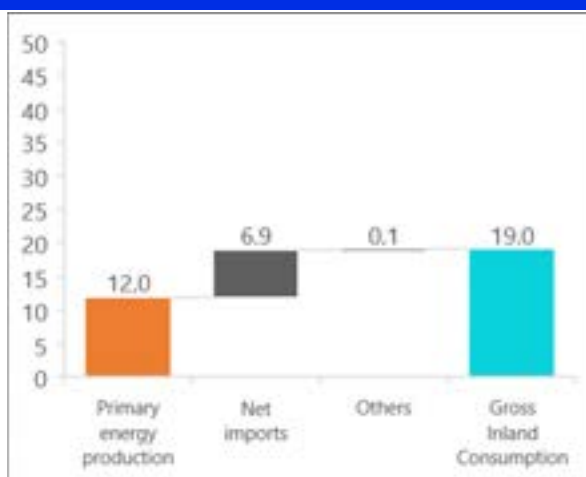
In Item 39 an energy balance of Bulgaria in 2018 as well as historical values of net imports of energy is shown. In 1990s, a rapid decline of energy net import was observed from 15.8 Mtoe in 1995 to a mere about 11 Mtoe in the year 2002. After that, net import increased and peaked again in 2008, achieving the level of 15.1 Mtoe and dropped afterwards amounting to 11.6 Mtoe in 2018. The variations are partially explained by changes in level of stocks.

As a result, the country's dependency on energy import is oscillating between 60% and 70%. At the same time, primary energy production in Bulgaria covered only 63% of gross inland consumption (moving from 44% in 1995).

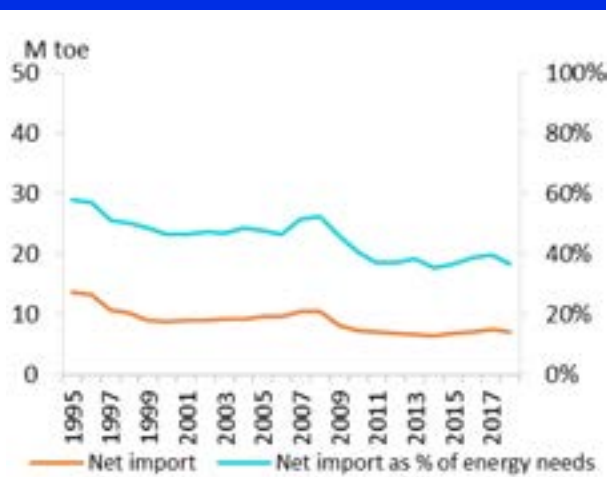
The difference between total primary energy production and gross inland consumption in Bulgaria is significant. The latter amounts for 158% of domestic production and therefore, the country is highly dependent on foreign suppliers.

Item 39: Energy balance in Bulgaria

Energy balance in Bulgaria in 2018 (Mtoe)



Net import of energy in Bulgaria in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Bulgaria (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

Considering the primary production, one can notice that 42% is based on solid fuels and 35% on nuclear power plants, which overwhelmingly dominate the structure (around 77% combined share). The remaining part is produced of renewable energy sources.

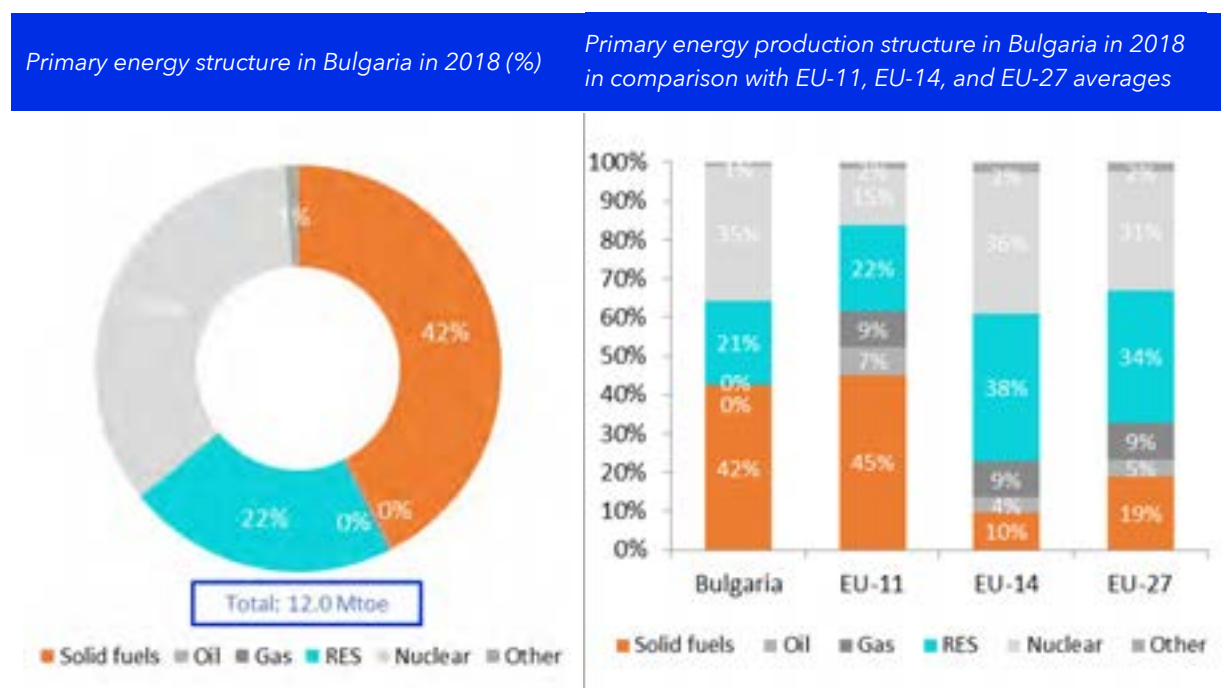
On the consumption side, solid fuels, oil, and gas have a dominant position - 66%. The share of nuclear is significant - 21% but the share of renewable energy sources remains at level of 13%.

Comparing to EU-11 group Bulgaria has a higher share of nuclear (35% versus 15%) and similar shares of solid fuels and renewable energy sources in primary energy production structure, but gas and oil are missing (no local sources of these fuels)

When compared to the group of developed Western European countries (EU-14), Bulgaria has a very high share of solid fuels in primary energy production (42% versus 10%). Furthermore, production in developed countries is much more balanced than in Bulgaria,

which is dominated by solid fuels, nuclear and renewable energy sources. Similar relations are observed when comparing Bulgaria primary energy structure to EU-27.

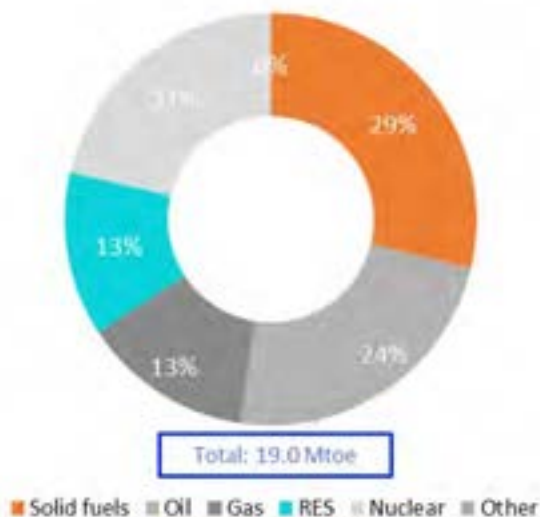
Item 40: Primary energy structure in Bulgaria



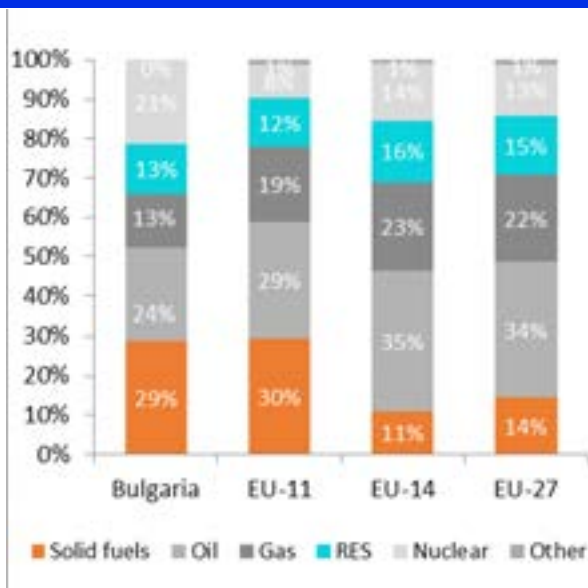
Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Item 41: Gross inland consumption structure in Bulgaria

Gross inland consumption structure in Bulgaria in 2018 (%)



Gross inland consumption structure in Bulgaria in 2018 in comparison with EU-11, EU-14, and EU-27 averages



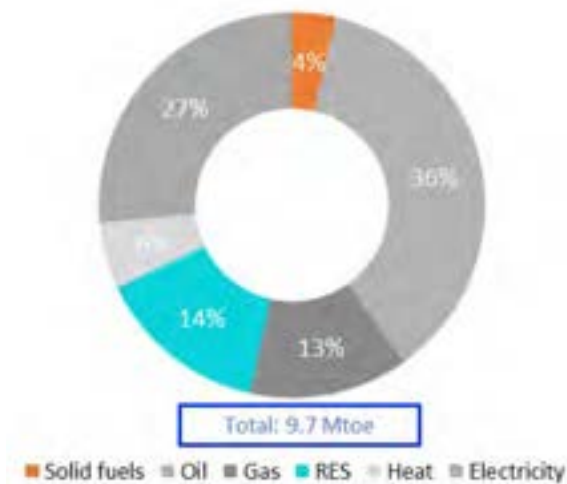
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Bulgaria is dominated by petroleum products and electricity, which accounted together for 63% of total energy consumption in 2018 (see Item 42). The shares of gas, heat and RES in final energy consumption fuel-mix are comparable to each other and amount to slightly over 10% each.

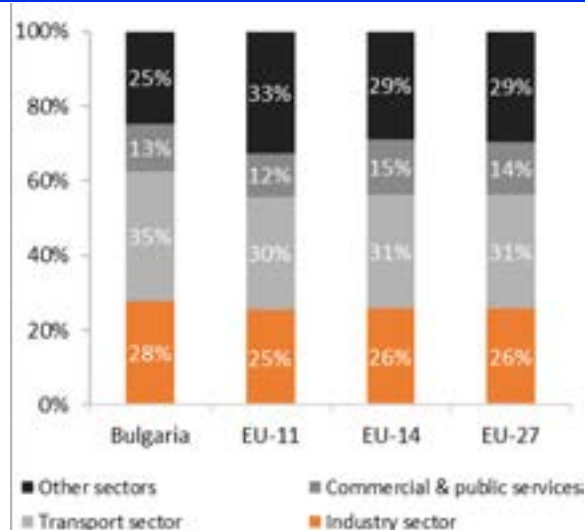
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Bulgaria hardly shows any particularities. The proportional consumption needs of each sector seem to be like those of developed countries. The final energy consumption in a little higher in industry and transport and lower in commercial and public services.

Item 42: Final energy consumption structure in Bulgaria

Final energy consumption structure in Bulgaria in 2018 (%)



Final energy consumption structure in Bulgaria in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

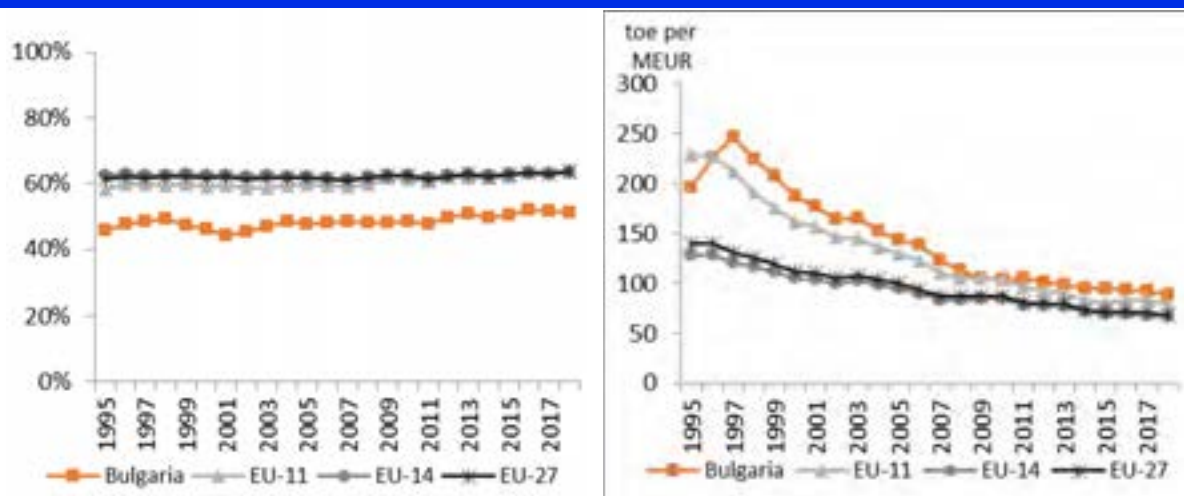
Bulgarian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were significantly lower than in EU-14 and EU-27. Furthermore, its level in Bulgaria has remained stable since 1995.

Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 196.0 toe per MEUR to 88.3 toe per MEUR). The latter value is only a bit higher than EU-11 average while corresponding values for EU-14 and EU-27 countries in 2018 were merely 66.2 and 68.4 toe per MEUR of GDP, respectively.

Item 43: Final energy consumption in Bulgaria in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Bulgaria in 1995-2018 (%)

Final energy consumption to gross domestic product ratio in Bulgaria in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

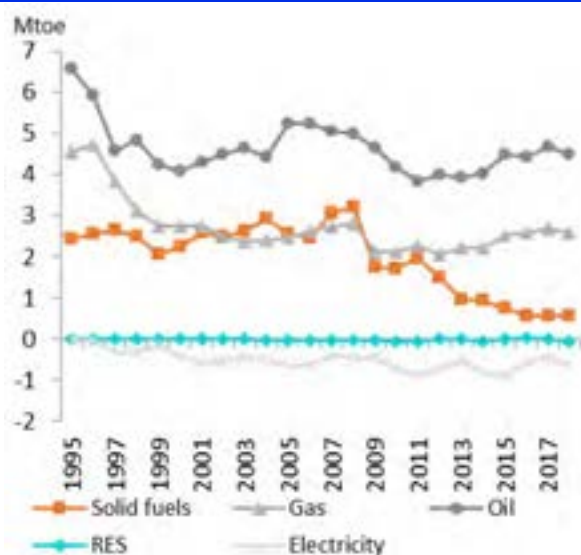


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

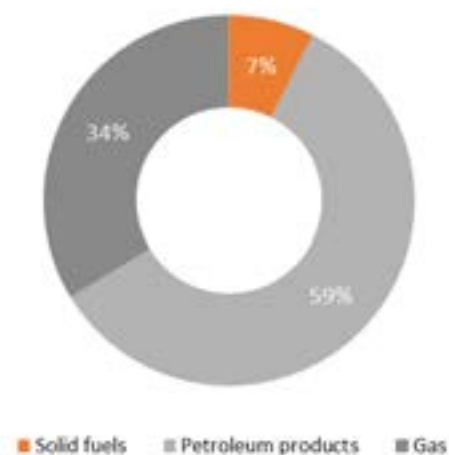
Total net import of energy in Bulgaria significantly decreased in years 1995-2018 (from 13.6 in 1995 to 6.9 Mtoe in 2018). Analysis of its structure in 2018 indicates the dominance of petroleum products which constitute over 59% of total net import value. The other two net imported fuels are gas and solids with respective shares of 34% and 7%. Over the time, however, the absolute value of net import of each type of fuel had decreased, gas and oil in years 1995-2000 and solid fuels in years 2010-2018. Bulgaria is also a net exporter of electricity and renewable energy sources (see Item 44).

Item 44: Net import of energy in Bulgaria

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)

In 2018, Russia was the main supplier of energy to Bulgaria. It absolutely dominated foreign supply of crude oil and gas - which are the most important imported fuels to Bulgaria. As far as gas is concerned, Russia was the sole exporter to Bulgaria. In terms of foreign solid fuels supply, Russia is followed by South Africa and Ukraine, 16% and 4% respectively. In general, the foreign supply structure of all the main imported fuel types to Bulgaria is very unbalanced, with one dominant exporting country (see Item 45).

Item 45: Foreign fuel suppliers

Foreign suppliers of solid fuels in Bulgaria in 2018 (%) Foreign suppliers of crude oil in Bulgaria in 2018(%)



Total: 0.6 Mtoe



Total: 8.1 Mtoe

Foreign suppliers of gas in Bulgaria in 2018 (%)

Foreign suppliers of electricity in Bulgaria in 2018 (%)



Total: 2.6 Mtoe



Total: 0.2 Mtoe

Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 3.3 Greenhouse gas emissions

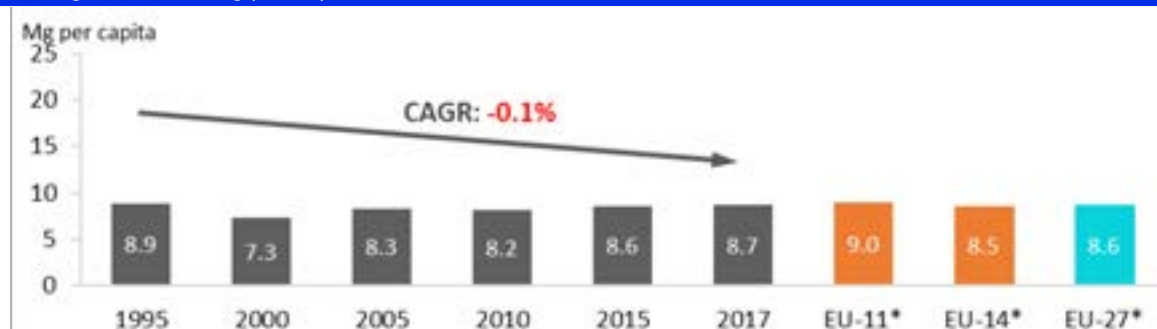
Between 1995-2017 greenhouse gases emissions in Bulgaria were reduced - from over 74.6 Mt CO<sub>2</sub> in 1995 to 61.4 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 8.7 Mg CO<sub>2</sub> per capita in 2017 (from 8.9 Mg CO<sub>2</sub> per capita in 1995), which is higher comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), but lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

There were some noteworthy changes in the Bulgarian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction sector emissions dropped swiftly by 72%, as well as emissions from industrial processes and waste management, respectively 38% and 46%. On other hand, transport emissions gained in importance increasing by 115%.

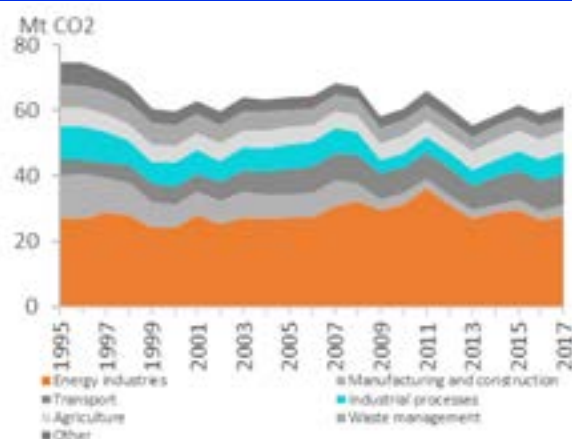
Comparing to EU-11, EU-14 and EU-27 countries, Bulgaria is characterized by higher share of emissions from energy industries (45% versus 35%, 26% and 28%). At the same time greenhouse gas emissions structures in EU-14 and EU-27 are more balanced with transport holding a more significant role.

Item 46: Greenhouse gas emissions in Bulgaria

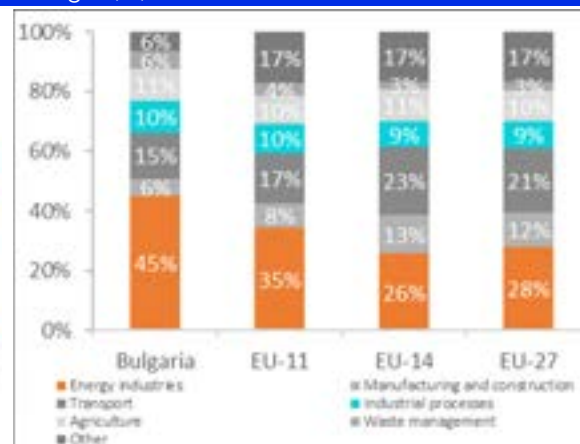
Greenhouse gas emissions per capita in Bulgaria in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Bulgaria by sectors in 1995-2017 (Mt CO<sub>2</sub>)



Greenhouse gas emissions in Bulgaria by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management

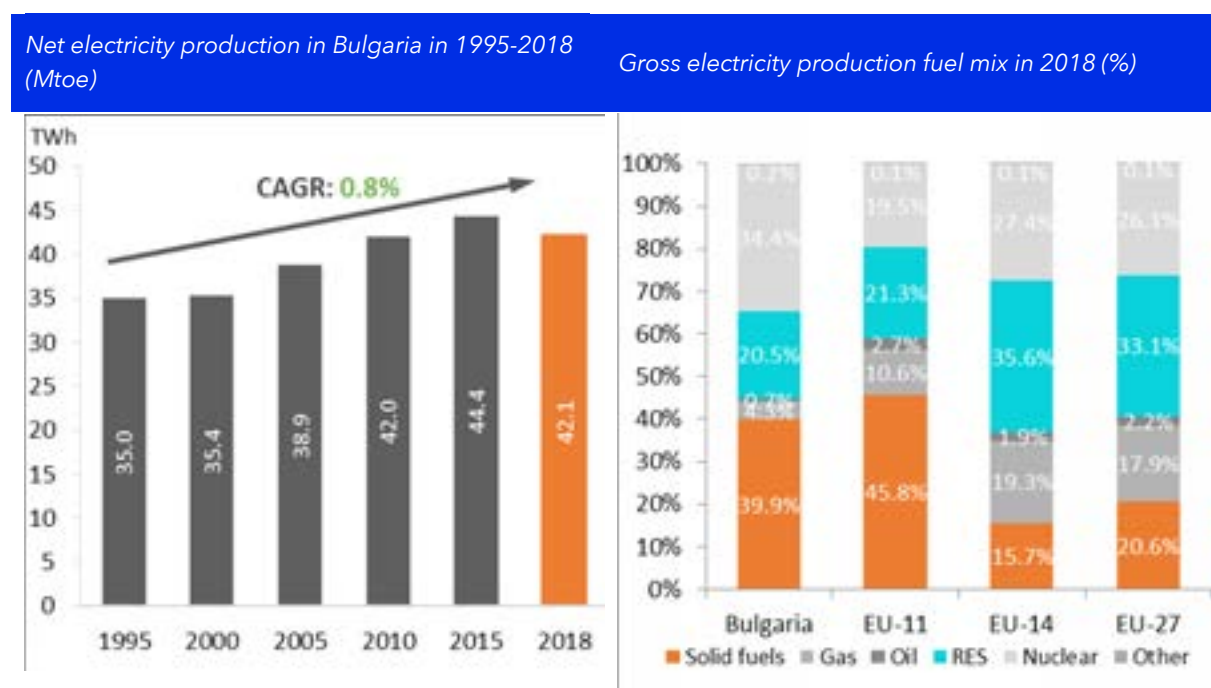
(CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

### 3.4 Overview of the electricity sector

Item 47 presents electricity production and the current fuel mix of Bulgaria. Over last 23 years net electricity production has increased from 35.0 TWh in 1995 to 42.1 TWh in 2018 (CAGR 0.8%). It represents 10.4% of EU-11 total electricity production, which is proportionally lower when compared to Bulgarian GDP share of 4.0%.

The Bulgarian fuel mix is dominated by solid fuels and nuclear energy with respective shares of 39.9% and 34.4%. In total, those two fuels represent therefore as much as 74.3% of total gross electricity production. Compared to EU-14 and EU-27 countries, Bulgaria has a much bigger share of solid fuels and nuclear in its energy mix. On other hand, the country produces relatively less electricity from gas and oil, respectively 4.3% and 0.7%. The share of electricity from renewable energy sources is also lower than in EU-14 and EU-27 countries, respectively 20.5% versus 35.6% and 33.1%).

Item 47: Net electricity production and gross electricity production fuel mix in Bulgaria



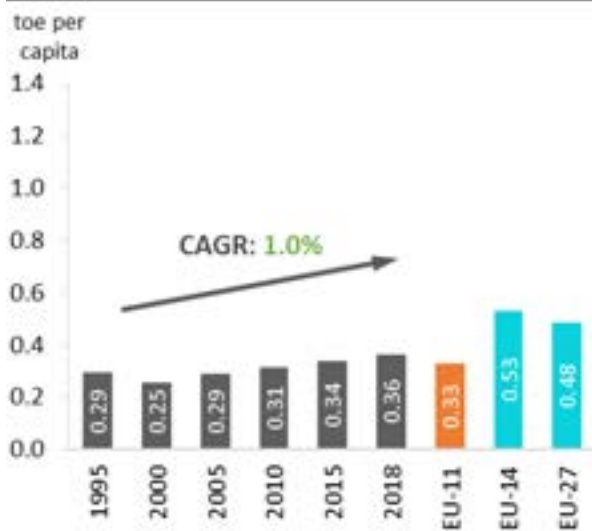
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 48 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Bulgaria has somewhat increased (CAGR in the period of 1995-2019 was around 1.0%) and

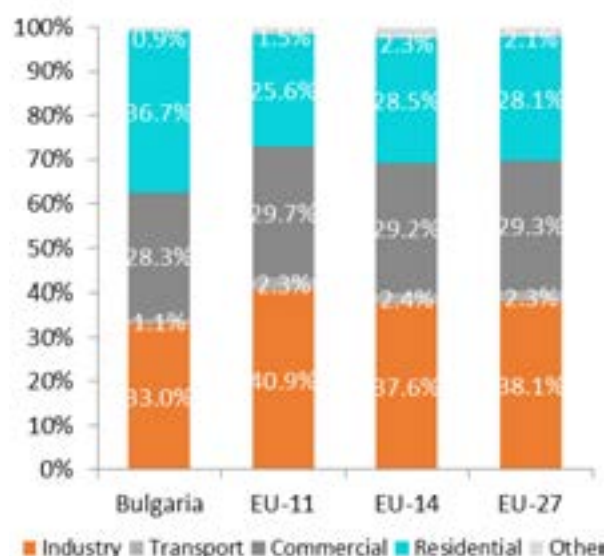
its level is still relatively low compared to EU-14 and EU-27 countries. Bulgarian final energy consumption per capita represents only 68.7% of EU-14 level and 75.3% of EU-27 level (see Item 48). That may indicate that there is an important potential for further growth of electricity consumption in Bulgaria. Generally, the structure of final electricity consumption in Bulgaria is rather like EU averages, with a somewhat higher share of the residential sector.

Item 48: Final consumption of electricity in Bulgaria

Final consumption of electricity per capita in Bulgaria (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)



Final consumption of electricity in Bulgaria by sectors in 2018 (%)

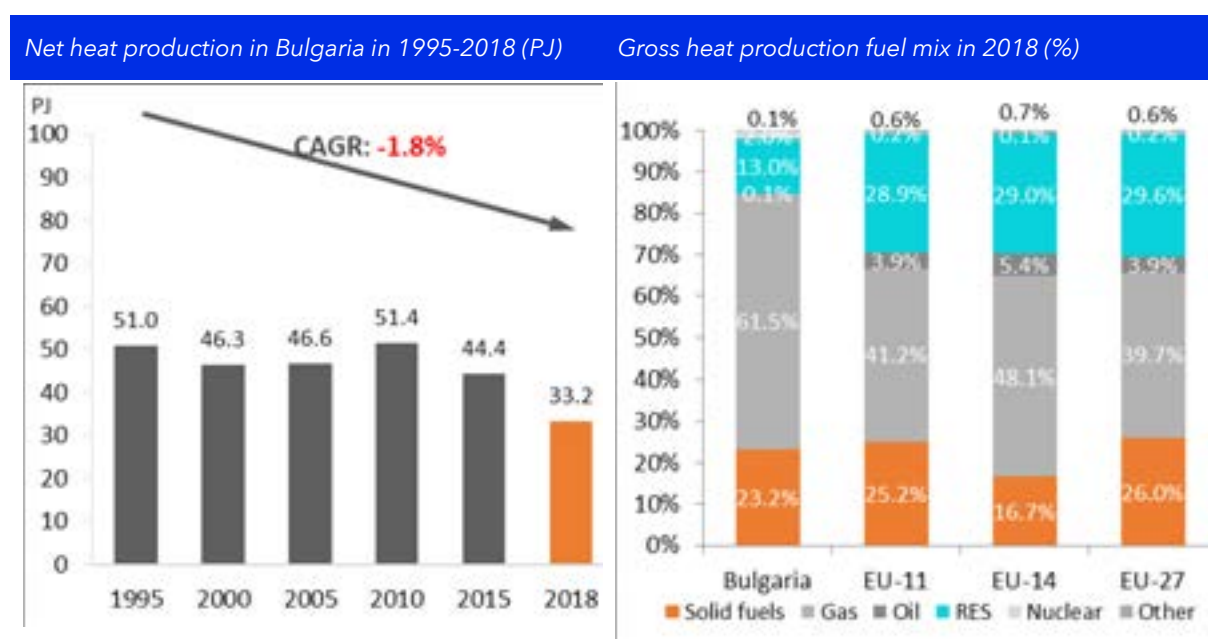


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

### 3.5 Overview of the heat sector

Item 49 presents heat production in Bulgaria as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Bulgaria has dropped between 1995 and 2018 from 51.0 PJ to 33.2 PJ, i.e. at CAGR of -1.8%. Bulgarian production fuel mix is dominated by gas (almost 61.5%) and solid fuels (almost 23.2%). That means that in comparison with EU-14 and EU-27 Bulgaria consumes relatively more gas in heat production. The share of solid fuels is similar, whereas the usage of oil is significantly lower (0.1% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower, about half of level in EU-11, EU-14 and EU-27 countries.

Item 49: Net heat production and gross electricity production fuel mix in Bulgaria



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 50 presents final heat consumption per capita and its breakdown by sectors.

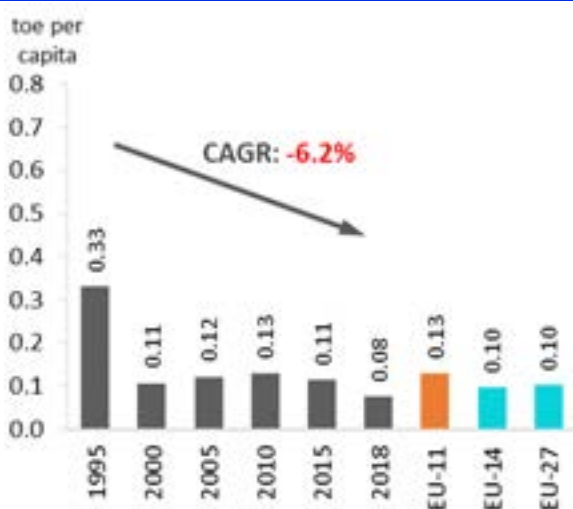
The per capita demand for heat in Bulgaria decreased very swiftly in late 1990s (from 0.33 toe in 1995 to 0.11 toe in 2000). After that, it rebounded slightly up to the level of 0.13 in 2010 and decreased to 0.08 toe per capita in 2018. As a result, within the 23 years analysed, heat consumption per capita in Bulgaria has decreased (from 0.33 toe to 0.08 toe per capita, i.e. at CAGR of -6.2%). The heat consumption in Bulgaria remains lower than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

The structure of final consumption of heat in Bulgaria is characterized by higher share of commercial (24.7% in Bulgaria compared to 21.3% in EU-14 and 20.7% in EU-27) and residential usage (60.0% in Bulgaria compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (13.7% in Bulgaria compared to 37.9% in EU-14 and 32.6% in EU-27).

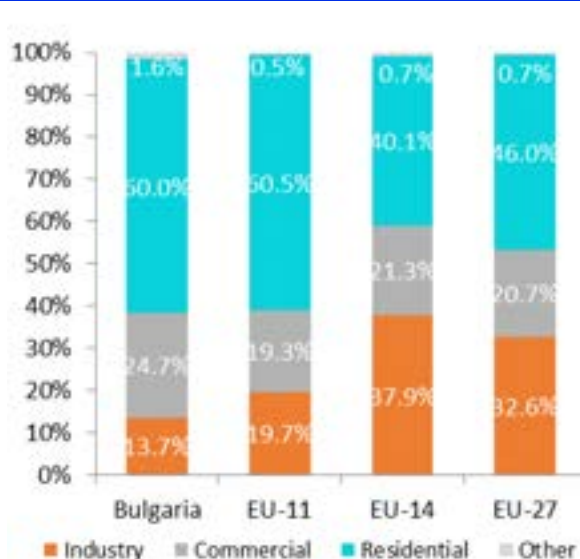
In relation to EU-11 countries, the structure of final heat consumption is similar.

Item 50: Final consumption of heat in Bulgaria

Final consumption of heat per capita in Bulgaria (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)



Final consumption of heat in Bulgaria by sectors in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

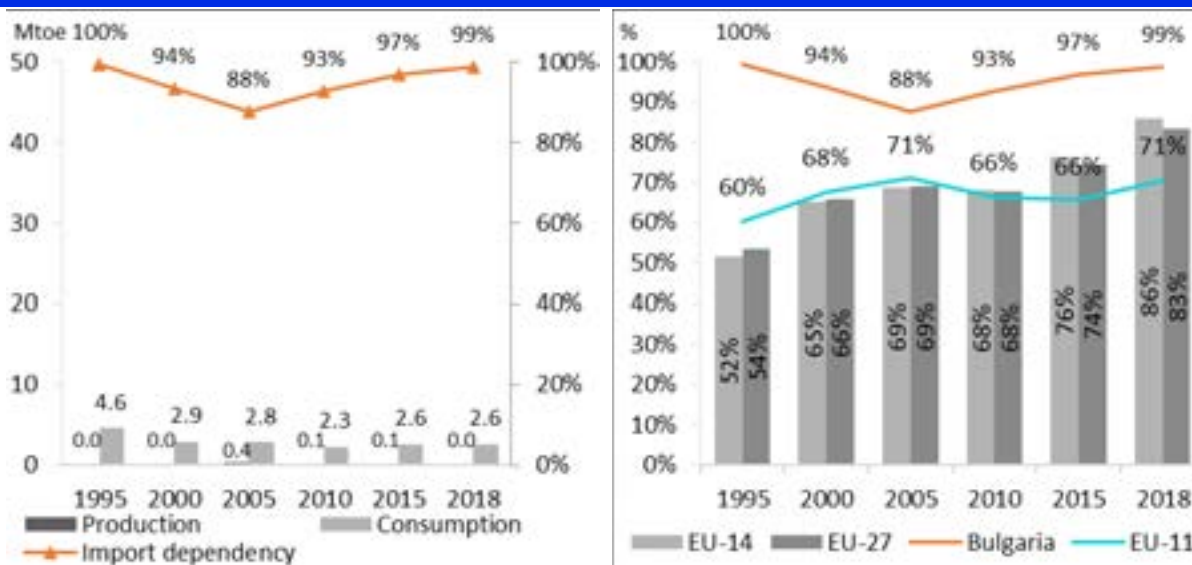
### 3.6 Overview of gas sector

Gas production in Bulgaria is very low comparing (less than 0.1 Mtoe in 2018) to the consumption (2.6 Mtoe in 2018). Therefore, the import dependence remains high - between 88% and 100% in years 1995-2018 (see Item 51). When compared to EU averages significantly higher import dependence is observed between Bulgaria and EU-11, EU-14 and EU-27 countries (99% import dependence of Bulgaria in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 51: Gas sector in Bulgaria

Gas production, gross consumption and import dependence in Bulgaria in 1995-2018 (Mtoe)

Gas Import dependence in Bulgaria and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

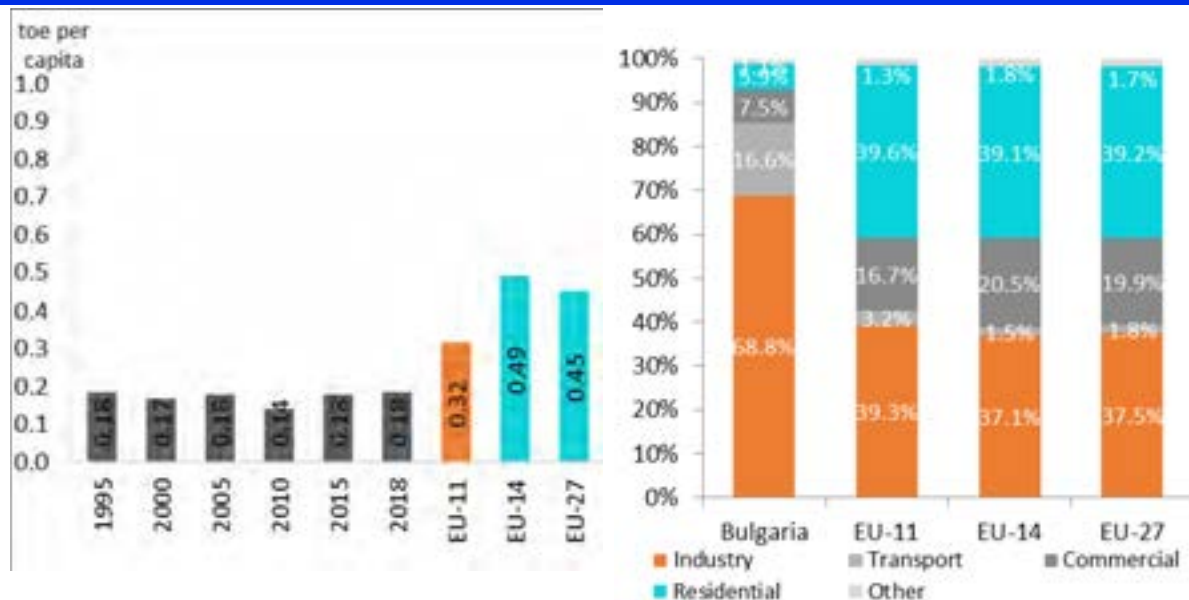
The final consumption of gas per capita in Bulgaria remains stable at level of 0.18 toe per capita and significantly lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

The structure of final gas consumption per sectors also differs. Gas usage in Bulgaria is dominated by industry (68.8%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%. The share of gas usage in transport sector in Bulgaria is also higher (16.6% compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27). On other hand gas in residential and commercial sectors is significantly less present - 7.5% in commercial sector in Bulgaria comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27, and 5.9% in residential sector in Bulgaria comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27.

Item 52: Final consumption of gas per capita in Bulgaria in 1995-2018 and gas final consumption by sectors in Bulgaria and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Bulgaria (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Bulgaria and EU-11, EU-14 and EU-27 countries in 2018

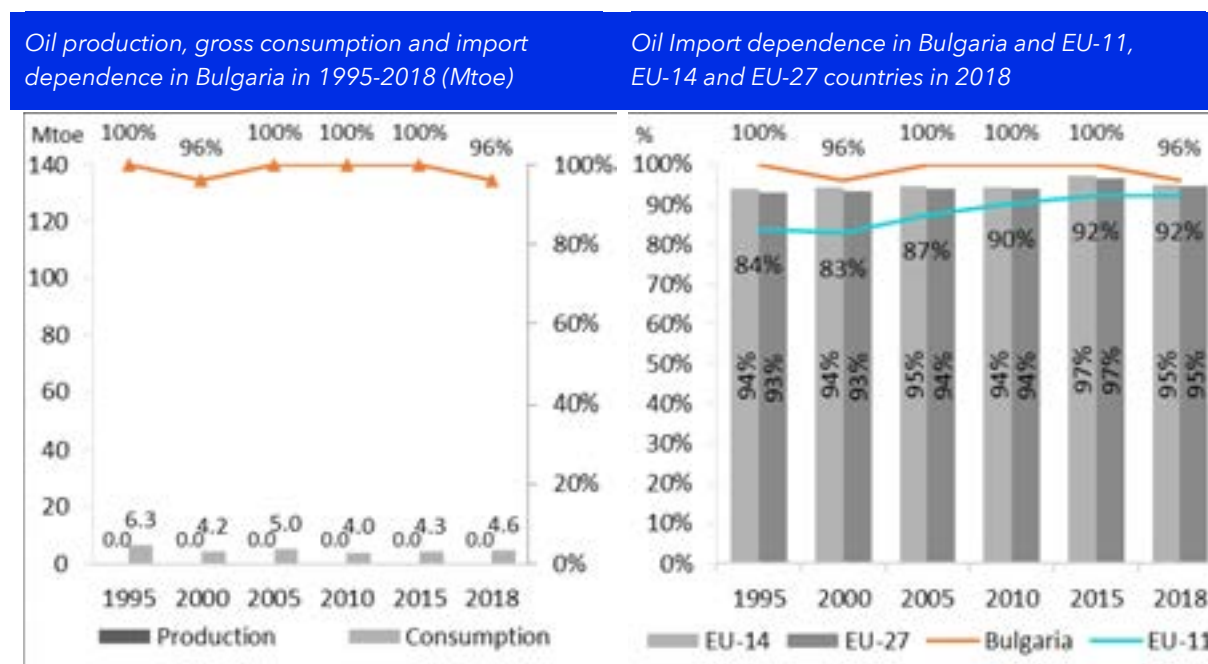


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

### 3.7 Overview of the oil sector

Oil production in Bulgaria is very low (less than 0.1 Mtoe in 2018) comparing to the consumption (4.6 Mtoe in 2018). Therefore, the import dependence remains high - between 96% and 100% in years 1995-2018 (see Item 53). When compared to EU averages higher import dependence is observed between Bulgaria and EU-11, EU-14 and EU-27 countries (96% import dependence of Bulgaria in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27). The level of oil import dependence of Bulgaria is closing to EU averages in 2018.

Item 53: Oil sector in Bulgaria



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

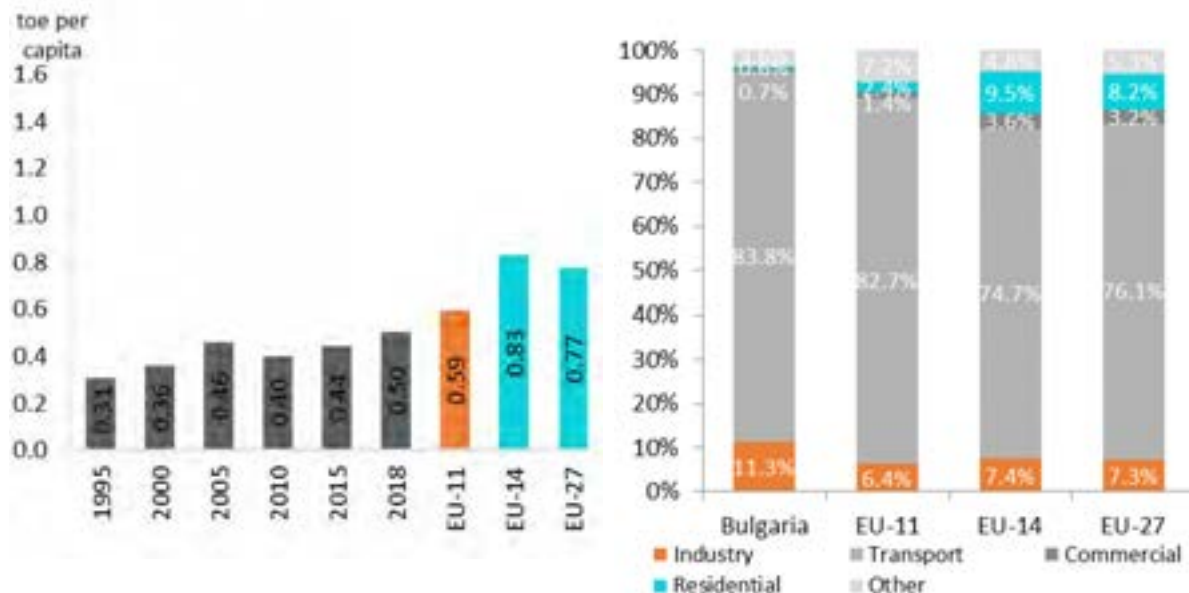
The final consumption of oil per capita in Bulgaria has increased for 0.31 toe per capita in 1995 to 0.50 toe per capita in 2018. It remains lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.59 toe per capita, 0.83 toe per capita, 0.77 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of industry and transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 83.8% in Bulgaria comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are twice higher in Bulgaria than in EU-11 and EU-27 countries, whereas commercial and residential usage is significantly lower.

Item 54: Final consumption of oil per capita in Bulgaria in 1995-2018 and oil final consumption by sectors in Bulgaria and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Bulgaria (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Bulgaria and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

### 3.8 EU climate policy and its targets for Bulgaria

Bulgaria is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 55)

*Item 55: Energy and climate targets for Bulgaria for 2020 and 2030*

	Bulgaria 2020 targets	Bulgaria 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS – Effort Sharing Decision (ESD)	+20% in relation to their 2005 levels	-
National emission reduction targets in non-ETS – Effort Sharing Regulations (ESR)	-	0% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	16% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 16.9 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 8.6 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

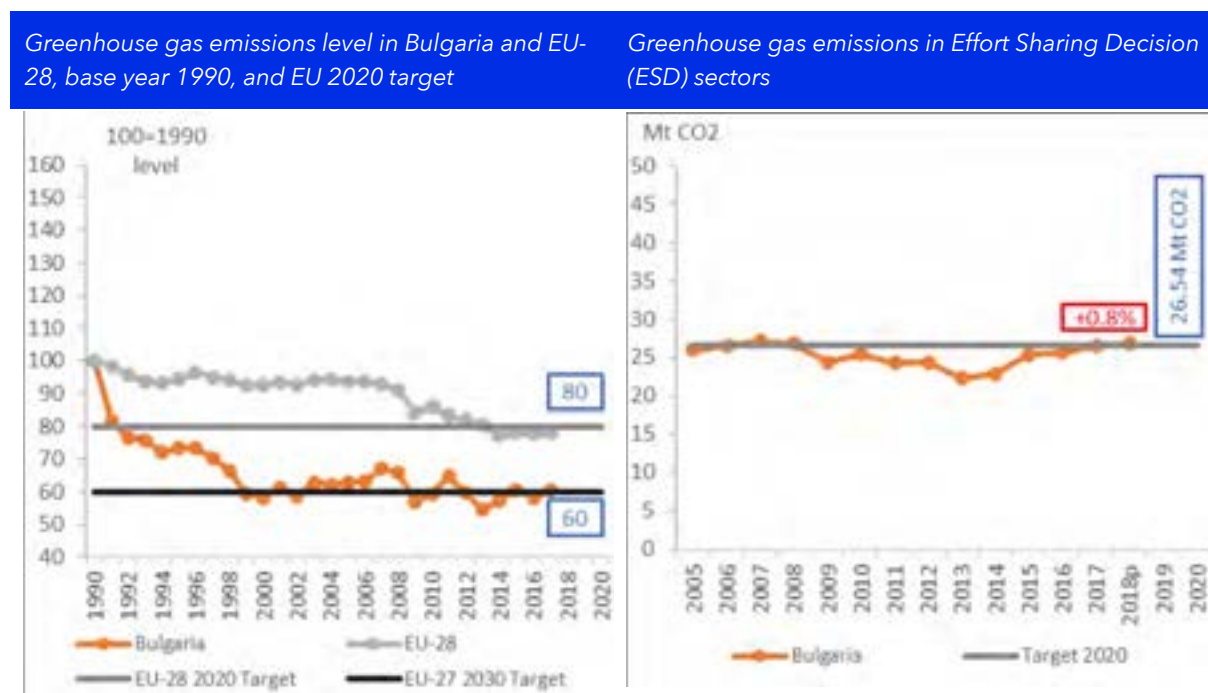
In following chapter, the overview of Bulgaria targets and performance are summarized.

### 3.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Bulgaria is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Bulgaria is 26.54 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions exceeds the target by 0.8%.

Item 56: Energy efficiency target data for Bulgaria



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 3.8.2 Renewable energy sources

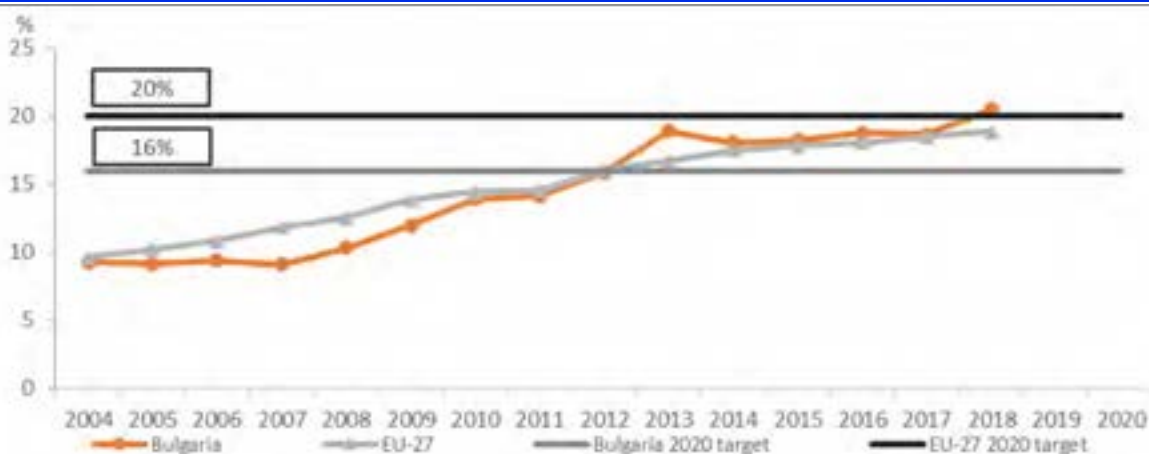
The following targets are set for Bulgaria regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 16% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Bulgaria is already above EU wide and country specific targets.

Item 57: Share of energy from renewable energy sources in gross final energy consumption in Bulgaria

Share of energy from renewable energy sources in gross final energy consumption in Bulgaria in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 3.8.3 Energy efficiency

The energy efficiency target set for Bulgaria are respectively:

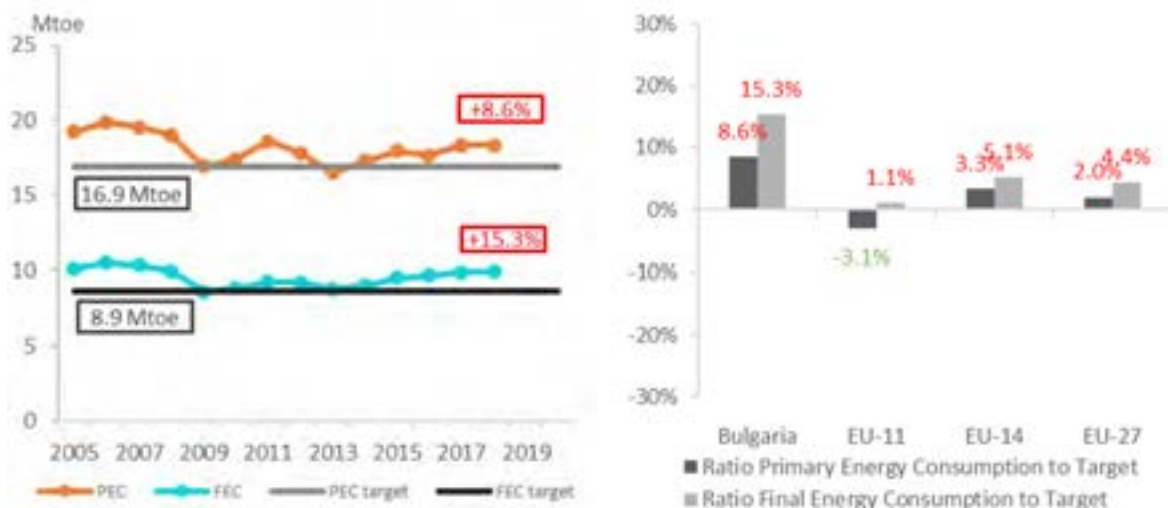
- Primary Energy Consumption in 2020: 16.9 Mtoe
- Final energy consumption in 2020: 8.9 Mtoe

Following the information provided in Item 58 the results for 2018 are above the targets in both criteria, respectively +8.6% of primary energy consumption and 15.3% of final energy consumption. This does not exclude Bulgaria to achieve the targets in 2020.

## Item 58: Energy efficiency target data for Bulgaria

Primary energy consumption and final energy consumption in Bulgaria in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Bulgaria, EU-11, EU-14 and EU-27 in 2018



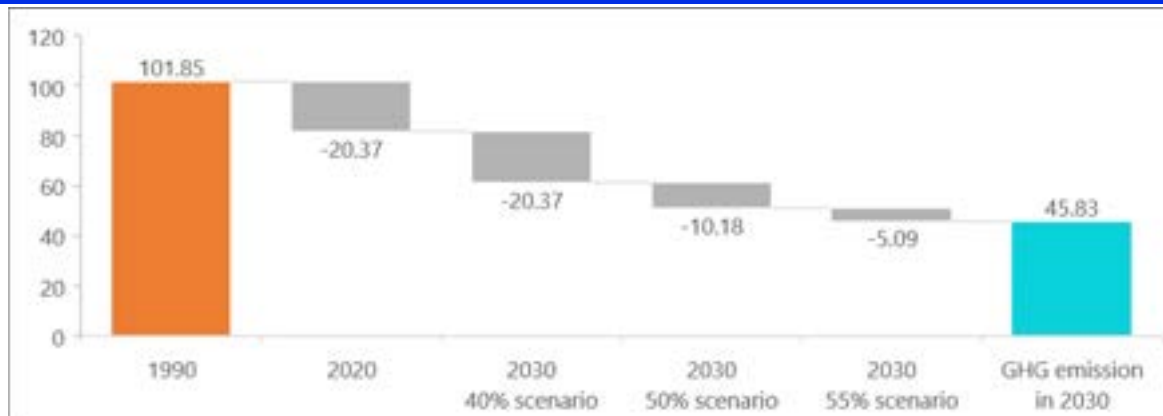
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030) (PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

### 3.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Bulgaria greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 20.37 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 20.37Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 10.18 Mt CO<sub>2</sub> emission decrease is needed, or 15.27 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Bulgaria up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Bulgaria was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% will be much higher than the one to achieve 2020 targets.

Item 59: Estimation regarding greenhouse gas emissions in Bulgaria under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Bulgaria under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 4 Croatia

### 4.1 General information

Croatia is the 8<sup>th</sup> largest country within EU-11 group in terms of total country area and represents 5.0% of the area. At the same time, it is the 18<sup>th</sup> country in EU-27 with 1.3% of the area. It represents 4.0% of EU-11 population and 0.9% of EU-27 population, but only 3.7% of its total nominal GDP of EU-11 and 0.4% of EU-27. Despite the robust economic growth in 1995-2018 period, in 2018 Croatian GDP per capita amounted only to 63% of the whole EU average.

Item 60: Croatia - key data



#### Key data

Population (M)	4.1
GDP per capita (EUR, nominal)	12,620
GDP per capita (EUR, PPS)	19,490
GDP as share of EU-11	3.7%
GDP as share of EU-27	0.4%
Energy intensity of the economy (kgoe per 1,000 EUR)	110.9
Greenhouse gas emissions (Mg per capita)	6.1

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 4.8% Croatian economy considerably grew in the period of 1995-2018 (see Item 61). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 58% and 63% of the respective averages) – if purchasing power is taken into consideration.

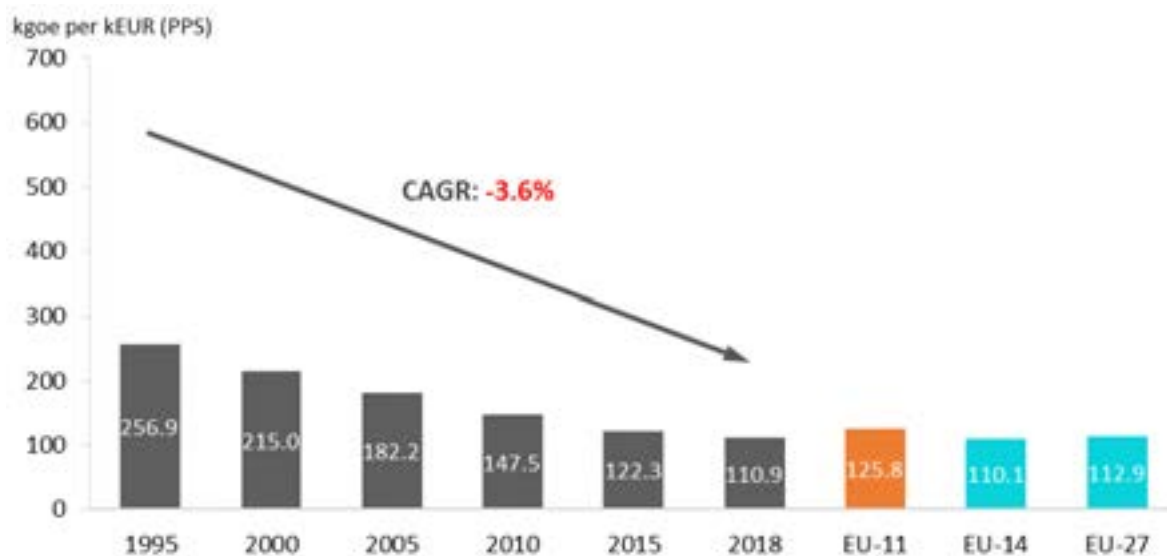
Item 61: GDP per capita in Croatia for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Croatia GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Croatian economy energy intensity is at EU-14 level thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 146.0 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than half. In EU-14 and EU-27 average values are similar and in EU-11 average is 1.1 times higher than in Croatia.

*Item 62: Energy intensity of the economy in Croatia in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)*



*Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) - EI\_GDP\_PPS*

## 4.2 Energy balance of Croatia

In Item 63 the energy balance of Croatia in 2018 as well as historical values of net imports of energy are shown. The primary energy production was 4.2 Mtoe in 2018. Net import accounted for 4.6 Mtoe and gross inland consumption was 8.7 Mtoe.

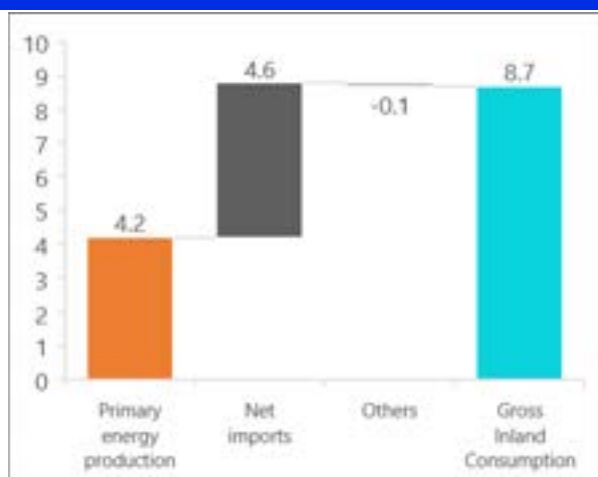
The primary energy production has dropped from about 5 Mtoe in 1995 to 4.2 Mtoe in 2018. At the same time gross inland consumption has increased from 7.8 Mtoe in 1995 to 8.7 Mtoe in 2018. The increased consumption is met by import.

Net import increased from about 3 Mtoe to more than 4 Mtoe over past 23 years. Its share in meeting the energy needs of the country increased from about 40% to more than 50% in 2018.

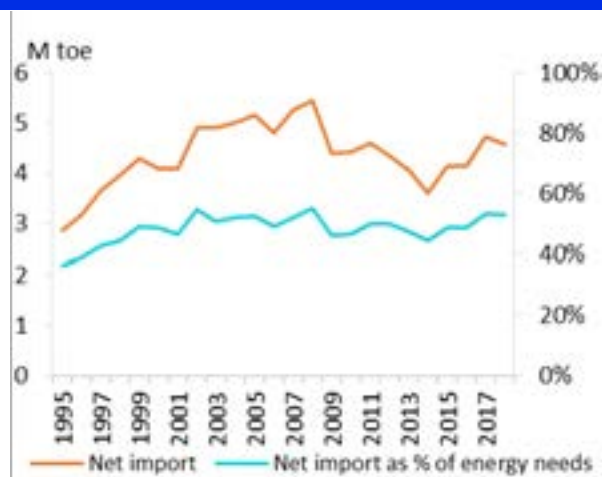
Due to an increase of gross inland consumption and decrease of primary energy production the import dependence of Croatia has increased. In 1995 the country was meeting 63% of its energy needs versus only 48% in 2018.

## Item 63: Energy balance in Croatia

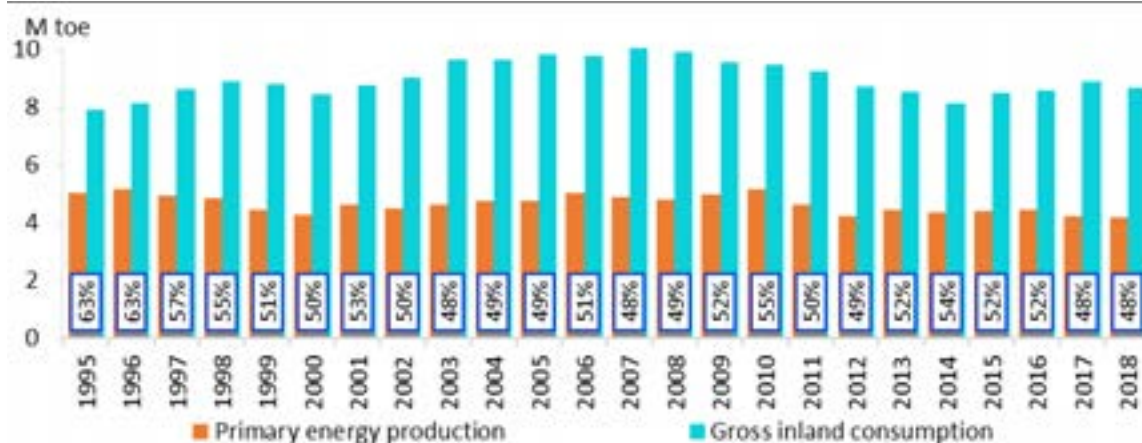
Energy balance in Croatia in 2018 (Mtoe)



Net import of energy in Croatia in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Croatia (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

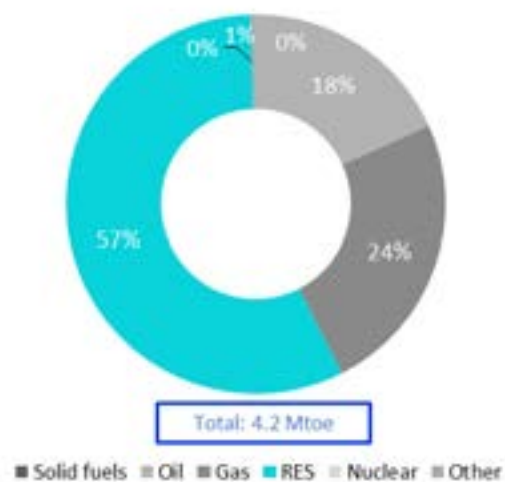
Considering the primary energy production, one can notice that 57% is based on renewable energy sources. Gas production accounts for 24% and oil for 18% of primary energy production.

Comparing to EU-11 group Croatia has a higher share of renewable energy sources - 57% versus 22% average for EU-11. The share of oil and gas in the primary energy production mix are also higher than EU-11 averages. On other hand the solid fuels and nuclear are absent from the energy mix.

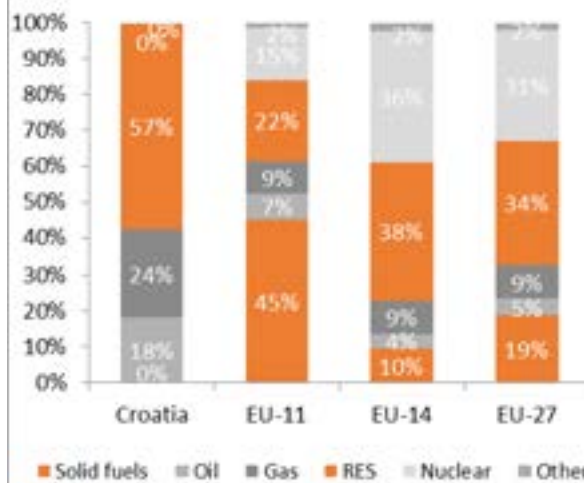
When compared to the group of developed Western European countries (EU-14), Croatia has a very high share of renewable energy sources (57% versus 36%). The share of oil and gas are also higher in Croatia (respectively 18% versus 4% and 24% versus 9%). In opposition to EU-14 countries average there is no nuclear and solid fuels in the Croatian primary energy production mix.

Item 64: Primary energy structure in Croatia

Primary energy structure in Croatia in 2018 (%)



Primary energy production structure in Croatia in 2018 in comparison with EU-11, EU-14, and EU-27 averages

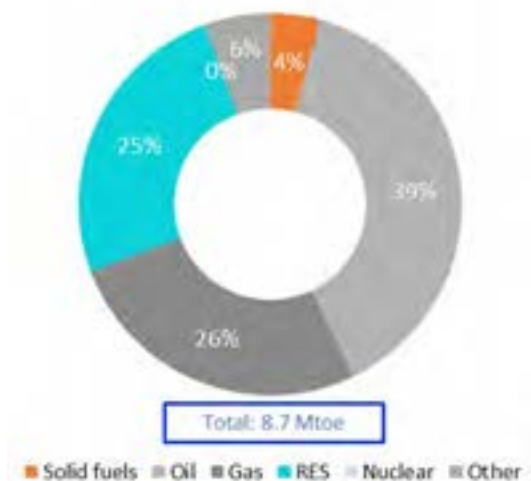


Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy – Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

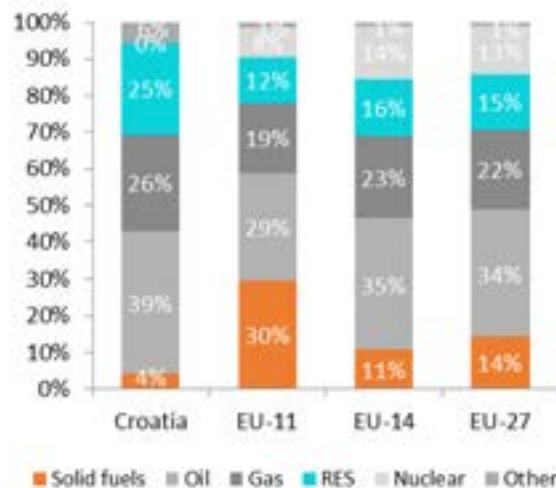
On the consumption side, oil, gas, and RES have a dominant position - 90%. The remaining 10% are solid fuels and other energy sources. The Croatian gross inland consumption is characterized by low share of solid fuels (4%) compared to EU-11 (30%), but also EU-14 (11%) and EU-27 (14%) averages.

## Item 65: Gross inland consumption structure in Croatia

Gross inland consumption structure in Croatia in 2018 (%)



Gross inland consumption structure in Croatia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



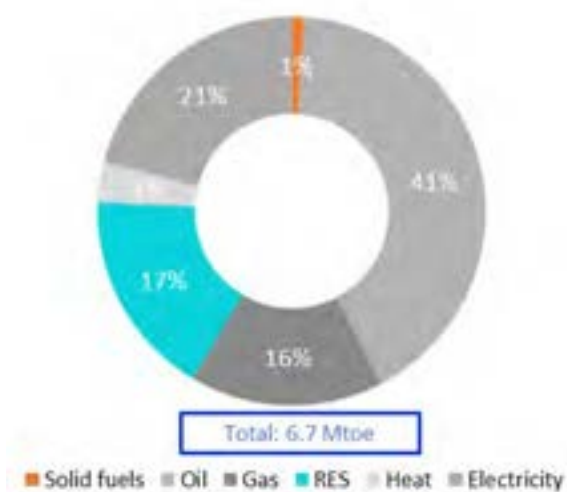
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption - GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Croatia is dominated by petroleum products - 41% of total energy consumption in 2018 (see Item 66). The shares of electricity, gas and RES are comparable, respectively 21%, 16% and 17%. The mix is completed by heat (4%) and solid fuels (1%).

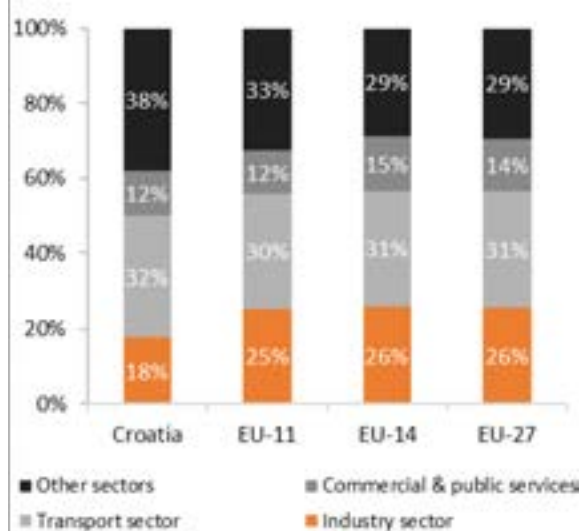
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Croatia has a lower share of industry sector in final energy consumption. At the same time, the commercial and public sectors consume more energy than EU-11, EU-14 and EU-27 averages. The share of other sectors is also slightly higher in Croatia than the averages presented in the graph.

Item 66: Final energy consumption structure in Croatia

Final energy consumption structure in Croatia in 2018 (%)



Final energy consumption structure in Croatia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

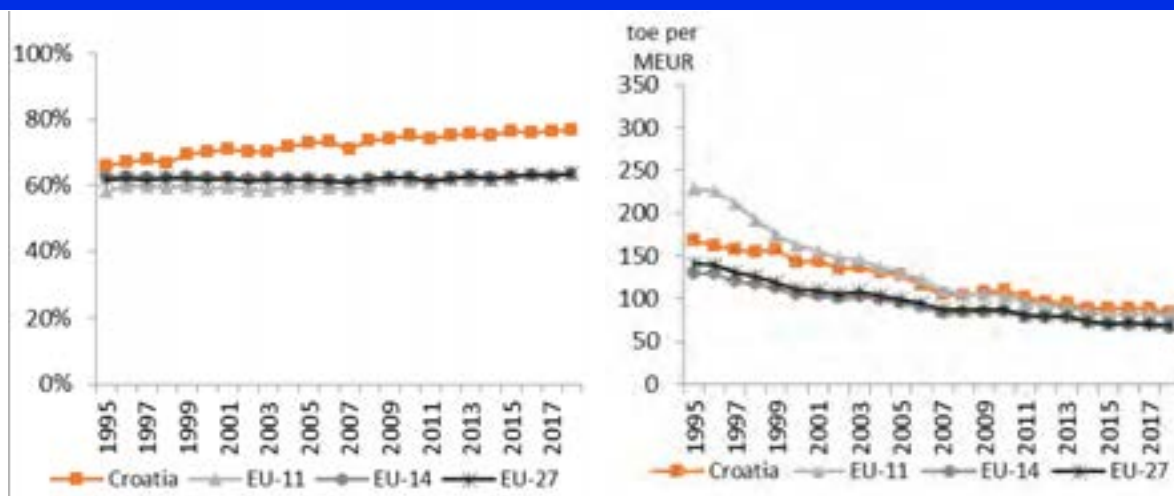
Croatian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were significantly higher than the averages for EU-11, EU-14 and EU-27. Furthermore, its level in Croatia has increased stable since 1995.

Simultaneously, a decrease of energy volume associated with generating gross domestic product was noticed (from 168.0 toe per MEUR to 83.8 toe per MEUR). The latter value is only a bit higher than EU-11 average while corresponding values for EU-14 and EU-27 countries in 2018 were merely 66.2 and 68.4 toe per MEUR of GDP, respectively.

## Item 67: Final energy consumption in Croatia in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Croatia in 1995-2018 (%)

Final energy consumption to gross domestic product ratio in Croatia in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)



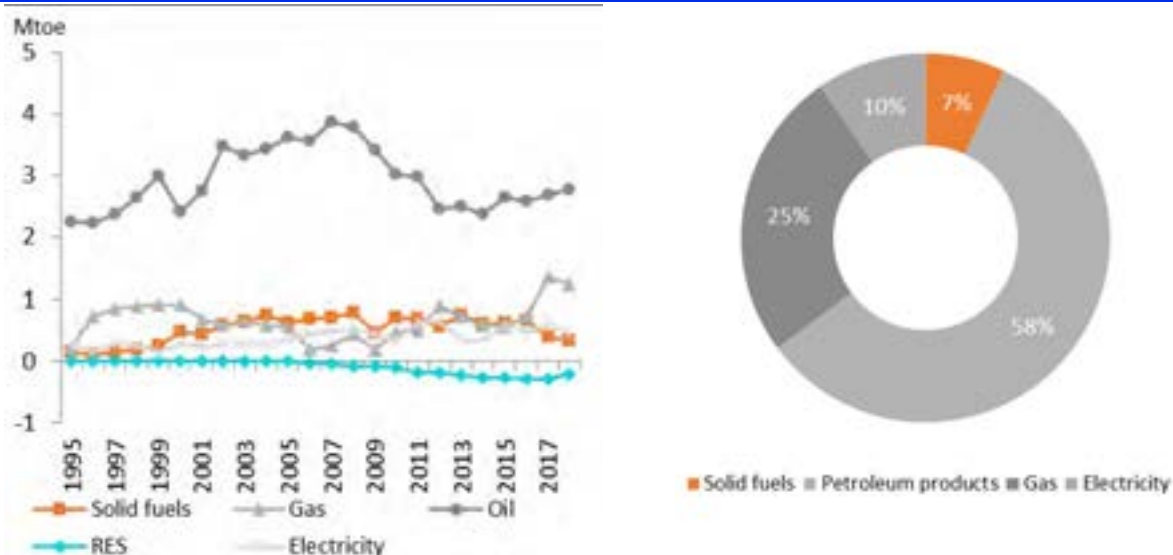
Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

Total net import of energy in Croatia has increased in years 1995-2018. Analysis of its structure in 2018 indicates the dominance of petroleum products which constitute over 58% of total net import value. The other two net imported energy sources are gas and electricity with respective shares of 25% and 10%. The mix is closed by solid fuels - 7%. The import of oil has increased since 1995 up to 2009 and then it has decreased close to initial level. The import of electricity has increased in last 23 years as well as export of RES (see Item 68).

## Item 68: Net import of energy in Croatia

Net import of energy by fuel in 1995-2018 (Mtoe)

Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)

Croatia import solid fuels mainly from Russia and the United States (respectively 39% and 38%). The rest is imported from several countries and only Columbia share is exceeding the 10%. The level of import remains low - 0.3 Mtoe.

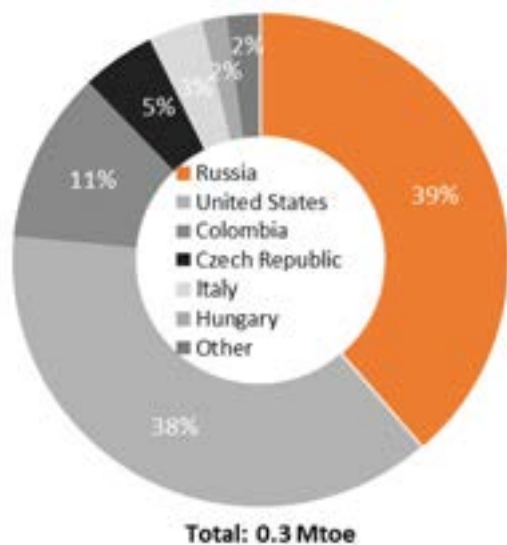
Crude oil is imported from many countries. The key suppliers are Iraq (18%), Italy (15%), Russia (14%) and Azerbaijan (13%). More than 40% is supplied by other countries.

Gas is imported mainly from Hungary (81%) and Slovenia (19%). Small amounts are imported from Austria and United Kingdom.

Electricity is supplied from Bosnia and Herzegovina (47%), Hungary (22%), Slovenia (17%) and Serbia (14%).

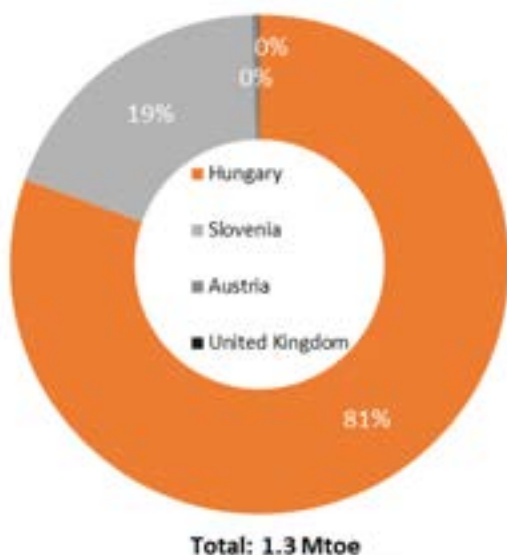
## Item 69: Foreign fuel suppliers

Foreign suppliers of solid fuels in Croatia in 2018 (%) Foreign suppliers of crude oil in Croatia in 2018(%)



Foreign suppliers of gas in Croatia in 2018 (%)

Foreign suppliers of electricity in Croatia in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 4.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Croatia were increased - from over 22.9 Mt CO<sub>2</sub> in 1995 to 25.0 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 6.1 Mg CO<sub>2</sub> per capita in 2017 (from 5.0 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

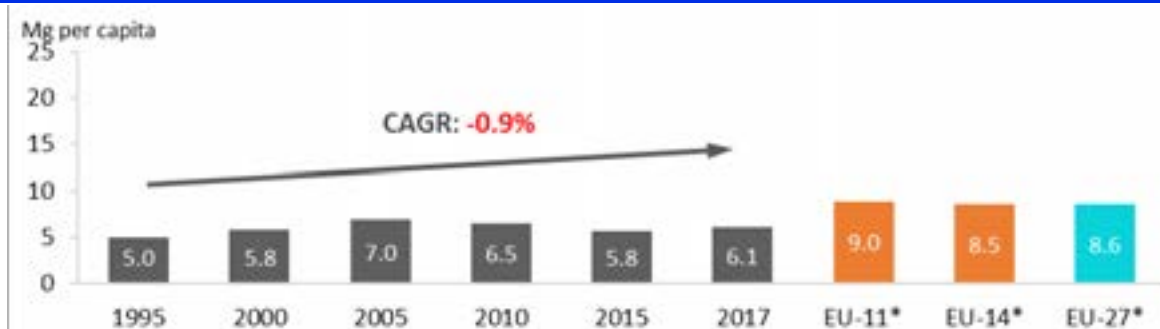
There were some noteworthy changes in the Croatian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction

sector emissions dropped swiftly by 19%, as well as emissions from energy industries and agriculture, respectively 14% and 13%. On other hand, transport emissions gained in importance increasing by 97%, as well as waste management - 79%.

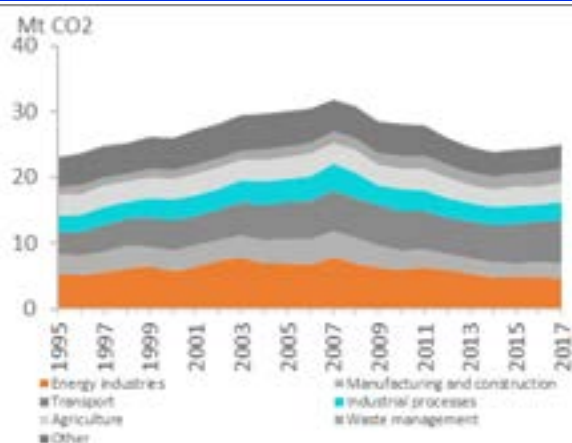
Comparing to EU-11, EU-14 and EU-27 countries, Croatia is characterized by lower share of emissions from energy industries (18% versus 35%, 26% and 28%), but higher share of emissions from transport (27% versus 17%, 23% and 21%).

