# Addendum: Potential Viability Implications of Different Policy Options

Climate Change Adaptation & Mitigation Study

Staffordshire County Council

Project number: 60625972

11th September 2020

## Quality information

| Prepared by | Checked by | Verified by | Approved by |
|---|---|---|---|
| Harper Robertson<br>Senior Consultant | Philip Exton<br>Principal Consultant | Luke Aldred<br>Associate Director | Luke Aldred<br>Associate Director |

## Revision History

| Revision | Revision date | Details | Authorized | Name | Position |
|---|---|---|---|---|---|
| 01 | 17th July 2020 | Draft | Y | Luke Aldred | Associate Director |
| 02 | 11th September 2020 | Final | Y | Luke Aldred | Associate Director |
| | | | | | |
| | | | | | |

## Distribution List

| # Hard Copies | PDF Required | Association / Company Name |
|---|---|---|
| n/a | Yes | |
| | | |
| | | |
| | | |

## Prepared for:

Staffordshire County Council

## Prepared by:

AECOM Infrastructure & Environment UK Limited
Aldgate Tower
2 Leman Street
London E1 8FA
United Kingdom
aecom.com

# 1. Introduction

The purpose of this note is to provide additional context regarding the potential viability implications of key policy recommendations presented in the final *'Staffordshire Climate Change Mitigation & Adaptation Study'* (version issued 11th September 2020). This is intended to help inform internal stakeholder discussions about the range of options described. **Note that any policy options that are taken forward for inclusion in local policy will require a separate, detailed viability assessment which is outside the scope of this study.**

# 2. Summary of Policy Options

Below, each policy option is presented along with the following information:

- **Section Reference** – This refers to paragraph numbers in the draft Final Report.
- **A qualitative 'Scale of Ambition' rating** – This is intended to provide a rough, qualitative indication of the relative level of impact and ease of implementation of each policy. *Note that these ratings are subjective, based on the views of our experienced team members, and are intended only as a starting point to inform further discussion.*
- **Potential cost impacts for developers and occupants** – Based on a simple up/down arrow system that draws from evidence in Section 3.
- **Key implications for Local Authorities** regarding implementation / enforcement.
- **Comments** to briefly elaborate on any ratings or inputs.

**LEGEND:**

| "Potential Cost Implications" | |
|---|---|
| ↑ | Costs tend to increase |
| ↓ | Costs tend to decrease |
| ↕ | Costs may increase or decrease |
| - | No impact / minimal impact on cost |
| n/a | Not applicable |

| "Scale of Ambition" | |
|---|---|
| 1 | Lower ambition - Options that are relatively easier to implement and could be adopted as standard, based on UK precedent |
| 2 | Medium ambition - Options that may increase costs to developers or require additional Local Authority resources to set up, enforce or administer, but offer greater benefits |
| 3 | High ambition - Options that may be more challenging to implement but offer the greatest benefits and represent best practice measures |

