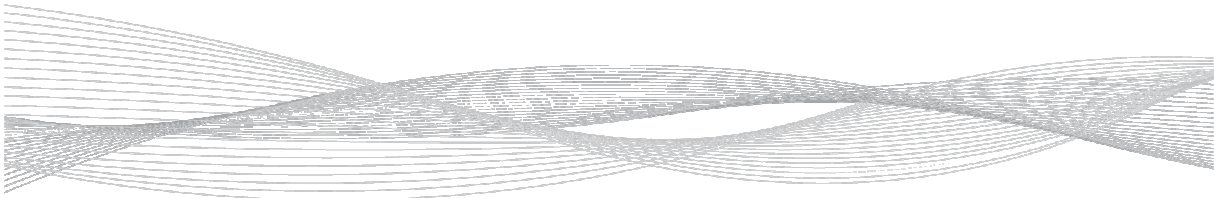


HILSON --- MORAN

consulting engineers



DYNAMIC SIMULATION MODELLING & POST OCCUPANCY EVALUATION

‘THE CURRENT REALITY’

13TH DECEMBER 2011

DAVID SPITERI
SUSTAINABILITY CONSULTANT

HILSON

MORAN

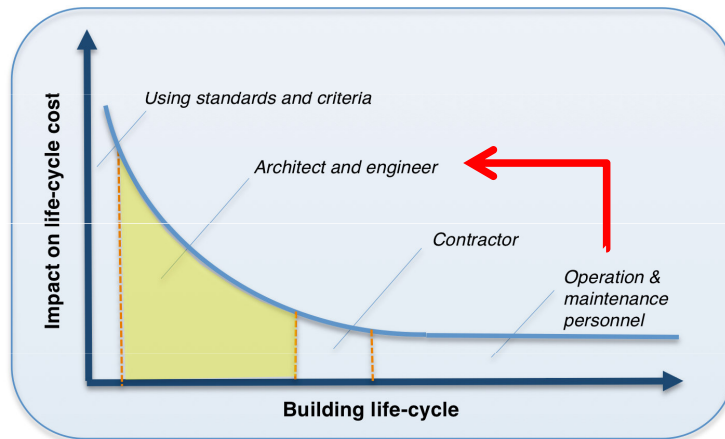
The bigger picture
The evolution of an energy efficient building
Mechanisms
Examples
Final thoughts

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



The bigger picture

Why do we do what we do!!

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



Taken from Lloyd's 360 Risk Insight Sustainable Energy Security White paper – 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 CO₂ 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

