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DISTRIBUTED ENERGY

A call for evidence for the review of barriers and incentives to distributed electricity generation, including combined heat and power

A JOINT GOVERNMENT-OFGEM REVIEW

ofgem

Distributed Energy

A Call for Evidence for the Review of Barriers and Incentives to Distributed Electricity Generation, Including Combined Heat and Power

November 2006

Distributed Energy: Call for Evidence

Energy is a vital part of every aspect of modern life in Britain and for our continued economic prosperity. The Government's Energy Review Report highlighted the challenges we face in addressing climate change and ensuring security of energy supplies. A key part of responding to this challenge is to investigate to what extent Distributed Energy (DE) could complement, or in the longer term potentially offer an alternative to, a centralised system. In the Energy Review we promised a comprehensive review of the incentives and barriers that impact on distributed electricity generation including Combined Heat and Power, to be undertaken jointly with Ofgem. We will draw the results of this review and various consultations together into a new Energy White Paper early next year.

As part of this review DTI and Ofgem are jointly publishing this Call for Evidence to seek interested parties' input. The separate Foresight Project on Sustainable Energy Management and the Built Environment – which was also announced in the Energy Review Report – will look at the long-term potential and challenges.

The Government has four long-term goals for energy policy:

- To put the UK on a path to cut our carbon dioxide emissions by some 60% by about 2050, with real progress by 2020;
- To maintain reliable energy supplies;
- To promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
- To ensure that every home is adequately and affordably heated.

Some argue that Government should do more to promote DE primarily because of its potential to reduce carbon emissions, but also on grounds of reliability and cost. There is much interest in the achievements of Woking Council and the plans to replicate similar ideas more broadly in London. However, the Government has to ensure that the interests of electricity consumers are properly taken into account. Cost implications of any changes will be a key consideration, as will preserving the integrity of electricity networks. The Government is therefore seeking a better understanding of the costs and benefits of various ways in which take-up of DE could be increased.

We are aware that there is considerable work already progressing in this area. The DTI/Ofgem-chaired Electricity Networks Strategy Group (ENSG), especially through its Distribution Working Group sub-committee, continues to build on the work done by the Distributed Generation Co-Ordination Group. We are committed to complementing rather than duplicating this work.

Terms of Reference

The review will examine all aspects of the incentives and barriers that impact on distributed electricity generation, including CHP. This will include:

- The economic and other incentives for suppliers to buy electricity from distributed generators;
- Options for resolving potential barriers to the sale of electricity from small generators, for example:
  - licensing procedures
  - technical standards for connection and for network operation;
- The economic costs and benefits, and other incentives, for Distribution Network Operators (DNOs) to connect new generators and to invest in upgrading distribution networks in order to accommodate increasing amounts of distributed generation; and
- The incentives for DNOs to engage in innovation aimed at minimising the costs and capturing the benefits of distributed generation.

Response Details

Representations from all interested parties are invited and a list of questions is attached at Annex A. We have already received submissions on some of these issues from a number of organisations and individuals in the consultation earlier this year ahead of the Energy Review report. We will of course take these into account in our work on the issues raised in this call for evidence, but any further comments from those who have addressed these issues already are most welcome.

During the period of the call for evidence we will be holding a number of events. Workshops for interested parties will be held during November, and details of these events will be made available shortly.

The deadline for responses to the call for evidence is **Tuesday 2nd January 2007**, though earlier responses would be helpful. Please note that your response may be made publicly available in whole or in part at the Department's discretion and, unless otherwise requested, will be published on Ofgem's website. If you do not wish all or part of your response (including your identity) to be made public, you must state in your response which parts you wish us to keep confidential.

Where confidentiality is not requested, responses may be made available to any enquirer, including enquirers outside the UK, or published by any means, including on the Internet.

Submissions of evidence should be sent (preferably electronically) in a Word document, and should clearly state which question(s) are being addressed.

Responses should be sent to:

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Chapter 1: Introduction

1.1 Most of our electricity is generated in large power stations, and around three quarters of our heat comes from gas fed through a nationwide network. This centralised model delivers economies of scale, safety and reliability. But a combination of new and existing technologies means we can generate electricity and heat increasingly efficiently near where we use it. There is the potential for some technologies to deliver lower emissions and increased diversity of supply.

1.2 A 'distributed energy' system using these technologies could radically change the way we meet our energy needs in the long-term. Electricity and heat can be generated locally from renewable sources. Where we use fossil fuels, local generation allows us to capture the heat generated in that process and use it nearby, provided there are customers that need the heat. Smaller-scale systems have the potential to be more flexible and to reduce the energy we lose in networks. And a more community-based energy system could lead to a greater awareness of energy issues, driving a change in social attitudes and, in turn, more efficient use of our energy resources.

What is Distributed Energy?

1.3 In the Energy Review we took a broad view, using the term to refer to the wide range of electricity generation technologies that do not rely on the high-voltage electricity transmission network, and heat technologies that are not connected to the gas grid. This definition includes:

- **Distributed electricity generation –** enables us to harness smaller-scale, low-carbon sources of power by directly connecting them to the distribution grid. Types of distributed electricity generation include:
  - All plant connected to a distribution network rather than the transmission network;

  – Small-scale plant that supplies electricity to a building, industrial site or community, potentially selling surplus electricity back through the local distribution network; and

  – 'Microgeneration', i.e. small installations of solar photovoltaic panels or wind turbines that supply one building or small community, again potentially selling any surplus

- **Combined Heat and Power (CHP) plants –** enable the heat associated with electricity generation to be used locally. Types of CHP plant include:

  – Large CHP plants (where the electricity output feeds into the higher voltage distribution network or the transmission network, but the heat is used locally);

  – Building- or community-level CHP plants;

  – 'Micro-CHP' plants that effectively replace domestic boilers, generating both electricity and heat for the home

- **Non-gas heat sources such as biomass (particularly wood), solar thermal water heaters, geothermal energy or heat pumps –** which generate heat from renewable sources for use locally, either by one household or through pipes to a number of users in a building or community (sometimes known as community or district heating schemes).

1.4 It is important to note that distributed heat and power technologies are not necessarily low carbon. For example, much of the Combined Heat and Power in operation in the UK burns fossil fuels. The real carbon benefits of specific technologies therefore need to be given proper consideration when considering their overall potential in helping us to tackle climate change.

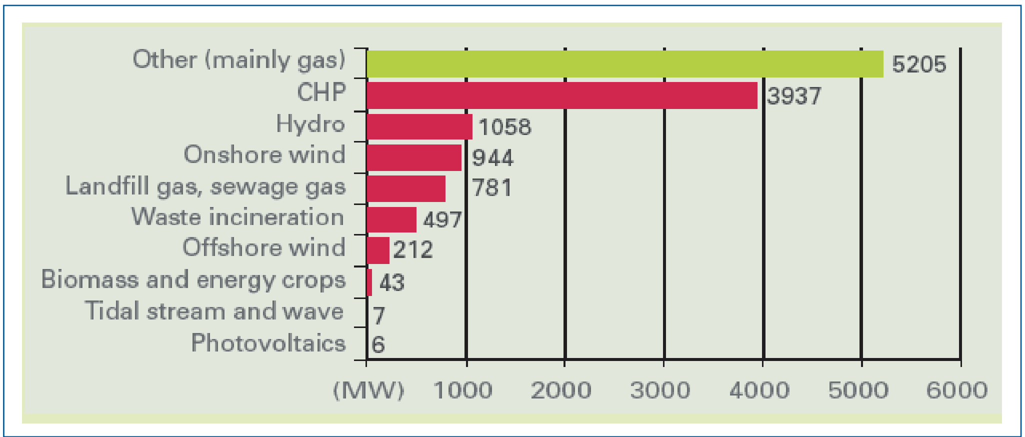
1.5 In addition, distributed electricity generation as defined above is not always located close to demand. For example, wind farms in remote areas of the country may be located further from demand than recently constructed centralised power stations. Such generation can still bring substantial environmental benefits, but it is important to bear in mind the diversity encompassed within the term distributed energy.

1.6 The main aim of this call for evidence is to inform the distributed generation review that was announced in the Energy Review Report, July 2006. The review will examine the barriers and incentives that impact on **distributed electricity generation, including Combined Heat and Power.**

1.7 Nevertheless we do recognise the need for a holistic discussion of the overall distributed energy landscape, as highlighted by several submissions to the Energy Review consultation. In fact, we drew together some of the main pieces of Government work currently in train on distributed energy in a separate chapter of the Energy Review Report partially in response to this. In keeping with this approach, in this document, we briefly discuss heat-only technologies.

What benefits can distributed generation bring?

1.8 The chart below shows the electricity generation plant currently connected to UK distribution networks:



Source: DTI Energy Review (2006)

1.9 Proponents of distributed generation highlight a number of potential benefits:

- **More efficient use of fossil fuels** – for example, by using the heat from Combined Heat and Power, there is scope to reduce carbon emissions and the demand for imported gas

- **Improved flexibility** – a more modular, decentralised energy system might be able to respond more readily to technological change

- **Increased number of energy producers/suppliers** – a decentralised system could lead to more market participants, potentially increasing competition and customer choice

- **Raised energy awareness** – the production of electricity and heat more locally can help raise awareness of energy production and consumption potentially resulting in more efficient use of energy

- **Enhanced network reliability** and resilience, due to reduced transmission power flows and the ability to secure local demand at times of system stress

1.10 In response to this call for evidence, **we would particularly welcome evidence and facts that will help us analyse the extent of these benefits**.

1.11 It is also important to note that growth and investment in distributed electricity generation will not avoid the need for continued investment in the transmission system. The transmission system will continue to play a role longer term.

1.12 For example, investment will be needed for the foreseeable future to ensure we have continued interconnection between the distribution networks to provide backup and security of supply. Moreover, many of the renewable projects that will be built in the coming years will necessarily be sited in remote areas, away from centres of demand. If we are to meet our aspiration of 20% of our electricity coming from renewables by 2020, a significant proportion of this will need to be sourced from Scotland. For example, around 10 GW of new wind projects are currently under development or construction in Scotland.[1] The centres of demand that need this electricity will mainly be many kilometres away and consequently substantial investment in the transmission grid will be required to transport this renewable, low carbon electricity to its point of use.

What are Government and Ofgem doing in the broader distributed energy context?

1.13 Government and Ofgem have each been involved in a number of initiatives in recent years that seek to address the barriers facing distributed energy in the short to medium term. Examples include Defra's CHP strategy in 2004, DTI's recent Microgeneration Strategy and the commitment to the production of a Biomass Strategy in 2007 in response to the findings of the Biomass Taskforce. Ofgem took particular account of distributed generation in its price control review for the distribution companies of last year. In addition, the DTI/Ofgem-chaired Electricity Networks Strategy Group[2] has made it easier for distributed generators to connect to the grid. Chapter 7 provides more detail here.

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1 http://www.bwea.com/statistics/
2 Formerly called the Distributed Generation Co-ordinating Group

1.14 This joint DTI-Ofgem Review on Distributed Generation will complement existing activity, again focusing mainly on the short to medium term. While issues like the development of the EU ETS and the Renewables Obligation. are relevant to the take-up of distributed energy, we are focussing this review on issues which have not received such attention so far.

1.15 Looking to the longer term, as announced in the Energy Review Report, the Office of Science and Innovation will undertake a wide-ranging review of the potential future role and relationship of centralised and decentralised energy generation in delivering the UK's long-term energy goals. This will be done through a Foresight Project on Sustainable Energy Management and the Built Environment which will consider scientific, technical and economic issues surrounding future systems for generating low carbon, distributed heat and power, transmission and distribution networks and demand management. This project is due to be completed in 2008 and will help inform longer-term thinking and policy-making.

