

Neuried



This project has received funding from the EU's Horizon 2020 programme under grant agreement no 101033706.



www.actionheat.eu



Contents

1. How was the network created?
2. What results are available?
3. Possible next steps



1. How was the network created?



Local heating planning



FNP



THERMOS



1. How was the



Local heating planning



ERMOS





Welcome, Aljoscha

[Settings](#) [Help](#) [Forum](#) [Logout](#)

You are participating in 14 projects

New Project

Create new project



Project options:

1USER  **DELETE**  **MAP**  **LIDAR** 

This project has no maps in it yet. Get started by creating a new map above.

Add user



Project options:

1 USER

DELETE

MAP

LIDAR

This project has no maps in it yet. Get started by creating a new map above.

LIDAR data can be added subsequently at this point. Please note that subsequently added LIDAR data has no influence on the calculation results of maps that have already been created.

Project options:

1 USER

DELETE X

MAP

LIDAR

This project has no maps in it yet. Get started by creating a new map above.

Create new map

Buildings and roads

Heat demands and supplies are associated with buildings in the map, and potential heat pipe routes are associated with roads and paths in the map. You can acquire map data from OpenStreetMap, or you can upload your own GIS data.

Use OpenStreetMap for buildings and roads

You can search for a named area in OpenStreetMap, or draw a box.



Upload GIS Files

Back

Next



Buildings and roads

Heat demands and supplies are associated with buildings in the map, and potential heat pipe routes are associated with roads and paths in the map. You can acquire map data from OpenStreetMap, or you can upload your own GIS data.

Use OpenStreetMap for buildings and roads

You can search for a named area in OpenStreetMap, or draw a box.



Upload shapefiles

Upload GIS Files

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Next



Create a new map Settings Help Forum Logout

Buildings and roads

Heat de
pipe routes an
You
Se

THERMOS has various estimation models. Depending on the information available, the appropriate model is selected individually for each demand point! This means that different estimation accuracies can be mapped in one project.

The share of the respective model in the overall project is displayed in the project overview. This currently looks as follows for the potential area:

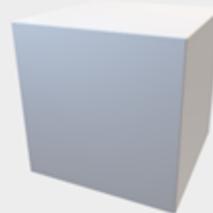
Demand estimates: 51% 3d-lm, 26% 2d-lm, 23% 3d-svm

The higher the proportion of measured estimates based on the 3D model, the more accurate the estimate of total demand.

The exact calculation methods can be found in the THERMOS documentation: <https://action-heat-thermos.cse.org.uk/help/demand/demand-model.html>

Upload GIS Files

Estimation accuracy

2D	3D	Measured	
<p>Building polygon data is derived from OSM or a GIS file. THERMOS estimates the demand without height data.</p>	<p>Building polygon data is derived from OSM or a GIS file and height data is added manually or via LIDAR data.</p>	<p>Building polygon data is derived from OSM or a GIS file. Demand data is user-specified based on measured data.</p>	
			
Lowest			Highest

Create a new map

Settings Help Forum Logout

Buildings and roads

The 3D estimation model was used for the buildings from the FNP.

Demand estimates: 51% 3d-tn, 16% 2d-tn, 23% 3d-sym

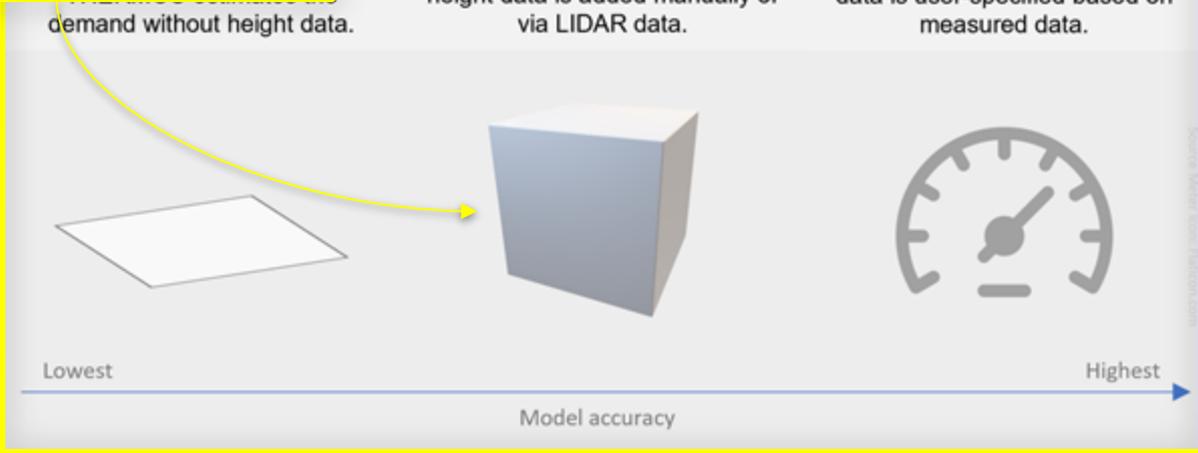
Buildings in the map
and roads
Map, or draw a



derived demand without height data.

Estimation accuracy

3D	Measured
Building polygon data is derived from OSM or a GIS file and height data is added manually or via LIDAR data.	Building polygon data is derived from OSM or a GIS file. Demand data is user-specified based on measured data.



Lowest

Highest

Model accuracy

Upload GIS Files

Back Next

Create a new map Settings Help Forum Logout

As no height data is available for the other buildings (e.g. gymnasium, school), the estimates are currently based on the less precise 2d model

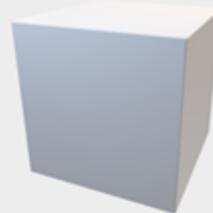
Demand estimates: 51% 3d-in, 26% 2d-in, 23% 3d-sim

Buildings in the map, and potential heat pipe routes are shown. Land roads. Map or draw a box.

Upload GIS

Back Next

Estimation accuracy

2D	3D	Measured
Building polygon data is derived from OSM or a GIS file. THERMOS estimates the demand without height data.	Building polygon data is derived from OSM or a GIS file and height data is added manually or via LIDAR data.	Building polygon data is derived from OSM or a GIS file. Demand data is user-specified based on measured data.
		
