



# Speed up Heat Zoning and District Heating Network planning with Design automation software

28 November 2023

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# Unleashing the potential of efficient district heating and cooling to decarbonise Europe



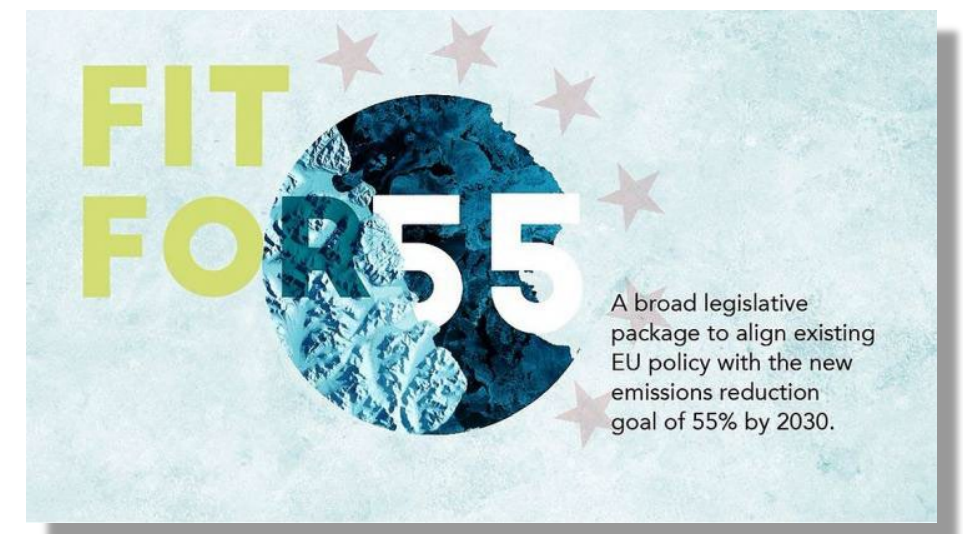
euroheat.org

## Key figures

- **67 million EU citizens are directly supplied by district heating and cooling.**
- **About 140 million EU citizens live in a city already equipped with a district heating and cooling infrastructure.**
- **There are over 17,000 heat/cold networks in Europe, representing about 13% of Europe's heat market**

Add text here





New sectorial targets for renewables and waste heat in the buildings industry, heating and cooling and DHC

Mandatory waste heat recovery for data centres above 1MW

Sector integration: accounting of green electricity towards H&C targets and DHC targets

## Drivers for DHC



District heating approach to building decarbonisation

**Mandatory local heating & cooling plans for cities > 45000 citizens**

Waste heat recognition: WH accountable towards sectorial renewable targets, coordination framework to foster recovery

**Approx. ~1200 cities in EU > 45k citizens**

Risk mitigation frameworks for renewable & waste heat

## Growth in Fit for 55

**Special case Germany, all cities/towns ~11000, mandatory heat plan**

- >100k citizens by 2026
- Rest by 2028

Carbon price of all fossil fuels used in buildings (ETS2)

Gradual phase-in renewables and waste heat with a new definition of efficient DHC, no new fossil fuel capacity from 2030

# Stepstone analysis: Energy transition causes boom in "climate jobs"

Düsseldorf, 19/07/2023

- Essential shift to more climate-friendly technologies undermined by considerable labor shortage
- Job offers in the "climate skilled labor sector" more than doubled compared to 2022
- Rising demand for skilled workers in heating, electrical and refrigeration engineering

ABN-AMRO Group Economics

Home Our research Our experts Newsletter

Publication 9 October 2023 • 07:01

## SustainaWeekly - Lack of personnel an obstacle to energy transition

Sustainability Climate economics Energy transition Climate policy Social impact



Professionals for the energy transition are essential but also unfortunately hard to find. In this week's SustainaWeekly we quantify the shortages of transition professionals in the Netherlands compared to the overall labour market using our labour market indicator. We go on to look at regional differences as well as whether there are other carbon-intensive sectors

CLEAN  
ENERGY  
WIRE

Journalism for the  
energy transition

Climate & CO2 Electricity Mobility Business Ef

NEWS

21 Feb 2022, 13:58 Edgar Meza

## Lack of skilled workers could put Germany's energy transition at risk

#Renewables #Business & Jobs



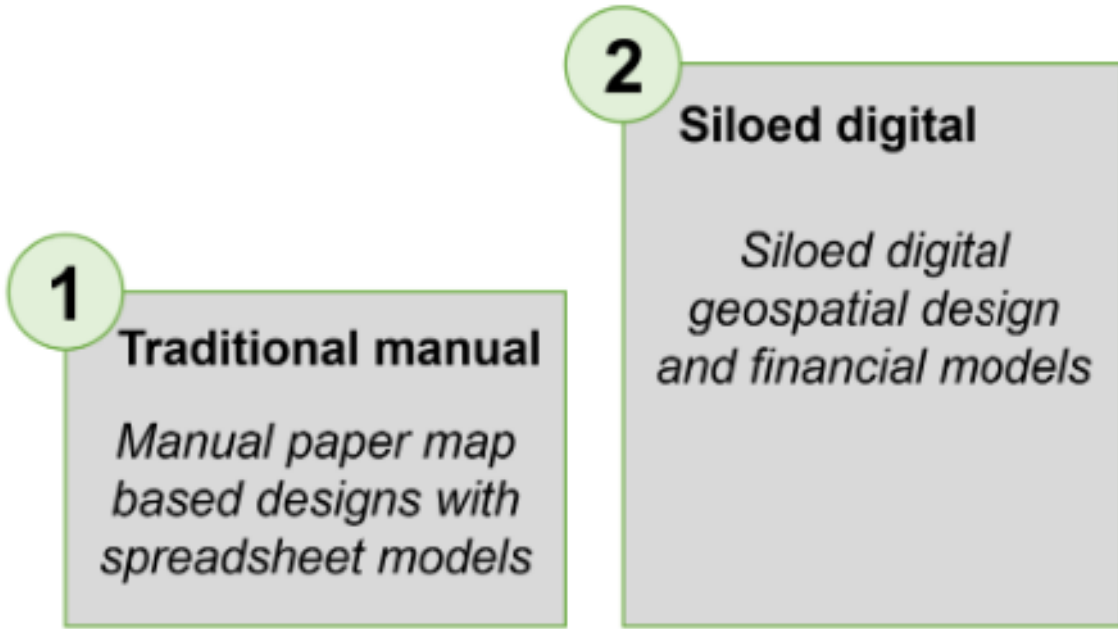
f t in

Handelsblatt

COMSOF  
An IQGeo business

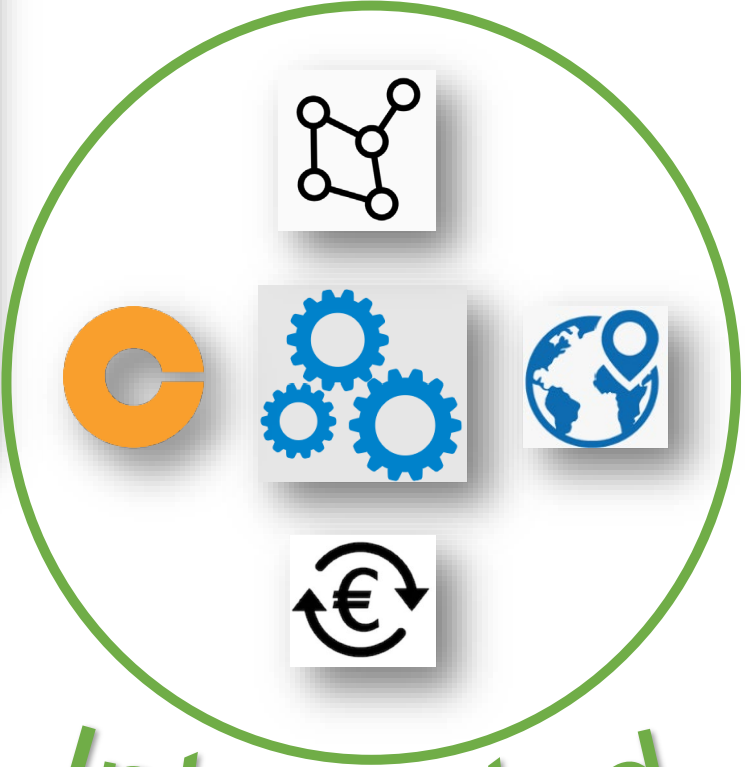
# Digitization, Automation and Optimisation of the planning process

