Adaptations to BRAZIL of the ODYSSEE data template by EPE and Enerdata

Annex 2

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1. Introduction

This report presents and comments some changes, inclusions and exclusions done in the Odyssee data template to adapt it to the Brazilian reality. This document explains further the changes done in the Excel data template dated of August 30. The modifications were initially proposed by EPE's staff and reviewed and finalized by Enerdata.

The report is subdivided by sector, following the various sheets in the Excel data template. In introduction are indicated general changes and data adaptations common for all sectors.

Part of the changes aims at adapting the template to the BEN (Energy Balance for Brazil), in particular in terms of subdivision in sectors. In particular, new sector sheets have been added in the Excel document, such as the energy sector, the public sector and the commercial sector.

2. General ADAPTATIONS, INCLUSIONS AND EXCLUSIONS

In all sheets (i.e. sectors) three general additions have been made to include monitoring data and indicators for Distributed Generation (DG), Water and Sewage, as well as CO2 Emissions.

2.1.   Distributed generation

Distributed generation correspond to the production of electricity (and possibly heat with cogeneration) by industrial consumers in their premises, the production of heat in buildings and in industry from solar water heaters and the production of electricity from solar PV in buildings and also in industry. Distributed generation is important to be added as it is the objective of energy policy to promote it.

Industrial autoproduction of electricity and heat

Production of electricity by industrial consumers is already well established and usually well accounted for in energy statistics and energy balances. According to international definitions (e.g. IEA, Eurostat), DG for industrial autoproducers is accounted for as follows:
- fuels used for DG are excluded from the final consumption
- and the electricity produced from DG consumed in the premises of the consumer are added: therefore the consumption of electricity include both purchased + self generated electricity.

The main reason for such definitions is that changes in the indicators of intensities or specific consumption are independent on the way electricity is obtained, and especially of the share of DG.
To do so surveys on industrial autoproduction are necessary, which is the common practice in most countries. In Brazil, in the BEE, the definition of energy consumption is

matching international definitions. For other sectors the situation is less clear as DG is still marginal.

DG activity variables have been added to monitor the trends in the development of DG: such indicators are called "diffusion indicators" in ODYSSEE.

Solar water heaters and solar PV

For solar water heaters and solar PV, which is something new, statistics are less harmonized and less consolidated but as these technologies should developed rapidly in the future, it is important to measure their development. Thus for solar water heaters and solar PV, activity indicators have been added in each sector (e.g. m2 installed, kWc PV installed).

The second question is how the development of solar will impact the energy efficiency indicators, if it is large enough, the solar development may result or not in a decrease of the amount of energy consumed from the grid, depending on how solar is accounted for in the energy balance. If it results in a decrease of the grid consumption, this may be wrongly interpreted as energy efficiency increase.

Solar water heaters

The contribution of solar water heaters can be done in two ways in the energy balance:

- The production of solar heat can be evaluated in toe and the consumption added in each sector consumption, as electricity, gas or LPG; in that case substitution of solar to electricity for water heating will result in a decrease of the electricity consumption with an increase of the solar energy consumption. The total consumption of the sector may only slightly decrease marginally because of the difference in energy efficiency between solar heaters and electric heaters. This approach is recommended by IEA and Eurostat. The sola consumption is generally calculated from the installed area of solar water heaters multiplied by the average solar output per m2.

- The production of solar heat is accounted for zero as solar water heaters are considered as an energy saving device; this is the method recommended by the European Commission to calculate energy savings for the Energy Service Directive[1].

Solar PV

Distributed generation by solar PV is not well accounted for in the statistics although it is quite important in some EU countries, such as Germany. The impact of its diffusion on the energy consumption depends on how it is accounted for and how it is used:

- If all solar power production is sold to the grid, which seems to be the general case rule in EU countries, the diffusion of DG by sola impact has no impact on the electricity consumption of the sector (e.g. households) and thus on the assessment of energy efficiency.

- If part or all the solar power production is used by the consumers, then this will reduce its consumption from the grid; therefore in that case the energy statistics should add to the electricity purchased the amount that is produced from the solar PV to get the full

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[1] This directive set a target of 1% saving /year to each EU country between 2008 and 2016, which corresponds to a target of 9% savings in 2016.

electricity consumption of the sector (i.e. using the same approach as for industrial generation).