Lowest		Highest
Model accuracy →		

Create a new map

Buildings and roads

Heat demands and supplies are associated with buildings in the map, and potential heat pipe routes are associated with roads.

Use OpenStreetMap for buildings and roads

You can search for a named area in OpenStreetMap, or draw a box.

Search...

In order for THERMOS to be able to use the 3D model, the elevation data must be correctly assigned at this point.

The same applies to the known consumption values. These are also transferred to THERMOS in this menu.

Buildings

Field	Meaning
@id	None
Gesamthoeh	Building height (m)
Nutzflaech	Floor area (m2)
addr_city	None
addr_count	None
addr_house	None
addr_postc	None
addr_stree	None
amenity	None
building	None
building_c	None
building_l	None
building_m	None
building_p	None
constructi	None
height	None
id	None
name	None
note	None
roof_colou	None
roof_direc	None
roof_heigh	None
roof_level	None
roof_mater	None
roof_shape	None
toilets_wh	None
url	None
wheelchair	None
wikidata	None
wikipedia	None

Work steps

- The building heights result from the number of storeys (known from the FNP) multiplied by a storey height of 2.8 m (assumption).
- Using the spreadsheet programme in QGIS, the corresponding values per demand point were calculated and assigned to each individual polygon.
- The altitude information was transferred to THERMOS using the import function and the corresponding attribute assignment.

THERMOS Neuried

Save Optimise

Search...

Project title

Map view: Constraints Solution

Map legend

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

- Required
- Optional
- Forbidden
- Network supply

Map data | Imagery by: CNR, Maxar, Earthstar Geographics, CNES/Airbus DS, USDA/FSA, USGS, AeroGRID, IGN, IGP, and the GIS User Community

THERMOS Neuried

Save Optimise

Search...

Zoom in/out

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Map view: Constraints Solution

Map legend

- Required
- Optional
- Forbidden
- Network supply

THERMOS Neuried

Save Optimise

Search...

Selection tools

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Required
Optional
Forbidden
Network supply

Map view: Constraints Solution

Map legend

THERMOS Neuried

Save Optimise

Search...

None
Maps
Satellite
Candidates
Heatmap
Labels

Required
Optional
Forbidden
Network supply

Map view: Constraints Solution

Map legend

Above: Hide unselected objects
below: centre on selection



Draw new connecting
element (cable)

Search...

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

- Required
- Optional
- Forbidden
- Network supply

Map view: Constraints Solution

Map legend

THERMOS Neuried

Save Optimise

Search...

Draw new object (Building)

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Required
Optional
Forbidden
Network supply

Map view: Constraints Solution

Map legend

The screenshot displays the THERMOS software interface. At the top left, the logo and name 'THERMOS' are visible, along with the user name 'Neuried'. On the top right, there are 'Save' and 'Optimise' buttons. A search bar is located in the top right corner. The main area is a satellite map of a residential neighborhood. A white outline highlights a specific area containing several buildings, representing the 'Candidates' for optimization. A yellow box on the left contains text: 'Switch map view', 'Constraints: View of candidates and constraints', and 'Solution: Solution view'. A yellow line connects this box to the 'Constraints' button in the bottom left corner. The bottom left corner shows a 'Map view:' section with 'Constraints' and 'Solution' buttons. The bottom right corner features a 'Map legend' button and a legend for map features: 'Required' (red line), 'Optional' (blue line), 'Forbidden' (grey area), and 'Network supply' (orange square). A vertical legend on the right side of the map shows 'None', 'Maps', 'Satellite', 'Candidates' (checked), 'Heatmap', and 'Labels'.

THERMOS Neuried

Save Optimise

Search...

○ None
○ Maps
● Satellite
☑ Candidates
☐ Heatmap
☐ Labels

Switch map view
Constraints: View of candidates and constraints
Solution: Solution view

Map view: Constraints Solution

Map legend

- Required
- Optional
- Forbidden
- Network supply

THERMOS Neuried

Save Optimise

Search...

- None
- Maps
- Satellite
- Candidates
- Heat map
- Labels

Map view: Constraints Solution

Map legend

- Required
- Optional
- Forbidden
- Network supply

Saving and starting the optimiser

Maplet | Images by Carto, Maxar, Earthstar Geographics, CNES/Airbus DS, USDA/FSA, USGS, AeroGRID, IGN, IGP, and the OpenStreetMap community

THERMOS Neuried

Save Optimise

Search...

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Legend

- Required
- Optional
- Forbidden
- Network supply

Map view: Constraints Solution

Map legend

THERMOS Neuried

Save Optimise

Search...

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Map view: Constraints Solution

Map legend

- Required
- Optional
- Forbidden
- Network supply

Show main menu

www.actionheat.eu

The screenshot displays the ActionHeat software interface. On the left, a sidebar contains several menu items: NETWORK PROBLEM (with 'Map view' highlighted), NETWORK SOLUTION, SUPPLY PROBLEM, HELP, and IMPORT / EXPORT DATA. The main area shows an aerial satellite map of a residential neighborhood with a white network overlay. A yellow callout box with the text 'back to map view' points to the 'Map view' option in the sidebar. In the top right corner, there are 'Save' and 'Optimise' buttons, a search bar, and a map style selector. The map style selector is currently set to 'Satellite'. A legend in the bottom right corner defines the network overlay colors: red for 'Required', blue for 'Optional', grey for 'Forbidden', and orange for 'Network supply'.

NETWORK PROBLEM

- Map view
- Objective
- Tariffs
- Pipe & connection costs
- Insulation
- Individual systems

NETWORK SOLUTION

- Solution summary
- Run log

SUPPLY PROBLEM

- Profiles
- Technologies
- Objective

HELP

Search help...

- Help contents
- Network editor help
- Keyboard shortcuts

IMPORT / EXPORT DATA

- Excel Spreadsheet
- Excel Spreadsheet
- Geojson

PROJECT

Save Optimise

Search...

