Energy in Buildings

The Convergent Imperatives of BEM and BIM

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PhD - The Integration of Architectural Design and Energy Modelling Software

Supervisors

Robin Laney

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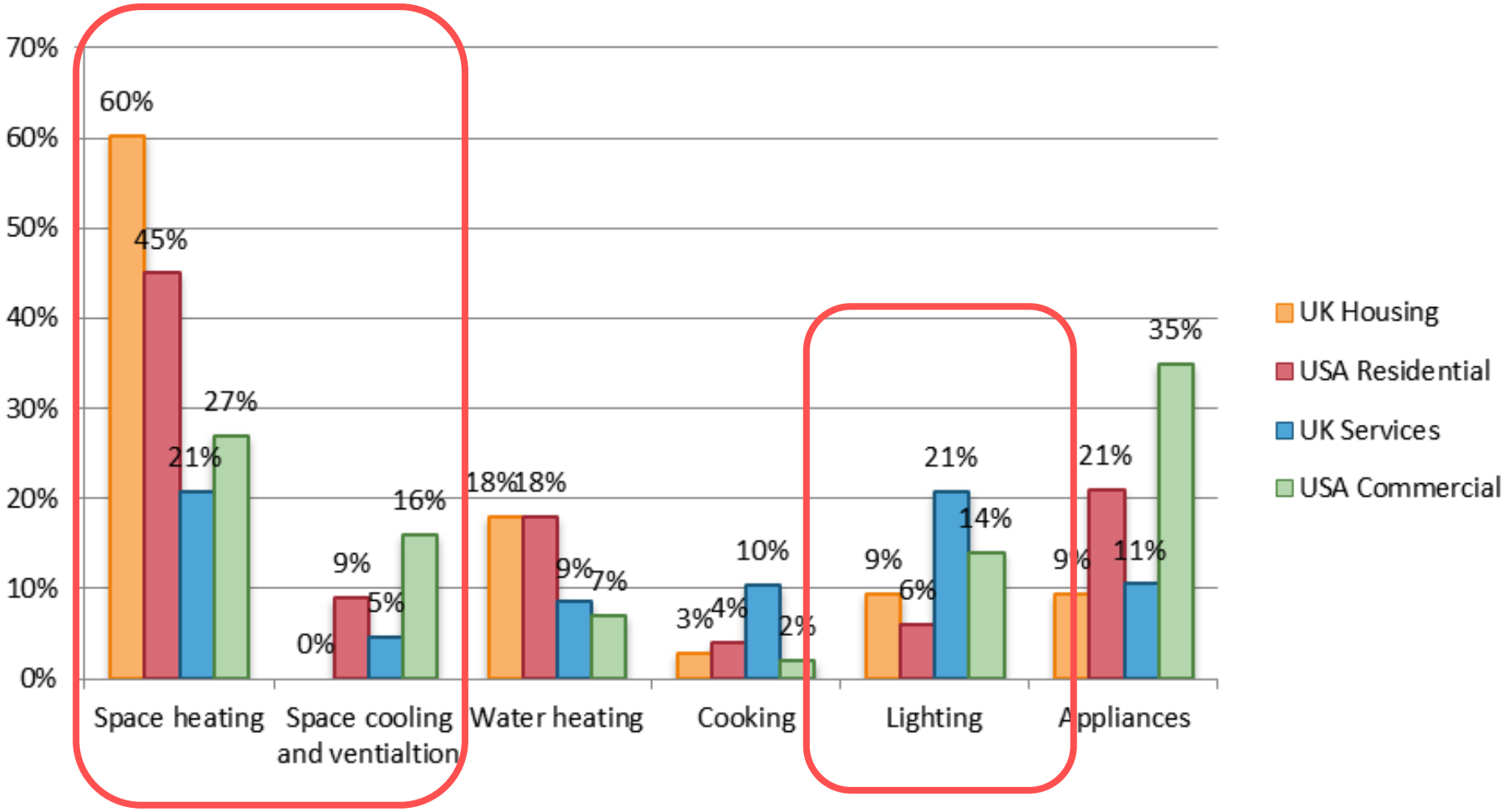
Transdisciplinary research

- Define BEM
  - Building Energy Modelling
- Define BIM
  - Building Information Modelling
- Government policies
- Outline a concept for new software to combine the modelling approaches to enhance energy efficient design

