
Hotmaps Dispatch Module Documentation

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CHAPTER 1

Getting Started

This Getting Started guide aims to get you using the Hotmaps-Dispatch-Application as quickly as possible

1.1 Workflow

1. Select a heat demand profile in the *Heat Demand – Tab* or upload your own profile via the *Load Individual Data -Tab*
2. Set the yearly heat consumption of your region in the *Heat Demand – Tab* or in the *Parameters- Tab*, by editing the Total Demand [MWh] input widget
3. Add predefined *heat generators* or *heat storages* in the *Heat Producers and Heat Storage - Tab* by pressing the + Button or *upload* custom generators via the Upload Power Plant Parameters – Button
4. Set various prices, parameters, profiles, etc. or upload your own data and click on the Run Dispatch Model - Button
5. After 60 to 120 seconds the results are shown in the output section

1.2 Things to consider

- Refreshing the page deletes all your progress
- Always save your progress by *downloading* the created structure
- After calculation is done *download* the result files
- *Copy the link of the results* if something occurs you can access your results within 2 hours (this saves you time)
- If you upload your own data, pay attention to the needed structure as described *here* and *here*
- Look up the *heat generator types* that are available when generating your custom structure outside the Application
- Don't forget to press the ✓ - Button in the *Sale-/Electricity Price Tab*, because only so changes take effect

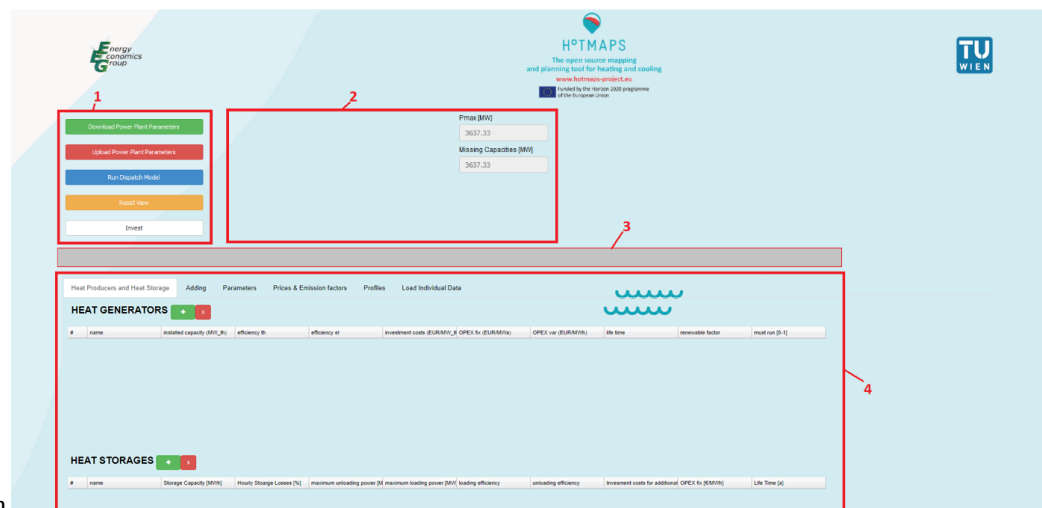
- If the page doesn't respond for a long time or something else happened refresh the page and try again, if the issue is still present look up the *User Guide*, if you have still the issue please document all setting you set (which browser, parameters, data, etc. did you use)
- At last but not least, be patient. . .

The User Guide is the primary resource for documenting key concepts that will help you use the Hotmaps-Dispatch-Application in your work

2.1 The Web User Interface

The figure below shows the User Interface. At first glance, you can see that the Application is divided into four sections:

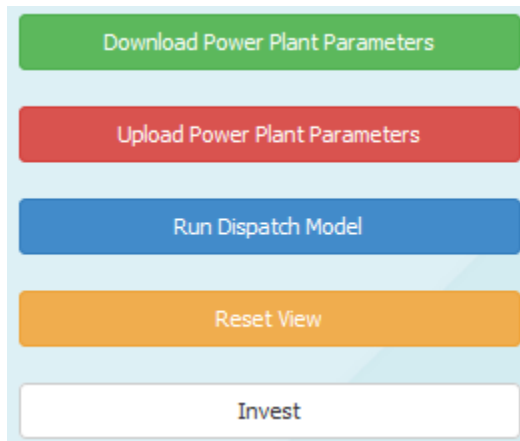
1. Button Section
2. Notification Section with Peak Load and Missing Capacities – Information
3. Output Section



4. Data Section

In the following chapters, each section is described in detail.

2.2 Button Section



2.2.1 Short Description:

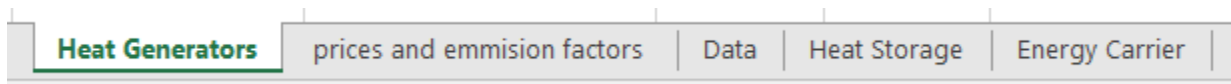
- In this Section, you can download the created structure to save your progress,
- You can upload your saved progress, or a custom structure into the Application,
- You can run the model you created,
- You can reset the view for better workflow or
- You can start an investment model

2.2.2 Long Description:

2.2.2.1 Download

By pressing this button, the browser will try to download a file with the name *download_input.xlsx* that contains all the Information regarding heat producers and heat storages. **The downloaded file has the following format (for uploading the same format must be specified):** It has five worksheets:

2.2.2.1.1 Worksheets



The worksheets have following structure (columns):

- **Heat Generators:**

	A	B	C	D	E	F	G	H	I	J	K	L
1		name	installed capacity (MW_th)	efficiency th	efficiency el	investment costs (EUR/MW_th)	OPEX fix (EUR/MW _a)	OPEX var (EUR/MW _h)	life time	renewable factor	must run [0-1]	type
2	0	Air Heat Pump	500	2.81	0	700000	2000	8.4	25	0	0	heat pump
3	1	heat boiler natural gas	200	0.99	0	150000	1100	0.8	20	0	0	boiler
4	2	Solar Thermal	172	0.8	0	550000	10000	0	20	0	0	Solar Thermal

- **prices and emission factors:**

	A	B	C	D
1		energy carrier	prices(EUR/MWh)	emission factor [tCO2/MWh]
2	0	ambient heat	0	1
3	1	electricity	0	0.8
4	2	gas. Biomass	62	1
5	3	gas/oil	47	0
6	4	natural gas	30	0
7	5	straw	22	1
8	6	various	20	1
9	7	waste	5	0.8
10	8	waste heat 20°	0	1
11	9	waste heat 40°	0	1
12	10	wood chips	22	1
13	11	wood pellets	36	1
14	12	radiation	0	0

• Data:

	A	B	C	D	E
1		CO2 Price [EUR/tCO2]	Interest Rate [0-1]	Minimum Renewable Factor [0-1]	Total Demand[MWh]
2	0	25	0.5	0	600000

• Heat Storage:

	name	Storage Capacity [MWh]	Hourly Storage Losses [%]	maximum unloading power [MW]	maximum loading power [MW]	loading efficiency	unloading efficiency	Investment costs for additional storage capacity [€/MWh]	OPEX fix [€/MWh]	Life Time [a]
0	Storage	1000	1	80	80	0.95	0.52	60	10000	25

• Energy Carrier:

	A	B	C
1		name	carrier
2	0	Air Heat Pump	electricity
3	1	heat boiler natural gas	natural gas
4	2	Solar Thermal	radiation

2.2.2.2 Upload

Upload Power Plant Parameters

By clicking this button, a pop up window will open and you will be able to upload a **xlsx** file. That overwrites the content of the web user interface. The file you upload **must** have the structure as described *before* in the long description of the download powerplant parameters -Button.

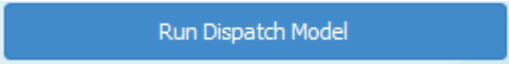
Consider following:

- You have to create a file that has the same names for the *worksheets* and columns
- The worksheet names are case sensitive

- The column names are case sensitive
- You must specify an index column starting with 0
- You can create maximum 13 energy carriers

Following heat generator types are available (type column in the Heat Generators worksheet)

2.2.2.3 Run

A blue rectangular button with the text "Run Dispatch Model" in white.

By Pressing this button, the optimization will start. You will get a progress shown in the notification section. Depending on the structure you create the optimization will run for about 60 to 120 seconds. Please be aware that your browser might freeze at that time. After the solution is found the results are shown in the output section. You can download then the results via the *buttons* in the *notification section*. Also, if something gets wrong you will get information in the notification section. If unexpected errors occur please document and send detailed instruction to reproduce the error and send these instruction with a short problem description.

2.2.2.4 Reset

An orange rectangular button with the text "Reset View" in white.

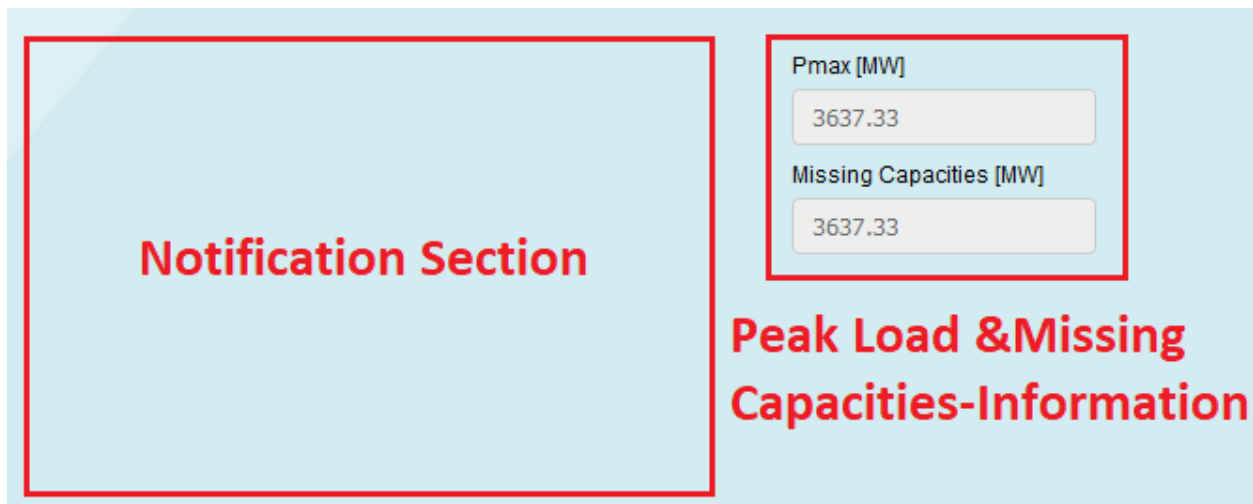
By pressing this button, the notification section and the output section will be cleared, and you will get a “fresh” view.

2.2.2.5 Invest

A light blue rectangular button with the text "Invest" in dark blue.

The Application is implemented as a linear program and can be used on the one hand as a pure dispatch model and on the other hand for investment planning (how much capacities to install) to cover a load profile with the minimum costs. If you enable this toggle button, it is important to specify the heat producers and heat storages by marking them (hold CTRL and left mouse click to select the desired generators and storages) for which an investment model should run.

