Energy, Policy & Technology

Ant Wilson FREng CEng FCIBSE FEI FSFE
Director/AECOM Fellow
Building Engineering

2nd December 2015
The Early Days as a University of Bath Student
The Early Days – Faber Computer Operations

Scamp/Fase 1980

Colour GDS 1987
**Part FF Check was Included in the APACHE Heat Loss Module**

**FACET LIMITED**

**TITLE FOR BUILDING ZONE 1 - WHOLE BUILDING**

<table>
<thead>
<tr>
<th>PPPP</th>
<th>AAA</th>
<th>RRRR</th>
<th>TTTT</th>
<th>FFFFF</th>
<th>FFFFF</th>
<th>CCC</th>
<th>H</th>
<th>H</th>
<th>EEEEE</th>
<th>CCC</th>
<th>K</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>P</td>
<td>A</td>
<td>R</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>C</td>
<td>C</td>
<td>H</td>
<td>H</td>
<td>E</td>
<td>C</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>A</td>
<td>R</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>C</td>
<td>C</td>
<td>H</td>
<td>H</td>
<td>E</td>
<td>C</td>
</tr>
<tr>
<td>PPPP</td>
<td>AAAA</td>
<td>RRRR</td>
<td>T</td>
<td>FFFF</td>
<td>FFFFF</td>
<td>C</td>
<td>HHHHH</td>
<td>EEEEE</td>
<td>C</td>
<td>K</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>A</td>
<td>R</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>H</td>
<td>H</td>
<td>E</td>
<td>C</td>
</tr>
<tr>
<td>P</td>
<td>A</td>
<td>R</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>CCC</td>
<td>H</td>
<td>H</td>
<td>EEEEE</td>
<td>CCC</td>
<td>K</td>
<td>K</td>
</tr>
</tbody>
</table>

The Heat Loss module within the APACHE suite calculates the steady state heat losses from any space using the standard C.I.B.S. method. The user is given the option of allowing heat gains from adjacent rooms. The characteristics of the heater (i.e. its radiant/convective split) can be defined to assess the energy use implications of different emitter types. Intermittent plant operation can be simulated within the program using the C.I.B.S method. The program outputs the required

**Building Regulations Purpose Group Four for Office Buildings**

**Wall Area Exposed to Outside Air Is**
- 423.00 sq. metres with an average U-value of 0.50 W/sq.m K
- Part FF allows an average U-value of 0.60 W/sq.m K

**Window Area in External Wall Is**
- 197.00 sq. metres with an average U-value of 3.30 W/sq.m K
- This represents 31.8% of the total external wall area.
- Equivalent to 19.4% single glazing (U-value 5.7 W/sq.m K)
- Part FF allows 35.0% single glazing (U-value 5.7 W/sq.m K)

**Roof Area Exposed to Outside Air Is**
- 453.00 sq. metres with an average U-value of 0.42 W/sq.m K
- Part FF allows an average U-value of 0.60 W/sq.m K

**Floor Area Exposed to Outside Air Is**
- 414.00 sq. metres with an average U-value of 0.42 W/sq.m K
- Part FF allows an average U-value of 0.60 W/sq.m K

**FF4 Deemed-to-Satisfy Provisions for the Conservation of Fuel and Power (as clauses (a) (11) and (b) (11))**

**Part FF Calculated Rate of Heat Loss**
- 1753. W/K (glazing)
- 774. W/K (opaque)
- 2527. W/K (whole building)

**Actual Calculated Rate of Heat Loss**
- 650. W/K (glazing)
- 574. W/K (opaque)
- 1224. W/K (whole building)

Based on the calculated rate of heat loss and the deemed to satisfy clause ......

**THIS BUILDING MEETS THE PART FF REQUIREMENTS**
Leaders in Design and Integration of Software

- Full dynamic thermal simulation
- Windows compatible
- Duct, fan, pipe and pump sizing
- Networkable
- 18th Edition IEE cable sizing
- 386/486 PC and Unix based
- Electric and day lighting analysis
- CIBSE heat gain and loss analysis
- Full technical support and training

FACET LTD Building Services Software

Contact: Jeremy Johnson at Simple Projects Ltd

Design and draft simultaneously.
INTERFACET can read MicroStation™ and AutoCAD® drawings directly, as well as importing DXF files.
Utlises the full power of MicroStation™'s graphical tools.
Easy-to-use - MicroStation™'s Graphical User Interface is based on MOTIF standards.
Enables better data management to increase quality assurance.
Creates in hours what used to take days.
Increases profitability through increased productivity.
Automates the building fabric for heat loss, heat gain, daylight and artificial lighting.
Sizing of the ductwork, pipework and electrical systems.
Multi-platform, including PC and UNIX

Set up
ENGINEERING THE FUTURE


Article 3
Member States (UK) shall adopt a methodology of calculation of the energy performance of buildings.

Article 4
Member States (UK) shall ensure minimum energy performance requirements are set based on methodology.

Article 5
Member States (UK) shall ensure that new buildings meet minimum energy performance requirements. If > 1000m², consider LZC systems.

Table 2: Lodgements to October 2012, England & Wales.
Energy Performance of Buildings - What Does It Mean For You?
The EPBD drives requirements for Building Regulations, Energy Performance and Display Energy Certificates, Plant inspections. The recent ‘recast’ places additional requirements on both the public and private sector to be implemented soon.

Recast is 31 Articles over 16 pages and five annexes over 7 pages

The implementation of the EPBD in England & Wales is the responsibility of the Department for Communities and Local Government (CLG). Implementation in Northern Ireland and Scotland is the responsibility of the devolved administrations, respectively: the Department of Finance and Personnel (DFPNI) (supported by the Department for Social Development, DSDNI) and the Scottish Building Standards Division (part) of the Directorate for Communities and Local Government).
EPBD – Recast 2010 Articles 3 - 10

Article 3
Adoption of a methodology for calculating the energy performance of buildings

Article 4
Setting of minimum energy performance requirements

Article 5
Calculation of cost-optimal levels of minimum energy performance requirements

Article 6
New buildings

Article 7
Existing buildings

Article 8
Technical building systems

Article 9
Nearly zero-energy buildings

Article 10
Financial incentives and market barriers
# Part 6 – Energy Efficiency Requirement

## PART 6

Energy Efficiency Requirements

21. Application of energy efficiency requirements
22. Requirements relating to a change to energy status
23. Requirements relating to thermal elements
24. Methodology of calculation and expression of energy performance
25. Minimum energy performance requirements for new buildings
26. CO₂ emission rates for new buildings
27. CO₂ emission rate calculations
28. Consequential improvements to energy performance
29. Energy performance certificates
30. Energy assessors
31. Related party disclosures
32. Duty of care
33. Right to copy documents
34. Application of building regulations to educational buildings and buildings of statutory undertakers
35. Interpretation of Part 6
PART 8
Information to be Provided by the Person Carrying Out Work

38. Fire safety information
39. Information about ventilation
40. Information about use of fuel and power

PART 9
Testing and Commissioning

41. Sound insulation testing
42. Mechanical ventilation air flow rate testing
43. Pressure testing
44. Commissioning
**EPBD - Article 5 - Calculation of Cost-optimal Levels**

Calculation of cost-optimal levels of minimum energy performance requirements

1. The Commission shall establish by means of delegated acts in accordance with Articles 23, 24 and 25 by 30 June 2011 a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements. The comparative methodology framework shall be established in accordance with Annex III and shall differentiate between new and existing buildings and between different categories of buildings.

