Final Report
Energy Taxes

Energy costs, taxes and the impact of government interventions on investments

Contract details

European Commission – DG Energy A.4.

Study on energy costs, taxes and the impact of government interventions on investments in the energy sector ENER/2018-A4/2018-471

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Energy Taxes Final Report

Study on energy costs, taxes and the impact of government interventions on investments in the energy sector

ENER/2018-A4/2018-471

In association with:

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And involving:

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vito

TRANSPORT & MOBILITY LEUVEN

WAGENINGEN UNIVERSITY & RESEARCH

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List of acronyms and country ISO codes

Acronyms

CIRCABC	Communication and Information Resource Centre for Administrations, Businesses and Citizens (European Commission)
DG TAXUD	Directorate-General for Taxation and Customs Union (European Commission)
EC	European Commission
EE	Energy efficiency
EII	Energy intensive industry
ETD	Energy Taxation Directive of the European Commission
EU	European Union
EU ETS	European Union Emissions Trading Scheme
EU27	The group of 27 countries comprising the EU, including: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.
EUR	Euro (€)
Eurostat	The statistical office of the European Union
FF	Fossil fuels
G20	The G20 (or Group of Twenty) is an international forum for the governments and central bank governors from Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Republic of Korea, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States and the EU.
GDP	Gross domestic product
ktoe	One thousand tonnes of oil equivalent
MS	Member State
MWh	Megawatt-hour
Odyssee	Database on energy efficiency indicators and energy consumption by end-use and their underlying drivers in industry, transport and buildings
RE	Recyclable
RES	Renewable energy sources
VAT	Value added tax

Country ISO codes

EU27	
BE	Belgium
BG	Bulgaria
CZ	Czechia
DK	Denmark
DE	Germany
EE	Estonia
IE	Ireland
EL	Greece
ES	Spain
FR	France
HR	Croatia
IT	Italy
CY	Cyprus
LV	Latvia
LT	Lithuania
LU	Luxembourg
HU	Hungary
MT	Malta
NL	Netherlands
AT	Austria
PL	Poland
PT	Portugal
RO	Romania
SI	Slovenia
SK	Slovakia
FI	Finland
SE	Sweden
G20	
AR	Argentina
AU	Australia
CA	Canada
ID	Indonesia
IN	India
JP	Japan
KR	South Korea
TR	Turkey
UK	United Kingdom
US	United States
ZA	South Africa

1 Taxes, levies and other fiscal measures (T7)

The aim of this task was to develop a detailed inventory and analysis of energy-related taxes, levies and other fiscal measures in European Union ('EU') Member States ('MS') and G20 countries. Tax data was collected from national sources (e.g., finance and energy ministries) and assembled into a database. Tax rates and revenues were analysed and benchmarked by sector and by product (fuel) across countries.

This report focuses on taxes on energy consumption in the EU27. Including:

- Excise taxes on fuels;
- Non-tax levies on fuel purchases, such as on natural gas and electricity bills, used to finance renewable energy (e.g., the Renewable Energy Sources Act ('EEG') in Germany), or energy efficiency (e.g., Italy's White Certificate scheme);
- All other taxes, levies and fiscal measures that end consumers pay when they consume energy.

Taxes on energy production and infrastructure in the EU27 and the United Kingdom[1] are also covered, although in less detail than taxes on energy consumption. Finally, taxes on energy in 11 G20 countries are reported and compared to tax rates and levels in the EU27.

Environmental charges such as carbon taxes (the EU Emissions Trading Scheme ('ETS')) are not considered taxes and are therefore covered under external costs. Value added taxes ('VAT') are not covered in this report[2].

Specific taxes included in the analysis are listed in the Annex.

In addition to this report, the main task output is an Excel tool presenting energy-related tax data, enabling visualisation per country, sector and fuel.

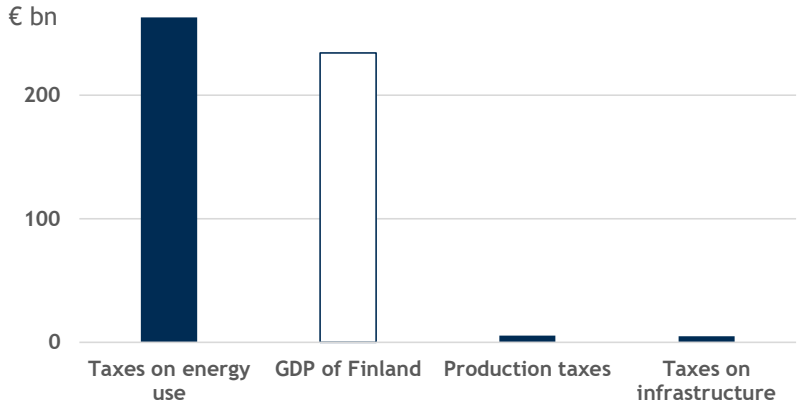
[1] The UK in considered a non-EU G20 country in this analysis.
[2] TAXUD provided the core team with VAT rates for EU MS, but they were not aware of any data or studies that show VAT taxes by sector or product. Our data collection generally showed that neither EU MS nor G20 countries are reporting VAT by sector or product. Estimating VAT taxes was also problematic. Our approach was to apply VAT rates from Eurostat to energy prices (from Enerdata) and then to energy volumes (from Eurostat) to estimate VAT revenues. But in the case of France, for example, we could not even determine which sectors are paying VAT because there is a non-transparent array of tax deductions and exemptions in place. For Italy, we found data on VAT on electricity use but no breakdown by sector is available and our attempt to recompose the total amount of VAT on electricity was not successful. We had a similar challenge with UK VAT data. Related challenges exist for most other countries. Therefore, we were unable to generate VAT tax revenue estimates for this report.

1.1 Key takeaways

All taxes analysed

- **Revenues from taxes on energy consumption in the EU27 totalled EUR 263 billion in 2018, more than the GDP of Finland, while taxes on energy production equalled 2% of taxes on consumption. Taxes on infrastructure also equalled 2% of taxes on consumption.**

Figure 1-1 Total revenues from taxes on energy use, production and infrastructure in the EU27 in 2018



Reported tax rates on energy consumption in the EU27

- **Tax rates on energy use increased by 29% between 2008 and 2018, in real terms.** The total reported tax rate on energy consumption in the EU27 was EUR 25/MWh in 2018[3]. Member states total tax rates ranged from EUR 9/MWh (Hungary) to EUR 34/MWh in 2018 (Germany), with a median of EUR 19/MWh;
- **There is now more differential tax treatment by sector than there was in 2008.** Rates increased the most, in absolute terms, in the non-energy-intensive industry ('non-EII'), services and construction sectors, while rate changes in the passenger road and water transport sectors were small;
- **Tax rates on EIIs are three times less than on non-EIIs.** And the median tax rate on EIIs is half that of non-EIIs;
- **Tax rates on liquid fuels used for road transport are the highest and rates on petroleum coke and coal are the lowest.** The median tax rate levied by EU MS on gasoline is EUR 60/MWh and EUR 37/MWh on diesel, while the median tax rate on solid fossil fuels (i.e. coal) is EUR 1/MWh, EUR 2/MWh on natural gas, and EUR 4/MWh on electricity.

Estimated tax revenues from taxes on energy consumption in the EU27

- **Total revenues from taxes on energy consumption increased 23% between 2008 and 2018** (from EUR 219 billion in 2008 to EUR 263 billion in 2018). 47% of the revenue in 2018 was accounted for by Germany and France, and another 28% by Italy, Spain and the Netherlands. Road transport accounts for 60% of tax revenue, followed by residential (15%), then services (12%);

[3] Calculated as the sum of consumption tax revenues across the EU27 divided by the sum of energy volumes taxed across the EU27.

- **Three-quarters of revenues in the EU27 were from excise taxes in 2018, and 20% were for renewables support.** Additional support for renewables accounted for EUR 40 billion, or 80% of the EUR 50 billion in additional revenue in 2018 relative to 2008;
- **Energy intensive industries and agriculture paid the least taxes relative to the amount of energy they consumed in 2018, whereas the road transport sectors paid the most.** EIIs account for 18% of energy consumption and 2% of tax revenue, and agriculture accounts for 3% of energy use and 0.5% of tax revenue while road transport accounts for 29% of energy consumption and 60% of tax revenue;
- **Revenues from taxes on electricity rose while those on gasoline fell.** Taxes on diesel account for the largest share of tax revenues in 2018 (41%), as they did in 2008. Electricity accounted for 30% of tax revenues in 2018, up 15 percentage points from 2008, while the gasoline share decreased from 30% to 20%, corresponding to a drop of a fifth in gasoline consumption between 2008 and 2018.

Taxes on energy production and infrastructure in the EU27

- **Revenues from taxes on energy production fell from EUR 21 billion in 2008 to EUR 5 billion in 2018, while taxes on infrastructure doubled to EUR 5 billion.**

Taxes on energy consumption in G20 countries

- **Total tax rates on passenger road transport within 11 G20 countries (including the United Kingdom, but excluding Germany, France and Italy) are, on average, half that in the EU27.** The US tax rate is 40% that of the lowest EU MS tax rate (Bulgaria) and a quarter of the total EU27 rate. The rate in Japan is 20% lower than the EU27 total and equivalent to the rates in Austria, Romania, and Latvia;
- **Tax rates on energy-intensive industries in Japan are twice that of the EU27 (EUR 12/MWh versus EUR 6/MWh), but tax rates on non-energy-intensive industries are a third lower (EUR 12/MWh versus EUR 18/MWh).**

1.2 Taxes on energy consumption in the EU27

1.2.1 Summary of approach

This task included three steps: data collection, data analysis and reporting.

The approach to data collection was to develop a detailed data collection template, pre-populate it for each EU and G20 country with data from transversal sources, including Enerdata Global Energy and CO_2 Data and Enerdata EnerDemand online databases, Eurostat, etc., send the templates to country experts for updating with data from national sources, and conduct data quality control.

The analysis presented below includes discussion of tax rates and tax revenues by sector and by fuel for the EU27.

1.2.2 Data collection

Data disposition

27 out of 27 EU MS country templates covering taxes were returned by country experts to the core team, plus the UK. All templates were reviewed by the core team and sent back to country experts for revision.

Data quality

Below, we summarise key issues encountered and lessons learned during quality control of energy tax data provided by country experts:

1. **Variance in national reporting**: There is little consistency between EU MS in how energy tax data are reported at country level. Data are dispersed across many administrations and it is notable that historical data series exist only in rare cases. This was known, to some degree, before the project started. However, the extent of the variation is far greater than anticipated. There is considerable variation in what is collected by countries, who is collecting it, and what is reported. This remark corroborates findings by DG TAXUD in its report of 12 September 2019[4]. We carefully developed the data collection template in anticipation of this issue, and provided specific instructions to country experts, yet still it was challenging for experts to report their data in a harmonised format. Our solution to this problem was to combine data from transversal sources with national data (primarily tax rates), to harmonise the data. We detail this solution in the next section of this chapter;
2. **Lack of detail**: Most countries do not collect energy tax data at the level of detail required for the project. The project requires tax data disaggregated by fuel, and by use ('use' implies knowing the type of consumer consuming the fuel, from which we can deduce the applicable economic sector). Some countries may collect data at this level but if so, they are reporting it in aggregate. There are notable exceptions, such as Germany and Finland, where detailed data is available. But for many country experts it was impossible to even estimate tax revenues at this level of detail using national sources;
3. **Lack of data on energy tax revenues**: Most country experts were able to collect data on energy tax liquidation rates, but corresponding tax revenues were not published, or not readily available;
4. **Variation in transparency**: Some countries collect and report – in readily available format – energy tax data in great detail. Germany, Spain and Slovenia, for example. This level of transparency is exemplary but exceptional. By and large, data transparency is poor. The only downside to complete transparency is overwhelming volume. For countries like Germany, it can be challenging for country experts to sift through the data available for what is required for the project;
5. **Bureaucratic complexity**: The data required for the project is often dispersed across many national sources and is poorly structured. Tax rates may be published by several public bodies (depending on who has oversight), including ministries of finance, customs, or energy, or by energy regulators, whereas energy balance data is housed within energy ministries and statistical offices or energy agencies. This made it challenging for country experts to conduct secondary research and increased the amount of time required for correspondence with the various ministries. The greater, long-term issue is that this bureaucratic complexity will make it difficult for MS to prioritise and implement hamonised reporting on energy taxes.

To summarise, collecting energy tax data was far more challenging than anticipated, and the project team needed to develop alternative methods for estimating data – particularly tax revenues – for many countries. This method is discussed below.

[4] "Due to the wide ranging flexibility left to Member States to apply exemptions, reductions and refunds it is vastly complicated to calculate effective rates in a harmonised way across the EU. In addition, at the time of the evaluation no official data collection existed that was equipped to capture effective tax rates." DG TAXUD, Commission report: evaluation of the Energy Taxation Directive, 12 September 2019, available at https://ec.europa.eu/taxation_customs/news/commission-report-evaluation-energy-taxation-directive%C2%A0_en

1.2.3 Revised approach to estimating tax revenues

To address the challenges encountered in collecting energy consumption-related tax data we developed a revised methodology pairing transversal sources with national data collected by country experts. The main goal was to estimate tax revenues and corresponding energy volumes at the level of detail required for the project.

Our approach applied Eurostat data on energy balances, complemented by Odyssee[5] database data on demand to refine energy consumption data in the project database. This data on energy volumes was applied to the tax rates collected by country experts to estimate tax revenues.

The approach had four steps:

1. Identifying relevant sectors and energy products in Eurostat (top down data);
2. Mapping tax rates from national sources/country experts to the sectors-products selected in step one;
3. Converting energy volumes from Eurostat, which are in ktoe, to the tax rate units provided by country experts;
4. Estimating tax revenues.

Step 1: Identifying relevant sectors and energy products

The first step was to identify relevant sectors in Eurostat. Final energy consumption data for 2008-2018 was pulled from Eurostat[6] for each EU MS by economic sector by energy product. Industrial sector data was aggregated into Energy-intensive industry ('EII'), non-energy-intensive industry ('non-EII'), mining, and construction (Figure 1-2) – these categories align with categories at which energy taxes on industry are typically applied by EU MS. Eurostat does not identify which industries are EIIs, and which are not. It was therefore necessary for us to do so, otherwise we could not distinguish between taxes on EIIs and non-EIIs in the project database. The EII classification shown below is consistent with the classification used in the previous energy prices and cost study.

