

European Residual Mixes

Results of the calculation of Residual Mixes for the calendar year 2018

Version 1.2, 2019-07-11

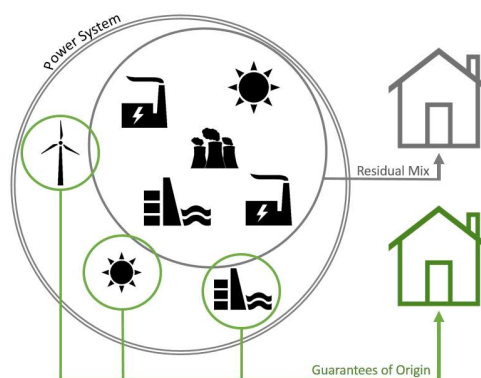
Introduction

Consumers have their say on how electricity is generated via the freedom to select the supplier and sometimes power product. For consumers to be able to make informed choices, electricity suppliers must disclose the origin and environmental attributes of sold electricity (IEM Directive 2009/72/EC, Art. 3(9)). This is called electricity disclosure.

For power companies to be able to tell their customers anything about the origin of the electricity in today's unbundled, international and complex power market, they need a way to track electricity from production to consumption. The main tracking tool for electricity is the Guarantee of Origin (GO) (RES Directive 2009/28/EC, Art. 15, REDII Directive 2018/2001, Art. 19). As long as not all consumption is tracked using GOs, a *residual mix* is needed to make the GO a reliable tracking instrument. A country's residual mix represents the shares of electricity generation attributes available for disclosure, after the use of explicit tracking systems, such as (the) GO, has been accounted for. Without a residual mix, renewable electricity sold with GOs would be double counted because the same electricity would be disclosed to consumers buying "regular" electricity.

Due to the international nature of both the electricity markets and tracking systems, the volume of available generation attributes in the domestic residual mix differs from the volume of untracked consumption¹. Thus, the calculation of residual mixes needs to be centrally coordinated and a common pool for balancing generation attributes must be used. This is achieved via the European Attribute Mix (EAM), which replaces the deficit of energy origin caused by exported GOs, by operating as an "equalising reservoir" for generation attributes for national residual mixes. After the attribute balancing via the EAM the volume of available generation attributes in each country's residual mix is equal to the untracked consumption in that country. This is a precondition for the GO to be a credible tracking instrument in the context of international trading.

The whole concept of a residual mix is needed only when consumption is only partially explicitly tracked. In so-called "full disclosure domains" residual mix is not needed. In 2018 residual mix is not calculated for Austria as it has an operational full disclosure system. Also, Switzerland has full disclosure regulation but, due to detailed implementation and calculation rules, a residual mix can still be calculated and is included in the results.



Note: For background information regarding the concept of residual mix calculations and its application please refer to the website of the RE-DISS project <http://www.reliable-disclosure.org> (temporarily unavailable at the time of publishing of this report), where you can find the final report of the project, residual mix calculation methodology, results of previous year calculations (up to year 2014) and the RE-DISS Best Practice Recommendations. For the results of 2015, 2016, and 2017, please refer to the AIB-website.

¹ Untracked consumption = Electricity consumption for which the energy source is not explicitly disclosed through tracking instruments such as Guarantees of Origin.

Description of the Document

The main results of this document are the **European Attribute Mix (EAM)** and the residual mixes for all countries. A wide variety of additional information is also presented as supporting material. The **EAM** (Table 1) is the mix of energy sources and the corresponding environmental indicators that is collected from countries with attribute surplus. The EAM is to be used for filling in national residual mixes (calculated by national responsible parties) in case of a deficit of disclosure attributes. The national surpluses and deficits to/from EAM are shown in Table 3 and Figure 3

The **national residual mixes** for 30 European countries² are shown in the Table 2, Figure 1 and Figure 2. Note that the official residual mixes for each country are in principle published by the respective national authorities. Also note that for countries without recorded explicit tracking, untracked consumption equals the total electricity consumption, and thus the residual mix is applicable for the disclosure of the entire electricity consumption.³

The results shown are based on the Shifted-Transaction Based Methodology. However, to acknowledge different perspectives to national calculations, Table 9 and Figure 21 provide national results following the Issuance-Based Methodology.⁴

Energy sources in the residual mixes are divided in three main categories: renewable, nuclear and fossil, of which renewable and fossil are further divided into subcategories (Table 10). Selected subcategories are based on relevance in terms of volume and perceived consumer importance. The used categorization is also identical to all residual mix calculations since the 2013.

Table 2 and Figure 4 show the **carbon emissions** for the final residual mixes differentiated into:

- direct greenhouse gas emissions given as the single greenhouse gas CO₂ emissions,
- greenhouse gas emissions given as the single greenhouse gas CO₂ emissions based on a life-cycle analysis (LCA) and thus including up- and downstream impacts throughout the electricity generation value chain,
- direct greenhouse gas emissions, given as CO₂ equivalents (CO₂e), which includes the effects of other greenhouse gases than CO₂, and
- greenhouse gas emissions based on an LCA approach, given as CO₂ equivalents (CO₂e). This is the most comprehensive emission figure as it contains CO₂ and other greenhouse gases and the full electricity generation value chain.

The base data for the direct CO₂-emissions have been based on the following references: Treyer and Bauer (2013), Dong Energy A/S, Energi.dk, Vattenfall (2010), Fritsche and Rausch (2009), Bauer (2008) and GEMIS database (GEMIS, 2015). The life-cycle-based CO₂-emissions, as well as the direct and life-cycle-based Global Warming Potential have been provided by the Ecoinvent database (Ecoinvent v3.1 Database). The data for the radioactive waste has been compiled based on BDEW (2014), DECC (2014), the Platts World Database and IAEA PRIS. However, where available, factors as reported by national competent authorities are used instead.

Note that these figures are destined for electricity disclosure purposes only. The RE-DISS Disclosure Guidelines for Electricity Suppliers recommend that the direct CO₂ emissions (and the indicator on radioactive waste) are used in disclosure statements directly on or with the bills. The other three indicators for carbon emissions are provided for information purpose and can be used for second-level information (e.g. on a related website) provided by suppliers and other bodies.

Table 1 and Figure 6 show the content of **high-level radioactive waste** in the European Attribute Mix (EAM), in the production mix (PM), in the residual mix (RM) and in the total supplier mix (TSM) of European countries. These indicators reflect the differences in waste rates produced by the types of nuclear power reactors used in the respective countries per kWh of electricity. Due to a lack of detailed data per reactor, the waste rates have been based on estimates of typical data for five major types of reactors used in Europe.

² Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Ireland (All-Island), Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland

³ Calculation of the Residual Mix obviously can only take the volumes of explicit tracking systems into account if the respective data is public or known by the authority and respectively being made available to the one who conducts the calculation. This means that explicit tracking systems, for which no statistical data is available to the competent authority and/or AIB, cannot be reflected in the residual mix and are therefore likely to lead to double counting.

⁴ For more information on the Shifted-Transaction Based Methodology and the Issuance-Based Methodology, see the Residual Mix Methodology description in Deliverable 7.2 of the RE-DISS II project (see http://www.reliable-disclosure.org/upload/234-D7.2_RMCalculation.pdf).

The total supplier mixes (TSMs) are presented in Table 4, Figure 7 and Figure 8. The total supplier mix represents the total consumption mix of the country, i.e. shares of energy sources in the tracked and untracked part of consumption. Thus, both available and explicitly tracked attributes are included in the TSM, which equals in physical volume with the country's total electricity consumption.

The evolution of attributes, on the European scale: how much renewables are in the Production mix, how much of those are left in the residual mix and finally how much renewables are carried on to EAM is shown in the Figure 11, Figure 12 and Figure 13.

The rest of the results are different kinds of **comparisons** between different mixes and different years. Table 5, Figure 9 and Figure 10 present the comparison between the production and residual mix of different countries, and Figure 13 and Figure 14 that of production and total supplier mix (in TWh in Figure 15 and Figure 16). Figure 17, Figure 18: Production Mixes 2016, 2017 and 2018, Table 7 and Table 8 show the difference between final residual mixes and production mixes of 2016, 2017 and 2018. Finally, Figure 19 and Figure 20 disclose the volumes of EECS and National GO transactions which have been taken into account for the calculation (but not those of other Reliable Tracking Systems).

Note: Any use of the data presented in this document should include a reference to AIB.

Note: The calculated country and energy source/technology emission factors forming the base for the National Residual Mix calculations may not be sold, distributed or processed as part of a derivative tool.

Disclaimer on data quality:

Because of the 12 months lifetime of GOs, the residual mixes were calculated based on all recorded GO transactions during the assumed time period (1.4.2018 – 31.3.2019) for disclosure of 2018 consumption, irrespective of the underlying production year of these GOs. This ensures that all GO transactions are considered in the calculation.

Volumes which have been explicitly tracked without the use of transparent tracking instruments, e.g. by so-called contract based tracking, self-declarations etc., cannot be taken into account at all.

Partners



References

Generation data: Entso-e: <https://www.entsoe.eu/data/power-stats/>

EECS Guarantee of Origin Statistics: Association of Issuing Bodies

Sources for emission factors:

BDEW (2014). Leitfaden "Stromkennzeichnung", Berlin, Oktober 2014

Bauer, C. 2008. Life Cycle Assessment of Fossil and Biomass Power Generation Chains An analysis carried out for ALSTOM Power Services. Paul Scherrer Institut (PSI). PSI Bericht Nr. 08-05, ISSN 1019-0643 http://ventderaison.eu/documents/PSI-Bericht_2008-05.pdf.

Bauer, C. 2014 Email confirmation of December 4th 2015 from Christian Bauer (Paul Scherrer Institut (PSI) and Econvent) to Hanne Lerche Raadal about the use of the Econvent database for Residual Mix calculations.

DECC (2014), Fuel Mix Disclosure Data Table, 2014

- Dong Energy A/S, Energi.dk, Vattenfall 2010: Livscyklusvurdering Dansk el og kraftvarme (Life Cycle Assessment of Danish electricity and heat), <http://osp.energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Klimaogmiljo/LCA%20-%20Dansk%20el%20og%20kraftvarme%202008.pdf>
- Ecoinvent v. 3.1 Database. The Ecoinvent database for processes, products and transport. Integrated in the life cycle software tool SimaPro (Pré)., Available at: <http://www.ecoinvent.org/>
- Fritsche, U and Rausch, L (2009). Life Cycle Analysis of GHG and Air Pollutant Emissions from Renewable and Conventional Electricity, Heating, and Transport Fuel Options in the EU until 2030. ETC/ACC Technical Paper 2009/18 June 2009. http://acm.eionet.europa.eu/reports/docs/ETCACC_TP_2009_18_LCA_GHG_AE_2013-2030.pdf
- GEMIS (Globales Emissions-Modell integrierter Systeme). Downloaded from <http://www.iinas.org/gemis.html> (Jan 2015)
- IAEA PRIS. The IAEA Power Reactor Information System (PRIS), 2015, <https://www.iaea.org/pris/>
- Platts: The Platts World Database, 2014
- Treyer and Bauer 2013. Life cycle inventories of electricity generation and power supply in version 3 of the ecoinvent database—part I: electricity generation. The International Journal of Life Cycle Assessment, 27 Nov 2013, doi:10.1007/s11367-013-0665-2

Table of Tables

Table 1: European Attribute Mix (EAM) 2018: Energy source distribution and environmental indicators	6
Table 2: Residual Mixes 2018.....	7
Table 3: Attributes [TWh] to/from the European Attribute Mix 2018	12
Table 4: Total Supplier Mix 2018	15
Table 5: Production Mix 2018	19
Table 6: European Total Production Mix, Total of all available attributes in Final Residual Mixes and EAM 2018 (detailed fuel categories)	25
Table 7: Residual Mixes 2016, 2017 and 2018 (Percentages).....	30
Table 8: Production Mixes 2016, 2017 and 2018 (Percentages).....	31
Table 9: Residual Mixes 2018 Issuance Based Methodology	33
Table 10: Fuel category breakdown.....	36

Table of Figures

Figure 1: Residual Mixes 2018.....	9
Figure 2: Residual Mixes 2018 (detailed fuel categories)	10
Figure 3: Attributes [TWh] to/from the European Attribute Mix 2018	11
Figure 4: CO ₂ content in Final Residual Mixes 2018 [gCO ₂ (e)/kWh].....	14
Figure 5: Direct CO ₂ emissions for Production Mix, Residual Mix, and Total Supplier Mix 2018 [gCO ₂ /kWh].....	14
Figure 6: High-level radioactive waste (RW) content in the Production Mix (PM), the Residual Mix (RM) and the Total Supplier Mix (TSM) 2018 [mgRW/kWh].....	15
Figure 7: Total Supplier Mix 2018	15
Figure 8: Total Supplier Mix 2018 (detailed fuel categories)	18
Figure 9: Production Mix (left) and Final Residual Mix (right) 2018.....	19

Figure 10: Production Mix (left) and Final Residual Mix (right) 2018 (detailed fuel categories)	22
Figure 11: European Total Production Mix (left), Total of all available attributes in Final Residual Mixes (middle) and EAM (right) 2018	23
Figure 12: European Total Production Mix (left), Total of all available attributes in Final Residual Mixes (middle) and EAM (right) 2018 (detailed fuel categories)	24
Figure 13: Production Mix (left) and Total Supplier Mix (right) 2018	26
Figure 14: Production Mix (left) and Total Supplier Mix (right) 2018 (detailed fuel categories)	27
Figure 15: Production Mix (left) and Total Supplier Mix (right) [TWh] 2018.....	28
Figure 16: Production Mix (left) and Total Supplier Mix (right) [TWh] 2018 (detailed fuel categories)	29
Figure 17: Residual Mixes 2016, 2017 and 2018	30
Figure 18: Production Mixes 2016, 2017 and 2018	31
Figure 19: Recorded cancellations of EECS and National GOs in 2018 [TWh]	32
Figure 20: Recorded imports and exports of EECS and National GOs in 2018 [TWh] (Note that ex-domain cancellations are not included)	32
Figure 21: Residual Mixes 2018 Issuance Based Methodology	33

Table 1: European Attribute Mix (EAM) 2018: Energy source distribution and environmental indicators

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Direct CO2 (gCO2/kWh)	LCA CO2 (gCO2/kWh)	Direct GWP (gCO2/kWh)	LCA GWP (gCO2/kWh)	RW (mgRW/kWh)
EAM	2.44%	0.14%	0.45%	0.77%	0.81%	0.00%	0.27%	36.96%	60.60%	2.48%	20.13%	13.28%	24.11%	0.61%	486.05	521.74	490.64	560.31	1.03

EAM = European Attribute Mix is used for balancing surpluses and deficits in national residual mixes caused by international trading of electricity and guarantees of origin.

