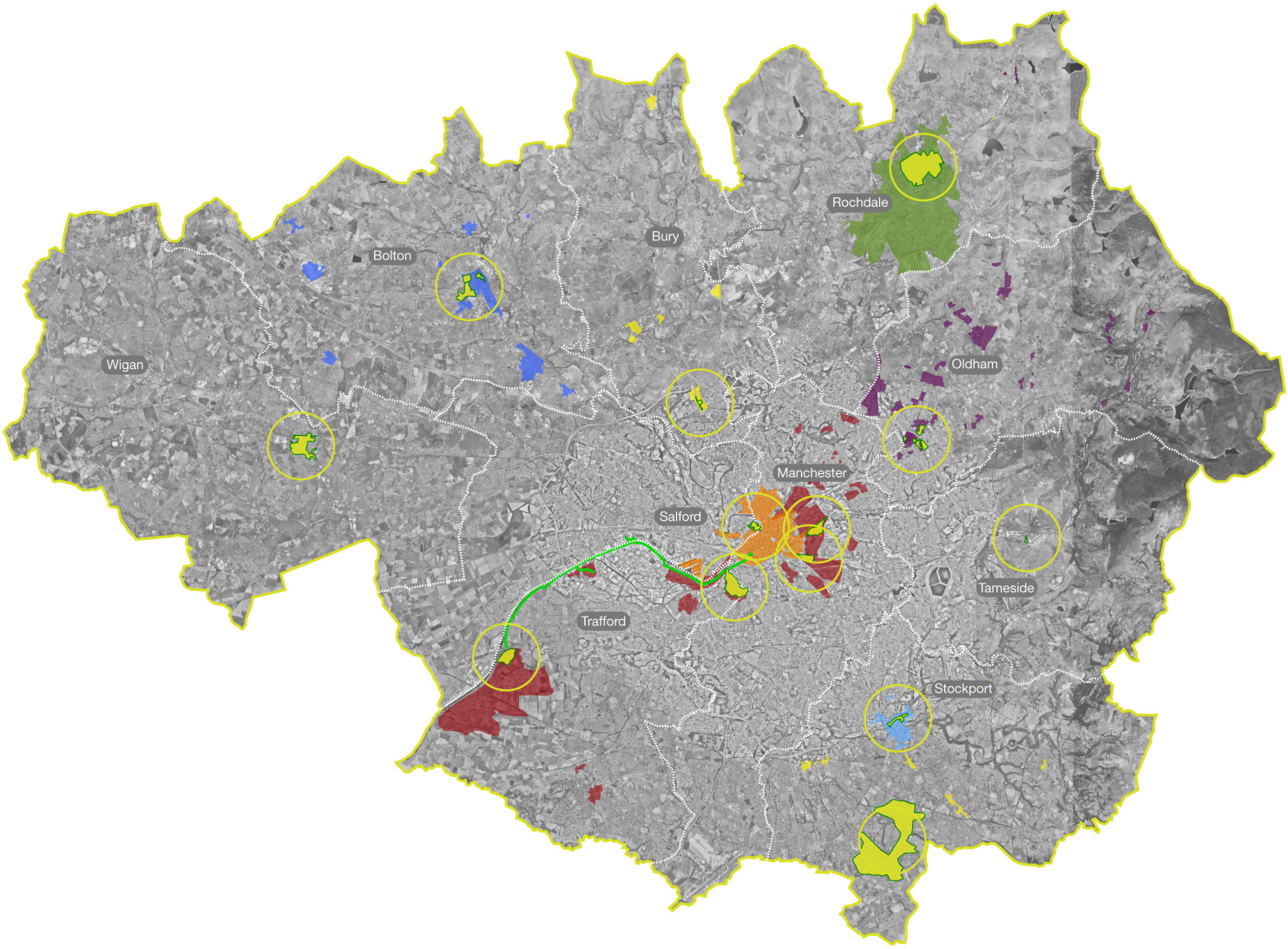
A report prepared for AGMA by URBED, AECOM and Quantum Strategy & Technology

# Case studies of character areas of change

Technical appendix

January 2010




urbed AECOM QUANTUM

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ASSOCIATION OF
GREATER MANCHESTER
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# Contents

# How the case studies work

In this appendix we provide a non-technical narrative for each of the case studies that form the main evidence base for this study. Each case study provides an illustrative planning framework for a character area.

Below we briefly outline the format for each of the case studies, the technical methodology for which was described in Section 7 of the main report. Each case study comprises a non-technical narrative under key headings, which is illustrated by a set of spatial plans, and supported by detailed technical analysis of energy and carbon budgets.

## Character area

Each case study has been chosen to be representative of development that might be brought forward in distinct character areas of change. The character area is therefore indicative of the broad context for development.

Whilst each case study is illustrative for the purposes of this study, and every local area will have its own distinctive features, the lessons should be readily patternable across similar character areas in Greater Manchester e.g. Prestwich is classified as a local centre of which there are 34 others across the sub-region.

## Technology mix

Here we describe the mix of energy supply technologies that have been identified as representing the 'best fit' for the case study in order to achieve the required level of $CO_2$ reductions. The proposed mix is based on the phasing and mix of development and the strategic energy opportunities identified in the local area.

## Allowable solutions

Here we describe off-site technologies that developers would be able to, or in some cases be required to, make financial contributions towards in order to obtain $CO_2$ credits for phases of development. Allowable solutions could work at a number of different spatial levels depending on their availability. Three broad levels have been identified and proposed:

- Defined planning area e.g. installations within a neighbourhood or regeneration area;
- Infrastructure-led focus area e.g. district heating network expansion area;
- Formal LDF area or sub-region e.g. wind energy cluster development;

## Indicative planned approach

Here we describe an indicative approach to energy infrastructure planning for the case study. Spatial planning policies are illustrated by indicative energy proposals plans that describe broad areas for infrastructure investment.  The plan for each character area outlines:

- Areas of change to which planning policies might apply;
- Target buildings for District Heating network connection;
- Areas where different 'allowable' solution contributions might apply;
- Possible energy centre locations based on broadly applied constraints.

Each plan is supported by a planning policy matrix that applies to each area (see below), including $CO_2$ reduction targets.

For each proposals plan we describe an indicative approach to implementation, linked to possible phases of development and the networking of existing buildings (where relevant).

## Existing energy networks

Here we provide a brief summary of the opportunities and constraints posed by the existing gas, electricity and district heating networks in seeking to meet the needs of the development and to connect decentralised energy generation technologies.

## Capital cost implications

Here we provide an outline estimate of the capital cost and the cost of carbon reduction for each technology, as well as an indicative payback period and options for mitigating the upfront cost to developers.

## Planning policy and enabling framework

Here we set out an indicative matrix of planning policies and complementary enabling mechanisms, which could be used to drive the delivery of the energy proposals plan and associated infrastructure.

## Disclaimer

Please note that all plans and costings are indicative only and should not be taken as representing planning proposals by any of the districts of Greater Manchester, or be used for costing purposes.

## Planning and enabling matrix

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|---|---|
| **$CO_2$ reduction targets** | **Planning policy**<br>$CO_2$ reduction target(s) as they relate to the infrastructure solutions for the character area.<br><br>**Complementary enabling requirements**<br>• Supporting information to evidence compliance with the target |
| **On-site policy areas** | **Planning policy**<br>Requirements as they relate to the spatial implementation of technologies and phases of development.<br><br>**Complementary enabling requirements**<br>• Schedules and guidance relating to the technology |
| **Near/off-site policy areas** | **Planning policy**<br>Target areas and buildings that may contribute to implementation of the infrastructure solution(s).<br><br>**Complementary enabling requirements**<br>• Schedules and guidance relating to the technology |
| **Energy centres** | **Planning policy**<br>Requirements and constraints relating to the location of energy centres in the urban environment.<br><br>**Complementary enabling requirements**<br>• Guidance and approvals relating to the technology |
| **Enabling mechanisms** | • Supporting regulatory and financial mechanisms, including 'allowable' infrastructure contributions. |

## Character area 1

# Sub-region, Strategic mixed development corridor

### Case study

Carrington Combined Cycle Gas Turbine (CCGT) power station

### Description

Major planned investment in 860 MWe of new power generation capacity making use of existing distribution network infrastructure on a former power station site. The Secretary of State's planning consent requires the developers to explore the potential to operate in CHP mode.

### Technology mix

The scale of the power station and the form of generating technology could facilitate the off-take of a substantial quantity of heat. This would allow the plant to operate in 'quality' CHP mode by supplying medium temperature steam to adjacent industrial end-users and low temperature hot water to urban centres along the ship canal via a primary (medium temperature hot water) district heating pipeline.

### Allowable solutions

Network expansion - Buildings requiring greater $CO_2$ reductions than that delivered by the heating network connection would be able to buy $CO_2$ credits in the form of contributions to expansion of the heating network.

### Indicative planned approach

The power station is likely to consist of two 330 MWe gas turbines and an accompanying steam generators using waste heat. In order to supply a network heat could be taken from at least one of the turbines, and a large thermal storage tank would need to be constructed.

Large-scale heat off-take from the power station, supported by approximately 15 km of medium temperature district heating pipeline, and large-scale heat storage to buffer supply and demand, would require substantial capital investment and a sufficient critical mass of firm heat connections to provide the security to go ahead with the project.

High level mapping of strategic heat loads that could be connected together suggest that, based on precedent from Copenhagen, Berlin and London, the Manchester Ship Canal could be used as a corridor to route a heat pipeline all the way to the city centre of Manchester. This routing would create access to a number of strategic heat loads:

- Industrial sites: Carrington refinery, proposed Partington Wharfside paper recycling mill, Trafford Park industrial estate;
- Local and retail centres: Eccles Town Centre, Salford Quays (including Media City) and the Trafford Centre;
- Growth Point sites: These include Trafford Quays, the Lancashire County Cricket Ground redevelopment, the Old Trafford masterplan area, Irwell Riverside and Pomona Dock;
- City regional centre sites: Great Jackson Street masterplan, Whitworth Street West masterplan, Town Hall complex, Manchester Central complex and adjacent hotel and leisure facilities;

The exact routing option would require detailed scoping, following which planning policy could be used to safeguard access to the strategic heat loads.

Each discrete connection area would require its own secondary district heating network which would circulate hot water at a lower temperature than the primary distribution network. It is likely that each network would install standby and peak boiler capacity.

These networks would each have their own spatial planning policy set, complementing a joint planning policy document adopted by Trafford, Salford and Manchester Councils which would set out the strategic framework for the project.

Each spur of the secondary network would be designated as 'secondary network connection' areas. In these areas planning policy could require district heating connections for new development in order to provide certainty for investors. The connection of existing buildings would also be actively pursued in these areas.

### Existing energy networks

The power station would make use of the sites existing high voltage grid connection capacity. A dedicated new high pressure gas main will be brought to the site in order to fuel the power station.

## Capital cost implications

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| **Capital cost** | £2.2m/km based on the Barking CCGT proposal, London |
| **Indicative payback period** | 15-25 years |
| **Options for mitigating upfront costs** | • Financing by UK Banks and/or European Investment Bank;<br>• Joint venture with power station investor to offset reduction in revenue from electricity generation;<br>• Joint venture with major landowner to facilitate pipeline route;<br>• Security provided by development agreements that provide utility contributions; |

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Requirement for a minimum 22% $CO_2$ reduction in net emissions against Part L 2006 based on energy supply from gas-fired CCGT<br><br>**Policy 1.2**<br>Higher $CO_2$ reductions should be sought from further efficiency measures and specified 'allowable' solutions (see below)<br><br>**Complementary enabling mechanisms**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Secondary network policy area** | **Policy 2.1**<br>Development will be required to obtain its heating by connecting to a district heating network supplied by gas-fired CCGT.<br><br>**Policy 2.2**<br>Heating systems should be designed to be compatible with and interface with district heating.<br><br>**Policy 2.3**<br>Identification of existing buildings to target for connection.<br><br>**Policy 2.4**<br>Network connection requirement for consequential improvement works.<br><br>**Complementary enabling mechanisms**<br>• Developers contribution schedule for district heating connections;<br>• Technical guidance on connections to be provided within a joint SPD;<br>• Alignment of public sector investment programmes. |

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| **Heat pipeline route** | **Policy 3.1**<br>Safeguarding of preferred route(s) for heat pipeline and spurs required to supply strategic heat loads. Potential for use of Local Development Orders to permit the laying of pipelines. |
| **Energy centre locations** | **Policy 4.1**<br>Location and design of standby plant and heat substations should seek to integrate them into the townscape.<br><br>**Policy 4.2**<br>Boiler plant, stack height and pollution control equipment to comply with AQMA, Smoke Control Area and PPC requirements (as relevant). |
| **Enabling mechanisms** | • Generic licensing framework for ESCo infrastructure investment within the policy area;<br>• Local Authority use of Local Development Orders for network routing, role to be set out in joint policy and SPD;<br>• Possible AGMA regulatory framework governing heat pricing and service provision. |

## Character area 2

# City Regional centre, mixed use residential neighbourhood

### Case study

Chancellor Place, Manchester

### Description

Major planned investment in a new central district to provide large floor plate offices, retail and leisure uses, and supporting short stay accommodation. The plan includes a new hospital and a significant proportion of residential property in later phases.