Item 70: Greenhouse gas emissions in Croatia

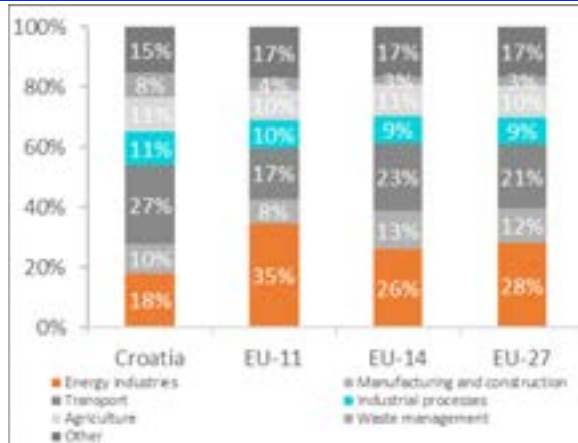
Greenhouse gas emissions per capita in Croatia in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Croatia by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Croatia by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



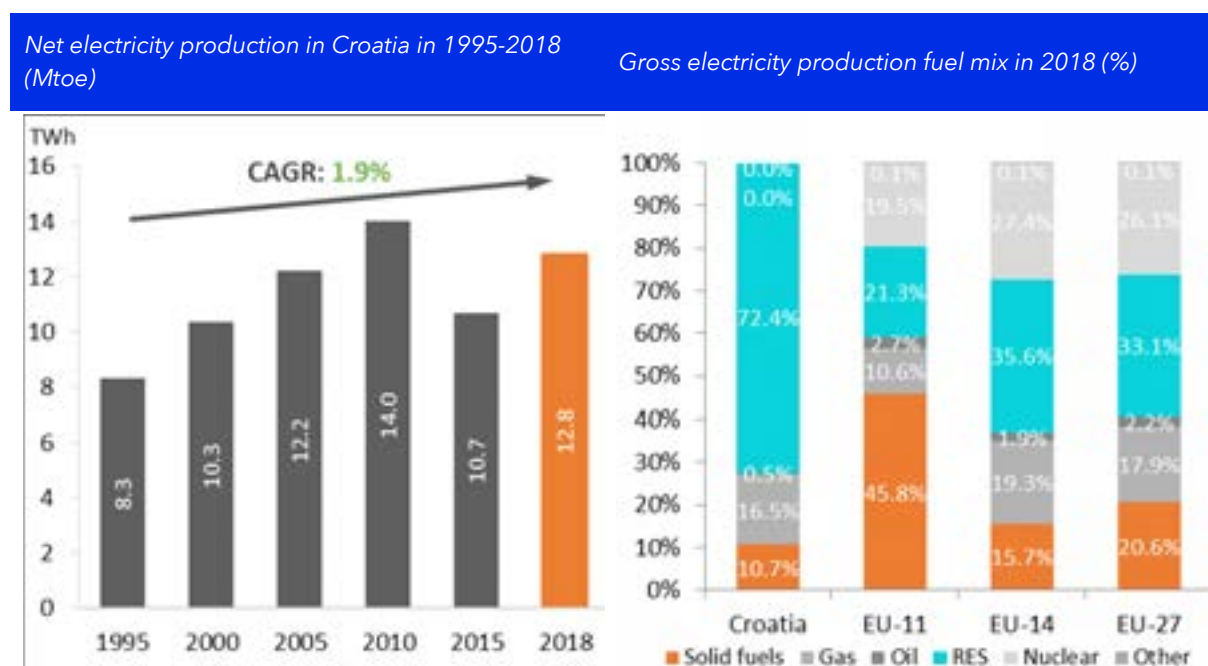
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 4.4 Overview of the electricity sector

Item 71 presents electricity production and the current fuel mix of Croatia. Over last 23 years net electricity production has increased from 8.3 TWh in 1995 to 12.8 TWh in 2018 (CAGR 1.9%). As visible, net electricity production represents 3.2% of EU-11 total electricity production, which is a significant value, especially when compared to Croatian GDP share of 4.0%.

The Croatian fuel mix is dominated by renewable energy sources with share of 72.4%. Compared to EU-14 and EU-27 countries, Croatia has a much bigger share of RES in its energy mix. On other hand, the country produces relatively less electricity from solid fuels and oil, respectively 10.7% and 0.5%. The share of electricity from gas is also lower than in EU-14 and EU-27 countries, respectively 16.5% versus 19.3% and 17.9%.

Item 71: Net electricity production and gross electricity production fuel mix in Croatia



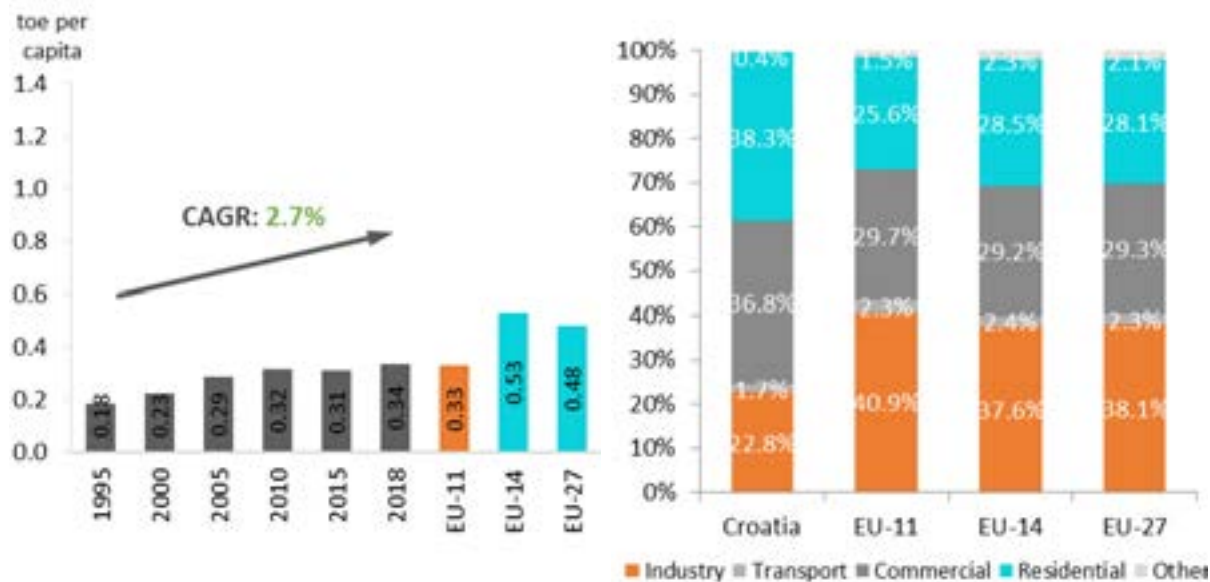
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 72 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. In recent years final consumption of electricity in Croatia increased (CAGR in the period of 1995-2019 was around 2.7%) and its level is still relatively low compared to EU-14 and EU-27 countries. Croatian final energy consumption per capita represents only 63.9% of EU-14 level and 70.0% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Croatia. Generally, the structure of final electricity consumption in Croatia is rather like EU averages, with a somewhat higher share of the commercial and residential sector and lower share of industry and transport.

Item 72: Final consumption of electricity in Croatia

Final consumption of electricity per capita in Croatia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Croatia by sectors in 2018 (%)

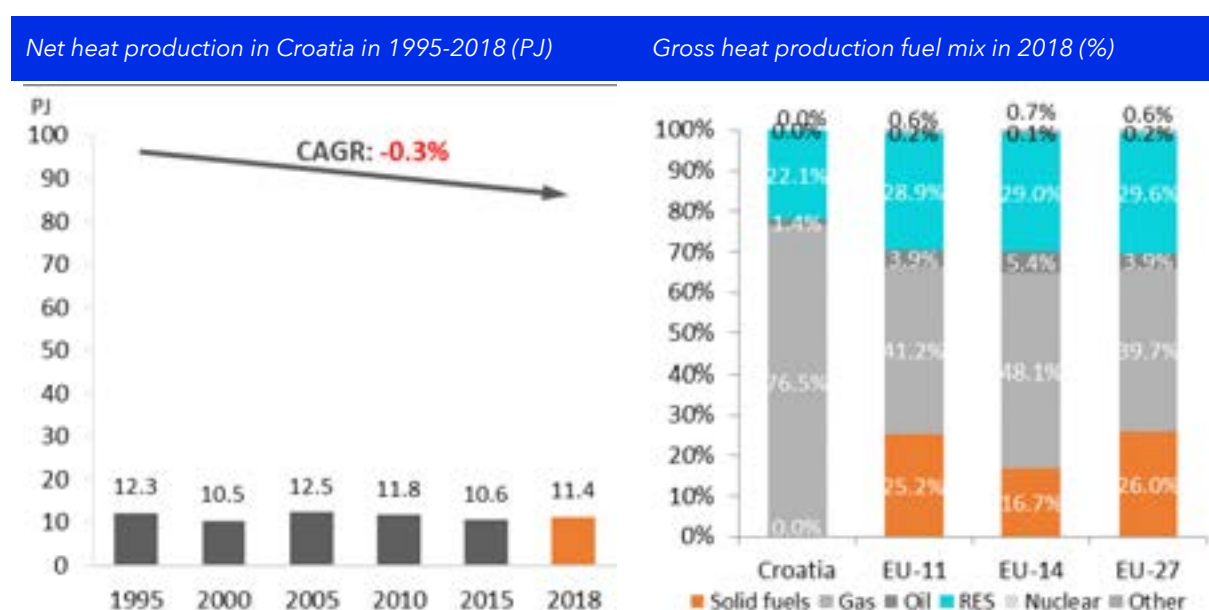


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 4.5 Overview of the heat sector

Item 73 presents heat production in Croatia as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Croatia has dropped between 1995 and 2018 from 12.3 PJ to 11.4 PJ, i.e. at CAGR of -1.3%. Croatian production fuel mix is dominated by gas (almost 76.5%) and renewable energy sources (almost 22.1%). That means that in comparison with EU-14 and EU-27 Croatia consumes relatively more gas in heat production. The share of solid fuels is very low, whereas the usage of oil is significantly lower (1.4% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries).

Item 73: Net heat production and gross electricity production fuel mix in Croatia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 74 presents final heat consumption per capita and its breakdown by sectors.

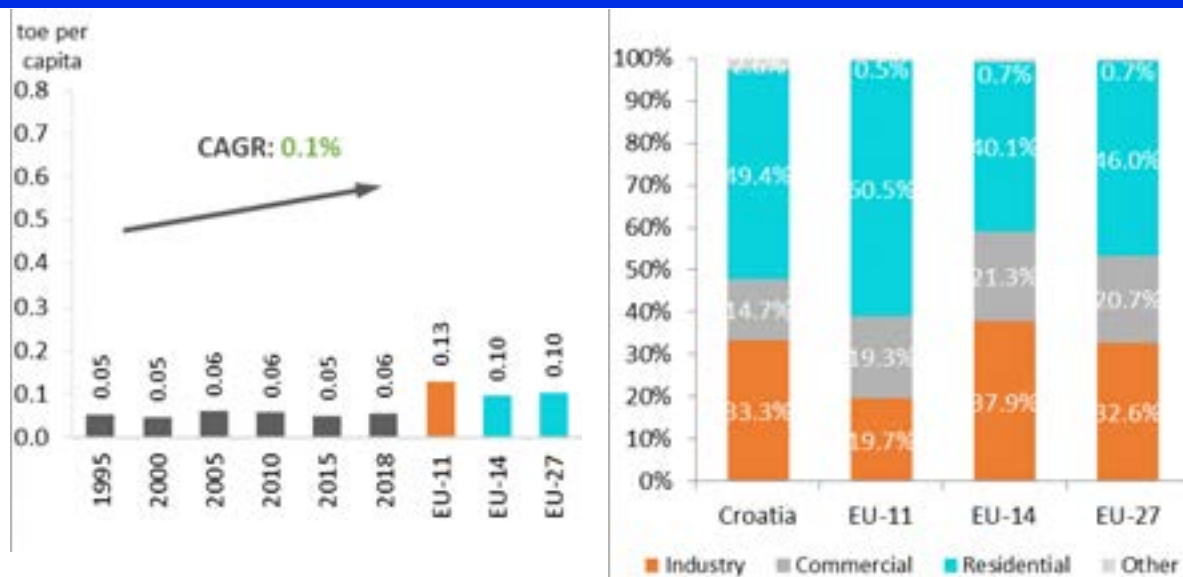
The per capita demand for heat in Croatia has increased from 0.05 toe in 1995 to 0.06 toe in 2018. As a result, within the 23 years analysed, heat consumption per capita in Croatia has increased at CAGR of 0.1%. The heat consumption in Croatia remains lower than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

The structure of final consumption of heat in Croatia is characterized by higher share residential usage (49.4% in Croatia compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (33.3% in Croatia compared to 37.9% in EU-14 and 32.6% in EU-27) as well as usage of heat in commercial sector (14.7% in Croatia compared to 21.3% in EU-14 and 20.7% in EU-27).

Item 74: Final consumption of heat in Croatia

Final consumption of heat per capita in Croatia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Croatia by sectors in 2018 (%)



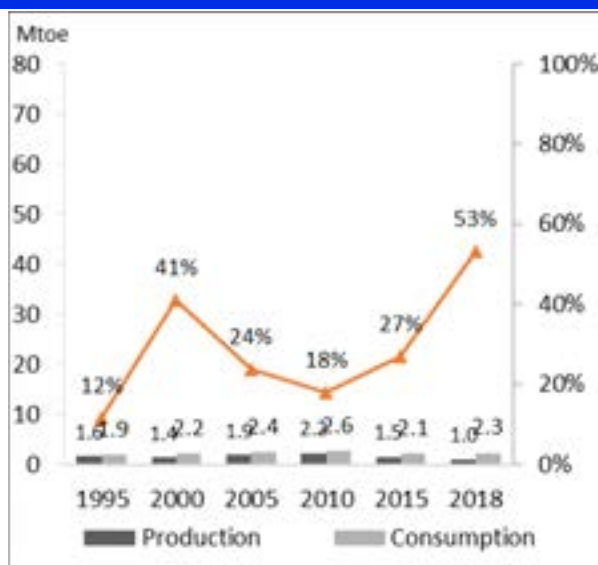
Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 4.6 Overview of gas sector

Gas production in Croatia is low (1.0 Mtoe in 2018) comparing to the consumption (2.3 Mtoe in 2018). Therefore, the import dependence remains considerable - between 12% and 53% in years 1995-2018 and it has been increasing (see Item 75). When compared to EU averages lower import dependence is observed between Croatia and EU-11, EU-14 and EU-27 countries (53% import dependence of Croatia in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 75: Gas sector in Croatia

Gas production, gross consumption and import dependence in Croatia in 1995-2018 (Mtoe)



Gas Import dependence in Croatia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

The final consumption of gas per capita in Croatia has increased from 0.19 toe per capita in 1995 to 0.26 toe per capita in 2018 and it remains lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

The structure of final gas consumption per sectors is similar to E. Gas usage in Croatia is predominantly use in residential sector (43.4% comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27) and industry (68.8%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%. The share of gas usage in transport sector in Croatia is also lower than European averages (0.4% compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27).

On other hand gas in commercial sectors is less present - 18.8% in commercial sector in Croatia comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27.

Item 76: Final consumption of gas per capita in Croatia in 1995-2018 and gas final consumption by sectors in Croatia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Croatia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Croatia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 4.7 Overview of the oil sector

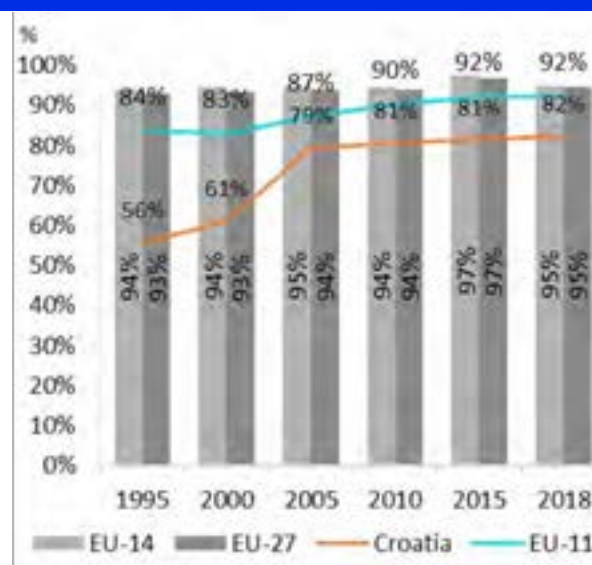
Oil production in Croatia is very low (0.8 Mtoe in 2018) comparing to the consumption (3.4 Mtoe in 2018). Therefore, the import dependence remains high - between 56% and 82% in years 1995-2018 (see Item 77). When compared to EU averages lower import dependence is observed between Croatia and EU-11, EU-14 and EU-27 countries (82% import dependence of Croatia in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 77: Oil sector in Croatia

Oil production, gross consumption and import dependence in Croatia in 1995-2018 (Mtoe)



Oil Import dependence in Croatia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

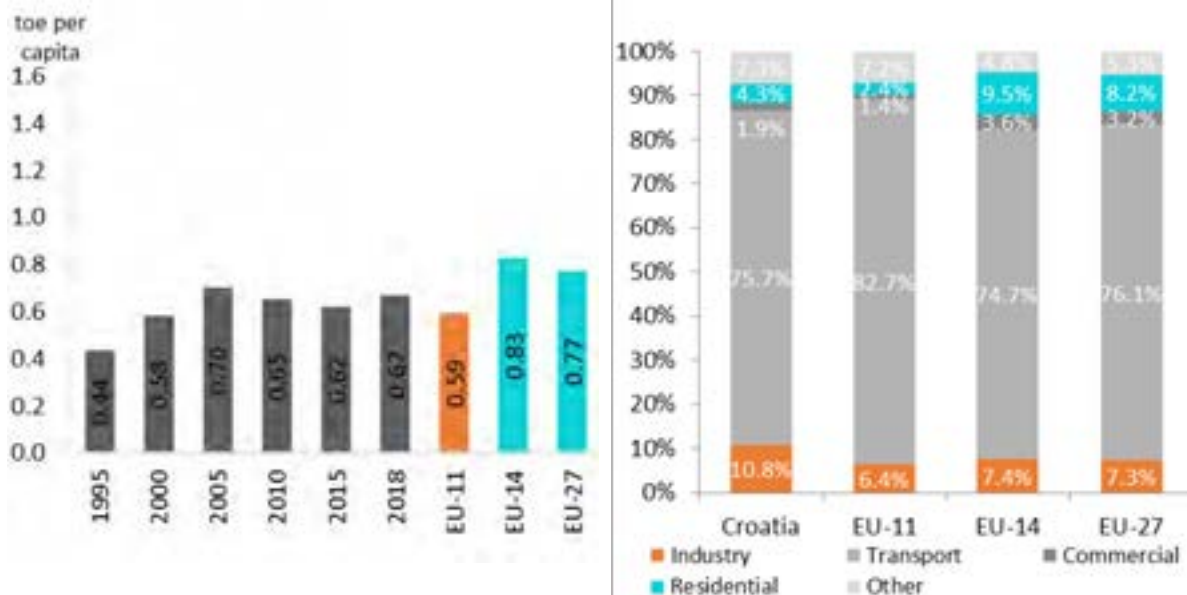
The final consumption of oil per capita in Croatia has increased for 0.44 toe per capita in 1995 to 0.67 toe per capita in 2018. It remains lower than the averages for EU-14 and EU-27 countries (respectively 0.83 toe per capita, 0.77 toe per capita) but higher than EU-11 average (0.59 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of industry and similar share of transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 75.7% in Croatia comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are twice higher in Croatia than in EU-11, whereas commercial and residential usage is lower than in EU-14 and EU-27.

Item 78: Final consumption of oil per capita in Croatia in 1995-2018 and oil final consumption by sectors in Croatia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Croatia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Croatia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 4.8 EU climate policy and its targets for Croatia

Croatia is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 79)

*Item 79: Energy and climate targets for Croatia for 2020 and 2030*

	Croatia 2020 targets	Croatia 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS - Effort Sharing Decision (ESD)	+11% in relation to their 2005 levels	-
National emission reduction targets in non-ETS - Effort Sharing Regulations (ESR)	-	-7.0% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	20% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 11.15 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 7.0 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

In following chapter, the overview of Croatia targets and performance are summarized.

#### 4.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Croatia is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Croatia is 19.32 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions lower than the target by 10.9%.

Item 80: Energy efficiency target data for Croatia

Greenhouse gas emissions level in Croatia and EU-28, base year 1990, and EU 2020 target

Greenhouse gas emissions in Effort Sharing Decision (ESD) sectors



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

#### 4.8.2 Renewable energy sources

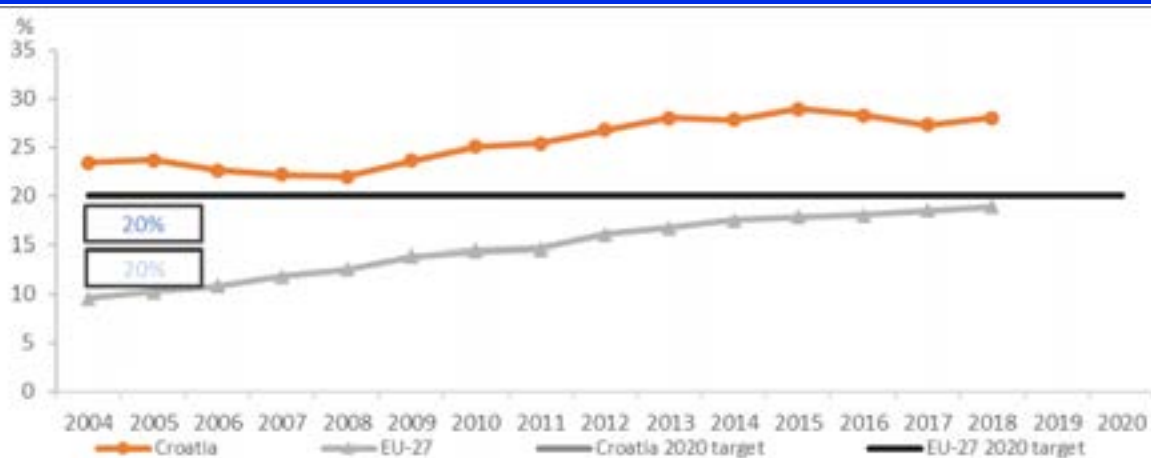
The following targets are set for Croatia regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 20% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Croatia is already above EU wide and country specific targets.

## Item 81: Share of energy from renewable energy sources in gross final energy consumption in Croatia

Share of energy from renewable energy sources in gross final energy consumption in Croatia in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

#### 4.8.3 Energy efficiency

The energy efficiency target set for Croatia are respectively:

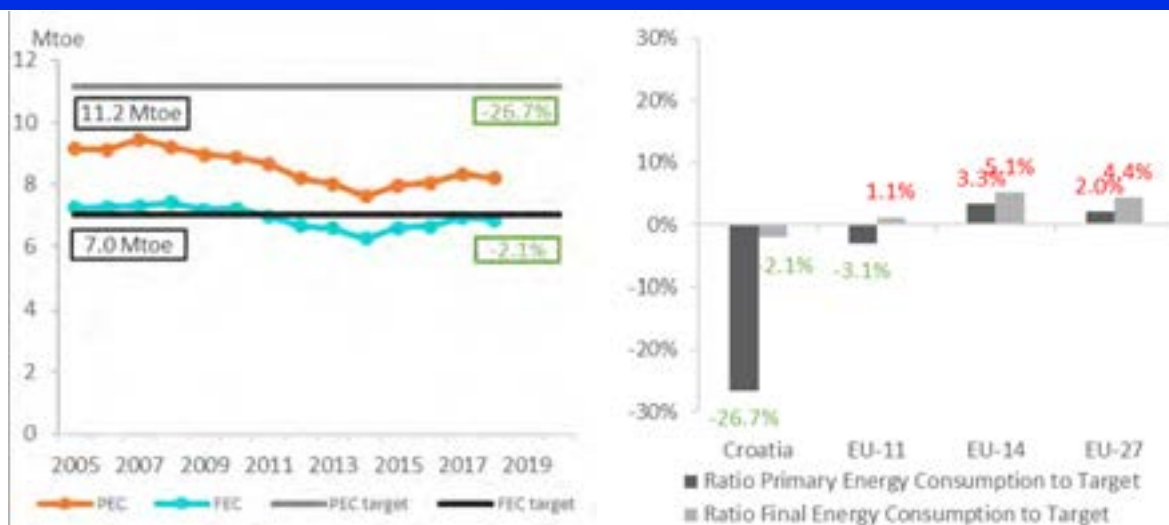
- Primary Energy Consumption in 2020: 11.2 Mtoe
- Final energy consumption in 2020: 7.0 Mtoe

Following the information provided in Item 82 the primary energy consumption for 2018 is below the target by 26.7%. The final energy consumption is below the target by 2.1%.

## Item 82: Energy efficiency target data for Croatia

Primary energy consumption and final energy consumption in Croatia in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Croatia, EU-11, EU-14 and EU-27 in 2018



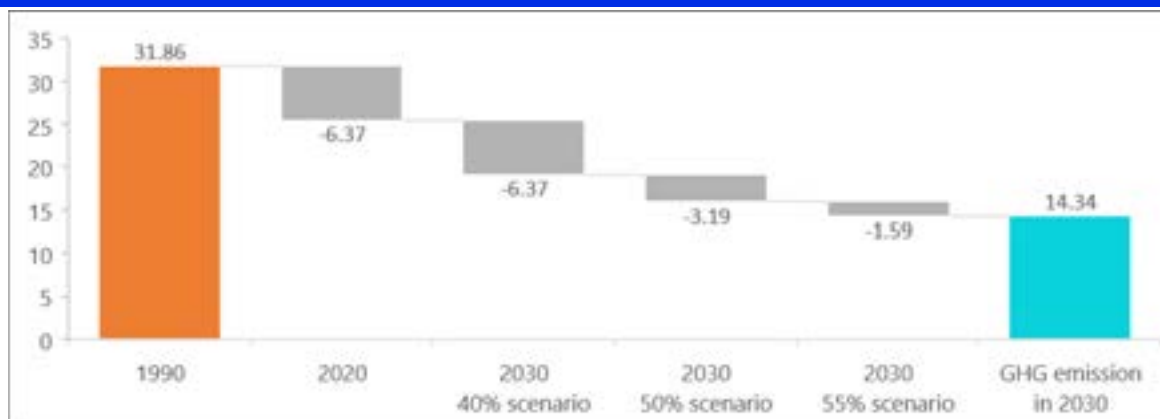
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

#### 4.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Croatia greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 6.37 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 6.37 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 3.19 Mt CO<sub>2</sub> emission decrease is needed, or 4.78 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Croatia up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Croatia was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 83: Estimation regarding greenhouse gas emissions in Croatia under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Croatia under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 5 Czech Republic

### 5.1 General information

Czech Republic is the 5<sup>th</sup> largest country within EU-11 group in terms of total country area and represents 7.0% of the area. At the same time, it is the 14<sup>th</sup> country in EU-27 with 1.9% of the area. It represents 10.3% of EU-11 population and 2.4% of EU-27 population, but 15.0% of its total nominal GDP of EU-11 and 1.5% of EU-27. Due the robust economic growth in 1995-2018 period, in 2018 Czech GDP per capita amounted to 91% of the whole EU average.

Item 84: Czech Republic - key data



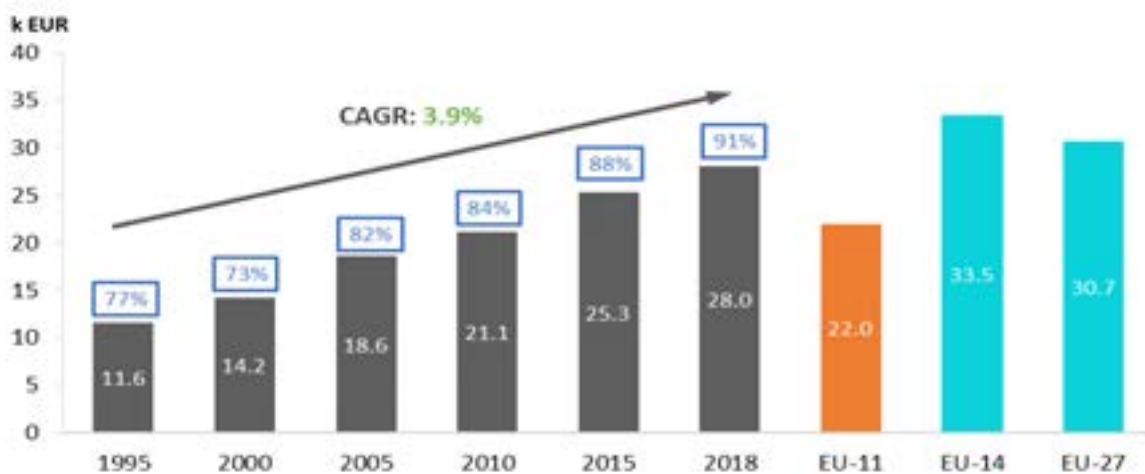
#### Key data

Population (M)	10.6
GDP per capita (EUR, nominal)	19,530
GDP per capita (EUR, PPS)	28,020
GDP as share of EU-11	15.0%
GDP as share of EU-27	1.5%
Energy intensity of the economy (kgoe per 1,000 EUR)	148.5
Greenhouse gas emissions (Mg per capita)	12.1

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 3.9% Czech economy considerably grew in the period of 1995-2018 (see Item 85). Its GDP per capita is above EU-14 but below EU-27 averages (equal to 84% and 91% of the respective averages) - if purchasing power is taken into consideration.

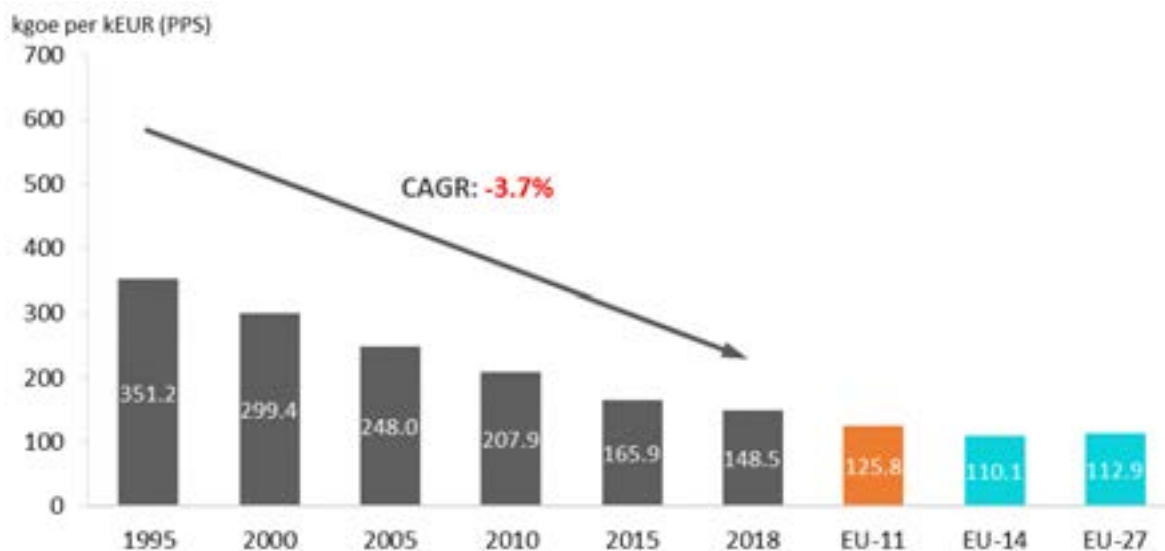
Item 85: GDP per capita in Czech Republic for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Czech Republic GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Czech economy energy intensity is 148.5 kgoe per 1,000 EUR (PPS) in 2018, despite a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 202.8 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than half. In EU-14 and EU-27 average values are 1.3 times lower and in EU-11 average is still 1.2 times lower than in Czech Republic.

Item 86: Energy intensity of the economy in Czech Republic in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) – EI\_GDP\_PPS

## 5.2 Energy balance of Czech Republic

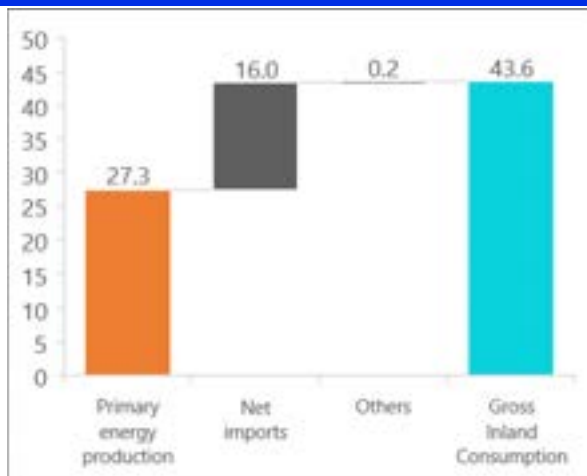
In Item 87 an energy balance of the Czech Republic in 2018 as well as historical values of net imports of energy are shown. The primary energy production was 27.3 Mtoe in 2018 and it has decreased since 1995. At the same time gross inland consumption of energy has remained similar in 2018 (43.6 Mtoe) to the level of 1995 (41.9 Mtoe) with some fluctuations over the time.

Net imports accounted for 16.0 Mtoe of energy in 2018, which is more than in 1995 where accounted only for 8.6 Mtoe. The absolute value of net import has been increasing steadily from 1995 up to 2018 (CAGR 3%), mainly due to the need to fulfil the energy demand of the country as the primary energy production has been decreasing.

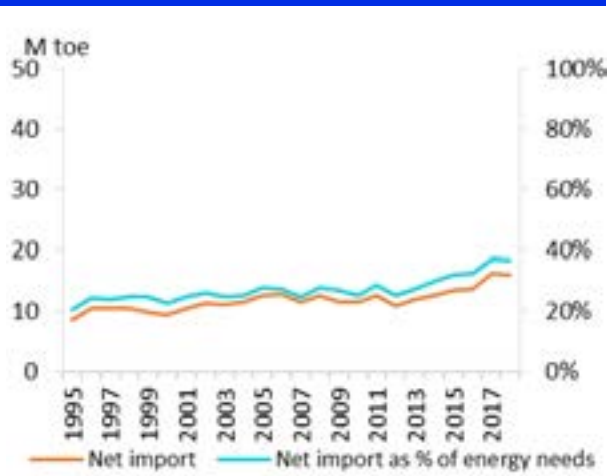
Net import as a percentage of energy needs has been increasing over last 23 years from 20.4% in 1995 to 36.7% in 2018 which is confirming the growing dependence of the country on import of energy. The numbers shown in the third graph are confirming that the initial share of primary energy production in gross inland consumption of 77% in 1995 has decreased to 63% in 2018.

Item 87: Energy balance in Czech Republic

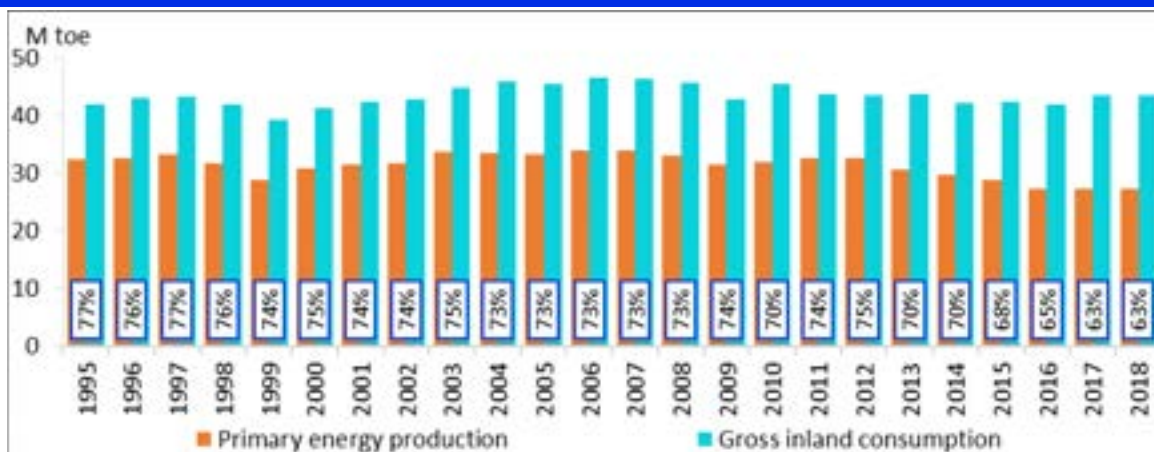
Energy balance in Czech Republic in 2018 (Mtoe)



Net import of energy in Czech Republic in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Czech Republic (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

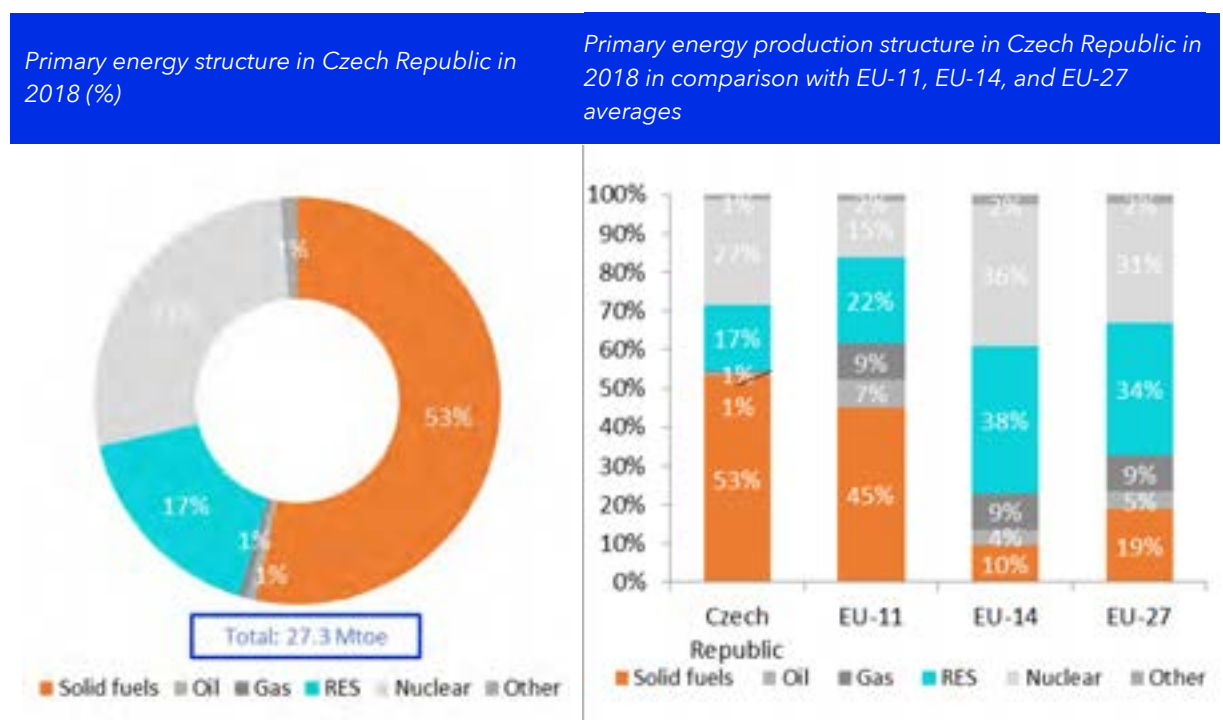
Considering the primary production in the Czech Republic, one can notice that 53% is based on solid fuels. Nuclear energy is also playing a key role with 27% share in primary energy structure. The remaining part of energy is produced mainly from renewable energy sources (17%). Usage of oil, gas and other sources are meaningless.

Comparing to EU-11 group the Czech Republic in terms of primary energy production a higher share of nuclear (27% versus 22%) and little higher shares of solid fuels (53% versus 45%) must be noticed. The production from renewable energy sources is lower, but gas and oil are practically absent.

When compared to the group of developed Western European countries (EU-14), the Czech Republic has a very high share of solid fuels in primary energy production (53% versus 10%). Furthermore, production in developed countries is characterized by higher share of RES

and nuclear (38% and 36%) than in the Czech Republic (17% and 27%). Similar relations are observed when comparing the Czech Republic primary energy structure to EU-27.

Item 88: Primary energy structure in Czech Republic

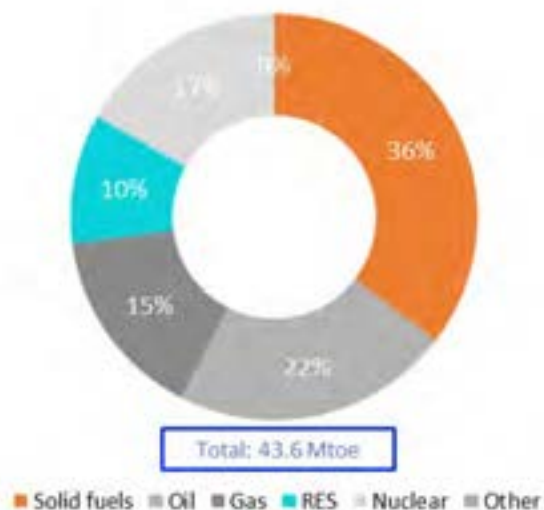


Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

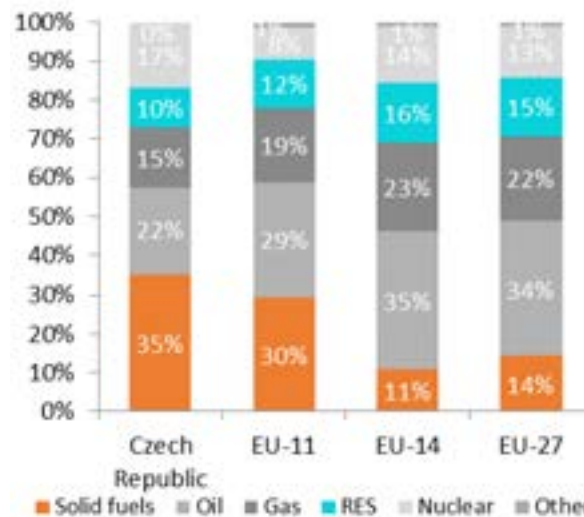
On the consumption side, solid fuels, oil, and gas have a dominant position - 73%. The share of nuclear is significant - 17% but the share of renewable energy sources is at level of 10%. The energy consumption structure is characterized by higher shares of solid fuels (35%) and nuclear (17%) than the averages for EU-11, EU-14 and EU-27 countries and lower shares of oil, gas, and renewables.

Item 89: Gross inland consumption structure in Czech Republic

Gross inland consumption structure in Czech Republic in 2018 (%)



Gross inland consumption structure in Czech Republic in 2018 in comparison with EU-11, EU-14, and EU-27 averages



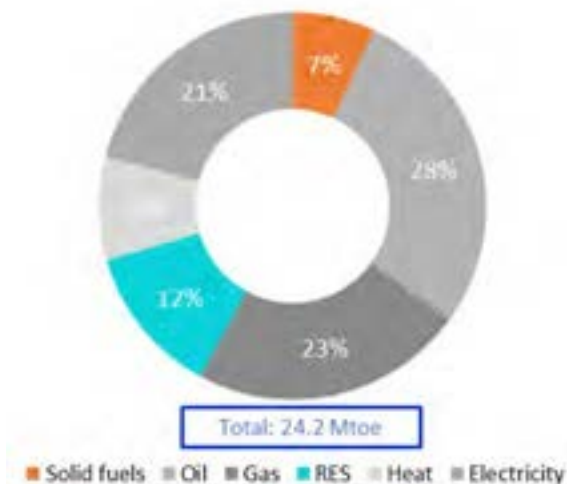
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in the Czech Republic is dominated by petroleum products (oil and gas) and electricity, which accounted together for 72% of total energy consumption in 2018 (see Item 90). The shares of solid fuels, heat and RES in final energy consumption fuel-mix are respectively 7%, 12% and 9%.

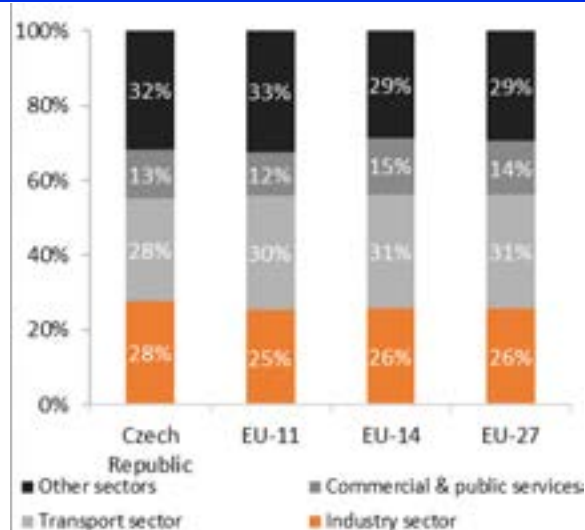
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in the Czech Republic hardly shows any particularities. The proportional consumption needs of each sector seem to be like those of developed countries. The final energy consumption is a little higher in industry and lower in commercial and public services.

Item 90: Final energy consumption structure in Czech Republic

Final energy consumption structure in Czech Republic in 2018 (%)



Final energy consumption structure in Czech Republic in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

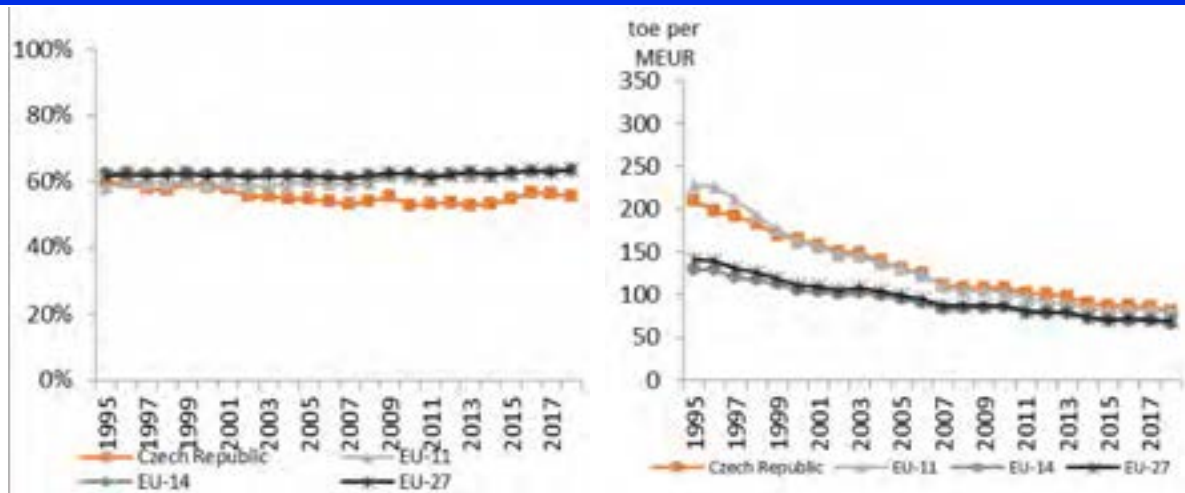
The Czech final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were lower than in EU-14 and EU-27. Furthermore, its level in the Czech Republic has decrease stable since 1995.

Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 209.5 toe per MEUR to 68.4 toe per MEUR). The latter value is only a bit higher than EU-11 average while corresponding values for EU-14 and EU-27 countries in 2018 were merely 66.2 and 68.4 toe per MEUR of GDP, respectively.

Item 91: Final energy consumption in the Czech Republic in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Czech Republic in 1995-2018 (%)

Final energy consumption to gross domestic product ratio in Czech Republic in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

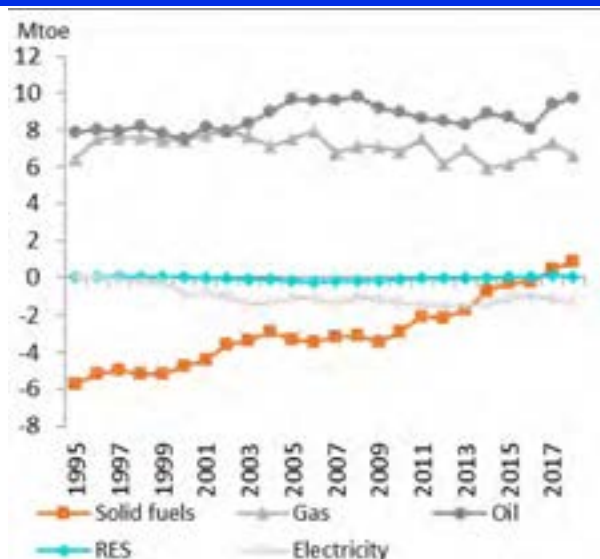


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

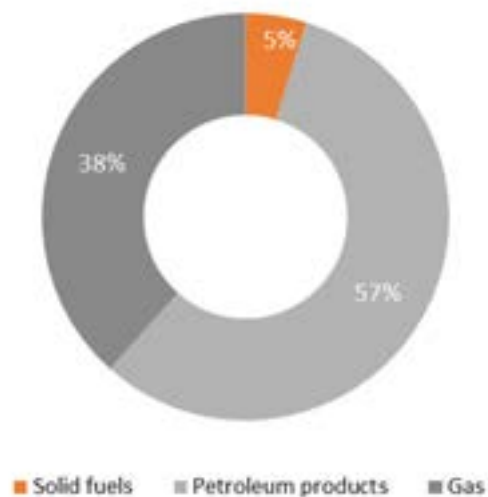
Total net import of energy in the Czech Republic has increased in years 1995-2018, mainly due to the increase of solid fuel net imports. In 1995 the country was a net exporter of solid fuels and in 2018 it has become a net importer. Nevertheless, the analysis of import structure in 2018 indicates the dominance of petroleum products which constitute over 57% of total net import value. Gas is the second most imported fuel with a share of 38%. The import of solid fuels accounts only for 5% of imports. The Czech Republic is also a net exporter of electricity (see Item 92).

## Item 92: Net import of energy in Czech Republic

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)

The supplies of solid fuels are dominated by Poland (68%). The rest is spread between different countries and no one is exceeding 10% of the imports.

The crude oil is imported from different countries. The highest share is attributed to Russia (34%), followed by Azerbaijan, Germany, and Slovakia (18%, 16% and 12% respectively). The share of other suppliers is also significant - 20%.

Gas is imported from Russia at almost 100%. Small amounts are imported from Norway (less than 1%).

The import of electricity is dominated by Germany and Poland (64% and 32% respectively). Other imports are less than 2%. (see Item 93).

Item 93: Foreign fuel suppliers

Foreign suppliers of solid fuels in Czech Republic in 2018 (%)



Foreign suppliers of crude oil in Czech Republic in 2018(%)



Foreign suppliers of gas in Czech Republic in 2018 (%)



Foreign suppliers of electricity in Czech Republic in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 5.3 Greenhouse gas emissions

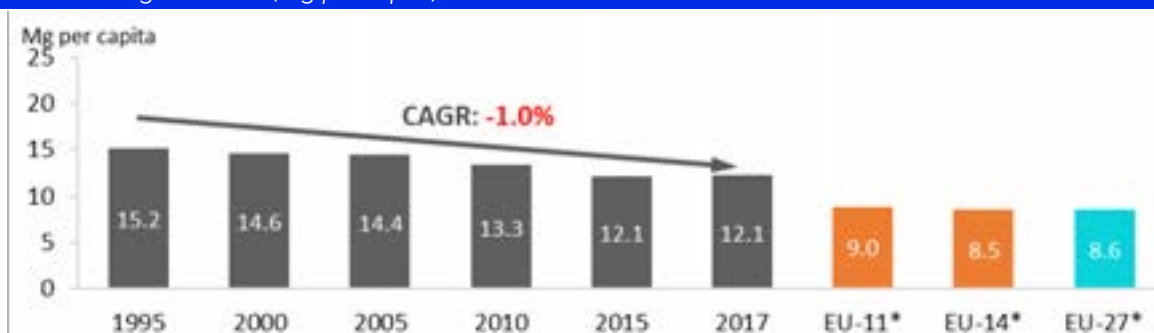
Between 1995-2017 greenhouse gases emissions in Czech Republic were reduced - from over 156.7 Mt CO<sub>2</sub> in 1995 to 128.7 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 12.1 Mg CO<sub>2</sub> per capita in 2017 (from 15.2 Mg CO<sub>2</sub> per capita in 1995), which is higher comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and higher than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

There were some noteworthy changes in the Czech Republic structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction sector emissions dropped swiftly by 57%, as well as emissions from energy industries and agriculture, respectively 16% and 12%. On other hand, transport emissions gained in importance increasing by 78%, as well as industrial processes (10%) and waste management (61%).

Comparing to EU-11, EU-14 and EU-27 countries, Czech Republic is characterized by higher share of emissions from energy industries (40% versus 35%, 26% and 28%). At the same time greenhouse gas emissions structures in EU-14 and EU-27 are more balanced with transport holding a more significant role.

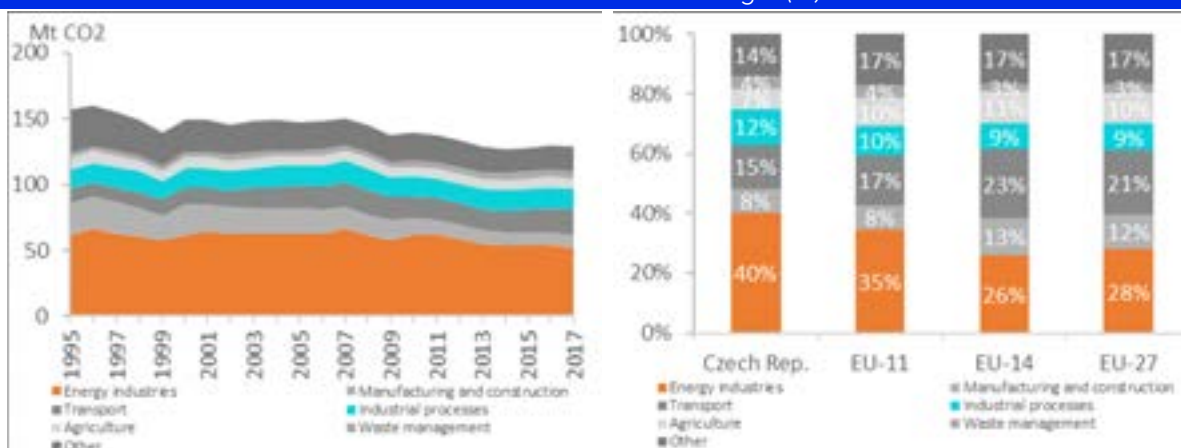
Item 94: Greenhouse gas emissions in Czech Republic

Greenhouse gas emissions per capita in Czech Republic in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Czech Republic by sectors in 1995-2017 (Mt CO2)

Greenhouse gas emissions in Czech Republic by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 5.4 Overview of the electricity sector

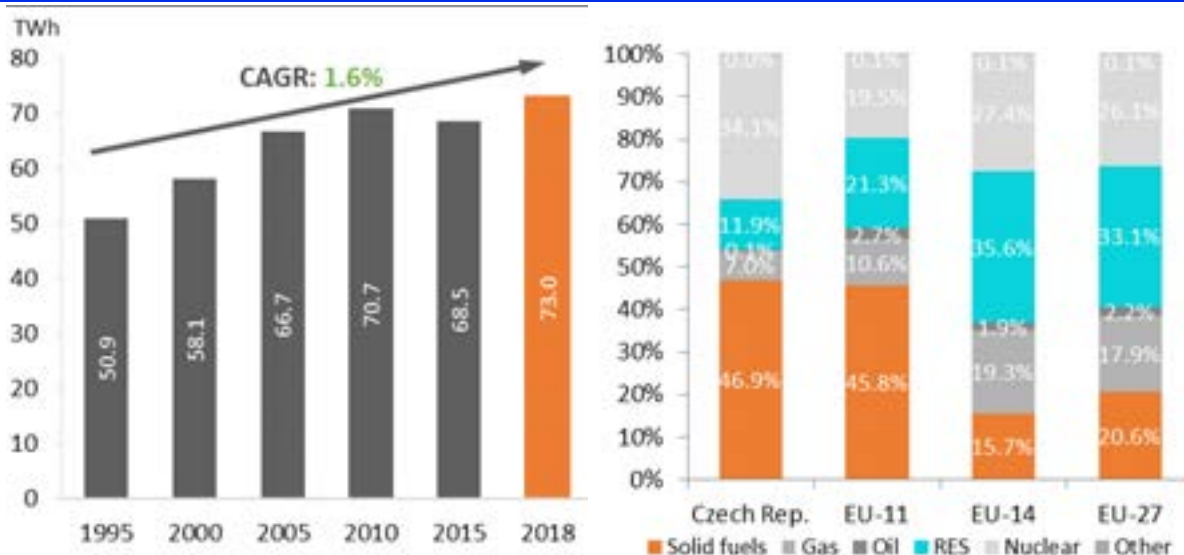
Item 95 presents electricity production and the current fuel mix of the Czech Republic. Over last 23 years net electricity production has increased from 50.9 TWh in 1995 to 73.0 TWh in 2018 (CAGR 1.6%). As visible, net electricity production represents 17.9% of EU-11 total electricity production, which is higher than the Czech Republic GDP share of 15.0%.

The Czech Republic fuel mix is dominated by solid fuels and nuclear energy with respective shares of 46.9% and 34.1%. In total, those two fuels represent therefore as much as 81% of total gross electricity production. Compared to EU-14 and EU-27 countries, Czech Republic has a much bigger share of solid fuels and nuclear in its energy mix. On other hand, the country produces relatively less electricity from gas and oil, respectively 7.0% and 0.1%. The share of electricity from renewable energy sources is also lower than in EU-14 and EU-27 countries, respectively 11.9% versus 35.6% and 33.1%).

Item 95: Net electricity production and gross electricity production fuel mix in the Czech Republic

Net electricity production in the Czech Republic in 1995-2018 (Mtoe)

Gross electricity production fuel mix in 2018 (%)



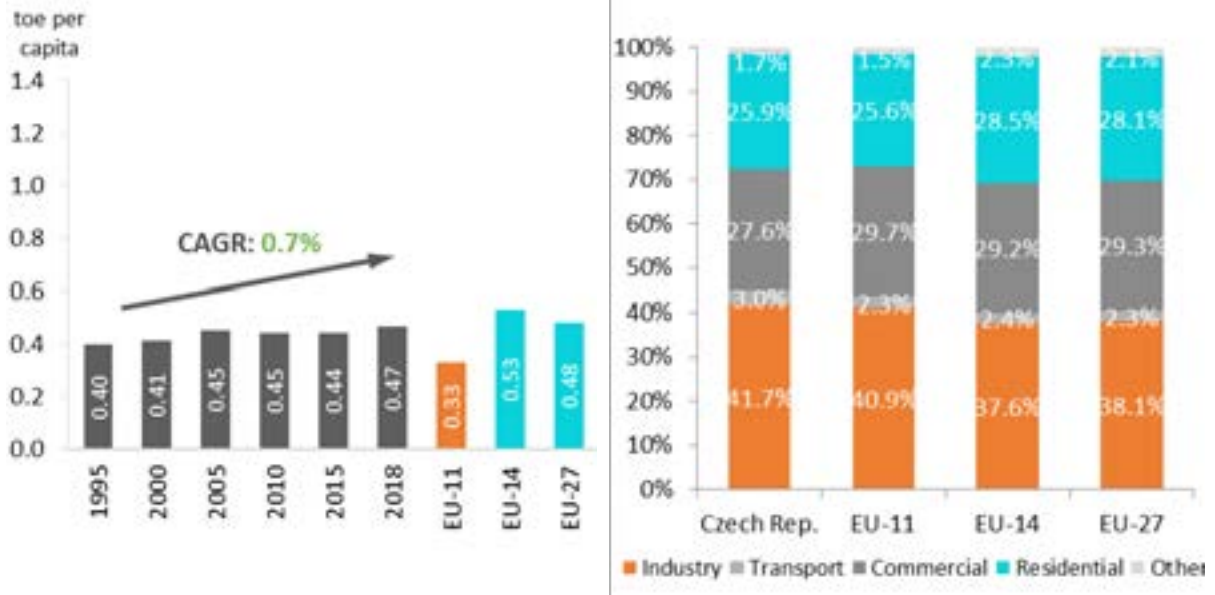
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 96 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in the Czech Republic has somewhat increased (CAGR in the period of 1995-2019 was around 0.7%) and its level is still relatively low compared to EU-14 and close to EU-27 countries. The Czech Republic final energy consumption per capita represents only 88.6% of EU-14 level and 97.1% of EU-27 level. That may indicate that there is a potential for further growth of electricity consumption in the Czech Republic. Generally, the structure of final electricity consumption in the Czech Republic is rather like EU averages, with a somewhat higher share of the residential sector.

Item 96: Final consumption of electricity in the Czech Republic

Final consumption of electricity per capita in the Czech Republic (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in the Czech Republic by sectors in 2018 (%)

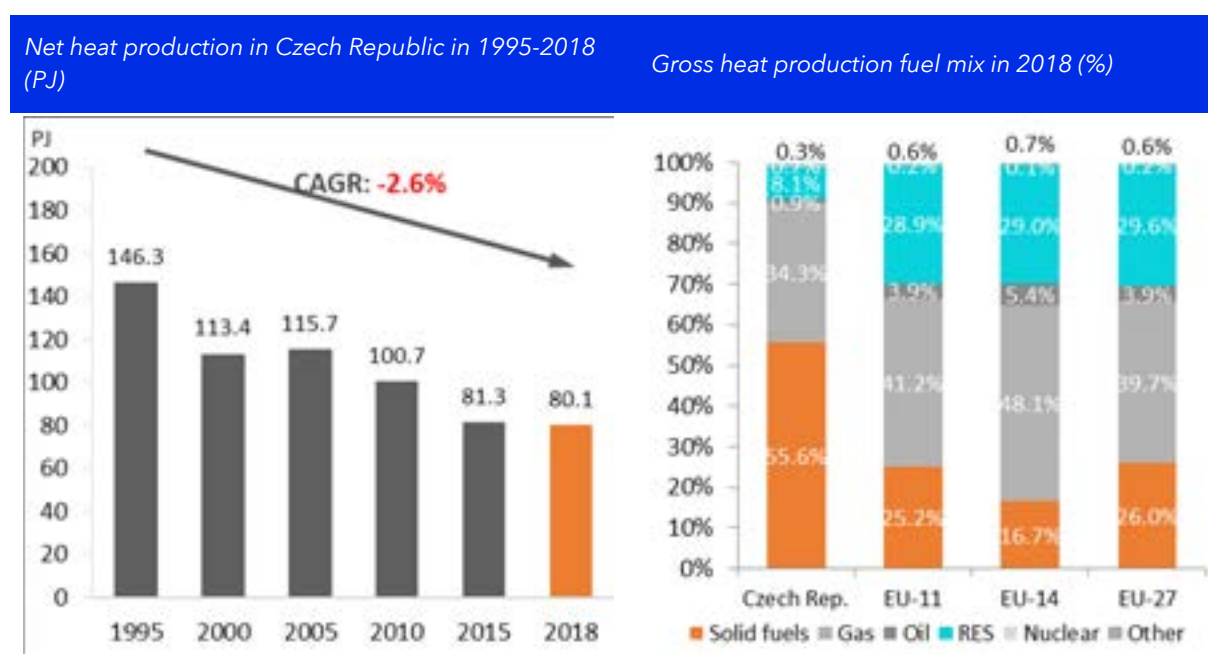


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 5.5 Overview of the heat sector

Item 97 presents heat production in the Czech Republic as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Czech Republic has dropped between 1995 and 2018 from 146.3 PJ to 80.1 PJ, i.e. at CAGR of -2.6%. The Czech Republic production fuel mix is dominated by solid fuels (almost 55.6%) and gas (almost 34.3%). That means that in comparison with EU-14 and EU-27 Czech Republic consumes relatively more solid fuels in heat production. The share of oil is lower (0.9% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower, about half of level in EU-11, EU-14 and EU-27 countries.

Item 97: Net heat production and gross electricity production fuel mix in Czech Republic



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 98 presents final heat consumption per capita and its breakdown by sectors.

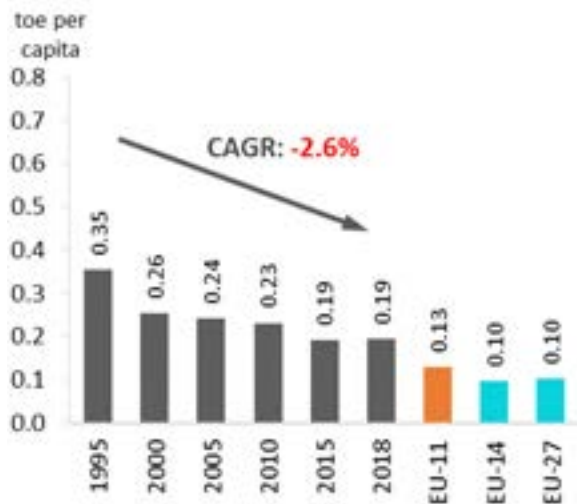
The per capita demand for heat in Czech Republic has decreased in years 1995-2018 from 0.35 toe in 1995 to 0.19 toe in 2018. Within the 23 years analysed, heat consumption per capita in Czech Republic has decreased at CAGR of -2.6%.

The structure of final consumption of heat in Czech Republic is characterized by higher share of commercial (23.9% in Czech Republic compared to 21.3% in EU-14 and 20.7% in EU-27) and residential usage (48.4% in Czech Republic compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (27.4% in Czech Republic compared to 37.9% in EU-14 and 32.6% in EU-27). The heat consumption in the Czech Republic remains higher than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

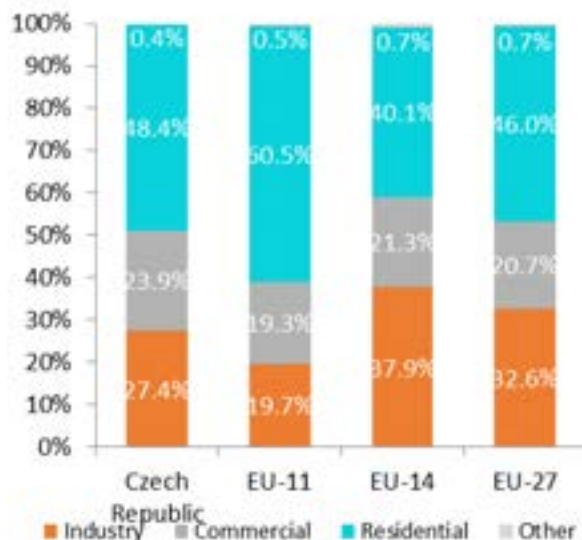
In relation to EU-11 countries, the structure of final heat consumption is similar with a little lower share of residential sector and higher of commercial and industry sectors.

Item 98: Final consumption of heat in Czech Republic

Final consumption of heat per capita in Czech Republic (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)



Final consumption of heat in Czech Republic by sectors in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

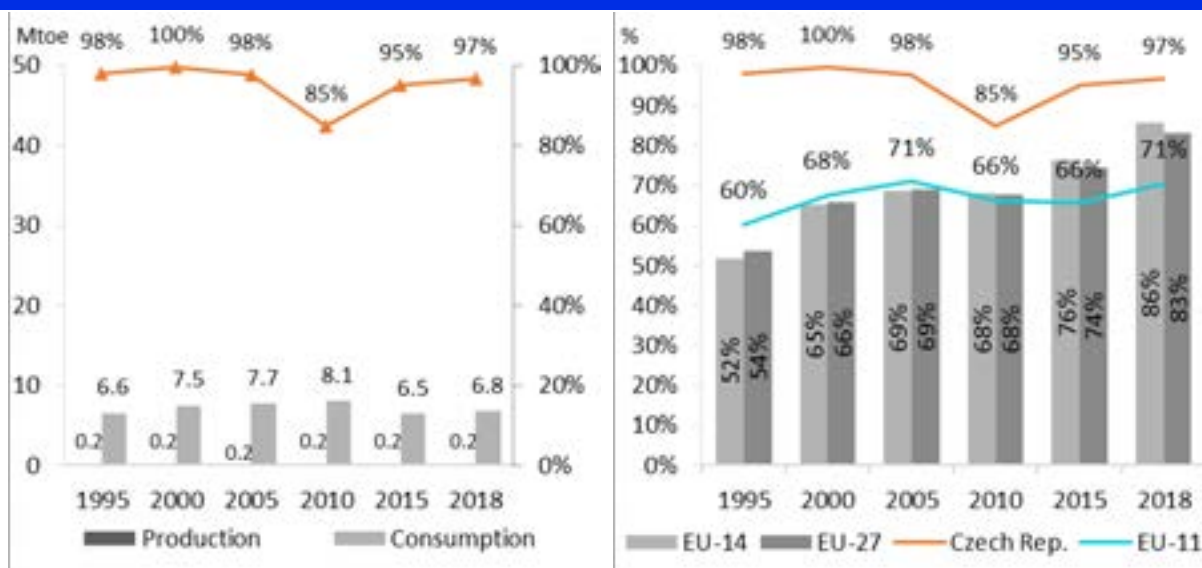
## 5.6 Overview of gas sector

Gas production in the Czech Republic is very low (about 0.2 Mtoe in 2018) comparing to the consumption (6.8 Mtoe in 2018). Therefore, the import dependence remains high - between 85% and 100% in years 1995-2018 (see Item 99). When compared to EU averages significantly higher import dependence is observed between the Czech Republic and EU-11, EU-14 and EU-27 countries (97% import dependence of the Czech Republic in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 99: Gas sector in the Czech Republic

Gas production, gross consumption and import dependence in the Czech Republic in 1995-2018 (Mtoe)

Gas Import dependence in the Czech Republic and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

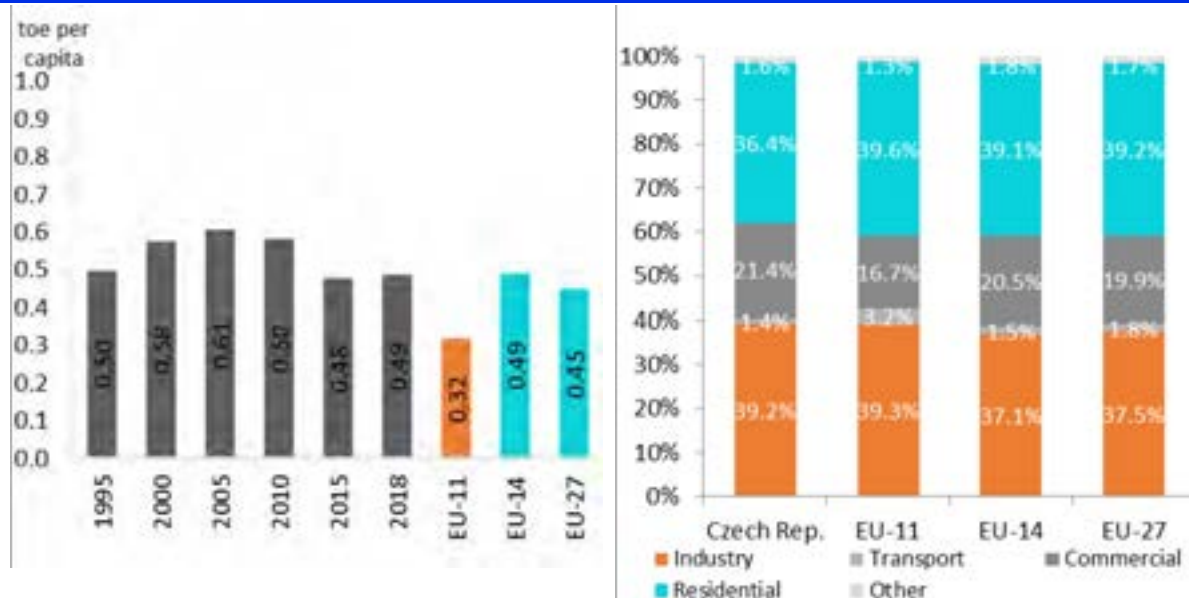
The final consumption of gas per capita in the Czech Republic remains stable at level of 0.49 toe per capita and close to the averages for EU-14 and EU-27 countries (respectively 0.49 toe per capita, 0.45 toe per capita) but higher than the average for EU-11 (0.32 toe per capita).

The structure of final gas consumption per sectors is similar as European averages. Gas usage in the Czech Republic is dominated by industry (39.2%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%. The share of gas usage in commercial sectors is higher than the averages (21.4% in the Czech Republic comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27). On other hand gas in residential and transport sector in the Czech Republic is less present - and 36.4% in residential sector in the Czech Republic comparing to 36.9% in EU-11, 39.1% in EU-14 and 39.2% in EU-27 and 1.4% in the transport sector in the Czech Republic compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27).

Item 100: Final consumption of gas per capita in the Czech Republic in 1995-2018 and gas final consumption by sectors in the Czech Republic and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in the Czech Republic (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in the Czech Republic and EU-11 EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

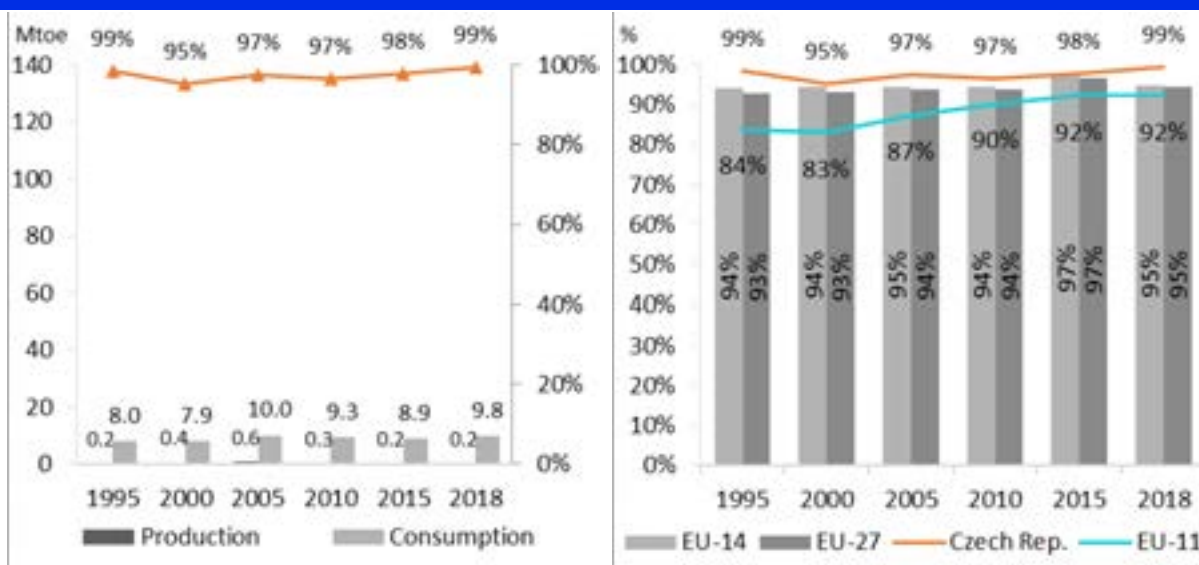
## 5.7 Overview of the oil sector

Oil production in the Czech Republic is very low (less than 0.2 Mtoe in 2018) comparing to the consumption (9.8 Mtoe in 2018). Therefore, the import dependence remains high - between 95% and 99% in years 1995-2018 (see Item 101). When compared to EU averages higher import dependence is observed between the Czech Republic and EU-11, EU-14 and EU-27 countries (99% import dependence of the Czech Republic in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 101: Oil sector in the Czech Republic

Oil production, gross consumption and import dependence in the Czech Republic in 1995-2018 (Mtoe)

Oil Import dependence in the Czech Republic and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

The final consumption of oil per capita in the Czech Republic has increased for 0.48 toe per capita in 1995 to 0.63 toe per capita in 2018. It remains lower than the averages for EU-14 and EU-27 countries (respectively 0.83 toe per capita, 0.77 toe per capita) but it is higher than the average for EU-11 (0.59 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of transport sector comparing to EU-11, EU-14 and EU-27 countries. Most of oil is used in transport - 91.4% in the Czech Republic comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are lower in the Czech Republic than in EU-11, EU-14 and EU-27 countries. Use in commercial and residential sectors is also lower.

Item 102: Final consumption of oil per capita in the Czech Republic in 1995-2018 and oil final consumption by sectors in the Czech Republic and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in the Czech Republic (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in the Czech Republic and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 5.8 EU climate policy and its targets for the Czech Republic

The Czech Republic is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 103)

*Item 103: Energy and climate targets for Czech Republic for 2020 and 2030*

	The Czech Republic 2020 targets	The Czech Republic 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS - Effort Sharing Decision (ESD)	+9% in relation to their 2005 levels	-
National emission reduction targets in non-ETS - Effort Sharing Regulations (ESR)	-	-14% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	13% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 39.6 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 25.3 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

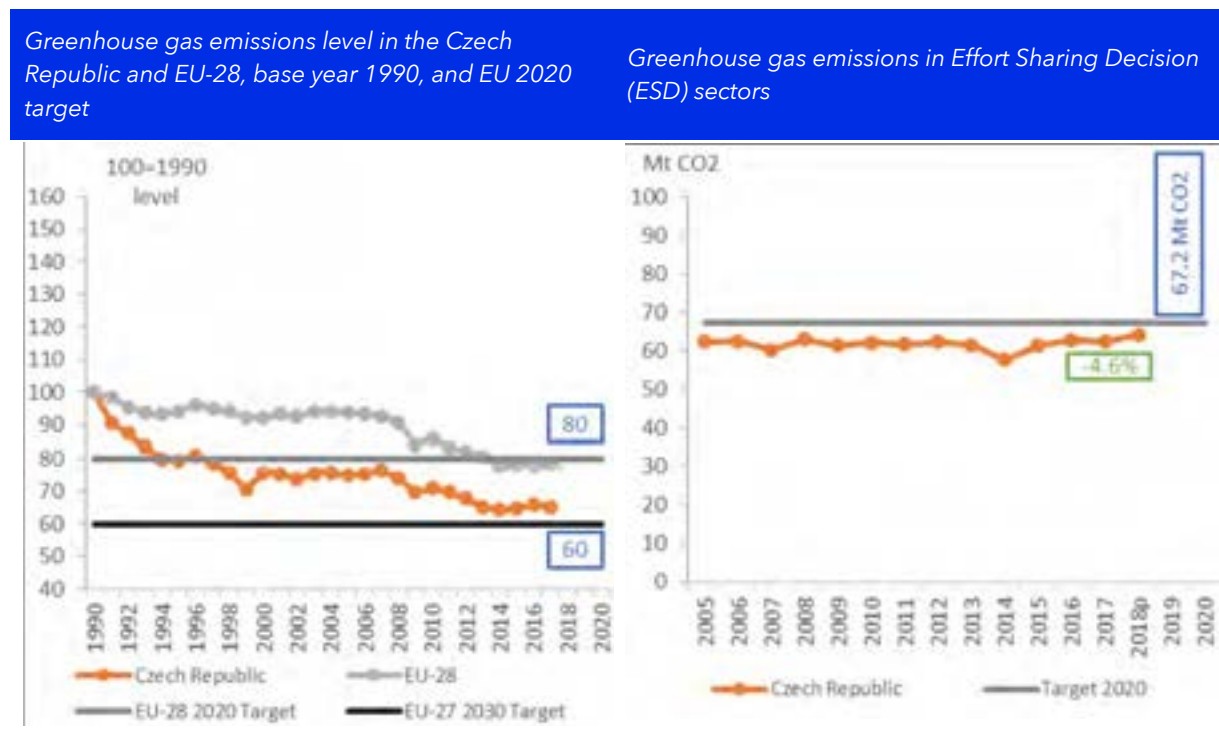
In following chapter, the overview of the Czech Republic targets and performance are summarized.

### 5.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in the Czech Republic is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for the Czech Republic is 67.2 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 4.6%.

