eurostat

Handbook for estimating raw material equivalents (RME)

of imports and exports and RME-based indicators for countries – based on Eurostat's EU RME model

December 2016

Preface

This handbook accompanies Eurostat's country raw material equivalents (RME) tool to estimate country-level raw material equivalents of product flows. The tool has been developed to support national statistical institutes in conducting country level estimates in a convenient manner by a model which is closely linked to the EU model in terms of methodological foundations and of data.

The calculation tool allows the user to estimate country-level estimates of flows in RME, such as imports and exports in RME, raw material input (RMI) and raw material consumption (RMC).

Due to the migration of the Eurostat RME model from NACE Rev. 1.1 to NACE Rev. 2 for the period 2008 and onwards the previous country RME tool had to be revised accordingly. The tool is presented as a package comprising the handbook, the Excel-based tool and the auxiliary data files (data pool). The data pool is providing all necessary data for the individual countries. Detailed technical instructions can be found in the Excel workbook of the tool.

Acknowledgements

This handbook has been created by Karl Schoer (SSG Wiesbaden). The country RME tool and the auxiliary files have also been prepared by Karl Schoer, in collaboration with Monika Dittrich (ifeu), Birte Ewers (ifeu) Jan Kovanda (CUEC), Jan Weinzettel (CUEC), Stephan Moll (Eurostat) and Maaike Bouwmeester (Eurostat) as part of Eurostat's project 'Regular up-dating and further methodological development of Eurostat's RME-model' (contract no. 05122.2013.001-2013.691). The project team would like to acknowledge the members of Eurostat's Task Force on material flow accounts for their contributions to the discussions during the meetings in 2013 and 2014 on the preceding version of this tool.

Version

December 2016; complete revision of the country RME tool and update to NACE Rev. 2.

For more information

Please consult the dedicated sections on material flows and resource productivity and methodology on Eurostat's website.

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Disclaimer

The country RME tool has been populated with publicly available data for France for illustrative purposes. Please note that the RME-based indicators reported in the tool and in Section 5 of this handbook do not constitute official estimates.

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Abbreviations

ADTA-IO	Adapted domestic technology assumption input-output
CN	Combined nomenclature
DE	Domestic extraction
DMC	Domestic material consumption
DMI	Direct material input
EFTA	European Free Trade Association
EU	European Union
EUR	Euro
EW-MFA	Economy-wide material flow accounts
EXP	Exports
GDP	Gross domestic product
HIOT	Hybrid input-output table
IMP	Imports
IOT	Input-output table
MFA	Material flows accounts
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne (Statistical classification of economic activities in the European Community)
Rev.	Revision
RMC	Raw material consumption
RME	Raw material equivalents
RMEEX	Raw material equivalents of exports
RMEIM	Raw material equivalents of imports
RMI	Raw material input
SBS	Structural business statistics
SUT	Supply and use tables
t	Tonne
USGS	United States Geological Survey

1 Introduction

1.1 Background

Resource productivity is an important indicator of the European Commission's EU 2020 flagship initiative 'Towards a resource efficient Europe'. In order to monitor this policy initiative Eurostat has established an indicator scoreboard in which resource efficiency is the lead indicator.

For the current measurement of resource productivity, domestic material consumption (DMC) is related to the gross domestic product (GDP). DMC is a key indicator for measuring the use of natural resources in an economy. The indicator is derived from economy-wide material flow accounts (EW-MFA) which cover all material inputs into national economies, the changes of stocks and their respective outputs. It is defined as the total amount of material directly used in a given economy.

Several research projects and expert groups pointed out that the value of DMC depends strongly on the origin of the input. If e.g. metal ore is extracted domestically the total amount of ore is accounted for, but if metals are imported only their imported mass (product weight) is used. This asymmetry between the concept of domestic extraction and the recording of trade in EW-MFA led to the proposal to express all imported goods and exported goods in terms of raw material content. Consequently, all imported semi-finished and finished goods need to be expressed in raw material equivalents (RME).

The European Commission has also expressed the aim to integrate indirect or embodied material consumption into material flow accounts (see Section 3.4 of Commission Staff Working Paper SEC(2011) 1067 final).

For these reasons, Eurostat developed and regularly publishes annual results on RME of product flows at EU-28 level [(1)]. Raw material consumption (RMC) is the main indicator provided by RME accounting. That indicator describes the amount of raw materials which are embodied, over the whole production chain, in the products of domestic final uses of an economy.