2. Member States shall calculate cost-optimal levels of minimum energy performance requirements using the comparative methodology framework established in accordance with paragraph 1 and relevant parameters, such as climatic conditions and the practical accessibility of energy infrastructure, and compare the results of this calculation with the minimum energy performance requirements in force.
UK Pound (£) to US Dollar ($) - Exchange Rate £1 = $1.55 today
Historic Crude Oil and Natural Gas Prices in US$
Predicting Energy Prices is Impossible

Figure: U.S. Energy Information Administration forecasts of U.S. wellhead natural gas prices, adjusted for inflation, in various years (blue lines) compared with actual prices (orange line).
World primary energy consumption grew by a below-average 0.9% in 2014, the slowest rate of growth since 1998 other than the decline in the aftermath of the financial crisis. Growth was below average in all regions except North America and Africa. All fuels except nuclear grew at below-average rates. Oil remains the world’s dominant fuel. Hydroelectric and other renewables in power generation both reached record shares of global primary energy consumption (6.8% and 2.5%, respectively).
**Who has all the Fuel? And Who Consumes it?**
Percentage Shares of Total Proved Resources all Fuels (End 2014)

<table>
<thead>
<tr>
<th>Region</th>
<th>Global Consumption (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>21.8</td>
</tr>
<tr>
<td>South and Central America</td>
<td>5.4</td>
</tr>
<tr>
<td>Europe and Eurasia</td>
<td>21.9</td>
</tr>
<tr>
<td>Middle East</td>
<td>6.4</td>
</tr>
<tr>
<td>Africa</td>
<td>3.2</td>
</tr>
<tr>
<td>Asia</td>
<td>41.3</td>
</tr>
</tbody>
</table>

*Source: BP Statistical Review of World Energy June 2015*
Major Trade Movements in Oil in 2014 in Million Tonnes of Oil
Major Trade Movements in Natural Gas 2014 (Billion Cubic metres)

Source: Includes data from Cedigaz, CISStat, FGE MENAgas service, GIIGNL, IHS Waterborne, PIRA Energy Group, Wood Mackenzie.
Energy Demand

Source: DUKES 2015
UK National Grid Electrical Generation (www.gridwatch.templar.co.uk)
DECC Energy Trends – Share of Electricity Generation in UK

Energy Trends September 2015

Q2 2014
- Oil and Other: 2.6%
- Coal: 28.2%
- Gas: 30.2%
- Renewables: 16.7%
- Nuclear: 22.2%

Q2 2015
- Oil and Other: 2.5%
- Coal: 20.5%
- Gas: 30.2%
- Renewables: 25.3%
- Nuclear: 21.5%

24 September 2015

2nd December 2015

Energy Flow Chart 2014 (million tonnes of oil equivalent)
UK Renewables Flow Chart 2014 (kTOe) from DUKES 2015
In 2015 Q1:

- Total electricity generated rose 1.3 per cent from 93.7 TWh in 2014 Q1 to 94.9 TWh.
- Coal fired generation fell by 14.3 per cent from 34.7 TWh to 29.7 TWh.
- Gas fired generation increased 9.2 per cent from 21.8 TWh to 23.8 TWh due to several gas stations running at low levels or opting not to run at all in Q1 2014.
- Nuclear generation rose 10.0 per cent from 16.5 TWh to 18.2 TWh.
- Wind and PV generation rose 7.6 per cent from 11.6 TWh to 12.4 TWh, due to an increase in capacity.
CO₂ Emission Factors by Fuel Type in SAP 2012
UK Production of Primary Fuels 1980 to 2014 - DUKES 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil</th>
<th>Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>86.9</td>
<td>34.8</td>
<td>121.7</td>
</tr>
<tr>
<td>1990</td>
<td>100.1</td>
<td>45.5</td>
<td>145.6</td>
</tr>
<tr>
<td>2000</td>
<td>138.3</td>
<td>108.4</td>
<td>246.7</td>
</tr>
<tr>
<td>2010</td>
<td>69.0</td>
<td>57.2</td>
<td>126.2</td>
</tr>
<tr>
<td>2013</td>
<td>44.5</td>
<td>36.5</td>
<td>81.0</td>
</tr>
<tr>
<td>2014</td>
<td>43.7</td>
<td>36.6</td>
<td>80.3</td>
</tr>
</tbody>
</table>
UK Import Dependency, 1970 - 2014
What Has Been Installed Under The Renewables Obligation
ROC Issued for Renewable Generation Since 2007

The chart illustrates the ROCs issued for renewable generation since 2007, with a focus on the numbers issued in millions or TWh generation. The data is segmented by regions and years, with specific details for Northern Ireland, Scotland, England, Wales, and the UK obligation. The chart shows a steady increase in ROCs issued over the years, indicating growth in renewable energy generation. The color-coding helps distinguish between different regions and obligations, providing a clear visual representation of the data.
Total and Year Four FIT Installations by Location and Technology

Regional breakdown of registered installations in year four
CIBSE Knowledge Series on Capturing Solar Energy

<table>
<thead>
<tr>
<th>Location</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>1.11</td>
<td>1.89</td>
<td>2.74</td>
<td>4.03</td>
<td>4.78</td>
<td>5.03</td>
<td>4.98</td>
<td>4.68</td>
<td>3.39</td>
<td>2.45</td>
<td>1.14</td>
<td>0.93</td>
</tr>
<tr>
<td>Manchester</td>
<td>1.11</td>
<td>1.81</td>
<td>2.67</td>
<td>4.05</td>
<td>4.78</td>
<td>4.77</td>
<td>4.86</td>
<td>4.53</td>
<td>3.46</td>
<td>2.24</td>
<td>1.38</td>
<td>0.88</td>
</tr>
<tr>
<td>Edinburgh</td>
<td>0.83</td>
<td>1.57</td>
<td>2.67</td>
<td>3.77</td>
<td>4.75</td>
<td>4.81</td>
<td>4.70</td>
<td>4.03</td>
<td>3.05</td>
<td>1.80</td>
<td>1.09</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Graph showing total annual solar radiation for different orientations and maximum output percentage.
Solar Photovoltaic System – Performance and Climate Conditions
Coloured Photovoltaic Glazing
Tesla Powerwall and Power Pack

Surface area of solar panels required to power entire U.S.

Powerwall
Tesla Home Battery

Powerwall

$3,500

10kWh
Tesla Supercharger – The World’s Fastest Charging Station

Find
Supercharger stations are shown in Google Maps on the car’s 17” touchscreen

Charge
Grab a cup of coffee or a bite to eat while your Model S charges

Drive On
Check the Model S app to see when your car is charged
Tesla GigaFactory 1 Making Power Packs

GIGAFACTORY 1
Graphene as a Super Conductor

Graphene superconducting property discovered

SLAC National Accelerator Laboratory see electrons dancing in superconducting material, setting a foundation for future explorations

March 21, 2014

Adding calcium atoms (orange spheres) between graphene planes (blue honeycomb) creates a superconducting material called CaC6. Now a study at SLAC has shown for the first time that graphene is a key player in this superconductivity: electrons scatter back and forth between the graphene and calcium layers, interact with natural vibrations in the material’s atomic structure, and pair up to conduct electricity without resistance. (Credit: Greg Stewart/SLAC)

Scientists at the Department of Energy’s SLAC National Accelerator Laboratory and Stanford University have discovered how graphene — a single layer of carbon atoms with great promise for future electronics — is superconducting in a graphene-calcium compound, meaning that graphene would carry electricity with 100 percent efficiency.
World Commodity Prices – World Bank


Note: Shaded area denotes price forecast.
Gold, Silver and Platinum Prices in US$ per Troy Ounce

- **Gold Price**: 1,099.40 USD/oz as of 7 Aug '15
- **Silver Price**: 15.01 USD/oz as of 7 Aug '15
- **Platinum Price**: 965.00 USD/oz as of 7 Aug '15

Graphs showing price fluctuations from January 2010 to August 2014.
## Soft Landings Framework

