December 2019

Welsh Government

Consultation Document

Building Regulations Part L and F Review - Changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings - Consultation Impact Assessment

Contents

1. Summary

Policy changes considered in this impact assessment

1.1 This assessment considers the impact of proposed changes to Part L and to Part F of the building regulations on new build residential in Wales. 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. The consultation document contains further detail on the proposals and therefore it is recommended they are read together.

Proposed changes to Part L

1.2 Two contrasting policy options designed to achieve improvement in energy efficiency standards in new build residential are considered

- Option 1: Improved Fabric + PV + Wastewater Heat Recovery + Natural Ventilation
- Option 2: Improved Fabric + PV + Wastewater Heat Recovery + Mechanical Ventilation Heat Recovery

1.3 In addition, three other specific changes to Part L are considered

- Air tightness tests – requiring all new homes to have air tightness tests
- Removing the fuel factors – removing the relief for high-carbon heating systems (such as oil and LPG)
- Self-Regulating Devices - the proposed policy will require that all new homes must have self-regulating devices.

Proposed changes to Part F

1.4 Two specific changes to Part F are considered:

- Naturally Ventilated Systems - the proposed policy change is to simplify the guidance for naturally ventilated systems.

1.5 Mechanical Extract Ventilation (MEV) *systems* - the proposed policy change is for the size of background ventilators to be increased from 2500mm2 to 5000mm2 equivalent area in habitable rooms for mechanical extract ventilation (MEV) systems

Impacts

Impacts of Part L improved energy efficiency standards at the level of Wales

1.6 Both of the options are estimated to result in a net cost at the level of Wales:

- Option 1 is estimated to cost £151m (EANC[1] £17.6m) (net of the counterfactual) and to generate £101m (EANC £11.8m) of benefits over the appraisal period, resulting in a net policy cost of £50m (EANC £5.8m) (a BCR[2] of 0.67)
- Option 2 is estimated to cost £331m (EANC £38.4m) (net of the counterfactual) and to generate £164m (EANC £19.0m) of benefits over the appraisal period, resulting in a net policy cost of £167m (EANC £19.4m) (a BCR of 0.50)

[1] Average annual figure
[2] Benefit Cost Ratio

Figure 1.1: Net costs and benefits of proposed changes to Part L proposals (improved energy efficiency standards) for all residential new builds			
	Costs	**Benefits**	**Net Additional Costs**
Policy Option 1	£151m	£101m	£50m
Policy Option 2	£331m	£164m	£167m

Impacts of the other proposed changes to Part L

Air Tightness Test Requirements - impacts

1.7 Analysis of Airt Tightness Test requirements suggests a net policy cost of £0.512m (£0.059m EANC)

Figure 1.2: Costs and Benefits of requiring all new homes to be have air tightness tests			
	Costs	**Benefits**	**Net Costs**
NPV	£0.594m	£0.082m	£0.512m
EANC	£0.069m	£0.009m	£0.059m

Removing the fuel factors - impacts

1.8 The costs will be assessed for the final impact analysis.

1.9 Analysis undertaken for the England Part L consultation suggests that in practice there may not be any substantive cost difference between retaining or removing the fuel factor if complying with the Part L 2020 option 2 target.

Self-Regulating Devices - impacts

1.10 It is assumed that in practice all new homes currently install SRDs. Therefore, if policy made this mandatory, there would be no significant additional costs or benefits.

Impacts of proposed changes to Part F

Naturally Ventilated Systems proposals - impacts

1.11 The benefit of this policy change is simplification and improved compliance. As previous Part F revisions assumed 100% compliance, no additional benefit has been accounted for here.

Mechanical Extract Ventilation (MEV) systems proposals - impacts

1.12 The analysis suggests an additional cost of £0.250m (£0.026m EANC). The benefit of this policy change is improved air distribution in the home. This should lead to improved ventilation and

indoor air quality, with associated health benefits. These benefits have not been monetised here and are intended to be included for the final Impact Assessment

Figure 1.3: Part F – additional cost increased background ventilator sizing	
	Costs
NPV	£0.250m
EANC	£0.026m

2. Policy context

Climate emergency declared in Wales

2.1 In Wales the Welsh Government has declared a Climate Emergency. This builds on the ambitious actions set in the Environment (Wales) Act 2016, which requires Welsh Government to reduce emissions of greenhouse gases (GHGs) in Wales by at least 80% for the year 2050 with a system of interim emissions targets and carbon budgets. Furthermore, Welsh Government has accepted advice from the UK Committee on Climate Change (UKCCC) and announced the intention to bring forward legislation in 2020 to adopt a 95% carbon reduction target.

