Economy-wide material flow accounts – assessment of early estimates for reference year 2018

Eurostat E2, 31 May 2021

1   Introduction

In June/July 2019 Eurostat produced and published early estimates of the domestic extraction of materials (*2019-vintage of early estimate*) for reference year 2018. Eurostat estimates domestic extraction by four main material categories (biomass, metals, minerals, fossils) for each EU Member State and the aggregated EU economy. The estimation method is regression modelling employing a range of predictor variables such as volume indices of production, gross value added, monthly energy statistics, crop statistics etc. Annex 1 provides a short description of the estimation methodology.

This report assesses the quality of the early estimates for reference year 2018 by analysing the estimation error. The estimation error is defined as the difference between the *2019-vintage of early estimate* and the actual *2021-outturn* reported in December 2020[1] and published in March 2021. Eurostat E2 will undertake this assessment each year enabling a routine monitoring and assessment.

The estimation error is decomposed into three effects and the remaining estimation error:

- Effect 1 – due to revision of model specifications introduced in June 2020:
  Eurostat revises, if appropriate, the specifications of the (regression) models applied for each country and material category of domestic extraction (see Annexes). In general, Eurostat makes the model specifications based on fitness-of-estimation statistics that are derived from time series of model input data; the latter include predictors and EW-MFA data. Revisions of model specifications may become appropriate due to the extended time series that include data for one more reference year in comparison to the previous year's situation. Effect 1 is quantified by simulating the estimation for reference year 2018 with the 2019-vintage of model specifications (whilst keeping the 2019-vintage of input data).

- Effect 2 – due to revision of model input data available in June 2020:
  Both model input data (predictors and EW-MFA data) may have been revised between June 2019 and June 2020. This effect 2 is quantified by simulating the estimation for reference year 2018 using revised model specifications (i.e. the 2020-vintage of model specification as explained under effect 1) and using revised model input data that became available in June 2020, i.e. one year later than the initial estimate.

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[1] Note, only by 31 December 2020, all European countries mandatorily reported EW-MFA data for reference year 2018 according to Regulation (EU) 691/2011 Annex III.

- Effect 3 – due to revision of EW-MFA available in March 2021:
  By March 2021 the EW-MFA data for some countries are revised again in comparison to the situation in June 2020. Most important, by March 2021 mandatorily reported data for reference year 2018 become available for all countries. While in June 2020 some countries' data for reference year 2018 were still estimates by Eurostat. Revised data for predictors are not available by March. This effect 3 is quantified by simulating the estimation for reference year 2018 with the June 2020 model specifications, the June 2020-vintage of predictor data, and the most recent and complete March 2021 vintage of EW-MFA data (2021-outturn).

- Remaining estimation error:
  This is the 'actual' remaining estimation error after the elimination of the above effects due to data revisions and changed model specifications. Eurostat quantifies this remaining error by simply 'deducting' the above three effect from the overall estimation error.

2 Assessing the estimation for the aggregated EU: non-metallic minerals cause the majority of estimation error

The *2021-outturn* for domestic extraction of materials for reference year 2018 and the aggregated EU is 5424.6 million tonnes, which is about 108 million tonnes lower than the *2019-vintage of early estimate* (see Table 1). Table 1 also shows the estimation error by material category. The estimation error for biomass is biggest with -124.5 million tonnes, i.e. the *2021-outturn* is lower than the *2019-vintage of early estimate*). The estimation error for non-metallic minerals amounts to 24 million tonnes, notably with reversed sign compared to the overall estimation error (i.e. the *2021-outturn* is above the *2019-vintage of early estimate*.

Table 1: Domestic extraction for the reference year 2018 (thousand tonnes) – outturn versus early estimate, by main material categories

EU-27	2019-vintage of early estimate	2021-outturn	Estimation error (overall)	
Total materials	5 532 424	5 424 552	-107 872	2.0%
Biomass	1 653 483	1 528 904	-124 579	8.1%
Metal ores	220 735	218 695	-2 040	0.9%
Non-metallic minerals	3 090 052	3 114 172	24 120	0.8%
Fossil energy material/carriers	568 154	562 780	-5 373	1.0%

Table 2 shows the EU estimation error in a breakdown by the three effects (see above) and by four main material categories. **Effect 1** quantifies the effect of the changed model specifications that took place in June 2020. With -14.4 million tonnes the effect of improved/changed model specifications was rather moderate.

