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Building Regulations Review: Changes to Part L (conservation of fuel and power); Part F (ventilation) and Part O (overheating); of the Building Regulations: Consultation Stage Impact Assessment

Prepared by Adroit Economics

For and on behalf of

Welsh Government

Contents

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1. Summary

1.1 This impact assessment accompanies the consultation on changes that are proposed to be made to the energy efficiency requirements of the Building Regulations. This assessment considers the proposals for both dwellings and non-domestic buildings in Wales.

Policy changes considered in this impact assessment

1.2 The assessment considers the impact on dwellings and non-domestic buildings in Wales of proposed changes to Part L, Part F and Part O of the building regulations.

1.3 The costs and benefits of the proposed changes have been assessed over a 70-year appraisal period (assuming a 10 year policy period + 60 year building lifespan). The costs and benefits are net of those that would be incurred under the current regulations, including what is being done voluntarily that is above the current regulations (i.e. the counterfactual).

1.4 The proposed policy changes are, in summary:

- New Dwellings:
  - An uplift in energy efficiency standards requirements in Part L of the building regulations. Two options have been considered for the notional building[1];
    - Option 1: the notional building to include an air source heat pump; solar photovoltaic panels and a decentralised mechanical ventilation system (dMEV);
    - Option 2: the same as option 1, except that the notional building includes a mechanical ventilation with heat recovery (MVHR) system instead of a dMEV. This option 2 also includes a higher level of airtightness than option 1;
  - A change to the current performance metrics. The current metric of Dwelling Energy Efficiency Rate (DEER) is proposed to be replaced with the Energy Use Intensity. The proposal also includes adopting the New Home Energy Model as the methodology to demonstrate compliance with the Part L standard (replacing SAP);
  - Changes to the commissioning and checking process for fixed building services in new homes.
- Existing Dwellings:
  - An uplift in building services energy efficiency standards in Part L of the Building Regulations;

[1] The 'notional building' is a set of specifications that is applied to the actual building dimensions of a proposed project and is used to model performance targets that the actual building and building specifications are measured against.

- Changes to the commissioning and checking process for fixed building services in existing homes;
- A requirement for renewable energy for significant extensions;
- Extend Part O of the Building Regulations to capture certain building works on existing domestic buildings.

- New Non-Domestic:
  - An uplift in energy efficiency standards in Part L of the Building Regulations. Two options have been considered for the notional buildings;
    - Option 1: the notional building to increase lighting efficiency; the introduction of an air source heat pump and the requirement for a solar photovoltaic array equal to 30% of GIA (for side lit buildings) or 50% (for top lit buildings);
    - Option 2: the same as option 1, except a requirement for a solar photovoltaic array equal to 50% of GIA (side lit buildings) or 70% (top lit buildings) and improved fabric thermal insulation for top lit buildings with direct electric heating;
  - Mandatory requirement for provision of photographic evidence to demonstrate compliance, focussing on high-risk areas where construction quality, changes, or substitutions during the construction process could impact the predicted performance outcomes;
  - Building automated control systems (BACs) – changing the minimum effective rated output of a space heating or air conditioning system at which a BACs must be installed from 270kW to 180kW;
- Existing Non Domestic:
  - An uplift in building services energy efficiency standards in Part L of the Building Regulations.

Results

1.5 The following tables set out the results of the analysis:

- Table 1.1 sets out the costs, benefits and net benefits of the proposed changes to Part L of the Building Regulations. This table also includes familiarisation costs with Part L, F and O;
- Table 1.2 sets out the costs, benefits and net benefits of the proposed changes to Part O of the Building Regulations.

Table 1.1: Summary - Present Value of the costs, benefits and net benefits, of an uplift in energy efficiency standards in Part L (£m)				
	Costs	Benefits	Net Benefits	*Reduction in Greenhouse Gas Emissions ($MtCO_2e$)*
Familiarisation (Part L, O and F)	£2m	-	-£2m	-
New Domestic				
Option 1	£250m	£455m	£205m	*2.34*
Option 2	£371m	£482m	£111m	*2.34*
Existing Domestic				
Extensions	£31m	£32m	*	*0.01*
New Non-Domestic				
Option 1	£76m	£91m	£15m	*0.54*
Option 2	£76m	£92m	£16m	*0.54*

* less than £1m

Table 1.2: Summary - Present Value of the costs, benefits and net benefits of an uplift in energy efficiency standards in Part O (£m)				
	Costs	Benefits (excluding health benefits)	Net Benefits (excluding health benefits)	*Reduction in Greenhouse Gas Emissions ($MtCO_2e$)*
Existing Domestic - Overheating	£12m	£23m	£11m	0.01

Further detail of the Costs and Benefits

- Tables 1.3 to 1.6 provide a more detailed breakdown of the costs and benefits of each of the proposed changes to Part L and Part O of the Building Regulations.
- Table 1.7 sets out the present value of the familiarisation costs, which includes the value of time and costs to understand the proposed changes, such as CPD and training courses.

Table 1.3: Present Value of the costs of proposed changes to all residential buildings (£m)				
	New Dwelling – Option 1	New Dwelling – Option 2	Existing Dwelling - Overheating	Existing dwelling – Extensions
	Part L	Part L	Part O	Part L
Capital costs	+ 120.94	+ 240.43	+11.69	+21.54
Replacement costs	+ 129.15	+ 130.48	-17.29	+ 9.66
Maintenance costs	-	-	-	-
Energy costs	- 3.48	- 29.56	-5.56	-30.60
Standing charge costs*	- 57.28	- 57.28	-	-
Carbon costs	- 380.42	- 381.36	-0.64	-1.35
Air quality costs	- 13.84	- 13.88	-	-0.06
Net costs (excluding health)	**- 204.93**	**- 111.17**	**-11.81**	**-0.81**
Health costs			-31.85*	-
Net cost (including health)	**- 204.93**	**- 111.17**	**-43.66**	**-0.81**

Note: *The analysis estimates the health impacts of the Part O changes for existing dwellings using the same modelling assumptions as estimated for the introduction of Part O for new build dwellings in the Previous 2022 IA. Also, the analysis assumes that without the Part O changes, some households will install air conditioning units – hence the reduction in replacement and energy costs as a result of the policy.*

**Note: the standing charge costs presented in the analysis represent the savings from no longer requiring gas to be supplied to a property as a result of not installing a gas boiler. These reduction in standing charges are in addition to the change in estimated energy costs.*