| | | | Implications for… Developers and Occupants | | | | Implications for… Local Authorities | | |
|---|---|---|---|---|---|---|---|---|---|
| Report Section | Policy Option | Scale of ambition | Build costs | Planning costs | Property value | Energy bills | Additional resources required? | Enforcement / monitoring | Comments |
| **Reducing $CO_2$ Emissions in the Built Environment** | | | | | | | | | |
| **3.1.3.1** | **Introduce $CO_2$ Emissions Standards that go Beyond UK Building Regulations** | | Various options - see below | | | | - | - | Note that, in future, Local Authorities may be limited in their ability to set targets that go beyond Building Regulations. Most of these options could be monitored/enforced by setting credit requirements in BREEAM or HQM or a similar third-party assessment scheme. |
| | 19% Improvement on Part L 2013 *Note: This may be superseded by future changes to Building Regulations.* | 1 | ↑ | - | ↑ | ↓ | Requires expert reviewer. | Monitor via Building Regulations compliance report. | The viability of this policy is supported by the viability assessments presented in the Future Homes Standard consultation. Various Local Authorities have adopted requirements for developments to achieve 10-20% improvements; see, for example, Stockton-on-Tees, Milton Keynes, Adur, Guildford, Plymouth, South West Devon. **Note: May be superseded by future Building Regulations.** |
| | Net Zero Regulated Emissions [in conjunction with carbon offset fund] | 2 | ↑ | - | ↑ | ↓ | Requires expert reviewer. | As above. Could also set credit requirements in BREEAM or HQM. | This policy would likely include a target for on-site carbon savings plus establishment of a carbon offset fund (see below). |
| | Net Zero Regulated and Unregulated Emissions [in conjunction with carbon offset fund] | 3 | ↑ | ↑ | ↑ | ↓ | Requires expert reviewer. | As above plus expert review of unregulated emissions estimates e.g. TM54 modelling. | This would require developers to estimate the unregulated emissions associated with proposals and adopt design measures aimed at reducing these emissions. This is inherently difficult because unregulated emissions (e.g. use of electronic appliances) are largely outside of the designer's control. Furthermore, there is currently no mechanism for Local Authorities to enforce such a policy. However, it could still be encouraged as a best practice measure. |
| | Require Developers to Monitor and Report on Operational Energy Use and/or $CO_2$ Emissions | 3 | - | ↑ | - | - | Requires expert reviewer. | Review of energy monitoring reports. | Smart meters are becoming standard and therefore are assumed to have no impact on build cost; however, there would be some cost to developers to produce monitoring reports and for Local Authorities to review them. Local Authorities would benefit from real data to assess policy effectiveness. |
| | Require Developers to Undertake Lifecycle Carbon Assessments (LCA) | 2 | ↕ | ↑ | - | - | Requires expert reviewer. | Monitor via review of LCA. Could also set credit requirements in BREEAM or HQM. | As described in the Final Report, embodied carbon can represent 30-70% of the total lifecycle carbon emissions for a given building. There will be some cost to developers to commission the assessment; however, if embodied carbon is considered from the outset there can be minimal or no uplift in build cost. |
| | Establish a Carbon Offsetting Fund [in conjunction with one or more of the above options] | 2 | n/a | n/a | n/a | n/a | Administration of Carbon Offset Fund. | n/a | Some cost to Local Authorities to set up and administer the scheme. Carbon price to be set based on individual viability assessment. Potential to generate significant funds towards projects such as energy efficiency retrofitting, LZC deployment and woodland creation. |
| **3.1.3.2** | **Set a Minimum Target for Fabric and Energy Efficiency Performance** | | Various options - see below | | | | - | - | - |
| | Meet Building Regulations Through Energy Efficiency Measures Alone | 1 | ↑ | - | - | - | - | Review Building Regulations compliance report. | The viability of this policy is supported by the viability assessments associated with Building Regulations Part L (2013). The targets set in Part L are devised in a way that it is possible to deliver compliance through reasonable fabric and energy efficiency measures alone. |
| | Encourage Developers to Gain Passivhaus Certification or an Equivalent Best Practice Standard | 3 | ↑ | ↑ | ↑ | ↓ | - | Third party assessment scheme. | Several UK Local Authorities encourage the use of Passivhaus as a best practice measure in their Local Plans, including but not limited to the London Borough of Camden, Ipswich, Cambridge and Brighton & Hove. |
| **3.1.3.3** | **Introduce an 'Energy and Heat Hierarchy'** | 1 | ↕ | - | ↑ | ↕ | Requires expert reviewer. | Applicant to provide Energy Strategy, validation statement or similar. | Impact on build costs, property value and household bills will depend on the system and fuel type but choosing the most efficient, low carbon systems will offer the best outcomes. This policy would place responsibility on the developer to demonstrate that they have selected the most efficient system that is feasible. **Note: It is strongly recommended that this policy (or similar) is implemented to ensure that low carbon heating systems are installed. An alternative would be to prohibit the use of gas boilers altogether on the basis that they have significantly higher lifecycle carbon emissions and will require replacement to meet Net Zero targets.** |
| **3.1.3.4** | **Require High Standards for Water Efficiency and Conservation** | | Various options - see below | | | | - | - | Note there is a wider social benefit in reducing water use given that the risk of water shortage may increase due to climate change. |
| | All Proposals to Adopt Water Saving Measures (e.g. Smart Meters), Fittings and Appliances | 1 | - | - | - | ↓ | - | Could set credit requirements in BREEAM or HQM. | According to the Energy Saving Trust, water efficient fittings do not necessarily cost more than standard alternatives. Occupants would benefit from lower water bills. |
| | Domestic Developments to Achieve the Optional Standard of Building Regulations Part G | 1 | - | - | - | ↓ | - | Review Building Regulations compliance report. | As above. |
| | Non-Domestic Developments to Achieve the Maximum Available Credits under BREEAM / HQM Wat | 2 | ↑ | ↑ | - | ↓ | - | Third party assessment scheme. | Potentially more challenging to achieve depending on the type of development in question. |