Effect 2 (-97.5 million tonnes) is by far the most important effect 'explaining' the overall estimation error (-107.9 million tonnes). Effect 2 quantifies the impact of data revisions between June 2019 and June 2020. It takes into account both model input data: predictors and EW-MFA. Within **Effect 2** the material category of non-metallic minerals is most important, followed by the material category biomass.

With +45.6 million tonnes, *Effect 3* also significantly contributes to the overall estimation error. It quantifies the impact of MFA data revisions between June 2020 and March 2021.

The *remaining error*, i.e. the overall estimation error adjusted for the aforementioned effects is moderate with -41.7 million tonnes. Like the overall estimation error, it is dominated by biomass.

Table 2: Domestic extraction for the reference year 2018 (thousand tonnes) – decomposing the overall estimation error into three effects and remaining error

EU-27	Estimation error (overall)	Effect 1	Effect 2	Effect 3	remaining error
Total materials	**-107 872**	-14 379	-97 450	45 632	-41 675
Biomass	**-124 579**	-32 665	-21 595	-2 406	-67 912
Metal ores	**-2 040**	-888	-2 347	568	626
Non-metallic minerals	**24 120**	30 246	-74 359	46 376	21 858
Fossil energy material/carriers	**-5 373**	-11 072	851	1 095	3 753

In summary, one may conclude that the *2019-vintage of early estimate* for reference year 2018 of the EU's domestic extraction was good (less than 1% deviation from actual *2021-outturn*) except for biomass.

3   Assessment by country

The overall estimation error – about 108 million tonnes – can also be broken down by country (see Table 3). The estimation errors for Poland and Romania contribute most to the EU overall estimation error. Data revisions in Germany (Effect3) played another significant role.

Table 3: Domestic extraction (all materials) for the reference year 2018 (thousand tonnes) – decomposing the EU overall estimation error by country

Geo	2019-vintage of early estimate	2021-outturn	Estimation error (overall)		Effect 1	Effect 2	Effect 3	remaining error
EU27	5 532 424	5 424 552	-107 872	100.0%	-14 379	-97 450	45 632	-41 675
Austria	144 666	135 540	-9 126	8.5%	-416	-8 484	2 682	-2 909
Belgium	96 138	95 709	-429	0.4%	-408	-1 414	1 194	200
Bulgaria	139 534	144 445	4 911	-4.6%	-4 745	6 749	4	2 903
Croatia	42 750	41 229	-1 521	1.4%	-19	131	0	-1 633
Cyprus	14 802	13 197	-1 604	1.5%	6 708	-6 842	144	-1 614
Czechia	167 142	163 486	-3 656	3.4%	124	-4 657	0	877
Denmark	114 662	111 222	-3 441	3.2%	1 201	-4 064	2 235	-2 813
Estonia	49 167	47 168	-2 000	1.9%	54	666	968	-3 689
Finland	181 565	179 621	-1 944	1.8%	741	926	0	-3 611
France	651 286	635 895	-15 391	14.3%	1 800	262	0	-17 453
Germany	1 048 588	1 036 362	-12 227	11.3%	-7 324	-22 051	36 422	-19 274
Greece	111 607	106 736	-4 872	4.5%	657	-11 744	0	6 216
Hungary	137 915	138 572	658	-0.6%	104	4 987	0	-4 434
Ireland	99 201	92 646	-6 554	6.1%	-928	-4 269	593	-1 950
Italy	335 302	317 159	-18 144	16.8%	235	-16 547	0	-1 831
Latvia	33 505	33 612	107	-0.1%	3 249	-526	0	-2 615
Lithuania	52 852	46 068	-6 785	6.3%	-2 120	431	-1	-5 095
Luxembourg	2 163	2 132	-31	0.0%	-115	5	-2	81

