adroit economics ltd

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Changes to Part L and F of the building regulations regarding standards for non-domestic buildings in Wales - Final Stage Impact Assessment

Prepared by Adroit Economics

For and on behalf of the

Welsh Government

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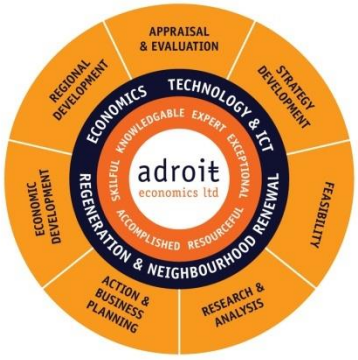

Registered Office:

Adroit House, 31 Finchley Road, Hale, Altrincham, Cheshire, WA15 9RE

Company registered in England No: 05567197

www.adroit-economics.co.uk

1. Summary

Policy changes considered in this impact assessment

1.1 This assessment considers the impact of 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 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 assessed in this report:

- Raising Part L standards for new non-domestic buildings - 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. The Welsh Government 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 for existing non-domestic buildings – improved standards for replacement 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;
- Changes to minimum standards for building services for new and existing non-domestic buildings;
- Aligning with relevant requirements from the Energy Performance of Buildings Directive (EPBD).

Non Domestic Building impacts

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

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

	New Building - Uplift in Part L Standards	Existing Buildings – replacement of windows and doors	Extensions – improved standard for windows and doors	Aligning with relevant requirements from the EPBD
Capital costs	£56.787m	£2.752m	£0.615m	0.585m
Energy costs	-£118.588m	-£0.717m	-£0.099m	-£1.429m
Replacement costs	£41.121m	£0.975m	£0.218m	n/a
Maintenance costs	£6.941m	£0.000m	£0.000m	n/a
Total financial costs	**-£9.482m**	**£3.042m**	**£0.737m**	**-£0.844m**
Carbon costs	-£30.529m	-£2.146m	-£0.296m	-£1.052m
Air Quality Costs	-£11.517m	-£0.097m	-£0.013m	-£0.059m
Total costs including carbon and air quality improvement	**-£51.529m**	**£0.798m**	**£0.428m**	**-£1.955m**
Tonnes of carbon saved (million tonnes)	*0.190m*	*0.016m*	*0.002m*	*0.006m*

Transition Costs

1.5 Transition costs are incurred by businesses as a result of the time spent by their employees to familiarise themselves with the new technical requirements.

1.6 The familiarisation costs have been calculated using the process developed to estimate the impact of the changes to Part L and Part F in England, which was based on consultations with a small sample of organisations to identify time/cost likely to be incurred.

1.7 The consultation identified:

- The types of organisations that will be affected by the changes;
- The types of familiarisation activity (training courses, self-study, CPD);
- Costs per organisation type.

1.8 The analysis then scaled up these costs across industry based on the number of organisations in Wales.

1.9 Familiarisation costs of £0.2m present value were calculated.

1.10 Table 1.2 shows the components of this figure.

	Familiarisation Costs
Part L	£0.018m
Part F	£0.017m
SBEM	£0.182m
Total	**£0.218m**

2. Part L and F Standards for Non-Domestic Buildings

Part L 2025

2.1 The Welsh Government's 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 The Welsh Government propose that energy efficiency and ventilation standards need to be uplifted as a stepping stone towards the next planned Part L changes in 2025. 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. The Welsh Government believe that significant carbon savings can be made by uplifting standards that apply when this type of work is carried out. .

2.4 The preferred option includes the following changes:

- 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;
- 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.

Part F 2022

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

2.5 The preferred option includes the following changes 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 a requirement for indoor air quality monitoring to be installed in offices and other high-risk rooms.

Aligning with relevant requirements from the EPBD

EPBD – Building Automation and Control Systems (BACS)

2.6 A building automation and control system is a term used for a centralised system installed to monitor and control a building's environment and services i.e. its heating, ventilation, air conditioning, lighting and other systems (such as security alarms and lifts).

