Europe Electrification Tracker Methodology

This document covers the methodology for Ember's Europe Electrification Tracker.

If you notice any issues or have any suggestions, comments or questions, please contact the author at leonard@ember-energy.org.

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Objective

As economies globally, and in Europe in particular, move away from fossil technologies to power their everyday lives, electricity makes up an increasing share of total energy consumption. The progress of electrification is usually measured using the so-called 'electrification rate', which is the percentage share of electricity in total energy consumption for the entire economy or its respective sub-sectors. The basis for this calculation is called the energy balance, which is Eurostat's annual accounting of energy flows and consumption. For reference about the construction of energy balances and especially aggregation of fuels and sector groups we suggest consulting Eurostat's Energy balance guide. Another useful resource is the International Recommendations for Energy Statistics (IRES).

However, Eurostat's energy balances are lagged by at least 16 months, meaning that the energy balances for 2025 will be published in April 2027 at the earliest. One of the gaps this data tool and dataset seeks to bridge is publishing a robust estimate of final energy consumption before Eurostat's official energy balance publication.
This is achieved by using what are called commodity balances. These are submitted for each of the energy balance fuel groups: solid fossil fuels (SFF), oil, gas, electricity, heat and renewables. Some of them, most importantly SFF and oil, are submitted in physical units, instead of energy contents. One challenge is to transform them into energy units. Another one is that the commodity balances are not immediately reported with all sub-sectors (meaning a country will only report the total electricity consumption for the transport sector, but not for rail, road etc. for example). Finally, commodity balance data quality is significantly less reliable than that of the energy balance. How all of these issues are rectified is explained in this document.

The United Kingdom stopped publishing its data to Eurostat in 2020 and instead publishes the Digest of UK Energy Statistics (DUKES). The format of DUKES has remained broadly consistent with Eurostat's. Throughout this document we will be referring to Eurostat for simplicity. Unless otherwise stated, everything in this methodology applies to DUKES as well.

Data sources

Eurostat

- Complete energy balances (nrg_bal_c)
- Supply, transformation and consumption of solid fossil fuels (nrg_cb_sff)
- Supply, transformation and consumption of gas (nrg_cb_gas)
- Supply, transformation and consumption of oil and petroleum products (nrg_cb_oil)
- Supply, transformation and consumption of renewables and wastes (nrg_cb_rw)
- Supply, transformation and consumption of electricity (nrg_cb_e)
- Supply, transformation and consumption of derived heat (nrg_cb_h)

DUKES

- Digest of UK Energy Statistics (DUKES)
- Digest of UK Energy Statistics (DUKES): calorific values and density of fuels

DUKES has already reported its full energy balance for 2025, meaning data for the UK are not estimated. Some other countries report provisional data ahead of the official Eurostat publication. Examples include the French *Bilan énergétique de la France en 2025 – Données provisoires* from the *Service des données et études statistiques (SDES)* and the German *Schätzbilanz* from the *AG Energiebilanzen*. We have chosen to use these data only as a supplement to Eurostat's commodity balances and not as a replacement thereof since national methodologies might differ from Eurostat.

Data update frequency

The dataset will be updated ad hoc as new data appear. One update will happen as soon as Eurostat publishes the 2025 energy balances. We will then do further updates throughout the year as Eurostat publishes each country's 2026 commodity balance.

Unit conversions

The data tool and corresponding dataset show all values in terawatt hours. One of the challenges this dataset tries to overcome is that commodity balances are not uniformly reported in their energy content units. Commodity balances for derived heat, electricity, renewables and gas are all reported in either gigawatt hours, terajoules or terajoules – gross calorific value. All of these are energy units that can be transformed into TWh using a fixed conversion rate. However, SFF and oil are reported in physical units, specifically thousands of tonnes (THS_T). The actual process to convert these into energy units to construct the complete energy balances is fairly complicated as the energy content of each fuel varies a lot depending on the circumstances. For more details please consult IRES (p. 45). The IRES also provides a table with default calorific values per fuel. Eurostat has something similar in that they have a table with calorific values per country and year.
We have, however, opted to use neither of these as the IRES values are a global average that may differ heavily based on geography. The Eurostat calorific values are useful, but often incomplete and frequently fall back to EU averages and the mapping between sectors is not straightforward.

