CHAPTER 3

Heat and Distributed Generation

Most of the UK's electricity and more than two thirds of the UK's gas is supplied through a large nationwide grid. This centralised system has kept down costs through economies of scale and provided secure, cost-effective delivery of energy directly to our homes and businesses. As we seek to reduce the carbon emissions from the electricity and heat we use, it is increasingly clear that technological developments are opening up the possibility of a more decentralised low carbon energy system with local energy supply, ranging from household to community-scale, which could play an important part in our strategy.

3.1 Electricity and heat can be generated locally from renewable sources, making valuable carbon savings. Losses incurred in transmitting centrally-generated electricity to the point of use can be significantly reduced. The costs of transporting heat mean that many of the options for generating heat renewably have to be local. And even where fossil fuels are used, Combined Heat and Power (CHP) can, in the right setting, ensure that these fuels are used more efficiently by capturing and using heat and generating electricity in a single process. A more community-based energy system would also lead to greater individual awareness of energy and its implications for carbon emissions, driving a change in social attitudes and, in turn, greater energy efficiency[63]. The importance of Distributed Energy (DE), and the need for further action was recognised by the Trade and Industry Committee in its recent report[64].

3.2 This chapter:

- sets out the potential benefits of more power and heat being produced locally;
- describes what the Government is already doing to realise this potential;
- sets out the work we are doing to determine a strategy for decarbonising heat;
- summarises the key proposals from the joint DTI/Ofgem Review of Distributed Generation; and
- describes how regional and local activity can help drive progress towards more locally-produced heat and power.

63 Research by the Sustainable Development Commission and the National Consumer Council shows that people moving into homes with built-in renewable energy technologies report far greater awareness of what they can do to reduce their climate impact, and their energy use. Sustainable Consumption Roundtable, May 2006: *I Will If You Will* – http://www.ncc.org.uk/responsibleconsumption/iwill-summary.pdf

64 House of Commons Trade and Industry Select Committee: *Local Energy – Turning Customers Into Producers* First Report of Session 2006-7.

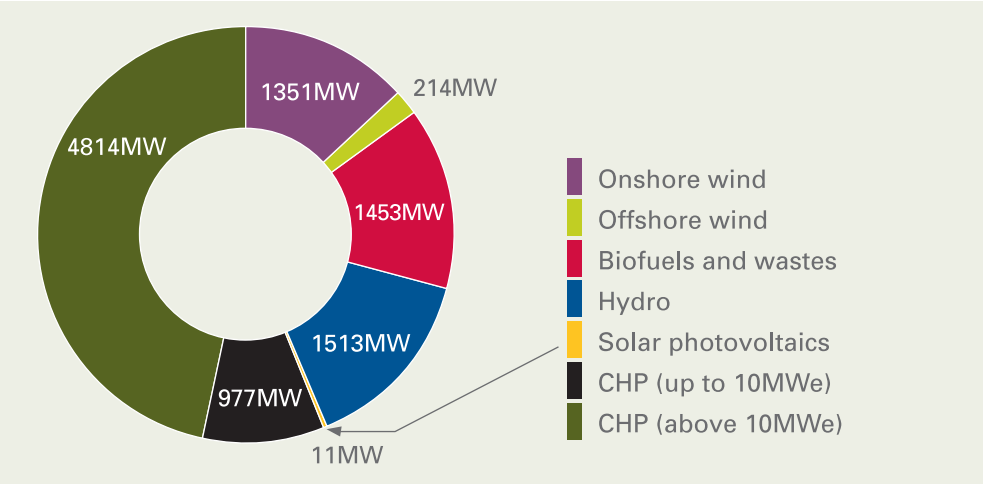
3.3 These measures will help to provide a basis on which decentralised energy can continue to grow alongside investment in the existing, predominantly centralised system.

3.4 The Devolved Administrations have various responsibilities in relation to the matters set out in this chapter. In line with the devolution settlements in Scotland, Wales and Northern Ireland, all proposals in this chapter which touch on devolved matters will be taken forward in accordance with the principles set out in the Memorandum of Understanding.

Distributed Energy (DE): the potential

3.5 The distributed generation of electricity and production of heat are collectively referred to as distributed energy. DE is not all low carbon. However, in this chapter we use the term DE to cover energy that is both local and low carbon. In practice this means some renewable energy, and CHP. DE currently accounts for less than 10% of UK energy supply. The Government wants to provide opportunities for DE to grow by removing barriers and putting the right incentives in place to promote DE where it proves to be cost-effective.

FIGURE 3.1 CURRENT CAPACITY OF CHP AND RENEWABLE GENERATION



Source: DTI, DUKES 2006
Note: Data is not separately collected for Distributed Generation, so this chart covers all CHP and renewable generation. In practice some of the CHP will be connected to the transmission network and some of the renewable generation (particularly wind) will generate electricity that is not used locally.

3.6 In many circumstances, heat and power sourced from DE technologies are more expensive than from the national gas and electricity networks. But, as the value of carbon is increasingly factored in to energy generation costs, and some of the DE technologies become more established, DE's relative costs are expected to improve.

3.7 We worked with WADE[65] to model the costs and benefits to the UK of a greater take-up of Distributed Generation (DG)[66] technologies over the coming twenty years. Modelling of this type is subject to considerable uncertainty.

65 The World Alliance for Decentralized Energy.
66 A definition of DG is provided in paragraph 3.46

It is necessary to develop possible scenarios for the likely future take-up of the different DG technologies and to project costs for each of these technologies over time. On the basis of the scenarios that we have modelled, the relative costs of DG depend upon the balance of a number of factors. On the one hand, fuel costs and carbon emissions are typically lower with an increased penetration of DG. However, CHP is an important component of any feasible DG scenario and offers only limited reductions in fuel use and carbon emissions relative to the most modern gas-fired generation. On the other hand, plant capital costs are typically lower for centralised generation. It is generally believed that transmission and distribution infrastructure costs would be lower with increased DG. However, the location-specific nature of these costs means that it has not been possible to model this effectively.

3.8 Overall our findings suggest that the costs to the UK of some DG technologies may be competitive with the costs of centralised technologies, but that overall system costs are likely to be lower if we retain a framework where DG is a complement rather than an alternative to centralised generation. However, this work is only a starting point and cannot give conclusive results about the relative costs of DG. We will carry out further analysis that incorporates the heat and electricity aspects of a decentralised energy system. Such a model is required to enable more robust conclusions about the relative costs of DG to be drawn.