[5] https://www.odyssee-mure.eu/
[6] https://ec.europa.eu/eurostat/data/database

Figure 1-2 Energy using sectors from Eurostat (left column) and the sector assignment for project database (right column)

NRG_BAL_LABEL	Sector short label
Final consumption - industry sector - iron and steel - energy use	Indu-EII
Final consumption - industry sector - chemical and petrochemical - energy use	Indu-EII
Final consumption - industry sector - non-ferrous metals - energy use	Indu-EII
Final consumption - industry sector - non-metallic minerals - energy use	Indu-EII
Final consumption - industry sector - transport equipment - energy use	Indu-non-EII
Final consumption - industry sector - machinery - energy use	Indu-non-EII
Final consumption - industry sector - mining and quarrying - energy use	Indu-Mining
Final consumption - industry sector - food, beverages and tobacco - energy use	Indu-non-EII
Final consumption - industry sector - paper, pulp and printing - energy use	Indu-EII
Final consumption - industry sector - wood and wood products - energy use	Indu-EII
Final consumption - industry sector - construction - energy use	Construction
Final consumption - industry sector - textile and leather - energy use	Indu-EII
Final consumption - industry sector - not elsewhere specified - energy use	Indu-non-EII
Final consumption - transport sector - rail - energy use	Trans-rail
Final consumption - transport sector - road - energy use	Trans-road-passenger
	Trans-road-freight
Final consumption - transport sector - domestic aviation - energy use	Trans-air
Final consumption - transport sector - domestic navigation - energy use	Trans-water
Final consumption - other sectors - commercial and public services - energy use	Services
Final consumption - other sectors - households - energy use	Residential
Final consumption - other sectors - agriculture and forestry - energy use	Agriculture
Final consumption - other sectors - fishing - energy use	Fishing

We then sorted energy product data from Eurostat by volume by sector for the EU27 in total to identify those products with the highest consumption in each sector. These were kept for the database and are as shown in Figure 1-3 in the second column from the left.

Inapplicability of ETD classification

As the Commission is aware, DG TAXUD, through the CIRCABC[7] platform, biannually publishes excise duty rate data for fossil fuels and electricity by energy use based on the framework of the Energy Taxation Directive 2003[8] (ETD 2003). At the start of the project, we developed taxation mapping based on CIRCABC information (i.e. on ETD framework) and Eurostat energy consumption data with two goals in mind: (1) to provide pre-populated templates to country experts, and (2) to map potentially unreported tax expenditures by MS. However, quality control of data returned by our country experts showed the use of the current ETD framework is too restrictive for the project for the following reasons:

- The current ETD framework allows MS to grant sector-specific energy tax exemptions or reductions, notably in the aviation, maritime and road freight, residential (for heating) and agricultural/fisheries sectors. For EIIs exemptions and reductions are not reported by sector in CIRCABC documents. For example, there are some cases where tax rates for a sector-product are published by MS but no tax is collected on energy consumed – we call such tax rates 'apparent'. We therefore recommend going beyond the current CIRCABC provisions and reporting tax rates for these industries;
- The ETD defines specific sectors such as 'energy-intensive business'[9] (EIIs) but this classification is not used for other statistical purposes such as calculating energy tax revenues

[7] https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp
[8] https://ec.europa.eu/taxation_customs/business/excise-duties-alcohol-tobacco-energy/excise-duties-energy_en
[9] "An 'energy-intensive business' shall mean a business entity, as referred to in Article 11, where either the purchases of energy products and electricity amount to at least 3,0 % of the production value or the national

and consumption from EIIs. As a result, the data required to quantify the effective taxation rate - tax revenue and tax expenditures – for these businesses does not exist because such dedicated reporting has not been implemented (as far as we know) in the EU. We discuss below how we estimated this data;

- The documents available on the CIRCABC platform do not include taxation data on biofuels, biogases or hydrogen;
- The transposition of the ETD into national laws by MS has led to heterogeneous reporting. Tax rates are often reported in legal documents that are difficult to read and interpret, especially when changes occur across years. Comparison between countries and even directly with the ETD is therefore challenging.

Thus, the current classification under the ETD was inappropriate for application to this study.

Figure 1-2 also shows how the tax bases we identified in Eurostat match with harmonised tax bases currently in effect under the ETD. One conclusion of this mapping is that taxation of liquid biofuels is not covered by CIRCABC, although countries do consume liquid biofuels and many of them have implemented biofuels mandates[10]. The case is similar for the services and residential sectors for peat, solid biomass, biogases, as well as for electricity in the road transport sector.

energy tax payable amounts to at least 0,5 % of the added value." Article 17, Energy Taxation Directive (2003/96/EC), available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0096

[10] http://www.res-legal.eu/

Figure 1-3 Eurostat energy consumption data matched with current ETD harmonised tax bases

Eurostat		ETD/CIRCABC	
Sector	**Energy product/carrier**	**Energy product**	**EDT classes**
Agriculture and forestry	Solid fossil fuels	Coal & coke	Agriculture, horticulture, pisciculture, forestry
	Electricity	Electricity	Agriculture, horticulture, pisciculture, forestry
	Natural gas	Natural gas	Agriculture, horticulture, pisciculture, forestry
	Liquefied petroleum gases	LPG	Agriculture, horticulture, pisciculture, forestry
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol
	Kerosene type jet fuel (excluding biofuel portion)	Kerosene	Agriculture, horticulture, pisciculture, forestry
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Agriculture, horticulture, pisciculture, forestry
	Fuel oil	Heavy fuel oil	Agriculture, horticulture, pisciculture, forestry
	Peat and peat products		
	Primary solid biofuels		
	Blended biogasoline		
	Pure biogasoline		
	Blended biodiesels		
	Pure biodiesels		
	Other liquid biofuels		
	Biogases		
Fishing	Electricity	Electricity	Agriculture, horticulture, pisciculture, forestry
	Natural gas	Natural gas	Agriculture, horticulture, pisciculture, forestry
	Liquefied petroleum gases	LPG	Agriculture, horticulture, pisciculture, forestry
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Agriculture, horticulture, pisciculture, forestry
	Fuel oil	Heavy fuel oil	Agriculture, horticulture, pisciculture, forestry
	Blended biogasoline		
	Pure biogasoline		
	Blended biodiesels		
	Pure biodiesels		
Commercial and public services	Solid fossil fuels	Coal & coke	Heating – Business use
	Electricity	Electricity	Business use
	Natural gas	Natural gas	Heating – Business use
	Liquefied petroleum gases	LPG	Heating – Business use
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol
	Other kerosene	Kerosene	Heating – Business use
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Heating – Business use
	Fuel oil	Heavy fuel oil	Heating – Business use
	Peat and peat products		
	Primary solid biofuels		
	Blended biogasoline		
	Pure biogasoline		
	Blended biodiesels		
	Pure biodiesels		
	Other liquid biofuels		
	Biogases		
	Non renewable waste		
	Renewable municipal waste		
Households	Solid fossil fuels	Coal & coke	Heating – Non business use
	Electricity	Electricity	Non-business use
	Natural gas	Natural gas	Heating – Non business use
	Liquefied petroleum gases	LPG	Heating – Non business use
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol
	Other kerosene	Kerosene	Heating – Non business use
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Heating – Non business use
	Fuel oil	Heavy fuel oil	Heating – Non business use
	Petroleum coke	Coal & coke	Heating – Non business use
	Peat and peat products		
	Primary solid biofuels		
	Charcoal		
	Blended biogasoline		
	Pure biogasoline		
	Blended biodiesels		
	Pure biodiesels		
	Other liquid biofuels		
	Biogases		

Eurostat		ETD/CIRCABC	
Sector	**Energy product/carrier**	**Energy product**	**EDT classes**
Transport sector road - personal	Electricity		
	Natural gas	Natural gas	Propellant
	Liquefied petroleum gases	LPG	Propellant
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol/Leaded petrol
	Other kerosene	Kerosene	Propellant
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Propellant
	White spirit and special boiling point industrial spirits		
	Blended biogasoline		
	Pure biogasoline		
	Blended biodiesels		
	Pure biodiesels		
	Other liquid biofuels		
	Biogases		
Transport sector road - freight	Electricity		
	Natural gas	Natural gas	Propellant
	Liquefied petroleum gases	LPG	Propellant
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol/Leaded petrol
	Other kerosene	Kerosene	Propellant
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Commercial gasoil used as propellant
	White spirit and special boiling point industrial spirits		
	Blended biogasoline		
	Pure biogasoline		
	Blended biodiesels		
	Pure biodiesels		
	Other liquid biofuels		
	Biogases		
Transport sector rail	Solid fossil fuels	Coal & coke	Railways
	Electricity	Electricity	Railways
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Railways
	Blended biodiesels		
	Pure biodiesels		
Transport sector domestic navigation	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol/Leaded petrol
	Other kerosene	Kerosene	Propellant
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Propellant
	Fuel oil	Heavy fuel oil	Propellant
	Blended biogasoline		
	Blended biodiesels		
Transport sector domestic aviation	Aviation gasoline		
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol/Leaded petrol
	Kerosene type jet fuel (excluding biofuel portion)	Kerosene	Propellant

Eurostat		ETD/CIRCABC	
Sector	**Energy product/carrier**	**Energy product**	**EDT classes**
Energy Intensive Industries (EII)*	Solid fossil fuels	Coal & coke	Heating – Business use
	Manufactured gases		
	Electricity	Electricity	Business use
	Natural gas	Natural gas	Industrial/Commercial use
	Liquefied petroleum gases	LPG	Industrial/Commercial use
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Industrial/Commercial use
	Fuel oil	Heavy fuel oil	Heating – Business use
	Petroleum coke	Coal & coke	Heating – Business use
	Peat and peat products		
	Primary solid biofuels		
	Other liquid biofuels		
	Biogases		
	Non renewable waste		
Non-energy Intensive Industries (non-EII)*	Solid fossil fuels	Coal & coke	Heating – Business use
	Electricity	Electricity	Business use
	Natural gas	Natural gas	Industrial/Commercial use
	Liquefied petroleum gases	LPG	Industrial/Commercial use
	Other kerosene	Kerosene	Industrial/Commercial use
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Industrial/Commercial use
	Fuel oil	Heavy fuel oil	Heating – Business use
	Petroleum coke	Coal & coke	Heating – Business use
	Primary solid biofuels		
	Other liquid biofuels		
	Biogases		
	Non renewable waste		
Industry sector - mining and quarrying	Solid fossil fuels	Coal & coke	Heating – Business use
	Manufactured gases		
	Electricity	Electricity	Business use
	Natural gas	Natural gas	Industrial/Commercial use
	Liquefied petroleum gases	LPG	Industrial/Commercial use
	Other kerosene	Kerosene	Industrial/Commercial use
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Industrial/Commercial use
	Fuel oil	Heavy fuel oil	Heating – Business use
	Petroleum coke	Coal & coke	Heating – Business use
	Primary solid biofuels		
	Blended biodiesels		
	Renewable municipal waste		
Industry sector - construction	Solid fossil fuels	Coal & coke	Heating – Business use
	Electricity	Electricity	Business use
	Natural gas	Natural gas	Industrial/Commercial use
	Liquefied petroleum gases	LPG	Industrial/Commercial use
	Motor gasoline (excluding biofuel portion)	Gasoline	Unleaded Petrol
	Gas oil and diesel oil (excluding biofuel portion)	Gasoil	Industrial/Commercial use
	Fuel oil	Heavy fuel oil	Heating – Business use
	Primary solid biofuels		
	Blended biodiesels		
	Biogases		
	Non renewable waste		

Step 2: Mapping tax rates

Tax rates, along with the tax rate units (litre, ton, etc.) from national sources, as reported by country experts, were matched with the appropriate sector-product pairs for each tax reported by country experts. Tax exemptions and reductions were also accounted for in this step.

Step 3: Energy volume conversion

Eurostat reports energy volumes in ktoe, but tax rates were reported by country experts in various liquidation units. Therefore, energy volumes needed to be converted to appropriate liquidation units for each tax. We performed these conversions using energy content data from Eurostat[11]. The energy content of solid fuels considerably varies (across lignite coal, anthracite coal, etc.) but many tax rates are applied to solid fuels generally; therefore, we calculated a weighted average solid fuel conversion rate for each using Eurostat conversion rates.

[11] https://ec.europa.eu/eurostat/documents/38154/4956218/ENERGY-BALANCE-GUIDE-DRAFT-31JANUARY2019.pdf/cf121393-919f-4b84-9059-cdf0f69ec045; http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Step 4: Tax revenue estimation

Tax revenues were then estimated as the product of converted energy volumes and tax rates. We checked our estimates against Eurostat data on revenues for each tax to ensure our estimates are reasonably consistent (although Eurostat's reporting is largely limited to taxes on fossil fuels). Where possible we documented differences between our estimates and Eurostat's reported data.

1.2.4 *Analysis*

Taxes on energy consumption analysed in this section include:

- Excise taxes on fuels;
- Non-tax levies on fuel purchases, such as on natural gas and electricity bills, used to finance renewable energy (e.g., the Renewable Energy Sources Act ('EEG') in Germany), or energy efficiency (e.g., Italy's White Certificate scheme);
- All other taxes, levies and fiscal measures that end consumers pay when they consume energy.

Specific taxes included in this analysis are listed by EU MS in the Annex.

Summary

The total reported tax rate[12] on energy consumption in the EU27 was EUR 25/MWh in 2018 (Figure 1-4), a 29% increase over the 2008 tax rate (EUR 19/MWh) in real terms, while tax revenues per capita increased 19% from EUR 486/capita in 2008 to EUR 590/capita in 2018, tax revenues as a share of GDP dropped slightly from 2.1% to 1.9%, and excise tax revenues as share of total government revenue increased from 6% to 7%.

