



# TerraDT project overview and urban impact model

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## Context – why is TerraDT needed?

- Destination Earth initiative develops **Digital Twins of Earth** to support decision-making on climate change.
- However, there are some limitations:
  - km-scale coupled climate models of DestinE have shortcomings for some key components of Earth system
  - information relevant for some key impact sectors limited
  - adding new components and AI/ML emulators is challenging as the models are not build in modular manner

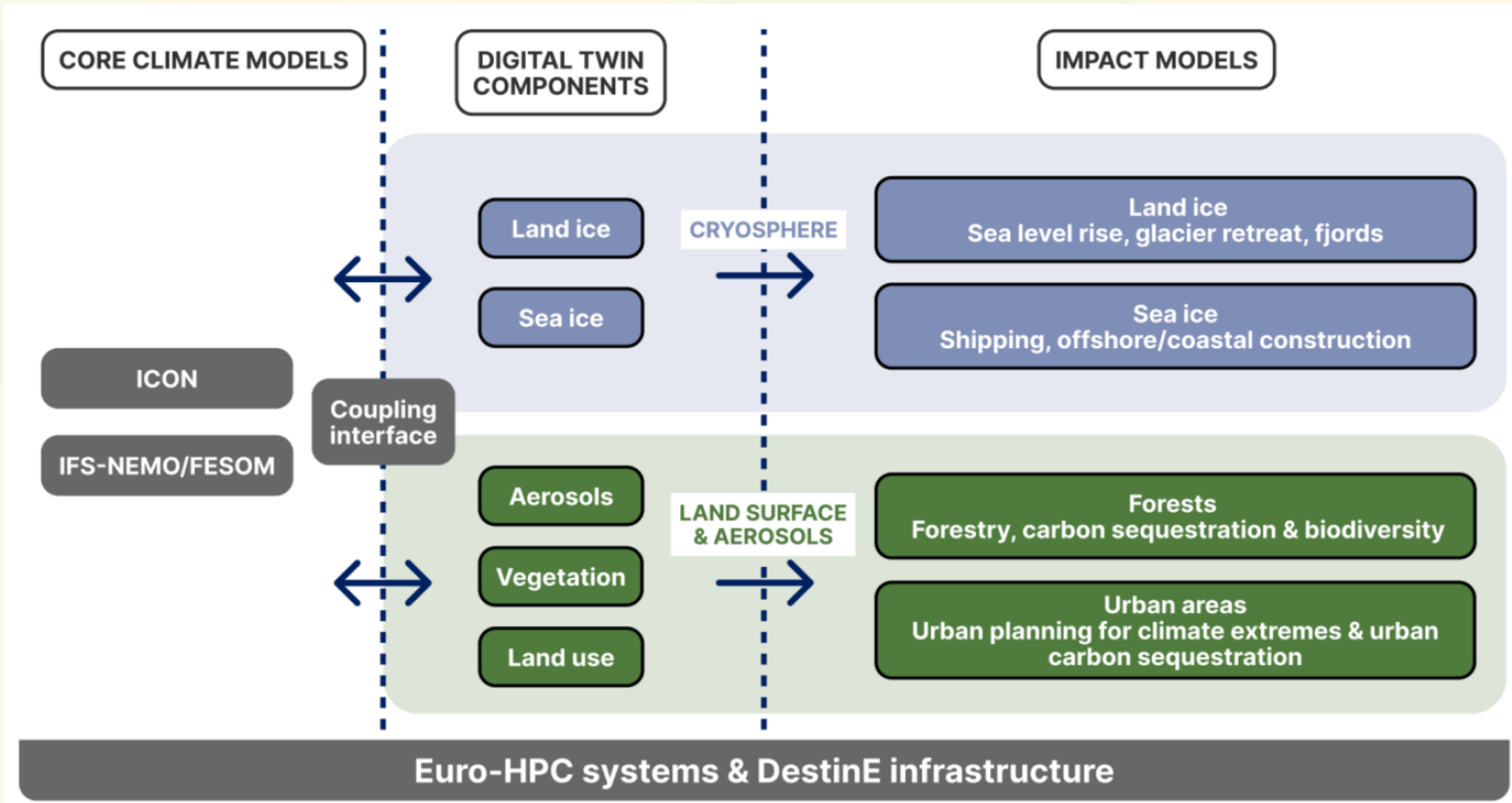
TerraDT develops **new Digital Twin components, impact models and a modular software infrastructure** → **Enhanced DestinE infrastructure** providing more reliable and relevant information for climate adaptation and mitigation!



