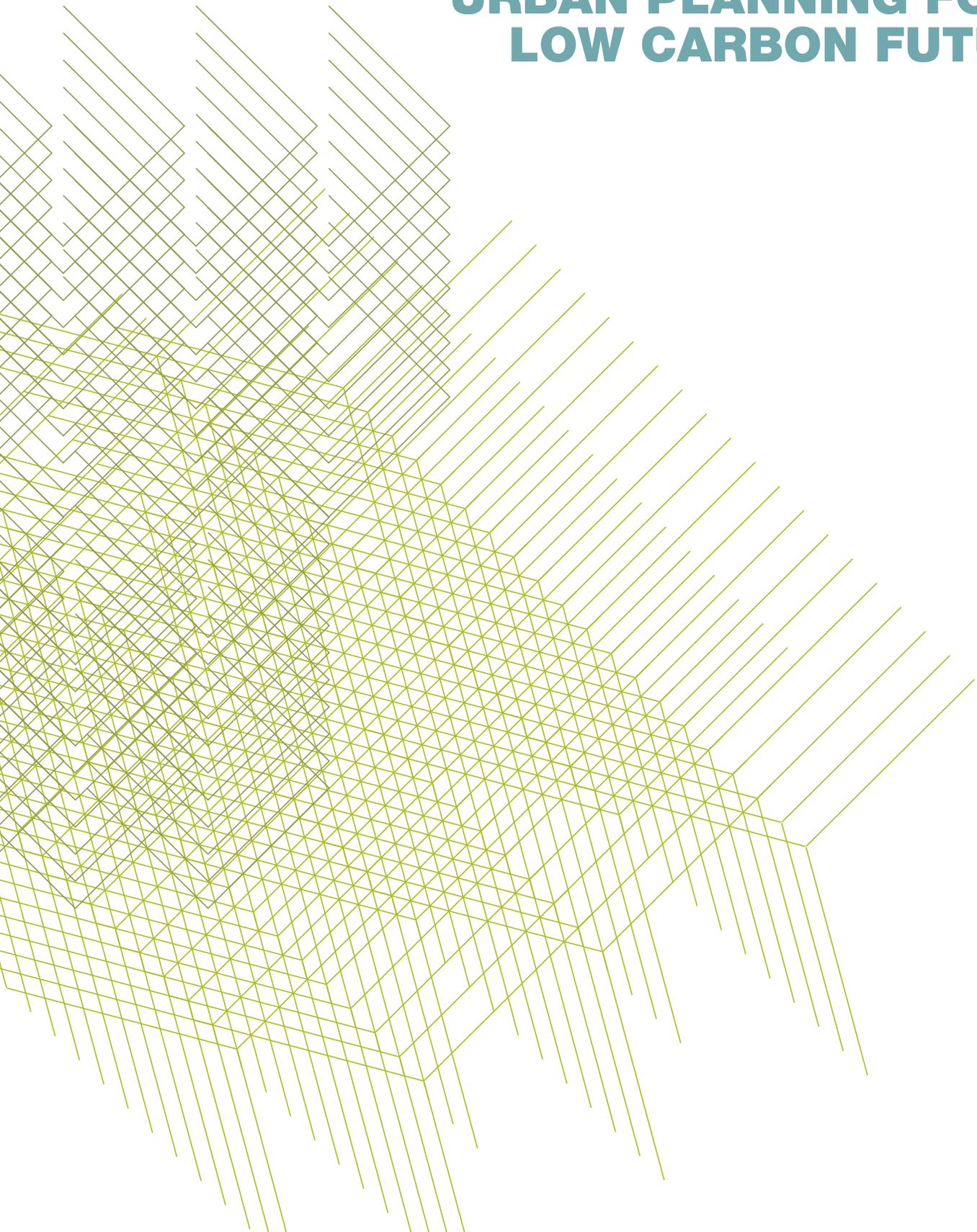


COMMUNITY ENERGY: **URBAN PLANNING FOR A LOW CARBON FUTURE**



Prepared for the TCPA & CHPA by Nick Dodd from URBED
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Conceived and commissioned by Michael King (CHPA) and Robert Shaw (formerly of TCPA and now Faber Maunsell).

The TCPA is an independent charity working to improve the art and science of town and country planning. The TCPA puts social justice and the environment at the heart of policy debate and inspires government, industry and campaigners to take a fresh perspective on major issues, including planning policy, housing, regeneration climate change. Our objectives are to:

- Secure a decent, well designed home for everyone, in a human-scale environment combining the best features of town and country
- Empower people and communities to influence decisions that affect them
- Improve the planning system in accordance with the principles of sustainable development

For more information see www.tcpa.org.uk

The Combined Heat and Power Association (CHPA) is the UK's leading advocate for CHP, district heating and microCHP, aiming to promote the role of these technologies in enhancing energy security, tackling climate change and managing energy costs. The CHPA is a long-established not-for-profit trade association, which acts as a focus for the CHP industry in the UK, providing support across its membership and working to establish and maintain the strong and stable market conditions necessary to grow the application of CHP technology.

For more information see www.chpa.co.uk

English Partnerships is the national regeneration agency helping the Government to support high quality sustainable growth in England by creating well-served mixed communities where people enjoy living and working. In collaboration with the Housing Corporation, the Academy for Sustainable Communities and Communities and Local Government we are establishing the new Homes and Communities Agency that will begin operating in 2009.

For more information see www.englishpartnerships.co.uk.

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FOREWORD

To achieve zero-carbon communities through planning we must seek to address the unparalleled demand for new homes and the necessary accompanying infrastructure while at the same time tackling climate change. Nearly half of the UK's carbon dioxide emissions come from buildings, a quarter of these from our homes. When transport is factored in it becomes clear that energy demand and supply are heavily influenced by the built environment.

It is essential that we meet the challenge of reducing our reliance on fossil fuels by improving the sustainability of large-scale power stations and focusing on the role that smaller scale decentralised energy generation can play. A step change is needed in how we generate and supply electricity, making a transition to decentralised energy and power based on low and zero carbon technologies.

This creates a new role for local authorities, their communities and stakeholders to be sustainable energy pioneers, as set out in Planning Policy Statement 1 on climate change. Local authorities are significant purchasers of energy services and can therefore act as a catalyst for energy projects. Leading by example local authorities also have the potential for their portfolio of buildings to provide long-term supply contracts as security for community energy projects.

Planning and developing local energy solutions involves exploring which combination of technologies makes most sense at different scales – looking at the opportunities for new and existing building typologies and uses and the relationship of a town or city to its rural hinterland. For example, small-scale microgeneration technologies such as solar PV can be complemented by efficient forms of generation and distribution such as CHP

and community heating networks.

Drawing upon best practice this joint TCPA and CHPA guide is designed to help planners, developers, architects, urban designers and infrastructure providers in the public and private sectors develop better understanding of policy support for low and zero carbon energy solutions. The guide demonstrates effective energy strategies and helps communities and other stakeholders plan for the delivery of community energy. There is a huge opportunity for local authorities to take ownership of their local area climate change targets and develop low and zero carbon solutions to meet them. In the end such approaches can help local neighbourhoods to mitigate and adapt to real climate change impacts such as more frequent flooding, drought and heat waves.

Planning provides a crucial tool to help us prevent further damage to our environment through the provision of secure and sustainable energy supply and generation.

Gideon Amos

Chief Executive

Town and Country Planning Association

PREFACE

The Government has set a target to reduce carbon dioxide emissions by 60% by 2050. Recent scientific evidence has suggested that this target will need to be raised to 80% if we are to avoid catastrophic impacts of climate change. This is a very challenging target. In order to meet it, all sectors of the economy and society will need to play their part.

Buildings are responsible for approximately 50 % of current carbon dioxide emissions. It is estimated that 30% of buildings that will exist in 2050 are yet to be built. This provides us with the opportunity to use the planning and development of these buildings to shape the towns and cities of the future, reducing their own carbon footprint but also realising and enhancing projects that can benefit the existing stock. Planners are in a vital position to influence how this happens.

In order to do so we need to develop a greater understanding of the energy implications – for heat, power and cooling - of buildings and the context in which they stand. Each locality has an individual energy ‘thumbprint’ in respect of the age, form, density and mix of uses of the buildings within it as well as its proximity to energy infrastructure, including transport networks for bulky fuels, and potential low and zero carbon energy sources that are presently under-exploited. Indeed, many seemingly insurmountable problems presented by some localities can, at the same time, prove to be golden opportunities if you know what to look for.

This Guide has been written to help raise understanding on these issues. It is necessarily a glancing coverage of a huge subject. A key message is to take a

strategic approach that sees the whole picture. Insisting on a ‘pure’ development on one specific site may undermine a greater opportunity for the whole community or provides an energy service that is too expensive for all members of society to use. These are examples of the nuanced approach required.

A further aim for this publication is to begin to forge a common language between the energy and building development industries. For too long these have existed in separate silos and the language used in each is a mystery to the other side. There is potentially a business opportunity here that can also provide social and environmental benefits. But we must be able to understand one another if it is to be realised.

We hope that you find it useful and that it stimulates an interest in how to develop a strategic framework in which buildings and energy technologies are put together in way that delivers the optimum local solution in meeting the challenge of climate change.

Michael King

Associate
Combined Heat & Power Association

HOW THIS GUIDE WORKS

This guide provides a practical vision of how our towns and cities can plan for the development of community-scale energy. Local Government has a key role to play in coordinating action, making full use of planning powers and acting as pioneers and champions for the development of decentralised energy networks.

The guide is aimed at:

- Key shapers of policy and practice in local government, including planners
- Regeneration agencies and Public:Private investment funds with a focus on site assembly and areas of change
- Private and social housing developers and specialist property investors
- Utilities, energy services companies (ESCOs) and specialist energy investors

Using this guide

The guide can be navigated using the spatial framework we have created for a hypothetical city which has developed a portfolio of low and zero carbon energy technologies in order to reduce its CO₂ emissions by 26%. The guide is organised by character areas of the city, and for each area we have explored the different building typologies and the opportunities which exist for low carbon and renewable energy supply technologies. This is intended to be illustrative rather than prescriptive.

This guide demonstrates the importance of developing a portfolio of energy technologies to map opportunities onto new and existing building typologies and uses. It also considers the relationship of a town or city to its rural hinterland and encourages planners to avoid too narrow a focus on building, site, district or borough boundaries.

Different solutions are appropriate at different scales, and should be supported by planning and enabling

mechanisms. For each of these themes the guide provides practical examples of local government pioneers, both in the UK and further afield.

Whilst the policy and legislative framework for local government, planning, waste and energy may vary between England, Scotland and Wales, the general principles and practice set out in this document are equally applicable.

The guide draws upon the lessons from over 20 examples of best practice from the UK and overseas, with a specific focus on experience from Denmark, and leading EU cities.

The need for a strategic approach

Energy planning at a town and city scale needs a strategic approach, supported by strong planning policies and complementary enabling mechanisms.

Energy strategies should be driven by a common purpose to reduce CO₂ emissions and increase the energy security of communities, and should be based on a clear and rational relationship between:

- The benefits of low carbon energy generation technologies
- Access to renewable resources in the local environment
- The forms and grades of energy required for different end-uses
- Parameters for cost effective and efficient deployment
- The scale and form of development opportunities

THE NEED FOR A STRATEGIC APPROACH

The Local Government White Paper highlights the responsibility of local authorities to create a strategic context for action on climate change, and this guide explores some of the key prerequisites for action:

Demonstrating leadership

Putting in place the high level commitment required to drive change and demonstrate leadership

- Political commitment: Making a strong political commitment in order to drive change and re-enforce the need for action, and making full use of local government's planning and enabling powers.
- Leading by example: Establishing a corporate commitment to low carbon energy across a council's property portfolio, and making full use of purchasing power to support and provide anchor loads for wider projects;

Planning for a low carbon future

Putting in place the vision, policies and strategies to develop low carbon energy generation

- Setting out a 2050 Vision: Setting out a vision based on future scenarios for the development of a 'portfolio' of low carbon energy generation across a town or city;
- Developing an energy strategy: Identifying the practical steps required to develop the 'portfolio' including the co-ordination and monitoring of progress and the engagement of stakeholders; ;
- Putting in place delivery mechanisms: Establishing a strong framework of planning and enabling mechanisms in order to facilitate and stimulate investment in the 'portfolio'.

Enabling change

Using Local Government's assets and its enabling powers to co-ordinate and support change

- Leading by example: Establishing a corporate commitment to low carbon energy across a council's property portfolio, and making full use of purchasing power to support and provide anchor loads for wider projects;
- Catalysing investment: Playing a leading role in linking together heat loads, establishing special purpose vehicles and identifying partners to lever investment into projects;
- Engaging the wider community: Co-ordinating and engaging the wider community of stakeholders in order to develop projects that contribute to wider vision for an energy 'portfolio'.

This guide illustrates how different decentralised energy technologies should form part of a town or cities 'portfolio'. Different solutions are appropriate at different scales, and should be supported by planning and enabling mechanisms. For each of these themes the guide provides practical examples of Local Government pioneers, both in the UK and further afield. The guide draws upon the lessons from over 20 examples of best practice from the UK and overseas, with a specific focus on experience from Denmark, and leading EU cities.

SETTING THE SCENE

The need for action to tackle climate change and to secure our energy supplies has come sharply into focus. So too has the imperative to develop forward looking policies and strategies that will enable us to plan for the challenges that may lie ahead. Here we explore the emerging national policy picture which is driving action at a regional and local level.

1. The Changing Climate

1.2 The Challenges that lie ahead

Reducing our reliance on fossil fuels will require a fundamental change in how we generate and supply energy, with a rapid transition to decentralised forms of heat and power generation based on low carbon, zero carbon and carbon neutral technologies.

Renewable forms of energy will need to be harnessed, based on zero carbon 'flow' resources, such as the sun, the wind and the sea, and 'carbon neutral' resource cycles, such as organic waste or plant-based biofuels. These will need to be complemented by more efficient forms of generation and distribution based on low carbon technologies such as Combined Heat and Power (CHP) and district heating networks.

This fundamental change will need to be delivered at a regional and local level, creating new and challenging roles for local authorities, their communities and their stakeholders. Decentralised, community energy is the new paradigm and it will need to be developed within our lifetimes if we are to create a path to a sustainable and low carbon future.

1.1.1 National energy policy

The Government's latest Energy White Paper placed action on climate change at the heart of energy policy. This reflects the Government's international commitment to the reduction of carbon dioxide (CO₂) emissions, as both a signatory to the Kyoto Protocol and as a strong advocate of the need for action. The UK's energy policies address four long-term strategic goals:

- Placing the UK on a path to cut CO₂ emissions by some 60% by 2050, with real progress by 2020
- Maintaining reliable energy supplies

- Promoting competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity

- Ensuring that every home is adequately and affordably heated

Energy security has become an increasingly prominent theme alongside climate change. For the last few decades, the UK has been relatively self-sufficient for energy. Plentiful supplies of coal, oil and gas kept power stations going, the lights switched on and our homes warm.

However, the UK now faces a number of major decisions in relation to the investment needed to address the security and sustainability of our energy supplies. With shrinking reserves of North Sea gas and oil and the decline in our coal industry, the UK is now a net importer of energy. In addition, the large coal and nuclear power stations which form the baseload capacity for the national grid are reaching the end of their operational lives.

The Energy White Paper raised the prospect of replacing this capacity with new 'clean' coal and nuclear power stations. Both options are likely to perpetuate our reliance on imported fuels. If we are to reduce this reliance, and to reduce CO₂ emissions, we will need to explore opportunities for generating electricity more efficiently and for moving towards renewable fuel sources.

WHERE DOES OUR ENERGY COME FROM?

Uranium (9%)

We currently rely on uranium imported from Africa, Australia and Russia and only a relatively small proportion of nuclear waste is recycled.

Coal (15%)

Whilst 50% of our coal is still mined in the UK, the rest is imported from countries such as South Africa and Australia. Economic deep mine reserves in the UK are estimated at 10 years.

Oil (35%)

North Sea reserves have begun to decline; we now import oil from Norway, the Middle East, North Africa and Russia.

Gas (39%)

North Sea reserves will decline over the next 20 years; we are increasingly coming to rely on gas from Russia, the Middle East and North Africa

1.1.2 National drivers for local action

Strategic policy makers and planners at a regional and local level will quickly need to respond to the step change in Government thinking. The national drivers for local action include:

- **Climate Change Bill:** This Bill should create one of the most radical national frameworks for action on climate change. It includes provision for a legally binding emissions reduction of between 26% and 32% by 2020, 5 year rolling targets and the establishment of a new independent body to oversee progress.
- **Energy White Paper:** The most recent Energy White Paper built on the two headline themes of climate change and energy security.
- **Stern Review:** The Stern review of the economic implications of climate change has raised the stakes, establishing a fiscal argument for a precautionary approach. Planning was identified as one of four priority areas for action.
- **Supplement to Planning Policy Statement (PPS) 1 on Planning and Climate Change:** Its implications are far reaching for planning policy and practice at all levels. The new supplement, together with PPS 3 and 22, establishes a robust framework for tackling climate change and delivering more sustainable decentralised energy through planning.
- **Local Government White Paper:** The White Paper highlights the important role of local authorities in coordinating reductions in CO₂ emissions in their communities. Climate change is one of seven key challenges and the White Paper calls for Local Area Agreements setting out climate change targets and supported by Sustainable Community Strategies. The new Comprehensive Area Assessment includes action on climate change as a priority target.

