JERSEY HERITAGE

ADVISORY NOTE ON THE

Retrofit of Historic Buildings in Jersey

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EXECUTIVE SUMMARY

1 THE PURPOSE OF THIS ADVISORY NOTE

This Advisory Note sets out the optimal approach to the energy retrofit of historic buildings in Jersey. Given the multiple drivers of decarbonisation, energy security and fuel poverty, reducing the energy use of the building stock has become an important policy area for all governments. Retrofit is particularly challenging for historic buildings, but the process of retrofit can also be used to protect and enhance heritage, as well as delivering other policy goals.

Under Programme 9 of A Heritage Strategy for Jersey, there is a commitment to 'demonstrate how historic buildings can be adapted and retrofitted to improve energy and thermal performance.'

Jersey's rich history and variety of architecture means that retrofit of its historic building stock must be carried out sensitively. However, Jersey's position as a self-governing Crown Dependency within the British Isles means that it is in a position to develop a bespoke approach which is appropriate to the Island and which serves its residents effectively.

2 DEFINITION OF HISTORIC BUILDINGS

All old buildings have heritage value, not just those which have some form of statutory protection, such as listing or (forthcoming) Conservation Area status. With the exception of ancient timber frame and earth structures, the majority of historic buildings are of solid masonry construction, also known as 'traditional construction'.

Solid walled buildings not only have heritage significance in their walls, windows & doors, roofs and other features including their setting and context, they also behave differently from modern buildings in terms of how they heat up and cool down, and how they handle moisture. The majority of unaltered solid walled buildings are 'moisture-open' - so they permit moisture to pass into and through the wall structure. For this reason, modern materials are often inappropriate for use on historic buildings, and great care is needed if we decide to alter their thermal and moisture properties.

3 AN OPPORTUNITY FOR JERSEY

There have been numerous failures both in public programmes and privately-funded retrofit in the UK. This is due to a variety of factors including a lack of proper assessment, lack of joined up design, single measure approaches, a shortage of training and skills, and the unreasonably short timescales of funding programmes. Added to this, historic buildings have suffered from one-size-fits-all thinking, while it is widely recognised that historic buildings are all different and need a bespoke approach to retrofit.

To some degree these issues have been addressed by the introduction of new publicly available specifications for retrofit - PAS 2035 and PAS 2038, published by BSI, covering domestic and non-domestic buildings respectively. There are also international standards such as EN16883 which Jersey may decide to use. These new specifications for retrofit are based upon a wide set of aims including the protection and enhancement of architectural heritage, plus the protection of human health and building fabric. While the full process which the specifications mandate for publicly funded programmes is unlikely to be appropriate for use in Jersey, there is much that could be taken forward and included in Jersey's own approach to the retrofit of historic buildings.

EPCs are beginning to be used more widely in Jersey, in part driven by the Home Energy Audits scheme[1]. However, there are numerous issues with EPCs, in terms of their narrow metric and the failure to take into account context, the condition of the building, interactions between fabric and services including ventilation - all of which are covered in PAS 2035 and 2038. There are also particular issues around how EPCs are applied to historic buildings, and their use as a policy lever - a purpose for which they were not designed. A whole building certification system would

[1]The Carbon Neutral Roadmap commits to a policy around EPCs.

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be needed to be consistent with the whole building approach, if Jersey is considering the widespread use of building metrics in the near future.

There is thus an opportunity in Jersey to get retrofit of historic buildings right first time, avoiding the unintended consequences apparent elsewhere, and aligning policy, standards and certification with emerging best practice in whole building retrofit.

4 BUILDING ON EXISTING WORK

This Advisory Note builds upon substantial and advanced work already carried out by Jersey in this area, including the Purcell Report (2013) and the St Helier Urban Character Appraisal (2021).

The Jersey Bridging Island Plan (2022) makes clear that any approach to the sustainability of historic buildings must begin with their proper repair and maintenance. The Plan also makes specific reference to the limitations of the one-size-fits all approach when it comes to traditional buildings, the avoidance of unintended consequences, use of a whole building, whole life approach, and the consideration of embodied energy and carbon.

The Carbon Neutral Roadmap (2022) recognises the impact of embodied energy and the importance of the circular economy. While this makes a convincing argument for retention and retrofit over demolition, it also has an impact on how retrofit measures are selected and implemented. If not correctly designed, retrofit measures can cause more emissions than they save over the medium-long term, due to the embodied impact of the materials & labour, and to the low carbon electricity available in Jersey.

A Heritage Strategy for Jersey (2022) has amongst its strategic objectives 'Actively addressing the climate crisis by implementing measures across the heritage sector which reduce carbon footprint and mitigate against the future impacts of global warming.' This Advisory Note sets the framework needed to address the process of retrofit of historic buildings, consistent with the Heritage Strategy.

5 KEY PRINCIPLES TO AVOID UNINTENDED CONSEQUENCES IN THE RETROFIT OF HISTORIC BUILDINGS

- Use a Whole Building approach to retrofit. This should include all aspects of building fabric and services, including ventilation.
- The aims of retrofit should be broad, beginning with human health, and using a wide range of environmental metrics, including embodied carbon of retrofit measures. Retrofit should include conservation of heritage but can also be used as an opportunity to enhance or reinstate heritage features of historic buildings.
- Thorough survey, including an assessment of significance and a moisture risk assessment, must precede a bespoke options appraisal for each historic building.
- A full design process is required which pays attention to junctions between elements, thermal bridging, and interactions between measures.
- Carry out all necessary maintenance and repairs prior to retrofit.
- Results must be monitored and the approach adjusted if necessary.

6 STRUCTURAL CONSIDERATIONS

In order to deliver the balanced approach to historic buildings outlined above, it may be necessary to make certain adjustments to the regulatory framework in Jersey and to the way that the retrofit industry is developed on the island.

- Introduce Supplementary Retrofit Planning Guidance for Historic Buildings, setting out the acceptable approach to measures which could have a material planning impact in specific circumstances.
- Make adjustments to the new Parts L and Part F of the UK Building Regulations when they are transposed across to the Jersey Building Bye-laws. These could cover special considerations for historic buildings, plus moisture risk, and clauses relating to walls, floors, roofs and ventilation.
- Introduce a simplified version of the new British Specifications for retrofit (PAS 2035 and PAS 2038) which reflects the size of the market in Jersey.
- Review the commitment to introduce minimum EPC levels and consider instead developing a 'whole building' certification scheme.
- Introduce a requirement that all assessors, designers and project managers working on the retrofit of historic buildings should have the Level 3 Award in Energy Efficiency Measures for Older and Traditional Buildings, or an equivalent to be delivered through Highlands College.
- Ensure that installers of fabric retrofit measures on historic buildings are appropriately qualified in conservation.
- Build industry capacity gradually through a process of demand stimulation and training provision.
- Review the supply chain to ensure that retrofit materials for use in historic buildings are available and certified for use in Jersey.
- Consider developing high quality advice to the general public, as owners and users of historic buildings.

These recommendations and structural considerations are set out in more detail in Sections 4, 5 and 6 of the Advisory Note.

1 CONTEXT

1.1 INTRODUCTION

This Advisory Note sets out the optimal approach to the retrofit of historic buildings in Jersey. The Government of Jersey has declared a climate emergency but has also made strong commitments to the retention and enhancement of heritage on the island. In resolving these dual drivers, this Advisory Note principally builds upon:

- A Heritage Strategy for Jersey (Programme 9);
- The Bridging Island Plan 2022 (Policies SP1, GD5, HE1, HE)
- The Carbon Neutral Strategy and Roadmap (Measures H1 and H2).

Jersey Heritage[2] has commissioned this Advisory Note, which specifically addresses Programme 9 of the Jersey Heritage Strategy. The third of the Projects Identified is 'To demonstrate how historic buildings can be adapted and retrofitted to improve energy and thermal performance.'

Historic buildings are constructed differently from modern buildings, and cannot be adapted in the same way. These differences are set out in more detail in the next section. Historic buildings therefore require a bespoke approach to retrofit, one which balances *energy, health, and heritage* in what has come to be known as a 'Whole Building' approach.

Key stakeholders were consulted during the preparation of this Advisory Note:

- Government of Jersey
  - Acting Head of Sustainability and Foresight
  - Principal Planner: Historic Environment
  - Planning Applications Manager
  - Regulation Standards Manager Building
- Jersey Heritage and the Heritage Partnership
- Association of Jersey Architects (AJA)
- Jersey Construction Council
- Highlands College
- Andium Homes

Heritage is greatly valued by the people of Jersey. Most people are keen to see heritage protected and nearly three quarters of adults visit a heritage site at least once a year[3] and more than 20,000 are members of heritage organisations.

This Advisory Note sets out the international and local policy context, before explaining the different approaches to retrofit, and then how the optimal approach for historic buildings can be used to inform the development of specific retrofit plans. Finally, any required changes to the policy and regulatory framework in Jersey are identified.

1.2 THE DEFINITION AND NATURE OF HISTORIC BUILDINGS

The terms 'historic', 'heritage' and 'traditional' are all used when discussing old buildings, but they have slightly different meanings.

In this Advisory Note, historic buildings are understood to mean all buildings which have heritage value, whether or not they are covered by any form of statutory protection such as listing or conservation area status. It is indeed important to recognise that all historic buildings will have some remaining significance, and thus have heritage value in terms of providing a visible and tangible connection to our past.

Almost all historic buildings are of traditional construction. Most have solid masonry walls (ie not cavity walls), though there are some cob, earth and ancient timber frame structures still in existence in other places. Such buildings often have different structural forms compared to modern buildings, and are built with very different materials. This means that historic buildings do not perform the same as modern buildings - they usually heat up and cool down more slowly, and they deal with moisture differently, allowing rain, groundwater and internal moisture (from washing, cooking and breathing) to move in a controlled way into and through their semi-

[2] Jersey Heritage is an independent charity established by the States of Jersey in the 1980s to co-ordinate aspects of the heritage work of the Government and the Société Jersiaise.

[3] Jersey Opinions and Lifestyles Survey 2019.

1 CONTEXT

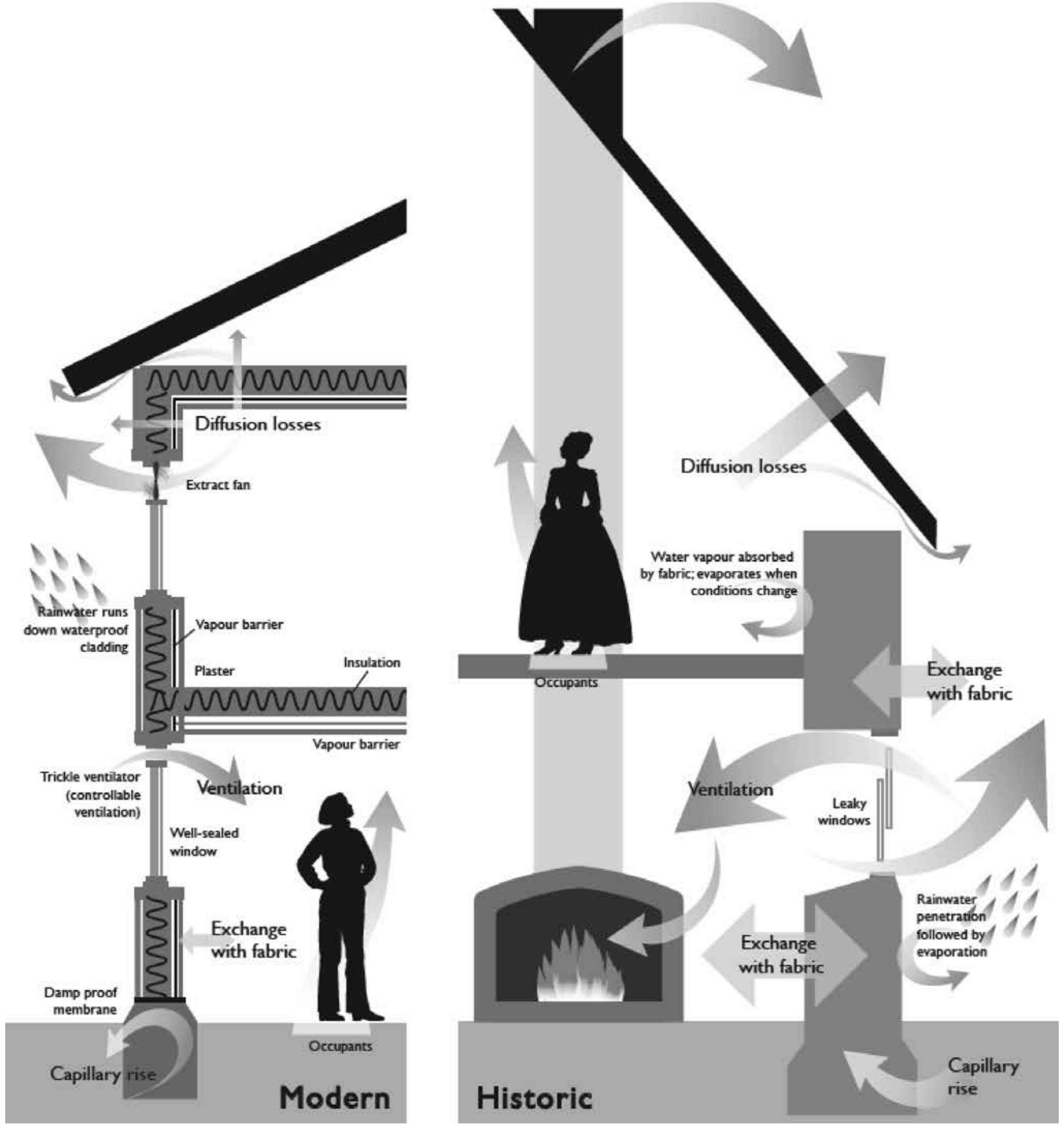


Image courtesy of Dr Robyn Pender

permeable fabric. They also rely on sunshine, wind, heating and adequate internal ventilation through windows, chimneys and draughts in order to keep dry. These differences can be illustrated graphically:
In good condition and with regular maintenance, the system in a historic building stays in balance. Changes to fabric performance, heating and ventilation, (i.e. retrofit), if not undertaken correctly, can change this balance and lead to problems of overheating, or damp, moulds and associated ill health.

In the UK, 'historic' is sometimes defined in policy documents as buildings which are protected by listing or conservation areas - normally in order to exempt such buildings from one or more retrofit requirements. This misses two key points:

- All buildings of traditional construction behave in the same technical way in terms of heating, cooling, moisture management and ventilation, whether or not they are protected.

- All historic buildings (including for example terraced housing) have heritage significance and contribute to a sense of place.

For that reason, it is important that 'historic buildings' are understood to be all buildings of traditional construction in Jersey, whether or not they are protected.

