



**Energy from Waste and Recycling Facility, Trident Park**

**Heat Plan**

**Viridor**

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## **1.0 INTRODUCTION**

### **1.1 Background**

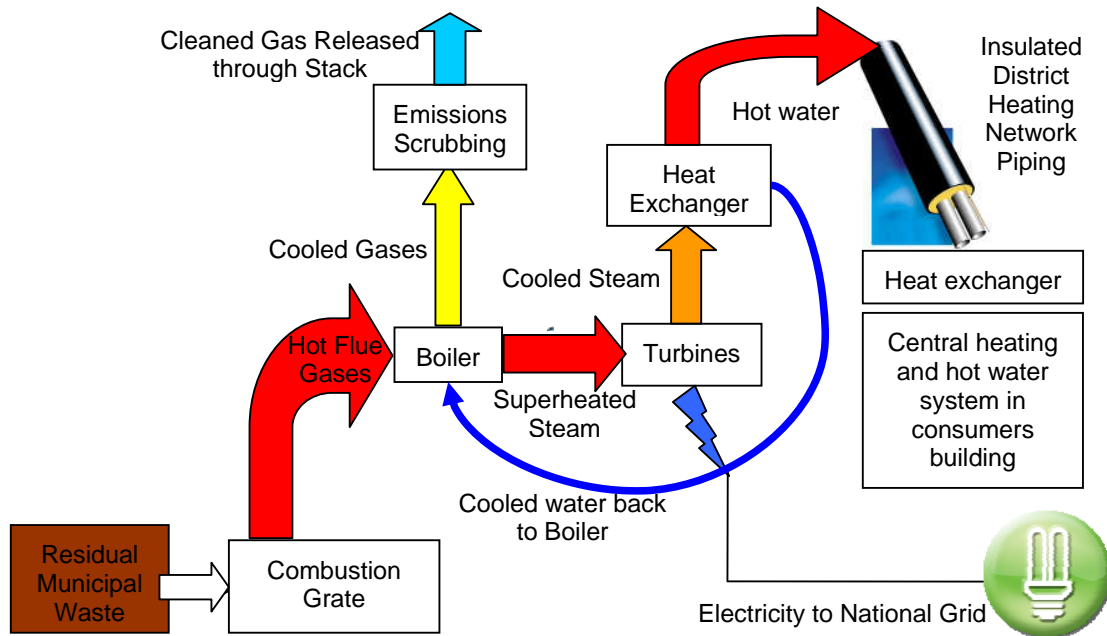
The proposed Energy from Waste and Recycling Facility at Trident Park has been designed as a Combined Heat and Power plant, generating both electricity to be exported to the National Grid and heat for local end users. The potential exists for the heat to be supplied via a district heating network of highly insulated underground pipes to nearby heat users, resulting in much lower carbon emissions as compared to conventional heating methods. This network would provide a sustainable heat supply, which, due to the insulated nature of the pipes, would be protected from the rising costs and supply issues associated with conventional fossil fuels. The large commercial and amenity presence in Cardiff city centre and Cardiff Bay, as well as the significant population within a few kilometres of the Trident Park site represents an opportunity to enhance the city's "green" credentials by using sustainable heat and power, dramatically reducing the quantity of waste going to landfill and reducing Wales' dependency on imported fossil fuels.

### **1.2 Energy from Waste Process**

The energy from waste process involves the combustion of residual waste, which has been sorted to remove those parts which can be recycled and composted. The residual waste is fed into a specifically designed moving grate over which the material passes as it is burning at a temperature in excess of 850° Celsius. This high temperature and close air control via the grate system ensures complete combustion and the minimum amounts of pollutants are created. The heat generated by this combustion is then used to heat water within a water tube boiler to produce high pressure steam, which is then fed through turbines to generate electricity, much as in conventional electricity generation. The flue gases from the combustion are then scrubbed using technologically advanced scrubbing mechanisms and reagents such that pollutant levels entering the atmosphere are minimised and well within the prescribed limits of the Waste Incineration Directive.