1.16 The Sustainable Development Commission is examining issues around Distributed Energy.[3] We will draw on their work and findings in our own review.

The structure of this document

1.17 In undertaking the review, we will clearly need to combine analysis of the barriers to individual generation technologies with work on cross-cutting issues, such as the barriers to distributed generation at national, regional, community and household level and the role of different players in the market. We have structured the call for evidence in the following way:

- Chapter 2 briefly describes how the UK energy market operates and how the UK's predominantly centralised transmission and distribution system evolved. It then sets out a number of cross-cutting technical and regulatory barriers that affect the development and connection of distributed generation.

- Chapter 3 concentrates on the technology-specific barriers relating to electricity generating **microgeneration technologies** (solar photovoltaics, wind, hydro, microCHP).

- Chapter 4 focuses on the barriers to connecting **renewable electricity generation** (above the microgeneration scale) to the distribution grid.

3 http://www.sd-commission.org.uk/publications.php?id=373

- Chapter 5 describes technology-specific barriers relating to **Combined Heat and Power.** The technologies covered include large-scale, industrial CHP technologies usually connected to distribution networks (and more rarely to the transmission system) and smaller scale multiple dwelling and commercial CHP solutions.

- Chapter 6 briefly describes the state of development of the **heat only renewable** market and the work Government already has in train in this context. Given our focus on distributed electricity generation including CHP, this chapter seeks views on whether there are important issues of read-across between the current review and existing Government work on heat.

- Chapter 7 describes the roles of Ofgem, national, regional and local government along with the main incentives and levers being utilised to facilitate the development of distributed generation.

1.18 At the end of each chapter, we highlight specific questions on which we would welcome views, evidence, facts and figures. However, if respondents also wish to provide evidence on issues that go beyond the specific questions, we will equally welcome these contributions. All the questions are brought together in one place at Annex A.

Chapter 2: Distributed Generation in Today's Electricity System

2.1 Our electricity system has been built up over several decades into the mostly centralised system we have today. In the early days of electricity, power stations were constructed close to the customers they supplied employing relatively simple networks to connect the two together. As a result, multiple 'islands' were developed to serve demand centres. In today's terms, all generation was 'distributed' in these initial stages of the development of the electricity supply system.

2.2 The limitations of this approach became apparent as the demand for electricity grew and the concept of a unified electricity grid became established. In Great Britain the 'national grid' first came into operation in the 1930s. Initially, the national system consisted of a number of geographic zones that had sufficient generation to meet their own demand in most circumstances, still effectively a 'distributed' model. Linking these zones together allowed inter-zonal transfers in exceptional circumstances.

2.3 This initial grid system developed rapidly through the 1950s and 1960s into the national supergrid system that we have today, comprising:

- a high voltage national transmission system which provides connections for approximately 85% of the total generating capacity. This is operated by National Grid Electricity Transmission plc (NGET) – the transmission system operator

- lower voltage distribution networks that provide connections for the remaining generating capacity and the vast majority of demand connections. These networks are owned and operated by the Distribution Network Operators (DNOs)

2.4 The primary drivers for the development of the unified national grid were to reduce the cost of generating electricity and enhance supply security. Until the 1990s there had been a continuous process of building ever-larger power stations to benefit from the economies of scale. These power stations were located either close to the source of fuel, primarily coal, or in remote locations in the case of nuclear. The increase in the distance between the generators and the centres of demand meant that the transmission system had to provide the capacity to connect the two together. The very high operating voltage of the transmission system reduced the level of network losses.

2.5 The market and regulatory models adopted at privatisation reflected this predominantly centralised model of transmission and distribution.

2.6 The future development of the electricity system will primarily be driven by the generation technologies we build to help us meet our future economic and environmental needs. If smaller technologies become the preferred option then we could, over time, return to a position where most electricity is generated locally and the transmission system returns to its original role (i.e. of providing interconnection for transfers from one distribution network to another under exceptional circumstances). However, it is perhaps more likely that a mix of low-carbon generation solutions will emerge. We can already see the scope for domestic-scale generation at one end of the capacity spectrum and large, offshore wind farms and conventional plant at the other.

2.7 It is therefore likely that the transmission system will retain a bulk transmission role. At the same time it is likely that distribution systems will have to develop to accommodate potentially hundreds of thousands of generation sources. We need to ensure that there are no unnecessary barriers to the potential role of these smaller generation technologies. In this chapter, we briefly review the issues that all distributed generators face within the current system. They include:

- the licensing regime for generation and supply;
- the mechanism for rewarding smaller, mostly unlicensed, generators for the electricity they wish to export and sell;
- the relationship that distributed generators have with the transmission system and the DNOs; and
- the role of private distribution networks, including licensing issues.

2.8 There are a number of issues that are specific to individual technologies. These technology-specific issues are explored in separate chapters (3-6).

Licensing

2.9 Government policy is that participation in the electricity sector is by licence, governed by an independent regulator. Therefore, the major electricity generators, energy suppliers to end-customers and network operators need a licence to operate in their part of the market. The licensing regime helps to ensure consumer choice and offers consumer protection. The licensing regime also helps ensure we have resilient and efficient networks. Exemptions from the licensing regime are set out in a Statutory Instrument[4] and can be broadly summarised as follows:

- Generators below 50 MW are allowed a class exemption, and those between 50 MW and 100 MW can obtain an individual exemption. This is because, as maintained by the National Grid which operates the transmission network, generators below 50 MW should have little impact on the overall integrity of the network and above 50 MW but below 100 MW they are still unlikely to have such an impact but need consideration on a case-by-case basis.

- For distribution and supply, the 2001 Statutory Instrument sets out, amongst other things, the maximum amounts of electricity that can be distributed and supplied without the need for a supplier or distribution licence.

2.10 The re-emergence of smaller, distributed sources of generation over the last 15 years has been accommodated within the market, in part by exempting many of them from the need to hold a generation licence, under the exemptions set out above.

2.11 Unlicensed generators operate in a very different commercial environment to their licensed counterparts. Generation licensing affects both trading arrangements and a distributed generator's relationship with the transmission system. For example, a licensed generator has to be party to the Balancing and Settlement Code. This defines and describes the trading arrangements for a generator selling their electricity into the market. Moreover, a licensed generator also has to enter an agreement with the transmission system operator (NGET) for using the transmission system. An unlicensed generator avoids the costs and burdens associated with the Code and the need, in most cases, for an agreement with NGET.[5]

4 The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001.
5 Arrangements vary depending on which of the three transmission licensees' areas a distributed generator is located.

2.12 Unlicensed distributed generators[6] also potentially have access to "embedded benefits". These reflect the fact that distributed generators have a shorter delivery path to consumers. Under current arrangements, an unlicensed generator is effectively treated as negative demand on the system and the electricity they generate is not subject to NGET's charges relating to the use of the transmission system. By purchasing this output from a distributed generator, an energy supplier reduces the overall charges they face from NGET. Energy suppliers can choose to pass back some of these savings to distributed generators by negotiation or equally can pass them on to end-consumers in the form of lower retail prices.

2.13 The exemptions relating to distribution and supply are very relevant to the issue of private wire networks. These are discussed later in this chapter.

2.14 The divide between the licensed and unlicensed sectors for distributed electricity generation is based on a Government assessment which balances the need to minimise the regulatory burden on smaller operators, against the need to protect the reliability and integrity of the overall network. Distributed generators may restrict the size of projects that might otherwise have been larger to benefit from the licensing exemptions. For example, it is not uncommon for the capacity of a distributed generation project to be set at or limited to 99 MW to avoid the need for a licence. Some proponents of distributed generation argue that the licence exemption provisions should be removed to allow more unlicensed activity as a way of stimulating growth in this market. However, the potential benefits would have to be weighed against the risk to the overall integrity of the network of having larger, unlicensed players operating outside the licensing regime. The impact on competition and consumer protection would also need to be considered.

Export Reward

2.15 There remain concerns, particularly in the microgeneration sector, that the market arrangements for some distributed generators in relation to export reward are not working well and need to be reviewed. The specific issues relating to microgeneration are discussed in chapter 3.

6 Any generator of less than 100 MW capacity potentially has access to embedded benefits, licensed or unlicensed. All unlicensed generators will have a capacity of less than 100 MW. In practice, most generators under 100 MW will be unlicensed.

2.16 More generally, there remains a lack of clarity and consensus across industry about the treatment of DG in the trading mechanism. There is agreement that electricity generated close to a customer is more valuable than electricity supplied to the transmission system because of the shorter delivery route. And distributed generators can already share in the financial reward associated with the "embedded benefits" described above. However, some claim that these embedded benefits are not sufficient on their own to recognise the full value of distributed generation, arguing that exports should be valued close to the retail price and that suppliers should have an obligation to purchase. Others however would link the export value closer to the market wholesale price of electricity.

Distributed Generators and the transmission system

2.17 The largest generators connected to distribution networks are required to contract with, and pay associated charges to, the transmission system operator, NGET. However, most generators connected to distribution networks are below 100 MW in capacity and are therefore currently treated as negative demand. As we have mentioned, their output is exempt from NGET's charges relating to the use of the transmission system and they avoid the need for participation in the balancing and settlement arrangements. These examples provide important financial incentives for distributed generation. However, the question has been raised as to whether this exemption is appropriate or sustainable longer term as the level of distributed generation grows. Ofgem has recently established a working group to consider this issue (the Transmission Access for Distributed Generation Group).[7]

2.18 Although not required to enter contractual arrangements with NGET for use of the transmission grid, some generators in the range 50 MW to 100 MW are still obliged to meet technical standards determined by NGET[8], even though these generators themselves are connected only to the distribution grid. Proponents of distributed generation argue this creates an unnecessary additional barrier.

7 For more details, see Ofgem's website: www.ofgem.gov.uk
8 Lower limits apply in Scotland.

Distributed Generators and the Distribution Network Operators[9]

2.19 DNOs' licences require them to offer connections to DGs within set timescales. They design these connections to ensure that the distributed generator does not cause the quality of electricity supply to fall below agreed standards, potentially affecting other generators and customers. To minimise these risks, connections are usually designed to allow the output from distributed generators to fluctuate. This approach offers valuable flexibility to the distributed generator but can be costly as it means the DNO has to provide capacity that is not always used. Therefore, distributed generators are increasingly looking for ways in which they can exchange some of this flexibility for a lower cost approach. Some DNOs and distributed generators are already working together to explore more innovative connection models. In addition, Ofgem is working on a number of fronts to help facilitate more innovative and lower cost connection models such as through their work on Innovation Funding Incentives and Registered Power Zones.[10] However, despite progress in recent years, some argue it is still time-consuming and resource-intensive for distributed generators to obtain a cost-effective connection and that this remains a barrier to the development of distributed generation.

2.20 The network development and investment strategies of the DNOs are also questioned by some parties. Some argue that the required performance of distribution systems in the future will be so different to today that strategic investment is required so that future DG investment can be accommodated in a way that allows its full potential to be realised. This strategic investment could include basic capacity growth ahead of need at one end of the spectrum to more intelligent, flexible distribution systems at the other. However, this presents a real dilemma. On the one hand, network investment ahead of need of the right type in the right location may itself encourage growth in distributed generation. On the other, it could also result in an increased risk of stranded assets which would have to be paid for by generators or by the end consumer (who indirectly pay for all network investment as part of their overall energy bill). A balance needs to be found that encourages DNOs to take proper account of future potential needs without taking undue risks on behalf of customers.

9 In England and Wales there are seven distribution companies operating twelve licensed distribution areas. In Scotland distribution is operated by two vertically integrated energy companies who, in addition to operating their respective distribution businesses, are also responsible for the Scottish transmission system (http://energylinx.co.uk/distribution_network_operators.htm).