Item 104: Energy efficiency target data for the Czech Republic



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 5.8.2 Renewable energy sources

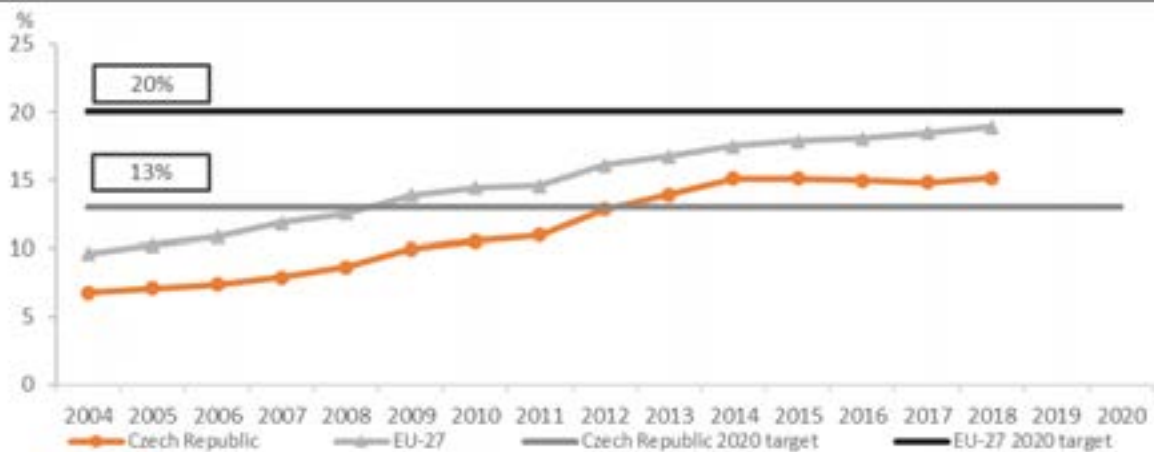
The following targets are set for the Czech Republic regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 13% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in the Czech Republic is already above the country specific targets but below EU wide target.

*Item 105: Share of energy from renewable energy sources in gross final energy consumption in Czech Republic*

*Share of energy from renewable energy sources in gross final energy consumption in Czech Republic in 2005-2018 and targets for 2020*



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 5.8.3 Energy efficiency

The energy efficiency target set for the Czech Republic are respectively:

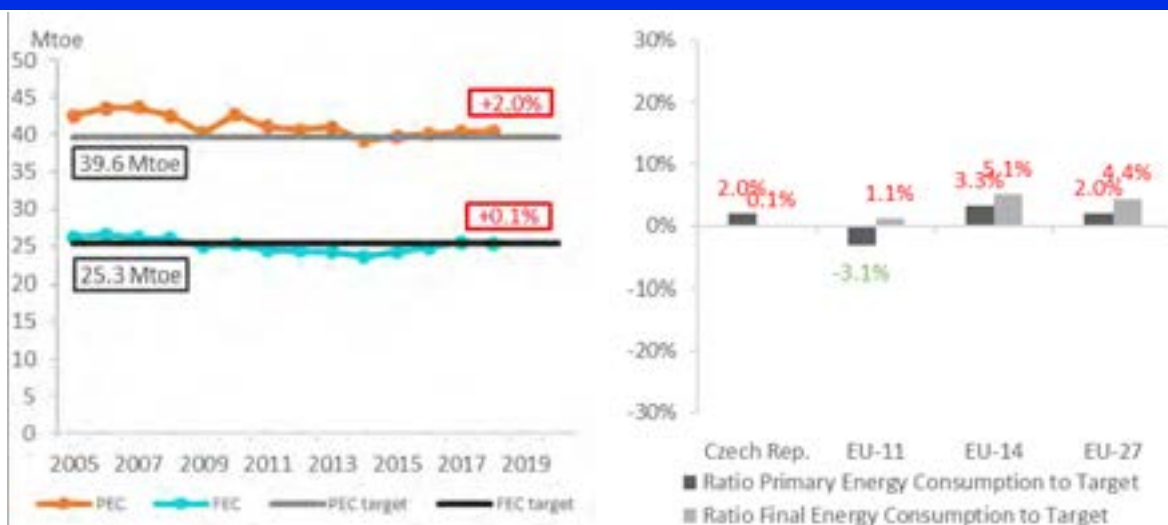
- Primary Energy Consumption in 2020: 39.6 Mtoe
- Final energy consumption in 2020: 25.3 Mtoe

Following the information provided in Item 106 the results for 2018 are above the targets in both criteria, respectively +2.0% of primary energy consumption and 0.1% of final energy consumption. This does not exclude the Czech Republic to achieve the targets in 2020.

Item 106: Energy efficiency target data for the Czech Republic

Primary energy consumption and final energy consumption in the Czech Republic in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in the Czech Republic, EU-11, EU-14 and EU-27 in 2018



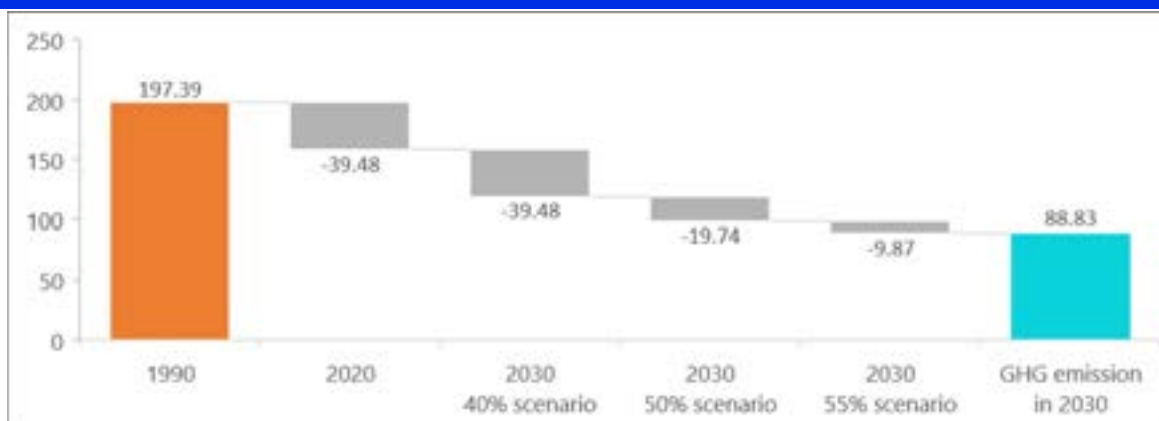
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030) (PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

## 5.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Czech Republic greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 39.48 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 39.48 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 19.74 Mt CO<sub>2</sub> emission decrease is needed, or 29.61 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by the Czech Republic up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 the Czech Republic was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be much higher than the one to achieve 2020 targets.

*Item 107: Estimation regarding greenhouse gas emissions in the Czech Republic under different scenarios (Mt CO<sub>2</sub>)*

*Estimation regarding greenhouse gas emissions in the Czech Republic under different scenarios (Mt CO<sub>2</sub>)*



*Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author*

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries.

Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 6 Estonia

### 6.1 General information

Estonia is the second smallest country within EU-11 group in terms of total country area and represents 4.0% of the area. At the same time, it is the 20<sup>th</sup> country in EU-27 with 1.1% of the area. It represents only 1.3% of EU-11 population and 0.3% of EU-27 population, but 1.9% of its total nominal GDP of EU-11 and 0.2% of EU-27. Due the robust economic growth in 1995-2018 period, in 2018 Estonian GDP per capita amounted to 82% of the whole EU average.

Item 108: Estonia - key data



#### Key data

Population (M)	1.3
GDP per capita (EUR, nominal)	19,740
GDP per capita (EUR, PPS)	25,270
GDP as share of EU-11	1.9%
GDP as share of EU-27	0.2%
Energy intensity of the economy (kgoe per 1,000 EUR)	199.4
Greenhouse gas emissions (Mg per capita)	15.8

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 6.9% Estonian economy considerably grew in the period of 1995-2018 (see Item 109/Item 37). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 76% and 82% of the respective averages) – if purchasing power is taken into consideration.

Item 109: GDP per capita in Estonia for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Estonia GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Estonian economy can be considered as a very energy intensive one, despite a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 476.4 kgoe per 1,000 EUR PPS, i.e. it was divided by 3. In EU-14 and EU-27 average values are 1.8 times lower and in EU-11 average is still 1.6 times lower than in Estonia.

Item 110: Energy intensity of the economy in Estonia in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) - EI\_GDP\_PPS

## 6.2 Energy balance of Estonia

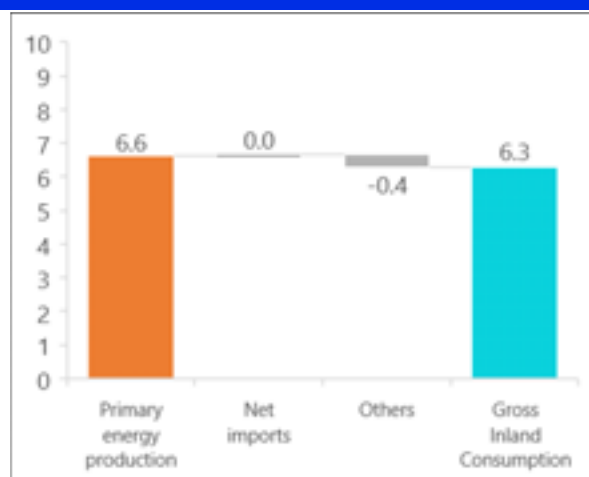
In Item 111 an energy balance of Estonia in 2018 as well as historical values of net imports of energy are shown. In 2018 Estonia primary energy production was 6.6 Mtoe. It has significantly increased since 1995 when it was only 3.4 Mtoe.

Net imports were practically zero (0.05 Mtoe) in 2018. It has been continuously reduced from about 1.8 Mtoe in 1995. The net share of imports in energy needs of Estonia has been decreased from about 35% in 1995 to 0.8% in 2018.

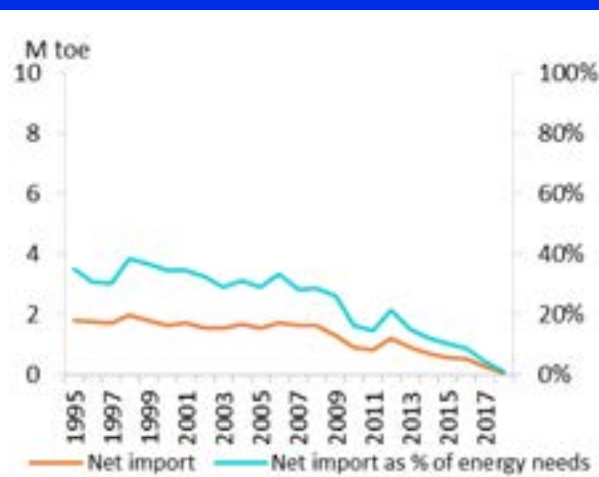
The above is in line with the data of primary energy production and gross inland consumption of energy in Estonia over past 23 years. The primary energy production has been increasing and the import has been decreasing. Currently (in 2018) the production has exceeded the consumption of energy by 5%.

Item 111: Energy balance in Estonia

Energy balance in Estonia in 2018 (Mtoe)



Net import of energy in Estonia in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Estonia (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

Considering the primary production, one can notice that 73% is based on oil (oil shale and oil sands which were accounted as oil in the current analysis). The remaining production comes from renewable energy sources (26%).

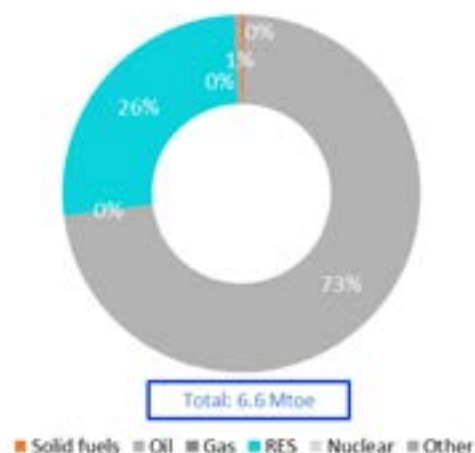
Comparing to EU-11 group Estonia has a very high share of oil in the primary energy production mix (73% versus 7%). The share of renewable energy sources is close to EU-11 average (26% versus 22%). The other fuels are practically absent from the Estonian primary energy mix. It is far from EU-11 averages.

When compared to the group of developed Western European countries (EU-14), Estonia has a very high share of oil in primary energy production (73% versus 4%). Furthermore, production in developed countries is much more balanced than in Estonia, which is dominated by oil. The share of renewable energy sources is lower than in EU-14 countries

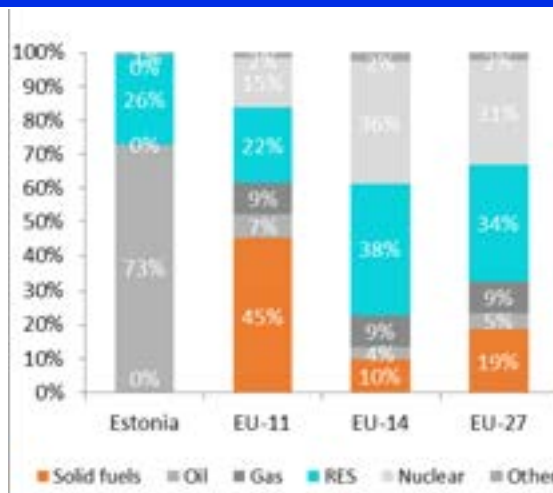
(26% versus 38%). Similar relations are observed when comparing Estonia primary energy structure to EU-27.

Item 112: Primary energy structure in Estonia

Primary energy structure in Estonia in 2018 (%)



Primary energy production structure in Estonia in 2018 in comparison with EU-11, EU-14, and EU-27 averages

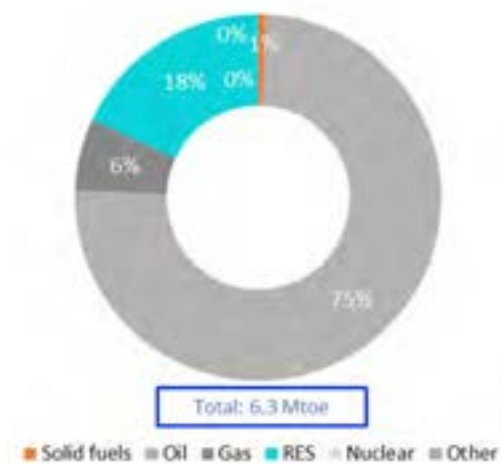


Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy – Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

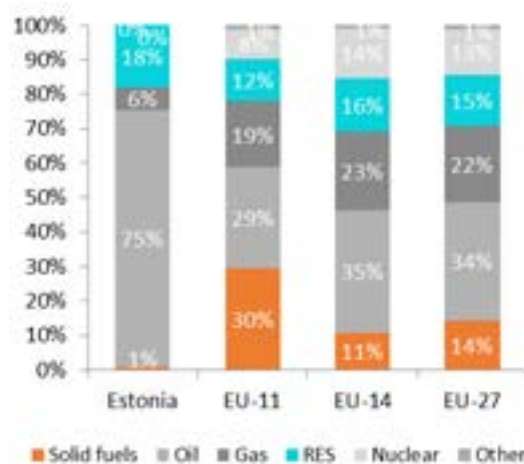
On the consumption side, oil remains at the dominant position – 75%. The share of RES is 21%. The mix is completed by gas at 18%. This structure differs from EU-11 countries which are more in solid fuels and gas. Comparing to EU-14 the conclusions are similar. EU-14 averages show a higher share of solid fuels (practically absent in Estonia), gas and nuclear. The share of RES in Estonia is higher than in EU-14 (18% versus 16%). Comparison with EU-27 averages draw similar conclusions.

## Item 113: Gross inland consumption structure in Estonia

Gross inland consumption structure in Estonia in 2018 (%)



Gross inland consumption structure in Estonia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption - GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Estonia is dominated by petroleum products and electricity, which accounted together for 57% of total energy consumption in 2018 (see Item 114). The shares of gas, RES and heat in final energy consumption fuel-mix are 9%, 16% and 17% respectively.

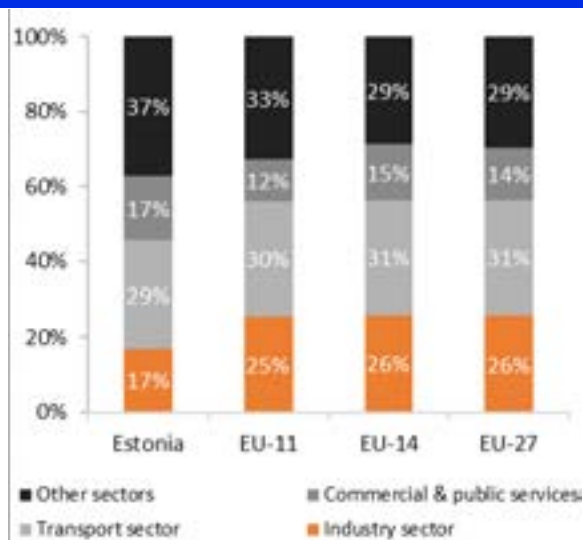
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Estonia shows lower use of energy in industry and higher in commercial and public services sector. The share of other sectors is also higher than the averages for EU-11, EU-14 and EU-27.

Item 114: Final energy consumption structure in Estonia

Final energy consumption structure in Estonia in 2018 (%)



Final energy consumption structure in Estonia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



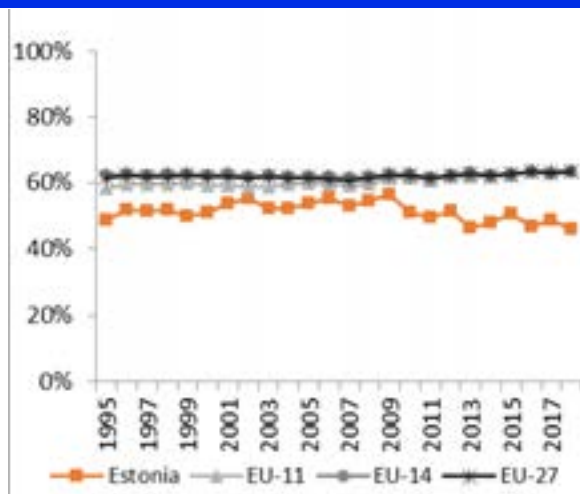
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Estonian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were significantly lower than in EU-14 and EU-27. Furthermore, its level in Estonia has remained stable up to 2009 and it has decreased since that.

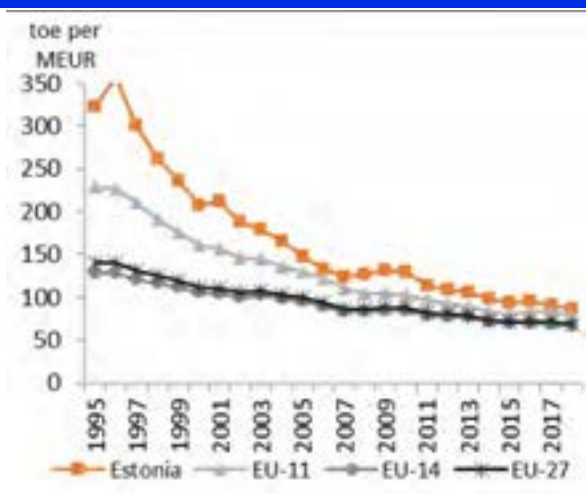
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 323.4 toe per MEUR to 68.4 toe per MEUR). The latter value is only a bit higher than EU-11 average while corresponding values for EU-14 and EU-27 countries in 2018 were merely 66.2 and 68.4 toe per MEUR of GDP, respectively.

Item 115: Final energy consumption in Estonia in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Estonia in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Estonia in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

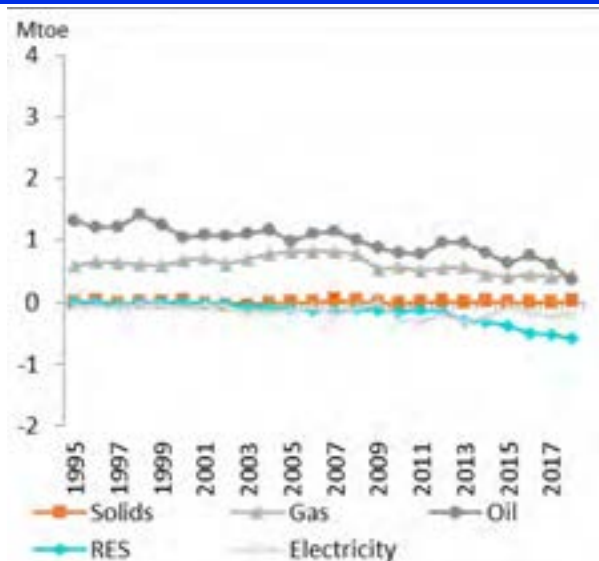


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

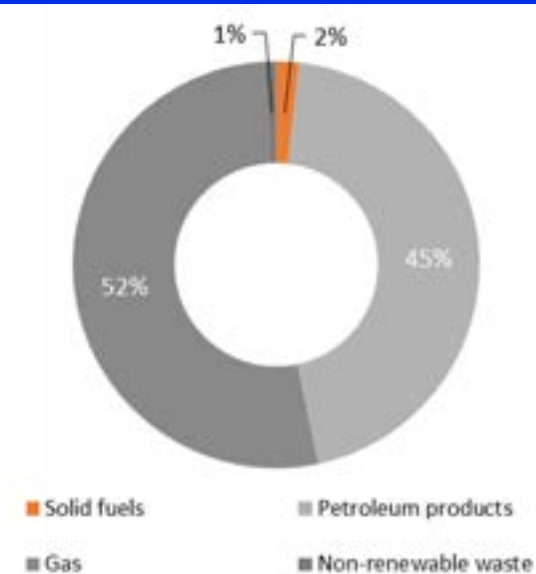
Total net import of energy in Estonia significantly decreased in years 1995-2018. Analysis of its structure in 2018 indicates the dominance of petroleum products and gas which constitute 45% and 53% of total net import value, respectively. The other two net imported fuels are solid fuels and non-renewable waste with respective shares of 2% and 1%. Estonia is also a net exporter of electricity and renewable energy sources (see Item 116).

Item 116: Net import of energy in Estonia

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil

*and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)*

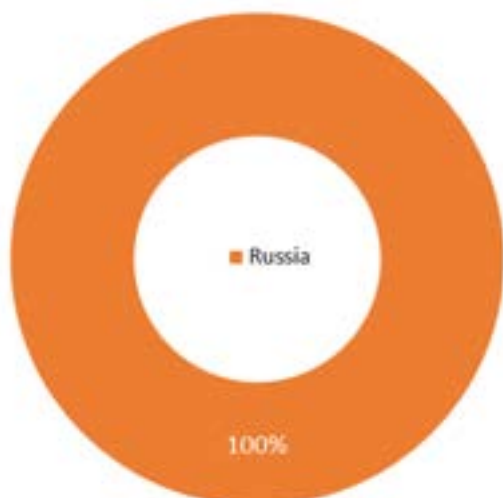
In 2018 Estonia has imported solid fuels only from Russia but considering the low level of import (0.02 Mtoe), its meaning is low.

Crude oil is imported mainly from Lithuania, Russia, and Belarus (43%, 30% and 12% respectively). The other suppliers are Finland and other countries, not exceeding 15% in total.

Gas is imported to Estonia only from Russia. Electricity is imported mainly from Finland (98%) and 2% from Lithuania. (see Item 117).

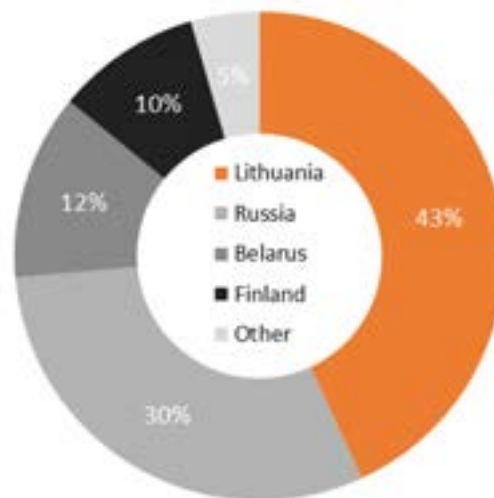
## Item 117: Foreign fuel suppliers

Foreign suppliers of solid fuels in Estonia in 2018 (%)



Total: 0.02 Mtoe

Foreign suppliers of crude oil in Estonia in 2018(%)



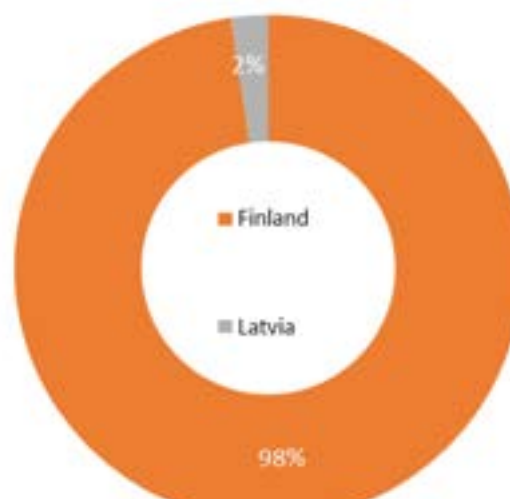
Total: 2.0 Mtoe

Foreign suppliers of gas in Estonia in 2018 (%)



Total: 0.4 Mtoe

Foreign suppliers of electricity in Estonia in 2018 (%)



Total: 0.3 Mtoe

Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 6.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Estonia were increased - from over 20.3 Mt CO<sub>2</sub> in 1995 to 20.9 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita increased to 15.8 Mg CO<sub>2</sub> per capita in 2017 (from 14.1 Mg CO<sub>2</sub> per capita in 1995), which is higher comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and higher than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

There were some noteworthy changes in the Estonian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction

sector emissions dropped swiftly by 30%, as well as emissions from waste management - 17%. On other hand, transport emissions gained in importance increasing by 54%.

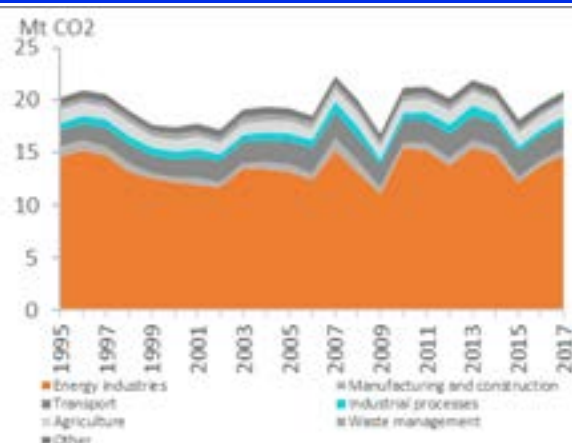
Comparing to EU-11, EU-14 and EU-27 countries, Estonia is characterized by higher share of emissions from energy industries (70% versus 35%, 26% and 28%). At the same time greenhouse gas emissions structures in EU-14 and EU-27 are more balanced with transport holding a more significant role.

Item 118: Greenhouse gas emissions in Estonia

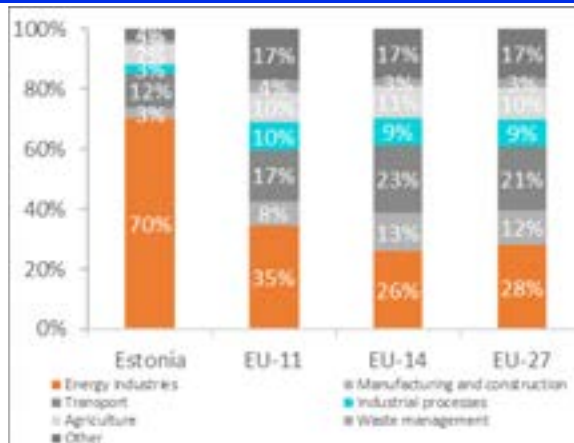
Greenhouse gas emissions per capita in Estonia in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Estonia by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Estonia by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



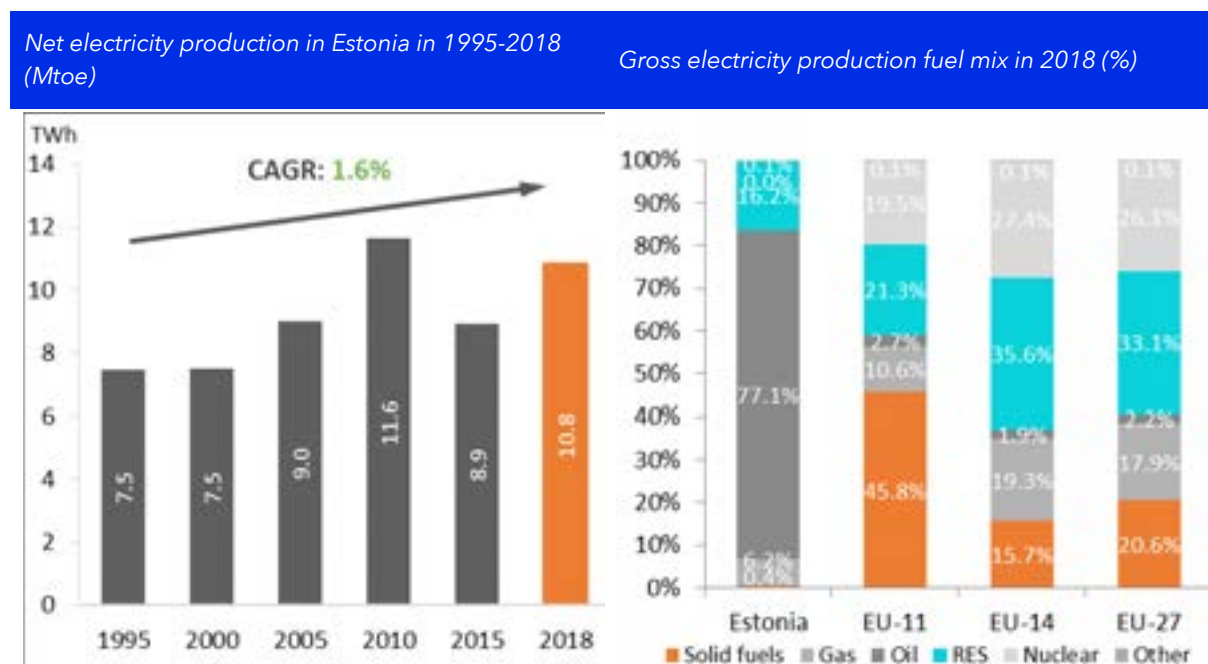
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 6.4 Overview of the electricity sector

Item 119 presents electricity production and the current fuel mix of Estonia. Over last 23 years net electricity production has increased from 7.5 TWh in 1995 to 10.8 TWh in 2018 (CAGR 1.6%). As visible, net electricity production represents 2.7% of EU-11 total electricity production, which is a higher compared to Estonian GDP share of 2.0%.

The Estonian fuel mix is dominated by oil with respective share of 77.1% which includes oil shale and oil sands in the current analysis. Compared to EU-14 and EU-27 countries, Estonia has a much bigger share of oil in its energy mix. On other hand, the country produces relatively less electricity from solid fuels and gas, respectively 0.4% and 6.2%. The share of electricity from renewable energy sources is also lower than in EU-14 and EU-27 countries, respectively 16.2% versus 35.6% and 33.1%).

Item 119: Net electricity production and gross electricity production fuel mix in Estonia



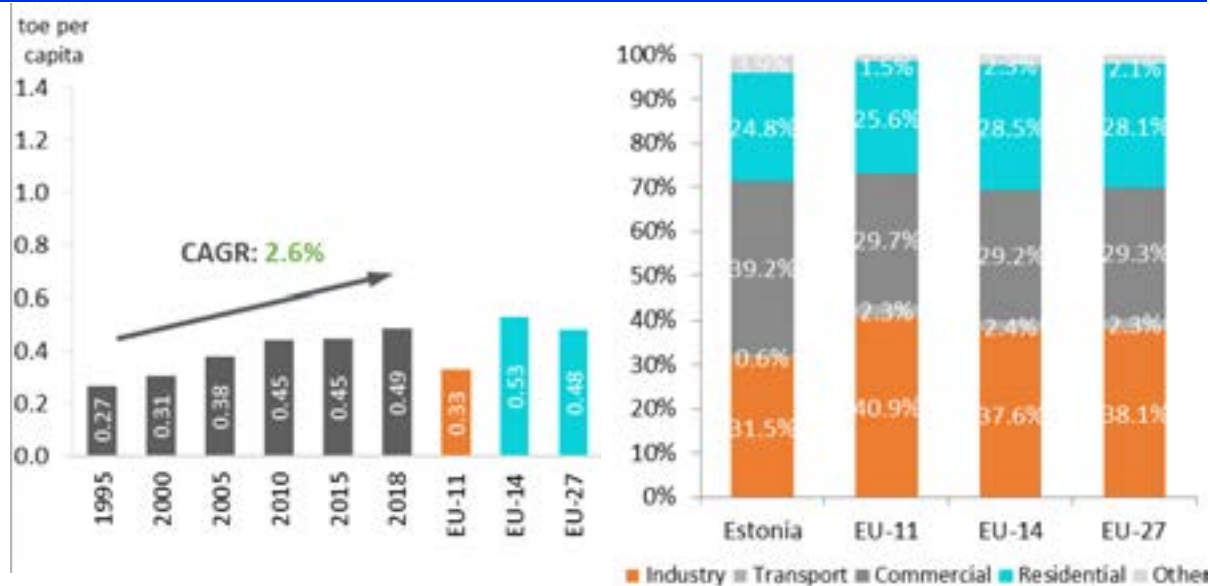
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 120 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. In recent years final consumption of electricity in Estonia has increased (CAGR in the period of 1995-2019 was around 2.6%) and its level is higher compared to EU-27 average, but it remains lower than EU-14 average. Estonian final energy consumption per capita represents only 92.0% of EU-14 level and 100.9% of EU-27 level. Generally, the structure of final electricity consumption in Estonia differs from EU averages. The share of industry and transport use is lower, but commercial sector use is higher.

Item 120: Final consumption of electricity in Estonia

Final consumption of electricity per capita in Estonia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Estonia by sectors in 2018 (%)

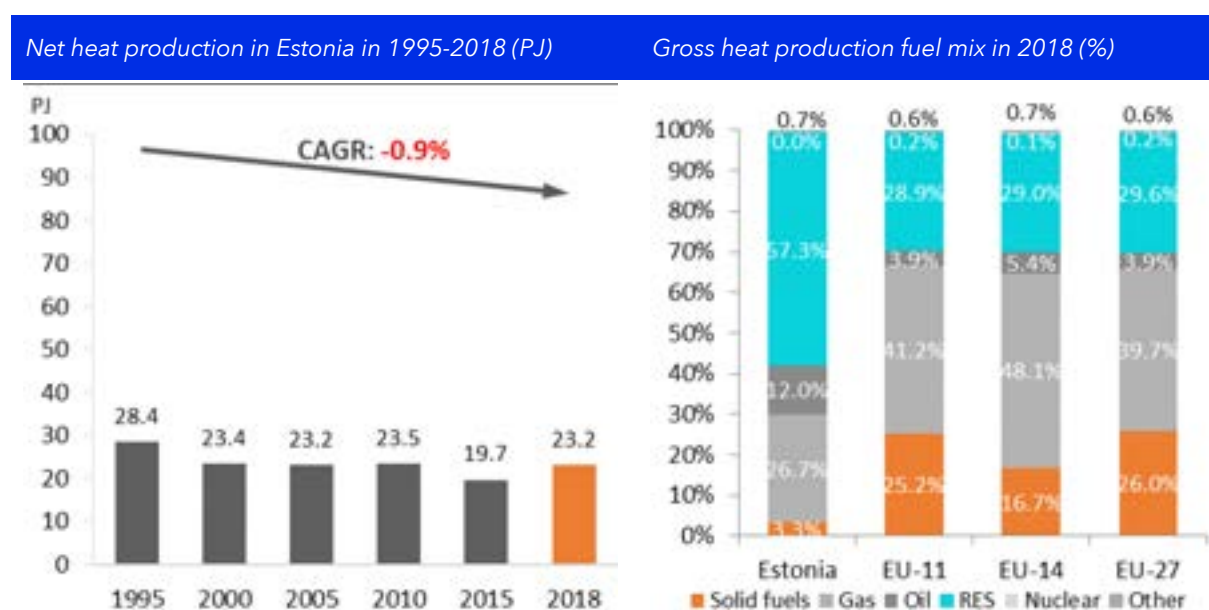


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 6.5 Overview of the heat sector

Item 121 presents heat production in Estonia as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Estonia has dropped between 1995 and 2018 from 28.4 PJ to 23.2 PJ, i.e. at CAGR of -0.9%. Estonian production fuel mix is dominated by renewable energy sources (almost 57.3%) and gas (almost 26.7%). That means that in comparison with EU-14 and EU-27 Estonia has a higher share of RES in heat production. The share of gas is lower - only 26.7% compared to 48.1% and 39.7% averages for EU-14 and EU-27. The share of solid fuels is low, lower than European averages, whereas the usage of oil is higher (12.0% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries).

Item 121: Net heat production and gross electricity production fuel mix in Estonia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 122 presents final heat consumption per capita and its breakdown by sectors.

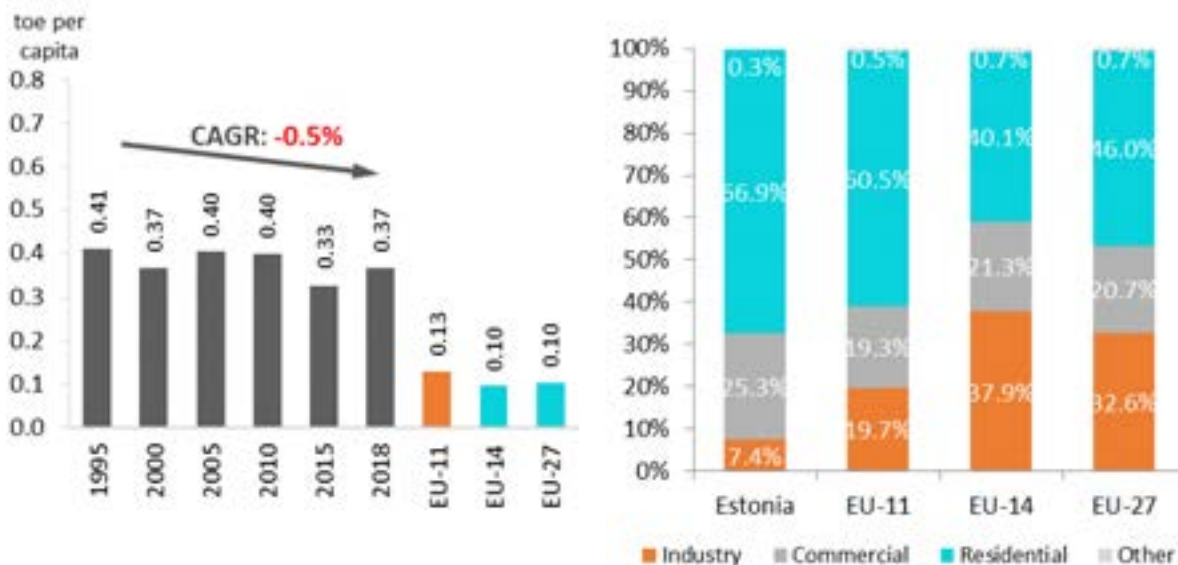
The per capita demand for heat in Estonia has decreased from 0.41 toe in 1995 to 0.37 toe in 2018. As a result, within the 23 years analysed, heat consumption per capita in Estonia has decreased at CAGR of -0.5%. The heat consumption in Estonia remains higher than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

The structure of final consumption of heat in Estonia is characterized by higher share of commercial (25.3% in Estonia compared to 21.3% in EU-14 and 20.7% in EU-27) and residential usage (66.9% in Estonia compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (7.4% in Estonia compared to 37.9% in EU-14 and 32.6% in EU-27).

Item 122: Final consumption of heat in Estonia

Final consumption of heat per capita in Estonia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Estonia by sectors in 2018 (%)

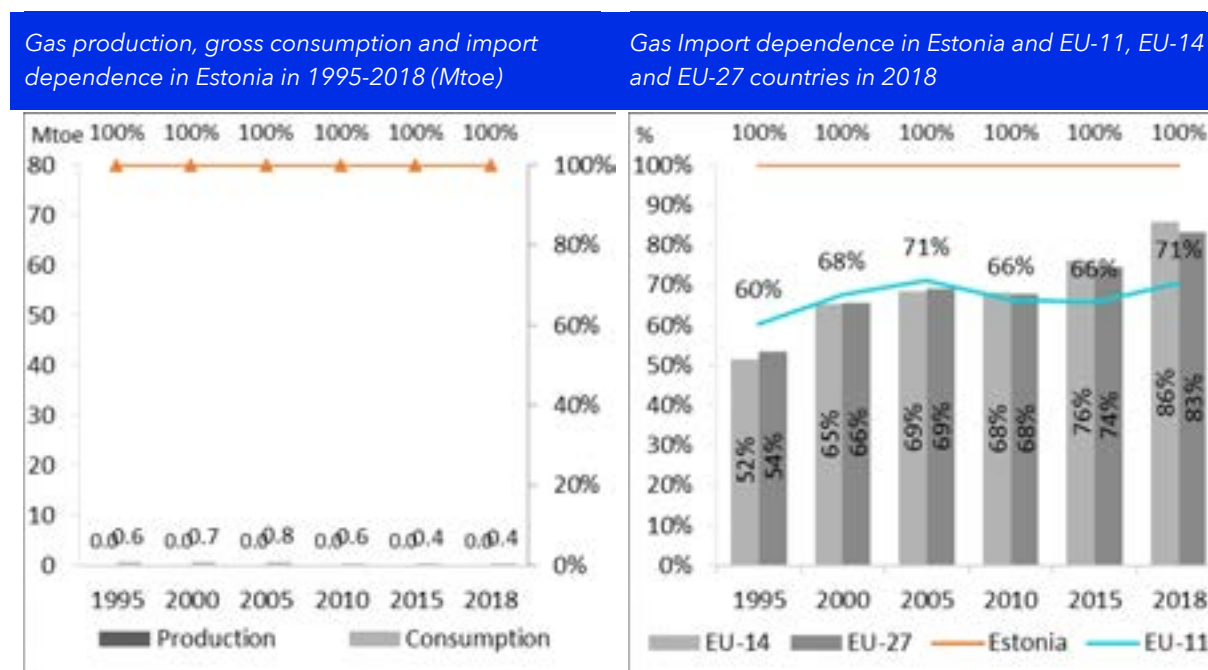


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 6.6 Overview of gas sector

Gas production in Estonia is null comparing to the consumption (0.4 Mtoe in 2018). Therefore, the import dependence remains high - 100% in years 1995-2018 (see Item 123). When compared to EU averages significantly higher import dependence is observed between Estonia and EU-11, EU-14 and EU-27 countries (100% import dependence of Estonia in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 123: Gas sector in Estonia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

The final consumption of gas per capita in Estonia has increased from 0.12 toe per capita in 1995 to 0.19 toe per capita in 2018 and it remains significantly lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

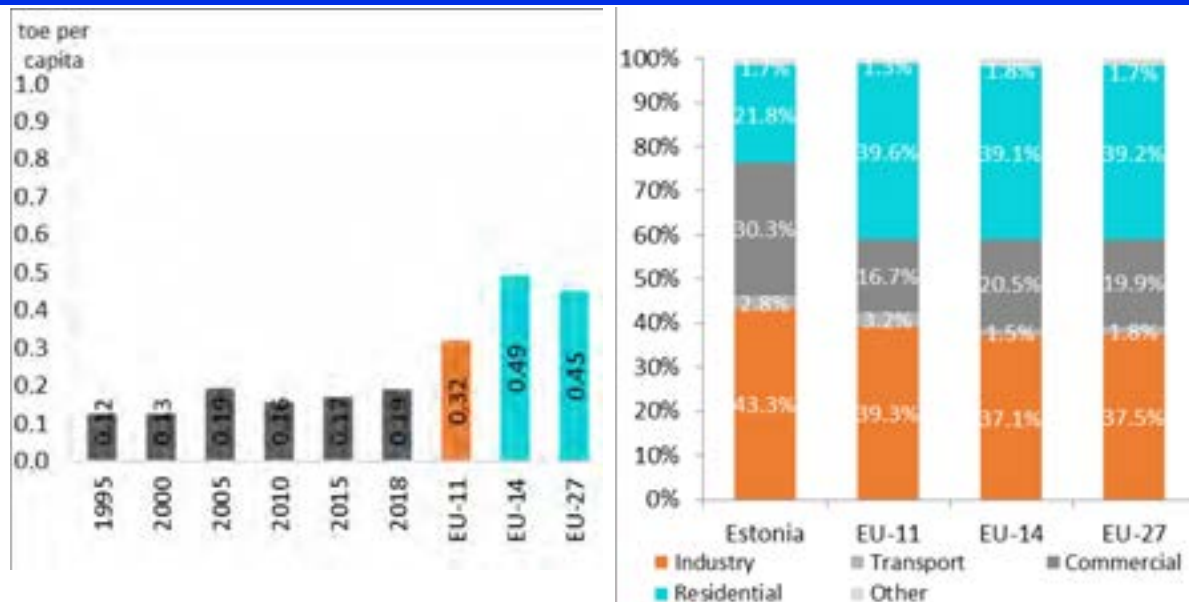
The structure of final gas consumption per sectors is like European averages. Gas usage in Estonia is dominated by industry (43.3%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%. The share of gas usage in transport sector in Estonia is also higher (2.8%) compared to 1.5% in EU-14 and 1.8% in EU-27 but lower compared to 3.2% EU-11 average. Share of final use of gas is also higher in commercial sector in Estonia - 30.3% comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27.

On other hand gas in residential sector is significantly less present - 21.8% in residential sector in Estonia comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27.

Item 124: Final consumption of gas per capita in Estonia in 1995-2018 and gas final consumption by sectors in Estonia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Estonia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Estonia and EU-11, EU-14 and EU-27 countries in 2018

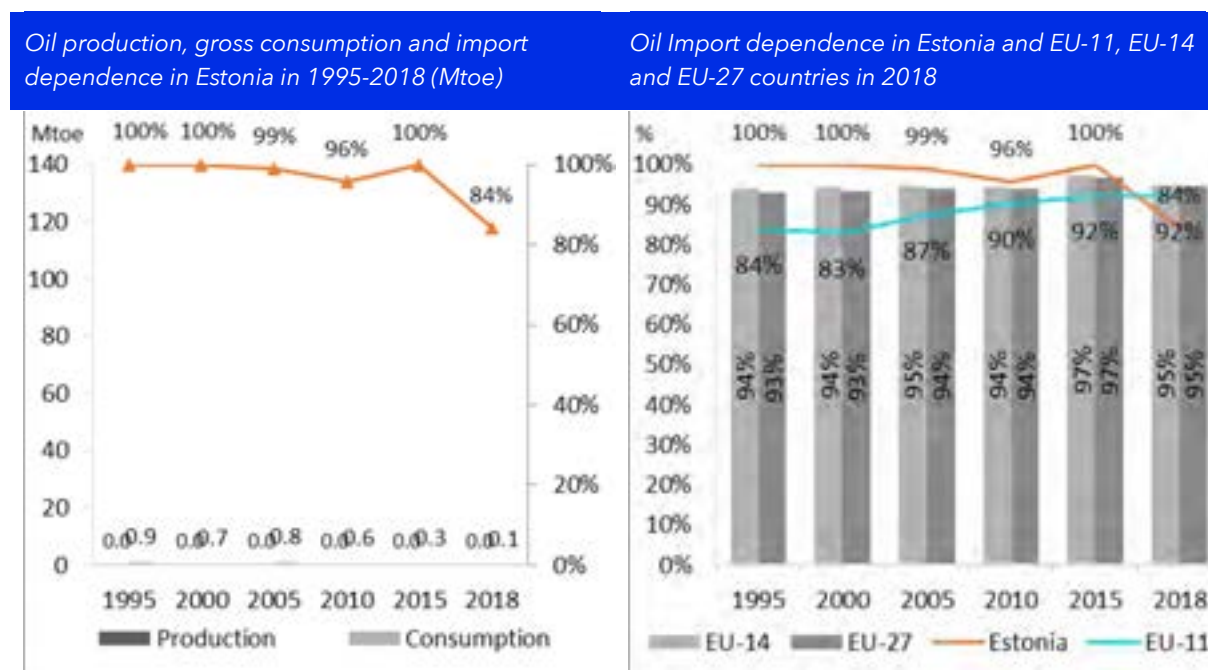


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 6.7 Overview of the oil sector

Oil production in Estonia is null and the consumption is 0.1 Mtoe in 2018. Therefore, the import dependence remains high - between 84% and 100% in years 1995-2018 (see Item 125). When compared to EU averages higher import dependence is observed between Estonia and EU-14 and EU-27 countries (84% import dependence of Estonia in 2018 versus 95% in EU-14 and 95% in EU-27) but lower compared to EU-11 countries (92%).

Item 125: Oil sector in Estonia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

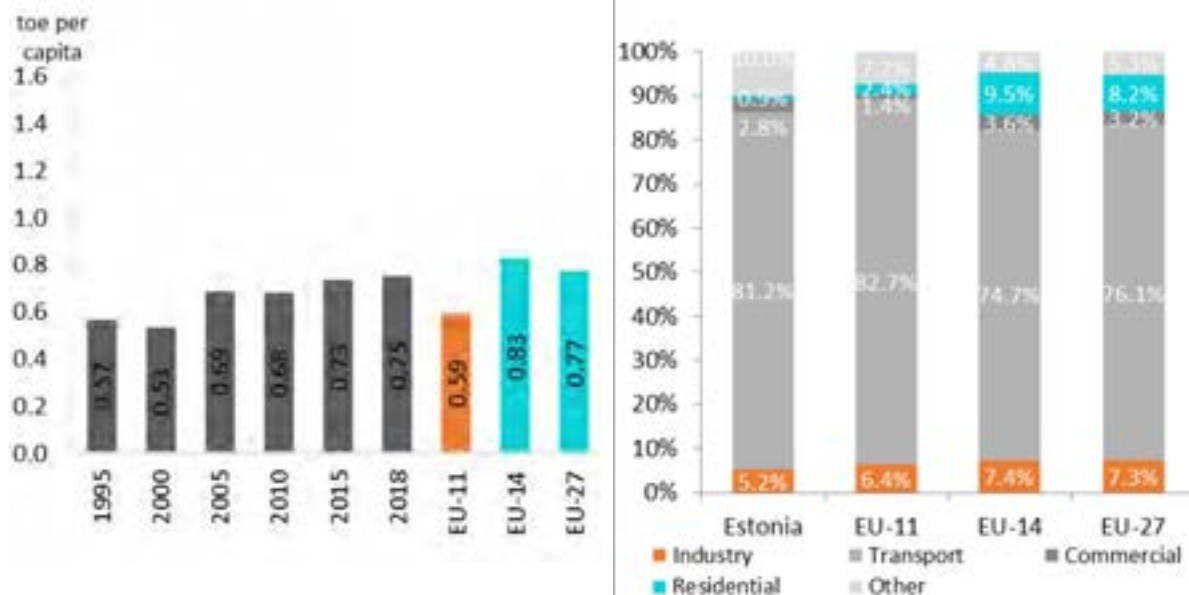
The final consumption of oil per capita in Estonia increased for 0.57 toe per capita in 1995 to 0.75 toe per capita in 2018. It remains lower than the averages for EU-14 and EU-27 countries (respectively 0.83 toe per capita, 0.77 toe per capita) but higher than EU-11 average (0.59 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 81.2% in Estonia comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are lower in Estonia than in EU-11, EU-14 and EU-27 countries. Commercial and residential usage are also lower than EU-14 and EU-27 averages.

Item 126: Final consumption of oil per capita in Estonia in 1995-2018 and oil final consumption by sectors in Estonia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Estonia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Estonia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 6.8 EU climate policy and its targets for Estonia

Estonia is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 127).

*Item 127: Energy and climate targets for Estonia for 2020 and 2030*

	Estonia 2020 targets	Estonia 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS – Effort Sharing Decision (ESD)	+11% in relation to their 2005 levels	-
National emission reduction targets in non-ETS – Effort Sharing Regulations (ESR)	-	-13% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	25% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 6.5 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 2.8 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

In following chapter, the overview of Estonia targets and performance are summarized.

### 6.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Estonia is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Estonia is 6.02 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions exceeds the target by 5.3%.

Item 128: Energy efficiency target data for Estonia

Greenhouse gas emissions level in Estonia and EU-28, base year 1990, and EU 2020 target



Greenhouse gas emissions in Effort Sharing Decision (ESD) sectors



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 6.8.2 Renewable energy sources

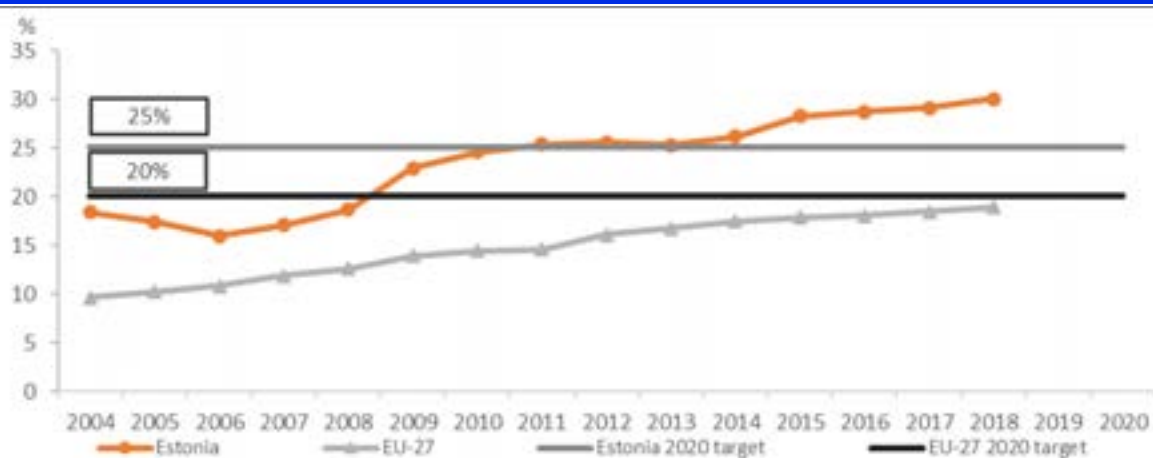
The following targets are set for Estonia regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 25% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Estonia is already above EU wide and country specific targets.

## Item 129: Share of energy from renewable energy sources in gross final energy consumption in Estonia

Share of energy from renewable energy sources in gross final energy consumption in Estonia in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 6.8.3 Energy efficiency

The energy efficiency target set for Estonia are respectively:

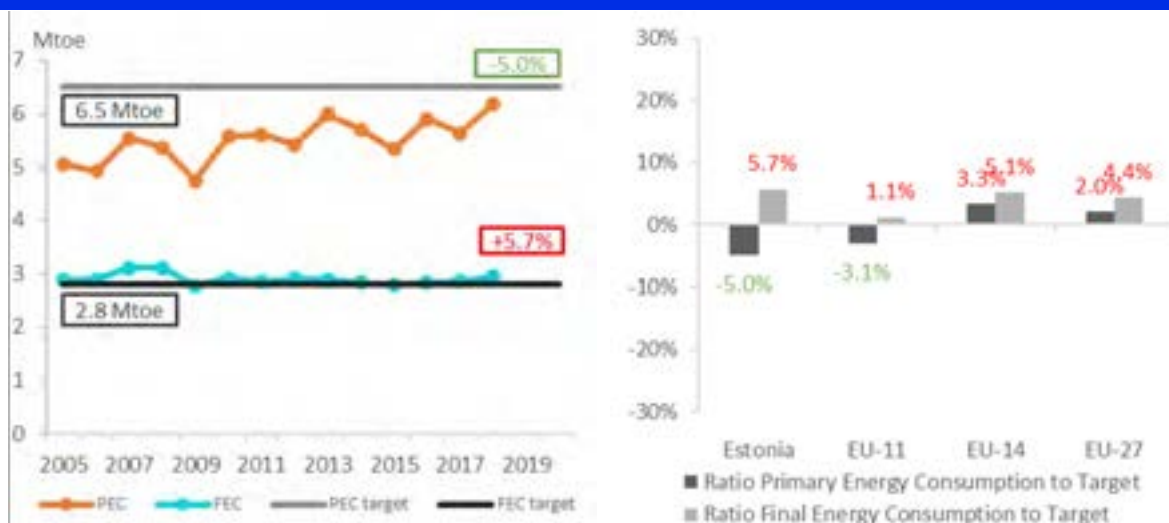
- Primary Energy Consumption in 2020: 6.5 Mtoe
- Final energy consumption in 2020: 2.8 Mtoe

Following the information provided in Item 130 the final energy consumption for 2018 is above the targets by 5.7% and primary energy consumption is below the target by 5.0%

## Item 130: Energy efficiency target data for Estonia

Primary energy consumption and final energy consumption in Estonia in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Estonia, EU-11, EU-14 and EU-27 in 2018



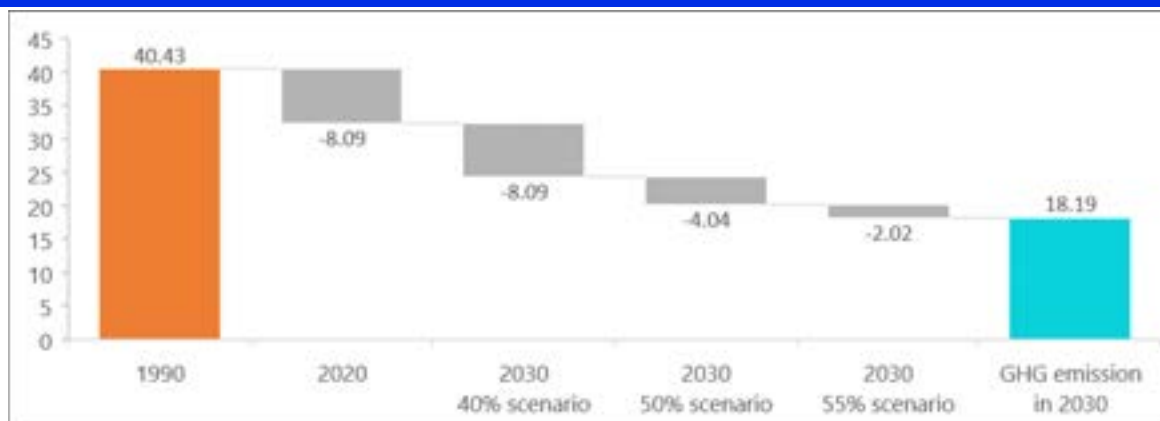
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

## 6.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Estonia greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 8.09 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 8.09 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 4.04 Mt CO<sub>2</sub> emission decrease is needed, or 6.06 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Estonia up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Estonia was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 131: Estimation regarding greenhouse gas emissions in Estonia under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Estonia under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 7 Hungary

### 7.1 General information

Hungary is the 4<sup>th</sup> largest country within EU-11 group in terms of total country area and represents 8.2% of the area. At the same time, it is the 11<sup>th</sup> country in EU-27 with 2.2% of the area. It represents 9.5% of EU-11 population and 2.2% of EU-27 population, but 9.6% of its total nominal GDP of EU-11 and 1.0% of EU-27. Despite the robust economic growth in 1995-2018 period, in 2018 Hungarian GDP per capita amounted only to 71% of the whole EU average.

Item 132: Hungary - key data



#### Key data

Population (M)	9.8
GDP per capita (EUR, nominal)	13,690
GDP per capita (EUR, PPS)	21,900
GDP as share of EU-11	9.6%
GDP as share of EU-27	1.0%
Energy intensity of the economy (kgoe per 1,000 EUR)	126.5
Greenhouse gas emissions (Mg per capita)	6.5

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 4.6% Hungarian economy considerably grew in the period of 1995-2018 (see Item 133/Item 37). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 65% and 71% of the respective averages) - even if purchasing power is taken into consideration.

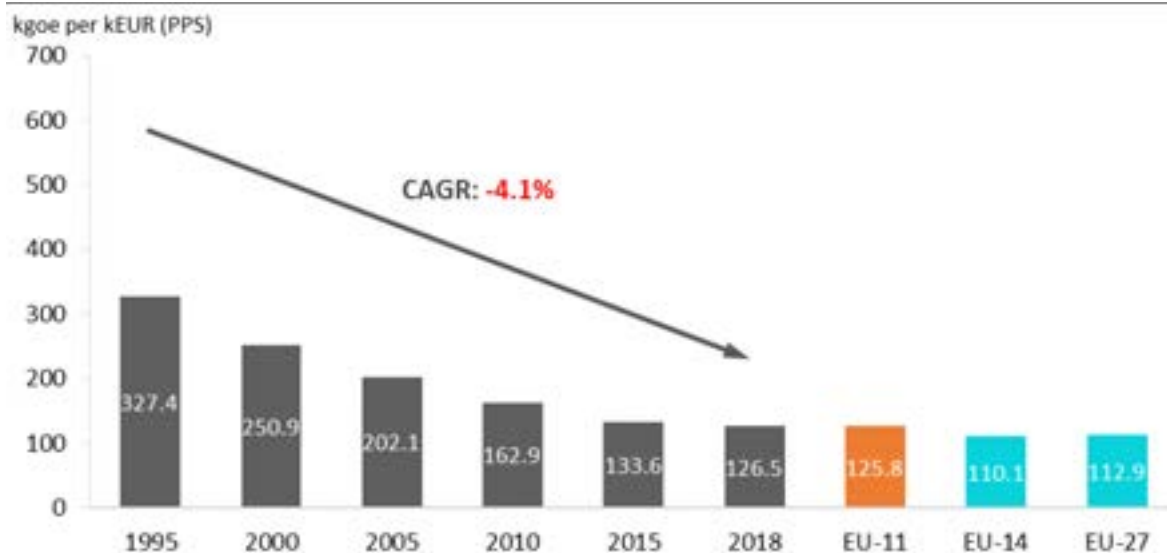
Item 133: GDP per capita in Hungary for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Hungary GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Hungarian economy energy intensity is about 126.5 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 200.0 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than 2 times. In EU-14 and EU-27 average values are 1.1 times lower and in EU-11 average is at a similar level than in Hungary.

Item 134: Energy intensity of the economy in Hungary in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) - EI\_GDP\_PPS

## 7.2 Energy balance of Hungary

In Item 135 the energy balance of Hungary in 2018 as well as historical values of net imports of energy are shown. The primary energy production was equal to 10.9 Mtoe. Net import accounted for 15.5 Mtoe and gross inland consumption of energy was 26.7 Mtoe.

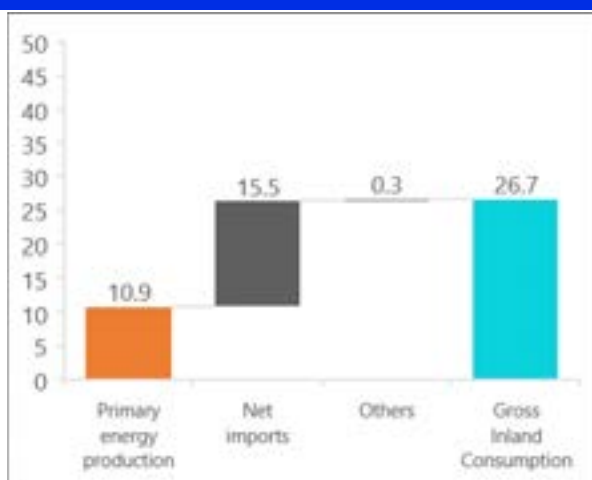
The production of primary energy in the country has decreased from 13.9 Mtoe in 1995 to 10.9 Mtoe in 2018. Gross inland consumption was oscillating at the level of 25-27 Mtoe in year 1995-2018.

Consequently, net import of energy has increased from 12.5 Mtoe in 1995 to 15.5 Mtoe in 2018. The share of import in total energy needs of the country has also increased from 47.8% in 1995 to 58.1% in 2018. In both cases, net import, and the share of net imports in energy needs of the country were increasing up to 2009, then it has decreased up to 2013 to finally increase to the current values of 2018.

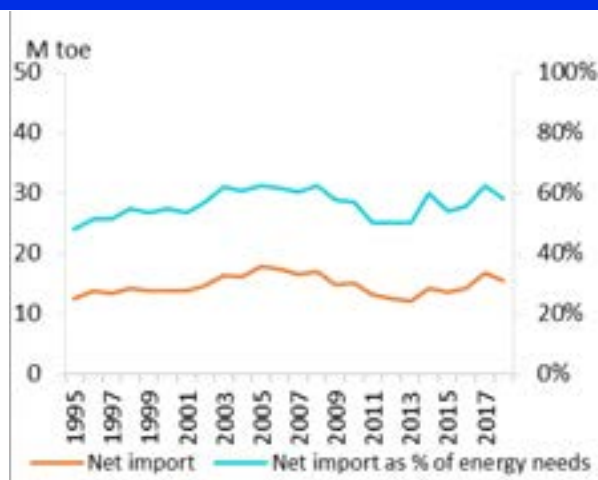
Hungary primary energy production compared to gross inland consumption has decreased from 53% to 41%. Therefore, the dependence of the country from foreign import of energy has increased.

Item 135: Energy balance in Hungary

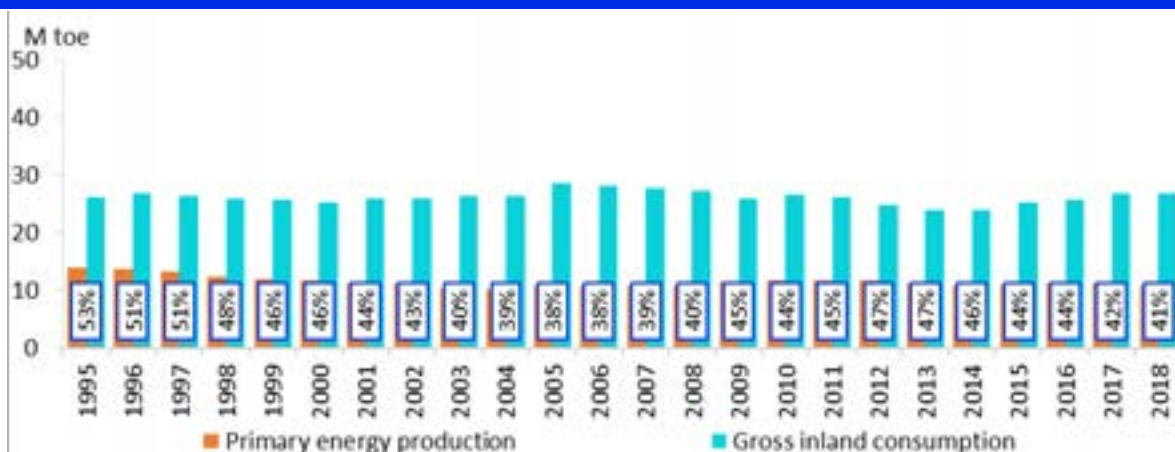
Energy balance in Hungary in 2018 (Mtoe)



Net import of energy in Hungary in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Hungary (%)



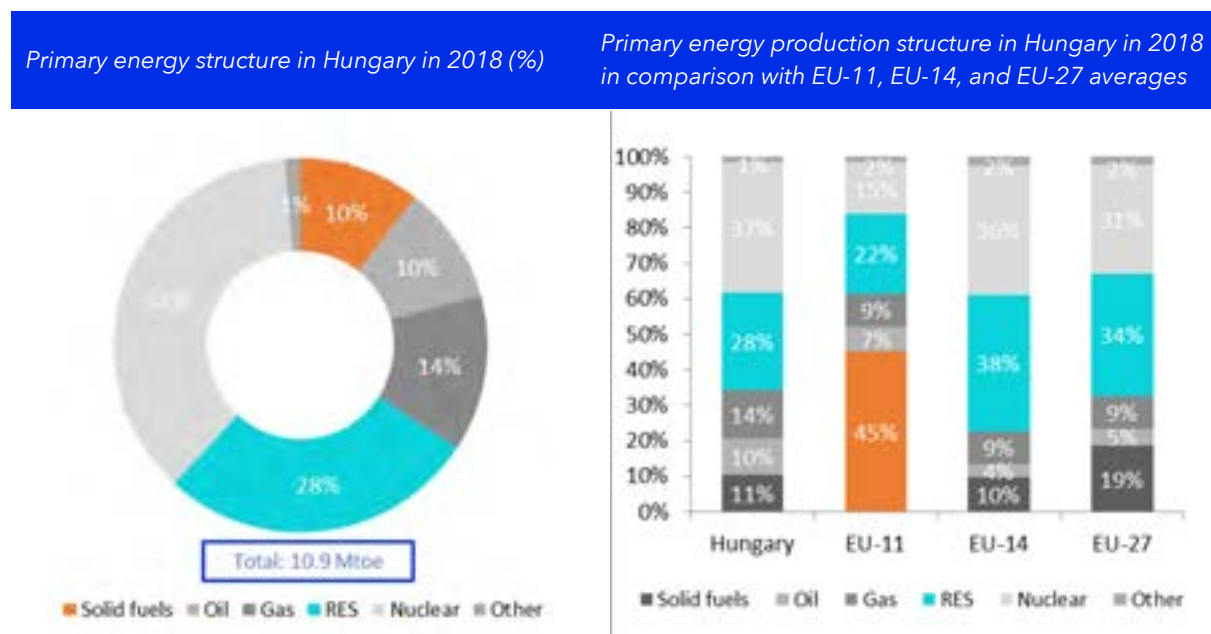
Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

Considering the primary production, one can notice that 37% is based on nuclear and 28% on renewable energy sources, which overwhelmingly dominate the structure (around 65% combined share). The remaining part is produced from solid fuels (10%), oil (10%) and gas (14%).

Comparing to EU-11 group Hungary has a higher share of nuclear (37% versus 15%). The share of renewable energy sources is also higher (28% versus 22%), as well as oil (10% versus 7%) and gas (14% versus 9%). Contrary to EU-11 averages the share of solid fuels in primary energy production is largely lower (11% versus 45%).

When compared to the group of developed Western European countries (EU-14), Hungary has similar share of nuclear energy in the primary energy production mix and a lower share of RES. (28% versus 38%). The share of gas and oil are higher in Hungary than EU-14 averages (14% versus 9% and 10% versus 4%). The share of solid fuels is similar - about 10%. Similar relations are observed when comparing Hungary primary energy structure to EU-27.

Item 136: Primary energy structure in Hungary



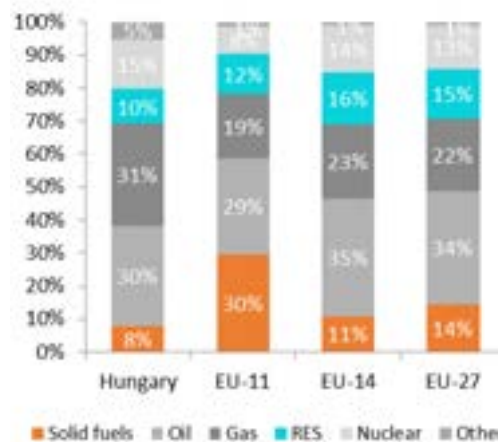
Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy – Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

On the consumption side, oil and gas have a dominant position - 61%. The share of nuclear is significant - 15%. Renewable energy sources represent 11% of gross consumption and solid fuels only 8%. Gross inland consumption of energy in Hungary differs from EU-11 averages by lower share of solid fuels and higher share of renewable energy sources. In this regard gross energy consumption structure is closer to EU-14 and EU-27 averages, with lower share of solid fuels and higher share of gas in Hungarian mix.

Item 137: Gross inland consumption structure in Hungary

Gross inland consumption structure in Hungary in 2018 (%)

Gross inland consumption structure in Hungary in 2018 in comparison with EU-11, EU-14, and EU-27 averages



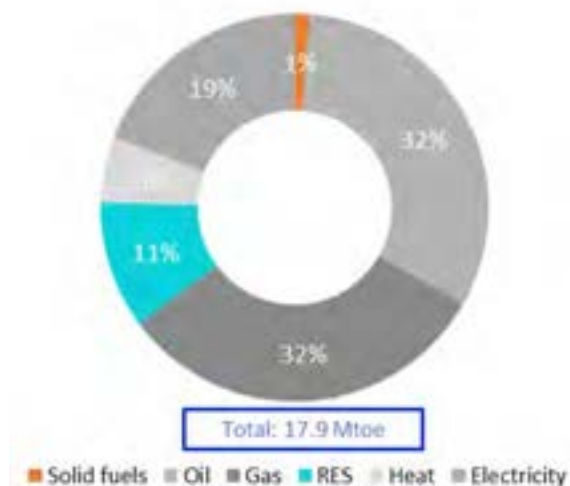
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Hungary is dominated by petroleum products, gas and electricity, which accounted together for 83% of total energy consumption in 2018 (see Item 138). The shares of heat and RES in final energy consumption fuel-mix are equal to 5% and 11%.

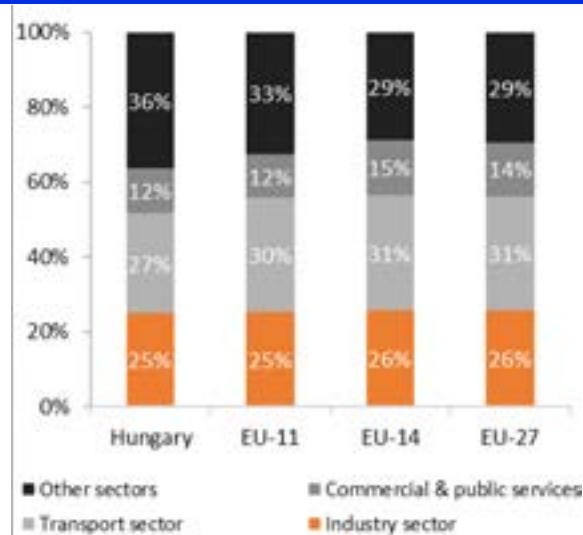
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Hungary hardly shows any particularities. The proportional consumption needs of each sector seem to be like those of developed countries. The final energy consumption is a little lower in transport but higher in other sectors.

Item 138: Final energy consumption structure in Hungary

Final energy consumption structure in Hungary in 2018 (%)



Final energy consumption structure in Hungary in 2018 in comparison with EU-11, EU-14, and EU-27 averages



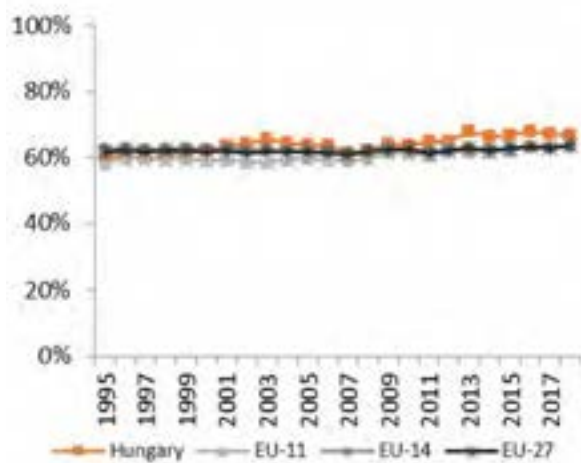
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Hungarian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were at similar level as EU-11, EU-14 and EU-27 averages. Furthermore, its level in Hungary has remained stable since 1995.

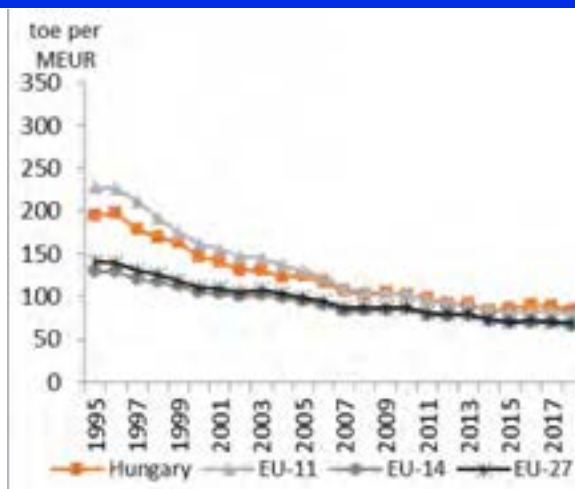
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 195.7 toe per MEUR to 83.5 toe per MEUR). The latter value is higher than EU-11, EU-14 and EU-27 averages.

Item 139: Final energy consumption in Hungary in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Hungary in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Hungary in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

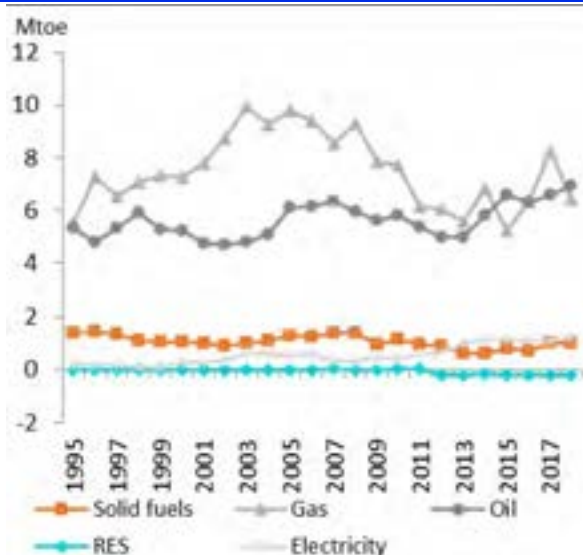


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

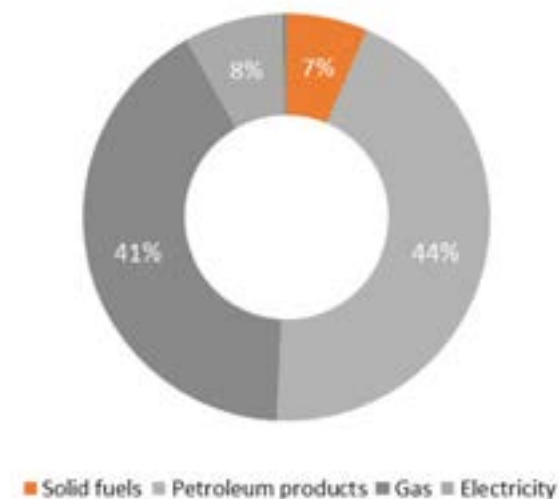
Total net import of energy in Hungary significantly decreased in years 1995-2018. Analysis of its structure in 2018 indicates the dominance of petroleum products and gas which constitute over 85% of total net import value. The other two net imported fuels are electricity and solid fuels with respective shares of 8% and 7%. Hungary has become a net exporter of renewable energy sources. The import of oil remained stable up to 2012 when it has increased. Gas import is fluctuating.

Item 140: Net import of energy in Hungary

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)

Solid fuels are mainly imported from United States (47%), Czech Republic (22%), Russia (14%), Poland (11%) and Australia (4%). Other countries complete the import with 2% share.

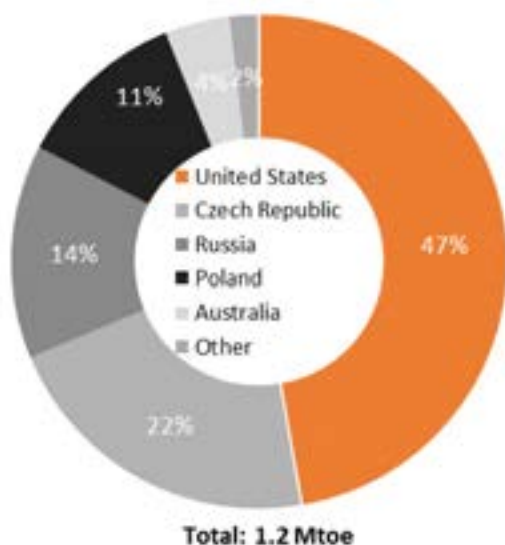
Crude oil is imported to Hungary mainly from Russia (47%) and Iraq (20%). Smaller amounts are imported from Slovakia and Austria (8% each). Remaining 17% are imported from other countries.

Gas imports are in 95% coming from Russia. The origin of the remaining 5% has not been disclosed.

Electricity is imported to Hungary from Slovakia (37%), Ukraine (27%) and Austria (20%). Additional imports from Serbia, Romania and Croatia are equal to 16% of total import.