## District heating Design maturity model



Technical capability

Operational efficiency



Integrated

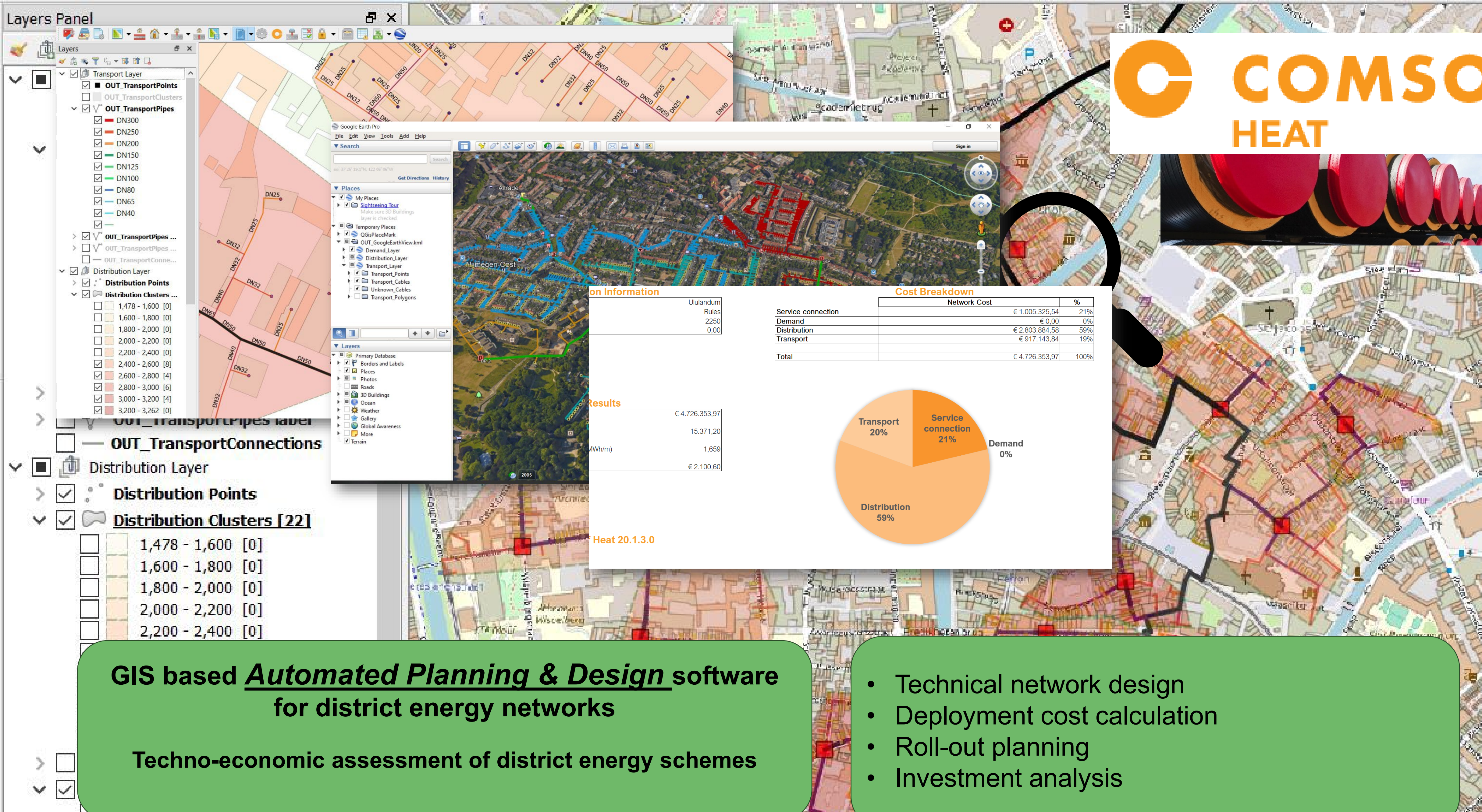
- Slow and time consuming
- Inaccurate and error prone
- Limited number of connections
- Not scalable
- Single scenario analysis
- High level cost estimates
- Process bottleneck
- Limiting business growth

- Automated design process, reduce design time
- Accurate calculations, uniform designs
- Large networks at city scale
- Very scalable approach
- Multiple scenario analysis and comparison
- Detailed cost calculation

- Process optimization
- Enabling business growth

*Reduce design and study time from weeks to days, while taking a consultancy business to an entirely new level of operational efficiency*



**Layers Panel**

- Transport Layer
  - OUT\_TransportPoints
  - OUT\_TransportClusters
  - OUT\_TransportPipes
    - DN300
    - DN250
    - DN200
    - DN150
    - DN125
    - DN100
    - DN80
    - DN65
    - DN40
- Distribution Layer
  - Distribution Points
  - Distribution Clusters ...
    - 1,478 - 1,600 [0]
    - 1,600 - 1,800 [0]
    - 1,800 - 2,000 [0]
    - 2,000 - 2,200 [0]
    - 2,200 - 2,400 [0]
    - 2,400 - 2,600 [8]
    - 2,600 - 2,800 [4]
    - 2,800 - 3,000 [6]
    - 3,000 - 3,200 [4]
    - 3,200 - 3,262 [0]
- OUT\_TransportConnections
- Distribution Layer
  - Distribution Points
  - Distribution Clusters [22]
    - 1,478 - 1,600 [0]
    - 1,600 - 1,800 [0]
    - 1,800 - 2,000 [0]
    - 2,000 - 2,200 [0]
    - 2,200 - 2,400 [0]

**Google Earth Pro**

**on information**

Ululandum	
Rules	2250
	0,00

**Cost Breakdown**

	Network Cost		%
Service connection	€ 1.005.325,54		21%
Demand	€ 0,00		0%
Distribution	€ 2.803.884,58		59%
Transport	€ 917.143,84		19%
<b>Total</b>	<b>€ 4.726.353,97</b>		<b>100%</b>

**Results**

	€ 4.726.353,97
	15.371,20
MWh/m)	1,659
	€ 2.100,60

**Heat 20.13.0**

**Cost Breakdown Pie Chart**

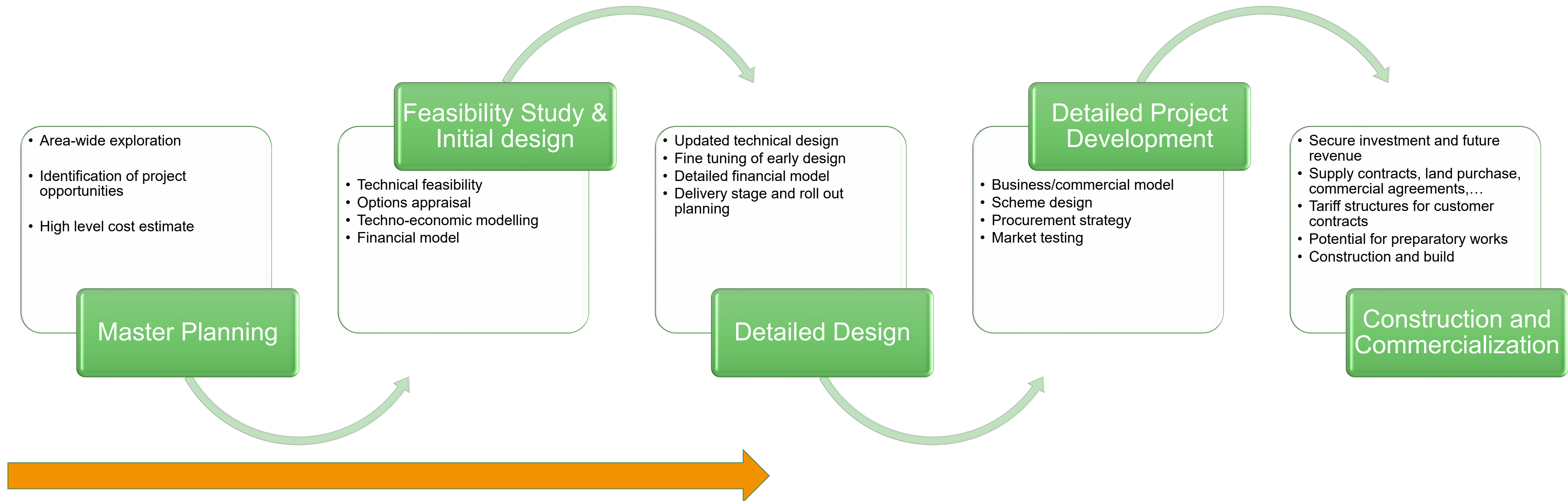
Category	Percentage
Transport	20%
Service connection	21%
Demand	0%
Distribution	59%

**GIS based Automated Planning & Design software for district energy networks**

**Techno-economic assessment of district energy schemes**

- Technical network design
- Deployment cost calculation
- Roll-out planning
- Investment analysis

# Project stages



# Design methodology

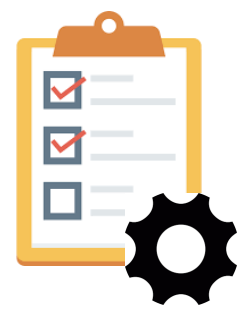
GIS data



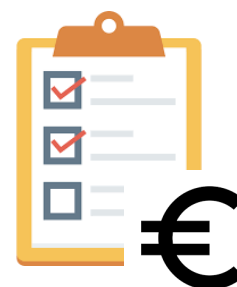
Energy data



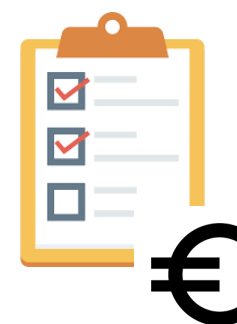
Technical parameters



Unit Costs



Financial



**Calculation**  
 Input demand selection: Hot water demand and space heating demand with priority switching

**Relative cost per nominal diameter per meter**

Route type	Relative Cost
Standard route (€/mm.m)	€ 8
Service connection route (€/mm.m)	€ 10
Medium utility density (€/mm.m)	€ 10
Low utility density (€/mm.m)	€ 8
Very high utility density (€/mm.m)	€ 10
Very low utility density (€/mm.m)	€ 8
High utility density (€/mm.m)	€ 10

**Design constraint**

- Design by flow velocity
- Design by pressure gradient
- Design by pressure number

