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User guide

D5.2 Digital monitoring and visualization tool (Demonstrator)

December 2024

SONNENPLATZ Großschönau

Città di Settimo Torinese

AMS Amsterdam Institute for Advanced Metropolitan Solutions

TU Delft

FH University of Applied Sciences TECHNIKUM WIEN

Reșița

PV Works

denkstatt create sustainable value

Leader: Sonnenplatz Großschönau

Dissemination Level

PU	Public	X
CO	Confidential	

History

Version	Description	Lead author	Date
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Disclaimer

This project has been developed in the framework of the PED Program, which is implemented by the Joint Programming Initiative Urban Europe and SET Plan Action 3.2. *The Austrian part is supported by the Austrian Ministry of Climate Action, Environment, Energy, Mobility, Innovation, and Technology (BMK); the Romanian part is supported by a grant of the Ministry of Research, Innovation and Digitization CNCS/CCCDI – UEFISCDI, project number PED-JPI-SIMPLY POSITIVE, contracts number 325/2022 and 326/2022, within PNCDI III; the Dutch part is supported by the RVO (the Netherlands Enterprise Agency), reference number ERANETPED-02767306; and the Italian part is supported by a grant of the Ministry of Education and Merit - Department for Higher Education and Research, project number PED_00042, from the Fund for Investment in Scientific and Technological Research (FIRST/FAR) and/or Special Accounting Account no. 5944.*

Executive Summary

The present user guide is intended to support PED developers in using D5.2 Digital monitoring and visualization tool (Demonstrator), in order to:

- visualize progress towards PED achievement rate
- calculate environment-related KPIs (quantity of CO_{2eq}) for various energy sectors and as on a yearly basis
- keep track of action implementation.

The guide is structured in 4 main sections:

1. Steps in defining a PED project
2. Guidelines on how to input yearly monitoring data
3. Description of the information provided in the dashboard for PED progress viewing
4. Input parameters including overall system architecture and emission factors used

The source code for the demonstrator can be found at: https://github.com/DragosPatru/ped-monitor . Using this source code and the affiliated technical documentation, the free-source Demonstrator can be further developed and updated by other developers.

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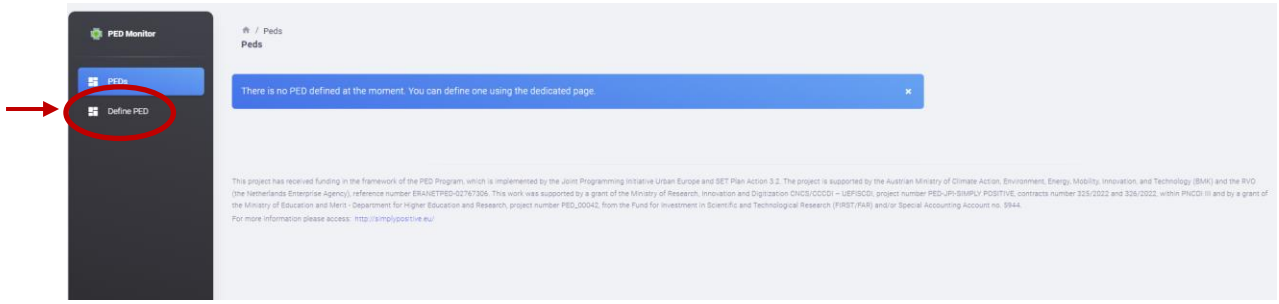
1. Defining a PED project

1.1. Select Define PED tab

In the main default view of the app, click on the right-hand panel to define a new PED

Please note that you can create multiple PED projects from your account.



1.2. Input profiling indicators

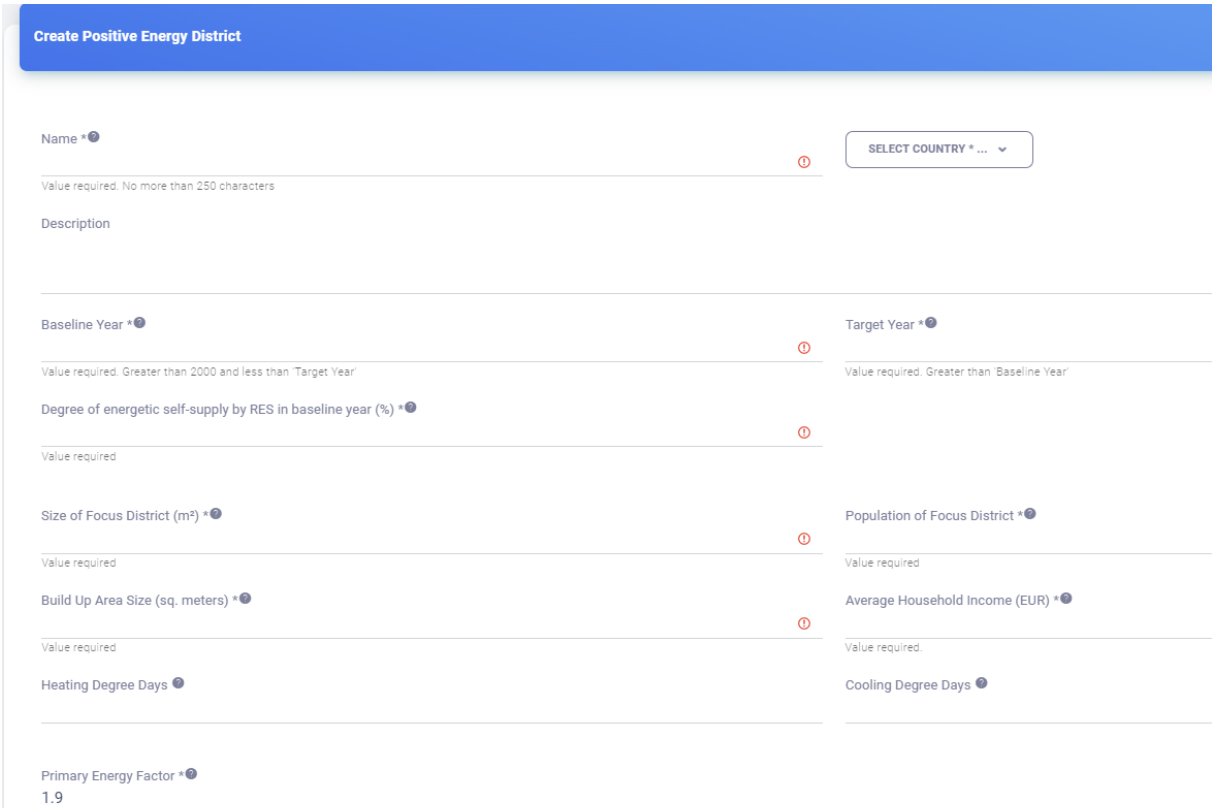
When defining a PED, start by inputting the required information in the fields indicated below.

Please keep in mind that detailed explanations for each field is available for viewing by clicking the ? icon on the right of the field name.

