



ReCOVer++ project

Exploring the effect of different measures on thermal resilience:
implications for design of HVAC systems and energy use

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05 May 2025

May 05, 2025

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Question

What **cooling strategies** (*passive and active*) can enhance the **resilience performance** of the current building stock to overheating risks without compromising **energy performance**?

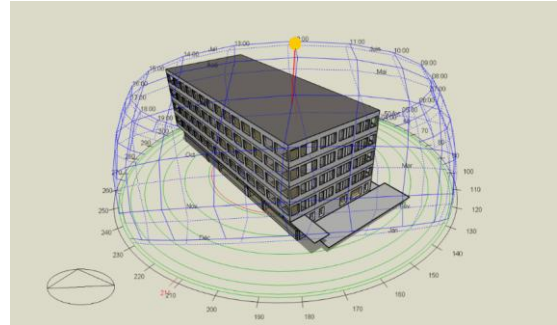
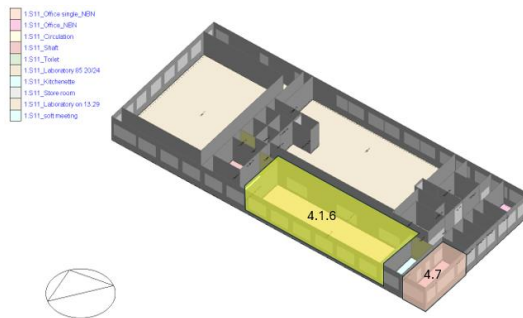
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Demonstration Case



- New projet with Passive design
- According to Belgian and european legislation
- Schedule office according to EN 16798-1 : 2019

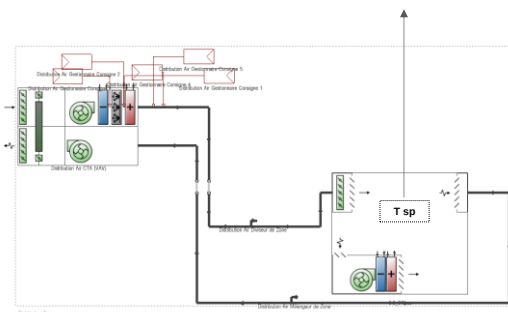


Software v7

Active cooling strategies

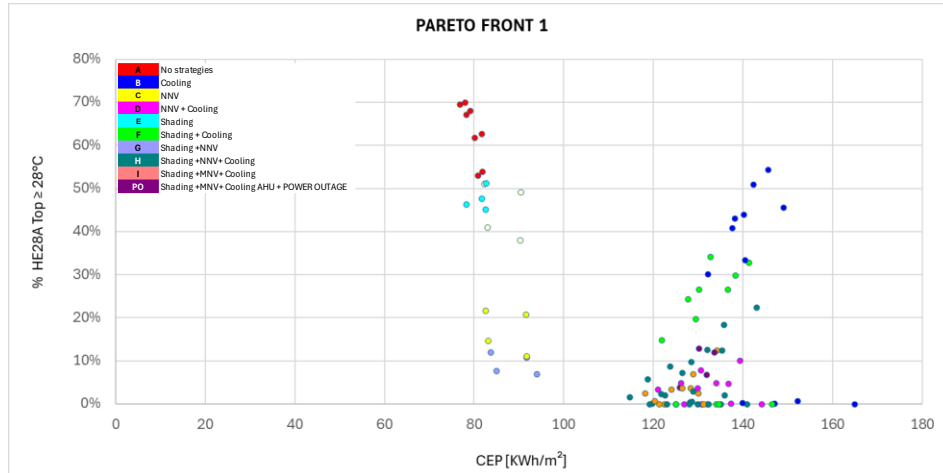
- **A/W Heat Pump**
with **3 scenarios** :
 1. Unlimited cooling power (Air Handling Unit + Fan coil)
 2. Limited cooling power
 - a) precooling AHU
 - b) precooling AHU + Local Fan coil
- **Variant** : MNC mechanical night cooling