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Required

Optional

Forbidden

Network supply

Map legend

back to map view

The screenshot displays a software interface for network optimization. The main area shows an aerial map of a residential neighborhood with a white network overlay. A yellow box highlights the 'Objective' option in the 'NETWORK PROBLEM' sidebar. A grey callout box with the text 'Set optimisation settings' points to the 'Objective' option. The sidebar also lists other categories: 'NETWORK SOLUTION', 'SUPPLY PROBLEM', 'HELP', and 'IMPORT / EXPORT DATA'. The top right corner has 'Save' and 'Optimise' buttons. A search bar is located in the top right. A legend in the bottom right corner defines line styles: Required (red), Optional (blue), Forbidden (grey), and Network supply (orange). Another legend in the top right corner shows map styles: None, Maps, Satellite, Candidates (checked), Heatmap, and Labels.

Save Optimise

Search

None
Maps
Satellite
Candidates
Heatmap
Labels

Required
Optional
Forbidden
Network supply

Map legend

Set optimisation settings

Objective

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Excel Spreadsheet

Geojson

PROJECT



Objective

Maximize network NPV

In this mode, the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the revenues from demands minus the sum of costs for the network.

The impact of non-network factors (individual systems, insulation, and emissions costs) can be accounted for using the market tariff, which chooses a price to beat the best non-network system.

Maximize whole-system NPV

In this mode, the goal is to choose how to supply heat to the buildings in the problem (or abate demand) at the minimum overall cost. The internal transfer of money between buildings and network operator is not considered, and there are no network revenues and tariffs have no effect.

Offer insulation measures Offer other heating systems*

Accounting period

Sum costs and benefits over years. Discount future values at % per year.

Capital costs

Item	Annualize	Recur*	Period	Rate	$\frac{1}{100}$	PV($\frac{1}{100}$)
Pipework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Other heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100

In this mode, the aim is to select the consumers to be connected to the grid in such a way that the net present value for the grid operator is maximised. This results from the sum of the revenue from demand minus the sum of the costs for the grid.



Objective

Maximize network NPV

In this mode, the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the revenues from demands minus the sum of costs for the network.

The impact of non-network factors (individual systems, insulation, and emissions costs) can be accounted for using the market tariff, which chooses a price to beat the best non-network system.

Maximize whole-system NPV

In this mode, the goal is to choose how to supply heat to the buildings in the problem (or abate demand) at the minimum overall cost. The internal transfer of money between buildings and network operator is not considered, so there are no network revenues and tariffs have no effect.

Offer insulation measures Offer other heating systems*

Accounting period

Sum costs and

In this mode, the objective is to choose how to supply heat to the affected buildings (or reduce demand) at the lowest total cost. The internal transfer of money between buildings and grid operators is not taken into account, so there is no grid revenue and tariffs have no impact.

Within this framework, you can control whether you

Offer insulation measures
offer other heating systems

These decisions are not relevant for maximising the net present value of the network, as they can never improve the net present value of the network operator and would therefore never be chosen.





Objective

Maximize network NPV

In this mode, the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the present value of the revenues and tariffs less the sum of the present value of the costs. The impact of non-network factors (individual systems, insulation, and emissions costs) can be accounted for using the market tariff, which chooses the most cost-effective option.

Maximize whole-system NPV

In this mode, the goal is to choose how to supply heat to the buildings in the problem (or abate demand) at the minimum overall cost. The internal revenues and tariffs have no effect.

Offer insulation measures Offer other heating systems*

Accounting period

Sum costs and benefits over years. Discount future values at % per year.

Future costs and benefits are discounted by assuming a discount rate. Using the controls for the accounting period, you can specify the number of years into the future to be taken into account and determine by how much the costs should be discounted for each year from the start of the simulation.

Capital costs

Item	Annualize	Recur	Period	Rate	$\frac{1}{100}$	PV($\frac{1}{100}$)
Pipework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Other heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100

Emissions costs

Emission	Cost/t
co2	<input type="text" value="0,00"/>
pm25	<input type="text" value="0,00"/>
nox	<input type="text" value="0,00"/>

Emissions limits

Emission Limited	Limit (t/yr)
co2 <input type="checkbox"/>	<input type="text" value="0,0"/>
pm25 <input type="checkbox"/>	<input type="text" value="0,0"/>
nox <input type="checkbox"/>	<input type="text" value="0,0"/>





Objective

Maximize network NPV

In this mode, the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the revenues from demands.

The impact of non-network factors (individual systems, insulation, and emissions costs) can be accounted for using the market tariff, which chooses a price to beat the best offer.

Maximize whole-system NPV

In this mode, the goal is to choose how to supply heat to the buildings in the problem (or abate demand) at the minimum overall cost. The internal transfer of money between buildings has no effect.

Offer insulation measures Offer other heating systems*

Accounting period

Sum costs and benefits over years. Discount future values at % per year.

Capital costs

Item	Annualize	Recur	Period	Rate	$\frac{1}{100}$	PV($\frac{1}{100}$)
Pipework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Other heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100

Capital costs can be annuitised, which means that they are converted into a fixed amortising loan.

Capital costs can be recurring, which means that the equipment they represent must be replaced at regular intervals, so that the original capital costs are incurred again after this time.

Emission

Emission	Cost/t
co2	<input type="text" value="0,00"/>
pm25	<input type="text" value="0,00"/>
nox	<input type="text" value="0,00"/>

Emission Limited	Limit (t/yr)
co2 <input type="checkbox"/>	<input type="text" value="0,0"/>
pm25 <input type="checkbox"/>	<input type="text" value="0,0"/>
nox <input type="checkbox"/>	<input type="text" value="0,0"/>





Objective

Maximize network NPV

In this mode, the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the revenues from demands minus the sum of costs for the network.

The impact of non-network factors (individual systems, insulation, and emissions costs) can be accounted for using the market tariff, which chooses a price to beat the best non-network system.

Maximize whole-system NPV

In this mode, the goal is to choose how to supply heat to the buildings in the problem (or abate demand) at the minimum cost. Buildings and network operator is not considered, so there are no network revenues and tariffs have no effect.

Offer insulation measures Offer other heating systems*

Accounting period

Sum costs and benefits over years. Discount future values at % per year.

Determination of
emission costs in
ct./kwh

Capital costs

Item	Annualize	Recur	Period	Rate	n 100'	PV(n 100)'
Pipework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Other heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100

Emissions costs

Emission	Cost/t
co2	<input type="text" value="0,00"/>
pm25	<input type="text" value="0,00"/>
nox	<input type="text" value="0,00"/>

Emissions limits

Emission	Limited	Limit (t/yr)
co2	<input type="checkbox"/>	<input type="text" value="0,0"/>
pm25	<input type="checkbox"/>	<input type="text" value="0,0"/>
nox	<input type="checkbox"/>	<input type="text" value="0,0"/>





Objective

Maximize network NPV

In this mode, the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the revenues from demands minus the sum of costs for the network.