2.7 To align with the EPBD requirement, the proposed change will mean:

- If a new building has a space heating or air-conditioning system with an effective rated output of greater than or equal to 290 kW, a building automation and control system must be installed to specifications as per below;
- If an existing building has a space heating or air-conditioning system with an effective rated output greater than or equal to 290kW, a building automation and control system being replaced or installed should meet the specifications below.

2.8 A building automation and control system installed in a new or existing building to meet the requirements in the paragraph above must be capable of carrying out all of the following functions:

- Fully complies with EN ISO 16484;
- Continuously monitors, logs, analyses and allows for adjusting energy use;
- Benchmarks the building's energy efficiency, detects losses in efficiency of technical building systems, and informs the person responsible for the facilities or building management about opportunities for energy efficiency improvement;
- Allows communication with connected technical building systems and other appliances inside the building and be interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers.

2.9 NOTE: A BS EN 15232 Class A Rated type system would meet these requirements.

2.10 Where a building automation and control system is installed, as well as meeting the requirements above, its control capabilities should be appropriate for the building, its expected usage, the expected technical knowledge of the building automation and control system user, and the building services specification. The system should be appropriately sized.

EPBD: Technical Building Systems

2.11 The amendment to the EPBD introduced a new requirement related to technical building systems[2]. The policy requires that when a technical building system is installed, upgraded, or replaced, that the energy performance of the altered system is assessed and the results provided to the building owner.

2.12 The analysis assumes that this is already standard industry practice, so mandating the requirement will have minimal impact.

EPBD: Self-regulating Devices (Thermostatic room controls)

2.13 Similar to the requirement for domestic buildings, in order to align with the EPBD requirement, the proposed change is to ensure that, when a heating system is replaced, a non-domestic building is equipped with thermostatic room controls for the separate regulation of the temperature in each room or designated heating zone of the building unit, where technically and economically feasible.

2.14 In general, when replacing a heat generator in an existing non-domestic building, it is a reasonable provision to also install thermostatic room controls. Hence, in such cases, the analysis assumes that thermostatic room controls will be commonly installed in current practice and the mandating of thermostatic room controls will have minimal impact.

[2] A technical Building System is defined as technical equipment for space heating, space cooling, ventilation, domestic hot water, built-in lighting, building automation and control, on-site electricity generation, or a combination thereof, including those systems using energy from renewable sources, of a building or building unit.

3. Overall methodology

3.1 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.

3.2 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.

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

3.4 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.

Monetised and non-monetised impacts

Monetised Impacts:

3.5 The principal policies have been included in the Impact Assessment (IA) are:

- Uplift minimum energy standards for whole building energy performance;
  - = 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.
- If a new or existing building has a space heating or air-conditioning system installed with an effective rated output of greater than or equal to 290 kW, a building automation and control system must also be installed.

Non-Monetised Impacts

3.6 A small number of other policies have been identified which relate to minor changes to the guidance, target setting, or which affect relatively few buildings. Given the nature of these changes, the impacts are expected to be negligible. Consequently, it was considered disproportionate to include these in the cost benefit analysis within this IA. These are as follows:

- 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;
- Performance metrics to assess the energy performance of new non-domestic buildings, including primary energy and CO2 – The Welsh Government 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
- Introduce a new airtightness testing methodology. The Welsh Government 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.

Types of costs considered in the assessment

3.7 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.

3.8 The costs are derived as follows:

- Capital, maintenance and replacement costs – unit costs (in 2019 prices[4]) are estimated for the life of the building (60 years). If an elemental component, such as a door or window, has a shorter lifespan than the building, the cost of replacing that element is included in the analysis. Unit costs have been calculated by cost

[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. The Welsh Government 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.

[4] The unit costs of the proposals were estimated for the Consultation Stage IA in 2019 prices.

consultants based on specifications developed by the technical advisors[5]. 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[6]

- 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[7] – these are valued using the HMT Greenbook Supplementary Guidance: *Valuation of energy use and greenhouse gas emissions for appraisal (updated July 2021);*

Types of benefits considered in the assessment

3.9 Two environmental benefits are quantified:

- Carbon emissions;
- Air quality.