*Where applicable, the units of measurement are presented in brackets **()** at the end of the field name.*

*Fields market with ***** are mandatory.*

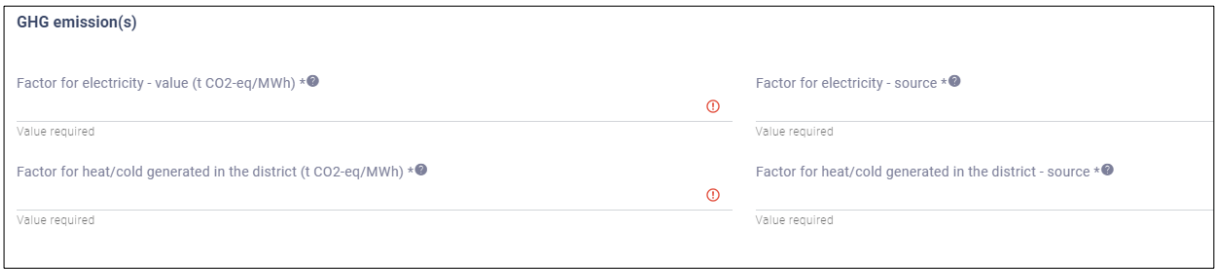
Please not that Primary Energy Factor is set at a default EU value of 1.9, but can be updated if another specific primary energy factor is available for your region.



1.3. Input GHG emissions profiling indicators

In order to calculate environmental indicators (GHG emissions) for the focus district, emission factors are embedded in the system for most of the energy sources. However, in emission factors in the case of grid electricity and locally produced heat (or cold) are dependent on local characteristics.

In this sense, please input the emission factors for these types of energy sources, if they are applicable to your focus district. For each emission factor, please input the source. If one or both types of energy sources are unapplicable for your energy district, please input 0.



Grid electricity:

- Emission factors may be obtained: (1) from electricity provider (suggested) and should be updated anually; (2) from international databases such as IPPC
- all yearly conversion factors introduced in the tool must be from the same source (e.g. energy provider) for all the monitoring years
- Examples of open-source database: Joint Research Centre Data Catalogue -> please select the lates version of GHG Emission Factors for Electricity Consumption -> Table 3: CoM emission factors for national electricity for EU member states, Iceland and Norway: Life-cycle (LC) approach, GHG emissions in tonnes CO2-eq/MWh -> select the conversion factor closest to your baseline year -> yearly check the database for updates; link: https://data.jrc.ec.europa.eu/collection/id-00172

Locally produced heat (or cold):

- if local powerplants are in place for the district. Emission factors may be obtained: (1) from generation facility, based on specific studies; (2) from international databases such as IPPC
- all yearly emission factors introduced in the tool must be from the same source (e.g. IPPC) for all the monitoring years
- Examples of open-source database: Joint Research Centre Data Catalogue -> please select the lates version of GHG Emission Factors for Local Energy Use -> Table 1 & Table 2 -> select the conversion factor according to the source of energy used within your facility -> yearly check the database for updates; link: https://data.jrc.ec.europa.eu/collection/id-00172

1.4. Select applicable energy indicators

In order to set up the framework for PED monitoring, please select ALL energy sources and types of energy sectors which apply to your PED. If you do not select in this stage ALL applicable data for your district, data cannot be inserted in the later stage

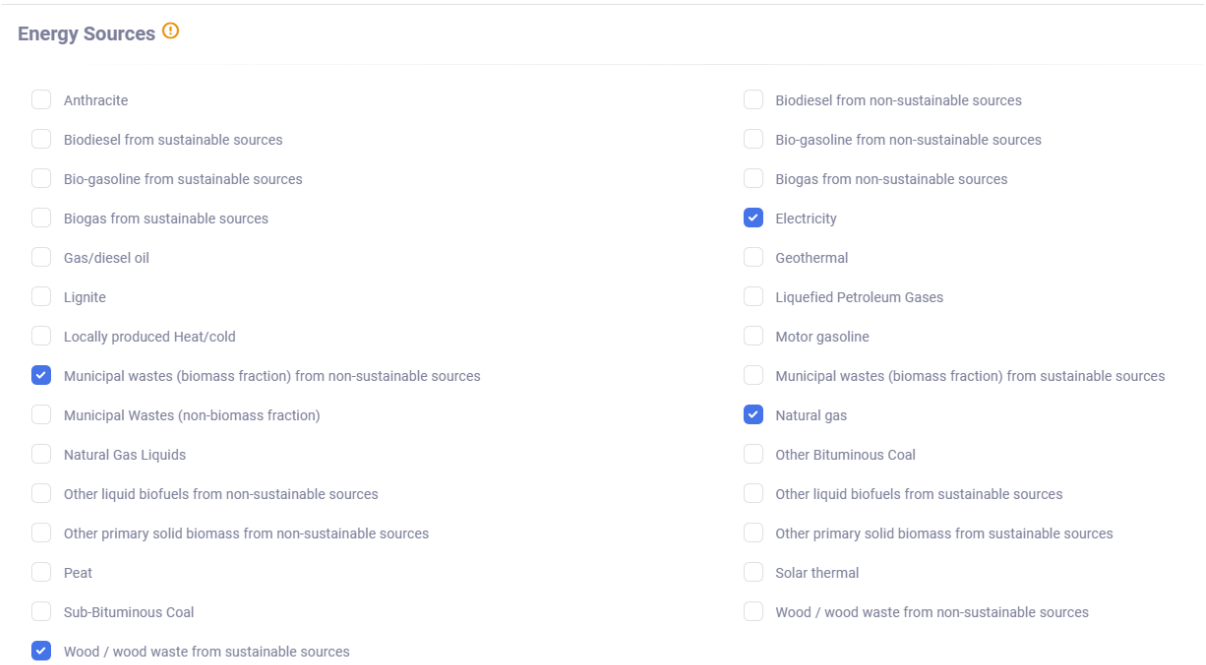
Select the tab “Energy consumption and generation”.

Please select the types of ENERGY SOURCES applicable in your district

IMPORTANT:

(1) if you have Electricity provided by a grid supplier please select "Electricity",

(2) if you have local generation of heat/cold, please select "Locally produced Heat/cold", (3) if you do not select in this stage ALL energy sources which are applicable to your district, data cannot be inserted in the later stage



Please select the types of ENERGY SECTORS (sectors of energy consumptions / renewable energy production) you would like to monitor as part of your system boundaries; categories are defined according to Covenant of Mayors methodology.

