



Building Performance Simulation: Challenges and opportunities in a changing world

Lori McElroy

Past President – IBPSA

Professor Smart, Resilient Cities, University of Strathclyde



IBPSA – BS 2019 - Rome



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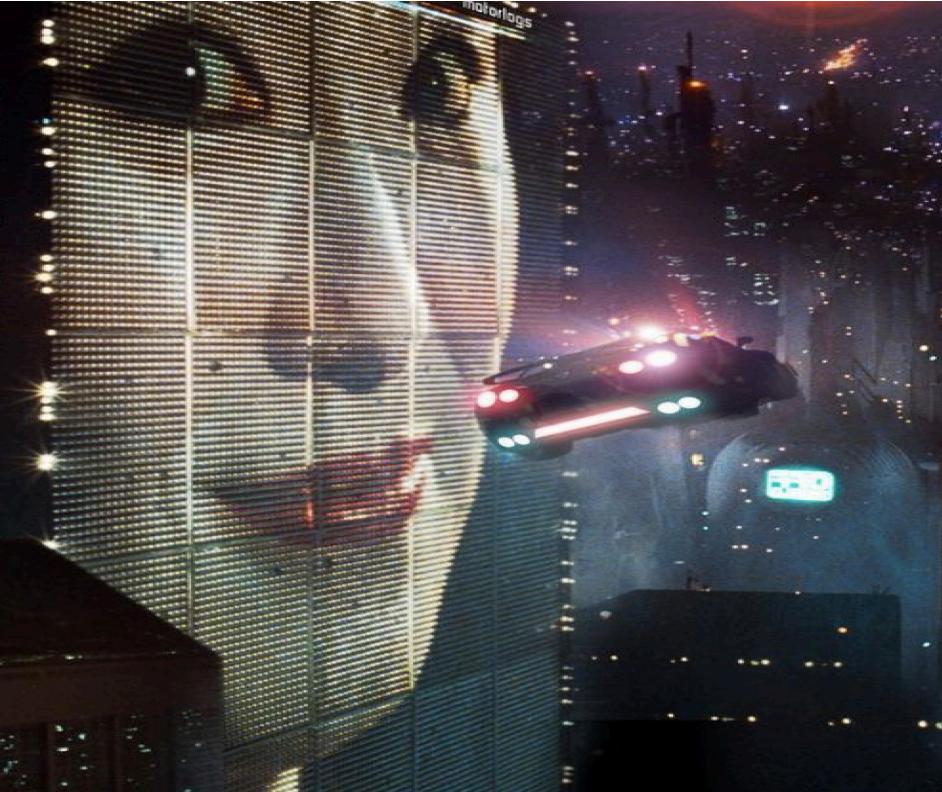
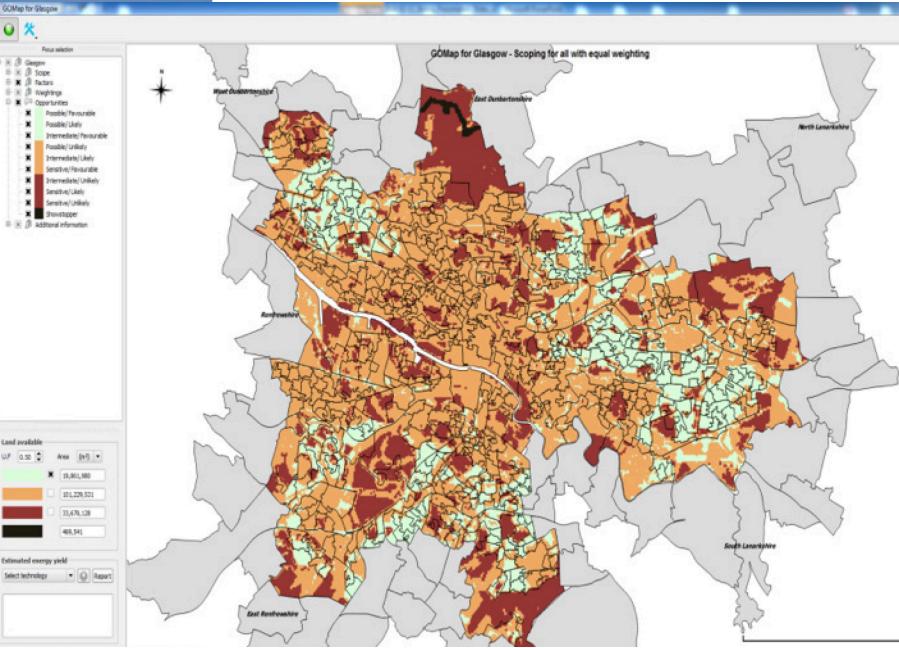
Source : Centre for ageing better





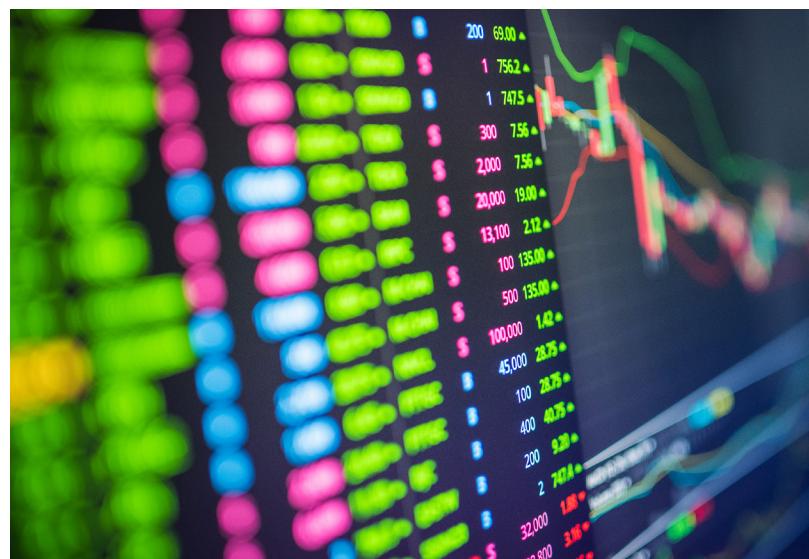
Cities consume **75%** of the world's natural resources and account for **80%** of global greenhouse gas emissions