2.3 Notification Section with Peak Load and Missing Capacities – Information



2.3.1 Short Description:

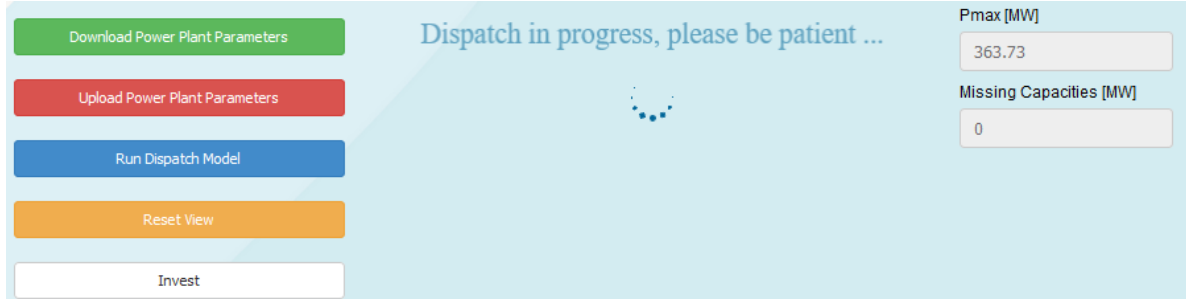
In this section, you will get information regarding the progress, the peak load, missing capacities and errors that occur.

2.3.2 Long Description:

In the following you will see some frequent messages (progress and error information) that might appear in the notification section.

2.3.2.1 After pressing the Run Dispatch Model Button

- **Dispatch in progress, please be patient...** This can take some time. Typically, also to browser can freeze when the calculation is done and the results are rendered in the browser



- **Calculation is Done** With these buttons, you can download your results. It might happen that the page freezes after downloading, please be patient. We recommend also to save the link of these file right click on the buttons Copy Link (after 2 hours this links will not work but you can download the files directly if the page freeze and so save so your time)

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

Calculation done

Download HTML File

Download XLSX File

Download ZIP File

Pmax [MW]

363.73

Missing Capacities [MW]

0

- **No Heat Generators available** This will happen if you haven't specified any heat generators and wanted to start the model from the initial page.

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

No Heat Generators available

Pmax [MW]

3637.33

Missing Capacities [MW]

3637.33

- **The installed capacities are not enough to cover the load** This will be shown when you haven't specified enough MW to cover the peak load (see missing Capacities in the right side of the notification section)

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

The installed capacities are not enough to cover the load

Pmax [MW]

3637.33

Missing Capacities [MW]

3637.33

- **Error: Problem proven to be infeasible or unbounded** This happens typically when constraints cannot be met and can have a lot of reasons, it's upon you to think about what could happen.

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

Error: Problem proven to be infeasible or unbounded.

Pmax [MW]

363.73

Missing Capacities [MW]

0

- **Error: Please specify the technologies for the investment model** This is shown when you enable investment planning but you forgot to select the heat generators and heat storages to mark, with whom it should do an investment optimization

The screenshot shows the interface with the following elements:

- Buttons:** Download Power Plant Parameters (green), Upload Power Plant Parameters (red), Run Dispatch Model (blue), Reset View (orange), Invest (grey).
- Error Message:** "Error: Please specify the technologies for the investment model !!!" and "Mark Heat Generators by pressing 'CTRL' + 'left mouse'". Below it, "Selection is marked yellow".
- Inputs:** Pmax [MW] (363.73) and Missing Capacities [MW] (0).

2.3.2.2 After Pressing the Download Button

- **Nothing to download** Typically, this occurs when you want to download the initial page, to download you need to *add* first a heat generator

The screenshot shows the interface with the following elements:

- Buttons:** Download Power Plant Parameters (green), Upload Power Plant Parameters (red), Run Dispatch Model (blue), Reset View (orange), Invest (white).
- Message:** "Nothing to download".
- Inputs:** Pmax [MW] (3637.33) and Missing Capacities [MW] (3637.33).

The screenshot shows the interface with the following elements:

- Buttons:** Download Power Plant Parameters (green), Upload Power Plant Parameters (red), Run Dispatch Model (blue), Reset View (orange), Invest (grey).
- Message:** "Download done."
- Inputs:** Pmax [MW] (363.73) and Missing Capacities [MW] (0).

- **Download done**

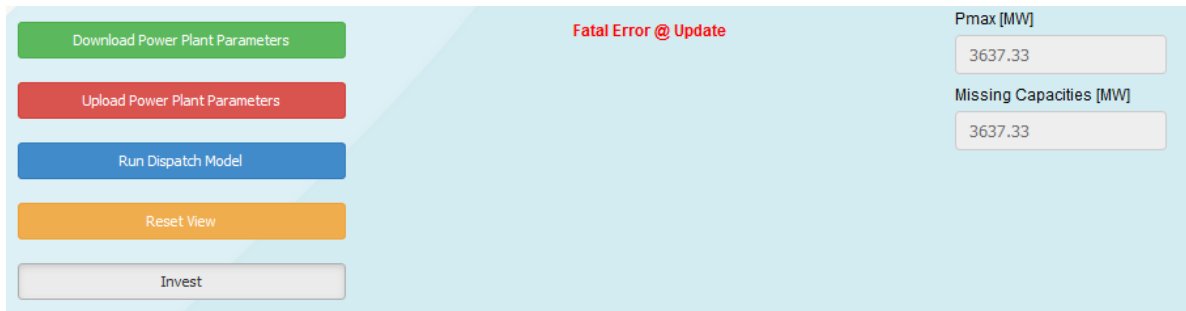
2.3.2.3 After Pressing the Upload Button

- **Not a valid file to upload** This is shown when you try to upload a filetype other than .xlsx

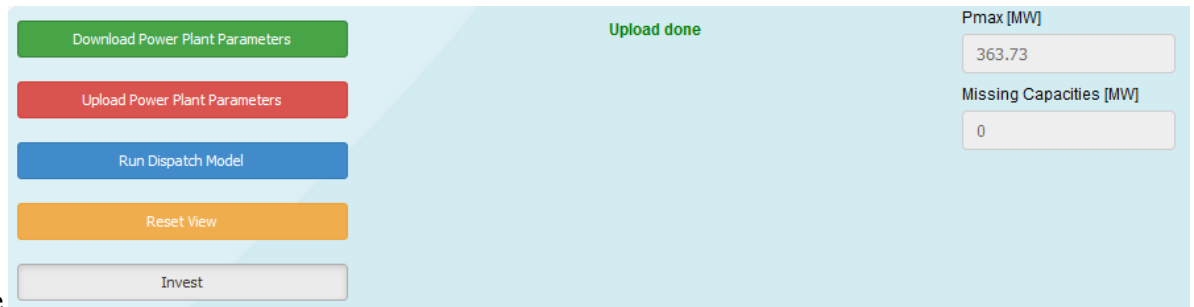
The screenshot shows the interface with the following elements:

- Buttons:** Download Power Plant Parameters (green), Upload Power Plant Parameters (red), Run Dispatch Model (blue), Reset View (orange), Invest (grey).
- Message:** "Not a valid file to upload".
- Inputs:** Pmax [MW] (363.73) and Missing Capacities [MW] (0).

- **Fatal Error @ Update** This is shown when your file you want to upload has not the needed *structure*.

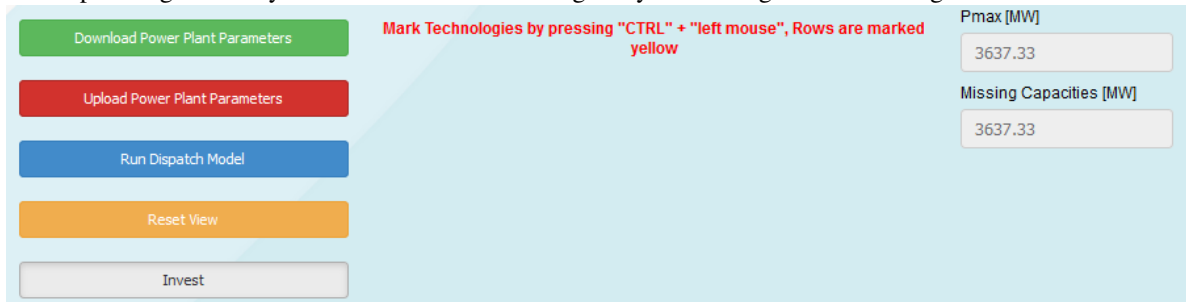


- **Upload Done**



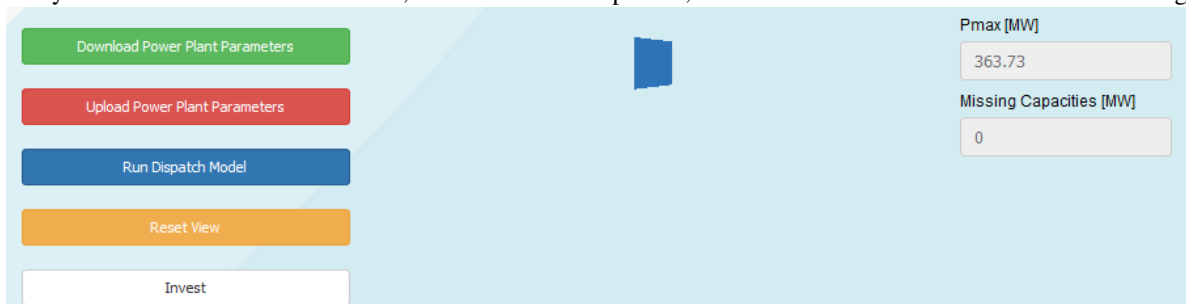
2.3.2.4 After Pressing the Invest Button

- **Mark Technologies by pressing “CTRL” + “left mouse”** Rows are marked yellow As soon as you press the Invest Button you will see this Information in the notification section, it tells you that you need to specify for which generators and storages to do the investment planning. If you don't mark technologies you will get the message as described [here](#)

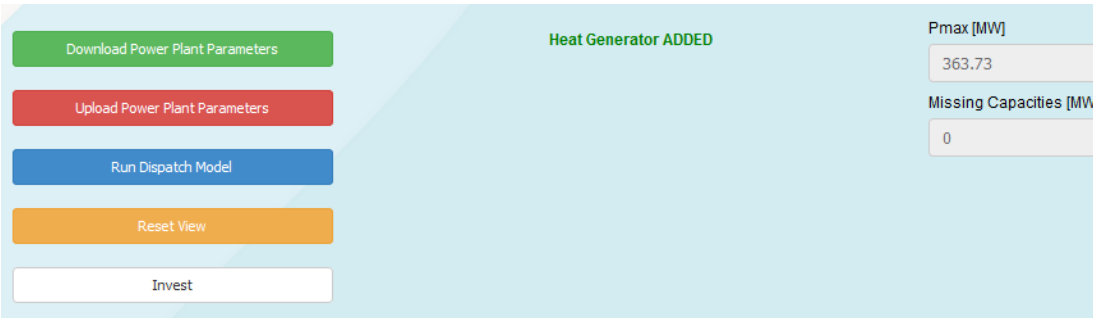


2.3.2.5 After Pressing the + Button in the Heat Producers and Heat Storage Tab

- This waiting spinner is especially visible after pressing the + Button, typically the browser freezes, so be patient, the *add* section is loading

