

# The Role of Thermal Modelling In the Design Process

30<sup>th</sup> September 2009

Peter A. Brown CEng MBA

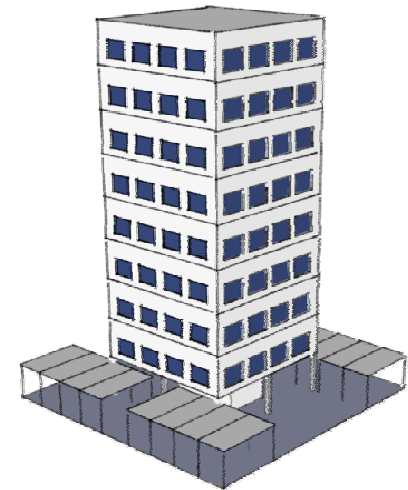
# Introduction

## The Importance of Modelling:

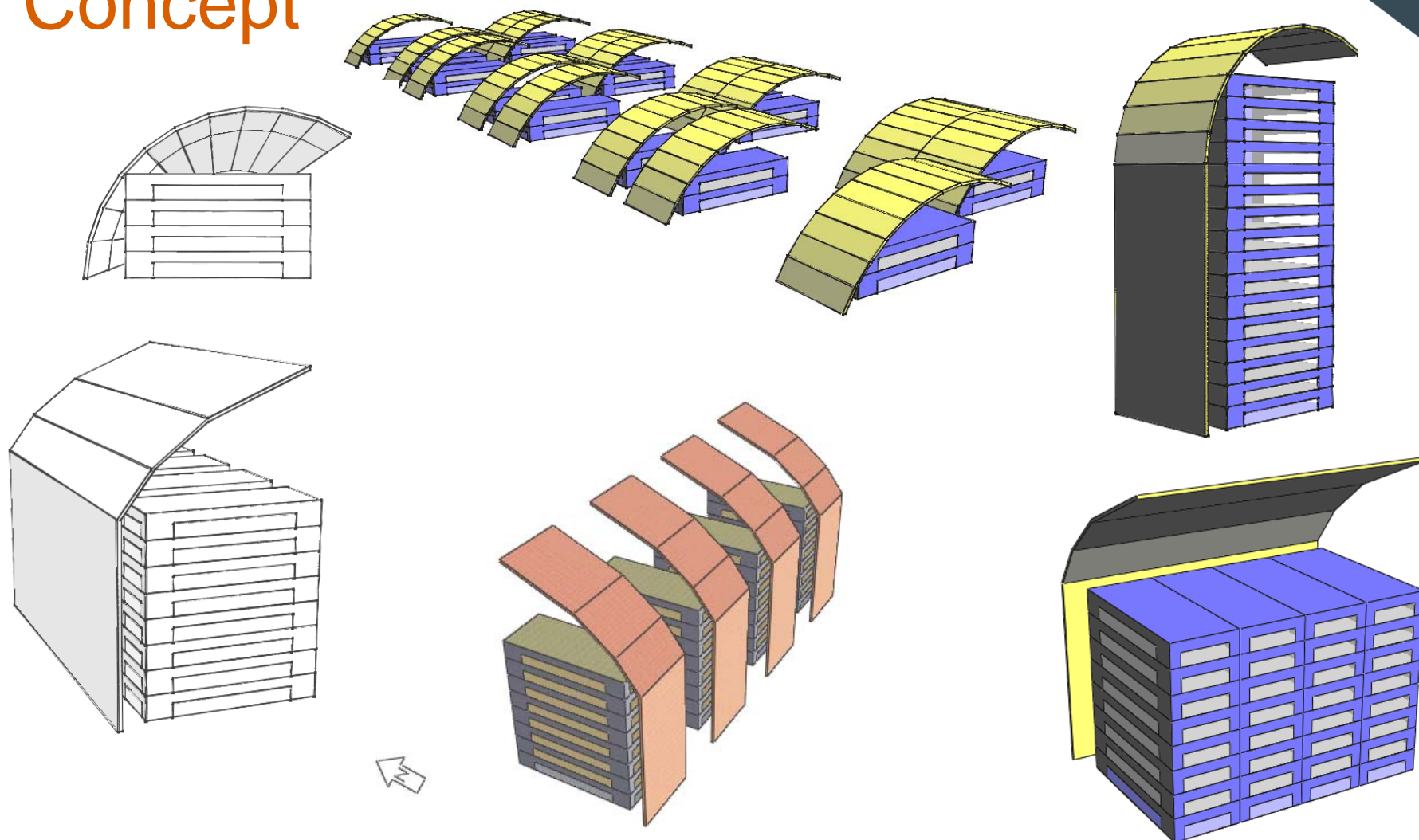
- Relative Measurement - Design Options and Features
- Assumptions - INCLUDING THE WEATHER!
- New Build & Refurbishment
- Technical / Client Requirements
- Carbon Critical Design
- Evolving Design Process

