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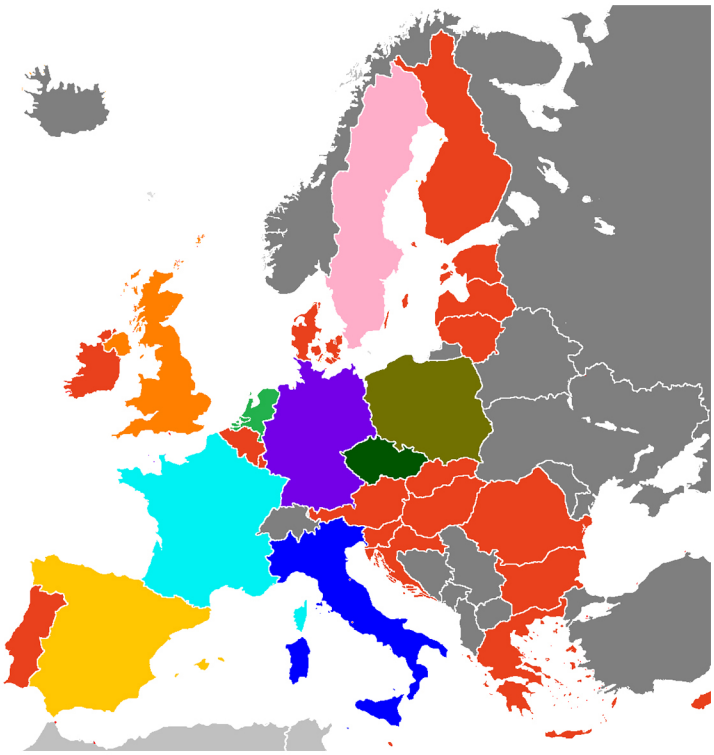
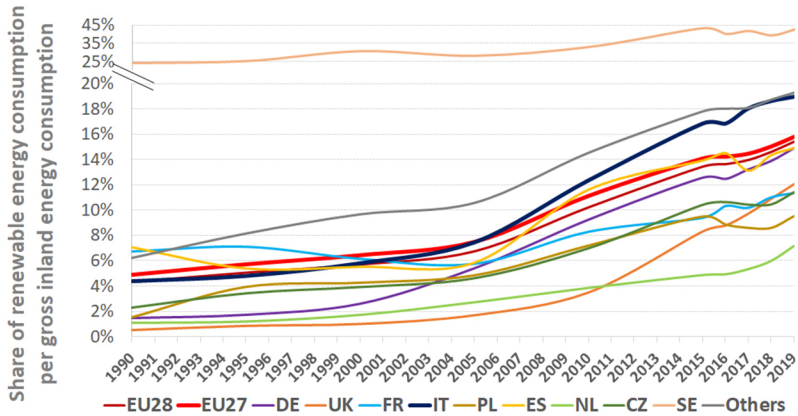
Efficiency and decarbonization indicators for total energy consumption and power sector

Comparison among Italy and the biggest European countries





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RAPPORTI

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"La mia ansia che il presente diventasse subito passato perché potessi amarlo e vagheggiarlo a mio agio era anche sua, tale e quale. Era il nostro vizio, questo: d'andare avanti con le teste sempre voltate all'indietro."
Giorgio Bassani, *Il giardino dei Finzi-Contini,* 1962.

"…to be efficient it was necessary to be able to learn from the past, which meant having a fairly accurate idea of what had happened in the past."
George Orwell, *1984*, 1949

"Que sera, sera
Whatever will be, will be
The future's not ours to see
Que sera, sera…"
Ray Evans and Jay Livingston, *Que sera, sera (Whatever Will Be, Will Be)*, 1956.

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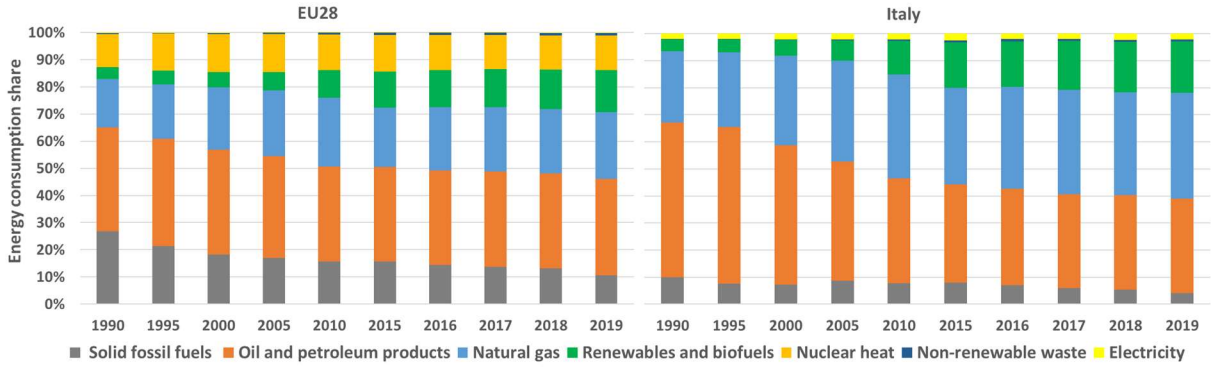
EXECUTIVE SUMMARY

Efficiency and decarbonization indicators

Comparison of decarbonization and efficiency indicators is carried out among Italy and the largest European countries. The EU Member States with more than 3% of EU28 GHG emissions or more than 3% of EU28 GDP in 2019 are considered for comparison. The Member States examined (Germany, United Kingdom, France, Italy, Spain, Poland, the Netherlands and Sweden) represent 77.9% of the population in EU28 in 2019. In terms of GHG emissions, they account for 78.2% of EU28 emissions, GDP represents 82.4% of EU28 GDP. The gross inland energy consumption accounts for 79.1% of the energy consumption of EU28.

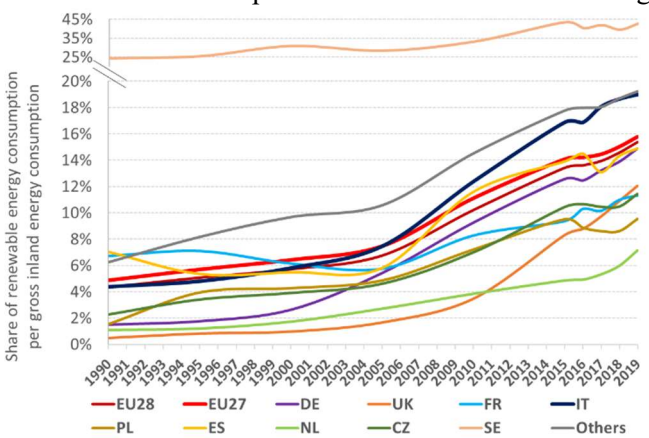
Since 1990, European environmental policies have led to a significant change of the energy mix in the Member States. The nuclear energy represents 12.8% of EU28 gross inland consumption in 2019 (13.5% in EU27). Solid fuels energy faces significant contraction since 1990, although there are still in 2019 significant shares in some of the largest States such as Germany (7.6%), Poland (42.2%) and Czechia (33.1%). Oil and petroleum products, on the other hand, show a modest reduction at European level (from 38.3% in 1990 to 35.4% in 2019) with different trends among the States. Natural gas energy consumption shows a considerable increase in almost all States and at EU28 level ranges from 17.8% in 1990 to 24.6% in 2019. As concerns renewable energy, there has been a significant increase in EU28 from 4.3% in 1990 to 15.4% in 2019 (from 4.9% to 15.8% in EU27).

The Italian share of gross inland consumption of solid fuels, mainly coal, decreased from 9.9% in 1990 to 4.2% in 2019 with an acceleration in the last years. EU28 share decreased from 26.7% to 10.7%.



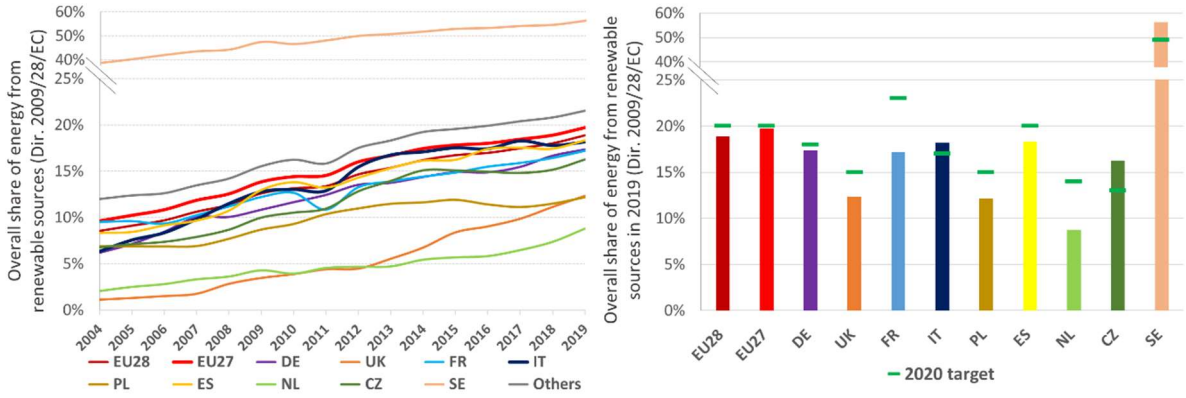
On the other hand, the share of natural gas for Italy goes from 26.3% to 39.2% from 1990 to 2019, and the EU28 average goes from 17.8% to 24.6%. Italy has contracted the share of oil and petroleum products from 57.3% to 34.8% while EU28 share decreased from 38.3% to 35.4%. Italian renewable share grew from 4.4% to 19%, EU28 share grew from 4.3% to 15.4%. Italy's renewable share in 2019 is among the highest in the countries examined, only Sweden's share is higher than the Italian one.

The share of fossil fuels is significantly reduced in almost all European countries. The EU28 average decreased from 83.1% in 1990 (81.9% for EU27) to 71.6% in 2019 (70.6% for EU27). Among the examined countries, the Netherlands share is still higher than 90% in 2019, while Poland share is just under such threshold. Among the biggest countries, Italy has the largest reduction of fossil share (-14.7 percentage points), exceeded only by Czechia (-17.7).

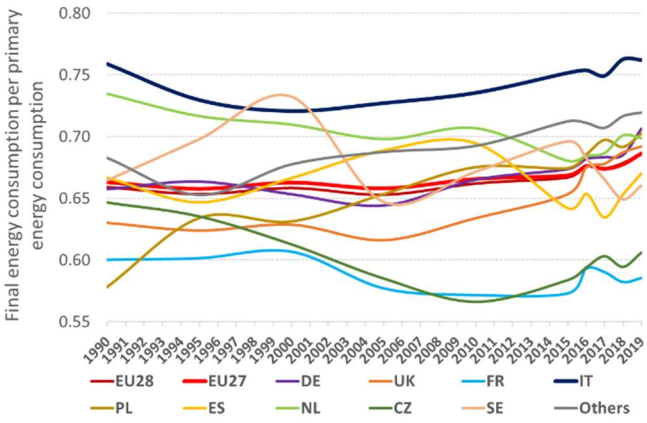


The overall share of renewable energy consumption according to European Directive 2009/28/EC in 2019 for Italy is 18.2%, over the target of 17% to be

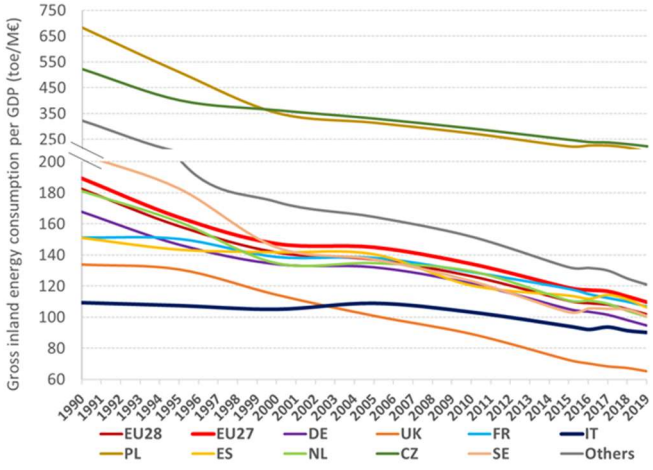
achieved in 2020. Among the countries examined only Italy, Czechia, and Sweden has already achieved their targets.



The ratio between the final energy consumption (including non-energy uses) and gross inland consumption is an indicator of energy efficiency. This indicator has always been higher for Italy than for the European average and shows values which, among the biggest countries, are comparable only with those of the Netherlands. Since 1990 the ratio for Italy has been around the average of 0.76, while both for EU28 and EU27 the average is 0.69. To evaluate energy transformation efficiency, it is useful to consider energy consumption without non-energy uses. In other words, the ratio between final energy consumption and primary energy. The Italian energy transformation efficiency is higher than any other countries examined.



The gross inland energy consumption per unit of gross domestic product is an indicator of the country's economic and energy efficiency (energy intensity). Italy was one of the European countries with lower energy intensity until 1995, when it was behind only to Denmark, then lost positions to reach 6th place in 2019. Among the biggest European countries, Italy, after the United Kingdom, continues having the lowest energy intensity.



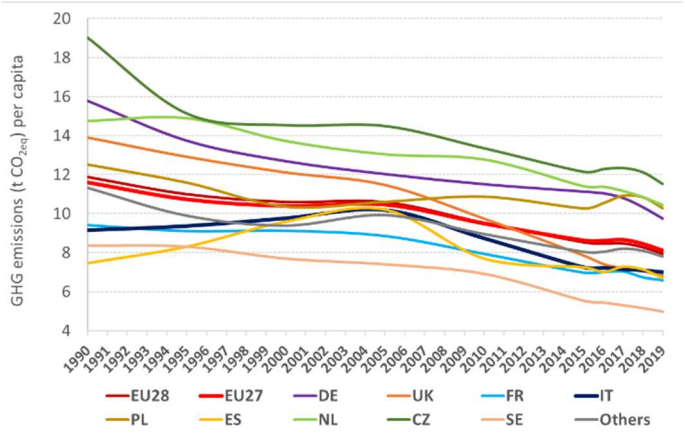
The final energy intensity (the ratio between final energy consumption including non-energy uses and gross domestic product) follows similar trends to energy intensity with a sudden reduction in the European countries which, starting from higher levels than Italy, reach Italian figures and in some cases exceed them. Since 1990 Italy shows considerable energy and economic efficiency, the final energy intensity reduced by 18% from 1990 to 2019; much higher reductions have occurred in the other European countries (-42.1% in EU28 and -40.3% in EU27). The reasons for the reduction in energy intensity observed are manifold such as the increase in building efficiency, industrial conversion (France and Germany), the high rate of electrification of final consumption (France) and the considerable shift of economic sectors towards high value added and low energy consumption activities of services to the detriment of industrial sectors (France and the United Kingdom).

European countries show a wide range of electrification of final energy consumption (energy uses only) in 2019 ranging from 14.5% in Luxembourg to 39.2% in Malta. Italy is just below the European average (22.6% EU28 and 22.8% EU27) with 22.2%. Among the biggest countries, France shows the highest levels of electrification (26.6% in 2019), followed by Spain (24.7%), while Czechia and Poland have the lowest values, 20.7% and 17.5% respectively. Sweden, after Malta, has the highest electrification of final energy consumption (34.2%).

At sectoral level, the Member States' electrification of final energy consumption shows fairly different figures although with a common growing trend. The electrification of industry final consumption in Italy is among the highest in Europe (41.2% in 2019). Services show the highest percentages of electrification of final energy consumption among sectors. The Italian share in 2019 is 42.2%, well below the European average (48% in EU28, 48.8% in EU27). The Italian electrification share in households (18.1% in 2019) is well below the European average (24.5% in EU28, 24.7% in EU27) and, after Poland (13.9%), it is the lowest value among the biggest countries. The transport sector shows the lowest percentages of electrification and in 2019 Italy is one of the three European countries with the highest share (2.8%), after Sweden (3.4%) and Austria (3.2%).

The Italian share of energy from renewable sources in gross electricity consumption is 34.8% in 2019, higher than the indicative target of 26.4% set by the National Renewable Energy Action Plan (2010).

The average of Italy's GHG emissions per capita from 1990 to 2019 is 8.9±1.1 t CO_2eq (ISPRA, 2021). Emissions per capita increased until 2004 when the maximum value of 10.2 t CO_2eq was reached, then a reduction of up to 7 t CO_2eq was observed in 2019. Italian emissions per capita have always been below the European average.



As for carbon intensity related to energy consumption all countries have reduced the GHG emissions per unit of gross inland energy consumption. Carbon intensity of Italy is higher than the European average, also for the contribute of nuclear power in Europe. By removing nuclear power from gross inland consumption, Italy's figures are below the European average. Among the biggest countries, the United Kingdom shows values reaching in recent years those recorded for Italy, while only the Netherlands and Sweden have lower values than the Italian ones.

The ratio between GHG emissions and gross domestic product is the carbon intensity related to economy. This indicator shows a reduction for all European countries and Italy's figures are just below the EU28 average in 2019.

The trends of indicators such as greenhouse gas emissions per capita, energy and economy carbon intensity show that the biggest countries are gradually moving closer to the Italian values and in some cases such values have been exceeded.

The indicators show that Italy, compared to the biggest EU Member States, has historically high energy and economy efficiency with a significant share of renewable energy and natural gas in the energy mix, and one of the lowest emissions per capita in Europe. The energy intensity per unit of GDP in Italy is, among the biggest countries, higher only to that of the United Kingdom, while the carbon intensity per unit of GDP is higher than those of the Netherlands, France, the United Kingdom and Sweden. The carbon intensity per unit of energy consumed without the nuclear power is, among the biggest countries, higher only than those of the Netherlands and Sweden and comparable with that of the United Kingdom. Although some indicators show that many countries have improved their greenhouse gas emission performance, sometimes achieving better results than Italy, the following factors need to be considered:

- countries with high shares of solid fuels or oil and petroleum products have greater potential for reducing emissions from fossil fuels than those available in Italy, where the fossil mix is mainly represented by natural gas;
- in several countries there is a significant contribution of nuclear power with emissive advantages, a source of energy which is not without controversy and which some countries intend to phase out gradually (Germany, Belgium);
- the emissive performance of a country depends closely on its economic structure. Countries with a predominance of productive activities in the service sector or with significant shares of non-energy consumption, such as the Netherlands, show lower emissions per GDP and energy consumed.

The biggest European countries have very different contributions from international bunkers with regard to GHG emissions. The GHG emissions from such sectors are relevant in some countries. The average share in total emissions with bunkers in 2019 is 7.3% in EU28 and, for the biggest countries, it ranges from 1% in Poland and Czechia to 21.8% in the Netherlands.

The gross available energy, which include the contribution of international bunkers, per unit of GDP highlights the different role of international bunkers energy consumption and shows that Italy's values were the lowest among the largest countries up to 2003 when only the United Kingdom reached the lowest values.

With regard to the GHG emissions per unit of gross available energy, the contribution of nuclear power appears to be decisive for the reduction of carbon intensity. Energy emissions per unit of gross available primary energy without nuclear energy shows that Italy's figures are below the values recorded for the other countries, except for Sweden.

The comparison of efficiency and decarbonization indicators at sectoral level among Member States shows a rather heterogeneous situation. As for industry in Italy, the final energy intensity, final energy consumption by value added, have been comparable to those of Germany since 2005, although lower. Among the biggest European countries, only the United Kingdom shows lower values than the Italian ones. Among the countries examined the Netherlands shows the highest energy intensity for industry.

In commercial and public services Italy shows a countertrend of energy intensity from that of other European countries in recent years. In particular, in the last years, the accounting of energy consumed by heat pumps since 2017 has increased the sector energy intensity. The average annual rate of energy intensity from 2005 to 2019 shows an increase of 0.9% for Italy against a decrease of -1.5% in the European average.

The agriculture sector shows a general decrease in energy intensity with an annual average rate of -0.5% since 2005 in EU28. The Italian energy intensity is among the lowest in Europe and in 2019, among the main European countries, it is comparable to those recorded for Spain and the United Kingdom.

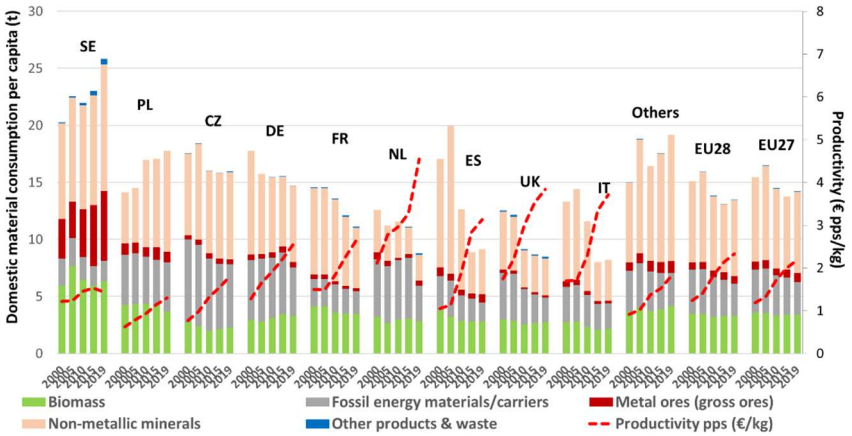
In the household sector, since 2005 the countries examined show higher reductions of energy consumption per unit of GDP than Italy (from -1.3% per annum in Spain to -4.4% per annum in Poland *vs* -0.6% per annum in Italy). The values and trends of Italy's energy intensity for transport are broadly comparable to those of the European average with an average annual rate decrease of -1.1% since 2005.

Among the biggest countries, the Italian industry has carbon intensities only higher than those of the United Kingdom, Sweden, and Germany, although in recent years the Italian and German figures are very close. For agriculture, the Italian carbon intensity is among the lowest in Europe, after Malta and Greece. The European average is more than double the Italian intensity.

On the other hand, the civil sector (households and services) in Italy shows wide room for improvement and, among the biggest countries, the carbon intensity is lower only than that registered in Czechia and Poland. The Italian civil sector therefore shows very wide emission reduction potentials, especially considering the sectoral electrification of final consumption in 2019 that is among the last in EU28 (households: 18.1% *vs* 24.5%; services: 42.2% *vs* 48%).

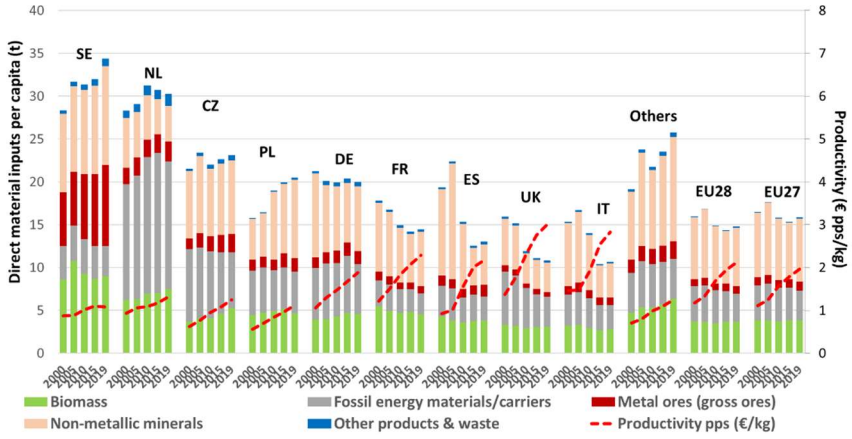
Indicators of *direct material inputs (DMI)* and *domestic material consumption (DMC)* describe, in aggregate terms, the direct use and provenance of natural resources and products. The first indicator includes all materials which have an economic value and are used for production and consumption activities and the indicator is calculated as the sum of internal extractions and imports. The second indicator represents domestic consumption of matter in the national economy net of exports and is calculated by subtracting from direct material inputs the share of physical exports.

Since 2000, there has been a general decrease in domestic material consumption per capita of matter in the European countries. In 2019 Italy has the lowest consumption per capita of matter among all European countries. As far as productivity is concerned, there is a general increase from 2000 to 2019, although the absolute values of the countries are very different.



Among the biggest countries, the Netherlands shows the highest value (€ 4.5/kg in 2019), followed by the UK (€ 3.8/kg) and Italy (€ 3.7/kg). Germany and France productivities are € 2.5/kg and € 2.6/kg, respectively.

Direct material inputs represent domestic consumption without exports and it is useful for assessing actual material consumption, including that not used in domestic production and consumption activities and addressed to exports. Sweden and the Netherlands have high share of fossil extraction, biomass, and metal ores destined for exports and shows the highest DMI per capita among the biggest European countries, far above the European average. According also to this indicator, in 2019 Italy recorded the lowest value among all European countries.



As far as productivity is concerned, Sweden in 2019 has the lowest value (€ 1.1/kg) among the countries examined and one of the lowest in Europe. The Netherlands (€ 1.3/kg) has a productivity higher only than that of Poland (€1.0/kg). The United Kingdom and Italy have the highest productivity in Europe, with € 3/kg and € 2.8/kg respectively, followed by France (€ 2.3/kg).

Although productivity provides information on the economic efficiency of a system as a whole, it is nevertheless necessary to consider that efficiency depends not only on maximizing the performance of the material used but also on structural factors. In this sense, the production structure of a country plays a decisive role as concerns the material consumption. A service-based economy will have lower material consumption than an economy based more on manufacturing industry. Industrial activities are more energy-intensive than service activities. This is true to a greater extent for the material consumption which is the subject of extraction and transformation of industrial activities.

The sectoral breakdown of domestic material consumption and direct material inputs shows that Italy, despite having a higher share of industrial value added than France and Spain, has a higher

productivity of resources, a clear result of greater efficiency in the use of resources, especially in the industrial sector. This result is in line with what was seen for energy intensity indicators.

The trend of *kaya identity* parameters for EU28 and EU27 show that the sharp reduction of GHG emissions since 2005 corresponds mainly to a decrease of driving factors such as final energy consumed per unit of GDP and share of renewable energy consumed. The other factors (efficiency and carbon intensity) show lesser decreases, while the population and GDP per capita are the factors with increasing trend. Each country shows some degree of decoupling between GHG emissions and GDP per capita, although with a wide range and much differentiated role of driving factors. Higher decoupling is observed for those States where the GDP per capita has a growing trend.

Among the countries examined, Italy is the only State in which GDP per capita is below the level of 2005 up to 2019, although a growing trend is observed since 2016. Such factor in Italy contributes for its share to the reduction of GHG emissions. In the other States, there is evidence of a greater decoupling of economic growth and GHG emissions. Poland shows the highest distance between the two parameters.

The decomposition analysis allows to quantify the contribution of each driving factor. The decomposition analysis shows that in Italy, the population is the only factor that has contributed to the growth of GHG emissions (+2.8%). The remaining factors have led to the reduction of emissions from 2005 to 2019. Among these, the final energy intensity (final energy consumption / GDP; -12.4%) and the share of renewable energy (fossil energy consumption / gross inland energy consumption; -11.4%) played a significant role together with the efficiency (final energy consumption/ gross domestic consumption; -3.7%), and GDP per capita (-3.4%). The carbon intensity played a minor role (-0.8%). The contribution of all factors leads to the reduction of GHG emissions over the period 2005-2019 of -29%.

In summary higher decoupling between economy and GHG emissions has been registered in every country than that recorded in Italy and the reduction of economic activities played a role to decrease the emissions in Italy. However, it should be considered that decoupling does not necessarily correspond to a reduction in emissions in line with the targets to be achieved by 2020. According to EEA (2020), among the largest countries, France, Italy, the Netherlands, Spain, Sweden and the United Kingdom had already achieved their 2020 GHG reduction target from the Effort Sharing sectors, while Germany, Poland, and Czechia, had 2019 Effort Sharing emission levels (proxy EEA) greater than their respective annual emission allocations; as for the renewable target, France, Germany, Netherlands, Poland, Spain, and United Kingdom do not meet in 2019 (proxy EEA) the renewable share targets outlined in their national renewable energy action plans; as for efficiency target, only Italy, the Netherlands, and Spain have sufficiently reduced their final energy consumption in 2019 (proxy EEA). Moreover, it should be emphasized that the analysis of the decomposition focuses on the relative variations of the parameters without assigning any weight to the respective starting points of the same. As already mentioned, the economic and energy efficiency of the Italian system is among the highest in Europe. *The 2018 International Energy Efficiency Scorecard,* issued by the *American Council for an Energy-Efficient Economy* (ACEEE), assigns the first position to Italy, together with Germany among 25 nations globally, with scores assigned according to quantitative and qualitative parameters, including efficiency indicators and policies aimed at reducing consumption.

Power sector

The electricity sector is one of the largest GHG emission sources in Europe. The sector's GHG emissions in 2005 in EU28 were around 33% of the energy emissions and about 26% of total emissions with a sharply decreasing share to 26% and 20% in 2019, respectively. The electricity sector is therefore one of the main objectives of the measures aimed to decarbonize the economy, both for the amount of emissions and for the potential for deployment of renewable energy sources. The countries examined for comparison with Italy account for 80.2% of EU28 and 77.6% of EU27 gross electricity production in 2019.

In 1990 the installed capacity in EU28 consisted mainly of thermoelectric plants (more than 57%), nuclear (21%) and hydroelectric (21.6%). Wind and photovoltaic sources constituted a marginal share. In 2019 the installed capacity was 43% for thermoelectric, 11.4% for nuclear, 14.8% for hydroelectric, 18.2% for wind, and 12.5% for photovoltaic. The total installed capacity increase of 38.5% in 2019 compared to 2005, from 758 GW to 1,050 GW. The nuclear capacity is the only one with a relevant reduction, from 135 GW to 119.2 GW (-11.7%).

There is considerable heterogeneity of power capacity among countries. In Poland, there is a clear prevalence of thermoelectric plants. The nuclear plants, which are not present in Italy and Poland, make up a significant share of the capacity in France, Sweden, and Czechia, although the shares of other countries are not negligible. Since 1990, hydroelectric capacity has accounted for a considerable proportion of traditional renewable sources in Spain, France, Italy and Sweden. In all the countries examined, the share of thermoelectric and nuclear capacity shows a considerable contraction. Wind power has increased in all countries since 2005. Photovoltaic plants begun to have significant shares only after 2005.

Gross electricity production in Europe has shown a marked increase compared to 1990 and a relative stability in recent years. In 2019, 14.3% of EU28 electricity production without pumping comes from solid fuels and 21.8% from natural gas. Oil and petroleum products account for 2%. Nuclear source accounts for 25.6% and 34.3% comes from renewable energy.

The energy mix in the examined countries is quite heterogeneous, mainly as far as fossil fuels are concerned. In 2019, solid fuels make up 72.4% of electricity production in Poland, 44.6% in Czechia, and 28.4% in Germany. Even more interestingly, 52.7% of electricity production from solid fuels originates from lignite in EU28. Germany, Poland, and Czechia are the main countries that use this fuel for electricity production and account collectively for 78.7% of the EU28's electricity production by lignite (46.7% Germany, 17.5% Poland, and 14.6% Czechia). The group of other countries accounts collectively for the remaining 21.3% (mainly Bulgaria, Greece, and Romania). The electricity produced from lignite in Germany, Poland and Czechia is 65.7%, 35.7%, and 94.2% of electricity from solid fuels respectively.

France and Sweden are characterized by low production of non-nuclear power plants, 11.1% in France and 9.7% in Sweden of the total electricity production without pumping in 2019. In France, electricity production from nuclear power accounts for 70.5% of total production, while in Sweden nuclear power plants provide 39.3% of electricity. Czechia has also a relevant share of electricity from nuclear power plants (36.1%). Among the countries examined Poland and Italy do not have nuclear power plants, while in the Netherlands the electricity from nuclear source accounts for 3.2%. In the other countries the share ranges from 12.4% in Germany to 21.5% in Spain. At European level, the nuclear source provides more than a quarter of electricity production.

In Italy and the United Kingdom, natural gas determines 48.5% and 40.6% of total electricity production respectively. Both countries have shown a conversion of their thermal power plants since 1990 with a sharp contraction of oil and petroleum products (Italy) and solid fuels (the United Kingdom), with the expansion of natural gas at the same time. A significant contraction of solid fuels is also observed in all countries although some countries as Germany, Poland, and Czechia still have relevant shares of solid fuels.

As regards electricity production from renewable sources, the share has increased from 12% to 34.3% in EU28 since1990. In all the countries examined there is a marked increase of renewable electricity production with a strong acceleration since 2005. After 2015 the growth slowed down and has resumed in recent years although with different rates among the States. Sweden has one of the highest renewable shares in Europe. The Italian figure is higher than the European average and Italy’s renewable share of electricity is one of the highest among the biggest countries. Among such countries only Sweden has a much higher share and Germany’s share exceeded the Italian one only in 2019 (39.7% in Italy and 40.2% in Germany).

The renewable share for the achievement of the European targets, in accordance with the Directive 2009/28/EC, refers to gross inland consumption of electricity, i.e. electricity production without electricity from pumping plus the net import of electricity. The renewable share thus calculated

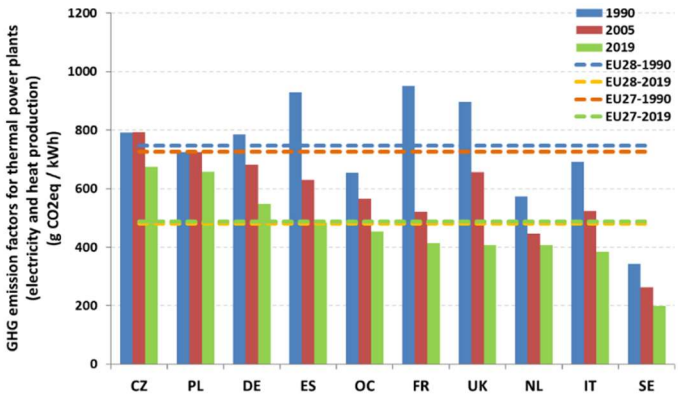
will therefore be lower for importing countries when compared with the renewable share of electricity production. This shows that electricity importing countries, such as Italy, face a relatively greater effort than exporting countries to achieve their renewable targets in the electricity sector.

The most important parameter for assessing the efficiency of an electricity generation system is the transformation efficiency of fuels into electricity and heat. The electrical efficiency of Italian non-cogeneration plants (0.46 in 2019) is among the highest in the biggest European countries after the United Kingdom (0.47) and the Netherlands (0.51). In 2019, the Italian average is higher than the EU28 average (0.43). As concerns the electrical efficiency of CHP plants, in 2019 Spain shows the highest value among the main European countries (0.66), far higher than the EU28 average (0.38). Italy's efficiency is 0.39. The total efficiency of the Italian cogeneration plants (0.61) is below the EU28 average (0.65) and increased of 23.1% since 1990.

In 2019 the total efficiency of Italian plants is 0.55, just a little higher than the EU28 average (0.53). The Italian electrical efficiency is 0.42, exceeded by Spain (0.48), the Netherlands (0.48) and the United Kingdom (0.47). Electrical efficiency of the examined countries shows a wide range, from 0.24 in Sweden to 0.48 in the United Kingdom with the EU28 average at 0.40.

In order to compare the GHG emission factors for the electricity sector in different countries the Tier 1 approach has been adopted to estimate the GHG emissions. GHG emissions from the 28 European countries for the production of electricity and heat are 925.2 Mt CO_2eq in 2019, 37.3% lower than 1990 level and 36.9% lower than 2005 level. Since 2005 a significant reduction of GHG emissions in the electricity sector begun to take place. Overall, in 2019 GHG emissions from power sector in the selected countries (741.8 Mt CO_2eq) account for 80.2% of EU28 emissions. Italy accounts for 10.6% of Europe's emissions. GHG emissions for electricity production have been estimated after unbundling the fuel energy consumption for heat production in CHP plants. EU28 emissions in 2019 are 778.7 Mt CO_2eq and the countries examined account for 81% of total emissions.

At EU28 level there has been a decoupling since 1990 between electricity production and GHG emissions. However, emissions show a significant decrease only after 2005, leading to the increase of the decoupling mainly due to the increasing share of renewables. Decoupling is evident in almost all countries although with different dynamics.



GHG emission factors for electricity and heat production due to fuel combustion in thermal power plants reduced since 1990. In 2019 the emission factor in Italy (384.4 g CO_2eq/kWh) is higher than that of Sweden (198.2 g CO_2eq/kWh), where the thermal power plants are mainly fuelled by bioenergy. The United Kingdom has the largest reduction since 2005 (-37.8%), followed by Italy (-26.7%) and Sweden (-24.5%). Germany reduced the emission factor by 19.6%. The lowest percentages of reduction were recorded in the Netherlands (-8.8%) and Poland (-9.2%).

The emission factors for electricity and heat production by the whole electricity sector, including renewable and nuclear power production, in Italy are higher than the European average. The average EU28 emission factor in 2019 (253 g CO_2eq/kWh) shows a reduction of 34.3%, compared to the 2005 level, while the Italy reduced its emission factor (278.6 g CO_2eq/kWh) by 39.1%.

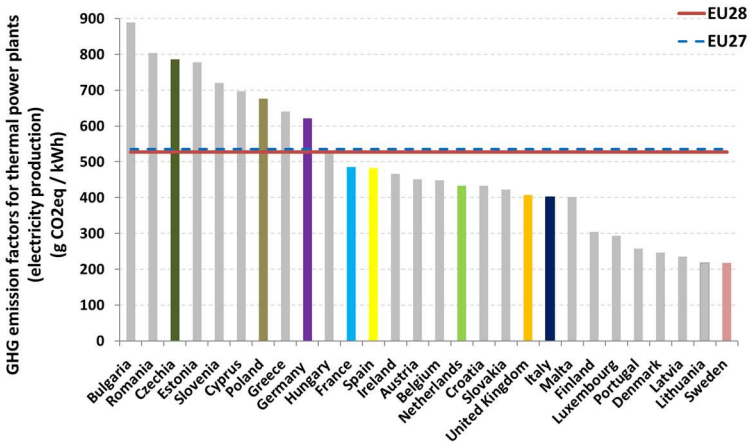
Countries with a significant share of electricity from nuclear power and renewable sources have a benefit in terms of emissions per unit of electricity produced. France has a relevant amount of energy from nuclear power plants, which allows the emission factor to be drastically reduced as compared to thermal plants. Sweden, Czechia, Spain, Germany and the United Kingdom also have not insignificant shares of nuclear power (from 12.4% in Germany to 39.9% in Sweden). The Netherlands electricity production from nuclear power plants is 3.2%, while Italy and Poland do not have this item.

Overall, nuclear electricity in EU28 was 25.6% in 2019, down from 30.9% in 1990. In 2019, 83.9% of EU28 nuclear electricity comes from the countries examined, with France accounting for 48.6%.

Italian emission factor for electricity production by thermal plants in 2019 (402.1 g CO_2eq/kWh) is second only to that of Sweden (217.9 g CO_2eq/kWh), where the share of bioenergy in the thermoelectric plants is much higher. The Italian factor is well below the EU28 average of 527.7 g CO_2eq/kWh. Czechia, Poland, and Germany have the highest emission factors, from 786.5g CO_2eq/kWh to 621.9 g CO_2eq/kWh, well above the European average.

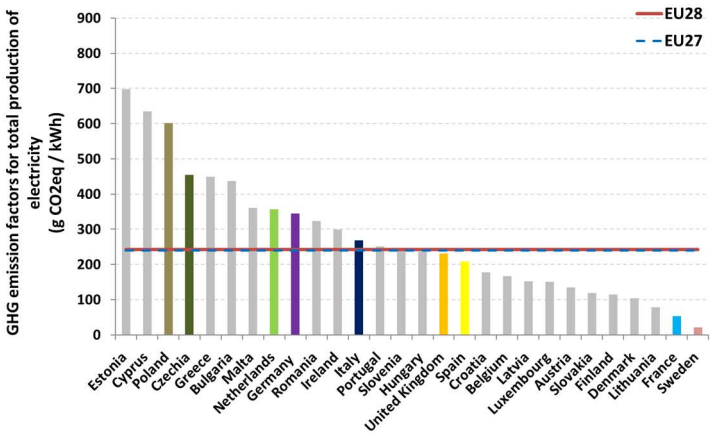
The average European emission factor for total electricity generation has always been lower than the Italian value, thanks in part to the contribution of nuclear electricity. The increasing renewable share of electricity leads to a significant reduction of the emission factors. In addition, the reduction of nuclear electricity share in Europe brings the Italian emission factor closer to the EU28 average. The Italian emission factor in 2005 was greater than the European average of 23.7%, while in 2019 it is greater than 10.6%.

The outcomes concerning the GHG emissions esteems allow to conclude that Italy have one of the lowest GHG emission factor for electricity and heat production by fuel mix combustion among the biggest European countries. The comparison between the share of power sector emissions and the share of electricity production from fuel combustion shows that Germany and Poland have shares for GHG emissions higher than their shares of electricity production. The same pattern is true for Czechia, Sweden, and the group of other countries. The opposite pattern is observed for Italy, the United Kingdom, Spain, the Netherlands, and France.

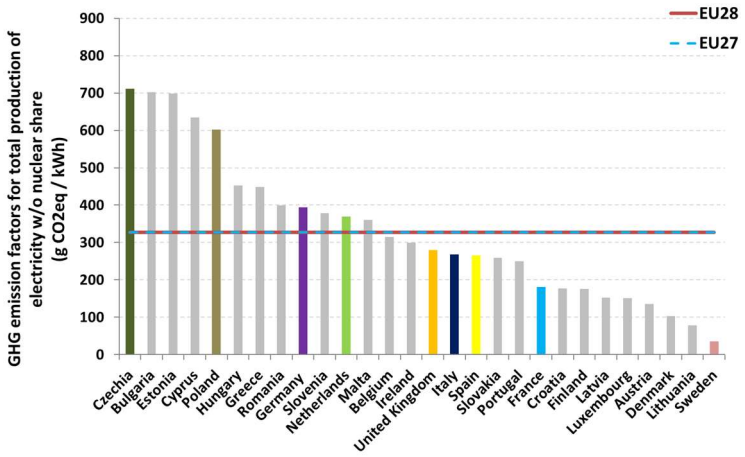


Considering all Member States in EU28, the Italian GHG emission factor for electricity production by thermal plants occupies the 9th position, well below the European average. The Italian fuels mix, with greater share of natural gas than in other countries and the contribution of bioenergy, is a driving factor for the emission factor in thermal power plants.

As for total electricity production, therefore considering the contribution of renewables other than bioenergy and the contribution of nuclear power plants, the Italian emission factor loses positions compared to other countries. Countries with nuclear power plants have a benefit in terms of avoided emissions. The renewable share in Italy is one of the highest in Europe and higher than in Spain, the United Kingdom and France, which nevertheless have significant shares of nuclear energy. In 2019, Italy, after Sweden and Germany, has the highest renewable share of electricity production among the biggest countries. The contribution of nuclear electricity to electricity production in Spain, the United Kingdom, and France played a decisive role in reducing the emission factors of these countries. The effect of nuclear energy is particularly evident for France: although the renewable share of electricity production is much lower than Italy and the emission factor by thermal plants is higher, France has the lowest emission factor for total electricity production in Europe, second only to that recorded for



Sweden. Germany has 12.4% of nuclear electricity and 40.2% of renewable electricity but the relevant presence of solid fuels in the fossil mix (28.4% of electricity production), mainly high-carbon lignite, results into a greater emissive impact of the electricity sector than the Italian one.



The emission factors for electricity generation without the contribution of the nuclear electricity show that in 2019 Italy has higher value than Sweden, France, and Spain among the main European countries. Such indicator removes the effect of nuclear contribute allowing to consider all other factors, such as fuel mix, renewable energy, and transformation efficiency.

As a result of many factors (fuel mix shift, efficiency, share of renewable) Italy reduced the emission factor for electricity and heat production by 51.9% from 1990 to 2019 (39.1% since 2005), against a reduction of 42.4% in Germany (29.3% since 2005) and 16.2% in Poland (15.7% since 2005). The reduction rates in Poland are the lowest among the biggest emitters in Europe. If Germany and Poland had reduced their GHG emission factors since 1990 at the same rate of Italy, it would have led (with the same electricity and heat production) to avoid 94.3 Mt CO_2eq in 2019, about 10% of EU28 emissions from power plants in 2019. The power plants in Germany and Poland are still fuelled by significant shares of high-carbon content solid fuels, such as lignite, and the transition to natural gas has been much slower than in countries as Italy or the United Kingdom.

Heat-only producers

Heat production accounts for a significant share of energy transformation processes. The plants dedicated to the production of heat by district heating and other uses (mainly for industry) consume an important share of the energy in the European balance. In 2019 the energy consumption of plants with only heat production in EU28 was 18.7 Mtoe of which 0.6 Mtoe from geothermal and solar thermal, and 0.2 Mtoe from heat pumps. Bioenergy consumption (5.2 Mtoe in 2019) shows a rapidly growing share: it is more than double the consumption in 2005 and 7.2 times the consumption in 1990.

Total energy consumption in 2019 is much less than that recorded in 1990 and a marked fuel shift has occurred with decrease of solid fuels and, to a greater extent, of oil and petroleum products being replaced by natural gas and bioenergy. The contribution of other renewable sources (more than 90% from geothermal energy and the rest from solar thermal in 2019) and heat pumps recorded a constant increase that, nevertheless, remains marginal on total consumption (4.5% in 2019).

As a result of such fuel shift, GHG emissions registered a sharp decrease by 50% since 1990 due to the decrease in energy consumed (-27.2%) and decreasing GHG emission factor per unit of heat produced (-37.4%). In 2019, EU28 GHG emissions from these plants are 43.6 Mt CO_2eq. Fuel shift and increase of efficiency result in 17.2% reductions in the emission factors from 2005 to 2019 in EU28 (from 289.2 to 239.8 g CO2eq / kWh). Italy's emission factor in 2019 is 21.4% lower than the EU28 average. The relevant solid fuels or non-renewable waste consumption in Poland and Germany results in higher emission factors in 2019, respectively 97.7% and 50.5% higher than the Italian one.

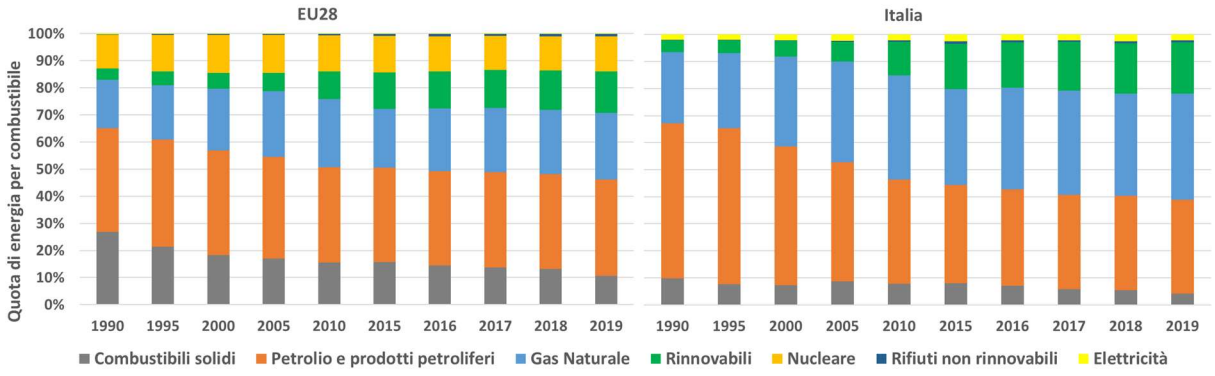
SOMMARIO (Italiano)

Indicatori di efficienza e decarbonizzazione

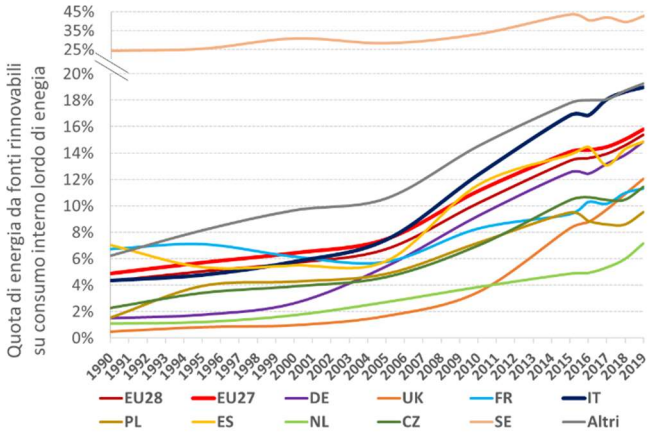
Il rapporto propone il confronto degli indicatori di decarbonizzazione ed efficienza per l'Italia e i maggiori paesi Europei. Gli Stati membri dell'UE28 con oltre il 3% delle emissioni di gas a effetto serra o più del 3% del PIL nel 2019 sono considerati per il confronto. Gli Stati membri esaminati (Germania, Regno Unito, Francia, Italia, Spagna, Polonia, Paesi Bassi e Svezia) rappresentano il 77,9% della popolazione nell'UE28 nel 2019. In termini di emissioni di gas serra, rappresentano il 78,2%, il PIL rappresenta l'82,4%. Il consumo interno lordo di energia rappresenta il 79,1% del consumo energetico dell'UE28.

Le politiche ambientali Europee hanno portato a un cambiamento significativo del mix energetico negli Stati membri fin dal 1990. In Europa l'energia nucleare rappresenta il 12,8% del consumo interno lordo dell'UE28 nel 2019 (13,5% nell'UE27). Il consumo di energia da combustibili solidi subisce una contrazione significativa dal 1990, anche se nel 2019 vi sono ancora quote significative in alcuni dei maggiori Stati come Germania (7,6%), Polonia (42,2%) e Cechia (33,1%). Il petrolio e i prodotti petroliferi, invece, mostrano una modesta riduzione a livello Europeo (dal 38,3% del 1990 al 35,4% del 2019) con tendenze diverse tra gli Stati. Il consumo di energia da gas naturale mostra un notevole aumento in quasi tutti gli Stati e a livello di EU28 varia dal 17,8% nel 1990 al 24,6% nel 2019. Per quanto riguarda le energie rinnovabili, vi è stato un aumento significativo del consumo interno lordo nell'UE28 dal 4,3% nel 1990 al 15,4% nel 2019.

La quota italiana del consumo interno lordo di combustibili solidi, principalmente carbone, è scesa dal 9,9% nel 1990 al 4,2% nel 2019, con un'accelerazione negli ultimi anni. La quota dell'UE28 è scesa dal 26,7% al 10,7%. D'altra parte, la quota di gas naturale per l'Italia passa dal 26,3% al 39,2% dal 1990 al 2019 e la media dell'U28 passa dal 17,8% al 24,6%. L'Italia ha ridotto la quota di petrolio e prodotti petroliferi dal 57,3% al 34,8% mentre la quota UE28 è scesa dal 38,3% al 35,4%. La quota italiana di rinnovabili è cresciuta dal 4,4% al 19%, la quota UE28 è cresciuta dal 4,3% al 15,4%. La quota rinnovabile in Italia nel 2019 è tra le più alte nei paesi esaminati; solo la Svezia ha una quota superiore.

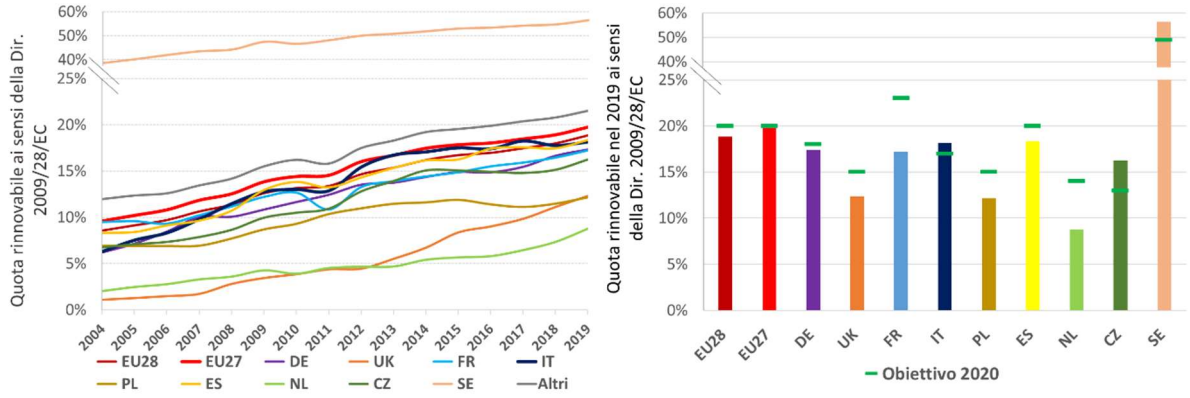


La quota di combustibili fossili è significativamente ridotta in quasi tutti i paesi Europei. La media dell'UE28 è scesa da 83,1% nel 1990 a 71,6% nel 2019. Tra i paesi esaminati, i Paesi Bassi hanno una quota superiore al 90% nel 2019, mentre la quota della Polonia è appena al di sotto di tale soglia. Tra i paesi più grandi, l'Italia ha la maggiore riduzione della quota fossile, superata solo dalla Cechia.

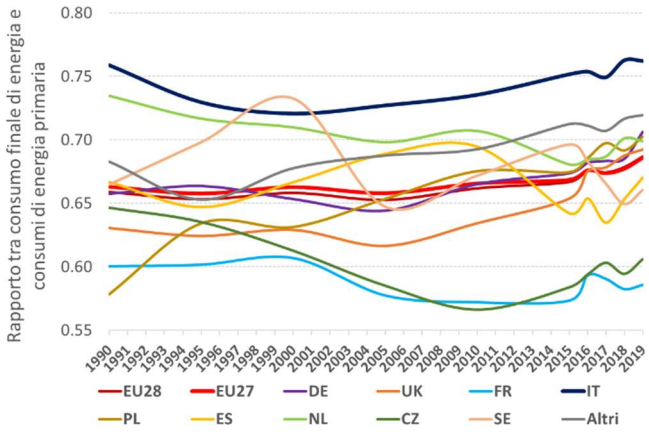


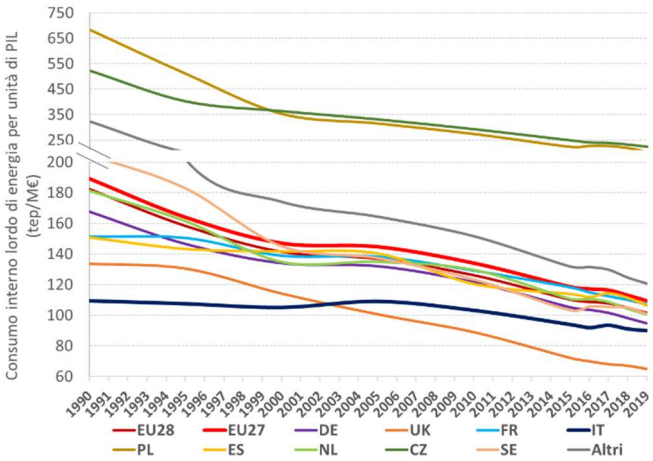
La quota complessiva del consumo di energia rinnovabile ai sensi della Direttiva Europea 2009/28/CE nel 2019 per l'Italia è del 18,2%, rispetto all'obiettivo del 17% da

raggiungere nel 2020. Tra i paesi esaminati solo l'Italia, la Cechia e la Svezia hanno già raggiunto i loro obiettivi.



Il rapporto tra il consumo finale di energia (compresi gli usi non energetici) e il consumo interno lordo è un indicatore dell'efficienza energetica. Questo indicatore è sempre stato più elevato per l'Italia che per la media Europea e mostra valori che, tra i paesi più grandi, sono comparabili solo con quelli dei Paesi Bassi. Dal 1990 l'indicatore per l'Italia è stato intorno alla media di 0,76, mentre per l'UE28 la media è di 0,69. Per valutare l'efficienza della trasformazione energetica, è utile considerare il consumo energetico senza usi non energetici. In altre parole, il rapporto tra consumo finale di energia e consumi di energia primaria. L'efficienza della trasformazione energetica italiana è superiore a quella dei paesi esaminati.





Il consumo interno lordo di energia per unità di prodotto interno lordo è un indicatore dell'efficienza economica ed energetica (intensità energetica) del paese. L'Italia è stata tra i paesi Europei con minore intensità energetica fino al 1995, quando era indietro solo alla Danimarca, per poi perdere posizioni fino al 6° posto nel 2019. Tra i maggiori paesi Europei, l'Italia, dopo il Regno Unito, continua ad avere la più bassa intensità energetica.

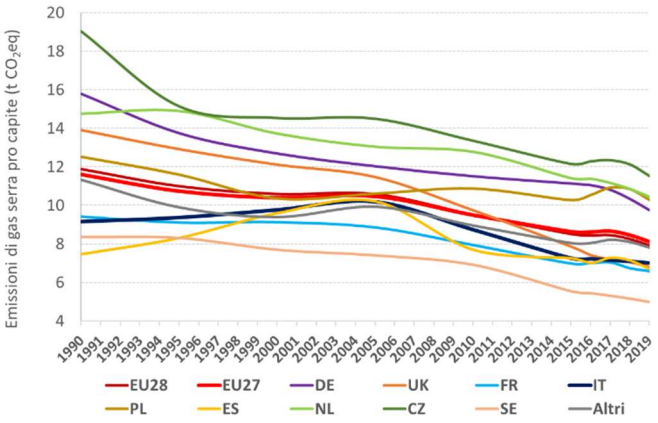
L'intensità energetica finale (rapporto tra consumi energetici finali compresi gli usi non energetici e il prodotto interno lordo) segue tendenze simili all'intensità energetica con una sensibile riduzione nei paesi Europei che, partendo da livelli superiori all'Italia, raggiungono i valori italiani e in alcuni casi li superano. Dal 1990 l'Italia mostra una notevole efficienza energetica ed economica con una riduzione del 18% dell'intensità energetica finale dal 1990 al 2019. Negli altri paesi Europei si sono verificate riduzioni molto più elevate, 42,1% in EU28. Le ragioni della riduzione dell'intensità energetica osservata sono molteplici, quali l'aumento dell'efficienza edilizia, la riconversione industriale (Francia e Germania), l'elevato tasso di elettrificazione dei consumi finali (Francia) e il notevole spostamento dei settori economici verso attività ad alto valore aggiunto e a basso consumo energetico dei servizi a scapito dei settori industriali (Francia e Regno Unito).

I paesi Europei mostrano un ampio intervallo elettrificazione del consumo finale di energia (solo usi energetici) e nel 2019 vanno da 14,5% del Lussemburgo a 39,2% di Malta. L'Italia è appena al di sotto della media Europea (22,6% UE28) con il 22,2%. Tra i paesi più grandi, la Francia mostra i più alti livelli di elettrificazione (26,6%), seguita dalla Spagna (24,7%), mentre Cechia e Polonia hanno i valori più bassi, rispettivamente 20,7% e 17,5%. La Svezia, dopo Malta, ha la più alta elettrificazione del consumo finale di energia (34,2%).

A livello settoriale, l'elettrificazione dei consumi finali degli Stati membri presenta cifre abbastanza diverse, sebbene con una tendenza comune alla crescita. L'elettrificazione dei consumi finali dell'industria in Italia è tra le più alte d'Europa (41,2% nel 2019). I servizi mostrano le percentuali più elevate di elettrificazione del consumo finale di energia tra i settori. La quota italiana nel 2019 è del 42,2%, ben al di sotto della media Europea (48% nell'UE28). La quota italiana di elettrificazione nel settore residenziale (18,1% nel 2019) è ben al di sotto della media Europea (24,5% nell'UE28) e, dopo la Polonia (13,9%), è il valore più basso tra i paesi più grandi. Il settore dei trasporti mostra le percentuali più basse di elettrificazione e nel 2019 l'Italia è uno dei tre paesi Europei con la quota più alta (2,8%), dopo la Svezia (3,4%) e Austria (3,2%).

La quota italiana di energia da fonti rinnovabili nel consumo lordo di energia elettrica nel 2019 è del 34,8%, superiore all'obiettivo indicativo del 26,4% fissato dal Piano d'azione nazionale per le energie rinnovabili (2010).

La media nazionale delle emissioni pro capite di gas serra dal 1990 al 2019 è 8,9±1,1 t CO_2eq (ISPRA, 2021). Le emissioni pro capite sono aumentate fino al 2004, quando è stato raggiunto il valore massimo di10,2 t CO_2eq. Successivamente le emissioni si sono ridotte fino a 7 t di CO_2eq nel 2019. Le emissioni pro capite in Italia sono sempre state inferiori alla media Europea.



Per quanto riguarda l'intensità di carbonio legata al consumo energetico, tutti i paesi hanno ridotto le emissioni di gas serra per unità di consumo interno lordo di energia. L'intensità di carbonio dell'Italia è superiore alla media Europea, anche per il contributo dell'energia nucleare in Europa. Eliminando l'energia nucleare dal consumo interno lordo, le cifre dell'Italia sono inferiori alla media Europea. Tra i paesi più grandi, il Regno Unito mostra valori che raggiungono negli ultimi anni quelli registrati per l'Italia, mentre solo i Paesi Bassi e la Svezia hanno valori inferiori a quelli italiani.

Il rapporto tra emissioni di gas serra e prodotto interno lordo è l'intensità di carbonio legata all'economia. Questo indicatore mostra una riduzione per tutti i paesi Europei e i valori nazionali sono appena al di sotto della media UE-28 nel 2019.

L'andamento di indicatori quali le emissioni pro capite di gas serra, l'intensità energetica e l'intensità di carbonio dell'economia mostrano che i paesi più grandi si stanno gradualmente avvicinando ai valori italiani e in alcuni casi tali valori sono stati superati.

Gli indicatori mostrano che l'Italia, rispetto ai maggiori Stati membri dell'UE, ha storicamente un'elevata efficienza energetica ed economica con una quota significativa di energia rinnovabile e gas naturale nel mix energetico e una delle emissioni pro capite più basse d'Europa. L'intensità energetica per unità di PIL in Italia è, tra i paesi più grandi, maggiore solo a quella del Regno Unito, mentre l'intensità di carbonio per unità di PIL è superiore a quella dei Paesi Bassi, Francia, Regno Unito e Svezia. L'intensità di carbonio per unità di energia consumata senza l'energia nucleare è, tra i paesi più grandi, superiore solo a quella dei Paesi Bassi e della Svezia e paragonabile a quella del Regno Unito. Sebbene alcuni indicatori mostrino che molti paesi hanno migliorato le loro prestazioni in termini di emissioni di gas serra, talvolta ottenendo risultati migliori rispetto all'Italia, è necessario considerare i seguenti fattori:

- paesi con elevate quote di combustibili solidi o petroliferi hanno un maggior potenziale di riduzione delle emissioni da combustibili fossili rispetto a quelle disponibili in Italia, dove il mix fossile è rappresentato principalmente dal gas naturale;
- in diversi paesi vi è un contributo significativo dell'energia nucleare con vantaggi emissivi, una fonte di energia che non è priva di controversie e che alcuni paesi intendono eliminare gradualmente (Germania, Belgio);
- le emissioni di un paese dipendono strettamente dalla struttura economica. I paesi con una predominanza di attività produttive nel settore dei servizi o con quote significative di consumo non energetico, come i Paesi Bassi, mostrano minori emissioni per unità di PIL e di energia consumata.

I maggiori paesi Europei hanno contributi emissivi molto diversi dai bunker internazionali. Le emissioni di questi settori sono rilevanti in alcuni paesi. La quota media per UE28 nel 2019 è del 7,3% delle emissioni totali compresi i bunker internazionali e per i paesi più grandi varia dall'1% in Polonia e Cechia al 21,8% nei Paesi Bassi.

L'energia lorda disponibile, che comprende il contributo dei bunker internazionali, per unità di PIL evidenzia il diverso ruolo dei consumi energetici dei bunker internazionali e mostra che i valori dell'Italia sono stati i più bassi tra i paesi più grandi fino al 2003, quando solo il Regno Unito ha raggiunto valori più bassi.

Per quanto riguarda le emissioni di gas serra per unità di energia lorda disponibile, il contributo dell'energia nucleare sembra essere decisivo per la riduzione dell'intensità di carbonio. Le emissioni energetiche per unità di energia primaria lorda disponibile senza energia nucleare mostrano che i dati dell'Italia sono inferiori ai valori registrati per gli altri paesi, ad eccezione della Svezia.

Il confronto tra gli Stati membri degli indicatori di efficienza e decarbonizzazione a livello settoriale mostra una situazione piuttosto eterogenea. Per quanto riguarda l'industria in Italia, l'intensità energetica finale, il consumo finale di energia per unità di valore aggiunto, è paragonabile a quella della Germania dal 2005, sebbene inferiore. Tra i maggiori paesi Europei, solo il Regno Unito mostra valori inferiori a quelli italiani. Tra i paesi esaminati i Paesi Bassi mostrano la più alta intensità energetica per l'industria.

Nel settore dei servizi l'Italia mostra negli ultimi anni una controtendenza per l'intensità energetica rispetto a quella di altri paesi Europei. In particolare, negli ultimi anni, la contabilità dell'energia consumata dalle pompe di calore dal 2017 ha aumentato l'intensità energetica del settore. Il tasso medio annuo di intensità energetica dal 2005 al 2019 mostra un incremento dello 0,9% per l'Italia a fronte di una diminuzione del -1,5% nella media Europea.

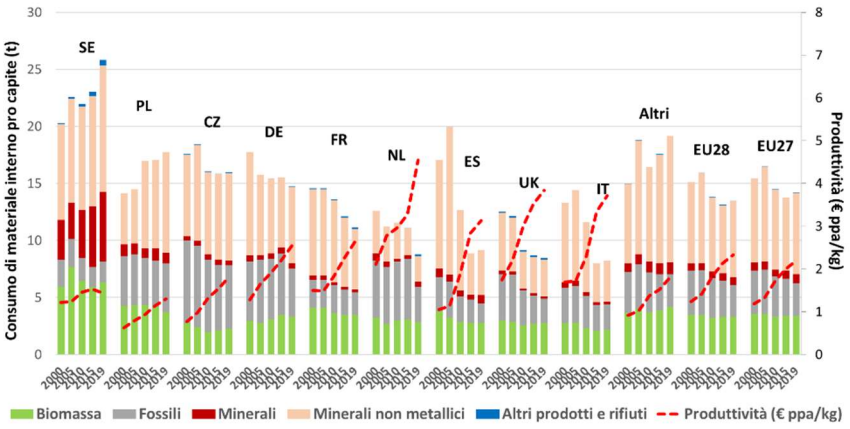
Il settore dell'agricoltura mostra una diminuzione generale dell'intensità energetica con un tasso medio annuo di -0,5% dal 2005 nell'UE28. L'intensità energetica italiana è tra le più basse in Europa e nel 2019, tra i principali paesi Europei, è paragonabile a quella registrata per Spagna e Regno Unito.

Nel settore residenziale, dal 2005 i paesi esaminati mostrano riduzioni dei consumi energetici per unità di PIL più elevate rispetto all'Italia (da -1,3% annuo in Spagna a -4,4% annuo in Polonia *vs* -0,6% annuo in Italia). I valori e le tendenze dell'intensità energetica italiana per i trasporti sono sostanzialmente paragonabili a quelli della media Europea con una diminuzione media annua del -1,1% dal 2005.

Tra i paesi più grandi, l'industria italiana ha intensità di carbonio superiori a quelle del Regno Unito, Svezia e Germania, anche se negli ultimi anni i dati italiani e tedeschi sono molto vicini. Per l'agricoltura, l'intensità di carbonio italiana è tra le più basse d'Europa, dopo Malta e Grecia. La media Europea è più del doppio dell'intensità italiana.

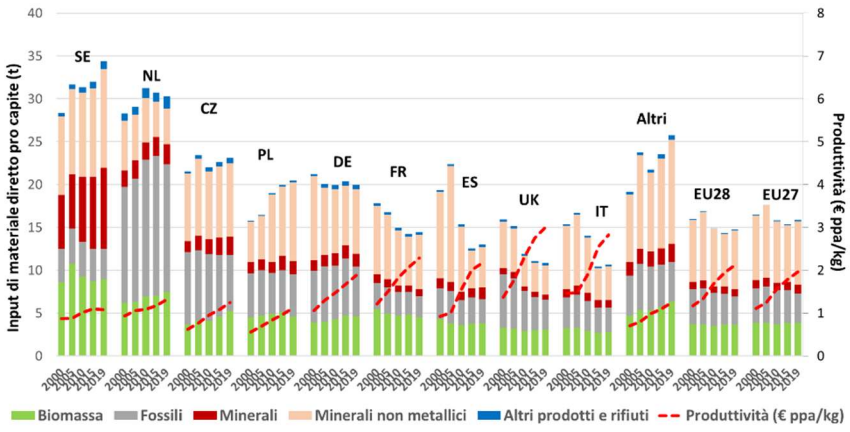
D'altra parte, il settore civile (residenziale e servizi) in Italia mostra ampi margini di miglioramento e, tra i paesi più grandi, l'intensità di carbonio è inferiore solo a quella registrata in Cechia e Polonia. Il settore civile italiano mostra quindi un ampio potenziale di riduzione delle emissioni, soprattutto considerando l'elettrificazione dei consumi finali del settore che nel 2019 è tra le ultime nell'UE28 (residenziale: 18,1% *vs* 24,5%; servizi: 42,2% *vs* 48%).

Gli indicatori *input di materiale diretto (IMD)* e *consumo di materiale interno (CMI)* descrivono, in termini aggregati, l'utilizzo diretto e la provenienza di risorse naturali e di prodotti. Il primo indicatore include tutti i materiali che hanno un valore economico e che sono utilizzati nelle attività di produzione e consumo ed è calcolato come la somma delle estrazioni interne e delle importazioni. Il secondo indicatore rappresenta il consumo interno di materia nell'economia nazionale al netto delle esportazioni ed è calcolata sottraendo all'Input di materiale diretto la quota di esportazioni fisiche.



Dal 2000 si registra una generale diminuzione del consumo di materiale interno pro capite nei paesi Europei. Nel 2019 l'Italia ha il più basso consumo pro capite tra tutti i paesi Europei. Per quanto riguarda la produttività a parità di potere di acquisto, vi è un aumento dal 2000 al 2019, sebbene i valori assoluti dei paesi siano molto diversi. Tra i paesi più grandi, i Paesi Bassi mostrano il valore più alto (€ 4,5 / kg nel 2019), seguiti dal Regno Unito (€ 3,8 / kg) e dall'Italia (€ 3,7 / kg). Le produttività di Germania e Francia sono rispettivamente di € 2,5/kg e € 2,6/kg.

L'input di materiale diretto rappresenta il consumo interno senza esportazioni ed è utile per valutare il consumo effettivo di materiale, compreso quello non utilizzato nelle attività di produzione e consumo interno e destinato alle esportazioni. La Svezia e i Paesi Bassi hanno un'alta quota di estrazione fossile, biomassa e minerali metallici destinati alle esportazioni e mostrano il CMI pro capite più elevato tra i maggiori paesi Europei, molto al di sopra della media Europea. Secondo questo indicatore, nel 2019 l'Italia ha registrato il valore più basso tra tutti i paesi Europei.



Per quanto riguarda la produttività a parità di potere di acquisto, la Svezia nel 2019 ha il valore più basso (€ 1,1 / kg) tra i paesi esaminati e uno dei più bassi d'Europa. I Paesi Bassi (€ 1,3/kg) hanno una produttività superiore solo a quella della Polonia (1,0 € /kg). Il Regno Unito e l'Italia hanno la più alta produttività in Europa, rispettivamente con € 3 / kg e € 2,8 / kg, seguiti dalla Francia (€ 2,3 / kg).

Sebbene la produttività fornisca informazioni sull'efficienza economica di un sistema nel suo insieme, è tuttavia necessario considerare che l'efficienza dipende non solo dalla massimizzazione delle prestazioni del materiale utilizzato, ma anche da fattori strutturali. In questo senso, la struttura produttiva di un paese svolge un ruolo decisivo per quanto riguarda il consumo di materia e energia. Un'economia basata sui servizi avrà un consumo di materiali inferiore rispetto a un'economia basata più sull'industria manifatturiera. Le attività industriali sono ad alta intensità energetica rispetto alle attività di servizio. Ciò vale in misura maggiore per il consumo di materiale che è oggetto di estrazione e trasformazione delle attività industriali.

La ripartizione settoriale del consumo di CMI e IMD mostra che l'Italia, pur avendo una quota di valore aggiunto industriale superiore a quella della Francia e della Spagna, ha una maggiore

produttività quale risultato di una maggiore efficienza nell'uso delle risorse, soprattutto nel settore industriale. Questo risultato è in linea con quanto osservato per gli indicatori di intensità energetica.

L'andamento dei parametri utilizzati per la *Kaya identity* per l'UE28 mostra che la forte riduzione delle emissioni di gas serra dal 2005 corrisponde principalmente a una diminuzione dei fattori trainanti come l'energia finale consumata per unità di PIL e la quota di energia rinnovabile consumata. Gli altri fattori (efficienza e intensità di carbonio) mostrano minori diminuzioni, mentre la popolazione e il PIL pro capite sono i fattori con una tendenza all'aumento. Ogni paese mostra un certo grado di disaccoppiamento tra le emissioni di gas serra e il PIL pro capite, sebbene si registri un'ampia varietà tra i paesi Europei e un ruolo molto differenziato dei fattori determinanti. Un disaccoppiamento più elevato si osserva per gli Stati in cui il PIL pro capite ha un andamento crescente.

Tra i paesi esaminati, l'Italia è l'unico Stato in cui il PIL pro capite è inferiore al livello del 2005 fino al 2019, anche se dal 2016 si osserva un andamento in crescita. Tale fattore in Italia contribuisce per la sua quota alla riduzione delle emissioni di gas serra. Negli altri Stati si registra un maggiore disaccoppiamento della crescita economica e delle emissioni di gas serra. La Polonia mostra la distanza più alta tra i due parametri.

L'analisi di decomposizione permette di quantificare il contributo di ogni fattore determinante per la variazione delle emissioni di gas serra. L'analisi mostra che in Italia la popolazione è l'unico fattore che ha contribuito alla crescita delle emissioni di gas serra (+2,8%). I restanti fattori hanno portato alla riduzione delle emissioni dal 2005 al 2019. Tra questi, l'intensità energetica finale (consumi energetici finali/PIL; -12,4%) e la quota di energia rinnovabile (consumo di energia fossile / consumo lordo di energia interna; -11,4%) ha svolto un ruolo significativo insieme all'efficienza (consumi energetici finali/consumo interno lordo; -3,7%) e al PIL pro capite (-3,4%). L'intensità di carbonio ha avuto un ruolo minore (-0,8%). Il contributo di tutti i fattori porta alla riduzione delle emissioni di gas serra nel periodo 2005-2019 del -29%.

In sintesi, in tutti i paesi è stato registrato un maggiore disaccoppiamento tra economia ed emissioni di gas serra rispetto a quello registrato in Italia e la riduzione delle attività economiche ha svolto un ruolo nella riduzione delle emissioni in Italia. Tuttavia, va considerato che il disaccoppiamento non corrisponde necessariamente a una riduzione delle emissioni in linea con gli obiettivi da raggiungere entro il 2020. Secondo EEA (2020), tra i principali Stati membri, Francia, Italia, Paesi Bassi, Spagna, Svezia e Regno Unito hanno già raggiunto i loro obiettivi di riduzione delle emissioni di gas serra dai settori *Effort Sharing*, mentre Germania, Polonia e Cechia, secondo le stime preliminari elaborate da EEA per il 2019, hanno emissioni più elevate delle rispettive allocazioni annuali; in merito alle risorse rinnovabili, Francia, Germania, Paesi Bassi, Polonia, Spagna e Regno Unito, secondo le stime preliminari per il 2019, non raggiungono gli obiettivi definiti nei rispettivi piani di azione per le energie rinnovabili; per quanto riguarda gli obiettivi di riduzione dei consumi energetici solo Italia, Paesi Bassi e Spagna hanno sufficientemente ridotto i consumi di energia finale nel 2019. Inoltre, va sottolineato che l'analisi della decomposizione si concentra sulle variazioni relative dei parametri senza assegnare alcun peso ai punti di partenza degli stessi. Come già accennato, l'efficienza economica ed energetica del sistema italiano è tra le più alte d'Europa. Il rapporto *The 2018 International Energy Efficiency Scorecard, pubblicato* dall'*American Council for an Energy-Efficient Economy* (ACEEE), assegna la prima posizione all'Italia, insieme alla Germania tra 25 nazioni a livello globale, con punteggi assegnati in base a parametri quantitativi e qualitativi, inclusi indicatori di efficienza e politiche volte a ridurre i consumi.

Settore elettrico

Il settore della produzione di energia elettrica e calore è una delle maggiori fonti di emissioni di gas a effetto serra in Europa. Le emissioni del settore nel 2005 nell'UE28 erano circa il 33% delle emissioni energetiche e circa il 26% delle emissioni totali, con una quota in forte diminuzione, rispettivamente al 26% e al 20% nel 2019. Il settore elettrico è quindi uno dei principali destinatari delle misure volte a decarbonizzare l'economia, sia per la quantità di emissioni che per il potenziale di diffusione delle fonti energetiche rinnovabili. I paesi esaminati per il confronto con l'Italia rappresentano l'80,2% dell'UE28 della produzione lorda di energia elettrica nel 2019.

Nel 1990 la capacità installata nell'UE28 era costituita principalmente da centrali termoelettriche (oltre il 57%), nucleari (21%), idroelettrico (21,6%). Le fonti eolica e fotovoltaica costituivano una quota marginale. Nel 2019 la capacità installata è stata del 43% per il termoelettrico, 11,4% per il nucleare, 14,8% per l'idroelettrico, 18,2% per l'eolico e 12,5% per il fotovoltaico. La capacità installata totale è aumentata del 38,5% nel 2019 rispetto al 2005, da 758 GW a 1.050 GW. L'unica fonte con una riduzione rilevante è quella nucleare, da 135 GW a 119,2 GW (-11,7%).

Vi è una notevole eterogeneità nella capacità installata tra i paesi. In Polonia, vi è una chiara prevalenza di centrali termoelettriche. La fonte nucleare, non presente in Italia e Polonia, rappresenta una quota significativa della capacità in Francia, Svezia e Cechia, anche se le quote di altri paesi non sono trascurabili. Dal 1990, la capacità idroelettrica ha rappresentato una parte considerevole delle fonti rinnovabili tradizionali in Spagna, Francia, Italia e Svezia. In tutti i paesi esaminati, la quota della capacità termoelettrica e nucleare mostra una notevole contrazione. L'energia eolica è aumentata in tutti i paesi dal 2005. Gli impianti fotovoltaici hanno iniziato ad avere quote significative solo dopo il 2005.

La produzione lorda di elettricità in Europa ha registrato un netto aumento rispetto al 1990 e una relativa stabilità negli ultimi anni. Nel 2019, il 14,3% della produzione di elettricità dell'UE28 senza pompaggio proviene da combustibili solidi e il 21,8% da gas naturale. Il petrolio e i prodotti petroliferi rappresentano il 2%. Le fonti nucleari rappresentano il 25,6%, mentre il 34,3% proviene da energia rinnovabile.

Il mix energetico nei paesi esaminati è piuttosto eterogeneo, soprattutto per quanto riguarda i combustibili fossili. Nel 2019, i combustibili solidi rappresentano il 72,4% della produzione di elettricità in Polonia, il 44,6% in Cechia e il 28,4% in Germania. Ancora più interessante è che il 52,7% della produzione di elettricità da combustibili solidi proviene dalla lignite nell'UE28. Germania, Polonia e Cechia sono i principali paesi che utilizzano questo combustibile per la produzione di elettricità e rappresentano collettivamente il 78,7% della produzione di elettricità da lignite nell'UE28 (46,7% Germania, 17,5% Polonia e 14,6% Cechia). Il gruppo di altri paesi rappresenta collettivamente il restante 21,3% (principalmente in Bulgaria, Grecia e Romania). L'elettricità prodotta da lignite in Germania, Polonia e Cechia è rispettivamente del 65,7%, del 35,7% e del 94,2% dell'elettricità prodotta dai combustibili solidi.

Francia e Svezia sono caratterizzate da una bassa produzione elettrica da fonti diverse da quella nucleare, 11,1% in Francia e 9,7% in Svezia della produzione totale di elettricità senza pompaggio nel 2019. In Francia, l'elettricità prodotta da energia nucleare rappresenta il 70,5% della produzione totale, mentre in Svezia le centrali nucleari forniscono il 39,3% dell'elettricità. Anche la Cechia ha una quota rilevante di elettricità proveniente dalle centrali nucleari (36,1%). Tra i paesi esaminati, la Polonia e l'Italia non hanno centrali nucleari, mentre nei Paesi Bassi l'elettricità prodotta da fonte nucleare rappresenta il 3,2%. Negli altri paesi la quota varia dal 12,4% in Germania al 21,5% in Spagna. A livello Europeo, la fonte nucleare fornisce più di un quarto della produzione elettrica.

In Italia e nel Regno Unito, il gas naturale determina rispettivamente il 48,5% e il 40,6% della produzione totale di elettricità. Entrambi i paesi hanno mostrato una conversione delle loro centrali termiche dal 1990 con una forte contrazione del petrolio e dei prodotti petroliferi (Italia) e dei combustibili solidi (Regno Unito), e l'espansione del gas naturale. Una significativa contrazione dei combustibili solidi si osserva in tutti i paesi, sebbene alcuni paesi come Germania, Polonia e Cechia abbiano ancora quote rilevanti di combustibili solidi.

Per quanto riguarda la produzione di elettricità da fonti rinnovabili, dal 1990 la quota è aumentata dal 12% al 34,3% nell'UE28. In tutti i paesi esaminati si è registrato un marcato aumento della produzione di elettricità rinnovabile con una forte accelerazione dal 2005. Dopo il 2015 la crescita ha rallentato ed è ripresa negli ultimi anni anche se con tassi diversi tra gli Stati. La Svezia ha una delle quote rinnovabili più alte d'Europa. Il dato italiano è superiore alla media Europea e la quota di energia elettrica rinnovabile in Italia è una delle più alte tra i paesi esaminati. Tra questi paesi solo la Svezia ha una quota molto più alta e la quota della Germania ha superato quella italiana solo nel 2019 (39,7% in Italia e 40,2% in Germania).

La quota rinnovabile per il raggiungimento degli obiettivi Europei, ai sensi della direttiva 2009/28/CE, si riferisce al consumo interno lordo di elettricità, vale a dire alla produzione di

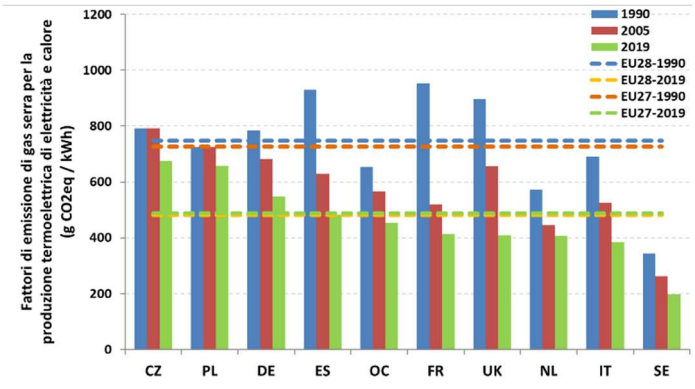
elettricità senza elettricità da pompaggio più l'importazione netta di elettricità. La quota rinnovabile così calcolata sarà quindi inferiore per i paesi importatori rispetto alla quota rinnovabile della produzione di elettricità. Ciò dimostra che i paesi importatori di elettricità, come l'Italia, devono affrontare uno sforzo relativamente maggiore rispetto ai paesi esportatori per raggiungere i loro obiettivi di energia rinnovabile nel settore elettrico.

Il parametro più importante per valutare l'efficienza di un sistema di generazione di energia elettrica è l'efficienza della trasformazione dei combustibili in elettricità e calore. L'efficienza elettrica degli impianti non cogenerativi in Italia (0,46 nel 2019) è tra le più alte tra i maggiori paesi Europei, dopo Regno Unito (0,47) e Paesi Bassi (0,51). Nel 2019 la media italiana è superiore alla media UE28 (0,43). Per quanto riguarda l'efficienza elettrica degli impianti cogenerativi, nel 2019 la Spagna mostra il valore più alto tra i principali paesi Europei (0,66), molto superiore alla media dell'UE28 (0,38). L'efficienza dell'Italia è 0,39. L'efficienza totale degli impianti cogenerativi in Italia (0,61) è inferiore alla media UE28 (0,65) ed è aumentata del 23,1% dal 1990.

Nel 2019 l'efficienza totale degli impianti italiani è 0,55, poco superiore alla media UE28 (0,53). L'efficienza elettrica italiana è 0,42, superata da Spagna (0,48), Paesi Bassi (0,48) e Regno Unito (0,47). L'efficienza elettrica dei paesi esaminati mostra un ampio intervallo, da 0,24 in Svezia a 0,48 nel Regno Unito con una media di 0,40 per UE28.

Al fine di confrontare i fattori di emissione dei gas serra per il settore elettrico nei diversi paesi, è stato adottato l'approccio *Tier 1* per stimare le emissioni. Le emissioni di gas serra dei 28 paesi Europei per la produzione di elettricità e calore sono 925,2 Mt CO_2eq nel 2019, 37,3% in meno rispetto al livello del 1990 e 36,9% in meno rispetto al livello del 2005. Dal 2005 si registra una significativa riduzione delle emissioni di gas serra. Nel complesso, nel 2019 le emissioni di gas serra del settore elettrico nei paesi selezionati (741,8 Mt CO2eq) rappresentano l'80,2% delle emissioni dell'UE28. L'Italia rappresenta il 10,6% delle emissioni Europee. Le emissioni di gas serra per la produzione di elettricità sono state stimate dopo lo scorporo del consumo di energia dei combustibili per la produzione di calore negli impianti di cogenerazione. Le emissioni dell'UE28 nel 2019 sono di 778,7 Mt CO_2eq e i paesi esaminati rappresentano l'81% delle emissioni totali.

Dal 1990 si registra in UE28 un disaccoppiamento tra produzione di energia elettrica ed emissioni di gas serra. Tuttavia, le emissioni mostrano una significativa diminuzione solo dopo il 2005, con un aumento del disaccoppiamento dovuto principalmente alla crescente quota di energie rinnovabili. Il disaccoppiamento è evidente in quasi tutti i paesi, anche se con dinamiche diverse.



I fattori di emissione di gas serra per la produzione di elettricità e calore dovuti alla combustione nelle centrali termiche si sono ridotti dal 1990. Nel 2019 il fattore di emissione in Italia (384,4 g CO_2eq/kWh) è superiore a quello della Svezia (198,2 g CO_2eq/kWh), dove le centrali termiche sono alimentate principalmente da bioenergia. Il Regno Unito ha la riduzione maggiore dal 2005 (-37,8%), seguito dall'Italia (-26,7%) e Svezia (-24,5%). La Germania ha ridotto il fattore di emissione del 19,6%. Le percentuali di riduzione più basse sono state registrate nei Paesi Bassi (-8,8%) e in Polonia (-9,2%).

I fattori di emissione per la produzione di elettricità e calore dell'intero settore elettrico, compresa la produzione di energia rinnovabile e nucleare, in Italia sono superiori alla media Europea. Il fattore di emissione medio dell'UE28 per la produzione di elettricità e calore nel 2019 (253 g CO2eq/kWh) mostra una riduzione del 34,3%, rispetto al livello del 2005, mentre il fattore di emissione in Italia (278,6 g CO2eq/kWh) è diminuito del 39,1%.

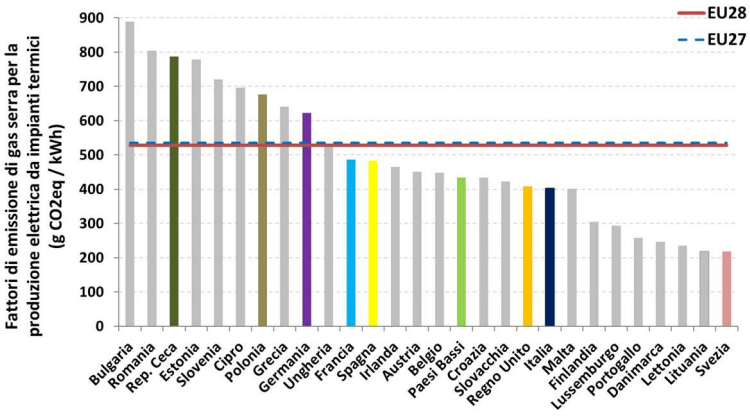
I paesi con una quota significativa di elettricità da fonte nucleare e da fonti rinnovabili hanno un vantaggio in termini di emissioni per unità di elettricità prodotta. La Francia dispone di una

notevole quantità di energia proveniente dalle centrali nucleari, il che consente di ridurre drasticamente il fattore di emissione rispetto alle centrali termiche. Anche Svezia, Cechia, Spagna, Germania e Regno Unito hanno quote non insignificanti di energia nucleare (dal 12,4% in Germania al 39,9% in Svezia). La produzione di elettricità nei Paesi Bassi dalle centrali nucleari è del 3,2 per cento, mentre Italia e Polonia non hanno questa fonte. Complessivamente, l'elettricità nucleare nell'UE28 è stata del 25,6% nel 2019, in calo rispetto al 30,9% del 1990. Nel 2019, l'83,9% dell'elettricità nucleare dell'UE28 proviene dai paesi esaminati, con la Francia che rappresenta il 48,6%.

Il fattore di emissione italiano per la produzione di energia termoelettrica nel 2019 (402,1 g co2eq/kWh) è secondo solo a quello della Svezia (217,9 g CO2eq/kWh), dove la quota di bioenergia nelle centrali termoelettriche è molto più elevata. Il fattore italiano è ben al di sotto della media UE28 di 527,7 g CO_2eq/kWh. Cechia, Polonia e Germania hanno i fattori di emissione più elevati, da 786,5 g CO_2eq/kWh a 621,9 g CO_2eq/kWh, ben al di sopra della media Europea.

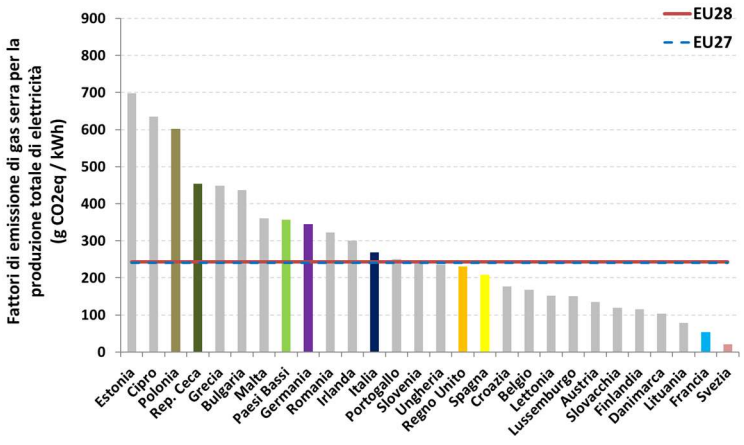
Il fattore di emissione medio Europeo per la produzione totale di energia elettrica è sempre stato inferiore al valore italiano, grazie in parte al contributo dell'elettricità nucleare. L'aumento della quota di elettricità rinnovabile porta a una significativa riduzione dei fattori di emissione. Inoltre, la riduzione della quota di elettricità nucleare in Europa avvicina il fattore di emissione italiano alla media dell'UE28. Il fattore di emissione italiano nel 2005 è stato superiore alla media Europea del 23,7%, mentre nel 2019 è superiore al 10,6%.

I risultati relativi alle stime delle emissioni di gas serra consentono di concludere che l'Italia ha uno dei più bassi fattori di emissione di gas serra per la produzione di elettricità e calore negli impianti termoelettrici tra i maggiori paesi Europei. Il confronto tra la quota delle emissioni del settore termoelettrico e la relativa quota della produzione elettrica mostra che Germania e Polonia hanno quote di emissioni di gas serra superiori alle loro quote di produzione elettrica. Lo stesso vale per Cechia, Svezia e per il gruppo di altri paesi. Lo schema opposto si osserva per Italia, Regno Unito, Spagna, Paesi Bassi e Francia.

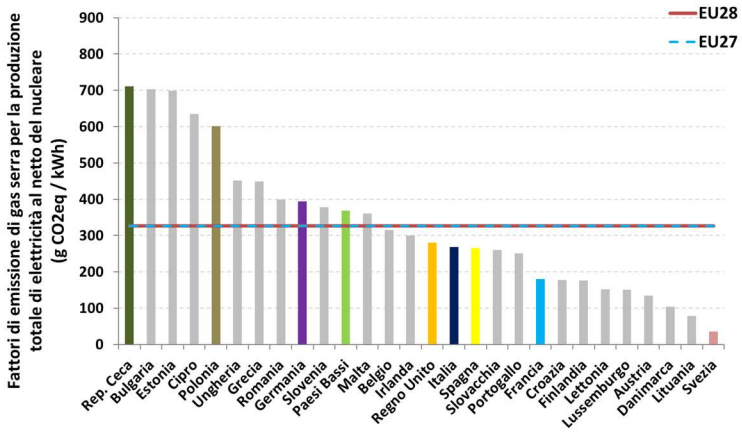


Considerando tutti gli Stati membri dell'UE28, il fattore di emissione italiano di gas serra per la produzione di energia termoelettrica occupa la nona posizione, al di sotto della media Europea. Il mix di combustibili italiani, con una quota maggiore di gas naturale rispetto ad altri paesi e il contributo della bioenergia, è un fattore determinante per il fattore di emissione nelle centrali termiche.

In merito alla produzione totale di energia elettrica, considerando quindi il contributo delle energie rinnovabili diverse dalla bioenergia e il contributo delle centrali nucleari, il fattore di emissione italiano perde posizioni. I paesi che dispongono di energia nucleare hanno un vantaggio in termini di emissioni evitate. La quota di energie rinnovabili in Italia è una delle più alte d'Europa e superiore a quella di Spagna, Regno Unito e Francia, che tuttavia hanno quote significative di energia nucleare. Nel 2019 l'Italia, dopo Svezia e Germania, ha la più alta quota rinnovabile di produzione elettrica tra i paesi più grandi. Il



contributo dell'elettricità nucleare in Spagna, Regno Unito e Francia ha un ruolo decisivo nella riduzione dei fattori di emissione di questi paesi. L'effetto dell'energia nucleare è particolarmente evidente per la Francia: sebbene la quota rinnovabile della produzione elettrica sia molto inferiore a quella italiana e il fattore di emissione degli impianti termoelettrici sia più elevato, la Francia ha il fattore di emissione più basso per la produzione totale di elettricità in Europa, secondo solo a quello registrato per la Svezia. La Germania ha il 12,4% dell'elettricità nucleare e il 40,2% di elettricità rinnovabile ma la presenza rilevante di combustibili solidi nel mix fossile (28,4% della produzione elettrica), principalmente lignite ad alto tenore di carbonio, si traduce in un impatto emissivo maggiore del settore elettrico rispetto a quello italiano.



I fattori di emissione per la produzione elettrica senza il contributo della fonte nucleare mostrano che nel 2019 l'Italia ha un valore superiore rispetto a Svezia, Francia e Spagna tra i principali paesi Europei. Tale indicatore elimina l'effetto del contributo nucleare consentendo di considerare tutti gli altri fattori, come il mix di combustibili, l'energia rinnovabile e l'efficienza di trasformazione.

Come risultato di molti fattori (variazione del mix combustibile, efficienza, quota rinnovabile) l'Italia ha ridotto il fattore di emissione per la produzione di energia elettrica e calore del 51,9% dal 1990 al 2019 (39,1% dal 2005), contro una riduzione del 42,4% in Germania (29,3% dal 2005) e del 16,2% in Polonia (15,7% dal 2005). I tassi di riduzione in Polonia sono i più bassi tra i maggiori emettitori in Europa. La riduzione dei fattori di emissione in Germania e Polonia dal 1990 con lo stesso tasso dell'Italia avrebbe portato (a parità di produzione di elettricità e calore) a evitare 94,3 Mt CO_2eq nel 2019, circa il 10% delle emissioni dell'UE28 dalle centrali termoelettriche nel 2019. Le centrali termoelettriche in Germania e Polonia sono ancora alimentate da quote significative di combustibili solidi ad alto contenuto di carbonio, come la lignite, e la transizione verso il gas naturale è stata molto più lenta che in paesi come l'Italia o il Regno Unito.

Impianti per la produzione di calore

La produzione di calore rappresenta una quota significativa dei processi di trasformazione energetica. I consumi energetici degli impianti dedicati alla produzione di calore per teleriscaldamento e altri usi (principalmente per l'industria) rappresentano una quota importante del bilancio energetico Europeo. Nel 2019 il consumo energetico di tali impianti nell'UE28 è stato di 18,7 Mtoe, di cui 0,6 Mtoe da geotermia e solare termico e 0,2 Mtoe da pompe di calore. Il consumo di bioenergia (5,2 Mtoe nel 2019) mostra una quota in rapida crescita: più del doppio del consumo nel 2005 e 7,2 volte il consumo nel 1990.

