adroit economics ltd

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Proposed changes to Part L and F of the building regulations regarding standards for non-domestic buildings in Wales - Consultation Impact Assessment

Welsh Government

Contents

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1. Summary

Policy changes considered in this impact assessment

1.1 This assessment considers the impact of proposed changes to Part L and F of the building regulations in Wales regarding standards for non-domestic buildings.

1.2 The costs and benefits of the proposed changes have been assessed over a 70-year appraisal period. The costs and benefits are net of those that would be incurred under the current regulations.

Proposed changes

1.3 The following changes are considered in this report:

- Raising Part L standards for new non-domestic buildings – option 1 - is intended to deliver an average 18% improvement in CO2 emissions per building, compared to the current Part L standard, across the build-mix of non-domestic buildings. We expect this would typically be delivered by an increase in the efficiency of building services such as lighting, and through on-site low carbon technology such as heat pumps or photovoltaic panels;
- Raising Part L standards new non-domestic buildings – option 2 - is intended to deliver an average 28% improvement in CO2 emissions per building, compared to the current Part L standard, across the build-mix of non-domestic buildings. This is the Welsh Government's preferred option, and we expect this would typically be delivered by further adoption of low carbon technologies (e.g. larger array of photovoltaic panels) compared to Option 1;
- Raising Part L standards for existing non-domestic buildings – replacement of doors and windows;
- Raising Part L standards for existing non-domestic building extensions – improved standards for windows and doors;
- Raising the Part F standards for works in new and existing non-domestic buildings;
- Introducing Part S standards to mitigate overheating in non-domestic buildings that are residential in character;
- Changes to minimum standards for building services for new and existing non-domestic buildings.

Part L Changes – Non Domestic Building impacts

1.4 Table 1.1 presents the Net Present Value of the proposed changes to Part L for Non-Domestic Buildings.

Table 1.1: Net Present Value of proposed changes to Part L (£m)

	New Building - Uplift in Energy Standards – Option 1	**New Building - Uplift in Energy Standards – Option 2**	**Existing Buildings – replacement of windows and doors**	**Extensions – improved standard for windows and doors**
Capital costs	£36.245m	£56.787m	£2.752m	£0.615m
Energy costs	-£73.099m	-£118.588m	-£0.717m	-£0.099m
Replacement costs	£32.061m	£41.121m	£0.975m	£0.218m
Maintenance costs	£0.981m	£6.941m	£0.000m	£0.000m
Total financial costs	**-£0.921m**	**-£9.482m**	**£3.042m**	**£0.737m**
Carbon costs	-£20.939m	-£30.529m	-£2.146m	-£0.296m
Air Quality Costs	-£7.129m	-£11.517m	-£0.097m	-£0.013m
Total costs including carbon and air quality improvement	**-£28.989m**	**-£51.529m**	**£0.798m**	**£0.428m**
Tonnes of carbon saved (tonnes)	*0.133m*	*0.190m*	*0.016m*	*0.002m*

2. Part L Standards for Non-Domestic Buildings

Part L 2025

2.1 Our vision for the Part L 2025 standard is designed to shift non-domestic buildings to use low-carbon heat sources for heating and hot water. This in turn means that for 2022 new non-domestic buildings constructed to the standard will be fit for the future with the ability to become carbon neutral over time as the electricity grid and heat networks decarbonise.

Part L 2022

2.2 We propose that standards need to be uplifted as a stepping stone towards the next Part L changes in 2025, and we are consulting on two ambitious options to uplift the energy efficiency and ventilation standards for new non-domestic buildings in 2022. The preferred option will deliver a 28%[1] reduction in carbon emissions on average per office building compared to the existing standard. It will also ensure that construction professionals and supply chains are working to higher specifications in readiness for the introduction of the Part L 2025 standard.

2.3 Many of the non-domestic buildings that will exist in 2050 have already been built. The Building Regulations provide an important opportunity to raise standards in existing buildings under certain circumstances, such as during the major refurbishment of an office building. We believe that we can make significant carbon savings by uplifting standards that apply when this type of work is carried out, and this consultation sets out proposed uplifts in these standards.