Source: United Nations 2015





Source : Centre for ageing better





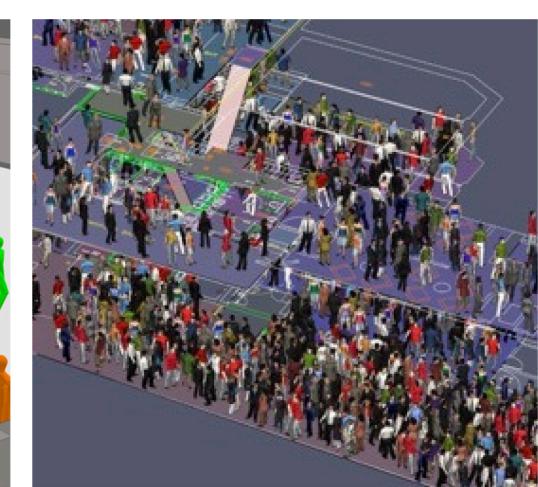
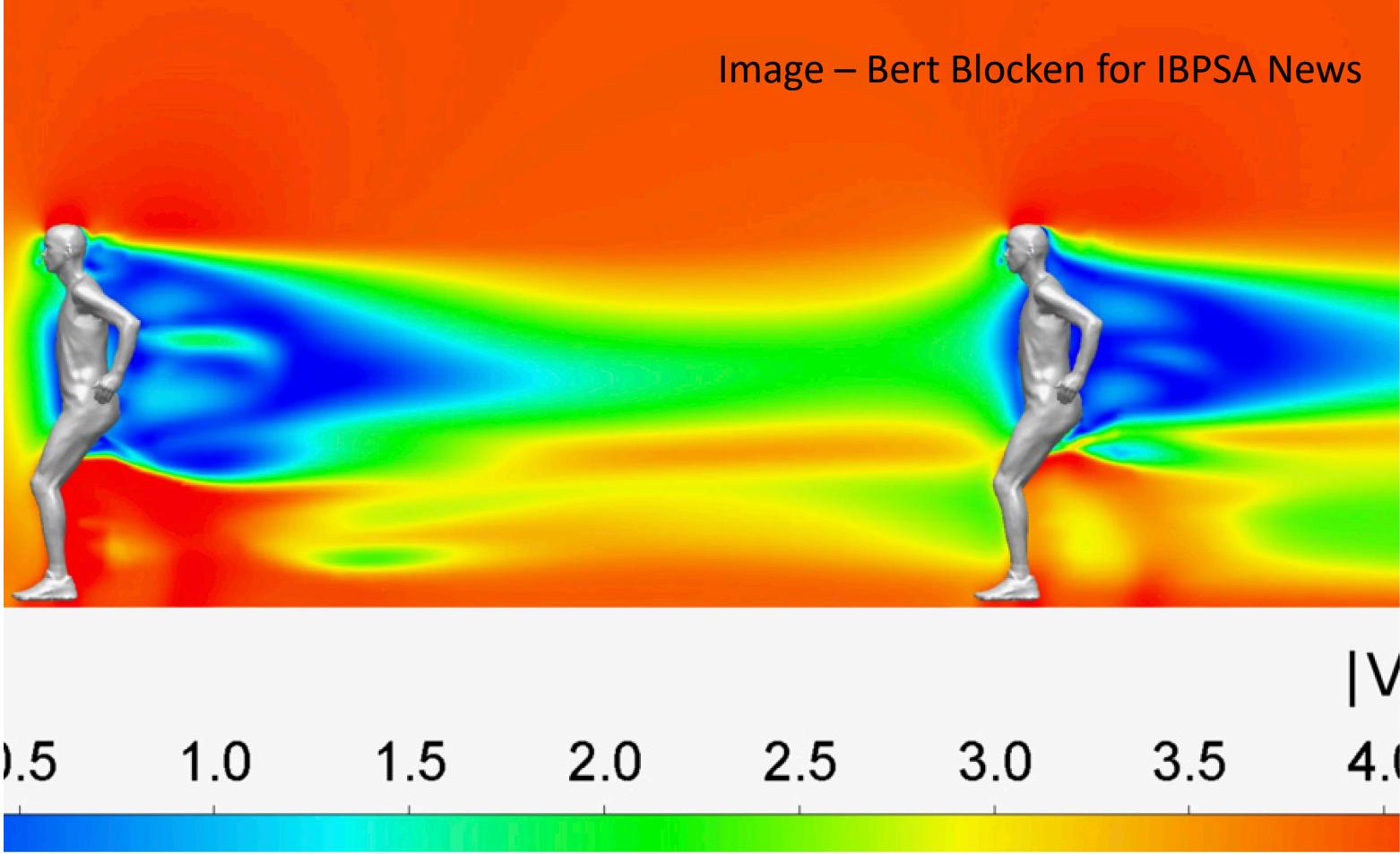
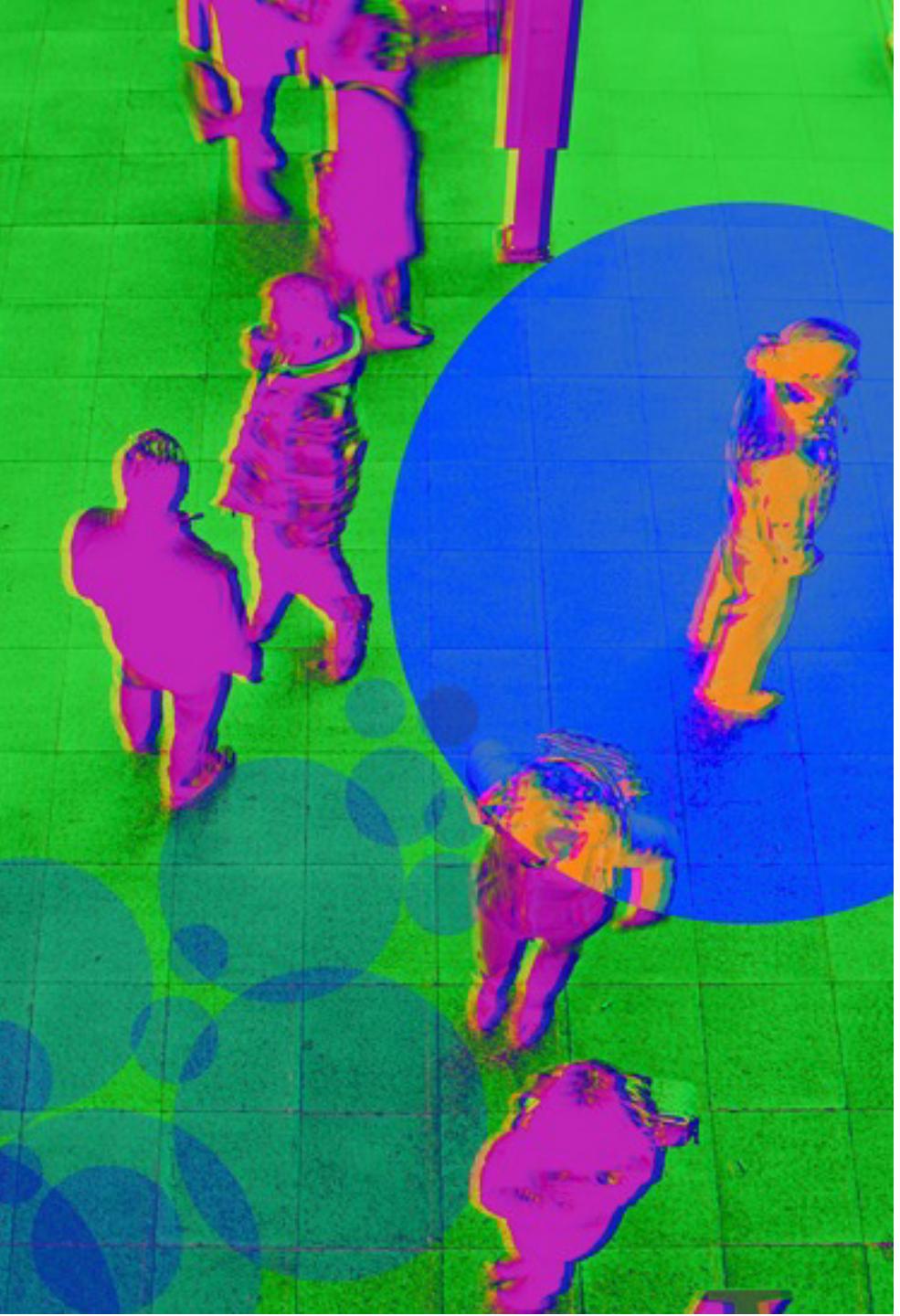




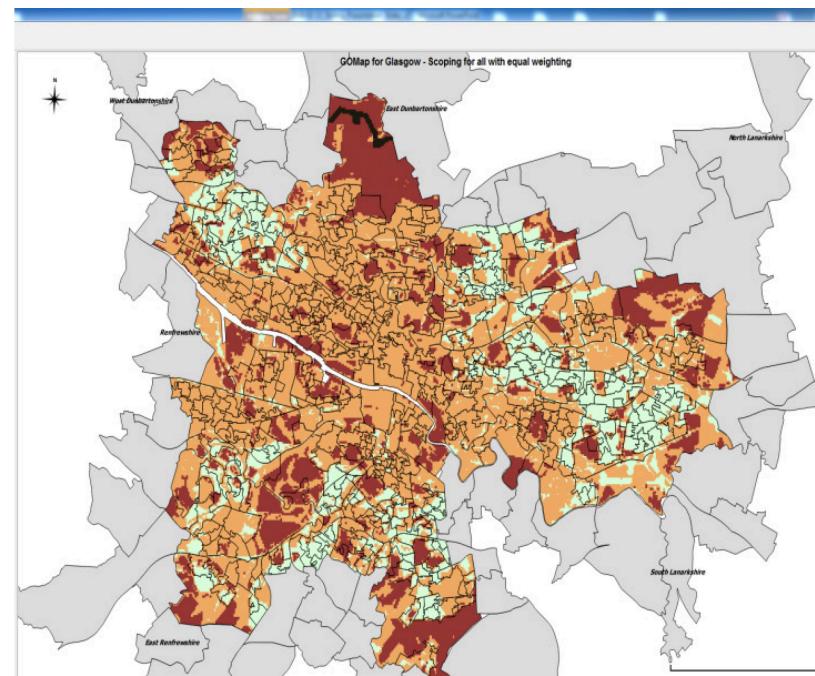


Source : Centre for ageing better

Image – Bert Blocken for IBPSA News







BIG DATA

BIG DATA
ORGANIZATION
PRICING
SEGMENTATION
SOCIAL NETWORKS
DIGITAL INFORMATION
MOBILE
SERVICES
PROJECTS
BUZZ BEHAVIOUR
B2B TARGET PLANNING MEDIA
WEB SERVICES
SOLVED
BUSINESS
BRAND