| | | | Implications for… Developers and Occupants | | | | Implications for… Local Authorities | | |
|---|---|---|---|---|---|---|---|---|---|
| Report Section | Policy Option | Scale of ambition | Build costs | Planning costs | Property value | Energy bills | Additional resources required? | Enforcement / monitoring | Comments |
| | 01 or an Equivalent Best Practice Standard | | | | | | | | |
| | All Proposals to Incorporate Rainwater Harvesting Systems | 1 | ↑ | - | - | ↓ | - | Could set credit requirements in BREEAM or HQM. | Cost varies depending on the system selected but simple rainwater butts can be found for under £100. Larger systems can also offer short payback periods due to savings in water used for irrigation. |
| **Holistic Interventions in Development** | | | | | | | | | |
| **3.1.3.5** | **Promote Holistic Sustainable Design Measures** | | Various options - see below | | | | - | - | - |
| | Require Developments to undertake a BREEAM or HQM Assessment | 2 | ↕ | ↑ | ↑ | ↓ | - | Third party assessment scheme. | Cost of assessment depends on the type of development proposal and therefore may be more viable for larger schemes; most Local Plans that refer to BREEAM or HQM only require assessments for major developments. |
| | Require Applicants to Submit a Sustainability Strategy as Part of the Planning Application | 1 | - | ↑ | - | - | - | Standalone report or part of DAS. | Some costs for developers to produce the report and planning officer resources required to review it. |
| **3.1.3.6** | **Promote Adoption of Circular Economy Principles** | | Various options - see below | | | | - | - | - |
| | Set a Minimum Target for Number of Credits Achieved in Relevant BREEAM or HQM Categories | 2 | ↕ | - | ↑ | - | - | Third party assessment scheme. | It is assumed that this would only apply to projects that were already going to undertake a BREEAM or HQM assessment hence no impact on planning costs for developers. implications for build cost depend on which BREEAM credits are targeted and what the proposed design solution will be. |
| | Require Applicants to Demonstrate How Circular Economy Principles Have Been Considered Within the Proposals | 1 | - | ↑ | - | - | Requires expert reviewer. | Could set credit requirements in BREEAM or HQM. | Some costs for developers to produce the report and planning officer resources required to review it. |
| **Sustainable Transport** | | | | | | | | | |
| **3.2.4** | **Provision of Infrastructure for ULEVs** | 2 | ↑ | ↑ | ↑ | Depends on location and use | - | Enforced via planning conditions. | Due to the electricity demands, these may require infrastructure improvements which might increase costs to developers (this could be partially mitigated through on-site renewable electricity generation and battery storage). However, provision of EV infrastructure is crucial for facilitating a shift away from traditional fuel vehicles and therefore it is recommended that this should be adopted as standard. |
| **3.2.4** | **Reduce Reliance on Private Vehicles; Promote Walking, Cycling and Public Transport** | 1 | - | - | ↕ | - | - | - | Some costs and spatial implications associated with cycle parking provision, but if considered from the outset this would not reduce the build cost. Reducing vehicle parking spaces may lower the property value. On the other hand, the value could increase if the development consists of safe, walkable neighbourhoods with good public transport links, nearby amenities and low traffic noise. |
| **Low and Zero Carbon Technologies** | | | | | | | | | |
| **4.1.4.1** | **Require All New Developments to Maximise Opportunities for Renewable Energy Technologies** | | Various options - see below | | | | - | - | The amount of on-site renewables that can be accommodated will depend on the scheme in question |
| | Require All Developments to Demonstrate How the Layout, Orientation and Massing has been Designed to Maximise Opportunities for On-Site Renewables | 1 | - | ↑ | - | - | Requires expert reviewer. | Likely to form part of DAS or Sustainability Statement. | No cost impact if considered from the outset. It is assumed that the strategy would be set out in a Design and Access Statement. |
| | Require All Developments to Include On-Site Renewables | 2 | ↑ | ↑ | ↑ | ↓ | Requires expert reviewer. | Enforced via planning conditions. | Costs to provide on-site renewables - though note that these may be necessary in order to meet future Building Regulations so may represent minimal uplift. Additional costs to upgrade electricity infrastructure (depending on size of system). |
| | Require All Developments to Include On-Site Renewables and Set a Target for the Proportion of Energy Demands to be Met | 2 or 3 (depending on target) | ↑ | ↑ | ↑ | ↓ | Requires expert reviewer. | Enforced via planning conditions. | Cost implications as above; however, the impacts and level of ambition will depend on the target that is set. There is precedent in the UK for Local Authorities to require 10%-20% of energy demands to be met with on-site renewables but a higher proportional target would be appropriate if the development has low operational energy demands. |
| **4.1.4.2** | **Increase Support for LZC Energy Developments that Meet Local Criteria for Acceptability, and Seek to Broaden those Criteria** | 1 | - | ↓ | ↑ | n/a | Could reduce demands on planning officer's time. | - | Reducing planning requirements/restrictions would be expected to reduce costs to developers. This would tend to increase the value of properties that are considered suitable for large-scale renewables. |

