Renewable and efficient solutions for cooling in the different climatic conditions across Europe

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Cooling Down Day 2025
Tackling the Cooling Demand for Urban Heat Islands, Grids, and Data Centres

Brussels – 3 April 2025

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Potential cooling demand in future: a focus on global warming and UHI

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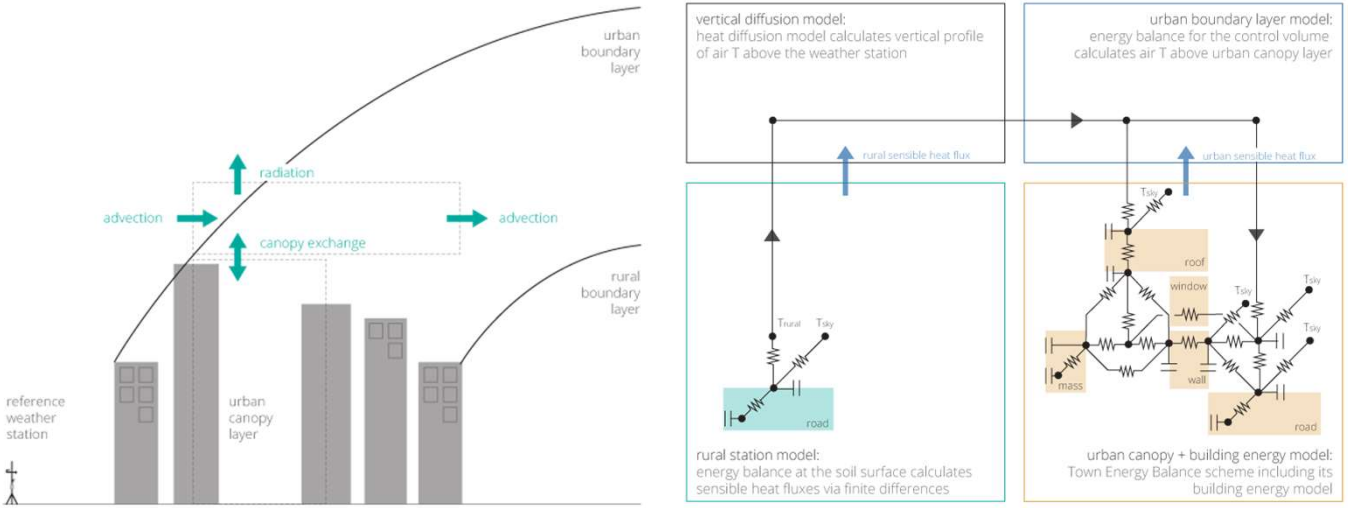