The EU RME model that Eurostat uses to compile the estimates is an adapted domestic technology assumption input–output model (ADTA-IO model). The calculation approach provides detailed annual results on product flows in RME in a breakdown by the following dimensions:

- Categories of final uses and imports
- 182 product groups
- 51 raw material categories (without aggregates)

The current Eurostat EU RME model represents a revised version of the NACE Rev 1.1 based model, which was published in 2012 [(2)]. The major change is the migration from the NACE Rev 1.1 to the NACE Rev. 2 classification. In addition, a number of methodical improvements were introduced with the primary aim of improving the estimates for RME of imports, such as increasing the degree of resolution of the input–output table (IOT), improving the price concepts and the

[1] Eurostat: EU RME Model, December 2016
[2] See Schoer, K. et al., 2012.

utilization of further regionalized information. The model results are annually updated and published on Eurostat's online database, (see data code env_ac_rme).

In order to make full use of the RME framework, **it is desirable to supplement the figures on EU-level by corresponding information for Member States and EFTA countries**. Therefore, Eurostat also developed a so-called country RME tool for estimating results of RME accounting at country level, which is coherent with Eurostat's EU RME model. Establishing the full EU calculation model on country level would be rather resource-consuming and would suffer from limited data availability. Therefore, applying the full Eurostat RME model or another model with similar degree of detail would only be an option for a few countries. The purpose of the country RME tool is to assist national statistical institutes to produce country-level estimates of RME with a manageable amount of effort. For this reason, the country RME tool has been implemented as a simplified Excel based calculation tool (template). This handbook presents the country RME tool and provides supplementary information to compilers of country-level RME accounts.

1.2 Changes compared to the previous version

Due to the revision of the EU-level RME model, the supplementary country RME tool for estimating RME at country level had to be revised accordingly. The revised tool which is presented in this handbook is harmonised with the revised Eurostat RME model, which is following the NACE Rev. 2 activity classification. It is replacing the earlier version of this tool which was based on NACE Rev. 1.1 classification for the years 2008 and onwards. The revised tool is based on a so-called coefficient approach (estimates for RME of imports are based on EU-level import and export coefficients) which is similar to the coefficient approach of the unrevised tool. However, for the new version an adjusted coefficient is applied, which takes into account significant country specific differences in production technologies.

For the previous version of the tool, a combined coefficient-IOT approach was offered in addition to the coefficient approach in order to account for country specific production conditions. However, with respect to the revised model, the approach was not able to produce convincing results under the new revised data settings. It can be assumed that the major problem is resulting from the new classification of the standard IOT. In the new IOT, all mining activities comprising the most crucial raw products are lumped together as one product group. Therefore, in this handbook only an improved coefficient approach could be offered. More research is needed for developing a suitable IOT-based approach at country level.

2 Calculation model - overview

2.1 General remarks

The calculation model for estimating RME at country level was developed for conducting the estimation of RME of product flows at country level. The aim was to develop an approach which is satisfying the following conditions:

- Comparatively low resource requirement
- Sufficient degree of accuracy
- Compliance with the concepts, methods and data of the EU RME model
- Harmonized approach for all countries