2.4 The consultation document includes the following summary of proposals in respect to Part L, for both new and existing non-domestic buildings:

- Adopt primary energy as the principal performance metric for new non-domestic buildings, with the continued use of CO_2 as a secondary metric;
- Uplift minimum energy efficiency standards for whole building energy performance;
- Uplift minimum standards (backstops) for thermal elements and services for new and certain existing buildings (i.e., walls, floors, roofs) and controlled fittings in new buildings (e.g., windows, rooflights and doors);
- Uplift minimum standards for the replacement of controlled fittings (e.g., windows, rooflights and doors) in buildings domestic in character.
- Changes to minimum standards for building services for new and existing non-domestic buildings.
- Recalibrate relaxation factors applied to modular and portable buildings;
- Introduce a new airtightness testing methodology;

[1] This figure is for air conditioned offices – the % reduction varies across building types.

- Update energy sub-metering in monitoring the as-built performance of non-domestic buildings; and
- Seek views on what transitional arrangements should apply to new non-domestic buildings;

2.5 Further detail on these proposals can be viewed in Chapter 3 of the consultation document.

Part F 2022

2.6 The consultation document includes the following summary of proposals in respect to Part F, for both new and existing non-domestic buildings:

- changes to *Approved Document F - Ventilation (2010 edition incorporating 2010 and 2013 amendments)* to simplify the guidance in line with the principles presented in the Stage 1 and Part B of the Stage 2 consultations; and
- measures to reduce the risk of transmission of infection via aerosols in certain non-domestic buildings. These measures include guidance on ventilation rates, standards for systems that recirculate air in offices and a requirement for indoor air quality monitoring to be installed in offices and other high-risk rooms.

2.7 Further detail on these proposals can be viewed in Chapter 4 of the consultation document.

Overheating standards for new residential buildings 2022

2.8 The Stage 2A consultation set out the Welsh Government's proposals to reduce the risk of overheating in new dwellings. The consultation proposed both a new part of the Building Regulations (Part S) which is focussed on overheating risk and guidance on demonstrating compliance with Part S requirements.

2.9 This consultation proposes the following:

- Extension of the proposals to include non-domestic residential buildings where vulnerable people tend to be in the building for most of the day (e.g. care homes). The Stage 2a consultation highlighted the intention to consider extending Part S to capture other residential buildings when Part L for non-domestic buildings was next reviewed.

2.10 Amendments to the Stage 2a consultation proposals for new dwellings based on the consultation responses. These amendments are intended to apply to all buildings in scope i.e. both domestic and applicable non-domestic residential buildings.

2.11 Further detail on these proposals can be viewed in Chapter 5 of the consultation document.

3. Policy options considered

3.1 Improvements are considered with regard to the following elements:

Part F and L Standards for Non-Domestic Buildings

Costed – Part L:

- Uplift minimum energy standards for whole building energy performance (2 options);
  - = Improving fabric and services;
  - = Encouraging low-carbon heat;
  - = Heat recovery technologies; and
  - = On-site generation.
- Uplift minimum standards (backstops) for thermal elements and services for new and certain existing buildings (i.e., walls, floors, roofs) and controlled fittings in new buildings (e.g., windows, rooflights and doors);
- Uplift minimum standards for the replacement of controlled fittings (e.g., windows, rooflights and doors) in buildings domestic in character.

Not costed – Part L

- Changes to minimum standards for building services for new and existing non-domestic buildings:
  - = Updated energy sub-metering in monitoring the as-built performance of non-domestic buildings; costs/benefits have currently not been monetised and will be considered further in the final impact assessment
  - = Performance metrics to assess the energy performance of new non-domestic buildings, including primary energy and CO2 – we expect there to be minimal familiarisation impacts of changing the performance metrics. Trained Energy Assessors calculate these metrics using a piece of software, the Simplified Building Energy Model (SBEM) and Dynamic Simulation Models (DSM). These new performance metrics are all already calculated by the Energy Assessors using SBEM/DSM, they will simply have to report different metrics;
  - = Technical updates for the 'notional building' used in the National Calculation Methodology, including a proposal to balance the need to encourage the use existing heat networks in non-domestic buildings with the need to incentivise new heat networks to be low carbon. As district heat networks are optional i.e. people can select other means of heating, in addition the proportional of new homes in Wales with heat networks is low it is not proportional to assess the impact;
  - = Recalibrate relaxation factors applied to modular and portable buildings *have currently not been monetised and will be considered further in the final impact Assessment* ;

- = Introduce a new airtightness testing methodology. We are introducing an alternative testing methodology, providing two options to industry to use. As the developer can elect to use the original option, with no amendment to cost.