10 Ofgem published an open-letter consultation on the Innovation Funding Incentive and Registered Power Zones on 5th October 2006. The consultation closes on 30th November. For more information about the initiatives that Ofgem is facilitating in the context of innovative connection models, please see Ofgem's website: www.ofgem.gov.uk

Networks – Private

2.21 Most electricity consumers are connected directly to a licensed distribution system. These consumers have a connection agreement with the distribution company and pay for the use of its system, usually via an energy supply company. The consumers' connection agreements with a DNO are included within the terms of the agreement that the consumers have with their energy supplier.

2.22 An alternative arrangement is for a single party to connect its own private network to a licensed distribution network. This party can then provide connections to customers within its own private network. Once established, this private wire network allows distributed generation to be connected directly to it and allows a certain amount of unlicensed generation and supply to take place completely outside of the main market.

2.23 In particular, a party may be exempt from the licensing regime if they:

- generate no more than 50 MW (or no more than 100 MW with Secretary of State approval) – exempting them from the need for a generating licence
- distribute electricity over private wires to business customers without limit, and up to 2.5 MW to domestic customers – exempting them from the need for a distribution licence
- supply electricity directly to customers up to a maximum of 5 MW in aggregate of which no more than 2.5 MW can be supplied to domestic customers exempting them from the need for a supply licence.[11]

2.24 The benefit of this approach is that the unlicensed operator is able to avoid a number of costs that would usually apply to a licensed energy supplier. In particular, the unlicensed operator avoids the costs of the Renewables Obligation, the Climate Change Levy, and the Energy Efficiency Commitment. The unlicensed operator also avoids a number of costs associated with the use of the transmission and distribution systems. Some of these savings can be used to help the financial viability of the often lower-carbon distributed generation that connects into these private wire networks. Some savings can also be passed on by the exempted generator to the customers linked to the private wire

11 It should be noted that the provisions of the licence exemptions are complex, and that this concise summary provides a simplified overview.

network. It is worth pointing out however that customers supplied by licensed energy suppliers are in effect subsidising the electricity costs of those linked into the private wire network.

2.25 The schemes pursued by Woking Council and soon to be applied to London are examples of how this approach can operate.

2.26 There is currently some debate about the role that these private networks could play in the development of distributed generation and other energy services. Some argue that by exploiting these exemptions and associated financial benefits, private wire networks could provide an important boost to the development of a larger base of distributed generation in the UK. In fact, some argue that the levels in these exemptions should be raised to further facilitate this growth.

2.27 However, it is also important to remember why the licensing regime exists. Its main purpose is to protect the interests of the consumer, for example by ensuring competition, maintaining the overall reliability and integrity of the network and requiring licensees to meet certain security of supply conditions in the consumer's (and the economy's) interests. Consumers supplied by unlicensed businesses do not have this similar protection. For example, customers on a private wire network who experience unreliable supply or a poor quality of service would have no route of redress to Ofgem – because the private wire networks operate outside of Ofgem's licensing regime. Moreover, because these customers would not be directly connected to the licensed electricity system, they would not necessarily be able to switch to another energy supplier if they were dissatisfied with their current supplier.

2.28 Some also argue that although private wire networks operate independently, they are still reliant on the transmission grid for back-up power, just like licensed suppliers and therefore they should pay charges that reflect this dependence. In addition, patchworks of private networks may make it increasingly difficult to co-ordinate power flows efficiently. In the longer term, there may be concerns about ensuring private networks are adequately maintained and about safety issues such as whether other contractors will have ready access to cable location records. All of these issues will need careful consideration.

Case study: distributed energy in London through private wire

The Greater London Authority has put in place a number of measures to support the development of Decentralised and Distributed Energy. The London Plan now requires new developments to consider CHP and heat fired absorption cooling, and to produce 10% of energy needs from on-site renewables. The Further Alterations to the London Plan currently under consultation further strengthens the requirement for decentralised energy and increases the requirement for on site renewable energy to 20% as part of the Climate Change and Energy Strategy for London. One of the key features of the London system will be the use of private wire networks to maximise the economic benefits of decentralised energy and microgeneration.

The London Climate Change Agency (LCCA), is a municipal company owned by the London Development Agency and led by the Mayor as the Mayor's delivery agency, implementing projects that impact on climate change, especially in the energy, transport, waste and water sectors. The LCCA plays a key role in helping to deliver the Mayor's Energy Strategy for London, especially the target of reducing carbon dioxide CO_2 emissions by 20%, relative to the 1990 level, by 2015, as the crucial first step on a long-term path to a 60% reduction from the 2000 level by 2050. One of the key projects of the LCCA was the establishment of the London ESCO Ltd, a public/private joint venture Energy Services Company between the LCCA Ltd and EDF Energy plc, incorporated in 2006.

The London ESCO will implement low carbon decentralised energy projects across London on a commercial basis. The approach of the London ESCO is based on the private wire decentralised energy model originally established in Woking by the LCCA's Chief Executive Officer, who was recruited by the Mayor from Woking Borough Council to set up and run the LCCA. Using this model, Woking achieved cuts of 77.5% in carbon dioxide emissions in its own buildings over the period 1991–2004. It did this by establishing an energy efficiency revolving fund in 1990 and an Energy Services Company in 2000, where the return on investments were reinvested in renewable energy and tackling fuel poverty projects, reducing energy consumption by nearly 50% and installing 10% of the UK's solar PV and the UK's only fuel cell CHP by 2004.

The London ESCO has been established to deliver low carbon decentralised energy solutions in new and existing development. Initially, the focus will be on cogeneration (combined heat and power), trigeneration (combined heat, power and heat fired absorption cooling) and integrated renewable energy on local private wire district energy systems and networks but will also include special projects such as fuel cells, environmentally friendly waste to energy technologies, renewable gases and biomass fuels.

The London ESCO schemes will maximise the direct retailing of electricity, heating and cooling over private wire decentralised energy networks. Surplus electricity will also be traded between sites using an enabling agreement for exempt supplier operation.

Source: London Climate Change Agency

Questions:

1. The environmental benefits of DG are technology and application specific. If DG is to be further encouraged how can the best DG opportunities be identified and any unnecessary barriers be removed?

2. The licensing regime has developed in stages since 1990. Is there evidence that it is currently acting as an unnecessary barrier to DG? If so, what actions could be put in place to address this? In particular, there are a number of fixed transaction costs relating to connection, licensing and permissions, which could be said to disadvantage smaller projects. What more could be done to ensure that these costs are proportionate to the size of DG projects?

3. Are the incentives on DNOs sufficient to encourage them to connect smaller generators with minimum fuss and cost? While the connection and use of system arrangements managed by the distribution and transmission companies are well established, some still see them as a barrier to DG. Is there project-specific evidence of this? If so, we would welcome ideas that could help address such problems, while recognising the need for continued investment in the transmission and distribution systems. What further actions should distribution and transmission companies take to facilitate DG?

4. Private networks are being increasingly presented as a way to help DG. Is this approach one that should be encouraged or is it a short-term expedient necessary to capture more value for DG? If private networks do expand, how best can customers connected to them be protected and competition preserved?

5. A number of possible options, largely concerning licensing and the terms of trade between distributed generators and the existing electricity market, have been suggested by various proponents of DG. We would therefore particularly welcome views on the costs and benefits (to different stakeholders) of the following options:

   a) Increasing the exemption limits for distribution and/or supply licences, or introducing a simpler licence.[12] How would consumers be protected, both in respect of competition and also more generally, including safety?

   b) The Climate Change & Sustainable Energy Act has caused the industry to actively pursue the issue of export reward for microgeneration. Is there confidence that this will be successful and should this be extended to unlicensed generation that does not qualify as microgeneration under the Act? Do consultees have any other suggestions on how to increase the amount suppliers pay for exported electricity?

12 Simpler Distribution Licences have already been granted by Ofgem to independent Distribution Network Operators.

Chapter 3: Microgeneration Technologies

3.1 In March this year, the DTI published its Microgeneration Strategy.[13] This strategy covers the range of technologies defined in the 2004 Energy Act (Section 82). Micro technologies are defined as those that produce less than 50 kW of electricity or less than 45 kW of heat.

3.2 In summary the technologies included are:

Heat generation

- Solar water heating – using the heat of the sun to produce hot water. A $4m^2$ collection area will provide between 50-70% of a typical home's annual hot water requirement.

- Heat pumps – ground source heat pumps use the warmth stored in the ground to heat fluid circulating through pipes, a heat exchanger extracts the heat and then a compression cycle (similar to that used by refrigerators) raises the temperature to supply hot water for heating purposes. Air source and water source heat pumps operate in a similar fashion using temperature differentials in the air and water (these types of heat pump are not quite as efficient as ground source heat pumps)

- Biomass stoves and boilers[14] – systems can provide space and/or water heating from burning wood (pellets, chips and logs) and non-wood fuels. The biomass fuels are derived from forestry products, energy crops (willow and miscanthus) and waste wood products (sawdust, pallets or untreated recycled wood).

Electricity generation

- Solar photovoltaic (PV) systems generate electricity from sunlight. Small-scale PV modules are available as roof mounted panels, roof tiles and conservatory or atrium roof systems. A typical PV cell consists of two or more thin layers of semi-conducting material, which is most commonly silicon. The electrical charge is generated when the silicon is exposed to light and is conducted away by metal contacts.

13 http://www.dti.gov.uk/energy/sources/sustainable/microgeneration/strategy/page27594.html
14 Biomass systems for electrical generation and CHP can also be implemented at larger scale. These larger applications are covered by other policy statements.

- Micro-wind turbines convert wind to electricity. The most common design is for three blades mounted on a horizontal axis, with the blades driving a generator (directly or through a gear-box) to produce electricity. Most systems are mounted on a tall mast, but building-mounted turbines are now starting to come onto the market.

- Micro-hydro systems are typically used in hilly areas or in river valleys. Hydro-power can be captured wherever a flow of water falls from a higher level to a lower level. This may occur where a stream runs downhill, or a river passes over a waterfall or man-made weir, or where a reservoir discharges water back into the main river. The amount of electricity produced is determined by how much water is available and the speed of the flow.

Combined Heat and Power

- MicroCHP – these technologies use natural gas as a fuel but provide electricity as well as heat. The two main systems use either reciprocating engines or Stirling engines. Fuel cells are also an alternative source of power.[15]

3.3 Microgeneration takes the concept of distributed energy to its limit. Small-scale electricity generation at the point of use effectively eliminates the need to transport electricity from supplier to customer. However, the support of the centralised grid system is likely to continue to be required in most circumstances to provide back-up and peak supplies and the ability to export surplus electricity back into the main system. For example, if a micro-wind device is at any one time producing more electricity than a household or building needs, this electricity would be lost if it were not possible to export it back onto the grid.

3.4 The take up of microgeneration technologies is not material at present. The Microgeneration Strategy[16] produced data showing the number of installations in operation at the end of 2004, set out in the table below.

15 CHP microgeneration products can be based on gas-fired engines but may in the future use fuel cell technology. Fuel cells are electrochemical devices that combine hydrogen and air to produce electricity and water. More information is available at http://www.fuelcells.org. A Stirling Engine is an engine which harnesses the energy produced when a gas expands and contracts as it heats up and cools down.

16 http://www.dti.gov.uk/files/file27578.pdf

Technology	No. of Installations
Micro-wind	650
Micro-hydro	90
Ground source heat pumps	546
Biomass boilers (pellets)	150
Solar water heating	78,470
Solar PV	1,301
MicroCHP	990
Fuel Cells	5
Total	**82,202**

3.5 As discussed in Chapter 1, the heat-only opportunities of microgeneration and other forms of heat are briefly discussed in Chapter 6. This reflects the fact that the main focus of the current review is about examining the barriers to and incentives for distributed electricity generation including CHP. The following chapter concentrates on micro-electricity and CHP micro technologies.