| | | | Implications for… Developers and Occupants | | | | Implications for… Local Authorities | | |
|---|---|---|---|---|---|---|---|---|---|
| Report Section | Policy Option | Scale of ambition | Build costs | Planning costs | Property value | Energy bills | Additional resources required? | Enforcement / monitoring | Comments |
| **4.1.4.3** | **Encourage the Development of Heat Networks where Appropriate** | 2 | ↑ | - | - | ↓ | Requires expert reviewer. May require authorities to undertake energy mapping to identify suitable zones. | Connection or futureproofing would be enforced via planning conditions. | Heat network infrastructure may be more expensive than individual or communal systems, but this can be appropriate for larger developments or those with high energy demands. Minimal costs associated with designing heat systems with flexibility to connect to heat networks in future. Lower energy bills for occupants due to more efficient systems. |
| **Carbon Sequestration & Natural Capital** | | | | | | | | | |
| **4.2.4** | **Increasing Tree Planting and Afforestation Rate** | 1 | - | - | ↕ | n/a | - | Enforced via planning conditions. | Potential impacts on viability if tree planting requirements impact developable areas; however, this should be viewed in terms of wider requirements around tree protection / replacement, biodiversity net gain, etc. |
| **4.2.4** | **Increasing Agroforestry and Extending the Length of Hedgerows** | 2 | - | - | ↕ | n/a | - | As above. | Relevant to proposals that involve agricultural land and / or hedgerows. These interventions sometimes require changes in land use / management / agricultural practices but can also provide significant benefits to the land user - see report for further details. |
| **4.2.4** | **Ensure Ecological Experts are Involved in the Writing of Planning Conditions (Where Relevant)** | 1 | n/a | n/a | n/a | n/a | Requires expert reviewer. | See notes. | Note: This suggestion relates to Local Plan enforcement and is not a specific policy option. |
| **4.2.4** | **Use biodiversity net gain and environmental net gain opportunities through planning to create new habitats** | 2 | ↑ | ↑ | ↑ | n/a | Requires Local Nature Recovery Network Strategy | To be enforced via planning conditions | Biodiversity offsetting will be a major method of delivering new habitats once the Environment Bill is enacted (estimated before the end of 2020). |
| **4.2.4** | **Use opportunities through upcoming Environmental Land Management (ELM) schemes to deliver large-scale carbon sequestration and environmental restoration** | 3 | n/a | n/a | ↑ | n/a | Requires network with landowners and strategic development including expert input | To be enforced via upcoming Agricultural Bill | Supporting movement to the Government's ELMs schemes would provide opportunities for Local Authorities to drive the strategic delivery of a wide variety of environmental net gains, including carbon sequestration as well as linking to climate change pressures such as reducing flooding risks, improving air quality, regenerative agricultural practices, and health and wellbeing benefits for residents and visitors to the region. |
| **Climate Risk and Adaptation** | | | | | | | | | |
| **5.4.1** | **Potential Local Plan measures to address flooding** | | Various options - see below | | | | - | - | - |
| | Direct / restrict future development to areas with lower flood risk, considering long term projections and impacts of climate change. | 2 | n/a | n/a | n/a | n/a | - | Would require oversight from the Environment Agency, who advise on flooding. | Note: This suggestion primarily relates to site allocations and is not a specific policy option. Although flood risk is already taken into account, this issue has been highlighted due to the likely increase in flood risk over time, which would be expected to further limit suitable sites for development. Areas of "lower flood risk" should be monitored and revised in-line with the evolution of flood risk mapping with time as per the advice of the Environment Agency. |
| | Require planning applications for future development to consider long term flood risk projections in assessing flood risk and SuDS design. | 1 | ↕ | - | ↕ | n/a | Requires expert reviewer. | As above. | Note: This is assumed to be standard practice but, again, has been highlighted due to the likely increase in flood risk over time. There may be impacts on build cost and / or property value, for instance if SuDS impacts the developable area in a site; this will be site-specific. Developers should refer to CIRIA guidance and the SuDS Handbook produced by Staffordshire County Council (2017). |
| | Encourage flood resilient design responses where development on a floodplain is unavoidable. | 1 | ↑ | - | ↕ | n/a | - | - | Some design measures may increase build cost and / or affect property value but offer the potential to reduce longer-term risk and costs associated with the impacts of flood events. Developers could refer to the Ministry of Housing, Communities & Local Governments guidance on 'Improving the flood performance of new buildings; flood resilient construction'. |
| **5.4.1** | **Potential Local Plan measures to address heat** | | Various options - see below | | | | - | | |
| | Require developers to demonstrate that overheating risk has been mitigated via an Overheating Checklist. | 1 | - | ↑ | - | ↓ | Potential to adapt a checklist developed by other Local Authorities | Overheating Checklist to be submitted with application. | Impact on design and build cost will depend on measures selected but these may be minimal if considered from the outset. Increase in planning costs as these assessments may not be carried out as standard at present. If implemented correctly, in principle this would decrease operational costs of the property, such as energy bills and (potentially) maintenance, whilst also reducing the vulnerability of the occupants.<br><br>Reference can be made to Appendix 5 – Domestic overheating checklist, of London's 'Energy Assessment Guidance (2018)'. This has been developed in line with the London Plan policy 5.9 "Overheating and Cooling" and covers both 'site features affecting vulnerability to overheating' and 'design features implemented to mitigate overheating risk'. |