1.3 INTERNATIONAL POLICY CONTEXT

1.3.1 DEFINITION OF SUSTAINABILITY

The most commonly accepted definition of sustainable development is the Brundtland definition of 1987 - i.e. 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs.' This definition is useful as it is both broad (i.e. not limited to climate change) and intergenerational. The same report introduced the 'triple bottom line' of sustainability as:

- Economic
- Social
- Environmental

In 2010, UCLG The Global Network of Cities, Local and Regional Governments confirmed the addition of a 4th pillar - **Culture.**[4] As a key aspect of culture, heritage thus forms an essential part of sustainability, once understood in its correct broad sense. In this context, this means the kind of built environment we wish to leave to the next generation. This approach is exemplified in the Wellbeing of Future Generations (Wales) Act (2015)[5] which requires that all policy has to consider economic, social, environmental and cultural well-being. (see Section 3.3.2). Critically, this removes the false opposition sometimes posited between heritage and sustainability.

1.3.2 GREENHOUSE GAS REDUCTIONS

International commitments to greenhouse gas emissions reductions are well known. The Paris Agreement commits signatories to limiting global temperature rise to 2oC over pre-industrial levels.

Nationally determined targets are set to achieve this. In 2019, the UK made a legal commitment to reach 'net zero' by 2050, becoming the first country to do so. Under the Sixth Carbon Budget (2020) the UK also committed to achieving a 78% reduction in emissions by 2035, compared to 1990 levels.

1.3.3 HERITAGE CONSERVATION

At Global level, commitments to Heritage Conservation are limited to:

- Venice Charter (1964)
- Nara Document on Authenticity (1994)
- UNESCO Hangzou Declaration (2013)
- ICOMOS Madrid - New Delhi Document Approaches to the Conservation of Twentieth-Century Architectural Heritage (2011 updated 2017)[6]

At European level, the following commitments apply, or applied:

- Granada Convention (1985)
- Faro Convention (2005)[7]
- Madrid Document (2011)

Jersey's SPG on managing change in historic buildings specifically refers to the Granada Convention, and the European Convention on the Protection of the Archaeological Heritage, and notes that the Minister for the Environment has obligations under these conventions.

The Madrid - New Delhi Document was published after the Jersey SPG. Article 8 states:

'Care must be taken to achieve an appropriate balance between environmental sustainability and the conservation of cultural significance. Pressure for architectural heritage sites to become more energy efficient will increase over time. Cultural significance should not be adversely impacted by energy conservation measures.'

[4]https://www.agenda21culture.net/documents/culture-the-fourth-pillar-of-sustainability
[5]https://gov.wales/well-being-future-generations-act-essentials-html
[6]https://isc20c.icomos.org/policy_items/madrid-new-dehli-doc/
[7]Neither the Government of Jersey nor the UK government are signatories to the Faro Convention but the Heritage Strategy does reference this Convention.

1.4 INTERNATIONAL PUBLIC STANDARDS ON RETROFIT

EN16883 - The European Standard - 'Cultural Heritage - Guidelines for Improving the energy performance of historic buildings' was introduced in 2017. This standard presents a 'normative working procedure for selecting measures to improve energy performance, based on an investigation, analysis and documentation of the building including its heritage significance. The procedure assesses the impact of those measures in relation to preserving the character-defining elements of the building.' This is also adopted as a British Standard, so retrofit policy for historic buildings in Jersey should aim to be consistent with EN16883.

BS7913 (2013) 'Guide to the conservation of historic buildings' sets out best practice in the management and treatment of historic buildings and applies to buildings with or without statutory protection in the UK. The standard covers all stages from initial survey to the completion of practical work. This standard begins to address retrofit[8] but does not go into detail. Further information and resources are also signposted.

PAS 2035 (2019) and PAS 2038 (2021) are the two new Publicly Available Specifications covering domestic and non-domestic retrofit respectively in the UK. These two new documents are aimed at all buildings, not just historic buildings, but they are based on the 'whole building' approach to retrofit and set out a wide set of aims, including the 'protection and enhancement of the architectural and cultural heritage as represented by the building stock'. These spacifications are discussed in more detail in Section 3 - Retrofit Strategy.

1.5 JERSEY BRIDGING ISLAND PLAN

Vol 3 Historic Environment of the Bridging Island Plan (March 2022) sets out principles for a fully sustainable, whole life approach to a low carbon future.

The Plan is well ahead of most planning policy in the UK in recognising:

- that repair and adaptation of the historic environment is an inherently sustainable activity;
- the embodied carbon of existing buildings and prioritising them in promoting a whole life approach;
- that there are few 'one size fits all' energy improvement solutions available for traditional buildings;
- the potential for unintended consequences;
- promoting the 'whole building approach'.

This provides a sound foundation for developing retrofit policy for the historic built environment in Jersey and this Advice Note builds upon this.

1.6 A HERITAGE STRATEGY FOR JERSEY

The Heritage Strategy for Jersey was published in April 2022.

1.6.1 STRATEGIC OBJECTIVES

There are four Strategic Objectives set out in the Heritage Strategy. The second of these is the 'Protection and management of heritage assets', which is directly relevant to this Advisory Note. In the light of the need to reduce energy demand and the commitment to reduce carbon emissions, we need to consider how heritage is to be managed in the built environment.

1.6.2 STRATEGIC ACTIVITIES

There are eleven Strategic Activities set out in the Heritage Strategy. These include: 'Actively addressing the climate crisis by implementing measures across the heritage sector which reduce carbon footprint and mitigate against the future impacts of global warming.'

- Once the most appropriate measures to apply to heritage buildings have been identified, the other Strategic Activities (including public engagement with care for the heritage building stock and capacity increases in local communities) can then be planned and delivered.

[8]BS7913 Guide to the Conservation of historic buildings. BSI (2013) Sections 5.3.1 and 6.11.13

1.6.3 PROGRAMMES

Fourteen programmes are set out in the Heritage Strategy. Programme 9 is to 'Aim to Achieve Carbon Neutrality by 2030'.

The Heritage Strategy affirms that:

- 'The heritage sector will have a key role to play in this strategy by reducing its own carbon footprint across all sectors of its business activities including procurement.
- [The sector] will also need to demonstrate the value of retaining and refurbishing heritage buildings for new uses as well as illustrating how sensitive adaptation can improve thermal performance without compromising historic significance.
- Equally the sector will need to consider what measures will be required to mitigate against the adverse impacts of climate change including more extreme weather conditions, coastal flooding and invasive species.'

In the light of the aim to achieve carbon neutrality, this Advisory Note focuses on measures to achieve carbon emissions reductions rather than adaptation to deal with more extreme weather conditions. But note that maintaining buildings in good repair is essential to both emissions reduction and adaptation. If considering wholesale changes to the building stock, it may be wise to include adaptation at the same time, especially as historic buildings may be more vulnerable to moisture ingress than modern buildings, especially in extreme weather conditions.

1.6.4 PROJECTS IDENTIFIED

Four key projects are set out under Programme 9. Project 3 is 'To demonstrate how historic buildings can be adapted and retrofitted to improve energy and thermal performance.'

- Action: Review publications produced by SPAB and Historic England and produce a local equivalent for publication and adoption by Government.
- Leads: Heritage Partnership, Government, Climate Emergency Jersey, Jersey Architecture Commission and AJA
- Proposed changes to Byelaws - Carbon Neutral Roadmap HT2 which does not acknowledge historic buildings

This Advisory Note proposes the framework needed to address the project described above, but also discusses wider aims of retrofit, as set out in the new Publicly Available specifications PAS 2035 and PAS 2038, and by other broad definitions of sustainability.

1.7 JERSEY'S ENERGY SUPPLY

The particular energy mix in Jersey has a significant impact on the decision-making process for which retrofit measures are justifiable in terms of cost and carbon.

With the exception of the limited gas network on the island, the majority of buildings are heated electrically. As Jersey benefits from low carbon electricity (from France), the CO2 emissions saved by retrofit measures will be far lower than - for example - in the UK.[9] As retrofit materials are largely imported, the embodied carbon of measures in Jersey will be no less than in the UK, so the carbon saved is less likely to exceed the embodied carbon of the measures themselves. *This makes retrofit measures harder to justify in terms of saving carbon emissions.*

However, electricity remains the highest priced fuel available, so retrofit measures may still be justifiable in terms of the reduction in running costs. This addresses the agenda of reducing *fuel poverty*. By the same token, retrofit measures reduce energy use so will have a part to play in improving *energy security* for Jersey.

Clearly, there is more than one driver for retrofit. It is important to recognise that there will be measures which reduce energy consumption and reduce cost for the people and businesses of Jersey, while actually increasing carbon emissions due to the embodied impact of the carrying out the retrofit work. The Government of Jersey and partners will therefore need to think about how to balance these different drivers, and to consider ways of reducing the embodied impact.

[9]Some nuclear energy is being decommissioned in France's energy so energy generation may lean more on fossil fuels until renewables capacity is increased. In the short term this may increase the carbon intensity of French electricity.

1.8 JERSEY BUILDING BYE-LAWS

The Jersey Building Bye-laws largely follow the Building Regulations set for England and Wales, usually with a time-lag for their implementation, but they currently take a much less flexible approach to heritage buildings. The Jersey Building Bye-laws (Part 11.1B 2016 Edition) only provide an specific exemption for listed buildings (2.5.a) 'where compliance with the energy efficiency requirements would unacceptable alter their fabric or appearance'. This is a much narrower exemption than in the Regulations in England and Wales, where the exemption applies more broadly to include all buildings in designated conservation areas, and to ancient monuments, and there is also an exception for all buildings of traditional construction. In practice, reduced standards would be considered where a suitable argument can be formulated to avoid damaging the building fabric in all traditional buildings.

Where S 2.8 of the Jersey Building Bye-Laws require new extensions to comply fully with the energy efficiency standards in the approved document, the regulations in England (Part L 2021 para 0.11) have flexibility where 'there is a need to match the external appearance or character of the extension to that of the host building. The work should comply with standards in this approved document to the extent that it is reasonably practicable'.

It is important to recognise that there are some differences between English and Welsh Regulations, specifically regarding energy efficiency in traditional buildings (defined as primarily solid walled construction, generally pre-1919). Until recently the Regulations for both nations had an exception for historic and traditional dwellings which stated that retrofit work should not be detrimental to the character, fabric or fittings of traditional buildings. In the 2021 Regulations in England, this exception has been removed and is now solely framed in terms of moisture risk. The exception concerning character and appearance remains for buildings which are listed or which lie in conservation areas[10]. In Wales, it has been decided to retain the exception pertaining to the character of traditional buildings - as it is widely recognised that old buildings help to define the character of an area, whether or not they have statutory protection. This is set out in more detail in Appendix A.

1.9 PLANNING AND BUILDING (GENERAL DEVELOPMENT) (JERSEY) ORDER 2011

For most buildings there are certain permitted development rights relating to energy efficiency and micro generation measures, but for designated heritage buildings there are restrictions.

Excluding listed buildings, under the GDO, specifically insofar as it could be relevant to retrofit, there are permitted development rights for solid wall insulation and for certain changes to roof structures.

Under Class F, Permitted development [Part 3 Class F.1, K], the following is permitted: 'the re-rendering (up to a maximum additional wall thickness of 15 centimeters) of areas of a building that are already rendered including the installation of external insulation systems in the render finish.'[11] This recognises that an already rendered building will change little in appearance if EWI is added. Indeed, where cement render has cracked or otherwise failed, EWI may well be used to enhance heritage, as long as the texture and colour is appropriate.
There is a similar permitted development right [Part 3, Class F.1(d)] for the addition of height to roof structures: up to 15 centimeters is permitted and this would accommodate most warm roof insulation systems. However, this may cause issues in some terraced and semi-detached buildings where the roofline and its relation to other buildings is a significant feature of the context - i.e. its contribution to the overall streetscape and in this situation breaking a continuous roofline is unlikely to be acceptable. Also note that under F2 the work is not permitted under class F if the replacement alters the shape of the roof.

These permitted development rights do not apply in listed buildings or places. The GDO (amended 2021) restricts permitted development rights in relation to

[10]These differences are set out in full in Appendix A - Building Regulations & Traditional Buildings in the UK.
[11]Planning and Building (General Development) (Jersey) Order 2011 (Consolidated 2021): Schedule 1.

listed buildings or places, potential listed buildings, places in the Minister's register, and in Conservation Areas (CA), although these have not yet been introduced in Jersey.

For LBPs, pLBPs, and CAs, the following potentially relevant to retrofit are NOT permitted development:

- Part 3 Repairs Maintenance and Minor Works
  - Class A. A.1 Painting of a previously never painted exterior of an LBP, pLBP, or in a CA;
  - Class AB. AB1 Minor below-ground engineering work of bore holes, drains and other services;
  - Class F. FI (a) to (k) inclusive
  - Class K. K1 Maintenance and repairs, other than minor repairs
  - Class L. L1 Rainwater goods, verges or fascia boards (exception does not apply to CAs)
- Part 4 Renewables
  - Class A. A1 Solar panels (applies to land or buildings forming part of LBPs, pLBPs, and principal elevations in CAs)
  - Class B. B1 Heat pumps (applies to land or buildings forming part of LBPs, pLBPs, and principal elevations in CAs)
  - Class C. C1 Single wind turbines (applies to land or buildings forming part of LBPs, pLBPs, and principal elevations in CAs)

1.10 BUILDING CERTIFICATION

Energy Performance Certificates (EPCs) have been introduced in Jersey but they are not currently used as a policy lever[12]. This may be an advantage in terms of developing an approach to the retrofit of historic buildings, because EPCs do not currently recognise old buildings correctly, either in a technical sense or in terms of heritage.

- An EPC is not a measure of performance[13], but an estimate of energy costs and carbon emissions.
- The u-values assumed in the SAP programme which underlies the certificate do not accurately reflect the performance of old buildings. The SAP programme does not effectively allow for thermal mass - and most old buildings have thermal mass which heats up and cools down slowly, thus helping to even out variations in internal and external temperature. It is therefore recognised that old buildings tend to use less heating energy than is assumed by the models.
- An EPC takes no account of interactions between measures, between different aspects of building fabric, or between fabric and building services. These interactions are described further in Section 5 of this Advisory Note.
- Critically, an EPC does not address ventilation - and poor indoor air quality is a serious risk to human health and exacerbated by retrofit measures which reduce natural air infiltration by sealing up gaps.
- Lastly, the recommendations on an EPC take no account of heritage value. Solid wall insulation or window replacement are usually recommended as default options by the underlying programme, while for many historic buildings this would be wholly inappropriate.

Among the retrofit industry these issues are widely understood and there is agreement that a better system is required. In Scotland the limitations of EPCs are already officially recognised. There is an opportunity for Jersey to take a step ahead and introduce a more effective system of building certification, while avoiding the issues associated with EPCs.

WHOLE BUILDING CERTIFICATION

Section 3 of this Advisory Note explores different approaches to retrofit. Where a 'whole building' approach is used, it becomes necessary to use a whole building certification one which covers many more metrics than cost and carbon. Clearly there would be an additional cost to this broader assessment, but greater

Examples of broader building certification systems used elsewhere include BREEAM (UK and international, non-domestic) and LEED (USA). EcoHomes and the Code for Sustainable Homes both had broad metrics but are no longer used.

[12]although Policy HT3 of the Carbon Neutral Roadmap states that minimum EPC standards are to be introduced from 2026.
[13]Performance implies measurement.