Table 2: Residual Mixes 2018

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Untracked consumption	Direct CO2 (gCO2/kWh)	LCA CO2 (gCO2/kWh)	Direct GWP (gCO2/kWh)	LCA GWP (gCO2/kWh)	RW (mgRW/kWh)
BE	36.83%	2.36%	8.88%	7.06%	15.77%	0.35%	2.41%	22.71%	40.46%	0.00%	0.00%	0.00%	40.34%	0.12%	50.46%	178.63	230.75	189.06	255.62	0.61
BG	19.12%	0.00%	3.29%	3.22%	11.91%	0.00%	0.70%	36.39%	44.49%	0.00%	39.87%	0.63%	3.99%	0.00%	99.92%	469.54	518.07	495.43	528.54	1.27
HR	44.84%	0.06%	0.02%	0.27%	44.47%	0.00%	0.01%	1.63%	53.53%	0.37%	31.88%	9.95%	11.31%	0.03%	77.58%	558.59	592.10	561.68	617.87	0.05
CY	8.90%	0.00%	3.50%	4.64%	0.00%	0.00%	0.76%	0.00%	91.10%	0.00%	0.00%	0.00%	0.00%	91.10%	99.99%	638.89	877.06	770.21	905.01	0.00
CZ	6.17%	0.00%	2.07%	0.22%	0.77%	0.00%	3.11%	36.88%	56.95%	2.30%	44.63%	4.18%	5.80%	0.04%	98.65%	607.16	655.62	612.30	673.95	1.29
DK	9.83%	2.83%	2.41%	1.05%	3.38%	0.00%	0.16%	21.95%	68.21%	1.47%	11.96%	32.35%	21.77%	0.66%	82.35%	503.40	570.53	509.37	621.10	0.61
EE	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	99.34%	0.00%	0.00%	0.66%	0.00%	94.19%	1,041.76	1,076.09	1,043.29	1,095.43	0.00
FI	9.25%	0.05%	0.48%	0.20%	2.28%	0.01%	6.24%	45.58%	45.17%	6.80%	5.32%	14.30%	18.17%	0.59%	74.45%	294.00	340.37	301.64	373.11	1.35
FR	13.14%	0.00%	2.00%	5.43%	4.18%	0.04%	1.49%	77.64%	9.22%	1.44%	0.00%	1.15%	6.20%	0.43%	92.60%	51.23	71.03	53.20	79.18	2.10
DE	1.16%	0.30%	0.52%	0.08%	0.26%	0.00%	0.00%	18.79%	80.05%	2.04%	35.25%	19.07%	22.83%	0.85%	45.24%	724.24	760.29	728.69	816.70	0.51
GB	0.29%	0.02%	0.05%	0.09%	0.10%	0.00%	0.03%	30.82%	68.89%	0.30%	2.39%	8.32%	57.79%	0.09%	76.98%	380.52	399.72	380.96	416.46	2.24
GR	28.29%	0.00%	7.01%	10.78%	9.74%	0.12%	0.64%	1.22%	70.49%	0.12%	29.99%	1.62%	30.39%	8.36%	96.44%	661.62	734.96	695.83	755.46	0.03
HU	9.70%	0.93%	0.77%	1.53%	1.98%	0.00%	4.50%	48.41%	41.89%	0.44%	16.09%	6.98%	18.00%	0.38%	96.93%	345.37	432.50	378.98	460.23	1.65
IS	4.11%	0.13%	0.44%	0.78%	2.29%	0.20%	0.27%	36.32%	59.57%	2.44%	19.78%	13.05%	23.69%	0.61%	79.88%	477.72	513.02	482.24	550.95	1.01
IE	18.99%	0.00%	0.00%	13.03%	0.43%	0.00%	5.54%	0.00%	81.01%	1.95%	16.26%	24.43%	38.28%	0.09%	11.88%	634.20	684.98	640.35	727.04	0.00
IT	8.40%	0.23%	4.10%	1.37%	2.45%	0.17%	0.08%	11.48%	80.12%	4.98%	6.25%	14.64%	52.74%	1.51%	85.08%	483.29	546.40	487.23	596.09	0.32
LV	46.99%	0.01%	0.01%	1.56%	34.05%	0.01%	11.35%	2.81%	50.20%	6.02%	0.00%	2.45%	41.58%	0.16%	98.96%	313.03	346.90	322.76	375.08	0.08
LT	35.42%	0.26%	1.21%	16.56%	11.90%	0.02%	5.48%	7.68%	56.90%	5.27%	0.00%	6.71%	44.13%	0.79%	36.51%	370.64	411.58	380.73	446.15	0.23
LU	29.64%	0.09%	0.29%	2.99%	26.09%	0.00%	0.18%	24.17%	46.18%	6.31%	13.17%	8.68%	17.63%	0.40%	32.58%	360.47	373.42	361.21	398.55	0.67
MT	5.23%	0.05%	4.46%	0.30%	0.31%	0.00%	0.10%	14.26%	80.52%	0.96%	7.76%	5.12%	9.30%	57.38%	100.00%	654.82	747.04	668.92	779.46	0.40
NL	2.89%	0.00%	2.71%	0.18%	0.00%	0.00%	0.00%	3.26%	93.85%	0.00%	0.00%	18.32%	75.53%	0.00%	52.24%	530.30	589.57	533.39	642.85	0.09
NO	43.26%	0.98%	6.13%	5.62%	26.03%	0.03%	4.48%	21.08%	35.67%	1.36%	10.86%	7.17%	15.95%	0.33%	84.55%	276.90	304.62	280.49	329.07	0.61

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Untracked consumption	Direct CO ₂ (gCO ₂ /kWh)	LCA CO ₂ (gCO ₂ /kWh)	Direct GWP (gCO ₂ /kWh)	LCA GWP (gCO ₂ /kWh)	RW (mgRW/kWh)
PL	2.93%	0.01%	0.21%	0.98%	0.73%	0.00%	1.00%	4.18%	92.89%	1.60%	30.47%	49.37%	10.37%	1.09%	97.13%	897.12	958.82	904.62	1,031.32	0.12
PT	52.05%	0.00%	1.52%	22.93%	22.45%	0.00%	5.15%	0.00%	47.95%	0.42%	0.00%	20.64%	26.70%	0.19%	98.37%	306.99	359.35	315.52	396.54	0.00
RO	42.62%	0.00%	2.87%	10.25%	28.99%	0.00%	0.50%	17.39%	39.99%	8.57%	21.37%	1.78%	8.26%	0.01%	99.69%	401.20	429.92	402.59	442.66	3.13
SK	22.18%	0.10%	2.19%	0.07%	13.61%	0.00%	6.21%	54.49%	23.33%	2.28%	6.27%	5.20%	8.29%	1.28%	92.50%	188.59	227.94	193.95	246.64	1.89
SI	0.46%	0.03%	0.08%	0.14%	0.15%	0.00%	0.05%	52.25%	47.29%	2.94%	37.17%	2.49%	4.58%	0.11%	83.89%	501.24	525.66	502.23	542.83	1.42
ES	6.40%	0.49%	1.73%	2.42%	1.63%	0.00%	0.13%	33.94%	59.66%	1.70%	16.73%	8.32%	26.93%	5.98%	69.48%	448.39	501.78	450.91	527.78	0.92
SE	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	92.49%	7.51%	5.04%	0.00%	1.17%	0.86%	0.45%	16.13%	40.50	54.34	37.42	54.72	2.50
CH	39.56%	9.55%	7.62%	0.85%	21.30%	0.00%	0.24%	53.30%	7.14%	3.09%	0.00%	0.00%	3.82%	0.22%	16.34%	31.18	52.63	34.85	60.52	2.56
EAM	2.44%	0.14%	0.45%	0.77%	0.81%	0.00%	0.27%	36.96%	60.60%	2.48%	20.13%	13.28%	24.11%	0.61%		486.05	521.74	490.64	560.31	1.03

Untracked Consumption = Electricity consumption not explicitly disclosed through tracking instruments such as Guarantees of Origin.

Note: CO₂ and radioactive waste figures reported are destined for purposes of electricity disclosure only (rf. page 2).

Data Sources: Information reported by national Competent Bodies; Association of Issuing Bodies (AIB); ENTSO-E

Graphs with detailed calculations results

Figure 1: Residual Mixes 2018



Figure 2: Residual Mixes 2018 (detailed fuel categories)

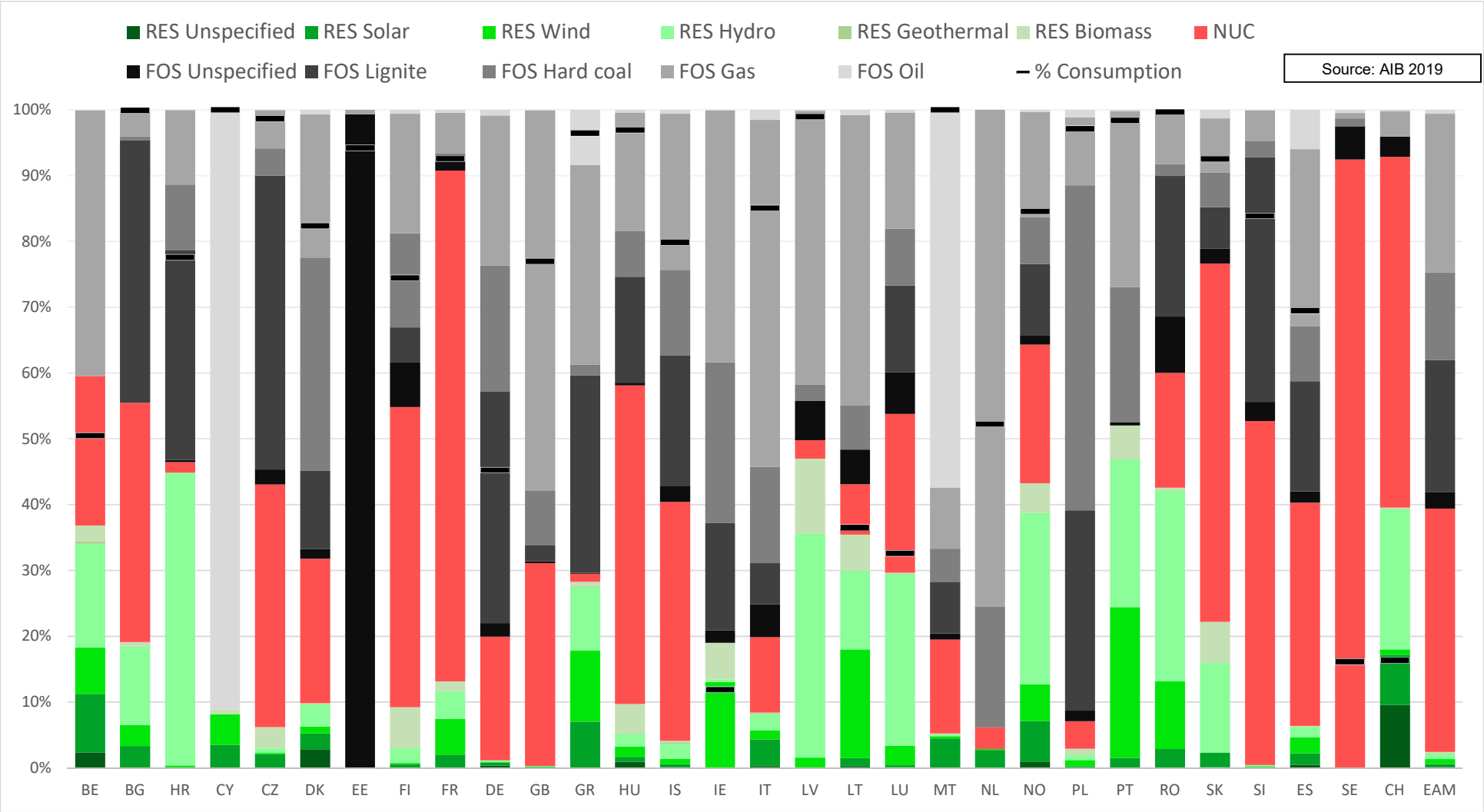
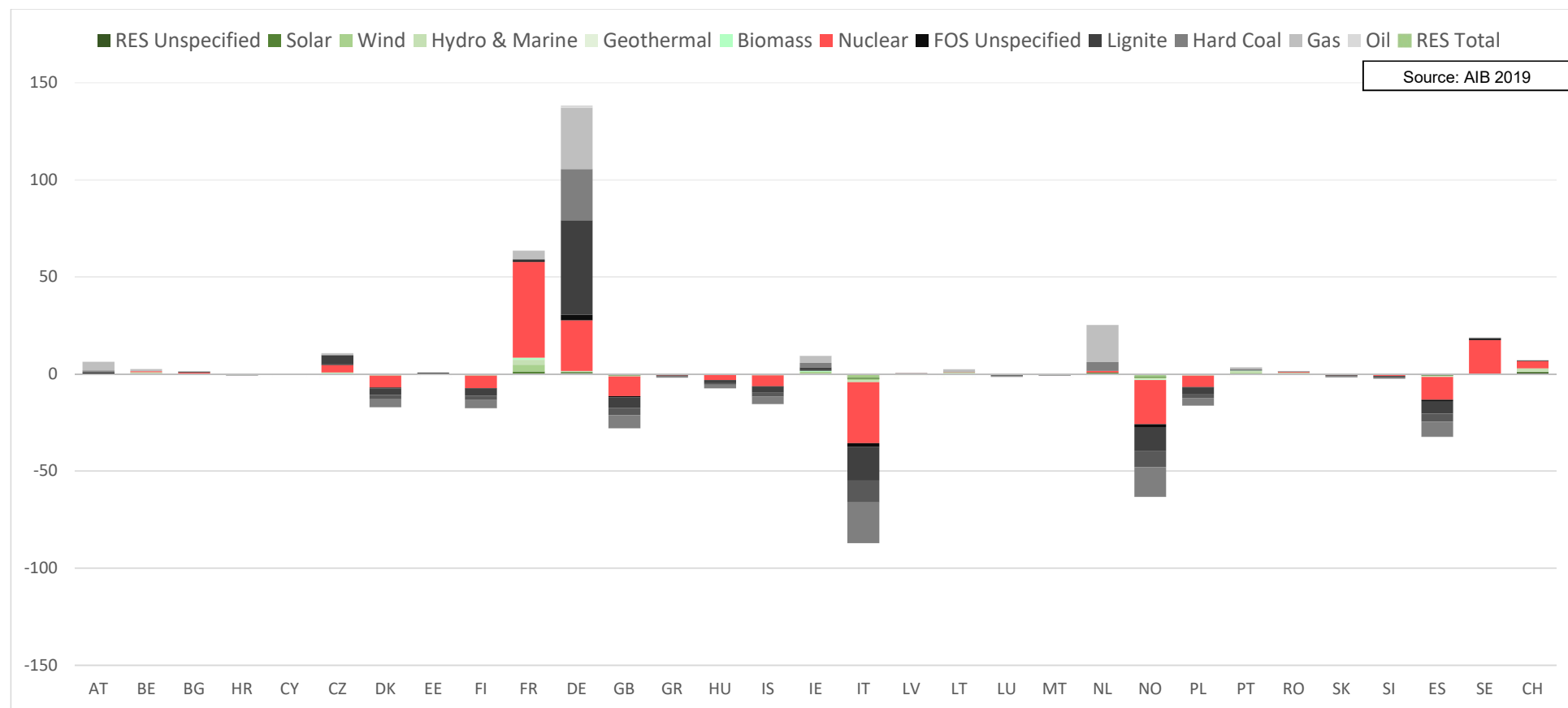