| | | | Implications for… Developers and Occupants | | | | Implications for… Local Authorities | | |
|---|---|---|---|---|---|---|---|---|---|
| **Report Section** | **Policy Option** | **Scale of ambition** | **Build costs** | **Planning costs** | **Property value** | **Energy bills** | **Additional resources required?** | **Enforcement / monitoring** | **Comments** |
| | Ensure all future development considers the urban heat island effect in its design. | 1 | - | ↑ | - | ↓ | - | - | As above, with additional consideration required to avoid excessive heat generation, taking into account the location of the development with respect to the urban heat island effect and the potential influence it could have on the surrounding areas' ambient temperature. |
| | Require planning applications for future developments to consider thermal comfort, through a dedicated overheating assessment (in line with CIBSE TM52 or equivalent) that considers high-emission climate projections. | 2 | ↕ | ↑ | - | ↓ | Requires expert reviewer. | Expert review of thermal comfort assessment e.g. TM52 modelling. | As above, but higher costs for developers due to the need for an additional overheating / thermal comfort assessment. |

# 3. Further Details

This section presents further discussion of the key cost implications of implementing high standards of sustainable design. It is based on a high-level review of published research and market data, as well as our team's experience in delivering sustainable design and renewable energy projects.

## 3.1 Build Cost

### Energy efficiency

Improving the energy efficiency of building fabric and services can increase build costs due to factors such as the need for more insulation, high-performance glazing, enhanced airtightness, provision of heat recovery systems, etc. The Future Homes Standard Consultation Impact Assessment suggests that the uplift in cost per dwelling would be in the range of £2,500-£6,500 (dependent on property type) to achieve a 20-31% improvement on Part L 2013 standards.[1] Analysis conducted by AECOM on behalf of the Committee Climate Change (CCC) suggests that it would be possible to achieve energy performance standards comparable to Passivhaus, with a 1-4% uplift in build cost.

