Monodraught

Coolphase

Low Energy Cooling, Ventilation and Heat Recovery Systems

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ARTICA TECHNOLOGIES

Imperial College London

DesignLondon

CARBON TRUST

Royal College of Art Postgraduate Art & Design

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HSBC START-UP STARS NATIONAL WINNER 2009 GRADUATE AWARD

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Designs for life

THE GOOD ENTREPRENEUR ONE IDEA TO CHANGE THE WORLD

Contents

1. The opportunity
2. Introduction of Cool Phase
3. Application of phase change materials (PCM)
4. Development of a steady state model
5. Dynamic modelling
6. Verification and case study

1. The opportunity

CoolPhase

1) Cost

2) Environment

3) Practical

2. Introduction to Cool Phase

2. Introduction to Cool Phase

» Low service & maintenance cost
» Meets Building Regs. & BREAM
» Improves indoor air quality
» No requirement for external units
» Modular, scalable & adaptable
» Uses no toxic coolants, e.g. R22

PARAFFIN:

Advantages:

- Stable
- Encapsulation
- Super cooling

Disadvantages:

- Expensive
- Flammable
- Thermal conductivity

SALT HYDRATES:

Advantages:

- Cost
- Energy density
- Sustainable

Disadvantages:

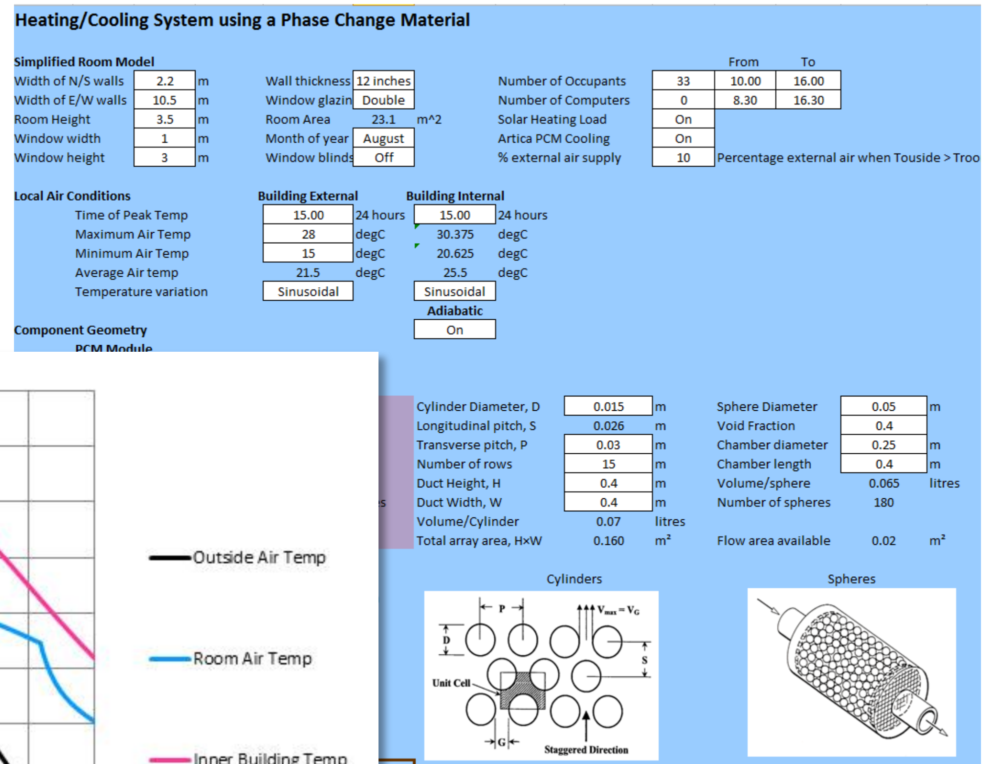
- Corrosive (plastic & metals)
- Thermal conductivity
- Segregation