### Technology mix

The scale and mix of development support investment in geothermal energy supplying district heating. The site could exploit shallow (100-150 metre) and deep geothermal aquifers (2-3 km) to meet base heating requirements. Mid and peak heat loads could be met by biomass and natural gas heating respectively.

### Allowable solutions

Network expansion - Buildings requiring regulated $CO_2$ reductions greater than the minimum target would be able to buy $CO_2$ credits from contributions to expansion of the heating network.

### Indicative planned approach

Geothermal technology and district heating both require a planned approach in order to create the right conditions to secure investment in the infrastructure, primarily because of the high upfront capital cost.

The four phases of development are proposed as being co-ordinated by one developer. The initial commercial office-led phase could be designated as an 'anchor' phase for the network to provide certainty. Subsequent phases of new development could then be designated as 'network connection' areas. Here planning policy would require connections in order to provide certainty to invest in further expansion of the district heating network.

Existing buildings with high-density heat loads can be identified in four further areas beyond the proposed development:

- UMIST campus which has a steam heating main linking the main buildings on-site,
- Piccadilly Station and surrounds which is characterised by large floor plate offices and hotels,

- Brunwick PFI housing area which is characterised by multi-storey residential blocks with existing communal heating,
- The Universal Square office refurbishment.

In each of these four areas it is proposed that the buildings and sites identified are targeted for connection to the expanding network – although the UMIST connection will depend on investment to move from a steam network to a lower temperature hot water network.

In each of these areas public sector investment by the PFI partner, the University and other bodies would need to be aligned in order to support and provide certainty for network investment. These connections could be paid for in part by developer contributions.

The location of a geothermal energy centre is relatively flexible because of the potential to use directional drilling. However, the use of biomass for some of the heat load would create specific constraints. The site is within an Air Quality Management Area and Smoke Control Area, so any plant will need to be specified to minimise particulate emissions and to have a suitable stack height.

Siting could be to east on the former Ardwick goods yard site, and in order to reduce the environmental impact of transporting the fuel, biomass imported from wider than Greater Manchester could be brought in by rail if there was sufficient scale to justify dedicated handling facilities.

### Existing energy networks

The nearest primary substation to the development is Piccadilly (Bloom Street BSP) that transforms down to 6.6kV. The substation capacity is higher than current load because of the loss of several uses hence there is capacity for some additional load.

Phase 1 could be connected to the existing network, but reinforcement will be required to meet demand from Phase 2 onwards.

The network operator has proposed the following ‘standard’ approaches:

- Depending on the capacity available, Phase 1 could be connected to the existing feeder or it may need up rating by overlaying with larger cable or installing a new feeder
- Phases 2 to 5 will require a new primary substation.

With regards to the existing district heating network serving the UMIST campus, this network dates back to the original Bloom Street CHP plant, which provided district steam. The cost of improving this network and/or moving to medium temperature hot water is currently perceived to be prohibitive. UMIST would therefore need re-assurance that additional finance might be made available for the network investment required.

## Capital cost implications

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| **Capital cost** | **Chancellor Place, all phases**<br>£15m geothermal well estimate<br>£10.4m heat substations and district heating network<br><br>**Wider network, existing buildings**<br>£8.8m heat substations and district heating network |
| **Indicative payback period** | 15-25 years |
| **Options for mitigating upfront costs** | • Financing by UK Banks and/or European Investment Bank;<br>• Public private joint venture to mitigate risk and gap fund the project;<br>• Security provided by developer's utility contributions; |

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Requirement for a minimum 37% $CO_2$ reduction in gross emissions against Part L 2006 based on energy supply from a deep geothermal well supported by biomass heating.<br><br>**Policy 1.2**<br>Higher $CO_2$ reductions should be sought from further efficiency measures and specified 'allowable' solutions.<br><br>**Supporting information**<br>• Carbon budget statement to be submitted by planning applicants using AGMA methodology |
| **Anchor network policy area** | **Policy 2.1**<br>Connection of initial phases in order to 'anchor' the energy centre and network development. |
| **Network connection policy area** | **Policy 3.1**<br>District heating network connection requirement for later phases.<br><br>**Policy 3.2**<br>Heating systems should be designed to be compatible with and interface with district heating.<br><br>**Policy 3.3**<br>Allowable solution network contribution requirement for higher $CO_2$ emissions reductions.<br><br>**Complementary enabling mechanisms**<br>• Technical guidance on connections to be contained within SPD;<br>• Developer contribution schedule for district heating connections;<br>• 'Network allowable solution' developer contribution schedule for network expansion. |

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| **Energy centres** | **Policy 4.1**<br>Location within light industrial area with lorry access from A and B roads only.<br><br>**Policy 4.2**<br>Rail delivery should be explored where large-scale movements, including imports, of biomass fuel are required.<br><br>**Policy 4.3**<br>Boiler plant, stack height and pollution control equipment to comply with AQMA, Smoke Control Area and PPC requirements (as relevant). |
| **Network expansion areas** | **Policy 5.1**<br>Identification of existing buildings to target for connection.<br><br>**Policy 5.2**<br>Network connection requirement for consequential improvement works.<br><br>**Complementary enabling mechanisms**<br>• Alignment of public sector investment programmes;<br>• Developer contribution schedule for district heating connections; |
| **Enabling mechanisms** | • Generic licensing framework for geothermal resource and ESCo infrastructure investment within policy area based on public or private procurement route;<br>• Local Authority use of Local Development Orders for network routing;<br>• AGMA regulatory framework governing heat pricing and service provision; |

## Character area 3

# City Regional centre, mixed use commercial neighbourhood

### Case study

Greengate Exchange, Salford

### Description

Major planned investment in a new central district to provide large floor plate offices and supporting short stay accommodation, leisure and retailing. The investment is likely to trigger follow-on development of surrounding sites.

### Technology mix

The scale and mix of the proposed development is well suited to Combined Heat and Power (CHP) supplying district heating and potentially also district cooling. This would provide a basic $CO_2$ reduction of at least 29% for all buildings connecting to the system. Constraints on emissions, land and vehicle access suggest that natural gas rather than biomass CHP would initially be more appropriate for a centrally located urban site.

### Allowable solutions

Network expansion - Buildings requiring regulated $CO_2$ reductions greater than the minimum target would be able to buy $CO_2$ credits by contributing towards expansion of the district-heating network.

### Indicative planned approach

District heating requires a planned approach in order to create the right conditions to secure investment in the infrastructure, primarily because heating networks have a high upfront capital cost.

The first phase of development together with a neighbouring development site on a former brewery site may both be taken forward with public sector involvement. They could therefore be designated as ‘anchor’ phases for the network which using their commitment could provide greater certainty.

Subsequent phases of new development, and follow-on windfall development, could be designated as ‘network connection’ areas. Here planning policy would require new development to connect to the network in order to provide certainty to invest in expansion.

Existing buildings with high-density heat loads have been identified in two further areas in the surrounding context:

- Trinity and Blackfriars which are characterised by ten blocks of multi-storey public sector housing, two schools and a Salford University campus,
- City Centre side which is characterised by large floor plate offices and landmark public buildings, including URBIS, Chethams music school, Victoria Station, MEN arena and the Co-operative Group's cluster of buildings.

The latter group of existing buildings and a number of potential development sites are located in Manchester, which would therefore require cross boundary planning to link together the infrastructure opportunities.

In both of these two areas it is proposed that the buildings identified are targeted for connection to the expanding network. In each area public sector investment by ALMO's, the LEA and other bodies would need to be aligned to support and underwrite network investment. These connections could partly be paid for by developer contributions.

Given the pressure for high quality development the area is relatively constrained in seeking to identify a suitable site for an energy centre. The design of such a building would therefore need to be contemporary and/or make use of existing built structures. It is also within an Air Quality Management Area, so plant will need to be specified to minimise $NO_X$ emissions and have a suitable stack height.

### Existing energy networks

The nearest primary substation is at Strangeways (Redbank BSP) that transforms down to 6.6kV. The substation capacity is 23 MVA, therefore there is enough capacity to incorporate some additional demand. The electricity demand from phases 1 and 2 (6 MVA) could be incorporated into the existing infrastructure, but reinforcement will be required for the subsequent four phases.

The network operator has proposed the following 'standard' solutions:

- Connect to existing feeder
- Up rate existing feeder by overlaying with larger cable
- For phase 3, install new feeder if there is still capacity at the primary substation
- Install new primary substation.

The fault level contribution from the proposed scale of CHP generation is under 4kA implying no fault level issues. The distance between the Strangeways primary and the potential energy centre sites highlighted is too great for co-location to be feasible, as the energy centre primarily needs to be located to serve the heating network.

A larger energy centre serving an expanded network encompassing sites such as the Boddintons Brewery and the Miller Street redevelopment site could, however, benefit from co-location whilst serving a wider heat network.

No issues were raised in relation to access to a medium pressure gas supply to fuel the CHP unit.

## Capital cost implications

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| **Capital cost** | **Greengate Exchange, all phases**<br>£7.8m energy centre and district heating network<br><br>**Wider scheme, existing buildings**<br>£22.4m heat substations and district heating network |
| **Indicative payback period** | 10-15 years |
| **Options for mitigating upfront costs** | • Financing by UK Banks and/or European Investment Bank;<br>• Public:private joint venture to mitigate risk and gap fund the project;<br>• Security provided by developer's utility contributions; |

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Requirement for a minimum 29% $CO_2$ reduction in gross emissions against Part L 2006 based on energy supply from gas-fired CHP<br><br>**Policy 1.2**<br>Higher $CO_2$ reduction contributions should be sought from further efficiency measures and specified 'allowable' solutions (see below)<br><br>**Supporting information**<br>• Carbon budget statement to be submitted by planning applicants using AGMA methodology |
| **Anchor network policy area 1** | **Policy 2.1**<br>Requirement for energy supply to be based on gas-fired CHP supplying district heating and cooling.<br>Heating and cooling systems should be designed to be compatible with and interface with the system.<br><br>**Policy 2.2**<br>District heating and cooling network connection requirement for phases of development.<br><br>**Complementary enabling mechanisms**<br>• Technical guidance on connections to be contained within an SPD<br>• Alignment of public sector partner investment decisions. |
| **Anchor network policy area 2** | **Policy 3.1**<br>District heating network connection requirement for further phases<br><br>**Policy 3.2**<br>Network contribution requirement as an 'allowable' solution for higher $CO_2$ reductions |

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| | **Complementary enabling mechanisms**<br>• Technical guidance on connections to be contained within an SPD;<br>• Developer contribution schedule for District Heating connections;<br>• 'Network allowable solution' developer contribution schedule for network expansion. |
| **Blackfriars network expansion area** | **Policy 4.1**<br>Identification of target buildings for connection to the network.<br><br>**Policy 4.2**<br>A network connection requirement will apply for significant consequential improvement works.<br><br>Complementary enabling mechanisms<br>• Alignment of public sector investment programmes;<br>• Contribution schedule for district heating connections |
| **City Centre network expansion area** | **Policy 5.1**<br>Identification of target buildings for connection to the network.<br><br>**Policy 5.2**<br>Network connection requirement for consequential improvement works.<br><br>**Complementary enabling mechanisms**<br>• Alignment of public sector investment programmes;<br>• Developer contribution schedule for district heating connections. |
| **Energy centres** | **Policy 6.1**<br>Design and location in order to integrate the building into the townscape and make use of the river for cooling. |

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| | **Policy 6.2**<br>Generating plant, stack height and pollution control equipment to comply with AQMA requirements. |
| **Enabling mechanisms** | • Generic licensing framework for ESCo infrastructure investment within proposal plan area based on public or private procurement route;<br>• Local Authority use of Local Development Orders for network routing;<br>• Possible AGMA regulatory framework governing pricing and service provision; |

## Character area 4

# City Regional centre, strategic growth point site

### Case study

Holt Town, Manchester

### Description

Major planned investment in a new residential district that will have an eventual population of around 4,500. The masterplan also proposes a number of mill conversions and provision for a new primary school. An intermediate housing market model has been proposed in place of a social housing requirement.