Figure 3: Attributes [TWh] to/from the European Attribute Mix 2018⁵

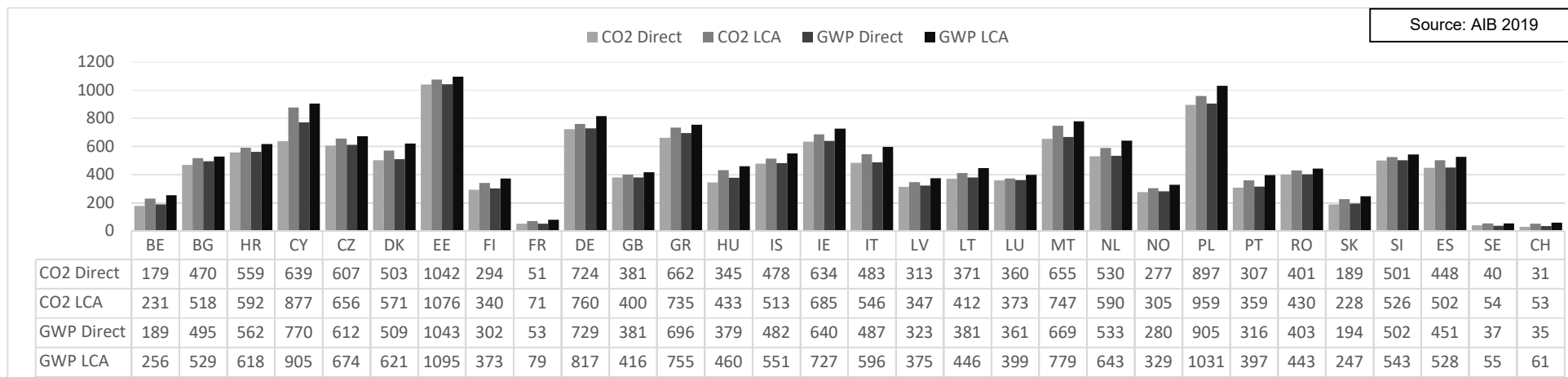
⁵ In this figure, the renewable energy added to the EAM does not equal the renewable energy taken out of it, which might seem peculiar. The reason for this is that some individual domains have negative renewable energy balance in domestic residual mixes (caused by previous production year GOs being used or exported). This negativity is transferred into the EAM

Table 3: Attributes [TWh] to/from the European Attribute Mix 2018⁶

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil
AT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	6.25	0.71	0.00	1.13	4.33	0.09
BE	0.89	0.06	0.21	0.17	0.38	0.01	0.06	0.55	0.98	0.00	0.00	0.00	0.97	0.00
BG	0.24	0.00	0.04	0.04	0.15	0.00	0.01	0.46	0.57	0.00	0.51	0.01	0.05	0.00
HR	-0.02	0.00	0.00	0.00	-0.01	0.00	0.00	-0.23	-0.38	-0.02	-0.13	-0.08	-0.15	0.00
CY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CZ	0.66	0.00	0.22	0.02	0.08	0.00	0.33	3.93	6.07	0.25	4.75	0.44	0.62	0.00
DK	-0.41	-0.02	-0.07	-0.13	-0.14	0.00	-0.05	-6.17	-10.11	-0.41	-3.36	-2.21	-4.02	-0.10
EE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.53	0.00	0.00	0.00	0.00
FI	-0.42	-0.02	-0.08	-0.13	-0.14	0.00	-0.05	-6.35	-10.42	-0.43	-3.46	-2.28	-4.15	-0.10
FR	8.35	0.00	1.27	3.45	2.66	0.03	0.95	49.37	5.86	0.92	0.00	0.73	3.94	0.28
DE	1.61	0.42	0.72	0.12	0.36	0.00	0.00	25.98	110.69	2.82	48.75	26.37	31.58	1.17
GB	-0.67	-0.04	-0.12	-0.21	-0.22	0.00	-0.07	-10.09	-16.55	-0.68	-5.50	-3.63	-6.58	-0.17
GR	-0.04	0.00	-0.01	-0.01	-0.01	0.00	0.00	-0.67	-1.10	-0.05	-0.37	-0.24	-0.44	-0.01
HU	-0.18	-0.01	-0.03	-0.06	-0.06	0.00	-0.02	-2.66	-4.37	-0.18	-1.45	-0.96	-1.74	-0.04
IS	-0.37	-0.02	-0.07	-0.12	-0.12	0.00	-0.04	-5.60	-9.17	-0.38	-3.05	-2.01	-3.65	-0.09
IE	1.77	0.00	0.00	1.21	0.04	0.00	0.51	0.00	7.53	0.18	1.51	2.27	3.56	0.01
IT	-2.07	-0.12	-0.38	-0.65	-0.69	0.00	-0.23	-31.45	-51.57	-2.11	-17.13	-11.30	-20.52	-0.52
LV	0.17	0.00	0.00	0.01	0.13	0.00	0.04	0.01	0.19	0.02	0.00	0.01	0.15	0.00
LT	0.85	0.01	0.03	0.40	0.29	0.00	0.13	0.18	1.37	0.13	0.00	0.16	1.06	0.02
LU	-0.04	0.00	-0.01	-0.01	-0.01	0.00	0.00	-0.54	-0.88	-0.04	-0.29	-0.19	-0.35	-0.01
MT	-0.02	0.00	0.00	-0.01	-0.01	0.00	0.00	-0.30	-0.49	-0.02	-0.16	-0.11	-0.20	0.00
NL	0.73	0.00	0.68	0.04	0.00	0.00	0.00	0.82	23.64	0.00	0.00	4.61	19.02	0.00
NO	-1.51	-0.08	-0.28	-0.47	-0.50	0.00	-0.17	-22.84	-37.45	-1.53	-12.44	-8.21	-14.90	-0.38

⁶ Same as in previous figure 5, the renewable energy added to the EAM does not equal the renewable energy taken out of it, which might seem peculiar. The reason for this is that some individual domains have negative renewable energy balance in domestic residual mixes (caused by previous production year GOs being used or exported). This negativity is transferred into the EAM

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil
PL	-0.39	-0.02	-0.07	-0.12	-0.13	0.00	-0.04	-5.90	-9.67	-0.40	-3.21	-2.12	-3.85	-0.10
PT	1.82	0.00	0.05	0.80	0.78	0.00	0.18	0.00	1.67	0.01	0.00	0.72	0.93	0.01
RO	0.64	0.00	0.04	0.15	0.44	0.00	0.01	0.26	0.60	0.13	0.32	0.03	0.12	0.00
SK	-0.04	0.00	-0.01	-0.01	-0.01	0.00	0.00	-0.61	-1.00	-0.04	-0.33	-0.22	-0.40	-0.01
SI	-0.06	0.00	-0.01	-0.02	-0.02	0.00	-0.01	-0.84	-1.38	-0.06	-0.46	-0.30	-0.55	-0.01
ES	-0.77	-0.04	-0.14	-0.24	-0.26	0.00	-0.09	-11.69	-19.17	-0.78	-6.37	-4.20	-7.63	-0.19
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.45	1.42	0.95	0.00	0.22	0.16	0.08
CH	2.81	0.68	0.54	0.06	1.51	0.00	0.02	3.79	0.51	0.22	0.00	0.00	0.27	0.02

Figure 4: CO₂ content in Final Residual Mixes 2018 [gCO₂(e)/kWh]

CO₂ Direct = Direct onsite CO₂ emissions [gCO₂/kWh].

CO₂ LCA = Life Cycle Assessment CO₂ emissions gCO₂/kWh].

GWP Direct = Direct onsite Global Warming Potential emissions gCO₂e/kWh].

GWP LCA = Life Cycle Assessment Global Warming Potential emissions gCO₂e/kWh].

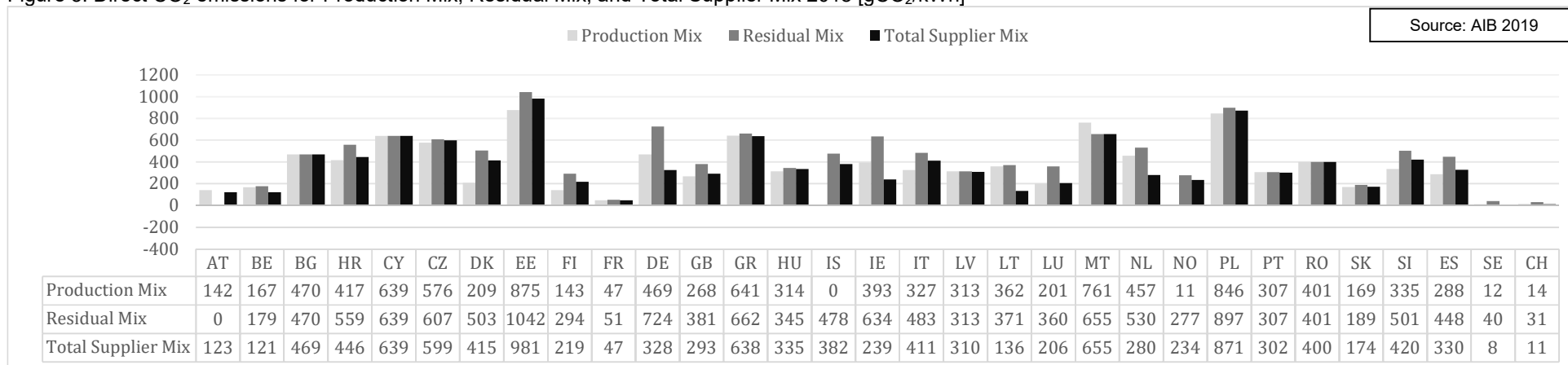
Figure 5: Direct CO₂ emissions for Production Mix, Residual Mix, and Total Supplier Mix 2018 [gCO₂/kWh]

Figure 6: High-level radioactive waste (RW) content in the Production Mix (PM), the Residual Mix (RM) and the Total Supplier Mix (TSM) 2018 [mgRW/kWh]

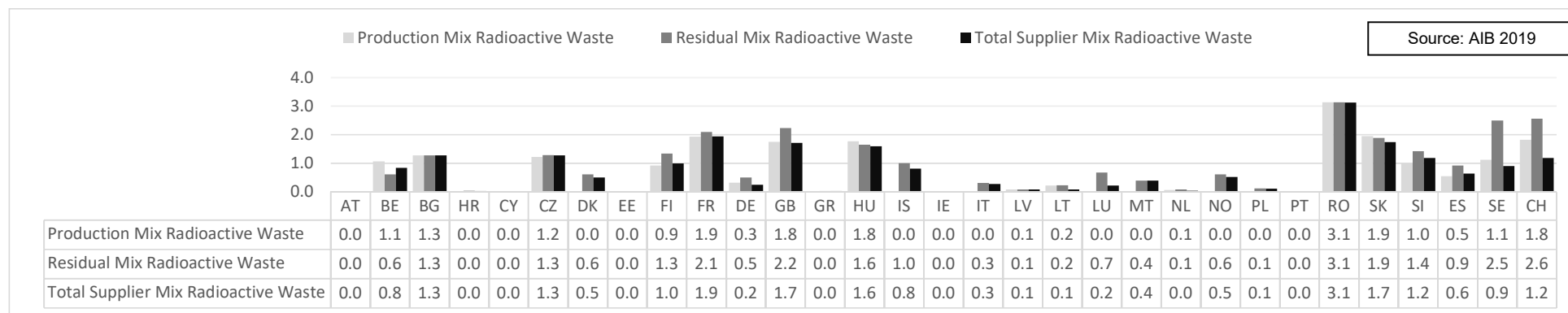


Table 4: Total Supplier Mix 2018

	Volume (TWh)	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Direct CO2 (gCO2/kWh)	RW (mgRW/kWh)
AT	72.88	77.76%	8.95%	0.00%	6.97%	60.27%	0.00%	1.56%	0.00%	22.24%	5.07%	0.00%	2.24%	14.18%	0.76%	123	0.00
BE	85.44	41.75%	1.38%	5.42%	7.41%	20.77%	0.21%	6.54%	30.96%	27.29%	3.86%	0.00%	0.00%	23.38%	0.06%	121	0.84
BG	34.21	19.18%	0.00%	3.28%	3.26%	11.94%	0.00%	0.70%	36.36%	44.46%	0.00%	39.83%	0.63%	3.99%	0.00%	469	1.27
HR	18.30	54.83%	0.05%	0.39%	7.56%	43.48%	0.00%	3.34%	1.26%	43.91%	0.28%	24.73%	7.72%	11.15%	0.02%	446	0.04
CY	4.77	8.91%	0.00%	3.50%	4.64%	0.01%	0.00%	0.76%	0.00%	91.09%	0.00%	0.00%	0.00%	0.00%	91.09%	639	0.00
CZ	66.87	7.43%	0.00%	2.06%	0.26%	1.48%	0.00%	3.64%	36.38%	56.18%	2.27%	44.03%	4.12%	5.72%	0.04%	599	1.27
DK	34.11	25.51%	2.36%	1.99%	15.65%	4.78%	0.00%	0.74%	18.08%	56.41%	1.21%	9.85%	26.64%	18.16%	0.55%	415	0.50
EE	8.72	5.81%	0.00%	0.03%	3.45%	0.20%	0.00%	2.13%	0.00%	94.19%	93.57%	0.00%	0.00%	0.62%	0.00%	981	0.00
FI	87.40	32.43%	0.10%	0.64%	2.85%	17.31%	0.00%	11.53%	33.93%	33.63%	5.06%	3.96%	10.65%	13.53%	0.44%	219	1.00
FR	478.00	19.57%	0.08%	1.91%	5.33%	10.56%	0.09%	1.60%	71.89%	8.54%	1.33%	0.00%	1.06%	5.74%	0.40%	47	1.94
DE	539.77	54.93%	0.74%	7.58%	20.85%	17.80%	0.30%	7.67%	8.83%	36.24%	0.95%	15.95%	8.63%	10.33%	0.38%	328	0.25
GB	298.18	23.24%	0.02%	2.24%	14.11%	0.71%	0.00%	6.17%	23.73%	53.03%	0.23%	1.84%	6.41%	44.49%	0.07%	293	1.72