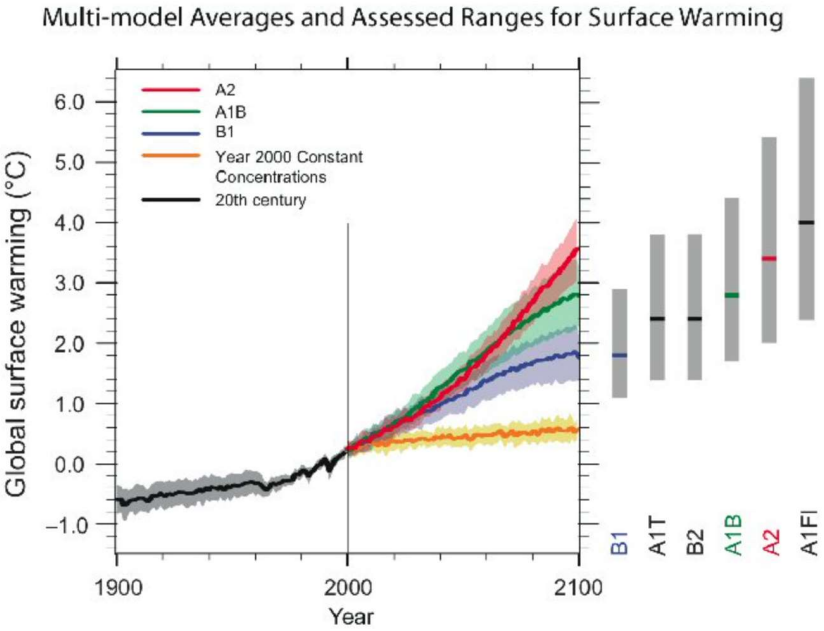

Climatic station

Pattern of temperature

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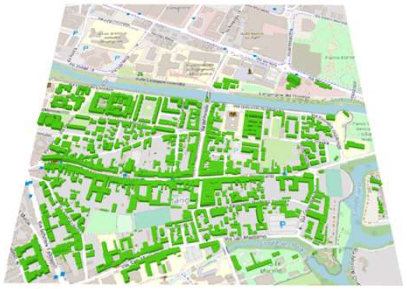
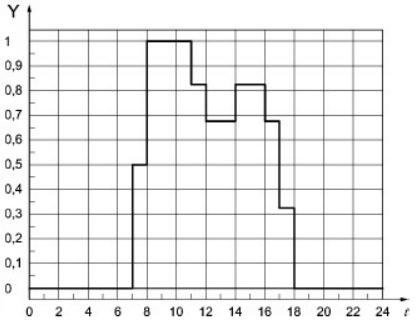
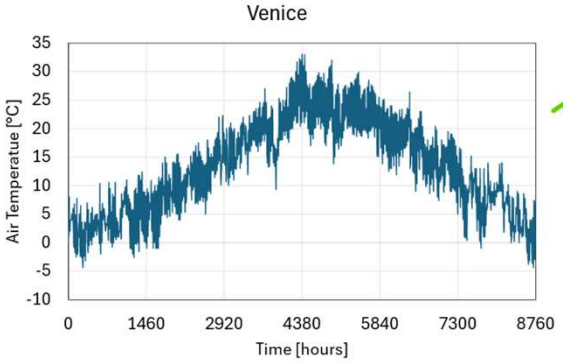
UBEM: Urban Building Energy Models





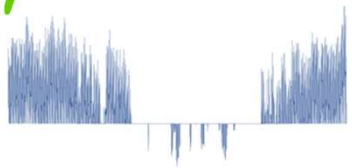
User profile for an office building according to BS EN 15232