Item 141: Foreign fuel suppliers

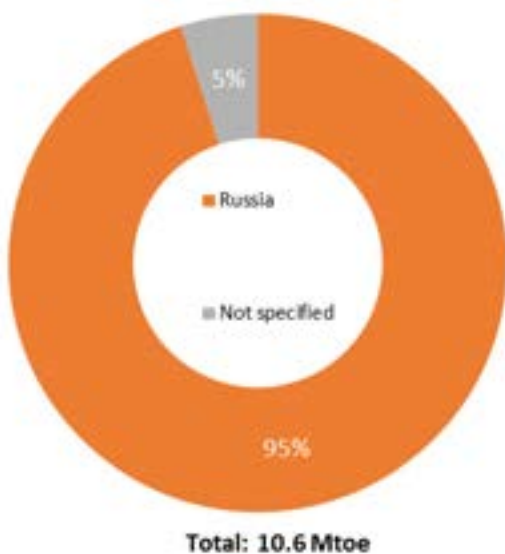
Foreign suppliers of solid fuels in Hungary in 2018 (%)



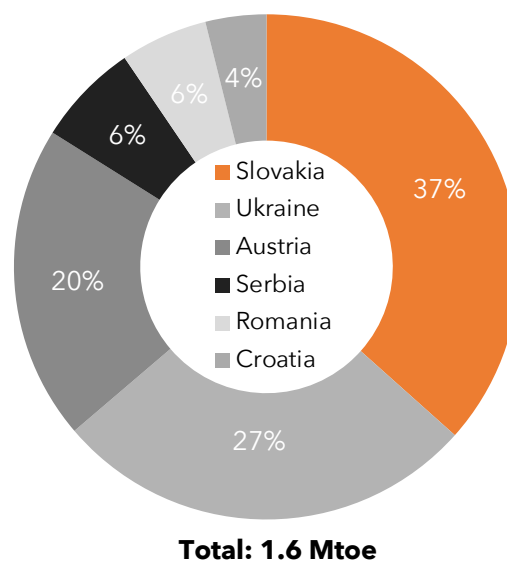
Foreign suppliers of crude oil in Hungary in 2018(%)



Foreign suppliers of gas in Hungary in 2018 (%)



Foreign suppliers of electricity in Hungary in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 7.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Hungary were reduced - from over 75.3 Mt CO<sub>2</sub> in 1995 to 63.8 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 6.5 Mg CO<sub>2</sub> per capita in 2017 (from 7.3 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

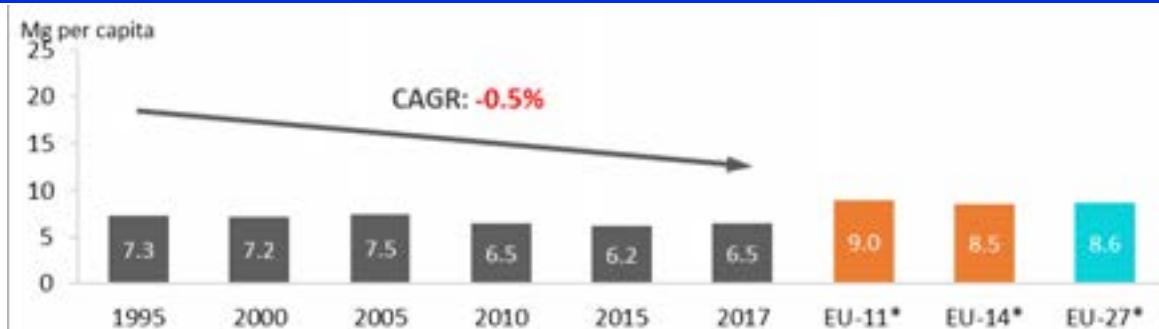
There were some noteworthy changes in the Hungarian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction

sector emissions dropped swiftly by 40%, as well as emissions from energy industries, industrial processes, and waste management, respectively 38%, 13% and 16%. On other hand, transport emissions gained in importance increasing by 75%.

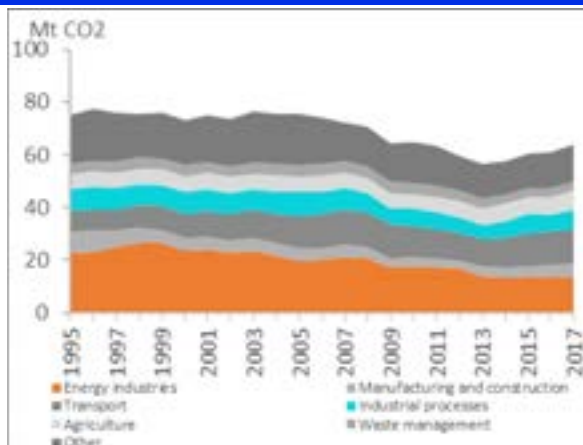
Comparing to EU-11, EU-14 and EU-27 countries, Hungary is characterized by lower share of emissions from energy industries (22% versus 35%, 26% and 28%). At the same time greenhouse gas emissions structures in Hungary is balanced more as in EU-14 and EU-27.

Item 142: Greenhouse gas emissions in Hungary

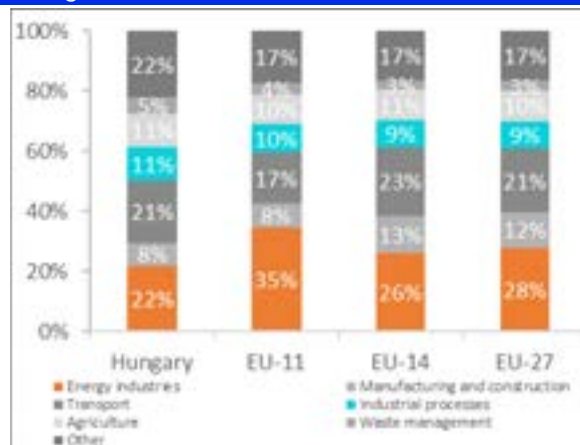
Greenhouse gas emissions per capita in Hungary in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Hungary by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Hungary by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



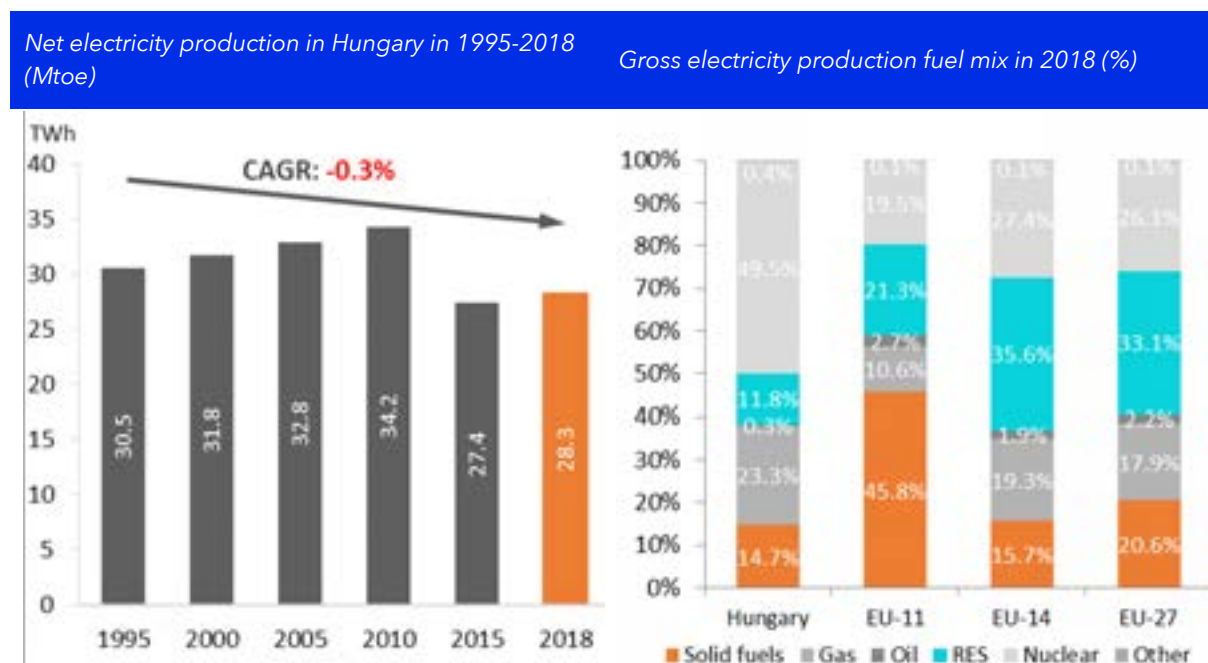
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 7.4 Overview of the electricity sector

Item 143 presents electricity production and the current fuel mix of Hungary. Over last 23 years net electricity production has dropped from 30.5 TWh in 1995 to 28.3 TWh in 2018 (CAGR -0.3%). As visible, net electricity production represents 7.0% of EU-11 total electricity production, which is lower compared to Hungarian GDP share of 10.0%.

The Hungarian fuel mix is dominated by nuclear energy with share of 49.5%. Compared to EU-14 and EU-27 countries, Hungary has a much bigger share of nuclear and gas in its energy mix. On other hand, the country produces relatively less electricity from renewable energy sources than in EU-14 and EU-27 countries, respectively 11.8% versus 35.6% and 33.1%).

Item 143: Net electricity production and gross electricity production fuel mix in Hungary



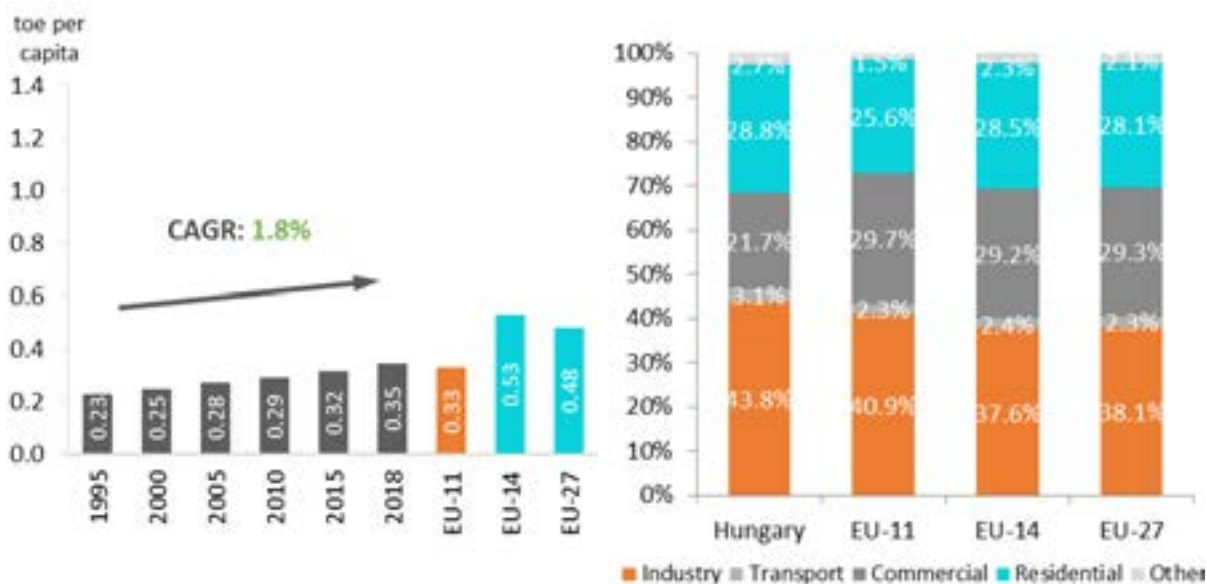
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 144 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Hungary has somewhat increased (CAGR in the period of 1995-2019 was around 1.8%) and its level is still relatively low compared to EU-14 and EU-27 countries. Hungarian final energy consumption per capita represents only 65.3% of EU-14 level and 71.6% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Hungary. Generally, the structure of final electricity consumption in Hungary is rather like EU averages, with a somewhat higher share of the industry and lower share of commercial sector.

Item 144: Final consumption of electricity in Hungary

Final consumption of electricity per capita in Hungary (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Hungary by sectors in 2018 (%)

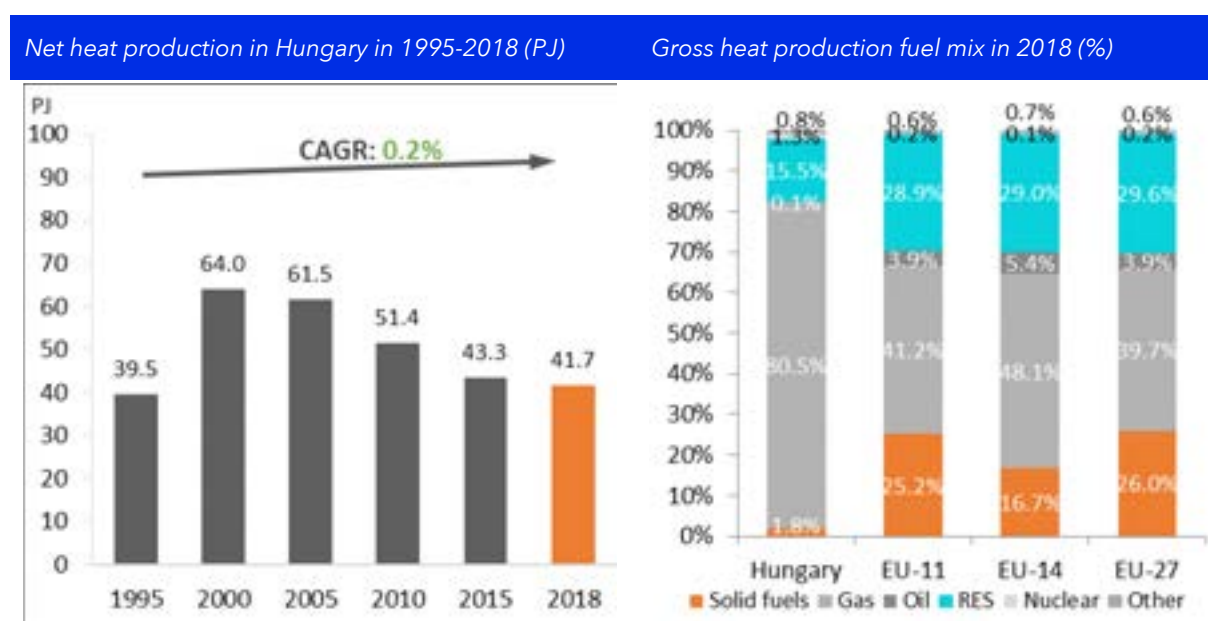


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 7.5 Overview of the heat sector

Item 145 presents heat production in Hungary as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Hungary has dropped between 1995 and 2018 from 39.5 PJ to 41.7 PJ, i.e. at CAGR of 0.2%. Hungarian production fuel mix is dominated by gas (almost 80.5%). That means that in comparison with EU-14 and EU-27 Hungary consumes relatively more gas in heat production. The share of solid fuels is low (1.8%), whereas the usage of oil is significantly lower (0.1% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower, about half of level in EU-11, EU-14 and EU-27 countries.

Item 145: Net heat production and gross electricity production fuel mix in Hungary



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 146 presents final heat consumption per capita and its breakdown by sectors.

The per capita demand for heat in Hungary has decreased from 0.13 toe in 1995 to 0.10 toe in 2018, with a small rebound in 2000 to 0.14 toe per capita. As a result, within the 23 years analysed, heat consumption per capita in Hungary has decreased at CAGR of -1.0%. The heat consumption in Hungary remains at the level of averages for EU-14 and EU-27, respectively 0.10 toe per capita and 0.10 toe per capita, but lower than EU-11 average.

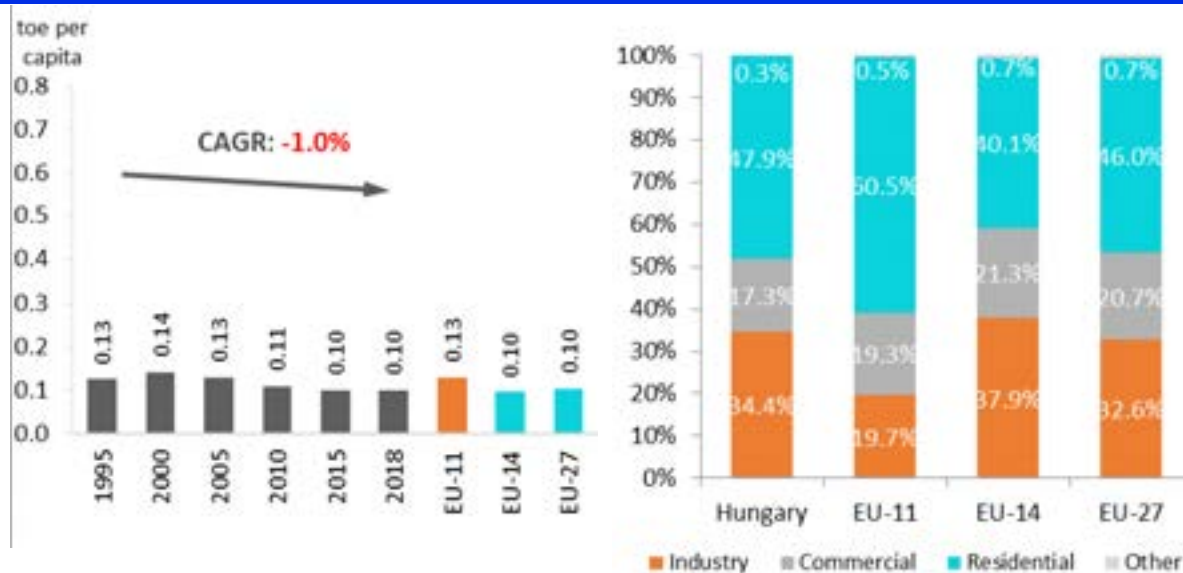
The structure of final consumption of heat in Hungary is characterized by higher share of residential usage (47.9% in Hungary compared to 40.1% in EU-14 and 46.0% in EU-27) and lower commercial (17.3% in Hungary compared to 21.3% in EU-14 and 20.7% in EU-27). Industry participation is comparable with European averages (34.4% in Hungary compared to 37.9% in EU-14 and 32.6% in EU-27).

In relation to EU-11 countries, the structure of final heat consumption is similar with a little higher share of industry sector and lower of residential one in final consumption of heat.

Item 146: Final consumption of heat in Hungary

Final consumption of heat per capita in Hungary (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Hungary by sectors in 2018 (%)

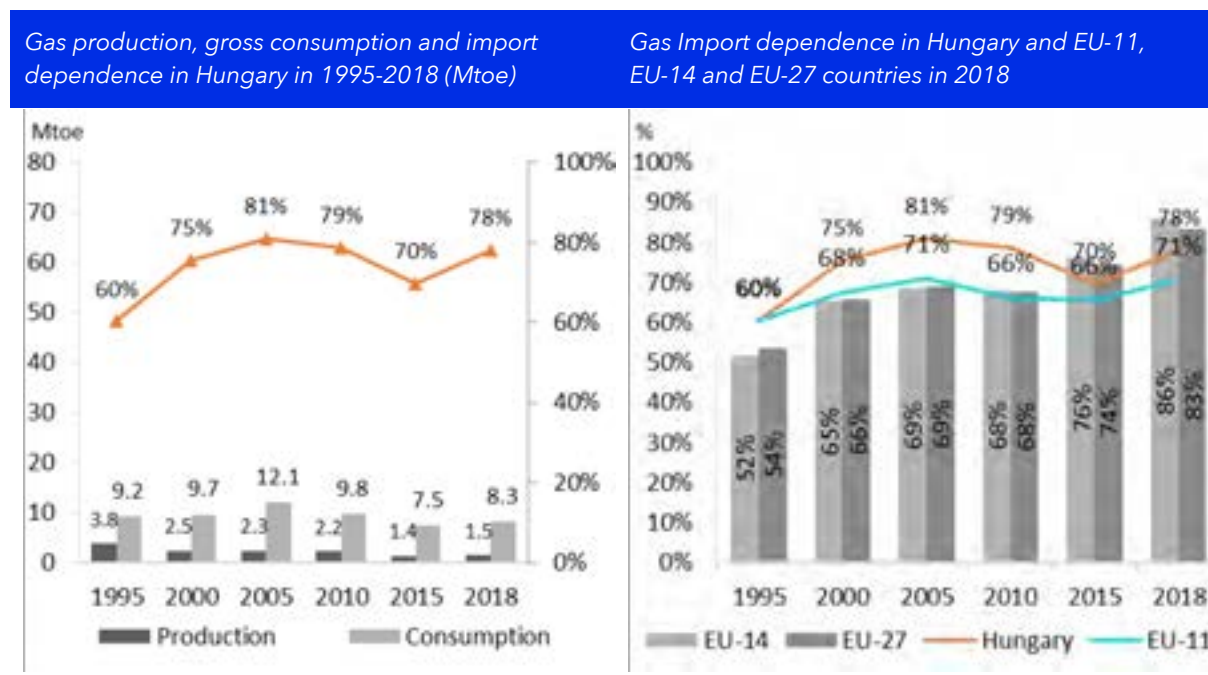


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 7.6 Overview of gas sector

Gas production in Hungary is very low (less than 1.5 Mtoe in 2018) comparing to the consumption (8.6 Mtoe in 2018). Therefore, the import dependence remains high - between 60% and 81% in years 1995-2018 (see Item 147). When compared to EU averages higher import dependence is observed between Hungary and EU-11 (78% import dependence of Hungary in 2018 versus 71% in EU-11) but lower than in EU-14 and EU-27 countries (86% in EU-14 and 83% in EU-27).

Item 147: Gas sector in Hungary



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

The final consumption of gas per capita in Hungary fluctuated over past years to finally decrease in the last 23 year from 0.59 toe per capita in 1995 to 0.57 toe per capita in 2018 and it remains higher than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

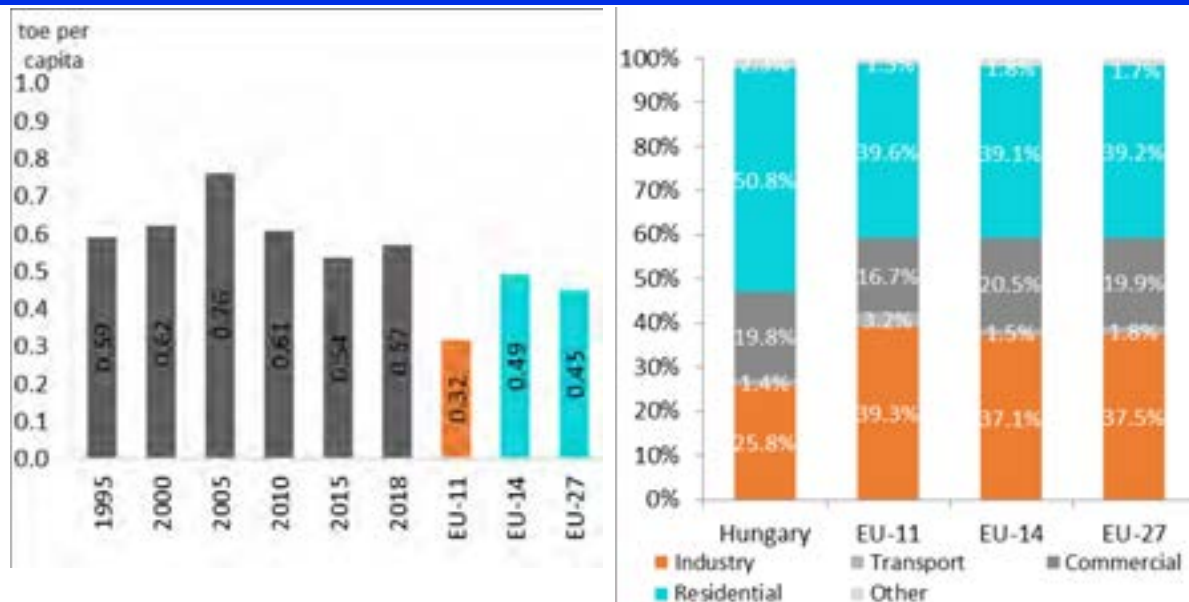
The structure of final gas consumption per sectors is like European averages. Gas usage in Hungary is dominated by residential sector (50.8% comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27). The use in commercial sector is similar - 19.8% in Hungary comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27. Transport has a lower share in Hungary (1.4%) compared to EU-11, EU-14 and EU-27 countries (3.2%, 1.5% and 1.8% respectively).

On other hand industrial application consumes only 25.8% whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%.

Item 148: Final consumption of gas per capita in Hungary in 1995-2018 and gas final consumption by sectors in Hungary and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Hungary (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Hungary and EU-11, EU-14 and EU-27 countries in 2018

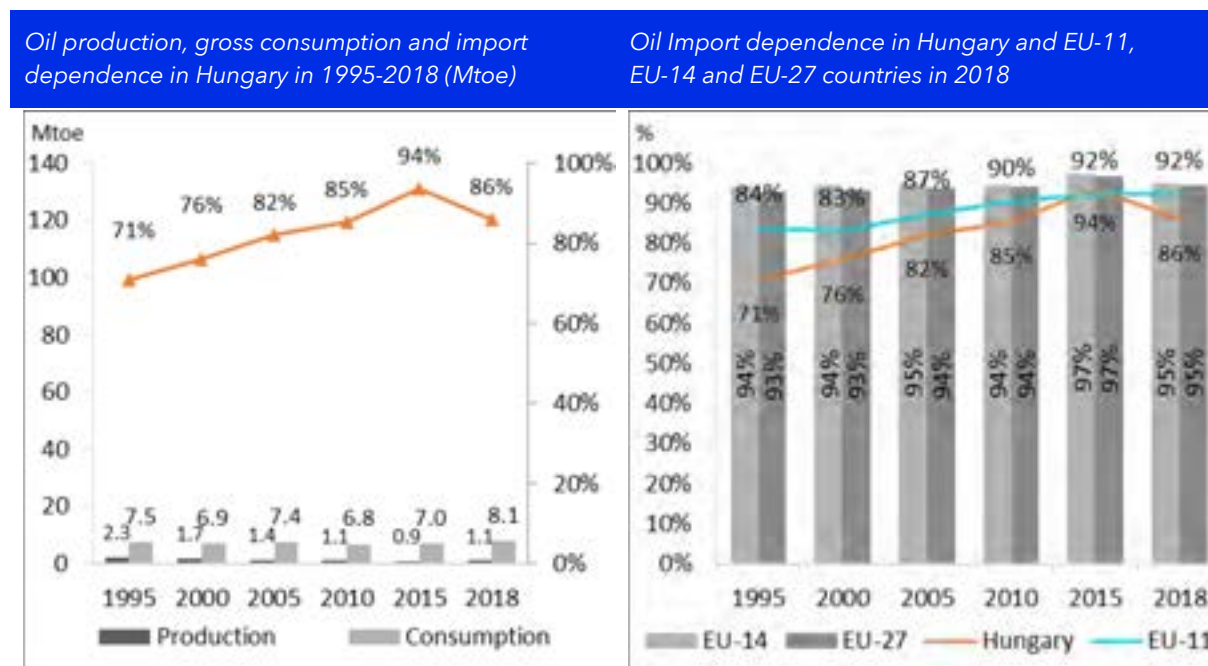


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 7.7 Overview of the oil sector

Oil production in Hungary is low (1.1 Mtoe in 2018) comparing to the consumption (8.1 Mtoe in 2018). Therefore, the import dependence remains high - between 71% and 94% in years 1995-2018 (see Item 149). When compared to EU averages lower import dependence is observed between Hungary and EU-11, EU-14 and EU-27 countries (86% import dependence of Hungary in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27). The level of oil import dependence of Hungary is closing to EU averages in 2018.

Item 149: Oil sector in Hungary



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

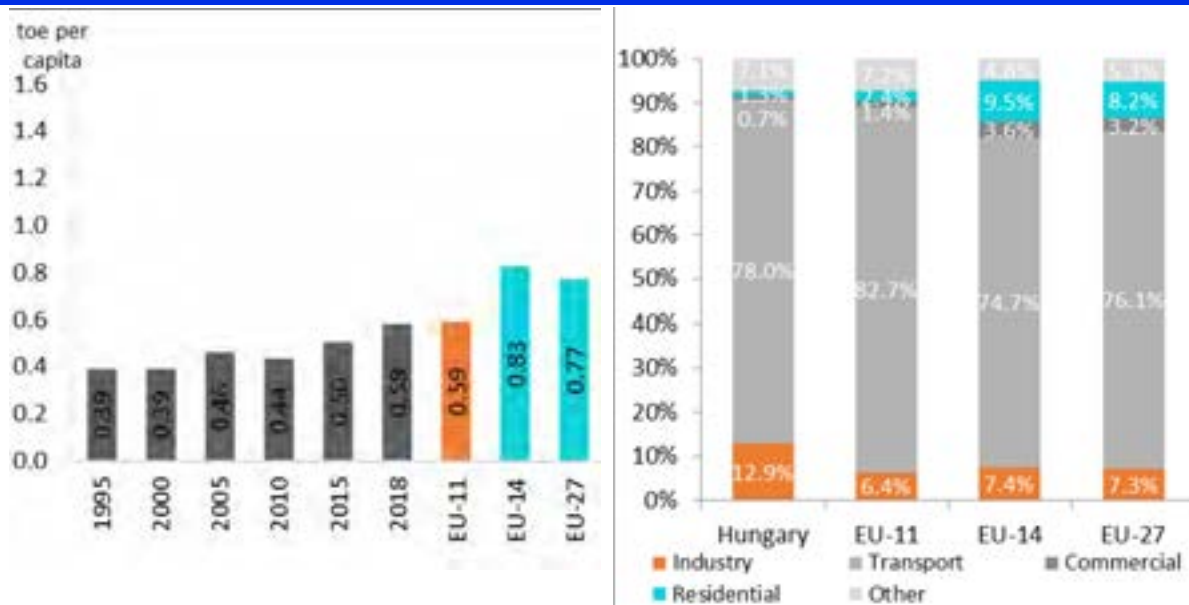
The final consumption of oil per capita in Hungary increased for 0.39 toe per capita in 1995 to 0.58 toe per capita in 2018. It remains lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.59 toe per capita, 0.83 toe per capita, 0.77 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of industry and transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 78.0% in Hungary comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are higher in Hungary than in EU-11, EU-14 and EU-27 countries, whereas commercial and residential usage is lower.

Item 150: Final consumption of oil per capita in Hungary in 1995-2018 and oil final consumption by sectors in Hungary and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Hungary (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Hungary and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 7.8 EU climate policy and its targets for Hungary

Hungary is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 151).

*Item 151: Energy and climate targets for Hungary for 2020 and 2030*

	Hungary 2020 targets	Hungary 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS – Effort Sharing Decision (ESD)	+10% in relation to their 2005 levels	-
National emission reduction targets in non-ETS – Effort Sharing Regulations (ESR)	-	-7% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	13% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 24.1 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 14.4 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

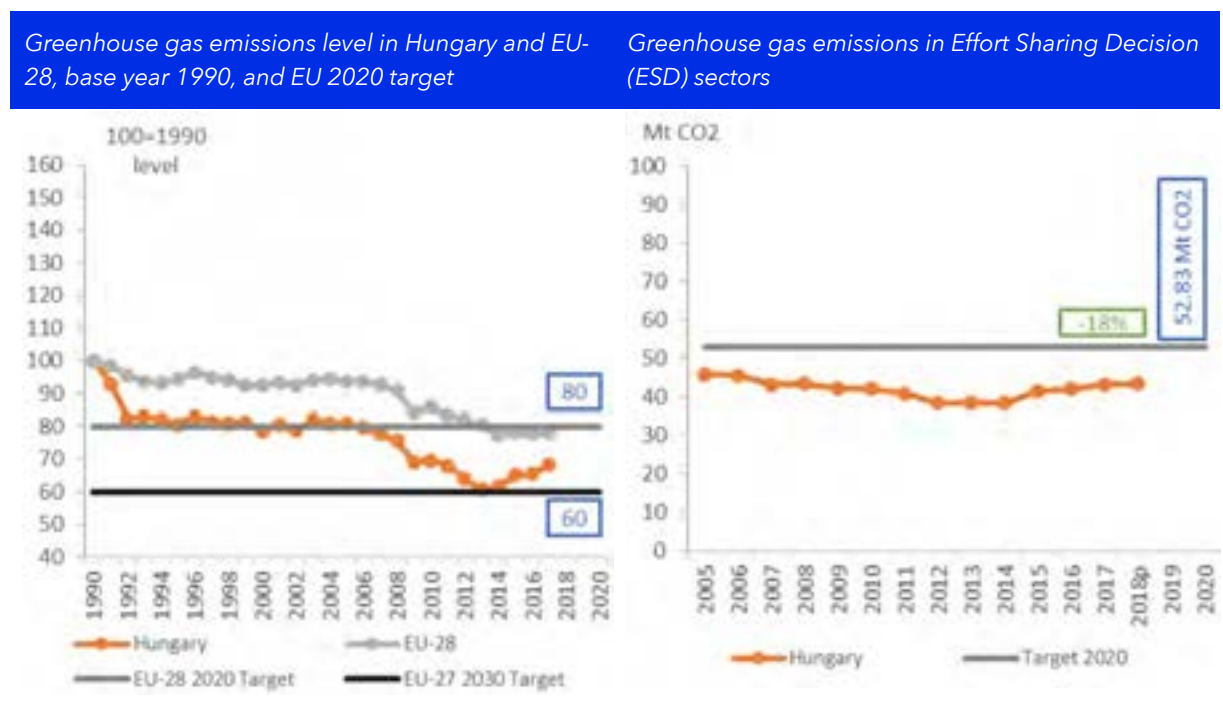
In following chapter, the overview of Hungary targets and performance are summarized.

### 7.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Hungary is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Hungary is 52.83 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 18%.

Item 152: Energy efficiency target data for Hungary



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 7.8.2 Renewable energy sources

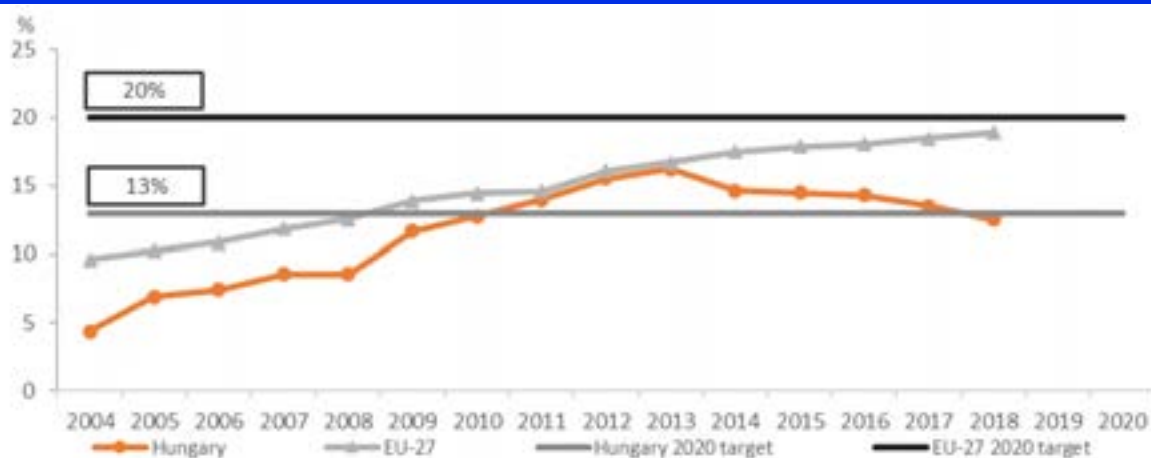
The following targets are set for Hungary regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 13% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Hungary is currently below EU wide and country specific targets.

Item 153: Share of energy from renewable energy sources in gross final energy consumption in Hungary

Share of energy from renewable energy sources in gross final energy consumption in Hungary in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 7.8.3 Energy efficiency

The energy efficiency target set for Hungary are respectively:

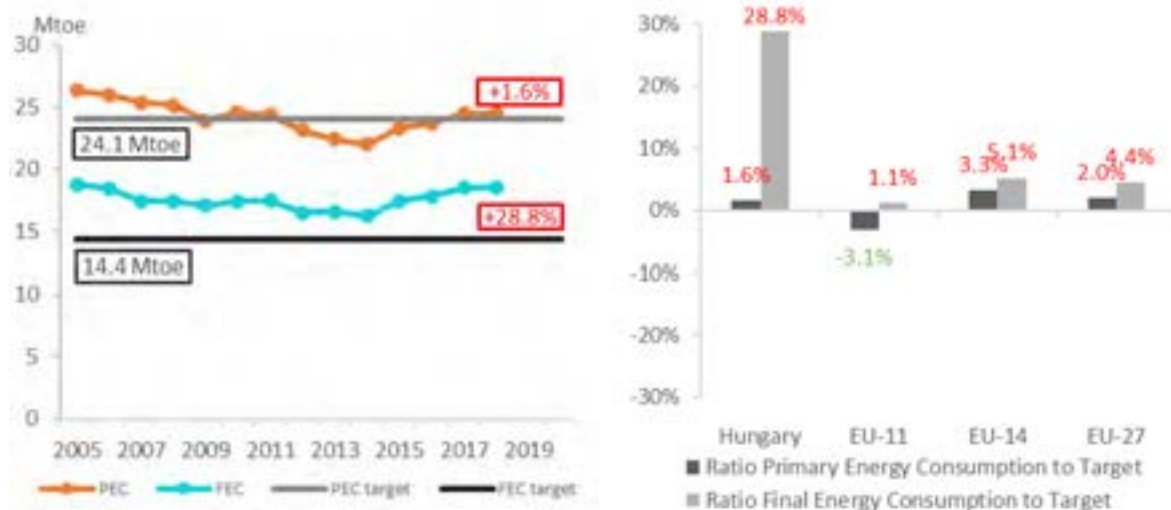
- Primary Energy Consumption in 2020: 24.1 Mtoe
- Final energy consumption in 2020: 14.4 Mtoe

Following the information provided in Item 154 the results for 2018 are above the targets in both criteria, respectively +1.6% of primary energy consumption and 28.8% of final energy consumption. This does not exclude Hungary to achieve the targets in 2020.

Item 154: Energy efficiency target data for Hungary

Primary energy consumption and final energy consumption in Hungary in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Hungary, EU-11, EU-14 and EU-27 in 2018



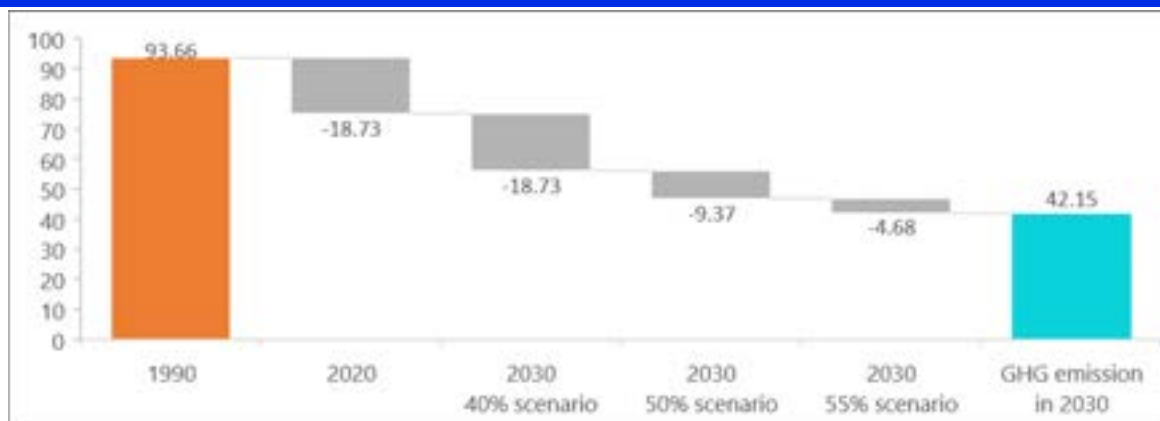
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

### 7.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Hungary greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 18.73 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 18.73 Mt CO<sub>2</sub> reduction. If the 50.5 targets proposed under European Green Deal is applied then additional 9.37 Mt CO<sub>2</sub> emission decrease is needed, or 14.05 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Hungary up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Hungary was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 155: Estimation regarding greenhouse gas emissions in Hungary under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Hungary under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 8 Latvia

### 8.1 General information

Latvia is the 7<sup>th</sup> largest country within EU-11 group in terms of total country area and represents 5.7% of the area. At the same time, it is the 17<sup>th</sup> country in EU-27 with 1.5% of the area. It represents 1.9% of EU-11 population and 0.4% of EU-27 population, but only 2.1% of its total nominal GDP of EU-11 and 0.2% of EU-27. Despite the robust economic growth in 1995-2018 period, in 2018 Latvian GDP per capita amounted only to 69% of the whole EU average.

Item 156: Latvia - key data



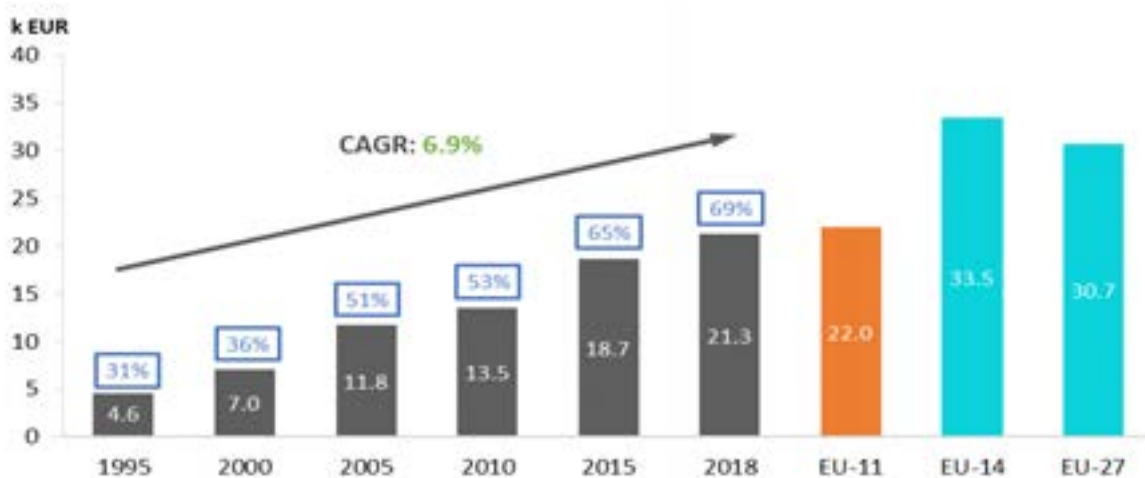
#### Key data

Population (M)	1.9
GDP per capita (EUR, nominal)	15,080
GDP per capita (EUR, PPS)	21,260
GDP as share of EU-11	2.1%
GDP as share of EU-27	0.2%
Energy intensity of the economy (kgoe per 1,000 EUR)	119.4
Greenhouse gas emissions (Mg per capita)	5.8

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 6.9% Latvian economy considerably grew in the period of 1995-2018 (see Item 157). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 64% and 69% of the respective averages) – if purchasing power is taken into consideration.

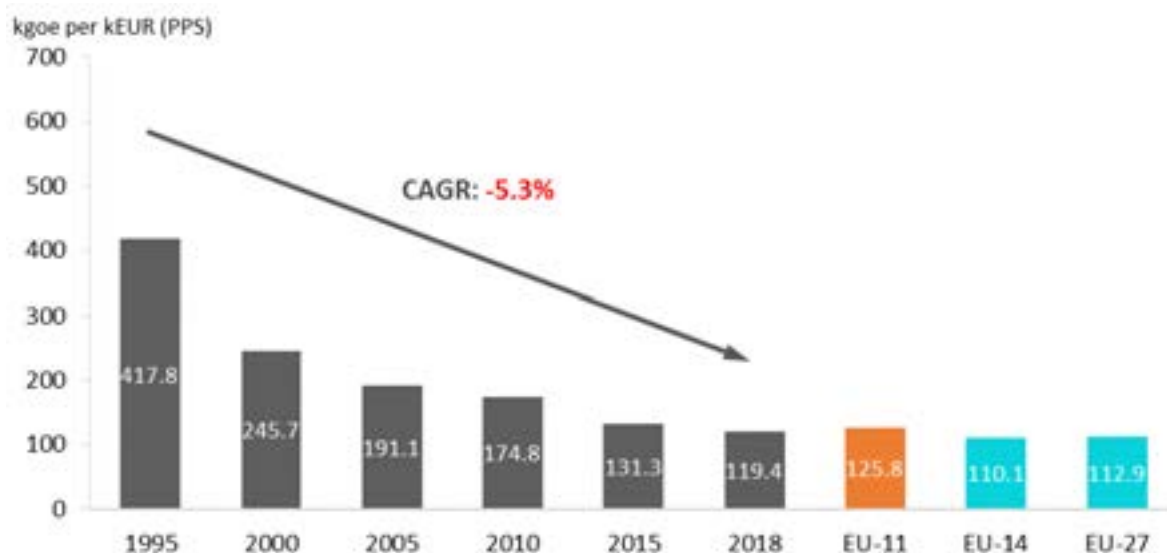
Item 157: GDP per capita in Latvia for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Latvia GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Latvian economy energy intensity is about 119.4 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 298.4 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than half. In EU-14 and EU-27 average values are 1.1 times lower and in EU-11 average is 1.1 times higher than in Latvia.

Item 158: Energy intensity of the economy in Latvia in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) – EI\_GDP\_PPS

## 8.2 Energy balance of Latvia

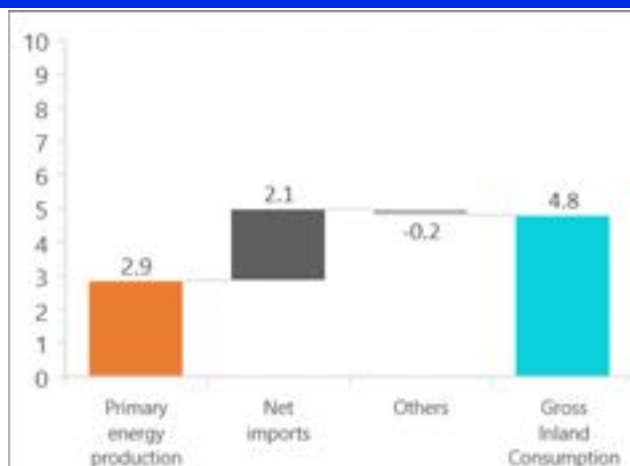
In Item 159 the energy balance of Latvia in 2018 as well as historical values of net imports of energy are shown. The primary energy production of the country is 2.9 Mtoe. Net imports accounts for 2.1 Mtoe and gross inland consumption of energy is 4.8 Mtoe.

The primary energy production has increased over past 23 years from 1.4 Mtoe in 1995 to 2.8 Mtoe in 2018. At the same time gross inland consumption has increased from 4.6 Mtoe in 1995 to 4.8 Mtoe in 2018. Due to this the country has increased its ability to meet country energy needs from 31% in 1995 to 60% in 2018.

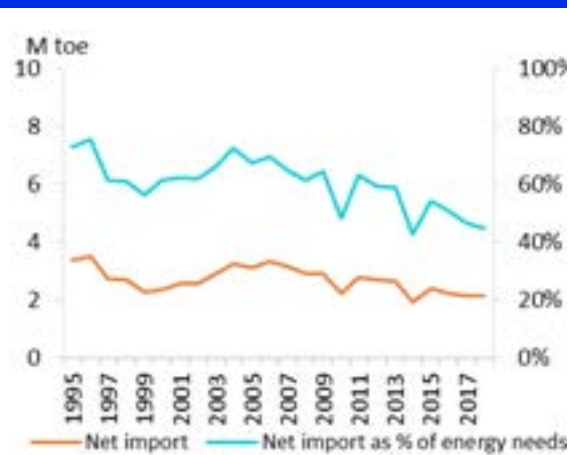
Over the same period net import has been reduced from 3.3 Mtoe in 1995 to 2.1 Mtoe in 2018. It corresponds to a reduction of net imports as share of energy needs from 73% to 45%.

Item 159: Energy balance in Latvia

Energy balance in Latvia in 2018 (Mtoe)



Net import of energy in Latvia in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Latvia (%)



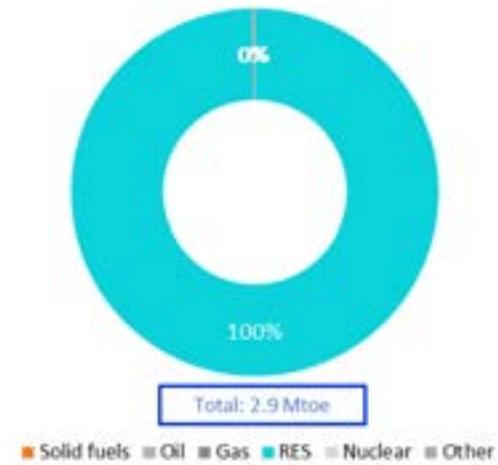
Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

Considering the primary production, one can notice that practically 100% from renewable energy sources. Small amounts below 1% are produced from solid fuels and other fuels.

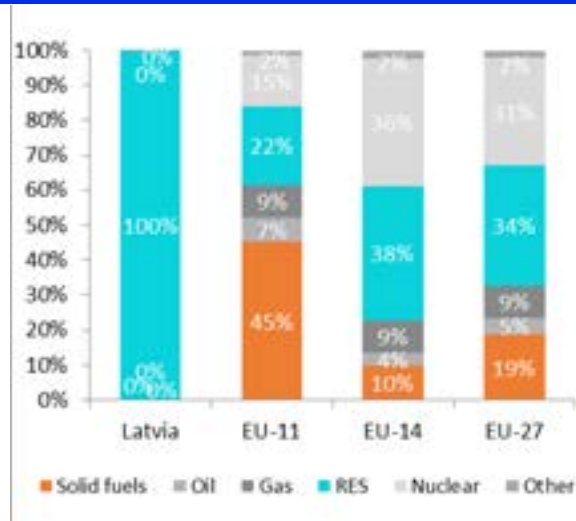
When compared to the group of developed Western European countries (EU-14), EU-11 or EU-27, Latvia has a very specific primary energy production structure fully dominated by RES.

Item 160: Primary energy structure in Latvia

Primary energy structure in Latvia in 2018 (%)



Primary energy production structure in Latvia in 2018 in comparison with EU-11, EU-14, and EU-27 averages

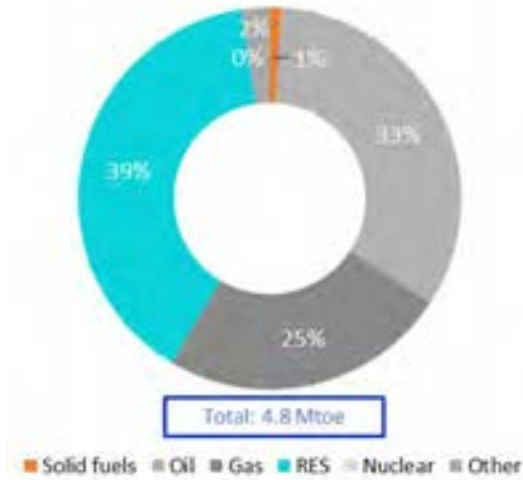


Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy – Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

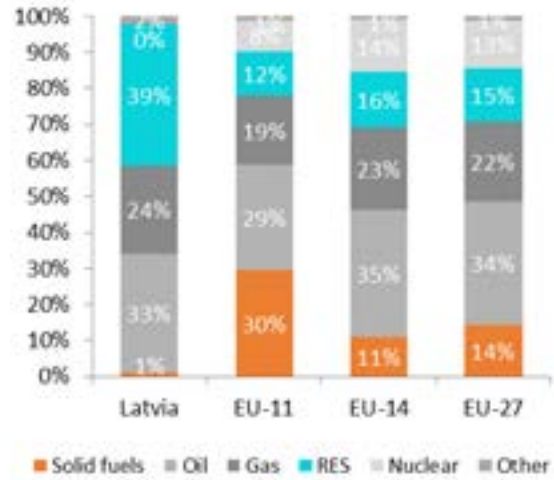
On the consumption side gross inland consumption is dominated by oil (33%), gas (25%) and renewable energy sources (39%). Compared to EU-11, but also to EU-14 and EU-27 averages, the particularly high share of renewable energy sources can be noticed (39% compared to 12%, 16% and 15%), as well as very low level of solid fuel consumption (1% compared to 30%, 11% and 14%).

Item 161: Gross inland consumption structure in Latvia

Gross inland consumption structure in Latvia in 2018 (%)



Gross inland consumption structure in Latvia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



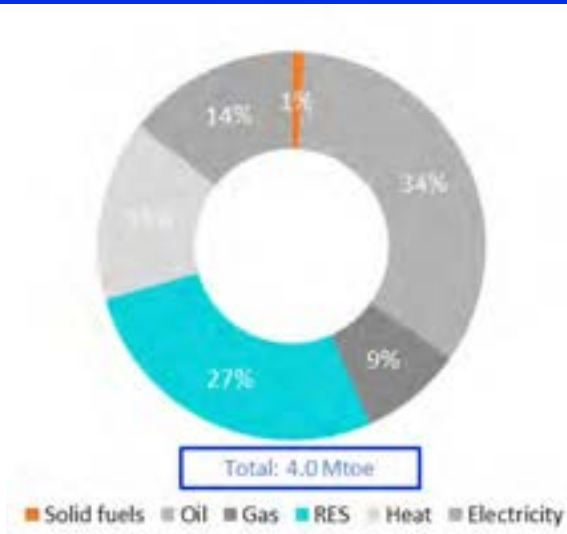
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H) , Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Latvia is dominated by petroleum products and renewable energy sources, which accounted together for 61% of total energy consumption in 2018 (see Item 162). The shares of gas, heat and electricity in final energy consumption fuel-mix are 9%, 15% and 14% respectively.

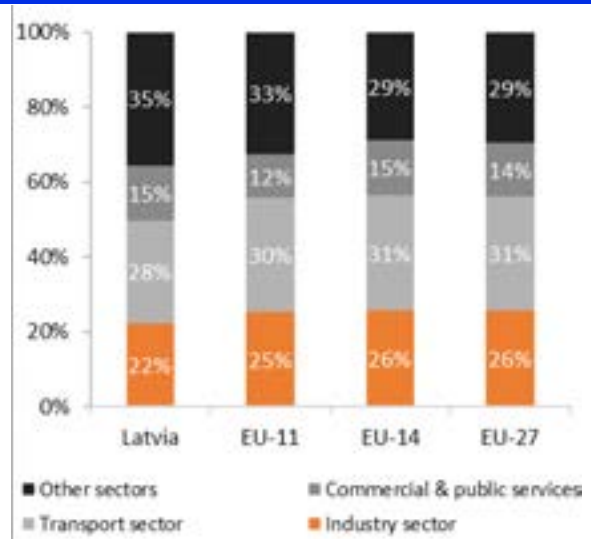
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Latvia hardly shows any particularities. The proportional consumption needs of industry and transport seem to be a little smaller than those of developed countries. The final energy consumption is a little higher in commercial and public services and other sectors.

Item 162: Final energy consumption structure in Latvia

Final energy consumption structure in Latvia in 2018 (%)



Final energy consumption structure in Latvia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



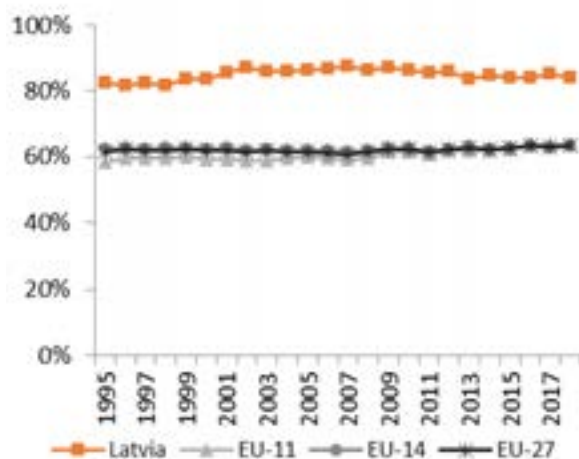
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Latvian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were significantly higher than in EU-11, EU-14 and EU-27. Furthermore, its level in Latvia has remained stable since 1995.

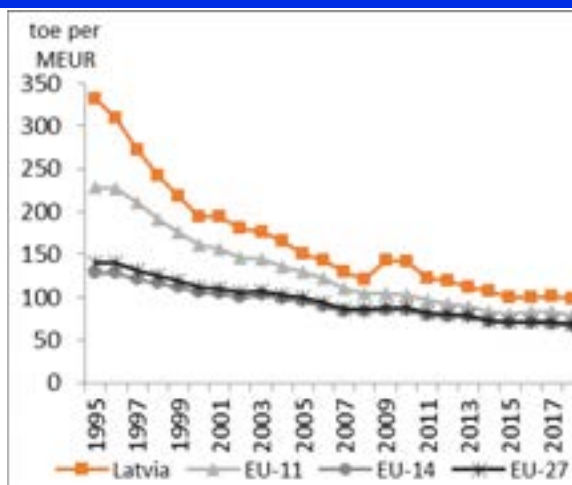
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 332.7 toe per MEUR to 98.3 toe per MEUR). The latter value is only a bit higher than EU-11, EU-14 and EU-27 averages.

Item 163: Final energy consumption in Latvia in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Latvia in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Latvia in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

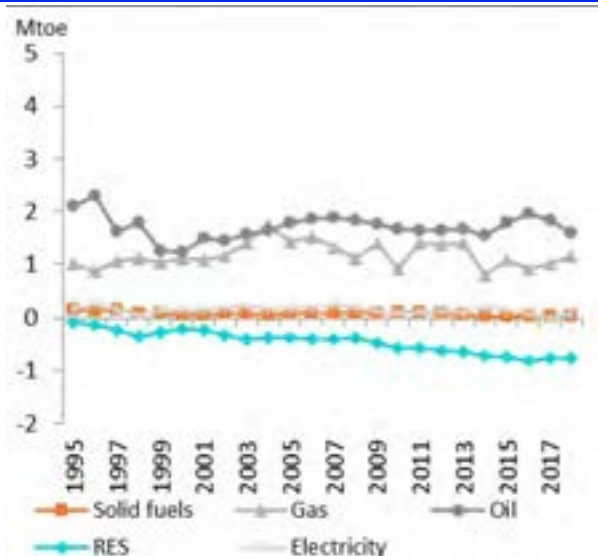


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

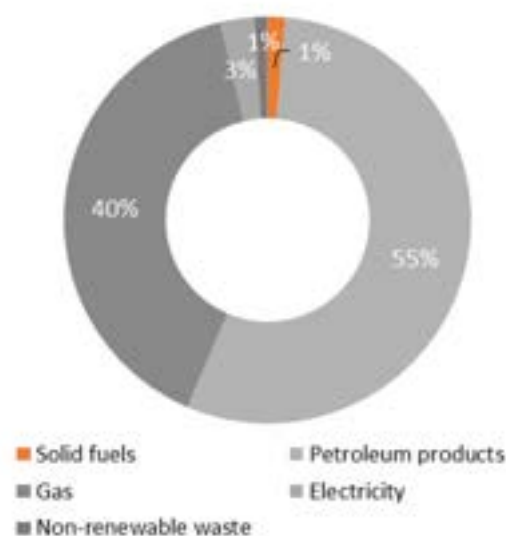
Total net import of energy in Latvia significantly decreased in years 1995-2018. Analysis of its structure in 2018 indicates the dominance of petroleum products which constitute over 55% of total net import value. The other net imported fuel is gas with share of 40%. The level of oil and gas imports seem to remain stable for last 23 years. However the export of renewable energy sources has increase (see Item 164).

Item 164: Net import of energy in Latvia

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil

*and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)*

Solid fuels are mainly imported from Russia (95%) but due to low level of import (0.05 Mtoe) it can be considered immaterial.

Crude oil is imported mainly from Lithuania (40%), Switzerland (18%), Finland (14%) and Russia (14%). The share of other suppliers is equal to 10%.

Gas is imported to Latvia only from Russia.

Electricity is imported mainly from Estonia (63%). Importations are carried out also from Russia (23%) and Lithuania (14%).

## Item 165: Foreign fuel suppliers

Foreign suppliers of solid fuels in Latvia in 2018 (%)



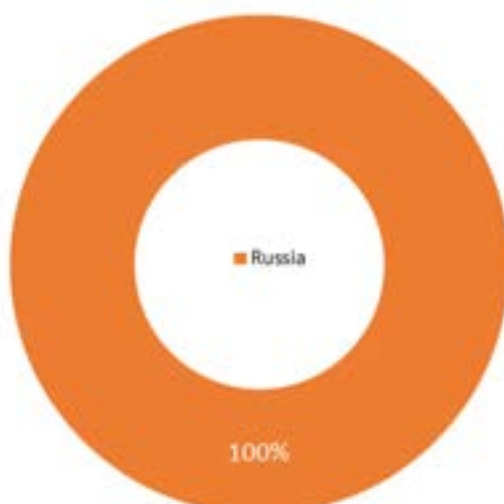
Total: 0.05 Mtoe

Foreign suppliers of crude oil in Latvia in 2018(%)



Total: 2.5 Mtoe

Foreign suppliers of gas in Latvia in 2018 (%)



Total: 1.2 Mtoe

Foreign suppliers of electricity in Latvia in 2018 (%)



Total: 0.4 Mtoe

Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 8.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Latvia were reduced - from over 12.9 Mt CO<sub>2</sub> in 1995 to 11.3 Mt CO<sub>2</sub> in 2017. In opposite, average emissions per capita increased to 5.8 Mg CO<sub>2</sub> per capita in 2017 (from 5.2 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

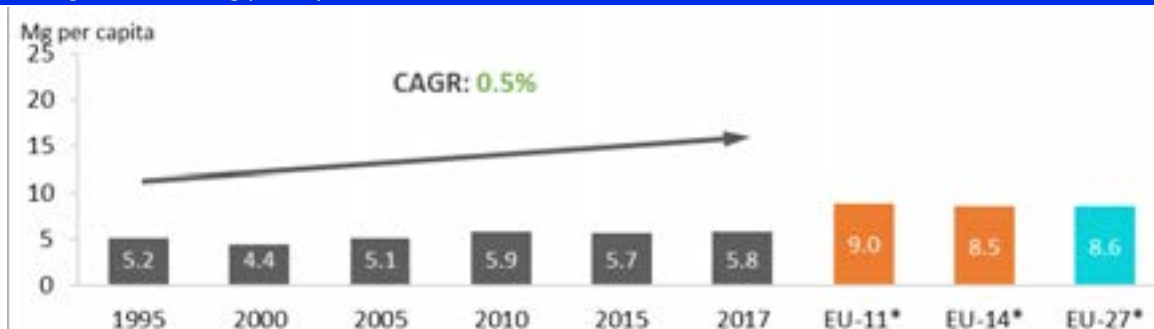
There were some noteworthy changes in the Latvian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction sector

emissions dropped swiftly by 65%, as well as emissions from energy industries - 46%. On other hand, transport emissions gained in importance increasing by 58% and industrial process - increase by 248%.

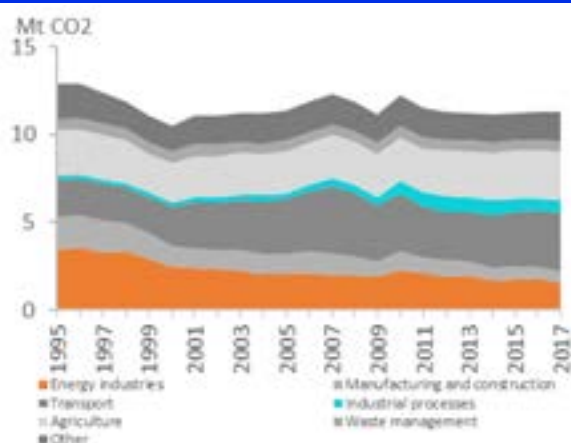
Comparing to EU-11, EU-14 and EU-27 countries, Latvia is characterized by lower share of emissions from energy industries (14% versus 35%, 26% and 28%) but higher share of GHG emissions from transport and agriculture.

Item 166: Greenhouse gas emissions in Latvia

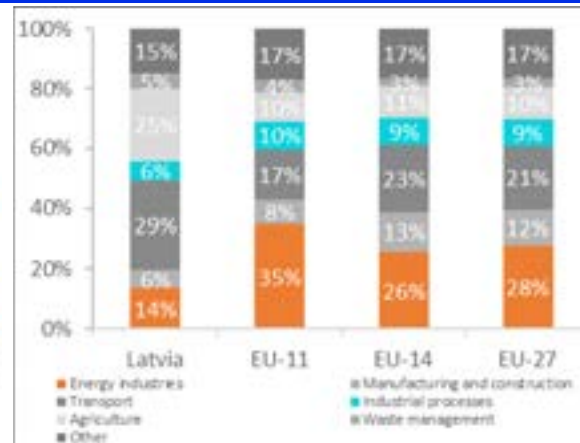
Greenhouse gas emissions per capita in Latvia in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Latvia by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Latvia by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



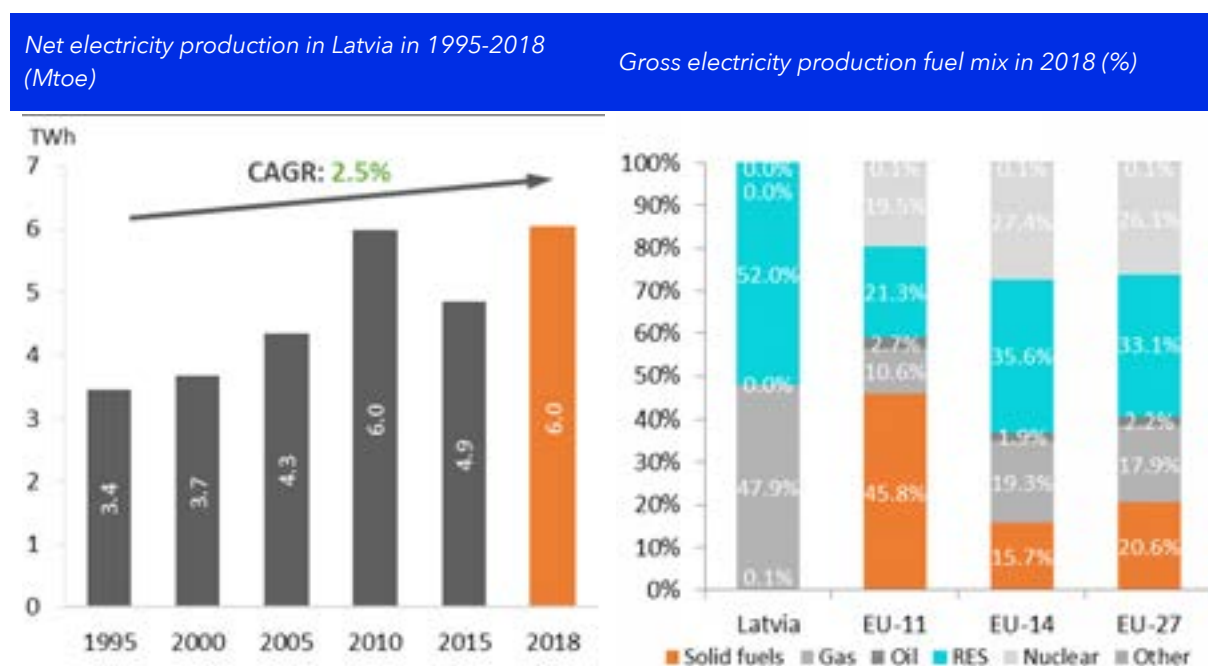
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 8.4 Overview of the electricity sector

Item 167 presents electricity production and the current fuel mix of Latvia. Over last 23 years net electricity production has increased from 3.4 TWh in 1995 to 6.0 TWh in 2018 (CAGR 2.5%). As visible, net electricity production represents 1.5% of EU-11 total electricity production, which is lower compared to Latvian GDP share of 2.0%.

The Latvian fuel mix is dominated by gas and renewable energy sources with respective shares of 47.9% and 52%. In total, those two fuels represent therefore as much as 99.9% of total gross electricity production. Compared to EU-14 and EU-27 countries, Latvia has a much bigger share of gas and renewable energy sources in its energy mix. On other hand, the country produces practically no electricity from solid fuels and oil, respectively 0.1% and <0.1%.

Item 167: Net electricity production and gross electricity production fuel mix in Latvia



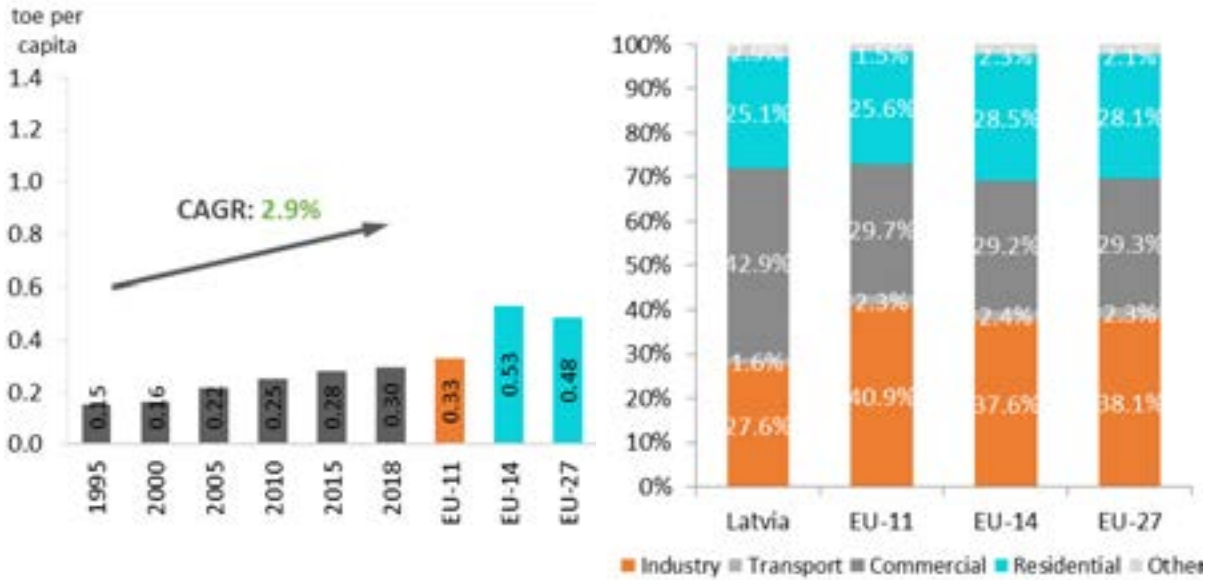
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 168 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Latvia has increased (CAGR in the period of 1995-2019 was around 2.9%) and its level is still relatively low compared to EU-14 and EU-27 countries. Latvian final energy consumption per capita represents only 55.8% of EU-14 level and 61.2% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Latvia. Generally, the structure of final electricity consumption in Latvia is rather like EU averages, with a somewhat higher share of the commercial sector and lower from industry.

Item 168: Final consumption of electricity in Latvia

Final consumption of electricity per capita in Latvia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Latvia by sectors in 2018 (%)

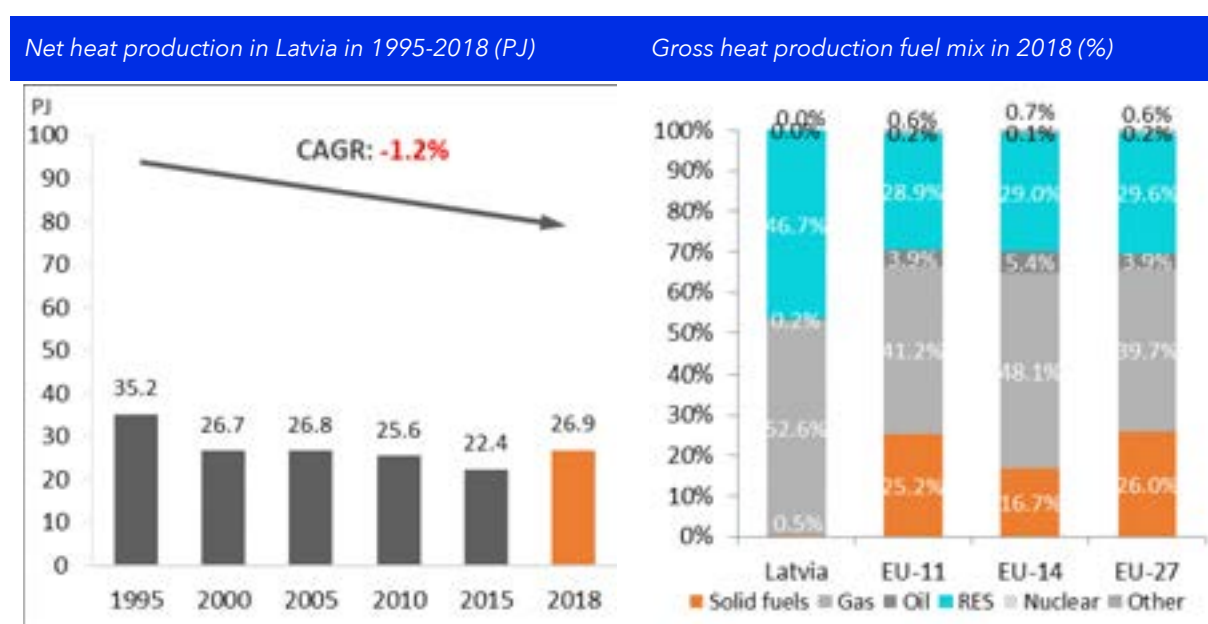


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 8.5 Overview of the heat sector

Item 169 presents heat production in Latvia as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Latvia has dropped between 1995 and 2018 from 35.2 PJ to 26.9 PJ, i.e. at CAGR of -1.2%. Latvian production fuel mix is dominated by gas (almost 52.6%) and renewable energy sources (almost 46.7%). That means that in comparison with EU-14 and EU-27 Latvia consumes relatively more gas in heat production. The share of solid fuels is low, whereas the usage of oil is even lower (0.2% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries).

Item 169: Net heat production and gross electricity production fuel mix in Latvia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 170 presents final heat consumption per capita and its breakdown by sectors.

The per capita demand for heat in Latvia has decreased from 0.37 toe in 1995 to 0.25 toe in 2015. After that, it rebounded slightly up to the level of 0.31 in 2018. As a result, within the 23 years analysed, heat consumption per capita in Latvia has decreased (from 0.37 toe to 0.31 toe per capita, i.e. at CAGR of -0.8%). The heat consumption in Latvia remains higher than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

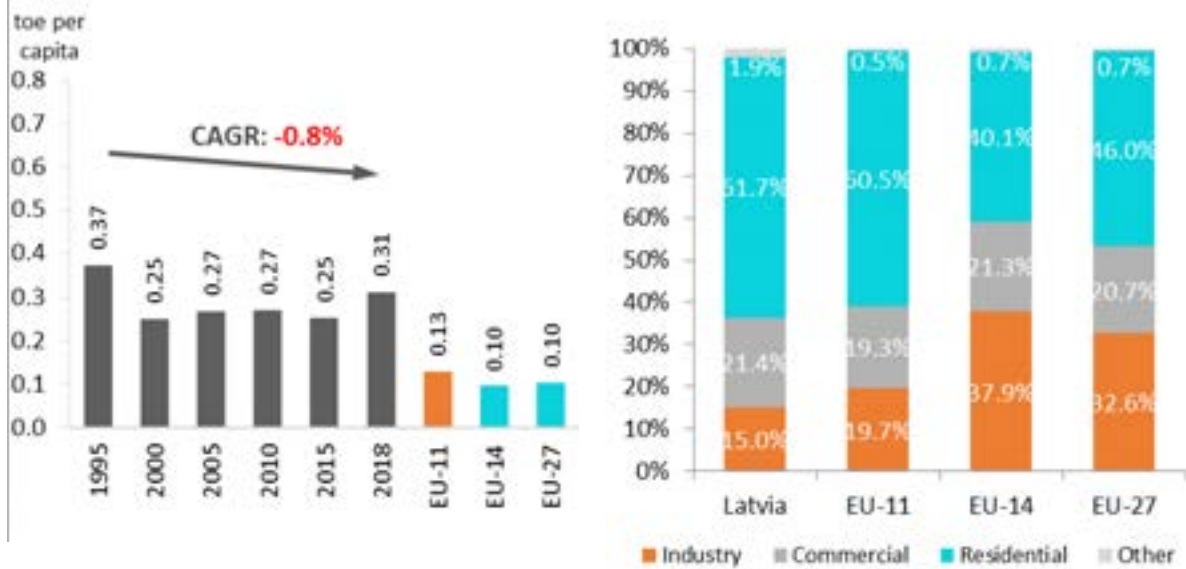
The structure of final consumption of heat in Latvia is characterized by higher share of residential usage (61.7% in Latvia compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (15.0% in Latvia compared to 37.9% in EU-14 and 32.6% in EU-27). The share of commercial sector in final consumption of heat is similar than European averages (21.4% in Latvia compared to 21.3% in EU-14 and 20.7% in EU-27).

In relation to EU-11 countries, the structure of final heat consumption is similar.

Item 170: Final consumption of heat in Latvia

Final consumption of heat per capita in Latvia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Latvia by sectors in 2018 (%)

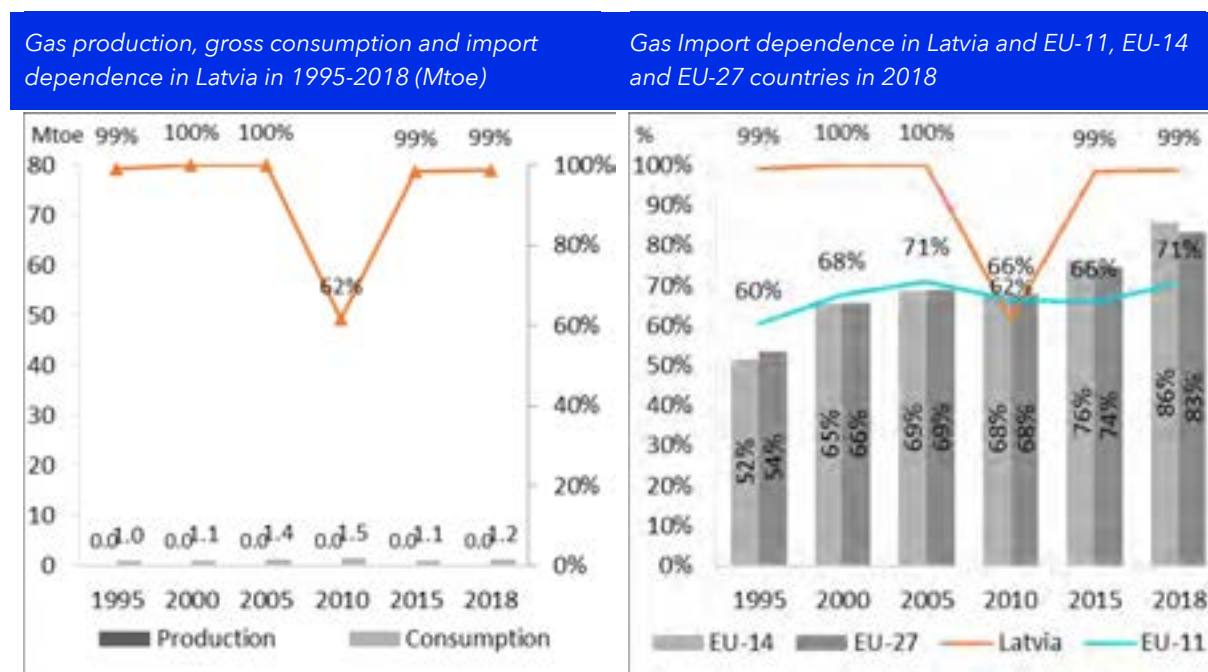


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 8.6 Overview of gas sector

Gas production in Latvia is null comparing to the consumption (1.2 Mtoe in 2018). Therefore, the import dependence remains high – between 62% and 100% in years 1995-2018 (see Item 171). When compared to EU averages significantly higher import dependence is observed between Latvia and EU-11, EU-14 and EU-27 countries (99% import dependence of Latvia in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 171: Gas sector in Latvia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

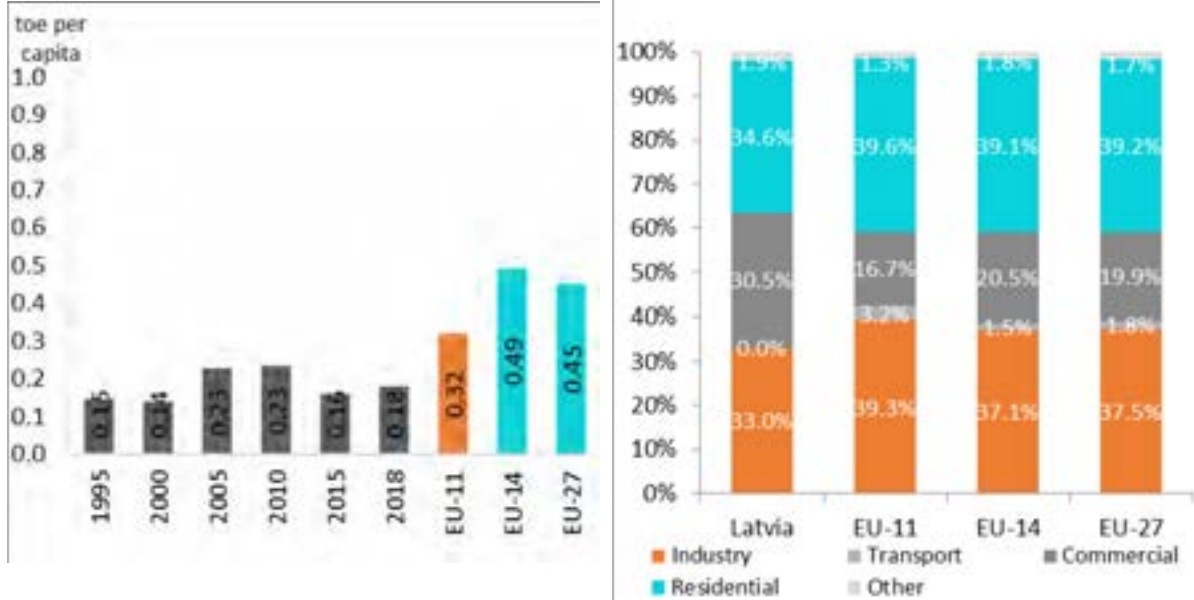
The final consumption of gas per capita in Latvia has increased from 0.15 toe per capita in 1995 to 0.18 toe per capita in 2018 and significantly lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

The structure of final gas consumption per sectors is like European averages. Gas usage almost equally spread between industry (33.0%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%, residential sector (34.6%) comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27 and commercial sector (30.5%) comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27. The use of gas in transport sector is null.