2 JERSEY'S HERITAGE BUILDING STOCK

2.1 STOCK PROFILE

According to the Jersey Heritage Strategy (2022) there are approximately 45,000 Buildings in Jersey. According to the Heritage Strategy, 9% of buildings in Jersey are listed, but there are many more historic buildings which are not listed.

Data on Jersey's building stock is only approximate as it is not complete or up-to-date. More accurate data might be obtained from interrogating the ratings system in due course.

2.1.1 DISTRIBUTION BY USE/FUNCTION

Buildings are normally classified in three main groups - residential, commercial and public.

a) Dwellings: The 2021 Jersey Census presents a total dwelling number of 48,610. As some buildings will contain multiple dwellings (and lodgers are counted as separate 'dwellings'), the number of buildings which are dwellings will be significantly less than this, so a net figure is required.

b) Commercial & Public buildings: No data is currently available. However, the Heritage Strategy estimates that there are 45,000 buildings in Jersey in total. Subtracting a net dwelling figure, should enable an estimation of the size of the non-domestic building stock.

2.1.2 DISTRIBUTION BY TENURE

Buildings are either owner-occupied, (be they domestic or non-domestic) or rented. In the domestic sector the rented dwellings can further broken down into the private rented sector and social housing stock.

Tenure is relevant to retrofit because, in rented properties, there is a difference between the owner of a property - who is responsible for the building fabric, and the occupants - who are responsible for paying the energy bills. Equally, retrofit measures must protect the health of the occupants, but the retrofit of old buildings poses risks in terms of moisture levels and thus indoor air quality.

For rented buildings, a landlord has no incentive to invest in energy saving measures, if they only benefit the tenant in the form of lower bills. Similarly, there is little incentive to invest in a heating system which costs less to run. The classic example is where a building is electrically heated and would cost much less to heat with a heat pump than with electrical resistance heating (i.e. storage heating / electric radiators etc). However, electrical resistance heating is cheap to purchase, and heat pumps are expensive, so many privately rented properties have electrical resistance heating. There may be benefits for landlords in terms of higher rents achieved in properties which are cheaper to heat, but the up-front capital barrier remains.

Different approaches to retrofit are thus needed for owner-occupied buildings and for rented buildings. Where domestic buildings are in the ownership of a social landlord, the situation is different, as the landlord has a statutory duty towards the welfare of the tenant.

DWELLING DISTRIBUTION BY TENURE[14]

TYPE OF TENURE	2021 NUMBER	2021 PERCENTAGE
Owner-occupied	23,870	54%
Social housing rent	5,826	13%
Qualified private rent	10,739	24%
Other (eg lodger/care home)	4,148	9%
Total	44,583	100%

[14]Jersey Census 2021 Bulletin 2: Households and housing.

2 JERSEY'S HERITAGE BUILDING STOCK

As only 54% of the dwellings in Jersey are owner-occupied, the rental sector represents a major challenge, and the number of private rental properties has increased 38% over the past decade.[15]

No similar data is currently available for non-domestic buildings in Jersey.

2.1.3 DISTRIBUTION BY AGE

No robust data exists regarding the age of properties in Jersey.

While a few buildings of later 20th century construction may be listed, it is fairly safe to assume that the vast majority of the 9% of buildings which are listed are 'historic' buildings, and are of 'traditional' construction - i.e. solid walled or old timber-framed.

However, not all historic buildings are listed. In the UK, approximately 25% of the building stock was constructed prior to 1919, and is of the traditional construction type. The 2008 Jersey Annual Social Survey (JASS)[16] included a question about dwelling age, noting that the results are based on people's judgement and not on evidence, and that 1 in 6 did not know when the property they lived in was built. This yielded a figure of 27% of domestic properties being constructed prior to 1930.

Although cavity wall construction began in the 1940s in Jersey, solid wall construction continued into the 1960s, so the actual percentage is likely to be higher than 27% - say 32%. However, new construction has continued steadily since 2008, so this again reduces the percentage of the total which will be historic buildings. It is therefore reasonable to assume that *30% of Jersey's current building stock might therefore be defined as 'Historic'*. This is a substantial proportion of the total building stock. If the total number of buildings is 45,000, the number of historic buildings in Jersey may therefore be in the order of 13,500. This is considerably more than the 4,100 buildings which are listed[17], even though all these buildings will behave differently and most will have heritage value.

2.2 LOCAL HERITAGE CHARACTERISTICS

The characteristics of Jersey's historic building stock are well set out in the Purcell Report of 2013[18] and in the St Helier Urban Character Appraisal[19]. Within a relatively small number of buildings, there is a great variety of architectural styles, reflecting the many phases in the Island's rich history. Several key characteristics have an impact on how retrofit of historic buildings should be planned and executed.

2.2.1 STONE WALLS

The principal local building material is granite. As is well known, granite is porous, so in exposed locations there is a risk of wind-driven moisture penetrating an unprotected stone wall and moisture being transferred to the indoor environment. This has implications for the design of internal wall insulation, which is discussed in more detail in Section 4.4.

2.2.2 RENDERED WALLS

A relatively high percentage of Jersey's solid walled buildings are already rendered, especially in St Helier. It is thought that the majority of these buildings are cement rendered, perhaps as cement was in use in Jersey earlier than in the UK and there is high exposure to a saltwater environment. This presents an opportunity for retrofit, as buildings can be improved thermally in many instances by the application of external insulation without significantly compromising the appearance of the building. There are of course implications at eaves and gable junctions with the roof, and at window and door reveals. This is discussed in more detail in Section 4.4.

[15]Jersey Census 2021 Bulletin 2: Households and housing.
[16]Jersey Annual Social Survey 2008.
[17]Heritage Strategy for Jersey - Government of Jersey 2022.
[18]Historic Buildings Energy Study Jersey - Purcell 2013.
[19]St Helier Urban Character Appraisal - Willie Miller Urban Design 2005, updated 2021.

2.2.3 WINDOWS & DOORS

Windows and doors are a particularly diverse and highly valued aspect of Jersey's historic building stock. This is recognised and explained in the Supplementary Planning Guidance advice note on windows and doors[20].

The Bridging Island Plan[21] goes into detail on historic windows and doors and the extent to which they 'bear witness to the artistic, social, cultural, economic and technological developments of the past.' This plan also provides a decision tree for replacement doors and windows, which is relevant to retrofit and is discussed further in Section 4.1.

SPG Advice Note 6[22] also records the fact that windows in traditional thick granite-walled buildings in Jersey tend to be small, so the energy efficiency of the whole building is likely to be higher than might be expected for a solid walled structure. This implies that the energy gains from retrofit may be smaller than expected so, coupled with a low carbon energy supply, the justification for deep retrofit in terms of decarbonisation may in many cases be weaker than in the UK.

[20]SPG: advice note. Protection of historic windows and doors - States of Jersey 2018.
[21]Bridging Island Plan - Government of Jersey 2022.
[22]SPG Advice Note 6 - Managing change in historic buildings P12.

3 RETROFIT STRATEGY

3 RETROFIT STRATEGY

3.1 THE AIMS OF RETROFIT

Retrofit is often defined as reducing the energy use and carbon emissions from buildings. This ignores two important points:

- At the same time as reducing energy use, if we are making wholesale changes to the building stock, we should consider what other social, economic, environmental and cultural benefits could be delivered at the same time as energy use reductions.
- If the aim of retrofit is to reduce energy use and carbon emissions, then the embodied energy and carbon of retrofit measures needs to be considered, otherwise retrofit could result in increased emissions, even over the long term.

There are three strong drivers for retrofit at present:

- CO2 emissions reductions
- Fuel poverty reductions
- Energy security

All three of these drivers point towards reducing energy use from buildings in occupation, and could result in a narrow focus which not only ignores heritage, but also other sustainability goals, embodied energy, and the value of the circular economy - all of which are already recognised in Jersey.

3.1.1 THE WHOLE BUILDING APPROACH TO RETROFIT

The single measure approach to retrofit has caused numerous building failures. This is most evident where insulation of old buildings has changed the way that they behave in terms of moisture and heat - their hygrothermal properties.

To address this, over the past decade, various bodies in the UK have developed what has become known as the 'whole building approach'[23] to retrofit. Inevitably, this has come to mean slightly different things to different people, but there is general agreement that a true whole building approach must (minimally) do all of the following:

- address all aspects of building fabric - walls, floors, roof, doors & windows with particular attention to junctions between thermal elements;
- address all building services including heating, lighting, hot water and ventilation;
- consider interactions between fabric, services and occupants;
- avoid unintended consequences.

The UK Government's 'Each Home Counts' report[24] embraced the whole house approach and called for the introduction of new publicly available specifications. The Bridging Island Plan also affirms this approach for all buildings.[25]

3.1.2 THE NEW PUBLICLY AVAILABLE SPECIFICATIONS ON RETROFIT

The two new publicly available specifications for retrofit are:

- PAS 2035: Domestic[26]
- PAS 2038: Non-domestic[27]

These specifications, published by the British Standards Institute, set out a process by which retrofit should be carried out. This is based upon accurate survey, full options appraisal, bespoke design, and finally installation and monitoring, all carried out by appropriately trained and qualified personnel.[28] These specifications are based on a broad set of aims. For ease of reading, the aims of the PAS 2035 domestic are set out below:

- improved functionality, usability and durability of buildings;
- improved comfort, health, well-being and productivity of building occupants and visitors;
- enabling buildings to use low- or zero-carbon energy supplies;
- improved energy efficiency, leading to reduced fuel use, fuel costs and pollution (especially greenhouse gas emissions associated with energy use);
- reduced environmental impacts of buildings;
- protection and enhancement of the architectural and cultural heritage as represented by the building stock;
- avoidance of unintended consequences related to any of the above; and
- minimisation of the 'performance gap' that occurs when reductions in fuel use, fuel cost and carbon dioxide emissions are not as large as intended or predicted.

It is instructive to note that the 'protection and enhancement of the architectural and cultural heritage as represented by the building stock' is included as one of the aims of retrofit. Retrofit can thus embrace heritage and take advantage of opportunities to enhance it - a good example is where inappropriate uPVC windows are replaced by double-glazed timber windows constructed to match the original pattern.

In the process of PAS 2035 and PAS 2038, where a traditional building is under consideration, an 'Assessment of significance' in line with BS7913 is required. The template which was developed for BSI, then withdrawn, was not complex, and indeed is in use already. While at present there is no requirement for a Retrofit Coordinator to take account of the assessment in the decision-making process, at least significance is recorded and the evidence presented to the RC.

Even if the Government of Jersey does not adopt the full process set out in the new British specifications on retrofit, the aims listed above are an effective starting point for all retrofit programmes.

3.1.3 WHOLE HOUSE ADVANCED AND THE REGENERATION APPROACH

It is possible with well-designed publicly-driven retrofit programmes to go beyond the aims used in PAS 2035 and PAS 2038.

As noted in the introduction to Section 3, there are many other social, economic, environmental and cultural benefits that could be delivered at the same time as energy use reductions. However, if these objectives are not considered at the outset, it is unlikely that they will be achieved to their fullest potential.

Local employment is a good example. The optimal way to address fuel poverty is to reduce poverty. Optimal retrofit schemes encourage the use of local labour and resources to stimulate the local economy, so they set a target up front to use a given percentage of local labour. This presents particular challenges in an island community, but training and other potential structural barriers are considered in Section 6.

Water efficiency, sustainable drainage, cleaning and re-greening neighbourhoods can all be included within a community context and what might be termed 'Advanced'[29] whole building retrofit. Taken together with local employment and the re-establishment of community facilities, this can be termed a Regeneration approach. This is set out in more detail in STBA's 2021 paper 'From Retrofit to Regeneration.'[30] In Jersey, a broader approach to the building stock is already signalled in the Bridging Island Plan - where Sustainable Urban Drainage Systems (SUDS) are mentioned and, for new large buildings (under ME2), BREEAM ratings will be used, covering a wide range of environmental metrics. Policies on biodiversity and green areas in new development both signal a change towards this more balanced an inclusive approach to future planning.

Jersey may not suffer from some of the same social challenges that the full Regeneration approach is designed to tackle but, if contemplating significant changes to the building stock, it makes sense to consider what other things could be achieved cost-effectively at the same time.

[23] What is whole house retrofit? - STBA 2015.
[24] Each Home Counts - Dr Peter Bonfield (2016) BEIS, DCLG.
[25] Bridging Island Plan - Government of Jersey 2022 P132.
[26] PAS 2035: Specification and Guidance for Energy Retrofit of Dwellings (2019).
[27] PAS 2038: Retrofitting non-domestic buildings for improved energy efficiency - Specification (2021).
[28] Specific new roles are introduced: Retrofit Coordinator, Retrofit Assessor, Retrofit Designer, Evaluator.

[29] 'What is whole house retrofit?' STBA 2015.
[30] From Retrofit to Regeneration STBA 2021.

3.1.4 EMBODIED ENERGY AND CARBON, AND THE CIRCULAR ECONOMY

The argument for retention over demolition and replacement is well made and accepted in Jersey, perhaps moving on from an earlier approach when demolition and rebuild was a more common approach to property development. Buildings contain a large store of energy embedded in their construction, and the carbon needed to demolish and rebuild is far greater than that needed to retrofit, taking into account the reduced emissions over the long term.[31]

The Carbon Neutral Roadmap also recognises the impact of waste and embodied energy, and thus the importance of the circular economy. The Roadmap contains a commitment to develop a Circular Economy Strategy by 2025.

The same approach can be applied to retrofit. It is essential that the materials which are used to reduce emissions in use are themselves low carbon (as well as the energy needed to fit and install measures), otherwise the process of retrofit would actually increase emissions. This is especially a risk in Jersey which benefits from low carbon electricity from France.

3.1.5 REPAIR BEFORE RETROFIT

Faults in building fabric lead to high levels of air leakage and often to damp and moisture ingress. As is well understood, a dry wall is thermally much more efficient than a wet wall ('Elements such as walls can be over a third less energy efficient if damp', BS 7913), so the first task when retrofitting a building is to repair it and return so far as possible to the condition which the original designers intended. This principle is enshrined within the processes outlined in the new British specifications for retrofit (PAS 2035 and PAS 2038). Repairs need to be appropriate to the fabric and character of the building, and to resolve (rather than perpetuate) problems such as trapped moisture.

Where moisture ingress has occurred and repairs take place, it is also essential to allow building fabric to dry out before any new insulation is added to the thermal element concerned. In severe cases for solid masonry walls, this can take more than one summer, so retrofit processes and timetables need to be designed to allow for this drying to take place.

3.2 ASSESSING AND RECORDING HERITAGE SIGNIFICANCE

In order to ensure that heritage is considered correctly in the design process for retrofit, heritage features must first be accurately identified, assessed and recorded.

