The impact of global warming and building renovation measures on district heating system techno-economic parameters

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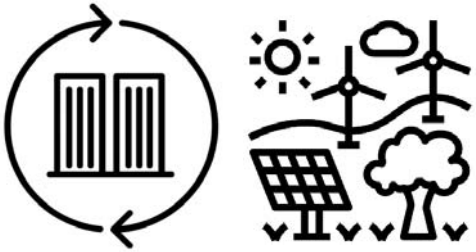
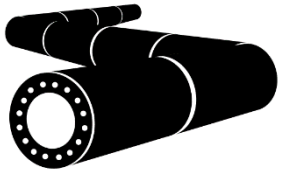
Research motivation

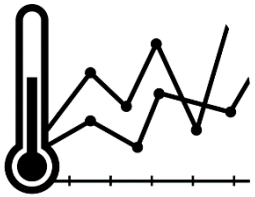


DHS for sustainable urban environment

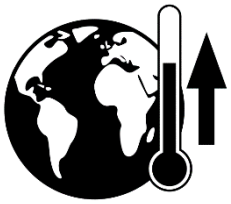


Significant infrastructure

Significant investment costs

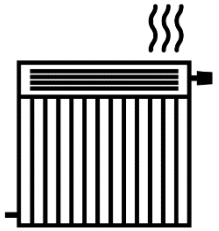


Increased temperature levels



