



Model for Analysis of Energy Demand (MAED)

Hands-on 3: Setting Up the Structure Part II

Learning outcomes

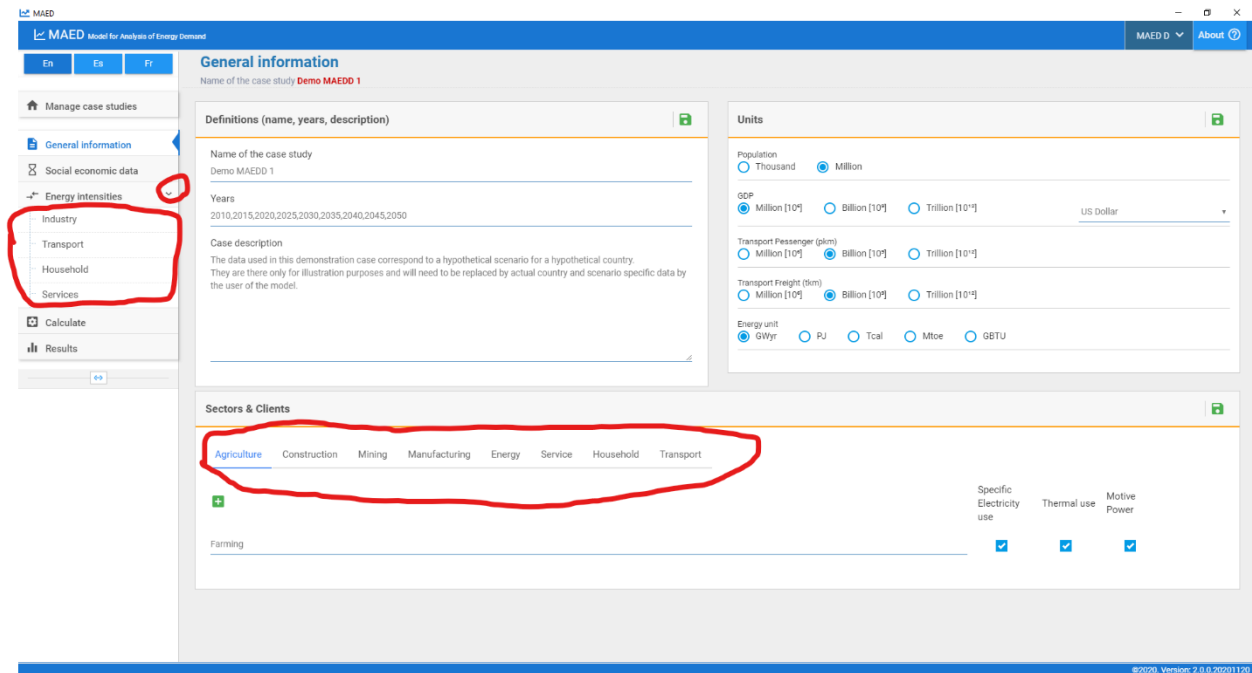
By the end of this exercise, you will be able to:

1. Navigate subsectors
2. Add and delete subsectors
3. Define the structure of the Industry sector
4. Define the structure of the Household sector

Activity 1: Navigating Subsectors

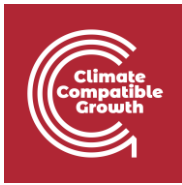
In the previous hands-on we learnt how to manage case studies and declare the case definitions. The next step in establishing the model structure is the defining of the subsectors of the economy.

Let us open the Demo MAEDD 1 case study that we created in Hands-on 2. The economic sectors are predefined and are shown in the main menu under Energy Intensities. You will have to click the drop-down menu to view them. In MAED-D, the **Industry sector** is further divided into the **Agriculture, Construction, Mining, and Manufacturing sectors**. From now on we shall refer to all of tabs in the Sectors & Clients block as sectors.



However, even though sectors are predefined and fixed in MAED-D, users can define the subsectors that they want to study. The number of subsectors to be defined by the user depends on the information available regarding both the economy and the energy consumption, which will be discussed in upcoming lectures.