The Bridging Island Plan makes explicit reference to the concept of significance and to the need to assess and record it as a first step:

'Managing change in the historic environment begins with understanding and defining how, why, and to what extent it has historic, cultural and natural heritage value: in sum, its significance. Only through understanding the significance of a building or place is it possible to assess how the special interests that people value are vulnerable to harm or loss. Understanding and articulating the significance of a building or place is necessary to inform decisions about its future. Every planning decision should be based on an understanding of the likely impact on the special interests of the fabric and other aspects of the building or place concerned.'[32]

BS7913: 2013 Guide to the conservation of historic buildings sets out a robust process for surveying and assessing. The standard is based around the concept of significance. This is defined slightly differently by the three main heritage bodies in the UK (Historic England, Historic Environment Scotland and Cadw in Wales). There is broad agreement that heritage values may be considered in four basic categories:

- aesthetic value
- communal value
- evidential value
- historical value

These are set out in S 4.2 of BS 7913, which also has a list of 25 possible alternative values (see Appendix B) which may contribute to a historic building's significance. Together, these provide a clear basis for identifying and assessing significance. Any statement of significance should therefore refer to these categories, and guide the ensuing heritage impact assessment, once any proposals for change have been brought forward at the end of the retrofit options appraisal process.

An Assessment of Significance (in line with BS7913) should therefore be the starting point for developing the approach to the retrofit of any historic building.

3.3 RETROFIT POLICY IN THE UK

3.3.1 UK-WIDE POLICY

The Clean Growth Strategy (2017) has to a large extent set current policy in the UK. The 'ambitions' set out in that document have become treated as policy by industry, which naturally wants to see the maximum amount of change, investment and therefore profit. Traditional buildings, historic buildings or heritage are not mentioned at all in the document - so there is no recognition at policy level that 25% of the building stock needs a different approach to retrofit. Ambitions set out in this document are all framed in terms of EPC scores and, as already noted, there are numerous issues with using EPCs as a metric, particularly for older buildings.[33]

The ambition for the 2.5 million homes defined (at that time) as fuel poor is to achieve an EPC rating of C or better by 2030. More broadly, the government's aspiration is that as many homes as possible are improved to EPC Band C by 2035, where practical, cost-effective and affordable. The UK government is consulting on strategy for the owner-occupied sector.

The Heat and Buildings Strategy (2021) mentions listed buildings (less than 2% of the stock) a handful of times but there is no recognition that traditional buildings (25% of the stock) need a different approach from other buildings. There is no mention of PAS 2035 and PAS 2038 which were introduced to manage the consequent risks. There is no mention of conservation areas. By contrast, there are over 100 mentions of heat pumps, so the direction of strategy is clear.

The Energy Security Strategy (2022) again does not mention traditional buildings or the risks of inappropriate retrofit. It did recommend reviewing the practical planning barriers to energy efficiency improvements that households can face in listed buildings and conservation areas - with a clear deregulatory agenda.

This review (report awaited) is part of a wider interdepartmental Government review, including Planning Policy, Building Regulations, EPCs etc. It was clear at the Regional Roundtables which formed part of this Review that there was a lack of holistic understanding of the issues, and no effective joining up between different Government departments and regulatory regimes. The UK Government has yet to effectively tackle embodied carbon and whole life challenges. All these make a stark contrast to the approach being developed in Jersey.

3.3.2 POLICY IN WALES

In Wales, a much more holistic and balanced approach to retrofit is taken, in part thanks to the Wellbeing of Future Generations (Wales)Act (2015)[34]. This is a helpful parallel to the Bridging Island Plan and the Future Jersey vision of sustainable wellbeing. The Act begins with a concept of sustainable development and requires that all policy now has to consider economic, social , environmental and cultural well-being. Note that all four pillars of sustainability are included here.[35]

The Act establishes seven interlocking wellbeing goals:

- A prosperous Wales
- A resilient Wales
- A healthier Wales
- A more equal Wales

[31]Bridging Island Plan Policy GD5 sets out the tests applied to allow demolition and replacement or not.
[32]Bridging Island Plan - Government of Jersey 2022 P131.

[33]EPCs and the Whole House Approach - STBA 2016.
[34]https://gov.wales/well-being-future-generations-act-essentials-html
[35]see Section 1.2.1 of this Advisory Note.

3 RETROFIT STRATEGY

- A Wales of cohesive communities
- A Wales of vibrant culture and thriving Welsh language
- A globally responsible Wales

The Act makes it clear that public bodies must work to achieve all these goals, not just one, so a narrow focus on carbon emissions reduction is no longer possible for retrofit programmes in Wales.

3.3.3 PRIVATE RENTED SECTOR LEGISLATION (ENGLAND & WALES)

Prior to the Clean Growth Strategy, legislation was already in place for the Private Rented Sector (both domestic and non-domestic). This came into force in 2018 and is particularly significant as it is the first example in the UK of a legal obligation placed on the private sector to carry out building retrofit.

The legislation is based around achieving specific EPC grades, triggered initially by new tenancies, then a backstop date is introduced for all existing tenancies, irrespective of their commencement date. In summary:

- From April 2018, landlords of privately rented domestic and non-domestic property in England or Wales must ensure that their properties reach a minimum EPC rating of 'E' before granting a new tenancy to new or existing tenants.
- A backstop date was included to require all domestic tenancies (i.e. all existing tenancies that have a valid EPC) to meet this standard as of 1 April 2020 and non-domestic by 2023.

In Scotland, EPC D is required for new tenancies from 1 April 2022, with a backstop date for all tenancies of 31 March 2025 for all tenancies which have an EPC.

One of the main issues with the MEES legislation is that it is based around EPCs, and the recommendations which appear on them. It is widely recognised that EPCs are a crude tool and cannot reflect the complexity of historic buildings. Moreover, the recommendations have effectively turned into a shopping list for landlords - so they have become a design tool - a purpose for which they were not intended and for which they are wholly inadequate. For example, external wall insulation comes up as a standard measure whatever the context, condition or heritage of a solid walled building. There are some exemptions for protected buildings, but these have been the subject of much debate and controversy[36]. Lastly, the key driver at the time of introduction was CO2 emissions reductions and it must be remembered that in the UK the headline rating on an EPC is not a measure of carbon emissions but an estimate of energy cost - it is common to be able to improve an EPC score whilst increasing emissions. However, in Jersey these two metrics are presented equally.

Helpfully, guidance for landlords is available and this does include the diagram reproduced in Section 1, which demonstrates how old buildings behave differently from modern buildings[37]. However, there is no requirement for landlords to take a different approach, no recognition of the issues with EPCs and no relaxation of the requirements where traditional buildings are under consideration.

3.4 REVIEW OF RETROFIT PROGRAMMES IN THE UK

3.4.1 CURRENT FUNDING PROGRAMMES

The Social Housing Decarbonisation Fund (SHDF) is a large fund designed to retrofit the social housing stock in England. Participants are required to work in line with PAS 2035, which is the first time that the new specification has been tested out at significant scale. This means that a proper process of assessment and design has to be followed, including an assessment of significance wherever buildings of traditional construction are under consideration for retrofit. This is an important departure for the UK and in stark contrast to some of the retrofit programmes which preceded it. Having said this, there are still some major issues emerging:

- The funding awards and finish times for the programme were set to follow the financial year. This means that awards were made too late for assessment, design and procurement to be completed before the autumn, and this has led to major external work being carried out in the winter, which is sub-optimal.
- The application process required measures to be specified and costed, but this was before survey was carried out. Survey informs options appraisal and design, which in turn informs procurement. It is impossible to know what measures are necessary, or are within budget, until a building has been properly assessed and this process completed.
- The scheme timelines have led to a constriction in the market for key measures such as External Wall Insulation, with prices rising rapidly and some materials constraints.
- The scheme has 2 key metrics, a maximum desirable kWh/m2 heat energy demand (modelled) and an absolute requirement of EPC C or better. This had led to measures being selected to get properties over the EPC threshold, with no regard to what is cost-effective, or appropriate for the building.

A 2-stage rolling process beginning with survey, design and costing, before applying for a second stage of funding for installation, would help to control or eliminate the first three of these issues.

The Energy Company Obligation (ECO) is a Government controlled scheme funded by the energy suppliers. Obligated suppliers must 'mainly promote measures which improve the ability of low income, fuel poor and vulnerable households to heat their homes. This includes actions that result in heating savings, such as the installation of insulation or the upgrade of an inefficient heating system. The target is divided between suppliers based on each supplier's relative share of the domestic gas and electricity market.'[38] This programme has been in place for some years but the most recent round of projects (ECO4) is now required to work in accordance with PAS 2035, which will result in an improved process with better design and execution than earlier phases of the ECO.

Neither the SHDF nor ECO have any metrics other than energy saving to address fuel poverty or carbon emissions reductions. Both programmes use the EPC metric, which as discussed earlier has serious limitations when used on older buildings, and which misses all the wider aspects of health and wellbeing.

The Optimised Retrofit Programme in Wales was launched in 2020. This was established to test out the whole-building approach to decarbonisation of homes. The trial period also identified capacity, skills and capability gaps in the delivery system. This scheme will trial several approaches to decarbonise social housing.

The Boiler Upgrade Scheme (BUS) applies across England and Wales until 2025 and is designed to encourage households to replace fossil fuel boilers with lower carbon forms of heating - principally heat pumps, though biomass boilers are included and permitted in off-gas-grid rural locations. The scheme provides a capital grant towards installation, unlike the previous schemes which it replaced (FiT and RHI) which provided a stream of payments. While not a retrofit scheme as such, the BUS is a single measure scheme which may not be appropriate for historic buildings, as many cannot be retrofitted in ways that make them suitable for a heat pump.

In Scotland, policy is still emerging. The Heat and Buildings Strategy (2021) set out plans to introduce regulations by 2025, with proposals currently as follows:

- Social housing: EPC B by 2032
- Private rented sector: EPC C by 2025 (where feasible, at change of tenancy) with backstop of 2028 for all remaining properties.
- Owner-occupiers: EPC C where feasible, with low carbon heating by 2045, no new fossil fuel boilers from 2025 (off gas grid) or 2030 (on grid).

Encouragingly, the Scottish Government recognises that EPCs as currently constituted are not appropriate to these targets. 'We are, however, aware of issues with the current EPC system, which we are planning to address through reform... This includes changing the headline metric to one that is more appropriate for decarbonisation of energy in Scotland.'[39]

[36] see for example the discussion in 'EPCs and the Whole House Approach' - STBA (2019).

[37] The Domestic Private Rented Property Minimum Standard - Guidance for landlords and Local Authorities on the minimum level of energy efficiency required to let domestic property under the *Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015*, as amended (P52) - Department for Business, Energy and Industrial Strategy (2020).

[38] https://www.ofgem.gov.uk/environmental-and-social-schemes energy-company-obligation-eco

[39] https://www.gov.scot/policies/energy-efficiency/energy-performance-certificates/

3.4.2 PREVIOUS FUNDED SCHEMES

The UK has a long history of poor quality funded retrofit schemes. These failures were in large part what gave rise to the new public specifications on retrofit (PAS 2035 and PAS 2038). Major failings have included the mistaken use of a 'one size fits all' approach to modern and traditional buildings, and funding timescales which have failed to recognise that deadlines tied to the financial year can result in works being carried out in the worst possible weather conditions.

CERT and CESP were domestic energy schemes funded and delivered by energy companies, and predecessors to the ECO (see 3.3.1 above). Some good work was clearly achieved but failures included the notorious Fishwick retrofit scheme[40] in Preston which resulted in hospitalisation of some residents and some properties were rendered uninhabitable. The causes of these failures were multiple, but included:

- Lack of bespoke assessment and options appraisal;
- Lack of robust design;
- Time pressures imposed by funding timetables leading to work being carried out hurriedly and at the wrong time of year;
- Poor workmanship and an absence of site supervision and inspections;
- Lack of training;
- Lack of monitoring.

The Green Deal was a loan-based scheme (Great Britain) which was heralded as the future of retrofit when it was introduced in 2012. Despite a great deal of public money spent in the lead-up, the application process was too bureaucratic and many measures would not have paid back within the timescales for the loans so the flagship scheme was closed in 2015 with less than 2,000 households having participated. The aspect of the scheme which caused most concern to the heritage bodies in the UK (and led to the formation of the STBA) was that individual measures were to be applied - with no attention paid to thermal bridging, or to junctions between different thermal elements, or interactions between fabric and services.

The Green Homes Grant was introduced (England only) at a late stage in the Covid pandemic. Despite all the work done to ensure a whole house approach is now used, this grant scheme reverted to an earlier single-measure approach and paid no attention to ventilation, heritage, interactions, etc. Fortunately this scheme was discontinued in 2021 with limited take-up.

The Home Upgrade Grant Phase 2 was a 'fabric-first' retrofit scheme aimed at properties in England which are off the gas grid and where the household income is below £31,000pa. As with all publicly funded retrofit programmes, this Phase 2 was required to be delivered in accordance with PAS 2035, though earlier points regarding the EPC metric still apply. Together with the Local Authority Delivery (LAD) scheme - now LAD3 - these formed the Sustainable Warmth programme. LAD3 applied to on-gas properties up to a £10K maximum (£5K for privately rented properties).

Arbed was the main domestic energy saving programme in Wales and was a 'strategic area-based fuel poverty scheme co-funded by Welsh Government and the ERDF. It has been running for some years and Arbed 3 concluded in 2021. These programmes were notable for having local employment included in their aims and metrics. The *Arbed 1 report identified numerous failures in design and execution. The Arbed 2 report*[41] *identified a wide range of non-energy benefits arising from the retrofit programme, and was quoted widely in the ensuing Welsh Government report on the co-benefits of decarbonisation*[42] *which included health, social equity and local environmental benefits.* The Arbed 3 report is more limited but still includes reporting on job creation. Importantly, the way in which Arbed 2 was designed (and in the wake of Arbed 1 issues) meant that there were very few applications to apply solid wall insulation to traditional buildings - probably the highest risk of all retrofit measures.

[40]https://passivehouseplus.ie/news/health/disastrous-preston-retrofit-scheme-remains-unresolved
[41]Welsh Government Warm Homes Arbed EU: Ricardo 2017.
[42]The value case for decarbonising homes in Wales - Literature Review - CSE 2020.

4 MANAGING THE IMPACT OF RETROFIT MEASURES

Jersey already has in place the Supplementary Planning Guidance Advice Note 6 - 'Managing change in historic buildings'. This document is not focused primarily on energy efficiency measures (retrofit) but it does address them, making initial reference to the energy efficiency standards contained in the Jersey Building Bye-laws, but adding:

'It is however recognised that in the case of historic buildings it may not always be appropriate for the specified standards to be fully met. In arriving at a balance between historic building conservation and energy efficiency improvements the aim will be to improve energy efficiency where and to the extent that is practically possible.'[43]

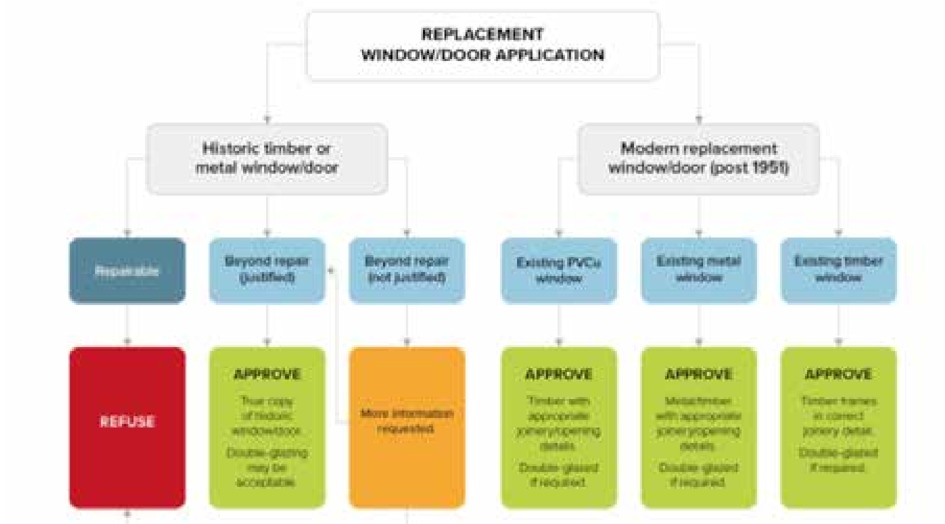
This remains the guiding principle of most conservation professionals, the requirements of the new British specifications, and Building Regulations in the UK insofar as they apply to protected buildings (as opposed to all historic buildings). Coupled with the broad aims of PAS 2035 and PAS 2038, or even a more advanced whole building approach, this provides a sound basis for developing retrofit policy for historic buildings in Jersey.