### Technology mix

The density and mix of development would support investment in district heating, which would need to be planned to supply zero carbon energy to phases post-2013 (subsidised housing) and 2016. A district-heating network would enable the development to be supplied with heat from a number of sources.

The primary source of heat (and power) could be an advanced fuel cell CHP technology. This will reduce the emissions from natural gas, and in the future would provide the flexibility to run on clean burning hydrogen gas. This could be complemented by a proportion of micro-generation (solar photovoltaics) on later phases as their cost reduces and potential new revenue streams, such as a feed-in tariff, become available.

Subject to further technical investigation a proportion of the base heating could be supplemented by geothermal energy from the 1 km deep Bradford mine workings that extend out from Sportcity under the site.

### Allowable solutions

Buildings requiring regulated $CO_2$ reductions greater than the proposed minimum target would be able to buy $CO_2$ credits by contributing to the expansion of the heating network into the wider area – some front-loading of this investment may be required as part of the investment in preparing the infrastructure for the site.

### Indicative planned approach

District heating and minewater geothermal both require a planned approach in order to create the right conditions to underwrite investment in the infrastructure, primarily because of the high upfront capital cost.

The masterplan phases are likely to be co-ordinated by one developer. The initial commercial-led phase could be designated as an 'anchor' phase for the network to provide certainty. The adjacent Sportcity leisure attraction site has also been designated an anchor phase as it is likely that decentralised generation would be needed in order to meet low carbon aspirations, and the early demand for power from this site could then complement Holt Town's base heat demand.

Subsequent phases of new development could be designated as 'network connection' areas. Here planning policy could require connections in order to provide certainty to invest in expansion of the district heating network.

Existing buildings with substantial heat loads have been identified in two further areas in the surrounding context:

- New Islington urban village where the developer is committed to installing communal heating systems;
- Beswick where there are three schools within close proximity and a proposed housing site,

In these two areas the buildings and sites identified could be targeted for connection to the expanding network. Investment decisions on improvements to the schools by the LEA would need to be aligned in order to support and underwrite the cost of network connections. These connections could partly be paid for by developer contributions.

Fuel CHP could either be introduced on a modular phase-by-phase basis, or if the leisure site proceeds first then a fuel cell CHP energy centre could be located adjacent to the Sportcity leisure site. It is likely that thermal storage would be required in order to buffer supply and demand for energy.

Solar photovoltaics provide the lowest cost carbon reductions to meet regulatory milestones (over and above the existing network connection) for later phases. This could be introduced and installed on later phases post 2016 in order to meet zero carbon regulatory milestones. With the introduction of a feed-in tariff likely to boost revenue from solar electricity generation there would be benefit in the developer retaining ownership of the solar arrays in order to recover the capital cost.

The location of a minewater energy centre would depend on the configuration of the mine galleries, the suitability of which would require further detailed investigation. Directional drilling could allow some locational flexibility.

### Existing energy network assessment

The nearest primary substation to the development is Eastlands (Stuart St BSP) which transforms down to 6.6kV. The substation has capacity for some additional load. Phase 1, 2 and

3 (10 MVA) could be connected to the existing network, especially when the diversity factor for the buildings is taken into account, but reinforcement will be required to meet demand from the subsequent phases.

The network operator has proposed the following ‘standard’ solutions:

- Connect to existing feeders if capacity is available or up-rate existing feeder by overlaying with larger cable or install new feeder if capacity still available at primary for Phases 1, 2 & 3
- Increase transformer capacity or install new primary substation to cater for phases 4 and beyond.

The distance between the Stuart Road primary and the potential energy centre sites highlighted is too great (just under 1 km) for co-location to be feasible, as the energy centre primarily needs to be located to serve the heating network, although there is a smaller secondary substation adjacent to and serving the City of Manchester stadium.  A larger energy centre serving Holt Town and an expanding Sportcity would, however, benefit from co-location at the Stuart Road site.

## Capital cost implications

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| **Capital cost** | **Holt Town, all phases**<br>District heating network £32m<br>Fuel cell energy centre £13.9m [1]<br>Solar photovoltaic's £25.4m [2] |
| **Indicative payback period** | Uncertain and highly dependant on a number of factors:<br>• The fuel used in the fuel cell CHP units,<br>• The extent of any future fall in the price of solar photovoltaic's<br>• The likely value of revenue from a feed-in tariff. |
| **Options for mitigating upfront costs** | • Adjustment of land value to reflect additional capital costs;<br>• Third party ESCo or joint venture with the lead developer provides the majority of the finance for the infrastructure;<br>• Modular installation of fuel cells as phases of development are complete;<br>• Developer retains ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• Investment in heat and power infrastructure forms part of site works; |

Notes:

1. Assumes a 28% cost reduction 2010/16 and 65.6% 2017/28
2. Assumes 28% cost reduction for modules over the phasing timeline

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Requirement for a minimum 35% $CO_2$ reduction in gross emissions against Part L 2006 based on energy supply from gas (fuel cell) CHP supplemented by geothermal energy.<br><br>**Policy 1.2**<br>Higher $CO_2$ reductions to be achieved based on energy supply from further efficiency measures, micro-generation technologies and specified 'allowable' solutions (see below).<br><br>**Complementary enabling mechanisms:**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Phase 1: Anchor policy area** | **Policy 2.1**<br>Requirement for primary energy to be supplied by fuel cell CHP supplying district heating. |
| **Network connection policy area** | **Policy 3.1**<br>District heating network connection requirement for all follow-on phases<br><br>**Policy 3.2**<br>Heating systems should be designed to be compatible with and interface with district heating.<br><br>**Policy 3.3**<br>Allowable solution network contribution requirement for higher $CO_2$ reductions than the policy minimum.<br><br>**Complementary enabling mechanisms:**<br>• Connection technical guidance contained within SPD<br>• 'Network allowable solution' contribution schedule for network expansion<br>• Alignment of public sector investment decisions to support network expansion |

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| **Combined policy area** | **Policy 4.1**<br>District heating network connection requirement for all follow-on phases.<br><br>**Policy 4.2**<br>Heating systems should be designed to be compatible with and interface with district heating.<br><br>**Phase 4.3**<br>Installation of micro-generation technologies as appropriate to the scale and form of the development to achieve further $CO_2$ reductions.<br><br>**Phase 4.4**<br>Developers are encouraged to support the City Region's market for solar technologies, with an emphasis on solar photovoltaics. |
| **Energy centre location** | **Policy 5.1**<br>Location of primary energy centre on designated industrial site adjacent to the leisure development site.<br><br>**Policy 5.2**<br>Generating plant, stack height and pollution control equipment to be selected to represent the Best Available Technology. |
| **New Islington and Beswick network expansion areas** | **Policy 6.1**<br>Identification of target buildings for connection to the network. Policy 3.1 applies to development sites in this area.<br><br>**Policy 6.2**<br>Network connection requirement for consequential improvement works.<br><br>**Complementary enabling mechanisms:**<br>• Alignment of public sector investment programmes;<br>• Contribution schedule for district heating connections. |

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| **Enabling mechanisms** | • Generic licensing framework for ESCo infrastructure investment within proposal plan area based on public or private procurement route;<br>• Local Authority use of Local Development Orders for network routing;<br>• AGMA regulatory framework governing pricing and service provision; |

## Character area 5

# Inner Regeneration Area, 1960/70's housing estate

### Case study

Old Trafford, Trafford

### Description

An inner city area characterised by a mix of high-rise residential tower blocks and low-rise 'Radburn' layout terraced housing that is now managed by an ALMO. The area has been highlighted as a 'gateway' to the City Regional centre and is the subject of a masterplan that will inform future development and investment decisions by the Council and the ALMO – including the possible demolition and replacement of housing stock.

### Technology mix

The framework area, which is the focus for the masterplan, has been divided into two energy planning areas, reflecting the timeline for regeneration, and suitability for the application of different technologies:

#### Area 1 (2010/15): Micro-generation installations

The early phases of development are likely to be at medium density (70-80 dwellings per hectare) and are located over 800 metres from the nearest district heating network. The optimal scale for solutions will therefore be individual homes or housing blocks, supported by allowable off-site solutions.

#### Area 2 (2016/onwards): Biomass CHP linking to existing district heating

The later phases of development will be required to meet zero carbon regulatory standards and form a natural cluster with existing buildings that could, together, support district heating. Their location also creates the potential to interface with the existing Alexandra Park district heating network. By connecting with this existing network a feasible scale for biomass CHP could be achieved (>4-5 MWe).

### Allowable solutions

These would be based on two solutions - micro-generation installations elsewhere within the regeneration area and contributions to district heating network expansion. Housing in Area 1 requiring $CO_2$ reductions greater than the regulatory minimum target under the Code for Sustainable Homes will be able to buy $CO_2$ credits by contributing to the installation of technologies on existing buildings within the area. Least cost options would include solar

photovoltaic and biomass boiler installations for local schools or on refurbished multi-storey blocks.

### Indicative planned approach

Phasing of the preferred masterplan option is driven by proposals to replace some of the housing stock. The preferred option includes proposals to demolish three of the eight existing tower blocks that do not meet the Decent Homes standard. Residents would be re-housed in proposed new-build property, which would form the early phases of redevelopment.

The new development is proposed as being mixed tenure, which will mean that social housing units in receipt of public subsidy will be required to meet higher levels of the Code for Sustainable Homes earlier. The mix is proposed as being approximately 40% social housing, 20% shared equity and 40% private for sale or rent.

Based on the phasing and spatial distance from the Alexander Park district heating network, development in Area 1 could meet early $CO_2$ reductions by selecting the most appropriate micro-generation technologies. As a minimum one micro-generation technology would have to be installed, using solar thermal collectors as the base case for homes.

Where possible the linking of new and existing buildings will be encouraged and opportunities identified (eg. a biomass boiler supplying a school and a block of apartments) but this will not be required. Instead the developer would be able to choose the most appropriate solution.

Economies of scale could be achieved by encouraging developers to procure technologies through an RSL, District or City Region supply chain initiative, which would aim to pool installation contracts to reduce costs. This might also enable developers to procure technologies that have been identified as being tried and tested and to access local maintenance support.

Where the cost of delivering all of the required $CO_2$ reductions on-site is not feasible within development or land values it will be possible to buy additional $CO_2$ credits by contributing to micro-generation installations on ALMO properties and community buildings in the framework area. These installations would be identified in order to be cheaper than installations on an individual home by home basis – so, for example, solar photovoltaic's installed as a large array on a tower block or school building could be around 20% cheaper.

Development in Area 2 will be required to connect with a district heating network that will link new and refurbished buildings. The network would form a new branch of the existing Alexander Park network. In order to enable developments to meet Code level 5 and 6 $CO_2$ reduction requirements a biomass boiler and/or CHP plant would also need to be installed. The advantage of combining the new and existing networks would be the scale, which would allow biomass CHP to become a technically feasible option.

District heating would require a planned approach in order to create the right conditions to secure investment in the infrastructure, primarily because heating network has a high upfront capital cost. New development and major refurbishments in Area 2 would therefore need to be required to connect to the network.

Locating a biomass CHP plant poses specific constraints in a central urban area. The energy centre could be located adjacent to the existing energy centre in Alexandra Park, or on a site in closer proximity to Area 2 (eg. next to a small existing brewery). Any site would need to accommodate frequent lorry-based deliveries of biomass fuel, and as such this would best be achieved with minimum disruption to residential streets by accessing the energy centre directly from a B road. The stack height and pollution control equipment would need to comply with AQMA standards.

### Contractual and financing issues

There could be benefit in working with the contractor responsible for running the Alexander Park network on behalf of the City South ALMO. In order to do this the contractual arrangement to operate the Alexandra Park district heating assets would probably require varying in order to facilitate network expansion.