# TerraDT consortium

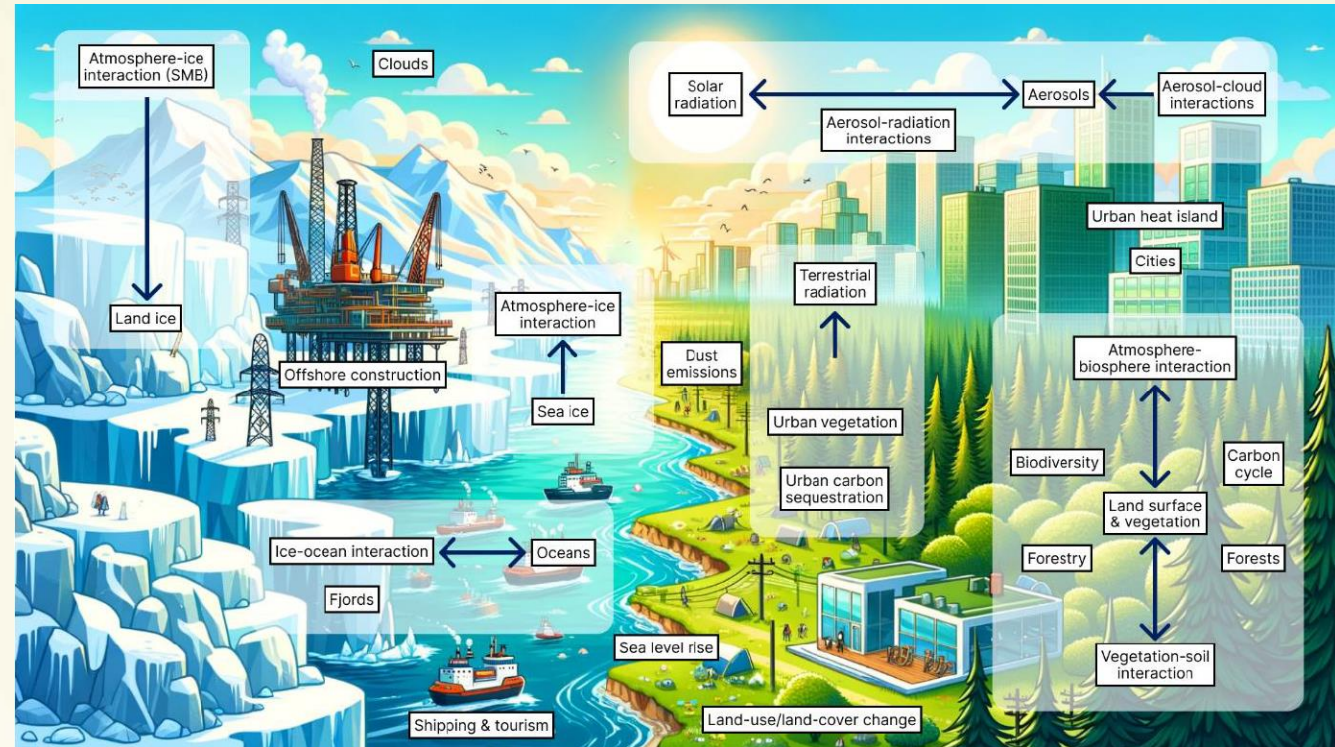


# TerraDT components



# TerraDT achievements so far

- **Initial versions of different components developed:**
  - digital twin components and impact models
  - general coupling interface
  - interactive user interface for impact models
- **Engagement activities launched:**
  - impact workshops, webinars & user story collection





# TerraDT

Digital Twin of Earth system for Cryosphere,  
Land surface and related interactions



## MAPPING OF HEAT- EXTREME EXPOSURE IN CITIES



Funded by  
the European Union

# THE PROBLEM

Climate and Environmental Hazards are LOCAL  
Their monitoring and forecast IS NOT