We have chosen instead to calculate our own proxy calorific values by dividing the reported values in energy units from the complete energy balance by the physical values from last years' commodity balance. We carry forward a three-year rolling average for each combination of country, fuel and sector to estimate this year's fuel-specific calorific value. This is done at sub-fuel level. Aggregate fuels, such as C0000X0350-0370/Coal, are not calculated this way. Instead, their sub-fuels are converted into energy units and then aggregated upwards into the respective parent fuel.

DUKES differs from Eurostat in an important aspect: Commodity balances from DUKES are transformed using gross calorific values, whereas Eurostat uses net calorific values. To maintain comparability between these two sources we are not showing the actual energy balances as reported by DUKES, but use the DUKES commodity balances and transform them into final consumption using net calorific values.

Fuel mapping and aggregation

The fuel mapping from Eurostat follows the Standard International Energy Product Classification (SIEC) as outlined in the IRES (p. 21). We simplify Eurostat's data somewhat as described below. For the purpose of this data tool, we aggregate fuels into three main groups: *'Fossil'*, *'Electricity'* and *'Other'*. These groups are further subdivided into:

- Fossil: Coal, Gas, Oil and Other fossil
- Other: Renewables and Heat

The data tool does not break down *'Other'* into *'Renewables'* and *'Heat'*, but we are including them in the dataset we release alongside the data tool. A table with the exact fuel mapping can be found in Annex I.

Sector mapping and aggregation

The breakdown of final consumption follows Eurostat's Statistical classification of economic activities in the European Community (NACE Rev. 2). We have further aggregated some smaller sub-sectors in order to focus on the most important trends in electrification. Additionally, we have split '*Other sectors'* into '*Buildings'*, which contains *'Commercial and public services'* and *'Households'*, and '*Other sectors'*, which consists of *'Agriculture and forestry'*, *'Fishing'* and *'Unspecified other sectors'*.

Since Eurostat's commodity balances do not provide a breakdown into sub-sectors for the most recent year, we are showing only the parent sector aggregate. We have carried forward the proportional split between '*Other sectors'* and '*Buildings'* from previous years, along with a slight adjustment to account for recent shifts in consumption patterns, since the latter usually account for more than 90% of a country's final consumption in Eurostat's *'Other sectors'* category. '*Other sectors'* as defined by Ember, meaning excluding *'Buildings'*, cannot be explored in the datatool itself, but are part of the data download for the sake of completeness. Since they account for less than 4% of the EU's total energy consumption in 2024 progress in these sectors has a negligible effect on the overall trajectory of electrification and additionally methodological changes can lead to large year-on-year changes in the electrification rate, because their underlying values are very small.

All sectors also report *'non-energy use'* from fossil fuels. We are excluding this from the calculation of the electrification rate as these processes, by definition, cannot be electrified. A table with the sector mapping can be found in Annex II.

DUKES maps some sectors different from Eurostat. '*Fishing'* is included in *'Agriculture and Forestry'*. *'Aviation'*, which Ember maps to *'Other transport'*, includes international aviation as well, whereas Eurostat only includes domestic aviation. We have carried forward the ratio between DUKES and Eurostat from 2019 and applied to all following years.