# Concept Design

- Crude Load Analysis
- Options
  - Form, Layout, Orientation & Servicing Strategies
- Metrics:
  - Peak Plant Load, Daylighting & Energy Consumption
  - Capital and Whole Life Cost
  - Carbon
- Impact of Structure (Thermal Mass)
- Façade Design and Shading
- Specific Requirements
- Developing an Energy Strategy, e.g. to Include Renewables



# Case Study 1 - Bahrain Residential Concept

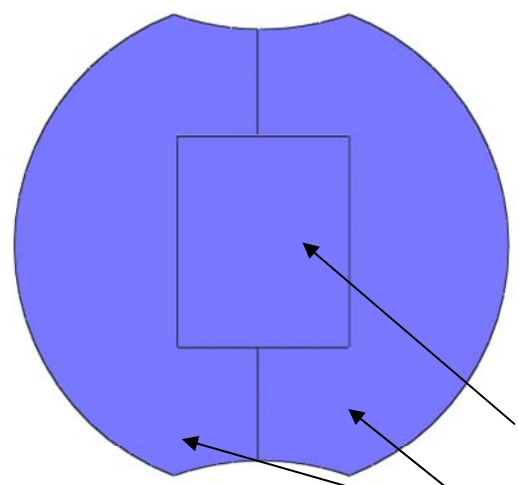


# Scheme Design

- Plant Loads for Central Plant and Main Service Sizing
  - Dynamic Analysis
  - Steady State Analysis
- Analysis of Façade and Shading
  - Thermal
  - Daylighting
- Compliance / Design Requirements Checks

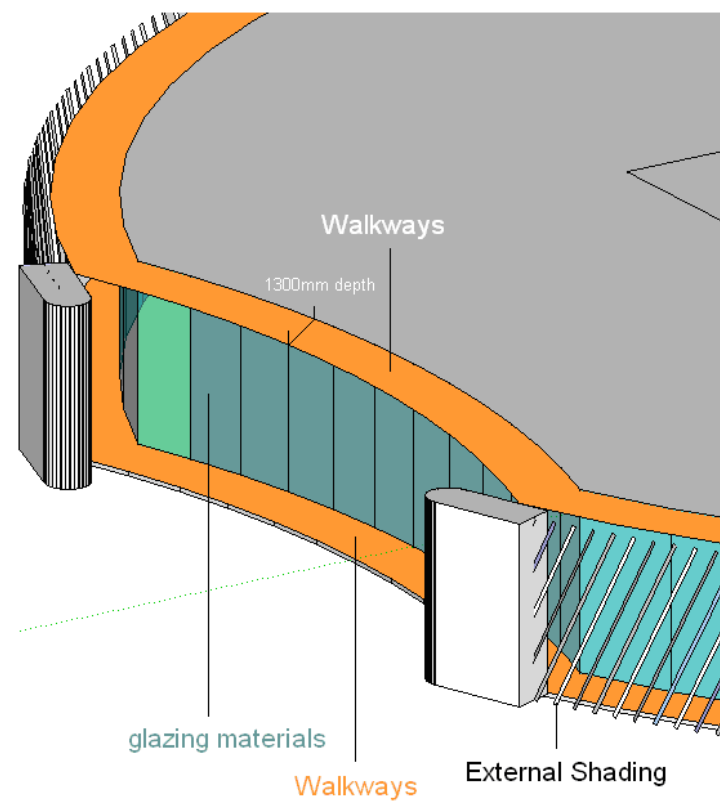
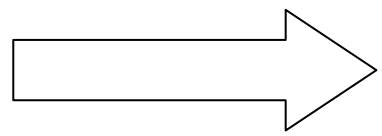
# Case Study 2 – Office Block N. Africa, Scheme Design