Superheated steam is supplied to the turbine which drives the electricity generator. The steam gradually reduces in pressure and can then be passed out from the latter stages of the turbine and used to heat a local water network i.e. Combined Heat and Power (CHP). The CHP facility is able to provide heat to a local heating network, by transferring it through a heat exchanger and piped via insulated piping to nearby heat consumers. In this particular case, potentially to a combination of residential, leisure and commercial/industrial users. The co-generation of heat and power in a single facility represents a huge efficiency gain over a conventional power station as the heat that would normally be wasted in a power plant's cooling towers is put to beneficial use instead, reducing the primary fuel use of the heat consumers. An overview of the process is shown below in figure 1-1.

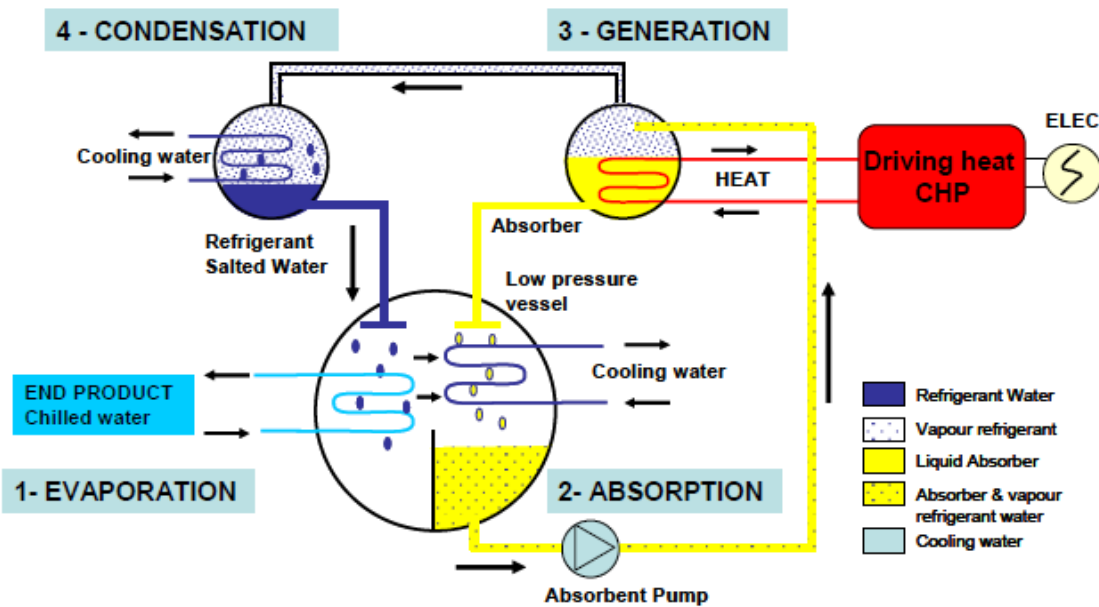
**Figure 1-1 - CHP Process Overview**



**1.3 Tri-generation**

Combined heat and power (sometimes referred to as co-generation) can be allied with other equipment to produce a third utility in the form of chilled water. This is achieved by the incorporation of absorption coolers into the CHP process. This chilled water is commonly used to cool buildings. A schematic of the absorption process is shown in figure 1-2 below.

**Figure 1-2 – Heat Fired Absorption Cooling**



The process works by the absorption of the heated water, which is at very low pressure, and so boils at very low temperature. This boiling causes refrigerant in the system to absorb heat from the medium being cooled, lowering the temperature of the water and producing chilled water.

Tri-generation systems are usually markedly more efficient than normal CHP systems since more of the heat that would otherwise be lost is utilised in the absorption chillers. This is of particular benefit during the summer months as the heat that is not required during this time would be dissipated through the heat exchangers in a CHP system, effectively going to waste, whereas in tri-generation the heat is efficiently utilised for users cooling demands.

#### **1.4 Energy Recovery**

The harnessing of the surplus heat from the electricity generation through Combined Heat and Power generation (CHP) is a much more efficient use of the fuel source than electricity only generation: surplus heat is not wasted as in conventional power generation, it is used where heat would have otherwise been generated using other fuels.

