P_23

A Local Plan for

Lancaster District

2020 – 2031

Plan period 2011 - 2031

Investigation into the promotion of macro and micro-renewable energy generation

[June 2021]

Shaping a better future

LANCASTER CITY COUNCIL
Promoting City, Coast & Countryside

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INVESTIGATION INTO THE PROMOTION OF MACRO-RENEWABLE AND MICRO-RENEWABLE ENERGY GENERATION IN THE LANCASTER DISTRICT

1.0 Introduction

To aid and assist the Climate Emergency Local Plan Review (the CELPR) Lancaster City Council has prepared a number of new evidence base documents. These have been produced to support the review to ensure that decisions about future policy content are made on a robust understanding of current evidence and best practice.

This paper relates to both macro and micro-renewable energy generation and provides information on available technologies, current generation and opportunities within the district and wider issues relating to their increased deployment.

<u>The Lancaster District</u>

Lancaster is the most northerly district in Lancashire covering an area of 565 square kilometres. It contains the coastal towns of Morecambe and Heysham, the historic city of Lancaster, the railway town of Carnforth and an extensive rural area including two Areas of Outstanding Natural Beauty (AONB), the Forest of Bowland AONB and the Arnside and Silverdale AONB.

The district is bound to the south by the Lancashire authorities of Wyre and Ribble Valley, to the east by the North Yorkshire authority of Craven and to

Figure 1: A map showing the extent of Lancaster District.

the north by the Cumbrian authority of South Lakeland.

Over 90% of the district is rural with drumlin fields and rolling upland farmland forming the predominant landscape types. This is complemented by coastal drumlins along the coast of the district, the floodplain valley of the River Lune and the wooded limestone hills and pavements at Silverdale.

Together these landscapes provide the setting for the main settlements of Lancaster, Morecambe, Heysham and Carnforth and mark the transition from the urbanised landscapes west of the Pennines, to the rural landscapes and national parks in Northern England. The proximity of these landscapes to the main urban settlement is a particular asset of the district, with residents and visitors readily able to access the countryside.

Complementing the main urban settlements is a network of villages which together are home to vibrant communities delivering key services and facilities for residents and the wider rural hinterland of the district.

Planning policy for this area is provided in the Lancaster District Local Plan. The Local Plan is made up of several documents:

- Strategic Policies and Land Allocations – accompanied by a policies map that shows the areas of the district that will be developed and those areas that will be protected.
- Development Management document – provides the planning policies that will be used to determine planning applications.
- Morecambe Area Action Plan – describes the actions to support regeneration in the central area of Morecambe.
- Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) – allocates land for development and provides additional planning policies that are relevant to this area of high landscape value.
- Gypsy and Traveller Accommodation – describes the planning policies that will consider in detail how to meet the needs for gypsy and traveller provision.
- Lancaster South Area Action Plan – this is under preparation and will allocate land for development within this area and complement strategic policy SG1 'Broad Location for Growth' in the Strategic Policies and Land Allocations document.

Figure 2: Shortly after adopting the Local Plan, Lancaster City Council started a Climate Change Review of the Local Plan to review the adopted policies in light of the Council's 2019 Climate Emergency Declaration.

The most recent documents, the Strategic Policies and Land Allocations document and the Development Management document, were adopted by the Council on the 29th July 2020. On 30th January 2019, the Council declared a climate emergency. Whilst the newly adopted Local Plan documents do seek to address climate change, it was too far advanced in the plan preparation process to incorporate some of the actions and directions of the climate emergency declaration. For this reason, the City Council has commenced an immediate review of the Local Plan focussed solely on climate change.

2.0 Planning Policy Context

The Lancaster District Adopted Local Plan

Current local planning policy in relation to both macro and micro renewable energy is contained within the adopted Development Management DPD.

Policy DM30 'Sustainable Design' of the Development Management document recognises the important role that design has in improving the overall sustainability of new development with this providing opportunity to deliver improved efficiency and reduced environmental impacts. The adopted policy states how the council will encourage development to deliver high standards of sustainable design and construction through a number of measures including measures to reduce energy consumption and carbon dioxide emissions as well as opportunities for energy generation on-site, decentralised, renewable or low-carbon energy systems.

POLICY DM30: SUSTAINABLE DESIGN

Sustainable design has an important role to play in improving the overall sustainability performance of new development, offering opportunities to deliver improved efficiency and reduced environmental impacts. The Council is supportive of proposals that deliver high standards of sustainable design and construction.

In delivering sustainable development the Council will encourage development to deliver high standards of sustainable design and construction through consideration of:

I. **Measures to reduce energy consumption and carbon dioxide emissions, and water consumption;**
II. **Opportunities for energy supply from on-site, decentralised, renewable or low carbon energy systems;**
III. **Opportunities to contribute to local and community-led energy initiatives;**
IV. **Account of landform, layout, building orientation, massing and landscaping to minimise energy, water consumption and water efficiency measures;**
V. **Use of materials that reduce energy demand (for example, insulation) and increase the energy efficiency of the building/development; and**
VI. **The reuse of existing resources (including the conversion of existing buildings) where this would be 'fit for purpose'.**

Policy DM53 ‘Renewable and Low Carbon Energy Generation’ sets out how the Council is committed to supporting the transition to a lower carbon future in Lancaster District and states that the Council will seek to maximise renewable and low energy generation, where it is compatible with other sustainability objectives.

POLICY DM53: RENEWABLE AND LOW CARBON ENERGY GENERATION

The Council is committed to supporting the transition to a lower carbon future and will seek to maximise the renewable and low carbon energy generated in the District where this energy generation is compatible with other sustainability objectives.

The Council will support proposals for renewable and low carbon energy schemes, including ancillary development, where the direct, indirect, individual and cumulative impacts on the following considerations are, or will be made, acceptable (unless material considerations indicate otherwise):

- **I. As a result of its scale, siting or design impacts on the landscape character, visual amenity, biodiversity, geodiversity, flood risk, townscape and historic assets of the district, highway safety, aviation and defence navigation system/communications are satisfactorily addressed;**
- **II. Impacts on the amenities of sensitive neighbouring uses and local residents are minimised (including by virtue of noise, dust odour, shadow flicker, air quality or traffic);**
- **III. The wider environmental, economic, social and community benefits directly related to the scheme outweigh any significant adverse effects; and**
- **IV. The proposal is consistent with other relevant policies within the local development plan.**

In areas that have been designated for their national importance, as identified in the National Planning Policy Framework, large-scale renewable energy infrastructure will only be permitted where it can be demonstrated that it would be appropriate in scale, located in areas that do not contribute positively to the objectives of the designation, is sympathetically designed and includes any necessary mitigation measures.

The Council will require that where renewable energy installations become non-operational the facility will be removed and the site will be fully restored to its original condition

Proposals for wind turbines will be supported where they are located within an area identified as suitable for wind energy as shown on the Local Plan Policies Map and in Figure 13.1 (Areas identified as suitable for Wind Energy).

Wind turbines in the areas identified as suitable for wind energy will be considered acceptable where the development can be positively assessed against the criteria outlined in (I) to (IV), National Planning Policy, the relevant Ministerial Statements and/or Guidance and following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.

The policy also details the specific approach that should be taken towards the deployment of wind turbines following the Written Ministerial Statement published in June 2015. The Ministerial Statement stated that the Local Planning Authority, when determining planning applications for wind energy development involving one or more wind turbines, should only grant permission if:

- The development site is in an area identified as suitable for wind energy development in a Local or Neighbourhood Plan; and
- Following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.

The Written Ministerial Statement was not accompanied by any further guidance, leaving what was considered an 'area suitable for wind energy' and to have the backing of the local community, open to interpretation. The statement also did not specify the size and/or scale of turbine this applied to, leaving the future of wind energy, large and small scale very uncertain.

The Planning Practice Guidance (PPG) states that "*There are no hard and fast rules about how suitable areas for renewable energy should be identified, but in considering locations, local planning authorities will need to ensure they take into account the requirements of the technology and, critically, the potential impacts on the local environment, including from cumulative impacts. The views of local communities likely to be affected should be listened to. When identifying suitable areas it is also important to set out the factors that will be taken into account when considering individual proposals in these areas. These factors may be dependent on the investigatory work underpinning the identified area*".

In the absence of specific guidance, to help direct wind energy development to the most suitable areas within the District for wind energy, it was decided in preparing the adopted Local Plan that the most appropriate method would be to adopt a constraints-based approach. To ensure the potential impacts upon the local environment were taken into account a number of designations were mapped, such as Conservation Areas, Scheduled Ancient Monuments, Registered Parks and Gardens, International, National and Local Environmental Designations, National and Local Landscape Designations, Green

Belt, Transport Networks and Housing Allocations (identified through the adopted Local Plan). Alongside the Urban Boundary (as shown on the adopted Local Plan Policies Map) which includes a 350m buffer for noise impacts, and all of the Neighbourhood Plan designations within the District because it was considered that it would be more appropriate for Neighbourhood Plan Groups to plan for wind energy within their designated areas.

Consequently, those areas not covered by a designation on the constraints map are identified as 'suitable areas for wind energy', but as recommended in the PPG, policy DM53 of the adopted Local Plan sets out the factors as a series of positively worded criteria that will need to be taken into account when considering individual proposals in the areas which have been identified as suitable for wind energy. Settlements outside of the urban boundary do not have a boundary around them and so it has not been possible to apply a 350m buffer around these areas, however, it is important to note that the criteria set out within Policy DM53 will apply to determine whether wind energy would actually be suitable in these areas because each site and situation is different dependent upon the scale and location of the development, as potential impacts are very context-specific.

National Policy

The Government has acknowledged that climate change is one of the gravest challenges facing the country. The recently published Energy White Paper (December 2020) confirms the need for action with the Paper highlighting the drastic and irreversible effects that climate change is having on the planet. Decarbonising the energy system is seen as crucial against the battle against climate change with the Government seeking as far as possible to replace fossil fuels with clean energy technologies such as renewables, nuclear and hydrogen. It is hoped that by 2050 the country will have a fully decarbonised energy system.

Central to this is the increased focus on electricity to meet our energy needs. The Energy White Paper estimates that electricity could provide more than half of our final energy demand by 2050. The electrification of cars together with the replacement of gas with electricity to heat our homes and businesses will be responsible for most of this increase.

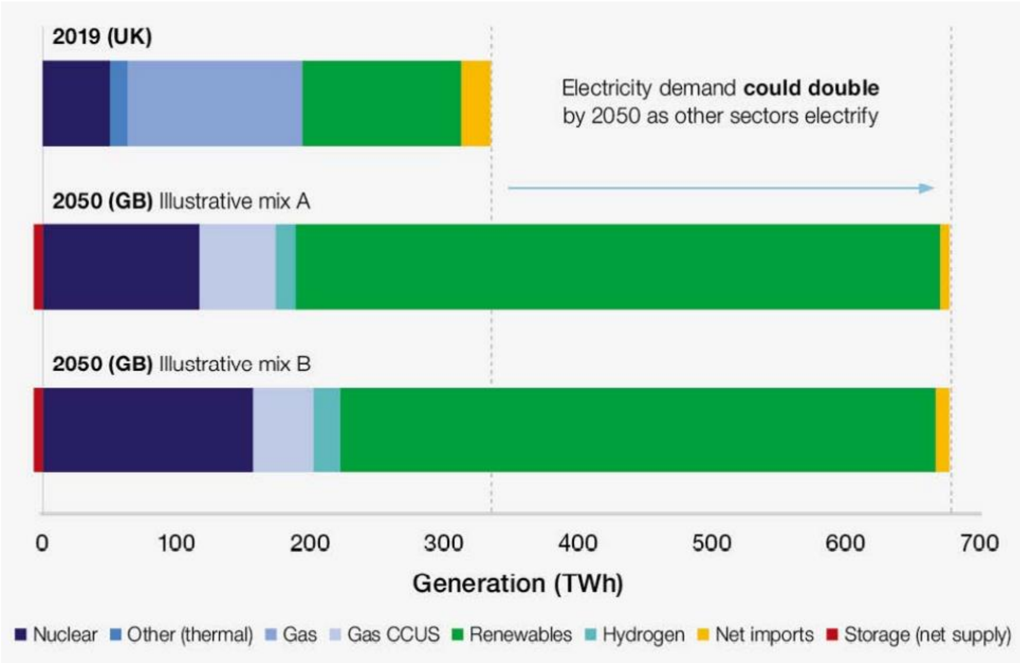


Figure 3: Figure 1 – Electricity mix today and illustrative 2050 mixes. Source: Energy White Paper Powering our Net Zero Future (December 2020)

Through the revised National Planning Policy Framework (NPPF) published in February 2019 the Government has continued to highlight the important role that the planning system can play in supporting the transition to a low carbon future, shaping the way in which we use and locate buildings and assisting in the decarbonisation of our energy system.

The NPPF calls for plans to take a proactive approach to mitigating and adapting to climate change and states that in order to help increase the use and supply of renewable and low carbon energy and heat, plans should identify opportunities for development to draw their energy supply from decentralised, renewable, or low carbon energy systems. The importance of having a positive strategy for energy is also highlighted with plans required to maximise the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts).

Further guidance on renewable and low carbon energy deployment is contained in the National Planning Practice Guide. This recognises the important role that planning plays in delivering new renewable and low carbon energy infrastructure in locations where the local environmental impact is acceptable. The guidance confirms that local authorities are responsible for renewable and low carbon energy development of 50MW or less installed capacity. Schemes over this are currently determined by the Secretary of State.

Opportunities to identify suitable areas for renewable energy in addition to wind energy are also supported by national policy. This recognises that the identification of such areas can provide greater certainty as to where developments will be permitted. Whilst local authorities are invited to consider the identification of suitable areas they are not required to do so. Lancaster City Council in preparing its local policy response, has with the exception of wind, sought to focus on a positively worded criteria-based policy offering support for all schemes subject to the satisfaction of a number of criteria.

In addition to requiring positively worded policies national policy also allows local authorities to consider the use of local standards to increase the deployment of micro-renewable and low carbon schemes from new development.

