Leeds CITY COUNCIL

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Report of the Director of City Development

Scrutiny Board: City Development

Date: 1st September 2009

Subject: Climate Change

Electoral Wards Affected: All	**Specific Implications For:**	
	Equality and Diversity	☐
	Community Cohesion	☐
☐ Ward Members consulted (referred to in report)	Narrowing the Gap	☐

1.0 Introduction

1.1 Over the past three years, significant progress has been made to understand the council's role in relationship to climate change and to take forward appropriate actions. This report provides contextual background, reference to other reports and attempts to identify broad areas that City Development Scrutiny could usefully investigate further. First, it is essential to provide key definitions.

2.0 Definitions

2.1 In order to respond to climate change, action is required in two inter-related areas:

- **Mitigation** – reducing greenhouse gas (GHG) emissions to a safe and stable level.
- **Adaptation** – increasing resilience so that that our society and natural environments can cope with a radically different climate.

2.2 This report focuses on mitigation rather than adaptation.

2.3 When dealing with climate change, the council's role is split into two broad areas:

- **Corporate** – our buildings, fleet vehicles, other assets and day to day operations that we can directly manage.
- **Service delivery and city leadership** – the services that we deliver to/on behalf of our citizens and business and our role to lead the strategic development of Leeds. We can set the framework for action, but rely on our partners, businesses and

residents to also contribute. An example of a service is municipal waste collection and leadership is the Leeds Strategic Plan.

2.4 This report considers all of these areas in a City Development context.

3.0 Context

3.1 Work already completed or underway in the climate change area relevant to City Development scrutiny includes:

- In 2008 the Environment and Neighbourhoods Scrutiny Board published their ***Statement On The Council's CO_2 Emissions***. This report made six recommendations to reduce corporate emissions, all of which have either been completed or are being taken forward. The focus was on short term emissions reductions, largely through energy efficiency, so renewable energy[1] was not considered as a major factor at the time.

- The council adopted ***NI185 – CO_2 reduction from local authority operations*** as one of our 32 priorities within the Leeds Strategic Plan. We have set a target to reduce corporate emissions by 3.4% over two years with activity focussed on energy efficiency in our buildings, the street lighting PFI, and low carbon vehicles. As this is a short-term target, renewable energy, combined heat and power[2] (CHP) and district heating[3] do not contribute significantly.

- A draft ***Carbon Reduction Strategy*** has recently been discussed with CLT and will be taken to members shortly. This aims to set the strategic direction to make corporate buildings as close to carbon neutral as technically and financially viable by 2026. In the short-term, this will be achieved by improved energy efficiency and reducing corporate office-space but longer-term significant amounts of on and off-site[4] low or zero carbon[5] (LZC) energy will be required.

- The ***Leeds Climate Change Strategy***, published in July 2009, sets the strategic direction for service delivery and city leadership action on both mitigation and adaptation. It identifies 35 priority areas to progress over the next two years. Many of these are already included within service plans (e.g. transport, waste and domestic energy efficiency). One of the main gaps is in strategic city scale energy planning.

4.0 Scope

4.1 It is clear from the above that energy efficiency is already well covered within existing plans and programmes and has recently been scrutinised. However, there are gaps

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[1] Renewable energy is defined as energy generated from natural resources - such as sunlight, wind, rain, tides and geothermal heat - which are renewable (naturally replenished). Common technologies are briefly described in Appendix 1.

[2] CHP is defined as the use of a heat engine or a power station to simultaneously generate both electricity and useful heat. Conventional power plants lose the heat created as a by-product of electricity generation into the environment through cooling towers, whereas CHP captures the by-product heat for domestic or industrial heating purposes, either very close to the plant, or as hot water for district heating.

[3] District heating is a system for distributing heat generated in a centralised location (i.e. CHP plant) for residential and commercial heating requirements such as space heating and water heating.

[4] On site energy is typically integrated into the building fabric and usually only supplies that site. Off site energy can be many miles distant from the site but is linked through district heating systems or specific electricity supply contracts.

[5] Low and zero carbon energy is the generic term for those technologies which can provide significant carbon reductions against traditional systems. This term includes renewables, CHP and district heating.

within strategic city scale energy planning and deployment of LZC energy within our estate.

4.2 Therefore, the recommended focus for City Development Scrutiny is on **our corporate and service delivery roles to stimulate new LZC energy capacity in Leeds to achieve emissions reductions.** This fits with the planning, asset management and sustainable development functions of the Directorate.

4.3 The remainder of the report provides additional supporting information regarding renewable energy, with descriptions of some common renewable energy technologies in appendix 1.