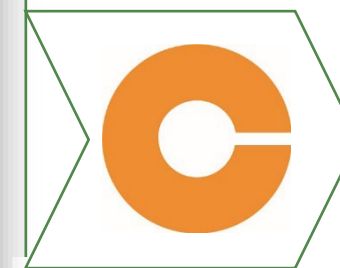
Pressure number: PN6

**Temperature**

Supply temperature (°C): 90.0  
 Return temperature (°C): 60.0

**Pressure**

Pressure margin (bar): 0.5  
 Min. pressure at heat exchanger (bar): 0.5



	Unit Costs			Calculated Cost		Unit
	Material Cost	Labour Cost	Total	Volume	Total Cost	
<b>Service connection</b>						
Pipe and trench - DN20	€ 0.	€ 200.	€ 200.	9260.2	€ 1,852,043.39	Meter
Pipe and trench - DN25	€ 0.	€ 250.	€ 250.	137.9	€ 34,474.53	Meter
Pipe and trench - DN32	€ 0.	€ 320.	€ 320.	11.8	€ 3,760.21	Meter
Pipe and trench - DN40	€ 0.	€ 400.	€ 400.	31.0	€ 12,401.89	Meter
<b>Demand</b>						
Extra activation cost per Home (Heat exchanger - power 1 to 50kW)	€ 0.	€ 0.	€ 0.	676.0	€ 0.	Home
Extra activation cost per Home (Heat exchanger - Power > 50 kW)	€ 0.	€ 0.	€ 0.	291.0	€ 0.	Home
<b>Distribution</b>						
Pipe and trench - DN100	€ 0.	€ 800.	€ 800.	40.4	€ 32,383.45	Meter
Pipe and trench - DN20	€ 0.	€ 160.	€ 160.	1968.5	€ 314,967.73	Meter
Pipe and trench - DN25	€ 0.	€ 200.	€ 200.	1093.2	€ 218,636.29	Meter
Pipe and trench - DN32	€ 0.	€ 256.	€ 256.	1094.8	€ 280,264.93	Meter
Pipe and trench - DN40	€ 0.	€ 320.	€ 320.	590.1	€ 188,847.18	Meter
Pipe and trench - DN50	€ 0.	€ 400.	€ 400.	462.5	€ 185,000.00	Meter
Pipe and trench - DN65	€ 0.	€ 520.	€ 520.	348.1	€ 181,032.00	Meter
Pipe and trench - DN80	€ 0.	€ 640.	€ 640.	281.3	€ 181,032.00	Meter
Substation	€ 0.	€ 0.	€ 0.	1	€ 0.	Substation
Pump	€ 0.	€ 0.	€ 0.	1	€ 0.	Pump
<b>Transport</b>						
Pipe and trench - DN125	€ 0.	€ 0.	€ 0.	1	€ 0.	Meter

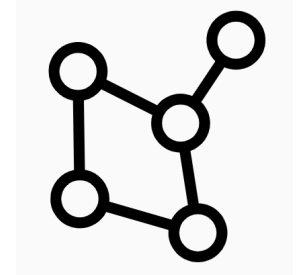
**Cost Breakdown**

Category	Cost (€)	%
Service connection	€ 1,852,043.39	21%
Demand	€ 0.00	0%
Distribution	€ 2,802,864.93	59%
Transport	€ 917,143.68	19%
<b>Total</b>	<b>€ 4,726,352.00</b>	<b>100%</b>

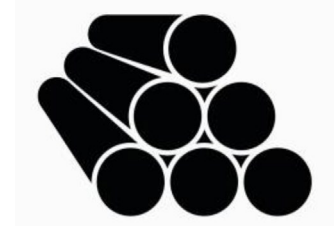
**Investment analysis**

Cumulative Cash flow graph showing investment over time.

Network topology



Network dimensions



CAPEX



Investment analysis



Techno economic assessment of district energy network



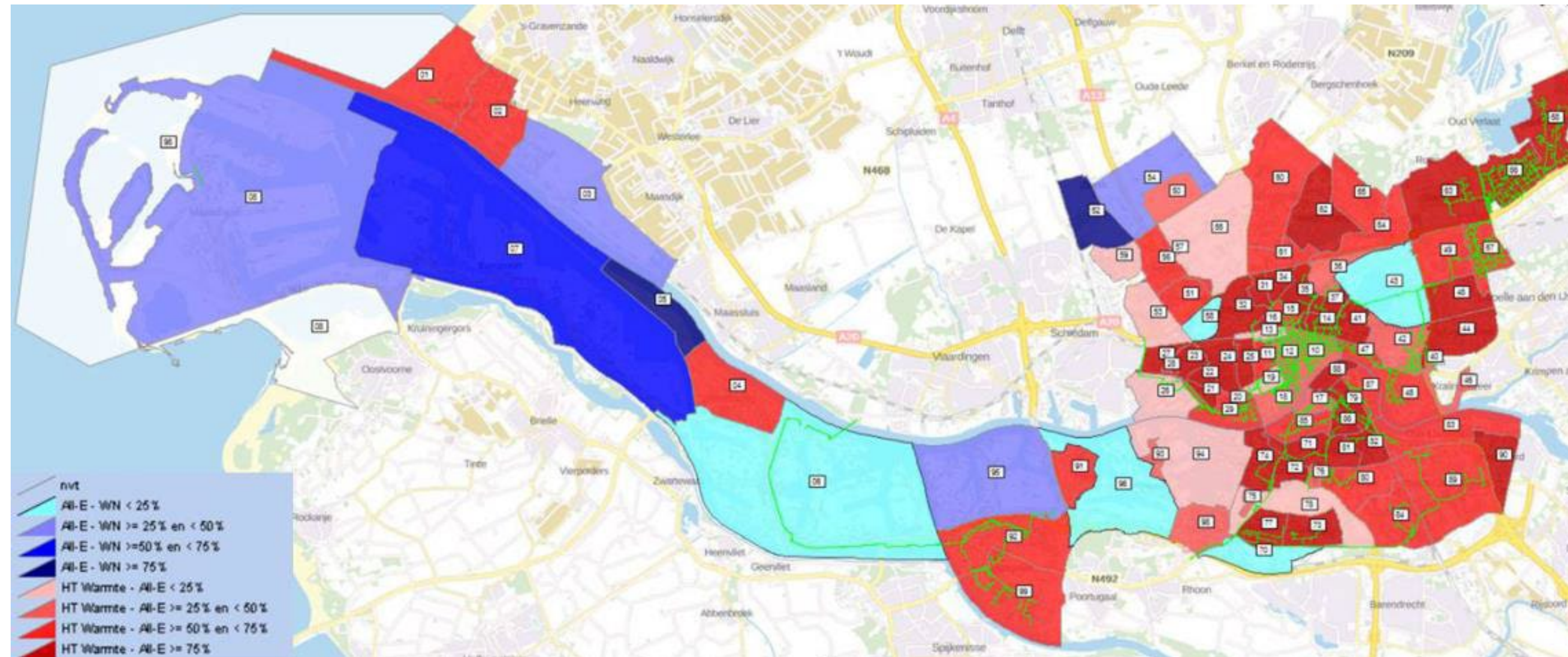
# Customer case: city of Rotterdam

- Netherlands was one of the first countries with the political decision to be natural gas free by 2050
- Due diligence on best heating solutions in greater Rotterdam area
- Active with Comsof Heat since 2019



# Heat zoning in Rotterdam

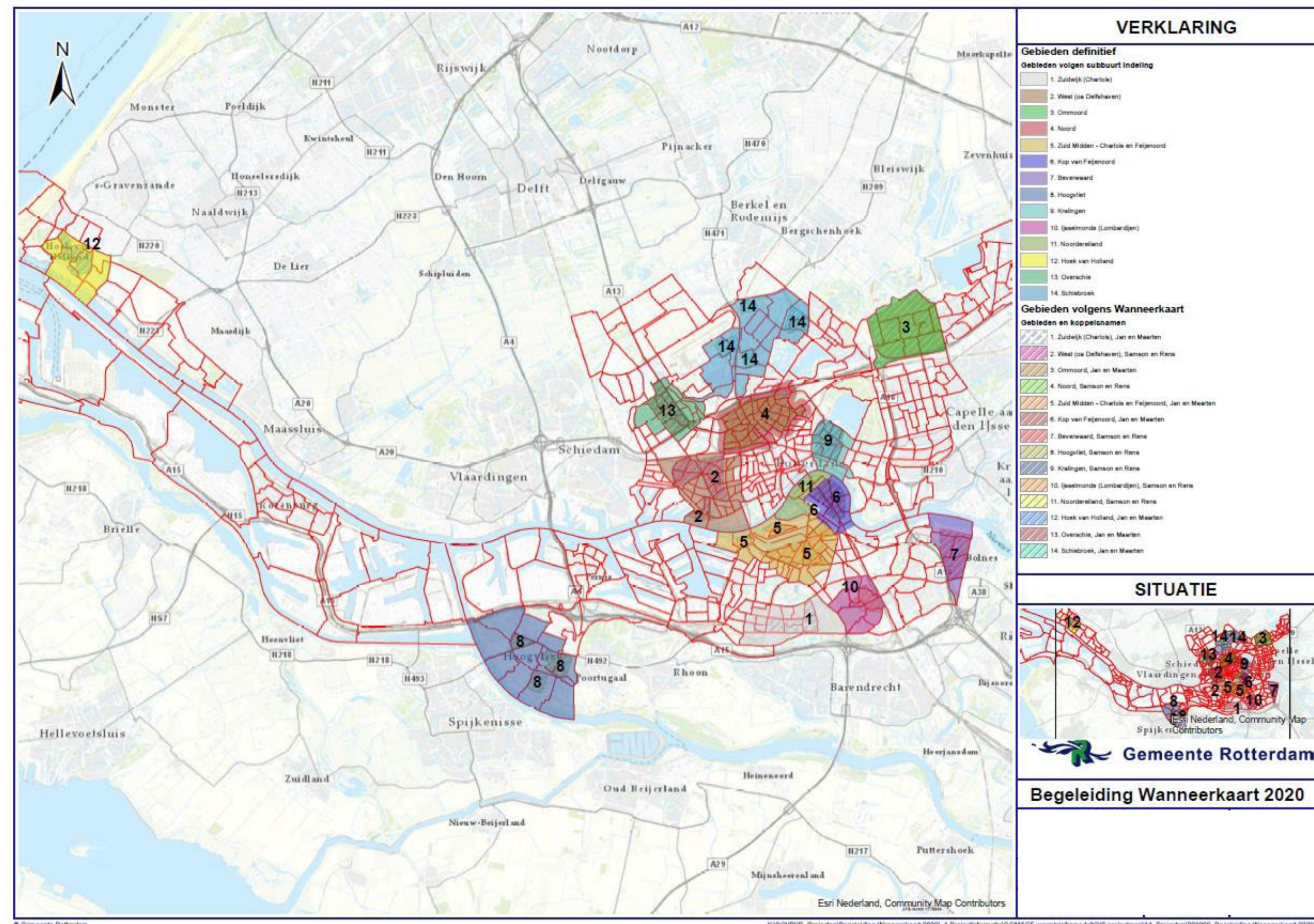
- Red area: High temperature district heating
- Blue area: All-electric (heat pumps)