For now, let us see how the model was structured for the Demo MAEDD 1 case study. This can be seen in the bottom half of the general information page in the Sectors & Clients block. The agriculture sector only has one subsector defined: Farming. Each sector needs to have at least one subsector, that is why the first subsector cannot be deleted.



MAED Model for Analysis of Energy Demand

General information

Name of the case study: Demo MAEDD 1

Definitions (name, years, description)

Name of the case study: Demo MAEDD 1

Years: 2010,2015,2020,2025,2030,2035,2040,2045,2050

Case description: The data used in this demonstration case correspond to a hypothetical scenario for a hypothetical country. They are there only for illustration purposes and will need to be replaced by actual country and scenario specific data by the user of the model.

Units

Population: Thousand Million

GDP: Million [10⁹] Billion [10⁹] Trillion [10¹²] US Dollar

Transport Passenger (pkm): Million [10⁶] Billion [10⁹] Trillion [10¹²]

Transport Freight (tkm): Million [10⁶] Billion [10⁹] Trillion [10¹²]

Energy unit: GWyr PJ Tcal Mtoe GBTU

Sectors & Clients

Agriculture Construction Mining Manufacturing Energy Service Household Transport

Farming Specific Electricity use Thermal use Motive Power

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The subsectors for other sectors can be accessed by clicking on their names. Please pause and explore the subsectors defined in other sectors of Demo MAEDD 1 case study.

MAED Model for Analysis of Energy Demand

General information

Name of the case study: Demo MAEDD 1

Definitions (name, years, description)

Name of the case study: Demo MAEDD 1

Years: 2010,2015,2020,2025,2030,2035,2040,2045,2050

Case description: The data used in this demonstration case correspond to a hypothetical scenario for a hypothetical country. They are there only for illustration purposes and will need to be replaced by actual country and scenario specific data by the user of the model.

Units

Population: Thousand Million

GDP: Million [10⁹] Billion [10⁹] Trillion [10¹²] US Dollar

Transport Passenger (pkm): Million [10⁶] Billion [10⁹] Trillion [10¹²]

Transport Freight (tkm): Million [10⁶] Billion [10⁹] Trillion [10¹²]

Energy unit: GWyr PJ Tcal Mtoe GBTU

Sectors & Clients

Agriculture Construction Mining Manufacturing Energy Service Household Transport

Agriculture Specific Electricity use Thermal use Motive Power

Farming

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Click on the Agriculture sector to look at the subsectors that are defined inside. We currently only have one subsector defined: Farming. All tables in MAED-D should have this subsector. Let us check, for example, the table of the GDP structure

The screenshot shows the MAED interface with the 'Social economic data' section selected. The 'GDP' table is displayed, showing data from 2010 to 2050. The 'Agriculture' sector is highlighted with a red box, and its subsector 'Farming' is also highlighted. The table shows that Farming accounts for 100% of the GDP in the Agriculture sector across all years.

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
GDP	US\$ Million	54.13092	67.78036	84.06328	103.26305						
GDP Growth rate	% p.a.		4.60000	4.40000	4.20000						
GDP per capita	US\$/Cap	2229.86802	2516.56917	2840.79860	3207.55620						
Sectorial shares of GDP											
Agriculture	%	21.50000	19.40000	17.40000	15.50000						
Construction	%	2.30000	2.30000	2.30000	2.20000						
Mining	%	5.10000	4.80000	4.30000	3.80000						
Manufacturing	%	15.20000	16.10000	16.80000	16.90000						
Energy	%	5.90000	5.60000	5.00000	4.30000						
Service	%	50.00000	51.80000	54.20000	57.30000						
Total	%	100.00000	100.00000	100.00000	100.00000						