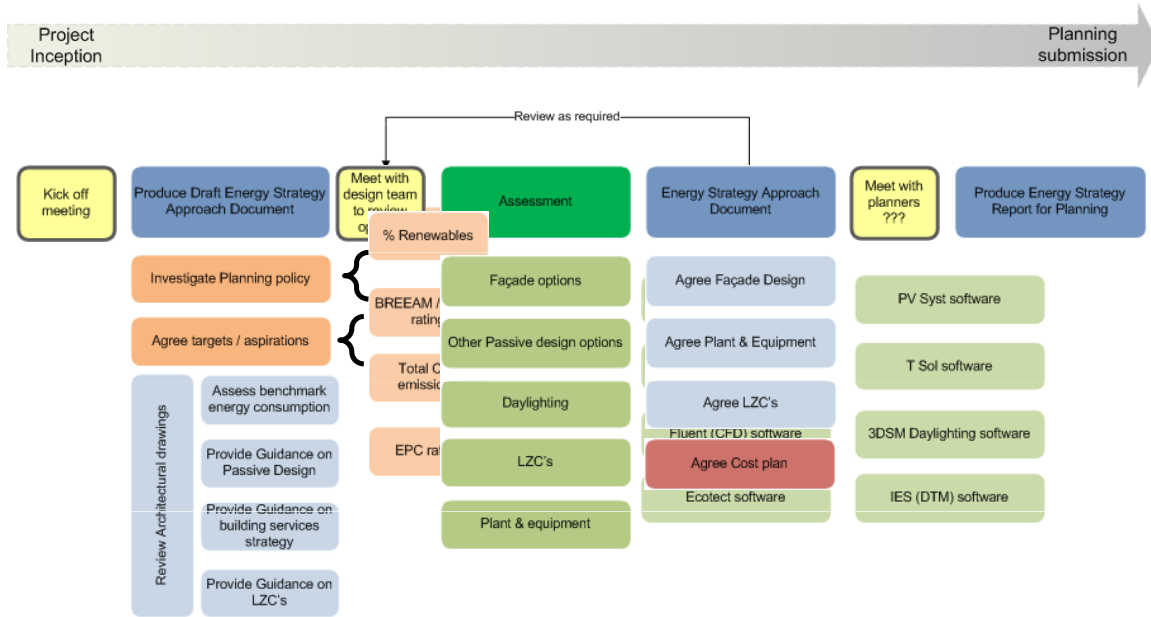
Standards

- 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'?

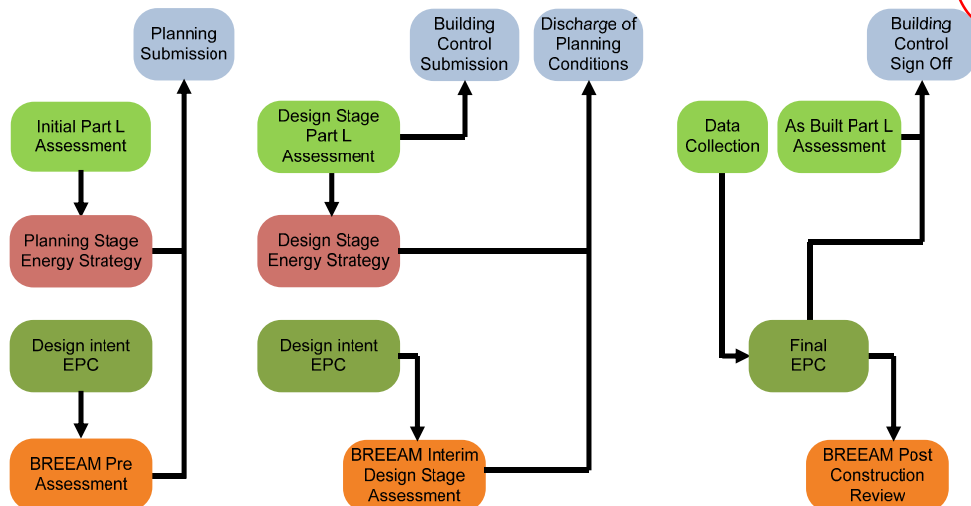


Evolution of a building



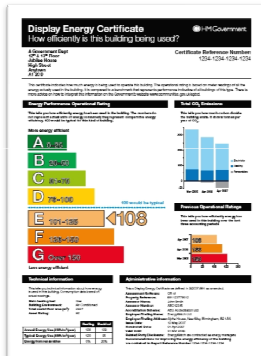
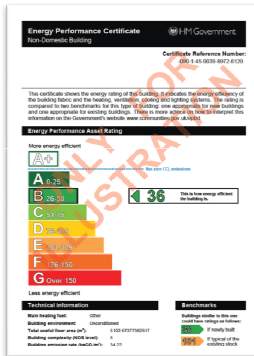
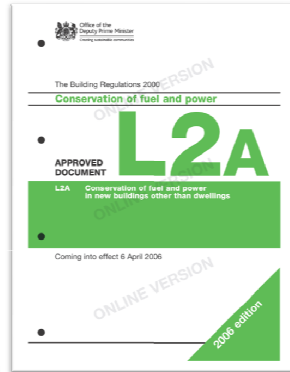
Evolution of a building