Malta	1 696	1 871	175	-0.2%	0	-99	0	274
Netherlands	114 968	102 104	-12 865	11.9%	-13 643	1 774	37	-1 032
Poland	719 714	687 087	-32 627	30.2%	-6 879	-4 343	0	-21 405
Portugal	144 130	144 596	466	-0.4%	-175	5 581	-106	-4 834
Romania	413 568	441 739	28 170	-26.1%	8 954	-20 108	-55	39 379
Slovak Republic	67 530	62 740	-4 790	4.4%	-338	-2 906	0	-1 545
Slovenia	26 446	25 890	-556	0.5%	-445	-795	0	684
Spain	367 070	366 129	-941	0.9%	-1 172	-9 777	867	9 141
Sweden	254 457	251 600	-2 856	2.6%	522	-334	649	-3 693
United Kingdom	450 454	441 571	-8 883		-4 968	-6 994	964	2 115
Norway	353 339	323 330	-30 009		-8 384	0	-17 811	-3 814
Switzerland	64 105	59 389	-4 716		-3 128	0	-871	-716

Annex 1: Estimation methodology

Eurostat has developed a tool to provide early estimates of domestic extraction of four main material flow categories for EU Member States. The tool calculates the early estimate for each country/material combination according to a selected model equation. For each of the more than 100 country/material combinations, the user (Eurostat) has to specify the model type and chose the predictor. This is termed the 'model specification' (see Annexes 2 and 3).

The tool offers seven model equations (see Figure 1). Four of the models are regression-type equations (M1, M2, M3, M7). Six of the models employ predictors, and one model simply uses the domestic extraction value of the previous year (M6).

Figure 1: List of model equations

Model type	Names	Description
M1	Regression of absolute values	de_Predicted(t) = a + b * Predictor(t) Where a + b are derived from OLS regression
M2	Regression of absolute changes	de_Predicted(t) = de(t-1) + Absolute_change_predicted(t) Absolute_Change(t) = a + b *(Predictor(t)-predictor (t-1)) Where a + b are derived from OLS regression
M3	Regression of relative changes	de_Predicted(t) = de(t-1) * (1+relative change predicted (t)) Relative_Change(t) = a + b * ((Predictor(t)-Predictor (t-1)) / Predictor (t-1)) Where a + b are derived from OLS regression
M4	Annual relative change in predictor	de_predicted(t) =de(t-1) * (Predictor(t)/Predictor(t-1))
M5	Sum of Individual fuels (MF4 only)	de_predicted(t) = $\sum_i$ (de_i(t) * fuel_i(t)/fuel_i(t-1))
M6	Value of previous year	de_predicted(t) = de(t-1)
M7	Regression of logged values	ln_Predicted(t) = a + b * ln_Predictor(t) + e(t-1) Where a + b are derived from OLS regression

Where: de_Predicted denotes the predicted value of domestic extraction, ln_Predicted and ln_Predictor denote the natural logs of the actual values of domestic extraction and the predictor respectively, a is the constant term, b is the regression coefficient for the predictor and e is the residual from the regression

Both model input data (predictors and EW-MFA) are available for reference years starting with 2000.

The predictors are European statistics for which data must be available for the reference year for which the domestic extraction is estimated. The tight timeliness is a constraint and limits the choice of potential predictors. Figure 2 presents the list of predictors. There are different predictors for the four material categories.

Figure 2: List of predictors

Predictor code	Description	Indicator	Comment
P1	Agriculture, forestry and fishing	Gross value added (at basic prices)	used to estimate MF1
P2	Manufacture of food products; beverages and tobacco products	Volume index of production	used to estimate MF1
P3	Agriculture goods output	Production value at basic price	used to estimate MF1
P4	Crop output	Production value at basic price	used to estimate MF1
P5	Cereals for the production of grain (including seed)	Harvested production (1000 t)	used to estimate MF1
P6	Processing and preserving of fish, crustaceans and molluscs	Volume index of production	used to estimate MF1
P7	Forage plants	Production value at basic price	used to estimate MF1
P8	Live bovine animals	Thousand head (animals)	used to estimate MF1
P9	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Volume index of production	used to estimate MF1
P10	Mining of iron ores	Volume index of production	used to estimate MF2
P11	Mining of metal ores	Volume index of production	used to estimate MF2
P13	Other mining and quarrying	Volume index of production	used to estimate MF3
P14	Construction	Gross value added (at basic prices)	used to estimate MF3
P15	Construction	Volume index of production	used to estimate MF3
P16	Mining of coal and lignite	Volume index of production	used to estimate MF4
P17	Extraction of crude petroleum and natural gas	Volume index of production	used to estimate MF4
P19	Natural gas	Primary production	used to estimate MF4
P20.1	Hard coal	Primary production	used to estimate MF4
P20.2	Lignite/Brown Coal	Primary production	used to estimate MF4
P20.3	Peat	Primary production	used to estimate MF4
P21.1	Crude oil (without NGL)	Primary production	used to estimate MF4
P21.2	Natural gas liquids (NGL)	Primary production	used to estimate MF4
P23	Extraction of crude petroleum	Volume index of production	used to estimate MF4