Table 1.4: Reduction in Greenhouse Gas Emissions of proposed changes to all residential buildings ($MtCO_2e$)				
	New Dwelling – Option 1	New Dwelling – Option 2	Existing Dwelling - Overheating	Existing dwelling – Extensions
	Part L	Part L	Part O	Part L

Greenhouse gas emissions ($MtCO_2e$)	*-2.34*	*-2.34*	*-0.01*	*-0.01*

Table 1.5: Present Value of the costs of proposed changes to non-domestic buildings (£m)			
	New Build Part L	New Build Part L	Part L
	Option 1	Option 2	BACS
Capital costs	+£33.57	+£46.74	+£0.17
Replacement costs	+£33.03	+£38.48	-
Maintenance costs	+£0.03	+£0.03	-
Energy costs	+£9.17	-£9.06	-£0.35
Carbon costs	-£87.78	-£89.14	-£0.25
Air quality costs	-£3.18	-£3.24	-£0.01
Health costs	-	-	-
Net cost	**-£15.15**	**-£16.18**	**-£0.61**

Table 1.6: Change in greenhouse gas emissions as a result of proposed changes to non-domestic buildings ($mtCO_2e$)			
	New build Part L	New Build Part L	Part L
	Option 1	Option 2	BACS
Greenhouse gas emissions ($MtCO_2e$)	- 0.54	- 0.54	*

* less than 0.01$MtCO_2e$

Familiarisation Costs

1.6 Businesses will incur transition costs as a result of employees spending time to familiarise themselves with the new technical requirements. Familiarisation costs are estimated to be:

- Part L – domestic – both options are expected to generate familiarisation costs of £0.95m
- Part L – non-domestic – both options are expected to generate familiarisation costs of £0.24m

- Transition from SAP to the Home Energy Model (HEM) – is expected to generate familiarisation costs of £0.28m
- Changes to SBEM – is expected to generate familiarisation costs of £0.11m
- **Total familiarisation costs are estimated at £1.58m present value**

Table 1.7: Present Value of familiarisation costs for proposed changes (£m)	
	Familiarisation Costs (£m)
Part L, F and O – dwellings	0.95
Part L – non-domestic	0.24
Transition from SAP to HEM	0.28
Changes to SBEM	0.11
Total	**1.58**

Conclusions

1.7 Table 1.8 shows the net present value of all the proposed changes.

Table 1.8: Net Present Value of all the proposed changes (£m)		
	Option 1	Option 2
Dwelling – New Build	204.93	111.17
Dwelling – Existing - Overheating	11.81	
Dwelling – Existing – Extensions Renewable Energy	0.81	
Non-Domestic – New Build	15.15	16.18
Non Domestic – Existing	-	-
Non Domestic - BACS	0.44	
Familiarisation Costs	-1.58	-1.58

1.8 The impact assessment estimates that each of the proposed changes will result in a net benefit to Wales as follows:

- The proposed changes for new build dwellings are estimated to deliver net benefits of £204m (Option 1) or £111m (Option 2);
- The proposed changes for existing dwellings are estimated to deliver net benefits of £13m;
- The proposed changes for new build non-domestic buildings are estimated to deliver net benefits of £15m (Option 1) or £16m (Option 2);
- Familiarisation costs are estimated to be £2m.

2. Policy Context

Climate emergency declared in Wales

2.1 In Wales the Welsh Government has declared a Climate Emergency. The Welsh Government has set a legally binding target through the Environment (Wales) Act 2016 of reaching net zero greenhouse gas emissions by 2050. The built environment is responsible for around 30% of the UK's greenhouse gas emissions,[1] therefore decarbonising buildings is a key part of our plans to meeting our net zero commitment. As set out in the Heat Strategy for Wales[2], the net zero target is a challenge but also an opportunity for achieving better outcomes for the people, businesses and environment of Wales.

2.2 The minimum energy efficiency requirements for homes and non-domestic buildings are set through Part L (Conservation of fuel and power) of Schedule 1 and Part 6 of the Building Regulations. In 2022 the Welsh Government implemented an uplift to energy and ventilation standards (Part L and Part F) for new and existing homes and for new and existing non-domestic buildings, which are now expected to produce significantly lower carbon emissions compared to those built to the previous 2014 standards. The uplift represented an important stepping stone towards a cleaner, greener and safer built environment.

2.3 When the Welsh Government consulted on the 2022 uplift, it also set out the intention for further improvements and more ambitious energy standards in 2025[2] which has resulted in this consultation. The 2022 amendments also aimed to not disadvantage developers who wished to adopt low carbon heating from a capital expenditure viewpoint when meeting the 2022 energy targets. The Welsh Government set out this timeline to give industry time to prepare, for example to allow time to upskill in relation to low carbon heating systems, as the proposed 2025 standard was envisaged to result in these low carbon heating systems becoming an integral part of the specification in new buildings.

Setting energy performance related targets in building regulations is an important means of reducing the carbon emissions of buildings

2.4 The built environment is responsible for around 30% of the UK's greenhouse gas emissions..

2.5 **Policy 45** of Net Zero Wales commits Wales to set higher energy efficiency standards for new builds through reviewing Building Regulations Part L (Conservation of Fuel and Power).

2.6 The performance-based targets set through the Building Regulations are an important means of ensuring reduced carbon emissions of new buildings. Segments of the development industry are implementing reduced carbon emission measures of their own accord, but not all segments of the industry are likely to achieve the required standards without introduction of performance-

[2] Building regulations Part L review | GOV.WALES

based target regulation. Causes of market failures include the cost of climate change not being fully reflected in energy prices, lack of information about energy efficiency opportunities and limited incentives to make improvements.

Policy objectives

2.7 The policy objectives considered in this assessment are to reduce carbon emissions of dwellings through changes to Part L of the Building Regulations, ,and to instigate the changes in specifications, skills and supply chains needed to stimulate innovation and learning in the sector, as the basis for introducing a world-leading performance standard incorporating low-carbon heat in new homes by 2025.

2.8 The proposed Part L 2025 standard aims to build on the previous 2022 uplift. A majority of the buildings we are constructing now will still exist in 2050, the Welsh Governments intention is to implement a standard to ensure new buildings are fit for the future and will require no further work to produce zero carbon emissions as the electricity grid decarbonises.

2.9 Policy objectives also include ensuring provision of adequate ventilation through changes to Part F of the Building Regulations to align with more airtight construction encouraged by Part L. In addition, mitigating overheating risks on certain high risk building works to existing dwellings through changes to Part O of the Building Regulations.

