D2EPC

Building performance assessment towards Next generation EPCs

Supporting automatic dynamic energy simulations under different usage scenarios

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Session 1: Smart buildings and energy efficiency

E-DYCE project context

(Energy flexible DYnamic building CErtification)

Current labelling systems are not able to accurately reflect the dynamic behaviour of buildings, increasing performance gap phenomenon.

Steady-state approach is restricting the potential of several climate and FR technologies – especially in the cooling seasons – not allowing for a correct analysis of their potential and not reflecting building dynamics.

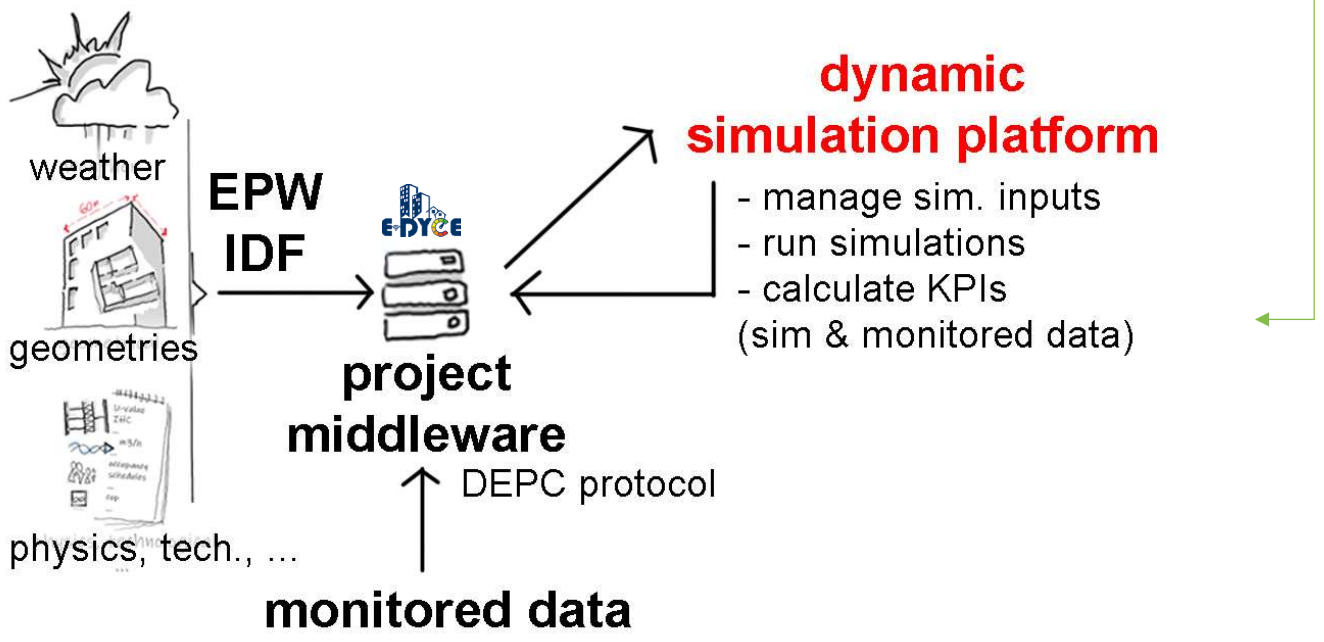
SO1. To deliver a methodology for dynamic certification of buildings based on openly available resources and tools for technology and service providers, effectively creating an evolving, technology neutral ecosystem.

SO2. To generate substantial savings of 30kWh/m^2 (+1 energy class) in buildings certified through a dynamic scheme, benefiting owner, tenant and the service provider and thus incentivizing all three.

SO3. To leverage the savings generated and reinvest into energy efficient refurbishments and optimization, scaling up the number of buildings certified to the level that can provide policy makers with meaningful data.

Presentation topic

- Introducing a dynamic simulation platform based on EnergyPlus that is underdeveloped to support extra-functionalities and usage scenarios to manage massive simulations automatically.