Il consumo totale di energia nel 2019 è molto inferiore a quello registrato nel 1990. Si registra una notevole variazione del mix di combustibili con una diminuzione dei combustibili solidi e, in misura maggiore, del petrolio e dei prodotti petroliferi, sostituiti da gas naturale e bioenergia. Il contributo di altre fonti rinnovabili (nel 2019 oltre il 90% da energia geotermica e il resto da solare termico) e dalle pompe di calore ha registrato un costante incremento che, tuttavia, rimane marginale sul consumo totale (4,5% nel 2019).

A seguito della variazione del mix di combustibili, le emissioni di gas serra hanno registrato una diminuzione del 50% dal 1990 a causa della diminuzione dell'energia consumata (-27,2%) e del fattore di emissione di gas serra decrescente per unità di calore prodotto (-37,4%). Nel 2019, le emissioni di gas serra dell'UE28 da questi impianti sono di 43,6 Mt CO_2eq. L'effetto del mix di combustibili e l'aumento dell'efficienza si traducono in una riduzione del 17,2% dei fattori di emissione dal 2005

al 2019 nell'UE28 (da 289,2 a 239,8 g CO_2eq / kWh). Le significative quote di combustibili solidi o di rifiuti non rinnovabili in Polonia e Germania determinano fattori di emissione più elevati, rispettivamente del 97,7% e del 50,5% maggiori rispetto a quello italiano nel 2019.

INTRODUCTION

A country's greenhouse gas (GHG) emissions depend on many factors related to the economic activities. In European Union (EU), energy emissions accounted for about 77% of total emissions in 2019, from 68.5% in France to 83.6% in Germany, among others. Italian GHG emissions from the energy sector are 80.5%. The energy system underlying economic activities is therefore the main area of investigation to understand the driving factors for GHG emissions. The fuel mix, as well as energy efficiency, in terms of transformation of primary energy and economic output, are key factors. The economic activities themselves, which are also driven by the demands, are a driving factor of emissions, and the reduction of such activities inevitably leads to the reduction of GHG emissions. While energy efficiency can be considered as intrinsic driving factors of the energy system, the demand for goods and services can be regarded as an extrinsic economic factor, although both energy and economy systems are intertwined and difficult to be treated as separate systems. The economic crisis that has affected the world's major economies, including Italy, since 2007-2008, has made the task of discerning the driving factors or GHG emissions even more difficult. After more than a decade, Italy, after Greece, among the EU countries, has suffered the most significant impacts of the economic crisis. Even though there have been signs of recovery since 2015, in 2019 Italy was the only country which had not yet filled the gap of GDP loss in EU. It is not taken into account in this report that the recent COVID-19 pandemic caused a further recession of the economy in 2020 resulting in GHG emissions reduction.

Climate and energy policies are undergoing an in-depth review following what was agreed at COP21 in Paris in 2015, when the Parties decided to keep the rise of global average temperature well below 2°C and to do everything possible to limit the increase to 1.5°C above pre-industrial levels. The historic significance of the Paris Agreement lies in virtually all the States of the world having committed to reducing their emissions by 2030, through mitigation plans. In the context of policies to reduce GHG emissions, the EU has already played an important role since the ratification of the Kyoto Protocol when it committed to reducing the GHG emissions, in the period 2008-2012, by 8% compared to 1990. This commitment was shared among the Member States and Italy was allocated a reduction of emissions of 6.5%. In 2007, before what was agreed at the international level, the European Council had already expressed the need for the EU to initiate a transition to a low-carbon economy through an integrated approach that included energy policies to curb climate change. In particular, the Council had set binding targets to be achieved by 2020, such as 20% reduction of GHG emissions compared to 1990, the share for renewable energy consumption set to 20% of the EU energy consumption, the use of biofuels for 10% of the amount of fuel used in the transport sector and the indicative target of reducing energy consumption by 20% compared to the reference energy scenario. Following the Council's conclusions, the “Climate and Energy Package” was approved, i.e. a set of legislative measures aimed at implementing the commitments was put in place.

For 2030 the European reduction targets reflected the commitments made by the EU under the Paris Agreement: reduction of GHG emissions by at least 40% compared to 1990, achievement of at least 32% of energy consumption from renewables and the achievement of least 32.5% increase in energy efficiency compared to projections of the expected energy used in 2030. Another target directly related to the electricity system is the achievement of 15% for electrical interconnections in 2030. With the European Green Deal the European Commission proposed in September 2020 to raise the 2030 GHG emission reduction target, including emissions and removals, to at least 55% compared to 1990. Relevant actions are required across all sectors in order to achieve the new targets, including increased energy efficiency and renewable energy. Such actions are considered in the Italy’s Recovery and Resilience Plan submitted in 2021 to European Commission in compliance with EU's extraordinary recovery effort, Next Generation EU: the plan agreed by EU leaders in July 2020 to overcome the economic and social impact of the pandemic facing the environmental, technological and social challenges of our time.

The Commission started the process of making detailed legislative proposals by July 2021 to implement and achieve the increased ambition that will enable EU to move towards a climate-neutral economy by 2050 – an economy with net-zero GHG emissions.

The consequent negotiating processes among EU countries cannot ignore the characteristics of Member States energy systems as well as the technical and economic potentials to change their systems. The development of a country's productive structure involves not only technological aspects but also the economic and social ones affecting the daily lives of millions of people. The definition of climate targets must therefore consider several factors. If GDP is an essential factor, as an expression of a country's investment capacity, it is equally essential to consider other aspects of energy and economy systems, such as industry share, fuel mix used by each country and the change potentials. In other words, the inertia of any complex systems and the decreasing returns of investments aimed at changing a particular equilibrium state cannot be ignored. This does not mean that a given situation cannot be changed, but we should be aware of the resources needed and the consequences. In particular, as far as energy sources are concerned, there are different reduction potentials between countries with a significant share of high-carbon fuels and countries with a very small share of high carbon content fuels. While comparing GDPs among countries, it can be misleading to only consider GDP as the investment capacity without looking at the different reduction potentials and the related costs.

This report does not aim at the analysis of energy and production systems but at the analysis of Italian performance indicators and the comparison with the largest European countries to establish the positioning of the Italian system concerning energy consumption and climate-changing emissions (Amici della Terra, 2009). The analysis will not go into details on factors determining the energy needs of the countries such as the geographical-climatic factor or demographic and social factors. While aware of the role played by these factors on energy requirements and efficiency, the objective of the analysis is to examine at macroscopic level the main indicators of decarbonization and energy efficiency. If the former indicators provide information on climate-changing gases emissions per unit of energy used or per unit of wealth produced, the latter provide information on how efficiently energy is used to produce wealth. The two families of indicators are strongly interlinked because if the production of goods and services cannot be separated from energy consumption, the consumption of energy from fossil fuels in turn determines climate-changing gas emissions. The economy decarbonization can be pursued by acting both on the energy sources used to produce goods and services and on the efficiency of energy use, acting on both fronts are the most virtuous path that can be taken. Concerning the energy sources, useful strategies point at the shift towards a fuel mix with lower carbon content, therefore mainly made up of natural gas, or at increasing the renewable share of energy that are not without other environmental worries, e.g. the combustion of biomass and the consequent emission of atmospheric contaminants harmful to air quality or the consumption of soil by wind and photovoltaics power plants. On the energy efficiency side, the goal is obviously optimization, which consists in achieving more with less. In other words, to reduce as much as possible the losses and inefficiencies of the production processes of goods and services (e.g. from the heating system of the buildings, to moving by vehicles, the production of steel, cement, paper, textiles and so on).

The power sector is a key stone of any energy system. The electricity generation accounts for a significant share of the energy sector, around one third of European energy GHG emissions. The EU long-term strategy by 2050 (EC, 2018a, b) examines different development scenarios and highlights how electricity will become the main energy carrier, from 22% of final energy consumption in 2015, to 41%-53% in 2050. The growing role of the electricity sector require an examination of electricity generation systems in the Member States. The analysis of the characteristics of electrical systems in the largest European countries was therefore carried out concerning the fuel mix, the transformation efficiency, and the emission factors of greenhouse gases. The same analysis, although less detailed, was carried out for plants producing heat only that represent a significant share of energy consumption especially in the countries of Northern Europe.

In a highly interconnected system, the identification of the causes of a given phenomenon, such as greenhouse gas emissions, is a thorny issue, however it is possible to assess the role of the different driving factors according to a conceptual model that establishes coherent relationships between the factors considered. In order to assess the role of the factors behind the change in greenhouse gas emissions, Kaya analysis and decomposition analysis was applied to study the variation of a parameter in a time interval in relation to the variation of its driving factors.

1 EFFICIENCY AND DECARBONIZATION INDICATORS

The chapter will examine the trends of some indicators related to efficiency and decarbonization. The indicators are elaborated using the most updated data about Member States energy balances from the EUROSTAT database (https://ec.europa.eu/eurostat/data/database, last download on 03 May 2021). As concern the GHG emissions CRFs (Common Reporting Formats) submitted in 2021 are downloaded from UNFCCC (https://unfccc.int/ghg-inventories-annex-i-parties/2020, last download on 28 April 2021).

Comparison with Italian values is carried out for some European countries and, at an aggregate level, for EU28 and EU27. The effective exit of the United Kingdom from the European Union took place on 31 December 2020. The targets set by the Climate and Energy Package 2020 will continue to apply to the UK. For the 2030 targets from March 2030, a negotiation has been opened to define EU-UK relations in a partnership agreement.

The report focuses on decarbonization and efficiency indicators, so greenhouse gas emissions and gross domestic products are the driving parameters for comparisons. The EU Member States with more than 3% of EU28 GHG emissions or more than 3% of EU28 GDP in 2019 are considered for comparison. The Member States examined (Germany, United Kingdom, France, Italy, Spain, Poland, the Netherlands and Sweden) represent 77.9% of the population in EU28 and 74.6 % in EU27 (excluding UK) in 2019. In terms of GHG emissions, they account for 78.2% of EU28 emissions (75.5% of EU27), GDP (chain linked volumes, reference year 2015) represents 82.4% of EU28 GDP (78.7% of EU27). The gross inland energy consumption accounts for 79.1% of the energy consumption of EU28 (76,5% of EU27). Member States are reported with the code used in EUROSTAT database in the following graphs (see Table A1.1 in Annex 1).

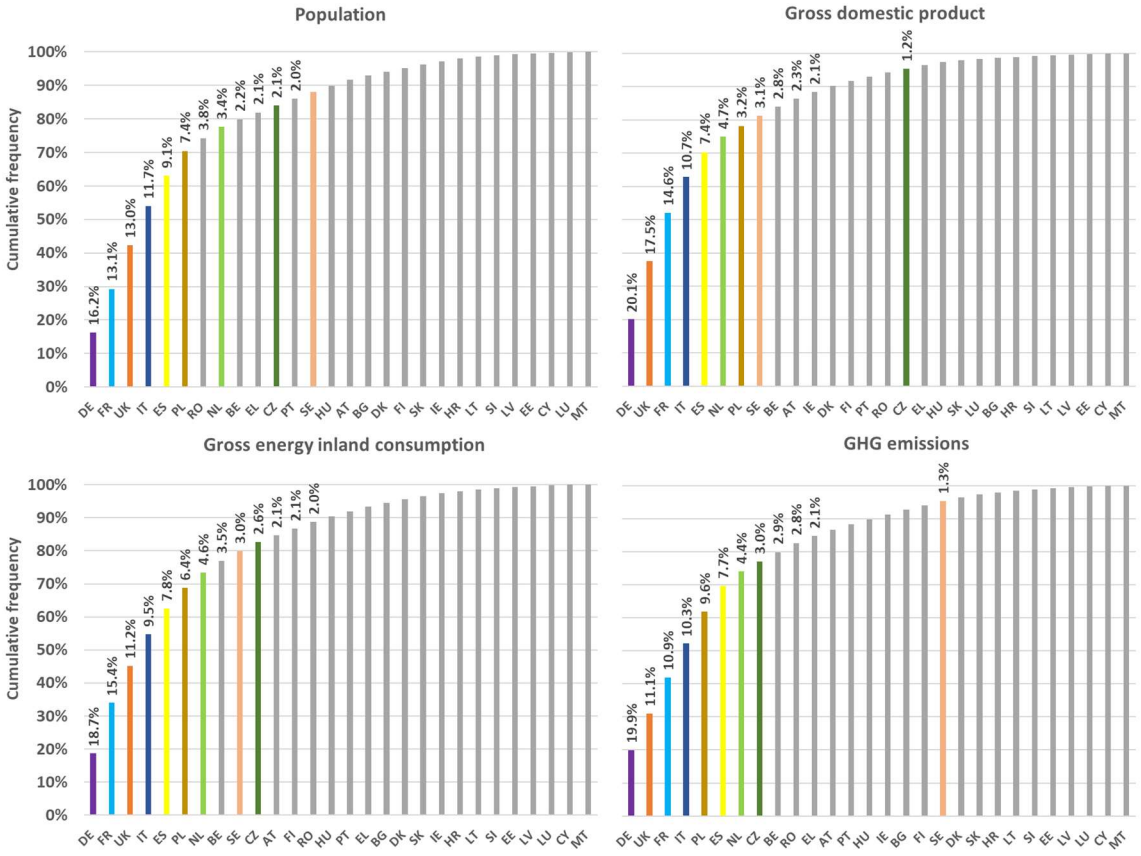


Figure 1.1 – *Cumulative frequencies for population, gross domestic product, gross inland energy consumption, and greenhouse gas emissions in the EU28 countries (data 2019). The labels of country frequencies greater than 2%, or for selected countries, are reported.*

The following graph shows the breakdown of greenhouse gas emissions in 2019 for EU28 and EU27 Member States.

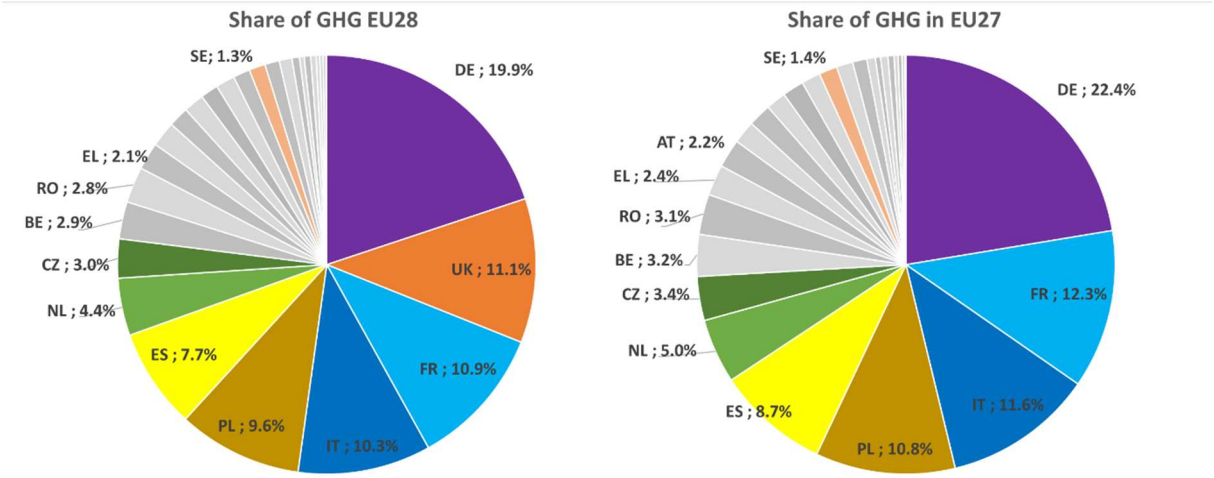


Figure 1.2 – *Breakdown of greenhouse gas emissions in 2019 for EU28 and EU27 Member States. The labels of the Member States with more than 2% of GHG emission share and selected Member States are reported.*

The values of the indicators considered for the comparisons are given in the Appendix for each Member State.

1.1 Energy consumption and gross domestic product

Since 1990, European environmental policies have led to a significant change of the energy mix in the Member States. As shown in the following graphs, each State has a specific energy mix. The nuclear source is relevant in France and Sweden, but there are also other States to which nuclear power is not negligible. The nuclear energy represents 12.8% of EU28 gross inland consumption in 2019 (13.5% in EU27). It is important to note the significant contraction of solid fuels energy since 1990, although there are still in 2019 significant shares in some of the largest States such as Germany (7.6%), Poland (42.2%) and Czechia (33.1%). Oil and petroleum products, on the other hand, show different trends: there are States, e.g. Italy, showing a significant contraction (from 57.3% in 1990 to 34.8% in 2019); other States, e.g. Germany, where a slight increase can be observed (from 35.5% in 1990 to 36% in 2019), and States, e.g. Poland, with a relevant increase (from 12.8% in 1990 to 30% in 2019). Natural gas energy consumption shows a considerable increase in almost all States and at EU28 level ranges from 17.8% in 1990 to 24.6% in 2019. As concerns renewable energy, there has been a significant increase in EU28 from 4.3% in 1990 to 15.4% in 2019 (from 4.9% to 15.8% in EU27). Italy's renewable share in 2019 (19%) is among the highest in the countries examined, only Sweden's share is higher than the Italian one.

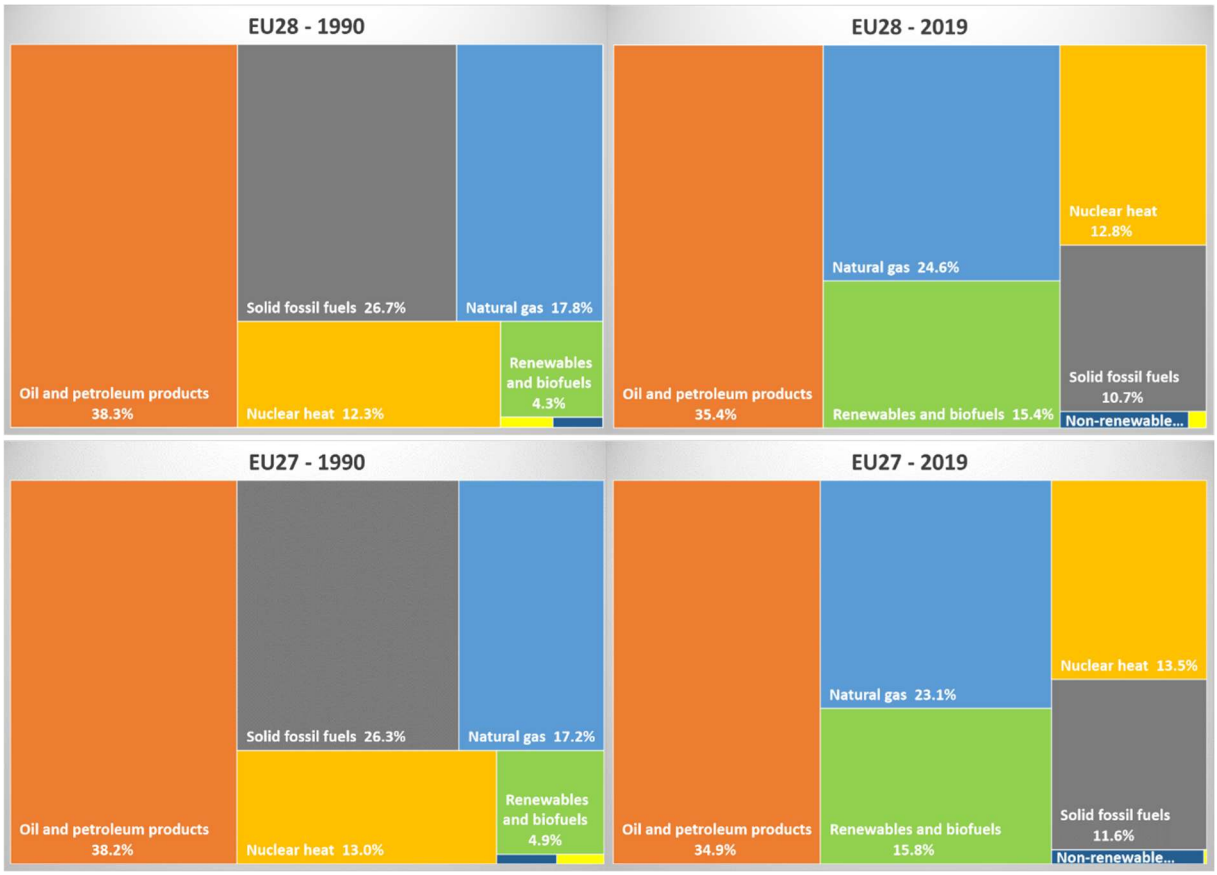


Figure 1.3 – *Share of energy sources in gross inland energy consumption of EU 28 and EU27.*

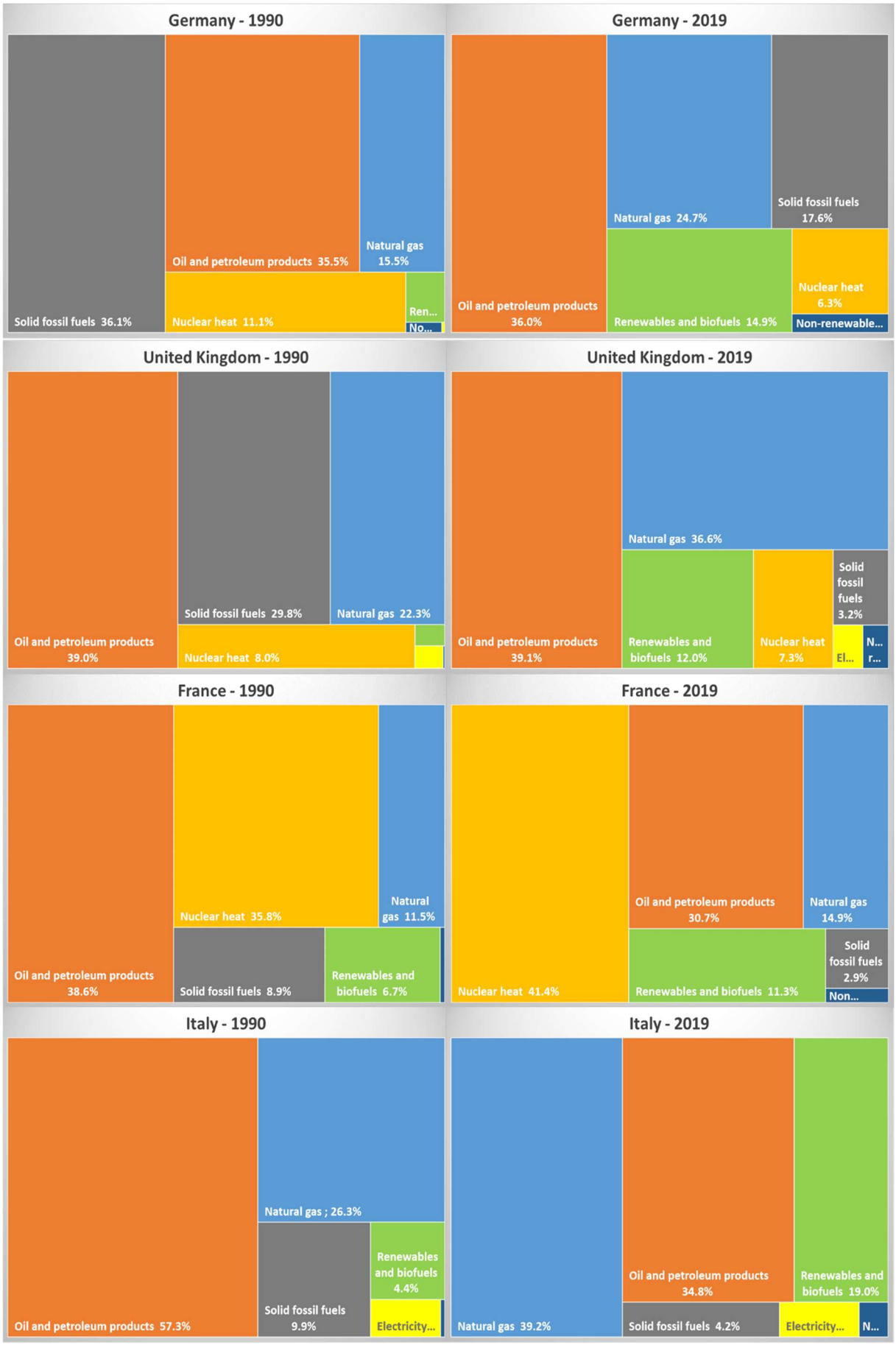


Figure 1.4a – *Share of energy sources in gross inland energy consumption in the selected European states.*

Figure 1.4b – *Share of energy sources in gross inland energy consumption in the selected European states.*

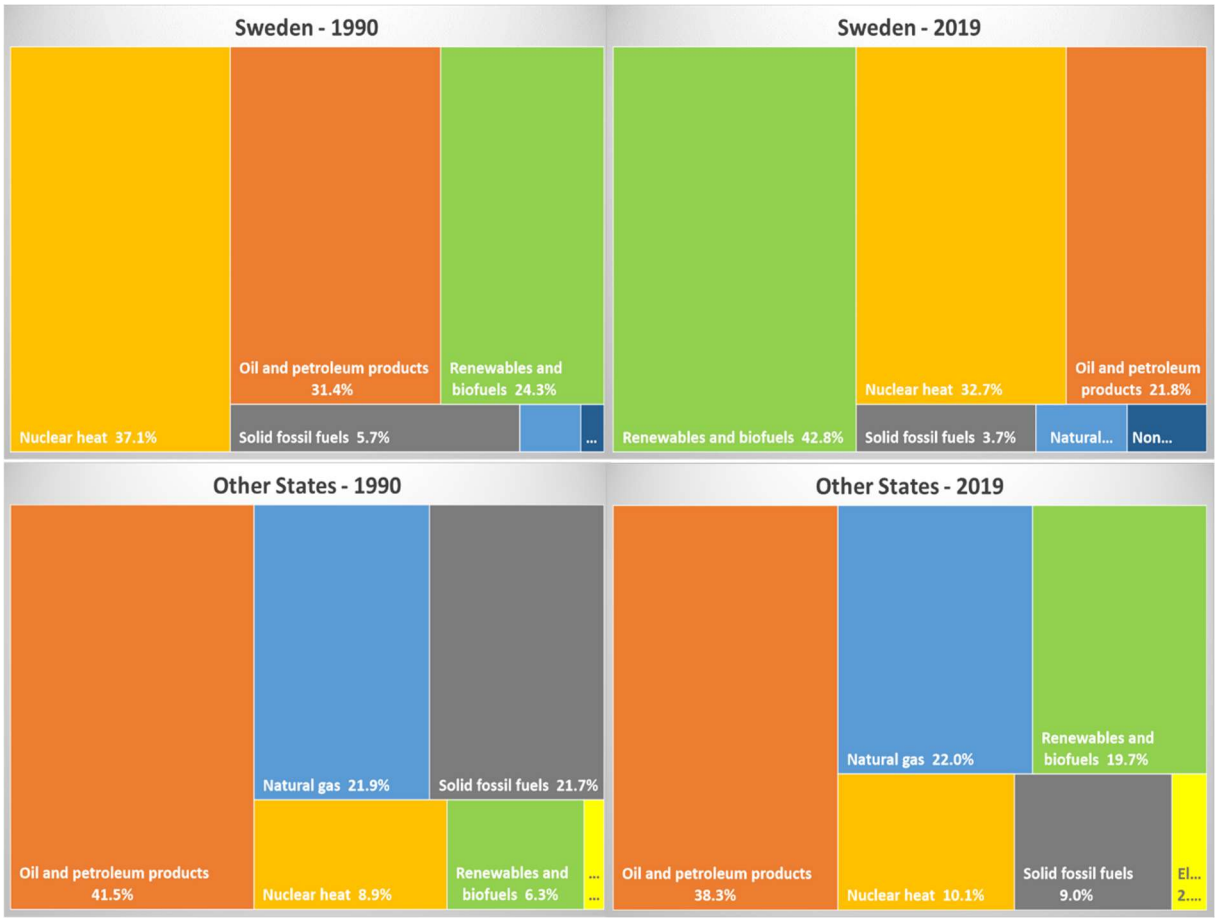


Figure 1.4c – *Share of energy sources in gross inland energy consumption in the selected European states and other states.*

In order to examine the shift to renewable sources and the role of a transition fuel such as natural gas (which among fossil fuels has the lowest carbon content), the following graph shows a dynamic picture for these sources in the EU States from 1990 to 2019. Each Member State is located in the point defined by the percentage of energy consumption of natural gas, and the percentage of energy consumption of renewable energy. The remaining share of energy consumption is met by solid fuels and oil-petroleum products, which are characterized by higher emission factors among fossil fuels. The European States moved to the upper right corner of the graph that indicates the shift towards a lower emissions fuel mix. EU28 or EU27 (with or without UK) are the centroids of the cloud. Spain and Italy, among the selected States, travelled longer distance from 1990 to 2019, while France and the Netherlands travelled the shortest distance among the 28 Member States. Such distances represent the country's change of energy supply in order to achieve environmental targets.

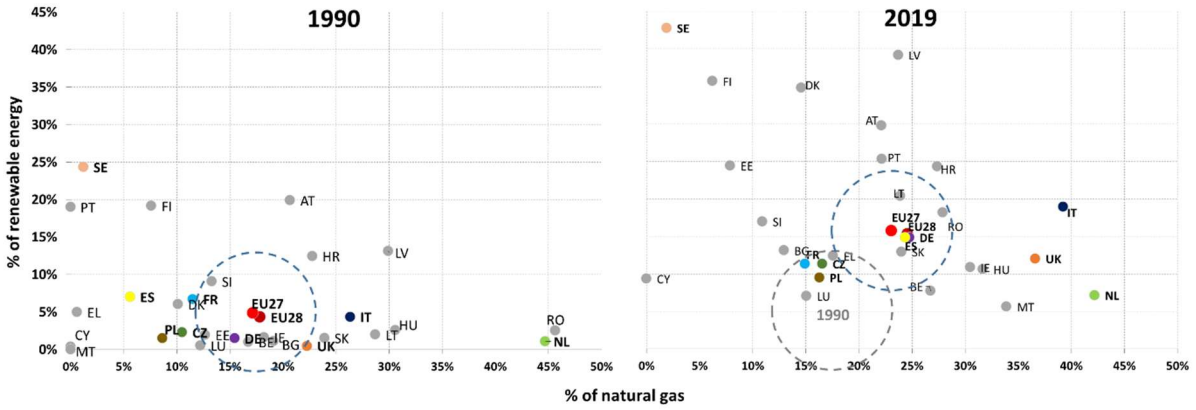


Figure 1.5 – *Each Member State is located in points defined by the percentage of energy consumption of natural gas (abscissa) and percentage of energy consumption by renewable energy (ordinate) in gross inland energy consumption. The circles are centred on EU27.*

The Italian share of gross inland consumption of solid fuels, mainly coal, decreased from 9.9% in 1990 to 4.2% in 2019 with an acceleration in the last years. EU28 share decreased from 26.7% to 10.7%. On the other hand, the share of natural gas for Italy goes from 26.3% to 39.2% from 1990 to 2019, and the EU28 average goes from 17.8% to 24.6%. Italy has contracted the share of oil and petroleum products from 57.3% to 34.8% while EU28 share decreased from 38.3% to 35.4%. Italian renewable share grew from 4.4% to 19%, EU28 share grew from 4.3% to 15.4%. Such figures show that Italy changed the fuel mix more swiftly than the European average.

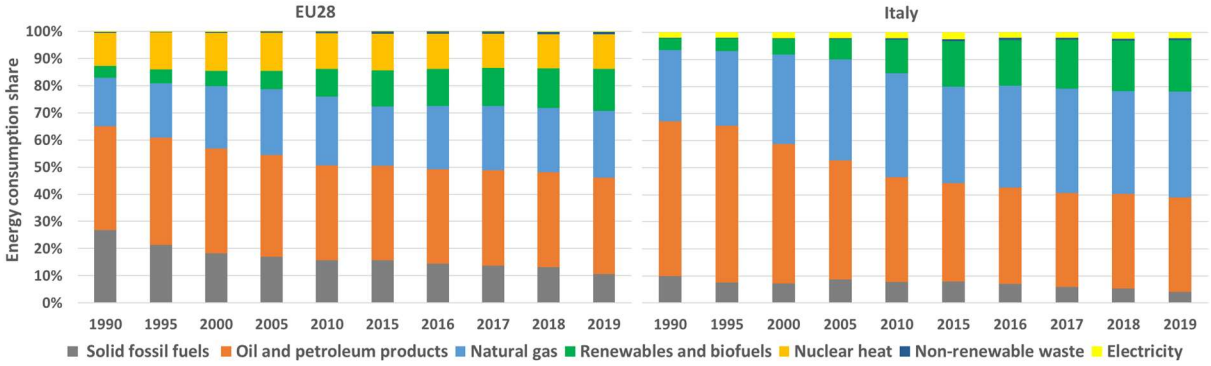


Figure 1.6 – *Fuel energy share in gross inland consumption for EU28 and Italy.*

The energy share from solid fuels in 2019 goes from about 3% in France to about 42% in Poland among the main member States. The Italian share of energy consumption from natural gas in 2019 is among the highest in Europe (39%) exceeded only by the Netherlands (42%). European countries have reduced the share of solid fuels and, to a lesser extent, oil and petroleum products since 1990. On the other hand, there is a significant increase of natural gas share (Figure 1.6).

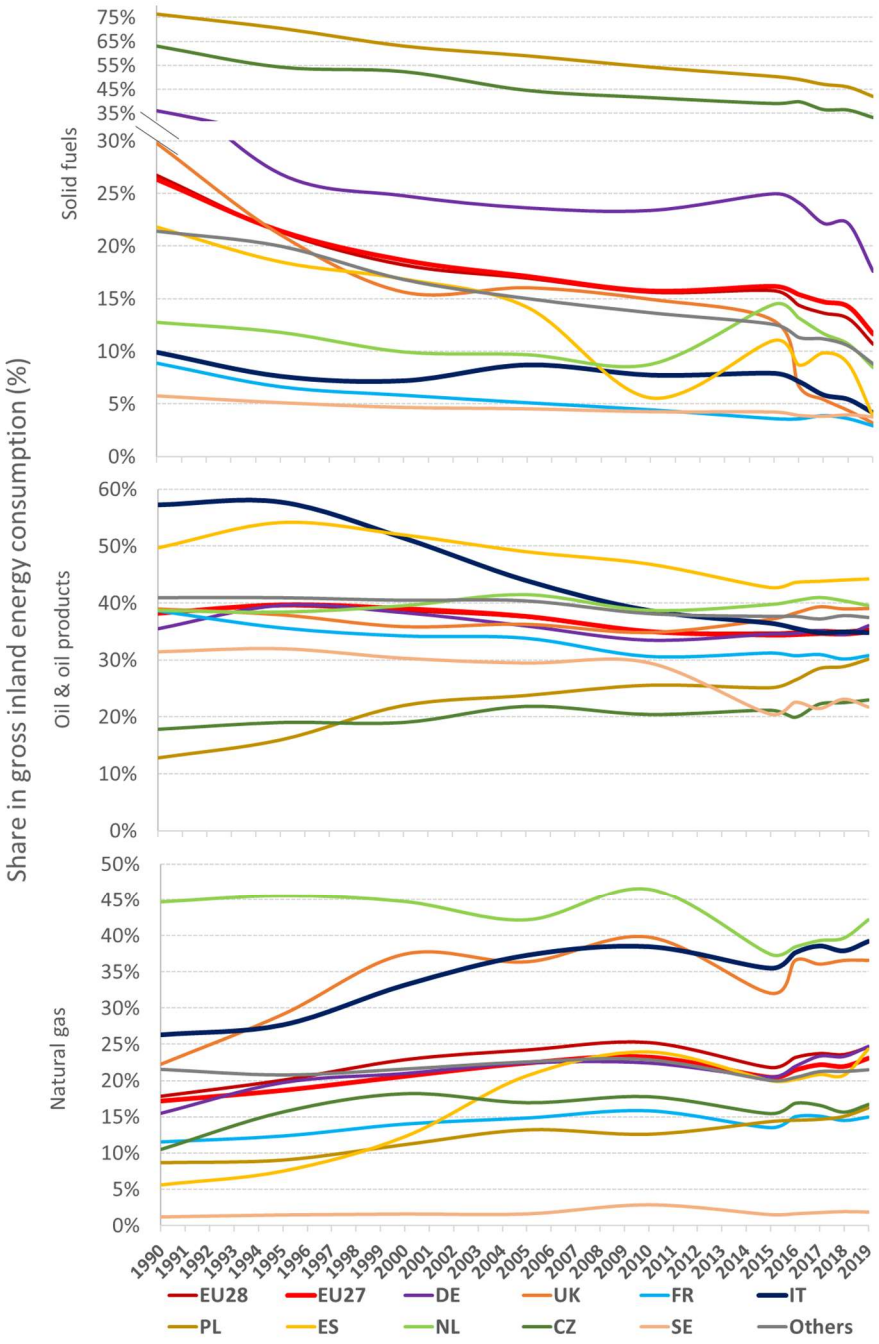


Figure 1.7 – *Share of solid fuels, natural gas, oil and petroleum products in gross energy inland consumption.*

The next graph shows the share of nuclear energy which is not negligible in many of the major European States and it is dominant in France.

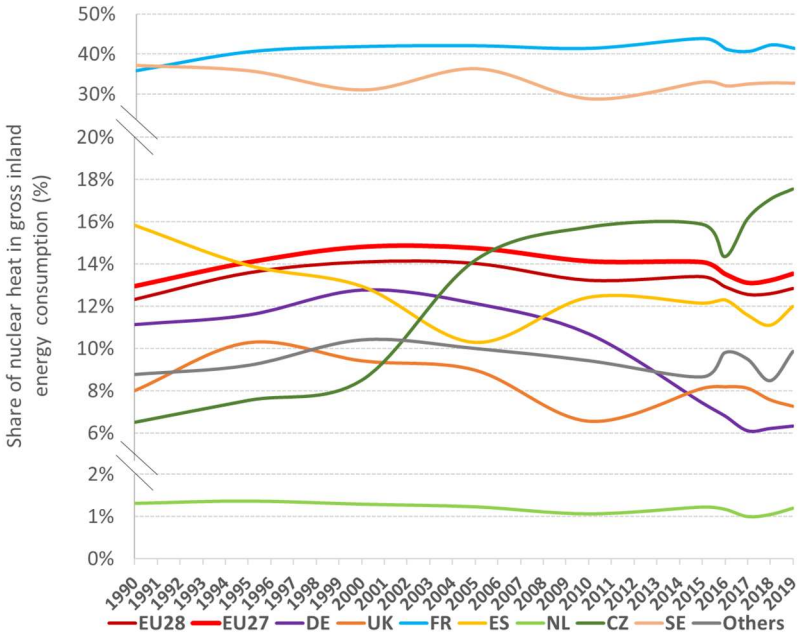


Figure 1.8 – *Share of nuclear energy in gross inland energy consumption.*

The share of fossil fuels is significantly reduced in almost all European countries. The EU28 average decreased from 83.1% in 1990 (81.9% for EU27) to 71.6% in 2019 (70.6% for EU27). Among the examined countries, the Netherlands share is still higher than 90% in 2019, while Poland share is just under such threshold. Among the biggest countries, Italy has the largest reduction of fossil share (-14.7 percentage points), exceeded only by Czechia (-17.7).

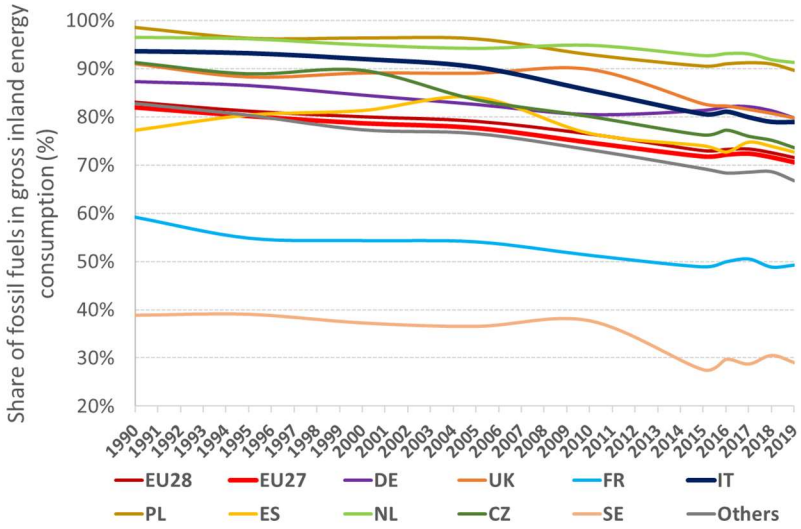


Figure 1.9 – *Share of fossil fuel energy in gross inland energy consumption.*

With regard to the share of renewable energy in gross inland consumption (Figure 1.10), the Italian trend shows an acceleration compared to the European average since 2002. In 2019, the share in Italy was 19% compared to 15.4% for EU28 and 15.8% for EU27. All the biggest countries have trends similar to the Italian one, although with smaller shares. Among the countries examined, the United Kingdom had the lowest values up to 2011, with a sharp increase in the next years. The Netherlands has the lowest share in recent years. The renewable share in the group of 'other' Member States is greater than the Italian share with the average of 19.2% in 2019.

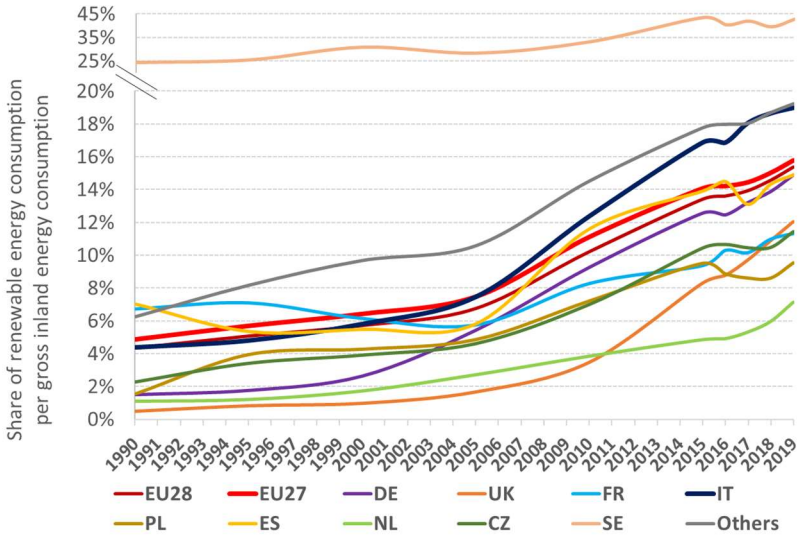


Figure 1.10 - *Share of renewable energy in gross inland energy consumption.*

The renewable share reported in the previous graph represents the actual gross inland consumption. Although such indicator has the same nature of the share considered by the European Directive 2009/28/EC, it cannot be compared with the 2020 targets. The renewable target according to the Directive concerns the share of energy from renewable sources in the gross final energy consumption. Gross final energy consumption is defined in Directive 2009/28/EC on renewable energy sources as energy commodities delivered for energy purposes to final consumers (industry, transport, households, services, agriculture, forestry and fisheries), including the consumption of electricity and heat by the energy branch for electricity and heat production, and including losses of electricity and heat in distribution and transmission. The accounting rules in the Directive prescribe that electricity generated by hydropower and wind have to be normalised for annual variations (hydro 15 years and wind 5 years). Below is shown the trends of the indicator since 2004 according to the Directive. The overall share of renewable energy consumption in 2019 for Italy is 18.2%, over the target of 17% to be achieved in 2020. Among the countries examined only Italy, Czechia, and Sweden has already achieved their targets.

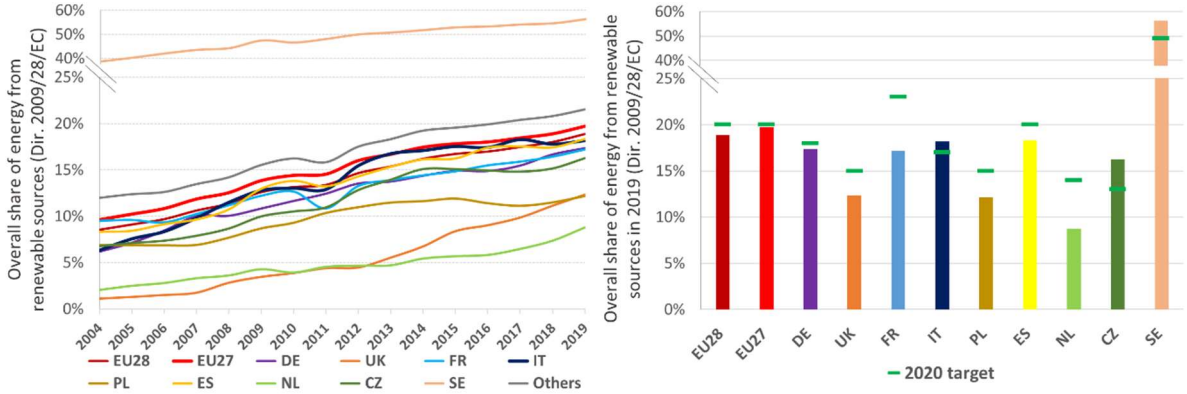


Figure 1.11 – *Trends of renewable energy share in gross final consumption (on the left) according to European Directive 2009/28/EC (source EUROSTAT). The shares in 2019 are compared with the 2020 targets on the right.*

Gross inland energy consumption per capita shows very different values in the European countries. Italian energy consumption per capita is well below the European average. Italian consumption increased from 2.61 toe (tonnes of oil equivalent) per capita in 1990 to 3.27 toe per capita in 2005. After 2005 the consumption falls to 2.60 toe per capita in 2019, while the EU28 average is 3.19 toe per capita (3.26 in EU27). In the last years, Italy has the lowest energy consumption per capita among the countries examined. Germany, France, Czechia, the Netherlands, and Sweden have higher figures than EU28 and

EU27 averages. The trends show that energy consumption has decreased everywhere since 2005 up to 2015 with some fluctuations in the last years (EU28, -14.2% in the period 2005-2019; EU27, -11.8%). The United Kingdom shows the highest rates of reduction (-29.8% from 2005 to 2019), followed by Italy (-20.6%), Spain (-18.9%), France (-15.3%), and Germany (-12.3%) among the biggest countries. Poland is the only exception to the observed trend for the countries examined, with a 12.9% increase of energy consumption per capita from 2005 to 2019.

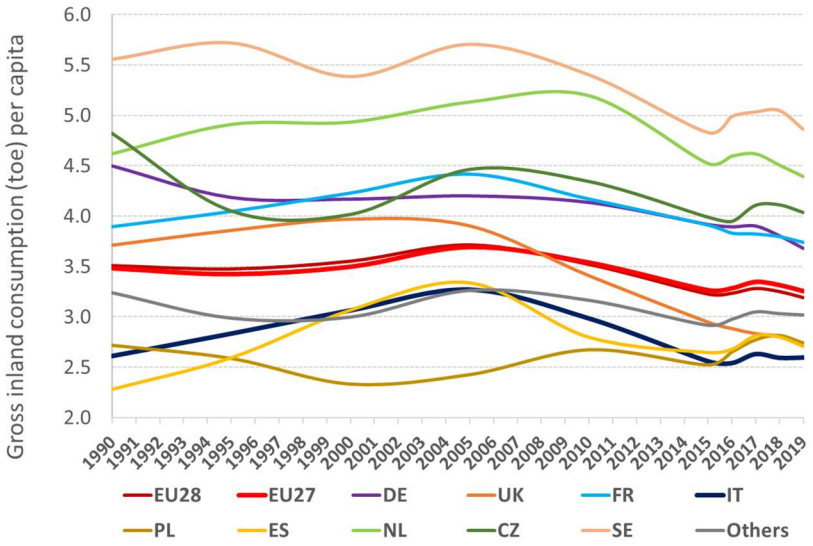


Figure 1.12 - *Gross inland energy consumption per capita.*

The ratio between the final energy consumption (including non-energy uses) and gross inland consumption is an indicator of energy efficiency. This indicator has always been higher for Italy than for the European average and shows values which, among the biggest countries, are comparable only with those of the Netherlands. The Italy's figures decreased until 2000 and then they increased as a result of many causes including rising shares of electricity production from cogeneration plants, electrification of final energy consumption, transformation efficiency of fossil fuels and renewable energy.

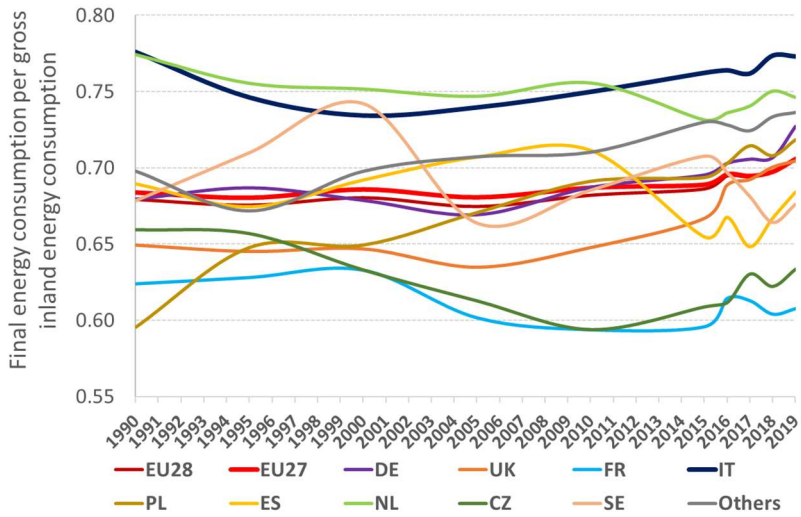


Figure 1.13 – *Ratio between final energy consumption (including non-energy uses) and gross inland energy consumption.*

Since 1990 the ratio between final energy consumption and gross inland consumption for Italy has been around the average of 0.76, while both for EU28 and EU27 the average is 0.69. In 2019 only six Member States showed greater efficiency than Italy: Latvia, Lithuania, Luxembourg, Croatia, Austria and Denmark. Among the States examined for the comparison only the Netherlands' values are comparable to the Italian average (Figure 1.13), although in recent years the efficiency for Italy has become higher and shows a sensible increase, contrary to the trend observed for the Netherlands. Except for France and Czechia, the other States fluctuate around the European average in the last years. France and Czechia have the lowest values among many European countries because of the low electrical conversion efficiency of nuclear power plants and the significant weight that the nuclear source has in the energy balance of such States (41.4% and 17.6% of gross inland consumption in 2019, respectively for France and Czechia). A sharp increase in efficiency made Poland reach and overcome the European average in recent years. It should be noted that also Germany, Spain, the United Kingdom, the Netherlands, and Sweden have shares of nuclear heat in their energy consumption in 2019 (from 1.2% for Netherlands to 32.7% for Sweden).

To evaluate energy transformation efficiency, it is useful to consider energy consumption without non-energy uses. In other words, the ratio between final energy consumption and primary energy. The trend of this indicator is quite similar to that of the previous one, although it highlights some differences between Member States concerning the share of non-energy uses. This indicator reveals that the Netherlands' energy transformation efficiency is lower than Italy's energy transformation efficiency. In the Netherlands, non-energy uses account for 15.8% of gross inland consumption in 2019, with slight decrease in recent years. For Italy the average is around 5% with a decreasing trend since 1990. The Netherlands' share of non-energy consumption in 2019 is the highest in Europe, followed by Lithuania (15.3%) and Belgium (12.8%). All the others States range from 0.8% of Luxembourg to 7.9% of Hungary (EU28, 6%; EU27, 6.2%).

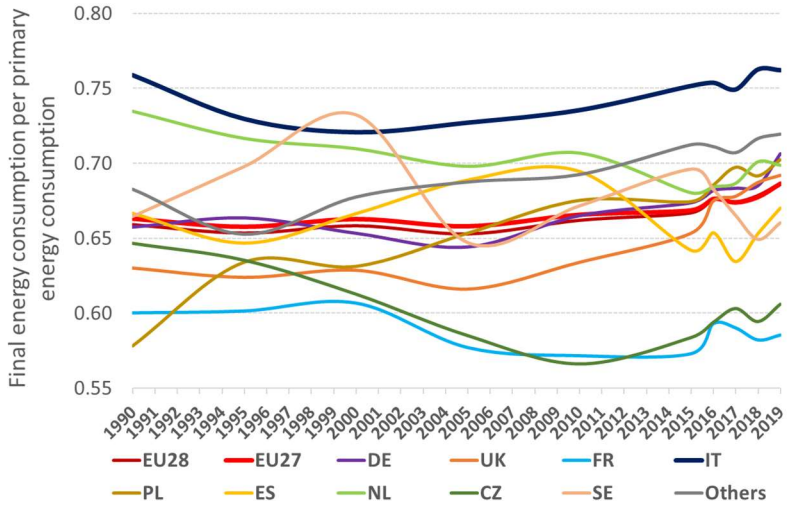


Figure 1.14 – *Ratio between final energy (w/o non-energy uses) and primary energy consumption.*

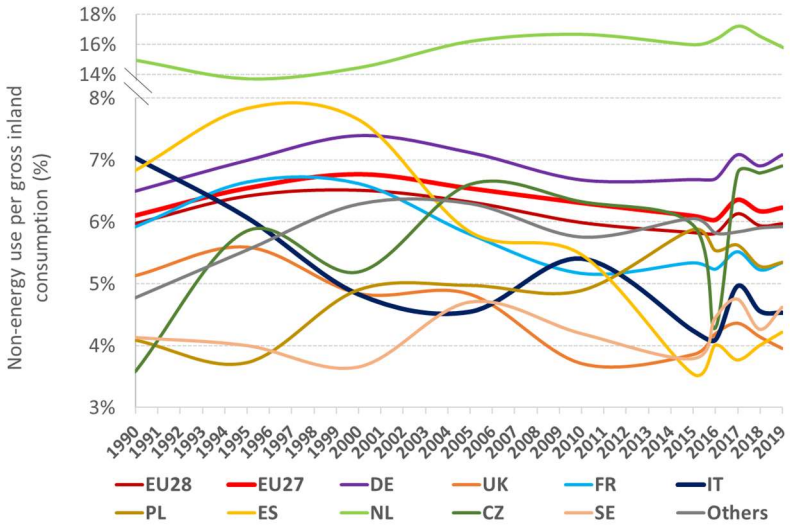


Figure 1.15 – *Ratio between final energy consumption (non-energy uses) and gross inland consumption.*

The gross inland energy consumption per unit of gross domestic product (GDP - chain linked volumes, reference year 2015) is an indicator of the country's economic and energy efficiency (energy intensity). Italy was one of the European countries with lower energy intensity until 1995, when it was behind only to Denmark, then lost positions to reach 6th place in 2019, after Ireland, Denmark, the United Kingdom, Malta and Luxembourg. Among the biggest European countries, Italy, after the United Kingdom, continues having the lowest energy intensity.

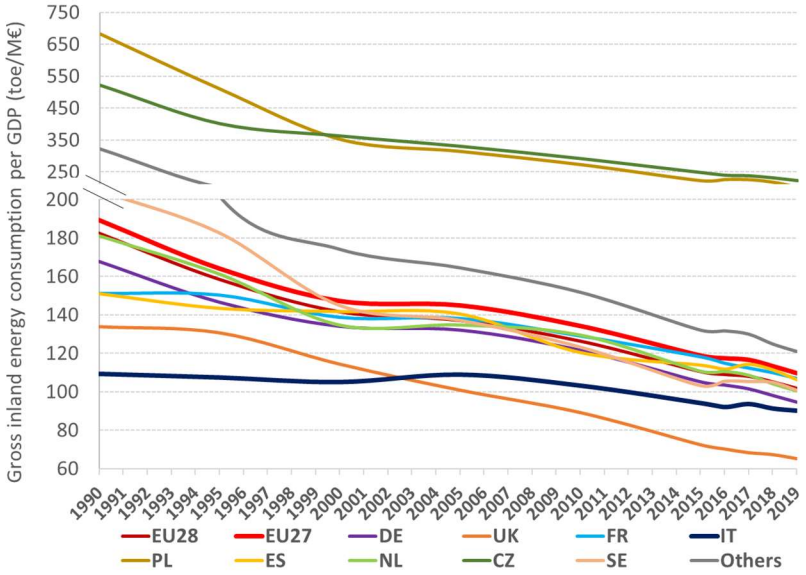


Figure 1.16 – *Gross inland energy consumption per unit of GDP (chain linked volumes, reference year 2015).*

Economic activities are heavily dependent on energy consumption. A highly significant correlation between gross inland consumption and gross domestic product is evident for the European countries. In the next graph each State has a distance along the perpendicular from the correlation line, which represents a measure of the country's economic efficiency. Countries above the line have above-average EU28 economic efficiency, while the opposite is true for countries below the correlation line.

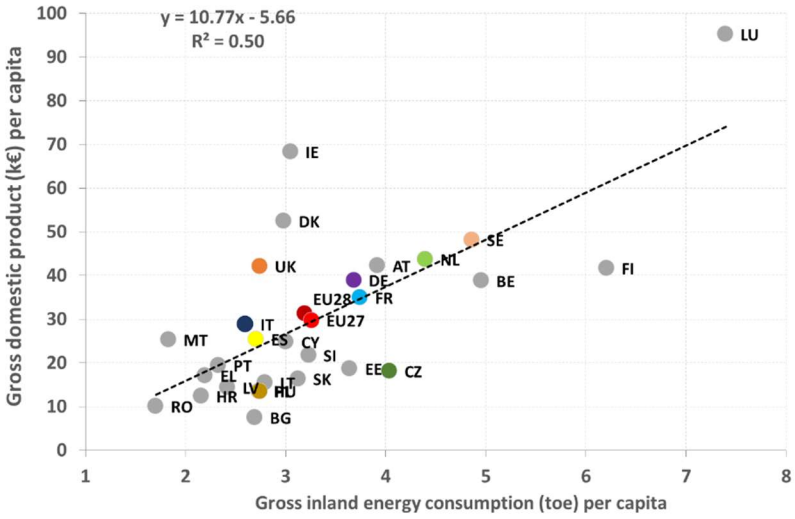


Figure 1.17 – *Relationship between gross inland energy consumption and gross domestic product in 2019.*

The final energy intensity (the ratio between final energy consumption including non-energy uses and gross domestic product) follows similar trends to energy intensity with a sudden reduction in the European countries which, starting from higher levels than Italy, reach Italian figures and in some cases exceed them. Since 1990 Italy shows considerable energy and economic efficiency, the final energy intensity reduced by 18% from 1990 to 2019; much higher reductions have occurred in the other European countries (-42.1% in EU28 and -40.3% in EU27). Poland and Czechia show rapid decrease since 1990 (-64.2% and -59% in 2019, respectively) but their energy intensities are still very higher and far from the European average. The same trend is also recorded for the group of other countries (-60.4%) whose average energy intensity is higher than the European one.

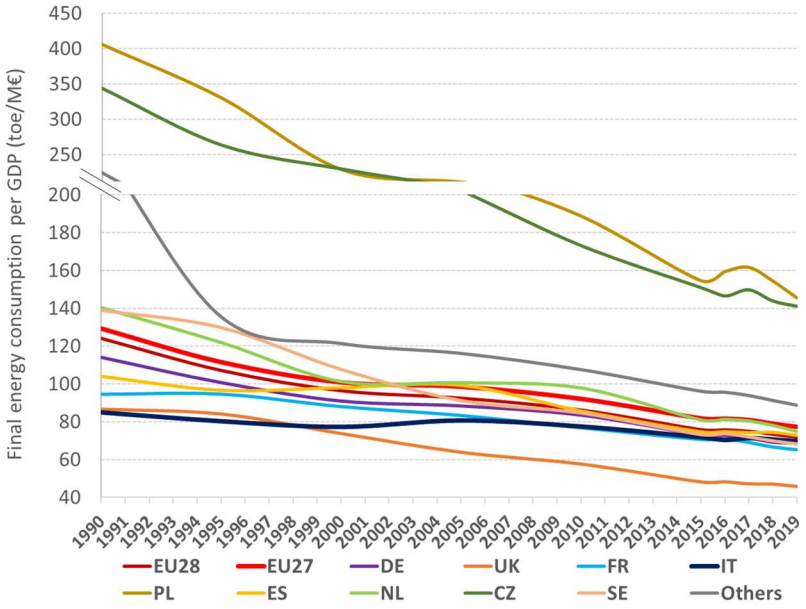


Figure 1.18 – *Final energy consumption per unit of GDP.*

The reasons for the reduction in energy intensity observed are manifold such as the increase in building efficiency, industrial conversion (France and Germany), the high rate of electrification of final consumption (France) and the considerable shift of economic sectors towards high value added and low energy consumption activities of services to the detriment of industrial sectors (France and the United Kingdom). The last aspect is particularly relevant considering the growth of GDP in the countries and,

above all, the increasing share of the value added from services, which in EU28 represents 74% of the value added (at current prices) of all economic activities in 2019, while in1995 it represented 68%. In contrast, the share of value added in industry (except construction), the most energy-intensive sector, fell from 23.3% in 1995 to 18.8% in 2019. In the United Kingdom, the shift of economic activities from industry to services appears to be particularly relevant throughout the period considered.

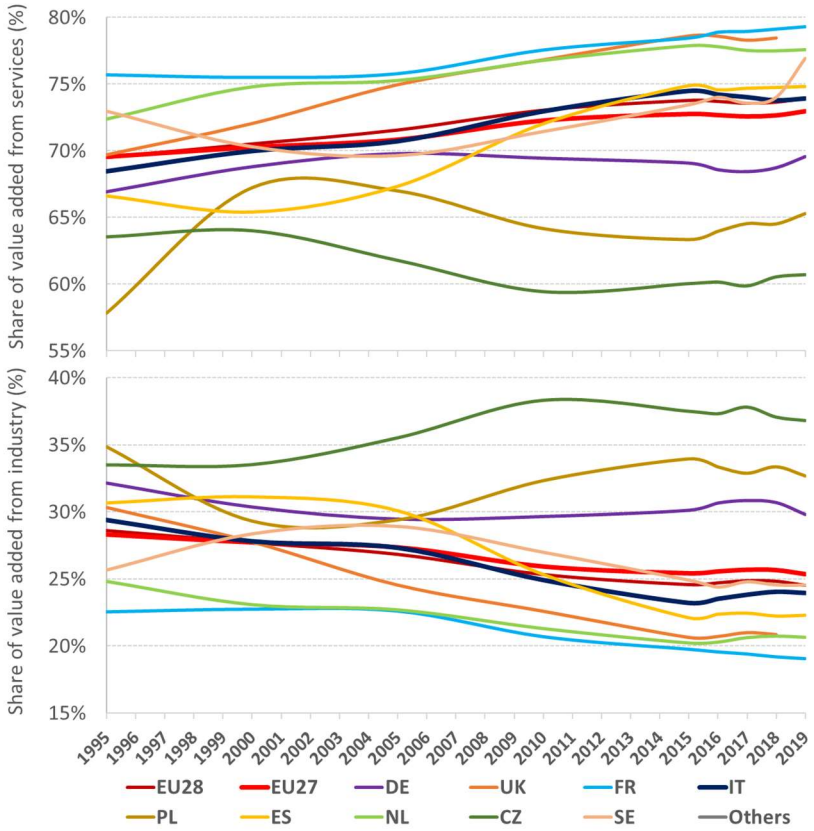


Figure 1.19 - *Shares of value added in services and industry. UK data up to 2018.*

In Italy, the share of value added in services increased from 67.5% to 73.9% from 1995 to 2019, while in the United Kingdom it was 69.7% in 1995 and the last figure available was 78.5% in 2018. Such increase is reflected in the reduction of the share in industry, a sector characterized by much greater energy demand per unit of value added than services.

1.1.1 *Electrification of final consumption (energy uses)*

The performances of the power sector are analysed in the next chapter, where parameters such as efficiency and greenhouse gas emissions due to electricity generation of the biggest European countries were analysed in details. Here only the electrification of final consumption and the share of renewable electricity will be considered.

European countries show a wide range of electrification of final energy consumption (energy uses only) in 2019 ranging from 14.5% in Luxembourg to 39.2% in Malta. Italy is just below the European average (22.6% EU28 and 22.8% EU27) with 22.2%. Among the biggest countries, France shows the highest levels of electrification (26.6% in 2019), followed by Spain (24.7%), while Czechia and Poland have the lowest values, 20.7% and 17.5% respectively. Sweden, after Malta, has the highest electrification of final energy consumption (34.2%).

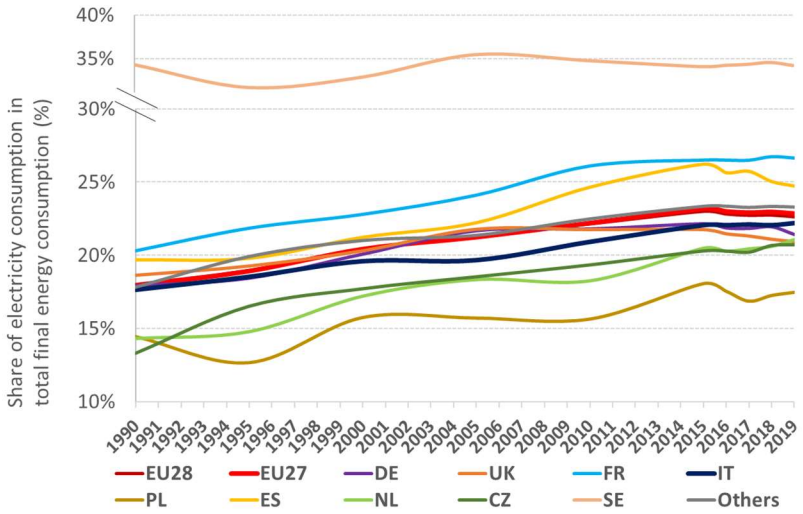


Figure 1.20 – *Share of final electricity consumption in total final energy consumption.*

An examination of final electricity consumption in the main sectors shows considerable sectoral heterogeneity. Industry, services, transport and households account for 96.7% of EU28 final energy consumption in 2019. The remaining share is consumed by agriculture. As regards electricity consumption, the industrial and civil sectors (households and services) account for 95.5% of electricity consumption, while transport and agriculture account for the remaining share.

Table 1.1 – *Sectoral shares of final energy and electricity consumption in EU28 and Italy.*

	2005	2010	2019	2005	2010	2019	2005	2010	2019
	Share of final energy consumption (%)			Share of electricity in total electricity consumption (%)			Share of electricity in final consumption (%)		
EU28									
Industry	28.6%	24.4%	24.6%	40.6%	36.3%	36.9%	31.8%	32.9%	33.9%
Transport	28.6%	29.1%	31.3%	2.3%	2.1%	2.3%	1.7%	1.6%	1.7%
Households	27.4%	29.4%	26.9%	28.8%	29.9%	29.1%	22.1%	22.5%	24.5%
Services	12.8%	14.2%	13.9%	26.6%	29.6%	29.5%	44.1%	46.3%	48.0%
Agriculture	2.6%	2.9%	3.3%	1.7%	2.1%	2.2%	12.9%	16.0%	16.4%
Italy									
Industry	28.3%	23.6%	22.0%	48.1%	42.7%	40.9%	33.5%	37.9%	41.2%
Transport	31.8%	31.3%	31.7%	3.3%	3.6%	4.0%	2.0%	2.4%	2.8%
Households	25.8%	28.8%	27.5%	22.3%	23.2%	22.5%	17.0%	16.9%	18.1%
Services	11.4%	13.8%	16.1%	24.6%	28.6%	30.6%	42.2%	43.4%	42.2%
Agriculture	2.6%	2.5%	2.7%	1.8%	1.9%	2.1%	13.9%	16.4%	17.8%

At sectoral level, the Member States show fairly different figures although they share a common growing trend (Figure 1.19). The electrification of industry final consumption in Italy is among the highest in Europe (41.2% in 2019). Only three States in EU28 have higher rates: Malta (76.3%), Slovenia (42.2%), and Luxembourg (42.1%). The sharp boost of industry electrification recorded in Poland and Czechia is particularly interesting, both countries are approaching the European average (33.9% in EU28, 33.6% in EU27). Equally important is the reduction in Germany from 36.4% in 2005 to 34.5% in 2019 and the substantially unchanged values in the Netherlands.

Services show the highest percentages of electrification of final energy consumption among sectors. The Italian share in 2019 is 42.2%, well below the European average (48% in EU28, 48.8% in EU27) and falling sharply in the last two years also for the inclusion of heat pumps final consumption in the energy balance not recorded before 2017. Italy accounts for 18.9% heat pumps final energy consumption in EU28 in 2019, almost entirely recorded in the service sector.

Table 1.2 – *Final energy consumption from heat pumps in EU28 and percentage of consumption in the selected countries since 2017. Countries in descending order of 2019 value.*

	2017	2018	2019
France	19.4%	19.3%	20.5%
Italy	22.6%	20.9%	18.9%
Sweden	10.9%	10.9%	10.2%
Germany	9.1%	9.3%	9.5%
United Kingdom	9.1%	8.7%	8.4%
Spain	5.3%	6.0%	6.5%
Netherlands	1.5%	1.7%	2.0%
Poland	1.6%	1.7%	1.9%
Czechia	1.2%	1.4%	1.5%
Others	0.0%	0.0%	0.0%
EU28 (Mtoe)	**11.7**	**12.4**	**13.2**

Spain shows the highest electrification share in services, 60.2% in 2019, among the largest countries although there has been a sudden reduction since 2010, when the share of electricity consumption in final consumption was 73.7%. Germany, Italy, and the United Kingdom are at the lower end with respectively 42%, 42.2%, and 42.9% of electricity consumption in 2019.

The Italian electrification share in households (18.1% in 2019) is well below the European average (24.5% in EU28, 24.7% in EU27) and, after Poland (13.9%), it is the lowest value among the biggest countries. Malta has the highest share followed by Sweden, 70.6% and 51.2% respectively.

The transport sector shows the lowest percentages of electrification and in 2019 Italy is one of the three European countries with the highest share (2.8%), after Sweden (3.4%) and Austria (3.2%). Electricity consumption in the mobility sector has been limited so far to public transport (train, tram, metro), while for private mobility the electricity carrier plays a marginal role. The rapid decline in the electrification rate in Poland is explained by the strong growth of final consumption in this sector, especially due to road transport, and an almost constant consumption of electricity until the early 2000s and subsequently in decline.

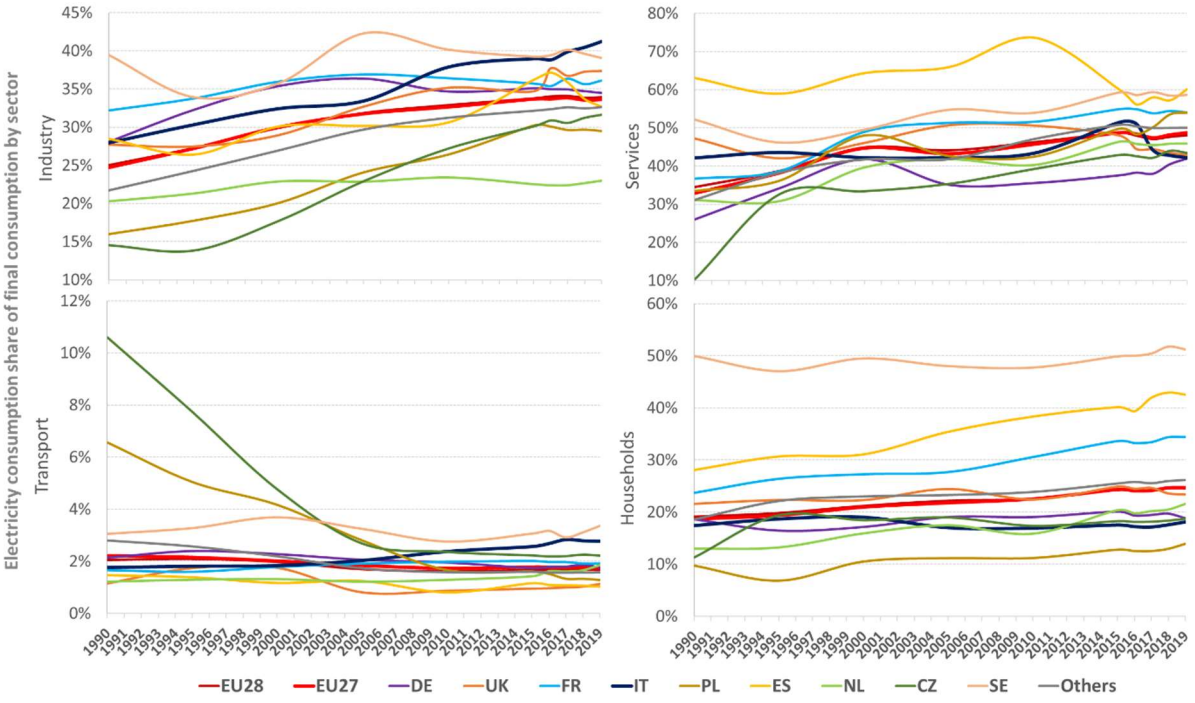


Figure 1.21 – *Share of electricity consumption in final consumption by sector.*

The share of sectoral electricity consumption can provide indications on the emission mitigation performance of each sector if the figure is read together with sectoral consumption of renewable energy and above all with the share of renewable electricity production. The following graph shows the renewable energy share of gross final consumption for each country, in accordance with Directive2009/28/EC. Among the largest European countries, Italy is the only one to have overachieved in advance its target of 17% for the share of energy from renewable sources by 2020 (GSE, 2020).

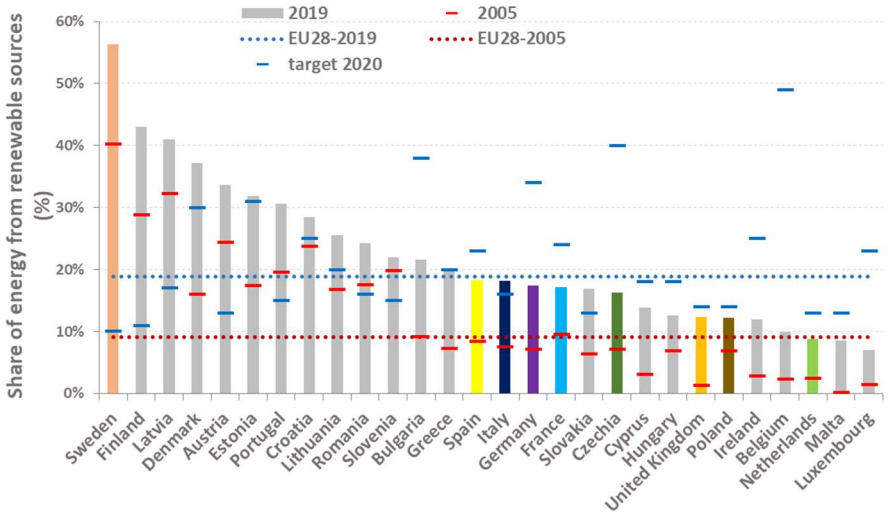


Figure 1.22 – *Share of renewable energy in gross final consumption in 2019 according to Directive 2009/28/EC (source EUROSTAT). Countries in descending order.*

The Italian share of energy from renewable sources in gross electricity consumption is 34.8% in 2019, higher than the indicative target of 26.4% set by the National Renewable Energy Action Plan (2010).

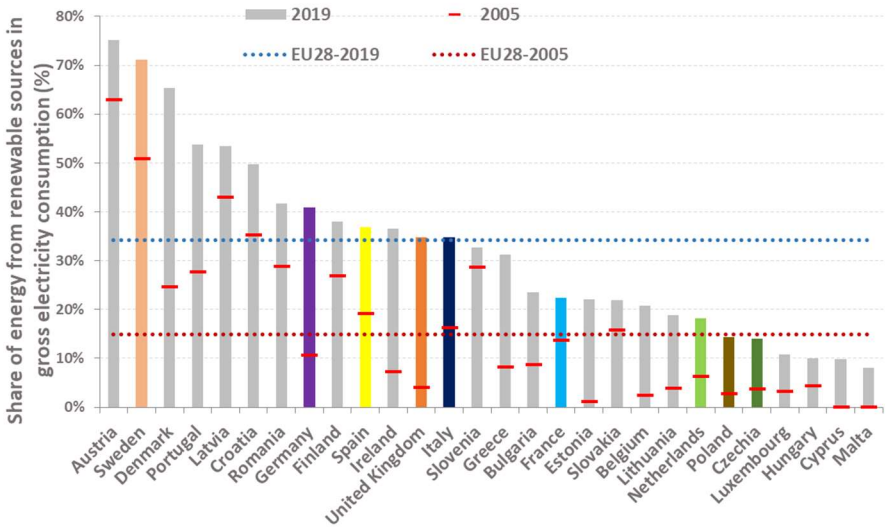


Figure 1.23 – *Share of renewable energy in 2019 in gross electricity consumption according to Directive 2009/28/EC (source EUROSTAT). Countries in descending order.*

The following graphs show the renewable energy share for transport and for heating and cooling.

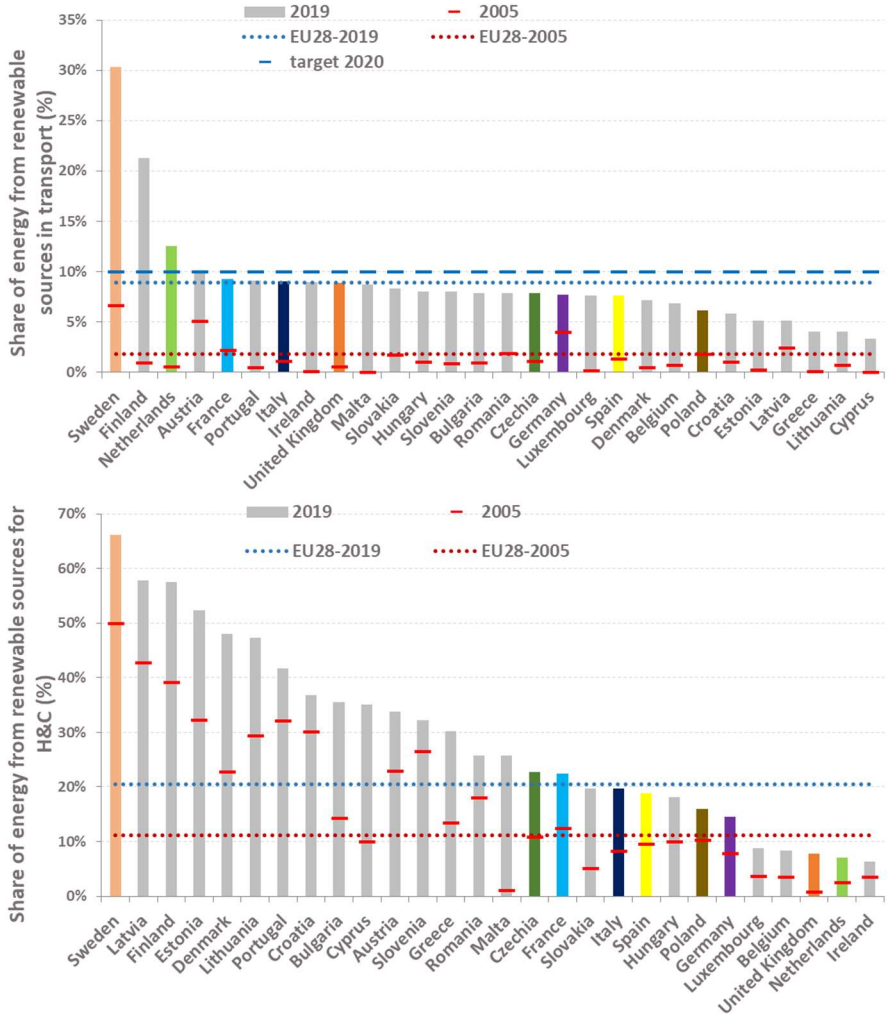


Figure 1.24 – *Share of renewable energy in 2019 for transport (up) and for heating and cooling (down) according to Directive 2009/28/EC (source EUROSTAT). Countries in descending order.*

The renewable energy consumption, as well as the sectoral electrification, must be considered both concerning the final consumption of each Member State and the relative weight of each State in Europe. Italian consumption in 2019 accounts for 10% of EU28's renewable energy consumption, the third after Germany (17.7%) and France (12.2%).

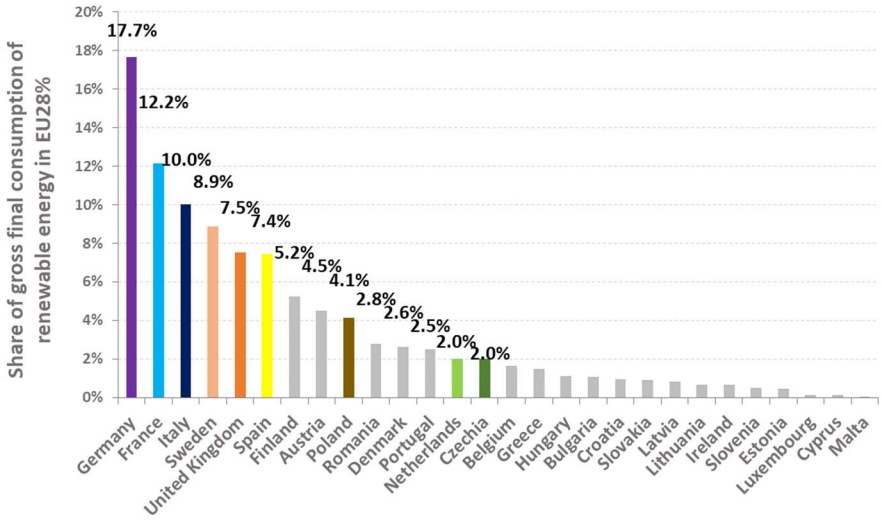


Figure 1.25 – *Share of gross final consumption of renewable energy (2019). Percentages higher than 2% are reported. Countries in descending order.*

The countries examined for comparison with the Italian figures represent 71.8% of EU28 final consumption of renewable energy in 2019. Such figures show clearly that the electrification of the final consumption of Italy involves a significant contribution to the consumption of renewable energy in Europe, both because of the size of consumption and because a significant amount of electricity is produced from renewable energy.

1.2 Total greenhouse gas emissions and energy processes

The average of Italy's GHG emissions per capita from 1990 to 2019 is 8.9±1.1 t CO_2eq (ISPRA, 2021). Emissions per capita increased until 2004 when the maximum value of 10.2 t CO_2eq was reached, then a reduction of up to 7 t CO_2eq was observed in 2019.

The next graph shows that Italian emissions per capita have always been below the European average. The graph also shows that, apart for Italy and Spain, the trend of emission reductions began as early as 1990. Emissions per capita in Spain increased more than in Italy until 2005, when the emissions per capita of the two countries reached the same level. After 2005 the emissions per capita decrease also in Italy and Spain. In recent years, emissions per capita in France, Spain, the United Kingdom, and Italy are very close. The reduction of the UK's emissions per capita is particularly steep, especially as a result of the boost of services and decline of industry in the UK's economy. Czechia, the Netherlands, Germany, and Poland have the highest emissions per capita among the biggest countries. For Poland, unlike all other countries, there has been an increase in emissions per capita in recent years. Among the countries examined Sweden has the lowest GHG emissions per capita.

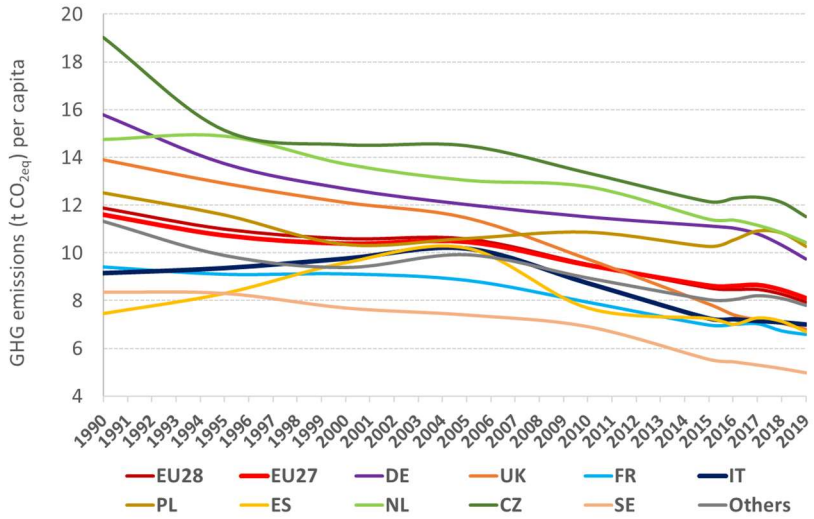


Figure 1.26 - *Greenhouse gas emissions per capita.*

The trends of GHG emissions per unit of gross inland energy consumption (carbon intensity related to energy) in the countries examined is shown in Figure 1.27. All countries have reduced the carbon intensity. Among the examined countries Poland has the highest values (3.8 t CO_2eq/toe in 2019), while Sweden and France have the lowest values (1.7 t CO_2eq/toe and 1 t CO_2eq/toe, respectively). The significant weight of nuclear energy in such countries (32.7% and 41.4% respectively for Sweden and France in 2019) makes reason for the distance from other countries. Among the other countries examined, Italy and Poland do not have nuclear energy, while the other countries have shares of gross inland consumption ranging from 1% in the Netherlands to 17.6% in Czechia. Smaller countries ("Others" in the graphs) have 9.9% share of nuclear heat in 2019. The Italian carbon intensity for energy consumption is higher than the European average (2.69 *vs* 2.49 t CO_2eq/toe in 2019).

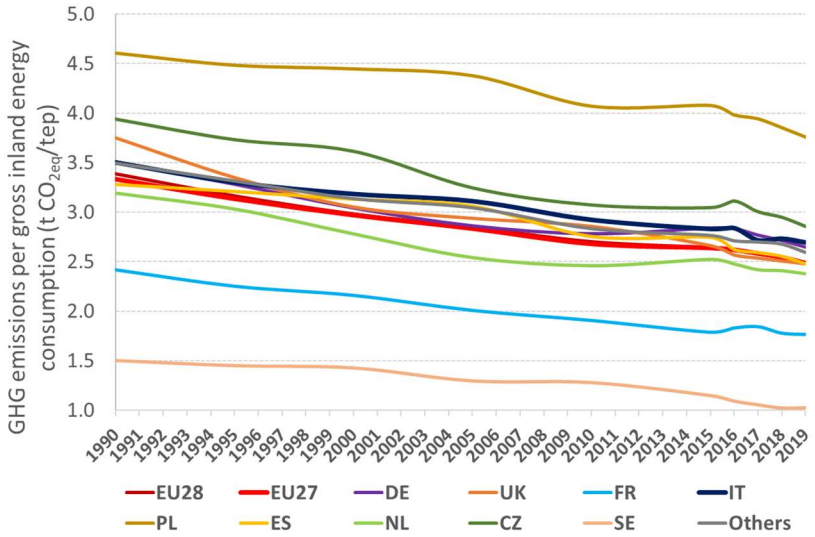


Figure 1.27 – *Greenhouse gas emissions per gross inland energy consumption.*

By removing nuclear power, which is not a source of GHG emissions, from gross inland consumption, the carbon intensity so calculated is due to the mix of fossil fuels and renewable energy. According to this approach the trend of carbon intensities has been revised in the following graph, as a consequence Italy's figures are below the European average. Among the biggest countries, the United Kingdom shows a significant reduction (-34.3% since 1990) with values reaching in recent years those recorded for Italy, while only the Netherlands and Sweden have lower values than the Italian ones.

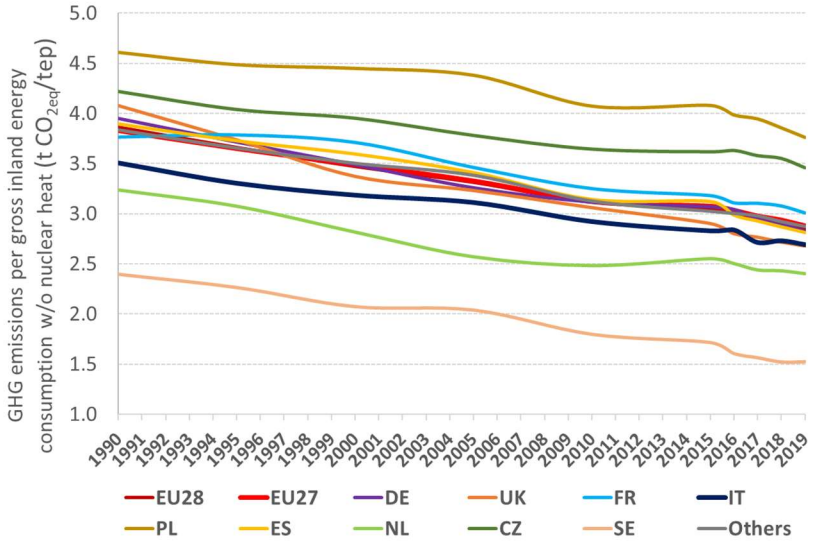


Figure 1.28 – *Greenhouse gas emissions per unit of gross inland energy consumption without nuclear energy consumption.*

Apart from Sweden, whose fossil share is much lower than the Italian one (29% *vs* 78.9% in 2019), this result is in apparent contrast to what was previously said about the energy mix of the Netherlands which, compared to Italy, have a higher share of fossil fuels (91.3% *vs* 78.9%) and a lower share of renewable energy (7.2% *vs* 19%). In order to overcome the apparent contrast, it is necessary to consider that the Netherlands, as already mentioned, has a significantly higher share of non-energy consumption than Italy (15.8% *vs* 4.5% in 2019). While primary energy consumption has a direct relationship with greenhouse gas emissions, the same is not true for non-energy uses. These consumptions include industrial processes in sectors such as the petrochemical, pharmaceutical, *etc*., where oil and its products are not used as fuels, but for transformation into other products. Therefore, the comparison of decarbonization indicators between countries with significantly different shares of non-energy uses can be corrected by considering the GHG emissions per unit of primary energy consumption. This indicator highlights the decarbonization of a country's energy sector. GHG emissions per unit of primary energy without nuclear energy intake (Figure 1.29) show that in 2019 the Italian figures are quite overlapping those of France and Spain. Sweden has the lowest values while the other countries examined have higher values than Italy.

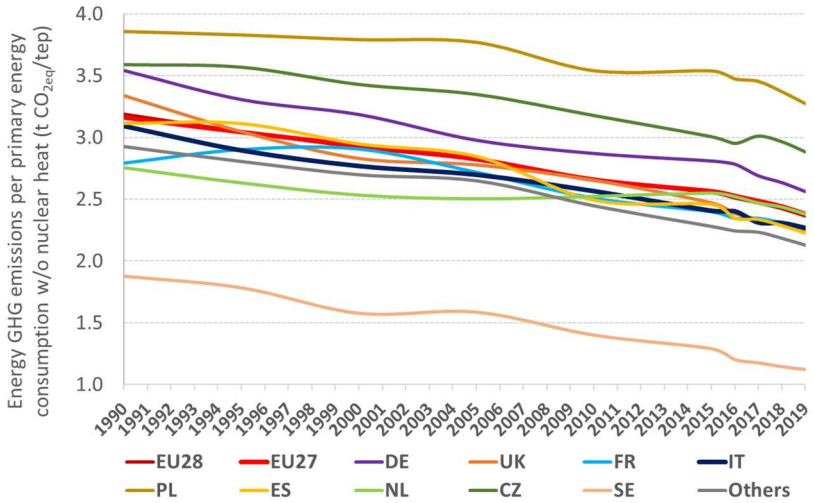


Figure 1.29 – *Greenhouse gas emissions from primary energy consumption without nuclear energy consumption.*

The ratio between GHG emissions and gross domestic product is the carbon intensity related to economy. This indicator shows a reduction for all European countries and Italy's figures are just below the EU28 average in 2019 (Figure 1.30). At the lowest end there is Sweden with 0.1 t CO_2eq/k€, while Poland is at the upper end with 0.8 t CO_2eq/k€ in 2019. The reductions since 1995 range from -31.7% for Italy to -66.7% for Poland. The European average is -49.6% for UE28 and -47% for EU27. The causes of such reductions are manifold and concern both the common increase in efficiency of industry and the increasing share of value added from services, whose carbon intensity is far lower than those of the energy and manufacturing industries.

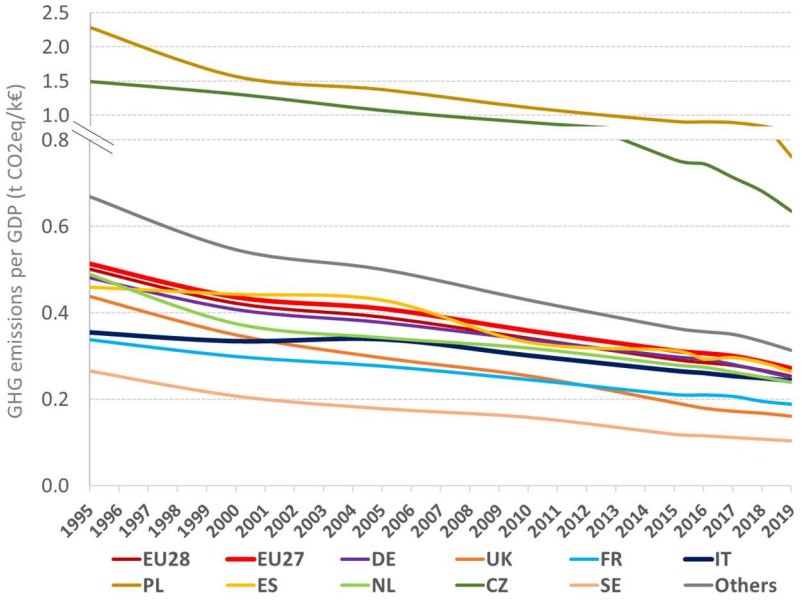


Figure 1.30 – *Greenhouse gas emissions per unit of GDP.*

In the phase space defined by GHG emissions per unit of GDP and GHG emissions per capita, each point represents the position of a Member State. For each year considered in Figure 1.31, all the Member States are shown on the left side, while on the right one there is the enlarged box that inscribes the biggest Member States in 2019. Poland and Czechia are excluded because, although approaching the European average in the recent years, they remain far from the group of the other countries. Poland, together with the group of eastern countries, had GHG emissions per GDP greater than 2 t CO_2eq/k€ in 1995. Since 2005, all 28 countries have economy carbon intensity below 1.5 t CO_2eq/k€. The graphs show that States have moved to the bottom left corner of the phase space, becoming more and more numerous in the box. In 1995 only Sweden was already in the box while all other States were outside: the further shift towards the phase space with lower emissions per capita and GDP has brought them in. Since 2005 France was in the box while Italy and the United Kingdom were approaching the boundary.

The distance that each country has travelled since 1995 in the phase space defined by the two indicators provides a measure of the progress made in the decarbonization process. The distance of two points in the two-dimension Euclidean space, $P = (p_x , p_y)$ and $Q = (q_x , q_y)$, is calculated as:

$$\sqrt{(p_x - q_x)^2 + (p_y - q_y)^2}$$

According to this metric, Italy travelled 2.4 units from 1995 to 2019 against EU28 average of 3.1 units (2.6 for EU27). Among the biggest countries, the United Kingdom, the Netherlands, and Germany travelled the greatest distances with 6.1, 4.5, and 4 units respectively, while the distances travelled by Spain and Poland are the lowest with 1.6 and 2 units, respectively. In addition to the distance travelled, it is also appropriate to consider the starting points of each State as concerns the efficiency and decarbonization indicators and the mix of energy resources used to meet their needs. Moreover, differently from Italy, many States had significant share of solid fuels to displace and even today benefit significant shares of nuclear energy without GHG emissions.

As we have seen before the Italian greenhouse gas emissions per capita have been among the lowest since 1990 in Europe, the same can be said of the energy and economy carbon intensity. The trends of these indicators show that the biggest countries are gradually moving closer to the Italian values and in some cases such values have been exceeded.

Figure 1.31 – *In the phase space defined by emissions per capita (abscissa) and economy carbon intensity (ordinate) is shown the position for each Member State on the left. On the right the enlarged box that inscribes the biggest Member States in 2019 is shown.*

Even more interesting is the countries positioning in the phase space defined by GHG emissions per and gross inland consumption per unit of GDP (Figure 1.32). In such picture both abscissa and ordinate

report intensities indicators. No country occupies in 1995 the box where the biggest countries are in 2019. The United Kingdom was the first, among the biggest countries, to enter in the box since 2005. Poland and Czechia are off the graph scale having in 1995 energy intensities per GDP of 509 toe/M€ and 400.8 toe/M€, respectively.