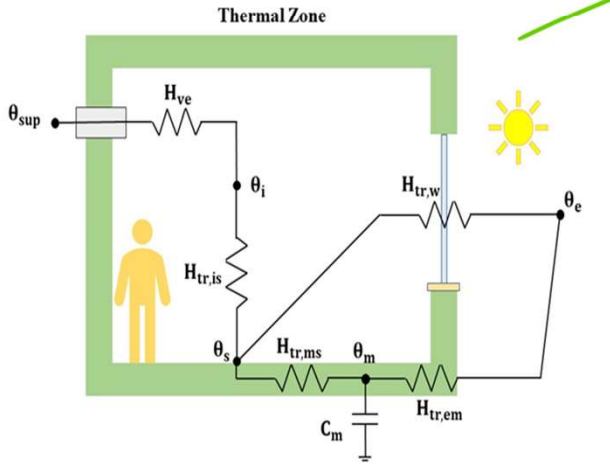
Weather data

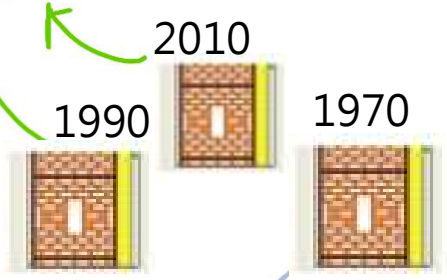
Archetypes DB

RC model



Heating and cooling demand





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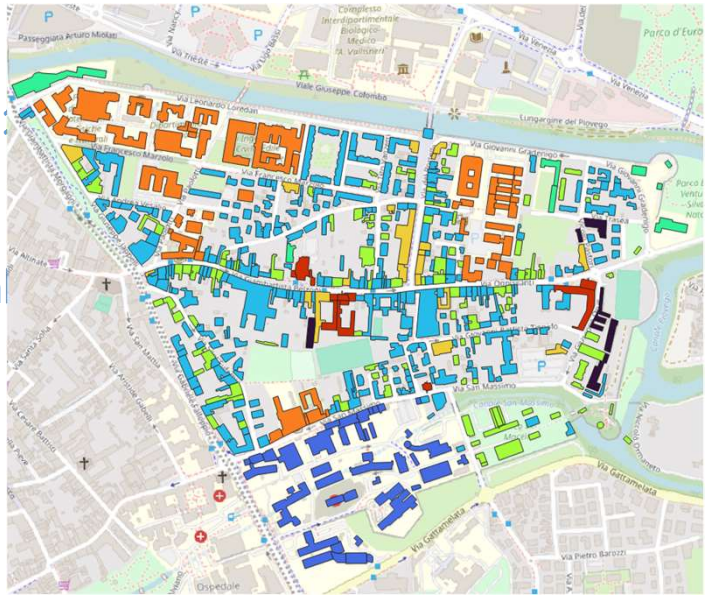
Two case studies: Italy and Germany

Italy (Padova)

540 Buildings:

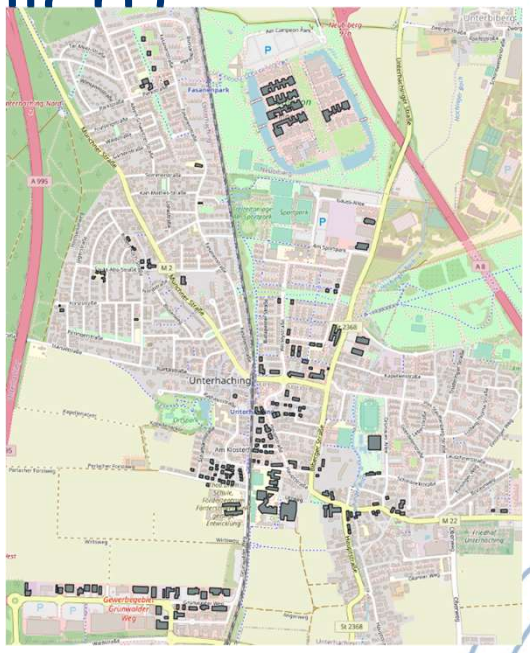
- residential
- educational
- office
- shops



Germany (Muenich)

184 Buildings:

- Residential
- Commercial
- Public
- Industrial



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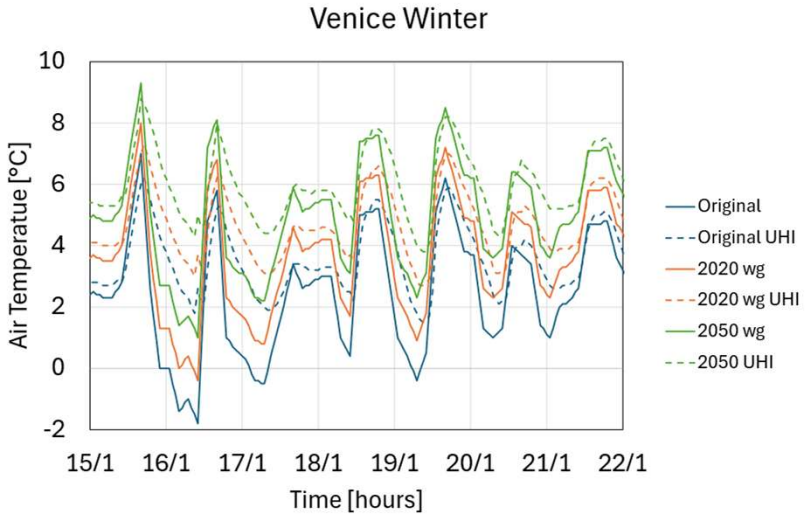
Scenarios

