User Manual for Region Related Data Entry and Modification in DH Knowledge Platform (www.dhknowledge.eu)

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This manual describes actions needed to use the calculation tools and enter the region related data-sets into database of Knowledge platform (www.dhknowledge.eu). This manual is intended to use by project partners who, as a registered users, can create records in the database about specific parameters in a particular region of the country.

1. Signing up into the system

Only registered and approved users can save data in the system. In order to sign up we choose Register from Menu and the following registration form opens where user name, e-mail address, and password should be entered:

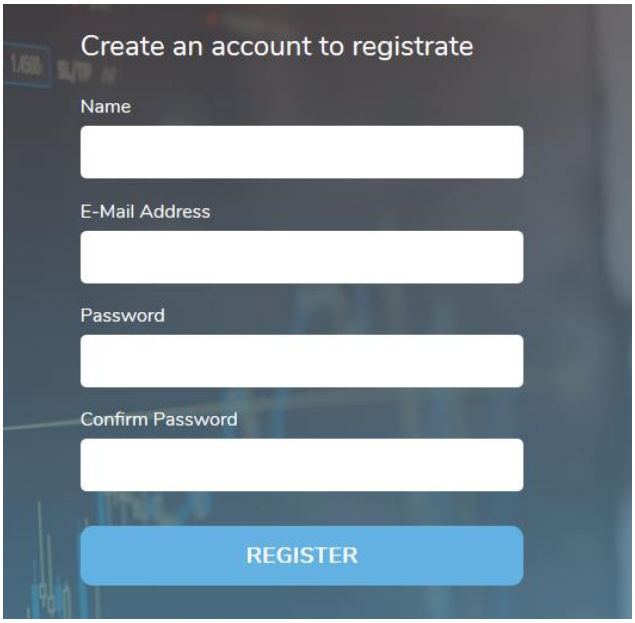

Fig. 1 User registration window

After registration the user name appears on the right of the menu which indicated that the user is logged on. By clicking user name the Log out option can be selected:

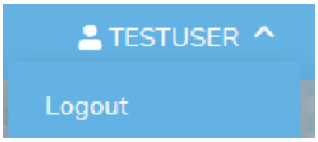

Fig. 2 Loged in user name

For a full access to data entry the new registered user should be approved by systems administrator. The system administrator sends a confirmation link to the user's email (which was provided during the registration). To finalize the approbation of the registered user you will get the following message to your email, where you need to click **Verify Email Address** button:

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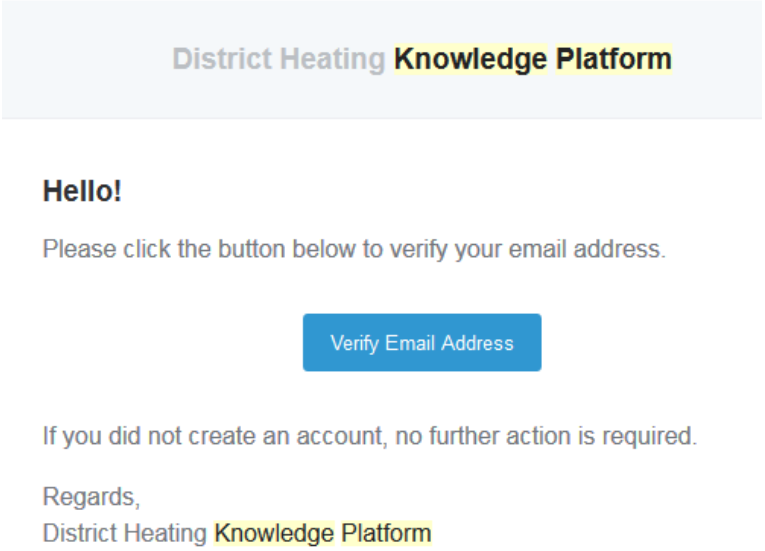

Fig. 3 Email, for registered user verification

The registered and approved user now can access the data entry forms, to save data into database, edit (user can only edit their own inputs), preview and delete data entries.

2. Using Tools for Evaluation DH performance

These tools can be accessed by public user i.e. there is no need to login into the system. Data used in calculators and the results of calculations are not stored in the database.