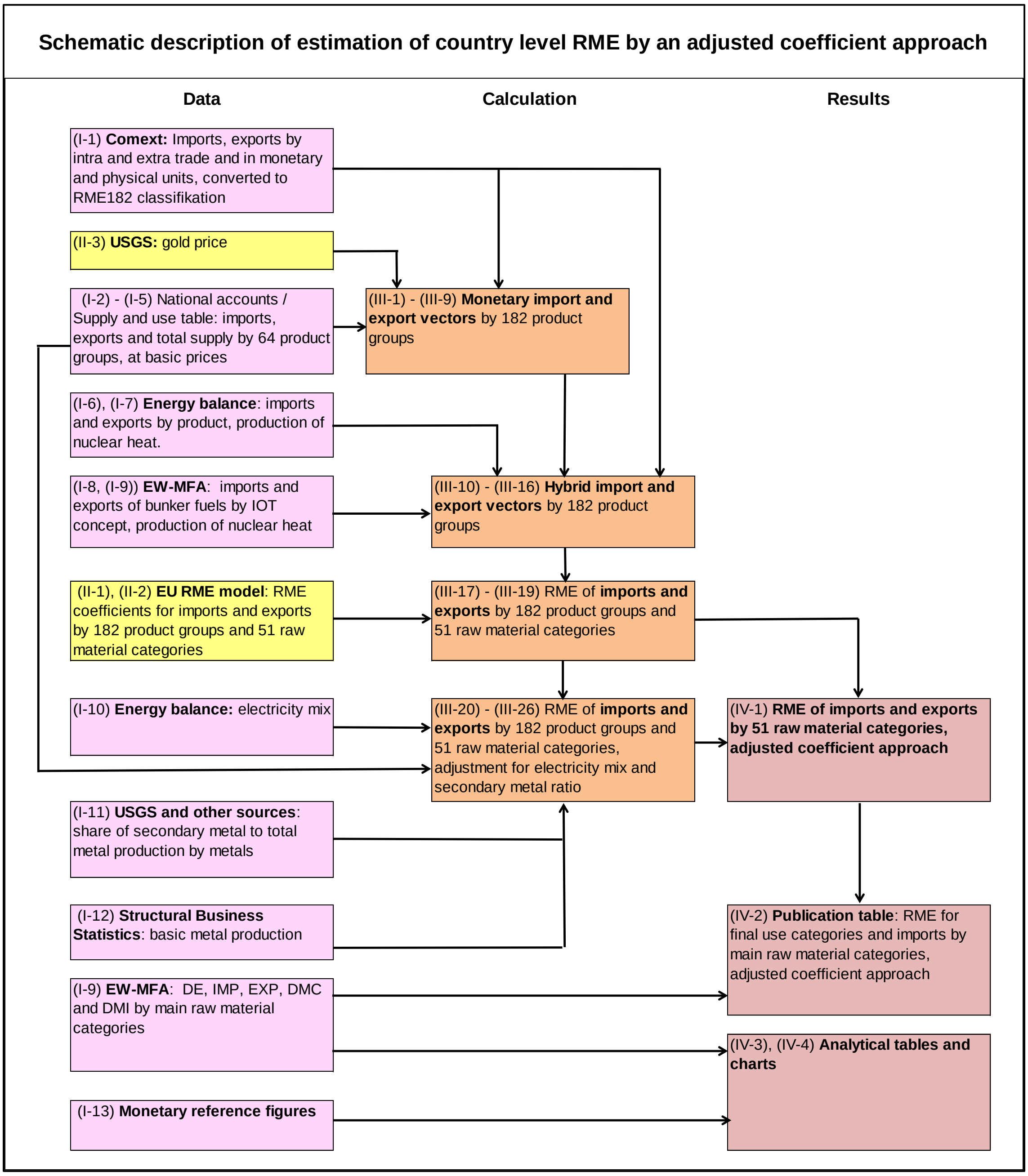
2.2 Calculation model

Figure 1 presents a schematic description of the calculation model. The chart shows the data inputs, the major calculation steps and the different types of results.

The following data sources are used:

- Country-level data: Comext database (statistics on international trade in goods), national accounts/supply and use tables; energy balance, EW-MFA, United States Geological Survey (USGS) and other sources, structural business statistics;
- Data valid for all countries: Eurostat's RME model (annual RME coefficient matrices for imports and exports, EU-level) and USGS (gold prices). The EU model is applying a **hybrid** IOT matrix, i.e. **selected** sales structures are expressed in physical units and not in monetary units. Accordingly, also the RME coefficients from that model have mixed units across the denominators, depending on the specific product to which the RME coefficient relates.

Figure 1: Schematic description of estimation of country-level RME by the "adjusted coefficient approach"



The calculation method of the adjusted coefficient approach combines annual **EU-level RME coefficient matrices** for imports and exports with hybrid **country-level import and export vectors.** The mix of units of the hybrid trade vectors is fully matching the mix of units for the EU coefficients.

In a first principal calculation step (II-1 to III-9), country-level monetary imports and export vectors in a breakdown by 182 product groups are estimated. In a second step (III-10 to III-16), hybrid (mixed monetary and physical units) trade vectors are calculated which correspond to the mix of units of the EU-level RME model. In a third step (III-20 to III-26), country-level RME of imports and exports are calculated by multiplying EU coefficients with country-level trade vectors. The results for RME of exports are adjusted by regarding differences in country specific and EU production technology. In a final set of steps (IV-1 to IV-4), the calculation results and some supporting analytical results are presented.

2.3 Calculation of RMI and RMC

The indicators raw material input (RMI) and raw material consumption (RMC) correspond to direct material input (DMI) and direct material consumption (DMC) of EW-MFA respectively. These indicators are obtained in the same way as the EW-MFA indicators. They combine the numbers on domestic extraction (DE) from EW-MFA with RME of imports (RMEIM) and RME of exports (RMEEX) in the following manner:

RMI = DE + RMEIM

RMC = RMI – RMEEX

3 Data input to the model

Table 1 presents an overview of the data input to the calculation model. More detailed technical descriptions are directly included in the Excel workbook of the country RME tool. The source and the extraction format for each dataset are shown in the attached data pool.

