

D4.2 Results from Calculation on Tracking Relevant Data

Summary of the Results of the Residual Mix Calculations for 2010 and 2011

Written by

Markus Klimscheffskij (markus.klimscheffskij@grexel.com), Grexel Systems Ltd.

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1 Introduction

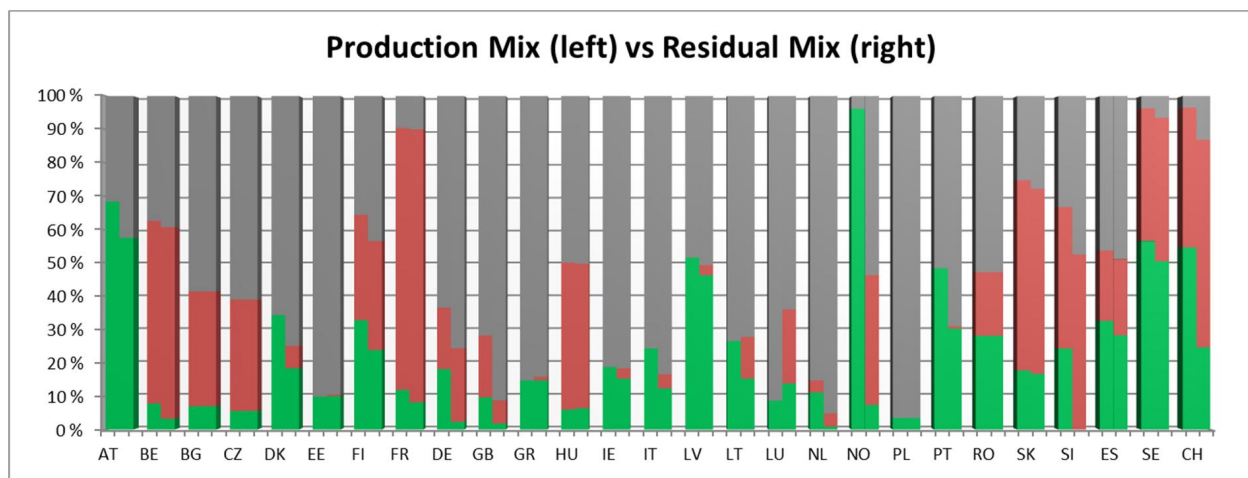
This document compiles the results of residual mix calculations of 2010 and 2011 for 27 European countries¹, executed as part of the RE-DISS project. The necessary background information for residual mix calculation is presented in chapter 2. Chapter 3 portrays the most important results of the two years: residual mixes, environmental indicators of residual mixes and total supplier mixes, as well as compares residual mixes of 2010 and 2011. In Chapters 2 and 3 also the balancing of attributes in the European Attribute Mix and the comparison of production mixes to residual mixes is shown for 2010 and 2011. Chapter 4 draws main conclusions from the results of the two calculation years.

¹ EU27 without Cyprus and Malta, but including Norway and Switzerland

2 Residual Mix Calculation – Background

A country's residual mix represents the electricity generation attributes available for disclosure after explicit tracking of generation attributes has been accounted for. Residual mix is used to determine the energy origin of untracked consumption, i.e. consumption, which has not been disclosed with explicit tracking instruments such as guarantees of origin or contract-based tracking. Figure 1 shows the 2011 production mixes of European countries compared to the residual mixes, which portrays the importance of using the residual mix for disclosure of untracked consumption in order to avoid double counting of RES.