The impact of non-network factors (individual systems, insulation, and emissions costs) can be accounted for using the market tariff, which chooses a price to beat the best non-network

Maximize whole-system NPV

In this mode, the goal is to choose how to supply heat to the buildings in the problem (or abate demand) at the minimum overall cost. The internal transfer of money between buildings

Offer insulation measures Offer other heating systems*

Setting emission limits

Accounting period

Sum costs and benefits over years. Discount future values at % per year.

Capital costs

Item	Annualize	Recur	Period	Rate	$\frac{n}{100}$	PV($\frac{n}{100}$)
Pipework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100
Other heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0,0"/>	100	100

Emissions costs

Emission	Cost/t
co2	<input type="text" value="0,00"/>
pm25	<input type="text" value="0,00"/>
nox	<input type="text" value="0,00"/>

Emissions limits

Emission Limited	Limit (t/yr)
co2 <input type="checkbox"/>	<input type="text" value="0,0"/>
pm25 <input type="checkbox"/>	<input type="text" value="0,0"/>
nox <input type="checkbox"/>	<input type="text" value="0,0"/>



NETWORK PROBLEM

- Map view
- Objective
- Tariffs
- Pipe & connection costs
- Insulation
- Individual systems

NETWORK SOLUTION

- Solution summary
- Run log

SUPPLY PROBLEM

- Profiles
- Technologies
- Objective

HELP

Search help...

- Help contents
- Network editor help
- Keyboard shortcuts

IMPORT / EXPORT DATA

- Excel Spreadsheet
- Excel Spreadsheet
- Geojson

PROJECT

Save Optimise

Search...

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Set tariff

- Required
- Optional
- Forbidden
- Network supply

Map legend

Water | Imagery by: Carto, Maxar, Earthstar, GeoEye/GeoBC, CNES/Airbus DS, USDA-FSA, USGS, AeroGRID, IGN, IGP, and the GIS User Community

Save Optimise

Search

None
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PROJECT

Set tariff

A tariff consists of three parts:

- A fixed basic fee that the building pays to the grid every year.
- A variable capacity charge per kilowatt hour that the building pays to the grid each year, multiplied by the building's peak demand.
- A variable unit rate per kilowatt hour that the building pays each year multiplied by the building's annual consumption.

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Tariffs

Each building can have an associated tariff, which determines the revenue to the network operator.

Tariff name	Standing charge	Unit charge	Capacity charge
Standard	50 n/yr	5 c/kWh	0 n/kWp.yr

Add tariff

Map legend

Save Optimise

Search

None
Maps
Satellite

Candidates
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Required
Optional
Forbidden
Network supply

Map legend

NETWORK PROBLEM

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- Excel Spreadsheet
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PROJECT

Setting the costs for pipes and labour as well as the water temperature



Capacity & loss model

- Hot water
 Saturated steam

Flow temperature: °CReturn temperature: °CGround temperature: °C

Pipe capacity is calculated from diameter using [recommended flow rates for the diameter](#), the specific heat of water, and the flow/return difference.

Heat losses are calculated from diameter using [this model](#).

Pipe costs

NB mm	Capacity Wp	Losses kWh/m.yr	Pipe cost €/m	Civil cost (€/m)		
				Soft	Hard	
20	24,42 k	13.36	81	206	534	✗
25	43,95 k	15.87	91	208	545	✗
32	83,44 k	18.65	107	211	562	✗
40	147,99 k	21.16	126	215	583	✗
50	261,12 k	23.67	152	220	611	✗
65	506,3 k	26.63	193	228	656	✗
80	851,92 k	28.97	237	237	705	✗
100	1,49 M	31.48	300	249	774	✗
125	2,58 M	33.99	385	266	866	✗
150	4,05 M	36.05	474	283	964	✗
200	8,22 M	39.28	667	321	1174	✗
250	14,21 M	41.80	874	362	1401	✗
300	22,18 M	42.86	1094	406	1647	✗

Setting the water temperature and the soil temperature. THERMOS uses the soil temperature to estimate the loss rates per pipe diameter.



THERMOS FFO Save Optimise

NB mm	Capacity Wp	Losses kWh/m.yr	Pipe cost €/m	Civil cost (€/m)			
				Soft	✗	Hard	✗
20	24,42 k	13.36	81	206		534	✗
25	43,95 k	15.87	91	208		545	✗
32	83,44 k	18.65	107	211		562	✗
40	147,99 k	21.16	126	215		583	✗
50	261,12 k	23.67	152	220		611	✗
65	506,3 k	26.63	193	228		656	✗
80	851,92 k	28.97	237	237		705	✗
100	1,49 M	31.48	300	249		774	✗
125	2,58 M	33.99	385	266		866	✗
150	4,05 M	36.05	474	283		964	✗
200	8,22 M	39.28	667	321		1174	✗
250	14,21 M	41.80	874	362		1401	✗
300	22,18 M	43.85	1094	405		1642	✗
400	44,69 M	47.09	1568	498		2161	✗
450	59,49 M	48.42	1819	547		2435	✗
500	76,83 M	49.60	2079	598		2719	✗
600	119,53 M	51.66	2622	705		3313	✗
700	173,58 M	53.39	3192	817		3937	✗
800	239,7 M	54.90	3788	933		4589	✗
900	318,56 M	56.22	4407	1055		5265	✗
1000	410,77 M	57.41	5046	1180		5965	✗

Add diameter Add civil costs Default civil costs: Hard

Standard values for costs and diameters are stored in THERMOS, but these can be customised.

THERMOS Neuried Save Optimise

200	8,22 M	39.28	667	321	1174	✕
250	14,21 M	41.80	874	362	1401	✕
300	22,18 M	43.85	1094	405	1642	✕
400	44,69 M	47.09	1568	498	2161	✕
450	59,49 M	48.42	1819	547	2435	✕
500	76,83 M	49.60	2079	598	2719	✕
600	119,53 M	51.66	2622	705	3313	✕
700	173,58 M	53.39	3192	817	3937	✕
800	239,7 M	54.90	3788	933	4589	✕
900	318,56 M	56.22	4407	1055	5265	✕
1000	410,77 M	57.41	5046	1180	5965	✕

Add diameter **Add civil costs** Default civil costs:

The costs for heat transfer stations in the individual buildings can be set here.

