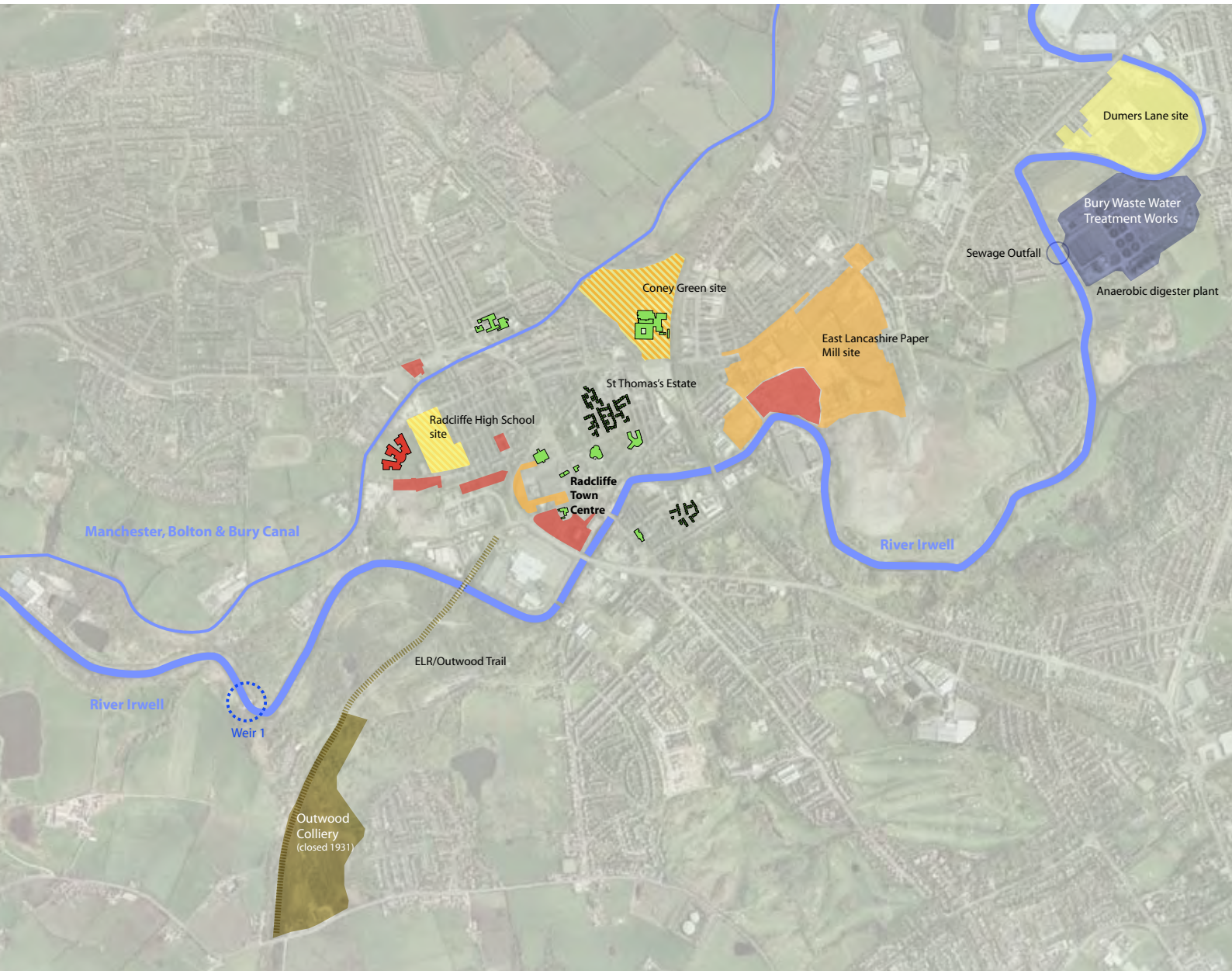
A report prepared for Bury Council by URBED and AECOM

Inner Radcliffe & Town Centre energy framework

March 2011



urbed AECOM

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This report was adopted by Bury Council as a non-statutory material planning consideration 24th March 2011. It was prepared by Nick Dodd, Paul Bower, Stephanie Fischer, Rob Young and John Sampson from URBED with support from Timothy Kay of AECOM.

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1. Introduction

In this section we provide a brief overview of the study aims and objectives, the scope of the work and the methodology used to develop the Radcliffe Energy Framework. We also describe the approach to carbon emissions modelling and spatial analysis.

1.1 Study aims and objectives

The overall aim of the study was to develop an evidence base to support local delivery of the Core Strategy DPD, as well as the Radcliffe Town Centre Masterplan (October 2010) and Re-inventing Radcliffe strategy (May 2004). The study explores and analyses how the town centre could plan for CO_2 reductions based on investment in decentralised, low carbon energy infrastructure.

The study set out to explore how development in Radcliffe town centre and the Inner Radcliffe area could respond to the zero carbon growth objective proposed by the AGMA decentralised energy study and Bury's new LDF Core Strategy energy policies. The potential to reduce Bury Council and business exposure to the Carbon Reduction Commitment (CRC) was also established as an objective.

1.2 Scope of the study

The scope of work undertaken to develop the framework was as follows, based on the AGMA decentralised energy study methodology:

- Identify and characterise future development in and around Radcliffe and the town centre, as defined by the Re-inventing Radcliffe report;
- Use assumptions of the quantum and mix of development to create a model of the projected energy demands and CO_2 emissions;
- Carry out a 'least cost' heat load mapping exercise identifying and characterising existing buildings, including those in public ownership;
- Identification of low/zero carbon energy supply technologies that could be retrofitted to developments currently underway;
- Identification of low/zero carbon energy supply technologies that could be implemented through a planned approach based on specified levels of % CO_2 reductions and/or decentralised energy network development;
- Outline a planning policy framework that could support Radcliffe's development, with specific reference to the Radcliffe Town Centre Masterplan, engaging with development managers in the Council to explore how the approach could be adopted and negotiated with commercial developers;
- Outline an approach to the use of 'allowable solutions' and the procurement of ESCo delivery mechanisms.

1.3 Methodology

The methodology for the study had two main elements – a carbon emissions model and spatial analysis layers. Data to populate the model and inform the spatial analysis was collected from the following sources between November 2009 and May 2010:

- Existing building energy audit: An energy audit of existing buildings in the town centre and the wider area was carried out in conjunction with the team involved with Re-inventing Radcliffe and the Town Centre Masterplan and with additional input from Six Town Housing.

- Future new development: A timeline of potential future development was characterised in conjunction with the team involved with Re-inventing Radcliffe and Radcliffe Town Centre Masterplan, with additional supporting information sourced from masterplans and planning applications.

- Energy resource scoping: Distinctive local sources of low or zero carbon energy in the wider area were investigated for their potential. This included wind energy, biomass wood fuel, sewage gas, hydroelectric and minewater geothermal.

- Follow-up research: Contact was made with United Utilities, the Environment Agency and the Coal Authority in order to scope in more detail the potential associated with the Bury wastewater treatment works, the former Outwood Colliery and hydroelectric from downstream weirs.

The findings from the modelling and analysis were then used to formulate proposals for the energy framework, including specific proposals to take forward strategic projects and to apply policies and targets to development sites. Indicative assessments of cost and viability were carried out using the approach set out in the AGMA decentralised energy study.

1.3.1 Carbon emissions modelling

A carbon emissions model was setup based on a combination of actual data, estimates and projections for buildings and development during four periods of time, taking into account regulatory milestones for carbon reduction (see Table 1.1 below). The four periods are as follows:

1. Existing buildings (as of 2010);
2. Committed developments (completion 2009/13);
3. Proposed developments (completion 2013/16);
4. Proposed future developments (completion 2016/21).

Where possible actual metered data was sourced for existing buildings. Where this was not accessible estimates were made using a combination of Gross Internal Areas and CIBSE energy benchmarks. For future new buildings projections were made based on the timescale for each development.

Table 1.1
Anticipated future Building Regulation CO_2 reduction targets

Year	CO_2 reduction target over a 2006 compliant building			
	Residential (public or subsidised)	Residential (private)	Non-domestic (public or subsidised)	Non-domestic (private)
2006	-25%	0%	0%	0%
2010	-44%	-25%	-25%	-25%
2013	Zero carbon	-44%	-44%	-44%
2016		Zero carbon	-100%	-100%
2018			Zero carbon	-100%
2019				Zero carbon

Emissions projections for future new buildings are based on the modelled performance of 20 indicative building types, the energy demand of these building types is then adjusted to comply with, as a minimum, Part L of the Building Regulations at future points in time, and to reflect the contribution of different selected energy technologies.

The model was used to estimate and project emissions for each building type, including the split of regulated and unregulated emissions. Unregulated energy use and carbon emissions were estimated using the National Calculation Methodology. This then allowed for a complete assessment of the emissions savings from the contribution of different selected energy technologies.

1.3.2 Spatial analysis

The spatial analysis was carried out using data generated from the Re-inventing Radcliffe and Radcliffe Town Centre Masterplan studies, as well as a review of the status of negotiations and planning applications associated with strategic sites. Potential future development and the possible timeline for completion were mapped onto a base plan, which was then used to explore the spatial relationships between existing buildings, projected development and near and off-site energy resources.

A wider spatial plan was created in order to locate near site and off-site energy resources. The National Wind Speed Database formed the basis for the wind opportunity scoping, overlaid with constraints obtained from Arup, Electricity North West and Ordnance Survey. The AGMA decentralised energy study provided an initial layer of information locating resources such as wastewater treatment works, collieries and hydroelectric sites.

1.3.3 Cost and viability

Technologies were selected based on the strategic energy resources available in the local area and the best fit for the scale and type of projected development for individual sites or groups of sites. The aim of the study was to identify options in each case that would:

- Support compliance with Building Regulations at that point in time,
- Support compliance with Bury's LDF Core Strategy energy policies which require a minimum of between 10% and 15% on site energy generation (depending on the building type),
- Provide lower cost options that would enable greater carbon reductions to be achieved but at lower cost, in line with the maximum targets outline in the LDF Core Strategy.