Data errors

General note: The energy balances are a statistical accounting of energy flows and consumption. We have not made any changes to the raw energy balance data as reported by Eurostat as we believe that they are the best possible representation of each country's energy consumption in any given year. While they are incredibly detailed, they can still fall short of showing actual energy consumption. A frequent issue is methodology updates, which present themselves in a reassignment of sectors. One such example is Sweden's paper, pulp and printing industry, where consumption of electricity fell from 22 TWh in 2013 to 0 TWh in 2014. At the same time, consumption of electricity in what Eurostat calls '*Industry - Not elsewhere specified'* rose by about the same amount. It stands to reason that the paper, pulp and printing industry did not stop consuming electricity at all, but rather that the agency responsible for collecting Swedish energy consumption data chose to assign their consumption in this particular year to a different sector. Since we have no way of disproving the reasoning behind this reassignment, we have taken the conscious decision to not alter the raw data as reported by Eurostat, even if this leads to some unrealistic shifts in year-on-year consumption patterns for certain sub-sectors.

This, however, is not the case with commodity balances. They do have clear and obvious data errors that we have taken steps to rectify. It is possible that we have not caught all errors. If you spot anything else, feel free to reach out to the dataset's maintainer at leonard@ember-energy.org. Annex III has a table with all errors we have identified in the commodity balances for 2025 and the respective fix.

Heat pump and electric vehicle data

The data for electric vehicle registrations, stock and avoided MBO through EV adoption come from Ember's EV Sales Data Tracker.
The data for heat pumps come from the European Heat Pump Association's (EHPA) data platform or their latest press release on heat pump sales and stock. The EHPA does only have data for 18 of the 27 EU members. The EU total is calculated by upscaling the available data by their share of the EU's total production of ambient heat through heat pumps. Avoided gas is calculated by summing the direct gas heating and gas-fired electricity displaced by heat pumps, subtracting the additional gas burned to generate electricity to power those heat pumps, and converting the net savings into billion cubic meters (bcm).

Annex I: SIEC mapping

SIEC	Eurostat name	Ember name	Parent SIEC
TOTAL	Total	Total energy consumption	
C0000X0350-0370	Solid fossil fuels	Coal	TOTAL
C0110	Anthracite		C0000X0350-0370
C0121	Coking coal		C0000X0350-0370
C0129	Other bituminous coal		C0000X0350-0370
C0210	Sub-bituminous coal		C0000X0350-0370
C0220	Lignite		C0000X0350-0370
C0311	Coke oven coke		C0000X0350-0370
C0312	Gas coke		C0000X0350-0370
C0320	Patent fuel		C0000X0350-0370
C0330	Brown coal briquettes		C0000X0350-0370
C0340	Coal tar		C0000X0350-0370
C0350-0370	Manufactured gases	Other fossil	TOTAL
C0350	Coke oven gas		C0350-0370
C0360	Gas works gas		C0350-0370
C0371	Blast furnace gas		C0350-0370
C0379	Other recovered gases		C0350-0370
P1000	Peat and peat products	Other fossil	TOTAL
P1100	Peat		P1000
P1200	Peat products		P1000
S2000	Oil shale and oil sands	Other fossil	TOTAL
G3000	Natural gas	Gas	TOTAL

O4000XBIO	Oil and petroleum products (excluding biofuel portion)	Oil	TOTAL
O4100_TOT	Crude oil		O4000XBIO
O4200	Natural gas liquids		O4000XBIO
O4300	Refinery feedstocks		O4000XBIO
O4400X4410	Additives and oxygenates (excluding biofuel portion)		O4000XBIO
O4500	Other hydrocarbons		O4000XBIO
O4610	Refinery gas		O4000XBIO
O4620	Ethane		O4000XBIO
O4630	Liquefied petroleum gases		O4000XBIO
O4640	Naphtha		O4000XBIO
O4651	Aviation gasoline		O4000XBIO
O4652XR5210B	Motor gasoline (excluding biofuel portion)		O4000XBIO
O4653	Gasoline-type jet fuel		O4000XBIO
O4661XR5230B	Kerosene-type jet fuel (excluding biofuel portion)		O4000XBIO
O4669	Other kerosene		O4000XBIO
O4671XR5220B	Gas oil and diesel oil (excluding biofuel portion)		O4000XBIO
O4680	Fuel oil		O4000XBIO
O4691	White spirit and special boiling point industrial spirits		O4000XBIO
O4692	Lubricants		O4000XBIO
O4693	Paraffin waxes		O4000XBIO

