EBS & MAED

Hands-on 2: EBS Mauritius Case Study

Learning outcomes

By the end of this exercise, you will be able to:

1) Use an official Energy Statistics publication to compile basic energy statistics in EBS

2) Identify energy forms and energy flows (from primary energy requirements)

3) Identify appropriate data and input them into EBS

4) Produce an Energy Balance

Preparation

To complete this exercise, you must have available:

- EBS
- the Mauritius Demo Case – empty.ebsz
- the pdf "Mauritius Energy Statistics"

Download the Demo Case and Energy Statistics from the following link:

https://zenodo.org/records/14975551

The objective of this exercise is to use real data on energy production, import/export, and consumption to demonstrate use of the EBS tool for energy balance compilation. To do this, we will conduct a real case example, based on the annual Digest of Energy and Water Statistics published by the Central Statistics Office of the Ministry of Finance and Economic Empowerment of the Republic of Mauritius.

We will use 2008 data because there are fewer fuels to enter compared to the more recent balances.

In this exercise the publication is used to compile basic energy statistics using EBS and check whether energy balance corresponds to the published energy balance. The United Nations Statistical Division questionnaire is referred to at points throughout this hands-on exercise as the UNSD questionnaire.

The steps are as follows:

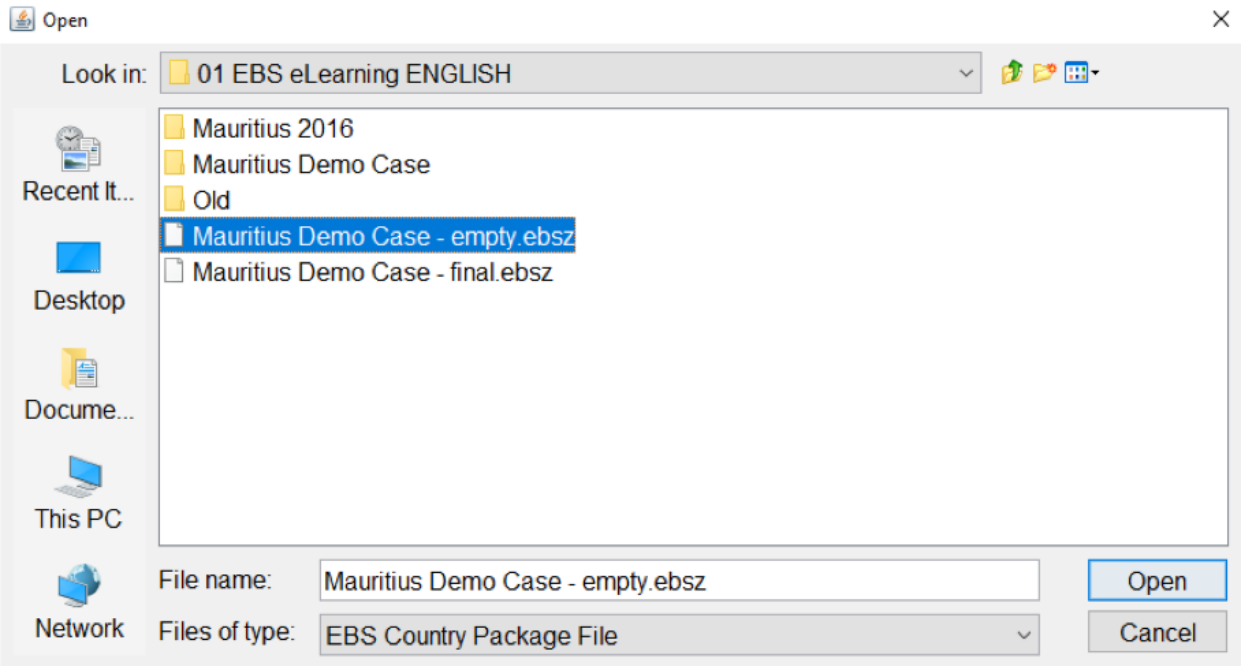
- Check the different sections in the energy section of the publication
  - Energy Balance (to be used for checking our results at the end of the exercise)
  - Primary energy requirements
  - Transformation of energy
  - Final energy consumption
- Identify energy forms and energy flows (from primary energy requirements)
- Use specific energy coefficients (if available)
- Identify appropriate data and input them into EBS
- Check the energy balance (i.e., compare EBS results to the publication)
- Save your work

Open the empty case study

For the exercise, again go to "File" and click "Open". Change "Files of type" to "EBS Country Package File".

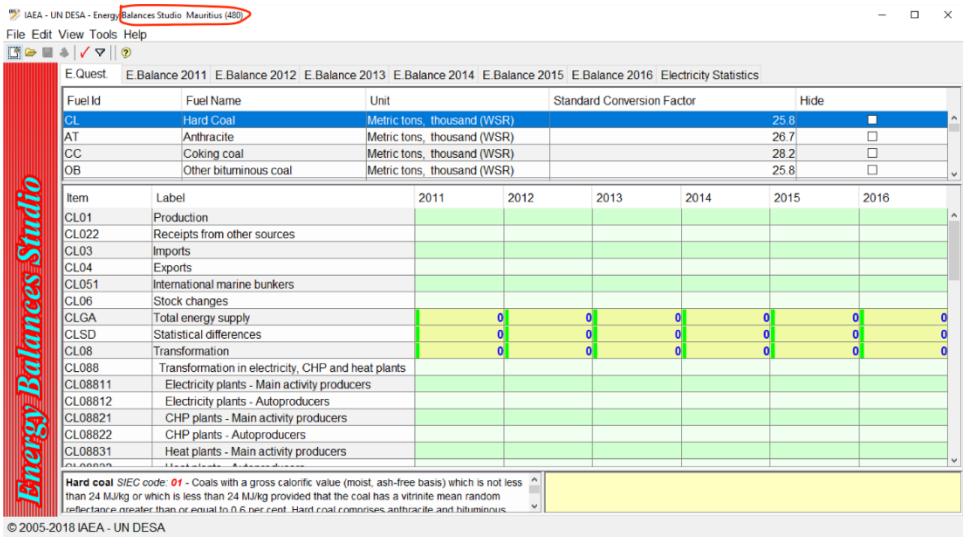
Select: Mauritius Demo Case – empty.ebsz

Press "Open"



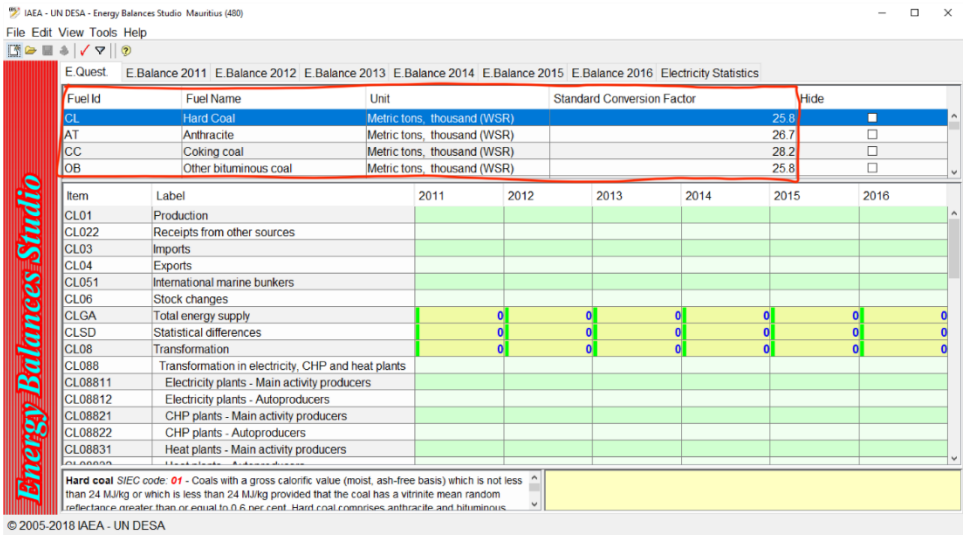
EBS is laid out as follows:

The Country name is in the top bar

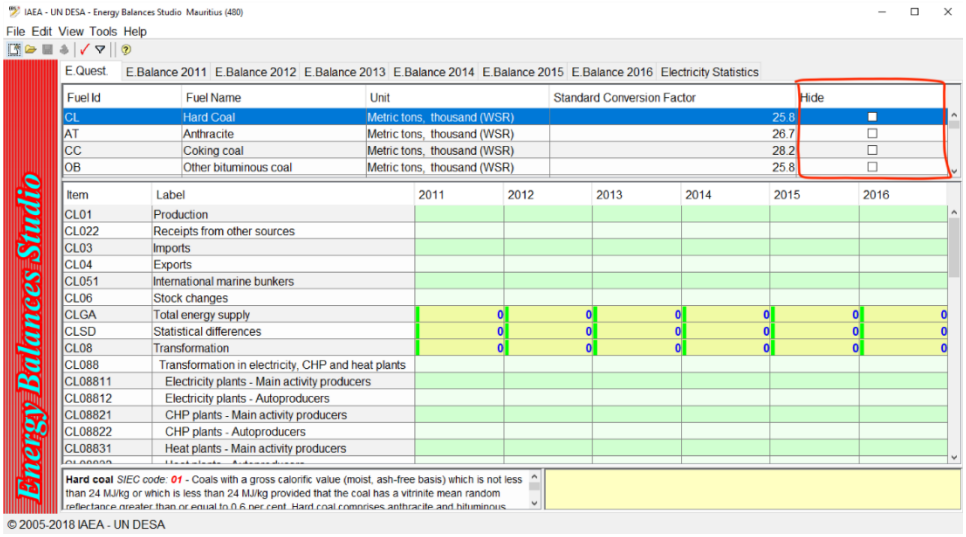


The Upper part of the screen shows the list of fuels organized by:

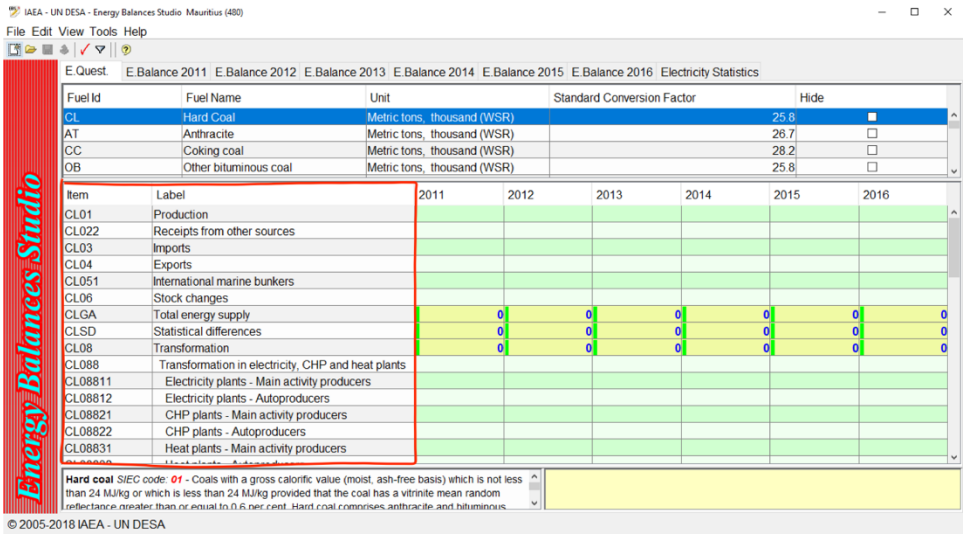
- Fuel ID
- Fuel Name
- Unit (standard metric unit)
- Standard Conversion Factor



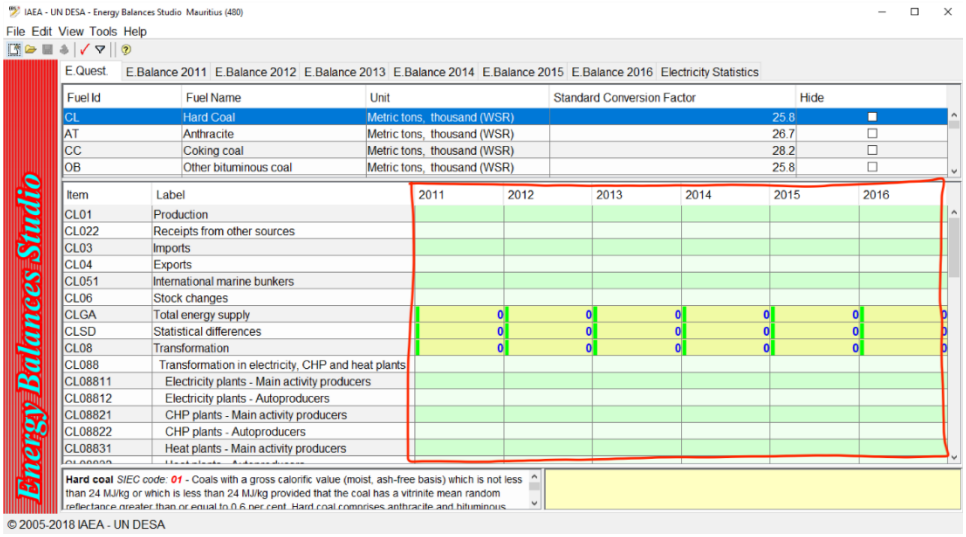
You may hide fuels that are not of interest to your country.



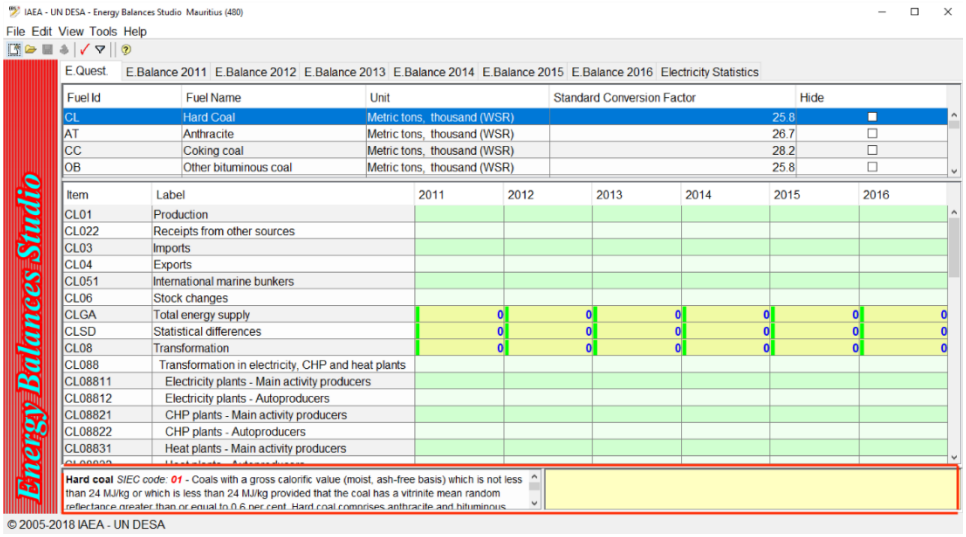
Energy flows for selected fuels are visible on the left of the screen. Each fuel has an ID consisting of fuel ID and row number.



The right side of the screen shows editable cells, with one column for each year. Cells in green can be edited, those in yellow are calculated.



The lower part of the screen shows the fuel description. On the right side there is a field to provide notes as needed.



Note that some energy forms are not available in the list (e.g., wind, solar) – this will be explained later.