Connection Costs

Each building also has associated connection costs, which determine the capital costs of connecting the building to the network. These costs are borne by the network operator.

Add connection cost

Pumping costs

Pumping costs are taken to be a proportion of the system output. In a heat network they offset supply output. In a cooling network, they add to the required supply output.

Pumping overheads are % of system output, and cost €/kWh. They cause emissions of g/kWh co₂, mg/kWh pm_{2.5}, mg/kWh no_x

THERMOS Neuried Save Optimise

200	8,22 M	39.28	667	321	1174	✕
250	14,21 M	41.80	874	362	1401	✕
300	22,18 M	43.85	1094	405	1642	✕
400	44,69 M	47.09	1568	498	2161	✕
450	59,49 M	48.42	1819	547	2435	✕
500	76,83 M	49.60	2079	598	2719	✕
600	119,53 M	51.66	2622	705	3313	✕
700	173,58 M	53.39	3192	817	3937	✕
800	239,7 M	54.90	3788	933	4589	✕
900	318,56 M	56.22	4407	1055	5265	✕
1000	410,77 M	57.41	5046	1180	5965	✕

Default civil costs:

The pump costs represent the proportion of the system power required to operate the pumps. As the pumps are usually operated with electricity, an individual electricity tariff for the pump can also be set here.

From the literature, a value of 2% of the system output is assumed at this point for the operation of the pumps.

Connection Costs

Each building also has associated connection costs, which determine the capital costs of connecting the building to the network. These costs are borne by the network operator.

Pumping costs

Pumping costs are taken to be a proportion of the system output. In a heat network they offset supply output. In a cooling network, they add to the required supply output.

Pumping overheads are % of system output, and cost €/kWh. They cause emissions of g/kWh co₂, mg/kWh pm_{2.5}, mg/kWh no_x

Save Optimise

Search...

None
Maps
Satellite

Candidates
 Heatmap
 Labels

Required
Optional
Forbidden
Network supply

Map legend

NETWORK PROBLEM

Map view
Objective
Tariffs
Pipe & connection costs
Insulation
Individual systems

NETWORK SOLUTION

Solution summary
Run log

SUPPLY PROBLEM

Profiles
Technologies
Objective

HELP

Search help...

Help contents
Network editor help
Keyboard shortcuts

IMPORT / EXPORT DATA

Excel Spreadsheet
Excel Spreadsheet
Geojson

PROJECT

Key **Function** ✕

c Change constraint status of selection (optional→required→forbidden)

s Edit supply properties for selection

z Zoom display to show selection

a Select all optional or required elements

A (Shift + a) Invert selection amongst optional and required elements

e Edit details for selected candidates

j Draw a connector line

g Select also candidates grouped with selected candidates

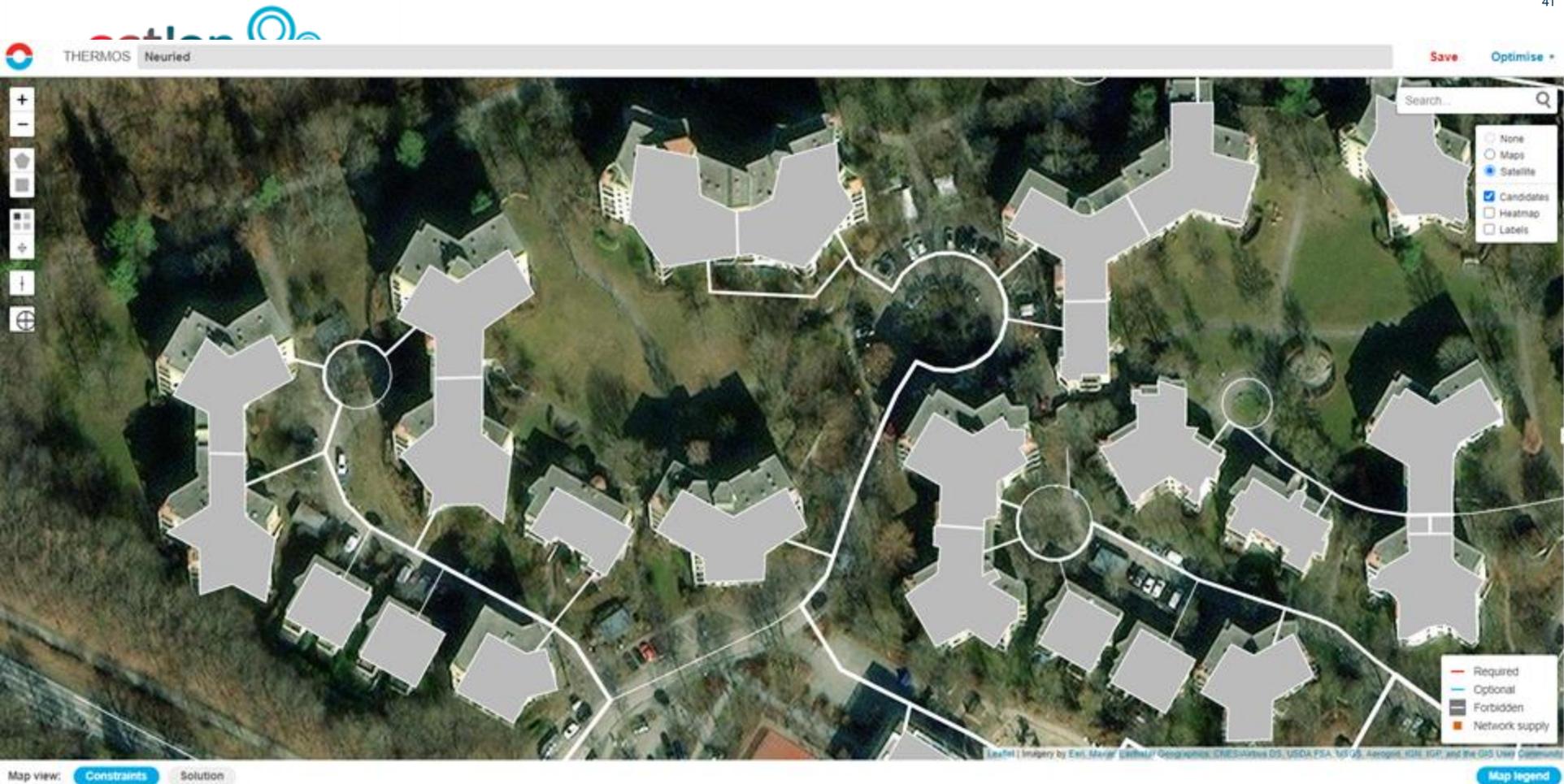
G Put all selected candidates into a group

U Ungroup all selected candidates

i Show mystic information panel

? Show this help

Search help (type query and press return)...