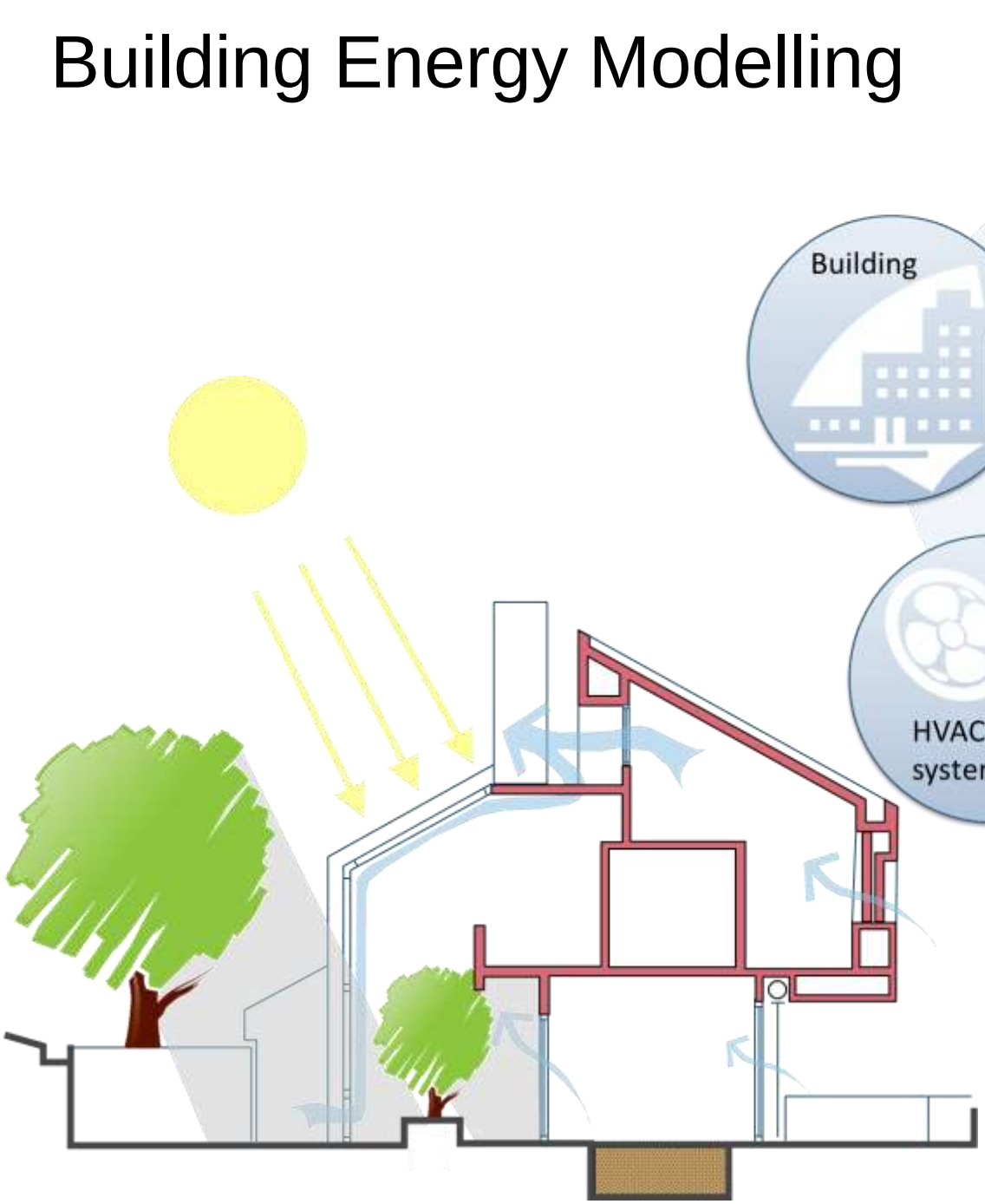
Outline

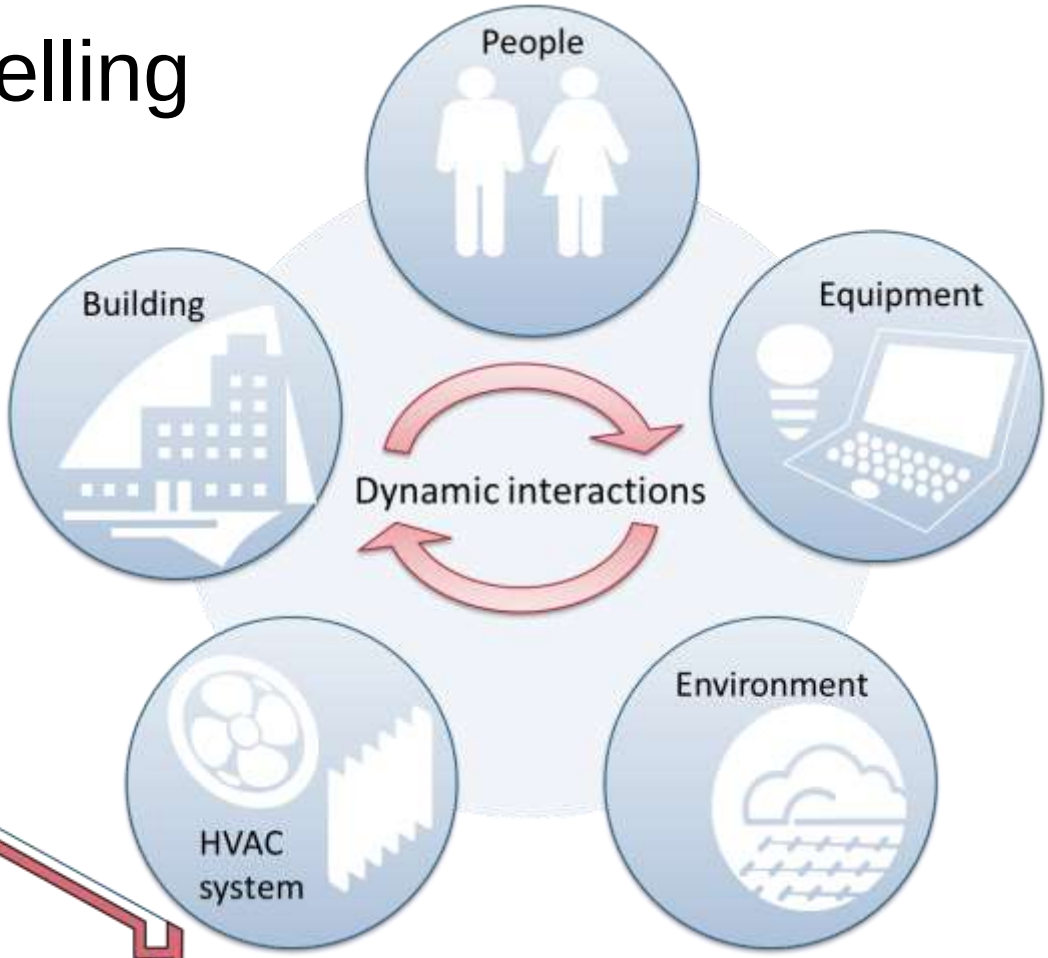
Patterns of energy consumption for buildings in the UK and USA in 2011