### Renewable energy technologies

Adding additional renewable technologies such as PV will increase development costs due to the need to purchase and install the system. (There may also be some lost value in the form of 'opportunity costs', that is for example the removal of amenity space (e.g. roof terraces) from roofs in order to accommodate PV systems. However, this is inherently subjective, and may in some cases be zero, since the loss of space may have no amenity value.) At the time of writing, rooftop PV typically costs around £1,000-£1,500 per kW (a typical domestic system would be around 2-4 kW per unit, depending on the type of dwelling provided).[2] There may be additional costs payable to the Distribution Network Operator (DNO) depending on the size of the installation, which is needed to cover infrastructure upgrades when connecting to the grid.[3]

It is worth noting that, in future, renewable energy technologies may be necessary in order to meet Part L of the Building Regulations, so this may not represent a cost uplift per se.[4] In addition, depending on the size of development, grid infrastructure upgrades may be required anyway; the use of on-site renewable energy, in combination with high levels of energy efficiency and / or battery storage may help to minimise the grid reinforcement that is needed, which could ultimately save costs associated with utility capacity enhancements.

### Individual heating systems

The cost of installing individual heating systems varies considerably. However, for context, the Energy Saving Trust suggests that the typical costs of installing a domestic air source heat pump are around 3-4 times higher than for gas boilers, while the costs for ground source heat pumps are 6-8 times higher.[5] Direct electric heating systems are likely to be cheaper than gas boilers. Costs for non-domestic heating systems vary considerably due to the wide range of building types and uses and estimates are not presented here.

As with renewable energy technologies, note that that electric heating systems, and especially heat pumps, are expected to become commonplace if not standard in new developments in the next few years due to changes in Building Regulations. Furthermore, gas boiler systems are expected to be phased out completely by 2025, in line with Government policy. This could potentially lower the cost of such systems.

The capital costs should be weighed against other considerations. For example, using electric heating systems removes the need to install a gas connection, and the lack of local combustion of petroleum products such as

[1] https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings
[2] https://data.gov.uk/dataset/738a7bdb-a533-443d-bd02-69a8dd7fe68d/solar-pv-cost-data
[3] https://energysavingtrust.org.uk/sites/default/files/reports/Solar%20pv%20connection%20to%20the%20grid.pdf
[4] https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings
[5] These costs refer to the capital cost of the system plus cost of installation in a single dwelling. For more information, see https://energysavingtrust.org.uk/renewable-energy/heat

natural gas improves local air quality and avoids carbon monoxide risks. When combined with energy efficient fabric, heat pumps can also result in lower energy bills (see discussion of 'Operational Costs' below).

## Heat networks

The cost of delivering heat networks varies widely depending on the development and system in question.[6] Significant capital costs are associated with pipework, installation and connection[7] although research carried out by AECOM on behalf of the Energy Technology Institute found that these costs could be reduced by 30-40% in the coming decades via innovative solutions.[8]

In some parts of the UK where there are 'Heat Network Opportunity Areas' or planned heat networks, some developments may be required to offer a 'futureproofed' design that facilitates connection. At an individual building level this would likely involve, for instance, the use of low temperature distribution systems (underfloor heating or over-sized radiators) which, again, are likely to become more commonplace due to future changes in Building Regulations. Futureproofing is therefore assumed to have a minimal impact on viability.

## Cycle parking provision

The type of cycle parking provision that is suitable will depend on the development in question. For individual homes this may simply comprise a storage space. Large-scale cycle parking facilities (e.g. for apartments) may include the provision of weatherproofing, security systems, changing rooms and showers, with significant design implications, whether delivered at ground or basement level or externally.[9] These may result in cost/value implications; for example, if provided at ground or basement level, these measures may result in the loss of net lettable/sellable area, while external provision of these facilities may reduce the provision of amenity space. Schemes seeking BREEAM accreditation will need to meet specific requirements in terms of the design and amount of provision.[10] These costs should be weighed against the alternative implications of delivering additional vehicle parking and associated infrastructure.

## Water saving measures

Water efficient fittings and appliances often cost no more than standard alternatives and are assumed to have minimal or no impact on viability.[11] Water meters are assumed to be installed as standard.

The cost of rainwater harvesting systems depends on the system in question; a standalone domestic water butt can cost less than £100 to purchase and connect to a downpipe, whereas commercial-scale pumped irrigation systems for large landscaping areas can cost thousands of pounds.[12] However, depending on the type of landscaping and irrigation requirements, these can offer short payback periods due to the reduction in mains water consumption. As temperatures increase and weather patterns become more extreme due to climate change, these systems may become more common and more sought after, and may be considered commonplace in the future.

## Circular Economy design measures

There are a wide range of potential Circular Economy design measures that can be implemented in buildings, with varying impacts on cost.[13] In our view, the viability impacts are likely to be almost entirely project-specific.