The following calculators can be used:

- Two heat load calculators based on different input datasets:
  - Consumption Based Heat Load Calculator;
  - Capacity Based Heat Load Calculator.
- Calculator for Relative Importance of Losses (RiL)
- Calculator for Primary Energy Factor (PEF)
- DH ranking and comparison tool

1.1. Consumption Based Heat Load Calculator

(*Evaluate DH performance -> Consumption Based Heat Load Calculator*)

This calculator finds the optimal capacities for an existing or new to design boiler house. It presents the correlation between outdoor temperature and transferred heat to the network. This information can be used to control the transferred heat and thus to increase the energy efficiency. Heat load calculation in this tool considers:

- heating season
- transferred heat to network

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- hours in a month
- average outdoor temperature
- total operating hours in a year at appropriate outdoor temperature

The main users of this calculator can be DH operators, DH engineers, urban planner and energy managers in municipalities, to have an overview about the transferred heat of heat distribution processes and thus to increase the energy efficiency.

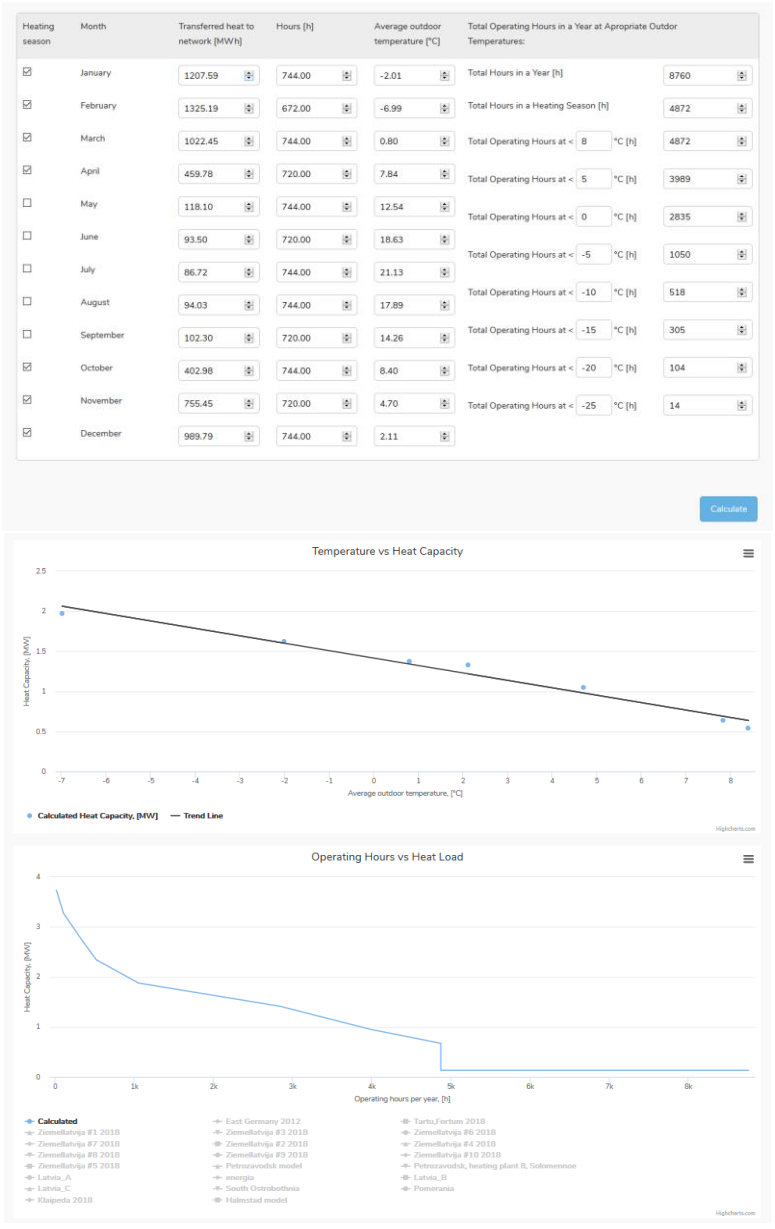

Fig. 4 Consumption Based Heat Load Calculator

To calculate the heat load by using this approach the following parameters should be indicated:

1. By ticking determine if the corresponding month belonged to the heating season.
2. Transferred heat to network in MWh in a corresponding month.

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3. Hours in a corresponding month (number_of_days_in_a_month ×24).
4. Average outdoor temperatures of each month in °C.
5. Total operating hours in a year at appropriate outdoor temperature. The temperature range must be selected according to the regional climate conditions and national regulations to cover the typical temperature range of the heating season.