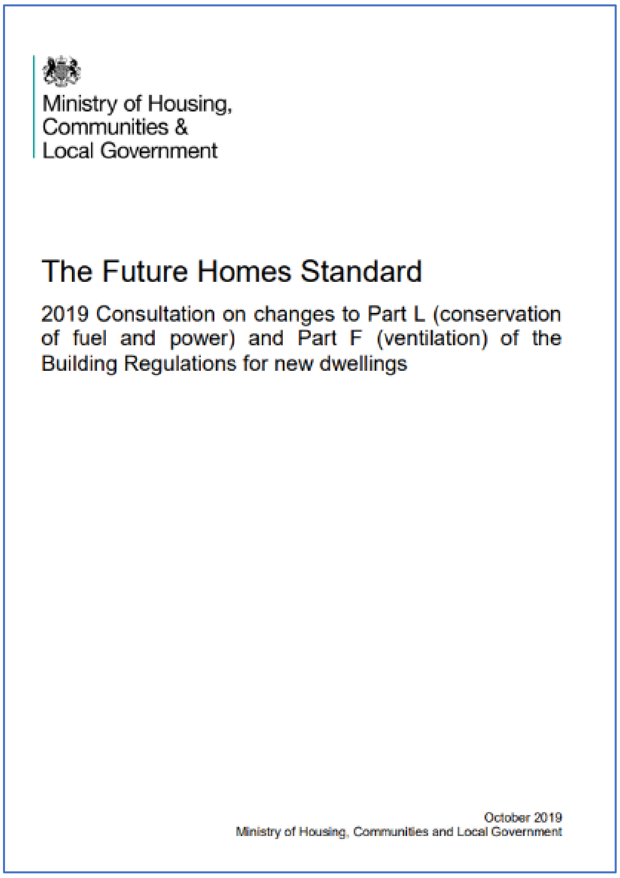
The encouragement of local standards is not a new concept to planning. Authorities have for a long time explored how, through planning, they could encourage and require new developments to adopt sustainable means of energy generation. Most notable is Merton London Borough Council which in 2003 adopted the Merton Rule. This represents the first local standard adopted by a council. The Merton Rule required new commercial buildings over 1,000 square metres to generate at least 10% of their energy needs from on-site renewable energy equipment. The rule was subsequently expanded to include domestic dwellings and following its success was adopted by several other local authorities.

In 2008, building on the success of the Merton rule, the Government through the Planning and Energy Act provided the legal basis for local authorities to establish and enforce local standards for the on-site deployment of renewable energy. The act provided the basis through which authorities were encouraged to adopt Merton rule style policies. This was continued in the 2008 Planning Policy Statement (PPS1) Planning and Climate Change which required all local authorities to adopt a Merton rule policy.

Whilst providing a popular policy tool for increased deployment the Merton Rule faced criticism from many with concerns over increased costs for development and also concerns as to whether on-site generation was always the most appropriate method for improving the sustainability performance of buildings with many instead calling for improvements to the building fabric and improved energy efficiency measures instead.

Following a review of housing standards in 2013 the Government indicated their intentions to remove the ability of local authorities to set local standards instead preferring to rely on nationally agreed building regulations to deliver sustainable design and construction.

In 2015, the Deregulation Act included legislation which stated that local authorities should not set in their emerging Local Plans any additional local technical standards or requirements relating to the construction, internal layout or performance of new dwellings. At this point most authorities took this as a clear message that local targets should not be set. Importantly however the legislation which allows local authorities to set targets, the 2008 Planning and Energy Act, was never amended meaning that the opportunity to set onsite targets like the Merton Rule remain.



Ministry of Housing, Communities & Local Government

The Future Homes Standard

2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings

October 2019
Ministry of Housing, Communities and Local Government

Figure 4: The Future Homes Standard will come into force in 2022. By 2025 the standard will require homes to emit 75-80% less emissions compared to current standards.

The ability of Local Authorities to continue to set local energy efficiency standards has recently been confirmed by Government via 'The Future Homes Standard: 2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings – Government Response' (January 2021).

The Future Homes Standard consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations ran from the 1st October 2019 to the 7th February 2020. The consultation explored the introduction of a consistent approach to energy efficiency standards in new homes across the country by 2025. Part of the Government's direction on this matter was to investigate the removal of local planning authority's ability to set localised standards that are over and above the Future Homes Standards. The intention being for the energy efficiency of new homes to be assessed through the building regulations process only, not through plan making. Views on this were sought through the consultation. As noted above the Government's response to this consultation (January 2021) confirms that based on the comments received local authorities can for now continue to set local standards.

The Future Homes Standard is due to be adopted in 2025. The Government anticipates that an average home built under the Future Homes Standard will have 75-80% lower carbon emissions than one built under Approved Document L 2013. To achieve this, the Government would expect new homes built under these new standards to have low carbon heating and higher levels of energy efficiency. This would mean that typically a new home would have a heat pump, a wastewater heat recovery system, triple glazing and minimum standards for walls, floors and roofs that limit heat loss.

The consultation recognises that the Future Homes Standard represents a step up in energy efficiency standards compared to current requirements. The consultation therefore proposes introducing an achievable but meaningful uplift in energy efficiency standards in advance of 2025.

The consultation set out two options to uplift energy efficiency standards and requirements in advance of the new Future Homes Standard. The transitional arrangements had been anticipated to be adopted by 2020 but it is now expected that they will be required from 2022 with the standard legislated in 2021.

- Option 1: ‘Future Homes Fabric’ - 20% reduction in carbon emissions compared to the current standard for an average home. It is anticipated this could be delivered by very high fabric standards (typically with triple glazing and minimal heat loss from walls, ceilings and roofs).

- Option 2: ‘Fabric plus technology’ - 31% reduction in carbon emissions compared to the current standard. It is anticipated this could be delivered based on the installation of carbon-saving technology such as photovoltaic (solar) panels and better fabric standards, though not as high as in option 1 (typically double not triple glazing).

Option 2 has been confirmed as the preferred option.

Viability Evidence

As part of the Local Plan Review the City Council commissioned viability consultants, Three Dragons, to investigate the viability of delivering improved energy efficiency standards and renewable energy installations. A range of potential standards aimed at decarbonising development have been investigated (Table 1). This includes the Future Homes Standard as well as other higher environmental performance standards for buildings. Options 1 and 2 below have not been investigated further having now been overtaken by the Future Homes Consultation response and the likely pursuit of Option 2 Fabric Plus Technology.

Table 1: Optional higher environmental performance standards for buildings.

Options Reference	Optional Standard
1	Sustainable Homes Code Level 4 Equivalent (19% carbon reduction above 2013 Building Regulations)
2	MHCLG Option 1 –Future Homes Fabric (20% reduction in CO2)
3	MHCLG Option 2 –Fabric Plus Technology (31% reduction in CO2)
4	Proposed Future Homes Standards 2025 (75-80% less carbon than 2013 Building Regulations),
5	Passivhaus House or Net Zero Operational Carbon
6	Net Zero Whole Life Carbon (operational and embodied carbon)

The report notes the importance of a Fabric First Approach where achieving zero carbon emissions in buildings starts first with reducing the energy demand. Once demand has been minimised other measures (efficient heating and hot water systems and the installation of onsite renewable technologies) can be used to offset any energy used on site. The report notes that the latter might not be required if energy demand can be sufficiently reduced onsite by designing well insulated, thermal bridge free and airtight homes.

A range of potential energy efficiency approaches and renewable energy technologies required to deliver the above options are investigated within the Three Dragons report. These are being reviewed to determine the optimal viable combination which will achieve the highest carbon reduction above the 31% proposed for Building Regulations. The following technologies/approaches are considered:

- Air source heat pump for each new home
- Ground source heat pump for each new home
- District heating systems (typologies of 15 units and over)
- 4 square metres/300 litre solar hot water panels/system
- 4kW solar panel system
- Domestic wind turbines 5-6kW
- Rainwater harvesting system
- Grey water recycling system
- Low energy light and appliances
- Waste-water heat recovery
- Mechanical ventilation with heat recovery

The report confirms that whilst there remains an ability to set local requirements for micro-renewables the evidence base and direction of national policy both confirm that the focus should be on securing energy efficiency measures to reduce carbon (and fuel bills) with renewable energy installations to be encouraged where appropriate and viable. A fabric first approach is the priority. Renewable energy technologies clearly have their part to play but only once improvements in the overall building fabric of new development have been secured.

The approaches being explored by other local authorities is set out in Appendix 1. It is important to note that they placed their requirements prior to the publication of the Future Homes Standard. The most ambitious authorities are exploring 35% reductions in emissions, 4% above that set to be required by all authorities by 2022 and substantially less than the 75-80% reduction to be required by the implementation of the Future Homes Standard in 2025. Improvements in the building fabric remain the priority across all areas.

Further information is available in the viability assessment produced by Three Dragons.

3.0 Micro-Renewable Energy Generation

Notwithstanding the promotion of a fabric first approach micro-renewable technologies clearly have a role to play in the transition to a low carbon future. They provide the opportunity to offset what energy is used within a building both domestic and non-domestic and in existing and new buildings.

Whilst there is clearly opportunity to encourage increased deployment of renewable energy technologies through positive planning policies and potential local targets, amendments to permitted development rights has meant that many micro-renewable energy schemes no longer require planning permission. The Council must be mindful of this within the review.

The permitted development rights (as of April 2021) of individual technologies are discussed below.

What is micro-renewable energy?

Microgeneration is the small-scale production of heat and/or electricity from low carbon sources used by individuals, small businesses and communities to meet their own energy needs. Under the Energy Act 2004 micro-generation is defined as having a capacity of 45kW for micro heat (thermal) and 50kW for micro-electricity.

It can be delivered through a number of technologies with these grouped into two categories:

- Micro-electricity technologies – including solar photovoltaic (PV) or solar panels, micro-wind turbines, micro-hydro and micro-combined heat and power (CHP).
- Micro-thermal technologies – including heat pumps, biomass and solar thermal.

Figure 5: A home with solar photovoltaic panels on the roof. Solar can provide for all of a household's energy needs and can be part of helping the building reduce its energy associated emissions. Installing them can help to reduce energy bills and can increase house value.

The increased deployment of micro-generation has an important role to play in reducing carbon emissions from both domestic and non-domestic properties. It can also assist in alleviating fuel poverty and improving fuel security by increasing access to more affordable and locally available supplies of both electricity and heat.

Through the Local Plan review the Council are seeking to investigate current planning policy in relation to micro-renewable energy generation and identify ways in which this might be strengthened and deployment increased across the district.

Micro-electricity technologies

Solar Photo Voltaic

Photo Voltaic (PV) panels produce electricity by converting light from the sun into electricity.

Figure 6: Solar panels on the roofs of terraced homes at Lancaster Cohousing. Photo provided by Lancaster Cohousing.

A typical solar panel is made up of two thin layers of sillicon which have been treated in slightly different ways. The top later, facing the sun, has atoms that are unstable. When the sun hits this layer the atoms become excited and are attracted down towards the bottom later of the panel. This movement creates a direct current which can then be converted via an inverter to an alternating current and can then be used to power a building as well as meeting other residential and business demands.

A 4kW residential scale solar PV system will typically cost between £4,000 and £8,000 depending on the size of the system and the brand of system. This size of system can provide enough energy to meet the energy demands of an average 3-4 person family.

The installation of photovoltaic technology onto a building is often permitted development and as such does not require planning permission provided that the installation is not of an unusual design, does not involve a listed building, and is not in a designated area.

In order to benefit from permitted development rights the following limits must be met for solar equipment mounted to a house or block of flats or on a building within the curtilage:

- Panels should not be installed above the highest part of the roof (excluding the chimney) and should project no more than 200mm from the roof slope or wall surface.
- The panels must not be installed on a building that is within the grounds of a listed building or on a site designated as a scheduled monument.
- If the building is in a conservation area, or in a World Heritage Site, panels must not be fitted to a wall which fronts a highway.

For stand-alone schemes (panels not on a building but within the grounds of a house or a block of flats) the following limits must be met to benefit from permitted development rights:

- Only the first stand-alone solar installation will be permitted development. Further installations will require planning permission.
- No part of the installation should be higher than four metres
- The installation should be at least 5m from the boundary of the property
- The size of the array should be no more than 9 square metres or 3m wide by 3m deep
- Panels should not be installed within boundary of a listed building or a scheduled monument.
- If the property is in a conservation area, or in a World Heritage Site, no part of the solar installation should be nearer to any highway bounding the house than the part of the house that is nearest to that highway.

When installing systems, equipment should be sited, so far as practicable, to minimise the external appearance of the building and the amenity of the wider area and where the technology is no longer needed it should be removed as soon as is reasonable possible.

Where a planning application is required the following factors will be considered:

- The importance of siting systems in situations where they can collect the most energy from the sun;
- The need for sufficient area of solar modules to produce the required energy output from the system;
- The effect on a protected area such as an Area of Outstanding Natural Beauty or other designated areas; and
- The colour and appearance of the modules, particularly if not a standard design.

Whilst not always requiring planning permission, building regulations will still apply. In installing a scheme, the capacity of the roof to support the weight of the panels will need to be checked and proven. It is possible that some strengthening work might be required.

In relation to historic buildings, the Council has produced a paper ‘Heritage and Carbon Zero: responding to the climate emergency’ which appraises current Conservation policies and practice and offers recommendations for how it might adapt in light of the Climate Emergency Deceleration.

Photovoltaic Local Case Study: St John's Church in Yealand

Figure 7: Photo from: https://www.hpa.ltd/architectural-projects/st-johns-church-yealand-conyers/

St John's Church in Yealand Redmayne installed 4kW capacity solar panels in 2011. The discreetly placed solar panels in a roof valley are an example of how renewables and heritage assets can work together. In 2019, the Feed in Tariff provided £1700 in payments, this covered one third of their electricity costs.

For more information see: https://www.hpa.ltd/architectural-projects/st-johns-church-yealand-conyers/

Wind **Energy**

Energy is harnessed from wind through the use of turbines. The blades of the turbine are turned by the wind, which causes the axis to rotate. The axis is attached to a generator which produces direct current electricity. An invertor converts the direct current to alternating current electricity, that is used to power the home. The stronger the wind, the more electricity is produced.

The British Isles have one of the best wind power resources in the world. The best locations for onshore wind are nearer the coast or on hills; Lancaster district has both. Wind speed is also greater here during Winter, when energy demand is highest.

There are two types of domestic-sized wind turbine:

1. Pole mounted - These are free standing and are erected in a suitably exposed position, with generation capacity of about 5-6kW.
2. Building mounted – These are smaller than pole mounted systems and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1-2kW in size.

Figure 8: A small building mounted wind turbine. Photo from: Lancaster City Council Planning Team

Building mounted systems are cheaper to install than pole mounted turbines, but they generally are less efficient. Which one will meet energy demand requirements depends on the size of the property, the amount of electricity one wants to generate and the energy efficiency of one's home. For instance, A 1.5kW wind turbine situated in an area with an average wind speed of 14mph would be sufficient to meet the needs of a home requiring 300kWh per month. A certified installer, such as a an HEIS installer, will be able to offer expert advice on the specific requirements of a property.

A rotor diameter of approximately 1 metre could provide a few hundred kilowatt-hours (kWh) of electricity per year. This is about the same as one solar panel. To get as much energy per year as a solar roof, a rotor about 4 metres in diameter would be required. For most houses this sort of turbine would not be feasible, but it may be suitable if there is enough land around surrounding the property.

In order to benefit from permitted development rights the following limits must be met for pole mounted turbines:

- The wind turbine must adhere to the MCS planning standards.
- The installation must not be sited on safeguarded land.
- One turbine is considered a permitted development and the property must not have an Air Source Heat Pump installed already. Otherwise, you need to ask for planning permission.
- The highest part of the wind turbine blade must not exceed 11.1 metres.
- The distance between the ground and the lowest part of the wind turbine blade needs to exceed 5m.
- The turbine's height plus 10% is the distance that the wind turbine needs to be from the boundary of your property.
- The swept area of the wind turbine cannot exceed $3.8m^{2}$.
- If you live in a conservation area/world heritage site, the closest part of the wind turbine needs to be further away from any highways than the closest part of the house.
- Permitted development rights do not apply to a turbine within the curtilage of a Listed Building or within a site designated as a Scheduled Monument or on designated land other than Conservation Areas.