- Higher costs – e.g. use of specialist demountable systems to facilitate deconstruction, higher floor-to-ceiling heights to facilitate building adaptation, use of recycled or biodegradable building materials
- Lower costs – e.g. less material due to lean design, less waste and associated disposal costs, higher resale value of reclaimed materials

Circular economy principles that are implemented at an organisational level, rather than on individual projects, can offer significant additional cost savings. For example, see Clarion Housing's Circular Economy Strategy.[14]

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/424254/heat_networks.pdf
[7] https://d2umxnkyjne36n.cloudfront.net/insightReports/District-Heat-Networks-in-the-UK-Final.pdf?mtime=20181105145836
[8] https://d2umxnkyjne36n.cloudfront.net/teaserImages/Reducing-the-capital-cost-of-district-heat-network-infrastructure.pdf?mtime=20171103092304
[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/742451/typical-costings-for-ambitious-cycling-schemes.pdf
[10] www.breeam.com/NC2018/content/resources/output/10_pdf/a4_pdf/print/nc_uk_a4_print_mono/nc_uk_a4_print_mono.pdf
[11] energysavingtrust.org.uk/sites/default/files/Guidance%20on%20water%20and%20associated%20energy%20efficiency.pdf
[12] https://www.renewableenergyhub.co.uk/main/rainwater-harvesting-information/cost-of-installing-rainwater-harvesting-system/
[13] https://www.ukgbc.org/wp-content/uploads/2019/04/Circular-Economy-Report.pdf
[14] https://www.myclarionhousing.com/-/media/C4456E44A75840788169060AC54F1333.pdf

## 3.2 Planning costs

Some of the policy options proposed would incur additional planning costs for developers / planning applicants. These would generally comprise consultants' fees to carry out work such as:

- Production of planning documents such as sustainability statements or energy strategies;
- Overheating / thermal comfort modelling; and
- Environmental assessments e.g. BREEAM, HQM, and Passivhaus.

An estimate of these costs has not been provided but it is assumed that they would represent a smaller burden for larger developments. This is supported by our observation that local planning policies within the UK generally only require BREEAM assessments for major developments.

## 3.3 Property Value

### Domestic buildings

There is evidence to suggest that domestic buildings that achieve a high standard of energy performance and / or have undergone a third-party sustainability assessment have higher property values, although it is difficult to quantify the uplift with regards to the specific policy options proposed in this study.

One of the largest studies of the link between Energy Performance Certificate (EPC) ratings and house prices was published by the Government in 2013.[15] The study found that there was a positive correlation between higher EPC ratings and the sale prices of residential properties, even when accounting for differences in dwelling age, size and type. In the West Midlands, properties with an EPC 'C' rating sold for around 10% more than similar properties with a 'G' rating, and for properties with an 'A' or 'B' rating the uplift was around 17%.

Due to their historically limited uptake in the UK, there is relatively little data on the potential price uplift that could be achieved for buildings with a Passivhaus, HQM or other form of 'green' certification.

### Non-domestic buildings

The uplift in property value due to sustainable design measures will depend on the types of measures in place and the type / use of property. Guidance from the Royal Institute of Chartered Surveyors (RICS) states that sustainability features should be taken into account when valuing a property, citing evidence that this is increasingly taken into account by investors.[16]

Commercial properties with a better energy performance rating or BREEAM certification can potentially obtain higher rental values. For instance, Landsec (a major developer) undertook a review of its property portfolio and found that BREEAM certification had a significant impact on price variability.[17] Similarly, research carried out by the UK-Green Building Council in 2013 found that the increase in rental value for buildings with some form of 'green' certification could be over 20%. The same study found that the increase in sale price could be as high as 30% compared with equivalent 'code-compliant' buildings (although it should be noted that this was based on case studies from several countries and most were in the 5-20% range).[18]

### UK Minimum Energy Efficiency Standards (MEES)

Since 1st April 2018, any properties newly rented out in the UK's private sector have been required to have a minimum EPC rating of E. Over time, the Government intends to progressively increase the minimum EPC rating, meaning that building owners would need to install upgrades in order for the property to be sold or rented.[19] In principle, this could increase general awareness of sustainable design standards and could result in higher price premiums for sustainable buildings.