Figure 1-4 Summary statistics, taxes on energy consumption in the EU27 in 2018 (N=27 Member States)

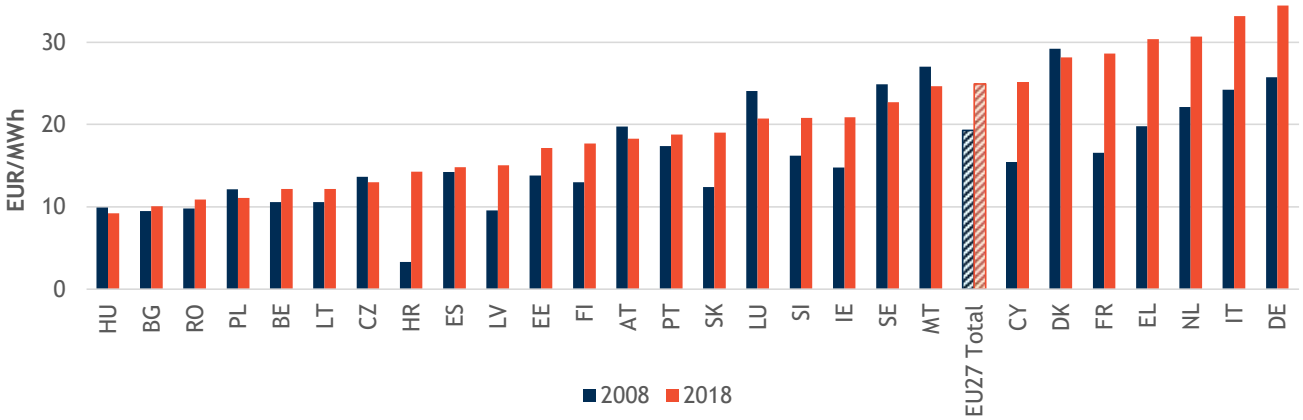
Metric	EU27 Total	Minimum	25th Percentile	Median	75th Percentile	Maximum
EU27 total reported tax rate, EUR/MWh	**24.9**	9.2	13.6	18.8	24.9	34.4
EU27 total effective tax rate, EUR/MWh	**18.4**	7.6	11.8	15.9	20.0	27.7
EU27 total tax revenues, EUR/capita	**590**	149	291	477	694	1480
EU27 total tax revenues, % of GDP	**1.9%**	0.8%	1.7%	1.9%	2.2%	2.8%
EU27 excise tax revenues, % of total government revenue	**6.8%**	2.0%	4.7%	6.4%	7.5%	14.1%

Reported tax rates

MS reported total tax rates[13] ranged from EUR 9/MWh to EUR 34/MWh in 2018, with a median of EUR 19/MWh. Total reported tax rates for 2008 and 2018 by EU MS are shown in Figure 1-5, in rank order from lowest on the left to highest in 2018 on the right. Reported tax rates are those researched by country experts from national sources, such as energy and finance ministries.

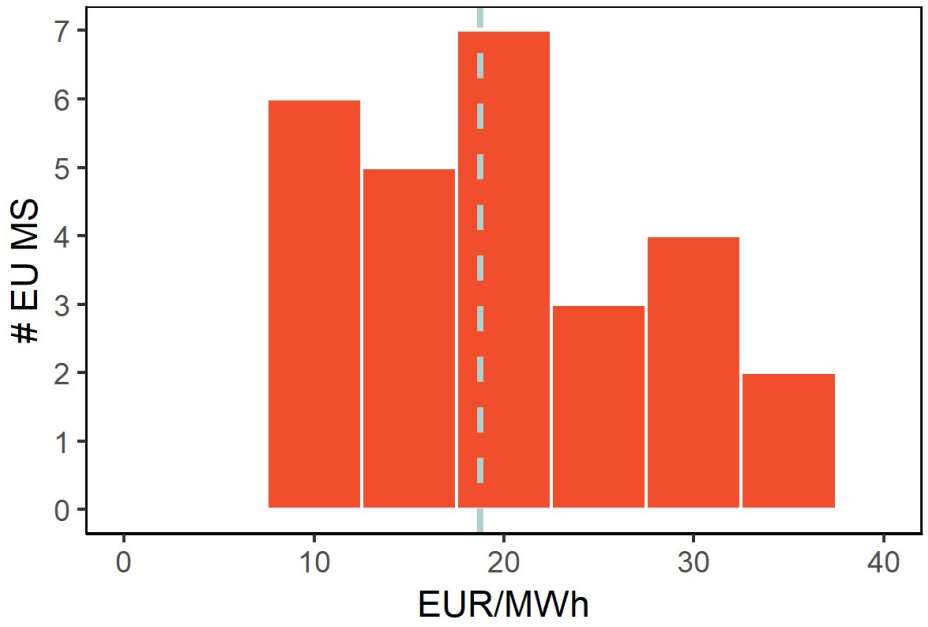
[12] Calculated as the weighted average tax rate, i.e., the sumproduct of tax rates by sector and energy volumes by sector divided by the total energy volume. This is the same as total revenues divided by total volumes.
[13] Total reported tax rates account for exemptions and reduced rates.

Figure 1-5 Reported total tax rates on energy consumption in the EU27 in 2008 and 2018



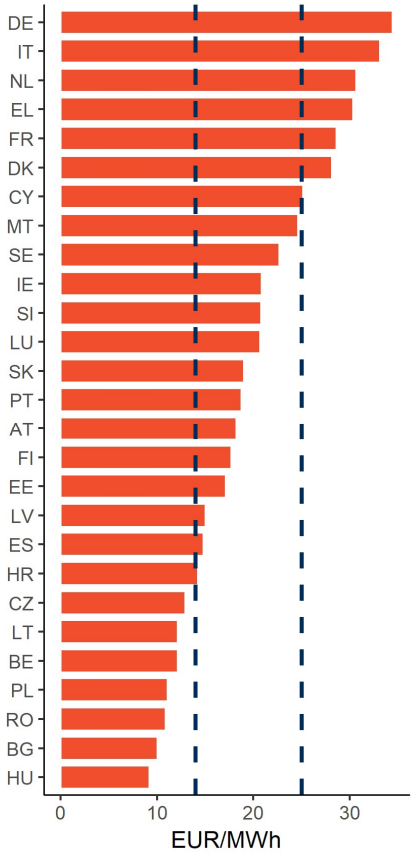
The distribution of total reported tax rates across EU MS is bi-modal, with the first mode centring around EUR 10/MWh and the second around EUR 20/MWh – at the right-tail there are four MS with rates of above EUR 30/MWh (Figure 1-6).[14] The bar chart in Figure 1-7 shows how reported tax rates statistically compare. The dotted blue lines show the interquartile range[15] (between 14 and 24 EUR/MWh). MS with tax rates less than the line on the left have relatively low tax rates while those with values greater than the line on the right have relatively high rates.

Figure 1-6 Histogram of total reported tax rates in 2018 in EU MS



[14] The median is represented by the grey dotted line.
[15] The interquartile range or 'IQR' is calculated as: IQR = Q3 – Q1, where Q1 and Q3 are the 25th and 75th percentiles (and 'Q' denotes 'quartile').

Figure 1-7 Total reported tax rates in 2018 in EU MS[16]



Tax rates by sector

Energy consumption in the EU27 decreased 4% between 2008 and 2018 to 911 million ktoe.[17] Residential and energy intensive industry account for nearly all the drop in about equal parts, while passenger road transport accounts for the largest increase in energy use, followed by construction and agriculture.

Figure 1-8 Share of energy consumption by sector, 2008 and 2018

Sector	2008	2018	Absolute change
Fishing	0.1%	0.1%	0.0%
Indu-Mining	0.4%	0.4%	0.1%
Trans-water	0.6%	0.5%	-0.1%
Trans-rail	0.7%	0.6%	-0.1%
Trans-air	0.6%	0.7%	0.1%
Construction	0.7%	1.0%	0.3%
Agriculture	2.6%	3.0%	0.3%
Indu-non-EII	5.6%	5.8%	0.1%
Trans-road-freight	11.1%	11.3%	0.1%
Services	14.1%	14.6%	0.5%
Indu-EII	19.2%	17.7%	-1.5%
Trans-road-passenger	16.6%	17.8%	1.1%
Residential	27.7%	26.6%	-1.0%

[16] The blue dashed lines indicate the interquartile range.
[17] https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_34

Tax rates by sector range from EUR 6/MWh for EIIs to EUR 51/MWh for road transport (2018). The statistical dispersion of rates by sector, measured by the interquartile range, tripled between 2008 and 2018. This means there is now more differential tax treatment across sectors than there was in 2008. Rates increased the most, in absolute terms, in the non-energy-intensive industry, services and construction sectors, while rate changes in the passenger road and water transport sectors were small. Rates increased the most, in percentage terms, for non-energy-intensive industry (138%) and agriculture (119%).[18]

Figure 1-9 Tax rates by sector in the EU27, 2008 and 2018

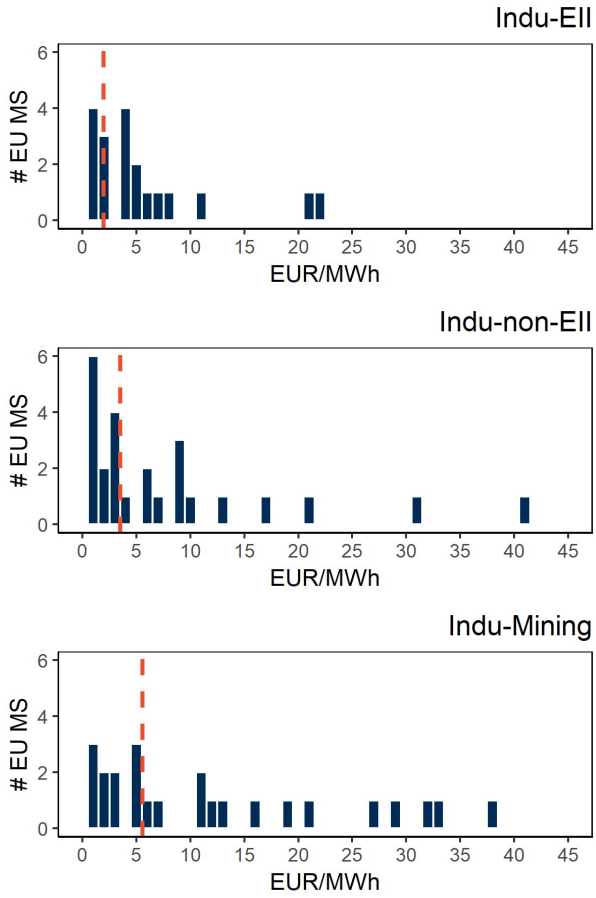
	Tax rate (EUR/MWh)		Change (2018 v. 2008)		# MS taxing sector	
Sector	2008	2018	Absolute (EUR/MWh)	Increase/ Decrease (%)	2008	2018
Indu-EII	2.7	6.5	3.7	136%	26	25
Trans-water	9.9	9.2	-0.7	-7%	11	13
Trans-rail	9.8	12.7	3.0	30%	20	23
Agriculture	5.8	12.6	6.9	119%	24	26
Residential	8.6	14.3	5.7	66%	26	27
Indu-Mining	10.8	15.8	5.0	46%	24	25
Indu-non-EII	7.7	18.3	10.6	138%	25	25
Construction	10.9	18.9	8.1	74%	23	26
Services	11.6	21.8	10.2	88%	27	27
Fishing	18.0	26.4	8.4	46%	14	20
Trans-road-freight	47.7	50.0	2.3	5%	27	27
Trans-road-passenger	50.7	51.1	0.4	1%	27	27
Interquartile range	4.9	17.1				

Tax rates within industry

Tax rates widely vary by industry type across EU MS. Figure 1-10 shows the distributions of tax rates for EIIs, non-EIIs and mining. The dotted red lines show the median of each distribution and indicate the skewness of the tax rates within each sub-sector. The distribution of tax rates on EIIs is the most left-skewed, with 11 MS charging EUR 1/MWh or less, and only three member states charging more than 10 EUR/MWh, whereas there are six MS charging non-EIIs EUR 1/MWh or less and 6 MS charging more than EUR 10/MWh. The median tax rate on EIIs is half that of non-EIIs and overall, and in the EU27 in total EIIs are taxed three times less than non-EEIs and half that of mining.

[18] It has been common practice for aircraft fuel for international flights to be exempted from all taxes - a policy originally established to promote civil aviation during its infancy. The legally binding exemptions are found in bilateral air service agreements. Regarding the application of energy taxation to aviation fuel, the Commission considers that the process of removing all legal obstacles from bilateral air service agreements remains essential and will continue.

Figure 1-10 Histograms of reported tax rates in EU MS by industry type in 2018



Our research indicates that several EU MS have tax rates of nearly zero on EIIs. The word 'indicates' is key here – many assumptions comprise the calculated tax rates on industry. First, classification of specific industries into energy-intensive and non-energy-intensive categories (see Figure 1-2). Second, in many cases country experts could not provide tax rates by industry type because the rates were not reported by national sources at that level. In these cases, the core team made professional judgments about which tax rate was appropriate to apply in the database. This was particularly complicated for tax rates on natural gas and electricity, which are sometimes 'tiered' or 'blocked' by consumption volume, yet consumption is not often reported by tier or block. In these cases, we needed to determine which tax rate tier was the most applicable to industry; or to calculate an average rate.

These types of assumptions partially explain variances in tax rates and revenues reported here versus those reported by Eurostat.[19]

Tax rates by fuel

Energy consumption in the EU27 decreased 4% between 2008 and 2018 to 911 million ktoe;[20] consumption of gasoline dropped by a fifth, accounting for about half the total decrease. Solid fossil fuel use also dropped by a fifth, though it accounts for only 2% of total energy use in 2018 (Figure 1-11).

[19] Note also that reporting by Eurostat only covers 'taxes' and not non-tax levies (such as those financing RES, EE and nuclear decommissioning). Neither does the Council of European Energy Regulators (CEER) provide such reporting on non-tax levies. These differences add to the challenge of comparing the tax revenue estimates here to those reported by Eurostat and CEER.
[20] https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_34

Natural gas use decreased 3%, while its share of total use increased slightly. Consumption of liquid biofuels about doubled, and heat pump use increased five-fold to 1% of total energy consumption in 2018.