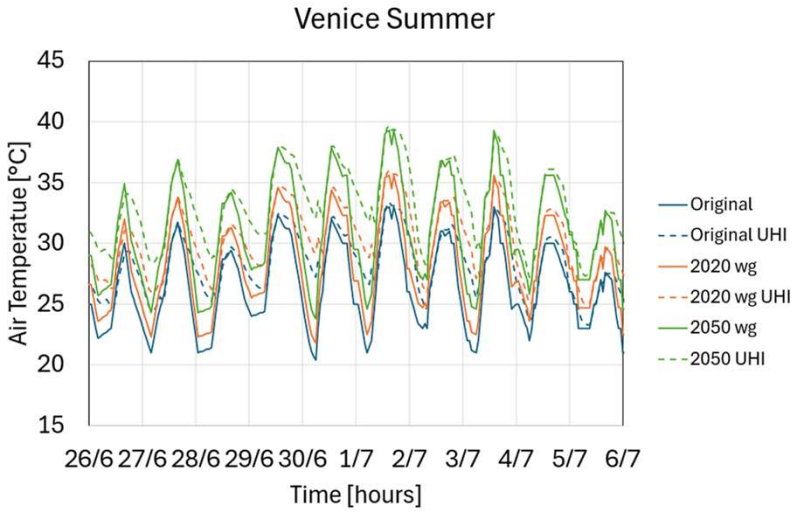
Used to verify models

1. original .epw by EnergyPlus (Venice)
2. original with UHI, urban weather generator (uwg)

3. 2020 using CCWorldWeatherGen tool
4. 2020 with UHI
5. 2050 using CCWorldWeatherGen tool
6. 2050 with UHI