— **Building a Greener Future:** The Government has set out its ambition that all new UK homes should be zero carbon by 2016. This includes the introduction of the Code for Sustainable Homes as a national standard for new homes.

— **Code for Sustainable Homes:** The Code includes requirements to reduce CO₂ emissions. It is now mandatory for publicly funded development and will be enforced at Code level 3 through the Building Regulations from 2010. By 2016, all new homes should be zero carbon (Code level 6).

Whilst significant progress has clearly been made in building the policy impetus and in establishing national standards for new housing, clear guidance is still needed on how to translate the overall message into action at a regional and local level.

The Code for Sustainable Homes levels 5 and 6 in particular will require low carbon infrastructure for new development sites, requiring new business models for the delivery of energy at a local scale. But in order to deliver deep cuts in CO₂ emissions we will need to look beyond new development to our wider communities, and where they source their energy from.

We urgently need to implement low carbon energy strategies for our towns and cities so that they can begin to chart a clear course towards a low carbon future. In the absence of clear direction, some Local Authorities are showing the way, with forward looking Councillors, chief executives and officers in London Boroughs as well as towns and cities such as Leicester, Southampton and Woking demonstrating the kind of leadership that will be needed in order to make progress.

In order to respond to the energy challenges of the 21st century, Local Government once again has a strategic role to play in planning for the future energy needs of our communities.

1.2 Local Government as an energy pioneer

At an international level, Local Government is playing a pioneering role in responding to the threats of climate change and energy security, often by being bolder and more radical than national governments.

Towns and cities in the EU and North America are taking action in a range of different ways by:

- Demonstrating leadership in their communities
- Providing planning and financial support
- Establishing partnerships to demonstrate and invest in new technologies
- Engaging with citizens to educate and raise awareness

With its remit in the UK strengthened by the well-being powers under the Local Government Act of 2000 and the Local Government White Paper (2007), Local Government can be a 'strategic leader and place shaper', coordinating, facilitating, and directly engaging in the development of community energy projects.

The past can provide a key to the present. If we turn the clock back to the 19th century, we can see the pioneering role that Local Government played in developing the first decentralised gas and electricity and district heating networks. Some of these schemes remain, and are expanding - such as Pimlico in London.

In order to respond to the energy challenges of the 21st century, Local Government once again has a strategic role to play in planning for the future energy needs of our communities. Evidence from pioneers such as Germany and Denmark, and research by organisations such as the Royal Commission on Environmental Pollution and the Tyndall Centre, indicates that a balanced approach is needed: more efficient, large-scale power generation complemented by substantial investment in decentralised energy generation at a range of scales – from multi megawatt wind farms and city-scale CHP to

microgeneration on thousands of homes and buildings.

This will require a renewed focus by the energy industry and Local Government on localised solutions. It will also result in the need to locate decentralised, community-scale energy technologies in everyone's 'backyards'. This will fundamentally change our relationship with how our energy is generated. Local leadership and the engagement of communities will be needed in order to overcome the potential barriers to change.

In order to make progress a step change is needed not just in strategic policy and planning, but in the scale of investment being made. Local authorities are significant purchasers of energy services in their local areas. They have the ability to act as a catalyst for energy projects, with the potential for their portfolio of buildings to provide baseloads and long-term supply contracts as anchors for community energy projects.

They can also provide covenant strength as partners in Energy Service Companies (ESCOs).



1

Local Government pioneers
Bloom Street CHP, Manchester

Developed by the Manchester Corporation, Bloom Street power station in central Manchester opened in 1898 to meet soaring demands for electricity to power the city's trams and light its streets. At the time Bloom Street was the most advanced power station of its kind in the country with a capacity of 7.2 MWe from its four reciprocating engines fed by coal brought by barges up the adjacent Rochdale Canal.

In 1911 Bloom Street became the first power station in Britain to introduce Combined Heat and Power (CHP). It began to supply low pressure steam to heat textile buildings and, in due course, other businesses up to a mile away were connected to the system via a network of underground pipes, among them UMIST, the Refuge building (now the Palace Hotel), the Ritz Ballroom and the Palace Theatre. The station closed in the 1989 as major heat consumers switched to conventional boilers and the system became uneconomic.



2

International pioneers
'Green cities': The need for urban solutions

Cities across the EU are taking the lead in responding to the need for action on climate change and in seeking to be 'green cities'.

London: The Mayor of London and the GLA have led the way with the development of an energy strategy containing ambitious targets and a strong focus on decentralised energy.

Berlin (Germany): The city has strong overall climate change and energy strategies, expressed through its commitment to CHP – it has one of the largest district heating networks in the world – and innovative support for micro-generation.

Copenhagen (Denmark): The city has maintained and developed an extensive CHP and district heating network, switching progressively to low carbon fuels. Citizens have driven major projects and investment in wind power using co-operative models.

Freiburg (Germany): The city has made a strong commitment to environmental sustainability coordinating the development of low energy urban extensions, a solar business park, a wind farm, a solar photovoltaic programme and a municipal biogas plant.

Malmö (Sweden): The city has strengthened its identity through new urban developments that demonstrate a comprehensive approach to decentralised energy, and complementing the cities existing energy networks.

Barcelona (Spain): The city has enacted a planning requirement that all new developments should use solar thermal collectors; this is now being adopted by other Spanish cities.



3

Local Government pioneers
Energy planning in London

London is emerging as an exemplar of how to bring together clear political leadership and a strategic planning framework for decentralised energy. The London Plan is notable in establishing targets and requirements for new development encompassing carbon reduction, installed renewables capacity and technology deployment.

The Mayor of London has made a commitment to the development of decentralised energy, setting ambitious targets and establishing the London Climate Change Agency and the Decentralised Energy Delivery unit within the London Development Agency. The challenge is now to translate this high level commitment into action on the ground in each of the thirty-two London Boroughs with a combined population of over seven million.



1.3 Shifting from centralised to decentralised energy

The transition to a more efficient, low carbon decentralised energy supply will depend on investment not just in a network of new, smaller power stations and renewable energy sources, but also in improving the efficiencies of new and existing large power stations.

1.3.1 Securing a future for large power stations

The majority of the UK's electricity is supplied by large-scale power stations that reject up to 60% of their fuels' energy as waste heat. If this waste heat was to be captured, it could meet the UK's entire heating and hot water energy needs.

The Secretary of State now requires new power stations of more than 50 MWe to ensure that they have fully considered the opportunities for operating in Combined Heat and Power mode, now or in the future. In practice, this is only possible if there are large-scale district heating networks to which they can connect. This can be achieved but it requires long-term energy planning and investment. The UK could have adopted a similar approach under the government's 1979 Marshall heat plan.

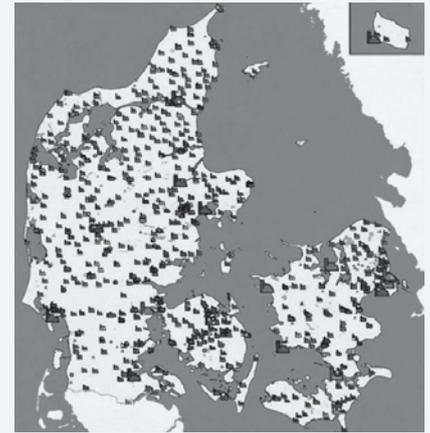
In the short to medium term, large centralised power stations are here to stay, and so we will need to revisit the principles of the Marshall Plan if we are to maximise their generating efficiencies. Many of the UK's power stations could operate in CHP mode if investment was forthcoming in large new district heating networks – for example, Barking town centre in London is proposing to utilise waste heat from Barking power station.

Networks could be developed by power companies, but would require enabling by key partners. In particular, they would require the support of local authorities to enable or develop networks within urban areas, as well as to provide the guarantee of baseload demand from, for example, large new areas of development.

1.3.2 Developing decentralised energy

Whilst improving the sustainability of large power stations is vital, there is an increasing need to focus on the role that smaller scale decentralised energy generation could play. Renewable forms of energy are receiving growing public backing and large-scale deployment of these, together with city, town and neighbourhood-scale CHP with district heating networks, could make a significant contribution to cuts in CO₂ emissions.

Careful local planning with sustained, targeted support are needed in order to bring projects to fruition, as well as greater engagement of communities and stakeholders, based on the principle of 'self-sustainability'. Whilst the market has a role to play, a coordinated approach to decentralised energy is needed.



4

Learning from past practice
The UK's 1979 Marshall heat plan

The Marshall heat plan for the UK was the output of the CHP group of the Department of Energy. Responding to the oil crisis, it recommended the development of district heating networks to supply high density heat loads in the UK's major cities. Thirty years on, its strategic vision remains uniquely relevant to our present situation. The plan emphasised:

- The importance of district heating networks as a prerequisite for CHP
- The potential to develop heat-only networks as a starting point to build up heat loads
- The need to support long-term investment in the face of short-term competition from other fuels.

Its main recommendation was an initial focus on 'lead city' CHP schemes in London, Birmingham, Manchester, Liverpool and Glasgow, followed by schemes in other cities.

5

European pioneers
Heat plan Aarhus (Denmark)

The city of Aarhus responded to the energy crisis of the 1970s by developing 'Heat Plan Aarhus'. The aim of the plan was to supply heat to the city, which has a population of 280,000 people, from the 700 MWe Studstrup power station located 17km north of the city.

The plan was implemented in 1985 with investment by the local authority in 122km of primary heat 'transmission' mains, 1,600km of secondary heat 'distribution' mains and the gradual connection of the majority of homes, workplaces and public buildings to the new district heating network, replacing oil and solid fuel heating.

6

European pioneers
Danish energy planning for 'self-sustainability'

Denmark's energy policies date from the mid-1970s when the country was heavily reliant on oil for heat and power generation. The oil crises of 1973-4 led to national energy plans to reduce reliance on imported oil and achieve sustainable development:

- **Danish Energy Policy 1976:** The first plan and the subsequent Energy Act 1979 introduced an energy tax on oil and granted powers to local authorities to implement municipal district heating plans – enabling greater fuel flexibility.
- **Energy Plan 1981:** The second plan showed greater recognition of the potential role of renewable energy, introducing subsidies and/or feed-in tariffs to support wind power, district heating from existing large power stations and new, smaller distributed plant.
- **Energy 2000 (1990):** The third plan set a target of reducing CO₂ emissions by 20% between 1988 and 2005. Specific targets were also established for the use of natural gas for CHP, biomass and wind turbines.
- **Energy 21 (1996):** The fourth plan set a new overall target of 12-14% of energy to come from renewables by 2005. This share was to increase by 1% every subsequent year, with the aim of reaching 35% by 2030.

Each plan has supported and emphasised the role of Local Government in implementation, giving it responsibility for delivery mechanisms and investment vehicles for decentralised energy generation.

Denmark is now a net exporter of energy and energy security has improved 150% since 1980, with hundreds of small-scale 'distributed' generators making use of wind resources and a range of fuels.

MAKING IT HAPPEN

This section explores the different ways in which Local Government can demonstrate leadership, creating the context for action at a number of levels.

2. Demonstrating Leadership

2.1 Political commitment

A strong political commitment is essential to demonstrate leadership and reinforce the need for action across a local authority and by all stakeholders in local communities.

Local authorities can start by signing up to recognised initiatives such as the Nottingham Declaration on Climate Change, placing action on climate change within the context of high level corporate policies.

Political commitment should form the starting point for action at a number of levels:

— **Corporate** – Establishing a corporate commitment to carbon reduction across a council's building stock, housing and property investments. This should include performance targets, policies for engagement with private sector partners and wider strategic projects to develop supply chains.

— **Planning** – Highlighting the need for a strong planning framework at a district level to secure carbon reductions from development and associated energy infrastructure. Regional Assemblies, County Councils and regeneration agencies have an important role to play including the provision of guidance.

— **Community** – Engaging with stakeholders to increase acceptance of the need for action, generate projects and embed climate change action in Sustainable Community Strategies. Counties and city-regional groupings have the potential to bring together partnerships to take forward strategic projects.

Alongside CO₂ reductions, Local Government can align with other national and regional energy policy themes – including energy security and affordable warmth – to drive action.

2.2 Leading by example

It is important for the credibility of community energy strategies that local authorities lead by example. As a first step, they should seek to establish a corporate commitment to carbon reduction.

The Carbon Trust has developed a five-step carbon management process for local authorities. Successful local

authority carbon management sends out a powerful signal to communities of progress to reduce emissions.

As part of a carbon management programme, local authorities are able to make use of their purchasing power to install low carbon energy technologies supplying their own properties. This can form a catalyst for projects across a district or county.

There is also scope for local authorities to work in partnership to install renewable energy capacity. The Carbon Trust's Partnerships for Renewables initiative supports on-site generation projects where there is scope for a local authority to support projects across counties and major urban areas or that may be outside of their locality but where there is a renewable resource.

This approach has been demonstrated by the cities of Freiburg and Copenhagen, both of which have invested in and supported major wind farm projects on their doorstep, in each case matched by significant investment from the wider community. Freiburg has taken this approach further, with the local authority owned utility company Badenova establishing a new electricity tariff to generate investment in regional projects.



7

Local Government pioneer
Biomass heating policy, Barnsley

Barnsley Metropolitan Borough Council has made CO₂ emissions reductions of more than 20% since the early 1990s through a comprehensive programme to improve the energy efficiency of its buildings, including its housing stock. It has now set a more ambitious target, adopted at Member level, to reduce its emissions by 60% by 2015 by switching to biomass heating.

Working with biomass heating specialists, the Council has initiated a switch over programme. The central library, schools and council blocks of flats have already switched to biomass and the new civic centre will follow. The council has also carried out a survey of the available biomass resources in the district, and has begun to establish wood fuel handling centres to supply its boiler programme.



8

European pioneers
'Regiostrom' funds renewable energy, Freiburg (Germany)

In addition to national support for renewable energy provided by the German Government, the regional power supply company Badenova (which is jointly owned by a number of local authorities including Freiburg) is investing in new renewable energy capacity with revenue generated by a new electricity tariff designed to support regional projects – 'Regiostrom'.

Badenova invests all of the additional income from the higher rate 'Regiostrom' tariff into new capacity, including solar photovoltaics, biomass heat and power (including the supply for two major new urban extensions), and small hydropower. Around 10% of Badenova's customers have chosen to switch to the tariff in order to support new investment. Direct subsidy is provided to customers who wish to install solar photovoltaic panels.

PLANNING FOR A LOW CARBON ENERGY FUTURE

Our towns and cities are supplied by gas and electricity networks that are carefully coordinated at a national and regional level to ensure security of supply. Decentralised energy networks require the same level of planning if they are to meet our energy needs at a local level.

3.1 Developing a vision and strategy

Towns and cities will require an energy strategy in order to realise their 2050 vision of a low carbon energy supply. This section explores the practical steps required to develop an energy portfolio, including the development of future scenarios, the identification of energy technologies and the coordination and monitoring of progress.

3.1.1 Future scenarios

National Government policy makes a commitment to achieve a 60% reduction in CO₂ emissions by 2050, and between 26% and 32% by 2020. Recent statements from government suggest that this target is likely to increase to reflect current climate science. In order to plan for the transition to a low carbon future and work towards achieving the radical reductions in CO₂ emissions required, it is important to explore what a future decentralised energy supply could look like. It is therefore appropriate to use the 2020 and 2050 timeframes as a starting point.

Developing a 2050 vision will help you to:

- Understand energy demands and supply needs
- Develop scenarios for the portfolio of energy technologies that will be required to meet these
- Relate energy technologies to local opportunities and requirements
- Think about technologies and their supply chains at a range of different scales, as emphasised in the Supplement to PPS1 on Planning and Climate Change

A medium-term 2020 vision should also be developed to provide more accessible, nearer term planning and enabling objectives. In-line with the approach set out in the Climate Change Bill, this can then be used to create the strategic context for short-term five year plans.

The longer range target for 2050 will require an approach based on future visioning and scenario

development. This will help to shape strategic policy directions across all areas of local government activity, highlight the wider role of key stakeholders and identify the potential risks arising from different scenarios.

Scenario-based approaches emphasise the importance of considering how new forms of energy generation will meet the demand for different grades of energy use. For example, around 80% of the energy consumption of existing residential properties is thermal energy for space heating or hot water. New residential property is considerably more thermally efficient, with energy demand split roughly equally between space heating, hot water and electricity use. Commercial uses introduce additional demands such as electricity for air conditioning and computer equipment.

A useful example of how energy grades, and the matching of supply and demand, can be overlooked or miscalculated is French energy planning in the 1970s.

The diversity of energy use is equally important. The seasonal, and even daily, fluctuations in demand require careful consideration. Residential hot water and electricity loads, for example, have very pronounced peaks during weekdays. The overall load profile for a large area of a city which includes a mix of uses will tend to be flatter and more diversified than a single use residential, commercial or industrial district.

OUR HYPOTHETICAL CITY

City Centre

With their mix of uses town and city centres create the most significant opportunity for the large-scale deployment of Combined Heat and Power (CHP) supplying district heating and for the large-scale deployment of solar photovoltaics on public and commercial buildings.

Edge of centre

The heat densities of university and hospital sites, as well as new residential and mixed use developments will support CHP/district heating, with the potential to be supplemented and complemented by other communally deployed renewable technologies, such as solar thermal collectors.