3. Policy Options Assessed

3.1 This assessment considers the impact of proposed changes to Part L, Part F and Part O of the building regulations. The Options considered include the following.

New Dwellings – policy changes

Part L standards for New Dwellings

3.2 Two options are assessed for the uplift in energy efficiency standards in Part L.

3.3 In addition, two other specific changes are assessed, as follows:

- A change to the current performance metrics;
- Amendments to Part L and Part F to improve the commissioning and checking process for fixed building services in new homes.

Existing Dwellings – policy changes

Part L standards for Existing Dwellings

- An uplift in building services energy efficiency standards in Part L is considered;
- Amendments to Approved Documents L and F to improve the commissioning and checking processes for fixed building services in existing homes are considered;
- A requirement for renewable energy for significant extensions is considered.

Part O standards for Existing Dwellings

3.4 Proposals to extend Part O to include replacement windows in flats and new glazing in loft extensions with a glazed area equivalent to over 15% of the floorspace are considered.

New Non-Domestic – policy changes

Part L standards for New Non-Domestic Buildings

3.5 Two options have been considered for the uplift in energy efficiency standards in Part L.

3.6 In addition, two other specific changes to Part L are assessed:

- Photographic evidence being mandated to demonstrate compliance, focussing on high-risk areas where construction quality, changes, or substitutions during the construction process, could impact the predicted performance outcomes;
- Building automated control systems (BACs) – changing the minimum effective rated output of a space heating or air conditioning system at which a BACs must be installed from 270kW to 180kW.

Existing Non Domestic – policy changes

Part L standards for Existing Non-Domestic Buildings

3.7 An uplift in building services energy efficiency standards in Part L is considered.

4. Analytical Approach

4.1 This section sets out the principal steps and key considerations used to estimate the impact of both policy options.

4.2 In summary, the assessment:

- Estimates the additional costs to house builders and occupiers of both policy options, over and above the current situation (as defined by BR2022), termed the counterfactual;
- The assessment then estimates the additional benefits likely to derive from each policy option, over and above the current situation;
- And then deducts the additional costs from the additional benefits to arrive at the net policy cost.

Types of costs considered in the assessment

4.3 This analysis assesses the following types of costs of the proposed options for a 'typical dwelling' compared to the counterfactual (BR2022):

- Capital costs;
- Maintenance costs;
- Replacement costs.

4.4 The costs are derived as follows:

- Costs include capital, maintenance and replacement costs;
- All costs are in current prices;
- Costs are estimated for the life of the building;
- Cost estimates are provided by AECOM;
- Changes in costs over time, due to anticipated future learning, are taken into account. The analysis uses the same learning rate assumptions as used for the England Part L analysis.[3]

Types of benefits considered in the assessment

4.5 Three types of benefit are assessed in the analysis:

- Energy Usage - reduced energy usage as a result of improved energy efficiency;
- Two environmental benefits - reduced carbon emissions and air quality improvements;
- Health impacts - improved health of occupants of dwellings as a result of improved ventilation and reduced overheating.

[3] England Part L Domestic IA – Para 7.17

4.6 The benefits are calculated as follows:

- Energy usage – estimated by AECOM for gas, grid electricity and electricity generated by dwelling / exported to grid;
- Energy, greenhouse gas emissions and air quality costs – valued using the HMT Greenbook Supplementary Guidance: Valuation of energy use and greenhouse gas emissions for appraisal (updated November 2023);
- Improved Health – additional life years valued at £70,000 per quality adjusted life year, as per Green Book Guidance (updated March 2022).

Types of residential dwelling considered in the assessment

4.7 The assessment is based on four standard dwelling types:

- Detached House (117m^2 total floor area TFA);
- Semi Detached House (84m^2 TFA);
- Terraced House (84m^2 TFA);
- Block of Flats (assuming 32 flats per block) (50m^2 TFA 1 bed single aspect apartment and 70m^2 TFA 2 bed corner apartment).

Types of non-domestic buildings considered in the assessment

4.8 The assessment is based on 10 non-domestic building types:

- Primary School (2,353 m^2)
- Office - Naturally Ventilated (1,080 m^2)
- Office - Air Conditioned (2,160 m^2)
- Hotel (1,062 m^2)
- Secondary School (7,864 m^2)
- Medium Warehouse (1,200 m^2)
- Large Warehouse (5,261 m^2)
- Health Centre (1,995 m^2)
- Multi-Residential (non-domestic) building (2,374 m^2)
- Retail (1,250 m^2)

Appraisal period

4.9 Costs and benefits are assessed over a 70-year period (2025-2094) as follows:

- A 10-year policy period (2026-35);
- The impact of which is assessed over the assumed 60-year lifespan of each building built in the 10-year policy period.

Sequence of calculations

- Costs and benefits are first assessed for each of the build types;
- The costs and benefits of each policy option across Wales are then calculated by multiplying each building type's costs and benefits by the

estimated stock, or the number of new build completions over a 10-year period for each of the dwelling types (see Annex A for new build completion figures used).

Discount rates used

4.10 The results are presented in present value terms using the HM Treasury's standard discount rates:

- Non-Health impacts – 3.5% for the first 30 years and 3.0% for the subsequent years;
- Health impacts – 1.5% for the first 30 years and 1.0% for the subsequent years.

5. New Dwellings

Policy standards for new dwellings

Part L Standards for New Dwellings

5.1 Two policy options have been considered to achieve improvement in energy efficiency standards in new dwellings:

- Option 1 includes:
  - Air source heat pumps;
  - dMEV;
  - Improved air tightness;
  - increase in solar photovoltaic;
- Option 2 includes:
  - Air source heat pumps;
  - MVHR;
  - Improved air tightness;
  - increase in solar photovoltaic.

5.2 In addition, two other specific changes to Part L are assessed:

- A change to the current performance metrics.
- Amendments to Part L and Part F to improve the commissioning and checking process for fixed building services in new homes

Impacts of the proposed policy changes on new dwellings and how they have been calculated

5.3 Table 5.1 sets out the present value of costs of proposed Part L changes for residential new builds (£m), which in summary are:

Part L 2025 – Option 1: improved energy efficiency standards are estimated to result in:

- Additional capital, replacement, and maintenance costs of £250.09m present value (net of the counterfactual):
- Reduced energy costs (including standing charge) of £60.76m present value
- Increased social benefits (derived from reduced carbon and improved air quality) of £394.26m present value over the appraisal period;
- **Resulting in a net present value policy benefit of £204.93m**.