Annex 2: 2019-vintage of model specifications

MF1 - Biomass (Estimation Range 2000–2015)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Bulgaria	FALSE	P5	M1	
Czech Republic	FALSE	P4 + P6 + P7 + P8 + P9	M3	!
Denmark	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Germany	FALSE	P4	M2	
Estonia	FALSE	P9	M3	
Ireland	FALSE	P4	M6	
Greece	FALSE	P5	M4	
Spain	FALSE	P5	M7	
France	FALSE	P4	M3	
Croatia	FALSE	P5	M3	!
Italy	FALSE	P5	M7	
Cyprus	FALSE	P5	M1	
Latvia	FALSE	P9	M3	!
Lithuania	FALSE	P5	M6	
Luxembourg	FALSE	P4	M4	
Hungary	FALSE	P5	M7	
Malta	FALSE	P4	M6	
Netherlands	FALSE	P4 + P6 + P7 + P8 + P9	M6	
Austria	FALSE	P4 + P6 + P7 + P8 + P9	M3	!
Poland	FALSE	P3 + P9	M2	
Portugal	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Romania	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Slovenia	FALSE	P3	M7	
Slovakia	FALSE	P5	M3	!
Finland	FALSE	P9	M3	
Sweden	FALSE	P9	M6	
United Kingdom	FALSE	P5	M6	
Norway	FALSE	P9	M3	
Switzerland	FALSE	P4	M2	

MF2 - Metal ores (Estimation Range 2000–2015)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	n.a.	n.a.	
Bulgaria	FALSE	P11	M3	!
Czech Republic	FALSE	n.a.	M6	
Denmark	FALSE	n.a.	n.a.	
Germany	FALSE	P11	M6	
Estonia	FALSE	n.a.	n.a.	
Ireland	FALSE	P11	M6	
Greece	FALSE	P11	M3	!
Spain	FALSE	P11	M6	
France	FALSE	P11	M6	
Croatia	FALSE	n.a.	n.a.	
Italy	FALSE	P11	M6	
Cyprus	FALSE	P11	M6	
Latvia	FALSE	n.a.	n.a.	
Lithuania	FALSE	n.a.	n.a.	
Luxembourg	FALSE	n.a.	n.a.	
Hungary	FALSE	P11	M6	
Malta	FALSE	n.a.	n.a.	
Netherlands	FALSE	n.a.	n.a.	
Austria	FALSE	P11	M6	
Poland	FALSE	P11	M6	
Portugal	FALSE	P11	M6	
Romania	FALSE	P11	M6	
Slovenia	FALSE	n.a.	n.a.	
Slovakia	FALSE	P11	M6	
Finland	FALSE	P11	M3	
Sweden	FALSE	P11	M4	
United Kingdom	FALSE	P11	M6	
Norway	FALSE	P11	M4	
Switzerland	FALSE	n.a.	n.a	!!

MF3 - Non metallic minerals (Estimation Range 2000–2015)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	P15	M4	
Bulgaria	FALSE	P15	M4	
Czech Republic	FALSE	P15	M4	
Denmark	FALSE	P15	M3	
Germany	FALSE	P15	M3	
Estonia	FALSE	P15	M2	
Ireland	FALSE	P14	M3	
Greece	FALSE	P15	M6	
Spain	FALSE	P14	M4	
France	FALSE	P13	M4	
Croatia	FALSE	P15	M7	
Italy	FALSE	P15	M4	
Cyprus	FALSE	P14	M3	
Latvia	FALSE	P13	M3	!
Lithuania	FALSE	P15	M4	
Luxembourg	FALSE	P15	M4	
Hungary	FALSE	P15	M4	
Malta	FALSE	P15	M6	
Netherlands	FALSE	P15	M4	
Austria	FALSE	P14	M4	
Poland	FALSE	P15	M1	
Portugal	FALSE	P15	M4	
Romania	FALSE	P14	M6	
Slovenia	FALSE	P14	M4	
Slovakia	FALSE	P15	M3	!
Finland	FALSE	P14	M3	
Sweden	FALSE	P14	M7	
United Kingdom	FALSE	P15	M4	
Norway	FALSE	P15	M4	
Switzerland	FALSE	P15	M1	