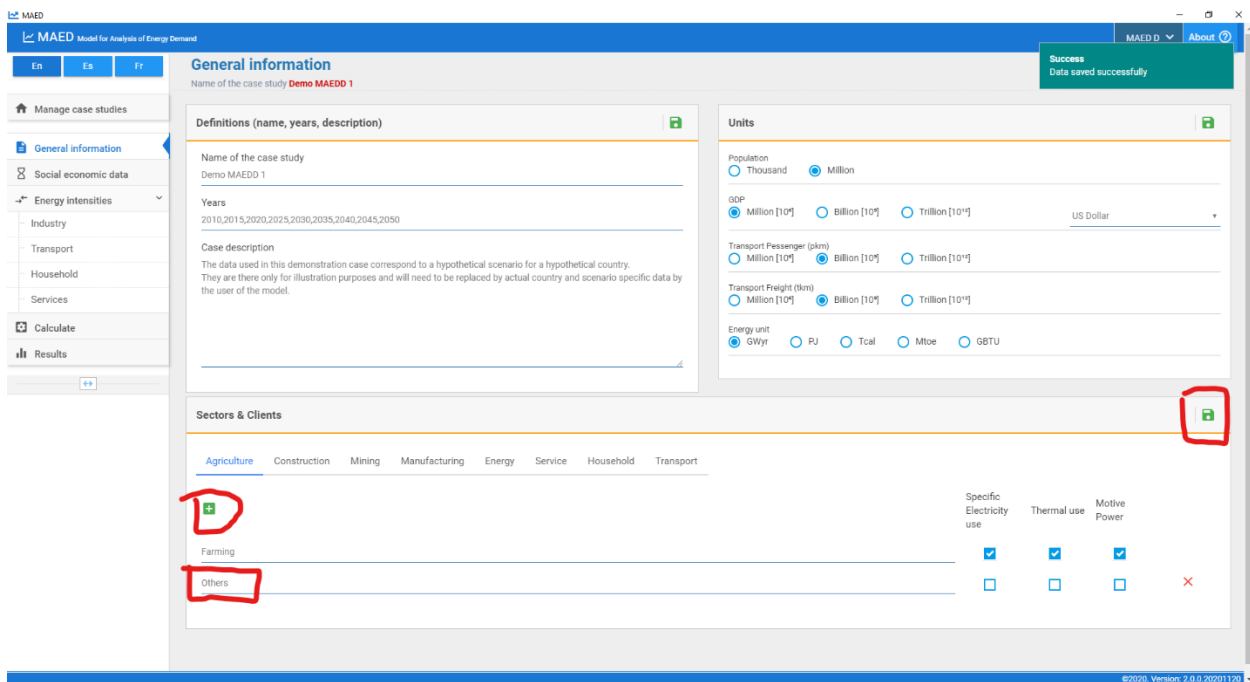
Let us also check the energy intensity of motive power.

The screenshot shows the MAED interface with the 'Energy intensities' section selected. The 'Industry' subsector is highlighted, and the 'Energy intensities of Motive Power (final energy per unit of value added)' table is displayed. The table shows data from 2010 to 2050 for various subsectors, with 'Farming' highlighted in red. The table shows that Farming has an energy intensity of 1.40000 kWh/US\$ in 2010, which decreases to 1.20000 kWh/US\$ by 2025.

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	kWh/US\$	1.40000	1.30000	1.25000	1.20000						
Construction											
Buildings	kWh/US\$	0.10000	0.10000	0.10000	0.10000						
Mining											
Metal ores	kWh/US\$	0.30000	0.30000	0.30000	0.30000						
Non-metal ores	kWh/US\$	0.20000	0.20000	0.20000	0.20000						
Manufacturing											
Basic materials	kWh/US\$	0.15000	0.15000	0.15000	0.15000						

Activity 2: Adding and Deleting Subsectors

Let us now see how to add and delete subsectors in a sector. Return to the general information page and select the agriculture tab in the Sectors & Clients block. We can add a subsector to the agriculture sector by clicking the plus button. This should create a new subsector called Agr_2. To change the name simply type it in the field. Change the name of the new subsector to Others. Remember to click save to save the changes.



The screenshot shows the MAED software interface. The 'General information' page is displayed, with the 'Sectors & Clients' section active. The 'Agriculture' tab is selected, and a table lists subsectors: 'Farming' and 'Others'. A red box highlights the 'Others' subsector name. Another red box highlights a plus icon in the top right corner of the 'Sectors & Clients' section, indicating the 'Add' button. A success message 'Data saved successfully' is visible in the top right.

Let us examine the same tables that we saw a moment ago. Go to the GDP page. We can now see the Others subsector under the Agriculture Sector.