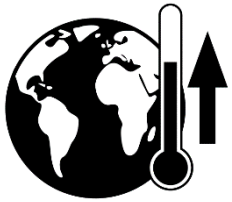
Climate change

Building renovation

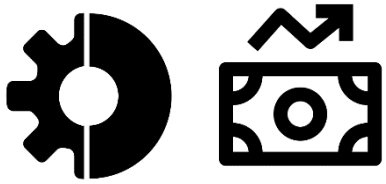


Decreased heat demand

Study scope



Climate change



Techno-economic parameters

Linear heat density

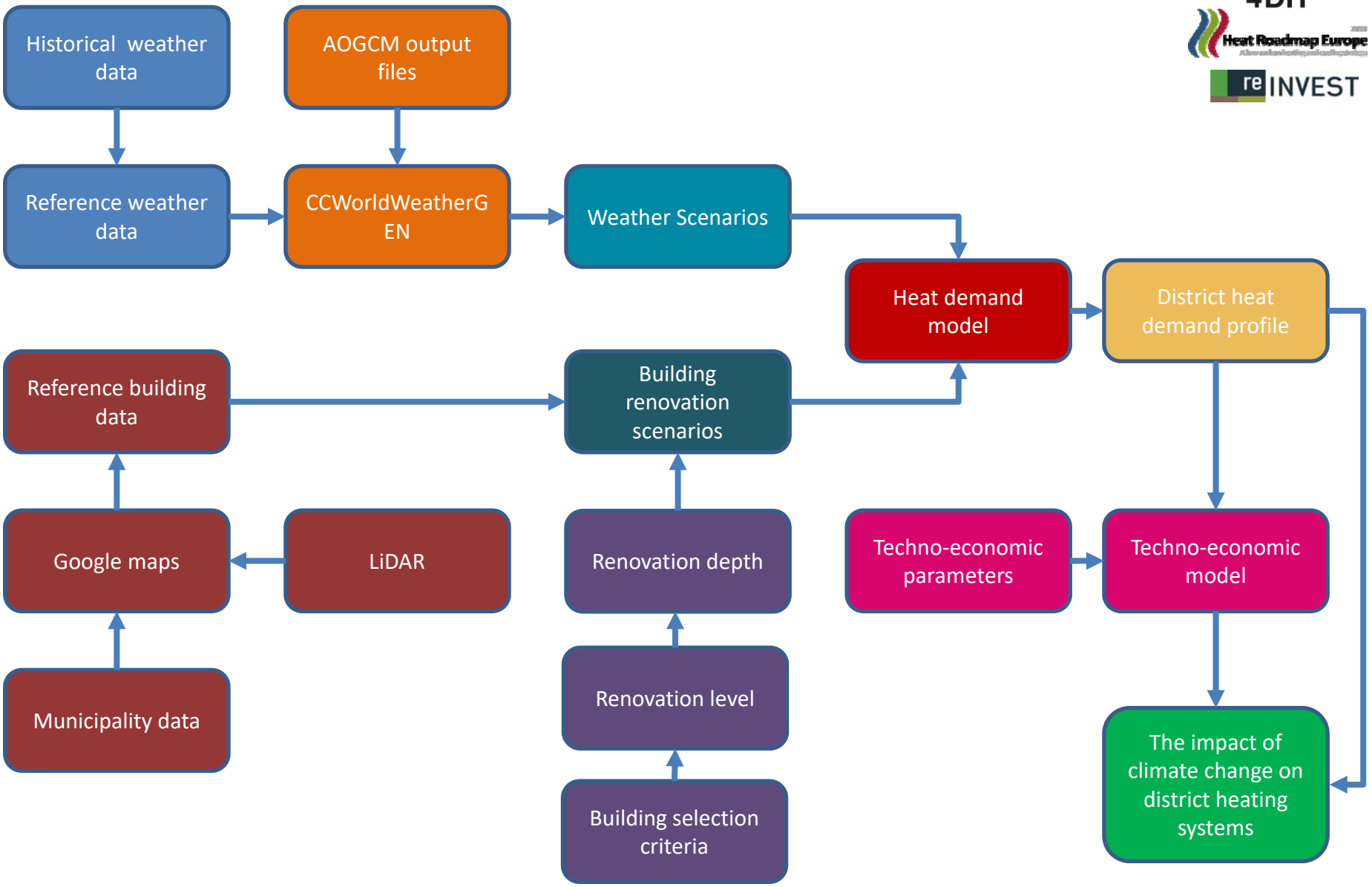