Figure 1-11 Share of energy consumption by fuel in the EU27, 2008 and 2018

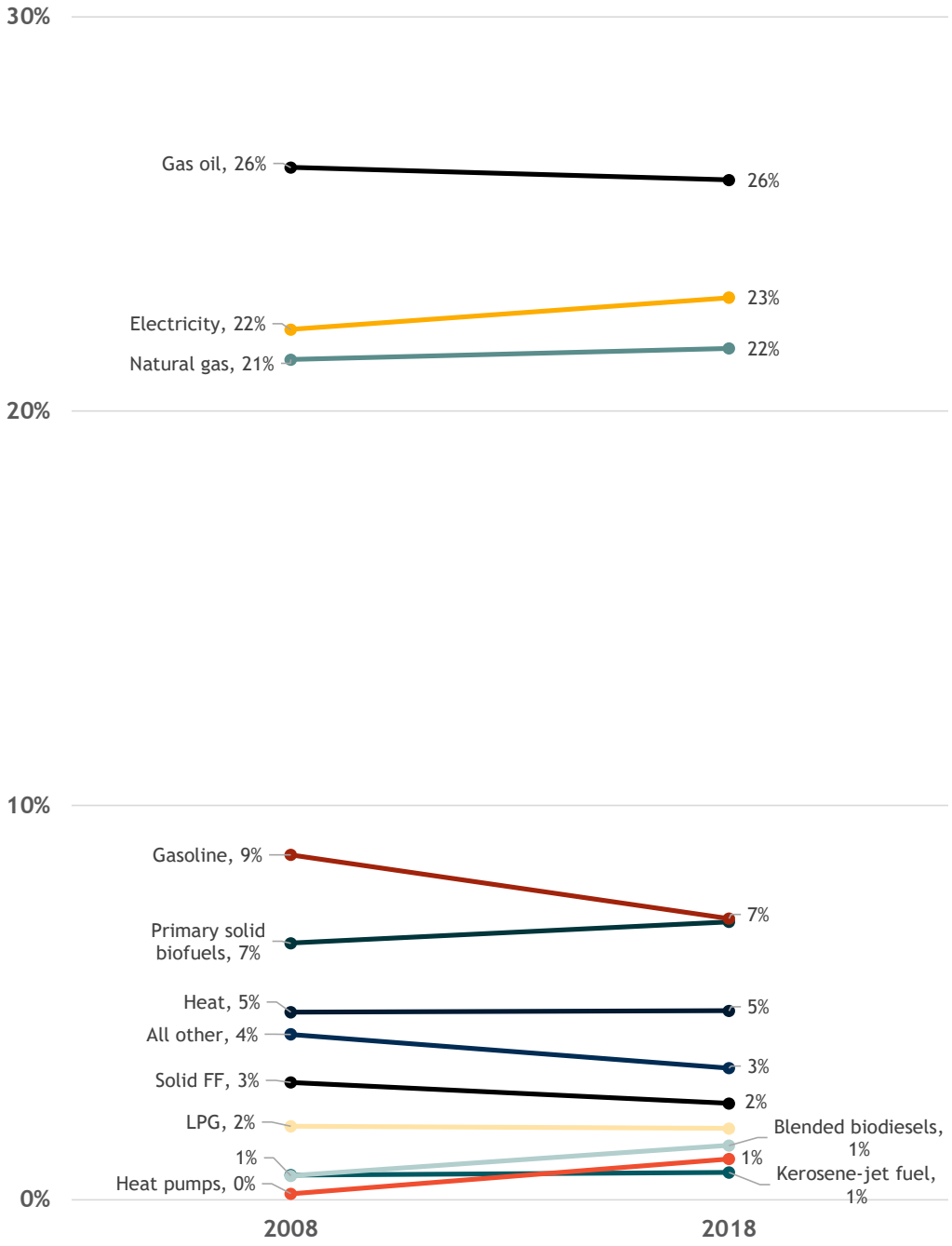


Figure 1-12 shows total tax rates for the EU27 by fuel, which range from EUR 2/MWh to EUR 108/MWh (2018). Tax rates increased the most, in absolute terms for biofuels (except pure biodiesels, which decreased significantly) and electricity. Only one MS taxes peat (Ireland) and two tax consumption of pure biogasoline (Spain and Sweden), whereas all MS tax gasoline and diesel (gas oil). Our research found there are several MS who do not tax consumption of electricity and natural gas. Based on available data, there are no taxes on the following fuels in any EU MS:

1. Aviation fuels;
2. Charcoal;
3. Manufactured gases;
4. Refinery gas;
5. RE municipal waste;
6. Biogases;
7. Primary solid biofuels;
8. Other liquid biofuels;
9. Heat;
10. Non-RE waste;
11. Heat pumps.

Figure 1-12 Reported total tax rates in the EU27, by fuel, 2008 and 2018

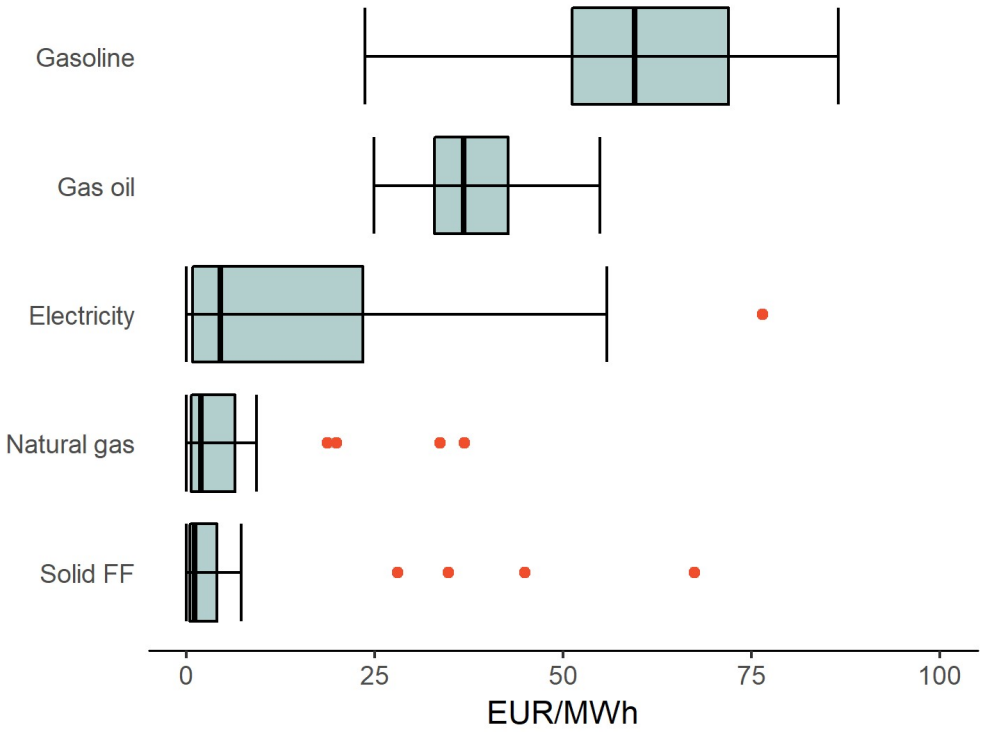
	Tax rate (EUR/MWh)		Change (2018 v. 2008)		# MS taxing fuel	
Fuel/Product	2008	2018	Absolute (EUR/MWh)	Increase/ Decrease (%)	2008	2018
Petroleum coke	1.2	1.7	0.5	38%	7	7
Peat	0.0	2.3	2.3	NA	0	1
Solid FF	1.4	2.9	1.5	108%	18	23
Other kerosene	0.2	4.0	3.8	1985%	1	2
Fuel oil	4.1	5.0	0.9	22%	23	23
Pure biodiesels	16.7	6.0	-10.7	-64%	3	5
Natural gas	5.9	7.0	1.1	19%	17	23
LPG	8.5	11.3	2.8	33%	24	25
Electricity	13.4	32.1	18.7	140%	21	25
Gas oil	32.3	38.6	6.4	20%	26	27
Blended biodiesels	26.2	42.4	16.2	62%	13	16
Blended biogasoline	28.6	52.3	23.8	83%	10	16
Gasoline	68.2	67.0	-1.2	-2%	27	27
Pure biogasoline	78.8	107.8	29.0	37%	1	2

Interquartile range	25.9	37.1

Tax rates on fuels used for road transport are the highest and taxes on fuels used for industry (i.e., coal and coke) are the lowest. Figure 1-13 shows how tax rates on key fuels statistically compare. Each grey-filled box represents the interquartile range and the bar within each box is the median tax rate on the fuel. The far-right whisker of each box is 1.5 times greater than the 75th percentile (which is represented by the right edge of each grey box), and the far-left whisker on each box is 1.5 times less than the 25th percentile (which is represented by the left edge of each box). Red dots represent possible outliers. The median tax rates on fuels for road transport are EUR 59/MWh on gasoline and EUR 37/MWh on gas oil (diesel), while the median tax rate on solid fossil fuels (i.e. coal) is EUR 1/MWh, EUR 2/MWh on natural gas, and EUR 4/MWh on electricity.[21]

[21] Note that energy inputs to the electricity sector are not taxed to avoid double taxation – only the final consumer is taxed on electricity consumption, not the power producer on the consumption of input fuels.

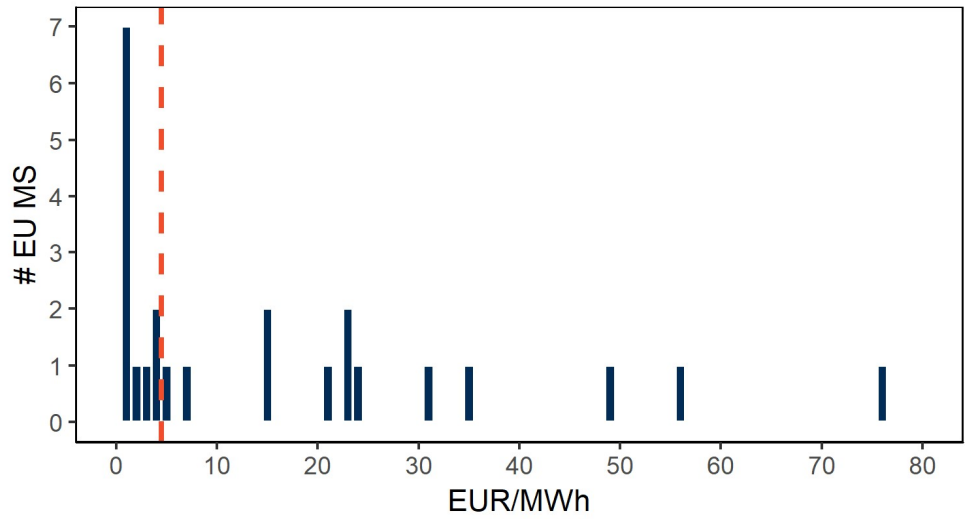
Figure 1-13 Box plots of reported tax rates for key fuels, by EU MS in 2018 (EUR/MWh)



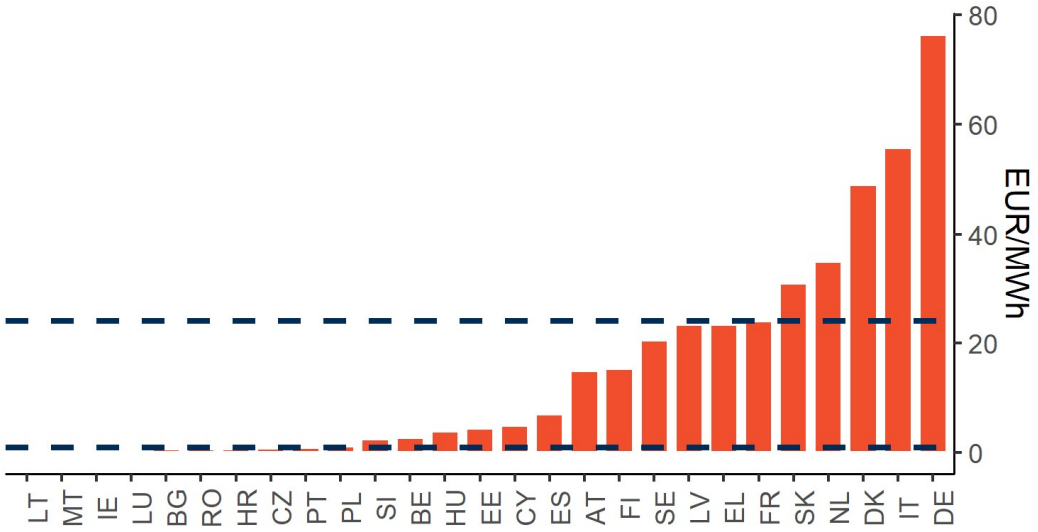
Taxes on electricity and natural gas

The distribution of taxes on electricity is highly left-skewed with a long right tail; half of MS who tax electricity do so at below EUR 4/MWh (Figure 1-13) but tax rates set by seven MS exceed the 75th percentile (those MS above the upper blue dotted line in the bar chart in Figure 1-14), with a max of EUR 76/MWh (Germany).

Figure 1-14 Histogram (upper)[22] and bar chart (lower)[23] of reported tax rates on electricity in the EU27 (2018)

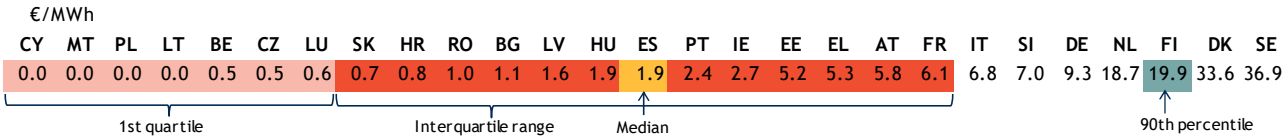


[22] The dotted red line indicates the median (EUR 4/MWh)
[23] The area between the two blue dotted lines is the interquartile range (between 1 and 24 EUR/MWh).



Tax rates on natural gas in 2018 ranged from zero to EUR 37/MWh. The overall rate on natural gas in the EU27 was EUR 7/MWh in 2018, up just EUR 1/MWh from 2008 levels.

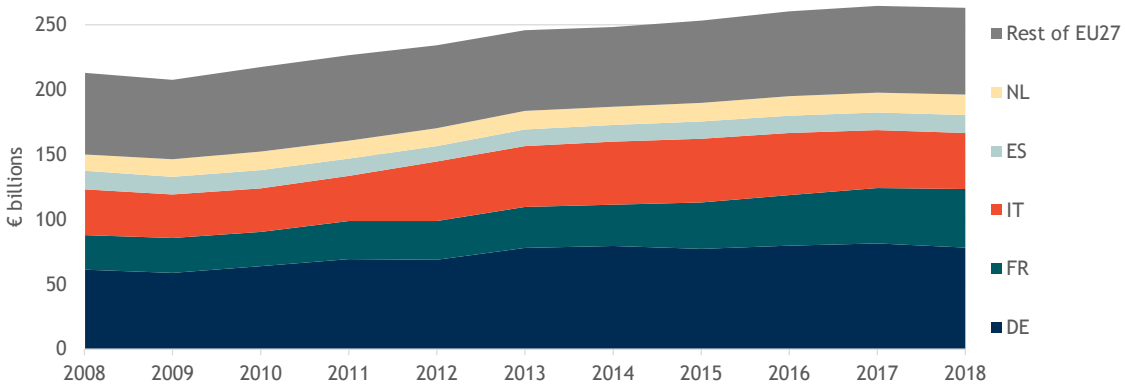
Figure 1-15 Reported tax rates on natural gas in the EU27 (2018)



Estimated tax revenues

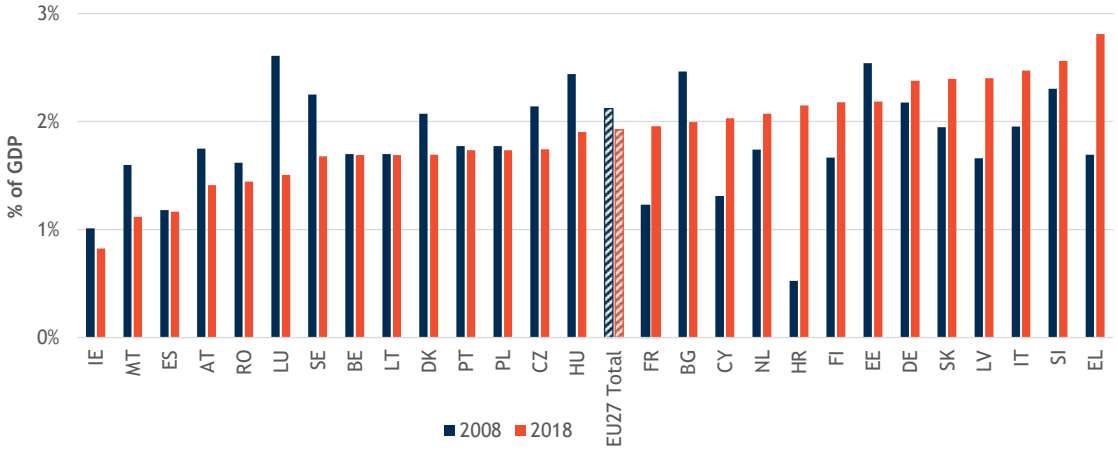
Total revenues from taxes on energy consumption increased 23%, from EUR 213 billion in 2008 to EUR 263 billion in 2018. 47% of the revenue in 2018 was accounted for by Germany and France, and another 28% by Italy, Spain and the Netherlands.