Part L 2025 – Option 2: improved energy efficiency standards are estimated to result in:

- Additional capital, replacement, and maintenance costs of £370.91m present value (net of the counterfactual):

- Reduced energy costs (including standing charge) of £86.84m present value
- Increased social benefits (derived from reduced carbon and improved air quality) of £395.23m present value over the appraisal period;
- Resulting in a total net present value policy benefit of £111.17m

Table 5.1: Present Value of costs of proposed Part L changes for residential new builds (£m)		
	Part L – Option 1	Part L – Option 2
Capital costs	120.94	240.43
Renewals costs	129.15	130.48
Maintenance costs	-	-
Energy costs	- 3.48	- 29.56
Standing charge costs	- 57.28	- 57.28
Carbon costs	- 380.42	- 381.36
Air quality costs	- 13.84	- 13.88
Health costs	-	-
Net Costs	**- 204.93**	**- 111.17**
Greenhouse Gas Emissions ($MtCO_2e$)	- 2.34	- 2.34

Non quantified benefits

5.4 The two options also include improvements to ventilation systems (option 1 includes dMEV and Option 2 includes MVHR). The additional costs of including these systems in a dwelling relative to intermittent extract fans and trickle vents have been included in the analysis. It is expected that Mechanical Ventilation will improve ventilation within dwellings.

5.5 However, the benefits of improved ventilation has not been monetised because the analysis has not identified relevant robust research sufficient to support assumptions to quantify the benefits of improvement. Monetisation however will be considered further for the final IA.

Unit costs used in the calculations

5.6 Table 5.2 sets out the summary costs and energy use assumptions per building used in the calculations for the counterfactual and policy options to uplift Part L standards.

Table 5.2: Unit costs for New Build Part L Regulated Elements		
Reference	Building Cost / Unit	Energy Demands by Fuel Type (kWh/yr/unit)

Building Reference	Building Type	(2024 prices)	Gas	Grid Elec	Gen Elec
BR2022 case	Detached House	£226,678	10,863	309	2,763
Policy Option 1	Detached House	£233,843	-	3,257	4,131
Policy Option 2	Detached House	£238,138	-	2,893	4,153
BR2022 case	Semi-detached House	£129,735	6,577	281	2,119
Policy Option 1	Semi-detached House	£135,370	-	2,287	3,231
Policy Option 2	Semi-detached House	£138,939	-	2,056	3,234
BR2022 case	Mid-terrace House	£128,061	5,725	277	2,120
Policy7 Option 1	Mid-terrace House	£133,648		2,176	3,252
Policy Option 2	Mid-terrace House	£137,038		1,943	3,248
BR2022 case	Block of Flats	£3,196,800	52,503	2,662	8,940
Policy Option 1	Block of Flats	£3,294,394	-	22,294	13,821
Policy Option 2	Block of Flats	£3,420,284	-	23,791	13,423

Source: The building energy modelling was undertaken using the Home Energy Model. AECOM provided current capital and lifecycle cost data for Wales based on the notional building specifications using a base building cost from BCIS and prices for the building elements that differ between options.

Counterfactual Assumptions

5.7 The analysis of the costs and benefits of the proposed policy include an estimate of the number of buildings that would have been built to the proposed standards without the policy changes. The estimate is based on analysis of the reported number of recently completed buildings that have heat pumps and using trend data to forecast how this may change over the appraisal period.

5.8 This analysis estimates that about 35% of new dwellings are being constructed with heat pumps, expected to increase to 40% by the end of the appraisal period without the proposed policy changes. The analysis assumes that half of these buildings would meet the Option 1 specification and half would meet the Option 2 specification.

Other (non-monetised) Changes for New Dwellings

A change to the current performance metrics.

5.9 Transition to the Home Energy Model (HEM) will involve familiarisation costs. The analysis has estimated the costs of familiarisation with the new modelling approach presented in Section 10 of this report.

5.10 It is expected that HEM will require more data collection and preparation than the current modelling approach. However, the model has not yet been finalised, so although there may be some additional ongoing costs of the Home Energy Model over the counterfactual, this has not been quantified at this stage.

Amendments to Part L and Part F to improve the commissioning and checking process for fixed building services in new homes.

5.11 The changes are expected to result in a small additional cost to invest in new equipment to undertake airflow rate system tests. However, the tests should be quicker to complete, so there is not expected to be a significant change in the overall cost of commissioning and checking fixed building services.

6. Existing Dwellings

Policy standards for existing dwellings

Part L and F Standards for existing dwellings

6.1 Improvements are considered with regard to the following elements:

- An uplift in building services energy efficiency standards in Part L;
- Amendments to Approved Documents L and F to improve the commissioning and checking process for fixed building services in existing homes;
- A requirement for inclusion of renewable energy for significant extensions.

Part O Standards for existing dwellings

6.2 The proposal to extend Part O of the Building Regulations to capture certain high risk building work on existing domestic buildings.

Impacts of policy proposals for existing dwellings and how they have been calculated

Part L - uplift in building services energy efficiency standards is estimated to result in:

6.3 The policy will increase the minimum performance standard for some building services. Technical analysis of the changes indicates that the uplift will bring the standards in line with industry practice. Therefore, the analysis does not assume the change will result in a significant net additional costs and benefits over and above the counterfactual i.e. what industry is doing already.

Amendments to Approved Documents L and F to improve the commissioning and checking process for fixed building services in existing homes.

6.4 The technical analysis indicates that the amendments will mainly change how some MEV and MVHR systems are commissioned. The changes will mean that some installers will need to invest in new equipment to commission the systems.

6.5 When installing centralised mechanical extract ventilation (cMEV) or centralised mechanical ventilation with heat recovery (cMVHR), the total power consumption should be measured. Installers of centralised ventilation systems will typically need to purchase a power meter this requirement. Based on current costs, there would typically be a one-off cost of around £20 for a power meter. The analysis also estimates that a small amount of additional time will be required to carry out the measurement and to record the results.

6.6 When conducting air flow rate testing, MEV and MVHR (both centralised and decentralised) systems should be tested and commissioned using calibrated powered flow hoods instead of rotating vane anemometers with hoods. Based on current costs, a calibrated powered flow hood would cost around £2,800, while rotating vane anemometers with hoods cost around £650. This represents a capital cost uplift for commissioning engineers of around £2,150, incurred on average every 10 years but heavily dependent on frequency of use and care

taken. The annual calibration cost for calibrated powered flow hoods is £175 for commissioning engineers, representing an uplift of £40 compared to the calibration cost for rotating vane anemometers. However, despite needing more expensive equipment, a powered hood requires significantly less time to prepare and undertake the assessment properly compared with a rotating vane anemometer.