Parameter	Value
Heating set point temperature	21°C
Heating set back temperature	16°C
Cooling set point temperature	26°C
Cooling set back temperature	32°C



Autosize scenario DB:
(Unlimited cooling power)

Result PF1 : CEP / EH 28 A



Design response to new HWs compared to normalized weather

- + 20% CEP
- +120% CD
- 20% HD

HWs : Heatwaves

CEP : primary energy consumption

CD : cooling demand

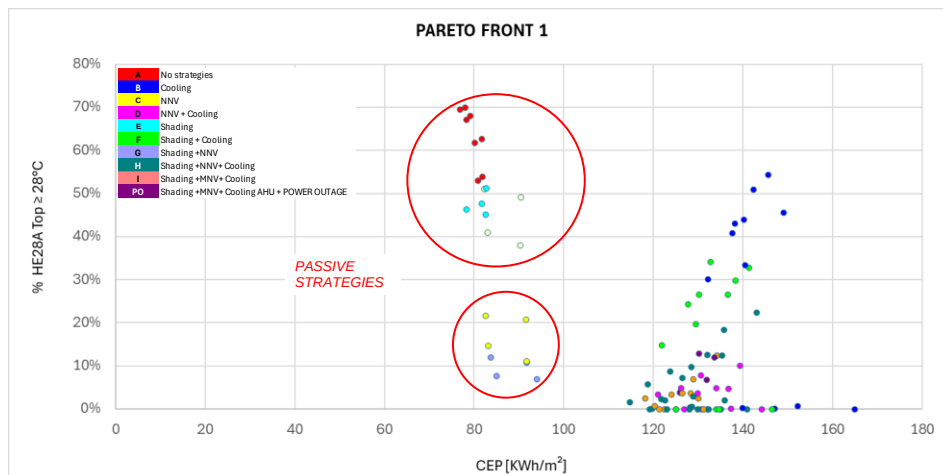
HD : heating demand

Top : indoor operative temperature

EH28A : Annual Exceedance Hours when the Top $\geq 28^{\circ}\text{C}$

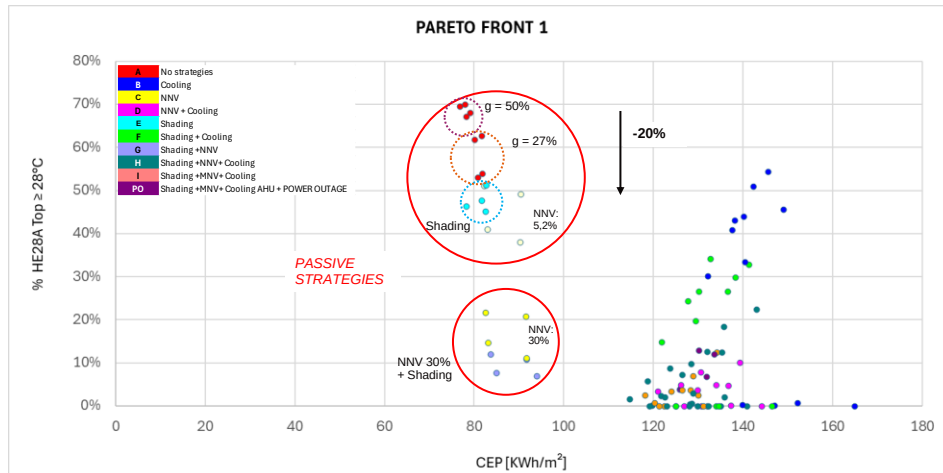
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Result PF1 : CEP / EH 28 A