	Volume (TWh)	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Ma- rine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspec- ified	Lignite	Hard Coal	Gas	Oil	Direct CO2 (gCO2/kWh)	RW (mgRW/kWh)
GR	57.18	30.84%	0.00%	6.79%	11.05%	12.26%	0.12%	0.61%	1.17%	67.99%	0.12%	28.93%	1.56%	29.31%	8.06%	638	0.03
HU	42.50	12.47%	0.94%	0.76%	1.77%	4.26%	0.00%	4.75%	46.92%	40.60%	0.43%	15.60%	6.76%	17.45%	0.37%	335	1.60
IS	19.29	23.40%	0.11%	0.35%	0.62%	10.22%	11.89%	0.21%	29.01%	47.58%	1.95%	15.80%	10.42%	18.93%	0.49%	382	0.81
IE	38.20	55.13%	0.78%	1.61%	31.24%	16.47%	0.00%	5.02%	0.00%	44.87%	0.23%	1.93%	2.90%	39.66%	0.15%	239	0.00
IT	322.07	22.01%	0.21%	3.59%	1.64%	12.51%	1.99%	2.07%	9.82%	68.17%	4.23%	5.32%	12.46%	44.87%	1.28%	411	0.28
LV	7.41	47.54%	0.01%	0.01%	2.10%	34.01%	0.01%	11.40%	2.78%	49.68%	5.96%	0.00%	2.42%	41.15%	0.16%	310	0.08
LT	12.33	76.42%	0.56%	0.53%	37.38%	7.81%	0.01%	30.14%	2.80%	20.78%	1.92%	0.00%	2.45%	16.11%	0.29%	136	0.08
LU	6.83	56.86%	0.13%	1.72%	4.95%	46.76%	0.00%	3.30%	7.88%	35.26%	19.71%	4.29%	2.83%	8.30%	0.13%	206	0.22
MT	2.10	5.23%	0.05%	4.46%	0.30%	0.31%	0.00%	0.10%	14.26%	80.52%	0.96%	7.76%	5.12%	9.30%	57.38%	655	0.40
NL	116.52	48.71%	0.08%	2.37%	30.46%	10.66%	0.03%	5.11%	1.71%	49.58%	0.00%	0.00%	9.57%	40.01%	0.00%	280	0.05
NO	135.47	51.99%	0.78%	5.20%	5.62%	35.74%	0.60%	4.05%	17.85%	30.16%	1.15%	9.18%	6.06%	13.49%	0.28%	234	0.52
PL	162.39	5.71%	0.17%	0.20%	2.48%	1.25%	0.00%	1.59%	4.06%	90.23%	1.55%	29.59%	47.95%	10.07%	1.06%	871	0.11
PT	51.22	52.82%	0.00%	1.50%	22.56%	23.71%	0.00%	5.06%	0.00%	47.18%	0.42%	0.00%	20.30%	26.27%	0.19%	302	0.00
RO	58.17	42.80%	0.01%	2.86%	10.33%	29.07%	0.00%	0.52%	17.34%	39.86%	8.55%	21.30%	1.78%	8.23%	0.01%	400	3.12
SK	28.56	28.02%	0.41%	2.03%	1.18%	14.99%	0.00%	9.42%	50.41%	21.58%	2.11%	5.80%	4.81%	7.67%	1.19%	174	1.75
SI	14.44	16.50%	0.02%	1.05%	0.12%	12.91%	0.00%	2.39%	43.84%	39.67%	2.46%	31.18%	2.09%	3.84%	0.10%	420	1.19
ES	270.07	31.07%	0.34%	4.88%	15.22%	6.25%	0.00%	4.38%	23.58%	45.35%	1.18%	11.62%	5.78%	22.34%	4.43%	330	0.64
SE	141.06	65.03%	0.51%	0.49%	6.99%	50.22%	0.13%	6.68%	33.53%	1.44%	1.04%	0.00%	0.19%	0.14%	0.07%	8	0.91
CH	61.98	72.83%	1.82%	2.26%	1.06%	67.17%	0.00%	0.53%	24.70%	2.47%	0.97%	0.00%	0.00%	1.46%	0.04%	11	1.19

Figure 7: Total Supplier Mix 2018

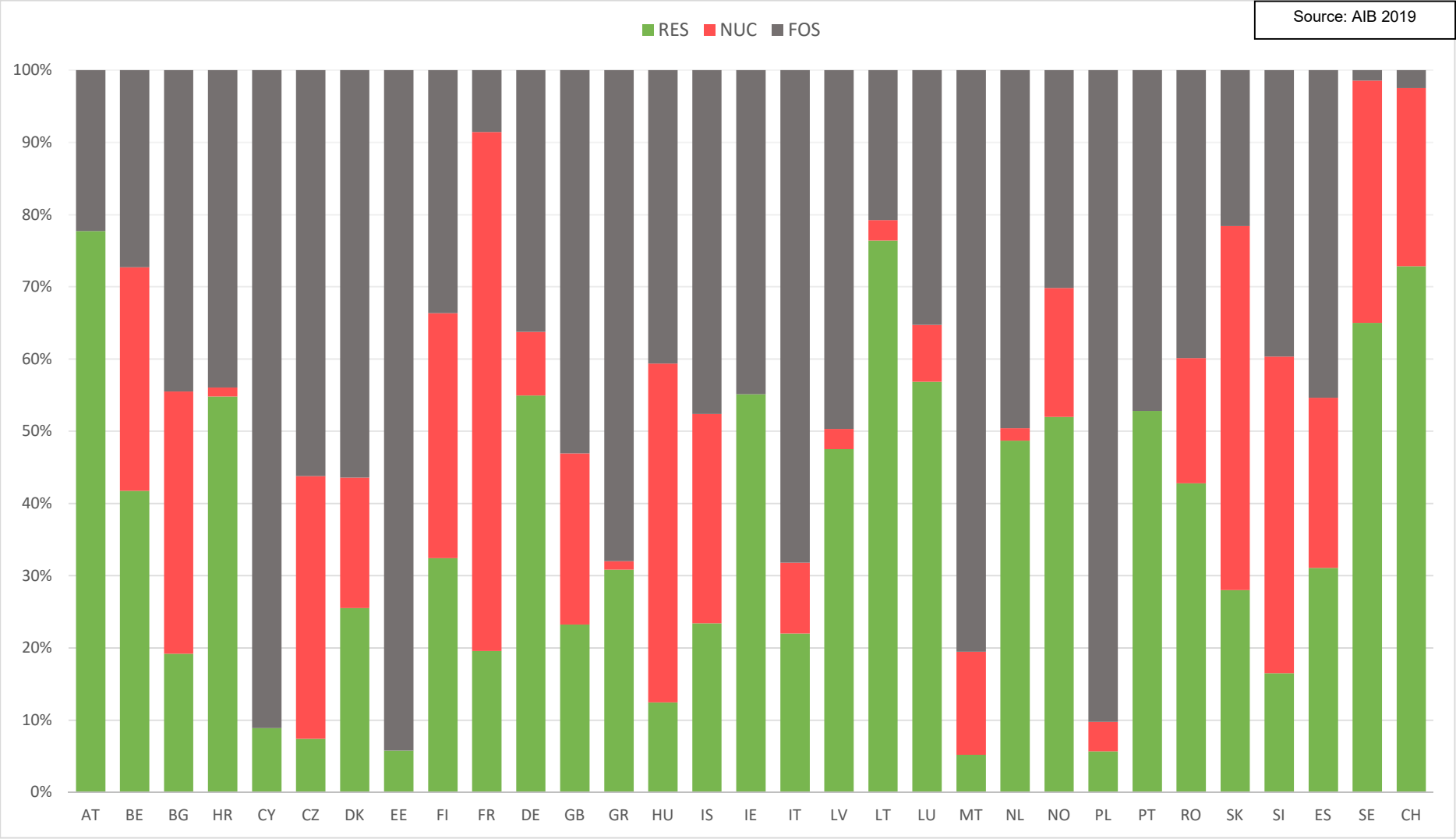


Figure 8: Total Supplier Mix 2018 (detailed fuel categories)

Source: AIB 2019

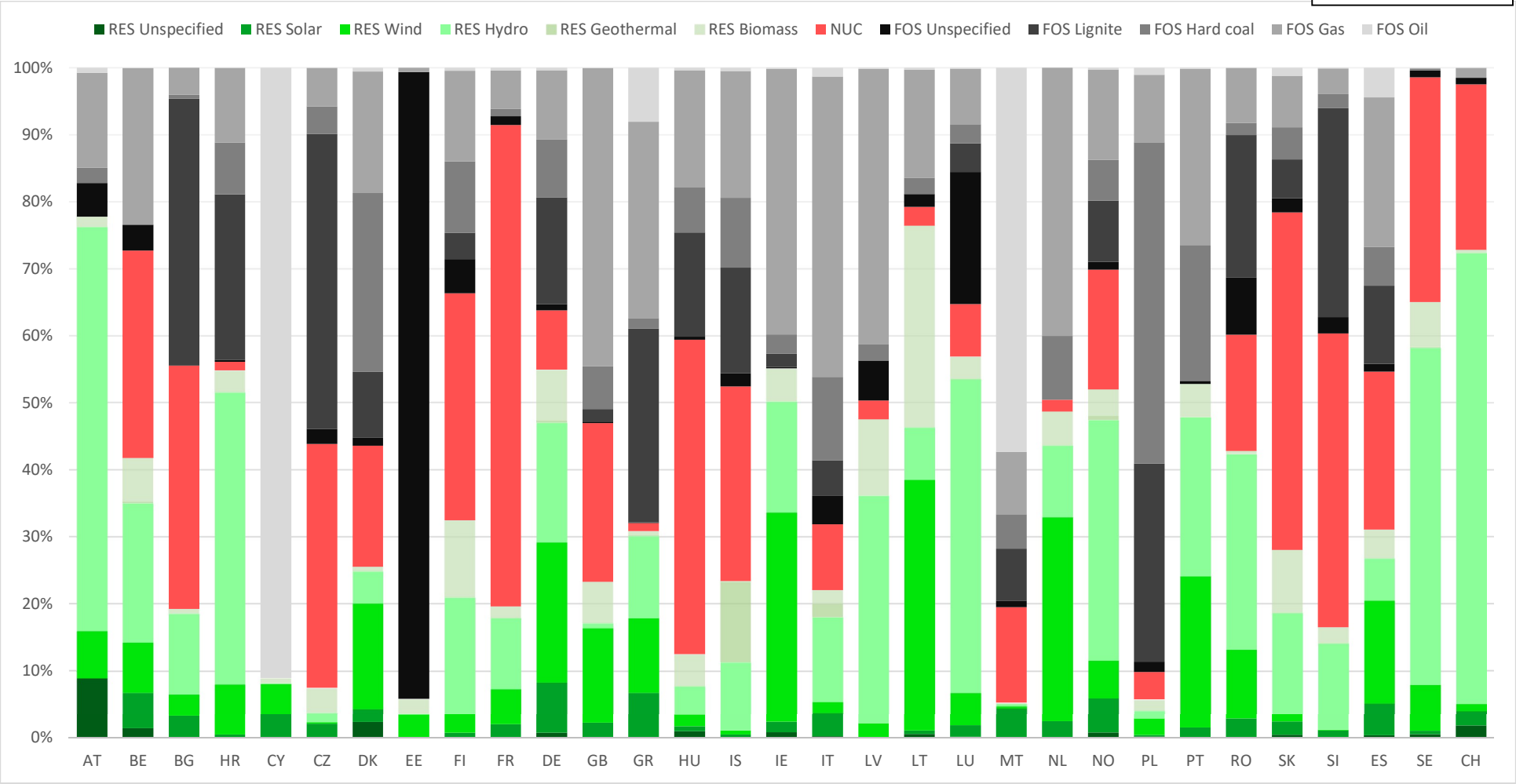


Table 5: Production Mix 2018

	Volume (TWh)	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Direct CO2 (gCO2/kWh)	RW (mgRW/kWh)
AT	63.94	74.21%	11.60%	0.00%	9.22%	53.39%	0.00%	0.00%	0.00%	25.79%	6.62%	0.00%	2.79%	15.38%	1.00%	142	0.00
BE	68.11	22.93%	1.79%	5.12%	10.41%	0.38%	0.00%	5.22%	39.64%	37.44%	4.89%	0.00%	0.00%	32.46%	0.08%	167	1.07
BG	42.02	19.12%	0.00%	3.29%	3.22%	11.91%	0.00%	0.70%	36.39%	44.49%	0.00%	39.87%	0.63%	3.99%	0.00%	470	1.27
HR	12.14	73.57%	0.35%	0.55%	10.98%	56.80%	0.00%	4.88%	0.00%	26.43%	0.00%	0.00%	10.95%	15.48%	0.00%	417	0.00
CY	4.77	8.90%	0.00%	3.50%	4.64%	0.00%	0.00%	0.76%	0.00%	91.10%	0.00%	0.00%	0.00%	0.00%	91.10%	639	0.00
CZ	80.77	11.00%	0.00%	2.84%	0.74%	1.99%	0.00%	5.42%	34.98%	54.02%	2.18%	42.33%	3.96%	5.50%	0.04%	576	1.22
DK	28.93	68.44%	4.38%	3.31%	48.01%	0.05%	0.00%	12.68%	0.00%	31.56%	0.00%	0.00%	23.75%	7.51%	0.29%	209	0.00
EE	10.58	15.74%	0.00%	0.12%	5.58%	0.18%	0.00%	9.85%	0.00%	84.26%	83.71%	0.00%	0.00%	0.55%	0.00%	875	0.00
FI	67.46	46.96%	0.00%	0.24%	8.68%	19.48%	0.00%	18.55%	32.44%	20.60%	5.90%	0.00%	8.58%	5.82%	0.30%	143	0.93
FR	548.60	19.81%	0.00%	1.86%	5.07%	11.50%	0.00%	1.39%	71.67%	8.51%	1.33%	0.00%	1.06%	5.72%	0.40%	47	1.94
DE	590.91	36.03%	0.99%	6.96%	18.14%	3.12%	0.03%	6.79%	12.16%	51.81%	1.32%	22.82%	12.35%	14.78%	0.55%	469	0.33
GB	276.69	26.91%	0.17%	4.25%	14.01%	2.14%	0.00%	6.34%	21.92%	51.17%	0.00%	0.00%	5.60%	45.56%	0.01%	268	1.75
GR	50.91	31.71%	0.00%	7.46%	12.38%	11.29%	0.00%	0.59%	0.00%	68.29%	0.05%	29.28%	0.00%	29.95%	9.01%	641	0.00
HU	28.16	12.07%	1.39%	0.95%	2.09%	0.76%	0.00%	6.88%	52.55%	35.38%	0.00%	15.94%	0.14%	19.08%	0.22%	314	1.77
IS	19.29	99.99%	0.00%	0.00%	0.02%	70.98%	28.99%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%	0	0.00
IE	38.14	35.30%	0.90%	0.09%	31.21%	1.92%	0.00%	1.17%	0.00%	64.70%	0.71%	5.90%	8.86%	49.06%	0.17%	393	0.00
IT	278.16	39.61%	0.77%	8.23%	6.21%	16.96%	2.05%	5.39%	0.00%	60.39%	4.14%	0.00%	10.36%	44.58%	1.30%	327	0.00
LV	6.50	52.48%	0.00%	0.00%	1.85%	37.18%	0.00%	13.45%	0.00%	47.52%	7.09%	0.00%	0.00%	40.43%	0.00%	313	0.08
LT	2.70	77.57%	2.70%	3.00%	42.19%	15.80%	0.00%	13.88%	0.00%	22.43%	13.18%	0.00%	0.00%	9.25%	0.00%	362	0.22
LU	0.77	58.26%	0.00%	8.00%	32.65%	10.45%	0.00%	7.16%	0.00%	41.74%	13.58%	0.00%	0.00%	28.16%	0.00%	201	0.00
MT	1.29	6.98%	0.00%	6.98%	0.00%	0.00%	0.00%	0.00%	0.00%	93.02%	0.00%	0.00%	0.00%	0.00%	93.02%	761	0.00
NL	108.55	16.24%	0.00%	2.87%	10.09%	0.07%	0.00%	3.21%	2.59%	81.17%	0.00%	0.00%	15.42%	65.74%	0.00%	457	0.07
NO	145.69	97.81%	0.73%	0.00%	2.32%	94.75%	0.00%	0.00%	0.00%	2.19%	0.02%	0.00%	0.00%	2.18%	0.00%	11	0.00