6.7 Industry is already transitioning towards using powered flow hoods. The England FHS consultations stage IA estimated that around 25% of commissioning engineers have already upgraded, and that this number would increase going forward regardless of this policy.

6.8 Finally, because of the technical challenges of retrofitting mechanical ventilation systems into older properties, there are not many MVHR systems retrofitted into existing dwellings. Therefore, it is unlikely that the policy will result in significant additional costs for existing dwellings.

6.9 Based on the points set out above, the change to how MEV and MVHR systems are commissioned is not expected to add additional cost to the homeowner. The analysis includes familiarisation costs for industry to understand the proposed policy changes, but does not included any change in ongoing costs associated with this policy proposal.

A requirement for renewable energy for significant extensions

6.10 This element of the proposed policy requires that renewable energy technologies are installed on extensions above 30m^2. The costs and benefits of this are shown in table 6.1 and have been calculated as follows:

- 1,100 extensions p.a. in scope of the policy;
- With each installing a 2kw solar photovoltaic system;
- Additional capital and replacement costs are estimated to total present value of £31.19m;
- These measures are estimated to result in reduced energy costs of £30.60m;
- It is estimated that the measures will also deliver environmental improvements valued at £1.41m;
- Together resulting in a net present value policy benefit of £0.81m.

Table 6.1: Present value costs of proposed changes to Part L for existing residential dwellings (£m)

	Extensions – Renewable Energy
Capital costs	+21.54
Replacement costs	+9.66
Maintenance costs	-
Energy costs	-30.60

Carbon costs	-1.35
Air quality costs	-0.06
Net Cost (excluding health impacts)	**-0.81**
Health costs	-
Net Cost (including health impacts)	**-0.81**
Greenhouse Gas Emissions ($MtCO_2e$)	-0.01

Part O - Mitigating overheating in existing residential buildings[4]

6.11 This element of the proposed policy requires window replacement in highly glazed flats and new glazing in loft conversions, that are not close to northerly facing, to use low g-value glazing. The costs and benefits of this are shown in table 6.2 and have been calculated as follows:

- Additional capital costs of £11.69m;
- Reduced replacement costs of £17.29m;
- Reduced energy costs of £5.56m;
- Social benefits (improved health and reduced carbon) equalling £32.49m;
- Resulting in a net present value policy benefit of £43.66m.

Table 6.2: Present Value costs and benefits of proposed changes to Part O for existing residential dwellings (£m)

	Present Value Costs (£m)
Capital costs	+11.69
Replacement costs	-17.29
Energy costs	-5.56
Carbon costs	-0.64
Net Cost (excluding health impacts)	**-11.81**
Health costs	-31.85
Net Cost (including health impacts)	**-43.66**
Greenhouse Gas Emissions ($MtCO_2e$)	-0.01

[4] The policy applies to window replacements in flats and new windows in loft conversions with a high proportion of glazing (>15% of GFA). The analysis has been done for flats as these are expected to make up the majority of the dwellings impacted.

Unit metrics used in the calculations

6.12 Table 6.3 shows the key assumptions per dwelling used in the analysis.

Table 6.3: Energy Demands by Fuel Type (kWh/yr/unit) and cost

		Energy Usage (electricity) kWh	Energy Export (electricity) kWh	Capital Cost
Extension	Extension BR2025 - net change over counterfactual	-604	+848	£3,749
Part O[5]	Part O – net change over counterfactual – single aspect flat	note	-	£494
	Part O – net change over counterfactual – dual aspect flat	note	-	£659

6.13 Note - *The Part O proposals will help avoid future retrofit of air conditioning units as temperatures increase due to global warming. The modelling assumes an increasing proportion of flats with a high proportion of glazing will experience overheating in the future under the counterfactual and install air conditioning units (0.2% p.a.). The estimated cost of installing an air-conditioning system in a flat is £8,713 for a single aspect flat and £9,383 for a dual aspect flat. These systems are assumed to use 310kwh and 650kwh per annum respectively. The proposed policy will help to avoid the cost of installing the air conditioning units – hence the negative replacement and energy costs presented in Table 6.2.*

6.14 *It should also be noted that the analysis has calculated health benefits based on the value of avoided casualties as a result of reduced overheating in existing properties using the same modelling assumptions as that used to estimate the benefits for the introduction of Part O requirements for new builds in 2022. Further analysis will be undertaken for the final IA to test these assumptions.*

Buildings in scope

Number of extensions per annum

6.15 To estimate the additional impact of the policy across all dwellings in Wales, the analysis assumes:

- 1,100 extensions over 30m^2 and in scope of the policy are constructed per annum;
- This is based on the assumption that 0.5% of dwellings in Wales build an extension each year and 15% of these are in scope of the policy;

[5] The policy applies to window replacements in flats and new windows in loft conversions with a high proportion of glazing (>15% of GFA). The analysis has been done for flats as these are expected to make up the majority of the dwellings impacted. The average GIA for flats in Wales is estimated to be 54sqm.

Number of flats with a high proportion of glazing replacing windows per annum

6.16 The policy will apply to new windows that are not northerly facing installed in flats with glazing that equates to over 15% of the Gross Floor Area. To estimate the additional impact of the policy across all dwellings in Wales, the analysis assumes:

- 2,000 flats are in scope of the policy are replacing windows each year:
- This is based on the assumption of 200,000 flats in Wales;
  - Assume windows are replaced every 20 years;
  - Assume 40% have glazing that is over 15% of the Gross Floor Area;
  - Assume 25% are northerly facing and exempt from the policy;
  - Assume 33% counterfactual for flats already installing low g-value windows.

7. New Non-Domestic

Proposed Changes to Part L

7.1 An uplift in energy efficiency standards in Part L. Two options have been considered for the notional buildings

- Option 1: an increase in lighting efficiency; Air Source Heat Pump, solar photovoltaic area equivalent to 30% of GIA (side lit buildings) or 50% (top lit buildings);
- Option 2: the same as option 1, except solar photovoltaic area equivalent to 50% of GIA (side lit buildings) or 70% (top lit buildings) and improved fabric thermal insulation for top lit buildings with direct electric heating.