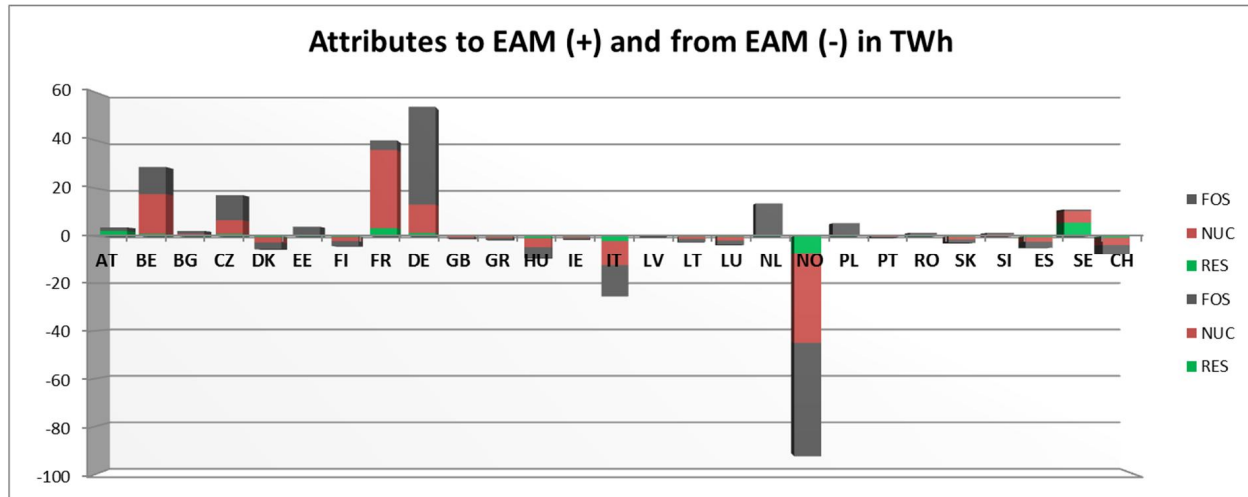
Figure 1: Comparison between Production and Residual Mixes of 2011



If untracked consumption were disclosed with the production mix, it would mean that the renewable attributes which a country uses for explicit tracking inside the country and which it net exports to other countries, would be double counted in disclosure. Evidently, the residual mix differs significantly from the production mix only in countries where explicit tracking is used.

Due to international trade of both electricity and generation attributes, the amount of available generation attributes in the domestic residual mix differs from the volume of untracked consumption in the country. Thus, the calculation needs to be harmonized for the entire Europe, which is achieved through the European Attribute Mix (EAM). After surplus and deficit attributes have been balanced via the EAM, the volume of attributes in the residual mix of each country equals the volume of untracked consumption in the country. This is an absolute precondition for the residual mix of a country to be reliably used for the disclosure of untracked consumption in the country. Figure 2 shows the balancing of attributes through the EAM in the 2011 calculation. Without the balancing, the attributes portrayed in Figure 2 would be neglected in disclosure, and the corresponding consumption would be disclosed otherwise, most often with too “green” attributes.

Figure 2: Attribute Balancing with the EAM in 2011



It is important to understand that Figure 2 actually portrays the combined effect of physical transfer of electricity and transfer of electricity generation attributes between domains. If GO trading is set aside, countries on the negative side would be the ones net importing physical electricity (i.e. such in which the domestic production would not amount to the domestic consumption). On the other hand, net exporters of electricity, would have too many attributes to merely disclose the domestic consumption. The status of Czech Republic, Italy and France in Figure 2 can be largely explained by this factor, and not by the exchange of GOs.

When GO exporting and importing is added to the picture, large exporters of GOs, such as Norway, lose generation attributes. Even though the difference between production and consumption in Norway is not great, the large export of GOs causes there to be significantly more untracked consumption than available attributes in the domestic residual mix. This would not happen, if GOs were used internally, since the cancellations would also decrease the amount of untracked consumption. The counter-effect of Norway can be seen mainly in Belgium, Germany and the Netherlands. Also there the production and consumption are quite equal, but Norwegian attributes as well as the domestic ones are used for disclosure.

3 Residual Mixes of 2010 and 2011

3.1 2010

Table 1, Figure 3 and Figure 4 present the shares of different energy sources as well as content of CO₂ and radioactive waste in the residual mixes of European countries in 2010. The value “% Cons” means the share of untracked consumption from the total consumption of the country, i.e. the consumption which should be disclosed with the residual mix. Note that in countries without explicit tracking mechanisms, the residual mix should be used for the disclosure of the entire consumption, and hence the value “% Cons” is 100 % for such countries. In such countries, the shares of energy sources in the residual mix are very close or equal to their respective shares in the domestic production mix.