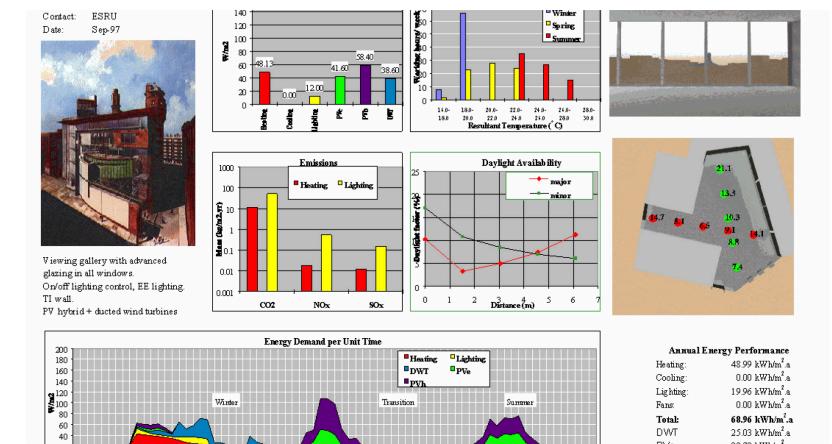
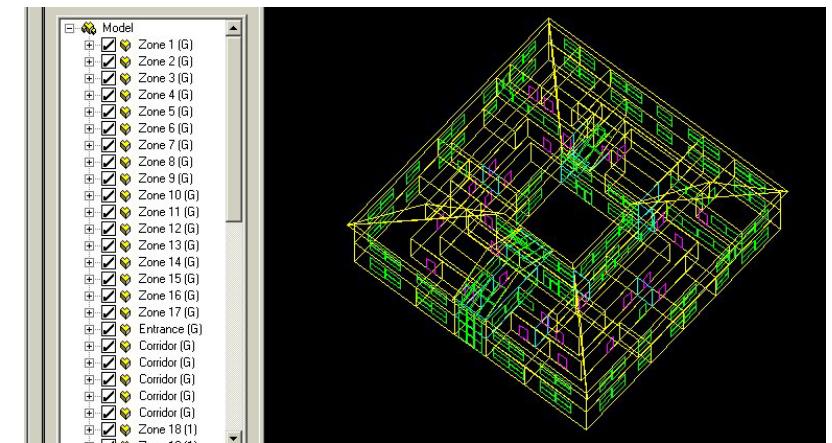
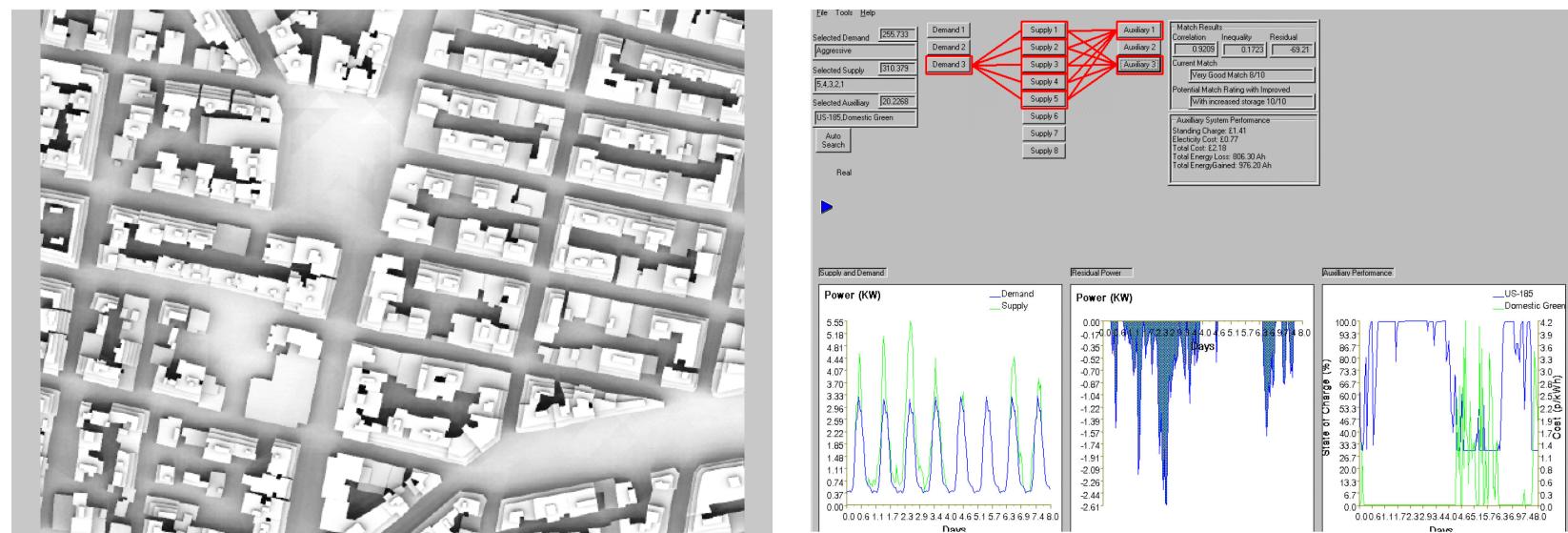
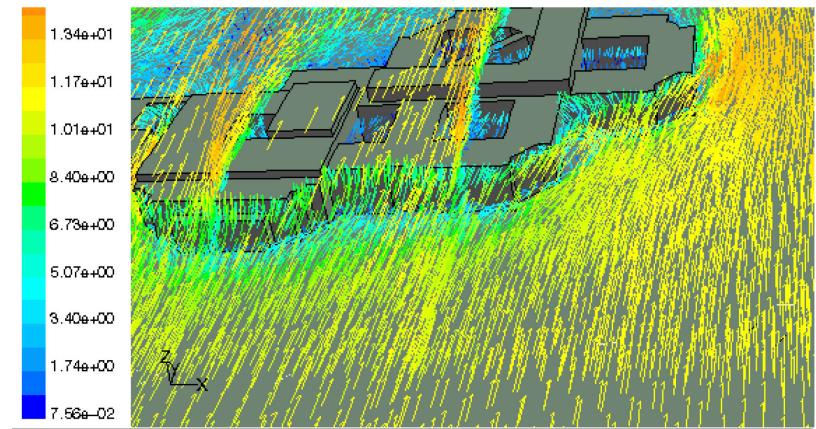
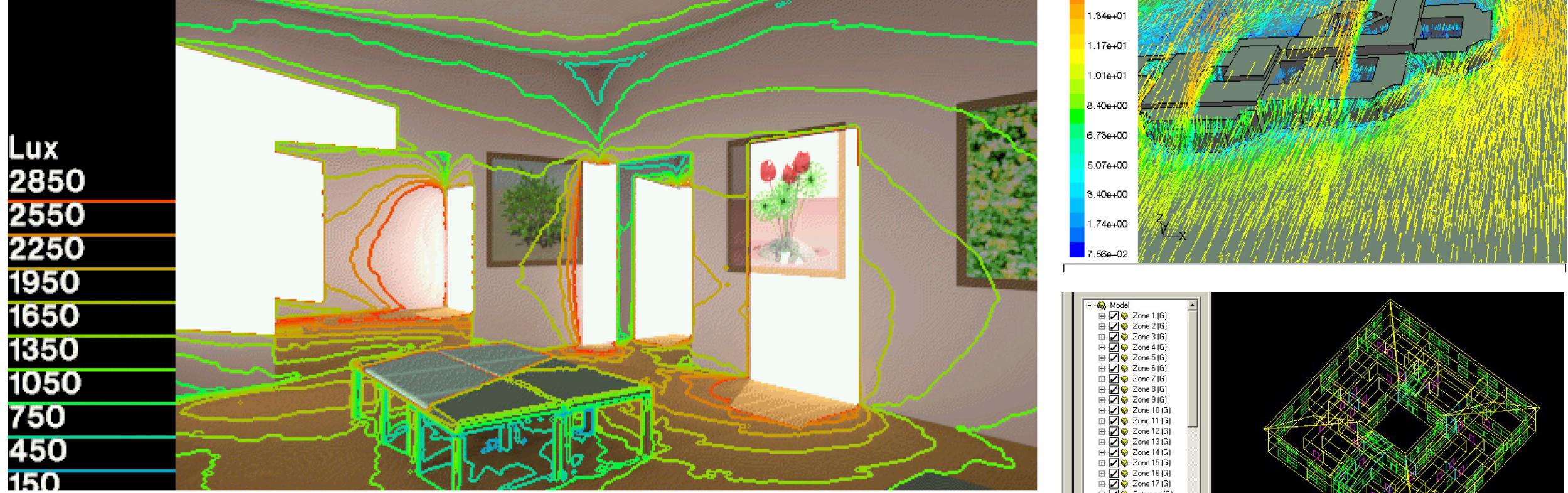


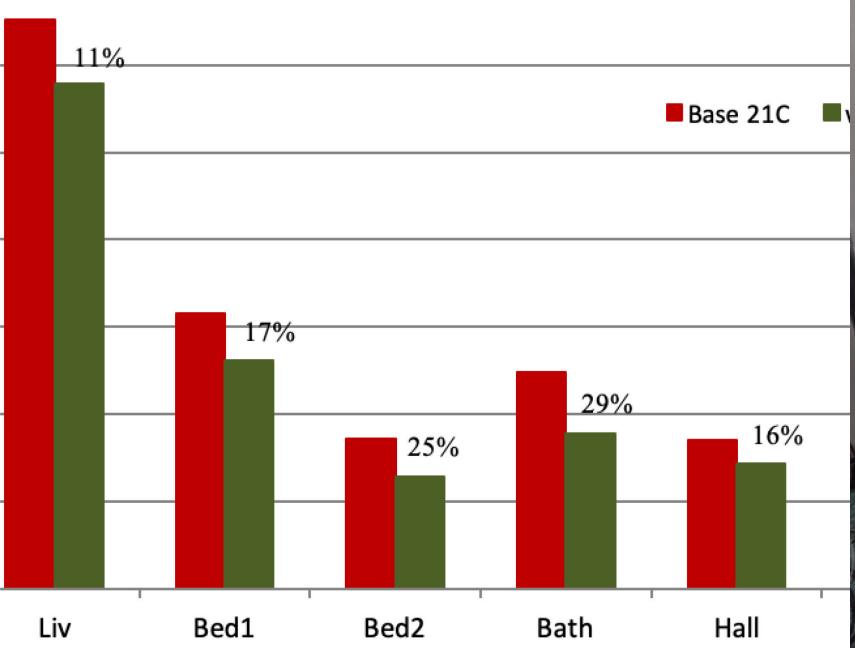
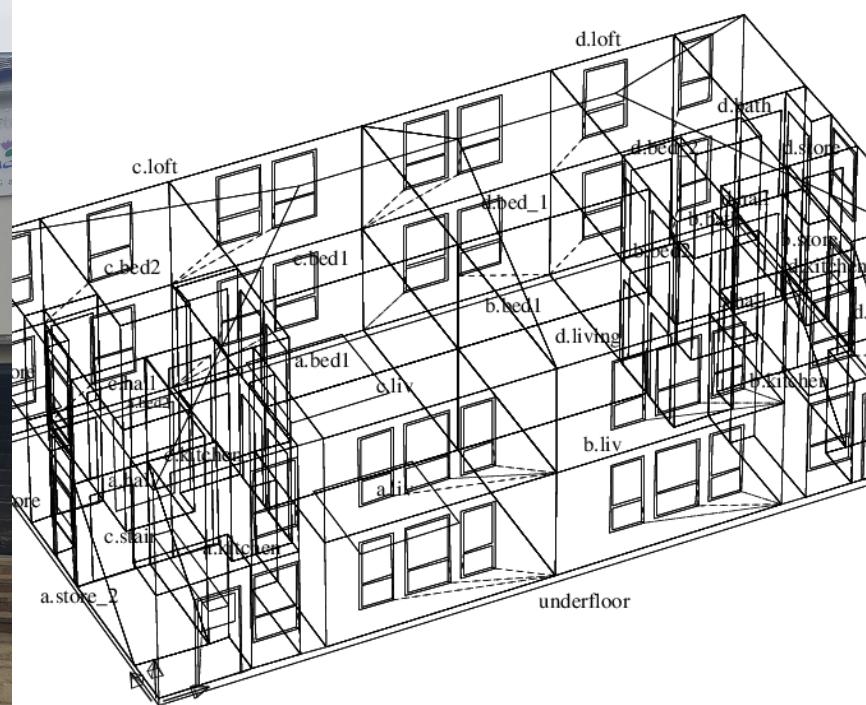