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Name of the case study: Demo MAEDD 1

Demography GDP

GDP

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
GDP	US\$ Million	54.13092	67.78036	84.06328	103.26305						<input type="checkbox"/>
GDP Growth rate	% p.a.	-	4.60000	4.40000	4.20000						<input type="checkbox"/>
GDP per capita	US\$/Cap	2229.86802	2516.56917	2840.79860	3207.55620						<input type="checkbox"/>
Sectorial shares of GDP											
Agriculture	%	21.50000	19.40000	17.40000	15.50000						<input type="checkbox"/>
Construction	%	2.30000	2.30000	2.30000	2.20000						<input type="checkbox"/>
Mining	%	5.10000	4.80000	4.30000	3.80000						<input type="checkbox"/>
Manufacturing	%	15.20000	16.10000	16.80000	16.90000						<input type="checkbox"/>
Energy	%	5.90000	5.60000	5.00000	4.30000						<input type="checkbox"/>
Service	%	50.00000	51.80000	54.20000	57.30000						<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000						<input type="checkbox"/>

* Enter GDP data for first Year & Average annual growth rate for each period/timestep

Data notes

Distribution of GDP by subsectors

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											<input type="checkbox"/>
Farming	%	10.00000	100.00000	100.00000	100.00000						<input type="checkbox"/>
Others	%										<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000						<input type="checkbox"/>
Construction											
Buildings	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>

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Let us now go to the Energy Intensities of Motive Power. We note that the Others subsector does not appear under the Agriculture Sector.

MAED Model for Analysis of Energy Demand

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Energy intensities

Name of the case study: Demo MAEDD 1

EI-Motive Power EI-Specific Electricity use EI-Thermal use Penetration of Energy Forms in ACM Efficiencies in ACM Temperature level in Manufacturing Penetration of Energy Forms in Manufacturing Efficiencies in Manufacturing

Energy intensities of Motive Power (final energy per unit of value added)

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											<input type="checkbox"/>
Farming	kWh/US\$	1.40000	1.30000	1.25000	1.20000						<input type="checkbox"/>
Construction											
Buildings	kWh/US\$	0.10000	0.10000	0.10000	0.10000						<input type="checkbox"/>
Mining											
Metal ores	kWh/US\$	0.30000	0.30000	0.30000	0.30000						<input type="checkbox"/>
Non-metal ores	kWh/US\$	0.20000	0.20000	0.20000	0.20000						<input type="checkbox"/>
Manufacturing											
Basic materials	kWh/US\$	0.15000	0.15000	0.15000	0.15000						<input type="checkbox"/>

Data notes

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This is because the programme has not been informed about the end-use categories to be studied in the Others subsector. We must go to the general information page and select the

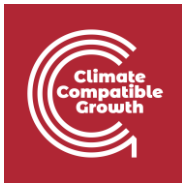


End-Use categories for the Others subsector. Check all three end-use categories for the Others Subsector to include them as end-uses. Remember to save the changes.

The screenshot shows the MAED (Model for Analysis of Energy Demand) software interface. The 'General information' section is active, displaying details for a case study named 'Demo MAEDD 1'. The 'Sectors & Clients' section is also visible, showing a table of sectors and their associated end-use categories. The 'Others' sector is highlighted, and its end-use categories are checked:

Sector	Specific Electricity use	Thermal use	Motive Power
Farming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

The programme will now build tables for input data in the energy intensities of Specific Electricity use, Thermal use, and Motive Power. Let us look at the energy intensities of motive power to confirm this.



MAED Model for Analysis of Energy Demand

Energy intensities

Name of the case study: Demo MAEDD 1

Energy intensities of Motive Power (final energy per unit of value added)

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	kWh/US\$	1.40000	1.30000	1.25000	1.20000						
Others	kWh/US\$										
Construction											
Buildings	kWh/US\$	0.10000	0.10000	0.10000	0.10000						
Mining											
Metal ores	kWh/US\$	0.30000	0.30000	0.30000	0.30000						
Non-metal ores	kWh/US\$	0.20000	0.20000	0.20000	0.20000						
Manufacturing											
Basic materials	kWh/US\$	0.15000	0.15000	0.15000	0.15000						

Data notes

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Let us now look at the mining sector. There are 2 subsectors defined.

