7. Character areas of change

In this section we identify broad character areas of change as the basis for a 'bottom up' analysis of how energy planning policies could be adapted to the forms of growth and development being brought forward across the City Region.

At the heat of this study is a 'bottom up' analysis of thirteen case studies of development. In order to give the study relevance the case studies are based on real data from developments at concept, pre-planning or outline planning stage.

The case studies have been selected to be representative of the type and forms of growth projected across the City Region. For each case study a detailed analysis of projected carbon budgets and technology mixes to meet regulatory requirements, including zero carbon, have been carried out.

The results of this analysis are compiled in a separate volume of this report, providing a mock energy proposals plan and planning framework for each case study, as well as outline costings and notes on complementary enabling mechanisms.

7.1 Reflecting the changing role of planning

In the last decade there has been a shift in the role of planning from the regulation of new development to a pro-active role creating strategic frameworks to guide new development, as well as the alignment of investment with new infrastructure provision. This pro-active role is promoted by PPS1 and RSS Policies DP1 and 2, and fits well with the need for a more strategic approach to energy planning.

The downside of this is that because of the need for flexibility to negotiate new development, and the timescales for putting in place formal planning policies in the form of new DPD's or AAP's, many proposals associated with broad character areas are not likely to be supported by site-specific planning policies, with Supplementary Planning Document the most common formal status.

Assumptions are made in Local Authority SHLAA's and Employment Land Reviews, about the level of expected 'windfall' development that may be brought forward – that is development not on allocated sites and which may arise as a catalytic follow-on effect of market transformation in planned areas of development. For the purpose of this study the view has been taken that policies towards windfall development would be accommodated within area-based spatial energy planning frameworks.

Permitted Development and Consequential improvement are two further routes through which existing buildings could contribute to CO_2 reductions that have been considered. The former now enables forms of micro-generation to be installed without planning permission, and might therefore benefit from guidance on what is acceptable across suburban areas of existing housing.

Consequential improvements are regulated by Building Control and with new requirements to reduce CO_2 emissions for major improvements of over 1,000 m^2 it is likely to have a role to play in certain locations, for example in seeking to connect existing buildings to district heating networks, or to require the retrofitting of specific technologies.

7.2 Identifying the character areas

In order to align the policy framework with areas of change across the sub region a broad scoping of the types and forms of planned developed being brought forward was carried out. The scoping encompassed development with the following use classes, and excluding industrial uses:

A1,2	Retail services
A3,4	Food and drink
B1,2	Offices and workspace (excluding light industrial)
C1	Hotels and hostels
C2,3	Residential institutions and dwelling houses
D1	Public buildings and facilities
D2	Leisure facilities

This process was steered by stakeholders from the ten districts of Greater Manchester and resulted in the identification of 12 broad character areas, reflecting the varying degree of certainty their delivery, the scale of change and the deliver partners. In order to identify a manageable number of representative case studies to analyse a simplified hierarchy was developed based on areas of change where development is to be focussed:

- The regional centres, Manchester and Salford;
- Regional centre inner areas, representing formally designated regeneration and Housing Market Renewal areas;
- Sub-regional towns and cities, represented by Altrincham, Ashton, Bolton, Bury, Oldham, Rochdale, Stockport and Wigan;
- Larger urban centres, represented by the hierarchy of 'towns under urban influence or in a local network' and local centres as identified by Land Use Consultants as part of the RSS evidence base [100].

This hierarchy reflects the North West RSS Policy RDF 1 'Spatial priorities' and the emphasis of Policy DP9 on Climate Change mitigation, which highlights their importance as areas where investment can be used to pump prime low and zero carbon infrastructures.

[100] Land Use Consultants et al, *The North West: Key service centres – role and functions*, Manchester City Region, September 2006

In addition the Growth Point programme encompasses sites earmarked for increased housing numbers over and above RSS projections in the following broad areas across four districts of Greater Manchester, and in broad accordance with the described spatial hierarchy:

- Manchester: In and around North Manchester, East Manchester and Ardwick, including major development sites including Holt Town and Chancellor Place as well as PFI housing areas;
- Salford: In and around Broughton (an existing HMR area), the River Irwell corridor including the Ordsall Riverside masterplan, and West Salford;
- Trafford: In and around Old Trafford regeneration area, Pomona Docks, Salford Quays, Trafford Quays, Partington and Carrington, as well windfall from ALMO estate in-fill;
- Bolton: In and around the town centre, the Horwich Locomotive Works site as well as windfall from mill refurbishment and ALMO estate in-fill.

A number of strategic employment sites, public sector precincts and mixed retail and leisure locations can also be seen to function as centres in their own right. These include those earmarked by the NWDA, Local Authorities and their associated economic development agencies.

The opportunity for district heating created by the proposed gas-fired power station at Carrington in Trafford forms the basis for a high level case study at a sub-regional scale, covering a development corridor encompassing the regional centre, a number of local centres, and number of Growth Point sites.

Table 7.1

Case studies selected from character areas of change

Character area	Case study selection		
	Framework	**Masterplan**	**Windfall**
Sub-regional: Strategic mixed development corridor	Carrington power station, Trafford		
Regional centre: Mixed commercial and residential		Chancellor Place, Manchester Exchange Greengate, Salford	Office, hotel or apartment blocks
Regional centre: Large growth point residential		Holt Town, Manchester	Urban family housing blocks
Regeneration area: 1960's/70's estate	Old Trafford, Trafford		Private and social housing in-fill
Regeneration area: HMR terrace in-fill	East Central, Rochdale		Private and social housing in-fill
Regional town centre: Retail and leisure		Town centre, Stockport (retail phases)	Mixed retail blocks
Regional town centre: Mixed use and public sector-led precincts	Town centre, Bolton (five quarters)	Quarters: Innovation Zone Church Wharf St Helena Merchants Quay Urban Village	Office, hotel and/or apartment blocks
Sub-regional centre: Retail-led investment		Prestwich, Bury	Supermarket and mixed office/retail

