Appendix to “European Residual Mixes: Results of the calculation of Residual Mixes for the calendar year 2022”

Understanding the impact of updated emission factors (2023.09.25)

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1 Introduction – Purpose of this document

With the publication of the “Results of the calculation of Residual Mixes for the calendar year 2022” (AIB, 2023) the emission factors (EFs) for the individual fuel categories were changed compared to previous years. In order to facilitate understanding of the effects resulting from the shift from the prior set of emission factors, which stemmed from the RE-DISS project, to the new EFs, we have reevaluated the direct emissions for the preceding three years of residual mix calculations (2019-2021) using the updated EFs.This report provides a supplementary list of reasons explaining the changes in EFs, in addition to those already found in the Appendix of AIB (2023). It presents a comparison of previously published direct emissions of residual mixes with recalculated direct emissions based on the new set of EFs. This comparison aims to quantify the changes to the direct emissions based solely on the methodological change of updating the EFs. Furthermore, this report presents insights and comments regarding special cases where significant changes have occurred (see Appendix of AIB, 2023).

2 The sole objective of recalculating historical data using new emission factors is to improve comprehension of the update's impact. It is not our intention for the figures in this Appendix to be used for revising figures from past years disclosed to consumers. Given that not all entities can effectively communicate such historical figure changes, and certain national legislations may even not permit it, the potential confusion generated by such actions would outweigh the benefits of enhanced accuracy.Reasons for change of EFs: Increased accuracy and transparency

The new set of emission factors is mostly based on v3.9.1 of the ecoinvent database (see Appendix of AIB, 2023). Apart from EFs maintained by the Competent Disclosure Bodies, the previous set of emission factors originated from the RE-DISS project and their derivation is not apparent. The new set of emission factors offers increased transparency as the Unit Processes (UPR) or also called life cycle inventory, i.e. the composition of the datasets describing the electricity-producing technologies, can be viewed with a guest account in the ecoinvent database (www.ecoinvent.org). The ecoinvent database also offers multiple electricity-generating technologies per fuel category and country (e.g. “FO gas” is represented by combined cycle and conventional gas power plants) leading to a better technological representation of each country’s EFs. Furthermore, country-specific import EFs for the residual mixes that import electricity from outside the calculation area are

provided, while previously those were based on an average of EFs inside the calculation area. Future calculation of the direct emissions of the residual mixes will also benefit from any updates of the ecoinvent database.

3 Table of comparison of previous years with recalculated factors

The first section of Table 1 shows the published values for the direct carbon dioxide emissions (in gCO2/kWh) in the yearly reports on the residual mix calculation by AIB for the years 2019-2022. While the years 2019-2021 are based on the previous set of EFs, the year 2022 is based on the new set of EFs. The second section details the recalculated values of the residual mixes of the years 2019-2021 with the new set of emission factors, while the third section presents the percentage change between the published direct carbon dioxide emissions and the recalculated values. The last row lists the values for the European Attribute mix (EAM).

Table 1: *Published values for direct emissions of the residual mix calculations for years 2019-2021 based on the old set of EFs and the year 2022 based on the new set of EFs, recalculated values for the years 2019 to 2021 based on the new set of EFs and a comparison of published and recalculated values. *Not applicable (reason: Full Disclosure). ** EFs maintained and updated by the national Competent Disclosure Body and thus not recalculated.*