All the input fields must be filled in to make the calculation run. The calculation results are represented in two graphs: average outdoor temperature vs heat capacity and annual operating hour vs heat load.

1.2. Capacity Based Heat Load Calculator

(*Evaluate DH performance -> Capacity Based Heat Load Calculator*)

This calculator finds the capacities for an existing or new to design boiler house. It allows for finding the heat load curve. It presents the correlation between outdoor temperature and transferred heat to the network. This information can be used to control the transferred heat and thus to increase the energy efficiency. Heat load calculation in this tool considers:

- Heating capacity at average outdoor temperature
- Hot water capacity at average outdoor temperature
- Heat losses capacity at average outdoor temperature
- Average outdoor temperature
- Average room temperature
- Total operating hours in a year at appropriate outdoor temperature.

The main users of this calculator can be DH operators, DH engineers, urban planners and energy managers in municipalities to have an overview about the transferred heat of heat distribution processes and thus to increase the energy efficiency.

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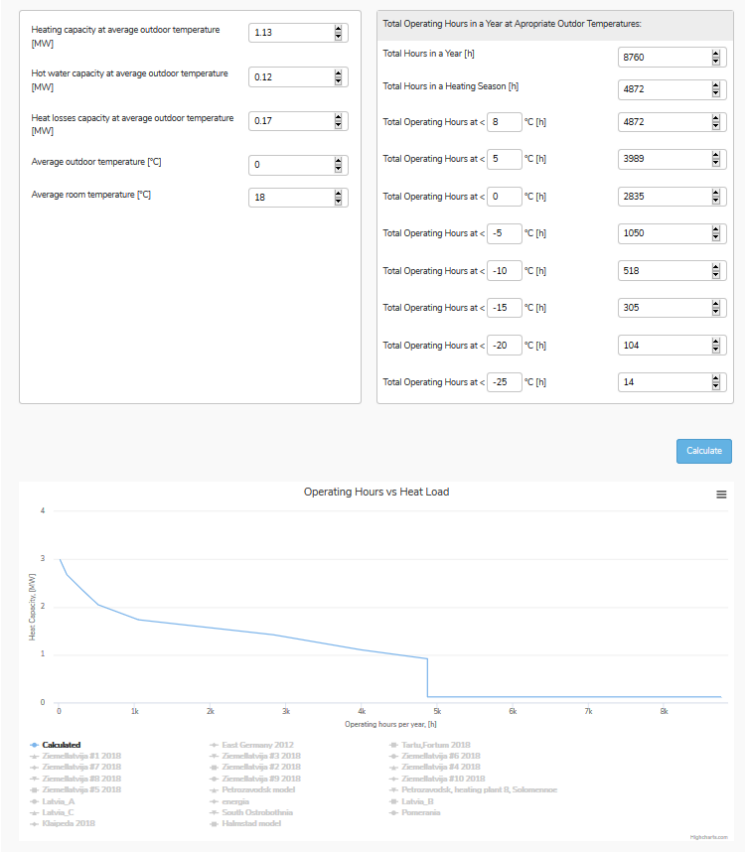

Fig. 5 Capacity Based Heat Load Calculator

To calculate the heat load by the second approach the following parameters should be indicated:

1. Heating capacity at average outdoor temperature
2. Hot water preparation capacity at average outdoor temperature
3. Heat losses capacity at average outdoor temperature
4. Average outdoor temperature of the region
5. Average room temperature
6. Total operating hours in a year at appropriate outdoor temperature. The temperature range must be selected according to the regional climate conditions and national regulations to cover the typical temperature range of the heating season

All the input fields must be filled in to make the calculation run. The calculation results are represented in a graph: annual operating hour vs heat load.

1.3. Calculator for Relative Importance of Losses (RiL)

(*Evaluate DH Performance -> Calculator for Relative Importance of Losses (RiL)*)

This calculator obtains the coefficient of Relative Importance of Losses (RiL) by consumed heat, transferred heat to network and hours in a month. RIL represent the energy efficiency of a DH company and the sum of energy lost in DH (e.g. thermal loss through pipes, water replenishment, etc.)