A	B	C	D	E	F	G	H	J	K	L	M
Appraisal	Strategic Briefing	Outline Proposals	Detailed Proposals	Final Proposals	Production information	Tender Documents	Tender Action	Mobilisation	Construction	Completion	Feedback



Mechanisms

- Building Regulations
- Carbon Reduction Commitment
- BREEAM 2011
- BSRIA 'Soft Landings'
- EPCs and DEC's



Mechanisms

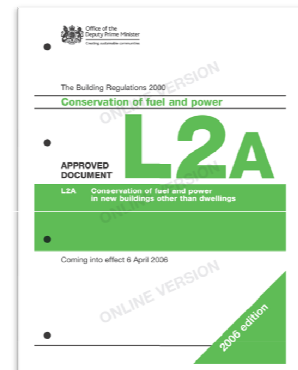
Building Regulations

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

Statutory	Effectiveness	Feedback
✓	≈	✗

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 CO₂ emissions and purchase allowances

Performance league Table (PLT) is produced yearly



Statutory	Effectiveness	Feedback
≈	✓	≈

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



Statutory	Effectiveness	Feedback
≈	✓	≈

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)



Statutory	Effectiveness	Feedback
≈	✓	≈

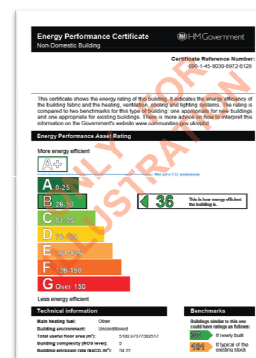
Mechanisms

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)

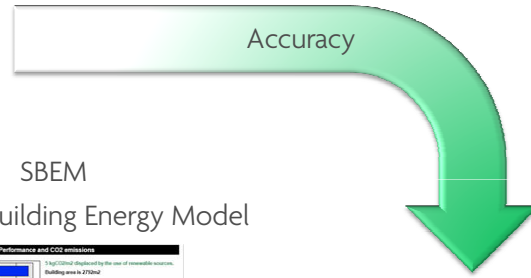
- To raise public awareness on energy use
- Same scale Energy rating (A-G)
- Measured energy data, recorded annually



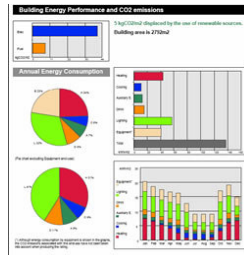
Statutory	Effectiveness	Feedback
≈	✓	≈

Modelling Approach

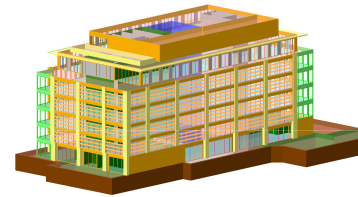
SAP
Standard Assessment Procedure



SBEM
Simplified Building Energy Model



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

Display Energy Certificate

How efficiently is this building being used?



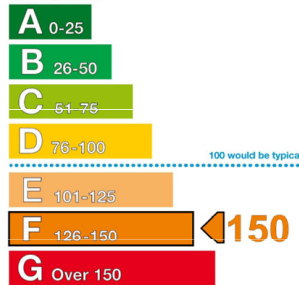
Certificate Reference Number:

This certificate indicates how much energy is being used to operate this building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/ledapt.

Energy Performance Operational Rating

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

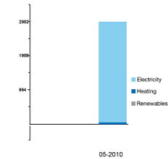
More energy efficient



Less energy efficient

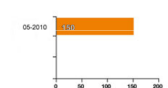
Total CO₂ Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO₂.



Previous Operational Ratings

This tells you how efficiently energy has been used in this building over the last three accounting periods.