In order to compare different options a 'base capital cost' at 2009 prices of £392/tonne CO_2 for domestic buildings and £333/tonne CO_2 for non-domestic buildings has been used. These are based on the installation of micro-generation technologies to meet Bury's minimum LDF Core Strategy target. The equation used to calculate the cost per tonne of CO_2 saved is set out in Box 1.1

Consideration of the cost and viability of solutions was with reference to the AGMA decentralised energy study case study evidence base. This evidence base in turn informs the AGMA target framework which has been adoped into Bury's LDF Core Strategy.

Indicative costings were arrived at for distinct local energy opportunities based on a combination of yardsticks published by the Government and recent tender prices obtained by the consultant team on other projects.

Box 1.1

Equations required to calculate comparative costs and CO_2 reduction targets

Calculation 1: The cost/benefit of a proposed solution

C / (ST) = £ investment in energy infrastructure required per tonne of CO_2 saved

Where:
C = Capital cost of energy infrastructure
S = Savings of CO_2 emissions per annum from the energy infrastructure
T = Time over which the savings will be made

Calculation 2: The target to be applied

(B / N) M = Target % reduction in CO_2 emissions in addition to Part L compliance

Where:
B = Base capital cost in £ per tonne of CO_2 saved
N = New cost for site specific opportunity in £ per tonne of CO_2 saved
M = Maximum target to be applied to the application

2. Policy context

In this section we briefly review the national, regional and sub-regional planning policy context for decentralised and zero carbon infrastructure, and discuss how this has informed the approach taken by this study.

2.1 National energy planning policy

The PPS1 supplement Planning and Climate Change is one of the main drivers for this study. Whilst covering a broad range of spatial planning issues relating to climate change mitigation and adaptation, the main focus of the PPS is the creation of a policy framework to support delivery of the 'Building homes for a greener future' policy commitment to zero carbon homes, and future carbon reduction milestones for non-residential buildings.

The PPS1 supplement places a strong emphasis on the adaption of policies and targets to local opportunities, including the development of decentralised networks linking new and existing buildings, and describes a more pro-active 'criteria-based' approach to identifying opportunities for energy generation (as also covered in PPS22).

The European Union Renewable Energy Directive has driven new national targets for renewable electricity and heat. The UK's Renewable Energy Strategy which was published in 2009 sets out a target for 15% of our energy from renewables by 2020, broken down into a 35% target for electricity and 14% target for heat. Pro-active planning was identified as a key mechanism to achieve these targets.

The Home Energy Management Strategy (HEMS) was published in Spring of 2009. It responds to the EU Renewables Directive and UK Renewable Energy Strategy's emphasis on heat as well as electricity, and includes specific focus on the role of local authorities in planning for Combined Heat and Power (CHP) and district heating. It includes recommendations for the use of public buildings as 'anchor' loads for heating networks, and for the introduction of a new regulatory framework to direct investment in networks.

There is, however, a degree of uncertainty relating to the national and regional policy context. Following the election of a new Government in May 2010 a number of areas of policy have been abolished or are under review:

- The North West Regional Spatial Strategy (RSS) is to be abolished;
- A series of policy reviews are under way which includes a review of Planning Policy Statements 1 and 22;
- The extent to which the HEMS strategy is taken forward will become clearer following the Comprehensive Spending Review of October 2010.

The new Government has indicated that they intend to pursue a policy of 'localism' and that it will bring forward new policies, strategies and support for local action by Local Authorities and communities to tackle climate change. This is likely to include new energy infrastructure and community ownership of renewable energy projects.

2.2 Manchester City Region and the 'Low Carbon Economic Area'

This study is directly informed by the findings of the AGMA 'decentralised energy and zero carbon' energy study. The AGMA study sought to provide an evidence base for a sub-regional response to national and, at the time, regional planning policy guidance.

The study proposed a framework of planning policies and targets that could be adopted by each of the ten districts of Greater Manchester. Bury has responded by incorporating new energy policies into its draft LDF Core Strategy.

The planning policy framework and evidence base provided by the AGMA study are now being taken forward with a view to the broad approach being adopted by each of ten districts. The main driver for the sub-regional approach is designation of Greater Manchester as a City Region with Low Carbon Economic Area (LCEA) status.

It is important that planning policies are unified in order to support the economic objectives of the LCEA. Planning has been identified as a key mechanism for the LCEA to provide certainty for investment in low carbon infrastructure.

The 'Mini Stern' report (2008) identified risks and opportunities for Manchester City Region in responding to climate change. The report highlighted the potential for the City Region to position itself as a low carbon economic centre. This would enable it to compete in a changing regulatory environment in which carbon reduction will increasingly become a commercial priority and a changing world in which rising energy prices will also drive more efficient resource use.

2.3 Bury's approach to energy planning

Bury's approach to energy planning is now set out in LDF Core Strategy policy DM15 and 16 (see Box 2.1). The overall approach is based on the methodology proposed by the AGMA 'Decentralised and zero carbon energy planning' study.

The Core Strategy policy implements the AGMA target framework which is intended to drive investment in low and zero carbon infrastructure.

In considering the role that the Council could play in managing the costs of achieving higher carbon reduction targets three potential scenarios have been identified based on recent research for the UK Green Building Council and the Zero Carbon Hub:

Option 1: Failure to meet targets

Code for Sustainable Homes targets and planning policy targets are not met because they are evaluated as being too onerous for developers;

Option 2: Development meets targets but at a high cost

Code for Sustainable Homes targets and planning policy targets are met but at a relatively high cost to developers, who must find their own solutions on-site (>£300/tonne CO_2);

Option 3: Development meets targets at a lower cost

Code for Sustainable Homes targets and planning policy targets are met through a planned approach and shared infrastructure investments, thereby providing cheaper near site and off-site solutions (£52-£152/tonne CO_2).

The first option would fail to meet national and regional objectives and could result in a decline in investor confidence. The second option could have implications for property values and development if Bury was alone within Greater Manchester in requiring compliance.

The preferred option for the Council is to help orchestrate and co-ordinate Option 3. Whilst both Options 2 and 3 have high upfront capital costs, the costs associated with Option 3 can more readily be shared between developers if it was to be delivered as part of a long-term business plan.

Box 2.1

LDF Core Strategy energy policy DM15

The Council will facilitate the achievement of national targets for reducing carbon emissions from new built development as specified in the code for sustainable homes, building regulations and any future code for non-domestic developments. In pursuit of these national targets, the Council will adhere to the national programme for achieving zero carbon development.

Where opportunities arise and where circumstances warrant it, the Council may also require developers to meet higher targets, as identified in the AGMA target framework for carbon reductions and energy infrastructure.

In achieving these targets, the Council will ensure that proposals for new-build residential and non-domestic development (excluding conversions and extensions) accord with the following requirements:

a. All new-build development should adhere to the 'zero carbon hierarchy';
b. Where possible, new-build development should be sited, designed and 'future proofed' in a manner that allows for connection to decentralised, low and zero carbon energy sources (including connections at a future date or a phase of development) and change of fuel source;
c. Where practicable, new-build development should connect to existing or planned/potential decentralised heat and/or power schemes;
d. Where opportunities arise, new development should be used as a catalyst for enabling the retrofitting of energy efficiency improvements in existing built stock and facilitation of their connection to new zero and low carbon energy infrastructure;
e. Where development is being undertaken adjacent to a public sector building, full consideration shall be given to the potential role that the public sector building and development combined can support decentralised generation (e.g. by sharing an energy centre and the associated decentralised energy infrastructure);

Applications for all new residential developments and non-residential uses over 1,000sq.m. should be accompanied by an energy and carbon budget statement to demonstrate compliance with the CO_2 emission target framework. Developments below these thresholds which involve the erection of a building or substantial improvement to an existing building will be expected to incorporate appropriate micro-generation technologies.

2.4 Radcliffe Development Strategy context

Radcliffe Town Centre is identified in the LDF Core Strategy Publication Version as an opportunity area for low carbon infrastructure (illustrated by Figure 2.1). In order to identify further development sites within the Inner Radcliffe area that may require investment in low or zero carbon infrastructure we have referred to two Development Strategy documents that are intended to guide future development in Radcliffe – the Re-inventing Radcliffe study and the Radcliffe Town Centre Masterplan.

A series of wider low or zero carbon energy opportunities are identified by the LDF Core Strategy as being of strategic importance. It may be possible to relate these to development within the Inner Radcliffe area These include hydroelectricity from the River Irwell and waste heat from the Bury wastewater treatment works.

The potential for developing strategic energy opportunities is explored further in Section 3.1 of this document before we then relate them to potential development sites in Section 3.2, 3.3 and 3.4.

2.4.1 Reinventing Radcliffe (May 2004)

The Reinventing Radcliffe strategy was commissioned by Bury Metropolitan Borough Council and became part of the review of the Unitary Development Plan (UDP). During 2004 this was developed into a series of more detailed masterplans and included a plan for new development at the heart of the town known as the SUN Quarter Development Brief. The overall strategy was adopted in May 2004.

Because of the overall prosperity of Bury Borough, Radcliffe, unlike many similar towns in North Manchester, was not a Neighbourhood Renewal Area and had very limited access to regeneration funds. It was therefore unrealistic to make recommendations requiring public funding. Instead, the strategy set out a new vision for Radcliffe suggesting a route for realising this vision by encouraging private developers to invest in the town.

2.4.2 Radcliffe Town Centre Masterplan (October 2010)

The Radcliffe Town Centre Masterplan is currently being developed and is intended to supersede the original Radcliffe SUN Quarter Development Brief. The original Development Brief is being revisited because of the loss of the lead developer following the recession.

