Installation and setup

Package requirements for **Python** based tool are:

- Python 3.7.3
- PySide2 5.11.2
- qt 5.12.5
- matplotlib 3.1.1
- oemof 0.3.1
- shiboken2 5.14.2

For the Python version management, Python 3 based installation of **Anaconda** system is recommended (https://www.anaconda.com/download/). In the Anaconda system, user can define a specific Python environment with selected package versions.

User should launch **Anaconda Prompt** and in following order create (1) environment (user can select name for environment - here exemplar *environment_name* is used), activate (2) the environment and install (3-6) packages:

```
1. conda create -n environment_name python=3.7.3
2. conda activate environment_name
3. pip install pyside2==5.11.2
4. conda install -c conda-forge qt
5. conda install -c conda-forge matplotlib
6. pip install oemof==0.3.1
7. pip install shiboken2==5.14.2
```

After the installation, user can launch the tool by using **Anaconda Prompt** to activate (1) the created environment (*environment_name*) and going to the directory (2) where tool was installed and starting the Python program (3) as follows:

```
1. conda activate environment_name
2. cd "<folder name here>" [1]
3. python Indigo_main.py
```

[1] It should be noted that in Anaconda Prompt, the change directory command (cd) does not function if the targeted folder is located in a different drive. Therefore, if the case folder is in a different drive, user should first select the correct target drive (X:) and then use the cd command in order to change the directory.

Using the tool

Planning tool contains three major tabs:

1. **Model analysis**: In this tab, existing DC model is optimized and results can be examined.
2. **Model construction**: In this tab, DC model is constructed and parameters defined.
3. **Sensitivity**: In this tab, sensitivity analysis in terms of model parameters can be performed.

In this brief manual, user of planning tool is guided through construction of new DC model by using GIS tool and performing optimization and result analysis of existing models.

Creating new case

Import map

Creation of new model begins by choosing **Model construction** tab and clicking **Create case** button. See Figure 1.

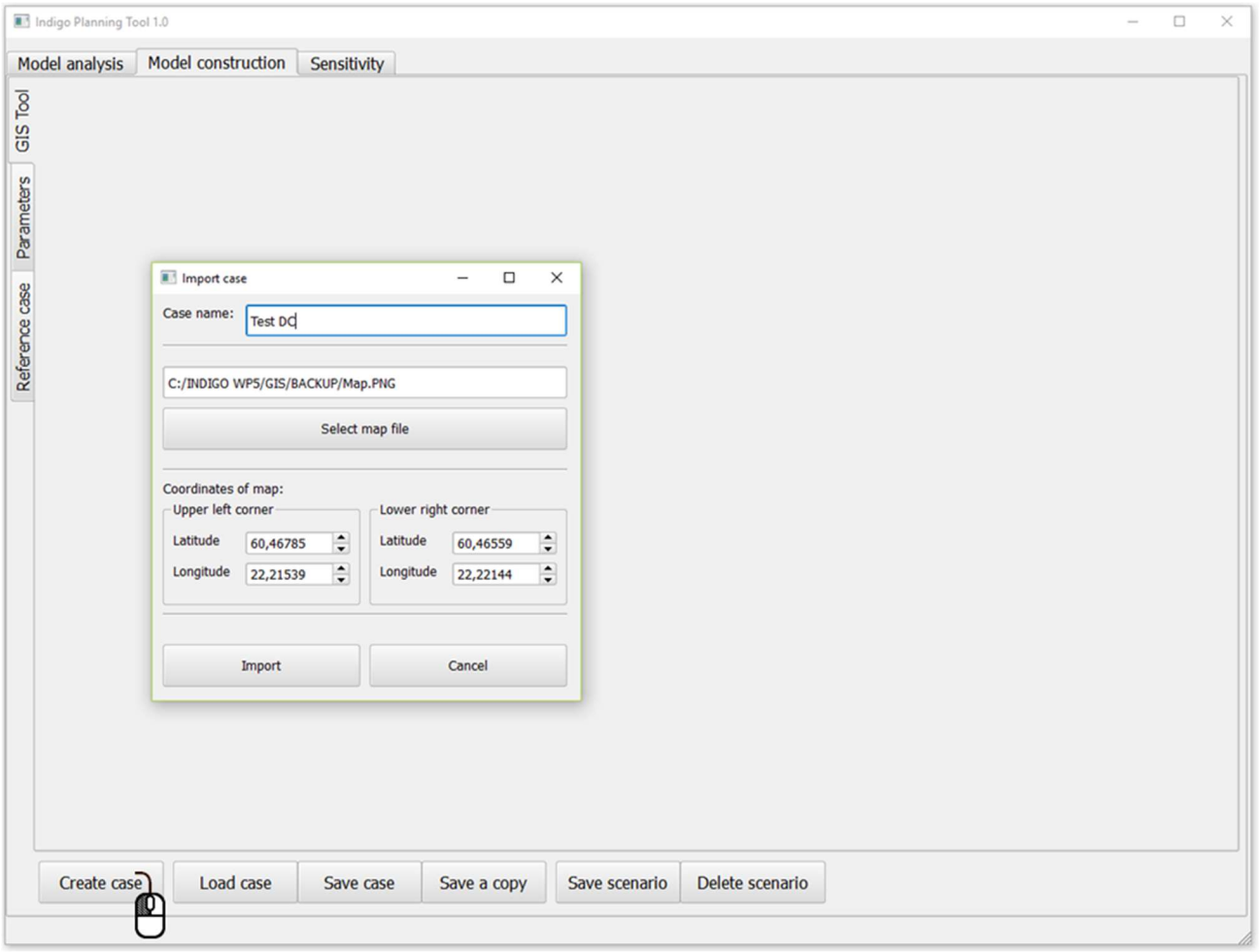


Figure 1. Creating new case by clicking Create case button.

Create case button ejects **Import case** window illustrated in Figure 2. Importing model includes following features:

1. **Case name**: case is not created if case name is missing or case folder already exists.
2. **Select map file** button: user browses for map file (.png format)

3. **Coordinates of map**: user inserts latitude and longitude of upper left and lower right corner of map file. Import window warns if coordinates are inconsistent.
4. **Import** button: model is created (model folder is created) if case requirements are met.

Corner coordinates of map file can be obtained from e.g. google maps.

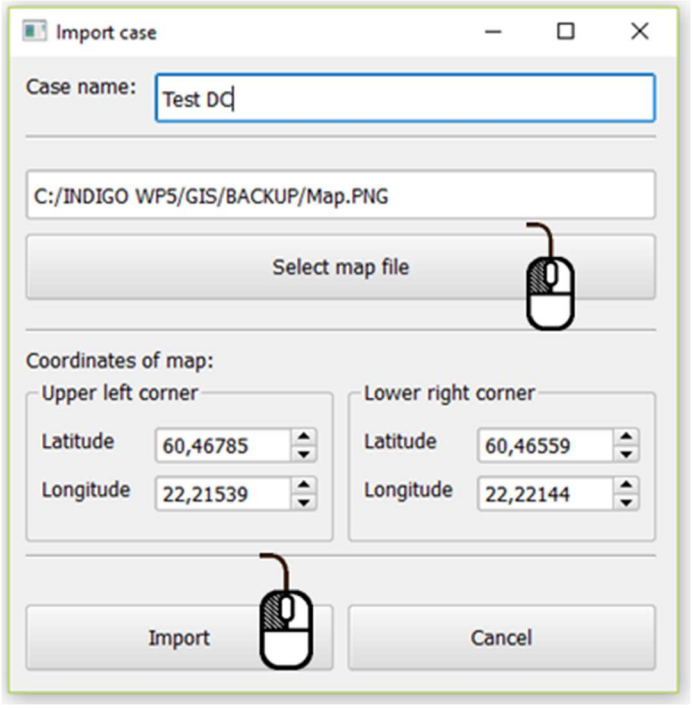


Figure 2. Case import window.

Load case

Once case is imported, and case folder with necessary files is created with import tool, cases can be loaded for model construction by pressing **Load case** button in **Model construction** tab. Pressing **Load case** button brings out selection of cases, illustrated in Figure 3, (all the case folders in **.\GIS** folder) and user can select case to be modified.

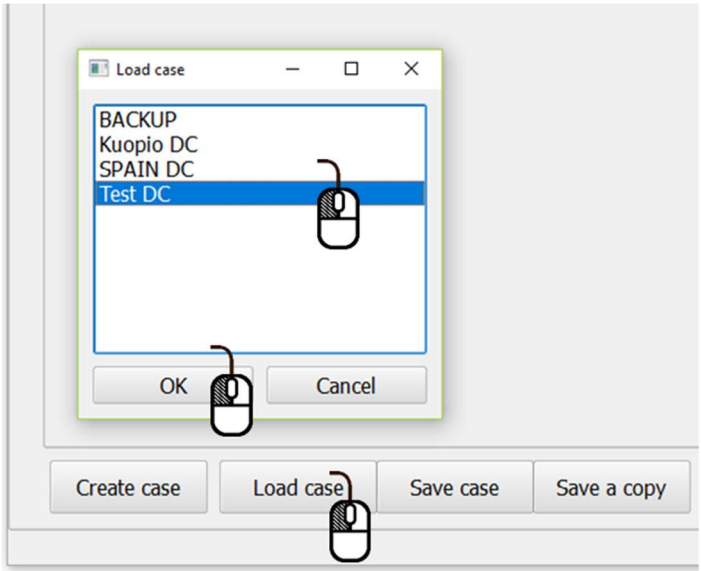


Figure 3. Loading case to be modified.

Initialize model

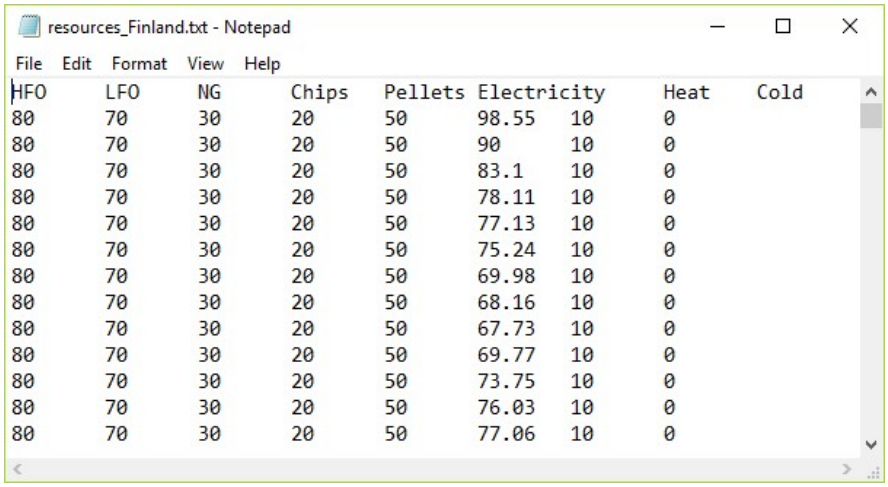
Once the case is loaded, the DC model can be constructed or modified in three different tabs:

1. **GIS tool:** In this tab, user can construct DC network in GIS interface by inserting consumers, producers, pipeline network and energy suppliers.
2. **Parameters:** In this tab, user can define and modify technical and economical parameters.
3. **Reference case:** In this tab, user can modify details of building specific reference case.

User should have the following location specific files in the **.\data** folder:

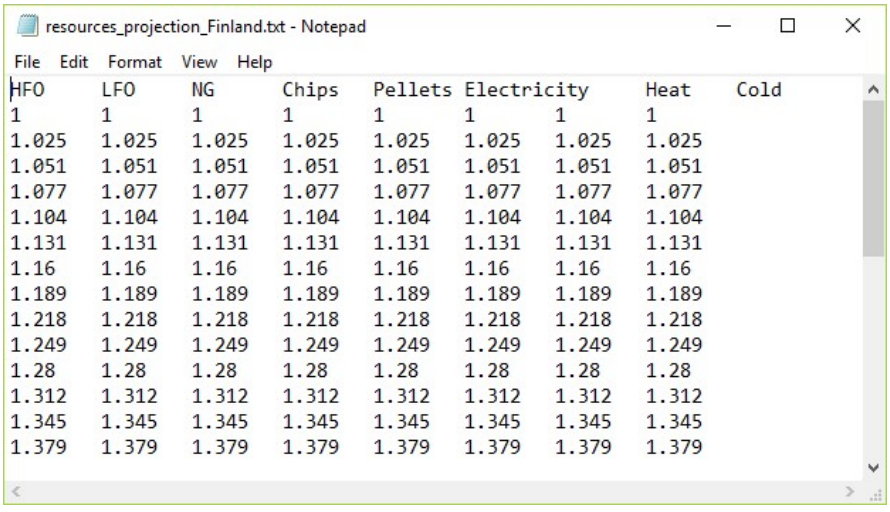
1. **resources_location.txt**: This file lists hourly time series for energy prices (€/MWh) for several fuels and energy sources. These time series should have at least 8760 rows (hours of one normal year).
2. **resources_projection_location.txt**: This file represents annual development of prices as an index series based on price level from resources_location.txt.
3. **solar_location.txt**: This file lists parameters of conditions for solar power.
4. **emissions_location.txt**: This file lists emission factors (gCO2/kWh) for energy sources. Also, this file includes primary energy factors (kWh/kWh) for energy commodities used in the system.

