BRE: Energy management - producing an efficient culture

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Date: 11th October 2011

Part of the BRE Trust

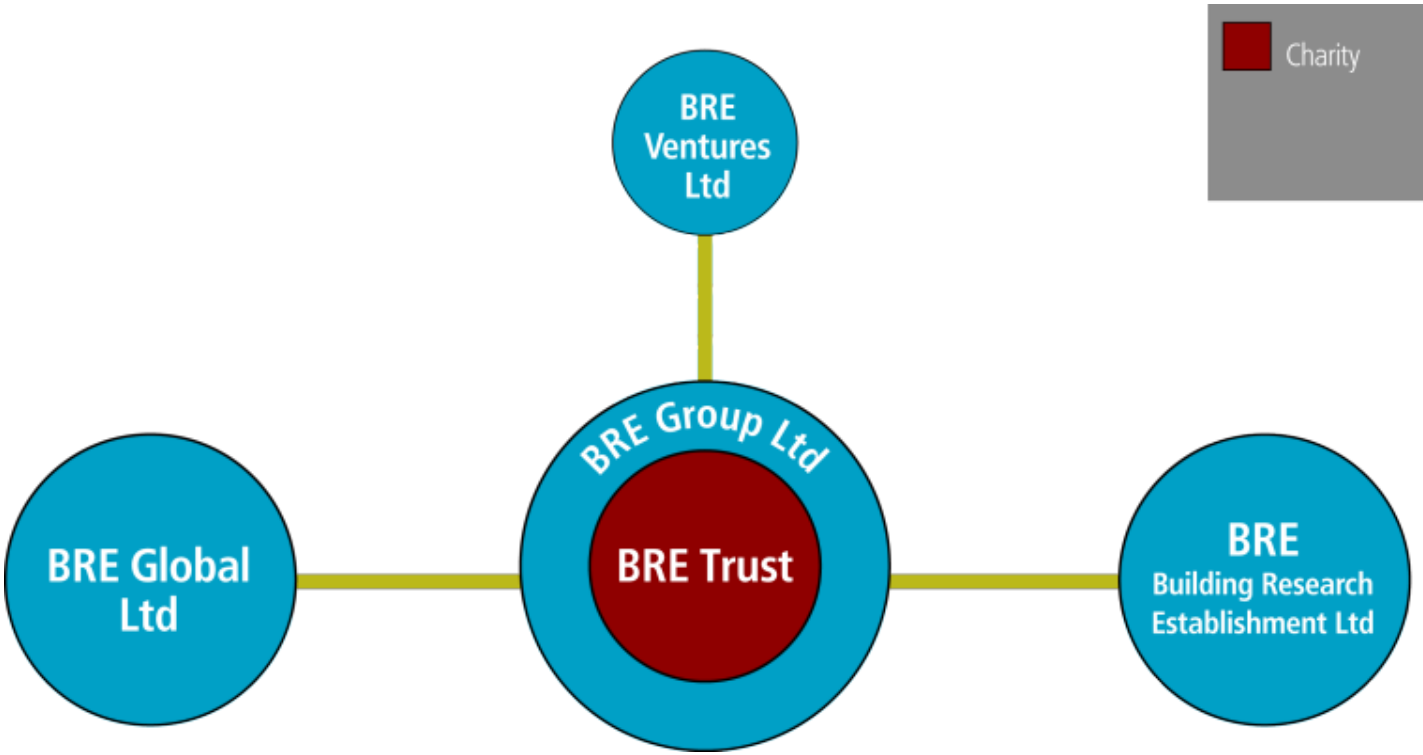
Building Research Establishment

A world leading centre of expertise for the construction industry providing:

- » Research
- » Consultancy
- » Information services

to customers worldwide

Corporate and Management Structure



Our Staff…

- Over 650 staff
- Over 400 professionally qualified
- Many national and international experts
- An integrated team of professionals

…people at the heart of our business

BRE Trust

Some BRE trust statistics:

- Since 2001 has provided £1.8m support to over 60 PhD students
- Funding of more than £1m has been provided to BRE University Chairs
- Supported over 180 projects since 2000 with funding in excess of £8m
- In less than two years has commissioned over 100 publications

The BRE University Centres of Excellence

The BRE Trust provides financial support to five Chairs at the BRE Centres of Excellence at:

- Edinburgh University – *Fire Safety Engineering*
- Strathclyde University – *Energy Utilisation Research*
- University of Bath – *Innovatory Construction Materials*
- Cardiff University – *Welsh School of Architecture (Sustainable Building Design)*
- Cardiff University – *School of Engineering (Centre for Sustainable Engineering)*

BRE's experience in Energy Efficiency

- 40 years experience since 1970's oil crisis
- 100 professionals working on all aspects of EE in construction
- Developed UK Government's Best Practice programme
- Demonstration projects and testing on-site
- European and international standard work
- Modelling team producing UK Govnt software
- Rolled out experiences to several other countries
- Training and CPD courses
- Certification schemes to accredit professionals
- Certification services

Today's agenda

- Reasons for managing energy
- Energy management systems
- BS (ISO) 50001
- Positioning an organisation – Energy matrices
- Establishing the facts - Energy audits, DECs, EPCs and M&T

Why managed Energy?

Business drivers

- Security of supply
- Rising costs
- Wastage and good management practice
- Green Credentials
- Legislation

Security of supply

Energy security questioned as National Grid cuts off gas to factories

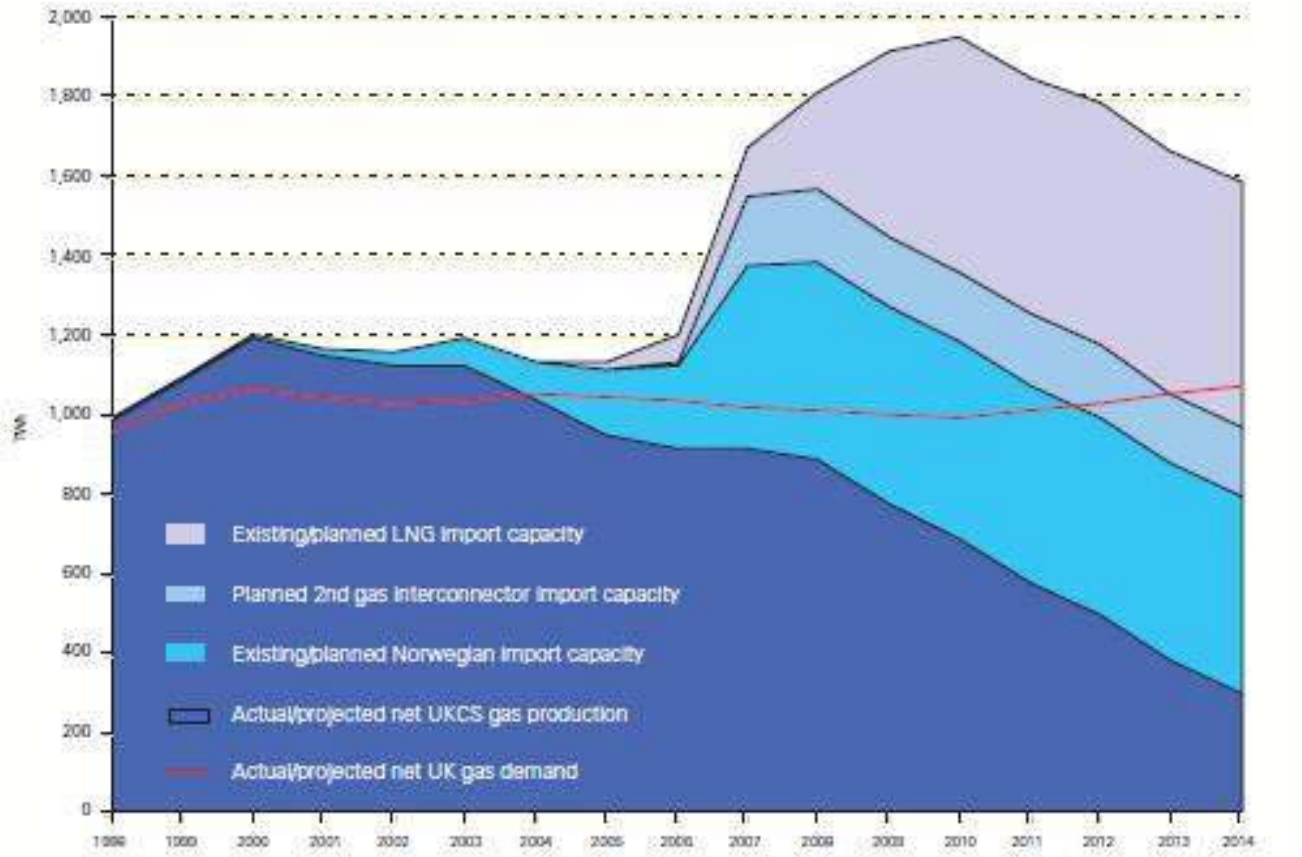
Exclusive: Severe weather and creaking power infrastructure lead to first tangible sign that fears over energy shortages are translating into supply disruption