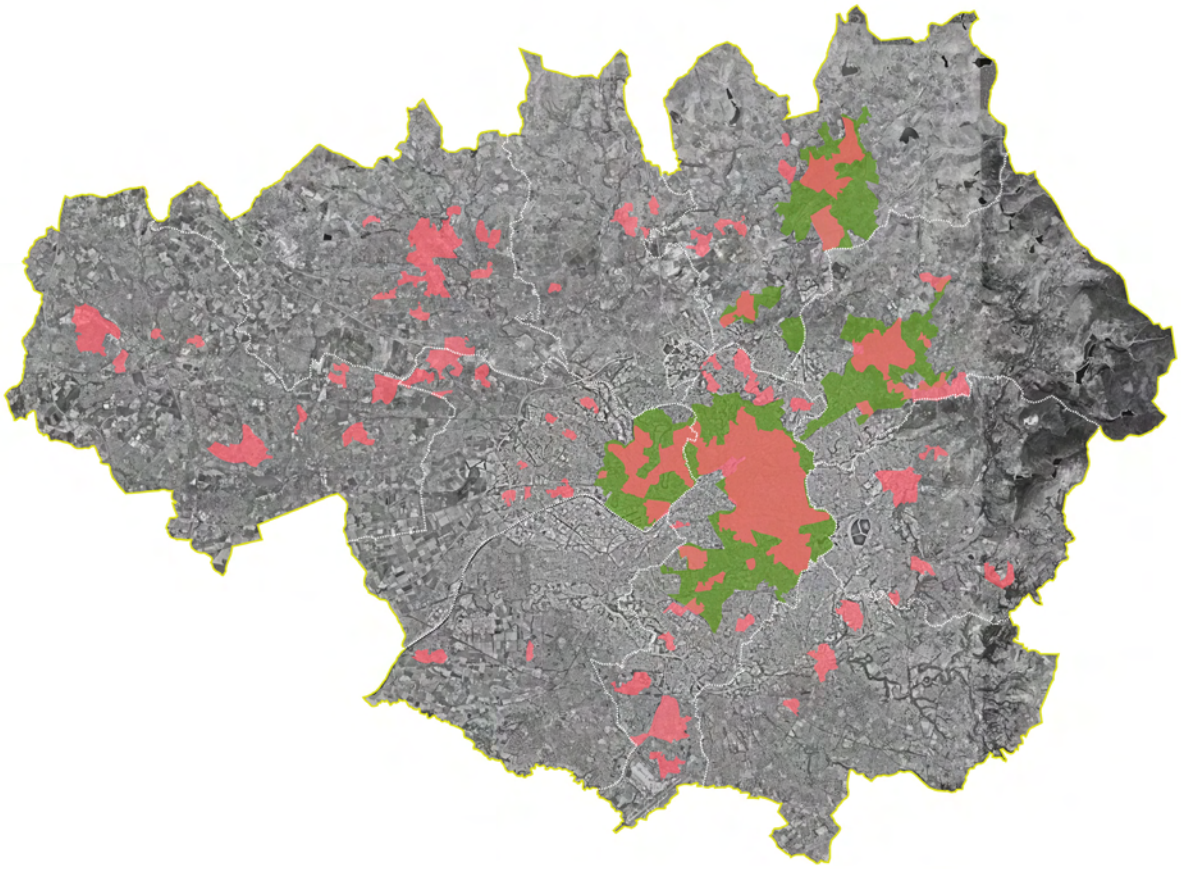
Sub-regional housing: Strategic sites	North Leigh, Wigan		Suburban housing in-fill
Sub-regional employment: Refurbishment and new-build		Tower Mill, Dukinfield	Historic building changes of use, Speculative commercial offices
Strategic employment: Large floorplate office	Hollinwood, Oldham		Office buildings and B2 workspace
Existing residential: Improvements and property sales	Bramhall, Stockport		Permitted Development, consequential improvement, property sales