2.2 Delivery of these targets will happen through actions set out in Prosperity for All: A Low Carbon Wales. This includes 100 policies and proposals to meet the 2020 carbon emissions targets, coupled with the next plan which sets our measures to meet emissions reduction targets for 2021-26. Setting energy performance related targets in building regulations are an important means of reducing the carbon emissions of new buildings

2.3 Homes, both new and existing, account for 20% of greenhouse gas emissions.

2.4 **Proposal 39** of the current plan commits Wales to set higher energy efficiency standards for new builds through reviewing Building Regulations Part L (Conservation of Fuel and Power).

2.5 The performance-based targets set through the Building Regulations are an important means of reducing the carbon emissions of new buildings, where the market would not meet these of its own accord. 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

2.6 The policy objectives considered in this assessment are to reduce carbon emissions of new buildings 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. To provide adequate ventilation provisions through changes to Part F of the Building Regulations to align with more airtight construction encouraged by Part L.

3. Policy options assessed

3.1 This assessment considers the impact of proposed changes to Part L and to Part F of the building regulations.

Proposed changes to Part L

3.2 Two contrasting policy options designed to achieve improvement in energy efficiency standards in new build residential are considered

- Option 1: Improved Fabric + PV + Wastewater Heat Recovery
- Option 2: Improved Fabric + PV + Wastewater Heat Recovery + Mechanical Ventilation Heat Recovery

3.3 In addition, three other specific changes to Part L are considered

- Air tightness tests – requiring all new homes to have air tightness tests
- Removing the fuel factors - removing the relief for high-carbon heating systems (such as oil and LPG)
- Self-Regulating Devices - the proposed policy will require that all new homes must have self-regulating devices.

Proposed changes to Part F

3.4 Two specific changes to Part F are considered:

- Naturally Ventilated Systems - the proposed policy change is to simplify the guidance for naturally ventilated systems.
- Mechanical Extract Ventilation (MEV) *systems* - the proposed policy change is for the size of background ventilators to be increased from 2500mm2 to 5000mm2 equivalent area in habitable rooms for mechanical extract ventilation (MEV) systems.

4. Proposed changes to Part L energy efficiency standards

4.1 Two policy options are being considered for Part L designed to achieve an improvement in energy efficiency standards.

4.2 The key features of each option are summarised in Figure 4.1

Figure 4.1

Two policy options have been assessed:

- Option 1: Improved Fabric + PV + Wastewater Heat Recovery + Natural Ventilation
- Option 2: Improved Fabric + PV + Wastewater Heat Recovery + Mechanical Ventilation Heat Recovery

4.3 The "functional" nature of the Building Regulations, by having regulation setting out the broad requirement rather than prescribing how it must be achieved, seeks to provide flexibility and also ensure innovation is not hindered. The above are examples of technical specifications designed to achieve the proposed required standards, but the construction industry is free to innovate and deploy alternative combinations of technology to achieve the proposed standards. The above technical examples are those have been costed for the purposes of this Impact Assessment.

4.4 In non-technical terms, Options 1 and 2 are intended to deliver a 37% and 56% improvement on the current Part L standard.[3] We expect both options to be delivered through high fabric standards alongside the use of low-carbon heating and/or renewables, such as photovoltaic panels.

4.5 The key difference between the two options is that:

- Option 1 is expected to be delivered through natural ventilation whilst
- Option 2 is expected to be delivered through mechanical ventilation with heat recovery (MVHR) with a higher standard of airtightness.

4.6 Details of the costs and benefits of both options are set out below.

4.7 In broad terms Option 2 would deliver more carbon savings and result in lower fuel bills for the householder but has higher build costs and maintenance.

Option 1 is the preferred option.