Table 1: Data inputs

Section	Worksheet of the country RME tool	Description
I. Data input country-level	I-1-COMEXT-182	**Comext**: Imports, exports by intra and extra-trade in EUR and tonnes. Data converted to RME182 classification
	I-2-Tot IMP EXP Nat Acc	Data of national accounts on total imports and exports of goods and of services
	I-3-IMP SUPPLY 64	Data of supply table of national accounts for imports and supplies by 64 product groups
	I-4-EXP 64	Data of use table of national accounts for exports by 64 product groups, basic prices
	I-5-IMP SERVICES	Data of supply table of national accounts for imports of services by intra and extra trade by 43 product groups, basic prices
	I-6-Energy balance IMP EXP	Data of energy balance: imports and exports by product
	I-7-Energy balance: nuclear heat	Data of energy balance on primary production of nuclear heat
	I-8-Bunker fuels IOT concept	Data of EW-MFA on imports and exports of bunker fuels by IOT concept (residence principle)
	I-9-EW-MFA	Data of EW-MFA on DE, IMP, EXP, DMC and DMI by main raw material categories and for nuclear fuel
	I-10-Electricity mix	Data of energy balance on electricity mix.
	I-11-Secondary metal ratio	Data of USGS and other sources on share of secondary metal production to total metal production by metals
	I-12-SBS basic metals	Data of Structural Business Statistics (SBS) on basic metal production
	I-13-Monetary reference figures	Data of national accounts on total GDP, EXP and IMP, chain linked volumes
II. Data inputs EU-level	II-1-EU RME coeff IMP	Annual data from EU model: RME coefficients for IMP, valid for all countries
	II-2-EU RME coeff EXP	Annual data from EU model: RME coefficients for EXP, valid for all countries
	II-3-USGS gold price	Annual data from USGS on gold price, valid for all countries

For the tool, two different categories of data inputs are required.

- Country-specific data (items I-1 to I-13)
- EU-level data which are used for all countries (items II-1 to II-3)

As the tool is calculating all years (2008 to currently 2014) the input data are needed as time series as well. The tool is prefilled with data for the pilot country France to showcase the required layout of the data. Please replace data for France by your country data.

Country-level data: The preparation of the data input for the individual countries has to follow a number of principal steps: data extraction, gap filling and a plausibility check.

- **Data extraction:** The worksheets for data input of the tool show the source and format of the required data. Refer also to the data pool (see below).
    - Core data input to the model is EU-level data on RME coefficients of imports and exports. Those coefficients are valid for all countries. Further data from USGS (United States Geological Survey) on annual gold prices are needed, which are also valid for all countries.
    - The required annual country level data (I-1 to I-13) can be derived completely from Eurobase (Eurostat's online database), with the exception of the data on secondary metal ratios which originate from USGS and some other sources (I-11). As an alternative to Eurobase, national data sources could be utilized, provided that data are entered to the tool according to the prescribed format.
    - For your convenience, an accompanying data pool with prefilled data was attached to the tool. In the Excel workbook "Input data country RME tool" all required input data items for all countries and all years, except for Comext data, are provided. The complete data pool can be downloaded in conjunction with the country RME tool. Data from Comext which are needed by the tool in a model-specific classification by 182 product groups can be obtained on request from Eurostat [(3)]. As an alternative, the procedure of converting Comext CN 8-digit data to RME classification by 182 product groups can also be made available to users on request.
    - The data for the data pool have been extracted at the time of publication of this tool. The intension is to publish and updated version of this input data file once a year. If you want to use the most recent data at the time of running the tool you will have to do your own extraction.
- **Gap filling**: The tool is only able to work properly if all data gaps (missing values) are closed. As far as data for complete years are missing (usually because data are not available), automatic gap filling procedures were established within the tool (see below III. Calculation steps). As far as applicable, ":" tags where replaced by "0" in the data pool in order to enable automated gap filling procedures.
    - Users may decide to improve upon this gap-filling by using additional data or other methods.
    - Manual gap filling is necessary for missing sectoral values. As a rule those data are missing due to suppression for confidentiality reasons (see attached information on flags and footnotes to each data table). That is, in case the tool is run within a statistical institute confidential data could usually be filled in. If missing data are definitely not available, gaps should be closed by simple assumptions.

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- **Plausibility check:** Beyond filling data gaps, the input data should also be checked for plausibility. In case of implausible values, data should be corrected. There may also be feedbacks from plausibility checks at the level of calculation results which may give reasons for correcting input data [(4)].

EU coefficient matrices: EU-level RME coefficients are derived from the Eurostat RME model by dividing the matrices (product groups by raw material categories) with RME of imports and exports in tonnes by the import and export vectors of the hybrid IOT (HIOT 182). Those coefficients measure cumulated raw material requirement in tonnes RME per unit of product. The denominator of the different products is measured in different units; EUR, tonnes and other physical units.

