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Analyzing possibilities of using energy from surface and waste water - Study in the Netherlands

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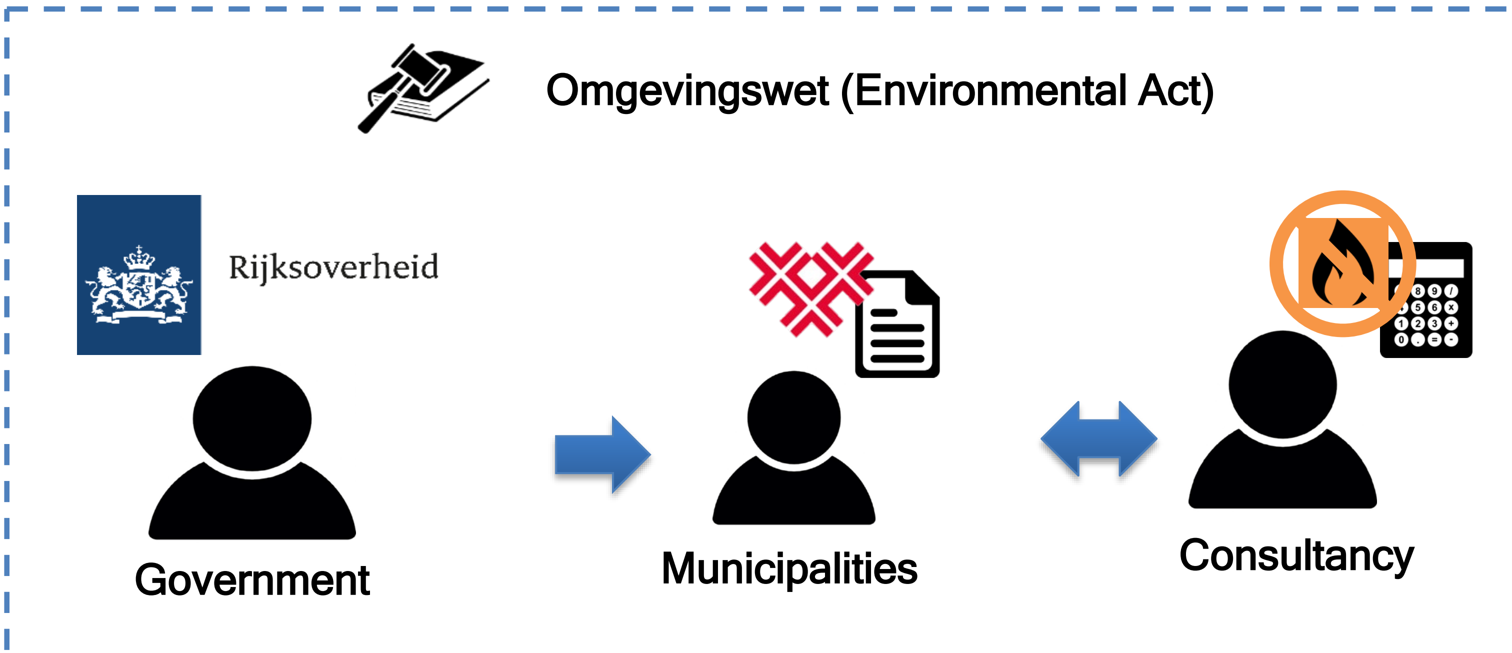
Introduction