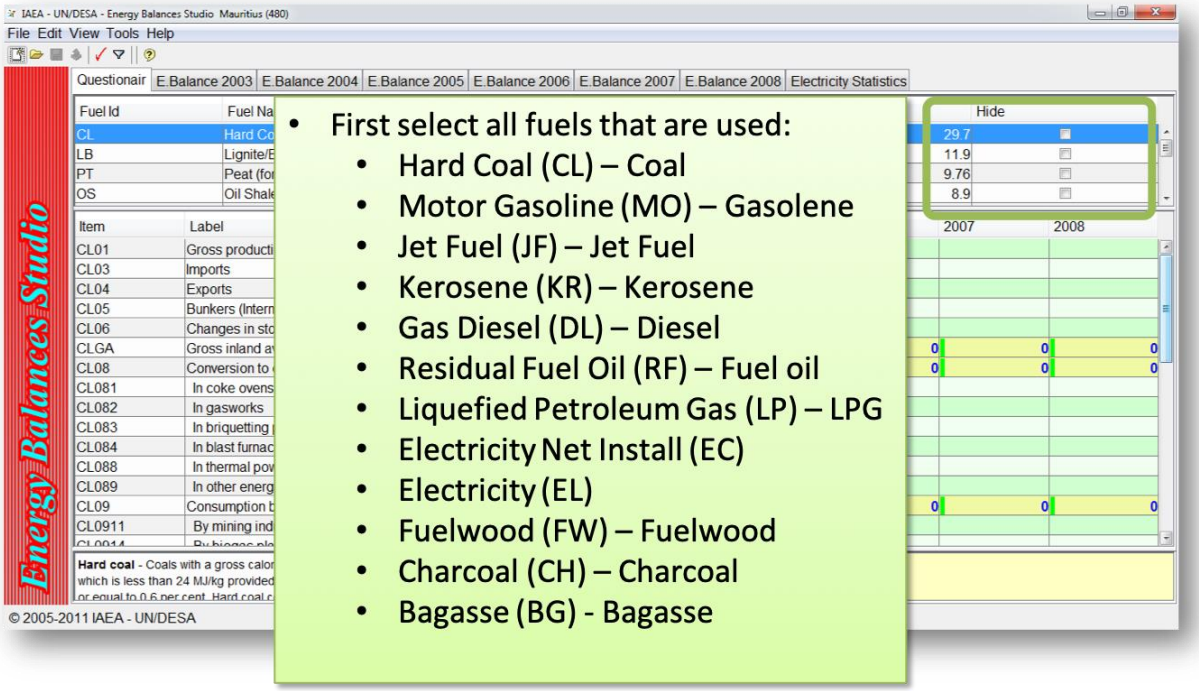
Note that fuel names may differ from the Standard International Energy Product Classification (SIEC) names.

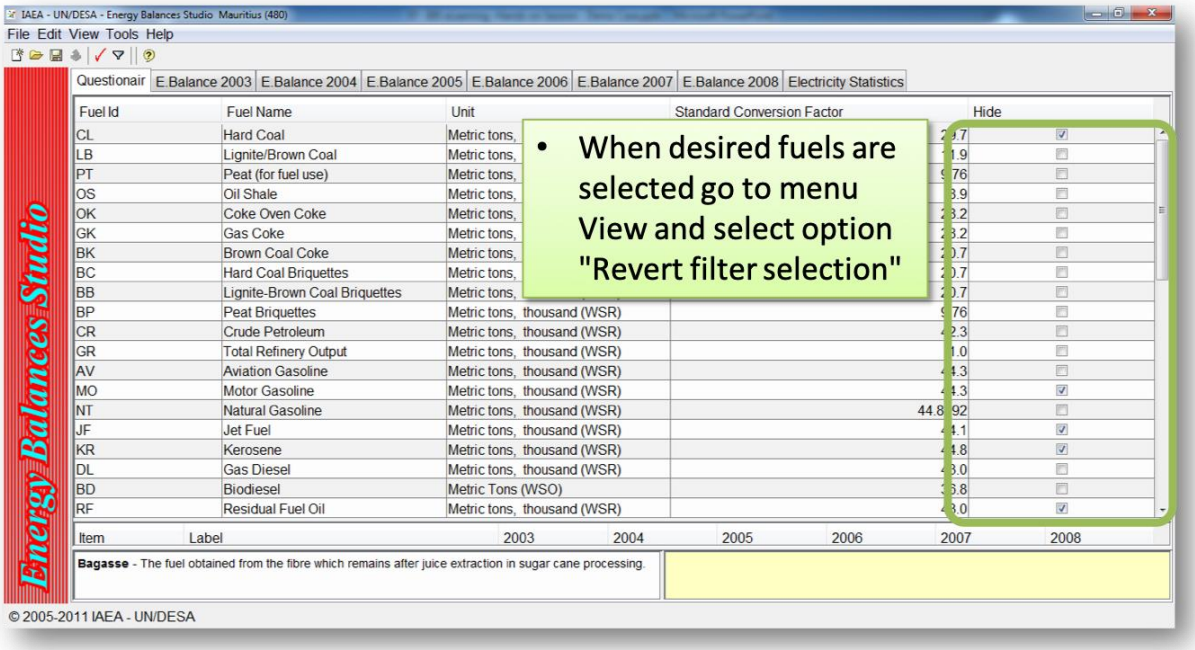
Note that the years you will see on your screen will differ.

Before you start, you must organize your workspace by hiding unused energy forms.

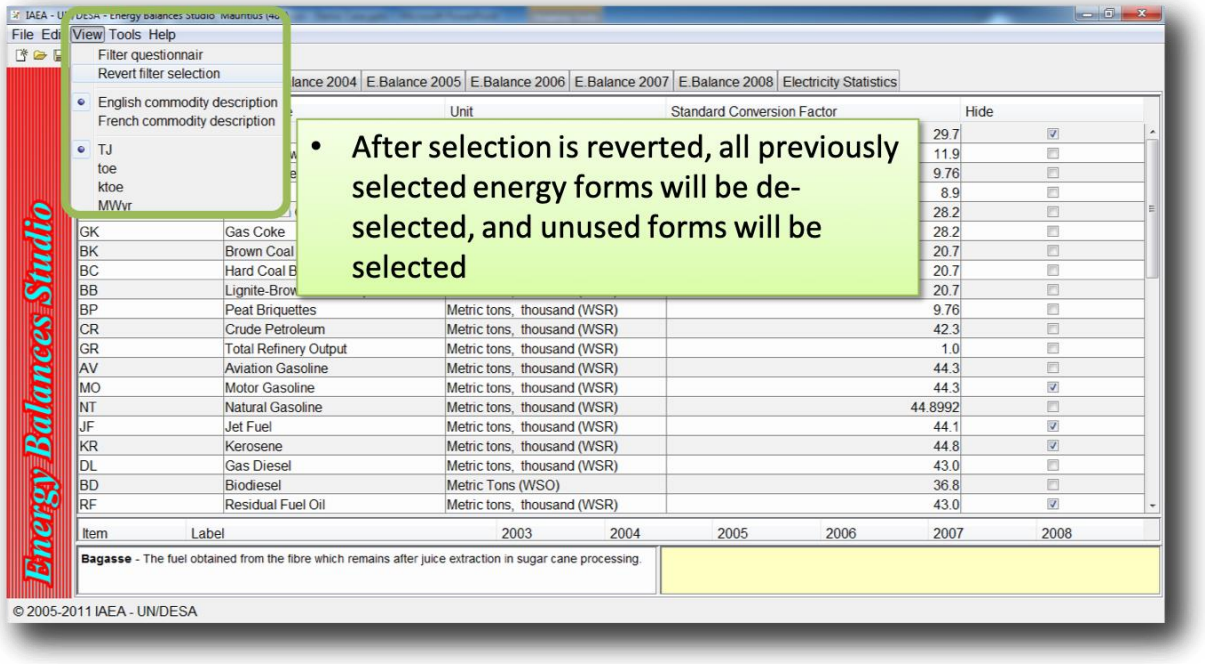
In order to hide unused energy forms, it is possible to use "hide" checkbox and "revert" selection from the View menu, as follows.

Hide used energy forms:

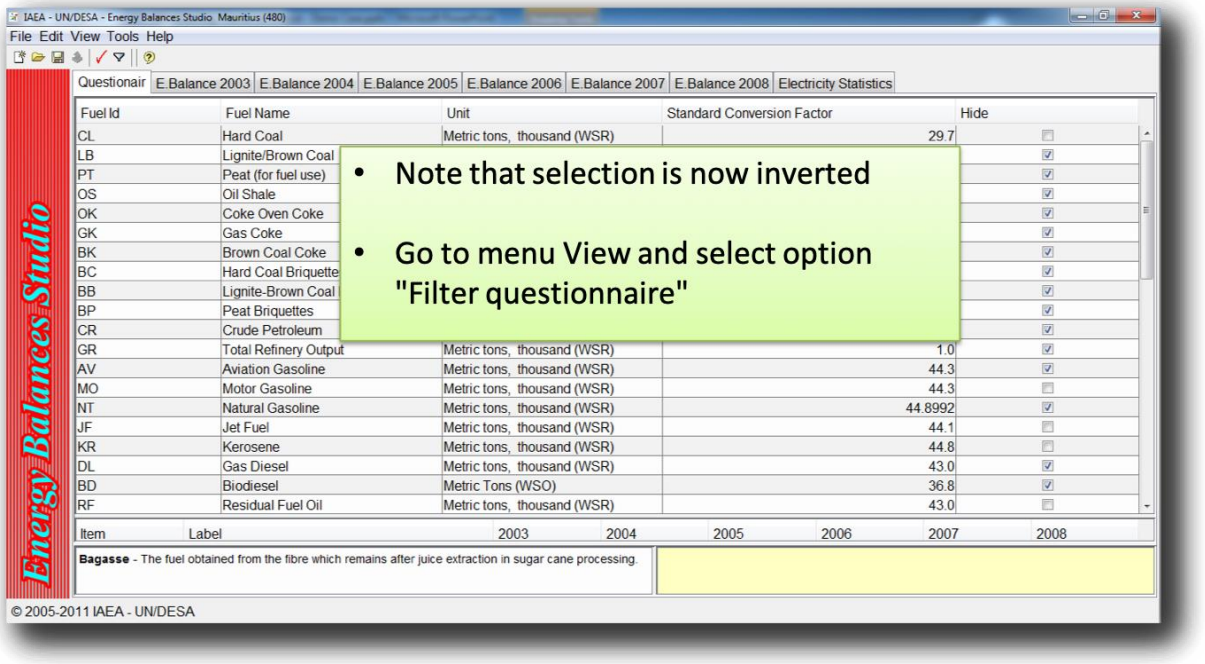


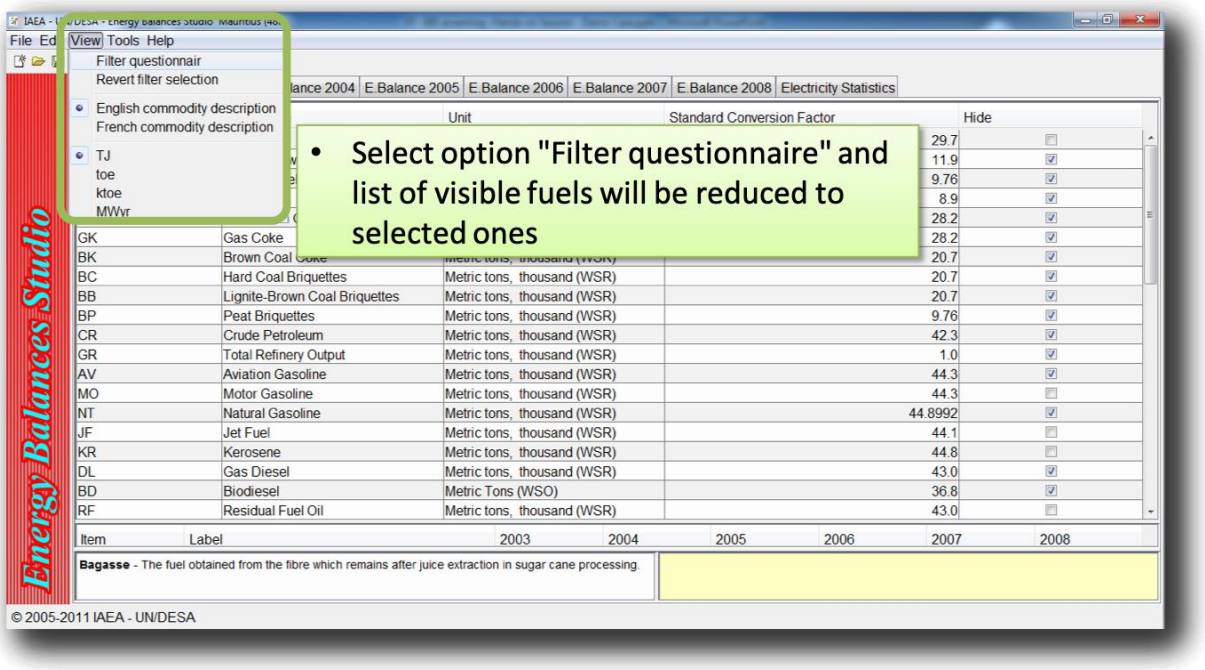


Revert selection from View menu:



Activate filter from View menu

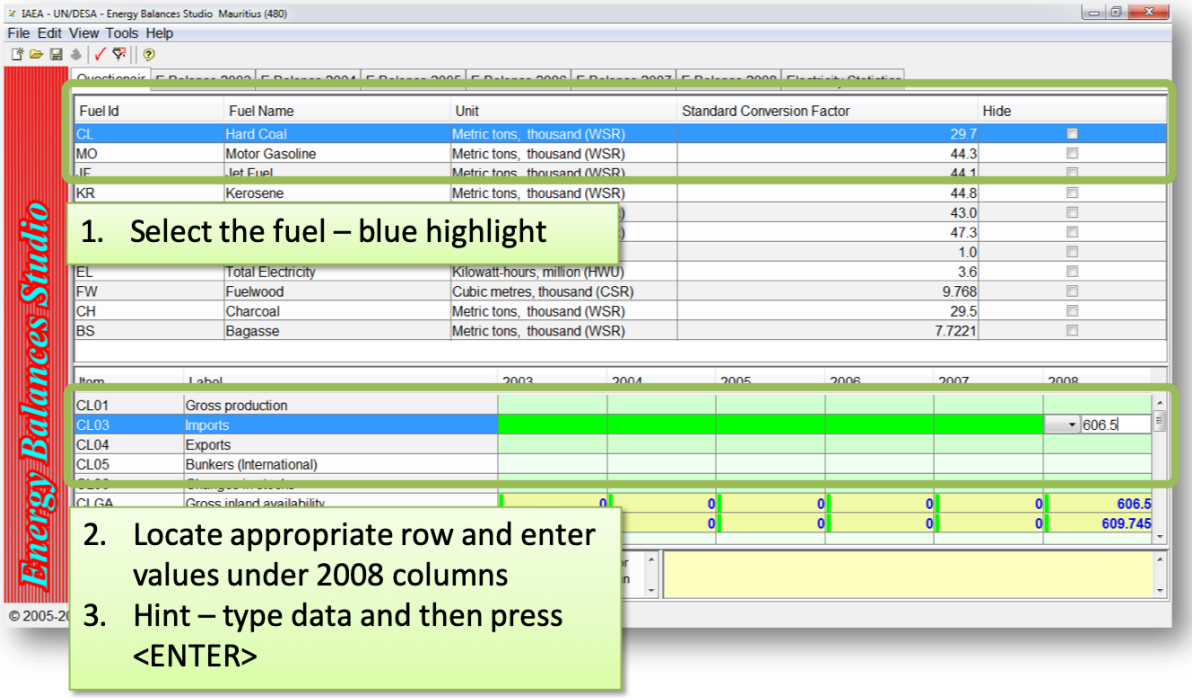




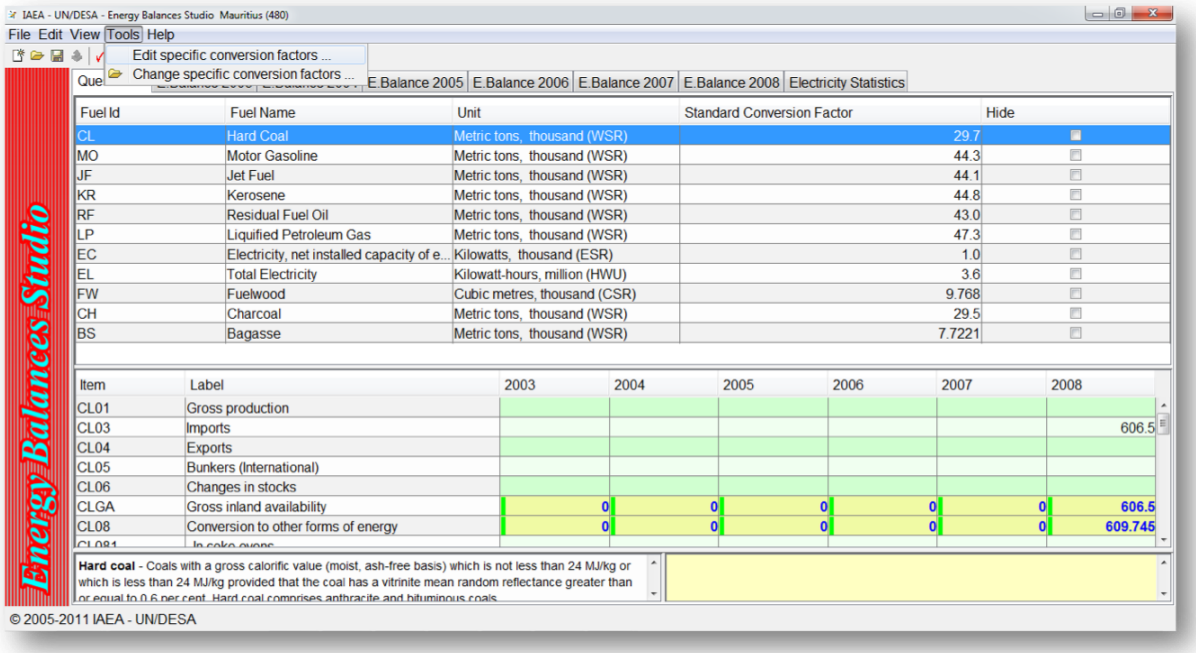
How to enter data

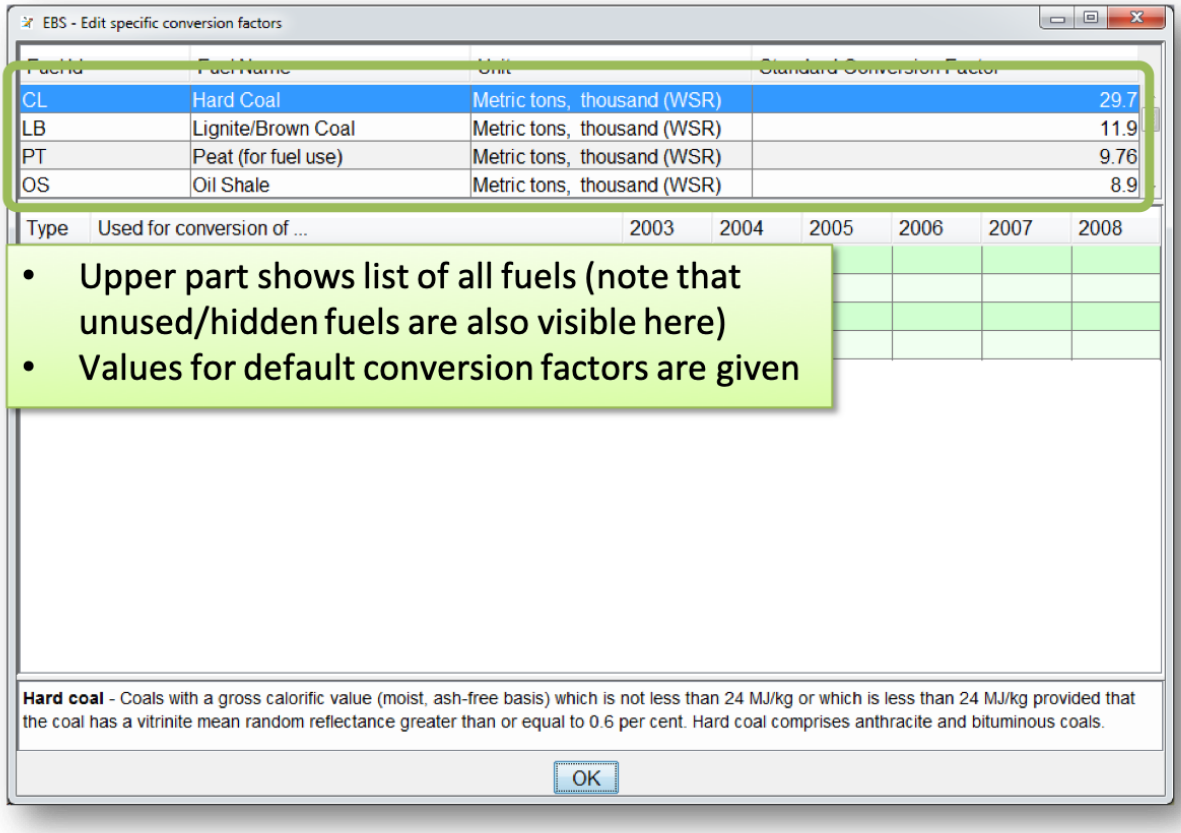
All inputs into questionnaire should be in natural units. To input the data, you must:

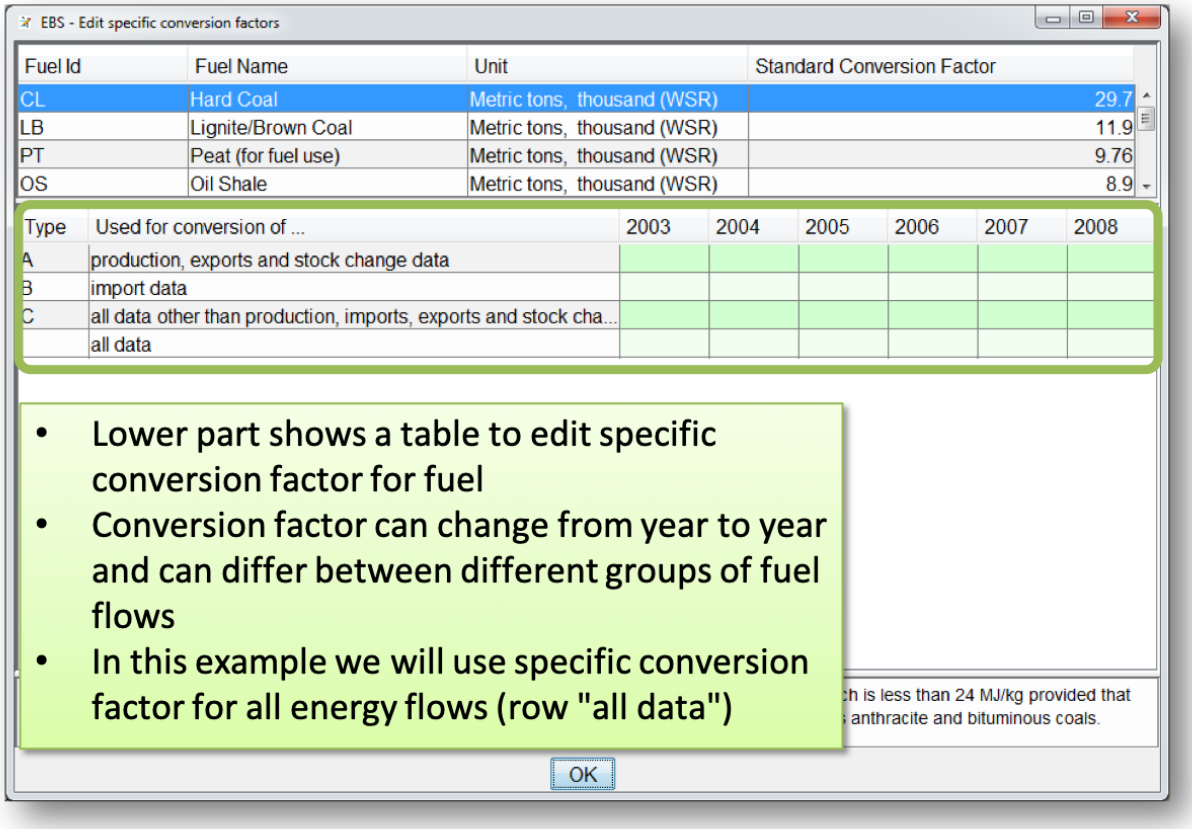
1. Select the appropriate fuel under Questionnaire view.
2. Provide specific conversion data if available.
3. Enter data for different energy flows.
4. Repeat these actions for all fuels.