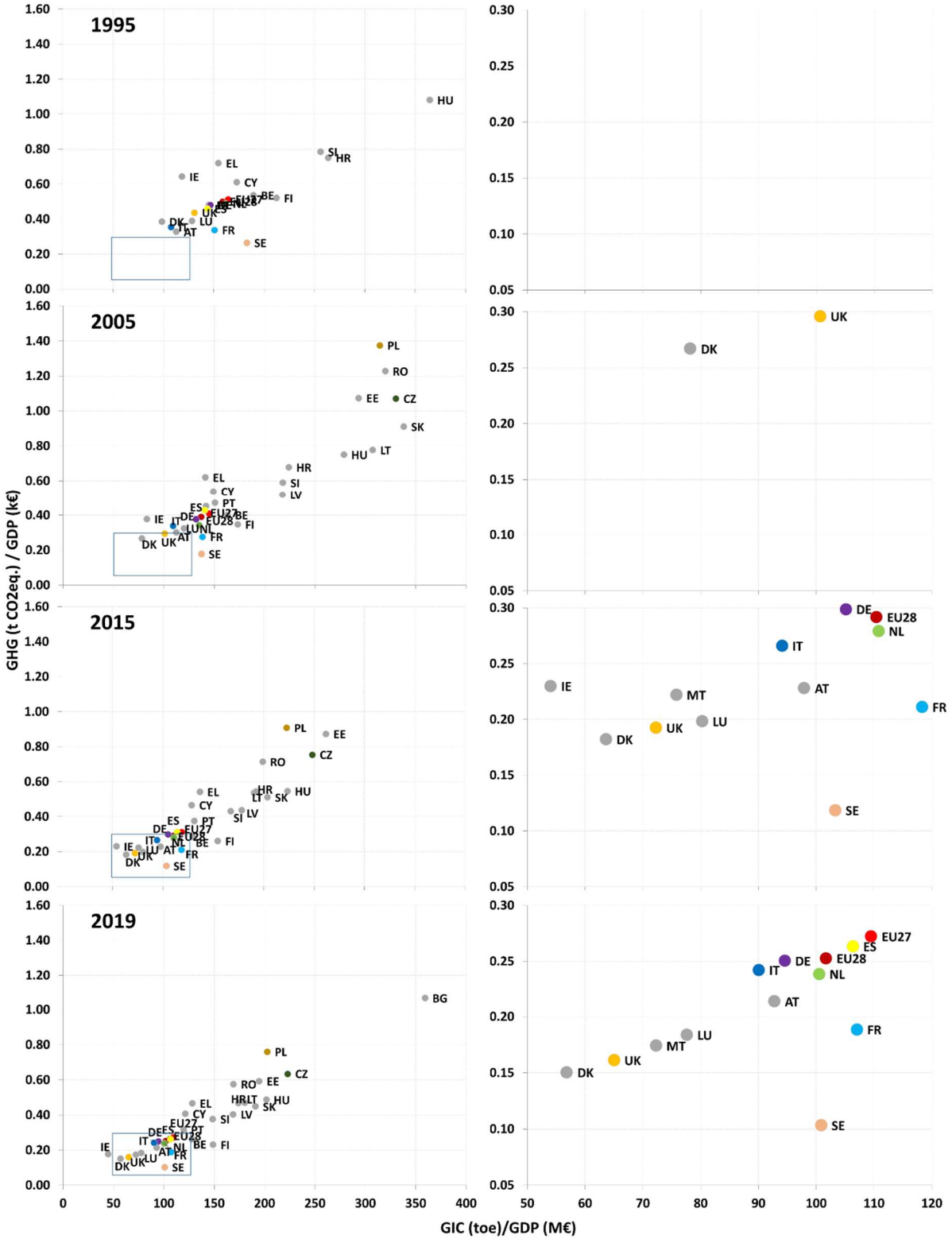


Figure 1.32 – *In the phase space defined by economy energy intensity (abscissa) and economy carbon intensity (ordinate) is shown the position for each Member State on the left. On the right the enlarged box that inscribes the biggest Member States in 2019 is shown.*

The indicators examined show that Italy, compared to the biggest EU Member States, has historically high energy and economy efficiency (Figures 1.13, 1.14) with a significant share of renewable energy and natural gas in the energy mix (Figures 1.4a, 1.5, 1.10, 1.11, 1.22-1.25), and one of the lowest emissions per capita in Europe (1.26, 1.31). The energy intensity per unit of GDP in Italy (Figures 1.16, 1.32) is, among the biggest countries, higher only to that of the United Kingdom, while the carbon intensity per unit of GDP is higher than those of the Netherlands, France, the United Kingdom and Sweden (Figures 1.30, 1.31, 1.32). The carbon intensity per unit of energy consumed without the nuclear power is, among the biggest countries, higher only than those of the Netherlands and Sweden and comparable with that of the United Kingdom (Figure 1.28). Although some indicators show that many countries have improved their greenhouse gas emission performance, sometimes achieving better results than Italy, the following factors need to be considered:

- countries with high shares of solid fuels or oil and petroleum products (Figure 1.4, 1.7) have greater potential for reducing emissions from fossil fuels than those available in Italy, where the fossil mix is mainly represented by natural gas;
- in several countries there is a significant contribution of nuclear power with emissive advantages (Figures 1.4, 1.8), a source of energy which is not without controversy and which some countries intend to phase out gradually (Germany, Belgium);
- the emissive performance of a country depends closely on its economic structure. Countries with a predominance of productive activities in the service sector (Figures 2.19) or with significant shares of non-energy consumption, such as the Netherlands (Figure 1.15), show lower emissions per GDP (Figure 2.30) and energy consumed (Figures 1.28).

1.2.1 *International bunkers*

The elaboration of decarbonization and efficiency indicators including emissions from international bunkers (international flights and shipping) requires a premise on the composition of national emission inventories and energy balance sheets.

GHG emission inventories submitted to the UNFCCC Secretariat include emissions from international aviation and maritime activities. Such emissions, although methodologically consistent with IPCC guidelines, are reported as "memo" items and are not included in total national emissions.

Similarly, for energy consumption, the items that make up a country's gross inland energy consumption must be considered in relation to GHG emissions from international bunkers. In EUROSTAT's energy balance, gross inland energy consumption includes the consumption of international aviation but not those of international maritime activities.

In particular, the main items in the budget can be explained by the following equations:

$$GAE = PPRD + RCV\_RCY + IMP - EXP + STK\_CHG \qquad (1)$$

where

GAE: gross available energy;

PPRD: primary production;

*RCV*_RCY: recovered or recycled products;

IMP: import;

EXP: export;

STK_CHG: stock changes.

$$GIC = GAE - INTMARB \qquad (2)$$

where

GIC: gross inland energy consumption;

INTMARB: international maritime bunkers;

$$NRGSUP = GIC - INTAVI \quad (3)$$

where

NRGSUP: total energy supply;

INTAVI: international aviation;

$$AFC = NRGSUP - (TI\_E - TO) - NRG\_E - DL \quad (4)$$

$$AFC = FC\_E + FC\_NE \quad (5)$$

where

AFC: energy available for final consumption;

*TI*_E: transformation input of energy:

TO: transformation output;

NRG_E: energy consumption in the energy sector;

DL: distribution losses;

FC_E: energy uses of final energy;

FC_NE: non-energy uses of final energy.

Equations (2) and (3) show that in the gross inland energy consumption is not considered the energy consumption by international maritime bunkers, while the consumption by international aviation is included. Therefore, a decarbonization indicator that considers total emissions reported in the inventories should be the ratio between GHG emissions to total energy supply *(NRGSUP),* as both terms are without international bunkers. Similarly, decarbonization indices can be drawn up with gross inland energy consumption *(GIC)* or with gross available energy *(GAE)* considering the contribution of international aviation in the first case and of all international bunkers in the second case.

The energy available for final uses (*AFC*) consist of energy and non-energy uses. The former component is directly related to greenhouse gas emissions from combustion, while the latter is involved in transformation processes not directly related to atmospheric emissions. Final uses consist of total energy without transformation losses, energy branch sector consumption and distribution losses.

This report has not the aim to examine in detail the components of gross domestic product, but in the first approximation it can be considered that GDP is also determined by activities related to flights and international navigation.

The biggest European countries have very different contributions from international bunkers with regard to GHG emissions. The GHG emissions from such sectors are relevant in some countries. The average share of total emissions with memo items in EU28 is 7.3% in 2019 and, for the biggest countries, it ranges from 1% in Poland and Czechia to 21.8% in the Netherlands.

In the light of such different contributions, it is reasonable to investigate the dynamics of decarbonization and efficiency indicators considering the role of international bunkers. Carbon intensity related to gross domestic product and energy consumption will be considered. The first indicator is equal to the ratio between GHG emissions including contribution from international bunkers and gross domestic product (GDP). The second indicator is equal to the ratio between energy GHG emissions including contribution from international bunkers and gross available energy (GAE) without final consumption for non-energy uses (FC_NE), a measure that can be defined as gross available primary energy. With regard to the efficiency indicator, carbon and energy intensities will be calculated through the ratio between gross available energy (GAE) and gross domestic product (GDP).

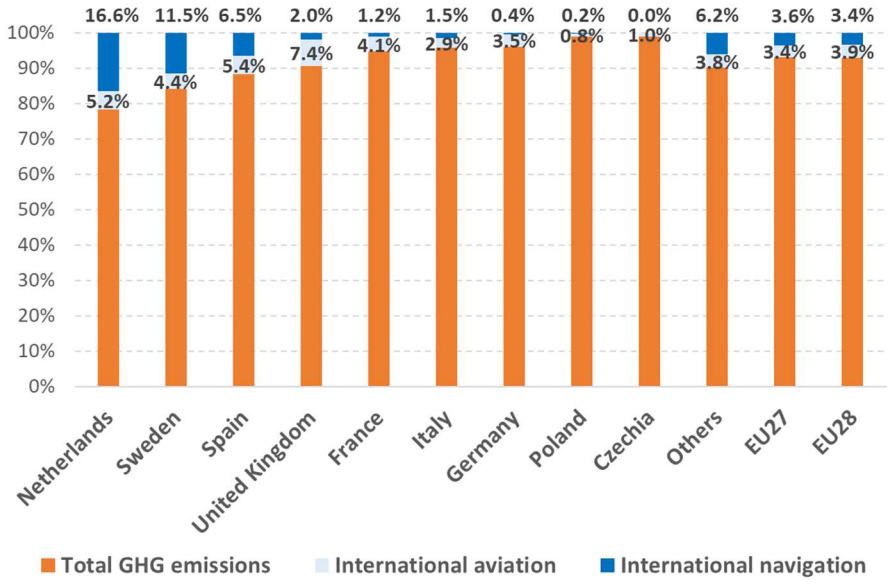


Figure 1.33 – *Share of national emissions in the inventories and international bunkers emissions (2019 data). Countries in descending order of international bunkers emissions share.*

The following graph shows the GHG emissions per unit of GDP. The indicator, which is related to figure 1.30, is affected by the role of bunkers and highlights the increase in carbon intensity per GDP in countries where bunkers have a significant share, such as the Netherlands. Whereas in Figure 1.30 the Netherlands had an intensity below the European average, in Figure 1.34 the intensity is greater than the European average.

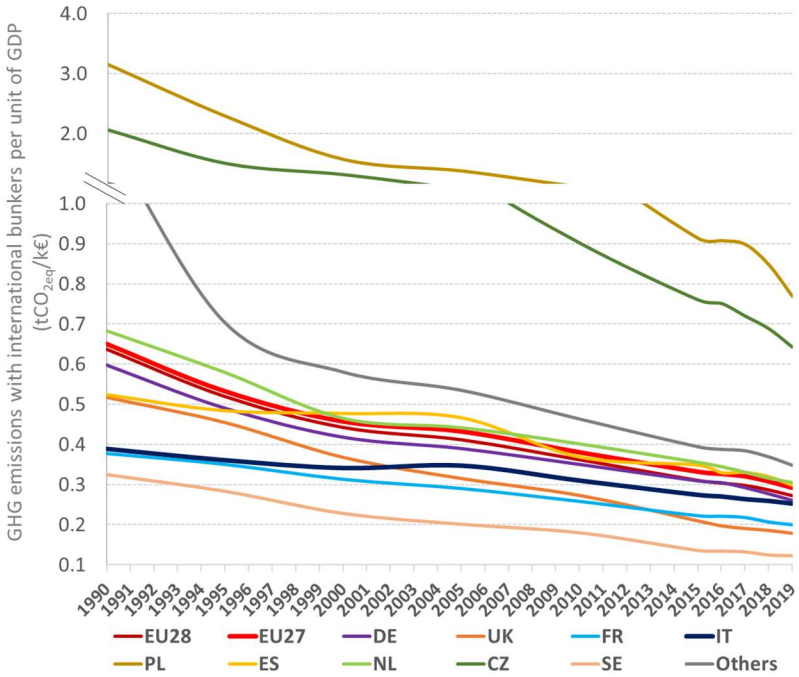


Figure 1.34 – *Greenhouse gas emissions including international bunkers per unit of GDP.*

The gross available energy per unit of GDP (Figure 1.35) highlights the different role of international bunkers energy consumption (cf. Figure 1.16) and shows that Italy's values were the lowest among the largest countries up to 2003 when only the United Kingdom reached the lowest values.

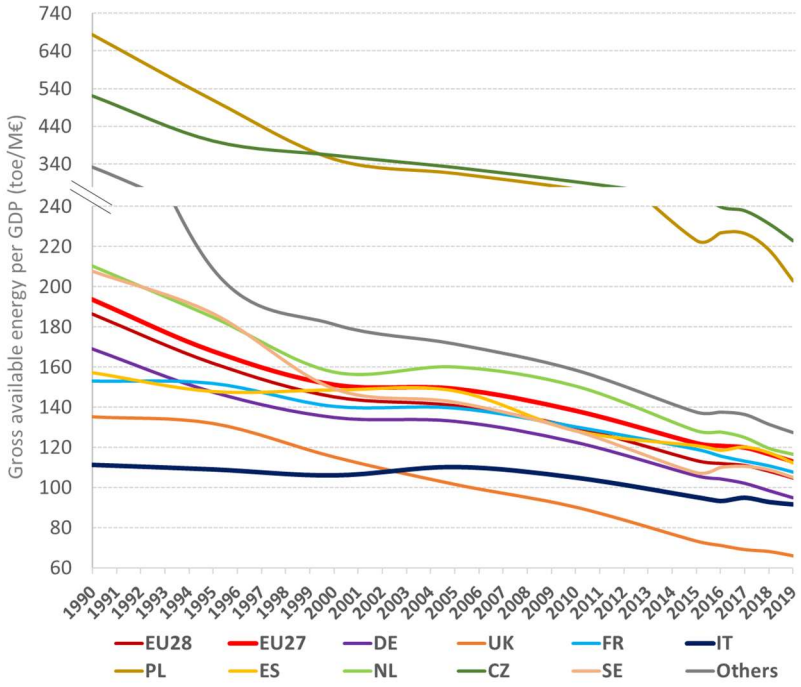


Figure 1.35 – *Gross available energy per unit of GDP.*

With regard to the GHG emissions per unit of gross available energy, the contribution of nuclear power in France appears to be decisive for the reduction of carbon intensity (Figure 1.36, 1.37). The trend in Figure 1.36 can be compared with that observed in Figure 1.27, although the two indicators are different.

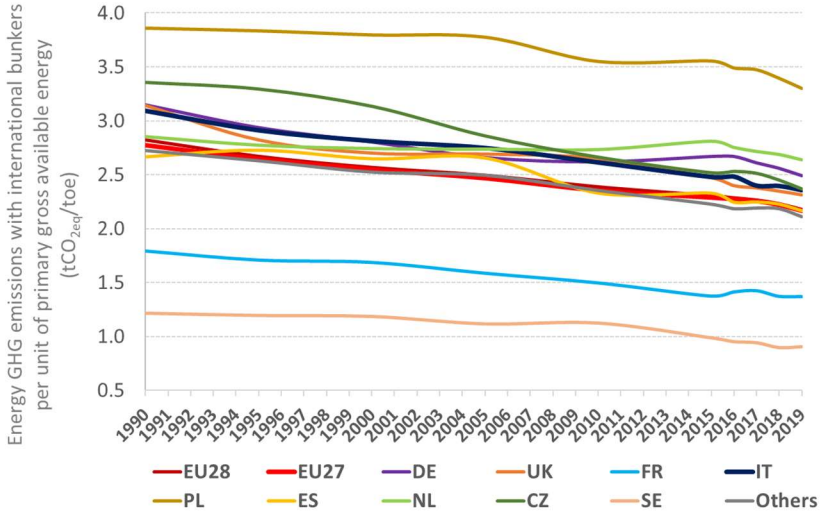


Figure 1.36 – *Energy GHG emissions including bunkers per gross available energy without non-energy final consumption.*

Energy emissions per unit of gross available primary energy without nuclear energy in Figure 1.37 should be compared with those observed in Figure 1.29. The indicator shows that the higher the share of bunker emissions in countries compared to Italy, the greater the differences among carbon intensities of countries. As shown in Figure 1.29 the carbon intensities per unit of primary energy consumption of Italy, Spain, the United Kingdom and France are quite overlapping in the recent years whereas in Figure 1.37 the carbon intensities per unit of gross available primary energy of the same countries are more parted and Italy's figures are below the values recorded for the other countries, except for Sweden.

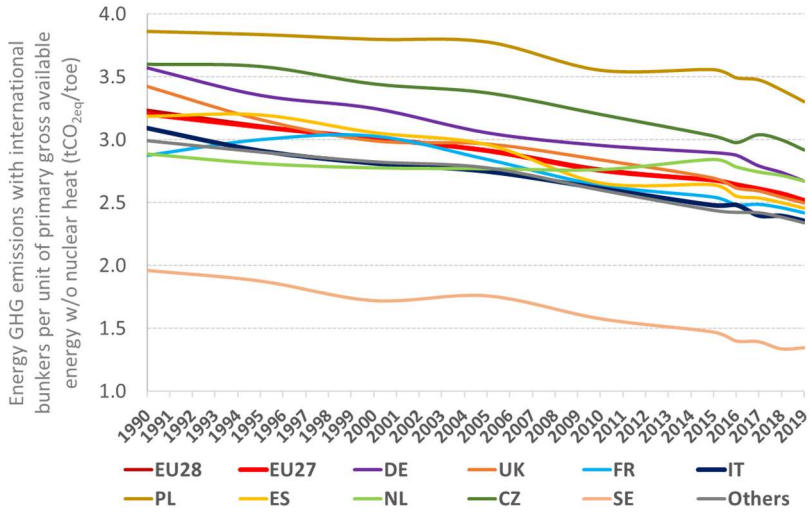


Figure 1.37 – *Energy GHG emissions including bunkers per gross available energy without non-energy final consumption and without nuclear energy.*

1.2.2 *Sectoral efficiency and decarbonization*

Efficiency and decarbonization indicators have been developed at sectoral level considering final energy consumption and GHG emissions by value added. For households and transport the GDP is considered. The final energy consumption in industrial and transport sectors includes non-energy uses. Non-energy uses for the "other sectors" reported by EUROSTAT have been entirely attributed to the agriculture sector. Sectoral value added data for the United Kingdom are available up to 2018.

The comparison of efficiency and decarbonization indicators at sectoral level among Member States shows a rather heterogeneous situation. As for industry in Italy, the final energy intensity, final energy consumption by value added, have been comparable to those of Germany since 2005, although lower. Among the biggest European countries, only the United Kingdom shows lower values than the Italian ones, and among all Member States only Ireland, Denmark, and Malta have lower energy intensity values than Italy in 2019. Between 2005 and 2019 the Italian average annual rate of energy intensity reduction is -1.8% as in EU27 (-1.9% for EU28). Poland and Czechia have higher energy intensity than the European average, although higher annual average rates of reduction is registered (-3.9% and -4.6%, respectively). Among the countries examined, the Netherlands shows the highest energy intensity for industry.

In commercial and public services Italy shows a countertrend of energy intensity from that of other European countries in recent years. In particular, in the last years, the accounting of energy consumed by heat pumps since 2017 has increased the sector energy intensity. The average annual rate of energy intensity from 2005 to 2019 shows an increase of 0.9% for Italy against a decrease of -1.5% in the European average.

The agriculture sector shows a general decrease in energy intensity with an annual average rate of -0.5% since 2005 in EU28 (-0.6% in EU27). The Italian energy intensity is among the lowest in Europe and in 2019, among the main European countries, it is comparable to those recorded for Spain and the United Kingdom. The trend of Germany's indicator appears quite unrealistic.

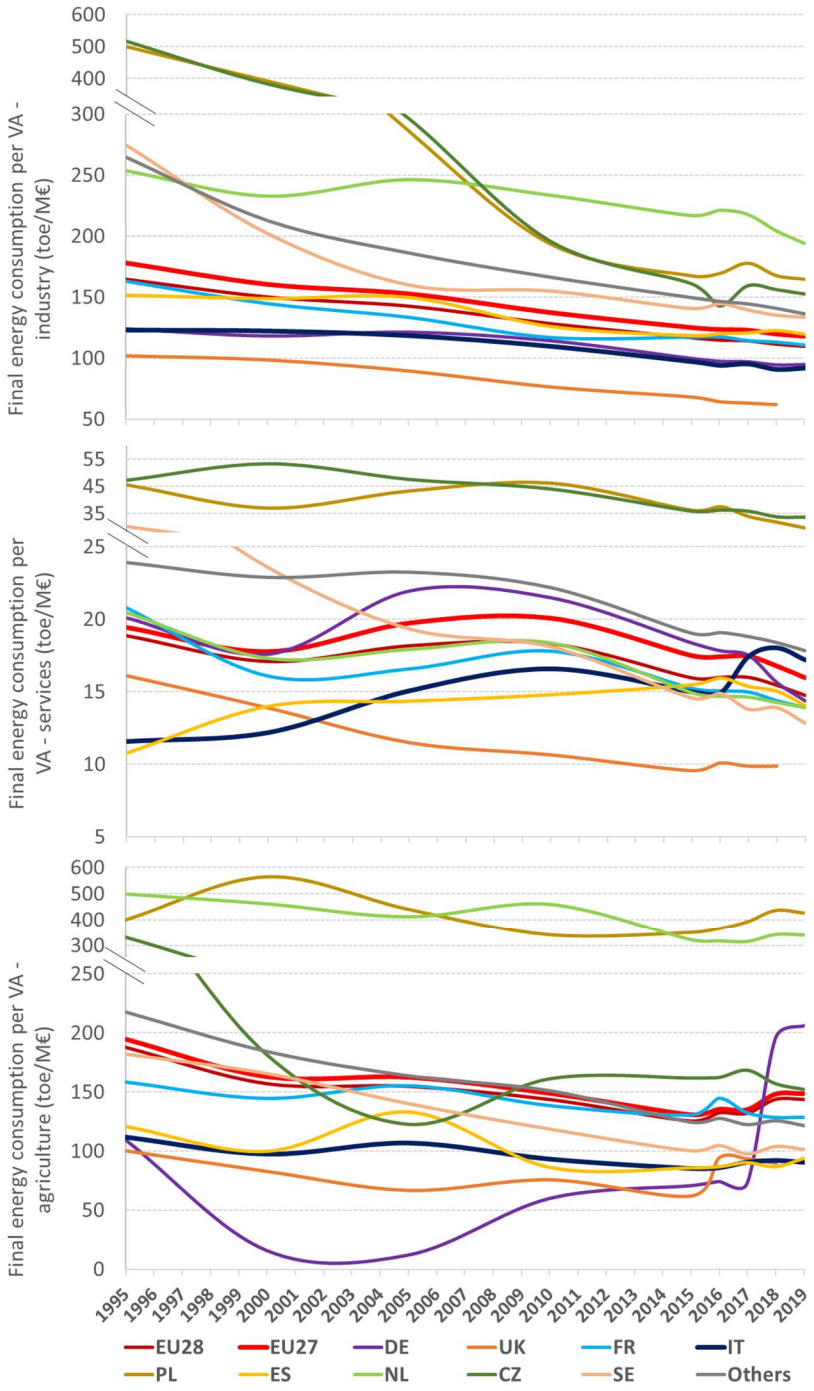


Figure 1.38 – *Final energy consumption per unit of sectoral value added.*

The GDP will be considered to assess the energy intensity of those sectors not directly related to value added output (Figure 1.39). In the household sector, since 2005 the countries examined show higher reductions of energy consumption per unit of GDP than Italy (from -1.3% per annum in Spain to -4.4% per annum in Poland *vs* -0.6% per annum in Italy). The values and trends of Italy's energy intensity for transport are broadly comparable to those of the European average with an average annual rate decrease of -1.1% since 2005.

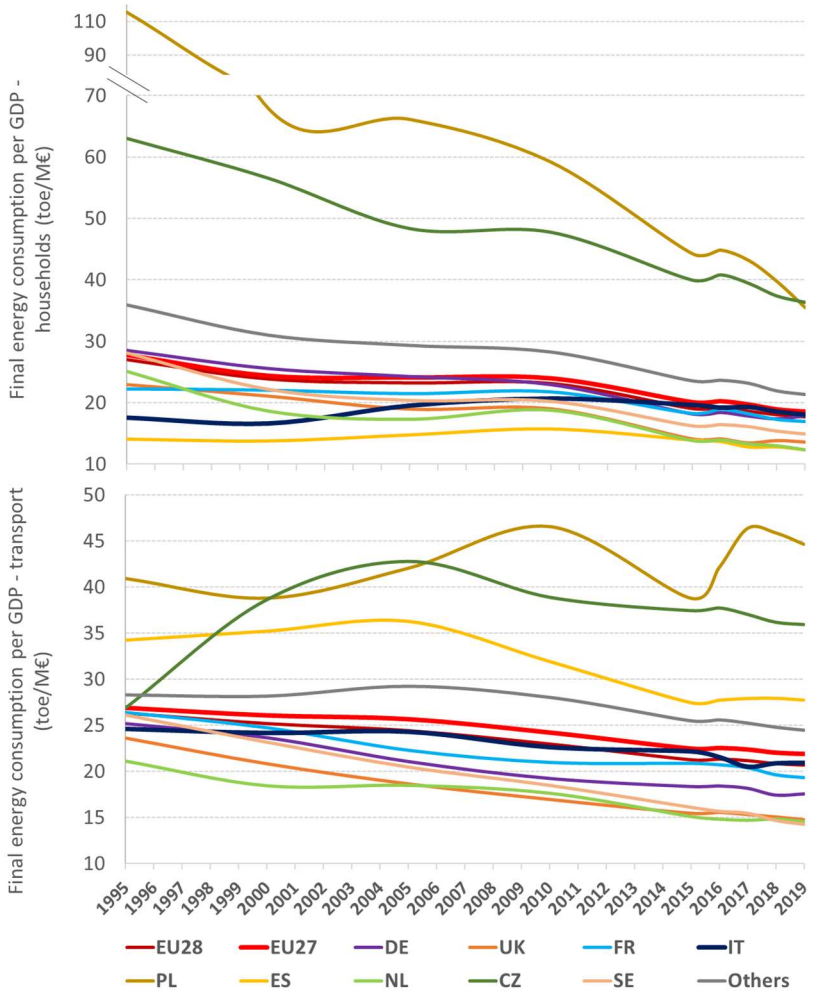


Figure 1.39 – *Final energy consumption per unit of GDP.*

What is seen for energy intensity is reflected in the carbon intensity (t CO_2eq/M€), but this indicator is sensible to the contribution of renewable energies and the share of nuclear power. Among the biggest countries, the Italian industry has carbon intensities only higher than those of the United Kingdom, Sweden, and Germany, although in recent years the Italian and German figures are very close. For agriculture, the Italian carbon intensity is among the lowest in Europe, after Malta and Greece. The European average is more than double the Italian intensity.

On the other hand, the civil sector (households and services) in Italy shows wide room for improvement and, among the biggest countries, the carbon intensity is lower only than that registered in Czechia and Poland. The Italian civil sector therefore shows very wide emission reduction potentials, especially considering the sectoral electrification of final consumption in 2019 that is among the last in EU28 (households: 18.1% *vs* 24.5%; services: 42.2% *vs* 48%).

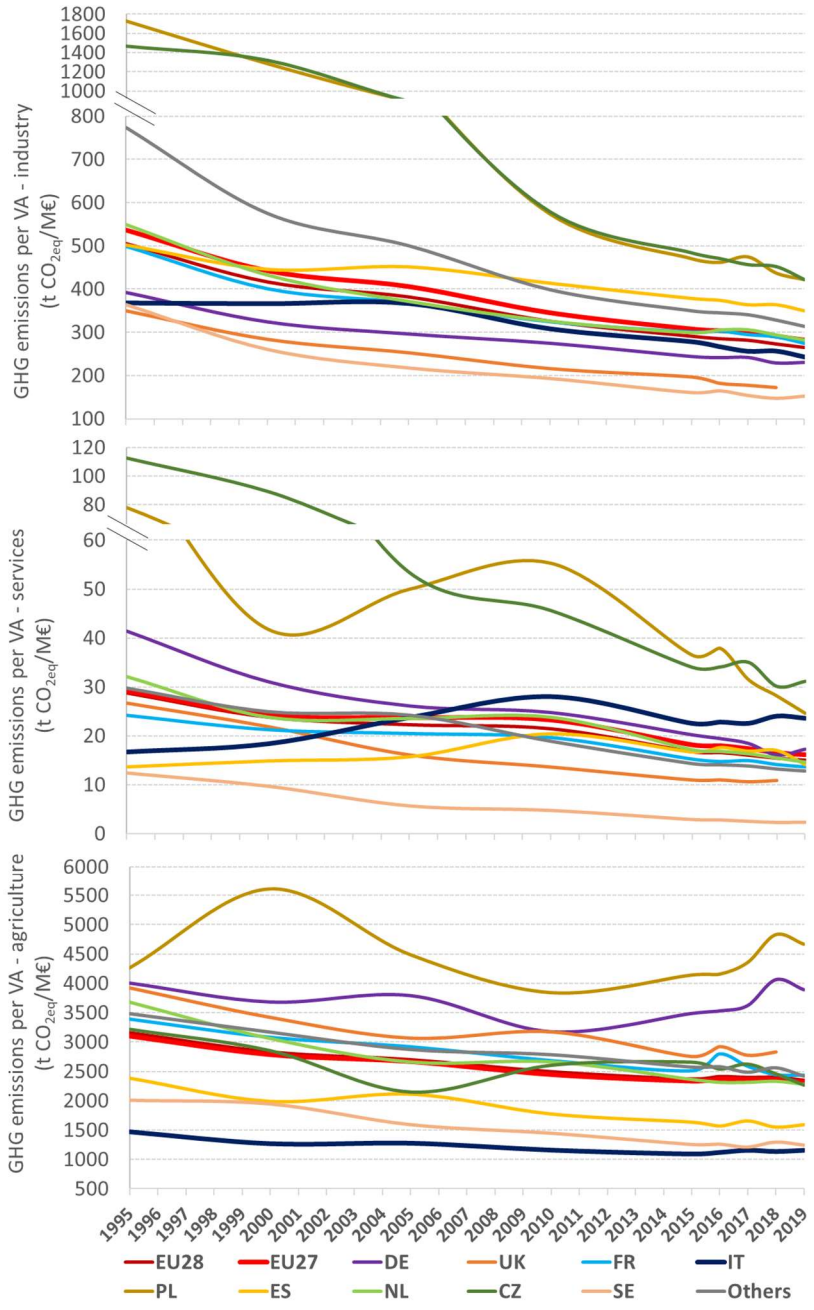


Figure 1.40 – *Greenhouse gas emissions per unit of sectoral value added.*

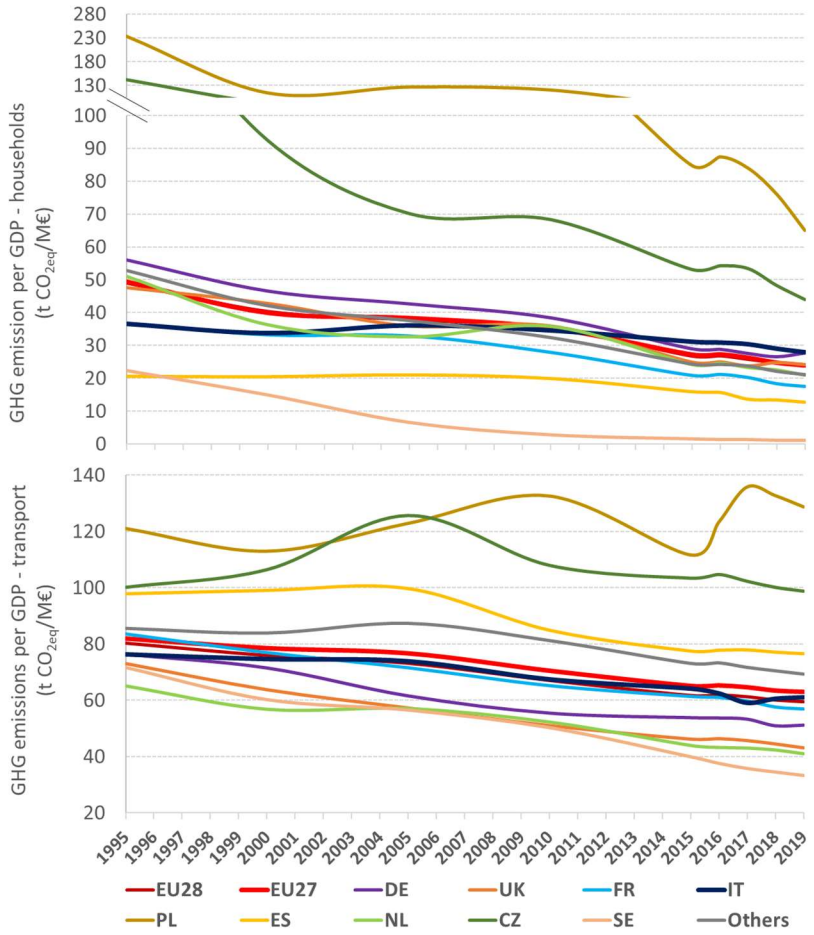


Figure 1.41 – *Greenhouse gas emissions per unit of gross domestic product.*

The following graphs show the position of the EU States in the phase space defined by the carbon and final energy intensity by added value. For each sector, it is evident that all countries move (2018 for UK) to the lower left corner with less intensity from 2005 to 2019.

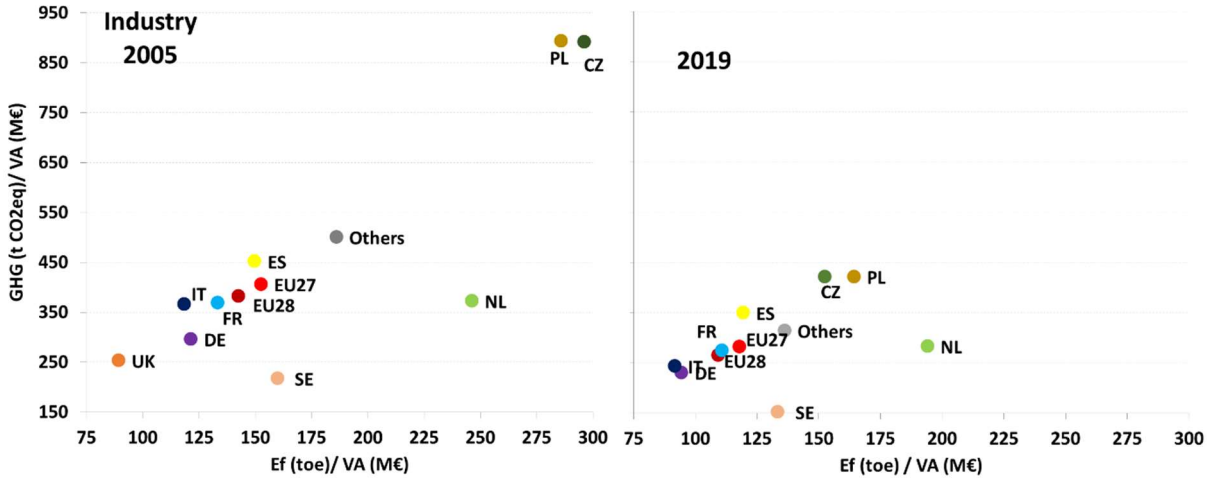


Figure 1.42 – *It is reported the position in the phase space defined by the energy (abscissa) and carbon intensities (ordinate) by value added of industry for the biggest European countries and for the groups of other countries.*

Unlike industry, the intensity for services shows that Italy has lost many positions compared to other countries. In particular, energy intensity increased from 15.1 toe/M€ to 17.2 toe/M€ from 2005 to 2019.

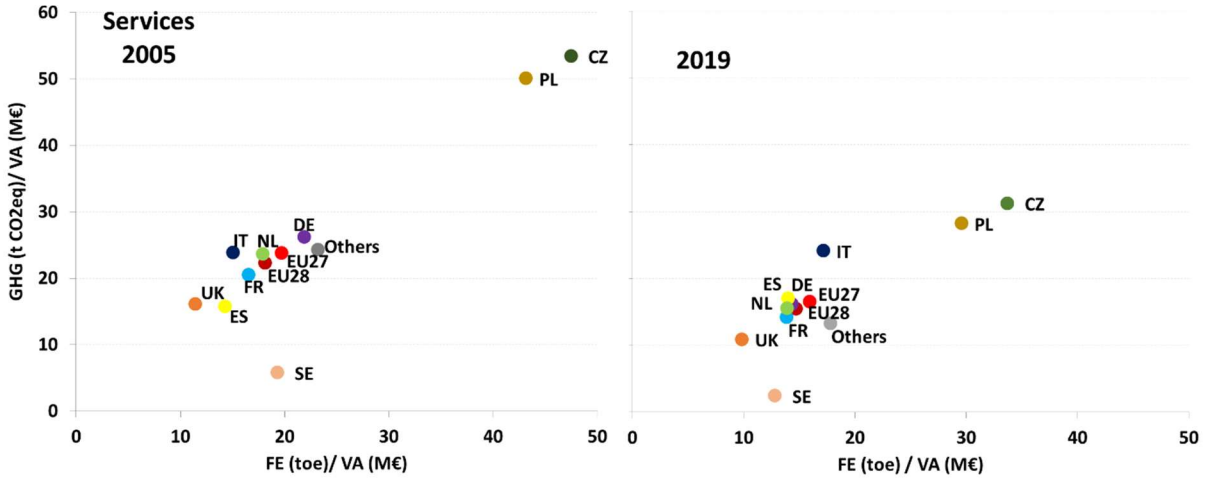


Figure 1.43 – *It is reported the position in the phase space defined by the energy (abscissa) and carbon intensities (ordinate) by value added of services for the biggest European countries and for the groups of other countries.*

The agriculture shows the highest intensities among the sectors. The following graphs show that Italy occupy the position at the lower left corner of the graph.

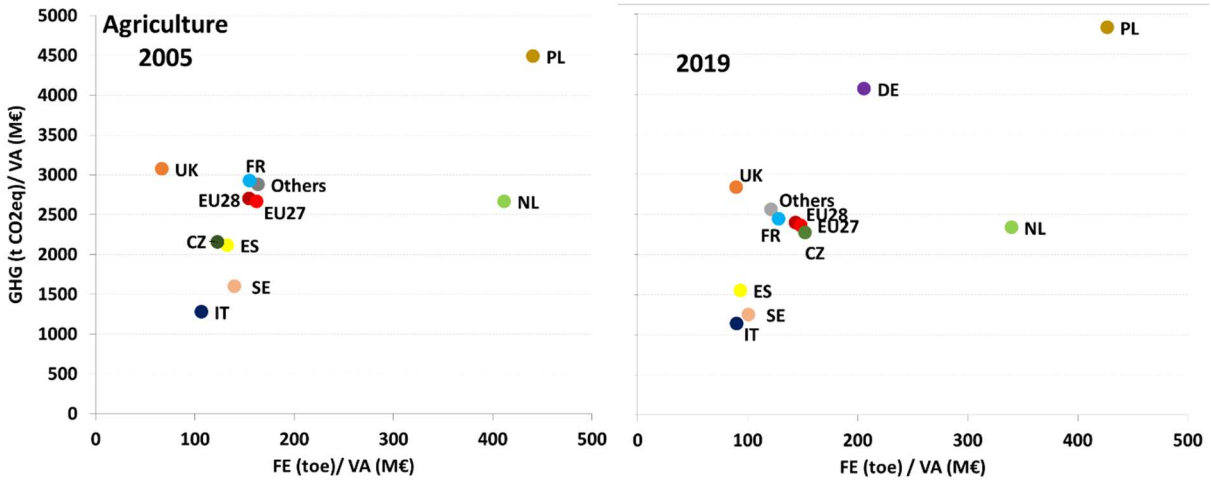


Figure 1.44 – *It is reported the position in the phase space defined by the energy (abscissa) and carbon intensities (ordinate) by value added of agriculture for the biggest European countries and for the groups of other countries.*

For the household and transport sectors, the intensities related to GDP are reported in the following figures. For the household sector, too, it is clear that the Italian intensity has been overcome by countries that had higher values in 2005, such as Germany (Figure 1.45).

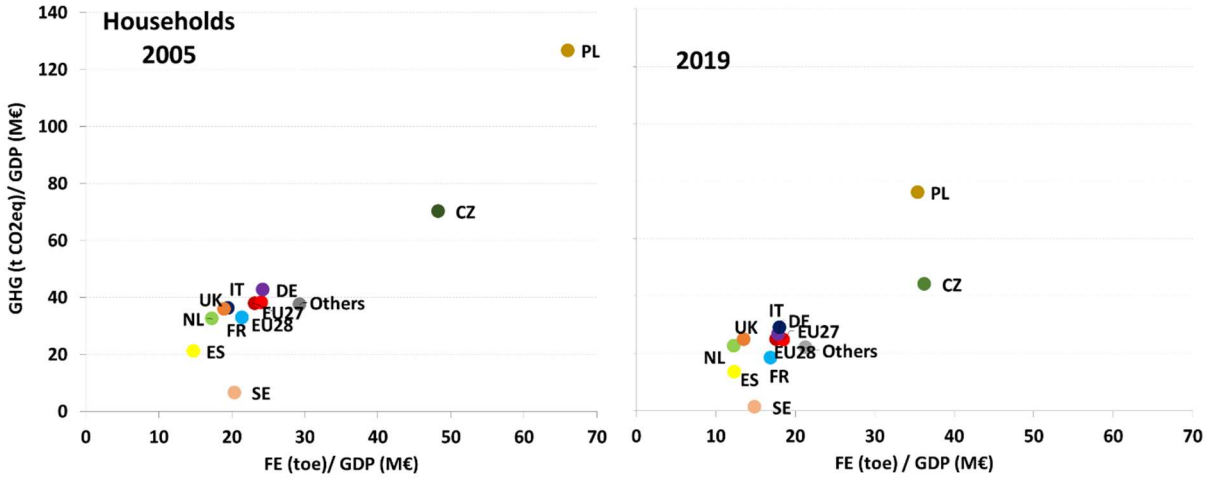


Figure 1.45 – *It is reported the position in the phase space defined by the energy (abscissa) and carbon intensities (ordinate) by value added of households for the biggest European countries and for the groups of other countries.*

The sector of transport shows the high linear correlation between GHG emissions and energy consumption, mainly made up of fossil fuels. For this sector too, it is possible to observe the shift of countries towards lower carbon and energy intensities, with the sole exception of Poland, which instead recorded a marked increase of intensities (Figure 1.46).

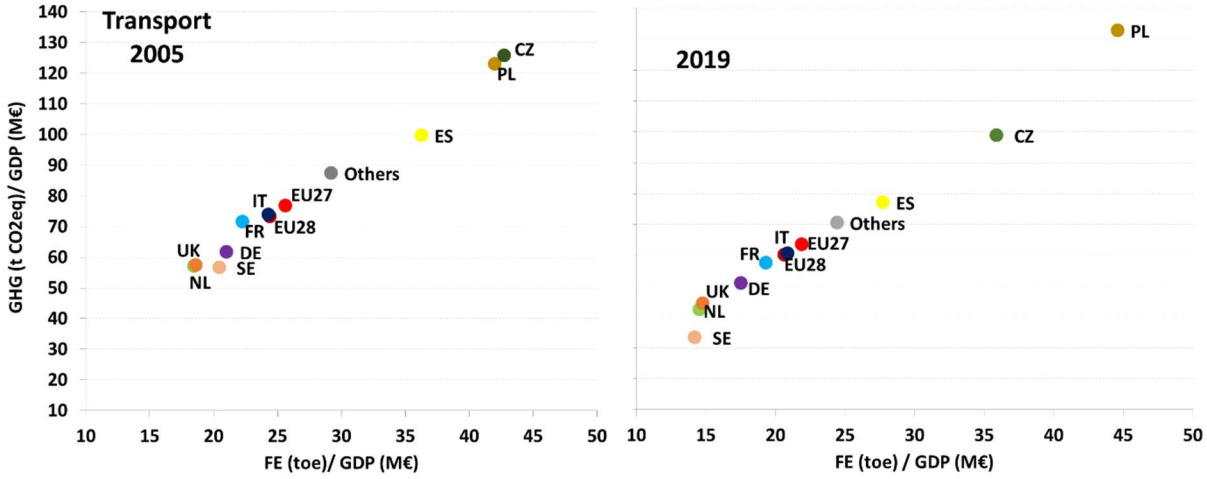


Figure 1.46 – *It is reported the position in the phase space defined by the energy (abscissa) and carbon intensities (ordinate) by value added of households for the biggest European countries and for the groups of other countries.*

1.3 Material flow accounts

This paragraph compares material flow accounts among countries *(EW-MFA Economy Wide - Material flow Accounts).* The material flows for Italy are processed by ISTAT (2021) and communicated to EUROSTAT in whose database the material flows of the other Member States are also available (last download on 24 May 2021). For Italy, the historical series is drawn up from 1990 to 2019 (provisional data). The availability of data from other countries allows comparison only from 2000.

The EW-MFA is a measure of the interactions between the environment and the anthropogenic system, that is, the exploitation of resources used in human activities. EW-MFA provides an aggregate measure (mass) of material flows in and out of an economic system. In Eurostat's EW-MFA material inputs to the economy cover extractions of natural resources (excluding water and air) from the natural environment and imports of material products (goods) from the rest of the world economy. Material outputs are disposals of materials to the natural environment and exports of material products and

waste to the rest of the world. EW-MFA is a satellite account of national accounts prepared by ISTAT in accordance with the European Regulation 691/2011 on environmental accounting and is developed with harmonized methodologies at European and international level (ISTAT, 2020).

Indicators of *direct material inputs (DMI)* and *domestic material consumption (DMC)* describe, in aggregate terms, the direct use and provenance of natural resources and products. The first indicator includes all materials which have an economic value and are used for production and consumption activities and the indicator is calculated as the sum of internal extractions and imports. The second indicator represents domestic consumption of matter in the national economy net of exports and is calculated by subtracting from direct material inputs the share of physical exports.

The indicators make possible to analyse the material aspects of socio-economic metabolism related to the environmental sustainability of production and consumption patterns, and - in conjunction with the traditional national accounts, with which they are consistent - allow economic activity to be dissociated from environmental pressures and the intensity/efficiency of resource use (Femia and Paolantoni, 2012; Paolantoni and Femia, 2016). One economic system which, with the same flow of matter, produces more wealth than another is a more efficient system.

The following graph shows the consumption per capita of domestic material by type of material. For each State or group of States, the consumption in the years 2000, 2005, 2010, and 2019 is reported and the resource productivity, which is a measure of the wealth produced per kg of material consumed. Productivity is calculated by the ratio of GDP (at purchasing power standard) to the mass of material consumed.

Since 2000, there has been a general decrease in domestic material consumption per capita of matter in the European countries (-0.61% per year in EU28, -0.44% in EU27), although countries show different rates of variation ranging from +1.29% per year in Sweden to -4.28% in Spain. For Italy, the average annual rate of domestic material consumption per capita is -2.54%. Poland and the group of other countries increase the consumption with an average annual rate of 1.18% and 1.26% respectively. In 2019 Italy has the lowest consumption per capita of matter among all European countries.

As far as productivity is concerned, there is a general increase from 2000 to 2019, although the absolute values of the countries are very different. In most cases the increase was rather rapid with average annual growth rates ranging from 0.9% for Poland to 6.8% for Spain. Italy showed an average annual increase of 4.2%. Among the biggest countries, the Netherlands shows the highest value (€ 4.5/kg in 2019), followed by the UK (€ 3.8/kg) and Italy (€ 3.7/kg). Germany and France productivities are € 2.5/kg and € 2.6/kg, respectively.

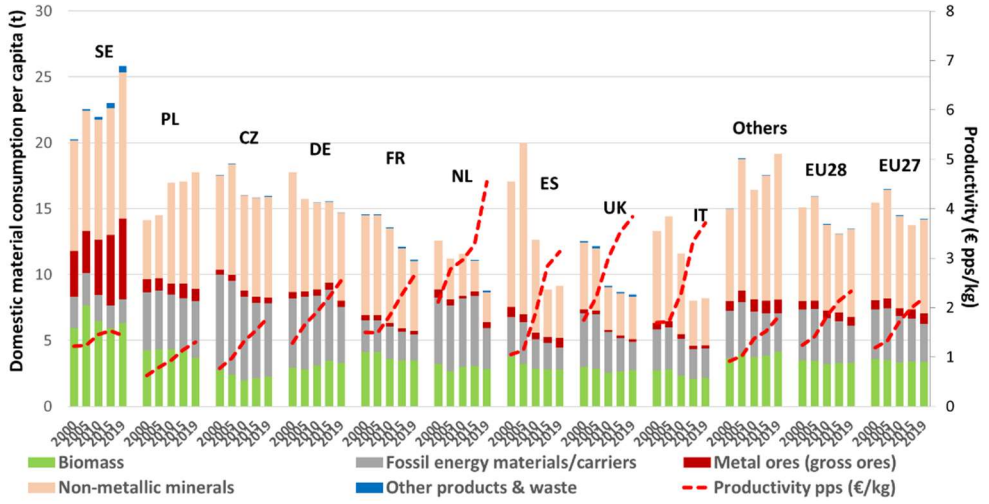


Figure 1.47 – *Domestic material consumption per capita by type of material and economic productivity at purchasing power standard. Countries sorted in descending order by DMC per capita in 2019.*

As already reported, direct material inputs include all materials which are economically valued and are directly used in production and consumption activities. Such indicator is equal to the sum of internal extractions and imports. Since this indicator represents domestic consumption without exports, it is useful for assessing actual material consumption, including that not used in domestic production and consumption activities and addressed to exports.

The following graph, realized in the same way as the previous one, shows the direct material inputs per capita and the productivity. Sweden and the Netherlands have high share of fossil extraction, biomass, and metal ores destined for exports and shows the highest DMI per capita among the biggest European countries, far above the European average. According also to this indicator, in 2019 Italy recorded the lowest value among all European countries.

As far as productivity is concerned, Sweden in 2019 has the lowest value (€ 1.1/kg) among the countries examined and one of the lowest in Europe. The Netherlands (€ 1.3/kg) has a productivity higher only than that of Poland (€1.0/kg). The United Kingdom and Italy have the highest productivity in Europe, with € 3/kg and € 2.8/kg respectively, followed by France (€ 2.3/kg).

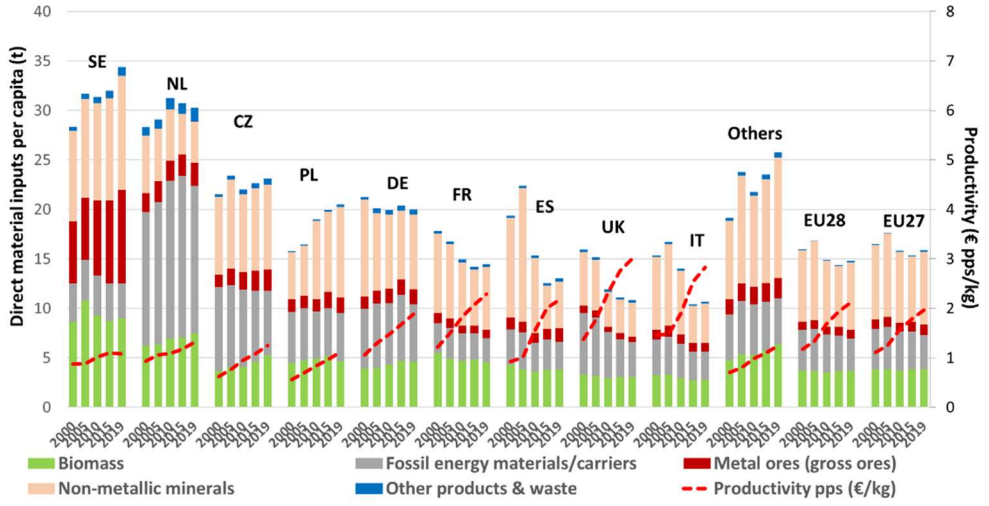


Figure 1.48 – *Direct material inputs by type of material per capita and economic productivity at purchasing power standard. Countries sorted in descending order by DMI per capita in 2019.*

The direct material inputs are far greater than the domestic material consumption due to the amount of material exported. The surplus percentage of DMI per capita relative to DMC per capita is on average 9.8% for EU28 in 2019 (11.7% for EU27), and ranges from 16.3% in Poland to 244.5% in the Netherlands. Also for Czechia and Sweden the share of export is relevant and the surpluses are 209.4% and 155.5% respectively. The Italian figure is 31.5%, in line with the other biggest countries (France 30.3%; the United Kingdom 27.9%; Germany 35.7%; Spain 44.1%).

It should be noted that the productivity reciprocal is an indicator of material intensity (Fischer-Kowalski *et al.*, 2011), *i.e.* a measure of the exploitation of material resources. The countries with the lowest productivity are therefore the countries with the greatest pressure on their material reserves.

Although productivity provides information on the economic efficiency of a system as a whole, it is nevertheless necessary to consider that efficiency depends not only on maximizing the performance of the material used but also on structural factors. In this sense, the production structure of a country plays a decisive role as concerns the material consumption. A service-based economy will have lower material consumption than an economy based more on manufacturing industry. As seen in the previous chapters, industrial activities are more energy-intensive than service activities. This is true to a greater extent for the material consumption which is the subject of extraction and transformation of industrial activities.

Germany, with a significant share of industrial activity, has an intrinsically lower productivity than the United Kingdom, whose economy is mainly based on services.

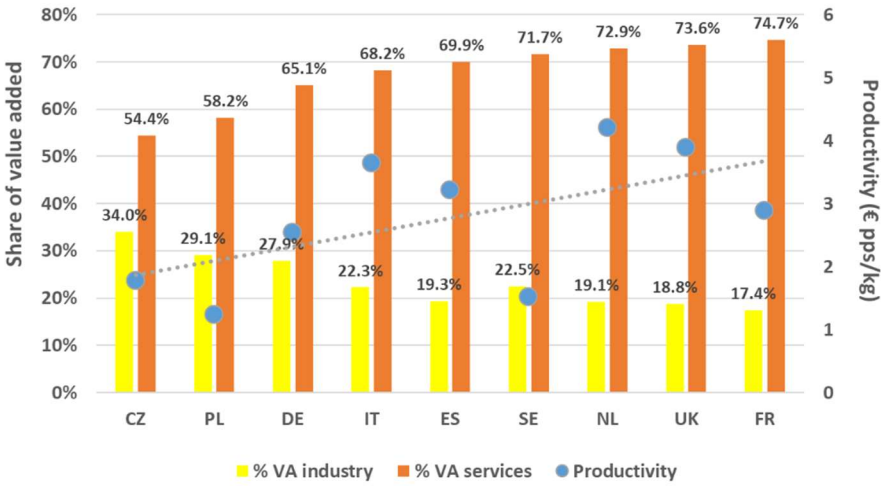


Figure 1.49 – *Share of value added for industry and services in 2019 (2018 for the UK) and productivity for domestic material consumption. The data are sorted in increasing order for the share of services value added.*

It is therefore clear that resource productivity depends jointly both on the efficiency of resource use in each sector and on sector's share for each State. Material consumption at sectoral level is not available so it is possible to assess the role of each sector only using *proxy* variables to unbundle material consumptions at the level of single sector. In order to assess the impact of economic sectors on the productivity index, final energy consumption was used as a proxy to disaggregate the material consumption among sectors. The material consumption, similar to energy consumption, also takes place in sectors that do not have a corresponding value added, such as the households and transport sectors. In addition, transport is a cross-cutting sector which contributes to the value added of the productive sectors. No breakdown of transport energy consumption in the economic sectors was made for the following elaboration. The purpose of the breakdown is to assess the productivity range of the following economic sectors: industry (including construction), services and agriculture.

Domestic material consumption of each country has been broken down into sectors (including households and transport) according to their share of final energy consumption. The value added for industry and construction, services and agriculture has been divided by their estimated material consumption. Sectoral productivity highlights the contribution of each sector to total productivity. The following graph makes it clear that a predominantly service-based economy has a higher resource productivity than an industry-based economy regardless of the efficiency of individual sectors. The median sector productivity in 2019 is €1/kg in the industry and construction sector, € 6.5/kg in services and €1.1/kg in agriculture.

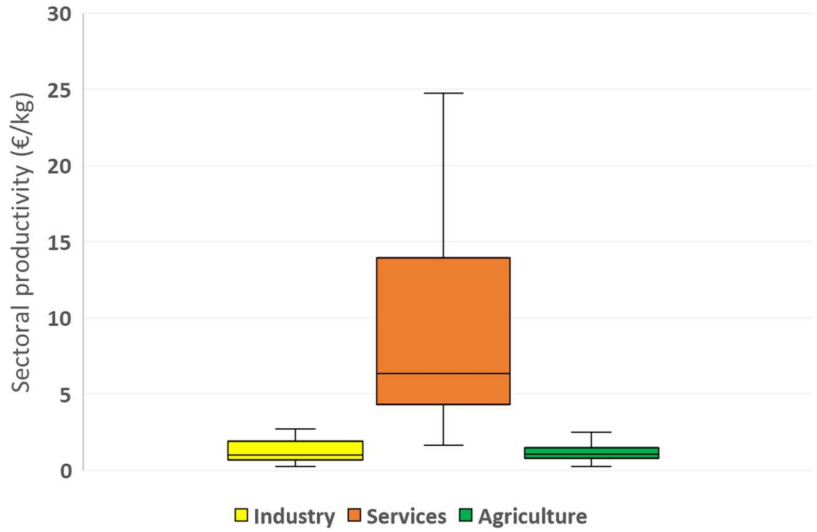


Figure 1.50 – *Estimated productivity by sector. For each sector, the minimum and maximum are reported outside the box. The box is delimited by the 25th and 75th percentiles. The line within the box is the median.*

The sectoral productivities in the countries examined range from 0.7 €/kg (Poland) to 3.8 €/kg (the United Kingdom) for industry and construction, 3.8 €/kg (Poland) to 26.7 €/kg (the Netherlands) for services and 0.3 €/kg (Poland) to 2.7 €/kg (Italy) for agriculture. What is shown in Figures 1.50 should therefore be considered in the light of the share of value added for services and industry in the countries. Among the biggest countries Germany and Italy have relevant share of industrial value added, while the Netherlands, France and the United Kingdom have higher prevalence of value added from services.

The following graph shows that Italy, despite having a higher share of industrial value added than France and Spain, has a higher productivity of resources, a clear result of greater efficiency in the use of resources, especially in the industrial sector. This result is in line with what was previously seen for energy intensity indicators.

The reduction of productivity is also evident when considering the direct material inputs. In particular, productivity in the Netherlands fell by 71% with regard to domestic material consumption productivity. For the other countries the reduction ranges from 14% for Poland France to 30.9% for Czechia. The Italian figure shows a contraction of 24%.

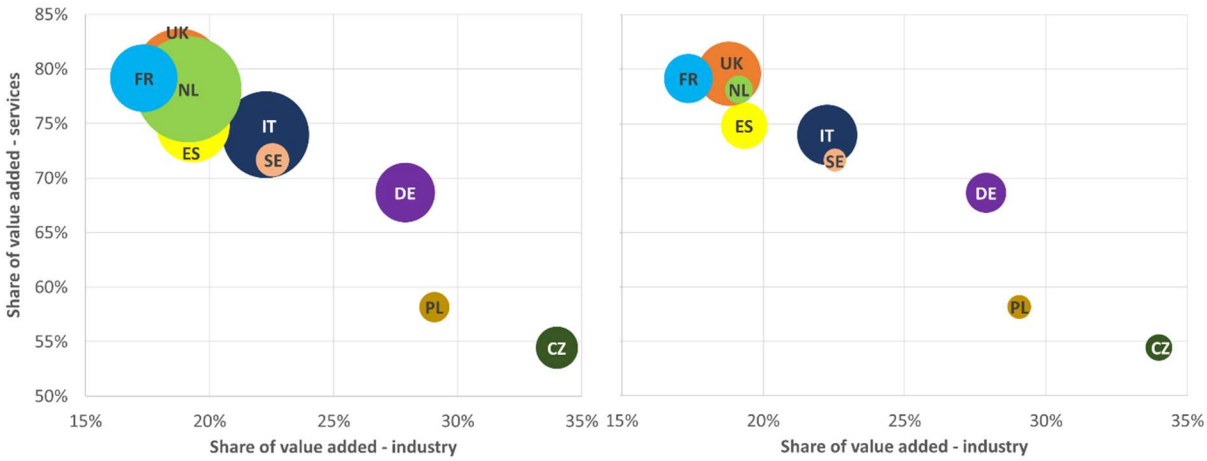


Figure 1.51 – *The examined countries are arranged in the space defined by the percentage of added value of industry (abscissa) and services (ordinate). For each country the circle size is proportional to the productivity for the domestic material consumption (left) and direct material inputs (right).*

1.4 Decomposition analysis: driving factors of GHG emissions in EU

Decomposition analysis is a technique for studying the variation over time of an indicator allowing the identification of the main drivers. In other words, the variation of a parameter is decomposed in the variation of its drivers.

The starting point of the analysis is the construction of an identity equation, where the variable of interest is represented as the product of components considered as the causes of the observed variation. This identity is provided *a priori* and have to be realized according to a conceptual model consistent with the physical constraints of the studied variable, and also considering data availability and the aims of the analysis.

This analysis has been developed in the economic literature with the aim of studying the impact of changes in the production structure on the industry energy demand. The analysis allows to examine the driving factors for energy uses in a given sector. This approach has also been extended in the environmental field, in the context of the analysis of atmospheric emissions, in order to understand the underlying causes of the variations (Zhang *et al.*, 2012: Malla, 2009).

Two main decomposition categories are available in the literature: *Structural decomposition analysis* (SDA) and *Index decomposition analysis* (IDA), (Hoekstra and van der Bergh, 2003; de Boer and Rodrigues, 2020). The two methodologies have been developed independently and have different characteristics both in relation to the scope and to the data they need. The main difference is the data model. IDA can only be applied to aggregated data at the sectoral level in vector form and allows to evaluate only the direct effects of the driving factors variation, while SDA allows both to use of *input-output* matrices with the evaluation of indirect effects and the use of sectoral data. Among the different IDA methodologies*, Logarithmic Mean Divisia Index* (LMDI) has a wide application in energy and environmental studies (Ang and Zhang, 2000).

For the purposes of this study, the aggregated data model does not allow preferences to be established between the two methodologies and LMDI has been applied due to the lower need for calculation and faster application. This methodology was applied according to the model proposed by Ang (2005).

Although the analysis of decomposition can be used to describe the driving factors for the GHG emissions, it should be stressed that the identity equation has among its assumptions the independence among factors, this assumption is also a limit of the analysis whose results can nevertheless be tested with the help of other statistical techniques, such as regression analysis.

1.4.1 *Index Decomposition Analysis (IDA)*

Index decomposition analysis has several approaches, a brief description of the methodology used in this work will be presented below: the *Logarithmic Mean Divisia Index* (LMDI) proposed by Ang (2005).

Let V be a variable subject to time variation in the range $(0, t)$. The variation of V from V^0 to V^t is determined by n factors ($X_1, X_2, ..., X_n$). Let i be the subcategories which drive the structural variations of V for each factor, so that for each subcategory is true the equation:

$$V_i = X_{1.i} \times X_{2.i} \times ... \times X_{n,i}$$

The aim is to derive the contribution of the n factors in the variation of V which can be expressed both in additive terms and multiplicative terms:

$$\Delta V = V^t - V^0 = \Delta V_{X1} + \Delta V_{X2} + ... + \Delta V_{Xn} \qquad \text{additive form}$$

$$\Delta V = V^t / V^0 = D_{X1} \times D_{X2} \times ... \times D_{Xn} \qquad \text{multiplicative form}$$

The general formula for applying the LMDI are as follows:

$$\Delta V_{xk} = \sum_i L(V_i^t, V_i^0) \ln\left(\frac{X_{k,i}^t}{X_{k,i}^0}\right)$$

$$D_{xk} = \exp(\sum_i \frac{L(V_i^t, V_i^0)}{L(V^t, V^0)} \ln(\frac{X_{k,i}^t}{X_{k,i}^0}))$$

where $L(a, b) = (a - b)/(\ln a - \ln b)$and $L(a, a) = a$

1.4.2 *Kaya Identity and driving factors of greenhouse gas emissions*

The driving factors of greenhouse gas emissions considered in this report were borrowed from the report published in 2014 by the European Environmental Agency which had among its objectives the evaluation of the role of the economic crisis in the reduction of greenhouse gas emissions (EEA, 2014).

The starting point of the analysis is an identity equation (*Kaya Identity*), which breaks down the time variation of greenhouse gas emissions into the different factors. In the EEA study, the decomposition concerned energy emissions, directly associated with primary energy consumption. In this study total emissions, including process emissions, are considered.

In the simplest form, 4-factor formulation, the *Kaya Identity* is:

E = P x **g** x **e** x **f**

where:
E = CO_2eq emissions
P = Population
g = GDP per capita (GDP / P)
e = Energy intensity of the economy (Energy consumed / GDP)
f = Carbon intensity of energy (Emission / Energy consumed)

Such formulation is a useful tool because mitigation policies act directly on energy and carbon intensities. Moreover, it is possible to process a 6-parameter version in which the term *f* (carbon intensity of energy) is divided into further three terms that consider:

- efficiency in energy production (from fuel)
- how many non-fossil fuels are used
- what fossil fuels are used (carbon content)

the 6-parameter *Kaya Identity* is therefore:

E = P x **g** x **e** x **k** x **c** x **s**

Where:
e = Energy intensity of the economy (final energy consumption / GDP)
k = Energy efficiency index (gross inland energy consumption / final energy consumption)
c = Consumption of fossil fuels (fossil fuel consumption / gross domestic energy consumption)
s = Average emission factor of fossil fuels (fossil fuel emissions/ fossil energy consumption)

The c factor is inversely correlated to the renewable share, so it provides information about the role of renewable consumption in the reduction of GHG emissions.

The trend of *kaya identity* parameters for EU28 and EU27 in the period 1995-2019 is shown in the next graph, with values normalized to 2005. The sharp reduction of GHG emissions since 2005 corresponds mainly to a decrease of driving factors such as final energy consumed per unit of GDP and share of renewable energy consumed. The other factors (efficiency and carbon intensity) show lesser decreases, while the population and GDP are the factors with increasing trend. The GHG emission change is the integrated result of the driving factors change.

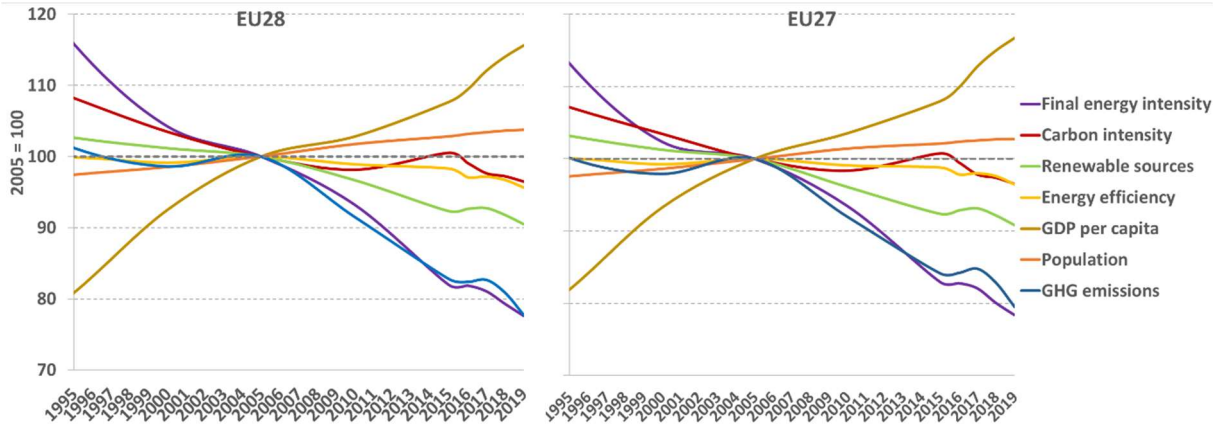


Figure 1.52 – *Trend of kaya identity parameters normalized to 2005 in EU28 and EU27.*

Moreover, the pictures show the marked decoupling between GHG emissions and GDP following the increasing share of renewable energy, the increase of efficiency, and the decrease of energy intensity.

The trend of the *Kaya Identity* for the examined countries is reported in Figure 1.53. Each country shows some degree of decoupling between GHG emissions and GDP per capita, although with a wide range and much differentiated role of driving factors. Higher decoupling is observed for those States where the GDP per capita has a growing trend.

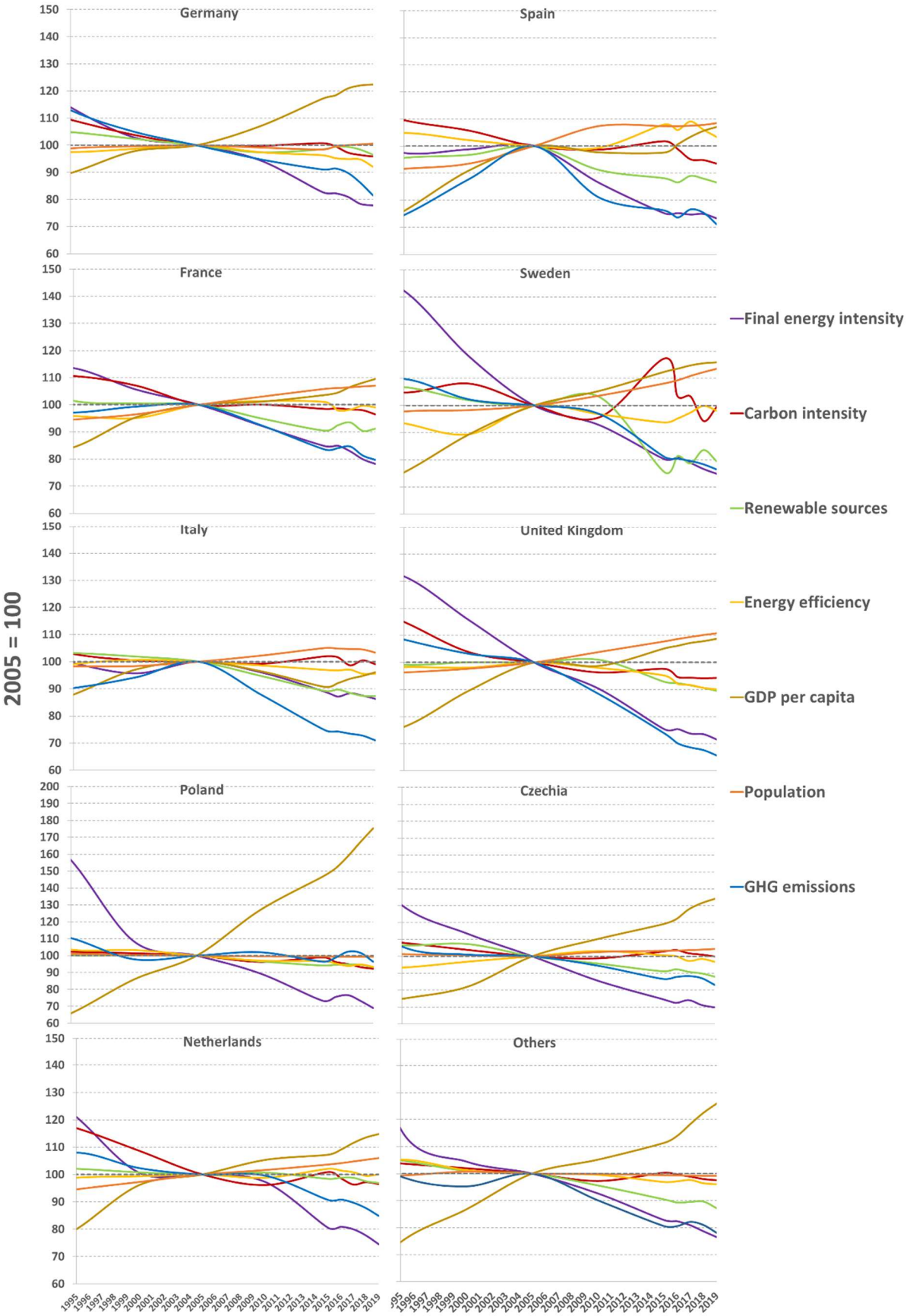


Figure 1.53 – *Trend of Kaya identity parameters normalized to 2005 in the European countries and the group of other countries.*

Among the countries examined, Italy is the only State in which GDP per capita is below the level of 2005 up to 2019, although a growing trend is observed since 2016. Such factor in Italy contributes for its share to the reduction of GHG emissions. In the other States, there is evidence of a greater decoupling of economic growth and GHG emissions. Poland shows the highest distance between the two parameters.

The decomposition analysis allows to quantify the contribution of each driving factor. The identity is expressed in logarithmic form:

$$ln(GHG) = ln(POP)\, x\, ln\left(\frac{GDP}{POP}\right)\, x\, ln\left(\frac{GIC}{FEC}\right)\, x\, ln\left(\frac{FFC}{GIC}\right)\, x\, ln\left(\frac{GHG}{FFC}\right)\, x\, ln\left(\frac{FEC}{GDP}\right)$$

where

GHG: greenhouse gas emissions;

POP: population (effect of population);

GDP/POP: Gross domestic product per capita (effect of economic growth);

GIC/FEC: gross inland energy consumption on final energy consumption, including non-energy uses (efficiency effect);

FFC/GIC: fossil fuel energy consumption on gross inland energy consumption (effect of renewable energy);

GHG/FFC: total GHG emissions from fossil fuels energy consumption (effect of carbon intensity from fossil fuels);

FEC/GDP: final energy intensity on gross domestic product (effect of energy intensity).

The individual terms of the equation therefore allow us to consider the effect of population, economy, efficiency, renewable sources, carbon intensity, and energy intensity.

Below are the values of the parameters for the years 2005 and 2019.

Table 1.3 – *Values of the parameters used for the decomposition analysis of GHG emissions change in the years 2005 and 2019 for EU28, EU27, and for the States examined.*

	EU28		EU27	
	2005	**2019**	**2005**	**2019**
GDP (Bln €, chain linked volumes - 2015)	13,423.0	16,096.3	11,075.7	13,280.6
Gross inland energy consumption - CIL (Mtoe)	1,838.3	1,636.6	1,603.5	1,454.0
Renewable energy – RE (Mtoe)	1,240.3	1,154.7	1,091.3	1,026.0
Final energy consumption – FEC (Mtoe)	123.9	251.7	120.0	229.7
Fossil energy consumption –FFE (Mtoe)	1,454.7	1,171.7	1,245.6	1,026.1
Population – POP (Millions)	494.6	513.1	434.4	446.4
CO_2eq – GHG (Mt CO_2eq)	5,236.1	4,069.1	4,546.0	3,616.0

	Germany		United Kingdom		France		Italy	
	2005	**2019**	**2005**	**2019**	**2005**	**2019**	**2005**	**2019**
GDP (Bln €, chain linked vol. - 2015)	2,624.6	3,232.3	2,332.3	2,809.4	2,005.2	2,349.1	1,737.6	1,725.7
Gross inland consumption - CIL (Mtoe)	346.5	305.6	234.8	182.6	277.2	251.4	189.4	155.4
Renewable energy – RE (Mtoe)	231.9	222.2	149.1	128.6	166.8	152.8	140.1	120.2
Final consumption – FEC (Mtoe)	18.8	45.5	3.9	22.0	15.9	28.5	14.1	29.5
Fossil consumption –FFE (Mtoe)	286.1	243.6	209.2	145.6	150.0	123.9	171.1	122.6
Population – POP (Millions)	82.5	83.0	60.2	66.6	62.8	67.2	57.9	59.8
CO_2eq – GHG (Mt CO_2eq)	992.5	809.8	690.1	453.1	556.0	443.0	589.1	418.3

	Spain		Poland		Netherlands		Czechia	
	2005	**2018**	**2005**	**2019**	**2005**	**2019**	**2005**	**2019**
GDP (Bln €, chain linked vol. - 2015)	1,028.7	1,193.9	294.6	513.6	620.7	755.2	137.9	193.1
Gross inland consumption - CIL (Mtoe)	144.5	127.0	92.6	104.0	83.7	75.9	45.5	43.0
Renewable energy – RE (Mtoe)	102.2	86.9	62.1	74.7	62.5	56.7	27.9	27.2
Final consumption – FEC (Mtoe)	8.4	18.9	4.5	9.9	2.3	5.4	2.1	4.9
Fossil consumption –FFE (Mtoe)	121.3	92.3	89.0	93.1	78.8	69.3	38.1	31.6
Population – POP (Millions)	43.3	46.9	38.2	38.0	16.3	17.3	10.2	10.6
CO_2eq – GHG (Mt CO_2eq)	442.1	314.5	405.2	390.7	212.6	180.3	147.7	122.6

	Sweden		Others	
	2005	**2005**	**2005**	**2005**
GDP (Bln €, chain linked vol. - 2015)	374.5	492.8	2,266.8	2,831.2
Gross inland consumption - CIL (Mtoe)	51.4	49.7	372.6	342.0
Renewable energy – RE (Mtoe)	34.1	33.6	263.6	251.8
Final consumption – FEC (Mtoe)	14.6	21.3	39.4	65.8
Fossil consumption –FFE (Mtoe)	18.8	14.4	285.0	228.1
Population – POP (Millions)	9.0	10.2	114.3	113.4
CO_2eq – GHG (Mt CO_2eq)	66.7	50.9	1,134.2	885.8

The following graph shows the results of the decomposition analysis for EU28 and EU27.

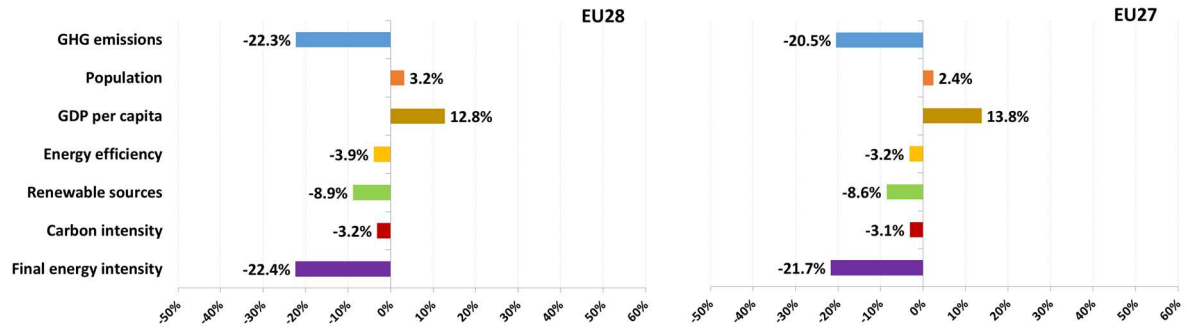


Figure 1.54 – *Decomposition analysis of GHG emissions in EU28 and EU27 in the period 2005-2019.*

The decomposition analysis for each country shows that in the period 2005-2019 the effect of the factors that led to the emission reductions prevailed over the effect of the factors that led to the increase.

In Italy, the population is the only factor that has contributed to the growth of GHG emissions (+2.8%). The remaining factors have led to the reduction of emissions from 2005 to 2019. Among these, the final energy intensity (final energy consumption / GDP; -12.4%) and the share of renewable energy (fossil energy consumption / gross inland energy consumption; -11.4%) played a significant role together with the efficiency (final energy consumption/ gross domestic consumption; -3.7%), and GDP per capita (-3.4%). The carbon intensity played a minor role (-0.8%). The contribution of all factors leads to the reduction of GHG emissions over the period 2005-2019 of -29%.

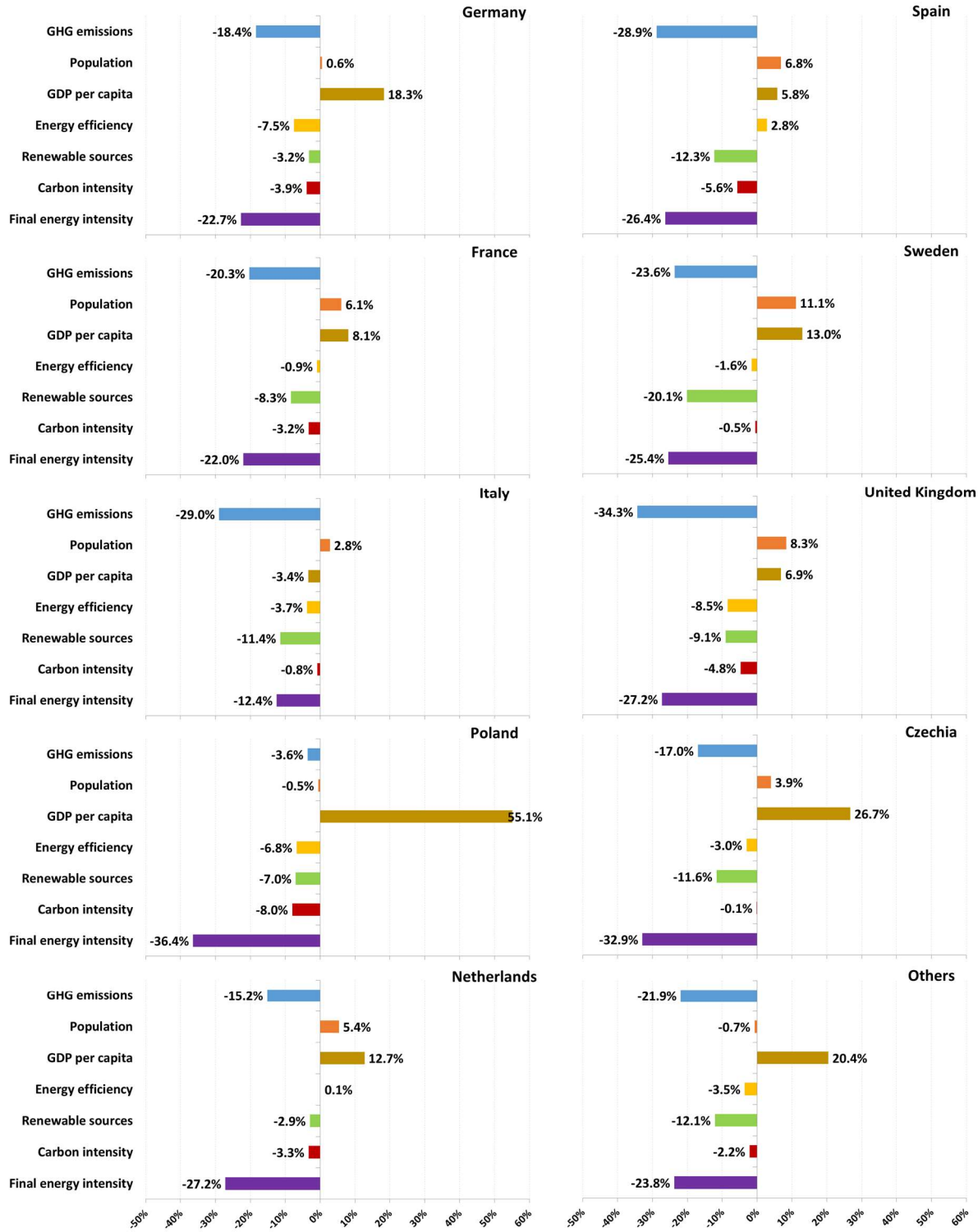


Figure 1.55 – *Decomposition of GHG emissions in the period 2005-2019.*

In summary, higher decoupling between economy and GHG emissions has been registered in every country than that recorded in Italy and the reduction of economic activities played a role to decrease the emissions in Italy. However, it should be considered that decoupling does not necessarily correspond to a reduction in emissions in line with the targets to be achieved by 2020. According to EEA (2020), among the largest countries, France, Italy, the Netherlands, Spain, Sweden and the United Kingdom had already achieved their 2020 GHG reduction target from the Effort Sharing sectors, while Germany, Poland, and Czechia, had 2019 Effort Sharing emission levels (proxy EEA) greater than their respective annual emission allocations; as for the renewable target, France, Germany, Netherlands, Poland, Spain, and United Kingdom do not meet in 2019 (proxy EEA) the renewable share targets outlined in their national renewable energy action plans; as for efficiency target, only Italy, the Netherlands, and Spain have sufficiently reduced their final energy consumption in 2019 (proxy EEA). Moreover, it should be emphasized that the analysis of the decomposition focuses on the relative variations of the parameters without assigning any weight to the respective starting points of the same. As already mentioned, the economic and energy efficiency of the Italian system is among the highest in Europe. *The 2018 International Energy Efficiency Scorecard,* issued by the *American Council for an Energy-Efficient Economy* (ACEEE), assigns the first position to Italy, together with Germany among 25 nations globally, with scores assigned according to quantitative and qualitative parameters, including efficiency indicators and policies aimed at reducing consumption.

The improvement of efficiency cannot be separated from the assessment of the variability potentials and cost effectiveness of the energy system, as well as a mindful assessment of the economy structure have to be considered, especially as regards the role of services and industry.

2 POWER SECTOR

The electricity sector is one of the largest GHG emission sources in Europe. Sector 1.A.1.a., according to the classification adopted by the *Common Reporting Formats* submitted to UNFCCC, represents emissions from "Public electricity and heat production", *i.e.* thermoelectric plants that supply electricity to the grid. The sector's GHG emissions in 2005 in EU28 were around 33% of the energy emissions and about 26% of total emissions with a sharply decreasing share to 26% and 20% in 2019, respectively. It should also be noted that sector 1.A.1.a does not represent the whole electricity system, since emissions from auto producers shall be allocated/accounted for in the specific categories and subcategories (refineries, other energy industries, iron and steel plants and other manufacturing industries) of the Energy sector. In 2005, auto produced electricity from fossil energy in EU28 accounted for about 11.2% with an increasing share up to 16.7% in 2019. GHG emissions due to electricity generation are therefore higher than the figures reported in sector 1.A.1.a. of CRF.

The electricity sector is therefore one of the main objectives of the measures aimed to decarbonize the economy, both for the amount of emissions and for the potential for deployment of renewable energy sources. Since 2005, these sources have doubled their share of electricity production in EU28 from 13.9% to 34.1% in 2019.

The physical peculiarities of emission sources are important in this respect since the electricity sector is characterized by a relatively small number of large point sources, unlike other sectors, such as transport, which is equally relevant in emissive terms although characterized by millions of small and mobile sources with greater inertia as far as the deployment of renewable energies is concerned.

In November 2018, the European Parliament approved the new targets to increase the use of renewable energy in Europe. The renewable energy consumption must be 32% of gross energy consumption by 2030. As with the targets set by the 2020 Climate and Energy Package, a significant part will be played by the electricity sector. According to JRC (2017) "to reach the target of 30% renewable energy[1], in 2030 it is necessary that 54% of the gross electricity production in EU is from renewable energy." As part of the European Green Deal, the Commission proposed in September 2020 to raise the 2030 greenhouse gas emission reduction target, including emissions and removals, to at least 55% compared to 1990. As consequence of this new target further actions are required across all sectors, including increased energy efficiency and renewable energy. This will enable the EU to move towards a climate-neutral economy and to implement its commitments under the Paris Agreement by updating the EU's Nationally Determined Contribution.

2.1 Methodological notes and sources of data

The data related to the electricity sector in the European countries are from EUROSTAT database.[2] The renewable energy share required to achieve the European 2020 target are communicated by Member States in accordance with Directive 2009/28/EU.[3]

For the estimation of GHG emissions from the electricity sector, fuels used in the thermoelectric sector are considered according to the EUROSTAT fuel classification given in the following table. The default emission factors for CO_2, CH_4, and N_2O of the IPCC guidelines (2006) are also reported:

[1] the target was subsequently set to 32%

[2] http://ec.europa.eu/eurostat/data/database

[3] http://ec.europa.eu/eurostat/web/energy/data/shares

Table 2.1 – *List of fuels used in the thermoelectric sector according to the EUROSTAT classification and default emission factors for CO_2, CH_4, and N_2O.*

Type	Fuels	Emission factors		
		CO_2 t/TJ	**CH_4 kg/TJ**	**N_2O kg/TJ**
Solid	Patent fuels	97.5	1.0	1.5
	Anthracite	98.3	1.0	1.5
	Coking coal	94.6	1.0	1.5
	Other bituminous coal	94.6	1.0	1.5
	Sub bituminous coal	96.1	1.0	1.5
	Coke oven coke	107.0	1.0	1.5
	Gas coke	107.0	1.0	0.1
	Coal tar	80.7	1.0	1.5
	Lignite	101.0	1.0	1.5
	Brown coal briquettes	97.5	1.0	1.5
	Peat	106.0	1.0	1.5
	Peat products	106.0	1.0	1.5
	Oil shale and oil sands	107.0	1.0	1.5
Oil	Crude oil	73.3	3.0	0.6
	Natural gas liquid	64.2	3.0	0.6
	Refinery gas/Refinery feedstocks	57.6	1.0	0.1
	Liquefied petroleum gas	63.1	1.0	0.1
	Other kerosene	71.9	3.0	0.6
	Kerosene-type jet fuel (excluding biofuel portion)	71.5	3.0	0.6
	Naphtha	73.3	3.0	0.6
	Gas oil and diesel oil (excluding biofuel portion)	74.1	3.0	0.6
	Fuel oil	77.4	3.0	0.6
	Bitumen	80.7	3.0	0.6
	Petroleum coke	97.7	3.0	0.6
	Other oil products n.e.c.	73.3	3.0	0.6
Natural gas	Natural gas	56.1	1.0	0.1
Derived gases	Coke oven gas	44.4	1.0	0.1
	Blast furnace gas	260.0	1.0	0.1
	Gas works gas	44.4	1.0	0.1
	Other recovered gases	50.3	1.0	0.1
Other non-renewable	Industrial waste (non-renewable)	143.0	30.0	4.0
	Non-renewable municipal waste	91.7	30.0	4.0
Other renewables	Renewable municipal waste	-	30.0	4.0
	Primary solid biofuels	-	30.0	100.0
	Biogases	-	1.0	0.1
	Pure biodiesel	-	3.0	0.6
	Other liquid biofuels	-	3.0	0.6

The analysis of the main parameters of the electricity sector will concern the selected European countries, as illustrated in the previous chapter, and at aggregate level the group of other countries, EU28, and EU27. The countries examined for comparison with Italy account for 80.2% of EU28 and 77.6% of EU27 gross electricity production in 2019.

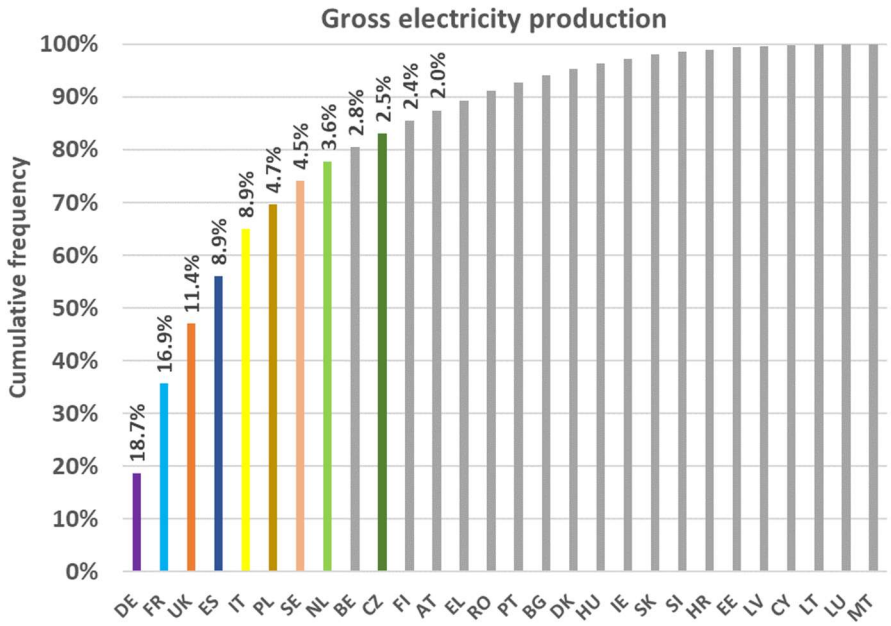


Figure 2.1 – *Cumulative frequencies for gross electricity production in the EU28 countries (data 2019). The labels of country frequencies higher than 2% are reported.*

The amounts of energy allocated to the production of electricity and heat in cogeneration plants have been calculated according to the methodology proposed by EUROSTAT (2016) for the compilation of national questionnaires by Member States.

The following equation defines the total efficiency (ε):

$$\varepsilon = (H + E) / F \qquad (1)$$

where H is the heat produced, E is the electricity produced and F is the fuel energy.

The fuel used for electricity production, F*e*, and that used for heat production, F*h*, are given by the equations:

$$Fe = F - (H / \varepsilon = F \times [E/ (E + H)] \qquad (2)$$

$$Fh = F - (E / \varepsilon = F \times [H/ (E + H)] \qquad (3)$$

In this way it is possible to allocate the fuel energy used in cogeneration plants for the production of electricity and heat in order to calculate the emission factor for electricity production.

The total efficiency (ε_t) and the electrical efficiency (ε_{el}) are calculated with the equations:

$$\varepsilon_t = (H + E) / F \qquad (4)$$

$$\varepsilon_{el} = E / F \qquad (5)$$

Another way for comparing the electrical efficiency of different countries considers only the share of fuel allocated to electricity generation after having parted the share of fuel for heat generation (according to equations 2 and 3). The electrical efficiency thus defined (equivalent electrical efficiency), ε'_{el}, will be given by the equation:

$$\varepsilon'_{el} = E / Fe \qquad (6)$$

2.2 Structure of the electricity sector

2.2.1 *Net electrical capacity*

The graphs in the following picture show the breakdown of the installed net capacity in EU28 and EU27 in the years 1990, 2005 and 2019. The data show that in 1990 the installed capacity consisted mainly of thermoelectric plants (more than 57% in EU28), nuclear (21%) and hydroelectric (21.6%). Wind and photovoltaic sources constituted a marginal share. In 2005 there was a significant increase in the share of wind farms (more than 5%), which have been increasing further in the following years, reaching about 18% of installed capacity in 2019. Photovoltaic plants, still marginal in 2005, has reached more than 12% of installed capacity. Geothermal and tidal sources, used to a significant extent only by Italy and France, remain marginal at European level. In EU28 the total installed capacity increase of 38.5% in 2019 compared to 2005, from 758 GW to 1,050 GW. The nuclear capacity is the only one with a relevant reduction, from 135 GW to 119.2 GW (-11.7%).

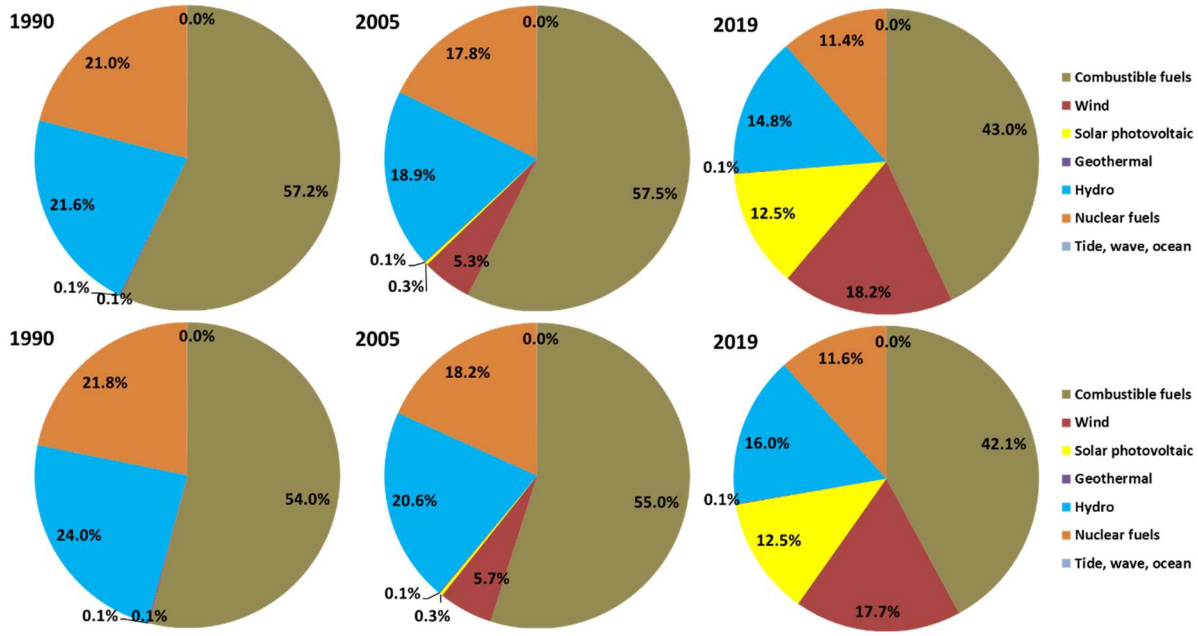
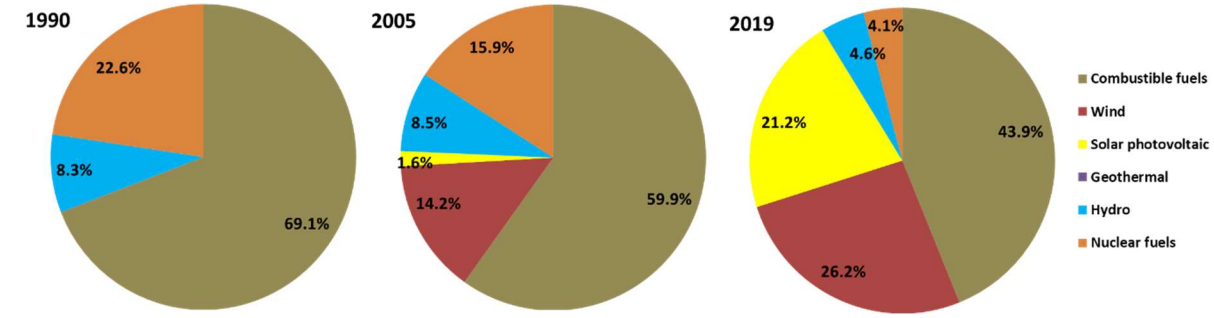


Figure 2.2 – *Distribution of net electrical* capacity *in EU28 (up) and EU27 (down).*

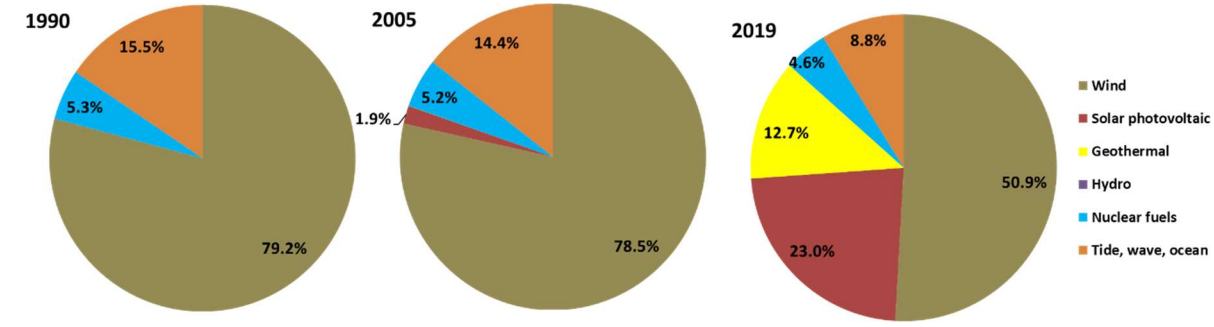
It is also noteworthy the increase of bioenergy net capacity from 17.6 GW in 2005 to 44.9 GW in 2019, representing 9.4% of total thermoelectric capacity.