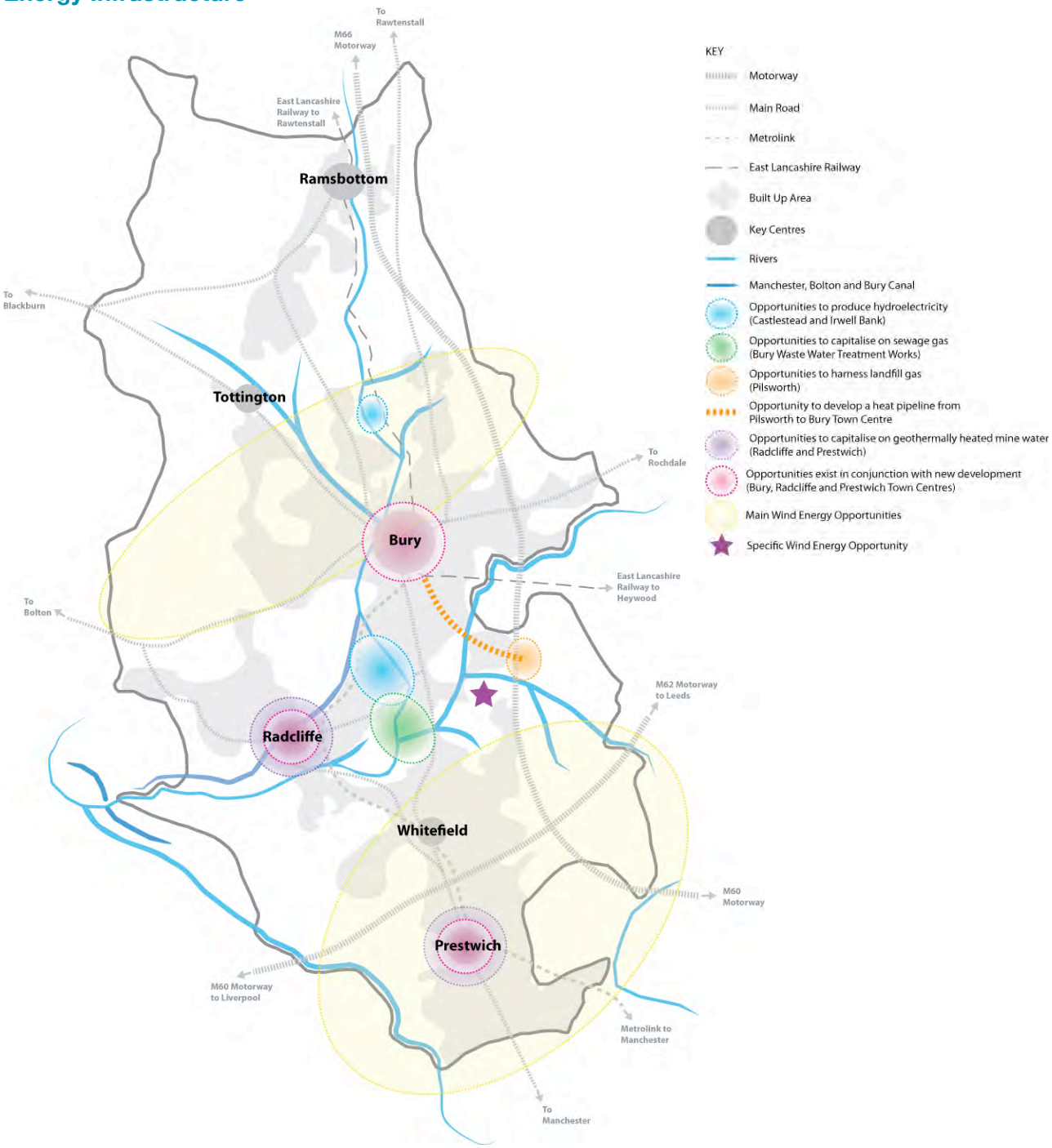
Once the Plan document has been subject to a period of public consultation it will be amended and considered by Bury Council with a view to adopting it as a non-statutory planning policy for Radcliffe Town Centre and as part of the evidence base for the Local Development Framework.

Just like the Reinventing Radcliffe strategy, this masterplan will depend on private investment for implementation. The Masterplan has also had to take into account of the current economic conditions. This has led to a new strategy, splitting the masterplan into two phases.

The first phase prioritises the retail element close to the town centre which could realistically be developed over the next five years. The second phase looks to introduce a residential element into the town centre and is likely to be implemented in the medium term, between five and ten years from now, when the economic climate is anticipated to have improved.

Figure 2.1

Bury-wide opportunities for Investment in Decentralised Low and Zero Carbon Energy Infrastructure



Source: Bury Council (2010) *LDF Core Strategy,* Publication version

3. Strategic energy opportunities

In this section we describe the findings of a scoping exercise to identify strategic opportunities for decentralised and zero carbon infrastructure in Radcliffe. The opportunities are organised into four spatial levels:

- Strategic resources: Off-site energy resources based on wind power, biomass fuel, sewage gas, hydroelectric and minewater geothermal;
- Radcliffe Town Centre Masterplan opportunity area: Identifying strategic opportunities within the town centre for infrastructure investment;
- Inner Radcliffe opportunity area: Identifying strategic opportunities relating to individual buildings and/or development sites within Inner Radcliffe.
- Irwell Bank Employment opportunity area: Indentifying strategic opportunities relating to emerging development sites in this wider employment opportunity area.

We take each in turn, exploring how they could form part of an overall framework of carbon reduction.

3.1 Strategic resources

The study has been able to identify five off-site strategic resources in Radcliffe. In this section we discuss the potential scale of each opportunity, and the key implementation issues they raise.

Other potential opportunities such as solar technology and gas-fired CHP are site specific and are discussed in relation to development sites in Sections 3.2 and 3.3

3.1.1 Wind energy

This study has focussed on large scale (1.0 MWe or greater) turbines as they represent the largest and most cost effective option for carbon reduction. The AGMA decentralised energy study described two forms of opportunity for large-scale wind turbines:

- 'Wind clusters' of at least 4-5 turbines. These would generally require a wind speed of at least 6.5 metres/second to be viable.
- 'Single turbine' sites in industrial areas. These would generally require a wind speed of at least 5.5-6.0 metres/second to be viable.

Based on a wind speed of 6.5 metres/second and a wind turbine hub height of 45 metres and application of 'absolute', 'moderate' and 'local' constraints from the AGMA decentralised energy study we were unable to identify any broad area of potential within the wider Radcliffe area (see Wind Map WE1).

Based on a wind speed of 6.0 metres/second and a wind turbine hub height of 45 metres, application of the same constraints, and with a focus on industrial sites, one broad area of potential was identified. This is marked as Area 001 on Wind Map WE1.

Area A001 comprises the former Rhodes Farm sewage works site owned by United Uilities and the rough pasture of Hurst Wood which is owned by the Forestry Commission and which is bisected by National cycle route 6/the Irwell Trail.

The area identified is heavily constrained by the M60 motorway, high voltage power cables, proximity to homes, changes in level and the Irwell Trail. This location could, subject to further detailed investigation within the area of search marked as A001, create the potential for 2-3 large (1-1.5 MWe) turbines.

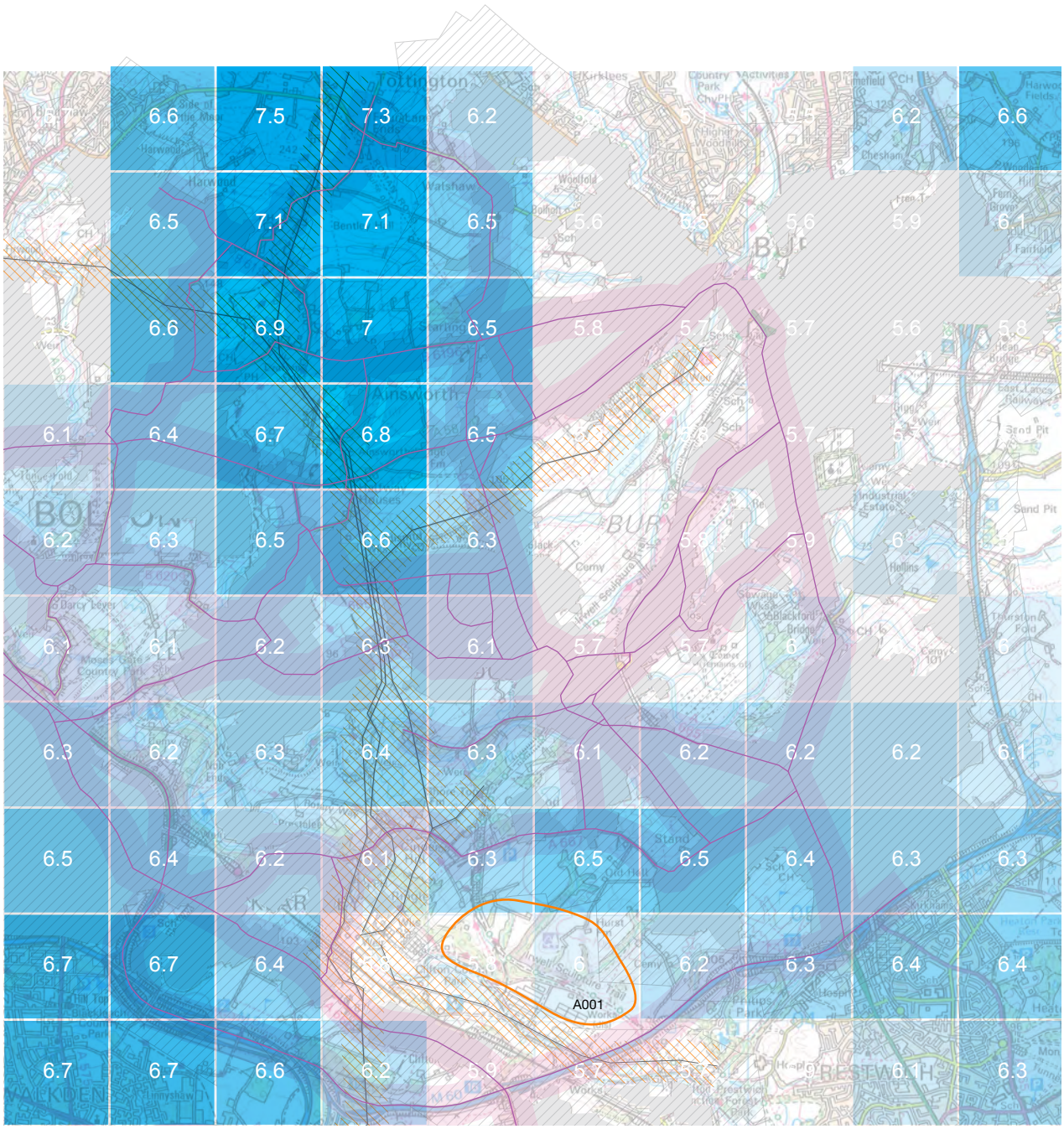
Large scale turbines would not preclude the potential to develop smaller turbines within the study area. They would be less efficient and the capital cost of carbon reduction would be higher - approaching the 'base cost' for micro-generation - but this could be offset by the value of higher Feed-in tariffs for electricity generation.