- EPBD: Technical Building Systems[2]
- Introducing Part S standards to mitigate overheating in non-domestic buildings that are residential in character *have currently not been monetised and will be considered further in the final impact Assessment*.

Not costed – Part F

- Increased ventilation rates to mitigate against infection risk for buildings other than offices – costs/benefits have currently not been monetised and will be considered further in the final impact assessment.

[2] Already consulted on in Stage 2A

4. Overall methodology

4.1 This section sets out the overall approach, key considerations, methodology and sources used to assess the impact of the proposed amendments to Part L 2022 of the Building Regulations in Wales, regarding non-domestic buildings.

4.2 The methodology is similar to that used to assess the impact of policy changes to Part L and F of the building regulations in Wales for new dwellings.

4.3 The assessment considers the impact of different elements of the proposed policy changes on different building types.

4.4 In summary, the assessment:

- (i) estimates the additional costs to builders/occupiers, of the proposed policy changes, over and above the current situation (the counterfactual) (as defined by BR2014);
- (ii) estimates the additional benefits likely to derive from the proposed policy changes, over and above the current situation;
- (iii) and then deducts (ii) from (i) to calculate the net policy cost.

Types of costs considered in the assessment

4.5 This analysis assesses the following types of policy cost for a 'typical non-domestic building, compared to the counterfactual (BR2014)[3]:

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

4.6 The costs are derived as follows:

- Capital, maintenance and replacement costs – unit costs (in current prices) are estimated for the life of the building. Unit costs have been calculated by cost consultants based on specifications developed by the technical advisors[4]. Change in costs due to anticipated future learning rates for each asset are based on the same assumptions used for the England Future Buildings Standard Consultation Impact Assessment[5]

[3] The building regulations set minimum standards, and building owners may exceed these standards. This may be undertaken because of funding requirements or to meet their own carbon targets. For example, Welsh Government funding can require a Building to meet BREEAM Excellent. We also expect voluntary adoption of higher standards to increase over time. Where a building would exceed the 2014 baseline (the counterfactual base cost) the increase in building costs relative to the 2022 standard will be reduced. This will mean a reduction in the costs of meeting the new standard, providing greater benefits of the policy over time. This has currently not been taken into account and will be considered further in the final impact assessment.

[4] The team of cost consultants and engineers that have provided the technical input includes AECOM, Currie and Brown, RLF and SCMS Associates

[5] https://www.gov.uk/government/publications/the-future-buildings-standard-consultation-impact-assessment - see Appendix B pg 64

- Energy usage – estimates of the impact of changes in energy usage are based on a combination of (i) calculations undertaken by the technical advisors and (ii) relevant published reports;
- Energy, greenhouse gas emissions and air quality costs – these are valued using the HMT Greenbook Supplementary Guidance: *Valuation of energy use and greenhouse gas emissions for appraisal (updated July 2021);*
- Administrative burden and familiarisation/ training have not been costed but will be considered in the final IA.

Types of benefits considered in the assessment

4.7 Two environmental benefits are quantified:

- Carbon emissions;
- Air quality.

Some of the proposed changes result in a cost saving, such as reduced energy demand, which could be considered to be a benefit. However, for the purpose of the appraisal, all financial benefits have been accounted for in the cost assessment.

Types of buildings considered in the assessment

4.8 The table below provides the assumed number of new buildings being completed per annum. This estimate is based on published data on floorspace and building numbers and assumptions about the rate of new build[6].

Table 4.1: Estimated Number of New non-Domestic Buildings Completions

Building Type	2022	2031
Office - Air Conditioned	17	17
Office - Naturally Ventilated	18	18
Hotel	20	20
Health Centre	10	10
School	6	7
Retail	36	37
Warehouse	10	10
Residential (non-domestic buildings)	21	24

4.9 Costs of the proposed policy changes have been estimated for each building type using the following average building size.

[6] Business Floorspace estimated using VOA published data for Wales. Non-Business floorspace derived from floorspace estimates provided in BEES Appendix B Table 3.1, and assuming 5% of total figures for England and Wales is based in Wales. Estimated annual new build rate estimated using average annual new commercial floorspace reported by CoStar; other non-domestic floorspace new build rate estimated based on net change in VOA stock numbers. Estimates of floorspace converted into building numbers using average building size presented in Table 4.2.