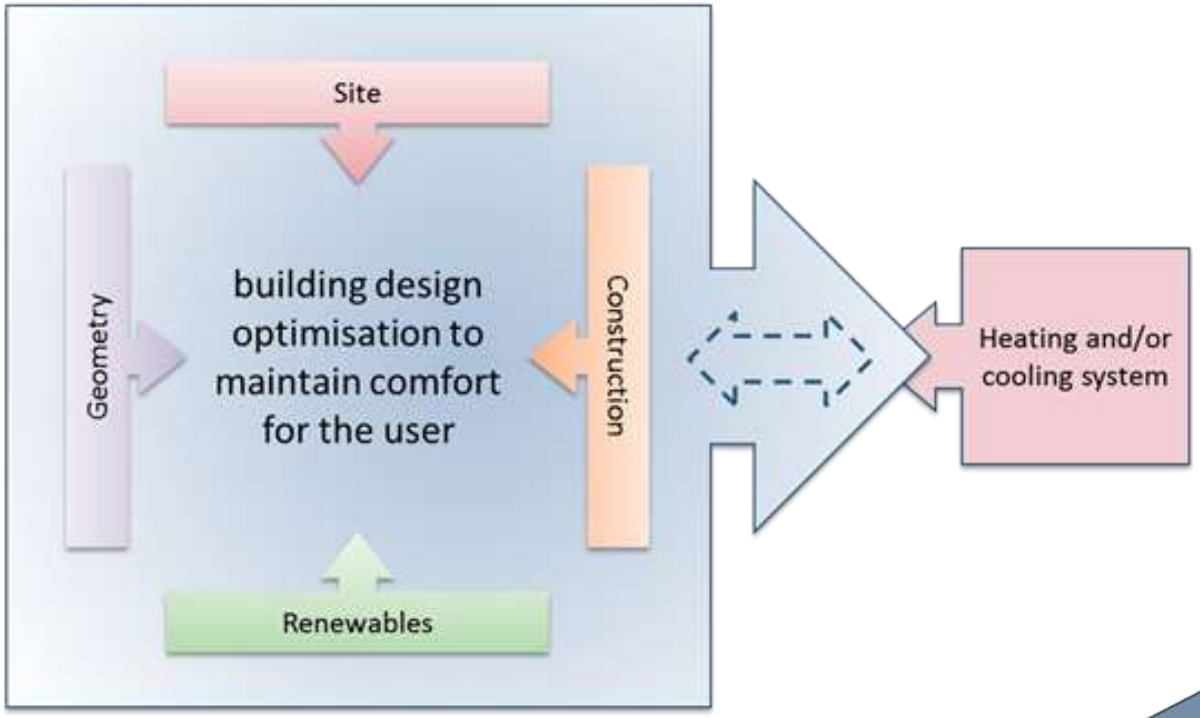
Energy and Buildings

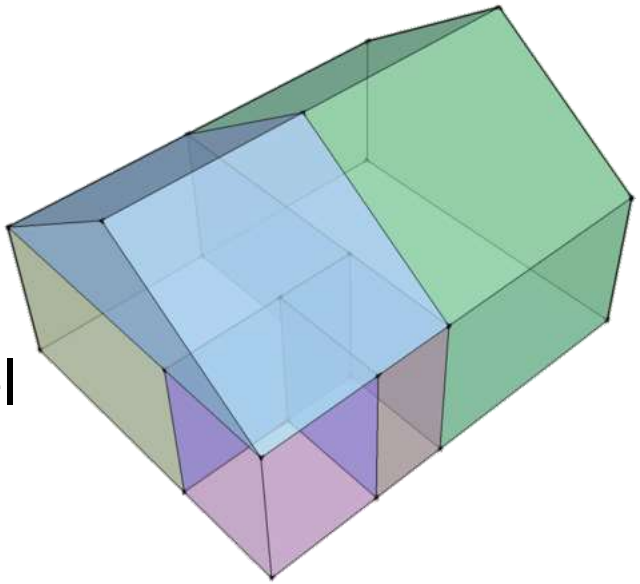
Building Energy Modelling





Building Energy Modelling Optimisation



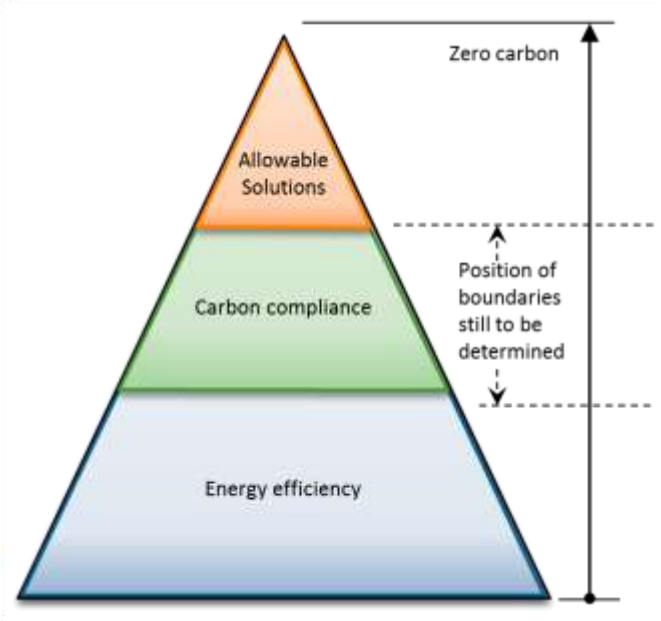


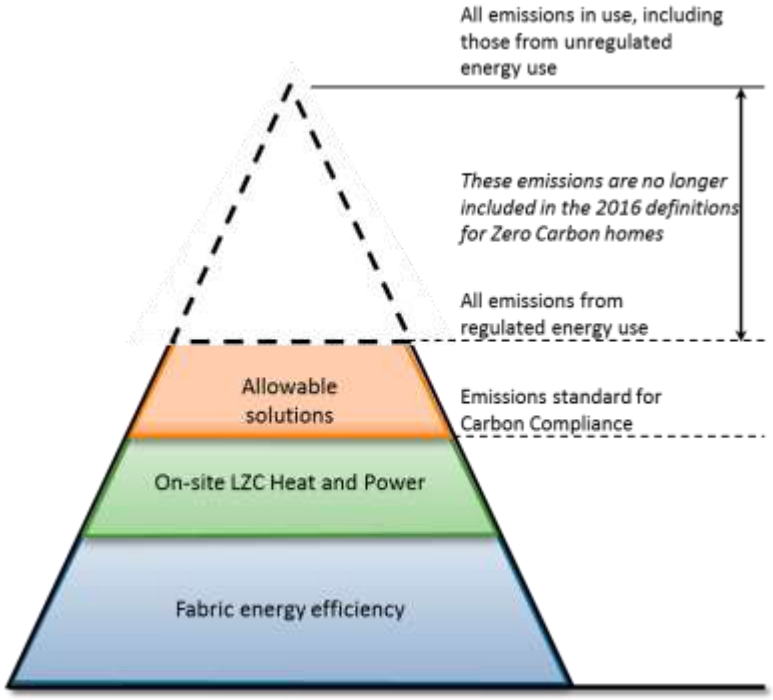
Simplified model

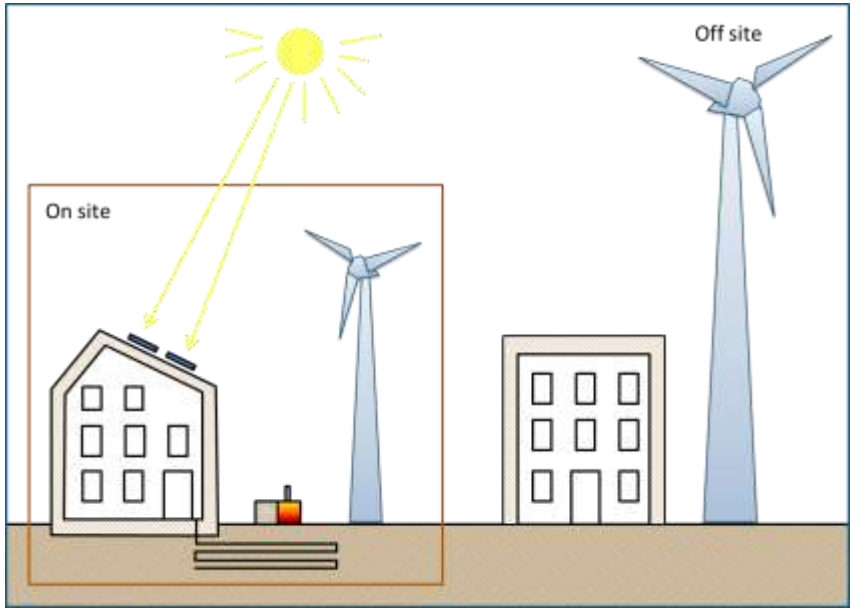
Zones

Zero thickness surfaces

Zero carbon policy

