

Model for Analysis of Energy Demand (MAED)

Hands-on 4: Setting Up the Structure Part III

Learning outcomes

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

1. Define the structure of the transport sector
2. Configure the end-use categories

Activity 1: Transport Sector - Fuel Types Definition

Now, let us move on to define the structure of the **transportation sector**. We must first specify the fuels we want to model. To access the fuel types, click the [Fuel Types Definition](#) button in the Transport tab.

MAED Model for Analysis of Energy Demand

2010, 2017, 2020, 2025, 2030, 2035, 2040, 2045, 2050

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- Industry
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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.

Transport Passenger (plm)

☐ Million [10⁶]
 ☒ Billion [10⁹]
 ☐ Trillion [10¹²]

Transport Freight (tkm)

☐ Million [10⁶]
 ☒ Billion [10⁹]
 ☐ Trillion [10¹²]

Energy unit

☒ GWyr
 ☐ PJ
 ☐ Tcal
 ☐ Mtoe
 ☐ GBTU

Sectors & Clients

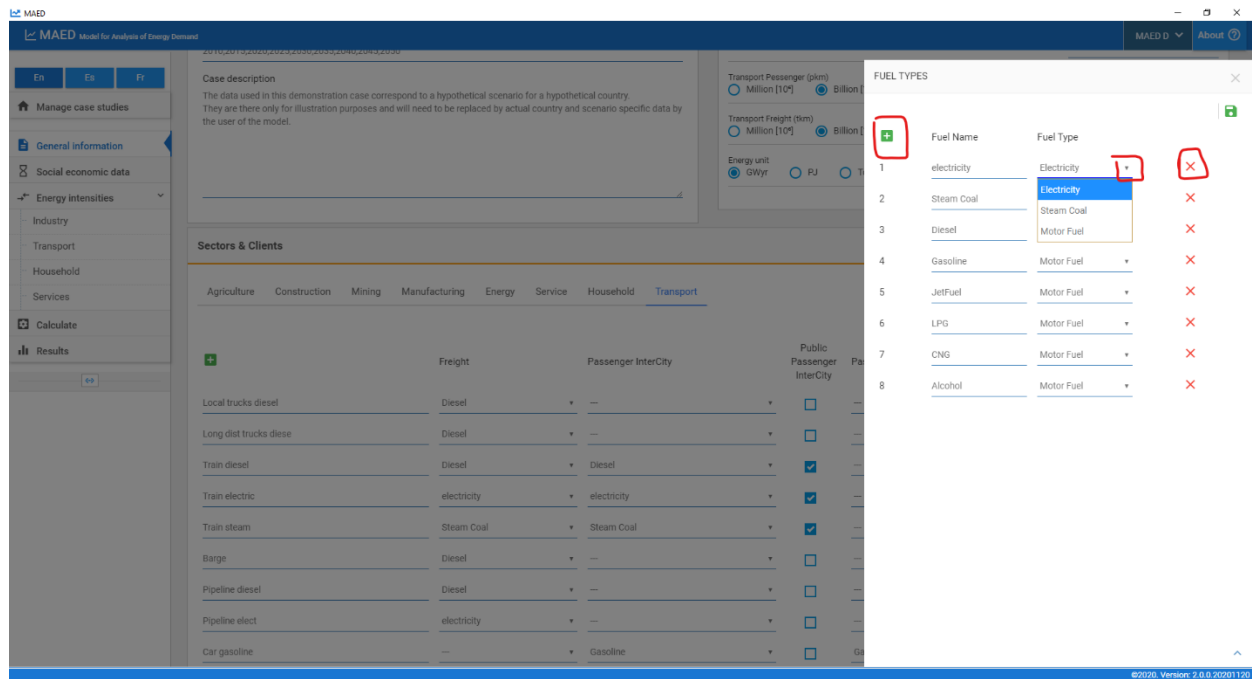
Agriculture Construction Mining Manufacturing Energy Service Household **Transport**

FUEL TYPES DEFINITION

	Freight	Passenger InterCity	Public Passenger InterCity	Passenger Urban	Car	Air plane
Local trucks diesel	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Long dist trucks diese	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Train diesel	Diesel	Diesel	<input checked="" type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Train electric	electricity	electricity	<input checked="" type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Train steam	Steam Coal	Steam Coal	<input checked="" type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Barge	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pipeline diesel	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pipeline elect	electricity	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Car gasoline	—	Gasoline	<input type="checkbox"/>	Gasoline	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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You can add or delete fuels using the respective buttons from this menu. Each fuel specified needs to be associated with a fuel type using the drop-down menu. The MAED methodology groups fuel into three fuel types: **electricity, steam coal, and motor fuel**.