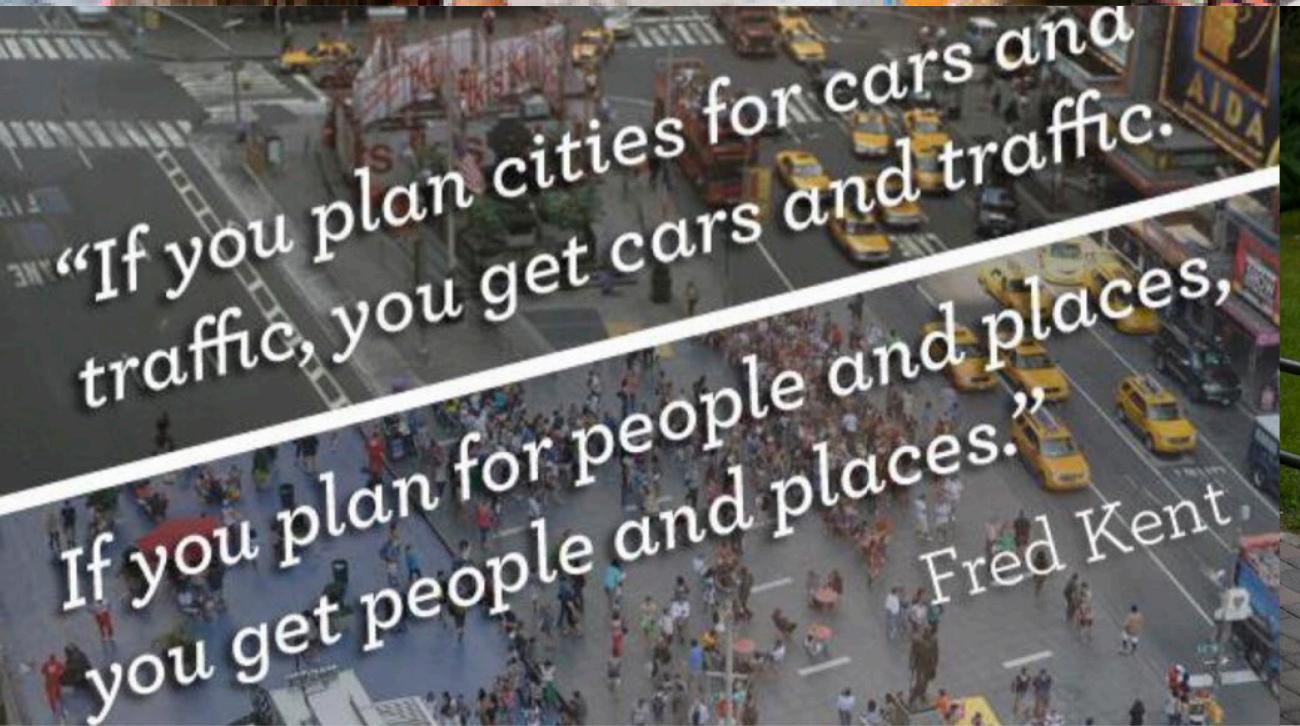


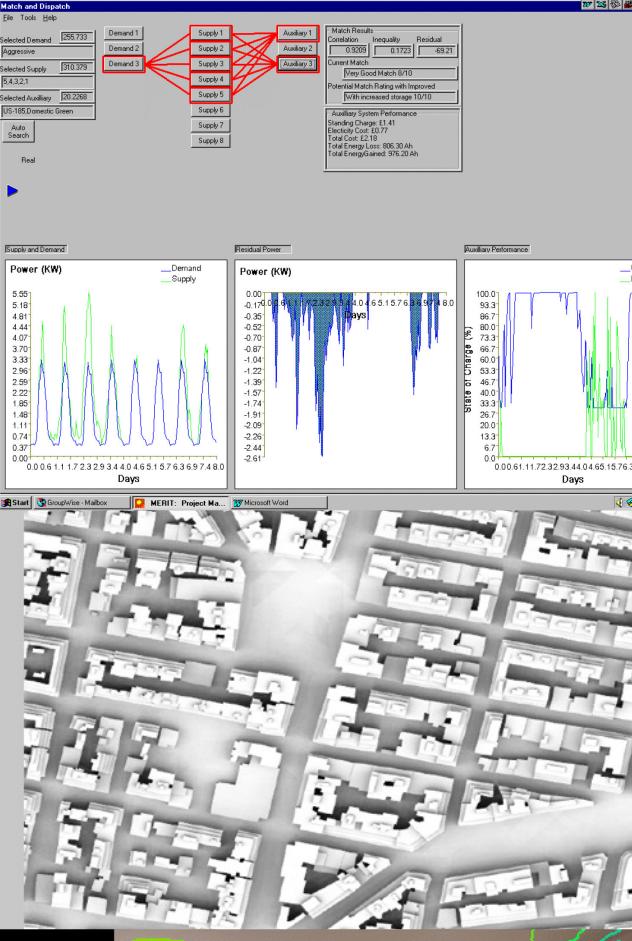










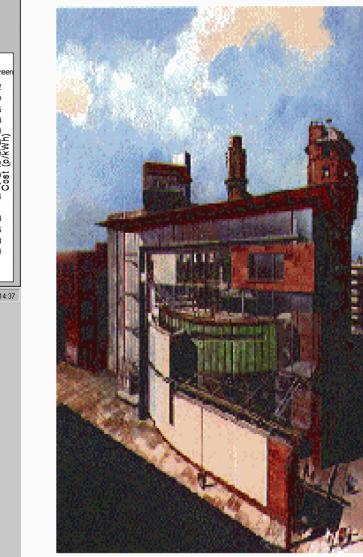


Lighthouse Viewing Gallery

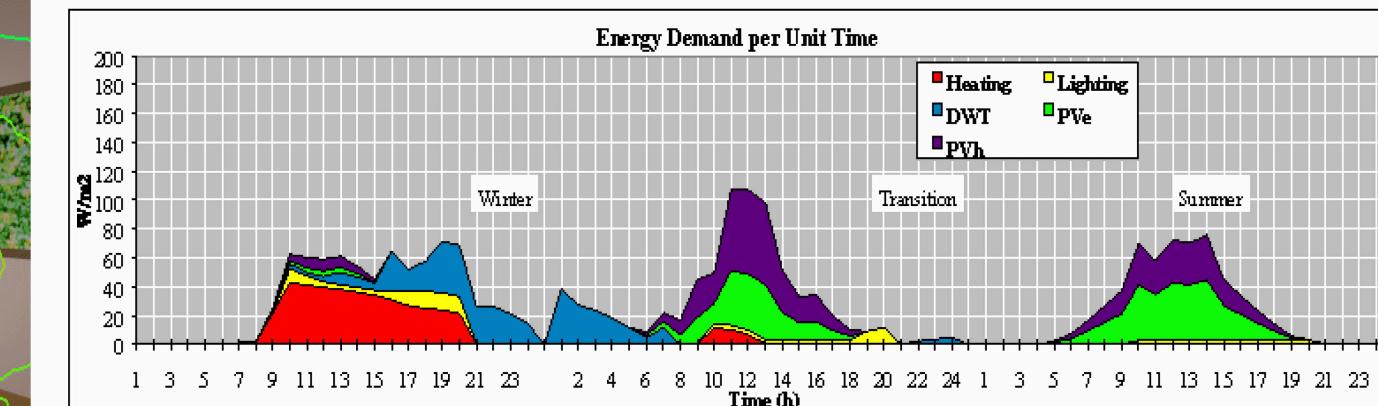
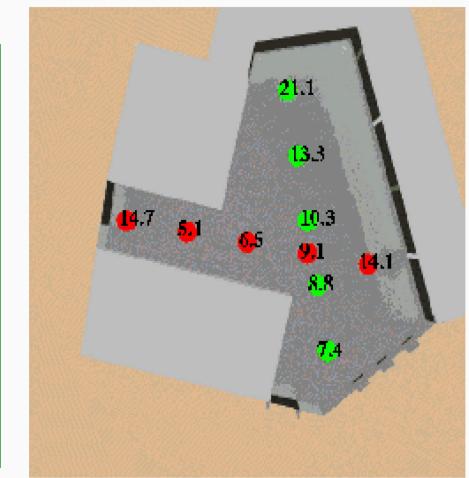
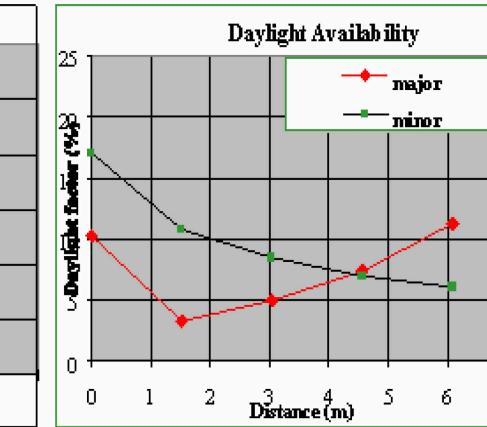
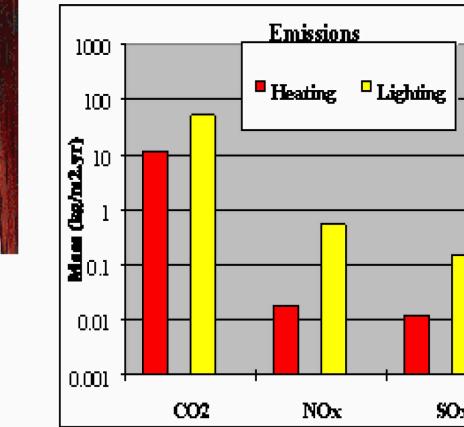
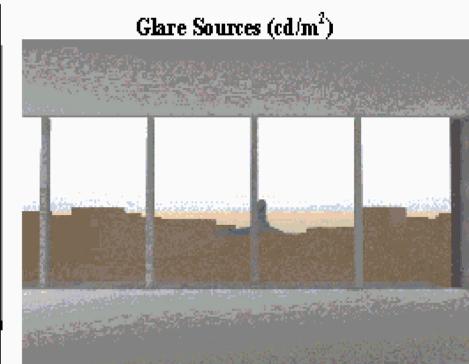
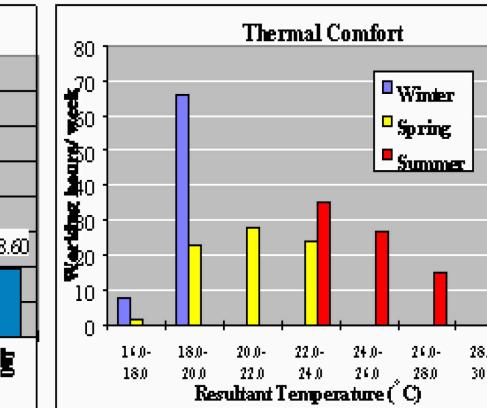
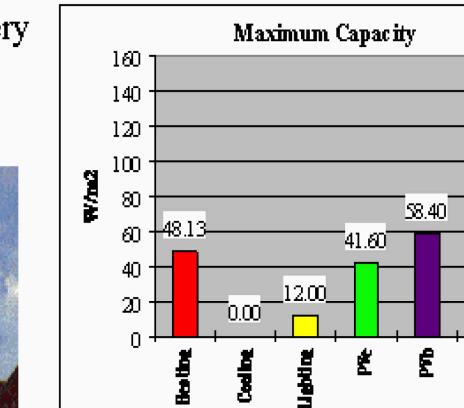
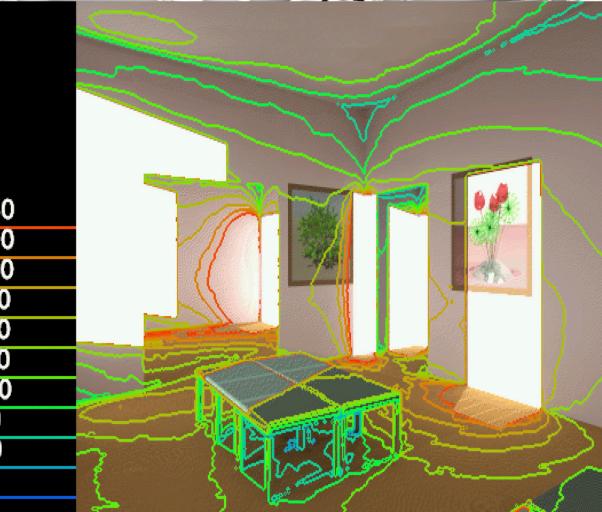
Version: reference 3 opt 2 + RE