**The SOFT LANDINGS FRAMEWORK**

*for better briefing, design, handover and building performance in-use*

---

### Table: RIBA Plan of Work 2008 vs Soft Landings

<table>
<thead>
<tr>
<th>RIBA Plan of Work 2008</th>
<th>Soft Landings</th>
<th>OGC Gateways (at end of stage) and milestones in the RIBA Plan of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage letter and name</strong></td>
<td><strong>Main activities</strong></td>
<td><strong>Principal additions</strong></td>
</tr>
<tr>
<td>Preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Appraisal</td>
<td>Identify client needs.</td>
<td>Define roles and responsibilities</td>
</tr>
<tr>
<td></td>
<td>Do feasibility studies.</td>
<td></td>
</tr>
<tr>
<td>B. Design brief</td>
<td>Develop an initial statement of requirements and procurement methods</td>
<td>Explain Soft Landings to all participants. Identify processes and sign-off gateways.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Concept</td>
<td>Implement and expand the brief. Prepare the concept design. Review the procurement route.</td>
<td>Review past experience. Agree performance metrics. Agree design targets.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Design development</td>
<td>Develop concept design. Update outline specification and costs. Complete project brief.</td>
<td>Review design targets. Review usability and manageability.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Technical design</td>
<td>Prepare technical design and specification sufficient for coordination and information for statutory standards.</td>
<td>Review against design targets. Involve the future building managers.</td>
</tr>
<tr>
<td>Production information</td>
<td>Prepare detailed information for construction. Review information provided by specialists.</td>
<td>Review against design targets. Involve the future building managers.</td>
</tr>
<tr>
<td>Tender documentation</td>
<td>Prepare or collate tender information.</td>
<td>Include additional requirements related to Soft Landings procedures.</td>
</tr>
<tr>
<td>Tender action</td>
<td>Identify and evaluate potential contractors and/or specialists. Submit recommendations to client.</td>
<td>Include evaluation of tender responses to Soft Landings requirements.</td>
</tr>
<tr>
<td>Contraction</td>
<td>Set the contract. Issue information to the contractor. Arrange site handover to the contractor.</td>
<td>Confirm roles and responsibilities of all parties in relation to Soft Landings requirements.</td>
</tr>
<tr>
<td>Construction</td>
<td>Administer the contract. Provide further information as required. Review information provided.</td>
<td>Include FM staff and/or contractors in reviews. Demonstrate control interfaces. Liaise with move-in plans.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-practical completion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**BSRIA 8G 4/2009**

---

[Energy, Policy & Technology](#)
Very Active in Soft Landings

how to Procure Soft Landings
Specifications and supporting guidance for clients, consultants and contractors

By Roderic Bunn

Presented and supported by:

BSRIA Limited

www.softlandings.org.uk

BSRIA B6 45/2014

AECOM

Is a member of the Soft Landings User Group

As a member of the Soft Landings User Group
We are committed to ensuring that Soft Landings core principles are applied on our new build and refurbishment projects, that operational outcomes match the design intentions, and that the expectations of the building’s end users are met

Roderic Bunn
Project Manager of the Soft Landings Framework

B6 Certificate

BSRIA Limited
Old Broadwell Court, Broadwell
Bristol, BS30 7FU, UK
T: +44 (0) 1454 464010 F: +44 (0) 1454 464660
E: sales@bsria.co.uk W: www.bsria.co.uk
Offices in Bristol, Beijing, Dusseldorf, St Helens, South America, Taiwan, Paris, and Aarhus in Aarhus
Soft Landings and Government Soft Landings

Soft Landings & Government Soft Landings
A Convergence Guide for Construction Projects

| BSRJA | www.softlandings.org.uk |

| Soft Landings & Government Soft Landings | Developed Design |

<table>
<thead>
<tr>
<th>3</th>
<th>Key activities for Government Contract Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate how the design proposals are developed to meet user and operator needs, using a model or some other means of explaining the end product to end users, operators and owners.</td>
<td></td>
</tr>
<tr>
<td>Provide calculations in relation to energy and show how energy has been considered.</td>
<td></td>
</tr>
<tr>
<td>Demonstrate how any operating constraints have been advised to the planning authority and operators / owners.</td>
<td></td>
</tr>
<tr>
<td>Provide an update of what will be required for aftercare and the scope of the engagement required from all parties.</td>
<td></td>
</tr>
<tr>
<td>Provide controls operating descriptions for all engineering systems.</td>
<td></td>
</tr>
<tr>
<td>Provide an updated plan for removal and replacement of plant.</td>
<td></td>
</tr>
<tr>
<td>Provide an updated plan for commissioning, training and handover.</td>
<td></td>
</tr>
</tbody>
</table>

| 4 | Key activities in the Soft Landings Framework |

<table>
<thead>
<tr>
<th>Developed Design</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Supporting activities:
- Review design targets.
- Review usability and maintainability.

Guidance notes:
- Design review meetings should continue through the developed design stage. They require sensitive preparation and chaired if they are to be constructively critical. Timing is important; reviews are best undertaken when options are relatively clear, allowing discussion to be focused, but with solutions not so well crystallized that the design team finds it difficult to respond to important comments.

Technical Design

| 3 | Key activities in the Soft Landings Framework |

<table>
<thead>
<tr>
<th>4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
HM Government Construction 2025 Strategy Plan – July 2013

Working together, industry and Government have developed a clear and defined set of aspirations for UK construction.

It begins with a clear vision of where UK construction will be in 2025:

- **PEOPLE** An industry that is known for its talented and diverse workforce
- **SMART** An industry that is efficient and technologically advanced
- **SUSTAINABLE** An industry that leads the world in low-carbon and green construction exports
- **GROWTH** An industry that drives growth across the entire economy
- **LEADERSHIP** An industry with clear leadership from a Construction Leadership Council

This vision will provide the basis for the industry to exploit its strengths in the global market.

**Lower costs**

- 33% reduction in the initial cost of construction and the whole life cost of built assets

**Faster delivery**

- 50% reduction in the overall time, from inception to completion, for newbuild and refurbished assets

**Lower emissions**

- 50% reduction in greenhouse gas emissions in the built environment

**Improvement in exports**

- 50% reduction in the trade gap between total exports and total imports for construction products and materials
Developing Carbon Measurement Tools

WHOLE LIFE CARBON

PRODUCTS COMPONENTS PROCESS BUILDINGS

RAW DATA

STANDARD METHODOLOGY ‘CALCULATORS’
E.G. CEN TC350

PERFORMANCE DATA

DESIGN TOOLS CREATED BY INDUSTRY

STANDARD ADOPTED ACROSS INDUSTRY

OPERATIONAL CARBON

PRODUCTS COMPONENTS BUILDINGS

RAW DATA

STANDARD METHODOLOGY ‘CALCULATORS’
E.G. SAP AND S-BEM

PERFORMANCE DATA

ACTIVITIES COMPLETED

ACTIVITIES UNDERWAY OR TO BE COMPLETED
WRAP Resource Efficiency Diagram
Whole-Life Cost Analysis

1. Scenario and context
2. Timing and cost data
3. Scoping and context
4. Develop the models
5. Interpret the results

Decision-making
The CIBSE TM56 - 2014

The CIBSE Technical Memoranda is divided into three main parts.