Figure 1-16 Revenue from taxes on energy consumption in the EU27 (2018)



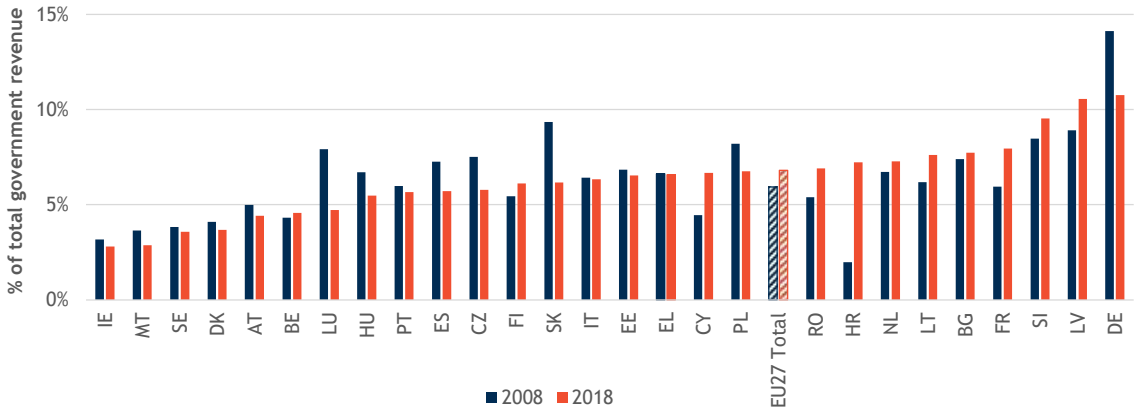
Estimated revenues from taxes on energy consumption as a percentage of GDP decreased slightly, from 2.1% to 1.9%, in the EU27 between 2008 and 2018.[24] Values range from 0.8% to 2.8% in 2018, with a median of 1.8% (Figure 1-17).

Figure 1-17 Estimated tax revenues as a % of GDP in 2008 and 2018 in EU MS



Total estimated excise tax revenues as a share of total government revenue increased from 6% to 7% between 2008 and 2018. Revenue shares ranged from 2% to 14% across EU MS in 2018, with a median of 6% (Figure 1-18).

Figure 1-18 Estimated excise tax revenues as a % of total government revenue in 2008 and 2018 in EU MS

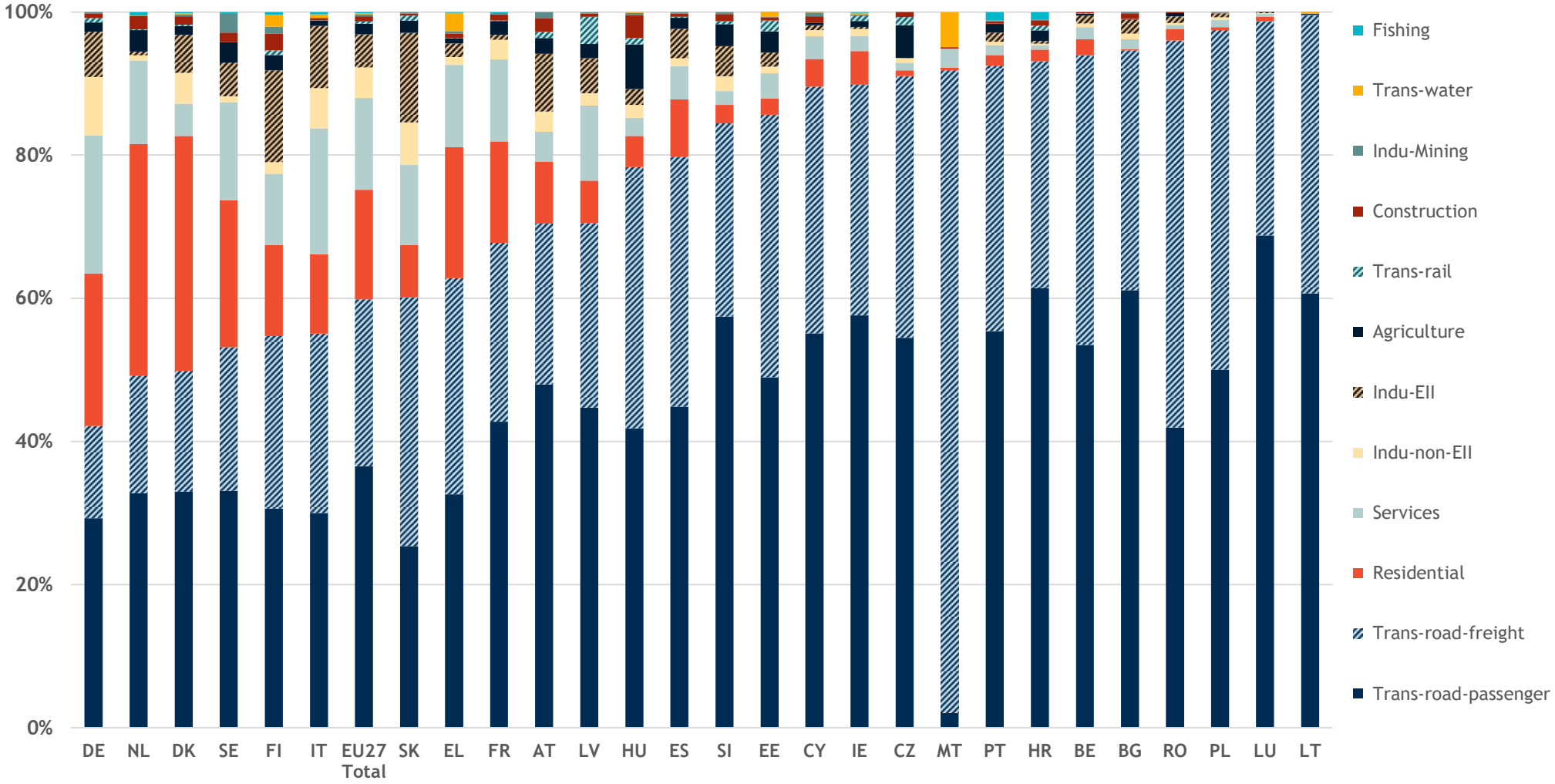


Tax revenues by sector

Road transport accounts for 60% of tax revenue in the EU27, followed by residential (15%), then services (12%). The road transport sectors account for 90% of energy-related tax revenue in 12 MS (BE, BG, CY, CZ, HR, IE, LT, LU, MT, PL, PT, RO). On the other side, they account for less than half of energy tax revenue in three MS (DE, DK and NL) (Figure 1-19). In Denmark, the residential sector accounts for a third of total revenue – 80% of this is from taxes and charges on electricity. In Germany the residential and services sectors each account for 20% of revenue – taxes and charges on electricity make up 74% of residential revenues, and 86% for services. In the Netherlands, the residential sector accounts for a third of revenue – about half is from natural gas, and half from electricity.

[24] The share for Croatia (HR) increased significantly due to a quadrupling of excise tax rates on fuels for road transport.

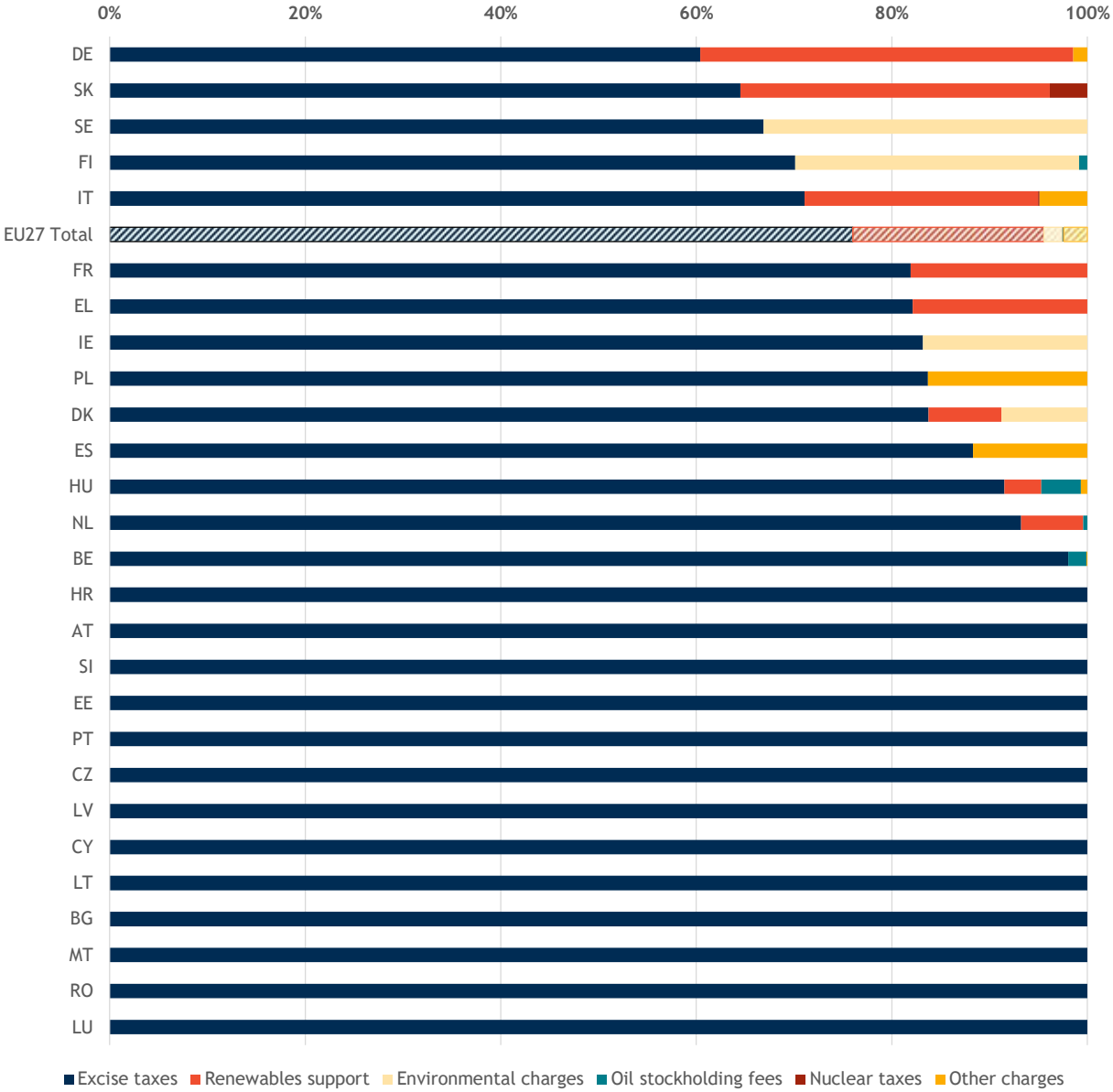
Figure 1-19 Share of reported total tax revenue by sector in EU MS, 2018



Tax revenues by type

Three-quarters of revenues in the EU27 were from excise taxes in 2018, and 20% were for renewables support. Excise taxes account for 100% of revenues in 13 member states. Renewables support accounts for 38% of revenue in Germany, 32% in Slovakia, 24% in Italy and 18% in France and Greece, while environmental charges add up to a third of revenues in Sweden, 29% in Finland and 17% in Ireland (Figure 1-20).

Figure 1-20 Distribution of revenues from taxes on energy use by tax type in the EU27 (2018)



There was EUR 50 billion in additional revenues from taxes on energy consumption in 2018, compared to 2008. Additional revenues for renewables support accounted for EUR 40 billion, or 80% of the EUR 50 billion. Additional excise taxes accounted for 15% (Figure 1-21). 58% of the additional revenues for renewables support in 2018 was from the Renewable Energies Surcharge on electricity ('EEG') in Germany; 18% was from similar charges in Italy, and 16% from comparable contributions in France.