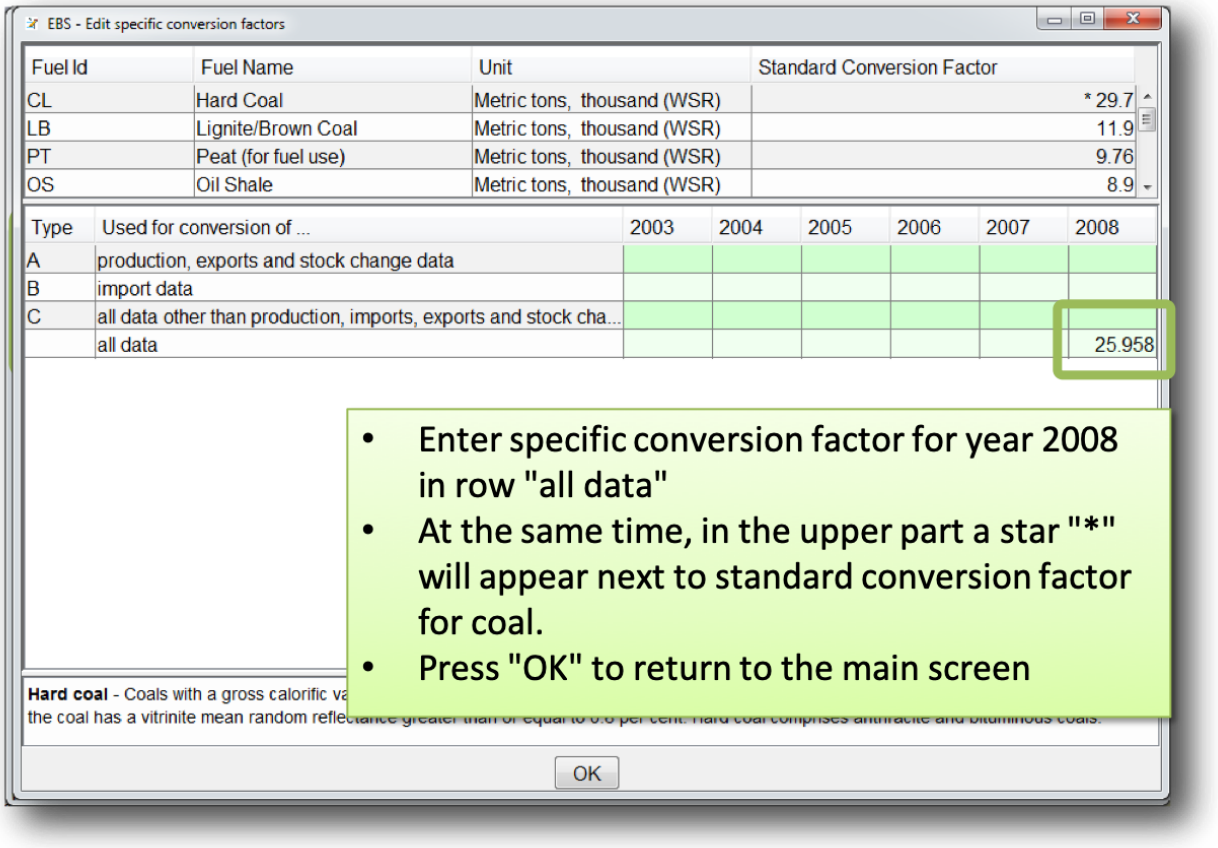


Edit specific conversions where data are available.

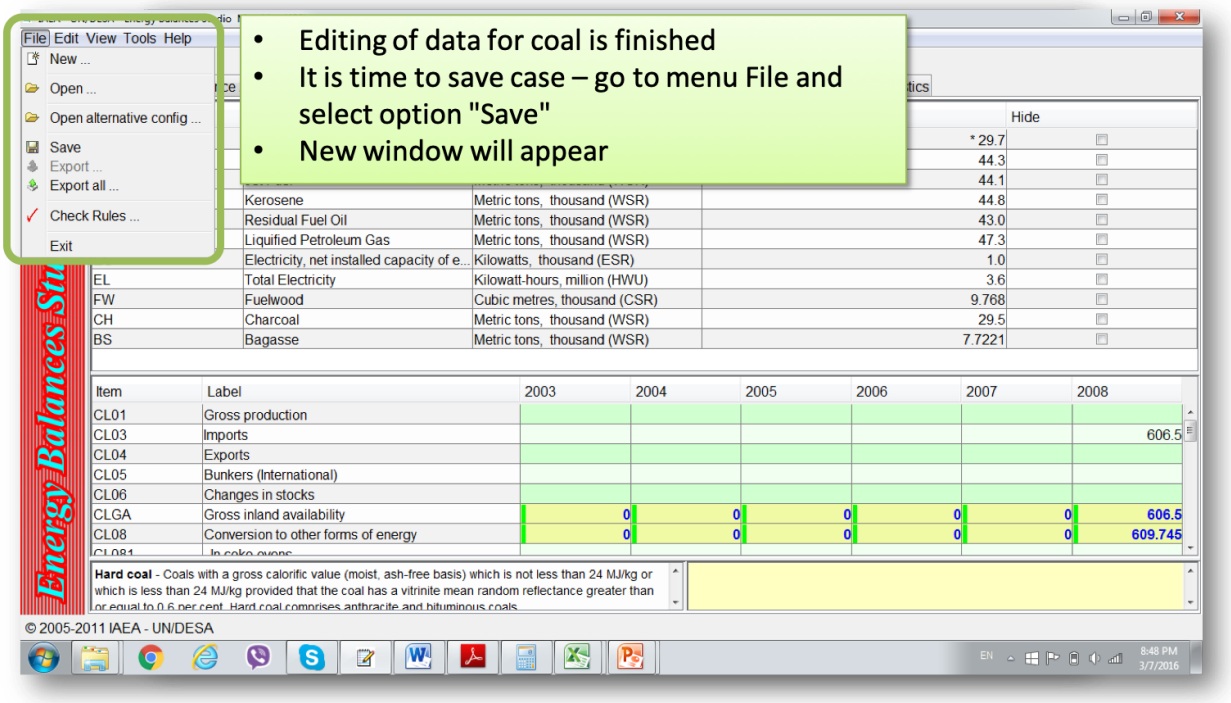



EBS - Edit specific conversion factors
CL Hard Coal Metric tons, thousand (WSR) 29.7
LB Lignite/Brown Coal Metric tons, thousand (WSR) 11.9
PT Peat (for fuel use) Metric tons, thousand (WSR) 9.76
OS Oil Shale Metric tons, thousand (WSR) 8.9
Type
Used for conversion of ...
2003
2004
2005
2006
2007
2008
• Upper part shows list of all fuels (note that unused/hidden fuels are also visible here)
• Values for default conversion factors are given
Hard coal - Coals with a gross calorific value (moist, ash-free basis) which is not less than 24 MJ/kg or which is less than 24 MJ/kg provided that the coal has a vitrinite mean random reflectance greater than or equal to 0.6 per cent. Hard coal comprises anthracite and bituminous coals.
OK


EBS - Edit specific conversion factors
Fuel Id
Fuel Name
Unit
Standard Conversion Factor
CL
Hard Coal
Metric tons, thousand (WSR)
29.7
LB
Lignite/Brown Coal
Metric tons, thousand (WSR)
11.9
PT
Peat (for fuel use)
Metric tons, thousand (WSR)
9.76
OS
Oil Shale
Metric tons, thousand (WSR)
8.9
Type
Used for conversion of ...
2003
2004
2005
2006
2007
2008
A
production, exports and stock change data
B
import data
C
all data other than production, imports, exports and stock cha...
all data
• Lower part shows a table to edit specific conversion factor for fuel
• Conversion factor can change from year to year and can differ between different groups of fuel flows
• In this example we will use specific conversion factor for all energy flows (row "all data")
h is less than 24 MJ/kg provided that
anthracite and bituminous coals.
OK



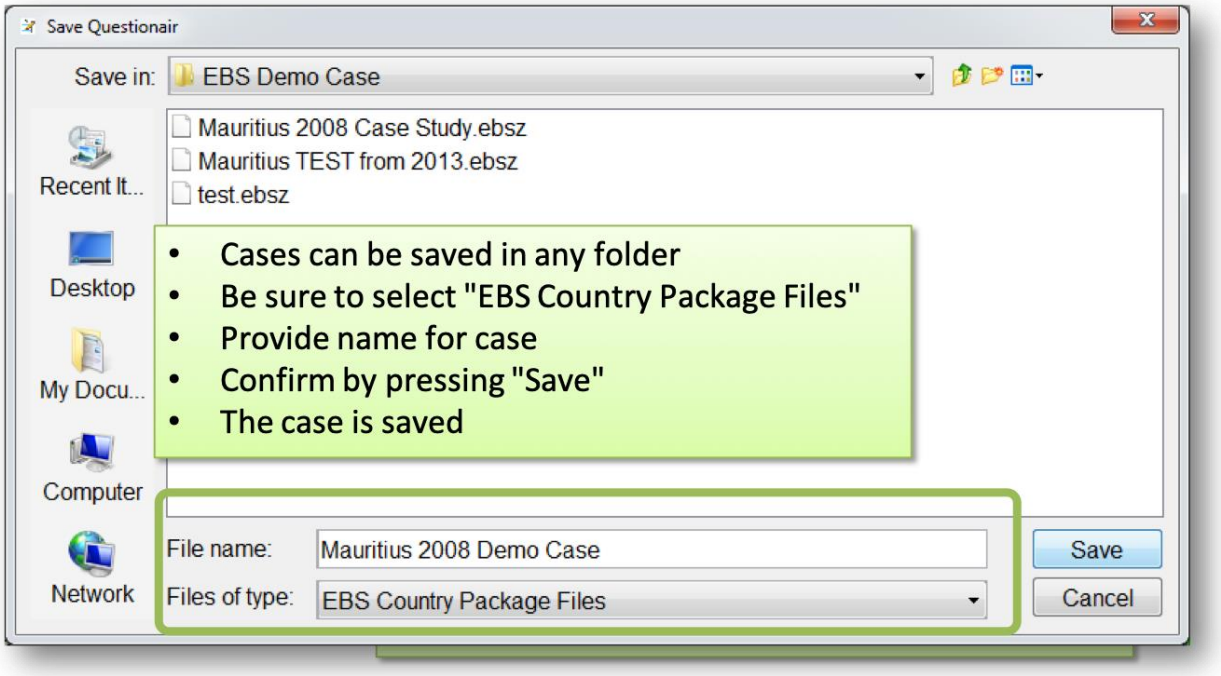
After editing specific conversion factors, you should save the case.



