LondonClimateChangeAgency

DTI/OFGEM REVIEW

DISTRIBUTED ENERGY

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

Distributed Energy: Call for Evidence

<u>Tackling Climate Change – A Further Debate or a Call to Arms</u>

Climate Change is the most serious long-term problem facing the world today. Average global surface temperatures have increased by 0.6°C over the 20th century. The ten hottest years on record have all occurred since the beginning of the 1990s. It is vital that London (and the UK), as one of the world's wealthiest and most successful cities but a city especially vulnerable to the impacts of climate change, takes the necessary action.

Much of the observed rise in sea-level (10 - 20 cm) during the 20th century may be related to this increase in global mean temperatures. Current climate models predict that global temperatures will rise by a further 1.4 to 5.8°C by the end of the 21st century. Global mean sea levels are also predicted to rise by 9 to 88 cm by 2100.

Worldwide, hundreds of millions of people are at risk from flooding. Extreme weather events, such as droughts and rainstorms, are also likely to become more frequent and unpredictable.

In London, climate change means a higher risk of floods, hotter temperatures, increasing demand for water and electricity and a decrease in the comfort and safety of buildings and transport infrastructure.

Climate change is the greatest threat facing the planet today and is close to passing the tipping point of catastrophic climate change. Recent evidence has shown that the UK targets set are not going to be met on current policies alone. Further political leadership and action is urgently needed. Therefore, it is imperative to tackle the primary cause of climate change – the highly inefficient centralised energy system.

This submission is set in the context of tackling climate change and therefore, decentralised energy (distributed energy) needs to be viewed in the wider context which may conflict with current thinking on the value of a centralised power generation system.

For example, supporters of a centralised power generation system may think that it is a safe and secure system but in the wider context it is not safe when viewed in the context of climate change or secure when viewed in the context of reliance on overseas primary non renewable energy resources, some of which is reliant on unstable countries or regimes.

Centralised Energy

The annual thermal efficiencies of UK centralised power stations[1] are, as follows:-

Coal	36%
Gas	46%
Nuclear	38%

The efficiencies of power stations are very low as most of the energy generated is heat which is rejected into the atmosphere through power station cooling towers or water cooling systems. There is a further 9% loss of energy in the grid transmission (2%) and distribution (7%) networks[2] so by the time the electricity reaches our buildings we can have as little as 33% of the energy burnt at the power stations. To make matters worse 50% of the UK's water resources is used to evaporate the waste heat from power stations[3] into the atmosphere and we burn further energy to heat our buildings.

This is a tremendous waste of energy and unnecessary emission of greenhouse gases and other pollutants into the atmosphere. On the other hand decentralised energy (distributed energy) technologies such as CHP can achieve efficiencies of 85% to 90% simply by recovering the heat that is generated as a by product of electricity generation to heat and cool (using trigeneration) our buildings as well as supplying local electricity with little or no losses.

Local generation, distribution and supply on private wire district energy systems can deliver more affordable energy services to customers connected to these systems, particularly for householders who currently pay the most for their energy services, by avoiding the huge waste of energy and losses from centralised energy systems as well as significantly reducing greenhouse gas emissions to combat climate change.

Distributed Energy or Decentralised Energy

Distributed energy is the term used by the DTI/Ofgem in this call for evidence whereas decentralised energy is the term adopted by the Mayor of London and the London Climate Change Agency in its various papers and evidence to differentiate between low and zero carbon decentralised energy and high carbon centralised energy.

[1] DTI Digest of UK Energy Statistics http://www.dti.gov.uk
[2] The Office of Gas and Electricity Markets or Ofgem http://www.ofgem.gov.uk
[3] South East of England Development Agency or SEEDA Taking Stock – Fact Sheet 4: Energy and Water www.takingstock.org/Downloads/Fact_Sheet4-energy.pdf .

In essence, distributed energy and decentralised energy can mean the same thing and in the submission to this call for evidence the term distributed energy has been used throughout wherever possible or a dual definition used. However, for the avoidance of doubt decentralised energy and the London Climate Change Agency's interpretation of distributed energy are both based on combined heat and power, renewable energy and other low and zero carbon energy systems. This definition does not include power stations connected into the distribution network rather than the transmission network as similar inefficiencies and losses will be experienced by both power station models.

<u>Woking Model</u>

Woking Borough Council has implemented a series of decentralised energy (distributed energy) projects in the past 15 years, including the UK's first small-scale combined heat and power (CHP)/heat fired absorption chiller or trigeneration system, first local authority private wire residential CHP and renewable energy systems, largest domestic combined photovoltaic/CHP installations, first local sustainable community energy systems, first fuel cell CHP system and first public/private joint venture Energy Services Company or ESCO in the UK.

The Council is now recognised as the most energy efficient local authority in the UK having achieved the greatest percentage reduction in both energy consumption and CO_2 emissions in the UK, as well as establishing Thameswey Ltd and Thameswey Energy Ltd (a public/private joint venture Energy Services Company or ESCO) and supplying itself with the highest proportion of on site decentralised energy supplies in the UK. In recognition of this pioneering work the Council gained the Queen's Award for Enterprise: Sustainable Development 2001 in respect of its Energy Services activities in the development of Local Sustainable Community Energy Systems, the only local authority ever to receive a Queen's Award for Enterprise.

Since the Council implemented its energy efficiency and environmental policies in 1990 (the base year), it has achieved a 51% reduction in energy consumption, a 44% reduction in water consumption and a 79% reduction in CO_2 emissions by 2005 in its own corporate buildings and housing stock. Complimenting the reduction in energy consumption the Council receives more than 93% of its electrical and thermal energy requirements from on site low or zero carbon decentralised energy sources, squeezing the carbon content out of its buildings at both ends of the spectrum.

<u>London Taking the Climate Change Leadership</u>

London, as a large and wealthy world city, has taken the commitment to lead and show by example in taking action to avert catastrophic climate change. Key drivers to achieve this ambitious objective are political leadership and effective partnerships on the ground. The Mayor of London Ken Livingstone and the Deputy Mayor Nicky Gavron have committed to addressing the causes of climate change one of the main priorities of London's strategies and have set ambitious targets and policies for both mitigating and adapting to climate change. The Mayor's Energy Strategy for London has a 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[4].

London is using its policy, strategic and planning powers to ensure the necessary policy direction and action to achieve its objectives of transforming London into a sustainable city. From using its Mayoral and planning powers to ensure that any new build will incorporate the best low carbon sustainable designs with a minimum of 20% of the development carbon emissions being further reduced by on site renewable energy, through to the implementation of the congestion charge in 2002 and associated improvement of the public transport networks, to Greater London being designated as a low emission zone in 2008 to improve air quality and reduce carbon emissions. The Mayor's powers to act further in this area are set to increase with government proposals to increase the Mayor's powers, including a new Climate Change Duty, the first time that any body has been granted such a power in the world.