Table 4.2: assumed average building size, used to estimate costs of proposed policy changes

Building type	Description	Area	unit
Office - Air Conditioned	Four-storey air-conditioned office	2160	sqm
Office - Naturally Ventilated	Two-storey naturally ventilated office	1080	sqm
Hotel	Hotel with 32 rooms	1087	sqm
Health Centre	Surgery/clinic type building with 14 consulting rooms and two dental surgery rooms	2089	sqm
School	16 classroom primary school	2379	sqm
Retail	Large retail building with a 1,000m^2 shop floor	1250	sqm
Warehouse	Large warehouse with warehouse, office, canteen, food preparation, changing rooms and shower areas	5262	sqm
Residential (non-domestic buildings)	Student accommodation type building with 112 rooms	2374	sqm

Assumptions regarding extensions of non-domestic buildings and building work to existing buildings

- Existing non-Domestic Buildings: Replacement of windows and doors:
  - = Costed for care homes and student accommodation (non-domestic, residential in character);
  - = Costings are based on a 2,374sqm building with 4 external pedestrian doors and 521sqm of windows.
  - = Windows and doors are assumed to be replaced based on lifecycle of 30 years.
- Extensions to non-domestic buildings: Improved Standard for Windows and Doors:
  - = Costed only for care homes and student accommodation (non-domestic, residential in character);
  - = Assume that extensions made to 0.5% of stock per annum;
  - = Costings are based on a 2426sqm building, of which 52sqm is an extension with 1 external pedestrian door and 7.9sqm of windows.
  - = Average floorspace of 9,100 sqm p.a. of extensions built.

Appraisal period

4.10 Costs and benefits are assessed over a 70-year period (2022-2091) as follows:

- The analysis assumes a 10-year policy period (2022-31), the period over which changes are made to buildings in scope;
- The impact of these changes, in many cases, will continue beyond 2031 however. To capture these longer-term impacts, the assessment calculates impacts of changes based on the effective lifespan of the element of the

building that is being changed. This is to ensure that all costs and benefits associated with the change are included in the assessment. For example, for extensions, the appraisal is over the 60-year life of the building whereas for windows the appraisal is over the 30- year life of the window;

- Phase in Assumptions – the analysis assumes that policy is introduced in 2022 and the transition is phased as below.

Table 4.3: Transition Period Phase-in Assumptions

Building regulations	2022	2023	2024	2025
BR2014	60%	40%	10%	0%
BR2022	40%	60%	90%	100%

Sequence of calculations

4.11 The following sequence is applied:

- Costs and benefits are first assessed for an average building type;
- The costs and benefits of each policy option across Wales are then calculated by multiplying the individual building costs and benefits by the estimated number of elements that are expected to be installed over a 10-year period.

Discount rates used

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

- Costs – 3.5% for the first 30 years;
- Costs – 3.0% for the remainder up to year 70.

5. Non-Domestic Buildings: New Buildings – Air Conditioned Offices

Results

5.1 Table 5.1 sets out the results of the analysis for the uplift in energy performance for new buildings

Table 5.1: Results

Area	Option 1	Option 2
Capital Costs	£4.1m	£6.9m
Energy Costs	-£8.1m	-£14.3m
Replacement Costs	£2.5m	£3.7m
Maintenance Costs	£0.3m	£1.1m
Total financial costs	**-£0.9m**	**-£2.1m**
Carbon costs	-£2.4m	-£3.7m
air quality costs	-£0.8m	-£1.4m
Total costs including carbon and air quality improvement	**-£4.2m**	**-£7.2m**
Tonnes of carbon saved (million tonnes)	*-0.016*	*-0.023*

Cost breakdown per new building

5.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £43,000 (0.6%);
- Option 2: £75,000 (1.0%).

Benefit breakdown per new building

5.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = Reduced gas: 3,300 kWh/yr;
  - = Reduced grid electricity: 24,400 kWh/yr
- Option 2:
  - = Reduced gas: 3,300 kWh/yr;
  - = Reduced grid electricity: 43,700 kWh/yr.

5.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency, improved fabric and improved heat recovery efficiency for mechanical ventilation. These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency, improved chiller efficiency and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

5.5 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 17 air conditioned offices per annum (36,000 sqm per annum).