Diffusion indicators

Capacity and annual production of electricity from DG
M2 of solar water heaters
Share of electricity consumed coming from self generation.

2.2.   Water and sewage consumption

The objective would be to monitor water consumption and to link it with energy efficiency, furthermore to be so able to promote combined policies of energy and water efficient use.

Data added are:
- o *Annual water consumption*
- o *Annual reused water consumption*
- o *Annual captured rainwater consumption*
- o *Annual sewage production*

Indicators

Water Intensities – Annual consumption by VA

Specific water consumptions – Annual consumptions by physical production/unit/area or employee

2.3.   GHG and CO2 emissions

*E*missions have been included to get some indicators of emissions and to link them with energy efficiency indicators. Data added are:
- o *Annual GHG emission by branch*
- o *Annual CO2 emissions from energy combustion by branch*

Data should come from official GHG and CO2 inventories and will be considered for the sector as a whole. For emissions from energy combustion, more detailed emissions could be calculated from the energy consumption data available in the data sheets (an additional sheet should be added for such calculations)[2]

Indicators

Emissions Intensities – Annual emissions by VA

Specific Emissions – Annual emissions by physical production/unit/area or employee

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[2] In ODYSSEE there is a mix of the two approaches: we use official CO2 inventories and we calculate CO2 emissions that are not available in these inventories (e.g. by type of vehicles).

3. Macro Economy

The following changes have been made:

- Geothermal and solar energy has been renamed solar and should include solar power production
- "Other renewable primary sources" have been added
- LPG has been deleted from transport
- Consumption of air transport has been renamed aviation kerosene.
- Inclusion of Natural Gas in transport
- Separation of ethanol and biodiesel in transport
- Separation of consumption of firewood in the residential sector.

4. Industry Sector

The main changes in industry sheet were related to the segmentation of energy consumption by branches. It was made in order to get closer to our actual data base. The alterations are difficult to follow; a lot of information available in the original file has disappeared; the ISIC numbers have been removed; the logical order of branches has been changed.

Our idea was to show you the international classifications that are also used in economic statistics for sake of international comparisons and not to use directly your classification as used in EPE balance. The classification is fine to get specific consumption in physical units (in toe/ton) but will be more difficult to link to economic statistics (value added or production index).

⇨ Data by branch has been re organized to follow the classification EPE. The worksheet

Question : Non metallic minerals is included in mining? No non metallic mineral is the sum of cement, glass, ceramics in the case of Brazil.

Classification EPE

ktoe	2010
TOTAL SETOR INDUSTRIAL	**85 567**
SETOR INDUSTRIAL - CIMENTO	**4 157**
SETOR INDUSTRIAL - FERRO-GUSA E AÇO	**16 445**
SETOR INDUSTRIAL - FERRO-LIGAS	**1 695**
SETOR INDUSTRIAL - MINERAÇÃO/PELOTIZAÇÃO	**3 182**
SETOR INDUSTRIAL - QUÍMICA	**7 214**
SETOR INDUSTRIAL - NÃO-FERROSOS E OUTROS DA METALURGIA	**6 492**
SETOR INDUSTRIAL - TÊXTIL	**1 212**
SETOR INDUSTRIAL - ALIMENTOS E BEBIDAS	**23 244**
SETOR INDUSTRIAL - PAPEL E CELULOSE	**10 131**
SETOR INDUSTRIAL - CERÂMICA	**4 455**
SETOR INDUSTRIAL - OUTRAS INDÚSTRIAS	**7 338**

Addition branches as aggregate to match economic statistics	
non metallic minerals	cimento +ceramica
basic metals	FERRO-GUSA E AÇO+ FERRO-LIGAS+ MINERAÇÃO/PELOTIZAÇÃO
main issue is the separation of NÃO-FERROSOS E OUTROS DA METALURGIA into non ferrous and metallic products	

The inclusions in Industry sheet were made to adequate Brazilian reality of different energy carries and production structure.

Because of different aggregation on our data base and to keep comparison we've relocated some branches and rename others.