4.8 There are several reasons for this:

- Option 1 delivers a significant improvement to the current standard. It is based on the preferred consultation option for Part L 2014 with additional measures to further reduce energy demand (improved building fabric and a wastewater heat recovery system).
- There is concern in Option 2 encouraging significant take-up of MVHR systems at this time. Recently published research commissioned by MCHLG[4] shows that the actual ventilation rates from mechanical ventilation not achieving the standards set out in Approved Document F. This

[3] Based on CO_2 reduction for a semi-detached home.
[4] https://www.gov.uk/government/publications/ventilation-and-indoor-air-quality-in-new-homes

aligns with research produced by the Mackintosh Environmental Architecture Research Unit [5] and the Zero Carbon Hub[6]. Issues identified include the design, installation, commissioning and/or operation of mechanical ventilation. Whilst these studies also identify issues of the under-performance of natural ventilation systems, this is expected to have greater impact in homes with MVHR systems installed as they tend to be used in more airtight properties with less infiltration i.e. more reliant on their ventilation system performing as designed.

4.9 There is limited design flexibility to meet the Option 2 target uplift if the developer chose not to use MVHR e.g. adopts natural ventilation. It may not be feasible or viable to design an alternative option with gas heating and it is likely to require a low carbon heating source, such as an air source heat pump. It is further recognised that a significant transition to low carbon heat requires the market for technologies such as heat pumps, as well as those qualified to install these technologies, to be significantly developed.

Technologies underpinning the Part L energy efficiency standards policy options

4.10 The following technologies underpin the policy options:

- high fabric standards that limit heat loss and reduce the demand for heat
- Renewable and low carbon technologies.

Heat pumps

4.11 We anticipate that the installation of heat pumps, particularly air-to-water and air-to-air heat pumps, will play a major role in delivering low carbon heat for homes built to meet our future Part L 2025 standard. Heat pumps come with the same low-carbon benefits as direct electric heating, but can deliver heat much more efficiently, which can help to overcome the affordability and grid-resource constraints associated with direct electric heating.

Heat networks

4.12 Heat networks (sometimes referred to as district heating) are a distribution system that takes heat from a centralised source and delivers it to a number of different buildings. These heat networks could form an important part of our plan in the future of low carbon heat, in particular in cities and high-density areas. Heat networks can decarbonise more easily compared to most other heat sources because new technologies can be added to the system with little disruption to individual householders. They provide a unique opportunity to exploit larger scale, renewable and recovered heat sources that can't be accessed at an individual building level. Heat networks also provide system benefits such as thermal storage and reducing the energy demand of the grid at peak times.

Direct electric heating

4.13 We anticipate that direct electric heating will play a minor role in our plan for the future of low carbon heat. Direct electric heating is a well-established technology that produces heat through a near-100% efficient process, with no emissions at the point of use. Despite this, direct electric heaters can be very expensive to run, and if deployed at scale may have a significant effect on the national grid. Under some circumstances it may be an appropriate technology in applications where heat demand is particularly low, for instance where a home is built to the very highest fabric standards.

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[5] Sharpe, McGill, Gupta, Gregg, Mawditt (2016) *Characteristics and Performance of MVHR systems.* MEARU, fourwalls, Oxford Brookes University

[6] Nicholls, Dollard, Mawditt, Pannell (2016) *Ventilation in New Homes*. London: Zero Carbon Hub http://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCH_Ventilation.pdf

Other technologies

4.14 Other technologies, such as hydrogen, may have a role to play in heating systems of the future. However, for new homes, we anticipate that heat pumps and heat networks (and to a lesser extent direct electric heating) will be the principal means of producing low-carbon heat for buildings built to our future energy standard

5. Improved Energy Efficiency Standards Impact Methodology

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

5.2 The assessment only applies to new build residential completions. It does not apply to existing buildings, conversions or changes of use. It also does not consider non-domestic buildings. This will be assessed separately.

5.3 The methodology is similar to that recently used to assess the impact of similar policy changes to Part L and F of the building regulations in England

5.4 In summary, the assessment:

- Estimates the additional costs to house builders/ occupiers of both policy options, over and above the current situation (as defined by BR2014), termed the counterfactual
- 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

5.5 This analysis assesses the following costs of the proposed options for a 'typical new-build dwelling' compared to the counterfactual (BR2014):

- Capital costs
- Maintenance costs
- Energy costs
- Replacement costs

5.6 The costs are derived as follows:

- Capital, maintenance and replacement costs –costs (in current prices) estimated by AECOM for the life of the building. Change in costs due to anticipated future learning rates projected for each asset using same assumptions developed for England Part L analysis.
- 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 March 2019)

Types of benefits considered in the assessment

5.7 Two environmental benefits are quantified:

- Carbon emissions
- Air quality

5.8 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 impacts have been assessed as part of the costs.