6. Non-Domestic Buildings: New Buildings – Schools

Results

6.1 Table 6.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 6.1: Results

Area	Option 1	Option 2
Capital Costs	£1.2m	£2.4m
Energy Costs	-£2.4m	-£5.1m
Replacement Costs	£0.8m	£1.3m
Maintenance Costs	£0.1m	£0.4m
Total financial costs	**-£0.2m**	**-£0.8m**
Carbon costs	-£0.7m	-£1.3m
air quality costs	-£0.2m	-£0.5m
Total costs including carbon and air quality improvement	**-£1.2m**	**-£2.6m**
Tonnes of carbon saved (million tonnes)	*- 0.005*	*- 0.008*

Cost breakdown per new building

6.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £36,000 (0.6%);
- Option 2: £72,000 (1.2%).

Benefit breakdown per new building

6.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = Reduced gas: 2800 kWh/yr;
  - = Reduced grid electricity: 18,300 kWh/yr.
- Option 2:
  - = Reduced gas: 2800 kWh/yr;
  - = Reduced grid electricity: 39,500 kWh/yr.

6.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency, improved fabric and improved heat recovery efficiency for mechanical ventilation. These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

6.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

6.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 7 new school buildings p.a. (15,000sqm per annum).

7. Non-Domestic Buildings: New Buildings – Warehouses

Results

7.1 Table 7.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 7.1: Results

Area	Option 1	Option 2
Capital Costs	£7.6m	£11.6m
Energy Costs	-£6.4m	-£15.3m
Replacement Costs	£7.7m	£9.5m
Maintenance Costs	£0.0m	£1.2m
Total financial costs	**£9.2m**	**£7.5m**
Carbon costs	-£1.6m	-£3.5m
air quality costs	-£0.6m	-£1.5m
Total costs including carbon and air quality improvement	**£6.9m**	**£2.5m**
Tonnes of carbon saved (million tonnes)	*- 0.010*	*- 0.021*

Cost breakdown per new building

7.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £126,000 (2.8%);
- Option 2: £204,000 (4.6%).

Benefit breakdown per new building

7.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = Reduced gas: 2,200 kWh/yr;
  - = Reduced grid electricity: 32,800 kWh/yr.
- Option 2:
  - = Reduced gas: 2,200 kWh/yr;
  - = Reduced grid electricity: 79,700 kWh/yr.

7.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency, improved fabric (access doors only) and improved heat recovery efficiency for mechanical ventilation (serving the office area). These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

7.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency, improved chiller efficiency (serving the office area only) and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

7.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 10 new warehouses constructed per annum (52,000 sqm per annum).

8. Non-Domestic Buildings: New Buildings – Naturally Ventilated Offices

Results

8.1 Table 8.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 8.1: Results

Area	Option 1	Option 2
Capital Costs	£1.2m	£2.7m
Energy Costs	-£3.3m	-£6.7m
Replacement Costs	£0.8m	£1.5m
Maintenance Costs	£0.0m	£0.4m
Total financial costs	**-£1.2m**	**-£1.8m**
Carbon costs	-£0.5m	-£1.2m
air quality costs	-£0.3m	-£0.6m
Total costs including carbon and air quality improvement	**-£2.0m**	**-£3.7m**
Tonnes of carbon saved (million tonnes)	*-0.003*	*-0.007*

Cost breakdown per new building

8.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £14,000 (0.5%)
- Option 2: £30,000 (1.1%)

Benefit breakdown per new building

8.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = increased gas: 700 kWh/yr
  - = Reduced grid electricity: 9,800 kWh/yr
- Option 2:
  - = increased gas: 700 kWh/yr
  - = Reduced grid electricity: 19,500 kWh/yr

8.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency and improved fabric. These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

8.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

8.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 18 new naturally ventilated offices per annum (19,000sqm per annum)

9. Non-Domestic Buildings: New Buildings – Hotels

Results

9.1 Table 9.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 9.1: Results

Area	Option 1	Option 2
Capital Costs	£2.6m	£4.3m
Energy Costs	-£7.9m	-£11.7m
Replacement Costs	£2.0m	£2.8m
Maintenance Costs	£0.1m	£0.5m
Total financial costs	**-£2.9m**	**-£3.6m**
Carbon costs	-£6.1m	-£6.9m
air quality costs	-£0.8m	-£1.2m
Total costs including carbon and air quality improvement	**-£9.8m**	**-£11.7m**
Tonnes of carbon saved (million tonnes)	*-0.042*	*-0.047*

Cost breakdown per new building

9.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £23,000 (0.6%)
- Option 2: £39,000 (1.1%)

Benefit breakdown per new building

9.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = Reduced gas: 17,000 kWh/yr
  - = Reduced grid electricity: 16,000 kWh/yr
- Option 2:
  - = Reduced gas: 17,000 kWh/yr
  - = Reduced grid electricity: 26,000 kWh/yr

9.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency (with large savings for hot water generation), improved fabric and improved heat recovery efficiency for mechanical ventilation. These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

9.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency, improved chiller efficiency (serving the restaurant area only) and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

9.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 20 new buildings per annum (22,000 sqm p.a.).