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Also, this calculator takes into account the electricity needed to deliver power and heat to the consumers. The lower the RIL, the higher the energy efficiency of the DH company. The main users of this tool can be DH operators to have an overview about the energy efficiency of heat distribution processes or heat losses in the grid. This tool can also be used by municipalities and national stakeholders to evaluate the DH companies and write specific regulation acts to consequently give regulatory advices.

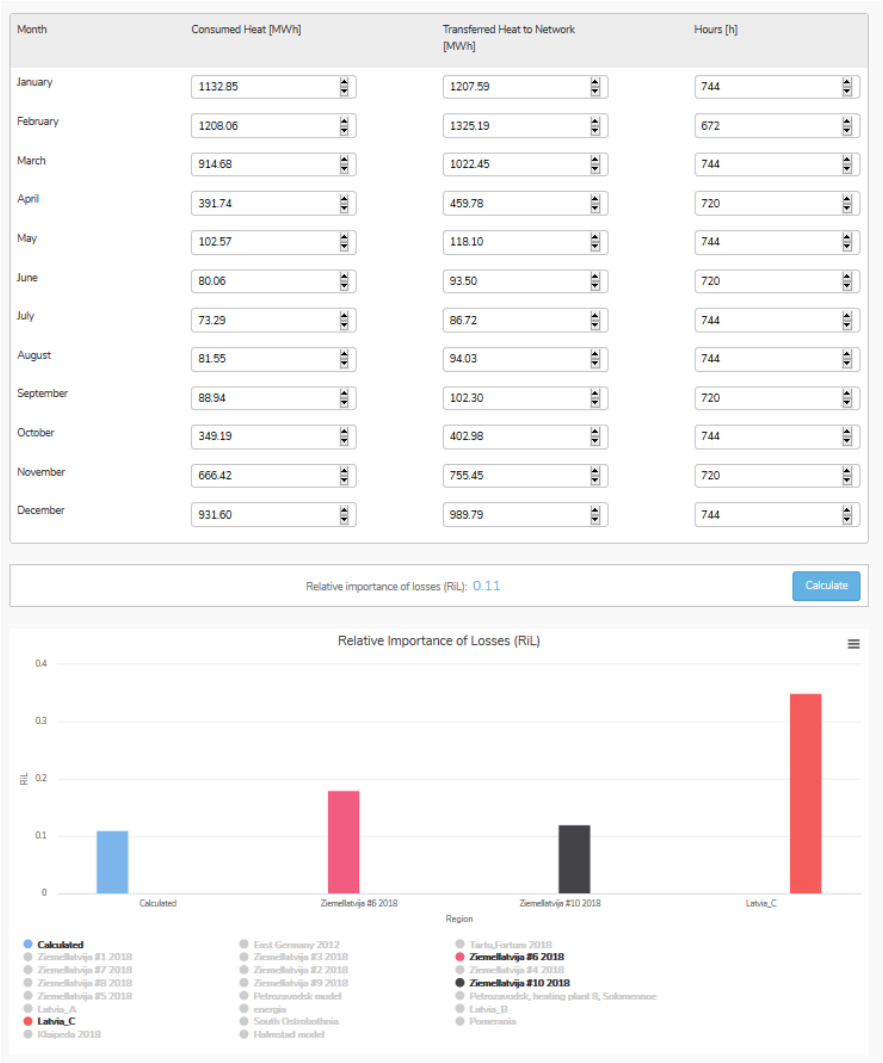

Fig. 6 Calculator for Relative Importance of Losses (RiL)

To calculate the relative importance of losses (RiL) the following parameters should be indicated:

1. Consumed heat in a corresponding month
2. Transferred heat to network in a corresponding month
3. Hours in a corresponding month (number_of_days_in_a_month ×24)

All the input fields must be filled in to make the calculation run. The calculation result (RiL coefficient) is output at the bottom of the web page.

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1.4. Calculator for Primary Energy Factor (PEF)

(*Evaluate DH Performance -> Calculator for Primary Energy Factor (PEF)*)

The Primary energy factor (PEF) is an energy indicator used for quantifying the primary energy use of a plant. It is calculated by using the methodology described in the European Standard EN 15316-4-5. Using this calculator, the coefficient of the PEF is obtained by:

- Consumed heat
- Fuel input to the Heating Plant (HP) and Combined Heat and Power (CHP)
- Electricity production of the cogeneration plants
- Fuel
- Its primary resource factor (indicates how much primary energy is used to generate a unit of heat and electricity).