1) Explains resource efficiency

2) Sets out the key principles

3) Covers the opportunities for resource efficiency in:-
   a. Heating
   b. Cooling
   c. Ventilation
   d. Lighting
   e. Lifts and escalators
Approved Document L1A – 2013 Edition

The approved documents

The Building Regulations

Approved Document L1A: Conservation of fuel and power in new dwellings

Section 1: The requirements

Part L of Schedule 1 – Conservation of fuel and power

Section 2: Design standards

Regulations 24 and 25

Target CO₂ emission rate (TER)

Target Fabric Energy Efficiency (TFEE) rate

Buildings containing multiple dwellings

Criterion 1 – Achieving the TER and TFEE rate

Calculating the CO₂ emissions from and fabric energy efficiency performance of the actual dwelling

CO₂ emission and fabric energy efficiency rate calculations

Secondary heating

Internal lighting

Buildings containing multiple dwellings

Achieving the TER and TFEE rate

Consideration of high-efficiency alternative systems

Special considerations

Criterion 2 – Limits on design flexibility

Limiting fabric standards

Limiting system efficiencies

Criterion 3 – Limiting the effects of heat gains in summer

Limiting the effects of solar gains in summer

Heat losses and gains from circulation pipes
Main Changes to ADL1A 2013

The main changes in this approved document are that:

- A new requirement, regulation 26A, has been introduced that requires new dwellings to achieve or better the notional dwelling efficiency target introduced for new homes.
- The notional dwelling used to determine carbon dioxide and fabric energy efficiency targets is the same size and shape as the actual dwelling, constructed to a concurrent specification. The Part L 2013 strengthened to deliver 6% carbon dioxide savings across the new homes building mix relative to Part L 2010.
- A summary of the Part L 2013 notional dwelling is published at Table 4 in the Approved Document with the full detail in SAP 2012 Appendix R. If the actual dwelling is constructed entirely to the notional dwelling specifications it will meet the carbon dioxide and fabric energy efficiency targets and the limiting values for individual fabric elements and buildings services. Developers are however free to vary the specification, provided the same overall level of carbon dioxide emissions and fabric energy efficiency performance is achieved or bettered.
- The document consolidates the amendments made in December 2012 requiring the feasibility of high-efficiency alternative systems to be taken into account before construction commences.
- The guidance for insulation of circulation pipes within communal spaces is given greater prominence.
- The document is in a new style format and an index has been introduced.
### Requirement

**Schedule 1 – Part L Conservation of fuel and power**

**L1.** Reasonable provision shall be made for the conservation of fuel and power in buildings by:

- (a) limiting heat gains and losses—
  - (i) through thermal elements and other parts of the building fabric; and
  - (ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;

- (b) providing fixed building services which—
  - (i) are energy efficient;
  - (ii) have effective controls; and
  - (iii) are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.
New-Build Dwellings 2013: The Five Compliance Steps

1. Achieving the TER (Regulation 26) and the TFEE (Regulation 26A)

   Domestic Emission Rate (DER) ≤ Target Emission Rate (TER) and
   Dwelling Fabric Energy Efficiency (DFEE) ≤ Target Fabric Energy Efficiency (TFEE)

2. Limits on design flexibility

3. Limiting the effects of heat gains in summer

4. Building Performance Consistent with DER - Quality of construction & commissioning (Regulation 43 & 44)

5. Provisions for energy efficient operation of the dwelling - Providing information / O&M instructions (Regulation 40)
Emissions Compliance Checks for Part L 2013

- Actual Fabric & Plant
  - Actual Building
    - Standard Activity Schedule
    - Building Geometry
    - Notional Building
      - 2013 Elemental Standards Fabric & Plant
- Revise Design
  - CO₂ Actual Emission Rate (BER or DER)
    - Calculation Tool
      - CO₂ Notional Target Emission Rate (TER)
        - Is BER>TER?
          - OK
Consideration of High-efficiency Alternative Systems

**Regulation 25A Consideration of high-efficiency alternative systems for new buildings**

1. Before construction of a new building starts, the person who is to carry out the work must analyse and take into account the technical, environmental and economic feasibility of using high-efficiency alternative systems (such as the following systems) in the construction, if available—
   a. decentralised energy supply systems based on energy from renewable sources;
   b. cogeneration;
   c. district or block heating or cooling, particularly where it is based entirely or partly on renewable sources; and
   d. heat pumps.

2. The person carrying out the work must—
   a. not later than the beginning of the day before the day on which the work starts, give the local authority a notice which states that the analysis referred to in paragraph (1)—
      i. has been undertaken;
      ii. is documented; and
      iii. the documentation is available to the authority for verification purposes; and
   b. ensure that a copy of the analysis is available for inspection at all reasonable times upon request by an officer of the local authority.

3. An authorised officer of the local authority may require production of the documentation in order to verify that this regulation has been complied with.
Limits on Design Flexibility – Criterion 2 (ADL1A – 2013)

Criterion 2 – Limits on design flexibility

2.31 While the approach to complying with Criterion 1 allows design flexibility, paragraph L1(a)(i) of Schedule 1 to the Building Regulations requires that reasonable provision be made to limit heat gains and losses through the fabric of the building, and paragraphs L1(b)(i) and (ii) require that energy-efficient fixed building services with effective controls be provided.

2.32 One way of showing that the Part L is satisfied is to demonstrate that the fabric elements and the fixed building services all meet the minimum energy efficiency standards specified in the following paragraphs.

NOTE: Note that, in order to satisfy the TER and the TFEE rate, the building specification needs to be considerably better than the stated limiting values in many aspects of the design.

NOTE: Achieving the TFEE rate could be dependent on very good performance of one specific feature of the fabric design with poorer fabric performance elsewhere. If this key element of fabric design was to fail, or perform less well than expected, this would have a significant impact on performance. Continuing to have limiting fabric standards in Criterion 2 reduces such an impact.

To satisfy the TER and the TFEE rate, the building specification needs to be considerably better than the stated limiting values.
Comparison of English and Welsh: Criteria 2 – Fabric Limits

Fabric elemental backstops have been updated in Wales for 2014.

Whereas in Part L 2010 the limits were advisory, they are now mandatory for Part L 2014 in Wales.

The English Part L backstops continue to be advisory and same values as Part L 2010 for Part L 2013.

<table>
<thead>
<tr>
<th>Limiting Fabric Parameters</th>
<th>English 2013</th>
<th>Welsh 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>External Wall</td>
<td>0.30</td>
<td>0.21</td>
</tr>
<tr>
<td>Floor</td>
<td>0.25</td>
<td>0.18</td>
</tr>
<tr>
<td>Party Wall</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Windows, doors, curtain walling</td>
<td>2.0</td>
<td>1.60</td>
</tr>
<tr>
<td>Air permeability</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>
Criterion 3 Changes: Limiting the Effects of Heat Gains in the Summer

- Change in title stresses that it is not just solar gains that need to be controlled during the summer period

- It highlights the need to **insulate circulation pipes** for domestic hot water
  - For example: feedback is that in apartment blocks, poorly insulated pipes in communal areas can contribute to overheating

- This guidance is in the Domestic Building Services Compliance Guide

- *Note*: The Government is investigating more widely the causes and impact of overheating in a changing climate and potential policy options
Criterion 4 - Air Permeability and Pressure Testing - 2013

43. Pressure testing

(1) This regulation applies to the erection of a building in relation to which paragraph L1(a)(i) of Schedule 1 imposes a requirement.

(2) Where this regulation applies, the person carrying out the work shall, for the purpose of ensuring compliance with regulation 26 and paragraph L1(a)(i) of Schedule 1:

   a. ensure that:
      i. pressure testing is carried out in such circumstances as are approved by the Secretary of State; and
      ii. the testing is carried out in accordance with a procedure approved by the Secretary of State; and
   b. subject to paragraph (5), give notice of the results of the testing to the local authority.

(3) The notice referred to in paragraph (2)(b) shall:

   a. record the results and the data upon which they are based in a manner approved by the Secretary of State; and
   b. be given to the local authority not later than seven days after the final test is carried out.

(4) A local authority is authorised to accept, as evidence that the requirements of paragraph (2)(a)(ii) have been satisfied, a certificate to that effect by a person who is registered by the British Institute of Non-destructive Testing or the Air Tightness and Testing and Measuring Association in respect of pressure testing for the air tightness of buildings.

(5) Where such a certificate contains the information required by paragraph (3)(a), paragraph (2)(b) does not apply.
Criterion 4 - Commissioning in ADL1A 2013

44 Commissioning

(1) This regulation applies to building work in relation to which paragraph FI(2) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed system for mechanical ventilation or any associated controls where testing and adjustment is not possible.

(2) This regulation applies to building work in relation to which paragraph L1(b) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed building service where testing and adjustment is not possible or would not affect the energy efficiency of that fixed building service.

(3) Where this regulation applies the person carrying out the work shall, for the purpose of ensuring compliance with paragraph FI(2) or L1(b) of Schedule 1, give to the local authority a notice confirming that the fixed building services have been commissioned in accordance with a procedure approved by the Secretary of State.