Terry Macalister, energy editor

guardian.co.uk, Thursday 7 January 2010 14.00 GMT

Security of supply

Chart 4.1: Annual UK gas demand and supply infrastructure

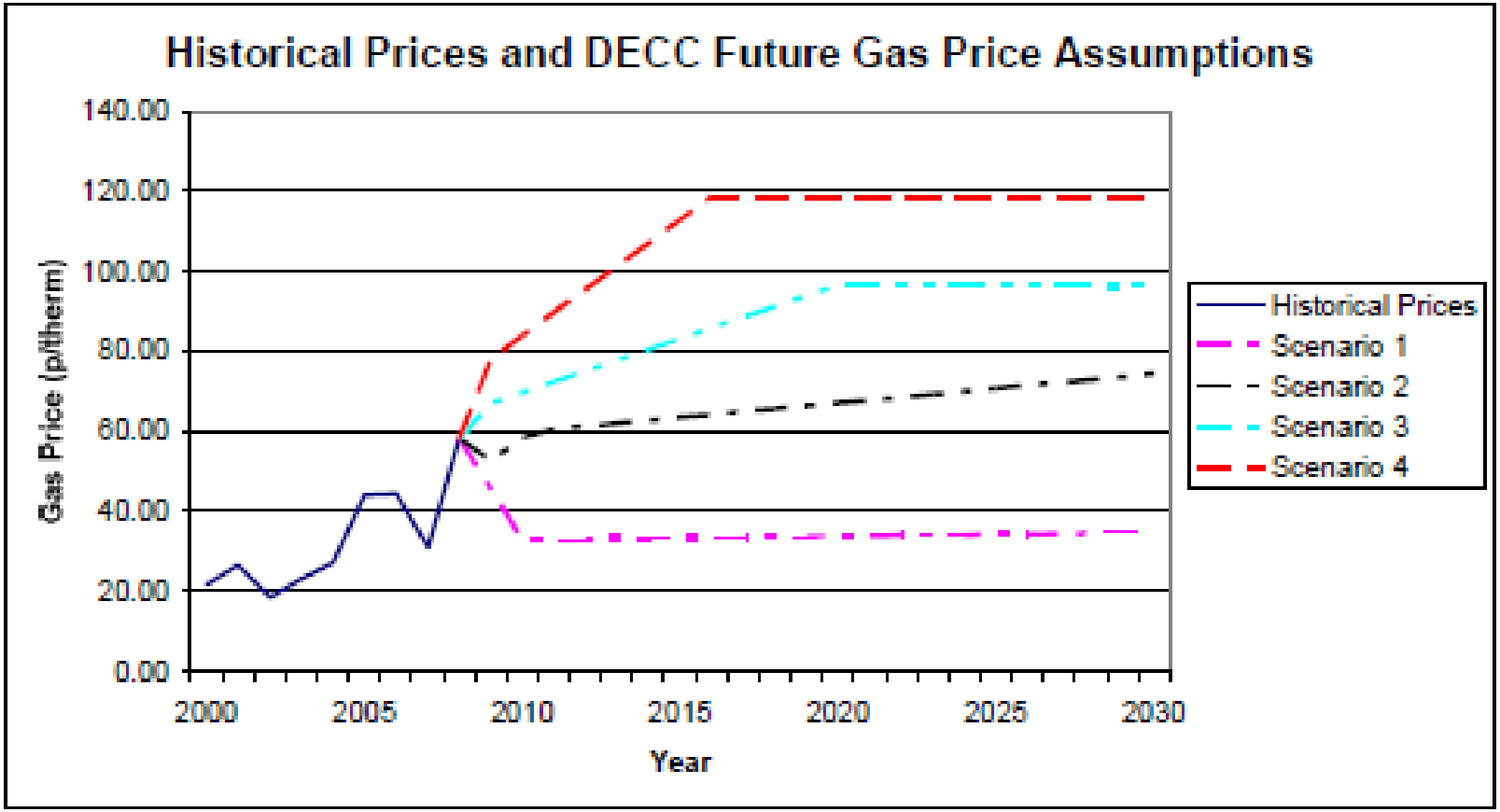


Source: JESS Report April 2006

Security of supply

- Affects productivity
- Have IT got emergency back-ups?
- Do you need local generation?
- Contracts – have you protection?
- Energy companies want voluntary cuts
- How long before compulsory cuts?

Rising costs

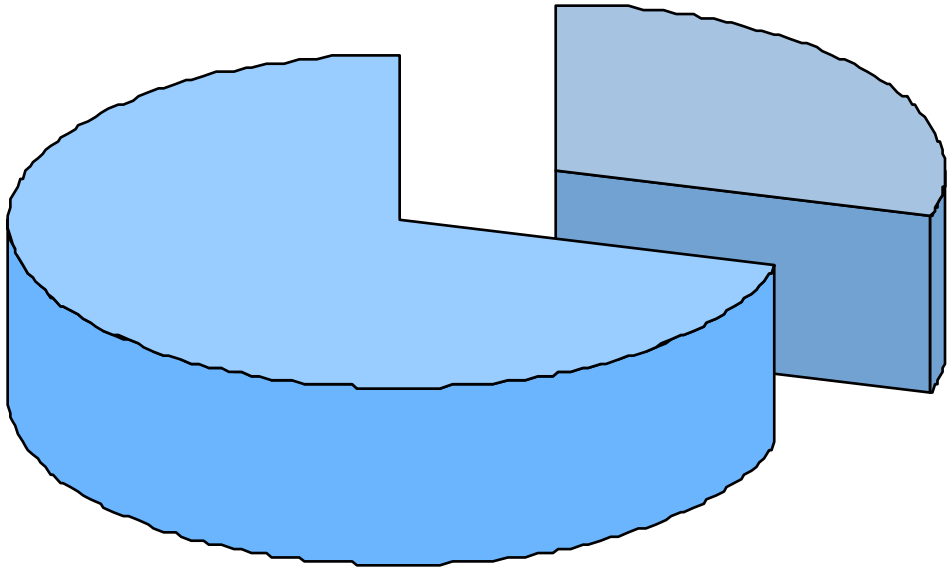


Rising costs

- Dash for energy
- Worst of these predicts a 100% increase in prices over the next 10 years.
- Competition between countries for energy resources results in tight gas supplies and high fuel prices
- Assumes no new nuclear plant is operational before 2020