Typical Mid – Level  
Office Plan



Core

Lettable Office Space



Walkways

1300mm depth

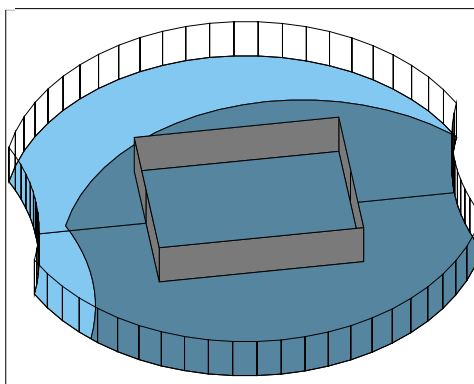
glazing materials

Walkways

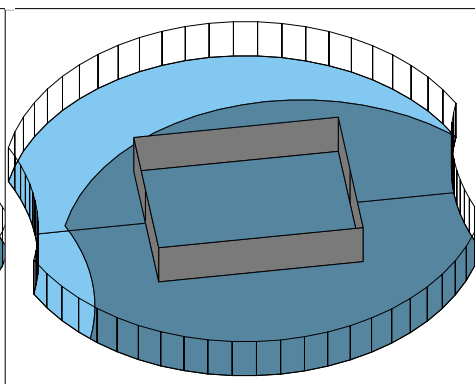
External Shading

# Case Study 2 – Office Block N. Africa, Scheme Design

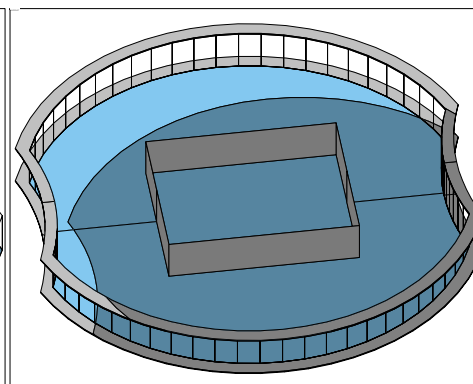
Standard Glazing



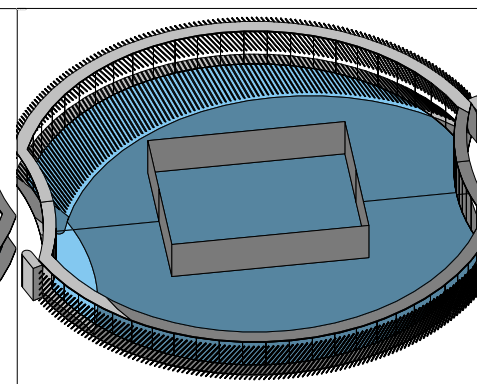
Improved Glazing