The exploitation of surplus heat from the electricity generation process can increase the overall energy efficiency of an energy from waste facility significantly, from approximately 22-25% to as much as 85% for combined heat and power generation<sup>1</sup>, representing a significant environmental benefit. This use of surplus heat to provide heating for nearby premises through a district heating scheme therefore has the effect of significantly reducing the consumption of primary energy sources by the final user, thus representing potential significant benefit to the environment, as well as protection for consumers from rising fossil fuel prices and removal of vulnerable consumers from fuel poverty.

#### **1.5 Incinerator Bottom Ash Facility**

It is proposed that Incinerator Bottom Ash, a by-product of the combustion process, will be treated to produce aggregate material at an on site plant adjoining the EfW. The material will be moved from the EfW via a covered conveyor to the bottom ash facility.

The bottom ash material is wet on leaving the EfW and needs to be matured and turned for between 4-6 weeks before it can be processed for aggregate. At full capacity it is estimated that the plant will produce approximately 75,000 tpa of recycled aggregate for the local market.

#### **1.6 Pre- Treatment Area**

The proposed pre- treatment area at the western end of the EfW building will ensure that any unsuitable residual waste delivered to the site can be 'picked-out' or shredded to increase the efficiency of the facility. Waste materials will be delivered into the building and deposited within a designated tipping area. From here material will be screened and sorted prior to being moved to the waste bunker.

#### **1.7 Relevant Planning Guidelines**

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<sup>1</sup> Energy from Waste: A Good Practice Guide. CIWM, November 2003

### 1.7.1 Renewable Energy Route Map for Wales

*Renewable Energy: Route Map for Wales* published in consultation form by the Welsh Assembly Government (2008) specifies targets for renewable energy generation in Wales, citing the production of CHP from waste as a key priority for several reasons, including the redirection of waste from landfill and the locality of the fuel source to the end user, reducing transport costs and environmental impact.

“3.7 The UK Government biomass strategy has assessed biomass for energy generation in relation to the cost-effectiveness of carbon savings. The hierarchy (...) is as follows:

- heat of combined heat and power from waste biomass
- electricity from waste biomass...”

Also regarding CHP from waste in urban areas:

“Modern EfW plant has to meet stringent operating standards set out by the Pollution Prevention and Control (England and Wales) Regulations 2000, which implement the provisions of the EU Waste Incineration Directive (WID). This has enabled some EU member states to establish CHP plant fuelled by local waste in urban areas. EfW plants operating under the terms of the Waste Incineration Directive (WID) have lower emissions than comparable industrial processes or traditional energy plants.”

The Table Below (Annex A) shows the Assembly Government's expected EfW CHP capacity for Wales by 2025.

#### **Annex A: Summary of Possible Electricity and Heat Generation from Renewable Energy in Wales by 2025**

<b>Technology</b>	<b>Proposed ROC's per MWh</b>	<b>Installed generation capacity (MWe)</b>	<b>Electricity load factor (%)</b>	<b>Electrical energy generated TWh(e)/yr</b>	<b>Annual heat power output TWh(th)</b>	<b>Potential Carbon Savings (tonnes C)</b>
<i>Biomass-indigenous including energy from waste</i>	Range of 0.5 to 2	350	70	2.6	2.4	400,000

The Welsh Assembly Government also states among other criteria, that an Energy from Waste Plant is only acceptable if:

“It includes combined heat and power wherever practicable”

### 1.7.2 Defra Paper: Analysis of the UK potential for Combined Heat and Power (October 2007)

Page 20: *Renewable energy and waste to energy*, recognising the importance of locality of fuel production to energy generation in reducing environmental impact in urban waste to energy schemes:

“Given the right fuel supply it could be the case that biomass CHP is more economic than gas-engine CHP and inclusion of biomass in the potential study would mean that

*the economic CH/CHP potential could be greater than estimated from the use of gas-engines alone. Similar arguments apply to waste to energy projects except that as the waste is generated within an urban environment there is potentially a greater opportunity to develop a CH/CHP system from an energy from waste plant.”*

Page 20: Cooling demand identifies additional use for CHP heat in absorption chillers.