User can have several location files in the **.\data** folder. These locations form the listing for locations in the model construction phase. Important: the columns in all these data files must be tabular separated.



HFO	LFO	NG	Chips	Pellets	Electricity	Heat	Cold
80	70	30	20	50	98.55	10	0
80	70	30	20	50	90	10	0
80	70	30	20	50	83.1	10	0
80	70	30	20	50	78.11	10	0
80	70	30	20	50	77.13	10	0
80	70	30	20	50	75.24	10	0
80	70	30	20	50	69.98	10	0
80	70	30	20	50	68.16	10	0
80	70	30	20	50	67.73	10	0
80	70	30	20	50	69.77	10	0
80	70	30	20	50	73.75	10	0
80	70	30	20	50	76.03	10	0
80	70	30	20	50	77.06	10	0

Figure 4. Example of the resources_location.txt file.



HFO	LFO	NG	Chips	Pellets	Electricity	Heat	Cold
1	1	1	1	1	1	1	1
1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025
1.051	1.051	1.051	1.051	1.051	1.051	1.051	1.051
1.077	1.077	1.077	1.077	1.077	1.077	1.077	1.077
1.104	1.104	1.104	1.104	1.104	1.104	1.104	1.104
1.131	1.131	1.131	1.131	1.131	1.131	1.131	1.131
1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
1.189	1.189	1.189	1.189	1.189	1.189	1.189	1.189
1.218	1.218	1.218	1.218	1.218	1.218	1.218	1.218
1.249	1.249	1.249	1.249	1.249	1.249	1.249	1.249
1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
1.312	1.312	1.312	1.312	1.312	1.312	1.312	1.312
1.345	1.345	1.345	1.345	1.345	1.345	1.345	1.345
1.379	1.379	1.379	1.379	1.379	1.379	1.379	1.379

Figure 5. Example of the resources_projection_location.txt file.

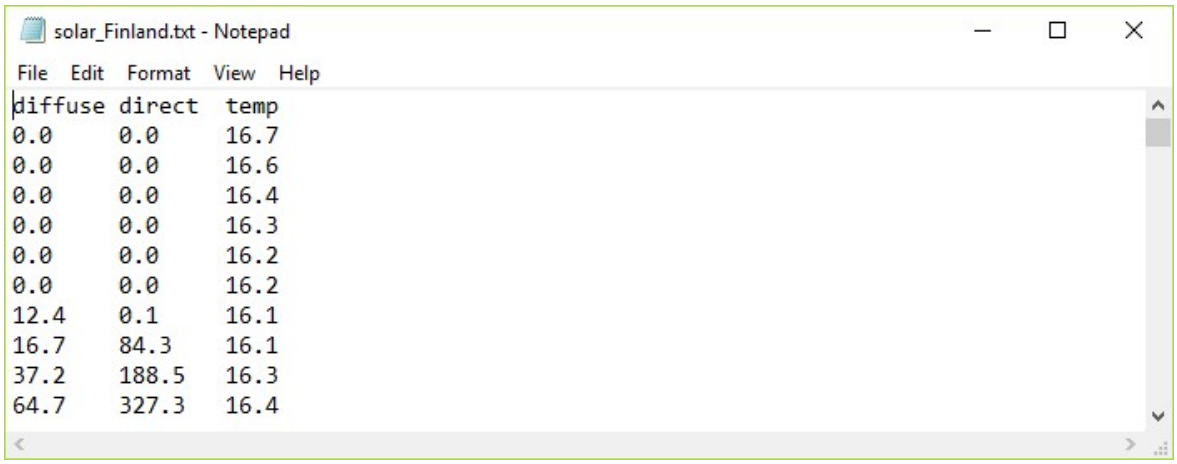


Figure 6. Example of the solar_location.txt file.

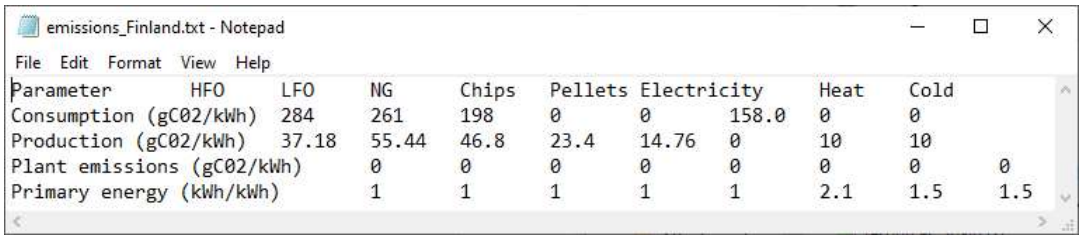


Figure 7. Example of the emissions_location.txt file.

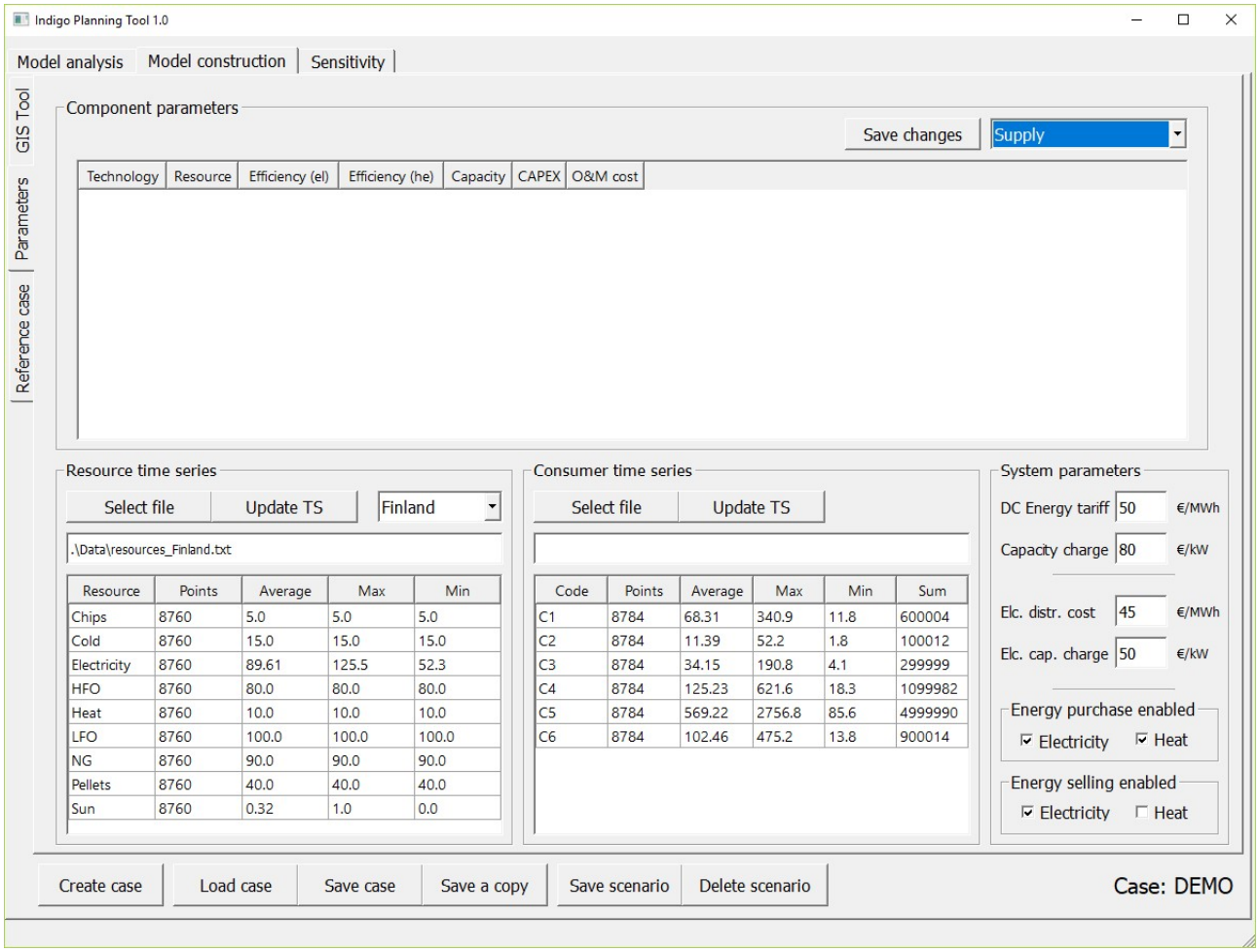
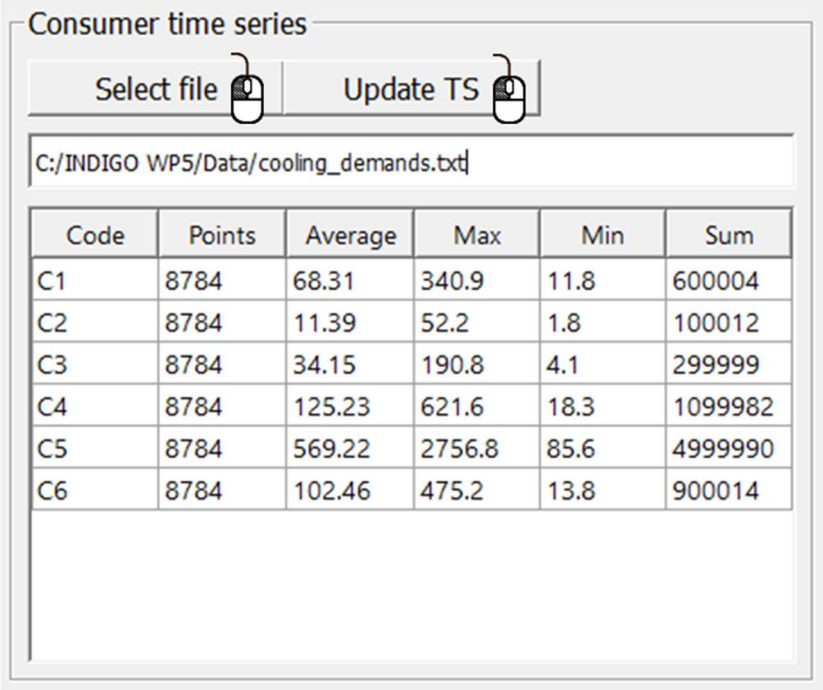


Figure 8. Model construction tool.

Model construction starts with defining consumer time series in Parameters tab (see Figure 8). User selects from **.\Data** folder (or any other folder) a .txt file, in which hourly consumption data for different buildings are listed, by clicking **Select file** button and proceeds to setting these time series into model by clicking **Update TS** button (see Figure 9). User can examine properties, such as number of data points, average value etc., of time series in a table. Also, user can similarly examine (see Figure 8) time series for resources and setting country in which DC network locates. All the energy data here is in kWh.



Code	Points	Average	Max	Min	Sum
C1	8784	68.31	340.9	11.8	600004
C2	8784	11.39	52.2	1.8	100012
C3	8784	34.15	190.8	4.1	299999
C4	8784	125.23	621.6	18.3	1099982
C5	8784	569.22	2756.8	85.6	4999990
C6	8784	102.46	475.2	13.8	900014

Figure 9. Import of consumer data.

Furthermore, in Parameters tab (Figure 10) user defines local energy tariff and other energy trade related values for DC as follows:

1. **DC Energy tariff**: this model parameter represents the price (€/MWh) for district cooling energy sold to consumers.
2. **Capacity charge**: this parameter represents the customer price (€/kW) for maximum dc power.
3. **Elc. distr. cost**: this parameter represents the distribution cost (€/MWh) for purchased electricity - this cost is the difference between purchased and sold electricity. The time series for electricity price in **resources_location.txt** file includes market price + distribution cost.
4. **Elc. cap. charge**: this parameter represents the charge (€/kW) for maximum power of the electricity consuming system.

Also, energy purchase and selling of electricity or heat can be enabled or disabled in the System parameters section (see Figure 10). In the case of disabling the purchase option, energy price is multiplied with 1000, in order to make the purchase too expensive but still maintaining source of energy for feasibility purposes. In the case of disabling the selling option, the selling price is basically set to zero for same feasibility reason.