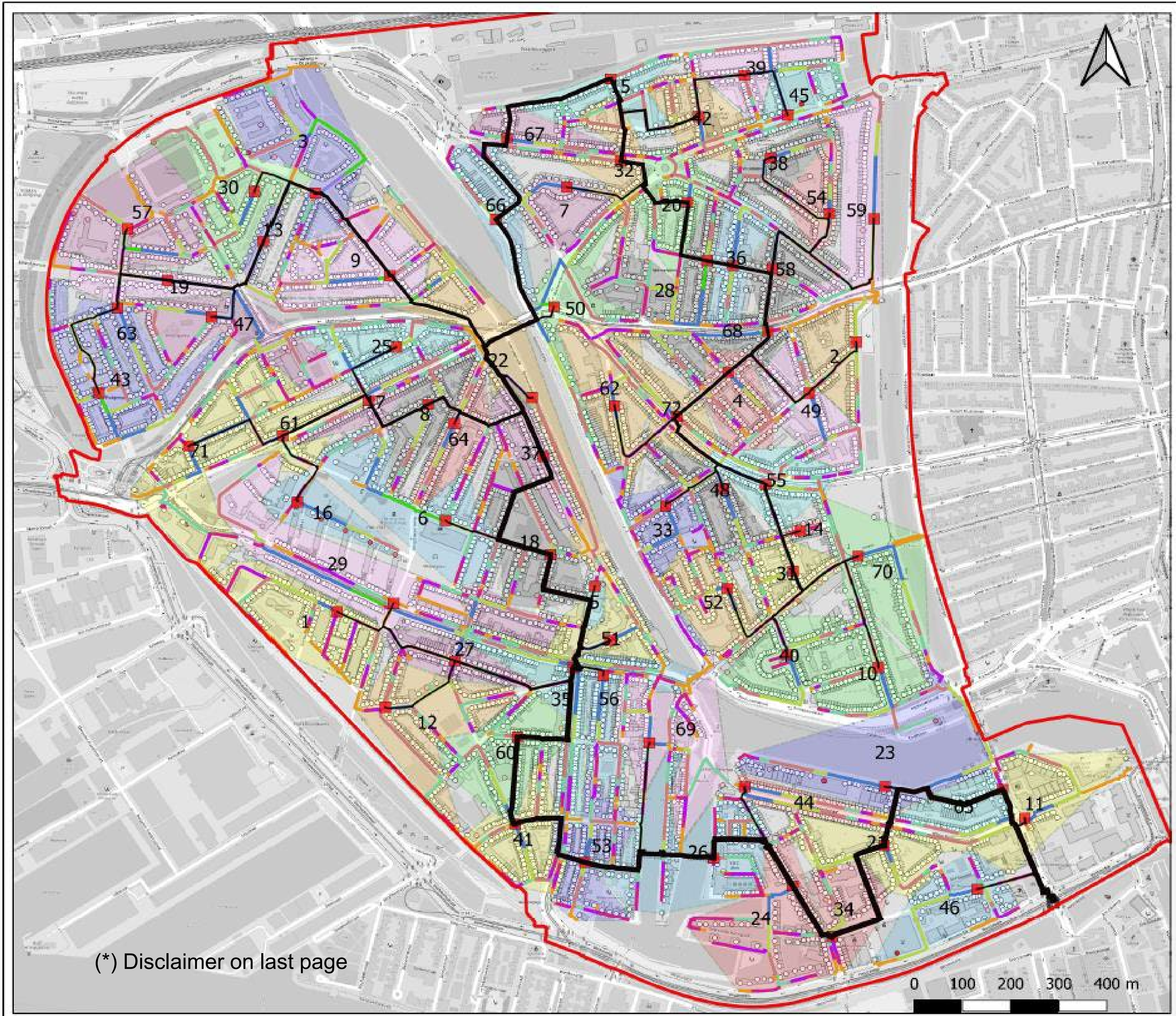
(\*) Disclaimer on last page

# Identification of 14 areas for district heating

- Total of 160000 housing equivalents



(\* ) Disclaimer on last page



VERKLARING

Transport Points

Transport Pipes

- DN50
- DN80
- DN100
- DN125
- DN150
- DN200
- DN250
- DN300
- DN350
- DN400
- DN450
- DN500

Distribution Pipes

- DN25
- DN32
- DN40
- DN50
- DN65
- DN80
- DN100
- DN125
- DN150

on Information

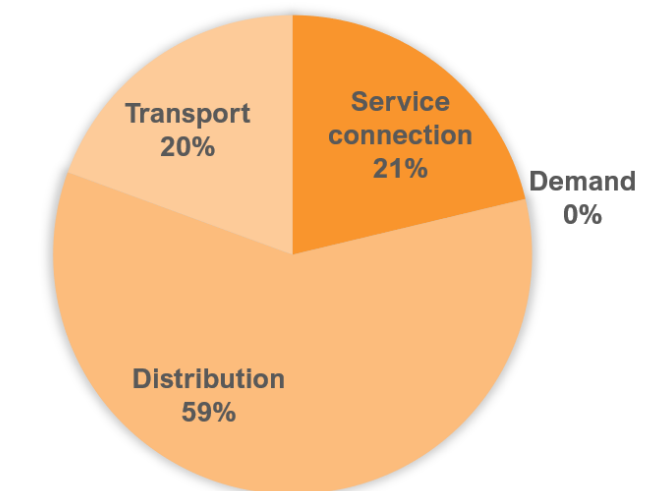
Uitlandum	
Rules	2250
	0,00

Cost Breakdown

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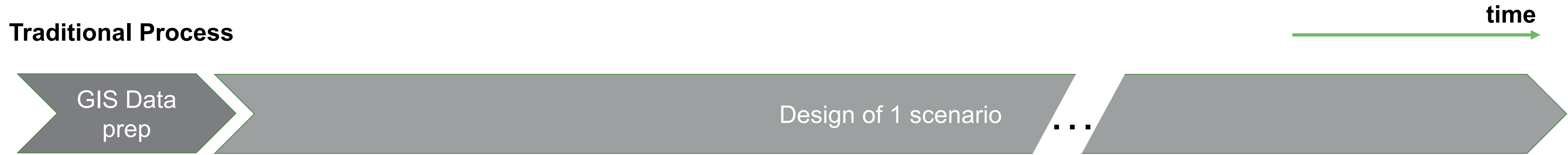
Results