Inner city districts

The improvement, remodelling and selective demolition of properties to achieve Housing Market Renewal and to meet Decent Homes Standards, as well as significant investment in new mixed tenure housing, and in programmes to deliver improved health, education, social services, leisure and retail facilities create a range of opportunities from the communal scale to individual buildings.

Industrial estates

Their existing uses, and often exposed locations, can make industrial areas ideal for the location of larger energy generation projects, including those with significant visual impacts such as wind power and requiring large movements of vehicles such as energy from waste (including biogas) and biomass heat and power generation.

Suburban districts

Because of their low densities suburbs are ideally suited for the deployment of micro-generation technologies, but because the existing housing stock is largely outside of the remit of the planning system, novel market mechanisms are likely to be required in order to increase their deployment.

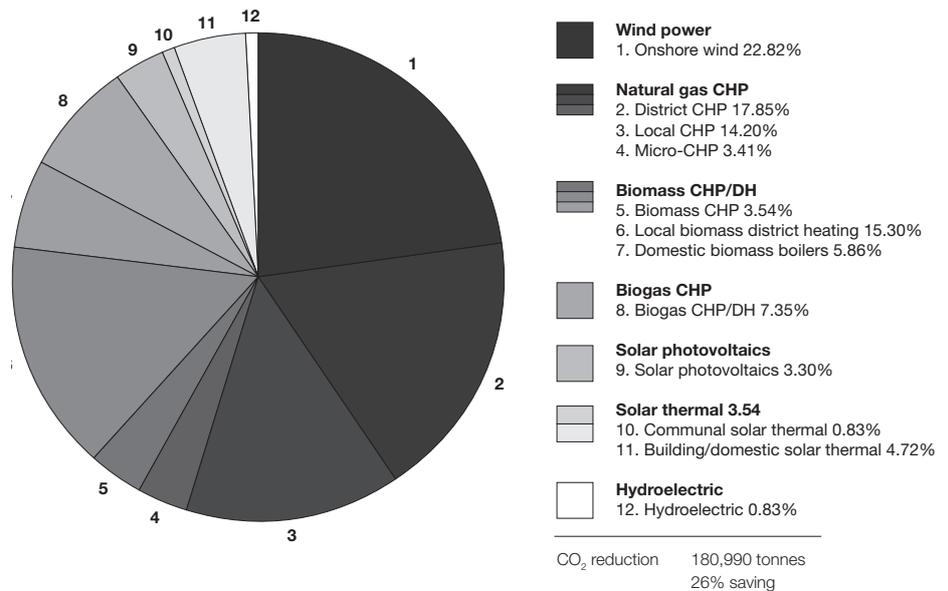
Urban extensions

Large new urban extensions and settlements such as those promoted by Millennium Communities, Growth Areas and the new Eco-towns Programme provide some of the best opportunities in the UK for putting the principles of low carbon, decentralised energy generation into practice – with a specific focus on communal energy networks as the cornerstone for the development as well as surrounding buildings.

Rural hinterlands

A town or city's energy supply should be looked at in the context of its rural hinterland. Opportunities may exist for cost effective deployment of medium to large-scale wind generation, and for the development of biofuel supply chains. Projects can also create the opportunity to develop beneficial relationships with farmers, to the benefit of the rural economy.

Contribution of low and zero carbon energy generation technologies towards CO₂ reductions for a hypothetical city



3.1.2 A portfolio approach to energy planning

The vision to 2020 and 2050 should form the starting point for a strategy to develop a portfolio of energy technologies. Opportunities should be mapped onto character areas defined by specific mixes of uses, areas of change, new and existing building typologies and heating densities. This reflects planning policy's emphasis on the development of area-specific strategies, driven by national and regional priorities.

The relationship of a town or city to its rural hinterland should also be considered, and planners should avoid too narrow a focus on building, site, district or borough boundaries. This is important because some locations may have relatively poor renewable energy resources, whereas others may have plentiful resources. The principle should be to harness renewable resources where they are most plentiful and cost effective.

3.1.3 The importance of heat planning

A key element of any energy strategy should be a heat plan. This could take the form of a Site Allocation, Development Plan Document (DPD) or Area Action Plan (AAP). The companion guide to the Supplement to PPS1 on Planning and Climate Change provides advice on how to approach this. In future, towns and cities will need to link together heating loads into district heating networks, as demonstrated by the approach taken in Denmark.

Heat planning for district heating networks can:

- Provide fuel flexibility now and into the future, preserving the ability to switch between natural gas, waste, biofuels and hydrogen
- Support the development of CHP up to 50 MWe in scale and to provide heat loads for larger power stations
- Balance and provide continuity of heating supplies between different renewable sources throughout the year

At a larger scale, and in the short to medium term, district heating supplied by natural gas or biofuel fired CHP remains the most cost effective way of delivering significant reductions in carbon emissions for city centres, local centres, large buildings and complexes, and higher density residential areas. CHP has the potential to reduce

emissions by between 25% and 35%. It is a significantly more efficient way of utilising our scarce natural gas resources and should form a major focus for heat planning.

Heat planning is supported by the Supplement to PPS1 Planning and Climate Change, which states that planning authorities should:

'have an evidence-based understanding of the local feasibility and potential for renewable and low-carbon technologies...to supply development in their area.'

'[they] should pay particular attention to opportunities for utilizing existing decentralised and renewable or low-carbon energy supply systems and to fostering the development of new opportunities to supply proposed and existing development.'

'Such opportunities could include co-locating potential heat customers and heat suppliers. Where there are existing decentralised energy supply systems, or firm proposals, planning authorities can expect proposed development to connect to an identified system, or be designed to be able to connect in future.'

In support of this aim it also states that:

'planning authorities can set specific requirements to facilitate connection'

With the caveat, however, that:

'Any requirement must be fair and reasonable and, in particular, not restrict those with responsibility for providing energy to new development, or the occupiers, to any one energy provider in perpetuity.'

The latter requires careful consideration of the basis on which energy is supplied, and associated energy contracts.

The balancing and future-proofing role of district heating is highlighted by the experience of Scandinavian cities. For example, heat pumps are used in Stockholm to extract heat from water courses and the sewage network, which is fed into the district heating network. But they are not suitable for meeting peak loads in winter and so are supplemented by CHP and heat-only plants burning a range of fuels, including waste and biomass. Heat pumps also require electricity, which would be carbon intensive in the UK, but in Sweden is provided at different times of the year by hydroelectricity and wind power.



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Lessons from past practice *French national energy planning*

The 1970s oil crisis led the French government to review their future energy supplies. Nuclear electricity generation was identified as a means to reduce oil imports and in 1974 the government made the decision to pursue a major programme of investment in nuclear plants.

Two decades on France's energy security has improved because it diversified its energy supply. However, it is still overwhelmingly reliant on imported fuel, sourcing most of its uranium from Canada, Niger and Russia.

Furthermore, electricity only accounted for small proportion of the primary energy used by France. Oil and gas were still needed for heating and transportation, and a surplus of nuclear electricity generation, required Electricite de France to persuade households and businesses to use electricity for heating.

10

European pioneers *Community heat planning, Denmark*

Denmark contrasts sharply with the UK in its choice of community or district heating rather than piped natural gas to heat its towns and cities. District heating currently accounts for 60% of space heating. This level of market penetration has been achieved over a period of twenty years almost entirely on a retrofit basis.

The 1979 Heat Supply Act was instrumental in stimulating major investment in heating networks. Local Authorities were required to prepare strategic heating plans. They were also given the planning powers to make consumers connect to new district heating networks, starting with the highest density heat loads, and the ability to establish new local community controlled heating companies (similar to ESCOs). Compulsory heating connections were balanced by a requirement for consumer control, not-for-profit operation and price transparency.

District heating has had the advantage of allowing cheaper, lower grade fuels than oil to be used, including municipal waste. This has enabled communities to become more resilient to fuel price fluctuations ensuring greater energy security.

PUTTING IN PLACE PLANNING MECHANISMS

This section explores the types of planning mechanism that can be put in place at the regional, sub-regional and local level to drive carbon emissions reductions.

3.2.1 Defining the scope and role of planning

The Supplement to PPS1 on Planning and Climate Change defines a clear role for planning that goes beyond the promotion of carbon reduction measures. Local Authorities should be seeking to create a strategic framework for CO₂ reduction including planning obligations and requirements.

Local Government's statutory planning powers are pivotal in establishing the spatial framework for the location, form and specification of new property developments as well as utility infrastructure and low carbon energy generation.

Planning will need to work at a number of different scales, including:

— City/sub-regional: Working with local authorities, key stakeholders, investors and central government to create a planning framework for large-scale renewable energy generation, large power stations consents based on higher generating efficiencies and biofuel supply chains, and to pool knowledge and resources in order to develop generic LDF policies and guidance.

— Districts or Boroughs: Developing a planning framework to support investment in heat networks in city, town and local centres through the creation of heat plans and medium to large scale renewable energy generation, rooted in strong LDF policies, strategies and guidance.

— Neighbourhoods and buildings: Developing a planning framework to support the neighbourhood and building-scale deployment of a range of microgeneration technologies, rooted in strong LDF policies, strategies and guidance, and aligning with the Code for Sustainable Homes.

Strategic heat planning will be required to facilitate the development of district heating networks, with district heating treated as essential utility infrastructure. In order for heat plans to have any status, they should be incorporated into Development Plan Documents and Area Action Plans.

Regions and sub-regions

Regions and sub-regions have an important role to play in establishing strong decentralised energy policies, based on wider CO₂ reduction targets and trajectories, that engage local planning authorities and the wider community. This can be supported by guidance for use by local planning authorities and to facilitate community energy strategies and supply chain partnerships. This has been demonstrated by the Yorkshire and Humber Regional Assembly and North Yorkshire County Council. Planning in the rural hinterland of towns and cities can also be used

to develop biomass supply chains and to screen sites for their suitability for wind farms.

An important principle at this scale is consistency in planning policies. At a Metropolitan scale, experience has highlighted the need for adoptable policies, with targets and requirements, supported by technical guidance that can be used when considering planning applications. The Supplement to PPS1 on Planning and Climate Change sets out the policy framework, supported by a good practice companion guide.

Waste management

Waste planning, the development of integrated waste strategies and the letting of major PFI contracts, should not take place in isolation from a town or city's energy strategy. Opportunities for synergy should be integrated into energy and waste planning, with a specific focus on biofuels and waste heat derived from energy from waste and mechanical biological treatment plant (where anaerobic digestion forms part of the process). Energy from waste plants should be required to maximise efficiency by operating as CHP plant, as demonstrated by Sheffield and Nottingham City Councils.

Local Development Frameworks

In support of regional energy and CO₂ reduction targets, local planning authorities should develop a suite of decentralised renewable and low carbon energy policies. These will need to be set out in Core Strategies and other Development Plan Documents, such as Site Specific Allocations and Area Action Plans.

In addition to the requirement in PPS22 to set criteria-based energy policies, the supplement to PPS1 on Planning and Climate Change requires local planning authorities to identify suitable locations, and to develop an evidence base, for low carbon and renewable energy sources and decentralised energy networks.

Areas of Change

With strong Development Plan Documents as the starting point, Supplementary Planning Documents can be used to support the development of low carbon energy strategies for major new masterplans, regeneration areas and development sites, with the mix of technologies and requirements tailored to the location, urban form and context.

Planning will not, however, be enough on its own to drive investment in a town or city's energy strategy – a range of complementary enabling mechanisms will also be needed to support implementation, examples of which are explored in Section 4.

The LDF Core Strategy and its associated Development Plan Documents are the fundamental building blocks for the creation of a strong policy and planning framework for low carbon, community-scale energy generation.

3.2.2 Creating Local Development Frameworks

The LDF Core Strategy and its associated Development Plan Documents are the fundamental building blocks for the creation of a strong policy and planning framework for low carbon, community-scale energy generation. LDF energy policies should form the basis for an energy planning framework which supports an overall vision and strategy. There are three main components to local energy planning, and the companion guide to the supplement to PPS1 on Planning and Climate Change sets out further advice on these:

1. Understanding local requirements and opportunities for decentralised energy to supply existing and new development. This could take the form of a GIS-based heat or energy plan.
2. Setting CO₂ and/or decentralised (i.e. on-site and near-site) renewable and low carbon energy targets for the local authority area as a whole. These should be supported by the evidence gathered under 1. These should be set out in the Core Strategy. In addition, where particular local opportunities exist higher site or area specific targets can be set. These should be set out in Site Specific Allocations or Area Action Plans.
3. Facilitate the creation of local decentralised energy networks. Policies will need to ensure that developers consider the opportunities for on-site energy systems in new developments to contribute to wider decentralised networks. This can be facilitated by policies that require

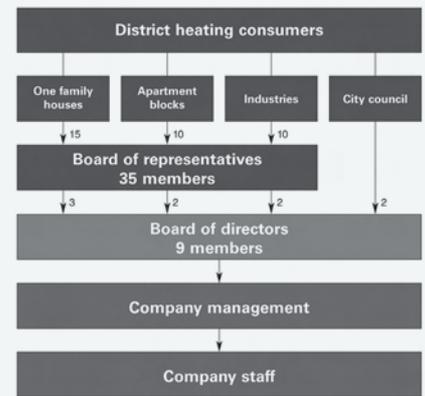
new developments to connect to existing decentralised energy networks. These could be further enabled 'on the ground' by Local Development Orders.

Prior to individual local authorities adopting locally specific policies the supplement to PPS1 on Planning and Climate Change is a material consideration in itself. Therefore, early action is possible with the supplement stating that:

'There will be situations where it could be appropriate for planning authorities to anticipate levels of building sustainability in advance of those set out nationally.'

A number of Councils have sought to develop an approach that anticipates the higher levels of CO₂ reduction set out in Code for Sustainable Homes level 3 and above, with Manchester City Council and Woking Borough Council being notable examples (see case study below). The experience from Woking is that policies are not enough, and that engagement with the development industry is required to deliver results on the ground.

The contribution made by each policy requirement should be considered as part of an overall sustainable energy planning framework and supporting an appropriate mix of measures. The energy themes of assessment tools such as the Regional Checklists, BREEAM and the Code for Sustainable Homes should be used to complement policy requirements, and to provide developers with tools to respond to renewable energy or carbon reduction targets.



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Local Government pioneers 40% carbon reduction requirement, Woking Borough Council

Woking's proposed new LDF Core Strategy energy policy requires a 40% reduction in carbon emissions (compared to Building Regulations) on all development, to be achieved by a mix of energy efficiency, renewables and CHP (the mix to be determined by the developer), carbon neutral development on greenfield sites and 25% reduced carbon emissions through energy efficiency on household extensions.

The Council's strategy for implementation has been based on educating all the stakeholders – developers, councillors and planning officers – through workshops and seminars looking at 'live' case studies. To promote good practice the Council has also produced Climate Neutral Development Guidance which includes a checklist to complete when submitting an application.

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European pioneers Community engagement in energy in Denmark

The direct engagement of communities – encompassing households, businesses, farmers and local authorities – has been central in the development of the Danish decentralised energy sector. This can be illustrated by the ownership models for each technology:

— Wind farms: 23% of Denmark's wind capacity is owned by investor co-operatives with 100,000 members, largely individual citizens, owning over 3,200 turbines. Local authorities own shares in a number of substantial wind farms.

— CHP/District heating: Around 300 of the 400 district heating networks are owned by their consumers, ensuring accountability for a monopoly supply. Local Authorities own most of the larger metropolitan heating networks.

— Biomass fuel: Farmer-owned businesses and co-operatives manage the fuel supply chain and own the majority of the 120 straw and woodfuel district heating plants. Local Authorities have assisted farmers by developing heating networks and underwriting investments.

— Anaerobic Digestors: Farmer-owned businesses and co-operatives own over 20 large-scale digester plants, providing them with a sustainable waste management solution. Local Authorities have assisted farmers by developing heating networks and underwriting investments.

Denmark's 1996 energy plan – 'Energy 21' – sought to ensure that 'the energy sector is well rooted in a democratic, consumer-orientated structure' and that this structure should be 'robust in relation to market developments' and based on the principles of 'self-sustainability' – to be achieved through an emphasis on consumer ownership and consumer democracy.

ENABLING CHANGE

Planning alone is not enough. Complementary enabling mechanisms will need to support implementation. This section describes the key enabling mechanisms that can be brought into play in order to support the development of community energy.

Complementary enabling mechanisms will be needed to support implementation of low carbon energy strategies, including full use of Local Authorities 'well-being' powers alongside:

- The land disposal process and valuations
- The establishment of selection criteria for development partners
- Acting as a catalyst for investment in decentralised energy networks

But it is not all a one way street. Private and social housing developers are central to raising standards and have a responsibility to support and develop low carbon energy strategies. Here we describe the key enabling mechanisms that can be brought into play in order to support the development of community energy.

4.1 Catalysing investment

Local Authorities have renewed powers under the Local Government Act 2000 and with reference to their Sustainable Community Strategies to act in the interests of their citizens in order to secure their social, economic and environmental well-being.

Government guidance expressly includes participation in special purpose vehicles established to deliver low carbon energy services, but their remit extends much wider than this – encompassing their strategic role in coordinating investment in the regeneration of neighbourhoods and, increasingly, the establishment of public-private property investment portfolios.