IMPORTANT:

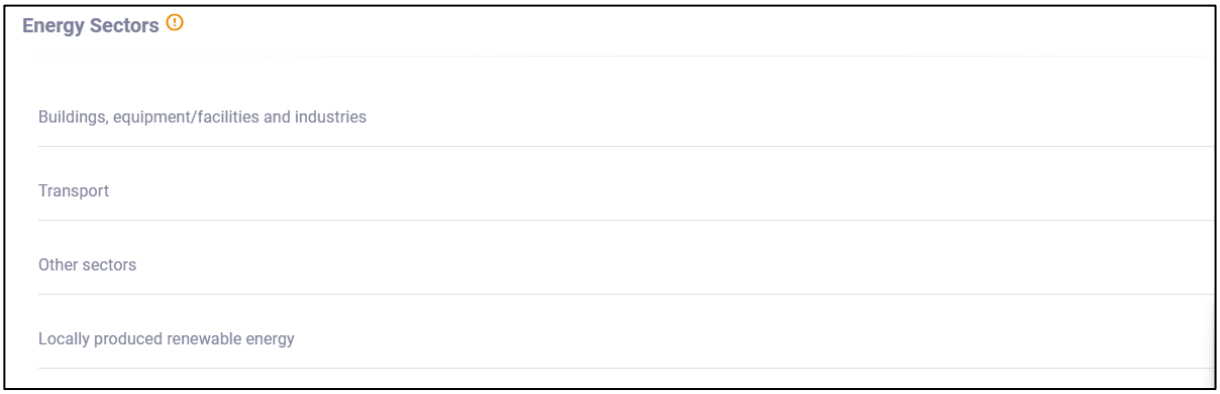
(1) select as many categories as possible in order to have an accurate PED progress,

(2) energy consumptions/generation must be monitored according to these categories,

(3) if you do not select in this stage ALL categories which are applicable to your district, data cannot be inserted in the later stage

Click on each of the following category tabs to reveal the sub-categories from which to choose:

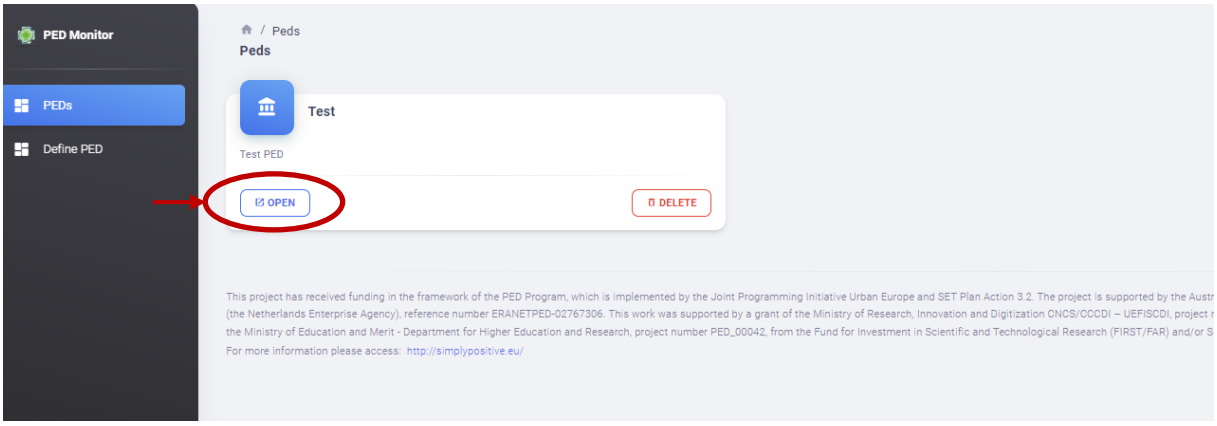
- Buildings, equipment/facilities and industries
- Transport
- Other sectors
- Locally produced renewable energy



To finish the PED set-up, please click “Create” at the bottom of the page.

2. Inputting monitoring data

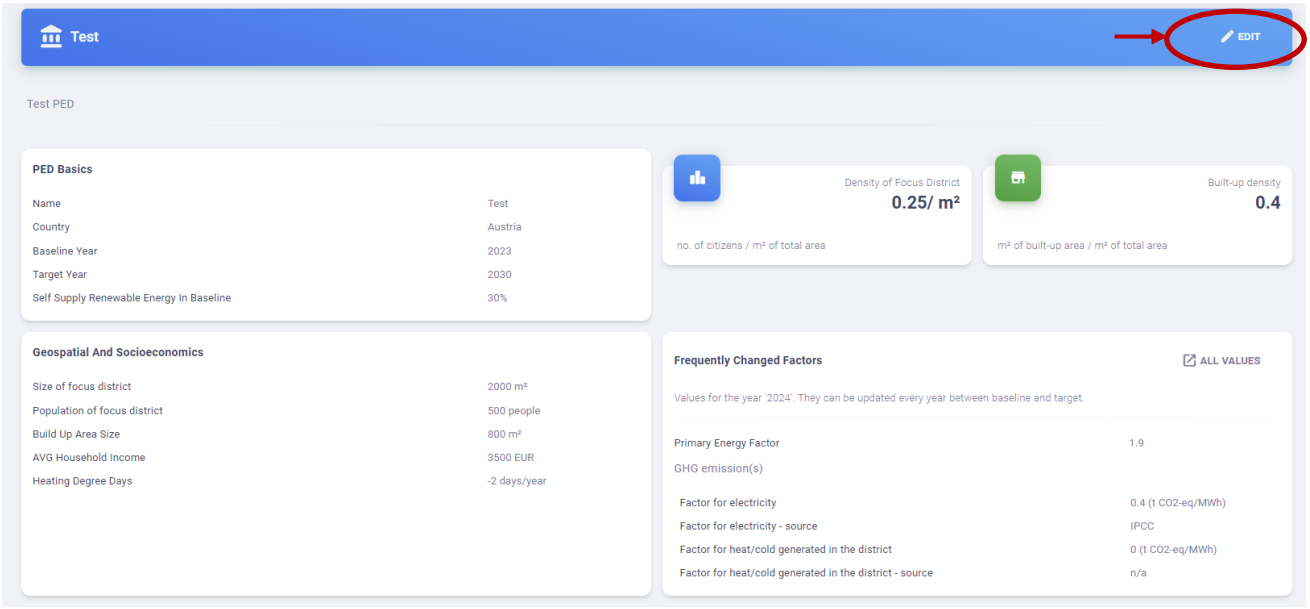
For regular input of monitoring data, please access the “Open” under your PED.