MAED Model for Analysis of Energy Demand

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Sectors & Clients
Agriculture Construction Mining Manufacturing Energy Service Household **Transport**

FUEL TYPES

	Fuel Name	Fuel Type	
1	electricity	Electricity	+
2	Steam Coal	Electricity	×
3	Diesel	Steam Coal	×
4	Gasoline	Motor Fuel	×
5	JetFuel	Motor Fuel	×
6	LPG	Motor Fuel	×
7	CNG	Motor Fuel	×
8	Alcohol	Motor Fuel	×

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Now change your list of Fuels to be the same as the one showed in the picture below. Then click **Save**.

FUEL TYPES			
	Fuel Name	Fuel Type	
1	electricity	Electricity	×
2	Steam Coal	Steam Coal	×
3	Diesel	Motor Fuel	×
4	Gasoline	Motor Fuel	×
5	JetFuel	Motor Fuel	×
8	Alcohol	Motor Fuel	×

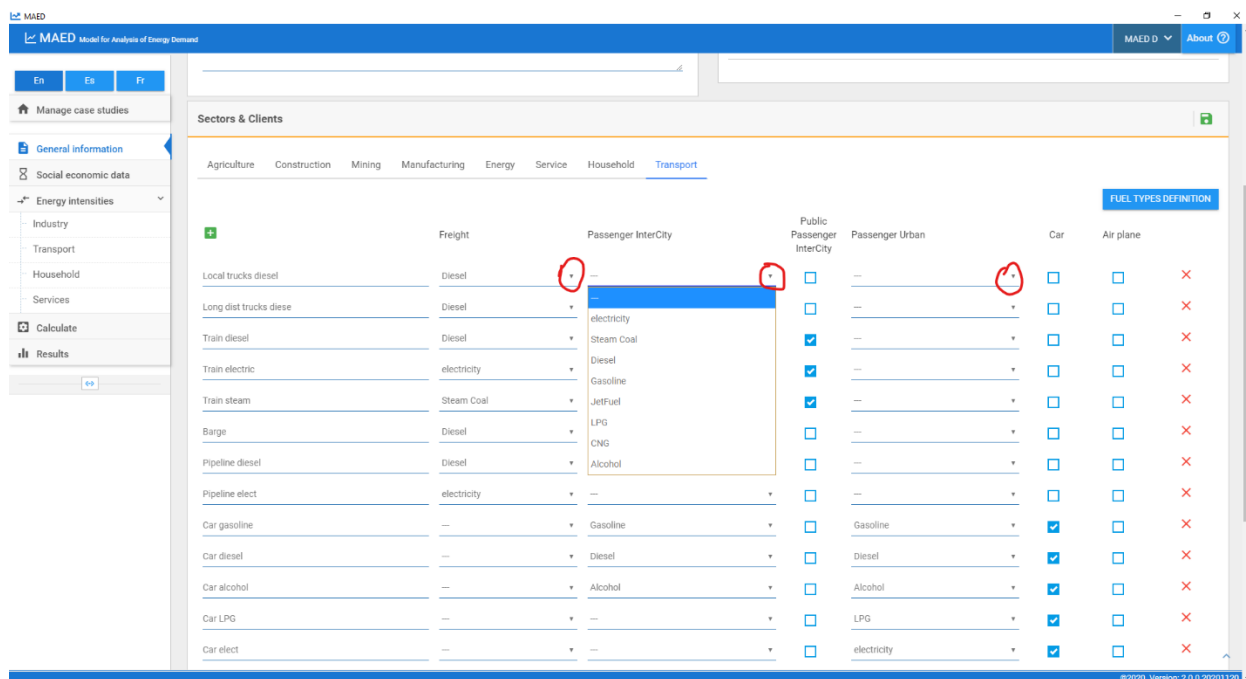
Activity 2: Transport Modes

The next step is to define the transport modes. The transport modes can be accessed using the Transport tab in the Sectors & Clients block in the General Information page. Each transport mode can be associated with the three transport subsectors: **Freight, Passenger InterCity, and Passenger Urban**.

With the buttons, add, or delete, the user creates or deletes transport modes. And with the check boxes the user decides in which subsector the transport mode defined belongs to.

For example, long-distance trucks belong to freight transport. Each transport mode can be associated with any of the subsectors but must be associated with at least one subsector. We can associate a transport mode with a subsector by selecting the fuel type used for that subsector for that transport mode; this is done using the drop-down menu.

If no fuel type is selected for a transport subsector, then that transport mode will not be modelled for that transport subsector.