Planning gain and land sale

The benefits of community energy should be reflected and valued in bidding processes for public sector land. This approach has been demonstrated by Local Authorities such as the London Borough of Sutton and Wolverhampton City Council on low carbon regeneration schemes. The

proposed new Planning Charge system could create opportunities to secure investment in projects and infrastructure at different scales.

Partnerships for innovation

With an increasing focus on public-private partnerships to deliver regeneration projects, there is the need to select partners with a track record and capacity to innovate and take risk. Urban Regeneration Companies (URCs) and Housing Market Renewal (HMR) Pathfinder are in a strong position to facilitate innovation.

Property investment policies

Carbon reduction policies and the careful selection of development partners have the potential to be used by Regional Development Agencies (RDA), Local Authorities and special purpose investment vehicles such as ISIS and the English Cities Fund to deliver low carbon developments.

Energy service companies (ESCOs)

Local authorities such as Aberdeen, Southampton and Woking have successfully demonstrated how ESCOs can lever in the long-term investment required for CHP and district heating. Other cities such as Birmingham, Leeds and Leicester, as well as RDAs such as the East of England Development Agency and Government Agencies such as English Partnerships, are now looking to emulate this approach.

Initiatives such as the Growth Areas, the Eco-towns programme and existing URCs, Public-Private partnerships and HMR Pathfinders can harness these mechanisms in order to achieve a step change in the performance of new settlements.



4.2 Engaging the wider community

There is increasing evidence of the importance of community engagement in achieving wider acceptance of the need for action on climate change. Engagement can inform the development of Sustainable Community Strategies and Local Area Agreements, as demonstrated by Cornwall County Council and the Marches Energy Agency in Shropshire.

Low carbon, decentralised energy generation by its very nature tends to be smaller scale. It challenges consumers of energy to become engaged in the generation of low carbon energy. Projects must, by necessity, therefore be located in many more 'backyards' - both urban and rural. Community engagement therefore has a crucial role to play in:

- Building acceptance for projects
- Harnessing demand for local action to tackle climate change
- Directly engaging consumers in low carbon energy generation
- Ensuring that projects are transparent and accountable
- Capturing locally the social and economic benefits that may accrue

The evidence from countries that have achieved a significant deployment of decentralised community energy is that projects work best if they operate on a 'more-than-just-profit' basis, taking a long-term view on investments and developing beneficial relationships with stakeholders that create value for the wider community. Here there is a natural role for Local Government and social enterprise, because of their commitments to multiple bottom lines.

'Statements of community involvement' should be used to bring people into this process. PPS 22 highlights the need to "foster community involvement in renewables and promote knowledge of and greater acceptance by the

public of prospective renewable energy developments." Community strategies developed by Local Strategic Partnerships – and associated new Local Area Agreements – can galvanise support for local action on climate change, bringing together the public, private, social enterprise and voluntary sectors.

The long-term aspiration should be to engage communities in the process of delivery. In this guide we explore a number of different forms of community engagement in decentralised energy, including models of Local Government and community ownership and investment.

Part 2

Character

Areas

A black and white photograph of a city center. In the foreground, there is a curved, modern structure with a grid-like pattern, possibly a roof or a walkway. In the background, a tall, rectangular tower stands prominently, and a large, multi-story building with many windows is visible. The sky is cloudy.

5.1

City Centre

With their mix of uses town and city centres create the most significant opportunity for the large-scale deployment of Combined Heat and Power (CHP) and for the large-scale deployment of solar photovoltaics (PV) on public and commercial buildings.

Town and city centres are the most suited for the large-scale deployment of CHP supplying district heating using a range of different fuels. Their high density of development and mix of uses create a continuous daytime heating load and a need for cooling in summer.

The 'urban renaissance' has stimulated substantial new residential and mixed use developments in most UK cities. Primary energy consumers are likely to include a range of public and private sector offices, residential developments and leisure and retail uses.

This character area supports large-scale deployment of solar PV on public and commercial buildings, helping to improve the economies of scale for what is still an expensive technology. The profile of the electricity generated by solar PV is particularly well matched to the peak summer loads created by air conditioning.

5.1.1 Technology: District CHP/District heating

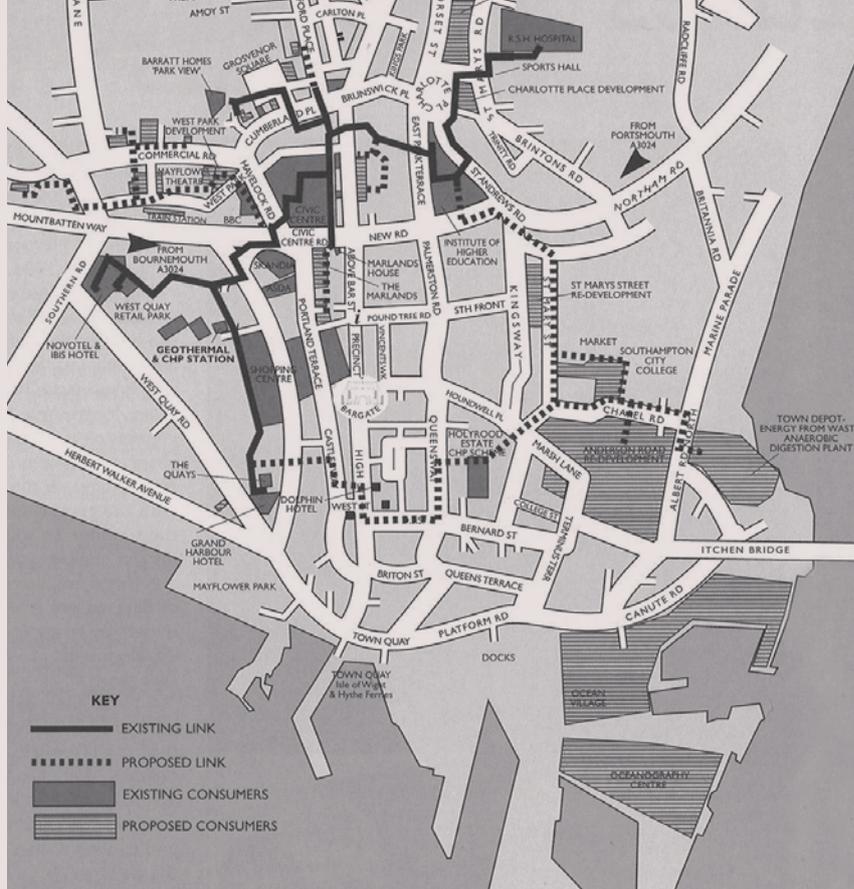
CHP with district heating is a cost effective way of delivering significant reductions in carbon emissions for mixed use areas with a heat density of more than 8 MWth/km² on the basis of a 6% discount rate. It is based on the principle that the waste heat from power generation should be utilised in order to maximise primary energy efficiencies.

This waste heat can be distributed to buildings via district heating pipes. This has the added benefit of future-proofing a district's energy supply because it allows a range of fuels and sources of waste heat to be used. CHP has a minimal visual impact on the townscape, although the siting of urban power stations requires careful consideration, particularly if they require biomass fuel deliveries.

CHP has the potential to reduce building CO₂ emissions by between 25% and 35%.

Possible Supply Mix

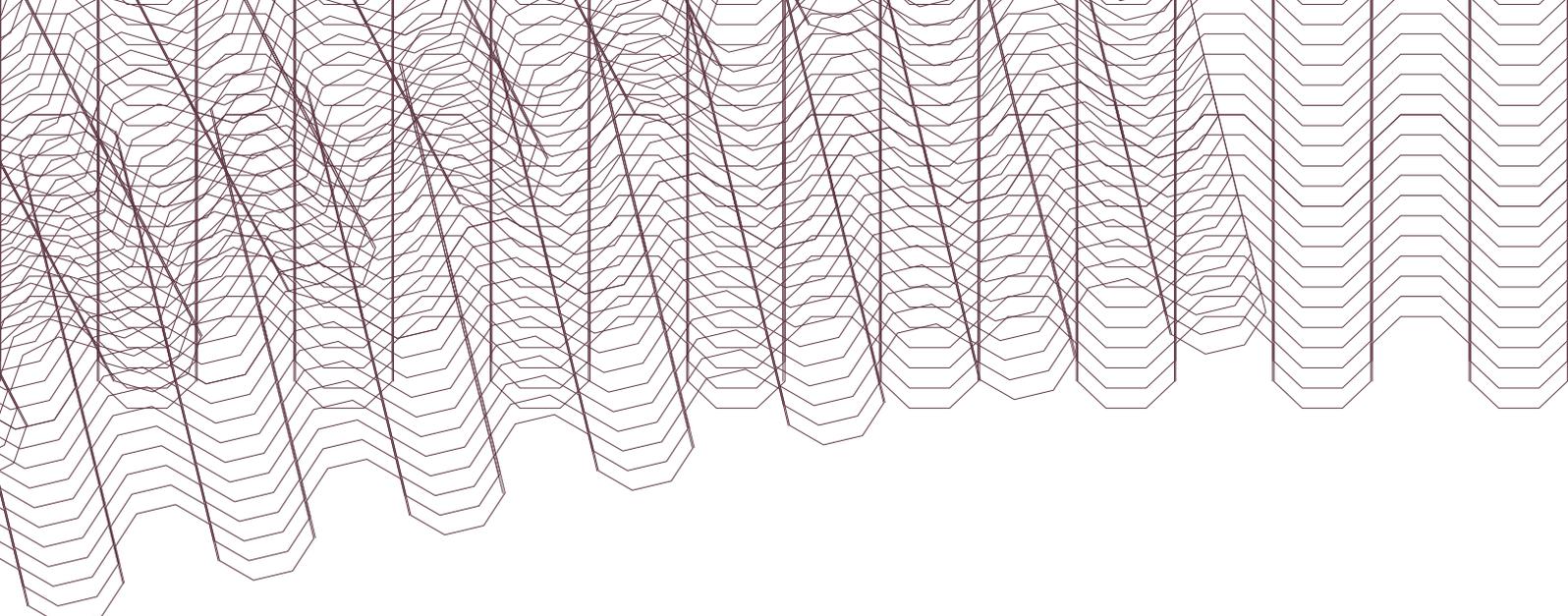
Technology	'District' scale CHP supplying district heating with via medium temperature steel distribution mains. Chilled water for cooling supplied from absorption chillers.
Scale	50 MWe natural gas-fired turbine generation, with at least 100 MWth standby boilers, and 10 MW absorption chillers. Heat is supplied by the 14 MWe biogas CHP plant in the 'industrial hinterland' character zone.
Location	One large-scale energy centre, 10 heat substations (heat exchangers and pumping) <ul style="list-style-type: none"> — Council Civic Centre and Central Library — Medium to large floor-plate office buildings (75% market penetration of heating and cooling) — Major sub-regional shopping centre — Central retail core (75% market penetration of heating and cooling) — Five national/international chain hotels — 1,000 apartment units, including owner occupier, Housing Association and Council/ALMO properties
Consumers	
Delivery mechanism	Options include utility or a private, local authority controlled or consumer-owned ESCO



Local Government pioneers *Southampton Geothermal Heating Company*

Established in 1986, the city's extensive CHP and district heating network has been delivered by a partnership between Southampton City Council and a private sector specialist energy company. The scheme consists of 11km of insulated heating mains and a 5.7 MW CHP engine. It supplies around 60 GWh of energy per annum with over 40 consumers including the Civic Centre, a hospital, four hotels, the Southampton Solent University, West Quay shopping complex, an ASDA supermarket, and over 400 flats (including two major new developments by Barratt Homes). Notably, over 95% of its revenue is from private consumes, and district cooling for offices and hotels has been added as a service.

The scheme delivers annual CO₂ reductions of approximately 10,000 tonnes and it has received support from the local authority through the planning system - with new city centre developments now required to justify why they should not connect to the district energy supply. The City Council is using its new planning powers, and working with private sector partners to expand the system elsewhere in the city, including the strategic planning of heating mains as a utility for regeneration masterplans.



Strategic heat plans identify areas of viable heat density, highlighting buildings that could create a baseload requirement for energy and adjacent areas which could be connected.

District-scale CHP supplying district heating has been slow to develop in the UK. Experience from pioneers such as Denmark, UK cities such as Sheffield and Southampton, and schemes such as Citigen in Central London suggests that greater deployment will require a combination of:

- Cost effective development of district heating networks
- Strategic heat planning to coordinate network development and requirements through planning to connect to networks
- Mechanisms for financing new projects
- The guidance note below on the design and development of district heating networks draw on experience from Danish and UK schemes.

Strategic heat planning

Local authorities should develop strategic heat plans for urban areas to form part of a Development Plan Documents and Area Action Plans. Strategic heat plans should identify areas of viable heat density, highlighting buildings that could create a baseload requirement for energy and adjacent areas which could be connected.

In order to secure investment, Local Authorities will need to use their planning powers to ensure that consumers connect to heating networks. Developers can be required to incorporate CHP and district heating on a site specific basis or to ensure that building Mechanical & Engineering services are designed to connect to wider networks in future, potentially with the support of Local Development Orders.

Energy Service Companies (ESCOs)

Given the caveats on the cost and viability of energy planning requirements set out in PPS22 and the Supplement to PPS1 on Planning and Climate Change, a local authority's position can be strengthened if there is an ESCO partner to invest in the infrastructure, offsetting the

capital costs and mitigating the risk for developers.

There are a number of different routes to procurement of an ESCO partner, and we would recommend selection and involvement of suitable partners as early on in the development process as possible. Procurement routes could include:

- **Identification of private ESCO partner:** Selection of a specialist CHP provider through OJEU tender process and based on competitive dialogue
- **Establishment of new standalone ESCO:** The establishment of a special purpose vehicle with a standalone business plan. Options could include:
 - **Public: private partnership:** Local authority partnership with a private sector CHP partner
 - **Social enterprise:** New enterprise established with local authority support (to provide covenant strength) and board representation

A report by the London Energy Partnership has highlighted the role that Local Authorities can play in helping to establish ESCOs, their powers to facilitate new infrastructure and the legal scope of their ability to participate in new ventures.

The Danish consumer-owned ESCO model could be particularly relevant to the UK situation, addressing as it does many of the concerns raised by developers and energy consumers such as accountability for a monopoly supply. This model could be established as a social enterprise with local authority support, potentially using Community Interest Company or Industrial & Provident Society legal structures.



Technical Guidance
Designing a district heating network

The design of a heat network is critical, as it represents a significant capital investment and incurs ongoing operational costs. The type of building(s) that are proposed for connection to the heat network and the specifications for the interface therefore require attention.

The cost of installing the heat network depends on four factors:

- The design operating temperature and pressure
- The complexity of services
- The length of the network
- The peak heat demand

The network can be split into three levels:

- The branches and connections to supply
- The distribution heat network
- The transmission heat network

In Denmark, district heating systems are so large that there is often a transmission system with high temperature and high pressure, transporting the heat to heat exchanger stations for distribution at low temperature and pressure.

For most proposed schemes in the UK, it is unlikely that there will be a requirement for a transmission heat network as the area for the scheme generally is small and the heat is supplied from a local source.

Clusters of smaller district heating schemes can be connected together and supplied by a larger transmission network from a single point. Anchor loads such as public sector and community buildings and campuses can also form the basis for schemes. This is how many of the Danish large schemes have developed over time.

Technical Guidance
Financing CHP with district heating

Security and risk must be addressed in order to service the loans required to finance new infrastructure, regardless of whether it is a public or private sector project. This will impose specific requirements on a project. The key issues to be addressed are likely to include:

- Developer contribution: Avoided utilities costs or a connection charge per property
- Developer agreement: Transfer of assets to an ESCO if they are installed by the developer
- Heat supply contracts: Public sector buildings will provide additional security and covenant strength
- Fuel supply contract: Index linked fuel prices based on a minimum 5 year contract and good covenant
- Insurance: CHP, boiler plant and heating network quality standards and warranties
- Due diligence: Quality of engineering and design specifications
- Property lease clauses: Preventing changes to heating systems by leaseholders/freeholders
- Revenue recovery: Contractual agreement with specialist metering/billing company
- Maintenance: Local arrangement with oversight by M&E contractors

Public sector buildings can act as important anchor loads to provide security to finance providers. Security is usually geared to around 50% of the value of any loan facility, providing a debt: equity split of around 70:30. However, public sector heating connections could be used to securitise a larger debt facility.



Technology: Solar Photovoltaics

Public and commercial buildings will typically have a substantial daytime requirement for electricity and in summer they may also require cooling. To reduce this peak load, they can obtain a proportion of their energy from a renewable source using solar PV.

Planning policies can be adopted that require a proportion of a building's energy requirement to be met using this technology. This approach has been adopted in Freiburg and Berlin in Germany. In England, local authorities such as Merton and Croydon have used planning mechanisms to stimulate the market.

The high capital costs of PV can be reduced by integrating them into new-build and retrofit building designs. They can form an attractive design feature, as well as communicating a highly visible commitment to renewable energy, as demonstrated by the Co-operative Insurance Society's tower in Manchester.