5.0 Renewable energy drivers for our estate

- **NI185 – CO_2 reduction from local authority operations**

5.1 NI185 concentrates effort primarily on cost-effective energy efficiency improvements. However, in order to gain operational experience of different technologies that will need to be deployed in future, the NI185 action plan also covers installation of smaller LZC energy technologies.

- **Carbon Reduction Commitment (CRC)**

5.2 The Government's new carbon trading scheme, the Carbon Reduction Commitment, will require us to purchase carbon allowances for every tonne of carbon that we emit from our corporate estate from 2011 onwards. Initially, this will cost approximately £1m pa but as the available allowances reduce, the likelihood is that this cost will rise significantly. Better than average emissions reductions each year will be rewarded with a high percentage of revenue recycled to us; a poor performance with a low percentage.

5.3 In the short term the most cost-effective carbon reductions will be energy efficiency investments, behaviour changes and consolidation of our estate. However, in order to continue to reduce emissions in line with the Carbon Reduction Strategy and to quality for revenue recycling from the CRC we will need to invest in some major LZC energy projects.

- **Energy security**

5.4 The International Energy Agency (IEA) estimates that the decline in oil production in existing fields is now running at 6.7 per cent a year and new fields are not being discovered or exploited fast enough to cover this long-term decline. Although the IEA believes 'peak oil' (the maximum level of extraction) will not arrive until 2020, it believes that we are heading for an earlier "oil crunch" because demand after 2010 is likely to exceed dwindling supplies.

5.5 This oil crunch will lead to rapidly escalating fuel prices and supply uncertainty. To reduce exposure to these risks, we need to reduce total energy demand and try to control the source of production through increased investment in local LZC energy sources.

6.0 Implications

6.1 There are now significant short, medium and long-term drivers to encourage us to invest in renewable energy within our corporate estate. However, we have not yet established all of the structures to respond to these drivers, particularly for larger scale projects. In order to deliver large scale projects we should consider:

- Conducting an assessment of renewable energy potential across our estate, both for building integrated and grid-connected renewables.

- Utilising support available through Partnership for Renewables (a Carbon Trust Enterprises company) to plan, finance and project manage the installation of large renewables, including wind, on our estate.

7.0 Renewable energy drivers for service delivery

- **Regional Spatial Strategy**

7.1 The Regional Spatial Strategy (RSS) includes two policies relating to renewable energy:

ENV5B1
Delivering at least the Regional and Sub-Regional targets for installed grid-connected renewable energy capacity. [The indicative local authority target for Leeds is 11MW by 2010 and 75MW by 2021]

ENV5B3
In advance of local targets being set in DPDs, new developments of more than 10 dwellings or 1000m^2 of non-residential floorspace should secure at least 10% of their energy from decentralised and renewable or low-carbon sources, unless, having regard to the type of development involved and its design, this is not feasible or viable.

7.2 These two policies require different actions from us. Policy ENV5B1 requires us to carry out a strategic review to ascertain the technical potential and financial viability of a mix of different technologies and locations to meet the target. This should then be presented as a Development Plan Document as part of the Local Development Framework. Some work has already been undertaken as part of the emerging Natural Resources and Waste DPD and support to develop this further may be available from Future Energy Yorkshire[6].

7.3 Policy ENV5B3 should be applied to all relevant applications through the planning approval process. This would result in a significant number of larger developments having on-site LZC energy, helping to stimulate the market locally and reduce future costs of compliance with likely Building Regulation changes. Although we have worked with a small number of developments to implement ENV5B3, we do not consistently require developers to make provision for renewable energy. The development market is tight at the moment and additional requirements may dissuade developers from bringing forward proposals in Leeds. The policy also requires planners to obtain new skills in order to properly assess each application and to provide assistance or challenge as appropriate to developers. Support may be available from next year via Future Energy Yorkshire to run courses for planners to develop the required skills.

- **Developers**

[6] Future Energy Yorkshire is a wholly owned subsidiary of Yorkshire Forward responsible for developing the renewable energy market in the region.

7.4 We are experiencing increased applications from private developers for renewables, particularly for large scale wind. Each application has to be carefully evaluated and an individual case constructed, taking scare officer time. Where planning permission is refused, experience from other authorities shows that developers often successfully take appeals to Planning Inspectors, with associated officer, reputational and financial costs.

7.5 Publishing a clear strategic framework with parts of the city zoned as suitable for different technologies would minimise the number of speculative or inappropriately located planning applications.