Figure 1-21 Decomposition of additional revenues from taxes on energy use in 2018 v. 2008 (€ bn)

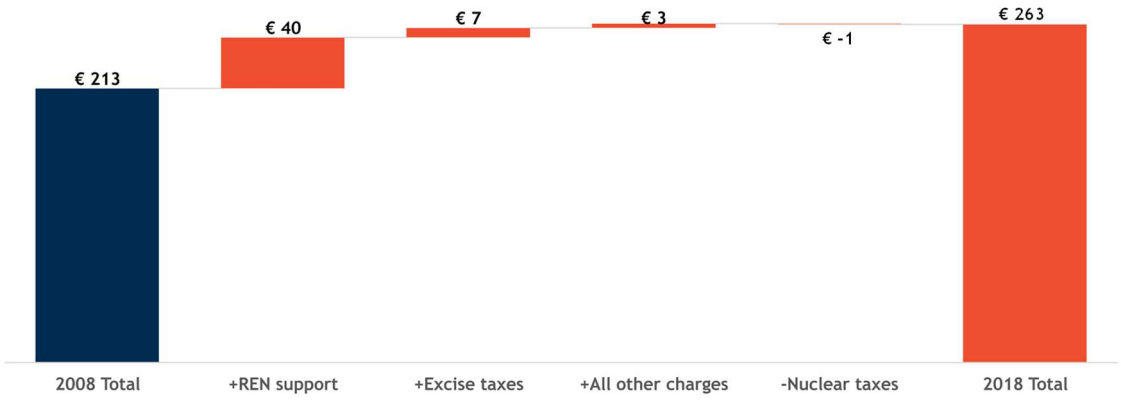


Figure 1-22 Revenues from renewables support charges in EU MS in 2008 v. 2018 (€ bn)[25]

Country	Renewables support charge	2008	2018	Change	% Total change
Germany	Renewable energy surcharge (EEG)	5.6	28.5	22.9	58%
	CHP levy	0.6	1.2	0.6	1%
	Offshore liability levy	0.0	0.2	0.2	0%
Italy	Fee to support renewable energy services	3.3	10.3	7.0	18%
France	Contribution to the public service of electricity (CSPE)	1.8	8.2	6.3	16%
Netherlands	Contribution to renewable energy storage	0.0	1.0	1.0	3%
Greece	Special Gaseous Emissions Reduction Fee	0.0	0.9	0.9	2%
Slovakia	System operation tariff	0.1	0.7	0.6	2%
Denmark	Public service obligations	0.3	0.4	0.1	0%
Hungary	Cogeneration restructuring fee	0.0	0.1	0.1	0%
	Total	**11.8**	**51.4**	**39.6**	

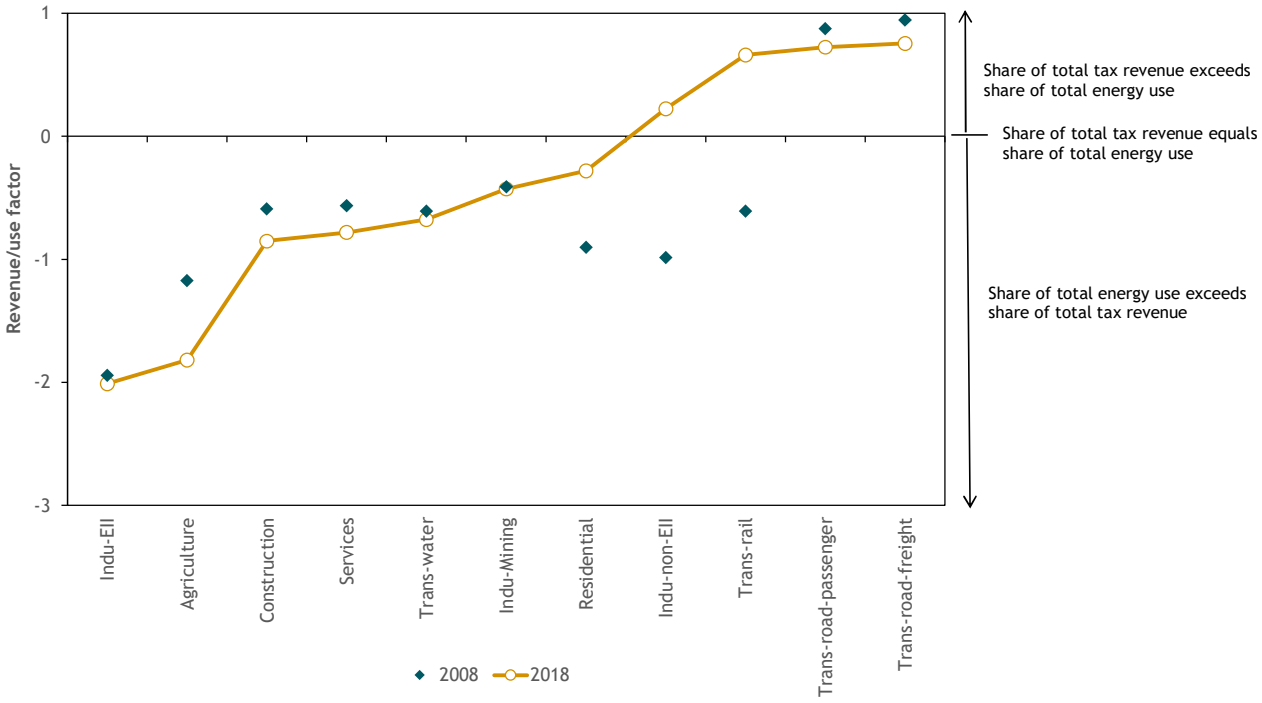
In 2018 EIIs and agriculture paid the least taxes relative to the amount of energy they consume, whereas the road transport sector paid the most; EEIs account for 18% of energy consumption and 2% of tax revenue and agriculture accounts for 3% of energy use and 0.5% of tax revenue while road transport accounts for 29% of energy consumption and 60% of tax revenue. Figure 1-23 shows the revenue/use ('RU') factors by sector in the EU27. The RU factor is a measure of energy tax proportionality. It is calculated as the natural logarithm of the ratio of the share of tax revenue to the share of energy consumption:

RU Factor = Ln (Share of total tax revenue / Share of total energy consumption)

An RU factor of zero means the sector's share of taxes on energy consumption is proportional to the share of energy it consumes. A factor of less than zero means the sector pays less taxes on energy relative to the amount it consumes, and a factor of greater than zero means the sector pays more taxes relative to the amount it consumes. If all sectors paid taxes on consumption proportional to what they consume the gold line would be horizontal at zero across the x-axis. Figure 1-23 shows that the road transport sectors, rail transport and non-EIIs are the only sectors paying taxes that are proportionally higher than the energy they consume, whereas EIIs and agriculture pay the least relative to what they consume. Agriculture, construction and services are all paying less taxes relative to what they consume compared to 2008. Conversely, residential is paying more proportionate taxes. Non-EIIs used to pay much lower taxes relative to their consumption, now they pay a little more relative to their use.

[25] The 'Change' column is the 2018 value minus the 2008 value. The '%Total Change' column is the 'Change' value for the charge divided by the total change.

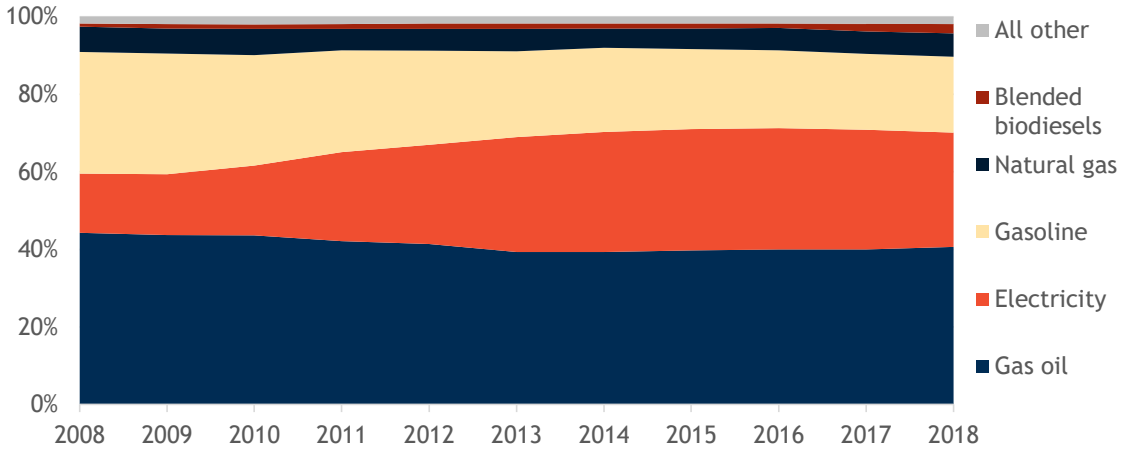
Figure 1-23 Revenue/Use factors by sector for the EU27 (2018)



Tax revenues by fuel

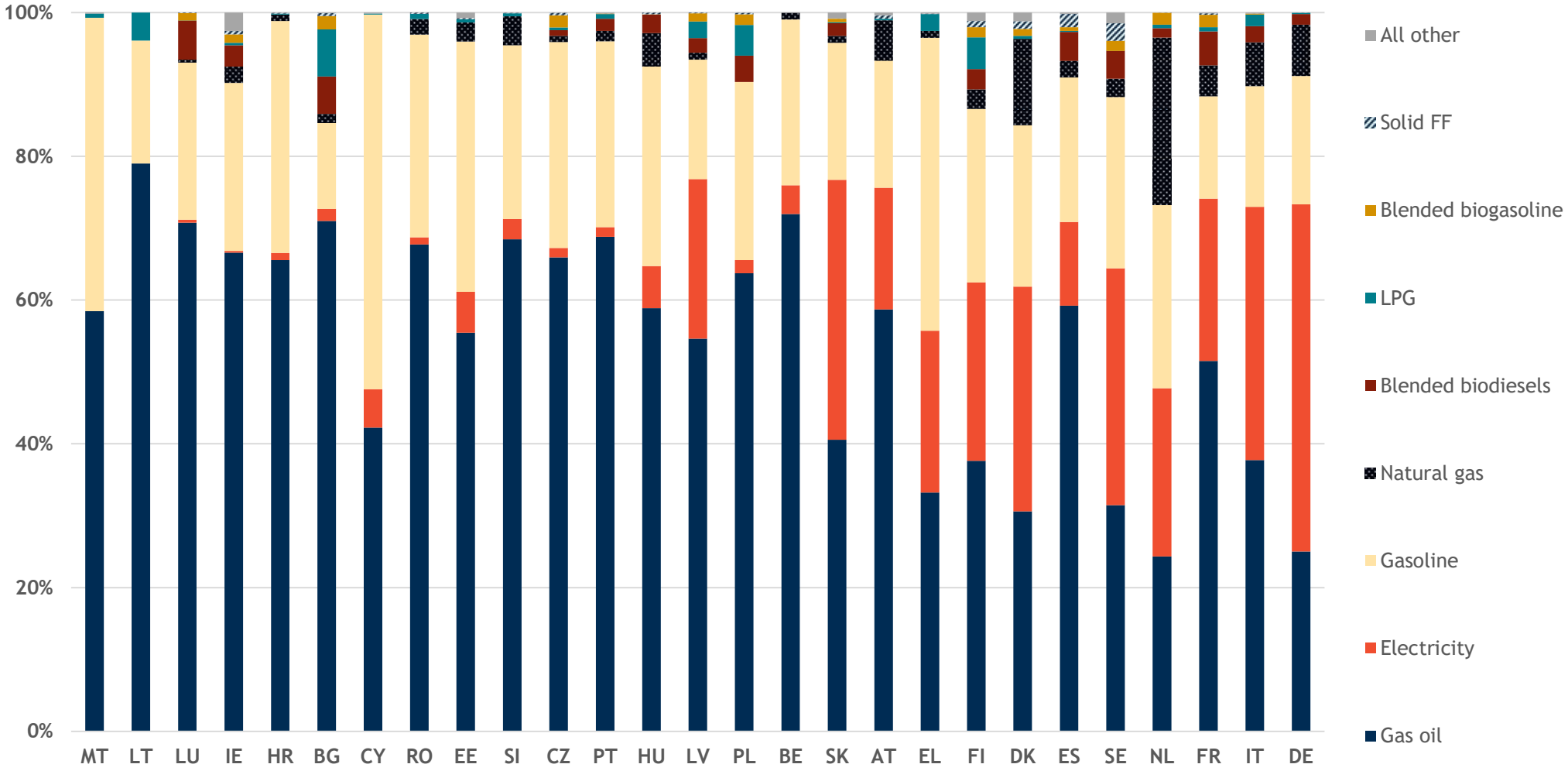
Taxes on gas oil (diesel) account for the largest share of tax revenues in 2018 (41%), as they did in 2008 (Figure 1-24). Electricity accounts for 30% of tax revenues in 2018, up 15 percentage points since 2008, while the gasoline share has decreased from 30% to 20%, corresponding to a 20% drop in gasoline use. The share of revenues from blended biodiesels increased three-fold to 2% since 2008, while the share of revenues from natural gas slightly decreased.

Figure 1-24 Share of tax revenues by fuel in the EU27, 2008-2018



Tax revenues by fuel type widely range across MS. In Spain, 57% of tax revenues come from gas oil (diesel), about 2.5 times that of Germany and the Netherlands. Electricity accounts for 45% of revenue in Germany, but half that in France, and 35% in Italy (Figure 1-25). Natural gas tax revenues add up to 23% of total in the Netherlands, which is about equal to combined natural gas shares in Germany, France, Italy and Spain.

Figure 1-25 Share of tax revenues by fuel in the EU27 (2018)[26]

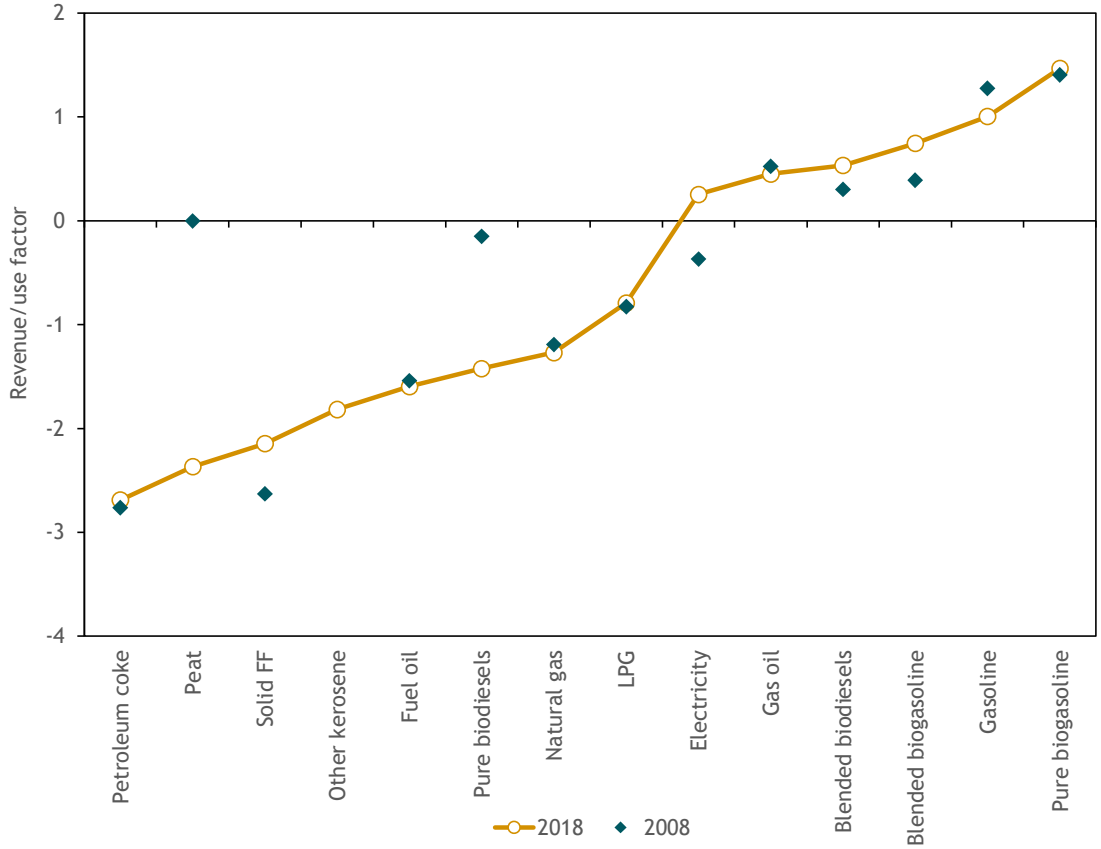


[26] EU MS are sorted from lowest to highest share of revenue from electricity.