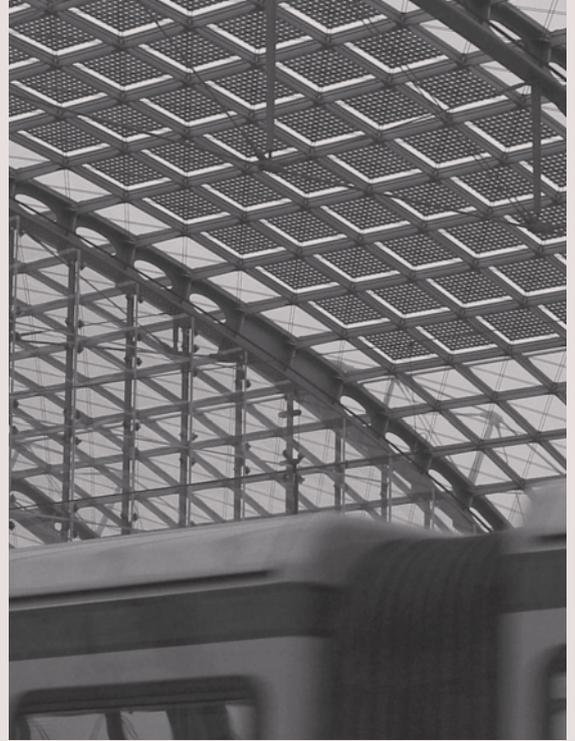
Managing the cost of PV

Although the cost of PV has fallen, it still remains an expensive form of renewable energy. The cost is likely to fall further in the medium to long-term as demand increases and manufacturers develop sources of dedicated 'solar-grade' silicon.

There are a number of emerging business models which can reduce the upfront capital cost and risk for building developers and owners. In German cities such as Berlin utilities have invited bids from building owners to host PV arrays for which it will pay and over which it will retain ownership. A premium solar 'feed-in' tariff of approximately 30p/kWh has also been very successful in making PV an attractive investment.

Possible Supply Mix

Technology	Polycrystalline and thin film photovoltaic cells in the form of modules, glass laminates and brise soleil
Scale	4 MWe installed
Location	Facades, brise soleil and roof mounted modules in arrays of between 50 and 200 kWe on a range of commercial and public sector buildings, including:
Consumers	<ul style="list-style-type: none"> — Civic Centre and associated Council buildings — Central railway station and 3 smaller stations — 20 large floor plate office buildings — 2 national chain hotels — 5 apartment blocks
Delivery mechanism	Investment by building owner, ESCO or utility



EU Best Practice
Berlin Energy Programme

Berlin has an ambitious energy programme designed to achieve 25% cuts in CO₂ emissions on 1990 levels by 2010. Amongst a range of energy efficient and low carbon energy technologies supported, and despite tight budgetary constraints, Berlin has coordinated a significant PV deployment programme. A target of 10 MW of installed PV capacity by 2002 was established and by 2006 7.4 MWe had been achieved. The authority also signed co-operation agreements with industry, Housing Associations, the chamber of architects and municipal utility BEWAG (now owned by Vattenfall).

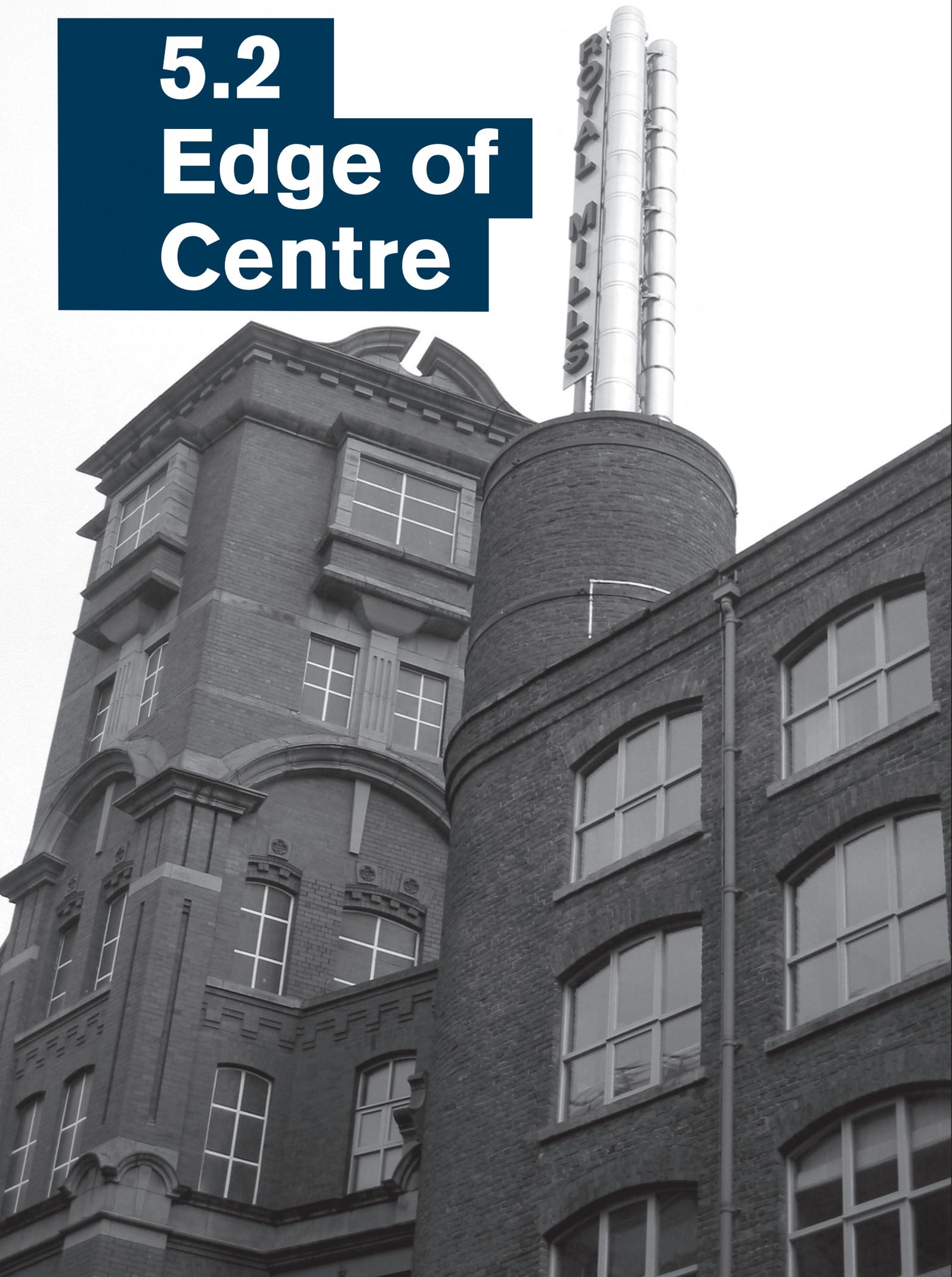
A large number of PV arrays has been installed as part of housing renewal investment by the city authority in East Berlin, such as the 48 KWp facade on a high rise block at Marzahn, and as part of major public building projects. The authority also initiated the 'Berlin Solar' promotional campaign, as well training and professional qualifications for installers.

BEWAG initiated a quarterly solar bidding process to contract electricity from new private PV generating capacity, with a top-up rebate available for installations less than 5 KWp and electricity price support to make it attractive. By 2000 2.3 MWp of capacity had been installed through this process, contributing to the 4.9 MWp of capacity that had been installed in total across the city.

EU Best Practice
Hauptbahnhof photovoltaic roof, Berlin

Opened in 2006, Berlin's new central station created the opportunity for a large scale demonstration of the city's commitment to solar energy. The 320m by 17m glass canopy that covers the new station incorporates 178,000 transparent photovoltaic cells. The 1,700 m² solar array has a peak rating of 178 kWe and generates 160,000 kWh of electricity per annum, which represents 2% of the station's annual electricity consumption.

5.2 Edge of Centre



The heat densities of university and hospital sites, as well as new residential and mixed use developments will support CHP/district heating, with the potential to be supplemented and complemented by other communally deployed renewable technologies, such as solar thermal collectors.

5.2.1 Technology: Local CHP/District heating

During the 1970s and 1980s the edges of our town and city centres became increasingly blighted by dereliction. This process is now being reversed with investment dominated by new mixed tenure housing developments and by new hotels and commercial offices.

On the edge of a town or city centre opportunities will exist for 'local' scale CHP schemes to supply existing sites, as well as localised clusters of higher density development, typically at least 120 residential units per hectare.

The economics of development mean that the majority of the uses in such a new-build cluster will be residential. This creates challenges for the viable operation of CHP, particularly relating to energy load profiles, reduced heating demands and future-proofing.

Load profiles and mix of uses

Residential load profiles for hot water tend to have pronounced morning and evening peaks. To maximise the benefits CHP would need to serve enough residents and blocks that it became viable to install a large thermal store (hot water tank) to meet demand at peak times. The thermal store would allow the CHP unit(s) to run throughout the day, maximising electricity generation and charging up the thermal store to meet peak demand.

A mix of uses alongside would help to create daytime loads reducing the need for thermal storage and making CHP more viable. Uses such as larger public sector sites, commercial offices and hotels create a flatter more consistent load profile.

Heat generated by a CHP unit in summer can also be utilised to supply chilled water for cooling, delivering a further 5-10% saving in CO₂ emissions. Office buildings, hotels and hospitals are all likely to have substantial chilling loads, and associated electrical demand to run compression chillers. Heat can be used to drive absorption chillers.

Absorption chillers are driven by heat rather than electricity. Although they have a higher capital cost than air conditioning, they have lower running costs and enable CHP operators to generate revenue from heat that would

otherwise be wasted.

Thermally efficient new-build properties Local CHP schemes where there are likely to be a high proportion of existing or refurbished buildings such as campuses, industrial conversions or offices will generally offer a healthy revenue stream for CHP heat and power sales.

New-build developments will, however, have a minimal space heating demand due to tighter Building Regulations and the Code for Sustainable Homes. Hence, new-build properties will significantly reduce the revenue stream available to an ESCO seeking to sell heat to consumers. The standing charge to consumers may therefore need to be somewhat higher than for existing properties in order to recover the high upfront capital cost of CHP plant and district heating networks. This approach has been successfully demonstrated on new German district heating networks in cities such as Hannover and Freiburg.

The importance of future-proofing

Phases of development may be carried out by different developers, particularly if there is a horizontal mix of uses. If developments are to be 'future-proofed' for connection to district heating then each phase must be designed to be compatible with and optimise the overall operation of district heating.

As a minimum, new blocks of residential development should be specified with 'wet' space heating systems supplied by communal boilers in order that they can be connected to a district heating network in the future, as demonstrated by projects such as Bermondsey Square in London, Westbar in Sheffield and Ancoats Urban Village in Manchester. This creates a specific need for guidance on common standards and requirements.

The common standards and requirements for future-proofing should form part of strategic heat planning guidance as set out in an LDF and/or relevant AAPs and Development Briefs. This approach has been adopted by the London Borough of Barking and Dagenham which is seeking to develop a town centre district heating network.



Possible Supply Mix

Technology	Localised natural gas-fired CHP supplying district heating supplying heat via low temperature heat mains. Summer heat load supplemented by solar thermal collectors on selected buildings.
Scale	5 MW gas turbines or engines, 25 MW standby boilers and 600 m ² thermal storage.
Location	3 development clusters each with an energy centre containing CHP prime mover(s) and standby boilers. Installation of six separate 1,000 sq m flat panel or evacuated tube solar thermal collectors arrays on key buildings in each cluster (see next section).
Consumers	Cluster 1 University campus with over 2,000 units of associated residential property. Cluster 2 University campus with associated University Hospital complex. Clusters 3 and 4 Mixed use development comprising 500 new apartments, a supermarket, 2 new national chain hotels and a mix of commercial office space.
Delivery mechanism	Utility, University with facilities management, or a private or consumer-owned ESCO.

Private sector pioneers

Communal heating in Ancoats, Manchester

To date, new residential developments in Manchester's city centre have tended to be specified with electric space heating. Although the cheapest option for developers, it has much higher CO₂ emissions and is generally not favoured by residents. With improvements in the Building Regulations Part L and the commitment of forward looking developers to provide a higher quality product, there is a move towards 'wet' space heating in flats.

Royal Mill in Ancoats Urban Village, a former textile works, is being redeveloped by ING in order to provide 312 residential units. It incorporates a communal heating system supplied by central gas boilers and supplemented by a small CHP unit.

Islington Wharf is a new-build residential development by ISIS Waterside Regeneration consisting of a courtyard block with a 18 storey tower. The whole block, which is being developed in three phases will be supplied by a communal energy centre, with flats specified with a high quality wet space heating system.



5.2.2 Technology: Communal solar thermal

Buildings that are linked together in a district heating network or are served by communal boilers can obtain a proportion of their energy from a renewable source using solar thermal collectors.

Communal arrays enable heat to be sold to consumers, creating a revenue stream to repay the upfront capital cost. Larger arrays have been shown to be more cost effective than collectors installed on individual homes, because of better economies of scale when procuring the collectors, reduced installation costs and rationalised systems.

Collectors can be installed as large arrays on roofs or facades using flat plate or evacuated tube technology. Collectors will enable CHP units and boilers to be switched off, or retained as standby, for most of the summer. Arrays can serve either individual buildings with communal heat distribution – such as the International Energy Agency Task 13 demonstration apartment block in Amstelveen - or they can be configured to feed into a district heating network – as demonstrated at BO01 in Malmo.

Planning policies can be adopted that require a proportion of a building or a development's energy requirement to be met using this technology. In the UK, solar thermal technology is emerging as the cheapest form of compliance with planning policies requiring at least a 10% reduction in CO₂ to come from renewable sources.

Solar driven chilling

There is an emerging opportunity to use solar thermal collectors to drive absorption chilling systems in order to provide comfort cooling for offices. The demand profile for comfort cooling is perfectly matched to the output from solar thermal collectors. This technology has the potential to reduce the peak demand for electricity in summer, which can account for as much as 10% of a modern office building's annual CO₂ emissions.

Possible Supply Mix

Technology	Large-scale flat panel or evacuated tube solar thermal collector arrays.
Scale	Six 1,000 m ² evacuated tube arrays.
Location	Installation of six separate 1,000 m ² evacuated tube arrays on key buildings in each of the three development clusters served by 'local' CHP/district heating.
Consumers	The arrays provide 5-10% of the annual heat demand for each of the three 'local' CHP clusters.
Delivery mechanism	Utility, Private or consumer-owned ESCO



EU Best Practice
Solar thermal district heating, Malmo (Sweden)

The Bo01 is a new development of 450 high density flats and townhouses in the Western Harbour of Malmo. The city authority established stringent primary energy reduction targets for developers to meet, including the planned incorporation of a range of different community energy technologies.

Whilst the scheme is connected to the city's wider district heating network, this is supplemented by a large communal solar thermal array which has been integrated into one of the blocks. The array supplies around 20% of the annual hot water requirements of the development.

Planning policies can be adopted that require a proportion of a building or a development's energy requirement to be met using this technology. In the UK, solar thermal technology is emerging as one of the cheapest form of compliance with planning policies requiring at least a 10% reduction in CO₂ to come from renewable sources.



EU Best Practice
Solar thermal ordinance, Barcelona (Spain)

In 2000, the Barcelona city authority adopted a planning requirement that all new buildings above a minimum size threshold should obtain 60% of their hot water from solar thermal collectors, with swimming pools obtaining 100%. The requirement also applies to larger refurbishment projects.

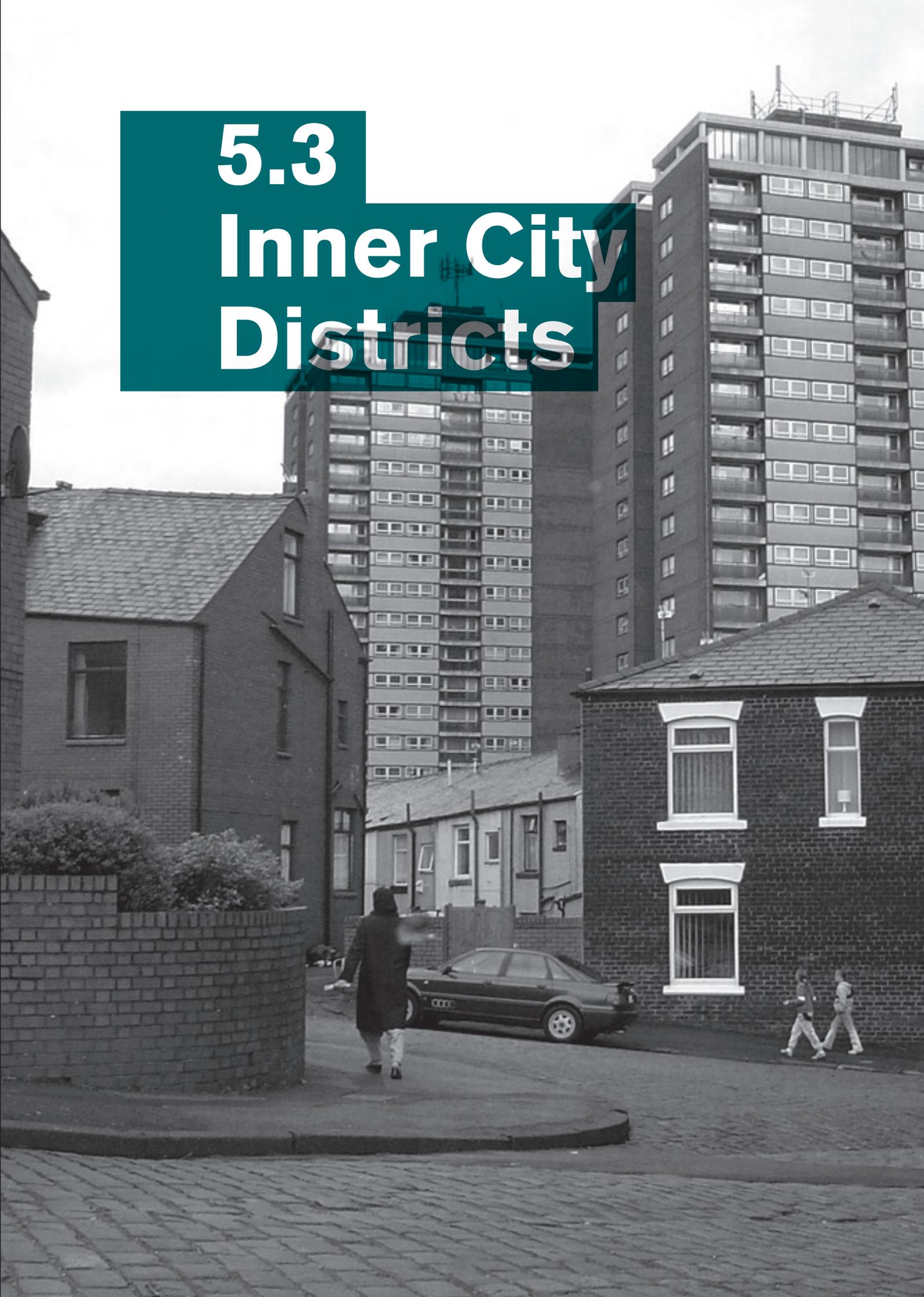
As a result of the ordinance the city's solar thermal capacity has increased 15-fold from 1.1m²/1,000 residents to 16.5 m²/1,000 residents in 2004. The target is now to achieve an installed capacity of 100,000m² by 2010. The ordinance has now been adopted by 34 other major towns and cities, including Madrid, Seville and Valencia.