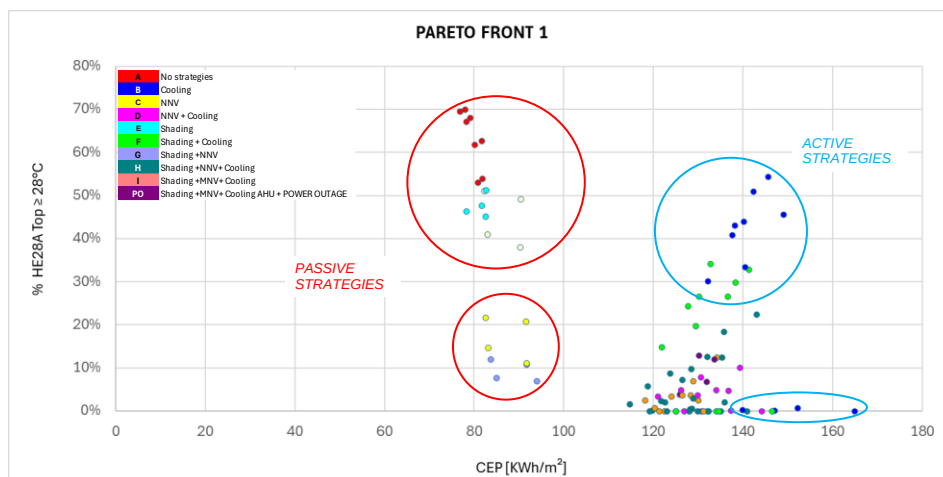
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Result PF1 : CEP / EH 28 A



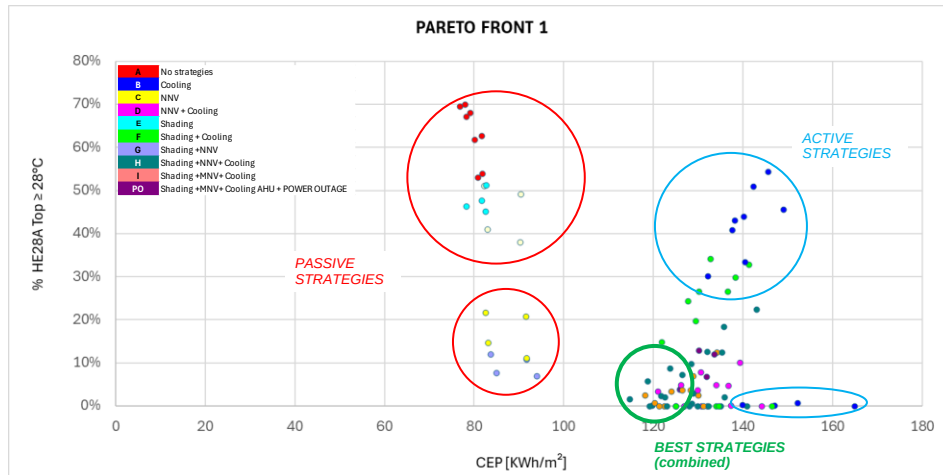
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Result PF1 : CEP / EH 28 A



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Result PF1 : CEP / EH 28 A



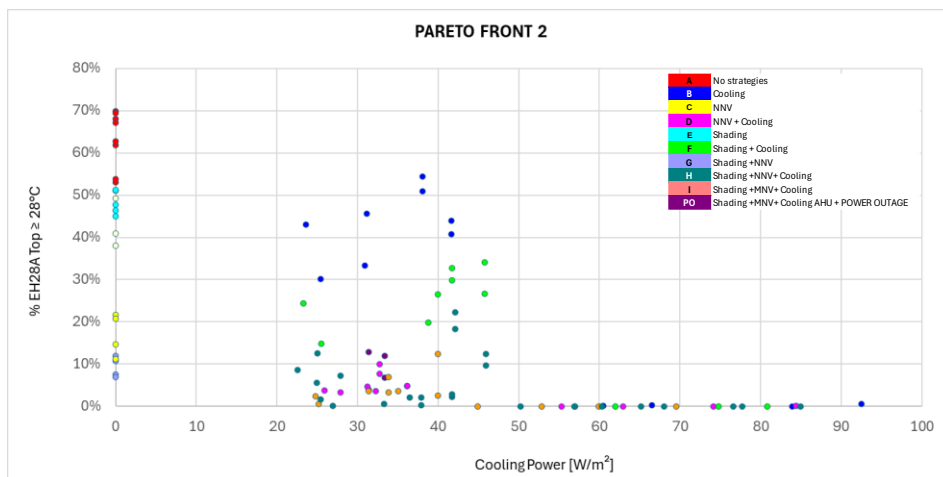
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Result PF2 : CP / EH 28 A