Contact: ESRU

Date: Sep-97



Viewing gallery with advanced glazing in all windows.
On/off lighting control, EE lighting.
TI wall.
PV hybrid + ducted wind turbines



Annual Energy Performance

Heating:	48.99 kWh/m ² .a
Cooling:	0.00 kWh/m ² .a
Lighting:	19.96 kWh/m ² .a
Fans:	0.00 kWh/m ² .a
Total:	68.96 kWh/m².a
DWT	25.03 kWh/m ² .a
PVe	33.79 kWh/m ² .a
PVh	40.91 kWh/m ² .a

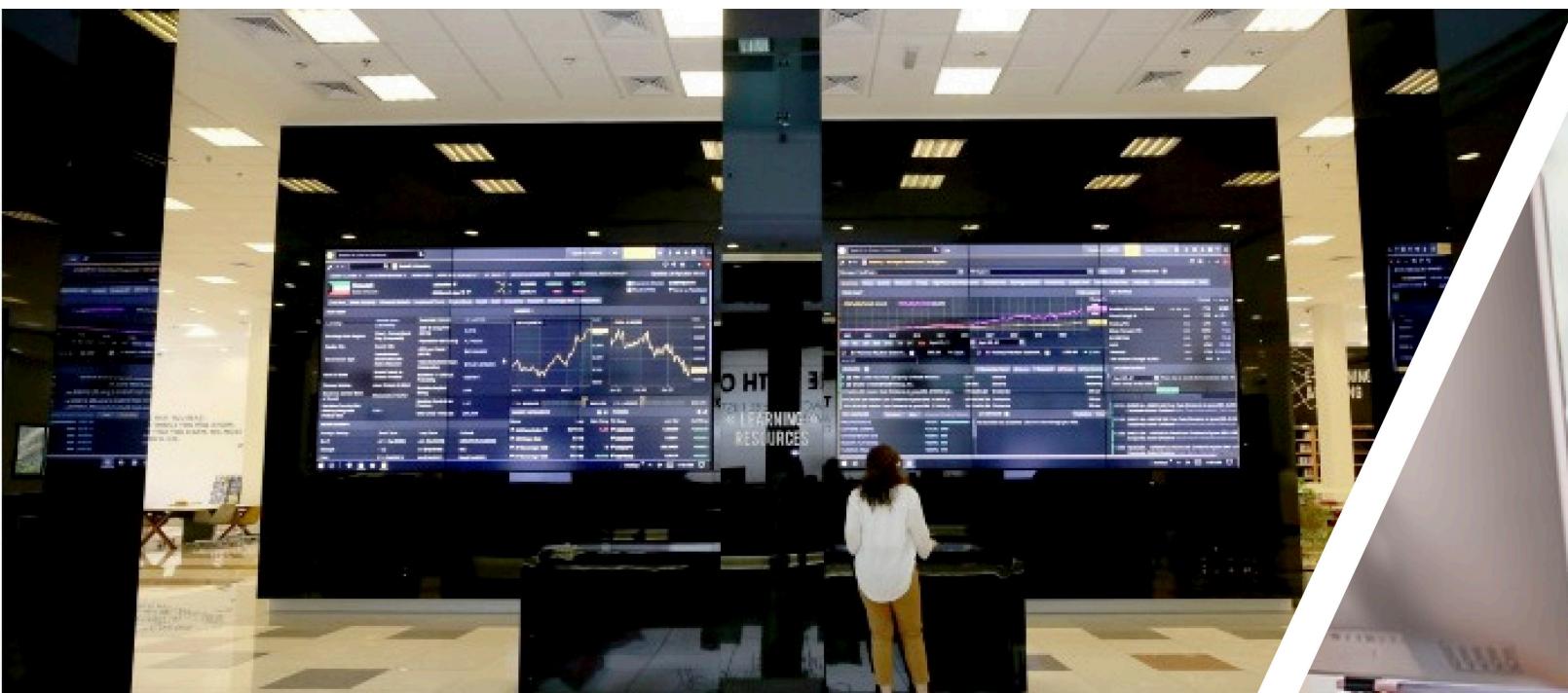




Image Adobe Stock

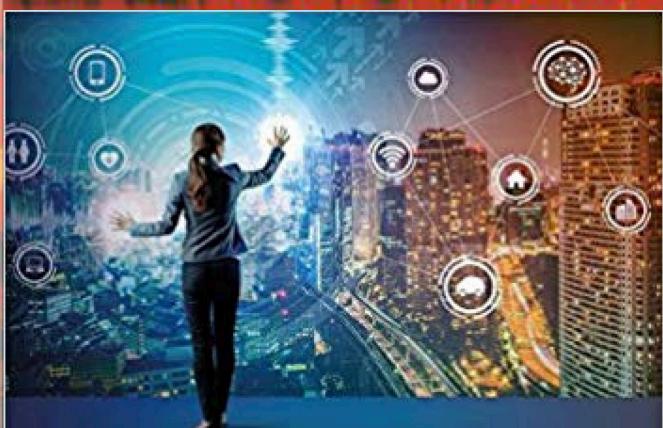


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SECOND EDITION

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BUILDING PERFORMANCE ANALYSIS

PIETER DE WILDE



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Module #1: Energy Monitoring and Effects on Indoor Climate