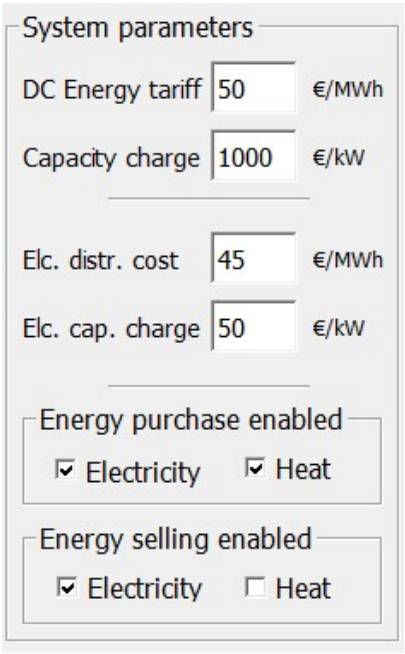


Figure 10.System parameters for sold district cooling and electricity, and options for selling/purchasing electricity/heat.

Model construction

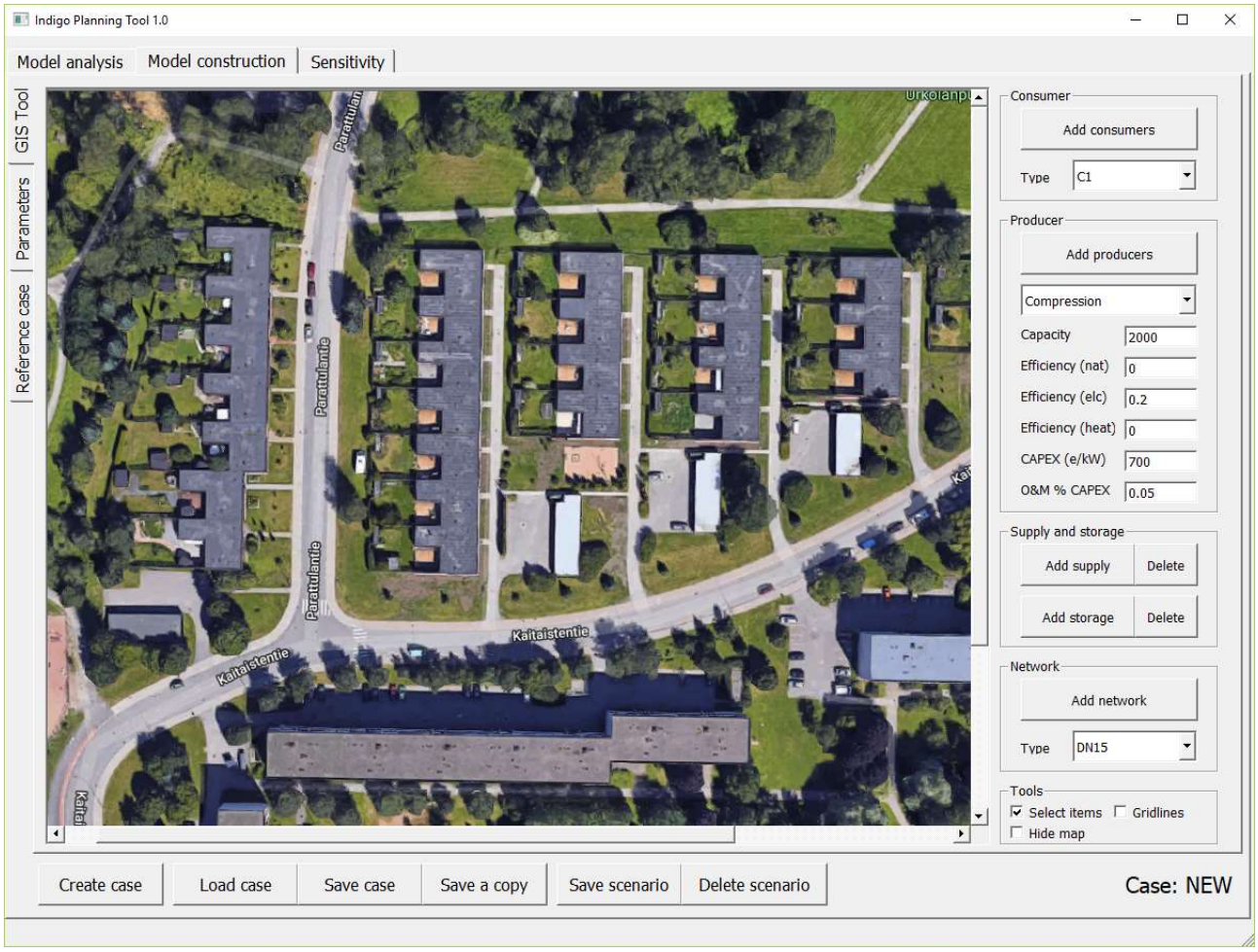


Figure 11. GIS construction tool.

After consumer time series have been defined, GIS based model construction can start in **GIS tool** tab (see Figure 11). User can insert model components by selecting the unit to add and clicking on the map screen. Map is based on a grid (size of 10 pixels) and added units snap to this grid in order to ease construction of continuous network.

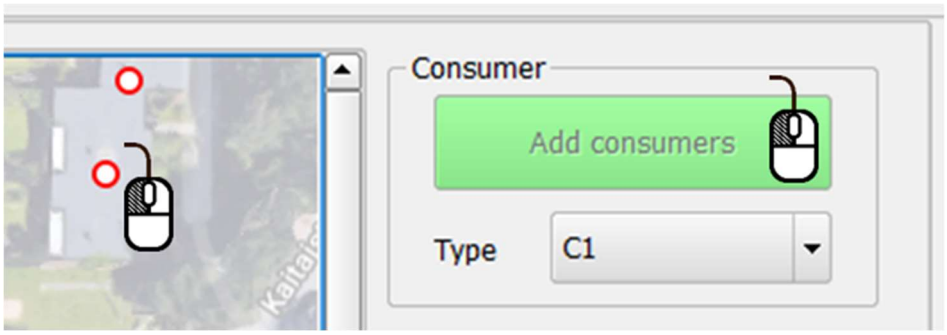


Figure 12. Adding consumers into the model.

Consumers can be added after pressing the **Add consumers** button (see Figure 12). User can select type of building from combo box and insert consumer into system by clicking on the map. Consumers are illustrated by red circles.

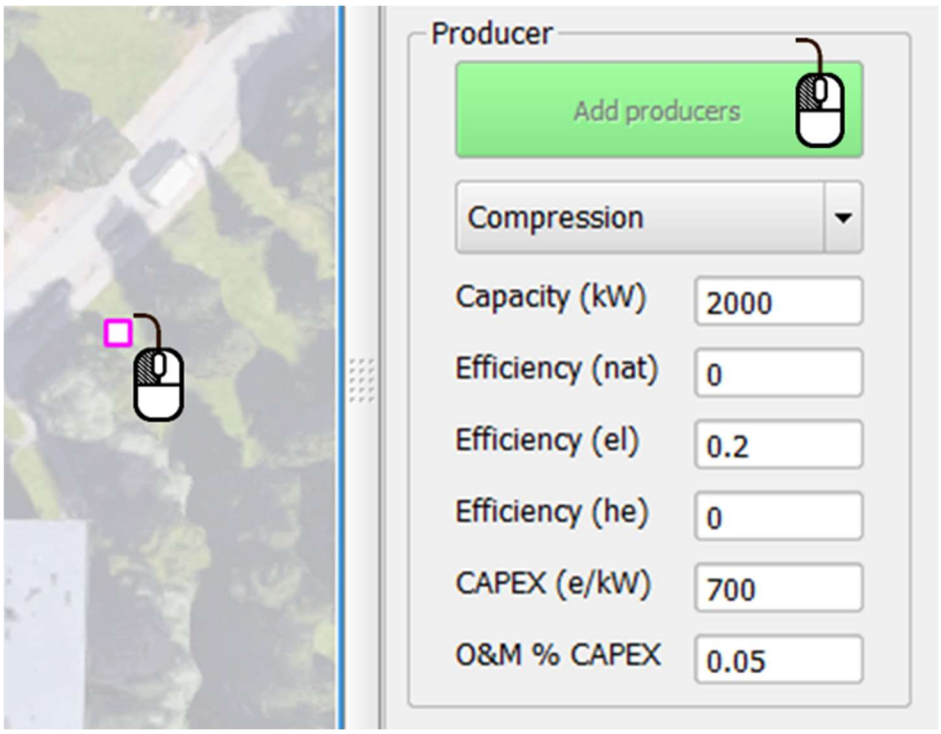


Figure 13. Adding producers into the model.

Producers of DC can be added after pressing **Add producers** button (see Figure 13). User can select type of producer technology (compression, absorption or free cooling) from combo box and edit technical and economical parameters of the unit (default values are based on a **cooling_techs.txt** file in **.\Data** folder). User inserts producer into system by clicking on the map. Producers are illustrated by violet squares.

Note - efficiency values (el = electricity, he = heat, nat = natural source) in the case of cooling producers represent consumption factors, that is, e.g. Efficiency (el) represents consumption (kWh) of electricity per 1 kWh of produced cooling energy.

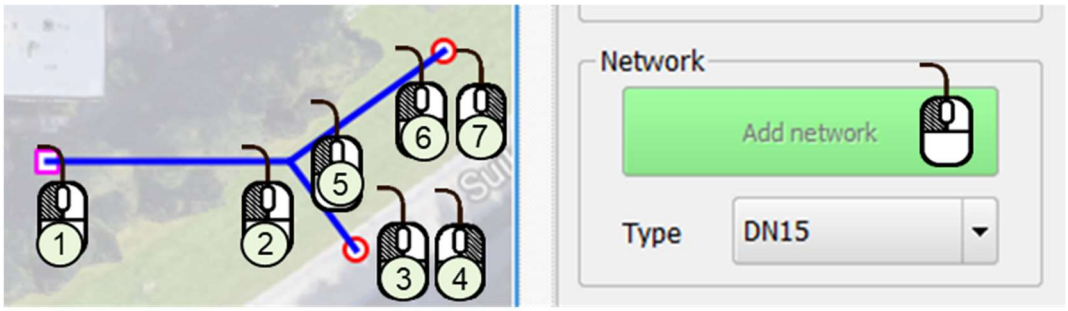


Figure 14. Drawing DC pipeline network.

DC network must connect producers and consumers by continuous pipeline. User can draw pipeline after pressing **Add network** button (see Figure 14). User can select type of each pipeline component from combo box before drawing. Drawing starts by left clicking on location of a producer or a consumer and proceeds by left clicking on the trail of pipeline (blue lines in Figure 14). Once a continuous pipeline section is finished, user right clicks and stops this section. User can then proceed from another location and continue left clicking as before. User can always undo latest component insertion by pressing **Ctrl-Z**.

It must be noted, that network must be continuous, that is, all the producers and consumers must be linked to each other and pipeline cannot have a loose ends. User can examine whether there are loose ends by holding **Space** key, as illustrated in Figure 15. This procedure shows all nodes, with connected nodes as green rings and unconnected nodes as light blue circles.

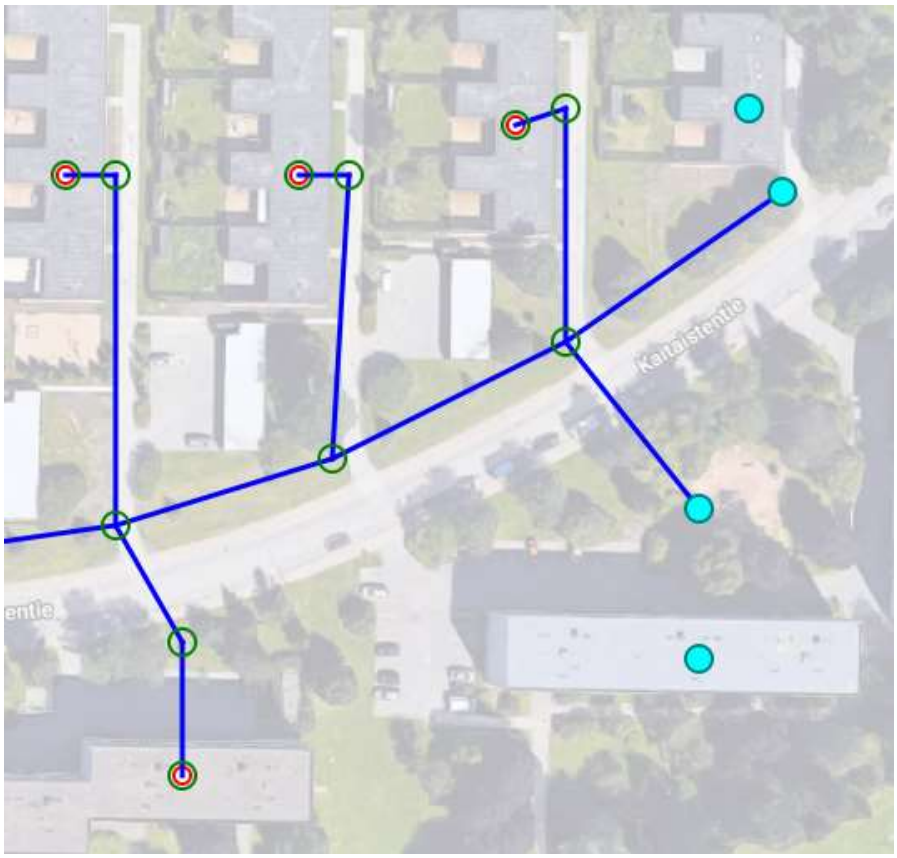


Figure 15. Indicators of finished/unfinished network connections.