(4) The notice shall be given to the local authority—
   a. not later than the date on which the notice required by regulation 16(4) is required to be given; or
   b. where that regulation does not apply, not more than 30 days after completion of the work.
Criterion 5 Changes: Provision of Information

- Provides more details of what this information should contain

- Content:
  - Explanation of essential design principles and key features
  - Floor plans to show main heating and ventilation components
  - Explain how to operate, control and maintain building services and LZCs
  - Signpost other key information that should be provided including appliance manuals, EPC recommendation report

40 Information about use of fuel and power

(1) This regulation applies where paragraph LI of Schedule 1 imposes a requirement relating to building work.

(2) The person carrying out the building work shall not later than five days after the work has been completed provide to the owner sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.
Domestic Building Services Compliance Guides – 2013 Editions
## Summary of Domestic Recommended Energy Efficiency Standards

| Table 1 Recommended minimum energy efficiency standards for building services$^6$ |
|---------------------------------|---------------------------------|
| **Gas-fired wet central heating** | **Seasonal efficiency**        |
| Condensing boilers               | SEDBUK 2009$^7$: 88%           |
|                                 | SEDBUK (2005): 90%             |
| Non-condensing boilers (where permitted) | 78% | 78% |
| Range cooker boilers             | 75% | 75% |
| **Gas-fired warm air heating**   | Efficiency                     |
|                                 | See Table 6                    |
| **Gas-fired fixed independent space heaters** | Efficiency (gross)$^8$ |
| Gas and LPG primary heating      | 63%                            |
| Gas and LPG secondary heating    | 63% (new build) 45% (existing build) |
| Decorative fuel-effect           | Not specified (set to 20% in SAP 2012) |
| **Gas fires in combined fire/backboilers (replacements)** | Efficiency (gross) |
| Inset live fuel-effect           | Natural gas: 45% | LPG: 46% |
| All types except inset live fuel-effect | 63% | 64% |

The approved documents

The Building Regulations

Approved Document L2A: Conservation of fuel and power in new buildings other than dwellings

Section 1: The requirements

Part L of Schedule 1 – Conservation of fuel and power

Demonstrating compliance

Section 2: Design standards

Regulations 24 and 25

Criterion 1 – Achieving the TER

Calculating the CO₂ emissions from the actual building

CO₂ emission rate calculations

CO₂ emission rate calculation before work commences

CO₂ emission rate calculation after completion

Achieving the TER

Consideration of high-efficiency alternative systems

Special considerations

Swimming pool basins

Shell and core developments

Industrial sites, workshops and non-residential agricultural buildings other than those with low energy demand

Criterion 2 – Limits on design flexibility

Limiting fabric standards

Limiting services efficiencies

Criterion 3 – Limiting the effects of heat gains in summer

Limiting the effects of solar gains in summer

HM Government

The Building Regulations 2010

Conservation of fuel and power

L2A Conservation of fuel and power in new buildings other than dwellings

2013 edition – for use in England*
Main Changes to Approved Document L2A 2013

- The notional building used to determine carbon dioxide targets is the same size and shape as the actual building, constructed to a concurrent specification. The Part L 2013 specifications have been strengthened to deliver 9% carbon dioxide savings across the new non-domestic building mix relative to Part L 2010.

- A wider set of notional buildings has now been defined for top-lit, side-lit (heated only) and side-lit (heated and cooled) buildings. The notional building air permeability has been further sub-divided by size.

- A summary of the Part L 2013 notional buildings is published at Table 5 in the Approved Document with the full detail in the National Calculation Modelling (NCM) Guide. If the actual building is constructed entirely to the notional building specifications it will meet the carbon dioxide targets and the limiting fabric and buildings services parameters. Developers are however free to vary the specification, provided the same overall level of carbon dioxide emissions is achieved or bettered.

- The document consolidates the amendments made in December 2012 requiring the feasibility of high-efficiency alternative systems to be taken into account before construction commences.

- The document is in a new style format and an index has been introduced.
Five Criteria for Part L2A Compliance 2013 in England

1. Building Emission Rate ≤ Target Emission Rate *(Regulation 26)*

2. Limits on design flexibility

3. Limiting the effects of solar gains in summer

4. Quality of construction & commissioning *(Regulation 43 & 44)*

5. Providing information / O&M instructions *(Regulation 40)*
Achieving the Target Emission Rate ADL2A 2013

Criterion 1 – Achieving the TER

2.7 Regulation 26 states that:

New buildings

26. Where a building is erected, it shall not exceed the target CO₂ emission rate for the building that has been approved pursuant to regulation 25.

Calculating the CO₂ emissions from the actual building

2.8 To demonstrate that the requirement in regulation 26 has been met, the actual Building CO₂ Emission Rate (BER) must be no greater (no worse) than the TER calculated as set out in paragraphs 2.2 to 2.6.

2.9 The BER must be calculated using the same calculation tool as used for establishing the TER.

2.10 In order to determine the BER, the CO₂ emission factors shall be as specified in Table 12 in The Government’s Standard Assessment Procedure for energy rating of dwellings, SAP 2012.
Limits on Design Flexibility – Criterion 2 ADL2A - 2013

Criterion 2 – Limits on design flexibility

2.37 While the approach to complying with Criterion 1 allows design flexibility, paragraph L1(a)(i) of Schedule 1 to the Building Regulations requires that reasonable provision be made to limit heat gains and losses through the fabric of the building, and paragraphs L1(b)(i) and (ii) require that energy-efficient fixed building services and effective controls be provided.

2.38 One way of showing that the Part L requirement is satisfied is to demonstrate that the fabric elements and the fixed building services all meet minimum energy efficiency standards as specified in the following paragraphs.

**NOTE:** In order to satisfy the TER, the building specification needs to be considerably better than the stated limiting values in many aspects of the design. Table 5 provides a summary specification of the notional building and is a better indication of the standards required to meet the TER.

Limiting fabric standards

2.39 Table 3 sets out the limiting standards for the properties of the fabric elements of the building. The stated value represents the area-weighted average value for all elements of that type. In general, achievement of the TER is likely to need better fabric performance than set out in Table 3.

2.40 U-values should be calculated using the methods and conventions set out in BR 443 Conventions for U-value calculations, and should be based on the whole unit (i.e. in the case of a window, the combined performance of the glazing and the frame).
# Limiting Fabric Parameters in ADL2A 2013

<table>
<thead>
<tr>
<th>Table 3 Limiting fabric parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
</tr>
<tr>
<td>Wall</td>
</tr>
<tr>
<td>Floor</td>
</tr>
<tr>
<td>Swimming pool basin¹</td>
</tr>
<tr>
<td>Windows, roof windows, roof-lights⁴, curtain walling and pedestrian doors²³</td>
</tr>
<tr>
<td>Vehicle access and similar large doors</td>
</tr>
</tbody>
</table>

**Notes:**

1. Where a swimming pool is constructed as part of a new building, reasonable provision should be made to limit heat loss from the pool basin by achieving a U-value no worse than 0.25 W/m².K as calculated according to BS EN ISO 13370.

2. Excluding display windows and similar glazing. There is no limit on design flexibility for these exclusions but their impact on CO₂ emissions must be taken into account in calculations.

3. In buildings with high internal heat gains, a less demanding area weighted average U-value for the glazing may be an appropriate way of reducing overall CO₂ emissions and hence the BER. If this case can be made, then the average U-value for windows can be relaxed from the values given above. However, values should be no worse than 2.7 W/m².K.

4. For the purposes of checking compliance with the limiting fabric values for roof-lights, the true U-value based on aperture area can be converted to the U-value based on the developed area of the roof-light. Further guidance on evaluating the U-value of out-of-plane roof-lights is given in Assessment of thermal performance of out-of-plane roof-lights, NARM Technical Document NTD 2 (2010).
Limiting the Effects of Heat Gains in Summer

Criterion 3 – Limiting the effects of heat gains in summer

2.50 This section sets out the approach to limiting heat gains as required by paragraph L1(a)(i) of Schedule 1 to the Building Regulations.