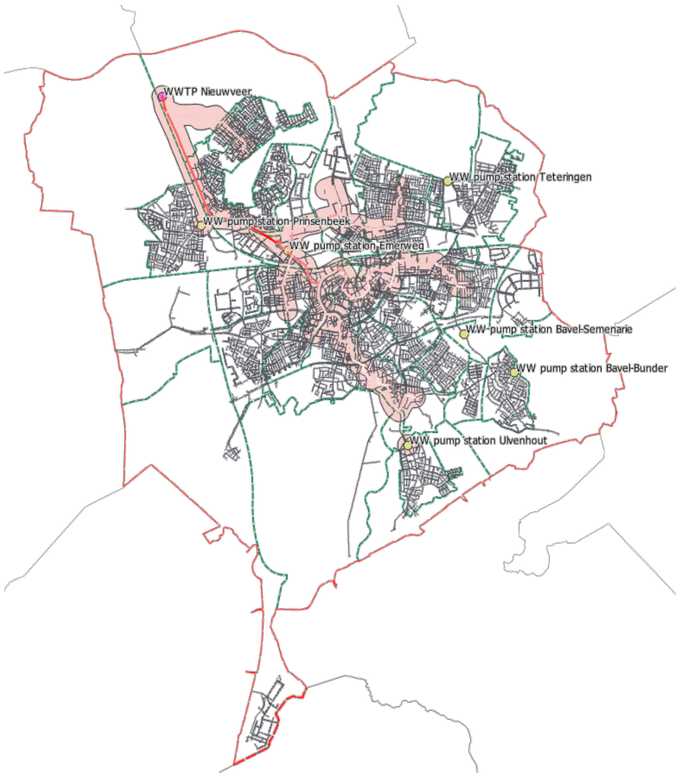
State of affairs in the Netherlands

Final energy demand (~2000 PJ): 2016 statistics

Heating (~1200 PJ) → 40% Built environment

Water boards

Case study: Municipality of Breda

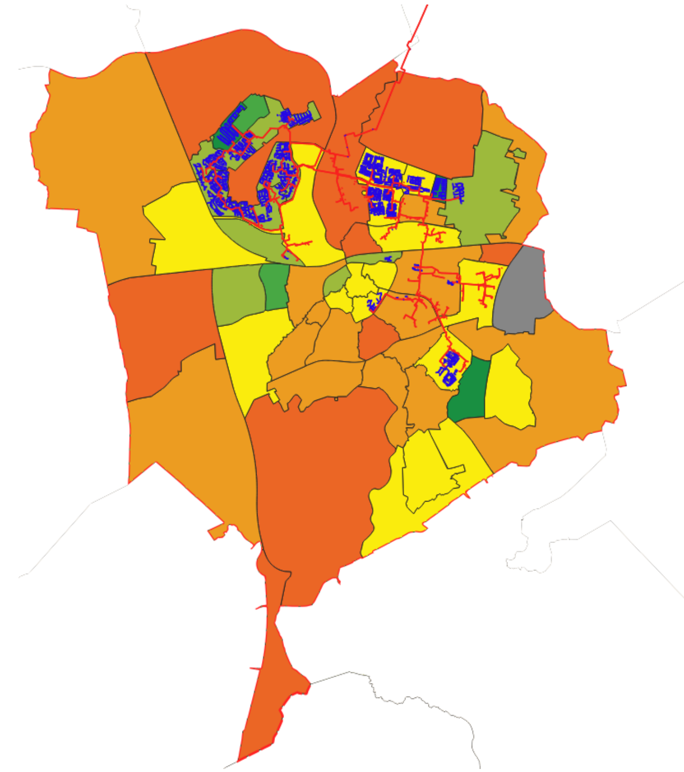


56 neighbourhoods
48,200 dwellings

Target → Become CO_2 neutral by 2044

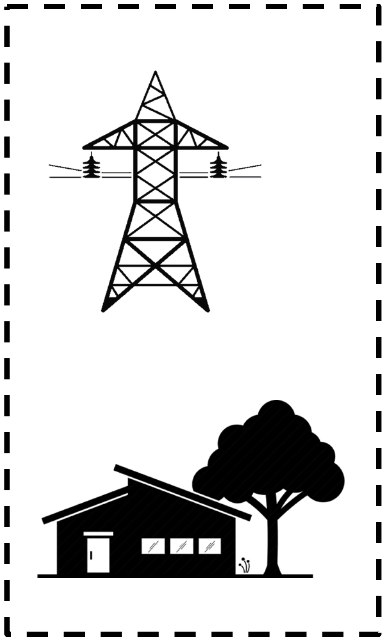
Current composition of heating:

- Gas
- High temperature district heating network (CHP-Coal)