	€ 4.726.353,97
	15.371,20
(kWh/m)	1,659
	€ 2.100,60



(\*) Disclaimer on last page

# Reduce study & design time from weeks to days with



**Automated Process with IQGEO Comsof Heat, same scope, more details in output. Shorter lead time.**

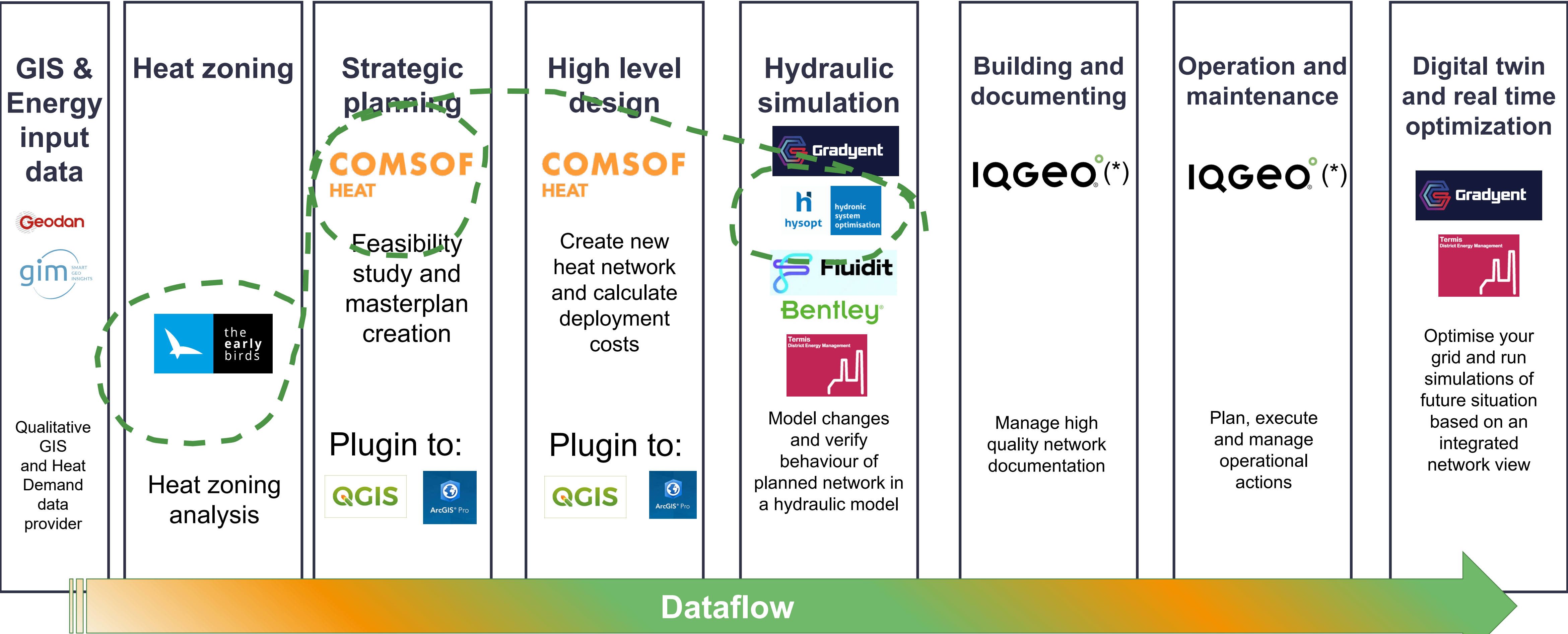


**Automated Process with IQGEO Comsof Heat, same scope, more details in output and better insight with multiple scenarios. Shorter lead time.**