The Heritage Strategy recognises that a full appreciation of heritage is to include the natural environment and biodiversity. Historic buildings provide roosting and nesting features for bats and birds, whilst small but important populations of wall lizards inhabit the fortifications on the Island's coasts. These species and their habitat are part of the heritage value of the building and are protected by law[44]. The impact of retrofit measures on biodiversity should therefore be a key consideration when carrying out works to historic buildings. This is consistent with Policy NE1 of the Bridging Island Plan, which requires that development must protect or improve biodiversity and geodiversity and that any potential impacts must be adequately avoided, minimised or compensated for[45].

The proposed supplementary retrofit guidance, set out in Sections 4.1-4.6 which follow, all build upon existing SPGs and are consistent with both the Bridging Island Plan and the Heritage Strategy.

4.1 WINDOWS & DOORS

It has been well established already that historic windows and doors are a strong and attractive component of Jersey's built heritage.[46] The decision tree featured in the Bridging Island Plan (2022) sets out a structure which is useful where a window is to be replaced.



[43]SPG Advice Note 6 - "Managing change in historic buildings P12- States of Jersey (2008).
[44] Wildlife (Jersey) Law 2021 (jerseylaw.je)
[45] Wildlife law Level 1 Bat Guidance.pdf (gov.je)
[46]Bridging Island Plan 2022 and SPG: advice note. Protection of historic windows and doors.

However, where a window is retained, this decision tree does not address how it should be upgraded. There are several options for the thermal upgrade of existing windows, and the decision may rest upon whether or not original glazing (drawn glass, as opposed to float glass) is present. The reflections of the original glass, with inherent imperfections, impart a unique character which is now difficult to replicate. A principle of retention of original glass is already included in the Bridging Island Plan (P136-138):

'Proposals for replacement windows or glazing that result in the loss of historic glass are not, however, appropriate and will not be supported'. 'In some cases, double-glazing can be incorporated within historically authentic window joinery; where this can be achieved, it will be supported where it does not involve the loss of historic glass.'

Proposed supplementary retrofit guidance for historic buildings
PSRG1: Upgrading historic windows which are to be retained

EXISTING GLAZING	APPLICABLE MEASURES*
Original glass, single glazed**	Retain glazing and add shutters/ thermal curtains/blinds
	Retain glazing and add secondary glazing
	Retain glazing and add secondary glazing and shutters/thermal curtains/ blinds
Later single glazing or poor quality double glazing**	Replace with slim profile double glazing
	Replace with standard double glazing, if frame permits
	Replace as above and add shutters and/or thermal curtains/blinds
	Consider modern replica drawn glass on outer pane to enhance/restore heritage.

* Interactions must be considered in all cases - see Section 5.
** The advice set out in HEAG039 - Traditional Windows - Their Care, Repair and Upgrading - Historic England (2017) should be followed in all cases.

Secondary glazing has improved markedly in recent years. This delivers a substantial proportion of the energy loss reductions that can be provided by window replacement[47], but does so at greatly reduced embodied energy and embodied carbon. Modern magnetic secondary glazing systems have minimal visual impact and are easily removable for maintenance. Depending on the design of the original window, the installation can be fully reversible[48]. The existing Policy HE2 in the Bridging Island Plan only applies to buildings which are listed or in a conservation area (the latter yet to be established). It does not consider the retention of original glass and the addition of secondary glazing.

4.2 WALLS

The Bridging Island Plan does not go into the same detail regarding the retrofit of walls as it does for windows, and there is no SPG in Jersey specifically relating to walls. The vast majority of historic buildings are solid walled, so this section will focus on the applicability (or not) of solid wall insulation.

As noted in Section 2.2, the principal local building material is granite, though there were brick factories in the island for an extensive period in its history.[49] The granite has a distinctive appearance and the 'many historic granite farm complexes' in the island are referenced in the Bridging Island Plan.

Solid wall insulation can be applied either externally or internally. External wall insulation (EWI) is always preferable in terms of achieving energy savings as the masonry encased within the insulation becomes 'thermal mass' and the whole building acts as a storage heater. External elevations are often, but not always, less complex to insulate than internal walls. Internal wall insulation (IWI) is technically more difficult, as there are many thermal bridges including floor structures, window and door reveals, staircases and interior dividing walls and space is much more limited so less scope exists for adding thickness to the walls and reducing the internal floor area.

SPG 6 (15.1) states that: 'Alterations to wall surfaces are usually the most damaging that can be made

[47]Single glaze - 5.5, Double glazing 1.5-1.6, Secondary Glazing 1.6 -1.7, Triple Glazing 1.3
[48]Sash windows need a minor adjustment at the centre rail to allow the windows to continue to pass each other. Casement windows normally have no need for adjustment.
[49]Covering the period 1807 - 1941. Source - Article: The Jersey Brickmaker - John Jean (Date unknown)

to the overall appearance of a historic building. Alterations or repairs to external elevations should respect the existing fabric and match it in materials, texture, quality and colour. Brick or stonework should not normally be rendered unless the surface was rendered originally. It may be necessary to remove more recently applied render if this is damaging the surface beneath. Every effort should be made to retain or re-use facing brickwork, stonework, tile or slate hanging.'

There are significant potential issues where existing unrendered or rendered solid walls retain the characteristic uneven textures of weathered masonry. Tradespeople unused to traditional buildings, particularly if applying sheet insulation or cladding systems, can create a completely 'modern' appearance harmful to both the building and its setting.

4.2.1 INTERNAL SOLID WALL INSULATION (IWI)

As the external appearance of walls is clearly valued, an unrendered solid wall can thus only be insulated internally, if at all. However, granite is porous, so in exposed locations there is a risk of wind-driven moisture penetrating an unprotected stone wall. Determining the amount (if any) of IWI which is appropriate and the materials to be used can only be assessed on a case-by-case basis

Before retrofit takes place, any failed pointing should be repaired, with similar materials to the original construction, to reduce moisture penetration and re-establish the original external appearance. Secondly, if IWI is under consideration, walls must be able to dry out both internally and externally.

To continue to dry externally, it is important that only a limited amount of insulation is applied internally, as a modest heat gradient through the wall from inside to out during heating season helps the wall to dry. To continue to dry internally it is equally important that any insulation and subsequent internal finishes are vapour open - so they allow excessive moisture vapour to pass into the internal environment. Failing to do this risks moisture build-up, with subsequent condensation, damp and mould growth - usually at the junction between the original masonry and the new insulation. Mould spores are then transferred to the internal environment, which is damaging to human health as well as to building fabric. It is not necessary or safe to insulate with IWI to modern u-values on buildings of vapour-open construction. This is recognised in the special considerations for traditional buildings in the UK Building Regulations and set out in detail in Appendix A.

However, this is not the case in Jersey. In the Jersey Building Bye-laws, the notes to Table 4 state that 'a lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall'. There is currently no specific provision for moisture risk.

The concept of 'reasonable provision' is also used. In this case, 'Reasonable provision would be to upgrade those thermal elements[50] whose U-value is worse than the threshold value in column (a) of Table 4 to achieve the U-values given in column (b) of Table 4 provided this is technically, functionally and economically feasible. A reasonable test of economic feasibility is to achieve a simple payback of 15 years or less. Where the standard given in column (b) is not technically, functionally or economically feasible, then the thermal element should be upgraded to the best standard that is technically and functionally feasible and delivers a simple payback period of 15 years or less. Generally, this lesser standard should not be worse than 0.7 W/m2K.' Limited amounts of vapour-open hygroscopic insulation material may attain this u-value, but the risk of interstitial condensation increases if u-values are driven below this point.

Furthermore, Section 2.7 states: 'The guidance given by English Heritage should be taken into account in determining appropriate energy performance standards for building work in historic buildings. In addition English Heritage has produced detailed technical guidance on how to implement specific energy efficiency measures.' This guidance and associated references supports the application of limited vapour-open IWI. As English Heritage has now changed its name to Historic England, there is an opportunity and a need to develop guidance which is specific to Jersey and which makes clear the need for vapour open materials, and sets limits for the amount to be used.

[50]This of course relates to retained thermal elements, not those which are rebuilt.

4.2.2 EXTERNAL SOLID WALL INSULATION (EWI)

Where solid walled buildings are already rendered, buildings can often be improved thermally by the application of external insulation without significantly compromising the appearance of the building. Provision already exists within the Jersey Building Bye-laws - up to an additional wall thickness of 150mm is permitted to account for external solid wall insulation systems.[51] It is only in rare cases now that render would be removed to reinstate an original wall finish.

The addition of EWI to previously rendered walls clearly will not be possible in all cases - for example where a building abuts a pavement or other public right of way and the pavement cannot be narrowed. The detailing at gables and eaves is another issue which will need to be resolved on a case-by-case basis. The use of cappings to EWI at eaves and on gables was identified as one of the main weak points in EWI systems in early failed retrofit schemes, and it is always safer if possible to extend the roofline. PAS 2030, the British specification for Installation (which was republished in 2019 to coincide with the new PAS 2035) states that plastic or metal cappings and trims shall not be used at interfaces with roofs at eaves and verges and gables[52]. Where top floor casement windows are situated at eaves level, roof extension would interfere with the operation of the windows, and would create an obstruction to the view from inside, so EWI would not always be possible.

EWI is also not always justifiable in terms of financial payback and the embodied impacts of carrying out the work. Front elevations of some historic buildings often have a high proportion of windows and there would be little to be gained by insulating the walled sections of the elevation, given unavoidable thermal bridging at junctions with the windows and doors. Note that windows in Jersey are typically smaller than in the UK, so windows may take up a small proportion of front elevations, so the calculation must be carried out on a case-by-case basis.

Proposed supplementary retrofit guidance for historic buildings
PSRG2: Solid wall insulation

EXISTING WALL	APPLICABLE MEASURES*
Unrendered stone or brick	Repair and repoint external surface
	Where the internal wall finish has not been identified as significant, consider limited internal wall insulation with vapour open materials (ideally with moisture buffering capacity) and with vapour-open interior finishes. **
Rendered masonry	Carry out an analysis to determine the amount of energy that EWI would save, noting that elevations have varying ratios of wall/window area. Compare the saving with the embodied energy of the work to see whether the EWI is justified in energy and carbon terms.
	Remove existing failed, damaged or cementitious render, repair and allow building to dry if necessary before re-rendering.
	If technically feasible and aesthetically acceptable, apply new insulated render (or an insulation system) using appropriate materials and a finish consistent with the original rendered finish of the building (noting that later renders may have changed the appearance, including both texture and evenness).
	Design input from an appropriately qualified conservation professional will be required to resolve detailing at reveals, eaves, verges, gables and junctions with other building elements.

* Interactions must be considered in all cases - see Section 5.
** For example, 40mm of wood wool insulation (eg Steico Therm) directly adhered internally to a 225mm solid brick wall would yield a u-value of 0.70W/m2K, which meets the limiting value in the Jersey Bye-laws. With 10mm of lime-based plaster this gives a total thickness of 50mm.

[51]Planning and Building (General Development) (Jersey) Order 2011 (Consolidated 2021): Class F, Permitted development F.1, K.
[52]PAS 2030: (2019) Specification for the installation of energy efficiency measures in existing dwellings and insulation in residential park homes Table B4 - External wall insulation.

If failed render is being replaced in any case as part of a programme of repair and maintenance, then the incorporation of insulation within the re-rendering would make practical sense as it adds little to the embodied impact of doing the work.

4.3 ROOFS

Due to the complex history of the island, Jersey's historic buildings have a wide variety of roof types - in terms of form, pitch and covering. Retrofit of historic roofs is complex if insulation is to be applied at rafter level, but relatively simple if insulation is laid over suspended top floor ceilings, if present. For listed buildings, the Heritage Strategy states that removal of historic roofing materials is unacceptable in most cases.

4.3.1 INSULATION AT SUSPENDED CEILING LEVEL

Insulation is already present over most top floor flat ceilings in historic buildings as this is 'low hanging fruit' in terms of retrofit. The measure has a medium payback, it is inexpensive and not normally disruptive to install.

The decision-making process for upgrading loft insulation still further is more complex. A little insulation goes a long way - so, if 150mm of mineral wool insulation has already been installed, this will do most of the work. The current retrofit recommendation enshrined in UK Building Regulations is to achieve a u-value which would be delivered by 275mm of mineral wool. The extra 125mm of insulation will only have limited impact . In Jersey, where there is a low carbon electricity supply but insulation materials are imported, the embodied carbon of the work is likely to exceed the carbon savings achieved in occupation. Minor savings in energy use will still be achieved, so there would be a small contribution to reducing fuel poverty and improving energy security. For fossil-fuelled buildings, the carbon savings from loft insulation are more likely to exceed the embodied carbon costs, and it is possible that historic buildings have a higher proportion of fossil fuel based heating systems in place than later buildings in Jersey.

Where flat ceiling rafters are 100mm deep and 100mm or less of mineral wool insulation is present between the rafters, there will be a thermal bridge through the rafters themselves. In this case, a second layer of insulation laid across the rafters will eliminate this thermal bridge and is likely to be justifiable. Insulating a loft will reduce the temperature of that space. If moist air from the internal environment enters the loft space it can condense anywhere on the cold side of the insulation - most likely on the underside of the rafters. There is a risk that this condensation can run down and become concentrated at lower points on the rafters and cause timber decay. In historic buildings it is not normally possible to install a vapour barrier at ceiling level, so it is important to ensure that the attic space is well ventilated. Ventilation at eaves should always be maintained, or introduced if not present, so insulation should not close off this pathway.

To reduce the incidence of moist air from entering the space, the loft hatch should be insulated and draft-proofed, but there are other air pathways such as ceiling lights which may need attention.

4.3.2 INSULATION AT PITCHED RAFTER LEVEL

Where there is a room in the roof, or a room which has any of its ceiling formed by the pitched roof members (rafters), it is necessary to insulate the sloping surface to create a complete thermal envelope.[53]

Insulation can be retrofitted in three ways to pitched rafters:

- under the rafters;
- within the rafter void;
- on top of the rafters.