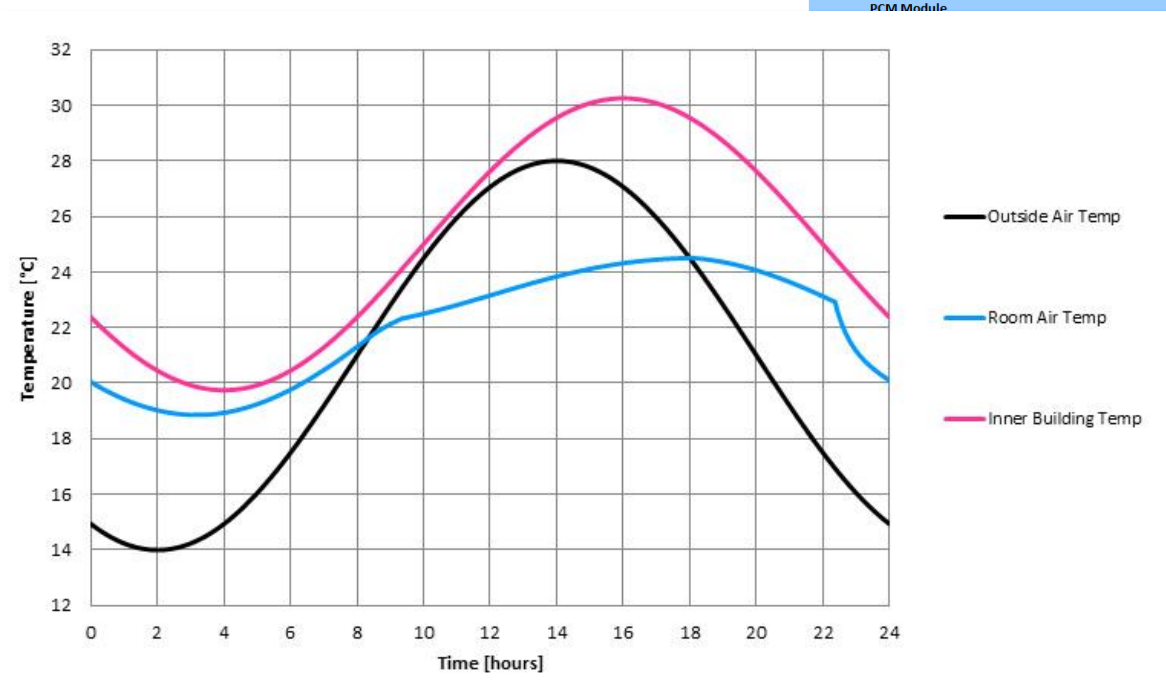
3. Application of PCMs

- Easy to retrofit, intelligent thermal mass
- 1kg of Phase Change Material (PCM) ~ 200kg of Concrete
- Actively dissipates heat built up during the day

1. Creation of a Design Tool

- Model of basic heat exchangers
- Simple environmental model
- Simple phase change temperature





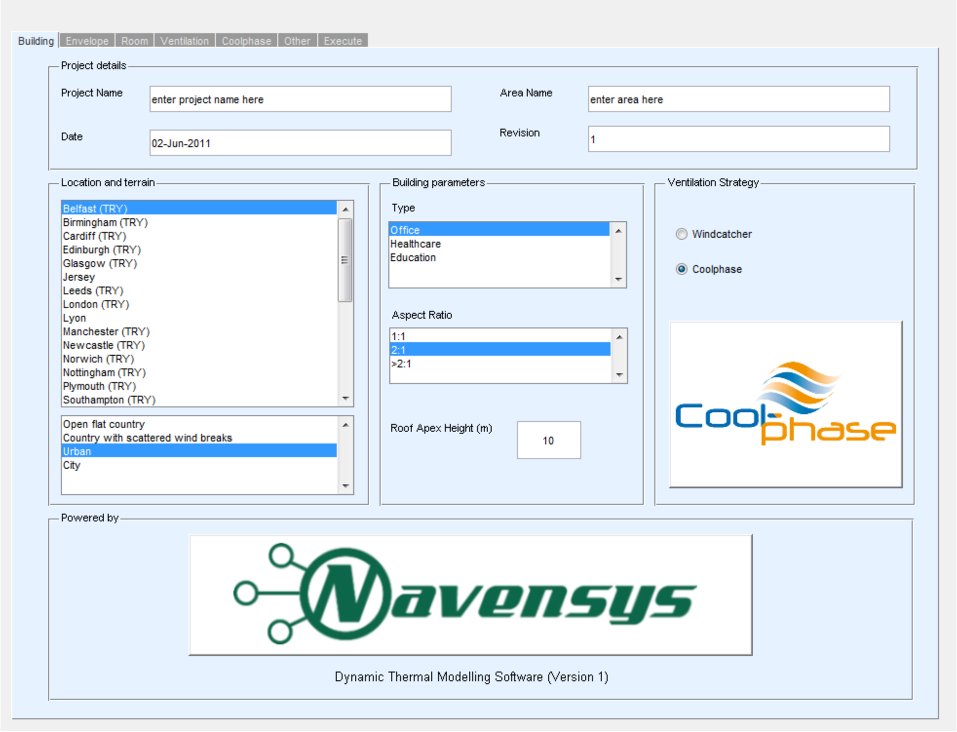
4. Development of a steady state model

1. Creation of a Design Tool

- Model of basic heat exchangers
- Simple environmental model
- Simple phase change temperature

2. Creation of a Specification Tool

- Incorporation into Navensys
- Improved PCM model
- Improved HE model
- Comparison to CFD