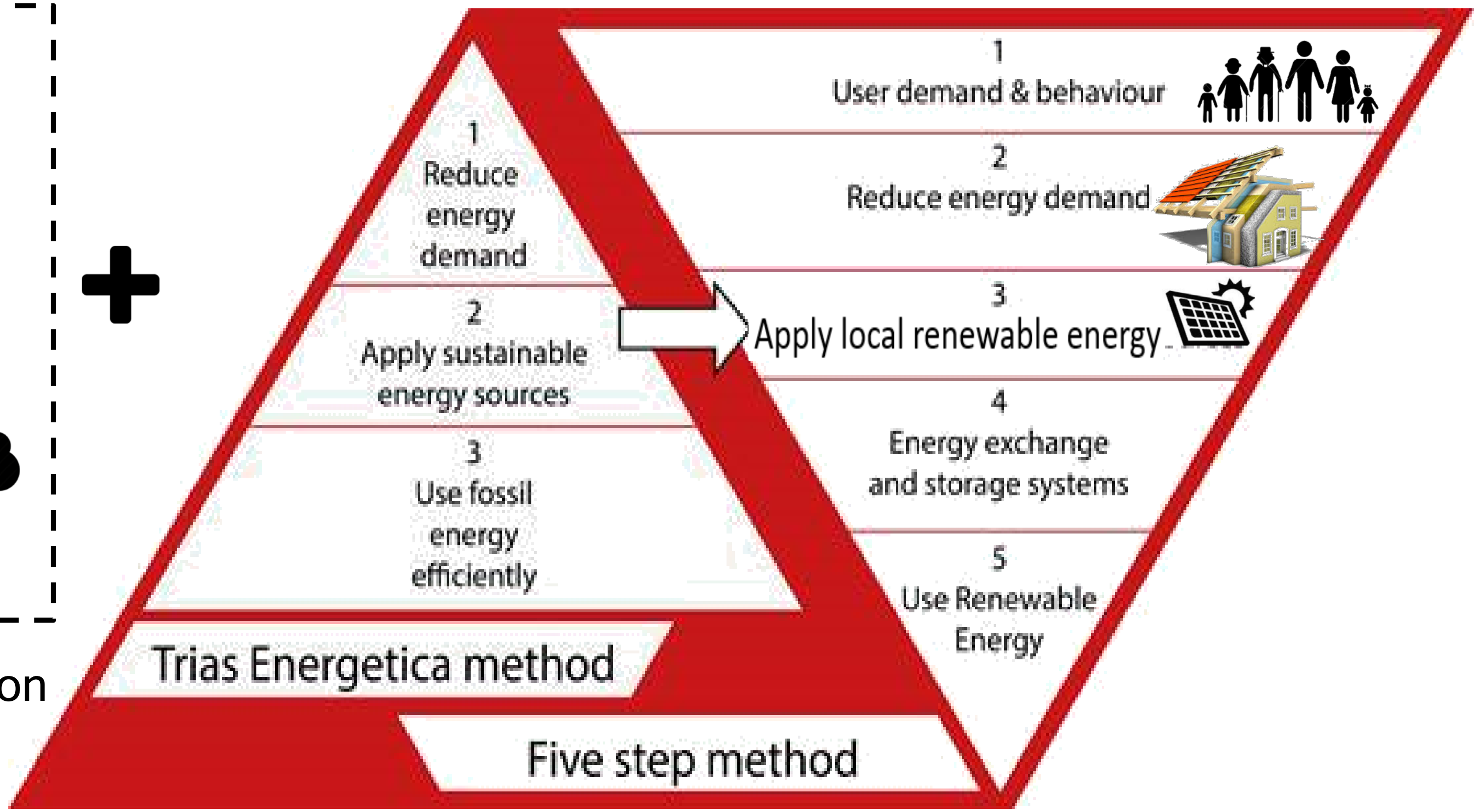


Introduction | Case study | Method | Results | Conclusion

Method



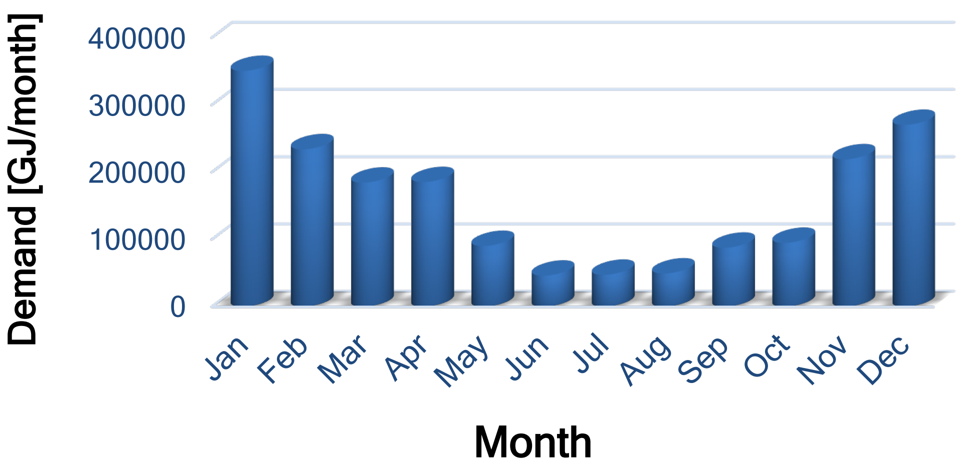
Existing situation



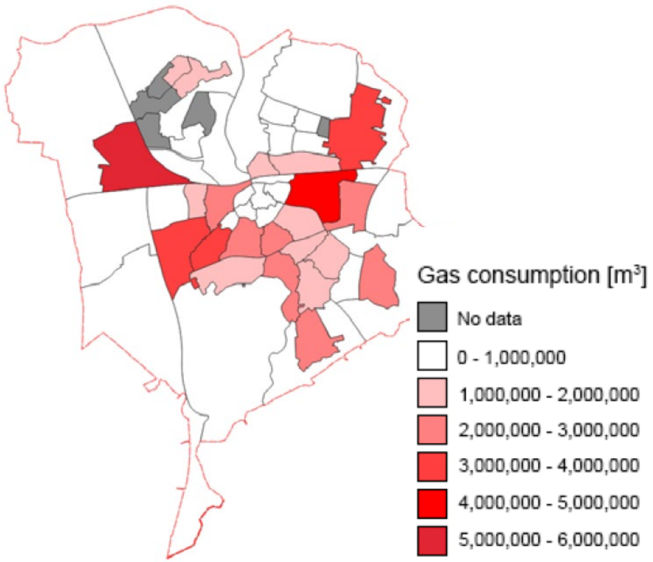
Step 1: Design according to user demand and behaviour