	Volume (TWh)	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Direct CO2 (gCO2/kWh)	RW (mgRW/kWh)
PL	156.67	13.05%	0.00%	0.18%	7.95%	1.23%	0.00%	3.69%	0.00%	86.95%	1.36%	28.62%	48.02%	7.93%	1.02%	846	0.01
PT	53.87	52.05%	0.00%	1.52%	22.93%	22.45%	0.00%	5.15%	0.00%	47.95%	0.42%	0.00%	20.64%	26.70%	0.19%	307	0.00
RO	60.71	42.84%	0.00%	2.89%	10.31%	29.13%	0.00%	0.51%	17.20%	39.96%	8.63%	21.50%	1.57%	8.27%	0.00%	401	3.13
SK	24.76	23.50%	0.10%	2.31%	0.02%	14.47%	0.00%	6.61%	55.66%	20.83%	2.27%	5.35%	4.66%	7.23%	1.33%	169	1.95
SI	14.82	33.62%	0.00%	1.52%	0.04%	31.01%	0.00%	1.06%	37.03%	29.35%	2.02%	27.28%	0.00%	0.05%	0.00%	335	1.00
ES	258.96	38.74%	0.35%	4.70%	19.14%	13.17%	0.00%	1.37%	20.54%	40.72%	0.95%	9.89%	4.51%	20.73%	4.65%	288	0.55
SE	158.28	56.08%	0.83%	0.00%	10.51%	38.53%	0.00%	6.22%	41.57%	2.34%	1.53%	0.00%	0.31%	0.39%	0.12%	12	1.12
CH	64.36	58.74%	2.56%	2.98%	0.19%	53.01%	0.00%	0.00%	37.93%	3.33%	1.76%	0.00%	0.00%	1.51%	0.06%	14	1.82

Figure 9: Production Mix (left) and Final Residual Mix (right) 2018

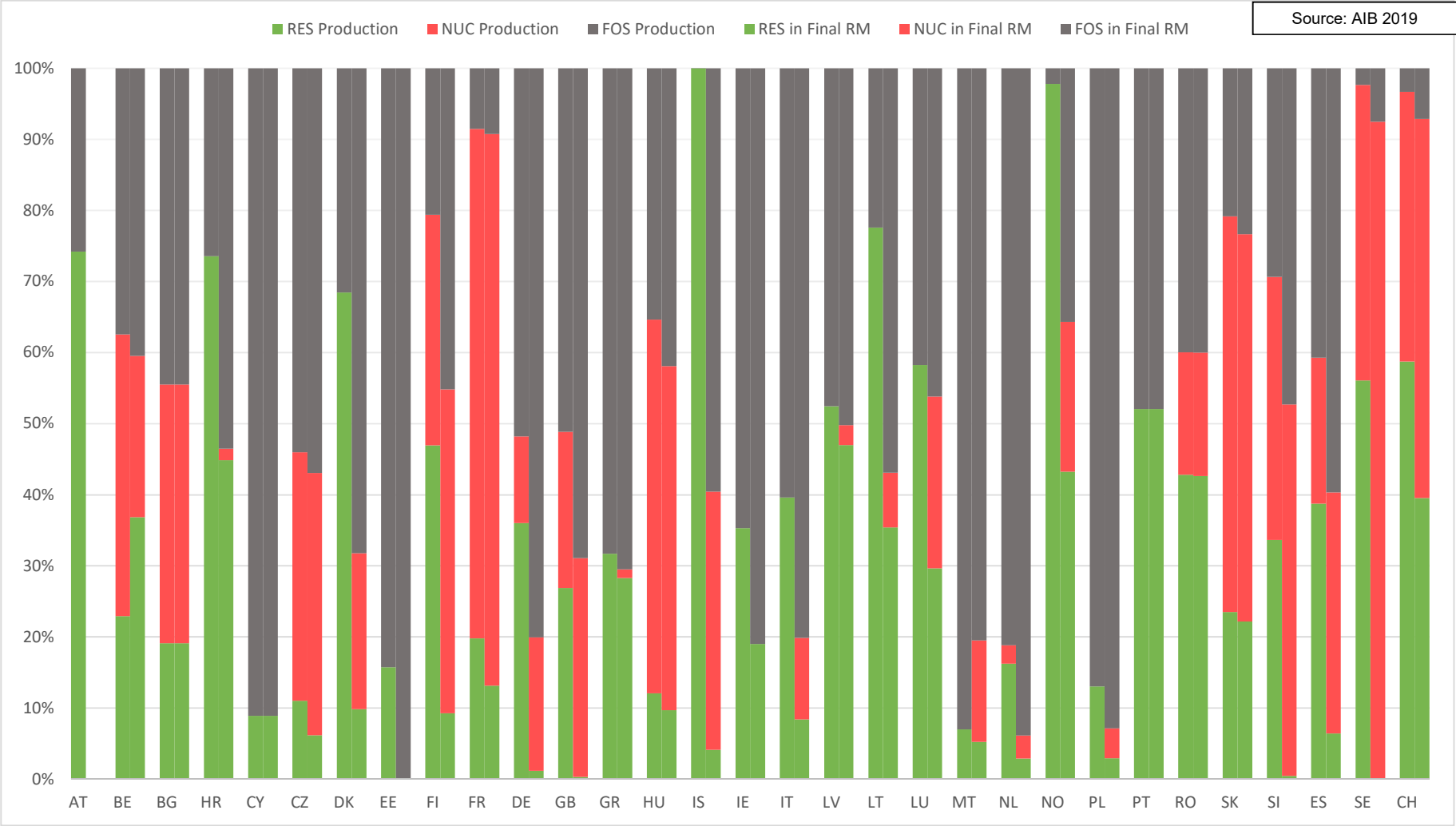


Figure 10: Production Mix (left) and Final Residual Mix (right) 2018 (detailed fuel categories)

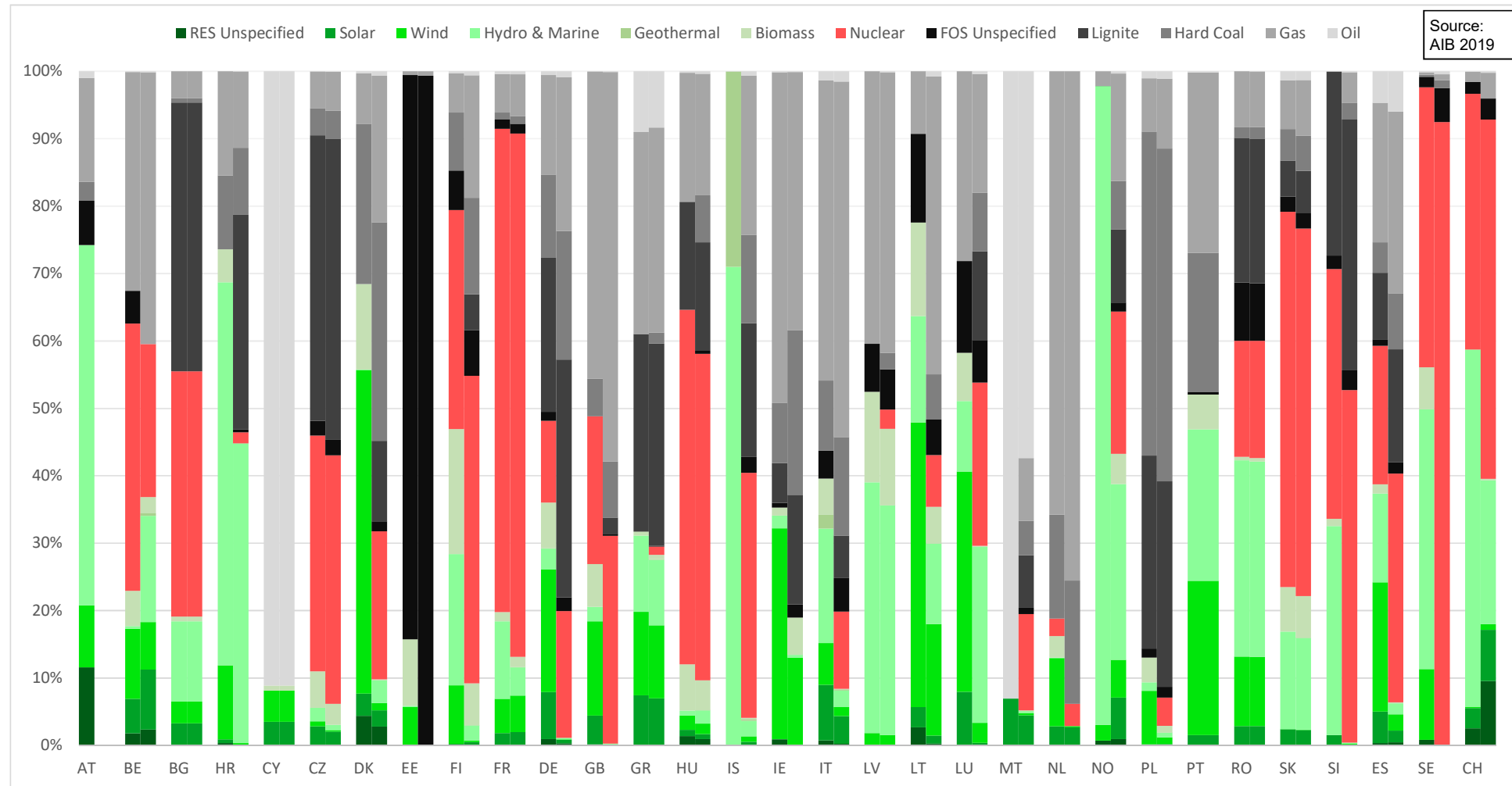


Figure 11: European Total Production Mix (left), Total of all available attributes in Final Residual Mixes (middle) and EAM (right) 2018

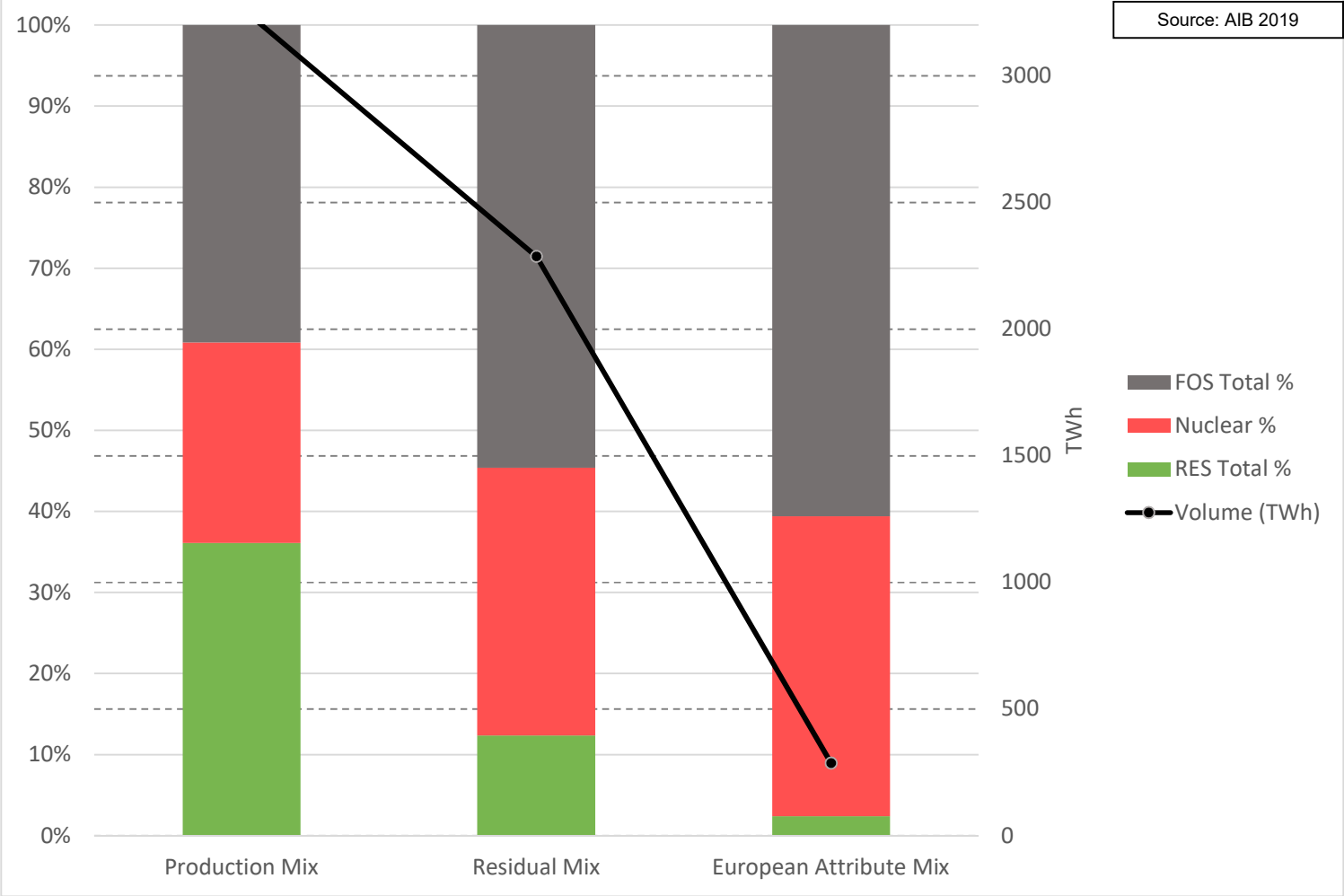


Figure 12: European Total Production Mix (left), Total of all available attributes in Final Residual Mixes (middle) and EAM (right) 2018 (detailed fuel categories)