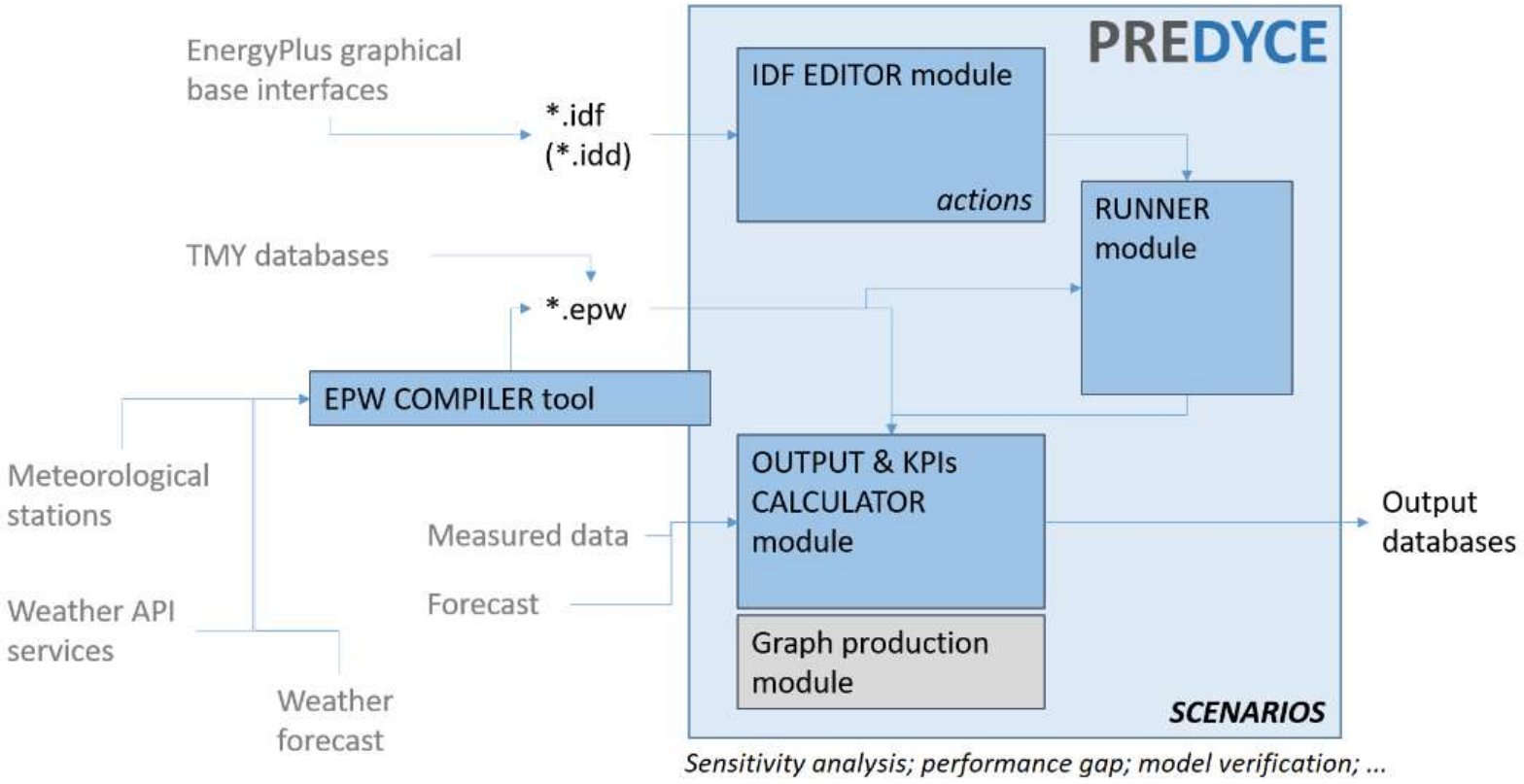
PREDYCE a new tool

Python Realtime Energy DYnamics and Climate Evaluation

- Python library
- Developed under two actions: "**DYCE**" and "PRE"
  - Automatic simulations and simulation usage scenarios, including changes in simulation input/output data
  - Parametric/sensitivity analyses
  - Comparison between monitored and simulated data (Performance Gap)
  - Free-Running KPIs and simulations
  - Server-to-server and REST communications and runs