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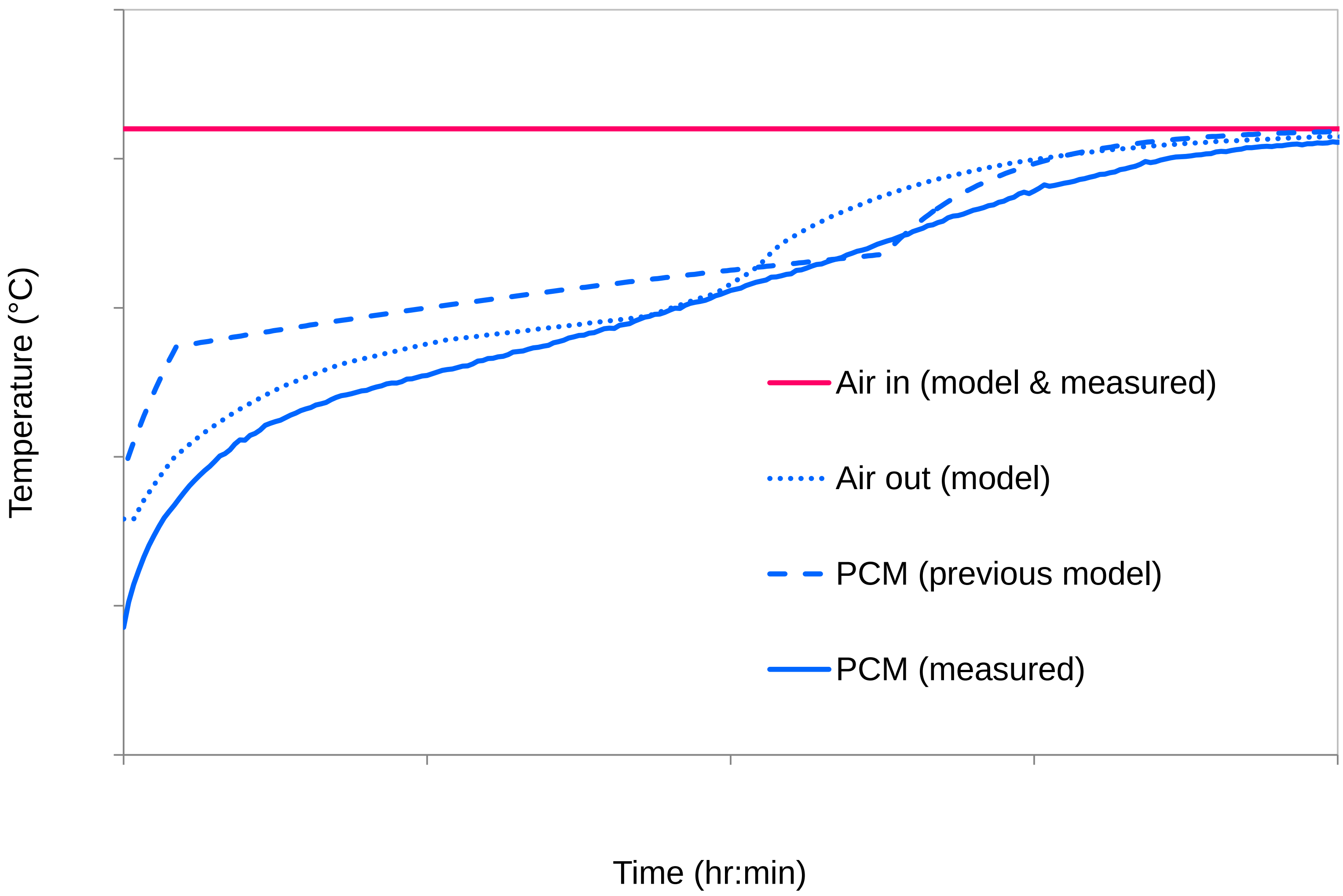