This approach not only contributes towards tackling climate change it also makes good commercial sense in stimulating London's economic and social development as well as creating businesses and jobs in London's new green economy. The London Development Agency's Green Alchemy Turning Green to Gold: Powering London's Future – A Study of the Sustainable Energy Sector[5] identified that the sustainable energy sector is set for substantial growth. The potential sustainable energy market generated as a direct result of deploying technologies as set out in the Mayor's Energy Strategy could be worth around £3.35 billion by 2015 and employ between 5,000 and 7,500 people.

However, the actual delivery of low and zero carbon systems in London is an area of market failure and the Mayor needed to do something to address this.

London Climate Change Agency

The establishment of the London Climate Change Agency (LCCA) was a manifesto commitment by the Mayor of London in the 2004 election. The Mayor of London appointed Allan Jones MBE in November 2004 to set up and run the London Climate Change Agency to implement the experience he gained during his work changing Woking into a sustainable energy community to transform London into a leading low carbon sustainable city. The LCCA was launched by the Mayor in 2005 with the support of the following founders: BP, Lafarge, Legal & General, HSBC, Sir Robert McAlpine, Johnson Matthey, and the Corporation of London. The Agency is also being supported by the Rockefeller Brothers' Trust, KPMG, Greenpeace, the Climate Group, the Carbon Trust and the Energy Savings Trust.

---

[4] "London's Energy Strategy: Green light to clean power: the Mayor's Energy Strategy March 2004" - http://www.london.gov.uk/mayor/strategies/energy/index.jsp

[5] London Development Agency, November 2003: "Green Alchemy, Turning Green to Gold: Powering London's future – a study of the sustainable energy sector" http://www.lda.gov.uk/upload/pdf/18_491_SustainableEnergyNov03.pdf

The London Climate Change Agency Ltd was subsequently established as a municipal company wholly owned by the London Development Agency (LDA) in March 2006. One of the LDA's five statutory purposes as set out in Section 4 of the Regional Development Agencies Act 1998 is to contribute to the achievement of sustainable development in the United Kingdom where it is relevant to its area to do so (i.e. Greater London). Such sustainable development includes sustainable energy, transport, waste and water.

The LCCA is a direct delivery agency implementing projects in the sectors that impact on climate change, especially energy, transport, waste and water. 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.

Following its establishment the LCCA has been implementing or working on a number of initial set up and flagship projects, such as carbon accounting, the establishment of energy efficiency revolving funds for the GLA Group and the London Boroughs, low and zero carbon inward investment projects, London Transport Museum, Palestra and City Hall renewable energy projects, fuel cell CHP projects, LDA development projects, including Gallions Park Zero Carbon Development, Dagenham Dock (including large scale wind farm and CHP trigeneration) and Silvertown Quays CHP trigeneration, London Borough and private sector development projects, including Elephant & Castle, and the establishment of the London ESCO.

<u>London ESCO</u>

Following a competitive negotiated procedure process in which 9 major energy utilities, US and international energy companies bid to become the private sector partner in the London ESCO the London ESCO Ltd was established as a public/private joint venture Energy Services Company between London Climate Change Agency Ltd and EDF Energy (Projects) Ltd in September 2006.

In advance of the procurement of the private sector partner in the London ESCO the LCCA had developed a project pipeline that formed part of the specification and subsequently incorporated into the shareholders agreement. Further projects have subsequently been added to the list which now stands at circa 50 short, medium and long term potential London ESCO projects with some 35 different parties with an approximate ESCO value of some £2 billion. Projects include EDF Energy and joint projects as well as those identified by LCCA.

The first tranche of immediate projects will double London's CHP capacity and implement both large and small scale renewable energy projects at an investment value of some £100 million and deliver a reduction in CO_2 emissions of approximately 310,000 tonnes pa.

The London ESCO will not only deliver the large scale and innovative ESCO projects required to deal with market it failure it will, by its very presence and activity, stimulate the ESCO market in London and elsewhere.

However, there is a need to remove the regulatory barriers to decentralised energy or distributed energy to stimulate and catalyse the ESCO market and to tackle the primary cause of climate change by displacing centralised power generation and separate forms of heating energy.

Existing Exempt Licencing Regime

The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001[6] governs the exempt licencing regime, which enables exempt generators, distributors and suppliers to supply electricity that they generate and distribute themselves directly to customers rather than to a licenced supplier (the grid).

The Electricity Act 1989 authorises the Secretary of State for Trade and Industry to make Orders under the exempt licencing regime. Amendments to this Order do not require primary legislation. Amendments to this Order can be enacted at any time by the Secretary of State for Trade and Industry. Since 1995 the Secretary of State for Trade and Industry has enacted three Orders, the 1995, 1997 and 2001 Orders progressively relaxing the exempt licencing regime and the barriers to sustainable energy.

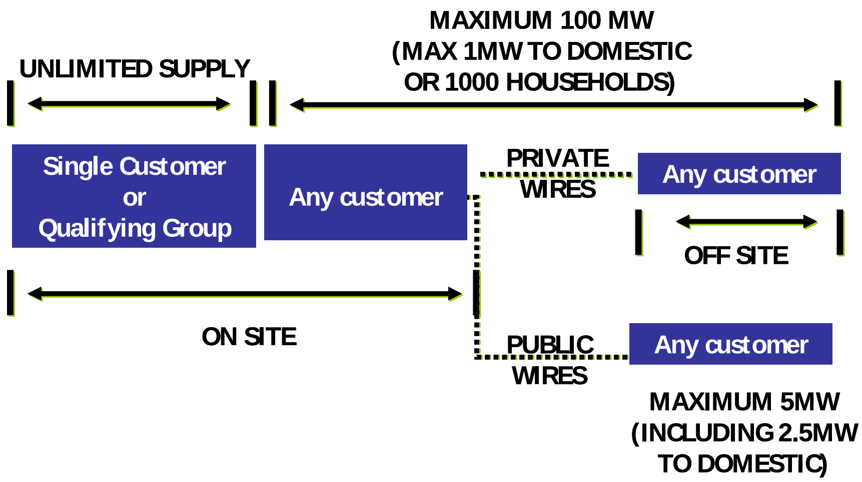
Existing Exempt Licencing Limits

The existing exempt licencing limits (see Figure 1) are, as follows:-

- An exempt generator can generate up to 50MW of electricity per site without Secretary of State approval and up to 100MW per site with Secretary of State approval.
- An exempt generator can distribute and supply exempt electricity from each generating site directly to customers, on site and over private wire up to 50MW (or up to 100MW) of which no more than 1MW (1,000 households) can be supplied to domestic customers. For example, up to 49MW can be supplied to non domestic customers but only 1MW can be supplied to domestic customers per site.
- An exempt generator can distribute and supply exempt electricity directly to customers over public wires up to 5MW in aggregate of which no more than 2.5MW (2,500 householders) can be supplied to domestic customers.