Chiesa G, Fasano F, Grasso P (2021) https://doi.org/10.3390/en14196429 **Energies 14(19), 6429**

PREDYCE tool's architecture



Sample KPIs:
- Qc, Qh, Qlight
- PMV/PPD
- IAQ classification

- Fictitious cooling
- Adaptive thermal comfort

Sample IDF actions:
- add insulation
- Change window
- Add shading
- Add scheduled ventilation
- Activate or deactivate systems
- Change occupancy

PREDYCE tool's I/O

building model

IDF

PREDYCE input file

JSON

weather file

EPW

PREDYCE SCRIPT

Multiple parallel runs of e+ with automatic and parametric model editing

dataframe of results (each row is a simulation)

CSV

Base output, referring to all simulations perfomed.

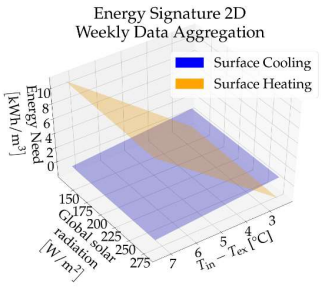
KPIs plots

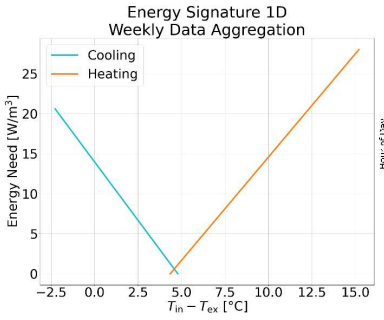
PNG

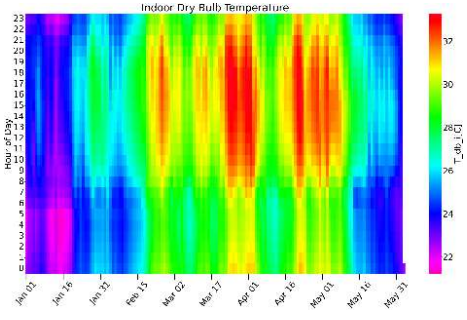
dataframe of timeseries results (each row is a timestep)

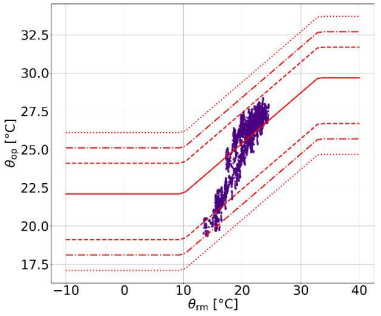
CSV

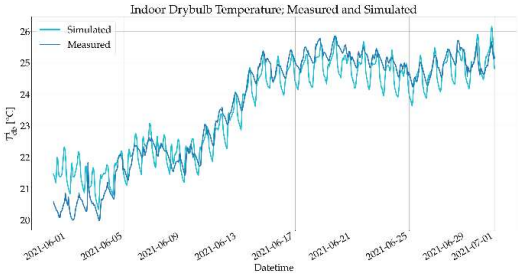
Generated in subfolders referred to specific simulations.