O4694	Petroleum coke		O4000XBIO
O4695	Bitumen		O4000XBIO
O4699	Other oil products n.e.c.		O4000XBIO
RA000	Renewables and biofuels	Renewables	TOTAL
RA100	Hydro		RA000
RA200	Geothermal		RA000
RA300	Wind		RA000
RA410	Solar thermal		RA000
RA420	Solar photovoltaic		RA000
RA500	Tide, wave, ocean		RA000
RA600	Ambient heat (heat pumps)		RA000
R5110-5150_W6000RI	Primary solid biofuels		RA000
R5160	Charcoal		RA000
R5210B	Blended biogasoline		RA000
R5210P	Pure biogasoline		RA000
R5220B	Blended biodiesels		RA000
R5220P	Pure biodiesels		RA000
R5230B	Blended bio jet kerosene		RA000
R5230P	Pure bio jet kerosene		RA000
R5290	Other liquid biofuels		RA000
R5300	Biogases		RA000
W6210	Renewable municipal waste		RA000
W6100_6220	Non-renewable waste	Other fossil	TOTAL
W6100	Industrial waste (non-renewable)		W6100_6220

W6220	Non-renewable municipal waste		W6100_6220
E7000	Electricity	Electricity	TOTAL
H8000	Heat	Heat	TOTAL

Annex II: Sector mapping

Eurostat code	Eurostat name	Ember name	Eurostat parent	Ember parent
FC_E	Final consumption - energy use	All sectors		
FC_IND_E	Final consumption - industry sector - energy use	Industry	FC_E	All sectors
FC_TRA_E	Final consumption - transport sector - energy use	Transport	FC_E	All sectors
FC_OTH_E	Final consumption - other sectors - energy use	Split into buildings and other sectors	FC_E	All sectors
FC_IND_CON_E	Final consumption - industry sector - construction - energy use	Construction	FC_IND_E	Industry
FC_IND_CPC_E	Final consumption - industry sector - chemical and petrochemical - energy use	Chemical and petrochemical	FC_IND_E	Industry
FC_IND_FBT_E	Final consumption - industry sector - food, beverages and tobacco - energy use	Food, beverages and tobacco	FC_IND_E	Industry
FC_IND_IS_E	Final consumption - industry sector - iron and steel - energy use	Iron and steel	FC_IND_E	Industry
FC_IND_MAC_E	Final consumption - industry sector - machinery - energy use	Machinery	FC_IND_E	Industry
FC_IND_MQ_E	Final consumption - industry sector - mining and quarrying - energy use	Other industry	FC_IND_E	Industry

FC_IND_NFM_E	Final consumption - industry sector - non-ferrous metals - energy use	Other industry	FC_IND_E	Industry
FC_IND_NMM_E	Final consumption - industry sector - non-metallic minerals - energy use	Non-metallic minerals	FC_IND_E	Industry
FC_IND_PPP_E	Final consumption - industry sector - paper, pulp and printing - energy use	Paper, pulp and printing	FC_IND_E	Industry
FC_IND_TE_E	Final consumption - industry sector - transport equipment - energy use	Other industry	FC_IND_E	Industry
FC_IND_TL_E	Final consumption - industry sector - textile and leather - energy use	Other industry	FC_IND_E	Industry
FC_IND_WP_E	Final consumption - industry sector - wood and wood products - energy use	Other industry	FC_IND_E	Industry
FC_IND_NSP_E	Final consumption - industry sector - not elsewhere specified - energy use	Other industry	FC_IND_E	Industry
FC_OTH_AF_E	Final consumption - other sectors - agriculture and forestry - energy use	Agriculture and forestry	FC_OTH_E	Other sectors
FC_OTH_CP_E	Final consumption - other sectors - commercial and public services - energy use	Commercial and public services	FC_OTH_E	Buildings
FC_OTH_FISH_E	Final consumption - other sectors - fishing - energy use	Fishing	FC_OTH_E	Other sectors
FC_OTH_HH_E	Final consumption - other sectors - households - energy use	Households	FC_OTH_E	Buildings