10. Non-Domestic Buildings: New Buildings – Health Centre

Results

10.1 Table 10.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 10.1: Results

Area	Option 1	Option 2
Capital Costs	£2.2m	£3.8m
Energy Costs	-£4.4m	-£8.0m
Replacement Costs	£1.8m	£2.5m
Maintenance Costs	£0.1m	£0.5m
Total financial costs	**-£0.2m**	**-£0.9m**
Carbon costs	-£0.6m	-£1.3m
air quality costs	-£0.4m	-£0.8m
Total costs including carbon and air quality improvement	**-£1.2m**	**-£3.0m**
Tonnes of carbon saved (million tonnes)	*-0.003*	*-0.007*

Cost breakdown per new building

10.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £40,000 (0.8%)
- Option 2: £71,000 (1.4%)

Benefit breakdown per new building

10.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = increased gas: 2,900 kWh/yr
  - = Reduced grid electricity: 23,500 kWh/yr
- Option 2:
  - = increased gas: 2,900 kWh/yr
  - = Reduced grid electricity: 42,100 kWh/yr

10.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency, improved fabric and improved heat recovery efficiency for mechanical ventilation. These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

10.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

10.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 10 new buildings per annum (21,000 sqm p.a.).

11. Non-Domestic Buildings: New Buildings – Retail

Results

11.1 Table 11.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 11.1: Results

Area	Option 1	Option 2
Capital Costs	£13.4m	£17.0m
Energy Costs	-£31.3m	-£39.2m
Replacement Costs	£13.8m	£15.4m
Maintenance Costs	£0.4m	£1.4m
Total financial costs	**-£2.4m**	**-£3.9m**
Carbon costs	-£6.7m	-£8.3m
air quality costs	-£3.0m	-£3.8m
Total costs including carbon and air quality improvement	**-£12.1m**	**-£16.0m**
Tonnes of carbon saved (million tonnes)	*-0.040*	*-0.050*

Cost breakdown per new building

11.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £58,000 (3.6%)
- Option 2: £76,000 (4.7%)

Benefit breakdown per new building

11.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = Reduced gas: 100 kWh/yr
  - = Reduced grid electricity: 44,600 kWh/yr
- Option 2:
  - = Reduced gas: 100 kWh/yr
  - = Reduced grid electricity: 55,800 kWh/yr

11.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency, improved fabric and improved heat recovery efficiency for mechanical ventilation. These improvements marginally outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

11.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency (particularly for display lighting), improved chiller efficiency and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

11.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 37 new buildings per annum (45,000 sqm p.a.).

12. Non-Domestic Buildings: New Buildings – Non Domestic Residential

Results

12.1 Table 12.1 sets out the results of the analysis for the uplift in energy performance for new buildings.

Table 12.1: Results

Area	Option 1	Option 2
Capital Costs	£4.0m	£8.1m
Energy Costs	-£9.2m	-£18.4m
Replacement Costs	£2.6m	£4.4m
Maintenance Costs	£0.2m	£1.3m
Total financial costs	**-£2.2m**	**-£3.9m**
Carbon costs	-£2.3m	-£4.2m
air quality costs	-£0.9m	-£1.8m
Total costs including carbon and air quality improvement	**-£5.4m**	**-£9.9m**
Tonnes of carbon saved (million tonnes)	*-0.014*	*-0.026*

Cost breakdown per new building

12.2 The analysis assumes that the build cost per building will increase by a total of:

- Option 1: £35,000 (0.6%)
- Option 2: £71,000 (1.3%)

Benefit breakdown per new building

12.3 The analysis assumes that the benefits for a typical building will be:

- Option 1:
  - = Reduced gas: 1300 kWh/yr
  - = Reduced grid electricity: 21,100 kWh/yr
- Option 2:
  - = Reduced gas: 1300 kWh/yr
  - = Reduced grid electricity: 42,300 kWh/yr

12.4 The reduced gas consumption for both options is due to a combination of improved gas boiler efficiency, improved fabric and improved heat recovery efficiency for mechanical ventilation. These improvements outweigh the increase in heat demand caused by the improved lighting efficiency which reduces internal heat gains.