We relocated water treatment and supply to public sector as we treat it in Brazil =>OK

A new category called "other manufacturing" (***dvi) has been added. This category is adapted to the Brazilian situation and corresponds to the residual branches of the manufacturing industry. Actually this category includes "machinery and metals products" (nace 25-28+33) and transport equipment (nace 29-30)[3]. The category that we called "others" in ODYSSEE (***idv) has however been kept.

The main other branches are: food, textile, wood, paper, steel, non ferrous, ferroalloys, chemicals, cement, and ceramics.

Energy Carries

For each branches, the following energies have been added to be adapted to the Brazilian situation:

- *LPG consumption*
- *Bagasse consumption*
- *Petroleum coke consumption*
- *Coal coke consumption*
- *Coke Gas consumption*
- *Charcoal consumption*
- *Firewood Consumption*
- *Black Liquor consumption*
- *Solar Energy (heating) consumption*

Products

- *Production of pig iron*
- *Production of Ceramics*

New categories

3 new categories have been added for the main branches. It concerns "distributed generation activity", "water and sewage" and "Emissions"

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[3] In ODYSSEE these branches are given seperetly; the category "other" (nace 31-32+22) included rubber & plastics, manufacture of furniture and other manufacturing

5. Households

5.1. INCLUSIONS

- Line 27 – "Stock of electric showers" – In Brazil the electric shower is responsible for approximately 19% of residential electricity consumption, accounting for the largest share of residential consumption.
- Line 28 – "Stock of lamps (CFL and incandescent)" – In Brazil the use of incandescent lamps in the residential sector is still very high: a new law intends to decrease it until it is excluded from the market.
- Line 35 - "% of households with electric shower" -
- Line 42 – "Annual sales of electric showers" -
- Line 43 – "Annual sales of incandescent lamps" –
- Line 49 – "% of new TV in label class A" –
- Line 50 % of new electric shower in label class A
- Line 51 – "% of new lamps in label class A"
- Line 53 a 58 – "Lower limit of efficiency/specific consumption to obtain label A for" all equipments to monitor the evolution of the minimum levels of energy efficiency in the labeling program, to see if they are becoming more restrictive over time.
- Line 65 – "% of households that at least one incandescent lamp" –to see if the number of households with incandescent lamps will decrease over time, what is expected after they will be more and more restrictive on the market.
- Line 72 – "Specific consumption of electric showers (permanently occupied dwellings)"
- Line 73 – "Specific consumption of lamps (can be calculated by dividing line 106 by line 9)
- Lines 68-73: Specific consumption of households electrical appliances: the mention (permanently occupied) has been removed as it is not really useful and makes the title a bit long;
- Line 80– "Specific consumption of new electric showers" -
- Line 81 – "Specific consumption of new lamps"
- Line 97 – "wood consumption of cooking for households" – In Brazil, the wood consumption for cooking is very high, approximately 28% of the total residential energy matrix. It was included in line 97; so line 98 was renamed other biomass and wastes?
- Lines 109 -115: insertion of various indicators of diffusion of solar technologies for households8 –
  - Line 109 to 111 : data and indicators on indicators on solar PV: "Number of households with photovoltaic panel"(line 109); "Self production of PV" (line 110); "Total capacity of PV" (line 111)
  - Lines 112 to 115: indicators on solar water heaters: Sales of solar water heaters (line 112), cumulative total area of solar thermal collectors installed per household (line 113), number of households with solar heaters[4] (line 114), % of households with solar heaters (line 114).
- Line 117 – "Water consumption" -
- Lines 118 and 119– "Number and % of buildings labeled" to monitor the evolution of this program[5].

  Indicators

4 indicators have been added in the worksheet

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[4] Can be calculated by dividing this cumulative total area of solar thermal collectors installed by the average size of collectors per household (e.g. 4 m2) (case of Brasilia).
[5] % of buildings labeled (number of buildings with label over the total number of buildings

- Line 145 – "Amount of energy consumed by households with electricity" As not yet all the households have electricity, it is a more useful indicator to get the consumption per household with electricity, to have a more real idea of consumption per household.
- Line 146 – "Amount of energy consumed per capita" – Is a good indicator to international comparisons, once the houses has very different number of dwellers. OK ➔ should rather be added in the indicator part after line 142
- Line 148 "Amount of electricity consumed by households with electricity" – As not yet all the households have electricity, it is a more useful indicator to get the consumption per household with electricity, to have a more real idea of consumption per household..
- Line 149 "Amount of electricity consumed per capita" –good indicator to international comparisons, once the houses has very different number of dwellers. Water consumption per dwelling