MF4 - Fossil energy material/carriers (Estimation Range 2000–2015)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	n.a.	n.a	
Bulgaria	FALSE	P16	M3	!
Czech Republic	FALSE	P16	M7	
Denmark	TRUE	P20 + P21 + P19	M5	
Germany	FALSE	P16	M7	
Estonia	FALSE	P17	M7	
Ireland	FALSE	P16	M6	
Greece	FALSE	P16	M3	!
Spain	FALSE	P16	M6	
France	FALSE	P17	M4	
Croatia	TRUE	P20 + P21 + P19	M5	
Italy	FALSE	P17	M7	
Cyprus	FALSE	n.a.	n.a	
Latvia	TRUE	P20 + P21 + P19	M6	
Lithuania	TRUE	P20 + P21 + P19	M6	
Luxembourg	FALSE	n.a.	n.a	
Hungary	FALSE	P16	M6	
Malta	FALSE	n.a.	n.a	
Netherlands	TRUE	P20 + P21 + P19	M6	
Austria	FALSE	P17	M6	
Poland	FALSE	P16	M6	
Portugal	FALSE	n.a.	n.a	
Romania	FALSE	P17	M3	!
Slovenia	TRUE	P20 + P21 + P19	M3	
Slovakia	TRUE	P20 + P21 + P19	M6	!
Finland	FALSE	P20 + P21 + P19	M6	
Sweden	TRUE	P20 + P21 + P19	M6	
United Kingdom	FALSE	P17	M3	
Norway	TRUE	P20 + P21 + P19	M1	!
Switzerland	FALSE	n.a.	n.a	!!

Annex 3: 2020-vintage of model specifications

MF1 - Biomass (Estimation Range 2000–2018)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Bulgaria	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Czech Republic	FALSE	P4 + P6 + P7 + P8 + P9	M3	!
Denmark	FALSE	P4	M2	
Germany	FALSE	P5	M3	!
Estonia	FALSE	P9	M3	
Ireland	FALSE	P4	M2	
Greece	FALSE	P5	M4	
Spain	FALSE	P5	M7	
France	FALSE	P4	M3	!
Croatia	FALSE	P5	M3	!
Italy	FALSE	P5	M7	
Cyprus	FALSE	P5	M6	
Latvia	FALSE	P9	M3	!
Lithuania	FALSE	P4 + P6 + P7 + P8 + P9	M3	!
Luxembourg	FALSE	P4	M6	
Hungary	FALSE	P5	M7	
Malta	FALSE	P4	M6	
Netherlands	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Austria	FALSE	P4 + P6 + P7 + P8 + P9	M7	!
Poland	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Portugal	FALSE	P4 + P6 + P7 + P8 + P9	M1	!
Romania	FALSE	P4 + P6 + P7 + P8 + P9	M7	!
Slovenia	FALSE	P5	M3	!
Slovakia	FALSE	P5	M3	!
Finland	FALSE	P9	M3	
Sweden	FALSE	P9	M6	
United Kingdom	FALSE	P4 + P6 + P7 + P8 + P9	M3	!
Norway	FALSE	P9	M6	
Switzerland	FALSE	P4	M6	