The graphs in Figure 2.3a and Figure 2.3b show the breakdown of net capacity by type in the countries examined. The graphs show considerable heterogeneity among countries. In Poland, there is a clear prevalence of thermoelectric plants. The nuclear plants, which are not present in Italy and Poland, make up a significant share of the capacity in France, Sweden, and Czechia, although the shares of other countries are not negligible. Since 1990, hydroelectric capacity has accounted for a considerable proportion of traditional renewable sources in Spain, France, Italy and Sweden.

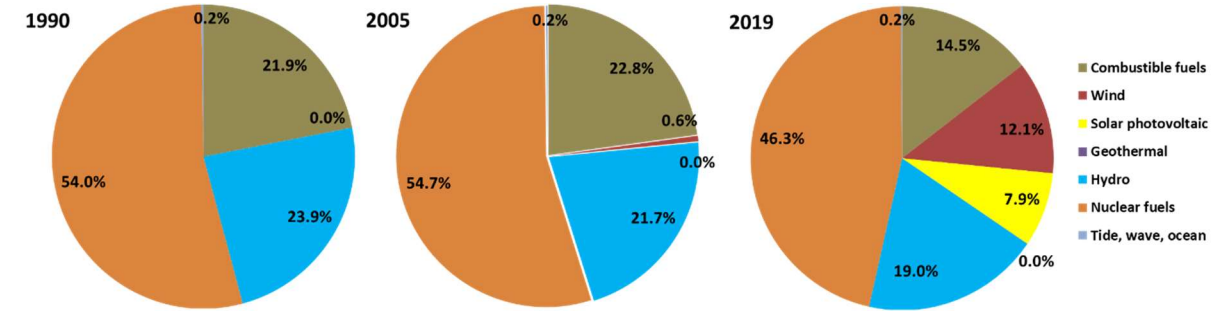
Germany



United Kingdom



France



Italy

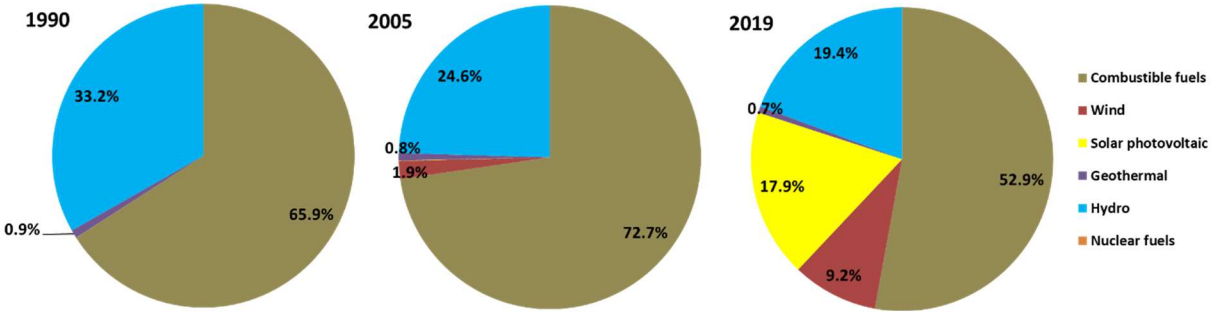
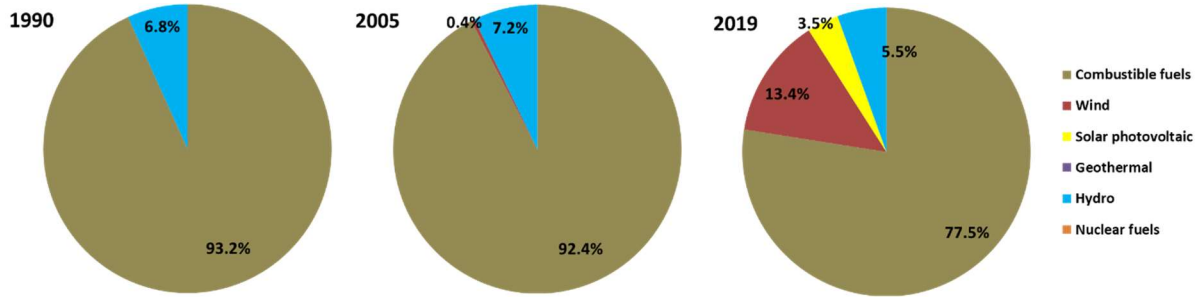
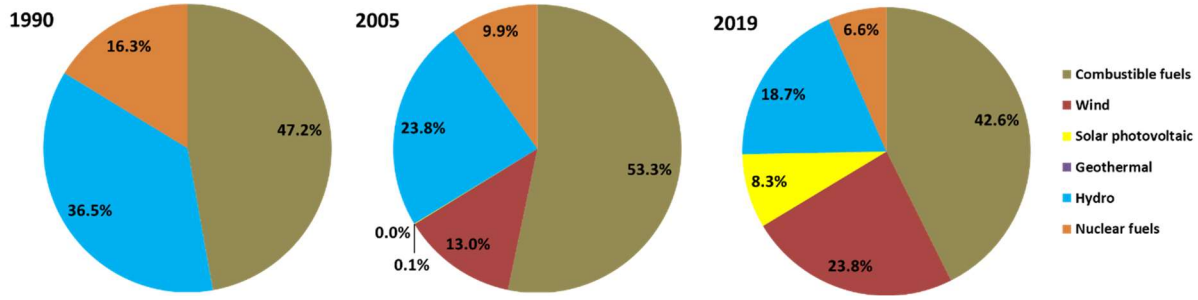


Figure 2.3a – *Distribution of net electrical capacity in the European countries.*

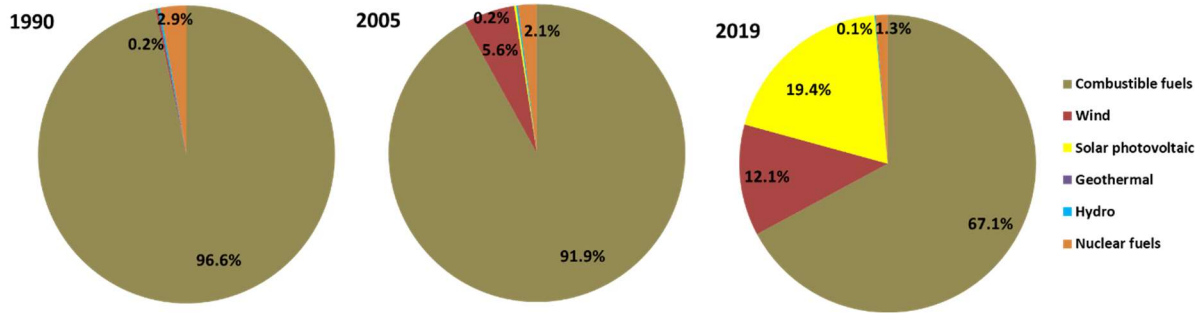
Poland



Spain



Netherlands



Czechia

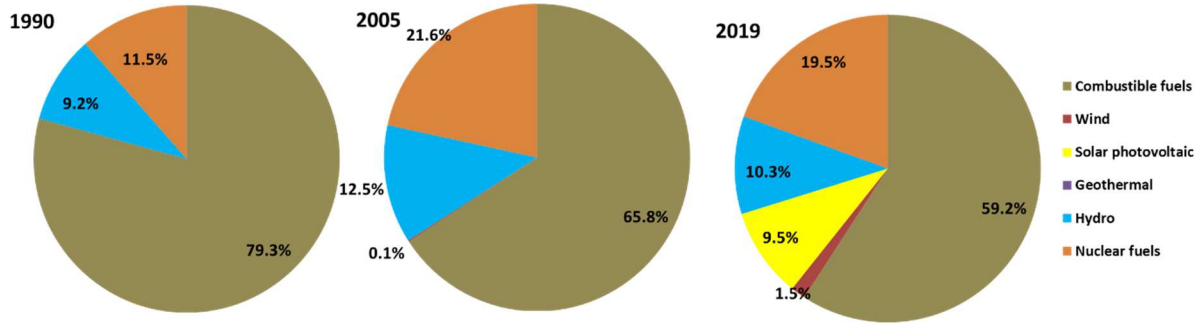


Figure 2.3b – *Distribution of net electrical capacity in the European countries.*

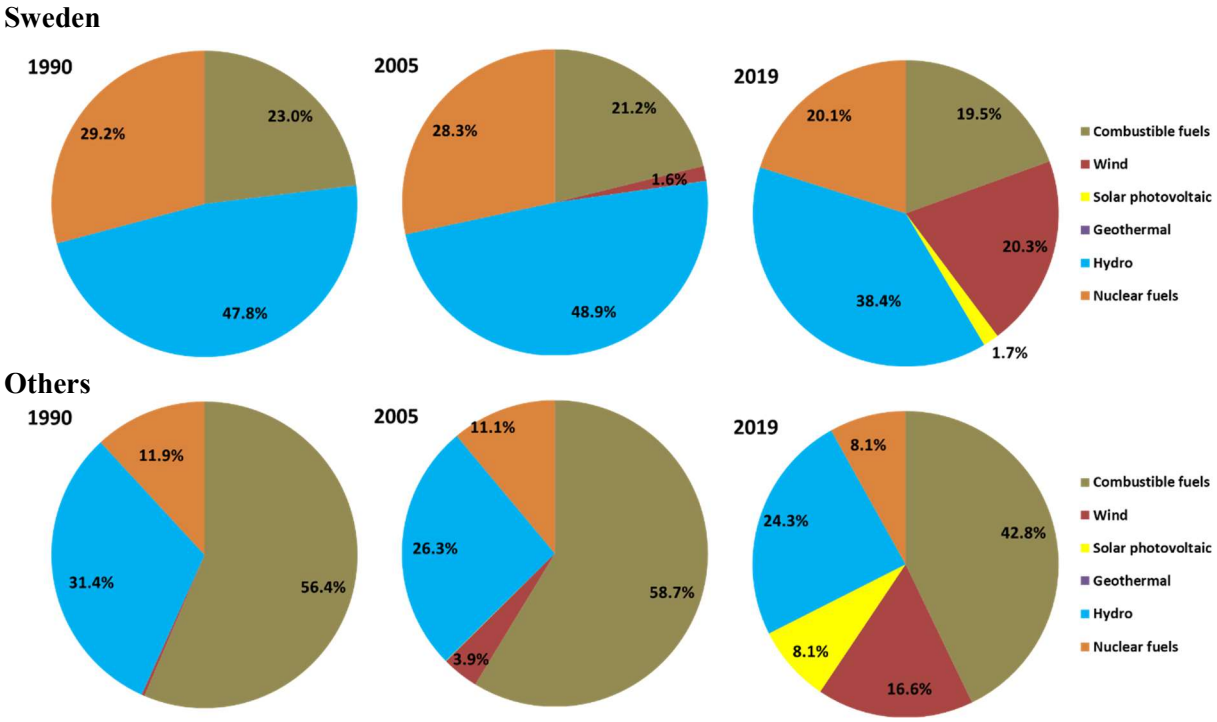


Figure 2.3c – *Distribution of net electrical capacity in the European countries.*

In all the countries examined, the share of thermoelectric and nuclear capacity shows a considerable contraction. Wind power has increased in all countries since 2005. Photovoltaic plants begun to have significant shares only after 2005 and Germany, Italy, the United Kingdom, and the Netherlands have shown a significant increase of these source in recent years.

With regard to thermoelectric capacity, it is useful to highlight the specificity of Sweden, whose share of capacity fuelled by bioenergy and waste is particularly high: 70.3% of the thermoelectric sector in 2019. The share in the other examined countries ranges from 2.7% in Spain to 14.7% in the United Kingdom. The share for Italy is equal to 6.3%. As for the group of other countries the average share is 10.8%.

2.2.2 *Electricity production*

The following graphs show gross electricity production by source in the countries examined and in EU28. In 2019, 14.3% of EU28 electricity production without pumping comes from solid fuels and 21.8% from natural gas. Oil and petroleum products account for 2%. Nuclear source accounts for 25.6% and 34.3% comes from renewable energy.

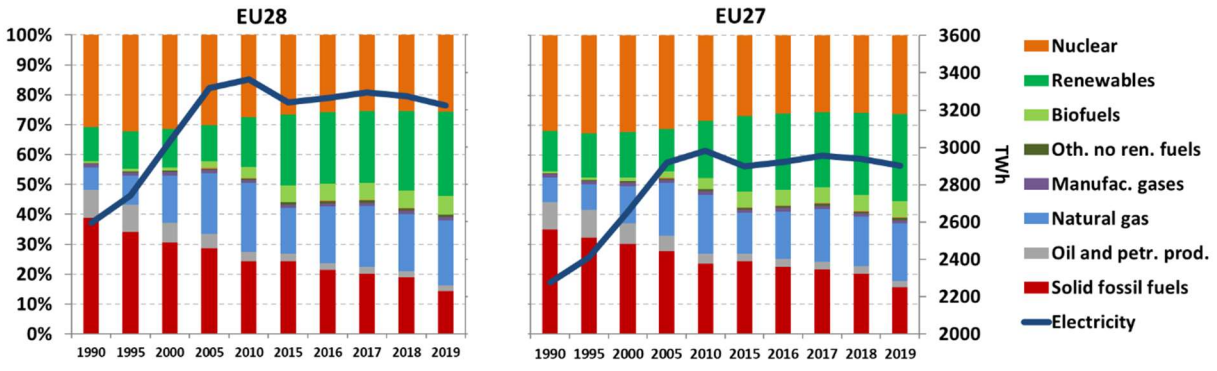


Figure 2.4 – *Gross electricity production by source in EU28 and EU27. Share (%) on the left axis, production (TWh) on the right axis.*

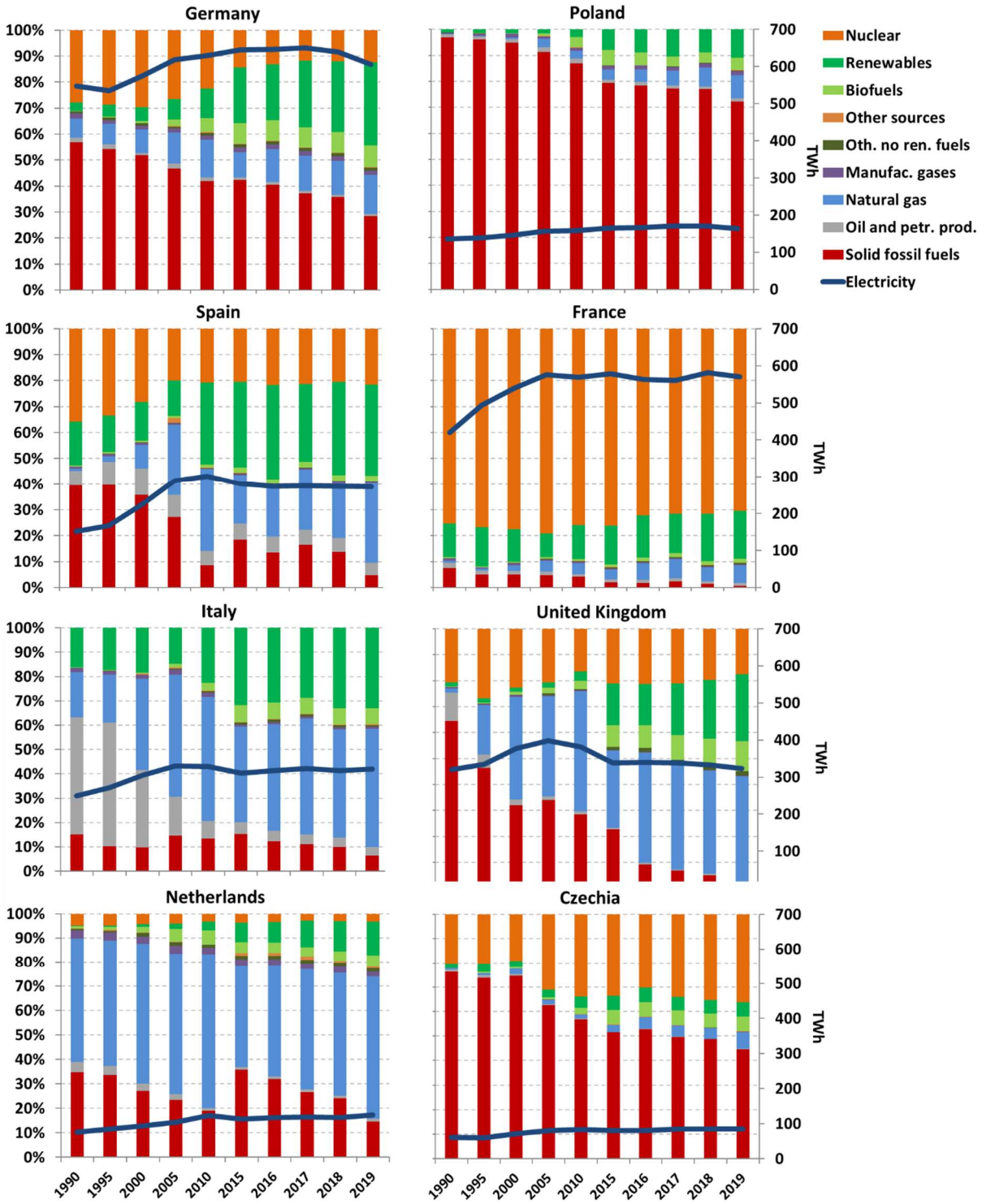


Figure 2.5a – *Gross electricity production by source in the selected countries. Share (%) on the left axis, production (TWh) on the right axis.*

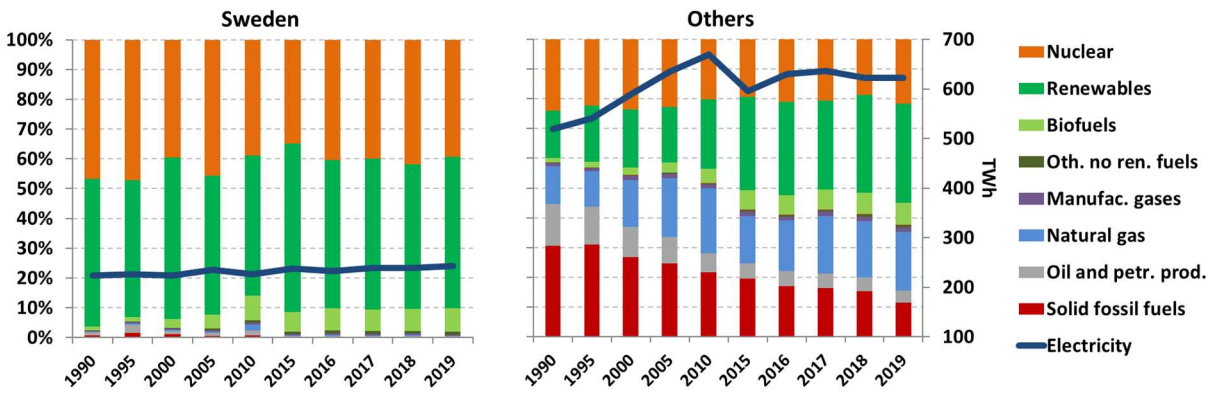


Figure 2.5b – *Gross electricity production by source in the selected countries. Share (%) on the left axis, production (TWh) on the right axis.*

Gross electricity production has shown a marked increase compared to 1990 and a relative stability in recent years, although the countries are characterized by different trends. Some countries, such as Germany and Poland, show increasing trends, although with a slowdown after 2005 and a relevant contraction in the recent years. Sweden, the Netherlands, and Czechia show slightly increasing trends of electricity production. Spain, Italy and the United Kingdom contracted significantly the electricity production after 2005 as a result of the economic crisis and the restructuring of production systems. The electricity production in France has been quite stable since 2005.

The energy mix in the examined countries is quite heterogeneous, mainly as far as fossil fuels are concerned. In 2019, solid fuels make up 72.4% of electricity production in Poland, 44.6% in Czechia, and 28.4% in Germany. Even more interestingly, 52.7% of electricity production from solid fuels originates from lignite in EU28. Germany, Poland, and Czechia are the main countries that use this fuel for electricity production and account collectively for 78.7% of the EU28's electricity production by lignite (46.7% Germany, 17.5% Poland, and 14.6% Czechia). The group of other countries accounts collectively for the remaining 21.3% (mainly Bulgaria, Greece, and Romania). The electricity produced from lignite in Germany, Poland and Czechia is 65.7%, 35.7%, and 94.2% of electricity from solid fuels respectively.

France and Sweden are characterized by low production of non-nuclear power plants, 11.1% in France and 9.7% in Sweden of the total electricity production without pumping in 2019. In France, electricity production from nuclear power accounts for 70.5% of total production, while in Sweden nuclear power plants provide 39.3% of electricity. Czechia has also a relevant share of electricity from nuclear power plants (36.1%). Among the countries examined Poland and Italy do not have nuclear power plants, while in the Netherlands the electricity from nuclear source accounts for 3.2%. In the other countries the share ranges from 12.4% in Germany to 21.5% in Spain. At European level, the nuclear source provides more than a quarter of electricity production (25.6% in EU28 and 26.3% in EU27).

In Italy and the United Kingdom, natural gas determines 48.5% and 40.6% of total electricity production respectively. Both countries have shown a conversion of their thermal power plants since 1990 with a sharp contraction of oil and petroleum products (Italy) and solid fuels (the United Kingdom), with the expansion of natural gas at the same time. A significant contraction of solid fuels is also observed in all countries although some countries as Germany, Poland, and Czechia still have relevant shares of solid fuels.

As regards electricity production from renewable sources, the share has increased from 12% to 34.3% in EU28 since1990 (from 14.1% to 34.6% in EU27). Sweden, which already had 51% of electricity from renewable sources in 1990 has increased to 58.7% in 2019. The Netherlands, Poland, Czechia, and the United Kingdom had the lowest shares of electricity from renewable sources in 1990, less than 2%. In 2019 the countries' shares increased to 18.8% in the Netherlands, 15.6% in Poland, 12% in Czechia, and 37.5% in the United Kingdom. Germany's share was 3.5% in 1990 and 40.2% in 2019. France, Italy and Spain, on the other hand, had already a large share of electricity produced from renewable sources

in 1990 (13.4%, 16.4% and 17.2% respectively). In 2019 France recorded a 20% increase, the lowest increase among the examined countries, Italy rose to 39.7% and Spain to 37.3%. The renewable share in the group of other countries was 17.3% in 1990 and increased to 40.7% in 2019.

The following graph shows in more details the electricity production without pumping from renewable sources and the mix of sources. In all the countries examined there is a marked increase of renewable electricity production with a strong acceleration since 2005. After 2015 the growth slowed down and has resumed in recent years although with different rates among the States.

In 1990, almost all electricity from renewable sources, 93.9% in EU28 was from hydroelectric. Countries show different development dynamics for the renewable sources related to the specificities of their electrical systems and national circumstances. Hydropower continues to cover about 30% of Europe's renewable production in 2019. Among the examined countries, hydroelectric power supplies 50.3% of renewable production in France and 66.1% in Sweden, but the shares recorded in Italy, Spain, and Czechia (40%, 24.4%, and 20% respectively) are not less important. The wind source shows considerable development in Germany, Spain, Poland, the Netherlands, and the United Kingdom, with shares ranging from 50.6% to 59.3%. Photovoltaic electricity production plays a significant role in Germany, Italy, the Netherlands, and Czechia with shares from 19.1% to 23.5%. Lower shares are recorded in Spain for photovoltaics and solar thermal (15%), in the United Kingdom (10.7%) and France (10.8%). Bioenergy covers over 50% of renewable production in Czechia, while the United Kingdom and Poland are just over 30%. The shares for the other countries range between 5.5% in Spain and 25.6% in the Netherlands. The electricity from this source represents 16.9% in Italy. Among the countries under examination, the geothermal source is present significantly only in Italy (5.2%).

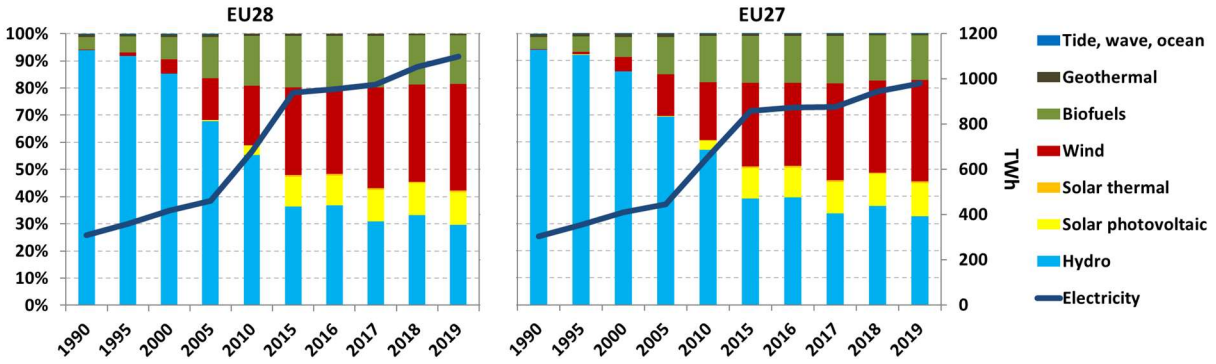


Figure 2.6 – *Gross electricity production without pumping from renewable sources in EU28 and EU27. Production share per source on the left axis, electricity production on the right axis.*

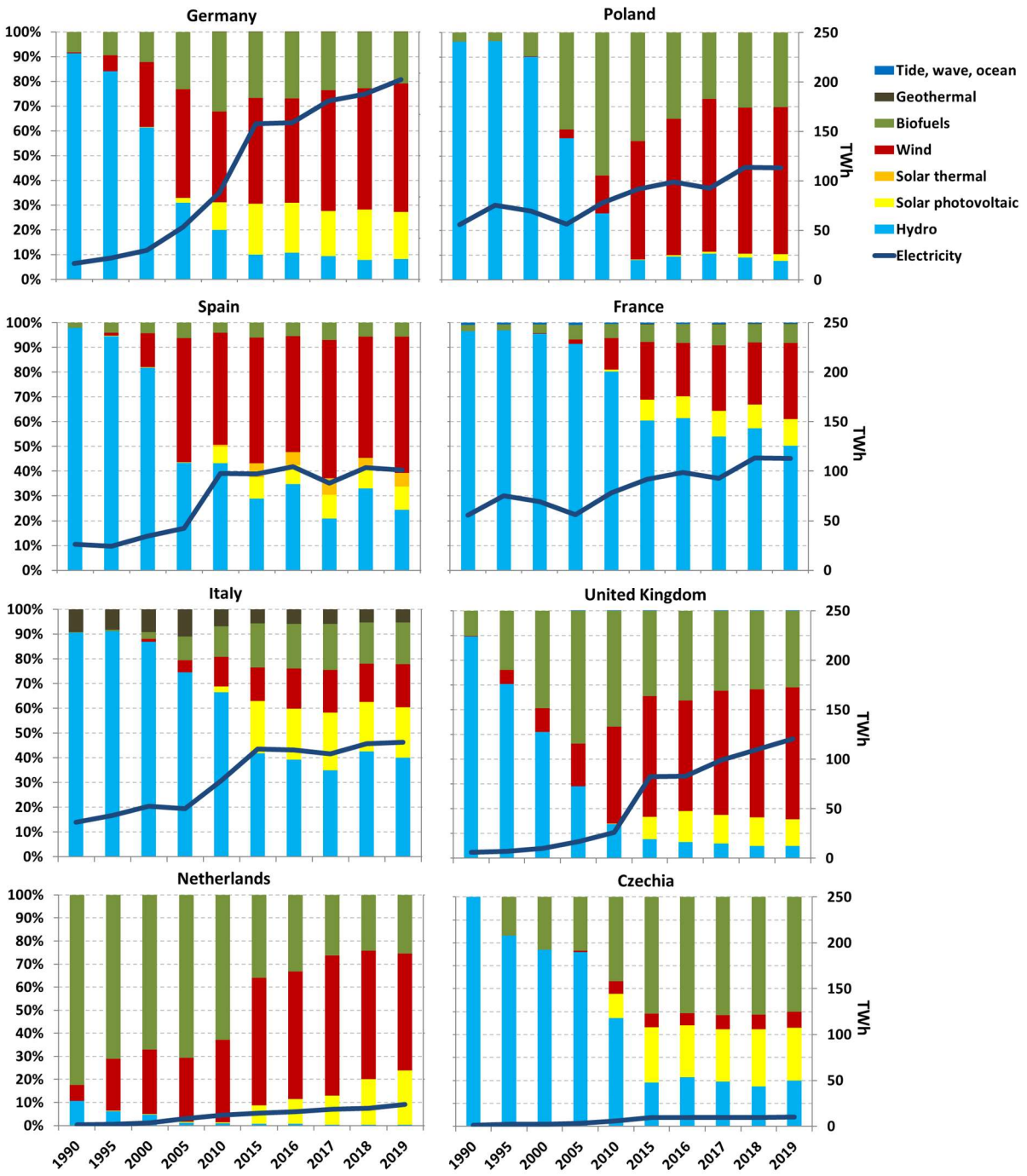


Figure 2.6a – *Gross electricity production without pumping from renewable sources in the selected countries. Production share per source on the left axis, electricity production on the right axis.*

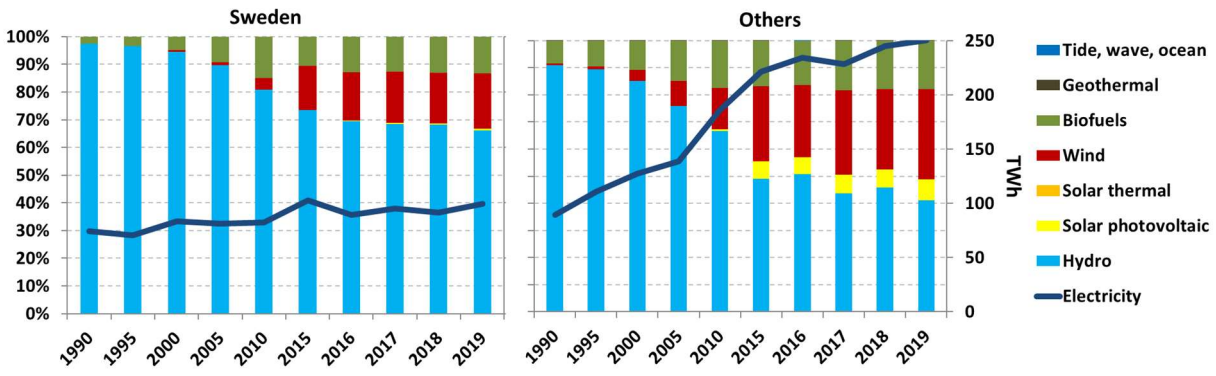


Figure 2.6b – *Gross electricity production without pumping from renewable sources in the selected countries. Production share per source on the left axis, electricity production on the right axis.*

The following graph shows the trend in the renewable share of electricity without pumping. Sweden has one of the highest renewable shares in Europe. At European level the share has been growing rapidly since 2005. The Italian figure is higher than the European average and Italy's renewable share of electricity is one of the highest among the biggest countries. Among such countries only Sweden has a much higher share and Germany's share exceeded the Italian one only in 2019 (39.7% in Italy and 40.2% in Germany).

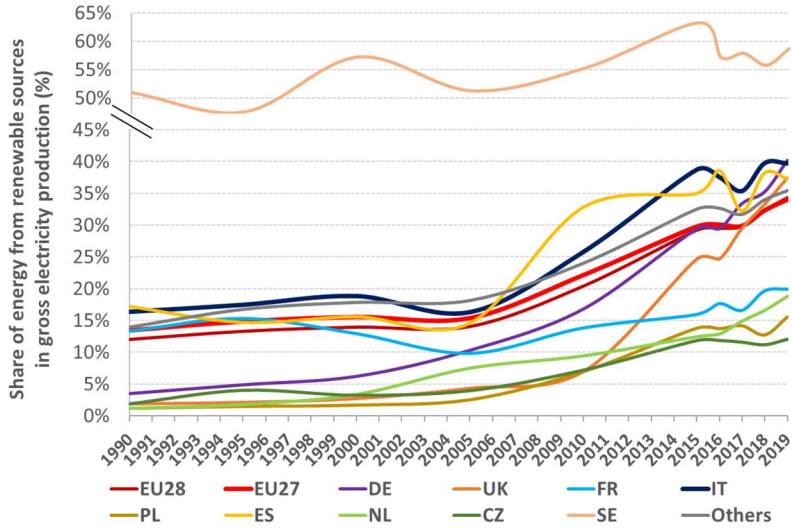


Figure 2.7 – *Renewable share of gross electricity production.*

The renewable share for the achievement of the European targets, in accordance with the Directive 2009/28/EC, refers to gross inland consumption of electricity, i.e. electricity production without electricity from pumping plus the net import of electricity. The renewable share thus calculated will therefore be lower for importing countries when compared with the renewable share of electricity production. This shows that electricity importing countries, such as Italy, face a relatively greater effort than exporting countries to achieve their renewable targets in the electricity sector.

2.2.3 *Electricity consumption*

As already reported, gross inland consumption of electricity for the calculation of renewable targets is given by gross electricity production without pumping added to the net import of electricity. The countries examined account for 78.6% of the gross inland electricity consumption of EU28. The countries have different import/export balance of electricity. Without considering the annual variability, the examined countries can be divided into traditionally exporting, such as France, and countries that

import a significant share of electricity, such as Italy. Germany and Sweden have seen increasing shares of electricity exported in recent years, while Czechia increased the export since 2005. On the other hand, Poland, Spain and the United Kingdom show an increase of imports.

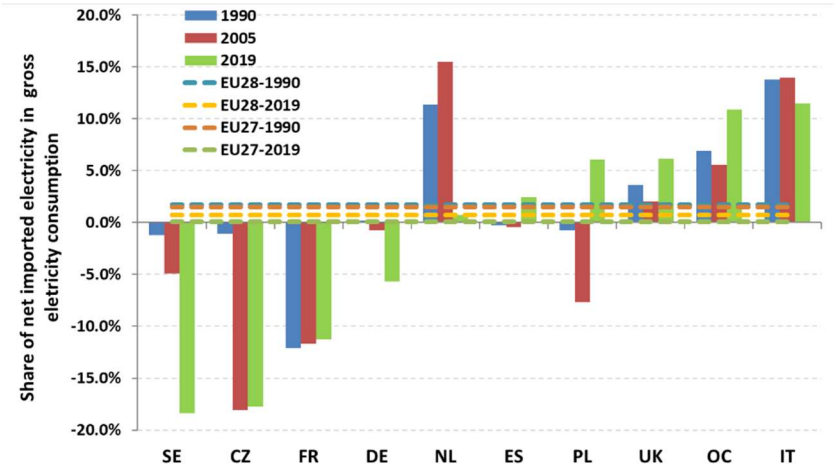


Figure 2.8 – *Share of imported electricity compared to gross inland consumption. Data in ascending order of the 2019 value. OC – Other countries.*

The data for import share is relevant for the assessment of GHG emissions and the calculation of the renewable share of electricity, as required by the Directive 2009/28/EC. While a significant share of imports brings a non-emission benefit to the satisfaction of inland electricity consumption, it has a negative impact on the renewable share in gross inland consumption, as noted above. The following graph shows trends in the renewable of electricity in final electricity consumption since 2005 according to the aforementioned Directive. The positions of Germany and Italy are reversed from what was seen in Figure 2.7. Spain also has a higher renewable share than Italy due to the lower share of imports.

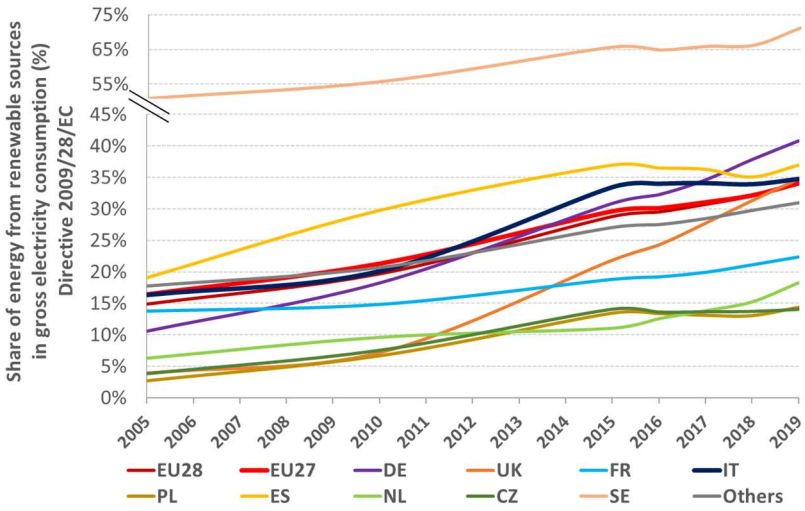


Figure 2.9 – *Trend of the renewable share in gross inland electricity consumption since 2005 according to Directive 2009/28/EC.*

The comparison of the data in Figure 2.7 and Figure 2.9 highlights the role of electricity import/export. An insight of the penalty for importing countries and the benefit to exporting countries in terms of the targets to be achieved is shown in the following graph.

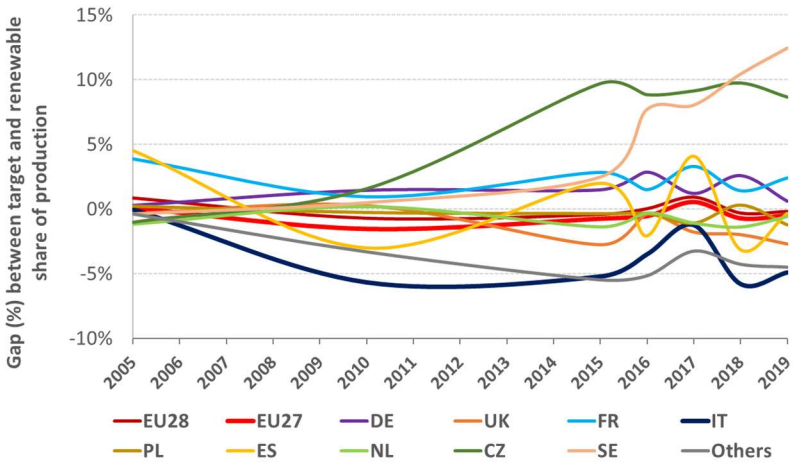


Figure 2.10 – *Gap between the renewable share of gross inland consumption of electricity and gross production.*

The graph shows that Italy has, among the countries examined, the lowest gap between the target renewable share and the share of production from renewables. The difference between the two shares is significantly reduced in 2016 and 2017 when the import decreased compared to domestic production.

2.2.4 *Efficiency of thermal power plants*

The performance of the electrical systems in different countries will be compared through parameters such as the share of own consumption, the distribution losses compared to the final consumption and above all the transformation efficiency of the fuel energy for electricity and heat generation. In the case of cogeneration plants, it should be considered that not all the electricity and heat produced in such plants can be regarded to as cogeneration production.[4] However, it is reasonable to compare the overall efficiency of the thermoelectric plants in different countries in terms of the transformation of the fuel energy into the final products regardless of the way in which the plants were used. In this respect, the distinction between cogeneration and non-cogeneration plants was made by considering the activities classified by Eurostat: "*combined heat and power*" and "*electricity only*".

Figure 2.11 shows the percentages of own consumption out of gross electricity production. In summary, own consumption is the consumption of electricity utilities functional to the electricity production and is an indicator of the energy required by the electricity generation system. The share of own consumption in Italy has always been below the European average and in 2019 the share is higher only than that recorded in the Netherlands and Sweden. In general terms, thermoelectric, geothermal and nuclear generation are the sources with the greatest demand of energy, while renewable sources, such as hydroelectric, wind and photovoltaic, have very low own consumption. The greatest own consumption in thermoelectric plants is related to plants powered by solid fuels and bioenergy, less energy is required by plants fuelled by oil and petroleum products and even less energy is required by plants fuelled by natural gas. Therefore, in addition to the efficiency, a decisive parameter is represented by the fuel mix used by each country.

[4] EEA, 2018 https://www.eea.europa.eu/data-and-maps/indicators/combined-heat-and-power-chp-1

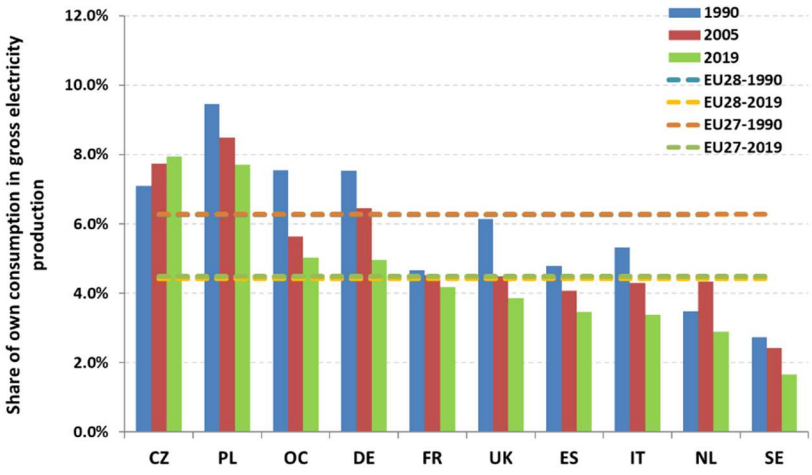


Figure 2.11 – *Own consumption compared to gross electricity production. Data in descending order of 2019 value. OC – Other countries.*

Distribution losses give insight on the network performance, higher losses determine higher energy consumption to supply the required electricity. In 2019 the distribution losses compared to the energy required for final consumption in Italy are higher than those recorded for Poland, Germany, and the Netherlands. The Italian share has always been lower than the European average.

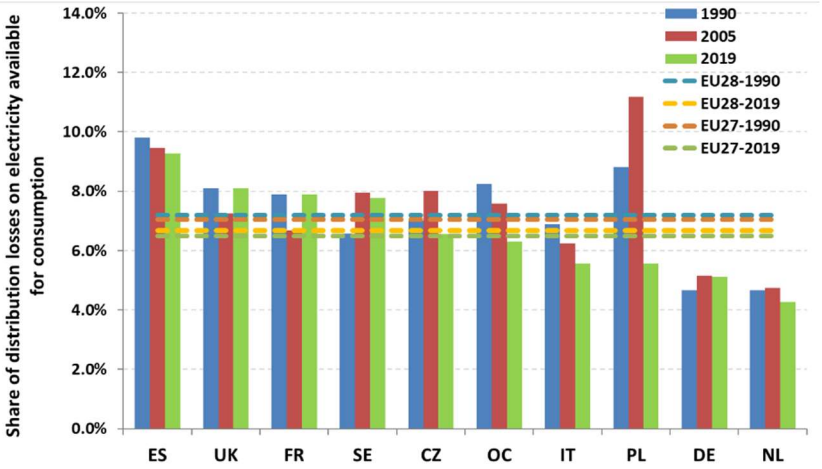


Figure 2.12 – *Distribution losses on electricity available for final consumption. Data in descending order of 2019 value. OC – Other countries.*

The most important parameter for assessing the efficiency of an electricity generation system is the transformation efficiency of fuels into electricity and heat.

The following graph shows that the electrical efficiency of Italian non-cogeneration plants (0.46 in 2019) is among the highest in the biggest European countries after the United Kingdom (0.47) and the Netherlands (0.51). In 2019, the Italian average is higher than the EU28 average (0.43). Since 1990 there has been an increase in Italy's efficiency of 13.8% against 16% of the EU28 average which had a lower starting point. The United Kingdom shows the higher increase (26.8% in 2019 compared to1990), while the efficiency in Sweden decreased of 31.5%.

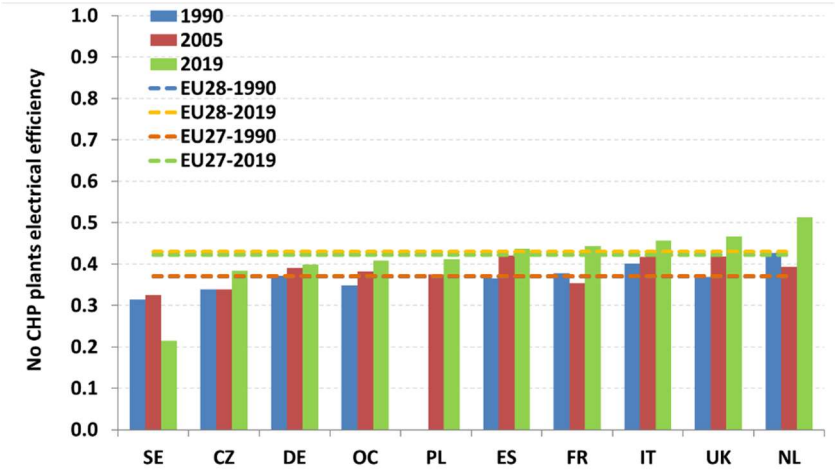


Figure 2.13 – *Electrical efficiency of non-cogeneration plants. Data in ascending order of 2019 value. OC – Other countries.*

With regard to the electrical efficiency of CHP plants, it should be stressed that Spain and the United Kingdom from 1990 to 2019 do not include heat production from these plants, while heat production has been recorded since 1995 in France and since 2004 in Italy. Without heat production, electrical efficiency will coincide with total efficiency.

In 2019, electrical efficiency in Spain is the highest among the main European countries (0.66), far higher than the EU28 average (0.38). Italy's efficiency is 0.39. The total efficiency of the Italian cogeneration plants (0.61) is below the EU28 average (0.65) and increased of 23.1% since 1990.

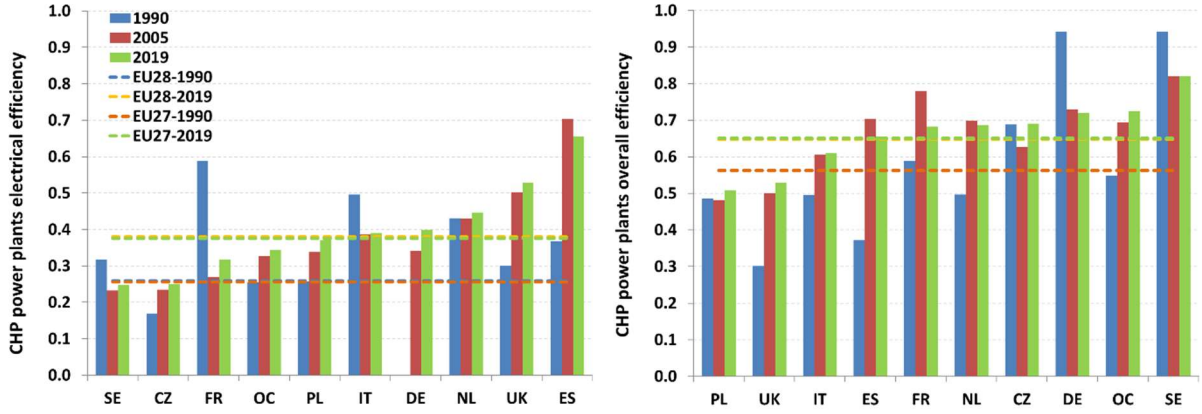


Figure 2.14 – *Electrical and total efficiency of CHP plants. Data in ascending order of the 2019 value. OC – Other countries.*

Total efficiency lesser than 0.75-0.80 in CHP plants shows that these plants produce electricity mainly not in cogeneration mode, except in Sweden and in the group of other countries.

The ratio between heat and electricity, H/E ratio, explains the significant differences between electrical and total efficiency. Sweden has one of the highest H/E ratios in Europe, which explains the low electrical efficiency against one of the highest total efficiency.

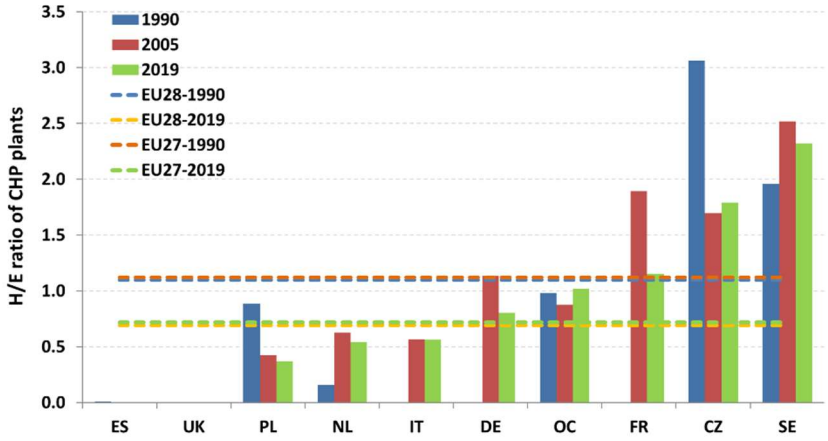


Figure 2.15 – *H/E ratio of CHP plants. The 1990 value for Germany is not given because Eurostat DB reports heat production without electricity production. Data in ascending order of 2019 value. OC – Other countries.*

The following graphs show the efficiency of all power plants (CHP and electricity only). The graphs show that in 2019 the total efficiency of Italian plants is 0.55, just a little higher than the EU28 average (0.53). The Italian electrical efficiency is 0.42, exceeded by Spain (0.48), the Netherlands (0.48) and the United Kingdom (0.47). Electrical efficiency of the examined countries shows a wide range, from 0.24 in Sweden to 0.48 in the United Kingdom with the EU28 average at 0.40.

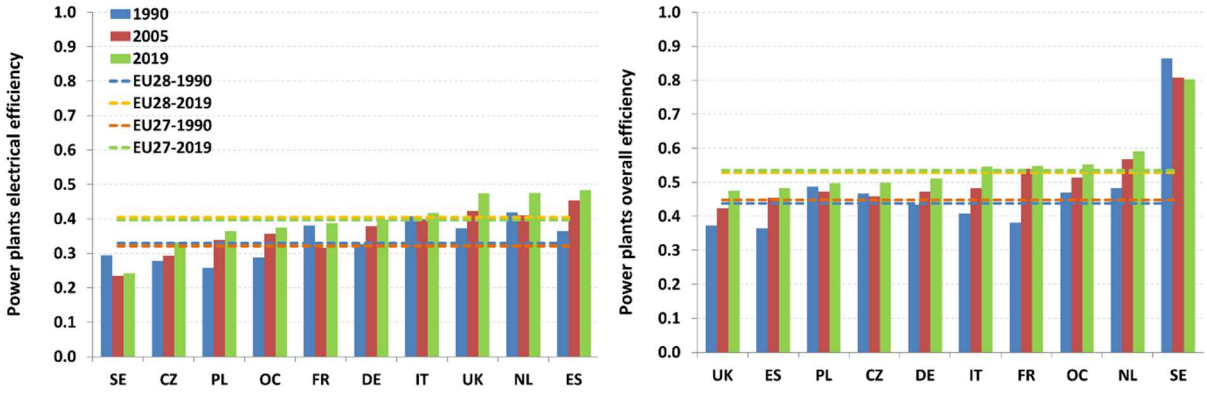


Figure 2.16 – *Electrical and total efficiency of thermal power plants. Data in ascending order of 2019 value. OC – Other countries.*

The equivalent electrical efficiency of CHP plants, calculated after unbundling the share of fuels for heat production, is 0.61 for Italy, below the EU28 average (0.63), with a growing trend (+9.6% since 2005). The equivalent electrical efficiency ranges from 0.49 in Poland to 0.74 in Sweden. The average for group of other countries is 0.88.

As far as the equivalent electrical efficiency for all plants is concerned in 2019, Italy (0.53) is exceeded only by the Netherlands (0.58) and Sweden (0.74). The EU28 average is 0.50.

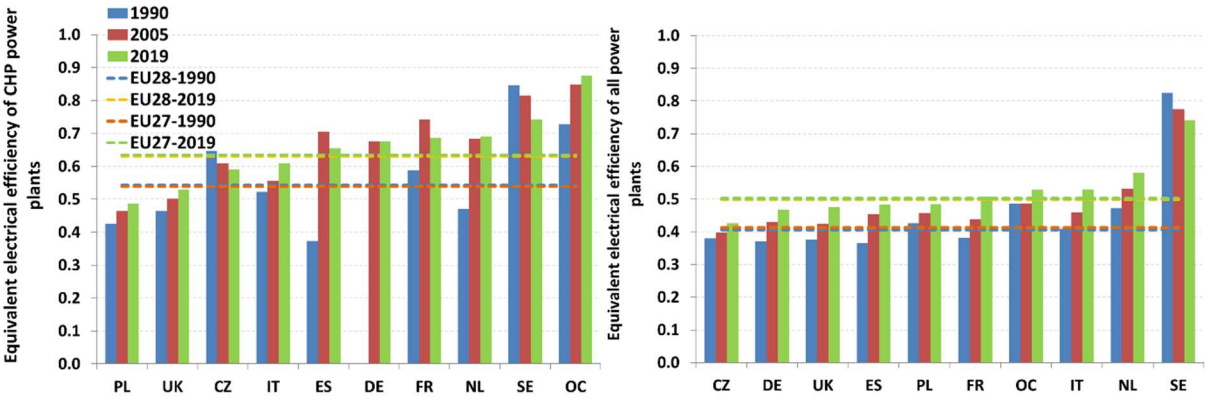


Figure 2.17 – *Equivalent electrical efficiency* for *CHP plants (left) and all thermal plants (right). Data in ascending order of 2019 value. OC – Other countries.*

2.3 Greenhouse gas emissions from the electricity sector

In order to compare the GHG emission factors for the electricity sector in different countries the Tier 1 approach has been adopted to estimate the GHG emissions. Tier 1 emission factors are available national or international factors such as those provided by the IPCC and therefore should be feasible for all countries. The use of a Tier 1 emission estimate requires data on the amount of fuel consumption and the default emission factor, as reported in Table 2.1. The GHG emissions from each fossil fuel are calculated using the default emission factors reported in the IPCC guidelines (2006) for stationary sources in the energy industries. The reference approach used for GHG emissions National Inventories submitted by Annex I countries to UNFCCC has been followed.

GHG emissions from the 28 European countries for the production of electricity and heat are 925.2 Mt CO_2eq in 2019, 37.3% lower than 1990 level and 36.9% lower than 2005 level. Since 2005 a significant reduction of GHG emissions in the electricity sector begun to take place.

Table 2.2 – *Estimation of GHG emissions (Mt CO_2eq) for electricity and heat production in thermal power plants. Data in descending order of 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1,476.3**	**1,375.1**	**1,362.1**	**1,466.2**	**1,336.8**	**1,166.3**	**1,121.3**	**1,111.8**	**1,048.3**	**925.2**
EU27	**1,255.1**	**1,187.5**	**1,178.6**	**1,265.5**	**1,159.4**	**1,041.0**	**1,021.4**	**1,023.4**	**966.4**	**850.9**
Germany	393.5	350.7	333.3	341.8	328.0	318.9	318.6	298.8	283.2	235.9
Other countries	329.6	314.2	288.4	298.4	285.0	221.1	213.7	220.8	209.3	183.4
Poland	181.5	150.3	146.7	154.6	149.6	143.3	142.2	143.7	142.1	130.2
Italy	123.3	130.5	137.1	160.2	137.1	110.8	110.5	110.8	102.9	98.1
United Kingdom	221.2	187.6	183.5	200.6	177.3	125.3	100.0	88.3	81.9	74.3
Spain	66.4	77.6	98.2	117.9	71.5	84.5	70.2	82.8	73.8	56.6
Netherlands	45.1	52.6	53.6	57.7	61.2	61.6	60.7	57.7	53.6	50.5
Czechia	63.9	64.2	64.0	64.6	63.1	53.9	55.0	53.4	53.0	49.0
France	46.4	38.4	48.7	59.2	50.0	37.5	40.0	44.5	37.1	36.4
Sweden	5.3	9.1	8.5	11.0	13.9	9.6	10.6	10.9	11.3	10.8

Overall, in 2019 GHG emissions from power sector in the selected countries (741.8 Mt CO_2eq) account for 80.2% of EU28 emissions. The share of emissions in 2019 is shown in the following graph. Italy accounts for 10.6% of Europe's emissions.

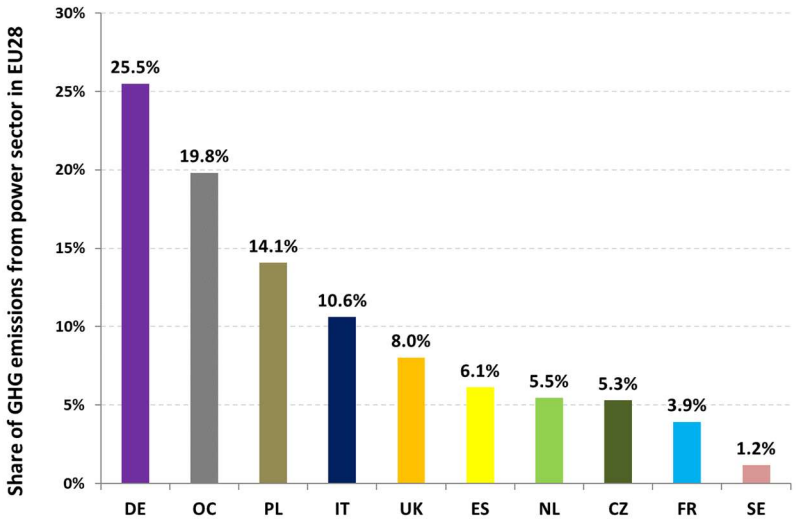


Figure 2.18 – *Share of GHG emissions from power sector in 2019 in EU28 emissions. OC – Other countries.*

GHG emissions from power sector in EU28 show a slight decrease from 1990 to 2005 (-0.7%) despite the steady increase of electricity and heat production, respectively+28.2% and 5.8%. At EU28 level, therefore, there has been a decoupling since 1990 between electricity and heat production and GHG emissions. However, emissions show a significant decrease only after 2005, leading to the increase of the decoupling mainly due to the increasing share of renewables. In other words, there has been a gradual increase in the distance between the rates of change of electricity and heat production, which have increased since 1990, and the rates of change of GHG emissions, which have been falling since 2007.

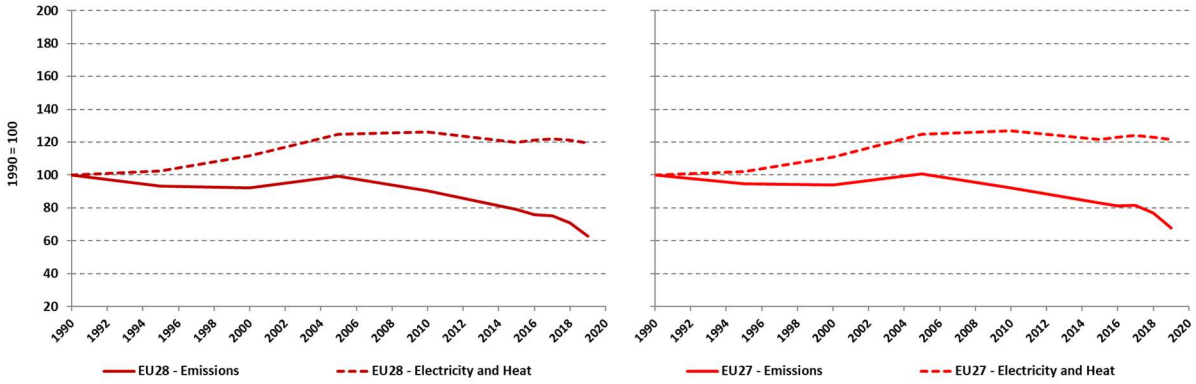


Figure 2.19 – *Rates of change for electricity and heat production and greenhouse gas emissions from the electricity sector compared with 1990.*

Decoupling is evident in almost all countries although with different dynamics. Among the selected countries only in Poland there is not a significant decoupling, while Sweden represents an exception because there is a decoupling in the opposite direction, i.e. sharp increase of emissions with lesser increase of electricity and heat production. It should be pointed out, however, that GHG emissions from Sweden's power sector account for little more than 1% of emissions from the 28 European countries.

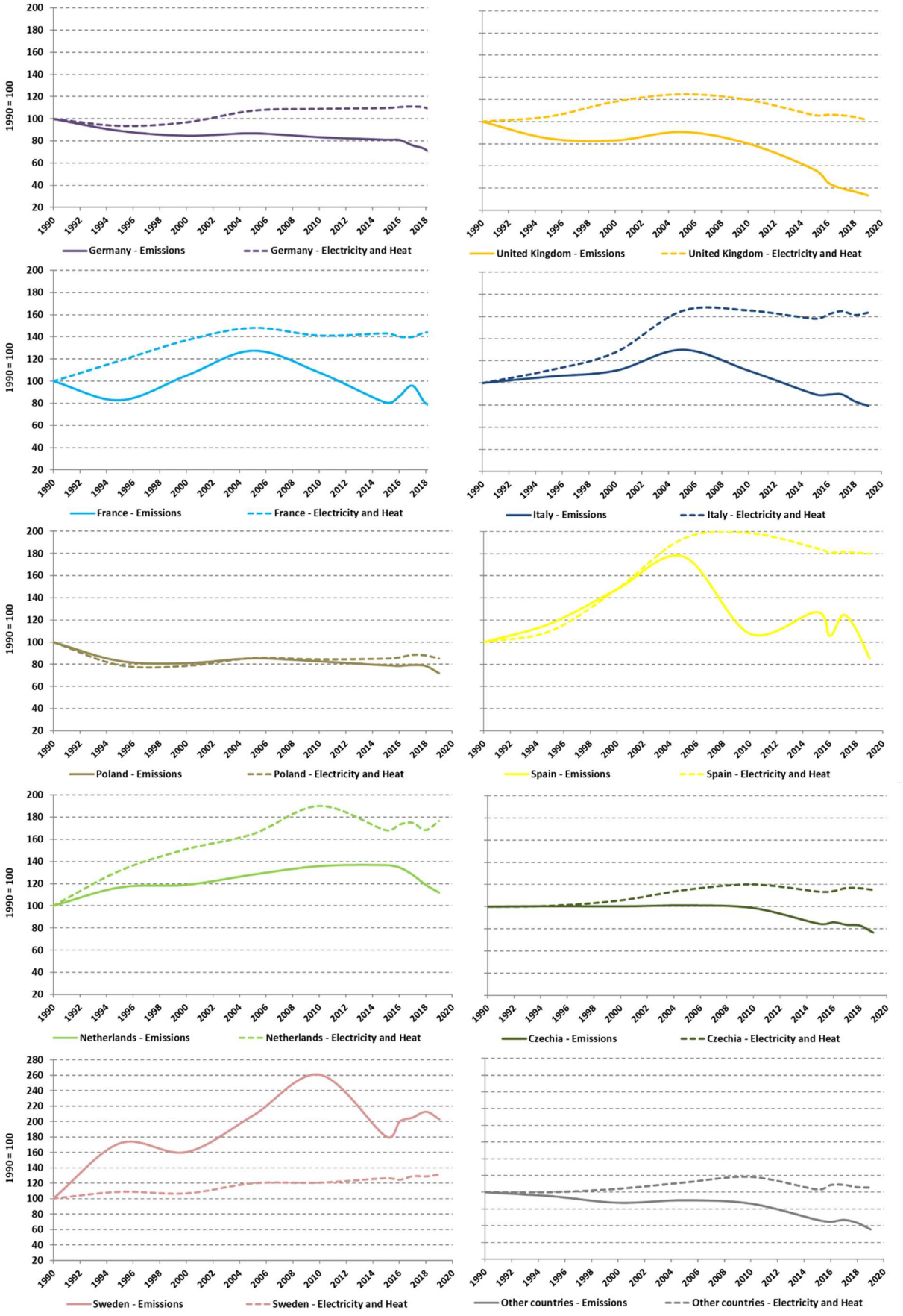


Figure 2.20 – *Rates of change compared to 1990 of electricity and heat production and GHG emissions from power sector.*

Considering the distance between the rates of change in GHG emissions and energy production as a measure of decoupling, the data show that in the period 2005-2019 Poland has the lowest decoupling (0.15). The decoupling shown by Italy is 0.38, lower only than those of the United Kingdom (0.44) and Spain (0.45).

Table 2.3 – *Rates of change of GHG emissions and electricity and heat production in the periods 1990-2005 and 2005-2019. Data in ascending order of decoupling between the two parameters in 2005-2019.*

	Change 1990-2005 (%)		Change 2005-2019 (%)	
	CO_2eq	Electricity and heat	CO_2eq	Electricity and heat
EU28	**-0.7%**	**24.6%**	**-36.9%**	**-4.2%**
EU27	**0.8%**	**24.6%**	**-32.8%**	**-2.5%**
Sweden	107.6%	20.1%	-2.3%	9.7%
Poland	-14.8%	-14.3%	-15.8%	-0.5%
Netherlands	28.2%	64.7%	-12.6%	7.1%
Czechia	1.1%	15.4%	-24.2%	-0.1%
Germany	-13.1%	7.3%	-31.0%	-2.4%
Other countries	-9.5%	11.7%	-38.5%	-5.5%
France	27.4%	48.1%	-38.5%	-4.2%
Italy	29.9%	65.0%	-38.7%	-0.9%
United Kingdom	-9.3%	24.6%	-63.0%	-18.8%
Spain	77.4%	93.5%	-52.0%	-7.1%

GHG emissions for electricity production have been estimated after unbundling the fuel energy consumption for heat production in CHP plants according to the methodology set out in paragraph 2.1. EU28 emissions in 2019 are 778.7 Mt CO_2eq and the countries examined account for 81% of total emissions. With regard to the trend of emissions and electricity production and the decoupling, there is no difference from what was observed for the production of electricity and heat.

Table 2.4 – *Estimation of GHG emissions (Mt CO_2eq) for electricity production in thermal power plants. Data in descending order of 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1,222.6**	**1,184.4**	**1,197.2**	**1,270.8**	**1,144.6**	**1,007.6**	**958.1**	**951.4**	**895.9**	**778.7**
EU27	**984.2**	**982.5**	**998.6**	**1054.3**	**950.3**	**866.2**	**843.5**	**849.1**	**800.8**	**692.0**
Germany	350.7	322.9	306.6	308.5	293.8	288.5	287.4	267.6	254.0	207.9
Other countries	198.5	218.2	213.3	227.4	212.5	162.9	156.7	166.9	158.9	135.8
Poland	110.6	108.0	110.0	115.3	112.5	109.5	108.2	109.0	108.5	98.2
Italy	122.7	129.8	134.4	141.8	116.8	91.4	89.8	90.5	83.5	78.4
United Kingdom	219.4	186.4	181.8	200.6	177.3	125.3	100.0	88.3	81.9	74.3
Spain	66.4	77.6	98.1	117.9	71.5	84.5	70.2	82.8	73.8	56.6
Netherlands	40.9	42.1	42.1	45.7	48.4	53.3	52.5	49.6	46.2	43.2
Czechia	46.2	43.3	49.8	48.4	46.5	41.5	42.1	41.6	41.4	38.0
France	46.4	37.0	40.9	45.7	43.2	31.7	33.6	38.0	31.2	30.2
Sweden	1.8	3.5	3.3	3.7	5.1	2.8	3.0	3.2	3.4	3.6

At EU28 level, GHG emissions increased by 3.9% from 1990 to 2005, while electricity production increased by 28.2%. From 2005 to 2019, emissions fell by 38.8% compared with a decrease in electricity production of 2.8%. These figures also show that the decoupling between GHG emissions and electricity production in Europe began since 1990 but that the emission reductions began only after 2005.

Table 2.5 – *Rates of change of GHG emissions and electricity generation in the periods 1990-2005 and 2005-2019. Data in ascending order of decoupling between the two parameters in 2005-2019.*

	Change 1990-2005 (%)		Change 2005-2019 (%)	
	CO_2eq	Electricity	CO_2eq	Electricity
EU28	**3.9%**	**28.2%**	**-38.7%**	**-2.8%**
EU27	**7.1%**	**28.7%**	**-34.4%**	**-0.7%**
Sweden	111.0%	8.1%	-3.7%	6.3%
Poland	4.3%	15.1%	-14.8%	4.5%
Netherlands	11.6%	38.8%	-5.4%	21.2%
Czechia	4.7%	28.9%	-21.4%	6.3%
Germany	-12.0%	13.3%	-32.6%	-2.3%
France	-1.5%	36.9%	-34.0%	-0.9%
Other countries	14.6%	22.5%	-40.3%	-1.9%
Italy	15.5%	40.2%	-44.7%	-3.2%
United Kingdom	-8.6%	24.6%	-63.0%	-18.8%
Spain	77.5%	93.6%	-52.0%	-7.1%

2.3.1 *Emission factors for electricity and heat production*

Table 2.6 reports the GHG emission factors for electricity and heat production due to fuel combustion in thermal power plants.

Table 2.6 – *GHG emission factors for electricity and heat production by thermal power plants (g CO_2eq / kWh). Data in descending order of 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**747.3**	**716.7**	**655.1**	**608.7**	**561.7**	**570.2**	**536.5**	**526.9**	**521.1**	**480.3**
EU27	**726.0**	**706.7**	**656.3**	**601.9**	**558.3**	**567.5**	**543.8**	**535.2**	**530.6**	**487.8**
Czechia	791.8	791.2	760.7	792.6	775.7	722.4	704.8	698.9	708.2	675.0
Poland	723.8	761.0	749.8	724.0	714.6	705.8	697.9	694.5	683.1	657.8
Germany	785.3	780.3	745.8	681.9	639.2	636.9	620.5	600.0	586.3	548.2
Spain	929.3	894.1	780.8	629.3	502.3	655.2	618.2	622.2	624.8	483.3
Other countries	654.6	643.1	595.5	565.0	520.5	516.3	487.5	492.9	487.8	453.6
France	952.2	856.6	547.4	520.1	578.9	509.5	446.3	447.7	454.2	413.5
United Kingdom	896.2	787.2	647.8	655.8	585.6	593.9	472.5	446.6	430.2	407.7
Netherlands	572.8	505.9	449.0	446.2	412.3	495.0	475.4	457.0	445.5	406.8
Italy	691.8	666.4	623.9	524.3	478.3	442.1	425.4	410.4	408.9	384.4
Sweden	343.0	280.8	274.8	262.6	225.0	190.1	195.6	201.4	207.3	198.2

The data show the emission factors reduction since 1990. In 2019 the emission factor in Italy (384.4 g CO_2eq/kWh) is higher than that of Sweden (198.2 g CO_2eq/kWh), where the thermal power plants are mainly fuelled by bioenergy. The United Kingdom has the largest reduction since 2005 (-37.8%), followed by Italy (-26.7%) and Sweden (-24.5%). Germany reduced the emission factor by 19.6%. The lowest percentages of reduction were recorded in the Netherlands (-8.8%) and Poland (-9.2%).

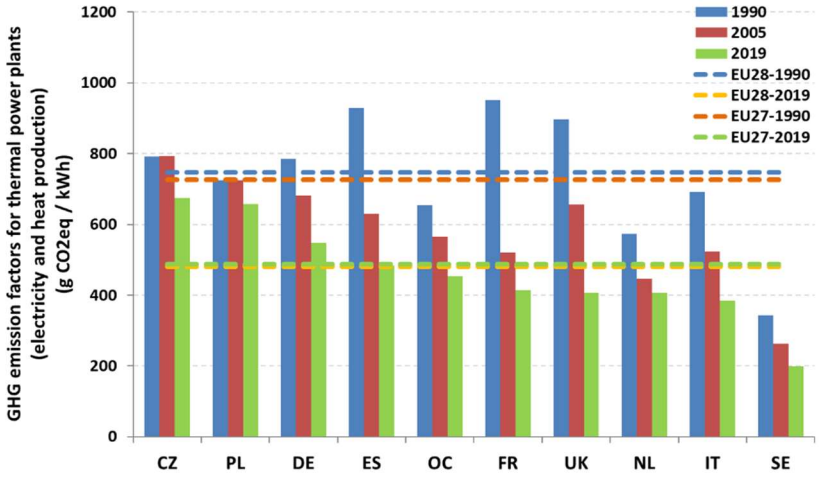


Figure 2.21 – *GHG emission factors for electricity and heat production by thermal power plants (g CO_2eq / kWh). Data in descending order of 2019 value.*

Table 2.7 reports the emission factors for electricity and heat production by the whole electricity sector, including renewable and nuclear power production. Heat from nuclear power plants is added up to calculate the emission factor due to total heat and electricity production. Heat from nuclear plants represents 0.2% of the heat produced in EU28 from power plants. Among the examined countries there is minor production of heat from nuclear power plants in Germany in the first half of the 1990s and in Czechia since 2005.

Table 2.7 – *GHG emission factor for total electricity and heat production (g CO_2eq / kWh). Data in descending order of 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**481.3**	**437.8**	**399.3**	**384.8**	**346.4**	**317.7**	**302.2**	**297.6**	**282.8**	**253.0**
EU27	**456.5**	**422.8**	**388.1**	**370.6**	**333.2**	**312.1**	**302.7**	**300.9**	**286.2**	**255.1**
Poland	719.7	753.8	741.8	715.2	699.0	663.7	650.3	639.8	636.6	602.9
Czechia	676.5	673.1	643.4	592.9	556.1	506.6	513.4	486.6	483.0	452.7
Netherlands	546.3	484.0	430.4	425.0	390.6	444.0	424.8	400.4	386.2	346.9
Germany	585.3	559.9	514.6	477.5	451.2	435.2	431.3	403.0	385.7	337.4
Italy	578.7	549.6	507.7	457.2	386.2	325.2	316.6	312.0	296.1	278.6
Other countries	461.6	440.1	388.3	374.2	337.3	300.2	275.6	284.5	276.9	243.7
United Kingdom	696.0	564.2	490.2	507.4	468.0	373.5	297.3	263.6	247.8	231.0
Spain	439.3	468.5	444.3	407.2	239.8	304.3	258.9	303.1	271.4	208.9
France	111.3	77.5	85.3	95.7	85.0	62.8	68.4	76.3	61.8	61.5
Sweden	34.0	53.5	50.9	58.7	73.2	48.3	54.5	53.8	55.9	52.2

The average EU28 emission factor in 2019 for electricity and heat production (253 g CO_2eq/kWh) shows a reduction of 34.3%, compared to the 2005 level, while the emission factor in Italy (278.6 g CO_2eq/kWh) decreased by 39.1%. Among the countries examined the United Kingdom shows the highest reduction (-54.5%) followed by Spain (-48.7%). Sweden, Poland, and the Netherlands recorded the lowest percentages of reductions (-11%, -15.7%, and -18.4% respectively). France reduced the emission factor of 35.8%, while for Germany and Czechia the reductions are respectively 29.3% and 23.6%.

Countries with a significant share of electricity from nuclear power and renewable sources have a benefit in terms of emissions per unit of electricity produced. France has a relevant amount of energy from nuclear power plants, which allows the emission factor to be drastically reduced as compared to thermal plants. Sweden, Czechia, Spain, Germany and the United Kingdom also have not insignificant

shares of nuclear power (from 12.4% in Germany to 39.9% in Sweden). The Netherlands electricity production from nuclear power plants is 3.2%, while Italy and Poland do not have this item. Overall, nuclear electricity in EU28 was 25.6% in 2019, down from 30.9% in 1990. In 2019, 83.9% of EU28 nuclear electricity comes from the countries examined, with France accounting for 48.6%.

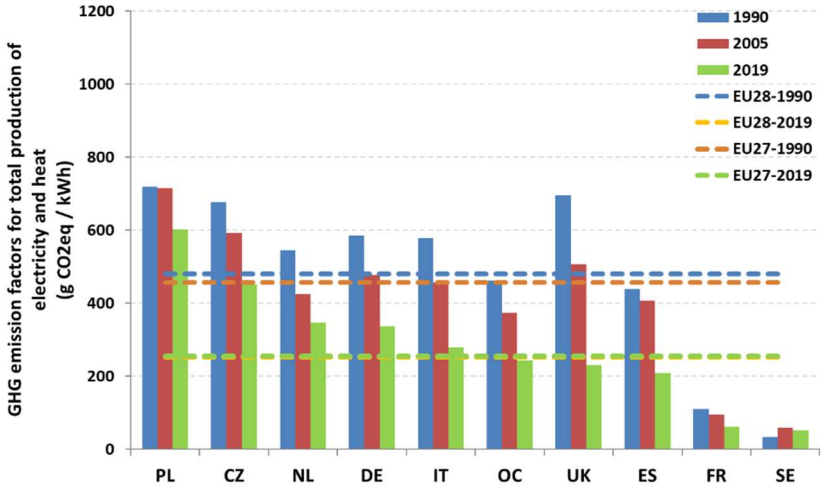


Figure 2.22 – *GHG emission factors for total electricity and heat production (g CO_2eq / kWh). Data in descending order of 2019 value.*

The emission factors for electricity production, shown in the following graphs and tables, was drawn up considering the only share of fuel energy for electricity production, after unbundling the energy for heat production in CHP plants.

Table 2.8 – *GHG emission factor for electricity production by thermal power plants (g CO_2eq / kWh). Data in descending order of 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**822.3**	**789.2**	**715.0**	**671.8**	**615.7**	**633.5**	**592.2**	**579.0**	**576.0**	**527.7**
EU27	**793.8**	**778.3**	**717.8**	**664.9**	**610.7**	**627.9**	**599.7**	**587.5**	**586.7**	**535.1**
Czechia	964.3	945.2	900.6	928.8	918.4	858.6	831.9	826.3	828.8	786.5
Poland	831.2	799.3	779.7	755.2	738.2	722.9	715.2	715.9	702.9	676.1
Germany	928.5	906.6	825.1	767.9	711.7	703.1	685.0	662.0	658.8	621.9
Other countries	641.6	691.1	643.7	618.9	569.0	565.8	533.7	540.4	536.8	493.9
France	952.2	918.0	771.1	684.9	696.0	619.3	525.0	521.7	540.9	485.6
Spain	929.4	894.0	780.6	629.3	502.3	655.2	618.2	622.2	624.8	483.3
Netherlands	600.5	550.8	497.8	488.6	435.9	556.2	525.0	499.3	482.5	433.9
United Kingdom	889.1	782.3	641.6	655.8	585.6	593.9	472.5	446.6	430.2	407.7
Italy	688.5	663.2	611.8	562.8	506.8	477.3	452.0	433.2	434.5	402.1
Sweden	332.3	342.8	374.3	302.8	244.6	202.6	196.8	205.4	215.7	217.9

Italian emission factor by thermal plants in 2019 (402.1 g CO_2eq/kWh) is second only to that of Sweden (217.9 g CO_2eq/kWh), where the share of bioenergy in the thermoelectric plants is much higher. The Italian factor is well below the EU28 average of 527.7 g CO_2eq/kWh. Czechia, Poland, and Germany have the highest emission factors, from 786.5g CO_2eq/kWh to 621.9 g CO_2eq/kWh, well above the European average.

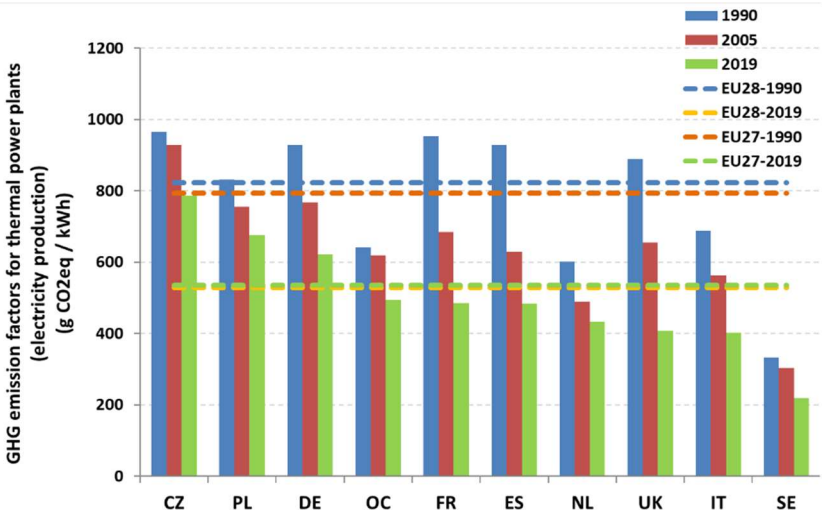


Figure 2.23 – *GHG emission factors for electricity production in thermal power plants (g CO_2eq / kWh). Data in descending order of the 2019 value.*

Figure 2.23 shows that in all countries there is a reduction in GHG emission factors per unit of electricity produced in the thermal plants. The emission factors are much lower when all renewable electricity is also considered (Table 2.9).

Table 2.9 – *GHG emission factor for total electricity production (g CO_2eq / kWh). Data in descending order of 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**474.5**	**435.1**	**398.4**	**386.1**	**343.1**	**313.4**	**296.0**	**291.1**	**275.7**	**242.9**
EU27	**435.8**	**411.1**	**379.5**	**364.1**	**321.3**	**300.8**	**290.7**	**289.5**	**274.4**	**240.0**
Poland	822.3	788.3	768.2	742.3	716.2	666.3	651.0	641.4	639.9	601.5
Czechia	749.4	721.2	705.0	610.9	564.1	519.7	530.1	498.4	489.5	454.2
Netherlands	568.7	518.8	469.2	457.1	405.6	484.0	455.7	423.3	404.5	357.0
Germany	640.3	606.1	535.7	500.5	468.8	449.1	445.7	413.2	398.9	344.8
Italy	575.9	546.9	497.8	477.7	391.0	324.6	311.9	307.7	289.9	268.6
United Kingdom	690.5	560.6	485.5	507.4	468.0	373.5	297.3	263.6	247.8	231.0
Other countries	382.3	403.9	362.2	358.0	317.2	273.7	248.9	262.4	255.4	218.2
Spain	439.1	468.5	444.2	407.2	239.8	304.3	258.9	303.1	271.4	208.9
France	111.3	75.4	76.5	80.0	76.5	55.2	60.1	68.3	54.1	53.3
Sweden	12.0	23.5	22.9	23.4	34.1	17.4	19.1	19.4	20.6	21.2

The average European emission factor for total electricity generation has always been lower than the Italian value, thanks in part to the contribution of nuclear electricity. The increasing renewable share of electricity leads to a significant reduction of the emission factors. In addition, the reduction of nuclear electricity share in Europe brings the Italian emission factor closer to the EU28 average. The Italian emission factor in 2005 was greater than the European average of 23.7%, while in 2019 it is greater than 10.6%.

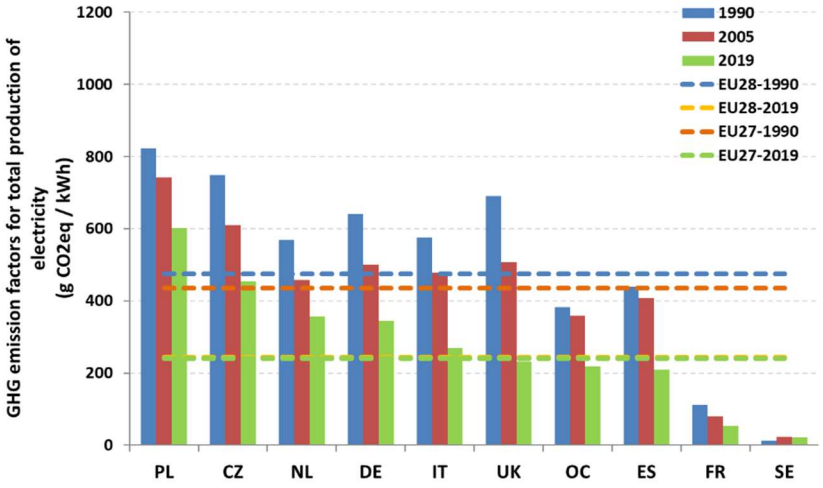


Figure 2.24 – *GHG emission factors for total electricity production (g CO_2eq / kWh). Data in descending order of the 2019 value.*

The outcomes concerning the GHG emissions esteems allow to conclude that Italy have one of the lowest GHG emission factor for electricity and heat production by fuel mix combustion among the biggest European countries (Figure 2.21). The following graph shows the share of power sector emissions of the countries examined, already seen in Figure 2.18, and the share of electricity production from fuel combustion. The shares of GHG emissions for Germany and Poland are higher than their shares of electricity production. The same pattern is true for Czechia, Sweden, and the group of other countries. The opposite pattern is observed for Italy, the United Kingdom, Spain, the Netherlands, and France.

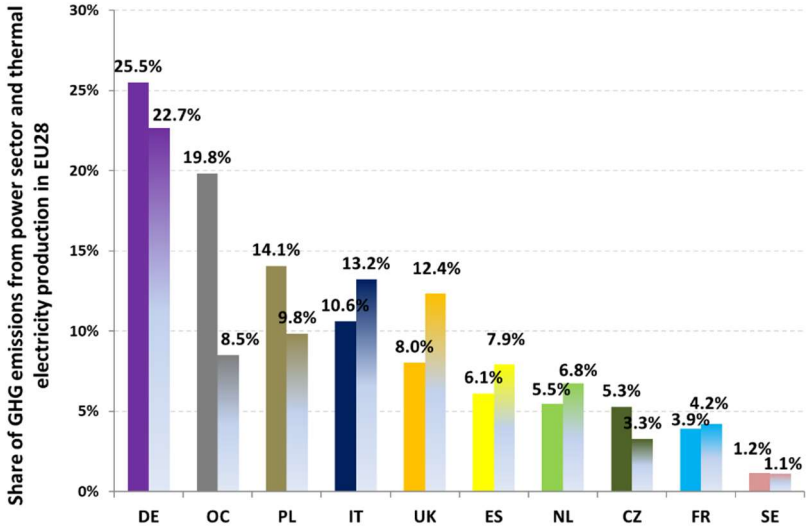


Figure 2.25 – *Share of GHG emissions in the power sector for electricity and heat production in 2019 in EU28 (full colour bars) and share of electricity production from fuel combustion (shaded colour bars).*

Considering all Member States in EU28, the Italian GHG emission factor for electricity production by thermal plants occupies the 9th position, well below the European average. The Italian fuels mix, with greater share of natural gas than in other countries and the contribution of bioenergy, is a driving factor for the emission factor in thermal power plants. Moreover, the equivalent electrical efficiency of thermal plants in Italy is exceeded only by the Netherlands and Sweden, among the countries examined.

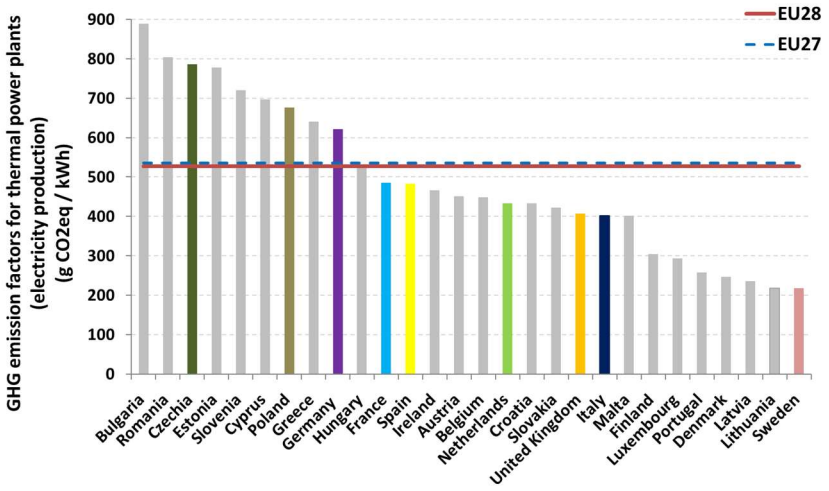


Figure 2.26 – *GHG emission factors electricity production by thermal power plants (g CO_2eq / kWh) in 2019. Data in descending order.*

Considering total electricity production, therefore the contribution of renewables other than bioenergy and the contribution of nuclear power plants, the Italian emission factor loses positions compared to other countries. Countries with nuclear power plants have a benefit in terms of avoided emissions. The renewable share in Italy is one of the highest in Europe and higher than in Spain, the United Kingdom and France, which nevertheless have significant shares of nuclear energy. In 2019, Italy, after Sweden and Germany, has the highest renewable share of electricity production among the biggest countries (Figure 2.7 and Figure 2.28). The contribution of nuclear electricity to electricity production in Spain, the United Kingdom, and France played a decisive role in reducing the emission factors of these countries. The effect of nuclear energy is particularly evident for France: although the renewable share of electricity production is much lower than Italy (Figure 2.28) and the emission factor by thermal plants (Table 2.8) is higher, France has the lowest emission factor for total electricity production in Europe, second only to that recorded for Sweden. Germany has 12.4% of nuclear electricity and 40.2% of renewable electricity but the relevant presence of solid fuels in the fossil mix (28.4% of electricity production), mainly high-carbon lignite, results into a greater emissive impact of the electricity sector than the Italian one.

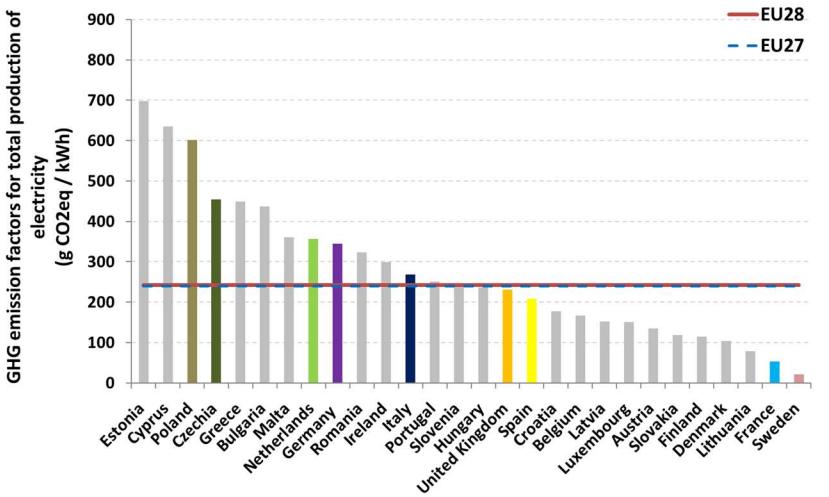


Figure 2.27 – *GHG emission factors for total electricity production (g CO_2eq / kWh) in 2019. Data in descending order.*

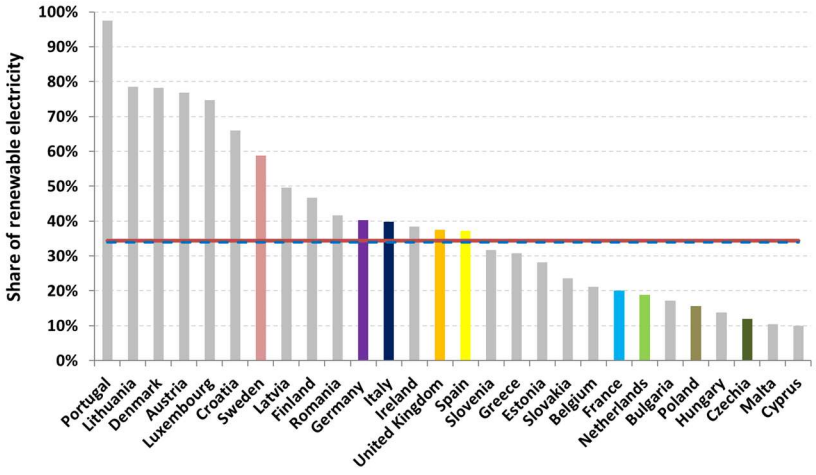


Figure 2.28 – *Share of renewable electricity production in 2019. Data in descending order.*

The emission factors for electricity generation without the contribution of the nuclear electricity (Figure 2.29) show that in 2019 Italy has higher value than Sweden, France, and Spain among the main European countries. Such indicator removes the effect of nuclear contribute allowing to consider all other factors, such as fuel mix, renewable energy, and transformation efficiency.

Comparing Figure 2.27 and 2.29, it is also interesting to note the change in countries ranking as in the case of the Netherlands and Germany: the Netherlands, because of lower share nuclear energy than Germany, would gain positions if nuclear electricity had not considered.

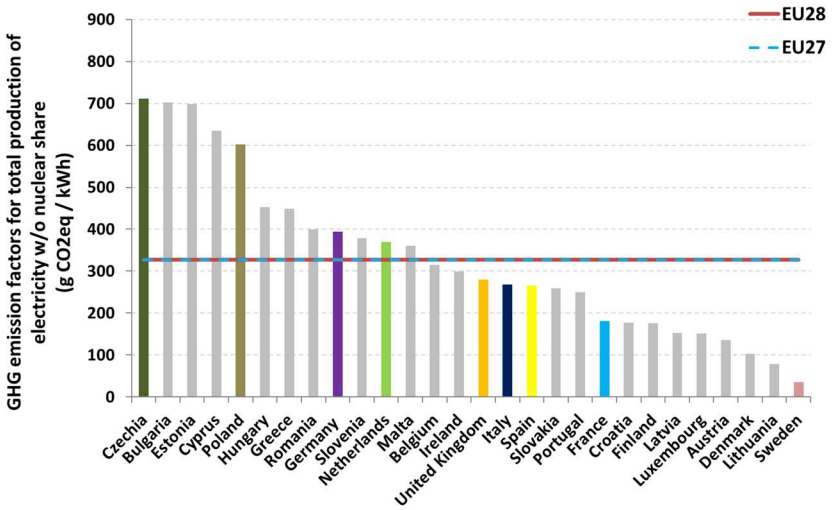


Figure 2.29 – *GHG emission factors for total electricity production without nuclear production (g CO_2eq / kWh) in 2019. Data in descending order.*

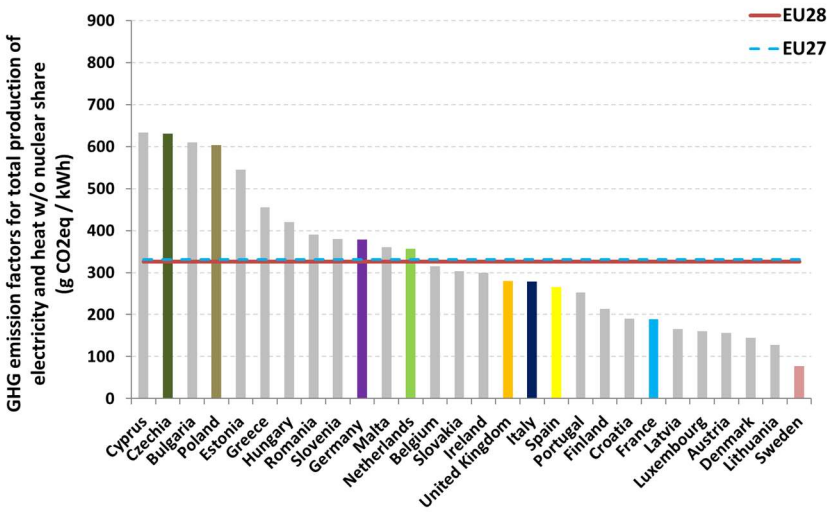


Figure 2.30 – *GHG emission factors for total electricity and heat production without nuclear production (g CO_2eq / kWh) in 2019. Data in descending order.*

The following graph shows GHG emissions from the thermal power sector of European countries with more than 3 Mt CO_2eq for the production of electricity and heat.