In 2018, the least taxes were paid on coke, and solid fossil fuels relative to the share of total energy consumption accounted for by these fuels in the EU27[27]. Conversely, the amount of tax revenues paid on gasoline and other fuels used mainly for road transport were highest relative to their consumption shares (with the exception of pure biodiesel). Solid fossil fuels (i.e., coal) account for 2.5% of energy consumption and 0.3% of tax revenue while gasoline accounts for 7% of total energy consumption and 20% of revenues.

Figure 1-26 shows revenue/use ('RU') factors by fuel in the EU27. Tax revenues on fuels with RU factors of less than zero are disproportionally lower than their shares of energy use. Solid fossil fuels are the only fuels where tax revenues are noticeably more proportionate than they were in 2008, whereas the share of tax revenues on pure biodiesel is noticeably lower relative its energy use share in 2008. Fuels used for road transport (with the exception of biodiesel), in addition to electricity, are the only fuels where the share of tax revenues exceeds the share of energy use. Overall, taxes on fuels with RU factors of greater than zero accounted for 58% of total energy consumption in 2018 and 93% of total revenue.

Figure 1-26 Revenue/use factors by fuel for the EU27 (2018)



[27] As well as peat, but very few countries tax this fuel.

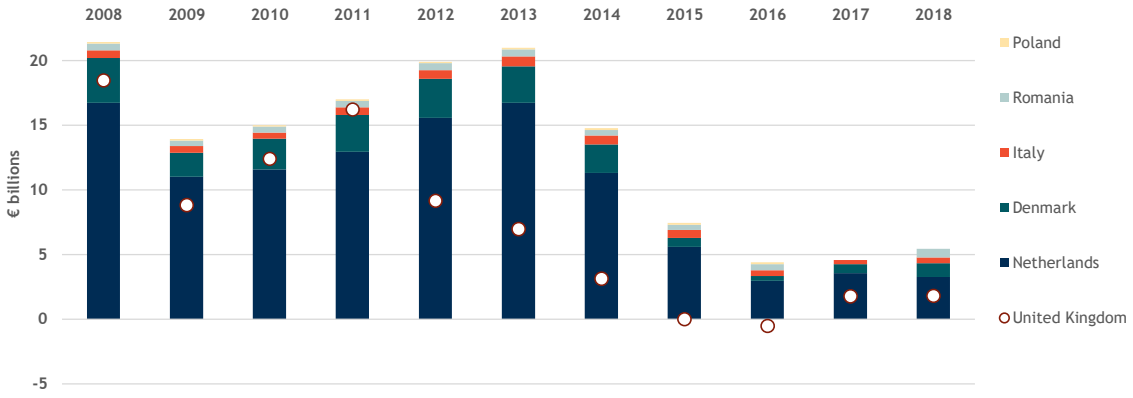
1.3 Taxes on energy production and infrastructure in the EU27

Data from MS and UK national reports was used to estimate taxes on energy production, and Eurostat data was used to estimate taxes on energy infrastructure.

Total revenues from taxes on production equalled 2% of taxes on energy use in the EU27 in 2018, as did total taxes on infrastructure.

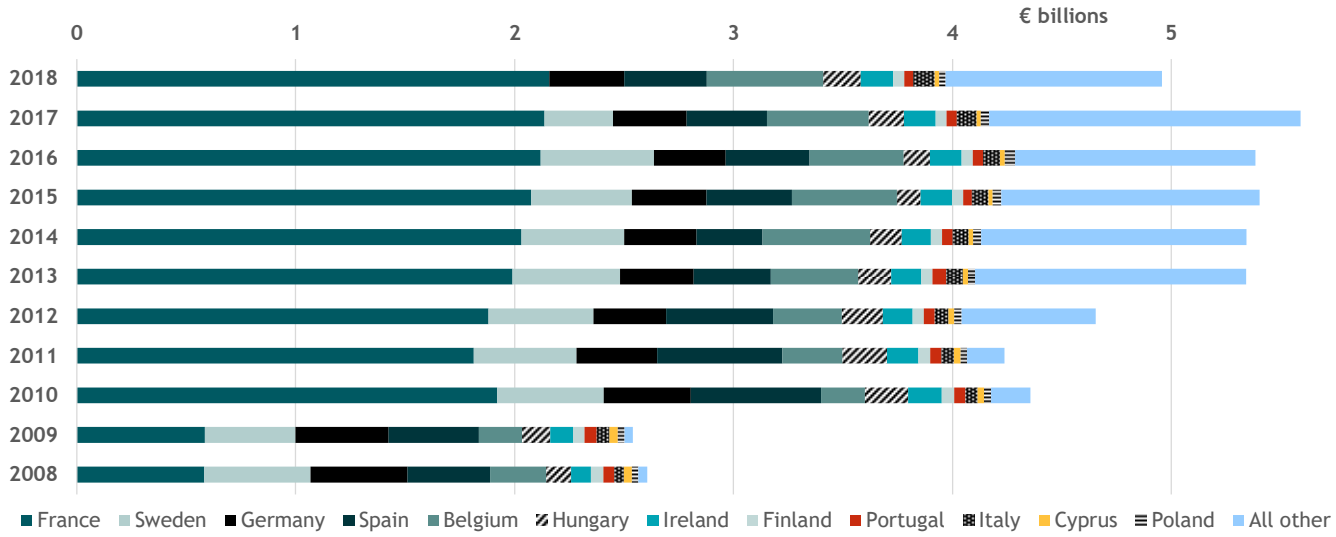
Taxes on energy production analysed for this study include taxes on producers of fossil fuels (oil, natural gas, coal, and other) in the EU27 in the Netherlands, Denmark, Italy, Romania, Poland and Germany, as well as the United Kingdom. Revenues from taxes on production fell from EUR 21 billion in 2008 to EUR 5 billion in 2018. The Netherlands accounted for 80% of revenue in 2008, and 60% in 2018. 80% of revenue in 2008 was from taxes on natural gas production (in the Netherlands), again falling to 60% (also entirely from the Netherlands) in 2018.

Figure 1-27 Revenues from taxes on energy production in the EU27, 2008-2018



Taxes on energy infrastructure are largely electricity network charges and petroleum reserve levies and fees. Revenues from such charges in the EU27 doubled to EUR 5 billion between 2008 and 2018. France is the country with the highest revenues from taxes on infrastructure; these are comprised of electricity network charges.

Figure 1-28 Revenues from taxes on energy infrastructure in the EU27, 2008-2018



1.4 Taxes on energy consumption in G20 countries

The approach to estimating taxes on energy use in G20 countries was the same as for the EU27. The data quality issues encountered in reviewing EU27 data (noted in section 1.2.2) also apply to data from G20 countries, although in many cases the data challenges were greater. This is why reporting on taxes in G20 countries is limited to 11 nations and focuses on the passenger road transport sector and specific countries (Japan and Canada).

This analysis first focuses on taxes on energy used for the passenger road transport sector. The analysis includes data on 11 G20 countries for which the core team was able to acquire quality data from country experts. This subset includes:

1. Argentina;
2. Australia;
3. Canada;
4. Indonesia;
5. India;
6. Japan;
7. South Africa;
8. South Korea;
9. Turkey;
10. United Kingdom;
11. United States.

EU MS who are also G20 members were not included in the G20 analysis, specifically Germany, France and Italy.

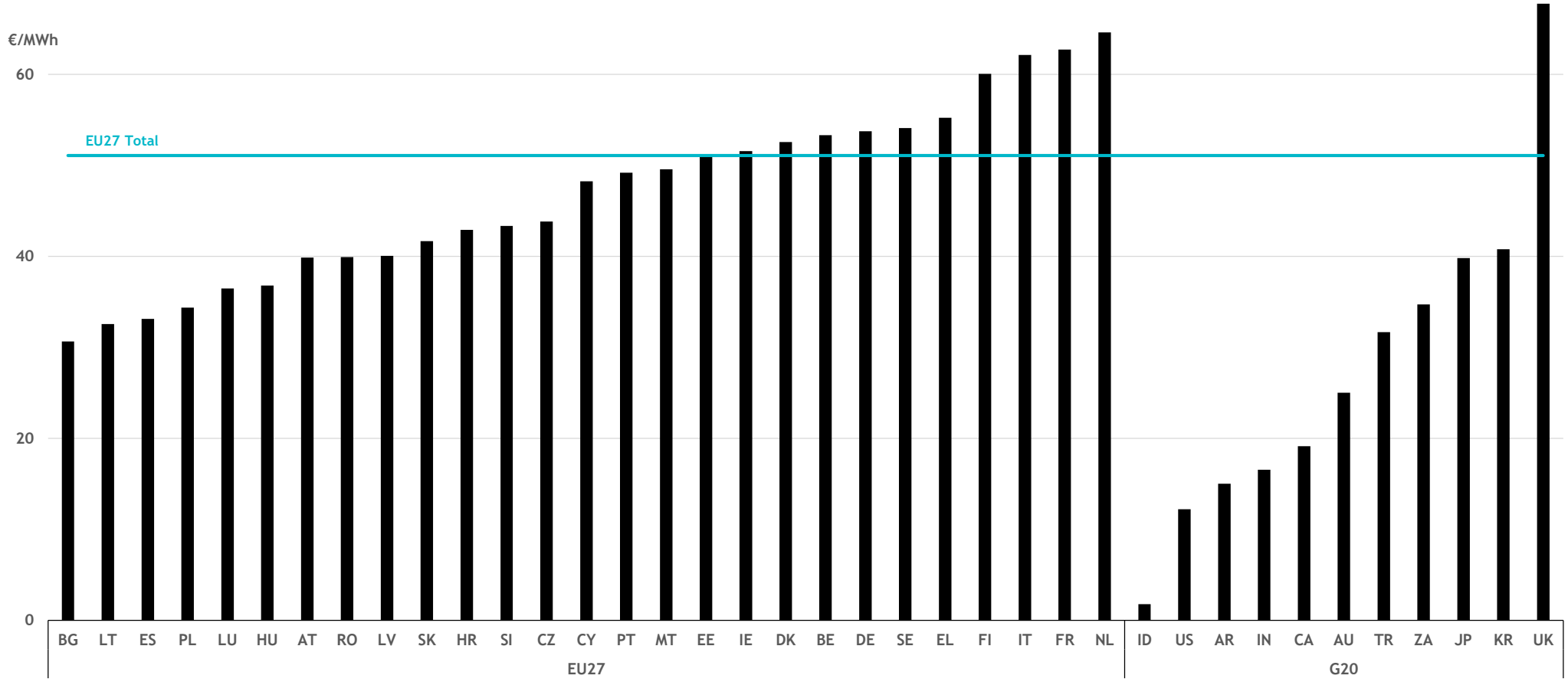
Next, we provide more detailed 'snapshots' of energy taxes in Japan and Canada. Country experts and the core team were able to acquire reasonably comprehensive tax data for both these G20 nations. The snapshots include comparisons to the EU27.

Passenger road transport sector

Total tax rates on passenger road transport within the G20 subset are, on average, half that in the EU27, and vary far more; the coefficient of variation[28] in the G20 subset is 62%, whereas in the EU27 it is 21%. The US tax rate[29] is 40% that of the lowest EU MS tax rate (Bulgaria) and a quarter of the total EU27 rate. The rate in Japan is 22% lower than the EU27 total and equivalent to the rates in Austria, Romania, and Latvia (Figure 1-29).

[28] The coefficient of variation indicates the dispersion of data around the average. It is calculated as the ratio of the standard deviation to the average.
[29] The US tax rate includes all federal and state taxes.

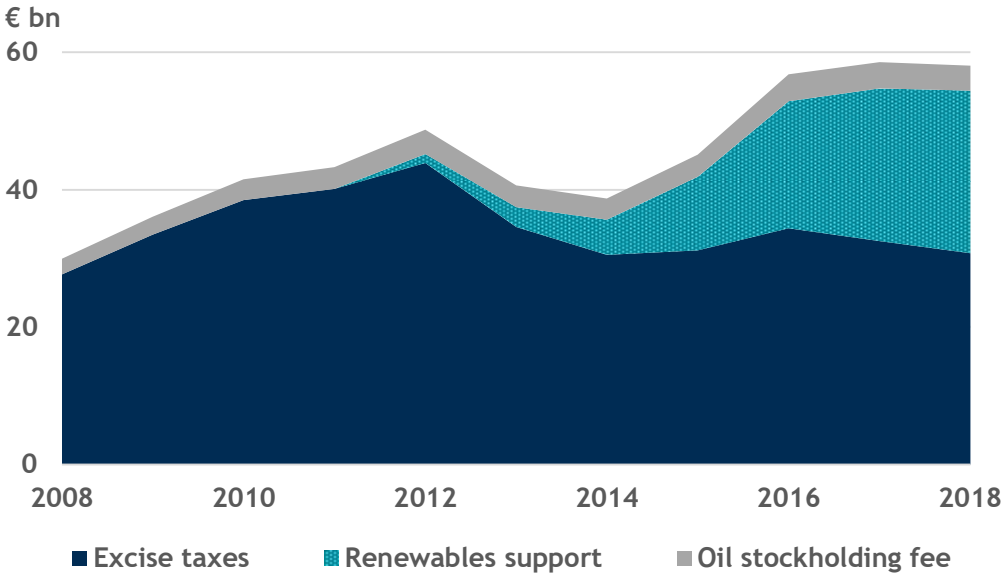
Figure 1-29 Total tax rates on the road-transport-passenger sector in the EU27 and in 10 G20 countries (2018)



Japan

Revenues from taxes on energy in Japan nearly doubled between 2008 and 2018 to EUR 58 billion; 84% of the growth was from renewables support charges. In 2018, 94% of revenues were from taxes on energy consumption (53% from excise taxes and 41% from renewables support) (Figure 1-30)[30]. Revenues from taxes on consumption equalled 1.3% of GDP in 2018, which is a third less than the total EU27 level and comparable to that of Spain and Austria.

Figure 1-30 Energy tax revenues in Japan by tax type, 2008-2018



The total tax rate on energy consumption grew from EUR 11/MWh to EUR 16/MWh between 2008 and 2018 (Figure 1-31); the 2018 rate is 64% of the EU27 total tax rate on energy use and comparable to that of Latvia and Estonia. Tax rates for renewables support grew at 64% per year (CAGR) between the first year it was reported in 2012, and 2018, while excise tax rates declined at a rate of 5% per year during the same period (CAGR).