For building mounted turbines, the following limits must be met to benefit from permitted development rights:

- Need to be a detached house and be surrounded by other detached houses in the vicinity.
- Development is permitted only if the building mounted wind turbine installation complies with the Microgeneration Certification Scheme Planning Standards or equivalent standards.
- The installation must not be sited on safeguarded land.
- Only the first installation of any wind turbine would be permitted development, and only if there is no existing air source heat pump at the property. Additional wind turbines or air source heat pumps at the same property requires an application for planning permission.
- No part (including blades) of the building mounted wind turbine should protrude more than three metres above the highest part of the roof (excluding the chimney) or exceed an overall height (including building, hub and blade) of 15 metres, whichever is the lesser.
- The distance between ground level and the lowest part of any wind turbine blade must not be less than five metres.
- No part of the building mounted wind turbine (including blades) must be within five metres of any boundary.
- The swept area of any building mounted wind turbine blade must be no more than 3.8 square metres.
- In Conservation Areas, an installation is not permitted if the building mounted wind turbine would be on a wall or roof slope which fronts a highway.
- Permitted development rights do not apply to a turbine within the curtilage of a Listed Building or within a site designated as a Scheduled Monument or on designated land other than Conservation Areas.

In addition, the following conditions must also be met. The wind turbine must:

- Use non-reflective materials on blades.
- Be removed as soon as reasonably practicable when no longer needed for microgeneration.
- Be sited, so far as practicable, to minimise its effect on the external appearance of the building and its effect on the amenity of the area

Micro Hydro

Micro-hydro turbines are an efficient, low-maintenance, convenient form of micro-renewable electricity generation. The systems are very site specific and constrained by the available head and flow at the site.

Small scale hydroelectric power generation systems are divided into[1]:

- **Pico hydro:** Systems delivering power generation of under 5kW. This also includes very small systems delivering even 200-300W.
- **Micro Hydro:** Systems with a power output of 5-100kW.

This following will refer to both pico and micro hydro systems as micro hydro unless specific differences are explicitly outlined.

Figure 9: A micro hydro scheme at Frensham Mill in Surry. The system has a power potential of 11kW or enough power to serve 14 average homes. Photo from: https://www.isoenergy.co.uk/micro-hydro-generation. See http://www.frenshammill.org/ for more information.

Upfront costs for micro hydro schemes can be quite high, however when suitably located can be a good long-term investment that provides the lowest cost per kW of all renewable technologies. They also lend themselves well to community ownership. Micro hydro systems have the benefit of lasting 40-50 years over which they incur low maintenance and running costs. There is also the potential that they last longer than a standard lifespan should they be well maintained.[2] They have the highest efficiency of renewable energy sources, have potential to generate energy 24 hours a day, a slow rate of change in output and good correlation with demand (tend to have higher outputs in winter).[3]

Risks to the system are damage from debris during flooding, however there are ways to protect the system (such as screening) which reduces this risk.[4] They do require regular maintenance and often environmental monitoring which needs to be accounted for. Hydro systems also have potential environmental impacts which must be taken into account. They range from affecting the visual amenity of a sight, altering flood risk, disturbing terrestrial and aquatic ecology and affecting recreational activities.[5] However at the pico and micro scale most schemes are physically small and 'run-of-river' (use water as it is available). As such they generally have a low visual impact, low environmental impact and low impact on the water course.

[1] MICRO AND PICO HYDRO - British Hydro Association (british-hydro.org)
[2] Use hydroelectricity to power your home - Energy Saving Trust
[3] British Hydro Association Protecting the environment & rural communities (british-hydro.org)
[4] Use hydroelectricity to power your home - Energy Saving Trust
[5] British Hydro Association Protecting the environment & rural communities (british-hydro.org)

Figure 10: The powerhouse shed for the pico hydro scheme for the National Trust Site at Tŷ Mawr Wybrnant in Wales used to power the heating and lighting in a Grade II Listed Building. The 4.5kW pico hydro scheme has an annual CO_2 emissions savings of over 5.2 tons. This is a pump-as-turbine scheme which has reduced cost and complexity than conventional hydro turbines. Photo from: https://www.nationaltrust.org.uk/ty-mawr-wybrnant-pico-hydro For more information see: https://www.dwr-uisce.eu/ty-mawr-wybrnant

Due to its rich hydrological assets, there is the potential for the implementation for micro-hydro turbines across Lancaster District. The Forest of Bowland AONB commissioned a Micro Hydro Feasibility Study in 2011 which included not only the AONB but also parts of Lancaster District outside the AONB.[6,7,8] The Environment Agency also holds a dataset for 'Potential Sites of Hydropower Opportunity.'[9] These data are meant to give an overview of potential sites where there is lower risk of environmental sensitivity to installation of hydro schemes. The dataset was last updated in 2015 and at site level has some error due to the mapping datasets. Throughout the District, there may also be additional sites where pico and other micro hydro schemes could be deployed that are not identified in the above.

In general, hydro schemes are not permitted development and planning permission will need to be sought. Where a planning application is required the following factors will be considered:

For local planning permission factors that should be accounted for include impacts on:

- The landscape and visual amenity
- The historic environment
- The natural environment
- The water environment
- Recreation
- Noise levels
- Air and water quality

Building regulations apply to all aspect of the work. Schemes need to submit some form of environmental assessment in line with the Town and Country Planning (Assessment of Environmental Effects) Regulations 1998 for both planning permission and for environmental licences.

Additionally, for planning permission to be granted, consultation and permission will need to be sought from relevant authorities. For hydro schemes diverting more than 20 cubic metres per day (this

[6] FoB Micro Hydro report intro (forestofbowland.com)
[7] Small Scale Hydro Power Feasibility | Forest of Bowland AONB
[8] Small Scale Hydro Power Feasibility | Forest of Bowland AONB
[9] Potential Sites of Hydropower Opportunity - data.gov.uk

will be virtually all schemes), an abstraction license must be acquired from the Environment Agency. They will also consider impoundment and changes to flood risk. Additionally, environmental protection measures may be included in this permission such as building a fish pass or ladder.

Figure 11: A 50 kW community funded hydro scheme Talisker Farm on Skye. The scheme powers 50 homes and displaces about 70 tons of CO_2 per year. Photo from: https://www.geograph.org.uk/photo/4784175 For more information see: https://northtalisker.com/

The vast majority of hydro schemes will need to consult with or a acquire permission from a range of agencies due to the potential impact on the local ecology. An example of some of the various areas for consideration include: If there is the potential that the hydro may disturb the ecology of the site, such as through the removal of silt, advice and guidance from the Environment Agency and Natural England will need to be sought. If the site is within or could impact a protected site or area, consultation with Natural England will be needed. For Biological Heritage Sites, Lancashire County Council will need to be consulted. An ecological survey should also be conducted to ensure there is mitigated impact on natural habitats.

Planning permission may not be required in some instances such as the refurbishment of an existing scheme providing there is no change in use.

Domestic combined heat and power

Combined heat and power (CHP) is a technology that generates heat and electricity simultaneously, from the same energy source; a micro-CHP system uses this technology in individual homes or buildings. The main output of a micro-CHP system is heat, with some electricity generation, at a typical ratio of about 6:1 for domestic appliances. Domestic micro-CHP systems are usually powered by mains gas or liquified petroleum gas (LPG), though some models are now powered by oil or bio-liquids, including biodiesel. However, a CHP system can also use renewable fuels, such as biomass. Although gas and LPG are fossil fuels rather than renewable energy sources, the technology is considered a low carbon technology because it can be more efficient than just burning a fossil fuel for heat and getting electricity from the national grid. This is because central electricity generation wastes a significant proportion of the energy it creates, through heat losses in the power station and in the transmission and distribution network. Micro-CHP boilers avoid these losses and capture the heat for use within the home.

Figure 12: Diagram showing the internal workings of a domestic hydrogen fuel cell/gas CHP. Diagram from: https://ahs-heating.co.uk/hydrogen-fuel-cell-heating/

Micro-CHP boilers are designed to generate all the heating and hot water, and a significant percentage of the electricity needed by a typical UK home. A typical domestic system will generate up to 1kW of electricity once warmed up. The amount of electricity generated over a year depends on how long the system is able to run.

Micro-CHP systems are a similar size and shape to standard domestic boilers. They can be wall mounted or stand alone. The primary difference between a micro-CHP system and a standard boiler is that a micro-CHP system can generate electricity while heating water – a boiler cannot do this.

There are three main micro-CHP technologies, with the difference between them being the way in which they generate electricity:

1. **Internal combustion engine CHP**

   This is the most proven technology. These are essentially, and sometimes literally, truck diesel engines modified to run on natural gas or heating oil, connected directly to an electrical generator. Waste heat is then taken from the engine's cooling water and exhaust manifold and used for heating needs. The engines can have a higher electrical efficiency than a Stirling engine, but are larger and mainly installed in commercial-scale applications.

2. **Fuel cell CHP technology**

   Fuel cell CHP technology generates electricity by taking energy from fuel at a chemical level rather than burning it. It uses a steam reformer to convert methane in the gas supply into carbon dioxide and hydrogen. The hydrogen then reacts with oxygen in the fuel cell to produce electricity. Waste heat is produced in this process, which is used within a hot water heating system.

3. **Stirling engine**

   A Stirling engine CHP system is essentially a normal boiler with a Stirling engine built in. A Stirling engine is an external combustion engine that heats up when the boiler is being used. When this happens, gas stored in the Stirling engine expands due to the heat, and a piston connected to a generator produces electricity. While they are much quieter than internal combustion engines, they can only generate electricity when the central heating is being used, so are less efficient.

Planning permission is not normally needed when installing a micro-combined heat and power system in a house if the work is all internal. If the installation requires a flue outside, however, it will normally be permitted development if the conditions outlined below are met:

- Flues on the rear or side elevation of the building are allowed to a maximum of one metre above the highest part of the roof.
- If the building is listed or in a designated area even if you enjoy permitted development rights it is advisable to check with your local planning authority before a flue is fitted. Consent is also likely to be needed for internal alterations.
- In a conservation area or in a World Heritage site the flue should not be fitted on the principal or side elevation if it would be visible from a highway.

Heat pumps (air and ground)

Air source and ground source heat pumps do the same job, they warm the building by extracting naturally occurring heat from outside. Air source heat pumps do this by using air, while ground source heat pumps extract heat from underground. When used correctly, they can lead to significant cost and energy savings.

Figure 13 A domestic air source heat pump. Photo from: https://www.cse.org.uk/advice/renewable-energy/air-source-heat-pumps

Single phase electricity heat pumps are an emerging and growing market in response to Government commitment to lower carbon heat sources. Many heat pump systems have traditionally been three phase systems as most systems originate from the European market where homes are most often fitted with three phase electricity supply. The change in market forces has made single phase supply heat pumps more widely accessible. Heat pumps run at lower temperatures than fossil fuelled thermal energy sources so users may need to change habits in relation to heating their homes. To maximise energy efficiency and minimise risk of high energy use, heat pumps should be used at low and constant temperatures over longer periods rather than a less hours at higher temperatures.

The potential for this technology is highlighted in the Energy White Paper which has a target to grow the installation of electric heat pumps from 30,000 per year to 600,000 per year by 2028. The Government sees this technology as being key to reducing the need for oil and gas to heat our homes.

Air Source Heat Pumps

An air source heat pump (ASHP) is typically placed outdoors at the side or back of a property. It takes heat from the air and boosts it to a higher temperature using a heat pump. Whilst the pump does need electricity to run, it should use less energy to boost the temperature than it would use if generating heat using a traditional heating method, like a gas or oil boiler, making them an efficient method for heating homes. ASHP can still extract heat even when air temperatures are as low as -15 degrees.

There are two main types of ASHP: air to water and air to air.

Air to water – these absorb heat from the outside air and transfer the heat to water. Heat is then distributed using the wet central heating system of a property. Heat pumps are noted to work more efficiently at a lower temperature than a standard boiler system would. This makes them more suitable for underfloor heating systems or larger radiators, which give out heat at lower temperatures over longer periods of time. Air to water heat pumps are the most common model used in the UK.

Air to air – these require a warm air circulation system to move warm air around a property. They do not provide hot water and importantly are not eligible for the Government's Renewable Heat Initiative Grant.

From the 1st December 2011 the installation of an ASHP on a domestic property does not require planning permission provided that the following are met:

- Development is permitted only if the ASHP installation complies with the Microgeneration Certification Scheme Planning Standards (MCS 020) or equivalent standards.
- The volume of the ASHP outdoor compressor unit (including housing) must not exceed 0.6 cubic metres
- Only the first installation of an ASHP would be permitted development, and only if there is no existing wind turbine on a building or within the curtilage of that property. Additional wind turbines or ASHP at the same property requires an application for planning permission
- All parts of the ASHP must be at least one metre from the property boundary
- Installations on pitched roofs are not permitted development. If installed on a flat roof all parts of the ASHP must be at least one metre from the external edge of that roof
- Permitted development rights do not apply for installations within the curtilage of a Listed Building or within a site designated as a Scheduled Monument
- On land within a Conservation Area or World Heritage Site the ASHP must not be installed on a wall or roof which fronts a highway or be nearer to any highway which bounds the property than any part of the building

- On land that is not within a Conservation Area or World Heritage Site, the ASHP must not be installed on a wall if that wall fronts a highway and any part of that wall is above the level of the ground storey.

In addition, the following conditions must also be met. The ASHP must be:

- Used solely for heating purposes
- Removed as soon as reasonably practicable when it is no longer needed for microgeneration
- Sited, so far as is practicable, to minimise its effect on the external appearance of the building and its effect on the amenity of the area.

In order to run efficiently the ASHP should have a minimum of 30cm around the sides and rear and 1.5m of unobstructed space in the front.

Ground Source Heat Pumps

Ground source heat pumps use heat from the ground to warm a building. A pipe is laid either in shallow trenches or in a deep bore hole. A refrigerant is passed through the pipes which collects heat from the ground. The pipes feed into a heat exchanger in the building, which is usually the size of a domestic appliance or floor mounted boiler. Ground source heat exchangers can provide heat at low temperatures. In the summer, some heat exchangers provide cooling.

Ground source heat pumps can connect to existing wet heating systems and are effective all year round. The equipment is simple and well established but can be difficult to install retrospectively. There are generally no visible external changes or nuisance issues but underground works can damage archaeology. In areas where archaeology may be present advice should be sought.

In most instances ground source heat pumps is considered permitted development. The exception to this may be where you live in a listed building or in a conservation area.

Heat Pumps Local Case Study: St John’s Church in Yealand

Figure 14: St. John’s Church which serves the communities of Yealand Conyers, Yealand Redmayne and Yealand Storrs has installed a range of renewable energy technologies and provides an excellent example of the ways in which heritage assets and renewable energy supplies are compatible. Image from: https://www.achurchnearyou.com/church/11654/

St John’s Church in Yealand installed two ASHPs in 2016. They use air-to-water systems and replaced twelve 3kW immersion heaters. The Church previously did not have a thermostatic control, which was highly inefficient in conjunction with the immersion heater system. Now, the Church is consistently kept at a reasonable temperature, is always comfortable, and kept at a minimum of 14°C. With the Renewable Heat Incentive, they received £1600 in payments from the Government in 2019, which paid one third of their energy bill.