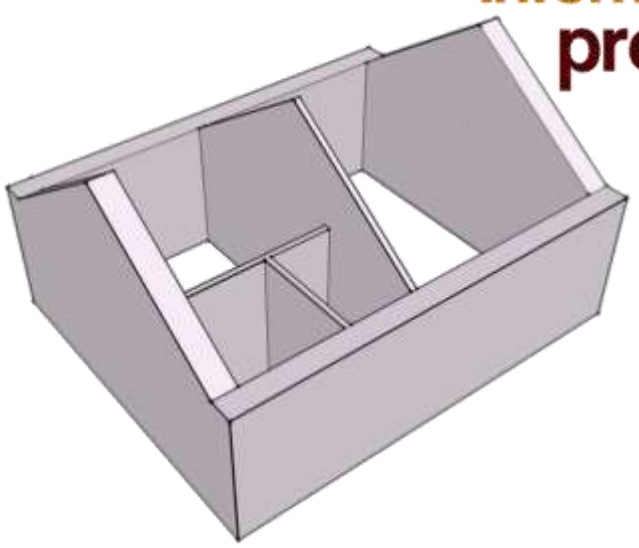


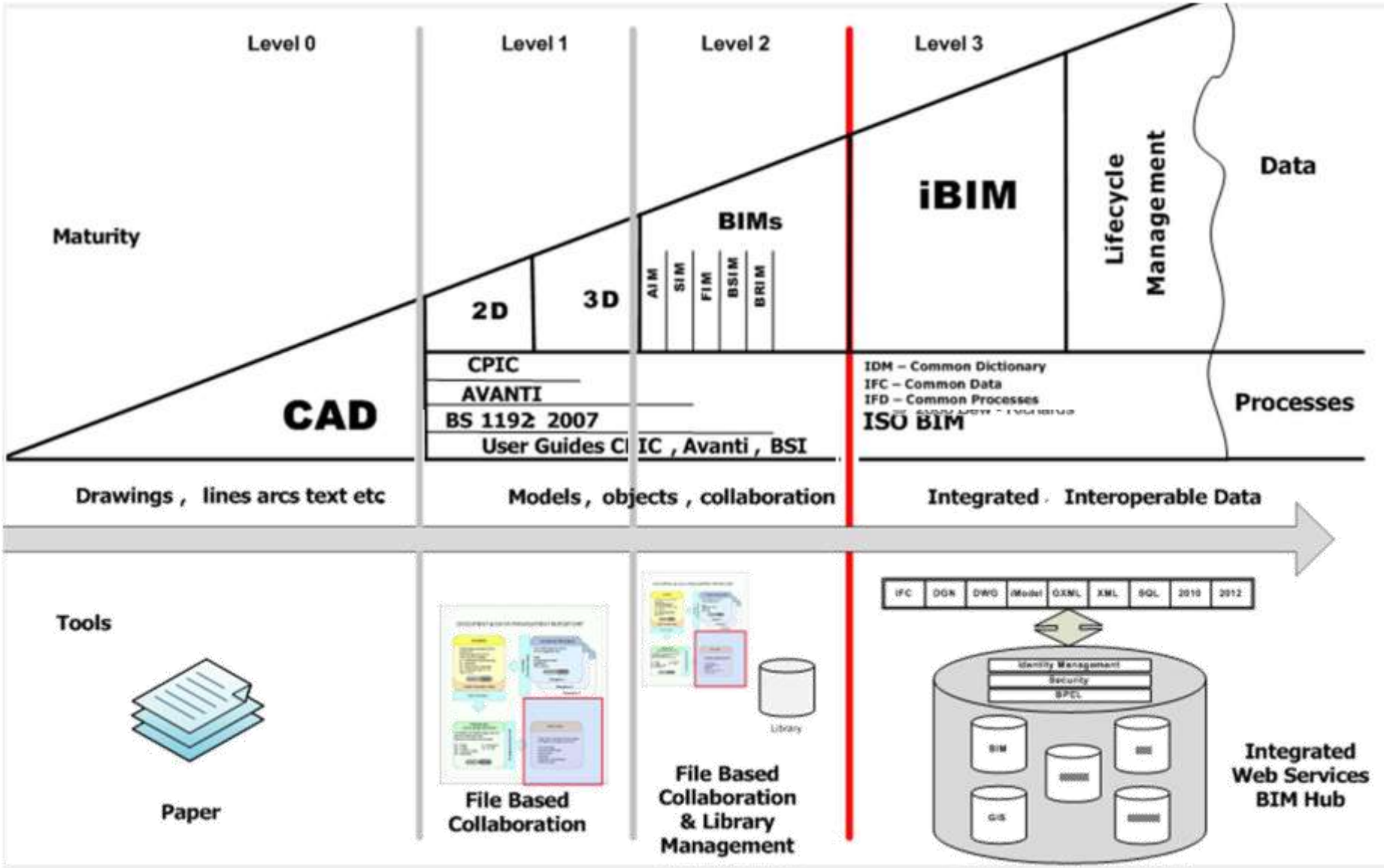




“Government as a client can derive significant improvements in cost, value and carbon performance through the use of open sharable asset information”

Mark Bew. Chairman HMG BIM Working Group





95% produce 2D drawings lacking coordination, increasing costs by 25% through waste and reworking