THERMOS Neuried

Save Optimise

Search

None
Maps
Satellite
 Candidates
 Heatmap
 Labels

Edit Candidates

Demands Tariff & Connection Costs Insulation & Systems Other Fields

Count	Connections	Demand (MWh/yr)	Peak (kW)	Profile
1	<input type="checkbox"/> 1	<input type="checkbox"/> 216	<input type="checkbox"/> 129	Unchanged

Cancel OK

1. Select building
2. Press "e"

→ The editing window opens

Required
Optional
Forbidden
Network supply

Map view: Constraints Solution

Map legend

THERMOS Neuried

Save Optimise

Search

None
Maps
Satellite
Candidates
Map
Layers

Edit Candidates

Demands Tariff & Connection Costs Insulation & Systems Other Fields

Count	Connections	Demand (MWh/yr)	Peak (kW)	Profile
1	<input type="checkbox"/> 1	<input type="checkbox"/> 216	<input type="checkbox"/> 129	Unchanged

Cancel OK

Map view: Constraints Solution

Map legend

Leaflet | Imagery by Esri, Mapbox, Geoportail, GeBCN, CNRS/Airbus DS, USDA FSA, USGS, AeroGRID, IGN, IGA, and the GIS User Community

The individual annual demand for each individual building can now be stored here - if known, the peak demand can also be set.

If this is not known, it is determined by THERMOS.

THERMOS Neuried Save Optimise

Search

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Edit Candidates

Demands Tariff & Connection Costs Insulation & Systems Other Fields

Count	Connections	Demand (MWh/yr)	Peak (kW)	Profile
1	<input type="checkbox"/> 1	<input type="checkbox"/> 216	<input type="checkbox"/> 129	Unchanged

Cancel OK

Showing the building properties

- Required
- Optional
- Forbidden
- Network supply

Map view: Constraints Solution Map legend

Leaflet | Imagery by Esri, Mapbox, GeoEye, GEBCO, IGN, NOAA, Swire, USDA, USGS, AeroGRID, IGN, SIA, and the USGS User Community

THERMOS Neuried

Save Optimise

Search...

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Map view: Constraints Solution

Map legend

One candidate selected

Type	1 demand	X
building_j	B	
Constraint	1 forbidden	X
Tarif	1 Standard	X
Edited	1 no	X
Profile	1 Residential	X
Base cost*	0=	
Heat demand	216,34 MWh/yr	
Heat peak*	129,21 kWp	
In solution	1 network	X
Principal	0	
Revenue	10,87 kw/yr	

Imagery by Esri, Mapbox, Earthstar Geographics, CNES/Airbus DS, USDA/FSA, USGS, AeroGRID, IGN, SPP, and the GeoCommunity



THERMOS Neuried

Save Optimise

Search

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

A new object was created using the "Create object" tool.

- Required
- Optional
- Forbidden
- Network supply

Map view: Constraints Solution

Map legend

THERMOS Neuried Save Optimise

Search

None
 Maps
 Satellite
 Candidates
 Heatmap
 Labels

Maximum capacity MW
 Fixed cost k€
 Capacity cost €/kW
 Annual cost €/kW
 Supply cost c/kWh

Emissions factors
 co2 g/kWh
 pm25 mg/kWh
 nox mg/kWh

Cancel OK

The "S" shortcut assigns the object the role of energy supply.
 The dialogue box for setting the parameters opens.