Current energy demand for heating and DHW of the municipality Breda

48,200 houses
1,8 PJ/year



Gas consumption share:
DHW = 23,5%



Step 2: Reduce energy demand

Using different scenarios

2018/2020 → 2030 → 2050

Scenario 1

Current situation

Scenario 2

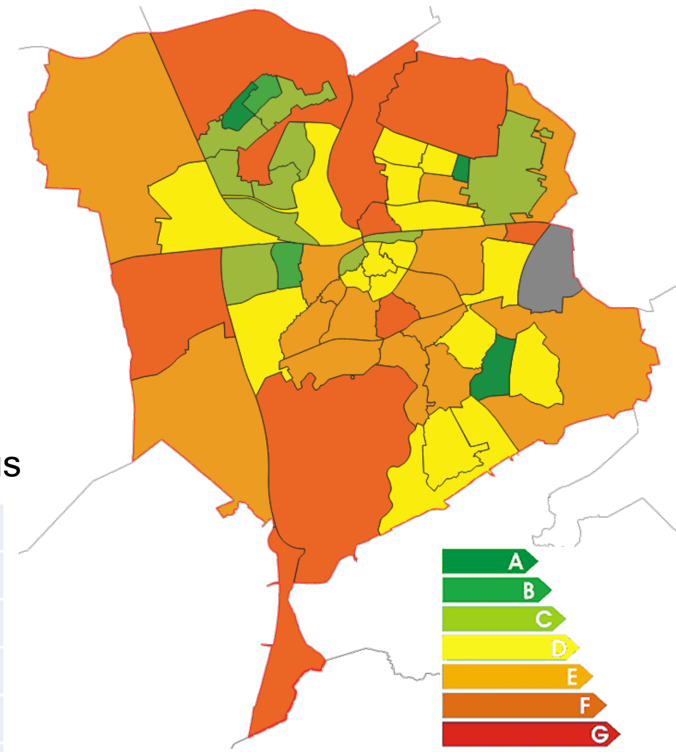
Average label **B** for all buildings

+ Cooling demand

Scenario 3

Average label **A/A+** for all buildings;

+ Cooling demand



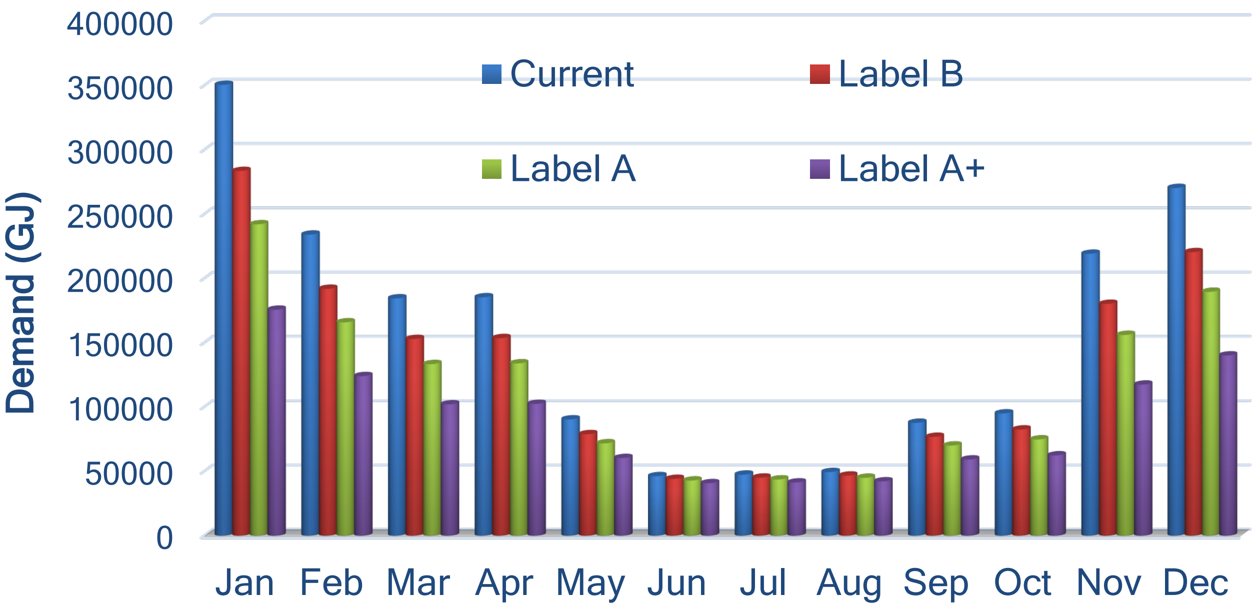
Percentage of heating energy savings after improvements of the dwellings

%	Future Label							
Current Label	A+	A	B	C	D	E	F	G
G	73	45	34	28	18	10	3	0
F	69	43	32	26	15	7	0	0
E	62	39	27	20	8	0	0	0
D	54	34	20	13	0	0	0	0
C	43	24	8	0	0	0	0	0
B	33	17	0	0	0	0	0	0

Reference values were sources from CEGOIA-Education tool

Step 2: Reduce energy demand

Current and expected energy demand for heating and DHW of the municipality Breda
Taking a certain growth of number of houses



Current:
- 48,200 houses
- 1,9 PJ/year

2030:
- 52,500 houses
- 1,5 PJ/year

2050:
- 53,000 houses
- 1,2 PJ/year

Step 3: Apply sustainable energy sources

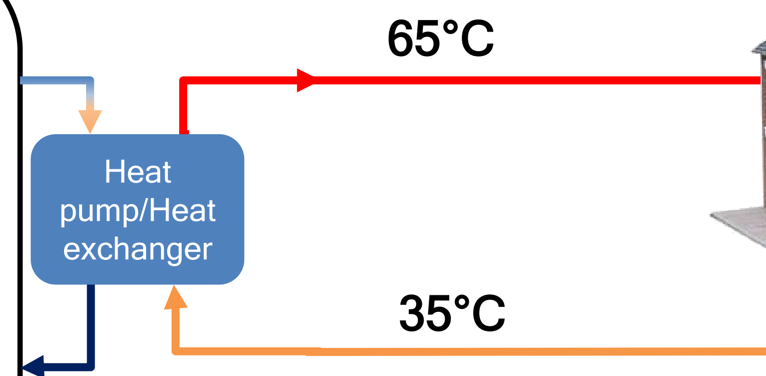
Thermal energy from waste water and surface water