- **Government Policy**

7.6 The Renewable Energy Strategy published by the Department of Energy and Climate Change (DECC) in 2009 committed to put in place mechanisms to provide financial support for renewable electricity and heat worth around £30 billion between now and 2020. Key commitments are to:

- Extend and expand the Renewables Obligation for large-scale renewable generation;
- Amend or replace the Renewable Transport Fuel Obligation to increase use of sustainable biofuels; and
- Introduce a new Renewable Heat Incentive and 'Feed-In Tariffs' to provide guaranteed payments to individuals, business and communities for renewable heat and small-scale electricity generation.

7.7 The policies contained in the strategy are likely to significantly increase the number of both small and large scale LZC energy developments in Leeds.

8.0 Implications

8.1 The changed nature of regional planning policy, national policy and incentives and increased demand for renewables means that we cannot afford to continue to take a reactive approach to planning for LZC energy. In order to develop a more strategic approach we should consider:

- Undertaking a detailed review of the renewable energy resources and constraints in order to identify zones within Leeds suitable for different forms of LZC energy.
- Establishing an Energy Services Company (ESCo) with the specific remit to support the development of large scale LZC energy in Leeds.

9.0 Recommendations

9.1 That the Scrutiny Board (City Development) concentrates on one or more of:

1. Evaluating options for installing LZC energy as part of the corporate estate, with a focus on large scale projects.
2. Progress in planning policy to strategically plan for large-scale grid-connected renewables.
3. Development control processes to ensure that developments of over 10 dwellings or 1000 m^2 have at least 10% on-site LZC technologies.
4. The appropriate delivery structure to ensure that LZC energy, particularly large grid connected or on-site in major regeneration areas, is delivered.

Appendix 1 – Common Renewable Energy Technologies

Wind turbines

A wind turbine harnesses energy from the wind to produce electricity. The most common design is of three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower or mast. The blades drive a generator either directly or via a gearbox (generally for larger machines) to produce electricity for consumption on site or sale to the grid. Modern designs can be very quiet in operation.

Wind turbines can be mounted on masts that are free-standing or tethered with wire guys. The greatest amount of power will be generated if turbines have a constant supply of steady wind, which is dependent on the site having a good wind profile (average wind speed of 5-6 m/s or higher) and being free of obstructions such as trees or buildings.

Wind turbines are amongst the most cost-effective renewables, on the right site. The main drawbacks are that not every site is suitable and negative perceptions amongst some local residents, based around outdated expectations of noise and subjective visual objections. For any wind-turbine application, it is essential to involve local residents early on in the design and make sure that photomontages are made available to allay fears.

In Leeds, there are only a few sites that are suitable for the largest (125m tall) turbines due to the large resident population, the number of high-quality environments, generally low wind-speeds and conflicts with radar. Smaller turbines have some potential even in these areas but give poorer returns on investment.

Biomass

Biomass, a renewable energy source, is biological material derived from living, or recently living organisms, such as wood, waste, and alcohol fuels. Forest residues, wood chips, waste organic material from fibre or food production and specifically grown energy crops (such as miscanthus, switchgrass, hemp, corn, poplar, willow, sorghum, sugarcane and a range of tree species) are all classified as biomass.

There are a number of technological options available to make use of the wide variety of biomass types as a renewable energy source. Conversion technologies may release the energy directly, in the form of heat or electricity, or may convert it to another form, such as liquid biofuel or combustible biogas. Examples include:

Thermal conversion - these are processes in which heat is the dominant mechanism to convert the biomass into another chemical form. The most common technology is combustion based (biomass boilers or CHP) but pyrolysis and gasification are growing in popularity.

Chemical conversion - a range of chemical processes may be used to convert biomass into other forms, such as to produce a fuel that is more conveniently used, transported or stored, or to exploit some property of the process itself.

Biochemical conversion - makes use of the enzymes of bacteria and other micro-organisms to break down biomass. In most cases micro-organisms are used to perform the conversion process: anaerobic digestion, fermentation and composting.

In Leeds there are many woods, both council and non-council, that are currently under-managed. Bringing these woodlands into a management regime would enable biomass to be extracted in a controlled manner, without a large impact on biodiversity or leisure usage.

Energy from Waste

Energy from waste (EfW) is the process of creating energy in the form of electricity or heat from waste. EfW is therefore a form of energy recovery to recoup some value from waste materials. Most EfW processes use a form of thermal combustion (typically incineration) to produce electricity directly with some heat recovery, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels.