Figure 1: Supply Exemption Order 2001

[6] The Electricity (Class Exemptions from the Requirement for Licence) Order 2001 http://www.hmso.gov.uk/si/si2001/20013270.htm



Source: Department of Trade and Industry, Electricity Directorate

The Grid

What most people refer to as the grid is actually made up of two component parts:-

- The national grid connecting centralised power stations (typically 1,000MW each) on a very high voltage grid to the grid supply points around the country.
- One of 12 distribution networks (ie., London, Seeboard, Eastern, Northern Regions, etc) plus the 2 Scottish Regions on lower voltage public wires distributing and supplying electricity to customers.

Sustainable Energy and the Grid

The laws of physics dictate that electricity will always flow to the nearest load, ie., the local community for on site/private wire combined heat and power (CHP) and renewable energy.
Most exempt generators are connected to the distribution network but sell their electricity to a licenced supplier at very low wholesale electricity prices to which transmission use of system (TUoS), distribution use of system (DUoS), transmission and distribution losses and other charges are added to make up the supply or retail price of electricity.

This exempt electricity makes very little use of the distribution network and no use at all of the national grid. CHP and renewable energy generators are effectively treated as if they were 1000MW coal fired power stations in the Midlands incurring all of the transmission and distribution charges, transmission and distribution losses, etc. The embedded generation benefits and the true economic value of CHP and renewable energy are lost when they supply electricity to a licenced supplier/the grid.

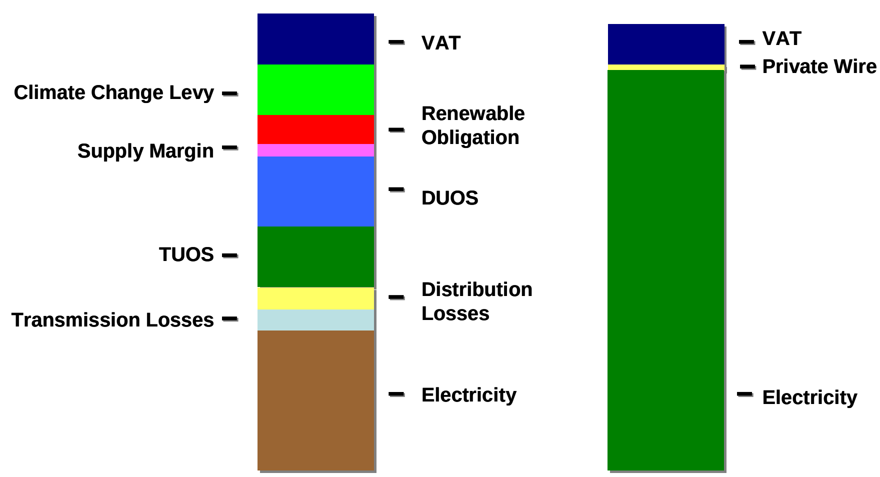
The ESCO or Woking Model

Although the exempt licencing regime was really intended for use by large industrial enterprises the ESCO model demonstrates how decentralised energy (distributed energy) can be implemented economically by replicating the laws of physics over private wire.

See Figure 2 for the comparison of the price make up between the grid supply price and the private wire supply price. As can be seen from the comparison most of the grid supply price is not electricity but transmission and distribution losses and use of system charges whereas most of the private wire supply price is electricity.

This is how private wire electricity competes with public wires electricity by taking advantage of the true economic value of decentralised energy (distributed energy) technology rather than lost to the grid trading mechanism.

Figure 2: Grid Supply Price and Private Wire Supply Price



Using the energy services company (ESCO) or Woking model approach Woking has been able to implement a number of private wire decentralised energy (distributed energy) systems, including the first town centre private wire trigeneration system, the first private wire residential cogeneration and renewable energy systems and the first fuel cell CHP system in the UK. Woking has also been able to implement nearly 10% of total installed photovoltaics and the first fuel cell CHP in the UK.

The ESCO or Woking model also enables fuel poverty to be tackled by being able to supply electricity and heat to fuel poor households at up to 10% of a state pension income only (ie., ignoring housing, council tax benefit, etc) whereas the Government's affordable warmth criteria is 10% of all income and this is for heating only!

The ESCO model provides competition in local generation, distribution and supply, not just supply.

The private wire network can also enable island generation to be provided, providing local security of supply in the event of a failure of the national grid.

Further innovation has been implemented by establishing a trading system under an enabling agreement for exempt supplier operation (which the host utility is legally obliged to provide under their licence conditions). This enables the ESCO to trade each half hour of electricity imported/exported over public wires (ie., the local distribution network) between its own exempt private wire generation sites to achieve virtual independence of the national grid and all of its energy from local decentralised energy (distributed energy) sources.

Woking Model Replicated in London

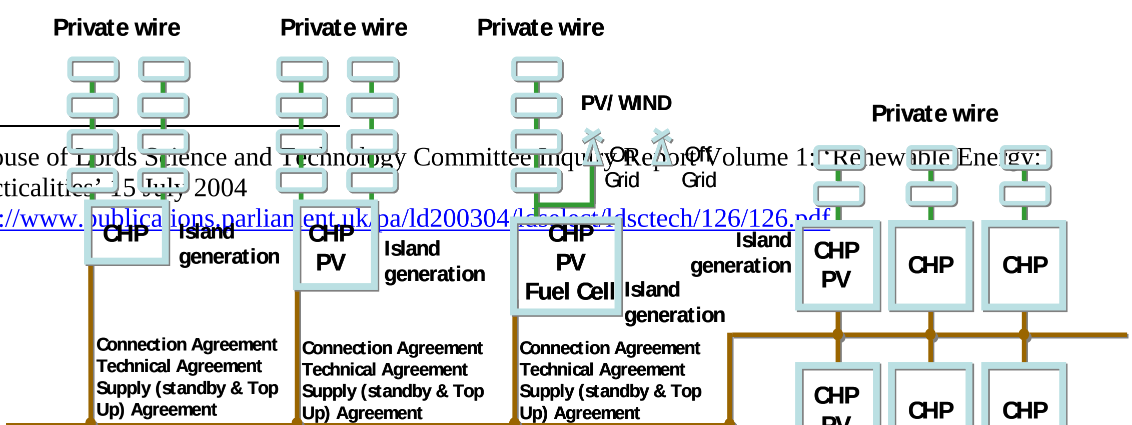
The ESCO or Woking model is being replicated in London within the existing exempt licencing regime. It will be able to supply any number of non domestic customers up to these limits on site and over private wire and domestic customers up to 1MW (1,000 householders) per site in addition to the exempt export over public wires which will be used for import/export and balancing between private wire island generation sites under an enabling agreement for exempt supplier operation.

However, the 1MW exempt supply domestic limit will be a barrier to large scale residential development and local balancing over the distribution network. For example, a large housing estate of 25,000 households would require 25 x 1MW CHP systems to keep within the exempt supply limit for domestic customers, rather than the 3 or 4 CHP systems that could otherwise be implemented for economic reasons. This represents a barrier to tackling fuel poverty since large housing estates tend to be in the public sector or fuel poor areas.