Biomass

Biomass refers to any material of biological origin (including wastes) which is used as a fuel for bioenergy (conventional combustion, gasification, energy from waste and low-carbon fuels like hydrogen) or in products (such as chemicals, bioplastics and timber for construction). Plants, as a biomass, store energy from the sun in their branches, trunks, leaves and roots. Domestically, this biomass can then be burned in boilers for the uses of space heating and hot water.

When burned, biomass fuels release the amount of carbon dioxide that they absorbed when growing. Therefore, biomass fuel is only sustainable if more trees are planted to replace the ones being harvested.

Each year, approximately 8.5 million tonnes of wood goes into landfill in the UK; this waste wood could be used in either biomass boilers. Biomass boilers can use logs, wood chips, or wood pellets.

Biomass boilers qualify for the Renewable Heat Incentive providing that the biomass fuel is sourced from a supplier of sustainable biomass on the Government's Biomass Suppliers List.

Biomass systems require flues. In many cases installing a flue on non-domestic land as part of a biomass heating system, is likely to be considered permitted development with no need to apply to the council for planning permission. There are, however, limits which must be met to benefit from the permitted development rights:

- The capacity of the system must not exceed 45 kilowatts thermal
- Only the first installation of a flue as part of either a biomass heating system or a combined heat and power system will be permitted development. Further installations will require planning permission from the local authority
- The flue must not be more than one metre higher than the highest part of the roof, or the height of an existing flue which is being replaced, whichever is the highest
- Permitted development rights do not apply to installing flues on listed buildings, within the grounds of a listed building, or on a site designated as a scheduled monument.

The Government is aiming to produce a new Biomass Strategy in 2022.

Solar Thermal

Solar thermal technology collect sunlight and convert it to heat. Heat is generated through solar panels mounted on roof tops. The panels are made up of a series of pipes containing a mixture of water and antifreeze. The panels absorb the suns heat which is then absorbed by the fluid. This is then collected and pumped into a heat exchanger located within the water tank. The heat from the exchanger is then used to heat water inside the tank providing hot water.

The solar thermal system is typically isolated from the rest of the plumbing system, due to the presence of antifreeze to prevent damage to the panels during the winter.

A conventional boiler or other heat source may be required to 'top up' the water temperature during the cooler months.

As with PV technology most solar thermal schemes will benefit from permitted development provided:

- Panels are not installed above the highest part of the roof (excluding the chimney) and should project no more than 200mm from the roof slope or wall surface.

- Panels are not installed on a building that is within the grounds of a listed building or on a site designated as a scheduled monument.
- The building is in a conservation area, or in a World Heritage Site, panels must not be fitted to a wall which fronts a highway.

Solar Thermal Local Case Study: Lancaster Cohousing

Figure 15: Solar thermal panels on the roof of the Halton Mill. Photo credit: Lancaster City Councl Planning Team

Lancaster Cohousing's 40kW solar thermal system operates on a glycol mixture and has a drain-back system to prevent over heating or discharge of solar thermal transfer fluid. The solar thermal system is designed to input thermal energy into the water entering the biomass boiler which provides district heating to 41 homes part of Lancaster Cohousing and commercial tenants in the Halton Mill.

Local Case Study: Maximising Renewables On Site at Jackdaw Quarry

Figure 16: A property at Jackdaw Quarry with a range of renewable electric and thermal energy sources. In the image is solar thermal at the top left of the roof, solar PV to the right, and an air source heat pump on at the side the home. Photo provided by the owner.

The owners of one of the holiday chalets at Jackdaw Quarry have maximised the renewable potential of their property by including:

- 12kW installed capacity air source heat pump.
- 1.744kW installed solar PV
- 2.18 square meters of Solar Thermal panels providing approximately 65% of the home's yearly hot water supply

While the original design of the home already had some energy efficiency measures such as a green roof, underfloor heating and higher levels of insulation, the owners "wanted to be as green as possible and be as independent of fossil fuels as possible" so had the renewable technologies included during the build stage.

4.0 Macro-Renewable Energy Generation

What is macro-renewable energy?

The term ‘macro-renewable’ covers schemes with generation potential greater than 45kW for thermal energy and 50kW for electricity.

It covers a large number of technologies including wind farms, solar farms, energy from biomass and waste as well as hydropower and geothermal schemes. Whilst all schemes are encouraged it is recognised that each technology has its own individual elements and impacts which must be considered with not all types of technology suitable at every location.

Through the Local Plan review the Council are seeking to investigate current planning policy in relation to macro-renewable energy generation and identify ways in which macro-renewable energy generation might be encouraged, and deployment increased across the district.

Solar

Macro-renewable energy generation from solar is likely to be in the form of solar farms. Solar farms are large scale applications of solar PV systems across large areas of land comprised of interconnected panels positioned to harvest large amounts of solar energy at the same time. They vary in size, often between one and 100 acres, and are generally located on lower grade agricultural land, in rural areas or over land that may be unsuitable for other development such as capped landfill sites. Solar farms are designed for extensive solar energy generation that generally feed directly into the national grid, as opposed to individual solar panels which usually power a single home or building. As of 2015, there were 426 solar farms located in the UK.

As the District benefits from sizeable rural and agricultural land, there is much opportunity for large-scale solar power. Based on the average annual consumption of a household, for every 5 megawatts (MW) installed, a solar farm will power approximately 1,500 homes for a year. As of 2015, approximately 25 acres of land is required for every 5 MW of installation.

Solar farms generate electricity locally and feed into the local electricity grid. They represent time-limited, reversible land use and provide an increased, diversified and stable source of income for landowners. There are no moving parts, so assembly and maintenance is minimal. There is no by-product or waste generated, except during manufacturing and decommissioning. They have lower visual and environmental impacts than other forms of power generation.

However, as large amounts of land are required, there is the potential that they may destroy wildlife and agricultural lands if not planned carefully and correctly. Grid capacity must also be a consideration for large schemes. Other pre-application considerations are:

- The requirement for site levelling works
- The current land usage
- Ground maintenance needs
- The location of the temporary construction compound
- Soil stripping, storage and replacement
- Access tracks
- Security fencing/lighting
- Ground anchors
- Tracking and orientation
- Landscape/visual impact
- Ecology
- Historic environment
- Drainage, surface water run-off and flooding
- Glint and glare
- Community involvement and gain
- Airport safety
- Electricity generating capacity
- Duration of planning permission
- Visitor attraction/educational facility

In order to get approval for solar farms in the UK, a series of rigorous planning procedures must be passed, taking into account:

- The suitability of the site
- Any potential impact on the locality (will the presence of solar farms harm or endanger the environment, taking into consideration ecological as well as socio-economic factors)
- The relevant renewable energy targets

More specifically, information likely to be required includes:

- A location plan (1:1250 metric scale)
- A site/block plan (1:500 metric scale)
- Elevations
- Design and access statement
- A supporting statement
- Fencing specification and details (where applicable)
- Details of connection to electrical grid
- Details of any ancillary works or buildings proposed, including elevations
- An ecological assessment (where applicable)
- An Environmental Impact Assessment
- A landscape/visual assessment if the application site lies within, or would impact upon, an Area of Outstanding Natural Beauty; National Park or World Heritage Site
- A historic environment statement (where applicable)
- Impact assessment on agricultural land (where applicable)
- Flood Risk Assessment
- Completed ‘Electricity Generating Capacity’ form

- Construction Traffic Management Plan (CTMP)
- Application fee where required

Local case study for solar energy generation: Lancaster City Council Solar Farm at Salt Ayre

Figure 17: Lancaster City Council is currently building a solar farm as part of a Government Public Sector Decarbonisation Scheme project to help decarbonise the Salt Ayre Leisure Centre.

As part of a £6.8m a Government funded Public Sector Decarbonisation Scheme project to decarbonise the Salt Ayre Leisure Centre, Lancaster City Council is installing a solar farm on the adjacent disused and capped landfill site. The 1.3MWp of PV will provide energy directly to the leisure centre via a direct wire. Currently Salt Ayre Leisure Centre is the Council's single largest CO_2 emitter. When the solar farm is combined with the other renewable and energy efficiency measures being installed on site, the emissions will be reduced by 52% and displace well over 400tCO_2e per year. Combined with Ofgem's Renewable Energy Guarantees of Origin scheme for the remaining electricity supply the Salt Ayre Leisure Centre is effectively carbon neutral.

Wind energy

Energy is harnessed from wind through the use of turbines. The blades of the turbine are turned by the wind, which causes the axis to rotate. The axis is attached to a generator which produces direct current electricity. An invertor converts the direct current to alternating current electricity, that is used to power homes and businesses. The stronger the wind, the more electricity is produced.
The British Isles have one of the best wind power resources in the world. The best locations for onshore wind are nearer the coast or on hills; Lancaster District has both. Wind speed is also greater here during winter, when energy demand is highest.

There are two types of wind turbines:

- Horizontal-axis: Most commonly, they have three blades and operate 'upwind', with the turbine pivoting at the top of the tower so the blades face into the wind. Horizontal-axis turbines are the type that most people associate with wind turbines.
- Vertical-axis: Vertical-axis turbines come in several varieties. These turbines are omnidirectional, meaning they don't need to be adjusted to point into the wind to operate.

Land-based wind turbines range in size from 100kW to as large as several MW. Larger wind turbines are more cost effective, and when grouped together into wind farms, they provide bulk power to the electricity grid. Wind farms are often built on land that has already been impacted by land clearing and they coexist easily with other land uses, such as grazing or crops.

However, wind turbines are installations of a significant scale and must be sited in appropriate locations, particularly some cases may impact the noise and visual pollution in an area. Therefore, planning permission is required for macro-energy schemes.

There are several areas that wind turbine planning applications need to consider, including:

- Planning policy
- Design and access
- Landscape and visual impact
- Environmental impact assessment
- Cultural heritage and archaeology
- Ecology and ornithology
- Hydrology
- Noise
- Shadow flicker
- Transport and access
- Aviation and telecommunication links

It is important to work closely with stakeholder and the Local Planning Authority beforehand, to know precisely what information and the level of detail is required.

The map in Figure 17 demonstrates the areas designated by the City Council as suitable for wind energy (seen in blue).

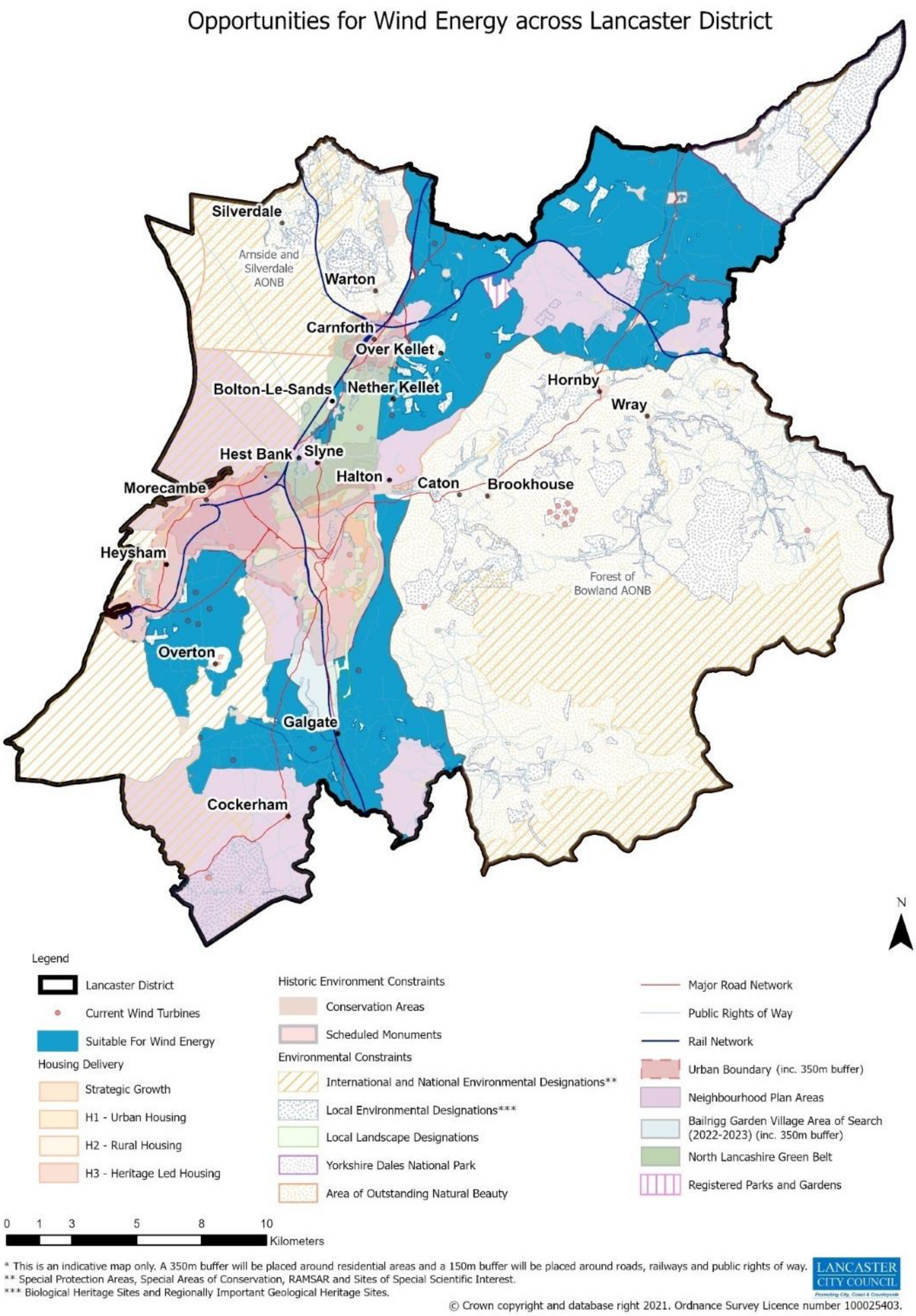


Figure 17: Opportunities for Wind Energy across Lancaster District Map

Local Case Study for Wind Energy Generation: Lancaster University

Figure 18: : Lancaster University's wind turbine at its Hazelrigg site to the east of the M6. Photo from and for more information see: https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/wind-turbine/

Lancaster University obtained planning permission for a 2.35MW wind turbine in April 2011, with construction commencing in February 2012. The turbine was operational in November 2012.

Annually the turbine:

- Produces an average of 4,400 MWh of electricity
- Approximately 15% of the campus electricity consumption
- Offsets approximately 2000 tonnes CO2e carbon emissions

This is the equivalent to supplying over 1500 average homes with electricity for one year.