Currently, weather, climate and environmental monitoring lacks spatial detail

- ✓ **OK** regarding **WHEN**
- ! **NOK** regarding **DETAIL**



# THE SOLUTION

## Observations

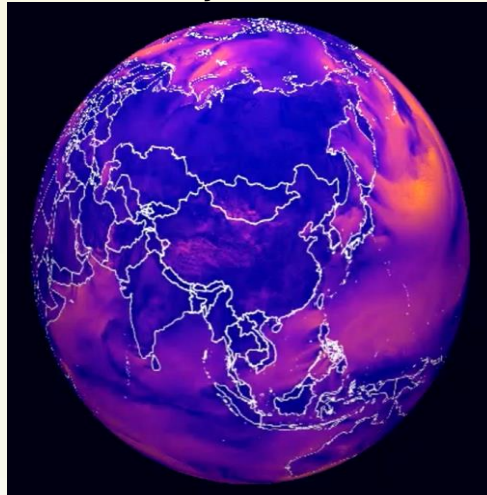
Sensors, IoT,  
Crowdsourcing



=

## Synoptic (Background) Weather

Reanalysis, Forecast  
and Climate  
Projections



+

## Local (Time-Fixed) Predictors

Landscape and  
Urban Features

### Topography

Terrain,  
Topographic  
Wind Exposure

### Green Features

Vegetation  
Density and  
Type, Phenology

+

### Urban Features

Urban Density,  
Imperviousness,  
Sky View Factor

### Blue Features

Proximity to the  
Coast or Large  
Water Bodies

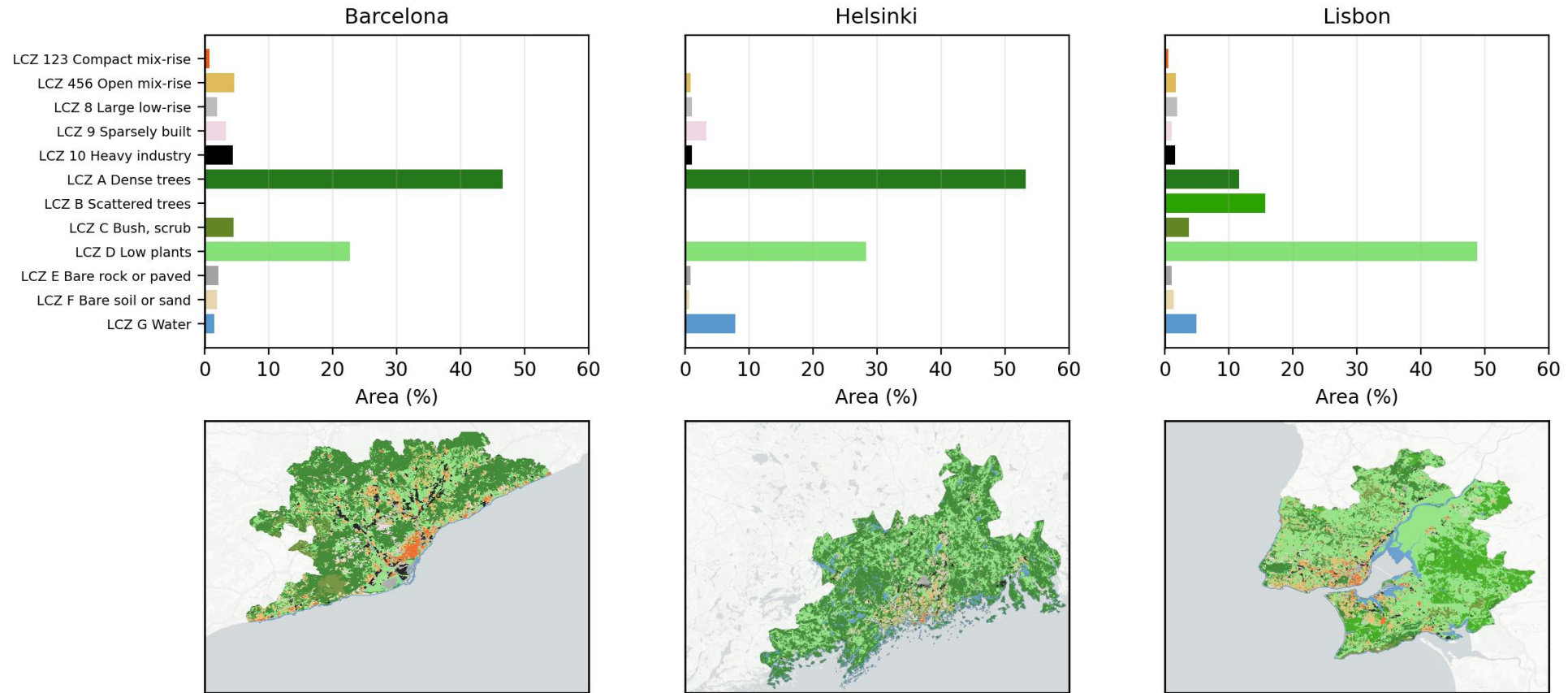
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## Machine Learning