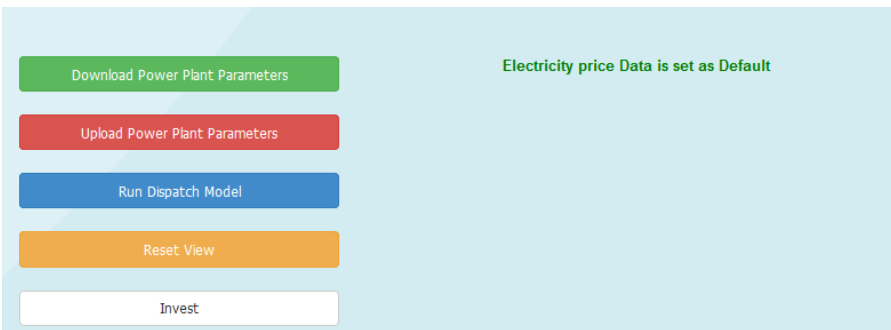


2.3.2.6 After Pressing the ✓ ADD Button in the Heat Generator Adding Section



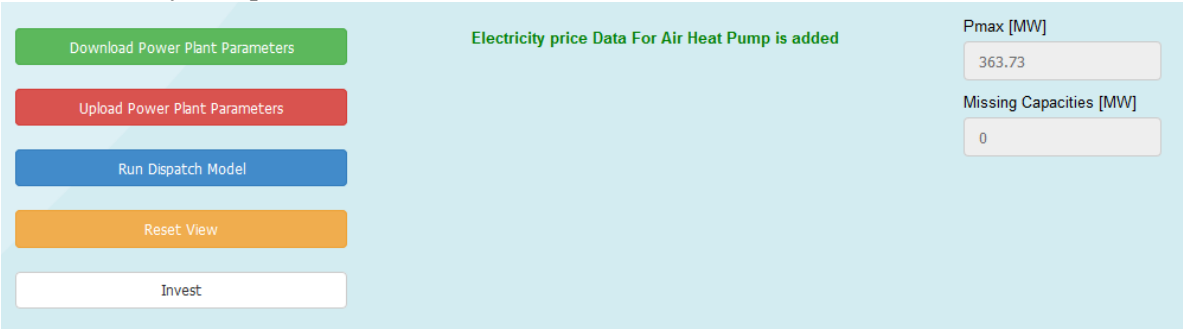
- Heat Generator ADDED

2.3.2.7 After Pressing the ✓ - Button in the Sale-/Electricity Price Tab



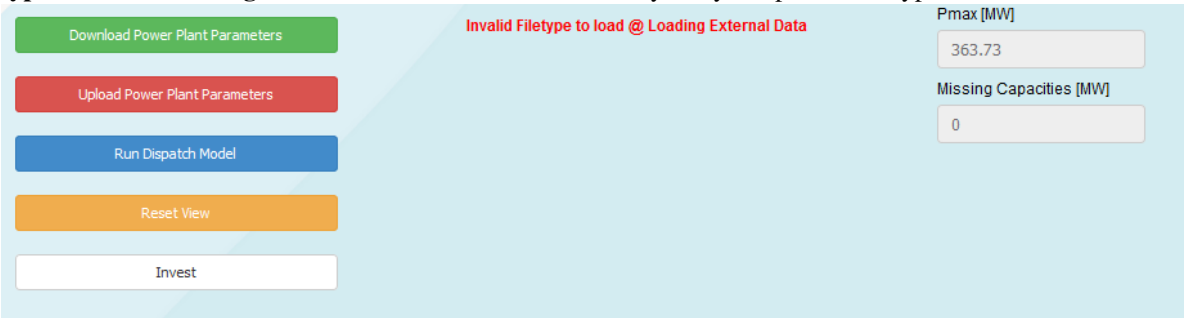
- Sale-/Electricity price Data is set as Default

- Sale-/Electricity price Data for Heat Generator name is added



2.3.2.8 After Uploading a file in the Load Individual Data Tab

- Invalid Filetyp to load @ Loading External Data This is shown when you try to upload a filetype that is not



.xlsx or .csv

- **Your file has not enough values (please specify 8760 values)** Your file that you upload has to have the structure as described *here*

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

Your File has not enough values (please specify 8750 values)

Pmax [MW]
363.73

Missing Capacities [MW]
0

- **External Data Loaded** This is shown when the external Data has been *uploaded*.

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

External Data Loaded

Pmax [MW]
363.73

Missing Capacities [MW]
0

2.3.2.9 After Pressing the ✓ Save Button in the Load Individual Data –Tab

- **External Data *name* added to Profile as *name_1*** This is shown after adding a custom data to the profiles as de-

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

External Data individual added to Radiation as individual_1

Pmax [MW]
363.73

Missing Capacities [MW]
0

scribed *here*

- **n_{th}/COP - External Data added to Heat Generator name** This is shown after adding a custom data for the thermal efficiency to a heat generator as described *here*

Download Power Plant Parameters

Upload Power Plant Parameters

Run Dispatch Model

Reset View

Invest

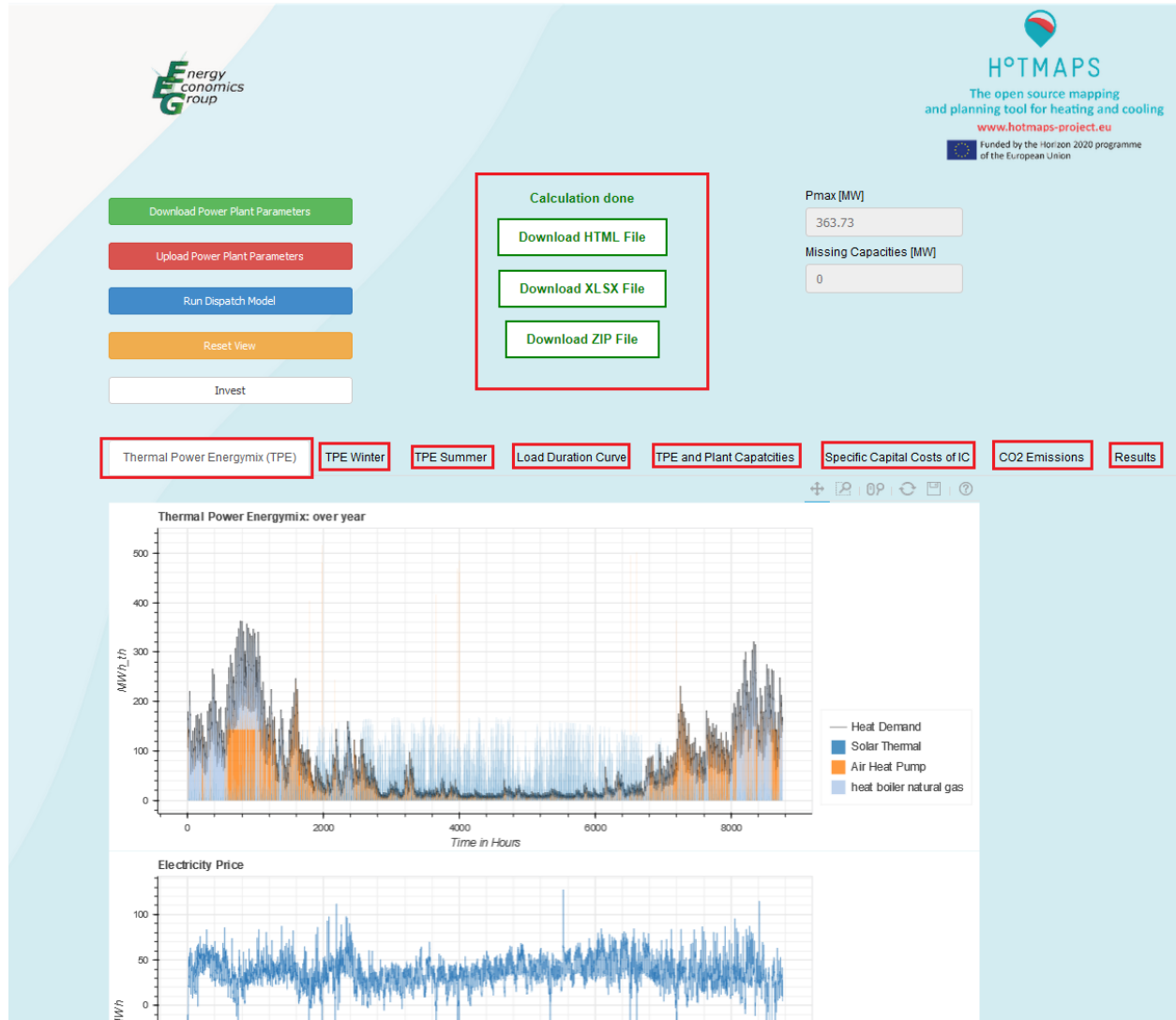
n_{th}/COP - External Data added to Air Heat Pump

Pmax [MW]
363.73

Missing Capacities [MW]
0

2.4 Output Section

2.4.1 Short Description:



2.4.2 Long Description:

2.5 Data Section

2.5.1 Heat Producers and Heat Storage – Tab

The screenshot displays the 'Heat Producers and Heat Storage' tab. At the top, there are navigation buttons: 'Heat Producers and Heat Storage', 'Adding', 'Parameters', 'Prices & Emission factors', 'Profiles', and 'Load Individual Data'. Below these, the 'HEAT GENERATORS' section is highlighted with a red border. It contains a table header with the following columns: #, name, installed capacity (MW_th), efficiency th, efficiency el %, investment costs (EUR/MW_th), OPEX fix (EUR/MWh), OPEX var (EUR/MWh), life time, renewable factor, and must run [0-1]. Below the header is a large red text area labeled 'Heat Generator Table'. The 'HEAT STORAGES' section is also highlighted with a red border. It contains a table header with the following columns: #, name, Storage Capacity (MWh), Hourly Storage Losses [%], maximum unloading power (MW), maximum loading power (MW), loading efficiency, unloading efficiency, investment costs for additional storage capacity (€/MWh), OPEX fix (€/MWh), and Life Time [a]. Below the header is a large red text area labeled 'Heat Storage Table'.

2.5.1.1 Short Description:

In this Tab, the *created* or *uploaded* heat generator and heat storage data is shown in two tables (heat storage table and heat generator table). The above picture shows the initial page (no heat generators and no heat storages are defined).

Please notice that it is possible to edit the values in the tables.

By pressing the + Button you will be navigated to the *Adding Tab*, for adding new heat generators or *heat storages*, pops up between the button section and the output section (see picture below) *.