Netherlands
TU Delft



Delft University of Technology

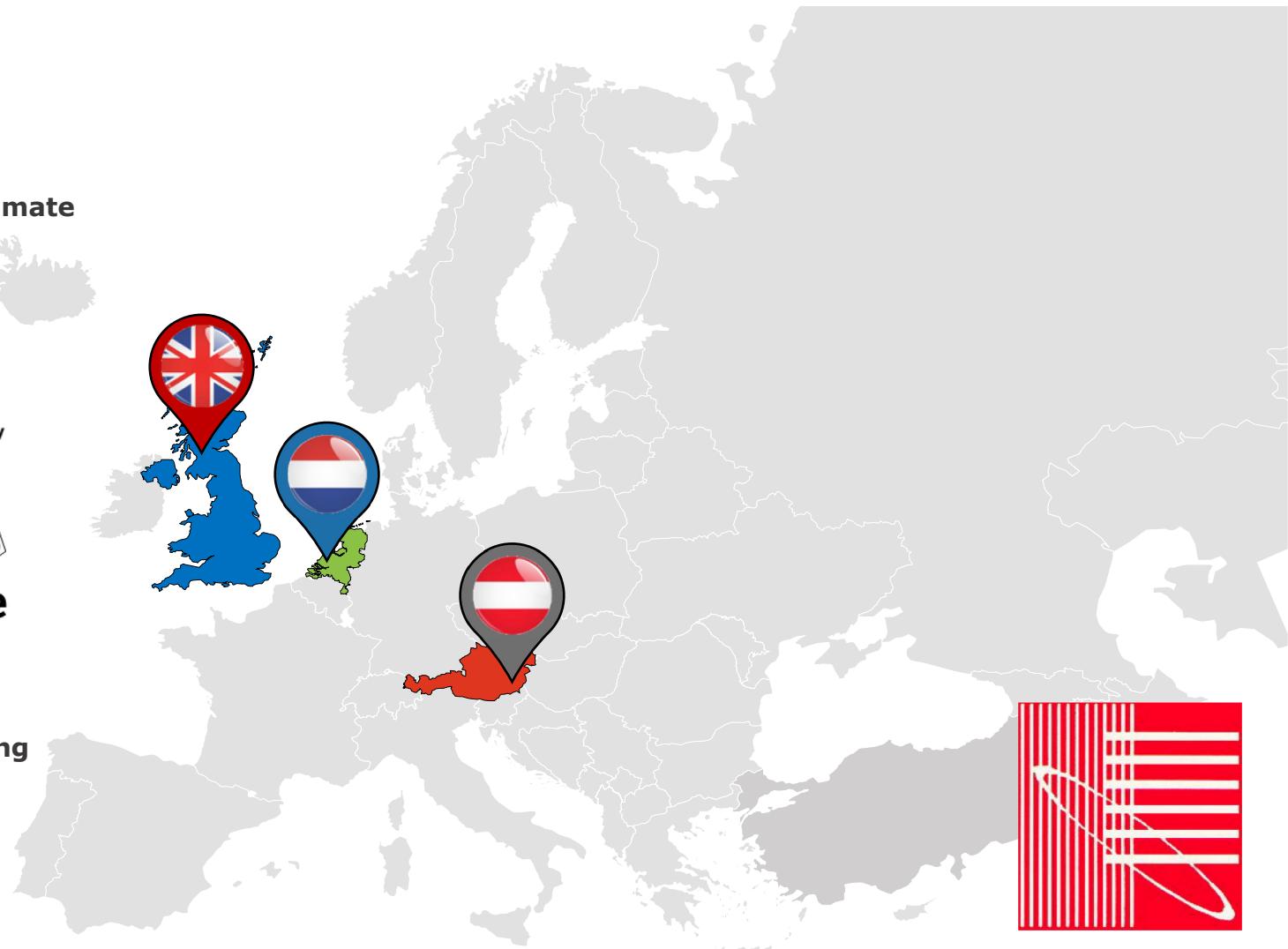
Module #2: Technoledge Climate



United Kingdom
University of Strathclyde



Module #3: Introduction to Building Simulation Modelling





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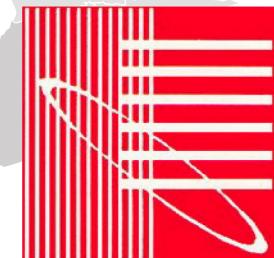
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Module #3: Introduction to Building Simulation Modelling





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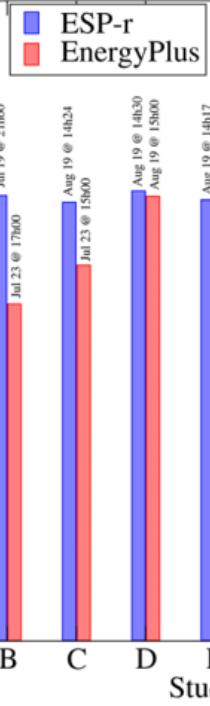
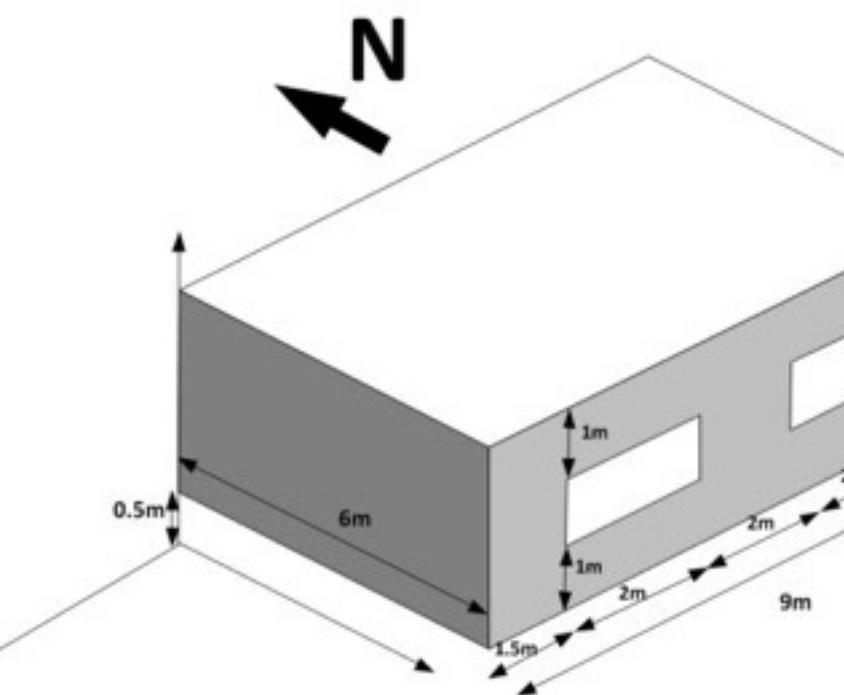
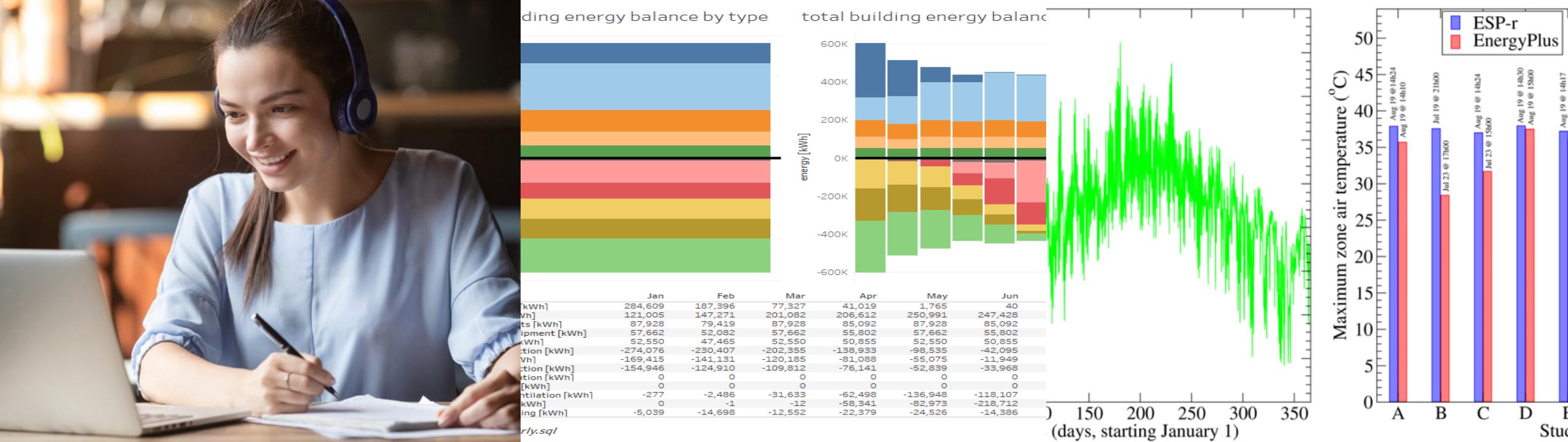
Graz University of Technology



Digital Erasmus Resilient Building Design using Building Performance Simulation

Graz University of Technology, **Technical University of Delft**, University of Strathclyde

A Pilot : 2021 - 2023

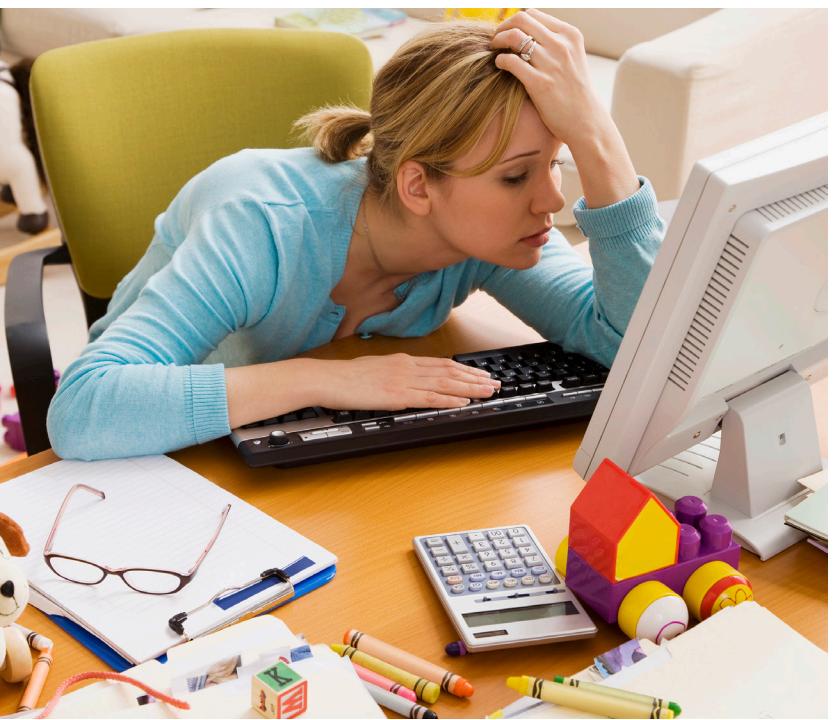


The focus of the project was to:

- build an inclusive higher education experience; and
- to promote international collaboration

while at the same time:

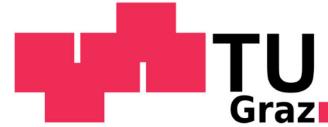
- addressing environmental and climate goals; and
- supporting students unable to meet face to face to acquire and develop new skills and key competences.