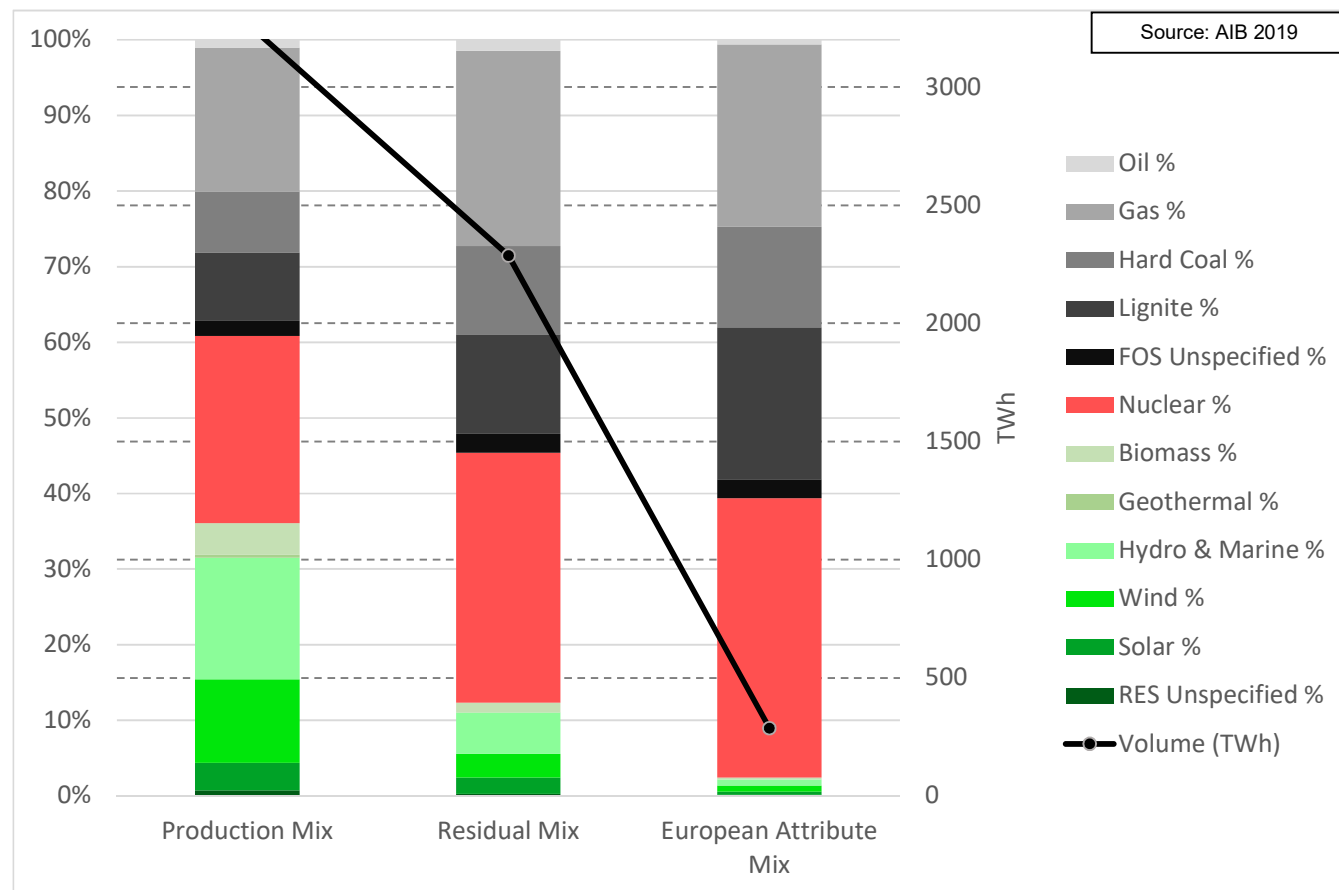


Table 6: European Total Production Mix, Total of all available attributes in Final Residual Mixes and EAM 2018 (detailed fuel categories)

	Production Mix	Residual Mix	European Attribute Mix
Volume (TWh)	3267.51	2286.99	286.65
RES Total %	36.09%	12.35%	2.44%
RES Unspecified %	0.74%	0.29%	0.14%
Solar %	3.66%	2.16%	0.45%
Wind %	11.01%	3.13%	0.77%
Hydro & Marine %	16.11%	5.43%	0.81%
Geothermal %	0.35%	0.04%	0.00%
Biomass %	4.22%	1.29%	0.27%
Nuclear %	24.76%	33.04%	36.96%
FOS Total %	39.15%	54.61%	60.60%
FOS Unspecified %	1.97%	2.48%	2.48%
Lignite %	9.07%	13.16%	20.13%
Hard Coal %	8.05%	11.70%	13.28%
Gas %	19.00%	25.82%	24.11%
Oil %	1.06%	1.46%	0.61%

Figure 13: Production Mix (left) and Total Supplier Mix (right) 2018

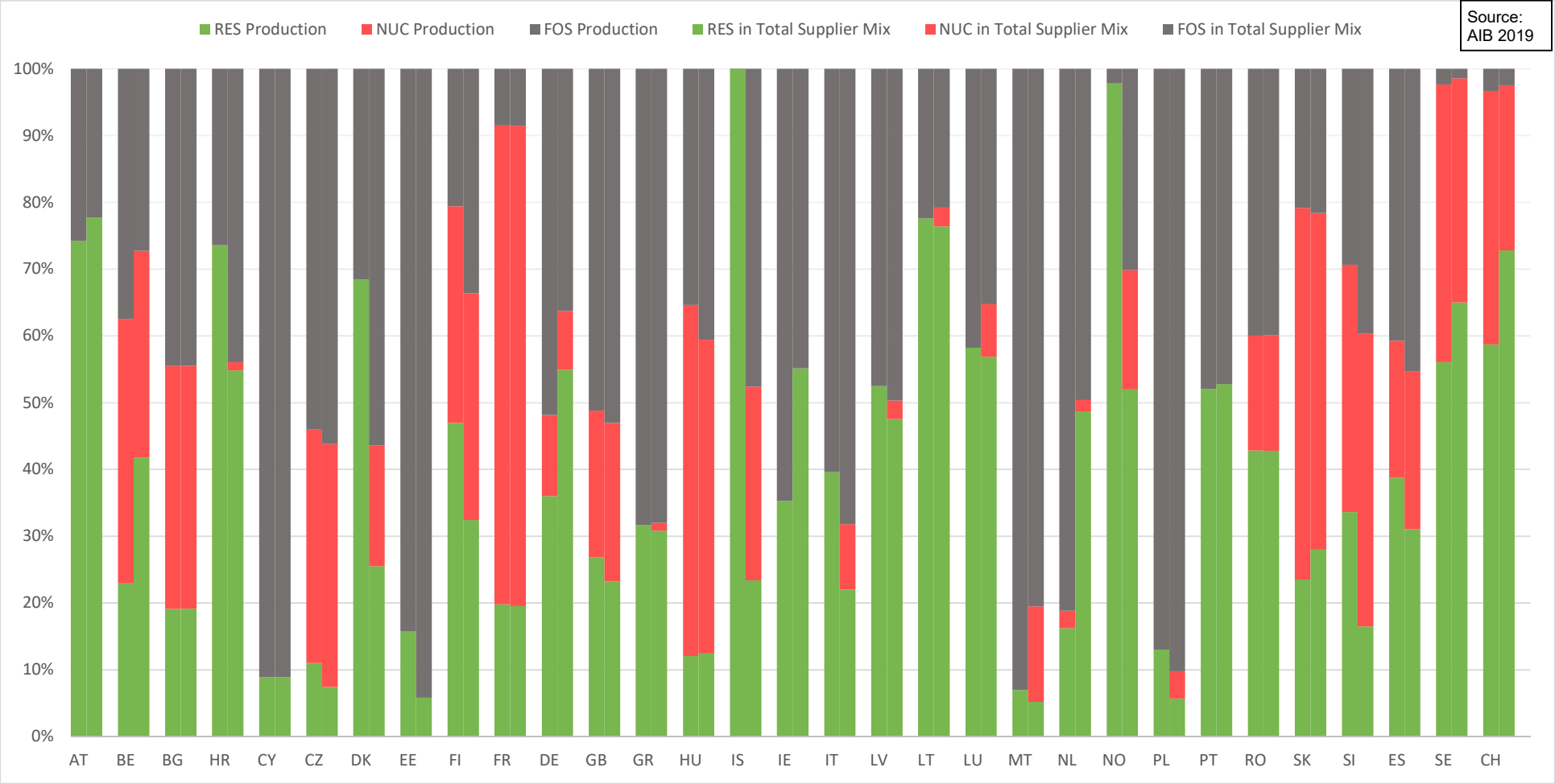


Figure 14: Production Mix (left) and Total Supplier Mix (right) 2018 (detailed fuel categories)

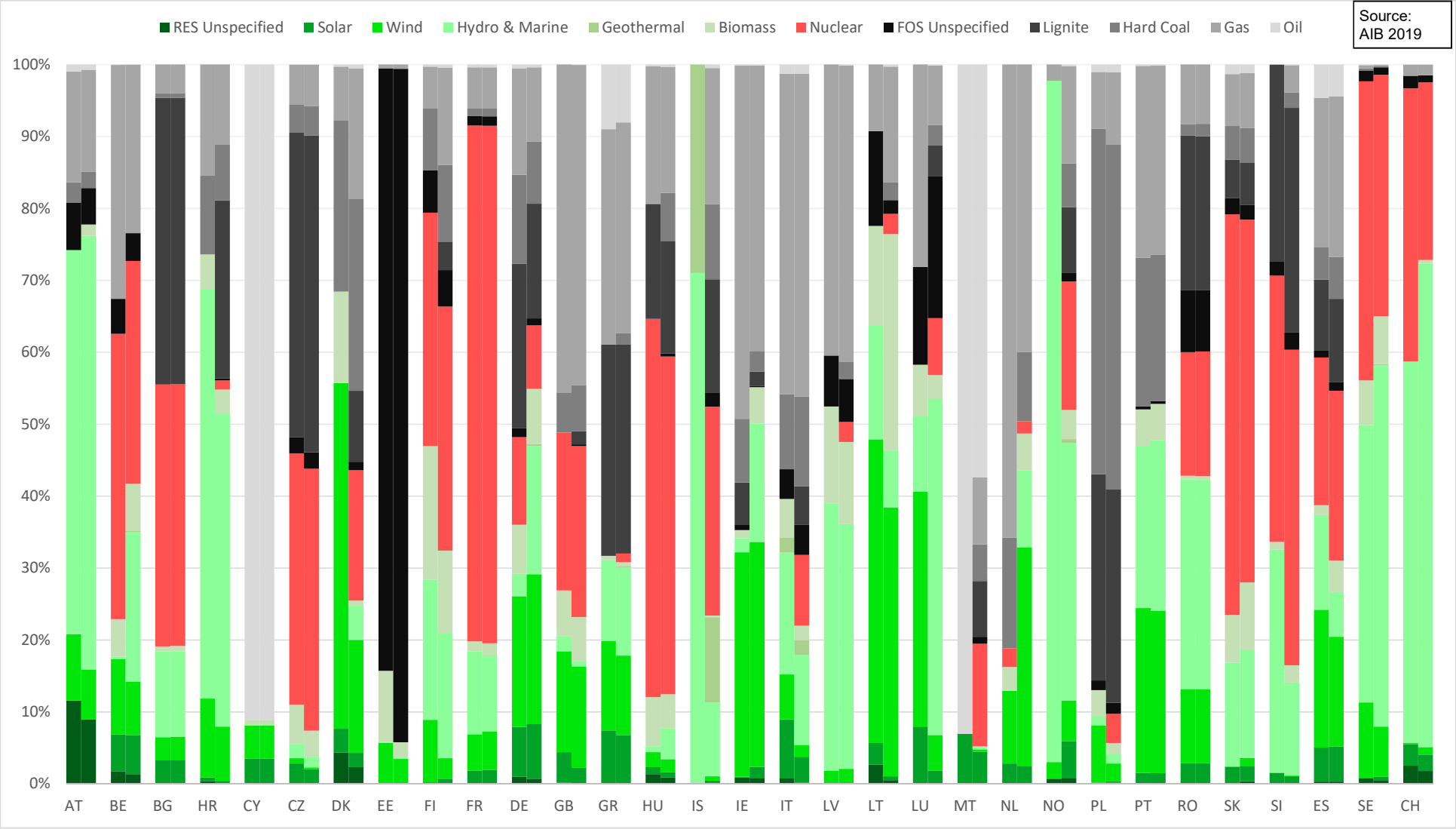


Figure 15: Production Mix (left) and Total Supplier Mix (right) [TWh] 2018



Figure 16: Production Mix (left) and Total Supplier Mix (right) [TWh] 2018 (detailed fuel categories)