Each time you want to save the case, the option to provide case name will appear. You will have to select from the list of cases and confirm by pressing "Save".

The model will not warn you if you have by mistake selected the wrong case name, so pay attention.

It is advisable to select ".ebsz" file type, especially if specific conversion factors are provided.



In this case study, the following must be considered for certain fuel types.

Coal

For coal, the natural unit is thousands of metric tons. Coal is imported; therefore, it is assumed it belongs to Hard Coal type. (High calorific coals are traded internationally, while low calorific coals such as lignite are usually extracted and consumed locally)

The specific conversion factor for coal is on p. 12 of the Mauritius Energy Statistics

- 0.62 toe/ton; this value must be recalculated to have the units TJ/thousand tons
- 1 toe = 0.041868 TJ
- 1000 ton = 1000 * 0.62 toe = 620 * 0.041868 TJ = 25.95816 TJ
- Therefore, the specific conversion factor is 25.95816 TJ/thousand ton

Imports – p. 26, Table 2.2

- Value for 2008 is 606.5 [thousand tons]
- Value to be entered into row CL03

Use for electricity generation – p. 39, Table 3.7

- Value for 2008 is 609.745 [thousand tons]
- Value to be entered into row CL088

Use in final consumption – p. 43, Table 4.3

- Used in Manufacturing (Industry)

- Value for 2008 is 41.672 [thousand tons]

Value to be entered into row CL1214

Independent Data Input

For all subsequent energy forms, you need to enter data independently. Try to research and understand the publication.

Wood

This is a locally produced energy form. The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 0.38 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it must be recalculated into TJ.
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 0.38 toe = 380 * 0.041868 TJ = 15.90984 TJ
- Therefore, the specific conversion factor is 15.90984 TJ/thousand tons

Production – p. 24, Table 2.1

- Production is given in thousand tons, while in the UNSD questionnaire the required unit is cubic meters [m^3]
- For the time being, the assumption is that we provide data in thousand tons and the specific conversion factor in TJ/thousand ton (the final calculation of the energy balance will be correct as the conversion factor is also adjusted)
- Fuel wood production has to be entered in row FW01 – value 20.8 thousand tons

Final consumption – p. 43, Table 4.3

- Fuel wood is used in industry (it is not specified in which industry). Industrial consumption is therefore entered into FW1214, value 1.425 thousand tons
- Fuel wood is used in household sector. Household consumption is therefore entered into FW1231, value 16.726 thousand tons

Bagasse

Domestic primary fuel. Bagasse is a by-product of sugar production, but it is treated as a primary energy form.

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 0.16 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 0.16 toe = 160 * 0.041868 TJ = 6.699 TJ
- Therefore, the specific conversion factor is 6.699 TJ/thousand tons

Production

- p. 24, Table 2.1 (values are estimated) – Row BS01 – value 1540.2
- p. 39, Table 3.7 –IPP (sugar factory) – Row BS088 – value 1300.939 thousand tons

Final consumption

- p. 43, Table 4.3 – only in industry

Note, it is not clear for which purposes it is used in industry.

Charcoal (Secondary)

Charcoal is secondary (transformed) energy form and can be produced locally (from fuel wood) or it can be imported.

There are no data on import of charcoal (p. 26, Table 2.2).

Transformation of energy – there are no data on charcoal production (i.e., no data on transformation of fuel wood to charcoal).

Energy balance (p. 19, Table 1.1) shows transformation data – fuel wood in Other transformation – (822) toe and respective production of charcoal – 400 toe.

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 0.74 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 0.74 toe = 740 * 0.041868 TJ = 30.98 TJ
- Therefore, the specific conversion factor is 30.98 TJ/thousand tons

According to the energy balance table, it was assumed that production is equal to consumption (consumption data most probably estimated) and statistical difference is zero.

- Therefore, there is a need to assess consumption of fuel wood for charcoal production and charcoal production.
- For our demo case we assume the same: availability (in this case assumption is that charcoal is imported) equals consumption – Row CH01 – value 0.543 thousand tons.

Final consumption

- p. 43, Table 4.3 – commercial sector – Row CH1234 (other)– value 0.422 thousand tons;
- residential (household) sector – Row CH1231 – value 0.119 thousand tones

Motor Gasoline

The assumption is that gasoline is motor gasoline according to the UNSD questionnaire.

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 1.08 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 1.08 toe = 1080 * 0.041868 TJ = 45.22 TJ
- Therefore, specific conversion factor is 45.22 TJ/thousand tons

There is no data on stock changes.

No export. It is an imported fuel:

- p. 26, Table 2.2 – Row MO03 – value 108.5 thousand tons

Final consumption:

- p. 43, Table 4.3 (transport only, assume road) – Row MO1221 - value 101.406 thousand tons

Dual Purpose Kerosene (S) – Jet fuel

The assumption is that it is kerosene-type jet fuel (JF) and other kerosene (KR) according to the UNSD questionnaire. Jet fuel is used for aircrafts, kerosene mainly for households

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 1.04 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 1.04 toe = 1040 * 0.041868 TJ = 43.54 TJ
- Therefore, the specific conversion factor is 43.54 TJ/thousand tons

Imported fuel:

- p. 26, Table 2.2 – Row JF03 – value 262.2 thousand tons

No data on stock changes.

International bunkers:

- p. 29, Table 2.6 – re-export to international (aviation) bunkers – Row JF052 – value 125.5 thousand tons

Final consumption:

- p. 43, Table 4.3 (domestic aviation) – Row JF1223 – value 131.631 thousand tons

Dual Purpose Kerosene (S) – Kerosene

Imported fuel.

Specific conversion factor (the same as for Jet Fuel) – p. 12

Import

- p. 26, Table 2.2 – Row KR03 – value 5.9 thousand tons

No export.

No stock changes.

Transformation:

- For electricity generation (transformation in electricity) – p. 39, Table 3.7 – Row KR088 – value 2.059 thousand tons

Final consumption:

- In households – p. 43, Table 4.3 – Row KR1231 – value 1.772 thousand tons

Diesel

Gas diesel in UNSD Questionnaire. Imported fuel.

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 1.01 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 1.01 toe = 1010 * 0.041868 TJ = 42.29 TJ
- Therefore, the specific conversion factor is 42.29 TJ/thousand tons

Import:

- p. 26, Table 2.2 – Row DL03– value 328.5 thousand tons

International (marine) bunkers:

- p. 29, Table 2.6 – Row DL051 – value 117.3 thousand tons

Transformation:

- Electricity generation (transformation), p. 39, Table 37 (both islands) – Row DL088 – value 1.580 thousand tons

Final consumption (p. 43, Table 4.3)

- Industry – Row DL124 – value 46.301 thousand tons
- Transport (not indicated mode of transport – assume road, but can be also boats) – Row DL1221 – value 152.910 thousand tons
- Agriculture – p. 43, Table 4.3 – Row DL1232 – value 2.241 thousand tons

Fuel Oil (Secondary)

Residual fuel oil (RF) in UNSD Questionnaire. Imported fuel.