Where insulation is retrofitted between and below the rafters, this is known as a *cold roof* ; the structural members of the roof - the rafters - are *outside* the thermal envelope of the building. In this case it is essential to maintain an air gap above the insulation so that any moisture which condenses in this area can be ventilated out. Insulation which is fitted between the rafters from within would entail removal of the

[53]Flat ceilinged sections of a room in roof can be insulated as per Section 4.3.1.

original internal surface. If lath & plaster, this would not be an acceptable loss of historic fabric as this is often the last remaining - for example where the building has been converted into flats in the 20th century.

Insulation below rafters reduces headroom. Table 4 (Upgrading retained thermal elements) of the Jersey Bye-laws sets out the improved u-values which roofs are required to achieve when the Bye-laws are triggered (according to Section 4.8). As only limited amount of insulation can be fitted between rafters (to ensure ventilation above), a considerable thickness of insulation would be required to meet the improved u-value of 0.16W/m2K set out in Table 4. However, the notes state that 'A lesser provision may be appropriate where meeting such a standard would create limitations on head room. In such cases, the depth of the insulation plus any required air gap should be at least to the depth of the rafters, and the thermal performance of the chosen insulant should be such as to achieve the best practicable U-value.' In this case the threshold u-value is 0.35W/m2K. However when rebuilding a thermal element it should be improved to the standards set out column B of table 4, as a starting point. Where achieving the improved value is not technically feasible or economically viable, on a case by case basis. Where insulation is retrofitted above the rafters, this is known as a *warm roof*; the structural members of the roof are *inside* the thermal envelope of the building. This presents an opportunity to bring the roof structure up to the improved u-value of 0.16W/m2K. Where buildings are not protected, there are permitted development rights enabling a roof to be increased in height by 150mm. Using hydrocarbon-based insulation materials such as PUR[54], it may be possible to achieve this without planning permission. Insulation for warm roofs using other materials would require planning permission as the roof height would be increased by more than 150mm. However, PUR materials (and similar) have little heat bearing capacity, so buildings will tend to heat up and cool down quickly. Other materials (eg wood wool, hemp) may help to reduce the overheating issue as they do have some thermal capacity and even if the limiting u-value is not met they could deliver a more comfortable internal environment by evening out fluctuations in temperature.

Proposed supplementary retrofit guidance for historic buildings
PSRG3: Roof insulation

TYPE OF ROOF	APPLICABLE MEASURES* FOR RETAINED STRUCTURES
Flat suspended ceiling, with u-value greater than 0.35W/m2K	Add 275mm of mineral wool or equivalent to meet a u-value of 0.16W/m2K. Ensure adequate ventilation of the loft space and maintain existing ventilation pathways at eaves. Insulate and draughtproof the loft hatch. Where the internal wall finish has not been identified as significant, consider limited internal wall insulation with vapour open materials (ideally with moisture buffering capacity) and with vapour-open interior finishes. **
Room in roof with pitched ceiling: **Cold roof**	Insulate between rafters, leaving a minimum gap of 50mm above the insulation to allow for ventilation. Insulate below the rafters to achieve a maximum u-value of 0.35Wm2K where technically feasible for retained roofs.
Room in roof with pitched ceiling: **Warm roof**	Insulate above rafters to achieve a maximum Iu-value of 0.16W/m2K.** Design input from an appropriately qualified conservation professional will be required to resolve detailing at valleys and junctions with walls including eaves, verges and gables. Planning permission will be required for protected buildings or increases in roof height exceeding 150mm.

* Interactions must be considered in all cases - see Section 5.
** Alternative materials should be considered even if they do not deliver the limiting u-value as they could deliver better thermal comfort. Room in roof with pitched ceiling: Warm roof
Insulate above rafters to achieve a maximum u-value of 0.16W/m2K.*

[54]Unlike walls, the use of vapour open materials is not essential, but other materials could deliver better thermal comfort if they have a higher heat bearing capacity.

4 MANAGING THE IMPACT OF RETROFIT MEASURES

4.4 GROUND FLOORS

Ground floors in historic buildings are either solid or suspended. Heat loss through ground floors is sometimes overestimated, as heat tends to rise. Nonetheless, some heat is lost downwards so opportunities should be taken where they are technically feasible and do not damage heritage.

4.4.1 SOLID GROUND FLOORS

Existing solid floor finishes in historic buildings are often significant - original tiling can be simple clay tiles or more ornate (eg Minton tiles or Swanage stone in hallways).

There are three ways to insulate a solid ground floor:

- Add insulation over the existing floor structure and a new floor finish.
- Excavate the existing floor and rebuild with insulation to the original FFL
- Apply a high quality thin thermal underlay and new floor covering to the existing floor.

The first option (insulating over the existing floor structure) is very disruptive and expensive as raising the finished floor level (FFL) has implications at junctions with staircases and all doorways, and lintels may need to be raised, all with significant heritage impact.

The second option (excavation and rebuild) is also highly disruptive and expensive. In many cases the embodied energy of carrying out the work would exceed the energy saved in occupation, even in the medium-long term.

The third option (use a good thermal underlay) has several advantages. Less heat is lost downwards than upwards, so the achieving modern u-values is perhaps not so critical. The original floor surface is untouched - whether or not it is significant in its own right. The embodied energy of carrying out this work is minimal, especially compared to option 2, and the disruption is minimal.

4.4.2 SUSPENDED GROUND FLOORS

In uncovered suspended timber ground floors, much heat is lost through air leakage through butt-jointed floorboards and through gaps at junctions with walls. The late 20th century fashion for removing floor coverings and restoring original floorboards has perhaps enhanced significance but has added to heat losses.

If there is access to the subfloor space (ideally a cellar), then the space between the floor joists

Proposed supplementary retrofit guidance for historic buildings
PSRG4: Ground floors

TYPE OF GROUND FLOOR	APPLICABLE MEASURES*
Suspended ground floor **	Insulate between the floor joists with an inert vapour open material such as mineral wool. If installing from above, with original floorboards to be refitted, ensure that these are carefully lifted with minimal damage. Ensure that sub floor ventilation is adequate (ideally cross-flow) and functioning, installing more if necessary.
Solid ground floor**	Unless the ground floor is to be excavated and reconstructed for other reasons (such as the installation of underfloor heating), leave the existing surface in place and install a good quality thermal underlay before fitting a new finished floor surface. In buildings with high ceilings, insulating over the existing floor slab (and fitting a new finished floor surface) might be considered but a heritage impact assessment would be needed to determine impact on staircases, doors and door frames.

* Interactions must be considered in all cases - see Section 5.
** Radon sumps may be needed in some cases.

4 MANAGING THE IMPACT OF RETROFIT MEASURES

may be easily insulated from below, using a vapour open but inert material, such as mineral wool. As sub floor spaces are often damp, natural materials such as wood wool or hemp are not recommended here. The installation of spray foam insulation below floorboards is not recommended for several reasons. Firstly, this is a hydrocarbon (oil-based) product and alternatives are available. Secondly, adhesive systems make the flooring materials difficult or impossible to reuse or recycle at end of life. Thirdly, spray foam insulation has now been flagged up as highly risky for use in lofts, under the current Social Housing Decarbonisation Fund. If the material is not safe in lofts it is unlikely to be safe in underfloor installation either.

Where it is impossible to retrofit insulation from below, the alternative is to lift the existing floor covering, insulate between the joists, then replace the floor covering. This is not without risk to heritage where original floorboards remain in place as these have sometimes become brittle and fixings have begun to decay. Previous incursions (for example by services engineers) may also have weakened the original structure. If installing insulation from above, it is therefore important to employ an experienced carpenter who can lift the boards with minimal damage.

4.5 MICRO RENEWABLES (PV)

As energy prices rise, there is increasing pressure from the public to install localised energy generation on domestic and commercial buildings. In the vast majority of cases, the interest is in generating energy from solar PV, so this section will focus on PV, insofar as it can have an impact on historic significance. All PV installations are subject to suitability of the roof structure (unless ground-mounted), and structural engineering advice should be sought where additional weight is added on potentially undersized rafters. PV installations are also subject to wildlife assessment, and Building Regulations including fire safety.

The roof is a strong visual feature of most buildings, and appearance can be changed substantially by the addition of PV. For protected buildings, listed building consent would be needed for any proposed change to the appearance of the building, and this includes the addition of PV collectors. For historic buildings which are not protected, the same principles apply.

The extent of visual impact depends upon:

- the type of collector proposed;
- the elevation to be used for collection, and the overall layout of the roof;
- the setting of the building.

There are two main types of collectors - over the roof or integrated into the roof covering. Where a collector system is to be installed over the roof covering, the impact depends on how high the panels are to be raised above the existing roof covering, and on the colour of the panels and their fixing rails. PV collectors can also be integrated into the roof covering, so that they sit within the existing plane of the roof covering. Built-in PV (BIPV) is available either as a solar slates or as pre-fabricated modules linked together with integral weatherproofing and drainage. It is generally accepted that BIPV has less visual impact than installations over the roof covering, as it is lower, and designed to be less visually intrusive. From a distance, PV slates are hard to distinguish from natural slates - and if they cover the whole roof they become an integral rather than an intrusive element of the appearance of the roof, and of the building as whole.

The elevation used for PV may have the greatest impact of all. If the elevation faces the aspect most commonly viewed when accessing or passing the building, the impact will be greater than on rear elevations. On that basis it will be necessary to have different planning rules depending on the elevation. Traditional rural buildings face south - to maximise daylight and solar gains - but are unlikely to be appropriate for the additional of PV (south facing roofs in valleys could perhaps have panels fitted above the roof covering without significant damage to heritage). Where flat roofs exist or other later extensions, or even outbuildings, the impact on the setting can be more easily managed, subject to the materials and fixing methods outlined above.

Historic England have produced a helpful guide to installing PV systems in historic buildings.[55] The guide includes the principle of reversibility and minimising the impact of fixing methods, and useful drawn details.

[55]HEAG173 Solar Electric (Photovoltaics) - Historic England (2018).

Proposed supplementary retrofit guidance for historic buildings
PSRG5: Photovoltaic generation

ROOF ELEVATION	APPLICABLE MEASURES*
Visible from a road or the foreshore	Roof mounted panels unlikely to be acceptable. Integrated systems dependent on assessment of setting, character and impact. Refer to historic environment team.
Not visible from a road or the foreshore	Integrated BIPV slates or panels

* If the building is listed then the advice of the Historic Environment Team must be sought.

PV can also be incorporated into glass roofs and other non-standard roof coverings. The advice of the planning service and the historic environment team should always be sought when considering PV on any non-standard historic roof structure.

Historic buildings frequently have outbuildings which may have less significance of their own, but are nevertheless within the curtilage of the historic building. Consideration must therefore be given as to whether PV would damage the setting of the main building, or whether less intrusive systems such as BIPV should be used on outbuildings, especially as their roofs are often lower and thus more easily visible than the main building. Again, the advice of the conservation officer should always be sought when considering PV on outbuildings.

4.6 HEATING SYSTEMS

Air source heat pumps

In general, the choice of heating systems has limited impact on the external appearance of buildings. The main exception to this is the installation of air source heat pumps (ASHPs), which require a large and visually intrusive external unit. Such units could significantly detract from the appearance of historic buildings.[56] However, the demand for ASHPs is likely to increase sharply, given the high price of fuel and the low carbon electricity available in the island. If the existing system is electrical resistance heating, then a heat pump will always deliver a cost and carbon saving.

Heat pumps can work in historic buildings, but they work most efficiently when used in modern buildings with high levels of insulation and good air tightness. It is difficult and frequently impossible to insulate old buildings in the same way as modern buildings as there is unavoidable thermal bridging in their solid masonry construction. It may even not be advisable to try to achieve modern levels of air tightness (see next section), but in many cases with modest intervention a building can be made 'heat pump ready' - if comparing to an existing fossil fuel based boiler.

Where a historic building can be insulated sufficiently to make an ASHP economically viable it is essential that the exterior unit is located to minimise visual and noise impact. This should only be in a place which is not immediately visible, and in all cases should be disguised by a shroud (such as a latticed timber screen) which does not interrupt the free flow of air to the external unit.

Proposed supplementary retrofit guidance for historic buildings
PSRG6: Air source heat pumps - external unit

ELEVATION	APPLICABLE MEASURES
Visible from a road or the foreshore	Unlikely to be permitted
Not visible from a road or the foreshore	The advice of the conservation officer should be sought. In some cases, permitted in unlisted historic buildings, if hidden by a visual screen.

Biomass Boilers

Biomass heating may also have an impact on appearance. The fuel store will need to be larger than that used for oil, LPG or coal, and the boiler itself may require more space and often a flue relocated. For larger boilers an accumulator will also be required. The existing outbuildings can sometimes accommodate all these requirements. Jersey has limited biomass resource so it is not expected that there will be high demand for new installations, so each application for installation in a historic building could be considered on a case-by-case basis.

[56]In historic buildings the services were designed to be hidden - coal deliveries and soil stacks at the rear, for example.

4.7 AIR TIGHTNESS

More heat is sometimes lost through gaps in old buildings than through the main body of building fabric. Improving air tightness is usually the most cost-effective retrofit measure, and often overlooked as it offers little profit to the retrofit industry. However, old buildings rely on a high degree of ventilation in order to deal with moisture ingress from any faults in the building fabric. In other words, if moisture gets in, it needs to be able to evaporate back out again. Air tightness strategies for old buildings must therefore ensure that any faults are corrected first, and then take a cautious approach to sealing up any remaining gaps. The application of modern metrics for air tightness such as m3 per hour or air changes per hour (ACH) are not applicable to old buildings but rather designed for very modern airtight buildings with purpose-built ventilation systems.

There are no specific recommendations for planning and building regulations regarding air tightness in old buildings, *other than not to impose modern standards of air tightness as part of retrofit metrics.* As for all buildings, and consistent with PAS 2035 and PAS 2038, an adequate supply of fresh air is essential and the requirements of the Building Bye-laws must be met.[57]

[57]Note that Approved Document F (Ventilation) has recently been updated in England & Wales but this has not yet been transferred across to the Jersey Building Bye-laws.

5 RISK MANAGEMENT, DECISION-MAKING

5.1 TYPES OF RISK

There are three principal risk categories when looking at the retrofit of historic buildings:

- Risks to building fabric and human health;
- Risks to heritage/community;
- Risks to achieving expected energy savings/ environmental impact.

Any single retrofit measure could give rise to one or all of these risks, so it is important to understand what they are in detail, and how to manage these risks.

a) Risks to building fabric and human health arise primarily from moisture, both as a liquid and a vapour, becoming trapped and possibly accumulating within building fabric as a result of changing either fabric or ventilation conditions. For instance, where there is rising damp in a wall, the application of vapour closed materials could result in moisture related problems (e.g. timber decay, mould growth). Reduced natural ventilation after retrofit coupled with trapped moisture can also lead to condensation, mould and poor indoor air quality, which is a major cause of ill-health.

b) Risks to heritage/community include temporary or permanent loss of external details that are linked to the particular character of the building e.g. high quality and/or vernacular masonry, decorative masonry details, string courses, window and door sills and lintels, replacement of doors and windows. Proposed alterations may also not be consistent with the overall streetscape.

c) Risks to achieving expected energy savings/ environmental impact arise due to incorrect assumptions about the effect of insulation on u-values, and a lack of understanding of the effects of thermal bridging. Retrofit measures can also lead to an increase energy use and carbon emissions due to their embodied impact. The rebound effect also results in lower than anticipated energy savings.