2.1. Updating conversion and emission factors

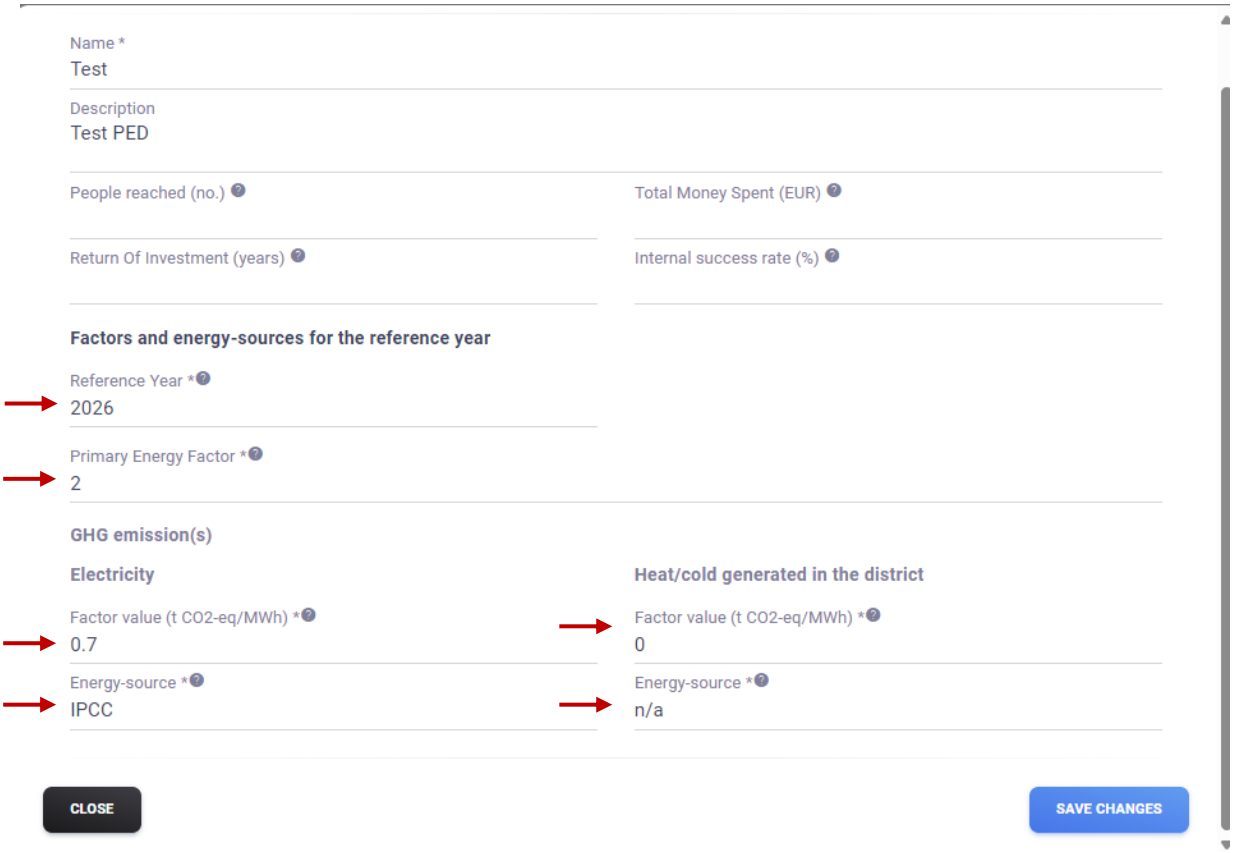
The application will use as default values inputted in the previous step of creating a PED project. If energy factors (primary energy and emission) change during the monitoring period, you can update these values.

From the general dashboard, select the “Edit” from the top section to update your Primary energy factor and Emission factors for grid electricity and heat/cold in a certain year, if it is applicable.

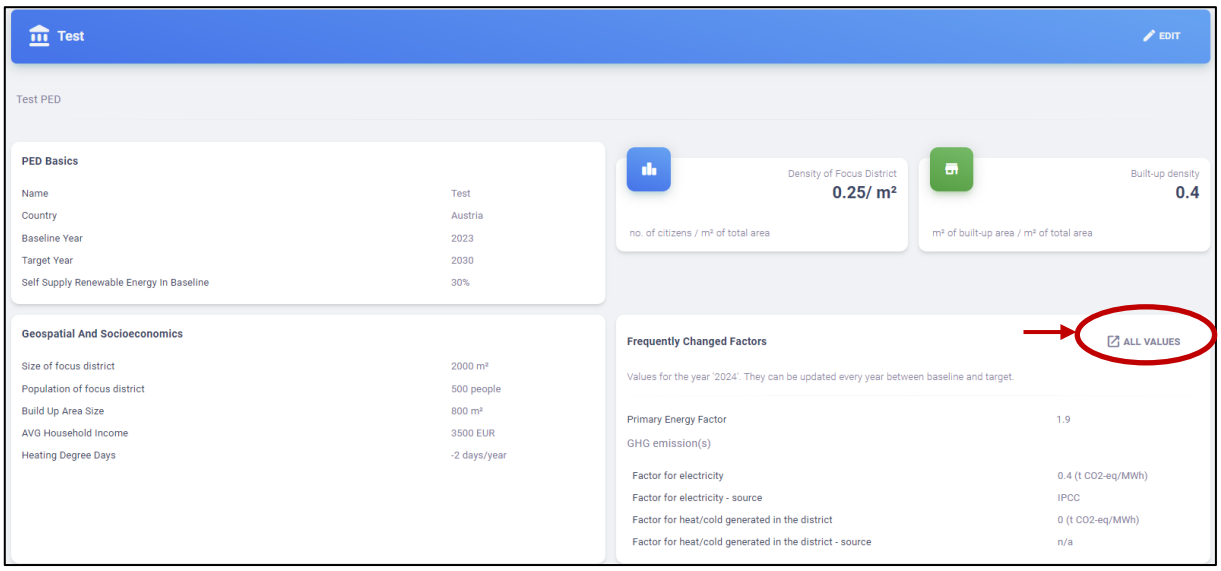


In the pop-up window, select the year you want update the necessary factors, while mentioning the year.

Please note that in this window some other fields such as PED name, description and some non-mandatory profiling data can also be updated.



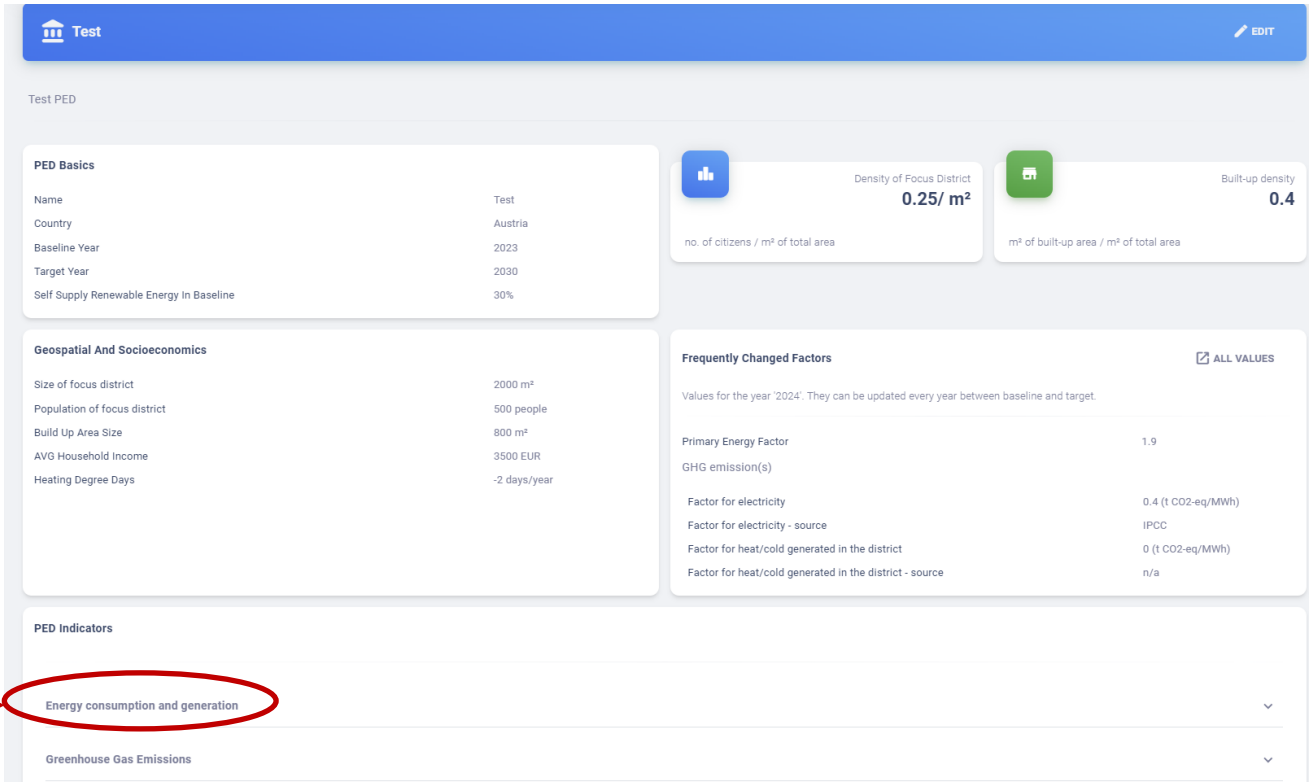
An overview of all updated energy factors can be viewed in the dashboard section, by clicking the “All values” tab under the “Frequently changed factors” section.