Wastage and good management practice

UK energy £58 billion pa



21% of this is wasted

Wastage and good management practice

- Energy is a manageable quantity
- It is not a fixed cost
- To manage it you must measure it
- Increases competitiveness
- Fits into management best practice - TQM, ISO 9001, European Foundation for Quality Management

Green Credentials

- Marketing - positioning
- Branding - promotion
- Public perception
- Supply chain pressure

But requires

- Independent standards - ISO 14001, BS EN 50001
- Auditable
- Part of management culture – mission statement

But not *"Green wash"* – just leads to loss of credibility

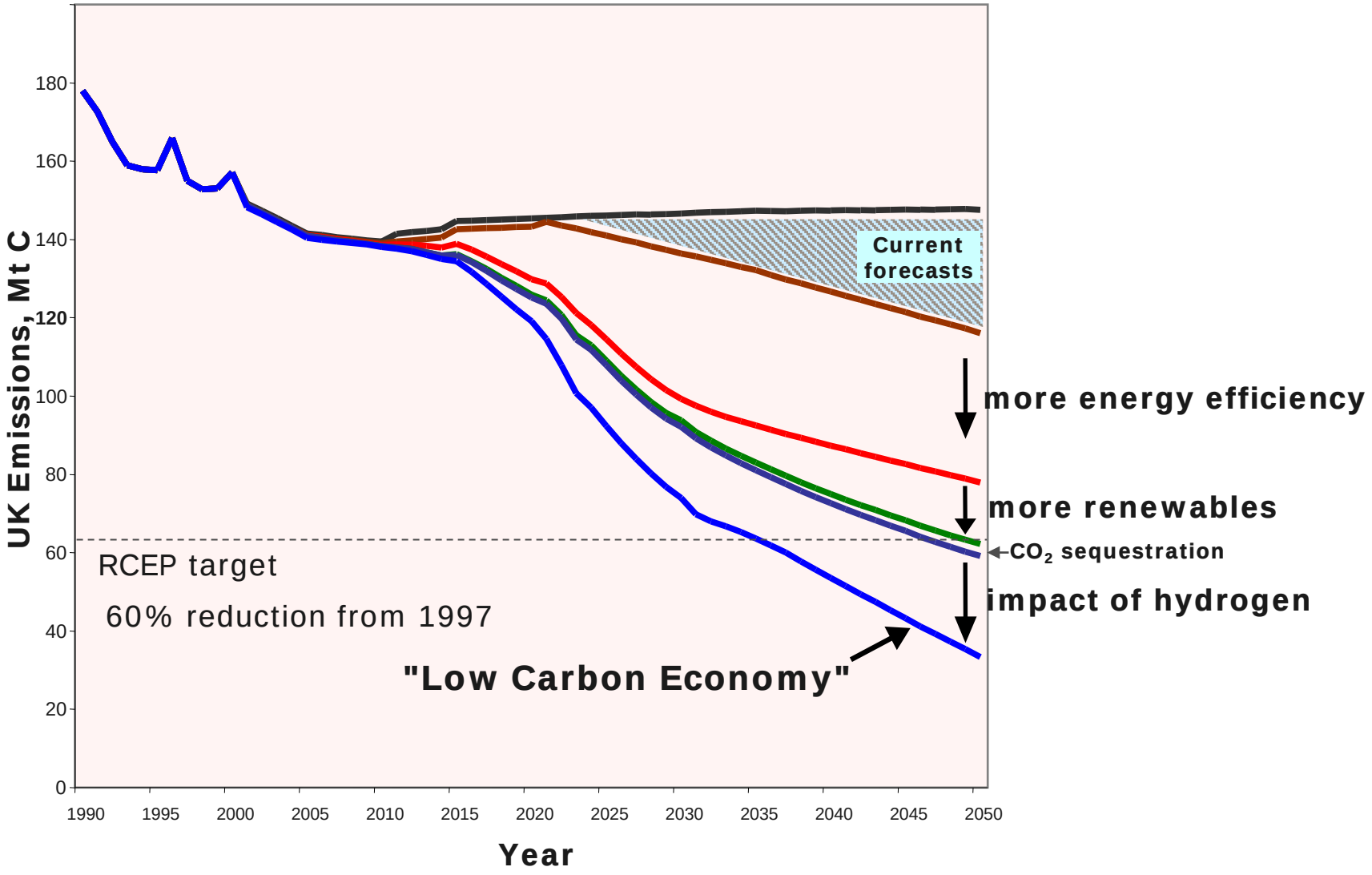
Legislation - UK Climate Change and Energy Policy Targets

- UK Kyoto obligation

  "Cut greenhouse gas emissions by 12.5% on 1990 levels averaged over 2008-12"
- EU commitment to reduce emissions by 30 per cent by 2020, over 1990 levels
- The Climate Change Act sets legally binding targets for reducing GHG emissions in the UK by 80 per cent between 1990 and 2050.
- UK to reduce GHG emissions by at least 34 per cent in 2020, relative to 1990 levels.
- UK target of 15 percent of energy from renewables by 2020.

Legislation - UK Climate Change

- **Climate Change Levy (CCL)**
  - **tax on the use of energy in industry, commerce and the public sector.**
  - **Revenue neutral, offset by:**
    - **cuts in employers' National Insurance Contributions**
    - **100% 1st year capital allowances for energy saving investments (ECAS)**
    - **Carbon Trust support for energy efficiency schemes**
    - **Exceptions for renewable sources of energy and CHP**
- **Energy Performance Buildings Directive (EPBD)**
  - **Energy Performance Certificates -** EPCs and DEC
  - **Air conditioning inspections -** Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007 - Articles 7 to 9 of the EPBD
- **Zero Carbon Homes**
  - by 2016 all new homes will be zero carbon, with a major progressive tightening of the energy efficiency building regulations (Part L) – by 25 per cent in 2010 and by 44 per cent in 2013 – up to the zero carbon target in 2016.
- **All new non-domestic buildings should be zero carbon from 2019 (Part L)**
  - with all Government non-domestic buildings to be zero-carbon from 2018
- **CRC Energy Efficiency scheme**


UK Emissions, Mt C
180
160
140
120
100
80
60
40
20
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year
Current forecasts
more energy efficiency
more renewables
CO_2 sequestration
impact of hydrogen
RCEP target
60% reduction from 1997
"Low Carbon Economy"

Energy management systems

Why?