Noise and proximity to residential properties would need to be examined on a case for case basis based on the model of turbine proposed and background noise levels. National guidance on the methodology to be used by Local Authorities is set out in the 1997 ETSU report *'The Assessment and rating of noise from wind farms'.*

Wind energy

Summary potential and implementation issues

Indicative potential	2-4.0 MWe on one site (6.0 m/s wind speed)
Associated CO_2 saving	at least 2,363 t CO_2/annum
Indicative capital cost	£3.7 million
Cost per tonne CO_2 saved	£63 over a 25 year period
Implementation issues	• The area of potential should be considered for inclusion in a possible wind options allocations plan for Bury; • The proximity to neighbouring dwellings may require community acceptance to take the project forward; • Engagement would be required with United Utilities, Electricity North West, the Forestry Commission and the local community; • A vehicle would be needed to pool contributions in order to underwrite investment; • There would be the need for risk capital in order to obtain planning permission; • There would be the need to identify a development manager.



Plan WE1

Radcliffe wind map

Not to scale

Key

- Urban Area
- 500m exclusion from housing
- Road
- 200m exclusion from road
- Overhead Pylon
- 200m exclusion from pylon
- Wind speed at 45m

3.1.2 Biomass fuel sources

Decentralised energy infrastructure to generate heat and power for Radcliffe could be fuelled by biomass (wood). Our energy modelling suggests that the plant required would be relatively small (kW rather than MW) , which would restrict the use of biomass fuel from commercial or municipal wood waste.

We have therefore focussed our scoping on the potential to source 'clean' wood in the form of chips from within Radcliffe and, more widely, from across Bury. Four potential sources of clean wood chips were identified based on discussions with the Parks and Countryside Service within the Council:

- Tree surgery: The Council carries out regular maintenance of street trees across the district;
- Parks and grounds maintenance: The Council maintains 14 urban parks and 60 play areas, the majority of which generate wood waste;
- Forest and country park management: The Council maintains 2 country parks and Bury also has a number of woodland sites;
- Park and tree surgery contractors: A number of contractors are located in Bury but would be likely to generate wood chips from works carried out across the sub-region.

An overall figure of approximately 300 tonnes per annum is currently generated from tree surgery and parks and grounds maintenance. This is currently used by the Council as mulch.

Recent studies carried out by Red Rose Forest suggest that much higher tonnages could be obtained from forest and country park management. For example, the North Manchester area was shown to have the potential to yield as much as 3,000 tonnes per annum based on all available sources. However, it is understood that management programmes are currently very limited and it was not possible within the scope of this study to ascertain the scale of the potential.

Biomass fuel sources

Summary potential and implementation issues

Indicative potential	At least 300 tonnes wood chips/annum (from across Bury)
Associated CO_2 saving	180 t CO_2/annum
Indicative capital cost	*To be determined based on the cost of processing, handling and distributing wood chips*
Cost per tonne CO_2 saved	Site specific based on mix of buildings and infrastructure
Implementation issues	• The Council would need to take a strategic decision to use wood chips for energy generation; • The Council would need to establish more intensive woodland management working with partners and contractors; • Facilities would need to be built to process and dry wood chips to the required grade for energy generating plant; • Delivery infrastructure would need to be procured or contracted out, including handling equipment and vehicles; • Guaranteed demand for the wood chip would be needed in order to invest in processing and distribution;

3.1.3 Bury wastewater treatment works

Bury waste water treatment works is located approximately 1.7 km east north east of Radcliffe Town Centre and upstream on the River Irwell. The works is owned and operated by United Utilities and treats 30,157,000 m^3 of wastewater per annum. Treated effluent is discharged into the River Irwell at a temperature of 13 ^oC

Sewage sludge from the primary and secondary processes on-site are subject to tertiary treatment in an Anaerobic Digestion plant. The methane gas produced by this process was burnt in a series of 3 engines with the capacity to generate 1.86 MWe of electricity. Only one of these engines is currently operating due to restrictions on emissions.

Approximately 78% of the waste heat from these engines is recovered from the engines for use on-site to maintain the temperature of the digestors.

United Utilities has commissioned consultants Geogen to investigate the potential for further waste heat recovery from on-site Anaerobic Digestion plant and from the waste water outfall which discharges into the River Irwell.

Based on this work, together with our own background research, we have been able to identify three potential sources of waste heat from the site:

- Engine exhaust: There may be the potential to recover further heat from the engine exhaust gas, which would boost the heat recovery by around 14%.

- Treated sludge: Once a batch of sludge has been treated in the Anaerobic Digestor it may be possible to recover low grade heat which could either be fed back to the process or upgraded for district heating using a heat pump.

- Waste water outfall: As demonstrated in a number of Scandinavian cities heat could be recovered and upgraded for district heating using heat pumps. This would be subject to maintaining the conditions of the treatment works' disccharge consent.

The limited availability of data during the study has meant that assumptions had to be made about the potential scale of the opportunity. Assumptions were only made in relation to the potential for heat recovery form the engine exhaust.

Bury wastewater treatment works

Summary potential and implementation issues

Indicative potential	At least 3.5 GWh/annum heat
Associated CO_2 saving	662 t CO_2/annum *(assumed to be supplied to the adjacent Dumers Lane site)*
Indicative capital cost	*Unable to determine at this stage*
Cost per tonne CO_2 saved	*Unable to determine at this stage*
Implementation issues	• Any changes to the discharge consent would need to be explored/agreed with the Environment Agency; • Determining the feasibility of retrofitting exhaust gas heat recovery to the engines; • Identifying adjacent heat demand and suitable route for district heating pipes, which may need to be carried across/under the River Irwell. • Guaranteeing the demand for heat in order to underwrite heat offtake and district heating network investment; • Agreement of responsibility for heat off-take investment and a heat off-take price with United Utilities. • Development of a viable business plan and identification of a procurement route for the project.

3.1.4 Hydroelectricity from weirs

In the nineteenth century many of the rivers and waterways in and around the Inner Radcliffe area were engineered and managed by the Victorians to utilise their flow for industry. Inner Radcliffe is bisected by both the River Irwell and the Manchester, Bolton and Bury Canal. The river in particular has a series of weirs which, as identified by the Bury Town Centre Energy Framework, may have the potential for 'low head' hydroelectricity generation.

Our scoping has identified three weirs downstream of Radcliffe Town Centre which could have the potential for electricity generation (see Energy Framework plan EF1). The Environment Agency's 2009 publication 'Opportunity and Environmental Sensitivity Mapping for Hydropower' identifies the potential for each weir as being at least 100 kWe.

Photographs of the weirs suggest head heights in the range of 2-5m which could, depending on the Flow Duration Curve for each site, equate to a potential of at least 30-60 kWe. For the purposes of our energy modelling we have used a figure of 60 kWe for each site.

Any hydroelectric plant would require consent from the Environment Agency. The Agency is responsible for a catchment area management plan for the River Irwell. This plan responds to the requirements of the EU Water Framework Directive which seeks to improve the ecological value of our rivers. The Agency's recently published mapping of hydroelectric potential identifies weirs on the River Irwell as being both 'high potential' but also 'high sensitivity'.

Discussions with the Environment Agency have confirmed that whilst the 'high sensitivity' status would not discount hydroelectric development in the area, it would mean that any project would need to mitigate their potential impact on fish. This would generally take the form of a fish pass but will also tend to require mitigation of the potential risk to fish caused by the generating plant.

The generating plant creates the risk of damage to fish if they attempt to pass through. Turbines create the greatest risk, particularly to younger fish, and so screws and waterwheels tend to be favoured in areas of sensitivity. The main form of mitigation would be in the form of fish screens.

A procedure for assessing different technologies, and appropriate mitigation for each type of generating plant, is set out in the Environment Agencies good practice guidance (see footnotes below).

1. Environmental Agency, *the environmental assessment of low head hydropower developments*, August 2009, www.environment-agency.gov.uk/business/topics/water/32038.aspx
2. Environment Agency, *Environmental permitting for discharges to surface water and groundwater*, www.environment-agency.gov.uk/business/topics/water/32038.aspx

Hydroelectricity

Summary potential and implementation issues

Indicative potential	180 – 1,500 kWe
Associated CO_2 saving	213 t CO_2/annum
Indicative capital cost	£277,000
Cost per tonne CO_2 saved	£52 over a 25 year period
Implementation issues	• Risk capital would be needed in order to carry out further detailed investigations and feasibility studies; • Ownership of the weirs and adjacent land and interest from these owners would need to be determined; • A vehicle would be needed to pool developer and community contributions in order to underwrite investment; • Engagement would be needed with the Environment Agency in order to assess the impact on the river system and ecology and agree any mitigation measures required.

3.1.5 Minewater geothermal

Radcliffe has a history of coal mining dating from the industrial revolution. All of these colliery sites are now closed. However, depending on their depth and extent they could have the potential to supply geothermally heated water to buildings via a district heating network.