- **Section After Pressing + Button in the *Heat Generator Table***

Heat Producers and Heat Storage

Adding

Parameters

Prices & Emission factors

Profiles

Load Individual Data

Add Heat Generators

Add Heat Storages

Add Heat Generator:

heat pump

Select a heat pump:

heat pump - High Temperature -Geo Thermal (60°C)

Technical Parameters

Coefficient of Performance, COP

Finance Parameters

Model Parameters

Energy Carrier

ambient heat

Name

heat pump - High Temperature -Geo Thern

Thermal Efficiency

48.67

Electrical Efficiency

0.0

✓ ADD

✗ CANCEL

• Section After Pressing + Button in the *Heat Storage Table*

Heat Producers and Heat Storage

Adding

Parameters

Prices & Emission factors

Profiles

Load Individual Data

Add Heat Generators

Add Heat Storages

Select a Heat Storage:

default heat storage

Technical Parameters

Finance Parameters

Model Parameters

name

default heat storage

Storage Capacity [MWh]

0

maximum loading power [MW]

80

maximum unloading power [MW]

80

loading efficiency: 0.95

unloading efficiency: 0.52

✓ ADD

✗ CANCEL

2.5.1.2 Long Description:

2.5.1.2.1 Heat Generator Table

HEAT GENERATORS + x										
#	name	installed capacity (MW _{th})	efficiency th	efficiency el	investment costs (EUR/MW _{th})	OPEX fix (EUR/MWh)	OPEX var (EUR/MWh)	life time	renewable factor	must run [0-1]
0	Air Heat Pump	100	46.67	0	700000	2000	8.4	25	0	0
1	Boller	500	0.85	0	800000	0	5.4	20	0	0
2	CHP Steam Extraction Wo...	200	0.64	0.29	4000000	29000	3.9	30	0	0
3	waste treatment	500	0.98	0	1200000	54000	5.6	20	0	0
4	Solar Thermal	300	0.8	0	550000	10000	0	20	0	0

Your *added* (by pressing the + Button) or *uploaded data* of heat generators is shown here. You have the opportunity to change the values of the table *.

These parameters can also be changed via *uploading*. Therefore you have to create an excel sheet with the structure as described *here*. Then the parameters must be specified in the *Heat Generators worksheet*.

Format, unit and description of the Heat Generators Table

*Caution: In this table, it is not possible to change the heat generators *type* or *energy carrier*. The type is either defined by the *type* column in the *Heat Generators* worksheet when uploading power plant parameters or internally by adding from the user interface in the *Add new Heat Generator Section*. The same applies for the energy carriers, they can only be adapted via uploading an excel file (*energy carrier* worksheet) or via the internal *adding section*.

2.5.1.2.2 Heat Storage Table

HEAT STORAGES + x										
#	name	Storage Capacity (MWh)	Hourly Storage Losses [%]	maximum unloading power [M]	maximum loading power [MW]	loading efficiency	unloading efficiency	Investment costs for additional	OPEX fix (EUR/MWh)	Life Time [a]
0	Storage	1000	1	80	80	0.95	0.52	60	10000	25
1	default heat storage	5000	1	200	200	0.8	0.8	60	10000	25

You have the opportunity to change the values of the table *. These parameters can also be changed via *uploading*. Therefore you have to create an excel sheet with the structure as described *here*. Then the parameters must be specified in the *Heat Storage worksheet*.

Format, unit and description of the Heat Storages Table

*Caution: Please be aware that only one heat storage is available, e.g. if you don't upload others only this storage will be editable. The + Button for heat storages does nothing, the implementation is in progress and in future this feature will become available.

2.5.1.2.3 Add new Heat Generator Section

Add Heat Generator:

heat pump

Select a heat pump:

heat pump - High Temperature -Geo Thermal (60°C)

Coefficient of Performance, COP

Technical Parameters

Finance Parameters

Model Parameters

Return Temperature

40°C

Inlet Temperature

70°C

COP

48.67

✓ ADD ✗ CANCEL

By pressing the + Button in the *Heat Generators Table* the above section pops up (please be patient this will take some time). All heat generators have the three red marked tabs in common, only for heat pumps an extra tab is shown (Coefficient of Performance, COP)

The picture below shows you all predefined heat generator types, that means by selection one of these, predefined values are loaded. You can see and edit the values in the *Technical Parameters Tab* and in the *Finance Parameters Tab*, but you can also change them in later in the *Heat Generator Table*. (after pressing ✓ ADD)

2.5.1.2.3.1 Available Heat Genrators

Add Heat Generator:

heat pump

heat pump

boiler

CHP Steam Extraction

CHP Back Pressure

waste treatment

Solar Thermal

Power To Heat

Waste Heat

Geo Thermal

COP

48.67

al (60°C)

Flow Temperature

70°C

ical Parameters

Finance Parameters

Model Parameters

✓ ADD

✗ CANCEL

2.5.1.2.3.2 Available types of boilers

Add Heat Generator:

boiler

Select a boiler:

heat boiler natural gas

heat boiler natural gas

heat boiler wood chips

heat boiler wood pellets

heat boiler straw

heat boiler electricity

natural gas

ers

Model Parameters

Name

heat boiler natural gas

Thermal Efficiency

1.03

Electrical Efficiency

0.0

✓ ADD

✗ CANCEL

2.5.1.2.3.3 Available types of heat pumps

Add Heat Generator:

heat pump

Select a heat pump:

heat pump - High Temperature -Geo Thermal (60°C)

heat pump - High Temperature -Geo Thermal (60°C)

heat pump - Default

heat pump - River 5°C

heat pump - River 10°C

Return Temperature

40°C

New Temperature

70°C

COP

48.67

✓ ADD ✗ CANCEL

2.5.1.2.3.4 Available types of CHP-Steam Extraction types

Add Heat Generator:

CHP Steam Extraction

Select a CHP Steam Extraction:

CHP-SE steam turbine (medium) wood chips

CHP-SE steam turbine (medium) wood chips

CHP-SE steam turbine (small) wood chips

CHP-SE steam turbine (medium) straw

CHP-SE steam turbine (small) straw

CHP-SE waste treatment waste

CHP-SE CC gas turbine/ steam extraction turbine gas/oil

Thermal Efficiency

0.64

Electrical Efficiency

0.29

✓ ADD ✗ CANCEL

2.5.1.2.3.5 Available types of CHP-Back Pressure types

Add Heat Generator:

CHP Back Pressure

Select a CHP Back Pressure:

CHP-BP stirling engine gas. Biomass

CHP-BP stirling engine gas. Biomass

CHP-BP spark ignition natural gas

CHP-BP spark ignition gas. Biomass

CHP-BP CC gas turbine/ back-pressure turbine gas/oil

Energy Carrier

gas. Biomass

CHP Back Pressure

Thermal Efficiency

0.58

Electrical Efficiency

0.2

✓ ADD ✗ CANCEL

2.5.1.2.3.6 Technical Parameters – Tab

Add Heat Generator:

heat pump

Select a heat pump:

heat pump - Default

Coefficient of Performance, COP

Technical Parameters

Finance Parameters

Model Parameters

Energy Carrier

ambient heat

Name

heat pump - Default

Thermal Efficiency

5.01

Electrical Efficiency

0.0

✓ ADD ✗ CANCEL

- Here you can select the energy carrier with which the heat generator is fired. You can define a name and set the thermal and electrical efficiency. For heat pumps the input for Thermal Efficiency is disabled, because

it is defined via the *Coefficient of Performance, COP – Tab*. Each *heat generator* has predefined values that are shown here. You can and should change them.

Select a Heat Storage:

default heat storage ▼

Technical Parameters Finance Parameters Model Parameters

name: default heat storage

Storage Capacity [MWh]: 0

maximum loading power [MW]: 80

maximum unloading power [MW]: 80

loading efficiency: 0.95

unloading efficiency: 0.52

✓ ADD ✗ CANCEL

- Here you can define the technical parameters for your heat storage

2.5.1.2.3.7 Finance Parameters – Tab

Add Heat Generator:

heat pump ▼

Select a heat pump:

heat pump - Default ▼

Coefficient of Performance, COP Technical Parameters Finance Parameters Model Parameters

investment costs (EUR/MW_{th}): 700000

life time (a): 25

OPEX fix (EUR/MW_a): 2000

OPEX var (EUR/MWh): 8.4

✓ ADD ✗ CANCEL

- Here you can see and change predefined values of financial parameters for selected heat generator.

Select a Heat Storage:

default heat storage ▼

Technical Parameters Finance Parameters Model Parameters

Investment costs for additional storage capacity [€/MWh]

60

OPEX fix [€/MWh]

10000

Life Time [a]

25

✓ ADD ✖ CANCEL

- Here you can set the financial Parameters for your heat storage.

2.5.1.2.3.8 Model Parameters -Tab

Add Heat Generator:

heat pump ▼

Select a heat pump:

heat pump - Default ▼

Coefficient of Performance, COP Technical Parameters Finance Parameters Model Parameters

Must Run

Renewable Factor: 0

Installed Capacity: 0

✓ ADD ✖ CANCEL

- In this Tab, you can set the orange toggle Button Must Run, that mean that this heat generator must run all the time with 100% of its capacity (for more details see [here](#)) With one slider, you can set a renewable factor (values from 0 to 1, more details see [here](#)) and with the other you can set the installed capacity of your heat generator (values from 0 to *P_{max}*, -Peak Load of the selected Heat Profile)

Select a Heat Storage:

default heat storage ▼

Technical Parameters Finance Parameters **Model Parameters**

Hourly Stoarge Losses [%]: 1

✓ ADD ✗ CANCEL

- In this Tab, you can set heat storage losses, please specify losses because if losses are zero it can happen that the storage is loading and unloading at the same time

2.5.1.2.3.9 Coefficient of Performance, COP – Tab

Coefficient of Performance, COP Technical Parameters Finance Parameters Model Parameters

Return Temperature Inlet Temperature

40°C 70°C

COP

48.67

✓ ADD ✗ CANCEL

Only heat pumps have this additional tab. Here you can select an Inlet-and-Return-Temperature and based on that selection a COP is defined. In the *Technical Parameters Tab* the COP value is inserted into the thermal efficiency input widget (the widget itself is disabled, meaning you cannot edit the value here, but you can change it later in the *heat generators table*)

2.5.2 Parameters – Tab

Heat Producers and Heat Storage		Adding	Parameters	Prices & Emission factors	Profiles	Load Individual Data	
#	CO2 Price [EUR/tCO2]			Interest Rate [0-1]		Minimum Renewable Factor [0-1]	Total Demand[MWh]
0	25			0.5		0	6000000

2.5.2.1 Short Description:

In this tab, you can change following parameters

These parameters can also be changed via *uploading*. Therefor you have to create an excel sheet with the structure as described *here*. Then the parameters must be specified in the *data worksheet*.