5.2.   COMMENTS

- Lines 24, 32, 39, 47, 67 e 75 – "Stock of refrigerator", "% of households with refrigerator", "Annual sales of refrigerator", "% of new refrigerators in label class A", "Specific consumption of refrigerator" and "Specific consumption of new refrigerators" It exclude independent freezers but include refrigerators with a freezer department. It could be interesting to separate between simple refrigerators and refrigerators with a with a freezer department
- Lines 38-43 – "Sales of electrical appliances" – Annual sales of goods means sales for the residential sector?. For the other equipment it is available (due to different sizes).
- Line 62: For CFLs annual sales for the residential sector are not available from statistics; the separation in total sales of the sales to households is usually based on surveys from manufacturers.

6. Transport

6.1.   INCLUSIONS

- Line 37 – "Stock of CNG light vehicles" –
- Line 38 – "Stock of flex fuel light vehicles"
- Line 47 – "Annual sales of new CNG light vehicles"
- Lines 104-105 " Separation of ethanol and biodiesel" in the energy consumption of road,
- Lines 124-125 " Separation of ethanol and biodiesel" in the consumption of cars,
- Lines 135-136: "Separation ethanol and biodiesel in the consumption of light vehicles
- Line 156 – "FLEX private cars specific consumption" – The consumption of gasoline and ethanol in a flex car is different from the consumption of gasoline and ethanol in motor spirit cars or in ethanol cars.
- Line 157 – "gasoline" – the consumption of gasoline in a flex car is different from the consumption of gasoline in motor spirit cars.
- Line 158 – "ethanol" – The consumption of ethanol in a flex car is different from the consumption of ethanol in ethanol cars.
- Line 159 – "Electricity specific consumption of private hybrid cars" – the consumption of electricity in a hybrid car is different from the consumption of these electricity in a electric car.
- Line 160 – "Fuel specific consumption of private hybrid cars" – the consumption of gasoline or ethanol in a hybrid car is different from the consumption of these fuels in other types of cars.
- Line 161 – "Electricity specific consumption of private electric cars"

- Line 171 – "Average normalized specific consumption of FLEX new cars (test)"
- Line 172 – "gasoline" - the consumption of gasoline in a flex car is different from the consumption of gasoline in motor spirit cars.
- Line 173 – "ethanol" - the consumption of ethanol in a flex car is different from the consumption of ethanol in ethanol cars.
- Line 174 – "Average normalized specific Electricity consumption of new electric cars (test)"
- Line 175 – "Average normalized specific Electricity consumption of new hybrid cars (test)" – the consumption of electricity in a hybrid car is different from the consumption of these electricity in an electric car.
- Line 176 – "Average normalized specific fuel consumption of new hybrid cars (test)" – the consumption of gasoline or ethanol in a hybrid car is different from the consumption of these fuels in other types of cars. OK
- Line 178-179 – "Cars with label A" – and "% of cars with label A"
- Line 180 – "Lower limit of efficiency/specific consumption to obtain label A for cars" –
- Line 183 – "Total CO2 emission of the sector" –