Heated water can be abstracted and re-injected by drilling into selected locations in the abandoned workings. The location of the well head may not therefore correspond with the original location of the pit head(s).

Outwood Colliery, which closed in 1931, was the largest mine within close proximity of Radcliffe Town Centre. During the last decade the 80 hectare site has been reclaimed and landscaped to create the Outwood forest park.

The East Lancashire Railway line ran past the colliery and there were sidings to load and transport coal. This line now forms part of the National Cycle Network and the Irwell Sculpture Trail.

The evidence from minewater geothermal projects such as in the town of Heerlen in the Netherlands is that the thermal potential of a mine is site specific, requiring detailed investigation of the condition of the workings and the potential for the transfer of heat. However, it is possible to make an initial estimate of the thermal potential using a simple methodology developed by the BRE.

In order to validate the potential geothermal resource at Outwood further investigation would be required in conjunction with the Coal Authority who, under the remit of the Coal Mines Regulation Act, monitor mine workings closed after 1872. The project would also be likely to require an abstraction license from the Environment Agency.

Minewater geothermal

Summary potential and implementation issues

Indicative potential	7.6 MW thermal
Associated CO_2 saving	up to 7,650 t CO_2/annum
Indicative capital cost	*Unable to determine at this stage*
Cost per tonne CO_2 saved	*Unable to determine at this stage*
Implementation issues	• Detailed geological investigation of the mine workings would need to be undertaken in order to determine the feasibility; • Engagement would be needed with the Coal Authority and the Environment Agency in order to review the Abandonment Plan; • Specialist technical input may be required, with the potential to draw upon the experience from completed EU projects; • There would need to be guaranteed demand for heat in order to underwrite investment in wellheads, an energy centre and a district heating network; • If there is a resource then this could be used to supply a potential district heating network serving Radcliffe Town Centre.

3.2 Town Centre Masterplan opportunity areas

The study has sought to characterise the projected mix of building types in Radcliffe Town Centre and their infrastructure requirements by splitting them into three distinct periods of time:

- Time period 1: Existing buildings;
- Time period 2: Proposed short-term developments (completion 2011-2016);
- Time period 3: Proposed medium to long-term developments (completion 2016 onwards);

Here we describe each Time Period and and indicative strategic approach that could be taken in order to apply LDF Policy DM15. These phases are illustrated by Energy Framework plan EF1.

Time period 1
'Existing buildings'

The town centre contains a number of public buildings which we have identified as having the potential to benefit from investment to reduce their carbon emissions. These include large energy users such as the Pool & fitness centre as well as the library, civic suite and Post Office delivery office.

There are also newer, more efficient buildings such as the NHS Primary Care centre (developed by the LIFTCo PFI vehicle) which could benefit from supplies of low or zero carbon energy.

For all the public buildings identified there is now a formal requirement to manage and reduce carbon emissions under the Carbon Reduction Commitment (CRC). There is therefore a direct financial incentive to invest in energy efficiency and sources of low carbon energy. This position is likely to continue under a proposed simplified replacement scheme that is currently being considered by the Department for Energy and Climate Change (DECC).

Six Town Housing, the Arms Length Management Organisation (ALMO) for Bury's housing stock, has 96 units of housing at the Thomas's Estate on the edge of the town centre. These properties have had recent investment in the form of new double glazed windows and loft and cavity wall insulation.

These properties still have electric heating and there is the possibility of improving these systems, which we understand from Six Town Housing are expensive to run and are unpopular with tenants, as well as per unit of energy consumed having higher carbon emissions.

Electric heating also makes it more difficult to raise the performance of properties which is usually modelled using the Standard Assessment Procedure (SAP). SAP is used to model energy use in order to comply with Decent Homes and Part L of Building Regulations, and in a simplified format to calculate Energy Performance Certificates.

Radcliffe town centre is identified as a network opportunity area in the LDF Core Strategy (publication version 2010). The cluster of public buildings and retrofit opportunities could act as anchor loads for a district heating network. This is because

they are a large discrete source of emissions with similar demand profiles and heating systems.

A town centre network could initially be supplied by a Combined Heat and Power (CHP) generator. The plant would be in the range of 772 kWe suggesting that it would initially be fuelled by natural gas. Heat from the generator would be circulated to buildings via insulated district heating pipes laid under the public highway.

In the long term the benefit of such a network would also be to future proof the town centre, facilitating the use of other sources of heat such as the Outwood mine workings (if found to be feasible) and biomass fuel.

The swimming pool and fitness centre could form the ideal starting point for such a network. We have identified this building as being the largest heat demand in the town centre, accounting for 38% of the modelled heat demand for the public buildings. Swimming pools require heat throughout the year and so would create a consistent baseload heat demand as the basis for a network. The network might then supply the Six Town Housing properties if they were to be converted from electric to wet heating systems.

Potential models for delivery of a Town Centre heating network are discussed in Section 4.3.

Time period 1
Indicative planned approach

Spatial coverage	**Description of indicative planned approach**
Town Centre 'network policy area' • Pool & Fitness Centre • Library • Civic Suite • NHS Primary Care Centre • Thomas's Estate • *Town Centre masterplan* • *Coney Green site*	• The existing building cluster could form the anchor for a town centre network connection policy area; • The network could initially be supplied by tried and tested natural gas-fired CHP; • New public buildings could be 'future-proofed' to connect to the district heating network.

Public sector investment • Buildings within the 'network policy area'	• Investment by public sector bodies in building improvements would need to incorporate district heating as an integral part of their servicing strategies; • Engagement would be required with public sector institutions such as the NHS LIFTCo, potentially through Team Bury. • District heating could provide a low cost source of emissions reductions to meet CRC and Decent Homes commitments.
Energy centre and network • Potential co-location with Pool & Fitness Centre	• Designation of possible sites for an energy centre – although this could be incorporated into the swimming pool and leisure centre; • The network would require planning permission and Street Works permits unless it was an investment by the Council or a suitably licensed utility.

Time period 2
'Proposed short-term development' (2011-2016)

The second period of development comprises key development sites that are anticipated in the revised Radcliffe Town Centre Masterplan. The masterplan anticipates the development of a new supermarket and a series of new retail units alongside a new bus station to be developed by the GMPTE and redevelopment of the market by the Council.

The proposed supermarket and retail units will create a significant new demand for electricity for heating, lighting and refrigeration. Based on our carbon emissions modelling this development would be classified under LDF Policy DM15 as being 'electricity intense'. The minimum target in the LDF Core Strategy for 'electricity intense' development is an additional 10% reduction in carbon emissions over and above Part L of the 2006 Building Regulations.

In line with the Core Strategy's 'zero carbon energy hierarchy' energy efficiency should be the first priority. For the supermarket operator this should include options for refrigeration and lighting – the two largest demands for electricity in a typical store. These could include:

- Natural daylighting in the form of rooflights. Research from the USA has demonstrated the potential benefits of natural daylight to supermarket operators, such as significantly increased customer satisfaction.

- New and more efficient forms of refrigeration which could include water based systems and heat recovery. Recent research by the Carbon Trust has identified a range of technical options for refrigeration that could be used to inform discussions with supermarket operators.

- Building energy management systems that engage all staff in minimising energy use and making efficient use of equipment. Experience from a number of supermarket operators has shown that this can lead to reductions in energy use of between 5-15%.

We have also identified a number of energy supply options which would enable compliance with LDF Core Strategy policy DM15. The Core Strategy energy policies would allow higher targets to be set depending on which option is selected. The target will depend on the comparative cost per tonne of CO_2 saved, which for each option is potentially lower than for individual actions by a developer.

In table 3.1 below we describe three options which we have identified. For each we highlight the target that could be set (based on the indicative cost of each option) and the potential role of the Council in facilitating investment into each option. The preferred option is the 'solar hub' based on the following potential benefits:

- Financial benefits: On-site electricity generation could benefit the supermarket and retail operator, reducing electricity bills by as much as £3,177/annum and generating as much as £21,900/annum of Feed in Tariff revenue. The latter would enable the capital costs to be recouped at an indicative rate of return of 7-8%;

- Ease of delivery: A building mounted technology would be easier to implement than an energy network or an off-site hydroelectric generator;

- Visibility: A visible solar array would fulfil the Council's desire to improve the image of Radcliffe, and could also benefit the supermarket operator.

The proposed model for delivery of the Solar Hub is discussed further in Section 4.3.

Table 3.1
Radcliffe Town Centre supermarket site options

Option	Target and cost	Council role
1. Combined Heat and Power station (CHP): The supermarket could generate its own electricity and cooling whilst supplying heating to community buildings and housing in the town centre.	10% (£306/tonne CO_2)	• To bring together public and private sector heat customers, • To procure/manage installation of heat distribution mains.
2. Solar hub: The supermarket, together with the market and new bus station, could become a solar power station by making use of all the available roof space to install photovoltaic panels.	28% (£120/tonne CO_2)	• To bring together the different roof providers, • To pool developer contributions in order to finance/install the solar panels, • To repay any loans using Feed in Tariff income.
3. Powered by the Irwell: The supermarket, together with the market and new bus station, could be powered by hydroelectricity from downstream weirs.	28% (£52/tonne CO_2)	• Commissioning of feasibility studies for each potential site, • To procure and manage project delivery.

Time period 2

Indicative planned approach

Spatial coverage	Description of indicative planned approach
Electricity intense buildings • Proposed new supermarket and retail units	• The supermarket and retail units could be required to meet the minimum target by reducing their electricity use through passive design and by installing innovative refrigeration technologies and building energy management systems; • Each applicant would have to meet higher targets related to communal infrastructure towards which contributions would be required (see Policy DM15, Target 2); • An operator could be selected through a competition process, with the brief requiring an innovative response to the energy supply and efficiency options that have been identified.
'Solar hub' initiative • Proposed new supermarket and retail units • Redeveloped Radcliffe market • New apartments and townhouses • St Thomas's Estate	• A requirement could be placed on the supermarket and retail units that their roofspaces are made available for solar photovoltaic installations and that the buildings electrical systems are designed to connect the installations; • Establishment of a dedicated Council project or Special Purpose Vehicle to which developers would contribute through Section 106 (or an equivalent allowable solutions fund) in order to securitise additional borrowing to fund larger installations.