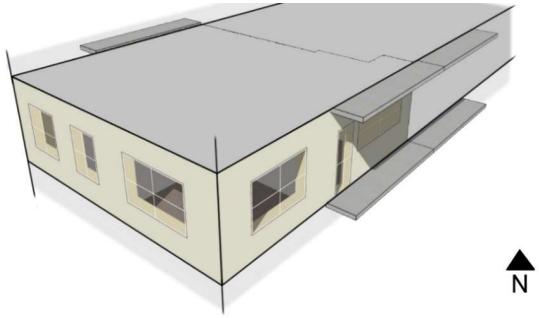


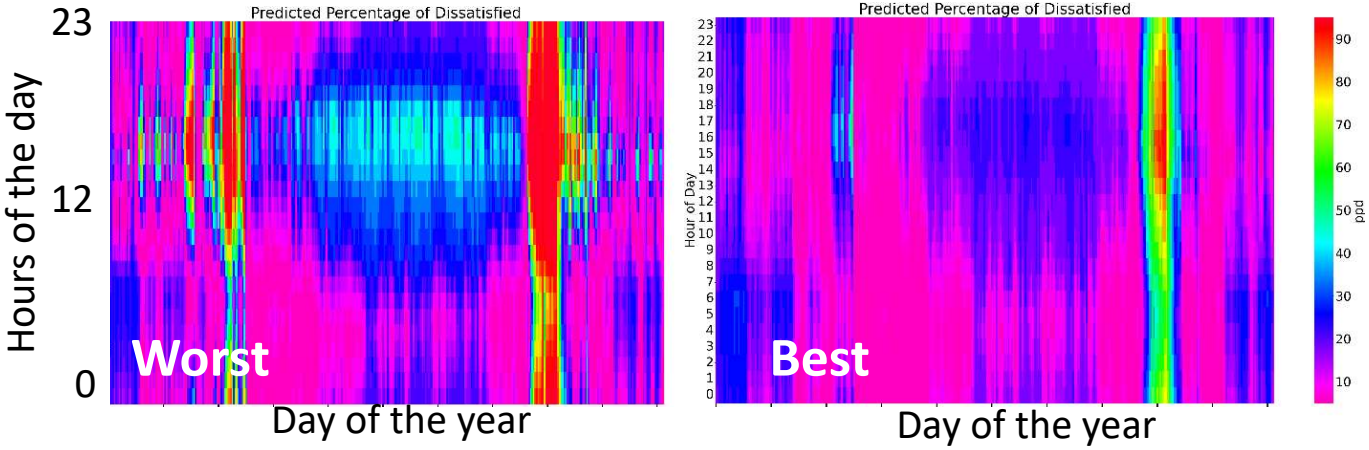
PREDYCE scenarios of use

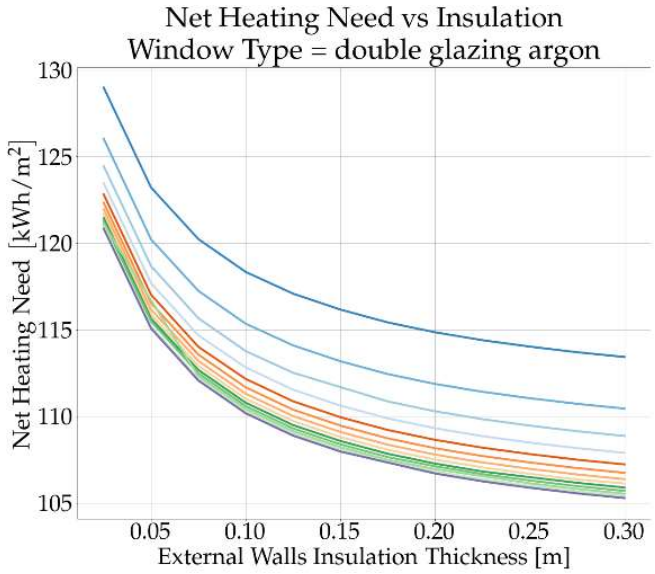
- **Sensitivity analysis**: performs parametric analysis by automatically modifying the base building model and computing requested KPIs.
- **Performance gap**: returning the gap between verified simulation performed under standard & standard-modified schedules vs monitored data (AMY).
- **Model Verification**: semi-automatic scenario. Support changes in building parameters to minimise RMSE and MBE on defined variables (e.g. consumption or internal temperatures), comparing simulation and monitored data.