Used for scenarios





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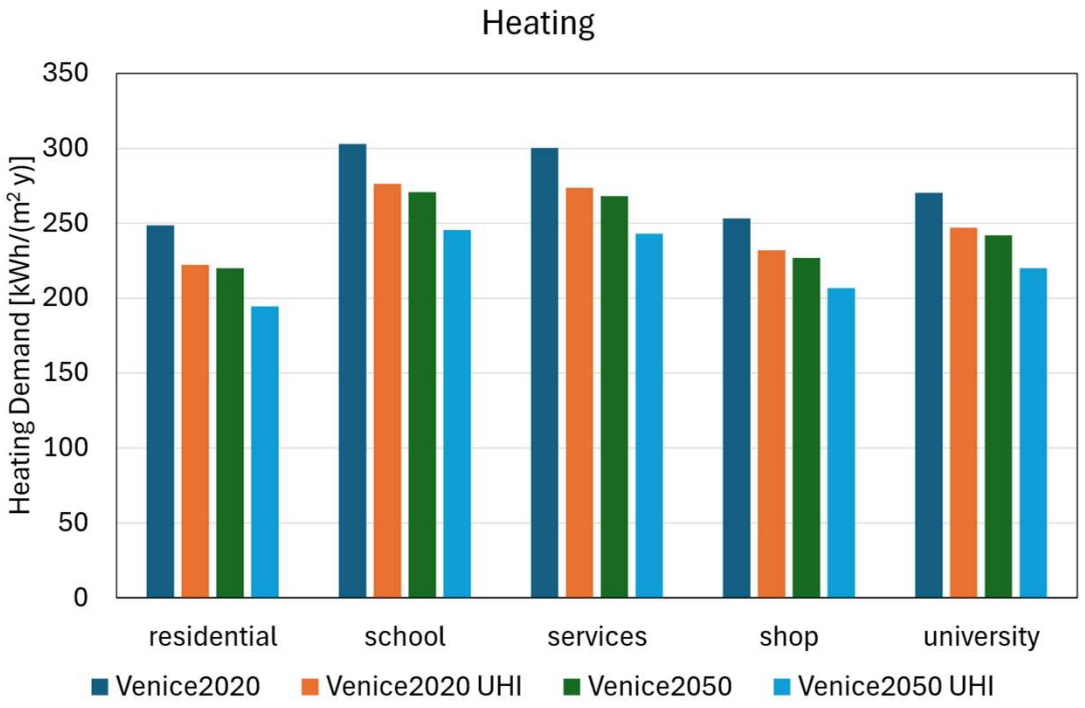
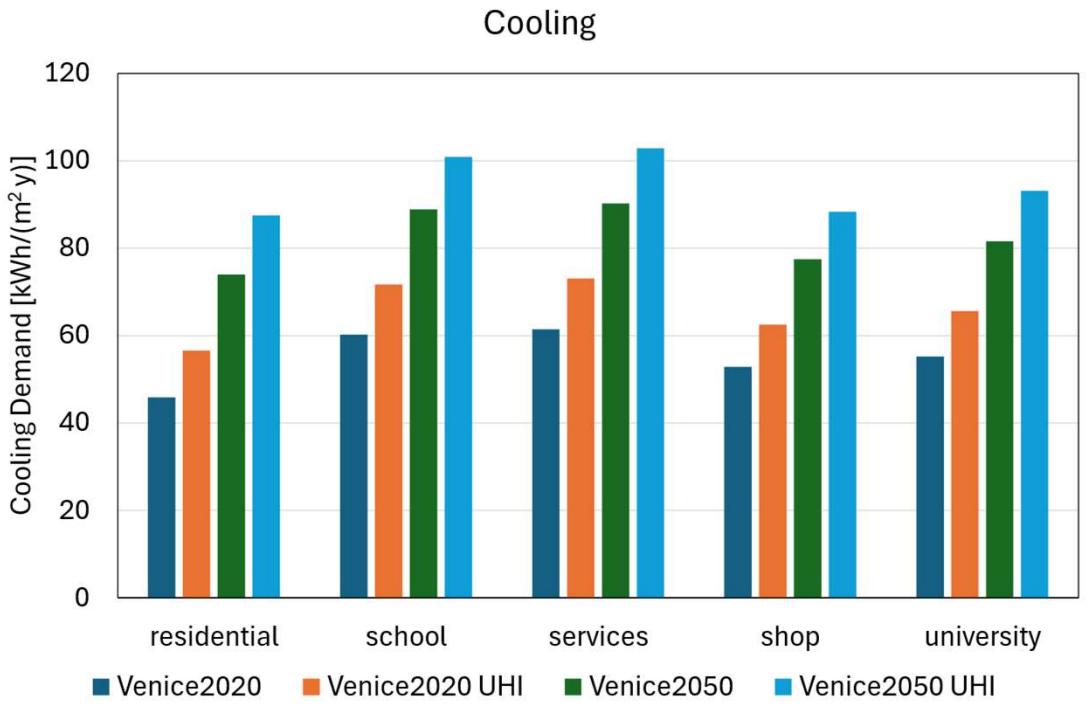
Scenarios for Italy