- Deals with management issues
- Provides a structured approach
- Framework in which to work

But must:

- Deliver outputs that provide a clear sense of direction
- Communicate the objectives to all of the stakeholders
- Measure and monitor
- Be easy to audit
- Philosophy is continuous improvement
- Review and capture the lessons learnt.

5 step approach –
Energy Efficiency Best Practice programme

Step 1 - Get commitment

- Get top-down support – on the boardroom agenda
- Look for a boardroom champion
- Build the business case – convince senior managers
- Embed into the management approach and systems – especially TQM
- Develop bottom-up buy-in – awareness and training
- Start to change the culture – good communication
- Establish basic criteria for energy policy and high level action plan

Step 2 – Understand the issues

- Use energy management matrices
- Understand energy usage
- Understand the management process and culture
- Identify the key decision makers
- Understand the needs and drivers of all the stakeholders
- Identify attitudes and motivators at all levels
- Identify barriers and any possible show stoppers

Step 3 – Plan and organise

- Develop an Energy Policy/strategy and get to MD to sign it off
- Set objectives and targets – “SMART” – which are agreed with the board
- Produce an Action Plan with a complete roles and responsibilities matrix
- Have key staff develop their own action plans
- Establish monitoring procedures and identify key KPIs
- Develop a procurement policy

Step 4 – Implement

- Initiate Action plan – go for low lying fruit
- Marketing campaign – publish performance
- Initiate priority actions and investments
- Overcome barriers and persuade – communicate success
- Carry out training and staff awareness
- Communicate with line managers and ensure they understand the barriers to implementation
- Integrate with other business processes and environmental initiatives

Step 5 – Monitor on-going performance

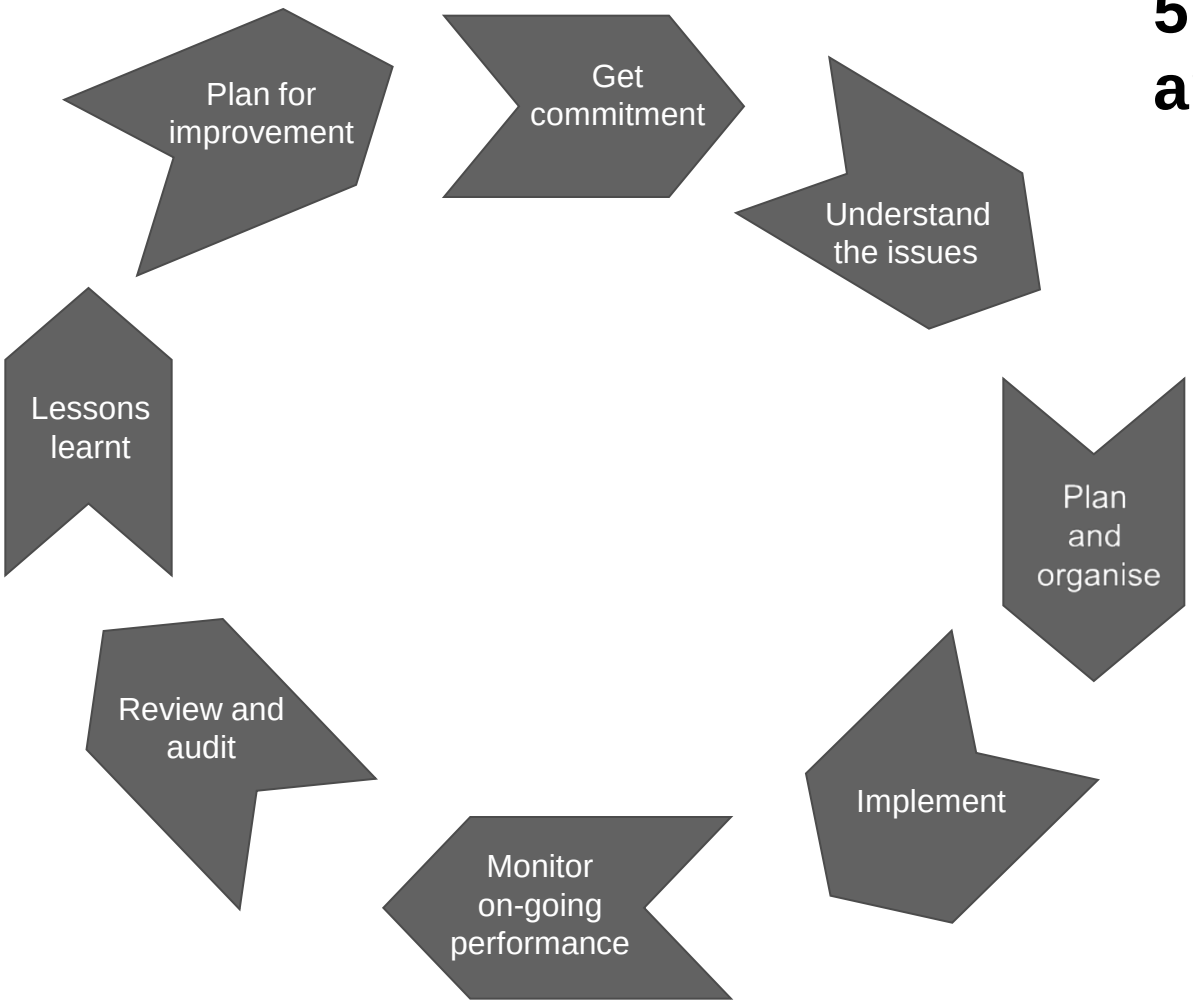
- Assess programme
- Review progress – M&T targets, KPIs etc.
- Plan continuous improvement – define standards
- Review and learn lessons
- Adopt independent standards
  - ISO 14001
  - BS ISO 50001

5 plus step approach

5 step approach has a fundamental flawed.

- **It does not close the loop**
- **Produce an iterate process where the lessons learnt feed back into the process, which is then improved.**