3.9 The market is best placed to decide which technologies are most effective in supplying the UK's energy whilst also meeting our carbon reduction goals. It is for the Government to ensure that the opportunities for DE are opened up so that it is a viable option for the market to consider. DE is the current main option for increasing the use of renewables for heat generation.

3.10 Our policies on DE will also play a part in the UK's contribution to the EU's climate change and energy policy. In March 2007, the European Council committed the EU to a binding target of reducing greenhouse gas emissions by 20% by 2020 and by 30% in the context of international action. The agreement commits the EU, amongst other things, to a binding target of a 20% share of renewable energies in overall EU consumption by 2020. This applies to heat and electricity, where DE has a key role to play, as well as transport. The Commission has been asked to bring forward detailed proposals for each Member State's contribution to the overall EU renewables target. After a decision has been reached, and each Member State has agreed its contribution, we will bring forward appropriate policies to deliver the UK's share.

3.11 Whilst DE has the potential to reduce carbon emissions, and help security of energy supplies by diversifying the UK's sources of energy, significant growth of DE supply would represent a considerable change from the status quo. The current market and regulatory structures have been designed primarily to meet the needs of large, transmission-connected generators. There are some technical constraints on making DE compatible with the grid, as well as planning issues and other barriers such as upfront costs, and a lack of information about the possibilities available.

TABLE 3.1: EXAMPLES OF LOW CARBON DISTRIBUTED ENERGY TECHNOLOGIES

Technology	Description	Commentary
Total DG	All generating technologies connected to distribution systems	The Energy Networks Association (ENA) reports the total generating capacity connected to distribution networks[67]. At the end of 2006 the total was 12.7GW. However, this does include conventional generators (e.g. small Combined Cycle Gas Turbines (CCGTs) as well as renewable generation
Distributed Heat Technologies		
Solar water heating	Uses the heat of the sun to produce hot water	The DTI's Microgeneration Strategy[68] reported almost 80,000 UK installations
Heat pumps	Uses the warmth stored in the ground or air, via a cycle similar to that used in refrigerators, to heat water for space heating	The Microgeneration Strategy reported over 500 UK installations
Biomass	Small-scale biomass installations from ~10kW to ~2MW that provide space and water heating by combustion of wood, energy crops or waste	The Microgeneration Strategy reported some 150 pellet boiler installations – likely to be a conservative figure
Distributed Electricity Generation Technologies		
Solar Photovoltaics (PV)	Panels, often roof-mounted, generate electricity from daylight (not just direct sunlight)	The Microgeneration Strategy reported some 1300 UK installations
Wind	Large wind turbines that convert wind energy directly to electricity	The BWEA[69] reports 140 operational projects (onshore and offshore) having a total capacity of 2065MW

67 http://www.energynetworks.org/spring/engineering/pdfs/DGSG/Connection_Activity_DNOs_Dec2006.pdf
68 http://www.dti.gov.uk/energy/sources/sustainable/microgeneration/strategy/page27594.html
69 http://www.bwea.com/ukwed/index.asp

Micro-wind (<100kW)	Small wind turbines generate electricity – can now be roof-mounted as well as attached to tall masts	It is estimated[70] that there are over 20,000 small wind turbines with a total capacity of 7MW
Micro-hydro	Devices that capture the power of flowing water and convert it to electricity	The Microgeneration Strategy reported some 90 installations
Biomass /waste	Installations range from landfill gas generation stations to large power only facilities approaching 40MW	DUKES 2006 reports that total capacity is approaching 1400MW. See Biomass Strategy for map of installations
Combined Heat & Power Technologies		
Biomass /waste	Installations range from 100kW biomass CHP to ~ 85MWth/20MWe	See Biomass Strategy for map of installations
Micro-CHP, and CHP up to 1MWe	Small devices, usually gas-fired, that produce electricity and capture the waste heat produced as a by-product. CHP used on this scale tends to be for heat and power for a single house or on a community or commercial scale (i.e. a housing estate, or office block)	DUKES 2006 reports 1263 installations having a combined capacity of 206 MWe
CHP from 1MWe – 10MWe	CHP on this scale tends to be large community projects or small industrial applications	DUKES 2006 reports 196 installations having a combined capacity of 771 MWe
CHP over 10MWe	CHP on this scale tends to be large gas-turbine industrial applications that require a substantial heat load on a continuous basis	DUKES 2006 reports 75 installations having a combined capacity of 4814 MWe

70 By AEA Energy and Environment: see http://www.restats.org.uk

3.12 The DE challenge is therefore to make sure that new market opportunities are identified, that the market and regulatory environment is "user-friendly" for smaller participants, that potential barriers are identified and addressed, and that genuine market failures are resolved.

3.13 The Foresight Sustainable Energy Management and the Built Environment project, also referred to in chapter 2, will consider the long-term impacts of more decentralised ways of generating low carbon heat and electricity, and their interaction with current energy systems. This will include looking at the long-term potential and challenges of distributed generation, and its role and relationship with centralised generation. The work will examine the critical uncertainties, map possible future directions and test the policy implications, and will report in summer 2008.

3.14 There are a number of measures we can take in the short-term, as well as a range of existing policies, which will help support the take up of DE. The energy efficiency policies set out in chapter 2 will also drive investment in DE as, increasingly, take-up of the most cost-effective energy saving measures, such as insulation, will have been exhausted.

Existing and recent Government measures

3.15 Existing policies which will stimulate the take-up of DE include particularly:
- the zero carbon new homes policy;
- support for renewables, microgeneration and CHP; and
- public sector leadership.

Zero carbon new homes

3.16 The Government's drive towards zero carbon homes will increase demand for DE. In *Building a Greener Future*[71] the Government proposed that all new homes in England should be zero carbon from 2016. A firm decision on this timetable will be announced later this year. By 2016, if we meet our housing supply ambitions, there will be an additional 200,000 homes every year, the majority of which will be newly-built, zero carbon homes. This will include homes which will use DE sources of energy.