2.5.3 Prices & Emission factors – Tab

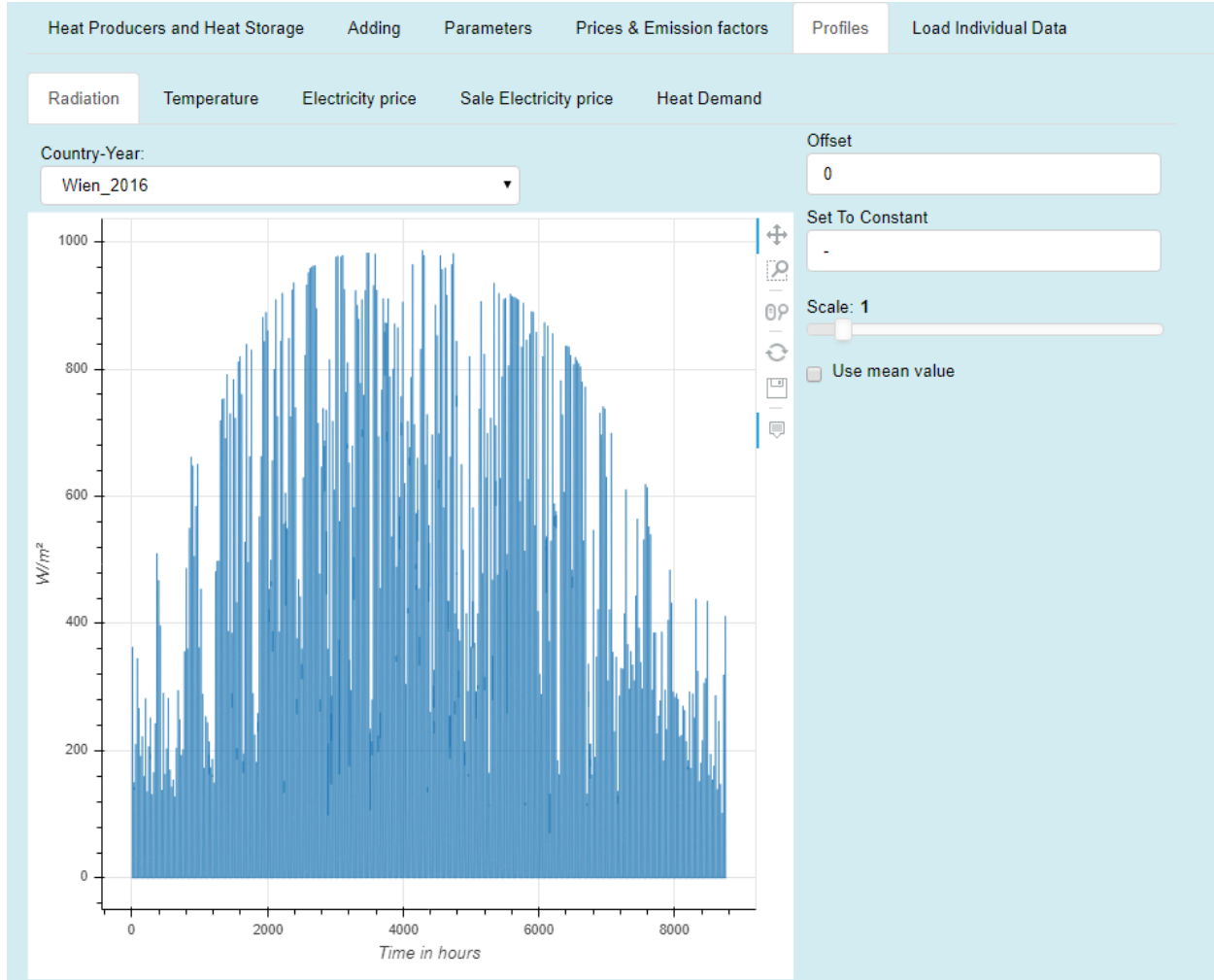
Heat Producers and Heat Storage		Adding	Parameters	Prices & Emission factors	Profiles	Load Individual Data
#	energy carrier			prices(EUR/MWh)	emission factor [tCO ₂ /MWh]	
0	ambient heat			0	1	
1	electricity			NaN	0.8	
2	gas Biomass			62	1	
3	gas/oil			47	0	
4	natural gas			30	0	
5	straw			22	1	
6	various			20	1	
7	waste			5	0.8	

2.5.3.1 Short Description:

In this Tab, you can set prices and emission factors for different energy carriers. These prices are used to calculate the short run marginal costs.

These parameters can also be changed via [uploading](#). Therefor you have to create an excel sheet with the structure as described [here](#). Then the parameters must be specified in the *prices and emission factors worksheet*. With the uploading method, you can create your own energy carriers (max. 13). If you create new ones don't forget to specify the new names to your heat generators in the *Energy Carrier worksheet*.

2.5.4 Radiation – Tab



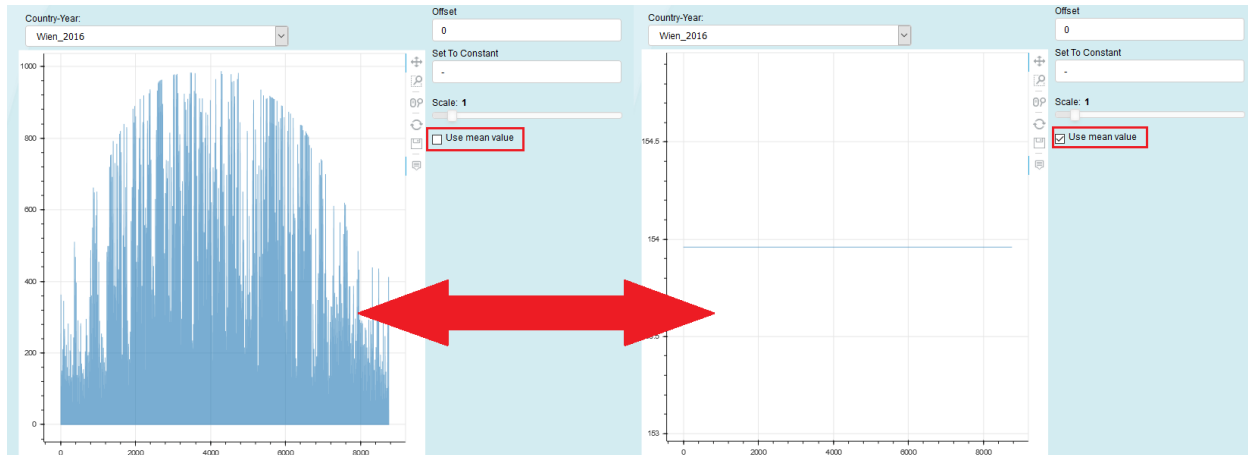
2.5.4.1 Short Description:

- In this Tab, you can select (*Country-Year* drop-down-box) a predefined or a custom radiation profile with which you want to run the Application.
- If you have created your own profile with the *Load Individual Data - Tab* the profile will show up in *Country-Year* drop-down-box (*Caution please*).
- The Unit of the profile is W/m^2 and the model use this profile for the solar thermal power plants. For hours where the radiation is larger than 1000 W/m^2 the plant works with it peak capacities installed .

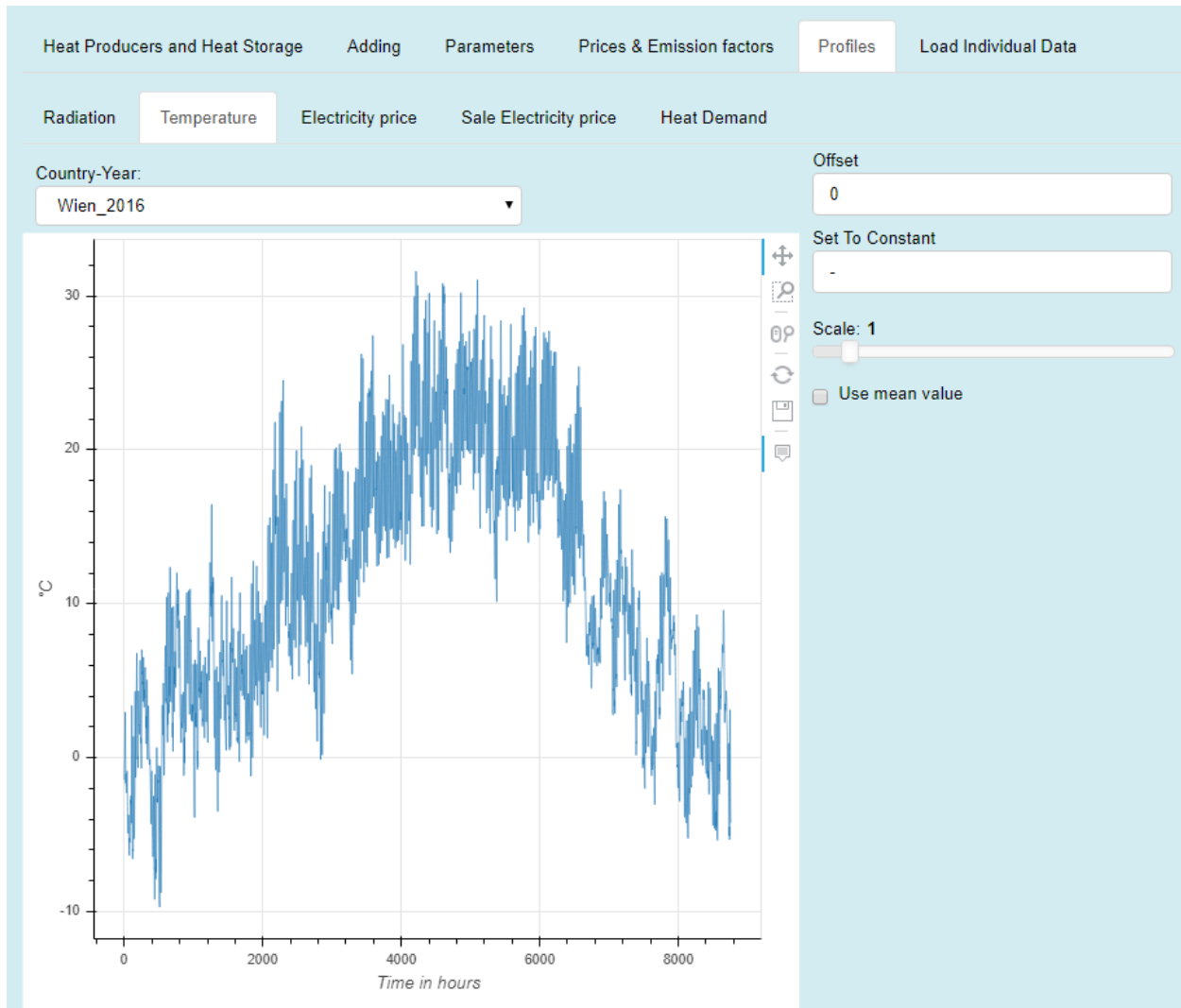
You have the opportunity to make **reversible* modifications on the profile:

- you can set an offset (every value of the profile will be added by the offset value),
- you can set the whole profile to a constant value
- you can scale the profile (multiplication by a factor)
- or you can use the mean value as constant profile.

*By reversible we mean e.g. if you check the use mean value checkbox and uncheck again you will get your profile back (see picture below), the same applies if you set a constant value and then delete this value you will get the profile back, see in contrast the irreversible *modification tool* in the [Load Individual Data - Tab](#)).