FC_OTH_NSP_E	Final consumption - other sectors - not elsewhere specified - energy use	Unspecified other sectors	FC_OTH_E	Other sectors
FC_TRA_DAVI_E	Final consumption - transport sector - domestic aviation - energy use	Other transport	FC_TRA_E	Transport
FC_TRA_DNAVI_E	Final consumption - transport sector - domestic navigation - energy use	Other transport	FC_TRA_E	Transport
FC_TRA_PIPE_E	Final consumption - transport sector - pipeline transport - energy use	Other transport	FC_TRA_E	Transport
FC_TRA_RAIL_E	Final consumption - transport sector - rail - energy use	Rail	FC_TRA_E	Transport
FC_TRA_ROAD_E	Final consumption - transport sector - road - energy use	Road	FC_TRA_E	Transport
FC_TRA_NSP_E	Final consumption - transport sector - not elsewhere specified - energy use	Other transport	FC_TRA_E	Transport

Annex III: Commodity balance 2025 data errors

Country	Fuel	Sectors	Error description	Replacement data
Austria	Renewables	Industry, Other sectors	2025 value identical to 2024	2024 value carried forward
Belgium	Coal	Industry, Transport	2025 value identical to 2024	2024 value carried forward
Croatia	Renewables	Industry	2025 value not reported	2024 value carried forward
Cyprus	Electricity	Industry, Other sectors, Transport	Consumption allocated to the wrong sector	Re-allocated across sectors using 2024 shares
Estonia	Electricity	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Estonia	Gas	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Estonia	Heat	Industry, Other sectors	2025 value not reported	Estimated from 2024, adjusted for heating demand
Estonia	Renewables	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward with EU-average growth. 2024 value carried forward
France	Oil	Industry, Other sectors, Transport	2025 value not reported	Replaced with SDES provisional data
France	Renewables	Industry, Other sectors, Transport	2025 value not reported	Replaced with SDES provisional data

Germany	Electricity	Industry	2024 and 2025 not calculated on the same basis	Aligned with 2024 baseline
Germany	Gas	Industry, Other sectors, Transport	Implausibly large year-on-year change	Replaced with AG Energiebilanzen provisional data
Germany	Oil	Industry, Other sectors, Transport	2025 value not reported. Implausibly large year-on-year change. 2025 value identical to 2024 (not updated by source). Reported figure includes international aviation (not comparable with 2024)	Replaced with AG Energiebilanzen provisional data
Germany	Renewables	Industry, Other sectors, Transport	2025 value not reported. Consumption allocated to the wrong sector. Implausibly large year-on-year change	Replaced with AG Energiebilanzen provisional data
Greece	Electricity	Industry	Implausibly large year-on-year change	Estimated from monthly Eurostat data
Greece	Gas	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Hungary	Electricity	Industry, Other sectors, Transport	2024 and 2025 not calculated on the same basis. 2025 value not reported	Aligned with 2024 baseline. Estimated from 2024 trend
Hungary	Gas	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Hungary	Oil	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward
Hungary	Coal	Industry, Other sectors	2025 value not reported. Incorrect energy conversion factor	2024 value carried forward. Conversion factor to be corrected
Hungary	Heat	Industry, Other sectors	2025 value not reported	Estimated from 2024, adjusted for heating demand