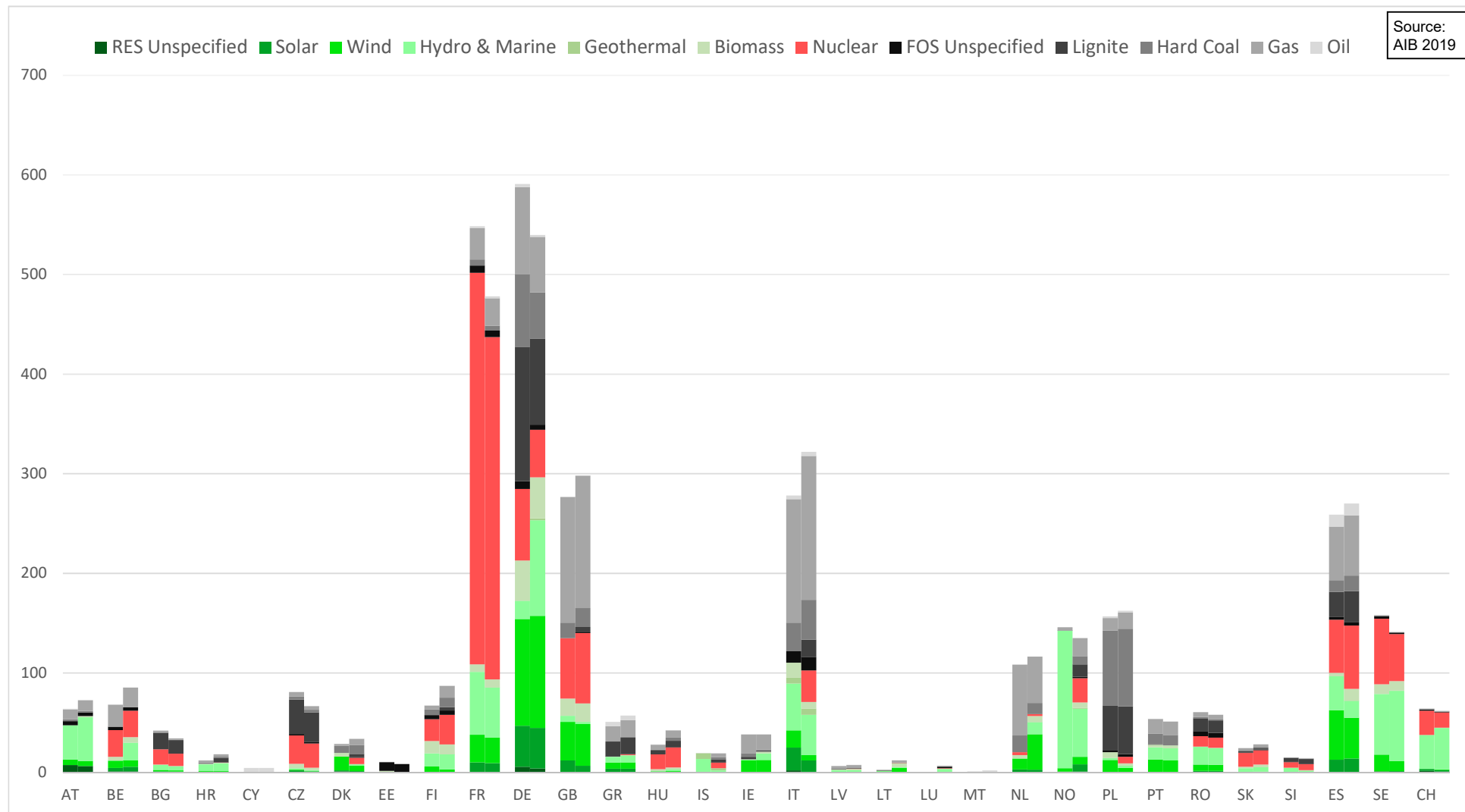


Figure 17: Residual Mixes 2016, 2017 and 2018

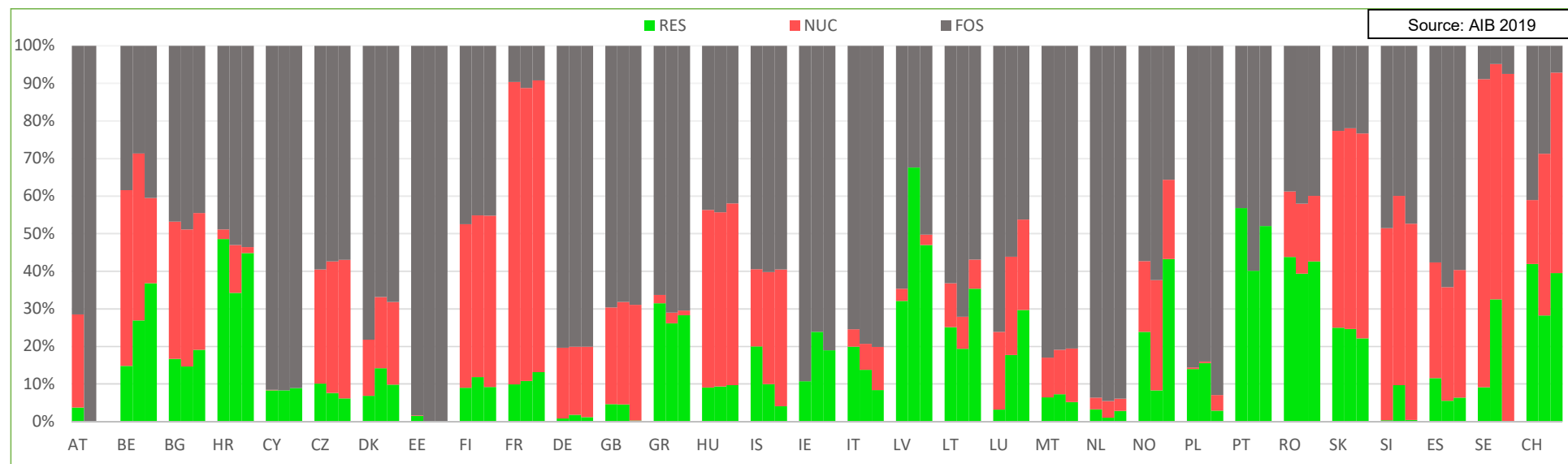


Table 7: Residual Mixes 2016, 2017 and 2018 (Percentages)

Percentages		AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MT	NL	NO	PL	PT	RO	SK	SI	ES	SE	CH
2016	RES	3.8	14.8	16.7	48.6	8.3	10.1	6.9	1.5	9.0	9.9	0.8	4.6	31.5	9.1	20.0	10.7	20.0	32.1	25.1	3.2	6.4	3.2	23.9	14.0	56.8	43.8	25.0	0.4	11.6	9.2	42.0
	NUC	24.7	46.8	36.5	2.6	0.1	30.4	14.9	0.1	43.6	80.5	18.8	25.7	2.2	47.2	20.5	0.0	4.6	3.2	11.7	20.7	10.6	3.1	18.9	0.4	0.0	17.5	52.3	51.1	30.7	81.9	17.0
	FOS	71.5	38.4	46.8	48.9	91.6	59.5	78.2	98.3	47.4	9.6	80.4	69.6	66.3	43.7	59.4	89.3	75.4	64.6	63.2	76.1	83.0	93.6	57.3	85.6	43.2	38.7	22.7	48.5	57.7	8.9	41.0
2017	RES	0.0	26.9	14.7	34.3	8.3	7.6	14.2	0.0	11.9	10.8	1.8	4.5	26.2	9.4	9.9	23.9	34.3	67.6	19.4	17.8	7.3	1.1	8.3	15.6	40.2	39.4	24.7	9.7	5.5	32.6	28.2
	NUC	0.0	44.4	36.5	12.7	0.0	35.0	19.0	0.0	43.1	78.0	18.2	27.3	2.9	46.3	29.9	0.0	12.7	0.0	8.5	26.1	11.8	4.4	29.4	0.4	0.0	18.6	53.4	50.3	30.3	62.6	43.0
	FOS	100.0	28.7	48.8	53.0	91.7	57.4	66.8	100.0	45.1	11.2	80.0	68.1	71.0	44.3	60.2	76.1	53.0	32.4	72.1	56.1	80.9	94.5	62.3	84.0	59.8	42.0	22.0	40.0	64.2	4.8	28.7
2018	RES	0.0	36.8	19.1	44.8	8.9	6.2	9.8	0.0	9.2	13.1	1.2	0.3	28.3	9.7	4.1	19.0	8.4	47.0	35.4	29.6	5.2	2.9	43.3	2.9	52.0	42.6	22.2	0.5	6.4	0.0	39.6
	NUC	0.0	22.7	36.4	1.6	0.0	36.9	22.0	0.0	45.6	77.6	18.8	30.8	1.2	48.4	36.3	0.0	11.5	2.8	7.7	24.2	14.3	3.3	21.1	4.2	0.0	17.4	54.5	52.3	33.9	92.5	53.3
	FOS	0.0	40.5	44.5	53.5	91.1	57.0	68.2	100.0	45.2	9.2	80.0	68.9	70.5	41.9	59.6	81.0	80.1	50.2	56.9	46.2	80.5	93.8	35.7	92.9	48.0	40.0	23.3	47.3	59.7	7.5	7.1

Figure 18: Production Mixes 2016, 2017 and 2018

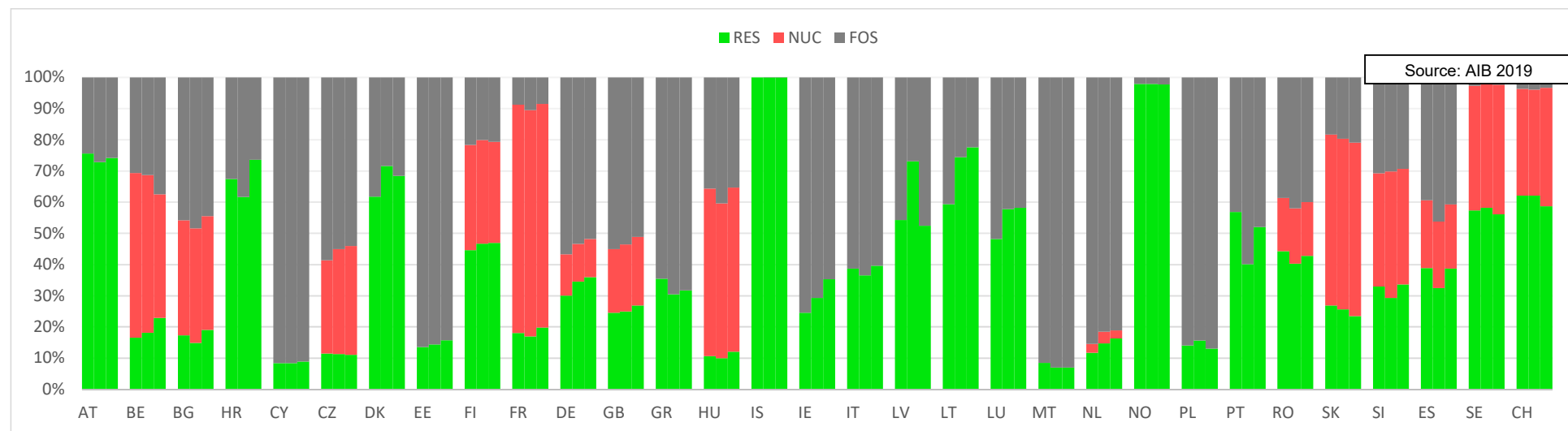


Table 8: Production Mixes 2016, 2017 and 2018 (Percentages)

Percentages		AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IS	IE	IT	LV	LT	LU	MT	NL	NO	PL	PT	RO	SK	SI	ES	SE	CH
2016	RES	75.6	16.6	17.3	67.5	8.4	11.5	61.7	13.6	44.6	18.1	30.0	35.5	35.5	10.6	100.0	24.6	38.7	54.2	59.3	48.2	8.4	11.8	97.9	14.1	56.8	44.3	26.9	33.0	38.9	57.3	62.2
	NUC	0.0	52.8	36.9	0.0	0.0	29.9	0.0	0.0	33.7	73.2	13.3	0.0	0.0	53.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	17.1	54.8	36.3	21.7	40.0	34.2
	FOS	24.4	30.6	45.8	32.5	91.6	58.6	38.3	86.4	21.7	8.7	56.7	64.5	64.5	35.7	0.0	75.4	61.3	45.8	40.7	51.8	91.6	85.4	2.1	85.9	43.2	38.6	18.4	30.8	39.4	2.7	3.6
2017	RES	72.9	18.2	14.9	61.7	8.3	11.3	71.6	14.4	46.7	17.0	34.5	30.4	30.4	10.0	100.0	29.3	36.5	73.1	0.0	57.7	7.0	14.7	97.9	15.6	40.2	40.3	25.7	29.3	32.5	58.2	62.1
	NUC	0.0	50.5	36.7	0.0	0.0	33.6	0.0	0.0	33.2	72.6	12.1	0.0	0.0	49.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	17.7	54.8	40.5	21.4	39.6	34.0
	FOS	27.1	31.3	48.5	38.3	91.7	55.1	28.4	85.6	20.1	10.4	53.3	69.6	69.6	40.3	0.0	70.7	63.5	26.9	0.0	42.3	93.0	81.5	2.1	84.4	59.8	42.0	19.6	30.2	46.2	2.2	3.9
2018	RES	74.2	22.9	19.1	73.6	8.9	11.0	68.4	15.7	47.0	19.8	36.0	26.9	31.7	12.1	100.0	35.3	39.6	52.5	77.6	58.3	7.0	16.2	97.8	13.0	52.0	42.8	23.5	33.6	38.7	56.1	58.7
	NUC	0.0	39.6	36.4	0.0	0.0	35.0	0.0	0.0	32.4	71.7	12.2	21.9	0.0	52.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	17.2	55.7	37.0	20.5	41.6	37.9
	FOS	25.8	37.4	44.5	26.4	91.1	54.0	31.6	84.3	20.6	8.5	51.8	51.2	68.3	35.4	0.0	64.7	60.4	47.5	22.4	41.7	93.0	81.2	2.2	87.0	48.0	40.0	20.8	29.3	40.7	2.3	3.3

Figure 19: Recorded cancellations of EECS and National GOs in 2018 [TWh]

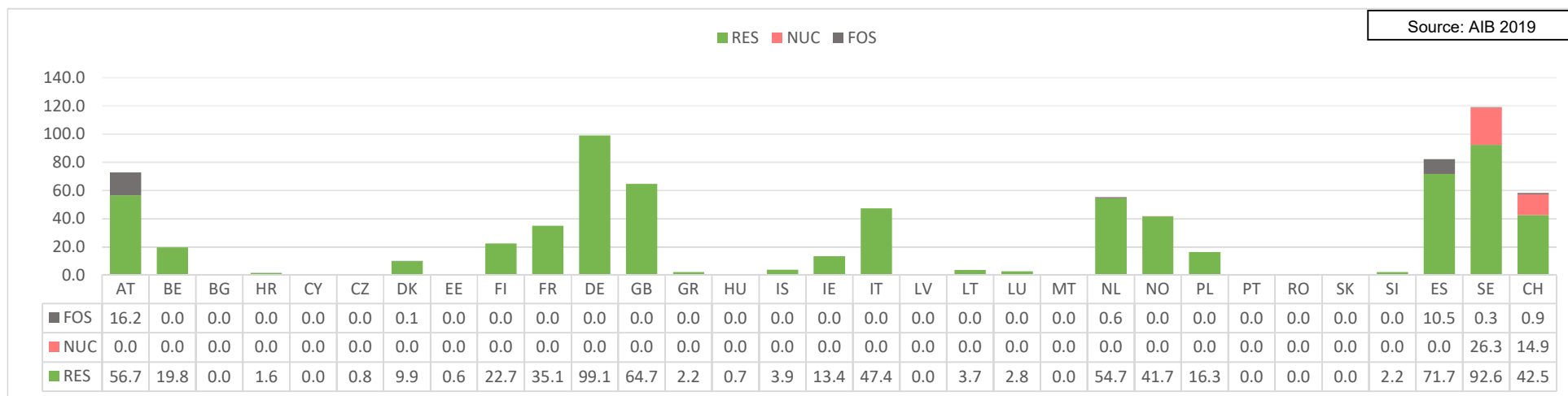


Figure 20: Recorded imports and exports of EECS and National GOs in 2018 [TWh] (Note that ex-domain cancellations are not included)