Item 172: Final consumption of gas per capita in Latvia in 1995-2018 and gas final consumption by sectors in Latvia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Latvia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Latvia and EU-11, EU-14 and EU-27 countries in 2018

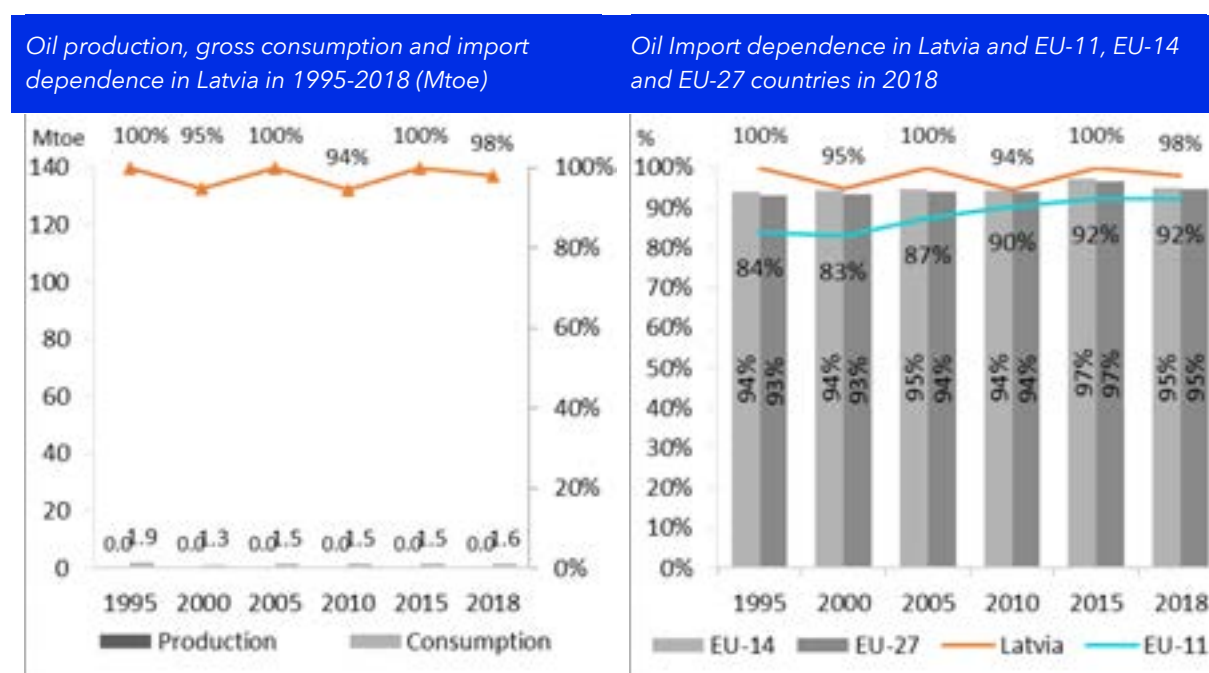


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 8.7 Overview of the oil sector

Oil production in Latvia has been null in 2018 and the consumption has been 1.6 Mtoe in 2018. Therefore, the import dependence remains high - between 94% and 100% in years 1995-2018 (see Item 173). When compared to EU averages higher import dependence is observed between Latvia and EU-11, EU-14 and EU-27 countries (98% import dependence of Latvia in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 173: Oil sector in Latvia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

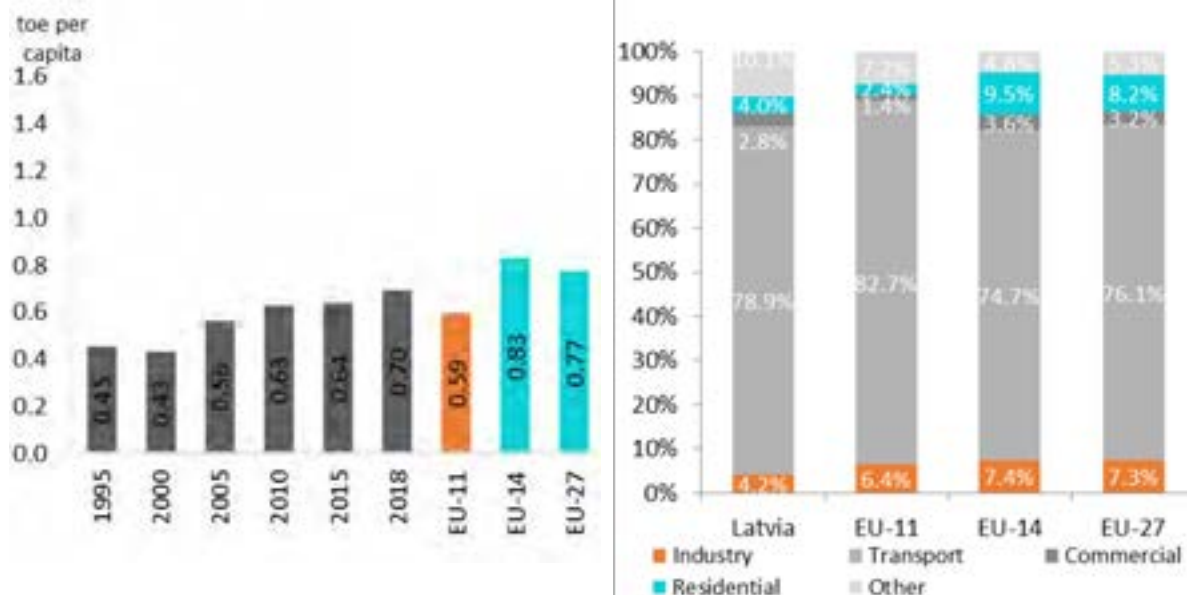
The final consumption of oil per capita in Latvia increased for 0.45 toe per capita in 1995 to 0.70 toe per capita in 2018. It remains lower than the averages for EU-14 and EU-27 countries (respectively 0.83 toe per capita, 0.77 toe per capita) but higher than the average for EU-11 (0.59 toe per capita)

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 78.9% in Latvia comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are lower in Latvia than in EU-11, EU-14 and EU-27 countries, as well as commercial and residential usage of oil compared to EU-14 and EU-27 averages.

Item 174: Final consumption of oil per capita in Latvia in 1995-2018 and oil final consumption by sectors in Latvia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Latvia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Latvia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 8.8 EU climate policy and its targets for Latvia

Latvia is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 175).

*Item 175: Energy and climate targets for Latvia for 2020 and 2030*

	Latvia 2020 targets	Latvia 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS – Effort Sharing Decision (ESD)	+17% in relation to their 2005 levels	-
National emission reduction targets in non-ETS – Effort Sharing Regulations (ESR)	-	-6% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	40% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 5.4 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 4.5 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

In following chapter, the overview of Latvia targets and performance are summarized.

### 8.8.1 Greenhouse gas emissions

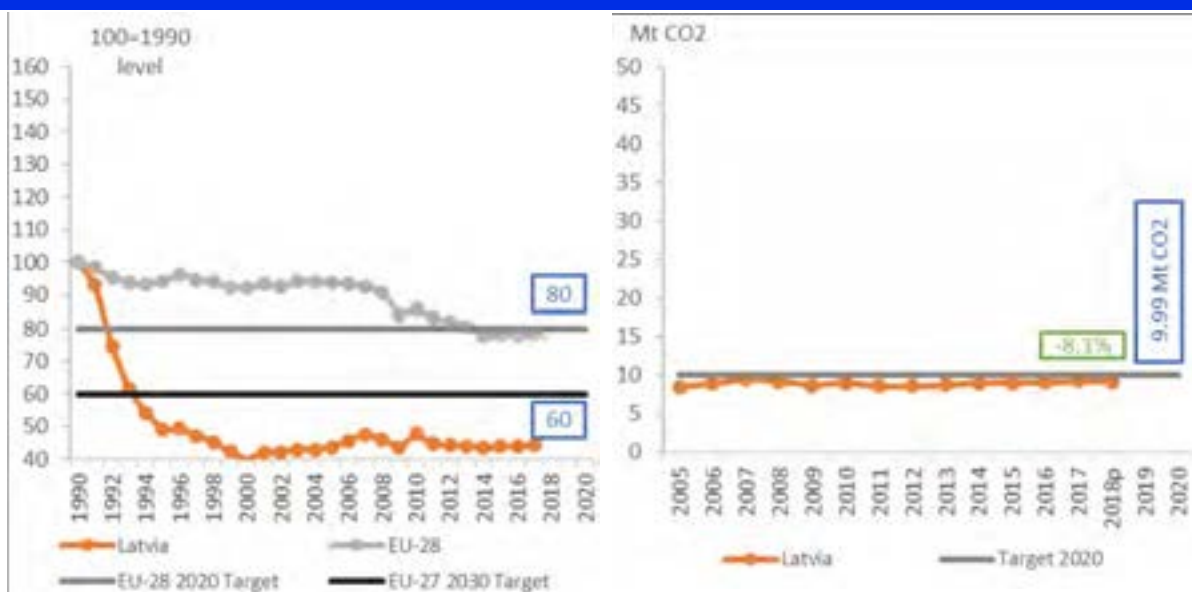
EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Latvia is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Latvia is 9.99 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 8.1%.

Item 176: Energy efficiency target data for Latvia

Greenhouse gas emissions level in Latvia and EU-28, base year 1990, and EU 2020 target

Greenhouse gas emissions in Effort Sharing Decision (ESD) sectors



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 8.8.2 Renewable energy sources

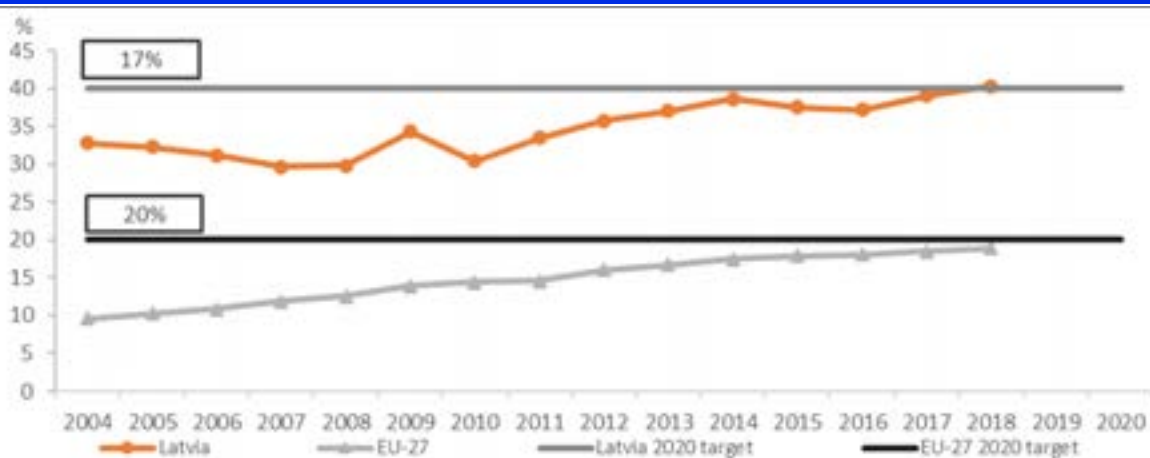
The following targets are set for Latvia regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 17% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Latvia is already above EU wide and country specific targets.

Item 177: Share of energy from renewable energy sources in gross final energy consumption in Latvia

Share of energy from renewable energy sources in gross final energy consumption in Latvia in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 8.8.3 Energy efficiency

The energy efficiency target set for Latvia are respectively:

- Primary Energy Consumption in 2020: 5.4 Mtoe
- Final energy consumption in 2020: 4.5 Mtoe

Following the information provided in Item 178 the results for 2018 are below the targets in both criteria, respectively 13.1% of primary energy consumption and 7.2% of final energy consumption.

## Item 178: Energy efficiency target data for Latvia

Primary energy consumption and final energy consumption in Latvia in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Latvia, EU-11, EU-14 and EU-27 in 2018



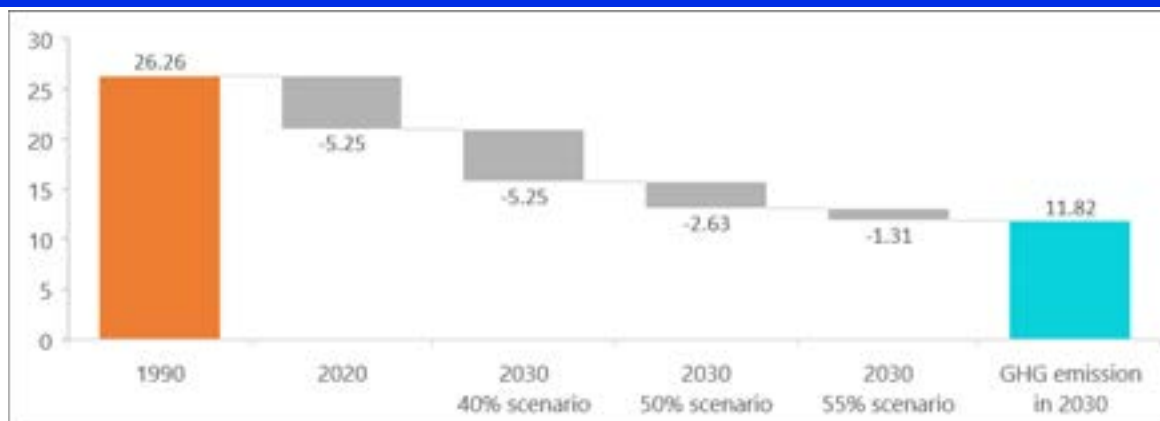
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

## 8.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Latvia greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 5.25 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 5.25 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 2.63 Mt CO<sub>2</sub> emission decrease is needed, or 3.94 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Latvia up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Latvia was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 179: Estimation regarding greenhouse gas emissions in Latvia under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Latvia under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 9 Lithuania

### 9.1 General information

Lithuania is the 6<sup>th</sup> largest country within EU-11 group in terms of total country area and represents 5.8% of the area. At the same time, it is the 16<sup>th</sup> country in EU-27 with 1.5% of the area. It represents 2.7% of EU-11 population and 0.6% of EU-27 population, but only 3.3% of its total nominal GDP of EU-11 and 0.3% of EU-27. Due the robust economic growth in 1995-2018 period, in 2018 Lithuanian GDP per capita amounted to 81% of the whole EU average.

Item 180: Lithuania - key data



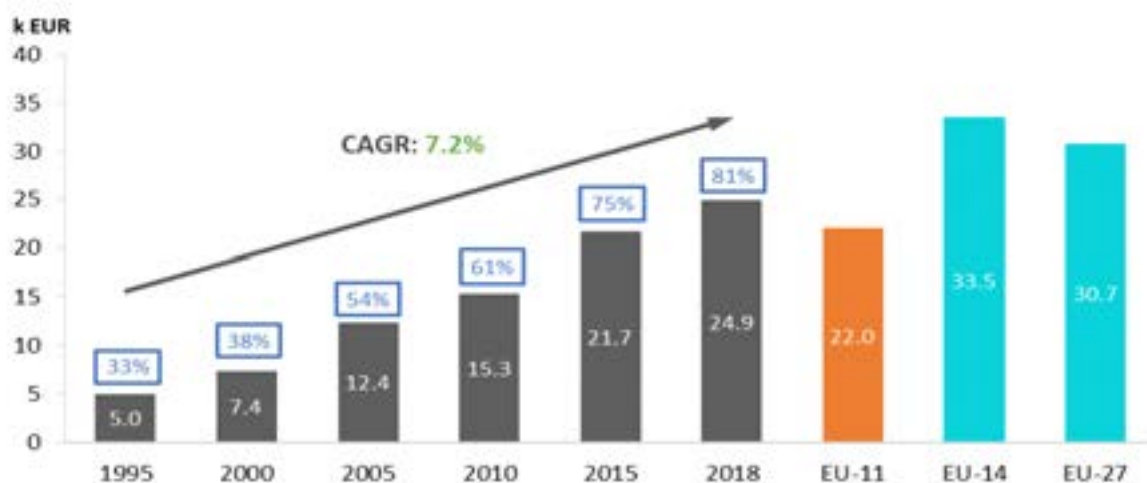
#### Key data

Population (M)	2.8
GDP per capita (EUR, nominal)	16,160
GDP per capita (EUR, PPS)	24,850
GDP as share of EU-11	3.3%
GDP as share of EU-27	0.3%
Energy intensity of the economy (kgoe per 1,000 EUR)	116.3
Greenhouse gas emissions (Mg per capita)	7.2

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 7.2% Lithuanian economy considerably grew in the period of 1995-2018 (see Item 181). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 74% and 81% of the respective averages) – if purchasing power is taken into consideration.

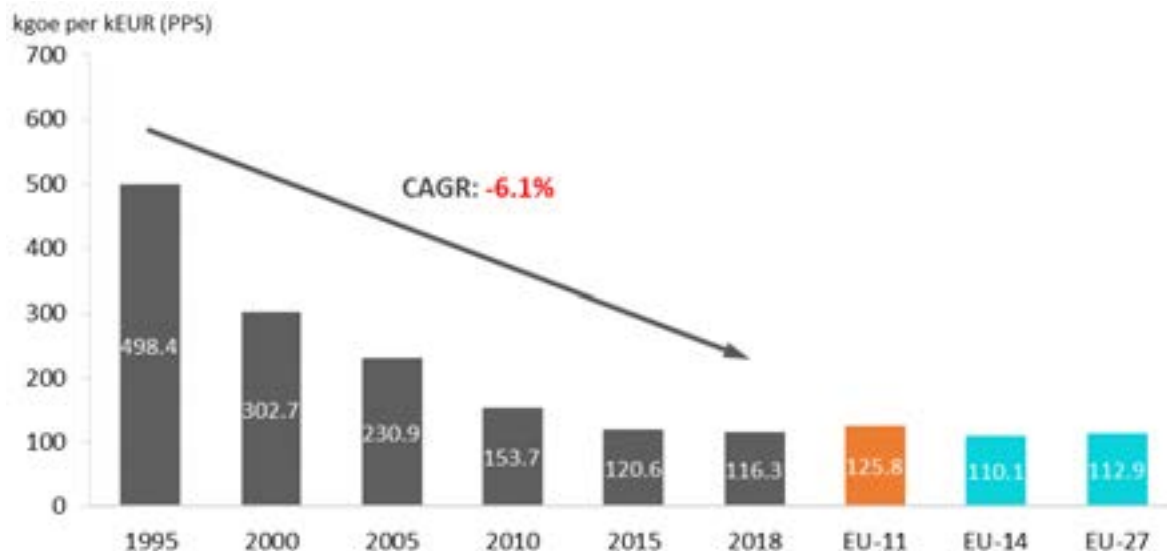
Item 181: GDP per capita in Lithuania for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Lithuania GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita – Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Lithuanian economy energy intensity is about 116.3 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 382.2 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than 3 times. In EU-14 and EU-27 average values are 1.1 times lower and in EU-11 average is 1.1 times higher than in Lithuania.

Item 182: Energy intensity of the economy in Lithuania in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) – EI\_GDP\_PPS

## 9.2 Energy balance of Lithuania

In Item 183 the energy balance of Lithuania in 2018 as well as historical values of net imports of energy are shown. The primary energy production was equal to 2.0 Mtoe. Net import accounted for 5.9 Mtoe and gross inland consumption of energy was 7.8 Mtoe.

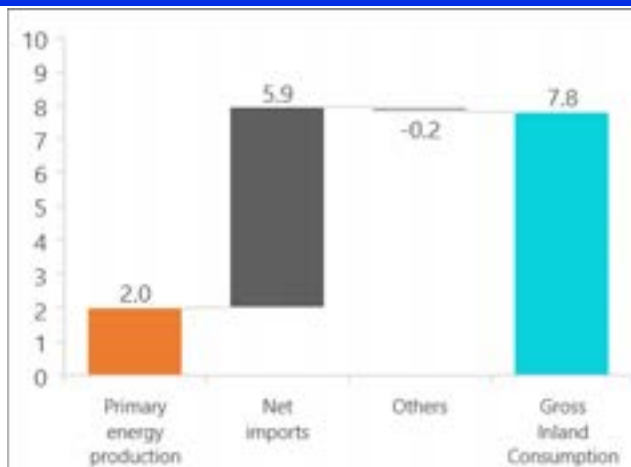
The production of primary energy in the country remained stable from 1995 to 2009 at the level of 4 Mtoe. Then it dropped to 1.6 Mtoe and increased to 2.0 Mtoe in 2018. Gross inland consumption was oscillating at the level of 8-9 Mtoe in year 1995-2009. It dropped to about 7 Mtoe in 2010 and it has increased to 7.8 Mtoe in 2018.

Net import of energy was about 5.6 Mtoe in 1995. It dropped to less than 4 Mtoe in 2001 and then increased to 5.9 Mtoe. At the same time, the share of net imports in meeting the country energy needs has changed significantly. In 2010 the net share of imports increased from 49.2% to 80.6% and remains at that level until 2018.

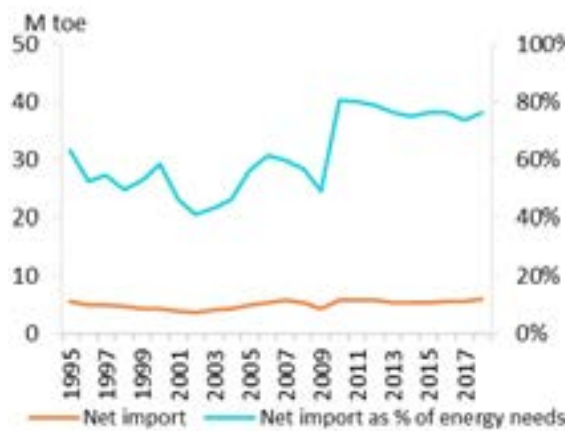
The significant changes described above are due to closure of the only nuclear power plant of the country – the Ignalina nuclear power plant on 31 December 2009.

Item 183: Energy balance in Lithuania

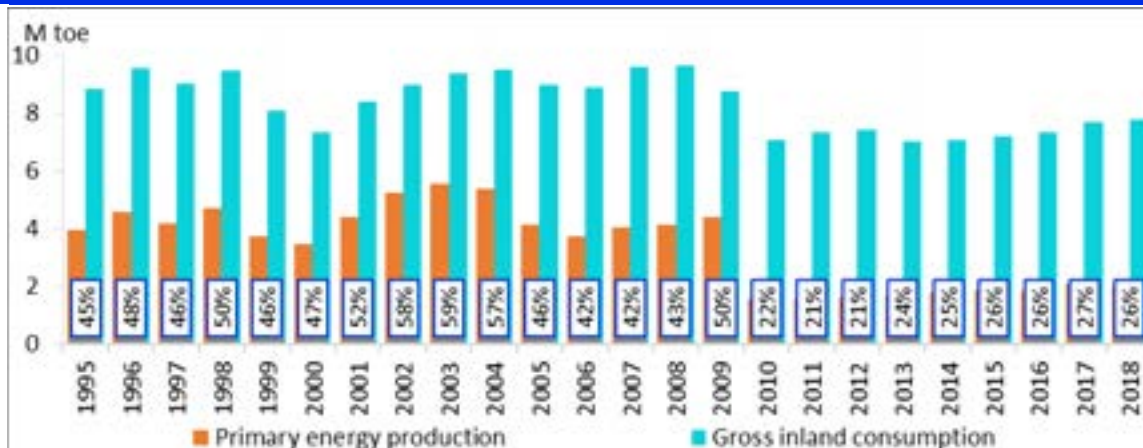
Energy balance in Lithuania in 2018 (Mtoe)



Net import of energy in Lithuania in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Lithuania (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

Considering the primary production, one can notice that 80% is based on renewable energy sources. About 17% of primary energy is provided from other sources. The remaining 3% are produced from solid fuels and oil.

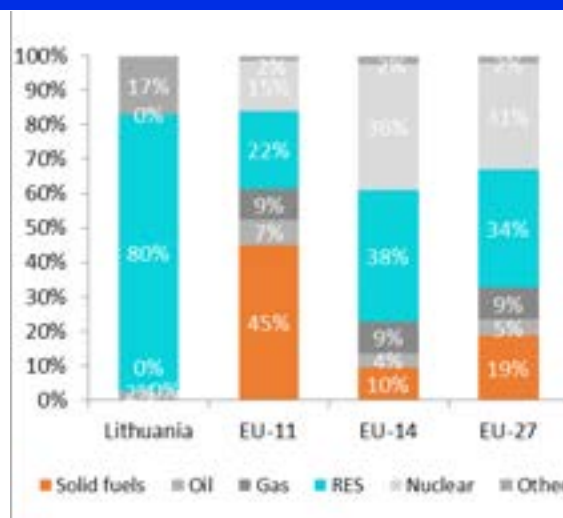
Comparing to EU-11 group Lithuania has a very high share of renewable energy sources in primary energy production mix. At the same time other energy sources are practically absent (solid fuels, gas, oil). Similar conclusion can be presented in comparing the Lithuanian primary energy mix with EU-14 and EU-27 averages.

Item 184: Primary energy structure in Lithuania

Primary energy structure in Lithuania in 2018 (%)



Primary energy production structure in Lithuania in 2018 in comparison with EU-11, EU-14, and EU-27 averages



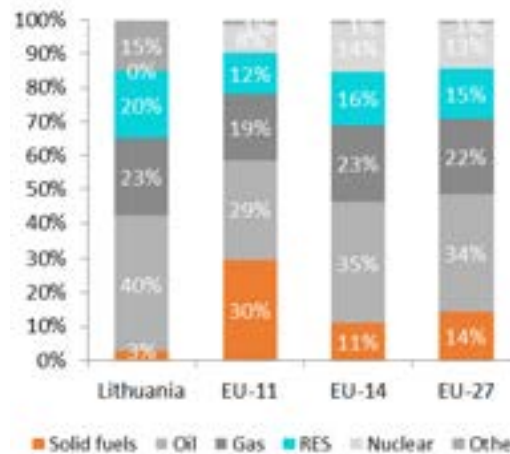
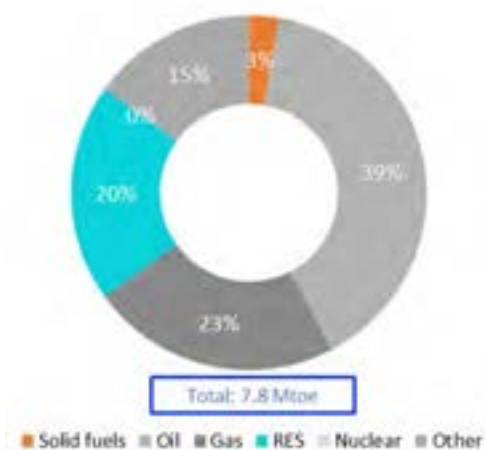
Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy – Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

On the consumption side, oil, gas, and RES have a dominant position – 82%. The mix is completed by other sources (15%) and solid fuels (3%). Gross inland consumption structure in Lithuania differs from EU-11, EU-14 and EU-27 countries by higher share of oil (40% to 29%, 35% and 34% respectively). The share of solid fuels in Lithuanian gross inland consumption is also specific when compared to European averages.

Item 185: Gross inland consumption structure in Lithuania

Gross inland consumption structure in Lithuania in 2018 (%)

Gross inland consumption structure in Lithuania in 2018 in comparison with EU-11, EU-14, and EU-27 averages



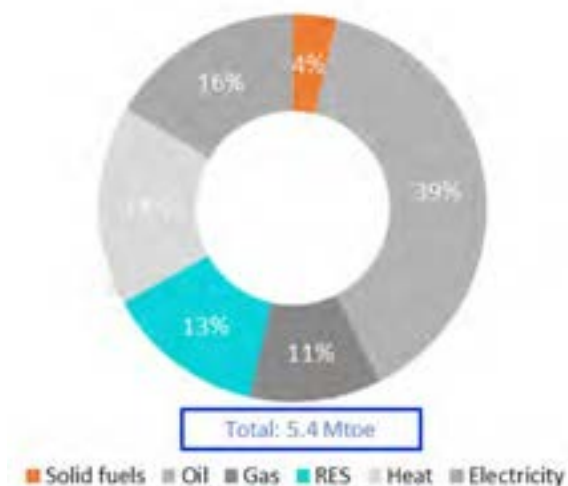
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption - GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Lithuania is dominated by petroleum products which accounts for 39% of total energy consumption in 2018 (see Item 186). The shares of gas, RES, heat, and electricity in final energy consumption fuel-mix are 11%, 13%, 17% and 16% respectively. The mix is closed by solid fuels - 4%.

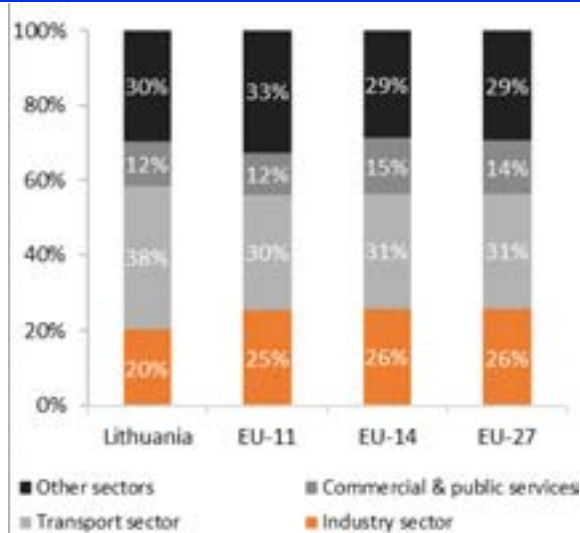
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Lithuania shows small particularities. The proportional consumption needs of industry sector are lower than those of developed countries. The final energy consumption in a little higher in transport.

Item 186: Final energy consumption structure in Lithuania

Final energy consumption structure in Lithuania in 2018 (%)



Final energy consumption structure in Lithuania in 2018 in comparison with EU-11, EU-14, and EU-27 averages



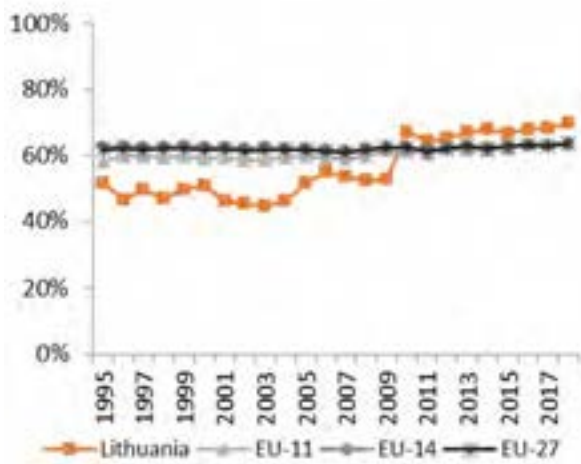
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Lithuanian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were lower than in EU-11, EU-14 and EU-27. After the close of Ignalina NPP the ratio of final energy consumption to gross inland consumption has increased and it is above European averages.

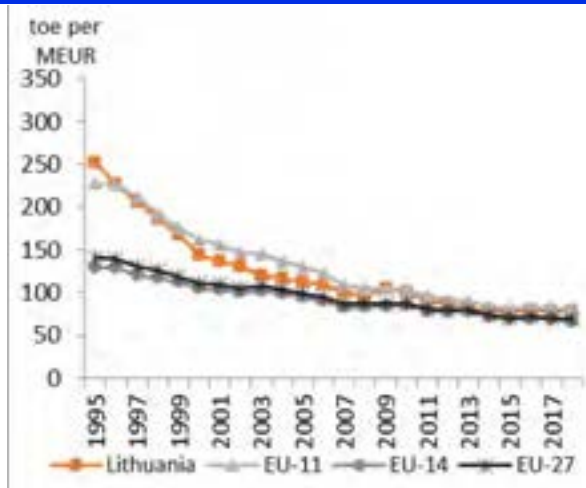
Simultaneously, a decrease of energy volume associated with generating gross domestic product was noticed (from 251.4 toe per MEUR to 78.2 toe per MEUR). The latter value is lower than EU-11 average while higher compared to values for EU-14 and EU-27 countries in 2018, which were merely 66.2 and 68.4 toe per MEUR of GDP, respectively.

Item 187: Final energy consumption in Lithuania in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Lithuania in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Lithuania in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

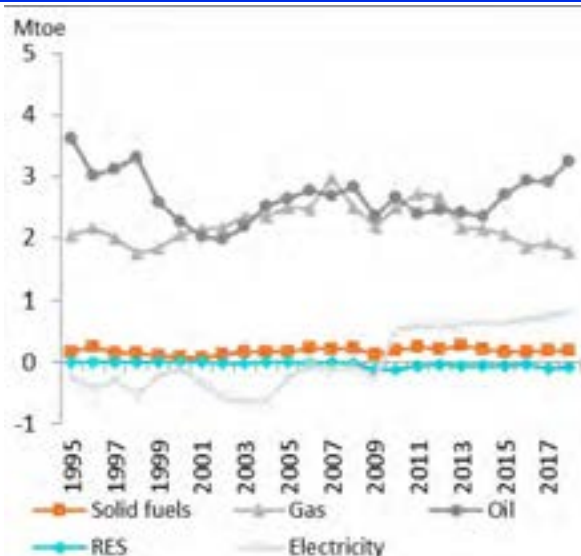


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

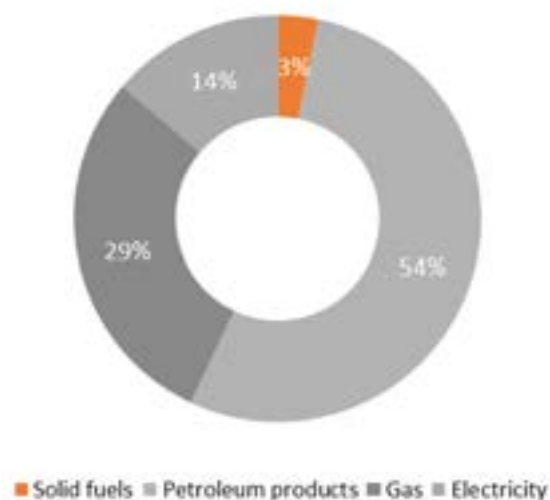
Total net import of energy in Lithuania slightly increased in years 1995-2018. Analysis of its structure in 2018 indicates the dominance of petroleum products which constitute over 54% of total net import value. The other two net imported fuels are gas and electricity with respective shares of 29% and 14%. The import is completed by 3% of import of solid fuels. (see Item 188).

Item 188: Net import of energy in Lithuania

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil

*and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)*

Solid fuels are imported to Lithuania mainly from Russia (93%). Other suppliers are Germany (6%), Poland (1%) and Kazakhstan (<1%).

Crude oil is imported mainly from Russia (64%). In addition to this oil is imported from Kazakhstan (17%), Saudi Arabia (10%) and Finland (3%). The imported is completed by other suppliers at the level of 6%.

Gas is imported to Lithuania from Norway (60%) and Russia (40%).

Electricity is imported mainly from Latvia (33%), Russia (24%), Sweden (22%) and Belarus (15%). The mix is closed by Poland - 6%.

Item 189: Foreign fuel suppliers

Foreign suppliers of solid fuels in Lithuania in 2018 (%)



Total: 0.2 Mtoe

Foreign suppliers of crude oil in Lithuania in 2018(%)



Total: 10.9 Mtoe

Foreign suppliers of gas in Lithuania in 2018 (%)



Total: 1.9 Mtoe

Foreign suppliers of electricity in Lithuania in 2018 (%)



Total: 1.1 Mtoe

Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 9.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Lithuania were reduced - from over 22.4 Mt CO<sub>2</sub> in 1995 to 20.4 Mt CO<sub>2</sub> in 2017. In opposite, average emissions per capita increased to 7.2 Mg CO<sub>2</sub> per capita in 2017 (from 6.2 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

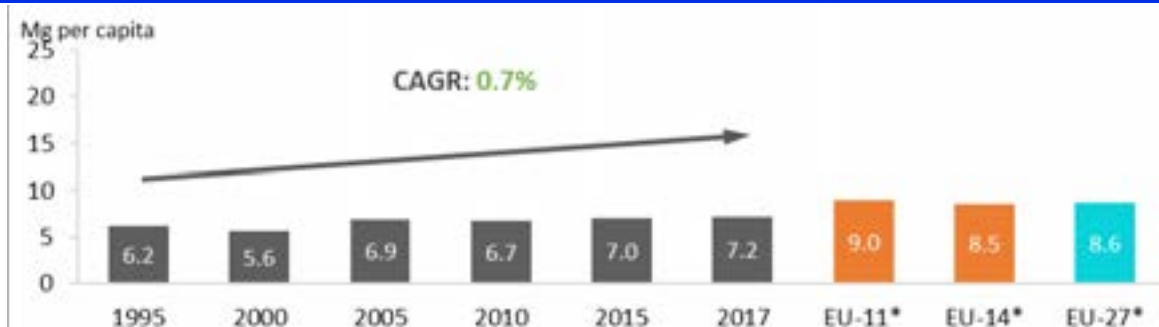
There were some noteworthy changes in the Lithuanian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction

sector emissions dropped swiftly by 33%, as well as emissions from energy industries and waste management, respectively 59% and 34%. On other hand, transport emissions gained in importance increasing by 84% and industrial processes by 64%.

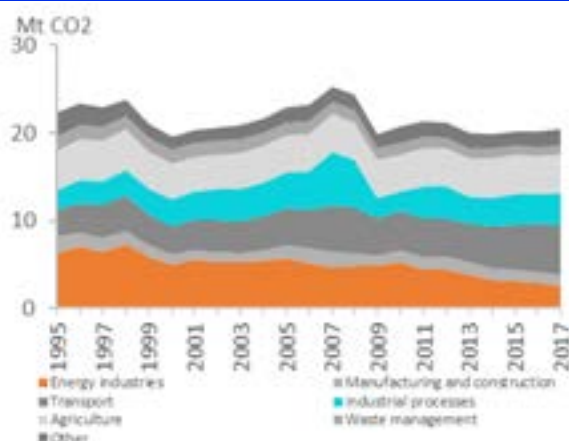
Comparing to EU-11, EU-14 and EU-27 countries, Lithuania is characterized by lower share of emissions from energy industries (13% versus 35%, 26% and 28%), but higher from transport, industrial processes, and agriculture.

Item 190: Greenhouse gas emissions in Lithuania

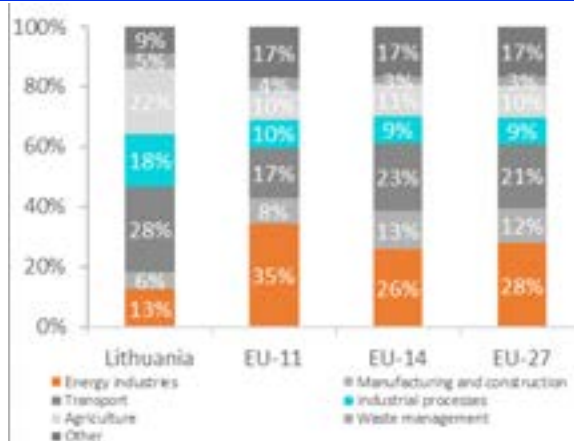
Greenhouse gas emissions per capita in Lithuania in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Lithuania by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Lithuania by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



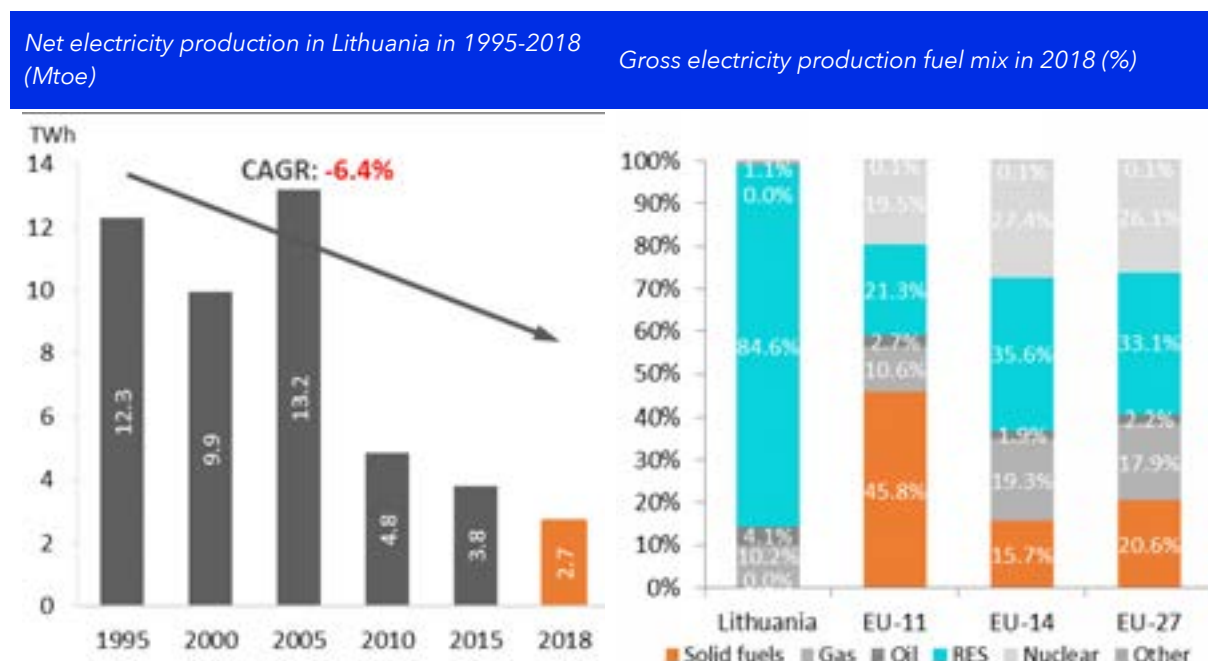
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 9.4 Overview of the electricity sector

Item 191 presents electricity production and the current fuel mix of Lithuania. Over last 23 years net electricity production has dropped from 12.3 TWh in 1995 to 2.7 TWh in 2018 (CAGR -6.4%) due to close down of Ignalina Nuclear Power Plant. As visible, net electricity production represents 0.7% of EU-11 total electricity production, which is lower compared to Lithuanian GDP share of 3.0%.

The Lithuanian fuel mix is dominated by renewable energy sources with share of 84.6%. Compared to EU-14 and EU-27 countries, Lithuania has a much bigger share of RES in its energy mix. On other hand, the country produces relatively less electricity from solid fuels and oil, respectively <0.1% and 4.1%.

Item 191: Net electricity production and gross electricity production fuel mix in Lithuania



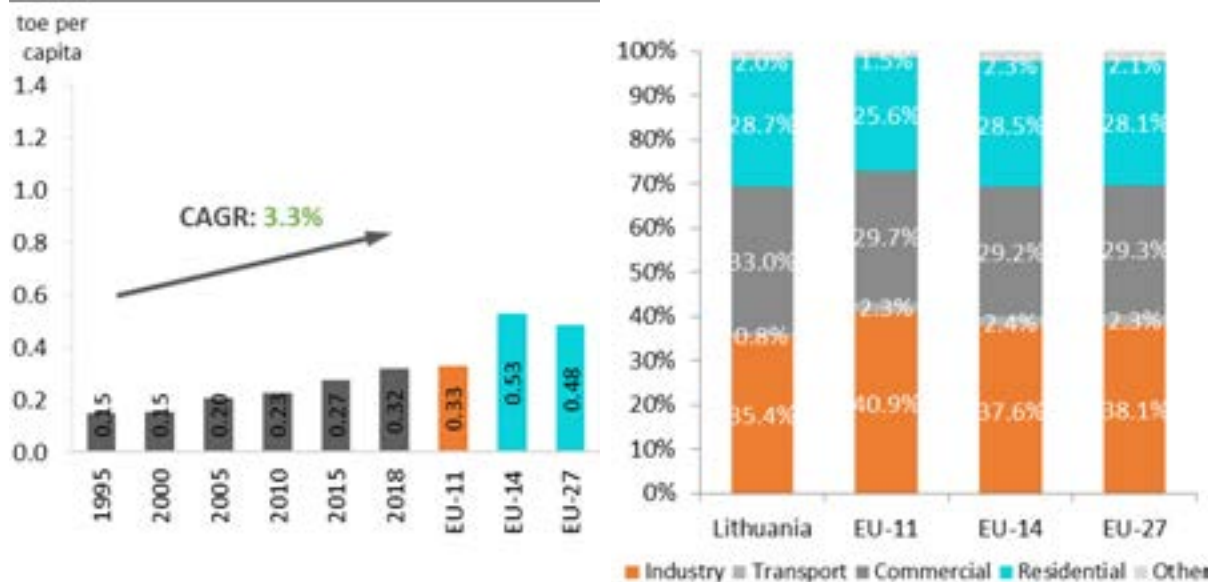
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 192 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Lithuania has increased (CAGR in the period of 1995-2019 was around 3.3%) and its level is still relatively low compared to EU-14 and EU-27 countries. Lithuanian final energy consumption per capita represents only 60.0% of EU-14 level and 65.7% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Lithuania. Generally, the structure of final electricity consumption in Lithuania is rather like EU averages, with a lower share of the transport sector.

Item 192: Final consumption of electricity in Lithuania

Final consumption of electricity per capita in Lithuania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Lithuania by sectors in 2018 (%)

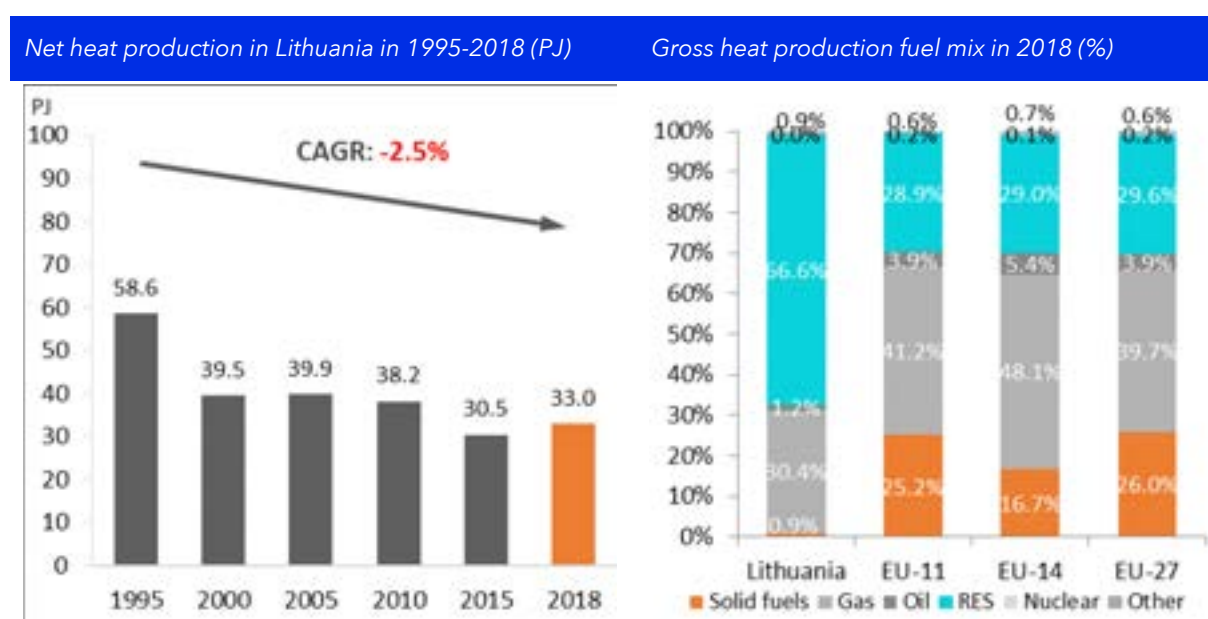


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 9.5 Overview of the heat sector

Item 193 presents heat production in Lithuania as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Lithuania has dropped between 1995 and 2018 from 58.6 PJ to 33.0 PJ, i.e. at CAGR of -2.5%. Lithuanian production fuel mix is dominated by gas (almost 30.4%) and renewable energy sources (almost 66.6%). That means that in comparison with EU-14 and EU-27 Lithuania consumes relatively more gas in heat production. The share of solid fuels is low, whereas the usage of oil is lower than European averages (1.2% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries).

Item 193: Net heat production and gross electricity production fuel mix in Lithuania



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 194 presents final heat consumption per capita and its breakdown by sectors.

The per capita demand for heat in Lithuania has decreased from 0.33 toe in 1995 to 0.24 toe in 2000. After that, it rebounded slightly up to the level of 0.32 in 2018. As a result, within the 23 years analysed, heat consumption per capita in Lithuania has remained almost stable (0.33 toe versus 0.32 toe per capita, i.e. at CAGR of about 0.0%). The heat consumption in Lithuania remains higher than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

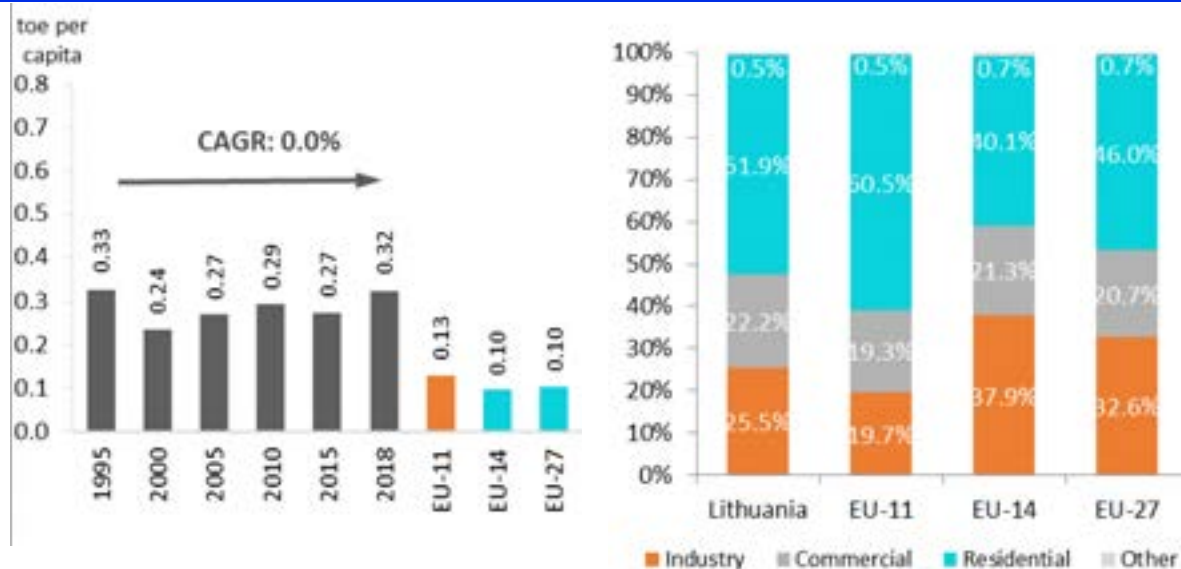
The structure of final consumption of heat in Lithuania is characterized by higher share of residential usage (51.9% in Lithuania compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (25.5% in Lithuania compared to 37.9% in EU-14 and 32.6% in EU-27). The share of commercial sector has a little higher share than European averages (22.2% in Lithuania compared to 21.3% in EU-14 and 20.7% in EU-27).

In relation to EU-11 countries, the structure of final heat consumption is similar.

Item 194: Final consumption of heat in Lithuania

Final consumption of heat per capita in Lithuania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Lithuania by sectors in 2018 (%)

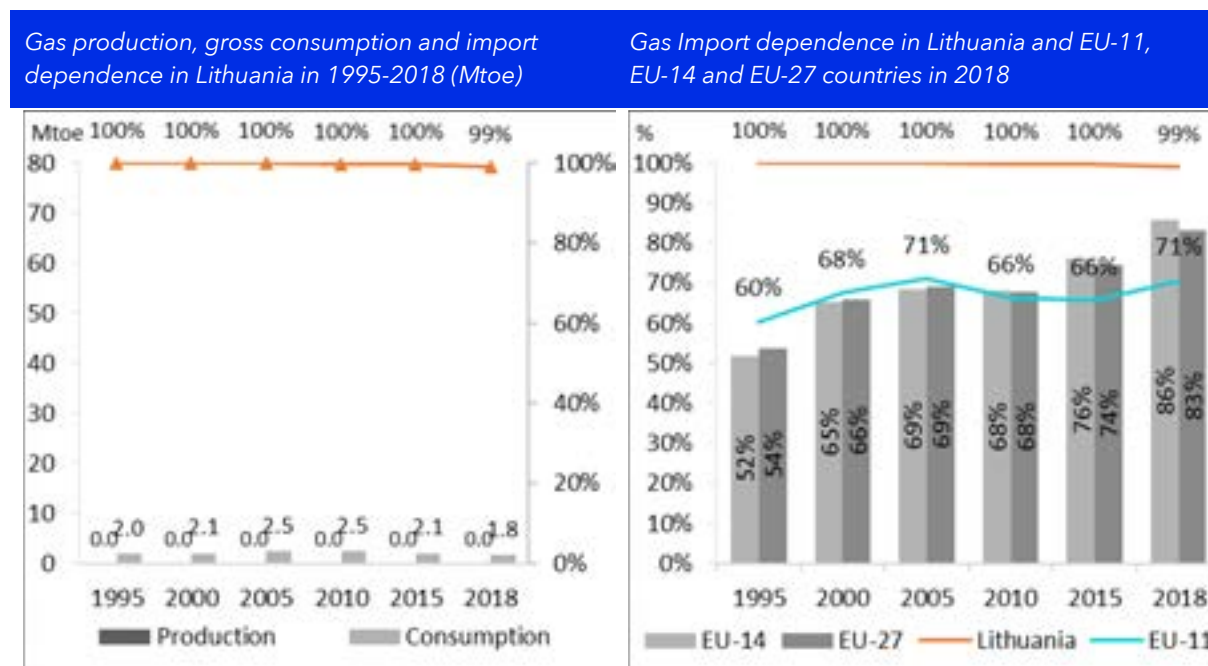


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 9.6 Overview of gas sector

Gas production in Lithuania is null comparing to the consumption (1.8 Mtoe in 2018). Therefore the import dependence remains high – between 99% and 100% in years 1995-2018 (see Item 195). When compared to EU averages significantly higher import dependence is observed between Lithuania and EU-11, EU-14 and EU-27 countries (99% import dependence of Lithuania in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 195: Gas sector in Lithuania



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

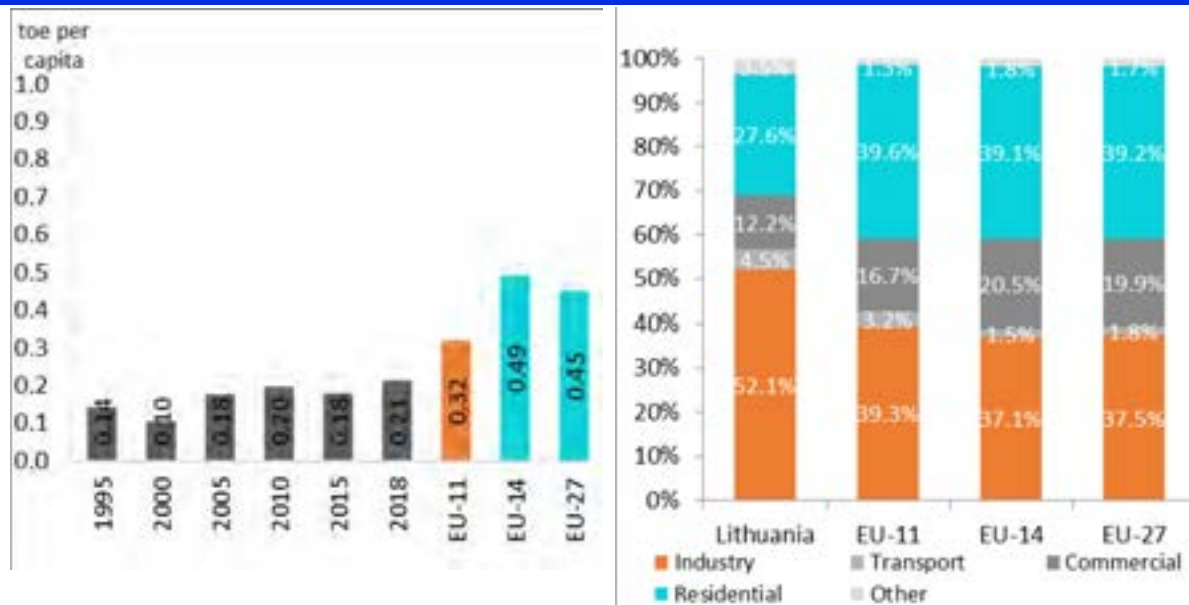
The final consumption of gas per capita in Lithuania has increased from 0.14 toe per capita in 1995 to 0.21 toe per capita in 2018 and it remains significantly lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

The structure of final gas consumption per sectors also differs. Gas usage in Lithuania is dominated by industry (52.1%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%. The share of gas usage in transport sector in Lithuania is also higher (4.5% compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27). On other hand gas in residential and commercial sectors is significantly less present – 12.2% in commercial sector in Lithuania comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27, and 27.6% in residential sector in Lithuania comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27.

Item 196: Final consumption of gas per capita in Lithuania in 1995-2018 and gas final consumption by sectors in Lithuania and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Lithuania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Lithuania and EU-11, EU-14 and EU-27 countries in 2018

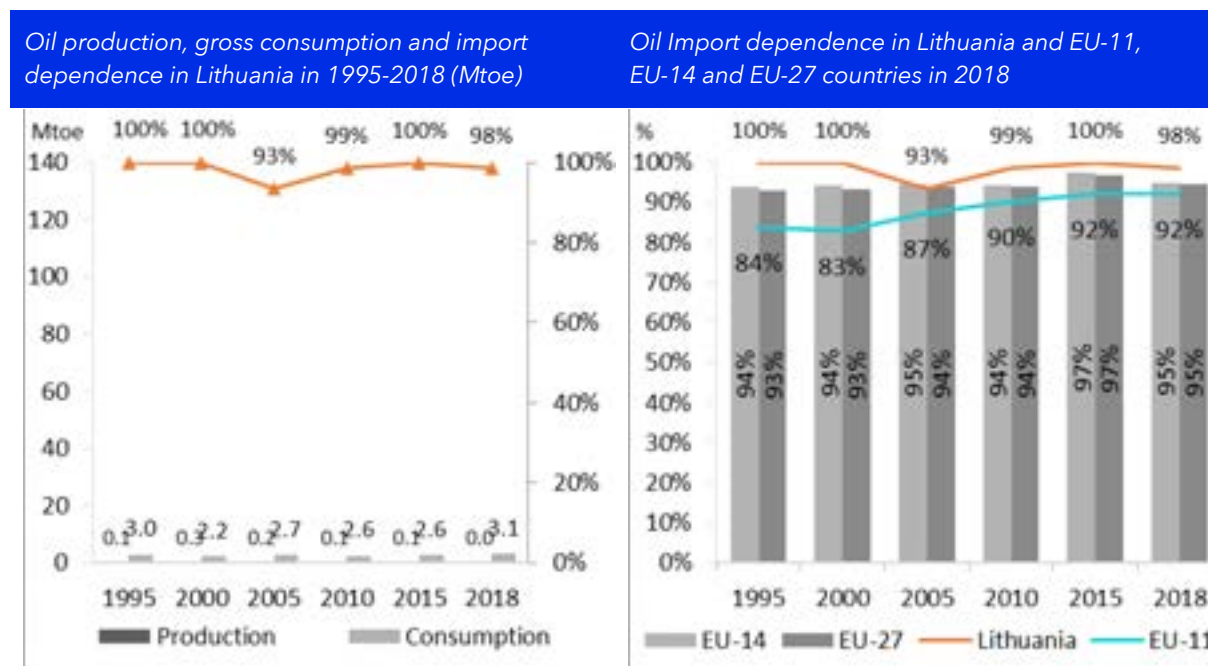


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 9.7 Overview of the oil sector

Oil production in Lithuania is very low (less than 0.1 Mtoe in 2018) comparing to the consumption (3.1 Mtoe in 2018). Therefore the import dependence remains high – between 93% and 100% in years 1995-2018 (see Item 197). When compared to EU averages higher import dependence is observed between Lithuania and EU-11, EU-14 and EU-27 countries (98% import dependence of Lithuania in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 197: Oil sector in Lithuania



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

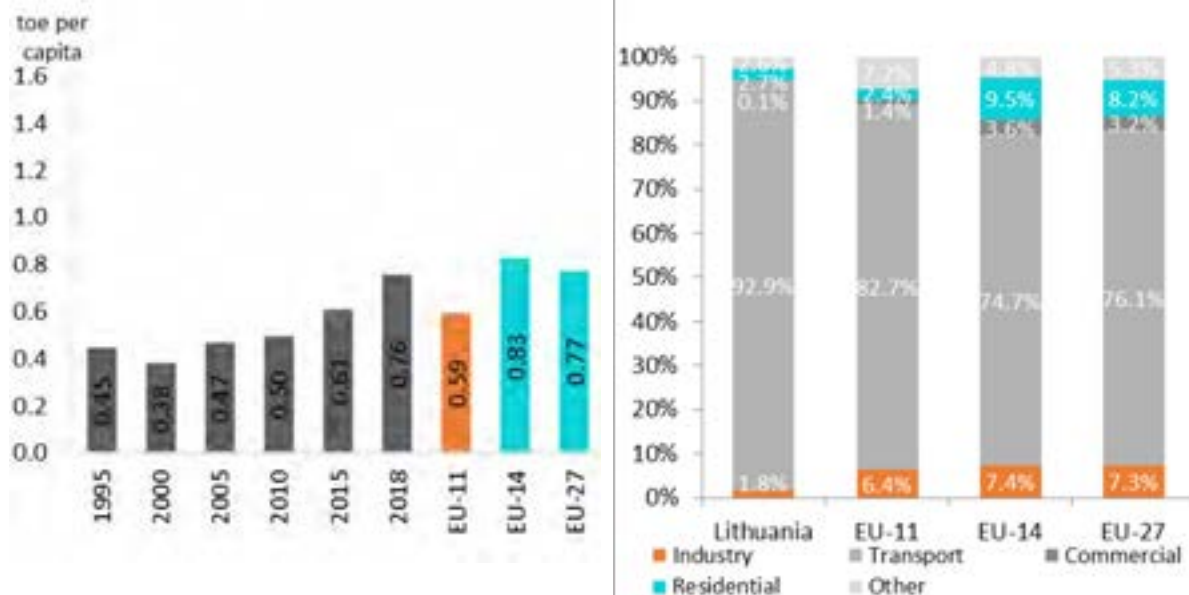
The final consumption of oil per capita in Lithuania increased for 0.45 toe per capita in 1995 to 0.76 toe per capita in 2018. It remains lower than the averages for EU-14 and EU-27 countries (respectively 0.83 toe per capita, 0.77 toe per capita) but higher than EU-11 average (0.59 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of transport sector comparing to EU-11, EU-14 and EU-27 countries. Most of oil is used in transport - 92.9% in Lithuania comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are lower in Lithuania than in EU-11, EU-14 and EU-27 countries, as well as commercial and residential use.

Item 198: Final consumption of oil per capita in Lithuania in 1995-2018 and oil final consumption by sectors in Lithuania and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Lithuania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Lithuania and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 9.8 EU climate policy and its targets for Lithuania

Lithuania is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 199).

*Item 199: Energy and climate targets for Lithuania for 2020 and 2030*

	Lithuania 2020 targets	Lithuania 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS – Effort Sharing Decision (ESD)	+15% in relation to their 2005 levels	-
National emission reduction targets in non-ETS – Effort Sharing Regulations (ESR)	-	-9% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	23% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 6.5 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 4.3 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

In following chapter, the overview of Lithuania targets and performance are summarized.

### 9.8.1 Greenhouse gas emissions

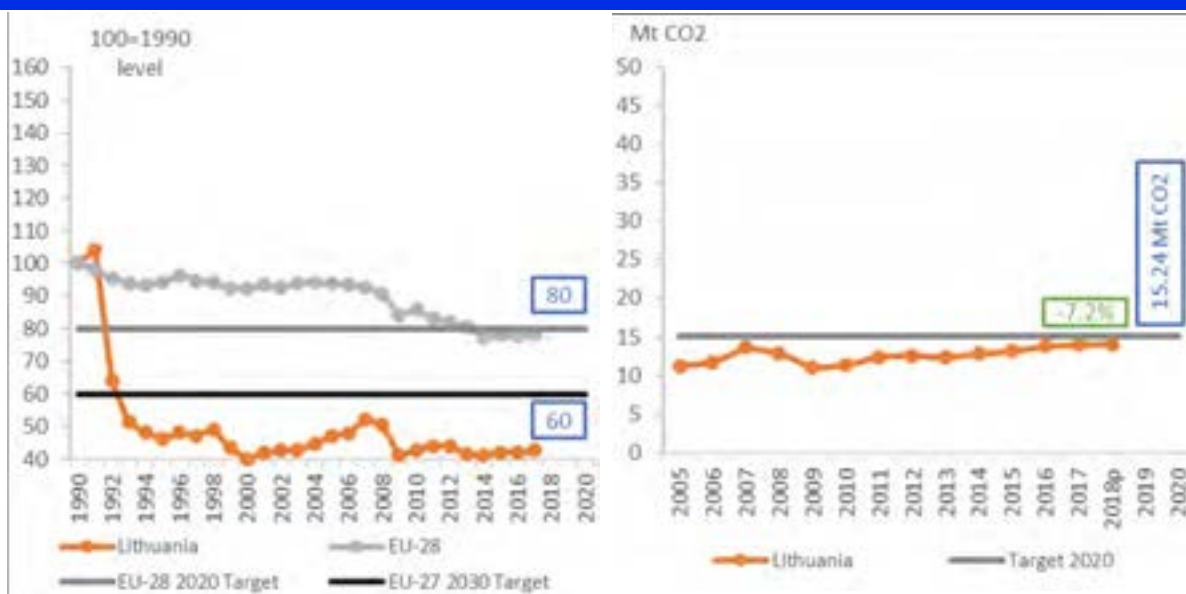
EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Lithuania is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Lithuania is 11.24 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 7.2%.

*Item 200: Energy efficiency target data for Lithuania*

Greenhouse gas emissions level in Lithuania and EU-28, base year 1990, and EU 2020 target

Greenhouse gas emissions in Effort Sharing Decision (ESD) sectors



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 9.8.2 Renewable energy sources

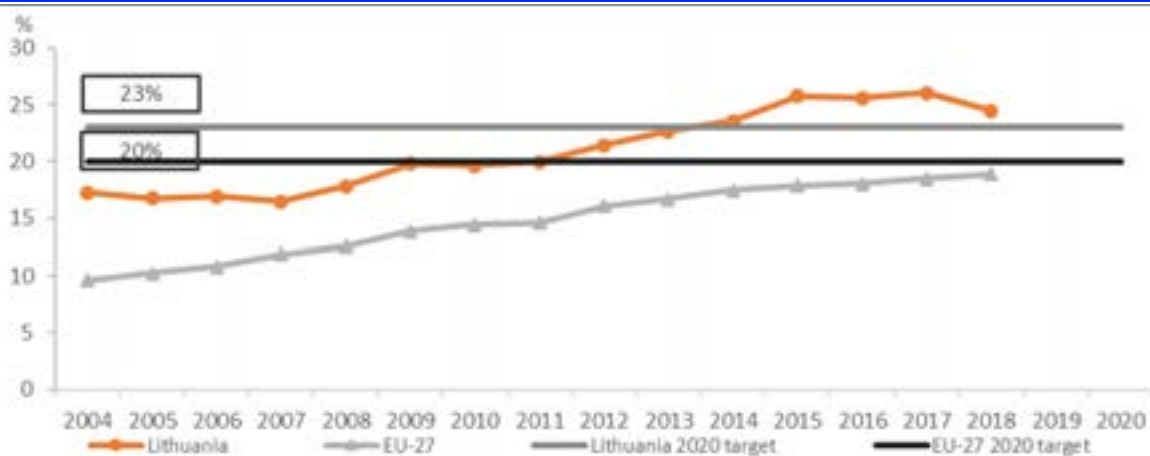
The following targets are set for Lithuania regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 23% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Lithuania is already above EU wide and country specific targets.

Item 201: Share of energy from renewable energy sources in gross final energy consumption in Lithuania

Share of energy from renewable energy sources in gross final energy consumption in Lithuania in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 9.8.3 Energy efficiency

The energy efficiency target set for Lithuania are respectively:

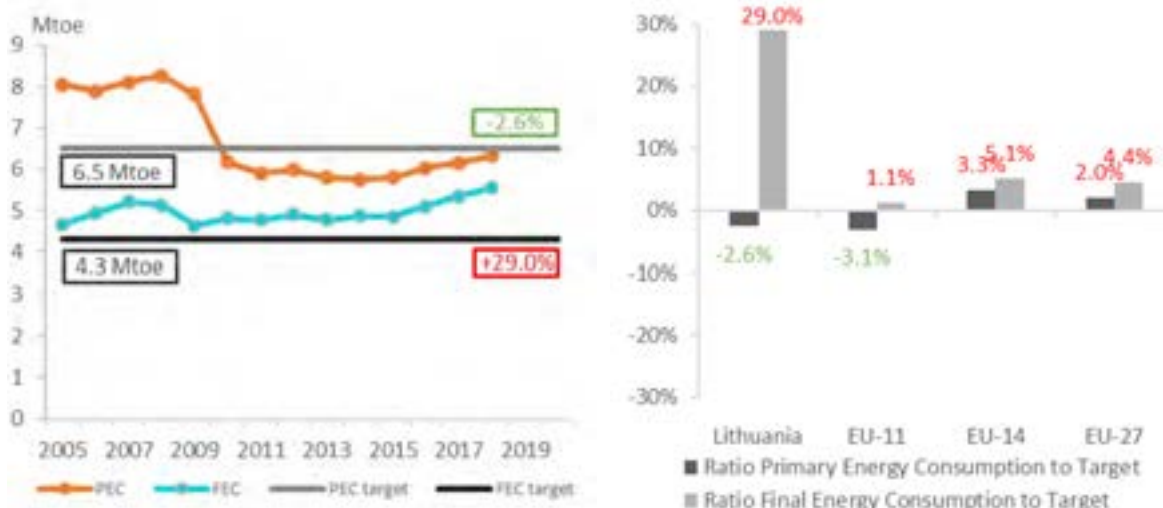
- Primary Energy Consumption in 2020: 6.5 Mtoe
- Final energy consumption in 2020: 4.3 Mtoe

Following the information provided in Item 202 the primary energy consumption for 2018 is below the targets but final energy consumption is above it.

## Item 202: Energy efficiency target data for Lithuania

Primary energy consumption and final energy consumption in Lithuania in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Lithuania, EU-11, EU-14 and EU-27 in 2018



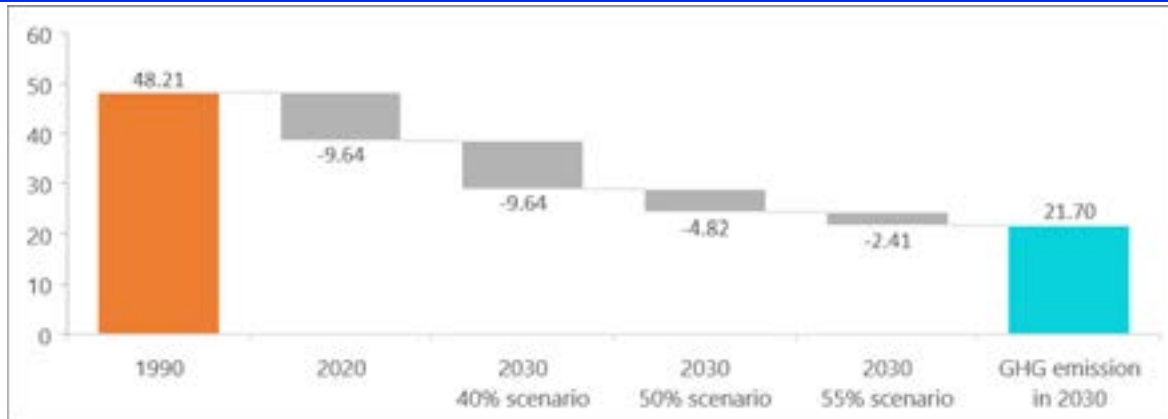
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

## 9.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Lithuania greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 9.64 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 9.64 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 4.82 Mt CO<sub>2</sub> emission decrease is needed, or 7.23 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Lithuania up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Lithuania was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 203: Estimation regarding greenhouse gas emissions in Lithuania under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Lithuania under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 10 Poland

### 10.1 General information

Poland is the largest country within EU-11 group in terms of total country area and represents 27.5% of the area. At the same time, it is the 6<sup>th</sup> country in EU-27 with 7.4% of the area. It represents 37.0% of EU-11 population and 8.5% of EU-27 population, but 35.9% of its total nominal GDP of EU-11 and 3.7% of EU-27. Despite the robust economic growth in 1995-2018 period, in 2018 Polish GDP per capita amounted only to 71% of the whole EU average.

Item 204: Poland - key data



#### Key data

Population (M)	38.0
GDP per capita (EUR, nominal)	12,950
GDP per capita (EUR, PPS)	21,820
GDP as share of EU-11	35.9%
GDP as share of EU-27	3.7%
Energy intensity of the economy (kgoe per 1,000 EUR)	129.4
Greenhouse gas emissions (Mg per capita)	10.9

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 5.6% Polish economy considerably grew in the period of 1995-2018 (see Item 205). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 65% and 71% of the respective averages) – even if purchasing power is taken into consideration.

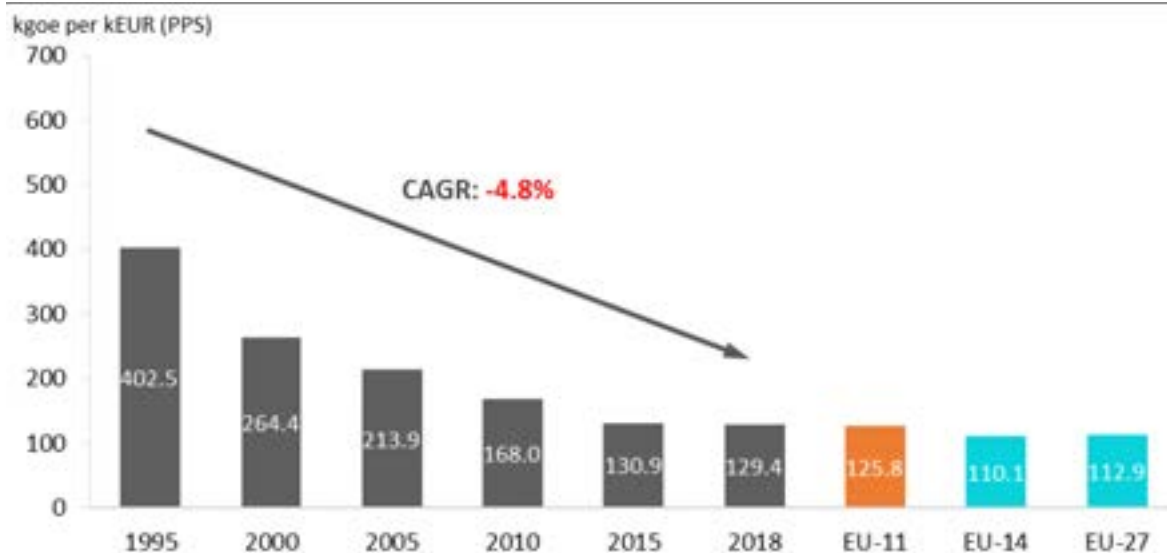
Item 205: GDP per capita in Poland for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Poland GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Polish economy energy intensity is about 129.4 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 273.2 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than 2 times. In EU-14 and EU-27 average values are 1.2 and 1.1 times respectively lower and in EU-11 average is at a similar level than in Poland.

*Item 206: Energy intensity of the economy in Poland in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)*



*Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) - EI\_GDP\_PPS*

## 10.2 Energy balance of Poland

In Item 207 the energy balance of Poland in 2018 as well as historical values of net imports of energy are shown. The primary energy production was equal to 61.4 Mtoe. Net import accounted for 48.0 Mtoe and gross inland consumption of energy was 106.8 Mtoe.

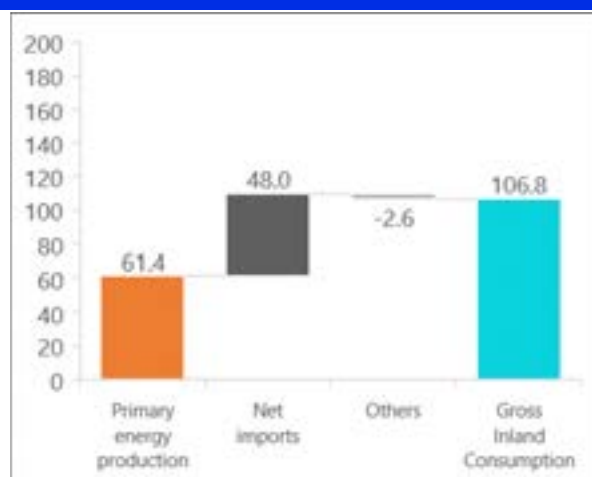
The production of primary energy in the country has decreased from 98.8 Mtoe in 1995 to 61.4 Mtoe in 2018. Gross inland consumption has increased in the same time from 99.8 Mtoe to 106.8 Mtoe.

Consequently, net import of energy has increased from -0.19 Mtoe in 1995 (i.e. Poland was an exporter) to 48.0 Mtoe in 2018. The share of import in total energy needs of the country has also increased from -0.2% in 1995 to 44.9% in 2018. In both cases, net import, and the share of net imports in energy needs of the country were increasing up to 2011, then it has decreased up to 2013 to finally increase to the current values of 2018.