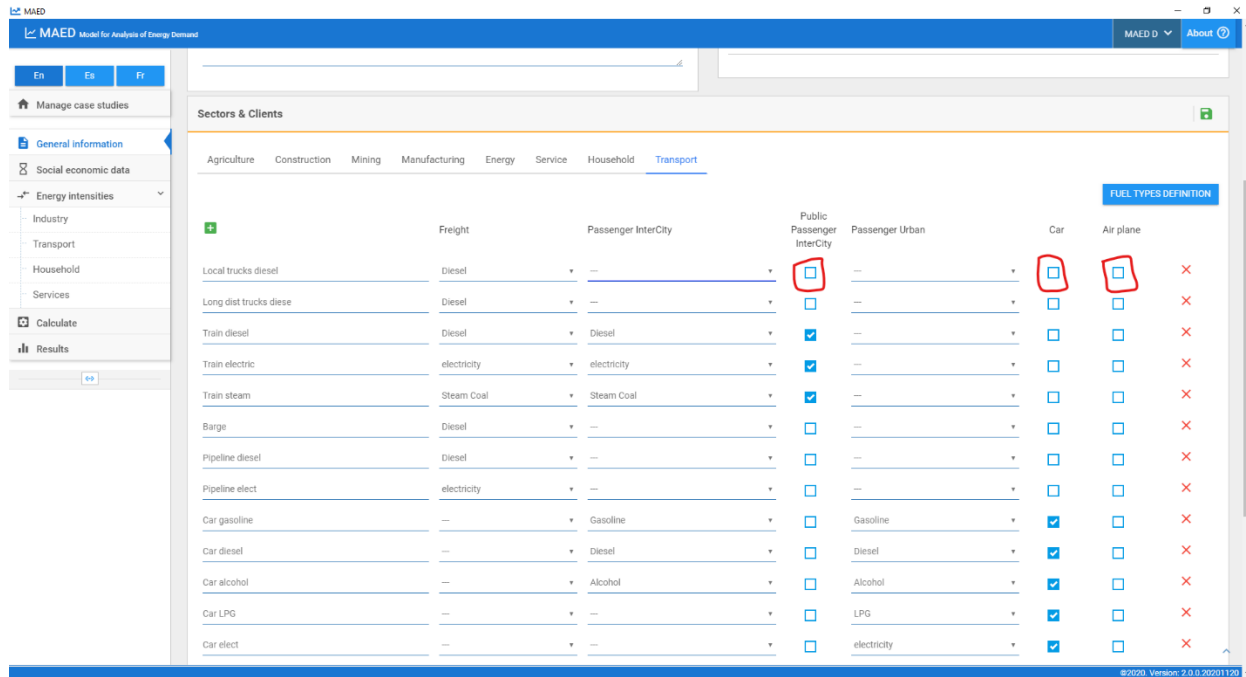


The screenshot shows the MAED (Model for Analysis of Energy Demand) interface. The 'Transport' tab is selected under 'Sectors & Clients'. The table lists various transport modes and their associated fuel types and subsectors.

Transport Mode	Fuel Type	Freight	Passenger InterCity	Public Passenger InterCity	Passenger Urban	Car	Air plane
Local trucks diesel	Diesel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Long dist trucks diesel	Diesel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Train diesel	Diesel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Train electric	electricity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Train steam	Steam Coal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barge	Diesel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pipeline diesel	Diesel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pipeline elect	electricity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Car gasoline	Gasoline	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Car diesel	Diesel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Car alcohol	Alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Car LPG	LPG	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Car elect	electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Finally, we must tell the programme which transport modes are cars or airplanes. We must also tell the programme if the transport mode for intercity passengers is considered public.

These can be done by using the checkboxes. There is no limit to the number of modes you want to use.



Sectors & Clients		FUEL TYPES DEFINITION					
	Freight	Passenger InterCity	Public Passenger InterCity	Passenger Urban	Car	Air plane	
Local trucks diesel	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Long dist trucks diese	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Train diesel	Diesel	Diesel	<input checked="" type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Train electric	electricity	electricity	<input checked="" type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Train steam	Steam Coal	Steam Coal	<input checked="" type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Barge	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Pipeline diesel	Diesel	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Pipeline elect	electricity	—	<input type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	×
Car gasoline	—	Gasoline	<input type="checkbox"/>	Gasoline	<input checked="" type="checkbox"/>	<input type="checkbox"/>	×
Car diesel	—	Diesel	<input type="checkbox"/>	Diesel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	×
Car alcohol	—	Alcohol	<input type="checkbox"/>	Alcohol	<input checked="" type="checkbox"/>	<input type="checkbox"/>	×
Car LPG	—	—	<input type="checkbox"/>	LPG	<input checked="" type="checkbox"/>	<input type="checkbox"/>	×
Car elect	—	—	<input type="checkbox"/>	electricity	<input checked="" type="checkbox"/>	<input type="checkbox"/>	×

Now edit this list based on the picture below and make sure are the same. Then click **Save**.