2.5.5 Temperature – Tab

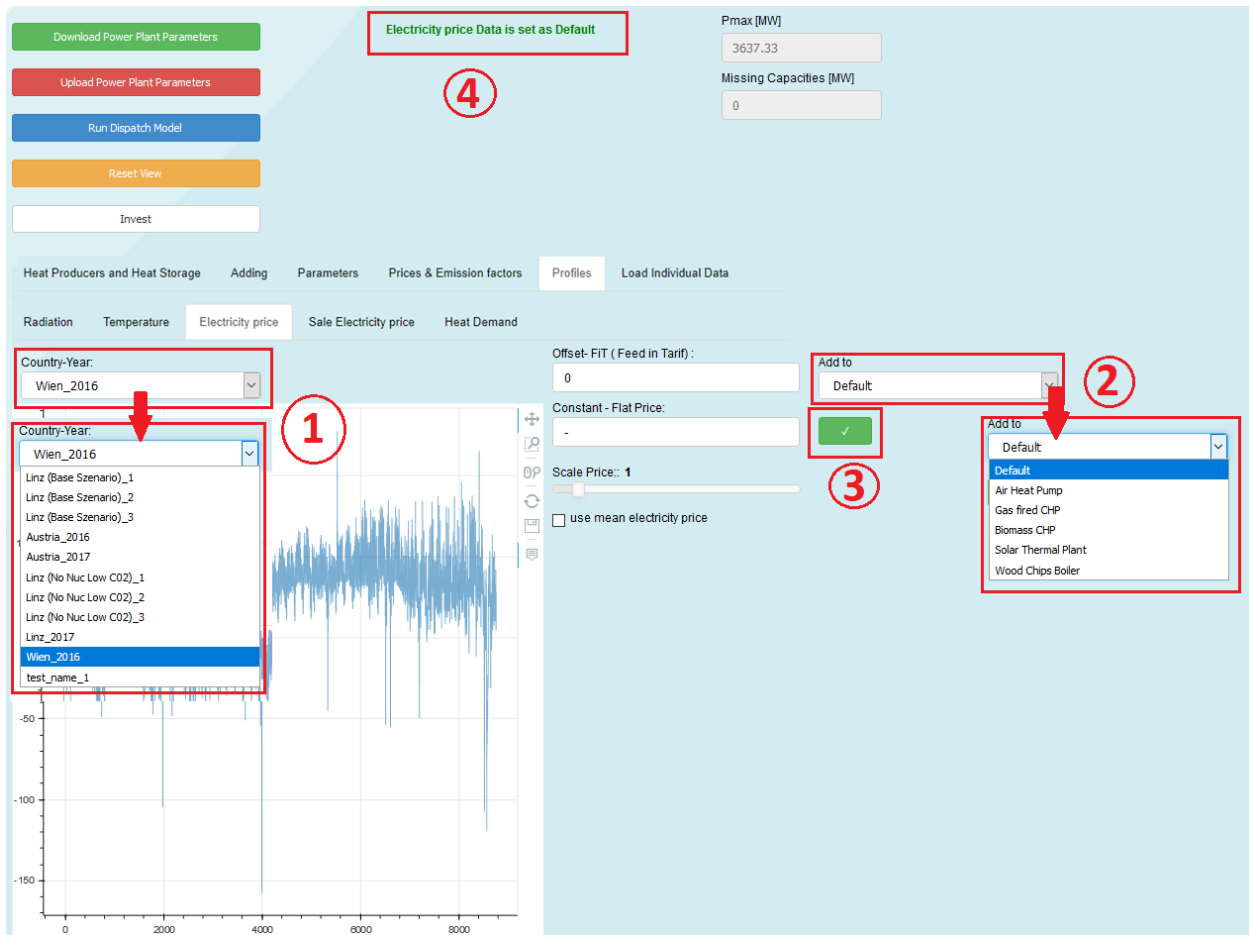


2.5.5.1 Short Description:

- In this Tab, you can select (*Country-Year* drop-down-box) a predefined or a custom temperature profile with which you want to run the Application.
- If you have created your own profile with the *Load Individual Data - Tab* the profile will show up in *Country-Year* drop-down-box (*Caution please*).
- The Unit of the profile is °C and the model use this profile for the heat pumps. For hours where the temperature is smaller than 0°C the heat pumps don't work.
- You have the opportunity to make reversible modifications on the profile (details see *here*).

2.5.6 Electricity price / Sale Electricity price – Tab

Process to assigning a sale-/or electricity price profile



2.5.6.1 Short Description:

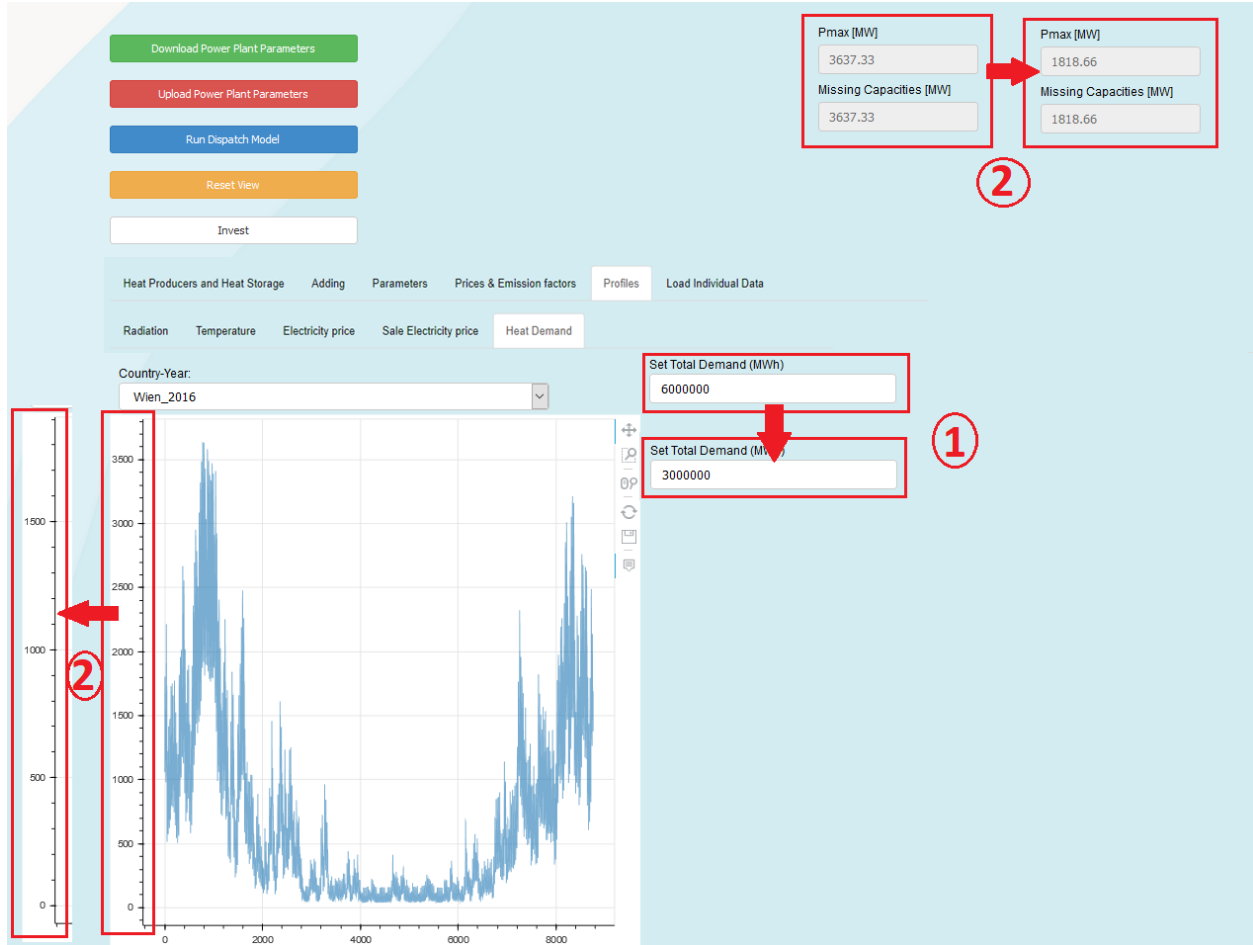
- In this Tabs, you can select (*Country-Year* drop-down-box) a predefined or a custom sale-/electricity price profile and then assign it to a generator (*Add to* drop-down-box) by pressing the ✓ - Button *.
- If you have created your own profile with the *Load Individual Data - Tab* the profile will show up in *Country-Year* drop-down-box (*Caution please*).
- The Unit of the profile is **€/MWh** and the model uses this for multiple purposes, e.g:
 - If the energy carrier is electricity this influences the short run marginal costs
 - If your generator produces electricity this affects the revenues
- Also, here you have the opportunity to make reversible modifications on the profile (details see *here*).

***Caution:** It is important to press the ✓ - Button, because only so changes take effect: e.g. Let's say we want to change the **default** electricity price (see picture above):

1. you select a new profile with the *Country-Year* drop-down-box
2. select **Default** in the *Add to* drop-down-box then
3. press the ✓ - Button,
4. then you will get an information in the notification section,

this is the only way to assign a price profile, otherwise the initial profile or the last set profile is used.

2.5.7 Heat Demand – Tab



2.5.7.1 Short Description:

- In this Tab, you can select (*Country-Year* drop-down-box) a predefined or a custom load profile with which you want to run the Application.
- If you have created your own profile with the *Load Individual Data - Tab* the profile will show up in *Country-Year* drop-down-box (*Caution please*).
- The Unit of the profile is **MW** and the model use this profile as the hourly heat demand curve.

You have the opportunity to set the total heat consumption of one year. By this you set technically the sum of all values of the profile selected.

This means if the Set Total Demand (MWh) value changes the plot will adapt so that the sum you specified is met, also the Total Demand [MWh] value in the *Parameters Tab* will change to the value specified (and vice versa). Additionally, in the notification section you can see how the peak load changes when you change the total heat consumption (see picture above).

2.5.8 Load Individual Data – Tab

2.5.8.1 Short Description:

2.5.8.1.1 Upload External Data – Button

Pressing this button will enable you to upload your own data

2.5.8.1.2 Create Data – Tools

Here you can create random data. You can choose between three distributions

1. Dirichlet Distribution
2. Normal Distribution
3. Linear Distribution

2.5.8.1.3 Table

The values of the uploaded data or the created distribution are shown here. You can also change specific values inside the table.

2.5.8.1.4 Plot Area

Here a line plot of the values from the table is shown. With the toolbar at the right sight of the plot area you can inspect the data in more detail.

2.5.8.1.5 Modification Tools

You have the opportunity to modify the data with these tools, e.g. set the sum of all values, set an offset, scale, etc.

2.5.8.1.6 Saving Tools

After loading your custom data, or creating a distribution you can choose for which profile you want this dataset to be added. By Pressing the save button your data can be found at the selected profiles and can be used by selecting it with the name you specified.

It is also possible to add your own thermal efficiency series to heat generators.