Types of residential dwelling considered in the assessment

5.9 The assessment has been undertaken using four standard new build 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).

Appraisal period

5.10 Costs and benefits are assessed over a 70-year period (2020-2089) as follows:

- A 10-year policy period (2020-29)
- 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 four new build dwelling 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 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

5.11 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

Additional calculations undertaken

5.12 In addition to the above, this assessment also considers:

- Part F – increased background ventilator sizing – this is costed by estimating the average cost per dwelling of increased background ventilators multiplied by the number of homes estimated to require the increase.
- Air tightness tests – requiring all new homes to have air tightness tests. The cost has been calculated by estimating the average cost of an airtightness test and the number of additional tests required. Benefits have been estimated based on the improved energy savings of buildings that have improved air tightness multiplied by the number of dwellings estimated to currently be untested and having an air tightness of less than the design target of 5 m^3/m^{2}h

6. Improved energy efficiency standards impact

6.1 This section sets out the results of the improved energy efficiency standards impact assessment, first at the level of individual typical dwellings, then scaled up across Wales as a whole

Impacts at the level of typical dwellings

6.2 Figures 6.1 to 6.4 show the additional construction and average annual maintenance, operation and renewal costs per typical dwelling built in 2020 for each policy, offset against the value of carbon saving achieved. The initial capital costs will be borne by developers, but these costs may ultimately be passed to landowners. The costs are likely to reduce over time as a result of increased learning rates and innovation enabling further technology development, increased efficiency and cost reduction, resulting in moderate efficiency gains over time. Maintenance and replacement costs will be borne by building owner/occupier.

Figure 6.1: Semi-detached house (costs per dwelling net of counterfactual (60-year lifetime of building)

	Capital	Energy	Renewal	Maintenance	Total costs	Value of TCO2e savings	Net Costs
Option 1	5,900	- 4,800	1,500	1,300	3,900	-£ 1,800	2,100
Option 2[7]	8,300	- 5,100	2,100	2,100	7,400	-£ 2,900	4,500

Figure 6.2: Detached house (costs per dwelling net of counterfactual (60-year lifetime of building)

	Capital	Energy	Renewal	Maintenance	Total costs	Value of TCO2e savings	Net Costs
Option 1	8,100	- 6,600	2,000	1,300	4,800	-£ 2,500	2,300
Option 2[6]	11,000	- 6,700	2,600	2,100	9,000	-£ 3,800	5,200

Figure 6.3: Terraced house (costs per dwelling net of counterfactual (60-year lifetime of building)

	Capital	Energy	Renewal	Maintenance	Total costs	Value of TCO2e savings	Net Costs
Option 1	5,300	- 4,800	1,500	1,300	3,300	-£ 1,700	1,600
Option 2[6]	7,700	- 5,000	2,100	2,100	6,900	-£ 2,800	4,100

[7] Option 2 *does not include any heating distribution system cost savings due to reduced space heating demands associated with MVHR.*

Figure 6.4: Flat (costs per dwelling net of counterfactual (60-year lifetime of building)							
	Capital	Energy	Renewal	Maintenance	Total costs	Value of TCO2e savings	Net Costs
Option 1	2,700	- 2,100	800	300	1,700	-£900	800
Option 2[6]	4,900	- 2,300	1,500	1,100	5,200	-£ 1,600	3,600

Average Annual Energy Savings per dwelling

6.3 Figure 6.5 shows the average annual energy saving, for a typical dwelling, likely to derive from each policy option.

Figure 6.5: Average Annual Energy Savings (average per building net of counterfactual)				
	Detached	Semi-detached	Terraced	Flats
Option 1	-£250	-£180	-£180	-£80
Option 2	-£260	-£190	-£190	-£90

Impacts of Part L improved energy efficiency standards at the level of Wales

6.4 The impacts of both policy options designed to improve energy efficiency standards in residential new builds across Wales have been calculated by applying the average costs and benefits per typical dwelling by the anticipated number of new builds over the appraisal period (see Annex A for the estimated number of new builds over the period).