Required
 Optional
 Forbidden
 Network supply

Map view: Constraints Solution Map legend

THERMOS Neuried Save Optimise

Search

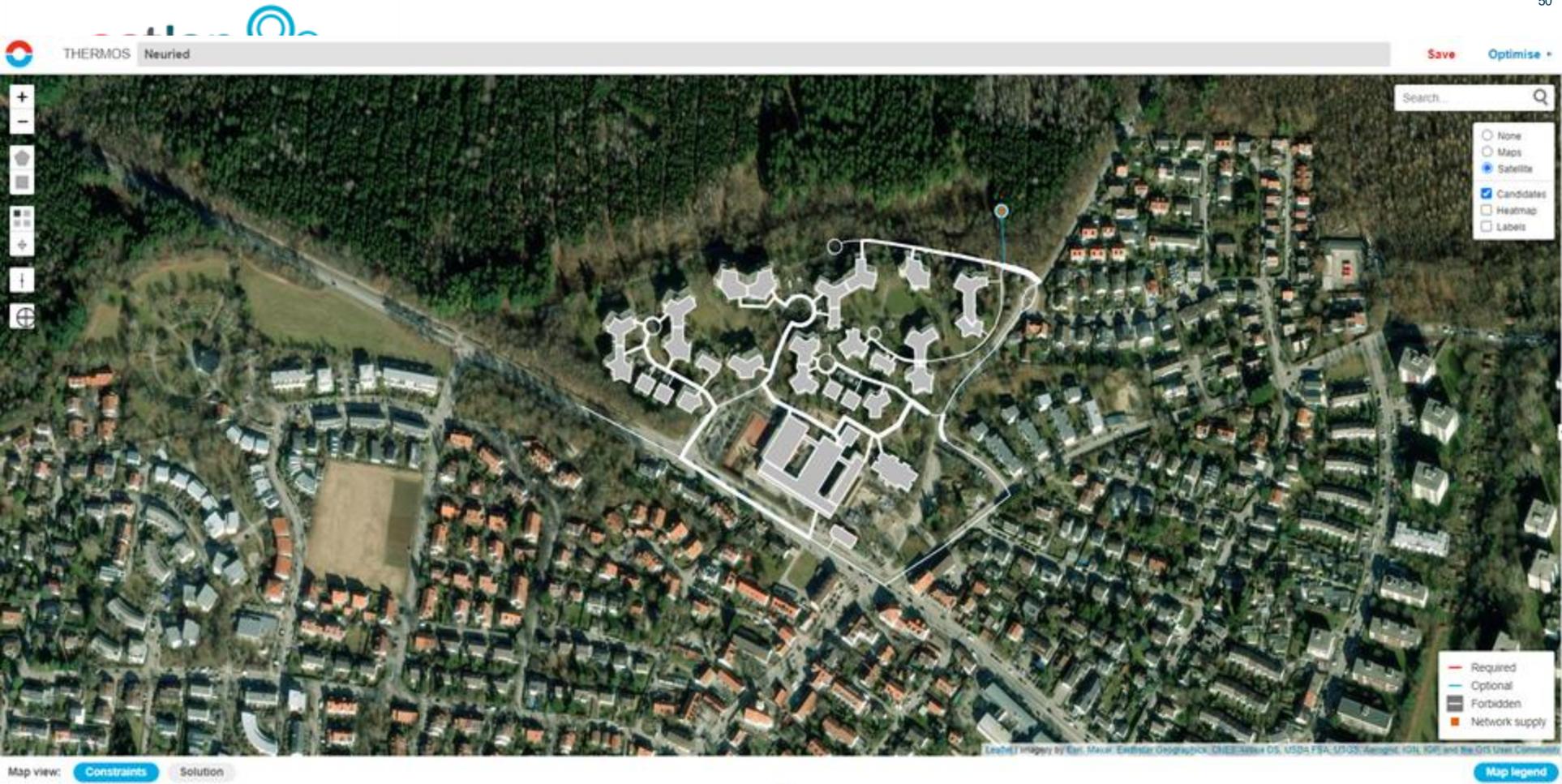
None
 Maps
 Satellite
 Candidates
 Heatmap
 Labels

Cost and capacity
 Maximum capacity MW
 Fixed cost k€
 Capacity cost €/kW
 Annual cost €/kW
 Supply cost c/kWh
Emissions factors
 co2 g/kWh
 pm25 mg/kWh
 nox mg/kWh

The parameters for capacity, costs and emissions can be set here according to the individual situation.

Required
 Optional
 Forbidden
 Network supply

Map view: Constraints Solution Map legend



THERMOS Neuried

Save Optimise

Search ..

None
 Maps
 Satellite
 Candidates
 Heatmap
 Labels

Cancel

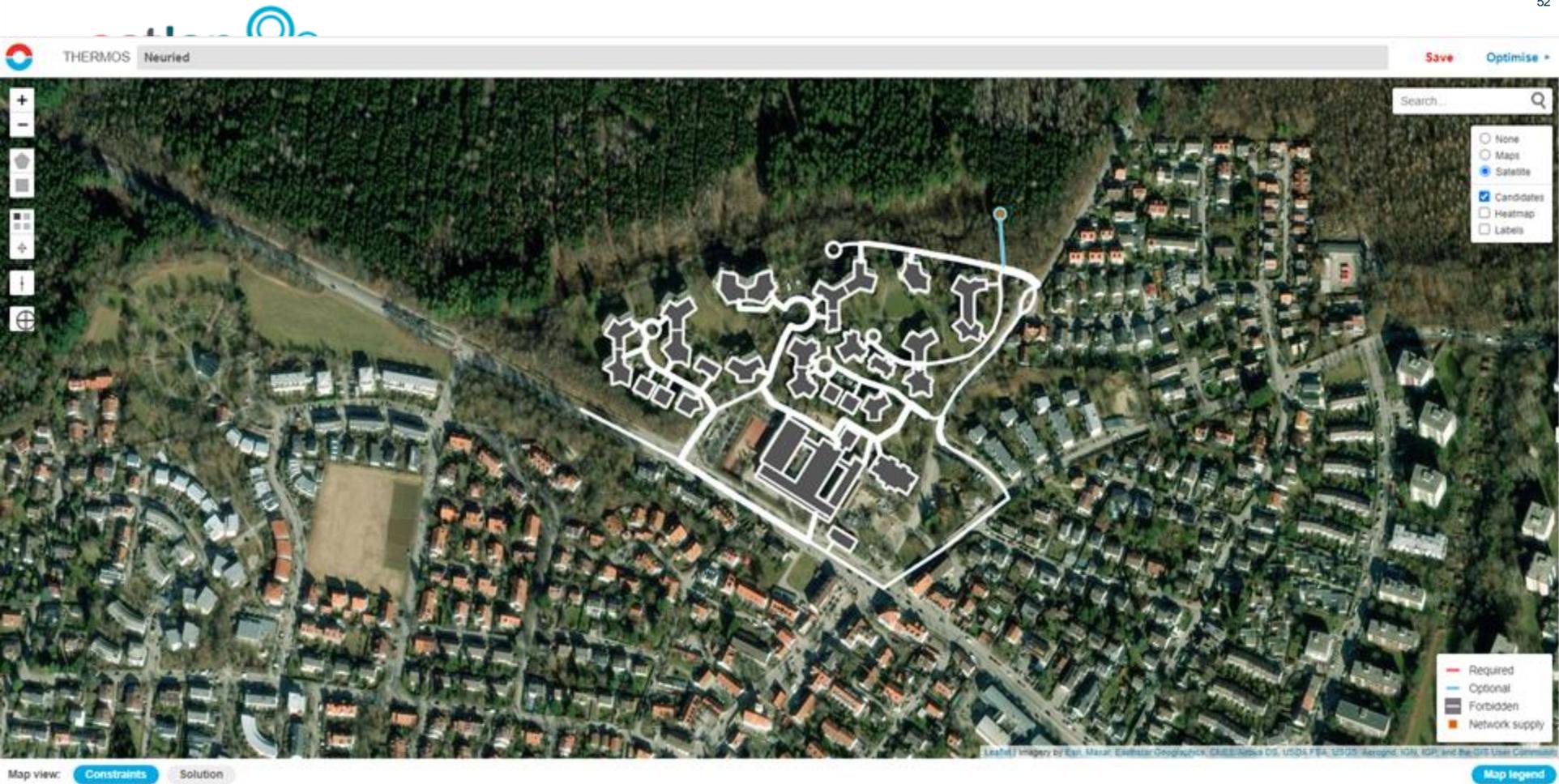
Release mouse to finish drawing

Required
 Optional
 Forbidden
 Network supply

Map view: Constraints Solution

Map Legend

Leaflet | Imagery by Esri, Maxar, Earthstar, GeoEye, IGN, CNES/Airbus DS, USDA FSA, USDA FSA, IGN, Esri, and the GIS User Community



THERMOS Neuried

Save Optimise

Search

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Once all settings have been made, the network optimisation can be started. To do this, click on "Optimise" and then on "Network".