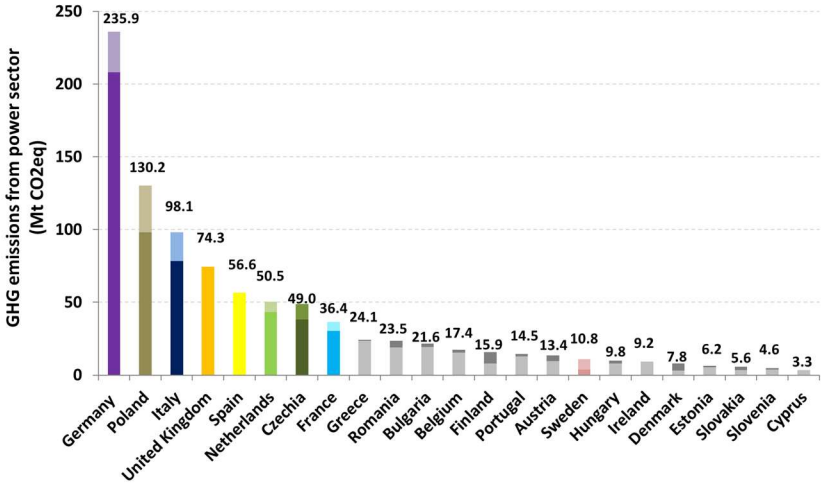


Figure 2.31 – *GHG emissions from power sector in European countries in 2019. The countries with more than 3 Mt CO_2eq are reported. Each bar shows the amount due to electricity generation (bottom) and heat (top). The remaining countries (Croatia, Latvia, Malta, Lithuania and Luxembourg) emit a total of 6.7 Mt CO_2eq.*

Data reported in Figure 2.31 make clear the contribution of the thermal power plants of each country and the potential for reducing emissions. As a result of many factors (fuel mix shift, efficiency, share of renewable) Italy reduced the emission factor for electricity and heat production by 51.9% from 1990 to 2019 (39.1% since 2005), against a reduction of 42.4% in Germany (29.3% since 2005) and 16.2% in Poland (15.7% since 2005). The reduction rates in Poland are the lowest among the biggest emitters in Europe. If Germany and Poland had reduced their GHG emission factors since 1990 at the same rate of Italy, it would have led (with the same electricity and heat production) to avoid 94.3 Mt CO_2eq in 2019, about 10% of EU28 emissions from power plants in 2019. The power plants in Germany and Poland are still fuelled by significant shares of high-carbon content solid fuels, such as lignite, and the transition to natural gas has been much slower than in countries as Italy or the United Kingdom.

2.4 Heat-only producers

Heat production accounts for a significant share of energy transformation processes. The plants dedicated to the production of heat by district heating and other uses (mainly for industry) consume an important share of the energy in the European balance.

In this paragraph the main parameters of such plants will be summarized with an approach similar to that used for power plants.

2.4.1 *Energy consumption, heat production and greenhouse gas emissions*

In 2019 the energy consumption of plants with only heat production in EU28 was 18.7 Mtoe of which 0.6 Mtoe from geothermal and solar thermal, and 0.2 Mtoe from heat pumps. The energy consumption of fuels was 17.9 Mtoe, of which 5.2 Mtoe from bioenergy. Bioenergy consumption shows a rapidly growing share: it is more than double the consumption in 2005 and 7.2 times the consumption in 1990.

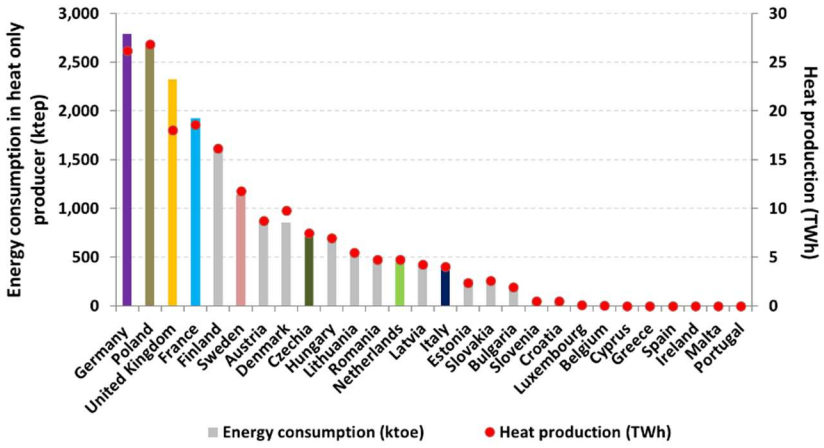


Figure 2.32 – *Energy consumption and heat produced by heat only producer plants in European countries (2019). Data in descending order for energy consumption.*

Total energy consumption in 2019 is much less than that recorded in 1990 and a marked fuel shift has occurred. The trend shown in the following graph shows the decrease of solid fuels and, to a greater extent, of oil and petroleum products being replaced by natural gas and bioenergy. The contribution of other renewable sources (more than 90% from geothermal energy and the rest from solar thermal in 2019) and heat pumps recorded a constant increase that, nevertheless, remains marginal on total consumption (4.5% in 2019).

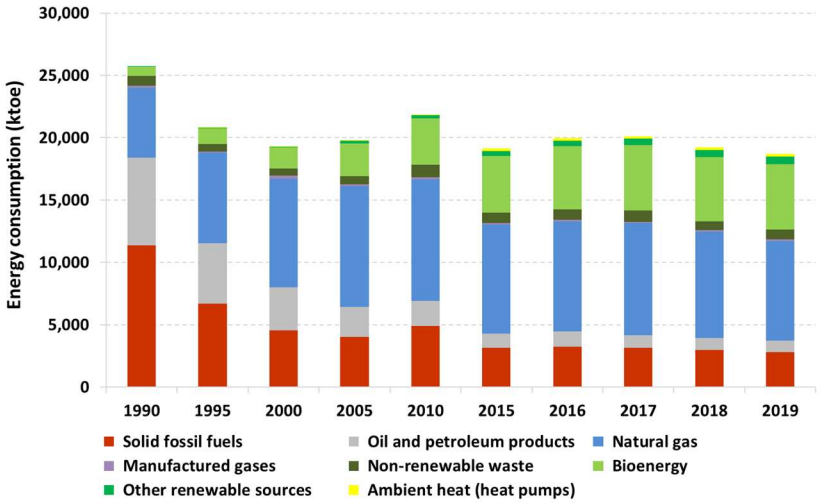


Figure 2.33 – *Energy consumption by source in heat only producer in EU28.*

As a result of such fuel shift, GHG emissions registered a sharp decrease by 50% since 1990 due to the decrease in energy consumed (-27.2%) and decreasing GHG emission factor per unit of heat produced (-37.4%). In 2019, EU28 GHG emissions from these plants are 43.6 Mt CO_2eq.

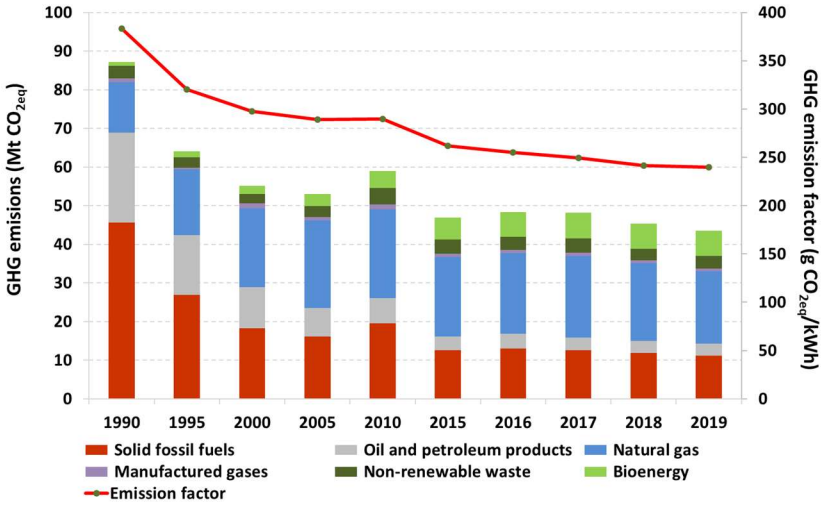


Figure 2.34 – *GHG emissions by source and average GHG emission factor for heat only producers in EU28.*

Table 2.10 shows the energy consumption of the examined countries. In 2019, such countries account for about 66.3% of the energy consumed at European level in plants dedicated to heat production and 64.7% of the heat produced (Table 2.11). For Spain there is no energy consumption or heat production from such plants throughout the historical series. In addition to the countries examined, the other countries with more than 4 TWh of heat produced in 2019 are Finland (8.9% of EU28), Denmark (5.4%), Austria (4.8%), Hungary (3.8%), Lithuania (3%), Romania (2.6%), Latvia (2.3%). Italy heat production from dedicated plants is 4 TWh, with a share of 2.2%.

The GHG emissions of the countries shown in Table 2.12 represent 71.3% of the emissions of EU28.

Table 2.10 – *Energy consumption in the biggest countries and EU28 from heat only producer plants (ktoe). Data in descending order of the 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**25,704**	**20,795**	**19,276**	**19,759**	**21,807**	**19,163**	**19,961**	**20,110**	**19,221**	**18,705**
EU27	**25,704**	**20,795**	**16,075**	**17,577**	**19,493**	**16,783**	**17,503**	**17,772**	**16,889**	**16,380**
Other countries	12,136	9,107	7,120	6,577	6,640	6,298	6,621	6,790	6,717	6,298
Germany	-	1,985	1,198	3,747	4,324	3,576	3,535	3,533	2,867	2,788
Poland	10,560	5,997	4,167	3,450	3,722	2,670	2,853	2,794	2,762	2,661
United Kingdom	-	-	3,201	2,181	2,314	2,380	2,459	2,338	2,332	2,325
France	510	199	156	308	1,670	1,740	1,909	1,933	1,923	1,925
Sweden	1,039	1,169	1,136	1,268	1,483	1,166	1,212	1,167	1,178	1,137
Czechia	1,186	1,379	956	898	940	652	713	721	706	715
Netherlands	274	958	1,343	1,331	603	552	521	447	315	443
Italy	-	-	-	-	110	128	137	386	423	413
Spain	-	-	-	-	-	-	-	-	-	-

Table 2.11 – *Heat produced (TWh) in the biggest countries and EU28 from heat only producer plants. Data in descending order of the 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**227.2**	**200.0**	**185.0**	**183.4**	**203.4**	**179.3**	**189.4**	**193.1**	**187.7**	**181.6**
EU27	**227.2**	**200.0**	**156.7**	**167.5**	**187.6**	**161.9**	**171.4**	**174.7**	**169.3**	**163.6**
Other countries	113.1	88.0	69.9	64.3	64.8	63.0	67.3	68.8	68.4	64.1
Poland	87.6	54.5	40.0	32.3	36.1	26.3	28.7	28.4	28.0	26.8
Germany	-	22.2	12.4	34.1	38.8	31.0	31.3	31.3	27.8	26.2
France	2.8	0.9	0.9	1.7	16.6	16.9	18.4	18.8	18.6	18.6
United Kingdom	-	-	28.4	15.9	15.8	17.4	18.0	18.3	18.3	18.0
Sweden	10.6	12.2	11.6	13.2	14.7	12.4	12.5	12.0	11.9	11.8
Czechia	10.3	13.5	9.7	8.7	9.9	6.7	7.3	7.4	7.3	7.4
Netherlands	2.8	8.7	12.3	13.0	6.0	4.6	4.7	4.3	3.2	4.7
Italy	-	-	-	-	0.8	1.0	1.1	3.8	4.1	4.0
Spain	-	-	-	-	-	-	-	-	-	-

Table 2.12 – *Estimation of GHG emissions in the biggest countries and EU28 from heat only plants (Mt CO_2eq). Data in descending order of the 2019 value.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**87.1**	**64.1**	**55.1**	**53.0**	**59.0**	**46.9**	**48.3**	**48.1**	**45.3**	**43.6**
EU27	**87.1**	**64.1**	**46.0**	**47.2**	**52.8**	**41.4**	**42.5**	**42.7**	**39.9**	**38.2**
Other countries	36.0	25.5	17.9	15.8	15.4	13.3	13.6	13.8	13.7	12.5
Poland	41.2	23.7	16.1	13.1	14.2	10.2	10.8	10.6	10.4	10.0
Germany	-	4.8	2.8	9.6	12.2	9.8	9.5	9.5	7.6	7.4
United Kingdom	-	-	9.2	5.8	6.2	5.5	5.7	5.5	5.4	5.4
France	2.0	0.8	0.6	0.5	4.3	3.7	3.9	3.7	3.5	3.3
Czechia	3.9	4.4	2.8	2.5	2.4	1.6	1.8	1.8	1.7	1.7
Sweden	3.4	2.8	2.4	2.4	2.5	1.5	1.7	1.6	1.5	1.4
Netherlands	0.6	2.3	3.3	3.3	1.6	1.3	1.2	1.0	0.7	1.0
Italy	-	-	-	-	0.1	0.1	0.1	0.7	0.8	0.8
Spain	-	-	-	-	-	-	-	-	-	-

The following graph shows, for the greatest heat producers (≥ 4 TWh), the share of energy sources and the emission factor in 2005 and 2019. For Italy there is no consumption and heat production in 2005. For the countries reported the reduction of solid fuels and petroleum products and the increase of bioenergy are evident.

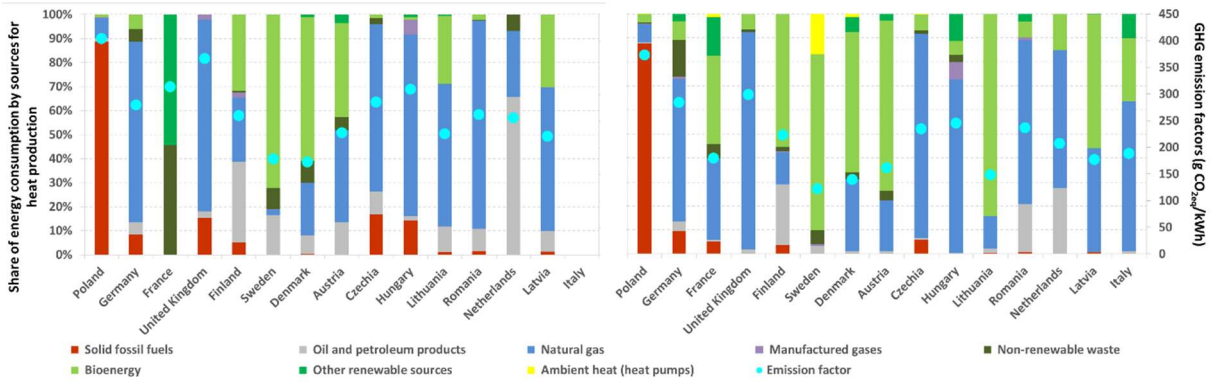


Figure 2.35 – *Share of energy sources for heat only producer plants and GHG emission factor in the greatest heat producers in 2005 (left) and 2019 (right). Countries in descending order of heat produced in 2019.*

Fuel shift and increase of efficiency result in 17.2% reductions in the emission factors from 2005 to 2019 in EU28 (from 289.2 to 239.8 g CO2eq / kWh). Italy's emission factor in 2019 is 21.4% lower than the EU28 average. The relevant solid fuels or non-renewable waste consumption in Poland and Germany results in higher emission factors in 2019, respectively 97.7% and 50.5% higher than the Italian one. The emission factor of the United Kingdom is one of the highest in Europe, but in this case the low conversion efficiency is decisive, the lowest in Europe after that recorded for Belgium.

Table 2.13 – *GHG emission factors in EU28 and countries with heat production from heat only producers greater than 4 TWh (g CO_2eq / kWh). Countries in descending order of heat produced in 2019.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**383.4**	**320.5**	**297.8**	**289.2**	**290.0**	**261.7**	**254.8**	**249.3**	**241.3**	**239.8**
EU27	**383.4**	**320.5**	**293.3**	**281.8**	**281.3**	**255.7**	**248.3**	**244.2**	**235.5**	**233.3**
Poland	470.7	433.7	402.2	404.9	393.3	386.0	377.8	372.2	371.3	372.8
Germany		214.2	229.6	280.1	315.4	314.2	302.3	303.7	273.7	283.7
France	719.3	823.8	713.8	314.3	260.6	216.2	209.2	196.3	186.6	179.3
United Kingdom			322.7	367.5	392.7	318.0	317.3	297.7	294.9	298.8
Finland	297.5	264.0	270.0	260.5	260.8	234.5	238.7	222.6	222.1	223.2
Sweden	317.0	225.3	202.8	179.4	170.3	120.2	134.0	131.7	126.0	122.0
Denmark	261.2	225.2	220.6	173.5	168.4	159.6	158.1	150.3	148.1	139.2
Austria	281.2	227.6	226.8	228.2	187.2	175.7	177.8	176.6	166.8	161.4
Czechia	374.5	324.1	290.8	285.5	246.5	243.8	242.1	241.1	239.1	234.1
Hungary	383.0	322.9	223.7	310.1	360.9	254.3	223.9	251.8	255.7	244.9
Lithuania	303.1	285.6	269.3	226.2	202.8	163.7	150.5	152.4	156.3	148.0
Romania		293.2	252.3	262.6	298.3	312.0	242.5	235.0	234.5	236.8
Netherlands	227.0	265.3	269.5	256.0	269.8	283.3	259.3	241.2	221.0	206.8
Latvia	362.8	287.3	238.3	221.6	211.6	186.0	178.3	188.0	189.3	176.7
Italy					131.5	110.8	110.6	189.7	190.1	188.6

CONCLUSIONS

The analysis of decarbonization and efficiency indicators and the comparison among the largest European countries has been carried out for the overall and sectoral energy consumption. The decomposition analysis was carried out on driving factors of greenhouse gas emissions. Decarbonization and efficiency indicators are also elaborated for the power sector with the same task of comparing the performance of largest European countries.

The main results of the report can be summarized as follows:

- the ratio between final energy consumption and primary energy consumption in Italy is the highest among the European countries considered, showing high energy transformation efficiency. After the United Kingdom, Italy is one of the largest European countries with the lowest gross inland energy consumption per unit of GDP;

- the share of renewable energy consumption per unit of gross inland consumption in Italy is greater than the average for EU28 since 1999. In 2007, the share of renewable energy accelerated sharply, with an increase in the distance between the Italian and average value of the largest European countries. In 2019 Italy is, among the countries considered for the comparison, second only to Sweden;

- Italian emissions per capita increased until 2004, unlike other European countries, which have seen decreasing emissions per capita since 1990. Emissions per capita of Italy were always below the European average and in 2019 are higher only to those recorded in the United Kingdom, France and Spain where the nuclear energy represents a not negligible share of inland consumption. Italian emissions per unit of gross inland energy consumption without nuclear share are some of the lowest among the largest European countries and overlapping the United Kingdom values, where the economy activities are more service-based than in Italy;

- at sectoral level, the final energy intensity and carbon intensity per unit of value added show that Italian industry has one of the lowest values among the 28 European States with one the highest levels of electrification. The agriculture intensities are among the lowest in Europe. On the other hand the civil sector shows wide margins for reducing emissions if compared with other countries, especially considering the level of electrification of final consumption that is among the lowest in Europe both for households and for services;

- Italy's energy intensity per unit of GDP considering the consumption by international bunkers confirms that among the largest countries Italy's intensity is higher than the United Kingdom's only;

- productivity per domestic material consumption or direct material inputs show that Italian productivity is one of the highest among the biggest countries despite the relevant share of energy intensive industrial activities.

- the results of decomposition analysis show that the reduction of final energy intensity and the increasing share of renewables have played a key role among the factors determining the European GHG emission reduction since 2005;

- the reduction of GHG emissions in the period 2005-2019 in Italy is also due to the reduction of economy activities. The comparison with the largest States of the European Union shows a greater decoupling between GDP and GHG emissions in other countries than the one observed in Italy although indicators such as energy efficiency, energy consumption per GDP, and GHG emissions per capita show that Italy had already a better performance than European average and many countries with much higher values are approaching Italian values.

- the Italian GHG emission factors for electricity and heat production are higher than the European average. The emission factors decrease is proportional to renewable share and nuclear energy that do not play any role in Italy. Italy in 2019 has one of the highest share of electricity from renewable sources among the European countries considered. Without the contribution of nuclear energy the emission factors in Italy are higher than those of Sweden, France, and Spain only and lower than the European average.

The results show that Italy has one of the most efficient energy and economic systems in Europe. The figures show that energy intensity per unit of GDP is among the lowest in Europe notwithstanding a relevant role of industry in the Italian economy. Low energy intensity often corresponds to more service-based economies with a minor role of industrial activities. Europe's carbon intensity per unit of energy consumption is on average lower than Italian one, since in several countries it is present a not insignificant share of nuclear energy. Without such share the carbon intensity of Italy is well below the European average.

The trend of greenhouse gas emissions depends on many factors. The economic crisis since 2008 has led to a drastic reduction in gross domestic product and a consequent reduction in greenhouse gas emissions. Although the emission reductions are mainly due to the decreasing energy intensity and increasing renewable energy consumption, the contraction of economy played a not insignificant role. In the other countries examined there is a clear decoupling between GDP and GHG emissions, although decoupling does not necessarily correspond to the emission reductions in line with the targets to be achieved, as for Germany. It is clear from the analyses carried out that the potential for reducing emissions must be assessed in parallel with the starting points of the driving factors for GHG emissions and the costs to change the energy system, as well as assessments of the economy structure, especially concerning the share of services and industry.

Sectoral decarbonization indicators in Italy show sectors such as industry and agriculture with energy intensities among the lowest in Europe and sectors such as households and services occupying one of the last positions among European countries with very wide emission reduction potentials, especially considering the level of electrification of final consumption that for such sectors is among the lowest in Europe.

As for the power sector Italy reduced its emission factor for electricity and heat production by 51.9% from 1990 to 2019, compared with a reduction of 42.4% in Germany and 16.2% in Poland, the last one is the lowest reduction rate among the major emitters in Europe. Poland and Germany have the highest share of lignite consumption and the highest emission factors among the biggest countries. In such countries the transition to natural gas has been slower than in countries such as Italy or the United Kingdom. The reduction of greenhouse gas emission factors since 1990 in Germany and Poland on an equal footing with that recorded for Italy would have led in 2019, at parity of electricity and heat production, to avoid 94.3 Mt CO_2eq, about 10% of the European GHG emissions from power plants in 2019.

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ANNEX 1

Table A1.1 – *Gross inland consumption of energy per capita (toe/inhabitant).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3.51**	**3.48**	**3.55**	**3.72**	**3.52**	**3.23**	**3.23**	**3.28**	**3.25**	**3.19**
EU27	**3.48**	**3.42**	**3.50**	**3.69**	**3.54**	**3.27**	**3.28**	**3.35**	**3.32**	**3.26**
AT - Austria	3.31	3.43	3.65	4.19	4.17	3.93	3.93	3.97	3.85	3.92
BE - Belgium	4.90	5.35	5.81	5.66	5.67	4.81	5.05	5.03	4.84	4.96
BG - Bulgaria	3.22	2.77	2.28	2.61	2.41	2.59	2.56	2.67	2.70	2.69
CY - Cyprus	2.83	3.06	3.51	3.48	3.37	2.72	2.91	3.01	3.05	3.00
CZ - Czechia	**4.82**	**4.05**	**4.02**	**4.46**	**4.35**	**3.99**	**3.95**	**4.11**	**4.11**	**4.04**
DE - Germany	**4.50**	**4.18**	**4.17**	**4.20**	**4.13**	**3.92**	**3.89**	**3.90**	**3.81**	**3.68**
DK - Denmark	3.50	3.85	3.66	3.66	3.69	3.07	3.12	3.12	3.10	2.98
EE - Estonia	6.14	3.69	3.38	3.87	4.24	4.14	4.56	4.38	4.68	3.64
EL - Greece	2.19	2.23	2.59	2.83	2.55	2.22	2.19	2.27	2.22	2.20
ES - Spain	**2.28**	**2.59**	**3.06**	**3.34**	**2.80**	**2.64**	**2.67**	**2.81**	**2.80**	**2.71**
FI - Finland	5.76	5.73	6.34	6.65	6.88	5.97	6.17	6.22	6.33	6.20
FR - France	**3.90**	**4.05**	**4.23**	**4.42**	**4.17**	**3.91**	**3.83**	**3.83**	**3.80**	**3.74**
HR - Croatia	2.02	1.69	1.88	2.28	2.20	2.01	2.05	2.14	2.11	2.16
HU - Hungary	2.81	2.52	2.47	2.82	2.66	2.56	2.60	2.72	2.73	2.73
IE - Ireland	2.93	3.01	3.80	3.76	3.31	3.04	3.16	3.08	3.10	3.05
IT - Italy	**2.61**	**2.84**	**3.07**	**3.27**	**2.99**	**2.56**	**2.54**	**2.63**	**2.60**	**2.60**
LT - Lithuania	4.41	2.43	2.09	2.68	2.25	2.46	2.55	2.70	2.79	2.79
LU - Luxembourg	9.26	8.20	8.43	10.41	9.25	7.43	7.28	7.33	7.48	7.39
LV - Latvia	2.98	1.85	1.62	2.04	2.18	2.21	2.23	2.33	2.48	2.42
MT - Malta	2.18	2.10	2.08	2.32	2.27	1.72	1.60	1.79	1.78	1.83
NL - Netherlands	**4.62**	**4.91**	**4.93**	**5.13**	**5.20**	**4.52**	**4.60**	**4.62**	**4.51**	**4.39**
PL - Poland	**2.72**	**2.59**	**2.33**	**2.43**	**2.67**	**2.52**	**2.65**	**2.77**	**2.81**	**2.74**
PT - Portugal	1.72	2.07	2.48	2.61	2.31	2.27	2.28	2.39	2.33	2.33
RO - Romania	2.72	2.06	1.64	1.81	1.72	1.60	1.61	1.71	1.72	1.71
SE - Sweden	**5.56**	**5.72**	**5.38**	**5.71**	**5.40**	**4.83**	**4.99**	**5.03**	**5.05**	**4.86**
SI - Slovenia	2.87	3.06	3.30	3.79	3.54	3.15	3.25	3.34	3.31	3.23
SK - Slovakia	4.02	3.32	3.28	3.48	3.29	3.00	3.01	3.17	3.13	3.12
UK - United Kingdom	**3.71**	**3.86**	**3.97**	**3.90**	**3.41**	**2.95**	**2.88**	**2.83**	**2.81**	**2.74**

Table A1.2 – *Ratio of final energy consumption to gross domestic energy consumption (toe/toe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.68**	**0.68**	**0.68**	**0.67**	**0.68**	**0.69**	**0.69**	**0.69**	**0.70**	**0.71**
EU27	**0.68**	**0.68**	**0.69**	**0.68**	**0.69**	**0.69**	**0.70**	**0.69**	**0.70**	**0.71**
Austria	0.77	0.77	0.81	0.79	0.80	0.81	0.82	0.81	0.82	0.82
Belgium	0.65	0.69	0.68	0.70	0.69	0.75	0.72	0.71	0.74	0.70
Bulgaria	0.62	0.51	0.51	0.52	0.51	0.53	0.55	0.54	0.54	0.54
Cyprus	0.55	0.62	0.60	0.63	0.63	0.63	0.62	0.62	0.62	0.63
Czechia	**0.66**	**0.66**	**0.63**	**0.61**	**0.59**	**0.61**	**0.61**	**0.63**	**0.62**	**0.63**
Germany	**0.68**	**0.69**	**0.68**	**0.67**	**0.69**	**0.70**	**0.70**	**0.71**	**0.71**	**0.73**
Denmark	0.74	0.73	0.73	0.76	0.74	0.79	0.79	0.79	0.79	0.80
Estonia	0.59	0.53	0.55	0.58	0.52	0.52	0.48	0.51	0.49	0.61
Greece	0.66	0.66	0.67	0.68	0.69	0.68	0.70	0.68	0.67	0.69
Spain	**0.69**	**0.67**	**0.69**	**0.71**	**0.71**	**0.65**	**0.67**	**0.65**	**0.67**	**0.68**
Finland	0.78	0.77	0.74	0.72	0.71	0.75	0.75	0.76	0.76	0.76
France	**0.62**	**0.63**	**0.63**	**0.60**	**0.59**	**0.60**	**0.61**	**0.61**	**0.60**	**0.61**
Croatia	0.73	0.76	0.78	0.80	0.82	0.82	0.82	0.83	0.83	0.83
Hungary	0.71	0.66	0.68	0.71	0.71	0.74	0.75	0.75	0.75	0.75
Ireland	0.74	0.75	0.76	0.80	0.76	0.75	0.75	0.76	0.78	0.77
Italy	**0.78**	**0.75**	**0.73**	**0.74**	**0.75**	**0.76**	**0.76**	**0.76**	**0.77**	**0.77**
Lithuania	0.64	0.58	0.60	0.60	0.77	0.82	0.82	0.84	0.84	0.85
Luxembourg	0.79	0.84	0.89	0.85	0.85	0.85	0.85	0.84	0.84	0.84
Latvia	0.81	0.83	0.85	0.88	0.88	0.87	0.86	0.87	0.86	0.86
Malta	0.35	0.48	0.39	0.42	0.44	0.62	0.65	0.61	0.62	0.62
Netherlands	**0.77**	**0.76**	**0.75**	**0.75**	**0.76**	**0.73**	**0.74**	**0.74**	**0.75**	**0.75**
Poland	**0.60**	**0.65**	**0.65**	**0.67**	**0.69**	**0.69**	**0.70**	**0.71**	**0.71**	**0.72**
Portugal	0.78	0.74	0.77	0.76	0.78	0.72	0.71	0.69	0.70	0.73
Romania	0.68	0.57	0.65	0.68	0.69	0.71	0.73	0.72	0.73	0.75
Sweden	**0.68**	**0.71**	**0.74**	**0.66**	**0.69**	**0.71**	**0.70**	**0.68**	**0.66**	**0.68**
Slovenia	0.65	0.69	0.73	0.72	0.72	0.74	0.75	0.74	0.75	0.75
Slovakia	0.73	0.61	0.64	0.63	0.64	0.61	0.62	0.64	0.66	0.66
United Kingdom	**0.65**	**0.65**	**0.65**	**0.63**	**0.65**	**0.67**	**0.69**	**0.69**	**0.70**	**0.70**

Table A1.3 – *Gross domestic product per capita, k€/inhabitant (chain linked volumes, 2015).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**19.24**	**21.95**	**25.11**	**27.14**	**27.90**	**29.21**	**29.69**	**30.40**	**30.94**	**31.37**
EU27	**18.41**	**20.88**	**23.77**	**25.50**	**26.39**	**27.52**	**28.01**	**28.74**	**29.31**	**29.75**
Austria	27.33	30.47	35.05	37.33	39.11	40.10	40.36	40.98	41.81	42.22
Belgium	24.99	28.25	32.19	34.74	36.04	37.08	37.31	37.78	38.29	38.78
Bulgaria	3.77	3.55	3.30	4.64	5.64	6.34	6.63	6.91	7.18	7.50
Cyprus	16.27	17.71	20.31	23.31	23.78	21.11	22.44	23.42	24.37	24.79
Czechia	**9.25**	**10.11**	**11.08**	**13.52**	**14.90**	**16.09**	**16.47**	**17.28**	**17.78**	**18.13**
Germany	**26.81**	**28.56**	**31.10**	**31.81**	**34.02**	**37.27**	**37.65**	**38.46**	**38.82**	**38.93**
Denmark	35.48	39.20	44.50	46.83	46.27	48.24	49.39	50.42	51.22	52.46
Estonia	4.35	6.41	8.99	13.20	13.24	15.81	16.30	17.20	17.90	18.71
Greece	12.55	14.42	16.86	20.04	19.45	16.22	16.25	16.48	16.78	17.12
Spain	**15.08**	**18.07**	**21.63**	**23.76**	**23.21**	**23.20**	**23.91**	**24.57**	**25.10**	**25.44**
Finland	28.26	27.01	34.18	38.40	39.35	38.63	39.61	40.75	41.21	41.70
France	**25.76**	**26.91**	**30.46**	**31.94**	**32.31**	**33.08**	**33.35**	**34.03**	**34.53**	**34.97**
Croatia	5.35	6.43	7.81	10.17	10.47	10.56	11.02	11.50	11.96	12.39
Hungary	5.96	6.91	8.07	10.13	10.16	11.44	11.71	12.26	12.94	13.55
Ireland	16.63	25.40	37.90	45.16	41.67	56.19	56.72	61.15	65.73	68.34
Italy	**23.88**	**26.38**	**29.17**	**30.02**	**28.94**	**27.23**	**27.64**	**28.14**	**28.45**	**28.85**
Lithuania	3.48	4.43	5.77	8.72	9.87	12.78	13.25	14.02	14.77	15.50
Luxembourg	51.26	63.97	79.86	86.83	90.00	92.49	94.49	93.84	94.94	95.24
Latvia	3.20	4.41	5.97	9.37	9.70	12.37	12.77	13.31	13.96	14.35
Malta		0.00	15.55	16.39	18.55	22.74	23.10	24.44	24.88	25.30
Netherlands	**25.49**	**30.44**	**36.61**	**38.07**	**40.11**	**40.83**	**41.53**	**42.48**	**43.23**	**43.70**
Poland	**3.98**	**5.08**	**6.63**	**7.72**	**9.79**	**11.33**	**11.69**	**12.26**	**12.91**	**13.53**
Portugal	11.68	14.26	17.01	17.34	17.73	17.32	17.73	18.41	18.97	19.47
Romania	4.05	4.10	4.10	5.66	6.86	8.06	8.49	9.16	9.62	10.08
Sweden	**27.12**	**31.28**	**37.12**	**41.56**	**43.79**	**46.73**	**47.20**	**47.71**	**48.04**	**48.17**
Slovenia	9.75	11.97	14.65	17.37	18.59	18.83	19.42	20.34	21.22	21.75
Slovakia	5.80	6.80	8.02	10.29	13.04	14.71	15.01	15.44	15.98	16.36
United Kingdom	**27.74**	**29.54**	**34.74**	**38.75**	**38.28**	**40.78**	**41.15**	**41.57**	**41.82**	**42.15**

Table A1.4 – *Gross inland energy consumption per unit of gross domestic product, toe/M€ (chain linked volumes, 2015).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**182.40**	**158.38**	**141.52**	**136.95**	**126.26**	**110.40**	**108.89**	**107.93**	**105.06**	**101.68**
EU27	**189.20**	**163.98**	**147.08**	**144.78**	**134.08**	**118.66**	**117.28**	**116.46**	**113.15**	**109.48**
Austria	121.24	112.69	104.18	112.30	106.63	97.94	97.37	96.80	92.20	92.76
Belgium	196.23	189.25	180.33	163.03	157.43	129.70	135.48	133.10	126.37	127.80
Bulgaria	852.70	781.60	689.14	562.93	428.13	408.86	385.64	385.67	375.43	359.10
Cyprus	173.72	172.70	172.87	149.14	141.70	128.60	129.53	128.57	124.99	121.14
Czechia	**521.47**	**400.83**	**362.64**	**330.15**	**291.63**	**248.01**	**239.62**	**237.70**	**231.26**	**222.71**
Germany	**167.70**	**146.55**	**133.99**	**132.01**	**121.53**	**105.11**	**103.45**	**101.44**	**98.01**	**94.55**
Denmark	98.61	98.28	82.20	78.22	79.71	63.62	63.24	61.82	60.52	56.84
Estonia	1409.91	576.17	375.70	293.42	320.30	261.82	279.98	254.86	261.71	194.61
Greece	174.71	154.65	153.53	141.26	131.07	136.78	134.98	137.44	132.24	128.27
Spain	**150.96**	**143.39**	**141.70**	**140.45**	**120.47**	**113.97**	**111.89**	**114.38**	**111.49**	**106.35**
Finland	203.77	212.12	185.37	173.27	174.71	154.47	155.73	152.64	153.55	148.78
France	**151.25**	**150.40**	**138.82**	**138.25**	**129.12**	**118.30**	**114.96**	**112.43**	**110.04**	**107.03**
Croatia	376.76	263.63	240.54	224.02	210.20	190.63	185.82	185.97	176.69	174.06
Hungary	471.30	364.58	305.80	278.71	261.46	223.63	221.69	221.98	210.98	201.66
Ireland	176.16	118.45	100.37	83.29	79.46	54.03	55.73	50.34	47.09	44.62
Italy	**109.40**	**107.51**	**105.13**	**109.02**	**103.25**	**94.08**	**92.01**	**93.57**	**91.23**	**90.07**
Lithuania	1266.48	548.43	362.78	307.14	228.40	192.37	192.13	192.70	188.76	180.16
Luxembourg	180.57	128.15	105.59	119.91	102.82	80.29	77.03	78.07	78.82	77.65
Latvia	930.34	420.58	271.98	217.76	225.01	178.31	174.67	175.30	177.49	168.76
Malta			133.82	141.76	122.18	75.81	69.06	73.32	71.58	72.32
Netherlands	**181.18**	**161.32**	**134.78**	**134.84**	**129.60**	**110.79**	**110.67**	**108.71**	**104.24**	**100.54**
Poland	**681.84**	**509.03**	**351.85**	**314.21**	**273.01**	**222.71**	**226.54**	**226.08**	**217.96**	**202.42**
Portugal	147.64	145.26	145.59	150.77	130.08	131.26	128.35	129.91	123.09	119.55
Romania	671.47	502.91	399.59	319.68	251.59	199.02	189.62	186.35	178.67	169.12
Sweden	**204.87**	**182.81**	**145.02**	**137.28**	**123.35**	**103.28**	**105.63**	**105.45**	**105.03**	**100.86**
Slovenia	294.45	255.86	225.37	218.02	190.60	167.29	167.38	164.28	155.98	148.53
Slovakia	693.83	488.04	409.68	338.08	252.01	203.90	200.63	205.57	196.00	190.96
United Kingdom	**133.72**	**130.55**	**114.23**	**100.69**	**89.03**	**72.25**	**70.05**	**68.13**	**67.12**	**65.01**

Table A1.5 – *Final energy consumption per unit of gross domestic product, toe/M€ (chain linked volumes, 2015).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**123.92**	**107.00**	**96.31**	**92.40**	**86.13**	**75.77**	**75.67**	**74.94**	**73.30**	**71.74**
EU27	**129.37**	**111.55**	**100.86**	**98.53**	**92.09**	**81.74**	**81.60**	**80.89**	**78.90**	**77.26**
Austria	93.74	87.06	83.89	89.22	85.01	79.22	79.64	78.38	75.61	75.78
Belgium	126.98	129.93	123.29	114.21	108.26	97.84	97.12	94.31	93.91	89.59
Bulgaria	525.84	400.08	354.25	292.97	217.98	218.72	211.08	208.13	202.39	193.64
Cyprus	94.97	106.33	103.67	93.66	88.86	80.96	80.38	79.45	76.90	76.79
Czechia	**343.82**	**263.25**	**229.52**	**202.27**	**173.17**	**150.96**	**146.52**	**149.80**	**143.87**	**141.06**
Germany	**113.98**	**100.69**	**90.97**	**88.38**	**83.54**	**73.10**	**72.74**	**71.60**	**69.27**	**68.76**
Denmark	72.62	71.35	60.37	59.26	59.02	50.48	49.82	48.55	47.56	45.32
Estonia	831.43	304.24	205.15	169.55	168.01	137.42	135.07	129.38	127.49	118.63
Greece	114.57	101.75	102.61	95.48	90.08	93.36	93.99	93.47	89.09	88.90
Spain	**104.09**	**96.73**	**98.06**	**99.30**	**85.71**	**74.62**	**74.70**	**74.16**	**74.38**	**72.76**
Finland	159.38	163.04	137.59	125.14	124.65	115.33	117.21	116.16	116.65	113.43
France	**94.39**	**94.47**	**87.87**	**83.20**	**76.69**	**70.50**	**70.65**	**68.92**	**66.49**	**65.05**
Croatia	275.10	200.88	187.85	178.76	171.49	157.26	152.68	153.43	145.98	144.39
Hungary	334.90	241.42	208.81	198.79	185.37	166.23	166.54	166.92	158.40	151.72
Ireland	130.42	89.36	75.88	66.34	60.55	40.65	41.54	38.03	36.61	34.42
Italy	**84.89**	**80.22**	**77.20**	**80.64**	**77.43**	**71.71**	**70.29**	**71.29**	**70.58**	**69.63**
Lithuania	808.70	315.54	217.37	183.12	174.79	157.86	157.96	161.49	158.95	153.69
Luxembourg	142.39	107.30	93.55	101.72	86.96	68.57	65.64	65.66	66.07	65.42
Latvia	751.49	350.70	232.44	192.49	198.08	154.44	150.91	152.55	152.76	145.81
Malta			52.84	59.99	53.39	46.84	44.93	44.68	44.50	45.09
Netherlands	**140.32**	**121.90**	**101.34**	**100.74**	**97.96**	**81.05**	**81.48**	**80.53**	**78.23**	**75.04**
Poland	**405.96**	**329.72**	**228.47**	**210.72**	**188.70**	**154.47**	**159.26**	**161.53**	**154.31**	**145.42**
Portugal	115.62	107.61	112.65	114.54	101.35	93.96	91.64	90.13	86.45	87.53
Romania	459.27	288.83	259.15	216.61	173.18	141.90	137.63	133.69	130.12	126.93
Sweden	**139.01**	**129.81**	**107.65**	**91.13**	**84.55**	**73.10**	**73.61**	**71.83**	**69.77**	**68.19**
Slovenia	190.17	175.64	164.28	156.30	138.18	124.60	125.26	121.31	116.40	110.96
Slovakia	504.20	298.46	261.22	211.30	162.54	125.20	125.25	131.13	128.40	126.18
United Kingdom	**86.83**	**84.23**	**73.89**	**63.92**	**57.66**	**48.18**	**48.24**	**47.16**	**47.01**	**45.79**

Table A1.6 – *Value added of industry per capita, k€/inhabitant (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**5.59**	**6.18**	**6.48**	**6.31**	**6.42**	**6.56**	**6.76**	**6.87**	**6.88**
EU27	**5.26**	**5.86**	**6.21**	**6.12**	**6.27**	**6.40**	**6.61**	**6.73**	**6.75**
Austria	8.12	9.26	9.88	9.75	10.10	10.26	10.57	10.95	11.06
Belgium	5.79	6.82	7.23	7.17	7.29	7.18	7.24	7.21	7.37
Bulgaria	0.63	0.80	1.11	1.30	1.50	1.59	1.66	1.65	1.65
Cyprus	3.38	3.23	4.12	3.33	2.15	2.47	2.64	2.94	3.12
Czechia	**3.04**	**3.31**	**4.29**	**5.14**	**5.44**	**5.54**	**5.89**	**5.95**	**6.01**
Germany	**8.10**	**8.40**	**8.43**	**9.10**	**10.10**	**10.39**	**10.69**	**10.74**	**10.45**
Denmark	9.85	11.10	10.71	9.38	9.64	10.11	10.64	10.91	11.19
Estonia	1.38	1.98	3.03	2.98	3.74	3.97	4.27	4.61	4.39
Greece	2.92	3.49	4.13	3.28	2.35	2.42	2.39	2.41	2.44
Spain	**5.07**	**6.11**	**6.44**	**5.36**	**4.66**	**4.85**	**5.01**	**5.07**	**5.16**
Finland	5.95	8.66	10.06	10.06	9.00	9.32	9.87	9.69	9.75
France	**5.39**	**6.17**	**6.42**	**5.97**	**5.85**	**5.83**	**5.89**	**5.92**	**5.95**
Croatia	1.52	1.97	2.60	2.39	2.26	2.39	2.47	2.54	2.62
Hungary	1.61	2.21	2.86	2.68	3.02	3.01	3.16	3.32	3.49
Ireland	7.47	12.62	14.60	11.81	21.56	21.15	21.77	23.94	24.42
Italy	**6.91**	**7.20**	**7.29**	**6.43**	**5.68**	**5.84**	**6.02**	**6.15**	**6.21**
Lithuania	1.03	1.33	2.39	2.53	3.42	3.48	3.72	3.93	4.14
Luxembourg	11.66	13.12	13.31	10.26	10.21	10.83	10.64	11.08	11.03
Latvia	1.11	1.49	2.25	1.96	2.36	2.38	2.58	2.68	2.74
Malta		3.32	2.92	2.94	2.80	2.88	3.02	3.17	3.30
Netherlands	**6.71**	**7.48**	**7.66**	**7.63**	**7.42**	**7.56**	**7.87**	**8.04**	**8.09**
Poland	**1.60**	**1.72**	**2.01**	**2.81**	**3.41**	**3.46**	**3.57**	**3.81**	**3.90**
Portugal	3.45	4.20	3.92	3.59	3.37	3.42	3.58	3.74	3.75
Romania	1.34	1.25	1.79	2.44	2.43	2.59	2.73	2.79	2.84
Sweden	**7.06**	**9.36**	**10.67**	**10.47**	**10.35**	**10.20**	**10.50**	**10.48**	**10.50**
Slovenia	3.30	4.22	5.18	5.30	5.28	5.47	5.85	6.07	6.40
Slovakia	1.24	1.67	2.78	3.66	4.49	4.45	4.55	4.81	4.76
United Kingdom	**8.07**	**8.50**	**8.44**	**7.70**	**7.51**	**7.60**	**7.78**	**7.78**	**0.00**

Table A1.7 – *Value added of service per capita, k€/inhabitant (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**13.60**	**15.73**	**17.28**	**18.22**	**19.29**	**19.57**	**20.00**	**20.38**	**20.75**
EU27	**12.92**	**14.85**	**16.07**	**17.06**	**17.93**	**18.21**	**18.66**	**19.05**	**19.41**
Austria	18.37	21.28	22.86	24.66	25.22	25.26	25.52	25.94	26.20
Belgium	19.31	21.41	23.34	24.67	25.67	25.89	26.23	26.77	27.06
Bulgaria	2.21	1.73	2.52	3.38	3.72	3.84	4.03	4.29	4.52
Cyprus	11.30	13.77	15.52	17.00	15.93	16.71	17.44	18.01	18.19
Czechia	**5.77**	**6.32**	**7.45**	**7.97**	**8.70**	**8.92**	**9.32**	**9.71**	**9.92**
Germany	**16.86**	**19.02**	**19.94**	**21.29**	**23.16**	**23.23**	**23.71**	**24.04**	**24.38**
Denmark	17.21	19.31	20.92	22.28	23.16	23.48	23.62	23.88	24.45
Estonia	4.01	5.58	8.04	8.27	9.53	9.80	10.40	10.86	11.53
Greece	9.06	10.56	12.75	12.93	11.35	11.30	11.55	11.74	11.91
Spain	**11.00**	**12.84**	**14.40**	**15.23**	**15.77**	**16.15**	**16.64**	**17.02**	**17.30**
Finland	17.49	21.02	22.86	23.58	23.50	23.93	24.51	24.99	25.35
France	**18.10**	**20.46**	**21.51**	**22.36**	**23.23**	**23.52**	**23.98**	**24.40**	**24.77**
Croatia	3.47	4.16	5.48	5.96	6.17	6.40	6.68	6.94	7.18
Hungary	3.88	4.31	5.29	5.46	6.18	6.37	6.71	7.13	7.48
Ireland	17.06	22.77	26.13	26.75	30.17	30.77	33.36	36.04	37.78
Italy	**16.09**	**18.12**	**18.86**	**18.83**	**18.24**	**18.45**	**18.72**	**18.87**	**19.17**
Lithuania	2.66	3.61	5.15	6.03	7.66	8.03	8.48	8.99	9.39
Luxembourg	47.42	59.48	65.41	71.83	73.17	74.63	74.20	74.47	74.76
Latvia	2.51	3.52	5.68	6.39	8.08	8.37	8.64	9.04	9.30
Malta		9.83	10.70	12.87	17.21	17.48	18.63	18.79	19.24
Netherlands	**19.56**	**24.24**	**25.39**	**27.51**	**28.61**	**29.01**	**29.57**	**30.07**	**30.42**
Poland	**2.65**	**3.95**	**4.59**	**5.58**	**6.37**	**6.64**	**7.01**	**7.38**	**7.80**
Portugal	8.56	10.03	10.57	11.36	11.35	11.60	11.99	12.30	12.68
Romania	1.94	2.06	2.77	3.25	4.32	4.53	4.93	5.19	5.54
Sweden	**20.06**	**23.19**	**25.69**	**27.70**	**30.52**	**30.94**	**31.15**	**31.56**	**32.91**
Slovenia	6.59	7.79	9.27	10.27	10.61	10.94	11.43	11.88	12.07
Slovakia	5.04	5.72	6.22	7.97	8.37	8.66	8.91	9.08	9.38
United Kingdom	**18.56**	**22.07**	**25.78**	**26.18**	**28.59**	**28.83**	**29.01**	**29.27**	**0.00**

Table A1.8 – *Value added of agriculture per capita, k€/inhabitant (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.37**	**0.40**	**0.40**	**0.40**	**0.43**	**0.42**	**0.42**	**0.42**	**0.42**
EU27	**0.39**	**0.42**	**0.41**	**0.43**	**0.45**	**0.44**	**0.45**	**0.44**	**0.45**
Austria	0.41	0.44	0.43	0.43	0.45	0.46	0.48	0.49	0.49
Belgium	0.20	0.23	0.23	0.25	0.25	0.23	0.24	0.21	0.20
Bulgaria	0.31	0.31	0.33	0.26	0.26	0.28	0.30	0.30	0.31
Cyprus	0.83	0.79	0.73	0.49	0.40	0.46	0.42	0.40	0.40
Czechia	**0.36**	**0.35**	**0.44**	**0.32**	**0.36**	**0.37**	**0.36**	**0.37**	**0.39**
Germany	**0.23**	**0.24**	**0.22**	**0.27**	**0.26**	**0.25**	**0.24**	**0.20**	**0.21**
Denmark	0.45	0.50	0.47	0.49	0.46	0.39	0.44	0.42	0.51
Estonia	0.16	0.27	0.29	0.37	0.45	0.34	0.35	0.24	0.38
Greece	0.73	0.71	0.72	0.59	0.63	0.59	0.66	0.66	0.69
Spain	**0.46**	**0.65**	**0.55**	**0.57**	**0.63**	**0.67**	**0.64**	**0.69**	**0.67**
Finland	0.74	0.73	0.71	0.82	0.87	0.89	0.90	0.88	0.97
France	**0.46**	**0.51**	**0.49**	**0.51**	**0.53**	**0.46**	**0.50**	**0.52**	**0.52**
Croatia	0.35	0.38	0.43	0.43	0.32	0.34	0.34	0.36	0.37
Hungary	0.33	0.32	0.45	0.36	0.43	0.49	0.46	0.48	0.48
Ireland	0.66	0.58	0.45	0.40	0.50	0.55	0.57	0.50	0.63
Italy	**0.54**	**0.61**	**0.56**	**0.56**	**0.56**	**0.56**	**0.54**	**0.55**	**0.55**
Lithuania	0.29	0.29	0.31	0.32	0.44	0.43	0.43	0.39	0.43
Luxembourg	0.84	0.72	0.34	0.25	0.21	0.18	0.17	0.16	0.16
Latvia	0.23	0.24	0.32	0.35	0.43	0.42	0.43	0.42	0.47
Malta		0.20	0.31	0.23	0.21	0.24	0.18	0.20	0.18
Netherlands	**0.61**	**0.62**	**0.63**	**0.68**	**0.70**	**0.72**	**0.72**	**0.70**	**0.71**
Poland	**0.32**	**0.22**	**0.27**	**0.30**	**0.27**	**0.27**	**0.28**	**0.25**	**0.25**
Portugal	0.38	0.34	0.33	0.33	0.36	0.36	0.37	0.37	0.38
Romania	0.36	0.26	0.35	0.29	0.34	0.35	0.41	0.45	0.43
Sweden	**0.52**	**0.52**	**0.61**	**0.63**	**0.68**	**0.66**	**0.69**	**0.61**	**0.64**
Slovenia	0.33	0.36	0.36	0.36	0.39	0.39	0.37	0.46	0.44
Slovakia	0.10	0.09	0.15	0.22	0.39	0.42	0.38	0.41	0.45
United Kingdom	**0.24**	**0.26**	**0.27**	**0.23**	**0.26**	**0.25**	**0.26**	**0.25**	**0.00**

Table A1.9 – *Total GHG emissions per capita, t CO_2eq/inhabitant.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**11.88**	**11.00**	**10.60**	**10.59**	**9.52**	**8.52**	**8.45**	**8.46**	**8.26**	**7.93**
EU27	**11.61**	**10.74**	**10.39**	**10.46**	**9.49**	**8.62**	**8.61**	**8.65**	**8.44**	**8.10**
Austria	10.26	9.98	10.01	11.24	10.10	9.14	9.13	9.33	8.91	9.01
Belgium	14.65	15.16	14.54	13.93	12.33	10.59	10.40	10.34	10.34	10.18
Bulgaria	11.40	8.65	7.06	8.16	8.06	8.52	8.22	8.61	8.13	7.99
Cyprus	9.73	10.82	12.03	12.56	11.53	9.84	10.35	10.49	10.20	10.09
Czechia	**19.02**	**15.13**	**14.52**	**14.48**	**13.34**	**12.14**	**12.28**	**12.33**	**12.12**	**11.52**
Germany	**15.78**	**13.74**	**12.69**	**12.03**	**11.51**	**11.14**	**11.05**	**10.81**	**10.34**	**9.75**
Denmark	13.84	15.12	13.46	12.49	11.68	8.79	9.07	8.64	8.58	7.89
Estonia	26.13	14.00	12.49	14.17	15.91	13.80	15.05	16.01	15.32	11.10
Greece	10.21	10.38	11.74	12.44	10.66	8.79	8.51	8.88	8.59	7.98
Spain	**7.46**	**8.31**	**9.59**	**10.21**	**7.70**	**7.26**	**7.01**	**7.28**	**7.14**	**6.70**
Finland	14.29	14.06	13.57	13.34	14.13	10.07	10.57	10.04	10.21	9.61
France	**9.42**	**9.11**	**9.12**	**8.86**	**7.94**	**6.98**	**7.01**	**7.04**	**6.74**	**6.59**
Croatia	6.58	4.83	5.68	6.90	6.45	5.66	5.73	5.95	5.73	5.79
Hungary	9.14	7.47	7.33	7.60	6.60	6.24	6.33	6.61	6.62	6.59
Ireland	15.51	16.33	18.12	17.09	13.62	12.92	13.22	12.98	12.94	12.19
Italy	**9.15**	**9.36**	**9.76**	**10.18**	**8.73**	**7.24**	**7.21**	**7.14**	**7.09**	**6.99**
Lithuania	12.94	6.09	5.53	6.77	6.60	6.94	7.03	7.20	7.17	7.29
Luxembourg	33.55	24.86	22.27	28.20	24.25	18.34	17.50	17.38	17.55	17.50
Latvia	9.70	4.98	4.22	4.86	5.57	5.40	5.44	5.52	5.82	5.80
Malta	7.36	7.13	7.24	7.41	7.17	5.05	4.22	4.48	4.29	4.41
Netherlands	**14.75**	**14.89**	**13.72**	**13.04**	**12.77**	**11.40**	**11.37**	**11.16**	**10.84**	**10.43**
Poland	**12.51**	**11.59**	**10.36**	**10.62**	**10.88**	**10.28**	**10.55**	**10.92**	**10.84**	**10.29**
Portugal	5.88	6.85	7.97	8.17	6.50	6.51	6.36	6.87	6.52	6.18
Romania	10.67	8.10	6.25	6.95	5.80	5.75	5.65	5.86	5.94	5.80
Sweden	**8.35**	**8.30**	**7.69**	**7.40**	**6.91**	**5.54**	**5.44**	**5.30**	**5.16**	**4.98**
Slovenia	9.31	9.39	9.35	10.23	9.58	8.13	8.53	8.57	8.48	8.20
Slovakia	13.88	9.87	9.02	9.37	8.42	7.51	7.58	7.77	7.75	7.33
United Kingdom	**13.91**	**12.92**	**12.11**	**11.47**	**9.74**	**7.85**	**7.41**	**7.19**	**7.04**	**6.80**

Table A1.10 – *Energy GHG emissions per capita*, tCO_2*eq/inhabitant.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**9.14**	**8.47**	**8.24**	**8.34**	**7.56**	**6.65**	**6.59**	**6.58**	**6.41**	**6.12**
EU27	**8.91**	**8.27**	**8.04**	**8.20**	**7.48**	**6.68**	**6.67**	**6.70**	**6.52**	**6.21**
Austria	6.91	6.83	6.90	8.15	7.12	6.18	6.24	6.39	6.19	6.21
Belgium	10.43	10.63	10.37	10.12	9.18	7.74	7.55	7.50	7.51	7.49
Bulgaria	8.13	6.10	5.00	5.97	6.23	6.36	5.98	6.34	5.86	5.75
Cyprus	6.95	7.95	9.25	9.75	9.23	7.23	7.69	7.76	7.55	7.51
Czechia	**15.57**	**12.52**	**11.89**	**11.84**	**10.76**	**9.37**	**9.48**	**9.53**	**9.28**	**8.79**
Germany	**13.11**	**11.26**	**10.59**	**10.09**	**9.80**	**9.44**	**9.37**	**9.10**	**8.70**	**8.16**
Denmark	10.46	11.83	10.30	9.65	9.15	6.34	6.57	6.14	6.11	5.45
Estonia	23.57	12.34	10.78	12.39	14.20	12.05	13.37	14.20	13.53	9.27
Greece	7.61	7.70	8.98	9.78	8.38	6.56	6.21	6.52	6.27	5.71
Spain	**5.48**	**6.31**	**7.17**	**7.97**	**5.72**	**5.48**	**5.25**	**5.56**	**5.43**	**5.04**
Finland	10.76	10.85	10.39	10.26	11.26	7.43	7.91	7.45	7.64	7.09
France	**6.35**	**6.21**	**6.34**	**6.27**	**5.60**	**4.77**	**4.83**	**4.84**	**4.61**	**4.52**
Croatia	4.49	3.43	4.05	5.00	4.58	3.93	4.05	4.18	4.00	4.03
Hungary	6.69	5.71	5.52	5.68	4.98	4.49	4.59	4.77	4.75	4.73
Ireland	8.85	9.40	11.25	11.12	8.90	7.87	8.07	7.76	7.67	7.18
Italy	**7.50**	**7.70**	**8.07**	**8.43**	**7.25**	**5.91**	**5.86**	**5.78**	**5.72**	**5.63**
Lithuania	8.97	3.89	3.11	3.91	4.17	3.85	4.01	4.04	4.23	4.25
Luxembourg	27.16	20.36	18.66	25.04	21.39	15.84	15.00	14.91	15.14	15.11
Latvia	7.31	3.83	3.11	3.62	4.01	3.61	3.68	3.71	3.97	3.88
Malta	6.86	6.56	6.58	6.62	6.26	3.96	3.13	3.40	3.24	3.39
Netherlands	**10.65**	**10.97**	**10.53**	**10.60**	**10.79**	**9.54**	**9.55**	**9.32**	**9.05**	**8.68**
Poland	**10.05**	**9.54**	**8.41**	**8.69**	**8.99**	**8.40**	**8.69**	**9.03**	**8.98**	**8.48**
Portugal	4.07	4.95	5.85	6.10	4.62	4.66	4.57	5.02	4.71	4.32
Romania	7.59	5.79	4.32	4.68	3.96	3.90	3.79	3.96	3.98	3.85
Sweden	**6.12**	**6.13**	**5.54**	**5.33**	**5.07**	**3.93**	**3.80**	**3.71**	**3.63**	**3.41**
Slovenia	7.33	7.64	7.46	8.27	8.00	6.50	6.90	6.93	6.85	6.56
Slovakia	10.64	7.23	6.67	6.74	5.94	5.03	5.06	5.22	5.18	4.92
United Kingdom	**10.76**	**9.89**	**9.63**	**9.35**	**8.12**	**6.41**	**6.03**	**5.80**	**5.69**	**5.46**

Table A1.11 – *Total GHG emissions per unit of gross domestic product, t CO_2eq/M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.50**	**0.42**	**0.39**	**0.34**	**0.29**	**0.28**	**0.28**	**0.27**	**0.25**
EU27	**0.51**	**0.44**	**0.41**	**0.36**	**0.31**	**0.31**	**0.30**	**0.29**	**0.27**
Austria	0.33	0.29	0.30	0.26	0.23	0.23	0.23	0.21	0.21
Belgium	0.54	0.45	0.40	0.34	0.29	0.28	0.27	0.27	0.26
Bulgaria	2.44	2.14	1.76	1.43	1.34	1.24	1.25	1.13	1.07
Cyprus	0.61	0.59	0.54	0.48	0.47	0.46	0.45	0.42	0.41
Czechia	**1.50**	**1.31**	**1.07**	**0.90**	**0.75**	**0.75**	**0.71**	**0.68**	**0.64**
Germany	**0.48**	**0.41**	**0.38**	**0.34**	**0.30**	**0.29**	**0.28**	**0.27**	**0.25**
Denmark	0.39	0.30	0.27	0.25	0.18	0.18	0.17	0.17	0.15
Estonia	2.18	1.39	1.07	1.20	0.87	0.92	0.93	0.86	0.59
Greece	0.72	0.70	0.62	0.55	0.54	0.52	0.54	0.51	0.47
Spain	**0.46**	**0.44**	**0.43**	**0.33**	**0.31**	**0.29**	**0.30**	**0.28**	**0.26**
Finland	0.52	0.40	0.35	0.36	0.26	0.27	0.25	0.25	0.23
France	**0.34**	**0.30**	**0.28**	**0.25**	**0.21**	**0.21**	**0.21**	**0.20**	**0.19**
Croatia	0.75	0.73	0.68	0.62	0.54	0.52	0.52	0.48	0.47
Hungary	1.08	0.91	0.75	0.65	0.55	0.54	0.54	0.51	0.49
Ireland	0.64	0.48	0.38	0.33	0.23	0.23	0.21	0.20	0.18
Italy	0.35	0.33	0.34	0.30	0.27	0.26	0.25	0.25	0.24
Lithuania	**1.38**	**0.96**	**0.78**	**0.67**	**0.54**	**0.53**	**0.51**	**0.49**	**0.47**
Luxembourg	0.39	0.28	0.32	0.27	0.20	0.19	0.19	0.18	0.18
Latvia	1.13	0.71	0.52	0.57	0.44	0.43	0.41	0.42	0.40
Malta		0.47	0.45	0.39	0.22	0.18	0.18	0.17	0.17
Netherlands	**0.49**	**0.37**	**0.34**	**0.32**	**0.28**	**0.27**	**0.26**	**0.25**	**0.24**
Poland	**2.28**	**1.56**	**1.38**	**1.11**	**0.91**	**0.90**	**0.89**	**0.84**	**0.76**
Portugal	0.48	0.47	0.47	0.37	0.38	0.36	0.37	0.34	0.32
Romania	1.98	1.53	1.23	0.85	0.71	0.67	0.64	0.62	0.58
Sweden	**0.27**	**0.21**	**0.18**	**0.16**	**0.12**	**0.12**	**0.11**	**0.11**	**0.10**
Slovenia	0.78	0.64	0.59	0.52	0.43	0.44	0.42	0.40	0.38
Slovakia	1.45	1.12	0.91	0.65	0.51	0.50	0.50	0.48	0.45
United Kingdom	**0.44**	**0.35**	**0.30**	**0.25**	**0.19**	**0.18**	**0.17**	**0.17**	**0.16**

Table A.12 – *Total GHG emissions per unit gross inland energy consumption, t CO_2eq/toe.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3.39**	**3.16**	**2.98**	**2.85**	**2.70**	**2.64**	**2.61**	**2.58**	**2.54**	**2.49**
EU27	**3.33**	**3.14**	**2.97**	**2.84**	**2.68**	**2.64**	**2.62**	**2.58**	**2.55**	**2.49**
Austria	3.10	2.90	2.74	2.68	2.42	2.33	2.32	2.35	2.31	2.30
Belgium	2.99	2.84	2.50	2.46	2.17	2.20	2.06	2.06	2.14	2.05
Bulgaria	3.54	3.12	3.11	3.12	3.34	3.28	3.21	3.23	3.01	2.97
Cyprus	3.44	3.54	3.43	3.61	3.42	3.62	3.56	3.49	3.35	3.36
Czechia	**3.94**	**3.73**	**3.62**	**3.24**	**3.07**	**3.04**	**3.11**	**3.00**	**2.95**	**2.85**
Germany	**3.51**	**3.28**	**3.04**	**2.86**	**2.78**	**2.84**	**2.84**	**2.77**	**2.72**	**2.65**
Denmark	3.96	3.92	3.68	3.41	3.17	2.86	2.90	2.77	2.77	2.65
Estonia	4.26	3.79	3.70	3.66	3.75	3.33	3.30	3.65	3.27	3.05
Greece	4.65	4.65	4.53	4.39	4.18	3.96	3.88	3.92	3.87	3.64
Spain	**3.28**	**3.21**	**3.13**	**3.06**	**2.75**	**2.74**	**2.62**	**2.59**	**2.55**	**2.48**
Finland	2.48	2.45	2.14	2.00	2.06	1.69	1.71	1.61	1.61	1.55
France	**2.42**	**2.25**	**2.16**	**2.01**	**1.90**	**1.78**	**1.83**	**1.84**	**1.78**	**1.76**
Croatia	3.26	2.85	3.03	3.03	2.93	2.81	2.80	2.79	2.71	2.69
Hungary	3.25	2.96	2.97	2.69	2.48	2.44	2.44	2.43	2.42	2.41
Ireland	5.30	5.43	4.76	4.54	4.11	4.26	4.18	4.22	4.18	4.00
Italy	**3.50**	**3.30**	**3.18**	**3.11**	**2.92**	**2.83**	**2.84**	**2.71**	**2.73**	**2.69**
Lithuania	2.93	2.51	2.64	2.53	2.93	2.82	2.76	2.67	2.57	2.61
Luxembourg	3.63	3.03	2.64	2.71	2.62	2.47	2.40	2.37	2.35	2.37
Latvia	3.25	2.69	2.60	2.38	2.55	2.45	2.44	2.36	2.35	2.39
Malta	3.38	3.40	3.48	3.19	3.16	2.93	2.65	2.50	2.41	2.41
Netherlands	**3.19**	**3.03**	**2.78**	**2.54**	**2.46**	**2.52**	**2.47**	**2.42**	**2.41**	**2.37**
Poland	**4.60**	**4.48**	**4.45**	**4.38**	**4.07**	**4.08**	**3.98**	**3.94**	**3.85**	**3.76**
Portugal	3.41	3.31	3.22	3.12	2.82	2.87	2.79	2.87	2.79	2.65
Romania	3.92	3.93	3.82	3.84	3.36	3.59	3.51	3.43	3.45	3.40
Sweden	**1.50**	**1.45**	**1.43**	**1.30**	**1.28**	**1.15**	**1.09**	**1.05**	**1.02**	**1.02**
Slovenia	3.24	3.07	2.83	2.70	2.70	2.58	2.63	2.56	2.56	2.54
Slovakia	3.45	2.97	2.74	2.69	2.56	2.50	2.52	2.45	2.47	2.35
United Kingdom	**3.75**	**3.35**	**3.05**	**2.94**	**2.86**	**2.66**	**2.57**	**2.54**	**2.51**	**2.48**

Table A1.13 – *GHG emissions from combustion per unit of primary energy consumption*, tCO_2*eq/toe.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**2.77**	**2.60**	**2.48**	**2.40**	**2.28**	**2.19**	**2.16**	**2.14**	**2.10**	**2.04**
EU27	**2.73**	**2.59**	**2.47**	**2.38**	**2.26**	**2.18**	**2.16**	**2.14**	**2.10**	**2.03**
Austria	2.23	2.10	2.01	2.04	1.80	1.66	1.68	1.69	1.70	1.69
Belgium	2.27	2.23	2.02	2.05	1.83	1.88	1.72	1.72	1.81	1.73
Bulgaria	2.66	2.32	2.32	2.39	2.64	2.53	2.40	2.44	2.23	2.19
Cyprus	2.51	2.69	2.73	2.89	2.83	2.69	2.69	2.62	2.51	2.54
Czechia	**3.35**	**3.28**	**3.12**	**2.84**	**2.64**	**2.50**	**2.51**	**2.49**	**2.42**	**2.34**
Germany	**3.12**	**2.89**	**2.74**	**2.59**	**2.54**	**2.58**	**2.58**	**2.51**	**2.46**	**2.39**
Denmark	3.04	3.12	2.86	2.67	2.51	2.10	2.13	2.00	2.00	1.85
Estonia	3.94	3.45	3.32	3.34	3.40	2.97	2.98	3.31	2.95	2.61
Greece	3.58	3.53	3.56	3.54	3.42	3.04	2.90	2.99	2.93	2.71
Spain	**2.58**	**2.64**	**2.53**	**2.54**	**2.16**	**2.15**	**2.04**	**2.06**	**2.02**	**1.95**
Finland	1.97	1.97	1.69	1.60	1.69	1.30	1.34	1.25	1.26	1.19
France	**1.73**	**1.64**	**1.60**	**1.51**	**1.41**	**1.29**	**1.33**	**1.34**	**1.28**	**1.27**
Croatia	2.40	2.26	2.34	2.36	2.22	2.08	2.10	2.08	2.00	2.00
Hungary	2.53	2.42	2.39	2.18	2.03	1.90	1.91	1.91	1.90	1.88
Ireland	3.22	3.30	3.10	3.06	2.75	2.63	2.60	2.56	2.52	2.39
Italy	**3.09**	**2.89**	**2.77**	**2.70**	**2.56**	**2.41**	**2.40**	**2.31**	**2.31**	**2.27**
Lithuania	2.15	1.70	1.63	1.59	2.04	1.85	1.83	1.77	1.77	1.80
Luxembourg	2.95	2.52	2.25	2.42	2.33	2.15	2.08	2.05	2.04	2.06
Latvia	2.48	2.09	1.95	1.81	1.87	1.68	1.69	1.62	1.64	1.64
Malta	3.17	3.12	3.16	2.91	2.79	2.32	1.98	1.92	1.85	1.89
Netherlands	**2.71**	**2.59**	**2.49**	**2.47**	**2.49**	**2.51**	**2.48**	**2.44**	**2.41**	**2.35**
Poland	**3.86**	**3.83**	**3.79**	**3.77**	**3.54**	**3.54**	**3.47**	**3.45**	**3.37**	**3.27**
Portugal	2.69	2.66	2.61	2.57	2.16	2.17	2.11	2.21	2.08	1.95
Romania	2.83	2.89	2.78	2.78	2.44	2.52	2.44	2.40	2.39	2.34
Sweden	**1.15**	**1.12**	**1.07**	**0.98**	**0.98**	**0.85**	**0.80**	**0.77**	**0.75**	**0.74**
Slovenia	2.56	2.54	2.35	2.28	2.33	2.10	2.16	2.12	2.12	2.08
Slovakia	2.86	2.30	2.20	2.08	1.92	1.79	1.79	1.76	1.79	1.68
United Kingdom	**3.06**	**2.72**	**2.55**	**2.52**	**2.47**	**2.26**	**2.18**	**2.14**	**2.11**	**2.07**

Table A1.14 – *GHG emissions from combustion per unit of primary energy w/o nuclear energy, tCO_2eq/toe.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3.19**	**3.04**	**2.92**	**2.82**	**2.66**	**2.55**	**2.51**	**2.47**	**2.42**	**2.36**
EU27	**3.16**	**3.04**	**2.93**	**2.82**	**2.66**	**2.56**	**2.53**	**2.48**	**2.44**	**2.38**
Austria	2.23	2.10	2.01	2.04	1.80	1.66	1.68	1.69	1.70	1.69
Belgium	3.00	2.87	2.65	2.68	2.37	2.20	2.24	2.21	2.14	2.25
Bulgaria	3.10	2.91	3.17	3.19	3.39	3.23	3.10	3.10	2.88	2.86
Cyprus	2.51	2.69	2.73	2.89	2.83	2.69	2.69	2.62	2.51	2.54
Czechia	**3.59**	**3.57**	**3.43**	**3.35**	**3.18**	**3.00**	**2.95**	**3.01**	**2.96**	**2.88**
Germany	**3.54**	**3.30**	**3.18**	**2.98**	**2.87**	**2.81**	**2.78**	**2.69**	**2.63**	**2.56**
Denmark	3.04	3.12	2.86	2.67	2.51	2.10	2.13	2.00	2.00	1.85
Estonia	3.94	3.45	3.32	3.34	3.40	2.97	2.98	3.31	2.95	2.61
Greece	3.58	3.53	3.56	3.54	3.42	3.04	2.90	2.99	2.93	2.71
Spain	**3.11**	**3.11**	**2.95**	**2.85**	**2.49**	**2.46**	**2.35**	**2.34**	**2.29**	**2.22**
Finland	2.41	2.39	2.07	1.94	2.01	1.58	1.62	1.50	1.50	1.44
France	**2.79**	**2.90**	**2.91**	**2.72**	**2.51**	**2.40**	**2.35**	**2.35**	**2.31**	**2.26**
Croatia	2.40	2.26	2.34	2.36	2.22	2.08	2.10	2.08	2.00	2.00
Hungary	2.91	2.84	2.83	2.52	2.41	2.29	2.30	2.29	2.27	2.26
Ireland	3.22	3.30	3.10	3.06	2.75	2.63	2.60	2.56	2.52	2.39
Italy	**3.09**	**2.89**	**2.77**	**2.70**	**2.56**	**2.41**	**2.40**	**2.31**	**2.31**	**2.27**
Lithuania	3.06	2.79	2.50	2.41	2.04	1.85	1.83	1.77	1.77	1.80
Luxembourg	2.95	2.52	2.25	2.42	2.33	2.15	2.08	2.05	2.04	2.06
Latvia	2.48	2.09	1.95	1.81	1.87	1.68	1.69	1.62	1.64	1.64
Malta	3.17	3.12	3.16	2.91	2.79	2.32	1.98	1.92	1.85	1.89
Netherlands	**2.75**	**2.63**	**2.53**	**2.50**	**2.52**	**2.55**	**2.52**	**2.47**	**2.44**	**2.38**
Poland	**3.86**	**3.83**	**3.79**	**3.77**	**3.54**	**3.54**	**3.47**	**3.45**	**3.37**	**3.27**
Portugal	2.69	2.66	2.61	2.57	2.16	2.17	2.11	2.21	2.08	1.95
Romania	2.83	2.89	2.90	2.89	2.68	2.79	2.69	2.63	2.62	2.57
Sweden	**1.87**	**1.78**	**1.58**	**1.58**	**1.40**	**1.29**	**1.20**	**1.17**	**1.14**	**1.12**
Slovenia	3.23	3.21	2.91	2.88	2.87	2.66	2.72	2.71	2.66	2.63
Slovakia	3.40	2.79	2.97	2.86	2.50	2.44	2.39	2.33	2.34	2.24
United Kingdom	**3.34**	**3.05**	**2.83**	**2.78**	**2.65**	**2.47**	**2.39**	**2.34**	**2.29**	**2.24**

Table A1.15 – *GHG emissions per unit of gross inland consumption w/o nuclear energy, t CO_2eq/toe.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3.86**	**3.66**	**3.47**	**3.31**	**3.11**	**3.05**	**3.00**	**2.95**	**2.91**	**2.85**
EU27	**3.83**	**3.65**	**3.49**	**3.33**	**3.12**	**3.07**	**3.03**	**2.97**	**2.93**	**2.88**
Austria	3.10	2.90	2.74	2.68	2.42	2.33	2.32	2.35	2.31	2.30
Belgium	3.86	3.53	3.17	3.10	2.73	2.52	2.57	2.55	2.47	2.57
Bulgaria	4.09	3.86	4.16	4.12	4.25	4.15	4.12	4.08	3.86	3.85
Cyprus	3.44	3.54	3.43	3.61	3.42	3.62	3.56	3.49	3.35	3.36
Czechia	**4.22**	**4.04**	**3.95**	**3.78**	**3.64**	**3.62**	**3.63**	**3.58**	**3.55**	**3.46**
Germany	**3.95**	**3.71**	**3.49**	**3.26**	**3.12**	**3.07**	**3.04**	**2.95**	**2.90**	**2.83**
Denmark	3.96	3.92	3.68	3.41	3.17	2.86	2.90	2.77	2.77	2.65
Estonia	4.26	3.79	3.70	3.66	3.75	3.33	3.30	3.65	3.27	3.05
Greece	4.65	4.65	4.53	4.39	4.18	3.96	3.88	3.92	3.87	3.64
Spain	**3.89**	**3.73**	**3.60**	**3.41**	**3.14**	**3.12**	**2.99**	**2.93**	**2.87**	**2.81**
Finland	3.00	2.95	2.60	2.42	2.42	2.04	2.05	1.91	1.91	1.86
France	**3.76**	**3.78**	**3.71**	**3.46**	**3.25**	**3.18**	**3.10**	**3.10**	**3.07**	**3.00**
Croatia	3.26	2.85	3.03	3.03	2.93	2.81	2.80	2.79	2.71	2.69
Hungary	3.70	3.44	3.48	3.08	2.92	2.90	2.90	2.87	2.85	2.85
Ireland	5.30	5.43	4.76	4.54	4.11	4.26	4.18	4.22	4.18	4.00
Italy	**3.50**	**3.30**	**3.18**	**3.11**	**2.92**	**2.83**	**2.84**	**2.71**	**2.73**	**2.69**
Lithuania	4.08	3.95	3.87	3.67	2.93	2.82	2.76	2.67	2.57	2.61
Luxembourg	3.63	3.03	2.64	2.71	2.62	2.47	2.40	2.37	2.35	2.37
Latvia	3.25	2.69	2.60	2.38	2.55	2.45	2.44	2.36	2.35	2.39
Malta	3.38	3.40	3.48	3.19	3.16	2.93	2.65	2.50	2.41	2.41
Netherlands	**3.24**	**3.07**	**2.82**	**2.57**	**2.48**	**2.55**	**2.50**	**2.44**	**2.43**	**2.40**
Poland	**4.60**	**4.48**	**4.45**	**4.38**	**4.07**	**4.08**	**3.98**	**3.94**	**3.85**	**3.76**
Portugal	3.41	3.31	3.22	3.12	2.82	2.87	2.79	2.87	2.79	2.65
Romania	3.92	3.93	3.97	3.99	3.67	3.95	3.85	3.76	3.78	3.72
Sweden	**2.39**	**2.26**	**2.07**	**2.04**	**1.80**	**1.71**	**1.60**	**1.56**	**1.52**	**1.52**
Slovenia	4.09	3.85	3.48	3.38	3.31	3.24	3.29	3.27	3.20	3.19
Slovakia	4.04	3.57	3.61	3.61	3.27	3.33	3.30	3.18	3.17	3.08
United Kingdom	**4.07**	**3.73**	**3.37**	**3.23**	**3.06**	**2.90**	**2.80**	**2.76**	**2.71**	**2.68**

Table A1.16 – *GHG emissions including bunkers per unit of gross domestic product t CO_2eq/k€ (chain linked volumes, 2015).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.64**	**0.52**	**0.44**	**0.41**	**0.36**	**0.31**	**0.30**	**0.30**	**0.29**	**0.27**
EU27	**0.65**	**0.53**	**0.46**	**0.43**	**0.38**	**0.33**	**0.33**	**0.32**	**0.31**	**0.29**
Austria	0.38	0.33	0.29	0.31	0.26	0.23	0.23	0.23	0.22	0.22
Belgium	0.65	0.59	0.52	0.48	0.42	0.34	0.34	0.34	0.35	0.33
Bulgaria	3.05	2.50	2.16	1.78	1.45	1.36	1.26	1.27	1.15	1.08
Cyprus	0.70	0.70	0.70	0.64	0.56	0.55	0.56	0.54	0.51	0.50
Czechia	**2.06**	**1.50**	**1.32**	**1.08**	**0.90**	**0.76**	**0.75**	**0.72**	**0.69**	**0.64**
Germany	**0.60**	**0.49**	**0.42**	**0.39**	**0.35**	**0.31**	**0.30**	**0.29**	**0.28**	**0.26**
Denmark	0.42	0.42	0.33	0.29	0.27	0.20	0.20	0.19	0.18	0.17
Estonia	6.10	2.22	1.42	1.10	1.25	0.92	0.97	0.98	0.90	0.62
Greece	0.90	0.81	0.78	0.68	0.60	0.59	0.57	0.60	0.57	0.53
Spain	**0.52**	**0.48**	**0.48**	**0.47**	**0.37**	**0.35**	**0.33**	**0.33**	**0.32**	**0.30**
Finland	0.53	0.53	0.41	0.36	0.37	0.27	0.28	0.26	0.26	0.25
France	**0.38**	**0.35**	**0.31**	**0.29**	**0.26**	**0.22**	**0.22**	**0.22**	**0.21**	**0.20**
Croatia	1.25	0.76	0.74	0.69	0.62	0.54	0.53	0.53	0.49	0.48
Hungary	1.54	1.09	0.92	0.76	0.66	0.55	0.55	0.54	0.52	0.49
Ireland	0.95	0.66	0.49	0.39	0.34	0.24	0.24	0.22	0.21	0.19
Italy	**0.39**	**0.36**	**0.34**	**0.35**	**0.31**	**0.28**	**0.27**	**0.26**	**0.26**	**0.25**
Lithuania	3.77	1.41	0.98	0.80	0.69	0.56	0.55	0.54	0.51	0.49
Luxembourg	0.68	0.41	0.31	0.36	0.30	0.22	0.21	0.22	0.22	0.21
Latvia	3.24	1.18	0.72	0.57	0.63	0.49	0.48	0.47	0.44	0.46
Malta			0.88	0.81	1.02	0.77	0.75	0.84	0.82	0.80
Netherlands	**0.68**	**0.58**	**0.47**	**0.44**	**0.40**	**0.36**	**0.35**	**0.33**	**0.32**	**0.31**
Poland	**3.15**	**2.29**	**1.57**	**1.38**	**1.12**	**0.91**	**0.91**	**0.90**	**0.85**	**0.77**
Portugal	0.53	0.50	0.49	0.49	0.39	0.41	0.39	0.41	0.38	0.35
Romania	2.64	1.99	1.53	1.23	0.85	0.72	0.67	0.65	0.62	0.58
Sweden	**0.32**	**0.28**	**0.23**	**0.20**	**0.18**	**0.14**	**0.13**	**0.13**	**0.12**	**0.12**
Slovenia	0.96	0.79	0.64	0.59	0.52	0.44	0.45	0.43	0.42	0.39
Slovakia	2.40	1.45	1.13	0.91	0.65	0.51	0.51	0.51	0.49	0.45
United Kingdom	**0.52**	**0.45**	**0.37**	**0.31**	**0.27**	**0.21**	**0.20**	**0.19**	**0.19**	**0.18**

Table A1.17 – *Gross available energy per unit of gross domestic product toe/M€ (chain linked volumes, 2015).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**186.31**	**161.71**	**144.99**	**140.62**	**129.78**	**113.23**	**111.81**	**110.79**	**107.96**	**104.53**
EU27	**193.51**	**167.68**	**151.05**	**149.04**	**138.09**	**121.90**	**120.62**	**119.75**	**116.47**	**112.77**
Austria	121.32	112.78	104.27	112.38	106.70	98.00	97.43	96.86	92.24	92.80
Belgium	212.54	202.77	196.53	184.05	176.87	143.67	151.27	150.58	147.64	146.25
Bulgaria	854.42	790.60	691.57	566.10	430.44	410.76	387.28	387.30	377.05	360.54
Cyprus	179.89	178.60	186.44	165.93	151.17	142.13	144.49	141.22	137.78	133.95
Czechia	**521.47**	**400.83**	**362.64**	**330.15**	**291.63**	**248.01**	**239.62**	**237.70**	**231.26**	**222.71**
Germany	**168.88**	**147.44**	**134.85**	**132.96**	**122.53**	**105.91**	**104.36**	**102.16**	**98.54**	**94.97**
Denmark	103.89	106.04	87.66	81.27	82.42	66.44	65.62	63.67	62.52	59.27
Estonia	1435.87	585.63	383.96	300.02	332.52	275.53	292.51	269.06	274.68	202.01
Greece	194.80	178.19	173.36	154.31	143.60	146.90	144.79	149.46	144.36	141.99
Spain	**157.21**	**147.84**	**148.57**	**148.14**	**128.28**	**120.92**	**118.66**	**120.23**	**117.47**	**112.37**
Finland	207.80	214.53	189.21	175.81	175.71	155.87	157.05	154.22	154.99	150.25
France	**152.90**	**151.73**	**140.35**	**139.52**	**130.21**	**119.08**	**115.70**	**113.19**	**110.89**	**107.75**
Croatia	378.57	264.72	241.05	224.58	210.35	190.72	185.93	186.10	177.12	174.55
Hungary	471.30	364.58	305.80	278.71	261.46	223.63	221.69	221.98	210.98	201.66
Ireland	176.47	119.75	101.45	83.87	80.19	54.64	56.32	50.88	47.60	45.05
Italy	**111.37**	**109.12**	**106.12**	**110.31**	**104.99**	**95.22**	**93.33**	**94.92**	**92.81**	**91.61**
Lithuania	1273.68	556.95	367.28	311.98	232.88	194.40	196.37	197.08	193.61	184.65
Luxembourg	180.57	128.15	105.59	119.91	102.82	80.29	77.03	78.07	78.82	77.65
Latvia	985.52	434.15	272.55	230.10	237.23	188.68	187.19	185.33	178.91	179.38
Malta			242.75	241.53	310.90	229.53	237.41	263.04	258.11	253.47
Netherlands	**210.47**	**184.82**	**157.45**	**160.00**	**150.45**	**128.10**	**127.50**	**124.77**	**119.34**	**116.36**
Poland	**684.46**	**509.75**	**352.97**	**315.31**	**273.59**	**223.16**	**226.95**	**226.65**	**218.51**	**202.96**
Portugal	152.88	148.67	149.42	153.94	132.53	134.83	132.51	134.00	127.24	124.31
Romania	671.47	502.91	399.59	319.68	251.71	199.30	189.80	186.50	178.77	169.29
Sweden	**207.75**	**186.61**	**149.15**	**142.45**	**128.14**	**107.29**	**109.94**	**110.45**	**108.75**	**104.95**
Slovenia	294.45	255.86	225.37	218.64	191.09	168.93	170.41	167.95	161.12	152.74
Slovakia	693.83	488.04	409.68	338.08	252.01	203.90	200.63	205.57	196.00	190.96
United Kingdom	**135.30**	**131.98**	**115.25**	**101.56**	**90.18**	**73.20**	**71.04**	**68.95**	**68.01**	**65.84**

Table A1.18 – *Energy GHG emissions including bunkers per unit of gross available energy w/o non-energy consumption, t CO_2eq/toe.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**2.82**	**2.67**	**2.57**	**2.50**	**2.39**	**2.31**	**2.29**	**2.27**	**2.23**	**2.18**
EU27	**2.77**	**2.65**	**2.55**	**2.47**	**2.35**	**2.29**	**2.27**	**2.25**	**2.22**	**2.16**
Austria	2.27	2.15	2.07	2.10	1.86	1.73	1.75	1.76	1.78	1.78
Belgium	2.42	2.37	2.20	2.27	2.08	2.12	1.99	2.01	2.14	2.04
Bulgaria	2.69	2.38	2.34	2.42	2.68	2.57	2.44	2.48	2.28	2.23
Cyprus	2.98	3.11	3.10	3.23	3.14	3.04	3.07	3.03	2.95	2.97
Czechia	**3.36**	**3.30**	**3.14**	**2.86**	**2.66**	**2.52**	**2.53**	**2.51**	**2.45**	**2.37**
Germany	**3.15**	**2.94**	**2.80**	**2.66**	**2.62**	**2.67**	**2.67**	**2.61**	**2.56**	**2.49**
Denmark	3.14	3.22	3.00	2.82	2.65	2.28	2.32	2.19	2.20	2.08
Estonia	3.94	3.46	3.33	3.36	3.41	3.00	3.01	3.33	2.99	2.66
Greece	3.65	3.60	3.61	3.60	3.50	3.18	3.06	3.15	3.13	2.93
Spain	**2.67**	**2.73**	**2.65**	**2.66**	**2.33**	**2.33**	**2.24**	**2.25**	**2.23**	**2.17**
Finland	2.03	2.02	1.76	1.66	1.75	1.38	1.42	1.33	1.35	1.29
France	**1.79**	**1.71**	**1.69**	**1.59**	**1.50**	**1.37**	**1.41**	**1.42**	**1.37**	**1.37**
Croatia	2.46	2.29	2.37	2.39	2.25	2.13	2.15	2.13	2.08	2.07
Hungary	2.55	2.44	2.42	2.21	2.06	1.92	1.93	1.94	1.93	1.91
Ireland	3.33	3.41	3.24	3.22	2.91	2.82	2.78	2.78	2.75	2.62
Italy	**3.09**	**2.91**	**2.81**	**2.75**	**2.61**	**2.48**	**2.48**	**2.40**	**2.39**	**2.35**
Lithuania	2.18	1.74	1.66	1.64	2.09	1.91	1.91	1.86	1.87	1.90
Luxembourg	3.07	2.69	2.51	2.69	2.61	2.48	2.45	2.45	2.46	2.46
Latvia	2.55	2.14	1.98	1.93	2.02	1.85	1.89	1.81	1.75	1.85
Malta	4.44	5.19	3.43	3.19	3.14	3.16	2.95	3.04	3.03	3.02
Netherlands	**2.85**	**2.77**	**2.74**	**2.74**	**2.73**	**2.81**	**2.75**	**2.72**	**2.69**	**2.64**
Poland	**3.86**	**3.84**	**3.80**	**3.78**	**3.55**	**3.56**	**3.49**	**3.48**	**3.40**	**3.30**
Portugal	2.77	2.74	2.69	2.67	2.30	2.34	2.29	2.40	2.29	2.19
Romania	2.84	2.90	2.80	2.79	2.45	2.55	2.47	2.43	2.40	2.35
Sweden	**1.21**	**1.19**	**1.18**	**1.11**	**1.12**	**0.98**	**0.95**	**0.94**	**0.89**	**0.90**
Slovenia	2.56	2.55	2.36	2.29	2.34	2.13	2.19	2.15	2.17	2.12
Slovakia	2.87	2.30	2.20	2.09	1.93	1.80	1.80	1.77	1.80	1.69
United Kingdom	**3.14**	**2.82**	**2.70**	**2.69**	**2.65**	**2.47**	**2.40**	**2.38**	**2.35**	**2.31**

Table A1.19 – *Energy GHG emissions including bunkers per unit of gross available energy w/o non-energy consumption and nuclear energy, t CO_2eq/toe.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3.23**	**3.11**	**3.01**	**2.92**	**2.77**	**2.68**	**2.64**	**2.61**	**2.57**	**2.51**
EU27	**3.21**	**3.10**	**3.01**	**2.91**	**2.76**	**2.68**	**2.64**	**2.61**	**2.57**	**2.52**
Austria	2.27	2.15	2.07	2.10	1.86	1.73	1.75	1.76	1.78	1.78
Belgium	3.11	2.99	2.81	2.87	2.60	2.43	2.49	2.49	2.47	2.54
Bulgaria	3.13	2.97	3.19	3.23	3.43	3.27	3.15	3.15	2.94	2.91
Cyprus	2.98	3.11	3.10	3.23	3.14	3.04	3.07	3.03	2.95	2.97
Czechia	**3.60**	**3.58**	**3.44**	**3.37**	**3.20**	**3.03**	**2.98**	**3.04**	**3.00**	**2.92**
Germany	**3.57**	**3.35**	**3.25**	**3.06**	**2.96**	**2.90**	**2.88**	**2.79**	**2.74**	**2.67**
Denmark	3.14	3.22	3.00	2.82	2.65	2.28	2.32	2.19	2.20	2.08
Estonia	3.94	3.46	3.33	3.36	3.41	3.00	3.01	3.33	2.99	2.66
Greece	3.65	3.60	3.61	3.60	3.50	3.18	3.06	3.15	3.13	2.93
Spain	**3.18**	**3.20**	**3.06**	**2.96**	**2.66**	**2.64**	**2.55**	**2.54**	**2.50**	**2.46**
Finland	2.47	2.44	2.14	2.01	2.07	1.67	1.71	1.59	1.61	1.56
France	**2.87**	**3.00**	**3.03**	**2.84**	**2.64**	**2.54**	**2.48**	**2.49**	**2.46**	**2.42**
Croatia	2.46	2.29	2.37	2.39	2.25	2.13	2.15	2.13	2.08	2.07
Hungary	2.93	2.87	2.87	2.56	2.45	2.32	2.33	2.33	2.31	2.30
Ireland	3.33	3.41	3.24	3.22	2.91	2.82	2.78	2.78	2.75	2.62
Italy	**3.09**	**2.91**	**2.81**	**2.75**	**2.61**	**2.48**	**2.48**	**2.40**	**2.39**	**2.35**
Lithuania	3.09	2.83	2.53	2.46	2.09	1.91	1.91	1.86	1.87	1.90
Luxembourg	3.07	2.69	2.51	2.69	2.61	2.48	2.45	2.45	2.46	2.46
Latvia	2.55	2.14	1.98	1.93	2.02	1.85	1.89	1.81	1.75	1.85
Malta	4.44	5.19	3.43	3.19	3.14	3.16	2.95	3.04	3.03	3.02
Netherlands	**2.89**	**2.81**	**2.78**	**2.77**	**2.76**	**2.84**	**2.79**	**2.74**	**2.72**	**2.67**
Poland	**3.86**	**3.84**	**3.80**	**3.78**	**3.55**	**3.56**	**3.49**	**3.48**	**3.40**	**3.30**
Portugal	2.77	2.74	2.69	2.67	2.30	2.34	2.29	2.40	2.29	2.19
Romania	2.84	2.90	2.91	2.90	2.69	2.82	2.72	2.67	2.63	2.58
Sweden	**1.96**	**1.88**	**1.72**	**1.76**	**1.58**	**1.47**	**1.40**	**1.39**	**1.33**	**1.34**
Slovenia	3.24	3.22	2.93	2.89	2.88	2.68	2.75	2.74	2.70	2.67
Slovakia	3.41	2.79	2.98	2.87	2.51	2.45	2.41	2.35	2.36	2.26
United Kingdom	**3.42**	**3.16**	**2.99**	**2.97**	**2.84**	**2.69**	**2.62**	**2.59**	**2.54**	**2.50**

Table A1.20 – *Share of renewable energy in gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**4.3%**	**5.1%**	**5.7%**	**6.7%**	**10.2%**	**13.4%**	**13.6%**	**13.9%**	**14.6%**	**15.4%**
EU27	**4.9%**	**5.7%**	**6.4%**	**7.5%**	**11.1%**	**14.1%**	**14.2%**	**14.5%**	**15.0%**	**15.8%**
Austria	19.9%	21.6%	22.5%	20.9%	27.2%	29.8%	30.2%	29.8%	29.4%	29.8%
Belgium	1.0%	1.0%	1.1%	2.0%	4.8%	6.9%	6.9%	7.2%	7.7%	7.7%
Bulgaria	1.1%	1.7%	4.1%	5.5%	8.3%	11.1%	11.1%	10.3%	13.4%	13.1%
Cyprus	0.4%	2.3%	1.9%	2.1%	4.0%	6.8%	6.6%	6.9%	9.1%	9.4%
Czechia	**2.3%**	**3.4%**	**3.9%**	**4.6%**	**7.0%**	**10.4%**	**10.6%**	**10.4%**	**10.5%**	**11.4%**
Germany	**1.5%**	**1.8%**	**2.6%**	**5.4%**	**9.2%**	**12.6%**	**12.4%**	**13.2%**	**13.9%**	**14.9%**
Denmark	6.0%	6.8%	9.6%	14.8%	19.8%	29.1%	29.3%	32.2%	32.0%	34.8%
Estonia	1.9%	9.2%	10.8%	11.2%	15.1%	17.2%	16.7%	18.7%	18.7%	24.4%
Greece	5.0%	5.5%	5.2%	5.5%	7.7%	11.8%	11.4%	12.0%	13.2%	13.5%
Spain	**7.0%**	**5.4%**	**5.5%**	**5.8%**	**11.6%**	**13.9%**	**14.5%**	**13.1%**	**14.3%**	**14.9%**
Finland	19.2%	21.0%	23.7%	23.2%	25.3%	32.1%	31.4%	34.4%	34.6%	35.7%
France	**6.7%**	**7.1%**	**6.1%**	**5.7%**	**8.3%**	**9.4%**	**10.3%**	**10.2%**	**11.0%**	**11.3%**
Croatia	12.5%	19.6%	18.4%	18.9%	22.0%	23.2%	23.5%	21.5%	25.2%	24.3%
Hungary	2.6%	3.3%	3.3%	5.9%	10.4%	12.0%	11.8%	11.2%	10.5%	10.6%
Ireland	1.6%	1.4%	1.6%	2.4%	4.5%	7.7%	7.6%	9.1%	9.8%	10.9%
Italy	**4.4%**	**4.8%**	**5.8%**	**7.4%**	**12.4%**	**16.9%**	**16.9%**	**18.1%**	**18.7%**	**19.0%**
Lithuania	2.0%	5.6%	9.2%	9.8%	15.0%	19.8%	19.9%	20.5%	20.3%	20.4%
Luxembourg	0.5%	1.0%	1.1%	1.5%	2.8%	5.0%	5.3%	6.1%	6.5%	7.1%
Latvia	13.1%	27.1%	30.8%	32.2%	31.0%	35.1%	37.0%	42.5%	38.9%	39.2%
Malta	0.0%	0.0%	0.0%	0.1%	0.5%	2.8%	3.4%	4.7%	5.4%	5.6%
Netherlands	**1.1%**	**1.2%**	**1.7%**	**2.7%**	**3.8%**	**4.9%**	**4.9%**	**5.3%**	**6.0%**	**7.2%**
Poland	**1.5%**	**3.9%**	**4.3%**	**4.8%**	**7.2%**	**9.5%**	**8.9%**	**8.6%**	**8.6%**	**9.5%**
Portugal	19.0%	16.0%	14.8%	12.7%	22.4%	23.6%	26.5%	22.1%	25.4%	25.3%
Romania	2.5%	6.0%	11.0%	12.8%	16.7%	18.7%	19.5%	18.0%	18.0%	18.2%
Sweden	**24.3%**	**25.5%**	**30.9%**	**28.4%**	**33.2%**	**43.5%**	**40.3%**	**42.0%**	**39.6%**	**42.8%**
Slovenia	9.1%	8.9%	13.7%	13.4%	16.0%	17.1%	17.4%	15.9%	16.8%	17.0%
Slovakia	1.5%	2.8%	2.8%	4.3%	7.5%	9.7%	9.6%	9.2%	9.3%	12.9%
United Kingdom	**0.5%**	**0.8%**	**1.0%**	**1.7%**	**3.5%**	**8.3%**	**8.8%**	**9.7%**	**10.9%**	**12.0%**