Design response to new HWS* compared to normalized weather

- + 35% CP
- - 18% HP

HWS : Heatwaves

CP : cooling power

HP : heating power

Top : Indoor operative temperature

EH28A : Annual Exceedance Hours when the Top $\geq 28^{\circ}\text{C}$

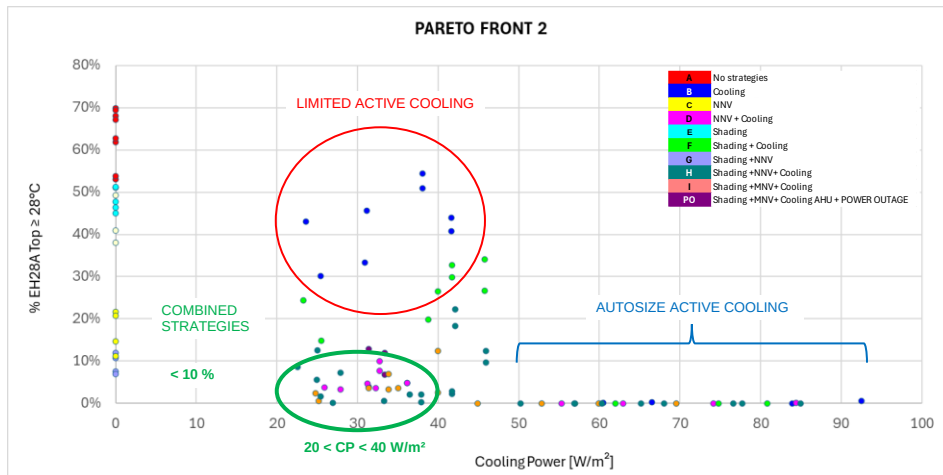
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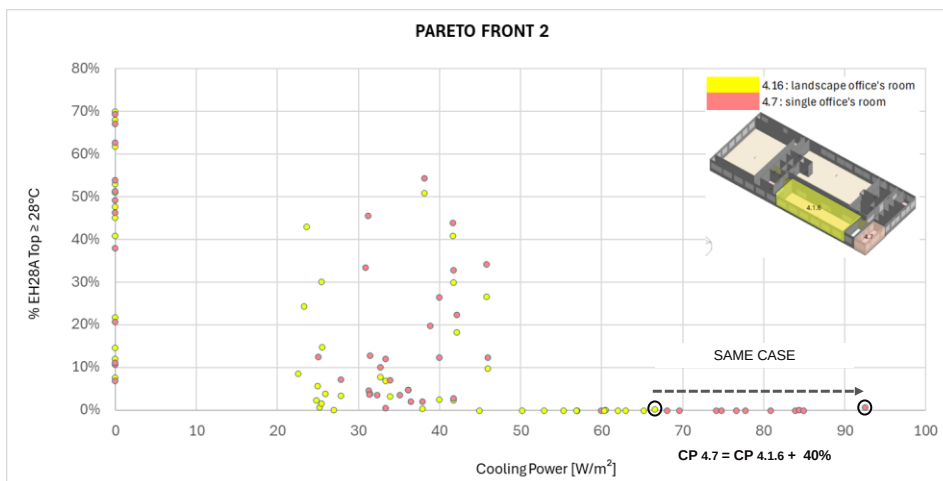
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Result PF2 : CP / EH 28 A