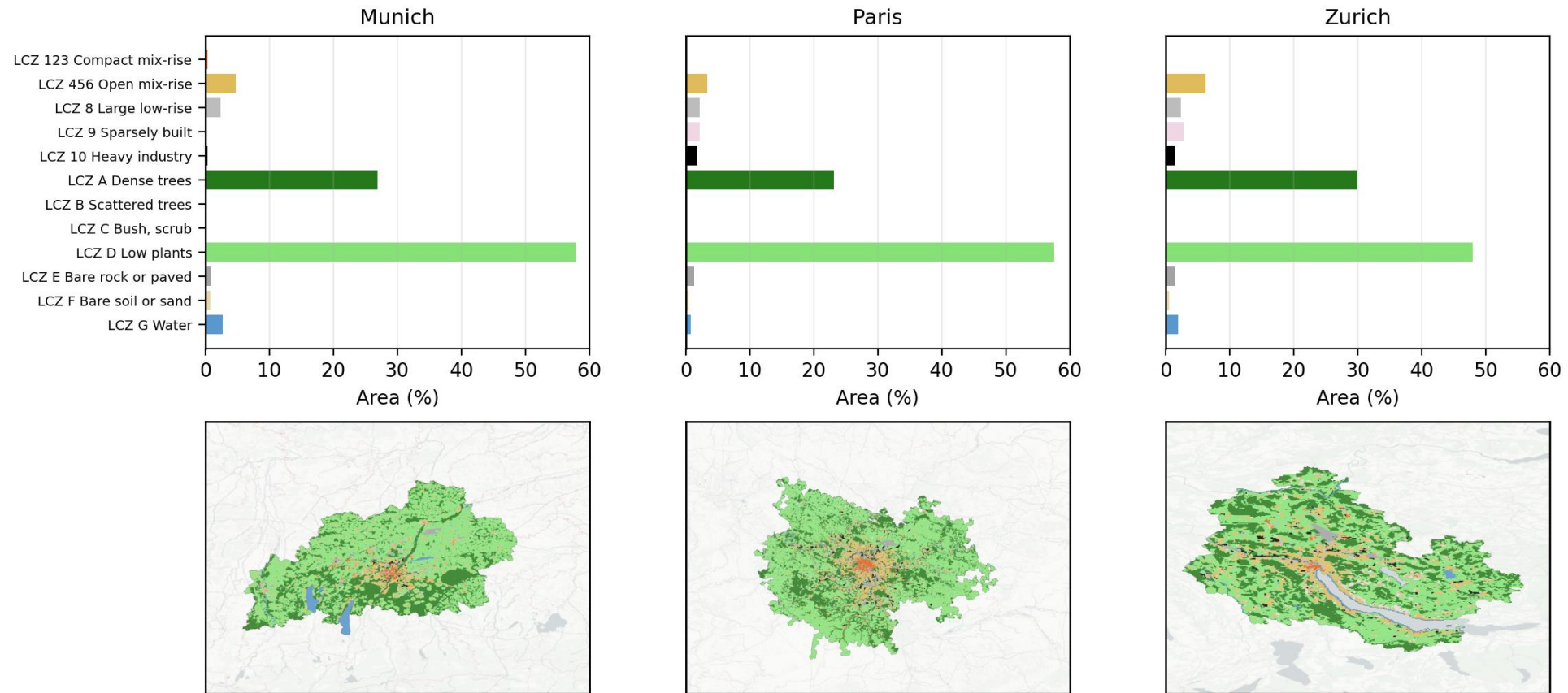
Domain-Informed  
Data-driven  
Downscaling



# LOCAL CLIMATE ZONES



# LOCAL CLIMATE ZONES



Urban impact models can inform citiverse standards by defining common requirements for:

- **data interoperability:** urban heat, carbon sequestration, land use, EO, sensors and climate projections.
- **model interfaces:** APIs linking local digital twins, DESP, HPC/AI workflows and virtual worlds.
- **trustworthy outputs:** uncertainty, provenance, validation and comparable indicators.
- **policy use cases:** testing nature-based solutions, outdoor comfort, carbon neutrality and adaptation scenarios.



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## THANK YOU

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