Hydro

In 2012, 1.8% of the UK's electricity came from hydro. While a large proportion of that came from large scale hydro (5MW and above)[10], there is little national potential for further large-scale hydro-electric scheme development. However, there remains significant opportunity for tapping small-scale hydro potential.[11] Small-scale hydro schemes (100kW-5MW installed capacity) are an efficient, low-maintenance, convenient form of micro-renewable electricity generation which provides one of the cheapest sources of renewable energy per unit.[12] Small scale hydro systems have the benefit of an operational lifetime well over 25 years over which they incur low maintenance and running costs.

Figure 19: The low head, 190kW small scale hydro scheme at Abbeystead became operational in 2019. The scheme makes use of a reservoir and weir thought to date back to the mid-19th century to supply water to the mills along the Wyre. Picture from: http://www.ellergreen.com/hydro/portfolio-item/abbeystead/ For more information see: http://www.ellergreen.com/hydro/portfolio-item/abbeystead/ and https://www.forestofbowland.com/files/uploads/pdfs/hydro/hydro-site-7-abbeystead-reservoir.pdf

The installation costs for a small-scale hydro schemes are relatively low for the generation potential and can provide a good long-term investment. They also lend themselves well to community ownership. They have the highest efficiency of renewable energy sources, have potential to generate energy 24 hours a day, a slow rate of change in output and correlate well with demand (tend to have higher outputs in winter when there is greater use of heating and lighting).[13]

Damage may occur to the scheme from debris during flooding, however there are ways to protect the system which reduces this risk.[14] They do require regular maintenance and often environmental monitoring requirements. Hydro systems also have potential environmental impacts which must be taken into account. They range from affecting the visual amenity of a sight, altering flood risk, disturbing terrestrial and aquatic ecology, and affecting recreational activities.[15] However these schemes are physically small and generally 'run-of-river', using water as it is available and without the need for building reservoirs or dams. As such they generally have a low visual impact, low environmental impact, and low impact on the water course.

Due to its rich hydrological assets, there is significant potential for the installation of small scale-hydro schemes across Lancaster District. The Forest of Bowland AONB commissioned a "Micro Hydro Feasibility Study" which included small-scale hydro generation in 2011 which included not only the

[10] https://www.british-hydro.org/large-hydro/
[11] https://www.gov.uk/guidance/harnessing-hydroelectric-power
[12] https://www.british-hydro.org/small-run-of-river/
[13] https://british-hydro.org/
[14] https://energysavingtrust.org.uk/advice/hydroelectricity/
[15] https://british-hydro.org/

AONB but also parts of Lancaster District outside the AONB.[16] The Environment Agency also holds a dataset for 'Potential Sites of Hydropower Opportunity.'[17] These data provide an overview of potential sites where there is lower risk of environmental sensitivity to installation of hydro schemes. The dataset was last updated in 2015 and at site level has some error due to the mapping datasets. Throughout the District, there may also be additional sites where small-scale hydro schemes could be deployed that are not identified in the above.

Small-scale hydro schemes are not permitted development and planning permission will need to be sought regardless of the size of the scheme in most all cases. An exception to this is planning permission potentially may not be required for the refurbishment of an existing scheme providing there is no change in use. Where a planning application is required, the following factors will be considered:

For local planning permission factors that should be accounted for include impacts on:

- The landscape and visual amenity
- The historic environment
- The natural environment
- The water environment
- Recreation
- Noise levels
- Air and water quality

Building regulations apply to all aspect of the work. Schemes need to submit some form of environmental assessment in line with the Town and Country Planning (Assessment of Environmental Effects) Regulations 1998 for both planning permission and for environmental licences.

Additionally, for Planning permission to be granted, consultation and permission will need to be sought from relevant authorities. Small-scale hydro schemes will need to acquire an abstraction license from the Environment Agency. They will also need to consider impoundment and changes to flood risk. Additionally, environmental protection measures may be included in this permission such as building a fish pass or ladder.

The vast majority of hydro schemes will need to consult with or a acquire permission from a range of agencies due to the potential impact on the local ecology. An example of some of the various areas for consideration include: If there is the potential that the hydro may disturb the ecology of the site, such as through the removal of silt, advice and guidance from the Environment Agency and Natural England will need to be sought. If the site is within or could impact a protected site or area, consultation with Natural England will be needed. For Biological Heritage Sites, Lancashire County Council will need to be consulted. An ecological survey should also be conducted to ensure there is mitigated impact on natural habitats.

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[16] https://www.forestofbowland.com/hydro-projects

[17] https://data.gov.uk/dataset/cda61957-f48b-4b75-b855-a18060302ed1/potential-sites-of-hydropower-opportunity

Local case study for hydro energy generation: The Halton Lune Hydro

Figure 20: View of the Halton Lune Hydro. The cascade of water to the right of the turbine house is the fish pass. Volunteers help with regular fish trapping for health checks. Fish numbers are electronically counted. Photo from: LCC Planning Team

The Halton Lune Hydro is England's Largest Community Owned hydro scheme. Sitting just downstream of Crook O'Lune the Halton Lune Hydro uses two 100 kW Kaplin turbines to produce over 750MW of energy per year (enough energy to power over 300 homes) and displace approximately 500 tonnes of carbon per year.

The Hydro was built largely on volunteer hours from people in the local community. The £1.72m build cost was funded through grants and a community share offer with a 20-year payback time. It also benefits from feed-in-tariffs.

The scheme is managed by both paid and volunteer labour. It relies on regular volunteers to assist with the fish trapping and also project based volunteers to help with maintenance particularly following flood waters.

One of the benefits of the project is that the surplus income that is generated goes to the Halton Lune Trust a registered charity which provides grants to provide public benefit in the Halton with Aughton Parish. This provides a renewable source of grant funding for local projects and is administered by local trustees. In 2021, £13,760 went into the Community through the Trust and this is expected to rise to £50,000 per year by 2031

For more information about the Halton Lune Hydro see: http://haltonlunehydro.org/

For more information about the Halton Lune Trust see: http://www.haltonlunetrust.org.uk/

Chairman's report: http://haltonlunehydro.org/wp-content/uploads/2020/03/Chairmans-AGM-2020-Hydro-Report.pdf

Combined Heat and Power

Combined heat and power (CHP) systems utilize a highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process. By generating heat and power simultaneously, through using gas or biomass as a fuel, CHP can reduce carbon emissions by up to 30% compared to the separate means of conventional generation via a boiler and power station. The heat generated during this process is supplied to an appropriately matched heat demand that would otherwise be met by a conventional boiler. CHP systems are highly efficient, making use of the heat which would otherwise be wasted when generating electrical or mechanical power. This allows heat requirements to be met that would otherwise require additional fuel to be burnt.

For many organisations, CHP is the measure that offers the most significant single opportunity to reduce energy costs and to improve environmental performance with existing users of CHP typically saving around 20% of their energy costs. Macro-CHP can be used in large-scale non-domestic buildings, such as schools, hospitals, offices, or alternatively in a district heating network for multiple domestic dwellings.

There are two types of CHP systems:

- Packaged: These are designed and supplied as complete units that are either connected to or added to a building's existing electrical and heating system. They are available in sizes ranging from 50kWe to over 1MWe generating capacity.
- Custom: These are designed to be integrated into a site's utilities and services. Being larger than packaged CHP systems, they are typically between 1MWe and hundreds of MWe of electrical generating capacity.

The UK Government is supportive of the use of CHP systems. CHP Focus is a Government initiative, which supports the development of CHP in the UK. It supports the development of CHP by providing information, education and online tools that assist CHP developers. It does this by offering a helpline service, a CHP Site Assessment Tool, the UK CHP Development Map, a CHP Scheme Database, a range of CHP developer guides, a series of CHP case studies and through CHP outreach events. The developer guides include guidance on project development, environmental considerations, finance, and more. It also provides information on the financial benefits the technology receives, such as a climate change levy exemption, and support from feed-in tariffs for systems that consume renewable fuels.

Installing a macro-CHP system in a non-domestic building, such as supermarkets or factories, will require planning permission, unless contained within an existing site building. Therefore, issues relating to access, visual impact, noise, construction activity and so forth, will need to be addressed in the planning application. Much larger commercial scale CHP plants may also require authorisation from the Environment Agency regarding emissions and wastes; in particular, larger plants installed within urban areas will need to demonstrate that they are not causing breaches of air quality standards and targets.

Local case study for combined heat and power: Lancaster University

Figure 21: Lancaster University Combined Heat and Power System. Phot from and for more information see: https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/combined-heat-and-power/

Lancaster University has been running a gas fired CGC-2000CS-072-NG-50-500 CHP since February 2012. It is rated at 5452 kW input, 2000 kW electrical output and 2248 kW thermal output. It provides heat and power to the University's student residences, offices and lecture theatres on the Campus.

The CHP supplies over 20% of the University's annual electricity consumption. Carbon emissions from electricity produced by the CHP are approximately half of those from electricity taken from the grid, whilst the cost of electricity from the CHP is significantly lower than that from the grid. The CHP reduces the University's carbon emissions by approximately 2,800 tonnes CO2e per year. The CHP alone reduces energy costs by about £750,000 per year with plans to increase capacity which will lead to yearly savings of approximately £1.3m.

A planned shutdown of the district heating system takes place from 1 June to 20 September each year to facilitate statutory inspection examinations and essential maintenance. The CHP is turned off during the summer months as part of this review.

At current annual rates the system:

- Produces approximately 7243 MWh of electricity
- Produces 20% of the campus electricity consumption

This is the equivalent to supplying 2498 houses with electricity for one year; based on a medium Profile Class 1 usage.

- Produces approximately 7243 MWh of heat
- Produces 34% of the campus heating demand on the district heating network

The system is currently being optimised and should soon produce 135 MWh of heat per year or enough to heat for more than 1200 homes.

Biomass

Biomass boilers are a low-carbon and renewable energy source which burn biological plant material – predominantly wood – to generate heat. Biomass can be used to heat spaces and water for homes, businesses and communities and can replace existing coal, gas or oil boilers.

Macro-biomass boilers can be used to supply and distribute heat to a number of homes in a district heating network, or to commercial or industrial buildings. The systems are often housed in their own buildings or in special boiler rooms, with the hot water piped underground, via insulated pipes to the buildings that require heat.

Large scale biomass systems may require a large, dedicated space. However, they can be housed outside or in an external building, provided there is a sufficient access for fuel; most large-scale units have large hoppers and fully automated fuelling systems that draw the biomass from large stores nearby.

Biomass boilers can reduce costs, alongside emissions. For example, a macro-biomass heating system producing around 450MWh of heat per year, can cut heating costs by 50% over oil (24,000ltrs) and reduce CO_2 emissions by 95 tonnes per year. There is the additional financial benefit of receiving payments from the Renewable Heat Incentive providing that the biomass fuel is sourced from a supplier of sustainable biomass on the Government's Biomass Suppliers List.

The Government aims to ensure that biomass used for energy is sustainable, therefore it should deliver real greenhouse gas savings, be produced in a way that does not give rise to deforestation or degradation of habitats or loss of biodiversity, and is cost effective. As a result, Since 1 April 2011, biomass electricity generators over 50KW have been required to report on their sustainability.

The Government is to provide £4 million in investment of biomass projects, aimed at increasing the production of sustainably sourced biomass in the UK, thus are interested in supporting the development of biomass. The Government is also developing a biomass strategy, with evidence being collected as of June 2021.

A larger biomass boiler does not require planning permission if it is installed in a pre-existing space, with the exception of regulations regarding flues. To be considered permitted development, flues on the rear or side elevation of the building must be a maximum of one metre above the highest part of the roof. Listed buildings and conservation areas may require further permissions. Furthermore, any permanent structure built to house a larger biomass boiler will require planning permission.

Local case study for biomass: Lancaster University

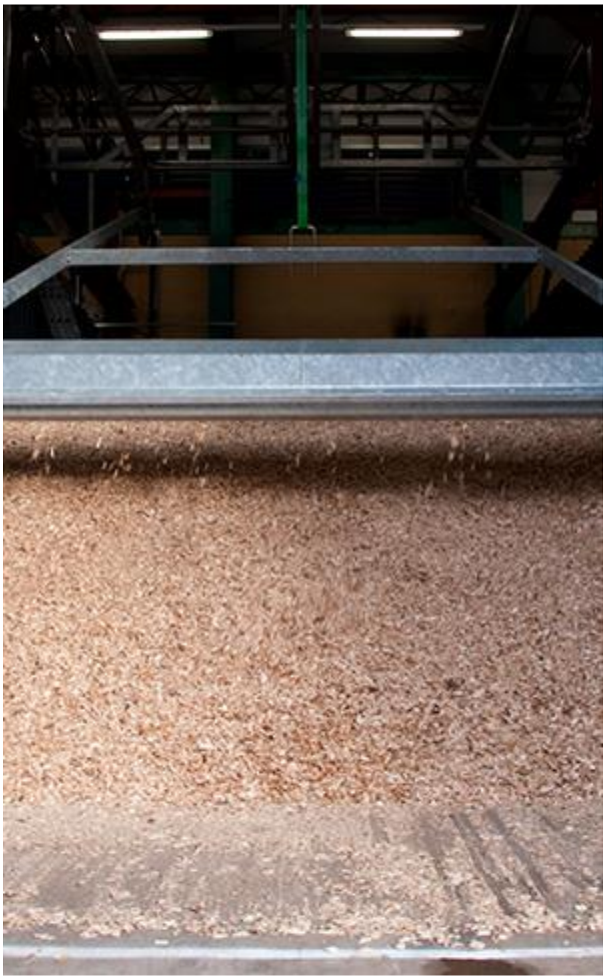

Figure 22: The biomass fuel for Lancaster University's biomass boiler. Photo from and for more information see: https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/biomass-boiler/

Lancaster University installed a biomass boiler in July 2012 which became operational in January 2013. The 0.99MW Schmid UTSR-1200 biomass boiler burns wood chips to generate heat, which feeds into its district heating system. The wood chips are sourced from local commercial forests within 30 miles of the University. These forests are replanted following harvesting and managed on a long-term sustainable basis. The system currently produces 1750 MWh of heat annually or 6% of the campus's heating demand

A planned shutdown of the district heating system takes place from 1 June to 20 September each year to facilitate statutory inspection and essential maintenance.

Geothermal energy

Geothermal energy is the heat that comes from the sub-surface of the earth. To produce power from geothermal energy, wells are dug deep into underground reservoirs to access steam and hot water, which can then be used to drive turbines connected to electricity generators. There are three types of geothermal power plants:

- Dry steam: The oldest form of geothermal technology which takes steam out of the ground and uses it to directly drive a turbine.

- Flash: These use high-pressure hot water from deep inside the earth and convert it to steam to drive generator turbines. When the steam cools, it condenses to water and is injected back into the ground to be used again

- Binary: These pass hot water through a secondary liquid with a lower boiling point, which turns to vapour to drive the turbine.

Geothermal energy also has the potential to provide heating and cooling needs. These schemes would exist on a large scale, working in a district heating network; please see the 'District Heating and Cooling' section.

Geothermal energy is a much more reliable source of renewable energy than solar or wind, as it does not fluctuate in the same way. There is huge potential for using this flexible resource, but it requires a high capital cost. The Department of Energy and Climate Change estimate deep geothermal could provide between 1 and 5 gigawatts of renewable electricity by 2030.