Support for renewables, microgeneration and CHP

3.17 Government has also taken a number of steps to promote some of the specific DE technologies. The proposed changes to the Renewables Obligation, set out in chapter 5, will boost support for renewable Combined Heat and Power (CHP), including the recovery of energy from waste and some types of microgeneration technologies. Defra's Waste Strategy, published in May 2007, sets out our broader policy on improving the recovery of energy from waste, which will also boost DE.

3.18 A number of incentives are available for people looking to invest in microgeneration technologies for their home, school, community, or business. They are available under:
- Warm Front Programme (and its equivalents in the Devolved Administrations);

71 http://www.communities.gov.uk/pub/173/BuildingaGreenerFutureTowardsZeroCarbonDevelopment_id1505173.pdf

- Low Carbon Buildings Programme; and
- Enhanced Capital Allowance Scheme.

3.19 The Low Carbon Buildings Programme will provide £86 million of grant funding for microgeneration installations in homes, communities, public and private sectors to 2009. This includes the additional £6 million[72] announced by the Chancellor in Budget 07 to fund householder installations only as a final tranche of funding for Phase One of the programme. Following this new funding and the high demand for the householder stream of the programme we have redesigned it – details can be found at www.lowcarbonbuildings.co.uk

3.20 Fiscal incentives are also important. A reduced VAT level of 5% is applicable to the installation of most microgeneration technologies. The list of applicable technologies was lengthened with the addition of ground-source heat pumps, air-source heat pumps and micro-CHP in the 2004 and 2005 Budgets. As announced in the December 2006 Pre-Budget Report, legislation in the Finance Bill 2007 will ensure that, where private householders install microgeneration technology in their home for the purpose of generating power for their personal use, any payments they receive from the sale of surplus power or Renewable Obligation Certificates to an energy company are not subject to income tax.

3.21 CHP benefits from a range of existing policies, including exemption from the Climate Change Levy and Business Rates. In addition, incentives for CHP have been improved by fully rewarding its carbon saving in the EU Emissions Trading Scheme (ETS) Phase II, which begins on 1 January 2008.

Public sector leadership

3.22 The public sector has a role to play in promoting DE. The Government has committed to carbon emission reduction targets[73] and its office estate becoming carbon-neutral by 2012. We will publish a report on ways in which local authorities can contribute to our climate change objectives, including by increasing levels of DE, by August 2007.

3.23 The Carbon Trust has allocated £10 million to Partnership for Renewables which provides support for public sector organisations wanting to invest in DE. It plans to have 500MW of renewable energy projects, primarily 3-5MW wind turbine projects, constructed or under development within the next five years by attracting private sector investment of up to half a billion pounds.[74]

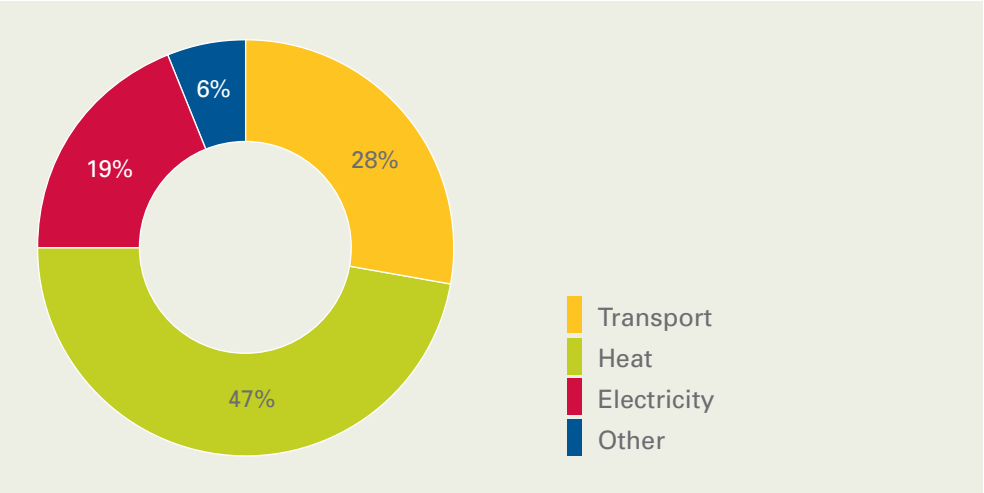
Heat

3.24 Decarbonising heat, by more DE and other means, is important as heat accounts for around 47% of the UK's total carbon emissions (including emissions from electrical heating) – equivalent to 71 million tonnes of carbon (MtC) in 2005.[75] Generating heat uses around half of the UK's total energy consumption by end-use. Nearly three quarters of that energy is used for

72 This £6 million takes the total level of funding available to householders to £18 million.
73 Commitments announced in June 2006 (and repeated in the March 2006 Sustainable Procurement Action Plan) aim to reduce carbon emissions from Government offices by 30% by 2020, relative to 1999/2000 levels.
74 www.carbontrust.co.uk/commercial/enterprises/pfr.htm
75 UK NAEI (2005).

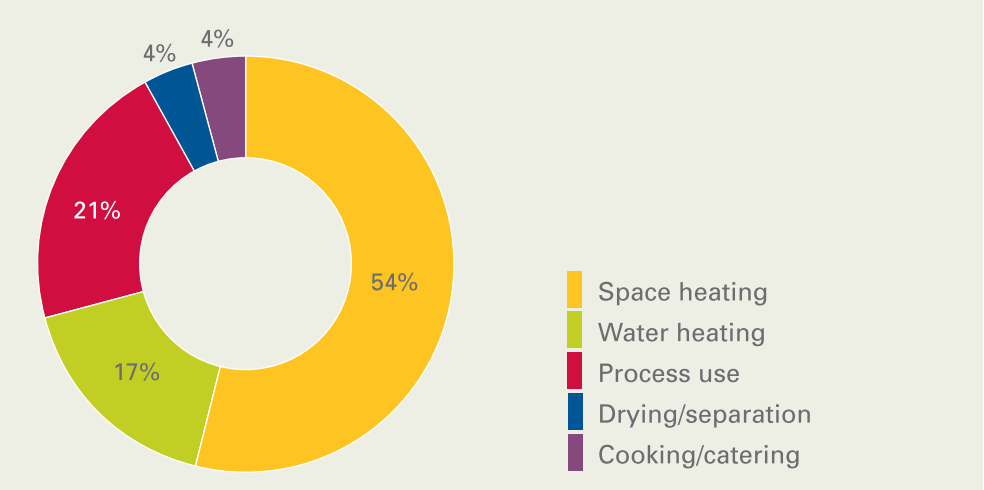
space and water heating, primarily in the domestic sector and to a lesser extent in the commercial and public sectors. The remainder is used by industry as an input to a wide range of processes; a small proportion is also used for cooking. The vast majority of heat demand in the domestic, commercial and public sectors is met by gas supplied through the gas distribution network;[76] industry tends to use a mix of heating fuels. Gas can be converted to useful heat at over 90% efficiency in modern condensing boilers.