Time period 3
‘Proposed medium to long term development’ (2016 onwards)

This time period comprises future new residential development that is likely to have to meet higher emissions reductions targets. The timeline for the anticipated housing and apartments suggests that they would need to achieve carbon reductions in line with both the Code for Sustainable Homes level 4 and LDF Core Strategy policy DM15.

As we identified in Time period 1 there is the potential to develop a district heating network for the town centre. LDF Core Strategy policy DM15 requires that development in an identified ´network development area´ connects to such a network. This could provide an advantage to residential developers as the AGMA evidence base and research for Government by the Green Building Council has demonstrated that this would be a low cost means of achieving Code level 4.

The preferred option would therefore be for the new homes to be connected to a town centre district heating network if this was developed. Properties would therefore need to be designed so their heating systems could be supplied by district heating. This option would need to be facilitated by the Council and enabled by a planning policy requirement for each developer to connect to the network and potentially to make additional financial contributions. At £366/tonne CO_2 this option would allow a target of 15% to be set.

There could also be the potential for further solar photovoltaic installations financed through the ‘solar hub’ initiative if this is established. In order to achieve this developers could be required to ensure that they maximise the viable roofspace available for any future solar photovoltaic installations.

Developers would need to provide evidence that a high proportion of roofspace can accommodate solar modules without shading and with no greater than a 5% loss in efficiency, which would be broadly equivalent to an orientation 45° from due south at a tilt angle of no more than 20° from 35°.

Potential models for delivery of the different technology options are discussed in Section 4.3.

Time period 3

Indicative planned approach

Spatial coverage	**Description of indicative planned approach**
Town Centre 'network policy area' • Pool & Fitness Centre • Library • Civic Suite • NHS Primary Care Centre • Thomas's Estate • *Town Centre Masterplan*	• The existing building cluster could form the anchor for a town centre network connection policy area; • New development would need to be designed so that it could connect to a district heating network; • Developers could be required to contribute to the capital cost of network connections, to be calculated based on the estimated cost of connections.
'Solar hub' initiative • Proposed new supermarket and retail units • Redeveloped Radcliffe market • New apartments and townhouses	• Developers could be require to ensure that the combined roof space available for future solar installations is maximised, with evidence provided to demonstrate compliance.

3.3 Inner Radcliffe Opportunity Areas

The study has identified opportunities relating to the wider portfolio of development sites identified in the Re-inventing Radcliffe strategy. Here we describe the opportunities and proposed approach as they relate to each site:

3.3.1 Former Radcliffe High School

The redevelopment of the Radcliffe High School site comprises two elements. The first is a new special needs school to be constructed on the playing fields of the former High School site (Application No. 52038). The second is a proposed residential development on the site of former High School buildings (Application No. 45673). This is proposed as a mix of 130 residential units, comprising apartments, townhouses and semi-detached houses.

The housing is currently being negotiated on the basis that an energy centre to be located in the new school could also supply the new housing. The preferred option of the Council is for the energy to be generated by a gas-fired CHP engine. The most practical approach would be for the school to initially meet its heating needs using gas boiler plant. The engine would then be installed in conjunction with construction of the new housing and the boiler plant would be retained as standby.

On the projected timeline for the residential development this would enable the residential developer (or developers) to meet Code for Sustainable Homes level 4. An additional capital contribution to the CHP engine could be required as a means for the developer to meet the additional requirements of LDF Policy DM15.

If a higher level of performance to Code levels 5 and 6 is required for the residential site – for example, if it takes longer to bring forward housing on the site - then a biomass boiler plant could be specified instead of gas CHP. This would enable 'Carbon compliance' standard to be met on-site. An additional contribution towards the overall capital cost of the boiler could provide an 'Allowable Solution' to meet Code level 6.

High School residential site

Indicative planned approach

Spatial coverage	Description of indicative planned approach
Micro-generation area • Former High School site • Former High School playing fields	• The Special Needs school could form the anchor for a small district heating cluster supplying the school and adjacent new housing. • New residential development could be required to obtain it's heating from an energy centre installed on the school site. • Development could be required to ensure it is designed in a way that it can connect to the school energy centre, with a financial contribution towards installing CHP or biomass plant.

3.3.2 East Lancashire Paper Mill site

A masterplan has been worked up for the former ELPM site which would see the development of a new secondary school followed by a mix of residential and commercial development (B1, B2 and B8) on the site over the next decade (Outline Application No. 45598). It is anticipated that the early phases will comprise the school and new housing. Development of the new school is dependant on continuity of the Building Schools for the Future programme.

The initial phases of housing are likely to have to meet Code for Sustainable Homes levels 3 or 4 (depending on their timing). Under LDF Policy DM15 the site would also be designated as a 'micro-generation' target area. However, a significant proportion of the later phases of residential development are likely to have to meet the Zero Carbon standard.

The infrastructure for the site will therefore require careful planning to ensure that the costs of bringing forward development plots are not excessive.

The completed masterplan is unlikely to be large enough to sustain the cheapest and most reliable option for meeting the Zero Carbon standard, which would be a biomass Combined Heat and Power (CHP) plant of at least 5 MWe supplying a district heating network. There may, however, be cost benefits in introducing heat-only biomass infrastructure from the outset.

The commercial elements of the scheme would require a different strategy as they would have a greater demand for electricity, with proportionately higher carbon emissions.

Below we outline three potential technology options:

Option 1: Biomass heating network with Allowable Solutions

The school could form the anchor for a biomass district heating network supplied by biomass boilers. These could be installed on a modular, phased basis in an energy centre constructed at the same time as the school. This would enable development to meet the 'Carbon Compliance' threshold proposed by the Government (70% carbon reduction) at an indicative cost of £153/tonne CO_2.

However, in order for later phases to meet Code level 6 the developer would need to achieve further reductions either by installing micro-generation technologies (such as solar photovoltaics) at an indicative cost of £333-392/tonne CO_2 or by contributing to cheaper off-site Allowable Solutions, such as hydroelectric and wind energy at an indicative cost of £52-63/tonne CO_2

Option 2: Solar roofs and off-site Allowable Solutions

All phases of residential and commercial development could incorporate solar thermal and photovoltaic technologies. Later phases would install enough equipment to meet the Carbon Compliance threshold (70% carbon reduction) at a cost of £333-392/tonne CO_2. In order to meet Code level 6 the developer would then need to contribute to cheaper off-site Allowable Solutions, such as hydroelectric and wind energy at an indicative cost of £52-63/tonne CO_2.

Option 3: Solar roof finance through the 'Solar Hub' initiative

Financing of solar roofs in conjunction with the town centre Solar Hub proposal could reduce the capital costs, enabling more equipment to be installed in all phases of development and Code level 6 to be met on-site. This could be achieved at an indicative cost of £120/tonne CO_2

If the school is taken forward the preferred option would be Option 1. This is because this option would maximise carbon reductions across all phases at the lowest capital cost, enabling sites to be marketed on the basis of their infrastructure, whilst retaining flexibility in how full Code level 6 compliance is achieved.

If the school is not taken forward then a combination of Options 2 and 3 (depending on the availability of the Solar Hub finance mechanism) would be preferable.

East Lancashire Paper Mill site

Indicative planned approach

Spatial coverage	Description of indicative planned approach
School heating network area • New Secondary School • Initial residential phases	• The new high school could form the anchor for a wider network connection policy area; • New residential development would need to be designed so that it could connect to the district heating network; • Developers could be required to contribute to the capital cost of network connections and the energy centre.
Micro-generation area • Later residential and commercial phases	• Developers could be required to participate in the Solar Hub initiative, with a capital contribution made towards financing for solar roofs; • The developer(s) could also be given the option to contribute towards the development of off-site solutions to include hydroelectric and wind power (subject to viability)

3.3.3 Coney Green

Located near to the Metrolink station this site, which is currently occupied by the Coney Green High School was identified in the Re-inventing Radcliffe report as having potential for housing. The site would become vacant if a new secondary school is developed on the former East Lancashire Paper Mill site.

The site is also located adjacent to the St Thomas's housing estate. If this estate, and nearby public buildings in the Town Centre, are linked together by a district heating network, there could be the potential for new housing on this site to form part of, and benefit from, connecting to the network. The site would therefore form part of the Town Centre 'network development area'.

If the town centre network is not taken forward then it is likely that the housing would only be required to meet the minimum LDF Core Strategy energy target for 'micro-generation areas'.

Given uncertainty over the timing of possible new housing on the site there may be the need to assist developers with allowable solutions, as described for the ELPM site. These could include participating in the 'solar hub' initiative if this is taken forward.

Coney Green site
Indicative planned approach

Spatial coverage	Description of indicative planned approach
Town Centre 'network policy area' • Pool & Fitness Centre • Library • Civic Suite • NHS Primary Care Centre • Thomas's Estate • *Town Centre Masterplan* • *Coney Green site*	• If the town centre network is taken forward the site could form part of the network connection area; • New development would need to be designed so that it could connect to a district heating network; • Developers could be required to contribute to the capital cost of network connections, to be calculated based on the estimated cost of connections.
Micro-generation area • All phases of Coney Green site	• If the town centre is not taken forward then the micro-generation target would apply to residential development. • Developers could be required to participate in the Solar Hub initiative, with a capital contribution made towards financing for solar roofs; • The developer(s) could also be given the option to contribute towards the development of off-site solutions to include hydroelectric and wind power (subject to viability)

3.4 Irwell Bank Opportunity Area

The emerging LDF Core Strategy identifies Irwell Bank, including Dumers Lane, Radcliffe Road and Eton Hill Road, as a key location for future employment growth and development.