The House of Lords Science and Technology Committee Inquiry into the Practicalities of Renewable Energy[7] identified the principle of the Energy Internet after its visit to view the Woking decentralised energy (distributed energy) system operating under the exempt licensing regime and this model has been adopted for London. See Appendix 11: An Energy Internet? of the Select Committee's report.

See Figure 3 for the London Energy Internet model.

Figure 3: Proposed London Energy Internet



7 House of Lords Science and Technology Committee Inquiry Report Volume 1: 'Renewable Energy: Practicalities' 15 July 2004
http://www.publications.parliament.uk/pa/ld200304/ldselect/ldsctech/126/126.pdf

Further Relaxation of Exempt Licencing Regime

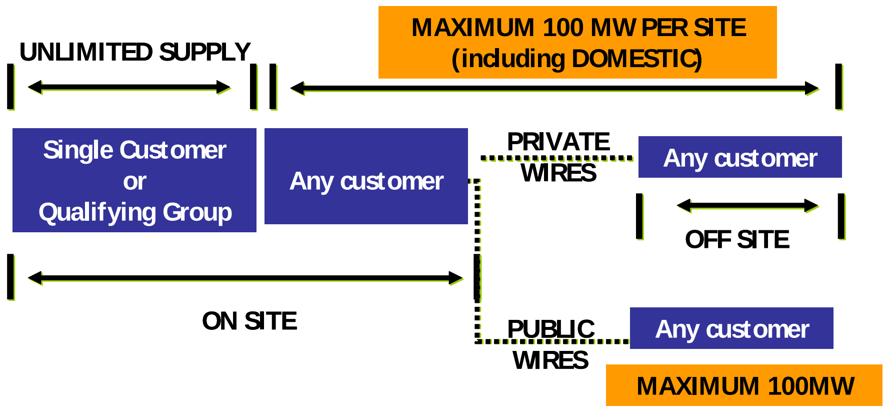
In order to deliver the full potential of decentralised energy (distributed energy), to maximise the reductions in CO_2 emissions and to tackle the primary cause of climate change (ie., centralised power generation and separate heating energy systems) within an economic framework the regulatory barriers to decentralised energy (distributed energy) will need to be removed by amending The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001, as follows:-

(i) The removal of the 1MW exempt distribution and supply to domestic customers limitation on exempt generation sites, on site and over private wire. The limitation to be incorporated into the 50MW (100MW) exempt generation per site with no differentiation between domestic and non domestic distribution and supply.

(ii) The removal of the 5MW and 2.5MW domestic exempt distribution and supply aggregate limitation from exempt generation over public wires. There should be no aggregation limit, the limit being governed by the amount of total surplus electricity that an exempt generator is able to export over public wires from each of its exempt generation sites.

See Figure 4 for the proposed exempt licencing regime.

Figure 4: Proposed Supply Exemption Order 2007



Chapter 2: Distributed Generation in Today's Electricity System

2.24 Customers supplied by licensed energy suppliers are not subsidising the electricity costs of those linked into the private wire network. In fact, the reverse is true. Distributed energy private wire networks have to pay for:-

- the full connection costs of connecting to the distribution network without any discount even though they are reducing load on the distribution and transmission networks;
- availability charges for being connected to the distribution network in the same way as other customers for both transmission and distribution availability. In some instances both import and export availability charges are applied by the licensed provider;
- Standby and top up charges to purchase electricity from a licenced supplier which are higher than normal than competitive prices that would be charged to a customer supplied directly by a licenced supplier and
- Export power purchased by the licenced supplier at very poor sub wholesale electricity prices.

2.27 Competition is provided at the front end of the project rather than the back end, similar to competition in the telecommunications industry, including mobile telephones, internet, broadband, etc. Like the telecommunications industry distributed energy on private wire networks provides competition in generation, distribution and supply whereas the licensed supply market only really provides competition in supply, which for domestic customers is only a small part of their retail price. See submission under Distributed Energy: Call for Evidence in this response.

Consumers supplied by unlicensed businesses can be provided with similar protection. Protection is normally incorporated in the connection and supply agreement which every customer has. These can incorporate 'step–in' rights and other such protection. The Combined Heat and Power Association did submit a draft Code of Practice to the previous regulator OFFER, but was not taken up by OFFER. This could be reconsidered by Ofgem.

2.28 Where private wire networks are reliant on the transmission grid for back-up power they have to and do pay charges to reflect this dependence just like licensed suppliers do, except that exempt suppliers are penalised for this in that this costs the exempt suppliers more than it costs the licensed suppliers. It is not a 'free ride'. See submission under 2.24.

Private wire networks should make it easier to manage power flows since distributed energy on private wire networks create or generate 'Negative Watts' or 'Negawatts'. This benefits both the transmission and distribution networks since these networks only see the smaller flow of imports and exports at a connection point as the majority of the generation and supply takes place 'off grid' on the private wire networks and therefore does not impact on the grid. Collectively, such systems will reduce or avoid the need for grid reinforcement and provide a more economic way of delivering renewable energy.

Private wire networks are not only an economic tool for extracting the true economic value of distributed generation against a 'protected' public wires generation system they are also a technical tool in facilitating CHP and renewable energy, initially, and over time. Private wire networks are normally designed as active networks, typically in the form of a ring, where additional CHP and/or renewable energy can be added later to the network without limitation as in the case of Woking.

Public wires networks are passive networks with distributed generation being at the end of a very long 'daisy chain' transmission and distribution system. Such passive networks limit the amount of distributed energy, ie., renewable energy, that can subsequently be added to about 20% to 30% of the system, whereas private wires can facilitate up to 100% of the system.

Distributed energy on private wire networks can also provide local security of supply as they can continue to operate in 'island generation' mode in the event of a power failure in the grid (transmission and/or distribution public wires) as in the case of Woking, whereas public wires cannot operate in island generation mode, even with distributed energy. This is another advantage of private wire networks and of keen interest to customers.

Trading between distributed energy on private wire networks or island generation sites can be facilitated by an enabling agreement for exempt supplier operation as in the case of Woking and to be facilitated in London. The local trading system reflects the laws of physics and as more distributed energy on private wire networks are installed the greater 'embeddedness' and resilience/self sufficiency there is on the local system with the distribution network becoming more important than the transmission network, gradually turning the distribution network from a passive network into an active network.

In the longer term distributed energy on private wire networks, as a group on a distribution network, can become self sufficient from the grid and not need back-up power from the grid as in the case of Woking. This would make the grid more leaner but more efficient over time, particular if centralised power stations are properly located near or adjacent to major energy intensive users who are taking electricity at very high voltage where the opportunity will arise to also provide thermal energy in the form of steam to turn large scale power stations into large scale CHP systems as in the case of the proposed Isle of Grain project.

A distributed energy system supplying energy into the distribution network directly to distribution voltage customers, where most load exists, and a centralised power generation system supplying energy into the transmission network directly to transmission voltage customers with some trading between can be likened to another transmission/distribution system, the internet. See submission under Distributed Energy: Call for Evidence.