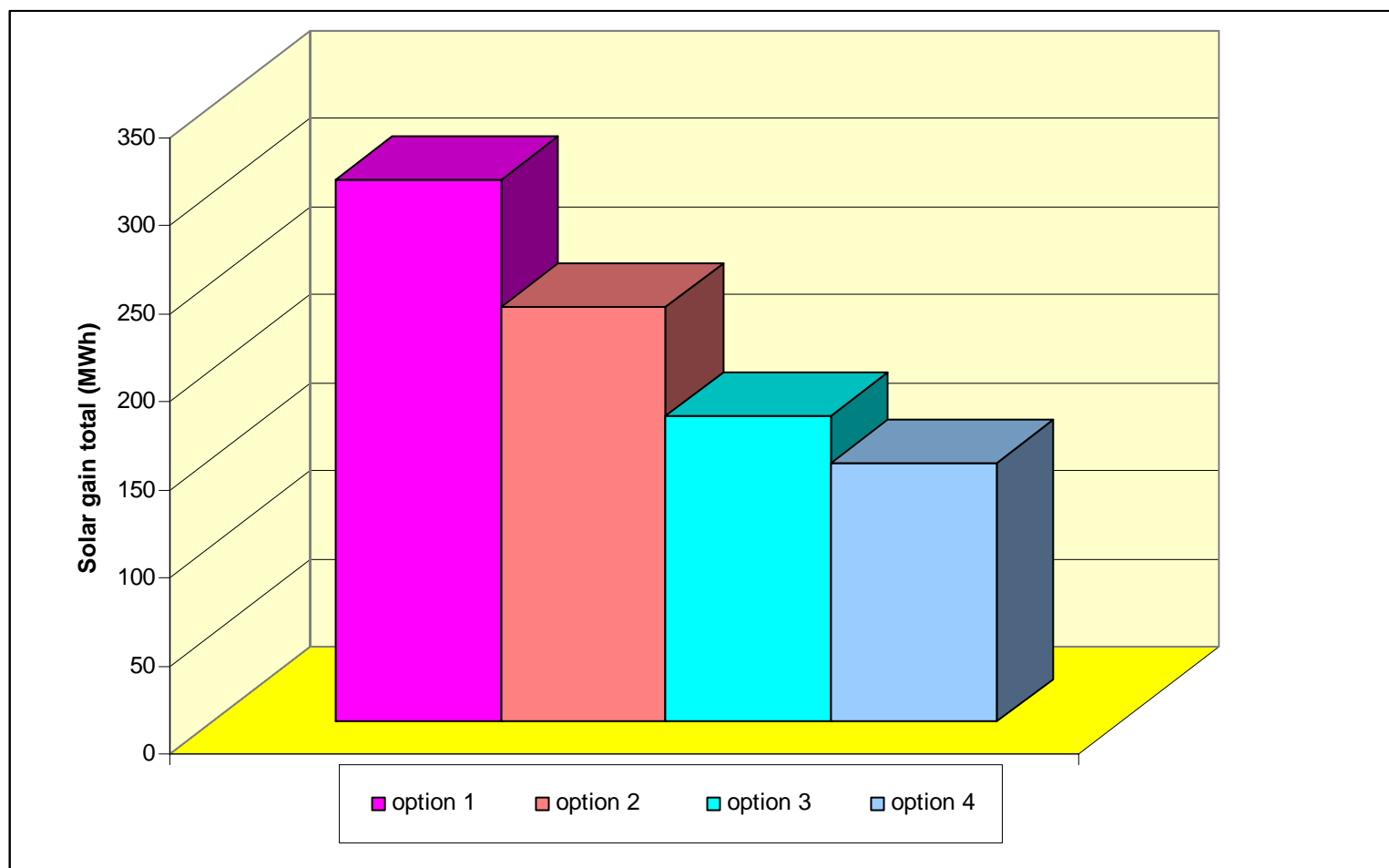
Added Walkway



Added Shading



# Case Study 2 – Office Block N. Africa, Scheme Design





# Detailed Design

- Detailed Load Analysis
  - Complex Studies e.g. Atria
- Natural Ventilation Analyses
  - Air Flow Rates, IAQ, Overheating
- Plant, Unit and Service Sizing
- Daylighting Factors
- Compliance Calculations
  - Part L Criteria 1 & 3
  - BB101
  - EPC's
  - Required for Part L 2010