12.5 The reduced electricity consumption for Option 1 is due to a combination of improved lighting efficiency and a higher PV efficiency. Option 2 has a greater electricity saving due to the larger amount of PV panel area and hence electricity generation.

Number of buildings per annum

12.6 To estimate the additional impact of the policy across all buildings in Wales, the analysis assumes 21 new buildings per annum that are residential in nature (care homes and student accommodation) (50,000 sqm p.a.).

13. Non-Domestic Buildings: Extensions – Windows and Doors

Results

13.1 Table 13.1 sets out the results of the analysis for the uplift in energy performance for extensions to non-domestic buildings residential in character.

Table 13.1: Results

Area	Option 1
Capital Costs	£0.615m
Energy Costs	-£0.099m
Replacement Costs	£0.218m
Maintenance Costs	£0.000m
Total financial costs	**£0.737m**
Carbon costs	-£0.296m
air quality costs	-£0.013m
Total costs including carbon and air quality improvement	**£0.428m**
Tonnes of carbon saved (million tonnes)	*- 0.002*

Cost breakdown per extension

13.2 The analysis assumes that the build cost per building will increase by a total of:

- £9 per sqm[7] (0.4%[8]).

Benefit breakdown per extension

13.3 The analysis assumes that the benefits for a typical extension will be:

- Reduced gas usage of 2kWh/yr per sqm.

Number of building per annum

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

- Sqm of extensions = 0.5% of existing stock per annum;
- 9,100 sqm of extensions per annum.

[7] Cost estimate is based on a 2,426sqm building, of which 52sqm is an extension. The extension is assumed to have 1 external pedestrian door and 7.9sqm of windows.
[8] Percentage uplift in costs presented as a % of the reference total capital construction costs for an extension.

14. Non-Domestic Buildings: Existing Buildings – Replacement of Windows and Doors

Results

14.1 Table 14.1 sets out the results of the analysis for the uplift in energy performance for the replacement of windows and doors in non-domestic buildings residential in character.

Table 14.1: Results

Area	Option 1
Capital Costs	£2.752m
Energy Costs	-£0.717m
Replacement Costs	£0.975m
Maintenance Costs	£0.000m
Total financial costs	**£3.042m**
Carbon costs	-£2.146m
air quality costs	-£0.097m
Total costs including carbon and air quality improvement	**£0.798m**
Tonnes of carbon saved (million tonnes)	*- 0.016*

Cost breakdown per new building

14.2 The analysis assumes that the build cost per building will increase by a total of:

- Increase in capital cost of £7 per sqm (6.3%)[9]

Benefit breakdown per new building

14.3 The analysis assumes that the benefits for a typical building will be:

- Reduced gas usage of 5kWh/yr per sqm

Number of building per annum

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

- Windows and doors replaced every 30 years
- 650 care homes (1,500 sqm per building)
- 180 student accommodations (2,400 sqm per building)

[9] Costs estimated based on a 2,374sqm building with 4 external doors and 521sqm of windows

15. Specific Impact Tests

Competition Assessment

15.1 The policy will primarily impact on the section of the construction industry undertaking works on new and existing non-domestic buildings along with the supply chains for construction materials used in those projects.

15.2 As a result of higher standards for existing buildings, 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.

15.3 The Part L uplift option for 2022 assumes 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.

Non-domestic building supply

15.4 The estimated additional costs for each building type are set out below. We believe this policy will only marginally impact the viability of a limited range of proposed non-domestic new buildings.

Building Type	Option 1 % cost increase	Option 2 % cost increase
Air-Conditioned Office	0.60	1.00
Primary School	0.60	1.20
Naturally Ventilated Office	0.50	1.10
Hotel	0.60	1.10
Large Warehouse	2.80	**4.60**
Medium Warehouse	3.20	4.80
Small Warehouse	2.90	4.40
Health Centre	0.80	**1.40**
Retail	3.60	4.70
Multi Residential	0.60	1.30

Innovation

15.5 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

15.6 We have currently not analysed the impacts and they will be considered further in the final impact assessment Environmental impact assessment.