7.2 Photographic evidence being mandated to demonstrate compliance, focussing on high-risk areas where construction quality, changes, or substitutions during the construction process could impact the predicted performance outcomes.

Estimate costs and benefits of the two proposed policy options for an uplift in energy efficiency standards in Part L

7.3 Table 7.1 sets out the estimated present value of the costs and benefits the two proposed policy options for an uplift in energy efficiency standards in Part L.

Table 7.1: Present Value costs and benefits of proposed Part L changes for residential new builds (£m)

	Part L – Option 1	Part L – Option 2
Capital costs	£33.57	£46.74
Renewals costs	£33.03	£38.48
Maintenance costs	£0.03	£0.03
Energy costs	£9.17	-£9.06
Carbon costs	-£87.78	-£89.14
Air quality costs	-£3.18	-£3.24
Net Cost	**-£15.15**	**-£16.18**
Greenhouse Gas Emissions ($MtCO_2e$)	- 0.54	- 0.54

7.4 The proposed uplift in energy standards is estimated to result in:

- Increased capital costs of £34m (option 1) or £47m (Option 2);
- Increased renewal/maintenance costs of £33m (Option 1) or £38m (Option 2);
- Increased energy costs of £9m (Option 1) or reduced energy costs of £9m (Option 2);

- Improved carbon and air quality impacts valued at £91m (Option 1) and £92m (Option 2);
- Together resulting in overall net additional benefits of £15m (Option 1) and £16m (Option 2).

Unit costs used in the calculations

7.5 Table 7.2 shows the unit cost assumptions per building used in the calculations for both the counterfactual and the two proposed policy options.

Table 7.2: Unit costs for New Build Part L Options

Reference		Building Cost / Unit (2024 prices)	Energy Demands by Fuel Type (kWh/yr/unit)		
Policy Option	Building Type		Gas	Grid Elec	Gen Elec
BR2022 case	Primary School	£6,242,496	74,841	16,555	25,897
Policy Option 1	Primary School	£6,422,285	0	29,343	32,139
Policy Option 2	Primary School	£6,451,328	0	29,343	52,633
BR2022 case	Office (Naturally Ventilated)	£2,694,600	31,578	5,387	13,886
Policy Option 1	Office (Naturally Ventilated)	£2,754,473	0	11,112	14,328
Policy Option 2	Office (Naturally Ventilated)	£2,766,623	0	11,112	22,808
BR2022 case	Office (air conditioned)	£4,376,160	26,340	35,192	19,272
Policy Option 1	Office (air conditioned)	£4,466,623	0	64,441	12,720
Policy Option 2	Office (air conditioned)	£4,478,773	0	60,201	16,960
BR2022 case	Hotel	£2,681,629	59,526	13,330	9,699
Policy Option 1	Hotel	£2,754,149	0	103,690	8,729
Policy Option 2	Hotel	£2,762,300	0	100,780	11,639
BR2022 case	Secondary School	£20,617,449	345,724	54,639	79,064
Policy Option 1	Secondary School	£21,184,019	0	177,663	102,540
Policy Option 2	Secondary School	£21,284,158	0	143,483	36,720
BR2022 case	Medium Warehouse	£1,089,600	203,646	6,876	14,537
Policy Option 1 (ASHP)	Medium Warehouse	£1,199,755	0	48,156	37,663
Policy Option 1 (Direct Electric)	Medium Warehouse	£1,142,134	0	150,088	37,663
Policy Option 2 (ASHP)	Medium Warehouse	£1,232,141	0	42,910	55,015
Policy Option 2 (Direct Electric)	Medium Warehouse	£1,174,521	0	138,789	48,962
BR2022 case	Large Warehouse	£3,925,452	558,346	29,466	64,432
Policy Option 1 (ASHP)	Large Warehouse	£4,384,455	0	127,553	203,634
Policy Option 1 (Direct Electric)	Large Warehouse	£4,155,079	0	351,798	165,593
Policy Option 2 (ASHP)	Large Warehouse	£4,526,799	0	127,553	302,990
Policy Option 2 (Direct Electric)	Large Warehouse	£4,297,423	0	302,120	215,271
BR2022 case	Health Centre	£5,805,331	53,528	16,377	20,900
Policy Option 1	Health Centre	£5,938,961	0	25,095	32,988
Policy Option 2	Health Centre	£5,965,452	0	25,095	52,348
BR2022 case	Multi Residential	£5,011,514	110,983	26,904	21,182
Policy Option 1	Multi Residential	£5,122,988	0	73,917	13,980

Policy Option 2	Multi Residential	£5,136,342	0	69,256	18,641
BR2022 case	Retail	£3,346,250	15,862	66,208	11,153
Policy Option 1	Retail	£3,471,051	0	60,287	29,445
Policy Option 2	Retail	£3,499,176	0	50,472	39,260

Source: The building energy modelling was undertaken using the SBEM. AECOM provided current capital and lifecycle cost data for Wales based on the notional building specifications using a base building cost from BCIS and prices for the building elements that differ between options.

Counterfactual Assumptions

7.6 The analysis of the costs and benefits of the proposed policy include an estimate of the number of buildings that would have been built to the proposed standards without the changes. The estimate is based on analysis of England and Wales EPC data and the strategic plans of a number of large developers.

7.7 This analysis indicates that about 30% of warehousing, 42% of offices/retail and 72% of schools/hotels/health centres are currently being constructed to either Option 1 or Option 2 specifications. This is expected to increase to 56% of warehousing, 60% of offices/retail and 90% of schools/hotels/health centres by the end of the appraisal period. The analysis assumes that half of these buildings would meet the Option 1 specification and half would meet the Option 2 specification.

Other Proposed Changes

Photographic evidence

7.8 Mandatory collection of photographic evidence to demonstrate compliance, focussing on high-risk areas where construction quality, changes, or substitutions during the construction process could impact the predicted performance outcomes.

7.9 From discussions with industry we understand that many developers already collect photographic evidence of the building work of interest. There may be costs associated with collating, emailing and printing; but these are believed to be minimal, in the order of £10 per building.

8. Existing Non-Domestic

Proposed Changes to Part L

8.1 One change for existing non-domestic buildings is proposed:

- An uplift in building services energy efficiency standards in Part L.

An uplift in building services energy efficiency standards in Part L.