FIGURE 3.3 CARBON DIOXIDE EMISSIONS BY SECTOR, 2005



Source: Defra
Note 1: Heat emissions comprise 35% direct emissions from heat and 12% indirect emissions from electricity used to generate heat.
Note 2: other emissions include those from non-fuel combustion, agricultural and industrial emissions which do not relate to heat and electricity.

FIGURE 3.4 HOW HEAT FOR ENERGY IS USED



Source: DTI

76 Some 77% of UK homes have gas central heating (2004 figures).

3.25 There are three options for reducing emissions from heating:

- reduce the absolute demand for heating by improving energy efficiency. The largest and most cost-effective carbon savings in the short-term will therefore come through improved energy efficiency, supported by the energy saving measures in chapter 2;
- make more use of CHP, which is covered later in this chapter; and
- increase the proportion of heat generated through less carbon-intensive technologies (see detail below on renewable heat and biomass), including producing heat from low-carbon electricity.

3.26 DE has the potential to reduce the carbon content of both electricity and heat. However, there are some key differences between heat and electricity which dictate different policy approaches. For example:

- heat has to be produced relatively close to its point of use (in contrast with electricity which can travel great distances without substantial loss);
- renewable heat technology currently requires a distributed approach, whereas large scale renewables are already an option for reducing the carbon content of electricity;
- affordable heat is a critical part of the fuel poverty agenda; and
- electricity cannot easily be stored[77] whilst heat can.

3.27 Many current policies contribute to reducing carbon dioxide emissions from heat – for example the EU ETS, the Climate Change Levy, tax incentives for CHP and the Energy Efficiency Commitment[78] (EEC) all contribute to reduced carbon emissions from heat. In addition, policies such as the Warm Front programme to tackle fuel poverty helps to reduce emissions. However, the Government recognises the value of considering the heat sector in a holistic and focussed way and exploring the scope for further reductions in carbon emissions from this sector.

The Government will conduct further work into the policy options available to reduce the carbon impact of heat and its use in order to determine a strategy for heat. The work will look at the full range of policy options, including the range of existing policy mechanisms such as the EU ETS.

Renewable heat

3.28 Renewable heat is a potentially important means of reducing carbon emissions. The Government is committed, through the Climate Change and Sustainable Energy Act 2006, to promote the use of renewable heat. Renewable heat will also need to play its part in contributing to the UK's share of the EU renewable energy targets. Renewable heat is already competitive in some circumstances and benefits from capital grant support; it is also incentivised through EU ETS, in some cases.[79]

77 While electricity storage technologies are available, costs and technical constraints mean they are not widely used. Further developments may make storage a viable power system option in the future.

78 The new name for EEC Phase 3 will be the Carbon Emission Reduction Target (CERT)

79 Capital grant support for renewable heat and renewable CHP has been provided through the DTI/Big Lottery Fund Bioenergy Capital Grants Scheme and Clear Skies Initiative. There is currently support available through the Low Carbon Buildings Programme, and a new round of the Bioenergy Capital Grants Scheme, funded by Defra, has recently closed.

3.29 However, the renewable heat market has been slow to develop,[80] and currently less than 1% of UK heat demand is supplied from renewable sources. A 2005 report by Future Energy Solutions[81] said that, by 2010, 1.8% of UK heat demand – rising to 5.7% by 2020 – could be produced from the range of renewable heat sources. The initial results of a draft Ernst & Young study, commissioned by DTI and Defra, indicate that renewable heat could provide significant carbon savings. They also find that various market failures exist, including the limited application and effectiveness of carbon pricing in this sector, which have slowed its development. This analysis is at a very early stage. The Government will continue to develop its thinking in this area.

3.30 The Government-appointed Biomass Taskforce, in its October 2005 report,[82] indicated that the proportion of UK heat demand supplied from renewable sources could rise to 3% by 2010 and 7% by 2015, provided a range of barriers were addressed, including:

- the lack of a carbon price;
- low investor confidence;
- lack of awareness in the construction and supply sectors; and
- fragmented supply chains.

3.31 In its response to the Biomass Task Force, the Government committed to producing a Biomass Strategy,[83] which is published alongside this White Paper. It brings together current Government policies on biomass and is summarised in Box 3.1. It provides a coherent framework for the development of biomass.

BOX 3.1 SUMMARY OF THE BIOMASS STRATEGY

The strategy identifies significant potential to increase the domestic supply of biomass, through the more efficient utilisation of agricultural land, unmanaged woodland and waste. Our analysis shows a hierarchy of use in terms of cost of carbon saving, with biomass heating as the most cost efficient use for energy. The Strategy is intended to realise a major expansion in the supply and use of biomass by:

- providing targeted support in key areas such as expansion of energy crops and biomass heat installations, through direct grants and other measures such as the schools building programme;
- sourcing an additional 1 million tonnes of wood from unmanaged woodlands;
- increasing land used for production of perennial energy crops by some 350,000 hectares;
- increasing the utilisation of organic waste materials; and
- stimulating technology development.

80 The main available renewable heat options are distributed: microgeneration (solar thermal, heat pumps) and biomass (still expensive on a small scale) for residential use, and larger biomass for commercial and industrial installations.
81 http://www.dti.gov.uk/energy/sources/renewables/policy/renewable-heat/page15963.html
82 http://www.defra.gov.uk/farm/crops/industrial/energy/biomass-taskforce/pdf/btf-finalreport.pdf
83 http://www.defra.gov.uk/environment/climatechange/index.htm

Combined Heat and Power (CHP)

3.32 CHP is a potentially carbon-efficient technology which captures the heat generated as a by-product in electricity generation. Typically the process is fired by fossil fuels, though biomass CHP is growing in importance. CHP installations vary in size from micro-CHP installations, an alternative to the domestic boiler, through community schemes generating heat for housing developments and office buildings, to industrial sites equal in size to a medium-sized power station.