Limiting the effects of solar gains in summer

2.51 The following guidance applies to all buildings, irrespective of whether they are air conditioned or not. The intention is to limit solar gains during the summer period to either:

a. reduce the need for air-conditioning; or

b. reduce the installed capacity of any air-conditioning system that is installed.

2.52 If the criterion set out below is satisfied in the context of a naturally ventilated building, this is NOT evidence that the internal environment of the building will be satisfactory, since many factors that are not covered by the compliance assessment procedure will have a bearing on the incidence of overheating (incidental gains, thermal capacity, ventilation provisions, etc.).

NOTE: Therefore the developer should work with the design team to specify what constitutes an acceptable indoor environment in the particular case, and carry out the necessary design assessments to develop solutions that meet the agreed brief. Some ways of assessing overheating risk are given in CIBSE TM37 Design for improved solar shading control and, for education buildings, in BB101 Ventilation of School Buildings.
Energy Meters in ADL2A 2013

Energy meters

2.47 Reasonable provision for energy meters would be install energy metering systems that enable:
   a. at least 90 per cent of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories (heating, lighting etc.). Detailed guidance on how this can be achieved is given in CIBSE TM39 Building energy metering; and
   b. the output of any renewable system to be separately monitored; and
   c. in buildings with a total useful floor area greater than 1000m², automatic meter reading and data collection facilities.

2.48 The metering provisions should be designed such as to facilitate the benchmarking of energy performance as set out in CIBSE TM46 Energy benchmarks.
Building Log Books – CIBSE TM31 and BSRIA BG26/2011

4.2 A way of showing compliance with regulation 40 would be to produce information following the guidance in CIBSE TM 31 Building log book toolkit. The information should be presented in templates as or similar to those in the TM. The information could draw on or refer to information available as part of other documentation, such as the Operation and Maintenance Manuals and the Health and Safety file required by the CDM Regulations.

NOTE: Further advice is provided in BSRIA BG26/2011 Building Manuals and Building User Guides.

4.3 The data used to calculate the TER and the BER should be included with the log book. The occupier should also be provided with the recommendations report generated with the ‘on-construction’ Energy Performance Certificate. This will inform the occupier how the energy performance of the building might be further improved.

NOTE: It would also be sensible to retain an electronic copy of the TER/BER input file for the energy calculation to facilitate any future analysis that may be required by the owner when altering or improving the building.
Non-domestic Building Services Compliance Guides – 2013 Editions
## Gas, Oil and Biomass-fired Boilers – Non-domestic BSCG 2013

### Table 1 Recommended minimum energy efficiency standards for building services (continued)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air distribution systems: New and existing buildings</strong></td>
<td><strong>Dry heat recovery efficiency</strong></td>
</tr>
<tr>
<td>Plate heat exchanger</td>
<td>50%</td>
</tr>
<tr>
<td>Heat pipes</td>
<td>60%</td>
</tr>
<tr>
<td>Thermal wheel</td>
<td>65%</td>
</tr>
<tr>
<td>Run around coil</td>
<td>45%</td>
</tr>
<tr>
<td><strong>Internal lighting: Option 1</strong></td>
<td><strong>Effective lighting efficacy</strong></td>
</tr>
<tr>
<td>General lighting in office, storage and industrial areas</td>
<td>60 luminaire lumens per circuit-watt</td>
</tr>
<tr>
<td>General lighting in other types of space</td>
<td>60 lamp lumens per circuit-watt</td>
</tr>
<tr>
<td>Display lighting</td>
<td>22 lamp lumens per circuit-watt</td>
</tr>
<tr>
<td><strong>Internal lighting: Option 2</strong></td>
<td><strong>Lighting Energy Numerical Indicator (LENI)</strong></td>
</tr>
<tr>
<td>Lighting system</td>
<td>≤ lighting energy limit (kWh/m²/year) specified in Table 44</td>
</tr>
<tr>
<td><strong>Heating system circulators and water pumps</strong></td>
<td><strong>Energy Efficiency Index</strong></td>
</tr>
<tr>
<td>Glandless standalone circulators</td>
<td>≤ 0.27 until 30 September 2015</td>
</tr>
<tr>
<td>Glandless, standalone and integrated circulators</td>
<td>≤ 0.23 from 1 Aug 2015</td>
</tr>
<tr>
<td>Water pumps</td>
<td>See Section 13</td>
</tr>
</tbody>
</table>
**Minimum Controls Packages for New Boilers**

<table>
<thead>
<tr>
<th>Boiler plant output</th>
<th>Package</th>
<th>Minimum controls</th>
</tr>
</thead>
</table>
| < 100 kW            | A       | a. Timing and temperature demand control, which should be zone specific where the building floor area is greater than 150 m².  
b. Weather compensation except where a constant temperature supply is required. |
| 100 kW to 500 kW    | B       | a. Controls package A above.  
b. Optimal start/stop control with either night set-back or frost protection outside occupied periods.  
c. Two-stage high/low firing facility in boiler, or multiple boilers with sequence control to provide efficient part-load performance. |
| > 500 kW individual boilers | C     | a. Controls package A and controls package B.  
b. For gas-fired boilers and multi-stage oil-fired boilers, fully modulating burner controls. |

Note: The heat loss from non-firing boiler modules should be limited by design or application. For boilers that do not have low standing losses, it may be necessary to install isolation valves or dampers.
## Minimum Energy Efficiency Ratio for Comfort Cooling

<table>
<thead>
<tr>
<th>Type</th>
<th>Cooling unit full load EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaged air conditioners</td>
<td></td>
</tr>
<tr>
<td>Single duct type</td>
<td>2.6</td>
</tr>
<tr>
<td>Other types</td>
<td>2.6</td>
</tr>
<tr>
<td>Split and multi-split air conditioners $&gt; 12$ kW</td>
<td>2.6</td>
</tr>
<tr>
<td>Split and multi-split air conditioners $\leq 12$ kW</td>
<td>SCOP ‘D’ rating for median temperature range in EN 14825</td>
</tr>
<tr>
<td>Variable refrigerant flow systems</td>
<td>2.6</td>
</tr>
<tr>
<td>Vapour compression cycle chillers, water-cooled $\leq 750$ kW</td>
<td>3.9</td>
</tr>
<tr>
<td>Vapour compression cycle chillers, water-cooled $&gt; 750$ kW</td>
<td>4.7</td>
</tr>
<tr>
<td>Vapour compression cycle chillers, air-cooled $\leq 750$ kW</td>
<td>2.55</td>
</tr>
<tr>
<td>Vapour compression cycle chillers, air-cooled $&gt; 750$ kW</td>
<td>2.7</td>
</tr>
<tr>
<td>Water loop heat pump</td>
<td>3.2</td>
</tr>
<tr>
<td>Absorption cycle chillers</td>
<td>0.7</td>
</tr>
<tr>
<td>Gas engine-driven variable refrigerant flow</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Welsh Part L 2014 Building Regulations

Part L (Conservation of fuel and power)

Technical guidance on Schedule 1 of the Building Regulations about fuel and power efficiency.
2014 changes (from 31 July 2014)
Welsh ADL1A 2014 – New Dwellings
Welsh ADL2A 2014 – New Buildings Other Than Dwellings

The Part L 2014 specifications have been strengthened to deliver 20% carbon dioxide savings across the new non domestic build mix relative to Part L 2010.