In order to finance of the network extension, and a new biomass CHP energy centre, firm energy supply contracts with public sector buildings (e.g. the local College) and housing developers (through planning requirements) are likely to be required.

### Existing energy network assessment

The nearest sub-station to the development is at Moss Side (Longsight BSP) that transforms from 33kV to 6.6kV. The sub-station is already operating above its capacity and it would not be able to accommodate any significant additional loads.

One option for the new development would be to connect to next nearest primary substation that is at Chester Rd (Stretford BSP). This substation is operating at below its capacity. It could accommodate the first phase but reinforcement would be needed for the second and subsequent phases.

The network operator has suggested the following ‘standard’ approaches:

- Connect to existing feeder from Chester Rd primary for Phase 1
- Load split between Moss Side & Chester Rd primaries
- Up rate Chester Rd primary transformers to 2 x 23MVA
- New primary substation.

The distance between the Chester Road or Moss Side primaries and the potential energy centre sites highlighted is too great for co-location as an innovative solution to be feasible, as the energy centre primarily needs to be located in order to serve the heating network.

With regards to gas the infrastructure in this area is sufficient to accept the full load of the projected development. An 18" ST Intermediate Pressure main to the South/East of the site would be used.

With regards to the existing district heating network that serves the Alexandra Park Estate, there may be technical issues in seeking to expand this network. This is because the new development would be at the furthest extent of the network, where the pipes are of their smallest dimension. A connection would need to be established joining to the largest pipe dimension on the network in order to link the existing and proposed energy centres.

## Capital cost implications

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| **Capital cost** | **Area 1: Micro-generation options**<br>Solar photovoltaic's £1.6m<br>*Biomass heating (apartment clusters) £5-6k/unit*<br><br>**Area 2: Biomass CHP**<br>District heating network £2.3m<br>Biomass energy centre £1.6m<br>Solar photovoltaic's £7.2m |
| **Indicative payback period** | **Micro-generation option**<br>>25 years, without feed-in tariff<br>5-10 years, with typical solar feed-in tariff<br><br>**CHP option**<br>15-25 years, without renewable heat tariff<br>5-10 years, with renewable heat tariff |
| **Options for mitigating upfront costs** | • Adjustment in publicly owned publicly owned land values to reflect additional capital cost for infrastructure;<br>• Joint venture between ALMO and Alexander Park ESCo contractor provides the majority of the finance for the CHP/district heating infrastructure;<br>• Developer and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• Off-site allowable solutions to provide additional $CO_2$ reductions; |

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Area 1: Requirement for a minimum 25% $CO_2$ reduction in gross emissions against Part L 2006 based on carbon compliance measures, which may increase in-line with regulatory requirements.<br><br>**Policy 1.2**<br>Area 2: Minimum requirement for 40% $CO_2$ reduction to be achieved through connecting to a zero carbon heating supply with supplementary technologies and/or allowable solutions required to meet higher regulatory requirements (Code levels 5 or 6).<br><br>**Supporting information**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Area 1: Micro-generation policy area** | **Policy 2.1**<br>Minimum 25% $CO_2$ reduction target to be met using a mix and scale of micro-generation technologies appropriate to the development.<br><br>**Policy 2.2**<br>Developers are encouraged to explore the potential to link with other buildings and developments in order to reduce the cost of compliance – including existing buildings within Area 1.<br><br>**Policy 2.3**<br>$CO_2$ reductions greater than the minimum target can be met using specified micro-generation 'allowable' solutions (see below). |
| **Area 2: Network connection policy area** | **Policy 3.1**<br>Biomass district heating network connection requirement for all new developments and major consequential improvement works to existing buildings. |

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| | **Policy 3.2**<br>Heating systems should be designed to be compatible with and interface with district heating.<br><br>**Policy 3.3**<br>$CO_2$ reductions greater than the minimum target for Area 2 can be met using the specified network 'allowable' solution (see below).<br><br>**Complementary enabling mechanisms:**<br>• Technical guidance for network connections described within an SPD;<br>• Developer contribution schedule for district heating connections;<br>• Alignment of public sector investment decisions to support micro-generation and network investments;<br>• 'Network allowable solution' contribution schedule; |
| **Energy centres** | **Policy 4.1**<br>Site allocation adjacent to existing industrial or leisure uses and with access directly from B roads to facilitate fuel deliveries.<br><br>**Policy 4.2**<br>Specification of generating plant, stack height and pollution control equipment to comply with AQMA requirements. |
| **Enabling mechanisms** | **Area 1: Micro-generation**<br>• 'Allowable' offsite contribution fund used to invest in micro-generation installations on existing buildings within the regeneration area;<br>• Developers will be encouraged to procure technologies through a strategic supply chain initiative.<br><br>**Area 2: ESCo arrangement**<br>• Local Authority use of Local Development Orders for network routing; |

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| | • Application of a generic ESCo licensing framework for infrastructure investment and expansion of the Alexandra Park heating network;<br>• Possible AGMA regulatory framework governing pricing and service provision; |

## Character area 6

# Inner Regeneration Area, Housing Market Renewal area

### Case study

East Central, Rochdale

### Description

An edge of centre area characterised by 19th Century terraced housing and light industrial uses. The area has been highlighted as an area for Housing Market Renewal (HMR) intervention to complement proposed investment in the town centre, where major redevelopment is also planned.

The area is the subject of an area framework intended as the basis for an Area Action Plan. The framework and/or AAP is intended to inform planning applications and help justify Compulsory Purchase Orders (CPO's) by the Council, public sector and private sector development partners – including demolition and replacement of sub-standard housing stock and workspace.

### Technology mix

The framework area has been divided into two energy planning areas, reflecting the timeline for regeneration (for the most part prior to 2016) and their suitability for the application of different technologies:

#### Area 1: Micro-generation installations

The early phases of redevelopment are likely to be at a medium density (less than 70-80 dwellings per hectare) and are located over 800 metres from the nearest potential district heating 'anchors' (see Area 2 description below). The optimal scale will therefore be individual homes or blocks, supported by 'allowable' off-site solutions.

#### Area 2: District heating supplied by CHP

The later phases of development will be required to meet higher regulatory standards and form a natural cluster with existing buildings and proposals for the redevelopment of public buildings. This co-location of different uses could support district heating supplied initially by natural gas-fired CHP. Co-location with the public buildings also creates the potential critical mass to form a link with the existing Royal Infirmary district heating network. This could create a viable scale for biomass CHP (>4-5 MWe) which would not be possible otherwise.

## Allowable solutions

These could be based on contributions to micro-generation off-site installations within the regeneration area, but could also include contributions to district heating network expansion. Buildings in policy Area 1 could obtain $CO_2$ reductions greater than the minimum target by conributing to installations on existing buildings within the HMR area, which could include solar photovoltaic arrays, biomass boilers or small wind turbines for schools and community buildings.

## Indicative planned approach

Phasing of the development plots described in the area framework is likely to be driven by CPO's at the eastern portion of the area. New housing together with a small number of retail uses, a community centre and a new NHS LIFT centre are proposed.

Development in Area 1 could be required to deliver $CO_2$ reductions by selecting the most appropriate micro-generation technology. As a minimum one micro-generation technology would have to be installed, using solar thermal collectors as the base case for homes.

Where possible the linking of new and existing buildings could be encouraged (for example, an existing school or the LIFT centre and a block of apartments) but this will not be required. Instead the developer and public sector partners may choose the most appropriate solution to meet their performance requirements.

The area framework states that new development across the area will need to be of a mixed tenure. The mix is proposed as a mix of social, shared equity and private for sale or rent housing. This means that units in receipt of public subsidy will need to meet higher levels of the Code for Sustainable Homes earlier.

Economies of scale could be achieved by encouraging developers to procure technologies through an RSL, District or City Region supply chain initiative, which would aim to pool installation contracts to reduce costs. This might also enable developers to procure technologies that have been identified as being tried and tested and to access local maintenance support.

Where the cost of delivering $CO_2$ reductions on-site is not feasible within the constraints of development or land values values it will be possible to buy additional $CO_2$ credits by contributing to micro-generation installations on existing properties and community buildings in the HMR area. These installations would identified in order to be cheaper than installations on an individual home by home basis – so, for example, a small wind turbine or solar photovoltaic's installed as a large array on a school, health or leisure building could be 20-40% cheaper.

Development in Area 2 could be required to form an 'anchor' heat load for a new district heating network in the western part of the HMR area. The network could link new housing development, a redeveloped leisure centre, and a range of public and private buildings in the adjacent town

centre. Public investment in the leisure centre with pool will be particularly important in underwriting this investment.

Redevelopment of the Civic Centre has been identified as a potential anchor load for such a network. The adjacent area of the town centre could therefore be designated as a network expansion policy area. Here new development could be required to connect to the network, and existing buildings identified on the plan could also be targeted for connection e.g. the shopping centre and Town Hall.

Financing of a heating network to supply Area 2 and the town centre would need to be secured by the negotiation of firm energy supply contracts with public sector buildings (e.g. the leisure centre, new civic centre) and housing developers (through planning requirements, leaseholds/freeholds and ongoing management provision).

Rochdale's Royal Infirmary, located 600 metres to the north west, has also been identified as a major existing heating network which is supplied by a gas-fired CHP engine. If the hospital could be linked with the HMR area and the town centre then greater economies of scale, and therefore lower cost carbon reduction, could be achieved.

Depending on the critical mass that can be achieved, the network policy area could be supplied by either natural gas or biomass CHP plant, enabling all developments to deliver $CO_2$ reductions broadly corresponding to Code level 4 and Code level 6 respectively.

There are a number of potential locations for an energy centre that would ultimately be influenced by the final specification and configuration of the heating network and CHP unit(s). A natural gas CHP unit would offer greater locational flexibility and could be co-located with the new leisure centre or civic centre, or form an upgrade of existing plant on the Royal Infirmary site.

More constraints would apply to a biomass CHP unit. Because of the need for large numbers of lorry-based fuel deliveries the preference would be for a location with ease of access directly from a B road to ensure that new residential streets are not affected. The plant specification, stack height and pollution control equipment would all need to comply with AQMA standards and requirements.

## Capital cost implications

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| **Capital cost** | **Area 1: Micro-generation options**<br>Solar photovoltaic's £0.7m<br><br>**Area 2: Natural gas CHP (new and existing buildings)**<br>District heating network £3.1m<br>Energy centre £2.6m |
| **Indicative payback period** | **Micro-generation option**<br>>25 years, without feed-in tariff<br>5-10 years, with typical solar feed-in tariff<br><br>**CHP option**<br>Natural gas: 15-20 years<br>Biomass: 10-15 years, without renewable heat tariff |
| **Options for mitigating upfront costs** | • Adjustment in publicly owned publicly owned land values to reflect additional capital cost for infrastructure;<br>• Joint venture between local authority and ESCo contractor to provide the majority of the finance for the CHP/district heating infrastructure;<br>• Developer and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• Off-site allowable solutions to provide additional $CO_2$ reductions; |

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Area 1: Requirement for a minimum 25% $CO_2$ reduction in gross emissions against Part L 2006 based on carbon compliance measures, increasing in-line with regulatory requirements.<br><br>**Policy 1.2**<br>Area 2: Minimum requirement for 36% $CO_2$ reduction to be achieved through connecting to a low carbon heating supply, with supplementary technologies and/or allowable solutions required to meet higher regulatory requirements (Code levels 5 or 6).<br><br>**Supporting information**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Micro-generation policy area** | **Policy 2.1**<br>Minimum $CO_2$ reduction target to be met using a mix and scale of micro-generation technologies appropriate to the development.<br><br>**Policy 2.2**<br>Developers are encouraged to explore the potential to link with other buildings and developments in order to reduce the cost of compliance – including existing buildings identified within Area 1.<br><br>**Policy 2.3**<br>$CO_2$ reductions greater than the minimum target can be met using specified micro-generation 'allowable' solutions (see below). |
| **Anchor network policy area** | **Policy 3.1**<br>Development will be required to connect to the district heating network, with the energy supplied by either a gas or biomass CHP option.<br><br>**Policy 3.2**<br>Heating systems should be designed to be |