3.33 The carbon savings from generating electricity in CHP installations, and making use of the heat for either heating or cooling processes, depend on many site-specific factors, including the size of the scheme and the nature of its heat load. Indicative carbon efficiencies are illustrated in Table 3.2.

TABLE 3.2: CARBON SAVINGS OFFERED BY GOOD QUALITY CHP[84] RELATIVE TO THE SEPARATE PRODUCTION OF HEAT AND POWER FROM GAS[85]

Size of installation	up to 1 MWe	1-50 MWe	over 50 MWe
Efficiency savings	18-30%	7-21%	10-23%

3.34 The more consistent the demand for heat throughout the day, the more economic CHP can be. Hence the best sites for CHP are industrial sites in continual operation. Community-scale projects are most effective where a range of different heat and cooling demands (residential flats, office blocks, municipal buildings) are aggregated within the system to ensure broadly constant overall demand. However, the costs of generating electricity using CHP are often higher than for standard centralised generation, even though there is a financial return for the heat that can be sold.

3.35 Therefore, in recognition of the carbon savings Good Quality CHP offers, Government has introduced a number of support measures to encourage development of such schemes, including:

- exemption from the Climate Change Levy;
- Business Rates exemption;
- full reward for the carbon saving of CHP under the allocations for EU ETS Phase II, which will inform our thinking for Phase III;
- Enhanced Capital Allowances for power stations and equipment; and
- Renewable Obligation Certificate (ROC) eligibility for the biomass element of fuel used in energy from waste plants that utilise CHP, as explained in chapter 5.

84 Good Quality CHP denotes those schemes that meet the energy efficiency criteria prescribed by the UK's CHP Quality Assurance Programme (CHPQA). Such schemes are entitled to certain financial benefits. Further information on the programme can be found at www.chpqa.com.

85 Source: data from the CHPQA programme on a "best available technology" basis. The range reflects the use of a range of technology types at the margins of the size boundaries and the use of alternative counterfactuals for the efficiency of a gas plant.

3.36 In addition to these measures to make CHP more financially attractive, Government has taken steps to increase awareness of the opportunities for CHP amongst users of heat. Since the publication of the Energy Review Report, DTI has published revised guidance for power station developers which includes industrial heat maps. We will work to develop those heat maps with Regional Development Agencies (RDAs) and local authorities.

3.37 Defra will work with local authorities on guidance to ensure that anyone replacing a mid-sized furnace as part of a boiler plant (over 400kW) is aware of the potential for CHP. In addition, the proposals announced here on export reward, market and licensing arrangements and connections will potentially improve the economics of CHP schemes.

Microgeneration Strategy

3.38 In March 2006, Government published the Microgeneration Strategy: *Our Energy Challenge: Power from the People*.[86] It aims to create conditions under which microgeneration becomes a viable source of energy generation for homes, communities and businesses. Actions to address the constraints on the uptake of microgeneration are summarised below.

Cost constraints

3.39 The costs of installing microgeneration technologies are relatively high. The aim of the Government's £86 million Low Carbon Buildings Programme, launched in 2006, is to demonstrate the potential of microgeneration technologies, and also stimulate the market by demonstrating their potential and providing grants to householders, public, not for profit and commercial organisations across the UK to cover installation cost. The aim of the programme is to drive up demand for microgeneration which in turn will lead to price reductions, making it more accessible across the board.

3.40 Further financial incentives include:

- rewarding the export of excess electricity, as discussed later in this chapter
- benefits associated with Renewable Obligation Certificates (ROCs), Climate Change Renewables Levy Exemption Certificates (LECs) and Renewable Energy Guarantees of Origin (REGOs). Clear guidance outlining the benefits of each and explaining how to obtain these will be published shortly. A typical domestic microgenerator would generate renewable electricity with a ROC value of around £40 at current market prices. However, as the Renewable Obligation was designed to support large-scale renewable generation, it has been difficult for householders to access this value. The changes to the Renewable Obligation introduced in April 2007, which are set out in chapter 5, are designed to remedy this.

86 http://www.dti.gov.uk/energy/sources/sustainable/microgeneration/strategy/page27594.html

Technical constraints

3.41 We are addressing a number of technical constraints to make it easier for microgenerators to connect to the grid. The smallest[87] microgenerators no longer need to obtain permission to connect to the network, and new wiring regulations will be published in January 2008 that will make it easier to connect microgenerators into existing electrical installations. DTI is working in partnership with Ofgem, energy supply companies and Distribution Network Operators (DNOs)[88] to ensure that network and market systems are able to cope with growing demand for microgeneration.

3.42 As discussed in chapter 2, smart metering is key to the overall development of the energy market and in particular allowing more sophisticated import and export tariffs to be introduced. It is important that smart meters interact intelligently with microgeneration.

Regulatory constraints/opportunities

3.43 The Microgeneration Strategy highlighted the role of Planning and Building Regulations. We are using these policies to support microgeneration. For example, the Code for Sustainable Homes was published in December 2006 along with the consultation on the move towards all new homes being zero-carbon by 2016.

3.44 We believe that the planning regime should be more supportive of microgeneration and, as a first step, we are committed to extending permitted development rights for householders which will mean that, under certain circumstances, planning permission would not be needed before installing microgeneration on a home.[89] This change will take effect in autumn 2007. Government is also considering how a similar approach could be extended to other buildings, for example, relating to agricultural and other commercial uses.

Development of the microgeneration industry

3.45 As well as addressing these constraints, the Microgeneration Strategy aims to help development of microgeneration technologies, in the following ways:

- a map of funding available for microgeneration R&D has been published on the DTI website to point companies to major funding sources in the UK[90];
- a route-map of all technologies is being developed by DTI and industry to address the specific challenges faced by each individual technology;
- DTI is working with the Sector Skills Councils to ensure the skills base develops to support the levels of demand in manufacturing, installing and maintaining microgeneration technologies;
- the Microgeneration Strategy recognises the importance of educating children in energy efficiency through their schools. Schools can access funding through the Low Carbon Buildings Programme; and
- working with industry to move away from grants-based funding to a more sustainable model.