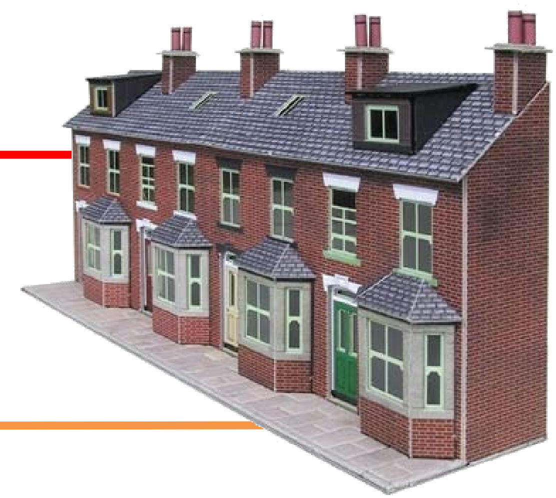
Source → Heat exchanger → Heat Pump/ Heat exchanger → Consumer

Energy source

Surface water
- River
- Surface water pumping stations

Waste water
- Influent - Pumping stations

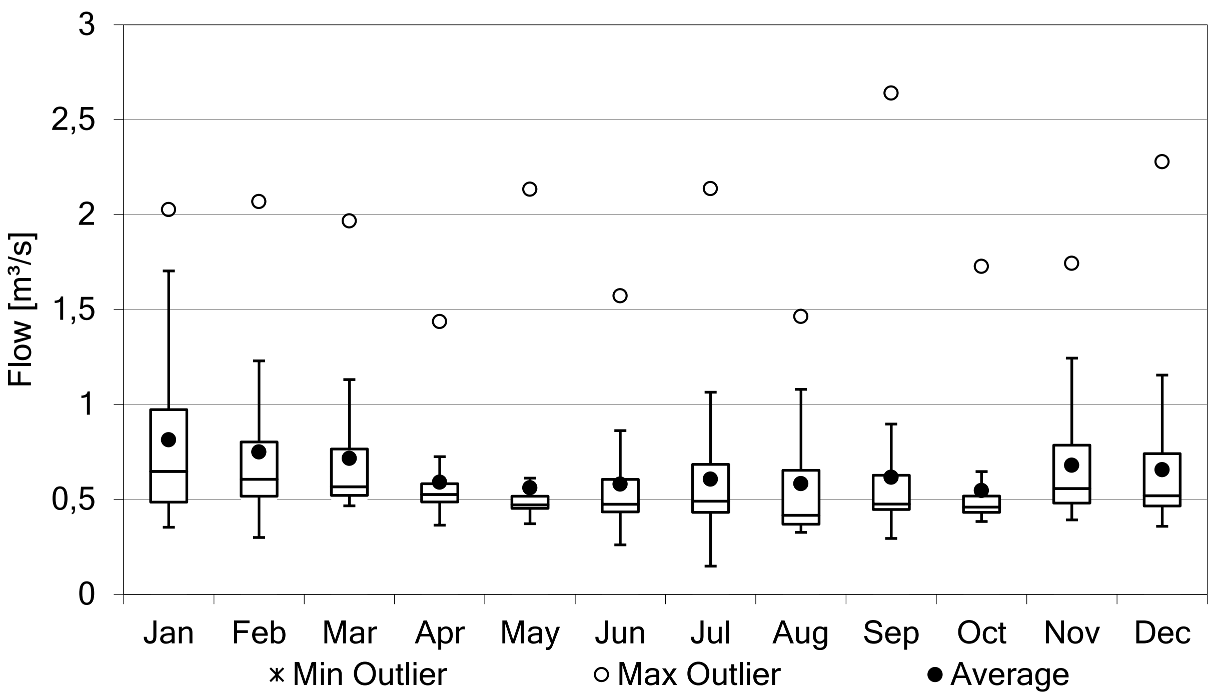


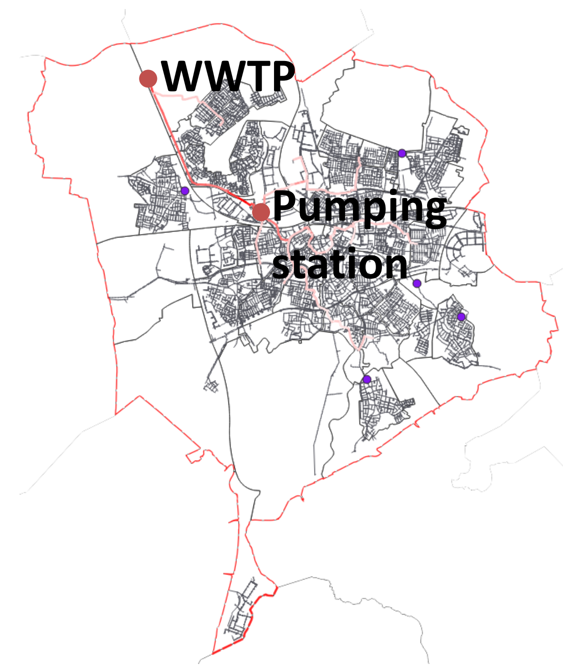