*“Meeting a cooling demand using heat from a CHP unit to supply an absorption chiller is technically viable and can be economic in the right conditions, particularly for larger projects.”*

### **1.7.3 Planning Policy Wales**

Planning Policy Wales Technical Advice Note (TAN) 21: Waste (2002) states with regard to Energy from Waste proposals (para. 4.8):

*“Proposals that incorporate combined heat and power plant could contribute toward district heating schemes for development such as schools or hospitals, providing these are environmentally acceptable. This makes the recovery of energy more efficient and it would potentially reduce the impact of using primary fuels.”*

The Planning Policy Wales Technical Advice Note (TAN) 8: Planning for renewable energy states (para 3.6):

*“A combined Heat and Power (CHP) plant is an installation where there is a simultaneous generation of useable heat and power (usually electricity) in a single process. The basic elements of a CHP plant comprise one or more prime movers usually driving electrical generators, where the heat generated in the process is utilized via suitable heat recovery equipment from a variety of purposes including: industrial processes, community heating and space heating. CHP plant allows “waste” heat produced from electricity production through thermal processes to be put to valuable use thus providing an opportunity for significant savings in carbon emissions. Local planning authorities should take an active role in facilitating CHP systems through development plan and development brief processes”*

As well as relating to the inclusion of renewable technologies including CHP in new development (para 4.5):

*“In order to further promote energy efficiency and energy conservation, local planning authorities should consider requiring in development plan policies or supplementary planning guidance that planning applications... should be accompanied by an Energy Design Advice Report if appropriate. The report should include recommendations relating to energy efficiency and appropriate energy technologies that could be incorporated into the development.”*

Supplementary Planning Guidance is suggested regarding District Heating among other topics (para 5.7)

*“Design and Energy SPG could cover such wide ranging topics as... community heating networks. Development briefs for major development should also requirements regarding renewable energy, energy efficiency and conservation.”*

Annex C of TAN 18 encourages the use of CHP wherever the opportunity is present:

*“The Assembly Government considers that a plant to recover energy from waste is acceptable only if:*

- *It includes combined heat and power wherever practicable.” (para. 14.3)*

And:

*“Where electricity is produced through thermal processes the efficiency of conversion is often only something like 35% i.e. 65% of the energy input is wasted through heat that is released into the atmosphere or a body of water. Combined heat and power plant allow that “waste” heat to be put to valuable use thus providing an opportunity for significant savings in carbon emissions and increased efficiencies. Such plant clearly needs to be carefully sited adjacent to a suitably matched heat load but CHP technology, for gas in particular, exists at a huge variety of scales. CHP units are now available down to the scale of the individual home and have been appropriate to locations such as public swimming pools for a number of years. The planning system can do much to assist in the feasibility of larger CHP systems by planning for community heating.” (para 15.1)*

*“The most efficient way of utilising renewable heating fuels (e.g. woodchips) is utilising one or more centralised boilers and a heat distribution network. This might be in a block of flats, a hospital complex or perhaps an estate of houses or small community. The ideal heat-load for a community heating network would include a variety of users with a good spread of demand throughout the day and week. A combination of residential, leisure and commercial/industrial users would be excellent. Such networks can also provide energy for cooling and this is a valuable summer load displacing energy intensive alternatives.” (para. 16.1)*

#### **1.7.4 Cardiff Council Replacement Structure Plan 1991-2011 (Adopted April 1997)**

The Structure Plan states under Environment Policies:

EV1. Proposals which encourage sustainable practices and are consistent with other development plan policies will be favoured, including:

- l) Proposals which contribute to energy conservation or energy efficiency, waste reduction and recycling, improved pollution control, biodiversity and reduction of dependency on fossil fuels;

#### **1.7.5 Cardiff Council Final Municipal Waste Strategy (November 2005)**

Cardiff Council's Waste Management Strategy states (page 46):