Questions:

1. As the experience in Woking shows any energy load in the distribution network can be converted into an opportunity for distributed energy for both new and existing development. The best opportunities and the greatest reduction in CO_2 emissions will be achieved by:-

- Combined heat and power (CHP) or cogeneration with thermal energy storage, particularly for mixed development where both electrical and thermal energy profiles can be complimented with time of day, day of week and seasonal energy use. Such systems should always be incorporated with large scale thermal storage to manage this and to provide a flat generation profile for the CHP.
- Combined, cooling and power (CCHP) or trigeneration with heat fired absorption cooling and thermal energy storage, particularly for mixed development where electrical, cooling (heat to cool) and thermal energy profiles can be complimented with time of day, day of week and seasonal energy use. Such systems should always be incorporated with large scale thermal storage to manage this and to provide a flat generation profile for the CHP.
- Integrating electricity generating renewable energy (eg., solar photovoltaics, wind and hydro) with CHP to compliment the electricity generating profiles, to locally balance electricity loads and to minimise or eliminate support from back-up grid power. Heat only generating renewable energy will not compliment CHP or local electricity balancing and will not achieve the substantial reductions in CO_2 emissions that can be achieved with integrated CHP (cogeneration or

trigeneration). However, renewable heat only back-up boilers can be used in conjunction with CHP.

- Mixed technology renewable energy systems (eg., solar photovoltaics and wind energy) since such physical renewable resources tend to provide complimentary summer/winter reverse profiles and mitigate against intermittency. Such systems can also be connected on large scale private wire dc networks to minimise on the cost of connections and inverters. Similarly, mixed technology renewable energy systems work very well with CHP (natural gas or renewable fuels) for the same reason.
- Renewable fuels derived from local wastes – renewable gases and liquid fuels for both CHP and transport. Industrial, commercial, municipal, sewage and biomass wastes (both organic and non organic) provide a huge renewable energy resource for an urban area like London which is currently not being captured or poorly and inefficiently utilised in landfill and incineration. Utilising technologies such as anaerobic digestion, gasification and pyrolysis will generate significant quantities of biogas, syngas and/or synthetic diesel. Renewable gases and fuels derived in this way captures most of the available energy content and can be stored or pipelined which are distinct advantages over mass burn incineration which is an inefficient technology. Renewable gases and fuels technologies are also modular and do not require particularly large scale installations and can be located at waste collection sites (rather than waste disposal sites), thereby cutting out the waste disposal transport emissions. Dewatering is inherent with such systems which can provide a significant non potable water resource as part of a holistic approach to energy and water services.
- Renewable gases and fuels derived from non waste biomass. The use of non waste biomass must be subject to any negative implication on food production, biodiversity, habitat loss and rainforest destruction. In addition, transport carbon emissions must also be taken into account when assessing the overall carbon reducing benefits of particular biomass. Biomass is not a zero carbon fuel and the justification for using biomass, in tackling climate change terms, is based on the carbon emitted by the biomass to produce energy being replaced by an equivalent amount of carbon being sequestered in re-growing the biomass. However, different biomass fuels contain different amounts of carbon and different periods of time to sequester the carbon emitted. For example, 50 year old tree wood contains more carbon than coal and requires a far longer growing time to sequester the carbon than say willow coppicing which has a lower carbon content and requires only 3 years to sequester the carbon.

The barriers to the best distributed energy opportunities include the following:-

- The regulatory barriers to distributed energy in The Electricity (Class Exemptions from the Requirement for a Licence) 2001 as detailed in the submission under Distributed Energy: Call for Evidence in this response.
- Planning barriers or the manipulation of the planning regime by planning officers to oppose distributed energy, particularly CHP and renewable energy. The London Plan is an example of a positive approach to distributed energy and tackling climate change which all other authorities should follow.
- Lack of education with planning officers and other local authority and public sector agencies, consulting architects and engineers and design and build contractors about taking a tackling climate change or carbon reducing led approach to development. In particular, a lack of experience or expertise in a mixed technology approach to distributed energy to maximise the economics and carbon reduction of such integrated systems.
- Lack of joined up thinking on the available renewable energy resource that is available in urban areas such as London due to waste being treated separately from distributed energy and tackling climate change. Integrated or joined up thinking that happen at all levels from government to local authorities in treating waste as a resource, particularly a low emissions flexible renewable energy resource. In this context, non organic renewable waste resources should be treated in the same way as organic renewable waste resources as a renewable fuel.

2. The existing licencing regime acts as an unnecessary barrier to distributed energy, particularly to domestic and existing development and to the local balancing of distributed energy. The limitations to generating, distributing and supplying exempt electricity to domestic customers and the aggregate limit over public wires are significant barriers to distributed energy in a city like London, not only in inhibiting the large scale reduction in CO_2 emissions but also in tackling fuel poverty. To address this the following will be required:-

(i) The removal of the 1MW exempt distribution and supply to domestic customers limitation on exempt generation sites, on site and over private wire. The limitation to be incorporated into the 50MW (100MW) exempt generation per site with no differentiation between domestic and non domestic distribution and supply.

(ii) The removal of the 5MW and 2.5MW domestic exempt distribution and supply aggregate limitation from exempt generation over public wires. There should be no aggregation limit, the limit being governed by the amount of total surplus electricity that an exempt generator is able to export over public wires from each of its exempt generation sites.

In addition to high connection charges the proposed Generation Distribution Use of System (GDUoS) is another example of how distributed energy is penalised, particularly for existing distributed generators who have already paid connection charges. These are proposed new barriers that should be removed.

3. The incentives on DNO's are not sufficient to encourage them to connect smaller generators with minimum fuss and cost. The distribution networks will change from passive networks into active networks and could become as important if not more important than the national grid in time with increasing penetration of distributed energy. It is important to recognise this and to provide sufficient incentives and flexibility to DNO's, including participation in distributed energy projects and to remove regulatory barriers to DNO's preventing them from doing so.

4. Private networks do assist the technical and economic attributes of distributed energy and should be encouraged. It is not a short term expedient necessary to capture more value for distributed energy but a necessary energy revolution to maximise the efficiency of our energy systems with indigenous fuel supplies, provide long term security of supply and to maximise reduction in CO_2 and other greenhouse gas emissions. Centralised power generation is the primary cause of climate change which will not be tackled without displacing inefficient high emission centralised generation with efficient low emission distributed energy.

   Customers connected to private networks can be protected with such devices as statutory codes of practice or decentralised energy licences to provide the necessary customer protection as agreed between the industry and Ofgem. Competition is preserved with distributed energy and private networks in generation, distribution and supply, whereas centralised generation and public wire networks provide competition in supply only. The competition aspects of private networks are front ended and can therefore, provide consumers with more affordable energy which is index linked to maintain the cost benefits to consumers over the period of the energy services contract.