Table 1: Residual Mixes 2010

	RES	NUC	FOS	% CONS	g of CO ₂ per kWh	mg of RW per kWh
AT	42,4 %	1,7 %	55,9 %	36,88 %	218,9	0,05
BE	0,0 %	56,2 %	43,8 %	69,31 %	162,1	1,69
BG	12,0 %	35,4 %	52,6 %	100,00 %	704,0	1,06
CZ	4,5 %	33,6 %	61,9 %	100,00 %	467,6	1,01
DK	26,8 %	0,5 %	72,7 %	96,51 %	543,8	0,01
EE	8,3 %	1,4 %	90,2 %	100,00 %	1091,2	0,04
FI	21,8 %	29,5 %	48,7 %	93,85 %	370,7	0,88
FR	11,2 %	77,5 %	11,3 %	98,79 %	49,8	2,33
DE	2,9 %	27,1 %	70,0 %	78,97 %	645,7	0,81
GB	2,1 %	14,3 %	83,6 %	27,79 %	519,9	0,43
GR	21,6 %	0,8 %	77,6 %	100,00 %	944,0	0,02
HU	6,8 %	42,5 %	50,6 %	99,97 %	413,0	1,28
IE	13,1 %	0,1 %	86,9 %	100,00 %	442,5	0,00
IT	19,3 %	1,5 %	79,2 %	87,28 %	337,7	0,05
LV	50,1 %	2,1 %	47,7 %	100,00 %	213,6	0,06
LT	7,9 %	10,5 %	81,6 %	100,00 %	661,3	0,32
LU	6,5 %	19,3 %	74,2 %	95,57 %	415,6	0,58
NL	0,0 %	3,8 %	96,2 %	72,07 %	402,5	0,11
NO	21,0 %	27,6 %	51,4 %	83,46 %	385,2	0,83
PL	3,4 %	0,0 %	96,6 %	99,99 %	1019,3	0,00

PT	41,3 %	1,4 %	57,3 %	58,10 %	427,4	0,04
RO	36,1 %	19,0 %	44,9 %	100,00 %	556,7	0,57
SK	21,1 %	53,8 %	25,1 %	100,00 %	180,1	1,61
SI	36,5 %	29,5 %	34,0 %	99,60 %	425,7	0,89
ES	32,6 %	23,1 %	44,3 %	95,88 %	242,9	0,69
SE	47,3 %	45,2 %	7,5 %	70,32 %	25,2	1,36
CH	25,4 %	58,3 %	16,3 %	75,72 %	109,9	1,75
EAM	4,7 %	35,5 %	59,8 %		472,5	1,06

RES = renewable energy sources; NUC = nuclear energy, FOS = fossil and other energy sources
 % CONS = share of the Residual Mix in total consumption, RW = radioactive waste

Please note that the values for g of CO₂ per kWh are relating to the onsite emissions of power production in fossil-fuelled power plants.

Note also that these figures are destined for electricity disclosure purposes only. Any use of these figures in corporate or product carbon foot-printing is not recommended due to unresolved data inconsistencies and open issues regarding carbon footprint methodologies.

Due to the lack of consistent and reliable data, it is assumed that all nuclear power plants in Europe produce 3 mg of radioactive waste per kWh of power output.