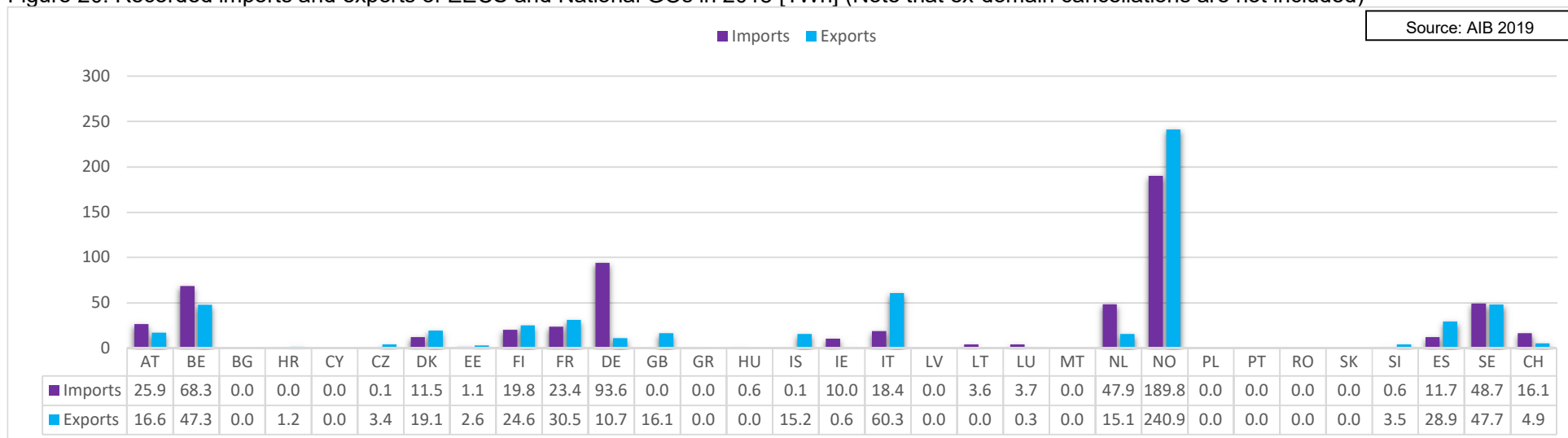
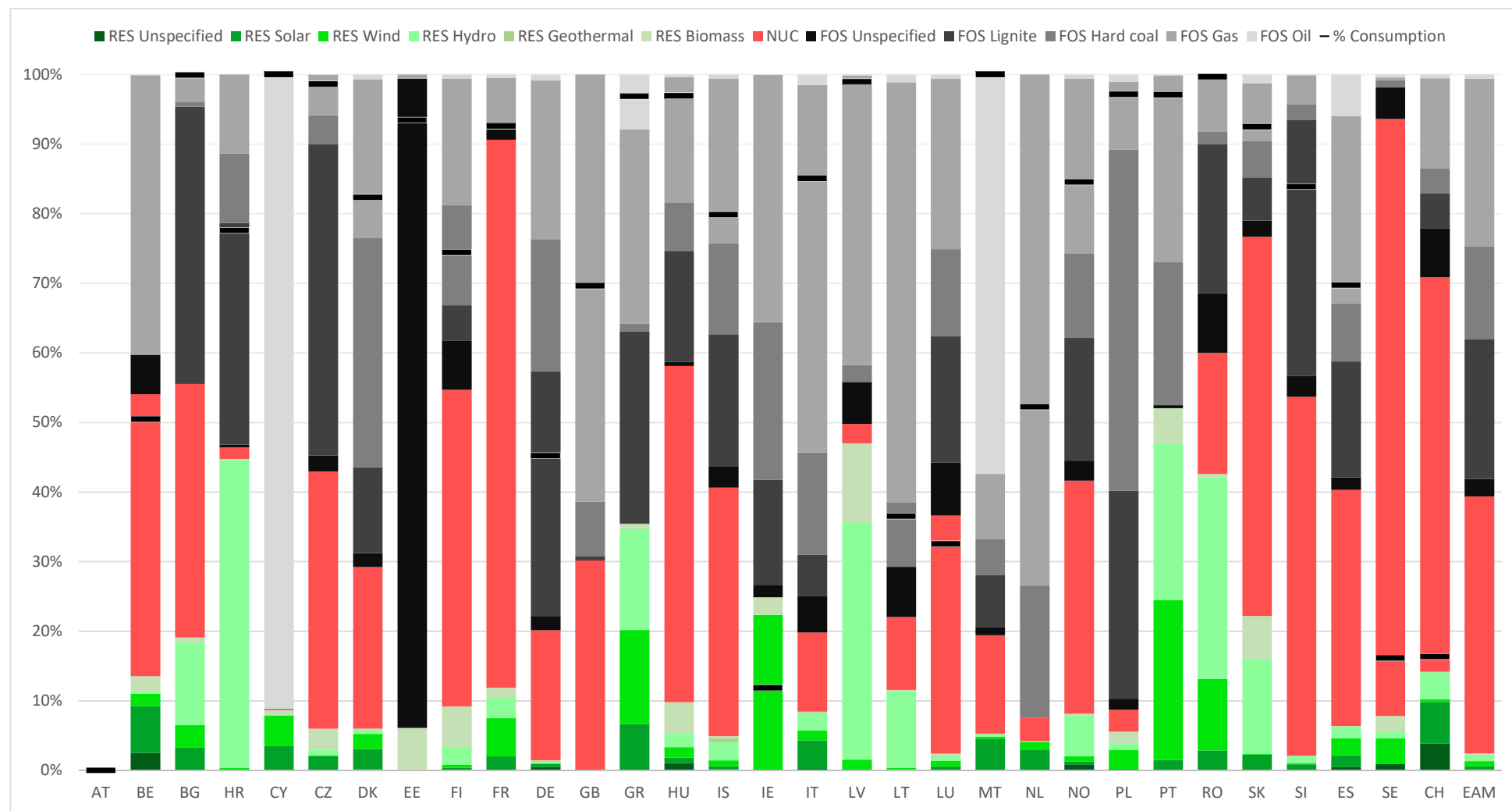


Table 9: Residual Mixes 2018 Issuance Based Methodology

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Untracked consumption	Direct CO2 (gCO2/kWh)	LCA CO2 (gCO2/kWh)	Direct GWP (gCO2/kWh)	LCA GWP (gCO2/kWh)	RW (mgRW/kWh)
BE	13.56%	2.51%	6.72%	1.77%	0.35%	0.00%	2.20%	40.50%	45.94%	5.68%	0.00%	0.00%	40.15%	0.12%	50.46%	204.41	259.47	214.14	287.00	1.09
BG	19.12%	0.00%	3.29%	3.22%	11.91%	0.00%	0.70%	36.39%	44.49%	0.00%	39.87%	0.63%	3.99%	0.00%	99.92%	469.54	514.62	495.43	526.80	1.27
HR	44.76%	0.06%	0.02%	0.28%	44.39%	0.00%	0.01%	1.65%	53.59%	0.40%	31.87%	9.96%	11.34%	0.03%	77.58%	559.02	573.67	562.12	605.87	0.05
CY	8.66%	0.00%	3.51%	4.40%	0.00%	0.00%	0.76%	0.09%	91.25%	0.01%	0.05%	0.03%	0.06%	91.11%	99.99%	640.09	878.33	771.42	906.37	0.00
CZ	6.02%	0.00%	2.00%	0.16%	0.79%	0.00%	3.06%	36.94%	57.04%	2.31%	44.70%	4.18%	5.81%	0.04%	98.65%	608.14	656.60	613.26	674.93	1.29
DK	6.01%	0.17%	2.88%	2.21%	0.57%	0.00%	0.19%	23.21%	70.77%	2.00%	12.31%	32.95%	22.82%	0.69%	82.35%	522.92	590.34	527.96	642.15	0.65
EE	6.14%	0.00%	0.06%	0.00%	0.10%	0.00%	5.98%	0.00%	93.86%	93.24%	0.00%	0.00%	0.62%	0.00%	93.44%	977.80	1,011.75	979.91	1,030.97	0.00
FI	9.19%	0.05%	0.37%	0.38%	2.50%	0.01%	5.89%	45.52%	45.29%	6.98%	5.15%	14.34%	18.23%	0.59%	74.45%	294.48	340.07	301.32	371.93	1.35
FR	11.89%	0.00%	2.02%	5.48%	3.01%	0.00%	1.38%	78.76%	9.35%	1.46%	0.00%	1.16%	6.29%	0.44%	92.60%	51.83	69.21	53.82	78.09	2.13
DE	1.42%	0.49%	0.52%	0.00%	0.40%	0.00%	0.00%	18.74%	79.84%	2.04%	35.16%	19.02%	22.78%	0.84%	45.24%	722.38	759.05	726.92	815.49	0.51
GB	0.07%	0.00%	0.01%	0.02%	0.02%	0.00%	0.01%	30.16%	69.77%	0.08%	0.50%	7.80%	61.36%	0.03%	69.61%	369.35	390.39	371.25	407.06	2.36
GR	35.43%	0.00%	6.71%	13.47%	14.54%	0.11%	0.59%	0.00%	64.57%	0.04%	27.65%	1.12%	27.90%	7.86%	96.84%	608.59	677.66	640.71	650.43	0.00
HU	9.81%	1.07%	0.76%	1.52%	1.97%	0.00%	4.48%	48.32%	41.87%	0.56%	15.95%	6.98%	18.01%	0.38%	96.93%	344.98	432.11	378.60	459.83	1.65
IS	4.93%	0.14%	0.45%	0.85%	2.64%	0.56%	0.29%	35.73%	59.35%	3.08%	18.94%	13.06%	23.66%	0.60%	79.88%	474.43	509.70	478.92	547.38	1.01
IE	24.87%	0.15%	0.05%	22.15%	0.05%	0.00%	2.47%	0.00%	75.13%	1.81%	15.08%	22.66%	35.50%	0.08%	11.88%	588.07	634.62	592.35	672.02	0.00
IT	8.45%	0.24%	4.11%	1.39%	2.45%	0.17%	0.09%	11.37%	80.18%	5.19%	6.03%	14.68%	52.78%	1.50%	85.08%	483.33	546.89	487.31	596.67	0.32
LV	46.99%	0.01%	0.01%	1.56%	34.05%	0.01%	11.35%	2.81%	50.20%	6.02%	0.00%	2.45%	41.58%	0.16%	98.96%	313.03	346.84	322.76	375.06	0.09
LT	11.54%	0.05%	0.13%	0.18%	11.03%	0.02%	0.13%	10.51%	77.95%	7.21%	0.00%	9.20%	60.46%	1.08%	36.51%	507.73	556.35	520.93	602.37	0.35
LU	2.42%	0.13%	0.43%	0.79%	0.79%	0.00%	0.28%	34.21%	63.36%	7.64%	18.14%	12.51%	24.51%	0.56%	32.58%	496.80	534.01	502.46	575.22	0.96
MT	5.29%	0.05%	4.46%	0.32%	0.33%	0.00%	0.12%	14.12%	80.59%	1.22%	7.49%	5.16%	9.35%	57.38%	100.00%	654.82	747.04	668.92	779.46	0.40
NL	4.21%	0.00%	2.93%	1.16%	0.11%	0.00%	0.00%	3.32%	92.47%	0.00%	0.00%	19.03%	73.45%	0.00%	52.24%	527.18	586.14	530.41	639.50	0.09
NO	8.16%	0.86%	0.42%	0.76%	5.83%	0.00%	0.27%	33.48%	58.36%	2.89%	17.61%	12.15%	25.17%	0.55%	84.55%	456.57	490.45	461.07	526.94	0.94
PL	5.58%	0.01%	0.21%	2.75%	0.91%	0.00%	1.70%	3.15%	91.27%	1.58%	29.87%	49.02%	9.73%	1.07%	97.13%	883.97	945.74	891.72	1,017.68	0.09

	Renewables Total	Renewables Unspecified	Solar	Wind	Hydro & Marine	Geothermal	Biomass	Nuclear Total	Fossil Total	Fossil Unspecified	Lignite	Hard Coal	Gas	Oil	Untracked consumption	Direct CO ₂ (gCO ₂ /kWh)	LCA CO ₂ (gCO ₂ /kWh)	Direct GWP (gCO ₂ /kWh)	LCA GWP (gCO ₂ /kWh)	RW (mgRW/kWh)
PT	52.05%	0.00%	1.52%	22.93%	22.45%	0.00%	5.15%	0.00%	47.95%	0.42%	0.00%	20.64%	26.70%	0.19%	97.07%	306.99	359.35	315.52	396.54	0.00
RO	42.62%	0.00%	2.87%	10.25%	28.99%	0.00%	0.50%	17.39%	39.99%	8.57%	21.37%	1.78%	8.26%	0.01%	99.69%	401.20	429.92	402.59	442.66	3.13
SK	22.19%	0.10%	2.19%	0.07%	13.61%	0.00%	6.21%	54.47%	23.34%	2.32%	6.23%	5.21%	8.30%	1.28%	92.50%	188.59	227.94	193.95	246.64	1.89
SI	2.14%	0.02%	0.82%	0.19%	1.03%	0.00%	0.07%	51.57%	46.29%	3.01%	36.70%	2.28%	4.19%	0.10%	83.89%	492.98	517.10	493.95	533.70	1.40
ES	6.41%	0.49%	1.73%	2.42%	1.63%	0.00%	0.13%	33.89%	59.70%	1.82%	16.62%	8.35%	26.95%	5.96%	69.73%	448.52	501.85	451.06	512.68	0.92
SE	7.83%	0.92%	0.00%	3.71%	0.98%	0.00%	2.22%	85.77%	6.40%	4.52%	0.00%	1.07%	0.40%	0.41%	16.13%	34.75	52.68	36.55	58.28	2.32
CH	14.18%	3.89%	5.96%	0.38%	3.88%	0.00%	0.08%	56.69%	29.13%	6.97%	5.09%	3.51%	13.02%	0.53%	16.34%	184.72	213.50	188.70	233.71	2.53
EAM	2.44%	0.14%	0.45%	0.77%	0.81%	0.00%	0.27%	36.96%	60.60%	2.48%	20.13%	13.28%	24.11%	0.61%		486.05	521.74	490.64	560.31	1.03

Figure 21: Residual Mixes 2018 Issuance Based Methodology



Annex 1: Fuel Categories

Table 10: Fuel category breakdown

Fact Sheet 5 compliance		Fuel code	Fuel description (including all subcategories)	Sub-table reference	
Renewable	Unspecified & Other	F01000000	Renewable - Unspecified		T1 Hard coal sub-categories
		F01040300	Renewable - Heat - Aerothermal		0 F0201010 Unspecified
		F01040400	Renewable - Heat - Hydrothermal		1 F0201010 Anthracite
		F01040501	Renewable - Heat - Process heat - Biogenic		2 F0201010 Bituminous coal
		F01050000	Renewable - Mechanical source or other - Unspecified		3 F0201010 Coking coal
	Solar	F01040100	Renewable - Heat - Solar		4 F0201010 Coke-oven coke
		F01050100	Renewable - Mechanical source or other - Wind		5 F0201010 Lignite coke
	Hydro & Marine	F01050200	Renewable - Mechanical source or other - Hydro & Marine		
	Geothermal	F01040200	Renewable - Heat - Geothermal		T2 Brown coal sub-categories
	Biomass	F01010000	Renewable - Solid		0 F0201020 Unspecified
F01020000		Renewable - Liquid		1 F0201020 Sub-bituminous coal	
F01030000		Renewable - Gaseous		2 F0201020 Lignite	
Nuclear		F03010100	Nuclear - Solid - Radioactive fuel		3 F0201020 Brown coal briquette
Fossil	Unspecified & Other	F02000000	Fossil - Unspecified		4 F0201020 Peat briquette
		F02010000	Fossil - Solid - Unspecified		
		F02010400	Fossil - Solid - Municipal waste		T3 Petroleum products sub-categories
		F02010500	Fossil - Solid - Industrial and commercial waste		0 F0202030 Unspecified
		F02020000	Fossil - Liquid - Unspecified		1 F0202030 Ethane
		F02030000	Fossil - Gaseous	T4	2 F0202030 Naphtha
		F02040000	Fossil - Heat		3 F0202030 Aviation gasoline
	Hard Coal	F02010100	Fossil - Solid - Hard coal	T1	4 F0202030 Motor gasoline
	Brown Coal / Lignite	F02010300	Fossil - Solid - Peat		5 F0202030 Aviation turbine fuel
		F02010200	Fossil - Solid - Brown coal	T2	6 F0202030 Other kerosene
	Natural Gas	F02030100	Fossil - Gaseous - Natural Gas		7 F0202030 Gas and diesel oil
		F02020200	Fossil - Liquid - Natural gas liquids		8 F0202030 Fuel oil low-sulphur
	Oil	F02020100	Fossil - Liquid - Crude oil		9 F0202030 Fuel oil high-sulphur
		F02020300	Fossil - Liquid - Petroleum products	T3	10 F0202030 Liquid petroleum gas
					11 F0202030 Orimulsion
				12 F0202030 Bitumen	
				13 F0202030 Lubricants	
				14 F0202030 Petroleum coke	
				15 F0202030 Refinery feedstock	
				T4 Gaseous sub-categories	
				0 F0203000 Unspecified	
				20 F0203020 Coal-derived gas	
				21 F0203020 Coal-derived gas	
				22 F0203020 Coal-derived gas	
				30 F0203030 Petroleum products	
				31 F0203030 Petroleum products	
				32 F0203030 Petroleum products	
				33 F0203030 Petroleum products	
				34 F0203030 Petroleum products	
				40 F0203040 Municipal gas plant	
				50 F0203050 Process gas	
				51 F0203050 Process gas	
				52 F0203050 Process gas	
				53 F0203050 Process gas	
				54 F0203050 Process gas	
				55 F0203050 Process gas	