5. The costs and benefits (to different stakeholders) of the options detailed are:-

   a) Increasing the exemption limits for distribution and/or supply – This benefits both the distributed generator and consumer in that the economics enable the distributed energy to be implemented in the first place and to pass on economic savings to consumers. Distributed generators can benefit from the application of active private networks by providing a system that future distributed energy, particularly renewable energy, can be added in the future without any significant implication to the distribution and transmission networks and consumers can benefit from island generation and the provision of local security of supply. Both stakeholders contribute to reducing CO_2 emissions and tackling climate change.

Introduction of a decentralised energy licence – There could be a very much simpler licencing arrangement effectively mirroring exempt generation, distribution and supply on private wire networks but with a simple licence for operation within and connected to distribution networks. However, the licence would have to be simple and cover basic requirements such as consumer protection and not just a mini version of the full licencing requirements, obligations and costs, otherwise the technical and economic advantages of distributed energy would be overcome or voided. It is also important to combine generation, distribution and supply on both private wire and public wire networks for the same reasons.

Quite apart from health and safety legislation and the law of the land exempt generators/distributors/suppliers are required to enter into technical and connection agreements with the licensed host which sets out the safety requirements in the same way as for the licensed market.

b) Climate Change & Sustainable Energy Act – The issue of export reward for microgeneration and its extension to unlicensed generation under the Act could become important. However, microgeneration is an ideal technology for the owner/occupier market but is unlikely to be implemented at any scale if it depends on consumers paying for microgeneration themselves. As microgeneration is primarily for domestic consumers it is a natural partner to unlicensed distributed generation where it provides complimentary energy profiles with other larger non domestic energy consumers in the same distribution network. Also, if the 28 day rule is removed microgeneration opens up a new market for Energy Services Companies or ESCO's owning and operating unlicensed distributed generation where microgeneration could be provided by ESCO's at much greater scale as the export reward would be part of the locally traded exempt license operations and therefore, of much greater value.

Chapter 3: Microgeneration Technologies

3.3 When discussing the grid it is important to differentiate between the national grid and the distribution networks since under the laws of physics electricity will always flow to the nearest load, ie., the nearest local consumers in the same distribution network. In other words your next door neighbours. As in the Woking system these systems would initially require grid back-up power but as the system grows less and less grid back-up power would be required until all of the back-up power can be provided collectively by distributed energy itself turning the passive distribution network into an active network. This can be designed around large scale renewable energy, such as off shore wind farms, to take advantage of such systems but an extensive distributed energy system would not necessarily require large scale thermal power stations.

3.4 With the removal of the regulatory barriers to distributed energy, microgeneration technologies could become very material and very quickly indeed. See submission under Chapter 2.

3.6 Although the cost reduction of microgeneration technologies and the development of 'consumer friendly' products have been recognised as significant to the development of microgeneration the removal of the regulatory barriers to distributed energy will be as if not more significant as the true economic value of microgeneration would be captured which would accelerate cost reductions and the take up of 'consumer friendly' products via ESCO's.

3.13 Much of the microgeneration technologies referred to have been around for many years and utilised around the world, including the UK. Today's consumers do not regard the existing status quo licensed utilities as known and trusted supply companies and they show a ready appetite for new technologies and for new companies implementing them. Hence, the success of new technologies and new companies in the telecommunications industry, eg., cable TV, mobile telephones, internet and broadband. The deployment of these new technologies was very rapid indeed and the existence of a 'known and trusted' landline utility did not create a barrier or stop this from happening. If Government chooses to, it can make the microgeneration market happen very quickly indeed.

3.23 The removal of the requirement for a sale-and-buyback agreement with an energy supplier is supported.

<u>Question:</u>

6. As stated under 3.6 ESCO's can provide the market stimulus for microgeneration if the regulatory barriers to distributed energy are removed. This is not even asked by the question but is an obvious way forward.

Chapter 4: Renewables Connected to the Distribution Network

4.3 The UK stands at the threshold of delivering more than 50% of the UK's electricity generation from distributed energy by 2050 (some would say more than this) if it has the courage and political will to do so and embrace a new energy revolution that is exportable and can actually tackle global climate change by 'showing by doing'. The UK was in the lead in introducing deregulated energy markets and can be in the lead again by showing how a new energy revolution can provide both economic development and security of supply as well as tackling climate change.

4.9 The impact on the transmission system with distributed energy on private wire networks (collectively or otherwise) is negligible, if non existent, and should not therefore, be exposed to unnecessary burdens. If anything, such systems should be encouraged and rewarded.

4.10 Not only is this an unnecessary disincentive to renewable generation it is not necessarily true that it impacts on the grid in the way perceived, particularly where renewable energy is installed in conjunction with CHP. See submission against Question 1 under Chapter 2.

Chapter 5: Combined Heat and Power

5.1 With regard to Footnote 27 the efficiencies for CHP stated in DUKES is based on gross calorific values, overall net efficiencies are some 5 percentage points higher. There is also the avoidance of transmission and distribution losses with CHP which apply to CCGT plants.

Although peak efficiencies for CCGT plants may be in the range of 50% to 60% their average efficiency over the year (as CHP has been measured) as a whole is lower. DUKES states that the average annual efficiency for gas power stations is 46%.

5.2 The more standard alternative of taking electricity from the grid and using conventional boilers for heat supply can never be more efficient than CHP. CHP will always produce a significant reduction in CO_2 emissions against the conventional separate grid electricity and boiler heat. However, the economics of CHP is dictated by the regulatory barriers to distributed energy (the subject of this call for evidence) and so the true economics of CHP cannot be realised unless advantage can be taken from the exempt licensing regime and private wire networks.

Conventional UK design of CHP is not the best way to design such systems. CHP used in mixed development (which most communities are or should be to be sustainable) with mixed technologies such as large scale thermal storage and heat fired absorption cooling can achieve very high levels of energy efficiency, steady and constant heat loads just by combining different parts of the community together on the same distributed heat, cooling and electricity networks rather than stand-alone CHP for stand-alone buildings.

5.7 Although power stations can be utilised as CHP this needs to be for energy intensive industries rather than for communities. Therefore, location and a requirement to connect, particularly for steam, is important to capture the CHP potential of power stations. Power stations rejecting waste heat through cooling towers located alongside or near to oil refineries, steel works and the like consuming more fossil fuel energy to generate steam for industrial uses is not only stupid, it is also a substantial waste of non renewable energy and unnecessary emission of CO_2 and toxic pollutant emissions. Therefore, power stations should be located in such places as the Isle of Grain where a power station is to be utilised as CHP for adjacent energy intensive industries and not in such places as Didcot.

5.15 In London, in cities and other urban centres the housing mix is very different to the overall UK mix. Housing density is much higher with a predominance of flatted or apartment blocks in close proximity to each other and other non residential buildings, ideal for CHP (cogeneration and trigeneration). Although opportunities exist for new build they also exist for existing build, particularly for social housing, community buildings (schools, hospitals, leisure centres, etc) and commercial buildings, particularly in London. The Barkantine CHP project supplied existing housing and community buildings not new build, although new build may subsequently be connected to the CHP.