2.2. Inputting yearly data

Input the yearly energy consumption/generation for the sectors you have defined in the earlier stage of creating the PED project.

Click the Energy consumption and generation under the PED Indicators section to display the sectors under which you want to register information.

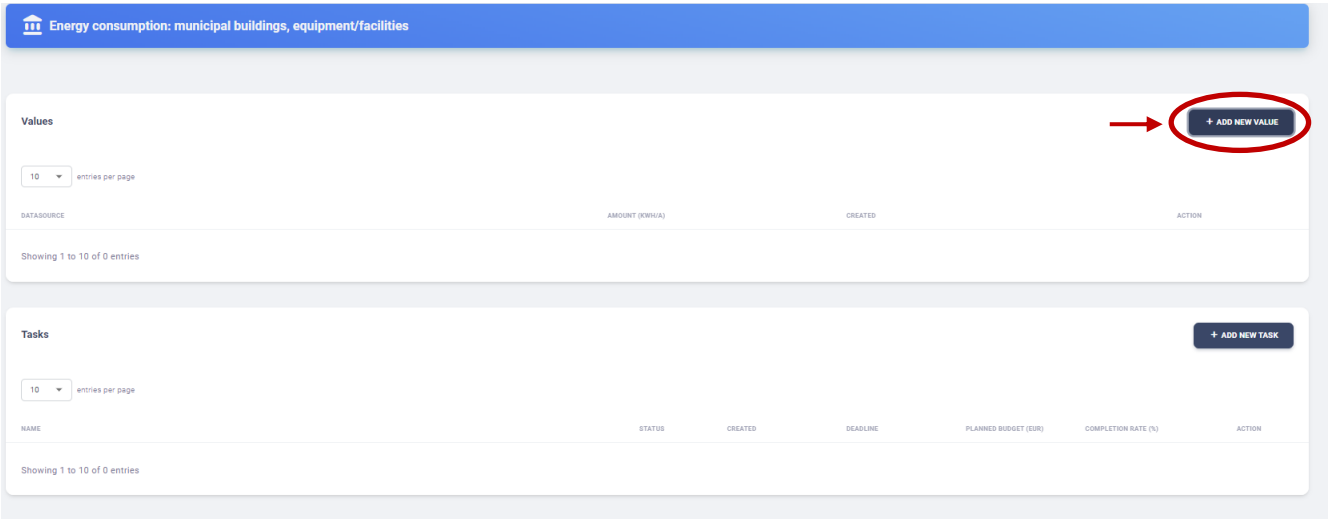


2.2.1 Inputting energy data

Select each sector that you want to introduce data for. Please note that renewable energy production will be entered under “Locally produced renewable energy”.

After selecting each sector, sub-sector will be displayed. Click on the ⟩ sign placed to thre right of each sub-sector to add yearly data.

In the new window, click on “Add new values” button from the right corner of the “Values” section to insert yearly consumption / generation data for each sector.



In the pop-up window, insert:

- amount of energy in kWh for the specific subsector (either energy consumed or energy generated under the Locally produced renewable energy tab)
- year end date (in the format mm/dd/yyyy), afferent to the year you are inputting data for
- select the energy source

Please note that if there are multiple energy sources for the same year (e.g. municipal buildings have been supplied by both grid electricity and thermal energy sourced from natural gas), you need to separate entries.

After completing, click “Save changes” button from the bottom right corner.

Repeat the process for all applicable sub-sectors.

2.2.2 Viewing centralized energy data

Once the information has been introduced in the corresponding section, the application will display the centralized progress for energy consumption and renewable energy generation.

The application will display graphical charts and numeric tables for:

Total district final energy consumption and primary energy consumption:

Energy consumption for each sector and sub-sector

(respectively, energy generation for Locally produced renewable energy)

2.2.3 Viewing centralized emissions data

Once the energy data has been introduced in the corresponding section (step 2.2.1), the application will display the centralized progress for emissions quantities.

The application will display graphical charts and numeric tables for:

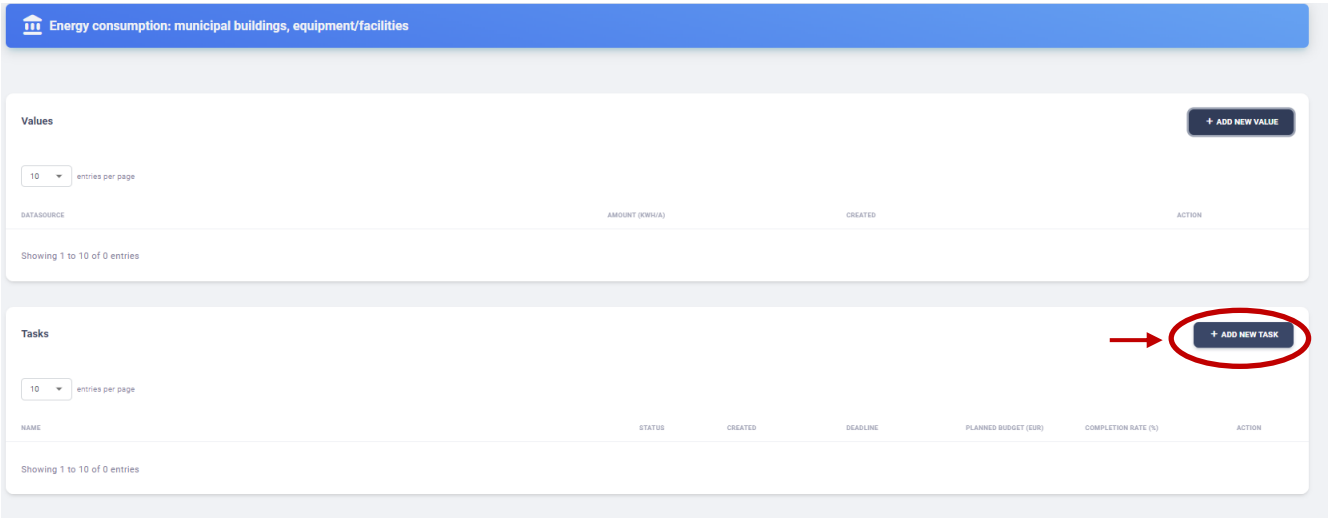
Total district emissions generation:

Emissions generation for each sector and sub-sector

2.2.3 Inputting and monitoring actions progress

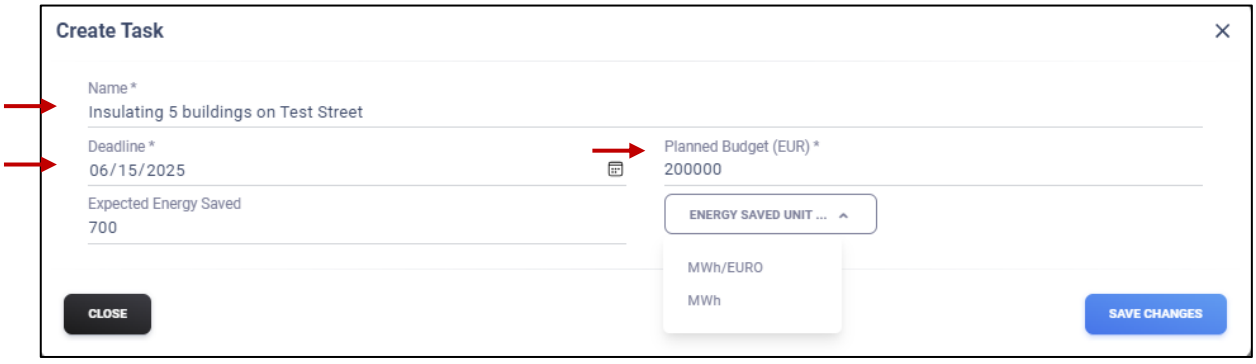
For each sub-sector, you can input actions planned for the operationalization of a PED.

From the dashboard menu, select the sub-sector and in the new window, click on “Add new task” button from the right corner of the “Tasks” section to insert actions for each sector.



In the pop-up window, define your action by entering:

- name/description of action
- deadline for completion
- planned budget
- expected energy savings (optional)



Click the “Save changes” button from the bottom right corner.

Once a task has been created, you can update its status by accessing the “Action” button (⋮) from the right of the listing and selecting “Edit” from the drop-down list.

You cand also remove the action by selecting “Remove”.

In the pop-up window, you can:

- close your task (by selecting “Done” from the top button)
- edit your task (update deadline, planned budget and expected energy savings if applicable)
- record its progress (by inputting recorded expenses and actual energy savings if applicable)

Click “Save changes” when update completed.

Repeat this process for all applicable sub-sectors where actions are being implemented for PED achievement.

3. Viewing the overall dashboard and PED progress

After filling in the required data and information according to steps 2.2.1-2.2.3, the application will update the dashboard section for the PED.

In this section, you can find:

a. the overview for profiling indicators defined at the PED project creation phase (step 1)

b. calculated district KPIs: population density and built area

c. overview of frequently changed factors (primary energy factors and emission factors)

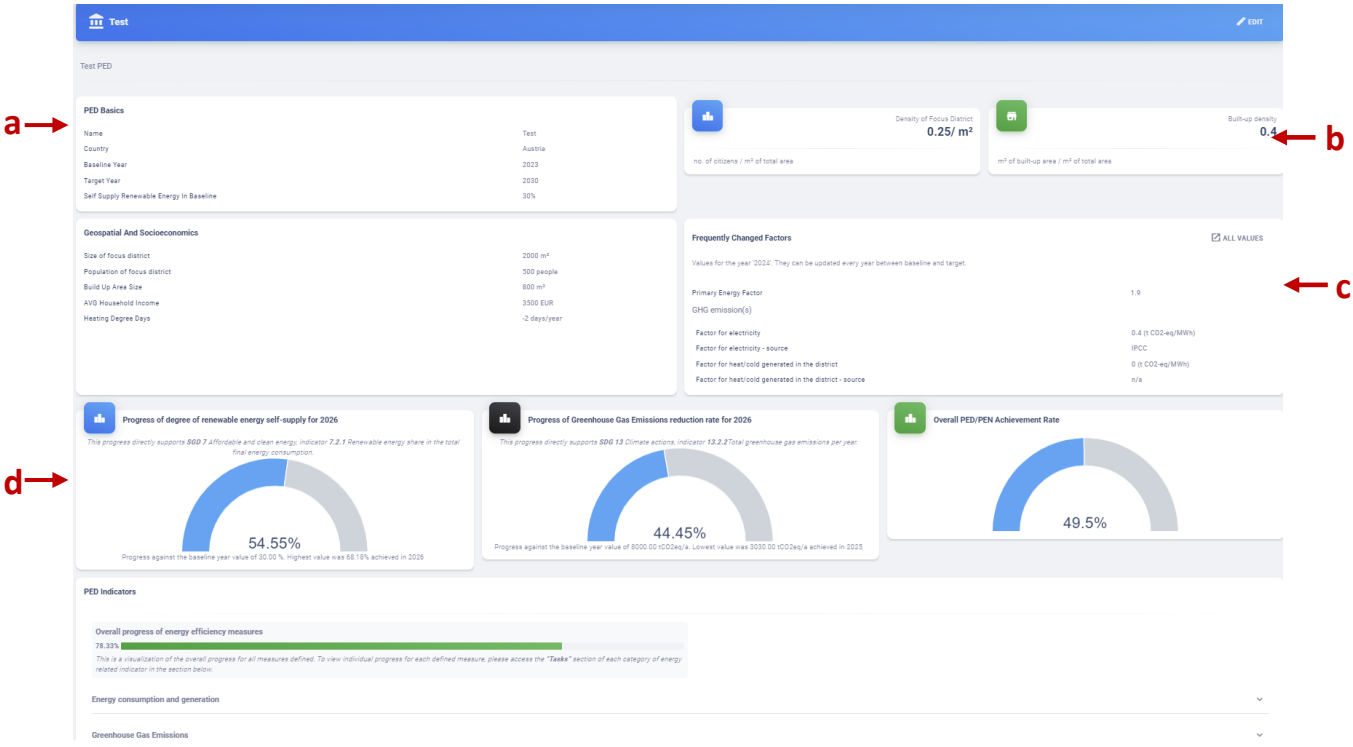
d. gauge charts for:

   i. Progress of degree of renewable energy self-supply for the last year

   ii. Progress of Greenhouse Gas Emissions reduction rate for the last year

   iii. Overall PED/PEN Achievement Rate

e. overall task completion rate



Progress of degree of renewable energy self-supply for the last year is displayed as the percent of final energy consumption provided by renewable energy generated on-site for the latest year for which data was filled in. The target value is at 100% degree of renewable energy self-supply. In the bottom of the gauge chart you can also see the progress against the baseline year value for degree of renewable energy self-supply and the highest yearly value for degree of renewable energy self-supply recorded throughout the years.

Progress of Greenhouse Gas Emissions reduction rate for the last year is displayed as the progress against the baseline year value of GHG emissions generated in that year. In the bottom of the gauge chart you can also see the best recorded value of GHG emissions throughout the years (the lowest amount of GHG emissions and the year it was achieved in).