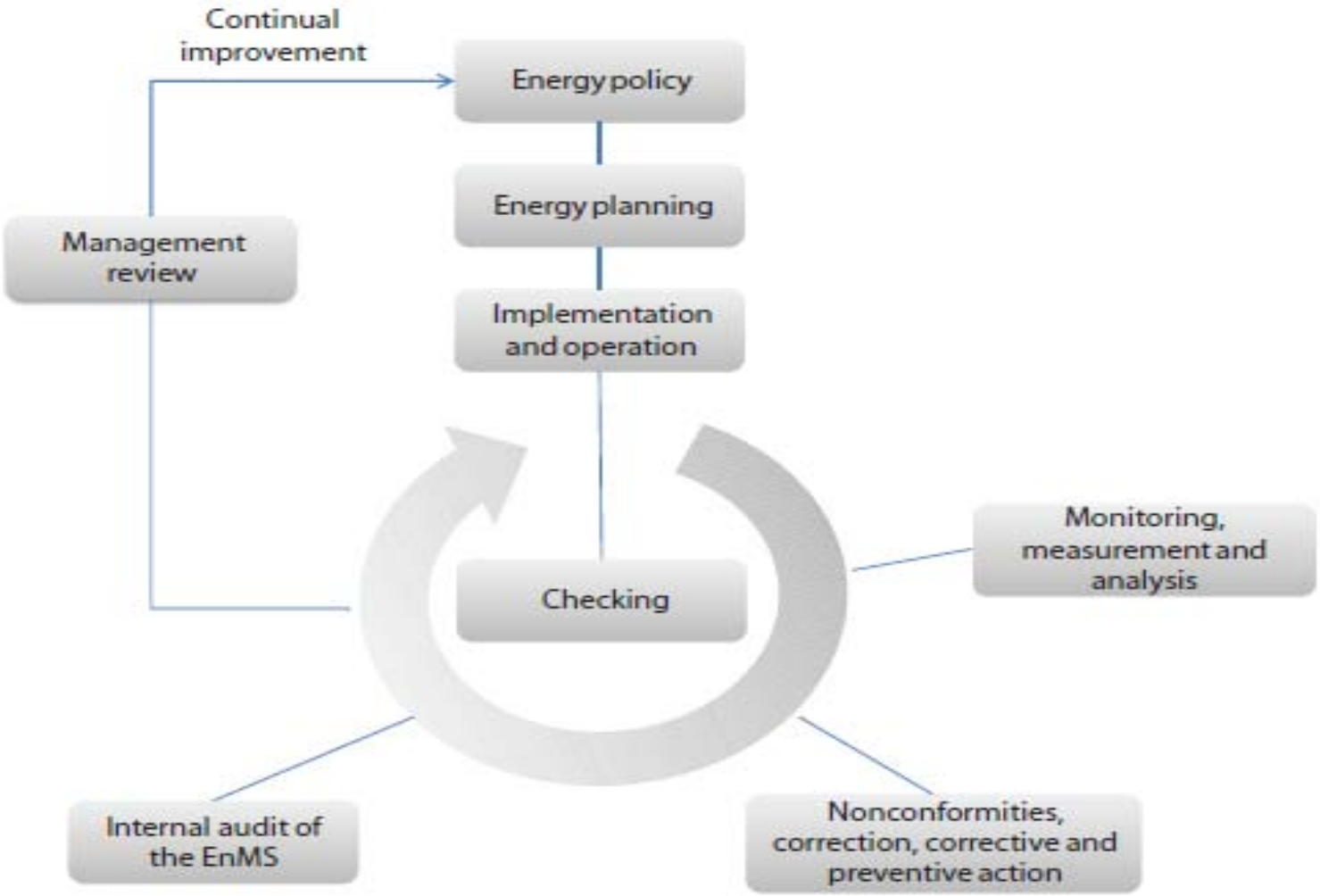
5 plus step approach



BS (ISO) Standard 50001

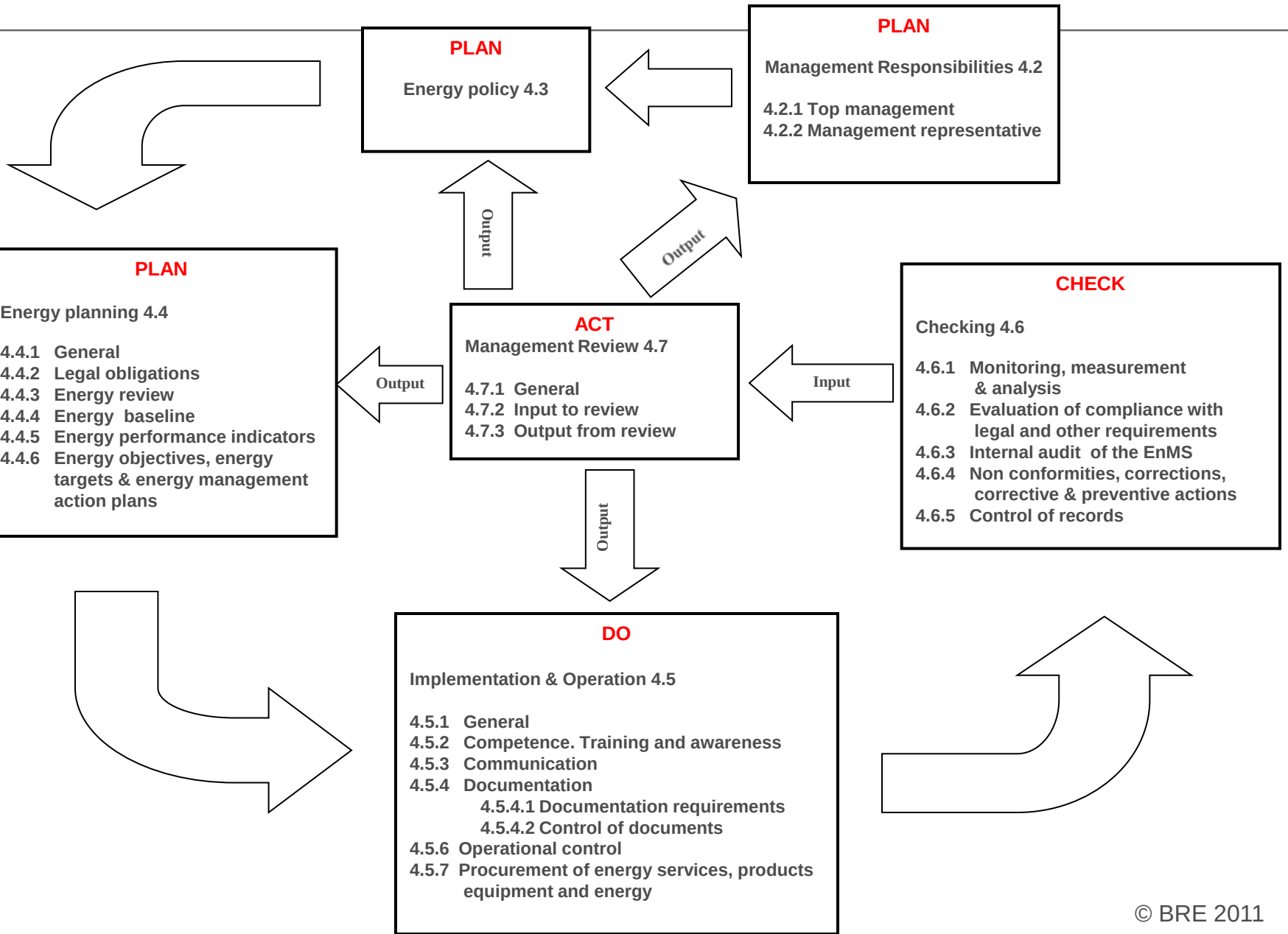
Unique features of the ISO Standard “50001” - History

- 3 years to write
- Published in June 2011
- 60 delegates from 23 countries
- Common global approach
- Aims to deal with:
  - Low carbon future
  - Energy price rises
- Must be:
  - Compatible with ISO14001


Continual improvement
Energy policy
Energy planning
Implementation and operation
Checking
Monitoring, measurement and analysis
Nonconformities, correction, corrective and preventive action
Internal audit of the EnMS
Management review