Once a suitable site has been identified, there are numerous considerations in determining the outcome of planning applications, including but not limited to:

- Exploratory works
- Noise pollution
- Water pollution
- Seismic activity
- Landscape and visual impact
- Design and access

Figure 23: Drilling rig at United Downs project site, Cornwall. The Power Purchase Agreement with Ecotricity will see a minimum of 3MW of baseload electricity produced by the UK's first deep geothermal power plant distributed to Ecotricity's customers via the National Grid. Geothermal Engineering Limited, the constructors and operators, are also looking into the possibility of Lithium and other mineral extraction from the deep geothermal water. Source: GEL Ltd.

Energy from Waste

Energy can be recovered from waste using a range of technologies including anaerobic digestion, incineration and gasification. With the increasing need to constructively manage waste streams these options are seen as a way to divert waste from landfills and exploit it for energy. It is with some caution that these technologies are included in this paper. They are considered low carbon as they produce lower greenhouse gas emissions than putting waste into landfills and displace fossil fuel alternatives. Ofgem classifies them as renewable technologies. However, they are still heavy greenhouse gas emitters, have higher emissions than the current National Grid average, and may end up emitting more greenhouse gasses than landfills, as the percentage of materials contained in a particular waste stream (being flows of specific waste, such as plastic, from its source through to recovery, recycling or disposal) changes with reductions in plastic use, especially for incineration. Climate is the focus of this review so wider benefits of landfill diversion are not included.

Anaerobic Digestion

Anaerobic digestion is the process by which organic matter such as animal or food waste is broken down to produce biogas and biofertiliser. This process happens in the absence of oxygen in a sealed, oxygen-free tank called an anaerobic digester. The biogas naturally created in the sealed tanks is used as a fuel in a CHP (combined heat and power) unit to generate renewable energy i.e. electricity and heat.

Anaerobic digestion is recognised by the Government, Defra, the Welsh Assembly, the Scottish Parliament, Friends of the Earth and the National Farmers Union as one of the best methods for food waste recycling and dealing with farm waste and sewage sludge. Every tonne of food waste recycled by anaerobic digestion as an alternative to landfill prevents between 0.5 and 1.0 tonne of CO2 entering the atmosphere[18].

Since the publication of the Anaerobic Digestion Strategy in 2011, anaerobic digestion growth has been supported by measures such as feed-in tariffs and renewable heat incentives. The number of facilities using food waste or farm waste in operation since then has increased from 63 to 420 in 2017, and energy recovered from anaerobic digestion increased from 713 GWh in 2013 to 2,470 GWh in 2017. Anaerobic digestion also produced 3,500 GWh of heat in 2017. WRAP has estimated that UK food waste sent to anaerobic digestion facilities produces 1,000 GWh[19], enough to power 1 million homes for over one month[20]

Energy Recovery Facilities

Waste incineration for energy has a long history in England. The first was the 'Destructor' built in Nottingham in 1874 and from there they took off powering steam engines, pumping sewage and

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[18] http://www.biogen.co.uk/Anaerobic-Digestion/What-is-Anaerobic-Digestion

[19] WRAP (2017) Estimates of Food Surplus and Waste Arisings in the UK. http://www.wrap.org.uk/sites/files/wrap/ Estimates_%20in_the_UK_Jan17.pdf

[20] Ofgem (2006), Electricity generation: facts and figures https://www.ofgem.gov.uk/data-portal/electricitygeneration-mix-quarter-and-fuel-source-gb https://www.ofgem.gov.uk/ofgem-publications/76160/13537- elecgenfactsfspdf

providing generated electricity.[21] Following a landfill lull, waste incineration is on the rise and has doubled since 2012 in England.[22,23]

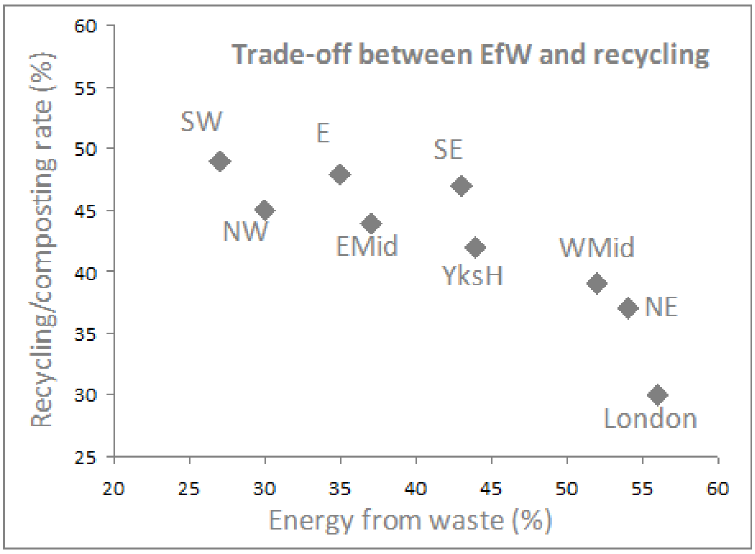

Figure 24: The relationship between recycling and waste incineration in England. Increased rates of incineration are correlated with decreased rates of recycling. The data highlights the need to carefully deploy incinerators in a way which does not reduce recycling rates. Data from Defra and cited in: http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidence document/housing-communities-and-local-government-committee/implications-of-the-waste-strategy-for-local-authorities/written/103388.html

Incineration can be used positively to recover energy from waste. Energy recovery is a technology that sees non-recyclable waste burned at high temperatures under carefully controlled conditions to produce electricity and/or heat. The process is extremely efficient, robust and safe, with emissions treated to meet the stringent European Industrial Emissions Directive, which is strictly enforced and monitored by the relevant regulatory authority. In England, this is the Environment Agency (EA).

A caution which cannot be ignored is that in Local Authority areas with energy from waste facilities, rates of recycling and composting drop (see Figure 24).[24] Addressing the climate and ecological emergency will require increased levels of recycling to avoid emissions and environmental impacts associated with virgin materials. In the event that an ERF is built in the District, the Council must take extra care to ensure that recycling is still prioritised, and rates do not drop. Also, while EfW plants are low carbon, with current grid decarbonisation, emissions from waste incineration accounted for 13% of all energy associated greenhouse gas emissions in 2020, despite representing only 2.4% of energy produced.[25]

UK waste policies identify the need for new recycling and recovery infrastructure, and support the use and creation of energy recovery facilities (also known as Energy from Waste Plants). As a result, the proportion of local authority collected waste going to Energy from Waste (EfW) plants increased

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[21] https://web.archive.org/web/20181126182428/https:/www.ciwm.co.uk/Custom/BSIDocumentSelector/Pages/DocumentViewer.aspx?id=QoR7FzWBtitMKLGdXnS8mUgJfkM0vi6KMAYwUqgqau3ztZeoed%252bsdmKIqDzPOm8yAXgBZR%252fn1fYhL%252bTNdjUq9g2xwY63C2g8GcAQQyfpf3SImIrrED%252bTfsUM91bKsogr

[22] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966114/Statistics_on_waste_managed_by_local_authorities_in_England_in_2019v3_accessible.pdf

[23] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/255610/Statistics_Notice1.pdf

[24] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/housing-communities-and-local-government-committee/implications-of-the-waste-strategy-for-local-authorities/written/103388.html

[25] https://www.theguardian.com/environment/2020/nov/16/increase-in-burning-of-plastic-driving-up-emissions-from-waste-disposal

from 9% in 2000/01 to 41% in 2017/18[26]; there are approximately 40 EfW plants in England. There are different types of technology that can be considered an EfW plant, such as Gasification or Pyrolysis.

Figure 25: The UK's largest gasification plant in Cheshire. The plant burns waste wood and has the capacity to produce 21.5MW of electricity or enough to power 40,000 homes. It expects to divert 65,000 tons of CO_2 per year. Photo and for more information see: https://bioenergyinfrastructure.co.uk/site/ince-bio-power/

The Heat Networks Investment Project can financially support the development of EfW's operating as CHP systems, and it is available until 2022.

An EfW plant proposal is likely to consist of the following:

- A main combustion plant building incorporating emissions abatement technologies, electricity generation units, a cooling assembly (variety of types and methods) and chimney stack(s);
- Buildings necessary for fuel reception, storage, sorting and pre-treatment facilities; and
- Ancillary plant such as an electricity substation, civil engineering workshops and offices.

Some development proposals may also incorporate additional features such as waste transfer facilities. Additionally, where EfW proposals for mixed waste incineration include material of animal origin, applicants may require ancillary development in order to comply with the requirements of the Animal By-Products Regulations 2005 (S.I. 2005/2347).

Some application considerations include:

- Grid capacity
- Transport infrastructure capacity/requirements
- Heat network capabilities
- Carbon capture readiness
- Nationally recognised designation area impact
- Visual and landscape impacts
- Noise impacts
- Generation capacity
- Water quality impacts
- Environmental Impact Assessment, including air quality
- Viability
- Feasibility

[26] UK Government services and information (2018) https://www.gov.uk/government/statistical-data-sets/env18- local-authority-collected-waste-annual-results-tables

Local case study for energy from waste: the proposed Veolia Energy Recovery Facility at Heysham

Figure 26: The proposed energy from waste facility being proposed by waste firm Veolia. Image from: https://www.placenorthwest.co.uk/news/heysham-energy-from-waste-plant-secures-consent/

Veolia's energy from waste facility (EWF) in Haysham was approved unanimously by Lancashire County Council in 2019 and is planned to be built on 10 acres of industrial land off of Imperial Road in the Haysham Gateway area. It will annually incinerate 330,000 tons of non-hazardous household and commercial waste from across Lancashire to run a steam turbine with a capacity of 33MW of electricity or enough energy to power 60,000 homes. Fichtner Consulting, who provided the Carbon Assessment for the proposed facility, calculates that once operational the facility will displace 32,802 tonnes of carbon equivalent emissions per year.

Approval for the facility includes £145,000 Section 106 contribution for local active travel infrastructure which will additionally support the offsetting of the emissions the plant does produce. The EWF also supports the creation of lower carbon jobs through the provision of 45 full time posts.

The EWF will have the potential to provide as much as 5 MW of thermal energy as heat. However, while the Facility will be constructed to be CHP ready, due to viability concerns it will not provide district heating initially. Planning permission includes a heat pipe along Imperial Road to help support future heat export. In their Heat Plan prepared by Fichtner Consulting, it outlines that Veolia is committed to pursuing heat export in the future and contributing to further development work. In the event that this does occur, the export of heat could further contribute to reducing the Facility's carbon footprint.

For more information see: https://www.veolia.co.uk/heysham/proposals
See Planning Application LCC/2019/0021 at Lancashire County Council's planning application portal for the submitted plan:
https://planningregister.lancashire.gov.uk/Planning/Display/LCC/2019/0021

Pumped Storage hydroelectricity

Figure 27: A view over the under-construction Glyn Rhonwy Pumped Hydro project in Snowdonia. Once operational it will have an output of 99.9MW and storage capacity of 700MW. These utilise abandoned quarries. For more information see: https://www.snowdoniapumpedhydro.com/

Pumped-storage hydropower is a type of hydroelectric energy, that also provides energy storage. It is a configuration of two water reservoirs at different elevations that can generate electricity (discharge) as water moves down through a turbine and generator, some energy is utilised, the remaining energy pumps water (recharge) back to the upper reservoir. Pumped storage hydropower provides a dynamic response and offers critical renewable energy back-up during periods of increased demand by maintaining grid stability.

These are good to use as "batteries" for renewables and to smooth out production, they also are very responsive so can be used as back up during peak times or unexpected shortfalls. For example, the six generating units at the Dinorwig pumped hydroplant in Wales can achieve the maximum output of 1,728MW, from nothing, within 16 seconds. The units are fixed vertically within the mountain, where the huge generators – weighing at 445 tonnes each – can maintain maximum output for up to five hours.[27]

Figure 28: Pumped storage hydro using mineral rich fluids in pipes is an emerging technology. RheEnergise's high intensity hillside pumped storage hydro using a mineral-rich fluid which can create the same amount of energy using slopes half the size of systems using water. This opens the potential for deploying them in a much wider range of places and could be placed next to solar and wind schemes. The company has identified over 9,000 potential sites in the UK and hopes to have its first system operating in 2024. Image from: https://www.imeche.org/news/news-article/high-density-pumped-hydro-could-be-installed-on-thousands-of-small-hills For more information see: https://www.rheenergise.com/

There are many benefits of pumped storage hydropower. Pumped storage hydropower provides one of the few large-scale, affordable means for storing and generating carbon-free and low-cost electricity. Pumped storage is one of the most cost-effective utility-scale options for grid energy

[27] Dinorwig: A unique power plant in the north of Wales (power-technology.com)

storage, acting as a key provider of ancillary services. Alongside its almost instantaneous responses to changes in the amount of electricity flowing through the grid, pumped storage is an essential component of the electricity network for countries that have an aggressive renewables agenda, as is the case of the UK, and have the potential for developing this type of hydro projects.

District Heating and Cooling systems

District heating systems use a network of pipes to deliver heat from a place where heat is generated to multiple customers where heat is used. This is highlighted in Figure 24 below. The heat is typically in the form of hot water and is transported through a network of pre-insulated underground pipes. The heat may be generated in an energy centre using a range of technologies (for instance surplus heat recovered from an energy from waste facility or other industrial plant, water source heat pump, gas combined heat and power (CHP), solar thermal, biomass etc) and could change over time as lower carbon renewable heat sources emerge.

Buildings are connected to the heat network through a substation where the heat is metered. Buildings may have an associated energy centre which at times provides heat to the building, but at other times feeds into the building, but at other times feeds heat into the wider district heating network. As the district heating network expands, higher levels of efficiency and resilience are achieved through the incorporation of multiple heat sources supplying multiple and varying demands.

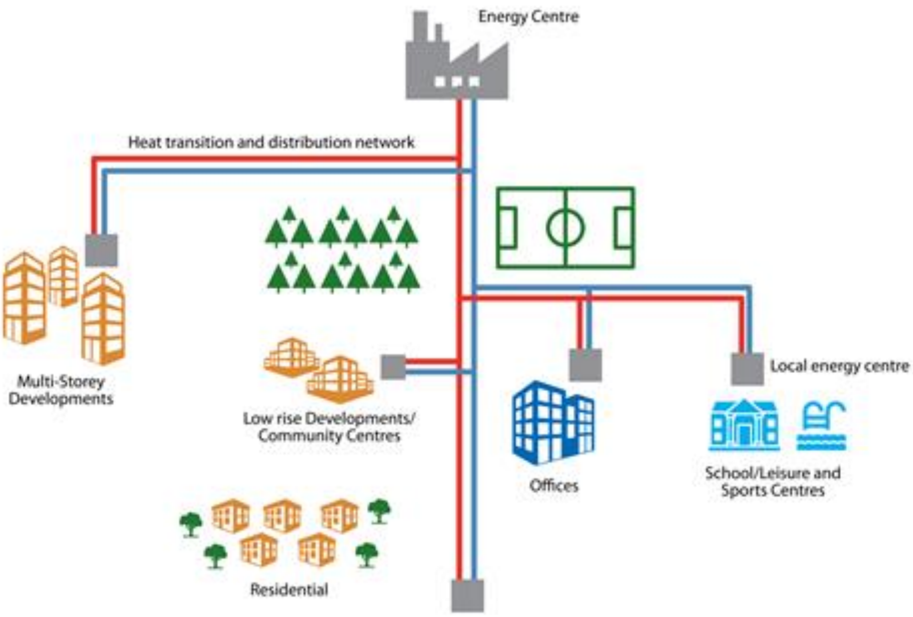

Figure 24: Diagram of a District Heating and Cooling Network (Source: Dundee CC 2018[4])

As the hot water from the energy centre is transported around the network, the water cools and then is returned to the centre. This cooler or cold water can provide cooling opportunities, particularly in warm weather, to assist in the cooling processes within energy efficient buildings.