5.18 Traditional UK CHP design is not the best model to base CHP systems on. The most efficient CHP systems interconnect different parts of the community together, rather than stand-alone CHP for stand-alone buildings, and use technologies such as large scale thermal storage and heat fired absorption cooling with CHP (cogeneration and trigeneration) which provides very high utilisation all year round. This also overcomes seasonal effects. The CHP design models to follow for the UK are the Denmark, Netherlands or Woking models not the traditional UK CHP design model.

5.19 The ‘spark spread’ for exempt CHP on private wire networks has a completely different meaning to traditional CHP supplying into the ‘grid’. With exempt CHP on private wire networks the difference between gas prices and electricity prices is substantial since electricity is trading at competitive retail prices rather than the very much lower wholesale prices. This is one of the reasons why the Woking model was able to buck the trend with the impact of NETA and the declining use of CHP.

5.21 The economics of CHP are not particularly dependent on the revenue stream for the sale of heat for exempt CHP cogeneration on private wire networks where the sale of retail electricity and heat and the economics thereof is much more relevant. Similarly, for CHP trigeneration where the sale of electricity, heat and cooling apply. This approach does not necessarily require large CHP projects or extensive pipe networks because the changed economics as in the case of some of the Woking projects.

5.22 The economics of community or district energy systems changes where exempt CHP on private wire networks apply.

5.23 As above.

5.27 There are CHP-specific planning issues in the London Plan and the Further Alterations to the London Plan where the planning issues are actually positive issues requiring such systems, along with renewable energy, for planning consent. This positive approach to planning for CHP and distributed generation could be replicated elsewhere in the UK to provide a positive driver for CHP and renewable energy rather than a negative one.

5.34 As above.

5.37 Denmark and the Netherlands are not necessarily different to the UK and such intervention does not necessarily lead to increased costs incurred by consumers and tax payers as a result as demonstrated in Woking. In addition to this, tackling climate change is now obviously a primary driver for the UK and the planet which distributed energy can deliver, which separate centralised power generation and heat only boilers cannot deliver, in fact they are the primary cause of climate change.

<u>Questions:</u>

9. The Mayor of London's Submission to the Energy Review dated April 2006[8] set out the evidence base for decentralised energy (distributed generation), which includes CHP. There are 25 evidence references in the Mayor's submission. The Mayor of London/Greenpeace report 'Powering London into the 21st Century[9]' identified that $3.7GW_e$ of CHP could be delivered by 2025 with the high decentralised energy scenario against the current existing CHP capacity in London of $175MW_e$. Decentralised energy could also meet 35.5% of London's energy demand and reduce CO_2 emissions by 33% by 2025.

The Greenpeace report 'Decentralising UK Energy – Cleaner, cheaper, more secure energy for the 21st century – Application of the WADE Economic Model to the UK – 2006[10]' identified similar outputs and that decentralised energy supply from CHP would produce lower bills for customers. The WADE model was also recently used by the UK Foreign and Commonwealth Office to project China's energy future, by the Federal Government of Canada to look at the country's energy system and by the European Commission to investigate the options for the EU.

Retrofitting CHP to existing properties or more importantly interconnecting existing properties, particularly industrial and commercial and social or affordable housing is highly feasible. Similarly, if not more so, for new development. Both

---

[8] The Mayor of London's Submission to the Energy Review – April 2006
http://www.london.gov.uk/mayor/environment/energy/docs/energy-review-response.pdf

[9] Mayor of London/Greenpeace 'Powering London into the 21st Century'
http://www.london.gov.uk/mayor/environment/energy/docs/powering-london-21st-century.pdf

[10] Greenpeace 'Decentralising UK Energy: Cleaner, cheaper, more secure energy for the 21st century – Application of the WADE Economic Model to the UK – 2006
http://www.greenpeace.org.uk/MultimediaFiles/Live/FullReport/7441.pdf

approaches provide opportunities to interconnect both existing and new development to each other and vice versa which is more than encouraged by the Further Alterations to the London Plan. The approach to developing CHP needs to be looked at in a more holistic and innovative way than suggested by this chapter.

Much of this CHP capacity can be stimulated and achieved by removing the regulatory barriers to distributed energy as already detailed in the submissions under Questions 1 and 2 and Distributed Energy: Call for Evidence in this response.

10. As already detailed in the submissions under Chapter 2: Distributed Generation in Today's Electricity System, this chapter and Questions 1 to 5 and 9. In particular,

- Exempt CHP on private wire networks which significantly improves the economics of CHP and therefore, the heat networks, due to the significantly higher economics of retail price electricity which effectively hypothecates the economics of CHP/heat networks.
- The ability for exempt CHP on private wire networks to operate in island generation mode to provide electricity, heat and cooling to consumers in the event of a power cut in the national grid or the distribution network. This affords local security of supply and has value to consumers.
- Mixed use community networks in conjunction with CHP cogeneration or trigeneration, particularly in conjunction with heat fired absorption cooling and large scale thermal storage. The complimentary reverse electricity, heating and cooling energy profiles achieves much higher efficiency, utilisation and economics than stand-alone CHP for stand-alone buildings. For example, some of the Woking systems achieve 125% to 135% capacity (ie., 25% to 35% above peak demand of the private wire site) as opposed to 15% to 25% base load capacity for stand-alone CHP for stand-alone buildings or for residential community heating only scheme.
- Heat fired absorption cooling in conjunction with CHP or trigeneration significantly increases the utilisation, efficiency, economics and CO_2 equivalent emissions reductions since grid electricity is displaced that would otherwise be used by conventional electric air conditioning and refrigeration, more low carbon distributed generation electricity is generated from the 'heat to cool' process and the very powerful greenhouse gas refrigerants (eg., 1 tonne of HFC 134a is equivalent to 3,400 tonnes of CO_2 emissions) used by conventional electric air conditioning and refrigeration are displaced as heat fired absorption cooling uses zero Ozone Depletion Potential (ODP) and zero Global Warming Potential (GWP) refrigerants. In addition, the heat fired absorption cooling thermal energy consumption is at the right time of the year (ie., the summer) and provides complimentary overlapping reverse summer/winter energy profiles. This will become of increasing

importance with hotter summers, warmer climate and increasing levels of thermal energy efficiency. It is no coincidence that the major power cuts that have occurred in the national grids of the USA, Canada, Europe, UK and in London have all occurred in the summer with increasing electric air conditioning and refrigeration loads. CHP with heat fired absorption cooling or trigeneration directly reduces and could eventually eliminate this problem and improve security of supply in the summer. Indeed several power stations could be decommissioned by changing over from electric cooling to heat fired absorption cooling derived from CHP.