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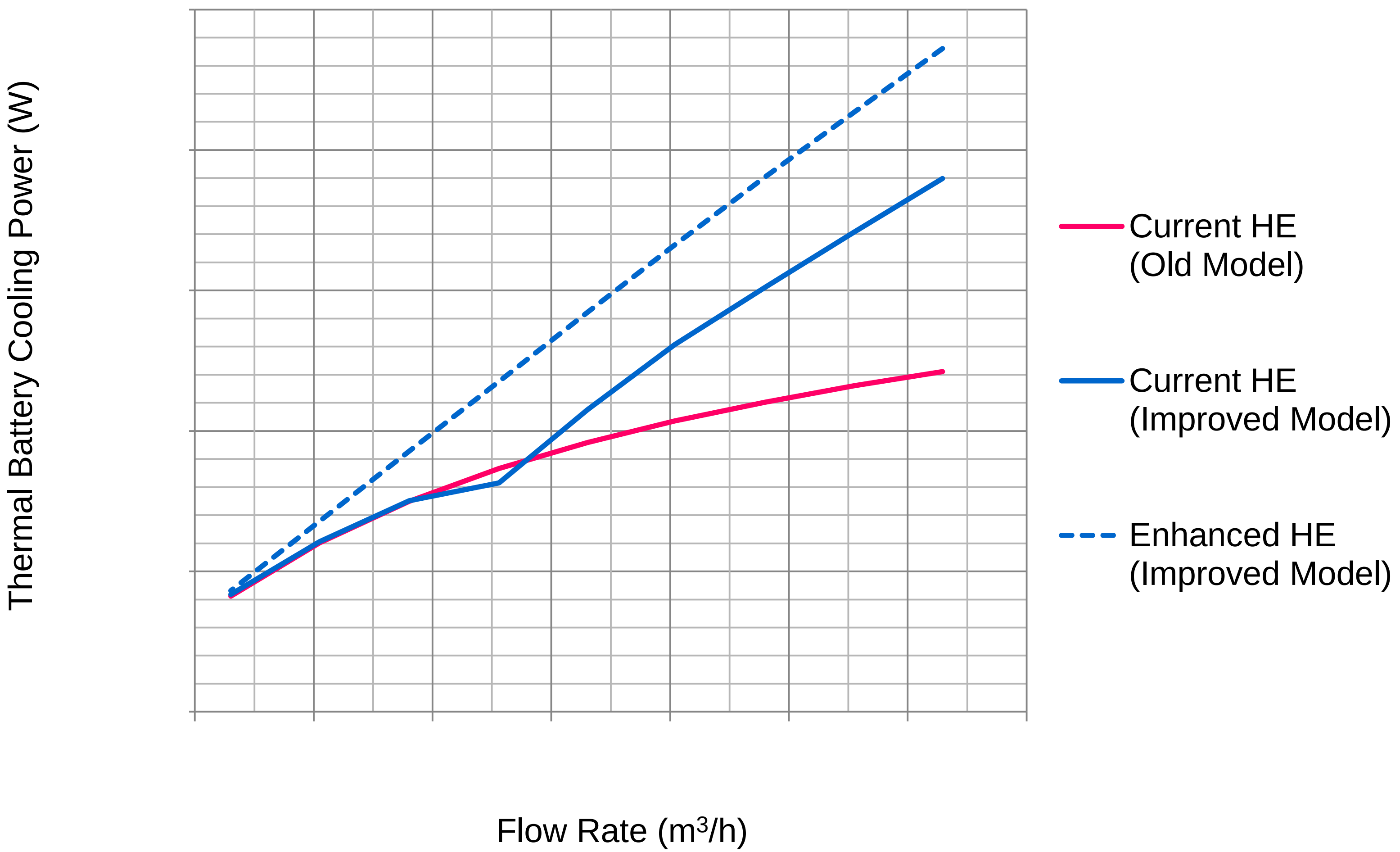

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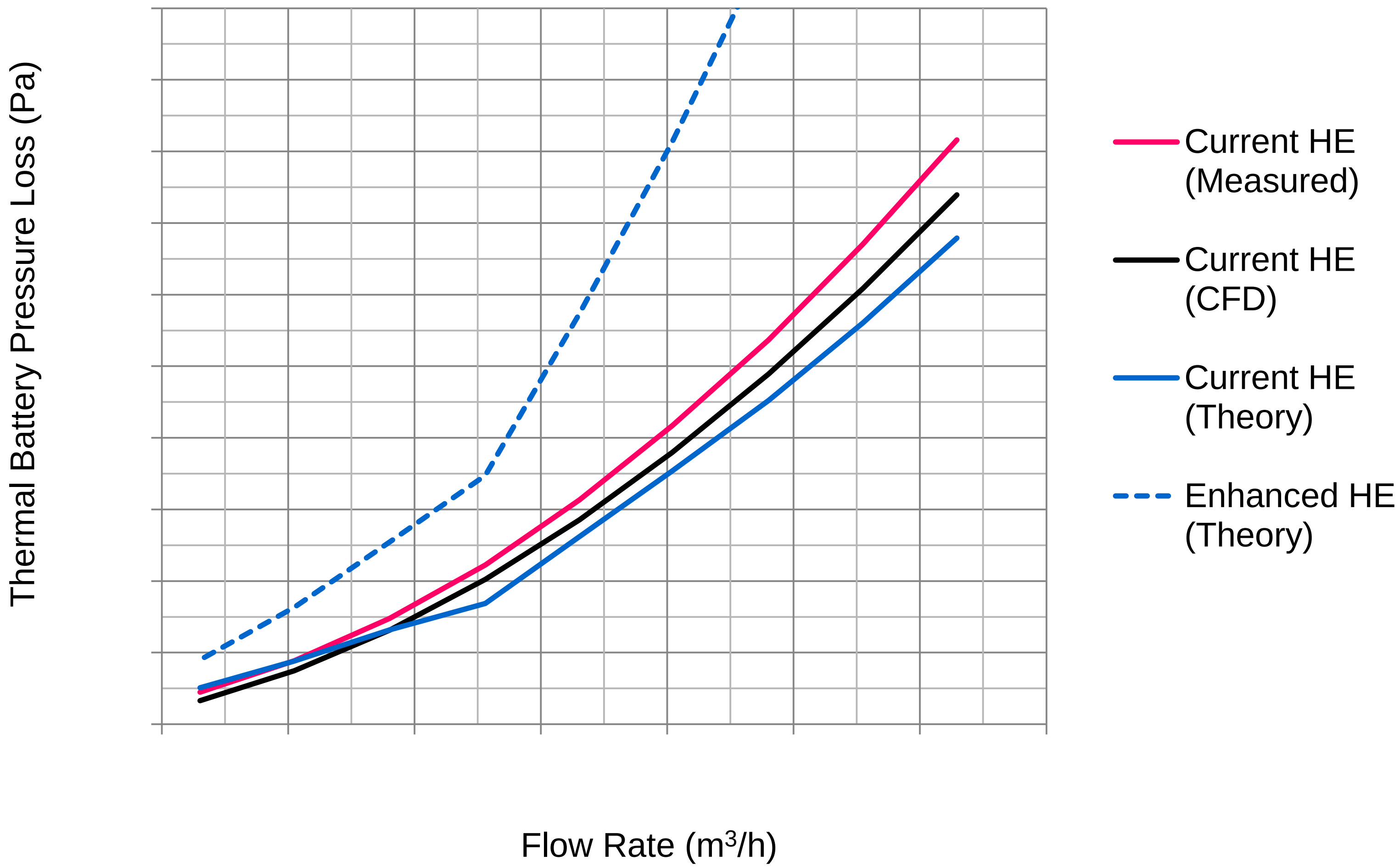