[4] It has to be noted that for The Netherlands the tool is not working well. The most probable reason might be the "Rotterdam effect", which means that Dutch data show an extraordinary high share of re-exports which go back to the fact that goods which are regarded as imports are more or less directly transferred (exported) to other countries. As the tool is assuming different RME coefficients for extra trade imports than for exports that could lead to implausible results. To cope for that problem a tailor-made approach may be necessary for The Netherlands.

4 Calculation method

The coefficient approach combines annual **EU-level RME coefficient matrices** for imports and exports with **country-level trade vectors**. RME of imports and exports at country level are obtained by multiplying the coefficient matrix with the corresponding country-level hybrid import and export vectors.

Table 2 gives an overview of the detailed calculation procedure. For more technical details refer to the workbook for the country RME tool.

Table 2: Adjusted coefficient approach calculation procedure

Sections	Worksheet of the country RME tool	Description
III. Calculation steps for adjusted coefficient approach	III-1-COMEXT-182 form ad	Comext 182 format adjustment: totals for IMP and EXP are added
	III-2-Gold smoothening	Gold smoothening: The data on imports and exports of gold show for some countries rather erratic movements over time. It is recommended to smoothen the time series for gold.
	III-3-COMEXT182 gold smoothened	Comext 182: correction for gold smoothening of monetary flows is added.
	III-4-IMP 64 gap filling	Automated gap filling for IMP 64 for missing years.
	III-5-EXP 64 gap filling	Automated gap filling for EXP 64 for missing years.
	III-6-IMP sectoral disaggr	Sectoral disaggregation of gap filled IMP 64 to IMP 182 by Comext relationships
	III-7-EXP sectoral disaggr	Sectoral disaggregation of gap filled EXP 64 to EXP 182 by Comext relationships
	III-8-IMP services gap filling	Estimation of share extra trade for services. Automated gap filling for missing values
	III-9-IMP disag intra-extra	Disaggregation of IMP into intra and extra trade.
	III-10-IMP EXP EB (2)	Energy balance: imports, exports, international bunkers. Assignment of energy products (classification for energy balance) to items of RME 182 classification. Estimation of imports of uranium and thorium ores in 1000 t RME.
	III-11-IMP EXP EB bunker fuels	Adjustment of IMP and EXP of energy balance to IOT concept.
	III-12-IMP EXP EB format ad	Expansion of energy balance IMP and EXP data to RME 182 format
	III-13-IMP EB intra extra	Disaggregation of the energy balance data on IMP into intra and extra-trade by Comext relationships
	III-14-IMP EXP hybrid vector	Merging of SUT/IOT, Comext and energy balance data for establishing annual hybrid country level vectors for IMP extra-trade, IMP intra-trade and EXP by 182 product groups
	III-15-IMP EXP hybr vect form a	Format adjustment annual hybrid IMP and EXP vectors: removal of sub-totals
	III-16-Hybrid vectors transp	Annual hybrid IMP and EXP vectors are transposed: transposing is required for the next calculation step III-17
	III-17-RME IMP EXTRA	Annual calculation of country level RME of IMP extra trade: EU level RME IMP coefficients x hybrid country level vector IMP extra trade.
	III-18-RME IMP INTRA	Annual calculation of country level RME of IMP intra trade: EU level RME EXP coefficients (= RME coefficients for final use) x hybrid country level vector IMP intra trade.

	III-19-RME EXP	Annual calculation of country level RME of total EXP: EU level RME EXP coefficients (= RME coefficients for final use) x hybrid country level vector total EXP
	III-20-Share of OUTPUT	Calculation of the share of output at total supply for total economy. Automatic gap filling for missing years. The share is used for weighting the impact of imports and domestic production on the average electricity mix of exports in step III-22
	III-22-Electricity mix adjustment factor	Estimation of adjustment factors for fossil energy carriers to regard differences in electricity mix for EU and country under review
	III-23-Energ cont EXP electr	Annual calculation of energy content of exported products, adjusted for the energy mix of electricity generation
	III-24-SBS basic metals	Format adjustment of SBS for basic metals
	III-25-IMP EXP OUTP basic met	Calculation of the share of output at total supply for basic metals by metal category. The share is used for weighting the impact of imports and domestic production on the average primary metal content of exported products
	III-26-Secondar metal adjm fact	Annual estimation of adjustment factors for differences in primary metal ratios for EU and country under review for major metal categories.

The calculation procedure follows a number of principal steps.