There are a number of other new and emerging technologies that are able to produce energy from waste and other fuels without direct combustion. Many of these technologies have the potential to produce more electric power from the same amount of fuel than would be possible by direct combustion.

Common thermal technologies include gasification and pyrolysis and common non-thermal technologies are anaerobic digestion and fermentation.

Hydropower

Hydropower, or water power, is power derived from the force of moving water, which may be harnessed for useful purposes. Most types of modern hydropower are used to generate electricity.

Small scale hydro or micro-hydro power has been increasingly used as an alternative energy source, especially in remote areas where other power sources are not viable. Small scale hydro power systems can be installed in small rivers or streams with little or no discernible environmental effect on things such as fish migration.

The main considerations in a micro-hydro system installation are: a sufficient and consistent flow of water, the height difference between the intake and the exit and compliance with legal and regulatory issues.

In Leeds, there is potential to install modern small scale hydro on both the river Aire and Wharf, using some of the old civil engineering works associated with old mills. Modern Archimedian screws (slow moving encased corkscrews) can generate around 250kW of electricity on a good site and are considered to be ‘fish-safe’ and relatively quiet and unobtrusive.

Combined heat and power (CHP)

CHP uses a heat engine or a power station to simultaneously generate both electricity and useful heat. CHP uses heat that would be wasted in a conventional power plant, potentially reaching an efficiency of up to 89%, compared with 55% for the best conventional plants. This means that less fuel needs to be consumed to produce the same amount of useful energy.

CHP is most efficient when the heat can be used on site or very close to it. However, an exact match between the heat and electricity needs rarely exists. A CHP plant can either meet the need for heat needs on site or use district heating to transfer excess heat to neighbouring developments.

Overall efficiency is reduced when the heat must be transported over longer distances. This requires heavily insulated pipes, which are expensive and inefficient; whereas electricity can be transmitted along a comparatively simple wire, and over much longer distances for the same energy loss.

In Leeds there already exist a number of CHP units (notably at St James's hospital, at the Carslberg-Tetley brewery and on the University of Leeds/LGI campus). There are major opportunities to develop new CHP schemes across Leeds with advanced plans to integrate CHP with the Eastgate/Harewood development, to expand the University/LGI scheme and in Holbeck Urban Village.

The biggest challenges for CHP in Leeds are raising sufficient capital finance and ensuring that new developments commit to using the heat to give investors certainty over financial returns.

Air or ground-sourced heat pumps

A heat pump is a machine that moves heat from one location (the 'source') to another location (the 'sink' or 'heat sink') using mechanical work. The most commonly understood heat pumps are fridges and freezers, which exploit the physical properties of evaporating and condensing fluids, known as refrigerants.

Recently, reversible-cycle heat pumps have started to be commonly used to for provide thermal comfort in homes and offices. These heat pumps use a vapour-compression refrigeration device that includes a reversing valve and optimized heat exchangers so that the direction of heat flow may be reversed. Most commonly, heat pumps draw heat from the air or from the ground.

Ground-sourced heat pumps require heat capturing coils filled with a heat transfer fluid to be laid in trenches or in deep bore holes, depending on the ground available. As the ground temperature stays relatively constant these provide consistent heat sources. Air source heat pumps resemble air-conditioning units and upgrade heat from external air to a useful temperature for internal heating. Typically, below about -5^{o}C air source heat pumps struggle.

Ground and air source heat pumps have good potential in Leeds.

Photovoltaics (solar cells)

Solar photovoltaic (PV) systems use energy from the sun to convert solar radiation into electricity, which can be used directly to run appliances and lighting or sold to the national grid.

PV systems perform best in direct sunlight, but continue to perform well in reduced light conditions. Systems come in various forms including solar tiles, roof-integrated panels and on-roof panels. PV systems are also available for cladding buildings and covering walkways.

PV systems main benefits are their flexibility, suitability to most situations, ease of installation, low maintenance and production of electricity in the day when it is most needed. Their main drawback is that they are expensive with long-payback periods.

Solar thermal (solar panels)

Solar panels can be fitted onto or integrated into a building's roof and use the sun's energy to heat a heat-transfer fluid which passes through the panel.

The fluid is fed to a heat store (e.g. a hot water tank) to provide part of the hot water demand for the building. Usually another heat source will be needed to supplement collectors in winter months. Solar panels can also be used to heat swimming pools.

Solar thermal installations’ main benefits are their relatively low capital costs and ease of maintenance. The drawback is that they are not suitable for integration to all existing heating systems, heat production doesn’t always match demand profiles (unless excess heat can be ‘dumped’ to a swimming pool) and the value of energy generated is relatively low.