Spatial plans

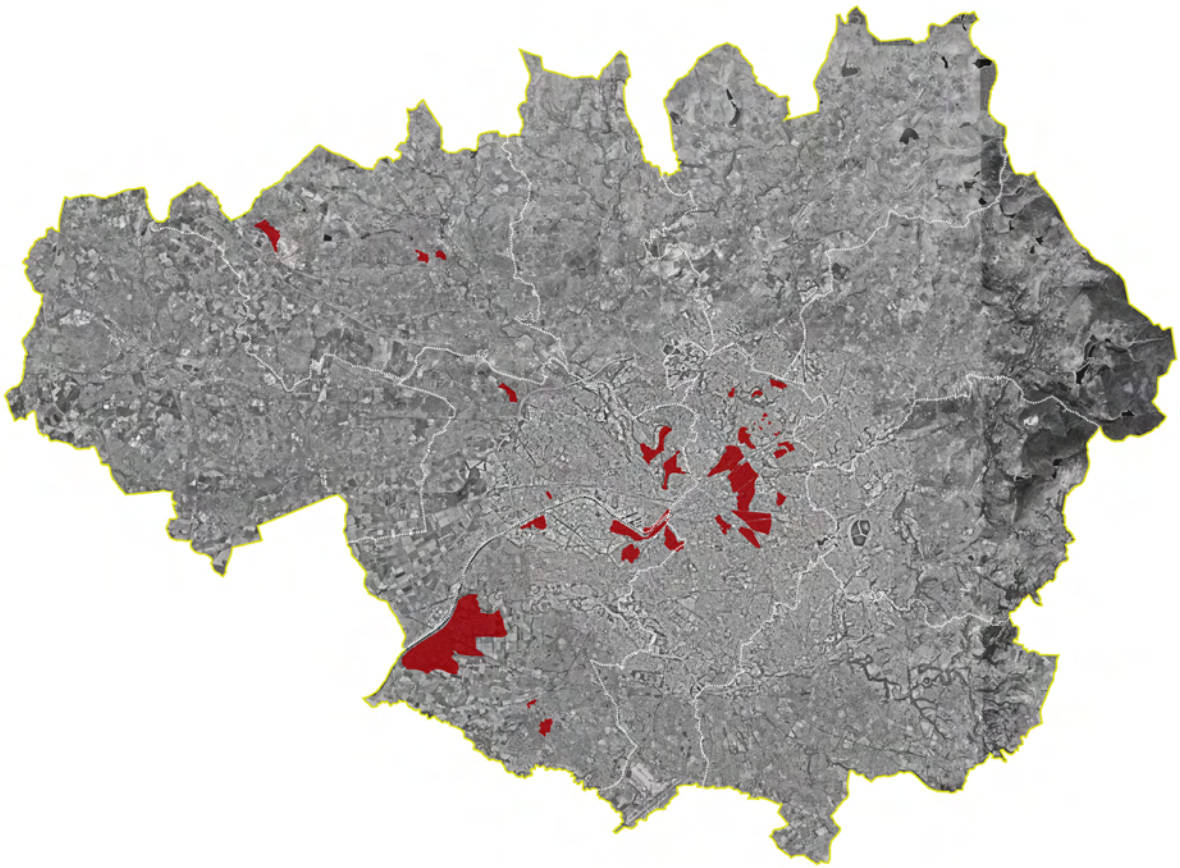
Character areas of change

^ Spatial plan 7.1: City regional centre and sub-regional towns

^ Spatial plan 7.2: Town, village and district centres



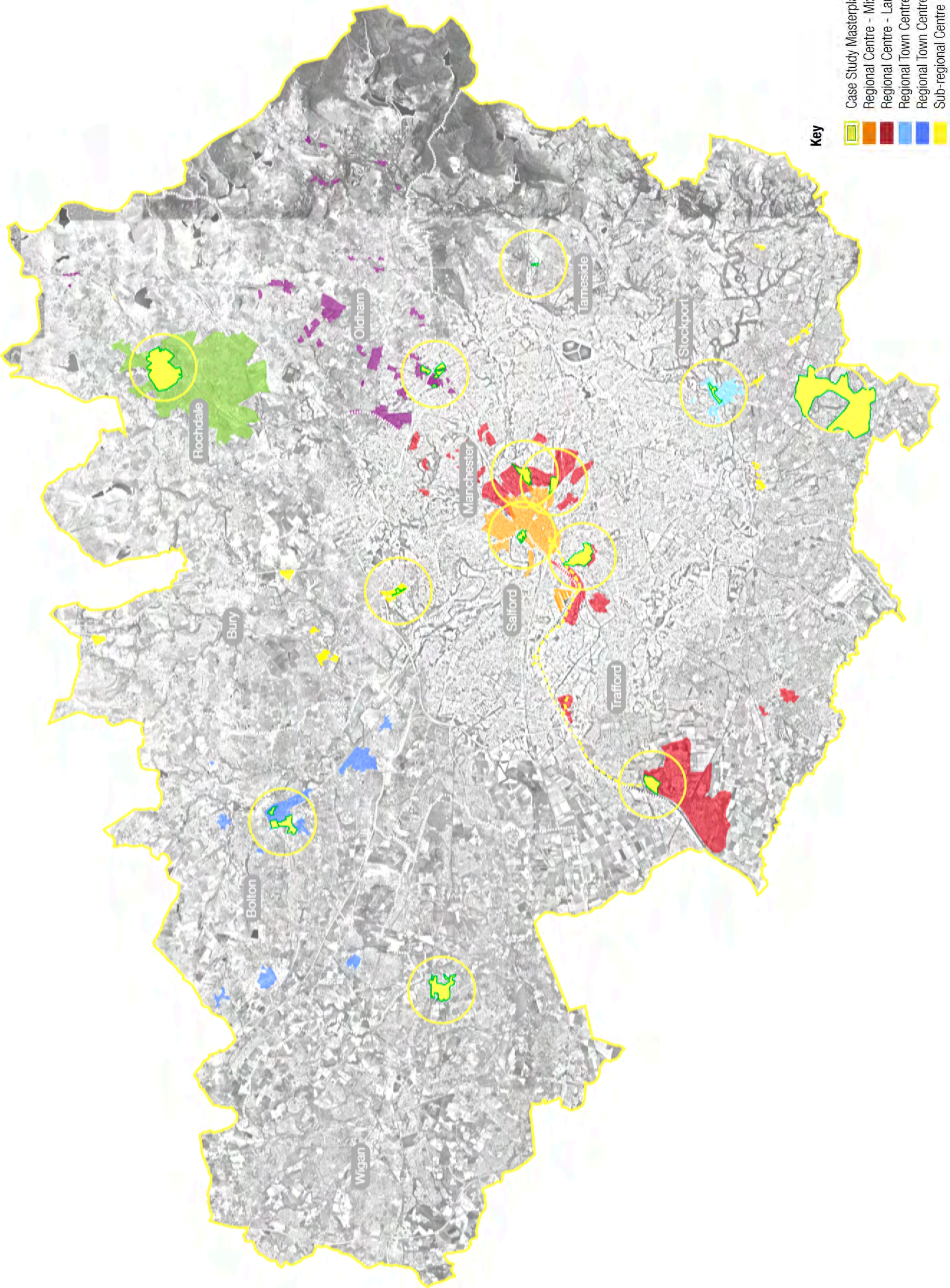
^ Spatial plan 7.3: Regeneration and Housing Market Renewal areas



^ Spatial plan 7.4: Growth Point locations

Spatial plan 7.5

Case study locations



^ Spatial plan 7.5: Case study locations and associated character areas of change by district

7.3 Technical methodology

Here we described in outline the technical methodology that has been used to analyse the case studies. The headline aims of the technical analysis were to:

- Establish suitable technology mixes appropriate to:
    - The proposed building types;
    - Resources within the local context;
    - Technologies used to supply existing surrounding buildings;
    - Timeline and phasing against anticipated future Building Regulations.
- Assess the impact of future development with respect to infrastructure capacity, current demands, anticipated future demands, any mitigation strategies required to stabilise infrastructure demands and issues relating to energy security.
- Draw conclusions from each character area to guide future planning policy in the context of proposals set out in recent Government consultations.

A detailed description of the assumptions used for the analysis has been provided as an appendix to this report.

7.3.1 Detailed methodology

Following the collation of baseline information for each case study - comprising an overview of the masterplan, the proposed mix of uses, the schedule of floor areas, the proposed phasing and timescales – analysis was carried out of:

- Future energy demand and CO_2 emissions from the development;
- Technology mix options to achieve different levels of CO_2 reductions;
- Relationships between the development and its context – including:
- Opportunities for decentralised energy networks and the use of local energy resources,
- the interface with existing gas and electricity networks.

Comparison of technology mixes for new-build building types centred on the use of baseline data for regulated parameters (i.e. space heating, hot water, cooling, lighting and fan/pump energy) for a building that is 2006 compliant (i.e. 0% improvement over the 2006 target emissions rate) to allow the carbon reduction from to be quantified in the context of future carbon reduction targets.

Surrounding buildings were also included in the energy models for some case studies. These buildings were identified following site visits and surveys to identify those with larger floor plates and single sources of heating and cooling, with a focus on public buildings. Where possible actual datasets were used based on, for example, Display Energy Certificates. Where this wasn't available then benchmarks were applied to floor area estimates.