# Data workflow and software partners



(\*) roadmap



the early birds

# Winterswijk

De huidige opbouw van het gebied

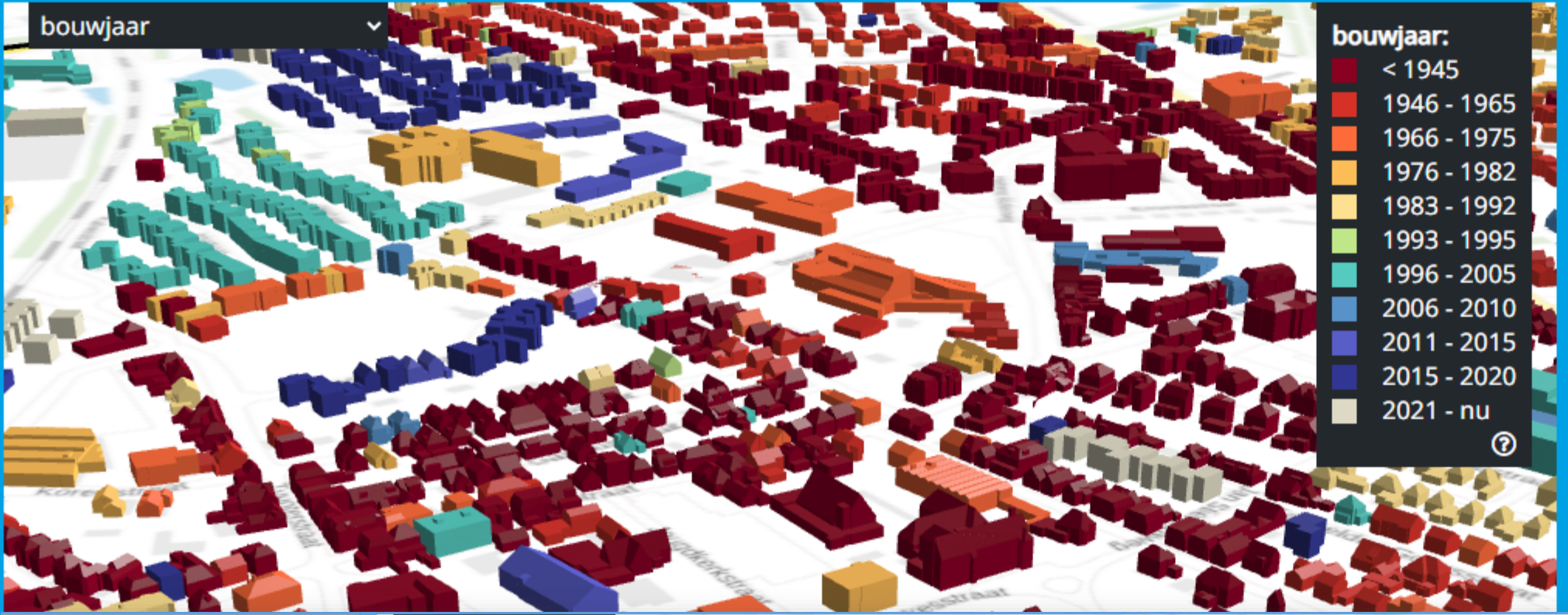


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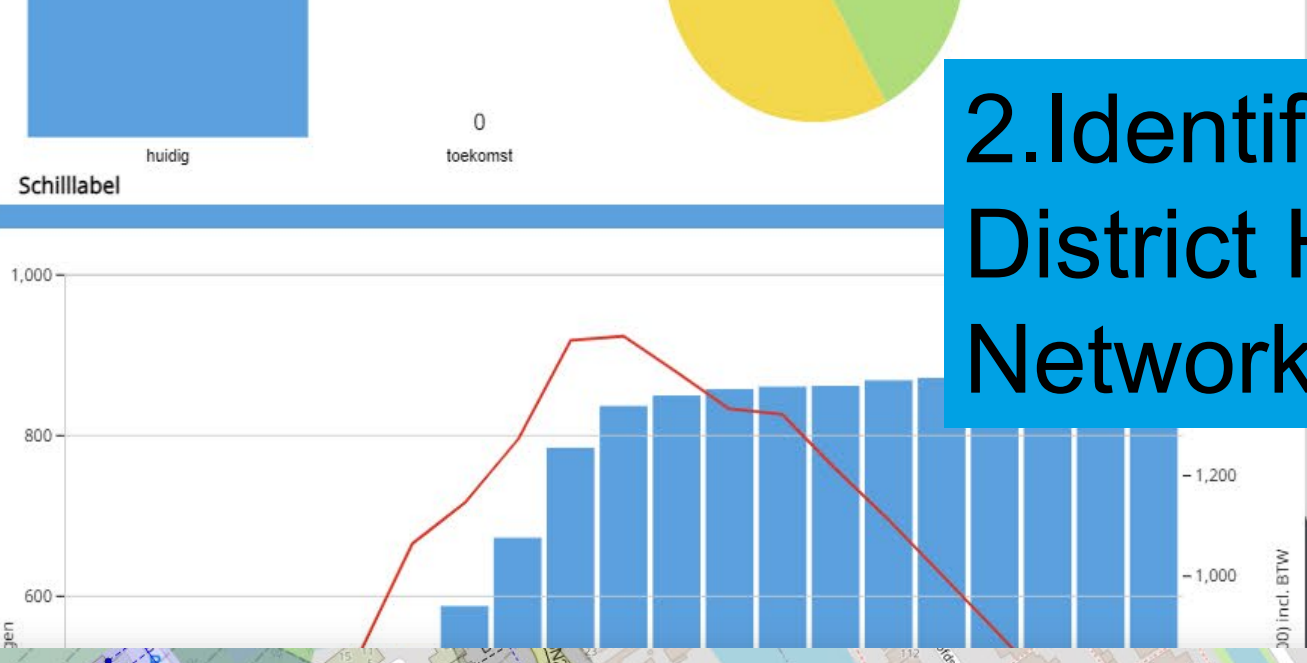
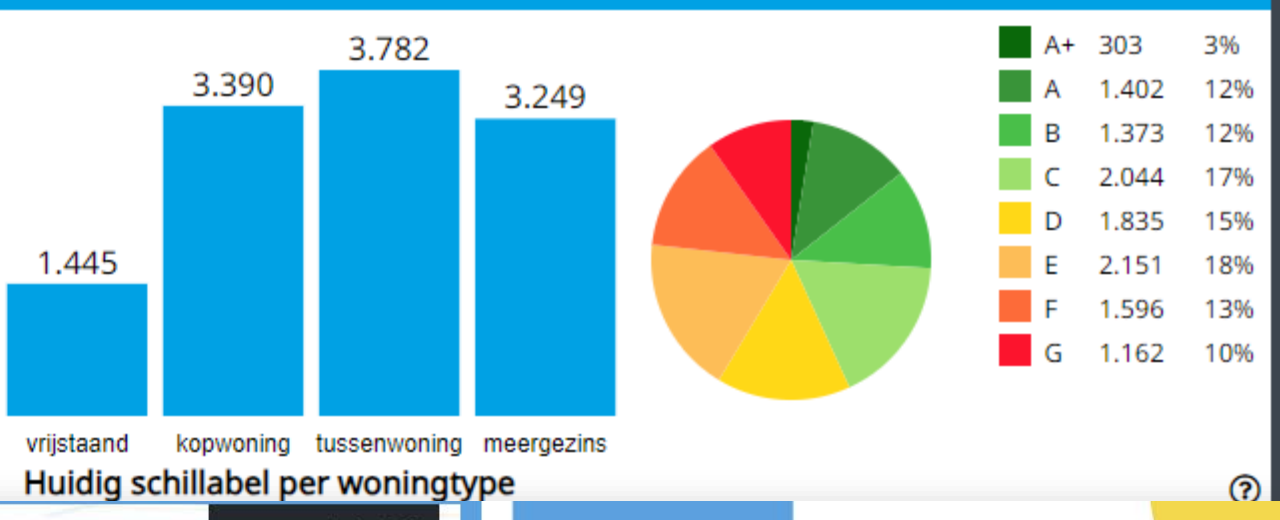
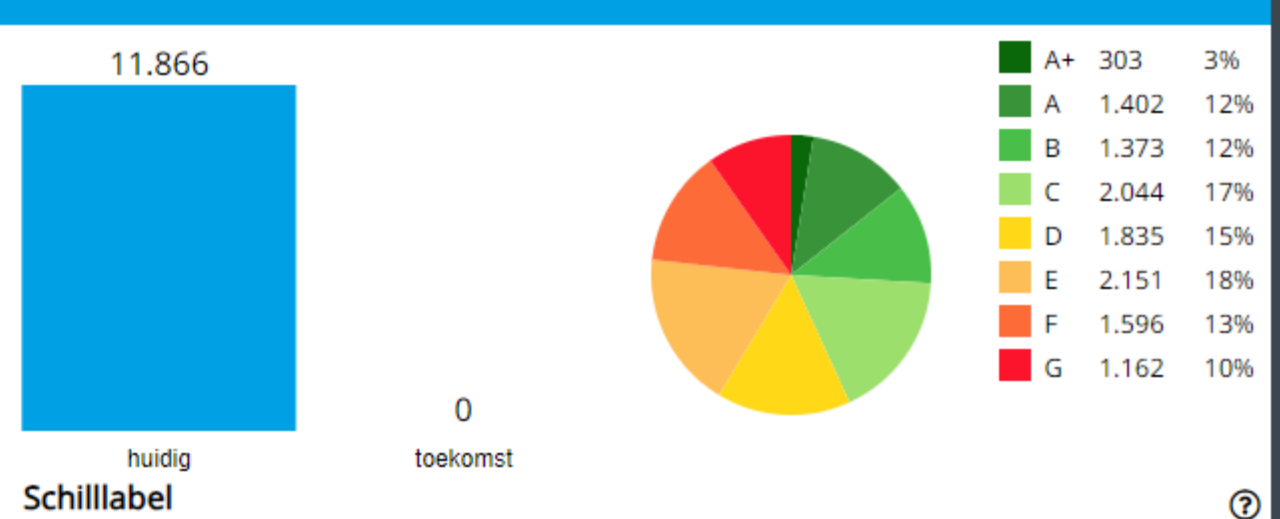
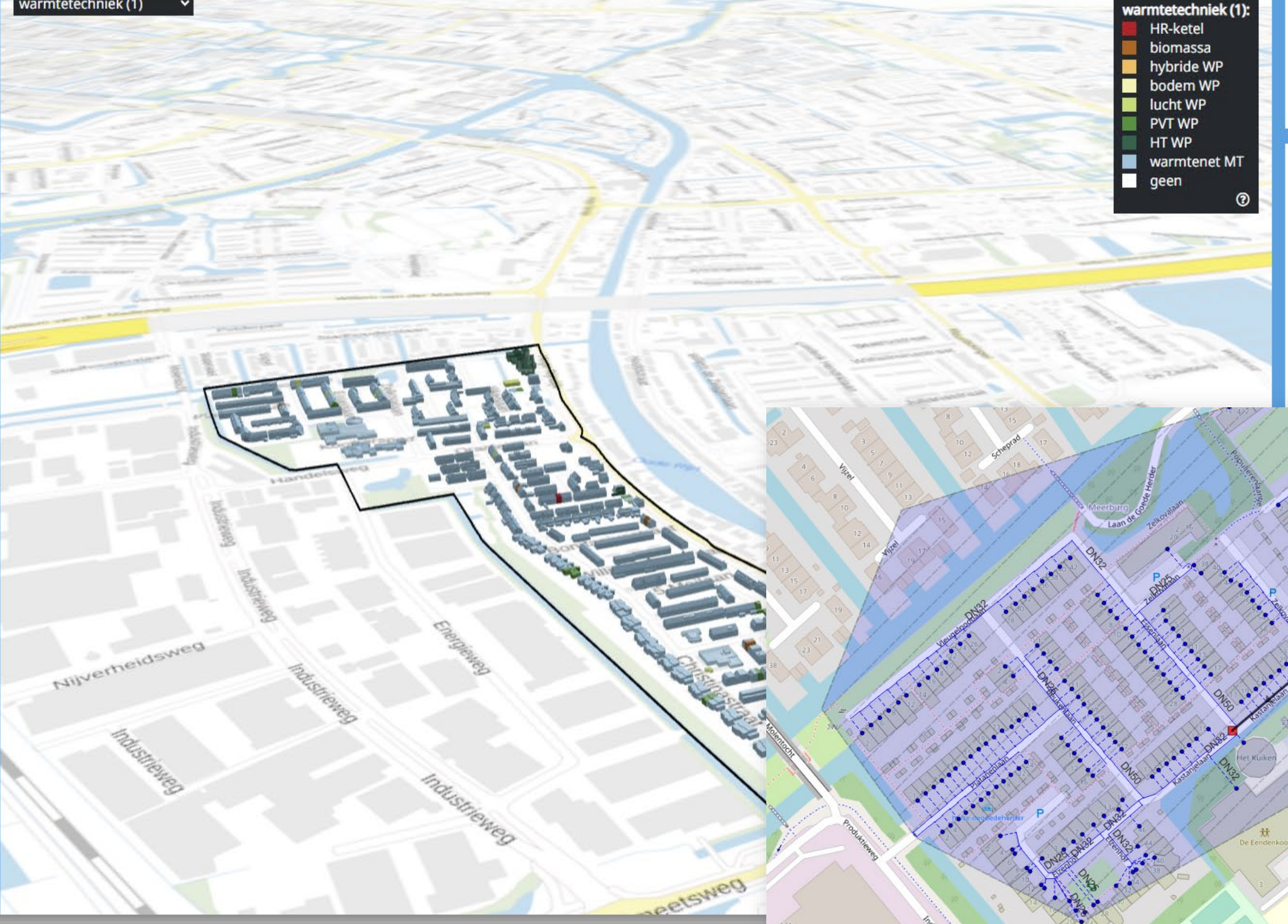
- Algemeen
- HUIDIG**
- VOORKEUR
- Warmtenet HT
- Warmtenet MT 70

gebruiksdoelen (aantal):

wonen	10.876
kantoor	100
onderwijs	20
gezondheidszorg	47
sport	14
winkel	271
bijeenkomst	80
logies	49
industrie	200
overig	52
gemengd	157

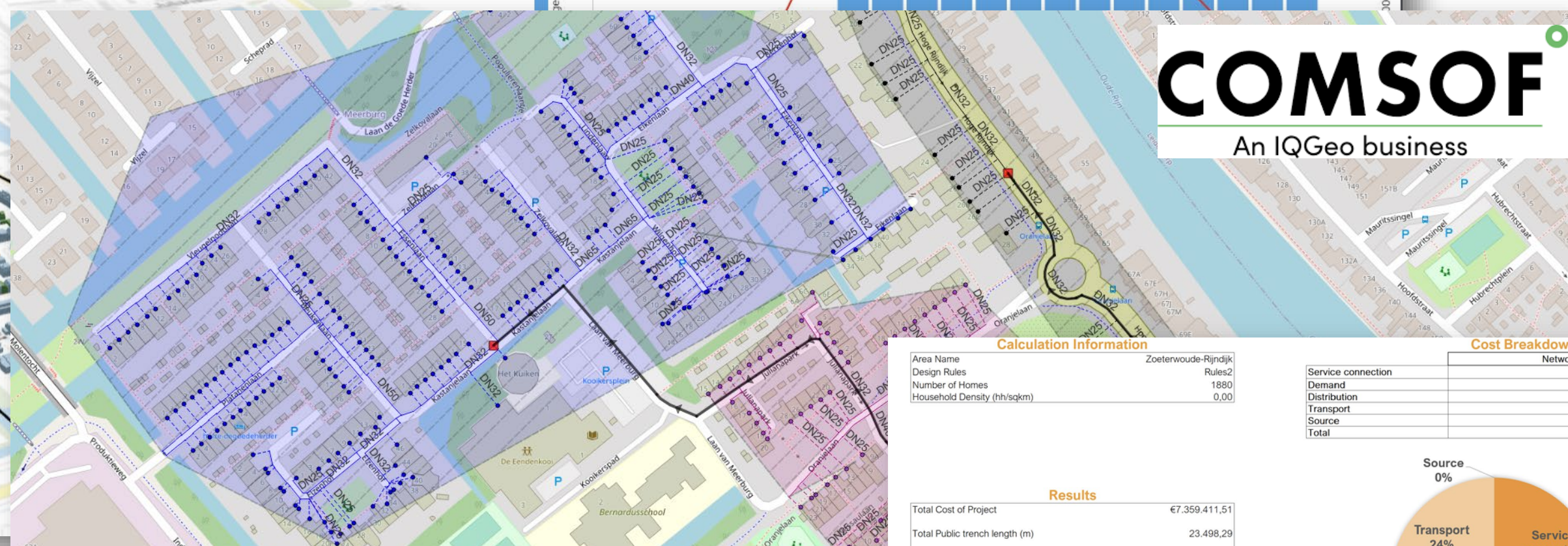


- warmtetechniek (1)
- Algemeen
  - HUIDIG
  - VOORKEUR
  - opbrengst wnet 60C
  - opbrengst wnet 70C
  - opbrengst HT-net
  - vergelijking HT-MT
- Voorkeuren: jaarlasten
- berekening: bereken VO > 500m<sup>2</sup>
- warmtetechnieken:
- gasketel
  - biomassa
  - wp hybride
  - wp bodem
  - wp lucht
  - wp PVT
  - wp HT
  - warmtenet HT
  - warmtenet MT
  - warmtenet LT
- warmtenet:
- MT-net 60°C
  - BAK 7.400€
  - vastrecht 261€
  - huur afleverset 125.5€
  - max.subsidie BAK 2.748€
  - ontzorgingsmarge 0%
  - bron restwarmte
- energieprijzen:
- looptijd energieprijis 10jr
  - startjaar energiepriis 2.022