Agriculture Construction Mining Manufacturing Energy Service Household <u>Transport</u>								
FUEL TYPES DEFINITION								
	Freight	Passenger InterCity	Public Passenger InterCity	Passenger Urban	Car	Air plane		
Local trucks diesel	Diesel	---	<input type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Long dist trucks diese	Diesel	---	<input type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Train diesel	Diesel	Diesel	<input checked="" type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Train electric	electricity	electricity	<input checked="" type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Barge	Diesel	---	<input type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Pipeline diesel	Diesel	---	<input type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Pipeline elect	electricity	---	<input type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Car gasoline	---	Gasoline	<input type="checkbox"/>	Gasoline	<input checked="" type="checkbox"/>	<input type="checkbox"/>		×
Car diesel	---	Diesel	<input type="checkbox"/>	Diesel	<input checked="" type="checkbox"/>	<input type="checkbox"/>		×
Car elect	---	---	<input type="checkbox"/>	electricity	<input checked="" type="checkbox"/>	<input type="checkbox"/>		×
Bus large diesel	---	Diesel	<input checked="" type="checkbox"/>	Diesel	<input type="checkbox"/>	<input type="checkbox"/>		×
Bus small diesel	---	Diesel	<input checked="" type="checkbox"/>	---	<input type="checkbox"/>	<input type="checkbox"/>		×
Metro electric	---	---	<input type="checkbox"/>	electricity	<input type="checkbox"/>	<input type="checkbox"/>		×
Tramway electric	---	---	<input type="checkbox"/>	electricity	<input type="checkbox"/>	<input type="checkbox"/>		×
Trolleybus electric	---	---	<input type="checkbox"/>	electricity	<input type="checkbox"/>	<input type="checkbox"/>		×
Air Plane	---	JetFuel	<input checked="" type="checkbox"/>	---	<input type="checkbox"/>	<input checked="" type="checkbox"/>		×

Activity 3: End-Use Categories

The final step in defining the structure of the model is the configuration of end-use categories. We must remember that, in MAED, there are 3 end-use categories: **motive power, thermal uses, and specific uses of electricity**. In the previous version of MAED the user was forced to fill in data tables for the three categories, in each sector or subsector defined. However, some end-use categories may not exist or may not be significant in some subsectors. Furthermore, even if that end-use exists, the data for that end-use may not be available for some subsectors. In the new version, we can define which categories of end-uses are present in each subsector. This is done by using check boxes. Let us focus, for instance, on the farming subsector of the agriculture sector. Note that all end-uses have been chosen in the sector definition block.

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 [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 ☐ GtU

Sectors & Clients

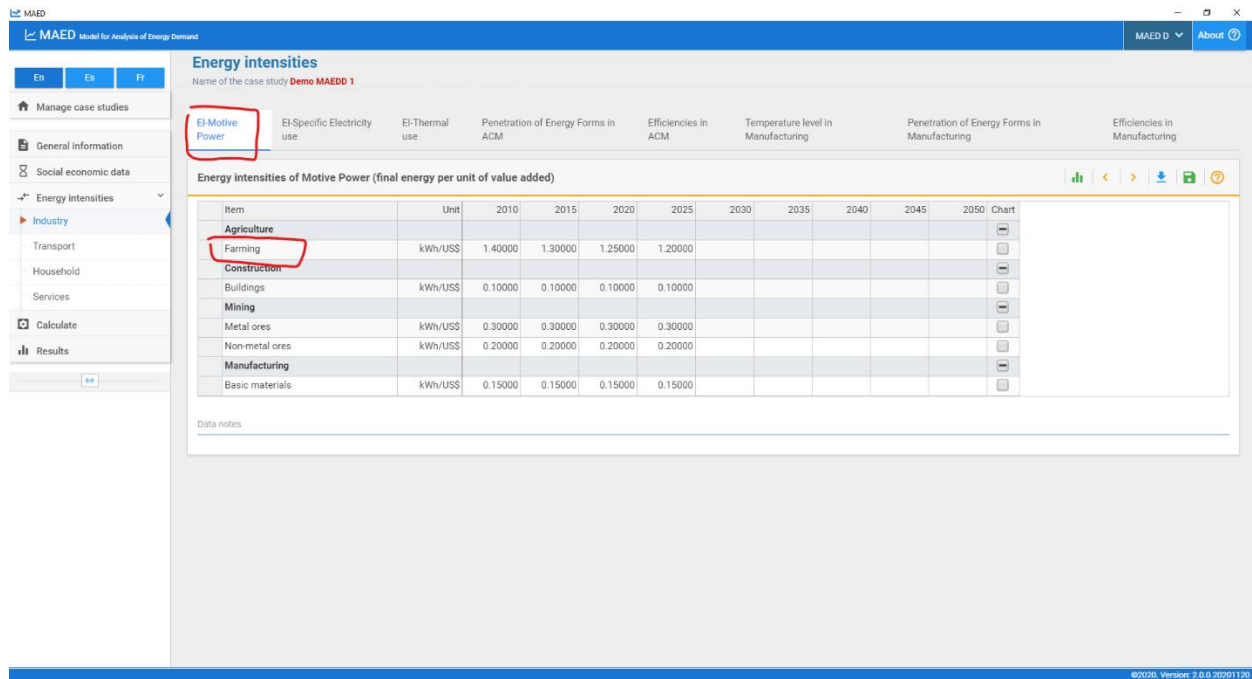
Agriculture Construction Mining Manufacturing Energy Service Household Transport