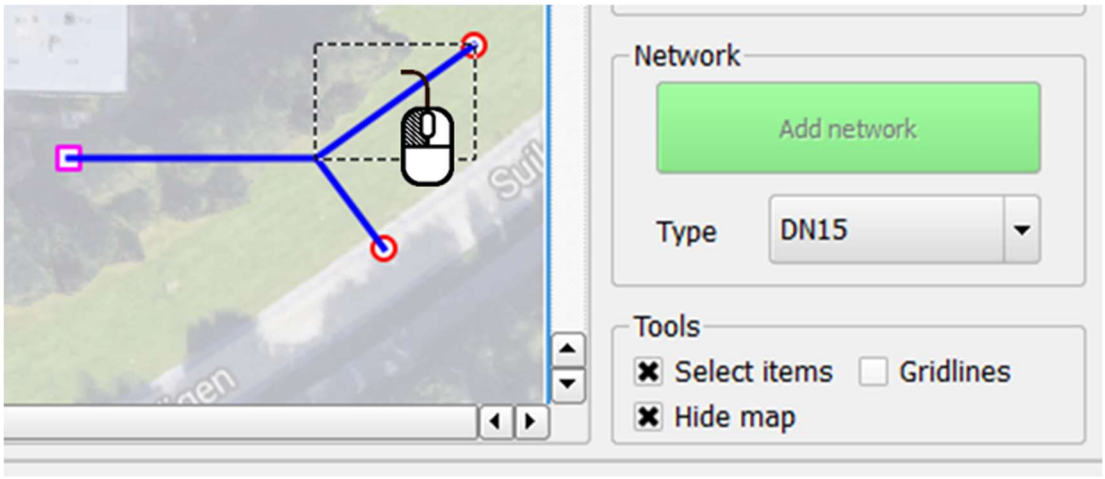


Figure 16. Editing DC system.

When user constructs DC system, components can be spatially edited by checking **Select items** check box (see Figure 16). When this option is checked, any component on map can be selected (all components can be selected by clicking **Ctrl-A**) and either moved by directional keys or removed by **Delete** key. Furthermore, in **Tools** section user can see gridlines or hide map as partially transparent.

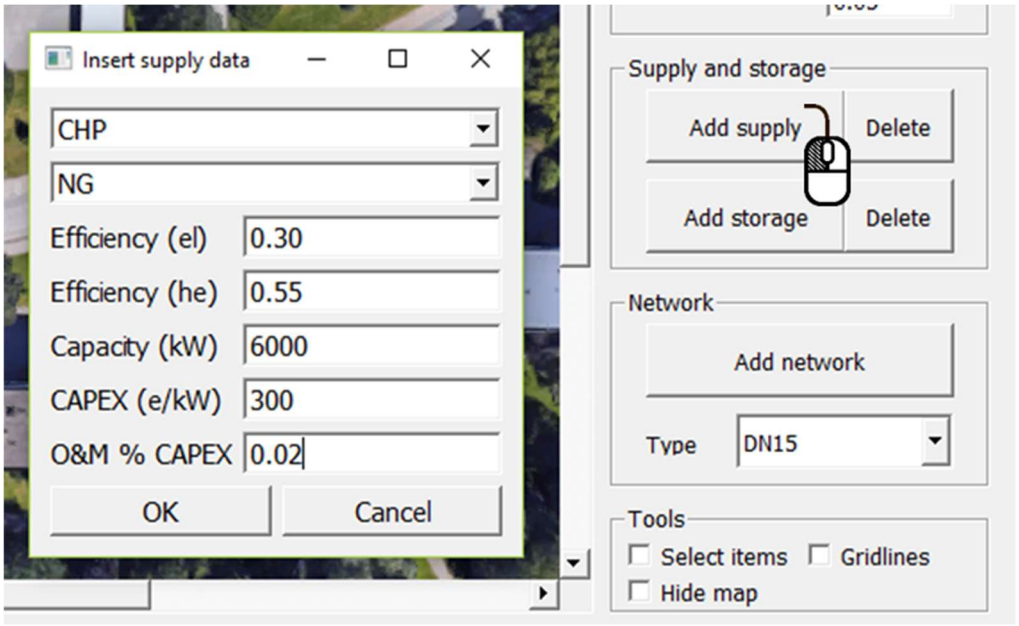


Figure 17. Inserting supply unit.

In DC system, energy (e.g. heat for absorption chiller) can be supplied by production units, which are inserted into model by clicking **Add supply** button (see Figure 17). User can select type of supply unit (e.g. CHP or solar PV) and fuel used (e.g. wood chips or fuel oil), and define technical and economical parameters. Supply units are not spatially modeled and therefore not inserted into map. Supply units can be deleted by clicking **Delete** button and selecting unit to be removed.

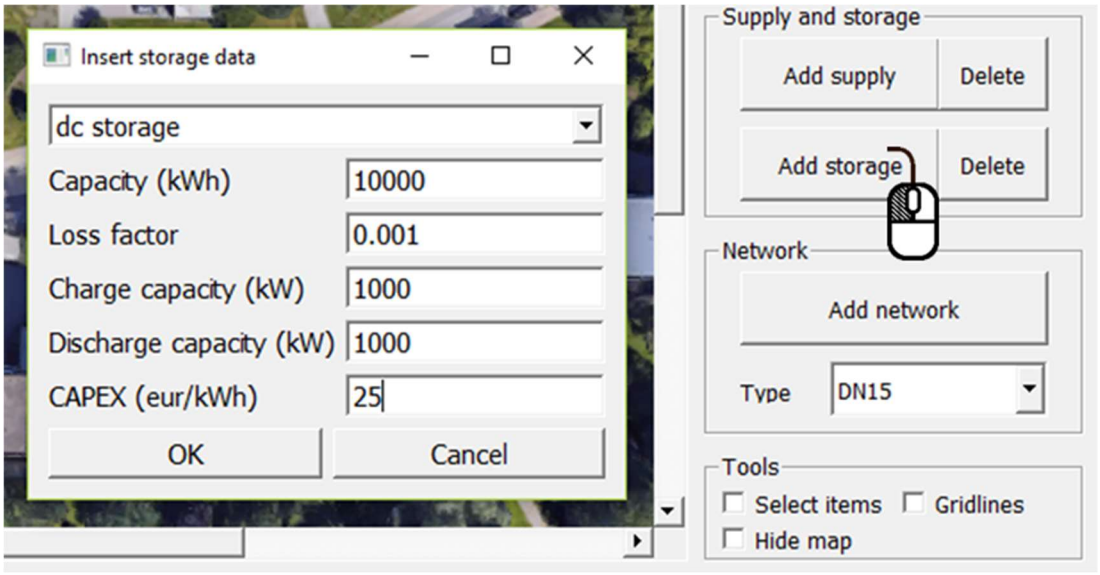


Figure 18. Inserting storage unit.

Storage unit concerning cooling, heat or electricity can be add into the system by clicking **Add storage** button (see Figure 18). User can select type of storage unit (dc storage, heat storage, electricity storage, free cool storage) and define technical and economical parameters (loss factor is hourly based). Storage units are not spatially modeled and therefore not inserted into map. Storage units can be deleted by clicking **Delete** button and selecting unit to be removed.

Modify and save case

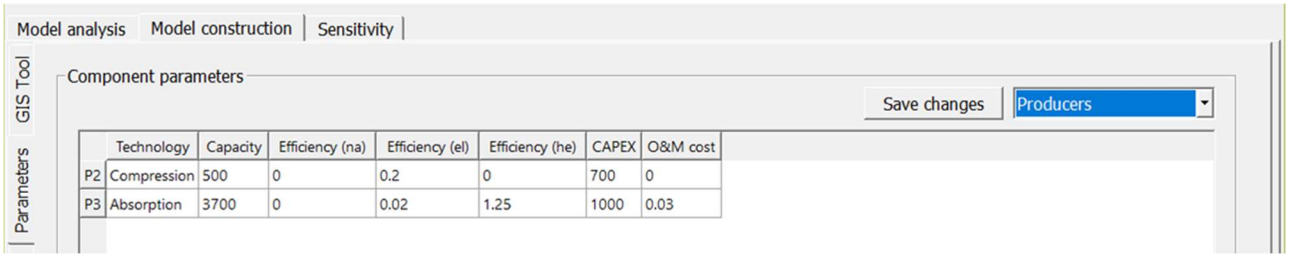


Figure 19. Component parameters of the system.

Elements and units of DC model can be examined in terms of parameters from **Component parameters** section in **Parameters** tab. User can select type of unit to be examined from the combo box. In addition, user can edit parameter values and save modifications by pressing **Save changes** button.

Note - this saving affects only current data structure and this change does not make any changes in case folder data files.

In **Component parameters** section, after selecting **Consumers**, user can examine hourly time series and duration curve of total building cooling consumption from a separate graph by clicking **Show consumption** button (see Figure 20).

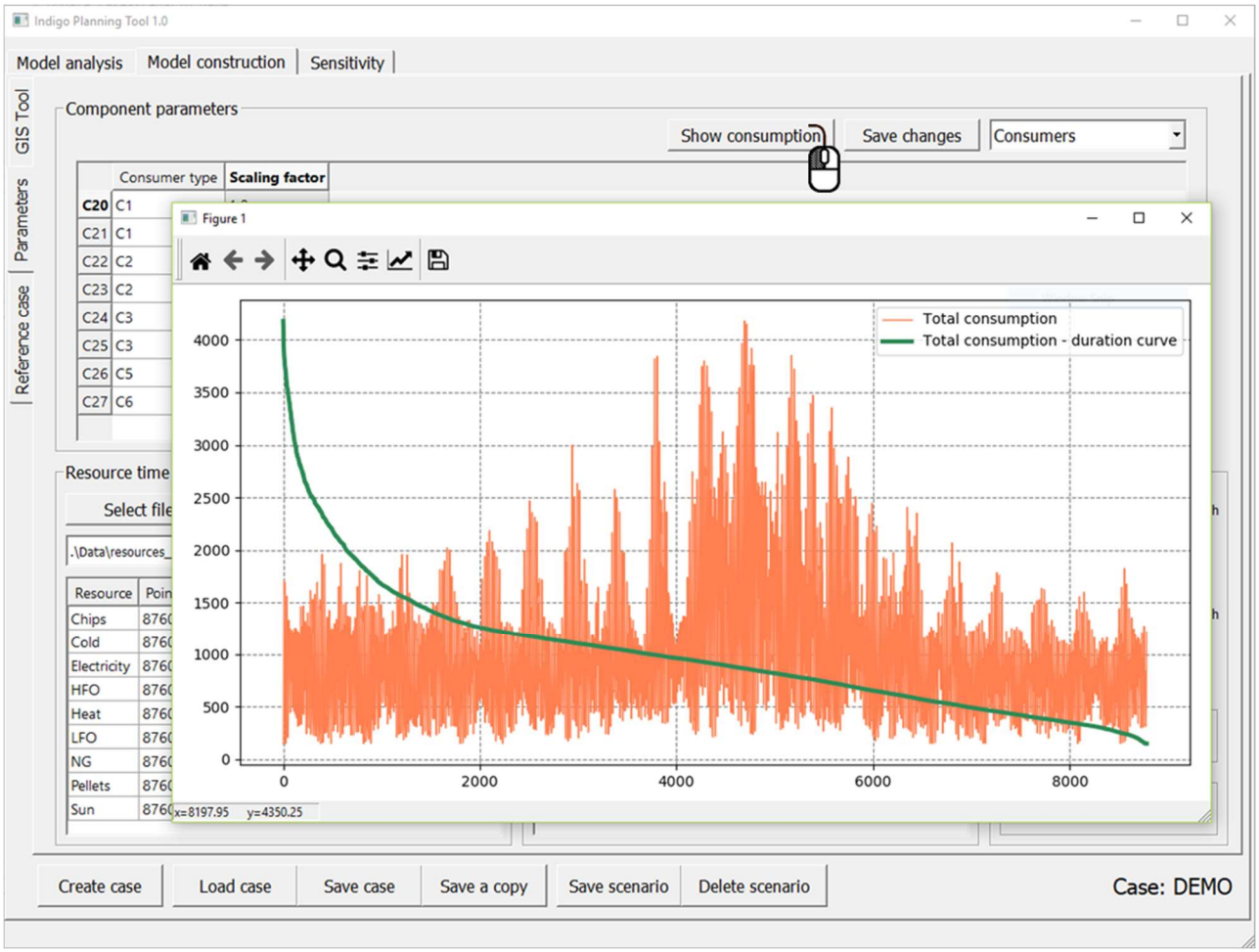


Figure 20. Duration curve of total cooling consumption in buildings.