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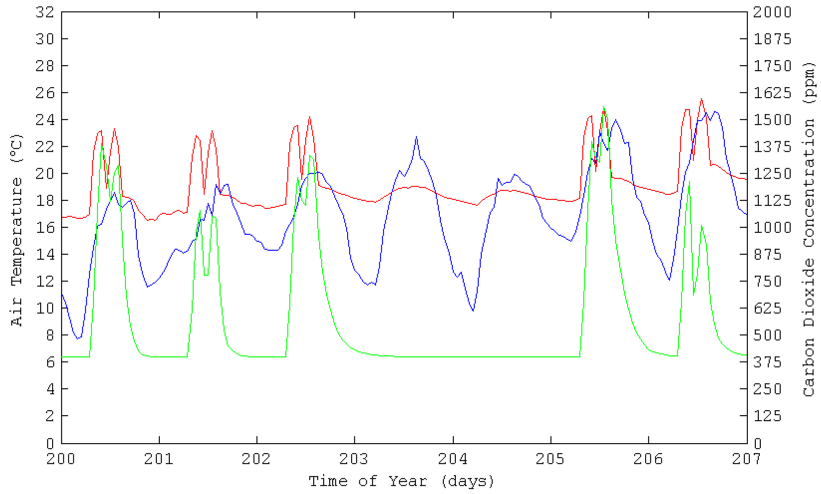

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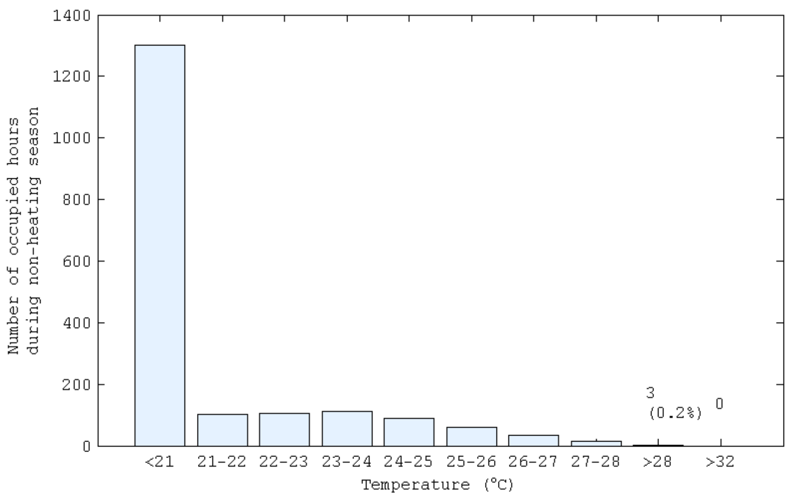


5. Dynamic modelling

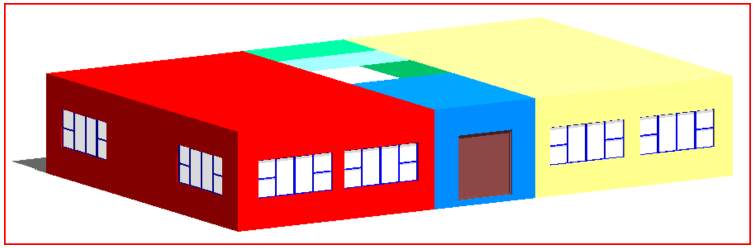
- Detailed modelling using analytical and numerical techniques
- Based on proven results and testing in the lab and on site