Whilst the scope of district heating projects can vary considerably, the vast majority of heat networks in the UK are relatively small-scale; in which these elements are under a high degree of common ownership or control.

Modern district heating networks allow heat to be efficiently transferred for up to 30km from a single heat source. The pipe network infrastructure may also be combined with the provision of other utilities such as electricity and data. With multiple heat sources, district heating networks, such as those in continental European countries can be hundreds of kilometres long. In some northern European countries, more than 50% of the building stock is connected to a district heating system; in Copenhagen this figure is in excess of 95%.

District heating and cooling networks provide opportunities to improve efficiency in energy use, particularly with CHP systems, reduce emissions, address fuel poverty, use renewable and/or low carbon sources of heat, connect to new neighbourhoods and so forth.

The Government supports the development of heat networks through the Heat Networks Delivery Unit (HNDU), established in 2013 to address the capacity and capability challenges which local authorities identified as barriers to heat network deployment in the UK. Additionally, the Heat Networks Investment Project is delivering £320 million of capital investment support to increase the volume of heat networks built, deliver carbon savings for carbon budgets, and help create the conditions for a sustainable market that can operate without direct government subsidy.

In 2020, the Government established a consultation on building a market framework for heat networks, which set out measures to increase investment in the sector, proposals for giving heat networks equivalent rights and powers (such as undertaker or statutory access rights) compared with other utilities, proposals to drive decarbonisation of heat networks and use of waste-heat source. At the time of writing, the outcome of this consultation is unknown. As the regulatory framework and legislation around heat networks is actively developing, compliance with the Heat Trust standards should be expected for systems connecting to both domestic and commercial customers.[28] While, adherence to these standards is currently voluntary, it represents best practice and is a framework for ensuring consumer protection.

The Chartered Institute of Building Services Engineers produce a Code of Practice for Heat Networks which outlines the best practice process in terms of district heating feasibility, design, operation and maintenance for the UK.[29] Its focus is on delivering value for the end-users of the heat networks. It is best practice for heat networks providers to adhere to this code.

Element Energy and Sweco delivered a BEIS HNDU commissioned study on opportunities for district heating in Lancaster District in 2019. This study, '*Heat Mapping and Masterplanning in Lancaster*' provides the initial mapping of some potential areas where heat distribution networks could be deployed in the District. [30]

[28] https://www.heattrust.org/
[29] https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q3Y00000IMrmGQAT
[30] *Heat mapping and masterplanning in Lancaster.* June 2019. Led by ElementEnergy on behalf of BEIS Heat Network Delivery Unit.

Local Case Study: Lancaster University

Figure 29: Lancaster University's district heating is powered by a biomass boiler (left picture of wood chips used) and a gas powered combined heat and power engine (right). Pictures from: https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/biomass-boiler/ and https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/combined-heat-and-power/

Lancaster University's uses both a biomass boiler and a Combined Heat and Power Engine (CHP) to provide district heating across its campus. This combined system is key to the University's commitment to reaching net zero emissions by 2035. It also provides significant cost savings for the University. The CHP alone reduces energy costs by about £750,000 per year with plans to increase capacity which will lead to yearly savings of approximately £1.3m.

Biomass Boiler

The University runs a 999kW Schmid UTSR-1200 biomass boiler. The system currently produces approximately 1,750,000 kWh of heat per year, enough to heat more than 145 homes. Avenues are being explored for increasing its output. The biomass boiler delivers about 6% of the University's heat demand on the district heating network. Wood chips are sourced from commercial forests within 30 miles of the site which are managed on a long-term sustainable basis.

Combined Heat and Power

The CHP is a CGC-2000CS-072-NG-50-500. It is rated at 5452 kW input, 2000 kW electrical output and 2248 kW thermal output. It produces around 7,000,000 kWh of electricity per year and about the same in terms of thermal energy. The amount of heat produced could more than 580 homes. The CHP delivers approx. 34% of the heat demand on our district heating network. The system is currently being optimised and should soon produce 13,500,000 kWh of heat per year or enough to heat for more than 1200 homes.

For more information:

Biomass Boiler: https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/biomass-boiler/
Combined Heat and Power: https://www.lancaster.ac.uk/sustainability/low-carbon-technologies/combined-heat-and-power/

Local Case Study: Lancaster Cohousing

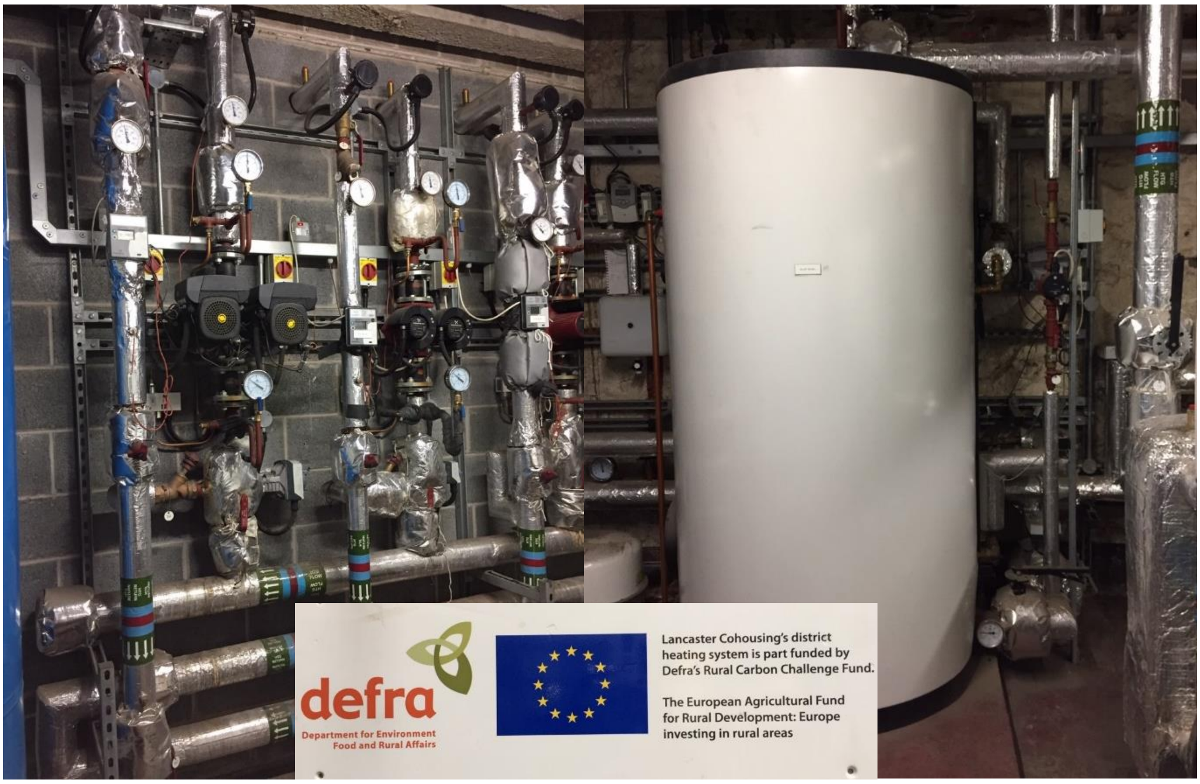

Figure 30: Lancaster Cohousing's district heating system provides heating and hot water to 41 homes which are part of the Cohousing development as well as the Halton Mill a low carbon co-working space. Photos from Lancaster City Council Planning Team

Lancaster Cohousing owns and operates a district heating system which provides both heating and hot water to the 41 Passivhaus homes, common house, children's playroom, guest rooms, and laundry in the cohousing development as well as the Lancaster Cohousing owned Halton Mill a shared working, art studio, and venue space.

The installation is comprised of a biomass boiler and solar thermal system which is backed up by three natural gas boilers to continue to provide continuity of service should the primary system be down or undergoing maintenance. The district heating is a key part of Lancaster Cohousing delivering on their commitment to be a low carbon development.

Solar Thermal

The 40kW solar thermal system operates on a glycol mixture and has a drain-back system to prevent over heating or discharge of solar thermal transfer fluid. The solar thermal system is designed to input thermal energy into the water entering the biomass boiler.

Biomass Boiler

A Herz Firematic 151kW wood chip boiler is used to heat a 5,000L buffer vessel which in turn supplies the district heating network via three pumped circuits. Woodchip is sourced from a local Ofgem accredited supplier who also regularly services and maintains the boiler to ensure it is operating efficiently. The biomass boiler provides on average 177,000 kWh of thermal energy to the district heating network and the system is registered under the government Renewable Heat Incentive (RHI) scheme.

For more information see: https://lancastercohousing.org.uk/

5.0 Deployment of Renewable and Low Carbon Energy

<u>Financial support</u>

Outside of the planning system there are several Government backed initiatives available to support the deployment of micro and macro renewable energy.

Smart Export Guarantee

Until April 2019 members of the public and business were able to access the Government's Feed in Tariff (FIT). This was available to schemes up to 5MW capacity and was designed to encourage smaller renewable electricity installations. Different technologies were given different amounts of support. The FIT guaranteed an income from renewable energy installations for 20 years (25 years for PV). Whilst this is now closed to new schemes, existing schemes are still receiving payment until the end of their 20/25-year contract.

The Smart Expert Guarantee was announced in January 2019 and is designed to replace the FIT. This pays households for the excess renewable electricity that they generate but do not use themselves. It covers the following technologies:

- Solar panels
- Wind
- Hydro
- Micro combined heat and power
- Anaerobic digestion

Individuals must sign up to an energy supplier to obtain this payment. These then set the tariffs that are paid and whether they are set at a fixed or variable rate.

Renewable Heat Initiative (RHI)

The Renewable Heat Incentive (RHI) supports renewable energy technologies that produce heat, rather than electricity. Similar to the FIT, the RHI is designed to compensate for the additional costs of using renewable heating technologies in place of conventional heating technologies. Technologies eligible to receive the RHI support include biomass boilers, ground-source heat pumps, air to water heat pumps and solar thermal panels. Introduced in April 2014 the RHI will be closed to new applications from March 2022. Those already signed up will continue to receive payments for 7 years.

Clean Heat Grant

In April 2020 the Government launched its proposals for the Clean Heat Grant, the successor to the RHI. The intention is that this will be targeted at households and small non-domestic buildings to support the installation of heat pumps and in certain circumstances biomass. The Clean Heat Grant is expected to begin in April 2022, with funding committed for two years, to March 2024. Further details will be announced after the analysis of the consultation which ended 5th March 2021. The proposal suggests a flat rate, £4000 grant for technologies eligible under the scheme.

Green Homes Grant

This is available to homeowners or residential landlords and can be used towards the costs of installing energy efficient improvements to homes, including the installation of low carbon heating. Applications must have been received by the 31st March 2021. The grant must be claimed, and the improvements installed and completed by the 31st March 2022. The grant covers two-thirds of the costs of the improvements, up to a maximum of £5,000.

Heat Networks Investment Project (HNIP)

The HNIP is available to the public, private and third sectors. It aims to increase the number of heat networks being built, deliver carbon savings, and help create the conditions necessary for a sustainable heat network market to develop. HNIP will provide £320 million of capital funding to gap fund heat network projects in England and Wales.

Public Sector Decarbonisation Scheme

The Public Sector Decarbonisation Scheme is delivered by Salix. Eligible applicants include, among others, emergency services, schools and nurseries, institutions providing further and higher education, NHS Trusts and Foundation Trusts and local authorities. Phase 1 closed on 11th January 2021. Phase 2 was opened to applications on the 7th of April 2021 however closed on 13th April 2021 due to the high volume of applicants. Phase 1 focused on the decarbonisation of heat and Phase 2 on whole building retrofit.

Council Initiatives

As part its climate change emergency declaration the City Council has pledged to be carbon zero in 2030. Following the declaration, the council is reviewing its capital programme to ensure that the repair and maintenance programmes for its housing stock are prioritised to reduce carbon. This includes opportunities to secure the installation of micro-renewable energy schemes where possible and appropriate.

Climate Change People's Jury

As part of the Climate emergency declaration, the Council agreed to convene a People's Jury. The Jury, made up of 28 members from across the district, was formed to examine the response to the climate emergency so far and produce recommendations that will be used to guide the future work of the council and a range of other organisations across the district. Specifically, the jury members were tasked with answering the question '*What do we need to do in our homes, neighbourhoods and district to respond to the emergency of climate change?*'

Following a series of meetings, the Peoples Jury have now made a series of recommendations. The recommendations relevant to the increased deployment of micro-renewable energy are highlighted below:

HOUSING

9) All new housing must:

- A) Have at least one of the following as green energy supply, direct to the property:
  - (a) Ground or air source heat pump or
  - (b) Solar panels. Roofs should be constructed so they are suitable for solar panels
- B) Have adequate drainage so they are suitable for solar panels
- C) Have hedges instead of fences (e.g. Halton co-housing) and greenspaces
- D) Be built to A/B energy performance rating
- E) Be constructed wit more suitable materials
- F) Any developer building new homes in the area should pay towards the retrofit of existing local properties, allocated for example, by a community lottery (a target could be applied to this to ensure consistent investment across developers).
- G) Green belt development should be avoided. Any houses built on green belt must be Passivhaus standard.

16) The Council should expand on existing plans (e.g. solar farms) to prioritise and invest in green energy sector industry and employment and encourage and incentivise (e.g. through planning) others to do so.

The Local Plan Review provides the opportunity to take forward and implement the above recommendations.

Installation of solar panels on sheltered accommodation

The Council has a target for all its housing stock to attain as a minimum a Band C SAP (Standard Assessment Procedure) rating by 2030. SAP ratings are calculated on a scale from Band A to G (Band A being the best performing and Band G the worst). Initial survey work indicates a typical rating for sheltered bungalows of band D.

The installation of solar powered PV panels to these properties offers the opportunity to increase their SAP rating to Band C, a small number could actually achieve Band B. Research shows that residents could achieve savings over a 3-year period ranging from £141 to £993 depending on the bungalow type.

Recognising these benefits, the Council is looking to redirect unspent HRA funds from its Capital Programme to pay for the installation of solar PV panels to 35 sheltered bungalows in the district.

Salt Ayre Leisure Centre (SALC)

To drastically reduce the Council's own corporate emissions, Lancaster City Council will install an array of solar panels on a former landfill site adjacent to Salt Ayre Leisure Centre. The purpose of this being to provide electricity to the leisure centre. The current energy consumption at SALC is 0.9GWh-1GWh per annum. The solar array will generate approximately 0.9GWh/pa.