*“Further recovery of the associated heat in a combined heat and power scenario would improve the performance of all options that utilise EfW and may wish to be considered by Cardiff as an additional potential benefit”*

### **1.8 Existing EfW CHP Schemes**

There are a number of schemes in operation both in the UK and in Europe where residual waste or waste derived products used to generate combined heat and power successfully. These are outlined below:

### **1.8.1 Schemes in Wales**

There are currently no operational Energy from Waste schemes in Wales. Biomass schemes include:

- The Shotton Paper Mill in Deeside, North Wales has a Biomass fuelled CHP facility fired by a mixture of waste residues and sludge from the paper mill, along with sawmill and forest residues. The facility provides electricity and heat in the form of steam for the energy intensive paper recycling process.
- The district heating scheme at Aberaeron which has been in operation since 2005 heats Ceredigion Council's Penmorfa offices and the adjacent residential care home and sheltered housing apartments using a woodchip fuelled biomass boiler.
- Llanwddyn, Powys has a district heating system that provides heat in the form of hot water to the village school, the community centre and 36 houses in the village, via highly insulated underground piping. The heating system is powered using locally sourced woodchip.
- The Bluestone Holiday Village near Narberth in Pembrokeshire is currently installing a 2.5MW biomass fired heating system to heat its leisure centre and surrounding buildings via a heating network, this will be one of the largest biomass fuelled heating networks in the UK when it is commissioned.

### **1.8.2 UK Schemes**

The Sheffield District Energy Scheme (DES) provides approximately 140 of Sheffield's landmark buildings with hot water for heating via a network of 44km of underground pipes as well as supplying electricity to the national grid. The EfW facility accepts 225,000 tonnes of waste per annum and produces up to 60MW of thermal energy and up to 19MW of electrical energy. The district heating network from this facility sells around 125 Million kWhours of thermal energy per annum to the surrounding heat users and is estimated to achieve savings of CO<sub>2</sub> emissions of around 45% compared to conventional gas heating.

The scheme, established in 1988, is the largest of its type within the UK and is still expanding. This scheme perhaps provides an example of what is possible for a scheme such as Trident Park to achieve, or even surpass, as firstly the proposed facility will be able to install the pipe work system as a new network as compared to the Sheffield DES, which installed the network as a retro-fit to an existing facility and secondly, has a larger waste input capacity and therefore the potential for even larger scale heat generation and distribution.

Viridor has been operating the clinical waste incinerator at Derriford Hospital in Plymouth for 5 years. The facility utilises heat generated from the thermal treatment of clinical, confidential and some hazardous wastes to generate heat and hot water for use in the adjacent hospital, effectively reducing its fuel requirements.

Nottingham District Heating Scheme (DHS) was established in 1973 and currently provides heat and power to 4,800 homes, schools, shops, residential care homes, university buildings, hotels, leisure centres and swimming pools. The facility accepts approximately 145,000 tonnes of waste per annum and produces 15MW of thermal and electrical energy combined.

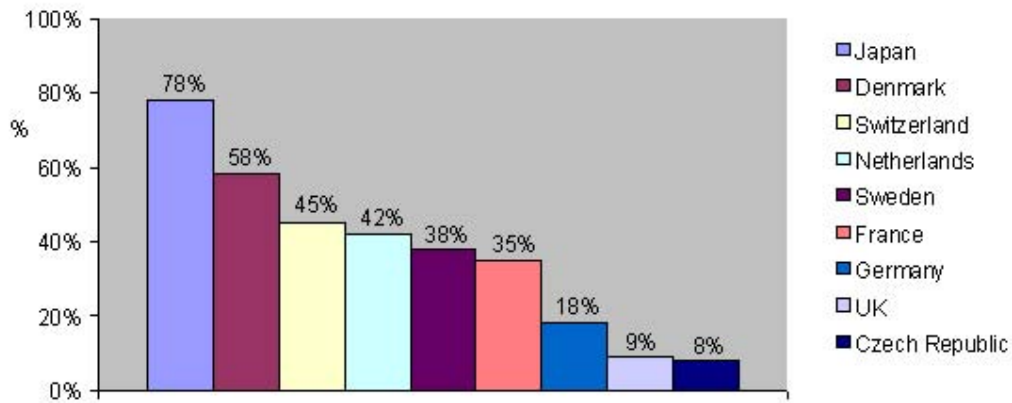
Cyclerval's plant near Grimsby produces around 3MW of heat and 3MW of electrical energy using 60,000 tonnes of waste per annum as fuel. The heat from the plant is fed directly to the adjacent Synthomer latex factory.