87 The ENA's Engineering Recommendation G83/1 allows this approach for generators up to 16A/phase. This approach applies up to a total generation capacity of around 4kW (micro-wind turbines and domestic CHP units are typically 1kW devices).

88 A DNO is an entity licensed to distribute electricity through cables and has a duty to provide connections to premises.

89 http://www.communities.gov.uk/index.asp?id=1508888. The Communities and Local Government consultation period closes on 27 June 2007.

90 http://www.dti.gov.uk/energy/sources/sustainable/microgeneration/strategy/implementation/page36314.html

Distributed Generation (DG) Review

3.46 Beyond this range of existing measures, the Energy Review Report in July 2006 announced a joint DTI/Ofgem Review of the specific barriers to DG (including CHP). DG refers specifically to those decentralised technologies which generate electricity, and are connected to the distribution grid, as well as transmission-connected CHP[91]. The full DG Review Report is published separately alongside this White Paper[92].

3.47 The UK energy market was established to meet the needs of large centralised generation. Aspects of the system disadvantage smaller players, such as distributed generators, particularly those involved in community generation projects. The system was also generally designed for one-way flow of electricity from large power stations, through the high-voltage transmission grid and into distribution networks across the country, rather than the sharing of electricity around sites within a distributed, more community-based network.

3.48 Some decentralised technologies (such as wind and solar) generate electricity intermittently, whilst CHP schemes primarily respond to the demand for heat rather than electricity. Consequently, the output of distributed generators often does not exactly match the electricity demand profile of particular consumers. As electricity cannot easily be stored, DG therefore requires the ability to both import from and export to the distribution network.

3.49 We consulted widely as part of the review. Key barriers to DG, identified by interested parties, were:

- **Cost** – DG technologies tend to have relatively high capital costs, being largely non-mass produced. The rewards for exporting excess electricity produced by distributed generators are seen as small and difficult to access. More generally, the true cost of carbon is not yet fully reflected in the price of electricity, which disadvantages lower carbon technologies.
- **Lack of reliable information** – there was a low awareness of DG options amongst potential consumers; grants and rewards such as ROCs were perceived as being hard to access; and the lack of a comprehensive accreditation scheme for suppliers and installers put people off untried technologies.
- **Electricity industry issues** – due to the nature of the existing network structure, it could be hard for small generators to connect to the centralised system, and the DNOs did not approach the connection of distributed generators in a sufficiently positive way. The cost to suppliers of rewarding small generators for exporting their excess electricity was a further disincentive to the industry.
- **Regulatory barriers** – the difficulties of getting planning permission for DG technologies was raised, especially in the context of community developments and new housing, where the associated costs and delays acted as a disincentive.

91 Most centrally-generated electricity is transported via the high-voltage transmission grid, only stepping down onto the lower voltage distribution grid to complete its journey from the power station to the customer. Transmission-connected CHP is included because the heat will be used locally.
92 http://www.dti.gov.uk/energy/whitepaper

3.50 In the context of Government's overall energy policy goals, we believe that any action to address these barriers should:

- stimulate take up of cost-effective, low-carbon forms of distributed generation;
- provide a means of enabling distributed generators to realise a reasonable economic value from their schemes;
- reduce complexity involved in setting up as a distributed generator. Requirements on these smaller players should be proportionate to their size and the use they make of the wider public network; and
- encourage, where possible, further development of DG within the licensed framework, rather than outside of it.

3.51 In light of these principles, the Government proposes a four-point package of measures as set out below.

Improving information and awareness

3.52 There is a lack of comprehensive and user-friendly information on DE. Some help (including from Government) is available to support householders, local authorities and developers to implement DE solutions, but the information is patchy or located in a variety of places. In some cases the required information does not exist.

3.53 Chapter 2 sets out the Government's strategy for getting citizens more engaged in combating climate change and advising them on how to reduce their carbon footprint. Defra launched a communications campaign in April to promote their "Act on CO_2" brand, including a CO_2 calculator. A key aim of this campaign is to encourage behaviour change and get the general public to take steps to reduce their carbon emissions.

3.54 As part of this, we intend to improve the provision of information and advice on DE, including:

- providing information about different technologies and how they work in the household, alongside the advice to households on energy efficiency set out in chapter 2;
- ensuring the availability of guidance on the potential benefits of microgeneration including how to maximise the financial benefits (grants, access to ROCs, export reward); and
- providing information for local authorities and developers on how to use DE to help achieve their emission reduction goals, including the role of planning policy, information on specific technologies, the role of Energy Service Companies and other financing options. We are considering how we could improve the advice and support available to the Core Cities and Local Authorities to help them deliver key opportunities for carbon abatement, including DE and innovative programmes of support for householders. DTI, Defra and CLG will jointly publish a report by August 2007 to help local authorities[93] meet our climate change objectives including by increasing levels of microgeneration and DE.

93 Local authorities in England and Wales will be under a statutory duty to have regard to this report in exercising their functions.

3.55 In addition to the provision of information we will improve confidence by introducing a microgeneration certification scheme covering products, installers and manufacturers. This will provide consumers with independent certification of microgeneration products and services, and a route for complaints. A pilot scheme[94] covering product installation, and a Code of Practice, opened for the transition phase in May 2007, building on the existing Clear Skies and Solar PV accreditation schemes. It will be supported by DTI initially, with the objective of the industry taking the responsibility for it in due course.

We will ensure that this improved information on DE provides a comprehensive picture of all the options, costs and benefits to help accelerate the take up of DE. We will keep under review the need for further measures.

More flexible market and licensing arrangements

3.56 Licences are required for the generation, distribution and supply of electricity,[95] though in some circumstances exemptions are applicable[96]. Licensed parties have to comply with a range of licence conditions to ensure, amongst other things, the safe distribution and supply of electricity, and to provide consumer protection. Licences also require the licensee to be a party to relevant industry codes, which are technically complex and therefore require significant expert resource to understand and comply with; the kind of resource that the smaller distributed generators do not have.