MF2 - Metal ores (Estimation Range 2000–2018)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	n.a.	n.a.	
Bulgaria	FALSE	P11	M3	!
Czech Republic	FALSE	n.a.	M6	
Denmark	FALSE	n.a.	n.a.	
Germany	FALSE	P11	M6	
Estonia	FALSE	n.a.	n.a.	
Ireland	FALSE	n.a.	M6	
Greece	FALSE	P11	M6	
Spain	FALSE	n.a.	M6	
France	FALSE	n.a.	M6	
Croatia	FALSE	n.a.	n.a.	
Italy	FALSE	n.a.	M6	
Cyprus	FALSE	n.a.	M6	
Latvia	FALSE	n.a.	n.a.	
Lithuania	FALSE	n.a.	n.a.	
Luxembourg	FALSE	n.a.	n.a.	
Hungary	FALSE	P11	M6	
Malta	FALSE	n.a.	n.a.	
Netherlands	FALSE	n.a.	n.a.	
Austria	FALSE	n.a.	M6	
Poland	FALSE	n.a.	M6	
Portugal	FALSE	n.a.	M6	
Romania	FALSE	P11	M6	
Slovenia	FALSE	n.a.	n.a.	
Slovakia	FALSE	n.a.	M6	
Finland	FALSE	P11	M3	
Sweden	FALSE	n.a.	M6	
United Kingdom	FALSE	n.a.	M6	
Norway	FALSE	P11	M6	
Switzerland	FALSE	n.a.	M6	!!

MF3 - Non metallic minerals (Estimation Range 2000–2018)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	P15	M4	
Bulgaria	FALSE	P15	M4	
Czech Republic	FALSE	P15	M4	
Denmark	FALSE	P15	M3	!
Germany	FALSE	P15	M3	
Estonia	FALSE	P15	M2	
Ireland	FALSE	P14	M3	
Greece	FALSE	P15	M4	
Spain	FALSE	P14	M4	
France	FALSE	P13	M4	
Croatia	FALSE	P15	M7	
Italy	FALSE	P15	M4	
Cyprus	FALSE	P15	M2	
Latvia	FALSE	P15	M4	
Lithuania	FALSE	P15	M4	
Luxembourg	FALSE	P15	M4	
Hungary	FALSE	P15	M4	
Malta	FALSE	P15	M6	
Netherlands	FALSE	P15	M4	
Austria	FALSE	P14	M4	
Poland	FALSE	P13	M1	
Portugal	FALSE	P15	M4	
Romania	FALSE	P13	M4	
Slovenia	FALSE	P14	M4	
Slovakia	FALSE	P15	M3	!
Finland	FALSE	P14	M4	
Sweden	FALSE	P14	M7	
United Kingdom	FALSE	P15	M4	
Norway	FALSE	P15	M6	
Switzerland	FALSE	P15	M6	

MF4 - Fossil energy material/carriers (Estimation Range 2000–2015)

	Disaggregation	Predictors	Model Type	
Belgium	FALSE	n.a.	n.a	
Bulgaria	FALSE	P20 + P21 + P19	M1	!
Czech Republic	FALSE	P16	M3	
Denmark	TRUE	P20 + P21 + P19	M5	
Germany	FALSE	P20 + P21 + P19	M3	!
Estonia	FALSE	P17	M7	
Ireland	TRUE	P20 + P21 + P19	M5	
Greece	TRUE	P20 + P21 + P19	M5	
Spain	FALSE	n.a.	M6	
France	FALSE	P17	M4	
Croatia	TRUE	P20 + P21 + P19	M5	
Italy	FALSE	P17	M7	
Cyprus	FALSE	n.a.	n.a	
Latvia	FALSE	P20 + P21 + P19	M1	!
Lithuania	FALSE	P20 + P21 + P19	M1	!
Luxembourg	FALSE	n.a.	n.a	
Hungary	TRUE	P20 + P21 + P19	M5	
Malta	FALSE	n.a.	n.a	
Netherlands	FALSE	P17	M4	
Austria	FALSE	P20 + P21 + P19	M1	!
Poland	FALSE	P20 + P21 + P19	M7	!
Portugal	FALSE	n.a.	n.a	
Romania	TRUE	P20 + P21 + P19	M5	
Slovenia	TRUE	P20 + P21 + P19	M5	
Slovakia	TRUE	P20 + P21 + P19	M5	
Finland	TRUE	P20 + P21 + P19	M5	
Sweden	FALSE	P20 + P21 + P19	M2	!
United Kingdom	TRUE	P20 + P21 + P19	M5	
Norway	TRUE	P20 + P21 + P19	M6	!
Switzerland	FALSE	n.a.	M6	!!