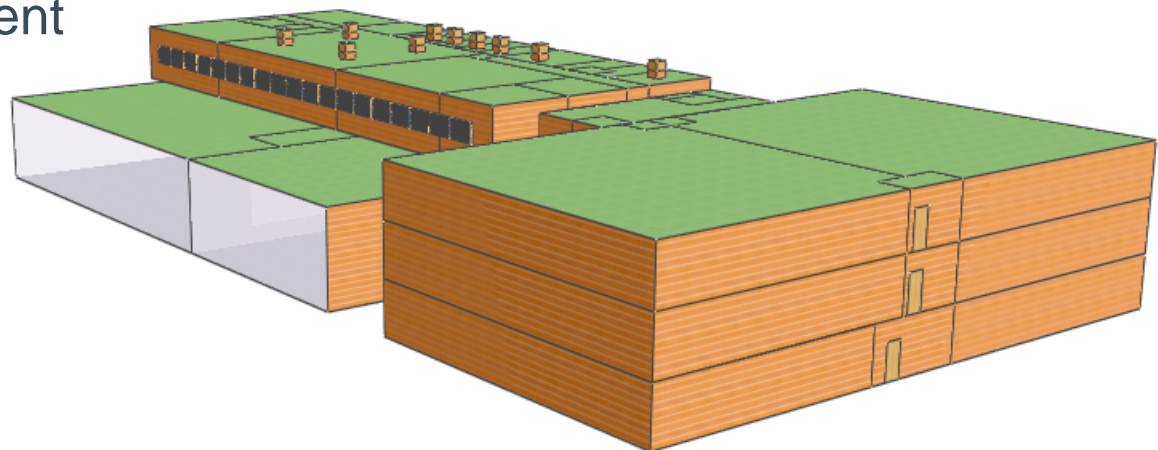




# Technical Compliance

## Case Study 4 - Historic Records Centre

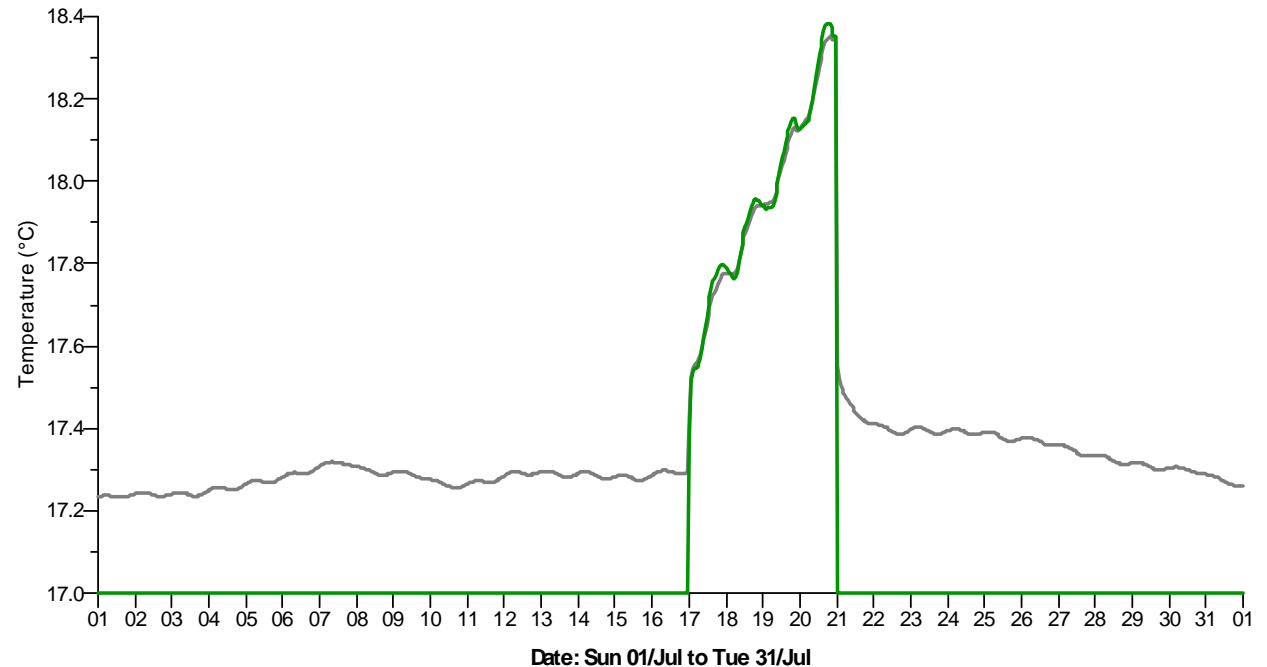
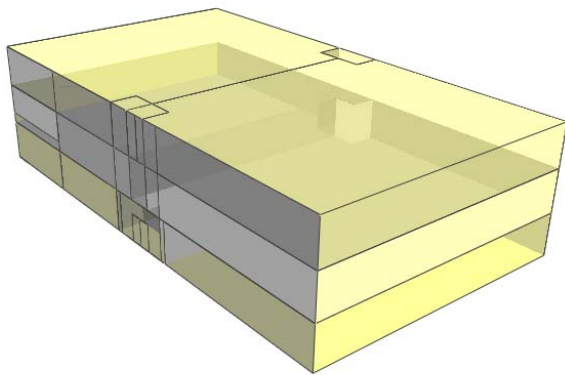
- One Model, Specific Requirements at Concept Stage
  - Dynamic Load Analysis
  - Plant Loads
  - Thermal Retention / BS5454 Compliant
  - Carbon Critical / Part L Benchmark
  - Daylighting Assessment



# Technical Compliance

## Case Study 4 - Historic Records Centre

- Thermal Retention, 17°C Set point, Turned Plant “Off” for 5 Days
- 18°C After 2 Days
- Peak Temperature:
  - 18.35°C DRT
  - 18.38°C Air