PREDYCE samples – sensitivity analysis

- Insulation wall & roof, change window types, WWR

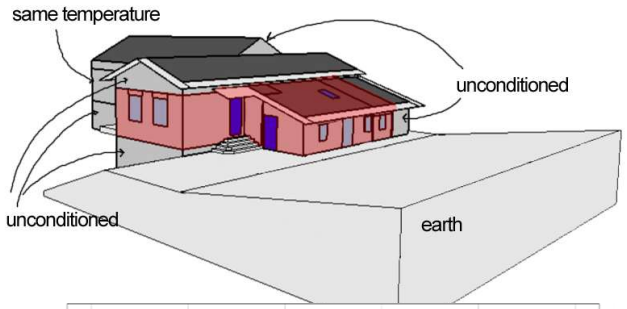


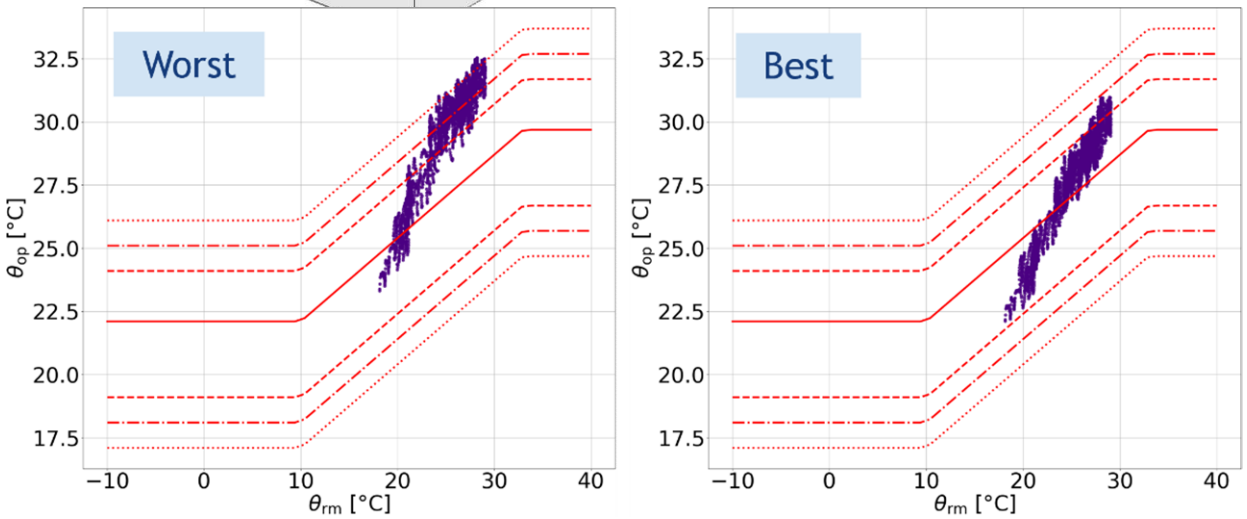


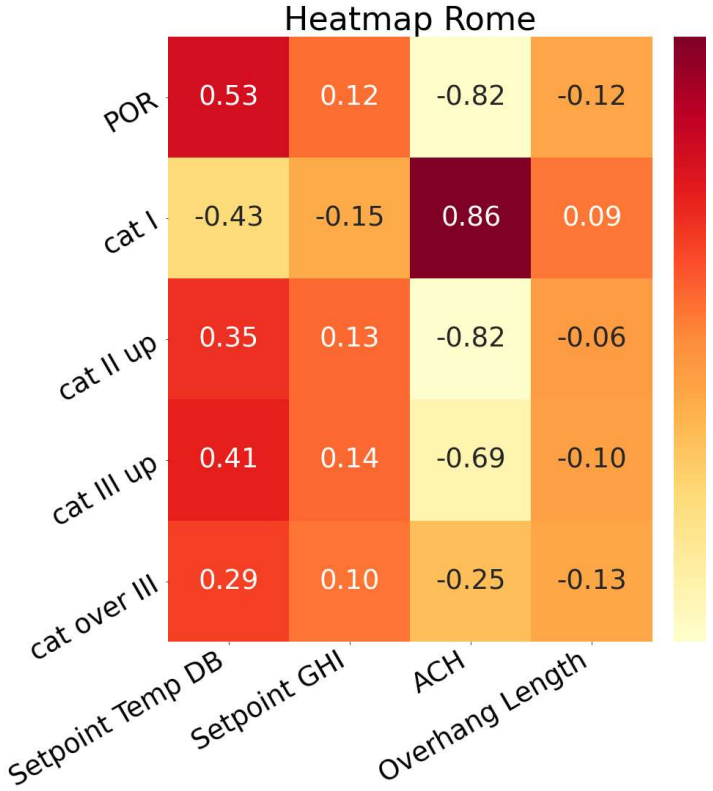


PREDYCE samples – sensitivity analysis