1. Digital Twin of a city  
Heat zoning with COLONY

2. Identify areas for  
District Heating  
Networks with COLONY



**COMSOF**  
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3. Export data and design the network  
with Comsof Heat incl. CAPEX

**Calculation Information**

Area Name	Zoeterwoude-Rijndijk
Design Rules	Rules2
Number of Homes	1880
Household Density (h/ha)	0,00

**Results**

Total Cost of Project	€7.359.411,51
Total Public trench length (m)	23.498,29
Total Network linear energy density (MWh/m)	0,000
Deployment Cost per Home	€3.914,58

**Cost Breakdown**

	Network Cost	%
Service connection	€2.305.536,89	31%
Demand	€0,00	0%
Distribution	€3.320.188,81	45%
Transport	€1.733.685,81	24%
Source	€0,00	0%
Total	€7.359.411,51	100%

**Source** 0%

**Transport** 24%

**Distribution** 45%

**Service connection** 31%

**Demand** 0%

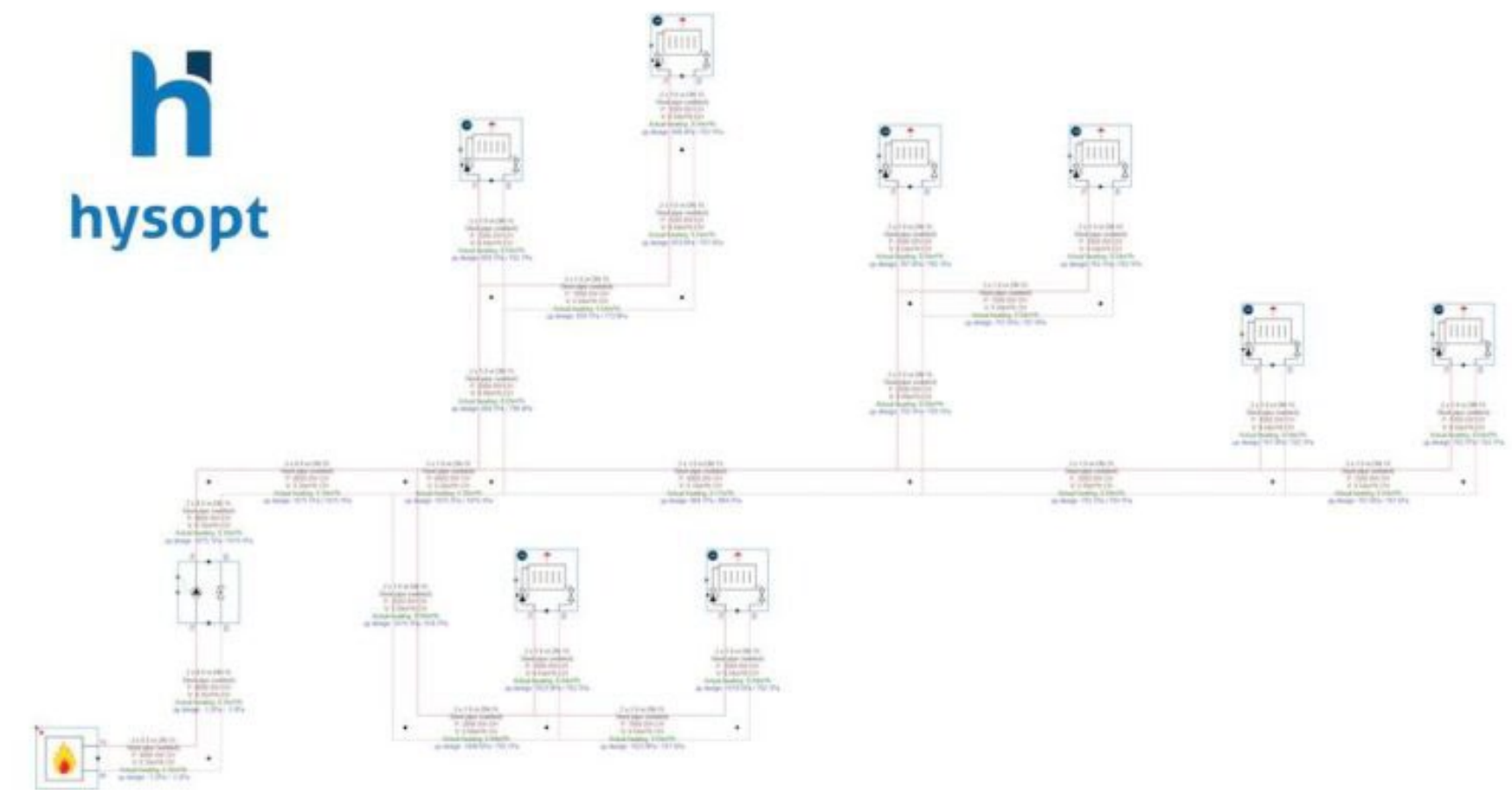
Generated by Comsof Heat 23.1.1.2822  
On 5/4/23, 2:13 PM





Exported data:

- Customer heat demand
- Pipe network topology
- Pipe diameters



Screenshot to be replaced

# Customers

Engineering & Consultancy

District Energy operators

(Large) cities

Universities

*“In addition to saving time, the software's ability to model different scenarios and incorporate data from multiple sources has been crucial in developing a flexible and adaptable plan for the project.”*

*“With a simple re-run, we have an entirely new network. All of these things would have been very time consuming and expensive to do manually”*

*“Now we have more insights, without losing ourselves in details.”*

*“Finding creative solutions together for problems together was something I appreciated, 'It's not just here's the software, it's more of a partnership”*

*“We made loads of scenarios and experimented with various runs we would like to test in Amsterdam. We are incredibly happy with the results we have”*

*“This software provides considerable more reliable capital cost calculations than manual designs, for only a fraction of the invested labor hours”*

**COMSOF**  
**HEAT**



## Biomass District Heating as a Sustainable Solution for Decarbonizing Communities in Nova Scotia, Canada

Discover how TorchLight Bioresources is revolutionizing sustainable energy in Nova Scotia, Canada. By challenging traditional heating solutions and exploring the potential of biomass, they aim to decarbonize communities while lowering costs and boosting the local economy.

[Read the study →](#)



## Sinnogy expands into district heating network planning in German market

Sinnogy has recently expanded its technical planning team in Erfurt, which now focuses on planning and designing district heating (DH) networks and doing simulations of such networks. This is in response to growing demand in the German market and increasing network complexity

[Read the study →](#)



## Amsterdam City explores the spatial impact of a district heating network for the city

The Netherlands has a goal to reduce carbon emissions by 95% by 2050. Amsterdam City took the opportunity to run some in-depth spatial explorative studies into the spatial impact of a largescale district heating network in their urban centre with the goal to improve cooperation and ameliorate spatial planning of district heating networks.

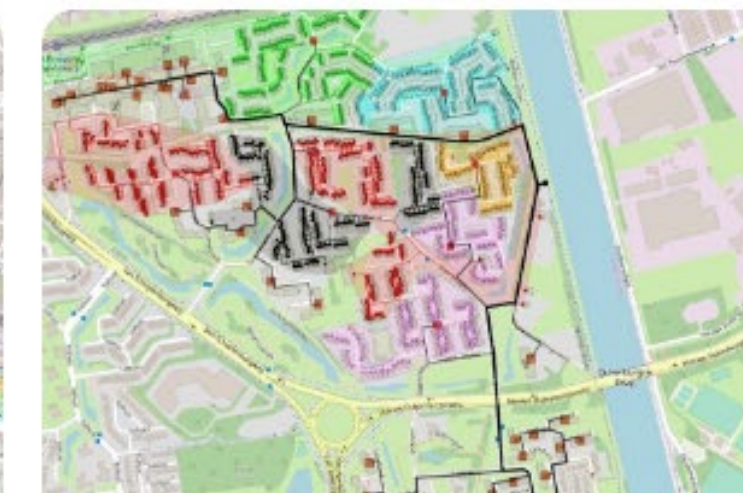
[Read the study →](#)



## Royal HaskoningDHV creates district heating network designs with Comsof

Royal HaskoningDHV is an engineering firm in the Netherlands tasked with rolling out district heating networks for a sustainable society.

[Read the study →](#)



## HVC strengthens district heating networks for 7 municipalities with Comsof Heat

Comsof Heat allows HVC to gather insights into local needs for district heat networks in the exploratory phase of their project.

[Read the study →](#)



## How Syntraal creates district heat network designs for a gas-free future

Syntraal supports municipalities in The Netherlands to create quality district heat network designs for a gas-free future.