End user
Buildings with low temperature radiators

Waste water flow rate and temperature

Pumping Station Emerweg





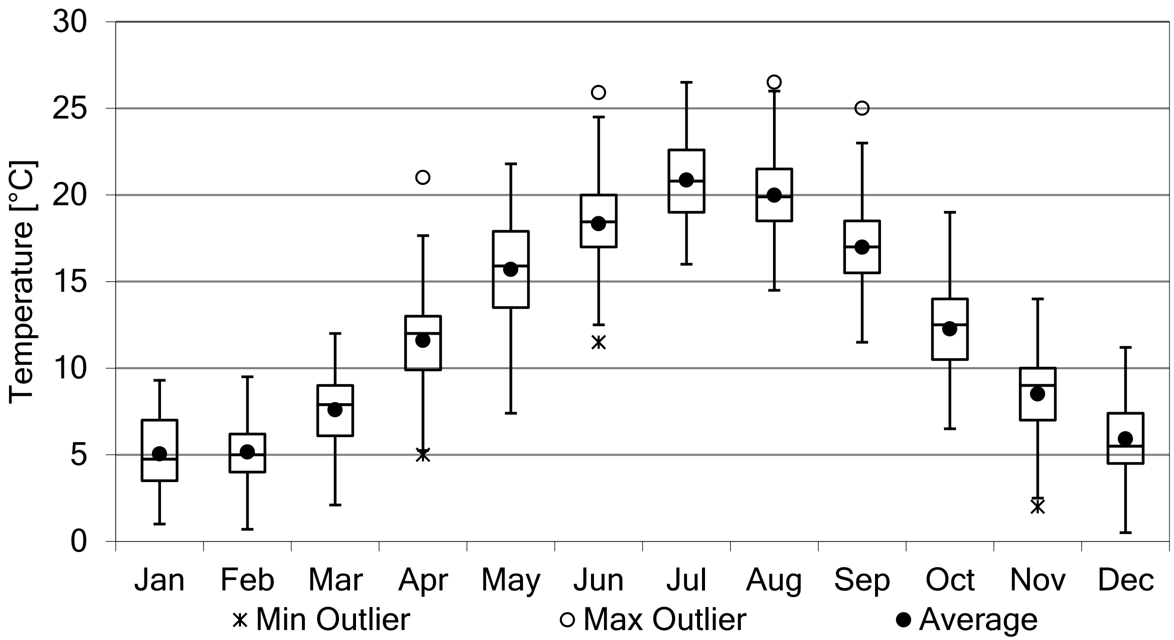
Average flow rates:
0,6 - 0,8 m^3/s

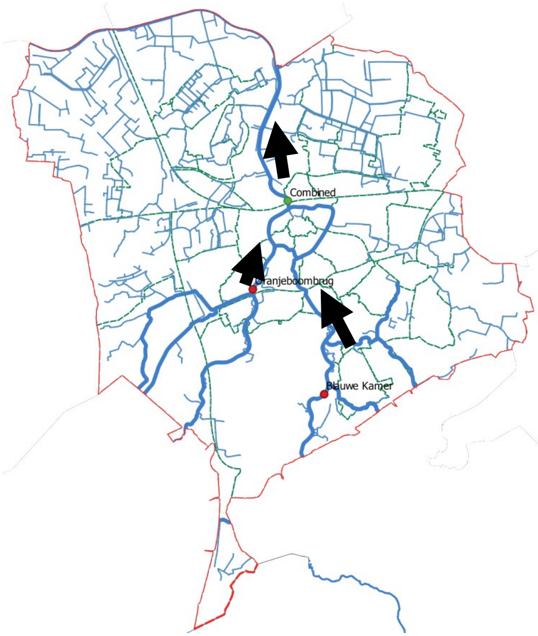
Average monthly temperatures and flow rates were used for calculation