5.2 INTERACTIONS BETWEEN MEASURES

There are complex inter-relationships between the different ‘thermal elements’ of a building (walls, floors, roof, windows, doors), the space heating and ventilation systems, the use of the building and its context. If alterations are made to one element then there may be knock-on effects with other elements. Two examples illustrate this phenomenon.

a) Interactions between adjacent fabric elements, and between fabric and services:

When introducing better-performing windows:

- adjacent walls will become cooler in relation to the windows, so without good ventilation the risk of condensation on the reveals is increased.
- space heating demand is reduced, so the heat distribution system will need adjustment;
- air leakage will be reduced, so additional ventilation may be required;

b) Interactions between non-adjacent fabric areas:

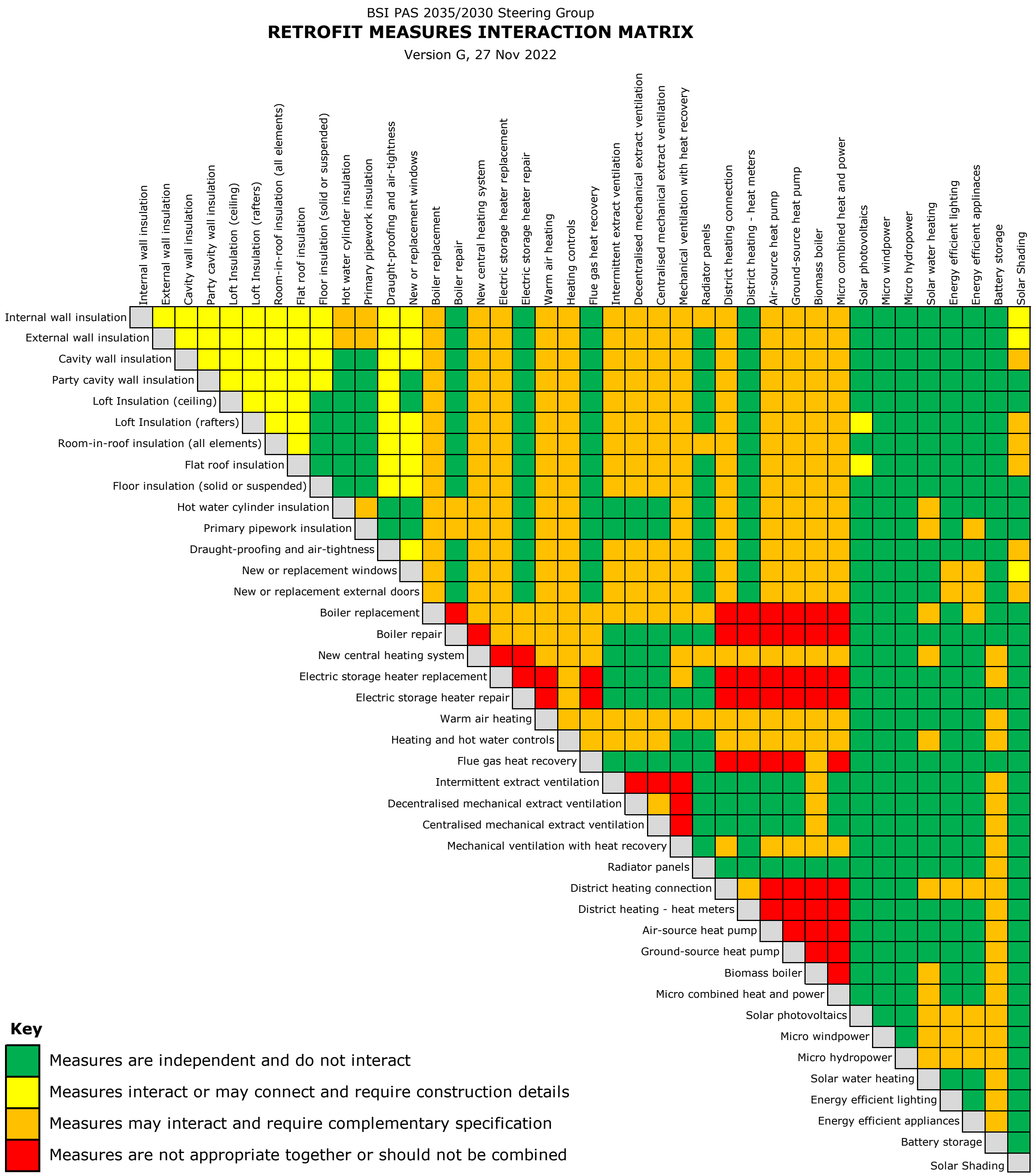
Some historic buildings have one or more elevations with greater heritage value. Consider a mid-terraced house with the original masonry visible on the front elevation but the rear already compromised. The rear elevation may be considered suitable for EWI but not the front. However, it is still necessary to do something to the front elevation:

If the rear walls have become thermally more efficient, and other thermal elements such as windows, floors and roof have been upgraded to some degree, the front wall has become relatively cooler. This has the effect that the front wall is now the coldest spot and it is more likely that condensation will occur on this wall then before the rest of the property was addressed.

At the same time, natural air leakage will have been reduced, which itself reduces the ability of the building to deal with its moisture load.

5 RISK MANAGEMENT, DECISION-MAKING

PAS 2035 Interactions Matrix



In order to address this risk, internal insulation (IWI) is usually added to the front elevation to prevent any condensation, (and returned along internal abutting walls to prevent thermal bridging). As explained in Section 4.2.1, such IWI must be vapour-open, and only seek to achieve u-values of around 0.70W/m2K as it is essential that some heat still flows into this masonry to help with drying. This is known as a 'hybrid' approach to solid wall insulation.
As should be clear from these examples, it is essential to use a Whole Building Approach as part of a joined-up process of survey, options appraisal, design, procurement, installation and monitoring.

PAS 2035 - the new British specification for domestic retrofit contains an matrix which highlights the interactions between thermal elements and services. Interactions are also flagged up graphically in the STBA Guidance Wheel[58]. Once any particular retrofit measure is selected, the tool provides linkages to other aspects of building fabric and services which must be considered at the same time, together with an explanation of why this must be done, in each case, and links to peer-reviewed research providing detailed background justification.

All these potential interactions require management. The whole building approach, if used correctly, should address these, but for clarity the interactions and the recommended mitigations are set out in Planning Responsible Retrofit of Traditional Buildings.[59]

5.3 VENTILATION AND MOISTURE MANAGEMENT

Good ventilation and moisture management are required in all buildings, not just historic buildings. The increased risk in historic buildings arises from the presence of permeable fabric which readily accepts and subsequently evaporates moisture, and from retrofit with modern materials which could interrupt this process as well as decreasing natural air infiltration.

5.3.1 VENTILATION

As noted earlier, ventilation is not only essential for the provision of fresh air to occupants, but also essential to enable historic buildings to stay dry, where fabric readily accepts moisture ingress. Building health and human health both depend on the provision of adequate ventilation.

Regulations on the provision of fresh air are rarely enforced. This is especially true in retrofit - which has usually proceeded without the benefit of the full design team which would be normally in place for new construction. Retrofit inevitably reduces air infiltration as thermal elements are covered over and new seals are applied at junctions between these elements (eg windows and walls).
In 2021, a new Approved Document F (in UK) was introduced. This specifically addresses the impact of energy efficiency works (retrofit). Volume 1 covers dwellings and Volume 3 covers non-domestic buildings.

'3.6: Many existing dwellings are ventilated through infiltration rather than purposeful ventilation. Energy efficiency measures carried out on existing dwellings might reduce infiltration and cause the dwelling to become under-ventilated. Building work should not reduce the ventilation provision of the dwelling unless it can be demonstrated that the ventilation provision after the work is carried out meets the minimum standards of requirement F1(1).

3.7 When carrying out energy efficiency measures to an existing dwelling, an assessment should determine what, if any, additional ventilation provision is needed, based on the estimated impact of the work. The assessment should be carried out by one of the following means.

- Applying the simplified method in paragraphs 3.8 to 3.13.
- Seeking expert advice, which may include carrying out an air permeability test that follows the procedures given in Approved Document L, Volume 1: Dwellings.'[60]

[58]https://responsible-retrofit.org/greenwheel/
[59]Planning Responsible Retrofit of Traditional Buildings - STBA (2015).
[60]Also note that the Approved Document notes that: 'Following BSI PAS 2035 is considered to be an adequate means of demonstrating compliance with paragraph 3.6.'

The 'simplified method' (described in ADF Vol 1) Table 3.1 'Energy efficiency measures' is adequate for use in historic buildings in Jersey. The method should include 'Energy efficiency measures fitted since the original dwelling was constructed, to consider accumulation of measures'. On that basis, assuming that the building was adequately ventilated when constructed, changes such as blocking up or removing air bricks ought to be identified and, if necessary, such background ventilation should be reinstated. This could be important as the over-arching requirement is that the ventilation of the dwelling when 'doing energy efficiency work' should either

- meet the standards in the relevant approved document . . (OR)
- not be less satisfactory than before the work was carried out.

If the ventilation was unsatisfactory before the work was carried out then there appears to be no requirement to upgrade it. This anomaly could be corrected when the new Part F is introduced in Jersey.

5.3.2 MOISTURE MANAGEMENT

The BSI White Paper on moisture in buildings[61] introduced the four principles of moisture management, also known as the four Cs:

- Compatibility with the context - location, built form, materials, condition, use;
- Coherence - moisture and thermal, air tightness, weathering, services;
- Capacity - in design and process;
- Caution - usability, maintenance, monitoring and feedback.

These four Cs particularly apply to retrofit of traditional buildings, where uncertainty exists as to the nature and performance of materials and the condition of the existing building fabric.

The most technically robust approach to managing moisture risk in buildings has been developed by the UK Centre for Moisture in Buildings (UKCMB). Among their tools are the Moisture Balance Calculator and Moisture Guidance (video) for existing homeowners.

Following work by the UKCMB, specific guidance has been developed for management of moisture in historic buildings. This is summarised in the paper: 'Retrofitting traditional buildings: a risk-management framework integrating energy and moisture.'[62] This presents an integrated process to support designers in the retrofit of traditional buildings. The paper also points to the need for a whole-building approach, effectively now as delivered by PAS 2035 and PAS 2038:

'There is evidence that retrofit interventions in the UK are rarely evaluated on a whole-building and medium-term basis and that proper design is frequently absent entirely' (Hansford 2015: 21), leading to damp, mould and poor building performance to name a few.'

It is therefore essential that wherever the retrofit of traditional buildings is under consideration, a moisture risk assessment is carried out, based on the four Cs and using the process set out in the risk management framework set out in the article quoted above. This should form part of the design process as mandated by PAS 2035 and PAS 2035.

[61]Moisture in Buildings: An Integrated Approach to Risk Assessment and Guidance - May & Sanders (2017).
[62]Gori, V., Marincioni, V., & Altamirano-Medina, H. (2021). Retrofitting traditional buildings: a risk-management framework integrating energy and moisture. Buildings and Cities, 2(1), pp. 411–424.

6 STRUCTURAL CONSIDERATIONS

6.1 PLANNING

For listed buildings, the Heritage Environment Team are consulted by Development Control Officers when any proposals for change are submitted.

For unlisted historic buildings (i.e. all buildings of traditional construction), draft Supplementary Retrofit Planning Guidance is developed and drafted in Section 4 of this Advice Note. This could form the basis of a new formal planning document which, once fully reviewed and agreed by key stakeholders, could be formally adopted.

Summary of draft Supplementary Retrofit Planning Guidance

For ease of reading, the full guidelines are not reproduced below - it is essential to refer to the full guidelines set out in Section 4, which also contain exceptions.

THERMAL ELEMENT*	EXISTING DETAIL	APPLICABLE MEASURES**
Windows	Original frame, original glazing	Retain glazing and add secondary glazing and shutters/thermal curtains/blinds.
	Original frame, replacement single or early double	Replace with slim profile double glazing, or standard if frame permits.
Doors	Original door, original glazing	Retain glazing and add secondary glazing and thermal curtain.
	Replacement door	Replacement door to original pattern with double glazing.
Walls	Unrendered stone or brick	Consider limited internal wall insulation with vapour open materials including finishes.
	Rendered masonry	If technically feasible and aesthetically acceptable, apply new insulated render or an insulation system.

*Recommendations for roof insulation and ground floor insulation set out in Section 4.3 and 4.4 are not repeated here as they do not give rise to a material planning concern.

For unlisted buildings, 150mm of additional height is covered under permitted development rights. However, if alternative and possibly better-performing insulation materials are used at this thickness, there is a potential implication for Building Bye-laws (see Section 6.2). There is no such exemption for listed buildings, although minor changes (subject to Planning Permission) are sometimes granted.

INSTALLATION	ASPECT	ACCEPTABLE APPROACH**
Photo-voltaic collectors	Visible from a road or the foreshore	Unlikely to be acceptable. Dependent on assessment of setting, character and impact. Refer to historic environment team.
	Not visible from a road or the foreshore	Integrated BIPV slates or panels.
ASHP exterior unit	Rear elevation	Permitted in unlisted historic buildings, if hidden by a visual screen.
	Side elevation	The advice of the conservation officer should be sought.

**Design input from an appropriately qualified conservation professional will be required to resolve detailing in all cases.

Historic buildings in conservation areas

With the forthcoming introduction of conservation areas in Jersey, the guidelines listed above should be sufficient to ensure that an appropriate balance is achieved between heritage, health and energy efficiency - even in these nominally higher status buildings.

Historic buildings not in conservation areas

It would be important to recognise that historic buildings not in conservation areas will still have heritage significance. There is a danger (already evident in the UK) that buildings outside conservation areas are treated as 'fair game' for deep retrofit despite this fact and inappropriate

6 STRUCTURAL CONSIDERATIONS

measures (in terms of technical performance and heritage value) are often specified. When introducing Supplementary Retrofit Planning Guidance it would therefore be necessary to clarify that these guidelines should apply to all historic buildings, regardless of conservation areas status.

6.2 BUILDING BYE-LAWS

The Building Bye-laws in Jersey tend to follow the Building Regulations in England and Wales. There are some recent changes to the Regulations which may not be optimal for Jersey, so minor adjustments would render them more robust when introduced, particularly for historic buildings.

It should be noted that regarding the treatment of buildings of solid wall construction (i.e. historic buildings) there already exists a discrepancy between the English and Welsh Regulations. This is set out in more detail in Appendix 1 as it presents an opportunity for Jersey to implement an improved system.

Summary of issues to consider in any forthcoming updates to Building Bye-laws

SUBJECT	RECOMMENDATIONS FOR AMENDMENTS TO BYE-LAWS
Special considerations	For buildings of traditional construction, follow the approach retained in Wales (not England) where the work should not prejudice the character and appearance of the host building.
Wall insulation	Introduce a requirement for vapour open materials to be used in internal wall insulation. Consider relaxing the limiting u-value in certain circumstances.
Roof insulation	Consider relaxing the limiting u-value to enable the use of materials with higher heat buffering capacity.
Suspended ground floors	Consider introducing guidance to ensure that appropriate material are used to insulate the suspended floor structure.
Moisture risk	Consider the use of an integrated moisture and energy risk management framework before retrofit designs are approved.
Ventilation	New ADF Section 3.2: Clarify that both (a) and (b) are required (not 'either') when addressing ventilation in retrofitted buildings.