Specific Electricity use Thermal use Motive Power

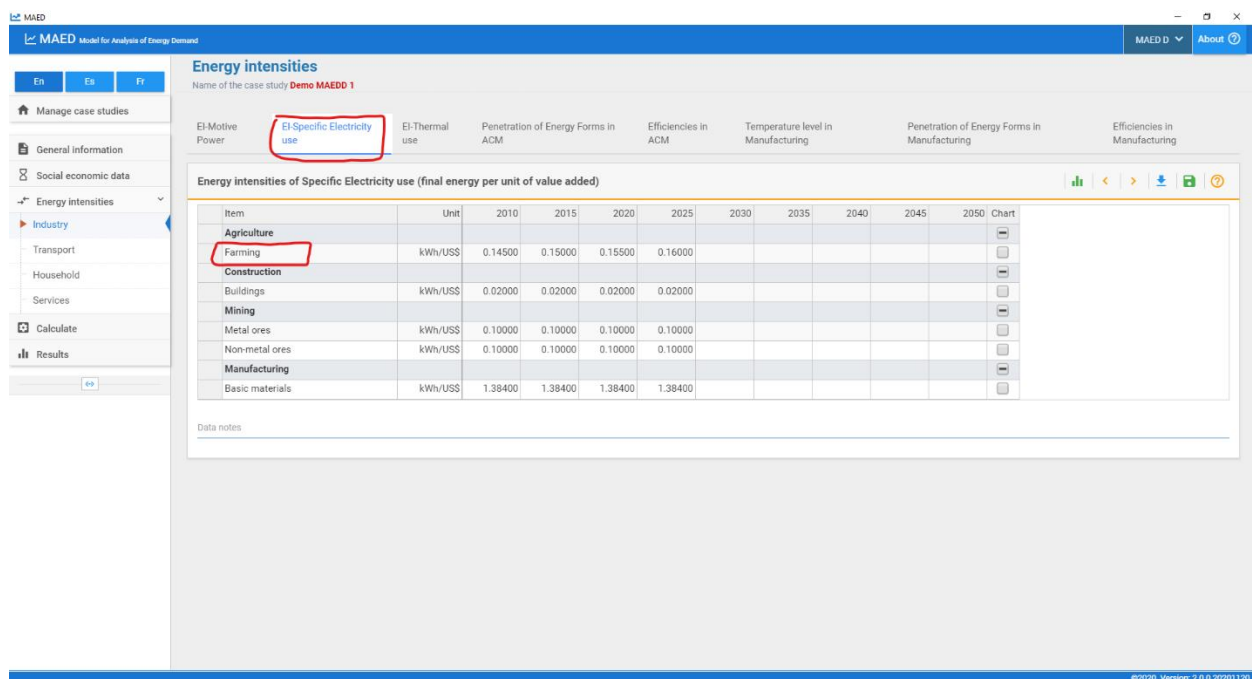
Farming

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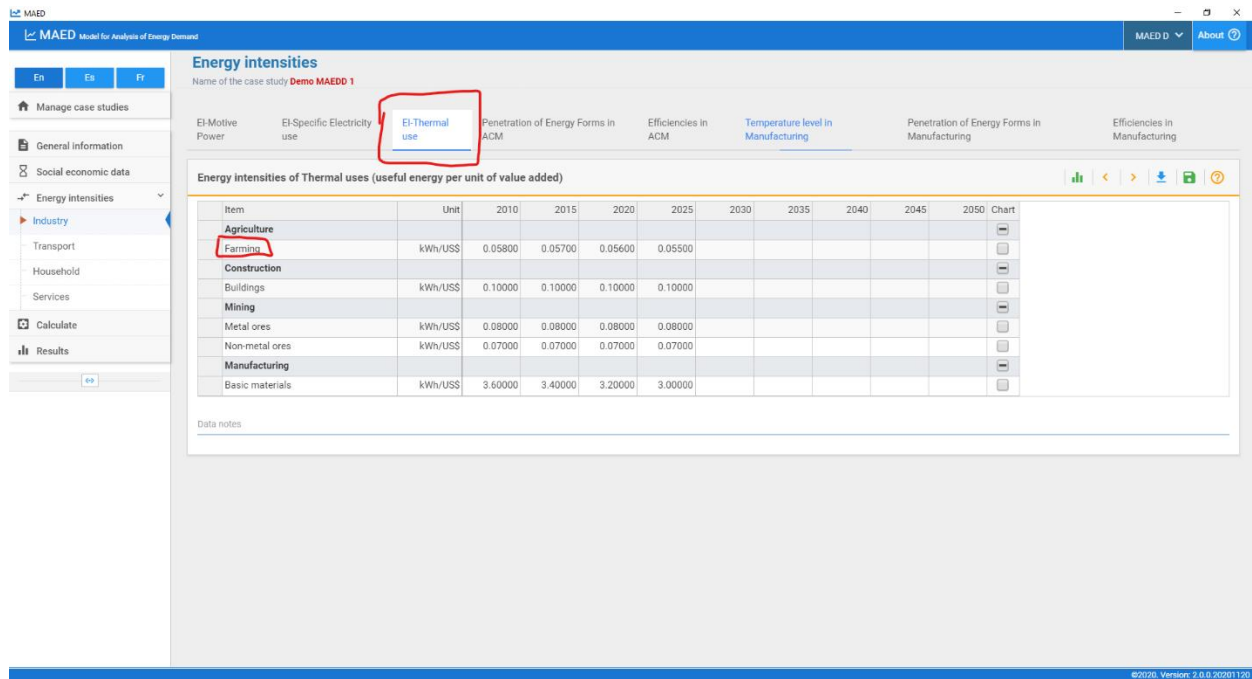
We should now be able to enter energy usage data for each of the three end-use categories. Let us confirm this by looking at the usage tables of the three end-use categories. Let us first look at the energy intensities of motive power.