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 0.96 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 0.96 toe = 960 * 0.041868 TJ = 40.2 TJ
- Therefore, specific conversion factor is 40.2 TJ/thousand tons

Import:

- p. 26, Table 2.2 – Row RF03 – value 291.0 thousand tons

International (marine) bunkers:

- p. 29, Table 2.6 – Row RF051 – value 96.2 thousand tons

Transformation:

- Electricity generation – p. 39, Table 3.7 (for both islands) – Row RF088 – value 167.547 thousand tons

Final consumption:

- Industry, p. 43, Table 4.3 – Row RF1214– value 54.639 thousand tons

LPG (Secondary)

Imported fuel

The specific conversion factor is on p. 12 of the Mauritius Energy Statistics.

- 1 ton = 1.08 toe (tons of oil equivalent)
- For use in EBS (i.e. in UNSD questionnaire), it has to be recalculated into TJ
- 1 toe = 0.041868 TJ
- 1000 tons = 1000 * 1.08 toe = 1080 * 0.041868 TJ = 45.22 TJ
- Therefore, the specific conversion factor is 45.22 TJ/thousand tons

No stock changes

Import

- p. 26, Table 2.2 – Row LP03 – value 63.1 thousand tons

Final consumption (p. 43, Table 4.3)

- Industry (other) – Row LP1214 – value 4.92 thousand tons
- Transport (assuming road) – Row LP1221 – value 5.184 thousand tons

- Commercial – Row LP1235 – value 10.094 thousand tons
- Residential – Row LP1231 – value 42.394 thousand tons

Hydro and Wind (Primary)

In the UNSD Questionnaire there is a separate part for electricity. Here, generation must be given by primary type of production (public, auto-producers…). The unit in the questionnaire is million kWh (i.e. GWh).

Hydro and wind are used to produce electricity; therefore, they appear in commodity balances as domestic electricity production.

On p. 24, Table 2.1 – electricity production is given in GWh.

On p. 36, Table 3.3 – electricity production is given by primary source, location, and company (two islands, public, IPP…)

Hydro and wind are under CEB (the national electricity company) and the assumption is that those are public generation plants.

Hydro generation should be entered under electricity (EL), row EL015HY – value 108.0 GWh

Wind generation should be entered under electricity (EL), row EL015W – value 0.4 GWh

Electricity

Under the electricity form in the questionnaire only one thermal category exists. Therefore, all thermal power generation must be included as thermal power plants.

The national electricity company is CEB. IPPs produce electricity and sell it to CEB, and part of it is consumed for their own uses (i.e., in this case in sugar factories). Therefore, this generation is placed under auto-producers

- –Row ET015C – value 833.7 GWh
- –Row ET016C – value 1615.1 GWh

There are values for losses and energy sector own use/consumption in the energy balance (p. 19, Table 1.1, electricity losses are 18.545 ktoe), but not in the rest of the document. There are some data on other consumption and losses (p. 44, Table 4.4) but with no indication of the fuel type.

The electricity sector's own use is also visible only in the energy balance (p. 19, Table 1.1, own use is 3.263 ktoe) and in Table 4.8 there is one part of consumption assigned to CEB (the electricity company).

On p. 48, Table 4.7 there are data on sale to consumers. The same table shows data on electricity sale to industrial consumers which are "different" from the previously given final consumption (probably because of auto-producers)

Electricity consumption – p 48. Table 4.7 (On p. 50, Table 4.8 indicates further division of sales by consumer)

- Domestic – Row EL1231, value 652.2 GWh
- Commercial – Row EL1235, value 672.7 GWh
- Other – Row EL1234, value 40.0 GWh
- Industry
  - The assumption is that the difference between IPP generation and sale to CEB is consumed in the sugar factories (industrial consumption) – value 250 GWh (other industry).
  - Industry reported in Table 4.7 is added, so Row EL1214 is 250+688.7 GWh = 938.7 GWh

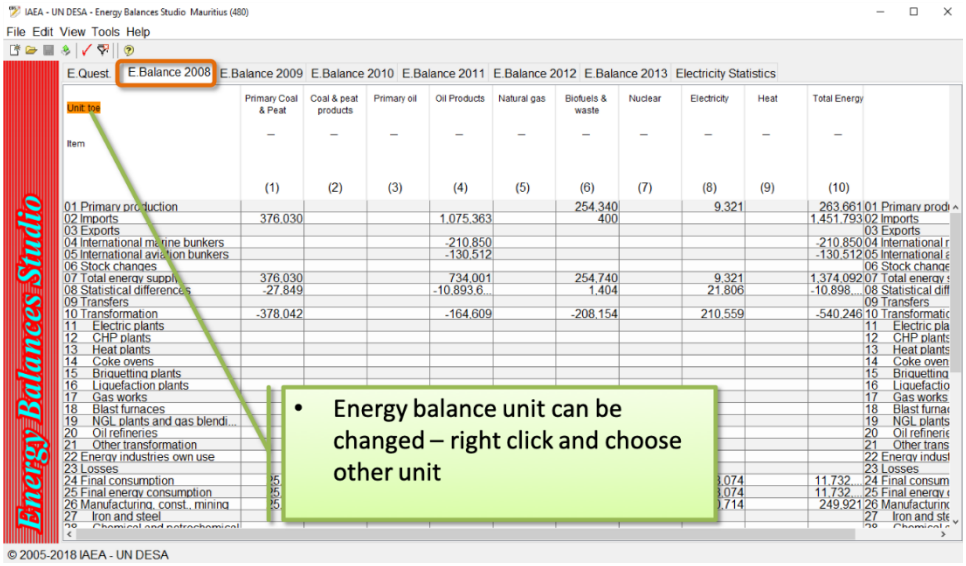
Note that plants' own consumption is not reported (therefore we cannot fill it in). As this row is calculated in EBS (row EL0927), we enter a value for the net production to have self-consumption of 0.

- Net Production – EL019, value 2557.2

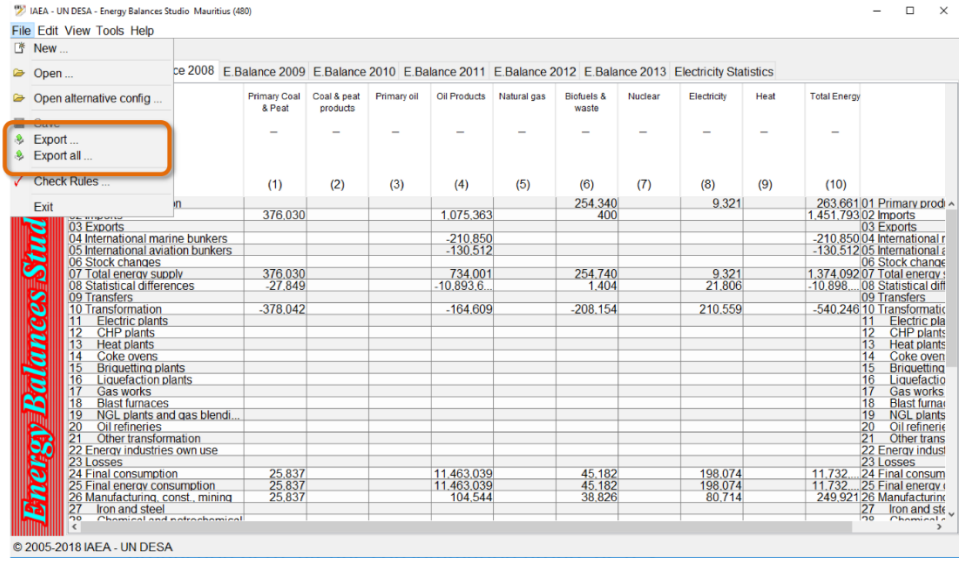
Checking the results

At this point the energy balance studio outputs can be compared to those of the Mauritius Energy Statistics.

It is possible to change the units if needed.



Once you have checked the results, you may wish to export them. Click File > Export or Export all.


IAEA - UN DESA - Energy Balances Studio Mauritius (480)
File Edit View Tools Help
New ...
Open ...
Open alternative config ...
Export ...
Export all ...
Check Rules ...
Exit
E.Balance 2009
E.Balance 2010
E.Balance 2011
E.Balance 2012
E.Balance 2013
Electricity Statistics
Primary Coal & Peat
Coal & peat products
Primary oil
Oil Products
Natural gas
Biofuels & waste
Nuclear
Electricity
Heat
Total Energy
(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)
Energy Balances Stud
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