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| | compatible with and interface with district heating.<br><br>**Policy 3.3**<br>Where only gas CHP heating or biomass heating is supplied $CO_2$ reductions greater than the minimum target can be met using the district heating network 'allowable' solution .<br><br>**Complementary enabling mechanisms:**<br>• Technical guidance on network connections to be contained within an SPD;<br>• Developer contribution schedule for district heating connections;<br>• 'Network allowable solution' developer contribution schedule linked to network expansion;<br>• Alignment of public sector investment decisions to support network expansion. |
| **Town centre network expansion area** | **Policy 4.1**<br>Identification of civic and commercial buildings for connection to the network. Policy 3.1 is to be applied to substantial development sites.<br><br>**Policy 4.2**<br>A network connection requirement will apply for significant consequential improvement works to existing buildings.<br><br>**Complementary enabling mechanisms**<br>• Alignment of public sector investment programmes;<br>• Developer contribution schedule for district heating connections. |
| **Energy centres** | **Policy 5.1**<br>Site allocation adjacent to existing industrial or leisure uses and with access directly from B roads to facilitate fuel deliveries. |

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| | **Policy 5.2**<br>Specification of generating plant, stack height and pollution control equipment to comply with AQMA requirements. |
| **Enabling mechanisms** | **Area 1: Micro-generation**<br>• 'Allowable' offsite contribution fund used to invest in micro-generation installations on existing buildings within the regeneration area;<br>• Developers will be encouraged to procure technologies through a strategic supply chain initiative.<br><br>**Area 2: ESCo arrangement**<br>• Local Authority use of Local Development Orders for network routing;<br>• Application of a generic ESCo licensing framework for investment in the heating network;<br>• Possible AGMA regulatory framework governing pricing and service provision; |

## Character area 7

# Regional town centre, Areas of change and growth point

### Case study

Bolton Town Centre

### Description

A regional town centre incorporating a number of major areas of change that form part of an overall regeneration framework. Each area has a different emphasis, and they include public and private sector investment in a major education cluster; masterplanned mixed use and retail districts; a new residential district identified in the City Region's Growth Point plan; and an areas characterised by opportunities for refurbishment and in-fill.

### Technology mix

The scale, density and mix of development means that the town centre is well suited to district heating. The town centre is located just over 2 km north west of the Raikes Lane energy from waste plant which has a thermal potential likely to be around 12 MW. The plant has the potential to meet a substantial proportion of the town centre's baseload heat demand. Steam would need to be bled from the boiler, reducing the electrical generating efficiency. This loss in revenue would therefore need to be offset by revenue from heat sale.

### Allowable solutions

These would largely be based on developers contributions to expansion of a district heating network based on the energy from waste plant, but could also include off-site large-scale wind power developed elsewhere in the district.

Buildings required to make higher $CO_2$ reductions than those associated with a district heating connection would be able to buy $CO_2$ credits from contributions to expansion of the heating network.

Buildings with a substantial electricity demand would be able to buy $CO_2$ credits from a wind turbine cluster which could be located in 6.0 or 6.5 metre/second wind energy opportunity areas identified in Bolton's LDF area, or within the wider sub-region.

### Indicative planned approach

District heating requires a planned approach in order to create the right conditions to secure investment in the infrastructure, primarily because the heating network itself has a high upfront capital cost.

A heat network could draw heat from the Raikes Lane energy from waste plant. The plant has the technical potential for heat off take, having been refurbished in with this capability in 2000. The heat could be supplied through a reciprocal agreement with the plant operator at an index-linked cost lower than wholesale natural gas prices. A heat pipeline would need to be constructed running under Manchester Road and supplying heat to a number of heat 'substations' in the city centre.

The cluster of civic buildings around Bolton Town Hall could form a natural 'anchor' for the development of a heat network serving the centre. The negotiation of firm heat supply contracts for these buildings would help to provide certainty on which investment could be made in establishing a network.

The Innovation Quarter, with its strong focus on public investment in higher education and leisure facilities, could become a further anchor area for the network. If public investment was aligned with development of the heating network then these could also form an anchor for further investment.

Private sector-led masterplans within the town centre area could act as further 'anchor' areas for the network. A policy requirement could be used to ensure that the heating needs of each masterplan was designed to be compatible with district heating and that each masterplan phases would then be connected to the network.

Higher $CO_2$ emissions reductions could be achieved cost effectively by allowing developers to make contributions towards expansion of the network to supply existing buildings. A series of existing buildings have been identified within the retail heart of the centre. These include two shopping centres, a number of large floor plate offices and a hotel. These buildings will be targeted for connection to the network.

A further allowable solution could be provided by large-scale off-site wind generation, particularly for commercial buildings with a significant proportion of unregulated electricity demand. This solution would need to be linked to a contributions fund and identification by Bolton, or developers, of suitable sites within the LDF area.

### Existing energy network assessment

Network assessment was not carried out for this case study as the intention was to explore the potential relationship between the town centre's heat demand and the Raikes Lane generating plant. A preliminary assessment of the potential heat output from the plant and the demand from existing buildings in the town centre was made.

## Capital cost implications

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| **Capital cost** | **Town centre network**<br>£10.0 - £20.0m indicative range dependant on extent of network.<br><br>**Raikes Lane heat pipeline**<br>£9.0m indicative based on a scheme proposed for Hanford, Stoke-on-Trent. |
| **Indicative payback period** | 10-15 years |
| **Options for mitigating upfront costs** | • Joint venture between local authority and waste PFI partner to offset reduction in revenue from electricity generation;<br>• Firm heat supply contracts for public buildings connected to the network;<br>• Security provided by development agreements that provide utility contributions;<br>• Financing by UK Banks and/or prudential borrowing; |

## Planning policy and enabling framework

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| **Base infrastructure $CO_2$ reduction** | **Policy 1.1**<br>Requirement for a minimum 22% $CO_2$ reduction in net emissions against Part L 2006 based on a heat supply from an energy from waste CHP plant.<br><br>**Policy 1.2**<br>Higher $CO_2$ reductions to be achieved through the installation of additional micro-generation technologies to meet carbon compliance, and contributions to specified 'allowable' solutions to meet additional reduction requirements (see below).<br><br>**Complementary enabling mechanisms**<br>• Carbon budget statement to be submitted using AGMA methodology. |
| **Town Hall network anchor area** | **Policy 2.1**<br>Heat loads associated with the civic cluster of buildings should be aggregated in order to underwrite network investment.<br><br>**Policy 2.2**<br>Requirement for the connection to the network of buildings, which are the subject of significant consequential improvement, works.<br><br>**Complementary enabling mechanisms:**<br>• Alignment of public sector investment;<br>• Developer contribution schedule for district heating connections. |
| **Anchor network policy area 1** | **Policy 3.1**<br>Requirement for development to form anchor loads for a district heating network supplied by energy from waste.<br><br>**Policy 3.2**<br>Heating systems should be designed to be compatible with and interface with district heating. |

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| | **Policy 3.3**<br>District heating network connection requirement for follow-on phases of development.<br><br>**Complementary enabling mechanisms:**<br>• Technical guidance on connections to be contained within an SPD;<br>• Alignment of public sector partner investment decisions. |
| **Network connection policy area 2** | **Policy 4.1**<br>District heating network connection requirement for development phase and for in-fill development within these areas.<br><br>**Policy 4.2**<br>Higher $CO_2$ reductions can be met by installing micro-generation technologies to meet carbon compliance levels, or 'allowable' solution contributions towards heat network expansion or off-site wind energy.<br><br>**Complementary enabling mechanisms:**<br>• Technical guidance on network connections to be contained within an SPD<br>• Developer contribution schedule for district heating connections<br>• 'Network allowable solution' contribution schedule for network expansion;<br>• 'Off-site wind allowable solution' contribution schedule. |
| **Town Centre network expansion area** | **Policy 5.1**<br>Identification of existing buildings for connection to the heat network.<br><br>**Policy 5.2**<br>A network connection requirement will apply for significant consequential improvement works to existing buildings. |

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| | **Complementary enabling mechanisms:**<br>• Alignment of public sector investment programmes;<br>• Developer contribution schedule for district heating connections. |
| **Heat substations** | **Policy 6.1**<br>The visual impact of substations is to be minimised through design of purpose built buildings and/or their integration into buildings.<br><br>**Policy 6.1**<br>Specification of boiler plant, stack height and pollution control equipment to comply with AQMA requirements. |
| **Enabling mechanisms** | • Local Authority use of Local Development Orders for network routing;<br>• Application of a generic ESCo licensing framework for investment in the heating network;<br>• Possible AGMA regulatory framework governing pricing and service provision;<br>• Local Authority identification of appropriate sites for large-scale wind power generation;<br>• Development of business plan for wind cluster development to be underwritten by projected developer contributions. |

## Character area 8

# Regional town centre, retail and leisure-led development

### Case study

Town centre, Stockport

### Description

A regional town centre in which masterplanned improvements and investment in a major shopping centre are proposed. The redevelopment would be led by private sector development partners selected by the Local Authority. The aim of the masterplan is to re-invigorate the centre by attracting new anchor retailers and by introducing leisure and residential uses.

### Technology mix

The energy demand for the associated retail and leisure uses is likely to be dominated by electricity use for air conditioning and lighting. This favours the use of a small proportion of more expensive on-site micro-generation to reduce peak cooling loads in summer, supported by a larger proportion of cheaper off-site electricity generation to provide year round supply.

### Allowable solutions

These would be based on the majority of developer contributions being made towards large standalone investments such as a cluster of large-scale wind turbines. These could either be located in a wind energy opportunity area identified within Stockport's LDF area, or within the wider sub-region. A smaller proportion of the contribution could be towards community-scale technologies within the LDF area.

### Indicative planned approach

Redevelopment of the core retail area is likely to be proceeded by the relocation of a large supermarket, characterised by electrical demand for refrigeration, lighting and heating.

The main phases of the redevelopment are likely to be characterised by a split between a small number of anchor retailers and a large number of smaller shell retail units. The energy demand of these uses would tend to be dominated by electrical demand for lighting and air conditioning, with the latter provided by packaged air heat pump units.

As a first step, and in order to achieve a minimum reduction in $CO_2$ emissions, developers and operators could be required to specify equipment that minimises electricity use for air conditioning. This could include:

- Water-based instead of electric heating/cooling systems e.g. underfloor heating and cooling using ground or river water;
- Absorption cooling systems driven by gas or waste heat from Combined Heat and Power;
- Heat recovery from refrigeration to meet space heating requirements.

This could be implemented in the form of a covenant requiring the landlord to specify the technology that can used to fit-out shell retail units – particularly for larger multiple retailers.

Given the constraints of the high capital cost and relatively low power output of micro-generation technologies such as solar photovoltaics they would only be likely to viably meet a small proportion of the required power. They could therefore be specified to reduce peak loads, for example summer cooling, thereby assisting the grid operator.

It is likely that higher emissions reductions would need to be achieved through off-site investment in other parts of the LDF area or the City Region, which could include a cluster of large-scale wind turbines. Developers could be able to purchase $CO_2$ reduction at a fixed £/tonne which would be taken as an upfront capital contribution towards planning and investment.

### Existing energy network assessment

The nearest primary sub-station to the development is at Portwood (Vernon Park BSP) which transforms down to 6.6kV. There is limited scope for a significant addition to the load without reinforcement of the network.

It is possible that the first phase of the development (758 kV) could be connected without any network reinforcement, particularly taking the diversity factor into account but subsequent phases would require investment in upgrading the network.

It is possible that wider investment in Combined Heat and Power (CHP) to supply existing buildings and district heating networks in and around the town centre could complement network investment, and with planning could even reduce the cost of the substation upgrade.

In the interim the network operator has proposed the following 'standard' approaches:

- Connect to existing feeder for Phase 1
- Load split between two primaries for Phase 2
- Up rate to 2 x 32MVA transformers for Phases 3 & 4
- Alternatively new 2 x 23MVA substation required by time Phase 3 kicks in.

An assessment of the 33 kV networks' capacity to serve two possible wind cluster locations in the east of the district was also carried out. Estimates suggest that the fault level contribution from wind generation would be under 1kA which implies no fault level issues.