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Result PF2 : CP / EH 28 A



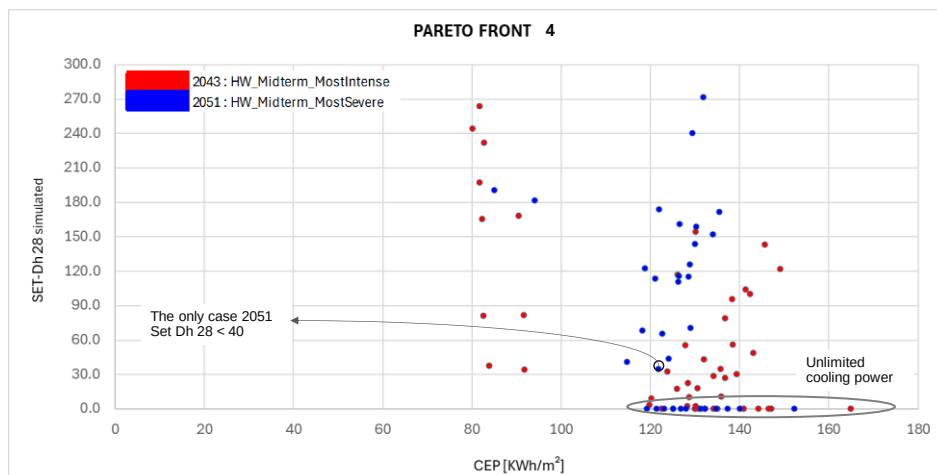
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Question

What effects do different strategies have on the **thermal resilience index**?

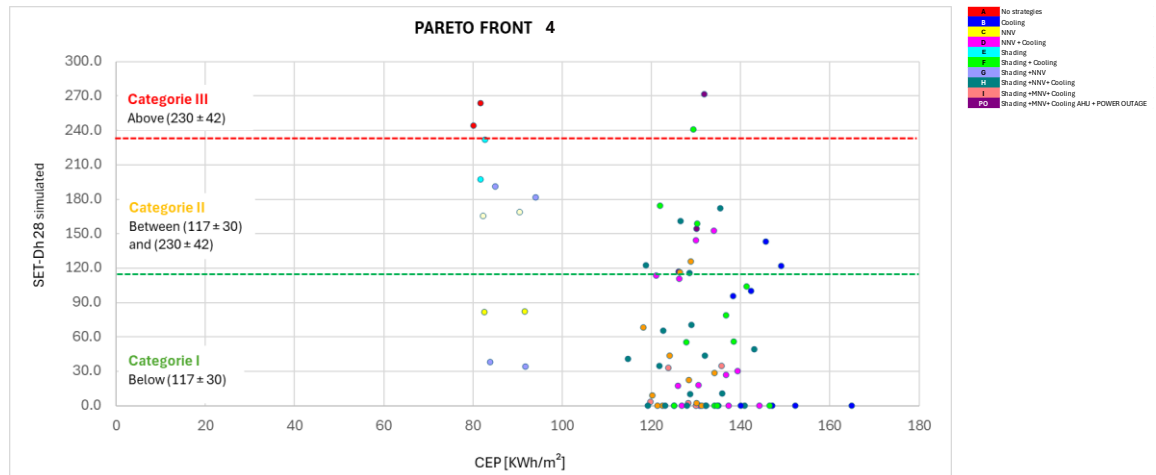
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Thermal resilience index : SET-Dh 28



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Thermal resilience index : SET-Dh 28



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Appendix - Question

What is the **right price to pay today** to ensure comfort and resilience tomorrow?