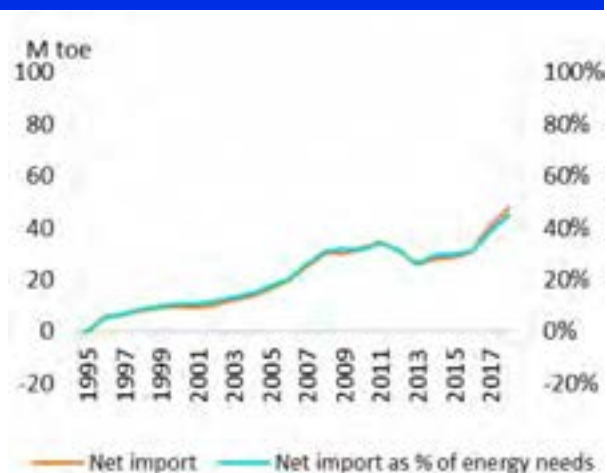
Poland primary energy production compared to gross inland consumption has decreased from 99% to 58%. Therefore, the dependence of the country from foreign import of energy has increased.

Item 207: Energy balance in Poland

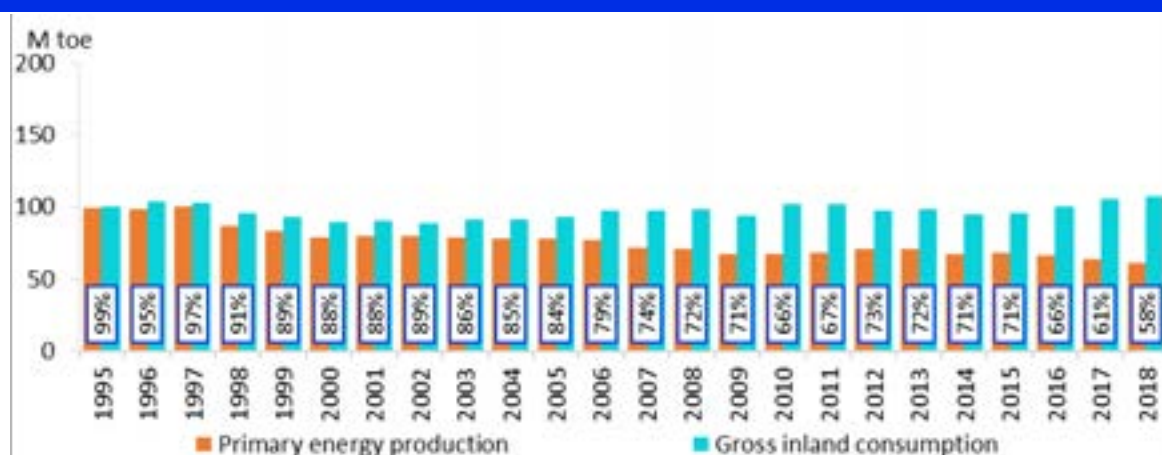
Energy balance in Poland in 2018 (Mtoe)



Net import of energy in Poland in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Poland (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

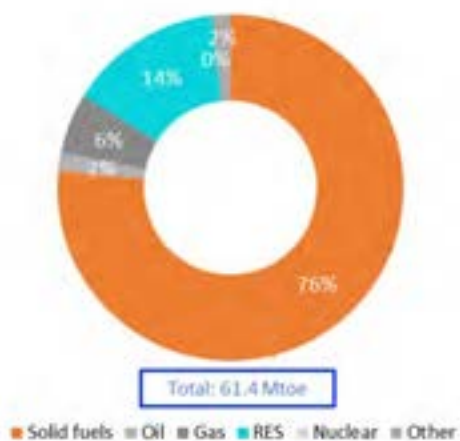
Considering the primary production, one can notice that 76% of the production is based on solid fuels. The remaining part is produced from renewable energy sources (14%), gas (6%) and oil (2%).

Comparing to EU-11 group Poland has a higher share of solid fuels in the primary energy production mix (77% versus 45%). Consequently, the share of other fuels is lower than the averages for EU-11.

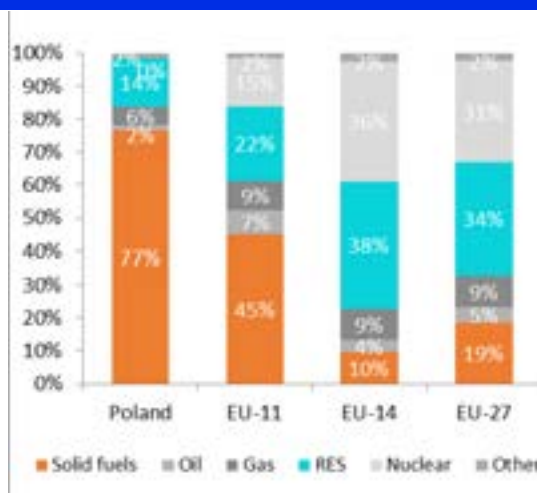
When compared to the group of developed Western European countries (EU-14), Poland has a very high share of solid fuels in primary energy production (77% versus 10%). Furthermore, production in developed countries is much more balanced than in Poland, which is dominated by solid fuels. Similar relations are observed when comparing Poland primary energy structure to EU-27.

Item 208: Primary energy structure in Poland

Primary energy structure in Poland in 2018 (%)



Primary energy production structure in Poland in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

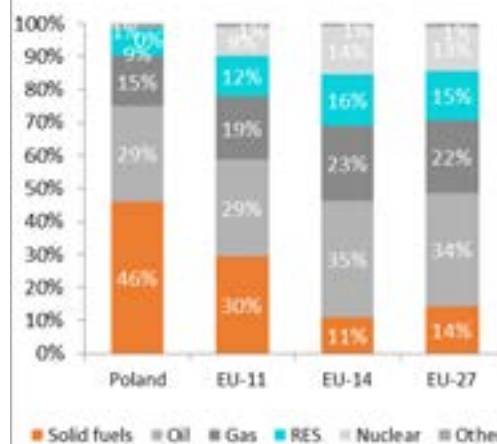
On the consumption side, solid fuels, oil, and gas have a dominant position - 90% whereas solid fuels accounts for 46%. The remaining 10% are supplied from RES and other sources. Gross inland energy consumption of energy in Poland is characterized by high share of solid fuels, higher than the averages for EU-11, EU-14 and EU-27. Oil plays a similar role as in EU-11 countries and smaller than in EU-14 and EU-27 countries. The share of gas in gross consumption of energy is lower in Poland than European averages. The same case is for RES.

Item 209: Gross inland consumption structure in Poland

Gross inland consumption structure in Poland in 2018 (%)



Gross inland consumption structure in Poland in 2018 in comparison with EU-11, EU-14, and EU-27 averages



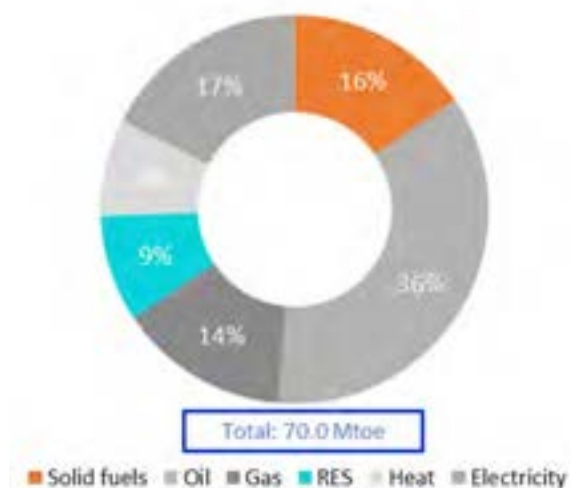
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Poland is dominated by petroleum products – 36%. The share of solid fuels (16%), gas (14%) and electricity (17%) are considerable, whereas RES and heat are only used in (5 and 8% of final energy consumption, respectively).

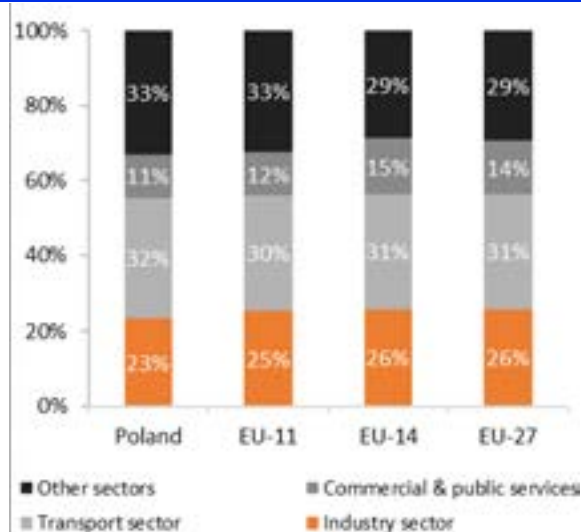
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Poland hardly shows any particularities. The proportional consumption needs of each sector seem to be like those of developed countries. The final energy consumption is lower in industry but higher in transport.

Item 210: Final energy consumption structure in Poland

Final energy consumption structure in Poland in 2018 (%)



Final energy consumption structure in Poland in 2018 in comparison with EU-11, EU-14, and EU-27 averages



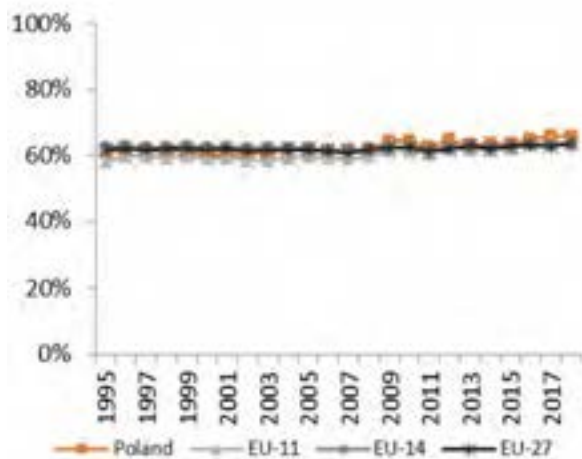
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Polish final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, is at the same level as the averages for EU-11, EU-14 and EU-27 countries.

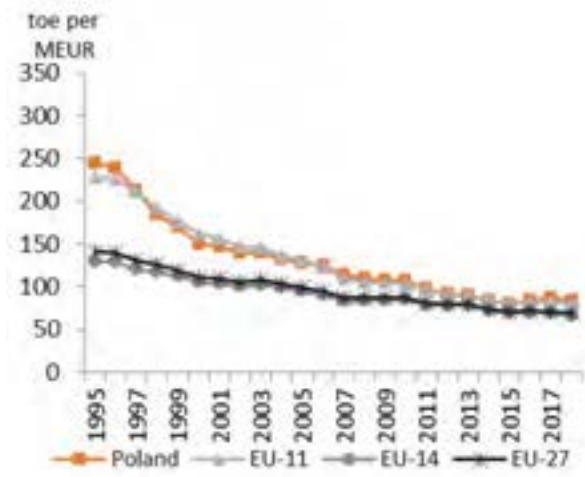
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 244.6 toe per MEUR to 83.5 toe per MEUR). It remains higher than the averages for EU-11, EU-14 and EU-27 countries.

Item 211: Final energy consumption in Poland in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Poland in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Poland in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

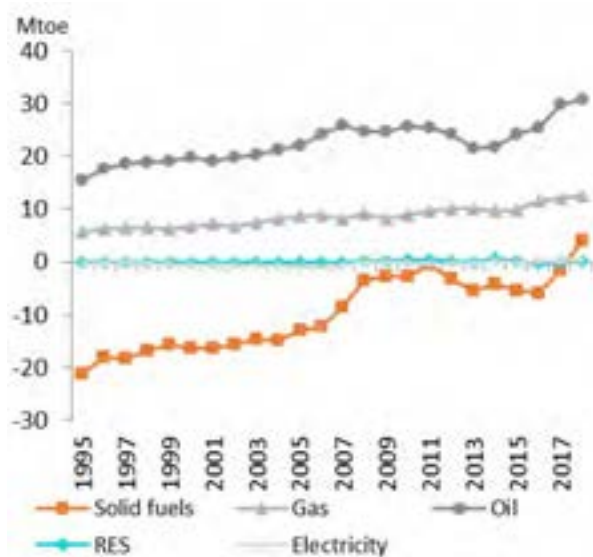


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

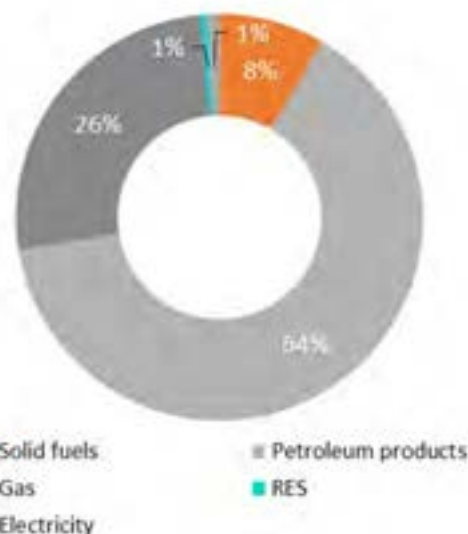
Total net import of energy in Poland significantly increased in years 1995-2018. It is the case of oil, gas, and particularly solid fuels where Poland has become a net imported whereas in 1995 was a significant exporter. The import structure of fuels is characterized by high share of oil (64%) and gas (26%), which constitutes in total 90% of import. The remaining 10% are mostly solid fuels (8%).

Item 212: Net import of energy in Poland

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil

*and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)*

Solid fuels are imported to Poland mainly from Russia (67%). The remaining import of solid fuels is spread different suppliers, but any of them exceeds 8%.

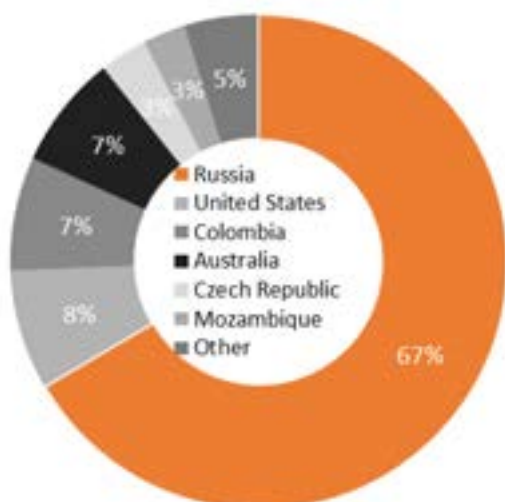
Crude oil imports to Poland are performed by Russia (69%). The remaining 31% are imported from different countries. The share of any of them is not exceeding 6%.

Gas is imported to Poland from Russia (52%), Qatar (25%) and Germany (16%). The missing 7% are imported from other countries.

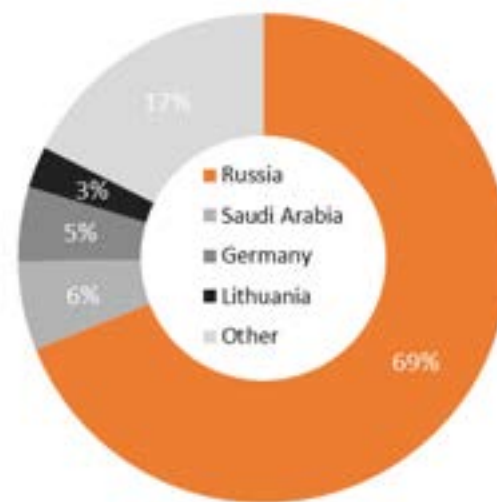
Electricity is mainly imported to Poland from Germany (51%), Sweden (23%), Lithuania (12%) and Ukraine (10%). Additional 4% are imported from Czech Republic and a very small amount from Slovakia.

Item 213: Foreign fuel suppliers

Foreign suppliers of solid fuels in Poland in 2018 (%) Foreign suppliers of crude oil in Poland in 2018(%)



Total: 12.1 Mtoe



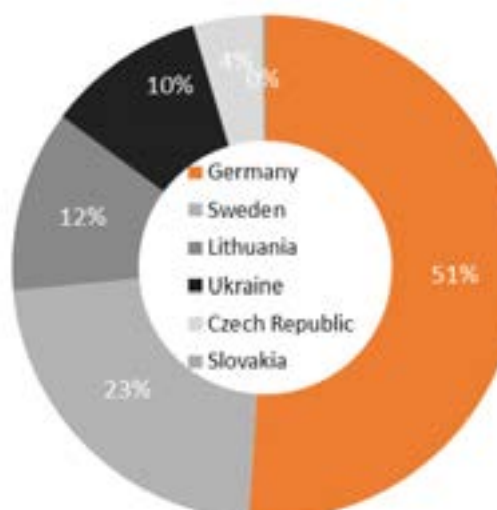
Total: 36.9 Mtoe

Foreign suppliers of gas in Poland in 2018 (%)

Foreign suppliers of electricity in Poland in 2018 (%)



Total: 13.1 Mtoe



Total: 1.2 Mtoe

Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 10.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Poland were reduced - from over 445.0 Mt CO<sub>2</sub> in 1995 to 413.8 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 10.9 Mg CO<sub>2</sub> per capita in 2017 (from 11.5 Mg CO<sub>2</sub> per capita in 1995), which is higher comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also higher than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

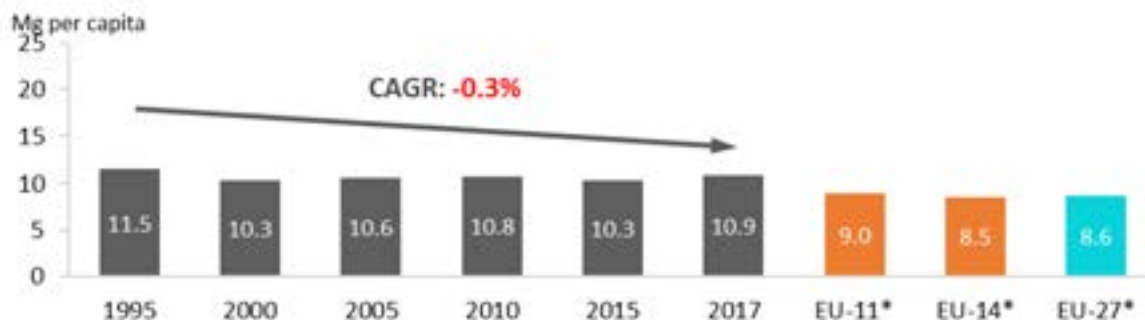
There were some noteworthy changes in the Polish structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction sector

emissions dropped swiftly by 51%, as well as emissions from energy industries and waste management, respectively 14% and 9%. On other hand, transport emissions gained in importance increasing by 166%.

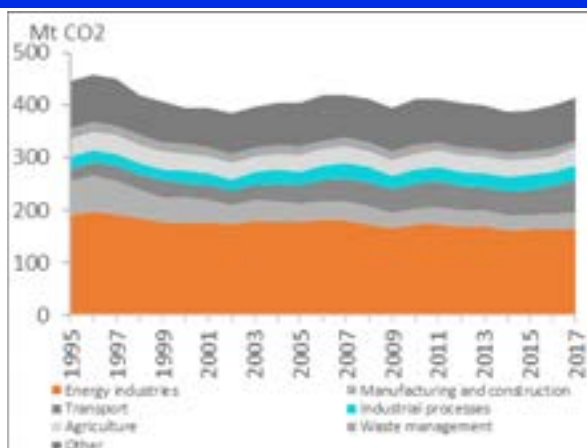
Comparing to EU-11, EU-14 and EU-27 countries, Poland is characterized by higher share of emissions from energy industries (40% versus 35%, 26% and 28%). At the same time, the share of greenhouse gas emissions from transport is lower than EU-14 and EU-27 averages.

Item 214: Greenhouse gas emissions in Poland

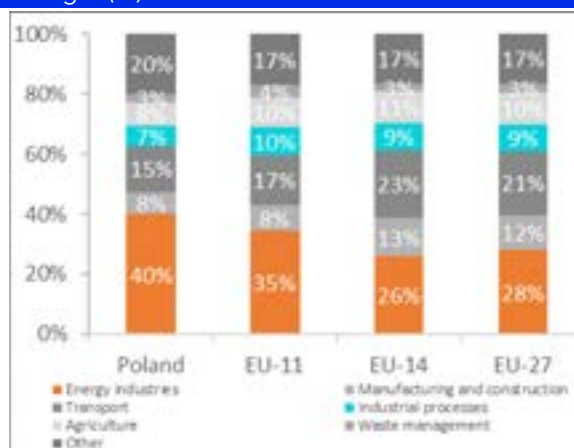
Greenhouse gas emissions per capita in Poland in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Poland by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Poland by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



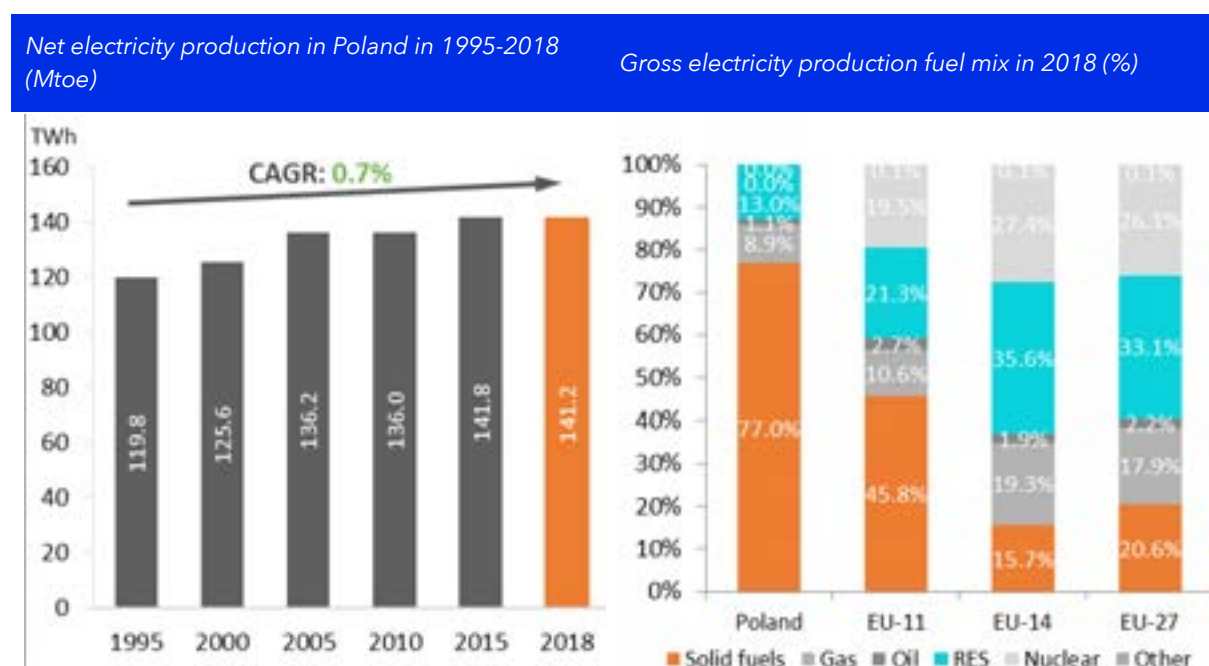
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 10.4 Overview of the electricity sector

Item 215 presents electricity production and the current fuel mix of Poland. Over last 23 years net electricity production has increased from 119.8 TWh in 1995 to 141.2 TWh in 2018 (CAGR 0.7%). As visible, net electricity production represents 34.7% of EU-11 total electricity production, which is lower compared to Polish GDP share of 36.0%.

The Polish fuel mix is dominated by solid fuels with share of 77.0%. Compared to EU-14 and EU-27 countries, Poland has a much bigger share of solid fuels in its energy mix. On other hand, the country produces relatively less electricity from gas and oil, respectively 8.9% and 1.1%. The share of electricity from renewable energy sources is also lower than in EU-14 and EU-27 countries, respectively 13.0% versus 35.6% and 33.1%).

Item 215: Net electricity production and gross electricity production fuel mix in Poland



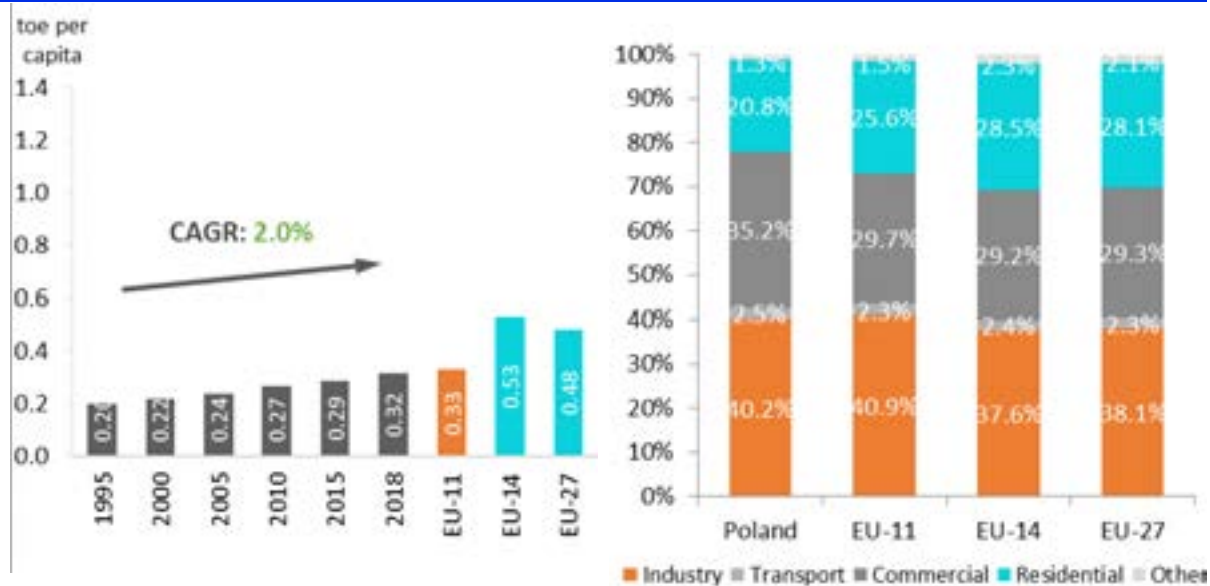
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 216 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Poland has somewhat increased (CAGR in the period of 1995-2019 was around 2.0%) and its level is still relatively low compared to EU-14 and EU-27 countries. Polish final energy consumption per capita represents only 59.9% of EU-14 level and 82.8% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Poland. Generally, the structure of final electricity consumption in Poland is rather like EU averages, with a somewhat higher share of the commercial sector and lower of residential one.

Item 216: Final consumption of electricity in Poland

Final consumption of electricity per capita in Poland (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Poland by sectors in 2018 (%)

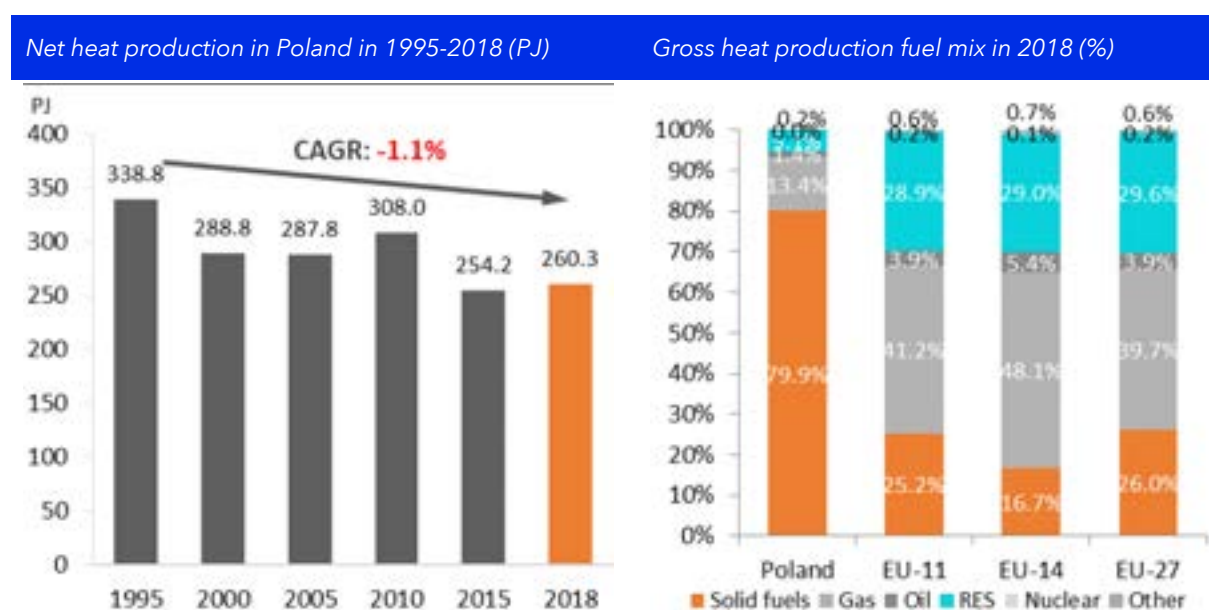


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 10.5 Overview of the heat sector

Item 217 presents heat production in Poland as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Poland has dropped between 1995 and 2018 from 338.8 PJ to 260.3 PJ, i.e. at CAGR of -1.1%. Polish production fuel mix is dominated by solid fuels (almost 79.9%). That means that in comparison with EU-14 and EU-27 Poland consumes relatively more solid fuels in heat production. The share of gas is lower (13.4% versus 48.1% in EU-14 and 39.7% in EU-27), whereas the usage of oil is significantly lower (1.4% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower than the averages for in EU-11, EU-14 and EU-27 countries.

Item 217: Net heat production and gross electricity production fuel mix in Poland



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 218 presents final heat consumption per capita and its breakdown by sectors.

The per capita demand for heat in Poland has decreased from 0.23 toe in 1995 to 0.15 toe in 2018. As a result, within the 23 years analysed, heat consumption per capita in Poland has decreased at CAGR of -1.9%. The heat consumption in Poland remains higher than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

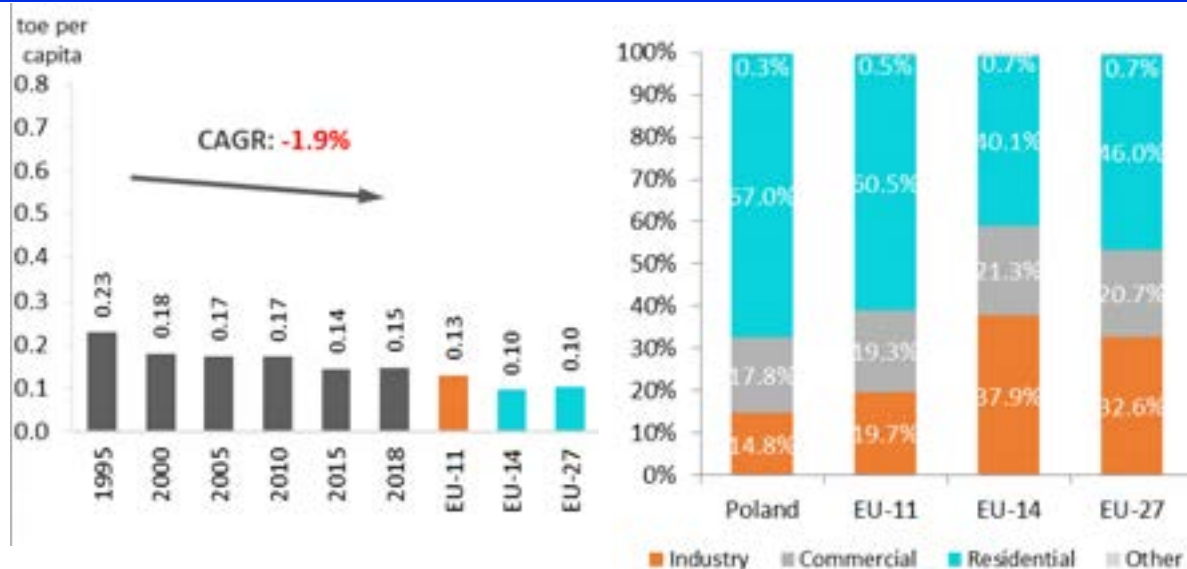
The structure of final consumption of heat in Poland is characterized by higher share of residential usage (67.0% in Poland compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (14.8% in Poland compared to 37.9% in EU-14 and 32.6% in EU-27) and commercial sector use of heat (17.8% in Poland compared to 21.3% in EU-14 and 20.7% in EU-27).

In relation to EU-11 countries, the structure of final heat consumption is similar.

Item 218: Final consumption of heat in Poland

Final consumption of heat per capita in Poland (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Poland by sectors in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

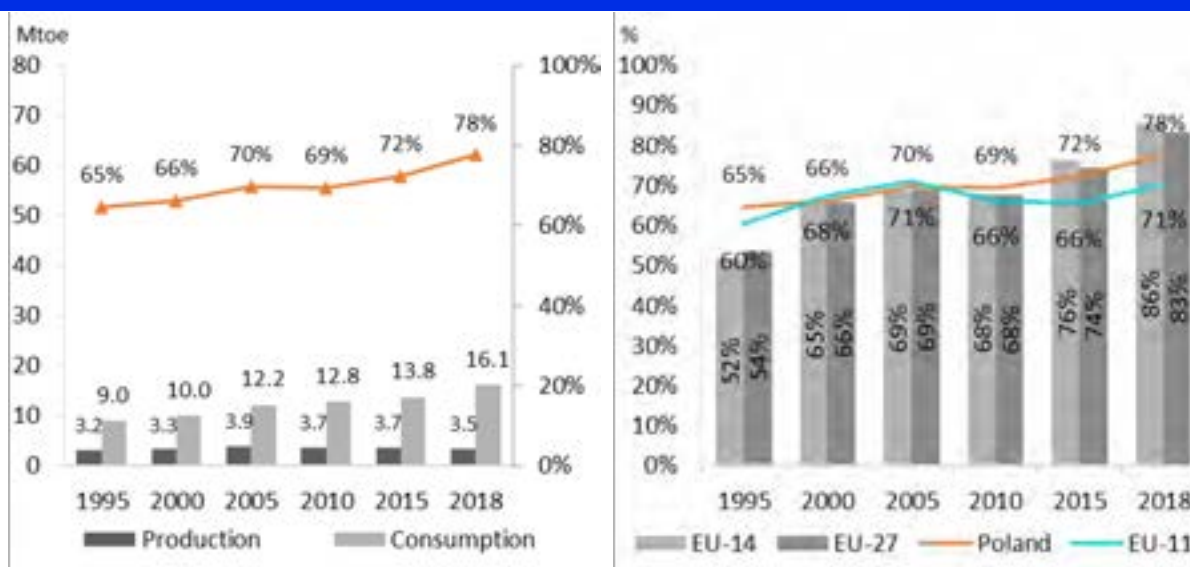
## 10.6 Overview of gas sector

Gas production in Poland is low (less than 3.5 Mtoe in 2018) comparing to the consumption (16.1 Mtoe in 2018). Therefore, the import dependence remains high – between 65% and 78% in years 1995-2018 (see Item 219). When compared to EU averages higher import dependence is observed between Poland and EU-11 countries (78% import dependence of Poland in 2018 versus 71% in EU-11) but lower compared to EU-14 and EU-27 countries (86% in EU-14 and 83% in EU-27).

Item 219: Gas sector in Poland

Gas production, gross consumption and import dependence in Poland in 1995-2018 (Mtoe)

Gas Import dependence in Poland and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

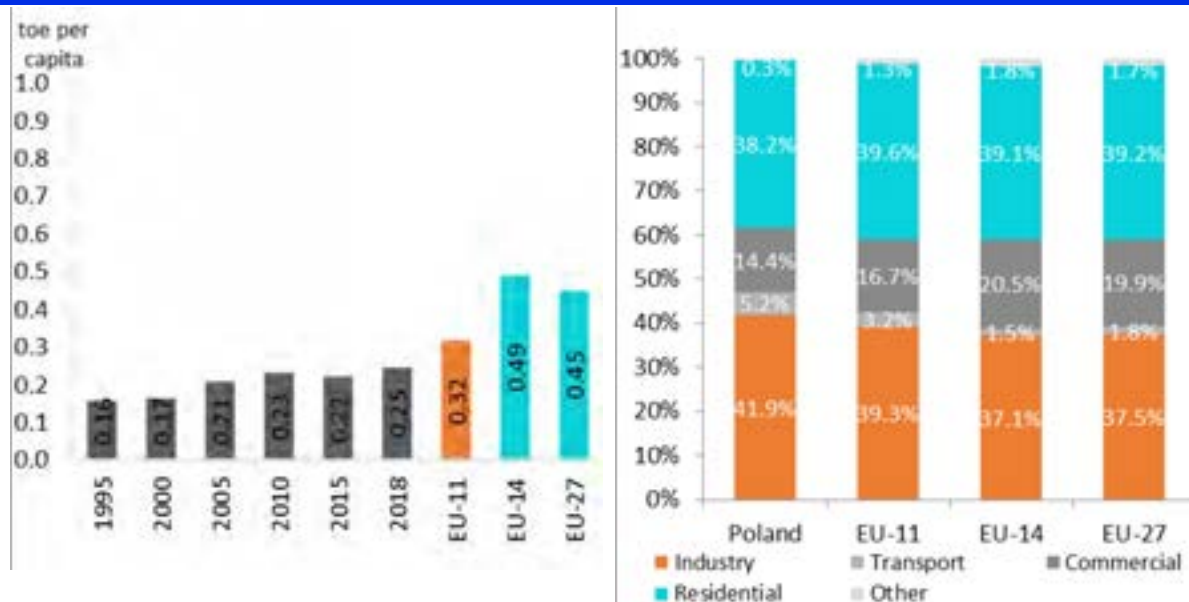
The final consumption of gas per capita in Poland has increased from 0.16 toe per capita in 1995 to 0.25 toe per capita in 2018 and it remains lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

The structure of final gas consumption per sectors is similar as European averages. Gas usage in Poland is dominated by industry (41.9%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%. The share of gas usage in transport sector in Poland is also higher (5.2% compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27). On other hand gas in residential and commercial sectors is significantly less present – 14.4% in commercial sector in Poland comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27, and 38.2% in residential sector in Poland comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27.

Item 220: Final consumption of gas per capita in Poland in 1995-2018 and gas final consumption by sectors in Poland and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Poland (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Poland and EU-11, EU-14 and EU-27 countries in 2018

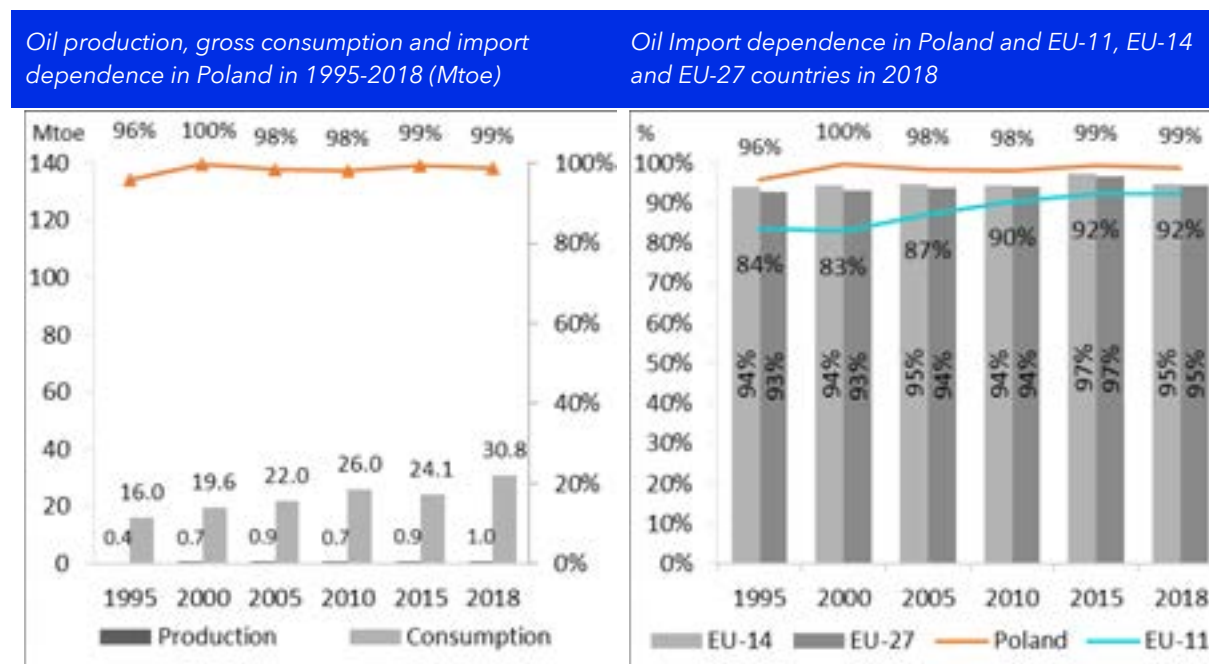


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 10.7 Overview of the oil sector

Oil production in Poland is low (1.0 Mtoe in 2018) comparing to the consumption (30.8 Mtoe in 2018). Therefore, the import dependence remains high – between 96% and 100% in years 1995-2018 (see Item 221). When compared to EU averages higher import dependence is observed between Poland and EU-11, EU-14 and EU-27 countries (99% import dependence of Poland in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 221: Oil sector in Poland



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

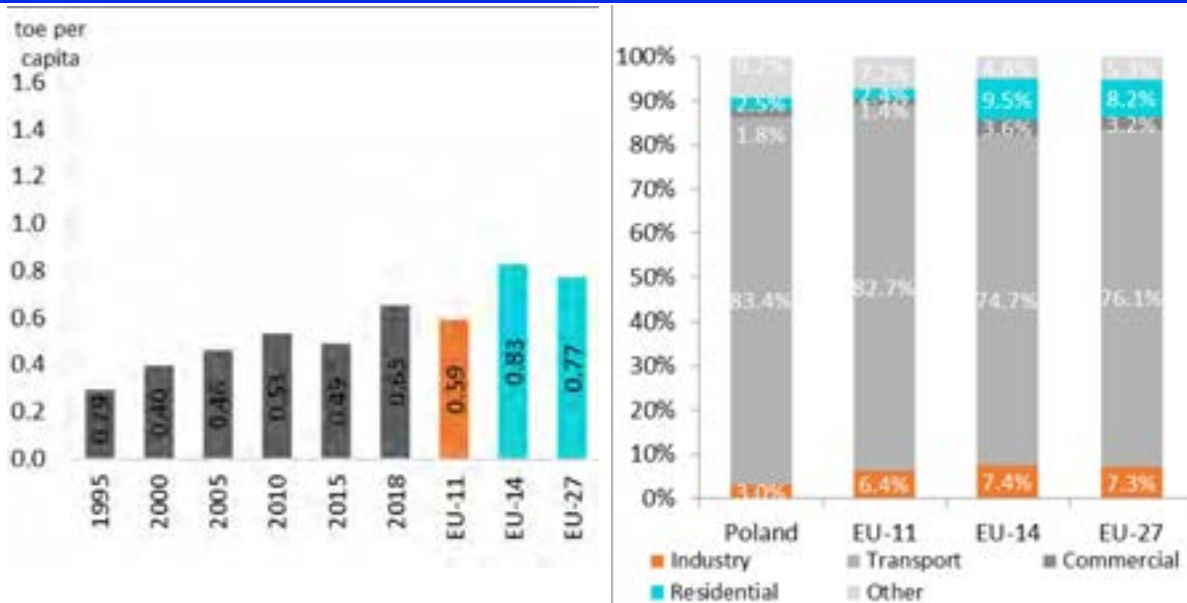
The final consumption of oil per capita in Poland increased for 0.29 toe per capita in 1995 to 0.65 toe per capita in 2018. It remains lower than the averages for EU-14 and EU-27 countries (respectively 0.83 toe per capita, 0.77 toe per capita) but higher than EU-11 average (0.59 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of transport sector comparing to EU-11, EU-14 and EU-27 countries. Most of oil is used in transport – 83.4% in Poland comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are lower in Poland than in EU-11, EU-14, and EU-27 countries, whereas commercial and residential usage are lower than in EU-14 and EU-27 countries.

Item 222: Final consumption of oil per capita in Poland in 1995-2018 and oil final consumption by sectors in Poland and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Poland (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Poland and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 10.8 EU climate policy and its targets for Poland

Poland is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 223).

*Item 223: Energy and climate targets for Poland for 2020 and 2030*

	Poland 2020 targets	Poland 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS - Effort Sharing Decision (ESD)	+14% in relation to their 2005 levels	-
National emission reduction targets in non-ETS - Effort Sharing Regulations (ESR)	-	-7% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	15% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 96.4 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 71.6 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

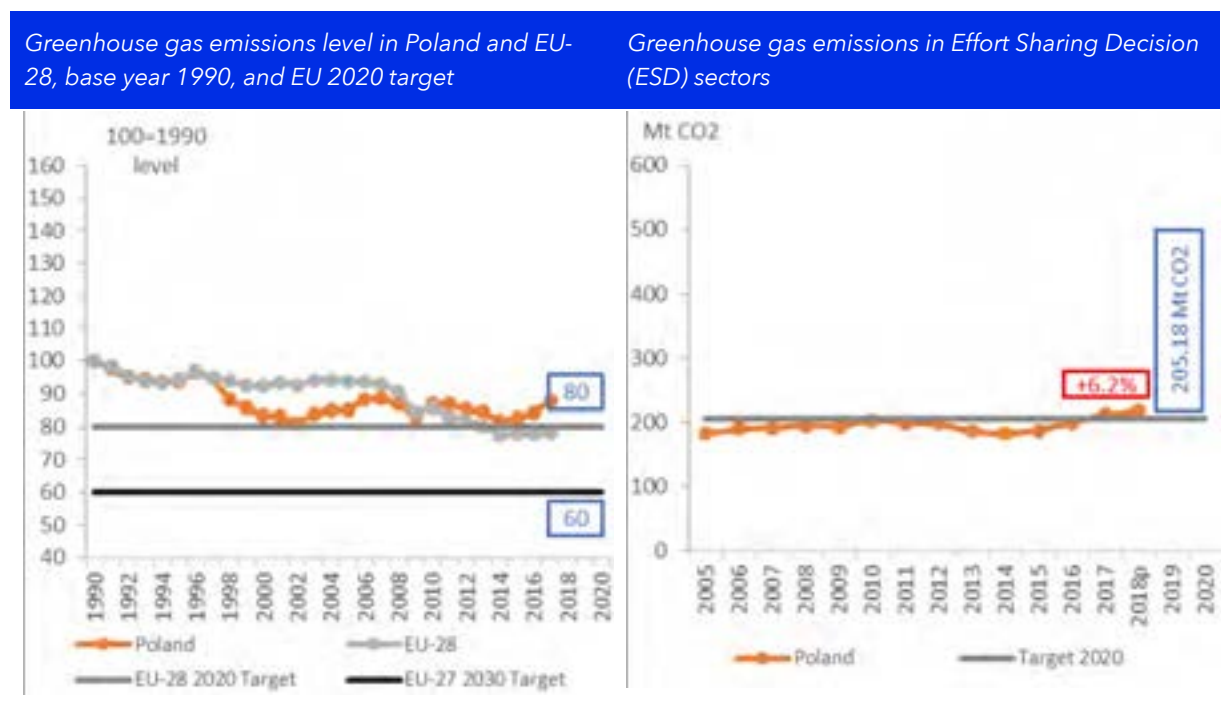
In following chapter, the overview of Poland targets and performance are summarized.

### 10.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Poland is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Poland is 205.18 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions exceeds the target by 6.2%.

Item 224: Energy efficiency target data for Poland



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 10.8.2 Renewable energy sources

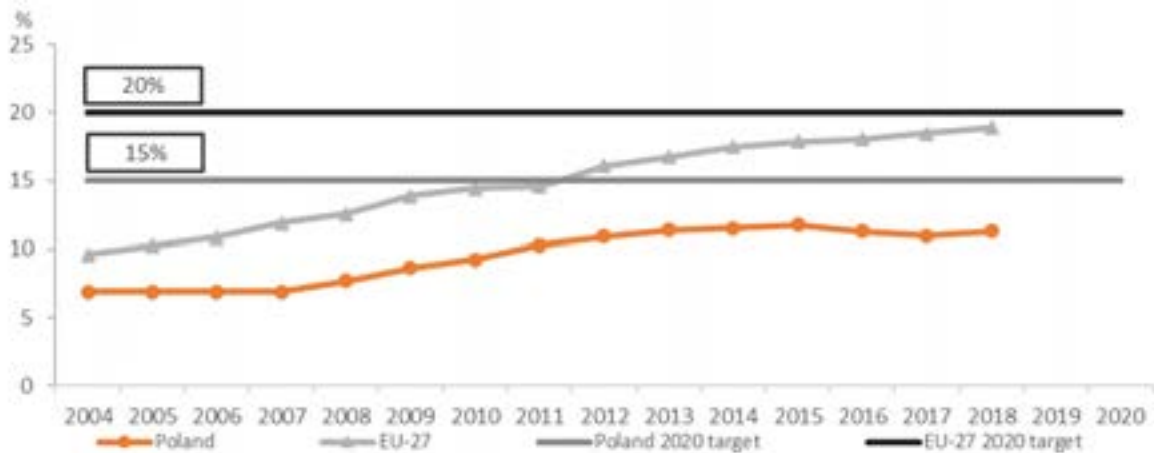
The following targets are set for Poland regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 15% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Poland is below EU wide and country specific targets.

## Item 225: Share of energy from renewable energy sources in gross final energy consumption in Poland

Share of energy from renewable energy sources in gross final energy consumption in Poland in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 10.8.3 Energy efficiency

The energy efficiency target set for Poland are respectively:

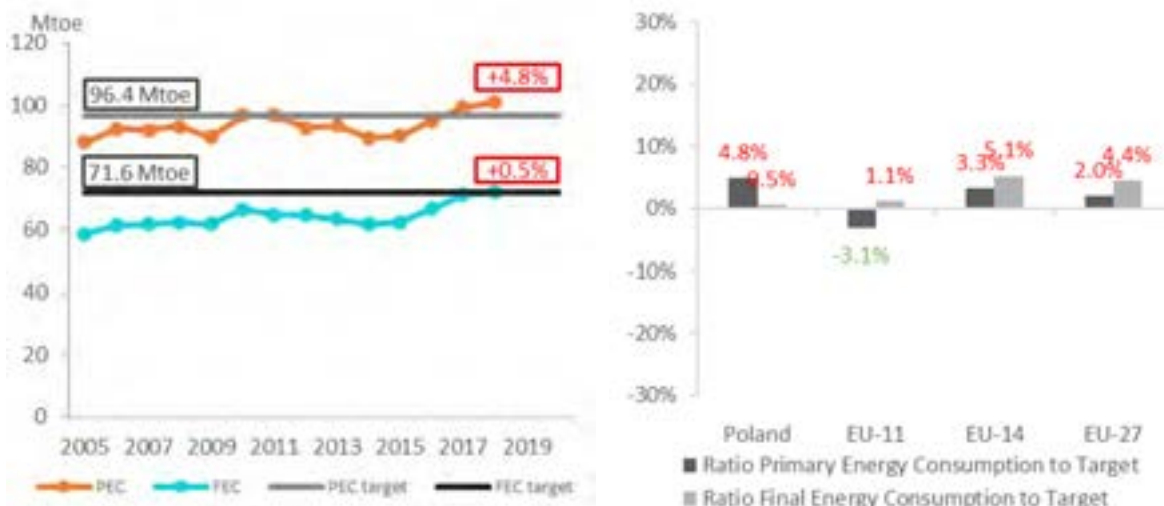
- Primary Energy Consumption in 2020: 96.4 Mtoe
- Final energy consumption in 2020: 71.6 Mtoe

Following the information provided in Item 226 the results for 2018 are above the targets in both criteria, respectively +4.8% of primary energy consumption and 0.5% of final energy consumption. This does not exclude Poland to achieve the targets in 2020.

Item 226: Energy efficiency target data for Poland

Primary energy consumption and final energy consumption in Poland in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Poland, EU-11, EU-14 and EU-27 in 2018



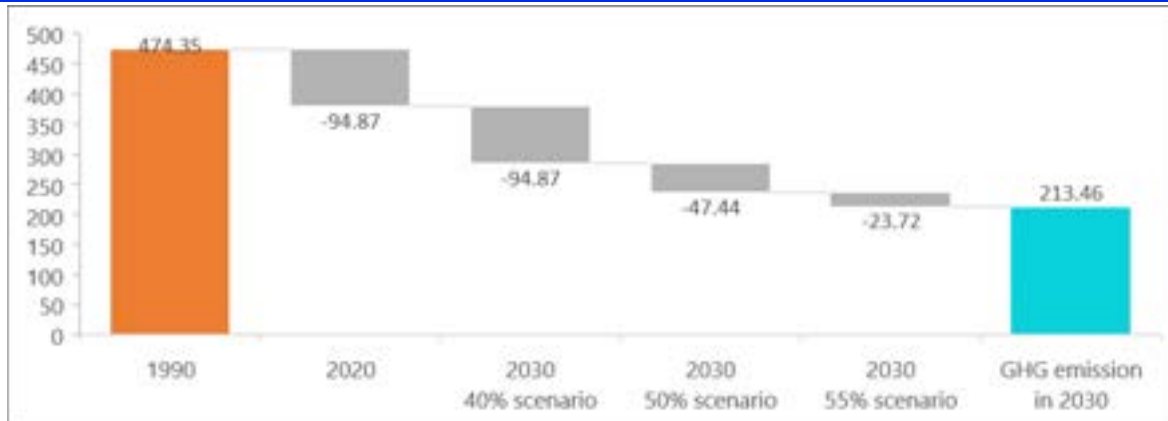
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

### 10.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Poland greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 94.87 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 94.87 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 47.44 Mt CO<sub>2</sub> emission decrease is needed, or 71.16 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Poland up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Poland was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 227: Estimation regarding greenhouse gas emissions in Poland under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Poland under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 11 Romania

### 11.1 General information

Romania is the second largest country within EU-11 group in terms of total country area and represents 21.0% of the area. At the same time, it is the 8<sup>th</sup> country in EU-27 with 5.6% of the area. It represents 19.0% of EU-11 population and 4.4% of EU-27 population, but 14.8% of its total nominal GDP of EU-11 and 1.5% of EU-27. Despite the robust economic growth in 1995-2018 period, in 2018 Romanian GDP per capita amounted only to 66% of the whole EU average.

Item 228: Romania - key data



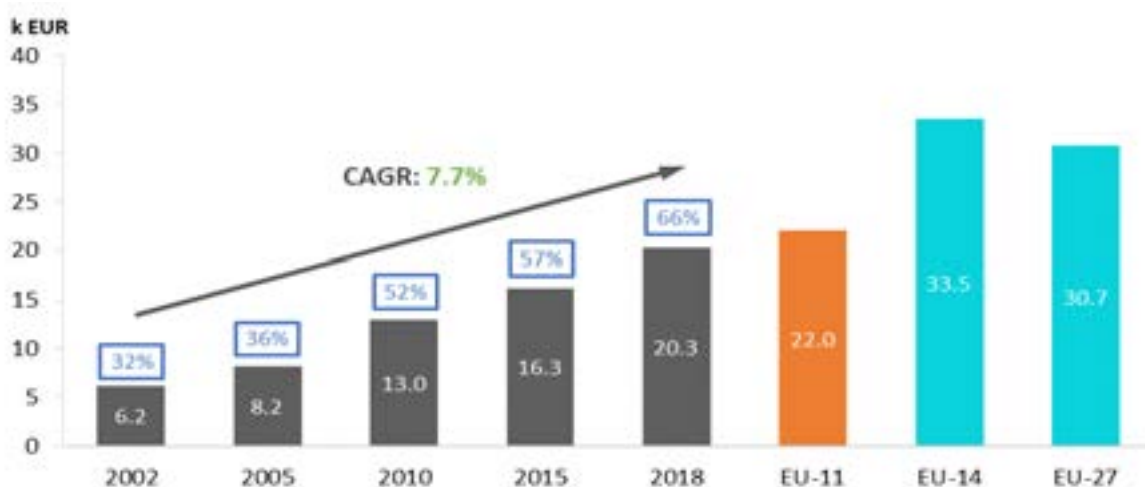
#### Key data

Population (M)	19.5
GDP per capita (EUR, nominal)	10,510
GDP per capita (EUR, PPS)	20,320
GDP as share of EU-11	14.8%
GDP as share of EU-27	1.5%
Energy intensity of the economy (kgoe per 1,000 EUR)	87.3
Greenhouse gas emissions (Mg per capita)	5.8

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 7.7% Romanian economy considerably grew in the period of 1995-2018 (see Item 229). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 61% and 66% of the respective averages) – even if purchasing power is taken into consideration.

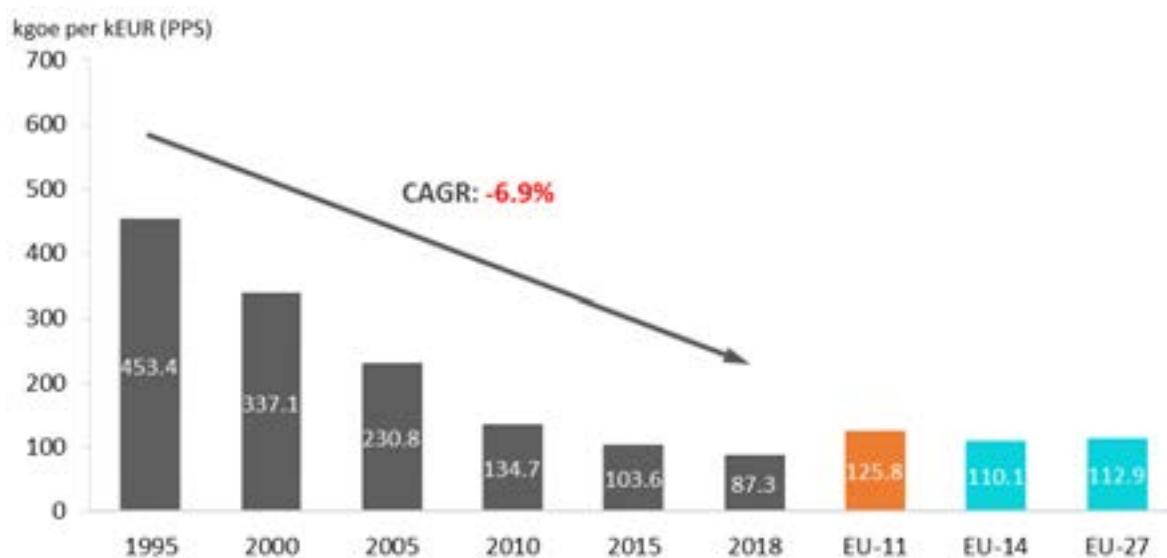
Item 229: GDP per capita in Romania for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Romania GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Romanian economy energy intensity is about 87.3 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 366.2 kgoe per 1,000 EUR PPS. The energy intensity of Romanian economy is below EU-11, EU-14, and EU-27 averages.

*Item 230: Energy intensity of the economy in Romania in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)*



*Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) - EI\_GDP\_PPS*

## 11.2 Energy balance of Romania

In Item 231 the energy balance of Romania in 2018 as well as historical values of net imports of energy are shown. The primary energy production was equal to 25.1 Mtoe. Net import accounted for 8.2 Mtoe and gross inland consumption of energy was 33.6 Mtoe.

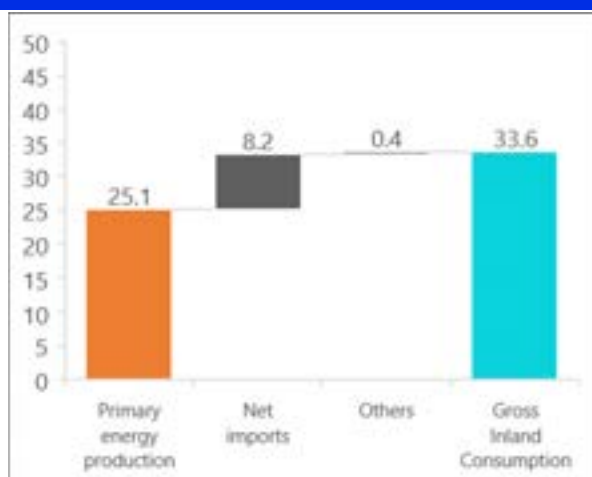
The production of primary energy in the country has decreased from 32.4 Mtoe in 1995 to 25.1 Mtoe in 2018. Gross inland consumption has also decreased in the same time from 46.8 Mtoe to 33.6 Mtoe.

Net import of energy has decreased from 14.4 Mtoe in 1995 to 8.2 Mtoe in 2018. The share of import in total energy needs of the country has also decreased from 30.9% in 1995 to 24.3% in 2018.

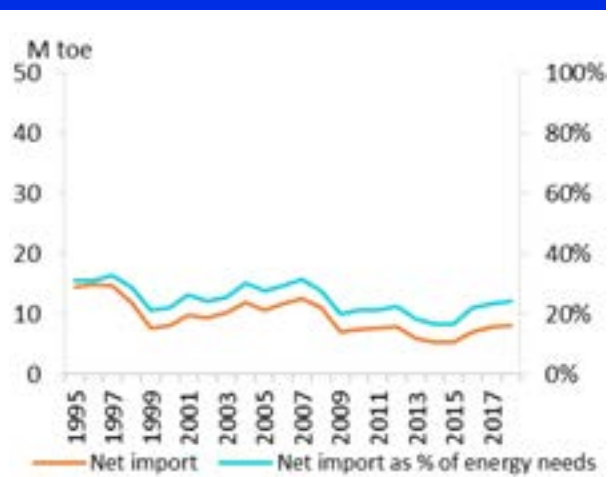
Romanian primary energy production compared to gross inland consumption has increase from 69% to 75%. Therefore, the dependence of the country from foreign import of energy has decreased.

Item 231: Energy balance in Romania

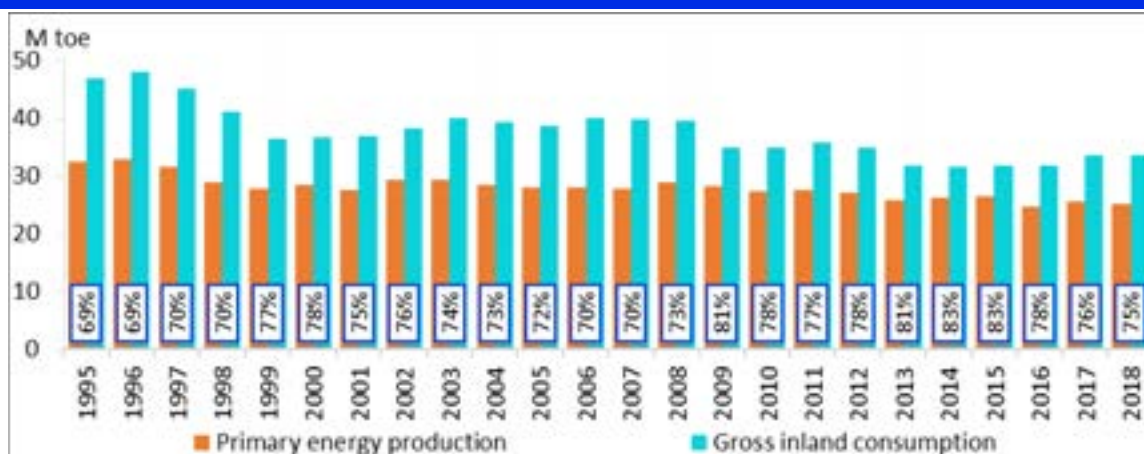
Energy balance in Romania in 2018 (Mtoe)



Net import of energy in Romania in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Romania (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

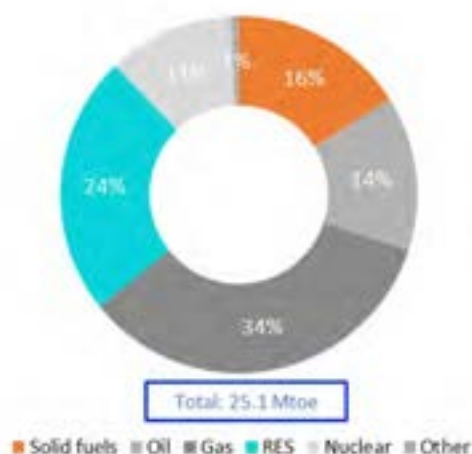
Considering the primary production, one can notice that the primary energy production structure is well balanced. Gas has the highest share (34%), followed by RES (24%), solid fuels (16%) and oil (14%). The mix is completed by 11% of nuclear energy.

Comparing to EU-11 group Romania has a higher share of gas (34% versus 9%) and similar shares of nuclear and renewable energy sources in primary energy production structure. Solid fuels shares in primary energy productions are lower than EU-11 averages whereas gas has a double share (14% versus 7%).

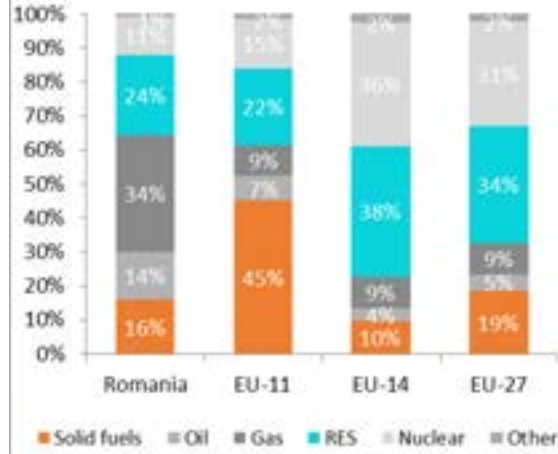
When compared to the group of developed Western European countries (EU-14), Romania has a very high share of gas in primary energy production (34% versus 9%) but lower share of RES (24% versus 38%). The usage of oil and solid fuels is also higher in Romania than EU-14 averages. Similar relations are observed when comparing Romania primary energy structure to EU-27.

Item 232: Primary energy structure in Romania

Primary energy structure in Romania in 2018 (%)



Primary energy production structure in Romania in 2018 in comparison with EU-11, EU-14, and EU-27 averages

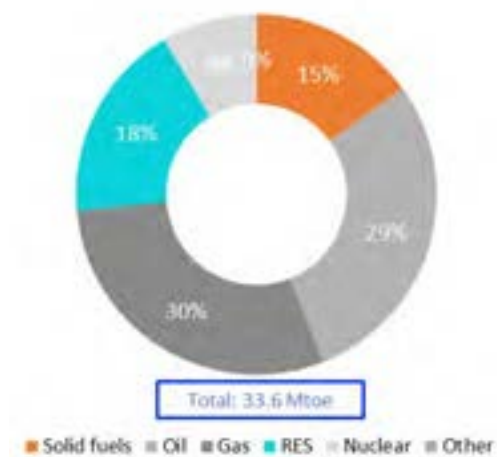


Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

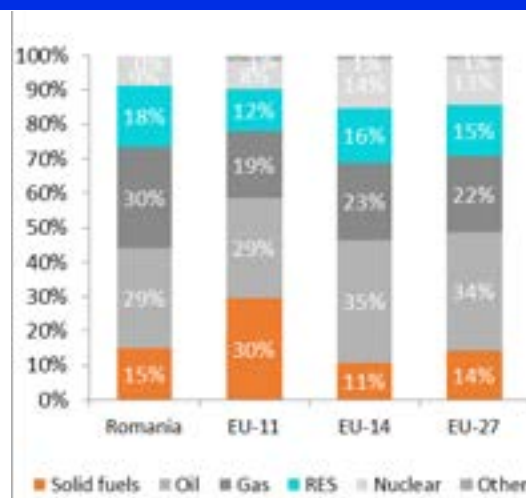
On the consumption side, the structure is well balanced. Gas remains the leader with 30%, followed by oil (29%), RES (18%) and solid fuels (15%). The mix is closed by nuclear with 8%. Gross inland energy consumption structure is closer to EU-14 and EU-27 averages than EU-11. Still Romania uses more gas than European averages. Solid fuel consumption is lower than in EU-11 but higher than in EU-14 and EU-27. The use of oil is at EU-11 level but lower than in EU-14 and EU-27.

Item 233: Gross inland consumption structure in Romania

Gross inland consumption structure in Romania in 2018 (%)



Gross inland consumption structure in Romania in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption - GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

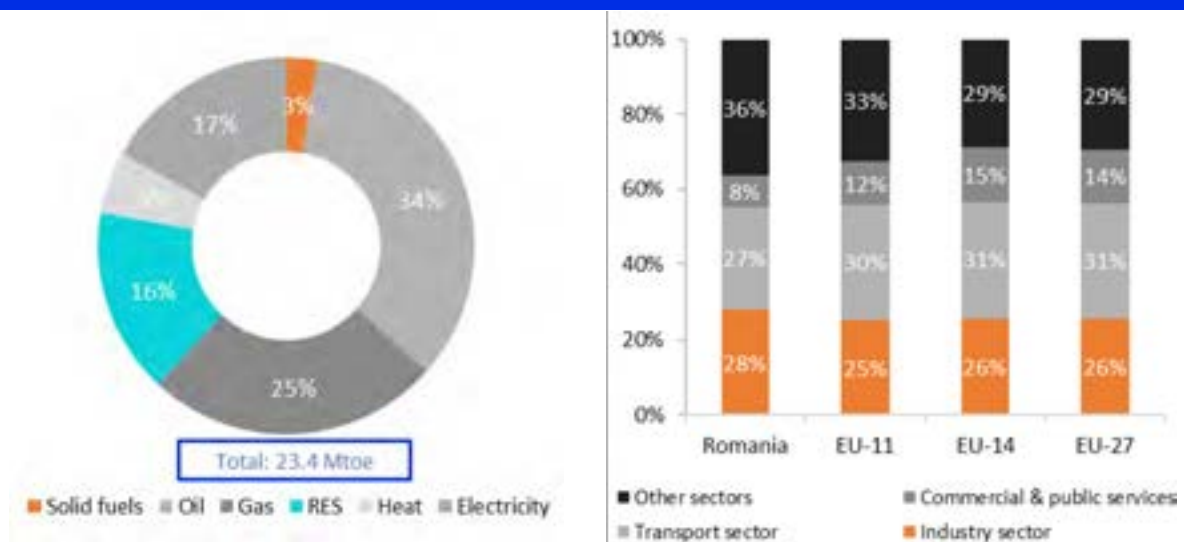
Final energy consumption in Romania is dominated by petroleum products and gas, which accounted together for 59% of total energy consumption in 2018 (see Item 234). The shares of electricity and RES in final energy consumption fuel-mix are 17% and 16% respectively. Total is closed by heat and solid fuels (5% and 3%).

When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Romania hardly shows any particularities. The proportional consumption needs of each sector seem to be like those of developed countries. The final energy consumption is a little lower in commercial and public services sector and transport but lower in industry sector.

Item 234: Final energy consumption structure in Romania

Final energy consumption structure in Romania in 2018 (%)

Final energy consumption structure in Romania in 2018 in comparison with EU-11, EU-14, and EU-27 averages



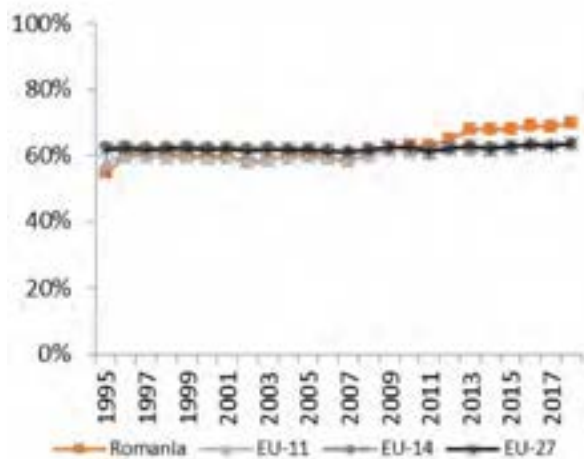
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Romanian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were at similar level as EU-11, EU-14 and EU-27 levels up to 2009. Then the ratio increased in Romania and it is above European averages.

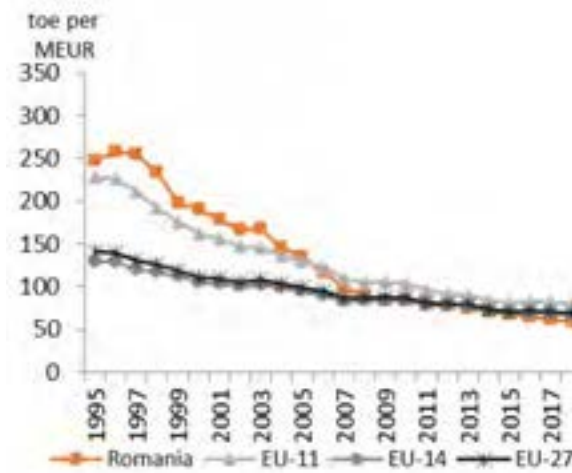
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 247.5 toe per MEUR to 59.3 toe per MEUR). The latter value is lower than EU-11, EU-14 and EU-27 averages.

Item 235: Final energy consumption in Romania in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Romania in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Romania in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

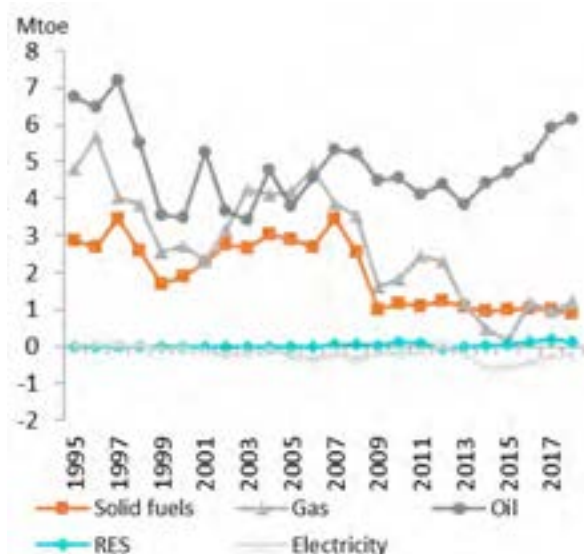


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

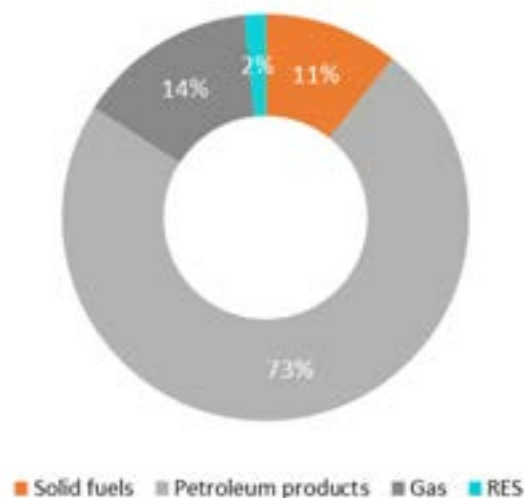
Total net import of energy in Romania significantly decreased in years 1995-2018, particularly solid fuels and gas imports. Oil import has rebound after 2013 and it has increasing since then. The structure of net import of energy is dominated by oil - 73%. Romania imports also 11% of solid fuels and 14% of gas, as well as 2% of RES. Romania is also a net exporter of electricity.

Item 236: Net import of energy in Romania

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil

*and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)*

Romania imports solid fuels from Poland (44%), Russia (40%) and United States. The remaining part is supplied by different countries with a share lower than 2%.

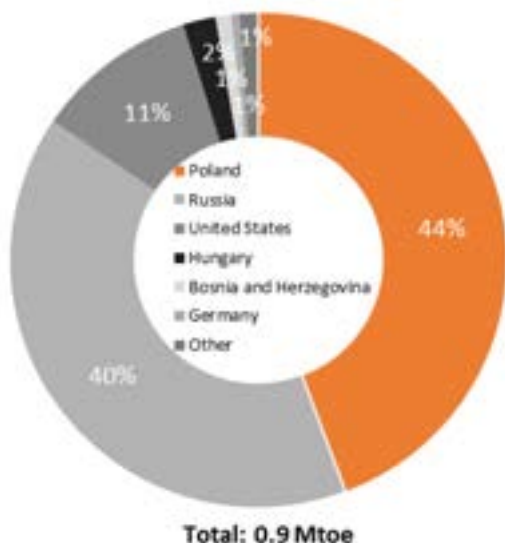
Crude oil is imported to Romania mainly from Russia (40%) and Kazakhstan (27%). Azerbaijan and Hungary are providing additional 6% of import each. The remaining 21% are provided by different suppliers.

The import of gas is provided by 3 countries: Russia (86%), Hungary (12%) and Bulgaria (2%).

Electricity is imported to Romania from Bulgaria (47%), Hungary (31%) and Serbia (31%). The mix is completed by Ukraine and Switzerland (2% and 1% respectively).

Item 237: Foreign fuel suppliers

Foreign suppliers of solid fuels in Romania in 2018 (%)



Foreign suppliers of crude oil in Romania in 2018(%)



Foreign suppliers of gas in Romania in 2018 (%)



Foreign suppliers of electricity in Romania in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 11.3 Greenhouse gas emissions

Between 1995-2017 greenhouse gases emissions in Romania were reduced - from over 187.2 Mt CO<sub>2</sub> in 1995 to 113.8 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 5.8 Mg CO<sub>2</sub> per capita in 2017 (from 8.3 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

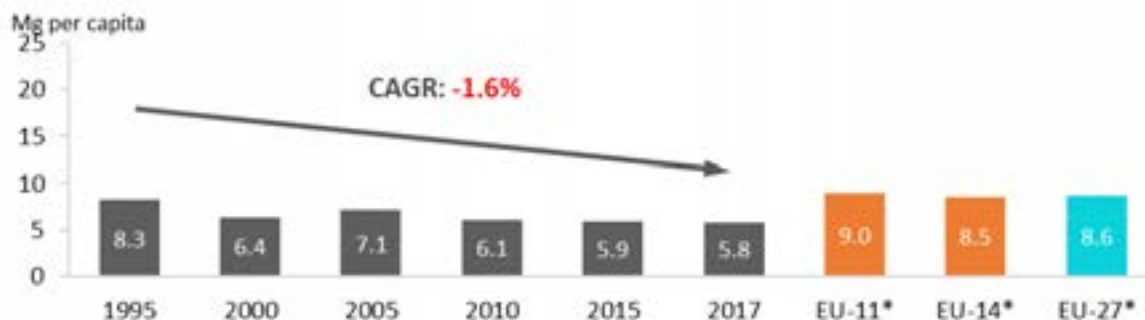
There were some noteworthy changes in the Romanian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction

sector emissions dropped swiftly by 59%, as well as emissions from energy industries, industrial processes, and agriculture, respectively 62%, 45% and 21%. On other hand, transport emissions gained in importance increasing by 110%.

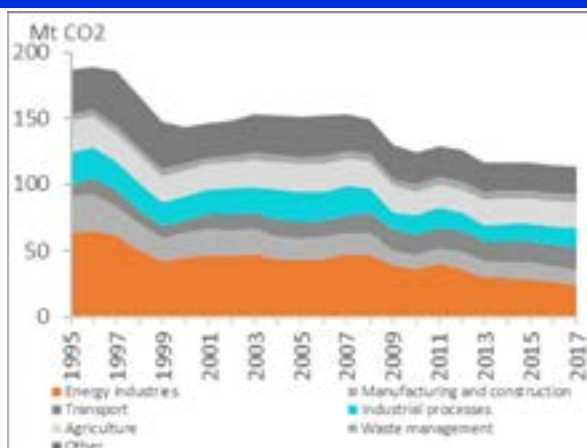
Comparing to EU-11, EU-14 and EU-27 countries, Romania is characterized by lower share of emissions from energy industries (21% versus 35%, 26% and 28%) and a higher share of emissions coming from agriculture.