Potential of microgeneration of electricity in the UK

3.6 In support of the Microgeneration Strategy, the Energy Savings Trust carried out a study to assess the growth potential for microgeneration. It suggested that 30-40% of the UK's electricity demands could be met through microgeneration technologies, by 2050, with CHP (both fuel-cell CHP and Stirling engine CHP) leading the way, followed by micro-wind and solar PV, but recognised that a number of technological and market developments will have to take place for such an outcome to be realised. The most significant of these developments are the cost reduction of microgeneration technologies and the development of 'consumer friendly' products.

What are the barriers to growth/take-up?

3.7 The Microgeneration Strategy identified constraints to microgeneration related to cost, information, technical and regulatory issues and set out 25 actions to tackle these barriers and stimulate the development of a sustainable market in microgeneration technologies. As far as microgeneration is concerned, this current DTI/Ofgem Review aims to build on these measures, with a specific focus on the wider issues related to the distribution of energy produced by microgenerators, that were not addressed in the Microgeneration Strategy (see box on p.28).

Cost of the technology

3.8 As already mentioned, it is generally agreed that cost remains a substantial barrier to the large-scale take-up of these relatively new and innovative technologies. Good quality data on costs of electricity from micro-generation technologies is limited. The lack of data partially reflects the low penetration of these technologies. The Energy Saving Trust has undertaken some analysis and modelling of how costs of various types of microgeneration might evolve over time. This work showed that for micro wind and solar PV in particular, uptake is slow due to high costs relative to base electricity prices.[17]

3.9 Mass-production of microgeneration will almost certainly be required to achieve cost/price levels necessary to achieve significant market penetration. We will need to see rising and sustained demand for these devices in order to see manufacturers making the necessary investment for the volume production needed for cost reduction. The recent introduction of microgeneration products (solar PV and wind and solar thermal) into high-street stores does, however, demonstrate a degree of growing commercial interest in the mass sale of such technologies.

Lack of information

3.10 General public and householders' understanding and awareness of these micro-technologies is still quite low. Many householders are therefore not even in a position to consider microgeneration as a possible alternative to the much more straightforward option of purchasing electricity directly from one of the large UK-based electricity suppliers (and using gas in a household boiler for heating and hot water).

3.11 There is also a lack of independent information about the costs of microgeneration options versus the costs of taking electricity through the traditional route. Some argue that this lack of information prevents potential purchasers of these new technologies from having the information they need to make an informed choice. That is, they argue that the lack of information about upfront costs and ongoing costs for maintenance is a larger barrier than the cost itself.

3.12 If potential future consumers of these technologies are not aware of the options, they are unlikely to create the demand needed for this market to develop and grow. Without consumer awareness, we are also unlikely to see investment in innovative

17 'Potential for Microgeneration – Study and Analysis' (EST, Econnect + element energy, 2005)

selling and packaging by suppliers to stimulate further demand and growth of this market segment.

Barriers to switching away from secure, reliable supplies

3.13 With new and innovative products, there will inevitably be a period of learning, testing and teething problems. When coupled with the fact that customers currently enjoy reliable and secure access to electricity from known and trusted electricity supply companies through the grid, there is a significant barrier to switching to this new type of set-up – even if it is for only part of their overall electricity needs. Customers will want to know that they can trust a potential installer to provide good quality service and reliable ongoing maintenance. Without a proven and substantive track record, it may be difficult for some potential suppliers to provide this.

Reward for exports

3.14 Electricity-generating microgenerators who export excess electricity already have the option of entering into an agreement with a willing energy supplier to receive payment for that electricity. This extra income can help tip the balance in the decision-making process of an interested consumer. The main obstacle to making progress in this area is that electricity suppliers face high transaction costs when dealing with very small quantities of exported power from individual consumers, reducing their incentive to offer export tariffs. This situation largely exists because the Balancing and Settlement Code was never designed to accommodate large numbers of relatively small power exports.

Getting connected

3.15 The distribution companies have made good progress in addressing the technical aspects of the connection of microgeneration. A single microgenerator can now be connected without an application approval process.[18]

3.16 However, metering arrangements are also an important part of microgeneration installation. While microgenerators (<30 kW) are not required to install half-hourly metering they are required to install an import/export meter if they wish to sell their exports to a supplier. Without half-hourly metering, some small generators may not be receiving fair reward for the electricity they produce as the amount they export and its timing will necessarily be based on

18 Engineering Recommendation (ER) G83/1, available from the Energy Networks Association.

approximations. In addition, if the microgenerator is a renewable technology and is therefore eligible for Renewable Obligation Certificates,[19] the output of the microgenerator also has to be recorded. There is therefore a level of complexity and expense in providing the necessary metering that presents a barrier to the installation of microgeneration that someone in the system has to pay for, thereby presenting a further barrier.

Planning

3.17 There is evidence that obtaining planning consent for the installation of these types of devices is not straightforward and can often be time-consuming. DCLG will shortly be publishing a consultation document on this issue.

Difficulty in accessing the financial rewards of the renewable obligation

3.18 Renewable microgenerators do now have access to Renewables Obligation Certificates but more work is necessary to make consumer access more straightforward.

Microgeneration Strategy

The Microgeneration Strategy was launched on 28th March 2006. Its objective is to create conditions under which microgeneration becomes a realistic alternative or supplementary energy generation source for the householder, for the community and for small businesses.

The strategy aims to overcome barriers such as cost, lack of information awareness, and regulatory and technical knowledge. These have historically stood in the way of the sector's expansion. Measures include:

- Capital grant programme (the Low Carbon Buildings Programme) worth £80m over 3 years
- Development of a scheme by electricity suppliers that will reward those microgenerators exporting excess electricity
- Making it easier for microgenerators to access the benefits of the Renewables Obligation.

19 A market-based financial reward for the production of renewable electricity. More detail about the RO is set out in Chapter 4.

Microgeneration Strategy ***(continued)***

- Research to be conducted into consumer behaviour in relation to microgeneration technologies and what drives early-adopter purchase decisions

- Facilitating the installation of microgeneration equipment by clarifying the permitted development status of these new technologies and removing any unnecessary controls over them

- Development of an accreditation scheme for all microgeneration technologies covering the product, installation and a Code of Conduct

- Work carried out in partnership with the energy supply companies and distributed network operators to ascertain whether the current systems will be sufficient to cope with growing numbers of microgenerators exporting electricity and, if not, what steps need to be taken to ensure that we have a system that facilitates microgeneration while still meeting the needs of those who have to manage the overall network

- Development of a route map for each microgeneration technology through collaboration with industry

More information on the actions resulting from the strategy can be found at **www.dti.gov.uk/energy/energy-sources/sustainable/microgeneration/microgen-strategy/page27594.html**

What incentives are currently in place?

3.19 A number of incentives are already in place, including those which help reduce initial installation costs, such as the 5% VAT rate on the installation of most microgeneration products.

3.20 The Government will soon be consulting on extending permitted development rights to reduce the number of situations in which planning permission is required for the installation of a microgeneration device.

3.21 The Government has also announced that it will take forward a process identifying a number of accredited suppliers of microgeneration technologies. By using accredited suppliers, potential customers will have more certainty about the quality of the microgeneration product they are purchasing and its installation and ongoing maintenance.

3.22 On the rewards for export issue, an industry-wide group, working with Government and Ofgem, is actively addressing this challenge. In addition, the Government has taken powers through the Climate Change & Sustainable Energy Act (2006) that strongly incentivise suppliers to bring forward proposals within a year.[20]

3.23 The current consultation on the Renewables Obligation[21] contains several suggested amendments to encourage development of a market where agents can remove the administrative burden of claiming ROCs, allowing microgenerators to claim the reward (less agents' costs) without needing to understand the administrative complexities of the RO. The proposals also include the removal of the requirement for a sale-and-buyback agreement with an energy supplier, which would further reduce the administrative burden.

3.24 Under the Energy Efficiency Commitment (EEC), electricity and gas suppliers are required to achieve targets for improving household energy efficiency. EEC already recognises the benefits of some microgeneration technologies, thereby encouraging electricity supply companies to consider offering these products to their customers alongside other measures. Defra launched a consultation on the shape of the next phase of EEC (2008-2011) in July 2006. As part of this, there is consideration of the idea of including additional microgeneration measures within EEC.

3.25 Ofgem is also taking steps to address microgeneration-related issues. In October 2006 Ofgem published a document entitled "Ofgem and Microgeneration: next steps"[22] and is leading a Microgeneration Forum to bring together key interested parties on a regular basis. In publishing the document, Ofgem called on suppliers to do more to respond to the requirement to provide a fair reward for export.

20 'Ofgem and Microgeneration: next steps', in which it was suggested that, unless suppliers come forward with offers, Ofgem will impose a solution upon them – http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/17008_MicroOctFINAL.pdf?wtfrom=/ofgem/index.jsp
21 Reform of the Renewables Obligation & Statutory Consultation on the Renewables Obligation Order 2007
22 http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/17008_MicroOctFINAL.pdf?wtfrom=/ofgem/index.jsp

Question:

There is a significant amount of work going on in the context of microgeneration. We have therefore focussed the call for further evidence on the following question:

6. In view of the cost reductions in microgeneration that are likely to come into effect over time, what evidence is there that further incentives are required to encourage take up of such devices either by householders, communities or businesses?

Chapter 4: Renewables Connected to the Distribution Network

4.1 Few non-CHP fossil fuel plants are now seeking connection to distribution networks. For fossil fuel plants, scale drives the economics. Most therefore tend to connect directly to the transmission grid, reflecting their large size. Therefore, CHP aside, most of the issues relating to electricity generation connecting to the distribution network relate to the development and connection of renewable electricity generation.

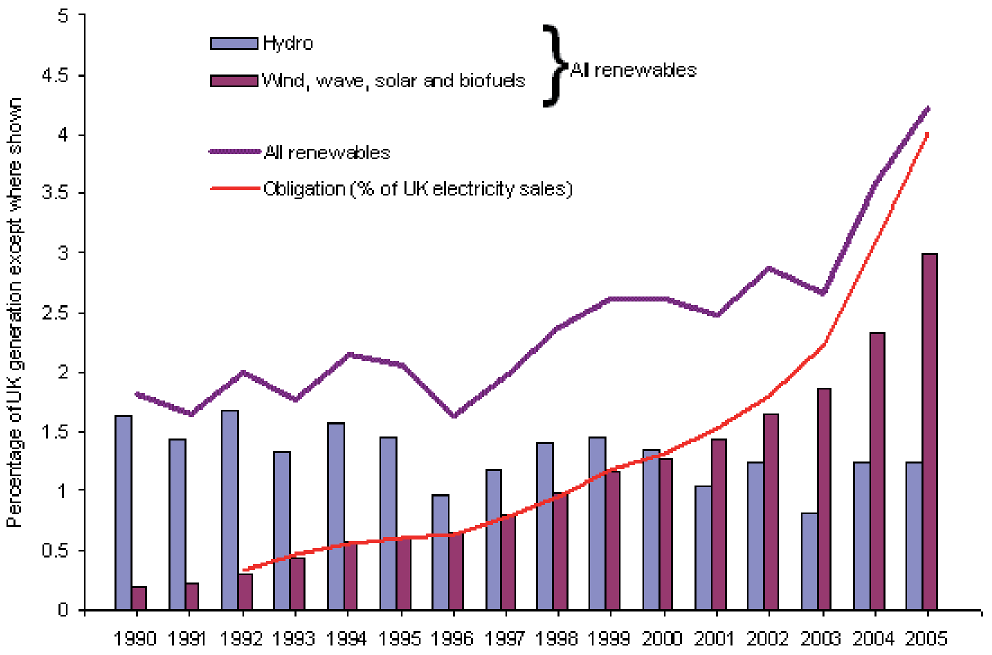
Current penetration

4.2 The charts below show the growth in generation from renewables in the UK. Penetration is still relatively limited at around 4%. However, more than 2 GW of renewables has been added to the system over the past three years and there are projects which together would add more than 10 GW of new capacity currently in the queue for planning consent and grid connection.[23]

4.3 Moreover, renewables have the potential to contribute significant levels of low carbon electricity to the UK's system. Work done for the 2004 Renewables Innovation Review[24] jointly by the Carbon Trust and the DTI stated that renewables had the technical potential to contribute more than 50% of the UK's electricity generation by 2050. However, it is important to note that the study did not pose cost constraints and focused mainly on technical potential.