Table 7.2

Anticipated future Building Regulation CO_2 reduction targets

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

7.3.2 Technology mix assessment

Following the selection of each case study, an assessment of available local resources was carried out to establish if solutions based on wider standalone renewable energy technologies or decentralised energy networks could be identified. These were investigated as a priority because of the potential to improve the financial and technical viability of large-scale technologies.

A number of technology types and combinations were selected for the technology mix assessment, supplemented by site-specific opportunities identified for each case study. These technologies were applied to the baseline datasets to determine the carbon reductions achievable at the proposed time of development. The technologies considered were:

- Solar Hot Water (SHW)
- Photovoltaics (PV)
- Wind (Large Scale)
- Ground Source Heat Pumps (GSHP)
- Biomass heating
- Gas Combined Heat and Power (Gas CHP)
- Biomass Combined Heat and Power (Biomass CHP)
- Energy from Waste (EfW)
- Deep Bore Geothermal
- Fuel Cell Technologies

As part of this study a methodology was developed to allow suitable combinations of these technologies to be applied to the baseline datasets for each building type at a variety of scales. These results were then compiled to demonstrate the potential carbon reductions achievable (in line with the calculation methodology used for building regulation Part L2A).

Where possible, two proposed solutions were assessed in order allow for a comparison in cost and carbon reductions between on-site solutions and a district or nearby solution. Where no suitable local resource was identified, the introduction of a district heat network was considered as an established method of achieving large carbon savings, particularly when used with a CHP system and even more so when used with biomass as the primary fuel source.

Where there were no suitable local resources and a district heat network was not deemed to be viable, solutions to a shortfall in carbon reductions was explored through the use of 'allowable solutions', as discussed in the Government's consultation on a revised definition of Zero Carbon [101]. The consultation proposes that where it is deemed impracticable to achieve further reductions in CO_2 above 44% as a result of site constraints, allowable solutions are permitted to further decrease the CO_2 emissions without exceeding a given cost per unit of CO_2.

7.3.3 Financial assessment

In addition to quantifying the changes in CO_2 emissions as a result of proposed new developments for each case study, an outline financial assessment will be included as part of these results to highlight a number of issues:

- The original selection of technologies suitable for each building type specifically for the surrounding character area of each case study
- Identification of where capital costs are prohibitive in achieving the required carbon reduction targets leading to the use of allowable solutions
- Comparison between technology options to demonstrate differences in cost between different approaches to achieving the required carbon reduction targets.

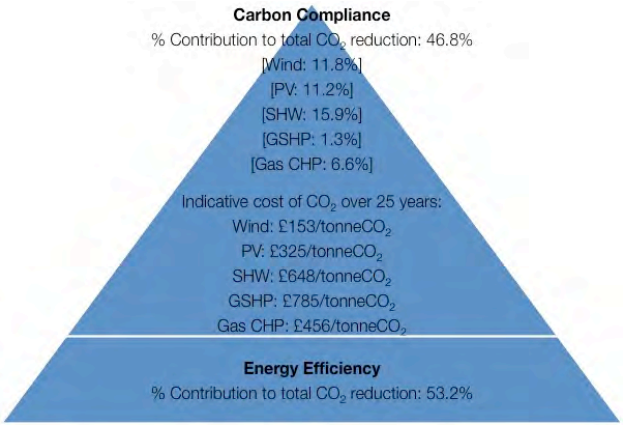
Whilst site-specific costings have not been possible within the scope of this study, where possible comparable recent datasets have been used. These results were plotted in the form of £/kg CO_2 saved over the anticipated lifespan of the technology and £/m^2 of development for each case study. Figure 7.1 illustrates a cost comparison for a case study and options for 'carbon compliance' and 'allowable solutions'.

[101] *See footnote 22*

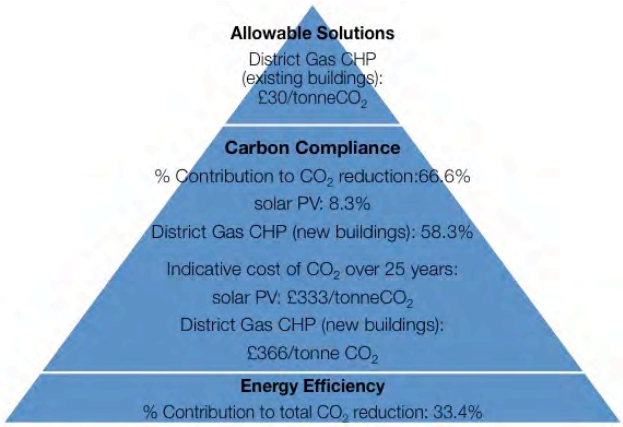
Figure 7.1

Comparative costs for carbon compliance and allowable solutions

Option 1: On-site solutions only



Option 2: On-site and off-site solutions



7.3.4 Modelling regulated and unregulated CO_2 emissions

Carbon dioxide emissions from buildings can be defined as either 'regulated' (emissions associated with 'fixed' M&E plant, i.e. space heating, ventilation, hot water and fixed lighting), or 'unregulated' (emissions associated with all other energy use in the building including IT equipment, task lighting, fridges etc). The 'gross' emissions therefore of a building account for both regulated and unregulated emissions.

In order to calculate the actual projected increase or decrease in CO_2 emissions associated with a new development, it is therefore necessary to consider the gross emissions from all new buildings within that development and not just the regulated emissions from fixed building services – an indicative example of which is illustrated below. The methodology used for this study was based on the Part L assessment methodology - known as the National Calculation Methodology (NCM) [102].