	Published values (gCO2/kWh)				Recalculated values (gCO2/kWh)			Comparison (recalculated vs. published)		
	2019	2020	2021	2022	2019	2020	2021	2019	2020	2021
AT	*	*	*	*	*	*	*			
BA			558.5	843.9			762.0			36.4 %
BE	187.7	204.8	149.2	144.3	172.4	187.1	136.1	-8.1 %	-8.6 %	-8.8 %
BG	437.4	372.1	404.1	517.1	451.5	388.2	421.6	3.2 %	4.3 %	4.3 %
CH	18.5	30.3	19.2	*	18.5	30.4	19.2	0.1 %	0.1 %	0.2 %
CY**	675.6	642.0	625.1	607.4	675.6	642.0	625.1	0.0 %	0.0 %	0.0 %
CZ	595.1	532.4	550.0	697.2	794.1	708.1	671.2	33.4 %	33.0 %	22.1 %
DE	609.4	588.8	617.8	684.0	589.2	568.6	597.5	-3.3 %	-3.4 %	-3.3 %
DK	465.2	427.7	529.3	557.4	478.0	435.4	547.3	2.7 %	1.8 %	3.4 %
EE	757.7	546.9	636.6	715.2	734.7	530.3	618.4	-3.0 %	-3.0 %	-2.9 %
ES	342.7	286.5	295.8	275.1	319.8	261.9	272.9	-6.7 %	-8.6 %	-7.8 %
FI	310.1	268.2	285.3	520.8	304.6	269.6	288.9	-1.8 %	0.5 %	1.3 %
FR**	43.2	58.5	48.6	125.0	43.2	58.5	48.6	0.0 %	0.0 %	0.0 %

	Published values (gCO2/kWh)				Recalculated values (gCO2/kWh)			Comparison (recalculated vs. published)		
	2019	2020	2021	2022	2019	2020	2021	2019	2020	2021
GB	347.5	316.0	351.2	365.1	352.4	321.7	359.6	1.4 %	1.8 %	2.4 %
GR**	577.4	490.4	444.6	531.4	577.4	490.4	444.6	0.0 %	0.0 %	0.0 %
HR	501.4	468.8	466.5	515.1	486.9	445.9	446.8	-2.9 %	-4.9 %	-4.2 %
HU	285.7	274.1	276.3	320.0	308.5	295.0	289.4	8.0 %	7.6 %	4.8 %
IE	495.2	446.5	570.1	474.8	441.5	403.2	513.8	-10.8 %	-9.7 %	-9.9 %
IS	393.7	401.9	423.5	531.3	387.3	391.3	415.2	-1.6 %	-2.7 %	-2.0 %
IT	465.9	458.6	456.6	457.1	448.8	442.7	438.5	-3.7 %	-3.5 %	-4.0 %
LT	351.9	340.2	384.5	466.4	348.9	330.1	377.6	-0.8 %	-3.0 %	-1.8 %
LU**	449.3	0.0	403.1	419.7						
LV	315.2	421.5	302.6	510.7	286.8	395.7	280.6	-9.0 %	-6.1 %	-7.3 %
ME			439.0	538.6			460.9			5.0 %
MT**	378.3	390.9	370.9	404.9	378.3	390.9	370.9	0.0 %	0.0 %	
NL	555.2	451.7	450.7	439.0	488.8	394.0	399.5	-12.0 %	-12.8 %	-11.4 %
NO	396.3	401.9	404.9	502.3	388.0	389.7	397.1	-2.1 %	-3.0 %	-1.9 %
PL	811.0	798.7	850.2	858.1	799.8	837.8	856.4	-1.4 %	4.9 %	0.7 %
PT	256.0	375.4	281.1	445.5	232.3	344.6	258.3	-9.3 %	-8.2 %	-8.1 %
RO	310.7	265.2	281.7	275.8	299.7	253.1	268.9	-3.5 %	-4.5 %	-4.5 %
RS	765.7	810.8	763.7	954.2	869.8	922.2	868.8	13.6 %	13.7 %	13.8 %
SE	50.2	23.1	76.6	39.0	51.4	23.5	82.7	2.4 %	1.8 %	7.9 %
SI	364.1	345.2	565.4	370.8	409.8	393.6	618.1	12.5 %	14.0 %	9.3 %
SK	198.6	218.2	184.6	186.5	226.6	240.6	202.2	14.1 %	10.2 %	9.5 %

4 Selected country or fuel-specific insights

BA (Bosnia and Herzegovina): Statistics used for the calculation of the residual mixes for BA do not distinguish between different coal types. Thus, an average factor for “FO hard coal” was assumed in the year prior 2022. However, electricity from coal in BA relies on

lignite (IEA, 2022) and thus an appropriate factor was chosen for the new set of EFs. As electricity from lignite has a notably higher carbon intensity, this leads to an increase of the EF for BA.