23 Source: http://www.restats.org.uk
24 Renewables Innovation Review, 2004, www.dti.gov.uk/energy

Growth in Electricity Generation from Renewables since 1990



Source: http://www.restats.org.uk

What are the barriers to growth/take-up?

Cost of technology

4.4 The growth of many renewable technologies is currently constrained by their relative cost. Under the right site conditions, the most cost effective forms of renewable generation are hydro-electric power and electricity from landfill gas. However, there are few remaining suitable sites in the UK so the potential for further expansion of these technologies is small.

4.5 Most of the recent development has come from the development of onshore wind, the costs of which are falling as more efficient and large capacity wind turbines are developed and economies of scale and learning are exploited. The current relatively high costs of offshore wind and dedicated biomass projects have meant that there has been a limited amount of development in the UK so far. Other forms of renewable electricity generation, such as wave and tidal, and solar PV, although having significant potential, are even further from being cost competitive.

Market and constraints imposed by the predominantly centralised system

4.6 In chapter 2, we set out a number of market and system barriers that impact on electricity generation connecting to the distribution network, including issues around licensing and the associated burdens, and appropriate rewards for exports. These are again relevant in the context of renewables, with their impact and relevance varying according to the scale of the project connecting to the distribution network. We ask at the end of this chapter whether there are also some issues specifically relating to generation using renewable sources of energy.

Planning

4.7 Securing planning permission and grid connection for renewables, and in particular onshore wind, can be an especially difficult process, with developers facing much uncertainty and a significant risk of delays.

4.8 Power generation projects are not always welcomed by communities local to them, and renewable projects typically face similar resistance in spite of their environmental benefits. However, many of the most significant delays affecting the connection of larger-scale renewables to the electricity network relate to issues around the investment and reinforcement of the transmission system. The Government is committed to working closely with Ofgem and National Grid, consulting industry and relevant experts as necessary, to resolve these issues and to accelerate access to the transmission system for renewable electricity. These issues are principally about the transmission grid and are already being addressed through other work (see chapter 5 and Annex E of the Energy Review report[25]). Therefore these issues are not being examined in the current joint DTI-Ofgem review, which is focusing mainly on the barriers and incentives that impact on generation connecting to the distribution grid. We will, however, report on progress on the broader set of issues in the White Paper next year.

Grid connection delays

4.9 The impact on the transmission system of an individual distribution-connected generator may be small. However, collectively, the impact of distributed generation on the transmission system will become increasingly significant and it is therefore necessary to impose certain technical and other

25 http://www.dti.gov.uk/energy/review/page31995.html

transmission-related requirements, even though the generator is not physically connected to the transmission system. Currently, as indicated in Chapter 2, this is achieved by requiring generators to enter into a contractual arrangement with National Grid, or to abide by certain Grid Code requirements. Ideally, a generator should only be required to enter an agreement with the owner of the network to which it is connected, and some argue that the current arrangements therefore represent an unnecessary burden.

4.10 Renewable generation such as wind has operating characteristics that are quite dissimilar from conventional generation. However, both the Grid Code and Distribution Codes with which renewable generation must comply essentially require renewable generation to behave as if it were conventional generation. Some argue this constitutes a disincentive to renewable generation.

What incentives are currently in place?

4.11 **Financial Incentives** – In 2002, the Government introduced the Renewables Obligation, a market-based instrument incentivising investment in renewable electricity. The Renewables Obligation was introduced to address two main issues:

- To provide an explicit financial reward for the carbon savings associated with renewable electricity generation; and

- To encourage deployment of renewable technologies, driving economies of scale and economies of learning, and increasing the cost effectiveness of renewable technologies.

4.12 The obligation works by requiring energy suppliers to source an annually increasing proportion of their electricity from renewable sources. The current target is 6.7% for 2006/07 rising to 15.4% by 2015/16. If suppliers are not able to source sufficient levels of renewable electricity to meet their obligation, they are required to pay into a fund for each MWh short of their obligation.

4.13 In the Energy Review Report, the Government announced that it would consult on changes to the Renewables Obligation (RO) aimed at strengthening and widening the impact of the RO including, amongst other things:

- extending Obligation levels after 2015 towards 20% (when justified by growth in renewable generation); and

- adapting the RO to provide greater support to emerging technologies and less support for established technologies. The Government announced that its preferred option for achieving this was through a "banding" system, ensuring that the rights of existing projects and for those built prior to implementation of changes are preserved. Any changes would be introduced in 2010.

4.14 The consultation on these proposed changes to the Renewables Obligation was launched on 9 October 2006. The consultation also addresses a number of other technical issues concerning the ongoing development of the RO and its operation (some of these relate to microgeneration and were described in chapter 3). The consultation seeks views on the strengthening and proposed banding of the RO by 5 January 2007.

4.15 **Planning** – As part of the Energy Review Report, the Government published a statement of national need for renewables, highlighting the importance of renewable energy in contributing towards the energy policy goals – in particular, by tackling climate change and increasing the diversity of energy supplies. Together with the Planning Policy Statement on renewable energy,[26] the Statement of Need should help alleviate some of the difficulties in securing planning permission for renewable projects and associated infrastructure. By explaining to all participants of the planning system the important national benefits of such developments, these measures help ensure that the national strategic need informs and is properly reflected in planning decisions taken by planning authorities. In Chapter 7 of the Energy Review Report, we set out a number of proposed changes to the planning regime for energy infrastructure, including proposals to make public inquiries more efficient and streamlined. Many of these proposals should help reduce delays and uncertainty for renewables projects.

Questions:

7. Are there specific barriers to the development of renewable projects that connect to the distribution network? How could they be addressed?

8. Are there other approaches which could be taken to promote the connection of renewables projects of all sizes to the distribution system?

26 PPS22 – Renewable Generation, ODPM

Chapter 5: Combined Heat and Power

5.1 Many electricity generation technologies, primarily those that burn carbon-based fuels, produce heat as a by-product. This heat is usually rejected to the atmosphere – power station cooling towers are a well-recognised sight – and is therefore wasted. Combined Heat and Power (CHP) technologies enable this rejected heat to be captured and directed to homes, businesses or factories where it can be used beneficially, provided there are customers to purchase the heat. CHP is therefore able to increase the overall conversion efficiency of primary fuel to useful energy from less than 40% in a conventional coal-fired power station to some 90%[27] for the very best CHP plant.

5.2 As described in more detail later in this chapter, CHP is best suited to industrial set-ups with a steady and constant heat load. As a potential project moves away from this ideal, the efficiency and economics tend to get worse. For some customers (or group of customers) the more standard alternative of taking electricity from the grid and using conventional boilers for heat supply might be more efficient and economic than a CHP alternative. Often this more standard approach is the default option.

5.3 The principles of CHP can be used on any scale from domestic applications to very large industrial sites. In total, CHP currently accounts for 7.5% of the total electricity generated in the UK whilst 8% of the heat market comes from CHP.[28] The overall penetration of CHP has increased significantly over the last 15 years although progress in the last 5 years has been much reduced. The current picture for CHP, as captured by the DTI's DUKES database, is shown in the table below.

Size	No of schemes	Total electricity capacity (MW)
Less than 100 kWe	581	35
100 kWe – 999 kWe	682	171
1 MWe – 9.9 MWe	196	772
Greater than 10 MWe	75	4814
Total	**1,534**	**5,792**

Source: DUKES (2005)

27 The Oxford Institute for Energy Studies quote an average UK figure of 'around 70%'. It should be noted that the CHP efficiency premium is being eroded as increasingly electricity is being generated by more efficient plant. For example, modern CCGT plants have efficiencies of 50–60%

28 Source: Digest of UK Statistics (DUKES), 2005 – www.dti.gov.uk/energy/statistics/publications/index.html

5.4 Currently the industrial sector lays claim to 94% of the available CHP electrical capacity.

5.5 This chapter describes the current state of development of industrial CHP and community/commercial CHP, and looks at the key barriers to take-up and growth in each area.

Industrial CHP

5.6 There are a number of process industries (such as petrochemicals) that require both heat and electricity on a continuous basis and are therefore perfectly suited to CHP solutions.

5.7 Because reliability is of fundamental importance in these industries, existing technology is usually preferred. Over the last 15 years this has meant that gas turbines have been the preferred choice matched to heat recovery steam generators with or without some form of additional firing. In some cases the exhaust gases from a gas turbine, essentially just a jet engine, can also be used directly as process heat (typically for material drying processes). Depending on the required steam conditions and the overall scheme economics, combined-cycle gas turbine designs, essentially similar in design to electricity-only CCGT power stations, can be used in some CHP applications.

Community and commercial-level CHP technologies

5.8 This relates to distributed electricity generation systems where the assets are mutually owned, either by private organisations, local authorities or both; and where the heat and electrical products of the system are also shared. This category comprises all 'non-micro'[29] unlicensed generators. Examples might include CHP installations linked to residential or commercial users.

5.9 Some studies suggests that in the area of CHP, particularly where it is used to supply district heating,[30] there is potential for a significant increase in distributed energy (and therefore a potential reduction in carbon emissions) but take-up in the UK is currently small. Within this section, we use the term community CHP to capture both community-level and commercial-level CHP.

5.10 Community-level CHP allows some of the benefits and efficiencies from CHP to be captured by combining the heat load from a collection of buildings and a variety of users (residential,

29 Microgenerators are defined as those that produce no more than 45 kilowatts thermal or 50 kilowatts of power.
30 District heating is a system for distributing heat generated in a centralised location for residential and commercial heating requirements.

commercial). This can produce a heat load that may be steadier than the heat demand of individual users, although to a lesser extent than process industries like petrochemical, chemical and papermaking, which tend to have heat loads that are very well suited to CHP.

5.11 It is difficult to pinpoint the precise number of community generation projects across the country. The DUKES survey identified that just 6% of the installed electrical capacity, or 348 MWe, available from CHP is represented by the non-industrial users, a combination of agricultural, commercial, public admin, residential and transport. These often provide heat and/or power from one central source to multiple buildings. The table below provides more information on how this 6% is split across different sectors.

5.12 The majority of CHP plants used in community generation are also gas fired. However, some community schemes use a combination of low carbon approaches to generation. For example, the BedZED project in Wallington, Surrey uses a biomass (waste wood) fired CHP plant to provide hot water and electricity, combined with the innovative design and construction of the buildings. Heat from the sun and heat generated by occupants and every day activities such as cooking is sufficient to heat homes to a comfortable temperature. The need for space heating, which accounts for a significant part of the energy demand in conventional buildings, is therefore reduced or completely eliminated.[31]

	No of schemes	Electrical capacity (MWe)	Heat capacity (MWth)
Leisure	419	45.7	71.9
Hotels	302	38.9	62.6
Health	212	117.9	210.0
Residential Group Heating	45	42.9	97.5
Universities/Colleges	36	42.7	85.7
Offices	26	20.0	22.7
Education	21	10.2	18.0
Government Estate	14	12.2	18.1
Retail	12	2.6	4.1
Other (inc agric, airports, domestic buildings)	5	14.8	22.8
Total:	**1,092**	**347.9**	**613.4**

Source: Dukes 2005

31 See Chapter 2 of the Energy Review Report (2006) for more on low-carbon buildings and CHP.

Potential for development

5.13 Many of the best industrial CHP opportunities in the UK have been developed in the last 15 years. However, some opportunities remain, for example where new investment is required in existing boiler capacity and/or where a number of heat loads can be aggregated to improve the overall level and relative stability of heat demand. An example of the latter might be an industrial park where a number of businesses have a common need for both heat and power.