Heat production mix

CO2 emission levels

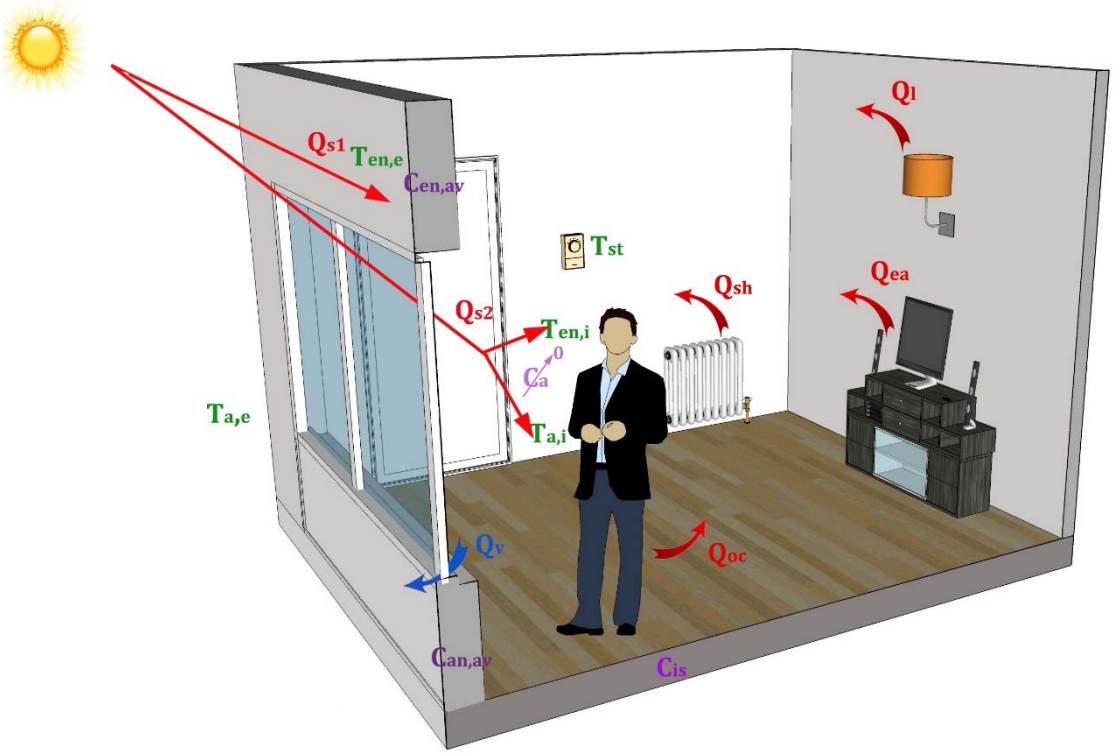
Heat sales

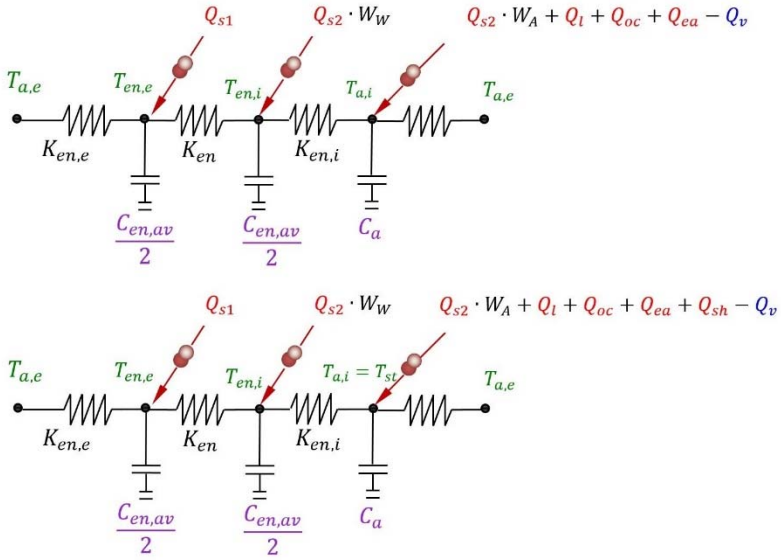
Heat price

Methodology outline

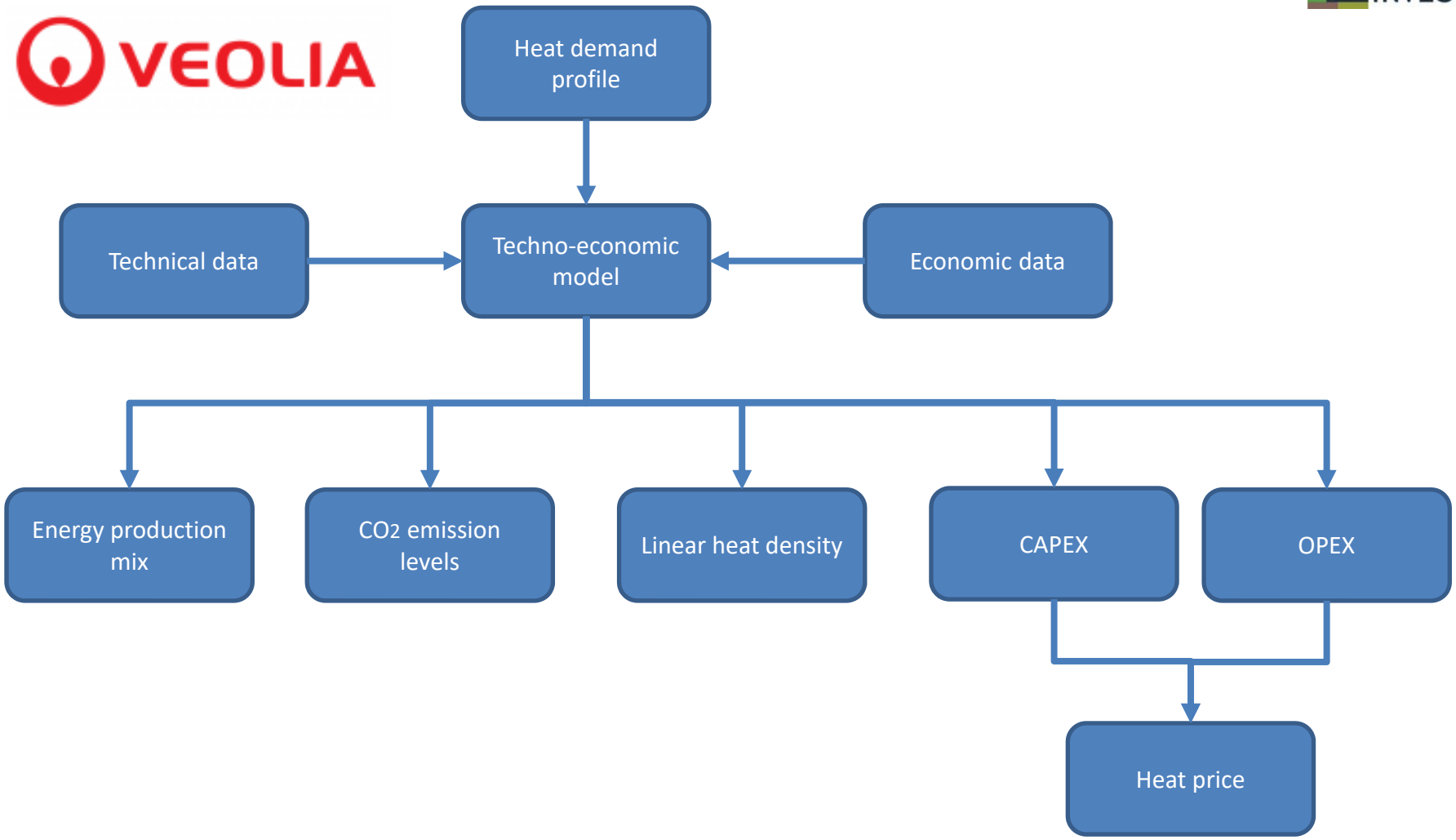


Heat demand model

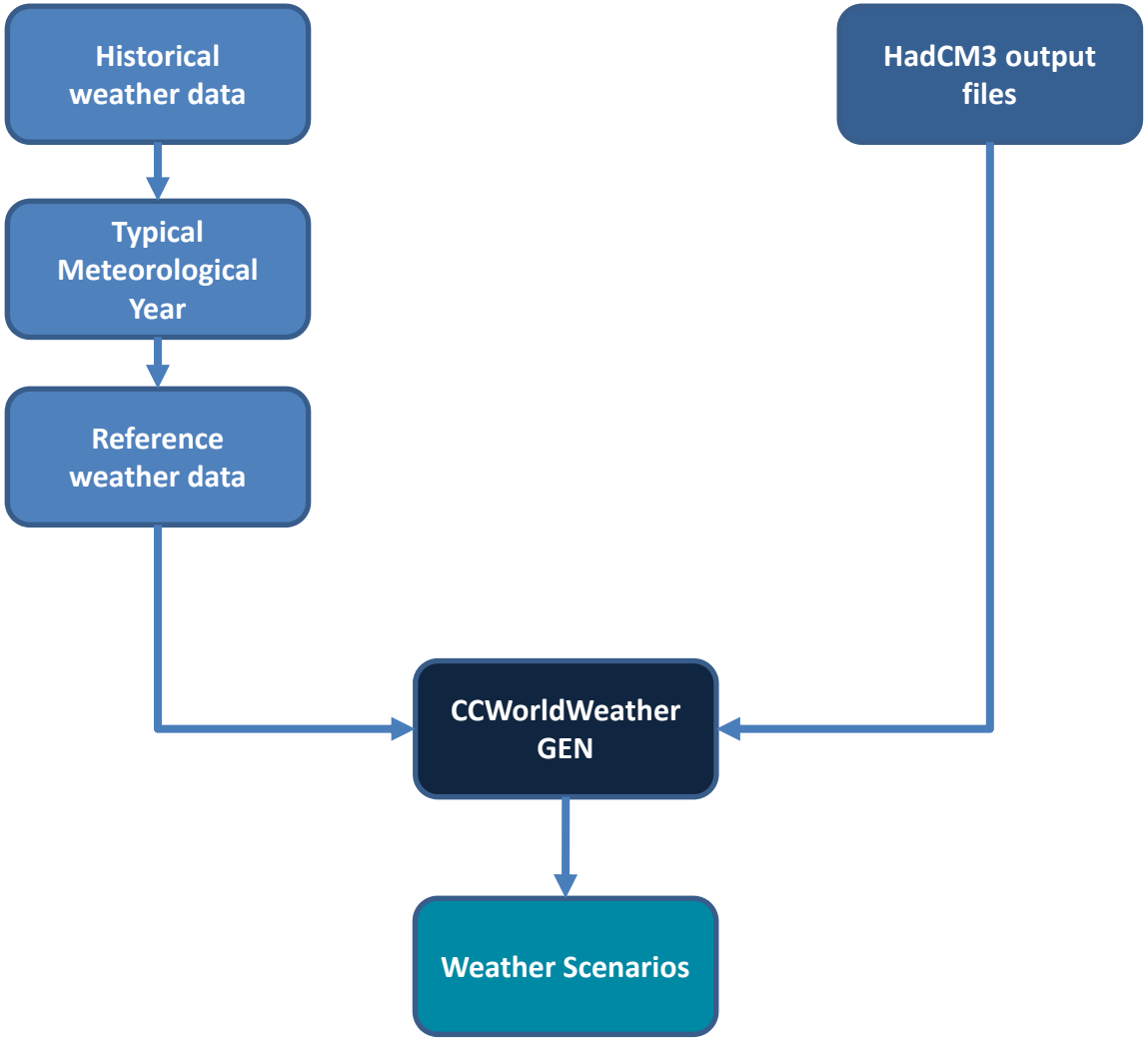