Item 238: Greenhouse gas emissions in Romania

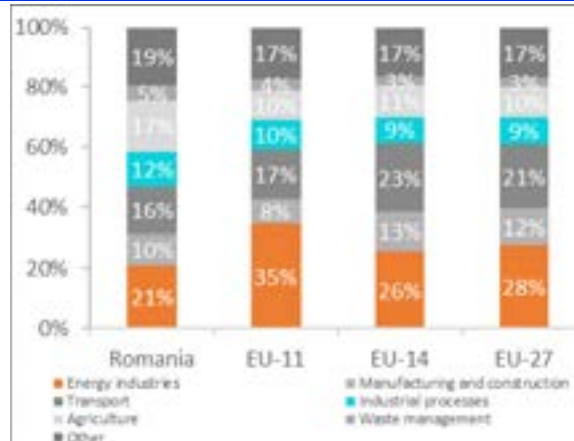
Greenhouse gas emissions per capita in Romania in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Romania by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Romania by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



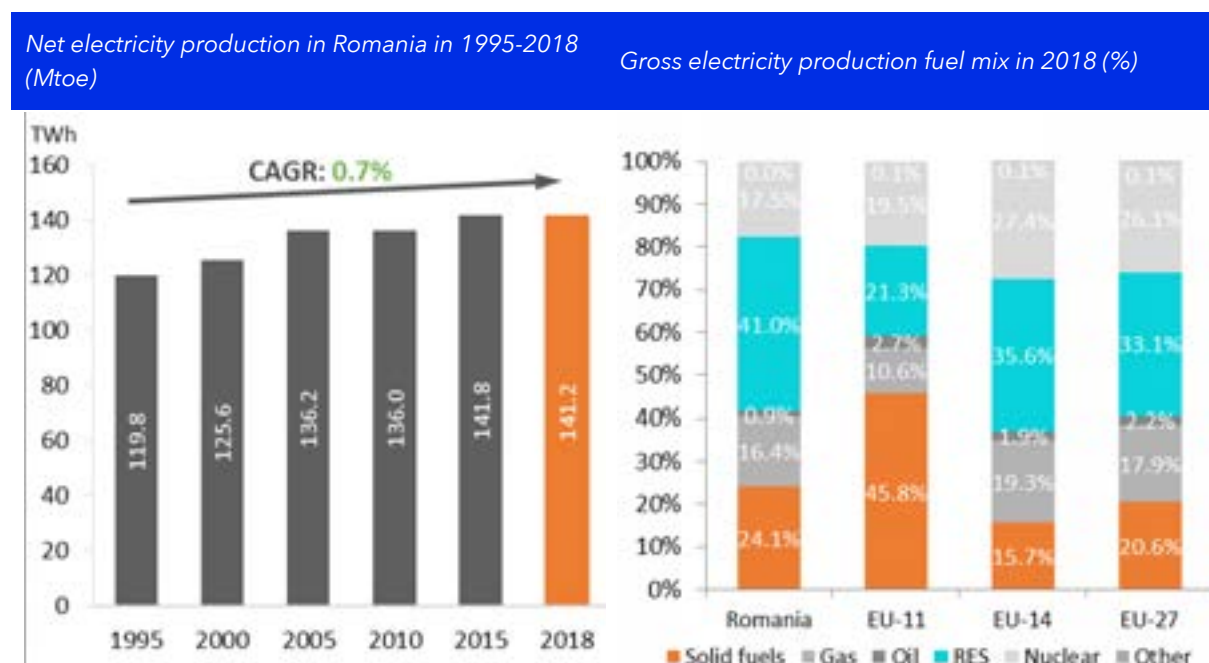
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 11.4 Overview of the electricity sector

Item 239 presents electricity production and the current fuel mix of Romania. Over last 23 years net electricity production has increased from 51.9 TWh in 1995 to 53.0 TWh in 2018 (CAGR 0.1%). As visible, net electricity production represents 13% of EU-11 total electricity production, which is lower compared to Romanian GDP share of 15.0%.

The Romanian fuel mix is dominated by renewable energy sources, solid fuels, and nuclear energy with respective shares of 41.0%, 24.1% and 17.5%. In total, those three fuels represent therefore as much as 82.6% of total gross electricity production. Compared to EU-14 and EU-27 countries, Romania has a much bigger share of renewable energy sources and solid fuels in its energy mix. On other hand, the country produces relatively less electricity from gas and oil, respectively 16.4% and 0.9%. The share of electricity from nuclear is also lower than in EU-14 and EU-27 countries, respectively 17.5% versus 27.4% and 26.1%).

Item 239: Net electricity production and gross electricity production fuel mix in Romania



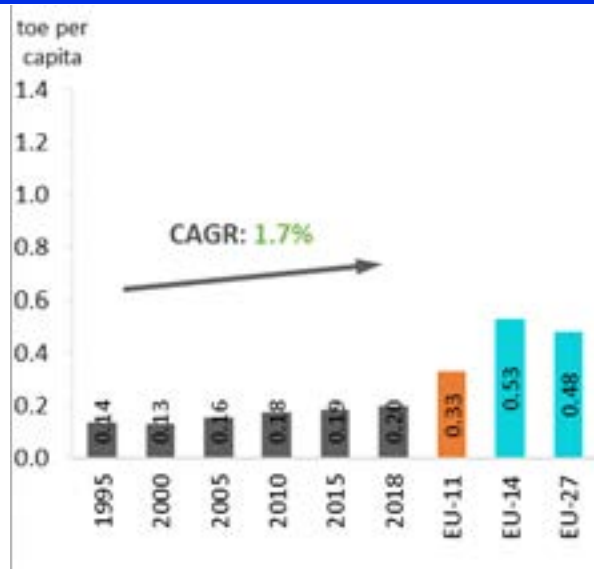
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 240 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Romania has somewhat increased (CAGR in the period of 1995-2019 was around 1.7%) and its level is still relatively low compared to EU-14 and EU-27 countries. Romanian final energy consumption per capita represents only 37.8% of EU-14 level and 41.4% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Romania. Generally, the structure of final electricity consumption in

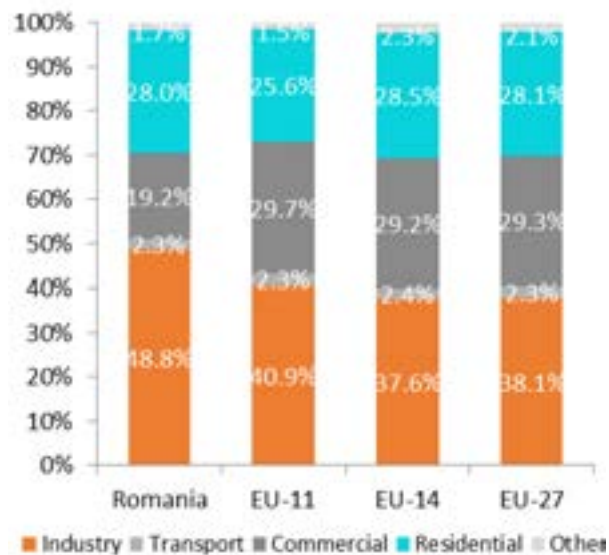
Romania is rather like EU averages, with a somewhat higher share of the industry sector and lower in commercial one.

Item 240: Final consumption of electricity in Romania

Final consumption of electricity per capita in Romania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)



Final consumption of electricity in Romania by sectors in 2018 (%)

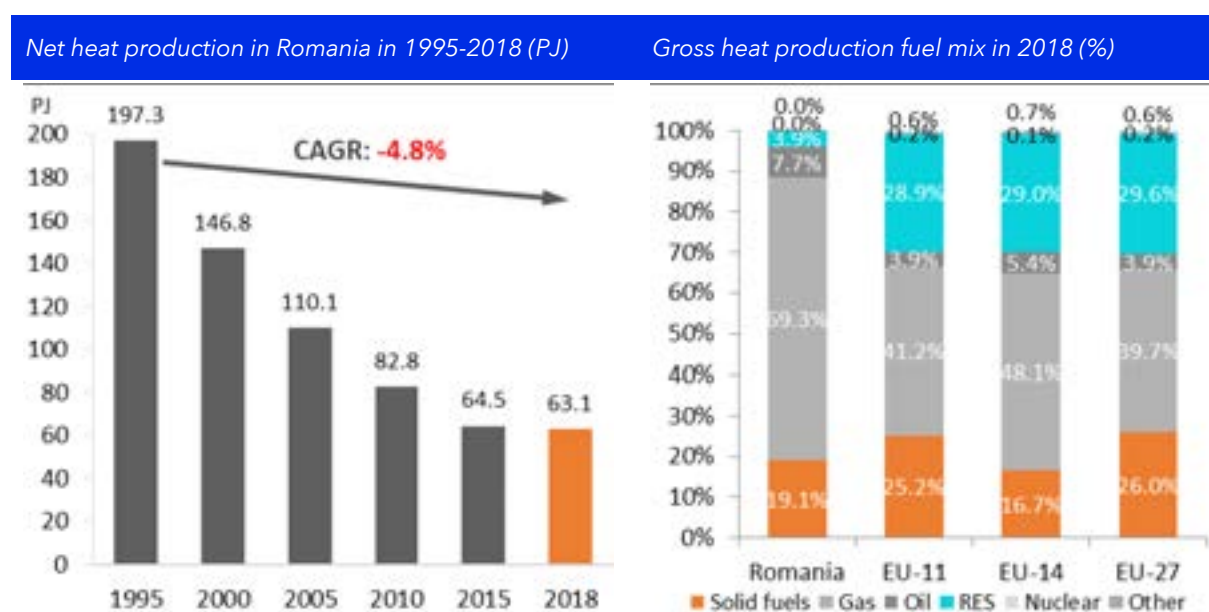


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 11.5 Overview of the heat sector

Item 241 presents heat production in Romania as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Romania has dropped between 1995 and 2018 from 197.3 PJ to 63.1 PJ, i.e. at CAGR of -4.8%. Romanian production fuel mix is dominated by gas (almost 69.3%) and solid fuels (almost 19.1%). That means that in comparison with EU-14 and EU-27 Romania consumes relatively more gas in heat production. The share of solid fuels is similar, whereas the usage of oil is higher (7.7% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower than in EU-11, EU-14 and EU-27 countries.

Item 241: Net heat production and gross electricity production fuel mix in Romania



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 242 presents final heat consumption per capita and its breakdown by sectors.

The per capita demand for heat in Romania has decreased from 0.21 toe in 1995 to 0.06 toe in 2018. As a result, within the 23 years analysed, heat consumption per capita in Romania has decreased at CAGR of -5.0%. The heat consumption in Romania remains lower than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

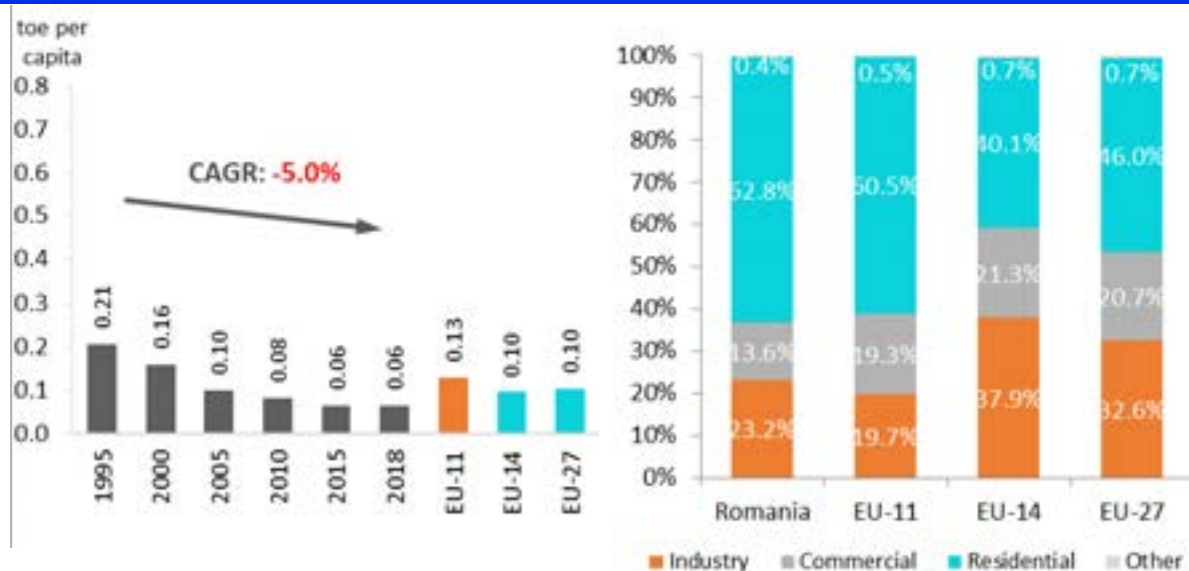
The structure of final consumption of heat in Romania is characterized by higher share residential usage (62.8% in Romania compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (23.2% in Romania compared to 37.9% in EU-14 and 32.6% in EU-27) and lower commercial sector use of heat (13.6% in Romania compared to 21.3% in EU-14 and 20.7% in EU-27).

In relation to EU-11 countries, the structure of final heat consumption is similar.

Item 242: Final consumption of heat in Romania

Final consumption of heat per capita in Romania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Romania by sectors in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

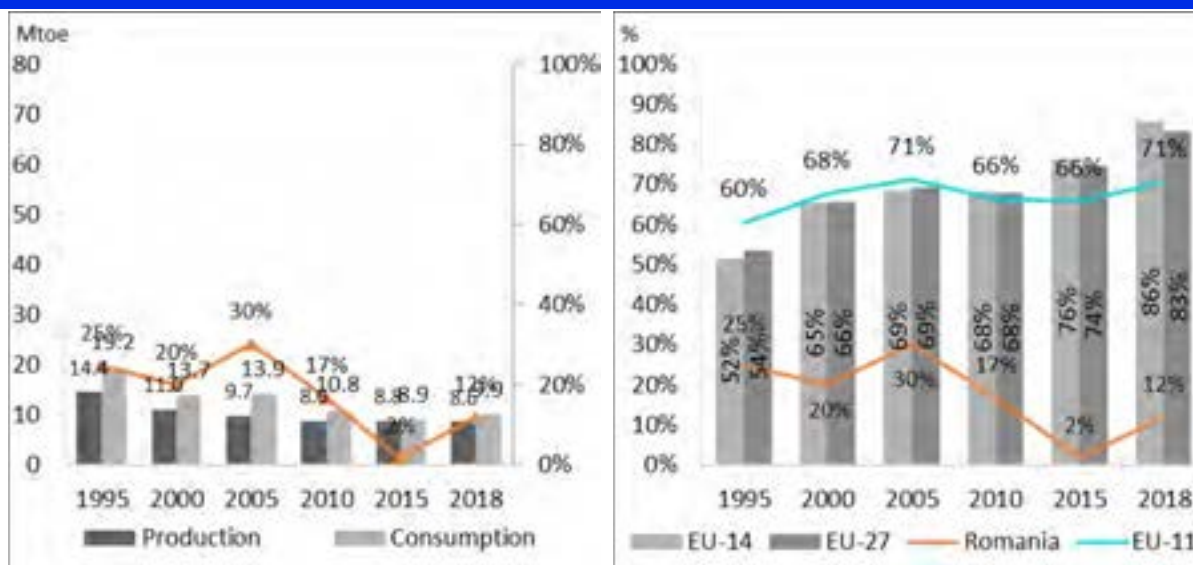
## 11.6 Overview of gas sector

Gas production in Romania is similar (8.6 Mtoe in 2018) comparing to the consumption (8.9 Mtoe in 2018). Therefore, the import dependence remains low - between 2% and 30% in years 1995-2018 (see Item 243). When compared to EU averages significantly lower import dependence is observed between Romania and EU-11, EU-14 and EU-27 countries (12% import dependence of Romania in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 243: Gas sector in Romania

Gas production, gross consumption and import dependence in Romania in 1995-2018 (Mtoe)

Gas Import dependence in Romania and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

The final consumption of gas per capita in Romania has decreased from 0.42 toe per capita in 1995 to 0.29 toe per capita in 2018 and it is lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

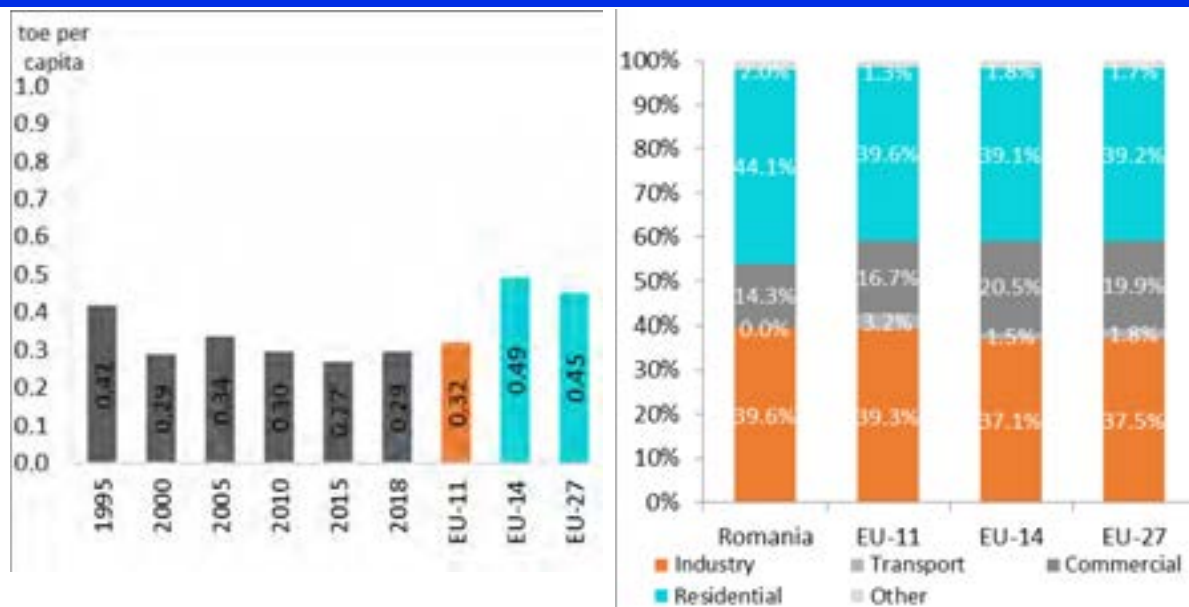
The structure of final gas consumption per sectors similar as European averages. Gas usage in Romania is dominated by industry (39.6% in Romania whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%) and residential sector (44.1% in Romania comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27).

The use of gas in transport is null in Romania whereas use of gas in commercial sector is lower than European averages (14.3% in Romania comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27).

Item 244: Final consumption of gas per capita in Romania in 1995-2018 and gas final consumption by sectors in Romania and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Romania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Romania and EU-11, EU-14 and EU-27 countries in 2018



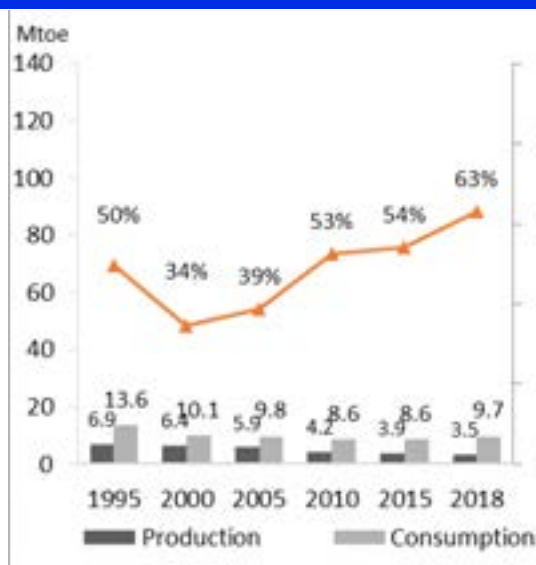
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 11.7 Overview of the oil sector

Oil production in Romania is 3.5 Mtoe in 2018 comparing to the consumption 9.7 Mtoe in 2018. Therefore, the import dependence remains considerable - between 34% and 63% in years 1995-2018 (see Item 245). When compared to EU averages lower import dependence is observed between Romania and EU-11, EU-14 and EU-27 countries (63% import dependence of Romania in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27). The level of oil import dependence of Romania is closing to EU averages in 2018.

Item 245: Oil sector in Romania

Oil production, gross consumption and import dependence in Romania in 1995-2018 (Mtoe)



Oil Import dependence in Romania and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

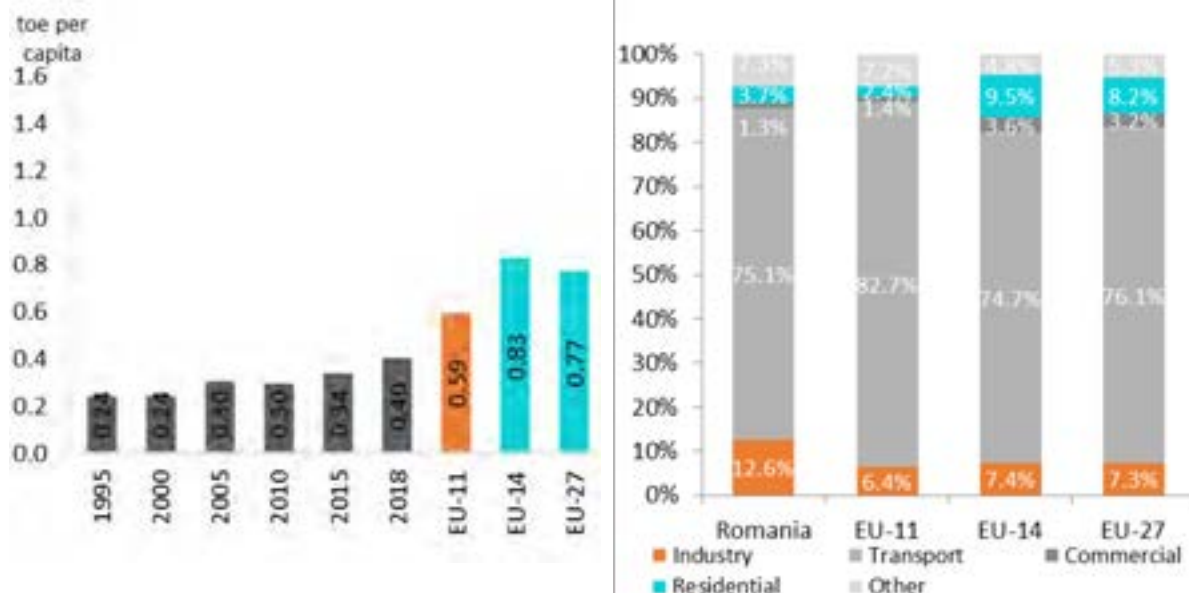
The final consumption of oil per capita in Romania increased for 0.24 toe per capita in 1995 to 0.40 toe per capita in 2018. It remains lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.59 toe per capita, 0.83 toe per capita, 0.77 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of industry and transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 75.1% in Romania comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are higher in Romania than in EU-11, EU-14 and EU-27 countries, whereas commercial and residential usage are lower.

Item 246: Final consumption of oil per capita in Romania in 1995-2018 and oil final consumption by sectors in Romania and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Romania (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Romania and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 11.8 EU climate policy and its targets for Romania

Romania is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 247).

*Item 247: Energy and climate targets for Romania for 2020 and 2030*

	Romania 2020 targets	Romania 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS - Effort Sharing Decision (ESD)	+19% in relation to their 2005 levels	-
National emission reduction targets in non-ETS - Effort Sharing Regulations (ESR)	-	-2% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	24% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 43.0 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 30.3 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

In following chapter, the overview of Romania targets and performance are summarized.

### 11.8.1 Greenhouse gas emissions

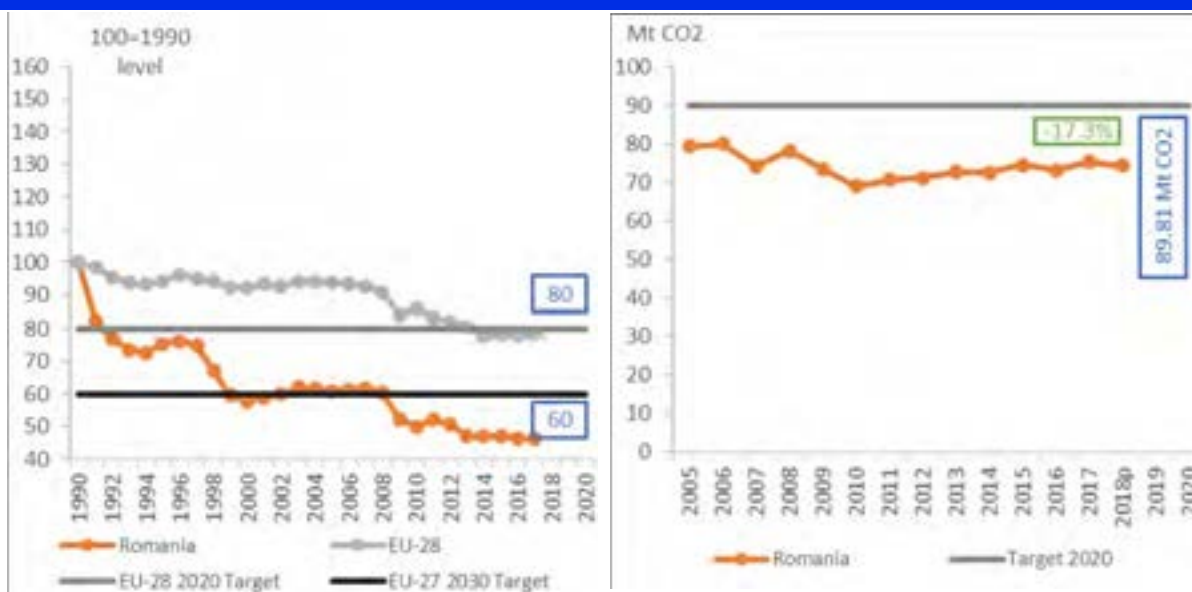
EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Romania is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Romania is 89.81 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 17.3%.

*Item 248: Energy efficiency target data for Romania*

Greenhouse gas emissions level in Romania and EU-28, base year 1990, and EU 2020 target

Greenhouse gas emissions in Effort Sharing Decision (ESD) sectors



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 11.8.2 Renewable energy sources

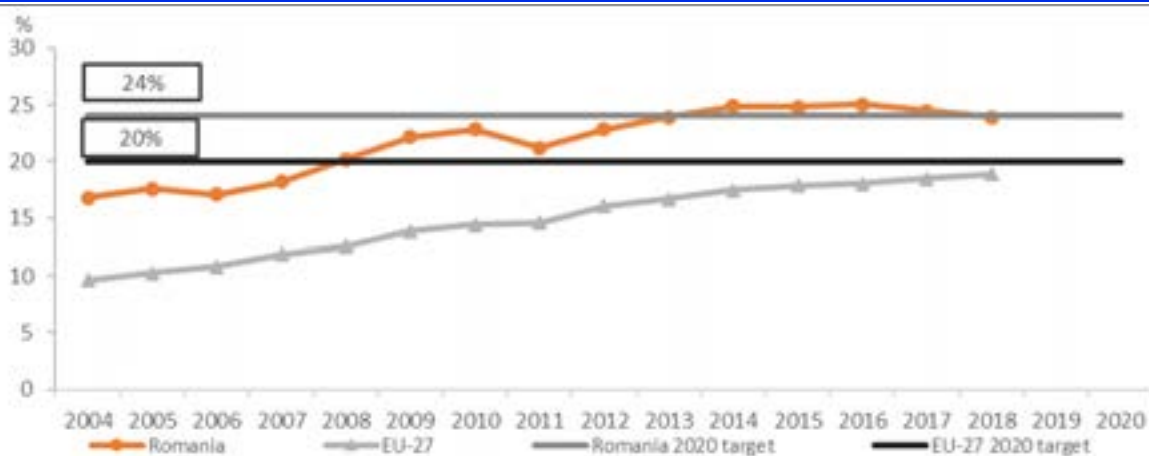
The following targets are set for Romania regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 24% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Romania is already above EU wide and country specific targets.

Item 249: Share of energy from renewable energy sources in gross final energy consumption in Romania

Share of energy from renewable energy sources in gross final energy consumption in Romania in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 11.8.3 Energy efficiency

The energy efficiency target set for Romania are respectively:

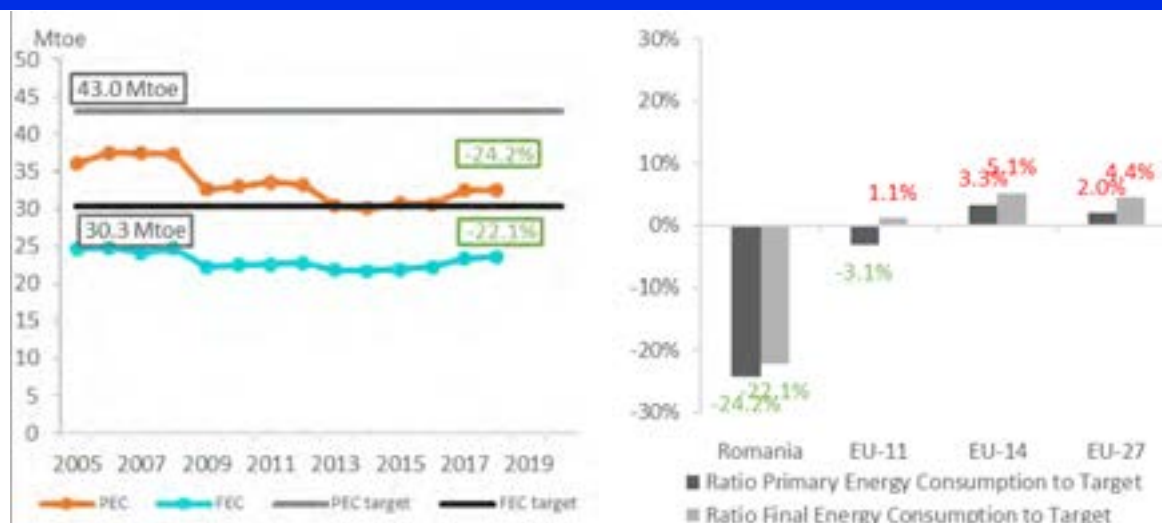
- Primary Energy Consumption in 2020: 43.0 Mtoe
- Final energy consumption in 2020: 30.3 Mtoe

Following the information provided in Item 250 the results for 2018 are below the targets in both criteria, respectively +24.2% of primary energy consumption and 22.1% of final energy consumption.

## Item 250: Energy efficiency target data for Romania

Primary energy consumption and final energy consumption in Romania in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Romania, EU-11, EU-14 and EU-27 in 2018



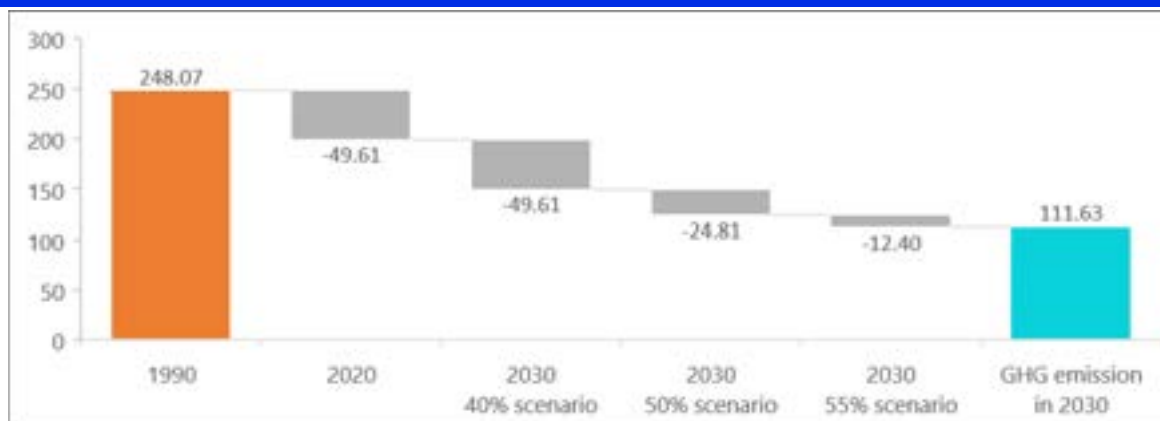
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

## 11.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Romania greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 49.61 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 49.61 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 24.81 Mt CO<sub>2</sub> emission decrease is needed, or 37.21 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Romania up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Romania was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 251: Estimation regarding greenhouse gas emissions in Romania under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Romania under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 12 Slovakia

### 12.1 General information

Slovakia is the third smallest country within EU-11 group in terms of total country area and represents 4.3% of the area. At the same time, it is the 19<sup>th</sup> country in EU-27 with 1.2% of the area. It represents 5.3% of EU-11 population and 1.2% of EU-27 population, but 6.5% of its total nominal GDP of EU-11 and 0.7% of EU-27. Due the robust economic growth in 1995-2018 period, in 2018 Slovakian GDP per capita amounted to 88% of the whole EU average.

Item 252: Slovakia - key data



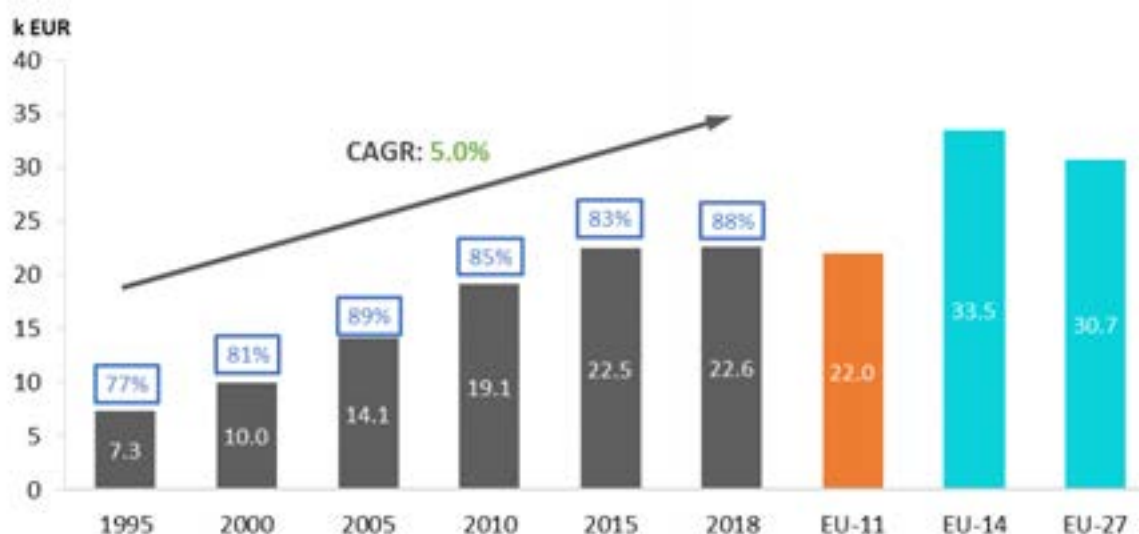
#### Key data

Population (M)	5.4
GDP per capita (EUR, nominal)	16,450
GDP per capita (EUR, PPS)	22,590
GDP as share of EU-11	6.5%
GDP as share of EU-27	0.7%
Energy intensity of the economy (kgoe per 1,000 EUR)	133.4
Greenhouse gas emissions (Mg per capita)	8.0

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 5.0% Slovakian economy considerably grew in the period of 1995-2018 (see Item 253). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 68% and 73% of the respective averages) – even if purchasing power is taken into consideration.

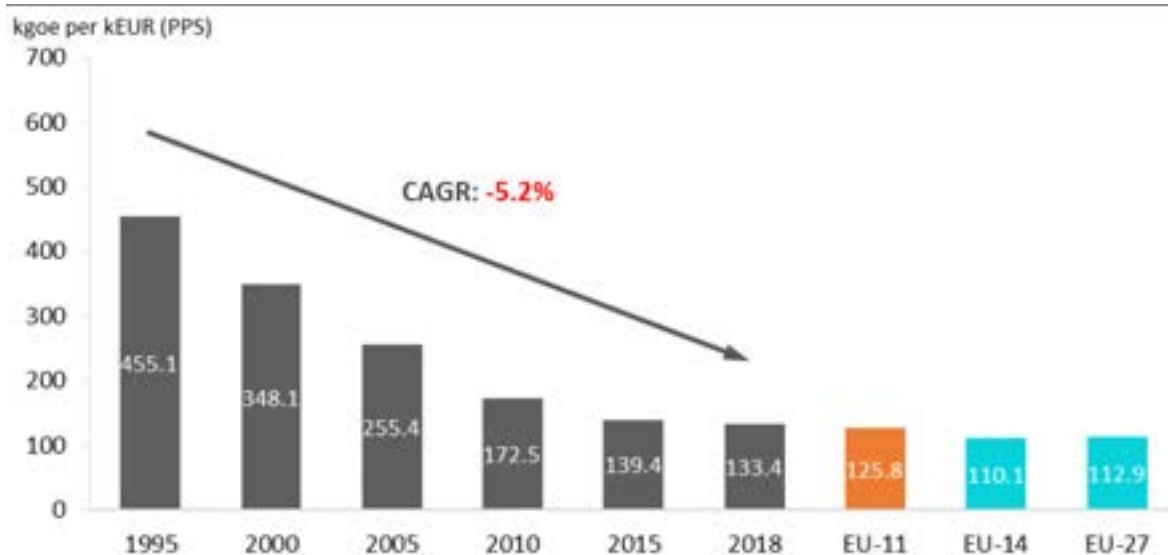
Item 253: GDP per capita in Slovakia for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Slovakia GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Slovakian economy energy intensity is about 133.4 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 321.7 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than 3 times. In EU-14 and EU-27 average values are 1.2 times lower and in EU-11 average is 1.1 lower than in Slovakia.

Item 254: Energy intensity of the economy in Slovakia in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)



Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) - EI\_GDP\_PPS

## 12.2 Energy balance of Slovakia

In Item 255 the energy balance of Slovakia in 2018 as well as historical values of net imports of energy are shown. The primary energy production was equal to 6.0 Mtoe. Net import accounted for 10.9 Mtoe and gross inland consumption of energy was 17.0 Mtoe.

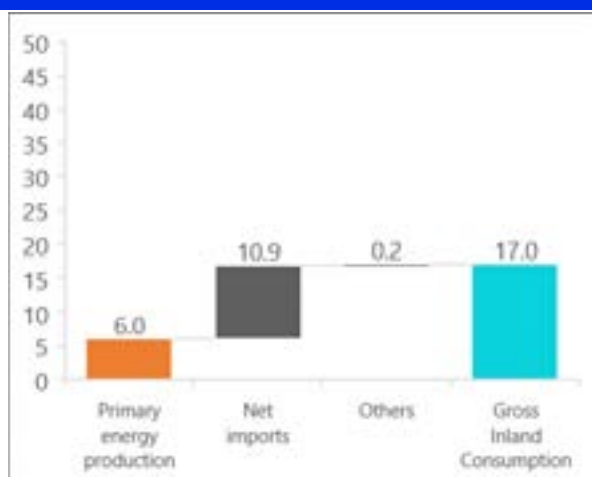
The production of primary energy in the country has increased from 5.0 Mtoe in 1995 to 6.0 Mtoe in 2018. Gross inland consumption has also decreased in the same time from 17.8 Mtoe to 17.0 Mtoe.

Net import of energy has dropped from 12.2 Mtoe in 1995 to 10.9 Mtoe in 2018. The share of import in total energy needs of the country has also decreased from 68.9% in 1995 to 63.7% in 2018.

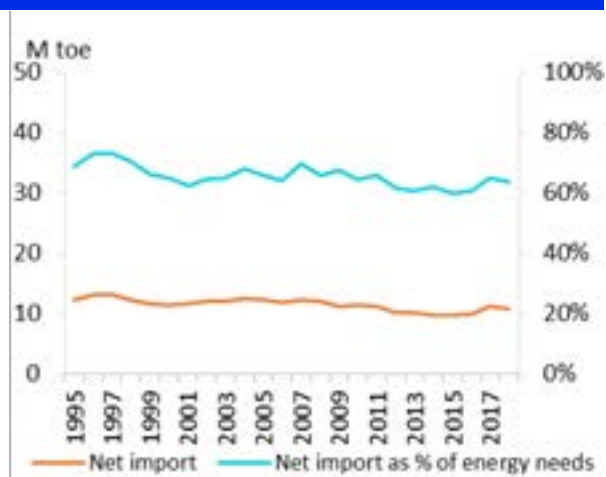
Slovakian primary energy production compared to gross inland consumption has increased from 28% to 35%. Therefore, the dependence of the country from foreign import of energy has increased.

## Item 255: Energy balance in Slovakia

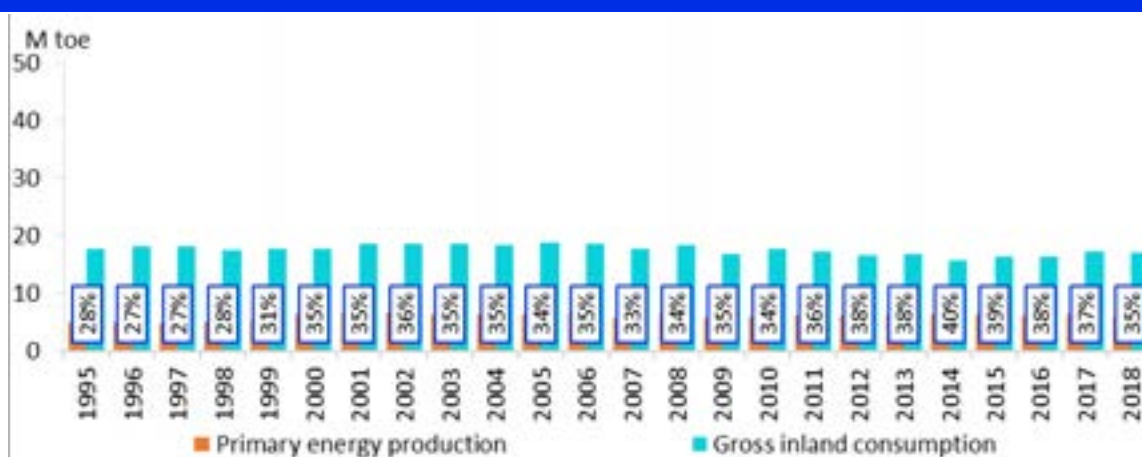
## Energy balance in Slovakia in 2018 (Mtoe)



## Net import of energy in Slovakia in 1995-2018 (Mtoe and as percentage of GIC)



## Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Slovakia (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

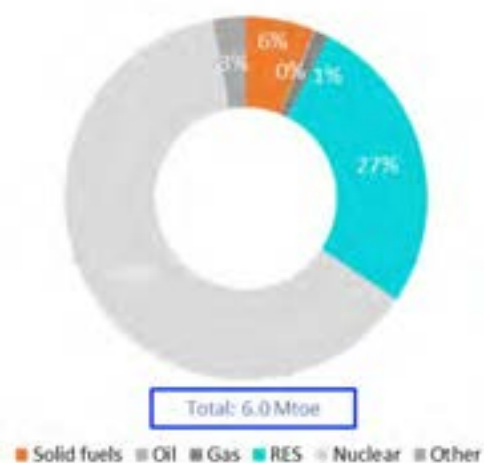
Considering the primary production, one can notice that 63% is based on nuclear and 27% on RES, which overwhelmingly dominate the structure (around 90% combined share). The remaining part is produced from solid fuels. The share of oil and gas in primary energy structure is marginal.

Comparing to EU-11 group Slovakia has a higher share of nuclear (63% versus 15%) and higher share of renewable energy sources (27% versus 22%) than EU-11 averages. Other fuels are below EU-11 averages.

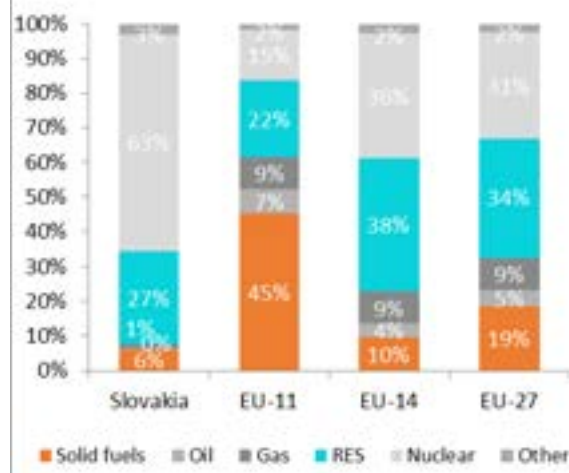
When compared to the group of developed Western European countries (EU-14), Slovakia has still a very high share of nuclear in primary energy production (63% versus 10%). Furthermore, production in developed countries is much more balanced than in Slovakia, which is dominated by nuclear. Similar relations are observed when comparing Slovakia primary energy structure to EU-27.

## Item 256: Primary energy structure in Slovakia

Primary energy structure in Slovakia in 2018 (%)



Primary energy production structure in Slovakia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

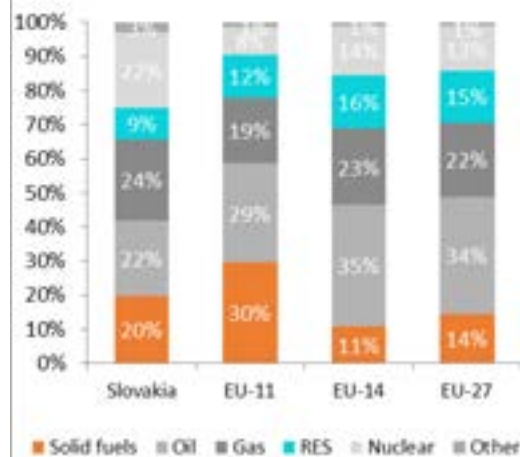
On the consumption side, gross inland energy consumption is well balanced between gas (24%), nuclear and gas (22%) and solid fuels (20%). The structure is completed by RES (9%) and other fuels. Comparing to EU-11 averages one can notice lower share of solid fuels, oil, and RES but higher of gas and nuclear. In relation to EU-14 averages, Slovakia has higher share of solid fuels and nuclear but lower of oil and RES. The share of gas is similar.

## Item 257: Gross inland consumption structure in Slovakia

Gross inland consumption structure in Slovakia in 2018 (%)



Gross inland consumption structure in Slovakia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



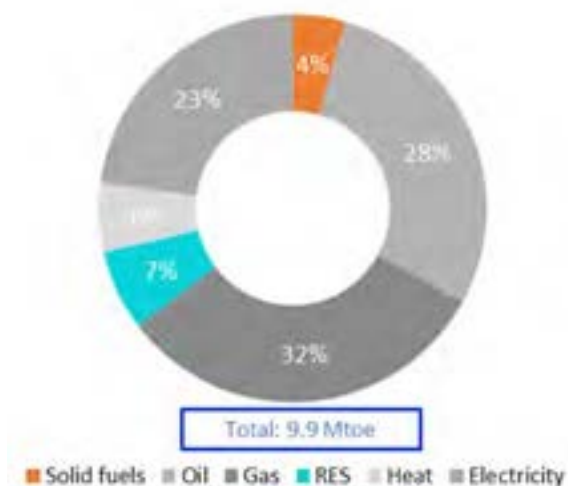
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Slovakia is dominated by petroleum products, gas and electricity, which accounted together for 83% of total energy consumption in 2018 (see Item 258). The shares of solid fuels, RES and heat in final energy consumption fuel-mix are 4%, 7% and 6% respectively.

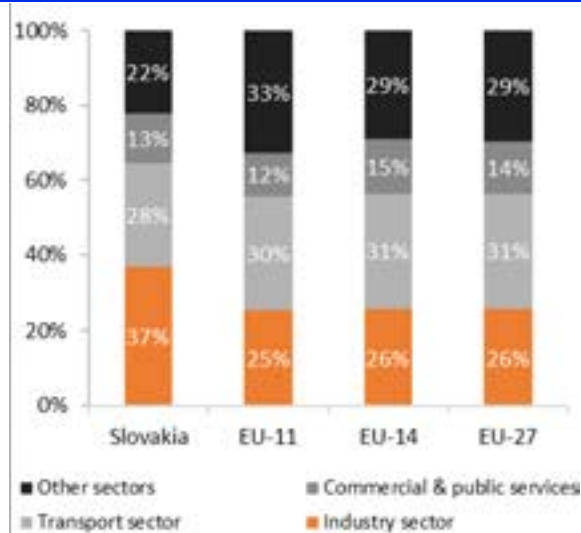
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Slovakia is characterized by higher share of industry sector and lower of transport one. The commercial and public services share in final energy consumption is similar.

## Item 258: Final energy consumption structure in Slovakia

Final energy consumption structure in Slovakia in 2018 (%)



Final energy consumption structure in Slovakia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



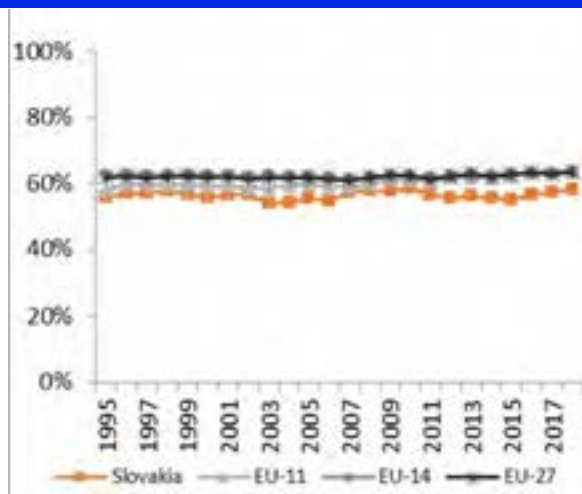
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Slovakian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were lower than in EU-11, EU-14 and EU-27. Furthermore, its level in Slovakia has remained stable since 1995.

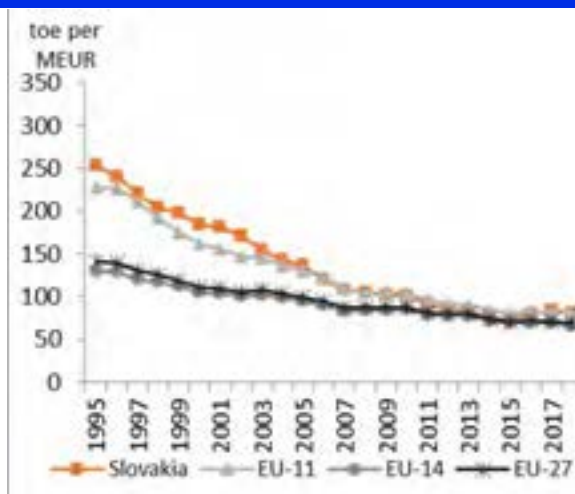
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 253.5 toe per MEUR to 88.7 toe per MEUR). The latter value remains higher than the averages for EU-11, EU-14 and EU-27.

## Item 259: Final energy consumption in Slovakia in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Slovakia in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Slovakia in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

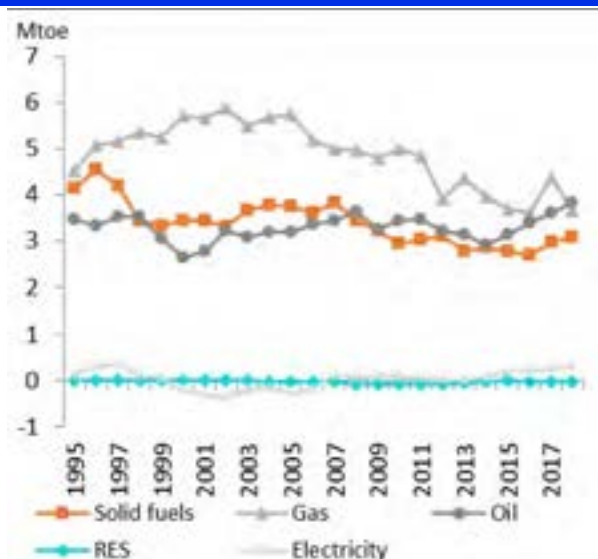


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

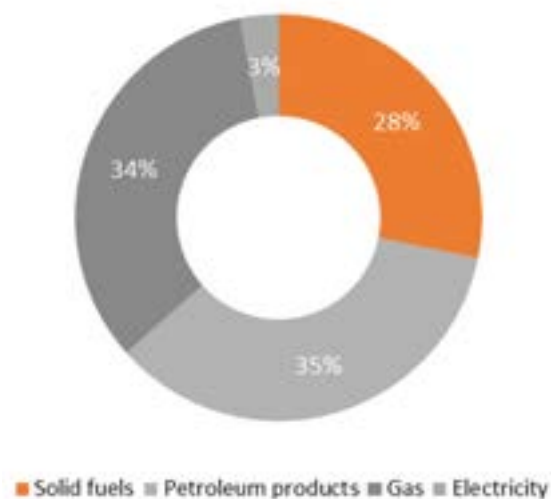
Total net import of energy in Slovakia decreased in years 1995-2018. The import of gas has increased in 1990's and then decreased to 2018 values. The import of solid fuels has also decreased. Oil has remained stable with a small increase after 2014. Slovakia has imported and exported electricity over last 23 years, depending on the year. The structure of import is dominated by oil and gas, 35% and 34% respectively. Solid fuels import account for 28% and electricity for remaining 3%.

## Item 260: Net import of energy in Slovakia

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)

Solid fuels are mainly imported from Russia (33%), Czech Republic (23%) and Poland 21%. The remaining part is imported from different countries but none of them account for more than 8%.

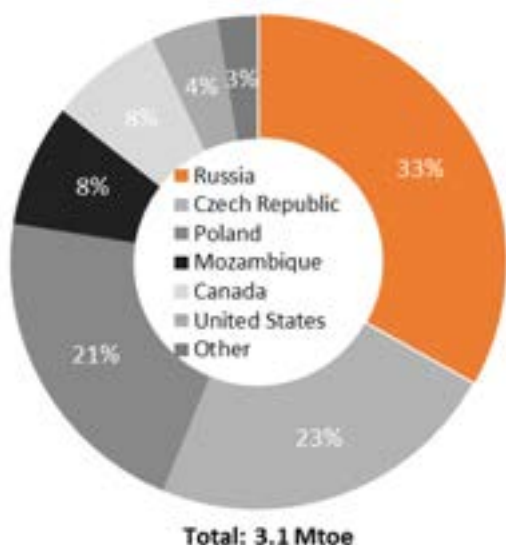
Slovakia imports crude oil mainly from Russia (74%). Other suppliers do not exceed 7%.

Gas is imported to Slovakia only from Russia.

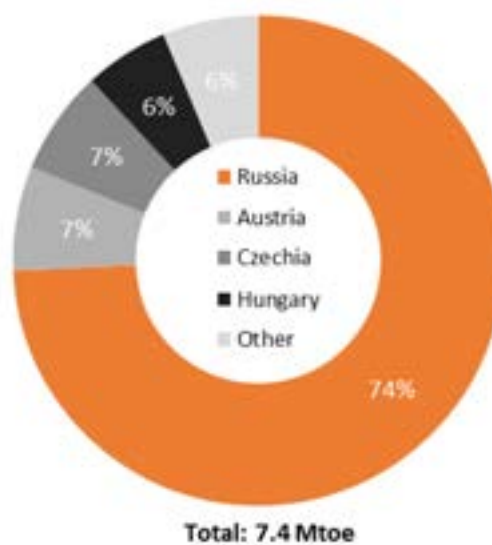
Electricity is imported mainly from Czech Republic (72%), Poland (26%) and Ukraine and Hungary (1% each).

Item 261: Foreign fuel suppliers

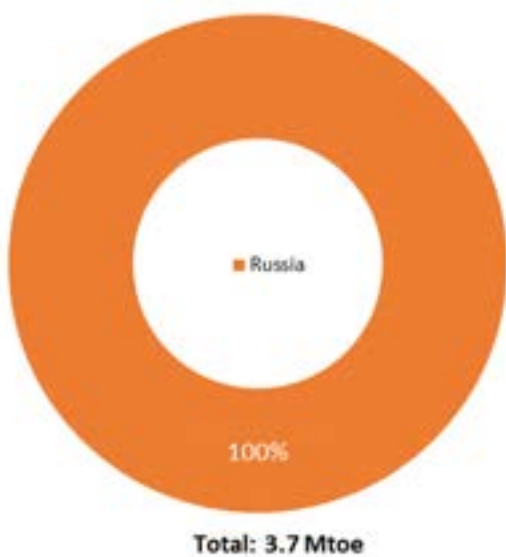
Foreign suppliers of solid fuels in Slovakia in 2018 (%)



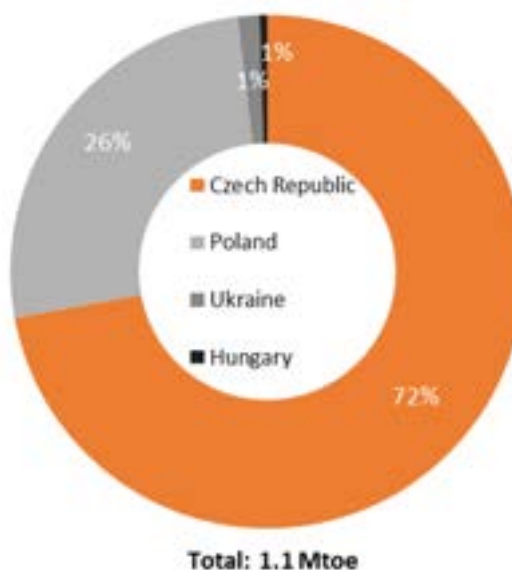
Foreign suppliers of crude oil in Slovakia in 2018(%)



Foreign suppliers of gas in Slovakia in 2018 (%)



Foreign suppliers of electricity in Slovakia in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 12.3 Greenhouse gas emissions

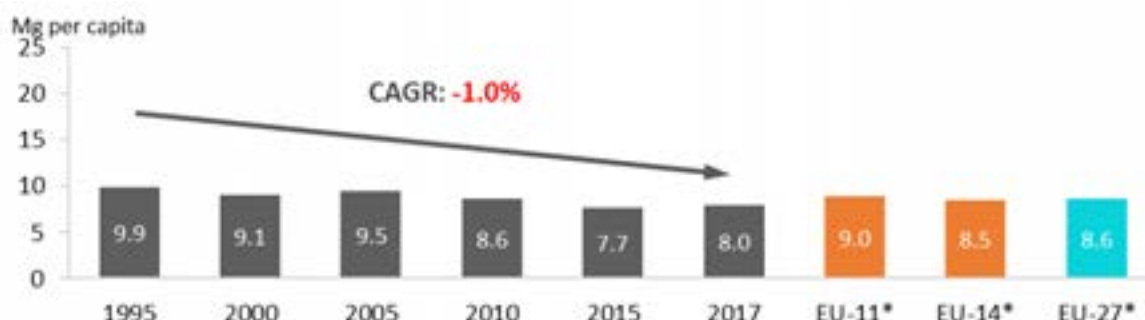
Between 1995-2017 greenhouse gases emissions in Slovakia were reduced - from over 53.2 Mt CO<sub>2</sub> in 1995 to 43.3 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 8.0 Mg CO<sub>2</sub> per capita in 2017 (from 9.9 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

There were some noteworthy changes in the Slovakian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction sector emissions dropped swiftly by 40%, as well as emissions from energy industries and agriculture, respectively 36% and 27%. On other hand, transport emissions gained in importance increasing by 39% and waste management - 22%.

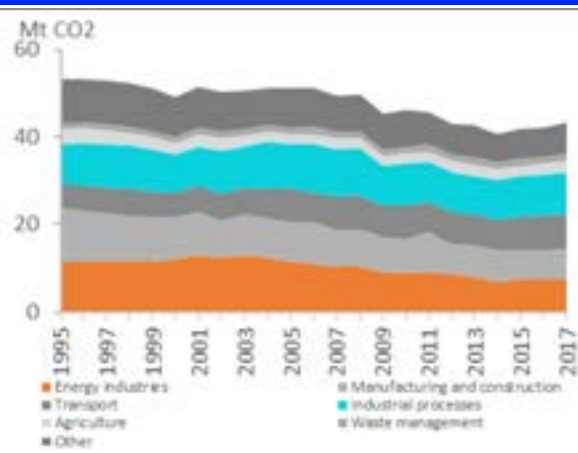
Comparing to EU-11, EU-14 and EU-27 countries, Slovakia is characterized by lower share of emissions from energy industries (17% versus 35%, 26% and 28%) but higher share of emissions from industrial processes.

Item 262: Greenhouse gas emissions in Slovakia

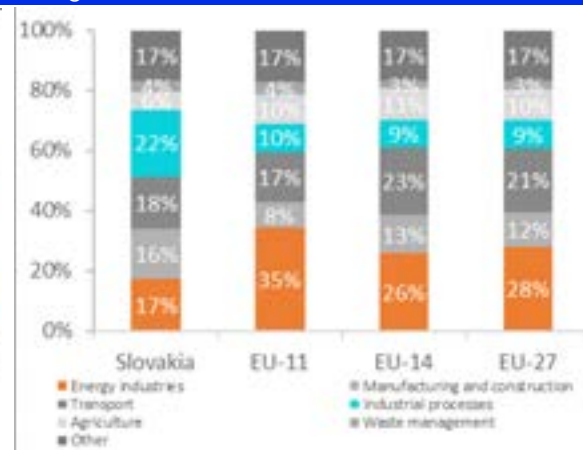
Greenhouse gas emissions per capita in Slovakia in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Slovakia by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Slovakia by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



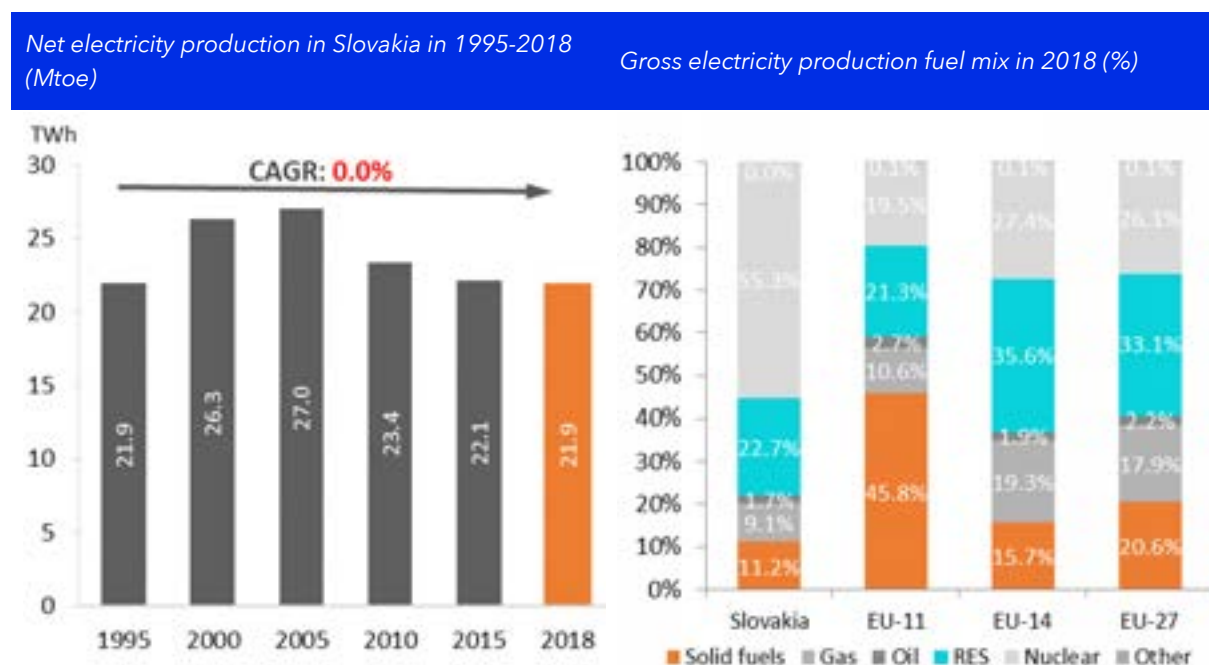
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

## 12.4 Overview of the electricity sector

Item 263 presents electricity production and the current fuel mix of Slovakia. Over last 23 years net electricity production has remained at the level of 21.9 TWh despite an increase up to 27.0 TWh in 2005 followed by a drop to the current value in 2018. As visible, net electricity production represents 5.4% of EU-11 total electricity production, which is lower compared to Slovakian GDP share of 6.0%.

The Slovakian fuel mix is dominated by nuclear energy and renewable energy sources with respective shares of 55.3% and 22.7%. In total, those two fuels represent therefore as much as 78.0% of total gross electricity production. Compared to EU-14 and EU-27 countries, Slovakia has a much bigger share of nuclear in its energy mix. On other hand, the country produces relatively less electricity from gas and oil, respectively 9.1% and 1.7%. The share of electricity from renewable energy sources is also lower than in EU-14 and EU-27 countries, respectively 22.7% versus 35.6% and 33.1%.

Item 263: Net electricity production and gross electricity production fuel mix in Slovakia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 264 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. Although in recent years final consumption of electricity in Slovakia has increased (CAGR in the period of 1995-2019 was around 0.7%) and its level is still relatively low compared to EU-14 and EU-27 countries. Slovakian final energy consumption per capita represents only 77.2% of EU-14 level and 84.6% of EU-27 level. That may indicate that there is an important potential for further growth of electricity consumption in Slovakia. Generally, the structure of final electricity consumption in Slovakia

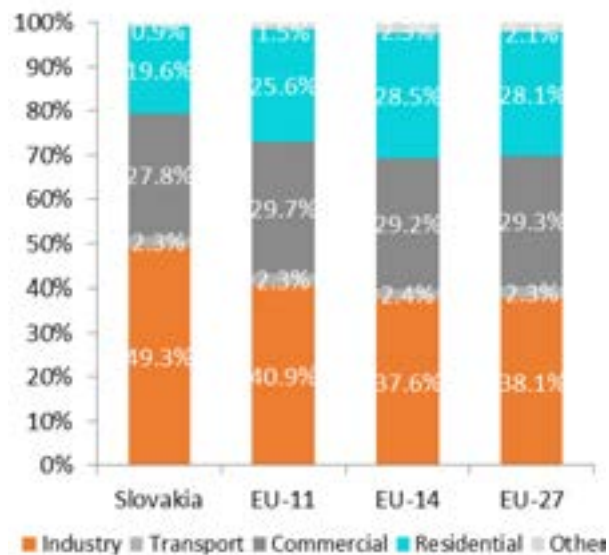
is rather like EU averages, with a somewhat higher share of the industry and lower share of residential and commercial sectors.

Item 264: Final consumption of electricity in Slovakia

Final consumption of electricity per capita in Slovakia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)



Final consumption of electricity in Slovakia by sectors in 2018 (%)

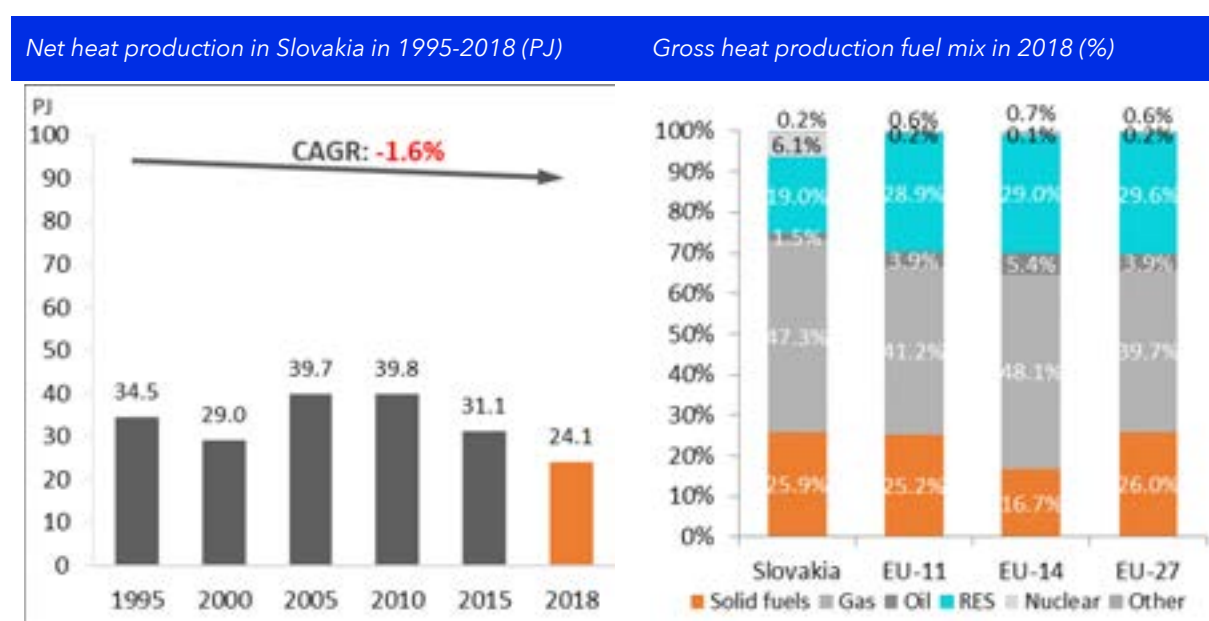


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

## 12.5 Overview of the heat sector

Item 265 presents heat production in Slovakia as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Slovakia has dropped between 1995 and 2018 from 34.5 PJ to 24.1 PJ, i.e. at CAGR of -1.6%. Slovakian production fuel mix is dominated by gas (almost 47.3%) and solid fuels (almost 25.9%). The share of solid fuels is similar, whereas the usage of oil is significantly lower (1.5% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower, about 2/3 of level in EU-11, EU-14 and EU-27 countries.

Item 265: Net heat production and gross electricity production fuel mix in Slovakia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 266 presents final heat consumption per capita and its breakdown by sectors.

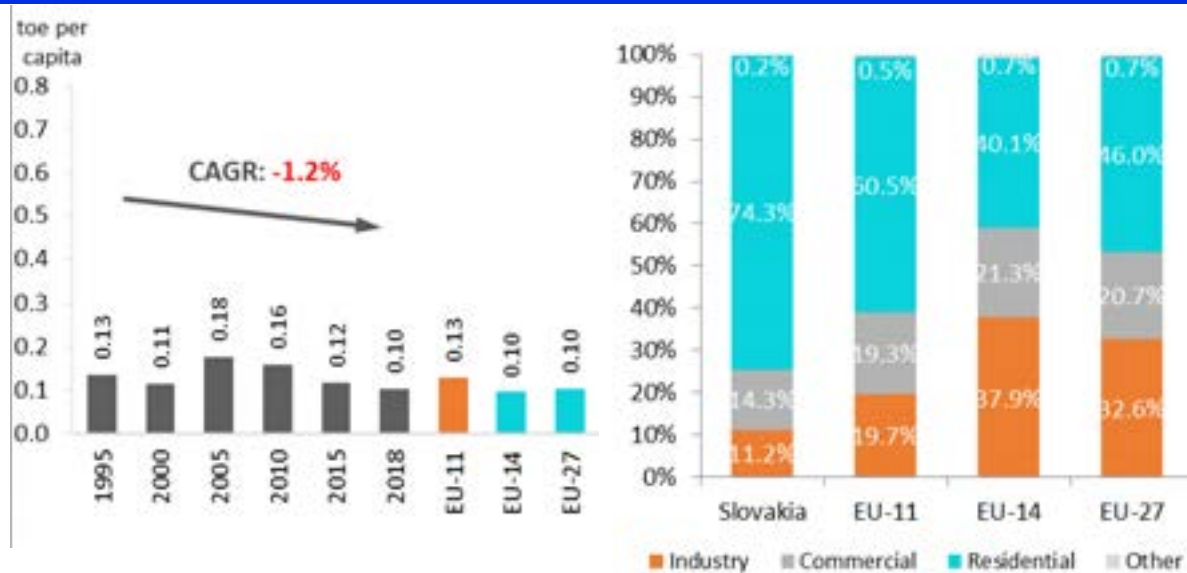
The per capita demand for heat in Slovakia has decreased from 0.13 toe in 1995 to 0.10 toe in 2018 with a pick at 0.18 toe per capita in 2005. As a result, within the 23 years analysed, heat consumption per capita in Slovakia has decreased at CAGR of -1.2%. The heat consumption in Slovakia remains at the level of averages for EU-14 and EU-27, respectively 0.10 toe per capita and 0.10 toe per capita, but lower than EU-11 average of 0.13 toe per capita.

The structure of final consumption of heat in Slovakia is characterized by higher share of residential usage (74.3% in Slovakia compared to 40.1% in EU-14 and 46.0% in EU-27) but lower use of heat in commercial sector (14.3% in Slovakia compared to 21.3% in EU-14 and 20.7% in EU-27) and lower industry participation (11.2% in Slovakia compared to 37.9% in EU-14 and 32.6% in EU-27).

## Item 266: Final consumption of heat in Slovakia

Final consumption of heat per capita in Slovakia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Slovakia by sectors in 2018 (%)

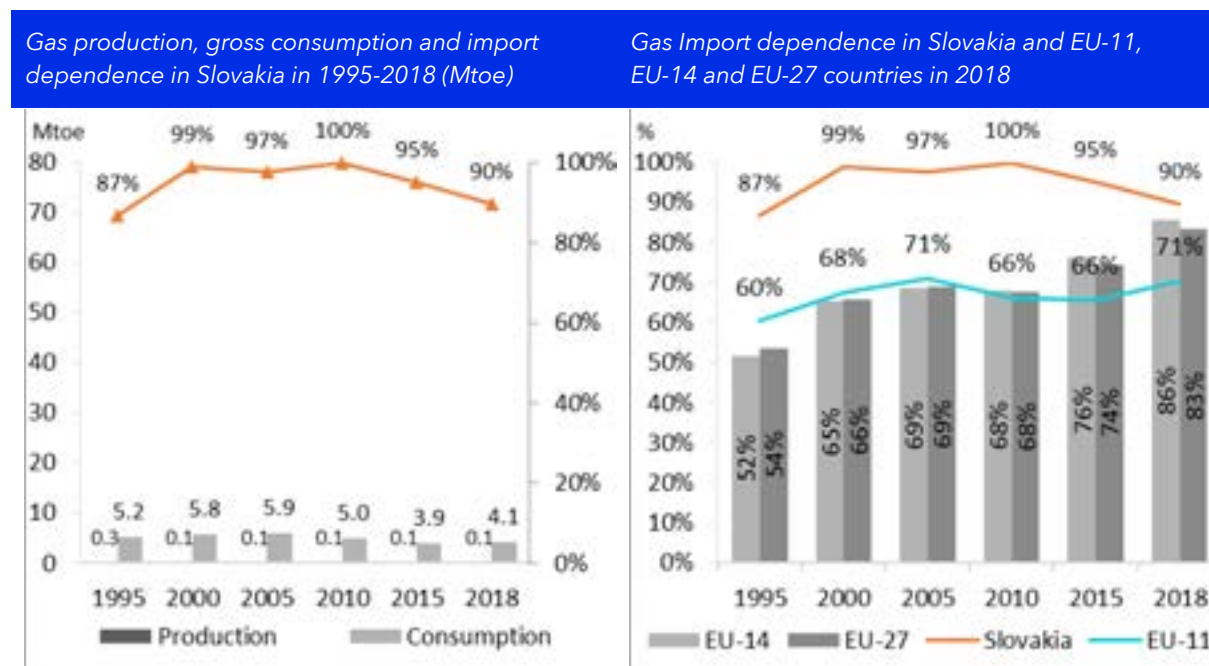


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 12.6 Overview of gas sector

Gas production in Slovakia is very low (0.1 Mtoe in 2018) comparing to the consumption (4.1 Mtoe in 2018). Therefore, the import dependence remains high - between 87% and 90% in years 1995-2018 (see Item 267). When compared to EU averages significantly higher import dependence is observed between Slovakia and EU-11, EU-14 and EU-27 countries (90% import dependence of Slovakia in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 267: Gas sector in Slovakia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

The final consumption of gas per capita in Slovakia has decreased from 0.66 toe per capita in 1995 to 0.49 toe per capita in 2018. It is higher than the average for EU-11 and EU-27 (0.32 toe per capita and 0.45 toe per capita) and equal to EU-14 average - 0.49 toe per capita.

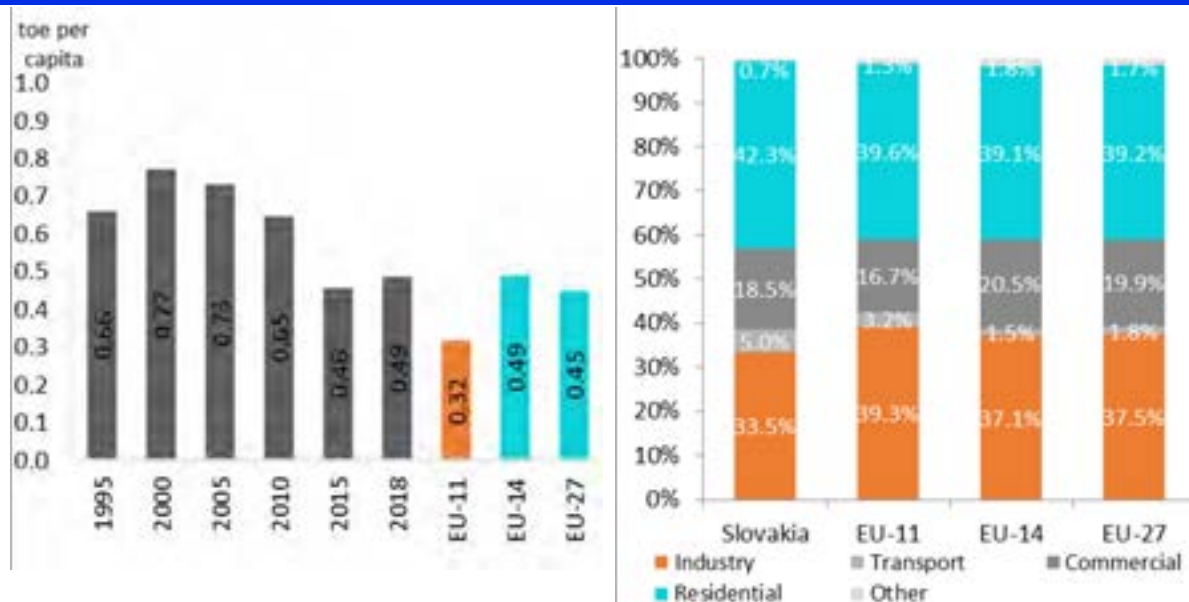
The structure of final gas consumption per sectors is like European averages. Gas usage in Slovakia is dominated by residential sector (42.3% in Slovakia comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27) and industry (33.5%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%.

The share of gas usage in transport sector in Slovakia is higher (5.0% compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27). On other hand the use of gas in commercial sector is higher than in EU-11 countries but lower than in EU-14 and EU-27 countries.