5.14 There is a significant technical potential for community CHP particularly in the UK. The Building Research Establishment carried out a study in this area.[32] It showed how the UK, with its predominance of high-density urban development, has a high technical potential for CHP, the vast majority of which is unrealised. However, estimates of the extent of the economic potential varies. One study commissioned by the Energy Saving Trust on behalf of Defra found that the cost-effective potential for CHP in community heating is estimated to be around 2,300 MWe by 2010.

5.15 In the household sector it is likely to be more cost-effective to consider opportunities for community CHP in new build rather than existing buildings. In England, for example, 82% of current housing lies in houses or bungalows.[33] It seems likely that the costs – resource and inconvenience – associated with retrofitting a series of existing houses to a district heating system – stripping out the old boilers and installing a series of underground pipes to share heat – will present significant barriers. New build scenarios and aggregations of apartment blocks represent the most likely cost-effective situations, and an example of the latter is the Barkantine CHP project.[34]

5.16 The Barker Review of Housing Supply envisages that around an extra million houses will have been constructed in the UK by 2020. This likely new build could present an opportunity for a greater use of community CHP if some of the barriers described below can be overcome.

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32 'The UK Potential for Community Heating with Combined Heat and Power', prepared by Building Research Establishment for the Carbon Trust, Feb 2003.
33 Survey of English Housing, 2006, www.communities.gov.uk
34 http://www.edfenergy.com/html/showPage.do?name=edfenergy.energy.barkantine.til

What are the barriers to growth/take-up?

Quality of available heat load

5.17 The fundamental requirement for the successful application of CHP is the existence of a suitable heat load. This heat load should ideally be continuous and stable. This allows the CHP plant to be operated continuously resulting in very high utilisation of the assets, which in turn improves the economics of the scheme.

5.18 As the parameters of the heat load deteriorate from this ideal position, the technical and economic advantages of CHP also deteriorate. Therefore, an industry that only operates on a 5-day week basis, even with a significant heat load, will find the economics of a CHP solution more difficult. For community CHP there is the added challenge of taking account of the seasonal effect (e.g. summer versus winter needs).

Fuel costs and the link to electricity prices

5.19 CHP schemes tend to be gas-fired. Like all gas-powered generation, their economic viability is significantly affected by the relationship between market gas and electricity prices, often referred to as the 'spark-spread'.[35] For example, some studies indicate that narrow spark spread can slow down or halt the take-up of CHP. The recent volatility in the gas and electricity markets has probably also made it more difficult to commit to investment in CHP.

Capital Outlay

5.20 CHP has to compete with the cost combination of grid-supplied electricity and stand-alone heat supply. Therefore, the capital cost of a CHP scheme plays a major part in any assessment of its benefits as compared with the alternative solutions.

5.21 Industrial CHP schemes are usually bespoke designs and by conventional power plant standards are small (e.g. starting at around 5 MW compared with electricity-only gas-fired power stations which might typically be around 500 MW and above). Moreover, CHP projects also need to invest in the additional infrastructure required to capture and transport the heat. The combination of the smaller size and additional infrastructure mean that the specific capital costs of CHP projects, usually quoted on a £/kWe installed basis, are higher than larger electricity-only plants. This makes the economics of CHP particularly dependent on the revenue stream from the sale of heat.

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35 A 'spark spread' is the difference between the selling price of electricity (in the open wholesale market) and the cost of the fuel (the main variable cost) used to generate it – source: www.moneyterms.co.uk

5.22 Community heating systems, with their extensive pipe networks, also have high up-front capital costs. CHP is therefore a more attractive option where scale is high and particularly where there is a steady heat load.[36]

5.23 One study suggests,[37] however, that if the commercial risks of the initial high capital costs of community CHP schemes can be managed, networks tend to grow with the connection of businesses and public sector and domestic buildings once the project has been established. This expanded network can improve the overall economics of a project. Modern systems can also provide a range of energy services to their customers, which may include cooling as well as heat, which again could improve the economics.

5.24 Nevertheless, the high capital outlay remains a barrier to the growth of CHP.

Lack of awareness of options

5.25 The majority of research in this area indicates a clear lack of awareness of the community generation options available on the part of developers, investors, local authorities and users alike. In most of the cases where community generation has been implemented, it has been the result of action taken by determined individuals who have taken time to learn about the options available and then make community generation happen.

5.26 As previously explained, CHP is most cost effective where the heat from the system is fully utilised. For CHP to be a viable option in any new development, a system ideally incorporating a variety of customers with different energy demands is likely to be required to ensure a steady, economically beneficial heat load. More widespread availability of heat maps (maps that indicate local heat load, and thus suitability of locations for e.g. CHP schemes) could ensure more of the cost-effective opportunities are exploited.

Planning

5.27 There are no CHP-specific planning issues. However, the initial burden of obtaining planning consent for a CHP plant, compared to other solutions (such as buying electricity from the grid and generating heat from an on-site boiler), adds time delays and risk to a CHP development.

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36 *Renewable Heat and Heat from Combined Heat and Power Plants'* – Study and Analysis, by Future Energy Solutions.

37 *UK Potential for Community Heating with Combined Heat and Power*, prepared for the Carbon Trust, Buildings Research Establishment, February 2003.

Licensing issues

5.28 The generic issues of licensing were raised in Chapter 2. Industrial CHP schemes can fall either side of the generation licence threshold. If a scheme has to be licensed it must enter a number of standard industry agreements and a contractual relationship with National Grid Electricity Transmission (NGET). In particular, it requires a generator to participate in the trading arrangements under the Balancing and Settlement Code.

5.29 Commercial/community level CHP and smaller industrial CHP schemes usually fall into the unlicensed category. The associated burden of balancing and settlement is removed and projects, in theory, have access to embedded benefits, subject to contracting with an energy supplier to purchase their electricity (the smaller the level of export the harder this becomes). At the smaller end of community schemes, operators begin to face similar barriers to selling their surplus electricity as microgenerators.

Arrangements for grid connection

5.30 CHP plants are treated like other forms of distributed generation with regard to grid connection. The relevant issues are described in Chapter 2.

What incentives are currently in place?

Installation and operational

5.31 To help address the upfront costs of installation, CHP plants are eligible for tax concessions through Enhanced Capital Allowances. To help enhance the financial benefits once operational, CHP power generation plant and machinery are exempt from Business Rates and there is an exemption from the Climate Change Levy on fuel inputs and electricity outputs for Good Quality CHP.[38] There is also a provision within Climate Change Agreements to provide an incentive for emissions reductions. Community CHP schemes can apply for grants from the Community Energy Scheme.[39]

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38 Broadly, to be certified as 'Good Quality' CHP, a CHP scheme must have a QI (Quality Index) of 100 and an electricity efficiency of at least 20%. The way in which QI are calculated, and more information on becoming Good Quality, can be found at www.chpqa.com

39 The Government's Community Energy Programme was launched in January 2002. The Programme had £50 million of capital funding available over two years for Local Authorities, Registered Social Landlords, Hospitals, Universities and other public sector organisations for the refurbishment of existing and installation of new community heating schemes. The Programme is jointly managed by the Energy Saving Trust and The Carbon Trust on behalf of Defra and welcomes grant applications from England, Wales, Scotland and Northern Ireland. In December 2004, Defra announced an extra £10m to extend the Community Energy programme to 31st March 2007.

5.32 In Phase II of the EU Emissions Trading Scheme (EU ETS), the UK has introduced a separate Good Quality (GQ) CHP sector to ensure consistent treatment of CHP installations. A portion of the Phase II new entrants reserve has been ring-fenced for use by GQ CHP new entrants. This set-aside is primarily funded by the CHP sector, but also receives a contribution from the other Phase II sectors. The UK has a target to increase the installed capacity of GQ CHP, as an energy-efficient technology, and in order to incentivise its installation GQ CHP new entrants will receive a higher level of allocation than other forms of new entrant in the scheme.

5.33 Also, eligibility for Renewable Obligation Certificates will be extended to include mixed waste plants that use Good Quality CHP.

Strategic encouragement

5.34 Higher awareness of the importance of energy efficiency has raised the profile of CHP schemes such that active consideration of their adoption is now encouraged in planning and other guidance. These include: the recent review of procedures on power station consent applications to ensure full consideration of CHP which will result in revised guidance being produced early in 2007; Building Regulations; low carbon housing measures; and the adoption of a 15% target for Government Departments to use CHP-generated electricity.

5.35 Ofgem and the DTI have led a number of projects to make grid connection easier for CHP and work is continuing in this area via an active industry-wide forum, the Electricity Networks Strategy Group.

What might we learn from international experience?

5.36 The centralised electricity generation model dominates energy markets in western economies, with the scale of development of distributed generation varying from country to country. However, Denmark and Netherlands are notable exceptions and have both taken steps to encourage a greater use of distributed electricity and heat generation.

5.37 We summarise in the case study below the main steps that these countries have taken to encourage and require growth in distributed energy. In Denmark 60% of homes are supplied by district heating, which has been achieved through Government regulation obliging suppliers to build power stations to supply district heating and requiring buildings to connect to these systems. In the Netherlands, 52% of electricity generation comes from the use of CHP in the industrial, residential and commercial sectors. This has been achieved through a combination of policies such as tax exemptions and favourable market trading arrangements.

Case study: Experiences of Distributed Generation in Denmark and the Netherlands

Although the benefits of district heating in Denmark were recognised locally in the early part of the 20th century, it was the oil crisis of 1973, when 94% of the country's energy needs were being met by imported fuel, which provided a catalyst for growth of the sector.

The Danish Government passed two key pieces of legislation to improve security of supply. The Electricity Supply Act of 1976 obliged the electricity utilities to build power stations in areas where district heating could be used. The Heat Supply Act 1979 effectively prohibited the use of electricity for heating except in rural areas that could not be served either by district heating or natural gas and enabled local authorities (through a heat planning programme) to decide whether gas or district heating should be used in specific areas and to require buildings to connect to district heating.

The heat-planning programme in particular has resulted in a much wider use of district heating, which has grown from 10% in 1975 to 60% of homes in 2004 being supplied by district heating. This has also reduced levels of fuel use for space heating requirements, which, in 2003, was 50% of the 1973 level. The current fuel sources for district heating are: natural gas 29%; waste 24%; coal 23%; biomass 18%; oil 7%.

Another factor, which has contributed to the expansion of district heating in Denmark, is the already established Danish culture of co-operative ownership (e.g. housing and agricultural co-operatives), particularly in rural areas. This trend is reflected in the ownership of district heating systems. Around 85% of district heating companies are consumer-owned with around 34% of heat sales. Municipalities own the remainder and are responsible for 66% of heat sales.

In the Netherlands, only about 3% of homes are served by district heating. CHP, which accounts for 52% of electricity generation, is used in industry, horticulture, apartments, nursing homes, swimming pools and hospitals. Most schemes use natural gas but biomass is increasingly used in newer schemes.