Overall PED/PEN Achievement Rate is displayed for the last year and is considered to be 100% achieved when both of the following conditions are met: degree of renewable energy self-supply is at least 100% and GHG emissions are 0.

The overall task completion rate is the visualization of the overall progress for all measures defined. To view individual progress for each defined measure, you can access the “Tasks” section of each category of energy related sector.

4. Input parameters

4.1. System architecture

Code	Type	CATEGORY	INDICATOR	U.M.	Description of indicator *(Information to be uploaded by user / calculated by Demo)*	Formula *(where information is calculated by Demo)*
P0.1	Mandatory	Profiling indicators	Baseline year	year	baseline year for the calculation of progress in energy consumption and emissions generation	-
P0.2	Mandatory	Profiling indicators	Target year	year	target year set up by the user to achieve PED status	-
P0.3	Mandatory	Profiling indicators	Degree of energetic self-supply by RES in baseline year	%	percent of final energy consumption provided by renewable energy generated on-site in baseline year	-
P0.4	Mandatory	Profiling indicators	GHG emissions in baseline year	tCO2eq/a	total quantity of GHG emissions in baseline year	-
P1	Mandatory	Profiling indicators	Size of Focus District	m²	m² of district	-
P2	Mandatory	Profiling indicators	Population of Focus District	no.	no. of citizens	-
P3	Mandatory	Profiling indicators	Density of Focus District	/ m²	no. of citizens / m² of total area	P2/P1
P4	Mandatory	Profiling indicators	Size of built-up area	m²	m² of the focus district which has buildings	
P5	Mandatory	Profiling indicators	Built-up density	no.	m² of built-up area / m² of total area	P5/P1
P6	Mandatory	Profiling indicators	Heating degree days	no.	no. of days	-
P7	Mandatory	Profiling indicators	Cooling degree days	no.	no. of days	-
P8	Mandatory	Profiling indicators	Average household income	€	average household income EUR	-
PEF	Mandatory	Energy related	Primary Energy Factor	no.	pre-selected primary energy factor of 2.5 **OR** insert manually	-
EF1	Mandatory	Energy related	GHG emission factor for electricity - value	t CO2-eq/MWh	yearly emission factor defined by user (local/national/from IPCC database)	-

EF1.0	Mandatory	Energy related	GHG emission factor for electricity - source	*(free text)*	source of yearly emission factor provided for electricity	
EF2	Mandatory	Energy related	GHG emission factor for heat/cold generated in the district - value	t CO2-eq/MWh	yearly emission factor defined by user (local/national/from IPCC database), depending on input for the local heat/cold plants (natural gas, diesel, biomass etc.)	
EF2.0	Mandatory	Energy related	GHG emission factor for heat/cold generated in the district - source	*(free text)*	source of yearly emission factor provided for locally produced heat/cold, depending on input for the local heat/cold plants (natural gas, diesel, biomass etc.)	
FET0	**Mandatory**	**Energy related**	**Total district final energy consumption**	**kWh/a**	**total actual quantity of energy consumed within the district**	**SUM(FET1:FET3)**
FET1	**Mandatory**	**Energy related**	**Total final energy consumption: buildings, equipment/facilities and industries**	**kWh/a**	**total actual quantity of energy consumed by buildings, equipment/facilities and industries**	**SUM(FET1.1, FET1.2, FET1.3, FET 1.4)**
FET2	**Mandatory**	**Energy related**	**Total final energy consumption: transport**	**kWh/a**	**total actual quantity of energy consumed by transport**	**SUM(FET2.1, FET2.2, FET2.3, FET2.4)**
FET3	**Mandatory**	**Energy related**	**Total final energy consumption: other sectors**	**kWh/a**	**total actual quantity of energy consumed by other sectors**	**FET3.1**
FET1.1	**Mandatory**	**Energy related**	**Subtotal Municipal Final energy consumption**	**kWh/a**	**actual quantity of energy consumed within the district by the municipal sector**	**SUM(FET1.1.1:FET1.1.3)**
FET1.1.1	Mandatory	Energy related	Energy consumption: municipal buildings, equipment/facilities	kWh/a	actual quantity of energy consumed within the district by the municipal buildings, facilicities and equipment owned by the municipality	-
FET1.1.2	Mandatory	Energy related	Energy consumption: public lighting	kWh/a	actual quantity of energy consumed within the district by the public lighting, owned by the municipality	-
FET1.1.3	Mandatory	Energy related	Energy consumption: other municipal category	kWh/a	other categories of municipality-owned sources of energy consumption	-
FET1.2	**Mandatory**	**Energy related**	**Subtotal Tertiary (non-Municipal) Final energy consumption**	**kWh/a**	**actual quantity of energy consumed within the district by the tertiary/service sector**	**SUM(FET1.2.1:FET1.2.2)**

FET1.2.1	Mandatory	Energy related	Energy consumption: institutional buildings, non-municipal	kWh/a	actual quantity of energy consumed within the district by the non-municipal buildings from the service sector	-
FET1.2.2	Mandatory	Energy related	Energy consumption: other non-municipal category	kWh/a	actual quantity of energy consumed within the district by other non-municipal categories	-
FET1.3.	**Mandatory**	**Energy related**	**Energy consumption: residential buildings**	**kWh/a**	**actual quantity of energy consumed within the district by residential buildings**	**-**
FET1.4	**Mandatory**	**Energy related**	**Subtotal Industry Final energy consumption**	**kWh/a**	**actual quantity of energy consumed within the district by the industry sector (manufacturing and construction)**	**SUM(FET1.4.1:FET1.4.2)**
FET1.4.1	Mandatory	Energy related	Energy consumption: non-ETS industry	kWh/a	actual quantity of energy consumed within the district by industrial activities (non-ETS)	-
FET1.4.2	Mandatory	Energy related	Energy consumption: ETS	kWh/a	actual quantity of energy consumed within the district by industrial activities (ETS)	-
FET2.1	**Mandatory**	**Energy related**	**Subtotal Municipal Fleet energy consumption**	**kWh/a**	**actual quantity of energy consumed by the fleet owned by the municipality**	**SUM(FET2.1.1:FET2.1.2)**
FET2.1.1	Mandatory	Energy related	Energy consumption: road fleet	kWh/a	actual quantity of energy consumed by the road vehicles owned by the municipality	-
FET2.1.2	Mandatory	Energy related	Energy consumption: other fleet	kWh/a	actual quantity of energy consumed by other types of vehicles owned by the municipality	-
FET2.2	**Mandatory**	**Energy related**	**Subtotal Public transport energy consumption**	**kWh/a**	**actual quantity of energy consumed by any type of vehicles used for public passenger transport**	**SUM(FET2.2.1:FET2.2.4)**
FET2.2.1	Mandatory	Energy related	Energy consumption: public road transport	kWh/a	actual quantity of energy consumed by public road transport used for passengers	-
FET2.2.2	Mandatory	Energy related	Energy consumption: public rail	kWh/a	actual quantity of energy consumed by public rail transport used for passengers	-
FET2.2.3	Mandatory	Energy related	Energy consumption: public local and domestic waterways	kWh/a	actual quantity of energy consumed by public waterways transport used for passengers	-