# Carbon Critical Design

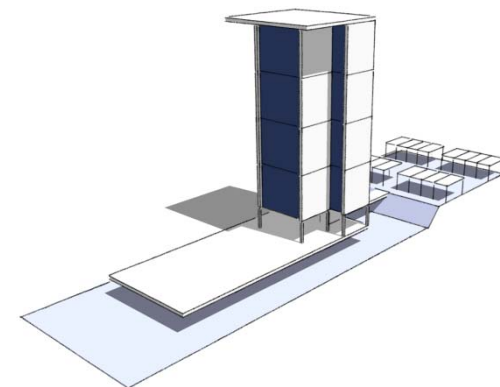
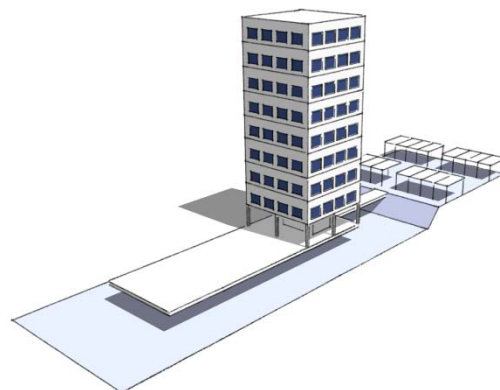
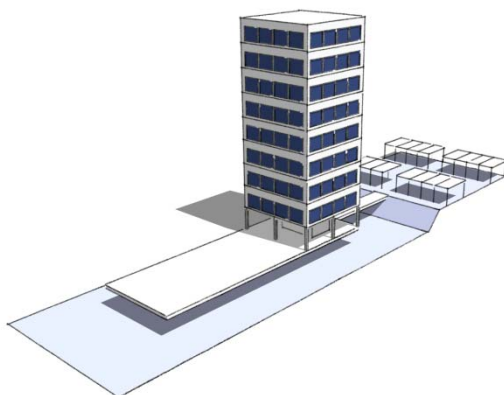
Using Carbon as a Design Factor, Equivalent to Time,  
Cost, CDM and H&S



# Carbon Critical Design

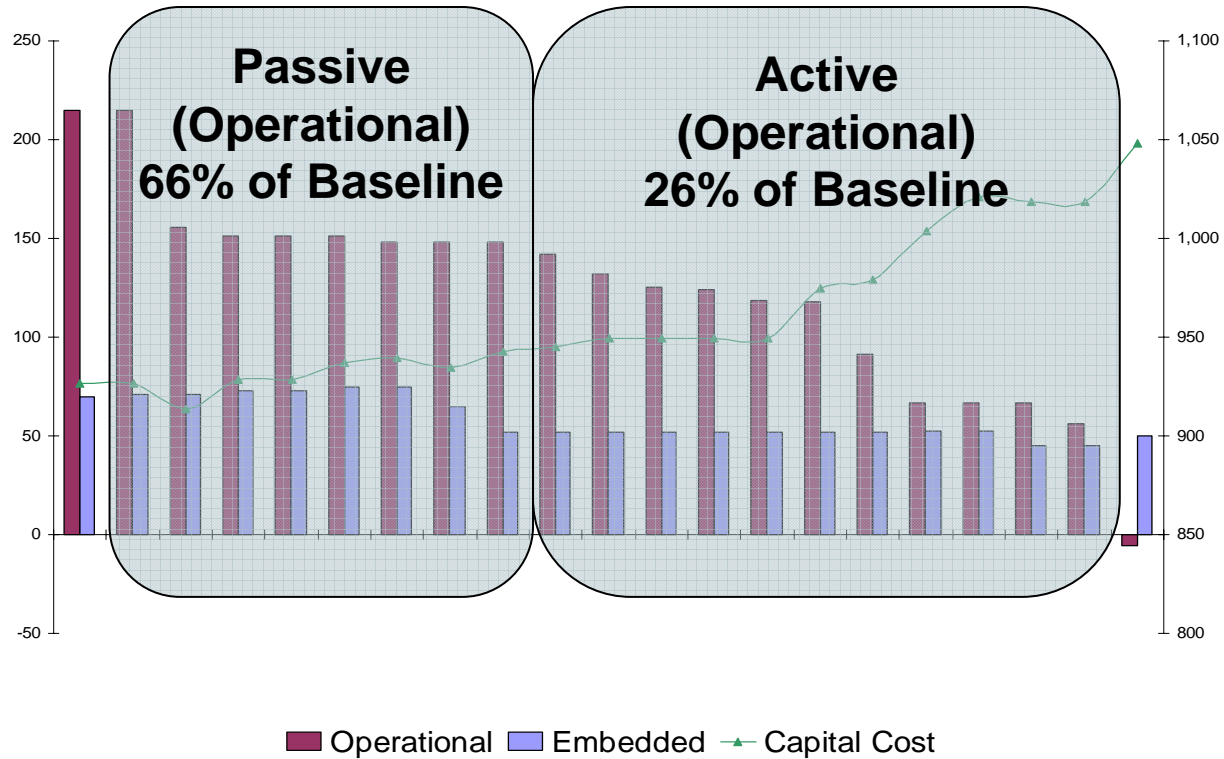
## Case Study 1 - Bahrain Residential

- DSM Can be Used as a Tool to Evaluate in Operational Carbon Terms:
  - Architecture – Form, Material & Glazing Strategy
  - Structure – Optimise Thermal Mass
  - Building Services – Strategy and Renewables
- Zero Pavilions, Four Towers, 16 Duplex Apartments