Annex 4: Estimation error by country and material

Table 4: Domestic extraction of biomass for the reference year 2018 (thousand tonnes) – decomposing the EU overall estimation error by country

Geo	Estimation error (overall)		Effect 1	Effect 2	Effect 3	remaining error
EU27	-124 579	100.0%	-32 665	-21 595	-2 406	-67 912
Austria	-3 901	3.1%	-531	-3 111	-75	-184
Belgium	-1 883	1.5%	-408	-310	1 315	-2 480
Bulgaria	1 077	-0.9%	-86	1 290	0	-127
Croatia	-891	0.7%	2	98	0	-991
Cyprus	-57	0.0%	-137	94	0	-14
Czechia	1 985	-1.6%	69	-368	0	2 284
Denmark	-1 370	1.1%	269	-465	2 235	-3 409
Estonia	-134	0.1%	7	-918	968	-191
Finland	1 645	-1.3%	-91	219	0	1 517
France	-29 961	24.0%	1 800	-2 097	0	-29 664
Germany	-47 648	38.2%	-8 639	-6 904	-7 791	-24 314
Greece	751	-0.6%	0	-1 408	0	2 159
Hungary	-513	0.4%	2	-356	0	-158
Ireland	-3 988	3.2%	-541	-3 016	36	-466
Italy	955	-0.8%	230	2 622	0	-1 896
Latvia	-788	0.6%	-22	331	0	-1 098
Lithuania	-2 776	2.2%	-2 202	392	0	-966
Luxembourg	-37	0.0%	-115	-26	-2	105
Malta	2	0.0%	0	4	0	-2
Netherlands	-5 654	4.5%	-8 342	1 883	37	769
Poland	-24 906	20.0%	-16 438	-1 403	0	-7 064
Portugal	-1 096	0.9%	-175	-189	3	-734
Romania	1 611	-1.3%	4 237	-2 767	0	140
Slovak Republic	550	-0.4%	72	106	0	371
Slovenia	-81	0.1%	-452	17	0	355
Spain	-2 332	1.9%	-1 172	-6 704	867	4 677
Sweden	-5 138	4.1%	0	1 393	1	-6 531
United Kingdom	-11 188		-6 983	-2 871	464	-1 798
Norway	-1 479		-133	0	-10	-1 336
Switzerland	-858		-452	0	-145	-261

Table 5: Domestic extraction of <u>metal ores</u> for the reference year 2018 (thousand tonnes) – decomposing the EU overall estimation error by country

Geo	Estimation error (overall)		Effect 1	Effect 2	Effect 3	remaining error
EU27	-2 040	100.0%	-888	-2 347	568	626
Austria	-149	7.3%	0	-7	0	-142
Belgium	0	0.0%	0	0	0	0
Bulgaria	239	-11.7%	-36	-9	0	284
Croatia	0	0.0%	0	0	0	0
Cyprus	-52	2.6%	0	0	144	-196
Czechia	-12	0.6%	0	0	0	-12
Denmark	0	0.0%	0	0	0	0
Estonia	0	0.0%	0	0	0	0
Finland	-8 279	406%	-836	-1 725	0	-5 718
France	-26	1.3%	0	0	0	-26
Germany	0	0.0%	0	0	0	0
Greece	-403	19.8%	-16	44	0	-432
Hungary	3	-0.1%	0	0	0	3
Ireland	-111	5.4%	0	0	0	-110
Italy	-160	7.9%	0	-66	0	-94
Latvia	0	0.0%	0	0	0	0
Lithuania	0	0.0%	0	0	0	0
Luxembourg	0	0.0%	0	0	0	0
Malta	0	0.0%	0	0	0	0
Netherlands	0	0.0%	0	0	0	0
Poland	-1 050	51.5%	0	0	0	-1 050
Portugal	23	-1.1%	0	35	0	-12
Romania	-86	4.2%	0	0	-55	-31
Slovak Republic	0	0.0%	0	0	0	0
Slovenia	0	0.0%	0	0	0	0
Spain	4 384	-214.9%	0	-618	0	5 002
Sweden	3 639	-178%	0	0	479	3 160
United Kingdom	4		0	5	0	-1
Norway	-11 258		-798	0	-10 498	38
Switzerland	0		0	0	0	0

Table 6: Domestic extraction of <u>non-metallic minerals</u> for the reference year 2018 (thousand tonnes) – decomposing the EU overall estimation error by country