3.10 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

3.11 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[8].

Table 3.1: 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

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

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

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

[7] The energy costs do not take account of the current (2022) volatility in the energy market.

[8] 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 3.2: 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

3.13 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 3.3: Transition Period Phase-in Assumptions

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

Sequence of calculations

3.14 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

3.15 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.

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

Results

4.1 Table 4.1 sets out the results of the analysis for the uplift in energy performance for new buildings

Table 4.1: Results

Area	
Capital Costs	£6.9m
Energy Costs	-£14.3m
Replacement Costs	£3.7m
Maintenance Costs	£1.1m
Total financial costs	**-£2.1m**
Carbon costs	-£3.7m
air quality costs	-£1.4m
Total costs including carbon and air quality improvement	**-£7.2m**
Tonnes of carbon saved (million tonnes)	*-0.023*

Cost breakdown per new building

4.2 The analysis assumes that the build cost per building will increase by a total of £75,000 (+1.0%):

Benefit breakdown per new building

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

- Reduced gas: 3,300 kWh/yr;
- Reduced grid electricity: 43,700 kWh/yr.

4.4 The reduced gas consumption 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.

4.5 The reduced electricity consumption is due to a combination of improved lighting efficiency, improved chiller efficiency and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

4.6 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).

5. Non-Domestic Buildings: New Buildings – Schools

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	
Capital Costs	£2.4m
Energy Costs	-£5.1m
Replacement Costs	£1.3m
Maintenance Costs	£0.4m
Total financial costs	**-£0.8m**
Carbon costs	-£1.3m
air quality costs	-£0.5m
Total costs including carbon and air quality improvement	**-£2.6m**
Tonnes of carbon saved (million tonnes)	*-0.008*

Cost breakdown per new building

5.2 The analysis assumes that the build cost per building will increase by a total of £72,000 (+1.2%):

Benefit breakdown per new building

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

- Reduced gas: 2,800 kWh/yr;
- Reduced grid electricity: 39,500 kWh/yr.

5.4 The reduced gas consumption 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.

5.5 The reduced electricity consumption is due to a combination of improved lighting efficiency and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

5.6 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).

6. Non-Domestic Buildings: New Buildings – Warehouses

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	
Capital Costs	£11.6m
Energy Costs	-£15.3m
Replacement Costs	£9.5m
Maintenance Costs	£1.2m
Total financial costs	**£7.5m**
Carbon costs	-£3.5m
air quality costs	-£1.5m
Total costs including carbon and air quality improvement	**£2.5m**
Tonnes of carbon saved (million tonnes)	*-0.021*

Cost breakdown per new building

6.2 The analysis assumes that the build cost per building will increase by a total of £204,000 (4.6%):

Benefit breakdown per new building

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

- Reduced gas: 2,200 kWh/yr;
- Reduced grid electricity: 79,700 kWh/yr.

6.4 The reduced gas consumption 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.

6.5 The reduced electricity consumption is due to a combination of improved lighting efficiency, improved chiller efficiency (serving the office area only) and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

6.6 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).

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

Results

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

Table7.1: Results

Area	
Capital Costs	£2.7m
Energy Costs	-£6.7m
Replacement Costs	£1.5m
Maintenance Costs	£0.4m
Total financial costs	**-£1.8m**
Carbon costs	-£1.2m
air quality costs	-£0.6m
Total costs including carbon and air quality improvement	**-£3.7m**
Tonnes of carbon saved (million tonnes)	*- 0.007*

Cost breakdown per new building

7.2 The analysis assumes that the build cost per building will increase by a total of £30,000 (+1.1%):

Benefit breakdown per new building

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

- increased gas: 700 kWh/yr
- Reduced grid electricity: 19,500 kWh/yr

7.4 The reduced gas consumption 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.

7.5 The reduced electricity consumption is due to a combination of improved lighting efficiency and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

7.6 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)