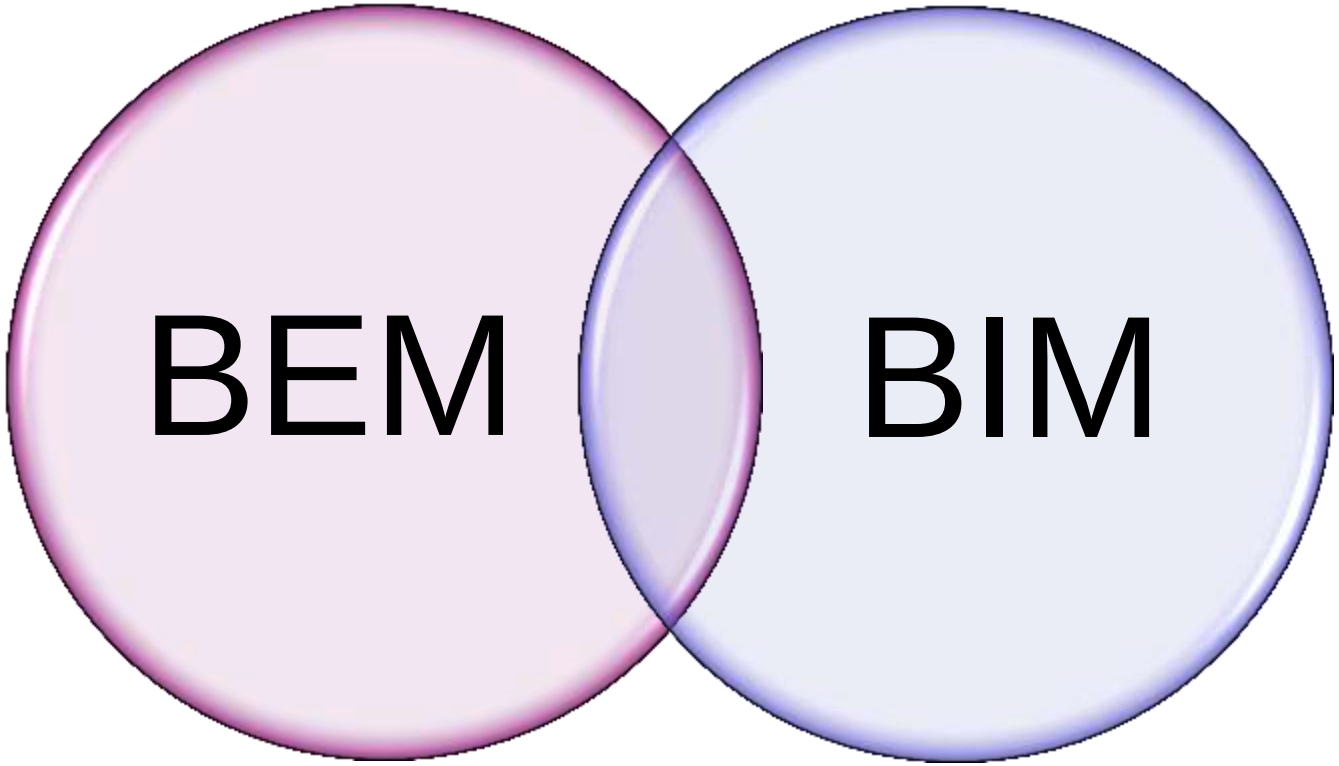
2D and 3D spatial coordination based on BS 1192:2007 has the potential to remove error and reduce waste by 50%. Implementation of the PAS 1192-2:2013 has the potential to reduce project cost by 20%

A fully integrated and interoperable BIM has the potential to mitigate risk throughout the process and to increase profit by +20% through a collaborative process

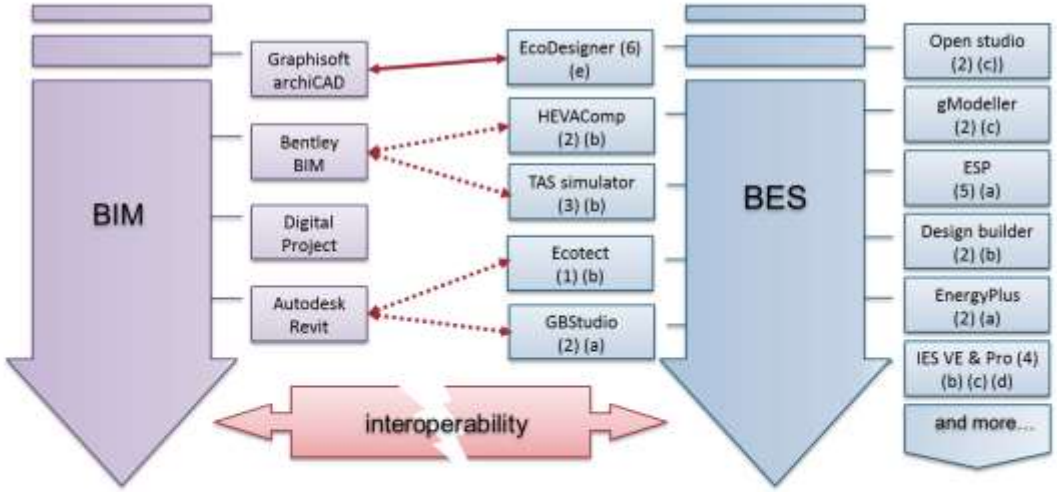
2008 the Government announced an ambition for new buildings to be Zero Carbon

- 2016 houses
- 2016 schools
- 2018 public buildings
- 2019 all buildings

2011 the Government announced the intention to require collaborative 3D BIM (with all project and asset information, documentation and data being electronic) on its projects by 2016