2.5.8.2 Long Description:

2.5.8.2.1 Upload External Data

Upload External Data

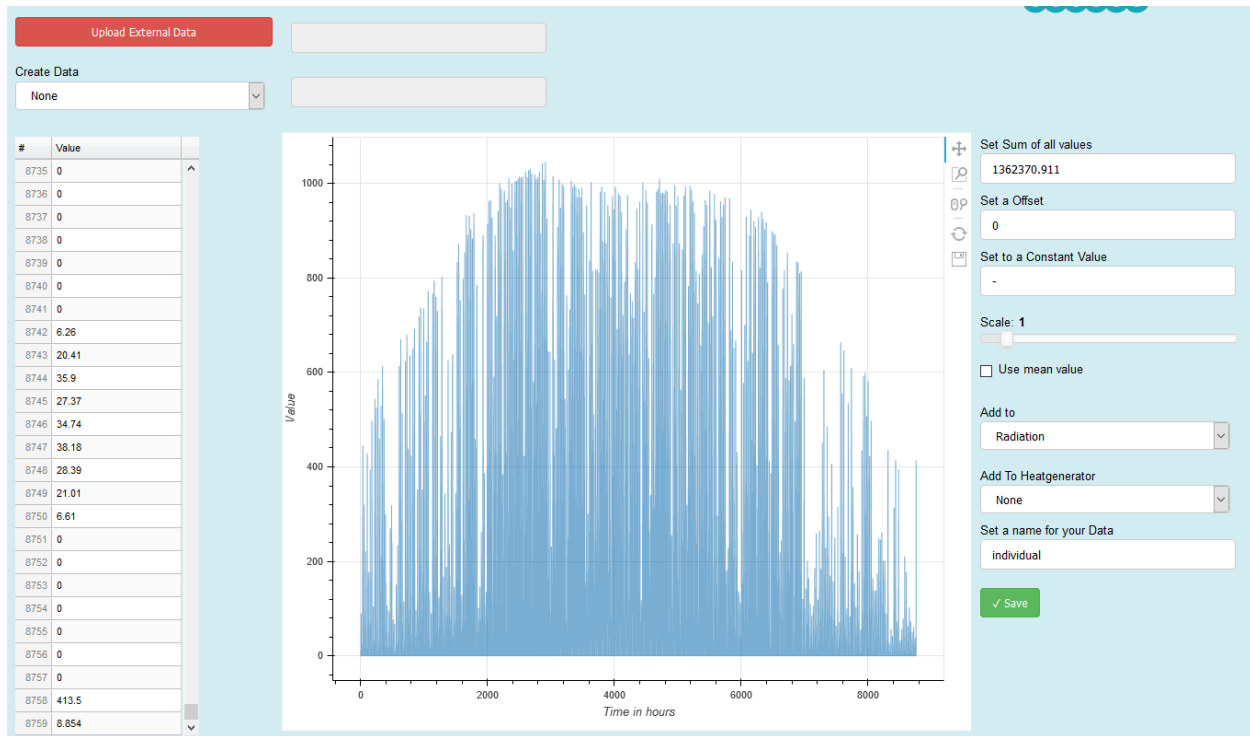
When you click on this button you will get a pop up window open, where you can select your file with the desired values. Information regarding the progress are shown in the notification section. **The file you upload must have following structure:**

1. It has to be either a **.xlsx** or a **.csv** data
2. the files **must** have the **structure** as below (left: *.xlsx*, right: *csv*)

	A		
1	header_name	1	header_name
2	3.142	2	3.142
3	2.718	3	2.718
4	6.673	4	6.673
5	6.626	5	6.626
6	9.798	6	9.798
...	...	...	...
8760	413.5	8760	413.5
8761	8.854	8761	8.854

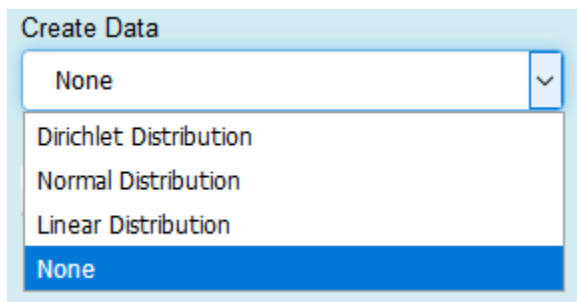
3. you have to specify **8760 values** and a **header name**
4. for *.xlsx* only the values of the **first worksheet** will be **uploaded**

An example of a successful upload can be seen in the picture below.



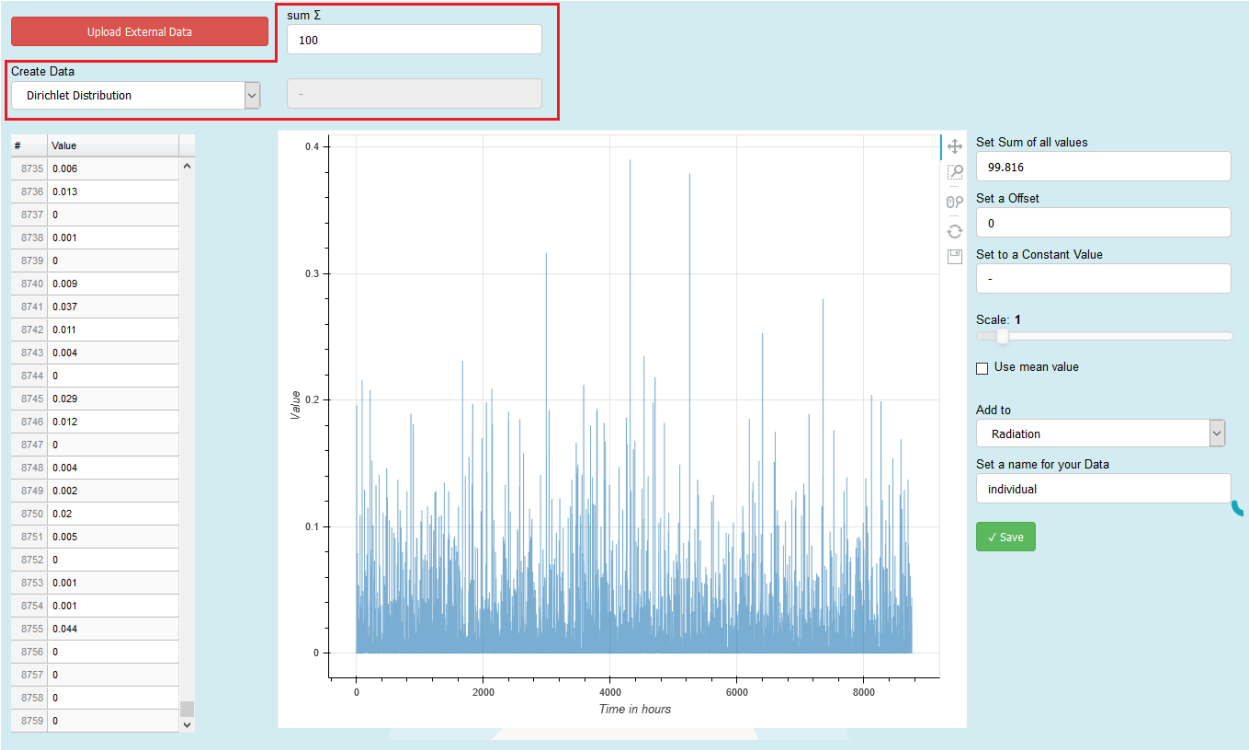
2.5.8.2.2 Create Data Tool

This part of the user interface enables you to create random data. For this purpose, following distributions are available



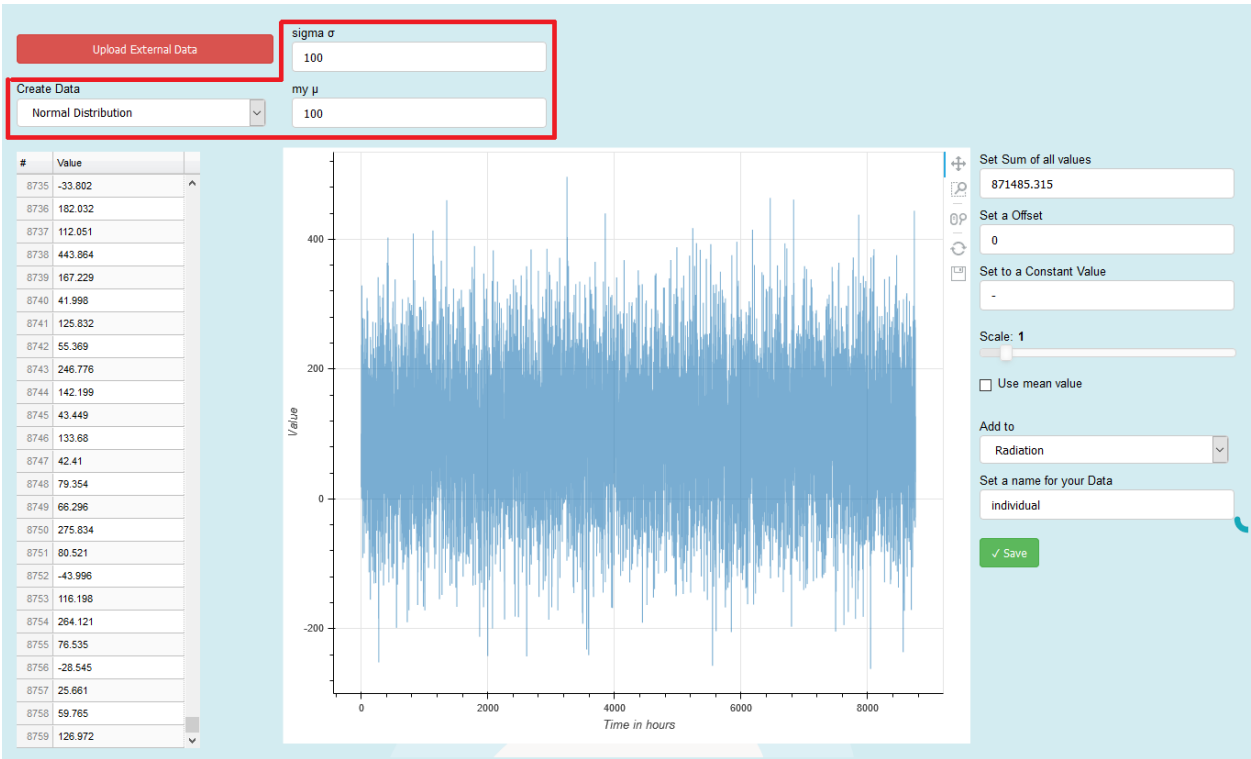
2.5.8.2.2.1 Dirichlet Distribution:

To use this distribution, you have to specify the $\sum$ - input widget. It gives you random numbers so the sum you specify is met. An example with $\sum=10$ is shown below.