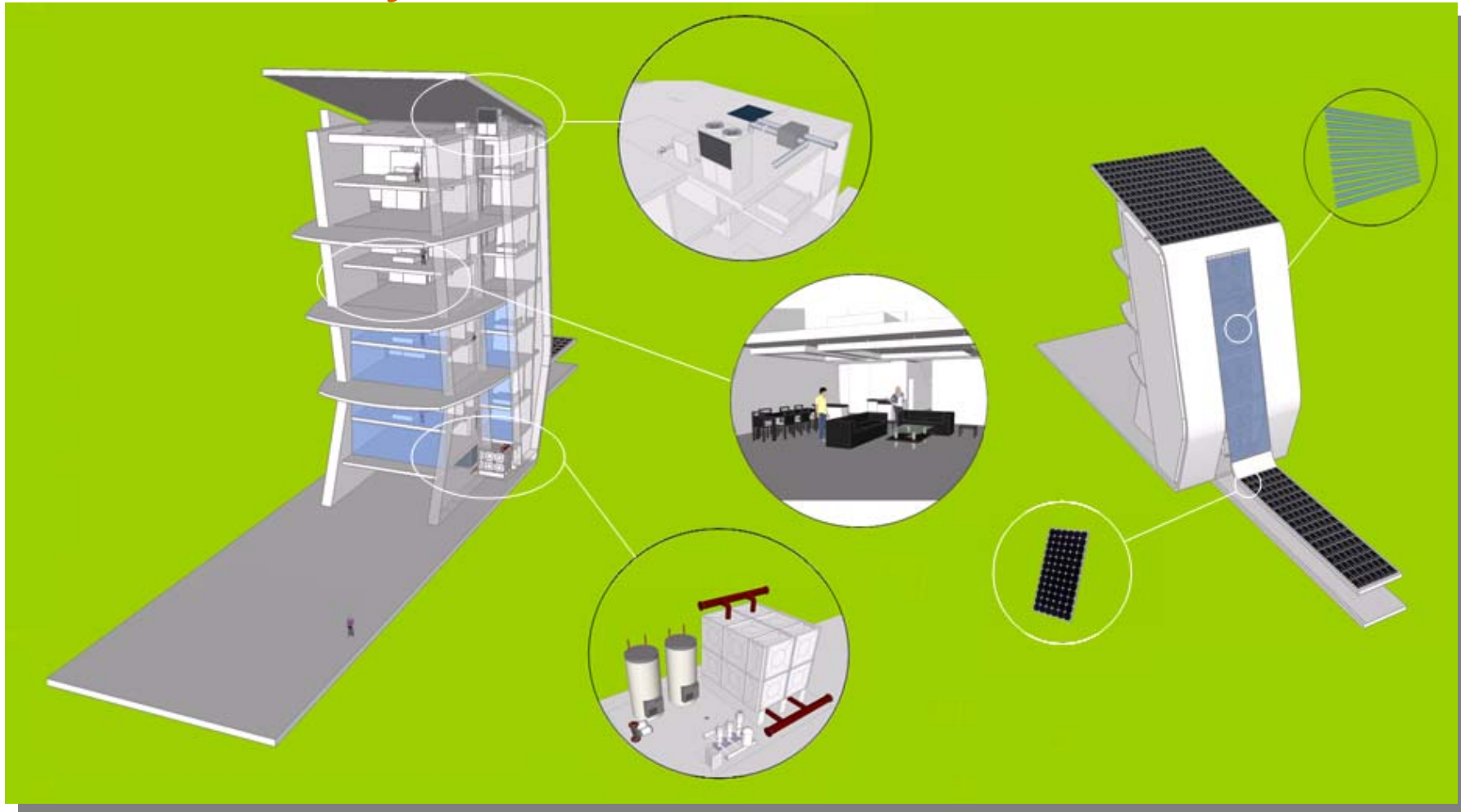
# Carbon Critical Design

## Case Study 1 - Bahrain Residential



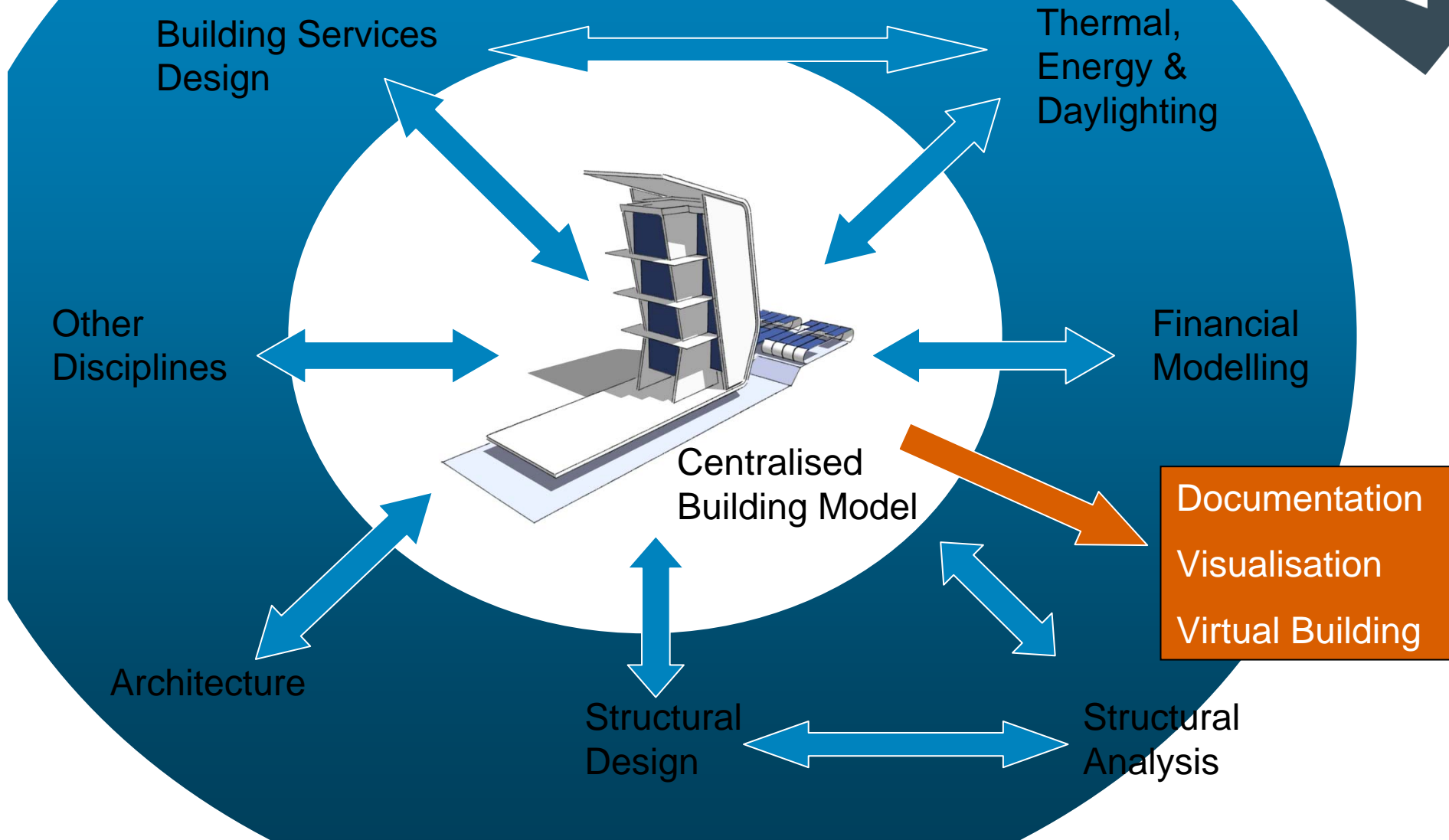


# Carbon Critical Design Case Study 1 - Bahrain Residential





# An Evolving Design Process - BIM



30/09/2009

The Role of Thermal Modelling

# Questions

The Atkins logo is a dark blue, downward-pointing triangle with the word "ATKINS" written vertically in white, sans-serif capital letters.

ATKINS