## Capital cost implications

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| **Capital cost** | Wind cluster (5.6 MWe capacity)<br>£7.3m |
| **Indicative payback period** | 5-10 years |
| **Options for mitigating upfront costs** | • Joint venture between local authority and specialist investor or bank to share risk;<br>• Financing by UK Banks and/or prudential borrowing;<br>• Security provided by development agreements that provide utility contributions;<br>• Power Purchase Agreement with shopping centre asset owner and large retailers; |

## Planning policy and enabling framework

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| **$CO_2$ reduction target** | **Policy 1.1**<br>Requirement for 30% reduction in gross $CO_2$ emissions against Part L 2006, a proportion of which should be from micro-generation to ensure carbon compliance.<br><br>**Policy 1.2**<br>High levels of $CO_2$ reduction are to be achieved for electricity intense users through contributions to off-site renewable power generation.<br><br>**Complementary enabling mechanism:**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Electricity intense policy area** | **Policy 2.1**<br>Minimum $CO_2$ emissions target to be met using a combination of efficient air conditioning systems, micro-generation and off-site renewable energy generation technologies as appropriate to the development.<br><br>**Policy 2.2**<br>Priority must be given during design and specification to solutions that minimise electricity use for air conditioning, and which support the use of heat recovery and ambient sources of energy.<br><br>**Policy 2.3**<br>Developers and occupiers are encouraged to explore the potential to share investments in solutions in order to reduce the cost of compliance with Policy 2.2.<br><br>**Policy 2.4**<br>A proportion of $CO_2$ reductions within the specified minimum can be met using the 'allowable' off-site solutions (see below). |

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| **Enabling mechanisms** | • Local Authority identification of appropriate sites for large-scale wind power generation;<br>• Development of business plan for off-site renewable energy generation to be underwritten by projected developer contributions.<br>• Developers and/or occupiers will be encouraged to procure air conditioning equipment and micro-generation technologies through a strategic supply chain initiative. |

## Character area 9

# Sub-regional town centre, retail-led development

### Case study

Prestwich Village, Bury

### Description

Planned improvements and investment in a local centre with the focus on redevelopment of a 1960's shopping centre. The masterplan proposes the development of a new mixed use centre anchored by a supermarket, public buildings (including a library and a LIFT Centre), commercial offices and apartments.

### Technology mix

The mix of uses, associated loads and the compact form of the local centre are well suited to Combined Heat and Power (CHP) supplying district heating. Greater economies of scale could be achieved by linking scheme focussed around the local centre with Prestwich Hospital's existing network.

### Allowable solutions

Two options could be made available. The first would be based on developer contributions to expansion of the associated heating network. This would, however, be constrained by the limited quantum of development in the centre, so a second option may therefore be required. This could be based on contributions to investment in a cluster of medium-scale wind turbines in an adjacent 6.0 metre/second wind opportunity area along the M6 corridor – subject to the Local Authorities screening of potential sites.

### Indicative planned approach

The development could utilise an efficient CHP system supplying district heating to meet its heating requirements, and an element of micro-generation (solar photovoltaic's) to meet peak electric demands. The low marginal cost of connecting adjacent public buildings and social housing would enable additional emissions savings to be achieved.

District heating requires a planned approach in order to create the right conditions to secure investment in the infrastructure, primarily because both the generators and heating network at this scale have a high upfront capital cost.

The redevelopment is likely to be anchored by public sector buildings. The core of the redevelopment could therefore be designated as an 'anchor' for a network and developers

would be required to support development of the network in order to provide certainty for financing.

Existing buildings with high density heat loads can be identified in two further areas beyond the proposed core redevelopment:

- Village Centre: The closest in proximity to the anchor phase are:
    - Rectory Green housing (Prestwich and North West Housing Association);
    - St Mary's Primary School which is immediately adjacent;
    - Sherbourne Court housing (Six Towns ALMO) which is located directly adjacent and across Bury New Road.
- Edge of Centre: A number of buildings are located further from the local centre:
    - Prestwich Arts College located to the east is to be rebuilt as part of the Building Schools for the Future programme;
    - The Post Office has a small local depot further to the north across Bury New Road;
    - Tesco supermarket has a large store to the north and across Bury New Road.

In these two areas the buildings identified could be targeted for connection to the expanding network. In each area public sector investment would need to be aligned with the aim of developing a network in order to support and underwrite investment. New connections could in part be paid for by developer contributions.

The compact nature of the local centre means that district cooling using waste heat from CHP could be an option. The mix of commercial uses in the proposed redevelopment would on their own not utilise all of the heat from CHP. There is therefore the opportunity to use this heat to provide comfort cooling and possibly also retail refrigeration.

Prestwich Hospital has a large existing heating network that links the complex of buildings. If future investment in upgrading or replacing the network could be aligned with the Village Centre heating network then greater economies of scale could be achieved. A heat pipeline linking the two locations would require a relatively short run of between 500 and 750 metres along Bury New Road and into the site.

The Village Centre is relatively constrained in seeking to locate an energy centre. The design of the building would therefore need to be contemporary and/or integrated within integral parking/storage forming part of the redevelopment. Alternatively the existing energy centre at Prestwich Hospital could be upgraded to form the location for a CHP plant.

The Village Centre is located within an Air Quality Management Area, so gas-fired plant would need to be specified to minimise $NO_X$ emissions from CHP engines or turbines and with adequate stack height.

If the emissions savings from the hospital site do not become available then an additional allowable solution would be needed for future development. This could be in the form of medium-scale off-site wind energy in a broad area of search to the north of the centre.

### Existing energy network assessment

The nearest primary sub-station to the development is at Prestwich (Agecroft BSP), which transforms down to 6.6kV. There is scope for connection of additional loads without reinforcement of the network. The estimated fault level contribution from the larger CHP plant option is under 1kA implying no fault level issues.

It is likely that the peak electricity load of 2.9 MVA for the CHP option could be connected to the network without any reinforcement of the primary substation, particularly taking the diversity factor into account. However, it may be necessary to up rate the existing feeder from the substation or to install a new feeder depending on the capacity available.

With regards to gas the network would require reinforcement or pressure elevation to accommodate the demand from the new development. The development could be connected to a 268mm Medium Pressure main to the North West of the site. This main could accept the full load of the completed development.

With regard to the existing district heating network serving the Prestwich Hospital site, discussions with the Primary Care Trust suggest that this is imminently to be decentralised because of problems maintaining the heat distribution mains, and the capital cost of replacement. Dialogue would need to be initiated immediately in order to provide confidence that a wider scheme could help overcome the problems faced to date.

## Capital cost implications

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| **Capital cost** | **Micro-generation**<br>Solar photovoltaic's £0.3m<br><br>**Natural gas CHP**<br>1. Core scheme<br>Energy centre £0.6m<br>District heating network £1.7m<br><br>2. Core scheme + Prestwich Hospital<br>Energy centre £1.4m<br>District heating network £2.2m |
| **Indicative payback period** | **Micro-generation element**<br>>25 years, without feed-in tariff<br>5-10 years, with typical solar feed-in tariff<br><br>**CHP and district heating infrastructure**<br>Natural gas: 10-15 years |
| **Options for mitigating upfront costs** | • Adjustment in publicly owned land values to reflect additional capital cost for infrastructure;<br>• Joint venture between local authority, PCT and ESCo contractor to provide the majority of the finance for the CHP/district heating infrastructure;<br>• Developer and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• Off-site allowable solutions used to provide additional $CO_2$ reductions; |

## Planning policy and enabling framework

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| **$CO_2$ reduction target** | **Policy 1.1**<br>Minimum 27% $CO_2$ reduction in gross emissions against Part L 2006 from gas fired CHP and micro-generation increasing in-line with regulatory requirements.<br><br>**Policy 1.2**<br>The reduction target is to be achieved through the connection of identified public buildings and social housing.<br><br>**Complementary enabling mechanisms**<br>• Carbon budget to be submitted using AGMA methodology |
| **Anchor network policy area** | **Policy 2.1**<br>Requirement for developments to utilise district heating and cooling supplied by natural CHP.<br><br>**Policy 2.2**<br>Heating and cooling systems should be designed to be compatible with and interface with the CHP system.<br><br>**Policy 2.3**<br>Higher $CO_2$ reductions should be achieved through contributing to expansion of the where only gas CHP heating or zero carbon heating is provided by the network.<br><br>**Complementary enabling mechanisms:**<br>• Technical guidance on connections to be contained within an SPD;<br>• Developer contribution schedule for district heating connections<br>• 'Network allowable solution' contribution schedule for network expansion;<br>• Alignment of public sector investment decisions to support network expansion. |

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| **Village network expansion area** | **Policy 3.1**<br>Identification of public sector and commercial buildings for connection to the network. Policy 2.1 is to apply to substantial new development sites.<br><br>**Policy 2.2**<br>Heating and cooling systems for new development should be designed to be compatible with and interface with the CHP system.<br><br>**Policy 3.2**<br>A network connection requirement will apply for significant consequential improvement works to existing buildings.<br><br>**Complementary enabling mechanisms:**<br>• Alignment of public sector investment programmes;<br>• Developer contribution schedule for district heating connections. |
| **Energy centres** | **Policy 4.1**<br>Location on a site or sites integrated into the building fabric or within a contemporary building designed to complement new development.<br><br>**Policy 4.2**<br>Specification of boiler plant, stack height and pollution control equipment to comply with AQMA requirements. This applies specifically to $NO_X$ emissions from CHP engines of turbines. |
| **Enabling mechanisms** | • Application of a generic ESCo licensing framework for investment in the heating network and/or a reciprocal agreement with the NHS ESCo contractor;<br>• Local Authority use of Local Development Orders for network routing;<br>• Possible AGMA regulatory framework governing pricing and service provision;<br>• Local Authority identification of appropriate sites for medium-scale wind power generation (if required); |

## Character area 10

# Sub-regional housing, strategic allocated site

### Case study
North Leigh, Wigan

### Description
A framework plan for a large strategic in-fill site comprising a mix of greenfield and brownfield land. The plan is proposed as being residential-led, with an element of workspace and lighting industrial spaces in the north west portion of the site.

### Technology mix
The relatively low density of the proposed housing and the limited scope for linking development with existing heat loads suggest that micro-generation technologies would represent the best fit for the development.

A combination of biomass heating (in the form of either a back boiler or whole house heating) with solar thermal and solar photovoltaic panels is likely to represent the most readily available on-site technology mix to meet carbon compliance requirements. The combined cost of these technologies suggest that options for off-site allowable solutions will also be required in order to achieve Code levels 5 and 6.

### Allowable solutions
Two options could be made available to developers, both of which require investment in infrastructure, either within Wigan, or in the wider sub-region.

The first could be large-scale wind power generation. Developer contributions could be used to invest in a wind turbine cluster located on suitable location to the west of the site where there is a 6.5 metre/second wind resource.

The second could be large-scale biogas production for injection into the gas network. Developer contributions could be used to offset the heating demand of the homes by contributing to the production of network-grade biogas. This could be fed to homes from a plant located in the sub-region via the gas network.

### Indicative planned approach
The masterplan has been split into three distinct sites for potential development, reflecting their uses and constraints on access to the site. The three sites would be designated micro-

generation policy areas and development on each would be required to deliver $CO_2$ reductions by selecting the most appropriate micro-generation technology.

The minimum on-site requirement would be the installation of at least one micro-generation technology on all new-build homes, using solar thermal collectors as the base case. If smaller clusters of apartments are developed on the site then these could be supplied by biomass heating.

Where possible the linking of new and existing buildings will be encouraged (eg. a biomass boiler supplying a school and a block of apartments) but this will not be required, for example, adjacent to policy Area 2. Instead the developer would be able to choose the most appropriate solution.

Economies of scale to reduce costs could be achieved by encouraging developers to procure technologies through a strategic supply chain initiative – arranged either locally or at a City Region scale. The aim of the initiative would be to enable developers to procure quality assured technologies that are tried and tested and have local maintenance support.

With this additional support in place local policies could include a requirement for, as a minimum, provision of specific micro-generation technologies on each new-build phase. This would have the benefit of creating certainty for installers.

Where the cost of delivering higher $CO_2$ reductions on-site is not feasible within development values it would be possible to buy additional lower cost $CO_2$ credits. Developer contributions would be used to finance investment in a large-scale wind power and/or biogas production 'allowable' solutions.

The emphasis for the commercial building element of the masterplan would be on the wind power allowable solution because of the higher proportion of electricity-use. Residential developers could contribute to both wind power and biogas allowable solutions.

### Existing energy network assessment

It is likely that reinforcement would be needed even for the first phase of the North Leigh development for which the estimated load is 5.2 MVA. But no fault level issues are envisaged. Two 'standard' options are available for the reinforcement:

- Uprate transformers at Kirkhall Lane to 32MVA instead of 23MVA and run new HV feeders to site.
- Alternatively install new primary equipped with 2 x 23MVA transformers at site.