PEF shows heat and electricity production efficiencies and allows a comparison among different DH companies or different scenario. The lower the PEF, the higher the energy production efficiency of the DH company. The main users of this tool can be DH operators to have an overview about the energy efficiency of heat distribution processes or heat losses in the grid. This tool can also be used by municipalities and national stakeholders to evaluate the DH companies and write specific regulation acts to consequently give regulatory advices.

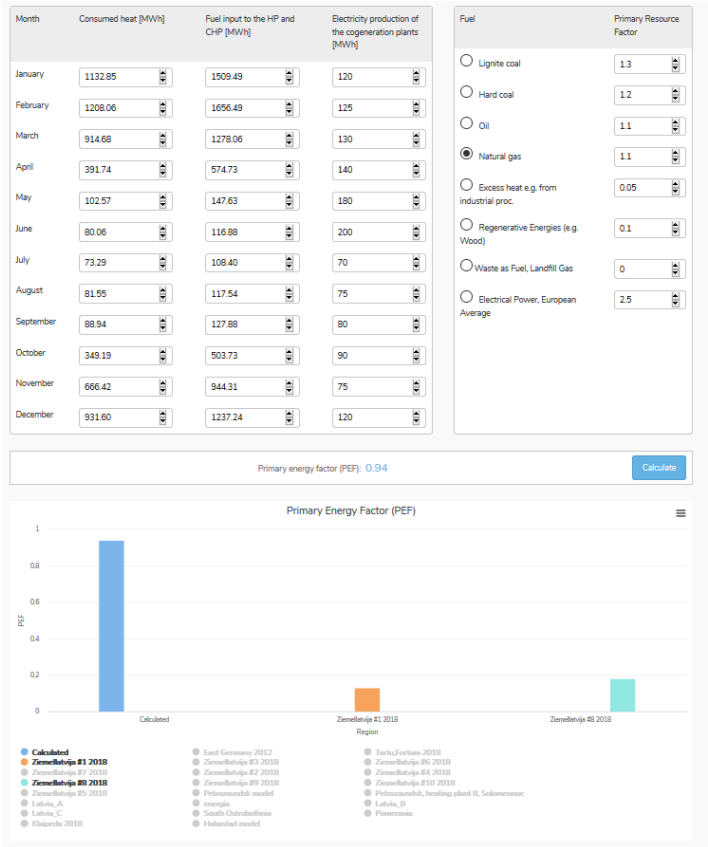

Fig. 7 Calculator for Primary Energy Factor (PEF)

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To calculate the Primary Energy Factor (PEF) the following parameters should be indicated:

1. Consumed heat in a corresponding month
2. Fuel input to the HP and CHP
3. Electricity production of the cogeneration plants
4. Selected fuel and its Primary Resource Factor

All the input fields must be filled in to make the calculation run. The calculation result (RiL coefficient) is output at the bottom of the Web page.

3. Creating a district model

Create district model option (*Region related data -> Create District Model*) is available for registered and approved users only. This tool combines both previously described heat load calculation tools and multi-criteria analysis methods. All entered data and results of calculations are saved into database.

Firstly data set must be related to specified Country, State and City. Choose the location from the dropdown lists (1) (see picture below). Secondly, name the model (2) by entering a short but meaningful name so that you can easily recognize the saved model later. It is recommended to add year in the name of the model (e.g. Klaipeda_data_2015) that indicate for which year data is provided.