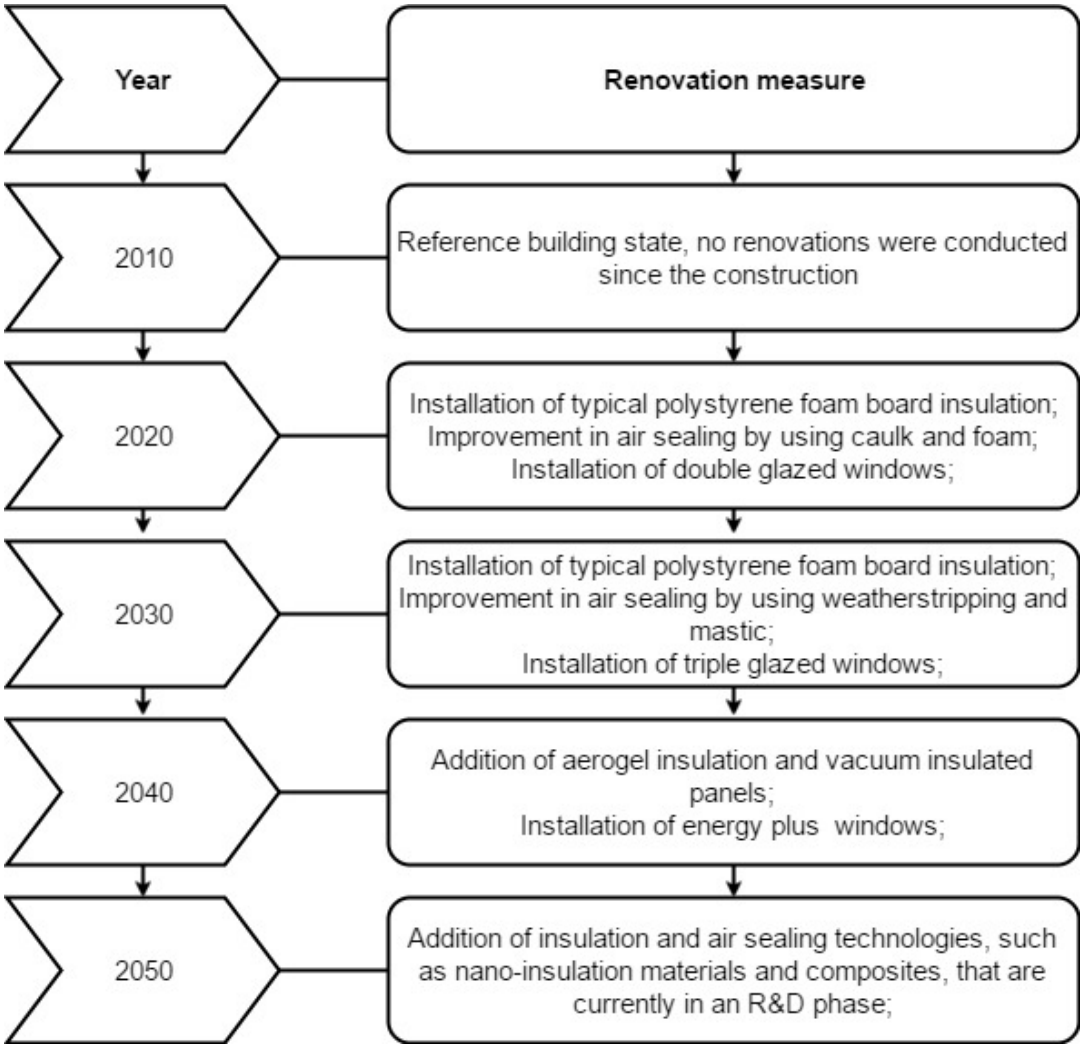
Techno-economic model



Weather scenarios

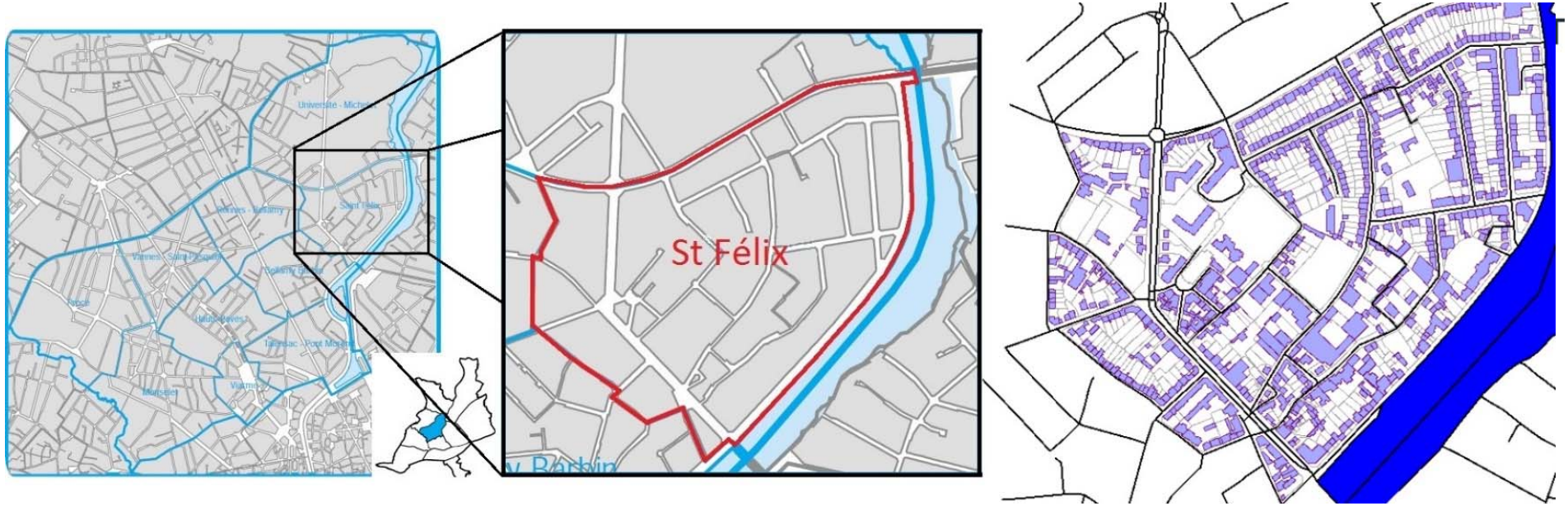


Building renovation scenarios



Source: International Energy Agency

Case study district



Two case scenarios for heat prices:

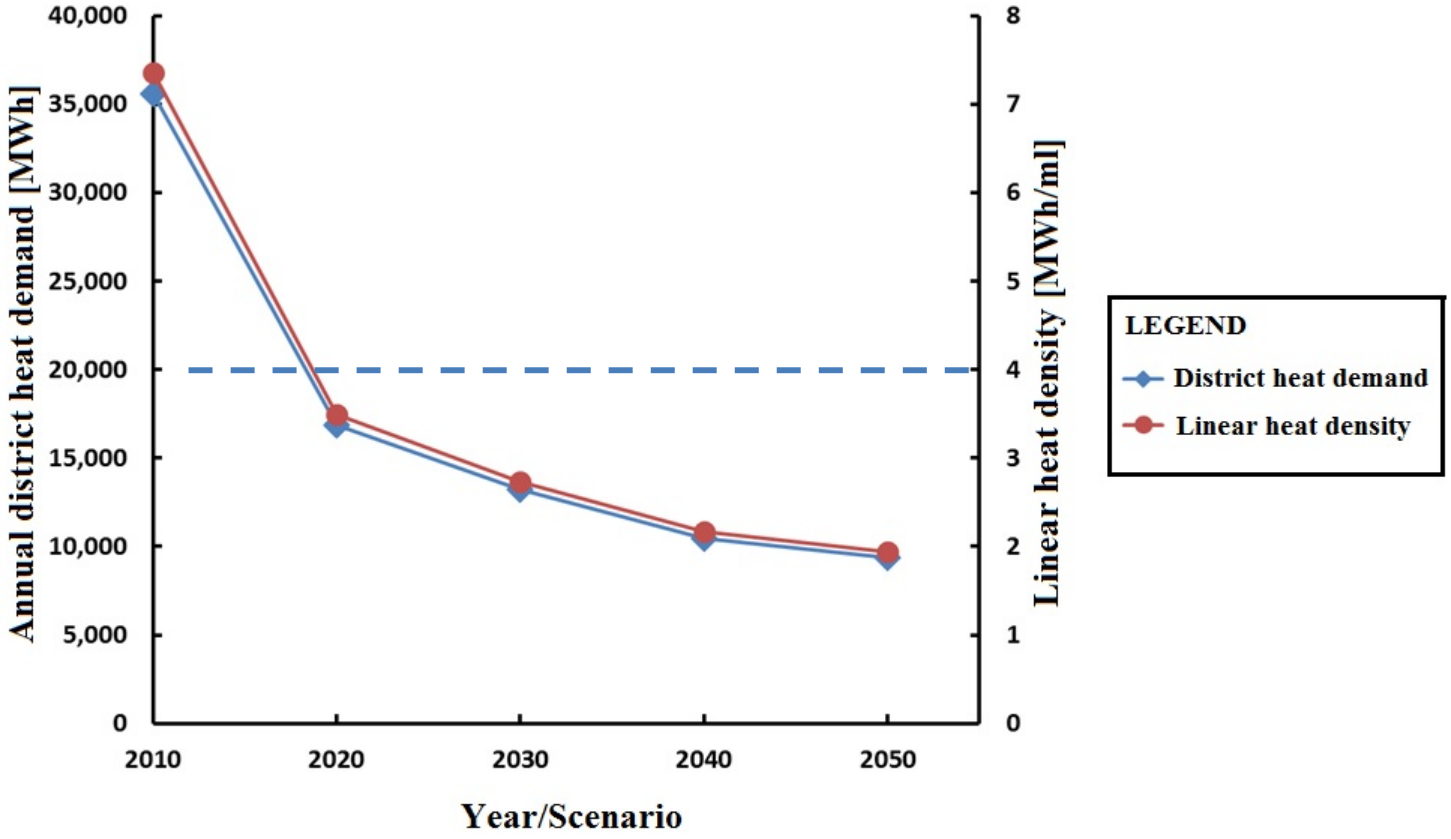
Network length:
4831m

Base load unit: 75%, biomass
Peak load unit: 25%, nat. gas