The PDCA approach

- Plan
- Do
- Check
- Act


PLAN
Energy policy 4.3
PLAN
Management Responsibilities 4.2
4.2.1 Top management
4.2.2 Management representative
Output
Output
PLAN
Energy planning 4.4
4.4.1 General
4.4.2 Legal obligations
4.4.3 Energy review
4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.4.6 Energy objectives, energy targets & energy management action plans
Output
ACT
Management Review 4.7
4.7.1 General
4.7.2 Input to review
4.7.3 Output from review
Input
CHECK
Checking 4.6
4.6.1 Monitoring, measurement & analysis
4.6.2 Evaluation of compliance with legal and other requirements
4.6.3 Internal audit of the EnMS
4.6.4 Non conformities, corrections, corrective & preventive actions
4.6.5 Control of records
Output
DO
Implementation & Operation 4.5
4.5.1 General
4.5.2 Competence. Training and awareness
4.5.3 Communication
4.5.4 Documentation
4.5.4.1 Documentation requirements
4.5.4.2 Control of documents
4.5.6 Operational control
4.5.7 Procurement of energy services, products equipment and energy

Positioning an organisation

Energy management matrices

- Simple tool to prioritise energy management activities
- Simple tool to maximise potential benefits
- Consists of performance matrices
- Positions organisation
- ID areas for improvement

- Not all matrices are relevant to each organisation and/or project

	Policy	Organising	Training	Performance measurement	Communicating	Investment
4	Energy policy action plan and regular review have active commitment of top management	Fully integrated into management structure with clear accountability for energy consumption	Appropriate and comprehensive staff training tailored to identified needs, with evaluation	Comprehensive performance measurement against targets with effective management reporting	Extensive communication of energy issues within and outside organisation	Resources routinely committed to energy efficiency in support of business objectives
3	Formal policy but not active commitment from top	Clear line management accountability for consumption and responsibility for improvement	Energy training targeted at major users following training needs analysis	Weekly performance measurement for each process, unit or building	Regular staff briefings, performance reporting and energy promotion	Same appraisal criteria used as for other cost reduction projects
2	Unadopted policy	Some delegation of responsibility but line management and authority unclear	Ad-hoc internal training for selected people as required	Monthly monitoring by fuel type	Some use of company communication mechanisms to promote energy efficiency	Low or medium cost measures considered if short payback period
1	Unwritten set of guidelines	Informal mainly focused on energy supply	Technical staff occasionally attend specialist courses	Invoice checking only	Ad-hoc informal contacts used to promote energy efficiency	Only low or no-cost measures taken
0	No explicit energy policy	No delegation of responsibility for managing energy	No energy related staff training provided	No measurement of energy costs or consumption	No communication or promotion of energy issues	No investment in improving energy efficiency

Types of Matrices - organisation matrices

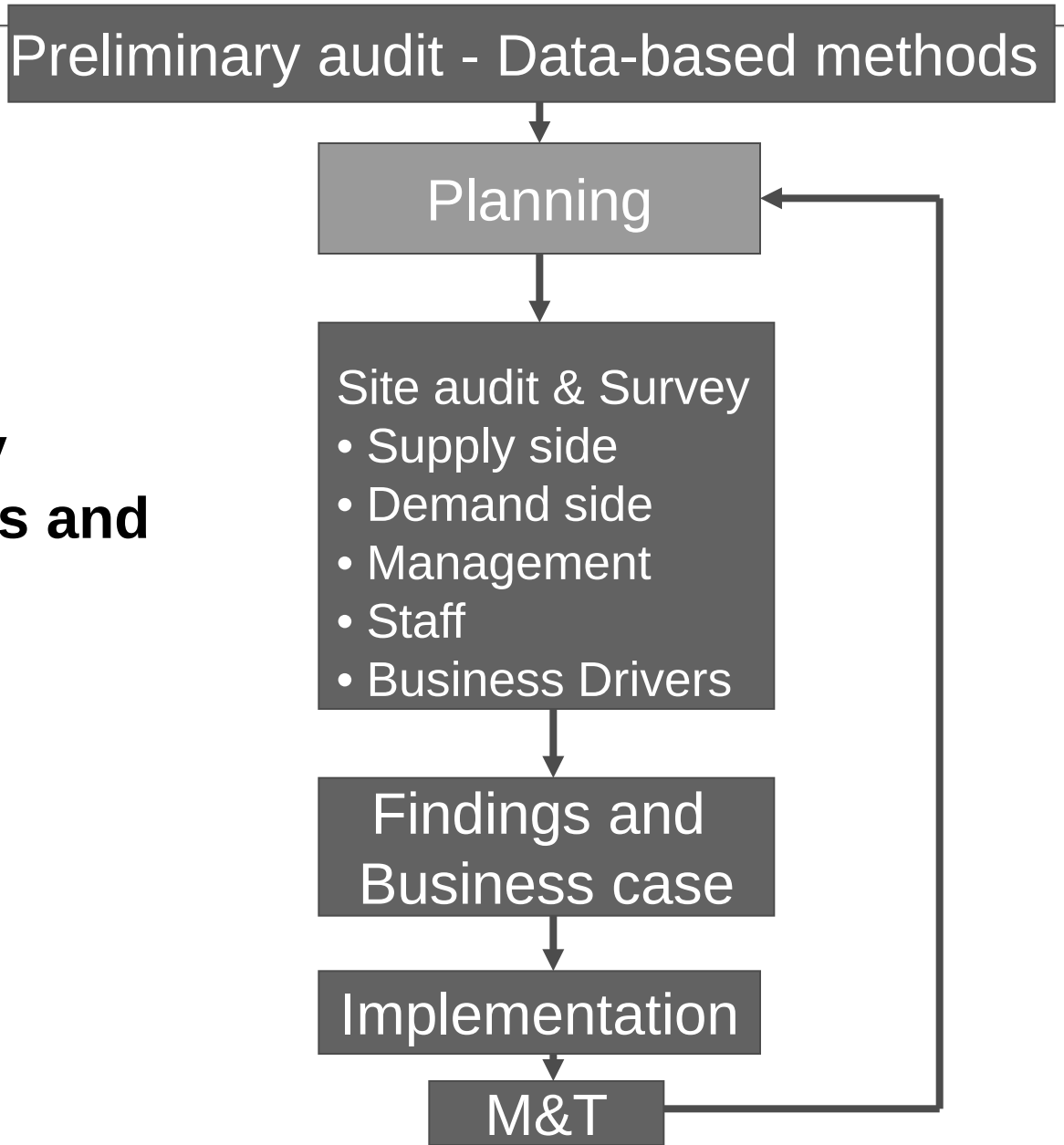
Four of them

- **Energy management**
- **Financial management**
- **Awareness and information**
- **Technical**

- **Underpin Board level tool**
- **Positions management structure**
- **Inputs to prioritisation of actions**
- **Monitors corporate progress**

Establishing the facts

Energy surveys and audits



Energy Performance Certificates - EPCs

- Asset rating
- Based on drawings and survey data
- Rated A-G
- Uses Simplified Building Energy Model (SBEM)
- iSBEM is free interface
- Provides recommendations on:
  - using the building more effectively;
  - cost effective improvements to the building; and
  - other more expensive improvements which could enhance the building's energy performance
- Carried out by qualified, accredited non-domestic energy assessors
- Indicates building quality not operation

Energy Performance Certificate

Non-Domestic Building

HM Government

56 London Road
LONDON
SW23 1HA

Certificate Reference Number:
0100-0038-0000-0029-0002

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25
B 26-50
C 51-75
D 76-100
E 101-125
F 126-150
G Over 150

63 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m^2):	2900
Building complexity (NOS level):	3

Benchmarks

Buildings similar to this one could have ratings as follows:

59 If newly built

113 If typical of the existing stock

Display Energy Certificates (DECs)

- Operational rating
- Based on meter readings
- Rated A-G
- Uses Operational Rating Calculation (ORCalc)
- Also provides recommendations
- Carried out by qualified, accredited non-domestic energy assessors
- Contains other factors such as unregulated loads (e.g. IT, plug-in appliances) or building user behaviour
- Indicates how building is managed

- Need both EPC and DEC to get complete picture

Display Energy Certificate

How efficiently is this building being used?