Hybrid trade vectors: The following operations are needed for deriving country-level hybrid trade vectors:

- **Preparation of Comext data**: The data of Comext have to undergo further preparations, such as format adjustments and a correction of gold statistics (gold smoothening) in order to meet the requirements for the next calculation steps (III-1 to III-3).
- **SUT/IOT gap filling for missing years:** Main starting point for establishing the trade vectors are the monetary import and export figures of SUT/IOT in a breakdown by 64 product groups. As for most countries, the complete period 2008 to 2014 is not covered by SUT/IOT data. A procedure of automated gap filling for missing years was developed (III-4 to III-5).
- **Sectoral disaggregation:** The monetary trade vectors by 64 product groups are disaggregated to the level of 182 product groups by using Comext relationships (III-6 to III-7).
- **Breakdown by intra and extra-trade:** The monetary vector for imports is subdivided into intra and extra-trade by using mainly Comext relationships (III-8 to III-9).
- **Preparation of the energy balance:** Energy balance data are required for expressing the imports and exports of energy carriers in physical units. In order to comply with National accounts concepts, and hence the concepts used in IOT (more specifically, the residence principle in this case [(5)]), energy balance data have to be adjusted for the flow of bunker fuels. Imports as reported by the energy balance have to be subdivided further into intra and extra-trade. Finally the imports of uranium ores in physical units have to be estimated in accordance with the energy balance information of production of nuclear heat (III-10 to III-13).
- **Hybrid trade vectors:** Hybrid trade vectors by 182 product groups are established by merging the physical information from the energy balance (energy carriers), physical information from Comext (raw materials excluding metal ores) and monetary information from disaggregated SUT/IOT for all other product groups (III-14 to III-16).

[5] See Figure 5.2 in the draft Chapter 2 of the SEEA-Energy; http://unstats.un.org/unsd/envaccounting/seeae/egm/chapter2-draft.doc

RME of imports and exports: As already described above, RME of imports and exports are estimated by multiplying EU-level RME coefficients with country-level hybrid trade vectors (III-17 to III-19).

The EU-level coefficients represent cumulated raw material requirement (embodied raw materials) per unit of product. The EU import coefficients are designed for approximating the average production technology of the countries of origin of imports to EU [(6)]. The EU export coefficients are representing the domestic EU production technology.

The following average production technologies by 182 product groups are assumed for country level imports and exports:

- **Extra-trade imports**: Average production technology of countries of origin for EU imports (country-level extra-trade imports x EU import coefficients)
- **Intra-trade imports**: Average EU production technology (country-level intra-trade imports x EU export coefficients)
- **Exports**: Average EU production technology (country level exports x EU export coefficients), adjusted

The rather detailed sectoral breakdown of the model assures that structural differences between EU and countries down to the level of 182 product groups are fully regarded. Further structural effects below that level may limit the accuracy of the calculation results to some extent.

A much more important issue, however, is that the assumptions about the production technology could be inadequate. With respect to RME of imports, the assumptions about the production technology can be considered to be quite realistic. That is, the model is able to provide fairly accurate results for RME of imports.

Adjustment of RME of exports: Unlike for imports, the assumption on the production technology for exports tends to be a weak point. The calculation for exports is based on EU average production technology. It has to be considered, however, that the production technologies of member countries might differ significantly from the EU average, at least for some product groups. Most obvious and quantitatively important cases in terms of raw material requirement are the production of electricity (different mix of energy carriers) and metal production (differences in the share of secondary metal production). Electricity and metals are embodied in almost all exported products. For taking account of those important country specific differences, a method for adjusting the coefficients for exports of metals and of energy carriers was developed, the so-called adjusted coefficient approach.

For the adjusted approach, the following corrections are regarded:

- **Electricity mix**: adjustment of embodied exports of fossil energy carriers for differences of country specific electricity mix to EU average electricity mix (III-20 to III-23).
- **Secondary metal ratio**: adjustment of embodied exports of metals for differences of country specific secondary metal ratios to EU average ratios (III-24 to III-26).

[6] See ADTA-IO approach for the EU RME model. See Eurostat: EU RME Model, December 2016

5 Data output of the model

Table 3 describes the presentation of the calculation results of the model. For more details refer to the workbook of the country RME tool.