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/207196/20130613_-_Hedonic_Pricing_study_-_DECC_template__2_.pdf
[16] https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/valuation/sustainability-and-commercial-property-valuation-2nd-edition-rics.pdf
[17] https://tools.breeam.com/filelibrary/Briefing%20Papers/BREEAM-Briefing-Paper----The-Value-of-BREEAM--November-2016-----123864.pdf
[18] https://www.worldgbc.org/sites/default/files/Business_Case_For_Green_Building_Report_WEB_2013-04-11-2.pdf
[19] BEIS, *'The Non-Domestic Private Sector Minimum Energy Efficiency Standards: The Future Trajectory to 2030'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839362/future-trajectory-non-dom-prs-regulations-consultation.pdf

### Note: Impacts of climate change

It is assumed that, at present, overheating does not have a significant impact on property value, but in the longer term this may change. The same applies to flood risk, which already affects issues such as insurance costs.

## 3.4 Operational Costs

Improving energy efficiency standards of buildings helps to reduce energy demand, and therefore can reduce operational costs. The level of financial savings does not necessarily scale with the change in energy demand due to differences in fuel costs. However, a building constructed to a high-performance standard (e.g. fabric efficiency and an ASHP) is likely to have lower heating bills than a less efficient building fitted with a gas boiler, despite the fact that electricity is more expensive.

In domestic buildings, the potential savings on heating bills can be very large; studies suggest that homes accredited through Passivhaus or Energiesprong can offer savings of over 90% compared with conventional dwellings, although this represents the upper end of the scale.[20] The Government estimates that the proposed Future Homes Standard would reduce costs by up to £260 per year per household. Water efficiency measures and rainwater harvesting would also tend to reduce water bills.

In non-domestic buildings, the potential improvement is more difficult to quantify due to the wide range of building typologies. However, for context, studies by the Building Research Establishment[21] have shown that, *'[t]he majority of BREEAM standards have no additional cost over typical practice and that total additional costs for Very Good or Excellent ratings are less than 2%. These studies also show that direct energy and water savings can typically be expected to pay for the additional costs involved within a few years of operation.'*

The adoption of passive design measures can reduce demands for both heating and cooling, although opportunities will be project-specific and the impacts of measures (e.g. shading, orientation, etc) are therefore difficult to quantify in broad terms. However, any measures that can reduce cooling demand will be beneficial. Due to climate change, it is anticipated that there will be a significant increase in the use of mechanical cooling systems in the UK in the coming decades, which will result in higher capital and operational costs of buildings and place additional pressure on electricity grid infrastructure.[22]

Note that there is a well-documented 'performance gap' between the predicted and actual energy use of buildings. If a high energy efficiency standard is to be set in policy, the benefits are more likely to be realised if this is accompanied by measures aimed at reducing the performance gap, such as post-completion monitoring.[23]

## 3.5 Recovery Costs

Flood resilience measures can help reduce the damage experienced by an event, whilst also speeding up the recovery time for occupants. The cost benefits experienced by the owners / occupants of buildings that have property level responses, whether they are active (such as manually installed door guards), passive (such as permanent flood proof external doors), or resilience measures, such as raised electrics and appliances, can be demonstrated by the analysis of past experiences through case studies.

The Environment Agency publicised a national level example calculation of cost benefits of multiple property level responses within their report on "Quantifying the benefits of flood risk management actions and advice".[24] This analysis showed that effective property level resilience measures can reduce damage costs significantly.

Another way of estimating the cost benefits of protection measures is through (flooding) depth-damage curves. Case studies for this indicate that significant whole life savings (which includes all costs to residents over a property's lifespan) can be accrued by effective property level flood resilience and resistance measures.[24]

[20] https://www.passivhaustrust.org.uk/UserFiles/File/Technical%20Papers/The%20performance%20of%20Passivhaus%20in%20new%20construction_July%202017%20V2.pdf
[21] https://files.bregroup.com/breeam/briefingpapers/93409-BRE_BREEAM-Delivering-Sustainable-Buildings_A4-.pdf
[22] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/835240/Research_into_overheating_in_new_homes_-_phase_1.pdf
[23] https://www.theccc.org.uk/wp-content/uploads/2019/07/The-costs-and-benefits-of-tighter-standards-for-new-buildings-Currie-Brown-and-AECOM.pdf
[24] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/414043/The_benefits_of_flood_risk_management_actions_and_advice_report.pdf