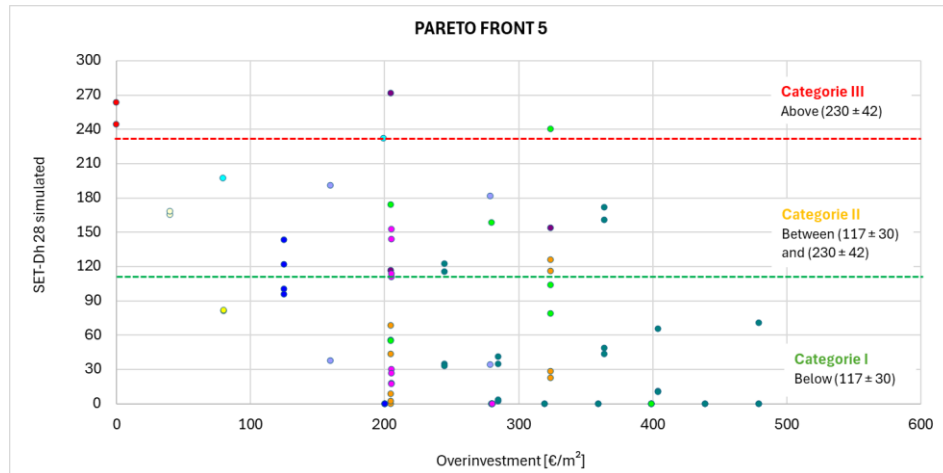
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Overinvestment



Important Notes:

- The **additional costs** for passive and active measures are **based on current conditions** but reflect future climate scenarios.
- Exclusions:** These estimates do not account for inflation or Life Cycle Costs (LCC).
- Preliminary forecast:** Figures are indicative and require further refinement

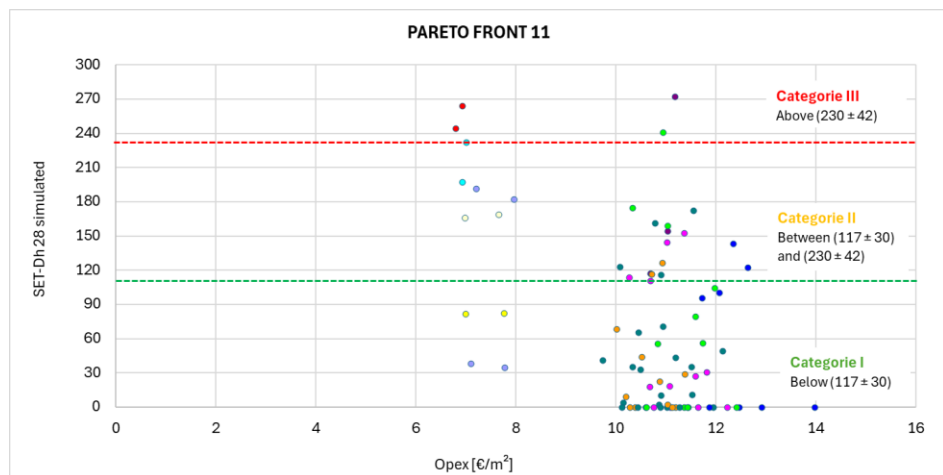
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Opex



Important Notes:

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Conclusion

According to the analysis:

- Ensuring comfort with HWs requires doubling the installed cooling capacity
- Implementing exterior solar shading is relevant for enhancing resilience
- Passive strategies alone are not sufficient to achieve good thermal comfort. **Combining passive strategies with active systems is essential**
- Cross natural ventilation allows to have the best comfort at lowest CEP but is not applicable everywhere
- Room and window sizes significantly influence heating and cooling demands
- A minimum additional investment of 200 €/m² is required to effectively mitigate overheating risks.

Notes:

- **Worst-case scenario** of offices facing south and southwest on the top floor
- 25 combinations x 2 HW weather data x 2 offices = **only 100 cases**
- The data set is limited and needs to be extended to other types
- **Preliminary Forecast**



THANK YOU FOR YOUR
ATTENTION

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