CY (Cyprus): EFs maintained and updated by the national Competent Disclosure Body.

CZ (Czech Republic): A part of electricity in this country is generated by heat and electricity co-generation units. The electricity from these productions is attributed higher emissions compared to a pure electricity generating power plant due lower electrical efficiency of the co-generation plant (Treyer & Bauer., 2016) and the allocation rules applied for co-generation (Primas, 2007).

FR (France): EFs maintained and updated by the national Competent Disclosure Body.

GR (Greece): EFs maintained and updated by the national Competent Disclosure Body.

HU (Hungary): Statistics used for the calculation of the residual mixes for HU do not distinguish between different coal types. Thus, an average factor for “FO hard coal” was assumed in the year prior 2022. However, electricity from coal in HU relies on lignite (Euracoal, 2023) and thus an appropriate factor was chosen for the new set of EFs. As electricity from lignite has a notably higher carbon intensity, this leads to an increase of the EF for HU.

LU (Luxembourg): EFs maintained and updated by the national Competent Disclosure Body.

NL (Netherlands): Set of new emission factors confirmed by national Competent Disclosure Body. Within 5% of the recently published EFs by Statistics Netherlands (CBS, 2023).

MT (Malta): EFs maintained and updated by the national Competent Disclosure Body.

RS (Serbia): A part of electricity in this country is generated by heat and electricity co-generation units. The electricity from these productions is attributed higher emissions compared to a pure electricity generating power plant due lower electrical efficiency of the co-generation plant (Treyer & Bauer., 2016) and the allocation rules applied for co-generation (Primas, 2007).

SI (Slovenia): A part of electricity in this country is generated by heat and electricity co-generation units. The electricity from these productions is attributed higher emissions compared to a pure electricity generating power plant due lower electrical efficiency of the co-generation plant (Treyer & Bauer., 2016) and the allocation rules applied for co-generation (Primas, 2007).

SK (Slovakia): A part of electricity in this country is generated by heat and electricity co-generation units. The electricity from these productions is attributed higher emissions compared to a pure electricity generating power plant due lower electrical efficiency of the

co-generation plant (Treyer & Bauer., 2016) and the allocation rules applied for co-generation (Primas, 2007).

5 References:

AIB (2023), Association of Issuing Bodies, European Residual Mixes, Results of the calculation of Residual Mixes for the calendar year 2022, Version 1.0, 2023-06-01, https://www.aib-net.org/facts/european-residual-mix

Statistics Netherlands (CBS), (2023), Emissiefactoren van elektriciteit uit steenkool en aardgas, 2000-2021, URL: https://www.cbs.nl/nl-nl/longread/discussion-papers/2023/emissiefactoren-van-elektriciteit-uit-steenkool-en-aardgas-2000-2021, Retrieved: 2023-07-15

Euracoal (2023), European Association for Coal and Lignite, Country Profile for Hungary, URL: https://euracoal.eu/info/country-profiles/hungary/ Retrieved: 2023-07-15

International Energy Agency (IEA), (2022), Coal Information 2022. Retrieved: 2023-07-15

Treyer, K., & Bauer, C. (2016). Life cycle inventories of electricity generation and power supply in version 3 of the ecoinvent database—part I: electricity generation. International Journal of Life Cycle Assessment, 21(9), 1236–1254. https://doi.org/10.1007/s11367-013-0665-2

Primas, A. (2007). Life Cycle Inventories of new CHP systems. ecoinvent report No. 20. Ecoinvent, 0(20).