Figure 3: Residual Mixes 2010

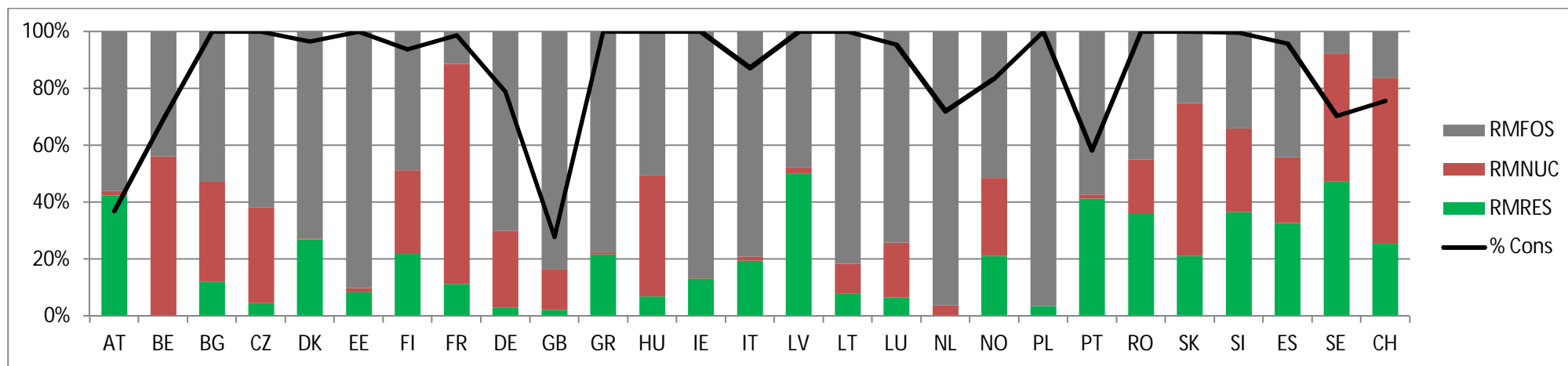


Figure 4: CO₂ and Radioactive Waste Content in Residual Mix 2010

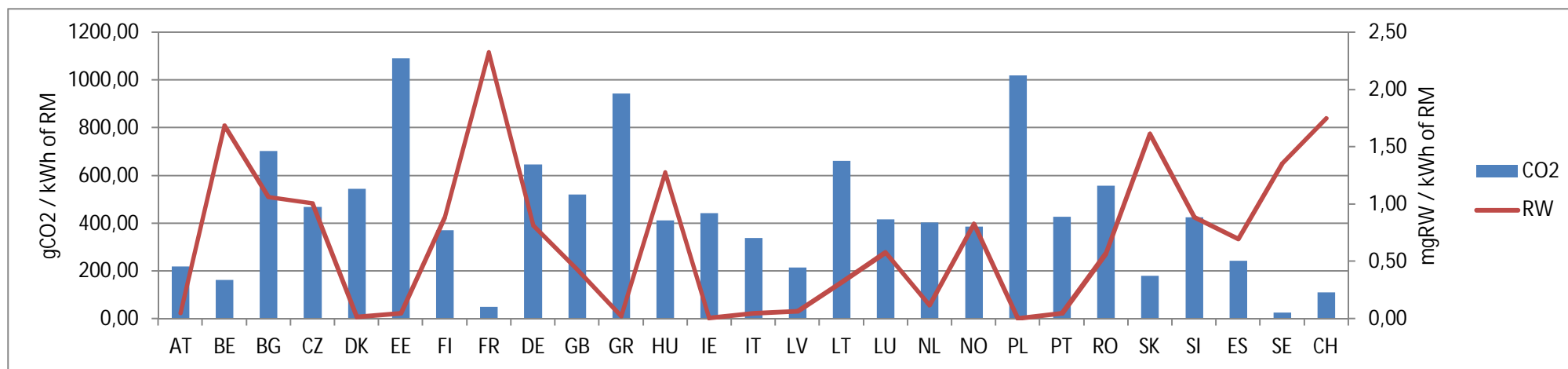


Figure 5 presents the total supplier mixes of European countries in 2010. Total supplier mix is the total mix of attributes used for disclosure in a country, meaning attributes both explicitly (GOs) and implicitly (residual mix) disclosed. To obtain the total supplier mix, attributes of cancelled GOs

in the country are added to the final residual mix of the country. In physical volume, the total supplier mix equals the total electricity consumption of the country.