6.5 Both of the options are estimated to result in a net cost at the level of Wales:

- Option 1 is estimated to cost £151m (EANC[8] £17.6m) (net of the counterfactual) and to generate £101m (EANC £11.8m) of benefits over the appraisal period, resulting in a net policy cost of £50m (EANC £5.8m) (a BCR of 0.67)
- Option 2 is estimated to cost £331m (EANC £38.4m) (net of the counterfactual) and to generate £164m (EANC £19.0m) of benefits over the appraisal period, resulting in a net policy cost of £167m (EANC £19.4m) (a BCR of 0.50)

Figure 6.6: Net Policy Costs - Total

NPV net of the counterfactual over 70 years[9]

[8] Average annual figure

[9] Costs and Benefits of the policy have been assessed over a 70 year period – 10 years of policy and assuming 60 year life of the building

	Costs (£m)	Benefits (reduced CO2e emissions and improved air quality) (£m)	Net Costs (£m)
Option 1	£ 151	£ 101	£50
Option 2	£ 331	£ 164	£ 167

Figure 6.7: Net Policy Costs - Annualised

EANC Net of Counterfactual

	Costs (£m) Annual cost	Benefits (Carbon and air quality improvement) (£m) Annual cost	Net Costs (£m) Annual cost
Option 1	£17.6	£11.8	£5.8
Option 2	£38.4	£19.0	£19.4

Figure 6.8: Benefit- Cost Ratio

Option 1	0.67
Option 2	0.50

Cost breakdown

6.6 Key points to note about the components of policy cost are:

- Capital costs are the most significant cost element
- Both options result in an increase in capital and replacement costs
- Both options result in a reduction in energy costs
- Both options result in an increase in maintenance costs.

Figure 6.9: Components of Costs (£m) NPV

	Capital	Energy	Renewal	Maintenance	**Total**
Option 1	266	-239	74	51	**151**
Option 2	385	-249	106	89	**331**

Benefits

6.7 Figure 6.10 sets out the breakdown of benefits estimated to derive from each option.

Figure 6.10: Components of Benefits

	TCO2e (millions)	Value of TCO2e savings (NPV £m)
Option 1	1.06	101
Option 2	1.90	164

7. Other proposed changes to Part L and estimated impact

Air tightness tests – requiring all new homes to have air tightness tests

7.1 The policy proposal is for all new homes to have air tightness tests.

7.2 Current Part L[10] policy requires a sample of new homes to be tested. It is estimated that 86% of new homes are currently tested for airtightness in compliance with current policy.

7.3 The policy proposal is to increase this testing to 100% of all new homes. This will result in the remaining 14% of new homes being tested. However, in practice, the increase in testing will be slightly greater (16.6%) due to retests on a small proportion of homes where the original test failed to meet requirements.

7.4 Based on data by BSRIA, the cost of each test is on average £64.13 for volume housebuilders.

7.5 The benefit is expected derive the improvement of the air-permeability of those dwellings that are not currently tested. It is assumed for the purpose of this analysis that 100% testing could improve the air-permeability of the currently un -tested dwellings that would fail the initial test and require additional works to pass. It is assumed that airtightness testing will not impact on those homes that are currently un -tested but would be expected to pass the test first time. The benefit will be the fuel savings and reduced fuel bills that result from that improvement.

7.6 The number of dwellings that will benefit from a reduced air-permeability is therefore the number of homes constructed x 14% (number of homes not currently tested) x 10.08% (unpublished BSRIA estimate of the percentage of homes that currently fail the airtightness test i.e. the airtightness test result is poorer than their design air permeability).

7.7 The energy saving per benefitted dwelling was determined using the consultation version of SAP for the semi-detached house used elsewhere in the new domestic ADL1A modelling (the results from the semi-detached home were assumed on average to be representative of the building stock). Unpublished data from BSRIA shows that the typical design air permeability target is 5m³/m²h and on average failed tests (i.e. their first airtightness test) had an air-permeability that was 1.4m³/m²h poorer than the design air-permeability. Hence, we assumed the benefit from testing is associated with a reduction in air permeability from 6.4m³/m²h to 5m³/m²h. The results from SAP show a reduced energy consumption of 172kWh/year.