Consumption profiles defined in imported data file can be altered in Component parameters section, by scaling the time series by a user defined factor (see Figure 21). User can change the scaling factor (default value is 1.0) in the table and update the consumption by pressing **Save changes** button.

*Note - user should update the reference case table in **Reference case** tab after altering the consumption time series.*

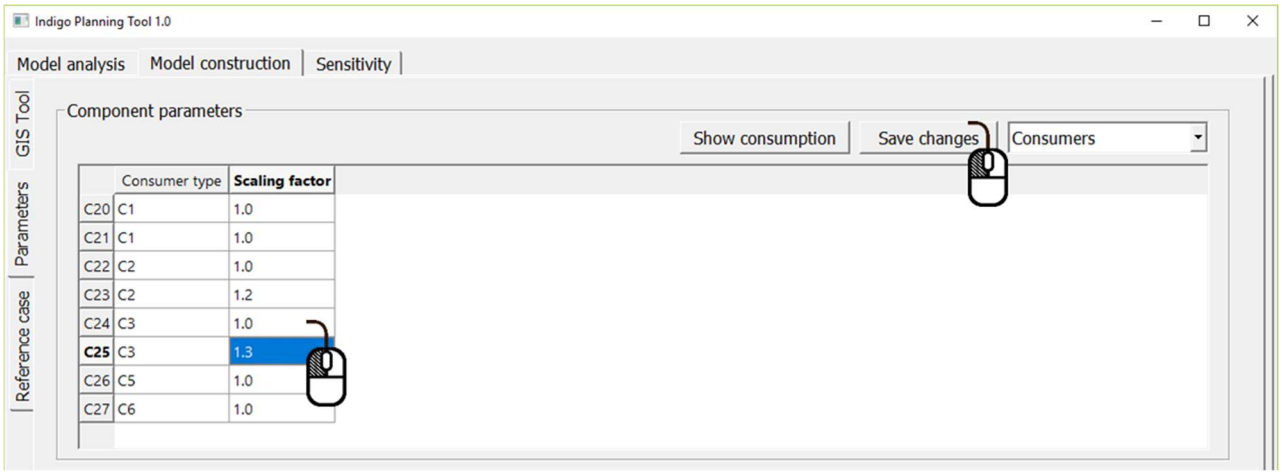


Figure 21. Setting scaling factors for consumers.

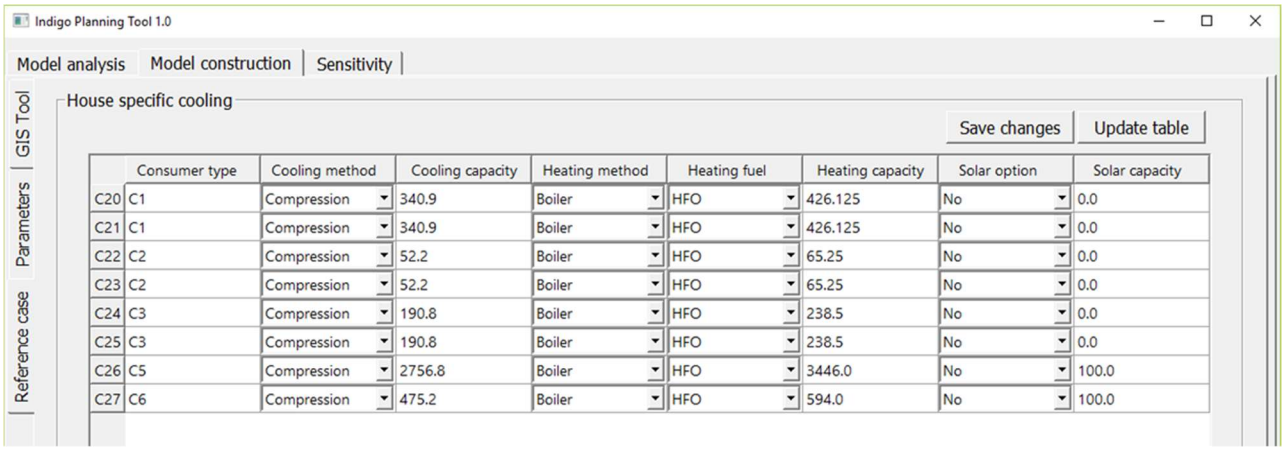


Figure 22. Building specific reference case.

In **Reference case** tab, user can examine and modify building specific reference case details by pressing **Update table** button (see Figure 22). In this table each consumer unit is listed with fitted cooling method capacity, that is, cooling capacity is calculated from peak load power divided by cooling efficiency. Furthermore, in the case of absorption cooling heat supply capacity is calculated by dividing cooling capacity by heating efficiency. Finally, there is an option for user to include solar collectors in the building. User can choose between options by using combo boxes and then **Save changes**.

*Note 1 - this saving affects only current data structure and this change does not make any changes in case folder data files (user should press **Save case** to make changes in case files).*

Note 2 - this reference table should be updated and saved after any change in consumer data (added or removed consumer point, change in consumer time series, scaling of consumption).

*Note 3 - techno-economical parameters for cooling technologies and supply technologies used in reference case can be viewed and edited in **cooling_techs.txt** and **supply_techs.txt** file in **.\Data** folder (see Figure 23 for details).*

Note 4 - if user wants to edit technical data in the reference case for each building separately, user can edit reference_data_SCENARIO.txt model file (see Figure 26*) in the case folder. It should be noted that order of data values in the model file follows the order in cooling_techs.txt data file (excluding emissions parameters).*

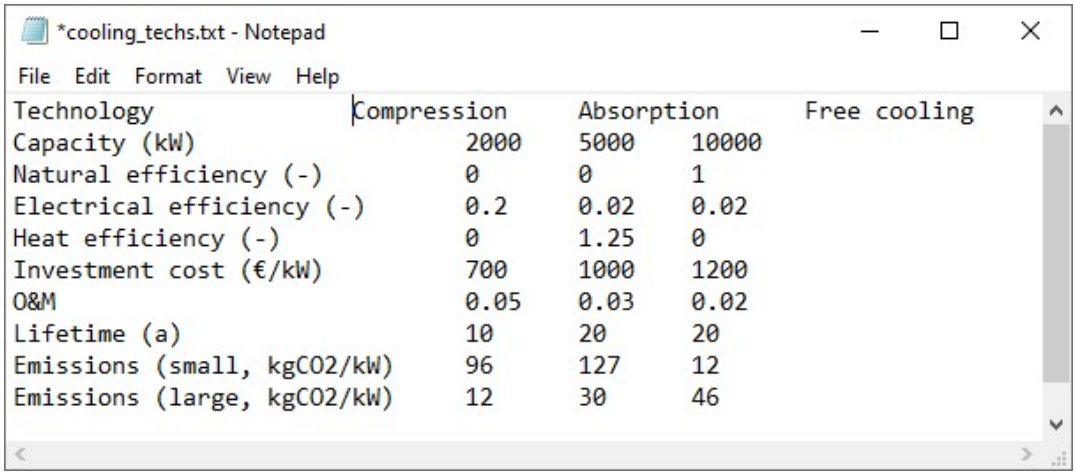


Figure 23. Cooling_techs file containing default data for cooling technologies.

*supply_techs.txt - Notepad

File Edit Format View Help

Technology	CHP	Boiler	Collectors	PVs
Electric efficiency (-)	0.4	0	0	0.13
Heat efficiency (-)	0.5	0.8	0.5	0
Capacity (kW, kW/m2)	5000	2000	0.6	0.1
Investment (€/kW)	2500	600	1200	1000
O&M (%-inv)	0.04	0.02	0.01	0.01
Lifetime (a)	20	25	20	20
Emissions (small, kgCO2/kW)	40	40	478	2353
Emissions (large, kgCO2/kW)	114	114	158	1584

Figure 24. Supply_techs file containing default data for supply technologies.

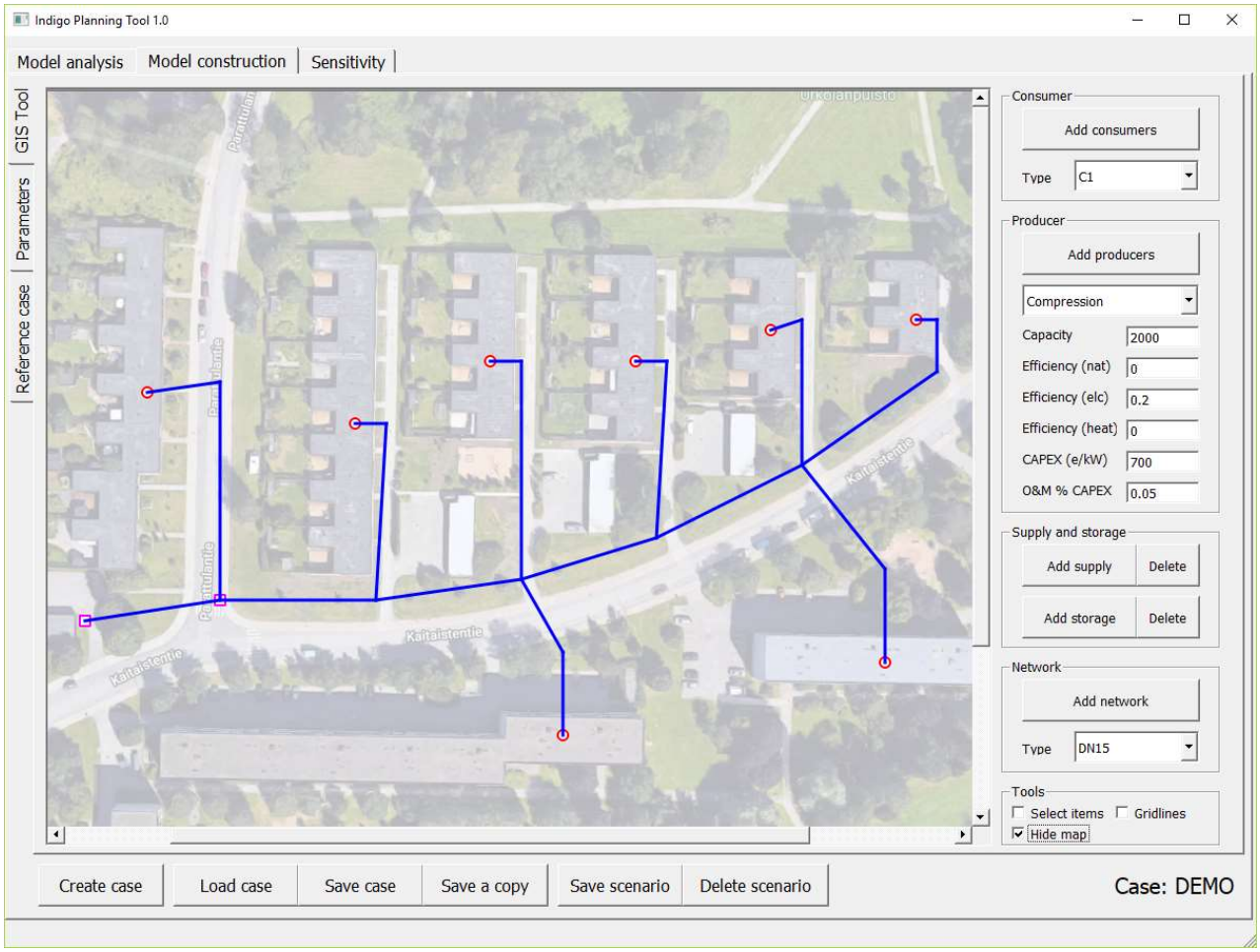


Figure 25. Finished DC model.

User can save model any time by pressing **Save case** button (see Figure 25). This saving procedure saves all the data structures, and these data structures are recovered from files when user loads case, that is, after loading user continues from the state in which model when saved. Also, **Save case** produces BASE case model files for optimization. If user makes modifications into model and presses **Save scenario** button, planning tool creates a snapshot of the current model in terms of model files (see Figure 26 for scenario model file example).

*Note - **Save scenario** button does not save data structures.*

User can make a copy of current case by clicking **Save a copy** button and renaming case. This procedure creates a copy of the case folder with new name. User can always delete scenarios by clicking **Delete scenario** button (note - BASE is not a scenario).