Three buildings, three challenges



Daylighting and lighting



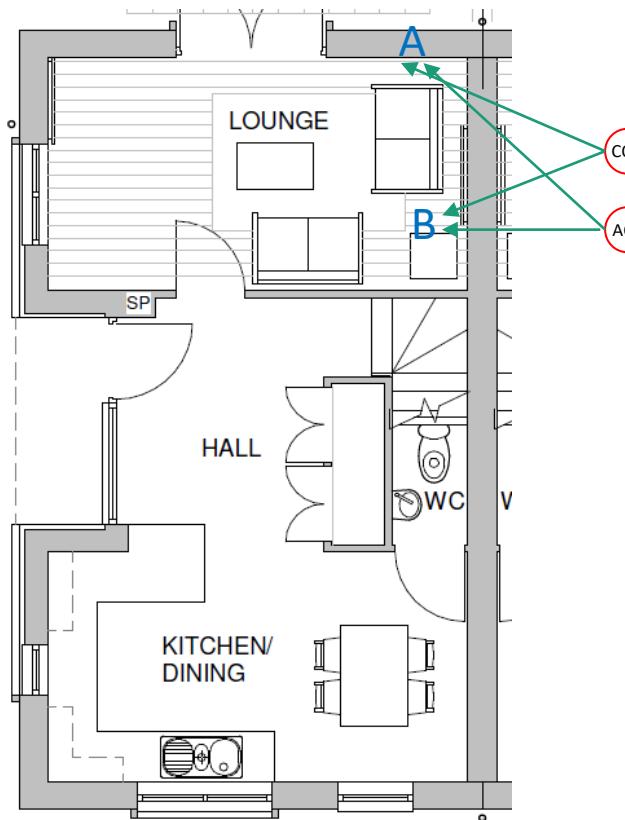
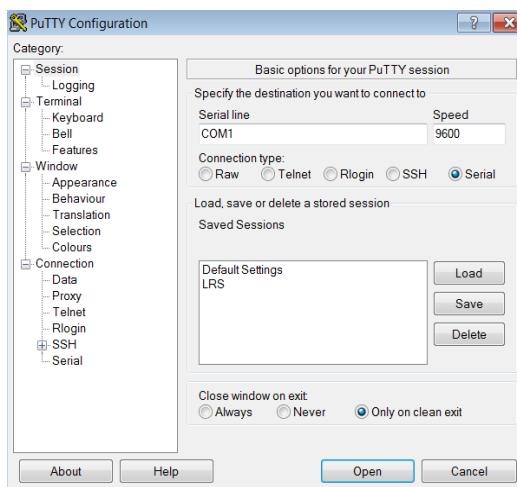
Energy and IAQ



Moisture and IEQ



Procedures for combining simulation modelling and monitoring



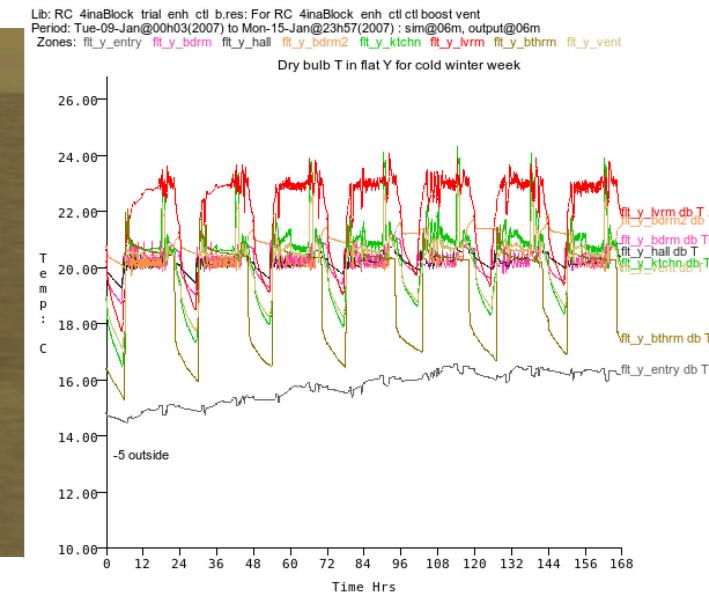
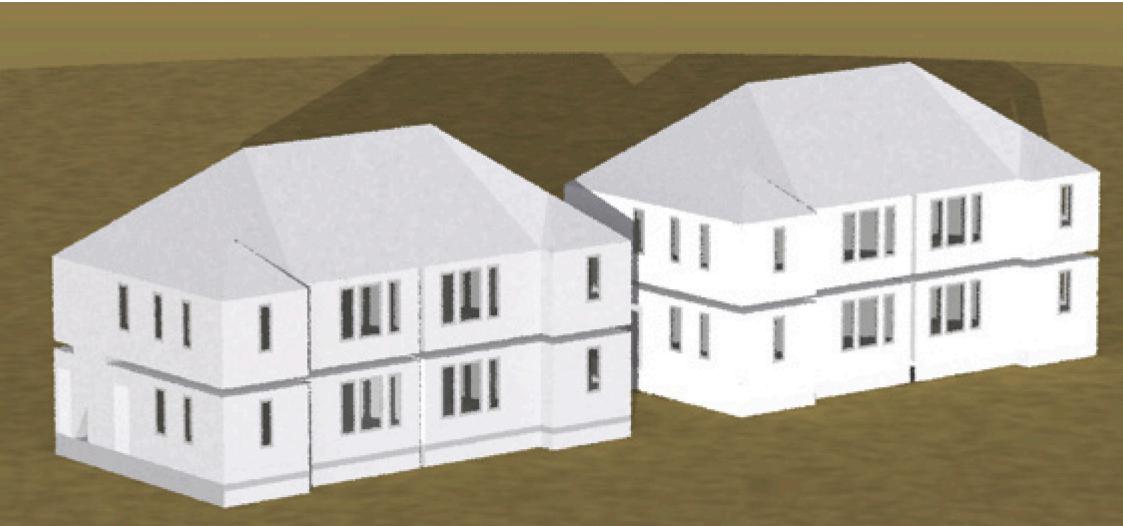
- to provide a learning platform to undertake a digital learning cycle in building performance appraisal;
- to offer opportunities and an inclusive environment for students from all backgrounds, and which enhances diversity, equality and inclusion outcomes;
- to challenge students to work in interdisciplinary and transnational teams to improve their social, communication and interpersonal skills.

What is the benefit of combining BPS and monitoring? Observations from experience:

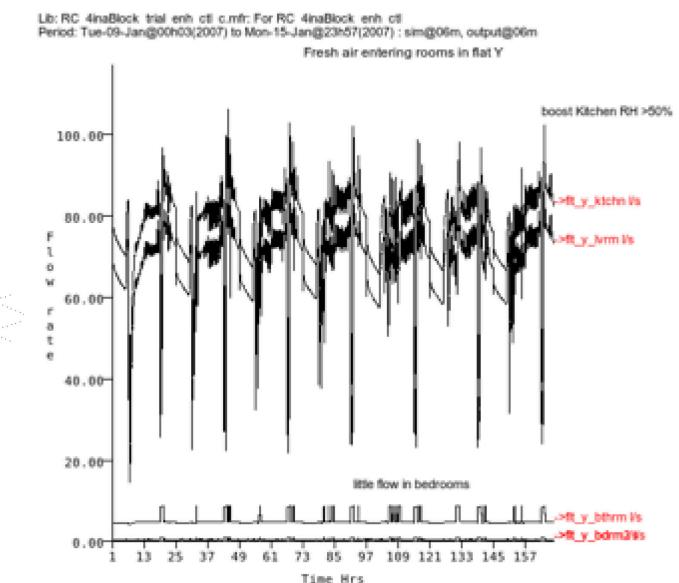
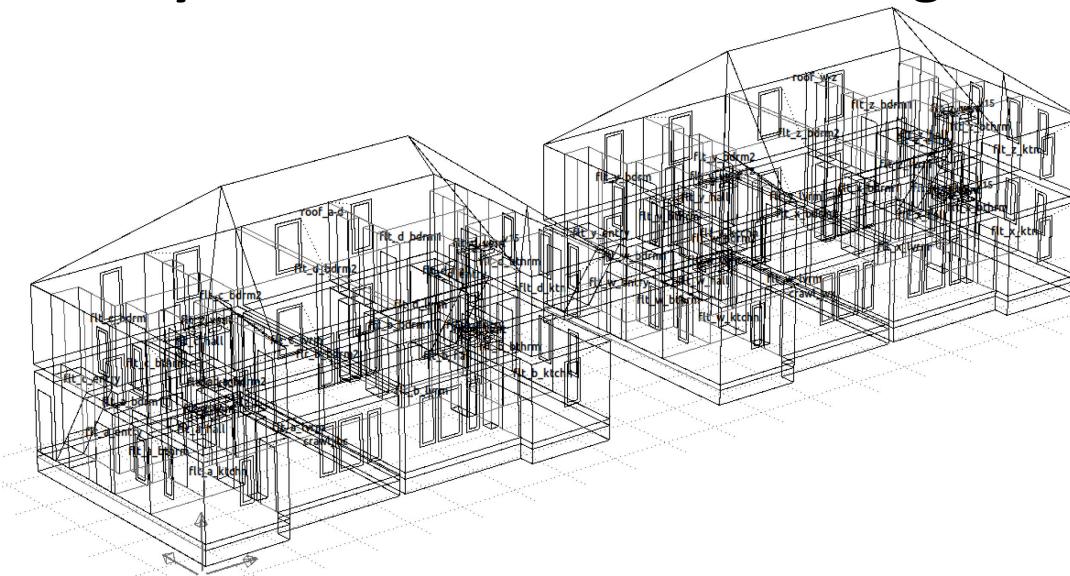
1. Experiential learning and studying theory both required to achieve best outcomes.
2. Training a user to operate a BPS tool is easy.
3. Predicting accurate results is difficult.
4. Insufficient scrutiny of monitoring data and simulation predictions.
5. Avoids too much faith in (BPS) tools.
6. User is greatest source of uncertainty.