CHP has grown substantially in the Netherlands since the 1980s through the introduction of subsidies, tax advantages and regulatory preferences that recognise its potential contribution to reducing CO_2 emissions. These have included

- investment subsidies and tax deductions, particularly for small scale CHP and biomass CHP

- exemptions from, or reductions in, energy and environmental taxes for CHP and renewable energy schemes

- lower charges on grid connection and system use

- modifications to the electricity trading system, including more favourable terms for generators selling surplus electricity back to the grid

Other factors have also been important. High heat load demands in industry, agriculture and horticulture make CHP a particularly cost-effective energy source. Industry considers CHP a cost-effective tool enabling them to deliver on the CO_2 reduction commitments agreed with the Government. Finally, controls on the development of large scale generation combined with the relaxing of market rules to permit large users of energy to build their own CHP plants or import electricity from elsewhere have meant that energy distributors or suppliers have started to offer CHP to customers, providing financing where necessary.

As we have already mentioned, the UK has a market-based approach for energy policy. The Government sets the overall economic and market framework, and companies make investments in power stations, networks and other energy infrastructure within that framework. This is designed to ensure the most efficient outcome for energy users and the economy. There will inevitably be lessons we can learn from the approaches taken by our international counterparts. However, we will need to bear in mind the different market and institutional set ups operating in different countries in learning any lessons and looking to apply them in the UK market. For example, Denmark has taken a strongly interventionist approach in driving the development of distributed energy. Any benefits that accrue in terms of increased distributed generation from the types of interventions that Denmark and Netherlands have implemented would clearly need to be weighed against the increased costs incurred by consumers and tax payers as a result.

Questions:

9. Estimates of the cost-effective potential for CHP, both industrial and community or commercial CHP, vary greatly. We would welcome further views, supported by evidence, on its realistic potential and the practical constraints to its development in each of the sectors. Considering community and commercial CHP, we would welcome ideas both on the feasibility of retrofitting CHP to existing properties, and whether there are any particular barriers to incorporating CHP in new developments.

10. What more could be done to make CHP more cost competitive? For example, are there more innovative ways of linking up heat demands for CHP schemes to ensure that any surplus heat is used effectively?

11. Research indicates that the initial capital outlay is a key barrier to the growth of community and commercial CHP because the returns on investment are much less certain compared to larger energy projects. However, one study suggests that if the high start up costs can be managed, a network will grow, adding customers and becoming economic over time. What do you see as the primary barriers to the take up of community/ commercial CHP? If this market grows, would new regulatory measures be required, to protect consumers who might effectively be locked into such projects for their heating needs?

12. A number of incentives are already in place to support community/commercial CHP. What more could the Government can do to encourage such schemes, for example through the planning system? What should the balance be between creating incentives on the one hand and communication or education initiatives to ensure that such schemes are seriously considered by those involved in planning, developing or upgrading buildings on the other?

13. Are there any lessons from the Netherlands or Denmark that could be applied to the different UK economic and social context, to increase beneficial take up of distributed generation?

Chapter 6: Renewable Heat Only Technologies

6.1 Heat accounts for over a third of our primary energy consumption. Cost-effective renewable heat solutions therefore have the potential to make significant contributions to our climate change goals. At present though, only about 1% of our heat is generated using renewable sources.

Current status

6.2 At a household level, the main renewable heat devices used are solar water heating, ground source heat pumps and biomass stoves and boilers.

Technology	Description	Approx cost	No of Installations
Ground source heat pumps	Transfer heat from the ground to provide space heating.	£6,500 – 9,500	546
Biomass boilers (pellets)	Usually burn wood pellets, wood chips and wood logs to create heat. Carbon neutral process.[40]	£1500 – £3000 (room heater) £5000 to heat small house	150
Solar water heating	Uses heat from sun to work alongside conventional water heater. Can meet around 50% of a household's hot water requirement	£2,000 – £4,500	78,470

Source: Energy Saving Trust, Microgeneration Strategy (2006)

6.3 In commercial settings the boilers would be multi-megawatt fully automatic systems burning chipped wood fuel. In total it is estimated that biomass (in the form of straw or wood products) contributes around 6.31 TWh per year to the heat market.

40 The CO_2 released when energy is generated from biomass is balanced by that absorbed during the fuel's production – a carbon neutral process.

6.4 According to recent energy statistics,[41] renewables used to generate heat are now only just over half the level they were in 1996. The decline is mainly due to tighter emissions controls on burning of biofuels and waste, although domestic and industrial use of wood and wood waste still provide the main contribution. The use of solar heating has increased by 165% in last 5 years and use of heating from biodegradable wastes has increase by 36% over the same period.

What is the growth potential and constraints?

6.5 Renewable heat, particularly biomass heat, could play a larger role in reducing carbon emissions. For example, the Energy Saving Trust estimates that, with appropriate support, biomass and ground source heat pumps could reduce domestic sector CO_2 emissions by 3%. A study carried out for the Biomass Task Force[42] suggests that biomass could provide 1.8% and 5.7% of the heat market by 2010 and 2020 respectively. The Carbon Trust estimates that biomass heat has the potential to deliver carbon savings of up to 5.6 million tonnes per annum.

6.6 Furthermore 4.42 million houses are not currently connected to the gas supply. Renewable heat could provide a low-carbon alternative for heating these homes.

What are the barriers to growth/take-up?

6.7 For many of the renewable heat technologies cost is still a key issue. In the residential sector, the upfront costs of purchase and installation are relatively high and, given current fossil fuel prices, they are only cost competitive when compared with electricity or LPG heating.

6.8 In commercial settings, expenditure on such systems is likely to be lower down the list of priorities within the user organisations who will prefer to use their capital for mainstream production investment. Consequently, for investments such as this, a very short payback period is required. This presents a major barrier to investment in new heat-generating systems, beyond the normal cycle of boiler replacement – once every 20 years.

6.9 On biomass a key barrier, identified in a number of recent studies, is the lack of a well-established supply chain: I.e. there is not adequate access to sufficient fuel processed economically to the right specification, and/or it is not available within a reasonable transport distance.

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41 http://www.dti.gov.uk/energy/statistics/publications/dukes/page29812.html

42 *'Renewable Heat and Heat from Combined Heat and Power Plants'* – Study and Analysis, by Future Energy Solutions.

6.10 Finally a number of studies suggest that the lack of a long term, sustained reward that recognises the low carbon benefits of renewable heat further disadvantages this sector.

Existing Government work in the context of heat

The Biomass Strategy

6.11 Work is now underway to develop a Biomass Strategy, which will create a focus for biomass policy across Whitehall. This is due to report in the middle of 2007.

6.12 The ultimate aim of the strategy is to develop an action plan for biomass in those areas of maximum UK advantage. The analysis is examining, amongst other things, the current status, market penetration, future potential (including innovation), and main barriers to biomass in the industrial, energy and transport sectors. The work will also consider the issues of reward for the carbon benefits of renewable heat. The strategy will build on recent work in this area including the Government Response to the Biomass Task Force.

Microgeneration Strategy and renewable heat

6.13 Several actions in the Microgeneration Strategy may have a positive effect on take up of renewable heat, primarily:

- £80m worth of capital grants to be allocated through the Low Carbon Buildings Programme
- The development of an accreditation scheme for microgeneration technologies and communications work to raise the profile of microgeneration, signposting consumers to reliable sources of information
- The development of a route map for each microgeneration technology, and taking action to address barriers where relevant
- Research looking at consumer behaviour on microgeneration and the drivers behind early adopter decisions

- An examination of ways to facilitate the installation of microgeneration equipment by clarifying the permitted development status of these new technologies and removing any unnecessary controls over them

- Work to ensure planning officers are appropriately informed about microgeneration options.

Cooling

6.14 This chapter has looked at distributed heat energy. But the demand for cooling energy is also becoming significant and is likely to increase as our society becomes more affluent.

6.15 There are opportunities for decentralised sources of renewable cooling. For example, in Amsterdam offices in the Zuidas district are cooled via a centralised system using cold water from an adjoining lake. And underground aquifiers can be used to reduce the overall energy requirement for temperature control by providing heating in the winter and cooling in the summer.

Question:

14. Work is already underway (e.g. the Microgeneration and Biomass Strategies in particular) to tackle the main barriers to renewable heat. Are there any significant barriers that are not being tackled by these strategies? If so, what further action does Government need to take?

Chapter 7: Encouraging Distributed Generation

7.1 Given the diversity of DG technologies it is important that action to support those that can contribute to carbon reduction is cross-cutting, and that local, regional and national action is joined up. This section sets out the different roles of different levels of government and the energy regulator, Ofgem.

The Roles of National Government and Ofgem

National Government

7.2 Government first of all has to ensure that it has, and maintains, a sound understanding of the opportunities, constraints and costs of delivering its energy objectives. This was the key objective of the Energy Review and the associated work programme that will culminate in a new Energy White Paper in 2007.

7.3 Government can also set strategic objectives and put in place measures to assist their successful delivery.

7.4 The recent Microgeneration Strategy[43] illustrates how Government can use its crosscutting influence to raise the profile of particular issues, bringing together the views of key stakeholders and engaging them in delivering change. The Strategy for Combined Heat and Power to 2010 (2004)[44] and more recently the analysis of distributed energy in the Energy Review[45] are other illustrations of the strategic role of Government in the area of distributed energy. The Biomass Strategy, planned for April 2007, will create a focus for biomass policy and action across Whitehall.

7.5 Government can also ensure that regulatory measures over which it has direct control are not causing unnecessary constraints and barriers to progress, e.g. planning. Removing planning barriers was a key focus of the 2006 Energy Review, and implementation of the review recommendations will affect all types of energy investments.

43 http://www.dti.gov.uk/energy/sources/sustainable/microgeneration/strategy/page27594.html
44 http://www.defra.gov.uk/environment/energy/chp/pdf/chp-strategy.pdf
45 http://www.dti.gov.uk/energy/review/page31995.html

7.6 There can be a case for Government to consider introducing market mechanisms or to provide fiscal or regulatory measures to encourage certain activities. The Government is introducing a number of measures aimed at promoting low carbon buildings, including the Code for Sustainable Homes, which will set the direction for further tightening of Building Regulations. The Government can also drive the market by its procurement policy, e.g. housing built with public money will be built to level 3 of the Code for Sustainable Homes. Fiscal incentives also exist that benefit some types of distributed energy. These include capital allowances, reduced VAT rates and Climate Change Levy exemptions.

7.7 As set out in the Energy Review Report, a key role for Government is to put in place a framework which, by placing a value on carbon, provides a financial incentive for businesses and households to minimise the climate change impact of their activities. Another example of action to tackle climate change will be set out in the forthcoming consultation on a new measure targeted at large non-energy intensive organisations, which lie outside the EU ETS and Climate Change agreements.

7.8 Government can also lead by example by adopting low-carbon energy solutions in its buildings and transport management policies. We aim to reduce carbon emissions from the central Government estate by 30% by 2020, relative to 1999/2000 levels.

7.9 Finally, national Government can also provide strategic direction to regional and local bodies. The housing and planning minister made it clear in a statement to Parliament in June 2006 that all planning authorities should include policies in their development plans that require a percentage of energy in new developments to come from on-site renewables, wherever viable. Later this year, we will also set out proposals that provide a framework to encourage all local authorities to take action on climate change in the Local Government White Paper.

Ofgem

7.10 Ofgem's powers and duties are provided for under the Gas Act 1986 and the Electricity Act 1989, as amended principally by the Utilities Act 2000, Competition Act 1998, Enterprise Act 2002 and Energy Act 2004.

7.11 Its principal objective is to protect the interests of present and future gas and electricity consumers, wherever appropriate by promoting effective competition. Where competitive markets are not achievable – the core gas and electricity transmission and distribution networks – it protects consumers by regulating the monopoly network businesses.