- 9% - 11% - 19%



+ 19% + 48% + 70%

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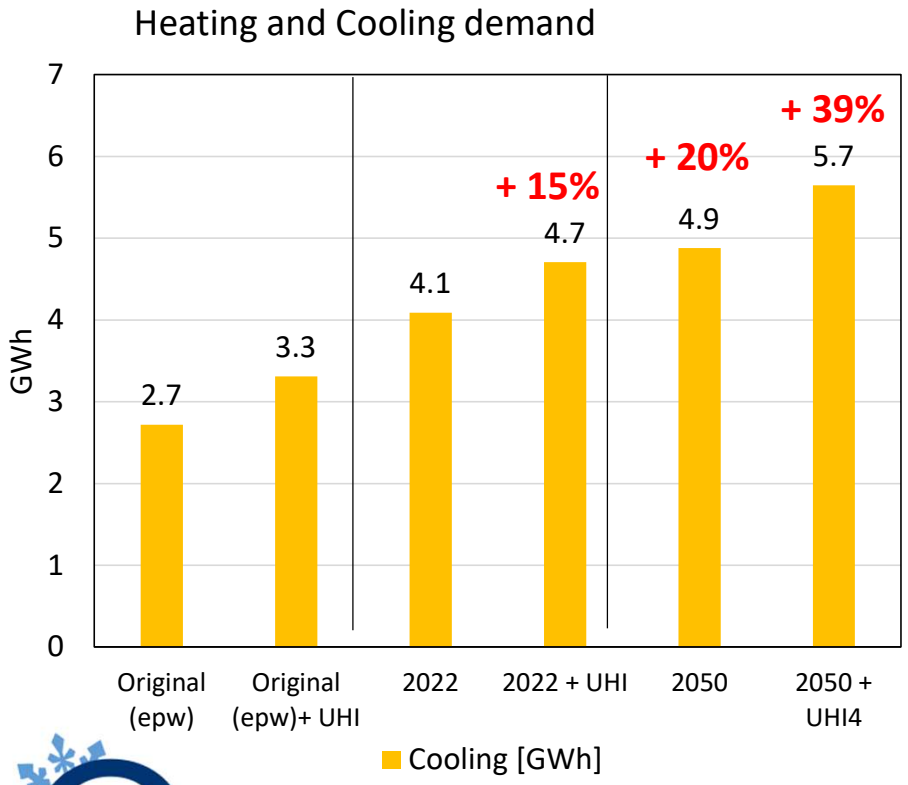
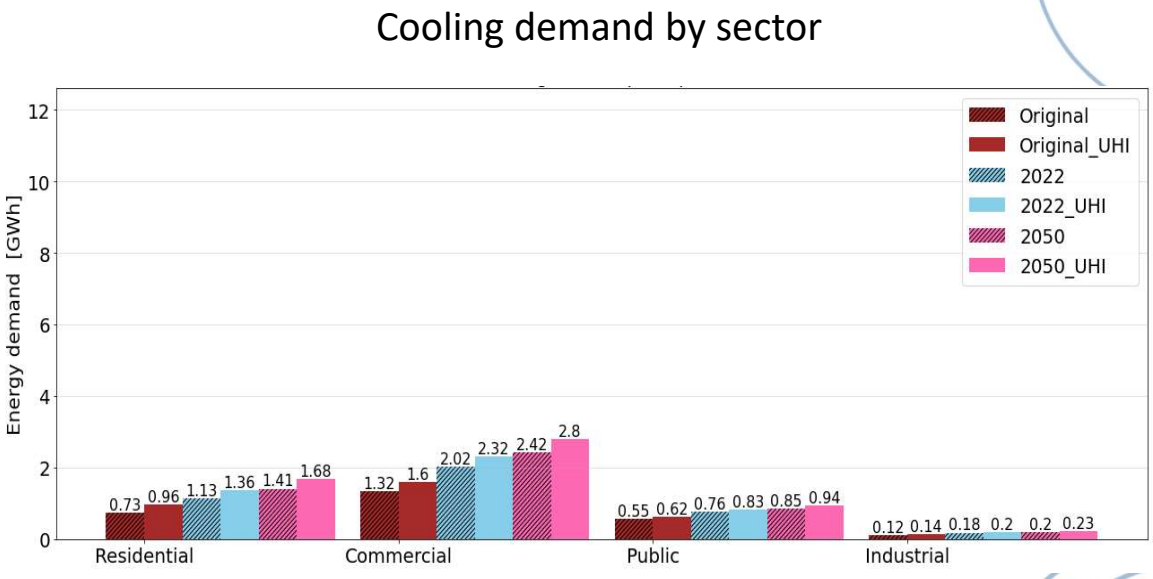
Scenarios for Germany