Table A1.21 – *Share of solid fuel energy in gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**26.7%**	**21.4%**	**18.2%**	**17.0%**	**15.6%**	**15.8%**	**14.4%**	**13.6%**	**13.1%**	**10.7%**
EU27	**26.3%**	**21.4%**	**18.6%**	**17.1%**	**15.7%**	**16.1%**	**15.4%**	**14.7%**	**14.2%**	**11.6%**
Austria	16.2%	12.7%	12.3%	11.8%	9.7%	9.6%	8.8%	8.9%	8.1%	8.1%
Belgium	21.7%	16.0%	13.5%	8.7%	6.2%	6.2%	5.6%	5.4%	5.6%	5.4%
Bulgaria	31.0%	32.6%	34.4%	34.4%	38.7%	35.4%	31.2%	32.3%	29.6%	27.8%
Cyprus	4.0%	0.7%	1.3%	1.4%	0.6%	0.2%	0.0%	0.1%	0.5%	0.7%
Czechia	**62.9%**	**54.2%**	**52.3%**	**44.4%**	**41.5%**	**39.0%**	**39.7%**	**36.4%**	**36.2%**	**33.1%**
Germany	**36.1%**	**26.8%**	**24.8%**	**23.6%**	**23.4%**	**25.0%**	**24.1%**	**22.1%**	**22.1%**	**17.6%**
Denmark	33.9%	32.3%	20.4%	18.7%	18.7%	10.5%	11.2%	8.6%	8.7%	5.0%
Estonia	2.3%	0.7%	0.9%	0.2%	0.4%	0.2%	0.1%	0.2%	0.3%	0.3%
Greece	36.3%	35.7%	32.4%	28.8%	27.7%	23.3%	18.5%	19.7%	19.1%	13.6%
Spain	**21.8%**	**18.5%**	**16.9%**	**14.2%**	**5.6%**	**11.1%**	**8.7%**	**9.9%**	**8.8%**	**3.9%**
Finland	14.3%	14.7%	11.1%	9.4%	12.5%	8.4%	8.7%	8.3%	7.9%	6.2%
France	**8.9%**	**6.6%**	**5.8%**	**5.1%**	**4.4%**	**3.6%**	**3.6%**	**3.9%**	**3.6%**	**2.9%**
Croatia	8.4%	2.2%	5.1%	7.0%	7.2%	7.1%	7.6%	4.4%	4.2%	4.8%
Hungary	21.3%	17.8%	15.3%	10.8%	10.2%	9.4%	8.6%	8.4%	8.0%	6.8%
Ireland	20.3%	16.5%	12.6%	12.2%	8.2%	10.3%	9.4%	7.9%	5.5%	2.5%
Italy	**9.9%**	**7.6%**	**7.2%**	**8.7%**	**7.7%**	**7.9%**	**7.1%**	**5.9%**	**5.4%**	**4.2%**
Lithuania	4.8%	2.5%	1.1%	1.9%	2.6%	2.2%	2.2%	2.1%	2.2%	2.2%
Luxembourg	31.6%	14.7%	3.0%	1.6%	1.4%	1.2%	1.2%	1.0%	0.9%	0.9%
Latvia	7.9%	3.8%	1.9%	1.7%	2.3%	1.1%	0.9%	0.9%	0.9%	0.8%
Malta	23.3%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Netherlands	**12.7%**	**11.8%**	**9.9%**	**9.7%**	**8.8%**	**14.5%**	**13.1%**	**11.7%**	**10.7%**	**8.5%**
Poland	**76.3%**	**70.5%**	**63.1%**	**59.0%**	**54.4%**	**50.5%**	**49.3%**	**47.2%**	**46.1%**	**42.2%**
Portugal	16.0%	17.4%	15.0%	12.2%	6.8%	13.8%	12.1%	13.1%	11.2%	5.2%
Romania	20.1%	23.1%	20.3%	22.6%	19.9%	18.5%	16.6%	16.1%	15.0%	14.8%
Sweden	**5.7%**	**5.1%**	**4.6%**	**4.5%**	**4.2%**	**4.2%**	**3.9%**	**3.8%**	**3.9%**	**3.7%**
Slovenia	27.4%	22.6%	19.9%	20.3%	20.0%	16.4%	17.1%	16.5%	16.5%	15.9%
Slovakia	36.8%	30.3%	24.1%	22.7%	22.0%	20.2%	19.7%	19.6%	19.6%	16.0%
United Kingdom	**29.8%**	**21.1%**	**15.6%**	**16.1%**	**15.0%**	**12.9%**	**6.7%**	**5.4%**	**4.4%**	**3.2%**

Table A1.22 – *Share of energy from oil and petroleum products in gross domestic energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**38.3%**	**39.5%**	**38.6%**	**37.5%**	**35.0%**	**34.7%**	**34.9%**	**35.1%**	**35.0%**	**35.4%**
EU27	**38.2%**	**39.7%**	**39.1%**	**37.7%**	**35.0%**	**34.3%**	**34.4%**	**34.6%**	**34.5%**	**34.9%**
Austria	42.7%	42.0%	42.2%	42.0%	37.4%	35.6%	35.9%	35.3%	36.7%	37.3%
Belgium	38.1%	42.4%	40.7%	41.7%	39.9%	43.3%	40.0%	39.9%	41.5%	38.7%
Bulgaria	34.2%	27.0%	22.4%	24.8%	22.4%	23.2%	23.7%	24.0%	24.3%	25.2%
Cyprus	95.7%	97.1%	96.8%	96.4%	95.2%	92.5%	92.8%	92.1%	89.6%	88.8%
Czechia	**17.9%**	**19.1%**	**19.0%**	**21.9%**	**20.4%**	**21.2%**	**19.9%**	**22.3%**	**22.5%**	**23.0%**
Germany	**35.5%**	**39.5%**	**38.3%**	**36.0%**	**33.5%**	**34.5%**	**34.6%**	**35.1%**	**34.4%**	**36.0%**
Denmark	45.6%	44.2%	45.1%	41.7%	38.3%	38.5%	38.3%	39.1%	39.3%	40.0%
Estonia	89.4%	80.5%	76.0%	76.0%	79.5%	76.0%	78.2%	77.4%	76.2%	62.7%
Greece	57.8%	58.2%	56.0%	57.0%	51.3%	50.0%	51.9%	48.9%	48.0%	50.1%
Spain	**49.7%**	**54.1%**	**52.0%**	**49.0%**	**46.9%**	**42.7%**	**43.6%**	**43.8%**	**44.1%**	**44.2%**
Finland	38.4%	35.1%	33.5%	35.0%	33.5%	30.0%	31.2%	29.4%	29.5%	28.9%
France	**38.6%**	**35.6%**	**34.2%**	**33.8%**	**30.6%**	**31.2%**	**30.7%**	**30.9%**	**30.2%**	**30.7%**
Croatia	50.2%	50.4%	46.8%	46.1%	39.4%	38.2%	37.9%	39.1%	38.6%	37.3%
Hungary	30.1%	28.8%	27.2%	26.1%	25.6%	27.9%	27.3%	28.3%	30.2%	30.6%
Ireland	59.8%	60.6%	61.8%	61.7%	55.8%	54.6%	54.6%	53.4%	53.7%	54.8%
Italy	**57.3%**	**57.8%**	**51.5%**	**44.0%**	**38.7%**	**36.4%**	**35.5%**	**34.7%**	**34.9%**	**34.8%**
Lithuania	42.1%	34.3%	29.6%	30.1%	36.4%	36.5%	38.9%	38.1%	39.9%	38.9%
Luxembourg	45.7%	54.3%	63.5%	65.8%	61.8%	63.1%	62.8%	63.7%	64.7%	65.0%
Latvia	45.1%	43.1%	35.1%	32.4%	32.9%	33.9%	33.9%	34.3%	33.2%	33.2%
Malta	76.7%	96.1%	100.0%	99.9%	99.5%	85.3%	78.3%	57.0%	53.7%	54.4%
Netherlands	**38.7%**	**38.4%**	**39.5%**	**41.4%**	**38.7%**	**39.7%**	**40.4%**	**40.9%**	**40.4%**	**39.5%**
Poland	**12.8%**	**16.0%**	**22.0%**	**23.7%**	**25.5%**	**25.1%**	**26.4%**	**28.5%**	**28.8%**	**30.1%**
Portugal	65.0%	66.2%	61.5%	58.8%	50.8%	43.9%	44.0%	42.9%	42.6%	45.3%
Romania	30.5%	29.0%	27.5%	25.3%	24.7%	27.2%	27.8%	28.8%	29.0%	29.7%
Sweden	**31.4%**	**32.0%**	**30.3%**	**29.5%**	**29.6%**	**20.5%**	**22.6%**	**21.5%**	**23.1%**	**21.8%**
Slovenia	30.9%	38.3%	36.8%	34.1%	35.9%	35.2%	35.8%	35.2%	35.9%	35.3%
Slovakia	21.0%	19.1%	16.1%	17.5%	19.8%	19.1%	20.3%	21.4%	22.2%	21.1%
United Kingdom	**39.0%**	**38.0%**	**35.9%**	**36.3%**	**34.9%**	**37.2%**	**38.3%**	**39.4%**	**39.0%**	**39.1%**

Table A1.23 – *Share of natural gas energy in gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**17.8%**	**20.0%**	**22.9%**	**24.2%**	**25.3%**	**21.8%**	**23.2%**	**23.7%**	**23.6%**	**24.6%**
EU27	**17.2%**	**18.6%**	**20.6%**	**22.4%**	**23.3%**	**20.4%**	**21.4%**	**22.2%**	**22.0%**	**23.1%**
Austria	20.7%	23.6%	22.5%	23.5%	23.3%	20.5%	21.2%	22.3%	21.7%	22.1%
Belgium	16.7%	19.6%	22.5%	24.9%	27.2%	25.8%	24.9%	25.5%	27.2%	26.8%
Bulgaria	19.1%	19.6%	15.7%	14.0%	12.8%	13.9%	14.7%	14.6%	13.7%	13.0%
Cyprus	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Czechia	**10.5%**	**15.6%**	**18.2%**	**16.9%**	**17.7%**	**15.4%**	**16.8%**	**16.6%**	**15.6%**	**16.7%**
Germany	**15.5%**	**19.7%**	**21.0%**	**22.4%**	**22.4%**	**20.5%**	**22.0%**	**23.4%**	**23.3%**	**24.7%**
Denmark	10.1%	15.8%	22.8%	22.2%	21.7%	16.6%	16.3%	15.5%	15.1%	14.8%
Estonia	12.7%	10.9%	14.0%	15.2%	10.0%	7.2%	7.1%	7.0%	6.7%	7.9%
Greece	0.6%	0.2%	6.1%	7.6%	11.4%	11.1%	14.8%	17.2%	17.3%	19.1%
Spain	**5.6%**	**7.5%**	**12.3%**	**20.7%**	**23.9%**	**20.0%**	**20.2%**	**20.9%**	**20.7%**	**24.3%**
Finland	7.6%	9.7%	10.5%	10.4%	10.4%	6.8%	6.1%	5.6%	6.2%	6.2%
France	**11.5%**	**12.3%**	**14.0%**	**14.8%**	**15.8%**	**13.5%**	**15.0%**	**15.1%**	**14.5%**	**14.9%**
Croatia	22.8%	24.5%	26.2%	24.1%	27.8%	24.5%	25.3%	28.1%	26.4%	27.4%
Hungary	30.6%	35.2%	38.3%	42.4%	36.9%	29.7%	31.5%	32.0%	31.0%	31.7%
Ireland	18.2%	21.6%	23.9%	22.6%	31.2%	26.5%	28.4%	29.3%	30.0%	30.5%
Italy	**26.3%**	**27.7%**	**33.2%**	**37.3%**	**38.5%**	**35.5%**	**37.6%**	**38.6%**	**37.9%**	**39.2%**
Lithuania	28.7%	22.9%	28.1%	27.6%	35.2%	28.8%	25.0%	25.0%	22.7%	23.9%
Luxembourg	12.2%	16.8%	18.4%	24.5%	25.8%	18.4%	16.9%	16.0%	15.2%	15.1%
Latvia	29.9%	21.8%	28.3%	29.6%	31.6%	25.1%	25.3%	21.8%	24.4%	23.7%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	29.3%	34.6%	33.9%
Netherlands	**44.7%**	**45.5%**	**44.7%**	**42.2%**	**46.5%**	**37.5%**	**38.5%**	**39.3%**	**39.7%**	**42.2%**
Poland	**8.6%**	**9.0%**	**11.2%**	**13.2%**	**12.6%**	**14.4%**	**14.5%**	**14.7%**	**15.1%**	**16.3%**
Portugal	0.0%	0.0%	8.0%	13.7%	18.4%	17.2%	18.4%	22.0%	21.0%	22.2%
Romania	45.6%	41.1%	37.2%	36.0%	30.8%	28.0%	28.4%	28.9%	29.6%	27.9%
Sweden	**1.2%**	**1.5%**	**1.6%**	**1.6%**	**2.9%**	**1.5%**	**1.7%**	**1.8%**	**2.0%**	**1.9%**
Slovenia	13.3%	12.2%	12.6%	12.3%	11.9%	10.2%	10.5%	10.7%	10.6%	10.9%
Slovakia	23.9%	29.3%	32.6%	31.5%	28.3%	23.9%	23.8%	24.0%	23.9%	24.0%
United Kingdom	**22.3%**	**29.1%**	**37.5%**	**36.4%**	**39.8%**	**32.1%**	**36.6%**	**36.1%**	**36.6%**	**36.6%**

Table A1.24 – *Share of nuclear energy in gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**12.3%**	**13.6%**	**14.1%**	**14.0%**	**13.2%**	**13.4%**	**12.9%**	**12.6%**	**12.6%**	**12.8%**
EU27	**13.0%**	**14.1%**	**14.8%**	**14.8%**	**14.1%**	**14.1%**	**13.5%**	**13.1%**	**13.2%**	**13.5%**
Austria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Belgium	22.6%	19.7%	20.9%	20.8%	20.3%	12.6%	19.8%	19.3%	13.5%	20.0%
Bulgaria	13.4%	19.1%	25.3%	24.2%	21.5%	20.9%	21.9%	20.8%	21.9%	22.8%
Cyprus	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Czechia	**6.5%**	**7.5%**	**8.5%**	**14.2%**	**15.7%**	**15.9%**	**14.3%**	**16.1%**	**17.1%**	**17.6%**
Germany	**11.1%**	**11.6%**	**12.8%**	**12.1%**	**10.7%**	**7.4%**	**6.8%**	**6.1%**	**6.2%**	**6.3%**
Denmark	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Estonia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Greece	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spain	**15.8%**	**13.9%**	**12.9%**	**10.3%**	**12.4%**	**12.1%**	**12.3%**	**11.6%**	**11.1%**	**12.0%**
Finland	17.3%	17.0%	17.7%	17.2%	15.1%	17.2%	16.5%	15.7%	15.6%	16.6%
France	**35.8%**	**40.5%**	**41.8%**	**42.0%**	**41.4%**	**43.8%**	**41.1%**	**40.6%**	**42.3%**	**41.4%**
Croatia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Hungary	12.2%	13.9%	14.7%	12.7%	14.9%	15.8%	16.0%	15.3%	15.0%	15.4%
Ireland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Italy	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Lithuania	28.2%	36.5%	31.7%	31.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Luxembourg	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Latvia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Netherlands	**1.3%**	**1.4%**	**1.3%**	**1.2%**	**1.1%**	**1.2%**	**1.2%**	**1.0%**	**1.0%**	**1.2%**
Poland	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Portugal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Romania	0.0%	0.0%	3.8%	3.7%	8.3%	9.2%	8.8%	8.7%	8.6%	8.6%
Sweden	**37.1%**	**35.8%**	**31.0%**	**36.3%**	**28.7%**	**33.0%**	**32.0%**	**32.5%**	**32.8%**	**32.7%**
Slovenia	20.8%	20.2%	18.7%	20.1%	18.4%	20.5%	20.1%	21.6%	19.9%	20.5%
Slovakia	14.6%	16.6%	24.0%	25.3%	21.8%	24.8%	23.8%	23.1%	22.1%	23.8%
United Kingdom	**8.0%**	**10.3%**	**9.4%**	**9.0%**	**6.5%**	**8.1%**	**8.2%**	**8.1%**	**7.6%**	**7.3%**

Table A1.25 – *Share of electricity in gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.2%**	**0.1%**	**0.1%**	**0.1%**	**0.0%**	**0.1%**	**0.1%**	**0.1%**	**0.1%**	**0.1%**
EU27	**0.2%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.1%**	**0.0%**
Austria	-0.2%	-0.8%	-0.4%	0.7%	0.6%	2.6%	1.8%	1.6%	2.3%	0.8%
Belgium	-0.7%	0.6%	0.6%	0.9%	0.1%	3.3%	0.9%	0.9%	2.7%	-0.3%
Bulgaria	1.2%	-0.1%	-2.1%	-3.2%	-4.1%	-4.9%	-3.0%	-2.5%	-3.5%	-2.7%
Cyprus	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Czechia	**-0.1%**	**0.1%**	**-2.1%**	**-2.4%**	**-2.8%**	**-2.6%**	**-2.3%**	**-2.6%**	**-2.7%**	**-2.6%**
Germany	**0.0%**	**0.1%**	**0.1%**	**-0.1%**	**-0.4%**	**-1.3%**	**-1.4%**	**-1.4%**	**-1.3%**	**-0.9%**
Denmark	3.4%	-0.3%	0.3%	0.6%	-0.5%	2.9%	2.4%	2.2%	2.5%	2.9%
Estonia	-6.2%	-1.2%	-1.7%	-2.6%	-4.9%	-1.5%	-2.9%	-4.1%	-2.6%	3.8%
Greece	0.3%	0.3%	0.0%	1.0%	1.7%	3.4%	3.2%	2.2%	2.3%	3.6%
Spain	**0.0%**	**0.4%**	**0.3%**	**-0.1%**	**-0.6%**	**0.0%**	**0.5%**	**0.6%**	**0.7%**	**0.5%**
Finland	3.2%	2.5%	3.1%	4.2%	2.5%	4.3%	4.8%	5.1%	4.9%	5.0%
France	**-1.7%**	**-2.5%**	**-2.3%**	**-1.9%**	**-1.0%**	**-2.1%**	**-1.4%**	**-1.3%**	**-2.1%**	**-2.0%**
Croatia	6.1%	3.4%	3.5%	3.9%	3.6%	6.9%	5.5%	6.7%	5.3%	6.0%
Hungary	3.3%	0.8%	1.2%	1.9%	1.7%	4.7%	4.3%	4.2%	4.6%	4.1%
Ireland	0.0%	0.0%	0.1%	1.1%	0.3%	0.4%	-0.4%	-0.4%	0.0%	0.4%
Italy	**2.0%**	**2.0%**	**2.2%**	**2.2%**	**2.1%**	**2.6%**	**2.1%**	**2.0%**	**2.4%**	**2.1%**
Lithuania	-6.3%	-2.6%	-1.6%	-2.8%	7.3%	8.6%	9.7%	9.7%	10.6%	10.3%
Luxembourg	9.6%	12.9%	13.4%	5.8%	7.5%	11.5%	12.9%	12.3%	11.8%	11.1%
Latvia	3.9%	4.2%	4.0%	4.0%	1.6%	3.6%	2.0%	-0.1%	1.6%	2.1%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	12.0%	18.3%	9.0%	6.3%	6.1%
Netherlands	**1.2%**	**1.3%**	**2.1%**	**1.9%**	**0.3%**	**1.0%**	**0.5%**	**0.4%**	**0.9%**	**0.1%**
Poland	**-0.1%**	**-0.2%**	**-0.6%**	**-1.0%**	**-0.1%**	**0.0%**	**0.2%**	**0.2%**	**0.5%**	**0.9%**
Portugal	0.0%	0.4%	0.3%	2.1%	0.9%	0.8%	-1.9%	-0.9%	-1.0%	1.2%
Romania	1.3%	0.1%	-0.2%	-0.6%	-0.6%	-1.8%	-1.4%	-0.7%	-0.7%	0.4%
Sweden	**-0.3%**	**-0.3%**	**0.8%**	**-1.2%**	**0.4%**	**-4.1%**	**-2.1%**	**-3.2%**	**-2.9%**	**-4.5%**
Slovenia	-1.5%	-2.3%	-1.7%	-0.4%	-2.5%	-0.1%	-1.5%	-0.6%	-0.6%	-0.4%
Slovakia	2.1%	0.7%	-1.3%	-1.5%	0.5%	1.3%	1.4%	1.5%	1.9%	0.9%
United Kingdom	**0.5%**	**0.6%**	**0.5%**	**0.3%**	**0.1%**	**0.9%**	**0.8%**	**0.7%**	**0.9%**	**1.0%**

Table A1.26 – *Share of fossil energy in gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**83.1%**	**81.2%**	**80.1%**	**79.1%**	**76.5%**	**73.1%**	**73.3%**	**73.4%**	**72.6%**	**71.6%**
EU27	**81.9%**	**80.2%**	**78.7%**	**77.7%**	**74.7%**	**71.8%**	**72.2%**	**72.4%**	**71.6%**	**70.6%**
Austria	80.3%	79.2%	77.9%	78.5%	72.2%	67.6%	67.9%	68.5%	68.3%	69.4%
Belgium	77.1%	78.7%	77.4%	76.2%	74.4%	76.6%	71.7%	72.0%	75.5%	72.1%
Bulgaria	84.3%	79.2%	72.7%	73.5%	74.0%	72.6%	69.7%	71.1%	68.0%	66.4%
Cyprus	99.6%	97.7%	98.1%	97.9%	96.0%	93.2%	93.4%	93.1%	90.9%	90.6%
Czechia	**91.3%**	**89.0%**	**89.7%**	**83.6%**	**80.1%**	**76.2%**	**77.3%**	**76.0%**	**75.2%**	**73.6%**
Germany	**87.3%**	**86.5%**	**84.5%**	**82.6%**	**80.4%**	**81.3%**	**82.1%**	**82.1%**	**81.2%**	**79.7%**
Denmark	90.6%	93.5%	90.1%	84.6%	80.6%	68.0%	68.3%	65.6%	65.4%	62.3%
Estonia	104.3%	92.0%	90.9%	91.4%	89.8%	84.3%	86.2%	85.4%	83.9%	71.7%
Greece	94.7%	94.2%	94.8%	93.5%	90.5%	84.8%	85.4%	85.9%	84.6%	82.9%
Spain	**77.2%**	**80.3%**	**81.3%**	**84.0%**	**76.5%**	**74.0%**	**72.7%**	**74.7%**	**73.9%**	**72.7%**
Finland	60.3%	59.6%	55.2%	55.0%	56.8%	46.0%	46.8%	44.2%	44.5%	42.2%
France	**59.2%**	**54.9%**	**54.4%**	**54.1%**	**51.3%**	**48.9%**	**50.0%**	**50.6%**	**48.9%**	**49.3%**
Croatia	81.4%	77.1%	78.1%	77.2%	74.4%	69.9%	70.9%	71.8%	69.5%	69.7%
Hungary	82.0%	82.0%	80.9%	79.5%	73.0%	67.5%	68.0%	69.4%	69.9%	70.0%
Ireland	98.4%	98.6%	98.3%	96.5%	95.2%	91.8%	92.8%	91.3%	90.2%	88.8%
Italy	**93.6%**	**93.2%**	**92.0%**	**90.3%**	**85.5%**	**80.6%**	**81.1%**	**79.9%**	**78.9%**	**78.9%**
Lithuania	75.6%	59.8%	58.7%	59.6%	74.1%	67.8%	66.7%	65.6%	65.2%	65.5%
Luxembourg	89.9%	86.0%	85.5%	92.7%	89.7%	83.5%	81.7%	81.6%	81.7%	81.8%
Latvia	83.0%	68.7%	65.2%	63.8%	67.4%	61.3%	61.0%	57.6%	59.5%	58.7%
Malta	100.0%	100.0%	100.0%	99.9%	99.5%	85.3%	78.3%	86.3%	88.3%	88.3%
Netherlands	**96.4%**	**96.1%**	**94.9%**	**94.2%**	**94.8%**	**92.7%**	**93.1%**	**93.0%**	**91.8%**	**91.3%**
Poland	**98.6%**	**96.3%**	**96.4%**	**96.2%**	**92.9%**	**90.5%**	**90.9%**	**91.2%**	**90.9%**	**89.6%**
Portugal	81.0%	83.6%	84.9%	85.2%	76.7%	75.6%	75.4%	78.8%	75.5%	73.4%
Romania	96.2%	94.0%	85.3%	84.2%	75.5%	73.9%	73.0%	74.1%	74.1%	72.8%
Sweden	**38.9%**	**39.0%**	**37.3%**	**36.6%**	**37.7%**	**27.6%**	**29.7%**	**28.8%**	**30.6%**	**29.0%**
Slovenia	71.6%	73.2%	69.3%	66.9%	68.1%	62.4%	64.0%	63.1%	63.8%	63.0%
Slovakia	81.8%	79.9%	74.6%	71.9%	70.3%	64.3%	65.1%	66.1%	66.8%	62.4%
United Kingdom	**91.0%**	**88.3%**	**89.1%**	**89.1%**	**89.9%**	**82.7%**	**82.2%**	**81.5%**	**80.7%**	**79.7%**

Table A1.27 – *Share of energy from non-renewable waste from gross inland energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.2%**	**0.3%**	**0.4%**	**0.4%**	**0.6%**	**0.8%**	**0.9%**	**0.9%**	**0.9%**	**0.9%**
EU27	**0.3%**	**0.4%**	**0.4%**	**0.4%**	**0.7%**	**0.9%**	**0.9%**	**0.9%**	**0.9%**	**1.0%**
Austria	0.8%	0.8%	0.9%	1.2%	1.8%	2.0%	2.1%	2.0%	1.9%	2.0%
Belgium	0.6%	0.8%	0.7%	0.8%	1.1%	1.2%	1.2%	1.1%	1.2%	1.2%
Bulgaria	0.0%	0.0%	0.1%	0.3%	0.0%	0.1%	0.2%	0.2%	0.3%	0.4%
Cyprus	0.0%	0.0%	0.0%	0.1%	0.3%	0.5%	0.6%	0.8%	0.9%	1.2%
Czechia	**0.0%**	**0.1%**	**0.2%**	**0.4%**	**0.4%**	**0.7%**	**0.7%**	**0.7%**	**0.8%**	**0.8%**
Germany	**0.3%**	**0.4%**	**0.5%**	**0.5%**	**1.2%**	**1.3%**	**1.4%**	**1.4%**	**1.3%**	**1.4%**
Denmark	0.9%	1.2%	1.7%	2.0%	2.0%	2.5%	2.4%	2.4%	2.3%	2.5%
Estonia	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.8%	0.8%	0.8%	0.9%
Greece	0.0%	0.2%	0.2%	0.1%	0.1%	0.4%	0.3%	0.0%	0.1%	0.2%
Spain	**0.1%**	**0.2%**	**0.2%**	**0.1%**	**0.1%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**
Finland	0.0%	0.0%	0.2%	0.3%	0.4%	0.7%	0.8%	0.8%	0.8%	0.9%
France	**0.3%**	**0.3%**	**0.4%**	**0.4%**	**0.5%**	**0.6%**	**0.7%**	**0.7%**	**0.7%**	**0.7%**
Croatia	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.2%	0.3%
Hungary	0.0%	0.1%	0.1%	0.2%	0.3%	0.5%	0.6%	0.6%	0.7%	0.8%
Ireland	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%	0.4%	0.8%	1.0%	1.0%
Italy	**0.1%**	**0.1%**	**0.1%**	**0.4%**	**0.6%**	**0.7%**	**0.8%**	**0.7%**	**0.7%**	**0.8%**
Lithuania	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.7%	0.4%	0.5%	0.4%
Luxembourg	0.3%	0.3%	0.7%	0.7%	0.7%	0.8%	0.8%	0.9%	0.8%	0.8%
Latvia	0.0%	0.0%	0.0%	0.1%	0.6%	1.3%	0.8%	0.6%	0.9%	0.9%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Netherlands	**0.3%**	**0.4%**	**0.7%**	**0.9%**	**0.8%**	**1.0%**	**1.1%**	**1.1%**	**1.1%**	**1.1%**
Poland	**0.7%**	**0.8%**	**0.1%**	**0.2%**	**0.4%**	**0.5%**	**0.7%**	**0.8%**	**0.9%**	**1.0%**
Portugal	0.0%	0.0%	0.3%	0.5%	0.7%	0.7%	0.9%	0.8%	0.8%	0.8%
Romania	0.0%	0.8%	0.3%	0.2%	0.1%	0.2%	0.3%	0.3%	0.5%	0.5%
Sweden	**0.5%**	**0.5%**	**0.7%**	**0.9%**	**1.0%**	**1.3%**	**1.6%**	**1.6%**	**1.5%**	**1.6%**
Slovenia	0.0%	0.0%	0.0%	0.1%	0.3%	0.6%	0.6%	0.7%	0.8%	0.9%
Slovakia	0.0%	1.2%	1.8%	0.3%	0.2%	1.2%	1.2%	1.2%	1.1%	1.2%
United Kingdom	**0.0%**	**0.1%**	**0.1%**	**0.3%**	**0.2%**	**0.5%**	**0.7%**	**0.6%**	**0.7%**	**0.8%**

Table A1.28 – *Share of electricity consumption in final energy consumption, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**18.0%**	**19.0%**	**20.4%**	**21.3%**	**22.1%**	**23.0%**	**22.8%**	**22.7%**	**22.7%**	**22.6%**
EU27	**17.9%**	**18.9%**	**20.4%**	**21.2%**	**22.2%**	**23.2%**	**23.0%**	**22.9%**	**22.9%**	**22.8%**
Austria	20.5%	20.4%	20.3%	19.2%	19.9%	20.6%	20.5%	20.5%	21.0%	20.8%
Belgium	17.5%	18.8%	19.8%	20.3%	20.7%	21.2%	21.2%	21.5%	21.5%	21.7%
Bulgaria	19.0%	23.0%	24.3%	23.0%	26.8%	25.9%	26.1%	26.4%	26.4%	26.7%
Cyprus	18.1%	16.6%	18.8%	22.3%	25.5%	24.7%	25.4%	25.2%	25.4%	25.0%
Czechia	**13.3%**	**16.5%**	**17.7%**	**18.5%**	**19.3%**	**20.3%**	**20.3%**	**20.2%**	**20.7%**	**20.7%**
Germany	**17.9%**	**18.4%**	**20.1%**	**21.7%**	**21.8%**	**22.1%**	**21.9%**	**21.8%**	**21.9%**	**21.4%**
Denmark	18.9%	18.6%	19.9%	19.5%	18.6%	19.6%	19.3%	19.3%	19.2%	19.7%
Estonia	10.8%	14.8%	17.9%	18.4%	20.7%	21.4%	22.5%	22.2%	22.3%	22.3%
Greece	17.6%	19.6%	20.7%	21.6%	24.9%	27.7%	28.9%	29.5%	28.1%	28.0%
Spain	**19.7%**	**19.8%**	**21.2%**	**22.2%**	**24.7%**	**26.2%**	**25.6%**	**25.7%**	**25.0%**	**24.7%**
Finland	24.2%	26.3%	28.0%	28.9%	28.7%	29.3%	29.0%	28.3%	28.4%	28.5%
France	**20.3%**	**21.9%**	**22.8%**	**24.1%**	**26.1%**	**26.5%**	**26.5%**	**26.5%**	**26.7%**	**26.6%**
Croatia	18.1%	16.4%	17.1%	17.3%	19.1%	20.3%	20.1%	20.2%	20.8%	20.7%
Hungary	14.3%	15.3%	16.2%	15.3%	17.4%	18.5%	18.5%	18.5%	19.0%	19.3%
Ireland	14.6%	16.8%	17.1%	17.7%	19.6%	21.2%	20.9%	21.0%	21.0%	21.6%
Italy	**17.7%**	**18.5%**	**19.6%**	**19.7%**	**20.9%**	**22.0%**	**22.0%**	**22.1%**	**22.0%**	**22.2%**
Lithuania	10.8%	12.0%	14.2%	14.8%	15.1%	16.8%	16.8%	16.5%	16.4%	16.6%
Luxembourg	13.0%	15.7%	15.6%	13.1%	14.5%	15.1%	15.5%	15.3%	14.9%	14.5%
Latvia	11.3%	10.0%	11.9%	12.4%	13.4%	15.1%	15.1%	14.4%	14.2%	14.6%
Malta	29.8%	28.5%	42.2%	42.5%	39.1%	39.3%	39.7%	40.5%	39.9%	39.2%
Netherlands	**14.3%**	**14.8%**	**17.2%**	**18.3%**	**18.3%**	**20.5%**	**20.3%**	**20.4%**	**20.6%**	**21.1%**
Poland	**14.4%**	**12.7%**	**15.7%**	**15.7%**	**15.6%**	**18.1%**	**17.5%**	**16.9%**	**17.2%**	**17.5%**
Portugal	17.8%	18.7%	19.2%	21.8%	24.8%	25.3%	25.5%	25.2%	25.5%	25.2%
Romania	11.0%	12.2%	13.3%	14.2%	16.1%	17.1%	17.0%	16.7%	16.7%	16.5%
Sweden	**34.3%**	**31.7%**	**32.9%**	**35.4%**	**34.7%**	**34.1%**	**34.2%**	**34.3%**	**34.6%**	**34.2%**
Slovenia	21.5%	19.8%	19.9%	21.4%	20.3%	23.3%	22.9%	23.5%	23.8%	24.2%
Slovakia	14.5%	18.8%	19.1%	18.9%	20.0%	23.4%	23.3%	22.4%	22.5%	21.1%
United Kingdom	**18.6%**	**19.2%**	**20.3%**	**21.8%**	**21.7%**	**21.7%**	**21.5%**	**21.3%**	**21.1%**	**20.9%**

Table A1.29 – *Share of electricity consumption in final energy consumption of industry, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**25.0%**	**27.3%**	**29.9%**	**31.8%**	**32.9%**	**33.8%**	**34.0%**	**34.1%**	**33.8%**	**33.9%**
EU27	**24.7%**	**27.2%**	**30.0%**	**31.7%**	**32.6%**	**33.7%**	**33.7%**	**33.8%**	**33.5%**	**33.6%**
Austria	30.3%	31.5%	29.8%	29.2%	29.6%	31.9%	31.8%	31.8%	32.4%	32.4%
Belgium	26.7%	30.6%	29.6%	33.0%	31.3%	30.9%	31.0%	31.7%	31.4%	31.9%
Bulgaria	17.9%	18.4%	20.6%	23.2%	26.4%	28.6%	29.4%	30.4%	31.1%	31.6%
Cyprus	10.7%	8.6%	8.6%	14.7%	21.1%	18.7%	19.4%	19.0%	20.0%	20.0%
Czechia	**14.5%**	**13.8%**	**17.7%**	**22.9%**	**27.2%**	**30.1%**	**30.9%**	**30.5%**	**31.2%**	**31.6%**
Germany	**28.1%**	**32.3%**	**35.4%**	**36.4%**	**34.7%**	**35.1%**	**35.0%**	**34.9%**	**34.7%**	**34.5%**
Denmark	26.8%	26.7%	29.2%	30.7%	29.9%	33.0%	32.8%	32.0%	31.9%	31.4%
Estonia	9.4%	18.0%	27.6%	26.0%	31.4%	33.1%	40.5%	42.5%	41.6%	39.6%
Greece	26.0%	25.8%	26.1%	29.7%	35.0%	34.8%	31.6%	38.2%	39.0%	40.9%
Spain	**28.5%**	**26.4%**	**30.1%**	**30.2%**	**30.6%**	**36.2%**	**37.2%**	**35.9%**	**33.7%**	**32.7%**
Finland	30.6%	32.8%	32.1%	33.3%	32.4%	31.9%	31.4%	31.1%	30.5%	30.7%
France	**32.2%**	**33.8%**	**36.0%**	**36.9%**	**36.4%**	**35.7%**	**35.4%**	**36.3%**	**35.6%**	**36.1%**
Croatia	23.6%	19.8%	18.3%	18.7%	22.5%	27.9%	27.9%	27.0%	27.3%	26.5%
Hungary	19.6%	20.7%	23.2%	25.7%	32.3%	34.2%	34.4%	33.7%	33.4%	34.3%
Ireland	21.6%	25.1%	26.8%	26.1%	27.1%	27.3%	27.5%	27.2%	27.2%	28.0%
Italy	**28.0%**	**30.3%**	**32.5%**	**33.5%**	**37.9%**	**39.0%**	**38.8%**	**39.9%**	**40.5%**	**41.2%**
Lithuania	14.1%	22.8%	25.3%	23.0%	24.0%	29.0%	29.7%	29.2%	28.6%	29.4%
Luxembourg	18.4%	29.4%	37.8%	37.8%	41.3%	41.9%	43.8%	41.5%	41.9%	42.1%
Latvia	13.8%	17.5%	21.4%	20.9%	17.7%	18.6%	19.1%	19.1%	17.6%	18.6%
Malta		100.0%	100.0%	82.5%	77.4%	64.7%	64.3%	69.0%	74.0%	76.3%
Netherlands	**20.3%**	**21.3%**	**22.9%**	**22.8%**	**23.4%**	**22.5%**	**22.4%**	**22.4%**	**22.6%**	**23.0%**
Poland	**16.0%**	**17.7%**	**20.0%**	**24.1%**	**26.4%**	**30.2%**	**30.1%**	**29.6%**	**29.6%**	**29.5%**
Portugal	22.6%	23.5%	21.9%	25.5%	27.5%	30.2%	30.7%	30.7%	31.0%	31.1%
Romania	13.6%	14.3%	19.9%	22.6%	27.0%	27.5%	28.6%	29.0%	28.9%	28.3%
Sweden	**39.4%**	**33.9%**	**35.8%**	**42.3%**	**40.1%**	**39.2%**	**39.4%**	**40.1%**	**39.6%**	**39.1%**
Slovenia	33.6%	36.0%	33.3%	37.5%	37.0%	43.4%	43.1%	42.8%	42.4%	42.2%
Slovakia	22.3%	21.7%	23.9%	26.4%	29.1%	29.9%	31.4%	30.8%	30.0%	30.4%
United Kingdom	**27.7%**	**27.5%**	**28.9%**	**32.7%**	**35.2%**	**34.7%**	**37.7%**	**36.7%**	**37.3%**	**37.3%**

Table A1.30 – *Share of electricity consumption in final energy consumption of services, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**34.5%**	**38.7%**	**44.9%**	**44.1%**	**46.3%**	**48.7%**	**48.0%**	**47.1%**	**47.7%**	**48.0%**
EU27	**32.8%**	**38.2%**	**44.7%**	**43.2%**	**45.7%**	**48.8%**	**48.4%**	**47.4%**	**48.2%**	**48.8%**
Austria	46.0%	37.2%	39.0%	35.1%	38.7%	42.9%	41.5%	40.5%	41.9%	40.7%
Belgium	23.3%	25.5%	30.3%	26.5%	38.1%	40.6%	40.6%	40.8%	40.8%	40.8%
Bulgaria	21.2%	51.6%	66.8%	62.8%	67.8%	64.4%	63.2%	62.1%	59.2%	59.4%
Cyprus	100.0%	100.0%	100.0%	95.6%	78.2%	78.5%	80.3%	78.7%	69.2%	66.3%
Czechia	**10.3%**	**32.7%**	**33.4%**	**35.4%**	**39.3%**	**43.0%**	**42.6%**	**42.2%**	**44.1%**	**43.5%**
Germany	**26.0%**	**34.2%**	**41.8%**	**35.0%**	**35.5%**	**37.6%**	**38.3%**	**38.0%**	**40.5%**	**42.0%**
Denmark	41.5%	42.9%	46.4%	45.0%	43.8%	45.7%	44.6%	45.1%	44.8%	45.9%
Estonia	6.3%	61.3%	41.8%	42.7%	50.9%	52.0%	51.3%	50.0%	51.4%	53.8%
Greece	74.0%	76.6%	80.0%	72.5%	79.1%	82.2%	82.1%	75.5%	73.1%	72.1%
Spain	**63.1%**	**59.0%**	**64.4%**	**66.0%**	**73.7%**	**60.1%**	**56.2%**	**58.0%**	**57.3%**	**60.2%**
Finland	100.0%	97.3%	49.1%	51.0%	49.5%	54.8%	52.5%	50.9%	50.8%	51.0%
France	**36.7%**	**38.7%**	**49.0%**	**51.3%**	**51.6%**	**54.9%**	**54.9%**	**53.8%**	**54.4%**	**54.1%**
Croatia	39.8%	39.5%	47.3%	51.8%	57.2%	60.0%	59.0%	59.9%	60.5%	60.9%
Hungary	23.5%	23.9%	25.2%	24.4%	32.0%	31.0%	31.6%	33.2%	35.0%	36.1%
Ireland	26.4%	31.0%	41.0%	52.2%	58.5%	58.5%	58.7%	59.2%	59.2%	59.6%
Italy	**42.1%**	**43.5%**	**42.2%**	**42.2%**	**43.4%**	**51.4%**	**51.1%**	**44.1%**	**42.8%**	**42.2%**
Lithuania	9.4%	18.5%	34.7%	41.1%	40.6%	46.5%	46.8%	44.9%	45.4%	48.6%
Luxembourg	100.0%	100.0%	39.0%	41.0%	40.4%	41.5%	38.4%	42.3%	40.7%	36.9%
Latvia	14.7%	18.7%	28.1%	31.0%	34.8%	40.0%	39.7%	39.2%	41.5%	43.0%
Malta	100.0%	100.0%	100.0%	76.3%	74.4%	71.2%	72.1%	73.3%	76.6%	75.6%
Netherlands	**31.1%**	**30.9%**	**39.7%**	**41.7%**	**40.3%**	**46.3%**	**45.8%**	**45.4%**	**45.8%**	**45.9%**
Poland	**33.5%**	**36.2%**	**48.1%**	**42.6%**	**42.5%**	**49.8%**	**48.3%**	**50.3%**	**53.6%**	**54.1%**
Portugal	68.8%	65.6%	69.3%	56.3%	74.8%	62.7%	61.8%	61.2%	60.5%	59.9%
Romania	100.0%	33.0%	49.9%	20.6%	34.7%	41.0%	40.8%	39.5%	38.1%	38.7%
Sweden	**52.2%**	**46.1%**	**49.5%**	**54.7%**	**53.9%**	**59.3%**	**58.6%**	**59.4%**	**58.4%**	**58.7%**
Slovenia	23.9%	36.2%	34.7%	43.8%	49.5%	61.1%	58.8%	63.0%	65.1%	67.2%
Slovakia	5.7%	17.2%	20.6%	30.2%	32.7%	45.4%	45.6%	46.2%	47.2%	46.8%
United Kingdom	**47.3%**	**42.1%**	**46.1%**	**50.7%**	**50.7%**	**48.1%**	**44.5%**	**44.5%**	**43.5%**	**42.9%**

Table A1.31 – *Share of electricity consumption in final energy consumption of agriculture, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**12.2%**	**10.6%**	**11.7%**	**12.9%**	**16.0%**	**18.0%**	**17.5%**	**17.6%**	**16.2%**	**16.4%**
EU27	**11.7%**	**10.0%**	**10.9%**	**12.1%**	**15.3%**	**17.3%**	**17.1%**	**17.2%**	**15.7%**	**15.9%**
Austria	15.5%	18.4%	13.8%	15.2%	18.7%	18.3%	18.6%	18.5%	19.2%	20.1%
Belgium	0.0%	0.0%	2.8%	3.9%	16.6%	18.6%	18.3%	17.3%	18.4%	17.1%
Bulgaria	10.8%	12.0%	4.8%	5.3%	10.5%	10.2%	10.4%	10.8%	12.2%	15.1%
Cyprus	100.0%	100.0%	100.0%	27.3%	33.3%	30.0%	33.5%	32.2%	34.1%	30.0%
Czechia	**16.3%**	**11.0%**	**15.2%**	**16.1%**	**14.5%**	**13.7%**	**12.7%**	**13.1%**	**13.4%**	**13.2%**
Germany	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**39.3%**	**32.8%**	**31.3%**	**30.9%**	**13.2%**	**12.9%**
Denmark	14.6%	16.4%	17.3%	19.0%	18.8%	20.2%	19.9%	21.0%	21.2%	22.6%
Estonia	25.4%	37.9%	32.9%	18.2%	17.2%	13.3%	14.2%	16.2%	11.4%	10.5%
Greece	13.0%	16.9%	22.4%	21.8%	28.6%	71.8%	72.9%	74.4%	70.6%	70.6%
Spain	**18.1%**	**18.9%**	**16.7%**	**14.6%**	**15.9%**	**20.0%**	**19.4%**	**19.1%**	**15.7%**	**16.2%**
Finland	9.2%	9.0%	17.0%	14.3%	17.6%	17.6%	17.8%	17.6%	18.0%	17.7%
France	**4.6%**	**5.5%**	**5.5%**	**13.8%**	**15.0%**	**16.9%**	**17.5%**	**17.7%**	**16.9%**	**16.7%**
Croatia	3.9%	5.3%	3.8%	4.7%	5.0%	5.1%	5.1%	5.1%	5.3%	5.2%
Hungary	14.6%	15.8%	12.3%	14.2%	13.4%	12.9%	11.9%	12.7%	13.1%	13.0%
Ireland	13.2%	11.0%	13.9%	14.4%	16.3%	21.7%	21.2%	20.3%	19.1%	19.0%
Italy	**11.7%**	**10.6%**	**13.3%**	**13.9%**	**16.4%**	**17.2%**	**16.7%**	**17.7%**	**16.6%**	**17.8%**
Lithuania	29.1%	22.0%	16.2%	15.7%	13.3%	16.5%	16.8%	16.0%	16.7%	16.4%
Luxembourg	55.3%	55.3%	16.5%	12.3%	11.5%	12.6%	10.2%	11.5%	11.5%	11.7%
Latvia	23.5%	12.8%	10.4%	8.8%	7.7%	8.8%	8.9%	8.6%	8.7%	7.9%
Malta				0.0%	11.6%	24.9%	20.1%	16.9%	13.9%	12.7%
Netherlands	**5.4%**	**6.9%**	**8.0%**	**11.9%**	**14.1%**	**20.3%**	**20.1%**	**21.6%**	**22.7%**	**23.9%**
Poland	**21.5%**	**9.9%**	**8.8%**	**2.9%**	**3.7%**	**3.9%**	**4.0%**	**3.8%**	**4.1%**	**4.2%**
Portugal	4.9%	8.7%	8.5%	15.2%	19.0%	16.7%	17.5%	19.7%	20.5%	18.4%
Romania	12.1%	15.1%	13.2%	13.2%	14.7%	17.3%	14.1%	12.9%	11.4%	11.6%
Sweden	**14.3%**	**14.1%**	**13.4%**	**17.1%**	**15.6%**	**16.4%**	**16.3%**	**14.7%**	**16.0%**	**13.3%**
Slovenia			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	2.0%
Slovakia	14.0%	25.8%	25.6%	20.4%	18.3%	15.0%	14.6%	16.3%	15.6%	20.5%
United Kingdom	**25.7%**	**25.6%**	**32.5%**	**36.7%**	**34.8%**	**36.3%**	**25.4%**	**24.8%**	**26.4%**	**25.2%**

Table A1.32 – *Share of electricity consumption in final energy consumption of households, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**19.1%**	**19.8%**	**21.2%**	**22.1%**	**22.5%**	**24.4%**	**24.1%**	**24.2%**	**24.5%**	**24.5%**
EU27	**18.7%**	**19.4%**	**21.0%**	**21.8%**	**22.5%**	**24.3%**	**24.0%**	**24.1%**	**24.6%**	**24.7%**
Austria	17.4%	18.5%	20.3%	21.5%	21.5%	22.3%	22.2%	22.2%	23.6%	23.6%
Belgium	19.1%	20.4%	21.5%	22.4%	17.8%	19.6%	19.5%	19.5%	19.6%	20.1%
Bulgaria	38.6%	38.5%	40.3%	37.2%	40.5%	41.7%	41.0%	41.3%	42.3%	43.2%
Cyprus	36.2%	46.4%	51.6%	38.9%	44.4%	39.9%	40.6%	41.5%	43.1%	42.0%
Czechia	**11.3%**	**19.4%**	**18.5%**	**19.0%**	**17.4%**	**18.3%**	**18.1%**	**18.2%**	**18.4%**	**18.7%**
Germany	**18.7%**	**16.5%**	**17.2%**	**19.1%**	**19.1%**	**20.1%**	**19.4%**	**19.5%**	**19.7%**	**18.8%**
Denmark	20.6%	19.6%	20.8%	19.9%	17.8%	19.7%	19.3%	18.8%	18.8%	20.1%
Estonia	7.5%	8.5%	13.6%	15.7%	16.9%	17.3%	17.7%	17.7%	17.0%	18.7%
Greece	25.5%	29.7%	26.8%	26.0%	33.4%	33.8%	39.5%	38.2%	36.8%	36.3%
Spain	**28.1%**	**30.7%**	**31.1%**	**35.4%**	**38.4%**	**40.2%**	**39.4%**	**42.0%**	**43.0%**	**42.6%**
Finland	23.5%	25.7%	33.4%	34.7%	33.9%	36.3%	36.2%	33.6%	34.3%	34.4%
France	**23.7%**	**26.4%**	**27.3%**	**27.7%**	**30.6%**	**33.7%**	**33.3%**	**33.5%**	**34.4%**	**34.5%**
Croatia	19.4%	18.1%	21.5%	19.3%	20.7%	21.9%	21.9%	22.5%	23.2%	23.8%
Hungary	11.8%	13.6%	15.0%	13.7%	14.5%	15.6%	15.3%	15.4%	16.8%	17.6%
Ireland	15.3%	19.0%	20.5%	19.9%	20.6%	24.3%	24.1%	24.4%	23.3%	24.3%
Italy	**17.4%**	**18.7%**	**19.0%**	**17.0%**	**16.9%**	**17.5%**	**17.2%**	**17.1%**	**17.6%**	**18.1%**
Lithuania	8.2%	8.1%	11.1%	12.3%	14.0%	16.8%	16.6%	16.8%	17.0%	17.3%
Luxembourg	9.9%	10.2%	14.6%	13.8%	13.7%	16.7%	15.9%	15.6%	16.0%	17.1%
Latvia	7.0%	6.2%	7.7%	9.0%	12.0%	13.7%	13.5%	11.9%	11.7%	11.9%
Malta	40.1%	46.8%	62.7%	74.3%	73.1%	70.6%	73.8%	68.7%	69.7%	70.6%
Netherlands	**13.0%**	**13.2%**	**15.9%**	**17.5%**	**15.8%**	**20.4%**	**19.7%**	**20.2%**	**20.5%**	**21.6%**
Poland	**9.7%**	**6.9%**	**10.5%**	**11.2%**	**11.2%**	**12.8%**	**12.5%**	**12.5%**	**12.9%**	**13.9%**
Portugal	22.1%	26.2%	30.7%	35.4%	42.0%	37.4%	39.6%	38.6%	39.5%	39.3%
Romania	4.4%	9.7%	7.8%	9.9%	12.0%	14.1%	14.0%	14.0%	14.1%	14.4%
Sweden	**50.0%**	**47.0%**	**49.5%**	**48.0%**	**47.7%**	**49.9%**	**50.0%**	**50.4%**	**51.7%**	**51.2%**
Slovenia	20.1%	18.9%	18.0%	17.8%	20.3%	23.6%	23.6%	24.7%	26.7%	27.8%
Slovakia	14.1%	21.7%	18.0%	15.9%	16.3%	21.8%	21.6%	20.0%	21.3%	17.7%
United Kingdom	**21.6%**	**22.3%**	**22.3%**	**24.4%**	**22.5%**	**24.9%**	**24.5%**	**24.6%**	**23.6%**	**23.4%**

Table A1.33 – *Share of electricity consumption in final energy consumption of transport, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**2.1%**	**2.1%**	**2.0%**	**1.7%**	**1.6%**	**1.7%**	**1.7%**	**1.7%**	**1.7%**	**1.7%**
EU27	**2.2%**	**2.1%**	**2.0%**	**1.8%**	**1.7%**	**1.8%**	**1.8%**	**1.8%**	**1.8%**	**1.7%**
Austria	5.1%	5.1%	4.6%	3.5%	3.4%	3.2%	3.2%	3.2%	3.2%	3.2%
Belgium	1.6%	1.7%	1.5%	1.7%	1.7%	1.6%	1.6%	1.7%	1.7%	1.7%
Bulgaria	4.9%	4.6%	2.3%	1.6%	1.3%	0.9%	0.9%	1.0%	0.8%	0.9%
Cyprus	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Czechia	**10.6%**	**7.7%**	**4.8%**	**2.7%**	**2.4%**	**2.2%**	**2.2%**	**2.2%**	**2.3%**	**2.2%**
Germany	**2.1%**	**2.4%**	**2.3%**	**2.1%**	**2.0%**	**1.7%**	**1.8%**	**1.8%**	**1.9%**	**1.8%**
Denmark	0.5%	0.5%	0.7%	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%	0.9%
Estonia	3.6%	2.6%	1.4%	1.2%	1.0%	0.5%	0.5%	0.5%	0.4%	0.6%
Greece	0.2%	0.2%	0.3%	0.2%	0.2%	0.6%	0.3%	0.3%	0.3%	0.3%
Spain	**1.5%**	**1.4%**	**1.2%**	**1.2%**	**0.8%**	**1.2%**	**1.1%**	**1.1%**	**1.1%**	**1.0%**
Finland	0.9%	1.0%	1.2%	1.3%	1.5%	1.5%	1.5%	1.6%	1.7%	1.8%
France	**1.7%**	**1.6%**	**1.8%**	**1.9%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**1.9%**	**1.9%**
Croatia	2.6%	1.2%	1.4%	1.2%	1.2%	1.1%	1.1%	1.0%	1.1%	1.0%
Hungary	3.5%	3.5%	2.9%	2.3%	2.3%	2.4%	2.4%	2.3%	2.2%	2.0%
Ireland	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%
Italy	**1.8%**	**1.8%**	**1.8%**	**2.0%**	**2.4%**	**2.6%**	**2.7%**	**2.8%**	**2.8%**	**2.8%**
Lithuania	1.0%	0.8%	0.6%	0.6%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
Luxembourg	0.5%	0.6%	0.3%	0.3%	0.5%	0.6%	0.6%	0.6%	0.6%	0.6%
Latvia	2.1%	2.3%	1.8%	1.3%	1.0%	0.9%	0.9%	0.8%	0.8%	0.9%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Netherlands	**1.2%**	**1.3%**	**1.3%**	**1.2%**	**1.3%**	**1.4%**	**1.6%**	**1.6%**	**1.7%**	**1.9%**
Poland	**6.6%**	**5.0%**	**4.2%**	**2.8%**	**1.7%**	**1.6%**	**1.5%**	**1.3%**	**1.3%**	**1.3%**
Portugal	0.8%	0.6%	0.5%	0.6%	0.6%	0.5%	0.7%	0.7%	0.7%	0.7%
Romania	5.4%	6.4%	4.8%	3.3%	2.3%	1.7%	1.6%	1.5%	1.4%	1.4%
Sweden	**3.1%**	**3.3%**	**3.7%**	**3.2%**	**2.8%**	**3.1%**	**3.2%**	**2.9%**	**3.1%**	**3.4%**
Slovenia	2.1%	1.1%	1.9%	1.2%	0.8%	0.7%	0.8%	1.0%	1.0%	1.0%
Slovakia	6.9%	8.6%	5.8%	2.1%	1.8%	2.4%	2.1%	1.8%	1.8%	1.6%
United Kingdom	**1.2%**	**1.7%**	**1.8%**	**0.8%**	**0.9%**	**0.9%**	**1.0%**	**1.0%**	**1.0%**	**1.1%**

Table A1.34 – *Carbon intensity in industry per unit of value added, t CO_2eq / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**504.34**	**416.11**	**381.45**	**325.53**	**290.86**	**285.21**	**281.66**	**272.98**	**264.94**
EU27	**536.29**	**442.07**	**405.48**	**344.68**	**307.26**	**303.15**	**299.78**	**290.35**	**281.57**
Austria	388.54	355.05	360.08	361.00	332.53	323.54	324.55	293.79	299.16
Belgium	985.46	776.56	661.34	535.69	464.72	471.20	463.03	463.41	431.38
Bulgaria	6211.73	2943.52	2167.64	958.53	948.14	969.22	1023.06	1096.75	1061.73
Cyprus	821.81	870.57	721.13	645.27	1161.24	1011.33	920.81	754.05	686.30
Czechia	**1466.95**	**1319.33**	**891.16**	**578.01**	**483.20**	**469.91**	**455.80**	**451.23**	**421.10**
Germany	**391.43**	**323.65**	**295.77**	**274.32**	**243.94**	**241.23**	**241.71**	**228.94**	**230.37**
Denmark	188.38	178.14	156.28	134.94	115.36	114.41	109.43	105.98	95.33
Estonia	1398.88	682.87	512.54	394.70	278.29	264.37	281.48	258.46	258.19
Greece	889.42	793.84	676.55	652.29	870.32	917.42	992.16	929.23	853.81
Spain	**502.47**	**445.88**	**451.56**	**413.52**	**378.20**	**373.85**	**363.24**	**363.42**	**349.18**
Finland	634.76	438.60	376.35	328.00	280.42	274.80	253.88	260.89	249.80
France	**499.18**	**401.01**	**368.38**	**324.38**	**300.58**	**302.74**	**294.65**	**289.35**	**274.17**
Croatia	875.33	849.21	770.04	735.34	650.22	581.60	616.94	578.89	579.92
Hungary	1357.18	709.51	558.10	423.56	409.74	424.76	438.90	436.06	412.13
Ireland	300.11	221.78	165.52	133.67	76.65	80.71	78.82	70.62	66.87
Italy	**367.27**	**365.56**	**366.01**	**307.71**	**278.13**	**266.57**	**255.97**	**256.49**	**242.82**
Lithuania	1241.62	1006.34	780.24	498.02	501.10	477.45	486.15	438.64	456.12
Luxembourg	970.06	401.65	367.81	392.91	330.41	311.76	310.83	298.77	299.87
Latvia	965.75	483.40	348.00	526.18	354.15	320.70	322.78	340.63	317.17
Malta		60.08	66.09	152.96	266.90	260.59	242.64	212.31	190.20
Netherlands	**549.49**	**433.01**	**372.05**	**326.45**	**299.79**	**306.12**	**306.46**	**294.61**	**282.83**
Poland	**1732.15**	**1286.71**	**892.78**	**572.99**	**469.81**	**461.13**	**474.04**	**436.41**	**421.33**
Portugal	559.53	528.49	540.76	521.49	521.45	474.62	475.85	448.28	463.00
Romania	1981.38	1445.47	1086.87	543.59	603.23	557.46	536.03	550.02	527.67
Sweden	**363.14**	**259.73**	**216.87**	**192.50**	**159.93**	**164.02**	**153.23**	**146.70**	**151.68**
Slovenia	617.38	445.00	404.26	293.44	273.44	264.92	258.81	259.29	242.93
Slovakia	3767.96	2425.58	1460.51	968.28	723.69	730.00	746.49	716.53	656.70
United Kingdom	**349.89**	**283.89**	**252.73**	**216.00**	**196.70**	**181.99**	**177.40**	**172.13**	**0.00**

Table A1.35 – *Carbon intensity in services per unit of value added, t CO_2eq / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**28.75**	**23.81**	**22.26**	**21.43**	**16.74**	**16.58**	**16.04**	**15.42**	**15.03**
EU27	**29.17**	**24.22**	**23.71**	**23.22**	**18.12**	**17.92**	**17.33**	**16.50**	**16.08**
Austria	23.05	18.30	20.10	8.84	6.56	6.10	6.81	6.54	6.62
Belgium	31.39	30.01	28.03	27.40	21.02	20.81	20.62	20.42	19.89
Bulgaria	22.40	26.48	13.84	15.18	14.61	14.26	13.82	12.53	12.11
Cyprus	16.25	13.67	9.58	9.52	7.20	6.35	8.23	7.79	8.22
Czechia	**112.80**	**89.36**	**53.41**	**45.67**	**34.08**	**34.15**	**35.08**	**30.18**	**31.20**
Germany	**41.44**	**31.12**	**26.16**	**24.81**	**20.26**	**19.48**	**18.49**	**16.11**	**17.32**
Denmark	16.77	12.25	12.25	9.85	7.02	6.93	6.86	6.62	5.66
Estonia	20.01	32.74	29.88	18.35	24.82	24.11	22.18	21.67	19.51
Greece	7.46	7.56	12.49	8.92	6.30	6.18	6.28	5.98	6.37
Spain	**13.64**	**14.86**	**15.70**	**20.38**	**16.70**	**17.60**	**16.84**	**16.98**	**14.11**
Finland	19.69	16.01	13.63	11.58	9.55	9.96	9.59	9.24	9.05
France	**24.20**	**21.27**	**20.48**	**19.66**	**15.25**	**14.76**	**14.94**	**14.14**	**13.66**
Croatia	44.59	36.86	36.09	28.21	23.98	24.27	24.33	23.80	22.66
Hungary	104.56	109.48	109.95	80.42	59.50	56.48	50.60	45.97	41.98
Ireland	34.75	24.02	18.71	14.61	12.76	12.37	10.90	10.52	10.03
Italy	**16.77**	**18.44**	**23.79**	**28.07**	**22.60**	**22.88**	**22.63**	**24.09**	**23.65**
Lithuania	144.67	30.28	24.16	24.13	15.67	17.14	17.49	18.42	15.66
Luxembourg	37.85	22.42	14.73	14.60	12.48	12.56	13.63	13.97	15.94
Latvia	132.40	67.67	51.37	48.22	33.80	30.19	29.31	28.23	25.32
Malta		62.31	12.93	14.31	14.59	13.30	11.24	8.68	8.39
Netherlands	**32.12**	**23.83**	**23.56**	**23.82**	**17.18**	**16.84**	**16.35**	**15.49**	**14.64**
Poland	**77.78**	**41.80**	**50.00**	**55.32**	**36.53**	**37.91**	**31.48**	**28.17**	**24.63**
Portugal	12.78	21.64	29.27	11.74	10.63	10.30	9.92	10.37	9.39
Romania	21.03	20.55	49.08	40.58	26.73	26.83	26.10	25.72	24.21
Sweden	**12.47**	**9.76**	**5.74**	**4.81**	**2.96**	**2.86**	**2.58**	**2.35**	**2.40**
Slovenia	48.81	61.02	42.59	34.29	19.87	22.85	17.29	15.10	15.11
Slovakia	99.91	57.50	74.32	64.18	37.47	34.42	37.03	33.14	29.70
United Kingdom	**26.65**	**21.84**	**16.07**	**13.59**	**10.95**	**10.96**	**10.58**	**10.86**	**0.00**

Table A1.36 – *Carbon intensity in agriculture per unit of value added, t CO_2eq / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3164.3**	**2833.8**	**2699.8**	**2493.4**	**2366.0**	**2409.8**	**2393.8**	**2396.4**	**2345.4**
EU27	**3098.0**	**2782.9**	**2664.3**	**2443.6**	**2332.2**	**2367.7**	**2359.5**	**2359.7**	**2312.7**
Austria	2727.9	2469.2	2319.6	2240.5	2110.7	2113.5	1980.0	1890.1	1890.8
Belgium	7161.5	5696.2	5089.0	4324.0	4118.2	4399.8	4256.3	4999.5	5118.9
Bulgaria	2585.9	2361.0	2370.2	3033.5	3593.3	3492.1	3194.7	3202.5	3067.1
Cyprus	1240.2	1206.7	1157.4	1513.6	1608.3	1434.8	1623.3	1683.3	1695.8
Czechia	3216.3	2854.7	2152.7	2606.1	2658.9	2541.6	2625.6	2461.3	2271.3
Germany	**4005.3**	**3681.0**	**3790.7**	**3171.5**	**3484.3**	**3528.6**	**3620.5**	**4064.1**	**3891.3**
Denmark	6580.3	5492.2	5491.0	4971.6	4942.0	5902.4	5230.2	5461.0	4448.4
Estonia	6639.3	3287.9	3657.1	3066.4	3050.5	3873.4	3898.0	5484.0	3654.1
Greece	1610.4	1564.5	1521.3	1629.7	1229.6	1317.8	1172.9	1182.3	1132.3
Spain	**2385.9**	**1989.0**	**2113.0**	**1773.9**	**1634.1**	**1567.5**	**1654.6**	**1549.2**	**1589.7**
Finland	2231.4	2197.9	2205.9	1884.5	1681.1	1659.6	1594.6	1605.7	1492.5
France	**3390.7**	**3081.7**	**2920.3**	**2684.4**	**2510.3**	**2799.0**	**2587.5**	**2444.7**	**2434.6**
Croatia	2248.3	2281.0	2176.0	2077.4	2524.7	2383.0	2495.1	2297.5	2273.0
Hungary	2255.8	2387.7	1643.9	1910.4	1908.8	1790.4	1897.8	1851.7	1863.9
Ireland	8860.9	9595.3	11020.0	10588.3	8493.4	7923.4	7760.1	9173.7	6855.7
Italy	**1469.4**	**1266.7**	**1274.4**	**1156.2**	**1089.6**	**1116.4**	**1153.2**	**1132.7**	**1152.8**
Lithuania	4526.3	4061.0	4102.3	4331.5	3711.7	3775.8	3752.4	4066.6	3721.2
Luxembourg	2216.5	2373.6	4242.0	5620.8	6127.2	7014.1	7481.6	7550.0	7304.2
Latvia	4345.2	3560.1	3039.0	3131.0	3012.9	3194.5	3191.8	3198.2	3012.0
Malta		1452.0	943.9	1074.4	951.6	826.1	1089.8	976.6	1069.1
Netherlands	**3683.7**	**3064.6**	**2662.7**	**2665.9**	**2366.5**	**2316.8**	**2316.7**	**2334.7**	**2283.7**
Poland	**4263.7**	**5612.1**	**4487.0**	**3840.7**	**4141.2**	**4156.4**	**4356.7**	**4830.7**	**4668.0**
Portugal	2181.3	2498.6	2302.3	2220.4	2065.9	2100.7	2081.8	2129.4	2085.7
Romania	3187.4	3400.5	2838.5	3163.9	2926.0	2801.7	2490.2	2373.9	2456.8
Sweden	**2006.6**	**1944.2**	**1594.0**	**1449.5**	**1259.8**	**1264.3**	**1215.2**	**1299.7**	**1248.3**
Slovenia	3037.8	2903.5	2709.0	2616.4	2403.5	2461.2	2548.9	2060.1	2145.4
Slovakia	7091.9	6251.6	3872.8	2403.3	1501.2	1402.4	1496.1	1378.0	1266.8
United Kingdom	**3921.5**	**3422.1**	**3070.2**	**3176.3**	**2759.3**	**2926.3**	**2779.6**	**2836.8**	**0.0**

Table A1.37 – *Carbon intensity in transport per unit of. GDP, t CO_2eq / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**80.40**	**76.02**	**73.21**	**67.10**	**61.74**	**61.91**	**61.27**	**60.09**	**59.47**
EU27	**81.91**	**78.51**	**76.67**	**70.50**	**65.11**	**65.28**	**64.63**	**63.45**	**62.99**
Austria	65.51	67.05	81.48	69.14	66.01	67.15	67.67	66.30	65.52
Belgium	80.21	75.86	73.73	68.32	64.55	63.07	60.72	60.05	58.45
Bulgaria	144.87	203.56	220.86	191.81	204.38	199.07	194.98	193.46	189.83
Cyprus	136.37	131.82	124.16	122.55	108.01	108.29	106.61	99.87	98.98
Czechia	100.19	106.47	125.75	108.01	103.44	104.76	102.34	100.18	98.82
Germany	**76.37**	**71.55**	**61.61**	**55.50**	**53.86**	**53.74**	**53.36**	**51.00**	**51.21**
Denmark	60.06	53.50	54.60	53.29	47.49	47.08	46.43	46.35	44.10
Estonia	169.74	132.31	120.16	128.87	111.95	110.74	108.21	103.91	96.61
Greece	109.16	103.79	99.57	103.93	97.10	99.51	96.99	96.77	97.13
Spain	**97.83**	**99.05**	**99.70**	**84.89**	**77.48**	**77.78**	**77.87**	**77.08**	**76.53**
Finland	82.37	68.54	64.24	60.34	51.37	55.55	51.11	51.34	48.95
France	**83.60**	**76.96**	**71.55**	**65.17**	**61.31**	**60.94**	**59.71**	**57.53**	**56.82**
Croatia	112.55	128.19	126.86	132.08	133.53	133.81	139.16	130.62	130.56
Hungary	105.19	110.71	118.23	115.19	108.49	106.45	108.68	109.59	111.01
Ireland	68.74	75.45	70.81	60.91	45.02	45.94	41.14	38.54	36.40
Italy	**76.23**	**74.57**	**73.81**	**67.47**	**64.19**	**62.52**	**59.20**	**60.64**	**61.14**
Lithuania	197.02	159.01	143.64	141.49	136.31	143.04	142.97	146.44	145.27
Luxembourg	129.48	140.67	179.47	144.30	109.55	101.64	101.87	105.46	105.47
Latvia	190.95	155.79	147.73	159.38	128.25	126.03	127.94	124.08	120.91
Malta		96.28	80.03	72.60	65.99	60.65	56.14	55.79	60.16
Netherlands	**65.07**	**56.81**	**57.08**	**52.29**	**44.01**	**43.29**	**43.07**	**42.40**	**41.05**
Poland	**121.00**	**112.89**	**122.86**	**132.64**	**111.55**	**123.27**	**135.88**	**132.79**	**128.74**
Portugal	99.51	113.36	109.70	101.32	91.20	91.91	90.61	88.42	88.72
Romania	91.93	107.76	103.96	102.32	98.12	100.36	99.89	98.06	96.72
Sweden	**71.69**	**60.28**	**56.59**	**50.34**	**39.99**	**37.65**	**35.84**	**34.56**	**33.34**
Slovenia	168.83	127.03	127.04	139.34	137.97	143.04	139.60	133.26	124.53
Slovakia	150.82	132.29	139.17	105.66	90.69	91.85	90.62	88.98	90.57
United Kingdom	**73.16**	**63.80**	**57.28**	**50.98**	**46.13**	**46.29**	**45.59**	**44.39**	**43.00**

Table A1.38 – *Carbon intensity in households per unit of GDP, t CO_2eq / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**48.96**	**40.32**	**37.82**	**35.31**	**26.79**	**26.86**	**25.78**	**24.74**	**23.95**
EU27	**49.30**	**39.85**	**38.26**	**35.22**	**27.18**	**27.24**	**26.20**	**24.72**	**23.90**
Austria	43.16	34.08	30.33	26.21	20.05	20.53	19.97	17.69	17.98
Belgium	79.02	64.69	58.65	53.23	40.27	40.05	39.06	37.98	36.27
Bulgaria	102.14	47.77	37.68	30.16	22.95	23.91	23.69	19.40	17.34
Cyprus	36.43	36.18	24.62	19.17	20.14	19.08	17.89	13.93	15.55
Czechia	142.85	92.36	70.19	68.38	53.18	54.31	53.44	48.32	44.04
Germany	**55.96**	**46.53**	**42.67**	**38.45**	**29.04**	**28.87**	**27.62**	**26.64**	**27.77**
Denmark	26.33	18.71	16.26	14.04	8.66	8.50	7.80	7.43	6.87
Estonia	55.71	33.81	19.83	20.36	15.02	15.37	14.32	13.42	12.22
Greece	33.74	43.63	46.55	32.18	30.36	28.21	27.93	23.41	25.60
Spain	**20.70**	**20.56**	**21.13**	**20.01**	**15.95**	**15.73**	**13.60**	**13.39**	**12.70**
Finland	21.07	15.51	12.73	10.70	7.04	7.06	6.45	5.94	5.46
France	**36.68**	**33.17**	**32.85**	**27.88**	**20.92**	**21.23**	**20.27**	**18.42**	**17.58**
Croatia	67.62	65.64	65.31	57.22	43.28	42.46	41.22	37.92	35.10
Hungary	158.94	115.19	112.02	93.61	67.74	70.42	71.57	62.80	57.81
Ireland	71.85	49.22	44.17	46.28	24.65	24.21	21.97	22.18	19.48
Italy	**36.65**	**33.81**	**36.19**	**34.62**	**31.14**	**30.89**	**30.35**	**28.99**	**27.89**
Lithuania	57.81	35.44	28.28	31.17	20.50	22.41	23.13	22.77	20.80
Luxembourg	27.70	31.23	30.33	25.68	20.84	20.54	20.54	18.23	16.25
Latvia	69.16	35.99	31.93	36.01	22.42	23.17	23.60	23.07	21.20
Malta		13.16	7.61	4.96	4.73	3.67	3.91	3.47	3.39
Netherlands	**50.91**	**36.21**	**32.58**	**35.75**	**24.14**	**24.60**	**23.22**	**22.52**	**20.90**
Poland	**233.06**	**114.52**	**126.68**	**120.59**	**84.82**	**87.47**	**83.96**	**76.11**	**65.04**
Portugal	17.29	16.57	15.20	15.30	11.71	11.31	10.84	10.72	10.60
Romania	60.76	81.66	68.27	50.95	45.48	43.78	42.61	42.00	40.67
Sweden	**22.25**	**14.87**	**6.60**	**2.85**	**1.61**	**1.44**	**1.41**	**1.19**	**1.18**
Slovenia	63.27	56.74	49.47	36.82	22.61	21.78	20.06	17.66	16.64
Slovakia	125.77	109.79	71.88	52.72	37.26	37.58	40.15	34.79	34.55
United Kingdom	**47.58**	**42.80**	**35.94**	**35.97**	**25.00**	**25.08**	**23.83**	**24.86**	**24.24**

Table A1.39 – *Final energy intensity in industry per unit of value added, toe / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**164.89**	**150.30**	**142.71**	**128.28**	**116.60**	**114.69**	**114.04**	**111.28**	**109.49**
EU27	**178.02**	**160.51**	**152.67**	**137.35**	**125.03**	**123.43**	**122.86**	**119.76**	**117.93**
Austria	106.24	110.19	116.25	124.45	113.34	113.75	107.79	104.51	104.86
Belgium	288.82	286.99	254.16	252.87	243.50	244.35	235.61	239.21	221.26
Bulgaria	1825.11	931.33	659.08	367.77	359.69	332.21	325.24	319.97	310.97
Cyprus	229.60	266.53	145.73	134.78	151.13	140.92	131.92	112.58	104.59
Czechia	**516.10**	**382.12**	**296.31**	**195.89**	**160.97**	**142.68**	**159.37**	**156.18**	**152.61**
Germany	**124.34**	**118.28**	**121.51**	**114.40**	**99.68**	**97.35**	**96.87**	**94.29**	**94.54**
Denmark	69.63	58.44	58.22	55.90	47.45	45.31	44.27	43.09	39.95
Estonia	596.21	301.14	257.04	189.31	141.16	110.57	107.27	100.40	98.41
Greece	171.37	162.77	128.21	158.92	191.05	186.05	191.40	190.56	179.65
Spain	**151.71**	**148.89**	**149.84**	**125.88**	**118.30**	**119.91**	**120.50**	**122.52**	**119.49**
Finland	391.59	306.44	254.83	241.69	257.86	256.93	246.47	258.91	254.56
France	**162.71**	**144.57**	**133.38**	**117.00**	**117.37**	**117.72**	**114.48**	**113.27**	**110.90**
Croatia	328.75	272.26	231.20	219.78	200.15	189.77	196.45	186.16	192.79
Hungary	418.72	268.48	211.99	196.36	211.19	218.75	227.81	223.32	209.82
Ireland	99.14	67.35	50.21	42.11	22.44	24.08	23.57	22.25	21.54
Italy	**123.04**	**122.33**	**118.54**	**109.79**	**97.24**	**94.14**	**95.28**	**90.79**	**91.86**
Lithuania	483.62	343.39	248.76	224.88	221.90	214.16	227.24	217.97	221.05
Luxembourg	230.07	147.03	139.56	159.17	127.65	121.30	112.03	109.01	104.98
Latvia	322.70	208.26	173.78	235.83	209.68	198.30	192.94	200.49	185.26
Malta		33.54	59.75	43.36	49.70	49.09	48.44	44.59	43.11
Netherlands	**253.55**	**232.84**	**246.34**	**233.60**	**216.97**	**221.33**	**217.82**	**204.49**	**194.25**
Poland	**498.67**	**391.20**	**286.05**	**193.54**	**167.17**	**169.18**	**177.58**	**167.42**	**164.39**
Portugal	227.01	227.76	232.17	221.68	191.42	180.03	177.70	157.28	171.21
Romania	582.69	419.35	324.20	172.15	182.74	169.27	161.43	160.66	159.72
Sweden	**274.74**	**202.22**	**159.98**	**155.07**	**140.72**	**144.69**	**139.51**	**135.21**	**133.56**
Slovenia	216.93	214.98	199.26	146.75	134.59	131.78	128.63	127.03	119.90
Slovakia	796.92	645.94	374.08	237.20	196.02	191.18	198.78	200.59	191.41
United Kingdom	**101.66**	**98.33**	**89.37**	**76.43**	**68.21**	**64.40**	**63.30**	**62.00**	**0.00**

Table A1.40 – *Final energy intensity in services per unit of value added, toe / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**18.87**	**17.09**	**18.18**	**18.32**	**15.96**	**16.00**	**16.00**	**15.45**	**14.75**
EU27	**19.42**	**17.76**	**19.73**	**20.06**	**17.48**	**17.41**	**17.44**	**16.76**	**15.95**
Austria	17.12	16.58	17.62	13.87	12.45	12.05	12.77	12.27	12.52
Belgium	19.44	17.36	18.38	19.71	17.02	16.85	16.58	16.22	15.80
Bulgaria	40.23	51.87	49.15	44.87	44.25	46.21	44.39	44.06	43.38
Cyprus	11.12	12.59	15.46	19.73	16.86	17.09	16.78	19.09	19.43
Czechia	**47.21**	**53.23**	**47.50**	**44.00**	**35.90**	**36.32**	**35.90**	**33.83**	**33.71**
Germany	**20.07**	**17.57**	**21.93**	**21.47**	**18.34**	**17.80**	**17.48**	**15.62**	**14.35**
Denmark	23.67	20.88	20.36	19.27	16.19	16.15	16.39	16.09	15.26
Estonia	34.13	43.11	41.33	44.31	42.44	43.98	39.05	39.44	35.38
Greece	10.50	12.66	15.72	15.15	16.54	18.12	19.33	18.30	18.52
Spain	**10.77**	**13.98**	**14.34**	**14.78**	**15.47**	**15.94**	**15.35**	**15.03**	**14.04**
Finland	12.44	23.46	23.83	26.43	22.87	23.62	23.56	23.97	23.13
France	**20.78**	**16.08**	**16.58**	**17.80**	**15.23**	**15.06**	**14.98**	**14.39**	**13.91**
Croatia	33.21	29.80	32.81	33.35	31.13	30.98	31.48	31.30	30.60
Hungary	73.66	76.84	73.26	62.29	40.25	39.01	36.47	33.49	31.28
Ireland	17.32	14.48	13.94	13.38	11.93	11.84	10.69	10.34	9.92
Italy	**11.58**	**12.19**	**15.07**	**16.58**	**14.99**	**14.90**	**17.43**	**18.02**	**17.19**
Lithuania	85.43	42.67	38.10	38.32	31.19	31.67	32.39	31.98	29.97
Luxembourg	3.89	14.83	12.91	12.33	10.14	9.82	11.01	11.29	12.22
Latvia	124.80	63.98	54.61	50.08	41.85	41.15	41.46	38.96	36.43
Malta		12.79	16.04	18.58	17.12	16.18	16.08	15.10	14.72
Netherlands	**20.46**	**17.32**	**17.93**	**18.38**	**14.94**	**14.71**	**14.64**	**14.27**	**13.92**
Poland	**45.43**	**36.92**	**43.20**	**46.08**	**36.09**	**37.47**	**33.83**	**31.76**	**29.60**
Portugal	11.23	14.55	21.21	16.83	21.40	20.37	19.91	20.14	19.37
Romania	13.46	16.40	32.50	31.83	23.40	23.45	22.31	22.58	21.04
Sweden	**30.28**	**23.58**	**19.34**	**18.11**	**14.57**	**14.90**	**13.79**	**13.91**	**12.83**
Slovenia	33.23	37.17	28.08	27.96	22.98	24.23	22.81	21.69	20.20
Slovakia	109.03	80.56	57.59	52.55	32.43	30.98	32.86	29.64	26.89
United Kingdom	**16.08**	**13.87**	**11.49**	**10.65**	**9.56**	**10.09**	**9.87**	**9.87**	**0.00**

Table A1.41 – *Final energy intensity in agriculture per unit of value added, toe / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**187.70**	**157.04**	**154.79**	**143.66**	**125.49**	**132.43**	**132.00**	**143.81**	**143.73**
EU27	**194.81**	**163.15**	**162.58**	**149.09**	**130.92**	**135.54**	**135.24**	**148.33**	**148.70**
Austria	165.83	152.24	150.22	148.55	137.54	137.60	132.33	122.49	121.47
Belgium	585.65	346.00	342.58	309.11	256.78	298.09	290.56	343.81	390.39
Bulgaria	148.55	123.89	121.51	96.47	101.05	93.61	82.36	89.26	86.87
Cyprus	11.05	14.97	70.92	98.36	123.22	112.91	128.38	129.65	128.62
Czechia	**331.84**	**181.75**	**122.93**	**161.38**	**162.06**	**162.54**	**168.67**	**157.22**	**152.43**
Germany	**109.51**	**15.50**	**11.71**	**59.69**	**70.57**	**74.07**	**72.77**	**195.75**	**206.24**
Denmark	410.96	367.55	344.22	327.82	293.50	344.17	288.58	297.45	239.73
Estonia	361.95	160.24	264.31	198.87	224.65	289.82	290.41	387.78	228.81
Greece	132.46	145.55	147.54	122.27	40.10	45.70	43.03	40.15	40.02
Spain	**120.63**	**99.53**	**132.93**	**86.01**	**85.45**	**86.49**	**89.91**	**86.48**	**93.56**
Finland	200.35	203.91	203.71	185.39	156.46	157.01	149.10	147.65	134.75
France	**158.49**	**144.61**	**155.35**	**138.52**	**130.59**	**144.69**	**132.28**	**128.50**	**128.64**
Croatia	125.23	170.67	134.17	137.94	177.39	168.72	170.87	164.06	163.66
Hungary	197.33	205.73	124.66	136.49	135.38	135.13	136.20	139.04	145.21
Ireland	164.70	162.93	233.04	163.71	94.18	88.35	86.87	104.89	80.37
Italy	**111.67**	**97.40**	**106.74**	**93.20**	**85.36**	**85.93**	**90.60**	**92.02**	**90.47**
Lithuania	193.86	98.26	101.51	110.29	78.37	86.09	89.92	99.38	92.99
Luxembourg	33.43	56.43	140.86	231.45	213.04	275.48	248.19	238.80	226.75
Latvia	297.16	228.34	209.87	211.29	189.32	216.13	232.79	234.67	231.27
Malta		0.00	66.31	84.24	44.83	47.56	76.25	73.79	83.89
Netherlands	**499.28**	**461.69**	**412.07**	**459.41**	**322.16**	**317.79**	**315.00**	**341.72**	**339.98**
Poland	**400.73**	**564.56**	**441.11**	**341.91**	**350.72**	**365.90**	**392.89**	**436.58**	**427.04**
Portugal	145.30	232.21	192.06	135.53	117.49	117.71	121.61	125.55	124.55
Romania	128.35	71.86	47.97	68.16	71.18	66.43	63.62	66.11	67.56
Sweden	**182.16**	**165.69**	**140.11**	**118.53**	**100.02**	**104.66**	**97.33**	**103.67**	**101.24**
Slovenia	0.00	109.83	134.74	114.91	91.05	91.35	95.66	79.02	80.25
Slovakia	698.25	537.41	278.69	149.31	92.25	85.18	93.54	81.79	68.09
United Kingdom	**100.27**	**82.91**	**66.82**	**75.75**	**62.10**	**94.52**	**93.40**	**89.76**	**0.00**

Table A1.42 – *Final energy intensity in transport per unit of GDP, toe / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**26.32**	**25.18**	**24.41**	**22.96**	**21.24**	**21.32**	**21.15**	**20.82**	**20.66**
EU27	**26.88**	**26.07**	**25.66**	**24.22**	**22.49**	**22.56**	**22.39**	**22.05**	**21.91**
Austria	22.42	23.05	27.59	25.08	24.61	24.52	24.31	23.96	23.82
Belgium	26.75	24.92	24.05	22.94	21.42	21.39	20.71	20.43	19.94
Bulgaria	50.25	71.43	76.17	64.40	70.29	68.89	67.72	66.98	65.34
Cyprus	43.22	41.52	39.67	39.39	34.83	34.63	34.08	32.56	32.02
Czechia	**26.88**	**38.63**	**42.77**	**38.88**	**37.43**	**37.72**	**37.02**	**36.16**	**35.92**
Germany	**25.15**	**23.62**	**21.03**	**19.20**	**18.33**	**18.39**	**18.13**	**17.40**	**17.53**
Denmark	19.36	17.14	17.72	17.20	15.63	15.34	14.94	14.83	14.20
Estonia	52.01	44.90	40.20	42.81	36.62	36.27	35.58	35.27	33.59
Greece	37.57	35.77	33.85	34.72	32.76	33.73	32.85	32.79	33.01
Spain	**34.26**	**35.23**	**36.29**	**31.94**	**27.47**	**27.75**	**27.93**	**27.95**	**27.76**
Finland	28.08	22.26	21.00	20.44	19.42	19.24	18.70	18.67	18.16
France	**26.38**	**24.72**	**22.29**	**20.98**	**20.88**	**20.72**	**20.40**	**19.64**	**19.34**
Croatia	37.94	42.62	42.29	44.32	45.13	44.64	46.36	44.08	44.60
Hungary	34.96	37.10	40.22	40.72	37.54	37.38	37.78	38.13	38.54
Ireland	22.34	25.22	23.53	20.72	14.74	15.36	13.94	13.01	12.36
Italy	**24.64**	**24.19**	**24.32**	**22.64**	**22.17**	**21.55**	**20.49**	**20.86**	**20.91**
Lithuania	62.72	52.07	48.36	48.93	47.37	49.17	49.63	50.76	50.24
Luxembourg	42.80	46.15	58.89	48.31	37.76	35.19	35.64	36.93	36.97
Latvia	64.74	52.30	49.06	53.34	43.18	42.42	42.40	42.02	40.94
Malta		25.35	25.02	24.11	19.98	19.20	18.43	19.56	20.20
Netherlands	**21.10**	**18.44**	**18.49**	**17.64**	**15.12**	**14.84**	**14.72**	**14.85**	**14.56**
Poland	**40.90**	**38.78**	**42.02**	**46.53**	**38.76**	**42.09**	**46.33**	**45.85**	**44.61**
Portugal	31.24	34.56	35.64	34.72	31.08	31.20	30.67	30.13	30.07
Romania	31.58	36.94	34.56	35.96	33.53	34.54	34.53	33.87	33.97
Sweden	**26.13**	**23.17**	**20.47**	**18.48**	**16.09**	**15.65**	**15.45**	**14.66**	**14.24**
Slovenia	55.40	42.03	42.17	46.73	45.62	46.95	46.04	45.02	42.57
Slovakia	37.72	33.03	42.59	36.93	27.19	29.83	33.05	31.55	31.29
United Kingdom	**23.58**	**20.81**	**18.65**	**16.97**	**15.48**	**15.57**	**15.34**	**15.09**	**14.78**

Table A1.43 – *Final energy intensity in households per unit of. GDP, toe / M€ (chain linked volumes, 2015).*

	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**27.00**	**23.83**	**23.19**	**23.11**	**19.00**	**19.14**	**18.58**	**17.99**	**17.64**
EU27	**27.81**	**24.40**	**24.12**	**23.98**	**20.07**	**20.23**	**19.68**	**18.88**	**18.51**
Austria	26.12	22.63	21.50	21.64	19.26	19.68	19.35	17.74	17.90
Belgium	32.56	28.81	27.49	24.61	19.85	19.70	19.08	18.60	17.78
Bulgaria	81.84	77.72	58.58	53.61	47.99	47.48	47.23	44.05	41.15
Cyprus	12.31	12.53	18.56	17.27	18.26	17.63	17.24	16.01	16.70
Czechia	**63.02**	**56.54**	**48.33**	**47.73**	**39.92**	**40.78**	**39.39**	**37.32**	**36.29**
Germany	**28.50**	**25.56**	**24.26**	**22.94**	**18.16**	**18.41**	**17.81**	**17.37**	**17.86**
Denmark	22.13	17.78	17.82	19.55	16.27	16.27	15.51	15.01	14.35
Estonia	116.60	73.58	49.59	58.18	41.26	43.39	41.59	39.86	38.38
Greece	21.96	25.08	25.35	21.58	25.33	24.81	24.86	21.72	22.41
Spain	**14.07**	**13.78**	**14.76**	**15.72**	**13.92**	**13.70**	**12.79**	**12.82**	**12.34**
Finland	39.57	25.41	24.96	27.60	23.42	24.58	25.69	25.05	24.47
France	**22.22**	**22.01**	**21.45**	**21.74**	**18.27**	**18.95**	**18.21**	**17.29**	**16.96**
Croatia	73.20	65.37	64.34	61.48	54.47	52.17	50.10	46.82	44.33
Hungary	86.80	67.90	68.13	65.37	52.97	53.62	52.42	45.97	42.86
Ireland	24.52	18.70	17.46	18.85	10.59	10.49	9.58	9.52	8.60
Italy	**17.56**	**16.62**	**19.52**	**20.66**	**19.63**	**19.19**	**19.30**	**18.54**	**18.04**
Lithuania	101.58	67.42	51.51	51.38	36.39	37.43	36.45	36.43	33.42
Luxembourg	21.47	13.51	13.12	11.35	9.81	9.69	9.64	8.74	7.89
Latvia	145.23	93.37	71.37	67.51	45.01	45.48	46.05	45.58	43.12
Malta		12.68	10.92	9.02	7.99	7.46	8.10	7.88	8.10
Netherlands	**25.09**	**18.64**	**17.30**	**18.77**	**13.84**	**13.95**	**13.27**	**12.99**	**12.32**
Poland	**115.57**	**67.86**	**66.08**	**59.12**	**44.21**	**44.79**	**43.11**	**39.69**	**35.43**
Portugal	18.11	16.18	17.69	15.85	15.31	15.38	14.76	14.74	14.45
Romania	68.10	91.51	66.03	58.23	46.05	44.22	42.97	41.36	39.60
Sweden	**28.09**	**22.20**	**20.40**	**20.25**	**16.27**	**16.47**	**16.14**	**15.41**	**14.94**
Slovenia	48.88	42.68	41.19	35.85	30.02	29.59	27.52	24.73	23.37
Slovakia	54.25	59.75	45.93	32.89	24.92	24.92	25.13	23.66	29.65
United Kingdom	**22.98**	**21.10**	**18.97**	**19.02**	**14.09**	**14.11**	**13.43**	**13.82**	**13.57**

Table A1.44 – *Domestic material consumptions per capita (DMC), t/inhabitant.*

	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**15.12**	**15.91**	**13.81**	**13.09**	**13.02**	**13.41**	**13.61**	**13.47**
EU27	**15.46**	**16.44**	**14.45**	**13.74**	**13.69**	**14.12**	**14.37**	**14.22**
Austria	20.19	20.98	19.21	18.45	19.18	18.89	19.02	18.97
Belgium	15.57	14.98	14.45	13.34	13.33	13.66	13.26	10.67
Bulgaria	12.35	16.54	16.33	21.31	18.93	19.68	20.38	21.08
Cyprus	24.32	24.91	27.81	14.12	15.63	18.37	18.04	18.82
Czechia	**17.54**	**18.40**	**16.02**	**15.85**	**15.61**	**15.67**	**15.90**	**15.96**
Germany	**17.69**	**15.75**	**15.44**	**15.52**	**15.55**	**16.05**	**15.43**	**14.72**
Denmark	25.65	27.88	21.22	22.89	23.38	24.08	24.05	24.98
Estonia	14.04	21.29	25.00	27.04	26.90	30.99	32.66	29.26
Greece	14.19	16.46	15.90	12.27	11.59	11.17	11.11	9.78
Spain	**17.01**	**19.89**	**12.64**	**8.82**	**8.60**	**8.78**	**9.38**	**9.04**
Finland	33.73	36.67	34.39	30.53	31.51	33.00	34.57	31.58
France	**14.55**	**13.60**	**12.10**	**11.12**	**10.86**	**11.69**	**11.53**	**11.48**
Croatia	7.49	12.73	10.44	9.78	10.11	9.98	10.43	10.84
Hungary	11.72	17.70	9.78	12.66	12.15	13.67	15.67	17.60
Ireland	33.50	39.02	22.69	20.44	21.70	22.95	24.29	24.66
Italy	**13.24**	**14.35**	**11.57**	**7.95**	**7.99**	**7.96**	**8.11**	**8.11**
Lithuania	8.34	12.31	12.42	14.97	15.70	17.83	17.70	18.96
Luxembourg	25.58	25.75	21.54	23.77	23.68	24.42	22.81	23.00
Latvia	6.45	11.19	9.53	12.95	11.71	13.24	14.52	13.86
Malta	9.36	8.86	7.15	13.80	13.68	11.50	13.00	11.63
Netherlands	**12.53**	**11.08**	**11.48**	**11.05**	**9.93**	**9.14**	**9.37**	**8.78**
Poland	**14.09**	**14.45**	**16.95**	**16.93**	**17.70**	**18.71**	**19.34**	**17.62**
Portugal	19.64	18.62	19.08	15.50	14.86	16.34	16.32	16.70
Romania	7.70	15.71	13.65	22.51	22.90	21.32	23.11	27.61
Sweden	**20.27**	**22.55**	**21.95**	**23.04**	**23.25**	**24.14**	**24.63**	**25.84**
Slovenia	17.19	18.47	16.01	13.31	12.83	13.11	14.40	13.53
Slovakia	10.07	13.96	13.31	12.48	12.40	12.79	13.50	12.29
United Kingdom	**12.55**	**12.13**	**9.17**	**8.68**	**8.51**	**8.62**	**8.57**	**8.48**