FET2.2.4	Mandatory	Energy related	Energy consumption: other public transport categories	kWh/a	actual quantity of energy consumed by any other public transport used for passengers	-
FET2.3	**Mandatory**	**Energy related**	**Subtotal Private and commercial transport energy consumption**	**kWh/a**	**actual quantity of energy consumed by private vehicles used for transport of persons and goods**	**SUM(FET2.3.1:FET2.3.5)**
FET2.3.1	Mandatory	Energy related	Energy consumption: private road transport	kWh/a	actual quantity of energy consumed by private road transport	-
FET2.3.2	Mandatory	Energy related	Energy consumption: private rail	kWh/a	actual quantity of energy consumed by private rail transport used	-
FET2.3.3	Mandatory	Energy related	Energy consumption: private local and domestic waterways	kWh/a	actual quantity of energy consumed by private waterways transport	-
FET2.3.4	Mandatory	Energy related	Energy consumption: private local aviation	kWh/a	actual quantity of energy consumed by private aviation transport	-
FET2.3.5	Mandatory	Energy related	Energy consumption: other private transport categories	kWh/a	actual quantity of energy consumed by any other private transport	-
FET2.4	**Mandatory**	**Energy related**	**Energy consumption: Other type of transport**	**kWh/a**	**actual quantity of energy consumed by any other types of transport**	**-**
FET3.1	**Mandatory**	**Energy related**	**Subtotal other sectors energy consumption**	**kWh/a**	**actual quantity of energy consumed by private vehicles used for transport of persons and goods**	**SUM(FET3.1.1:FET3.1.2)**
FET3.1.1	Mandatory	Energy related	Agriculture, Forestry, Fisheries	kWh/a	actual quantity of energy consumed by agricultural, forestry and fisheries sectors	-
FET3.1.2	Mandatory	Energy related	Other not allocated	kWh/a	actual quantity of energy consumed by other sectors	-
PET0	Mandatory	Energy related	Total district primary energy consumption	kWh/a	total actual quantity of energy consumed within the district	FET0 x PEF
PET1	Mandatory	Energy related	Total primary energy consumption: buildings, equipment/facilities and industries	kWh/a	total actual quantity of energy consumed by buildings, equipment/facilities and industries	FET1 x PEF

PET2	Mandatory	Energy related	Total primary energy consumption: transport	kWh/a	total actual quantity of energy consumed by transport	FET2 x PEF
PET3	Mandatory	Energy related	Total primary energy consumption: other sectors	kWh/a	total actual quantity of energy consumed by other sectors	FET3 x PEF
RES0	**Mandatory**	**Energy related**	**RES generation**	**kWh/a**	**actual quantity of energy generated from renewables**	**SUM(RES1:RES5)**
RES1	Mandatory	Energy related	Local electricity production: wind	kWh/a	renewable wind energy generated in the district	-
RES2	Mandatory	Energy related	Local electricity production: hydroelectric	kWh/a	renewable hydroelectric energy generated in the district	-
RES3	Mandatory	Energy related	Local electricity production: photovoltaics	kWh/a	renewable photovoltaic energy generated in the district	-
RES4	Mandatory	Energy related	Local electricity production: geothermal	kWh/a	renewable geothermal energy generated in the district	-
RES5	Mandatory	Energy related	Local electricity production: other	kWh/a	other types of renewable energy generated in the district	-
SS	**Mandatory**	**Energy related**	**Degree of energetic self-supply by RES**	**%**	**percent of final energy consumption provided by renewable energy generated on-site**	**RES0/FET0**
GHG0	**Mandatory**	**Environment related**	**Total amount of Greenhouse Gas Emissions**	**tCO2eq/a**	**-**	**SUM(…. (depends on how we define sub-categories for FETs). This indicator is supposed to have consumption of energy (from FET indicators) x multiplied with the corresponding emission factor from the next sheet. Option 2: we can define separate NEW**

						indicators for the 30 sub-categories in the next sheet, whithout their correspondence to FETs, but this should be a last resort
A1	Optional	Acceptance*	People reached	no.	percentage of people from P2 directly impacted by the initiatives to support PED (e.g.: triggered investments and created jobs, or reduction of energy bills per household)	
A2	Optional	Acceptance*	Rate of people reached	%	percentage of population of focus district directly impacted by the initiatives to support PED	A1/P2
A2	Optional	Acceptance*	Success rate	%	success rate of the project (according to internal KPIs set up by the user)	
E1	Mandatory	Economic	Money spent	€	total investment of initiatives to facilitate PED	-
E2	Optional	Economic	Return on investment	years	no. of years in which E2 is depreciated	-
		Overall Indicator (RES)	**PED / PEN achievement rate for rewable energy**	**%**	**Condition:** RES is achieved when SS is at least 100 **Representation:** This should be represented as gauge-diagram, showing progress against P0.3 (which is considered to be 0%). When condition is met, the gauge-diagram should be 100%.	
		Overall Indicator (GHG)	**PED / PEN achievement rate for GHg emissions**	**%**	**Condition:** GHG is achieved when GHG0 is at least 0 **Representation:** This should be represented as gauge-diagram, showing progress against P0.4 (which is considered to be 0%). When condition is met, the gauge-diagram should be 100%.	
		Overall Indicator (OI)	**PED / PEN achievement rate**	**%**	**Condition:** OI is achieved when both condtions for RES and GHG are achieved **Representation:** This should be represented as gauge-diagram, average of condition for RES achievemnt and GHG achievement	

4.2. Emission factors used

Subcategories for FET indicators	**Emission factors***
Electricity	EF1 - *to be introduced by user*
Locally produced Heat/cold	EF2 - *to be introduced by user*
Natural gas	0.202
Liquefied Petroleum Gases	0.227
Natural Gas Liquids	0.232
Gas/diesel oil	0.268
Gas/diesel oil	0.268
Motor gasoline	0.250
Lignite	0.365
Anthracite	0.355
Other Bituminous Coal	0.342
Sub-Bituminous Coal	0.348
Peat	0.383
Municipal Wastes (non-biomass fraction)	0.337
Other liquid biofuels from sustainable sources	0.001
Other liquid biofuels from non-sustainable sources	0.287
Bio-gasoline from sustainable sources	0.001
Bio-gasoline from non-sustainable sources	0.256
Biodiesel from sustainable sources	0.001
Biodiesel from non-sustainable sources	0.256
Wood / wood waste from sustainable sources	0.007
Wood / wood waste from non-sustainable sources	0.410
Municipal wastes (biomass fraction) from sustainable sources	0.007
Municipal wastes (biomass fraction) from non-sustainable sources	0.367
Other primary solid biomass from sustainable sources	0.007
Other primary solid biomass from non-sustainable sources	0.367
Biogas from sustainable sources	0.000
Biogas from non-sustainable sources	0.197
Solar thermal	0.000
Geothermal	0.000

**** Covenant of Mayors approved emission factors from IPCC (update 2024) - measured in tons of CO2-eq/MWh***

simply positive