8. Non-Domestic Buildings: New Buildings – Hotels

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	
Capital Costs	£4.3m
Energy Costs	-£11.7m
Replacement Costs	£2.8m
Maintenance Costs	£0.5m
Total financial costs	**-£3.6m**
Carbon costs	-£6.9m
air quality costs	-£1.2m
Total costs including carbon and air quality improvement	**-£11.7m**
Tonnes of carbon saved (million tonnes)	*- 0.047*

Cost breakdown per new building

8.2 The analysis assumes that the build cost per building will increase by a total of £39,000 (+1.1%)

Benefit breakdown per new building

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

- Reduced gas: 17,000 kWh/yr
- Reduced grid electricity: 26,000 kWh/yr

8.4 The reduced gas consumption 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.

8.5 The reduced electricity consumption is due to a combination of improved lighting efficiency, improved chiller efficiency (serving the restaurant area only) and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

8.6 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.).

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

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	
Capital Costs	£3.8m
Energy Costs	-£8.0m
Replacement Costs	£2.5m
Maintenance Costs	£0.5m
Total financial costs	**-£0.9m**
Carbon costs	-£1.3m
air quality costs	-£0.8m
Total costs including carbon and air quality improvement	**-£3.0m**
Tonnes of carbon saved (million tonnes)	*- 0.007*

Cost breakdown per new building

9.2 The analysis assumes that the build cost per building will increase by a total of £71,000 (+1.4%)

Benefit breakdown per new building

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

- increased gas: 2,900 kWh/yr
- Reduced grid electricity: 42,100 kWh/yr

9.4 The reduced gas consumption 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.

9.5 The reduced electricity consumption is due to a combination of improved lighting efficiency and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

9.6 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.).

10. Non-Domestic Buildings: New Buildings – Retail

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	
Capital Costs	£17.0m
Energy Costs	-£39.2m
Replacement Costs	£15.4m
Maintenance Costs	£1.4m
Total financial costs	**-£3.9m**
Carbon costs	-£8.3m
air quality costs	-£3.8m
Total costs including carbon and air quality improvement	**-£16.0m**
Tonnes of carbon saved (million tonnes)	*- 0.050*

Cost breakdown per new building

10.2 The analysis assumes that the build cost per building will increase by a total of £76,000 (4.7%):

Benefit breakdown per new building

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

- Reduced gas: 100 kWh/yr
- Reduced grid electricity: 55,800 kWh/yr

10.4 The reduced gas consumption 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.

10.5 The reduced electricity consumption is due to a combination of improved lighting efficiency (particularly for display lighting), improved chiller efficiency and a larger amount of PV panel area with higher efficiency.

Number of buildings per annum

10.6 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.).

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

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	
Capital Costs	£8.1m
Energy Costs	-£18.4m
Replacement Costs	£4.4m
Maintenance Costs	£1.3m
Total financial costs	**-£3.9m**
Carbon costs	-£4.2m
air quality costs	-£1.8m
Total costs including carbon and air quality improvement	**-£9.9m**
Tonnes of carbon saved (million tonnes)	*- 0.026*

Cost breakdown per new building

11.2 The analysis assumes that the build cost per building will increase by a total of £71,000 (1.3%):

Benefit breakdown per new building

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

- Reduced gas: 1300 kWh/yr
- Reduced grid electricity: 42,300 kWh/yr

11.4 The reduced gas consumption 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.

11.5 The reduced electricity consumption for 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

11.6 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.).

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

Results

12.1 Table 12.1 sets out the results of the analysis for the uplift in energy performance for extensions to non-domestic buildings residential in character.

Table 12.1: 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

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

- £9 per sqm[9] (0.4%[10]).

Benefit breakdown per extension

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

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

Number of buildings per annum

12.4 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.

[9] 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.
[10] Percentage uplift in costs presented as a % of the reference total capital construction costs for an extension.