Local Government pioneers
Skive City Hall, Jutland (Denmark)

Skive City Hall is a unique project which utilises solar heat to provide chilling in summer. The heat is collected by a 374m² array and is used to drive a 35 kW absorption chilling plant, displacing the need for electric chillers. The use of solar energy reduces operational overheads and provides a low maintenance solution, matching the seasonal availability of renewable energy with the building's comfort needs.

5.3

Inner City Districts



The improvement, remodelling and selective demolition of properties to achieve Housing Market Renewal, investment in new mixed tenure housing and programmes to deliver improved community facilities create a range of opportunities from the communal scale to individual buildings.

Inner city districts include a range of different forms of housing as well as neighbourhood centres. This can include council housing estates, which may be the subject of stock transfer, industrial-era terraces and interwar flats. In many towns and cities regeneration bodies are carrying out the improvement, remodelling and selective demolition of properties to achieve Housing Market Renewal and meet Decent Homes Standards.

Significant investment is taking place in new mixed tenure housing, and in programmes to deliver improved health, education, social services, leisure and retail facilities.

5.3.1 Local Authority buildings

Investment in low carbon and renewable energy to supply public buildings and retained council housing should be a core element of a local authority's commitment to carbon reduction.

The spatial location and energy requirements of key public buildings should be mapped so that they can be related to a local authority's strategic heat plan. The potential role of public buildings as anchor loads for district and local scale district heating networks can then be identified.

The size of clusters will dictate the technology solution, with biomass CHP requiring diversified loads and a size of at least 1-2 MWe – requiring the build-up of heat loads before it could be installed. Biomass CHP would increase revenue by allowing Renewables Obligation Certificates (ROC's) to be claimed.

Programmes of investment can become a catalyst for projects across a district or county, as demonstrated by Barnsley where a biomass heating policy has evolved into a much wider supply chain and infrastructure development programme. County Councils and public agencies such as Local Education Authorities can also make significant contributions, for example in switching schools and colleges over to biomass heating.

Community buildings

Community buildings such as schools, leisure centres and libraries create the potential for a rolling programme of investment as boilers come up for replacement. Biomass is increasingly the fuel of choice to reduce the CO₂

Possible Supply Mix

Technologies	'Local' biomass heating, solar photovoltaics
Scale	20 MWth biomass boilers supplying district heating, 240 kWe solar photovoltaic arrays.
Location	Local clusters supplied by biomass heat-only energy centres, with 20 kWe solar photovoltaic arrays installed on 12 selected schools and libraries.
Consumers	8 district clusters comprising in total: 16 primary and secondary schools, 8 public libraries and adult education centres, 4 Public leisure centres with swimming pools, 5,000 units Council/ALMO high rise apartments and radburn layout housing
Delivery mechanism	Elemental cost or Contract Energy Management

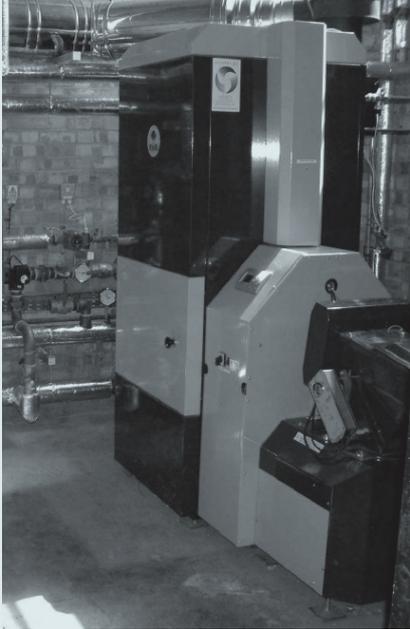
emissions of public buildings, as demonstrated by Local Authorities such as Telford, Suffolk and Worcestershire. The procurement of new buildings also creates the potential to incorporate solar thermal and PV technologies more cost effectively.

Council housing stock improvements

A key driver for the improvement of council housing stock is the need to tackle fuel poverty. Improvement works have tended to focus on thermal efficiency and heating systems, as required under the Decent Homes Standards.

Council housing stock can range in form from Radburn-type terraced units to deck access maisonettes and high rise tower blocks. Whilst Radburn-type units are relatively easy to remodel in order to improve their thermal efficiency, larger deck access and high rise blocks are more difficult and expensive to treat, requiring solutions such as overcladding.

An alternative approach is to invest in district heating supplied by CHP, as demonstrated by Aberdeen City Council which has established a community-led ESCO to supply its housing stock.



Local Government pioneers *Biomass replacement policy for schools, Suffolk County Council*

Suffolk County Council has worked closely with biomass boiler installers to replace oil-fired boilers with biomass-fired boilers starting with six primary schools. This has been driven by a combination of rising fuel prices and a commitment to improved environmental performance. Development of the wood chip supply chain has been supported by Angian Woodfuels.

The procurement of new buildings also creates the potential to incorporate solar thermal and PV technologies more cost effectively.



Case study *Solar library, Manchester*

As part of the wider regeneration of the Harpurhey area, Manchester City Council has built a new integrated public library and sixth form college building in the local centre. Reflecting Manchester's commitment to being a 'green city', the new library seeks to reduce its energy use and CO₂ emissions by integrating low energy design and renewable energy generation.

As well as incorporating low energy design features such as natural ventilation, the building has an integrated solar photovoltaic façade and roof top solar photovoltaic array. The striking facade makes use of the crystalline texture of the polycrystalline cells as a distinctive design feature. The 38 kWe façade generates xx kWh of electricity per annum, with a further kWh generated by the 38 kWe rooftop array. The façade serves the dual purpose of aiding natural ventilation of the library.



Local Government pioneers *Community ESCO to deliver affordable warmth, Aberdeen*

Aberdeen City council adopted an Affordable Warmth Strategy in 1999. This focussed investment into the least thermally efficient council-owned properties. An independent study was commissioned to identify the most cost-effective solution to providing affordable warmth and reduced CO₂ emissions. This was found to be district heating served by gas-fired CHP.

Capital constraints limited what the City Council could achieve. The Council therefore established an independent not-for-profit ESCO, Aberdeen Heat & Power Co, to undertake the development and management of CHP projects in Aberdeen on an initial 300 flat project at Stockethill. Contractual arrangements between the Council secured a favourable rate of interest.

Further projects have been undertaken at Hazlehead and Seaton serving high rise blocks and housing estates, a school, sheltered housing, a leisure centre, ice rink, and sports facilities. In total approximately 855 flats are now connected.

The company has a strategy to develop each project as a heat island and then link them together with the aim of creating a ring main serving a mixed portfolio of energy customers – domestic, institutional and commercial. It is also proposing to incorporate biomass CHP to diversify its input fuels.

Initial financial support, including grants from central government, enabled the company to achieve a critical size where it is now able to finance future projects against its own assets and undertake commercial projects for the Council and other landowners in the city.

5.3.2 Regeneration Areas

Planning and housing policy have focused on brownfield sites. The resulting constraints on the supply of land have led housebuilders and property investors to become strategic regeneration partners in order to access development opportunities. This creates opportunities for Local Authorities, HMR Pathfinders and URCs to require private sector partners to incorporate low carbon and renewable energy technologies into schemes.

Appropriate technologies could include CHP at a local scale or 'micro' CHP and solar thermal collectors at an individual house scale. Local CHP will benefit from linking existing public sector and community buildings together as the starting point for schemes, followed by new housing, where density and form are appropriate. Micro-CHP and solar thermal collectors will deliver respective reductions of 10% and 15% in CO₂ emissions for a typical new-build property.

In addition to the strategic heat plan for an area, planning requirements can be used to increase the deployment of on-site renewable energy, with a focus on specific technologies where appropriate. Current best practice is a 10% requirement expressed as a reduction in CO₂ emissions. The requirement in the London Plan has now risen to 20% and several pioneering local authorities, including Calderdale, Leicester, Milton Keynes and Norwich, have set rising targets into the future.

The low sales values for housing in low demand areas may limit the scope for developers to invest in low carbon and renewable energy measures. Local Authority aspirations and planning requirements could, in this instance, be realised by adjusting the value of the land.

Treasury guidance has been revised so that land may be sold at less than market value if proposed development can be demonstrated to deliver wider social and environmental value. The Local Government Act 1972: General Disposal Consent 2003 allows local authorities to dispose of land "for less than best consideration". In addition CLG guidance states that:

'...specific consent is not required for the disposal of any interest in land which the authority considers will help it to secure the promotion or improvement of the economic, social or environmental well-being of its area.'

The London Borough of Sutton set a legal precedent in 1999 when it sold land below market value in order to facilitate the Beddington Zero Energy Development. English Partnerships similarly has the powers to discount land values, although in practice there is still a financial imperative to maximise capital receipts. This could be overcome if discounted values were made time limited. Public sector bodies could, for example, enter into partnerships with private developers on the basis of reductions in the cost of sustainability measures over time as experience is gained and economies of scale achieved.

Existing terraced housing

Terraced housing accounts for around a quarter of the UK's housing stock. Its compact form is well suited to

the retrofitting of a range of energy technologies, with the potential to achieve significant economies of scale by targeting whole streets. Key opportunities could include:

— Communal Biomass heating or gas-fired CHP:

Terraced housing can require some of the shortest district heating pipe runs, making it a relatively cost effective form of housing for retrofitting. Retrofit projects could form part of fuel poverty strategies in regeneration areas. The compact form could also enable biomass district heating to be cost effective, with land for fuel storage facilities more likely to be available in inner city areas.

— **Solar mini-grids:** Instead of wiring solar photovoltaic arrays to supply individual properties, arrays on the rooflines of whole streets could be linked together in order to supply electricity to the local distribution network via a single point of connection.

Barriers to the development of projects include the diversity of tenures to be found in a typical inner city terrace and the lack of incentives for private landlords in low demand areas. These could be overcome through the use of an ESCO to finance solar or biomass technology on the basis of energy sales to residents or the national grid. Local authorities could assist projects by using their well-being powers to, for example, provide wayleaves to lay district heating mains in the streets.

Possible Supply Mix

Technology	<ul style="list-style-type: none">— 2 Local CHP/District heating clusters based on 5 MWe CHP engines with 600 m² thermal storage— 2 Local biomass heating clusters each based on 7.5 MWth of boiler capacity— 500 Domestic Micro-CHP units (1 kWe rating, 10:1 heat to power ratio)— 500 Domestic solar thermal collector arrays
Consumers	<p>The CHP, micro-CHP and solar thermal installations to supply:</p> <ul style="list-style-type: none">— 2,000 new-build mixed tenure private and Housing Association apartments and houses, 50% with district heating, 50% with micro-generation— New medium and small floorplate office and workspace supplied by district heating
Delivery mechanism	<p>The biomass heating clusters will supply via district heating 5,000 units of pre-1915 terraced property.</p> <p>ESCO, utility and/or elemental cost</p>



Local Government pioneers
Renewables requirement,
Croydon

The London Borough of Croydon has adopted a policy of requiring all new housing applications of more than ten units to reduce their carbon emissions by 10% by installing on-site renewable energy generation. This policy was adopted ahead of its new UDP (adopted 2006) and the new LDF that is currently entering the consultation phase. The policy was prompted by PPS22 and the London Plan.

To date, over 100 planning applications have had to respond to the policy, and the response has generally been positive, giving public and private sector applicants the opportunity to gain experience with the technologies. The Council has also made it clear that it will be flexible in the application of the policy, if there is the prospect of delivering greater carbon reductions on a housing scheme.



Local Government pioneers
Discounted land value pays for
solar thermal, Wolverhampton

Showell Park is a scheme of 205 residential units being developed by Haslam Homes. It comprises a mix of flats and houses, and will also provide 32 affordable housing units to be managed by Midland Heart. The development brief envisaged high design standards and an Ecohomes score of at least Very Good.

The City Council reserved the right not to take the highest bid for the site and instead opted to take a lower capital receipt in order to secure the social and environmental benefits of Haslam's proposed scheme. The adjusted land value paid for the integration of solar thermal collectors to provide hot water and space heating for the new homes.

Technical Note

Residential density and the economics of District heating

A district heating network typically accounts for the majority of the capital costs of delivering CHP and biomass heating for neighbourhoods.

The density and layout of properties has a significant impact on the cost of district heating. Higher density, compact urban development has the potential to reduce pipe lengths, including the primary distribution network in streets, and the secondary 'branch' connections to each property. There is, however, a trade-off in that high rise buildings greater than 20-30 storeys will tend to require more energy for pumping hot water.

In order to illustrate the relationship between urban densities and the costs of district heating, we have compared the costs for five typical housing typologies. The pipe lengths and costs per dwelling have been derived from district heating projects in Denmark and the UK, and have been calculated for clusters of 100 properties.

High-rise apartment block

Form	Corridor access, 10-15 storeys
Net density	240 dwellings per hectare
Pipe length	6.75 metres
Cost	£2,500

Medium-rise apartment block

Form	Corridor access, 5-6 storeys\
Net density	120 dwellings per hectare
Pipe length	8.0 metres
Cost	£2,800

Perimeter block of flats and townhouses

Form	Stairwell or street-level access, 3-4 storeys
Net density	80 dwellings per hectare
Pipe length	11 metres
Cost	£4,100

Terraced street of row houses

Form	Street level access, 2-3 storeys
Net density	80 dwellings per hectare
Pipe length	13 metres
Cost	£5,300

Detached/semi-detached houses

Form	Street level access, compact street layout
Net density	40 dwellings per hectare
Pipe length	19-24 metres
Cost	£7,700-£9,550

At lower densities the infrastructure costs increase significantly, by a factor of four compared to high density development. This, combined with the greater energy efficiency of new-build properties, may require a higher standing charge in order to recover the higher capital costs and offset reduced revenues.

5.4

**Industrial
Hinterland**



Industrial areas are ideal for the location of larger energy generation projects, including those with significant visual impacts such as wind power and requiring large movements of vehicles such as anaerobic digestion and large-scale biomass heat and power generation.

5.4.1 Wind Power

Industrial hinterlands are characterised by a diversity of B1, B2 and B8 uses, and in many edge of centre sites a degraded environment with varying levels of dereliction.

Industrial sites can also support the logistics of storing and distributing biomass fuels, with locations next to motorway junctions, rail freight yards, canals and docklands enabling them to link into wider distribution networks.

Large-scale onshore wind power is one of the most cost effective and mature renewable energy technologies. Industrial locations with a suitable wind resource can create viable sites for wind power generation, with their location and context potentially raising fewer objections with regards to visual impact and noise.

Projects can be developed to supply industrial and commercial sites – as demonstrated by the 3.6 MWe wind farm installed by the Mersey Docks and Harbour Company and the 6 MWe Bristol Port Wind Park - or to supply the rest of the city – as demonstrated by Lynnetten wind farm in Copenhagen.

5.4.2 Organic Waste Management

Biogas for heat and power generation can be produced on a large-scale from organic waste by a process called anaerobic digestion. A range of organic waste materials can be used as the feedstock for anaerobic digestion processes.

Experience from mainland Europe suggests that large centralised anaerobic digestors have the potential to utilise three distinct organic waste streams:

- Municipal waste disposal authorities dealing with household organic waste
- Sewage sludge arising from wastewater treatment
- Agricultural and food wastes from farmers and food processors

Municipal waste management in the UK is increasingly moving away from mass burn incineration towards mechanical and biological treatment (MBT), which in many cases incorporates anaerobic digestion to treat the organic portion of the waste stream. This is being driven by the EU Landfill Directive which seeks to reduce the amount of biodegradable waste being sent to landfill in order to reduce methane emissions.