MAED Model for Analysis of Energy Demand

General information

Name of the case study: Demo MAEDD 1

Definitions (name, years, description)

Name of the case study: Demo MAEDD 1

Years: 2010,2015,2020,2025,2030,2035,2040,2045,2050

Case description: The data used in this demonstration case correspond to a hypothetical scenario for a hypothetical country. They are there only for illustration purposes and will need to be replaced by actual country and scenario specific data by the user of the model.

Units

Population: Thousand Million

ODP: Million [10⁹] Billion [10⁹] Trillion [10¹²] US Dollar

Transport Passenger (pkm): Million [10⁶] Billion [10⁶] Trillion [10¹²]

Transport Freight (ton): Million [10⁶] Billion [10⁶] Trillion [10¹²]

Energy unit: GWyr PJ Tcal Mtoe G8TU

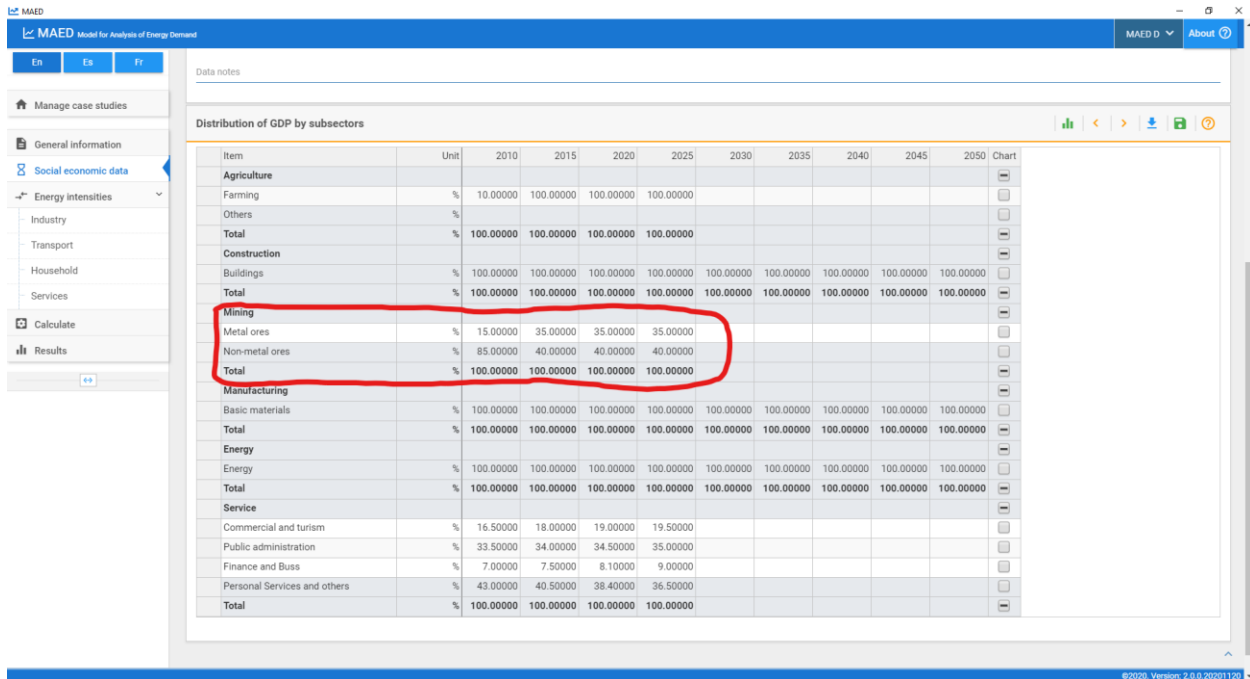
Sectors & Clients

Agriculture Construction **Mining** Manufacturing Energy Service Household Transport

	Specific Electricity use	Thermal use	Motive Power
Metal ores	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Non-metal ores	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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And we confirm this by looking at its corresponding GDP table.