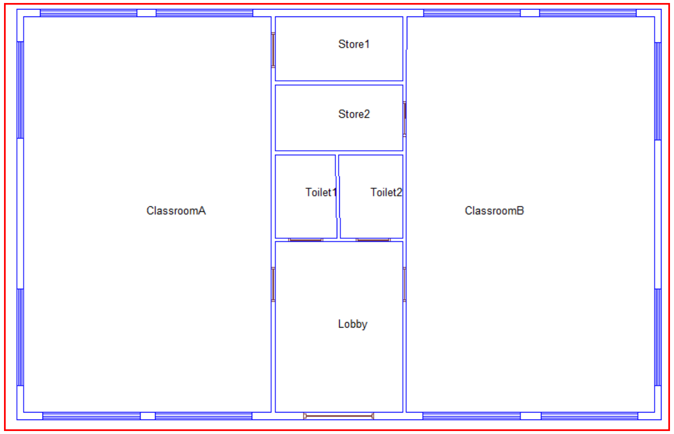
Allows creation of '**macro performance parameters**'

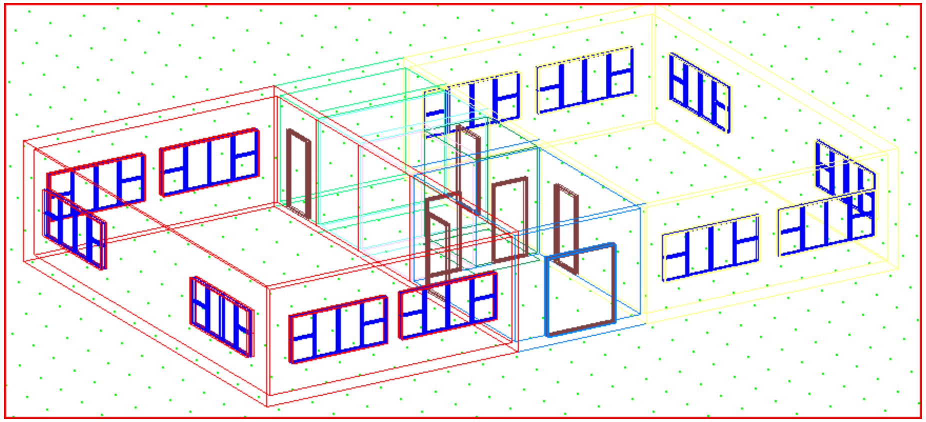
5. Dynamic modelling

Therefore you can model the system more easily…

… and complex models are not needed every time a room simulation is run







5. Dynamic modelling

Macro performance parameters:

- Relationships of system performance to variables, e.g. external temperature, CO_2…
- These variables can be used to control the performance of the system
- Simple physical and engineering relationships allow any system to be simulated
- System performance abstracted and reduced to ‘formula profiles’ in IES or control functions in TAS

5. Dynamic modelling

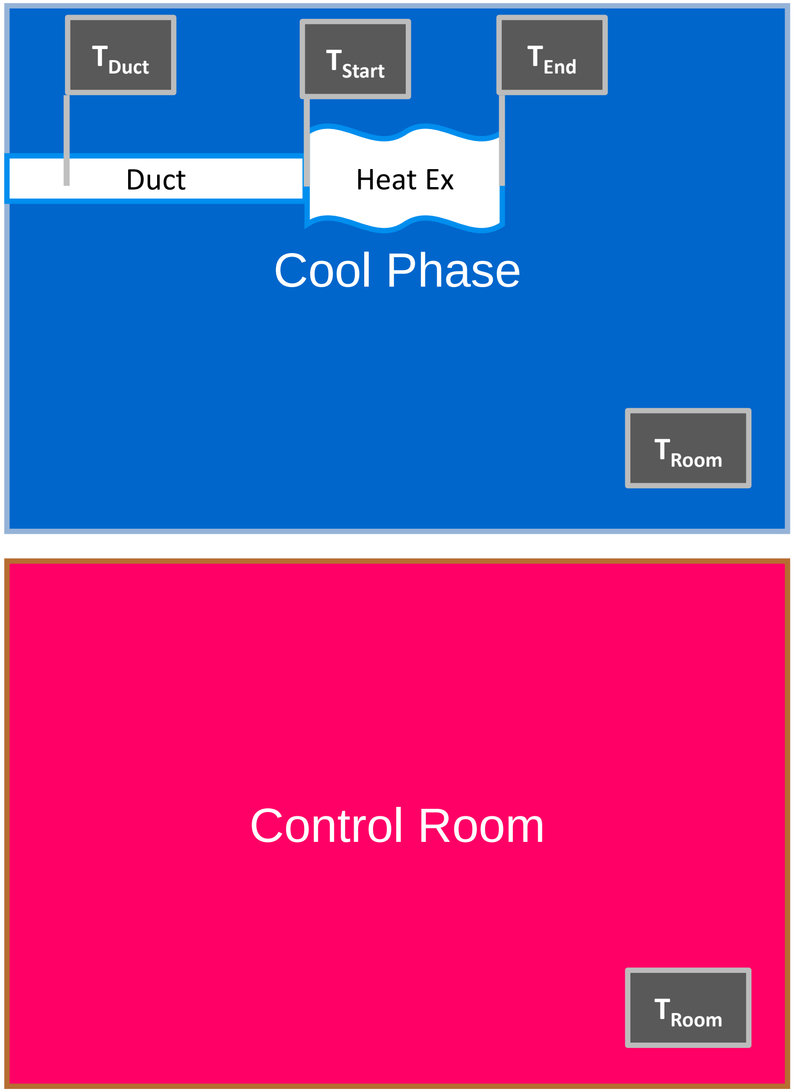
For example:

- On a very basic level we can use ‘building heat gain’ to charge and provide cooling
- Complexity can be added through the effects of internal temp, CO2, fan speed…
- By combining simple rules an accurate model and control strategy can be built up for a complex system.

External	Internal	Cooling	Cum. Cooling
26.5	30	0	0
28.8	25	4083.75	4083.75
30	25	3618.19	7701.94
30.7	25	3908.73	11610.67
31.6	25	4079.65	15690.32
31.8	30..	279.3	16000

Verification

- Data logging
- Lab tests
- Comparison to other systems



6. Workspace case study

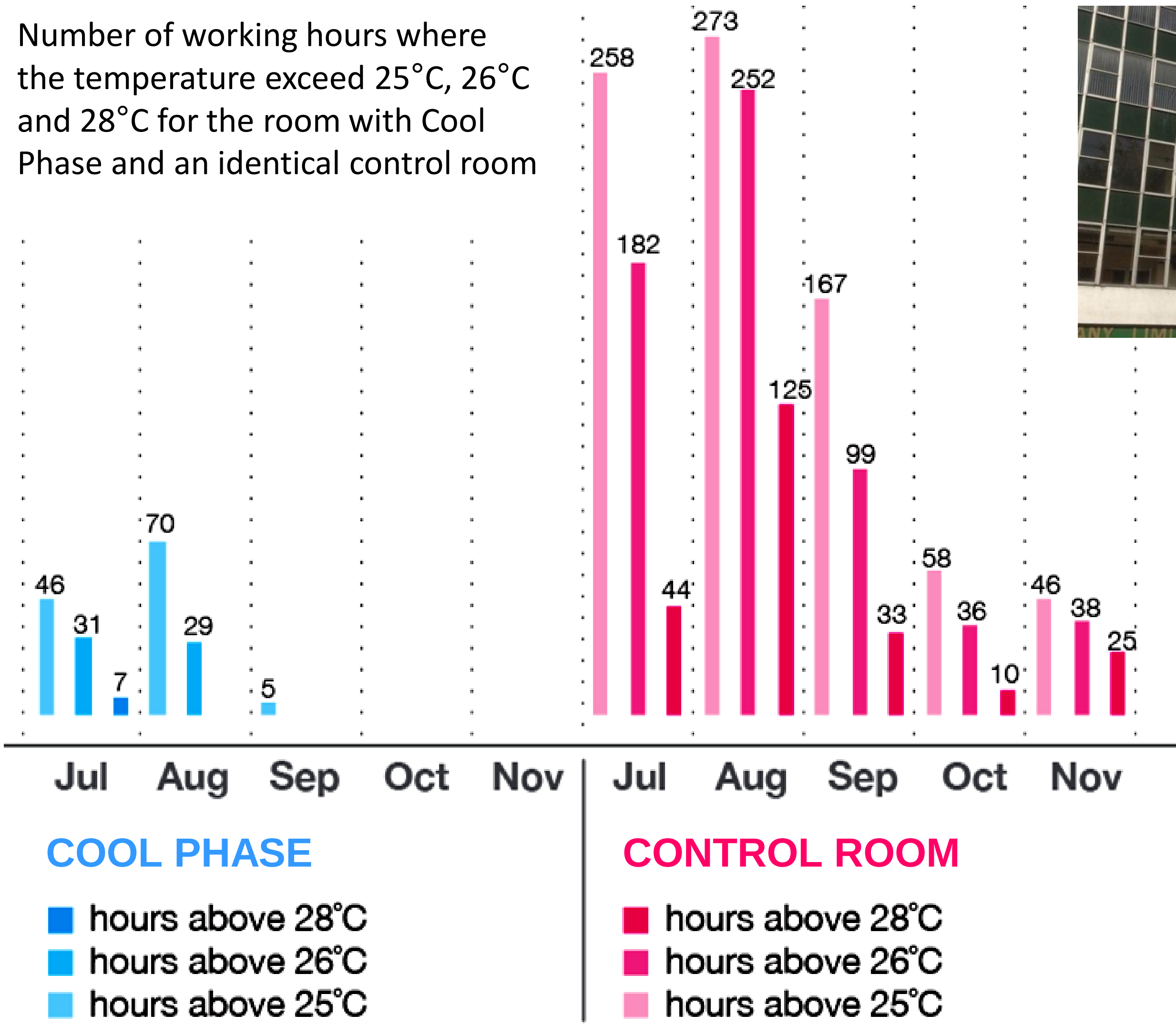
Workspace PLC:

- ~ 125 properties within M25
- ~ 700,000 m2 rentable floor space
- Serviced offices and light industrial units
- ‘Secondary’ locations
- £70m turnover (2009)

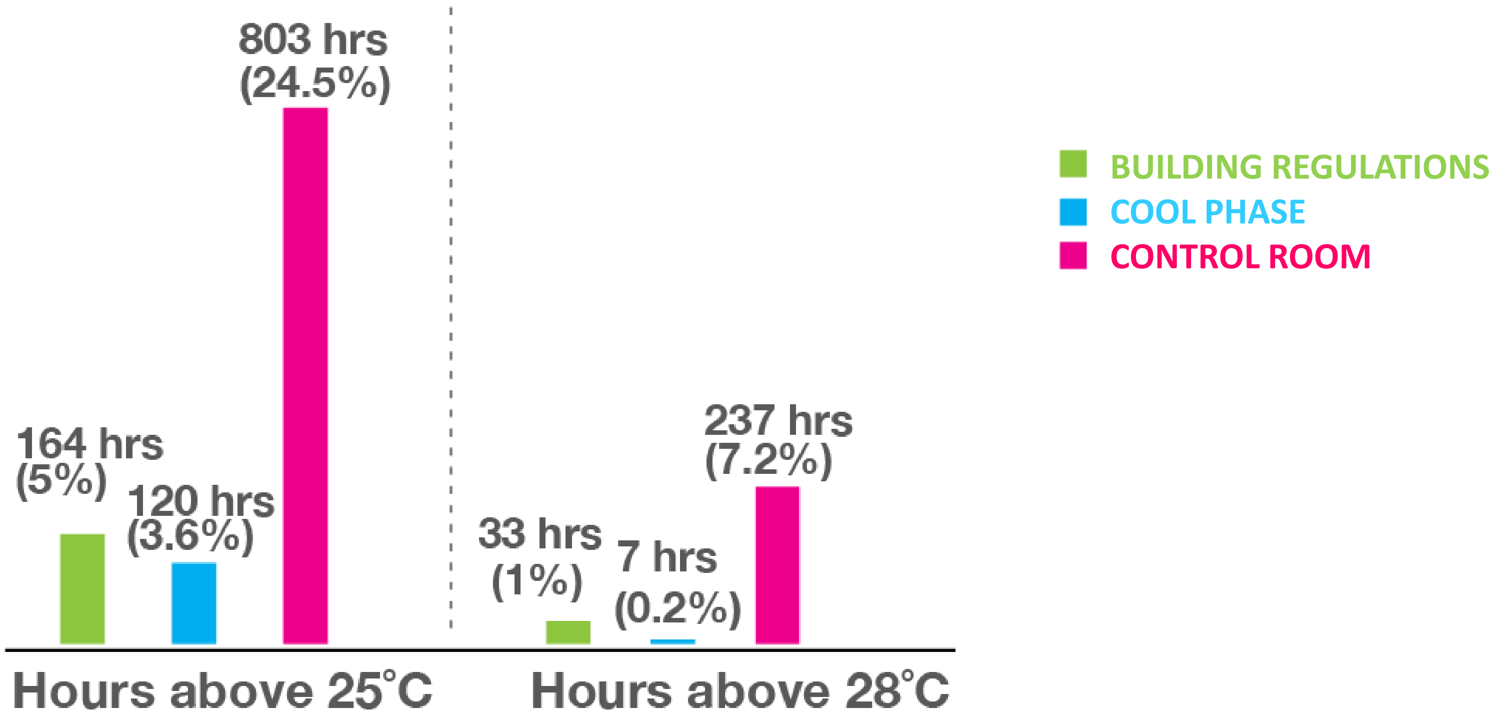
Workspace Group

6. Workspace case study

Number of working hours where the temperature exceed 25°C, 26°C and 28°C for the room with Cool Phase and an identical control room



6. Workspace case study



- The peak summer temperatures were reduced by an average of **5˚C**
- Energy usage was reduced by **86%** over 6 months
- Air quality was noticeably improved

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