- Required
- Optional
- Forbidden
- Network supply

Map view: Constraints Solution

Map legend

2. what results are available?



2. what results are available?

General Assumptions	
Objective	NPV
Flow temperature	90 °C
Return temperature	60 °C
Ground temperature	8 °C
Financial Assumptions	
Accounting period	40 yrs
Discount value	3,0 %
Tariff	5 c/kWh
Connection Costs	-
Emission Costs	-
Pumping costs	2%
Supply costs	-

The current calculation is based on these assumptions





Save Optimise

NETWORK PROBLEM

- Map view
- Objective
- Tariffs
- Pipe & connection costs
- Insulation
- Individual systems

NETWORK SOLUTION

- Solution summary
- Run log

SUPPLY PROBLEM

- Profiles
- Technologies
- Objective

HELP

Search help

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IMPORT / EXPORT DATA

- Excel Spreadsheet
- Excel Spreadsheet
- Geojson

PROJECT

Show pipe sizes

Search

- None
- Maps
- Satellite
- Candidates
- Heatmap
- Labels

Legend

- In network — 20mm — 125mm
- Not in network
- Peripheral to network
- Cannot be reached by network
- Has alternative
- Network supply

Map legend

A new section appears in the main menu to display the detailed calculation results



Solution Summary

Display Options

Capital costs:

 Total Principal Present value

Other costs:

 Total Annual Present value

Cost summary

Network Individual systems Insulation Emissions Optimisation

Item	Capital cost (€)	Operating cost (€)	Operating revenue (€)	LCH (c/kWh) ¹	NPV (€)
Pipework	1,66 M	--	--	--	-1,66 M
Heat supply	0	1,13 M	--	--	-670,04 k
Demands	0	--	9,67 M	--	5,76 M
Emissions	--	0	--	--	0
Network	1,66 M	1,13 M	9,67 M	2,04	3,43 M
Emissions	--	0	--	--	0
Individual Systems	--	0	--	--	0
Insulation	--	--	--	--	--
Whole system	1,66 M	1,13 M	--	--	-2,33 M¹





Solution Summary

Display Options

Capital costs:

 Total Principal Present value

Other costs:

 Total Annual Present value

Cost summary

[Network](#) Individual systems Insulation Emissions Optimis...

Item	Capital cost (€)	Operating cost (€)	Operating revenue (€)	LCH (ct/kWh) ¹	NPV (€)
Pipework	1,66 M	--	--	--	-1,66 M
Heat supply	0	1,13 M	--	--	-670,04 k
Demands	0	--	9,67 M	--	5,76 M
Emissions	--	0	--	--	0
Network	1,66 M	1,13 M	9,67 M	2,04	3,43 M
Emissions	--	0	--	--	0
Individual Systems	--	0	--	--	0
Insulation	--	--	--	--	--
Whole system	1,66 M	1,13 M	--	--	-2,33 M¹

The operating revenue results from the balance of revenues (from the assumed tariffs). It has no influence on the LCH.

Levelised Cost of Heat (LCH)

Heat distribution costs (ct./kWh) based on infrastructure costs + pumping costs



Solution Summary

Display Options

Capital costs:

 Total Principal Present value

Other costs:

 Total Annual Present valueCost summary **Network** Individual systems Insulation Emissions Optimisation**Pipework** Demands Supplies

Civils	ø mm	Length m	Cost k	Cost €/m	Losses Wh/yr	Capacity W
Hard (default)	20	47,04	28,93 k	615	5,51 M	1 k
Hard (default)	25	52,7	33,51 k	636	6,95 M	37,82 k
Hard (default)	32	143,84	96,23 k	669	21,71 M	71,67 k
Hard (default)	40	566,88	401,92 k	709	99,66 M	140,26 k
Hard (default)	50	374,9	286,05 k	763	73,64 M	255,09 k
Hard (default)	65	302,95	257,2 k	849	65,53 M	505,92 k
Hard (default)	80	37,19	35,03 k	942	9,38 M	822,1 k
Hard (default)	100	155,52	167,02 k	1,07 k	40,96 M	1,31 M
Hard (default)	125	283,51	354,67 k	1,25 k	78,78 M	1,96 M
All		1,96 k	1,66 M	845,28	402,12 M	1,96 M

Solution Summary

Display Options

Capital costs:

 Total
 Principal
 Present value

Other costs:

 Total
 Annual
 Present value

 Cost summary **Network** Individual systems Insulation Emissions Optimisation

 Pipework **Demands** Supplies

Category ▾	Count	Capacity W	Demand MWh	Conn. cost €	Revenue €
Unclassified	33	3,1 M	4,8 G	0	9,67 M
User-created building	1	0	0	0	2 k





Solution Summary

Display Options

Capital costs:

 Total Principal Present value

Other costs:

 Total Annual Present valueCost summary **Network** Individual systems Insulation Emissions Optimisation

Pipework

Demands

Supplies

Category	Capacity Wp	Output Wh/yr	Pumping Wh/yr	Capital a	Capacity a	Heat a	Pumping a	Coincidence %
User-created building	1,96 M	5,1 G	104,08 M	0	0	0	1,13 M	63



3. Possible next steps



3. Possible next steps

- Add user to THERMOS project (done)
- Feedback loop (within two weeks of receiving this presentation)



Thank you for your attention



This project has received funding from the EU's Horizon 2020 programme under grant agreement no 101033706.



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