Figure 7.1: Costs and Benefits of requiring all new homes to be have air tightness tests

	Costs	Benefits	Net Costs
NPV	£0.594m	£0.082m	£0.512m
EANC	£0.069m	£0.009m	£0.059m

Removing the fuel factors

7.8 Part L currently includes a fuel factor which differs by fuel type for heating. One purpose was to provide some relief in the target applicable to dwellings that are off the gas grid, principally those in rural areas. The fuel factor means that if the chosen heating fuel is more carbon

[10] The proportion has been estimated based on the total number of airtightness tests undertaken on new homes between April 2016 to March 2018, adjusted for multiple testing on the same buildings based on unpublished data from BSRIA (e.g. due to testing during the construction process or additional testing when a home fails their initial test), divided by the number of new build dwellings

intensive than gas (such as oil or LPG), the carbon emissions target is made less demanding. Without the fuel factor, builders would have to build to higher (and more expensive) fabric and/or services standards in order to meet the same emissions target as homes connected to a gas supply.

7.9 The intention is to remove fuel factors, so that any new building will need to meet primary energy and CO_2 emissions equivalent to that of option 1 or 2 above.

7.10 Grid electricity now has a lower carbon emission factor than gas. It therefore no longer needs a fuel factor to support its use. Since electricity use is now less carbon intensive than gas this proposed change has no impact on rural homes adopting an electric heated solution.

7.11 For other fuels (e.g. liquid petroleum gas (LPG), oil, solid mineral fuel heating) considerable mitigating measures would need to be installed to reach parity with a new gas-heated building.

7.12 Analysis undertaken for the England Part L consultation suggests that there may not be any substantive cost difference between retaining or removing the fuel factor in practice if complying with the Part L 2020 option 1 target. It will be challenging to comply with the option 1 target using LPG or oil as fuels even with the fuel factors. A potential solution is likely to be to change to a low carbon heat source, such as an air source heat pump. Moving to a low carbon heat source means that the need for a fuel factor becomes redundant. From discussion with industry, we are aware that there are many homes off of the gas grid that are already being constructed with heat pumps instead of using oil or LPG.

7.13 The costs will be assessed for the final impact analysis.

Self-Regulating Devices

7.14 The proposed policy will require that all new homes must have self-regulating devices. Technically this means including devices for the separate regulation of the temperature in each room or designated heating zone (where this is justified) of the building. A common way of achieving this in practice for new homes would be having thermostatic radiator valves (TRVs) on radiators in each room, which are often already installed as standard practice.

7.15 It is assumed that all new homes currently install SRDs in practice. Therefore, there are no significant costs and benefits of this policy change to make such installation mandatory.

8. Proposed changes to Part F and estimated impact

Naturally Ventilated Systems

8.1 The proposed policy change is to simplify the guidance for naturally ventilated systems. As a consequence of this, it will result in an increase in the size of background ventilators for each naturally ventilated property with an air permeability leakier than 5 m3/hr/m2.

8.2 The percentage of new homes impacted per year is estimated based on the number of new homes that currently have a naturally ventilated system with an air permeability leakier than 5 m3/hr/m2. Data for new homes made available from EPCs lodged on the Energy Performance of Buildings Register suggests that 59% of new homes are naturally ventilated. Furthermore, unpublished BSRIA data estimates that 65% of these are leakier than 5 m3/hr/m2. Hence, it is assumed that this policy applies to 38% of new homes.

8.3 For simplicity, it is assumed the increased trickle ventilator area on average can be based on the semi-detached home. This results in the requirement of two additional background ventilators – one of 5000mm2 and one of 10000mm2 equivalent area. The total capital cost of these trickle ventilators per home is £17.

8.4 The benefit of this policy change is simplification and improved compliance. As previous Part F revisions assumed 100% compliance, no additional benefit has been accounted for here.

Mechanical Extract Ventilation (MEV) *systems*

8.5 The proposed policy change is for the size of background ventilators to be increased from 2500mm2 to 5000mm2 equivalent area in habitable rooms for mechanical extract ventilation (MEV) systems.