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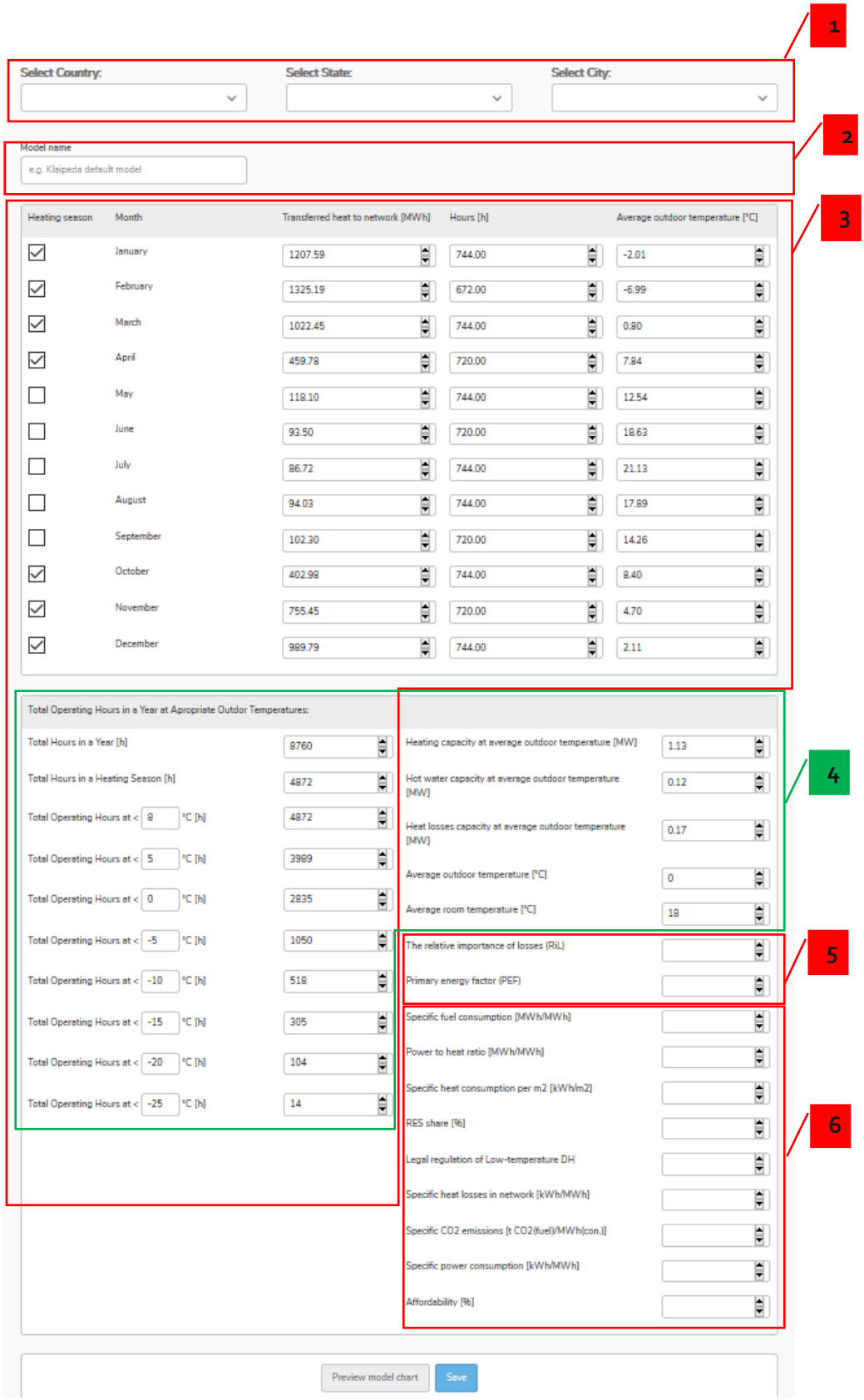

Fig. 8 Creating a district model

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According to the available input data set the heat load calculation method is automatically selected i.e. the consumption based heat load calculation is used if you specify (see Fig. 8 (3)):

- Heating season;
- Transferred heat to network in a corresponding month;
- Hours in a corresponding month (number_of_days_in_a_month ×24)
- Average outdoor temperatures of each month in °C
- Total operating hours in a year at appropriate outdoor temperature.

The capacity based heat load method is applied if you specify (see Fig. 8 (4)):

- Heating capacity at average outdoor temperature
- Hot water preparation capacity at average outdoor temperature
- Heat losses capacity at average outdoor temperature
- Average outdoor temperature of the region
- Average room temperature
- Total operating hours in a year at appropriate outdoor temperature.

Next you can specify RiL and PEF coefficients (see Fig. 8 (5)). And nine indicators should be specified (see Fig. 8 (6)) for multi-criteria analysis to rank the potential to implement the LTDH strategy in appropriate region. By clicking button **Save** the specified dataset and calculations are transferred into database.

4. Editing created model

Edit district model option (*Region related data -> Edit Models*) is available for registered and approved users only. The user can view the list (see Fig. 9) of his own created models (see Fig. 9 (1)) (the search and country, state and city filter tools (see Fig. 9 (2)) can be used to find the specific model in the list) and to choose between two actions: edit the created model (see Fig. 9 (3)) or delete it (see Fig. 9 (4)).