Figure 5: Total Supplier Mixes 2010

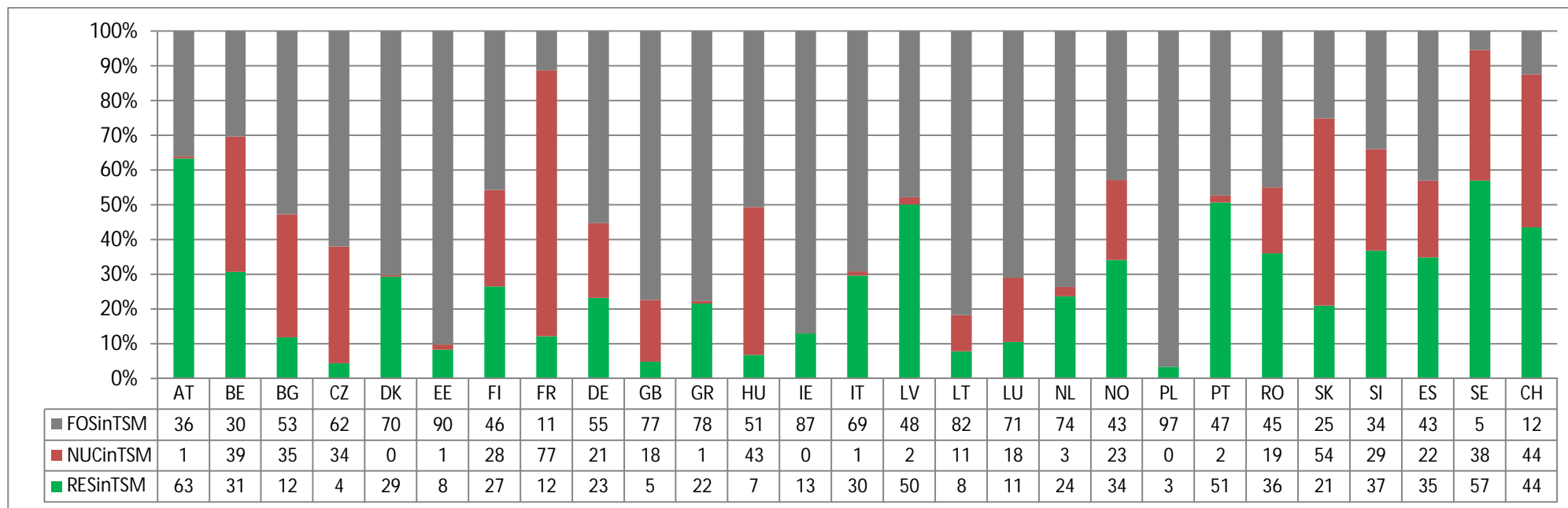


Figure 6: Attributes to EAM (+) and from EAM (-) in TWh in 2010

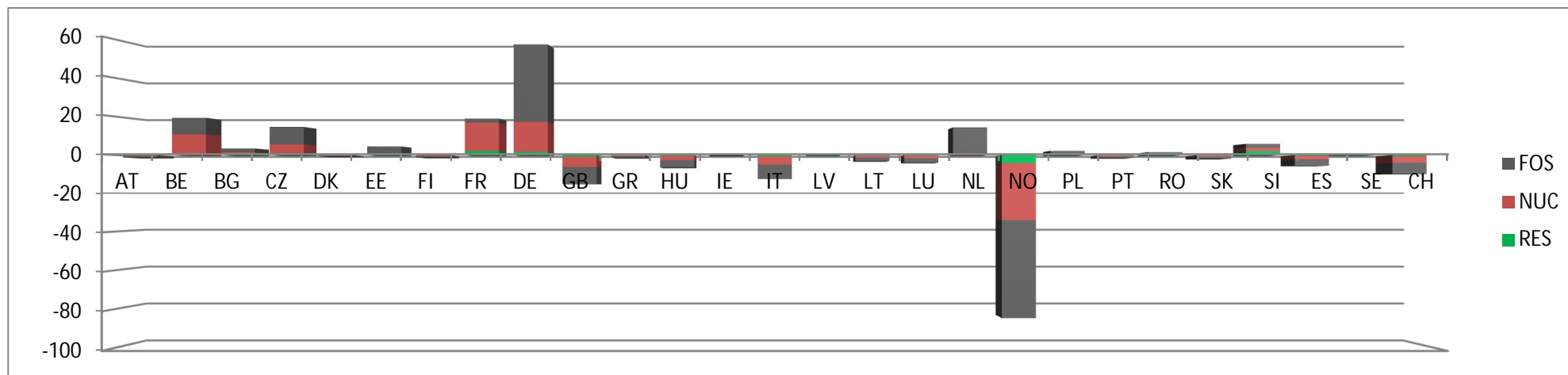
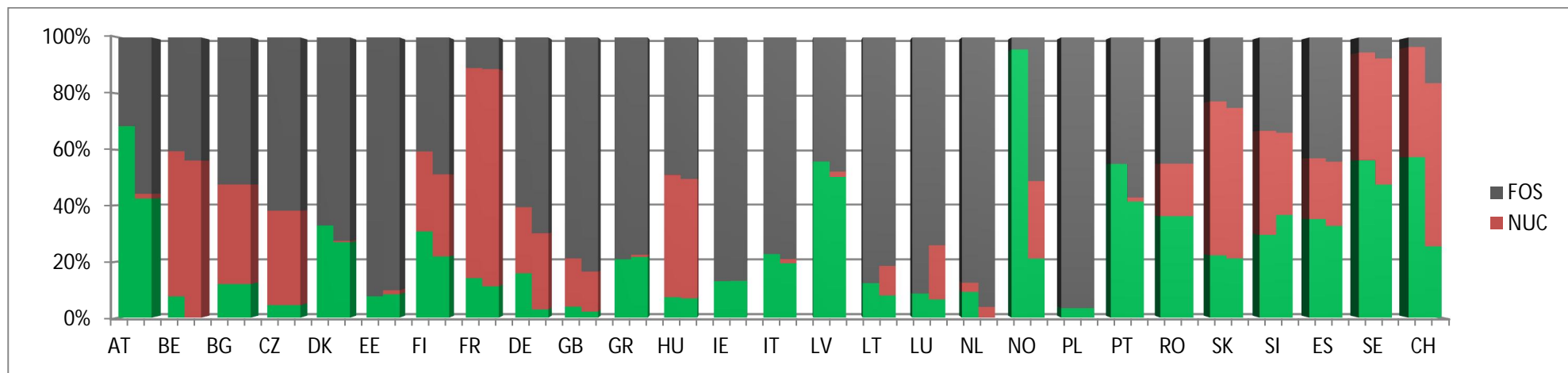


Figure 7: Comparison between Production and Residual Mixes of 2011



3.2 2011

Table 2: Residual Mixes 2011 - See explanations from 2010 results.