8.6 The percentage of new homes impacted per year is estimated based on the number of new homes that currently have an MEV system. Data for new homes made available from EPCs lodged on the Energy Performance of Buildings Register suggests that this comprises 24% of new homes.

8.7 The total cost per home is estimated as £6. This is based on approximately 4 background ventilators per home on average.

8.8 The benefit of this policy change is improved air distribution in the home. This should lead to improved ventilation and indoor air quality, with associated health benefits. These benefits have not been monetised here and are intended to be included for the final Impact Assessment.

Figure 8.1: Part F – increased background ventilator sizing

	Costs
NPV	£0.250m
EANC	£0.026m

9. Specific Impact Tests

Competition Assessment

9.1 The policy will primarily impact on the section of the construction industry involved in the development of new domestic buildings along with the supply chains for construction materials used in those developments.

9.2 As a result of higher standards for new buildings, building developers 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 developers broadly equally, any competitive effects in the market for building development in Wales are likely to be negligible.

9.3 Both Part L uplift options for 2020 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.

9.4 The average additional cost of these proposals over England's are £1000/dwelling. We don't view this as significant against differences in land values and construction costs generally.

Housing Supply

9.5 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.

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

9.7 There are a number of ways in which increased costs could manifest, of which a reduction in supply is just one possibility. More analysis would need to be carried out during consultation to understand this better.

Innovation

9.8 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 developers to choose building technologies to meet these standards. This should encourage innovation among manufacturers.

9.9 Option 2 would likely result in an increased use of low and zero carbon generation technologies. There is competition in the supply of such technologies with a mix of large and small suppliers. As the cumulative production of such technologies rises, learning effects coupled with competition should bring down the unit cost. This learning effect has been built into our modelling of costs.

Small firms impact test

9.10 These costs should affect all contractors broadly equally, whether large or small.

9.11 Small businesses in the housing sector principally comprise developers, constructors, architects, engineers and other technical specialists. The impacts of a change in building standards are likely to be most significant for developers 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.

9.12 Small developers typically operate in a different segment of the housing market to larger businesses and will undertake projects that are not well suited to a larger developer's business model such as smaller sites or those requiring a more bespoke design solution. Therefore, while the impact of new standards on absolute build costs for a smaller developer may be higher than those for a larger business, this does not necessarily mean they will be affected more significantly. This is because their starting cost base is likely to be higher and other elements of their business model will differ.

9.13 Further, smaller developers are less likely to hold land for extended periods prior to development. This means that the implications of new standards on small development companies may be more easily accommodated by altering their land offers whereas for larger businesses developing sites that they have owned for several years, any additional costs of new meeting standards are more difficult to pass back to the landowner

9.14 The increase in fabric specification may be more difficult to adjust to for smaller businesses which employ their own workforce and will therefore need to retrain. Both larger and smaller businesses will likely subcontract the installation of solar panels and alternative methods of complying with these standards such as installing heat pumps. Familiarisation will therefore not be an issue, but smaller and larger developers will receive varying quotes to account for the economy of scale. As discussed above the starting cost base is already different for smaller businesses.

9.15 We intend to use the consultation process to gather up-to-date information about differences in the effects of the regulations on small business.

Environmental impact assessment

9.16 The main assessment described in this report assess the impact on the environment.

Social impact assessment

9.17 Some health benefits are likely to derive from reduced energy use. Health and economic benefits are expected to derive from reduced overheating, which is being considered further in the final stage impact assessment.

9.18 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 and simplification of the guidance which should deliver greater compliance and reduce the risk of under-ventilation.

9.19 There are also potentially beneficial improvements in health and quality of life from the effect of increased energy efficiency on thermal comfort. We do need to be mindful of the potential effects that tighter building envelopes could have upon indoor air quality and indoor temperatures in summer. Hence, the parallel review of Parts F and L, and a planned consultation on new requirements and guidance to reduce the risk of overheating in new homes.

Rural impact assessment

9.20 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.

9.21 Part L currently includes a fuel factor which differs by fuel type for heating. One purpose was to provide some relief in the target applicable to dwellings that are off the gas grid principally those in rural areas. The fuel factor means that if the chosen heating fuel is more carbon intensive than gas (such as oil or LPG), the carbon emissions target is increased making it less demanding. Without the fuel factor, builders would have to build to higher (and more expensive) fabric and/or services standards in order to meet the same emissions target as homes connected to a gas supply.