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

Results

13.1 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

13.2 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%)[11]

Benefit breakdown per new building

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

- Reduced gas usage of 5kWh/yr per sqm

Number of buildings per annum

13.4 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)

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

14. EPBD: Building Automation and Control Systems (BACS)

Results

14.1 Table 15.1 sets out the results of the analysis of building automation and control systems (BACS).

Table 15.1: Results of the analysis for BACS	Net Present Value (£m)
Capital Costs	0.585
Energy Costs	-1.429
Replacement Costs	n/a
Maintenance Costs	n/a
Total financial costs	**-0.844**
Carbon costs	-1.052
air quality costs	0.059
Total costs including carbon and air quality improvement	**-1.955**
Tonnes of carbon saved (tonnes)	*5,716*

Cost breakdown per building

14.2 The analysis assumes that to upgrade from a Class C to a Class A BACS will be;

- An average cost of £244,000 per building.

Benefit breakdown per building

14.3 The analysis assumes that the benefits for a typical building of installing a compliant BACS will be a:

- 30% energy saving compared with the counterfactual.

Number of additional Class A BACS installed per annum

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

- Total number of buildings in scope is calculated by estimating number of buildings with heating of over 290kW based on floor area and data on energy use per floor area;
  - = Most (95%) of new buildings/refurbishments with space heating or air-conditioning system over 290kW will already be installing Class A BACS (counterfactual) in 2020, including all buildings over 10,000sqm – so will incur no additional costs
  - = The proportion of new buildings/refurbishments installing Class A BACS is expected to increase through the appraisal period – from 96% in 2022 to 98.5% in 2031.
  - = The new buildings/refurbishments with space heating or air-conditioning system over 290kW that would not install Class A BACS under the counterfactual will be installing (a non-compliant) Class C BACS (counterfactual) – so will be required to upgrade to a Class A system
    - Average of 0.1 additional new buildings installing a Class A BACS system per annum

- Average of 0.6 additional existing buildings undertaking a refurbishment and replacing an existing BACS system with a Class A BACS system per annum.

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. The Welsh Government believe this policy will only marginally impact the viability of a limited range of proposed non-domestic new buildings .

Building Type		% cost increase
Air-Conditioned Office		1.00
Primary School		1.20
Naturally Ventilated Office		1.10
Hotel		1.10
Large Warehouse		**4.60**
Medium Warehouse		4.80
Small Warehouse		4.40
Health Centre		**1.40**
Retail		4.70
Multi Residential		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 Most of the impacts of the policy should affect all contractors broadly equally, whether large or small.

15.7 Small businesses in the construction 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. The proposed higher standards will mean that building contractors will have to comply with more stringent energy efficiency and building emissions targets. Because of this, some capital costs, for example where additional materials are required, may rise. The need to develop and employ different construction techniques and methods may also result in additional time and financial cost to developers. As the changes in costs are expected to affect all building contractors equally, any competitive effects in the market for building development are likely to be negligible.

15.8 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 Impacts

15.9 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

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

15.11 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.

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

15.13 The Welsh Government have currently not undertaken a quantitative assessment of the impacts and they will be considered further in the final impact assessment.

Rural impact assessment

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 principal markets affected by this 2021 policy are the markets for the development of new non-domestic buildings and the refurbishment of existing non-domestic buildings. These markets are smaller within rural areas, however the effect of the changes does not impact upon supply chains, or disproportionately effect smaller business who are likely to operate there, therefore no specific rural impacts are identified.

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	m² element
External Wall - light metal frame	0.22	W/m²·K	£417	m² element
External Wall - masonry	0.26	W/m²·K	£132	m² element
External Wall - masonry	0.22	W/m²·K	£135	m² element
External Windows	1.4	W/m²·K	£525	m² element
External Windows	1.6	W/m².K	£495	m² element
External Windows	1.8	W/m²·K	£475	m² 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
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	m² GIFA
Airtightness levels 2 and 3	5 - 7	m³/h·m² at 50 Pa	£0	m² GIFA
Electric Lighting - office style	65	lm/W	£62	m² GIFA
Electric Lighting - office style	95	lm/W	£69	m² GIFA
Electric Lighting - warehouse style	65	lm/W	£40	m² GIFA
Electric Lighting - warehouse style	95	lm/W	£60	m² GIFA
Electric Lighting - display	22	lm/W	£15	m² GIFA
Electric Lighting - display	80	lm/W	£52	m² 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