6.2. COMMENTS

- LPG has been removed in transport
- "Stock of CNG cars" and "Annual sales of CNG cars" – CNG cars are not built, but converted vehicles, they originally are usually gasoline or flex cars, but we cannot shoot him in any of the two fleets, as we only have the total number of converted cars, not knowing their original fuel, and they continue to consume the original fuel, which guarantees autonomy, becoming a kind of bi-fuel or tri-fuel. The sale of CNG vehicle can be exchanged for vehicle conversion to CNG
- Line 53 – "Stock of trucks (include road tractors) and Sales" : tractors for agriculture are excluded; tractors correspond here to articulated trailers
- The category " trucks & light vehicles" has been removed ; the reason why it is included in ODYSSEE is that in several EU countries energy consumption by vehicle only separate between cars, buses and vehicles used to carry goods (trucks and light vehicles)
- Many light vehicles are used for light commercial cargo transporter, but many models are also used to transport passengers in small collectives or families as private transport. The allocation on the right category (goods or passenger) should be based on the way they are registered, which depends on their taxation.
- Line 67, 68, 82 and 83 –the breakdown by fuel for "km/year for motor spirit cars", "km/year for diesel oil cars" and "Traffic of motor spirit cars" and "Traffic of diesel oil cars" has been removed? The reason why the separation is done in ODYSSEE is that gasoline cars drive on average much less than diesel cars as the operating cost of diesel cars are lower (In France for instance a gasoline cars drives on average 9000 km/year and a diesel cars 16000 km/year)
- Line 108 – "Freight traffic of Trains in tons" is not asked for that transport as efficiency indicators for rail transport of goods relate the energy consumption to tkm which are always available for train; so the traffic in tons is not useful; for trucks the traffic in ton-km is not always available, this is why we asked for the traffic in tons which may be used to estimate the traffic in ton-km
- "Inland waterways" and "Inland waterways transport" have been renamed " water transport"; it corresponds to domestic transport by ships on sea or rivers; it excludes the fuel used for international see transport include in a specific category in the energy balance called "marine bunkers.
- Lines 154-160 "Average specific consumption of private cars", " is usually modeled of based on surveys

- Lines 167-174 – "Average normalized specific consumption of new private cars" – Private cars exclude light commercial vehicles? No light commercial vehicles are always excluded from cars (different type of use and of size)

7. Services

Services has been divided in two separate sub sectors included in two different sheets : "commercial" and "public". The sheet "service" has been linked to the two new sheets. The main reason is that energy efficiency in public buildings has a key role in policy statement (National Plan for Energy Efficiency in Brazil).

7.1.   Commercial

A new sheet has been added for the commercial sector. The following additions have been made compared to the initial sheet services :.

- Consideration of the following fuels for all segments of the commercial sector:
  - ° Natural Gas
  - ° Firewood
  - ° Diesel oil
  - ° Fuel oil
  - ° LPG
  - ° Electricity
  - ° Charcoal
  - ° Others

- Solar Water Heating to monitor the progress of the penetration of this technology.
- Lighting added
- Percentage of air conditioning and lighting efficiency label A. This information indicates that the penetration and what actions should be taken for this sector!
- Cogeneration and Solar Generation Photovoltaic by segment.
- CO_2 emissions by segment.
- Water consumption for all segments of the commercial sector to monitor the consumption and for policy.
- Production of sewage per segment. Important to monitor the consumption and for policy.

7.2.   Public

A new sheet called "public" has been added. The structure is the same as the sheet "commercial". All data control and indicators have been revised and adapt to this segmentation.

New indicators have been added to the new created files :

- ° kWh/end use (cooling, lighting)
- ° kWh/m² (building área)
- ° kWh/m² (Certified Buildings, label A)
- ° kWh / number of employees (by branch)
- ° kWh/ hospital bed or student or employee
- ° kWh / population served with public lighting
- ° kWh / m³ production of sewage
- ° kWh / population with treated water

8. Agriculture and Livestock (NEW sheet)

A new sheet has been added for agriculture and livestock. The data included follows the same structure than the industry sheet : value added, physical production and energy consumption.

Agriculture and livestock are very relevant for Brazilian economy (exportation and jobs) and society (wealth and development), even not being pretty relevant for Brazilian energy consumption. Other important factor is that sustainability in agriculture, it is an important issue each time more on international trade and energy is an essential issue on sustainability.

Indicators[6].

-Energy Intensities: Agriculture Energy Intensity, Livestock Energy Intensity and Agriculture and Livestock Energy Intensity.

-Specific Energy Consumptions: Sugarcane, soybeans, Cattle and Slaughter of cattle.

9. Energy Sector (NEW sheet)

A new sheet has been added for the energy sector, which is responsible for 10.5% of final energy consumption according to BEN.

We propose indicators of efficiency or rate of losses by type of transformations facilities (e.g. power generation, refineries, distilleries, coke plants): defined as output (O)/inputs (I); the higher this efficiency the lower the losses.

In the sheet the output of transformation should be added to enable the calculation of indicators, as indicated above.

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[6] ODEX for agriculture and livestock will be added in a second step after seeing the level of data available.