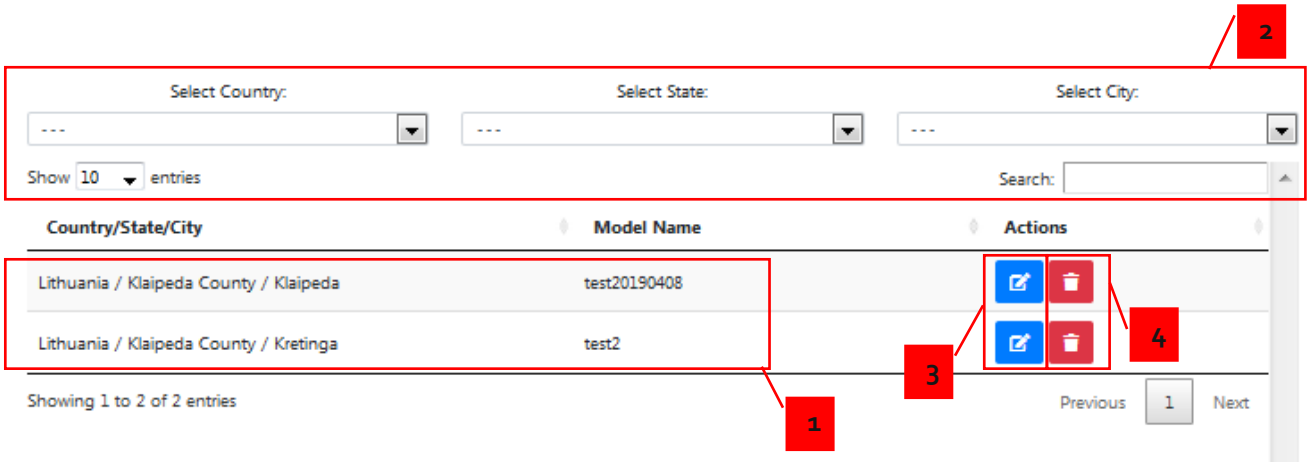

Fig. 9 Editing created models

By choosing delete option the dialog vindow opens to confirm the action. This action removes the selected model from database and it can not be restored.

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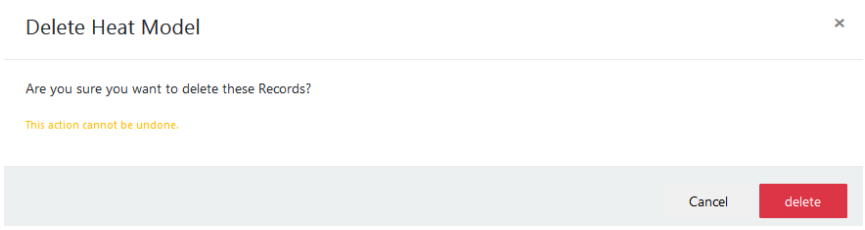

Fig. 10 Confirm the heat model delete

By choosing edit option the form opens where you can update previously specified values (see Fig. 11):

Edit Model

Lithuania / Klaipeda County / Klaipeda

Model name

test20190408

Heating season	Month	Transferred heat to network [MWh]	Hours [h]	Average outdoor temperature [°C]
☑	January	1207,59	744	-2,01
☑	February	1325,19	672	-6,99
☑	March	1022,45	744	0,8
☑	April	459,78	720	7,84
☐	May	118,1	744	12,54
☐	June	93,5	720	18,63
☐	July	86,72	744	21,13
☐	August	94,03	744	17,89
☐	September	102,3	720	14,26
☑	October	402,98	744	8,4
☑	November	755,45	720	4,7
☑	December	989,79	744	2,11

Total Operating Hours in a Year at Apropriate Outdor Temperatures:

Total Hours in a Year [h]		8760
Total Hours in a Heating Season [h]		4872
Total Operating Hours at <	8 °C [h]	4872
Total Operating Hours at <	5 °C [h]	3989
Total Operating Hours at <	0 °C [h]	2835
Total Operating Hours at <	-5 °C [h]	1050
Total Operating Hours at <	-10 °C [h]	518
Total Operating Hours at <	-15 °C [h]	305
Total Operating Hours at <	-20 °C [h]	104
Total Operating Hours at <	-25 °C [h]	14