The equivalent 'regulated' CO_2 emissions reductions for a pre-determined gross emissions reduction can be calculated for each indicative Part L compliant NCM building type – illustrated in Figures 7.2 and 7.3 below. The results in Table 7.4 below show the equivalent % reduction in regulated emissions over a 2006 building regulations complaint building, assuming a gross emissions target of 15% reduction. The twenty indicative building types modelled fit into one of four distinct bands of regulated carbon reduction targets – 30%, 25%, 20% and 15%

[102] See National Calculation Method, www.ncm.bre.co.uk

Figure 7.2

Gross emissions ($kgCO^2/m^2$ per annum) for twenty NCM building types

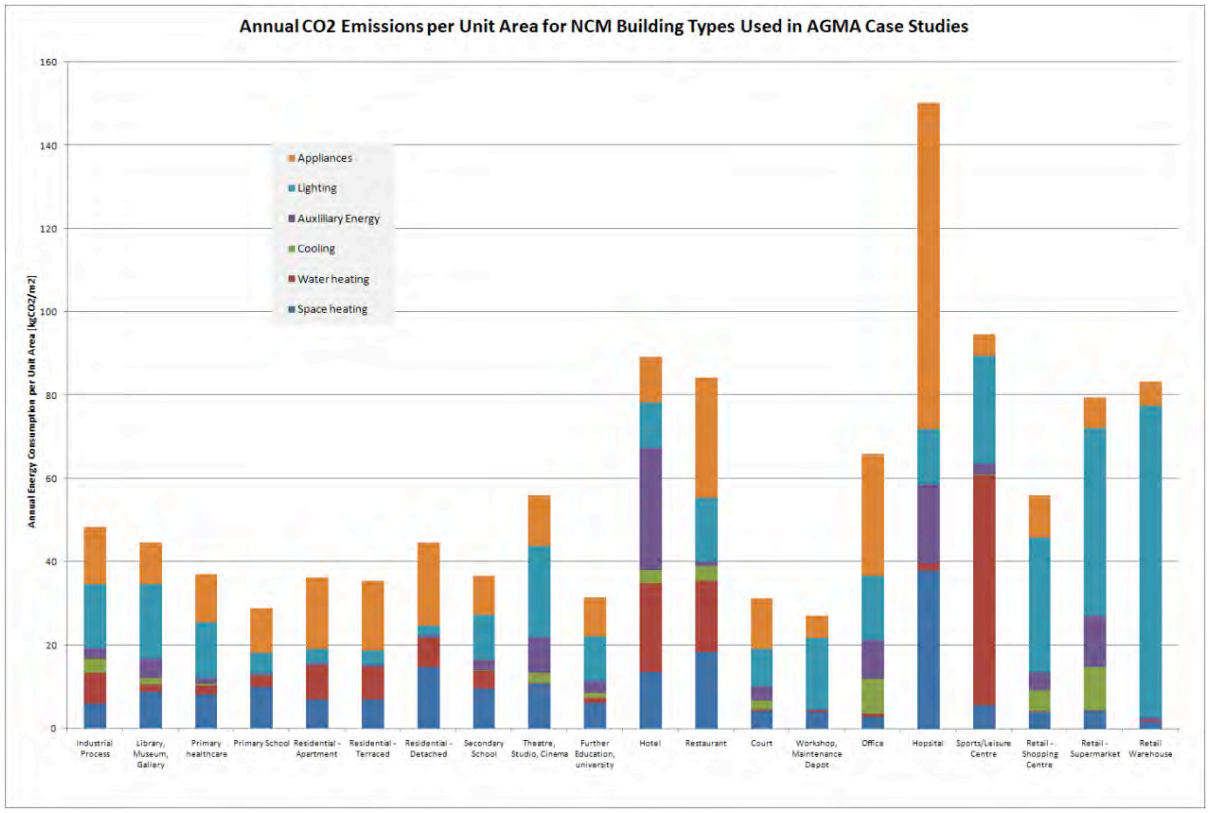


Table 7.3

% net CO_2 reduction equivalent to 15% gross CO_2 reduction

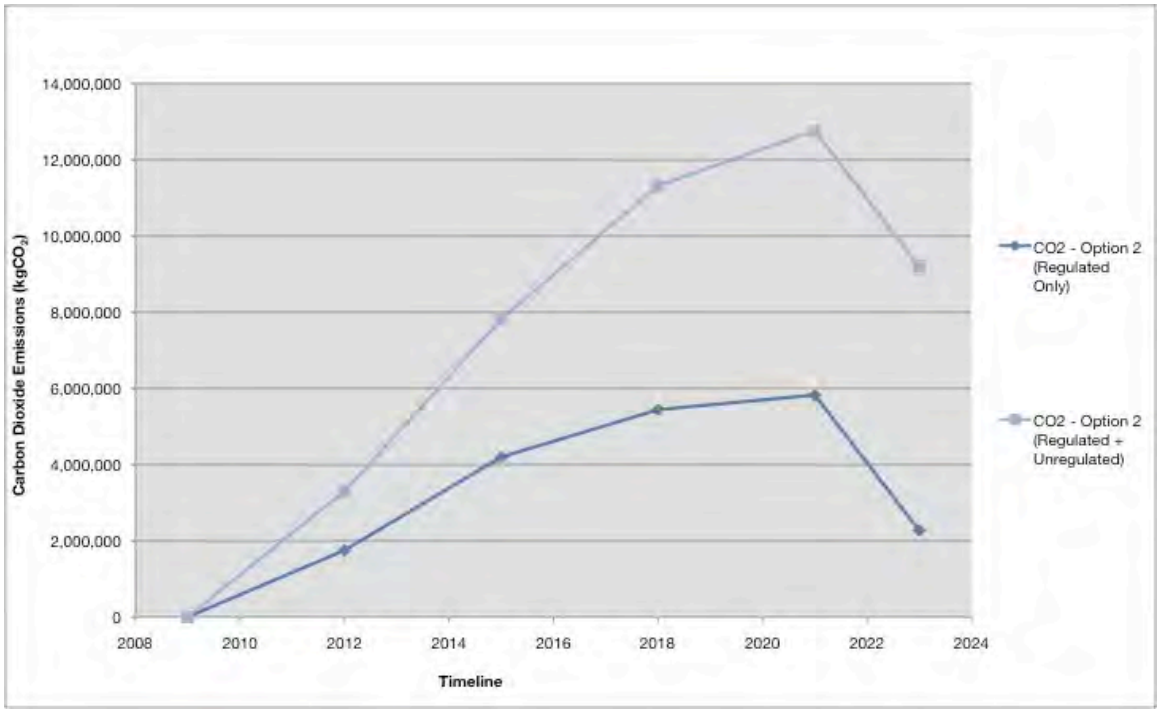
% Equivalent reduction over 2006 BRegs	**30%**	**25%**	**20%**	**15%**
Building Types in band:	Hospital	Office	Primary healthcare	Hotel
	Residential - Apartment	Residential - Detached	Further Education, university	Retail - Supermarket
	Residential - Terraced	Court	Secondary School	Retail Warehouse
		Primary School	Library, Museum, Gallery	Sports/Leisure Centre
		Restaurant	Theatre, Studio, Cinema	
			Workshop, Maintenance Depot	
			Retail - Shopping Centre	

For each case study estimates for the energy demand for the mix of uses was converted into a carbon budget projection for the development. The projection takes into account minimum regulatory requirements as well as the impact of investment in low or zero carbon infrastructure, including off-site infrastructure.