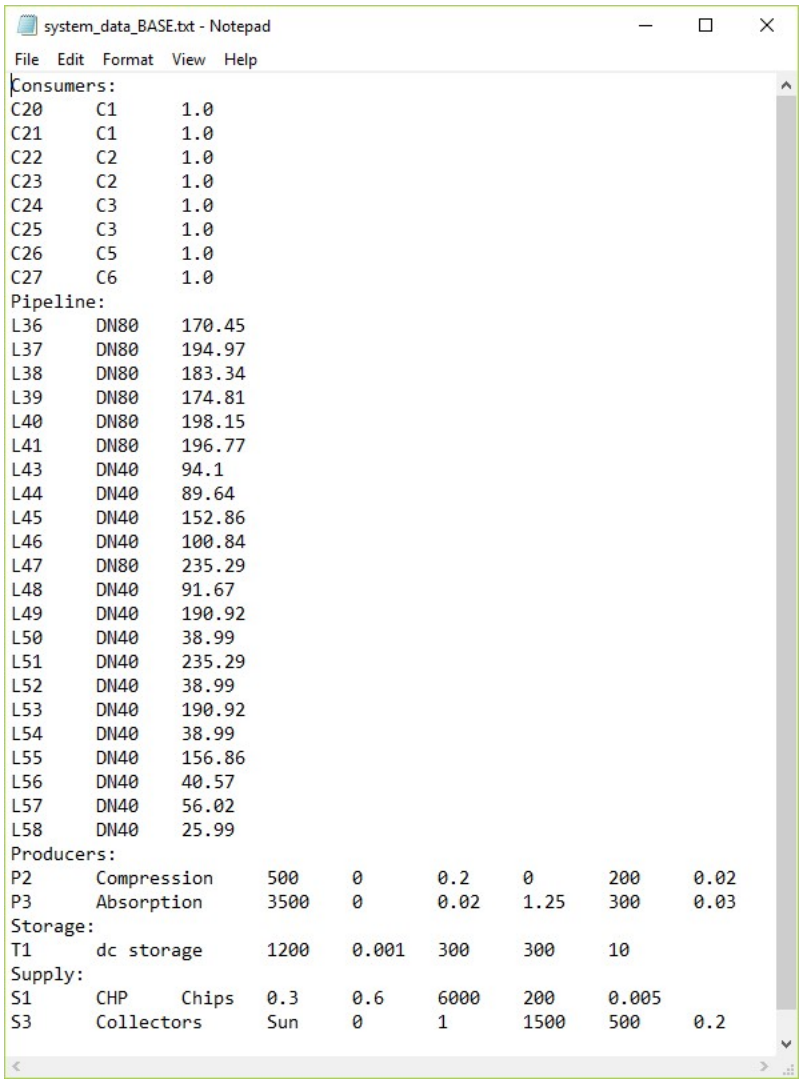


Figure 26. Example of scenario model file.

Running the model and examining results

Start optimisation

When user has created models in Model construction tab, user proceeds to run models in Model analysis tab, which contains following sections:

1. **Run model**: In this tab, user launches optimization of selected scenario in selected case.
2. **Model results**: In this tab, user can analyze results from optimized model or load previous model results

Model optimization takes place in **Run model** tab (see Figure 27). User selects case combo box and then selects a scenario of this case from the scenario list (user can check the details from a scenario by double-clicking the scenario name). User can modify model period length in hours, but user is recommended to use

hours of one year (8760 hours). If user wants to run in addition building specific reference case, user can fill **Run reference case** check box.

When optimization proceeds details of model and simulation progress is listed in the **Simulation log**. Optimization is completed when simulation log states "*END - Optimization ready*". Also, there can be two different notifications, when ready:

1. If optimization produces feasible result, notification is: *Optimal solution found - see results*
2. If no feasible solution is found, notification is: *Infeasible model - check model parameters*

Infeasible result indicates that parameters of DC system are set in a way that cooling demand cannot be covered with set of units in DC system.

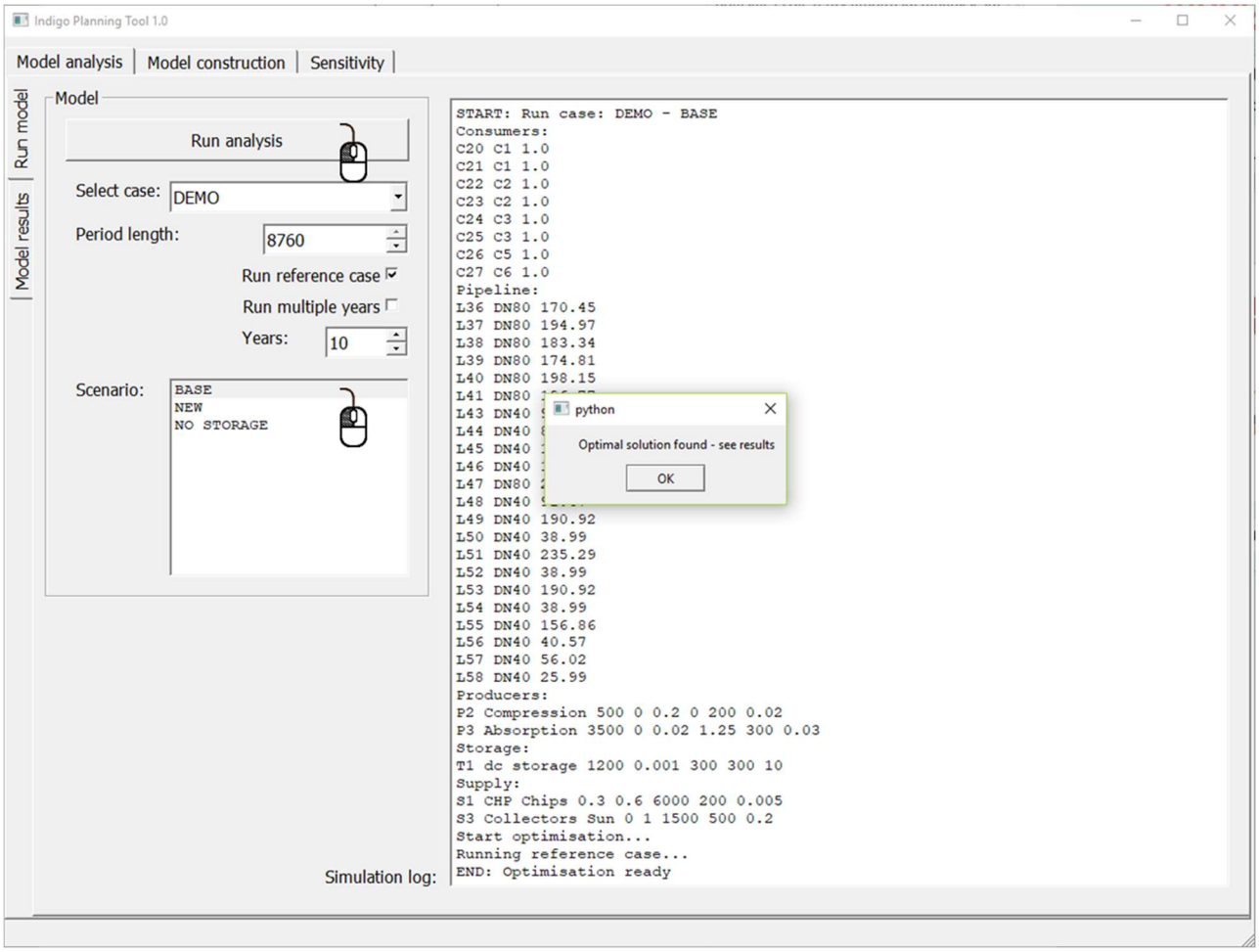


Figure 27. Running optimization model.

Multi-year model run

The planning tool enables multi-year running of the case with changing annual energy prices. This optimization mode uses **resources_projection_location.txt** file for scaling energy price based time series listed in **resources_location.txt** file. Index series in **resources_projection_location.txt** file can be interpreted in two manners (see Figure 28):

1. Scenario based interpretation: in this case all the rows in projection file can be interpreted as separate energy price scenarios and results include annualized investment costs.

2. Price development interpretation: in this case all the columns can be interpreted as annual time series for price development and results include amortization of the investment (paid for during year 0) by profits from district cooling.

Multi-year optimization is implemented by checking **Run multiple years** option in **Run model** tab and setting number of analyzed years according to Figure 29.

*Note - if **Run reference case** is selected, optimization is run for each building during each year, and this may result in long running time.*

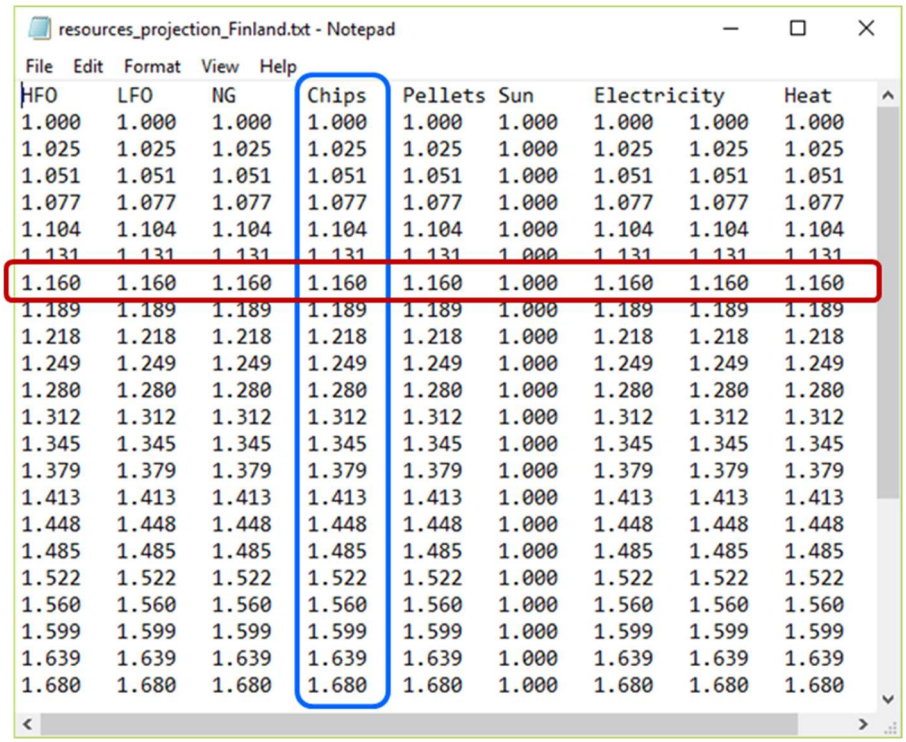


Figure 28. Two interpretations of energy price projections. Scenario based price alteration (red square) and annual development based price alteration (blue square).

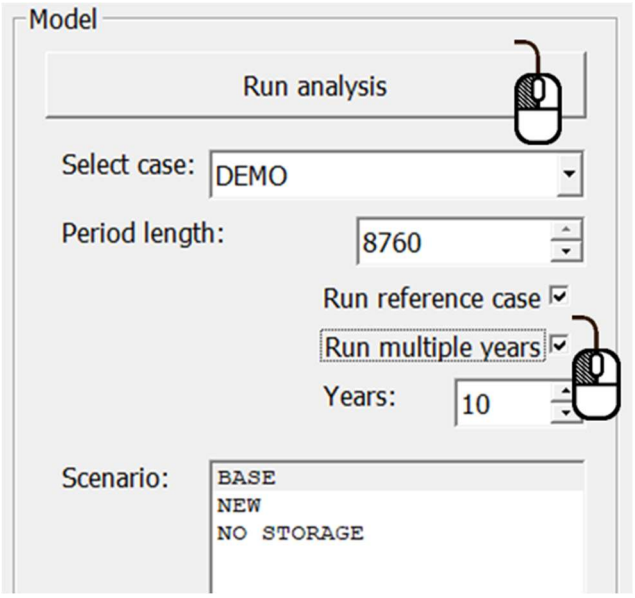


Figure 29. Launching of multi-year optimisation.

Running the multi-year optimisation does not result in any graphs due to the high number of runs. Therefore, results are listed in two separate tables illustrated in Figure 30. The table for the case lists scenario based results (includes annualized investment costs) for each year in green coloured cells. The price development based results are listed as a single red coloured column (including investment costs from year 0) representing amortization of the investment. In the reference case, merely scenario based results are listed.

DC case

	Total costs (ke)	Operational costs (ke)	Cooling production costs (e/MWh)	Cooling total costs (e/MWh)	Cooling emissions (kgCO2/MWh)	Profitability (ke)
Year 0						-3677.1
Year 1	557.23	274.69	34.77	70.53	19.06	-3204.75
Year 2	559.29	276.75	35.03	70.79	19.06	-2754.89
Year 3	561.43	278.89	35.3	71.06	19.06	-2326.45
Year 4	563.57	281.04	35.57	71.33	19.06	-1918.42
Year 5	565.8	283.26	35.85	71.61	19.06	-1529.81
Year 6	568.02	285.48	36.13	71.89	19.06	-1159.71
Year 7	570.41	287.87	36.44	72.2	19.06	-807.24
Year 8	572.8	290.26	36.74	72.5	19.06	-471.55
Year 9	575.19	292.65	37.04	72.8	19.06	-151.84
Year 10	577.74	295.2	37.36	73.12	19.06	152.64

Reference case

	Total costs (ke)	Operational costs (ke)	Cooling production costs (e/MWh)	Cooling total costs (e/MWh)	Cooling emissions (kgCO2/MWh)
Year 1	585.95	312.12	39.58	74.31	91.28
Year 2	589.49	315.66	40.03	74.76	91.28
Year 3	593.17	319.34	40.5	75.22	91.28
Year 4	596.85	323.02	40.96	75.69	91.28
Year 5	600.67	326.84	41.45	76.18	91.28
Year 6	604.49	330.66	41.93	76.66	91.28
Year 7	608.59	334.76	42.45	77.18	91.28
Year 8	612.69	338.87	42.97	77.7	91.28
Year 9	616.8	342.97	43.5	78.22	91.28
Year 10	621.18	347.36	44.05	78.78	91.28

Figure 30. Result tables for case (above) and reference case (below) from multi-year optimisation.