The screenshot displays the MAED software interface with the 'Distribution of GDP by subsectors' table. The table shows the percentage contribution of various subsectors to the total GDP for the years 2010, 2015, 2020, and 2025. The 'Mining' section is highlighted with a red box, showing 'Metal ores' and 'Non-metal ores' subsectors. The 'Total' row for each sector is shaded, indicating that these values are calculated by the program.

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	%	10.00000	100.00000	100.00000	100.00000						
Others	%										
Total	%	100.00000	100.00000	100.00000	100.00000						
Construction											
Buildings	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Mining											
Metal ores	%	15.00000	35.00000	35.00000	35.00000						
Non-metal ores	%	85.00000	40.00000	40.00000	40.00000						
Total	%	100.00000	100.00000	100.00000	100.00000						
Manufacturing											
Basic materials	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Energy											
Energy	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Service											
Commercial and tourism	%	16.50000	18.00000	19.00000	19.50000						
Public administration	%	33.50000	34.00000	34.50000	35.00000						
Finance and Buss	%	7.00000	7.50000	8.10000	9.00000						
Personal Services and others	%	43.00000	40.50000	38.40000	36.50000						
Total	%	100.00000	100.00000	100.00000	100.00000						

Note that, in each sector the rows of the last subsectors are shaded. This means that those rows are results of calculations performed by the programme, and the cells are locked from user editing. MAED-D is calculating the last subsector so that the sum of the participation of all subsectors is 100.

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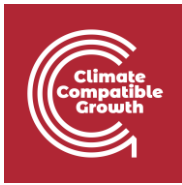
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Distribution of GDP by subsectors

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	%	10.00000	100.00000	100.00000	100.00000						
Others	%										
Total	%	100.00000	100.00000	100.00000	100.00000						
Construction											
Buildings	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Mining											
Metal ores	%	15.00000	35.00000	35.00000	35.00000						
Non-metal ores	%	85.00000	40.00000	40.00000	40.00000						
Total	%	100.00000	100.00000	100.00000	100.00000						
Manufacturing											
Basic materials	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Energy											
Energy	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	
Service											
Commercial and tourism	%	16.50000	18.00000	19.00000	19.50000						
Public administration	%	33.50000	34.00000	34.50000	35.00000						
Finance and Buss	%	7.00000	7.50000	8.10000	9.00000						
Personal Services and others	%	43.00000	40.50000	38.40000	36.50000						
Total	%	100.00000	100.00000	100.00000	100.00000						

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Let us try deleting a subsector. We can delete the same one that we added earlier. We must go to the structure of the agriculture sector in the general information page. Click the delete button (red cross next to the subsector name) on the subsector, Others. The subsector disappears from this menu. And, after clicking the Save; proceed, button, this subsector disappears from all tables in MAED.



MAED Model for Analysis of Energy Demand

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General information

Name of the case study **Demo MAEDD 1**

Definitions (name, years, description)

Name of the case study
Demo MAEDD 1

Years
2010,2015,2020,2025,2030,2035,2040,2045,2050

Case description
The data used in this demonstration case correspond to a hypothetical scenario for a hypothetical country. They are there only for illustration purposes and will need to be replaced by actual country and scenario specific data by the user of the model.

Units

Population
 Thousand Million

GDP
 Million [10⁹] Billion [10¹²] Trillion [10¹⁵] US Dollar

Transport Passenger (pkm)
 Million [10⁹] Billion [10¹²] Trillion [10¹⁵]

Transport Freight (tkm)
 Million [10⁹] Billion [10¹²] Trillion [10¹⁵]

Energy unit
 GWyr PJ Tcal Mtoe GBTU

Sectors & Clients

Agriculture Construction Mining Manufacturing Energy Service Household Transport

	Specific Electricity use	Thermal use	Motive Power
Farming	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Others	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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Let us return to the GDP table. Note that the Energy Sector appears shaded in the GDP table. This is because MAED calculates the share of this sector of the economy so that the sum of all sectors is set to 100.