	RES	NUC	FOS	% CONS	g of CO ₂ per kWh	mg of RW per kWh
AT	57,6 %	0,0 %	42,4 %	34,1 %	133,2	0,00
BE	3,3 %	57,6 %	39,2 %	58,8 %	94,2	1,73
BG	7,0 %	34,4 %	58,7 %	100,0 %	492,6	1,03
CZ	5,5 %	33,3 %	61,1 %	100,0 %	446,7	1,00
DK	18,3 %	6,7 %	75,0 %	95,0 %	510,4	0,20
EE	10,0 %	0,4 %	89,5 %	100,0 %	1094,1	0,01
FI	23,8 %	32,9 %	43,3 %	93,3 %	317,7	0,99
FR	8,1 %	81,9 %	10,0 %	38,7 %	34,2	2,46
DE	2,3 %	22,0 %	75,7 %	74,7 %	676,7	0,66
GB	1,9 %	6,9 %	91,2 %	30,7 %	522,5	0,21
GR	14,7 %	1,1 %	84,2 %	100,0 %	926,7	0,03
HU	6,4 %	43,2 %	50,4 %	100,0 %	373,5	1,30
IE	15,2 %	3,0 %	81,7 %	47,4 %	410,1	0,09
IT	12,4 %	4,2 %	83,5 %	75,1 %	358,5	0,13
LV	46,1 %	3,1 %	50,8 %	100,0 %	205,1	0,09
LT	15,2 %	12,5 %	72,3 %	100,0 %	513,8	0,37
LU	13,8 %	22,2 %	64,0 %	92,6 %	338,9	0,67
NL	0,9 %	4,0 %	95,1 %	71,5 %	385,9	0,12
NO	7,4 %	38,8 %	53,8 %	79,5 %	368,0	1,16
PL	3,4 %	0,0 %	96,6 %	100,0 %	1022,4	0,00
PT	30,2 %	0,8 %	69,1 %	55,0 %	347,0	0,02
RO	28,0 %	19,0 %	53,0 %	100,0 %	568,4	0,57
SK	16,7 %	55,5 %	27,8 %	100,0 %	162,7	1,67
SI	0,0 %	52,3 %	47,7 %	79,0 %	636,9	1,57
ES	28,1 %	22,8 %	49,0 %	94,7 %	250,6	0,68
SE	50,3 %	43,2 %	6,5 %	51,4 %	25,5	1,30
CH	24,6 %	62,4 %	13,0 %	70,9 %	77,5	1,87
EAM	7,82 %	40,81 %	51,36 %	67,66 %	368,09	1,22

RES = renewable energy sources; NUC = nuclear energy, FOS = fossil and other energy sources
% CONS = share of the Residual Mix in total consumption, RW = radioactive waste