6.3 STANDARDS & CERTIFICATION

It is already clear from the Bridging Island Plan that a whole building approach is to be used for all retrofit. The adoption of the principles and substantial process of PAS 2035 and PAS 2038 would ensure that this is delivered. However, the new processes may be suited to a more developed retrofit market than currently exists in Jersey. Further work would be required to determine whether a simplified version could be used, based on a well trained and qualified workforce of assessors, designers, project managers and builders.

A whole building approach would also require a consistent system of standards and certification. The information collected and metrics used in whole house certification would of course be broader than that used for EPCs[63]. As heritage significance would be included as one element of a whole house assessment, this will provide a basis for ensuring that retrofit is optimised for historic buildings.

A whole building assessment will cost more than a simple EPC, but not prohibitively as the process (survey, report, lodgement) is no different - but it requires consideration and inclusion of some further information covering condition, water use, ventilation, heritage significance and any other categories selected by the Government of Jersey. A cost-benefit analysis may be required to find the balance between affordability and effectiveness.

Summary of possible approach to introducing standards & certification in Jersey

	SUGGESTED APPROACH
Standards / Specifications	Review PAS 2035 and PAS 2038 to determine which aspects of the process can feasibly be adopted in Jersey, given the limited size of the market. Consider adopting the aims of both documents at an early stage.
Certification	Develop a whole building certification process which is appropriate for Jersey, minimally consistent with PAS 2035 and PAS 2038 and which may align with BREEAM or an equivalent system of sustainability assessment. Train assessors to carry out this work.

[63]EPCs are not currently used as a policy lever in Jersey, although Policy HT3 of the Carbon Neutral Roadmap states that minimum EPC standards are to be introduced from 2026. However, EPCs are not consistent with the whole building approach to retrofit which is to be used for retrofit in Jersey, so there is an opportunity to take a lead in this area by moving directly to the more advanced approach.

6.4 SKILLS AND CAPACITY

A recent study has been carried out on behalf of Highlands College entitled 'On-island training - Retrofitting of pre-1919 traditional buildings'.[64] This section of the Advisory Note draws upon this study, and is consistent with its conclusions.

6.4.1 ASSESSMENT

High quality retrofit design relies on the provision of accurate information about historic buildings, so it is essential that assessors are trained and appropriately qualified. Assessment should include an assessment of condition, so assessors must be fully aware of the pathology of historic buildings in order to spot defects which must be repaired prior to retrofit. An assessment of significance is also required prior to the appraisal of options for improvement.[65]

It is notable that one of the key recommendations of one previous study on retrofit in Jersey[66] was the provision of better information about the building stock, prior to the development of a more detailed strategy.

All assessors of historic buildings should therefore have attained the Level 3 Award 'Energy Efficiency Measures for Older and Traditional Buildings'[67] - and this was the clear recommendation of the Highlands College report. This qualification covers building pathology in some depth, so the quality of assessment on condition issues as well as significance assessment would both be improved. As the Highlands report suggests, it may be necessary to make minor adjustments to the course so that it is 'contextualised' for Jersey.

6.4.2 DESIGN

Retrofit most commonly goes wrong at the design stage. Frequently in small-scale retrofit, design is effectively carried out by contractors, or by suppliers of materials who provide installation guidance for their products. In such cases it is unlikely that a whole building approach would be used, and considerations such as interactions, thermal bridging between different elements, and ventilation, are all likely to be ignored. Even when an architect is employed, they may not have sufficient understanding of retrofit, or of historic buildings, to ensure that the optimal approach is designed, specified and followed through.

The key process is the assessment of options for retrofit (referred to in PAS 2035 and 2038 as an options appraisal). This needs to include not only the designer but also the building owner and the project manager - though in small scale domestic retrofit one person may perform more than one of these roles.

For this reason, the designer should also have completed the Level 3 Award.[68] In PAS 2035 and PAS 2038 there are additional requirements for designers to hold an appropriate qualification in older buildings, but at present it is unclear what these qualifications are[69] and this would require clarification if adopted in Jersey.

6.4.3 PROJECT MANAGEMENT

For single domestic retrofit in the owner-occupied sector, the project manager is often the householder or the contractor. In social housing, or in retrofit of multiple domestic properties as part of a portfolio upgrade, a project manager is likely to be employed. Contractors are not likely to be familiar with the whole building approach and assessment of significance, so training and awareness raising will be required for small contractors who would not otherwise gain qualifications.

Where a project manager (known as a 'Retrofit Coordinator in PAS 2035) is employed, it is again essential that this person is familiar with the processes set out in PAS 2035 and PAS 2038 and, for historic building retrofit, has attained the Level 3 Award.[70]

[64]On-island training - Retrofitting of pre-1919 traditional buildings - Bechelet (2022).
[65]Bridging Island Plan (2022) - see section on Heritage.
[66]Developing an approach to domestic energy efficiency retrofit in Jersey - Griffiths et al (2015).
[67]SQA Level 3 Award in 'Energy Efficiency Measures for Older and Traditional Buildings' (SQA, 2022).
[68]op cit.
[69]PAS 2035 (2019) Appendix A.
[70]op cit.

6.4.4 INSTALLATION

There is already a reasonable skills base in Jersey for the repair and maintenance of historic buildings. According to the Construction Council[71], there is a mature market for trades experienced in the use of lime mortar and lime plasters, the manufacture of timber joinery to original patterns, and associated trades including roofing.

It is less clear that this market is mature for retrofit measures. The British specification for retrofit installation is PAS 2030 - and a requirement could be introduced for contractors to have work in accordance with this specification and gain associated Trustmark accreditation. The Highlands College report instead recommends that contractors working on historic buildings should have achieved the Level 3 Award in Energy Efficiency Measures for Older and Traditional Buildings. Their report notes that, instead, 'their specialisms can always be topped-up by relevant CPD courses as new technologies emerge and supplementary training in traditional skills.' This is most likely to become relevant in the market for solid wall insulation, as other retrofit measures are already available in the island, though all trades will have to increase in capacity, so training courses will need to expand over time.

6.4.5 MATERIALS SUPPLY CHAIN

The supply chain for appropriate retrofit materials for historic buildings is currently weak - this is a UK wide problem and not specific to Jersey, but likely to be exacerbated in an island community. In particular, the supply chain for ventilation equipment, and a range of vapour-open insulation materials will both need to be improved if the requirements of a whole building approach are to be met with adequate competition in the market. In addition, as fossil-fuel based heating systems are phased out and as electrical resistance heating has become prohibitively expensive, the demand for heat pumps is likely to increase significantly.

Supply will always respond to demand, so it is not necessary to take steps to encourage this supply chain until it is clear that the market for whole building retrofit is beginning to expand, but early discussions should be held with materials suppliers to ensure that they are aware of the direction of policy in the Island and prepared for an increase in demand when it occurs.

6.4.6 CONCLUSION ON SKILLS AND CAPACITY

The conclusion of the Highlands College report and this Advisory Note is that a local version of the SQA Level 3 qualification in 'Energy Efficiency Measures for Older and Traditional Buildings' needs to be made available in Jersey.

The key components of the course (units) are as follows for 'older and traditional buildings':

- Age, nature and characteristics;
- Assessing options for the introduction of energy efficiency measures;
- Making recommendations and giving advice on the introduction of energy efficiency measures.

Assessors, Designers and Project Managers should be required to attain this qualification and contractors should be encouraged to undertake the course wherever feasible. Expansion of capacity in all retrofit trades will be required, so the associated labour and training requirements should be reviewed once the direction of strategy is clear, and before demand for retrofit begins to increase significantly.

[71]Interview with Ian Marrett and Ian Wilson 18/10/22.

APPENDIX A: BUILDING REGULATIONS IN ENGLAND AND WALES ON ENERGY EFFICIENCY IN TRADITIONAL BUILDINGS

Until 2021, the Building Regulations in England and Wales were substantially the same in terms of how buildings of traditional construction were treated. In essence, traditional buildings were subject to 'special considerations' and did not have to comply with the u-value requirements of Part L1B and Part L2B (existing domestic and non-domestic buildings respectively) if the proposed measures would unacceptably alter their appearance.

This has now changed in England, but not in Wales. The English Regulations now retain these 'special considerations'. Bold and italics have been added below to assist the reader.

1) Previous edition (domestic only quoted for ease of reference)

Part L1B (2010 edition incorporating 2013 and 2016 amendments) - existing dwellings - 3.8-3.10 stated:

3.8 There are three further classes of buildings where special considerations in making reasonable provision for the conservation of fuel or power may apply:

- buildings which are of architectural and historical interest and which are referred to as a material consideration in a local authority's development plan or local development framework;
- buildings which are of architectural and historical interest within national parks, areas of outstanding natural beauty, registered historic parks and gardens, registered battlefields, the curtilages of scheduled ancient monuments, and world heritage sites;
- buildings of traditional construction with permeable fabric that both absorbs and readily allows the evaporation of moisture.

3.9 When undertaking work on or in connection with a building that falls within one of the classes listed above, the aim should be to *improve energy efficiency as far as is* ***reasonably practicable****. The work should not prejudice the* ***character*** *of the host building or increase the risk of long-term* ***deterioration*** *of the building fabric or fittings.*

3.10 The guidance given by English Heritage[72] should be taken into account in determining appropriate energy performance standards for building work in historic buildings.

2) New edition Part L1B 2021 in England (but not in Wales)

Exemptions for listed buildings, buildings in conservation areas and scheduled monuments

0.8 Work to the following types of dwellings does not need to comply fully with the energy efficiency requirements where to do so would unacceptably alter the dwelling's character or appearance.

- Those listed in accordance with section 1 of the Planning (*Listed Buildings and Conservation Areas*) Act 1990.
- Those in a *conservation area* designated in accordance with section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990.
- Those included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979.

0.9 Work to a dwelling in paragraph 0.8 must comply with the energy efficiency requirements where this would not *unacceptably alter the dwelling's character or appearance.* The work should comply with standards in this approved document to the extent that it is reasonably practicable.'

'Historic and traditional dwellings

0.10 The energy efficiency of historic and traditional dwellings should be improved only if doing so will not cause long-term deterioration of the building's fabric or fittings. In particular, this applies to historic and traditional buildings with a vapour permeable construction that both absorbs moisture and readily

[72]Energy Efficiency and Historic Buildings, English Heritage, 2011 http://www.english-heritage.org.uk/publications/energy-efficiency- historic-buildings-ptl/.

allows moisture to evaporate. Examples include those built with wattle and daub, cob or stone and constructions using lime render or mortar.

0.11 New extensions to historic and traditional dwellings should comply fully with the energy efficiency standards in this approved document unless there is a need to match the external appearance or character of the extension to that of the host building. The work should comply with standards in this approved document to the extent that it is reasonably practicable.

0.12 In determining whether full energy efficiency improvements should be made, the building control body should consider the advice of the local authority's conservation officer.

0.13 Additional guidance is available in Historic England's Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings.'

Key changes in the 2021 edition

0.8 covers character and appearance - but only applies to listed buildings or those in conservation areas, **no longer to traditional buildings** more generally.

0.10 effectively retains the special considerations for **moisture risk** (only) for traditional buildings. For example, for IWI only use a limited amount and ensure vapour-open materials - in line with best practice (see References)

0.12 It is important to note that in the new edition, the Conservation Officer is invited to advise on whether measures should be implemented 'in full'. For example, a conservation officer is unlikely advise EWI on a significant elevation.

0.13 The HE guidance quoted would support a more cautious approach in any case but refers to the previous edition of the Regulations.

APPENDIX B: HERITAGE VALUES (FROM BS7913)

The significance of a historic building can be considered as comprising individual heritage values from a list that might include:

- Architectural, technological or built fabric value;
- Townscape characteristics;
- Spatial characteristics;
- Archaeological value;
- Artistic value;
- Economic value;
- Educational value;
- Recreational value;
- Social or communal value;
- Cultural value;
- Religious value;
- Spiritual value;
- Ecological value;
- Environmental value;
- Commemorative value;
- Inspirational value;
- Identity or belonging;
- National pride;
- Symbolic or iconic value;;
- Associational value;
- Panoramic value;
- Scenic value;
- Aesthetic value;
- Material value;
- Technological value

APPENDIX C: RESOURCES

The resources listed below are free to access.

Sustainable Traditional Buildings Alliance (STBA)

- Guidance Wheel - online tool (2014)
- Moisture risk assessment and guidance (2014)
- What is Whole House Retrofit (2015)
- Planning Responsible Retrofit of traditional buildings (2016)
- Bristolians' Guide to Solid Wall insulation (2017)
- EPC and the Whole House Approach (2019)
- Performance & energy efficiency of Traditional Buildings - Gap Analysis update (2020)
- From Retrofit to Regeneration (2021)

Society for the Protection of Ancient Buildings (SPAB)

- Energy Efficiency in Old Buildings (2014)
- Moisture monitoring research (available as separate reports)

Historic England (HE)

- Energy Efficiency and Historic Buildings (2018)
- A series of papers on specific building elements including:
  - HEAG039 Traditional Windows
  - HEAG071 Insulating Timber Framed Walls
  - HEAG078 Flat Roofs
  - HEAG081 Solid Walls
  - HEAG173 Photovoltaics
  - HEAG295 Energy Efficiency and Traditional Homes

Historic Environment Scotland (HES)

- Guide to the energy retrofit of traditional buildings (2021)
- Technical papers - 38 at present including:
  - 1 Thermal Performance of Traditional Windows
  - 2 In situ U-value Measurements in Traditional Buildings
  - 6 Indoor Air Quality and Energy Efficiency in Traditional Buildings
  - 9 Slim-profile double glazing
  - 10 U-values and Traditional Buildings
  - 12 Indoor Environmental Quality in Refurbishment
  - 13 Embodied energy considerations
  - 15 Assessing risks in insulation

Sustainable Energy Authority of Ireland

- Deep energy renovation of traditional buildings (2018)

Department for Business, Energy and Industrial Strategy (BEIS - UK Govt)

- Retrofit internal wall insulation: Guide to best practice (2021)
- Thin Internal Wall Insulation (2021)

Low Energy Transformation Initiative (LETI)

- The LETI Climate emergency retrofit guide (2021)

The publications listed below are not free to access:

British Standards Institute (BSI)

- BS 7913 Guide to the conservation of historic buildings (2013)
- BS EN 16883 Conservation of cultural heritage: Guidelines for improving the energy performance of historic buildings (2017)
- Moisture in buildings: An integrated approach to risk assessment & guidance (2017)
- PAS 2035 - Specification and Guidance for Energy Retrofit of Dwellings (2019)
- PAS 2038 - Retrofitting non-domestic buildings for improved energy efficiency - Specification (2021)
- BS 5250:2021 Management of moisture in buildings: Code of practice (2021)

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