MAED Model for Analysis of Energy Demand

Name of the case study: **Demo MAED 1**

Demography: **GDP**

GDP

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
GDP	US\$ Million	54.13092	67.78036	84.06328	103.26305						<input type="checkbox"/>
GDP Growth rate	% p.a.	-	4.60000	4.40000	4.20000						<input type="checkbox"/>
GDP per capita	US\$/Cap	2229.86802	2516.56917	2840.79860	3207.55620						<input type="checkbox"/>
Sectorial shares of GDP											
Agriculture	%	21.50000	19.40000	17.40000	15.50000						<input type="checkbox"/>
Construction	%	2.30000	2.30000	2.30000	2.20000						<input type="checkbox"/>
Mining	%	5.10000	4.80000	4.30000	3.80000						<input type="checkbox"/>
Manufacturing	%	16.20000	16.10000	16.80000	16.90000						<input type="checkbox"/>
Energy	%	5.90000	5.60000	5.00000	4.30000						<input type="checkbox"/>
Services	%	52.20000	52.20000	52.80000	53.20000						<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000						<input type="checkbox"/>

* Enter GDP data for first Year & Average annual growth rate for each period/timestep

Data notes

Distribution of GDP by subsectors

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>
Construction											
Buildings	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>

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Also note that the transport sector does not appear in the sectoral share of GDP in this table. The GDP component of the transport sector must be added to the service sector. And the same must be done with the energy consumed in the facilities associated with transportation. For example, electricity consumed at airports.

MAED Model for Analysis of Energy Demand

Name of the case study: **Demo MAED 1**

Demography: **GDP**

GDP

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
GDP	US\$ Million	54.13092	67.78036	84.06328	103.26305						<input type="checkbox"/>
GDP Growth rate	% p.a.	-	4.60000	4.40000	4.20000						<input type="checkbox"/>
GDP per capita	US\$/Cap	2229.86802	2516.56917	2840.79860	3207.55620						<input type="checkbox"/>
Sectorial shares of GDP											
Agriculture	%	21.50000	19.40000	17.40000	15.50000						<input type="checkbox"/>
Construction	%	2.30000	2.30000	2.30000	2.20000						<input type="checkbox"/>
Mining	%	5.10000	4.80000	4.30000	3.80000						<input type="checkbox"/>
Manufacturing	%	15.20000	16.10000	16.80000	16.90000						<input type="checkbox"/>
Energy	%	5.90000	5.60000	5.00000	4.30000						<input type="checkbox"/>
Service	%	50.00000	51.80000	54.20000	57.30000						<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000						<input type="checkbox"/>

* Enter GDP data for first Year & Average annual growth rate for each period/timestep

Data notes

Distribution of GDP by subsectors

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>
Construction											
Buildings	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>
Total	%	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	100.00000	<input type="checkbox"/>

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Activity 3: Household Sector

We are now going to work with the structure of the residential sector; this is referred to as the **Household sector** in MAED. Let us go to the Household tab in the Sectors & Clients block on the General Information page. In this case study, a few types of households have been established for urban and rural areas. In each area, you can add or delete household types. Again, the number of different types of households to be included depends on the availability of information or the type of study to be done. For example, in this case, we wish to study the different types of urban and rural households. There are three urban and three rural types of houses, please make sure that your case looks the same as the picture below. If it doesn't, add new subsectors and/or rename them. Then click **Save**.

Sectors & Clients			Add new	Specific Electricity use	Lighting	Air Conditioning	Cooking	Space Heating	Water Heating
Urban			+	✓	✓	✓	✓	✓	✓
urban_house_type1		✗							
urban_house_type1		✗							
urban_house_type1		✗							
Rural			+	✓	✓	✓	✓	✓	✓
rural_house_type1		✗							
rural_house_type1		✗							
rural_house_type1		✗							

The household sector contains the following additional end-use sub-types: **Lighting, Air Conditioning, Cooking, Space Heating, and Water Heating.**

Sectors & Clients			Add new	Specific Electricity use	Lighting	Air Conditioning	Cooking	Space Heating	Water Heating
Urban			+	✓	✓	✓	✓	✓	✓
Apartment		✗							
Familu house		✗							
DW with SH		✗							
Rural			+	✓	✓	✓	✓	✓	✓
Ruari1		✗							
Rural 2		✗							
rural 3		✗							



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