- ACH + shading control tresholds + overhang



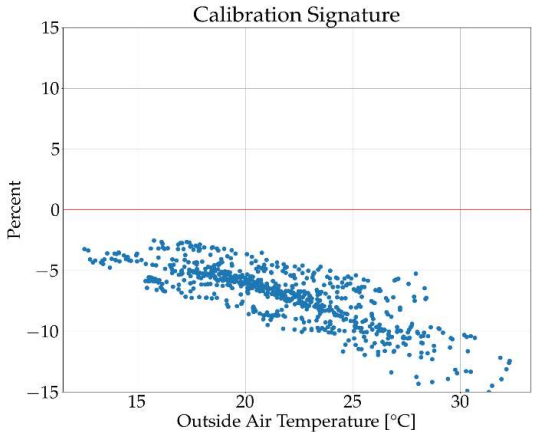


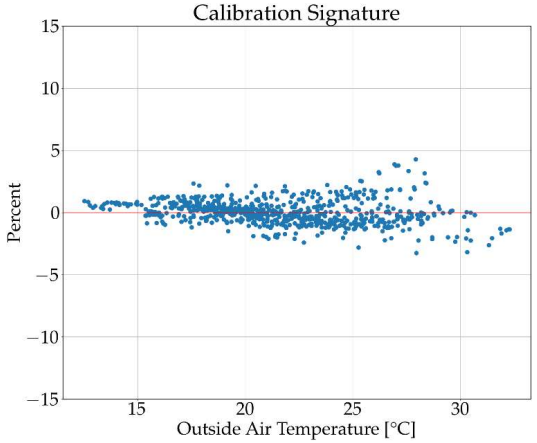


PREDYCE samples – verification

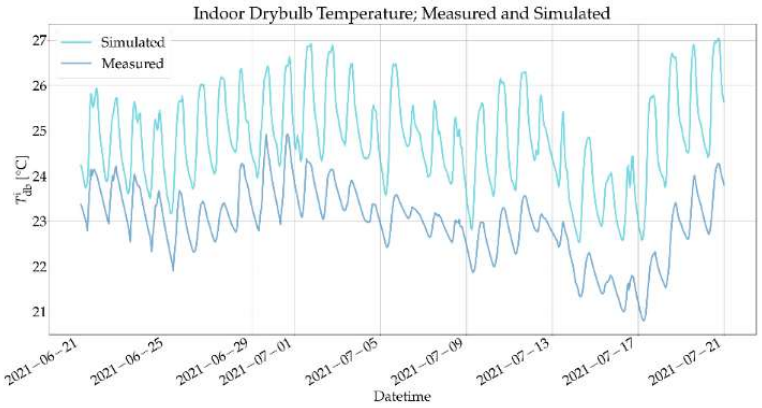
- E-DYCE Demo school building (post-coving conditions)