Figure 7.3 below shows an indicative carbon budget projection – in this case off-site investment in the final phase reduces the emissions but clearly it would be desirable to bring this investment forward in order to reduce emissions earlier.

Figure 7.3

Indicative carbon budget projection



7.4 How could the case studies inform energy planning policies?

The study used real-life case studies to test a general methodology for developing character area-specific policies and enabling mechanisms. The methodology was designed to reflect the approach described in national planning policy guidance, and to search for 'least cost' options for meeting carbon reduction targets.

Whilst the technology mix was tailored to the specifics of each case study, each of which was selected to be broadly representative of development forms across the City Region. Taken alongside the 'top-down' strategic resources identified in Section 6 they are intended to be used as the evidence base to inform an LDF policy framework.

Below we discuss the implications for the planning of low and zero carbon infrastructure, and set out a target framework for the City Region:

7.4.1 Making energy and CO_2 projections

A simplified but robust methodology was developed in order to project the energy demand and CO_2 emissions from each case study. This provided a clear overview of the distinct energy demands of the mix of use classes, including unregulated energy use, and the CO_2 emissions associated with each phase of development.

In order to provide evidence of compliance with policies, and to form a consistent basis for comparison across the sub region, a similar approach would need to be employed during the preparation of AAP's, frameworks and masterplans, and by individual planning applicants. It is proposed that this takes the form of a 'carbon budget statement' for development.

7.4.2 Preparing energy proposals plans

Preparation of the proposals plan for each case study required a number of layers of spatial information, brought together in an outline level of detail by this study. This enabled a general strategy for meeting, as a minimum, regulatory milestones using low and zero carbon infrastructure to be formulated.

The overall approach enabled energy opportunities identified from the 'top down' in section 5 to be related to opportunities from the 'bottom up'. In order to implement national planning policy guidance this approach could be adopted during the preparation AAP's, SPD's, area frameworks and masterplans. In each instance it would require the following information:

- Development profile: Assumptions relating to the floor area, units and mix of uses associated with new development as the basis for an energy and CO_2 projections;
- Existing infrastructure: Opportunities and constraints relating to existing energy networks in the local area, including gas, electricity and district heating;

- Energy resources: The broad location and potential of local, district and sub regional low and zero carbon energy resources;
- Existing heat loads: Mapping based on a site survey of public and private buildings with large heated floor areas and sufficient proximity to form anchors for district heating networks.

7.4.3 Managing the costs of regulatory compliance

A pragmatic approach was taken to the delivery of CO_2 emissions reductions based on the concept of 'allowable solutions' that have been proposed by the Government as a means of meeting the national 'zero carbon' standard. Each proposals plan sought to identify a framework of lower cost options for regulatory compliance. These included:

- Contributing to larger and more economic micro-generation installations;
- Connecting existing building with large heat loads via district heating;
- Using waste heat from existing and proposed power stations;
- Investing in off-site renewable energy resources within each district.

A summary of the results from evaluation of the case studies is presented in table 7.4 divided into the estimated technology and infrastructure costs for:

- Red line: Solutions integrated into buildings within the red line of a detailed or reserved matters planning application;
- Site-wide or near site: Solutions supplying phases of development – either on-site or near site - that might form part of a masterplan or outline planning application;
- Off-site: Solutions that are off-site but related to an area, masterplan, outline or detailed planning application by virtue of a financial contribution;

Based on the case studies, and the associated infrastructure opportunities, a scalable set of allowable solutions has been proposed. In each case the allowable solution would be cheaper than further on-site investment:

- Network expansion areas (£50-£250/tonne CO_2): Contributions would be used to finance the connection of existing public and private buildings to district heating networks;
- Micro-generation areas (£100-£320/tonne CO_2): Contributions would be used to subsidise lower unit cost micro-generation installations on adjacent public buildings, social housing or where economies of scale can be identified;
- Standalone off-site generation (£50-£100/tonne CO_2): Contributions would be used to underwrite investment in major infrastructure projects such as wind clusters (for example 4-5 large turbines) and biogas production using developer contributions as equity.

The exact form of these solutions, and how contributions will be priced, collected and regulated will need to be reviewed in the light of the final proposals that are still to be published by the Government.

Table 7.4

Character area technologies and carbon reduction costs

Character area	Planning designation and technology	Cost (£/t CO_2) and % contribution to carbon reduction		
		Red-line solution [1]	**Site-wide solution**	**Off-site solution** [2]
1. Sub-regional: Strategic corridor	'Network expansion area': CCGT power station heat off-take	Not applicable	Not applicable	£75 - £85 (38%) [3]
2. Regional centre: Mixed use	'Network expansion area': Gas CHP and geothermal heat	£237 (32%)	£222 - £435 (29%)	£48-£70 (54 - 84%)
3. Regional centre: Growth Point	'Network expansion area': Fuel cell CHP and solar PV	£202 (51%)	£846 [4] (35%)	Option not available
4. Regeneration area: Estate renewal	'Network' and 'Micro-generation' areas: Biomass CHP, solar thermal and solar PV	£316 (25%)	£92 (40%)	£92 (19%)
5. Regeneration area: HMR in-fill	'Network' and 'Micro-generation' areas: Gas CHP and solar PV	£214 (8.0%)	£636 (36%)	£149 (11%)
6. Regional town centre: Retail core	'Electricity intense area': Large-scale wind power and/or design reduction in electricity use	Not applied	Not applied	£65 (52%)
7. Regional town centre: Mixed use	'Network' and 'Electricity intense' areas: Heat off-take from energy from waste CHP plant	Not applicable	£134 [3] (30%)	£134 [3] (Unspecified %)

8. Sub-regional centre: Mixed use	'Network expansion area': Gas-fired CHP	£333 (28%)	£366 (58%)	£30 - £306 (Unspecified %)
9. Sub-regional strategic housing	'Micro-generation' area: Solar PV, solar thermal and large-scale wind power	£346 (14%)	Not applicable	£63 (61%)
10. Sub-regional strategic employment	'Network' and 'Electricity intense' areas: Biomass CHP and solar PV	£333 (% unspecified)	£303 (42%)	£65 (24%)
11. Mixed use windfall/refurbishment	'Micro-generation' area: Biomass heating and solar PV	£426 (49%)	£75 (36%)	Option not specified
12. Residential Windfall/improvement	'Micro-generation' area: Solar PV, solar thermal, biomass heating	£316 - £680 (Unspecified %)	Not applicable	£75 - £277 (Unspecified %)

Notes:

1. Solar PV costs could be 60-70% less if third party financing is sought on the basis of FIT revenue.
2. Site-wide and off-site network solutions costs could be 60-70% less if third party (off-balance sheet) ESCo financing is sought.
3. Costs assume investment in the incinerator is not required, only investment in heat offtake and the heat distribution network.
4. The costs of fuel cells include an assumption of a progressive reduction in capital costs over time.