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Case studies for showing energy efficiency in cooling

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11 case studies of buildings

- Case 1: the project”Miss Elly” in Bochum (**Germany**) with **free cooling with the ground**
- Case 2: the project “GeoStar” in Bochum (**Germany**) with **free cooling with the ground**
- Case 3: building “SAC – UBA” in Dessau (**Germany**) with **solar cooling**
- Case 4: residential building in Putte (**Belgium**) with **GSHP**
- Case 5: residential building in Mechelen (**Belgium**) with **GSHP**
- Case 6: Judetean Hospital in Oradea (**Romania**) with **DSHP**
- Case 7: Termoline Building in Oradea (**Romania**) with **free cooling with the ground**
- Case 8: nZEB in Bucharest (**Romania**) with **free cooling with the ground**
- Case 9: Office in Padova (**Italy**) with **DSHP**
- Case 10: CNR Pilot building in Padova (**Italy**) with **GSHP**
- Case 11: Health care in Paterna (**Spain**) with **DSHP**

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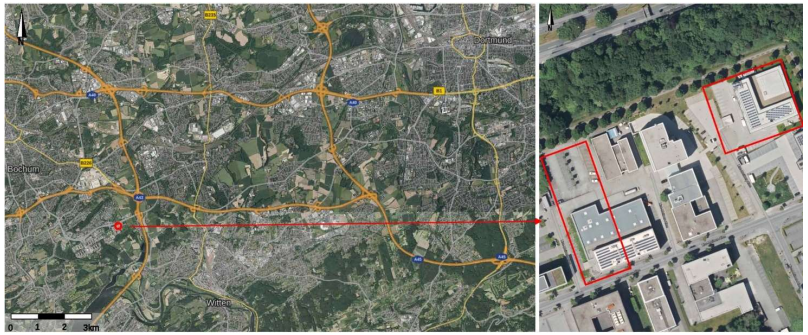
Case study 1 (DE)



Case study 4 (BE)

Case study 5 (BE)

Case study 8 (RO)

Case study 2 (DE)

Case study 3 (DE)

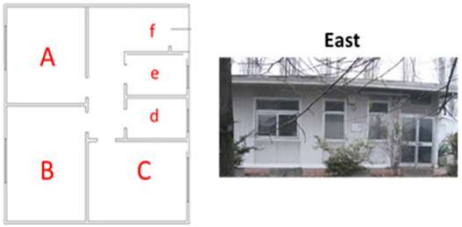
Case study 6 (RO)

Case study 7 (RO)

Case study 11 (ES)

Case study 9 (IT)

Case study 10 (IT)



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Conclusions

- **Free cooling with the ground**: very interesting. On average, **SEER ≥ 20** (just electricity spent for the pumps in the GHEs field). Solution suitable in dominant heating climates. Case studies in Germany (Case 1 and 2) and in Romania (Cases 7 and 8).
- **Solar cooling**: very interesting. Usually available when solar radiation is high (in phase with cooling demand), very well known technology for providing renewable energy in cooling. Commonly used in South of Europe (high solar radiation), but the Case 3 in Germany demonstrates that **solar cooling is feasible also in central Europe**. Usually **SEER > 10**.
- **GSHP**: three cases have been reported (Cases 4,5 and 10); the **SEER reported varies from 4.2 to 5.4** (anyhow EER far above the usual one 3.0). **The possibility to produce electricity with PV locally (as shown in case 4) allows to get renewable cooling**.
- **DSHP: in climate with balanced demand for heating and cooling or with dominant cooling energy demand** the possibility to use double source heat pump allows to balance the ground energy and hence to get high values of COP in heating and EER in cooling. Cases 6, 9 and 11 have shown that it is possible to have **SEER > 5** by means of suitable control startegies to exploit the two sources (air and ground). **Also in this case the possibility to produce electricity with PV locally allows to get renewable cooling**.

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