An increasing number of PFI municipal waste management contracts are being let based on MBT technology, and this creates the potential for biogas fuelled CHP plants to supply renewable heat and power to towns and cities. The municipal plant developed by Freiburg in Germany demonstrates how the link can be made between local treatment of household organic waste and the supply of renewable heat and power.

Possible Supply Mix

Technology	Large-scale wind turbines
Scale	Five 2 MWe turbines
Location	Onshore 2 miles from city centre along a dockside
Consumers	Power is exported to the grid, consumers are able to buy shares in the wind farm equivalent to annual MWh output.
Delivery mechanism	50% utility investment 50% consumer-owned co-operative

Possible Supply Mix

Technology	Mechanical Biological Treatment plant incorporating anaerobic digestion
Scale	Handles 250,000 tonnes per annum of mixed organic waste which is fermented to produce methane 'biogas' which is burnt in a 14 MWe of gas CHP engine capacity
Consumers	Supplies heat to the existing city centre district heating network
Delivery mechanism	PFI project delivered by waste management company



Local Government pioneers
*Lynetten wind farm, Copenhagen
(Denmark)*

Lynetten consists of seven turbines of 700 kW with a total capacity of 4.9 MW. It was the first of two projects to be developed by a partnership between the city authority and an investment co-operative established by the Copenhagen Environment and Energy Office. Four of the turbines are owned by Lynetten Wind Co-operative and three by a local power supply company. The wind farm is located on a breakwater amidst an industrial landscape in the city's docklands area.

Local Government pioneers
*Anaerobic digestion to produce
biogas, Freiburg (Germany)*

The city authority of Freiburg has, for the last decade, operated its own municipal anaerobic digestion plant. It converts annually 36,000 tonnes of household organic waste into 4 million m³ biogas and 15,000 tonnes fertiliser. The biogas is cleaned and then burned in a CHP engine generating 7 GWh of electricity annually – a third of the city's renewable electricity capacity – and feeding heat into the city's district heating network.



5.4.3 Biomass Handling and Distribution

Realising the potential for biomass as a major source of heat and power will depend on the development of biomass fuel supply chains. Sources of biomass include material from within the urban area - including tree surgery waste from the local authority and commercial wood waste – as well as from the rural hinterland – including forestry residues and energy crops. The rural supply chain is discussed further in Section xx.

The collection and processing of different sources of biomass requires coordination and planning in order to match supply and demand. Large areas are required for handling, storage and processing, as well as good transport links.

5.4.4 Small hydro-electric

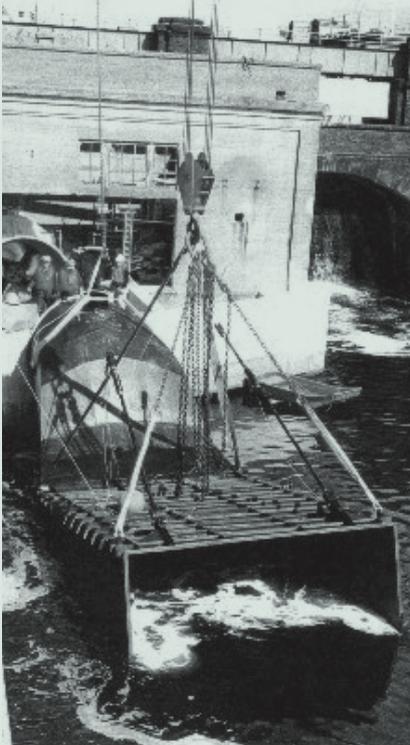
The weirs and locks engineered into the inland waterway networks can be used to generate electricity using hydro-electric turbines and waterwheels. Although the energy available from these opportunities will often be small, a series of installations along a waterway network could make an important contribution to a town or city’s energy portfolio. Where there is a significant flow rate but no weirs or locks, run-of-river turbines may have potential, although they tend to have a relatively low output.

Possible Supply Mix

Technology	Wood chip and pellet fuel
Scale	Handling and storage for an annual throughput of: 18,000 tonnes energy plantation wood chip fuel per annum. 23,000 tonnes of forestry residue derived wood chips per annum. 28,000 tonnes of wood pellets derived from wood waste.
Consumers	To supply 35 MWth of biomass boilers (Inner City) and 2 MWe of biomass CHP (Urban Extension)
Delivery mechanism	Jointly owned agro-forestry and farmer co-operative

Possible Supply Mix

Technology	Low head hydro-electric turbine
Scale	Ranging from 20 kWe to 660 kWe turbines
Location	Four locations, three of 20 KWe turbines incorporated into weirs, and one of 660 kWe turbine incorporated into a lock system.
Consumers	Power is exported to the grid, consumers are able to buy shares in the hydro-electric installation equivalent to annual MWh output.
Delivery mechanism	50% utility investment, 50% consumer-owned co-operative



Case study

Barton Lock low head hydro-electric scheme, Manchester

In 1994, a 660 kWe hydro-electric scheme was incorporated into a lock forming part of Manchester Ship Canal. Developed by United Utilities the project makes use of the head of water created where the ship canal meets the river Mersey. A single turbine was installed within an existing pump house. Water is piped from a culvert behind the lock gate to the turbine where it is used to generate electricity before being discharged downstream. The turbine generates 3.2 GWh of electricity per annum.

EU Best Practice

Urban biomass 'terminals', Sweden

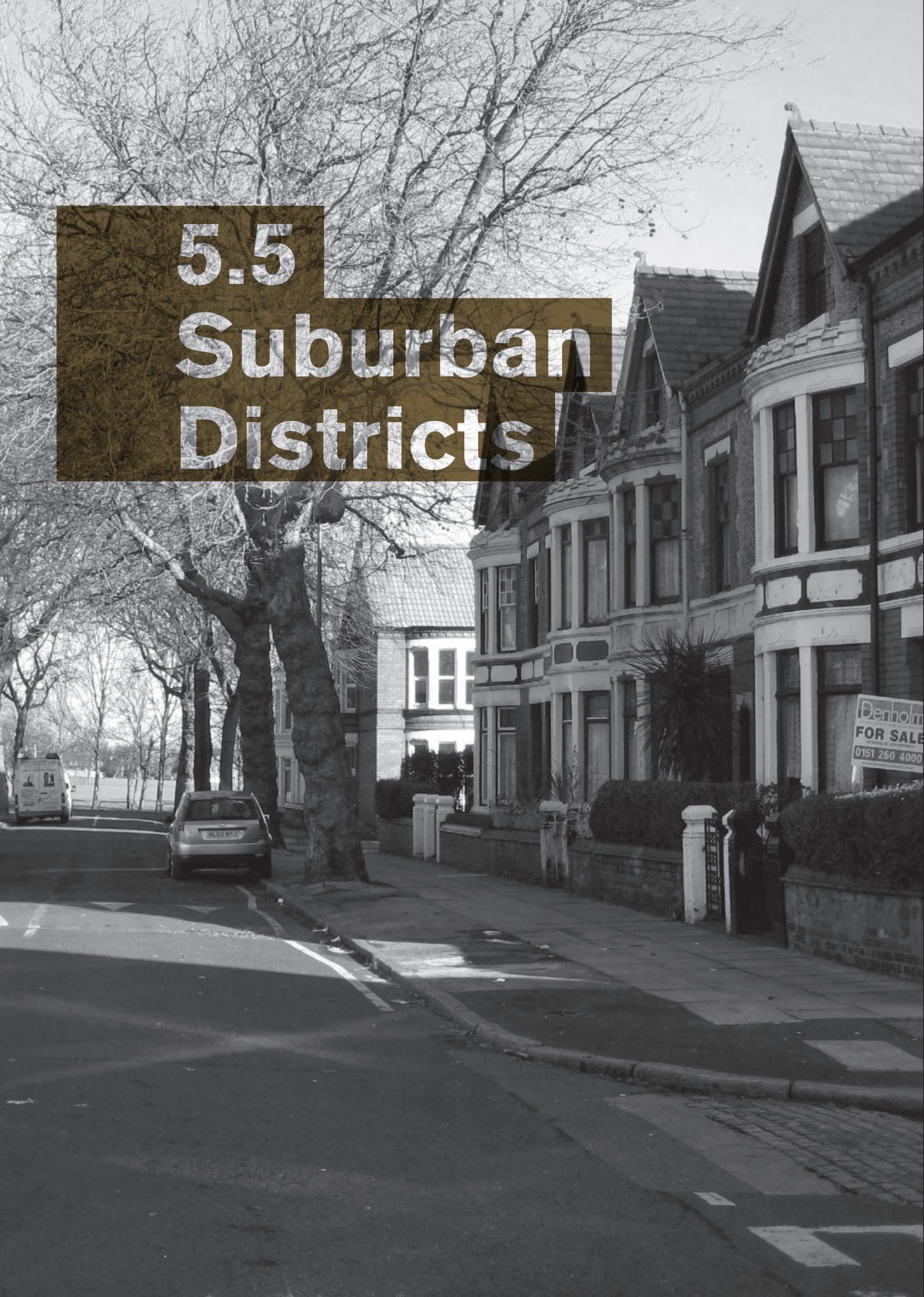
In Sweden, wood chip and pellet fuel is supplied to towns and cities via urban biomass 'terminals'. The process starts with forest and sawmill owners who supply wood by-products in a number of different forms, primarily including:

Forestry sector: Branch residue from forestry is chipped by contractors on site prior to being transported directly to the customer or to a storage 'terminal'.

Sawmills: Waste from mills is transported directly to wood pellet producers or to the storage terminals.

Raw materials are transported to storage terminals, strategically located throughout the region to balance production with customer demand. In the summer the terminals are used to build up reserves that are then called upon during the winter months.

5.5 Suburban Districts



The low density of suburbs makes them ideal for the deployment of microgeneration technologies. However, because the existing housing stock is largely outside of the remit of the planning system, novel market mechanisms will be required in order to increase their deployment.

Suburban districts are largely characterised by detached and semi-detached homes, as well as neighbourhood centres and commercial business parks. These districts contain the majority of homes and some of the oldest housing stock with the largest heating demand. They are also likely to contain households with the most interest in investing and adding value to their properties.

Possible Supply Mix

Technology	Solar thermal collectors, solar photovoltaics, micro-CHP and biomass boilers.
Scale	56,000m ² solar thermal arrays 2 kWe solar photovoltaics arrays 5 kWe gas micro-CHP units 35 kWth biomass pellet boilers
Installations	One low carbon technology per home in the following numbers: 14,000 solar thermal collectors 2,800 solar photovoltaic arrays 7,000 gas micro-CHP units 2,800 biomass pellet boilers
Consumers	Owner occupier households
Delivery mechanism	Co-operative buying groups, individual household investment

5.5.1 The challenge of microgeneration

Microgeneration technologies are best suited to reduce the CO₂ emissions of detached and semi-detached suburban homes. The key technologies are solar thermal collectors, solar photovoltaics, micro-CHP and biomass boilers.

Micro-wind installed on or near buildings has potential in locations where there is a clean wind resource, such as the coast, uplands or the rural fringe. However, in many urban locations, micro-wind is unlikely to be viable.

Achieving a high level of deployment for microgeneration creates a significant challenge, requiring mechanisms to finance, install and maintain technologies on many thousands of existing homes.

Permitted Development Rights are likely to relax the planning requirements for microgeneration technologies. However, the technologies remain relatively complex and expensive for the householder to install.

5.5.2 Biomass heating

Biomass heating has significant potential to supply large homes, but it can be problematic. The supply chain is

relatively immature and requires development in order to build consumer confidence. Local projects such as Gloucestershire Wood Fuels and Midlands Wood Fuels demonstrate how support from RDAs and Local Authorities can gradually improve the availability of fuel.

Most urban areas are smoke control zones which means that appliances must be Clean Air Act compliant. Very few compliant boilers are currently available on the UK market, even though most modern EU biomass boilers have emissions significantly below compliance levels. There is precedent for progressive Local Authorities pre-approving EU appliances for use in smoke control zones.

5.5.3 Achieving economies of scale

Critical mass and economies of scale should be key aims for microgeneration projects. To date installations have tended to be on single properties, rather than flats or across whole streets or neighbourhoods, reducing the scope for cost reductions.

Furthermore, high levels of deployment need to be supported by trained installers and engineers. Installer capacity is also currently a limiting factor in the UK.

Trust is also a major concern for consumers, with a confusing array of marketing material and tales of 'solar cowboys' creating very real problems in the marketplace.

There may be latent potential for community-led, non-profit initiatives which can build confidence in microgeneration and achieve greater economies of scale. Such initiatives could also work with local suppliers and installers to build their capacity to respond to demand.

This model has been successfully demonstrated in the USA by solar co-operatives such as Co-operative Community Energy (California) and the North West Solar Co-operative (Washington) and in Germany and Austria by solar PV shareholder projects such as the 'Sonnenschein' initiative. These organisations can:

- Act as neutral brokers for advice and information
- Achieve significant economies of scale
- Maximise revenue generation from projects by aggregating their output
- Build the capacity of trusted suppliers and installers

In the UK, grants from central government and emerging sources of finance for households (such as the Co-operative Bank's 'Energy efficient advance') could be coordinated in order to make co-operative buying schemes more attractive. Alternatively, installer enterprises could finance installations themselves and recover the capital costs by charging rental or selling the energy to households



International Best Practice
Developing the solar photovoltaic market

Germany, Japan, the USA and the Netherlands have the highest levels of deployment of solar photovoltaics in the world. They have largely achieved this by targeting individual households, using a range of different mechanisms:

Subsidies: Like the UK, the national governments of the Netherlands, Japan and the USA have provided direct subsidy for installed costs. California has required major utilities to provide funding for PV programmes.

Tax refunds: In the Netherlands businesses can apply for a tax refund.

Loans: In Germany and Japan interest-free and low-interest 10-year loans have been successfully used in combination with solar electricity tariffs.

Solar electricity tariffs: Germany has introduced special green tariffs for customers who want to buy exclusively solar electricity, and requirements on utilities to offer long-term contracts reflecting the full price of solar electricity.

Net-metering: Laws have also been passed in Germany, the Netherlands and Japan ensuring that 'net metering' – that is, sale of electricity to the grid at consumer prices rather than wholesale prices - is always available.

Co-operation agreements: in the Netherlands, the government has enabled utilities to lease the roofs of residential and commercial buildings to create large-scale PV integration.



International Best Practice
Co-operative Community Energy, California

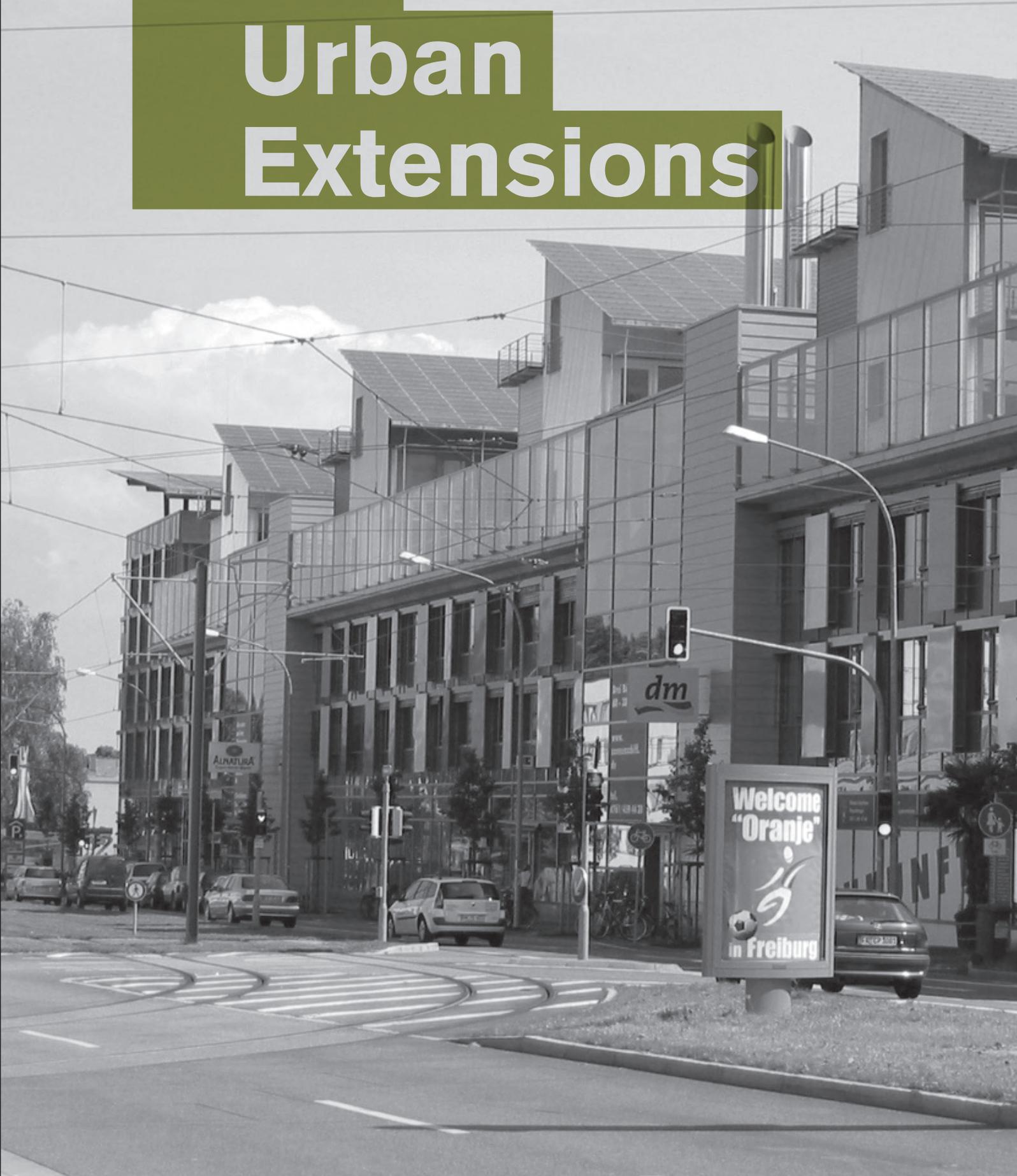
Established in 2002, Co-operative Community Energy is a member-owned, not-for-profit business which supports households and businesses who want to install solar energy. It was established to overcome four specific barriers to greater uptake of solar energy:

- Consumer awareness and understanding
- Places where products can be purchased from
- Trained installers and inspectors
- Access to financing options

The co-operative provides design and project management services to its members and, by bulk purchasing, is able to offer discounts against market rates of up to 25%.