Hungary	Renewables	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward with EU-average growth
Ireland	Electricity	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Ireland	Gas	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward
Ireland	Oil	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Ireland	Coal	Industry, Other sectors	2025 value not reported	Estimated from monthly Eurostat data
Ireland	Renewables	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward with EU-average growth. 2024 value carried forward. Reported value kept. Estimated from monthly Eurostat data
Lithuania	Electricity	Industry, Other sectors, Transport	Consumption allocated to the wrong sector	Re-allocated across sectors using 2024 shares
Lithuania	Gas	Industry, Other sectors, Transport	Consumption allocated to the wrong sector	Re-allocated across sectors using 2024 shares
Lithuania	Oil	Industry, Other sectors, Transport	2025 value not reported. Consumption counted twice across sectors. 2025 value identical to 2024 (not updated by source)	Re-allocated across sectors using 2024 shares. 2024 value carried forward. Reported value kept
Lithuania	Coal	Industry, Other sectors	2025 value not reported. Consumption counted twice across sectors	2024 value carried forward. Re-allocated across sectors using 2024 shares. Reported value kept

Lithuania	Heat	Industry, Other sectors	Consumption allocated to the wrong sector	Re-allocated across sectors using 2024 shares
Lithuania	Renewables	Industry, Other sectors, Transport	Consumption allocated to the wrong sector. 2025 value not reported. Implausibly large year-on-year change	Re-allocated across sectors using 2024 shares. 2024 value carried forward. Reported value kept, flagged for verification
Netherlands	Electricity	Industry	2024 and 2025 not calculated on the same basis	To be aligned with the 2024 basis
Netherlands	Oil	Industry, Transport	Reported figure includes international aviation (not comparable with 2024). 2025 value not reported	Reported value kept, flagged for verification. Reported value kept. Corrected to domestic aviation only
Netherlands	Heat	Industry	2024 and 2025 not calculated on the same basis. Implausibly large year-on-year change	To be aligned with the 2024 basis. Estimated from 2024, adjusted for heating demand
Poland	Coal	Other sectors	2025 value identical to 2024 (not updated by source). 2025 value not reported	2024 value carried forward (correction pending). Reported value kept
Portugal	Heat	Other sectors	Large year-on-year change	Estimated from 2024, adjusted for heating demand
Portugal	Renewables	Other sectors	Large year-on-year change	2024 value carried forward with EU-average growth
Romania	Coal	Industry, Other sectors	2025 value not reported	2024 value carried forward
Slovakia	Electricity	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Slovakia	Gas	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Slovakia	Oil	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward

Slovakia	Coal	Industry, Other sectors	2025 value not reported. Incorrect energy conversion factor	2024 value carried forward. Conversion factor to be corrected
Slovakia	Heat	Industry, Other sectors	2025 value not reported	Estimated from 2024, adjusted for heating demand
Slovakia	Renewables	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward with EU-average growth. 2024 value carried forward. No correction applied (not material)
Slovakia	Other fossil	Industry, Other sectors	2025 value not reported	2024 value carried forward. No correction applied (not material)
Slovenia	Gas	Industry, Other sectors, Transport	2025 value not reported	Estimated from monthly Eurostat data
Slovenia	Oil	Industry, Other sectors, Transport	2025 value not reported	2024 value carried forward
Slovenia	Coal	Industry, Other sectors	2025 value not reported	Reported value kept. 2024 value carried forward
Slovenia	Renewables	Transport	2025 value not reported	2024 value carried forward
Spain	Gas	Industry	2024 and 2025 not calculated on the same basis	To be aligned with the 2024 basis
Sweden	Gas	Industry	Implausibly large year-on-year change	2024 value carried forward
Sweden	Oil	Industry, Other sectors, Transport	2025 value identical to 2024 (not updated by source). Reported figure includes international aviation (not comparable with 2024)	2024 value carried forward. Reported value kept. Corrected to domestic aviation only
Sweden	Coal	Industry	2025 value not reported	2024 value carried forward
Sweden	Heat	Industry	Implausibly large year-on-year change	Estimated from 2024, adjusted for heating demand