Let us now look at energy intensities of specific electricity use.



Let us finally look at energy intensities of thermal use.



Energy intensities

Name of the case study: **Demo MAED0 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

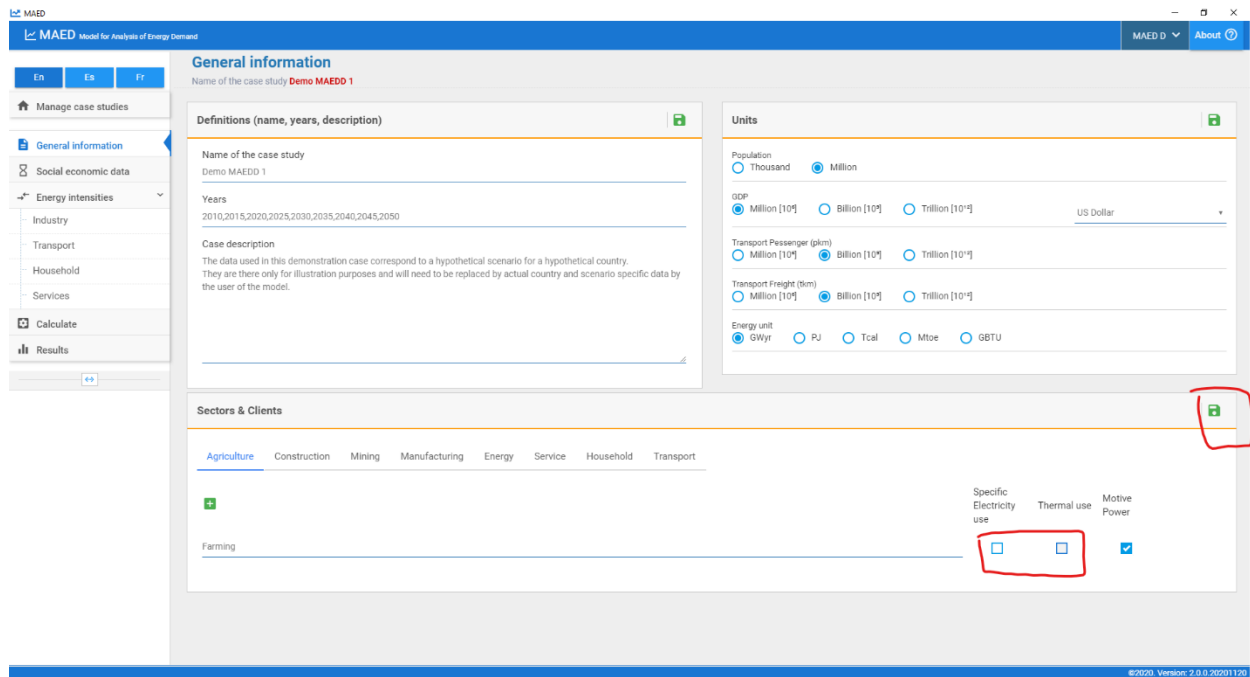
Energy intensities of Thermal uses (useful energy per unit of value added)

Item	Unit	2010	2015	2020	2025	2030	2035	2040	2045	2050	Chart
Agriculture											
Farming	kWh/US\$	0.05800	0.05700	0.05600	0.05500						<input type="checkbox"/>
Construction											
Buildings	kWh/US\$	0.10000	0.10000	0.10000	0.10000						<input type="checkbox"/>
Mining											
Metal ores	kWh/US\$	0.08000	0.08000	0.08000	0.08000						<input type="checkbox"/>
Non-metal ores	kWh/US\$	0.07000	0.07000	0.07000	0.07000						<input type="checkbox"/>
Manufacturing											
Basic materials	kWh/US\$	3.60000	3.40000	3.20000	3.00000						<input type="checkbox"/>

Data notes

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Let us consider the scenario where the specific uses of electricity and thermal uses are not present in the farming subsector. To model this, we uncheck the Specific Electricity Use and Thermal Use boxes and click save.