HM Government

A Government Dept
12th & 13th Floor
Jubilee House
High Street
Anytown
A1 2CD

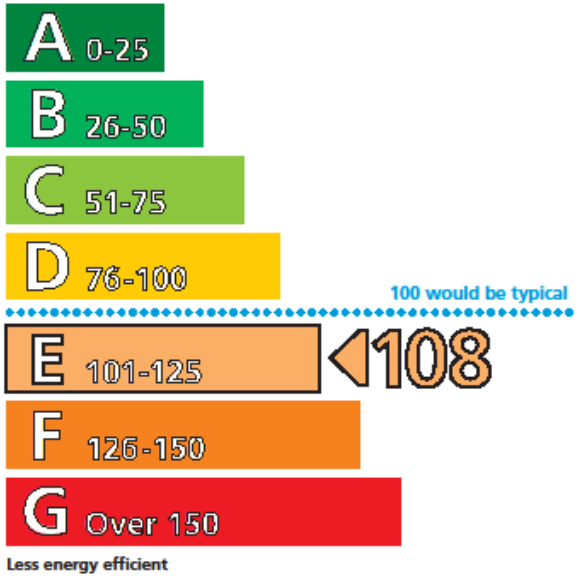
Certificate Reference Number:
1234-1234-1234-1234

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/epbd.

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.

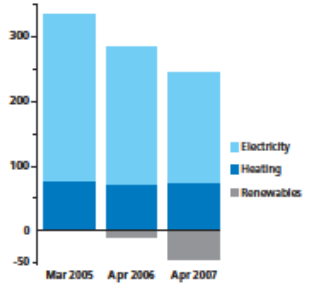
More energy efficient



Less energy efficient

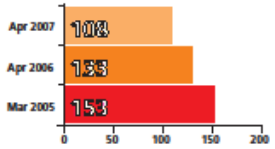
Total CO_2 Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO_2.



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

Main heating fuel:	Gas
Building Environment:	Air Conditioned
Total useful floor area (m^2):	2927
Asset Rating:	92

	Heating	Electrical
Annual Energy Use (kWh/m^2/year)	126	129
Typical Energy Use (kWh/m^2/year)	120	95
Energy from renewables	0%	20%

Administrative information

This a Display Energy Certificate as defined in SI2007:991 as amended.

Assessment Software:	OR v1
Property Reference:	891123776612
Assessor Name:	John Smith
Assessor Number:	ABC12345
Accreditation Scheme:	ABC Accreditation Ltd
Employer/Trading Name:	EnergyWatch Ltd
Employer/Trading Address:	Alpha House, New Way, Birmingham, B2 1AA
Issue Date:	12 May 2007
Nominated Date:	01 Apr 2007
Valid Until:	31 Mar 2008
Related Party Disclosure:	EnergyWatch are contracted as energy managers

Recommendations for improving the energy efficiency of the building are contained in Report Reference Number 1234-1234-1234-1234

What is Monitoring and Targeting (M&T) and the aims?

- The systematic procedures for the long term “tracking” of energy use and identifying areas for improvement, with the **aims** of:
- Establishing current consumption
- Comparing use with historical data and benchmarks for similar users
- Setting future targets
- Comparing consumption with these targets
- Identifying trends in consumption and areas for improvement
- Reporting on the above - providing information for energy management action
- Alerts users to irregular patterns of consumption
- It doesn’t save energy in itself if the information is not acted upon!

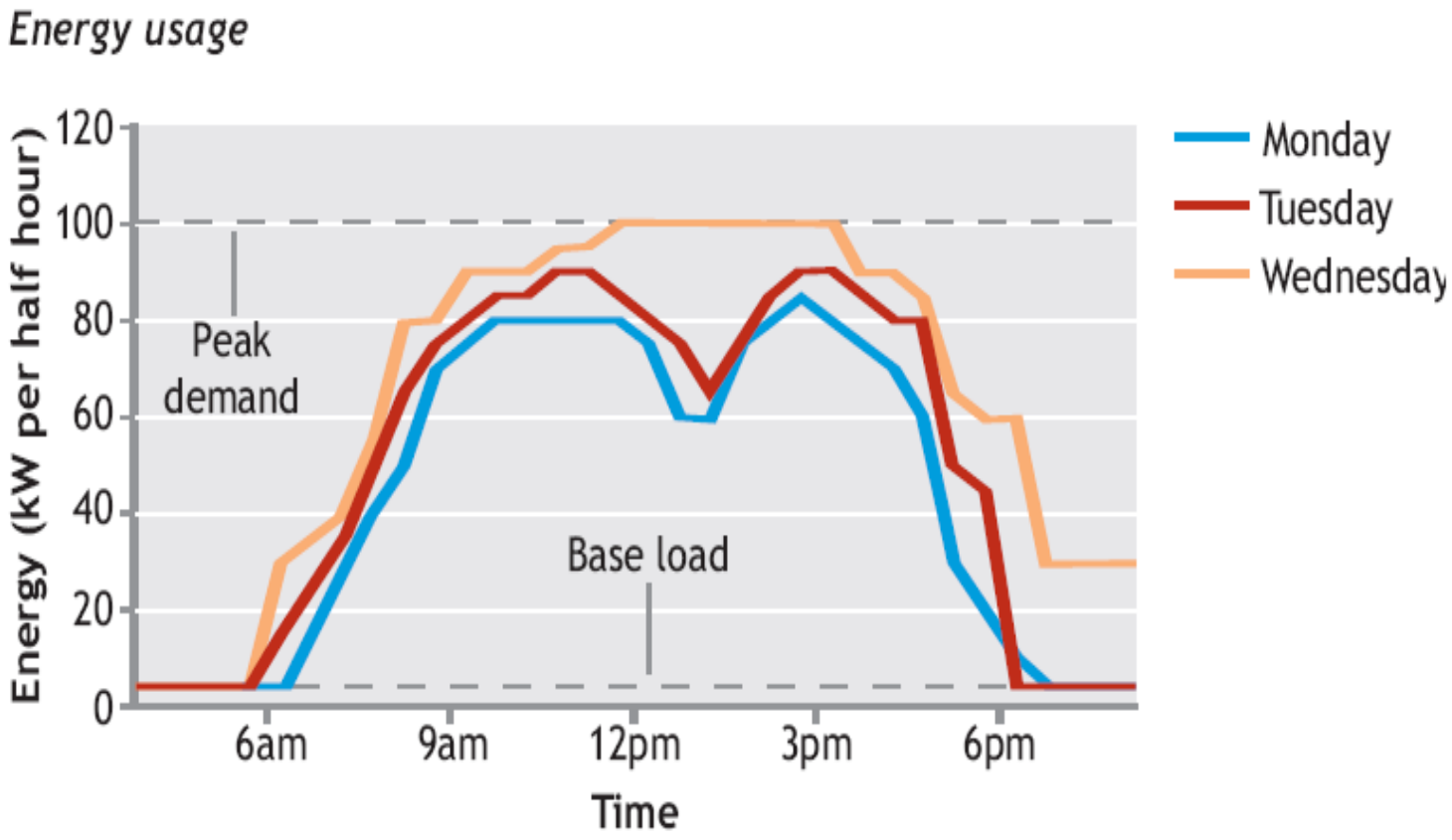
M&T process

- The 4 steps:
- Data collection
  - Meter readings (half hourly, daily, monthly…)
  - Fuel bills
  - Related data such as degree days
- Data analysis
  - Verify accuracy
  - Convert the raw data into useable forms (filter, organise)
  - Define targets / benchmarks, compare data
  - Identify areas of interest / concern