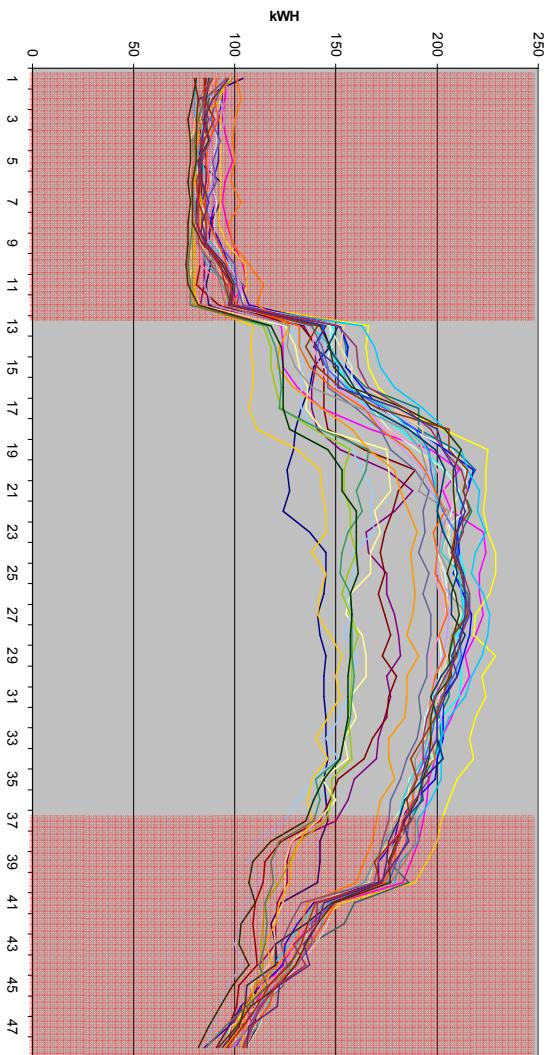
Technical information

This tells you technical information about how energy is used in this building. Consumption data based on actual meter readings.

Administrative information

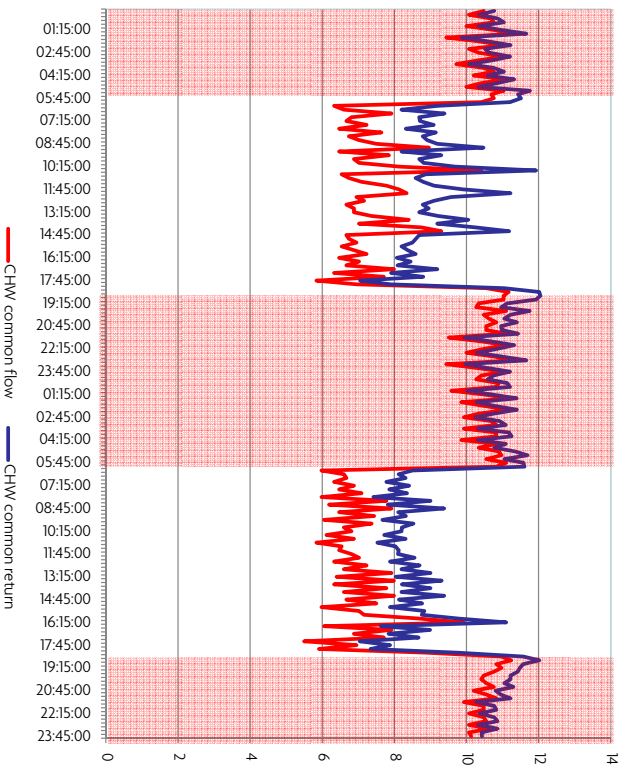
This is a Display Energy Certificate as defined in SI 2007/991 as amended.
 Assessment Software:
 Property Reference:
 Assessor Name:
 Assessor Number:
 Accreditation Scheme:
 Employer/Trading Name:
 Employer/Trading Address:

Examples



- Multi-tenant commercial office
- Half Hourly electricity supply over 24 hour period

Examples



- Chilled water
- Over 48 hour
- Very low loads during '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 ?