Examine results

After running the model and having received a feasible solution, model results can be examined in **Model results** tab (see Figure 31). In this tab there are two result sections:

1. **Result summary**: this tab contains operational result data and key performance indicators.
2. **Economy and emissions**: this tab contains economic data from case (and reference case) and emissions from DC system.

Result summary (see Figure 31) contains four result sections and one functional button:

1. Top row graph: this graph contains operational hourly data displayed for selected week. There are four different views, to be selected by user (see Figure 32) - DC production, heat supply, storage state and resource use.
2. Low left graph: this graph contains monthly sums of cooling production and heat supply.
3. Low middle table: this table contains utilization rates of production and supply units, and number of cycles in storage units.
4. Low right table: this table contains key performance indicators of DC system concerning costs and emissions.
5. **Show duration curves** - button: this button launches a graph window (see Figure 33) illustrating hourly duration curves for DC producers and heat supply technologies.

In **Model results** tab previous results can be loaded by selecting case from combo box and pressing **Load result** button.

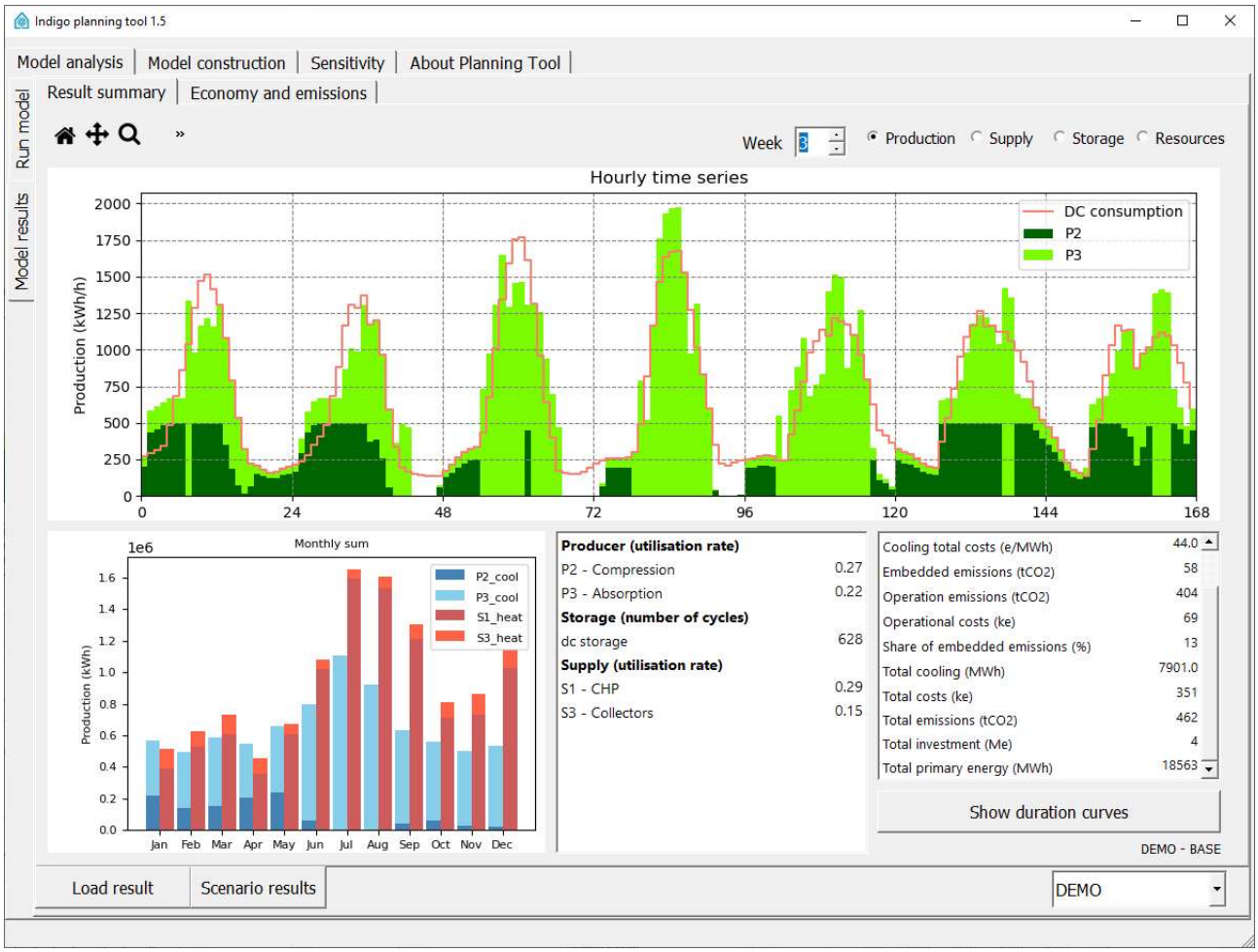


Figure 31. Result summary.

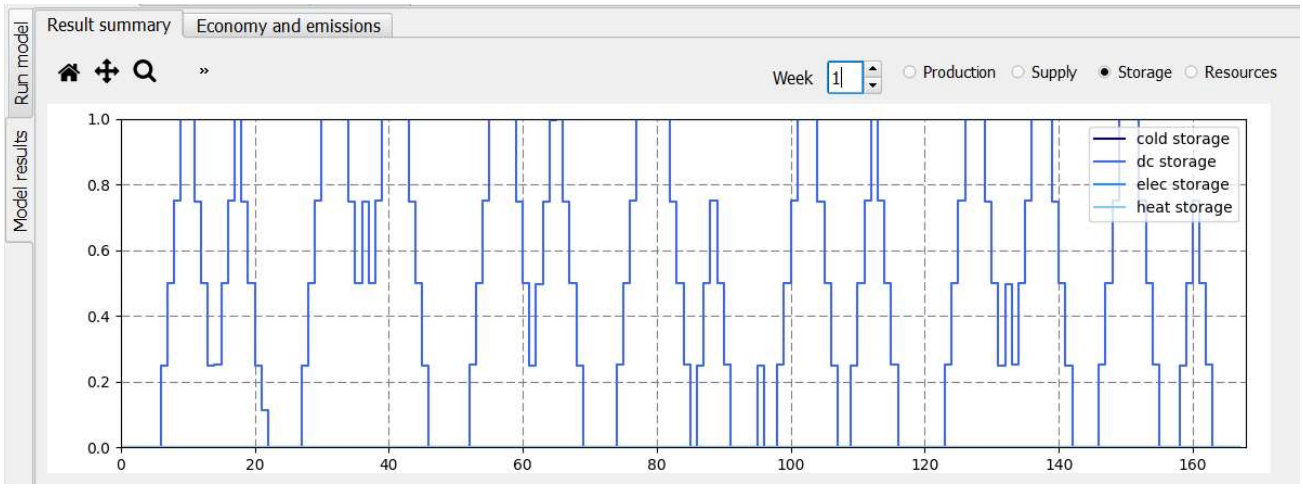


Figure 32. Operational data graph. Note - in the case of storage, the graph shows the state of the storage relative to maximum capacity (0.0 = empty storage, 1.0 = full storage).

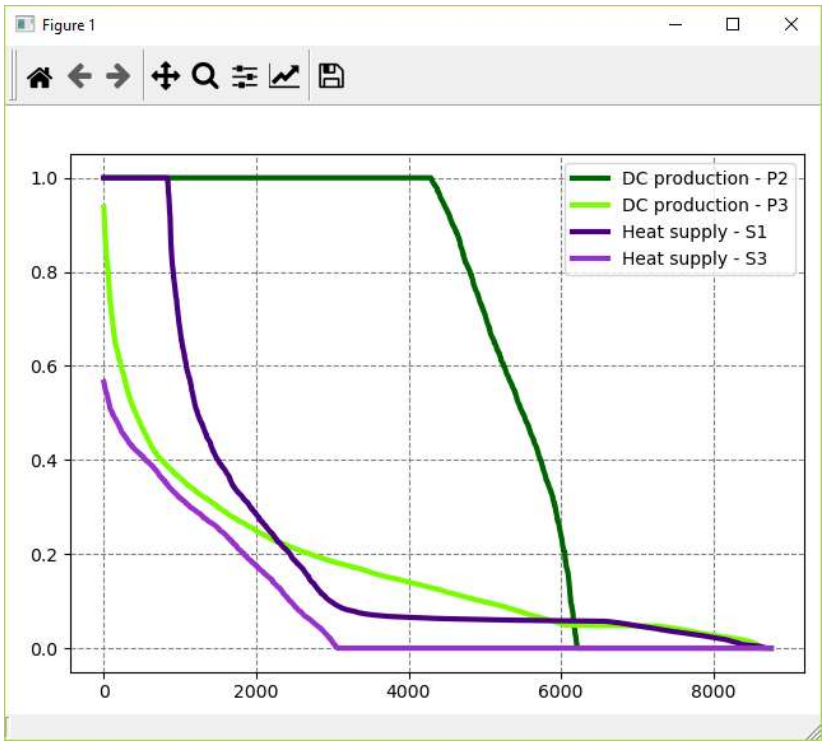


Figure 33. Duration curve window.

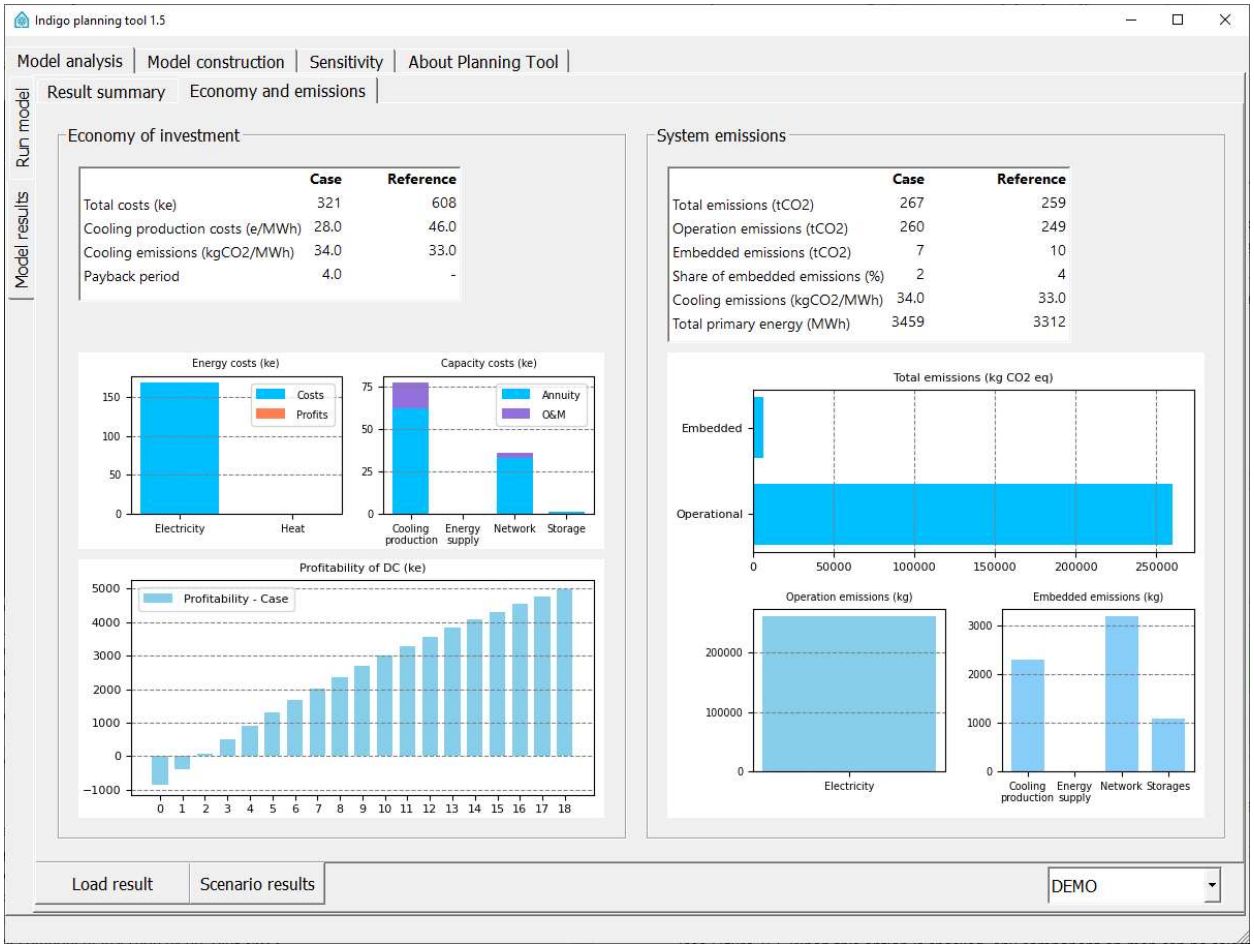


Figure 34. Economy and emission results.