7.4.4 Proposed target framework

Based on the distinct forms of development modelled we have been able to devise a target framework for carbon reductions from low and zero carbon infrastructure to 2016 for domestic buildings and 2019 for commercial uses.

The framework is designed to future proof the ability of districts to set higher targets based on local opportunities for decentralised and zero carbon energy generation, and associated with three distinct spatial contexts for development:

1. Network expansion area: Locations where the proximity of new and existing buildings creates sufficient density to support district heating and cooling;
2. Electricity intense area: Locations where the predominant building type has all-electric services, or a high level or proportion of demand for electricity;
3. Micro-generation area: Locations where lower densities and a fragmented mix of uses tend to favour building scale solutions;

A set of simple questions have been devised that could be used to identify which target would apply to any given development (see box 1 below). The proposed target framework is presented in tables 7.5 and 7.6.

It is proposed that the targets apply to all domestic applications – in-line with the Code for Sustainable Homes – and non-domestic buildings with a floor space greater than 1,000 m^2 – reflecting RSS policy EM18 and EU Directive 2002/91/EC.

Maximum and minimum targets

The framework proposes maximum and minimum targets. All % targets are based on reductions against Part L of Building Regulations 2010 or 2013. The minimum target is based on RSS policy EM18 or a District heating network connection requirement. The RSS target has been converted into carbon and recalculated against Part L emissions only. Target 1 is designed to support the growth of district heating networks and Target 2 is specifically intended to disincentivise all electric heating and cooling.

The maximum target is based upon a sliding scale of costs up to the maximum. The level at which the maximum target is set would be location-specific depending on the cost and availability of solutions. An increase from the minimum target would therefore only be justified if solutions cheaper than the base cost for the minimum target are available – the rationale being that the expenditure required to comply with the minimum target can then be used to achieve greater reductions.

So, for example, a development in a network expansion area might be able to purchase CO_2 credits at a price as low as £30/tonne, enabling the maximum target to be met cost effectively. An all-electric development could purchase CO_2 credits from a wind farm at less than £60/tonne, enabling the 42% target to be met cost effectively.

The onus will therefore be on each district, and the City Region as a whole, to work with developers to bring forward lower cost solutions in order to mandate higher carbon reductions. This would not, however, preclude developers bringing forward their own solutions.
A developer could of course choose to achieve meet the maximum target by investing on-site but this would of course be at a higher cost than minimum compliance.

Achieving early reductions in unregulated emissions

Compliance with the maximum target would be achieved by making off-site contributions towards infrastructure, effectively putting in place the Government's 'allowable' solutions approach in advance of 2016 and 2019. If compliance with the maximum target were achieved by making an off-site contribution this would not count towards achieving Code levels 1-5, and would instead be credited against 'unregulated' CO_2 emissions.

The assignment of CO_2 reductions against unregulated emissions is justified because this portion of energy use, which largely relates to electricity use, has been rising steadily since 1990. It will not be the subject of regulation until it is brought under the zero carbon definition in 2016 and 2019 and so, in the context of Manchester City Region's stated objective to differentiate itself as a Low Carbon Economic Area, the maximum targets serve as a means of providing interim reductions.

Reducing capital costs through third party investment

The capital costs quoted by this study do not take account of the prospect for using third party investment to reduce upfront costs. For example, CHP and district heating could be 60-70% debt financed by a specialist Energy Service Company (ESCo) investor thereby requiring only a 30-40% capital contribution from a developer. The same is likely to be the case for solar photovoltaics once the Feed-in Tariff regime is in place.

This raises the prospect of significantly reduced capital costs – facilitated by the involvement of a Local Authority and specialist investors - which would in turn justify the raising of maximum targets. The different mechanisms available to achieve this, and how they could inform a planned approach, are discussed in more detail in Section 8.

Box 1

Target selection questions

Q 1. Is the development in an RSS priority area for development (Policy RDF1) or a local or district centre?

If yes Q.2 if no Q.3

Q 2. Is there an existing or proposed district heating or cooling network the development could connect to?

If yes apply Target 1 'network connection policy area', with 'allowable' CO_2 credits from connecting other buildings to the network. If no see Q.3

Q 3. Does the development consist of at least three of the following uses – commercial office, hotel, residential apartments, public building and supermarket?

If yes a CHP/district heating feasibility study is required, encompassing buildings that could be connected in the surrounding area, and applying Target 1 if a scheme is taken forward. If no see Q.4

Q 4. Are the building(s) heating and cooling systems all electric?

If yes apply Target 2 'electricity intense policy area', with 'allowable' CO_2 credits from low cost renewable electricity generation. If no see Q.5

Q 5. Has a strategic opportunity been identified to supply the site/area with low or zero carbon energy?

If yes apply a target informed by the evidence base for the strategic opportunity. If no see Q.6

Q 6. Apply *Target 3* 'micro-generation policy area', *with 'allowable' CO_2 credits from unspecified renewable energy sources*.