Table A1.45 – *Direct material inputs per capita (DMI), t/ab.*

	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**15.97**	**16.89**	**14.91**	**14.36**	**14.34**	**14.78**	**14.94**	**14.79**
EU27	**16.49**	**17.67**	**15.82**	**15.35**	**15.35**	**15.84**	**16.04**	**15.89**
Austria	25.22	27.59	26.22	25.58	26.44	26.29	26.45	26.36
Belgium	31.94	33.34	31.56	29.72	29.85	30.47	30.65	29.34
Bulgaria	13.81	18.70	19.03	24.98	22.92	23.88	24.39	25.54
Cyprus	26.17	26.75	29.24	17.93	20.02	22.77	22.96	22.59
Czechia	**21.52**	**23.43**	**22.01**	**22.65**	**22.35**	**22.38**	**22.95**	**23.09**
Germany	**21.25**	**20.09**	**19.92**	**20.41**	**20.42**	**21.13**	**20.54**	**19.99**
Denmark	34.30	36.90	28.80	30.15	30.64	31.55	31.11	32.08
Estonia	20.55	29.04	34.39	37.31	37.41	43.14	46.32	42.43
Greece	16.45	18.45	18.45	16.00	15.63	15.40	15.58	14.16
Spain	**19.34**	**22.37**	**15.35**	**12.54**	**12.42**	**13.10**	**13.79**	**13.03**
Finland	41.01	44.09	42.23	38.19	39.57	41.34	43.47	40.79
France	**17.80**	**16.76**	**14.93**	**14.20**	**13.84**	**14.67**	**14.57**	**14.48**
Croatia	9.85	16.12	13.94	13.62	14.18	14.30	14.70	15.17
Hungary	13.56	20.21	13.00	16.58	16.03	18.29	20.16	22.16
Ireland	37.04	42.43	25.90	24.38	25.66	26.79	28.05	28.35
Italy	**15.37**	**16.70**	**14.02**	**10.43**	**10.54**	**10.54**	**10.66**	**10.67**
Lithuania	11.07	18.01	19.24	24.82	25.77	28.60	28.08	30.20
Luxembourg	50.33	49.14	41.75	38.80	38.78	39.94	38.60	37.21
Latvia	10.37	17.19	18.08	22.99	22.16	24.32	26.19	26.47
Malta	10.72	9.41	11.90	16.45	15.91	14.79	15.53	14.11
Netherlands	**28.31**	**29.06**	**31.27**	**30.75**	**31.37**	**31.08**	**30.81**	**30.26**
Poland	**15.77**	**16.45**	**19.02**	**19.95**	**20.51**	**21.54**	**22.26**	**20.49**
Portugal	21.43	21.16	22.15	19.58	18.84	20.48	20.41	20.84
Romania	8.55	16.96	15.19	24.43	24.87	23.38	25.38	30.02
Sweden	**28.36**	**31.66**	**31.36**	**32.00**	**32.54**	**33.64**	**33.79**	**34.39**
Slovenia	21.01	23.17	22.06	21.43	21.19	22.06	23.45	22.61
Slovakia	13.82	18.47	18.46	18.81	18.88	19.42	20.22	18.83
United Kingdom	**15.94**	**15.16**	**11.91**	**11.11**	**10.91**	**11.10**	**11.04**	**10.85**

Table A1.46 – *Productivity at purchasing power standard per domestic material consumption (DMC), €/kg.*

	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1.24**	**1.42**	**1.83**	**2.13**	**2.19**	**2.21**	**2.24**	**2.33**
EU27	**1.19**	**1.34**	**1.72**	**2.00**	**2.06**	**2.08**	**2.11**	**2.20**
Austria	1.21	1.37	1.66	1.94	1.91	1.97	2.03	2.08
Belgium	1.48	1.81	2.09	2.49	2.53	2.54	2.69	3.44
Bulgaria	0.43	0.51	0.69	0.62	0.73	0.75	0.76	0.78
Cyprus	0.73	0.91	0.91	1.62	1.59	1.42	1.52	1.48
Czechia	**0.77**	**0.98**	**1.32**	**1.54**	**1.61**	**1.70**	**1.75**	**1.81**
Germany	**1.28**	**1.65**	**1.91**	**2.21**	**2.26**	**2.27**	**2.42**	**2.55**
Denmark	0.93	1.00	1.53	1.54	1.54	1.58	1.62	1.62
Estonia	0.56	0.64	0.66	0.78	0.82	0.75	0.75	0.89
Greece	1.14	1.27	1.33	1.57	1.65	1.76	1.81	2.12
Spain	**1.05**	**1.14**	**1.90**	**2.84**	**3.01**	**3.09**	**2.94**	**3.13**
Finland	0.66	0.72	0.86	1.00	0.99	0.99	0.98	1.10
France	**1.49**	**1.84**	**2.25**	**2.64**	**2.74**	**2.62**	**2.74**	**2.89**
Croatia	1.17	0.98	1.43	1.69	1.71	1.84	1.86	1.87
Hungary	0.84	0.79	1.68	1.52	1.60	1.48	1.38	1.30
Ireland	0.75	0.85	1.44	2.43	2.29	2.35	2.37	2.44
Italy	**1.70**	**1.72**	**2.30**	**3.34**	**3.47**	**3.59**	**3.62**	**3.71**
Lithuania	0.84	0.97	1.22	1.38	1.37	1.30	1.39	1.37
Luxembourg	1.80	2.17	3.01	3.14	3.25	3.16	3.47	3.53
Latvia	1.03	1.02	1.40	1.39	1.58	1.49	1.44	1.55
Malta	1.63	2.06	3.04	1.95	2.02	2.55	2.32	2.70
Netherlands	**2.11**	**2.78**	**2.97**	**3.27**	**3.66**	**4.14**	**4.19**	**4.55**
Poland	**0.63**	**0.79**	**0.94**	**1.14**	**1.11**	**1.10**	**1.12**	**1.30**
Portugal	0.80	1.00	1.08	1.38	1.48	1.39	1.45	1.48
Romania	0.63	0.50	0.94	0.69	0.74	0.87	0.86	0.79
Sweden	**1.21**	**1.24**	**1.46**	**1.53**	**1.51**	**1.48**	**1.47**	**1.43**
Slovenia	0.87	1.06	1.32	1.71	1.84	1.91	1.83	2.04
Slovakia	0.94	0.98	1.43	1.72	1.66	1.62	1.58	1.78
United Kingdom	**1.75**	**2.20**	**3.01**	**3.53**	**3.60**	**3.64**	**3.73**	**3.84**

Table A1.47 *–Productivity at purchasing power standard per direct material inputs (DMI), €/kg.*

	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1.18**	**1.34**	**1.69**	**1.94**	**1.99**	**2.00**	**2.04**	**2.12**
EU27	**1.11**	**1.24**	**1.57**	**1.79**	**1.84**	**1.85**	**1.89**	**1.97**
Austria	0.97	1.04	1.21	1.40	1.38	1.42	1.46	1.49
Belgium	0.72	0.81	0.96	1.12	1.13	1.14	1.17	1.25
Bulgaria	0.39	0.45	0.59	0.53	0.61	0.62	0.64	0.65
Cyprus	0.68	0.85	0.87	1.28	1.24	1.15	1.20	1.23
Czechia	**0.63**	**0.77**	**0.96**	**1.08**	**1.12**	**1.19**	**1.22**	**1.25**
Germany	**1.06**	**1.30**	**1.48**	**1.68**	**1.72**	**1.72**	**1.81**	**1.88**
Denmark	0.69	0.76	1.13	1.17	1.18	1.20	1.25	1.26
Estonia	0.38	0.47	0.48	0.57	0.59	0.54	0.53	0.61
Greece	0.99	1.14	1.15	1.20	1.22	1.28	1.29	1.46
Spain	**0.93**	**1.01**	**1.56**	**2.00**	**2.08**	**2.07**	**2.00**	**2.17**
Finland	0.54	0.60	0.70	0.80	0.79	0.79	0.78	0.85
France	**1.22**	**1.49**	**1.83**	**2.07**	**2.15**	**2.09**	**2.17**	**2.29**
Croatia	0.89	0.78	1.07	1.21	1.22	1.29	1.32	1.34
Hungary	0.73	0.69	1.26	1.16	1.21	1.11	1.07	1.03
Ireland	0.68	0.78	1.26	2.04	1.94	2.02	2.05	2.12
Italy	**1.46**	**1.48**	**1.90**	**2.54**	**2.63**	**2.71**	**2.75**	**2.82**
Lithuania	0.63	0.66	0.79	0.84	0.83	0.81	0.88	0.86
Luxembourg	0.91	1.14	1.55	1.92	1.98	1.93	2.05	2.18
Latvia	0.64	0.66	0.74	0.78	0.84	0.81	0.80	0.81
Malta	1.42	1.94	1.83	1.64	1.74	1.98	1.94	2.23
Netherlands	**0.94**	**1.06**	**1.09**	**1.18**	**1.16**	**1.22**	**1.27**	**1.32**
Poland	**0.56**	**0.69**	**0.84**	**0.97**	**0.96**	**0.96**	**0.97**	**1.12**
Portugal	0.73	0.88	0.93	1.09	1.17	1.11	1.16	1.19
Romania	0.57	0.46	0.85	0.64	0.68	0.80	0.78	0.72
Sweden	**0.87**	**0.89**	**1.02**	**1.10**	**1.08**	**1.06**	**1.07**	**1.08**
Slovenia	0.71	0.84	0.95	1.06	1.11	1.14	1.12	1.22
Slovakia	0.68	0.74	1.03	1.14	1.09	1.06	1.06	1.16
United Kingdom	**1.38**	**1.76**	**2.32**	**2.75**	**2.81**	**2.83**	**2.90**	**3.00**

ANNEX 2

Table A2.1 – *Fuel energy content for electricity and heat production in thermoelectric plants (ktoe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**388,189**	**371,075**	**381,302**	**427,856**	**410,832**	**356,273**	**353,338**	**355,041**	**337,049**	**313,512**
EU27	**331,377**	**318,419**	**324,701**	**365,829**	**351,840**	**313,950**	**314,092**	**318,810**	**302,304**	**280,493**
Austria	4,146	4,574	4,052	5,683	5,858	4,667	4,579	5,042	4,676	4,749
Belgium	6,548	7,153	7,036	7,645	8,430	6,364	5,948	5,921	6,025	6,077
Bulgaria	9,620	8,112	5,898	6,518	7,273	6,912	6,163	6,457	6,045	5,798
Cyprus	521	647	890	1,088	1,198	938	1,020	1,026	1,039	1,023
Czechia	**14,865**	**15,192**	**15,105**	**15,261**	**14,837**	**13,339**	**13,645**	**13,389**	**13,203**	**12,497**
Germany	**99,151**	**88,606**	**84,581**	**91,262**	**91,629**	**89,980**	**91,365**	**86,905**	**83,021**	**72,199**
Denmark	6,023	8,472	7,835	7,131	7,625	4,102	4,619	4,398	4,352	3,751
Estonia	4,985	2,540	2,438	2,597	3,114	2,725	2,926	3,195	3,145	1,952
Greece	10,163	10,875	13,188	13,979	12,113	9,167	8,420	9,772	9,414	8,320
Spain	**16,828**	**20,246**	**26,497**	**35,456**	**25,118**	**25,893**	**22,310**	**26,270**	**23,570**	**20,837**
Finland	5,263	6,757	7,195	7,807	10,237	6,344	6,556	6,365	6,721	6,081
France	**11,008**	**9,719**	**13,305**	**18,124**	**16,997**	**12,910**	**14,804**	**16,246**	**13,283**	**13,783**
Croatia	1,395	1,057	1,297	1,513	1,284	1,039	1,170	1,213	1,085	1,229
Hungary	5,338	5,823	6,019	5,646	5,230	3,324	3,529	3,563	3,393	3,399
Ireland	3,046	3,771	4,818	4,811	4,615	3,813	4,229	4,067	3,770	3,492
Italy	**37,542**	**40,633**	**45,105**	**54,333**	**48,892**	**41,460**	**42,036**	**43,239**	**40,382**	**40,181**
Lithuania	2,610	950	914	1,227	1,306	720	582	520	488	459
Luxembourg	188	135	96	577	553	227	137	144	155	188
Latvia	890	596	518	576	789	974	1,041	751	944	912
Malta	504	485	498	611	578	264	173	284	299	316
Netherlands	**13,981**	**16,624**	**17,744**	**19,584**	**21,581**	**19,290**	**19,550**	**18,994**	**17,853**	**18,025**
Poland	**44,330**	**36,888**	**36,365**	**38,803**	**38,302**	**37,066**	**36,689**	**36,834**	**36,683**	**34,216**
Portugal	4,961	6,132	7,360	8,288	7,485	7,772	8,304	8,871	8,442	7,078
Romania	22,852	16,588	10,675	10,109	8,424	7,654	7,235	7,545	7,273	6,663
Sweden	**1,543**	**3,261**	**3,266**	**4,476**	**6,452**	**5,140**	**5,543**	**5,664**	**5,707**	**5,822**
Slovenia	1,486	1,387	1,302	1,508	1,562	1,171	1,253	1,264	1,235	1,191
Slovakia	3,369	3,267	2,556	2,518	2,392	2,148	2,122	2,197	2,030	1,981
United Kingdom	**56,812**	**52,656**	**56,601**	**62,028**	**58,992**	**42,322**	**39,246**	**36,231**	**34,744**	**33,019**

Table A2.2 – *Fuel energy content for electricity production in thermoelectric plants (ktoe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**314,607**	**311,972**	**326,594**	**358,833**	**340,888**	**295,163**	**290,499**	**292,717**	**276,967**	**254,477**
EU27	**258,184**	**259,601**	**270,370**	**297,230**	**282,138**	**253,159**	**251,496**	**256,684**	**242,435**	**221,638**
Austria	3,375	3,672	3,172	4,501	4,371	3,203	3,067	3,465	3,200	3,195
Belgium	6,236	6,854	6,565	7,030	7,355	5,425	5,050	5,121	5,162	5,298
Bulgaria	5,782	4,906	4,509	5,216	5,906	5,745	5,086	5,550	5,286	4,866
Cyprus	521	647	890	1,088	1,198	937	1,019	1,025	1,037	1,021
Czechia	**10,859**	**10,241**	**11,641**	**11,259**	**11,062**	**10,347**	**10,539**	**10,444**	**10,386**	**9,769**
Germany	**87,564**	**80,497**	**76,537**	**80,242**	**80,266**	**79,467**	**80,287**	**75,688**	**72,206**	**61,604**
Denmark	3,873	5,410	4,768	3,736	3,918	1,614	1,980	1,747	1,803	1,321
Estonia	2,659	1,904	2,042	2,277	2,802	2,389	2,578	2,854	2,694	1,484
Greece	10,160	10,875	13,125	13,854	11,986	9,028	8,280	9,633	9,269	8,175
Spain	**16,815**	**20,244**	**26,490**	**35,456**	**25,118**	**25,893**	**22,310**	**26,270**	**23,570**	**20,837**
Finland	3,633	4,674	4,157	4,156	6,149	3,150	3,204	3,005	3,512	3,086
France	**11,008**	**9,025**	**10,403**	**13,067**	**13,885**	**10,049**	**11,569**	**12,936**	**10,204**	**10,519**
Croatia	1,078	744	1,010	1,188	965	767	881	834	696	814
Hungary	3,952	4,630	4,438	4,355	4,100	2,657	2,785	2,900	2,738	2,795
Ireland	3,046	3,771	4,818	4,811	4,615	3,813	4,229	4,067	3,770	3,492
Italy	**37,395**	**40,472**	**44,312**	**47,131**	**40,911**	**33,243**	**33,460**	**34,609**	**31,929**	**31,694**
Lithuania	1,376	156	289	456	517	320	209	154	127	142
Luxembourg	188	135	72	493	471	162	73	74	76	82
Latvia	230	114	146	158	311	388	396	323	477	490
Malta	504	485	498	611	578	264	173	284	299	316
Netherlands	**12,434**	**12,697**	**13,325**	**15,107**	**16,829**	**15,694**	**15,984**	**15,415**	**14,588**	**14,748**
Poland	**26,847**	**26,236**	**26,945**	**28,701**	**28,695**	**28,471**	**27,961**	**27,920**	**28,021**	**25,794**
Portugal	4,904	6,035	7,123	7,812	6,796	7,139	7,699	8,259	7,788	6,404
Romania	6,073	7,172	5,523	6,529	5,857	5,643	5,208	5,666	5,594	5,145
Sweden	**551**	**1,065**	**986**	**1,359**	**2,209**	**1,513**	**1,630**	**1,723**	**1,738**	**1,901**
Slovenia	1,122	1,055	1,063	1,229	1,268	927	1,001	1,002	978	952
Slovakia	2,198	2,135	1,858	1,579	1,233	1,211	1,157	1,181	1,208	1,212
United Kingdom	**56,276**	**52,227**	**56,006**	**62,028**	**58,992**	**42,322**	**39,246**	**36,231**	**34,744**	**33,019**

Table A2.3 – *Fuel energy content for of electricity and heat production in cogeneration plants (ktoe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**138,310**	**125,051**	**119,439**	**156,102**	**165,240**	**146,673**	**150,601**	**152,674**	**147,324**	**144,826**
EU27	**136,784**	**122,868**	**115,614**	**151,438**	**160,849**	**142,668**	**146,931**	**149,134**	**143,669**	**140,932**
Austria	2,201	2,674	1,626	2,102	2,809	2,476	2,679	2,641	2,533	2,680
Belgium	1,586	1,413	1,142	1,561	2,744	2,735	2,743	2,600	2,730	2,613
Bulgaria	5,923	4,261	2,240	2,278	1,970	1,604	1,503	1,304	1,184	1,589
Cyprus	0	0	0	6	12	7	7	9	9	8
Czechia	**5,423**	**6,736**	**5,570**	**6,419**	**5,824**	**5,095**	**5,163**	**4,995**	**4,812**	**4,710**
Germany	**11,257**	**8,076**	**7,978**	**22,073**	**25,235**	**25,655**	**27,524**	**28,730**	**26,236**	**25,740**
Denmark	5,538	7,604	7,327	7,127	7,597	4,097	4,615	4,390	4,347	3,745
Estonia	4,902	2,519	522	405	422	447	437	469	582	617
Greece	206	236	743	1,848	2,543	2,648	2,563	2,343	2,323	2,277
Spain	**1,033**	**2,410**	**3,305**	**4,116**	**4,190**	**3,988**	**3,817**	**4,168**	**4,324**	**4,416**
Finland	3,542	4,593	5,600	6,463	6,994	5,309	5,478	5,530	5,503	5,235
France	**169**	**1,019**	**4,413**	**7,926**	**5,727**	**5,363**	**5,818**	**5,996**	**5,727**	**6,073**
Croatia	504	546	537	671	721	456	528	887	783	883
Hungary	1,645	1,381	1,956	2,208	1,847	1,151	1,284	1,265	1,229	1,045
Ireland	50	57	123	117	289	305	300	302	292	277
Italy	**2,876**	**4,676**	**9,646**	**21,012**	**24,087**	**21,827**	**23,332**	**24,153**	**23,373**	**23,602**
Lithuania	2,610	950	914	1,227	1,306	720	582	520	488	459
Luxembourg	0	25	68	126	125	102	101	107	118	150
Latvia	890	596	518	575	787	974	1,041	751	944	912
Malta	0	0	0	0	0	1	1	1	1	1
Netherlands	**13,535**	**15,668**	**10,518**	**11,495**	**12,960**	**9,028**	**8,596**	**8,830**	**8,412**	**8,733**
Poland	**44,330**	**36,823**	**36,132**	**36,339**	**36,528**	**35,332**	**35,097**	**35,294**	**35,174**	**32,765**
Portugal	235	678	804	1,068	1,370	1,290	1,236	1,255	1,301	1,333
Romania	22,852	13,226	7,412	5,920	4,257	3,181	3,135	3,049	2,767	2,710
Sweden	**1,409**	**3,094**	**3,018**	**4,365**	**6,223**	**4,998**	**5,371**	**5,470**	**5,518**	**5,695**
Slovenia	1,336	1,212	1,154	1,345	1,437	1,166	1,249	1,260	412	386
Slovakia	2,524	2,223	1,839	2,281	2,246	2,043	2,022	2,121	1,916	1,664
United Kingdom	**1,526**	**2,182**	**3,825**	**4,665**	**4,392**	**4,004**	**3,669**	**3,540**	**3,656**	**3,894**

Table A2.4 – *Fuel energy content for electricity production in cogeneration plants (ktoe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**66,046**	**67,153**	**66,364**	**88,951**	**97,612**	**87,184**	**89,408**	**91,867**	**88,837**	**87,214**
EU27	**64,908**	**65,256**	**62,916**	**84,712**	**93,463**	**83,497**	**85,982**	**88,526**	**85,394**	**83,500**
Austria	1,429	1,772	746	920	1,322	1,011	1,167	1,065	1,058	1,125
Belgium	1,524	1,394	671	946	1,670	1,796	1,845	1,800	1,867	1,835
Bulgaria	2,086	1,055	850	976	603	436	426	396	424	657
Cyprus	0	0	0	6	12	6	6	7	7	7
Czechia	**1,417**	**1,784**	**2,106**	**2,470**	**2,052**	**2,103**	**2,057**	**2,049**	**1,994**	**1,983**
Germany	**0**	**0**	**0**	**11,162**	**13,887**	**15,144**	**16,447**	**17,514**	**15,440**	**15,176**
Denmark	3,388	4,542	4,260	3,732	3,890	1,609	1,976	1,739	1,799	1,314
Estonia	2,659	1,904	151	123	144	135	133	168	179	188
Greece	204	236	680	1,723	2,416	2,508	2,423	2,204	2,177	2,133
Spain	**1,019**	**2,408**	**3,297**	**4,116**	**4,190**	**3,988**	**3,817**	**4,168**	**4,324**	**4,416**
Finland	1,911	2,510	2,563	2,811	2,913	2,159	2,154	2,193	2,326	2,273
France	**169**	**326**	**1,511**	**2,869**	**2,615**	**2,502**	**2,583**	**2,686**	**2,647**	**2,809**
Croatia	187	233	250	345	402	184	239	509	393	469
Hungary	259	188	505	989	805	564	604	649	642	515
Ireland	50	57	123	117	289	305	300	302	292	277
Italy	**2,729**	**4,515**	**9,437**	**14,621**	**16,981**	**13,649**	**14,872**	**15,553**	**14,953**	**15,148**
Lithuania	1,376	156	289	456	517	320	209	154	127	142
Luxembourg	0	25	44	43	43	37	37	36	39	45
Latvia	230	114	146	157	309	388	396	323	477	490
Malta	0	0	0	0	0	1	1	1	1	1
Netherlands	**12,359**	**12,211**	**6,257**	**7,233**	**8,425**	**5,624**	**5,235**	**5,419**	**5,344**	**5,645**
Poland	**26,847**	**26,233**	**26,936**	**26,419**	**27,512**	**27,522**	**27,080**	**27,077**	**27,195**	**24,959**
Portugal	178	581	568	592	681	658	631	643	646	659
Romania	6,073	3,876	2,353	2,370	1,699	1,175	1,111	1,174	1,092	1,193
Sweden	**529**	**1,024**	**908**	**1,247**	**2,142**	**1,507**	**1,624**	**1,719**	**1,732**	**1,897**
Slovenia	972	881	915	1,066	1,143	922	998	998	155	146
Slovakia	1,352	1,091	1,141	1,342	1,088	1,105	1,057	1,105	1,093	896
United Kingdom	**990**	**1,753**	**3,230**	**4,665**	**4,392**	**4,004**	**3,669**	**3,540**	**3,656**	**3,894**

Table A2.5 – *Fuel energy content for electricity production in non-cogeneration plants (ktoe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**248,561**	**244,819**	**260,230**	**269,882**	**243,276**	**207,979**	**201,091**	**200,849**	**188,130**	**167,263**
EU27	**193,275**	**194,345**	**207,454**	**212,518**	**188,675**	**169,661**	**165,514**	**168,159**	**157,041**	**138,139**
Austria	1,946	1,900	2,426	3,581	3,049	2,192	1,900	2,401	2,143	2,069
Belgium	4,712	5,460	5,894	6,083	5,685	3,629	3,205	3,321	3,295	3,464
Bulgaria	3,696	3,852	3,659	4,240	5,303	5,309	4,660	5,154	4,862	4,210
Cyprus	521	647	890	1,082	1,186	931	1,013	1,018	1,030	1,015
Czechia	**9,442**	**8,456**	**9,535**	**8,789**	**9,010**	**8,244**	**8,482**	**8,395**	**8,392**	**7,786**
Germany	**87,564**	**80,497**	**76,537**	**69,080**	**66,379**	**64,323**	**63,840**	**58,174**	**56,767**	**46,428**
Denmark	485	867	508	5	28	5	4	8	4	7
Estonia	0	0	1,890	2,154	2,658	2,254	2,444	2,686	2,515	1,297
Greece	9,956	10,639	12,445	12,131	9,570	6,519	5,858	7,429	7,091	6,042
Spain	**15,795**	**17,836**	**23,193**	**31,340**	**20,928**	**21,905**	**18,493**	**22,102**	**19,246**	**16,421**
Finland	1,721	2,165	1,595	1,345	3,236	991	1,050	813	1,186	813
France	**10,839**	**8,699**	**8,892**	**10,198**	**11,270**	**7,547**	**8,986**	**10,250**	**7,556**	**7,710**
Croatia	891	511	760	842	563	583	643	326	303	346
Hungary	3,693	4,442	3,933	3,366	3,296	2,092	2,181	2,250	2,096	2,280
Ireland	2,996	3,713	4,694	4,695	4,326	3,508	3,929	3,765	3,478	3,215
Italy	**34,666**	**35,957**	**34,875**	**32,510**	**23,930**	**19,594**	**18,588**	**19,056**	**16,976**	**16,546**
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	188	110	28	451	428	125	36	37	37	37
Latvia	0	0	0	0	2	0	0	0	0	0
Malta	504	485	498	611	578	263	172	283	298	315
Netherlands	**74**	**485**	**7,067**	**7,874**	**8,404**	**10,070**	**10,749**	**9,997**	**9,244**	**9,103**
Poland	**0**	**3**	**9**	**2,281**	**1,183**	**949**	**881**	**843**	**826**	**835**
Portugal	4,726	5,454	6,556	7,220	6,115	6,482	7,068	7,616	7,142	5,745
Romania	0	3,297	3,170	4,159	4,158	4,468	4,097	4,492	4,502	3,952
Sweden	**22**	**41**	**78**	**111**	**67**	**6**	**6**	**4**	**6**	**4**
Slovenia	151	174	148	163	125	5	3	5	823	806
Slovakia	846	1,044	717	237	146	106	100	76	114	316
United Kingdom	**55,286**	**50,474**	**52,776**	**57,363**	**54,601**	**38,318**	**35,577**	**32,691**	**31,089**	**29,125**

Table A2.6 – *Gross electricity production w/o pumping (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**2576.1**	**2721.5**	**3004.0**	**3280.9**	**3332.0**	**3208.7**	**3231.3**	**3261.6**	**3244.4**	**3200.3**
EU27	**2258.3**	**2389.0**	**2629.6**	**2885.5**	**2953.0**	**2873.4**	**2895.1**	**2926.5**	**2913.9**	**2878.6**
Austria	49.3	55.2	59.9	64.5	67.9	61.8	65.3	67.4	65.0	70.8
Belgium	70.3	73.5	82.8	85.4	94.3	68.3	84.2	85.1	73.6	92.4
Bulgaria	41.9	41.6	40.6	43.9	46.0	48.7	44.6	44.9	46.5	43.8
Cyprus	2.0	2.5	3.4	4.4	5.3	4.5	4.9	5.0	5.1	5.1
Czechia	**61.7**	**60.1**	**70.7**	**79.3**	**82.4**	**79.9**	**79.4**	**83.3**	**84.5**	**83.6**
Germany	**547.6**	**532.8**	**572.3**	**613.4**	**624.6**	**640.6**	**643.0**	**646.0**	**635.2**	**601.6**
Denmark	26.0	36.7	36.0	36.2	38.9	28.9	30.5	31.0	30.4	29.5
Estonia	17.2	8.7	8.5	10.2	13.0	10.1	12.2	13.2	12.4	7.6
Greece	40.5	48.1	60.1	66.3	61.6	55.6	58.2	59.1	57.0	52.3
Spain	**151.2**	**165.6**	**220.9**	**284.5**	**298.2**	**277.5**	**271.2**	**272.9**	**271.9**	**270.9**
Finland	54.4	64.0	69.8	70.3	80.4	68.4	68.5	67.1	70.0	68.4
France	**417.2**	**491.2**	**535.2**	**571.2**	**564.3**	**573.9**	**558.6**	**556.1**	**575.8**	**565.6**
Croatia	8.9	9.3	11.3	13.1	14.8	11.2	12.6	11.8	13.5	12.7
Hungary	28.4	34.0	35.2	35.8	37.4	30.3	31.8	32.8	31.9	34.0
Ireland	14.2	17.6	23.7	25.6	28.2	28.1	30.2	30.7	30.9	30.7
Italy	**213.1**	**237.0**	**269.2**	**295.7**	**298.0**	**281.0**	**287.2**	**293.3**	**287.4**	**291.4**
Lithuania	28.4	13.5	11.0	14.2	4.7	4.0	3.4	3.4	2.8	3.1
Luxembourg	0.6	0.5	0.4	3.3	3.2	1.3	0.8	0.9	1.0	1.1
Latvia	6.6	4.0	4.1	4.9	6.6	5.5	6.4	7.5	6.7	6.4
Malta	1.1	1.6	1.9	2.2	2.1	1.3	0.9	1.7	2.0	2.1
Netherlands	**71.8**	**80.9**	**89.4**	**99.7**	**119.1**	**108.8**	**113.8**	**115.6**	**113.5**	**120.4**
Poland	**134.4**	**137.0**	**143.2**	**155.1**	**157.0**	**164.2**	**166.1**	**169.9**	**169.5**	**163.0**
Portugal	28.3	33.1	43.1	45.9	53.4	51.0	58.8	57.4	58.1	51.5
Romania	64.3	59.1	51.6	59.4	60.6	65.9	64.6	63.9	64.4	59.2
Sweden	**146.0**	**148.3**	**145.2**	**158.4**	**148.4**	**162.0**	**155.9**	**164.2**	**163.4**	**168.4**
Slovenia	12.4	12.9	13.6	15.1	16.3	14.8	16.2	16.1	16.1	15.9
Slovakia	25.5	26.4	30.8	31.3	27.4	26.5	26.7	27.3	26.6	28.2
United Kingdom	**317.8**	**332.5**	**374.4**	**395.4**	**378.9**	**335.3**	**336.3**	**335.1**	**330.5**	**321.7**

Table A2.7 – *Gross electricity production from cogeneration plants (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**416.6**	**430.5**	**467.1**	**641.1**	**695.3**	**616.0**	**641.7**	**661.0**	**643.5**	**640.0**
EU27	**406.8**	**416.0**	**440.3**	**613.9**	**670.0**	**596.9**	**621.6**	**640.4**	**622.5**	**616.0**
Austria	8.7	10.5	5.7	7.7	11.5	9.0	10.6	9.6	9.6	10.2
Belgium	7.3	8.1	5.7	7.5	14.9	14.6	15.0	15.0	15.6	15.7
Bulgaria	11.3	8.4	5.6	5.8	5.1	4.0	3.9	3.7	3.8	5.2
Cyprus	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Czechia	**10.7**	**12.3**	**17.5**	**17.5**	**13.7**	**14.4**	**14.4**	**14.1**	**13.7**	**13.7**
Germany	**0.0**	**0.0**	**0.0**	**87.7**	**106.1**	**114.8**	**124.5**	**132.3**	**122.0**	**119.3**
Denmark	23.3	31.3	29.3	29.6	30.9	14.2	17.0	15.4	15.5	12.4
Estonia	17.2	8.7	1.2	1.0	1.3	1.2	1.3	1.5	1.5	1.5
Greece	1.1	1.2	3.6	8.2	10.9	10.1	9.5	9.6	9.1	8.7
Spain	**4.4**	**9.2**	**26.1**	**33.7**	**29.1**	**29.5**	**29.8**	**32.0**	**32.9**	**33.7**
Finland	16.9	22.3	25.1	27.3	29.0	21.6	21.6	21.5	22.6	22.3
France	**1.2**	**2.1**	**15.7**	**24.8**	**17.9**	**18.0**	**19.6**	**20.8**	**20.9**	**22.4**
Croatia	1.1	1.4	1.5	2.4	3.0	1.4	1.8	3.8	3.0	3.5
Hungary	2.6	2.1	4.8	8.7	7.5	4.6	5.1	5.4	5.3	4.6
Ireland	0.2	0.2	0.6	0.6	1.9	2.2	2.2	2.2	2.2	2.1
Italy	**16.6**	**29.2**	**60.1**	**94.4**	**111.5**	**95.9**	**105.1**	**110.1**	**104.9**	**107.3**
Lithuania	10.9	1.3	2.3	3.4	4.0	2.8	1.8	1.3	1.1	1.2
Luxembourg	0.0	0.1	0.2	0.4	0.4	0.3	0.4	0.3	0.4	0.4
Latvia	2.2	1.0	1.3	1.5	3.0	3.5	3.8	3.0	4.2	4.2
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	**67.8**	**75.3**	**46.9**	**57.5**	**65.6**	**42.8**	**41.1**	**43.1**	**42.2**	**45.3**
Poland	**133.0**	**135.1**	**141.0**	**142.8**	**147.0**	**147.1**	**147.1**	**148.2**	**150.5**	**141.3**
Portugal	0.9	2.6	3.8	4.5	5.6	5.4	5.3	5.4	5.3	5.5
Romania	50.2	31.7	18.9	17.6	12.8	9.8	9.1	9.4	8.5	7.9
Sweden	**5.2**	**10.0**	**8.6**	**11.8**	**20.5**	**13.9**	**15.1**	**15.5**	**15.5**	**16.4**
Slovenia	4.5	4.3	4.4	5.1	5.5	5.1	5.7	5.6	1.3	1.2
Slovakia	8.6	6.3	7.2	8.2	7.0	6.5	6.6	7.0	7.0	6.2
United Kingdom	**5.3**	**8.8**	**20.9**	**27.2**	**25.3**	**19.1**	**20.1**	**20.6**	**20.9**	**24.0**

Table A2.8 – *Gross electricity production from non-cogeneration plants (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1070.1**	**1070.2**	**1207.4**	**1250.4**	**1163.6**	**974.4**	**976.3**	**982.0**	**912.0**	**835.6**
EU27	**833.1**	**846.4**	**950.9**	**971.7**	**886.0**	**782.7**	**784.8**	**804.9**	**742.6**	**677.3**
Austria	9.1	7.6	12.2	18.3	15.9	9.9	8.3	11.7	10.3	11.0
Belgium	20.0	23.7	28.4	29.8	29.2	18.6	16.7	17.8	17.7	18.9
Bulgaria	14.3	13.8	14.2	15.1	19.9	20.9	18.2	19.9	18.8	16.4
Cyprus	2.0	2.5	3.4	4.3	5.2	4.1	4.5	4.6	4.6	4.6
Czechia	**37.3**	**33.5**	**37.8**	**34.6**	**37.0**	**34.0**	**36.3**	**36.2**	**36.3**	**34.7**
Germany	**377.7**	**356.2**	**371.6**	**314.0**	**306.7**	**295.5**	**295.1**	**272.0**	**263.6**	**215.0**
Denmark	2.1	4.2	2.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Estonia	0.0	0.0	7.3	9.1	11.3	8.2	10.3	10.9	10.2	5.4
Greece	37.6	43.3	52.4	51.8	40.4	30.9	34.1	36.1	32.1	28.0
Spain	**67.0**	**77.6**	**99.6**	**153.6**	**113.4**	**99.5**	**83.8**	**101.0**	**85.3**	**83.5**
Finland	7.4	9.6	7.4	5.8	15.3	4.4	4.8	3.6	5.3	3.6
France	**47.6**	**38.3**	**37.4**	**41.9**	**44.2**	**33.2**	**44.3**	**52.0**	**36.7**	**39.7**
Croatia	3.8	2.2	3.3	3.6	2.5	2.6	2.9	1.4	1.5	1.7
Hungary	11.9	17.7	16.1	13.0	13.4	8.8	9.5	10.0	9.4	10.7
Ireland	13.3	16.6	22.0	23.3	22.8	18.6	21.2	20.3	19.4	17.7
Italy	**161.7**	**166.6**	**159.6**	**157.5**	**119.0**	**95.6**	**93.6**	**98.7**	**87.2**	**87.8**
Lithuania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Luxembourg	0.6	0.3	0.1	2.7	2.6	0.7	0.1	0.1	0.1	0.1
Latvia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malta	1.1	1.6	1.9	2.2	2.1	1.2	0.7	1.5	1.8	1.9
Netherlands	**0.4**	**1.2**	**37.6**	**36.0**	**45.4**	**53.2**	**58.9**	**56.3**	**53.5**	**54.3**
Poland	**0.0**	**0.0**	**0.0**	**10.0**	**5.4**	**4.3**	**4.2**	**4.1**	**4.0**	**4.0**
Portugal	26.9	29.7	38.6	40.4	45.9	44.2	52.3	51.2	51.5	44.6
Romania	2.7	10.7	12.4	16.0	16.0	18.8	17.8	19.2	18.8	15.9
Sweden	**0.1**	**0.2**	**0.3**	**0.4**	**0.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Slovenia	0.4	0.6	0.7	0.7	0.6	0.0	0.0	0.0	4.1	4.1
Slovakia	3.0	3.8	2.5	0.7	0.6	0.5	0.4	0.3	0.6	1.8
United Kingdom	**236.9**	**223.8**	**256.5**	**278.8**	**277.6**	**191.8**	**191.5**	**177.1**	**169.4**	**158.3**

Table A2.9 – *Heat from cogeneration plants (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**488.8**	**418.0**	**404.7**	**517.0**	**520.8**	**454.8**	**471.9**	**466.9**	**456.2**	**450.9**
EU27	**488.8**	**418.0**	**404.7**	**517.0**	**520.8**	**454.8**	**471.9**	**466.9**	**456.2**	**450.9**
Austria	4.8	6.4	8.0	10.8	13.5	13.5	14.1	14.5	13.7	14.6
Belgium	2.6	2.7	6.0	5.3	9.5	7.3	7.1	6.1	6.7	5.8
Bulgaria	29.9	21.7	10.4	10.7	12.3	11.0	10.3	8.9	7.3	8.0
Cyprus	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
Czechia	**32.7**	**35.3**	**28.8**	**29.4**	**30.6**	**26.3**	**27.3**	**26.2**	**24.8**	**24.2**
Germany	**123.4**	**93.3**	**75.4**	**99.6**	**100.2**	**90.4**	**93.8**	**93.8**	**97.5**	**96.0**
Denmark	15.1	24.4	27.0	29.4	32.2	23.7	24.8	25.6	24.8	24.7
Estonia	13.7	3.4	3.0	2.6	2.9	3.1	3.3	3.0	3.8	3.7
Greece	-	-	0.3	0.6	0.5	0.6	0.6	0.6	0.6	0.6
Spain	**0.1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Finland	17.1	20.5	30.1	35.7	40.7	32.2	34.2	33.2	31.4	29.5
France	**-**	**4.5**	**35.9**	**47.0**	**24.4**	**22.4**	**25.7**	**26.6**	**24.0**	**25.8**
Croatia	3.3	2.9	2.4	2.7	2.6	2.5	2.5	3.0	3.0	3.2
Hungary	11.0	10.0	14.1	11.4	10.3	5.5	6.2	5.5	5.4	5.5
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	**-**	**-**	**-**	**53.6**	**56.3**	**59.2**	**61.0**	**61.1**	**59.6**	**60.2**
Lithuania	9.8	6.7	5.0	6.4	6.3	3.6	3.5	3.6	3.7	3.3
Luxembourg	-	-	0.1	0.9	0.8	0.6	0.6	0.7	0.8	1.0
Latvia	6.2	4.4	3.3	4.1	4.7	5.3	6.0	3.8	4.1	3.7
Malta	-	-	-	-	-	0.0	0.0	-	-	0.0
Netherlands	**10.5**	**27.4**	**34.9**	**35.9**	**37.4**	**28.4**	**27.6**	**27.0**	**24.6**	**24.5**
Poland	**117.8**	**62.3**	**54.7**	**60.9**	**57.0**	**51.5**	**52.5**	**54.6**	**53.7**	**52.7**
Portugal	0.3	0.4	1.6	3.8	5.9	5.4	5.2	5.3	5.6	5.8
Romania	71.7	61.1	35.3	27.8	21.9	17.6	17.5	16.0	14.3	12.3
Sweden	**10.2**	**22.3**	**22.1**	**29.8**	**40.9**	**36.5**	**39.2**	**38.6**	**38.9**	**38.0**
Slovenia	1.7	1.7	1.8	2.0	2.1	2.0	2.1	2.1	2.2	2.0
Slovakia	7.0	6.4	4.4	6.6	7.7	6.3	6.7	7.1	5.6	5.5
United Kingdom	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Table A2.10 – *Heat from nuclear plants (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1.9**	**1.0**	**0.9**	**1.8**	**1.4**	**1.1**	**1.1**	**1.2**	**1.1**	**1.1**
EU27	**1.9**	**1.0**	**0.9**	**1.8**	**1.4**	**1.1**	**1.1**	**1.2**	**1.1**	**1.1**
Austria	-	-	-	-	-	-	-	-	-	-
Belgium	-	-	-	-	-	-	-	-	-	-
Bulgaria	-	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2
Cyprus	-	-	-	-	-	-	-	-	-	-
Czechia	**-**	**-**	**-**	**0.3**	**0.3**	**0.2**	**0.2**	**0.3**	**0.2**	**0.2**
Germany	**1.2**	**0.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Denmark	-	-	-	-	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	-	-
Greece	-	-	-	-	-	-	-	-	-	-
Spain	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Finland	-	-	-	-	-	-	-	-	-	-
France	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Croatia	-	-	-	-	-	-	-	-	-	-
Hungary	-	-	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Lithuania	0.8	0.7	0.6	0.5	-	-	-	-	-	-
Luxembourg	-	-	-	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	-	-	-	-	-
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Poland	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Portugal	-	-	-	-	-	-	-	-	-	-
Romania	-	-	-	-	-	-	-	-	-	-
Sweden	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Slovenia	-	-	-	-	-	-	-	-	-	-
Slovakia	-	-	-	0.6	0.7	0.5	0.5	0.6	0.5	0.5
United Kingdom	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Table A2.11 – *Gross electricity production from nuclear plants (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**794.9**	**880.8**	**945.0**	**997.7**	**916.6**	**857.0**	**839.7**	**829.7**	**827.0**	**821.5**
EU27	**729.1**	**791.9**	**859.9**	**916.1**	**854.5**	**786.7**	**768.0**	**759.4**	**761.9**	**765.3**
Austria	-	-	-	-	-	-	-	-	-	-
Belgium	42.7	41.4	48.2	47.6	47.9	26.1	43.5	42.2	28.6	43.5
Bulgaria	14.7	17.3	18.2	18.7	15.2	15.4	15.8	15.5	16.1	16.6
Cyprus	-	-	-	-	-	-	-	-	-	-
Czechia	**12.6**	**12.2**	**13.6**	**24.7**	**28.0**	**26.8**	**24.1**	**28.3**	**29.9**	**30.2**
Germany	**152.5**	**153.1**	**169.6**	**163.1**	**140.6**	**91.8**	**84.6**	**76.3**	**76.0**	**75.1**
Denmark	-	-	-	-	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	-	-
Greece	-	-	-	-	-	-	-	-	-	-
Spain	**54.3**	**55.5**	**62.2**	**57.5**	**62.0**	**57.2**	**58.6**	**58.0**	**55.8**	**58.3**
Finland	19.2	19.2	22.5	23.3	22.8	23.2	23.2	22.5	22.8	23.9
France	**314.1**	**377.2**	**415.2**	**451.5**	**428.5**	**437.4**	**403.2**	**398.4**	**412.9**	**399.0**
Croatia	-	-	-	-	-	-	-	-	-	-
Hungary	13.7	14.0	14.2	13.8	15.8	15.8	16.1	16.1	15.7	16.3
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Lithuania	17.0	11.8	8.4	10.3	-	-	-	-	-	-
Luxembourg	-	-	-	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	-	-	-	-	-
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	**3.5**	**4.0**	**3.9**	**4.0**	**4.0**	**4.1**	**4.0**	**3.4**	**3.5**	**3.9**
Poland	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Portugal	-	-	-	-	-	-	-	-	-	-
Romania	-	-	5.5	5.6	11.6	11.6	11.3	11.5	11.4	11.3
Sweden	**68.2**	**69.9**	**57.3**	**72.4**	**57.8**	**56.3**	**63.1**	**65.7**	**68.5**	**66.1**
Slovenia	4.6	4.8	4.8	5.9	5.7	5.6	5.7	6.3	5.8	5.8
Slovakia	12.0	11.4	16.5	17.7	14.6	15.1	14.8	15.1	14.8	15.3
United Kingdom	**65.7**	**89.0**	**85.1**	**81.6**	**62.1**	**70.3**	**71.7**	**70.3**	**65.1**	**56.2**

Table A2.12 – *Gross electricity production from renewable sources w/o pumping (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**308.9**	**361.4**	**418.5**	**461.7**	**680.2**	**939.1**	**954.9**	**974.4**	**1052.6**	**1100.4**
EU27	**303.1**	**354.5**	**408.6**	**444.8**	**654.1**	**856.6**	**871.9**	**875.5**	**942.6**	**979.9**
Austria	32.6	38.9	43.4	40.9	45.0	47.6	51.1	51.1	50.1	54.4
Belgium	0.6	0.7	1.0	2.1	6.6	14.5	14.4	15.9	17.2	19.5
Bulgaria	1.6	2.2	2.6	4.3	5.8	8.8	7.0	6.1	9.4	7.5
Cyprus	-	-	-	0.0	0.1	0.4	0.4	0.4	0.5	0.5
Czechia	**1.2**	**2.4**	**2.3**	**3.1**	**5.9**	**9.4**	**9.4**	**9.6**	**9.4**	**10.1**
Germany	**19.1**	**25.9**	**35.5**	**63.4**	**105.2**	**188.8**	**189.7**	**216.3**	**224.5**	**242.4**
Denmark	0.8	1.9	5.6	9.8	12.4	18.9	18.4	21.8	20.8	23.1
Estonia	-	0.0	0.0	0.1	1.0	1.6	1.6	1.9	2.0	2.1
Greece	1.8	3.6	4.1	6.4	10.5	14.9	14.9	13.8	16.1	16.1
Spain	**26.0**	**24.4**	**34.5**	**42.3**	**97.8**	**97.1**	**104.6**	**87.9**	**103.9**	**101.0**
Finland	16.0	19.5	23.4	23.5	24.2	30.5	30.4	31.5	32.1	31.9
France	**55.8**	**75.5**	**69.4**	**56.3**	**78.2**	**91.8**	**99.0**	**92.6**	**113.6**	**113.1**
Croatia	3.9	5.7	6.5	7.1	9.3	7.5	8.4	7.1	9.8	8.3
Hungary	0.2	0.2	0.2	1.9	3.0	3.2	3.3	3.5	3.8	4.7
Ireland	0.7	0.7	1.2	1.9	3.7	7.9	7.5	8.9	10.2	11.8
Italy	**34.9**	**41.5**	**50.9**	**48.4**	**77.0**	**108.9**	**108.0**	**103.9**	**114.4**	**115.8**
Lithuania	0.4	0.4	0.3	0.5	0.9	1.7	2.1	2.5	2.2	2.5
Luxembourg	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Latvia	4.5	2.9	2.8	3.4	3.6	2.8	3.5	5.5	3.5	3.2
Malta	-	-	-	-	0.0	0.1	0.1	0.2	0.2	0.2
Netherlands	**0.8**	**1.4**	**3.0**	**7.4**	**11.2**	**13.7**	**14.8**	**17.4**	**18.9**	**22.7**
Poland	**1.5**	**2.0**	**2.3**	**3.8**	**10.9**	**22.7**	**22.8**	**24.1**	**21.6**	**25.5**
Portugal	18.5	16.9	23.8	13.9	52.3	44.3	60.3	41.1	54.3	50.1
Romania	11.4	16.7	14.8	20.2	20.3	26.2	27.0	24.3	26.2	24.6
Sweden	**74.5**	**70.6**	**83.1**	**81.2**	**82.1**	**102.5**	**89.1**	**95.1**	**91.2**	**98.9**
Slovenia	3.0	3.3	3.9	3.6	4.7	4.4	5.1	4.4	5.2	5.0
Slovakia	1.9	4.9	4.6	4.7	5.9	6.0	6.6	6.5	5.8	6.6
United Kingdom	**5.8**	**6.9**	**10.0**	**16.9**	**26.2**	**82.6**	**83.0**	**98.9**	**110.0**	**120.5**

Table A2.13 – *Share of renewable electricity production on total production, %.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**12.0%**	**13.3%**	**13.9%**	**14.1%**	**20.4%**	**29.3%**	**29.6%**	**29.9%**	**32.4%**	**34.4%**
EU27	**13.4%**	**14.8%**	**15.5%**	**15.4%**	**22.1%**	**29.8%**	**30.1%**	**29.9%**	**32.3%**	**34.0%**
Austria	66.2%	70.5%	72.6%	63.4%	66.3%	76.9%	78.3%	75.7%	77.0%	76.8%
Belgium	0.8%	0.9%	1.3%	2.5%	7.0%	21.3%	17.1%	18.6%	23.3%	21.1%
Bulgaria	3.9%	5.2%	6.5%	9.8%	12.5%	18.0%	15.8%	13.7%	20.2%	17.1%
Cyprus	0.0%	0.0%	0.0%	0.0%	1.4%	8.8%	8.7%	8.7%	9.4%	10.0%
Czechia	**1.9%**	**4.0%**	**3.2%**	**4.0%**	**7.2%**	**11.8%**	**11.8%**	**11.5%**	**11.2%**	**12.0%**
Germany	**3.5%**	**4.9%**	**6.2%**	**10.3%**	**16.8%**	**29.5%**	**29.5%**	**33.5%**	**35.3%**	**40.3%**
Denmark	3.2%	5.0%	15.5%	27.1%	32.0%	65.4%	60.2%	70.3%	68.4%	78.2%
Estonia	0.0%	0.1%	0.2%	1.1%	8.1%	15.4%	13.0%	14.1%	16.1%	28.1%
Greece	4.4%	7.4%	6.9%	9.7%	17.1%	26.7%	25.6%	23.4%	28.3%	30.7%
Spain	**17.2%**	**14.7%**	**15.6%**	**14.9%**	**32.8%**	**35.0%**	**38.6%**	**32.2%**	**38.2%**	**37.3%**
Finland	29.5%	30.5%	33.5%	33.4%	30.1%	44.7%	44.4%	46.9%	45.9%	46.6%
France	**13.4%**	**15.4%**	**13.0%**	**9.9%**	**13.9%**	**16.0%**	**17.7%**	**16.7%**	**19.7%**	**20.0%**
Croatia	44.3%	61.4%	57.3%	54.1%	62.8%	66.8%	66.3%	60.4%	72.2%	66.0%
Hungary	0.7%	0.6%	0.7%	5.2%	8.1%	10.7%	10.2%	10.6%	11.8%	13.8%
Ireland	4.9%	4.1%	5.0%	7.3%	13.2%	28.0%	24.9%	29.0%	33.0%	38.4%
Italy	**16.4%**	**17.5%**	**18.9%**	**16.4%**	**25.8%**	**38.8%**	**37.6%**	**35.4%**	**39.8%**	**39.8%**
Lithuania	1.5%	2.8%	3.1%	3.2%	19.2%	42.0%	61.5%	75.6%	80.1%	78.5%
Luxembourg	13.2%	22.1%	40.7%	6.2%	8.3%	32.3%	58.3%	66.8%	71.5%	74.7%
Latvia	67.6%	73.8%	68.3%	69.6%	54.9%	50.2%	54.2%	72.5%	52.0%	49.6%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	7.8%	15.9%	10.4%	10.1%	10.5%
Netherlands	**1.1%**	**1.7%**	**3.3%**	**7.5%**	**9.4%**	**12.6%**	**13.0%**	**15.1%**	**16.7%**	**18.9%**
Poland	**1.1%**	**1.4%**	**1.6%**	**2.5%**	**6.9%**	**13.8%**	**13.7%**	**14.2%**	**12.8%**	**15.6%**
Portugal	65.1%	51.0%	55.2%	30.2%	97.9%	86.8%	102.4%	71.6%	93.4%	97.4%
Romania	17.7%	28.3%	28.7%	34.0%	33.5%	39.7%	41.8%	38.0%	40.6%	41.6%
Sweden	**51.0%**	**47.6%**	**57.2%**	**51.3%**	**55.3%**	**63.3%**	**57.2%**	**57.9%**	**55.8%**	**58.7%**
Slovenia	23.7%	25.2%	28.7%	23.6%	29.2%	29.4%	31.2%	27.7%	32.4%	31.7%
Slovakia	7.4%	18.5%	15.0%	14.9%	21.7%	22.8%	24.8%	23.9%	21.9%	23.6%
United Kingdom	**1.8%**	**2.1%**	**2.7%**	**4.3%**	**6.9%**	**24.6%**	**24.7%**	**29.5%**	**33.3%**	**37.5%**

Table A2.14 – *GHG emissions (Mt CO_2eq) for electricity and heat production from thermoelectric plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1476.3**	**1375.1**	**1362.1**	**1466.2**	**1336.8**	**1166.3**	**1121.3**	**1111.8**	**1048.3**	**925.2**
EU27	**1255.1**	**1187.5**	**1178.6**	**1265.5**	**1159.4**	**1041.0**	**1021.4**	**1023.4**	**966.4**	**850.9**
Austria	13.8	14.1	12.9	17.9	17.2	13.4	12.8	14.1	13.0	13.4
Belgium	26.2	28.3	26.1	25.5	23.8	18.1	16.9	16.8	17.0	17.4
Bulgaria	35.7	30.7	23.3	26.1	29.1	27.9	24.5	25.8	23.0	21.6
Cyprus	1.7	2.1	2.9	3.5	3.9	3.0	3.3	3.3	3.3	3.3
Czechia	**63.9**	**64.2**	**64.0**	**64.6**	**63.1**	**53.9**	**55.0**	**53.4**	**53.0**	**49.0**
Germany	**393.5**	**350.7**	**333.3**	**341.8**	**328.0**	**318.9**	**318.6**	**298.8**	**283.2**	**235.9**
Denmark	23.3	30.5	25.2	21.5	22.6	10.8	12.3	10.4	10.4	7.8
Estonia	21.4	11.1	10.4	11.1	12.9	10.9	11.6	12.5	12.0	6.2
Greece	35.2	36.8	44.7	47.5	41.7	30.7	27.0	30.5	29.4	24.1
Spain	**66.4**	**77.6**	**98.2**	**117.9**	**71.5**	**84.5**	**70.2**	**82.8**	**73.8**	**56.6**
Finland	17.8	22.9	22.3	23.2	31.7	17.3	18.3	17.5	18.5	15.9
France	**46.4**	**38.4**	**48.7**	**59.2**	**50.0**	**37.5**	**40.0**	**44.5**	**37.1**	**36.4**
Croatia	4.2	3.2	4.0	4.9	4.0	3.2	3.5	3.1	2.7	3.0
Hungary	19.3	20.3	21.2	17.0	15.4	10.5	10.9	10.7	10.1	9.8
Ireland	10.8	13.1	15.6	15.4	13.3	11.9	12.7	11.8	10.5	9.2
Italy	**123.3**	**130.5**	**137.1**	**160.2**	**137.1**	**110.8**	**110.5**	**110.8**	**102.9**	**98.1**
Lithuania	7.1	2.7	2.3	3.0	3.1	1.5	1.2	1.0	0.9	0.9
Luxembourg	1.7	0.9	0.2	1.4	1.3	0.5	0.3	0.3	0.3	0.3
Latvia	2.3	1.8	1.4	1.3	1.8	1.9	2.0	1.3	1.7	1.7
Malta	1.8	1.6	1.6	2.0	1.9	0.9	0.6	0.7	0.7	0.7
Netherlands	**45.1**	**52.6**	**53.6**	**57.7**	**61.2**	**61.6**	**60.7**	**57.7**	**53.6**	**50.5**
Poland	**181.5**	**150.3**	**146.7**	**154.6**	**149.6**	**143.3**	**142.2**	**143.7**	**142.1**	**130.2**
Portugal	15.4	19.9	22.2	25.6	15.8	19.9	19.0	22.8	19.5	14.5
Romania	73.3	56.8	37.5	36.2	31.2	27.6	25.5	26.4	25.4	23.5
Sweden	**5.3**	**9.1**	**8.5**	**11.0**	**13.9**	**9.6**	**10.6**	**10.9**	**11.3**	**10.8**
Slovenia	6.1	5.7	5.3	6.2	6.2	4.6	4.9	4.9	4.8	4.6
Slovakia	12.6	11.7	9.3	9.2	8.2	6.6	6.4	6.7	6.2	5.6
United Kingdom	**221.2**	**187.6**	**183.5**	**200.6**	**177.3**	**125.3**	**100.0**	**88.3**	**81.9**	**74.3**

Table A2.15 – *GHG emissions (Mt CO_2eq) for electricity production in thermoelectric plants, after apportioning the energy for the heat production in cogeneration plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**1222.6**	**1184.4**	**1197.2**	**1270.8**	**1144.6**	**1007.6**	**958.1**	**951.4**	**895.9**	**778.7**
EU27	**984.2**	**982.5**	**998.6**	**1,054.3**	**950.3**	**866.2**	**843.5**	**849.1**	**800.8**	**692.0**
Austria	11.2	11.2	10.4	14.8	13.7	9.8	9.1	10.3	9.5	9.6
Belgium	25.3	27.3	24.9	24.0	21.3	16.0	14.8	14.9	15.0	15.5
Bulgaria	23.7	19.8	18.5	21.5	24.4	23.8	20.9	22.9	20.9	19.2
Cyprus	1.7	2.1	2.9	3.5	3.9	3.0	3.3	3.3	3.3	3.3
Czechia	**46.2**	**43.3**	**49.8**	**48.4**	**46.5**	**41.5**	**42.1**	**41.6**	**41.4**	**38.0**
Germany	**350.7**	**322.9**	**306.6**	**308.5**	**293.8**	**288.5**	**287.4**	**267.6**	**254.0**	**207.9**
Denmark	15.1	20.0	16.0	12.0	12.6	4.7	5.9	4.7	5.0	3.1
Estonia	11.7	8.5	9.0	10.0	12.0	10.1	10.9	11.7	11.0	5.3
Greece	35.2	36.8	44.4	46.9	41.2	30.1	26.4	29.9	28.8	23.5
Spain	**66.4**	**77.6**	**98.1**	**117.9**	**71.5**	**84.5**	**70.2**	**82.8**	**73.8**	**56.6**
Finland	11.8	15.6	13.3	12.9	20.2	8.7	9.3	8.4	9.8	7.9
France	**46.4**	**37.0**	**40.9**	**45.7**	**43.2**	**31.7**	**33.6**	**38.0**	**31.2**	**30.2**
Croatia	3.4	2.3	3.3	4.0	3.2	2.6	2.9	2.3	1.9	2.2
Hungary	14.8	16.4	15.8	13.4	12.2	8.5	8.8	9.0	8.3	8.1
Ireland	10.8	13.1	15.6	15.4	13.3	11.9	12.7	11.8	10.5	9.2
Italy	**122.7**	**129.8**	**134.4**	**141.8**	**116.8**	**91.4**	**89.8**	**90.5**	**83.5**	**78.4**
Lithuania	3.7	0.5	0.8	1.2	1.3	0.7	0.5	0.3	0.2	0.3
Luxembourg	1.7	0.9	0.2	1.2	1.1	0.4	0.2	0.2	0.2	0.2
Latvia	0.6	0.3	0.4	0.4	0.7	0.7	0.8	0.6	0.9	1.0
Malta	1.8	1.6	1.6	2.0	1.9	0.9	0.6	0.7	0.7	0.7
Netherlands	**40.9**	**42.1**	**42.1**	**45.7**	**48.4**	**53.3**	**52.5**	**49.6**	**46.2**	**43.2**
Poland	**110.6**	**108.0**	**110.0**	**115.3**	**112.5**	**109.5**	**108.2**	**109.0**	**108.5**	**98.2**
Portugal	15.2	19.6	21.5	24.3	14.1	18.4	17.6	21.4	17.9	12.9
Romania	16.9	25.5	20.6	24.8	23.0	21.2	19.3	20.8	20.4	19.1
Sweden	**1.8**	**3.5**	**3.3**	**3.7**	**5.1**	**2.8**	**3.0**	**3.2**	**3.4**	**3.6**
Slovenia	4.6	4.4	4.4	5.1	5.1	3.7	4.0	4.0	3.9	3.8
Slovakia	8.4	7.8	6.7	6.1	4.3	3.7	3.5	3.6	3.7	3.4
United Kingdom	**219.4**	**186.4**	**181.8**	**200.6**	**177.3**	**125.3**	**100.0**	**88.3**	**81.9**	**74.3**

Table A2.16 – *GHG emission factors in the thermoelectric plants for electricity and heat production (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**747.3**	**716.7**	**655.1**	**608.7**	**561.7**	**570.2**	**536.5**	**526.9**	**521.1**	**480.3**
EU27	**726.0**	**706.7**	**656.3**	**601.9**	**558.3**	**567.5**	**543.8**	**535.2**	**530.6**	**487.8**
Austria	613.4	577.3	495.6	486.1	420.4	413.6	386.0	394.1	386.1	374.3
Belgium	877.9	818.9	649.2	597.3	443.5	447.5	435.0	432.1	424.0	429.5
Bulgaria	642.8	698.4	770.7	823.8	781.0	777.6	757.9	795.6	767.1	728.2
Cyprus	858.2	842.0	857.8	807.5	730.1	717.5	722.4	706.6	712.1	694.2
Czechia	**791.8**	**791.2**	**760.7**	**792.6**	**775.7**	**722.4**	**704.8**	**698.9**	**708.2**	**675.0**
Germany	**785.3**	**780.3**	**745.8**	**681.9**	**639.2**	**636.9**	**620.5**	**600.0**	**586.3**	**548.2**
Denmark	576.8	509.6	429.0	364.8	357.1	283.7	293.3	253.9	258.6	211.0
Estonia	691.6	917.5	903.2	870.4	829.0	871.2	784.1	809.8	772.8	584.7
Greece	909.0	827.3	793.9	783.4	806.3	739.2	610.1	660.1	703.2	646.8
Spain	**929.3**	**894.1**	**780.8**	**629.3**	**502.3**	**655.2**	**618.2**	**622.2**	**624.8**	**483.3**
Finland	428.9	436.7	356.3	337.5	372.6	298.0	302.6	300.3	311.8	286.3
France	**952.2**	**856.6**	**547.4**	**520.1**	**578.9**	**509.5**	**446.3**	**447.7**	**454.2**	**413.5**
Croatia	510.6	496.3	554.9	555.1	491.0	498.2	487.3	386.2	359.9	360.7
Hungary	755.4	680.6	608.2	513.5	492.1	555.5	522.3	511.9	503.2	471.6
Ireland	796.9	775.5	689.7	643.2	537.9	573.5	543.1	525.6	485.1	465.7
Italy	**691.8**	**666.4**	**623.9**	**524.3**	**478.3**	**442.1**	**425.4**	**410.4**	**408.9**	**384.4**
Lithuania	342.8	337.5	320.9	309.4	302.9	242.6	234.7	199.5	193.1	189.3
Luxembourg	3,128.6	2,280.2	562.4	335.0	332.7	307.1	267.9	254.7	233.1	212.9
Latvia	274.1	324.0	298.5	237.9	236.7	215.4	203.9	187.4	210.9	213.9
Malta	1,605.0	977.9	838.6	883.9	884.1	704.1	766.3	477.0	397.2	401.7
Netherlands	**572.8**	**505.9**	**449.0**	**446.2**	**412.3**	**495.0**	**475.4**	**457.0**	**445.5**	**406.8**
Poland	**723.8**	**761.0**	**749.8**	**724.0**	**714.6**	**705.8**	**697.9**	**694.5**	**683.1**	**657.8**
Portugal	546.4	607.5	504.6	524.5	275.6	361.0	302.6	368.4	311.8	258.8
Romania	588.0	548.5	562.5	589.2	615.2	596.1	575.7	591.5	610.7	651.7
Sweden	**343.0**	**280.8**	**274.8**	**262.6**	**225.0**	**190.1**	**195.6**	**201.4**	**207.3**	**198.2**
Slovenia	933.8	866.5	781.1	794.2	751.3	646.8	629.2	638.6	637.9	627.5
Slovakia	679.3	708.9	655.1	592.6	532.4	493.2	467.6	462.9	468.9	414.8
United Kingdom	**896.2**	**787.2**	**647.8**	**655.8**	**585.6**	**593.9**	**472.5**	**446.6**	**430.2**	**407.7**

Table A2.17 – *GHG emission factors in the electricity sector for electricity and heat production (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**481.3**	**437.8**	**399.3**	**384.8**	**346.4**	**317.7**	**302.2**	**297.6**	**282.8**	**253.0**
EU27	**456.5**	**422.8**	**388.1**	**370.6**	**333.2**	**312.1**	**302.7**	**300.9**	**286.2**	**255.1**
Austria	256.0	229.8	189.5	238.0	211.2	177.9	160.8	172.3	164.9	156.8
Belgium	360.0	370.9	293.5	279.9	228.7	238.5	183.9	183.2	210.1	176.0
Bulgaria	497.0	483.7	455.2	476.0	497.5	465.1	445.9	478.7	424.6	414.1
Cyprus	858.2	842.0	857.8	807.3	724.9	662.5	667.5	652.6	653.1	632.6
Czechia	**676.5**	**673.1**	**643.4**	**592.9**	**556.1**	**506.6**	**513.4**	**486.6**	**483.0**	**452.7**
Germany	**585.3**	**559.9**	**514.6**	**477.5**	**451.2**	**435.2**	**431.3**	**403.0**	**385.7**	**337.4**
Denmark	567.9	499.3	399.7	327.9	317.7	204.2	221.5	184.2	188.9	144.4
Estonia	691.6	917.4	902.9	865.2	813.1	822.5	751.8	771.6	740.2	544.5
Greece	869.2	766.0	739.5	709.8	672.0	546.8	458.5	510.9	510.1	455.3
Spain	**439.3**	**468.5**	**444.3**	**407.2**	**239.8**	**304.3**	**258.9**	**303.1**	**271.4**	**208.9**
Finland	248.4	270.7	223.1	218.5	261.1	172.0	178.1	173.6	182.0	161.7
France	**111.3**	**77.5**	**85.3**	**95.7**	**85.0**	**62.8**	**68.4**	**76.3**	**61.8**	**61.5**
Croatia	345.7	265.5	293.6	307.4	229.7	234.6	232.0	213.6	162.2	190.8
Hungary	488.8	461.3	429.5	359.1	321.1	291.2	283.7	277.1	268.9	246.2
Ireland	757.9	743.4	657.9	599.4	472.7	422.8	420.3	386.0	338.3	299.9
Italy	**578.7**	**549.6**	**507.7**	**457.2**	**386.2**	**325.2**	**316.6**	**312.0**	**296.1**	**278.6**
Lithuania	182.2	129.0	139.4	142.6	275.6	196.5	171.9	136.6	138.6	128.3
Luxembourg	2,777.6	1,868.2	413.8	322.0	317.6	258.6	206.5	184.9	169.8	159.8
Latvia	178.3	210.2	185.8	148.6	161.9	175.4	160.3	112.8	161.1	166.2
Malta	1,605.0	977.9	838.6	883.9	883.8	652.9	652.0	430.1	359.0	360.7
Netherlands	**546.3**	**484.0**	**430.4**	**425.0**	**390.6**	**444.0**	**424.8**	**400.4**	**386.2**	**346.9**
Poland	**719.7**	**753.8**	**741.8**	**715.2**	**699.0**	**663.7**	**650.3**	**639.8**	**636.6**	**602.9**
Portugal	536.3	591.8	497.3	514.3	267.1	352.1	296.5	363.5	305.3	252.9
Romania	538.7	472.3	431.5	415.2	378.0	329.8	311.1	330.5	322.7	329.0
Sweden	**34.0**	**53.5**	**50.9**	**58.7**	**73.2**	**48.3**	**54.5**	**53.8**	**55.9**	**52.2**
Slovenia	432.7	390.9	345.5	359.9	334.9	271.7	268.3	271.3	263.3	256.4
Slovakia	388.6	356.3	262.7	239.5	227.1	196.0	187.9	190.8	187.7	163.2
United Kingdom	**696.0**	**564.2**	**490.2**	**507.4**	**468.0**	**373.5**	**297.3**	**263.6**	**247.8**	**231.0**

Table A2.18 – *GHG emission factors in the electricity sector for electricity and heat production w/o nuclear energy (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**650.3**	**608.6**	**552.6**	**521.7**	**454.6**	**414.6**	**390.8**	**382.7**	**364.1**	**326.4**
EU27	**621.9**	**589.1**	**541.7**	**506.9**	**441.9**	**408.6**	**392.1**	**387.6**	**369.8**	**331.2**
Austria	256.0	229.8	189.5	238.0	211.2	177.9	160.8	172.3	164.9	156.8
Belgium	870.0	810.8	641.6	586.5	424.2	363.1	350.0	339.3	325.2	314.9
Bulgaria	624.5	665.5	709.0	725.2	676.8	628.3	627.6	675.6	608.1	610.3
Cyprus	858.2	842.0	857.8	807.3	724.9	662.5	667.5	652.6	653.1	632.6
Czechia	**780.6**	**772.1**	**745.2**	**769.9**	**740.9**	**679.5**	**664.5**	**657.9**	**666.1**	**630.3**
Germany	**758.8**	**741.5**	**697.2**	**618.3**	**559.3**	**497.5**	**487.1**	**449.3**	**430.3**	**378.0**
Denmark	567.9	499.3	399.7	327.9	317.7	204.2	221.5	184.2	188.9	144.4
Estonia	691.6	917.4	902.9	865.2	813.1	822.5	751.8	771.6	740.2	544.5
Greece	869.2	766.0	739.5	709.8	672.0	546.8	458.5	510.9	510.1	455.3
Spain	**685.1**	**704.4**	**618.5**	**508.3**	**302.7**	**383.2**	**330.2**	**385.0**	**341.4**	**266.2**
Finland	339.8	350.3	287.7	279.7	321.5	223.6	229.9	223.5	234.6	213.6
France	**450.2**	**324.3**	**312.5**	**354.9**	**312.1**	**234.8**	**220.2**	**240.7**	**197.8**	**188.5**
Croatia	345.7	265.5	293.6	307.4	229.7	234.6	232.0	213.6	162.2	190.8
Hungary	750.2	676.9	605.1	510.2	480.9	524.1	492.4	479.5	465.9	419.6
Ireland	757.9	743.4	657.9	599.4	472.7	422.8	420.3	386.0	338.3	299.9
Italy	**578.7**	**549.6**	**507.7**	**457.2**	**386.2**	**325.2**	**316.6**	**312.0**	**296.1**	**278.6**
Lithuania	335.5	321.3	302.9	290.2	275.6	196.5	171.9	136.6	138.6	128.3
Luxembourg	2,777.6	1,868.2	413.8	322.0	317.6	258.6	206.5	184.9	169.8	159.8
Latvia	178.3	210.2	185.8	148.6	161.9	175.4	160.3	112.8	161.1	166.2
Malta	1,605.0	977.9	838.6	883.9	883.8	652.9	652.0	430.1	359.0	360.7
Netherlands	**570.5**	**502.6**	**444.4**	**437.9**	**400.7**	**457.4**	**436.9**	**410.1**	**396.3**	**356.4**
Poland	**719.7**	**753.8**	**741.8**	**715.2**	**699.0**	**663.7**	**650.3**	**639.8**	**636.6**	**602.9**
Portugal	536.3	591.8	497.3	514.3	267.1	352.1	296.5	363.5	305.3	252.9
Romania	538.7	472.3	460.4	443.4	439.9	383.2	360.6	386.1	377.2	390.6
Sweden	**60.4**	**90.6**	**77.4**	**95.4**	**105.4**	**67.4**	**80.5**	**79.5**	**84.5**	**76.9**
Slovenia	643.4	580.5	499.9	548.9	483.8	409.5	390.2	414.9	384.8	379.6
Slovakia	617.0	547.0	493.8	456.2	395.2	369.0	341.8	344.3	353.3	302.9
United Kingdom	**877.6**	**770.3**	**634.3**	**639.4**	**559.8**	**472.7**	**378.0**	**333.6**	**308.5**	**279.9**

Table A2.19 – *GHG emission factors in the thermoelectric plants for electricity production (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**822.3**	**789.2**	**715.0**	**671.8**	**615.7**	**633.5**	**592.2**	**579.0**	**576.0**	**527.7**
EU27	**793.8**	**778.3**	**717.8**	**664.9**	**610.7**	**627.9**	**599.7**	**587.5**	**586.7**	**535.1**
Austria	627.9	619.8	580.9	568.2	498.7	520.2	481.4	481.5	478.2	451.0
Belgium	925.2	859.2	730.6	641.7	482.4	480.7	465.4	455.4	448.9	448.3
Bulgaria	925.8	890.6	932.3	1,025.9	977.2	959.9	946.3	967.5	926.5	888.5
Cyprus	858.2	842.0	857.8	807.5	730.3	719.9	724.6	708.9	714.4	696.3
Czechia	**964.3**	**945.2**	**900.6**	**928.8**	**918.4**	**858.6**	**831.9**	**826.3**	**828.8**	**786.5**
Germany	**928.5**	**906.6**	**825.1**	**767.9**	**711.7**	**703.1**	**685.0**	**662.0**	**658.8**	**621.9**
Denmark	594.7	563.0	503.8	405.0	405.8	330.5	347.9	301.1	320.6	246.6
Estonia	683.1	975.4	1,053.8	986.5	948.3	1,078.0	944.2	946.8	941.7	778.0
Greece	908.9	827.3	793.7	782.0	804.3	735.2	604.8	655.8	698.5	640.9
Spain	**929.4**	**894.0**	**780.6**	**629.3**	**502.3**	**655.2**	**618.2**	**622.2**	**624.8**	**483.3**
Finland	485.3	489.8	409.2	389.1	455.7	335.8	353.4	337.0	350.9	304.2
France	**952.2**	**918.0**	**771.1**	**684.9**	**696.0**	**619.3**	**525.0**	**521.7**	**540.9**	**485.6**
Croatia	679.1	632.9	681.2	665.1	578.7	652.8	621.9	451.8	437.8	433.2
Hungary	1,015.7	826.5	757.3	615.8	583.7	636.1	605.3	584.9	568.1	528.1
Ireland	796.9	775.5	689.7	643.2	537.9	573.5	543.1	525.6	485.1	465.7
Italy	**688.5**	**663.2**	**611.8**	**562.8**	**506.8**	**477.3**	**452.0**	**433.2**	**434.5**	**402.1**
Lithuania	339.6	374.0	335.4	341.6	320.6	262.3	260.9	222.0	210.9	218.3
Luxembourg	3,128.6	2,280.2	646.6	363.3	360.2	355.1	329.4	325.2	310.0	293.4
Latvia	276.5	323.3	289.2	233.6	232.6	212.6	201.8	192.0	226.3	235.3
Malta	1,605.0	977.9	838.6	883.9	884.1	705.1	767.2	477.0	397.2	401.7
Netherlands	**600.5**	**550.8**	**497.8**	**488.6**	**435.9**	**556.2**	**525.0**	**499.3**	**482.5**	**433.9**
Poland	**831.2**	**799.3**	**779.7**	**755.2**	**738.2**	**722.9**	**715.2**	**715.9**	**702.9**	**676.1**
Portugal	546.2	605.9	506.2	540.1	274.0	370.2	305.3	377.6	315.4	257.1
Romania	319.4	601.9	657.4	736.6	797.8	739.8	720.0	724.5	747.6	803.7
Sweden	**332.3**	**342.8**	**374.3**	**302.8**	**244.6**	**202.6**	**196.8**	**205.4**	**215.7**	**217.9**
Slovenia	946.0	892.5	872.3	875.7	841.5	732.0	703.8	716.6	728.6	720.9
Slovakia	728.3	774.6	693.9	680.4	567.8	534.7	495.3	494.6	494.4	422.4
United Kingdom	**889.1**	**782.3**	**641.6**	**655.8**	**585.6**	**593.9**	**472.5**	**446.6**	**430.2**	**407.7**

Table A2.20 – *GHG emission factors in the electricity sector for electricity production (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**474.5**	**435.1**	**398.4**	**386.1**	**343.1**	**313.4**	**296.0**	**291.1**	**275.7**	**242.9**
EU27	**435.8**	**411.1**	**379.5**	**364.1**	**321.3**	**300.8**	**290.7**	**289.5**	**274.4**	**240.0**
Austria	226.6	203.4	174.1	229.4	201.1	159.1	139.8	152.1	146.3	135.0
Belgium	359.3	371.8	301.3	279.5	225.4	232.2	174.4	174.3	201.9	167.2
Bulgaria	565.7	475.0	454.5	489.9	531.2	489.3	468.8	508.7	449.8	437.2
Cyprus	858.2	842.0	857.8	807.3	725.0	664.6	669.4	654.5	655.1	634.4
Czechia	749.4	721.2	705.0	610.9	564.1	519.7	530.1	498.4	489.5	454.2
Germany	**640.3**	**606.1**	**535.7**	**500.5**	**468.8**	**449.1**	**445.7**	**413.2**	**398.9**	**344.8**
Denmark	580.1	544.2	443.5	330.8	324.0	162.0	193.6	150.2	163.6	103.5
Estonia	683.1	975.2	1,053.1	979.1	926.1	999.2	894.7	891.9	889.8	698.4
Greece	869.1	766.0	739.0	707.9	669.2	541.9	453.0	506.1	504.6	449.0
Spain	**439.1**	**468.5**	**444.2**	**407.2**	**239.8**	**304.3**	**258.9**	**303.1**	**271.4**	**208.9**
Finland	216.9	243.9	190.4	182.5	250.5	127.3	135.7	124.9	139.6	114.9
France	**111.3**	**75.4**	**76.5**	**80.0**	**76.5**	**55.2**	**60.1**	**68.3**	**54.1**	**53.3**
Croatia	378.9	245.1	290.9	306.2	216.3	232.0	230.9	199.1	143.3	177.5
Hungary	518.9	481.8	448.3	373.9	326.3	280.7	276.7	273.5	260.6	236.5
Ireland	757.9	743.4	657.9	599.4	472.7	422.8	420.3	386.0	338.3	299.9
Italy	**575.9**	**546.9**	**497.8**	**477.7**	**391.0**	**324.6**	**311.9**	**307.7**	**289.9**	**268.6**
Lithuania	130.6	35.9	68.5	81.2	255.5	170.1	124.2	81.5	77.0	78.4
Luxembourg	2,777.6	1,868.2	417.8	345.6	339.7	274.0	196.3	170.0	158.7	150.6
Latvia	89.5	84.7	91.8	73.0	107.3	135.5	118.3	76.5	140.3	152.5
Malta	1,605.0	977.9	838.6	883.9	883.8	653.7	652.7	430.1	359.0	360.8
Netherlands	**568.7**	**518.8**	**469.2**	**457.1**	**405.6**	**484.0**	**455.7**	**423.3**	**404.5**	**357.0**
Poland	**822.3**	**788.3**	**768.2**	**742.3**	**716.2**	**666.3**	**651.0**	**641.4**	**639.9**	**601.5**
Portugal	536.0	590.1	498.6	528.8	264.6	360.2	298.6	372.0	308.2	250.5
Romania	262.8	431.8	399.4	417.2	379.1	321.0	299.5	324.9	316.8	323.0
Sweden	**12.0**	**23.5**	**22.9**	**23.4**	**34.1**	**17.4**	**19.1**	**19.4**	**20.6**	**21.2**
Slovenia	370.4	337.4	321.9	334.3	314.0	251.0	248.7	250.4	243.6	239.8
Slovakia	330.8	296.4	218.3	194.5	156.5	140.7	129.6	132.8	139.7	119.0
United Kingdom	**690.5**	**560.6**	**485.5**	**507.4**	**468.0**	**373.5**	**297.3**	**263.6**	**247.8**	**231.0**

Table A2.21 – *GHG emission factors in the electricity sector for electricity production w/o nuclear energy (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**686.3**	**643.2**	**581.1**	**554.1**	**473.0**	**427.3**	**399.6**	**390.2**	**369.8**	**326.7**
EU27	**643.5**	**614.9**	**563.8**	**532.6**	**451.9**	**413.9**	**395.4**	**390.7**	**371.3**	**326.7**
Austria	226.6	203.4	174.1	229.4	201.1	159.1	139.8	152.1	146.3	135.0
Belgium	916.0	849.9	720.6	628.5	457.2	374.5	358.8	343.8	328.8	314.7
Bulgaria	870.3	811.2	822.9	851.3	794.7	714.9	725.5	777.7	688.2	702.3
Cyprus	858.2	842.0	857.8	807.3	725.0	664.6	669.4	654.5	655.1	634.4
Czechia	**941.5**	**905.6**	**872.8**	**887.9**	**853.9**	**782.4**	**760.9**	**754.9**	**757.3**	**710.9**
Germany	**887.4**	**850.5**	**761.3**	**680.5**	**604.3**	**524.0**	**513.1**	**468.4**	**453.0**	**393.8**
Denmark	580.1	544.2	443.5	330.8	324.0	162.0	193.6	150.2	163.6	103.5
Estonia	683.1	975.2	1,053.1	979.1	926.1	999.2	894.7	891.9	889.8	698.4
Greece	869.1	766.0	739.0	707.9	669.2	541.9	453.0	506.1	504.6	449.0
Spain	**685.0**	**704.3**	**618.3**	**508.3**	**302.7**	**383.2**	**330.2**	**385.0**	**341.4**	**266.2**
Finland	335.4	348.5	280.6	272.3	349.2	192.5	204.8	187.3	206.7	176.1
France	**450.2**	**324.9**	**341.1**	**382.0**	**317.7**	**231.0**	**215.3**	**240.0**	**190.7**	**180.5**
Croatia	378.9	245.1	290.9	306.2	216.3	232.0	230.9	199.1	143.3	177.5
Hungary	1,003.5	819.8	750.8	609.8	564.2	586.6	557.0	535.8	512.0	452.1
Ireland	757.9	743.4	657.9	599.4	472.7	422.8	420.3	386.0	338.3	299.9
Italy	**575.9**	**546.9**	**497.8**	**477.7**	**391.0**	**324.6**	**311.9**	**307.7**	**289.9**	**268.6**
Lithuania	326.1	285.5	281.9	286.9	255.5	170.1	124.2	81.5	77.0	78.4
Luxembourg	2,777.6	1,868.2	417.8	345.6	339.7	274.0	196.3	170.0	158.7	150.6
Latvia	89.5	84.7	91.8	73.0	107.3	135.5	118.3	76.5	140.3	152.5
Malta	1,605.0	977.9	838.6	883.9	883.8	653.7	652.7	430.1	359.0	360.8
Netherlands	**597.8**	**545.8**	**490.7**	**476.2**	**419.6**	**502.6**	**471.9**	**435.9**	**417.3**	**368.9**
Poland	**822.3**	**788.3**	**768.2**	**742.3**	**716.2**	**666.3**	**651.0**	**641.4**	**639.9**	**601.5**
Portugal	536.0	590.1	498.6	528.8	264.6	360.2	298.6	372.0	308.2	250.5
Romania	262.8	431.8	446.6	460.2	469.0	389.9	362.9	396.2	384.7	399.0
Sweden	**22.6**	**44.4**	**37.8**	**43.1**	**55.9**	**26.7**	**32.1**	**32.4**	**35.4**	**34.9**
Slovenia	589.2	535.7	494.9	547.4	481.7	405.7	383.9	411.6	379.5	378.3
Slovakia	626.6	522.5	470.0	447.5	333.6	326.3	288.5	294.8	314.9	259.7
United Kingdom	**870.7**	**765.5**	**628.2**	**639.4**	**559.8**	**472.7**	**378.0**	**333.6**	**308.5**	**279.9**

Table A2.22 – *Total efficiency of the thermoelectric plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.438**	**0.445**	**0.469**	**0.484**	**0.498**	**0.494**	**0.509**	**0.511**	**0.513**	**0.528**
EU27	**0.449**	**0.454**	**0.476**	**0.494**	**0.508**	**0.502**	**0.514**	**0.516**	**0.518**	**0.535**
Austria	0.468	0.461	0.551	0.558	0.601	0.597	0.621	0.611	0.619	0.648
Belgium	0.392	0.415	0.490	0.480	0.547	0.547	0.561	0.565	0.571	0.572
Bulgaria	0.496	0.466	0.440	0.418	0.441	0.446	0.452	0.433	0.426	0.439
Cyprus	0.326	0.332	0.326	0.346	0.379	0.385	0.382	0.388	0.385	0.395
Czechia	**0.466**	**0.459**	**0.479**	**0.459**	**0.471**	**0.481**	**0.491**	**0.491**	**0.487**	**0.499**
Germany	**0.435**	**0.436**	**0.454**	**0.472**	**0.481**	**0.478**	**0.483**	**0.493**	**0.500**	**0.513**
Denmark	0.577	0.608	0.644	0.711	0.713	0.795	0.778	0.803	0.796	0.851
Estonia	0.533	0.409	0.408	0.423	0.430	0.395	0.436	0.416	0.423	0.465
Greece	0.328	0.352	0.367	0.373	0.368	0.390	0.451	0.407	0.382	0.385
Spain	**0.365**	**0.369**	**0.408**	**0.454**	**0.487**	**0.428**	**0.438**	**0.435**	**0.431**	**0.483**
Finland	0.676	0.667	0.749	0.757	0.714	0.789	0.795	0.787	0.759	0.783
France	**0.381**	**0.397**	**0.575**	**0.540**	**0.437**	**0.490**	**0.521**	**0.526**	**0.529**	**0.549**
Croatia	0.506	0.532	0.481	0.497	0.545	0.534	0.530	0.578	0.593	0.587
Hungary	0.411	0.441	0.499	0.504	0.514	0.488	0.507	0.504	0.509	0.526
Ireland	0.382	0.385	0.403	0.427	0.461	0.467	0.476	0.476	0.491	0.487
Italy	**0.408**	**0.414**	**0.419**	**0.484**	**0.504**	**0.520**	**0.531**	**0.537**	**0.536**	**0.546**
Lithuania	0.682	0.725	0.683	0.691	0.675	0.763	0.779	0.821	0.849	0.851
Luxembourg	0.254	0.255	0.370	0.602	0.602	0.617	0.669	0.678	0.693	0.715
Latvia	0.809	0.783	0.773	0.838	0.842	0.776	0.809	0.784	0.753	0.743
Malta	0.188	0.290	0.331	0.315	0.314	0.394	0.362	0.451	0.510	0.507
Netherlands	**0.484**	**0.537**	**0.578**	**0.568**	**0.591**	**0.554**	**0.561**	**0.572**	**0.579**	**0.592**
Poland	**0.486**	**0.460**	**0.463**	**0.473**	**0.470**	**0.471**	**0.477**	**0.483**	**0.488**	**0.497**
Portugal	0.488	0.459	0.514	0.506	0.659	0.609	0.650	0.600	0.636	0.680
Romania	0.469	0.537	0.537	0.523	0.517	0.519	0.527	0.509	0.492	0.466
Sweden	**0.864**	**0.857**	**0.816**	**0.808**	**0.821**	**0.843**	**0.843**	**0.822**	**0.821**	**0.803**
Slovenia	0.378	0.409	0.450	0.442	0.451	0.518	0.535	0.524	0.525	0.529
Slovakia	0.475	0.434	0.475	0.533	0.551	0.533	0.554	0.567	0.556	0.586
United Kingdom	**0.374**	**0.389**	**0.430**	**0.424**	**0.441**	**0.428**	**0.464**	**0.469**	**0.471**	**0.475**

Table A2.23 – *Electrical efficiency of the thermoelectric plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.329**	**0.348**	**0.378**	**0.380**	**0.389**	**0.384**	**0.394**	**0.398**	**0.397**	**0.405**
EU27	**0.322**	**0.341**	**0.368**	**0.373**	**0.380**	**0.378**	**0.385**	**0.390**	**0.388**	**0.396**
Austria	0.369	0.340	0.381	0.394	0.402	0.348	0.356	0.363	0.366	0.384
Belgium	0.358	0.382	0.417	0.420	0.451	0.449	0.459	0.476	0.475	0.490
Bulgaria	0.229	0.235	0.289	0.277	0.296	0.309	0.308	0.315	0.322	0.320
Cyprus	0.326	0.332	0.326	0.346	0.379	0.384	0.380	0.387	0.384	0.394
Czechia	**0.277**	**0.259**	**0.315**	**0.294**	**0.294**	**0.312**	**0.319**	**0.323**	**0.325**	**0.333**
Germany	**0.328**	**0.346**	**0.378**	**0.378**	**0.387**	**0.392**	**0.395**	**0.400**	**0.399**	**0.398**
Denmark	0.362	0.361	0.348	0.357	0.350	0.297	0.316	0.303	0.306	0.284
Estonia	0.296	0.294	0.300	0.335	0.350	0.297	0.339	0.334	0.319	0.301
Greece	0.328	0.352	0.365	0.369	0.364	0.384	0.445	0.401	0.376	0.379
Spain	**0.365**	**0.369**	**0.408**	**0.454**	**0.487**	**0.428**	**0.438**	**0.435**	**0.431**	**0.483**
Finland	0.397	0.406	0.389	0.365	0.372	0.352	0.346	0.338	0.358	0.367
France	**0.381**	**0.357**	**0.343**	**0.317**	**0.314**	**0.341**	**0.372**	**0.386**	**0.373**	**0.388**
Croatia	0.305	0.292	0.319	0.342	0.370	0.331	0.344	0.368	0.351	0.363
Hungary	0.234	0.293	0.298	0.331	0.343	0.347	0.355	0.371	0.372	0.387
Ireland	0.382	0.385	0.403	0.427	0.461	0.467	0.476	0.476	0.491	0.487
Italy	**0.408**	**0.414**	**0.419**	**0.399**	**0.405**	**0.397**	**0.406**	**0.415**	**0.409**	**0.417**
Lithuania	0.360	0.117	0.214	0.240	0.262	0.330	0.258	0.219	0.192	0.227
Luxembourg	0.254	0.255	0.243	0.475	0.474	0.391	0.293	0.281	0.271	0.251
Latvia	0.208	0.150	0.218	0.229	0.333	0.311	0.311	0.344	0.380	0.393
Malta	0.188	0.290	0.331	0.315	0.314	0.394	0.362	0.451	0.510	0.507
Netherlands	**0.419**	**0.395**	**0.409**	**0.410**	**0.442**	**0.428**	**0.440**	**0.450**	**0.461**	**0.475**
Poland	**0.258**	**0.315**	**0.334**	**0.338**	**0.342**	**0.351**	**0.354**	**0.356**	**0.362**	**0.365**
Portugal	0.482	0.453	0.496	0.466	0.592	0.549	0.596	0.548	0.579	0.609
Romania	0.199	0.220	0.252	0.286	0.294	0.321	0.319	0.327	0.323	0.307
Sweden	**0.295**	**0.268**	**0.234**	**0.235**	**0.276**	**0.233**	**0.235**	**0.236**	**0.235**	**0.242**
Slovenia	0.282	0.303	0.332	0.329	0.334	0.373	0.393	0.382	0.376	0.382
Slovakia	0.296	0.266	0.326	0.306	0.272	0.280	0.284	0.288	0.319	0.345
United Kingdom	**0.374**	**0.389**	**0.430**	**0.424**	**0.441**	**0.428**	**0.464**	**0.469**	**0.471**	**0.475**

Table A2.24 – *Electrical efficiency after apportioning the energy for heat-production in thermoelectric plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.406**	**0.414**	**0.441**	**0.453**	**0.469**	**0.463**	**0.479**	**0.483**	**0.483**	**0.499**
EU27	**0.413**	**0.418**	**0.442**	**0.459**	**0.474**	**0.469**	**0.481**	**0.484**	**0.484**	**0.502**
Austria	0.453	0.424	0.487	0.497	0.539	0.508	0.531	0.528	0.535	0.571
Belgium	0.376	0.399	0.447	0.457	0.516	0.526	0.541	0.550	0.555	0.562
Bulgaria	0.381	0.389	0.378	0.346	0.364	0.372	0.373	0.366	0.368	0.381
Cyprus	0.326	0.332	0.326	0.346	0.379	0.384	0.381	0.388	0.385	0.394
Czechia	**0.380**	**0.385**	**0.409**	**0.398**	**0.394**	**0.402**	**0.413**	**0.414**	**0.414**	**0.426**
Germany	**0.371**	**0.381**	**0.417**	**0.430**	**0.442**	**0.444**	**0.449**	**0.459**	**0.459**	**0.467**
Denmark	0.563	0.565	0.572	0.681	0.681	0.756	0.738	0.762	0.739	0.807
Estonia	0.556	0.393	0.358	0.383	0.388	0.339	0.385	0.374	0.373	0.396
Greece	0.328	0.352	0.367	0.373	0.368	0.390	0.453	0.407	0.382	0.386
Spain	**0.365**	**0.369**	**0.408**	**0.454**	**0.487**	**0.428**	**0.438**	**0.435**	**0.431**	**0.483**
Finland	0.575	0.586	0.674	0.685	0.620	0.710	0.708	0.716	0.685	0.722
France	**0.381**	**0.384**	**0.439**	**0.439**	**0.384**	**0.438**	**0.475**	**0.484**	**0.486**	**0.508**
Croatia	0.394	0.415	0.410	0.435	0.493	0.448	0.457	0.535	0.548	0.547
Hungary	0.316	0.368	0.404	0.429	0.438	0.434	0.450	0.456	0.462	0.471
Ireland	0.382	0.385	0.403	0.427	0.461	0.467	0.476	0.476	0.491	0.487
Italy	**0.410**	**0.416**	**0.426**	**0.460**	**0.484**	**0.495**	**0.511**	**0.519**	**0.517**	**0.529**
Lithuania	0.683	0.713	0.675	0.646	0.663	0.741	0.720	0.738	0.736	0.731
Luxembourg	0.254	0.255	0.324	0.555	0.556	0.546	0.550	0.549	0.557	0.574
Latvia	0.805	0.783	0.776	0.837	0.844	0.781	0.819	0.798	0.752	0.732
Malta	0.188	0.290	0.331	0.315	0.314	0.394	0.362	0.451	0.510	0.507
Netherlands	**0.471**	**0.518**	**0.545**	**0.532**	**0.567**	**0.526**	**0.538**	**0.554**	**0.564**	**0.581**
Poland	**0.426**	**0.443**	**0.450**	**0.458**	**0.457**	**0.457**	**0.465**	**0.469**	**0.474**	**0.484**
Portugal	0.488	0.460	0.513	0.494	0.652	0.597	0.642	0.589	0.627	0.673
Romania	0.749	0.508	0.488	0.443	0.423	0.436	0.444	0.435	0.420	0.398
Sweden	**0.826**	**0.820**	**0.774**	**0.775**	**0.807**	**0.790**	**0.799**	**0.776**	**0.770**	**0.741**
Slovenia	0.373	0.398	0.407	0.404	0.411	0.471	0.492	0.481	0.474	0.477
Slovakia	0.453	0.407	0.448	0.488	0.528	0.498	0.521	0.537	0.537	0.564
United Kingdom	**0.377**	**0.392**	**0.435**	**0.424**	**0.441**	**0.428**	**0.464**	**0.469**	**0.471**	**0.475**

Table A2.25 – *Total efficiency of cogeneration plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.563**	**0.583**	**0.628**	**0.638**	**0.633**	**0.628**	**0.636**	**0.635**	**0.642**	**0.648**
EU27	**0.563**	**0.584**	**0.628**	**0.642**	**0.637**	**0.634**	**0.640**	**0.638**	**0.646**	**0.651**
Austria	0.525	0.545	0.727	0.758	0.766	0.781	0.793	0.787	0.794	0.797
Belgium	0.537	0.659	0.881	0.709	0.765	0.688	0.693	0.699	0.702	0.709
Bulgaria	0.598	0.608	0.616	0.623	0.759	0.800	0.813	0.831	0.809	0.714
Cyprus				0.416	0.514	0.762	0.760	0.712	0.735	0.754
Czechia	**0.688**	**0.608**	**0.715**	**0.628**	**0.654**	**0.686**	**0.695**	**0.693**	**0.688**	**0.691**
Germany	**0.942**	**0.993**	**0.812**	**0.730**	**0.703**	**0.688**	**0.682**	**0.677**	**0.719**	**0.719**
Denmark	0.596	0.630	0.660	0.712	0.715	0.796	0.779	0.804	0.797	0.852
Estonia	0.542	0.413	0.700	0.782	0.865	0.840	0.902	0.832	0.782	0.723
Greece	0.443	0.440	0.454	0.408	0.386	0.346	0.338	0.373	0.361	0.350
Spain	**0.372**	**0.328**	**0.680**	**0.704**	**0.596**	**0.636**	**0.671**	**0.661**	**0.654**	**0.655**
Finland	0.825	0.802	0.848	0.838	0.857	0.870	0.877	0.850	0.844	0.851
France	**0.589**	**0.554**	**1.005**	**0.779**	**0.634**	**0.647**	**0.669**	**0.680**	**0.675**	**0.683**
Croatia	0.753	0.690	0.636	0.656	0.674	0.727	0.703	0.655	0.660	0.654
Hungary	0.712	0.753	0.829	0.784	0.829	0.755	0.755	0.740	0.747	0.830
Ireland	0.337	0.355	0.404	0.464	0.579	0.608	0.630	0.624	0.633	0.646
Italy	**0.496**	**0.537**	**0.536**	**0.606**	**0.599**	**0.611**	**0.612**	**0.610**	**0.605**	**0.610**
Lithuania	0.682	0.725	0.683	0.691	0.675	0.763	0.779	0.821	0.849	0.851
Luxembourg		0.352	0.458	0.886	0.870	0.798	0.810	0.814	0.820	0.822
Latvia	0.809	0.783	0.773	0.839	0.844	0.776	0.809	0.784	0.753	0.743
Malta						0.650	0.784	0.762	0.768	0.783
Netherlands	**0.497**	**0.564**	**0.669**	**0.699**	**0.683**	**0.678**	**0.687**	**0.682**	**0.683**	**0.687**
Poland	**0.486**	**0.461**	**0.466**	**0.482**	**0.480**	**0.483**	**0.489**	**0.494**	**0.499**	**0.509**
Portugal	0.454	0.382	0.578	0.672	0.719	0.724	0.731	0.731	0.724	0.730
Romania	0.459	0.603	0.630	0.660	0.700	0.740	0.728	0.717	0.707	0.642
Sweden	**0.941**	**0.898**	**0.876**	**0.820**	**0.847**	**0.867**	**0.869**	**0.851**	**0.849**	**0.821**
Slovenia	0.395	0.427	0.459	0.452	0.455	0.519	0.536	0.525	0.723	0.729
Slovakia	0.532	0.489	0.545	0.561	0.564	0.541	0.562	0.574	0.564	0.605
United Kingdom	**0.301**	**0.348**	**0.470**	**0.501**	**0.495**	**0.411**	**0.472**	**0.501**	**0.493**	**0.529**