Figure 8: Residual Mixes 2011

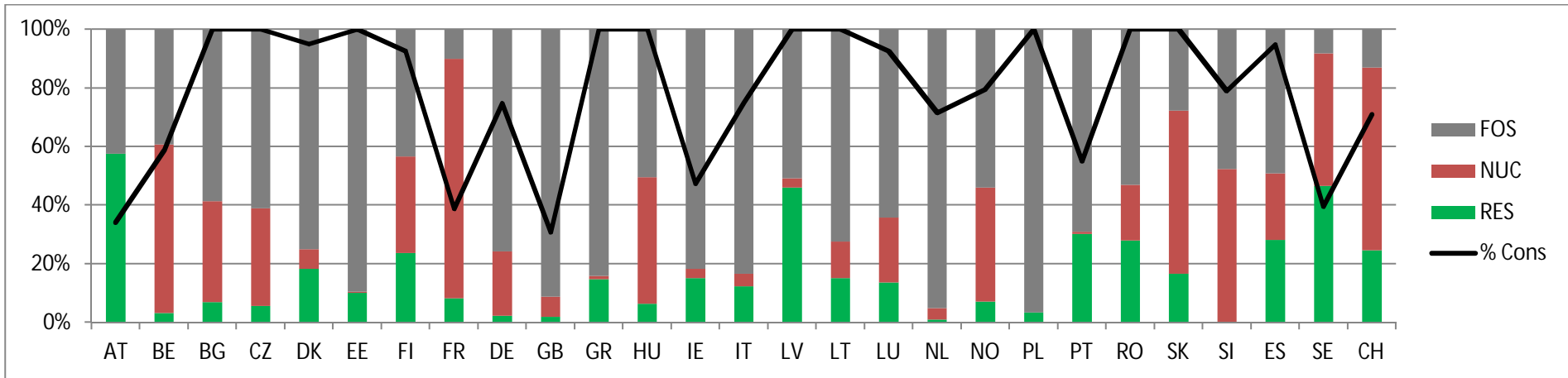
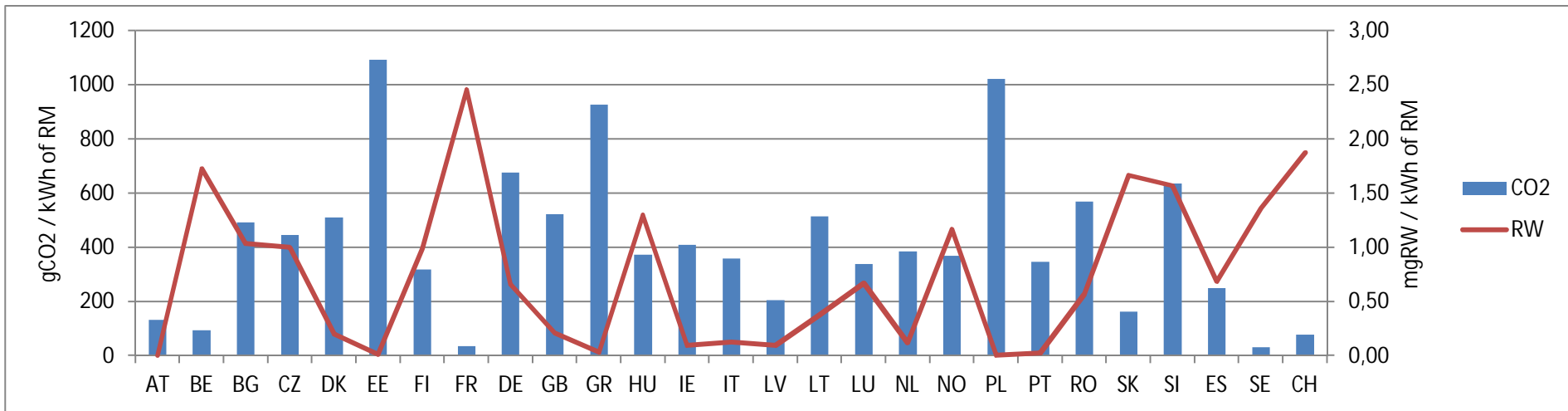
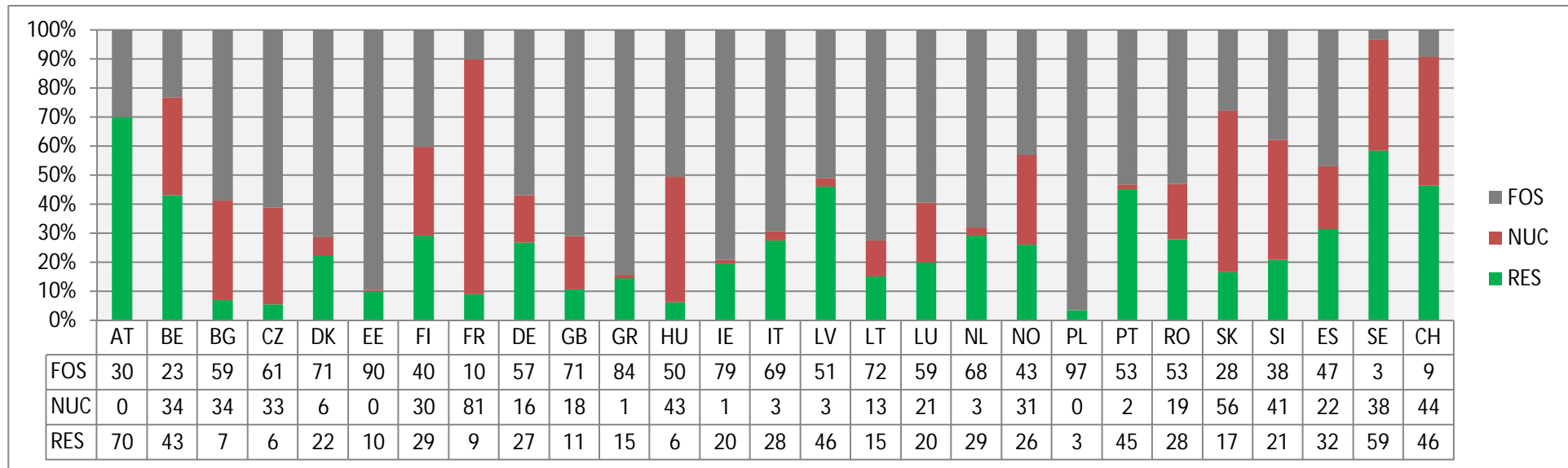