Average temperatures:
10 - 22 ^0C

Surface water flow rate and temperature

Routine water quality measurement stations





Data measurements from 2008 to 2018 has been used

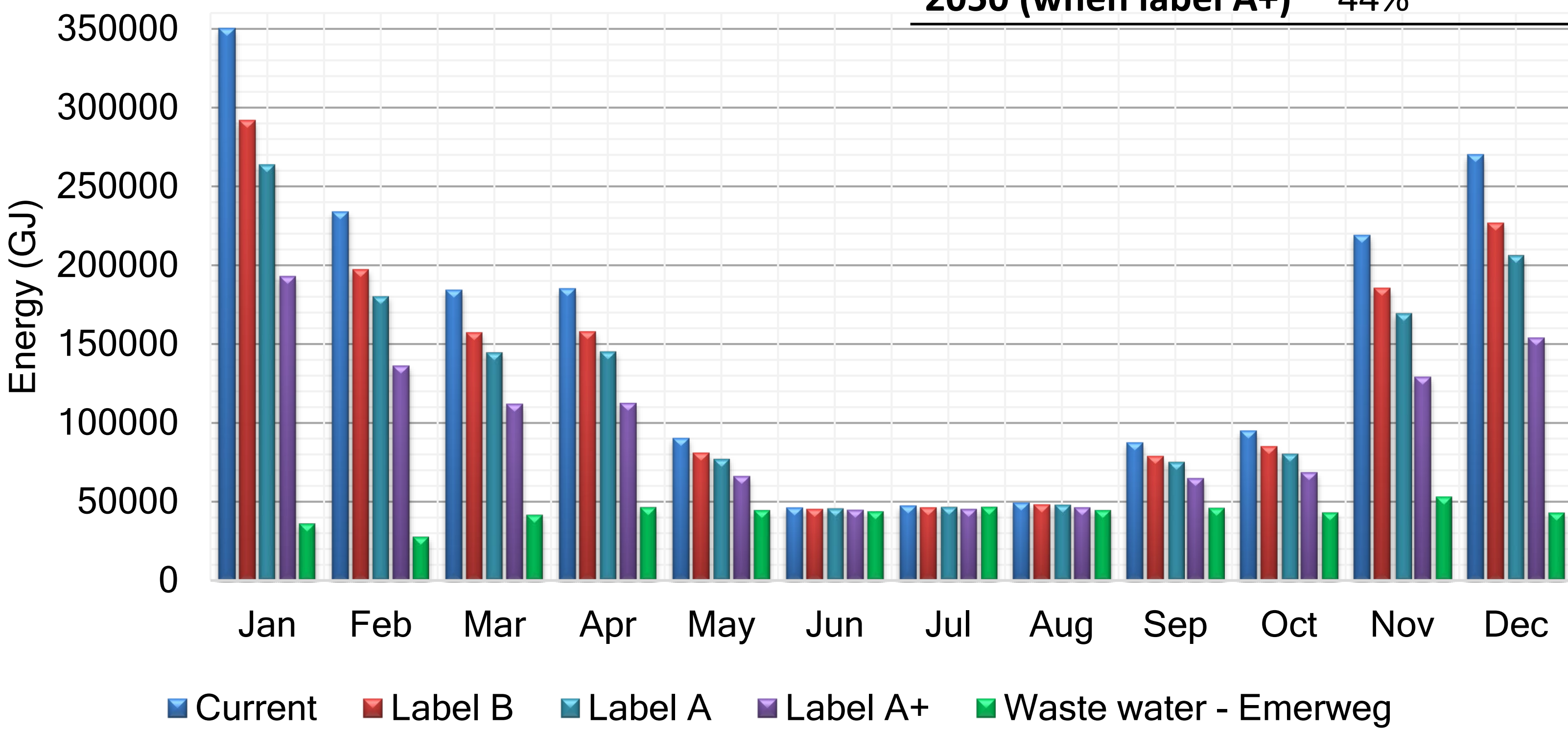
Average flow rates:
2,5 - 12 m^3/s

Average temperatures:
5 - 21 ^0C

Results

Thermal energy extracted from waste water

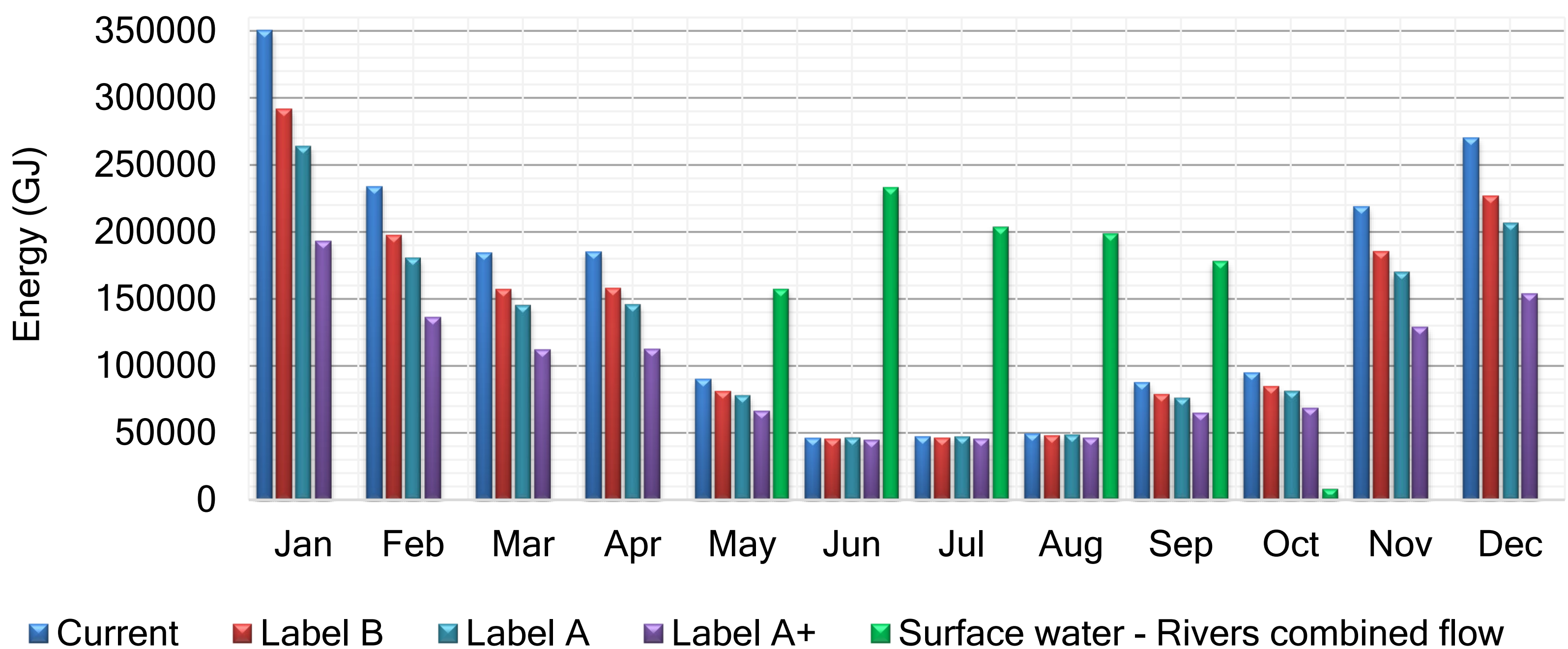
	Percentage of total
Current	28%
2020 (when label B)	32%
2030 (when label A)	35%
2050 (when label A+)	44%