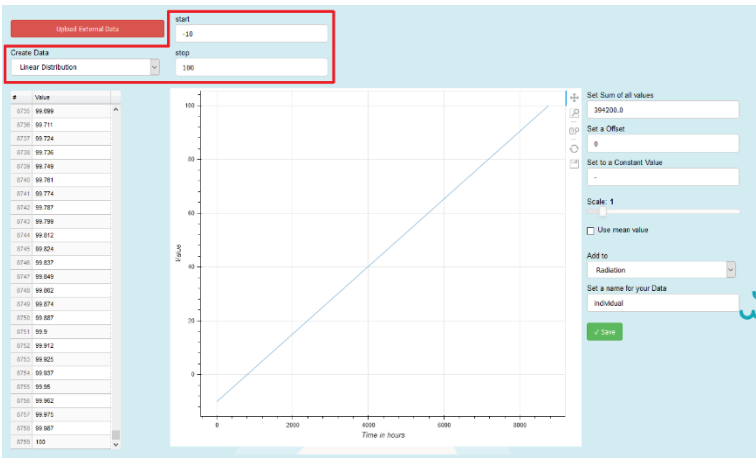
2.5.8.2.2 Normal Distribution

Another option to create random number is the gaussian-normal-distribution. To use this, you have to specify a mean value (sigma σ) and standard deviation from that value my μ . Below is a normal distribution with $\sigma = 100$ and $\mu = 100$ shown.

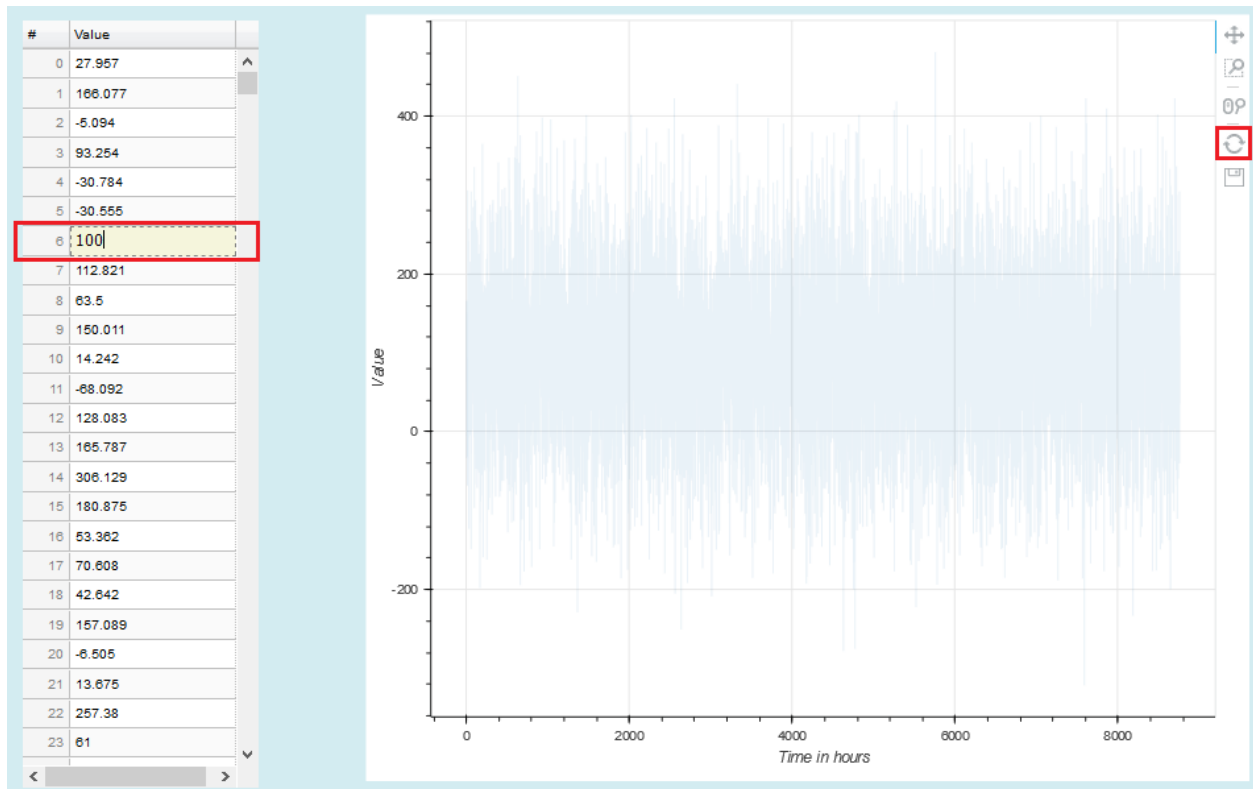


2.5.8.2.2.3 Linear Distribution

We this option you can create 8760 number that are linear distributed beginning from start and ending with stop. An example with start=-10 and stop=100 is shown below.



2.5.8.2.3 Table and Plot Area



The values of the uploaded data or the created distribution are shown here in tabular and graphical form. You can also change specific values inside the table, in that case the cell you are editing become yellow and the graph is blurred. After editing press, the reset button on the toolbar to remove the blur.

2.5.8.2.4 Modification Tools

Set Sum of all values

Set a Offset

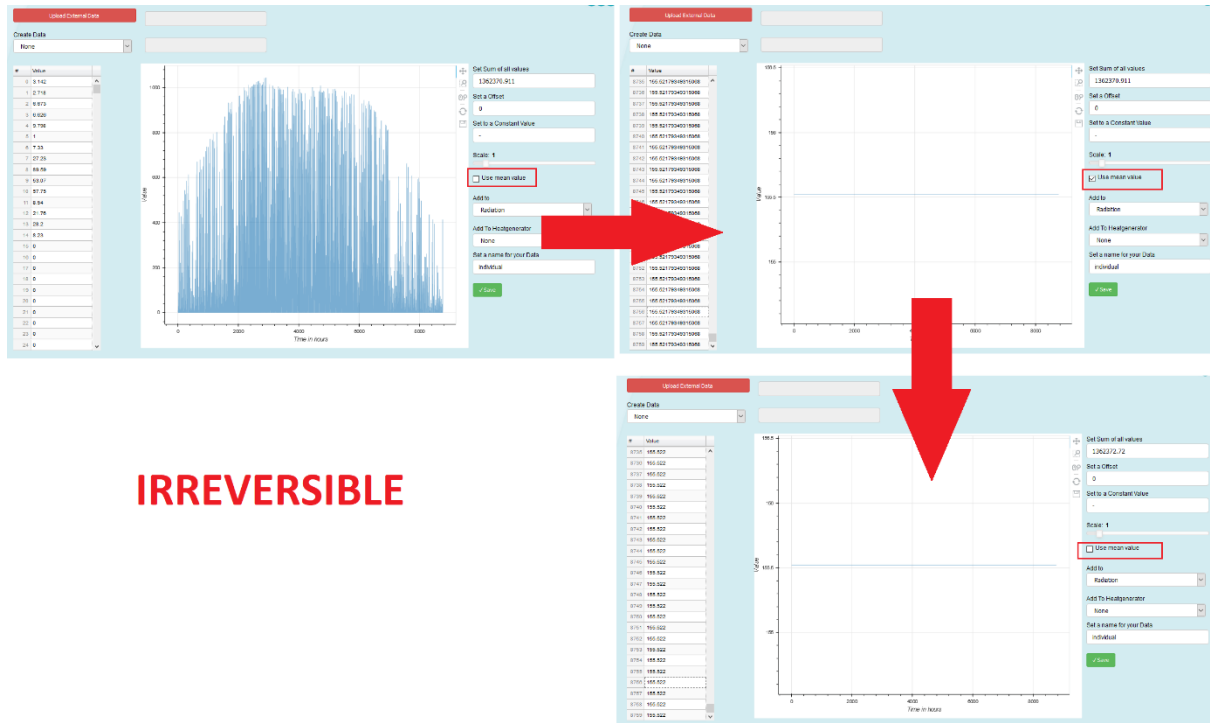
Set to a Constant Value

Scale: 1

☐ Use mean value

You have the opportunity to modify the data with these tools, e.g. set the sum of all values, set an offset, scale, etc. *.

**Caution: This permanently change the values in the table! (It works with the direct values and therefore it is an irreversible process e.g. if you check the use the mean value checkbox and then unchecked again you will not get your profile back see picture below, you have to upload or create your data again)*



Irreversible process of the modification tool in the Load Individual Data Tab

2.5.8.2.5 Saving Tools

Add to

Radiation

Add To Heatgenerator

None

Set a name for your Data

individual

✓ Save

After loading your custom data, or creating a distribution you can choose for which profile you want this dataset to be added.

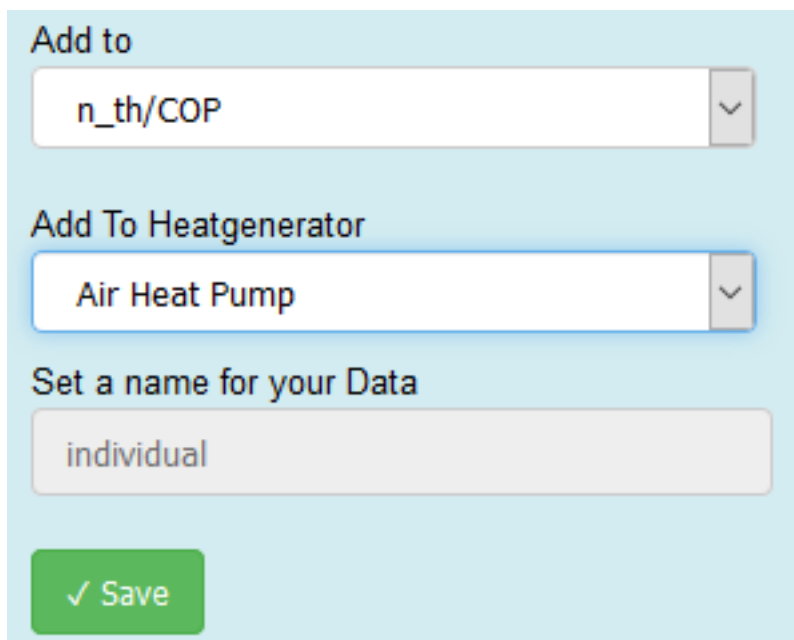
A screenshot of a web interface showing a dropdown menu titled "Add to". The menu is open, displaying a list of options: "n_th/COP", "Radiation", "Temperature", "Electricity price", "Sale Electricity price", "Heat Demand", and "n_th/COP". The "Radiation" option is currently selected and highlighted in blue.

By Pressing the save button your data can be found at the selected profiles (Add to) Tab and can be used by selecting it with the name you specified *.

***Caution: The name of the data will always be terminated by the string `_1` after saving (e.g. if you specify individual as your name and saved it to Radiation, you will find your profile in the Radiation Tab by the name `individual_1`**

It is also possible to specify a time specific thermal efficiency for a heat generator (or COP for heat pumps).

To use this feature, you have to select in the Add To-drop down button `n_th/COP` and then select the heat generator (Add To Heatgenerator) which you like to add your custom thermal efficiency. Then you press save and you get an information in the notification section. The picture below shows an example.

A screenshot of a web interface showing two dropdown menus and a text input field. The first dropdown menu, titled "Add to", has "n_th/COP" selected. The second dropdown menu, titled "Add To Heatgenerator", has "Air Heat Pump" selected. Below these is a text input field labeled "Set a name for your Data" with the text "individual" entered. At the bottom is a green button with a checkmark and the text "Save".

CHAPTER 3

Indices and tables

- `genindex`
- `modindex`
- `search`