Figure 9: CO₂ and Radioactive Waste Content in Residual Mix 2010



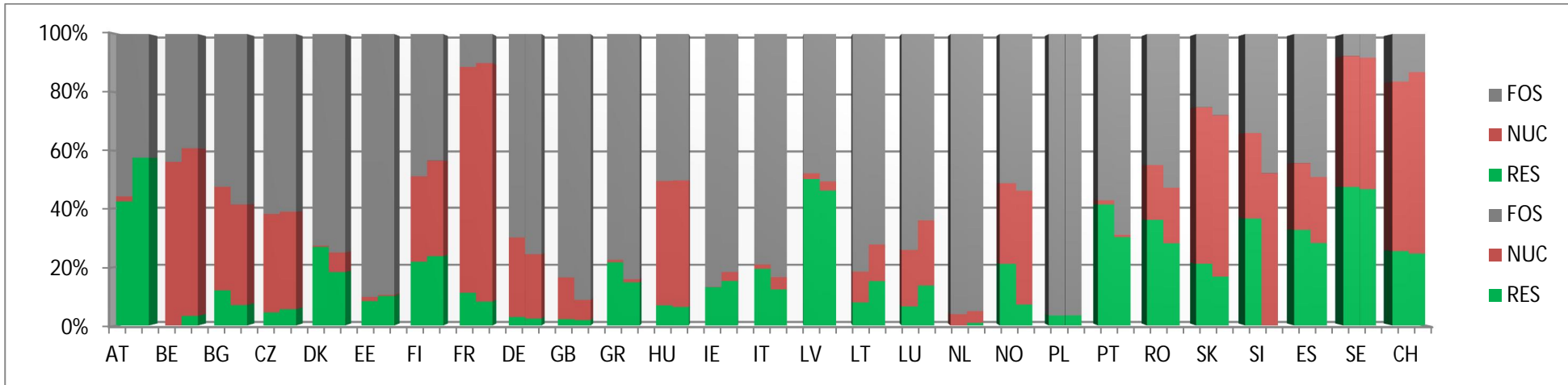
See explanation of the total supplier mix from the 2010 results.

Figure 10: Total Supplier Mixes 2011



3.3 Comparison of 2010 and 2011

Figure 11: Residual Mixes 2010 (left) vs. Residual Mixes 2011 (right)



4 Conclusions

From 2010 to 2011, the average share of untracked consumption in the 27 countries dropped from 86,7 % to 78,9 %, which means more electricity was explicitly disclosed with e.g. GOs. This can also be seen from the decreased amount of RES in the final residual mixes (in 2010 the total volume of residual mixes in Europe was 2624 TWh out of which 15,5 % was RES, whereas in 2011 the corresponding figures were 2161 TWh and 12,4 %). Same phenomenon can be observed in Figure 11.

The amount of RES-GO cancellations rose from 185,6 TWh in 2010 to 253,0 TWh in 2011. As the amount of explicit tracking of renewable energy attributes increases, the importance of the residual mix calculation is also emphasized.

The percentage of untracked consumption out of total consumption varied greatly. In general, countries where contract-based tracking was allowed and recorded (Great Britain and Sweden for 2010 and Great Britain, France, Ireland and Sweden for 2011) the percentage was lower. Austria and Sweden also allow issuance of non-renewable GOs, which encourages to explicitly track a high share of the total consumption. Tracking of all types of attributes is highly recommended by RE-DISS.

In all countries with explicit tracking, the total supplier mix was “greener” than the residual mix, which means GOs have been cancelled in all such countries, i.e. no country is a “pure exporter”. Not surprisingly, the difference is clearest in countries with strong market for “green power”; Belgium, Germany, the Netherlands and Switzerland, but also in Austria, Italy, Norway and Sweden. The gap between RM and TSM in Portugal is mostly explained by the fact that FIT volumes are removed from the residual mix.