Table 3: Adjusted coefficient approach calculation procedure

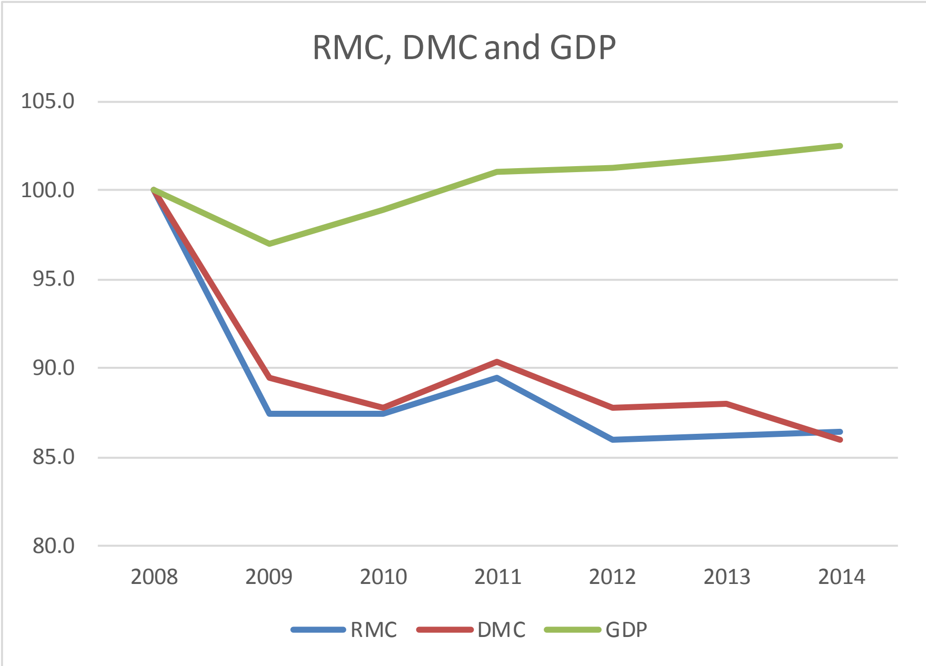
Sections	Worksheet of the country RME tool	Description
IV. Results	IV-1-Summary IMP EXP'	Presentation of annual results RME of imports and exports by raw material categories. 1st step: results by unadjusted coefficient approach. 2nd step: of RME of exports by adjusted coefficient approach
	IV-2-Summary publication	Annual results for publication for DE, RMEIM, RMI, RMEEX and RMC by main material categories
	IV-3-Summry analysis	Analytical tables with reference figures (used for charts)
	IV-4 Charts	Charts

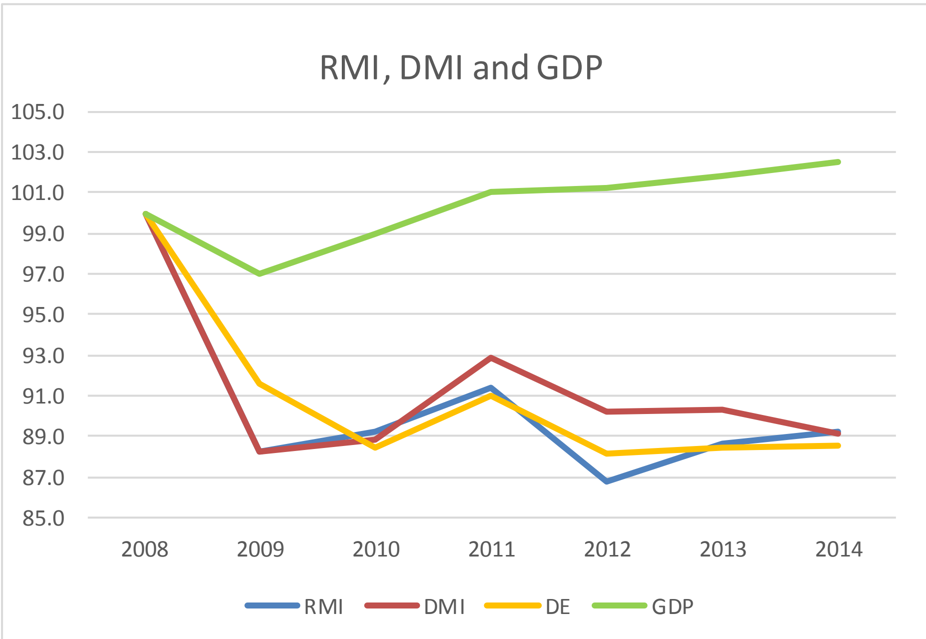
The output tables show:

- Results for imports and exports in a full breakdown by 51 raw material categories. For exports, the unadjusted and the adjusted results are presented (IV-1)
- Annual results for publication for DE, RMEIM, RMI, RMEEX and RMC by main material categories (IV-2)
- Analytical tables with reference figures (IV-3)
- A set of charts with summary results (IV-4).

Figures 2 and 3 provide summary results for the pilot country France. Note that these figures are for illustrative purposes only and as such they are not representing official estimates.