[Read the study →](#)

# Getting Started?

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Online Training Portal  
Comsof Heat

70+ videos  
Theory & Demo's

Chapter one  
Designing district heating networks – Essential topics  
In this chapter you will learn the essential functionality to design a single source district heating network including CAPEX calculation.  
[Start chapter one >](#)

Chapter two  
Improving your designs – Essential topics  
In this chapter you will learn additional functionality to improve your designs of 3rd generation district heating networks.  
[Start chapter two >](#)

Chapter three  
Network deployment strategies and investment analysis  
In this chapter you will learn how to run an investment analysis and how to roll out the network in a phased approach.  
[Start chapter three >](#)

Chapter four  
Advanced design topics: 4th and 5th generation DHC networks  
In this chapter you will learn to design district cooling networks and advance features for 4th and 5th generation networks.  
[Start chapter four >](#)

Chapter five  
Improving your designs – Advanced topics  
In this chapter you will learn advanced features to improve and fine tune your network designs.  
[Start chapter five >](#)

Chapter six  
Appendix  
This appendix shows a few public data sources with GIS data and Heat demand data.  
[Open appendix >](#)

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Products Case studies Resources  [Contact us](#)

Join our Comsof Heat Open Training

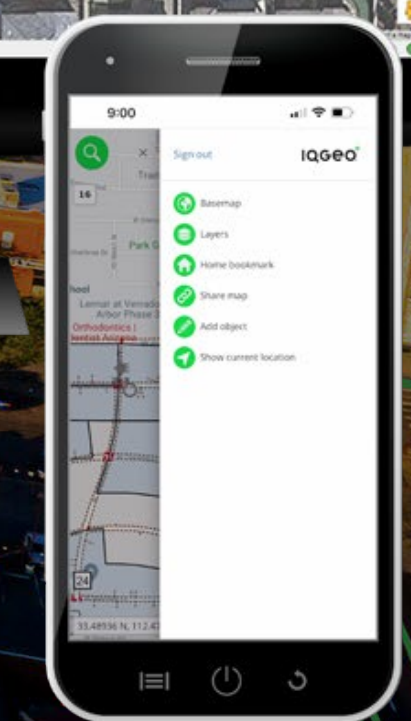
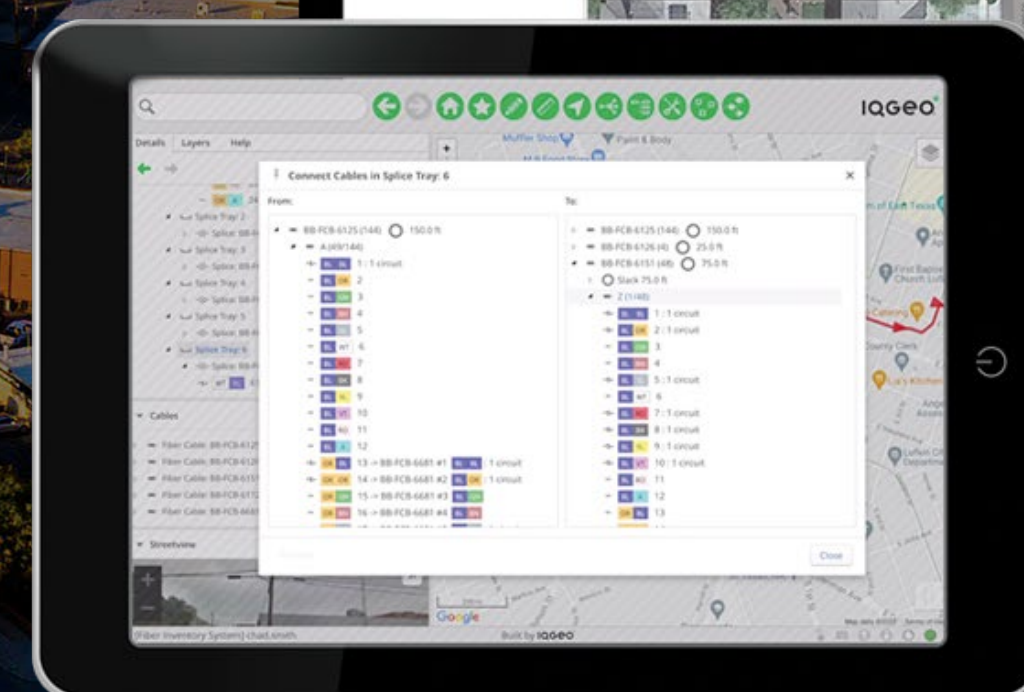
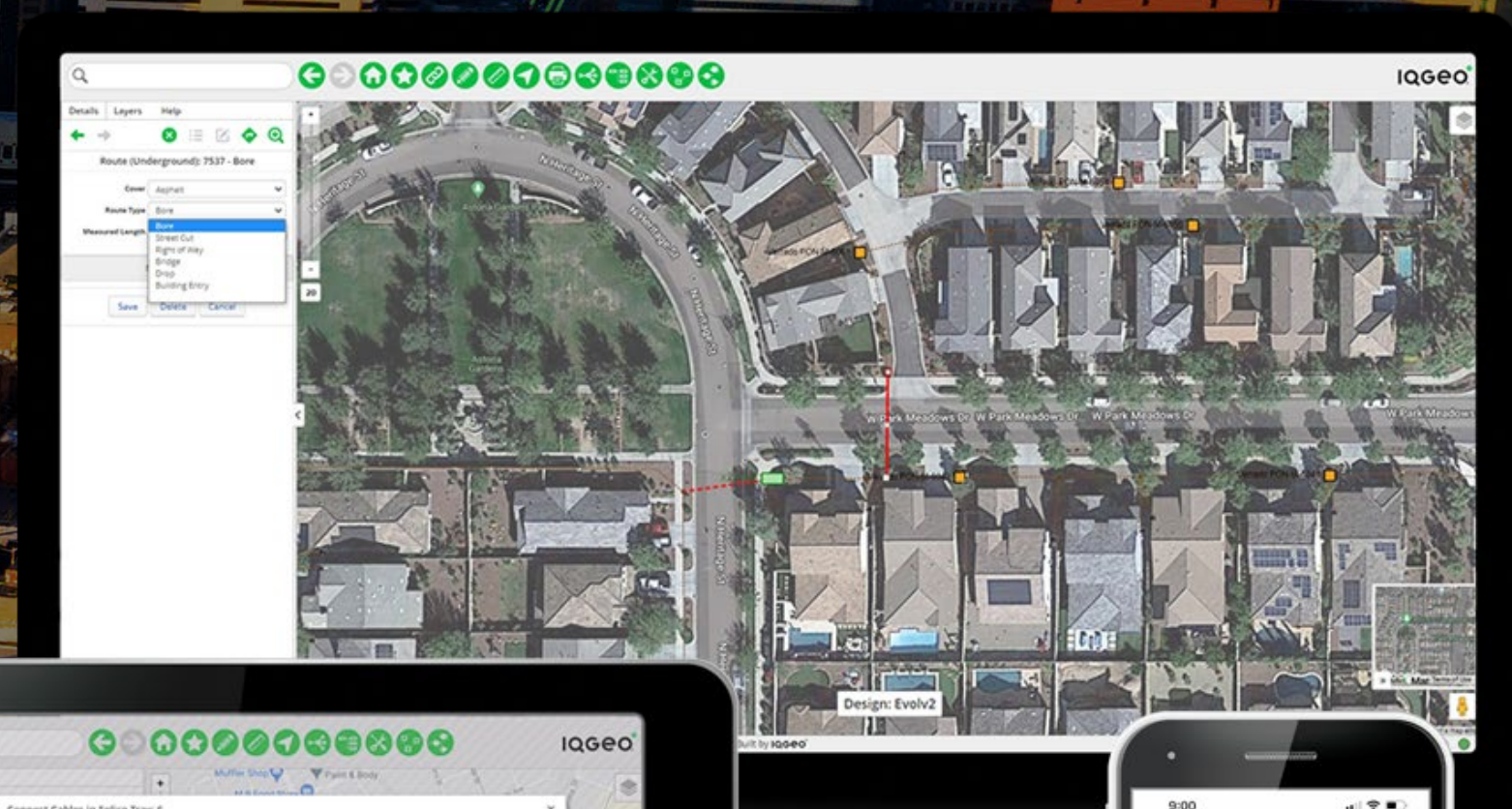
- 2-day training + 1 month trial
- Next edition in Ghent - March 2024

Contact: [kurt.marlein@iqgeo.com](mailto:kurt.marlein@iqgeo.com)

# Thank you !

# Building better networks

Contact: [kurt.marlein@iqgeo.com](mailto:kurt.marlein@iqgeo.com)



## Presentation disclaimer IQGEO

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## Presentation disclaimer Rotterdam Use Case

IQGEO declares that the information related to the district heating network in Rotterdam for the feasibility study phase is in this presentation solely intended for informational purposes. In recent years this has been subject to change; therefore, we recommend that those interested in using this information or to know more about it, please contact the person in charge of the calculations at the following e-mail: [fm.freyrehechavarria@rotterdam.nl](mailto:fm.freyrehechavarria@rotterdam.nl). The district heating network plans at the feasibility stage may evolve based on ongoing studies, technological advancements, regulatory changes, or unforeseen circumstances. The information presented does not guarantee future project specifics and should not be considered a final representation of the heating network. This information is offered without any warranty, expressed, or implied, as to its accuracy or completeness. Stakeholders, residents, or any parties involved are hereby notified that this information is not legally binding, and no claims can be made based on the content provided. By accessing and utilizing the information presented, users acknowledge and agree to the terms outlined in this disclaimer. The creators of the district heating network calculation in Rotterdam hold no liability for any consequences arising from the use of this information.