Results

Thermal energy extracted from surface water

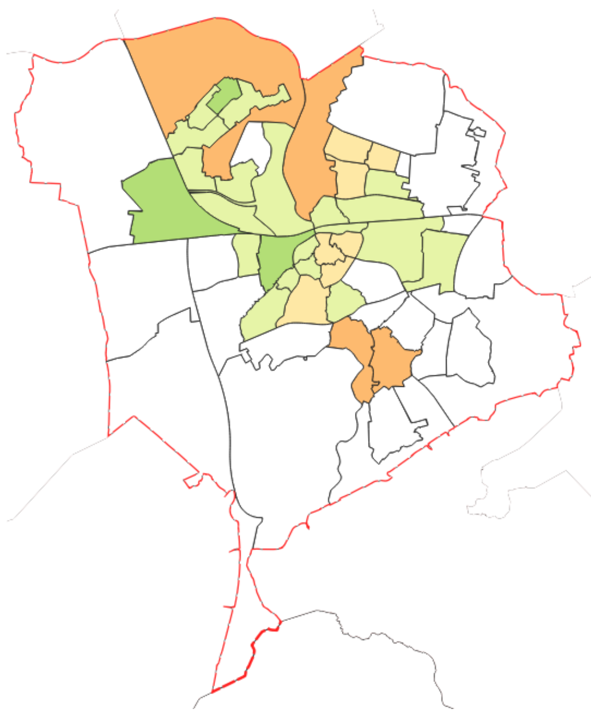
	Percentage of total	With ATES	@pumping station
Current	53%	46%	5%
2020 (when label B)	61%	53%	6%
2030 (when label A)	66%	57%	6%
2050 (when label A+)	83%	71%	8%



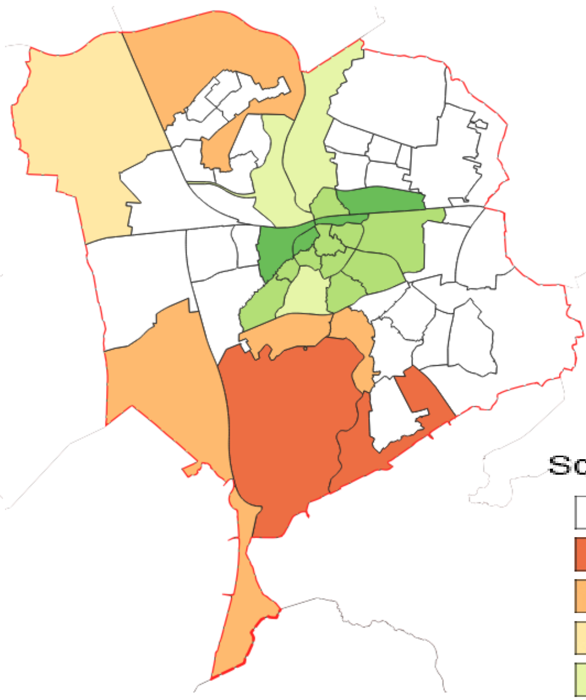
Results

Potential map

Category
Current energy label of the dwellings
Demand for energy
Supply of waste water/ surface water
ATES suitability
Botulism or Algae problems



Wastewater



Surface water

Analysis tool in excel

Conclusions

- Potential for energy from waste water and surface water has been identified
- Waste water sources are more stable throughout the year
- Surface water energy need storage options

Limitations

- The method is a preliminary analysis - A follow-up study is needed
- The calculation used average values for (there is a considerable difference between maximum and minimum)
- In the future maybe the waste water potential can go down
- Buildings need at least an energy label of "B"

Water boards can use this information and compare with other sources

THANK YOU