Figure 1-31 Tax rates in Japan by tax type, 2008-2018 (€/MWh)

Tax type	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Excise taxes	11.0	13.5	15.2	16.3	17.9	14.1	12.8	13.2	14.7	13.9	13.3
Renewables support	NA	NA	NA	NA	1.1	2.5	4.5	9.8	17.0	20.1	21.6
Total tax rate on consumption	**11.0**	**13.5**	**15.2**	**16.3**	**12.5**	**10.4**	**10.1**	**12.1**	**15.4**	**15.9**	**16.0**
Oil stockholding fee	1.0	1.2	1.4	1.5	1.6	1.5	1.5	1.6	1.9	1.9	1.8
Total tax rate	**8.8**	**11.0**	**12.3**	**13.0**	**14.7**	**12.3**	**12.0**	**14.3**	**18.1**	**18.5**	**18.6**

Industry in Japan pays a greater share of taxes on energy consumption than does industry in the EU27, and the road transport sectors pays less (Figure 1-32). Tax revenues from EIIs in Japan are 8.0% of total revenues, compared to 4.6% in the EU27. Non-EIIs in Japan pay 14.0%, whereas they pay 4.3% in the EU27. In total, the trans-road-freight and trans-road-passenger sectors account for half the revenue from taxes on energy use in Japan, versus 60% in the EU27.

Tax rates on EIIs in Japan are twice those of the EU27 (EUR 12/MWh versus EUR 6/MWh), but tax rates on non-EIIs are a third lower (EUR 12/MWh versus EUR 18/MWh). The difference in revenue shares is

[30] Excluding revenues from VAT and taxes on motor vehicle registration.

also driven by differences in where energy is used in Japan versus the EU27. EIIs use the most energy in Japan, whereas the residential sector uses the most in the EU27. The shares of energy used by EIIs is comparable, but non-EIIs use 14% of energy in Japan, versus 8% in the EU27 (Figure 1-33).

Figure 1-32 Share of total revenue from taxes on energy use in Japan vs. the EU27 (2018)

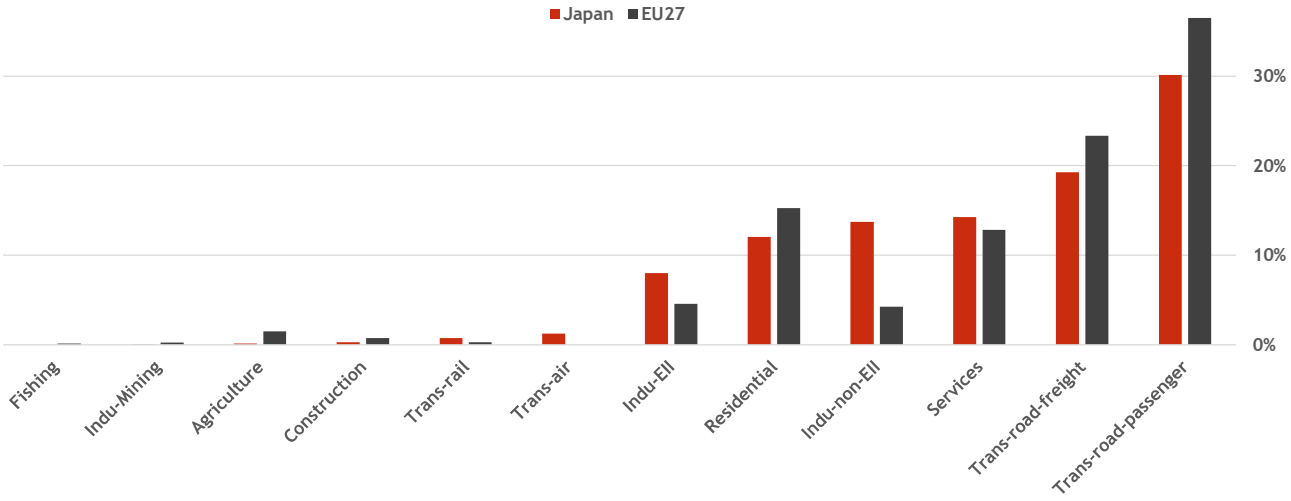


Figure 1-33 Share of energy use volumes in Japan vs. the EU27 (2018)[31]

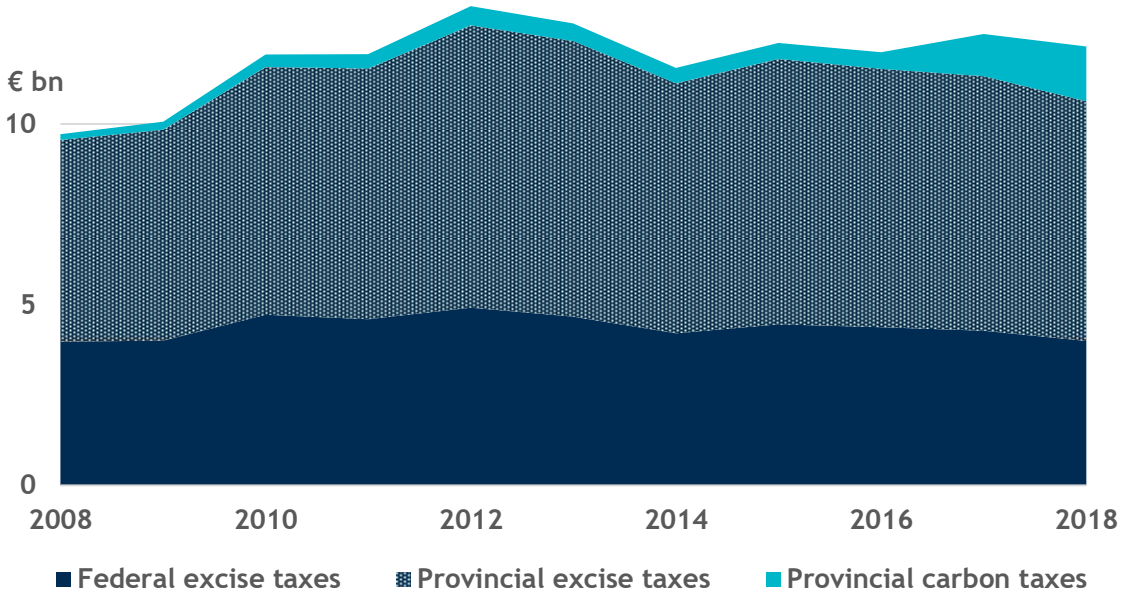
Sector	Japan	EU27	Absolute difference (Japan - EU27)
Indu-Mining	0.1%	0.4%	-0.3%
Fishing	0.5%	0.1%	0.4%
Trans-rail	0.6%	0.6%	0.0%
Construction	0.7%	1.0%	-0.2%
Trans-water	0.9%	0.5%	0.5%
Trans-air	1.6%	0.7%	0.9%
Agriculture	1.8%	3.0%	-1.1%
Trans-road-freight	12.7%	11.3%	1.4%
Indu-non-EII	13.8%	5.8%	8.1%
Residential	14.5%	26.6%	-12.2%
Services	16.3%	14.6%	1.7%
Trans-road-passenger	16.4%	17.8%	-1.4%
Indu-EII	19.9%	17.7%	2.2%

[31] Sources: Enerdata (Japan) and Eurostat (EU27).

Canada

Revenues from taxes on energy in Canada nearly grew by a fifth between 2008 and 2018 to EUR 12 billion; 56% of the growth was from provincial carbon taxes. In 2018, 100% of revenues were from taxes on energy consumption (55% from federal excise taxes, 33% from renewables support charges and 13% from provincial carbon taxes) (Figure 1-34)[32]. Revenues from energy taxes on consumption equalled 1.0% of GDP in 2018, which is half the total EU27 level, and comparable to the lowest levels among MS (between Ireland and Malta).

Figure 1-34 Energy tax revenues in Canada by tax type, 2008-2018



The total tax rate on energy consumption grew from EUR 12/MWh to EUR 14/MWh between 2008 and 2018 (Figure 1-35); the 2018 rate is 55% of the EU27 average tax rate on energy use and comparable to that of Croatia. Provincial carbon taxes grew at 25% per year (CAGR) between 2008 and 2018, while federal excise tax rates declined at a rate of -1% per year and provincial excise tax rates grew by 1% per year (CAGR).

Figure 1-35 Tax rates in Canada by tax type, 2008-2018 (€/MWh)

Tax	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Federal excise taxes	5.7	5.9	6.6	6.3	6.6	6.1	5.6	5.9	5.7	5.6	5.2
Provincial excise taxes	8.6	9.1	10.2	10.2	11.3	10.8	9.9	10.6	10.3	10.1	9.5
Provincial carbon taxes	0.2	0.3	0.4	0.5	0.6	0.6	0.5	0.5	0.6	1.4	1.8
Total tax rate	**11.6**	**12.5**	**14.2**	**13.9**	**15.4**	**14.7**	**13.4**	**14.2**	**13.9**	**14.4**	**13.8**

The road transport sectors in Canada account for nearly all energy tax revenues (91%) versus 60% in the EU27 (Figure 1-32). In total, industry[33] accounts for 1% of tax revenue in Canada versus 9% in the EU27.

Tax rates on the road transport sectors are much lower in Canada than in the EU27 (Figure 1-26), therefore variance in tax rates on road transport does not explain the difference in revenue shares noted above. But the road transport sectors in Canada use half of total energy, versus 29% in the EU27

[32] Excluding revenues from VAT.
[33] Including EIIs, non-EIIs and mining.

(Figure 1-33). The mining industry is more important in Canada, whereas the share of energy used by EIIs is 7% versus 18% in the EU27, and the share of energy used by homes is three times lower.

Figure 1-36 Share of total revenue from taxes on energy use in Canada vs. the EU27 (2018)

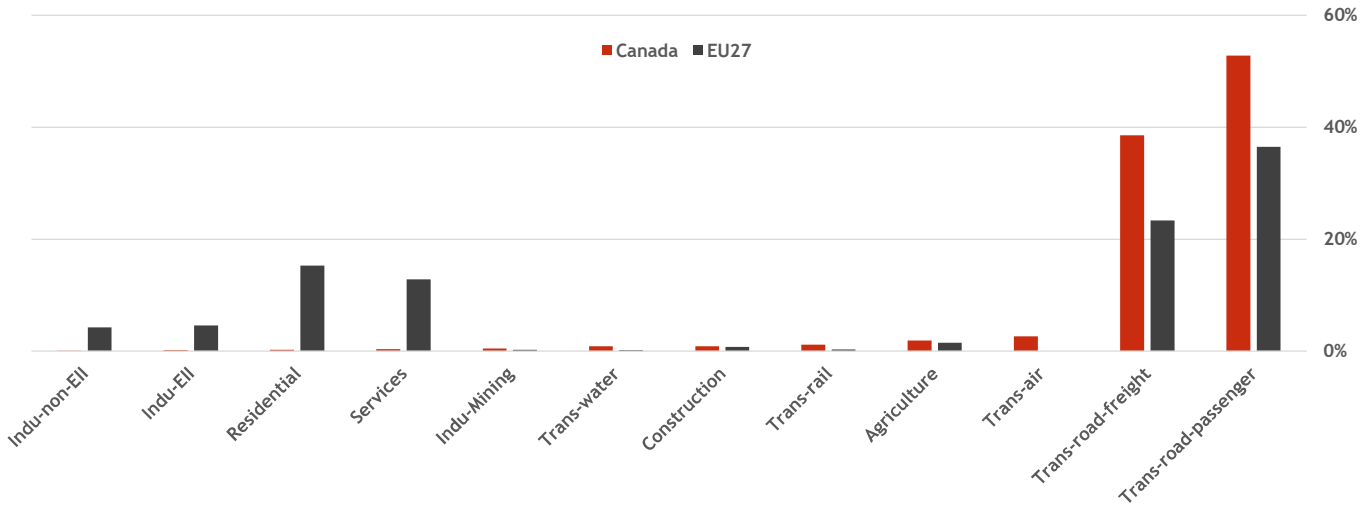


Figure 1-37 Share of energy use volumes in Canada vs. the EU27 (2018)[34]

Sector	Canada	EU27	Absolute difference (Canada - EU27)
Indu-Mining	1.5%	0.4%	1.1%
Trans-water	1.6%	0.5%	1.2%
Trans-rail	2.1%	0.6%	1.5%
Construction	2.3%	1.0%	1.3%
Indu-non-EII	5.2%	5.8%	-0.6%
Trans-air	5.6%	0.7%	4.9%
Agriculture	5.8%	3.0%	2.8%
Indu-EII	7.4%	17.7%	-10.3%
Services	7.9%	14.6%	-6.7%
Residential	9.1%	26.6%	-17.5%
Trans-road-freight	23.9%	11.3%	12.6%
Trans-road-passenger	27.5%	17.8%	9.7%

[34] Sources: Enerdata (Canada) and Eurostat (EU27).

2 Conclusion

Tax rates on energy consumption increased in the EU27 by 29% between 2008 and 2018 in real terms; during this time tax rates became more differentiated across sectors. The road transport sectors (passenger and freight) are taxed at the highest rates, and energy-intensive industry ('EIIs') are taxed at the lowest rates. EIIs also have far lower tax rates than non-EIIs.

Tax rates considerably vary across EU MS, ranging from EUR 9/MWh (Hungary) to EUR 34/MWh (Germany) in total. Tax rates on industry range from nearly zero to EUR 41/MWh. Within five of the largest EU economies (Germany, France, Italy, Spain and the Netherlands), total tax rates on electricity range from EUR 7/MWh (Spain) to EUR 77/MWh (Germany).

Three-quarters of revenues in the EU27 were from excise taxes in 2018, and 20% were from renewables support charges. Additional support for renewables accounted for EUR 40 billion, or 80% of the EUR 50 billion in additional revenue in 2018 relative to 2008.

Most tax revenues are paid by the road transport sectors, and the share of taxes they pay is disproportionally high compared to the shares of energy these sectors consume. Conversely, EIIs pay the least taxes relative to the shares of energy they consume.

Revenues from taxes on energy production in the EU27 fell from EUR 21 billion in 2008 to EUR 5 billion in 2018, while taxes on infrastructure doubled to EUR 5. Total taxes on production equal 2% of taxes on energy use in 2018, as do total taxes on infrastructure.

Total tax rates on passenger road transport within 11 G20 countries (including the UK, but excluding DE, FR and IT) are, on average, half that in the EU27. The US tax rate is 40% that of the lowest EU MS tax rate (Bulgaria) and a quarter of the total EU27 rate. The rate in Japan is 20% lower than the EU27 total and equivalent to the rates in Austria, Romania, and Latvia.

Tax rates on EIIs in Japan are twice that of the EU27 (EUR 12/MWh versus EUR 6/MWh), but tax rates on non-EIIs are a third lower (EUR 12/MWh versus EUR 18/MWh).

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