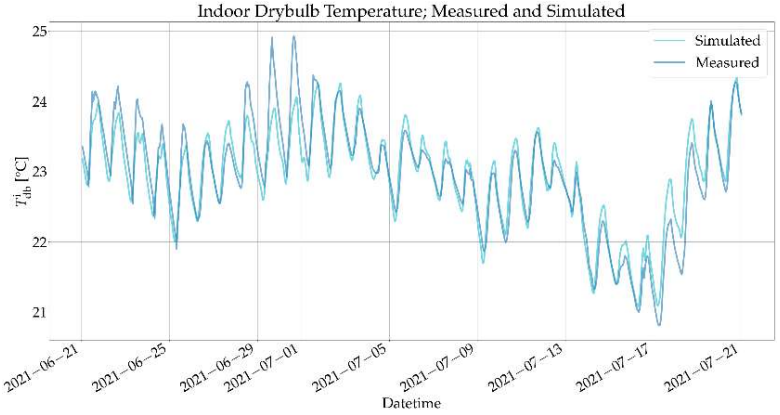
Starting point





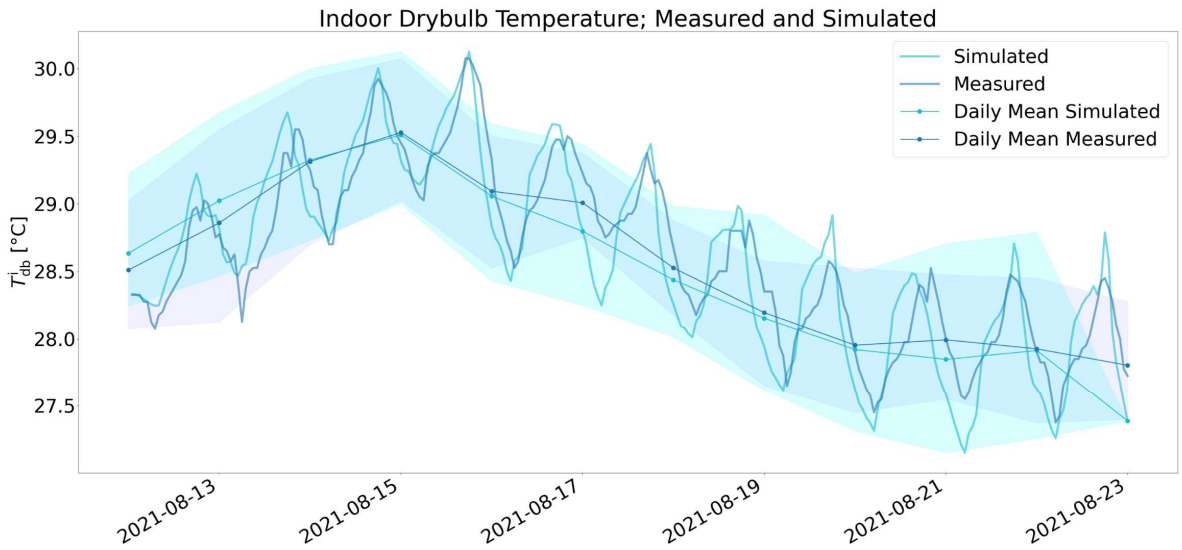
Verified point





Next steps & limitations

- Tests on ENEA living labs
- Long-run tests on E-DYCE demo cases
- Integration in project middleware
- Support DEPC tests



- EnergyPlus 8.x (8.9)
- GUI for JSON managing file

- Lack adv. optimization algorithms
- White-box modelling

Thank you for your attention

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Extra information

- Chiesa G, Fasano F, Grasso P (2021) A New Tool for Building Energy Optimization: First Round of Successful Dynamic Model Simulations, *Energies* 14(19), 6429
  https://doi.org/10.3390/en14196429

- Chiesa G, Fasano F, Grasso P (2022) D3.1 Dynamic simulation platform. E-DYCE report
- Chiesa G, Fasano F, Grasso P (2022) D3.2 Free running module. E-DYCE report
  Reports and Results - E-DYCE (edyce.eu)