MAED Model for Analysis of Energy Demand

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

Definitions (name, years, description)

Name of the case study
Demo MAED 1

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

Case description
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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

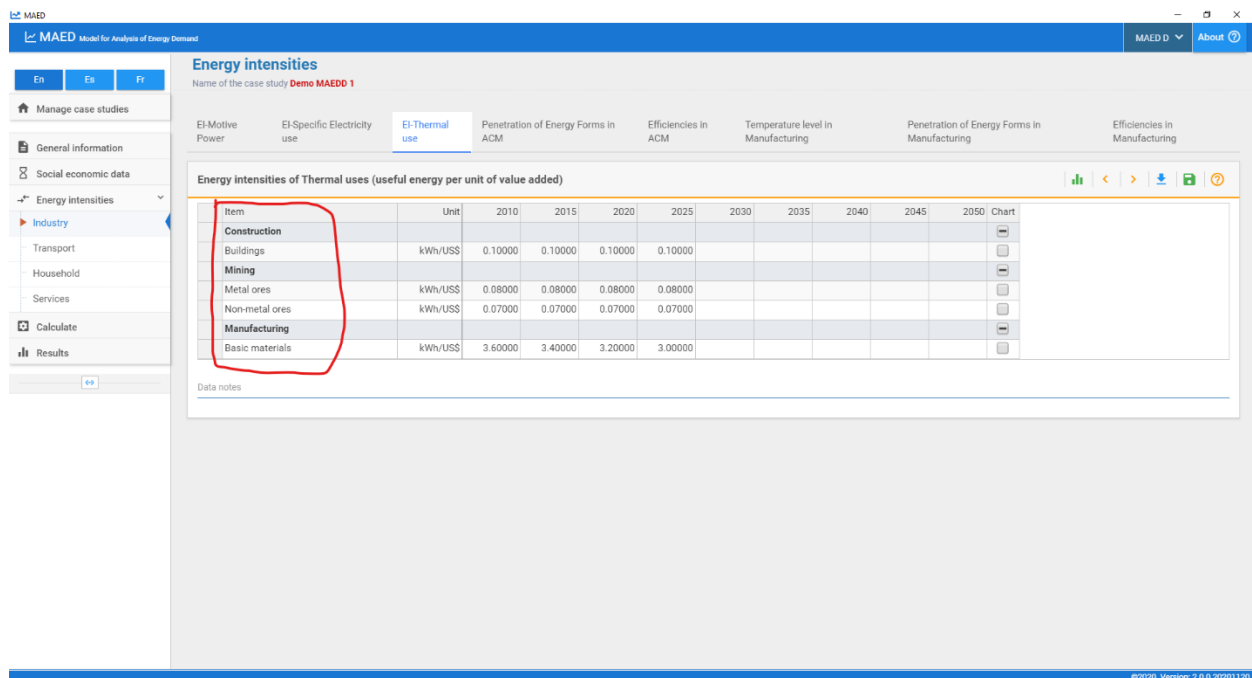
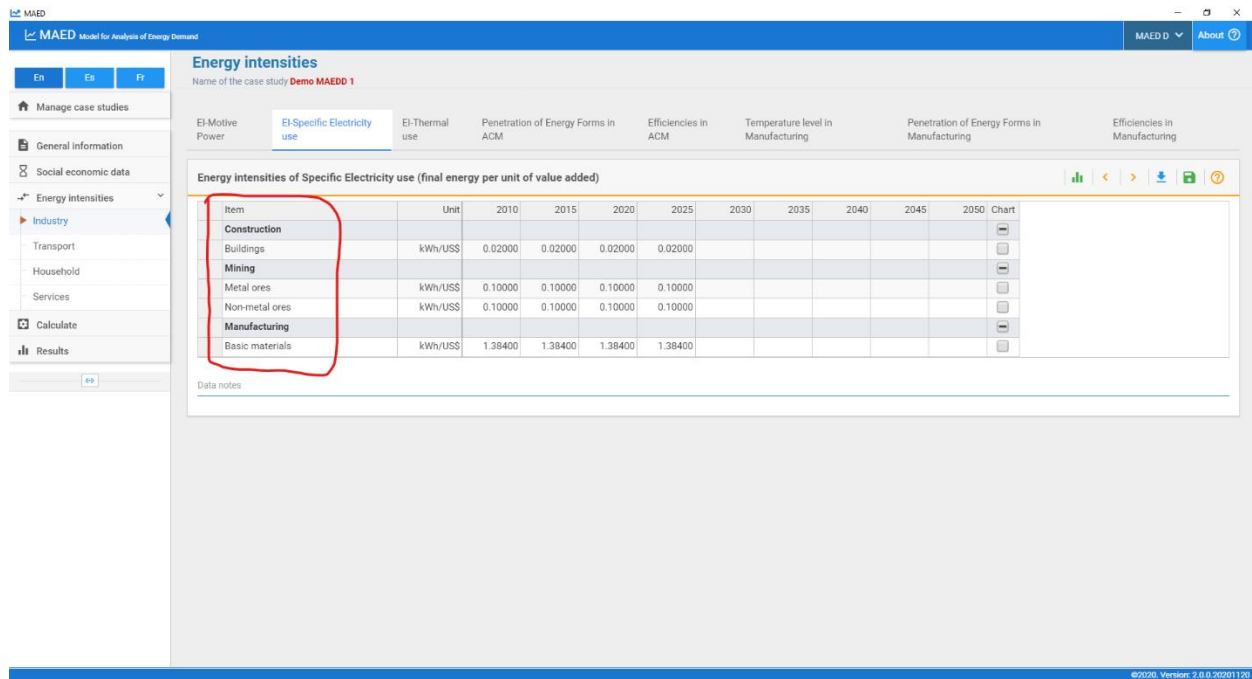
Agriculture Construction Mining Manufacturing Energy Service Household Transport