As highlighted in Section 3.1 our scoping has identified the potential to recover heat from the Bury wastewater treatment works in order to supply a district heating network. Here we explore how this could initially supply the Dumers Lane site:

The Bury Town Centre Energy Framework (March 2010) also identified a potential low head hydroelectric site at Warth Bridge. Subject to detailed investigation and discussions with the Environment Agency, this weir may also be able to serve the Irwell Bank opportunity area.

3.4.1 Dumers Lane

Dumers Lane is a proposal for 215 residential units on a 10.5 hectare site to the north of the Bury wastewater treatment works. An outline planning application (No. 50887) for a mix of houses and apartments was granted in 2009 subject to a Planning Condition that:

'No development shall be carried out unless and until an appropriate assessment [of Low and Zero Carbon Technologies] has been submitted to the Local Planning Authority and has been approved and the development shall not be carried out other than in accordance with the approved assessment.'

The condition requires that a 10% improvement over the Target Emission Rate (TER) for 2006 Part L of the Building Regulations is achieved. No specific technical solutions were highlighted in the Planning Condition. This should therefore be considered to represent the minimum that development on the site – both residential and commercial – should achieve.

Part L of the Building Regulations has subsequently been revised. The residential element of the development will now need to achieve a minimum of between 25% and 44% improvements on the 2006 Target Emissions Rate (TER). This will require some form of Low or Zero Carbon Technologies in order to ensure compliance.

As we highlighted in Section 3.1 our scoping has identified the potential to recover heat from the Bury wastewater treatment works in order to supply a district heating network.

Our modelling suggests that this option could deliver between 51% and 91% improvement on the TER for the commercial and residential elements respectively. LDF Policy DM15 allows higher targets to be applied if they can be shown to be cost effective to the developer – although this could only be applied retrospectively by negotiation.

Further detailed investigation would be required in conjunction with United Utilities in order to determine the feasibility of recovering heat to supply the Dumers Lane

site and the wider Irwell Bank area. This would, for example, need to include consideration of how heat would be piped across the River Irwell and supplied to each phase of the Dumers Lane development and any subsequent developments within the Irwell Bank Opportunity Area

Irwell Bank Opportunity Area
Indicative planned approach

Spatial coverage	**Description of indicative planned approach**
Bury wastewater treatment works heat network	• Development sites could form the anchor for a network connection policy area; • The Council would need to co-ordinate a detailed feasibility study in conjunction with United Utilities; • Each phase of the Dumers Lane proposal and future developments within the wider Irwell Bank opportunity area would need to be designed so that it could connect to a district heating network. • The lead developer for each site could be required to contribute to a heat pipeline across the river to connect sites. • If the Warth Bridge hydroelectric site is brought within this Opportunity Area then developers could be asked to contribute to the business plan for its development.

4. Proposed energy framework

In this section we bring together the evidence base from the study in order to develop an energy framework for Radcliffe Town Centre and the Inner Radcliffe area. The aim of the framework would be to deliver greater carbon reductions, earlier and at lower cost.

4.1 Principles for Development Management and Infrastructure Planning

It is proposed that the overarching aim, as a minimum, is to ensure that CO_2 emissions from existing buildings and new development are in-line with the UK Government's statutory objective to achieve a 34% reductions in emissions by 2020.

The aim of the Inner Radcliffe & Town Centre Energy Framework would therefore be to ensure that new development, as a minimum, is able to comply with regulatory milestones including zero carbon from 2016 (domestic buildings) and 2019 (commercial buildings).

Based on our analysis it is proposed that the following five principles guide Development Management and Infrastructure Planning in and around Inner Radcliffe and Radcliffe Town Centre:

- Net-zero carbon growth: Our analysis has shown that even with full implementation of future revisions of Part L of the Building Regulations further new development in Radcliffe could increase emissions by 8.5%.

  Principle: *Any future growth in carbon emissions should, in-line with LDF Core Strategy Policy DM15, be offset by investment in energy efficiency and low or zero carbon infrastructure;*

- Public buildings as a catalyst: Our analysis has identified public buildings and housing in Radcliffe that could, in-line with Government guidance, act as anchors for energy networks and micro-generation infrastructure.

  Principle: *The Council should invest in low carbon infrastructure in order to bring benefits to these buildings, which in turn would serve as a catalyst for wider investment;*

- Low carbon by design: Our analysis has shown that a number of proposed commercial buildings will create new demand for energy and generate proportionately higher carbon emissions.

  Principle: *Specific new buildings should, in line with LDF Core Strategy Policy DM15, be required to minimise or, where possible, design-out electricity use e.g. natural daylighting;*

- Security through diversity: Our analysis has identified a diverse range of opportunities for micro-generation, heating networks and off-site

renewables which could be used to improve future energy security;

Principle: *Radcliffe should make use of all available opportunities to supply energy more efficiently and harness local renewable energy resources.*

- Long-term investment: Our analysis has shown that a range of opportunities exist to achieve emissions reductions that are greater than the regulatory minimum. These opportunities could be realised if investment was co-ordinated and developer contributions used more effectively.

Principles: *Strategic planning and the use of developer contributions should focus on the need to attract long-term investment for strategic projects.*

Bury's Core Strategy Policy DM15 'Reducing carbon emissions from new buildings' incorporates a target framework for low and zero carbon infrastructure (see Table 4.1 below). The policy and target framework provides the planning policy basis to co-ordinate investment in the strategic opportunities identified by this study.

Table 4.1
Bury LDF Core Strategy energy infrastructure target framework

	Target 1 Network development areas	**Target 2** Electricity intense buildings	**Target 3** Micro-generation areas
Minimum CO_2 reduction requirements	Connect to a district heating network	+17% increase on part L for domestic *and* +10% for non domestic buildings.	+ 15% increase on Part L for domestic *and* +15% for non domestic buildings.
Maximum CO_2 reduction requirements	Up to 73% increase on Part L	Up to 56% increase on part L for domestic buildings *and* Up to 28% for non-domestic buildings.	Up to 49% increase on part L for domestic buildings *and* Up to 42% for non domestic buildings.

4.2 The proposed spatial approach

The overall aim of the energy framework is to support investment in strategic energy resources and low and zero carbon infrastructure. We have been able to identify three main spatial elements to the framework:

1. Strategic energy resources
2. Radcliffe Town Cantre Opportunity Area
3. Inner Radcliffe Opportunity Area

In addition, and wider than the scope of the Inner Radcliffe Opportunity Area we have also considered the Irwell Bank Opportunity Area.

Each spatial element reflects distinct opportunities across Radcliffe. In Table 4.2 we have highlighted our key implementation recommendations for each spatial element.

In order to manage the overall cost of achieving greater carbon reductions all three spatial levels will need to be interrelated. So, for example, developer contributions from development sites might be used to underwrite investment in strategic resources such as hydroelectric generators and wind turbines.

The findings and evidence base arising from this study have been used to produce an overall energy framework plan which is illustrated by Energy Framework plan EF1.The plan will need to be supported by planning policy, provision for which has now been made within the LDF Core Strategy. .

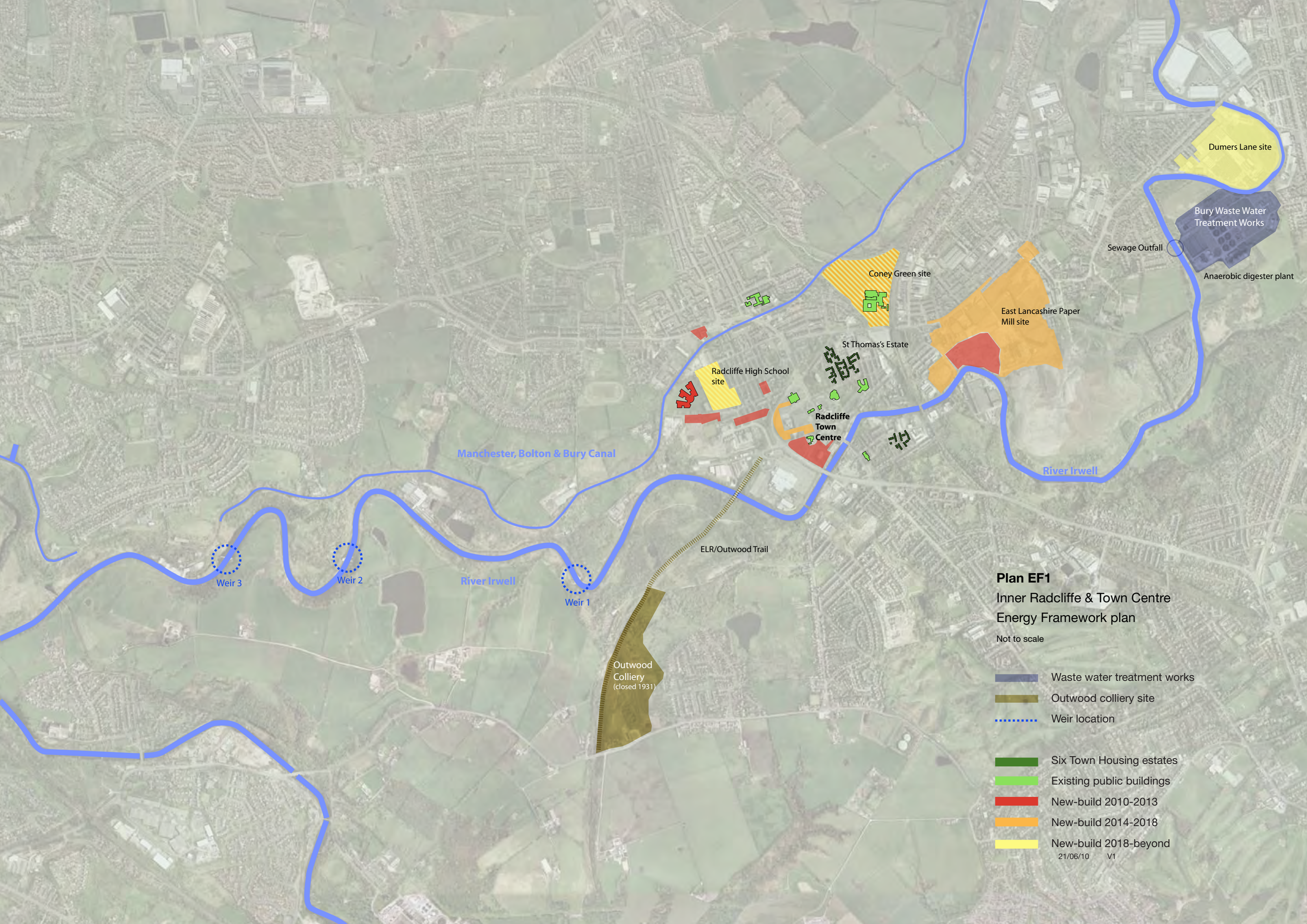

Dumers Lane site
Bury Waste Water Treatment Works
Sewage Outfall
Anaerobic digester plant
Coney Green site
East Lancashire Paper Mill site
St Thomas's Estate
Radcliffe High School site
Radcliffe Town Centre
Manchester, Bolton & Bury Canal
River Irwell
Weir 3
Weir 2
Weir 1
ELR/Outwood Trail
Outwood Colliery (closed 1931)
Plan EF1
Inner Radcliffe & Town Centre
Energy Framework plan
Not to scale
Waste water treatment works
Outwood colliery site
Weir location
Six Town Housing estates
Existing public buildings
New-build 2010-2013
New-build 2014-2018
New-build 2018-beyond
21/06/10 V1