Whilst feedback electricity network operator on early experiments with micro-generation on housing estates in the City Region – such as in New East Manchester - suggests that at a low level of deployment does not tend to create technical problems for low voltage networks or

substations, the impact of deploying micro-generation across a whole development phase for North Leigh would be likely to require modelling.

With regard to gas, reinforcement would be required to service the demand from the completed development as it is already operating close to capacity. The nearest relevant supply would be a 125mm Medium Pressure main to the North East of the site. A connection to this main would be capable of accepting the full load of the development.

In addition, the intermediate infrastructure feeding this Medium Pressure network is currently very sensitive and any new demand may require reinforcement. This may result in longer lead times and may also incur reinforcement costs.  The co-location of a biogas plant near to the site could go hand in hand with investment in network re-enforcement.

## Capital cost implications

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| **Capital cost** | **Micro-generation**<br>Solar photovoltaic's £5.1m<br>Ground source heat pumps £0.3m<br>*Biomass heating (apartment clusters) £5-6k/unit*<br><br>**Allowable solutions**<br>Large-scale wind power £3.2m<br>Biogas production £*uncertain at present time* |
| **Indicative payback period** | **Micro-generation option (solar photovoltaic's)**<br>>25 years, without feed-in tariff<br>5-10 years, with typical solar feed-in tariff<br><br>**Allowable solutions**<br>Large-scale wind power 5 -10 years<br>Biogas production uncertain at present time |
| **Options for mitigating upfront costs** | • Adjustment in publicly owned publicly owned land values to reflect additional capital cost for infrastructure;<br>• Developer and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• Joint venture between local authority and specialist investor, utility or bank to share risk of investment in wind generation;<br>• Financing for wind generation by UK Banks and/or prudential borrowing;<br>• Security and risk capital provided by development agreements and associated utility contributions;<br>• Power Purchase Agreement with partners for renewable electricity, which could include the local authority to underwrite capital investment;<br>• Utility partner to become incumbent supplier upon completion of properties; |

## Planning policy and enabling framework

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| **$CO_2$ reduction targets** | **Policy 1.1**<br>Requirement for a minimum 15% $CO_2$ reduction in gross emissions against Part L 2006 increasing in-line with regulatory requirements.<br><br>**Policy 1.2**<br>Emissions reductions over and above those delivered by the installation of one micro-generation technology can be offset using allowable solutions (see below).<br><br>**Complementary enabling mechanisms:**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Micro-generation policy area** | **Policy 2.1**<br>Requirement for a minimum $CO_2$ reduction target to be met using a mix and scale of micro-generation technologies appropriate to the development.<br><br>**Policy 2.2**<br>Technologies may be specified and agreed with the developer if they are supported through a specific supply chain initiative.<br><br>**Policy 2.3**<br>Mechanical and electrical specifications for commercial buildings must prioritise solutions that minimise electricity use for heating and cooling.<br><br>**Policy 2.4**<br>Developers are encouraged to explore the potential to share investment, and to link together buildings and developments in order to reduce the cost of compliance – including existing buildings identified within close proximity of the area. |

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| | **Policy 2.5**<br>Higher $CO_2$ reduction than the required minimum can be met using specified 'allowable' solutions (see below). |
| **Enabling mechanisms** | • Developers would be encouraged to procure micro-generation technologies through a strategic supply chain initiative – organised at either a local or sub-regional level.<br>• 'Allowable' offsite contribution fund used to invest in large-scale wind power and biogas production;<br>• Local Authority identification of appropriate sites for large-scale wind power generation;<br>• Development of business plan for wind cluster development to be underwritten by developer contributions and Power Purchase Agreements. |

## Character area 11

# Sub-regional employment, refurbishment and new-build

### Case study

Tower Mill, Tameside

### Description

An application for the conversion of a former 19th Century textile mill building into a mix of apartments and offices, accompanied by the construction of two commercial office blocks on adjacent land. The site is within an employment area characterised by mills and factories.

### Technology mix

The site is surrounded by industrial and commercial uses with a range of different energy demand profiles. There are no significant public buildings or local centres within close proximity. This suggests that on-site micro-generation is the best fit for the development.

Many mill sites are located adjacent to waterways. This creates the potential to use the water as a heat sink for heating and cooling systems. The use of the canal network for cooling is encouraged by British Waterways.

The adjacent section of river also has a number of weirs that could create the potential for hydroelectric generation. The head height does not appear to offer significiant potential for even a viable small scheme.

The large thermal demand of converted mills suggests that there should be a focus on the potential for biomass heating plant linking together the three buildings, supplemented by technologies installed on each building to generate heat and electricity. The development is too small to support biomass CHP.

An allowable solution may be required to enable the higher emissions from electricity use to be offset.

### Allowable solutions

The dominant energy demand for the commercial element of the development is likely to be for electricity. An allowable solution to offset a proportion of electricity use could take the form of a contribution to offsite wind power. This could form a share of the investment in a wind turbine cluster that could be located in the east of the district where there is a 6.5 metre/second wind resource.

## Indicative planned approach

The wider area, encompassing a number of mills that may in the future be redeveloped for other uses, could be designated a 'Mill conversion' micro-generation policy area. Mill redevelopments would be required to deliver $CO_2$ reductions by selecting the most appropriate micro-generation technology, with a specific focus on mitigating emissions from the large thermal energy demands of converted Mills.

Within the policy area it could therefore be a requirement to link together the heating systems of the existing mills with each new building brought forward in association with a Mill. This could include: the use of either gas-fired CHP, biomass heating or solar thermal supplemented by gas boilers, with the potential to utilise existing stacks. An accompanying requirement could be made that apartments should be fitted with wet space heating systems throughout instead of traditional electric systems.

There are two alternative options based on the use of waterways as a heat sink that could be used to reduce emissions from commercial cooling demands (if specified). The Huddersfield Narrow Canal is one option but the site is poorly located. Use of the River Tame would require dialogue with the Environment Agency.

Given the potential constraints on waterway-based cooling and renewable electricity generation based on biomass or hydroelectricity, solar photovoltaics are therefore the proposed alternative solution for mitigating commercial cooling demands. A large array could be installed on the main Mill building to achieve the best economies of scale.

## Existing energy network assessment

The nearest primary substation to the development is Tame Valley (Heyrod BSP) that transforms down to 6.6kV. The substation has capacity for some additional load. Based on forecast load growth (below 1 MVA) it should possible to connect this development without primary network reinforcement. It may be possible to connect to the existing feeder but, if not, then the feeder will need to be up-rated by overlaying with a larger cable.

The specification of wet space heating instead of electric heating and solar photovoltaics would reduce the estimated overall capacity demand and summer peak demand respectively.

## Capital cost implications

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| **Capital cost** | Biomass heating £0.6m<br>Solar photovoltaic's £0.2m |
| **Indicative payback period** | **Solar photovoltaics**<br>>25 years, without feed-in tariff<br>5-10 years, with typical solar feed-in tariff<br><br>**Biomass heating**<br>10-15 years, without renewable heat incentive |
| **Options for mitigating upfront costs** | • Developer and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• An ESCo finances the CHP and/or biomass boiler and manages heat/power sales to occupiers. |

## Planning policy and enabling framework

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| **$CO_2$ reduction target** | **Policy 1.1**<br>Minimum 17% $CO_2$ reduction in gross emissions requirement increasing in-line with regulatory requirements.<br><br>**Complementary enabling mechanisms:**<br>• Carbon budget statement to be submitted using AGMA methodology. |
| **'Mill conversion' micro-generation policy area** | **Policy 2.1**<br>Requirement for a minimum $CO_2$ reduction to be met using CHP or biomass heating plant linking together each phase of development, and solar photovoltaic's to mitigate cooling (if specified).<br><br>**Policy 2.2**<br>Further specific technologies to meet higher $CO_2$ emissions requirements may be required through agreement with the developer if they are supported by specific supply chain initiatives.<br><br>**Policy 2.3**<br>Mechanical and electrical specifications must prioritise solutions that minimise electricity use for lighting, heating and cooling.<br><br>**Policy 2.4**<br>Higher $CO_2$ reductions than the required target should be met using specified 'allowable' solutions (see below).<br><br>**Complementary enabling mechanisms**<br>• The developer would be able to procure ESCo services through a wider City Region framework; |
| **Enabling mechanisms** | • Developers would be encouraged to procure micro-generation technologies through a strategic supply chain initiative – organised at either a local or sub-regional level. |

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| | • ‘Allowable’ offsite contribution fund used to invest in large-scale wind power;<br>• Local Authority identification of appropriate sites for large-scale wind power generation; |

## Character area 12

# Strategic employment, large floorplate office

### Case study

Hollinwood, Oldham

### Description

A masterplan for the development of a strategic employment site located adjacent to the M60. It is proposed that the majority of the plots will be developed as large floor plate commercial offices. Two small hotels are also proposed in association with the employment uses.

### Technology mix

The site is surrounded by industrial and commercial uses with a diversity of energy demand profiles, as well an adjacent new-build secondary school. This suggests that micro-generation is the best fit for the development, with the potential on some plots to link new buildings with existing uses in order to meet supply low or zero carbon heating.

### Allowable solutions

The dominant energy demand for each phase of the masterplan is likely to be for electricity. Allowable solutions may therefore be required that would enable a proportion of these emissions to be mitigated at lower cost. Two options are proposed:

- Near site photovoltaic's: Greater economies of scale could be achieved from very large arrays installed on distribution sheds, supermarket roofs or motorway barriers;
- Off site wind power: Developer contributions towards a share of the investment in a cluster of large-scale wind turbines located where there is a 6.5 metre/second wind speed in the district or wider sub-region.

In addition it would also be possible to obtain $CO_2$ credits by contributing towards the supply of low or zero carbon heating for adjacent buildings. The scheme is not likely to be large enough or suitable for biomass CHP.

### Indicative planned approach

The masterplan area would be designated a micro-generation policy area. Within this area development would be required to deliver $CO_2$ reductions by selecting the most appropriate micro-generation technology.

Phases of development that are in close proximity to the school and office mill conversion could be required to link the new and existing buildings together to supply heating. Either gas-fired CHP or biomass heating could be selected as solutions. The emissions savings from linking the existing buildings could form an allowable solution for these phases.

For other phases of development micro-generation technologies should be selected that mitigate the energy demand of each plot and the proposed mix of commercial uses, with a focus on electricity generation.

The wider site could support the development of a single large 'merchant' wind turbine, but careful consideration would need to be made of the exact siting due to health and safety exclusion distances. Although the wind speed would be relatively poor at around 6.0 metres/second it could still be economic if linked to the development.

Solar photovoltaics could be an appropriate solution for mitigating commercial cooling demands. A small number of larger arrays would achieve the greatest economies of scale, and could be installed on larger buildings on the site, or even on adjacent buildings or structures such as the motorway retaining wall.

Where the cost of delivering higher $CO_2$ reductions on-site or by using near site allowable solutions is not feasible within development values it would be possible to buy additional $CO_2$ credits by contributing to off-site wind clusters in Oldham or the wider sub-region.

### Existing energy network assessment

The nearest primary substation to the development is Hollingwood (Chadderton BSP) that transforms down to 6.6kV. The substation has ample capacity for additional loads.

Based on forecast load growth (11.2 MVA) it should possible to connect this development without reinforcement of the primary network, especially when the diversity factor for the buildings is taken into account. This will require the installation of a new feeder from the existing substation.

The estimated fault level contribution from on-site generation is approximately 1kA implying no fault level issues.