9.22 The consultation seeks views on the option to remove the fuel factor. Note that due to the changes in carbon emission factors described previously, electricity use is now less carbon intensive than gas and thus the fuel factor is automatically dis-applied for heat pumps or direct electric heating; thus this proposed change has no impact on rural homes adopting an electric heated solution. Note that in this assessment we have continued to apply the fuel factor to the carbon target, rather than the primary energy target, as the carbon target is the harder to achieve for higher-carbon fossil fuels.

9.23 Analysis suggests that there may not be any substantive cost difference between retaining or removing the fuel factor in practice if complying with the Part L 2020 option 1 target. It will be challenging in either case to comply with this target using LPG or oil as fuels e.g. the design specifications for Option 1 in Table 4 will not be sufficient as the amount of PV likely to comply would exceed the roof area available (although it may be possible to comply with more expensive and efficient PV panels than assumed in the option 2 specification). A lower cost option is likely to be to change to a low carbon heat source, such as an air source heat pump. Moving to a low carbon heat source means that the need for a fuel factor becomes redundant.

9.24 From discussion with industry, we are aware that there are many homes off of the gas grid that are already being constructed with heat pumps instead of using oil or LPG.

10. Annex A: Scale up metrics

10.1 The following tables set out the scale-up figures used in this assessment:

- New build completion projections[11]
- Number of buildings affected by the transition period

Figure 9.1: Forecast of New Building Completions 2020-29: Mid Scenario[12]	
	New Dwelling Completions per annum
Detached	2,700
Semi Detached	1,300
Terraced	1,000
Flats (Block of 32 flats)	44

Figure 9.2: Transition Period – Proportion of dwellings built to current/proposed building regulations				
	2020	**2021**	**2022**	**2023 onwards**
BR2014	60%	40%	10%	0%
BR2020	40%	60%	90%	100%

[11] 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.

[12] These figures are based on an analysis of past trends, average annual household formation rates, new homes sales data, energy performance certificates and data on the housing stock.

11. Annex B: Unit cost assumptions

11.1 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.

11.2 The cost analysis is intended to reflect typical national costs from Q2 2019 that might be incurred by a medium sized housebuilder 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

11.3 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.

11.4 Base costs for future years are those for the 2019 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.

11.5 Table below includes details of the cost information used for each specification option, including any variations between building type, costs are only shown for those specifications that vary between the considered specification options.

Unit Cost data for fabric elements that vary between the selected specifications

Element	Specification	Unit	£ per unit
External Wall, Plasterboard, blockwork, rigid PIR insulation board, cavity and brickwork	0.18 W/m².K	m²	£184
	0.15 W/m².K	m²	£196.50
Air Tightness	5m³/h.m² at 50 Pa	m² GIFA	-
	3m³/h.m² at 50 Pa	m² GIFA	£5[13]
Ground/Exposed Floor	0.13 W/m².K	m²	£138
	0.11 W/m².K	m²	£145
Roof	0.13 W/m².K	m²	£166
	0.11 W/m².K	m²	£170

[13] Additional cost over current policy

Windows (Double Glazed)	1.4 W/m².K	m²	£216
	1.3	m²	£243
Waste-Water Heat Recovery	Vertical pipe system	Nr	£375
	Tray system	Nr	£1,150
Radiators (installed but excluding heating pipework)	Standard	Nr	£90
	Low temperature	Nr	£133
Roof mounted – photovoltaic panels	Fixed costs for systems <4kWp	Per installation	£1,200
	Variable costs for systems <4kWp	Per kWp installed	£800
	Variable costs for systems >4kWp	Per kWp installed	£1,200
Heat Source and storage	Condensing Gas Boiler 18kW	Nr	£2,103
	Condensing Gas Boiler 24kW	Nr	£2,602
	Hot water cylinder (200L)	Nr	£1,200
	ASHP	Nr	£6,000
Ventilation	Intermittent extract fan with trickle vents – houses	Nr	£597
	Intermittent extract fan with trickle vents - Flat	Nr	£448
	MVHR Unit	Nr	£1,712
	MVHR rigid ductwork - houses	m^2 GIFA	£10
	MVHR rigid ductwork - Flat	m^2 GIFA	£11