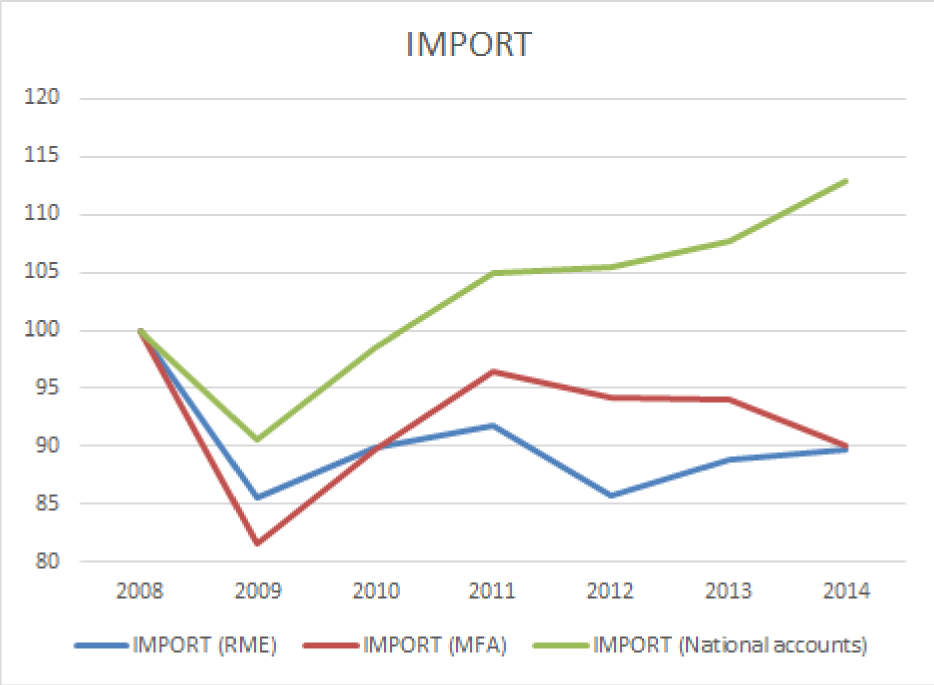
Figure 2: Country RME tool – summary results France I [7]

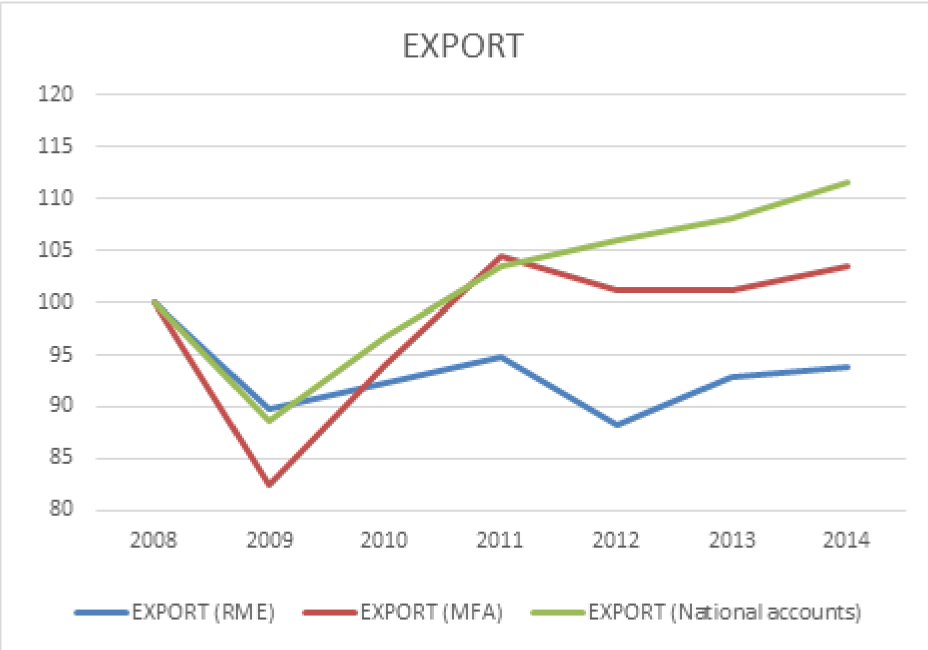




[7] For illustrative purposes only; these figures do represent official estimates for France.

Figure 3: Country RME tool – summary results France II [(8)]





[8] For illustrative purposes only; these figures do represent official estimates for France.

6 Future work

With the previous version of the country RME tool, a combined coefficient-IOT approach was offered in addition to the coefficient approach in order to cope for country-specific differences in production technology. However, that type of IOT-based approach was not able to produce convincing results with the revised data. It can be assumed that the major problem is resulting from the new classification of the standard IOT. According to the new classification for the IOT, all mining activities comprising the most crucial raw products are lumped together as one product group.

Therefore, in this handbook, only an improved coefficient approach could be provided. It would be desirable to have a supplementary IOT approach for estimating RME of exports as an alternative to the adjusted coefficient approach. In principle, an IOT approach would reflect the specific production conditions of the country under review more accurately than a coefficient approach, provided that an IOT of good quality could be established with an adequate degree of sectoral resolution. More research will be done in the future to determine whether an IOT model can be developed which is suitable and manageable for at least a larger number of member countries.