7.12 Ofgem must also have regard, amongst other things, to security of supply, energy efficiency, sustainability and the environment[46].

7.13 Ofgem has a direct impact on DG through its regulation of distribution and transmission licensees and an indirect impact through its regulation of the markets for gas and electricity.

Specific initiatives

7.14 In the most recent distribution price control[47], Ofgem recognised that a key challenge was to adapt the regulatory framework to accommodate the expected increase in distributed generation. This led to a number of policy developments:

- new incentives to encourage the distribution network operators to connect distributed generators, with a £/kW incentive and guaranteed cost recovery;
- new mechanisms to encourage innovation, both generally and specifically in generation connections;
- strengthening the losses incentive, which encourages DNOs to reduce losses from their system;
- changing the way distributed generators are charged for connection to, and use of, the system. Ofgem is pressing the distribution companies to develop charging models that reflect the benefits and costs of distributed generators.

7.15 Ofgem has also taken steps to provide increased flexibility to fund transmission investment – re-opening the previous transmission price control and proposing revenue drivers in the current review. Transmission reinforcement is needed to accommodate the significant renewable generation planned in Scotland, whether distribution or transmission connected.

7.16 Ofgem has taken an active lead in the debate on smart metering, which could be of benefit to smaller scale distributed generation.

7.17 Ofgem has proposed to remove the "28 day rule" (the requirement that suppliers should allow consumers to terminate supply contracts at 28 days notice), which was seen as a barrier to the development of energy services products.

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46 See Appendix 5 of Ofgem's Corporate Strategy and Plan 2006-2011 at http://www.ofgem.gov.uk/ofgem/about/planning-finance.jsp for full details of the Authority's powers and duties.
47 http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/9416_26504.pdf?wtfrom=/ofgem/work/index.jsp&section=/areasofwork/distpricecontrol

7.18 More generally, Ofgem has sought to improve the accessibility and transparency of market information. Distribution companies are now required to publish long-term development statements. Arrangements for access to ROCs have been improved. Contractual arrangements for use of the distribution system have been harmonised and more flexible governance introduced.

Joint Ofgem/DTI/Industry DG Initiatives

7.19 Ofgem has been active in addressing technical and regulatory barriers to distributed generation for several years. The prime example of this is its work with the DTI and industry stakeholders through the ENSG/DWG[48].

7.20 The DWG and its predecessors have overseen a significant number of projects to develop solutions and remove barriers to Distributed Generation. At present the DWG has four work programmes:

1. Horizon Scanning

2. Network Design for a Low-Carbon Economy

3. Enabling Active Network Management

4. Facilitating Small Scale Generation

Workstream 4 includes a project to develop fair export rewards for microgeneration.

Action at Local and Regional Levels

Regional Development Agencies (RDAs)

7.21 The primary role of the nine Regional Development Agencies is to act as strategic drivers of regional economic development in their region. Their strategic role is to mobilise the actions of key regional and sub-regional partners in the public and private sector and also in the voluntary and community sector to support the achievement of regional economic development priorities. Their total budget is around £2.2 billion per year.

7.22 One of the RDA statutory purposes is to contribute to the achievement of sustainable development in the UK, as measured, in part, by action on climate change. It is this remit that permits RDAs to invest or take forward action on distributed energy, if an economic case can be made. Each of the RDAs identifies areas for

48 http://www.ensg.gov.uk/

action on energy in their corporate plans. Generally speaking, these objectives are connected to improving energy efficiency, developing new energy technologies or developing renewable energy capabilities; all of which could serve distributed energy well. One example of an achievement in the area of renewable, but also distributed energy is the CIS Solar Tower whose development was supported by the North West Development Agency.

Manchester CIS Solar Tower – the largest solar project in the UK

The Solar Tower provides enough electricity per year to power 1,000 PCs for a year. The CIS Tower is set become Europe's largest vertical solar array, when all three sides of the 25 storey building's service tower are clad in energy-generating solar panels.

7,244 solar photovoltaic panels, designed to convert daylight into electricity, will create 180,000 units of renewable electricity each year – enough energy to make 9,000,000 cups of tea.

The ambitious £5.5m solar project, on what is currently the tallest office building in the UK outside London, is being supported by a £885,000 grant from the Northwest Regional Development Agency (NWDA) and a £175,000 grant from the DTI.

Gary Thomas, Head of Property and Facilities, came up with the idea for the groundbreaking solar project in 2000, and since then, staff across CFS have been working tenaciously with architects, regional authorities and technical specialists, to turn that vision into reality. Gary outlined the benefits, saying:

"With government grants, and green energy generation, the solar solution is cost effective, and helps build upon our socially responsible

brand image. It also meets the approval of heritage agencies, as the new installation will preserve the existing tiles in situ."

The 400ft high array of dark blue solar panels will work regardless of the weather. They will certainly stand out on the Manchester skyline, and may shortly become an eco tourist attraction.

Source: www.cis.co.uk/servlet/Satellite?cid=1116834043897&pagename=CoopBank/Page/tplBlank&c=Page

Local Authorities

7.23 There are a number of tools and levers that Local Authorities can use to stimulate the take up of distributed generation.

7.24 The most obvious lever available is through the local planning infrastructure. Through the Planning Policy Statement 22 (PPS 22), local authorities can set targets for on-site renewable energy in residential, commercial or industrial projects. An early pioneer in taking advantage of this provisions was the London Borough of Merton which stated in its Unitary Development Plan that all new non-residential development above a threshold of 1,000m^2 would be expected to incorporate renewable energy of at least 10% of predicted energy requirements.

7.25 During the passage of the Climate Change and Sustainable Energy Bill through Parliament earlier this year, the Minister for Housing and Planning undertook an urgent review of emerging local development plans to establish whether they properly reflected the above provision of PPS22. The review showed a strong take-up in new style plans of the PPS22 policy on use of on-site renewables in new developments.

7.26 Later this year DCLG will consult on the draft of a new Planning Policy Statement on climate change. This will set out how the Government expects participants in the planning process to work towards the reduction of carbon emissions in the location, siting and design of new development.

7.27 The Home Energy Conservation Act (HECA) commits Local Authorities to assist households in their area to reduce energy use and meet targets for reducing CO_2 emissions. Both of these objectives would be served by increased levels of distributed energy.

7.28 As owners of substantial estate – schools, housing, civic buildings – there is also a potential role for Local Authorities to ensure that those buildings are as efficient and low carbon as possible, and to exploit distributed energy wherever possible, through for example, the use of community heating or onsite renewable generation. Southampton City Council has taken the initiative with the development of the first geothermal energy and combined heat & power (CHP) district heating and chilling scheme in the UK. The system serves a range of residential and commercial customers in civic and privately owned buildings[49].

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49 www.southampton.gov.uk/environment/environmentandpollution/geothermal/thescheme.asp

7.29 Finally, through their power to promote well-being and their ongoing relationship with local residents, Local Authorities have the potential to contribute to awareness raising or communication of the DG options available and likely benefits, and to showcase good practice.

Questions:

15. How should Local Authorities and RDAs be further encouraged to play their part?

    a. is the best approach to focus on overall emission reductions, leaving them to make their own choices as to the means of achieving them,

    b. or should there be targets/encouragement specifically for DG?

16. Is there a need for better advice including case studies and lessons learned for Local Authorities and/or housing/commercial developers on distributed generation?

Annex A: List of Questions

As stated above, we would welcome views, evidence, facts and figures in relation to issues discussed and questions raised. However, if respondents also wish to provide evidence on issues that go beyond the specific questions, we will equally welcome these contributions. We would particularly welcome evidence to help us judge the casts and benefits of greater uptake of Distributed Generation.

1. The environmental benefits of DG are technology and application specific. If DG is to be further encouraged how can the best DG opportunities be identified and any unnecessary barriers be removed?

2. The licensing regime has developed in stages since 1990. Is there evidence that it is currently acting as an unnecessary barrier to DG? If so, what actions could be put in place to address this? In particular, there are a number of fixed transaction costs relating to connection, licensing and permissions, which could be said to disadvantage smaller projects. What more could be done to ensure that these costs are proportionate to the size of DG projects?

3. Are the incentives on DNOs sufficient to encourage them to connect smaller generators with minimum fuss and cost? While the connection and use of system arrangements managed by the distribution and transmission companies are well established, some still see them as a barrier to DG. Is there project-specific evidence of this? If so, we would welcome ideas that could help address such problems, while recognising the need for continued investment in the transmission and distribution systems. What actions should distribution and transmission companies take to facilitate DG?

4. Private networks are being increasingly presented as a way to help DG. Is this approach one that should be encouraged or is it a short-term expedient necessary to capture more value for DG? If private networks do expand, how best can customers connected to them be protected and competition preserved?

5. A number of possible options, largely concerning licensing and the terms of trade between distributed generators and the existing electricity market, have been suggested by various proponents of DG. We would therefore particularly welcome views on the costs and benefits (to different stakeholders) of the following options:

a) **Increasing the limits for distribution and/or supply licences, or introducing a simpler licence**[50]. How would consumers be protected, both in respect of competition and also more generally, including safety?

b) The Climate Change & Sustainable Energy Act has caused the industry to actively pursue the issue of **export reward for microgeneration**. Is there confidence that this will be successful and should this be extended to unlicensed generation that does not qualify as microgeneration under the Act? Do consultees have any other suggestions on how to increase the amount suppliers pay for exported electricity?

6. In view of the cost reductions in microgeneration that are likely to come into effect over time, what evidence is there that further incentives are required to encourage take up of such devices either by householders, communities or businesses?

7. Are there specific barriers to the development of renewable projects that connect to the distribution network? How could they be addressed?

8. Are there other approaches which could be taken to promote the connection of renewables projects of all sizes to the distribution system?

9. Estimates of the cost-effective potential for CHP, both industrial and community or commercial CHP, vary greatly. We would welcome further views, supported by evidence, on its realistic potential and the practical constraints to its development in each of the sectors. Considering community and commercial CHP, we would welcome ideas both on the feasibility of retrofitting CHP to existing properties, and whether there are any particular barriers to incorporating CHP in new developments.

10. What more could be done to make CHP more cost competitive? For example, are there more innovative ways of linking up heat demands for CHP schemes to ensure that any surplus heat is used effectively?

11. Research indicates that the initial capital outlay is a key barrier to the growth of community and commercial CHP because the returns on investment are much less certain compared to larger energy projects. However, one study suggests that if the high start up costs can be managed, a network will grow, adding customers

50 Simpler Distribution Licences have already been granted by Ofgem to independent Distribution Network Operators.

and becoming economic over time. What do you see as the primary barriers to the take up of community/commercial CHP? If this market grows, would new regulatory measures be required, to protect consumers who might effectively be locked into such projects for their heating needs?

12. A number of incentives are already in place to support community/commercial CHP. What more could the Government can do to encourage such schemes, for example through the planning system? What should the balance be between creating incentives on the one hand and communication or education initiatives to ensure that such schemes are seriously considered by those involved in planning, developing or upgrading buildings on the other?

13. Are there any lessons from the Netherlands or Denmark that could be applied to the different UK economic and social context, to increase beneficial take up of distributed generation?

14. Work is already underway (e.g. the Microgeneration and Biomass Strategies in particular) to tackle the main barriers to renewable heat. Are there any significant barriers that are not being tackled by these strategies? If so, what further action does Government need to take?

15. How should Local Authorities and RDAs be further encouraged to play their part?

a) is the best approach to focus on overall emission reductions, leaving them to make their own choices as to the means of achieving them,

b) or should there be targets/encouragement specifically for DG?

16. Is there a need for better advice including case studies and lessons learned for Local Authorities and/or housing/commercial developers on distributed generation?

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