CAY
113

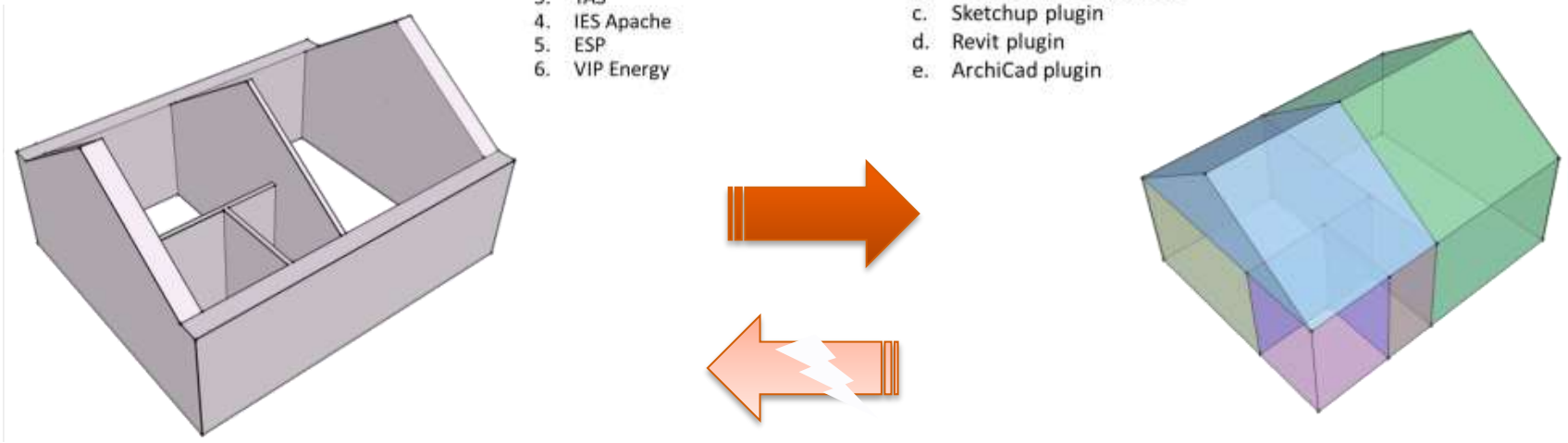


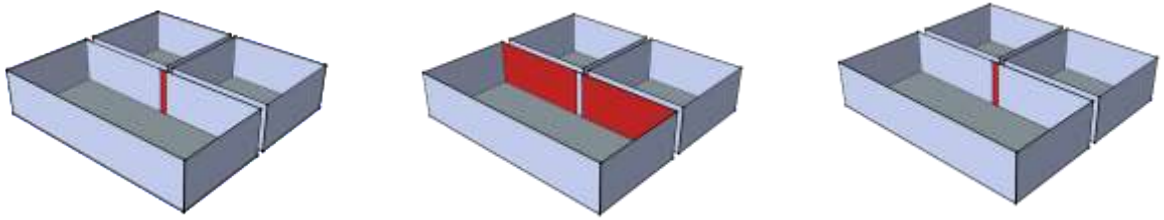
Thermal engine

1. Admittance method
2. Energy plus
3. TAS
4. IES Apache
5. ESP
6. VIP Energy

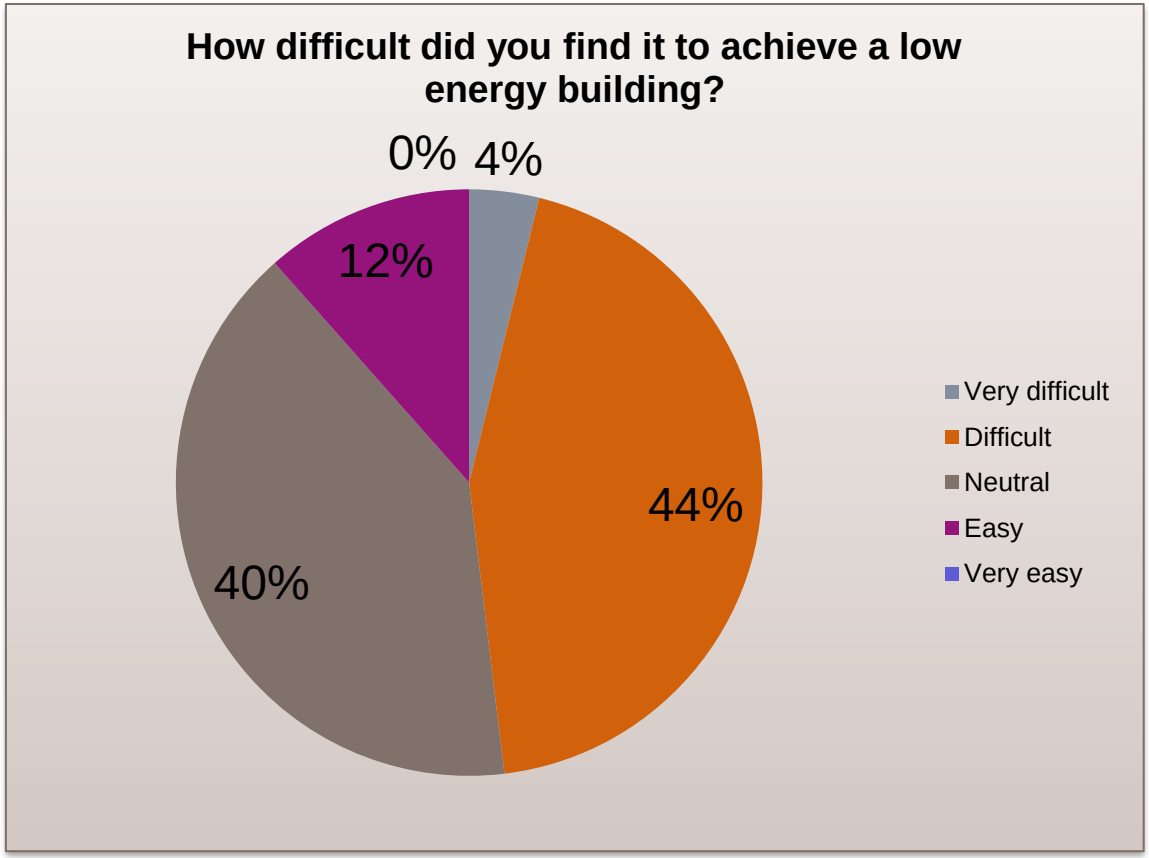
Interface

a. Text input
b. Proprietary 3D interface
c. Sketchup plugin
d. Revit plugin
e. ArchiCad plugin