5.6

Urban Extensions



Large new urban extensions and settlements such as those promoted by Millennium Communities, Growth Areas and the Eco-towns Programme provide some of the best opportunities in the UK for putting the principles of low carbon, decentralised energy generation into practice.

Urban extensions can influence the wider housing market by demonstrating new approaches, with the risk being managed by the support of national government as well as key stakeholders and partners.

The biggest barrier to low carbon development is the funding of new infrastructure. Research for CLG found that infrastructure in the UK typically costs more than construction. If homes in new communities are to be affordable as well as attractive, it will be vital to find ways of cutting both the long-term running costs and the up-front infrastructure costs.

Germany offers examples of large-scale new communities that can truly claim to set the standard. Projects such as Kronsberg in Hannover (3,500 units) and Vauban in Freiburg (2,000 units) have achieved high standards of performance across large numbers of homes, with a strong focus on low carbon infrastructure. In each case, a coordinating body, steered by the Local Authority and bringing together key partners, has guided the delivery of the vision.

Each of these new communities has created a clear framework for the implementation of tried and tested technologies at a large scale. More expensive or experimental measures have only been introduced on a smaller number of units by specialist developers or where developers or occupiers have chosen to incorporate them.

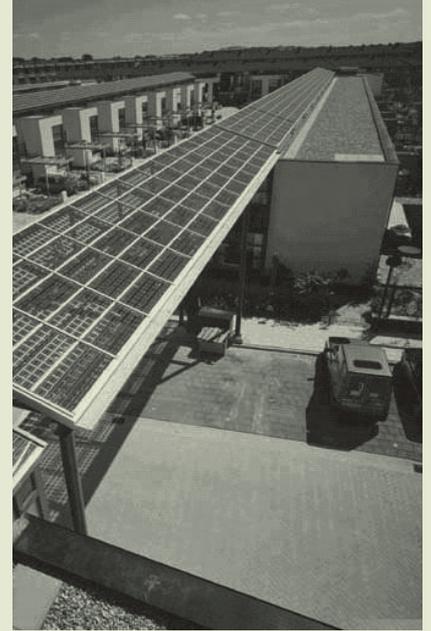
Targets have also been used – such as the ‘Kronsberg standard’ for energy efficiency – but not to the detriment of the community-wide infrastructure. Strategies and targets have been applied to all developers – private, social landlords and co-operatives – and, importantly, practical support has been provided to fill gaps in knowledge and skills.

Possible Supply Mix – Extension 1

Technology	Biomass district CHP supplying district heating via low temperature primary mains.
Scale	2 MWe biomass CHP based on steam boiler turbines, 10 MW biomass standby boilers
Location	One large-scale energy centre, with 20 apartment block substations (heat exchangers and pumping)
Consumers	<ul style="list-style-type: none"> — District centre incorporating office, retail, leisure and community buildings including schools and a library — Medium and small floorplate office and workspace — 2,000 apartments and houses (net density of 80 dwellings per hectare)
Delivery mechanism	Utility or ESCO that is private or consumer-owned

Possible Supply Mix – Extension 2

Technology	Solar photovoltaics and solar thermal collectors
Scale	10 MWe solar photovoltaics installed on 2,000 new apartment blocks and homes and 20 separate buildings including office, retail, leisure and community uses with the latter including schools and a library. 8,000 m ² of solar thermal collectors installed on 2,000 new apartment blocks and homes.
Delivery mechanism	Mix of different models - elemental cost for housing developers and utility or solar co-operative ownership



Local Government pioneers
Low carbon energy strategies,
Hannover

Kronsberg is a new high density neighbourhood of over 3,500 homes that was built as part of the World EXPO 2000. The scheme's energy strategy has the aim of achieving over 60% reductions in CO₂ emissions. Measures have included:

'Low Energy House' standards: All properties regardless of developer must deliver heating demand of less than 50 kWh/m². A smaller number of plots have been sold to developers with a requirement to build 'passive houses' with a consumption of less than 15 kWh/m².

Reducing electricity consumption: A comprehensive programme to encourage a reduction in electricity use, with a focus on providing low energy appliances and lighting, as well as targeted grants and awareness raising campaigns.

Supply infrastructure: The municipal utility developed a district heating

network supplied by natural gas fired CHP units and boilers. It supplies the whole neighbourhood, with the standing charge adjusted to ensure return on capital investment despite the lower energy use of the properties. Two large wind turbines (1.5 and 1.8 MWe) have also been installed in close proximity to the scheme.

Solar homes: A demonstration project for solar heat and power has been developed as part of the scheme.

Quality assurance and post-occupancy monitoring help to establish the actual CO₂ reductions achieved by the energy strategy. The results highlight the successful combination of combining efficient communal infrastructure with low energy buildings, awareness raising and building integrated renewables.

Local Government pioneers
Building a solar neighbourhood,
Amersfoort (Holland)

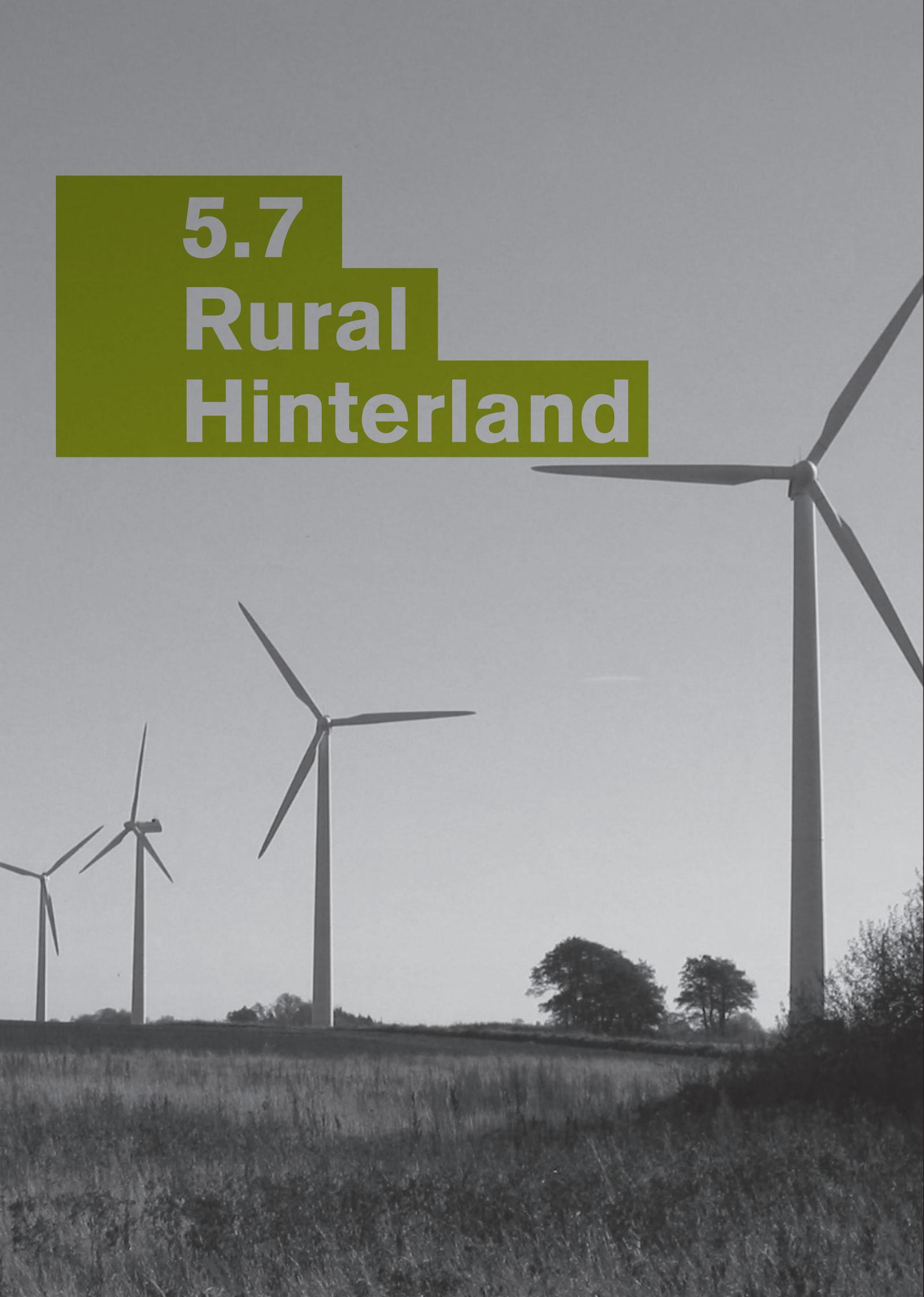
In 1997, an ambitious programme was initiated to integrate 1.35 MWp of solar PV into an extension of the city of Amersfoort with commissioning in 2000. The local authority and the Utrecht energy utility REMU have used the new development to demonstrate the building integration of 12,000 m² of solar PV. This has been delivered with a subsidy comparable to that available in the UK and through co-operation agreements between the government's energy agency NOVEM, property developers, architects and utilities.

The development comprises a mix of 500 owner-occupied and rented homes as well as a range of community buildings. The area has proved to be very popular with residents. As a result of their participation, property developers and architects are now promoting PV as an added value to properties.

5.7

Rural

Hinterland



A town or city's energy supply should be looked at in the context of its rural hinterland. Opportunities are likely exist for cost effective deployment of medium to large-scale wind power generation, the development of biofuel supply chains, and in the future marine power generation.

5.7.1 Wind Power

Wind turbines are most cost effective at a scale greater than 275 kWe and in clusters of more than 4-5 turbines. In the current market, the subsidy available through the Renewables Obligation means that wind turbines are being proposed for sites with a relatively modest wind resource. If we are to maximise wind generation a spatial approach to the exploitation of wind energy resources will be required.

Wind energy projects are now supported by strategic policies contained in PPS 22 and the Supplement to PPS1 on Planning and Climate Change, and by regional renewables targets established to meet the government's goals for electricity generation. National and regional guidance promote a 'criteria-based' approach that strongly favours approval unless a project would have unacceptable adverse impacts when weighed against the wider strategic benefits of a proposal.

The relationship between wind farm opportunities and the energy needs of the urban area should be fully explored. With the exception of exposed industrial sites and waterfronts, it is likely that the best onshore sites for wind turbines will be in the rural hinterland between towns and cities.

There may be the potential for towns and cities to become involved in the development of clusters of larger, more efficient wind turbines on appropriate sites and for new urban extensions, as demonstrated by Middelgrunden wind farm in Copenhagen and Regiowind in Freiburg.

Schemes such as these are important because they demonstrate how support, and even investment, from the urban community can build acceptance for projects. This approach may also be beneficial in taking forward projects that may be too small to be attractive to larger developers.

5.7.2 Biomass Supply Chain

Biomass is set to play a significant role in meeting the UK's renewable energy targets. Realising the potential for biomass will depend on the development of biomass fuel supply chains based on:

Possible Supply Mix

Technology	Large-scale wind turbines
Scale	Two wind farm sites consisting of 5 turbines and 10 turbines, 1.8 MWe rating.
Location	Onshore 5 miles from the rural fringe
Consumers	Power is exported to the grid; consumers are able to buy shares in the wind farm equivalent to annual MWh output.
Delivery mechanism	50% utility investment, 50% consumer-owned co-operative

Forestry residue: Branch residues and roundwoods from commercial forestry, as demonstrated by large-scale commercial enterprises such as Naturbransle in Sweden

Energy crops: The growth of energy crops such as Short Rotation Coppice willow, which is harvested on a 2-3 year cycle before being chipped. The bulking and transportation of fuels can be handled by farmer-owned businesses such as Rural Energy in Leicestershire, or biomass brokers such as Renewable Fuels in Yorkshire

Commercial wood waste: This can include sawmill waste from the wood processing and furnishing industry, as well as clean wood waste (as defined by the EU) from building demolition and refurbishment, and pallets, as demonstrated by Welsh Biofuels' pellet plant in Wales.

Municipal wood waste: Branch residues and roundwoods from Council tree surgery waste, as demonstrated by Bioregional's Treestation projects in London, Midland Wood Fuels and Barnsley Council's supply chain project.

Forestry and energy crops represent the largest potential biomass resource, requiring the engagement of key stakeholders in the rural economy – including forestry owners, the forestry industry and farmers - in order to create a stable and reliable supply chain for fuel.

The biomass supply chain has been slow to grow because of uncertainty of both supply and demand. Enterprises such as Rural Energy and Gloucestershire Wood Fuels have sought to provide stable supply contracts. These projects demonstrate how biomass supply chains can support rural diversification.

Possible Supply Mix

Fuel	Forestry residues, Energy crops (willow and switch grass)
Scale	1,500 hectares of plantation producing 18,000 oven dried tonnes fuel per annum 23,000 oven dried tonnes of fuel produced from forestry residue per annum
Location	Outside of rural fringe on low grade agricultural land and as part of forestry.
Consumers	To supply 35 MWth of biomass boilers (Inner City) and 2 MWe of biomass CHP (Urban Extension)
Delivery mechanism	Farmer and forestry owner co-operatives/producer groups



Local Government pioneers
*Middelgrunden offshore wind farm:
Copenhagen (Denmark)*

Completed in 2000, the Middlegrunden wind farm is located 1 mile off the coast of Copenhagen. It consists of twenty turbines of 2 MW each (total capacity 40 MW), ten of which are owned by Middlegrunden Wind Turbine Co-operative and ten by the local authority-owned utility company.

The project was initiated by Copenhagen's Environment and Energy Office, and it was recognised early on that local co-operation would be vital to the project's success. The co-operative has 8,500 members, consisting of citizens, businesses, trade unions and charities. The members provided the working capital for the wind farm, purchasing investment shares which are each equivalent to 1,000 kWh of the wind farm's output.



Local Government pioneers
*Borough supply chain: Barnsley
Metropolitan Borough Council*

In support of its corporate biomass fuel heating policy, Barnsley has sought to develop a stable and cost effective supply of wood fuel. The Council has carried out a survey of the available biomass resources in the district and has begun to establish wood fuel handling centres to supply its boiler switchover programme. The centres will handle and process a range of wood including tree surgery waste and forestry residue.



Local Government pioneers
Regiowind: Freiburg (Germany)

Developed in 2003 the city of Freiburg's wind farm consists of five turbines with a total installed capacity of 10.8 MW on sites located on an adjacent hillside. Promoted by the City of Freiburg and a range of partners, it was developed by Regio Wind, an organisation established in the city region to support the development of community owned renewable energy projects. Regio Wind has over 500 member investors who provide working capital to develop the wind farm.

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Elyo East London Energy designs, finances, builds, owns and operates local decentralised energy systems and networks for both new and existing developments. With an expertise covering the entire value chain associated with energy and utilities services, Elyo East London Energy has the internal competency for the delivery of diverse and innovative, multi-discipline and technically complex projects. Elyo East London Energy is part of SUEZ, a global leader in multi-technical services and community energy network schemes.

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Faber Maunsell

Faber Maunsell is an award winning multidisciplinary consultancy with more than 3000 staff in 30 offices across the UK. Faber Maunsell play a leading role in working with National, Regional and Local policy makers to develop and implement policy aimed at promoting low carbon and sustainable communities and work with the development community to plan, design and deliver decentralised low carbon and renewable energy solutions.

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Fontenergy

Fontenergy focuses on low carbon energy generation for the built environment, helping developers and public authorities deliver energy solutions that meet both financial and sustainability goals. Fontenergy provides an end-to-end service, engaging both in the development of distributed energy assets - from design through to installation - and in the ongoing management of those assets. The ongoing management is handled through Fontenergy's subsidiary, Fonten Power, which has been established as a not-for-profit ESCO provider.

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PB (Energy services division)

PB 's Communities team brings together the skills and experience to achieve holistic project delivery - energy solutions, environmental planning and management, buildings design, construction and facilities management, infrastructure and transportation. By drawing on this specialist expertise in combination, we can ensure the successful management and implementation of sustainable development projects which exceed national legislative and regulatory standards.

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