Geo	Estimation error (overall)		Effect 1	Effect 2	Effect 3	remaining error
EU27	24 120	100%	30 246	-74 359	46 376	21 858
Austria	-4 421	-18.3%	0	-5 344	2 757	-1 834
Belgium	1 337	5.5%	0	-1 104	-122	2 563
Bulgaria	5 250	21.8%	0	143	4	5 102
Croatia	-705	-2.9%	-21	-43	0	-642
Cyprus	-1 494	-6.2%	6 845	-6 935	0	-1 404
Czechia	-3 142	-13.0%	0	-1 263	0	-1 879
Denmark	-2 161	-9.0%	931	-3 606	0	513
Estonia	-1 146	-4.7%	40	-646	0	-540
Finland	1 201	5.0%	1 668	-1 523	0	1 056
France	14 550	60.3%	0	2 326	0	12 224
Germany	35 694	148.0%	1 959	-15 019	43 118	5 637
Greece	-4 669	-19.4%	0	-9 127	0	4 457
Hungary	1 339	5.6%	0	5 636	0	-4 297
Ireland	-3 173	-13.2%	-282	-1 462	557	-1 986
Italy	-19 398	-80.4%	0	-19 112	0	-286
Latvia	410	1.7%	3 485	-858	0	-2 218
Lithuania	-4 114	-17.1%	0	13	0	-4 127
Luxembourg	7	0.0%	0	31	0	-25
Malta	173	0.7%	0	-103	0	276
Netherlands	-1 366	-5.7%	0	801	0	-2 167
Poland	-12 074	-50.1%	9 545	-40	0	-21 579
Portugal	1 539	6.4%	0	5 735	-108	-4 088
Romania	29 924	124.1%	5 902	-15 278	0	39 299
Slovak Republic	-5 083	-21.1%	-370	-2 708	0	-2 005
Slovenia	-331	-1.4%	0	-673	0	342
Spain	-2 451	-10.2%	0	-2 456	0	4
Sweden	-1 573	-6.5%	545	-1 747	169	-539
United Kingdom	721		0	-3 726	500	3 948
Norway	-7 519		-3 383	0	-7 368	3 231
Switzerland	-3 858		-2 676	0	-726	-456

Table 7: Domestic extraction of <u>fossil energy material/carriers</u> for the reference year 2018 (thousand tonnes) – decomposing the EU overall estimation error by country

Geo	Estimation error (overall)		Effect 1	Effect 2	Effect 3	remaining error
EU27	-5 373	100%	-11 072	851	1 095	3 753
Austria	-654	12.2%	115	-21	0	-748
Belgium	117	-2.2%	0	0	0	117
Bulgaria	-1 656	30.8%	-4 624	5 325	0	-2 357
Croatia	75	-1.4%	0	75	0	0
Cyprus	0	0.0%	0	0	0	0
Czechia	-2 487	46.3%	56	-3 026	0	484
Denmark	90	-1.7%	0	7	0	83
Estonia	-721	13.4%	7	2 230	0	-2 958
Finland	3 489	-64.9%	0	3 955	0	-466
France	45	-0.8%	0	32	0	13
Germany	-273	5.1%	-643	-128	1 095	-597
Greece	-550	10.2%	673	-1 253	0	31
Hungary	-171	3.2%	103	-292	0	18
Ireland	717	-13.3%	-105	209	0	613
Italy	459	-8.6%	5	10	0	445
Latvia	486	-9.0%	-214	0	0	700
Lithuania	106	-2.0%	83	26	-1	-2
Luxembourg	0	0.0%	0	0	0	0
Malta	0	0.0%	0	0	0	0
Netherlands	-5 844	108.8%	-5 301	-910	0	367
Poland	5 403	-100.6%	15	-2 901	0	8 289
Portugal	0	0.0%	0	0	0	0
Romania	-3 278	61.0%	-1 185	-2 064	0	-29
Slovak Republic	-256	4.8%	-40	-304	0	88
Slovenia	-145	2.7%	7	-139	0	-13
Spain	-542	10.1%	0	0	0	-543
Sweden	215	-4.0%	-23	20	0	218
United Kingdom	1 580		2 015	-401	0	-34
Norway	-9 752		-4 070	0	65	-5 748
Switzerland	0		0	0	0	0