3.57 The wholesale electricity market was established around a centralised model. Therefore, the complexities and associated costs facing small generators in fully participating in this market, and the obligations that suppliers have to meet to trade across public networks, are significant discouragements to DG. Those that have established DG schemes have reported that success has come from finding solutions in spite of the system, rather than because of it.

3.58 For example, the Woking Borough Council DG scheme uses a private network, making full use of the licensing exemptions framework, to avoid the costs and complexities. Exemptions take enforcement of issues related to consumer choice, protection and safety largely outside of the remit of the regulator; on a small scale this has minimal impact on the market. However, in the future, as we hope to move towards increased levels of DG across the country, Government is committed to improving the market opportunities so that DG can flourish inside the licensed framework.

94 http://www.ukmicrogeneration.org.uk

95 Apart from transmission connected CHP schemes, for the majority of DG schemes transmission licences are not applicable.

96 The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001 provides for those that generate, distribute or supply specified, smaller amounts of electricity to remain exempt from the need to be licensed. Most DG schemes fall inside the exemption limits for generation. Such an unlicensed generator who supplies up to 5MW in aggregate, of which no more than 2.5MW is supplied to domestic consumers, can supply electricity across public networks, therefore making use of both the generation and supply exemptions framework.

3.59 Ofgem has proposed fundamental simplifications to the existing supply licence, and implementation of the modified licence is planned for June 2007 this year. It will contain half the number of standard conditions and will set out simpler, clearer obligations. It will retain only those obligations necessary for the energy market to function properly and to protect the interests of customers, especially those who are vulnerable. However, there is a requirement for a broader review of industry arrangements, including those relating to energy trading, to facilitate DG.

To address these barriers DTI and Ofgem will consult later in 2007 on options for more flexible market and licensing arrangements for distributed low-carbon electricity within the licensed framework, to be implemented by the end of 2008.

3.60 One important future model for delivering DG is the Energy Services Company (ESCo). The Government will be taking forward further work to examine the potential role of ESCos and ways in which we can support their development. Box 3.2 explains the concept and summarises current government action in this area.

BOX 3.2 ENERGY SERVICE COMPANIES (ESCOS)

An ESCo is a company that provides a customer with energy supply solutions (such as heating and lighting) rather than simply gas and electricity. An ESCo could provide a customer with a combination of energy-saving advice and equipment, renewable generation, planned maintenance, fuel and finance. Government recognises that ESCos offer a useful model for market delivery of its energy objectives, as they can bring together different areas of expertise, skills and investment to facilitate the cost-effective development and implementation of distributed energy systems.

Government's role in providing the framework to enable ESCos to develop involves:

- providing the right incentives through the development of efficient energy and carbon markets;
- removing barriers, such as addressing poor quality information on energy consumption through improved billing and metering. Ofgem has proposed the removal of the 28-day rule as part of its Supply Licence Review, and this has already been subject to extensive consultation. This Review will enable suppliers and consumers to reach longer-term agreements and facilitate the energy services approach;
- addressing lack of awareness and expertise by providing information and encouraging the sharing of experience among public sector, utility, corporate and financial stakeholders;
- overcoming risk and uncertainty by setting a standard framework for processes (such as contracts) and facilitating accreditation; and

BOX 3.2 continued

- ensuring competitive market conditions by making it easier for new market entrants while maintaining service standards.

Following the commitment in the Local Government White Paper, we will continue to work with the Core Cities to identify opportunities for low-carbon energy services, where developing a relationship with an ESCo could lead to better delivery of carbon emissions reduction. We will also work with the British Council of Shopping Centres to take forward the option of DG in new shopping centre developments.

Clearer export rewards for smaller generators

3.61 Many distributed generators produce more electricity than they need. This excess electricity can be sold ("exported") to suppliers in order to earn some extra income for the generator and supply a small amount of electricity to the system.

3.62 Suppliers are not currently required to make an offer for exported electricity. Most suppliers do now offer tariffs, but few of these tariffs are widely advertised and the terms vary considerably between suppliers. This makes it difficult for customers to determine which tariff will best meet their circumstances.

3.63 The tariffs available generally offer a lower price for exported electricity than the retail price for imported electricity. This reflects the expected difference between wholesale and retail price in any market, including the cost of transporting the exported electricity to a customer and the transaction costs for the supplier. In many situations where traded volumes are small it is, in fact, uneconomic (at present) for suppliers to purchase this electricity.

3.64 Transparency of prices offered by each supplier for exported electricity in a simple and easy to understand format is the first step to addressing this barrier.

All six major energy suppliers have now committed to publishing easily accessible export tariffs.

3.65 There are a number of technical changes that would help suppliers to cut their administration costs, thus making it more cost-effective to offer a tariff for exported electricity. We welcome the engagement of industry thus far on these changes, and will continue to work with them to progress this work.

3.66 We will keep under review whether it is necessary to use the powers granted under The Climate Change and Sustainable Energy Act 2006,[97] which allows Government, from August 2007, to vary supply licences to require suppliers to offer to acquire electricity exported by their customers. Our decision will be informed by Ofgem's work, announced in Budget 2007, to examine how green homes could benefit more from prices paid for electricity exported to the network, and how the market for rewarding microgenerators develops.

Facilitating connections for distributed generators

3.67 Distributed generators can range in size from a few KW to 100 MW or sometimes more. The smallest microgenerators no longer need permission from a DNO to connect to the distribution network – they can simply connect and inform the DNO that they have done so[98]. Generators above this limit, however, need to go through a more onerous process and several responses to the DG Call for Evidence[99] suggest that DNOs could make the connection process quicker and easier for their customers. In line with the Government's desire for DG to compete on a level playing field with conventional generation, the Government believes that it is important that distributed generators can connect to the grid easily and efficiently.

3.68 There is no evidence of fundamental technical barriers to connection for DG[100]. Instead the process for connection needs to be simplified for DG to make it more accessible and cost-effective. We recognise the significant progress that has been made in addressing barriers, much of it through the Energy Networks Strategy Group (ENSG) co-chaired by DTI and Ofgem.