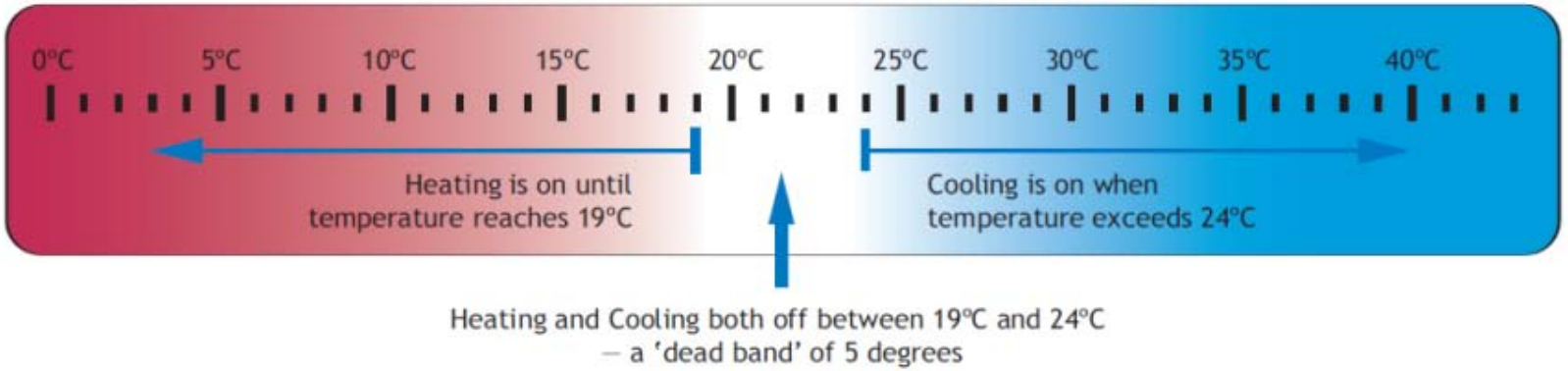
M&T process

- Reporting
  - What are the results / key findings of the analysis
  - Mechanisms so this gets fed back into the “actions” loop
  - Summary of the key findings to management with more detailed reports of the relevant areas to key end users / responsible persons
  - Production of reports also triggered whenever targets exceeded
- Action
  - Not much point to M&T if the reports from the data are not acted upon
  - Needs proper management structure to ensure the reports generated are used effectively
  - Those responsible for energy need to plan actions from reports and obtain feedback on their implementation

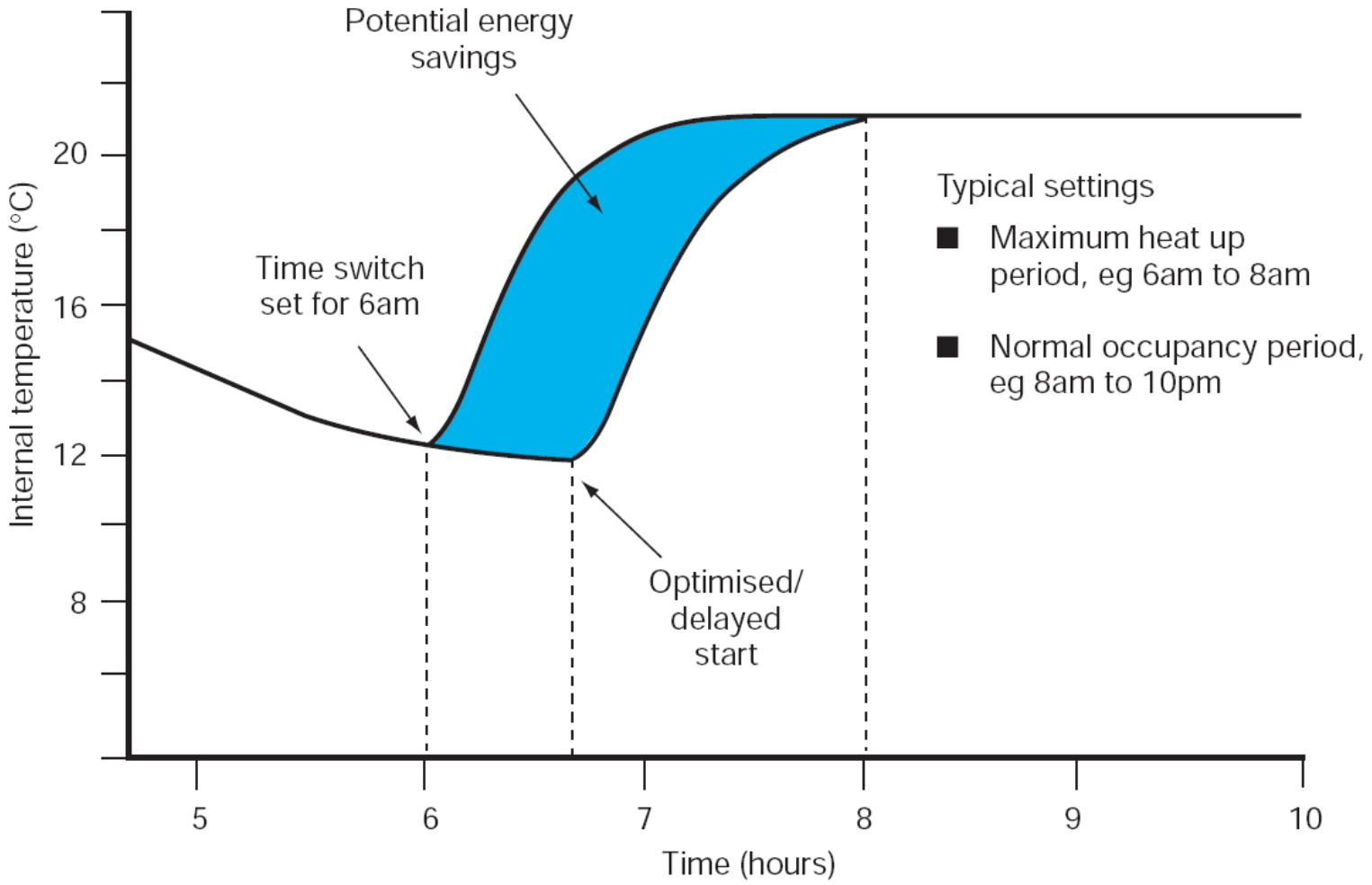
Match demand to consumption - profiles



Space heating and cooling – never at the same time!



An illustration of the potential energy savings from plant optimisation



Questions?

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