Heating capacity at average outdoor temperature [MW]	1,13
Hot water capacity at average outdoor temperature [MW]	0,12
Heat losses capacity at average outdoor temperature [MW]	0,17
Average outdoor temperature [°C]	0
Average room temperature [°C]	18
The relative importance of losses (RiL)	1
Primary energy factor (PEF)	1
Specific fuel consumption [MWh/MWh]	2
Power to heat ratio [MWh/MWh]	1
Specific heat consumption per m2 [kWh/m2]	2
RES share [%]	2
Legal regulation of Low-temperature DH	5
Specific heat losses in network [kWh/MWh]	1
Specific CO2 emissions [t CO2(fuel)/MWh(con.)]	2
Specific power consumption [kWh/MWh]	5
Affordability [%]	4

Cancel Save

Fig. 11 Edit data for selected model

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5. Using DH ranking and comparison tool

The DH ranking and comparison tool (*Evaluate DH Performance -> DH ranking and comparison tool*) (this tool can be accessed by public user) allows to compare and analyse the heat loads, RiLs and PEFs of different regions for the potential development of a LTDH strategy. In order to evaluate various DH systems and find the most suitable one for the development of a system, nine criteria are applied in the multi-criteria ranking tool:

- Specific fuel consumption
- Power to heat ratio
- Specific heat consumption for heating per m2
- RES share
- Legal regulation of Low-temperature DH
- Specific heat losses in network
- Specific CO_2 emissions
- Specific power consumption
- Affordability of DH heat

The ranking results show the efficiency of the performance of existing DH system cases in municipalities. Results are ranked from the smallest to the largest efficiency performance.

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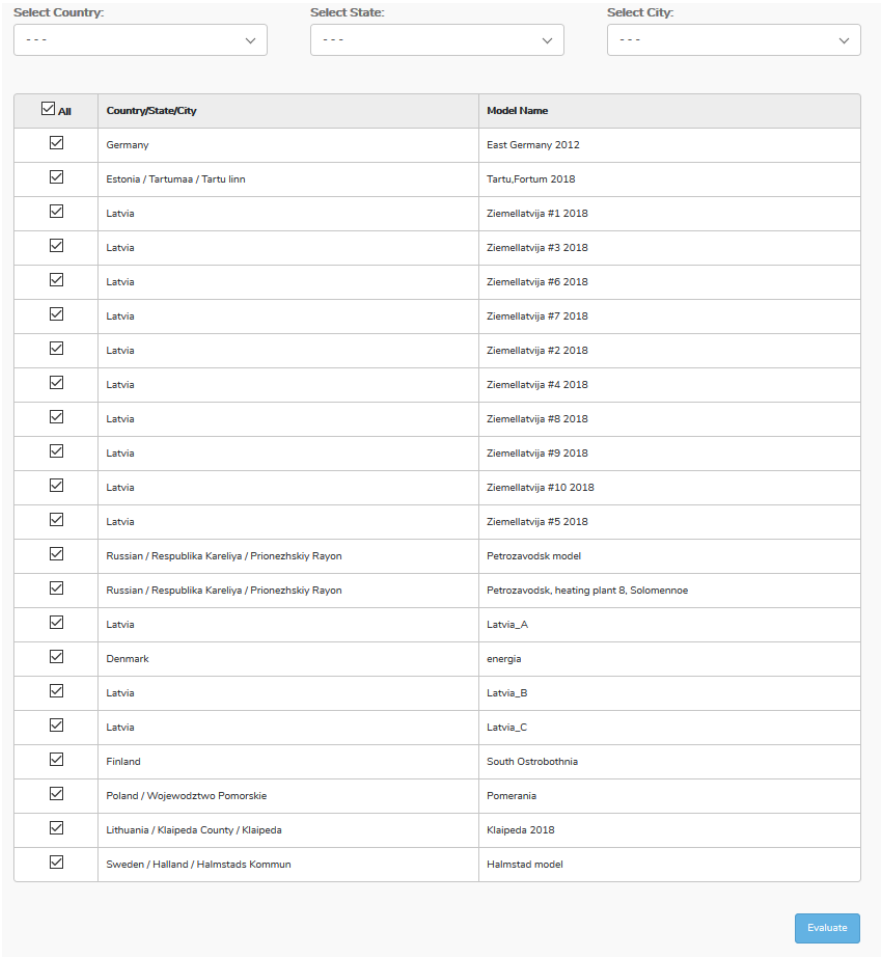

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Fig. 12 DH ranking and comparison tool

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