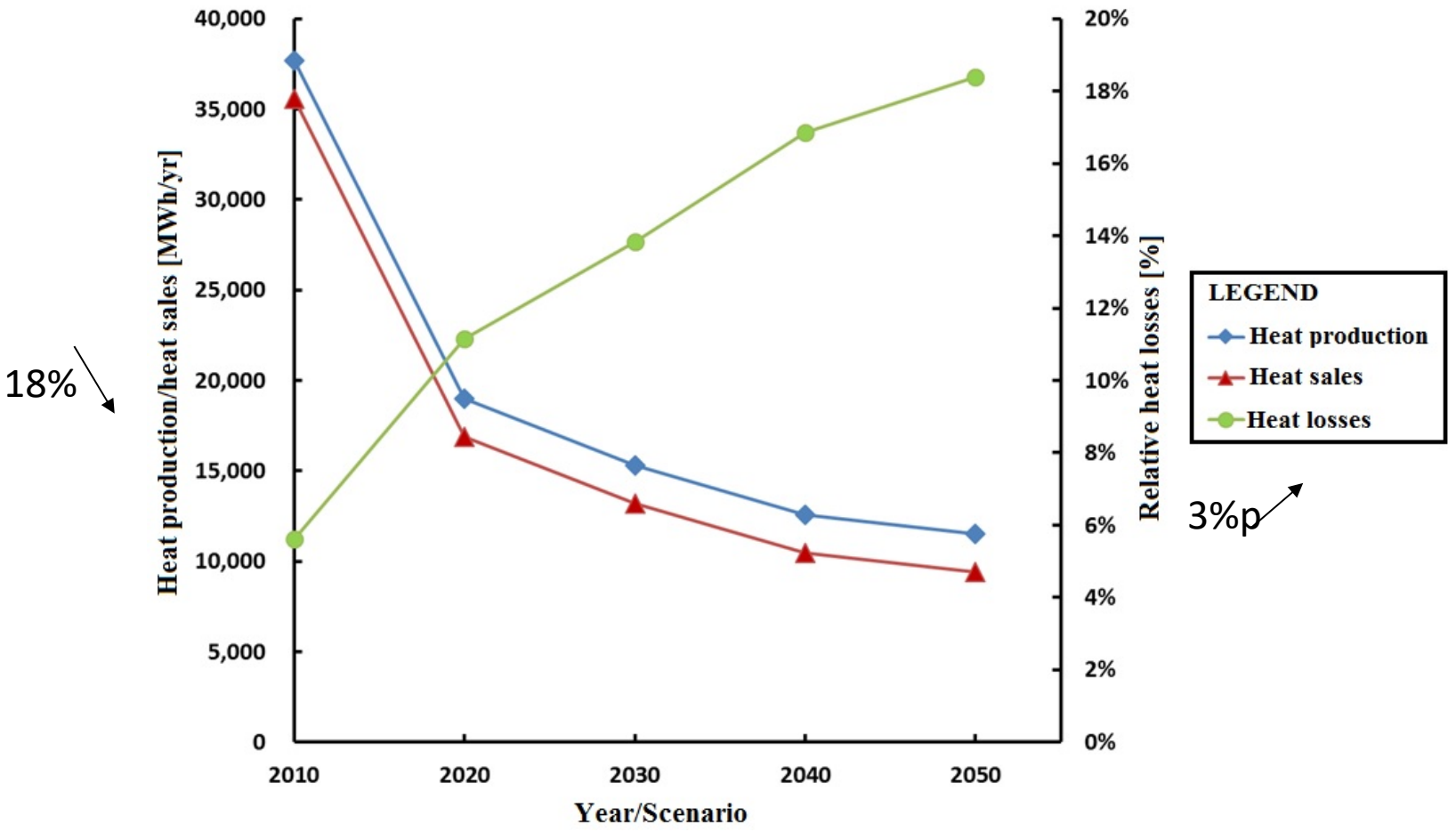
Existing network
(only OPEX)

Planned network
(CAPEX+OPEX)