8.2 The proposed changes to the minimum energy efficiency standards for building services energy efficiency standards are intended to bring the guidance set out in Part L in line with industry practice. Therefore, the proposals are not expected to result in changes to the type of systems installed in buildings. Therefore, the analysis does not include any change in costs and benefits compared with the counterfactual.

9. Building Automated Control Systems (BACs)

9.1 A BACs is a centralised system used to monitor and control a building's environment and services. The current requirement is that new and existing non-domestic buildings, where relevant work is being carried out and where there is a heating system over 270kW, should be equipped with a BACS to avoid the need to retrofit the building later. The proposed policy is to reduce the threshold at which a BACs is required from 270kW to 180kW.

9.2 The assessment estimates the net impacts of this requirement over and above the counterfactual over a 25 year period, which is the typical lifespan of the BACs system.

Estimate net costs and benefits of the BACs proposal

9.3 Based on an estimate of the size of buildings that would require a heating system of between 180 and 270kW, the assessment estimates that there will be 10 non-domestic buildings built or refurbished per annum in Wales within scope of the policy.

9.4 The typical building in scope of the policy is estimated to be over 1,000sqm. The analysis used in the previous impact assessment in 2022 for the introduction of the requirement for BACS in buildings with heating systems over 270kW assumes that 95% of buildings over 1000sqm will be voluntarily complying with the proposals. As a consequence, the proposed policy is expected to only affect 5 additional buildings over a 10 year period.

9.5 Table 7.3 sets out the present value of the costs and benefits of the proposed change.

Table 7.3: Present Value costs and benefits of proposed changes to the threshold for BACS (£m)

	10yr Present Value Costs
Capital costs	+£0.17
Energy costs	-£0.35
Carbon costs	-£0.25
Air quality costs	-£0.01
Net Costs	**-£0.61**

10. Transition Costs

10.1 Transition costs are incurred by businesses as a result of the time spent by their employees on familiarising themselves with the new technical requirements proposed by the policy options.

10.2 The method used to estimate familiarisation costs is the same as that used in the England analysis (regarding changes to Part L, F and O of the Building Regulations in England). The estimates are based on consultation with a small number of organisations designed to identify time/cost likely to be incurred. The consultation identified:

- The types of organisations that will be affected by the changes;
- The proportion of the workforce that need to understand the changes;
- The types of familiarisation activity (training courses, self-study, CPD) likely to be undertaken;
- Costs per organisation type - average hourly employment rates[6] for each of the affected occupation were used to monetise the resulting familiarisation time costs.

10.3 The estimates have been applied to the number of businesses and employees based in Wales. The assumptions have been reviewed to ensure that any estimates that were prepared for the changes in England are also relevant in Wales.

10.4 Table 10.1 sets out the present value of the estimated familiarisation costs for each element of the proposed policy changes.

Figure 10.1: Present Value familiarisation costs for proposed changes (£m)	
	Familiarisation Costs (£m)
Part L, O and F – dwellings	0.95
Part L – non-domestic	0.24
Transition from SAP to HEM	0.28
Changes to SBEM	0.11
Total	1.58

Further detail on the familiarisation cost calculations

10.5 Table 10.2 shows the assumptions used to calculate the number of organisations that will need to become familiar with the changes.

Table 10.2: Familiarisation Assumption – number of organisations		
	Domestic	Non-Domestic

[6] The analysis uses employment costs, calculated using salary rates for each of the occupations from the latest Annual Survey of Hours and Earnings, ONS and an uplift of 20.2% to allow for non-wage employment costs, also using ONS data.

Energy Consultant	50	10
SAP Assessor	130	-
Heating/Ventilation installers	480	150
Main Contractor/ Developer	2,210	630
Architect	300	90
Engineer - other	150	40
Engineer - energy modeller	-	20
Building Control	20	20

10.6 Table 10.3 shows the assumptions used to calculate of the time required per organisation to become familiar with the changes. This estimate includes time to read the guidance and attend CPD or external training events.

Table 10.3: Familiarisation Assumption – Time required per organisation (hrs)

	Part L - domestic	Part L – non-domestic	SAP	SBEM
Energy Consultant	176	220	72	73
SAP Assessor	11	-	25	-
Heating/Ventilation installers	13	1	2	7
Main Contractor/ Developer	4	5	1	4
Architect	5	7	2	8
Engineer - other	45	57	12	20
Engineer - energy modeller	-	2	-	3
Building Control	152	103	95	81

11. Specific Impact Tests

Competition Assessment

New Buildings

11.1 The policy will impact on housebuilders, developers and the section of the construction industry undertaking works on buildings along with the supply chains for construction materials used in those projects.

11.2 As a result of higher standards, builders and installers would have to comply with the more stringent targets and as a result would see costs rise. As the increase in costs will affect all builders broadly equally, any competitive effects in the market in Wales are likely to be negligible.

11.3 The high standards assume some improvement in fabric and services specifications. If fabric energy efficiency had been improved in isolation, this could have given manufacturers of products which impact on fabric performance (insulation, windows) an advantage over those involved in manufacturing and supplying building services (e.g. boilers, lighting); however, this is not the case. Furthermore, flexibility is provided in a way that developers can meet the higher performance standards, which should ensure that no one product or manufacturer can dominate any part of the market.

Housing Supply

11.4 This policy is expected to result in increased build cost, which could deter constructors from building as many houses as it may not be possible to pass this cost onto the price of land. This would then have a negative impact on net additional housing.

11.5 We are also aware that the sector will not have had a very long lead in time before this change is introduced and so it is likely that some of these costs will not be factored into land purchases in the short run (particularly where developers have already purchased sites for future pipeline developments).

11.6 As such, the short-term impact on housing supply viability may be slightly more volatile, but we also believe that the system as a whole is sufficiently robust to be able to absorb unanticipated costs in other ways. For example, developers have options to renegotiate their Section 106 or make changes to planning permissions to absorb these costs.

11.7 In the longer term it is likely that developers will offset higher costs with higher sales prices in areas of high demand

Innovation

11.8 Particularly with respect to raising the Part L standards, there should be the potential for new firms to enter the market due to the flexibility for builders and installers to choose building technologies to meet these standards. This should encourage innovation among manufacturers.

Small firms impact test

11.9 Most of the impacts of the policy should affect all contractors broadly equally, whether large or small.

11.10 Small businesses in the housing sector principally comprise builders, installers, architects, engineers and other technical specialists. The impacts of a change in building standards are likely to be most significant for builders as any change in costs will affect their cost of business. For other parties, impacts are most likely to comprise a short term need to understand and revise practices to reflect the new requirements, however this is unlikely to be above the level that would be typically expected as part of ongoing professional development.