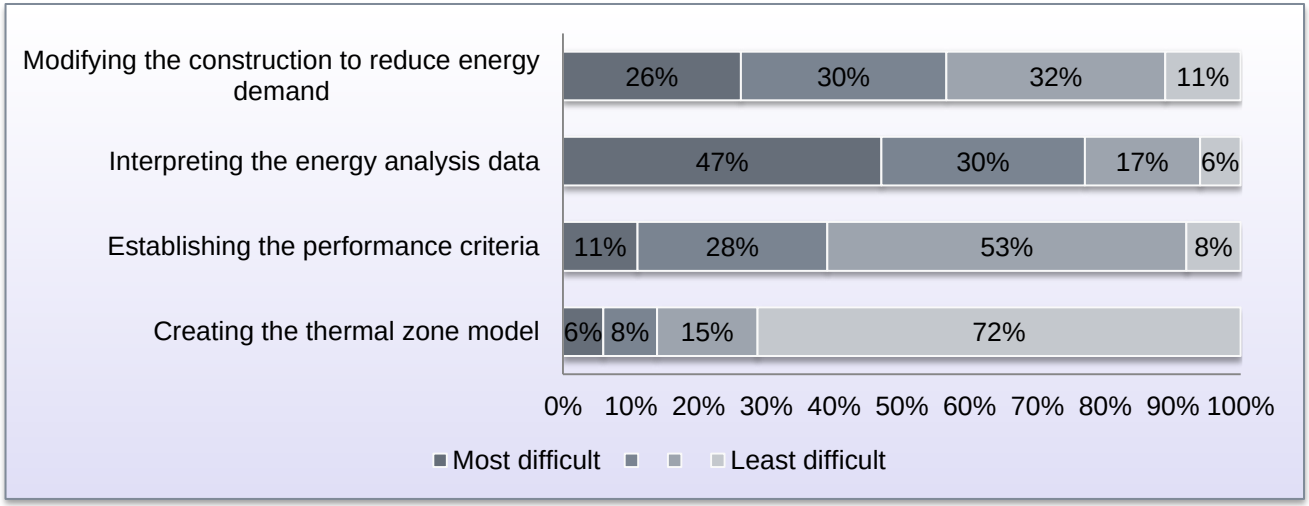
Knowledge demands



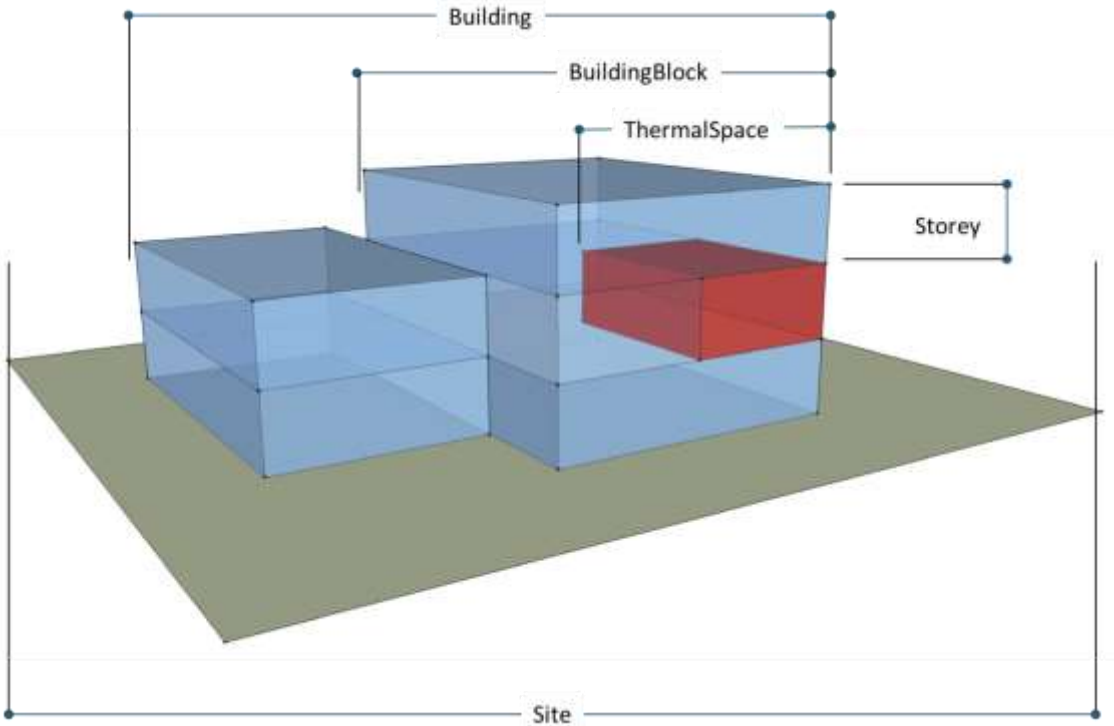
Student case study

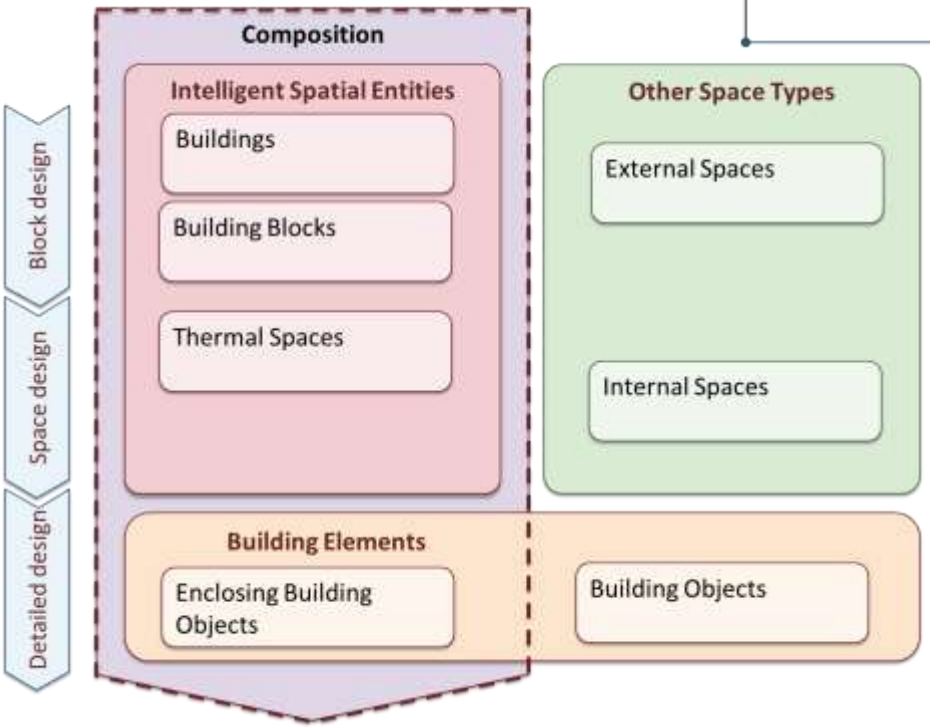
Model a low energy building

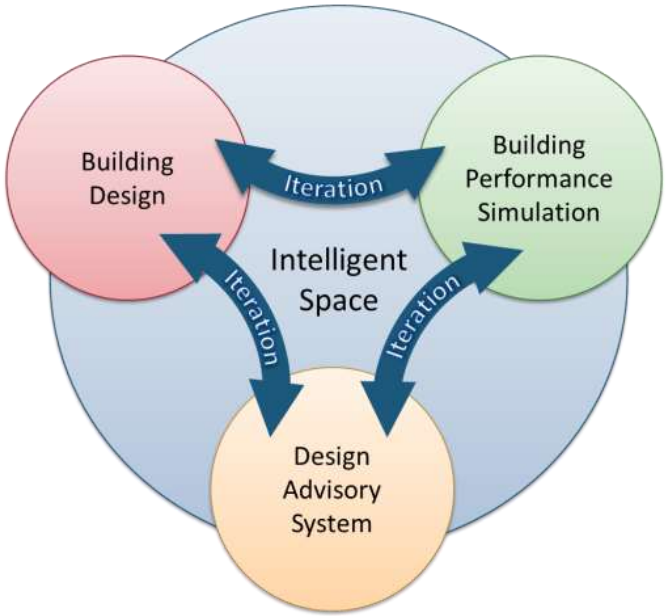
Working with energy data

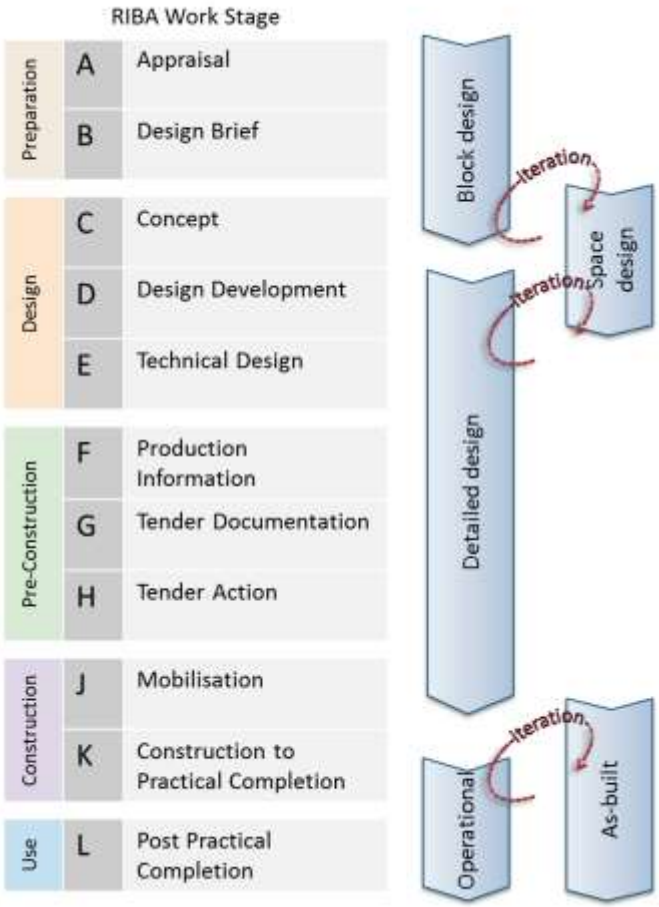


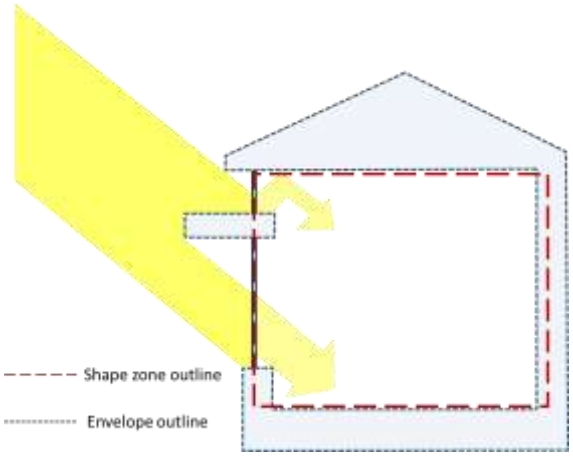
Intelligent Spaces would be abstract volumes, enclosed by zero thickness surfaces, which have data and rules attached

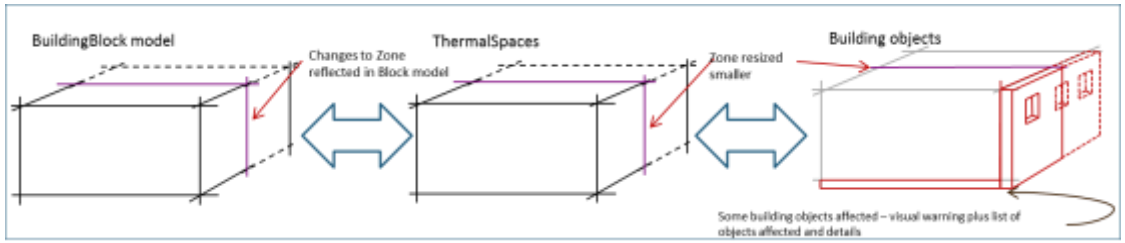


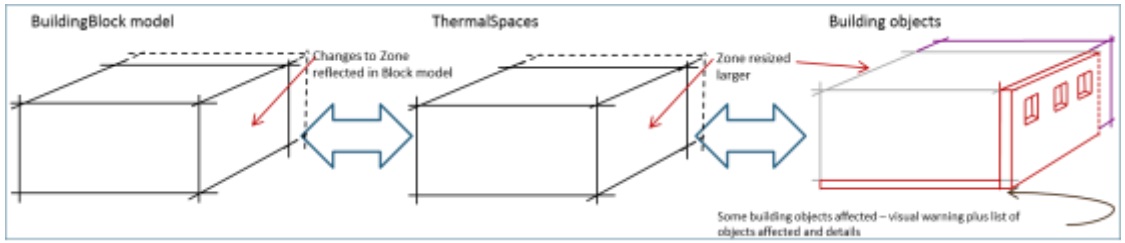





RIBA Work Stage
Preparation
A Appraisal
B Design Brief
Design
C Concept
D Design Development
E Technical Design
Pre-Construction
F Production Information
G Tender Documentation
H Tender Action
Construction
J Mobilisation
K Construction to Practical Completion
Use