- A wider set of notional buildings has now been defined for top-lit, side-lit (heated only) and side-lit (heated and cooled) buildings. The notional building air permeability has been further sub-divided by size.
- A summary of the Part L 2014 elemental specification of these notional buildings is published at Appendix B in the Approved Document. If the actual building is constructed entirely to the notional building specifications it will meet the carbon dioxide and primary energy consumption targets and the limiting values for individual fabric elements and building services. Developers are however free to vary the specification, provided the same overall level of primary energy consumption and carbon dioxide emissions is achieved or bettered.
- The document consolidates the amendments made in SI 2013/747 requiring the feasibility of high efficiency alternative systems to be taken into account before construction commences.
- The document is in a new style format.
Welsh Regulations 26 and 26A

**Regulation 26 – CO₂ emission rates for new buildings**

Where a building is erected, it shall not exceed the target CO₂ emission rate for the building that has been approved pursuant to regulation 25.

**Regulation 26A – Primary energy consumption rates for new buildings**

Where a building (other than a dwelling) is erected, it must not exceed the target primary energy consumption rate for the building which has been approved pursuant to regulation 25C (a).

3.1.1 Criterion 1 is a **mandatory requirement** and must be met by all new buildings as stated.

3.1.2 To comply with **regulation 26A and regulation 26** it will need to be demonstrated that:

a. the calculated **Building Primary Energy Consumption (BPEC)** rate does not exceed the **Target Primary Energy Consumption (TPEC)**; and

b. the calculated **Building CO₂ Emissions Rate (BER)** rate does not exceed the **Target CO₂ Emissions Rate (TER)**

3.1.3 This section focuses on the calculation of the **BPEC** and the **BER**. Details of how the **TPEC** and **TER** are calculated are set out in Section 8. Special considerations for specific building categories are given in sections 3.7 to 3.10.
Welsh ADL2B -2014 – Existing Buildings Other Than Dwellings

2.2 Building Fabric

2.2.1 New thermal elements constructed as part of an extension should achieve or better the U-values set out in Table 1. U-values should be calculated as given in Appendix C.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Maximum U-values for new fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Buildings that are essentially</td>
</tr>
<tr>
<td></td>
<td>domestic in character</td>
</tr>
<tr>
<td></td>
<td>All other buildings</td>
</tr>
<tr>
<td>Wall</td>
<td>0.21</td>
</tr>
<tr>
<td>Floors</td>
<td>0.18</td>
</tr>
<tr>
<td>Pitched roofs – insulation at</td>
<td>0.15</td>
</tr>
<tr>
<td>ceiling level</td>
<td></td>
</tr>
<tr>
<td>Pitched roofs – insulation at</td>
<td>0.15</td>
</tr>
<tr>
<td>rafter level</td>
<td></td>
</tr>
<tr>
<td>Flat roof or roof with integral</td>
<td>0.15</td>
</tr>
<tr>
<td>insulation</td>
<td></td>
</tr>
<tr>
<td>Swimming pool basin</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*For use in Wales*
Northern Ireland Building Regulations F1 & F2 – October 2012

Technical Booklet F1
Conservation of fuel and power in dwellings
October 2012

Technical Booklet F2
Conservation of fuel and power in buildings other than dwellings
October 2012
Scottish Technical Handbooks – Section 6

The Technical Handbooks provide guidance on achieving the standards set in the Building (Scotland) Regulations 2004 and are available in two volumes, Domestic buildings and Non-domestic buildings.

A Technical Handbook 2013 Summary Guide providing details on the main changes introduced to the mandatory standards and associated guidance for 2013 has been published. The changes involve Sections 0, 2, 3, 4 and 7 of the Technical Handbooks.

Errata May 2014 - This publication corrects typographical errors and corrections to the 2013 Technical Handbook editions.

Corrigenda October 2014 - This publication provides a list of corrections to the 2013 Technical Handbook editions.

Section 6 (energy) for 2015 – Revisions to section 6 of the Technical Handbooks, which will come into force on 1 October 2015, are now available. This early publication allows time for industry to become familiar with this next set of guidance.

Technical Handbooks for October 2015 (in force from 1 October 2015)

Changes have now been made to sections 2, 3, 4, 5 and 7 of the Technical Handbooks (as a result of the Better Regulation review) and these come into force on 1 October 2015. Also the section 6 (energy) changes (see paragraph above) have now been merged into the latest edition of the Technical Handbooks. The 2015 Changes Summary document identifies the key changes.
Scottish NCM – 2015 Edition

Building fabric

33. The U-values in the notional building must be as specified in Table 1. Taking into account guidance in BR 443, all U-values should be calculated in accordance with BS EN ISO 6946: 2007, where the U-values calculation methods are inclusive of repeating thermal bridges.

Table 1: U-values of construction elements in the notional building (W/m².K)

<table>
<thead>
<tr>
<th>Element</th>
<th>Heated and naturally ventilated</th>
<th>Heated and cooled or Heated and mechanically ventilated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roofs</td>
<td>0.18</td>
<td>0.16</td>
</tr>
<tr>
<td>Walls</td>
<td>0.23</td>
<td>0.20</td>
</tr>
<tr>
<td>Floors</td>
<td>0.22</td>
<td>0.2</td>
</tr>
<tr>
<td>Windows</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Roof-lights</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>External personnel doors</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Vehicle access and similar large doors</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Internal walls</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Internal windows</td>
<td>3.85</td>
<td>3.85</td>
</tr>
<tr>
<td>Internal ceilings</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Notes:
- Any part of a roof having a pitch greater or equal to 70° is considered as a wall.
- U-value of rooflights is the overall U-value including the frame and edge effects, and also relates to adjustment for slope as detailed in section 11.1 of BR443.
2015 Changes to Scottish Building Standards

### Section 6 - Energy

<table>
<thead>
<tr>
<th>Clause</th>
<th>Subject</th>
<th>Description of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>6.0.13</td>
<td>Latest changes</td>
<td>Changes introduced from October 2013</td>
</tr>
<tr>
<td>6.9</td>
<td>Energy performance certificates</td>
<td></td>
</tr>
<tr>
<td>6.9.1</td>
<td>Introduction</td>
<td>Floor area reduced for public buildings and buildings frequently visited by the public</td>
</tr>
<tr>
<td>6.C.1</td>
<td>Compliance flowchart</td>
<td>Flowchart updated</td>
</tr>
</tbody>
</table>

### Section 7 - Sustainability

<table>
<thead>
<tr>
<th>Clause</th>
<th>Subject</th>
<th>Description of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>7.0.5</td>
<td>Latest changes</td>
<td>Changes introduced from October 2013</td>
</tr>
<tr>
<td>7.1</td>
<td>Statement of sustainability</td>
<td></td>
</tr>
<tr>
<td>7.1.6</td>
<td>Carbon dioxide emissions only at Silver level for all other non-domestic buildings</td>
<td>New paragraph one and guidance deleted</td>
</tr>
<tr>
<td>7.1.9</td>
<td>Carbon dioxide emissions only at Gold level for all other non-domestic buildings</td>
<td>Guidance updated in paragraphs two and three</td>
</tr>
</tbody>
</table>
GSL and BIM are Linked

Thank you for visiting the Government Soft Landings (GSL) micro-site.

This site will provide you with an overview of GSL and how it works. It will be updated to support your implementation of GSL.

The Government objective is to champion better outcomes for our built assets during the design and construction stages through Government Soft Landings (GSL) powered by a Building Information Model (BIM) to ensure that value is achieved in the operational lifecycle of an asset.
Winner of the Bentley Success Award for Three Years 2000, 2001 & 2002
Prints from BIM Design Developments
Energy, Policy & Technology

CAD to BIM – What Next?

Level 2 by 2016

Lonely or isolated BIM Level 1
No Employers Information Requirements

Social or co-operative BIM Level 2
Employers Information Requirements

Open or intimate BIM Level 3

Maturity

Lifecycle Management

Data

Processes

Level 0

2D

3D

AutoCAD

MicroStation

SketchUp

AECOsim

ArchiCAD

CATIA

COBie

Inventor

Revit

Rhino

SciA

AECOM Standards

Proprietary Formats

File Based / Object Based

Open non Proprietary Formats

IDM

IFC

IFD

gbXML

CIS2

SDNF

COBie (schema)
(emerging standards)

Common Data Environment
BIM Roadmap & Soft Landings Activities
What Has Happened In BIM Since 2011?

