The bigger picture
The evolution of an energy efficient building
Mechanisms
Examples
Final thoughts
The bigger picture

Why do we do what we do!!

To provide buildings
(1) ..... an environment where people can live, work and achieve
(2) ..... in the most energy efficient way possible

Current Facts
• Average temperatures have climbed 0.8 °C since 1880
• Rate of warming is increasing. Last two decades were the hottest in 400 years
• In the Arctic - Average temperatures have risen at twice the global average
• Glaciers and mountain snows are rapidly melting
• Coral reefs deteriorating due to highly sensitive to small changes in temperatures
• Upsurge of extreme weather events

Cause
• Due to industrialization, deforestation, pollution, greenhouse gases carbon dioxide etc.

Predictions
• Extreme weather conditions (Strong hurricanes, droughts, heat waves, wildfires)
• Predicted ice-free summer in the Arctic by 2040
• Sea level could rise – 100 million people live within 1 meter of mean sea level
The bigger picture

Why do we do what we do!!

“A supply crunch appears likely around 2013... Given recent price experience, a spike in excess of $200 per barrel is not infeasible”

Professor Paul Stevens, Chatham House

Vulnerability

- Political instability of several energy producing countries
- Price (Supply vs Demand)
- Saving money (energy & water)
- Terrorist attacks on supply infrastructure
- Natural disasters

The bigger picture

Why do we do what we do!!

...... because we have to.

Policy

- In the EU, buildings are responsible for 40% of energy consumption.
- EU EPBD – 20% reduction in CO$_2$ emissions by 2020
- In UK – Zero carbon non-domestic buildings by 2019
- Local Authority Policy: 10-20% renewables

Building Regulations

- Approved Document Part L:2010 - Conservation of Fuel & Power

Standards

- BRE Environmental Assessment Method (BREEAM)
- Leadership in Energy & Environmental Design (LEED)
- British Council for Offices (BCO)
- Chartered Institute of Building Services Engineers (CIBSE)
- Other guidance – such as Building Bulletins for School

...... but are we? Do we stop at ‘handover’?
Mechanisms

Building Regulations
Carbon Reduction Commitment
BREEAM 2011
BSRIA ‘Soft Landings’
EPCs and DECs

Building design and ensure ‘as designed’ = ‘as built’ - Criterion 1 – 4
Ensure energy efficient operation – Criterion 5

Provide sufficient information about the building.
CIBSE TM31: Building Log Book Toolkit
- Purpose & responsibilities (Facilities Manager ?)
- Overall building design
- Maintenance review
- Metering monitoring and targeting strategy
- Building energy performance records (CIBSE TM22)

Benefits to all stakeholders:
- Client, designer, FM and occupants

<table>
<thead>
<tr>
<th>Statutory</th>
<th>Effectiveness</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>≈</td>
<td>✗</td>
</tr>
</tbody>
</table>
Mechanisms

Carbon Reduction Commitment (CRC)

Mandatory scheme for large public & private sector organisations

Responsible for 10% of the UK’s emissions

Scheme based on three drivers; reputational, behavioural and financial.

Monitor energy use, calculate CO\textsubscript{2} emissions and purchase allowances

Performance league Table (PLT) is produced yearly

<table>
<thead>
<tr>
<th>Statutory</th>
<th>Effectiveness</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈</td>
<td>✓</td>
<td>≈</td>
</tr>
</tbody>
</table>

Mechanisms

BREEAM 2011

Life cycle stages:
- Design Stage (DS) – leading to an Interim rating
- Post-Construction Stage (PCS) – leading to a Final BREEAM certified rating

Stakeholder participation (Man 04) – (1 credit mandatory for ‘Excellent’ & ‘Outstanding’)

Credits awarded for
- Building user information
- Post Occupancy Evaluation (POE)
- Information dissemination

<table>
<thead>
<tr>
<th>Statutory</th>
<th>Effectiveness</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈</td>
<td>✓</td>
<td>≈</td>
</tr>
</tbody>
</table>
Mechanisms

BSRIA – ‘The Soft Landings Framework’
- Used to smooth the transition throughout the design process
- Can be used for new construction, refurbishment and alteration
- Soft landings starts by raising awareness of in-use performance
- Early stages
- Manages expectations
- Critical handover
- Extended aftercare (year 1 – 3)

<table>
<thead>
<tr>
<th>Statutory</th>
<th>Effectiveness</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈</td>
<td>✓</td>
<td>≈</td>
</tr>
</tbody>
</table>

Mechanisms

Energy Performance Certificates (EPCs)
- Intended to inform potential buyers or tenants
- Can be used for new construction, refurbishment and alteration
- Energy rating (A-G)
- Provides recommendations
- Accredited software

Display Energy Certificates (DECs)
- To raise public awareness on energy use
- Same scale Energy rating (A-G)
- Measured energy data, recorded annually

<table>
<thead>
<tr>
<th>Statutory</th>
<th>Effectiveness</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈</td>
<td>✓</td>
<td>≈</td>
</tr>
</tbody>
</table>
Modelling Approach

SAP
Standard Assessment Procedure

SBEM
Simplified Building Energy Model

Accuracy

DSM
Dynamic Simulation Modelling

Examples

- EPC Asset rating band = B
- Plant run times extended occupied hours
- Gas usage was less than expected
- Tenancy : Landlord = 2 : 1
- Ventilation on unoccupied floors
- Trace heating energised on BCWS
Examples

- Multi-tenant commercial office
- Half-hourly electricity supply over 24-hour period
- Chilled water
- Over 48 hour
- Very low loads during 'out of hours'
- Over 48 hour
- Out of hours
Final thoughts

REMEMBER – **WE** are obliged to design **ZERO’ CARBON BUILDINGS** by the end of the decade

- Building simulation as a compliance tools vs design tools

- POEs can help account for “known unknowns”
  - The modeller
  - The physical models
  - The software
  - ‘Real conditions’ – Actual climate and occupancy
  - Design variations

- In this industry, post-occupancy evaluations have many advocates but a few practitioners

- Cannot manage what is not measured – measuring data is useless without taken action

THANK YOU - QUESTIONS ?