Environmental Impacts

15.7 The main assessment described in this report assess the impact on the environment. The improvements are expected to deliver at least 340,000 tonnes of carbon savings.

Social impact assessment

15.8 Some health benefits are likely to derive from reduced energy use. Health and economic benefits are expected to derive from reduced overheating.

15.9 There are improvements in indoor air quality, and consequently occupant's health and well-being, from the proposed changes to Part F. The proposals seek to incorporate the latest scientific evidence from Public Health England Minimising the ingress of external pollutants while limiting the noise of ventilation systems. Improved indoor air quality arises as a result of better air distribution between rooms and simplification of the guidance which should deliver greater compliance and reduce the risk of under-ventilation.

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

15.11 We have currently not undertaken a quantitative assessment of the impacts and they will be considered further in the final impact assessment.

Rural impact assessment

15.12 We have currently not analysed the impacts and they will be considered further in the final impact assessment.

16. Appendix A: Details of Elemental Costs

16.1 The costs stated in the table below are supplied and fitted 'all-in' rates, e.g. elemental costs for windows include all ironmongery, trims, window boards, and sealing, etc. Costs provided are based on the expert view of AECOM's cost specialists, using data from tenders received / internal cost databases, AECOM published cost data (Spon's publications, etc), and information provided by suppliers.

16.2 Rates applied are intended to reflect typical / average 'Wales' national costs @ Q2-Q3 2019 (base), as incurred by medium sized housebuilders / developers using traditional construction methods, with a reasonably efficient supply chain. However, it should be noted that costs incurred by individual organisations will vary according to procurement strategies, location factor (e.g. costs will be higher in the more rural areas of Wales), scope and the exact specification / detail of their products. Variations in design, location and delivery method could result in a cost range of and +/- c.15%. Notwithstanding these variations, the proportional uplift associated with moving from one specification to another is likely to be similar across different markets.

16.3 To provide context to the cost variations assessed in the study, an indicative overall build cost (in £ / m^2 based @ mid-point 2019) for each building type has been estimated using AECOM cost data. These figures give an indicative cost / m^2 that might be expected for a building built in accordance with the requirements of the 2014 version of Part L. These build costs / m^2 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, as discussed previously.'

Element	Specification	Specification Units	Cost	Costing Units
External Wall - light metal frame	0.26	W/m²·K	£414	m^2 element
External Wall - light metal frame	0.22	W/m²·K	£417	m^2 element
External Wall - masonry	0.26	W/m²·K	£132	m^2 element
External Wall - masonry	0.22	W/m²·K	£135	m^2 element
External Windows	1.4	W/m²·K	£525	m^2 element
External Windows	1.6	W/m².K	£495	m^2 element
External Windows	1.8	W/m²·K	£475	m^2 element
External Pedestrian Doors	1.4	W/m²·K	£1,250	per door
External Pedestrian Doors	1.6	W/m²·K	£1,025	per door

Element	Specification	Specification Units	Cost	Costing Units
External Doors	1.5	W/m²·K	£600	per door
External Doors	1.3	W/m²·K	£600	per door
Condensing gas boiler – system	1	kW	£47	kW
Condensing gas boiler – system – Higher Efficiency	1	kW	£47	kW
Airtightness level 1	3	m³/h·m² at 50 Pa	£5	m^2 GIFA
Airtightness levels 2 and 3	5 - 7	m³/h·m² at 50 Pa	£0	m^2 GIFA
Electric Lighting - office style	65	lm/W	£62	m^2 GIFA
Electric Lighting - office style	95	lm/W	£69	m^2 GIFA
Electric Lighting - warehouse style	65	lm/W	£40	m^2 GIFA
Electric Lighting - warehouse style	95	lm/W	£60	m^2 GIFA
Electric Lighting – display	22	lm/W	£15	m^2 GIFA
Electric Lighting – display	80	lm/W	£52	m^2 GIFA
Photovoltaic array including inverter	15% efficiency	kW_p	£1,300	kW_p
Photovoltaic array including inverter	20% efficiency	kW_p	£1,482	kW_p
Air cooled chiller	3.6	SSEER	£164	kW
Air cooled chiller	4.3	SSEER	£176	kW
Ventilation Heat Recovery Unit	70	%	£7,200	m^3/Second
Ventilation Heat Recovery Unit	80	%	£9,000	m^3/Second