Table 4.2

Inner Radcliffe & Town Centre Energy Framework: Proposed spatial approach

Spatial level	Key recommendations
1. Strategic energy resources: Our scoping identified five off-site energy resources which were wind power, biomass fuel, sewage gas, hydroelectric and minewater geothermal.	1.1 The three hydroelectric opportunities should be investigated in conjunction with the Environment Agency to confirm their feasibility, 1.2 A strategic view should be taken, based on further detailed investigation by Red Rose Forest of the resource, of the potential for the Council to invest in the developing its potential biomass resource, 1.3 Opportunities associated with the wastewater treatment works should be investigated in conjunction with the Dumers Lane developer and United Utilities in order to determine the potential, 1.4 Minewater geothermal should be the subject of a desk based investigation in order to determine the potential, 1.5 Bury's overall approach to wind power planning should be developed further, potentially including consultation on areas which could form part of an allocation plan.
2. Radcliffe Town Centre Masterplan opportunity area: Our analysis identified a series of opportunities relating to new and existing buildings in Radcliffe's Town Centre masterplan.	2.1 The potential for the Council to invest in a district heating network should be investigated. This would be on the basis that public buildings and housing would form 'anchor' heat customers. 2.2 New 'electricity intense' retail development in the town centre should be required to reduce carbon emissions through best practice design and technology, and by contributing to a 'solar hub' financing mechanisms. 2.3 The Council should establish a project or Special Purpose Vehicle – the 'Solar Hub' - with a view to investing in solar photovoltaic roofs using developer contributions to securitise borrowing.

	2.4 New residential development in the town centre should be required to connect to a town centre district heating network, if taken forward.
3. Inner Radcliffe opportunity area: Our analysis identified specific opportunities relating to key development sites identified in 'Re-inventing Radcliffe'.	3.1 On the former Radcliffe High School site the residential developer should contribute towards a shared energy centre based on gas-fired CHP, 3.2 On the former East Lancashire Paper Mill site the early residential phases should be linked to biomass heating for the new school. 3.3 On the Coney Green site new residential development could be linked to the potential Town Centre district heating network, if it is developed.
4. Irwell Bank opportunity area: Our scoping identified wider opportunities to supply new development sites with energy from strategic energy resources.	4.1 The potential to obtain heating from the Bury wastewater treatment works to supply both the Dumers Lane site and the wider Irwell Bank opportunity area should be investigated further in conjunction with United Utilities.

4.3 Potential delivery mechanisms

In order to deliver the energy framework investment in new energy infrastructure will be required. The proposed approach to delivery of the Radcliffe Energy Framework at a cost that is affordable to Bury Council and developers is that third party financing should be used to reduce the upfront capital costs to developers.

The benefit of this proposed approach is that whilst a contribution may still be required to securitise borrowing this will be substantially lower than if the developer or the Council had to pay for the investment themselves.

There are broadly four potential sources of finance that could be used, each of which imply different levels of involvement, risk and enabling from the Council:

1. Prudential borrowing: The Council decides to directly finance an opportunity using developer contributions as security;

2. Bank debt: Developer contributions are collected by the Council and then used as security either by the Council or an arms length Special Purpose Vehicle. This option could be extended in the future to include the proposed new Green Investment Bank and the Greater Manchester 'Evergreen' fund;

3. Community investment: A prospectus and share issue is set up by the Council in order to raise finance from individuals and organisations across Bury;

4. Third party investor: A delivery partner could be procured that would bring their own structures and financing – so, for example, there are a range of specialist Energy Service Companies (ESCo's) that can finance CHP and district heating schemes.

Options 1, 2 and 3 would all require enabling by the Council and imply varying levels of risk linked to the financing. Option 4 would mean that the Council (or the developer) would loose some control over how the project is delivered because the investor would be taking the risk.

Each of the opportunities identified will require a business plan to be developed - particularly for technologies such as CHP and biomass heating that have higher ongoing running costs – and a view taken as who will take on the risks. In all options the Energy Framework, if implemented, would assist in providing certainty to finance providers.

Here we discuss the options for taking forward the four main opportunities identified by the study:

4.3.1 'Solar Hub' initiative

With the establishment of the Feed-in-Tariff subsidy it is now possible to finance solar photovoltaic installations. Although this is a relatively new form of investment for the UK financial market there is evidence that, subject to any future changes to the Feed-in-Tariff regime, it provides a stable income stream to borrow against.

The Solar Hub is proposed as a means of financing solar installations. Developers would make capital contributions based on the minimum cost of compliance with the LDF Core Strategy energy policies. This would then be used to lever in finance, either using prudential borriowing or by going out the market, so enabling a larger solar installations to be carried out for a given capital contribution, and therefore at a lower upfront cost per tonne of CO_2 saved.

So, taking the Town Centre as an example, the cost of minimum compliance has been calculated as £124,210. Based on an assumption that 30% security would be required from a lender this sum could be used to lever in £289,823. This approach could also generate up to £3,177/annum of electricity for the building occupiers and £21,900/annum of Feed-in-Tariff revenue for 25 years. This approach could be used to finance solar roofs on other sites such as Coney Green and East Lancashire Paper Mill.

In order to secure finance there would need to be an accountable body, a business plan and contracts with the roofspace providers. The accountable body could be Bury Council, aligning with the future need to collect 'allowable solutions' contributions. If the Council is not in a position to take on this responsibility a Special Purpose Vehicle could be established, potentially as a means of collecting contributions across Bury.

4.3.2 District heating networks

District heating is the most complex form of project to finance because of the need to sign-up different building occupiers.

The Town Centre network would potentially be the most attractive opportunity from an investment point of view. This is because the majority of the buildings we have identified are owned and run by Bury Council, potentially streamlining development of a network.

Some of the smaller network opportunities we have identified also have 'anchor' heat loads, such as the Radcliffe High School site and East Lancashire Paper Mill. Coney Green has the potential to be connected to the Town Centre.

Each network would reduce commercial exposure to the Carbon Reduction Committment and, depending on the fuel used, future energy price rises.

Sites without an 'anchor' heat demand, such as Dumers Lane, are likely to be less attractive and would be unlikely to be financed without the use of developer contributions as gap funding. However, they could still deliver lower cost CO2 reductions than building integrated technologies.

Although the majority of CHP/district heating projects realised to date in the UK have been at a larger scale and relatively bespoke in how they were delivered three distinct delivery models have emerged:

1. Procure a private partner: The selection of a specialist private utility to design, build, finance and operate a network. Precedents include Southampton and Birmingham Councils

2. Establish a social enterprise or mutual body: The establishment of an arms length Special Purpose Vehicle which would operate on a not-for-profit basis. Precedents include Aberdeen Heat and Power and Mill Energy Services.

3. Use prudential borrowing: The use of prudential borrowing by a Local Authority to finance networks and benefit from low interest rates. Precedents include Woking and Nottingham Councils.

Each delivery model varies according to the balance of control and risk between the Local Authority and delivery partners. The ability to finance a project will depend on the level of certainty and the level of risk/exposure that the Council wishes to take.

Only the third option would ensure that the delivery body had powers of Statutory Undertaking, unless the private partner selected was an electricity generator with a district heating clause in their license conditions.

Finance providers will generally expect certainty in the form of heat supply contracts with end-users. For Radcliffe Town Centre the agreement of public sector heating contracts would facilitate higher level of borrowing – potentially up to 100% - at lower interest rates.

For networks with a higher proportion of new-build properties higher standing charges may need to be applied. These may be needed to recoup the capital outlay because the demand for heat will be lower.

4.3.3 Hydroelectric

The Feed-in-Tariff enables small hydroelectric projects to be financed. Once a technical feasibility study has confirmed the potential resource the financing of a project could follow a similar route to the Solar Hub, with developer contributions used to lever in debt finance which would be repayed using Feed-in-Tariff revenues.

4.3.4 Wind energy

An opportunity was identified for a small number of large turbines. Evidence from 'Merchant wind' projects, in which companies invest in 1-2 turbines in order to generate their own electricity, is that they can be financed by Banks.

Wind energy projects have significant risks associated with planning. The money invested to prepare a planning application and evidence the potential wind resource is at risk until planning is secured. This demonstrates the importance of there being a wider planning framework, including community engagement, for wind energy in order to reduce the risk for investors.

Financing options could follow a similar route to the Solar Hub, with developer contributions used to lever in debt finance which would be repayed from revenue streams

Other delivery options include partnering with a 'Merchant wind' specialist such as Ecotricity and a community share issue as demonstrated by projects developed by Energy4All. The latter has been shown to encourage local ownership over wind turbines, and so can reduce opposition.