Table 7.5

City Region domestic energy infrastructure target framework

% Minimum requirement	Example opportunities for greater reductions	% Indicative maximum requirement [1]
Target 1: Network development area Mixed use and high-density residential developments in RSS priority areas for development will be expected, where viable, to anchor the development of district heating networks [2]. Medium to high-density residential development in areas with networks will be expected to connect to existing networks.		
CHP/DH connection (£366/t CO_2) [3]	1. District centres and strategic housing site network contribution (£150-£250/t CO_2) 2. Regional town centre and regeneration area network contribution (£100-£150/t CO_2) 3. Regional centre and power station heat off-take network contribution (£50-£100/t CO_2)	Up to 73% (£75/t CO_2) [4]
Target 2: Electricity intense buildings Apartments with electric heating that are not connected to decentralised energy networks will be expected to mitigate a proportion of their emissions using low or zero carbon technologies. This will include major retrofit projects.		
+17% increase on Part L (£392/t CO_2) [5,6]	1. Offset CO_2 emissions from electric heating using cheapest solution (see Target 3 options) 2. Redesign servicing to use low carbon heating (revert to Target 1 or 3)	Up to 56% (£120/t CO_2)
Target 3: Micro generation area Medium to low density developments that are not in RSS priority areas for development will be expected to mitigate a proportion of their emissions using low or zero carbon technologies.		
+15% increase on Part L (£392/t CO_2) [6,7]	1. Utility or ESCo investment in on-site domestic solar roofs (£120/t CO_2) [8] 2. Off-site community micro-generation contribution (£100-£320/t CO_2) [9] 3. Off-site medium to large wind power generation contribution (£65/t CO_2)	Up to 49% (£120/t CO_2)

Explanatory notes:

1. The maximum requirement is dependant on the cheapest option being available, which, as an off-site contribution, would need to be offset against 'unregulated' emissions. This requirement could however, and at the developers discretion albeit at greater cost, be used to increase a Code for Sustainable Homes score, for example from 3 to 5;
2. Research for DECC suggests that this should be defined as a baseload heat density of at least 3 MWth/km^2
3. Base costs £366/t CO_2 based on a connection to a district centre gas CHP. Residential CHP/DH is more expensive than for commercial uses so Scenario 2 has been used to calculate the maximum requirement;
4. Assumes a specialist Energy Service Company (ESCo) investor finances 60% of the capital costs;
5. The minimum requirement is calculated based on the RSS +5% on-site requirement over and above Part L performance at that point in time e.g. Part L 2010 Code 3;
6. Base costs are £392/t CO_2 based on a minimum install of a 1.1 kWe solar photovoltaic array;
7. The minimum requirement is calculated based on the RSS 10% on-site requirement to be applied over and above Part L performance at that point in time e.g. Part L 2010 Code 3;
8. A utility or an ESCo could invest in solar photovoltaic's, reducing the capital cost for the developer by 70%. This option would be constrained by the available roof area;
9. Examples might include a wind turbine for a school, a biomass boiler for a library or a large solar PV array on a leisure centre;

Table 7.6

City Region non-domestic energy infrastructure target framework

% Minimum requirement	Example opportunities for greater reductions	% Indicative maximum requirement [1]
Target 1: Network development area Mixed use developments in RSS priority areas for development will be expected, where viable, to anchor the development of district heating networks. Development in areas with existing networks will be expected to connect to a network.		
CHP/DH connection (£366/t CO_2) [2]	1. District centres and strategic housing site network contribution (£150-£250/t CO_2) 2. Regional town centre and regeneration area network contribution (£100-£150/t CO_2) 3. Regional centre and power station heat off-take network contribution (£50-£100/t CO_2)	Up to 73% (£75/t CO_2) [3]
Target 2: Electricity intense buildings Commercial uses with a high proportion of emissions from electricity use (>45 kg CO_2/m^2) that are not connected to decentralised energy networks will be expected to mitigate a proportion of their emissions using low or zero carbon technologies.		
+10% increase on Part L (£333/t CO_2) [4,5]	1. Offset CO_2 emissions from electric heating using cheapest solution (see Target 3 options) 2. Redesign servicing to use low carbon heating (revert to Target 1 or 3)	Up to 28% (£120/t CO_2)
Target 3: Micro generation area Single use, lower density developments that are not in RSS priority areas for development will be expected to mitigate a proportion of their emissions using low or zero carbon technologies.		
+15% increase on Part L (£333/t CO_2) [5,6]	1. Utility or ESCo investment in on-site domestic solar roofs (£120/t CO_2) [7] 2. Off-site community micro-generation contribution (£100-£320/t CO_2) [8] 3. Off-site medium to large wind power generation contribution (£65/t CO_2)	Up to 42% (£120/t CO_2)

Explanatory notes:

1. The maximum requirement is dependant on the cheapest option being available, which, as an off-site contribution, would need to be offset against 'unregulated' emissions. This requirement could however, and at the developers discretion, albeit at greater cost, be used to increase a Code for Sustainable Homes score, for example from 3 to 5;
2. Base costs £366/t CO_2 based on a connection to a district centre gas CHP. Scenario 3 has been used to calculate the maximum requirement;
3. Assumes a specialist Energy Service Company (ESCo) investor finances 60-70% of the capital costs reducing upfront costs;
4. The minimum requirement is calculated based on the RSS +5% on-site requirement to be applied over and above Part L performance for a supermarket at that point in time e.g. over and above Part L 2010;
5. Base costs are £333/t CO_2 based on a minimum installation of a solar photovoltaic array;
6. The minimum requirement is calculated based on the RSS 10% on-site requirement to be applied over and above Part L performance for an office at that point in time e.g. Part L 2010;
7. A utility or an ESCo could invest in solar photovoltaic's, reducing the capital cost for the developer by 70%. This option would be constrained by the available roof area;
8. Examples might include a wind turbine for a school, a biomass boiler for a library or a large solar PV array on a leisure centre;

7.4.5 Justifying the City Region targets

The proposed electricity intense minimum targets and the maximum targets are higher than the minimum of 10% set out in RSS policy EM18 and shift the emphasis from energy use to CO_2 emissions. Based on the evidence base from this study the overarching justifications for this approach are two fold:

Strategic

- Unconstrained economic growth across the City Region creates the risk of further increases in carbon emissions;
- Where opportunities to plan for low/zero carbon infrastructure exist greater carbon emissions reductions can be achieved at a lower cost;
- A series of opportunities have been identified to provide on-site, near-site and off-site infrastructure that would allow for greater emissions reductions;
- In order to position itself as a low carbon economy the City Region will need to support this aspiration by:
    - Reducing its exposure to rising fossil fuel and carbon prices;
    - Creating certainty for investors in low/zero carbon infrastructure;

Technical

- The RSS target does not necessarily reflect the minimum deployment of technology required for all building types to meet upcoming regulatory requirements and develop the market for low/zero carbon technologies;
- Targets should therefore be framed in terms of CO_2 reduction, so that the contribution of technologies towards meeting regulatory milestones can be clearly understood,
- Unregulated emissions should be targeted in order to manage overall carbon emissions from development;
- Unregulated emissions should be subject to interim reductions ahead of the zero carbon milestones;