Farming

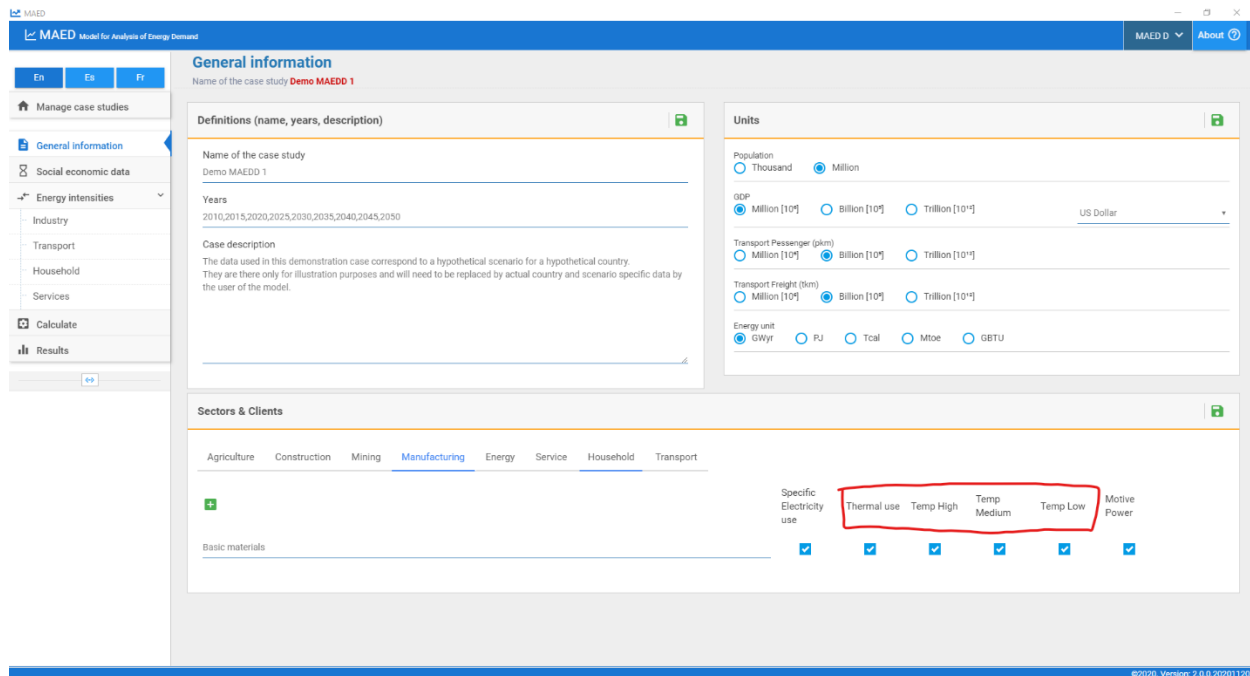
Specific Electricity use ☐ Thermal use ☐ Motive Power ☒

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Let us now look at the three energy usage tables again. Farming is still present in the energy intensity of motive power. However, it is no longer present in the energy intensities of specific electricity use and the energy intensities of thermal use.



In the **Manufacturing sector (part of the Industry Sector)**, thermal usage is further divided into three temperature ranges: **High Temperature, Medium Temperature, and Low Temperature**. When modelling thermal use of subsectors in the manufacturing sector, we also need to select which temperature ranges of thermal use to model for each subsector. In this case study, all three temperature ranges have been chosen for Basic Materials.



The screenshot shows the MAED interface with the following configuration:

- General information:**
 - Name of the case study: Demo MAED 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: Million
 - GDP: Million [10⁹]
 - Transport Passenger (pkm): Billion [10⁹]
 - Transport Freight (tkm): Billion [10⁹]
 - Energy unit: GWyr
- Sectors & Clients:**
 - Sector: Manufacturing
 - Client: Basic materials
 - Thermal use: [X] [X] [X] (High, Medium, Low)
 - Motive Power: [X]

The model structure is now configured. And all input data tables, and output tables, correspond to the defined structure.

The model is ready to be loaded with the input data.