Environmental impact assessment

11.11 The main assessment described in this report presents the impact on the environment.

Social impact assessment

11.12 Some health benefits are likely to derive from reduced energy use. Health benefits are expected to derive from reduced overheating.

11.13 There are improvements in indoor air quality, and consequently occupant's health and well-being, from the proposed changes to Part F. Improved indoor air quality arises as a result of better air distribution between rooms, improved air flow and simplification of the guidance which should deliver greater compliance and reduce the risk of under-ventilation.

11.14 There are also potentially beneficial improvements in health and quality of life from the effect of increased energy efficiency on thermal comfort.

Rural impact assessment

11.15 Assessing rural impacts means determining whether the impacts on rural areas will be different to those for urban areas, and whether there are specific local or regional effects. The proposed policy will have an impact on buildings (both domestic and non-domestic) in rural areas. The types of buildings in rural and urban areas are similar, although the market for buildings in rural areas is typically smaller than in urban areas. The proposed changes are not expected to disproportionately affect smaller businesses. Therefore, no specific rural impacts are identified.

12. Annex A: Scale up metrics

12.1 The following tables set out the number of buildings estimated to be impacted by the proposals in Wales. Thes are used to scale-up the building level impacts in this assessment:

- New build annual completion projections[7];
- Number of buildings affected by the transition period.

New build dwellings

12.2 Table 12.1 shows the average number of new dwelling completions per annum between 2016 to 2023.

Table 12.1: Average number of Number of New Dwelling Completions per annum between 2016-23	
	Per annum
Detached	1,936
Semi Detached/End Terrace	1,990
Mid Terrace	700
Flats	1,229
Total Dwellings	5,855
Source: New housebuilding data collection, Welsh Government, NHBC New Homes Statistics Review	

Existing Dwellings

12.3 Table 12.2 shows the average number of existing dwellings per annum estimated to be impacted by the policy proposals, and how these figures were arrived at.

Table 12.2: The average number of existing dwellings per annum estimated to be impacted by the policy proposals, and how these figures were arrived at.	
	Per annum
Large dwelling extensions	1,100 existing dwellings estimated to be impacted Assumptions used to estimate the above figure ▪ total number of extensions estimated are 7,400 p.a. ▪ assume 15% of all dwelling extensions are in scope
Replacement windows in flats with large glazed areas	2,000 existing dwellings estimated to be impacted Assumptions used to estimate the above figure ▪ total number of flats estimated at 200,000 ▪ assumed that windows are replaced on 5% of existing flats p.a. ▪ of which

[7] These projections were prepared by Adroit Economics Ltd. They are intended for the purposes of this assessment only and do not represent house building forecasts by the Welsh Government. These projections were prepared on a similar basis to those prepared by Adroit Economics for the England Part L assessment.

	○ 40% have large glazed area; ○ 75% are not northerly facing; ○ 33% are counterfactual;

New Non-Domestic

12.4 There are no comprehensive published data available on the number of non-domestic buildings built per annum in Wales. Therefore, the analysis estimates the number based on the following assumptions:

- The floorspace estimates presented in the England FBS Consultation Stage IA are taken as the starting point;
- A proportion is then taken as the figure for Wales based on the ratio of existing floorspace in Wales relative to England (published by the Valuation Office[8]) in each of the building typologies;
- The floorspace is then converted into number of buildings by dividing the estimated total floorspace built per annum by the average size of each of the reference buildings presented in Section 4.

12.5 Table 12.3 shows the results.

Table 12.3: Estimated number of new Non-Domestic Buildings built per annum in Wales

	Sqm built p.a. in Wales.	Number of reference buildings built p.a.
Office - Air Conditioned	52,800	24
Office - Naturally Ventilated	33,600	31
Hotel	30,800	29
Health Centre	16,800	8
Primary School	13,000	6
Secondary School	13,000	2
Retail	23,424	19
Medium Warehouse	16,900	14
Large Warehouse	21,760	4
Residential (non-domestic buildings)	49,854	21

[8] Non-domestic rating: stock of properties including business floorspace, 2023 - GOV.UK

13. Annex B: Transition Assumptions

13.1 Two transitional arrangements options are being considered in the consultation:

- Option 1: a 6-month period between the laying date of the Part L 2025 standard regulations and publication of full technical specification and the regulations coming into force;
- Option 2: up to 12-months between the laying date of the Part L 2025 standard regulations and publication of full technical specification and the regulation coming into force.

13.2 Both options would be followed by a 12-month transitional period.

13.3 The analysis presented in this assessment is based on Option 1, a 6-month period between the laying date of the Part L 2025 standard regulations and publication of full technical specification and the regulations coming into force. This would be followed by a 12 month transitional period.

13.4 The analysis estimates the proportion of building works being built to the proposed standards based on the proposed transitional arrangements. The same assumptions have been used for both new and existing buildings and domestic and non-domestic buildings.

Table 13.1: Transition Assumptions (% of buildings meeting standards) – Option 1

	2026	2027	2028	……	2034	2035
BR2022	95%	50%	5%		0%	0%
BR2025	5%	50%	95%		100%	100%

14. Annex C: Unit Cost Assumptions (New Build)

14.1 The costs are developed by AECOM cost consultants who are specialists in their field. The rates are based on their internal cost datasets, recent published cost data and information provided by suppliers.

14.2 The cost analysis is intended to reflect typical Welsh national costs in 2024 that might be incurred by a medium sized housebuilder / developer using traditional construction methods and with a reasonably efficient supply chain, design development and construction processes. However, costs incurred by individual organisations will vary according to their procurement strategies, the location of their activity and the detail of their housing product. Notwithstanding these variations, the proportional uplifts associated with moving from one specification to another are likely to be similar across different market segments

14.3 To provide context to the cost variations assessed in the study an indicative overall build cost (£ per m2) for each building archetype was estimated. However, it should be noted that the build costs should be taken as indicative only as it is sensitive to a wide range of design and specification variables in addition to the economies of scale and regional variations discussed previously.

14.4 Base costs for future years are those for the 2024 price year, and subject to adjustments for learning for technologies that have not yet reached a mature market position. It should be noted that construction costs can vary considerably and rapidly with market conditions, particularly where activity levels result in a change in the availability of skills and materials. In these situations, it is not unusual to see quite large (several percentage points) change in overall costs over a period of months.