Item 268: Final consumption of gas per capita in Slovakia in 1995-2018 and gas final consumption by sectors in Slovakia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Slovakia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Slovakia and EU-11, EU-14 and EU-27 countries in 2018



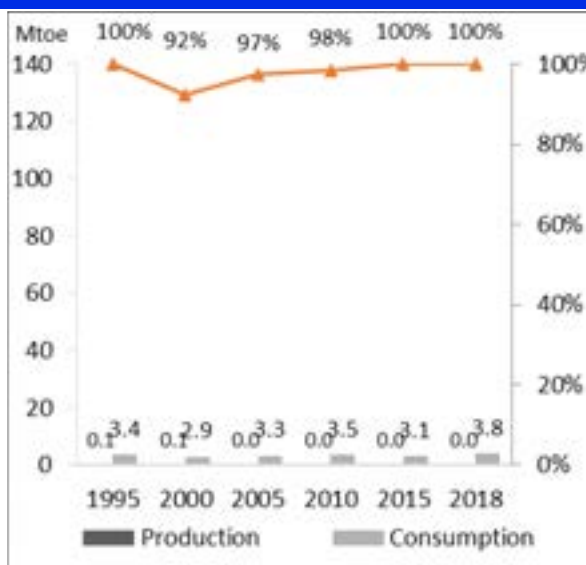
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

## 12.7 Overview of the oil sector

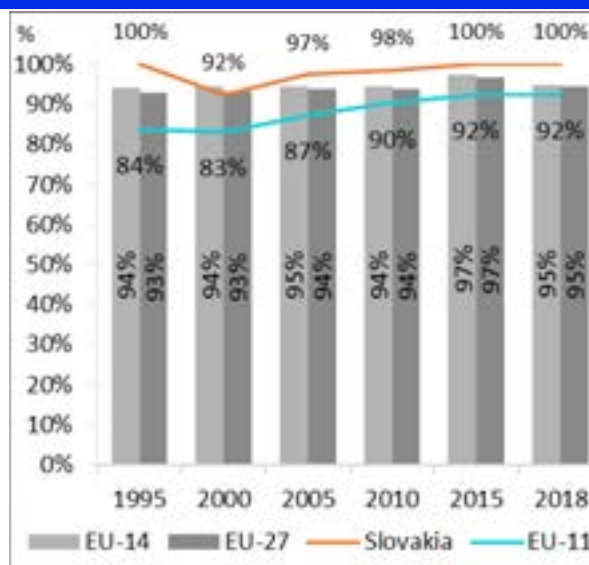
Oil production in Slovakia is very low (less than 0.1 Mtoe in 2018) comparing to the consumption (3.8 Mtoe in 2018). Therefore, the import dependence remains high - between 92% and 100% in years 1995-2018 (see Item 269). When compared to EU averages higher import dependence is observed between Slovakia and EU-11, EU-14 and EU-27 countries (100% import dependence of Slovakia in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 269: Oil sector in Slovakia

Oil production, gross consumption and import dependence in Slovakia in 1995-2018 (Mtoe)



Oil Import dependence in Slovakia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

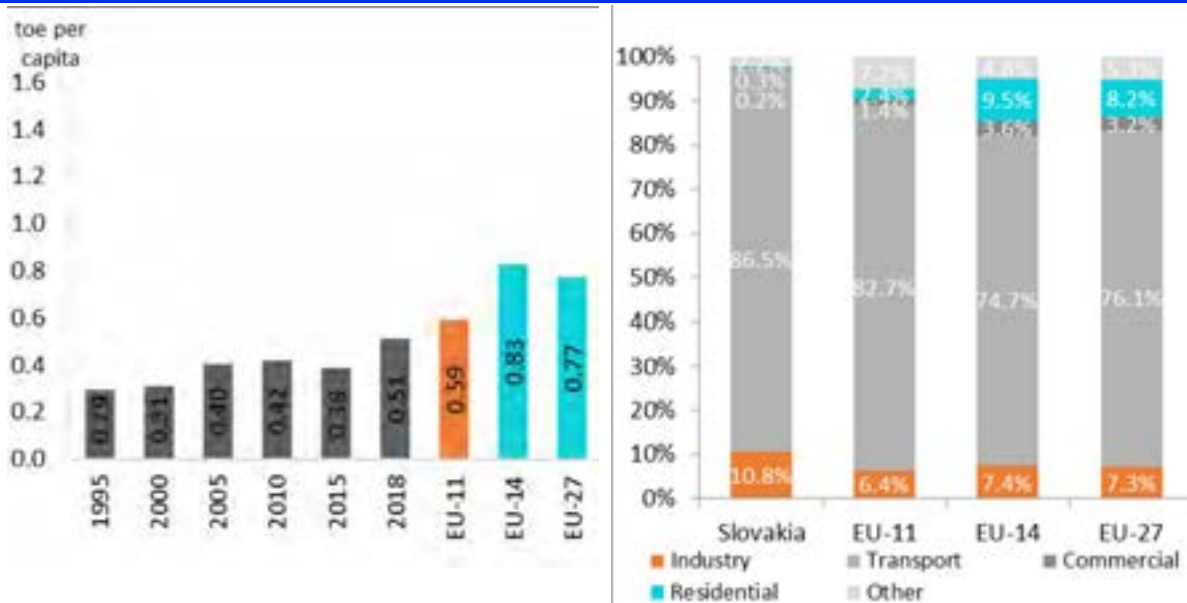
The final consumption of oil per capita in Slovakia increased for 0.29 toe per capita in 1995 to 0.51 toe per capita in 2018. It remains lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.59 toe per capita, 0.83 toe per capita, 0.77 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a higher share of industry and transport sector comparing to EU-11, EU-14 and EU-27 countries. Most of oil is used in transport - 86.5% in Slovakia comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are higher in Slovakia than in EU-11, EU-14 and EU-27 countries, whereas commercial and residential usage are lower.

Item 270: Final consumption of oil per capita in Slovakia in 1995-2018 and oil final consumption by sectors in Slovakia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Slovakia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Slovakia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 12.8 EU climate policy and its targets for Slovakia

Slovakia is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 271).

*Item 271: Energy and climate targets for Slovakia for 2020 and 2030*

	Slovakia 2020 targets	Slovakia 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS – Effort Sharing Decision (ESD)	+13% in relation to their 2005 levels	-
National emission reduction targets in non-ETS – Effort Sharing Regulations (ESR)	-	-12% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	14% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 16.4 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 9.0 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

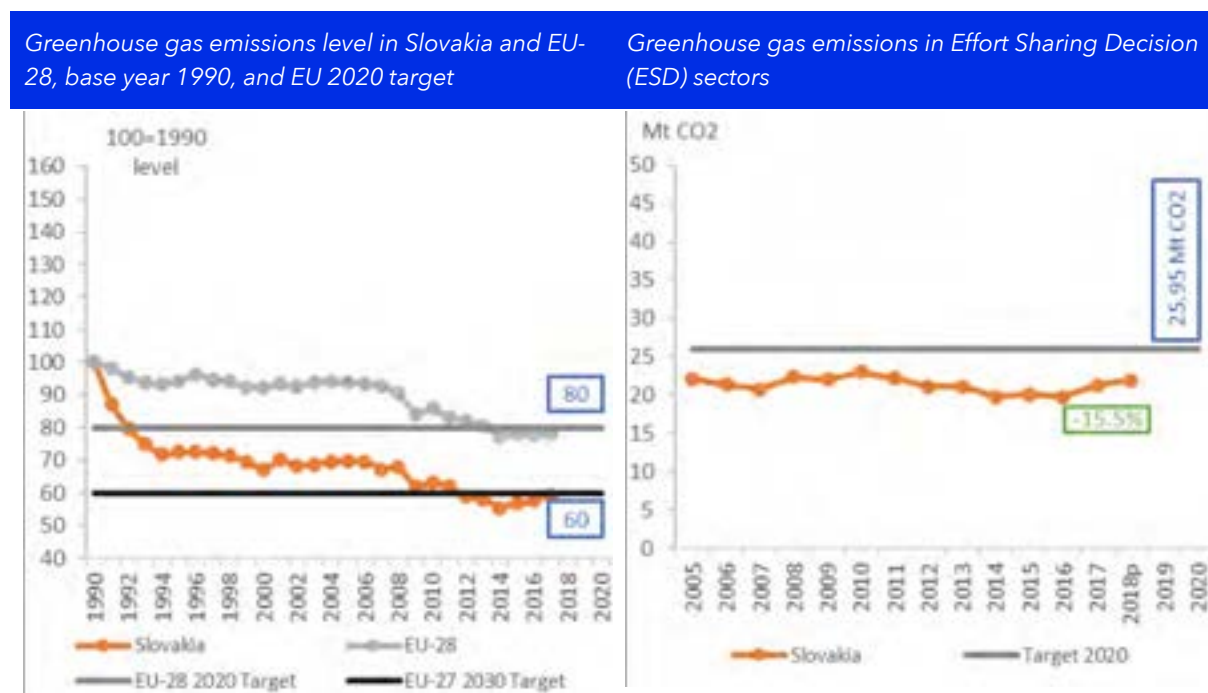
In following chapter, the overview of Slovakia targets and performance are summarized.

### 12.8.1 Greenhouse gas emissions

EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Slovakia is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Slovakia is 25.95 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 15.5%.

Item 272: Energy efficiency target data for Slovakia



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 12.8.2 Renewable energy sources

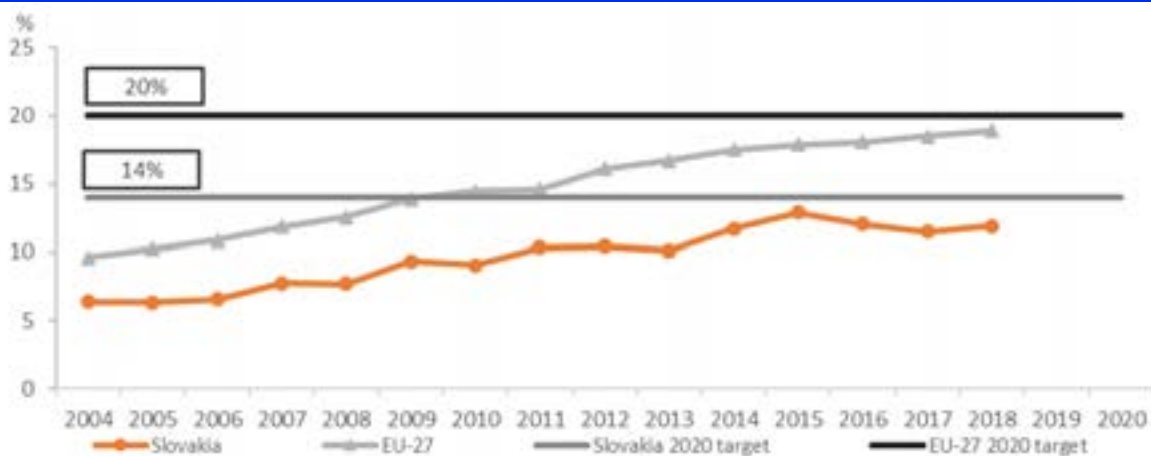
The following targets are set for Slovakia regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 14% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Slovakia is below EU wide and country specific targets.

## Item 273: Share of energy from renewable energy sources in gross final energy consumption in Slovakia

Share of energy from renewable energy sources in gross final energy consumption in Slovakia in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 12.8.3 Energy efficiency

The energy efficiency target set for Slovakia are respectively:

- Primary Energy Consumption in 2020: 16.4 Mtoe
- Final energy consumption in 2020: 9.0 Mtoe

Following the information provided in Item 274 primary energy consumption is below the target by 3.7% and the final energy consumption is above the target by 23.5%.

## Item 274: Energy efficiency target data for Slovakia

Primary energy consumption and final energy consumption in Slovakia in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Slovakia, EU-11, EU-14 and EU-27 in 2018



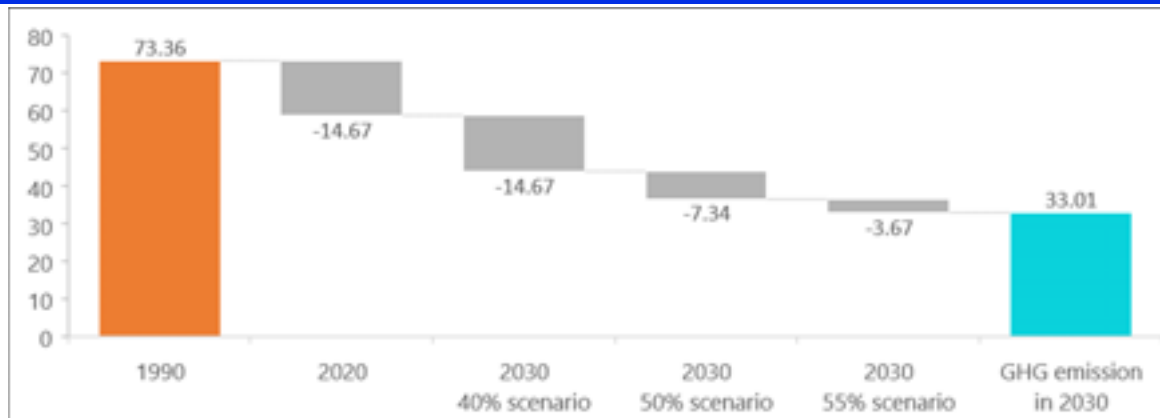
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030)(PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

## 12.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Slovakia greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 14.67 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 14.67 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 7.34 Mt CO<sub>2</sub> emission decrease is needed, or 11.01 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Slovakia up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Slovakia was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 275: Estimation regarding greenhouse gas emissions in Slovakia under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Slovakia under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



## 13 Slovenia

### 13.1 General information

Slovenia is the smallest country within EU-11 group in terms of total country area and represents 1.8% of the area. At the same time, it is the 24<sup>th</sup> country in EU-27 with 0.5% of the area. It represents 2.0% of EU-11 population and 0.5% of EU-27 population, but 3.3% of its total nominal GDP of EU-11 and 0.3% of EU-27. Due the robust economic growth in 1995-2018 period, in 2018 Slovenian GDP per capita amounted to 88% of the whole EU average.

Item 276: Slovenia - key data



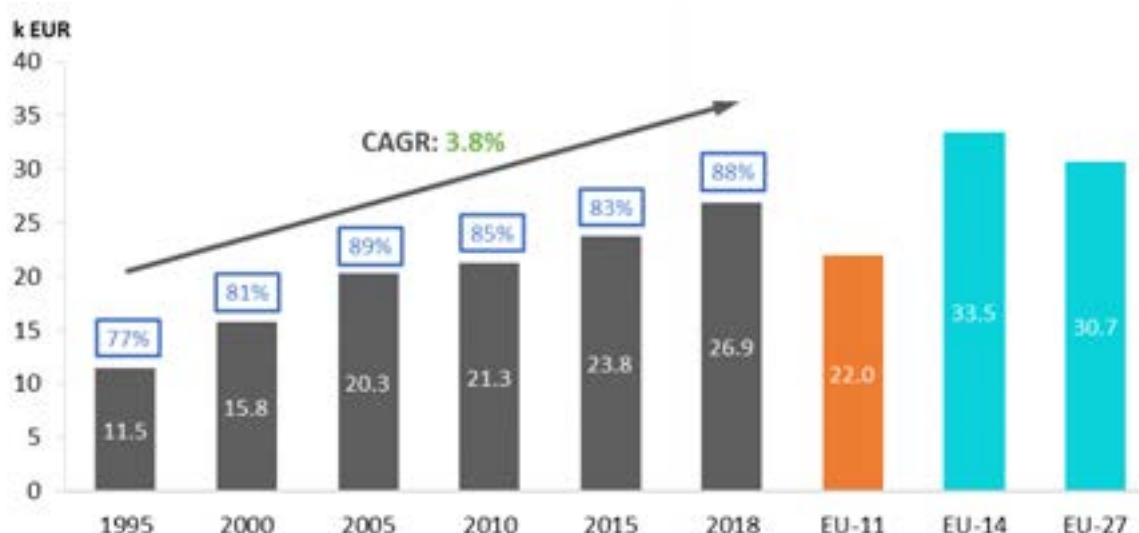
#### Key data

Population (M)	2.1
GDP per capita (EUR, nominal)	22,080
GDP per capita (EUR, PPS)	26,900
GDP as share of EU-11	3.3%
GDP as share of EU-27	0.3%
Energy intensity of the economy (kgoe per 1,000 EUR)	129.0
Greenhouse gas emissions (Mg per capita)	8.4

Source: Eurostat data for 2018, extracted in 2020

With the compounded annual growth rate amounting to 3.8% Slovenian economy considerably grew in the period of 1995-2018 (see Item 277). However, its GDP per capita is still below EU-14 and EU-27 averages (equal to 80% and 88% of the respective averages) – even if purchasing power is taken into consideration.

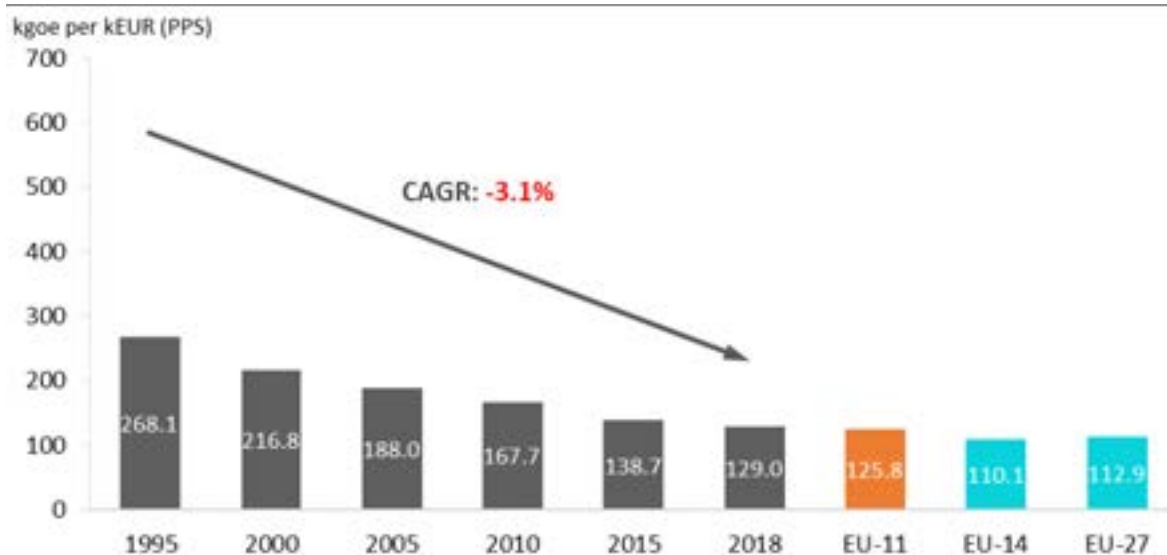
Item 277: GDP per capita in Slovenia for 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages in 2018 (kEUR, PPS) and share of Slovenia GDP per capita in relation to EU-27 average



Source: Eurostat data for 2018, extracted in 2020. Detail references: GDP per capita - Gross domestic product at market prices (B1GQ), Current prices, purchasing power standard per capita (CP\_PPS\_HAB)

The Slovenian economy energy intensity is about 129.0 kgoe per 1,000 EUR PPS, thanks to a significant decrease of the energy intensity indicator during the years 1995-2018. It dropped by 139.2 kgoe per 1,000 EUR PPS, i.e. it was reduced by more than 2 times. In EU-14 and EU-27 average values are 1.2 and 1.1 times respectively lower and in EU-11 average is at a similar level than in Slovenia.

*Item 278: Energy intensity of the economy in Slovenia in 1995-2018 in comparison with EU-11, EU-14 and EU-27 averages, 2018 (kgoe per 1,000 EUR PPS)*



*Source: Eurostat data for 2018, extracted in 2020. Values for EU-11 and EU-14 were recalculated based on energy intensity and GDP data from Eurostat. Detail references: Energy intensity of GDP in purchasing power standards (PPS) – EI\_GDP\_PPS*

## 13.2 Energy balance of Slovenia

In Item 279 the energy balance of Slovenia in 2018 as well as historical values of net imports of energy are shown. The primary energy production was equal to 3.4 Mtoe. Net import accounted for 3.6 Mtoe and gross inland consumption of energy was 6.8 Mtoe.

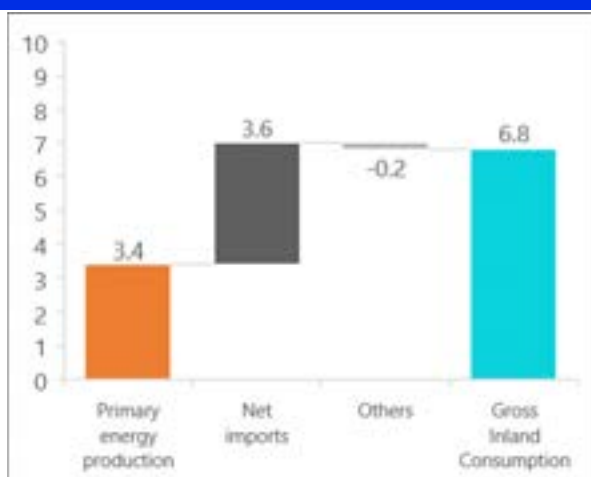
The production of primary energy in the country has increased from 3.0 Mtoe in 1995 to 3.4 Mtoe in 2018. Gross inland consumption has also increased in the same time from 6.1 Mtoe to 6.8 Mtoe.

Net import of energy has increased from 3.1 Mtoe in 1995 to 3.6 Mtoe in 2018. The share of import in total energy needs of the country has also increased from 51.0% in 1995 to 53.0% in 2018.

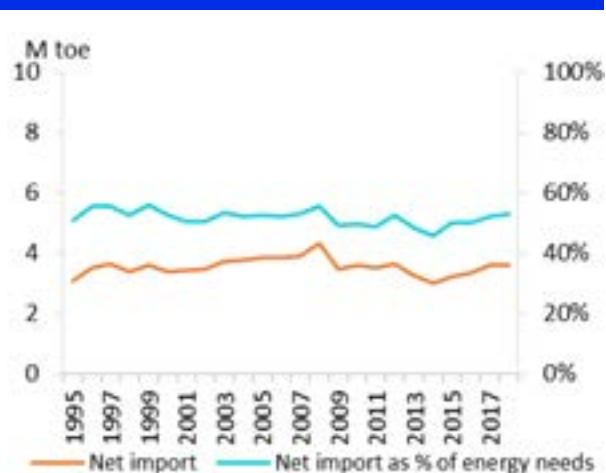
Slovenian primary energy production compared to gross inland consumption has increased from 49% to 50%. Therefore, the dependence of the country from foreign import of energy has slightly increased.

## Item 279: Energy balance in Slovenia

Energy balance in Slovenia in 2018 (Mtoe)



Net import of energy in Slovenia in 1995-2018 (Mtoe and as percentage of GIC)



Gross inland consumption, primary energy production (Mtoe) and ratio of primary energy production to gross inland consumption in 1995-2018 in Slovenia (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Gross inland consumption - GIC. Net imports = Import (IMP) - Export (EXP), Other = Change in stock (STK-CHG) - International maritime bunkers (INTMARB)

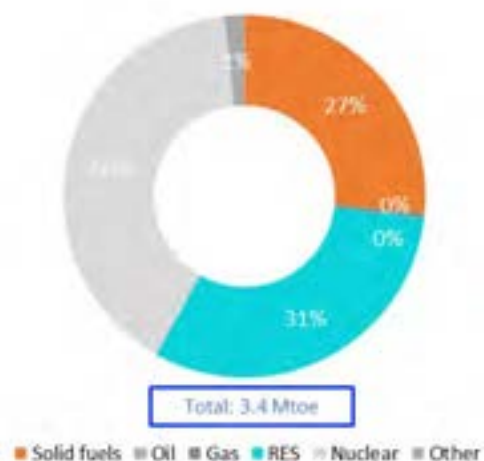
Considering the primary production, one can notice that three fuels dominates the mix: solid fuels - 27%, RES - 31% and nuclear - 40%. Oil and gas are practically absent.

Comparing to EU-11 group Slovenia has a higher share of nuclear (40% versus 15%) and renewable energy sources (31% versus 22%) in primary energy production structure. The share of solid fuels is lower than EU-11 averages (26% versus 45%) and contrary to EU-11 gas and oil are absent of the mix.

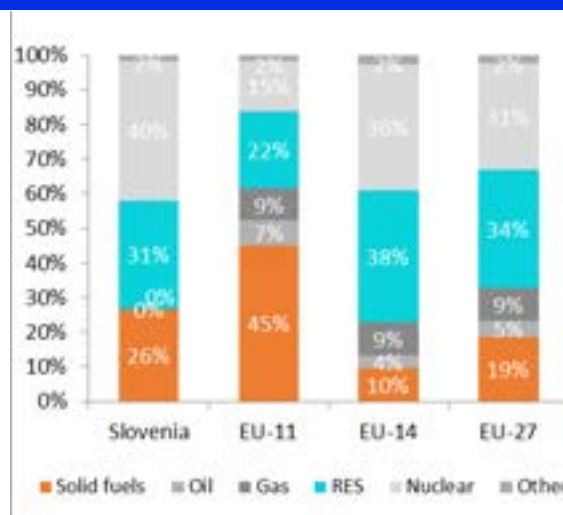
When compared to the group of developed Western European countries (EU-14), Slovenia has a still a higher share of nuclear in the energy mix (40% versus 36%), but a lower share of renewable energy sources (31% versus 38%). The share of solid fuels remains also higher than EU-14 average. Similar relations are observed when comparing Slovenia primary energy structure to EU-27.

Item 280: Primary energy structure in Slovenia

Primary energy structure in Slovenia in 2018 (%)



Primary energy production structure in Slovenia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



Source: Eurostat data for 2018, extracted in 2020. Detail references: Primary energy - Primary Production (PPRD), Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear - Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

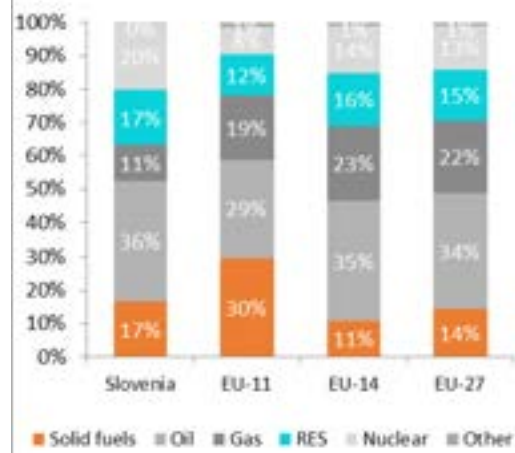
On the consumption side, gross inland energy consumption structure is balanced. Oil is dominating with 36%, followed by nuclear 20%, solid fuels 16%, RES 17% and gas 11%. When compared to European averages one can notice higher share of nuclear and RES but lower of gas. Oil share in gross inland consumption is higher in Slovenia than EU-11 averages, like EU-14 and EU-27 level. Slovenia is still more relying on solid fuels than EU-14 countries but less than EU-11.

## Item 281: Gross inland consumption structure in Slovenia

Gross inland consumption structure in Slovenia in 2018 (%)



Gross inland consumption structure in Slovenia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



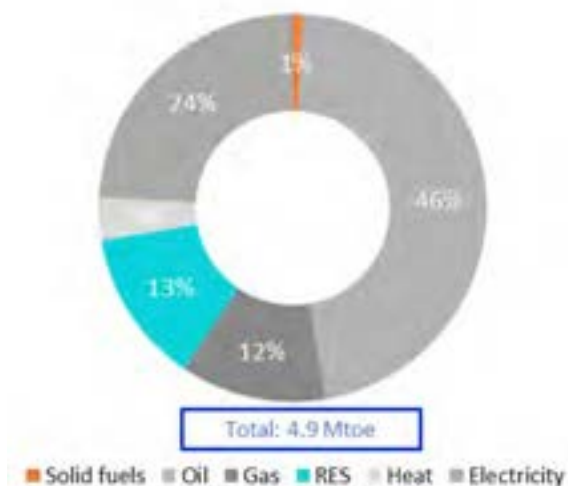
Source: Eurostat data for 2018, extracted in 2020. Detail references: Gross inland consumption – GIC, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion)(O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear – Nuclear Heat (N900H), Other = Heat (H8000) + Electricity (E7000) + Non-renewables waste (W6100-6220)

Final energy consumption in Slovenia is dominated by petroleum products and electricity, which accounted together for 70% of total energy consumption in 2018 (see Item 42). The shares of gas and RES in final energy consumption fuel-mix are 12% and 13% respectively whereas heat and solid fuels account only for 4% and 1% respectively.

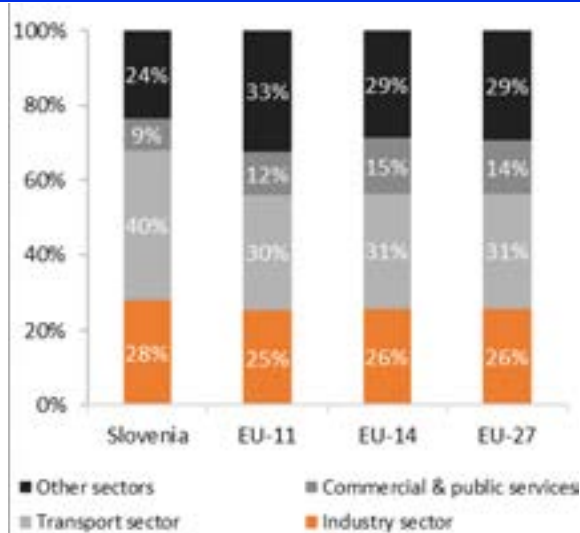
When compared to EU-11, EU-14 as well as EU-27 averages in 2018, the structure of final energy consumption by sectors in Slovenia is characterized by higher use of energy in transport and industry but lower in commercial and public services as well as in other sectors.

Item 282: Final energy consumption structure in Slovenia

Final energy consumption structure in Slovenia in 2018 (%)



Final energy consumption structure in Slovenia in 2018 in comparison with EU-11, EU-14, and EU-27 averages



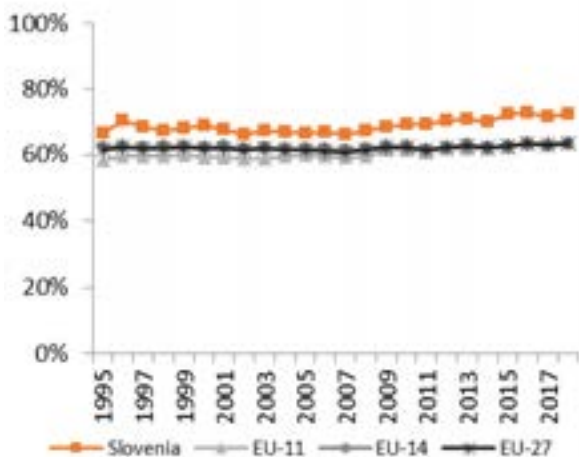
Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Heat (H8000), Electricity (E7000), Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial & public services - FC\_OTH\_CP\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E

Slovenian final energy consumption and gross inland consumption ratio, which measure energy efficiency, in 2018, were significantly higher than in EU-11, EU-14 and EU-27. Furthermore, its level in Slovenia has remained stable since 1995.

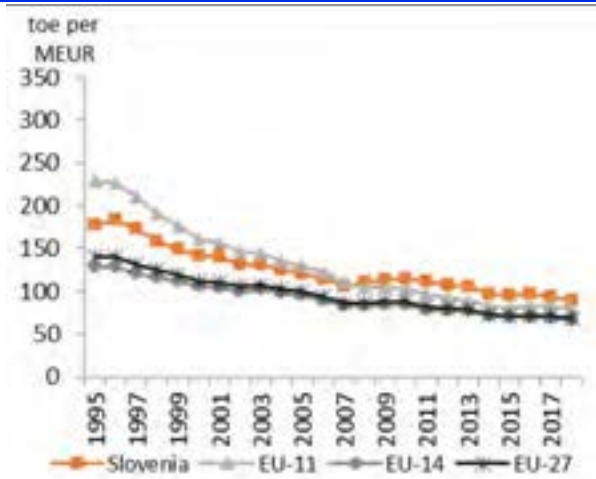
Simultaneously, a considerable decrease of energy volume associated with generating gross domestic product was noticed (from 178.2 toe per MEUR to 88.7 toe per MEUR). The latter value remains higher than the averages for EU-11, EU-14 and EU-27.

Item 283: Final energy consumption in Slovenia in relation to selected indicators

Final energy consumption to gross inland consumption ratio in Slovenia in 1995-2018 (%)



Final energy consumption to gross domestic product ratio in Slovenia in 1995-2018 in comparison with EU-11, EU-14, and EU-27 averages (toe per M EUR)

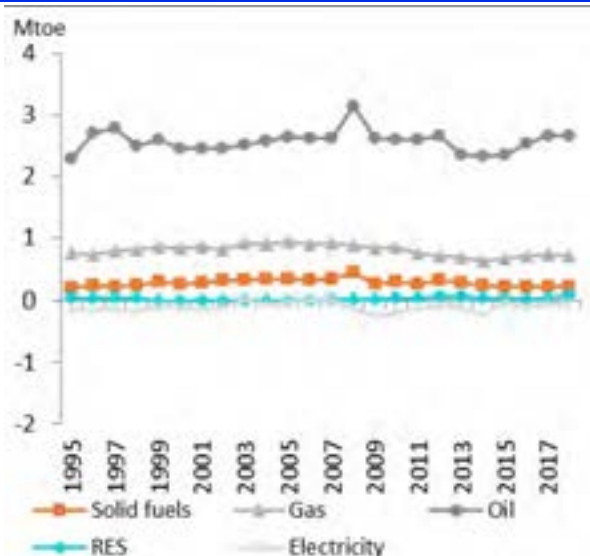


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final energy consumption - FEC, Gross inland consumption - GIC, Gross Domestic Product - Gross domestic product at market prices B1GQ, Current prices - CP-MEUR

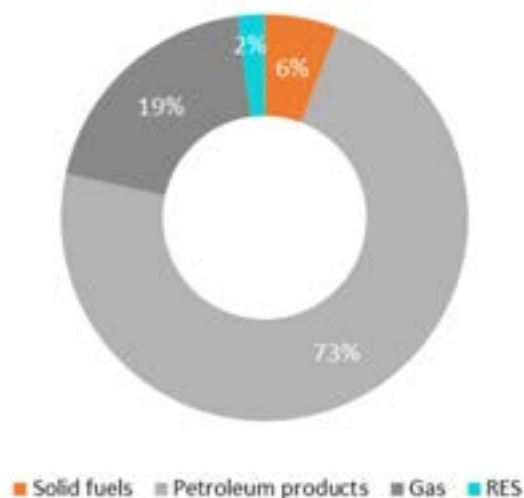
Total net import of energy in Slovenia increased in years 1995-2018, mainly due to an increase in oil import. The level of import of other fuels remains stable, whereas electricity is even exported from Slovenia. The import structure is characterized by high share of oil (73%). Import of gas accounts for 19% and the mix is completed by solid fuels (6%) and RES (2%).

Item 284: Net import of energy in Slovenia

Net import of energy by fuel in 1995-2018 (Mtoe)



Net import structure in 2018 (% , only fuels for which import is greater than export)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil

*and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Electricity (E7000)*

Solid fuels are mainly imported from Indonesia (91%). The rest is imported from Hungary, Czech Republic, Italy, and Germany. None of the above exceed 4% share of imports.

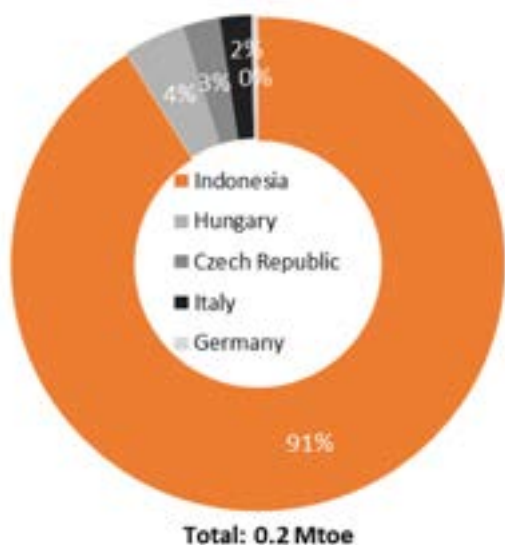
Slovenia imports crude oil from Italy (40%), United States (12%), Austria (11%) and Greece (10%). The remaining share of 27% is provided by other smaller suppliers.

Gas is imported to Slovenia from Austria (68%) and Russia (31%).

Electricity imports are dominated by Croatia (53%) and Austria (46%).

Item 285: Foreign fuel suppliers

Foreign suppliers of solid fuels in Slovenia in 2018 (%)



Foreign suppliers of crude oil in Slovenia in 2018(%)



Foreign suppliers of gas in Slovenia in 2018 (%)



Foreign suppliers of electricity in Slovenia in 2018 (%)



Source: Eurostat data for 2018, extracted in 2020. Detail references: Solid fossil fuels - C000X0350-0370, Gas - Natural gas (G3000), Oil - Oil and petroleum products (excluding biofuel portion) (O4000XBIO), Electricity - E7000

### 13.3 Greenhouse gas emissions

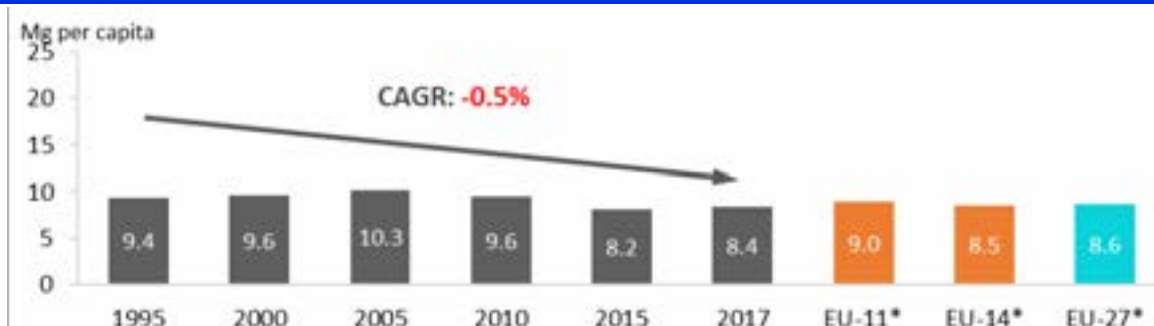
Between 1995-2017 greenhouse gases emissions in Slovenia were reduced - from over 18.7 Mt CO<sub>2</sub> in 1995 to 17.5 Mt CO<sub>2</sub> in 2017. In consequence, average emissions per capita decreased to 8.4 Mg CO<sub>2</sub> per capita in 2017 (from 9.4 Mg CO<sub>2</sub> per capita in 1995), which is lower comparing to EU-14 and EU-27 averages (8.5 Mg CO<sub>2</sub> per capita and 8.6 Mg CO<sub>2</sub> per capita, respectively), and also lower than in EU-11 (9.0 Mg CO<sub>2</sub> per capita)

There were some noteworthy changes in the Slovenian structure of greenhouse gas emissions over the period considered. The significance of manufacturing and construction sector emissions dropped swiftly by 36%, as well as emissions from energy industries and waste management, respectively 14% and 28%. On other hand, transport emissions gained in importance increasing by 46%.

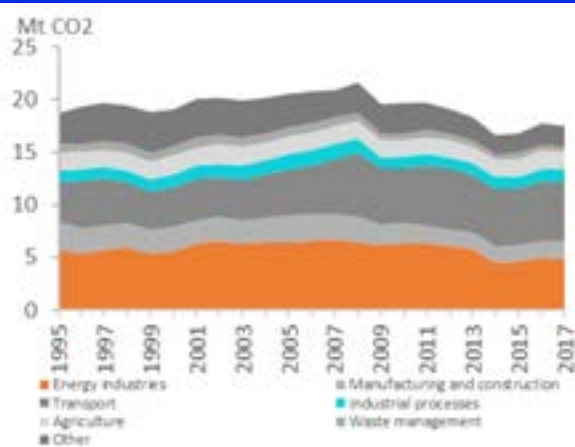
Comparing to EU-11, EU-14 and EU-27 countries, Slovenia is characterized by higher share of emissions from transport (32% versus 17%, 23% and 21%). The share of GHG emissions linked to energy industries is at EU-27 levels.

Item 286: Greenhouse gas emissions in Slovenia

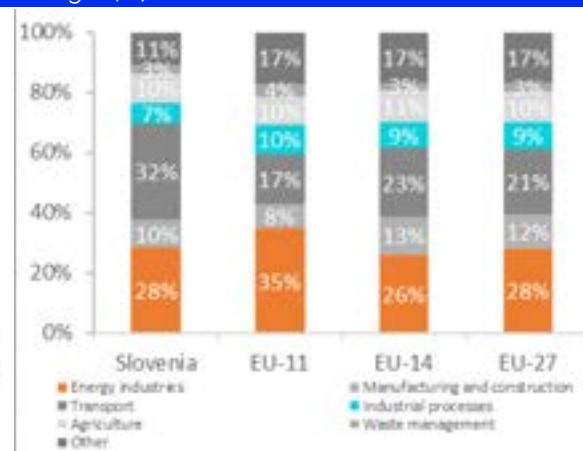
Greenhouse gas emissions per capita in Slovenia in 1995-2017 in comparison with EU-11, EU-14 and EU-27 averages in 2017 (Mg per capita)



Greenhouse gas emissions in Slovenia by sectors in 1995-2017 (Mt CO2)



Greenhouse gas emissions in Slovenia by sectors in 2017 in comparison with EU-11, EU-14 and EU-27 averages (%)



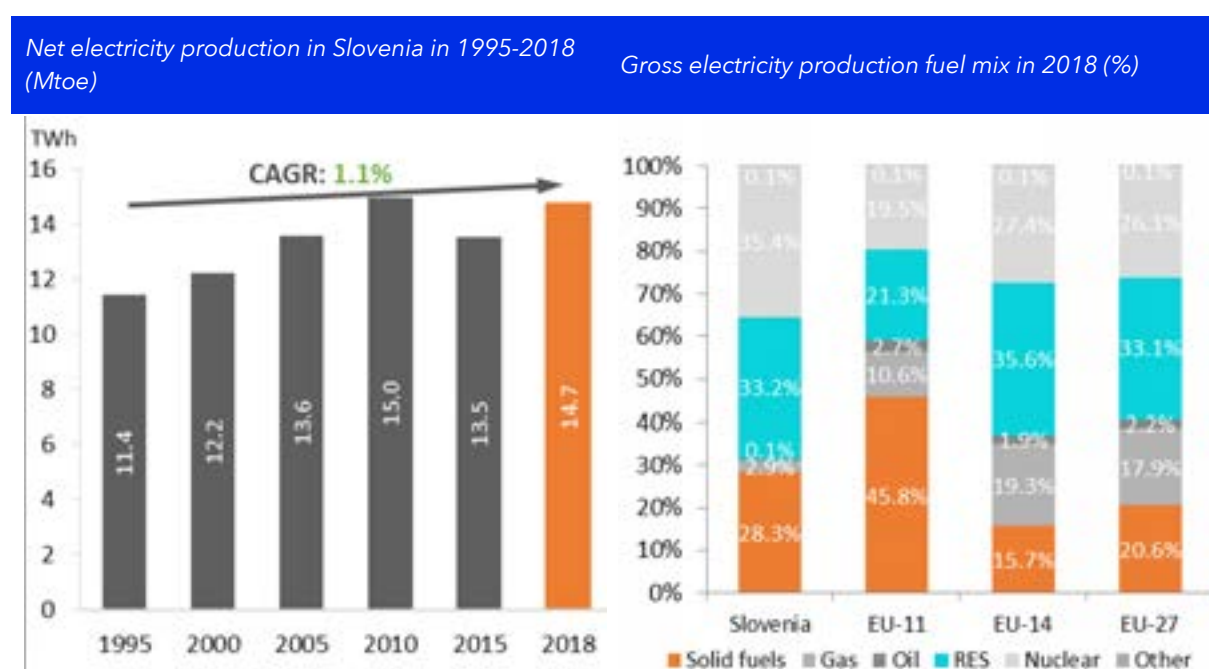
Source: Eurostat data for 2018, extracted in 2020; Detail references: Greenhouse gas emissions per capita source: EEA - \* values for EU-11, EU-14 and EU-27 recalculated by the Author; Energy industry - Fuel combustion in energy industries (CRF1A1), Manufacturing and construction - Fuel combustion in manufacturing industries and construction (CRF1A2), Transport - Fuel combustion in transport (CRF1A3), Industrial processes - Industrial processes and product use (CRF2), Agriculture - Agriculture (CRF3), Waste management - Waste management (CRF5), Other = Other fuel combustion sectors (CRF1A4)+ Other fuel combustion sectors n.e.c. (CRF1A5) + Fuels - fugitive emissions (CRF1B)+Other sectors (CRF6); Total GHG emissions equal to All sectors (excluding LULUCF and memo items) (CRF1-6X4\_MEMO) i.e. emission from all sectors excluding Land use, land use change, and forestry (LULUCF), Transport and storage of CO2 (memo item), International aviation (memo item), International navigation (memo item), Multilateral operations (memo item), Biomass - CO2 emissions (memo item). Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent) - GHG

### 13.4 Overview of the electricity sector

Item 287 presents electricity production and the current fuel mix of Slovenia. Over last 23 years net electricity production has increased from 11.4 TWh in 1995 to 14.7 TWh in 2018 (CAGR 1.1%). As visible, net electricity production represents 3.6% of EU-11 total electricity production, which is higher compared to Slovenian GDP share of 3.3%.

The Slovenian fuel mix is dominated by renewable energy sources, nuclear energy, and solid fuels with respective shares of 35.4%, 33.2% and 28.3%. In total, those three fuels represent therefore as much as 96.9% of total gross electricity production. Compared to EU-14 and EU-27 countries, Slovenia has a much bigger share of solid fuels and nuclear in its energy mix. On other hand, the country produces relatively less electricity from gas and oil, respectively 2.9% and 0.1%. The share of electricity from renewable energy sources is similar than in EU-14 and EU-27 countries, respectively 35.4% versus 35.6% and 33.1%).

Item 287: Net electricity production and gross electricity production fuel mix in Slovenia



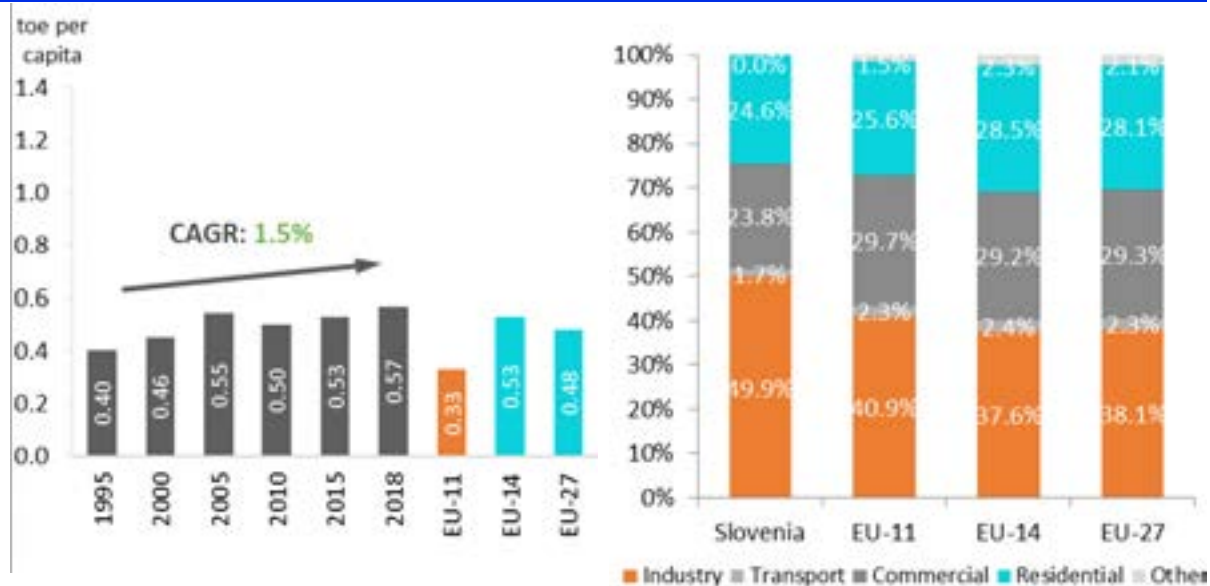
Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Electricity Production - NEP, Gross Electricity Production - GEP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

In Item 288 the final per capita consumption of electricity evolution and its breakdown by economic sector is presented. In recent years final consumption of electricity in Slovenia has increased (CAGR in the period of 1995-2019 was around 1.5%) and its level is higher compared to EU-14 and EU-27 countries. Slovenian final energy consumption per capita represents 107.6% of EU-14 level and 117.9% of EU-27 level. Generally, the structure of final electricity consumption in Slovenia is rather like EU averages, with a somewhat higher share of the industry and lower share of other sectors.

Item 288: Final consumption of electricity in Slovenia

Final consumption of electricity per capita in Slovenia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of electricity in Slovenia by sectors in 2018 (%)

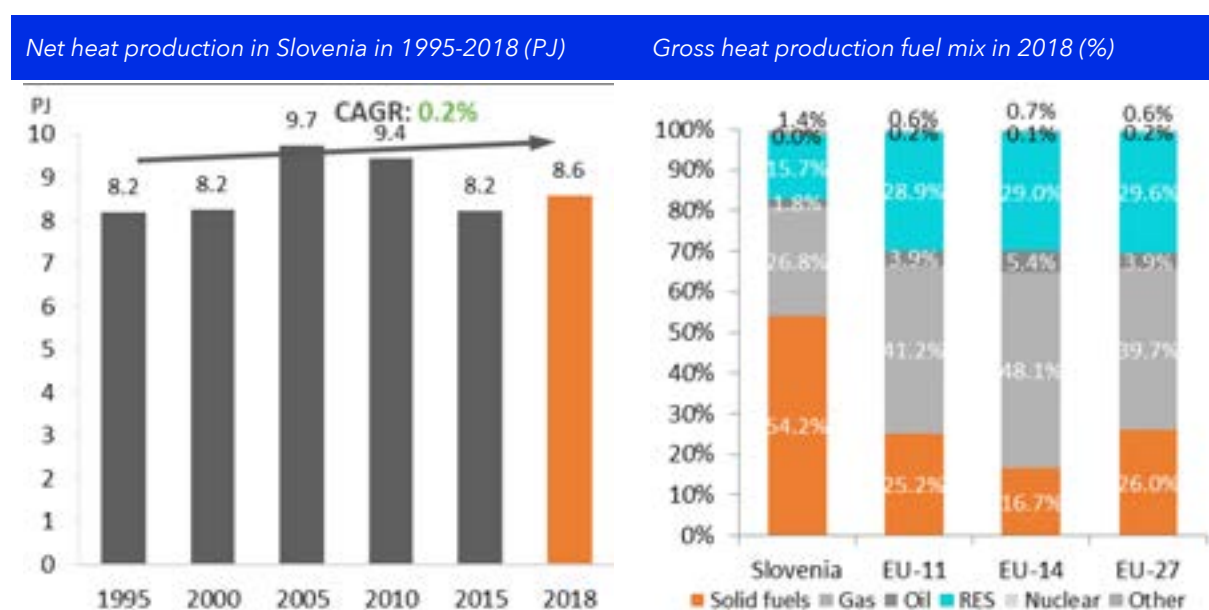


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Electricity E7000

### 13.5 Overview of the heat sector

Item 289 presents heat production in Slovenia as well as the comparison of its consumption fuel mix with those of EU-11, EU-14 and EU-27 countries. As can be seen, total net heat production in Slovenia has increased between 1995 and 2018 from 8.2 PJ to 8.6 PJ, i.e. at CAGR of 0.2%. Slovenian production fuel mix is dominated by gas (almost 26.8%) and solid fuels (almost 54.2%). The share of solid fuels is higher in Slovenia than EU averages (54.2% compared to 16.7% in EU-14 and 26.0% in EU-27), whereas the usage of oil is lower (1.8% compare to 3.9%, 5.4% and 3.9% in EU-11, EU-14 and EU-27 countries). The share of renewable energy sources in heat production is also lower, about half of level in EU-11, EU-14 and EU-27 countries.

Item 289: Net heat production and gross electricity production fuel mix in Slovenia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Net Heat Production - NHP, Gross Heat Production - GHP, Solid fuels = Solid fossil fuels (C000X0350-0370)+Peat and peat products (P1000), Gas = Manufactured gases (C0350-0370)+Natural gas (G3000), Oil = Oil and petroleum products (excluding biofuel portion) (O4000XBIO)+Oil shale and oil sands (S2000), RES = Renewables and biofuels (RA000), Nuclear = Nuclear heat (N900H), Other = Industrial waste (W6100) + Electricity (E7000)

Item 290 presents final heat consumption per capita and its breakdown by sectors.

The per capita demand for heat in Slovenia has decreased from 0.10 toe in 1995 to 0.08 toe in 2018. As a result, within the 23 years analysed, heat consumption per capita in Slovenia has decreased at CAGR of -0.9%. The heat consumption in Slovenia remains lower than the averages for EU-11, EU-14 and EU-27, respectively 0.13 toe per capita, 0.10 toe per capita and 0.10 toe per capita.

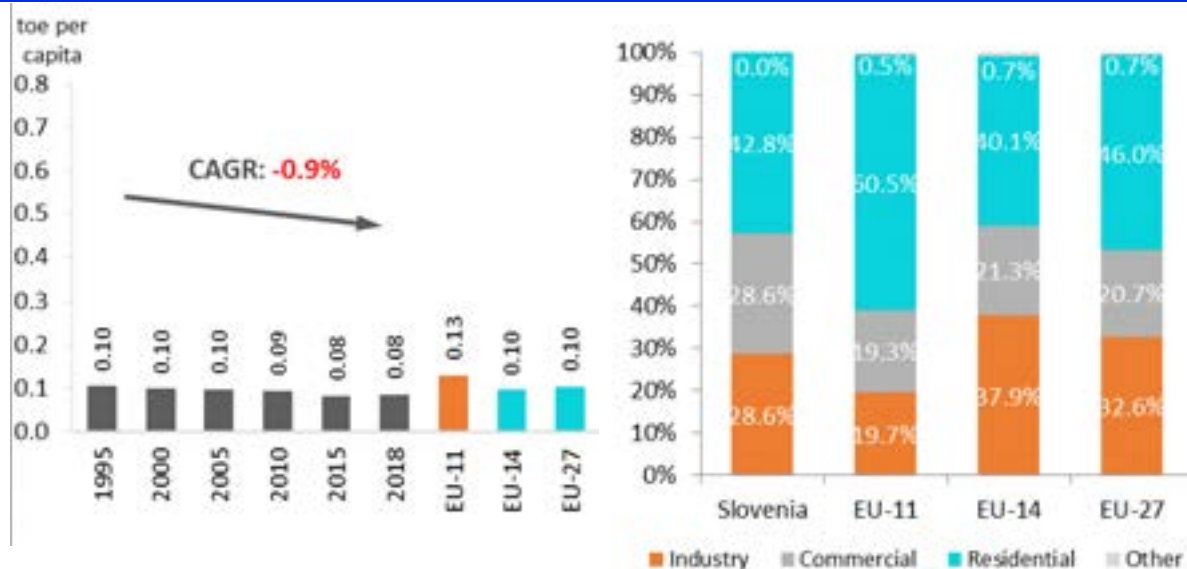
The structure of final consumption of heat in Slovenia is characterized by higher share of commercial (28.6% in Slovenia compared to 21.3% in EU-14 and 20.7% in EU-27) but lower residential usage (42.8% in Slovenia compared to 40.1% in EU-14 and 46.0% in EU-27) and lower industry participation (28.6% in Slovenia compared to 37.9% in EU-14 and 32.6% in EU-27).

In relation to EU-11 countries, the structure of final heat consumption is similar.

Item 290: Final consumption of heat in Slovenia

Final consumption of heat per capita in Slovenia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Final consumption of heat in Slovenia by sectors in 2018 (%)

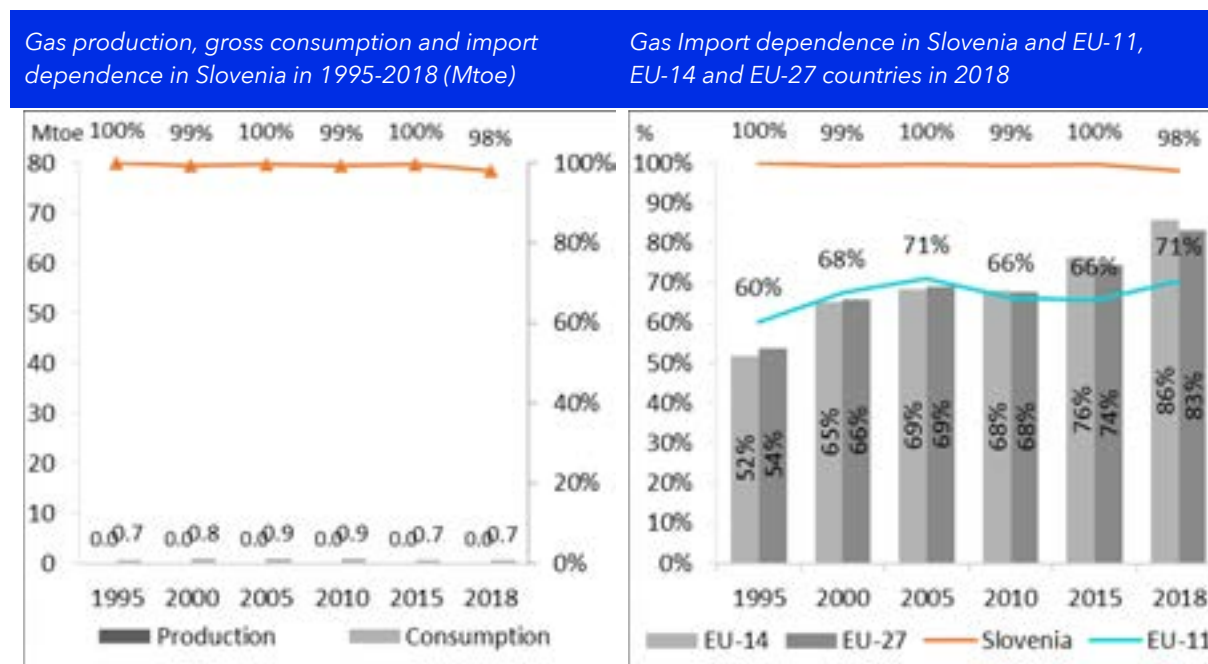


Source: Eurostat data for 2018, extracted in 2020. Detail references: Final consumption per capita - Final consumption energy use FC\_E/ Population (INDIC\_DE); Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Heat H8000

## 13.6 Overview of gas sector

Gas production in Slovenia is very low (less than 0.1 Mtoe in 2018) comparing to the consumption (0.7 Mtoe in 2018). Therefore, the import dependence remains high - between 98% and 100% in years 1995-2018 (see Item 291). When compared to EU averages significantly higher import dependence is observed between Slovenia and EU-11, EU-14 and EU-27 countries (98% import dependence of Slovenia in 2018 versus 71% in EU-11, 86% in EU-14 and 83% in EU-27).

Item 291: Gas sector in Slovenia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Gas production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Natural Gas G3000

The final consumption of gas per capita in Slovenia remains stable at level of 0.29 toe per capita and it is lower than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.32 toe per capita, 0.49 toe per capita, 0.45 toe per capita).

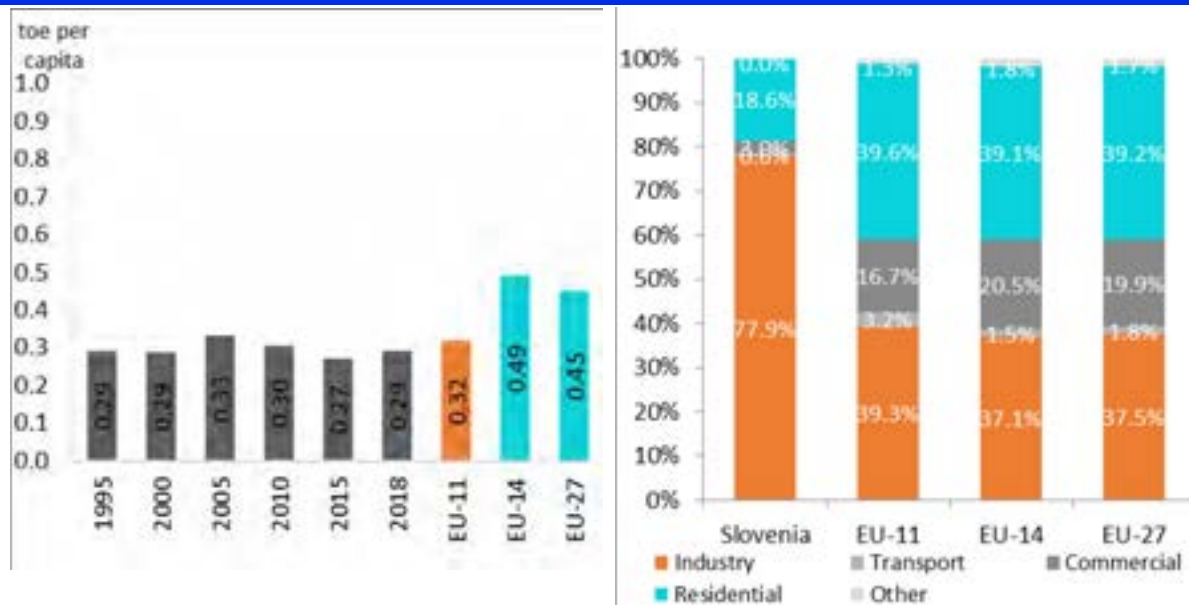
The structure of final gas consumption per sectors also differs. Gas usage in Slovenia is dominated by industry (77.9%), whereas the averages for EU-11, EU-14 and EU-27 are respectively 39.3%, 37.1% and 37.5%.

On other hand the share of gas usage in transport sector in Slovenia is low (<0.1% compared to 3.2% in EU-11, 1.5% in EU-14 and 1.8% in EU-27). Gas in residential and commercial sectors is significantly less present - 18.6% in commercial sector in Slovenia comparing to 16.7% in EU-11, 20.5% in EU-14 and 19.9% in EU-27, and 3.0% in residential sector in Slovenia comparing to 39.6% in EU-11, 39.1% in EU-14 and 39.2% in EU-27.

Item 292: Final consumption of gas per capita in Slovenia in 1995-2018 and gas final consumption by sectors in Slovenia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of gas per capita in Slovenia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Gas final consumption by sectors in Slovenia and EU-11, EU-14 and EU-27 countries in 2018

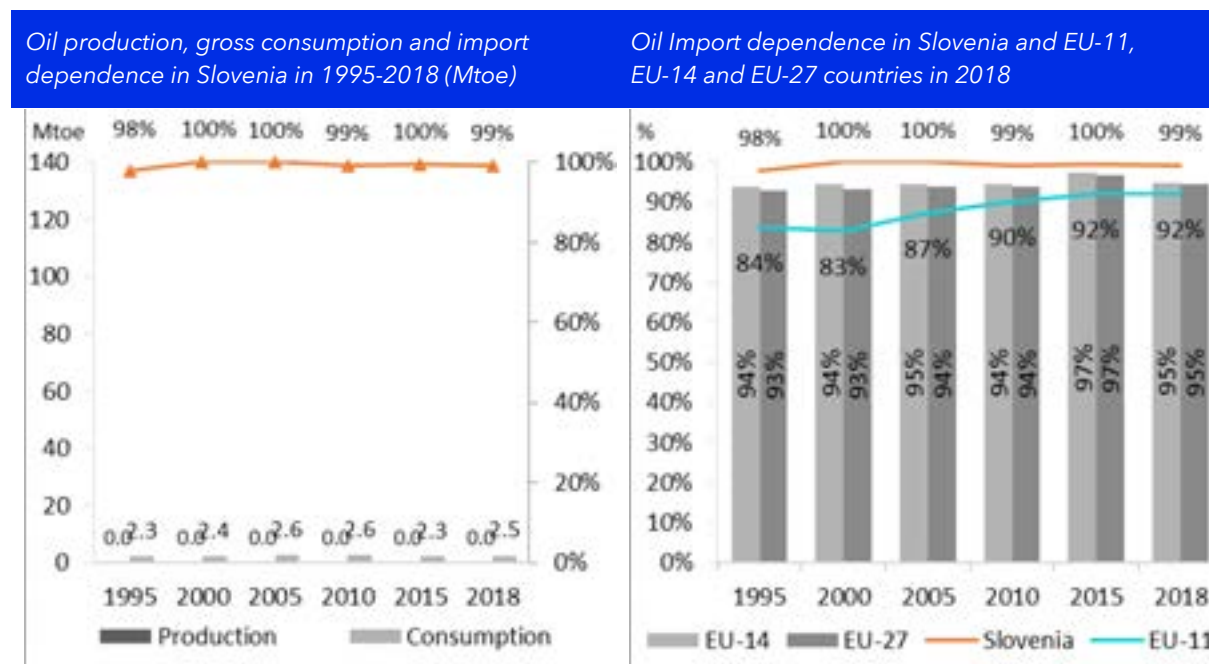


Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Natural Gas G3000

### 13.7 Overview of the oil sector

Oil production in Slovenia is very low (less than 0.1 Mtoe in 2018) comparing to the consumption (2.5 Mtoe in 2018). Therefore, the import dependence remains high - between 98% and 100% in years 1995-2018 (see Item 293). When compared to EU averages higher import dependence is observed between Slovenia and EU-11, EU-14 and EU-27 countries (99% import dependence of Slovenia in 2018 versus 92% in EU-11, 95% in EU-14 and 95% in EU-27).

Item 293: Oil sector in Slovenia



Source: Eurostat data for 2018, extracted in 2020. Detail references: Oil production - PPRD, gross consumption - GIC, import dependence (IMP-EXP)/GAE. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO. Import dependence above 100% has been rounded to 100%

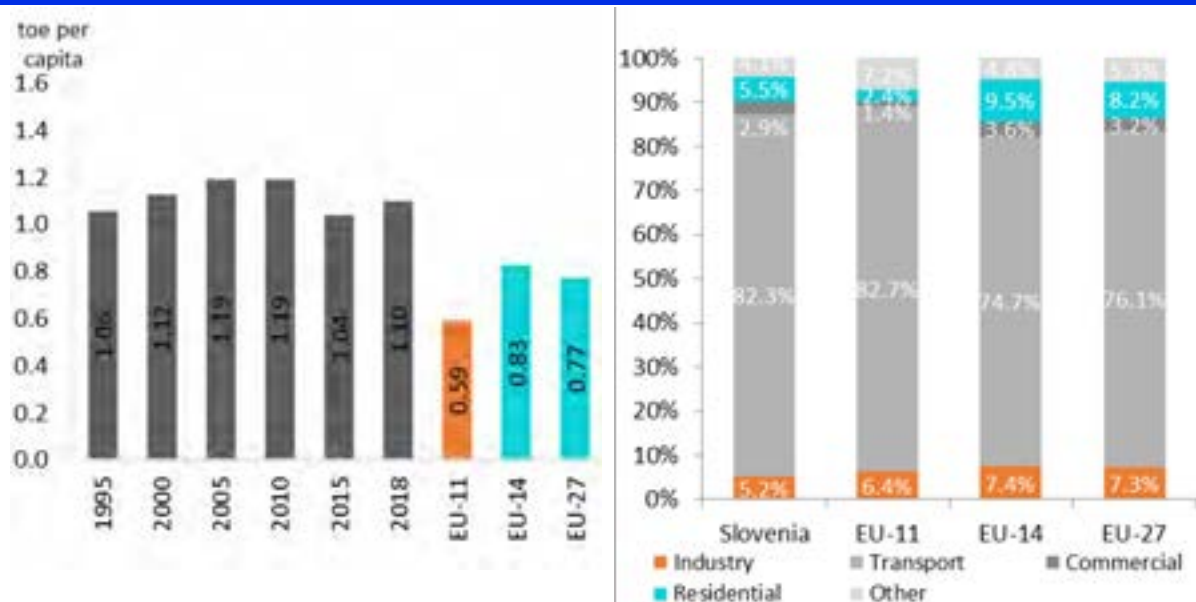
The final consumption of oil per capita in Slovenia increased for 1.06 toe per capita in 1995 to 1.10 toe per capita in 2018. It remains higher than the averages for EU-11, EU-14 and EU-27 countries (respectively 0.59 toe per capita, 0.83 toe per capita, 0.77 toe per capita).

The structure of final oil consumption per sectors is similar than EU-11 averages with a high share of transport sector comparing to EU-14 and EU-27 countries. Most of oil is used in transport - 82.3% in Slovenia comparing to 82.7% in EU-11, 74.7% in EU-14 and 76.1% in EU-27. Industrial applications are lower in Slovenia than in EU-11, EU-14 and EU-27 countries, whereas commercial and residential usage are lower than in EU-14 and EU-27 countries but higher than in EU-11.

Item 294: Final consumption of oil per capita in Slovenia in 1995-2018 and oil final consumption by sectors in Slovenia and EU-11, EU-14 and EU-27 countries in 2018

Final consumption of oil per capita in Slovenia (1995-2018) and in EU-11, EU-15 and EU-27 in 2018 (toe per capita)

Oil final consumption by sectors in Slovenia and EU-11, EU-14 and EU-27 countries in 2018



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Final consumption per capita - FC\_E/INDIC\_DE; Final consumption - FC\_E, Industry - FC\_IND\_E, Transport - FC\_TRA\_E, Commercial - FC\_OTH\_CP\_E, Residential - FC\_OTH\_HH\_E, Other - FC\_OTH\_E-FC\_OTH\_CP\_E-FC\_OTH\_HH\_E. All for Oil and petroleum products (excluding biofuel portion) O4000XBIO

## 13.8 EU climate policy and its targets for Slovenia

Slovenia is subject to EU energy and climate regulations and therefore specific targets are set and verified regarding greenhouse gas emission, share of energy from renewable energy sources and energy efficiency improvements (see Item 295).

*Item 295: Energy and climate targets for Slovenia for 2020 and 2030*

	Slovenia 2020 targets	Slovenia 2030 targets
<b>Greenhouse gas emissions</b>	<b>EU wide target of 20% reduction from 1990 levels (14% from 2005 level)</b>	<b>EU wide target of 40% reduction from 1990 levels</b>
Greenhouse gas emissions in ETS	EU wide target of 21% reduction from 2005	EU wide target of 43% reduction from 2005
National emission reduction targets in non-ETS - Effort Sharing Decision (ESD)	+4% in relation to their 2005 levels	-
National emission reduction targets in non-ETS - Effort Sharing Regulations (ESR)	-	-15% in relation to their 2005 levels
<b>Share of energy from renewable energy sources</b>	<b>EU wide target of 20% energy from renewables</b>	<b>EU wide target of minimum 32% share for renewable energy</b>
EU wide target of share of energy from renewable energy sources	EU wide target of 20% share of gross final energy consumption by 2020	EU wide target of 32% share of gross final energy consumption by 2030
National target of share of energy from renewable energy sources	25% of gross final consumption by 2020	Not yet available
<b>Improvement in energy efficiency</b>	<b>EU wide target of 20% improvement in energy efficiency</b>	<b>EU wide target of at least 32.5% improvement in energy efficiency (compared with a projected business-as-usual scenario for 2030)</b>
Primary energy consumption	EU wide target < 1,483 Mtoe National target < 7.3 Mtoe	EU wide target of 1,273 Mtoe (< 1,128 Mtoe EU-27) National targets not available yet
Final energy consumption	EU wide target < 1,086 Mtoe National target < 5.1 Mtoe	EU wide target < 956 Mtoe (< 846 Mtoe EU-27) National targets not available yet

Source: EU website

In following chapter, the overview of Slovenia targets and performance are summarized.

### 13.8.1 Greenhouse gas emissions

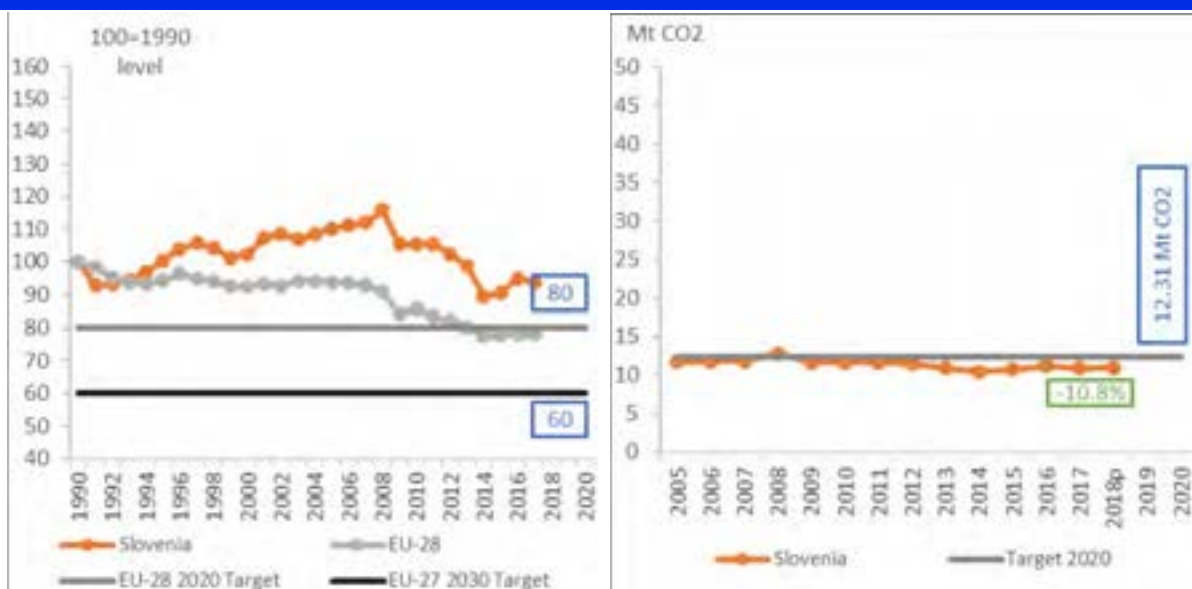
EU has set a target for CO<sub>2</sub> reduction by 20% compared to 1990 level at EU level. Regardless the fact that the target is not binding for specific country, the level of CO<sub>2</sub> emission in Slovenia is below EU wide target.

The non-ETS greenhouse gas emissions the binding national targets for Slovenia is 12.31 Mt of CO<sub>2</sub> equivalent emissions. Comparing to 2018 provisional results the level of emissions is below the target by 10.8%.

Item 296: Energy efficiency target data for Slovenia

Greenhouse gas emissions level in Slovenia and EU-28, base year 1990, and EU 2020 target

Greenhouse gas emissions in Effort Sharing Decision (ESD) sectors



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Greenhouse gas emissions, base year 1990 [T2020\_30], Greenhouse gas emissions in ESD sectors [T2020\_35]

### 13.8.2 Renewable energy sources

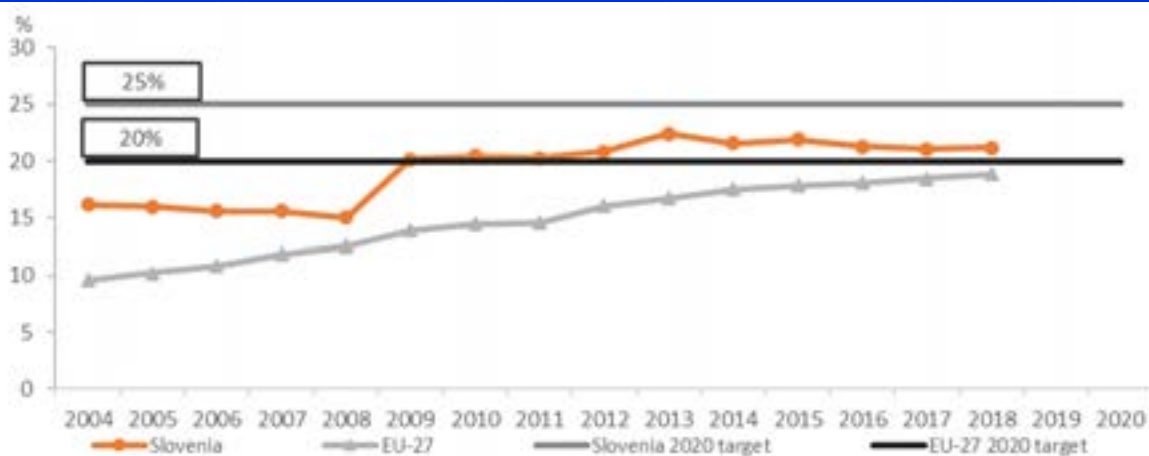
The following targets are set for Slovenia regarding the share of energy from renewable energy sources in gross final energy consumption:

- a 20% share of gross final energy consumption by 2020,
- a 25% national target for share of energy from renewable sources in gross final consumption of energy in 2020.

The share of energy from renewable energy sources in Slovenia is above EU wide but below the country specific one.

Item 297: Share of energy from renewable energy sources in gross final energy consumption in Slovenia

Share of energy from renewable energy sources in gross final energy consumption in Slovenia in 2005-2018 and targets for 2020



Source: Eurostat data for 2018, extracted in 2020. Detailed references: Share of energy from renewable sources [nrg\_ind\_ren]

### 13.8.3 Energy efficiency

The energy efficiency target set for Slovenia are respectively:

- Primary Energy Consumption in 2020: 7.3 Mtoe
- Final energy consumption in 2020: 5.1 Mtoe

Following the information provided in Item 298 the results for 2018 are below the targets in both criteria, respectively +8.6% of primary energy consumption and 2.4% of final energy consumption.

## Item 298: Energy efficiency target data for Slovenia

Primary energy consumption and final energy consumption in Slovenia in 2005-2018 and targets for 2020

Ratio of primary energy consumption to target for 2020 and final energy consumption to target for 2020 in Slovenia, EU-11, EU-14 and EU-27 in 2018



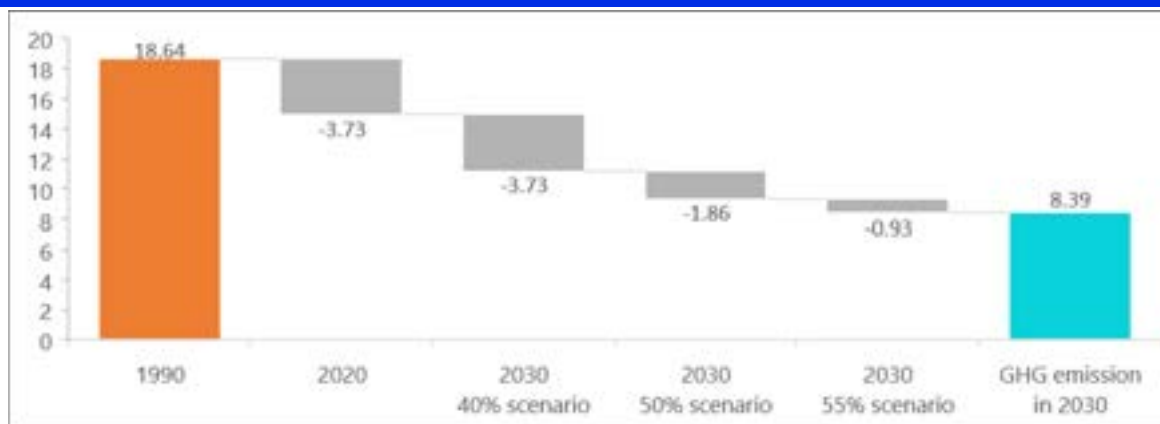
Source: Eurostat data for 2018, extracted in 2020. Detailed references: Primary energy consumption - Primary energy consumption (Europe 2020-2030) (PEC2020-2030), final energy consumption - Final energy consumption (Europe 2020-2030) (FEC2020-2030). EU-11 and EU-14 data estimated based on Eurostat data

### 13.9 Review of potential impact of Green Deal propositions

At the current stage of discussions regarding European Green Deal only partial information are available regarding the future targets. EU is proposing to increase the greenhouse gas emission reduction to 50% or 55% for 2030. This is a proposition included in the draft proposal of "Climate Law". Assuming the Slovenia greenhouse gas emissions in 1990, an estimation of EU 2030 target emissions can be drafted. The 2020 target of 20% reduction resulted in 3.73 Mt CO<sub>2</sub> emission drop. Further increase of the target to 40% in 2030 require additional 3.73 Mt CO<sub>2</sub> reduction. If the 50% target proposed under European Green Deal is applied then additional 1.86 Mt CO<sub>2</sub> emission decrease is needed, or 2.79 Mt CO<sub>2</sub> decrease, if 55% target is adopted. Therefore, the reduction required by Slovenia up to 2030 could be higher than the one planned for 2020. Considering the different starting point (in 1990 Slovenia was starting economic reforms after collapse of communist system), the effort needed to achieve the 50% can be higher than the one to achieve 2020 targets.

Item 299: Estimation regarding greenhouse gas emissions in Slovenia under different scenarios (Mt CO<sub>2</sub>)

Estimation regarding greenhouse gas emissions in Slovenia under different scenarios (Mt CO<sub>2</sub>)



Source: Eurostat data for 2018, extracted in 2020. Estimations delivered by the Author

Nevertheless, it is worth to highlight that, if the current structure of greenhouse gas emissions target is maintain, then the 50% target for 2030 is an EU wide target. It is not a binding element for specific countries. Country specific targets could be expected as per ESD and ESR but there is no way to anticipate the potential targets.

At the same time, the review of key EU regulations in climate and energy as:

- Emissions Trading System Directive;
- Effort Sharing Regulation;
- Land use, land use change and forestry Regulation;
- Energy Efficiency Directive;
- Renewable Energy Directive;
- CO<sub>2</sub> emissions performance standards for cars and vans
- Energy Taxation Directive

can bring some additional targets in area of share of energy from renewable energy sources and energy efficiency. For the moment, any estimation of potential targets is not available nor possible to estimate.



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