Economy and emissions (see Figure 34) contains two sections:

1. Economy of investment: In this section, cost based indicators from case and reference case are compared in a table. Also, in the cost graph, operational and fixed costs are illustrated in more detail. Finally, profitability curve illustrates how investment cost in the selected case is amortized by profits from DC system.
2. System emissions: In this section, emission based indicators from case and reference case, are listed and system emissions divided into embedded and operational emissions are illustrated. Also, primary energy consumption of the system is presented here.

In Model results tab user can view summary results from several scenarios of selected case by pressing **Scenario results** button. This button launches separate windows (see Figure 35) containing:

1. Graphs of monthly sums of cooling production and heat supply from all scenarios.
2. Table of key performance indicators from all scenarios.

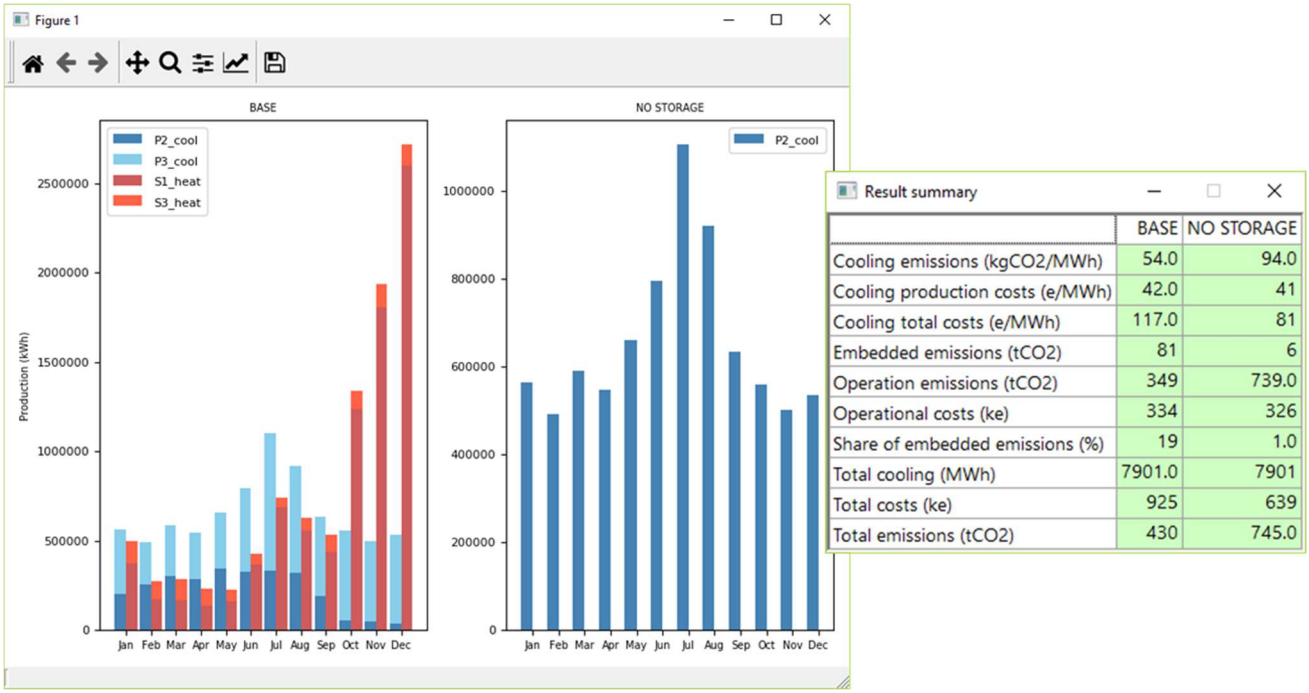


Figure 35. Scenario result summaries.

*Note 1 - contents in all the tables in the planning tool can be copied to easily to excel. User can select one cell in the table and press **Ctrl-C** in order to copy the content as tab-separated list to Clipboard. This can be pasted to excel by pressing **Ctrl-V**.*

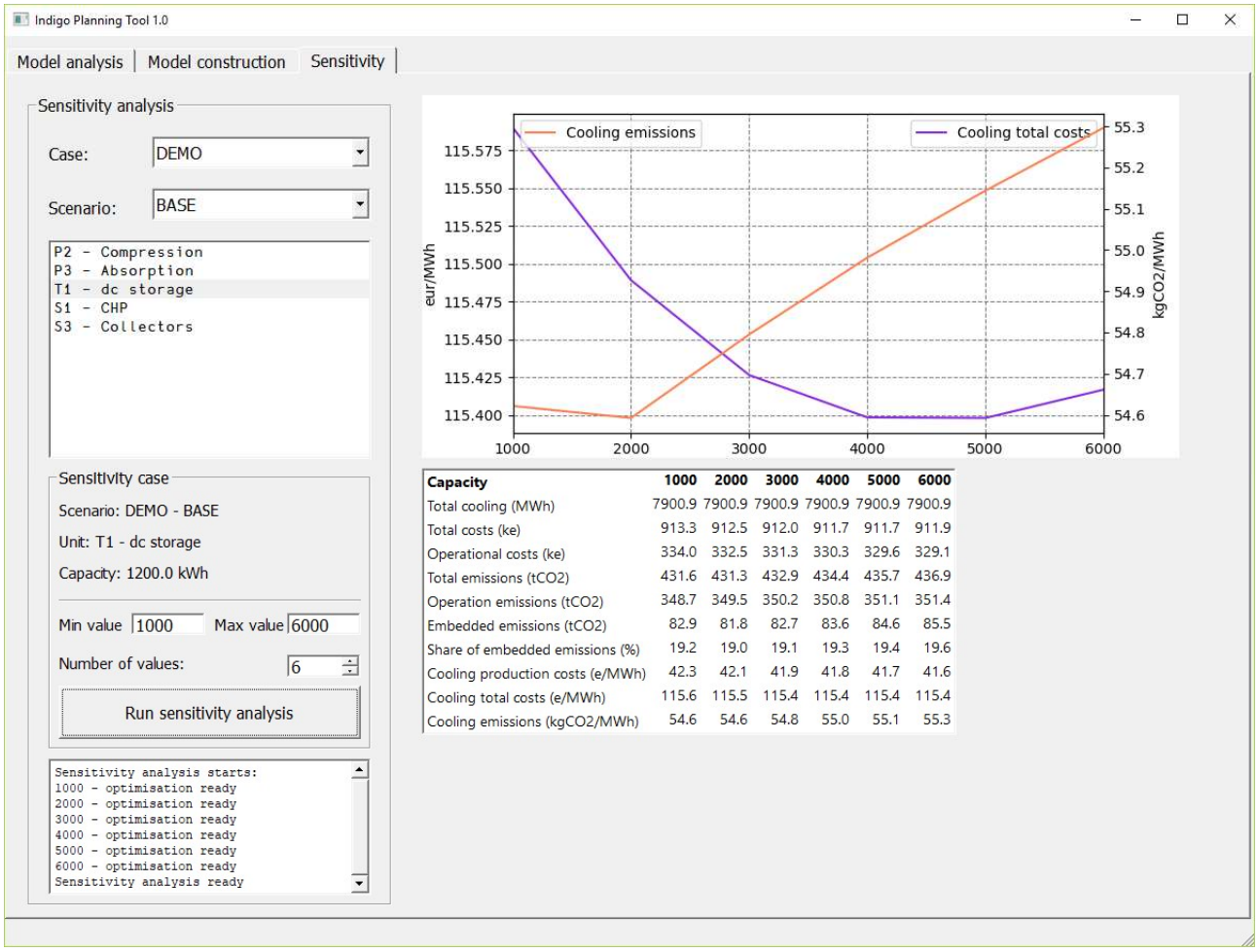
Note 2 - hourly results in terms of all the units in the DC system can be examined in detail (including consumed energy and produced energy) by viewing "Optimisation_results_(CASE_NAME).txt" file located in the Planning Tool folder. This feature applies also to building specific reference case in which the files are named as "Optimisation_results_(BUILDING_CODE).txt".

Run sensitivity analysis

In **Sensitivity** tab (see Figure 36) user can perform sensitivity analysis on selected case in terms of unit capacity parameter. User selects a case from combo box and then selects one scenario from this case. After selection, application presents list of units (producer, supply or storage) in this scenario. User can double-click one unit and activate that unit to be submitted to sensitivity analysis. Activated unit can be examined in Sensitivity case section. User sees current capacity value of analyzed unit and can set minimum and maximum value and number of values (min + max + points between) to be simulated. By pressing **Run sensitivity analysis**, user initiates as many optimization runs as there are number of values defined. Progression of sensitivity analysis can be examined in sensitivity log.

Results from sensitivity analysis are illustrated in graph and table:

1. In top graph, cooling total costs (€/MWh) and total emissions (kgCO2/MWh) are illustrated as function of capacity value.
2. In bottom table, key performance indicators are listed as function of capacity value.



Capacity	1000	2000	3000	4000	5000	6000
Total cooling (MWh)	7900.9	7900.9	7900.9	7900.9	7900.9	7900.9
Total costs (ke)	913.3	912.5	912.0	911.7	911.7	911.9
Operational costs (ke)	334.0	332.5	331.3	330.3	329.6	329.1
Total emissions (tCO2)	431.6	431.3	432.9	434.4	435.7	436.9
Operation emissions (tCO2)	348.7	349.5	350.2	350.8	351.1	351.4
Embedded emissions (tCO2)	82.9	81.8	82.7	83.6	84.6	85.5
Share of embedded emissions (%)	19.2	19.0	19.1	19.3	19.4	19.6
Cooling production costs (e/MWh)	42.3	42.1	41.9	41.8	41.7	41.6
Cooling total costs (e/MWh)	115.6	115.5	115.4	115.4	115.4	115.4
Cooling emissions (kgCO2/MWh)	54.6	54.6	54.8	55.0	55.1	55.3

Figure 36. Sensitivity analysis.

Appendix: Case and system specific data files

In the folder application is installed, there is subfolder named **.\GIS** in which case folders are created. There are several files in a case folder (see Table 1). During the case creation, map file and coordinate files are inserted in the case folder. When user saves case during model construction, application saves data structures into pickle files (.pickle), which store data objects and can be utilized easily when case is loaded into model construction tool. Furthermore, when user saves case, application creates model text files with scenario name BASE. If user saves scenarios, similar model files named after scenario are created in the case folder. Optimization procedure uses these model text files to construct optimization model. User can delete scenario files, except BASE scenario, in order to delete a scenario (all the model .txt files for deleted scenario should be removed), but using the **Delete scenario** functionality is recommended.

Table 1. Files located in the case folder.

File type	Description
GIS case files	**User should not delete or edit**
Map.png	Map file used in GIS tool
Coordinates.txt	Longitude and latitude of left top corner and right bottom corner
Model .txt files	**User can edit numeric values and delete files (except BASE scenario!)**
dh_network_<scenario>.txt	Topology of DC network
dh_nodes_<scenario>.txt	Location of network nodes
prod_con_<scenario>.txt	Location of producers and consumers
reference_data_<scenario>.txt	Building specific reference case data
System_cost_<scenario>.txt	System data - tariffs, selling/purchase options and location
system_data_<scenario>.txt	System data - consumers, production and supply units, storages and pipeline
Pickle files	**User should not delete or edit**
arc.pickle	System data object structure
con_ts.pickle	Consumer time series data structure
cons.pickle	Consumer location data structure
lines.pickle	Pipeline location data structure
prod.pickle	Producer location data structure
ref.pickle	Building specific reference case data structure
res_ts.pickle	Resource time series data structure
scen_af_<scenario>.pickle	Unit utilization factors - scenario result file
scen_emission_<scenario>.pickle	Emissions - scenario result file

scen_months_<scenario>.pickle	Monthly data - scenario result file
scen_profit_<scenario>.pickle	Profit data - scenario result file
scen_results_<scenario>.pickle	Operational time series - scenario result file
scen_types_<scenario>.pickle	Unit types - scenario result file
scen_values_<scenario>.pickle	Key performance indicators - scenario result file