3.69 However, more is needed to ensure that DG can play its full part. The Government welcomes Ofgem's initiatives to:

- extend cost-reflective charging to the distribution network. This benefits local generation because it potentially allows credits to generators where they provide benefits to the network;
- extend its Innovation Funding Incentive to the end of the next price review period (likely to be 2015) and to extend eligibility for Registered Power Zones to generation connected in the next five years;
- allow developers of DG a choice of connection provider
- review during 2008, as part of the next price control review, the incentives and investment drivers for DNOs to connect DG; and
- review how the DNOs' Long-Term Development Statements can be made more useful to distributed generators.

3.70 More broadly, it will be important for network operators to invest in the light of these longer-term developments. We have funded work on long-term scenarios through the ENSG and we welcome Ofgem's plans to undertake long-term analysis (see chapter 5). Taken together, these connections

97 Sections 7 and 8, Climate Change and Sustainable Energy Act 2006: http://www.publications.parliament.uk/pa/cm200506/cmbills/017/2006017.pdf
98 See footnote 87
99 http://www.dti.gov.uk/energyreview/implementation/distributed-energy/page35076.html
100 http://www.dti.gov.uk/files/file31648.pdf: Econnect carried out a study of the network reinforcement costs for increasing DG penetration. It found that almost 20% penetration of microgeneration could be accommodated without network reinforcement, but that for larger DG power stations, average reinforcement costs will rise from current levels. More details are in the DG Review Report.

measures should better facilitate the connection of DG to distribution networks. This will increase incentives for DG and increase the possibility for DG to compete alongside centralised generation to supply GB's electricity needs.

3.71 The Ofgem-chaired Transmission Arrangements for Distributed Generation Group (TADG) is currently considering the interaction between DG and the transmission system, and plans to report its findings later this month. Many respondents to the Call for Evidence were concerned that this work could be detrimental to DG, by eroding the "embedded benefits" that reward DG for the network benefit it brings. The Government would not want to see additional barriers erected to DG. However, charges should be cost-reflective, with charges being proportionate to the costs imposed, and with parties appropriately rewarded for any benefit contributed. In general, the Government believes that the burden of regulation on a distributed generator should be proportionate to its use of the network.

Driving demand for DE at local and regional level

3.72 Local authorities and regions have a key role to play in facilitating the development and uptake of DE – as community leaders, through their knowledge of local opportunities, and through their powers and responsibilities for planning and regeneration. Some local authorities and regions are already at the cutting edge of efforts to develop DE schemes in the UK. Government has taken steps to support this drive for low carbon energy generated locally, particularly in its planning and development policy. Government has made it clear that it expects all planning authorities to make full use of the positive approach to renewables set out in Planning Policy Statement 22 on Renewable Energy.

3.73 Chapter 2 sets out the additional measures that the Government is taking to improve energy efficiency and reduce the carbon footprint of the built environment. The Government's ambition is that all new housing development in England should, by 2016, be zero carbon, and has consulted on a timetable for moving towards that standard[101]. The measures to support the move towards zero carbon homes and development, and thereby stimulate demand for DE include in particular:

- the draft Planning Policy Statement: Planning and Climate Change which expects planning to be a positive force for change by helping to create an attractive environment for innovation and for the private sector to bring forward investment in renewable and low carbon technologies;
- measures to improve the energy performance of Building Regulations so that over time all new homes meet the energy and carbon standards set out in the Code for Sustainable Homes;
- time-limited stamp duty exemption for new zero carbon homes[102]; and

101 http://www.communities.gov.uk/pub/173/BuildingaGreenerFutureTowardsZeroCarbonDevelopment_id1505173.pdf

102 From 1 October 2007, all new zero-carbon homes costing up to £500,000 will pay no stamp duty, with zero-carbon homes costing in excess of £500,000 receiving a reduction in their stamp duty bill of £15,000. The exemption will be time-limited for 5 years until September 2012, with the Government considering the case for an extension before then. For further details see Budget Note 26 in http://www.hm-treasury.gov.uk/media/757/0A/bud07_budgetnotes_381.pdf

- low to zero-carbon demonstration projects – notably the Carbon Challenge and the Thames Gateway study. In the Thames Gateway, CLG will be supporting the development of decentralised energy projects in specific locations such as Barking, and by working with English Partnerships to develop a portfolio of energy projects that a future ESCo could take forward.

3.74 The English Regions, particularly through the RDAs with their role in supporting sustainable economic development, regeneration and innovation, will play an important role in identifying and securing opportunities for distributed energy. As well as their role in helping developers identify potential customers for heat, RDAs will act to support innovative energy financing and delivery models in their regions. RDAs will also support the development of DE projects (such as anaerobic digestion plants) for example, by supporting the development of energy supply chains and skills, and by ensuring regeneration projects meet high standards of carbon efficiency.
This is covered in more detail in chapter 9.

Next steps

3.75 The measures in this chapter should substantially improve the environment for DE in the UK. The measures to promote lower carbon developments will drive demand for decentralised heat and electricity generation. Meanwhile,
a number of barriers to DE projects are being removed, making DE a more realistic alternative to the traditional, centralised approach.

3.76 It is for the market to decide on the best mix of technologies but we are committed to ensuring that DE solutions have a real opportunity to compete. We are establishing a new Distributed Energy Unit within the DTI to monitor the development of markets for these technologies, to drive the implementation of these measures and to ensure that any further barriers to DE that may be identified are addressed. Our further work will take account of the impact of these measures and proposals for implementing the EU renewables target, as they are developed over the next few years.

Distributed Energy
Summary of Measures

- **to remove barriers and encourage more widespread deployment of distributed generation we are bringing forward a package of measures, including:**
  - **information, and guidance on options in distributed generation;**
  - **more flexible market and licensing arrangements for distributed, low-carbon electricity supply, within the licensed framework, to be implemented by end 2008;**
  - **more clarity on the terms offered by energy suppliers to reward micro-generators for the excess electricity they produce and export; and**
  - **making it easier to connect to and use the distribution network.**
- **these measures will support the drive for distributed energy from the Government's move to zero carbon homes;**
- **we are conducting further work into policy options to reduce the carbon impact of heat, including reviewing the impact of the range of existing mechanisms;**
- **we are publishing the UK Biomass Strategy to maximise the supply and use of biomass – wood, energy crops, waste, and more – in the production of sustainable energy; and**
- **we are continuing to take forward implementation of the Microgeneration Strategy, announced last year, including making it easier to get planning permission and providing funding to help meet the costs of installation.**