Calibrating simulations through gathered sensor data



ESPr Dynamic Simulation Modelling





Module #3: Introduction to Building Simulation Modelling

The module teaches:

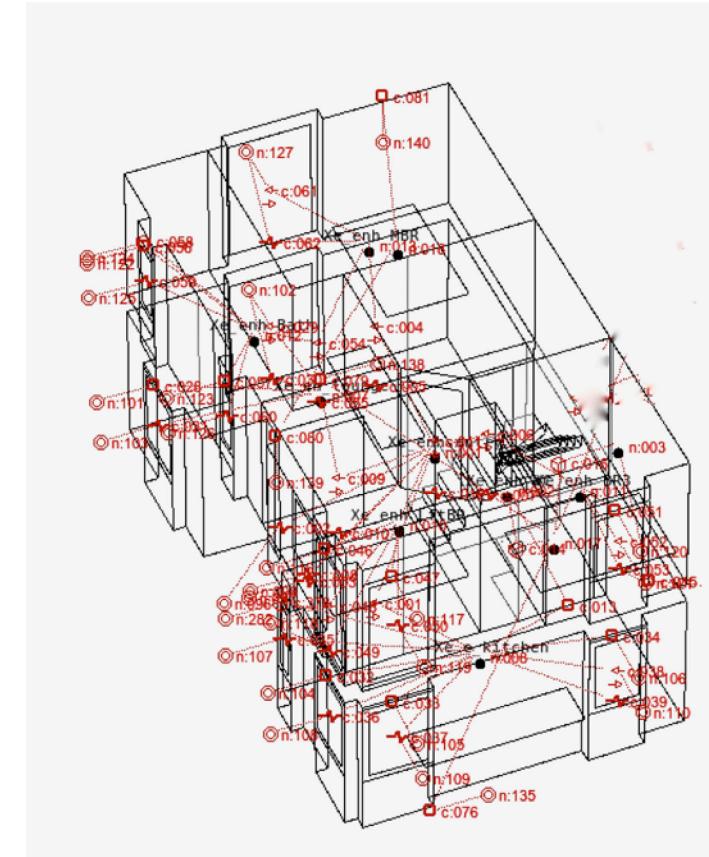
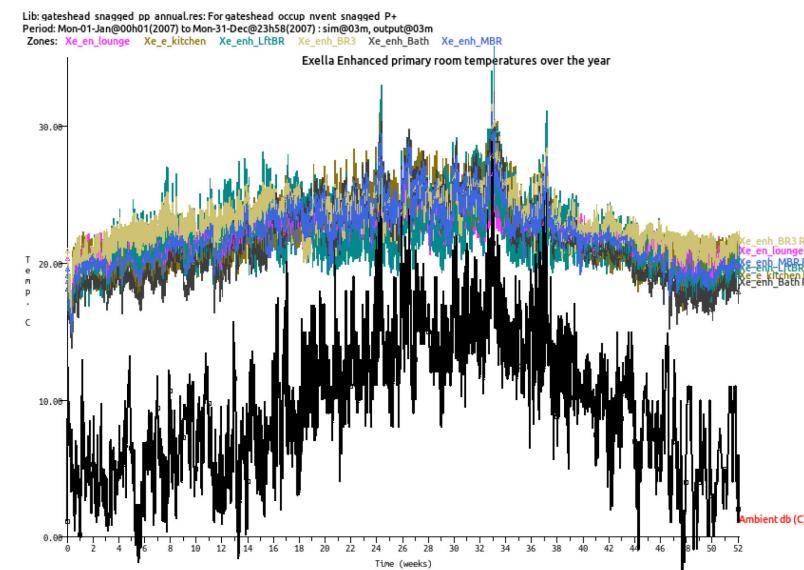
- Simulation principles: problem representation, treatment of time and space, numerical methods, validation, use in practice.
- Simulation practice: problem description, modelling methodology, results interpretation, case studies
- Built environment: energy demand, passive and active energy systems, options for intervention, performance assessment methods.
- Heat and mass transfer processes occurring within energy supply and demand systems.
- Information systems: energy management, monitoring and targeting, classification techniques, trend analysis, smart metering.

The emphasis is on practical computer lab-based modelling exercises.

On completion of the module the student is expected to be able to:

Generate and adapt computer models, undertake simulations and analyse predicted performance.

Develop and understanding of the main factors that influence energy and environmental performance.



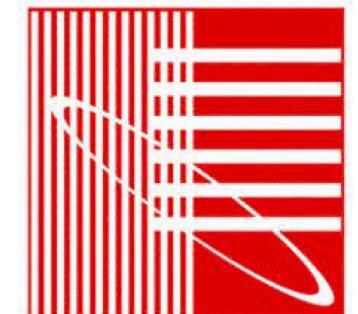
Whole house deep retrofit - University of Strathclyde

- Housing provider is exploring a number of approaches including comparing deep retrofit and whole house ventilation with more traditional approaches to balance user needs and emissions targets, in order to arrive at workable solutions.
- Work includes calibration of building models with recorded and monitored data.
- Sensors to be fitted in the building: Indoor temperature sensors, CO₂, RH, Temperature and heat flux sensors, Weather station (wind/external temperature/light level), Wifi/Mobile network data transmitter



Future work

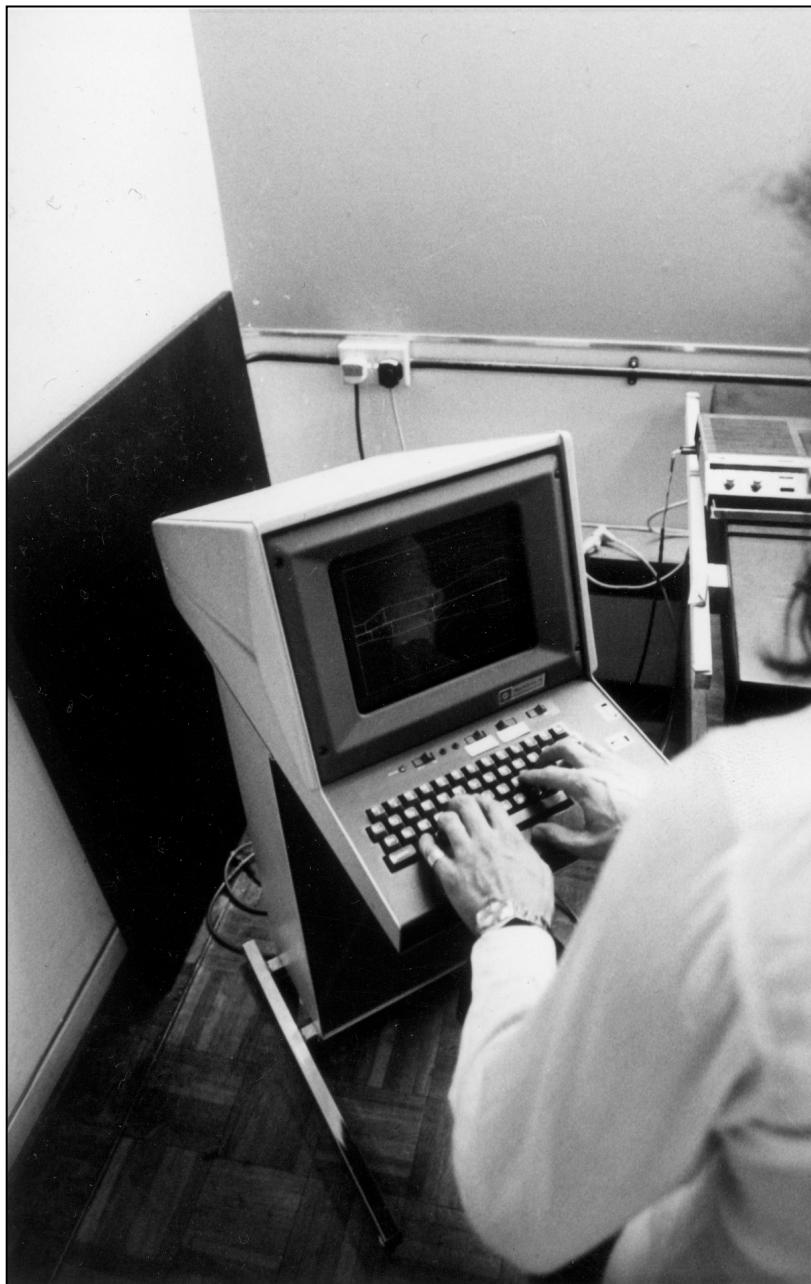
- Find new ways of incorporating hybrid teaching modes that will allow students to continue collaborating between the different partner countries.
- Create links to external organisations such as the International Building Performance Simulation Association (IBPSA), REHVA, CIBSE, ASHRAE. etc. for additional accreditation (e.g. IBPSA academy)
- Add new modules ...



www.ibpsa.org



CSE 142 ROCKS HARDCORE. IT'S A GOOD THING WE DON'T USE PUNCH CARDS



Thank you

For further information on Digital Erasmus – see www.desres.eu



Resilient Building Design using Performance Simulation



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