- Large scale thermal storage, which is unusual outside of Woking and Barkantine but common place in Europe, significantly improves the diurnal operation and load factor of CHP enabling a much higher and flatter generation profile. For example, in the Woking Town Centre CHP trigeneration system nightclubs receive their air conditioning from heat fired absorption chillers which receive their heat from large scale thermal storage from electricity generated from the CHP earlier in the day, significantly increasing the load factor and efficiency of the trigeneration system. As part of the Woking balancing system night time electricity for the Woking Town Centre customers is provided from export electricity over the local distribution network from the Woking Park CHP trigeneration system which has the opposite profile with the thermal energy loads for 3 swimming pools but low electricity consumption so the full electricity output from the CHP can be utilised to provide night time electricity to Woking Town Centre. This local balancing system operates in conjunction with other Woking CHP and renewable energy and private wire island sites (about 80 in all) but the foregoing provides a simple example of innovation and how CHP can be effectively and efficiently utilised.
- Renewable electricity generation, particularly distributed generation, used in conjunction with CHP compliments each other in improving the overall energy utilisation, efficiency, balancing and emission reductions.
- Using all of the above together, as in the case of Woking, would make CHP and the overall energy system more cost effective, more efficient and more balanced as well as maximising the reduction of CO_2 and other greenhouse gas emissions.

11. The primary barriers to the take up of community/commercial CHP are the regulatory barriers to distributed energy or decentralised energy (addressed elsewhere in this submission) and a lack of education or knowledge or indeed ignorance of how to properly design distributed energy or decentralised energy systems in the traditional UK engineering design environment. Woking and the London ESCO are examples of how the best of European energy engineering design can be combined with the exempt licensing regime (brought about by the UK deregulated energy environment) to overcome these barriers. Removing the

final regulatory barriers will enable distributed energy or decentralised energy to realise its full environmental and economic potential to the benefit of UK plc. This energy concept is highly exportable to other countries and with the UK 'showing by doing' the UK could really tackle global climate change.

Consumer protection can be provided by a statutory code of practice within the exempt licensing regime and/or by a simple decentralised energy license. However, both would need to be vertically integrated for the economics and technical design and operation to work.

12. Removing the regulatory barriers to distributed energy would be the primary incentive to really catalyse this market. Other incentives would also help such as communication and education and the revision of the planning system elsewhere in the UK along the lines of the Further Alterations to the London Plan. However, new development is only 1% of the building stock a year and climate change will not be tackled by just dealing with new development alone. Existing development must be tackled (and at a large scale) through the revision of the Building Regulations and other regulations, particularly with regard to housing. The EU Directive on the Energy Performance of Buildings could be used a major plank in which to tackle existing development and must be implemented sooner than currently planned by the Government.

13. As detailed in the submission under Question 11 Woking and the London ESCO are examples of the utilisation of the best of European energy engineering design combined with the exempt licensing regime (brought about by the UK deregulated energy environment). The UK has an advantage here which it could capitalise on and show the way as to how the best of engineering design can be combined with best of regulatory action to catalyse low carbon energy markets which any city or country in the world could replicate.

Chapter 6: Renewable Heat Only Technologies

6.1 In climate change terms preference should always be given to the renewable cogeneration of heat and electricity rather than renewable heat only, although renewable heat only boilers will be required as standby and top up to CHP.

6.13 In climate change terms the use of biomass must be subject to any negative implication on food production, biodiversity, habitat loss and rainforest destruction. In addition, the carbon content to be emitted and the associated carbon sequestration and timescale to offset the carbon emission from the re-growing of each particular fuel and the associated transport carbon emissions must also be taken into account when assessing the overall carbon reducing benefits of particular biomass fuels. If this is not taken into account and if the biomass fuels are not certified or accredited in some way some biomass could actually increase carbon emissions rather than reduce them.

Question:

A very big omission from this call for evidence is the development of renewable gases and synthetic fuels from the organic and residual fractions of industrial, commercial, sewage, municipal and biomass wastes as well as from non waste biomass. In an urban environment like London this is a far bigger renewable energy resource than transported solid biomass. It also significantly reduces, if not virtually eliminates, waste to landfill and incineration, treats waste as a resource, converts a renewable resource into a form of renewable energy that can be stored and pipelined, creates a common energy carrier for both buildings and transport, can create a macro renewable energy infrastructure for zero carbon development and transport, reduce London's traffic congestion through the minimisation of transport movements for both renewable fuels and wastes, increase London's indigenous renewable energy footprint and significantly reduce London's CO_2 and toxic pollutant emissions.

Chapter 7: Encouraging Distributed Generation

7.9 The London Plan and in particular, the Further Alterations to the London Plan is a model that Government could direct other local authorities to replicate for their area. However, the term 'where feasible' – a traditional planning term in this area must be omitted to have any effect.

7.11 As detailed in the submissions under Questions 4, 5 and 11 competition is achieved by exempt distributed generation on private wire networks in generation, distribution and supply, not just supply as in the case of grid electricity, and consumer protection can be delivered by a statutory code of practice, or similar, as agreed between the distributed generation industry and Ofgem.

7.17 The removal of the '28 day rule' is supported.

7.22 As announced by David Miliband (Secretary State at Defra) in his speech to the Lunar Society on 26 October 2006 and in particular, on decentralised energy and decreased energy demand, the Government wants to replicate or roll out the Woking and London models and it wants to see Energy Services Companies or ESCO's as the norm. As stated in the Secretary of State's speech the London Climate Change Agency (LCCA) has replicated the Woking model for London and has established, following procurement, the London ESCO, a public/private joint venture Energy Services Company between the London Climate Change Agency Ltd and EDF Energy plc. The LCCA has given several presentations on the London ESCO model to the joint RDA meetings and is working closely with English Partnerships on specific ESCO opportunities.

7.24 The London Plan, which incorporates the 10% renewable energy policy, covers major developments in the whole of London and the Further Alterations to the London Plan goes even further than this by increasing this to a 20% renewable energy policy, this time by carbon reductions rather than by reduction in energy requirements. This will make the London Plan carbon led rather than energy led and teases out the differences between different renewable energy technologies which are not equal in relation to the amount of carbon they can reduce for the same energy requirements.

The Further Alterations to the London Plan strengthens the requirements for decentralised energy (distributed energy) and its infrastructure, and in particular, CHP cogeneration and trigeneration.

The proactive London Plan approach to decentralised energy (distributed energy) can be adopted by any local authority in the UK but will require Government to make this an obligation rather than optional if climate change is to be tackled in the UK.

Questions:

15. The Woking and London Climate Change Agency models show how distributed energy can be delivered both at the local authority level and the RDA level driven by an elected Mayor who has made tackling climate change a major priority of his administration.

    Although the UK has a climate change target to reduce CO_2 emissions by 60% by 2050 recent evidence suggests that climate change will need to be tackled in the next 10 to 15 years if permanent catastrophic climate change is to be avoided. As time is of the essence distributed energy would be better led by the RDA's rather than local authorities whose RDA boundaries roughly coincide with the distribution network boundaries which is no accident since both organisations originated from historic local government boundaries, give or take a few local boundary changes.

    As the carbon reductions required are so large and cannot be achieved without distributed energy there should be specific statutory targets for distributed energy.

16. There is a need for better advice, including case studies, etc., on distributed energy.

Allan Jones MBE
Chief Executive Officer
London Climate Change Agency
22 December 2006