## Capital cost implications

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| **Capital cost** | **Biomass heating option**<br>District heating network £1.8m<br>Energy centre £3.1m<br><br>**Solar photovoltaic option**<br>On-site £*not specified in modelling*<br>Near site >20% reduction against on-site unit costs<br><br>**Large-scale wind power**<br>£1.0-£1.5m/turbine |
| **Indicative payback period** | **Biomass heat and power**<br>10-15 years, without renewable heat incentive<br><br>**Solar photovoltaics**<br>>25 years, without feed-in tariff<br>5-10 years, with typical solar feed-in tariff<br><br>**Large-scale wind power option**<br>5-10 years |
| **Options for mitigating upfront costs** | • Developer and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• An ESCo finances the energy centre and the heating network, and manages heat/power sales to occupiers.<br>• 'Allowable' offsite contribution fund used to invest in large-scale wind power;<br>• Local Authority identification of appropriate sites for large-scale wind power; |

## Planning policy and enabling framework

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| **$CO_2$ reduction target** | **Policy 1.1**<br>Cluster area: Minimum 42% $CO_2$ reduction in gross emissions increasing in-line with regulatory requirements.<br><br>**Policy 1.2**<br>On-site solutions area: Minimum $CO_2$ reduction increasing in-line with regulatory requirements.<br><br>**Complementary enabling mechanisms**<br>• Carbon budget statement to be submitted using AGMA methodology |
| **Micro-generation 'cluster' policy area** | **Policy 2.1**<br>Requirement for a minimum $CO_2$ reductions target to be met using CHP or biomass heating plant linking together each phase of development, and solar photovoltaic's to mitigate any cooling.<br><br>**Policy 2.2**<br>Further specific technologies to meet higher $CO_2$ emissions requirements may be required through agreement with the developer if they are supported by specific supply chain initiatives.<br><br>**Policy 2.3**<br>Mechanical and electrical specifications must prioritise solutions that minimise electricity use for heating and cooling. Electric cooling should be mitigated using solar photovoltaics – either on or near site.<br><br>**Policy 2.4**<br>Higher $CO_2$ reductions than the minimum target requirements can be met using specified 'allowable' solutions.<br><br>**Complementary enabling mechanisms**<br>• The developer would be able to procure ESCo services through a wider City Region framework; |

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| **Micro-generation policy area** | **Policy 3.1**<br>Requirement for a minimum $CO_2$ emissions reduction to be met using a mix of micro-generation technologies as appropriate to the development.<br><br>**Policy 3.2**<br>Technologies may be specified through agreement with the developer if they are supported through specific supply chain initiatives.<br><br>**Policy 3.3**<br>Specifications must prioritise solutions that minimise electricity use for lighting, heating and cooling.<br><br>**Policy 3.4**<br>Higher $CO_2$ reduction than the minimum target requirement can be met using specified 'allowable' solutions (see below). |
| **Enabling mechanisms** | • Developers would be encouraged to procure micro-generation technologies through a strategic supply chain initiative – organised at either a local or sub-regional level.<br>• 'Allowable' offsite contribution fund used to invest in large-scale solar photovoltaics and wind power;<br>• Local Authority identification of appropriate sites for large-scale wind power generation; |

## Character area 13

# Existing residential area: Windfall, improvements and property sales

### Case study

Bramhall, Stockport

### Description

Large areas of the City Region are characterised by suburban residential neighbourhoods, consisting of a mix of terraced, semi-detached and detached homes. Within these areas new development is likely to take the form of small numbers of housing units on planned or windfall sites. Consequential improvements and property sales create the potential to install technologies on existing homes in order to add value.

### Technology mix

The relatively small numbers associated with new development and the low density in these areas makes it particularly challenging to deliver higher $CO_2$ reduction targets.

A combination of biomass heating (in the form of either a back boiler or whole house heating) with solar thermal and solar photovoltaic panels is likely to represent the most readily available on-site mix to meet higher targets.

The focus for improvements to existing properties should initially be on the building fabric, so targets for micro-generation should be lower than for new-build, reflecting higher proportional spend and emissions reductions from fabric improvements.

Because of constraints on supply biomass should not be installed on existing properties before significant improvements to the energy efficiency of the building fabric (and its Energy Performance rating) have been carried out.

### Allowable solutions

Individual detached or semi-detached housing units are likely to incur the highest unit costs in order to deliver higher targets, and in particular Code levels 5 and 6. However, stamp duty exemption and an increase in value may, to some extent, offset these costs.

Uncertainty relating to the future economies of scale that could be achieved for micro-generation technologies, and their practicality at a single house scale, may require provision for 'allowable'

solutions. The focus in this area could be on larger micro-generation installations on public buildings in the local area, such as schools, libraries and health centres.

### Indicative planned approach

The whole area could be designated a micro-generation policy area. Within this area new developments could be required to deliver $CO_2$ reductions by selecting the most appropriate micro-generation technology – adapted to the house types and potentially also informed by City Region targets for market development.

Economies of scale to reduce costs could be achieved by encouraging developers to procure technologies through a strategic supply chain initiative – arranged either locally or at a City Region scale. The aim of the initiative would be to enable developers to procure quality assured technologies that are tried and tested and have local maintenance support.

With additional support in place local policies could include a requirement for, as a minimum, provision of one micro-generation technology on each new-build home eg. solar technology. This would have the benefit of creating certainty for installers.

In order to further improve the economies of scale, the policy area could also focus on encouraging micro-generation installations as part of consequential improvement works and when properties are sold. Permitted Development Rights would be promoted, accompanied by clear technical guidance for households and greater assistance to procure the technologies. Low cost finance for micro-generation could be made available through partner organisations.

Where the cost of delivering higher $CO_2$ reductions on-site for new-build property is prohibitively expensive – as is currently the case – and in the absence of a renewable electricity feed-in tariff, it would be possible to buy additional $CO_2$ credits by contributing to micro-generation installations in the wider neighbourhood. This could, for example, include larger solar arrays, biomass boilers and medium-scale wind turbines installed on/adjacent to schools, public buildings and existing social housing.

### Existing energy network assessment

Feedback from the gas and electricity network operators on early experiments with micro-generation on housing estates in the City Region – such as in New East Manchester - suggests that at a low level of deployment they do not tend to create technical problems for low voltage networks or substations.

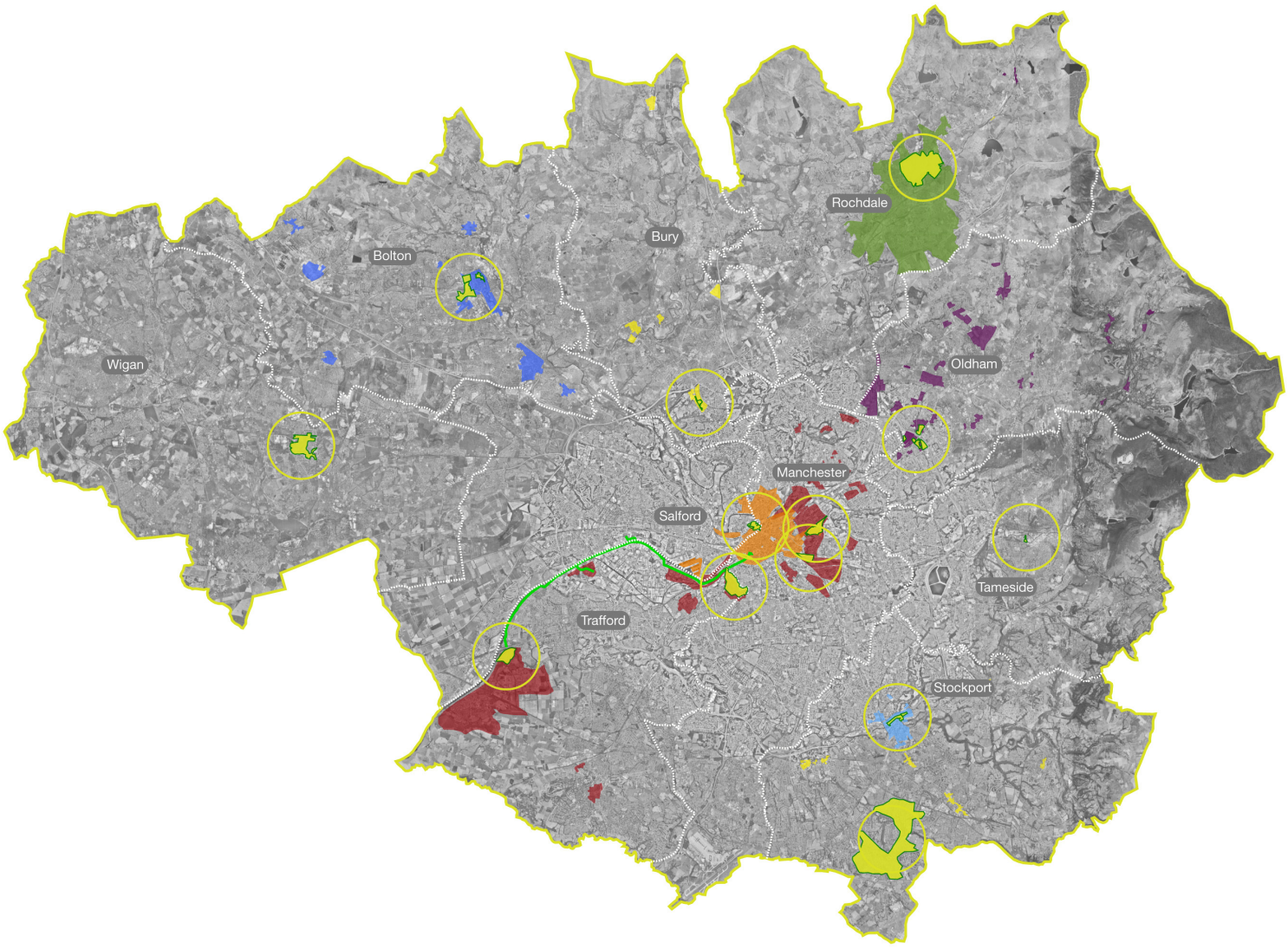
## Capital cost implications

| Capital cost | Example micro-generation options |
|---|---|
| | (2008 prices, new-build semi-detached home)<br>Base cost: Solar thermal £3-4k/unit<br>Solar photovoltaics £5k/unit (minimum 1.1 kWe array)<br>Biomass back boiler £1.5-4.5k/unit<br>Biomass whole house heating £5-10k/unit |
| **Indicative payback period** | **Micro-generation element**<br>>25 years, without feed-in tariff<br>5-10 years, with electricity feed-in tariff<br><br>**Offsite allowable options**<br>Medium-scale wind turbine<br>10-15 years<br><br>**Large solar photovoltaic array**<br>>20 yrs, without feed-in tariff<br>5-10 years, with feed-in tariff (at 30p/kWh) |
| **Options for mitigating upfront costs** | • Local or sub-regional supply chain initiative to achieve economies of scale;<br>• Adjustment in publicly owned land values to reflect additional capital costs;<br>• Developers and/or RSL's retain ownership of solar photovoltaic's in order to recover capital cost from future feed-in tariff;<br>• Off-site allowable solutions used to provide lower cost/additional $CO_2$ reductions; |

## Planning policy and enabling framework

| | |
|---|---|
| **$CO_2$ reduction target** | **Policy 1.1**<br>New-build: Requirement for a minimum 15% $CO_2$ reduction in gross emissions against Part L 2006 increasing in-line with regulatory requirements.<br><br>**Policy 1.2**<br>Emissions reductions over and above those delivered by the installation of one micro-generation technology can be offset using allowable solutions (see below).<br><br>**Policy 1.2**<br>Improvements: Minimum 8% $CO_2$ reduction in gross emissions based on at least one micro-generation technology installed on a band C property.<br><br>**Policy 1.3**<br>For improved properties developers or households must demonstrate an increase in the properties EPC rating to a performance of at least C.<br><br>**Complementary enabling mechanisms:**<br>• Carbon budget statement to be submitted using AGMA methodology;<br>• Detailed SAP assessment to be submitted for improvements, to be based on accurate u-values for fabric elements. |
| **Micro-generation policy area** | **Policy 2.1**<br>Minimum $CO_2$ reduction target for new homes to be met using a mix and scale of micro-generation technologies appropriate to the development and/or improvements.<br><br>**Policy 2.2**<br>Technologies may be specified through agreement with the developer if they are supported through a specific supply chain initiative. |

| | |
|---|---|
| | **Policy 2.3**<br>Higher $CO_2$ reduction than the minimum target can be met using specified 'allowable' solutions (see below).<br><br>**Policy 2.4**<br>Micro-generation installations are to be promoted to all property buyers, accompanied by easy access to installers and financing. |
| **Enabling mechanisms** | • 'Allowable' offsite contribution fund used to invest in micro-generation installations on/adjacent to existing buildings within the local area;<br>• Developers would be encouraged to procure technologies through a strategic supply chain initiative – organised at either a local or sub-regional level.<br>• Accessible guidance on permitted technology to be provided to households;<br>• Provision of access to practical support and additional mortgage finance. |

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