PAS 1192-2:2013
Specification for information management for the capital/delivery phase of construction projects using building information modelling

PAS 1192-3:2014
Incorporating Compendium No. 1
Specification for information management for the operational phase of assets using building information modelling

PAS 1192-5:2015
Specification for security-minded building information modelling, digital built environments and smart asset management
BS 1192-4:2014 – Collaborative Production of Information

Other publications/online resources


---

2) PAS 1192-5 will be developed in due course.
BIM Modelling in 3D Cad

Shenzhen Kerry Centre Phase 2 model and a sample of the model's 2D output
Detailed Clash Detection Within 3D CAD Environment
Community High School and Oasis Academy
Smart Meters?

How smart are smart meters?

The smart meter sends your meter reading directly to us, so you don't have to. That means more accurate bills and one less thing to think about.
Sustainable Technologies Used By Housing Associations in the UK

Figure 11 General satisfaction with technologies
Energy and Water Efficient Installations by Housing Associations
Future Use of Sustainable Technologies for Housing

Energy efficiency – main stream technologies
- PV: 79% would use, 6% would try to avoid
- MVHR: 57% would use, 10% would try to avoid
- Solar thermal: 55% would use, 11% would try to avoid
- Air source heat pumps: 45% would use, 28% would try to avoid
- Communal heating: 48% would use, 25% would try to avoid
- Flue gas heat recovery: 47% would use, 18% would try to avoid
- Ground source heat pumps: 36% would use, 6% would try to avoid

Energy efficiency – low use technologies
- Exhaust air heat pumps: 35% would use, 10% would try to avoid
- Boiler flow restrictors: 29% would use, 8% would try to avoid
- Voltage optimisers: 20% would use, 12% would try to avoid
- Wastewater heat recovery: 16% would use, 16% would try to avoid

Water efficiency
- Low-flush toilets: 79% would use
- Low-flow taps and showers: 75% would use
- Low-volume baths: 60% would use
- Rainwater harvesting: 36% would use
- Greywater recycling: 34% would use

Other
- Other: 10% would use
- No/none: 7% would use
- Don't know: 3% would use
- Will depend on circumstances/will vary: 1% would use
Smart and Intelligent Buildings

What does it actually mean to be a “Smart Building” or “Intelligent Building”? "Smart" is used to describe advanced actuators, sensors and related devices. A “Smart Device” is operated by a microprocessor and communicates with external systems via some form of data network.

An "Intelligent System" is used to describe a combination of ”Smart Devices and Systems”, with software coordinating the “Smart Items”. True “Intelligence” implies the ability to automatically adjust operating parameters interactively between “Smart Items” to optimize building functionality or performance.
Smart Grids
Siemens – Our Future Depends on Intelligent Infrastructure

Dynamic tolling system, Tel Aviv
In Tel Aviv, the Siemens dynamic tolling system keeps traffic moving by automatically increasing tolls when the traffic volume is high. The system has increased the use of public transportation and reduced congestion as well as exhaust emissions.

Driverless trains, Paris
Driverless trains from Siemens can increase capacity by about 20 percent by safely reducing the intervals between trains by 20 seconds. Since converting to a driverless system, Paris Metro Line 1 can carry an additional 70,000 passengers during peak travel times, while reducing energy consumption by 15 percent.

eTicketing, Lisbon
Thanks to the new Siemens eTicketing system in Lisbon, commuters can use a single card to access a large group of public transport options. The system provides updated information panels, help points, video surveillance, data networks, and uninterruptable power supply systems, which means that each user can enjoy a safe, quick, and comfortable trip.

Public transportation, London
Public transportation in London is becoming more efficient, less congested, and more comfortable thanks to Siemens technologies. For example, Siemens detection and enforcement infrastructure is being used to enforce the city congestion charge in central London, resulting in a 20 percent traffic decrease. And hybrid drive technology has been installed in a growing number of double-decker buses to decrease the amount of emissions emitted by 40 percent and save up to 30 percent on fuel.
Fujisawa Sustainable Smart Town South of Tokyo in Japan

Each of the 600 detached homes and 400 apartments in this Panasonic Smart Town is fitted with photovoltaic panels and storage batteries. There are a total of 30MW of solar modules.

First homes completed in 2014 with town due for 2018 completion

Photos from Panasonic
Take a Traditional 100 Watt GLS Lamp (From Web Google Image)

- **Traditional incandescent**
  - 100 watts
  - Electric current heats an incandescent bulb's tungsten filament until it glows.
  - Life span: 750 hours
  - Price: $0.37 per bulb
  - Wasted energy: 1,600 lumens

- **Halogen incandescent**
  - 77* watts
  - Halogen gas such as iodine inside the bulb prevents wear on the filament, allowing it to glow brighter.
  - Life span: 1,000 hours
  - Price: $1.59 per bulb
  - Wasted energy: 1,600 lumens

- **Compact fluorescent (CFL)**
  - 23 watts
  - Excited gas in a CFL tube emits ultraviolet photons, which coat the bulb’s coating to emit visible light.
  - Life span: 10,000 hours
  - Price: $2.23 per bulb
  - Wasted energy: 1,600 lumens

- **Light-emitting diode (LED)**
  - 20 watts
  - An LED bulb contains many small semiconductor units, each emitting light when a voltage is applied.
  - Life span: 20,000 hours
  - Price: $45 per bulb
  - Wasted energy: 1,600 lumens
Ten LED (60 Watt GLS Equivalent) Lamps

Crompton Lamps 10W
With an output of 900 lm, Crompton Lamps has produced a 10W LED lamp equivalent to the 60W incandescent. Providing a warm white light, the lamp has a life of 25,000 hours. The new lamps have an opal finish and offer a colour appearance of either daylight (6,000K) or warm white (3,000K). Crompton’s LED GLS range is available in 8W, 10W and 12W versions that are 40W, 60W or 75W equivalent.

Philips 9.5W
Philips’ rotary LED bulb provides a warm white light at 2,700K and a high colour rendering index of 960s. Special plastic material provides protection for the lamp. Philips says the lamp offers households energy savings of up to 90 per cent, the manufacturer has said it has significantly reduced the product’s weight by using lighter components.

Ledon 12W
Ledon has produced a 12W (900 lm) lamp that is equivalent of the 60W incandescent, the manufacturer says it is unique in the market because it has a higher colour rendering index of 960s. The 12W offers energy savings of up to 85 per cent compared with conventional light sources and a service life of 25,000 hours. Ledon has also produced a 10W LED (600 lm) that is a 48W incandescent equivalent. The 10W was named “Best Buy” product in the May issue of What? magazine.
New LED Lamp Technology
The New LED Lamp Market ... 120 Lumens per Watt!!

<table>
<thead>
<tr>
<th>Light Bulb Description</th>
<th>Price</th>
<th>Product Code</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osram Edison Screw Cap (E27) 7W GLS LED Light Bulb</td>
<td>£8</td>
<td>5397007180084</td>
<td>4.9</td>
<td></td>
</tr>
<tr>
<td>Diall Edison Screw Cap (E27) 4W GLS LED Filament Light Bulb</td>
<td>£8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diall ES (E27) Fluorescent Globe Light Bulb</td>
<td>£5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osram Edison Screw Cap (E27) 10W GLS LED Light Bulb</td>
<td>£10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This Edison Screw Cap (E27) GLS LED filament light bulb has an impressive low energy A++ rating. It has a 4W power consumption, which is equivalent to a 40W standard incandescent bulb and gives off a warm white light.

- 3 years Guarantee
- Lumens - 470lm
THANK YOU FOR LISTENING

We are Here to Enhance and Sustain The Worlds Environment

"THE WORLD WE HAVE CREATED TODAY, AS A RESULT OF OUR THINKING THUS FAR, HAS PROBLEMS WHICH CANNOT BE SOLVED BY THINKING THE WAY WE THOUGHT WHEN WE CREATED THEM"

ALBERT EINSTEIN