Table A2.26 – *Electrical efficiency of cogeneration plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.259**	**0.296**	**0.336**	**0.353**	**0.362**	**0.361**	**0.366**	**0.372**	**0.376**	**0.380**
EU27	**0.256**	**0.291**	**0.327**	**0.349**	**0.358**	**0.360**	**0.364**	**0.369**	**0.373**	**0.376**
Austria	0.338	0.339	0.303	0.314	0.352	0.312	0.341	0.313	0.327	0.329
Belgium	0.397	0.495	0.429	0.416	0.468	0.458	0.472	0.496	0.491	0.518
Bulgaria	0.164	0.169	0.217	0.220	0.222	0.212	0.223	0.247	0.275	0.279
Cyprus				0.416	0.504	0.597	0.600	0.561	0.584	0.605
Czechia	**0.169**	**0.158**	**0.270**	**0.234**	**0.202**	**0.243**	**0.239**	**0.243**	**0.244**	**0.249**
Germany				**0.342**	**0.362**	**0.385**	**0.389**	**0.396**	**0.400**	**0.399**
Denmark	0.361	0.354	0.344	0.357	0.350	0.297	0.316	0.303	0.306	0.284
Estonia	0.301	0.297	0.198	0.221	0.272	0.239	0.249	0.273	0.222	0.204
Greece	0.443	0.440	0.416	0.382	0.368	0.327	0.318	0.351	0.338	0.327
Spain	**0.368**	**0.328**	**0.680**	**0.704**	**0.596**	**0.636**	**0.671**	**0.661**	**0.654**	**0.655**
Finland	0.410	0.418	0.386	0.363	0.357	0.349	0.339	0.334	0.353	0.367
France	**0.589**	**0.174**	**0.306**	**0.269**	**0.268**	**0.288**	**0.290**	**0.299**	**0.314**	**0.317**
Croatia	0.196	0.226	0.245	0.306	0.362	0.264	0.291	0.368	0.325	0.343
Hungary	0.138	0.130	0.210	0.340	0.347	0.345	0.339	0.367	0.369	0.379
Ireland	0.337	0.355	0.404	0.464	0.579	0.608	0.630	0.624	0.633	0.646
Italy	**0.496**	**0.537**	**0.536**	**0.386**	**0.398**	**0.378**	**0.387**	**0.392**	**0.386**	**0.391**
Lithuania	0.360	0.117	0.214	0.240	0.262	0.330	0.258	0.219	0.192	0.227
Luxembourg		0.352	0.278	0.304	0.302	0.295	0.302	0.278	0.266	0.242
Latvia	0.208	0.150	0.218	0.229	0.333	0.311	0.311	0.344	0.380	0.393
Malta						0.520	0.712	0.762	0.768	0.754
Netherlands	**0.431**	**0.413**	**0.383**	**0.430**	**0.435**	**0.407**	**0.411**	**0.420**	**0.431**	**0.446**
Poland	**0.258**	**0.316**	**0.336**	**0.338**	**0.346**	**0.358**	**0.360**	**0.361**	**0.368**	**0.371**
Portugal	0.333	0.328	0.411	0.365	0.351	0.362	0.366	0.367	0.354	0.356
Romania	0.189	0.206	0.220	0.256	0.258	0.264	0.248	0.266	0.263	0.252
Sweden	**0.318**	**0.277**	**0.245**	**0.233**	**0.283**	**0.239**	**0.242**	**0.244**	**0.242**	**0.247**
Slovenia	0.288	0.305	0.326	0.326	0.328	0.374	0.394	0.382	0.274	0.274
Slovakia	0.293	0.242	0.338	0.311	0.267	0.275	0.279	0.285	0.313	0.319
United Kingdom	**0.301**	**0.348**	**0.470**	**0.501**	**0.495**	**0.411**	**0.472**	**0.501**	**0.493**	**0.529**

Table A2.27 – *Electrical efficiency after apportioning the energy for heat-production in cogeneration plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.542**	**0.551**	**0.605**	**0.620**	**0.613**	**0.608**	**0.617**	**0.619**	**0.623**	**0.631**
EU27	**0.539**	**0.548**	**0.602**	**0.623**	**0.616**	**0.615**	**0.622**	**0.622**	**0.627**	**0.634**
Austria	0.521	0.511	0.661	0.719	0.748	0.765	0.782	0.777	0.784	0.783
Belgium	0.413	0.502	0.730	0.686	0.769	0.697	0.701	0.716	0.717	0.737
Bulgaria	0.464	0.685	0.570	0.514	0.725	0.779	0.787	0.813	0.768	0.676
Cyprus				0.416	0.510	0.757	0.759	0.705	0.735	0.754
Czechia	**0.648**	**0.595**	**0.715**	**0.609**	**0.572**	**0.588**	**0.601**	**0.592**	**0.589**	**0.592**
Germany				**0.676**	**0.657**	**0.652**	**0.651**	**0.650**	**0.679**	**0.676**
Denmark	0.590	0.593	0.591	0.682	0.684	0.757	0.739	0.764	0.740	0.810
Estonia	0.556	0.392	0.684	0.728	0.796	0.792	0.817	0.760	0.724	0.672
Greece	0.447	0.440	0.455	0.410	0.387	0.345	0.336	0.373	0.361	0.349
Spain	**0.373**	**0.329**	**0.682**	**0.704**	**0.596**	**0.636**	**0.671**	**0.661**	**0.654**	**0.655**
Finland	0.760	0.765	0.843	0.835	0.856	0.858	0.863	0.842	0.836	0.845
France	**0.589**	**0.543**	**0.893**	**0.743**	**0.588**	**0.618**	**0.654**	**0.667**	**0.679**	**0.686**
Croatia	0.529	0.530	0.527	0.594	0.650	0.655	0.644	0.642	0.648	0.646
Hungary	0.877	0.951	0.813	0.759	0.797	0.704	0.720	0.716	0.706	0.770
Ireland	0.337	0.355	0.404	0.464	0.579	0.608	0.630	0.624	0.633	0.646
Italy	**0.522**	**0.556**	**0.548**	**0.555**	**0.564**	**0.604**	**0.608**	**0.609**	**0.603**	**0.609**
Lithuania	0.683	0.713	0.675	0.646	0.663	0.741	0.720	0.738	0.736	0.731
Luxembourg		0.352	0.430	0.897	0.877	0.805	0.818	0.817	0.817	0.815
Latvia	0.805	0.783	0.776	0.839	0.848	0.781	0.819	0.798	0.752	0.732
Malta						0.650	0.784	0.762	0.768	0.783
Netherlands	**0.472**	**0.530**	**0.645**	**0.683**	**0.669**	**0.654**	**0.675**	**0.684**	**0.679**	**0.691**
Poland	**0.426**	**0.443**	**0.450**	**0.465**	**0.459**	**0.460**	**0.467**	**0.471**	**0.476**	**0.487**
Portugal	0.439	0.383	0.582	0.660	0.707	0.711	0.717	0.717	0.711	0.719
Romania	0.711	0.703	0.692	0.639	0.647	0.714	0.701	0.692	0.667	0.572
Sweden	**0.846**	**0.837**	**0.815**	**0.815**	**0.822**	**0.792**	**0.801**	**0.777**	**0.772**	**0.742**
Slovenia	0.395	0.420	0.411	0.411	0.412	0.472	0.493	0.482	0.728	0.721
Slovakia	0.547	0.494	0.544	0.528	0.552	0.509	0.534	0.548	0.549	0.593
United Kingdom	**0.464**	**0.433**	**0.556**	**0.501**	**0.495**	**0.411**	**0.472**	**0.501**	**0.493**	**0.529**

Table A2.28 – *Electrical efficiency of non-cogeneration plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.370**	**0.376**	**0.399**	**0.398**	**0.411**	**0.403**	**0.417**	**0.420**	**0.417**	**0.430**
EU27	**0.371**	**0.374**	**0.394**	**0.393**	**0.404**	**0.397**	**0.408**	**0.412**	**0.407**	**0.422**
Austria	0.404	0.342	0.433	0.441	0.448	0.389	0.378	0.418	0.412	0.456
Belgium	0.365	0.373	0.415	0.421	0.442	0.442	0.448	0.460	0.463	0.469
Bulgaria	0.333	0.308	0.333	0.307	0.323	0.338	0.336	0.332	0.333	0.335
Cyprus	0.326	0.332	0.326	0.346	0.378	0.382	0.379	0.386	0.382	0.392
Czechia	**0.339**	**0.340**	**0.341**	**0.339**	**0.353**	**0.355**	**0.368**	**0.371**	**0.372**	**0.383**
Germany	**0.371**	**0.381**	**0.417**	**0.391**	**0.397**	**0.395**	**0.397**	**0.402**	**0.399**	**0.398**
Denmark	0.370	0.417	0.417	0.305	0.296	0.235	0.259	0.272	0.264	0.278
Estonia			0.332	0.363	0.366	0.311	0.361	0.349	0.348	0.356
Greece	0.325	0.350	0.362	0.367	0.363	0.408	0.501	0.417	0.389	0.398
Spain	**0.365**	**0.374**	**0.369**	**0.421**	**0.466**	**0.390**	**0.390**	**0.393**	**0.381**	**0.437**
Finland	0.371	0.380	0.401	0.371	0.408	0.386	0.391	0.377	0.388	0.378
France	**0.378**	**0.378**	**0.362**	**0.354**	**0.337**	**0.378**	**0.424**	**0.437**	**0.418**	**0.443**
Croatia	0.366	0.363	0.371	0.370	0.381	0.383	0.387	0.368	0.418	0.414
Hungary	0.277	0.344	0.351	0.332	0.350	0.361	0.375	0.381	0.387	0.403
Ireland	0.383	0.385	0.403	0.426	0.454	0.455	0.464	0.464	0.479	0.473
Italy	**0.401**	**0.398**	**0.393**	**0.417**	**0.428**	**0.419**	**0.433**	**0.445**	**0.442**	**0.456**
Lithuania					1.000				0.000	
Luxembourg	0.254	0.233	0.158	0.522	0.524	0.469	0.270	0.287	0.287	0.287
Latvia		1.000		0.126	0.322			1.000		1.000
Malta	0.188	0.290	0.331	0.315	0.314	0.393	0.360	0.450	0.509	0.507
Netherlands	**0.427**	**0.205**	**0.457**	**0.393**	**0.465**	**0.454**	**0.471**	**0.484**	**0.497**	**0.513**
Poland		**0.400**	**0.282**	**0.375**	**0.395**	**0.394**	**0.407**	**0.413**	**0.414**	**0.412**
Portugal	0.489	0.468	0.507	0.481	0.646	0.586	0.636	0.578	0.620	0.668
Romania		0.279	0.336	0.332	0.331	0.363	0.374	0.368	0.360	0.345
Sweden	**0.314**	**0.396**	**0.301**	**0.325**	**0.326**	**0.331**	**0.331**	**0.235**	**0.313**	**0.215**
Slovenia	0.230	0.287	0.380	0.355	0.405	0.259	0.266	0.259	0.426	0.433
Slovakia	0.303	0.317	0.296	0.262	0.350	0.380	0.385	0.370	0.420	0.482
United Kingdom	**0.369**	**0.381**	**0.418**	**0.418**	**0.437**	**0.430**	**0.463**	**0.466**	**0.469**	**0.467**

Table A2.29 – *Total efficiency of the electricity generation sector.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.424**	**0.428**	**0.443**	**0.453**	**0.476**	**0.487**	**0.499**	**0.501**	**0.508**	**0.517**
EU27	**0.432**	**0.436**	**0.448**	**0.459**	**0.480**	**0.490**	**0.500**	**0.501**	**0.507**	**0.517**
Austria	0.678	0.682	0.762	0.720	0.750	0.775	0.797	0.783	0.792	0.815
Belgium	0.356	0.367	0.391	0.392	0.424	0.469	0.437	0.444	0.480	0.455
Bulgaria	0.456	0.427	0.405	0.401	0.434	0.446	0.440	0.426	0.427	0.423
Cyprus	0.326	0.332	0.326	0.346	0.381	0.404	0.400	0.407	0.406	0.417
Czechia	**0.446**	**0.443**	**0.456**	**0.427**	**0.437**	**0.448**	**0.460**	**0.454**	**0.448**	**0.454**
Germany	**0.412**	**0.414**	**0.425**	**0.448**	**0.467**	**0.502**	**0.507**	**0.527**	**0.537**	**0.556**
Denmark	0.581	0.613	0.661	0.733	0.737	0.843	0.823	0.849	0.842	0.893
Estonia	0.533	0.409	0.408	0.424	0.435	0.409	0.447	0.427	0.434	0.483
Greece	0.337	0.370	0.384	0.396	0.411	0.463	0.523	0.469	0.460	0.471
Spain	**0.394**	**0.389**	**0.419**	**0.463**	**0.518**	**0.474**	**0.488**	**0.467**	**0.488**	**0.507**
Finland	0.551	0.567	0.603	0.609	0.616	0.638	0.643	0.644	0.632	0.632
France	**0.371**	**0.376**	**0.389**	**0.382**	**0.375**	**0.382**	**0.393**	**0.393**	**0.397**	**0.401**
Croatia	0.602	0.680	0.636	0.641	0.719	0.708	0.703	0.712	0.763	0.717
Hungary	0.381	0.400	0.437	0.439	0.445	0.418	0.428	0.427	0.429	0.443
Ireland	0.394	0.395	0.414	0.444	0.494	0.543	0.540	0.553	0.581	0.596
Italy	**0.426**	**0.436**	**0.438**	**0.484**	**0.519**	**0.543**	**0.550**	**0.552**	**0.561**	**0.570**
Lithuania	0.463	0.427	0.439	0.452	0.707	0.821	0.855	0.897	0.915	0.921
Luxembourg	0.277	0.294	0.444	0.611	0.613	0.657	0.724	0.744	0.756	0.770
Latvia	0.867	0.848	0.845	0.892	0.887	0.810	0.843	0.858	0.800	0.788
Malta	0.188	0.290	0.331	0.315	0.314	0.412	0.401	0.477	0.535	0.534
Netherlands	**0.476**	**0.528**	**0.568**	**0.562**	**0.589**	**0.568**	**0.576**	**0.594**	**0.600**	**0.614**
Poland	**0.488**	**0.463**	**0.465**	**0.477**	**0.476**	**0.486**	**0.495**	**0.504**	**0.506**	**0.519**
Portugal	0.482	0.460	0.509	0.503	0.643	0.579	0.618	0.567	0.603	0.632
Romania	0.491	0.573	0.560	0.565	0.542	0.561	0.573	0.550	0.548	0.531
Sweden	**0.529**	**0.540**	**0.579**	**0.549**	**0.604**	**0.598**	**0.601**	**0.598**	**0.595**	**0.603**
Slovenia	0.414	0.434	0.463	0.442	0.481	0.506	0.522	0.502	0.520	0.518
Slovakia	0.421	0.425	0.420	0.434	0.461	0.439	0.454	0.458	0.459	0.457
United Kingdom	**0.368**	**0.376**	**0.407**	**0.406**	**0.439**	**0.462**	**0.488**	**0.504**	**0.514**	**0.518**

Table A2.30 – *Electrical efficiency of the electricity generation sector.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.359**	**0.374**	**0.394**	**0.394**	**0.414**	**0.430**	**0.438**	**0.442**	**0.448**	**0.456**
EU27	**0.357**	**0.374**	**0.392**	**0.392**	**0.411**	**0.426**	**0.433**	**0.435**	**0.442**	**0.450**
Austria	0.631	0.623	0.688	0.639	0.654	0.672	0.686	0.681	0.689	0.708
Belgium	0.347	0.358	0.370	0.374	0.390	0.428	0.406	0.417	0.443	0.430
Bulgaria	0.268	0.281	0.324	0.325	0.345	0.366	0.362	0.360	0.370	0.359
Cyprus	0.326	0.332	0.326	0.346	0.381	0.403	0.399	0.406	0.405	0.416
Czechia	**0.293**	**0.280**	**0.327**	**0.313**	**0.320**	**0.342**	**0.346**	**0.349**	**0.349**	**0.356**
Germany	**0.337**	**0.355**	**0.378**	**0.388**	**0.405**	**0.442**	**0.445**	**0.464**	**0.469**	**0.483**
Denmark	0.368	0.368	0.378	0.405	0.403	0.463	0.454	0.465	0.464	0.486
Estonia	0.296	0.294	0.300	0.337	0.355	0.313	0.351	0.347	0.332	0.324
Greece	0.339	0.372	0.384	0.396	0.407	0.459	0.518	0.465	0.455	0.466
Spain	**0.396**	**0.393**	**0.425**	**0.463**	**0.523**	**0.479**	**0.494**	**0.472**	**0.492**	**0.510**
Finland	0.419	0.429	0.421	0.403	0.408	0.432	0.428	0.429	0.435	0.440
France	**0.374**	**0.375**	**0.368**	**0.356**	**0.363**	**0.371**	**0.379**	**0.378**	**0.384**	**0.387**
Croatia	0.441	0.516	0.524	0.534	0.616	0.590	0.595	0.579	0.627	0.577
Hungary	0.275	0.309	0.311	0.331	0.347	0.352	0.355	0.363	0.364	0.379
Ireland	0.402	0.401	0.420	0.450	0.497	0.549	0.545	0.557	0.585	0.600
Italy	**0.433**	**0.443**	**0.448**	**0.418**	**0.440**	**0.450**	**0.456**	**0.459**	**0.466**	**0.474**
Lithuania	0.337	0.283	0.298	0.308	0.345	0.486	0.474	0.487	0.447	0.515
Luxembourg	0.611	0.743	0.923	0.601	0.694	0.940	1.150	1.063	0.967	0.706
Latvia	0.448	0.403	0.468	0.487	0.520	0.415	0.435	0.568	0.497	0.500
Malta	0.188	0.290	0.331	0.315	0.314	0.412	0.400	0.477	0.535	0.534
Netherlands	**0.414**	**0.393**	**0.408**	**0.412**	**0.448**	**0.446**	**0.459**	**0.476**	**0.490**	**0.508**
Poland	**0.264**	**0.323**	**0.342**	**0.345**	**0.350**	**0.371**	**0.377**	**0.382**	**0.385**	**0.394**
Portugal	0.480	0.456	0.496	0.468	0.584	0.535	0.579	0.535	0.561	0.584
Romania	0.232	0.282	0.332	0.385	0.401	0.445	0.454	0.442	0.451	0.443
Sweden	**0.497**	**0.470**	**0.503**	**0.462**	**0.474**	**0.488**	**0.481**	**0.484**	**0.480**	**0.492**
Slovenia	0.365	0.383	0.410	0.391	0.430	0.455	0.471	0.451	0.464	0.465
Slovakia	0.339	0.347	0.372	0.353	0.357	0.352	0.360	0.359	0.375	0.378
United Kingdom	**0.370**	**0.378**	**0.410**	**0.409**	**0.443**	**0.465**	**0.493**	**0.509**	**0.518**	**0.521**

Table A2.31 – *Fuel energy content in the thermoelectric plants in the main European countries (ktoe).*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28										
Anthracite, BKB	1,374	539	611	1,117	5,340	2,979	3,318	1,824	1,624	1,314
Coal and other solid fuels	164,446	148,276	136,444	137,938	112,636	105,116	89,297	82,223	73,509	51,516
Lignite	98,229	85,756	81,791	83,043	76,345	74,777	70,552	71,264	68,827	57,135
Coke oven coke	289	-	-	-	1	3	-	-	0	-
Oil and petroleum products	55,228	54,156	41,184	35,205	22,741	16,549	16,363	15,503	14,025	13,174
Peat and peat products/Oil shale and oil sands	5,818	4,575	3,952	4,381	5,344	3,908	3,973	4,028	4,105	2,572
Natural gas	49,138	60,959	94,327	126,582	140,720	88,893	106,240	114,361	108,232	119,733
Manufactured gases	8,006	6,964	8,420	8,911	8,535	8,566	8,337	8,509	8,299	8,031
Primary solid biofuels/Charcoal	2,172	3,648	5,456	12,451	19,558	24,546	24,647	25,417	26,661	28,221
Liquid biofuels	-	-	-	419	908	1,057	1,005	959	960	1,043
Biogases	334	795	1,744	3,333	6,931	12,256	12,546	12,651	12,534	12,581
Renewable waste	1,245	2,069	3,021	4,917	6,535	8,199	8,602	8,750	8,709	8,875
Non-renewable waste	1,952	3,339	4,353	5,680	7,215	8,910	9,880	9,723	9,652	9,949
Total	**388,231**	**371,075**	**381,302**	**423,977**	**412,808**	**355,758**	**354,759**	**355,211**	**337,137**	**314,144**

EU27										
Anthracite, BKB	1,374	539	611	1,117	5,340	2,979	3,318	1,824	1,624	1,314
Coal and other solid fuels	116,765	112,310	108,434	106,914	88,209	87,703	82,141	76,945	69,506	49,768
Lignite	98,229	85,756	81,791	83,043	76,345	74,777	70,552	71,264	68,827	57,135
Coke oven coke	289	-	-	-	1	3	-	-	0	-
Oil and petroleum products	47,976	50,146	39,895	34,034	21,683	15,987	15,566	15,003	13,618	12,765
Peat and peat products/Oil shale and oil sands	5,818	4,575	3,952	4,381	5,344	3,908	3,973	4,028	4,105	2,572
Natural gas	48,024	49,325	69,210	100,916	111,537	72,434	83,226	92,335	87,053	98,789
Manufactured gases	7,451	6,537	7,538	7,939	7,884	7,797	7,805	8,000	7,818	7,526
Primary solid biofuels/Charcoal	2,172	3,536	5,295	11,502	18,436	21,044	21,150	21,636	22,313	23,448
Liquid biofuels	-	-	-	419	908	1,057	1,005	959	960	1,043
Biogases	200	508	989	1,926	5,145	10,145	10,282	10,376	10,318	10,404
Renewable waste	1,197	1,951	2,776	4,616	6,109	7,560	7,814	7,914	7,741	7,791
Non-renewable waste	1,923	3,236	4,209	5,141	6,876	8,042	8,682	8,697	8,509	8,571
Total	**331,419**	**318,419**	**324,701**	**361,950**	**353,816**	**313,436**	**315,513**	**318,980**	**302,393**	**281,125**

Czechia										
Anthracite, BKB	-	-	-	-	2	-	-	-	-	-
Coal and other solid fuels	2,042	2,524	1,898	1,776	2,131	1,862	1,885	1,569	1,282	898
Lignite	12,290	11,894	12,055	12,373	11,636	9,661	9,747	9,770	9,910	9,227
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	329	317	206	154	71	44	35	45	38	45
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	204	344	694	675	430	607	824	781	785	1,080
Manufactured gases	266	228	542	617	732	681	681	649	634	567
Primary solid biofuels/Charcoal	-	79	182	147	369	585	600	648	618	689
Liquid biofuels	-	-	-	-	-	-	-	-	-	-
Biogases	-	34	32	35	122	473	436	449	451	432
Renewable waste	-	-	23	24	42	57	64	70	65	69
Non-renewable waste	-	-	15	17	29	46	49	55	51	53
Total	**15,131**	**15,421**	**15,647**	**15,819**	**15,565**	**14,016**	**14,322**	**14,035**	**13,834**	**13,061**

Table A2.31 - *following*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Germany										
Anthracite, BKB	1,129	465	404	590	2,313	1,758	1,818	755	835	900
Coal and other solid fuels	33,504	35,184	32,549	29,006	25,514	24,446	24,585	19,748	17,386	13,144
Lignite	46,057	35,908	34,157	34,688	32,310	34,404	33,274	32,812	32,124	25,041
Coke oven coke	289	-	-	-	-	-	-	-	-	-
Oil and petroleum products	3,342	2,369	1,421	2,449	1,677	1,265	1,212	1,190	1,034	966
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	10,614	10,273	11,095	15,886	17,700	11,940	15,210	16,116	15,495	16,778
Manufactured gases	2,430	1,742	1,796	2,024	2,272	2,314	2,449	2,486	2,409	2,323
Primary solid biofuels/Charcoal	111	386	330	1,769	2,648	3,040	2,902	2,853	3,004	3,019
Liquid biofuels	-	-	-	19	196	74	70	72	77	91
Biogases	152	255	439	673	3,116	5,631	5,699	5,691	5,667	5,649
Renewable waste	562	588	709	1,371	1,821	2,147	2,318	2,341	2,222	2,178
Non-renewable waste	1,000	1,437	1,681	1,371	2,434	2,663	2,865	2,848	2,543	2,543
Total	**99,188**	**88,606**	**84,581**	**89,847**	**92,001**	**89,683**	**92,401**	**86,914**	**82,796**	**72,631**

Spain										
Anthracite, BKB	158	-	-	-	1,770	89	1,078	693	532	218
Coal and other solid fuels	10,733	13,360	16,751	14,678	5,483	10,790	8,031	10,298	9,127	3,249
Lignite	3,103	1,833	1,480	1,178	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	2,207	3,692	4,497	5,302	3,506	3,562	3,420	3,240	2,977	2,615
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	273	753	2,685	10,798	14,621	8,260	8,086	9,929	8,979	12,760
Manufactured gases	216	234	391	342	218	300	237	283	284	262
Primary solid biofuels/Charcoal	56	93	284	732	648	1,203	1,190	1,282	1,210	1,174
Liquid biofuels	-	-	-	-	-	-	-	-	3	3
Biogases	-	54	106	277	204	202	193	201	203	198
Renewable waste	40	93	115	189	174	250	230	253	250	251
Non-renewable waste	48	135	190	189	174	250	230	253	321	309
Total	**16,834**	**20,246**	**26,497**	**33,686**	**26,800**	**24,904**	**22,696**	**26,431**	**23,884**	**21,037**

France										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	6,942	5,569	6,473	6,404	4,444	2,771	2,440	3,015	1,975	952
Lignite	759	529	108	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	1,641	1,236	1,246	2,897	1,652	1,590	1,687	1,692	1,201	1,213
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	437	551	3,000	5,463	6,712	3,835	5,814	6,632	5,096	6,542
Manufactured gases	923	706	1,002	835	656	733	564	610	615	599
Primary solid biofuels/Charcoal	162	219	168	637	1,279	1,244	1,488	1,481	1,520	1,561
Liquid biofuels	-	-	-	-	-	1	1	0	0	0
Biogases	17	19	68	192	375	561	578	582	619	661
Renewable waste	63	445	620	848	927	1,038	1,070	1,077	1,089	1,084
Non-renewable waste	63	445	620	848	952	1,137	1,162	1,157	1,167	1,172
Total	**11,008**	**9,719**	**13,305**	**18,124**	**16,997**	**12,910**	**14,804**	**16,246**	**13,283**	**13,783**

Table A2.31 - *following*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Italy										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	6,737	5,244	6,044	10,399	9,035	9,801	7,960	7,253	6,404	4,335
Lignite	264	43	1	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	21,531	25,009	18,954	12,079	7,365	4,522	4,315	4,164	4,103	3,705
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	8,075	9,375	18,689	28,283	27,855	20,362	22,735	24,986	23,111	25,180
Manufactured gases	896	859	979	1,302	1,112	608	767	655	652	642
Primary solid biofuels/Charcoal	2	8	106	780	852	1,673	1,747	1,728	1,722	1,703
Liquid biofuels	-	-	-	-	572	940	905	861	835	910
Biogases	1	23	131	324	506	1,827	1,831	1,849	1,827	1,936
Renewable waste	11	28	86	556	778	846	871	853	847	873
Non-renewable waste	25	45	115	611	818	881	907	889	881	899
Total	**37,542**	**40,633**	**45,105**	**54,333**	**48,892**	**41,460**	**42,036**	**43,239**	**40,382**	**40,181**
Netherlands										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	5,544	5,798	4,998	4,958	4,669	8,040	7,277	6,126	5,304	3,502
Lignite	-	-	-	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	601	891	664	545	386	317	310	265	339	397
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	6,798	8,663	10,373	11,471	13,567	7,972	8,929	9,592	9,312	10,985
Manufactured gases	483	554	562	643	615	616	575	602	570	547
Primary solid biofuels/Charcoal	11	12	122	485	974	494	515	516	506	815
Liquid biofuels	-	-	-	328	11	-	-	-	-	-
Biogases	15	51	56	57	188	159	149	138	129	129
Renewable waste	306	353	497	515	620	930	970	930	881	875
Non-renewable waste	223	302	472	581	550	761	826	824	813	776
Total	**13,981**	**16,624**	**17,744**	**19,584**	**21,581**	**19,290**	**19,550**	**18,994**	**17,853**	**18,025**
Poland										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	28,852	23,256	22,935	23,535	22,984	19,880	20,246	20,224	20,295	18,957
Lignite	13,185	12,622	12,054	12,747	11,397	12,125	11,573	11,861	11,124	9,428
Coke oven coke	-	-	-	-	-	-	-	-	0	-
Oil and petroleum products	1,248	409	436	565	562	405	432	393	377	354
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	71	63	299	1,070	973	1,235	1,482	1,798	2,209	2,527
Manufactured gases	602	425	540	488	792	990	968	913	926	857
Primary solid biofuels/Charcoal	249	22	70	372	1,510	2,249	1,711	1,282	1,314	1,605
Liquid biofuels	-	-	-	-	0	2	1	1	1	1
Biogases	-	3	9	13	66	150	173	196	205	206
Renewable waste	-	-	-	-	-	-	8	34	37	49
Non-renewable waste	124	89	21	13	17	32	96	133	196	234
Total	**44,330**	**36,888**	**36,365**	**38,803**	**38,302**	**37,066**	**36,689**	**36,834**	**36,683**	**34,216**

Table A2.31 - *following*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Sweden										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	537	535	334	282	292	191	123	149	157	98
Lignite	-	-	-	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	274	761	281	320	435	70	119	75	93	64
Peat and peat products/Oil shale and oil sands	52	162	128	226	305	109	120	114	178	118
Natural gas	130	272	215	198	700	174	246	73	146	107
Manufactured gases	123	134	225	292	230	185	191	226	229	189
Primary solid biofuels/Charcoal	294	1,107	1,696	2,509	3,344	2,972	3,227	3,434	3,407	3,675
Liquid biofuels	-	-	-	28	67	10	19	15	22	15
Biogases	-	15	20	23	13	5	5	5	5	8
Renewable waste	53	110	137	225	628	844	767	809	756	796
Non-renewable waste	80	165	231	372	439	580	726	765	716	753
Total	**1,543**	**3,261**	**3,266**	**4,476**	**6,452**	**5,140**	**5,543**	**5,664**	**5,707**	**5,822**

United Kingdom										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	47,681	35,966	28,010	31,024	24,427	17,414	7,156	5,278	4,003	1,748
Lignite	-	-	-	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	7,252	4,009	1,288	1,171	1,057	562	798	499	407	409
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	1,114	11,634	25,117	25,666	29,184	16,458	23,014	22,026	21,179	20,944
Manufactured gases	554	427	882	971	651	769	532	510	481	505
Primary solid biofuels/Charcoal	-	112	161	950	1,122	3,502	3,497	3,780	4,347	4,773
Liquid biofuels	-	-	-	-	-	-	-	-	-	-
Biogases	134	287	754	1,406	1,786	2,111	2,263	2,275	2,216	2,177
Renewable waste	49	118	245	301	426	638	788	835	968	1,084
Non-renewable waste	29	103	144	540	339	868	1,198	1,026	1,143	1,378
Total	**56,812**	**52,656**	**56,601**	**62,028**	**58,992**	**42,322**	**39,246**	**36,231**	**34,744**	**33,019**

Other countries										
Anthracite, BKB	87	74	207	528	1,255	1,133	422	375	258	196
Coal and other solid fuels	21,874	20,840	16,452	15,875	13,656	9,922	9,594	8,563	7,577	4,633
Lignite	22,571	22,927	21,936	22,057	21,003	18,587	15,958	16,821	15,669	13,440
Coke oven coke	-	-	-	-	1	3	-	-	-	-
Oil and petroleum products	16,804	15,464	12,190	9,723	6,029	4,212	4,035	3,937	3,455	3,406
Peat and peat products/Oil shale and oil sands	5,767	4,413	3,824	4,155	5,039	3,799	3,854	3,914	3,927	2,453
Natural gas	21,421	19,030	22,161	27,072	28,979	18,050	19,899	22,427	21,920	22,830
Manufactured gases	1,513	1,656	1,501	1,395	1,257	1,370	1,374	1,576	1,499	1,542
Primary solid biofuels/Charcoal	1,288	1,610	2,338	4,070	6,811	7,584	7,771	8,413	9,013	9,208
Liquid biofuels	-	-	-	44	60	30	8	10	23	24
Biogases	15	55	129	333	554	1,137	1,218	1,264	1,212	1,186
Renewable waste	162	334	589	888	1,119	1,449	1,517	1,548	1,595	1,616
Non-renewable waste	360	618	863	1,139	1,462	1,693	1,822	1,774	1,823	1,833
Total	**91,862**	**87,020**	**82,190**	**87,278**	**87,225**	**68,967**	**67,472**	**70,621**	**67,970**	**62,368**

Table A2.32 – *Gross electricity production in the thermoelectric plants in the main European countries (TWh). Total production includes electricity from pumping.*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28										
Anthracite, BKB	2	1	1	21	13	15	8	6	6	2
Coal and other solid fuels	659	609	575	581	482	452	383	353	315	214
Lignite	338	320	344	341	313	314	299	302	292	241
Coke oven coke	1	-	-	-	0	0	-	-	0	-
Oil and petroleum products	224	230	181	143	87	65	64	60	56	53
Peat and peat products/Oil shale and oil sands	20	16	14	17	20	14	15	15	15	9
Natural gas	193	268	480	668	766	496	610	662	622	700
Manufactured gases	31	26	34	36	34	33	33	33	33	31
Primary solid biofuels/Charcoal	11	15	20	44	70	91	92	95	100	107
Liquid biofuels	-	-	-	2	5	5	5	5	5	5
Biogases	1	2	6	13	32	60	63	64	63	63
Renewable waste	2	4	7	12	17	21	21	22	23	23
Non-renewable waste	5	9	12	14	19	23	26	25	26	27
Total	**1,487**	**1,501**	**1,674**	**1,892**	**1,859**	**1,590**	**1,618**	**1,643**	**1,555**	**1,476**

EU27										
Anthracite, BKB	2	1	1	21	13	15	8	6	6	2
Coal and other solid fuels	455	455	455	447	375	377	352	330	298	207
Lignite	338	320	344	341	313	314	299	302	292	241
Coke oven coke	1	-	-	-	0	0	-	-	0	-
Oil and petroleum products	190	213	173	137	82	63	62	59	55	52
Peat and peat products/Oil shale and oil sands	20	16	14	17	20	14	15	15	15	9
Natural gas	188	205	331	516	590	396	466	525	491	569
Manufactured gases	29	25	31	34	33	32	32	33	32	30
Primary solid biofuels/Charcoal	11	15	20	41	65	72	72	74	76	81
Liquid biofuels	-	-	-	2	5	5	5	5	5	5
Biogases	0	2	4	8	26	54	55	56	55	55
Renewable waste	2	3	6	11	16	18	18	19	19	19
Non-renewable waste	5	8	12	12	17	19	21	21	22	21
Total	**1,240**	**1,262**	**1,391**	**1,586**	**1,556**	**1,380**	**1,406**	**1,445**	**1,365**	**1,293**

Czechia										
Anthracite, BKB	-	-	-	-	0	-	-	-	-	-
Coal and other solid fuels	6	7	6	6	6	6	6	4	3	2
Lignite	41	37	47	44	41	35	36	37	38	35
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	1	1	0	0	0	0	0	0	0	0
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	0	0	2	1	1	2	4	4	4	6
Manufactured gases	1	1	2	3	3	3	3	2	2	2
Primary solid biofuels/Charcoal	-	0	0	1	1	2	2	2	2	2
Liquid biofuels	-	-	-	-	-	-	-	-	-	-
Biogases	-	0	0	0	1	3	3	3	3	3
Renewable waste	-	-	0	0	0	0	0	0	0	0
Non-renewable waste	-	-	0	0	0	0	0	0	0	0
Total	**49**	**46**	**58**	**55**	**53**	**51**	**53**	**53**	**52**	**50**

Table A2.32 - *following*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Germany										
Anthracite, BKB	1	1	0	9	8	9	3	3	5	2
Coal and other solid fuels	141	147	143	127	111	110	111	91	80	57
Lignite	168	141	153	153	145	153	148	147	144	113
Coke oven coke	1	-	-	-	-	-	-	-	-	-
Oil and petroleum products	10	9	5	12	9	6	6	6	5	5
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	40	43	52	74	90	63	82	88	83	91
Manufactured gases	11	7	7	10	11	12	11	12	11	10
Primary solid biofuels/Charcoal	0	0	1	7	10	11	11	11	11	11
Liquid biofuels	-	-	-	0	1	0	0	0	0	0
Biogases	0	1	2	4	18	33	34	34	33	33
Renewable waste	1	1	2	3	5	6	6	6	6	6
Non-renewable waste	4	5	6	3	6	7	7	7	7	7
Total	**378**	**356**	**372**	**402**	**413**	**410**	**420**	**404**	**386**	**334**
Spain										
Anthracite, BKB	0	-	-	8	0	5	3	2	1	0
Coal and other solid fuels	48	58	73	65	25	47	33	43	36	13
Lignite	12	8	6	5	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	9	15	23	24	17	17	17	16	14	13
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	2	4	20	79	95	52	53	64	58	84
Manufactured gases	1	1	2	2	1	1	1	1	1	1
Primary solid biofuels/Charcoal	0	1	1	2	3	4	4	4	4	4
Liquid biofuels	-	-	-	-	-	-	-	-	0	0
Biogases	-	0	0	1	1	1	1	1	1	1
Renewable waste	0	0	0	0	1	1	1	1	1	1
Non-renewable waste	0	0	1	0	1	1	1	1	1	1
Total	**71**	**87**	**126**	**187**	**142**	**129**	**114**	**133**	**118**	**117**
France										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	29	22	27	28	23	12	10	13	8	4
Lignite	2	2	0	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	9	8	7	8	6	7	7	7	6	6
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	3	4	12	23	24	21	35	41	31	39
Manufactured gases	4	2	4	3	3	3	2	2	2	2
Primary solid biofuels/Charcoal	1	1	1	1	1	3	3	3	4	4
Liquid biofuels	-	-	-	-	-	0	0	0	0	0
Biogases	0	0	0	0	1	2	2	2	2	3
Renewable waste	0	0	1	2	2	2	2	2	2	2
Non-renewable waste	0	0	1	2	2	2	2	2	2	2
Total	**49**	**40**	**53**	**67**	**62**	**51**	**64**	**73**	**58**	**62**

Table A2.32 - *following*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Italy										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	31	24	26	44	40	43	36	33	28	19
Lignite	1	0	0	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	103	121	86	47	22	13	12	12	11	10
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	40	47	101	149	153	111	126	140	129	142
Manufactured gases	4	3	4	6	5	2	3	2	2	2
Primary solid biofuels/Charcoal	0	0	0	2	2	4	4	4	4	4
Liquid biofuels	-	-	-	-	3	5	5	4	4	5
Biogases	0	0	1	1	2	8	8	8	8	8
Renewable waste	0	0	0	1	2	2	2	2	2	2
Non-renewable waste	0	0	1	1	2	2	3	2	2	2
Total	**178**	**196**	**220**	**252**	**230**	**191**	**199**	**209**	**192**	**195**
Netherlands										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	25	27	24	23	23	39	37	31	27	18
Lignite	-	-	-	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	3	3	3	2	1	1	1	1	1	1
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	37	42	52	58	75	46	53	58	57	70
Manufactured gases	2	3	3	3	3	3	3	3	3	2
Primary solid biofuels/Charcoal	0	0	0	2	4	2	2	2	2	3
Liquid biofuels	-	-	-	1	0	-	-	-	-	-
Biogases	0	0	0	0	1	1	1	1	1	1
Renewable waste	1	1	1	1	2	2	2	2	2	2
Non-renewable waste	0	1	1	1	2	2	2	2	2	2
Total	**68**	**76**	**84**	**93**	**111**	**96**	**100**	**99**	**96**	**100**
Poland										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	76	77	82	87	88	78	79	79	81	76
Lignite	55	54	53	55	49	53	51	52	49	42
Coke oven coke	-	-	-	-	-	-	-	-	0	-
Oil and petroleum products	2	2	2	3	3	2	2	2	2	2
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	0	0	1	5	5	6	8	10	13	15
Manufactured gases	1	1	2	1	2	2	3	2	2	2
Primary solid biofuels/Charcoal	0	0	0	1	6	9	7	5	5	6
Liquid biofuels	-	-	-	-	0	0	0	0	0	0
Biogases	-	0	0	0	0	1	1	1	1	1
Renewable waste	-	-	-	-	-	-	0	0	0	0
Non-renewable waste	0	0	0	0	0	0	0	0	0	1
Total	**133**	**135**	**141**	**153**	**152**	**151**	**151**	**152**	**154**	**145**

Table A2.32 - *following*

Fuel	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Sweden										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	1	2	2	1	1	0	0	0	0	0
Lignite	-	-	-	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	1	4	2	1	2	0	0	0	0	0
Peat and peat products/Oil shale and oil sands	0	0	0	1	1	0	0	0	0	0
Natural gas	0	1	0	1	3	0	1	0	0	0
Manufactured gases	0	1	1	1	1	1	1	1	1	1
Primary solid biofuels/Charcoal	2	2	4	7	10	9	10	10	10	11
Liquid biofuels	-	-	-	0	0	0	0	0	0	0
Biogases	-	0	0	0	0	0	0	0	0	0
Renewable waste	0	0	0	1	2	2	2	2	2	2
Non-renewable waste	0	0	0	1	1	1	2	2	2	2
Total	**5**	**10**	**9**	**12**	**21**	**14**	**15**	**16**	**16**	**16**
United Kingdom										
Anthracite, BKB	-	-	-	-	-	-	-	-	-	-
Coal and other solid fuels	205	154	120	135	108	76	31	23	17	7
Lignite	-	-	-	-	-	-	-	-	-	-
Coke oven coke	-	-	-	-	-	-	-	-	-	-
Oil and petroleum products	35	17	8	5	5	2	2	2	2	1
Peat and peat products/Oil shale and oil sands	-	-	-	-	-	-	-	-	-	-
Natural gas	5	64	148	153	176	100	143	137	131	131
Manufactured gases	2	1	2	2	1	1	1	1	1	1
Primary solid biofuels/Charcoal	-	0	1	3	5	19	20	21	24	26
Liquid biofuels	-	-	-	-	-	-	-	-	-	-
Biogases	0	1	3	5	6	6	8	8	8	8
Renewable waste	0	0	1	1	2	3	3	3	3	4
Non-renewable waste	0	0	1	3	1	4	5	4	5	5
Total	**247**	**238**	**283**	**306**	**303**	**211**	**212**	**198**	**190**	**182**
Other countries										
Anthracite, BKB	0	0	1	4	5	1	1	1	1	1
Coal and other solid fuels	99	89	73	67	59	41	40	36	32	19
Lignite	59	77	84	84	79	73	64	66	61	51
Coke oven coke	-	-	-	-	0	0	-	-	-	-
Oil and petroleum products	53	52	46	39	23	16	16	15	15	15
Peat and peat products/Oil shale and oil sands	20	16	13	16	20	14	15	15	15	9
Natural gas	65	63	91	125	144	94	105	121	116	122
Manufactured gases	6	5	6	5	5	6	6	7	6	7
Primary solid biofuels/Charcoal	7	10	12	17	27	28	29	32	34	35
Liquid biofuels	-	-	-	0	0	0	0	0	0	0
Biogases	0	0	1	1	3	5	6	6	6	6
Renewable waste	0	1	1	2	3	3	3	4	4	4
Non-renewable waste	1	1	2	3	3	4	4	4	5	5
Total	**309**	**315**	**329**	**365**	**371**	**285**	**291**	**306**	**294**	**273**

Table A2.33 – *Gross of electricity production from renewable sources w/o pumping in the main European countries (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28										
Hydro	290.0	331.9	356.9	313.3	376.9	342.3	351.0	300.2	349.3	325.8
Geothermal	3.2	3.5	4.8	5.4	5.6	6.6	6.7	6.7	6.7	6.7
Wind	0.8	4.1	22.2	71.0	150.1	303.5	304.0	361.9	377.4	431.5
Solar thermal	-	-	-	-	0.8	5.6	5.6	5.9	4.9	5.7
Solar photovoltaic	0.0	0.0	0.1	1.5	22.5	102.8	105.9	113.5	123.2	133.0
Tide, wave, ocean	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bioenergy	14.3	21.4	34.1	70.1	123.8	177.9	181.2	185.6	190.6	197.2
Total	**308.9**	**361.4**	**418.5**	**461.7**	**680.2**	**939.1**	**954.9**	**974.4**	**1,052.6**	**1,100.4**
EU27										
Hydro	284.8	327.0	351.8	308.4	373.3	336.0	345.6	294.3	343.9	319.9
Geothermal	3.2	3.5	4.8	5.4	5.6	6.6	6.7	6.7	6.7	6.7
Wind	0.8	3.7	21.3	68.1	139.8	263.2	266.8	312.3	320.5	367.1
Solar thermal	-	-	-	-	0.8	5.6	5.6	5.9	4.9	5.7
Solar photovoltaic	0.0	0.0	0.1	1.5	22.5	95.3	95.5	102.0	110.5	120.0
Tide, wave, ocean	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bioenergy	13.7	19.8	30.1	61.0	111.6	149.4	151.2	153.7	155.7	159.9
Total	**303.1**	**354.5**	**408.6**	**444.8**	**654.1**	**856.6**	**871.9**	**875.5**	**942.6**	**979.9**
Czechia										
Hydro	1.2	2.0	1.8	2.4	2.8	1.8	2.0	1.9	1.6	2.0
Geothermal	-	-	-	-	-	-	-	-	-	-
Wind	-	-	0.0	0.0	0.3	0.6	0.5	0.6	0.6	0.7
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	-	-	0.0	0.0	0.6	2.3	2.1	2.2	2.4	2.3
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	-
Bioenergy	-	0.4	0.5	0.7	2.2	4.8	4.8	5.0	4.8	5.0
Total	**1.2**	**2.4**	**2.3**	**3.1**	**5.9**	**9.4**	**9.4**	**9.6**	**9.4**	**10.1**
Germany										
Hydro	17.4	21.8	21.7	19.6	21.0	19.0	20.5	20.1	17.7	19.7
Geothermal	-	-	-	-	0.0	0.1	0.2	0.2	0.2	0.2
Wind	0.1	1.7	9.4	27.8	38.5	80.6	79.9	105.7	110.0	125.9
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	0.0	0.0	0.1	1.3	11.7	38.7	38.1	39.4	45.8	46.4
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	-
Bioenergy	1.6	2.4	4.3	14.7	33.9	50.3	50.9	50.9	50.9	50.2
Total	**19.1**	**25.9**	**35.5**	**63.4**	**105.2**	**188.8**	**189.7**	**216.3**	**224.5**	**242.4**
Spain										
Hydro	25.5	23.1	28.3	18.4	42.3	28.1	36.4	18.3	34.3	24.6
Geothermal	-	-	-	-	-	-	-	-	-	-
Wind	0.0	0.3	4.7	21.2	44.3	49.3	48.9	49.1	50.9	55.6
Solar thermal	-	-	-	-	0.8	5.6	5.6	5.9	4.9	5.7
Solar photovoltaic	0.0	0.0	0.0	0.0	6.4	8.3	8.1	8.5	7.9	9.4
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	0.0
Bioenergy	0.5	1.0	1.5	2.7	4.0	5.8	5.7	6.1	5.9	5.6
Total	**26.0**	**24.4**	**34.5**	**42.3**	**97.8**	**97.1**	**104.6**	**87.9**	**103.9**	**101.0**

Table A2.33 – *following*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
France										
Hydro	53.9	73.1	66.4	51.5	62.7	55.6	60.8	50.0	65.1	56.9
Geothermal	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1
Wind	0.0	0.0	0.0	1.0	9.9	21.4	21.4	24.6	28.6	34.7
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	-	0.0	0.0	0.0	0.6	7.8	8.7	9.6	10.9	12.2
Tide, wave, ocean	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bioenergy	1.4	1.8	2.5	3.4	4.4	6.5	7.5	7.8	8.4	8.6
Total	**55.8**	**75.5**	**69.4**	**56.3**	**78.2**	**91.8**	**99.0**	**92.6**	**113.6**	**113.1**

Italy										
Hydro	31.6	37.8	44.2	36.1	51.1	45.5	42.4	36.2	48.8	46.3
Geothermal	3.2	3.4	4.7	5.3	5.4	6.2	6.3	6.2	6.1	6.1
Wind	0.0	0.0	0.6	2.3	9.1	14.8	17.7	17.7	17.7	20.2
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	0.0	0.0	0.0	0.0	1.9	22.9	22.1	24.4	22.7	23.7
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	-
Bioenergy	0.1	0.2	1.4	4.7	9.4	19.4	19.5	19.4	19.2	19.6
Total	**34.9**	**41.5**	**50.9**	**48.4**	**77.0**	**108.9**	**108.0**	**103.9**	**114.4**	**115.8**

Netherlands										
Hydro	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Geothermal	-	-	-	-	-	-	-	-	-	-
Wind	0.1	0.3	0.8	2.1	4.0	7.5	8.2	10.6	10.5	11.5
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	0.0	0.0	0.0	0.0	0.1	1.1	1.6	2.2	3.7	5.3
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	-
Bioenergy	0.7	1.0	2.0	5.3	7.0	4.9	4.9	4.6	4.6	5.8
Total	**0.8**	**1.4**	**3.0**	**7.4**	**11.2**	**13.7**	**14.8**	**17.4**	**18.9**	**22.7**

Poland										
Hydro	1.4	1.9	2.1	2.2	2.9	1.8	2.1	2.6	2.0	2.0
Geothermal	-	-	-	-	-	-	-	-	-	-
Wind	-	0.0	0.0	0.1	1.7	10.9	12.6	14.9	12.8	15.1
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	-	-	-	-	-	0.1	0.1	0.2	0.3	0.7
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	-
Bioenergy	0.1	0.1	0.2	1.5	6.3	9.9	8.0	6.5	6.5	7.7
Total	**1.5**	**2.0**	**2.3**	**3.8**	**10.9**	**22.7**	**22.8**	**24.1**	**21.6**	**25.5**

Sweden										
Hydro	72.5	68.1	78.6	72.8	66.4	75.3	62.0	65.1	62.2	65.4
Geothermal	-	-	-	-	-	-	-	-	-	-
Wind	0.0	0.1	0.5	0.9	3.5	16.3	15.5	17.6	16.6	19.8
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	-	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.7
Tide, wave, ocean	-	-	-	-	-	-	-	-	-	-
Bioenergy	1.9	2.4	4.1	7.5	12.2	10.8	11.5	12.1	11.9	13.0
Total	**74.5**	**70.6**	**83.1**	**81.2**	**82.1**	**102.5**	**89.1**	**95.1**	**91.2**	**98.9**

Table A2.33 – *following*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
United Kingdom										
Hydro	5.2	4.8	5.1	4.9	3.6	6.3	5.4	5.9	5.4	5.9
Geothermal	-	-	-	-	-	-	-	-	-	-
Wind	0.0	0.4	0.9	2.9	10.3	40.3	37.2	49.6	56.9	64.3
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	-	-	0.0	0.0	0.0	7.5	10.4	11.5	12.7	12.9
Tide, wave, ocean	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bioenergy	0.6	1.6	3.9	9.1	12.3	28.5	30.1	31.9	34.9	37.3
Total	**5.8**	**6.9**	**10.0**	**16.9**	**26.2**	**82.6**	**83.0**	**98.9**	**110.0**	**120.5**
Other countries										
Hydro	81.2	99.2	108.6	105.3	124.0	108.7	119.1	100.0	112.1	102.8
Geothermal	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3
Wind	0.6	1.3	5.3	12.7	28.5	61.7	62.2	71.5	72.8	83.5
Solar thermal	-	-	-	-	-	-	-	-	-	-
Solar photovoltaic	0.0	0.0	0.0	0.0	1.1	14.1	14.5	15.4	16.5	19.3
Tide, wave, ocean	-	-	-	-	-	0.0	0.0	0.0	-	-
Bioenergy	7.5	10.5	13.6	20.6	32.1	37.0	38.4	41.4	43.5	44.4
Total	**89.3**	**111.0**	**127.6**	**138.7**	**185.9**	**221.7**	**234.5**	**228.5**	**245.1**	**250.3**

Table A2.34 – *Other parameters of electricity production and distribution for the main European countries (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28										
Net import	46	21	23	16	8	14	18	10	28	24
Gross electricity production	2,595	2,743	3,035	3,326	3,367	3,245	3,268	3,299	3,278	3,232
Energy own consumption	162	159	162	173	169	156	160	161	154	143
Electricity for pumped storage	28	29	41	48	43	41	41	43	40	37
Distribution losses	176	201	217	220	212	208	206	205	208	205
Gross inland consumption	2,641	2,764	3,058	3,342	3,375	3,259	3,286	3,309	3,306	3,256
Final consumption	2,161	2,257	2,528	2,783	2,839	2,754	2,786	2,806	2,811	2,780
Industry	*994*	*961*	*1,060*	*1,131*	*1,030*	*1,007*	*1,019*	*1,035*	*1,040*	*1,026*
Agriculture and forestry/Fishing	*49*	*40*	*40*	*44*	*52*	*56*	*56*	*57*	*57*	*58*
Commercial and public services	*444*	*519*	*635*	*740*	*841*	*828*	*833*	*837*	*835*	*819*
Households	*609*	*657*	*718*	*802*	*849*	*800*	*813*	*812*	*813*	*810*
Transport	*62*	*67*	*70*	*64*	*60*	*61*	*62*	*63*	*64*	*64*
Not elsewhere specified	*4*	*13*	*5*	*3*	*7*	*3*	*3*	*2*	*2*	*3*

EU27										
Net import	34	4	9	7	5	-7	1	-5	9	3
Gross electricity production	2,275	2,409	2,658	2,928	2,985	2,907	2,928	2,961	2,945	2,909
Energy own consumption	143	141	146	155	153	146	144	146	139	130
Electricity for pumped storage	25	27	38	45	38	38	37	39	36	35
Distribution losses	151	174	186	192	185	179	180	178	183	179
Gross inland consumption	2,309	2,414	2,667	2,935	2,990	2,900	2,929	2,956	2,954	2,912
Final consumption	1,887	1,963	2,198	2,434	2,510	2,451	2,482	2,507	2,510	2,485
Industry	*893*	*860*	*946*	*1,015*	*925*	*914*	*926*	*943*	*946*	*934*
Agriculture and forestry/Fishing	*45*	*36*	*36*	*40*	*47*	*52*	*52*	*53*	*53*	*54*
Commercial and public services	*373*	*439*	*544*	*641*	*744*	*733*	*739*	*744*	*743*	*729*
Households	*515*	*555*	*606*	*676*	*730*	*692*	*705*	*707*	*708*	*706*
Transport	*57*	*59*	*61*	*60*	*56*	*56*	*58*	*58*	*59*	*59*
Not elsewhere specified	*4*	*13*	*5*	*3*	*7*	*3*	*3*	*2*	*2*	*3*

Czechia										
Net import	-1	0	-10	-13	-15	-13	-11	-13	-14	-13
Gross electricity production	63	61	73	83	86	84	83	87	88	87
Energy own consumption	4	4	5	6	8	7	7	7	7	7
Electricity for pumped storage	0	0	1	1	1	2	2	2	1	2
Distribution losses	4	5	5	5	4	4	4	4	4	4
Gross inland consumption	62	61	63	70	71	71	72	74	74	74
Final consumption	48	48	49	54	54	54	56	57	58	58
Industry	*27*	*18*	*19*	*23*	*22*	*23*	*23*	*24*	*24*	*24*
Agriculture and forestry/Fishing	*3*	*2*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Commercial and public services	*4*	*9*	*12*	*13*	*15*	*15*	*15*	*16*	*16*	*16*
Households	*10*	*15*	*14*	*15*	*15*	*14*	*15*	*15*	*15*	*15*
Transport	*3*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Not elsewhere specified	*2*	*2*	*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Germany										
Net import	1	5	3	-5	-15	-48	-51	-52	-49	-33
Gross electricity production	550	537	577	623	633	648	650	654	643	609
Energy own consumption	41	38	38	40	39	38	36	35	34	30
Electricity for pumped storage	5	6	6	10	9	8	7	8	8	8
Distribution losses	24	25	34	29	24	26	26	27	27	27
Gross inland consumption	551	542	580	619	618	600	600	601	594	576
Final consumption	455	451	483	522	532	515	518	519	513	500
Industry	216	205	212	231	229	229	231	232	231	223
Agriculture and forestry/Fishing	0	0	0	0	6	6	5	5	5	5
Commercial and public services	88	103	125	137	144	141	142	141	137	133
Households	137	127	130	141	142	129	128	128	128	127
Transport	14	16	16	13	12	11	12	12	12	12
Not elsewhere specified	0	0	0	0	0	0	0	0	0	0

Table A2.34 – *following*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Spain										
Net import	0	4	4	-1	-8	0	8	9	11	7
Gross electricity production	152	167	224	294	302	281	275	276	274	273
Energy own consumption	7	8	10	12	11	11	10	11	11	9
Electricity for pumped storage	1	2	5	6	4	5	5	4	3	3
Distribution losses	14	16	19	26	27	27	27	24	26	25
Gross inland consumption	152	172	229	293	293	281	282	285	286	280
Final consumption	126	141	188	242	245	232	233	239	238	235
Industry	*63*	*61*	*86*	*105*	*73*	*76*	*78*	*81*	*79*	*76*
Agriculture and forestry/Fishing	*4*	*5*	*5*	*5*	*4*	*6*	*6*	*6*	*5*	*5*
Commercial and public services	*25*	*30*	*50*	*64*	*84*	*74*	*73*	*75*	*75*	*75*
Households	*30*	*36*	*44*	*63*	*76*	*70*	*70*	*71*	*75*	*73*
Transport	*4*	*4*	*4*	*5*	*3*	*4*	*4*	*4*	*4*	*4*
Not elsewhere specified	*0*	*6*	*0*	*0*	*4*	*2*	*2*	*2*	*1*	*2*
France										
Net import	-45	-70	-69	-60	-31	-64	-42	-40	-63	-58
Gross electricity production	421	494	540	576	569	580	564	562	582	571
Energy own consumption	20	22	24	26	25	24	24	24	24	24
Electricity for pumped storage	5	4	7	7	7	7	7	7	7	6
Distribution losses	28	30	30	32	35	36	37	39	39	38
Gross inland consumption	375	424	470	516	539	516	523	522	519	513
Final consumption	302	343	385	423	444	435	443	439	437	432
Industry	*115*	*124*	*135*	*140*	*117*	*116*	*118*	*117*	*117*	*116*
Agriculture and forestry/Fishing	*2*	*3*	*3*	*7*	*8*	*9*	*9*	*9*	*9*	*8*
Commercial and public services	*81*	*95*	*106*	*125*	*145*	*141*	*142*	*141*	*140*	*137*
Households	*97*	*109*	*129*	*138*	*162*	*157*	*163*	*161*	*160*	*160*
Transport	*7*	*8*	*9*	*10*	*10*	*11*	*11*	*11*	*10*	*10*
Not elsewhere specified	*0*	*5*	*3*	*2*	*3*	*1*	*1*	*1*	*1*	*1*
Italy										
Net import	35	37	44	49	44	46	37	38	44	38
Gross electricity production	217	241	277	304	302	283	290	296	290	294
Energy own consumption	12	12	13	13	11	11	10	11	10	10
Electricity for pumped storage	5	6	9	9	4	2	2	2	2	2
Distribution losses	16	18	19	21	21	20	19	19	18	18
Gross inland consumption	251	279	321	353	346	329	327	334	334	332
Final consumption	215	238	273	301	299	287	286	292	293	292
Industry	*111*	*120*	*142*	*145*	*128*	*113*	*113*	*116*	*116*	*120*
Agriculture and forestry/Fishing	*4*	*4*	*5*	*5*	*6*	*6*	*6*	*6*	*6*	*6*
Commercial and public services	*40*	*50*	*57*	*74*	*86*	*92*	*92*	*93*	*94*	*89*
Households	*53*	*57*	*61*	*67*	*70*	*66*	*64*	*65*	*65*	*66*
Transport	*7*	*8*	*9*	*10*	*11*	*11*	*11*	*11*	*12*	*12*
Not elsewhere specified	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Netherlands										
Net import	9	11	19	18	3	9	5	4	8	1
Gross electricity production	72	81	90	100	119	110	115	117	114	121
Energy own consumption	3	3	4	4	4	4	4	4	3	3
Electricity for pumped storage	0	0	0	0	0	0	0	0	0	0
Distribution losses	4	4	5	5	6	5	5	5	5	5
Gross inland consumption	81	93	109	118	122	119	120	121	122	122
Final consumption	71	80	95	104	108	104	105	107	109	110
Industry	*33*	*36*	*40*	*42*	*39*	*34*	*36*	*36*	*36*	*36*
Agriculture and forestry/Fishing	*3*	*4*	*4*	*6*	*7*	*9*	*9*	*10*	*11*	*11*
Commercial and public services	*19*	*21*	*29*	*34*	*37*	*36*	*36*	*37*	*37*	*37*
Households	*16*	*18*	*20*	*22*	*23*	*23*	*23*	*23*	*23*	*23*
Transport	*1*	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Not elsewhere specified	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Table A2.34 – *following*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
Poland										
Net import	-1	-3	-6	-11	-1	0	2	2	6	11
Gross electricity production	136	139	145	157	158	165	167	170	170	164
Energy own consumption	13	12	13	13	14	14	15	16	15	13
Electricity for pumped storage	3	3	3	2	1	1	1	1	1	1
Distribution losses	11	18	14	15	12	11	9	10	9	9
Gross inland consumption	135	136	139	146	156	165	169	173	176	175
Final consumption	96	90	98	105	119	128	133	136	140	140
Industry	*43*	*44*	*40*	*41*	*41*	*49*	*51*	*55*	*56*	*57*
Agriculture and forestry/Fishing	*9*	*6*	*5*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Commercial and public services	*19*	*17*	*28*	*33*	*44*	*45*	*48*	*47*	*49*	*49*
Households	*20*	*18*	*21*	*25*	*29*	*28*	*29*	*29*	*29*	*29*
Transport	*5*	*5*	*5*	*4*	*3*	*3*	*3*	*3*	*3*	*3*
Not elsewhere specified	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sweden										
Net import	-2	-2	5	-7	2	-23	-12	-19	-17	-26
Gross electricity production	147	148	145	158	149	162	156	164	163	168
Energy own consumption	4	4	4	4	3	3	3	4	4	3
Electricity for pumped storage	1	0	0	0	0	0	0	0	0	0
Distribution losses	9	10	11	12	11	7	9	9	11	11
Gross inland consumption	145	147	150	151	151	140	144	145	146	142
Final consumption	120	125	129	131	131	125	127	127	128	125
Industry	*54*	*52*	*57*	*58*	*54*	*50*	*50*	*51*	*51*	*49*
Agriculture and forestry/Fishing	*1*	*1*	*1*	*2*	*1*	*1*	*1*	*1*	*1*	*1*
Commercial and public services	*24*	*26*	*25*	*26*	*27*	*28*	*29*	*28*	*28*	*27*
Households	*38*	*42*	*42*	*43*	*46*	*43*	*45*	*45*	*45*	*44*
Transport	*2*	*3*	*3*	*3*	*2*	*3*	*3*	*2*	*3*	*3*
Not elsewhere specified	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
United Kingdom										
Net import	12	16	14	8	3	21	18	15	19	21
Gross electricity production	320	334	377	398	382	338	339	338	333	323
Energy own consumption	20	17	16	18	16	11	15	15	15	13
Electricity for pumped storage	3	2	3	4	4	4	4	4	3	2
Distribution losses	25	27	31	28	27	29	26	27	26	27
Gross inland consumption	332	350	391	407	385	359	357	353	352	345
Final consumption	274	295	329	349	329	304	304	300	301	295
Industry	*101*	*101*	*114*	*116*	*105*	*93*	*93*	*92*	*94*	*92*
Agriculture and forestry/Fishing	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Commercial and public services	*71*	*80*	*90*	*99*	*97*	*94*	*94*	*93*	*92*	*90*
Households	*94*	*102*	*112*	*126*	*119*	*108*	*108*	*105*	*105*	*104*
Transport	*5*	*8*	*9*	*4*	*4*	*5*	*5*	*5*	*5*	*5*
Not elsewhere specified	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Other countries										
Net import	38	20	19	37	26	86	64	67	83	76
Gross electricity production	519	540	587	633	668	594	628	635	621	621
Energy own consumption	39	38	35	36	38	33	35	36	32	31
Electricity for pumped storage	6	6	8	10	13	14	13	15	13	12
Distribution losses	42	48	48	47	46	45	44	41	45	41
Gross inland consumption	557	560	606	671	694	680	692	702	704	697
Final consumption	453	447	497	552	578	570	581	590	594	594
Industry	*231*	*201*	*216*	*232*	*221*	*223*	*226*	*232*	*236*	*234*
Agriculture and forestry/Fishing	*20*	*13*	*12*	*12*	*13*	*13*	*13*	*13*	*13*	*14*
Commercial and public services	*74*	*89*	*113*	*134*	*163*	*161*	*163*	*165*	*167*	*166*
Households	*114*	*132*	*145*	*162*	*169*	*162*	*168*	*168*	*167*	*169*
Transport	*13*	*12*	*12*	*12*	*11*	*11*	*11*	*11*	*11*	*11*
Not elsewhere specified	*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Table A2.35 – *Total electricity production per capita (MWh/inhabitant).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**5.42**	**5.65**	**6.17**	**6.63**	**6.62**	**6.31**	**6.33**	**6.38**	**6.33**	**6.24**
EU27	**5.40**	**5.64**	**6.14**	**6.64**	**6.70**	**6.48**	**6.51**	**6.57**	**6.53**	**6.45**
Austria	6.45	6.95	7.48	7.86	8.13	7.20	7.50	7.69	7.37	8.00
Belgium	7.07	7.26	8.08	8.18	8.70	6.07	7.44	7.50	6.46	8.07
Bulgaria	4.78	4.94	4.96	5.71	6.19	6.76	6.23	6.32	6.60	6.26
Cyprus	3.45	3.87	4.88	5.97	6.50	5.35	5.76	5.85	5.86	5.87
Czechia	**5.95**	**5.81**	**6.88**	**7.77**	**7.88**	**7.58**	**7.52**	**7.87**	**7.96**	**7.85**
Germany	**6.92**	**6.53**	**6.97**	**7.44**	**7.64**	**7.89**	**7.82**	**7.83**	**7.67**	**7.25**
Denmark	5.06	7.04	6.76	6.70	7.02	5.11	5.35	5.40	5.25	5.09
Estonia	10.94	6.00	6.08	7.51	9.72	7.72	9.25	10.00	9.37	5.75
Greece	4.00	4.57	5.58	6.05	5.54	5.12	5.40	5.49	5.31	4.88
Spain	**3.89**	**4.18**	**5.46**	**6.57**	**6.41**	**5.97**	**5.84**	**5.87**	**5.83**	**5.77**
Finland	10.93	12.56	13.49	13.43	15.02	12.49	12.48	12.20	12.69	12.39
France	**7.18**	**8.28**	**8.84**	**9.10**	**8.73**	**8.64**	**8.38**	**8.32**	**8.59**	**8.42**
Croatia	1.86	1.99	2.50	3.03	3.44	2.66	3.01	2.84	3.30	3.10
Hungary	2.74	3.29	3.44	3.54	3.73	3.07	3.24	3.35	3.26	3.48
Ireland	4.06	4.89	6.27	6.23	6.19	6.01	6.39	6.41	6.40	6.26
Italy	**3.76**	**4.17**	**4.73**	**5.11**	**5.03**	**4.62**	**4.73**	**4.84**	**4.75**	**4.87**
Lithuania	7.68	3.70	3.14	4.24	1.51	1.37	1.18	1.18	0.98	1.13
Luxembourg	1.65	1.20	0.97	7.25	6.44	2.37	1.36	1.52	1.59	1.74
Latvia	2.49	1.59	1.74	2.18	3.13	2.79	3.26	3.86	3.48	3.35
Malta	3.12	4.34	4.93	5.56	5.11	2.97	1.90	3.59	4.12	4.21
Netherlands	**4.82**	**5.24**	**5.63**	**6.11**	**7.19**	**6.43**	**6.70**	**6.77**	**6.61**	**6.97**
Poland	**3.53**	**3.55**	**3.74**	**4.06**	**4.13**	**4.32**	**4.37**	**4.48**	**4.46**	**4.29**
Portugal	2.84	3.31	4.21	4.37	5.05	4.91	5.69	5.57	5.65	5.01
Romania	2.77	2.60	2.30	2.78	2.99	3.32	3.27	3.25	3.30	3.05
Sweden	**17.12**	**16.82**	**16.39**	**17.57**	**15.89**	**16.62**	**15.82**	**16.43**	**16.14**	**16.46**
Slovenia	6.23	6.49	6.85	7.57	7.94	7.18	7.86	7.77	7.81	7.64
Slovakia	4.82	4.93	5.70	5.83	5.09	4.89	4.92	5.02	4.88	5.17
United Kingdom	**5.56**	**5.74**	**6.37**	**6.57**	**6.06**	**5.17**	**5.14**	**5.09**	**4.99**	**4.83**

Table A2.36 – *Renewable electricity production per capita (MWh/inhabitant).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.65**	**0.75**	**0.86**	**0.93**	**1.35**	**1.85**	**1.87**	**1.91**	**2.05**	**2.14**
EU27	**0.72**	**0.84**	**0.95**	**1.02**	**1.48**	**1.93**	**1.96**	**1.97**	**2.11**	**2.19**
Austria	4.27	4.90	5.43	4.99	5.39	5.54	5.87	5.82	5.67	6.14
Belgium	0.06	0.07	0.10	0.20	0.61	1.29	1.27	1.40	1.50	1.70
Bulgaria	0.19	0.26	0.32	0.56	0.78	1.22	0.98	0.86	1.33	1.07
Cyprus	0.00	0.00	0.00	0.00	0.09	0.47	0.50	0.51	0.55	0.59
Czechia	**0.11**	**0.23**	**0.22**	**0.31**	**0.56**	**0.89**	**0.89**	**0.91**	**0.89**	**0.94**
Germany	**0.24**	**0.32**	**0.43**	**0.77**	**1.29**	**2.33**	**2.31**	**2.62**	**2.71**	**2.92**
Denmark	0.16	0.36	1.05	1.81	2.25	3.35	3.22	3.79	3.59	3.98
Estonia	0.00	0.01	0.01	0.08	0.78	1.19	1.21	1.41	1.51	1.62
Greece	0.17	0.34	0.38	0.58	0.95	1.37	1.38	1.28	1.50	1.50
Spain	**0.67**	**0.62**	**0.85**	**0.98**	**2.10**	**2.09**	**2.25**	**1.89**	**2.23**	**2.15**
Finland	3.22	3.83	4.52	4.48	4.52	5.58	5.54	5.72	5.83	5.78
France	**0.96**	**1.27**	**1.15**	**0.90**	**1.21**	**1.38**	**1.49**	**1.39**	**1.69**	**1.68**
Croatia	0.82	1.22	1.43	1.64	2.16	1.78	2.00	1.71	2.38	2.05
Hungary	0.02	0.02	0.02	0.19	0.30	0.33	0.33	0.36	0.39	0.48
Ireland	0.20	0.20	0.31	0.46	0.82	1.68	1.59	1.86	2.11	2.40
Italy	**0.62**	**0.73**	**0.89**	**0.84**	**1.30**	**1.79**	**1.78**	**1.71**	**1.89**	**1.94**
Lithuania	0.11	0.10	0.10	0.14	0.29	0.57	0.73	0.89	0.78	0.88
Luxembourg	0.22	0.26	0.39	0.45	0.53	0.77	0.79	1.02	1.14	1.30
Latvia	1.69	1.17	1.19	1.52	1.71	1.40	1.77	2.80	1.81	1.66
Malta	0.00	0.00	0.00	0.00	0.00	0.23	0.30	0.37	0.42	0.44
Netherlands	**0.05**	**0.09**	**0.19**	**0.46**	**0.68**	**0.81**	**0.87**	**1.02**	**1.10**	**1.32**
Poland	**0.04**	**0.05**	**0.06**	**0.10**	**0.29**	**0.60**	**0.60**	**0.64**	**0.57**	**0.67**
Portugal	1.85	1.69	2.32	1.32	4.94	4.27	5.83	3.99	5.28	4.88
Romania	0.49	0.73	0.66	0.95	1.00	1.32	1.36	1.24	1.34	1.27
Sweden	**8.73**	**8.00**	**9.38**	**9.01**	**8.79**	**10.52**	**9.05**	**9.51**	**9.01**	**9.67**
Slovenia	1.48	1.63	1.96	1.79	2.32	2.11	2.45	2.15	2.53	2.42
Slovakia	0.36	0.91	0.85	0.87	1.10	1.11	1.22	1.20	1.07	1.22
United Kingdom	**0.10**	**0.12**	**0.17**	**0.28**	**0.42**	**1.27**	**1.27**	**1.50**	**1.66**	**1.81**

Table A2.37 – *Electricity consumption per capita (MWh/inhabitant).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**4.55**	**4.68**	**5.19**	**5.63**	**5.64**	**5.42**	**5.46**	**5.49**	**5.48**	**5.42**
EU27	**4.51**	**4.63**	**5.13**	**5.60**	**5.70**	**5.52**	**5.58**	**5.63**	**5.63**	**5.57**
Austria	5.59	5.88	6.44	7.01	7.18	7.12	7.14	7.19	7.19	7.17
Belgium	5.83	6.76	7.57	7.68	7.81	7.26	7.27	7.25	7.28	7.16
Bulgaria	4.02	3.40	2.96	3.34	3.65	3.93	4.04	4.21	4.24	4.30
Cyprus	3.13	3.44	4.34	5.40	5.96	4.83	5.19	5.31	5.40	5.39
Czechia	**4.65**	**4.65**	**4.80**	**5.26**	**5.18**	**5.17**	**5.29**	**5.43**	**5.48**	**5.49**
Germany	**5.75**	**5.53**	**5.88**	**6.33**	**6.50**	**6.34**	**6.30**	**6.29**	**6.19**	**6.02**
Denmark	5.52	5.92	6.09	6.18	5.79	5.44	5.41	5.40	5.34	5.37
Estonia	4.33	3.15	3.58	4.44	5.18	5.21	5.55	5.50	5.68	5.52
Greece	2.81	3.24	4.00	4.64	4.78	4.68	4.95	5.01	4.61	4.68
Spain	**3.24**	**3.55**	**4.66**	**5.59**	**5.27**	**5.00**	**5.01**	**5.14**	**5.11**	**5.00**
Finland	11.85	12.79	14.64	15.42	15.60	14.35	14.75	14.73	15.01	14.80
France	**5.20**	**5.78**	**6.36**	**6.73**	**6.87**	**6.55**	**6.64**	**6.58**	**6.52**	**6.43**
Croatia	2.79	2.13	2.63	3.34	3.69	3.63	3.65	3.85	3.94	3.96
Hungary	3.05	2.68	2.88	3.20	3.42	3.68	3.78	3.93	4.03	4.13
Ireland	3.38	4.13	5.37	5.92	5.58	5.51	5.58	5.57	5.77	5.80
Italy	**3.79**	**4.19**	**4.80**	**5.20**	**5.06**	**4.73**	**4.71**	**4.82**	**4.85**	**4.88**
Lithuania	3.25	1.74	1.76	2.38	2.65	3.20	3.38	3.53	3.70	3.77
Luxembourg	10.94	12.32	13.32	13.34	13.13	11.06	11.05	10.83	10.73	10.42
Latvia	3.12	1.79	1.88	2.55	2.93	3.25	3.29	3.33	3.44	3.46
Malta	2.58	3.34	4.03	4.61	4.41	4.81	4.70	5.03	5.02	5.05
Netherlands	**4.80**	**5.22**	**5.99**	**6.40**	**6.50**	**6.16**	**6.21**	**6.24**	**6.33**	**6.34**
Poland	**2.53**	**2.32**	**2.56**	**2.75**	**3.12**	**3.36**	**3.50**	**3.58**	**3.70**	**3.70**
Portugal	2.36	2.88	3.74	4.41	4.72	4.42	4.49	4.52	4.66	4.66
Romania	2.34	1.60	1.51	1.82	2.04	2.17	2.19	2.28	2.33	2.35
Sweden	**14.11**	**14.13**	**14.53**	**14.50**	**14.05**	**12.81**	**12.94**	**12.73**	**12.60**	**12.18**
Slovenia	4.63	4.70	5.29	6.38	5.84	6.20	6.31	6.55	6.63	6.57
Slovakia	4.43	4.06	4.08	4.25	4.48	4.50	4.60	4.75	4.76	4.62
United Kingdom	**4.80**	**5.09**	**5.60**	**5.79**	**5.26**	**4.68**	**4.65**	**4.55**	**4.54**	**4.43**

Table A2.38 – *GHG emissions per capita from electricity and heat production (t CO_2eq/inhabitant).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**3.11**	**2.85**	**2.80**	**2.96**	**2.66**	**2.29**	**2.20**	**2.17**	**2.05**	**1.80**
EU27	**3.00**	**2.80**	**2.75**	**2.91**	**2.63**	**2.35**	**2.30**	**2.30**	**2.17**	**1.91**
Austria	1.81	1.78	1.61	2.19	2.06	1.56	1.47	1.61	1.47	1.51
Belgium	2.64	2.79	2.54	2.44	2.19	1.61	1.49	1.48	1.49	1.52
Bulgaria	4.07	3.64	2.84	3.39	3.93	3.87	3.43	3.64	3.26	3.08
Cyprus	2.96	3.26	4.19	4.82	4.71	3.56	3.86	3.83	3.84	3.72
Czechia	**6.16**	**6.21**	**6.23**	**6.33**	**6.03**	**5.12**	**5.21**	**5.05**	**4.99**	**4.60**
Germany	**4.97**	**4.30**	**4.06**	**4.14**	**4.01**	**3.93**	**3.88**	**3.62**	**3.42**	**2.84**
Denmark	4.54	5.85	4.73	3.98	4.08	1.90	2.15	1.81	1.80	1.35
Estonia	13.60	7.66	7.45	8.18	9.68	8.30	8.85	9.51	9.06	4.66
Greece	3.48	3.50	4.15	4.33	3.75	2.83	2.50	2.83	2.74	2.25
Spain	**1.71**	**1.96**	**2.43**	**2.72**	**1.54**	**1.82**	**1.51**	**1.78**	**1.58**	**1.21**
Finland	3.57	4.49	4.32	4.43	5.92	3.17	3.34	3.18	3.36	2.87
France	**0.80**	**0.65**	**0.80**	**0.94**	**0.77**	**0.56**	**0.60**	**0.67**	**0.55**	**0.54**
Croatia	0.88	0.70	0.89	1.13	0.93	0.76	0.84	0.76	0.66	0.74
Hungary	1.86	1.97	2.08	1.68	1.53	1.06	1.10	1.09	1.03	1.00
Ireland	3.08	3.64	4.12	3.74	2.93	2.54	2.69	2.47	2.16	1.88
Italy	**2.18**	**2.30**	**2.41**	**2.77**	**2.32**	**1.82**	**1.82**	**1.83**	**1.70**	**1.64**
Lithuania	1.92	0.74	0.66	0.91	0.99	0.53	0.43	0.35	0.33	0.31
Luxembourg	4.57	2.24	0.54	2.93	2.57	0.89	0.50	0.49	0.49	0.54
Latvia	0.86	0.70	0.58	0.59	0.86	0.95	1.01	0.66	0.90	0.88
Malta	5.01	4.24	4.14	4.92	4.51	1.94	1.24	1.54	1.48	1.52
Netherlands	**3.03**	**3.41**	**3.38**	**3.54**	**3.69**	**3.64**	**3.57**	**3.38**	**3.12**	**2.92**
Poland	**4.77**	**3.90**	**3.84**	**4.05**	**3.94**	**3.77**	**3.74**	**3.78**	**3.74**	**3.43**
Portugal	1.54	1.98	2.17	2.44	1.50	1.91	1.84	2.21	1.89	1.41
Romania	3.16	2.50	1.67	1.69	1.54	1.39	1.29	1.34	1.30	1.21
Sweden	**0.62**	**1.04**	**0.96**	**1.23**	**1.48**	**0.98**	**1.08**	**1.09**	**1.12**	**1.05**
Slovenia	3.06	2.88	2.68	3.08	3.01	2.21	2.38	2.38	2.33	2.21
Slovakia	2.39	2.18	1.71	1.72	1.51	1.21	1.18	1.23	1.13	1.03
United Kingdom	**3.87**	**3.24**	**3.12**	**3.33**	**2.84**	**1.93**	**1.53**	**1.34**	**1.24**	**1.12**

ANNEX 3

Table A3.1 – *Fuel energy content for heat generation in heat only producer plants (ktoe).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**25,704**	**20,795**	**19,276**	**19,759**	**21,807**	**19,163**	**19,961**	**20,110**	**19,221**	**18,705**
EU27	**25,704**	**20,795**	**16,075**	**17,577**	**19,493**	**16,783**	**17,503**	**17,772**	**16,889**	**16,380**
Austria	335	423	547	602	870	952	983	1,032	952	877
Belgium	9	6	39	20	9	8	3	3	3	3
Bulgaria	2,803	1,419	324	368	304	225	235	255	231	180
Cyprus	-	-	-	-	-	-	-	-	-	-
Czechia	**1,186**	**1,379**	**956**	**898**	**940**	**652**	**713**	**721**	**706**	**715**
Germany	**-**	**1,985**	**1,198**	**3,747**	**4,324**	**3,576**	**3,535**	**3,533**	**2,867**	**2,788**
Denmark	832	626	416	476	763	958	989	908	954	857
Estonia	1,552	501	451	488	446	289	389	418	355	274
Greece	-	-	-	-	-	-	-	-	-	-
Spain	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Finland	662	567	1,070	1,268	1,585	1,406	1,681	1,479	1,567	1,628
France	**510**	**199**	**156**	**308**	**1,670**	**1,740**	**1,909**	**1,933**	**1,923**	**1,925**
Croatia	78	72	84	104	98	68	67	52	50	47
Hungary	1,158	785	471	624	467	783	741	767	717	661
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	**-**	**-**	**-**	**-**	**110**	**128**	**137**	**386**	**423**	**413**
Lithuania	1,818	1,074	652	518	498	557	572	608	591	549
Luxembourg	-	-	1	3	4	6	8	11	11	12
Latvia	2,560	891	570	476	356	203	228	448	426	425
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	**274**	**958**	**1,343**	**1,331**	**603**	**552**	**521**	**447**	**315**	**443**
Poland	**10,560**	**5,997**	**4,167**	**3,450**	**3,722**	**2,670**	**2,853**	**2,794**	**2,762**	**2,661**
Portugal	-	-	-	-	-	-	-	-	-	-
Romania	-	1,834	1,740	826	688	477	373	470	551	476
Sweden	**1,039**	**1,169**	**1,136**	**1,268**	**1,483**	**1,166**	**1,212**	**1,167**	**1,178**	**1,137**
Slovenia	65	76	80	89	57	44	41	51	47	50
Slovakia	265	835	675	715	496	325	312	287	262	260
United Kingdom	**-**	**-**	**3,201**	**2,181**	**2,314**	**2,380**	**2,459**	**2,338**	**2,332**	**2,325**

Table A3.2 – *Heat generation in heat only producer plants (TWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**227.2**	**200.0**	**185.0**	**183.4**	**203.4**	**179.3**	**189.4**	**193.1**	**187.7**	**181.6**
EU27	**227.2**	**200.0**	**156.7**	**167.5**	**187.6**	**161.9**	**171.4**	**174.7**	**169.3**	**163.6**
Austria	3.1	4.4	5.1	5.4	8.0	9.3	9.4	9.9	9.4	8.7
Belgium	0.1	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Bulgaria	28.4	15.3	3.6	3.6	3.3	2.4	2.4	2.7	2.5	1.9
Cyprus	-	-	-	-	-	-	-	-	-	-
Czechia	**10.3**	**13.5**	**9.7**	**8.7**	**9.9**	**6.7**	**7.3**	**7.4**	**7.3**	**7.4**
Germany	**-**	**22.2**	**12.4**	**34.1**	**38.8**	**31.0**	**31.3**	**31.3**	**27.8**	**26.2**
Denmark	8.7	6.7	4.2	5.1	8.4	10.8	11.1	10.3	10.8	9.8
Estonia	15.1	5.1	4.4	4.8	4.2	2.7	3.4	3.7	3.1	2.4
Greece	-	-	-	-	-	-	-	-	-	-
Spain	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Finland	6.9	6.5	10.7	12.9	16.3	14.4	17.1	14.8	15.8	16.2
France	**2.8**	**0.9**	**0.9**	**1.7**	**16.6**	**16.9**	**18.4**	**18.8**	**18.6**	**18.6**
Croatia	0.7	0.7	0.8	1.0	0.9	0.6	0.6	0.5	0.5	0.5
Hungary	9.5	7.0	5.0	6.1	4.2	8.3	7.9	8.2	7.5	6.9
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	**-**	**-**	**-**	**-**	**0.8**	**1.0**	**1.1**	**3.8**	**4.1**	**4.0**
Lithuania	16.6	10.4	6.3	4.9	4.8	5.2	5.8	6.1	5.9	5.5
Luxembourg	-	-	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Latvia	21.0	8.4	5.5	4.6	3.3	1.8	2.0	4.5	4.2	4.2
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	**2.8**	**8.7**	**12.3**	**13.0**	**6.0**	**4.6**	**4.7**	**4.3**	**3.2**	**4.7**
Poland	**87.6**	**54.5**	**40.0**	**32.3**	**36.1**	**26.3**	**28.7**	**28.4**	**28.0**	**26.8**
Portugal	-	-	-	-	-	-	-	-	-	-
Romania	-	17.4	17.3	7.7	5.7	3.7	3.8	4.7	5.6	4.8
Sweden	**10.6**	**12.2**	**11.6**	**13.2**	**14.7**	**12.4**	**12.5**	**12.0**	**11.9**	**11.8**
Slovenia	0.6	0.8	0.8	0.8	0.6	0.4	0.4	0.5	0.4	0.5
Slovakia	2.3	5.3	5.8	7.3	5.0	3.3	3.2	2.8	2.5	2.6
United Kingdom	**-**	**-**	**28.4**	**15.9**	**15.8**	**17.4**	**18.0**	**18.3**	**18.3**	**18.0**

Table A3.3 – *GHG emissions for heat generation in heat only producer plants (Mt CO_2eq.).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**87.1**	**64.1**	**55.1**	**53.0**	**59.0**	**46.9**	**48.3**	**48.1**	**45.3**	**43.6**
EU27	**87.1**	**64.1**	**46.0**	**47.2**	**52.8**	**41.4**	**42.5**	**42.7**	**39.9**	**38.2**
Austria	0.9	1.0	1.2	1.2	1.5	1.6	1.7	1.7	1.6	1.4
Belgium	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Bulgaria	8.6	4.0	0.8	0.9	0.8	0.5	0.5	0.6	0.6	0.4
Cyprus	-	-	-	-	-	-	-	-	-	-
Czechia	**3.9**	**4.4**	**2.8**	**2.5**	**2.4**	**1.6**	**1.8**	**1.8**	**1.7**	**1.7**
Germany	**-**	**4.8**	**2.8**	**9.6**	**12.2**	**9.8**	**9.5**	**9.5**	**7.6**	**7.4**
Denmark	2.3	1.5	0.9	0.9	1.4	1.7	1.8	1.6	1.6	1.4
Estonia	4.8	1.4	1.1	1.1	1.0	0.6	0.7	0.8	0.7	0.5
Greece	-	-	-	-	-	-	-	-	-	-
Spain	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Finland	2.1	1.7	2.9	3.4	4.2	3.4	4.1	3.3	3.5	3.6
France	**2.0**	**0.8**	**0.6**	**0.5**	**4.3**	**3.7**	**3.9**	**3.7**	**3.5**	**3.3**
Croatia	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.1	0.1	0.1
Hungary	3.7	2.3	1.1	1.9	1.5	2.1	1.8	2.1	1.9	1.7
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	**-**	**-**	**-**	**-**	**0.1**	**0.1**	**0.1**	**0.7**	**0.8**	**0.8**
Lithuania	5.0	3.0	1.7	1.1	1.0	0.9	0.9	0.9	0.9	0.8
Luxembourg	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Latvia	7.6	2.4	1.3	1.0	0.7	0.3	0.4	0.8	0.8	0.7
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	**0.6**	**2.3**	**3.3**	**3.3**	**1.6**	**1.3**	**1.2**	**1.0**	**0.7**	**1.0**
Poland	**41.2**	**23.7**	**16.1**	**13.1**	**14.2**	**10.2**	**10.8**	**10.6**	**10.4**	**10.0**
Portugal	-	-	-	-	-	-	-	-	-	-
Romania	-	5.1	4.4	2.0	1.7	1.1	0.9	1.1	1.3	1.1
Sweden	**3.4**	**2.8**	**2.4**	**2.4**	**2.5**	**1.5**	**1.7**	**1.6**	**1.5**	**1.4**
Slovenia	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Slovakia	0.7	2.7	2.0	1.7	1.1	0.7	0.7	0.6	0.5	0.5
United Kingdom	**-**	**-**	**9.2**	**5.8**	**6.2**	**5.5**	**5.7**	**5.5**	**5.4**	**5.4**

Table A3.4 – *GHG emission factors for heat generation in heat only producer plants (g CO_2eq / kWh).*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**383.4**	**320.5**	**297.8**	**289.2**	**290.0**	**261.7**	**254.8**	**249.3**	**241.3**	**239.8**
EU27	**383.4**	**320.5**	**293.3**	**281.8**	**281.3**	**255.7**	**248.3**	**244.2**	**235.5**	**233.3**
Austria	281.2	227.6	226.8	228.2	187.2	175.7	177.8	176.6	166.8	161.4
Belgium	387.2	279.7	257.9	939.2	493.4	636.9	8.0	29.5	28.1	22.0
Bulgaria	302.2	263.8	224.3	247.7	231.3	223.5	225.0	223.7	220.3	223.2
Cyprus										
Czechia	**374.5**	**324.1**	**290.8**	**285.5**	**246.5**	**243.8**	**242.1**	**241.1**	**239.1**	**234.1**
Germany		**214.2**	**229.6**	**280.1**	**315.4**	**314.2**	**302.3**	**303.7**	**273.7**	**283.7**
Denmark	261.2	225.2	220.6	173.5	168.4	159.6	158.1	150.3	148.1	139.2
Estonia	314.0	266.0	252.4	236.3	247.9	227.5	206.0	209.1	225.0	224.0
Greece										
Spain										
Finland	297.5	264.0	270.0	260.5	260.8	234.5	238.7	222.6	222.1	223.2
France	**719.3**	**823.8**	**713.8**	**314.3**	**260.6**	**216.2**	**209.2**	**196.3**	**186.6**	**179.3**
Croatia	294.7	280.0	307.8	293.1	294.8	262.8	255.0	260.8	253.4	248.1
Hungary	383.0	322.9	223.7	310.1	360.9	254.3	223.9	251.8	255.7	244.9
Ireland										
Italy					**131.5**	**110.8**	**110.6**	**189.7**	**190.1**	**188.6**
Lithuania	303.1	285.6	269.3	226.2	202.8	163.7	150.5	152.4	156.3	148.0
Luxembourg			292.7	222.6	198.3	166.3	186.2	208.3	201.2	207.5
Latvia	362.8	287.3	238.3	221.6	211.6	186.0	178.3	188.0	189.3	176.7
Malta										
Netherlands	**227.0**	**265.3**	**269.5**	**256.0**	**269.8**	**283.3**	**259.3**	**241.2**	**221.0**	**206.8**
Poland	**470.7**	**433.7**	**402.2**	**404.9**	**393.3**	**386.0**	**377.8**	**372.2**	**371.3**	**372.8**
Portugal										
Romania		293.2	252.3	262.6	298.3	312.0	242.5	235.0	234.5	236.8
Sweden	**317.0**	**225.3**	**202.8**	**179.4**	**170.3**	**120.2**	**134.0**	**131.7**	**126.0**	**122.0**
Slovenia	296.4	244.6	223.6	248.2	214.3	232.4	208.0	214.7	226.4	209.4
Slovakia	326.1	517.2	350.7	231.7	218.7	209.0	207.4	216.7	213.1	207.0
United Kingdom			**322.7**	**367.5**	**392.7**	**318.0**	**317.3**	**297.7**	**294.9**	**298.8**

Table A3.5 – *Efficiency of heat only producer plants.*

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
EU28	**0.760**	**0.827**	**0.825**	**0.798**	**0.802**	**0.805**	**0.816**	**0.825**	**0.839**	**0.835**
EU27	**0.760**	**0.827**	**0.838**	**0.819**	**0.827**	**0.830**	**0.842**	**0.845**	**0.862**	**0.859**
Austria	0.787	0.887	0.804	0.777	0.795	0.841	0.822	0.824	0.850	0.855
Belgium	0.782	0.718	0.831	0.292	0.383	0.320	0.504	0.521	0.520	0.514
Bulgaria	0.871	0.925	0.948	0.849	0.929	0.907	0.872	0.916	0.933	0.927
Cyprus										
Czechia	**0.747**	**0.839**	**0.868**	**0.837**	**0.904**	**0.879**	**0.884**	**0.878**	**0.884**	**0.895**
Germany		**0.962**	**0.889**	**0.783**	**0.771**	**0.746**	**0.762**	**0.762**	**0.834**	**0.807**
Denmark	0.903	0.916	0.862	0.913	0.949	0.966	0.965	0.977	0.977	0.983
Estonia	0.838	0.878	0.846	0.844	0.807	0.797	0.749	0.761	0.758	0.747
Greece										
Spain										
Finland	0.897	0.991	0.864	0.878	0.883	0.881	0.873	0.858	0.866	0.853
France	**0.469**	**0.409**	**0.472**	**0.488**	**0.853**	**0.837**	**0.831**	**0.835**	**0.834**	**0.829**
Croatia	0.807	0.875	0.774	0.799	0.757	0.801	0.825	0.809	0.827	0.839
Hungary	0.709	0.769	0.906	0.839	0.779	0.912	0.916	0.918	0.904	0.902
Ireland										
Italy					**0.619**	**0.698**	**0.710**	**0.837**	**0.842**	**0.838**
Lithuania	0.784	0.832	0.825	0.820	0.836	0.806	0.877	0.859	0.856	0.859
Luxembourg			0.732	0.780	0.791	0.817	0.805	0.784	0.807	0.783
Latvia	0.705	0.813	0.831	0.826	0.795	0.763	0.763	0.860	0.839	0.858
Malta										
Netherlands	**0.890**	**0.778**	**0.790**	**0.840**	**0.855**	**0.712**	**0.769**	**0.825**	**0.878**	**0.917**
Poland	**0.714**	**0.782**	**0.825**	**0.806**	**0.834**	**0.848**	**0.865**	**0.875**	**0.873**	**0.867**
Portugal										
Romania		0.814	0.857	0.798	0.708	0.661	0.887	0.868	0.868	0.860
Sweden	**0.879**	**0.899**	**0.878**	**0.899**	**0.852**	**0.913**	**0.889**	**0.884**	**0.867**	**0.890**
Slovenia	0.815	0.853	0.885	0.802	0.884	0.869	0.910	0.880	0.797	0.844
Slovakia	0.744	0.547	0.737	0.876	0.871	0.879	0.875	0.828	0.830	0.857
United Kingdom			**0.762**	**0.626**	**0.587**	**0.628**	**0.629**	**0.674**	**0.675**	**0.666**

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