In normal use, SALC produces 850 tonnes CO2e per annum (642 from gas and 208 from electricity). Once the solar array and air source heat pumps (replacing the gas system and CHP) are installed by 2022, the emissions from these measures should reduce by 52%; to around 408 tonnes CO2e per annum.

Current renewable energy deployment in the Lancaster District

Current renewable energy deployment in the district is reported in Table 2 below. This does not provide a breakdown into micro-renewable schemes. Table 2 reports a total installed capacity as of December 2019 in the district for 1,318 MW an increased from 1,194 MW in 2018.

The majority of this capacity comes from wind and solar energy. Onshore wind generation was responsible for over 68,000 MWh of electricity generation in 2019. The greatest generation came from offshore wind with this responsible for over 3,625,968 MW of electricity generation in 2017. It is notable that Lancaster District ranks 1st in the UK for the number of offshore wind installations.

Table 2: Renewable electricity overview in Lancaster District, 2019. Source: Department for Business, Energy and Industrial Strategy, 24th September 2020.

	Number of installations	Installed capacity (MW)	Generation (MWh)
Photovoltaics	1,445	20.1	19,616
Onshore wind	24	28.6	68,005
Hydro	3	0.4	1,072
Anaerobic Digestion	3	1.1	6,108
Offshore wind	6	1,327.00	3,625,968
Wave/Tidal			
Sewage Gas	1	0.9	3,495
Landfill Gas	2	3.2	12,417
Municipal Solid Waste	-	-	-
Animal Biomass-	-	-	-
Plant Biomass	-	-	-
Cofiring	-	-	-

TOTAL	**1,484**	**1,381**	**3,736,679**

With many schemes not requiring planning permission, determining the amount of energy and heat generated in the district by micro-renewables is difficult. An indication of current levels of deployment can be ascertained by national government statistics in relation to take up of the grants and tariffs discussed above.

Table 3 reports those schemes still receiving feed in tariff as of March 2019. This is the last time this data will be available following the closure of this tariff. A map showing the number of photovoltaic installations by Local Authority as of March 2019 is shown in figure 1. The map indicates lower levels of take-up when compared to other parts of the Country.

Table 3: Renewable schemes in Lancaster District receiving feeding tariffs (March 2019)

	Number of installations	**Installed capacity (kW)**
PV (domestic)	**1,364**	**5,848**
Wind (domestic)	**9**	**626**
Anaerobic digestion	-	-

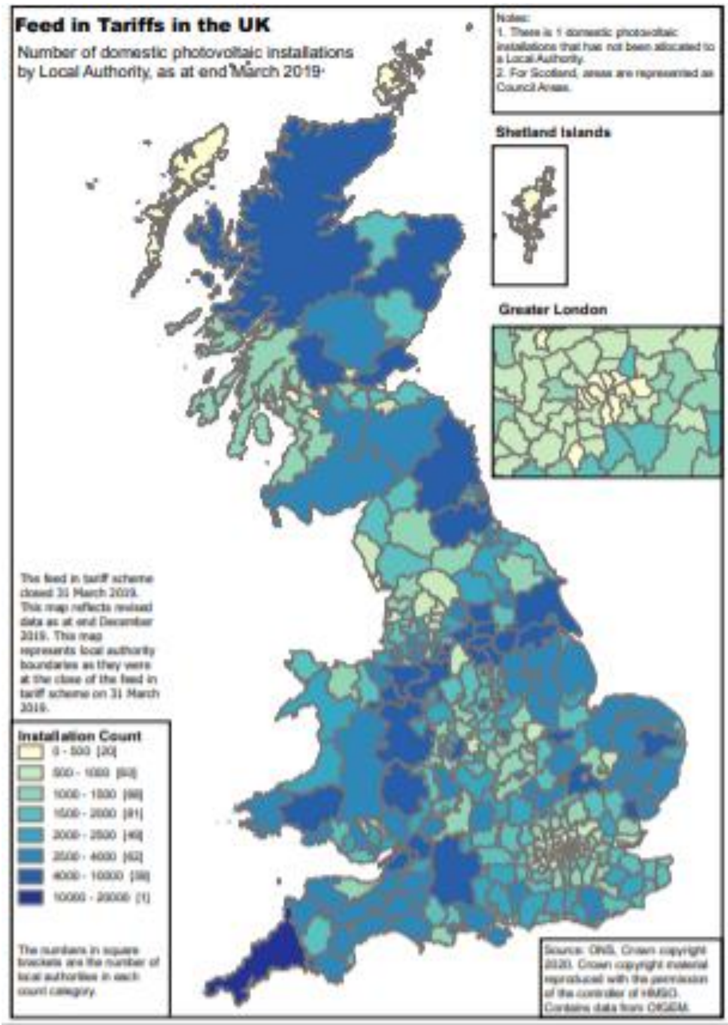

Figure 31: A map showing the installation count of renewable energy schemes which were receiving feed in tariffs as of 2019.

Figure 32 details the distribution of those micro-renewable energy schemes that have been submitted to the Council and approved since 2011. This provides further evidence on the distribution of schemes across the district with solar schemes to date representing the greatest uptake when compared to other technologies. It should be noted that whilst providing important information it is not a true representation of deployment with the data only showing schemes approved by the council, it does not show the many schemes that have been deployed through permitted development rights nor does it confirm that schemes have been implemented. Notwithstanding this it does still provide a useful source of evidence in understanding where technologies are being investigated and are potentially suitable.

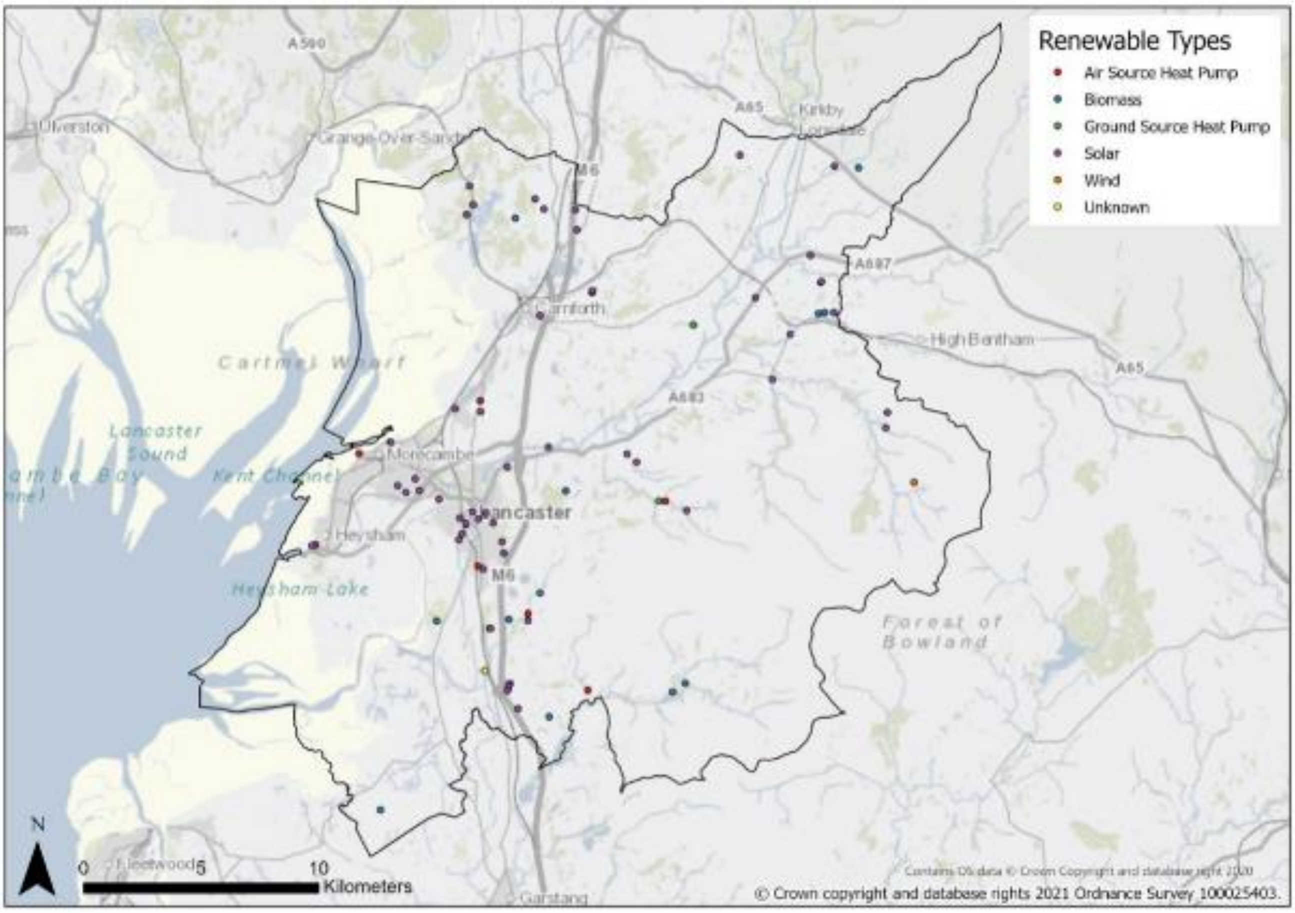

Figure 32: The distribution of those micro-renewable energy schemes that have been submitted to the Council for planning permission and were approved since 2011.

6.0 Moving Forward

The background paper confirms a strong commitment at a national level to reducing the CO2e emissions of new and existing development as well as maximising the potential for the increased deployment of renewable and low carbon energy where appropriate, through both positively worded policies and, where appropriate, the identification of suitable areas.

Whilst there remains an ability to set local requirements for micro-renewables the evidence base and direction of national policy both confirm that the focus should be on securing energy efficiency measures to reduce carbon (and fuel bills) with renewable energy installations to be encouraged where appropriate. A fabric first approach is considered to be the priority. Renewable energy technologies clearly have their part to play but only once improvements in the overall building fabric have been secured.

The efficiency of any technology is directly dependent on the robust efficiency of the fabric of the building in the first place. The installation of renewable energy technology on a poorly insulated and designed building for example will require more power from the technology, causing it to be inefficient in operation. A blanket on-site local renewable energy target is therefore not always appropriate.

The priority should be securing a fabric first approach supported by encouragement for micro-renewable energy schemes for both new and existing buildings. Whilst most schemes are now covered by permitted development rights the Local Plan Review must ensure that micro-renewable energy schemes continue to be encouraged where appropriate and that information is available to both the public and developers to allow and support further uptake. This includes information on the planning process and what funding might be available to support greater uptake. The preparation of a locally prepared guidance note covering these issues is one potential example of how this could be provided.

Whilst already supportive of micro-renewable energy there is the potential to raise further awareness through the Local Plan review to the opportunities for installation when purchasing a new property. One way to achieve this is to encourage developers to include provisions as part of the sales particulars for new properties allowing purchasers to pay for the installation of micro-technologies at the point of sale. Such a process would be like other add-ons that are agreed during the purchase of a new property such as floor types, kitchen units, etc. The cost would be fully absorbed by the purchaser with no extra cost to the developer. It would however ensure that the availability of micro-renewables is made aware to the purchaser at the outset and potential savings could be secured by ensuring installation as part of the construction of the property. Such an approach is already being investigated by developers but the encouragement of this in policy would further the opportunity to promote increased deployment within the district where there is a desire to do so.

As noted above the paper has also confirmed the continued need for a positively worded policy in relation to macro-renewable energy schemes. It confirms the need to offer support for schemes where local environmental impacts are acceptable. A positively worded policy remains key to this, providing support for schemes where appropriate. This is supported by the identification of suitable areas of search for wind energy, recognising the need to carefully balance wider landscape and environmental considerations with the increased deployment of this technology.

The background paper has confirmed the opportunities that micro and macro renewable technologies can play in securing the transition to a low carbon future. Their promotion and encouragement remain key to this. This importance is clearly recognised at a national level with the expansion of permitted development rights for most micro-technologies and the likely requirement for some form of micro-technology as part of building regulation strengthening showing a clear commitment to ensure greater uptake. The Local Plan review can add to this by securing increased awareness of the opportunities provided by renewable and low carbon energy through continuing to support deployment and the provision of additional information to the public on what opportunities exist.

Appendix 1

Table 4: Local Authority planning policy positions on carbon reductions in new development 2019 (information collected by the Passivhaus Trust, UK and assembled by Enhabit (2021) for the "Lancaster City Climate Emergency Review of the Local Plan").

Local Authority	Summary of policy	Status
Glasgow City Council	New residential buildings to be Passivhaus	Adopted
Bristol City Council	35% reduction in emissions and then the remainder offset. Passivhaus alternative.	Emerging - consultation stage (May 2019)
Exeter City Council	New council buildings to be Passivhaus	N/A
Norwich City Council	New council housing to be Passivhaus	N/A
Camden Council	Subject to London Plan	Adopted 2017
Lambeth Council	Subject to London Plan	Adopted 2015
Greater London Authority	35% beyond BRegs and the to Zero Carbon via offset	New London Plan is emerging (at EIP stage Apr 2019)
Reading Borough Council	Minimum 19% reduction in TER Major new housing should be a 35% reduction followed by carbon offset.	Emerging - at examination (May 2019)
Suffolk Coastal Draft Plan	20% reduction beyond Bregs	Emerging - at examination (May 2019)
Guildford Borough Council	20% beyond BRegs	Emerging - undergoing consultation (May 2019)
Bedford Borough	19% beyond BRegs	At examination (May 2019)
Brighton and Hove City Council	19% beyond Bregs. Passivhaus as an alternative to BREEAM	Adopted March 2016
Cambridge City Council	19% beyond Bregs.	Adopted Oct 2018
Greater Manchester Combined Authority	19% beyond BRegs	Emerging - undergoing consultation (May 2019)
Eastleigh Borough Local Plan	19% beyond Bregs. Flexibility use Passivhaus alongside BREEAM	Emerging - at examination (May 2019)
Havant Borough Council	19% beyond Bregs	Emerging - pre-submission (May 2019)
Ipswich Borough Council	19% beyond Bregs. Flexibility to use Passivhaus to demonstrate reduction is achieved	Adopted Feb 2017

Milton Keynes Council	19% beyond Bregs on site, another 20% via renewables/low carbon energy and the remaining emissions offset by payment	Emerging - at examination (May 2019)
Oxford City Council	19% Reduction from Bregs. Increasing 2026 and Zero Carbon by 2030	Emerging - submission stage (May 2019)

Exeter City Council initiative – EXESeed (Exeter Sustainable Energy Efficient Developments)

"The EXESeed Framework has appointed local small and medium sized building contractors as well as national building contractors. This will help the local economy and help provide employment opportunities for local people. The Framework will encourage contractors to create local apprenticeship opportunities creating additional benefit to the local economy. Exeter City Council would like to encourage other public sector bodies such as local authorities, universities and the NHS to use the Framework to provide access to building contractors committed to delivering low energy sustainable developments."[28]

Ashden: A toolkit for city regions and local authorities.[29]