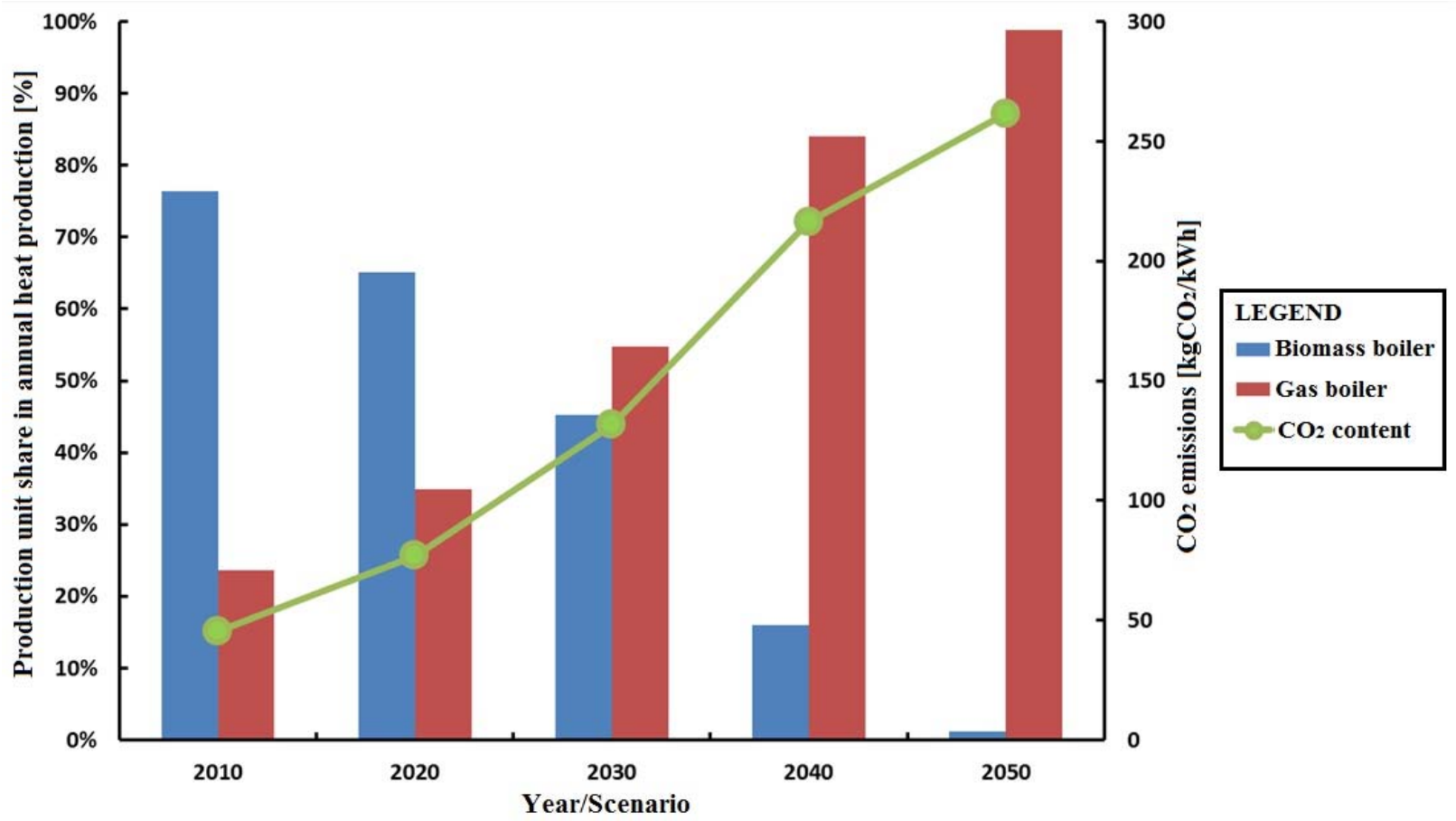
Linear heat demand and heat density



Heat production, sales and losses



Heat production mix and emissions



Heat prices & integration of solar panels

The impact on heat prices

	Heat price [€/MWh]	
Scenario/Year	2010	2010-2030
Existing DHN	47	49
New DHN	66	76

Integration of solar thermal panels

Year/Scenario	Annual district heat demand [GWh]	Annual solar thermal collectors heat production [GWh]	Number of hours with space (SH) [h]	Number of hours when solar thermal collectors do not satisfy heat demand (SH+DHW) [h]	Number of hours when solar thermal collectors exceed heat demand (SH+DHW) [h]
2010	35.56	0	5654	0	0
2020	16.88	48.85	5219	5221	3539
2030	13.21	49.21	4626	5066	3695
2040	10.45	49.56	3204	4956	3804
2050	9.40	49.91	1438	4887	3873

Conclusions

Decrease in linear heat demand density

Increase in heat losses

Impact on heat production mix

Increase in emissions

Heat price increase

Heat storage integration

Further developments

Validation of the RC model with the measured data

Integration of cooling demand calculations

Improvement of the techno-economic model

Integration with other software packages

References

Journal publications

Andric, I., Jamali-Zghal, N., Santarelli, M., Lacarrière, B., Le Corre, O., 2014."Environmental performance assessment of retrofitting existing coal fired power plants to co-firing with biomass: carbon footprint and emergy approach", *Journal of Cleaner Production,* 103, p13-27. DOI: https://doi.org/10.1016/j.jclepro.2014.08.019;

Andric, I., Gomes, N., Pina, A., Ferrão, P., Fournier, J., Lacarrière, B., Le Corre, O., 2016. "Modeling the long-term effect of climate change on building heat demand: case study on a district level. *Energy and Buildings*, 126, p77-93. DOI: https://doi.org/10.1016/j.enbuild.2016.04.082;

Andric, I., Pina, A., Ferrão, P., Lacarrière, B., Le Corre, O., 2017. "Environmental performance of district heating systems in urban environment: an emergy approach", *Journal of Cleaner Production*, 142, Part 1, p109-120. DOI: https://doi.org/10.1016/j.jclepro.2016.05.124;

Andric, I., Pina, A., Ferrão, P., Lacarrière, B., Le Corre, O., 2017. "The impact of climate change on building heat demand in different climate types", *Energy and Buildings*, 149, p225-234. DOI: https://doi.org/10.1016/j.enbuild.2017.05.047;

Andric, I., Pina, A., Ferrão, P., Lacarrière, B., Le Corre, O., 2017. "The impact of renovation measures on building lifecycle: an emergy approach", *Journal of Cleaner Production*, 162, p776-790. DOI: https://doi.org/10.1016/j.jclepro.2017.06.053;

Andric, I., Pina, A., Ferrão, P., Lacarrière, B., Le Corre, O., 2017 "Assessing the feasibility of using the heat demand-outdoor temperature function for a long-term district heat demand forecast". *Elsevier Energy Procedia*, 116c, p462-471. DOI: https://doi.org/10.1016/j.egypro.2017.05.093;

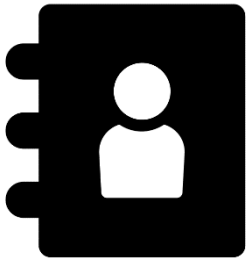
Conference publications

Andric, I., Darakdjian, Q., Ferrão, P., Fournier, J., Lacarrière, B., Le Corre, O., 2014. "The impact of global warming on district heating demand: The case of St Félix". *14th International symposium on district heating and cooling*, Stockholm, 7-10th September 2014;

Andric, I., Pina, A., Silva, C., Ferrão, P., Fournier, J., Lacarrière, B., Le Corre, O. "*The impact of climate change and building renovation on heating related CO2 emissions on a neighborhood level*". CISBAT15 international conference, Lausanne, 9th-11th September 2015;

Thank you for your attention!

Questions? **Comments?**



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