L Post Practical Completion
Block design
Iteration
Space design
Iteration
Detailed design
Iteration
Operational
As-built


Shape zone outline
Envelope outline


BuildingBlock model
Changes to Zone reflected in Block model
ThermalSpaces
Zone resized smaller
Building objects
Some building objects affected – visual warning plus list of objects affected and details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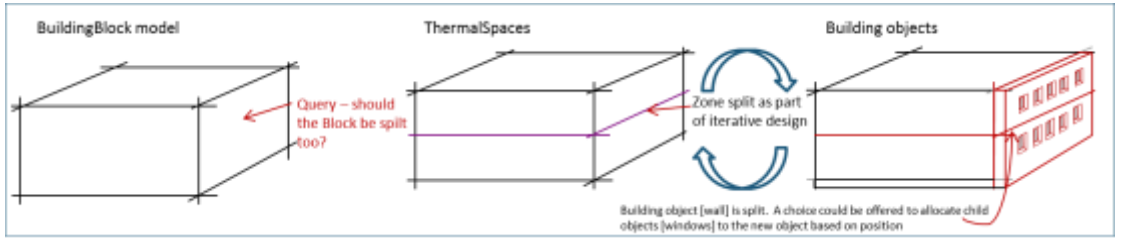
BuildingBlock model
Query – should the Block be split too?
ThermalSpaces
Zone split as part of iterative design
Building objects
Building object [wall] is split. A choice could be offered to allocate child objects [windows] to the new object based on position

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Questions?

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