Coventry EfW plant accepts approximately 200,000 tonnes of waste per annum and produces 11MW of energy, of which the heat is exported to the surrounding factories, with surplus electricity being exported to the national grid.

### 1.8.3 European Schemes

Many countries in Europe currently employ a much larger number of EfW facilities than the UK, with countries such as Denmark, Switzerland, the Netherlands, Sweden, France and Germany generating significant amounts of energy from waste and heating significant numbers of buildings through district heating schemes. For Example, District Heating Schemes in Denmark provide heat for around 1.5 million homes<sup>2</sup>, around 60% of the domestic heat requirement, with half of this coming from energy from waste, unlike in the UK, where this kind of application is yet to find widespread use. This is illustrated below:

**Figure 1-3**  
**Percentage of Waste Treated in EfW Facilities by Country<sup>3</sup>**



**Table 1**  
**District Heating Usage across Europe in 2003<sup>4</sup>**

EU Country	Percentage of Heat Market Provided by District Heating
Iceland	95
Estonia	52
Poland	52
Denmark	51
Sweden	50
Slovakia	40

<sup>2</sup> Danish District Heating Association

<sup>3</sup> Environmental Services Association

<sup>4</sup> Sabine Fröning, Euroheat & Power

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<b>EU Country</b>	<b>Percentage of Heat Market Provided by District Heating</b>
Finland	49
Hungary	16
Austria	12.5
Germany	12
Netherlands	3
United Kingdom	1

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As can be seen from the table above, District heating and CHP use is limited in the UK. The number of EfW facilities incorporating CHP in the UK is also limited. There are 15 operational energy from waste facilities in the UK, of which only 3 (Nottingham, Sheffield and Coventry) generate CHP, and one (Lerwick<sup>5</sup>) generates heat alone. The European model of generating large amounts of EfW for district heating is often cited in UK planning guidance (section 1.7, above) as an example that the UK should be looking to move towards.

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<sup>5</sup> Environmental Services Association

## **2.0 SEARCH METHODOLOGY**

### **2.1 Specific Issues for CHP at Trident Park**

Trident Park is ideally located for the integration of a CHP system, as it is sited close to the metropolitan centres of Cardiff city centre and Cardiff Bay, which both represent large amounts of energy use, in many buildings of considerable size which could feasibly be linked by a district heating system. Cardiff's status as a capital city has attracted a number of industries and a large amount of commercial activity, as well as an abundance of high density apartment-type residential accommodation and a significant amount of amenity facilities.

The development of a metropolitan heating network for Cardiff could represent a major advance in renewable energy generation and usage in Wales as a whole and continue to promote Cardiff's image as a forward-thinking Capital city, as well as potentially helping Cardiff County Council to achieve the carbon emissions savings of 60% for their own buildings which they have committed themselves to by 2018 and assisting reaching the EU target of 20% of all energy from renewable sources by 2020<sup>6</sup>.

### **2.2 Potential Power Output**

The facility at Trident Park would produce circa 20 Mega Watts of electrical energy, or 175 Million kWh per year based on an input of up to 350,000 Tonnes per annum, which would be exported to the National Grid. This is enough to serve around 42,000 households<sup>7</sup>, approximately 30% of the population of Cardiff.

The heat from the facility at Trident Park has the potential to be piped in a heat main to various end users, who would take heat from the main via heat exchangers, with meters such that heat use by each user can be measured. The heat in the heating network would be set at a relatively high temperature of 80-125° Celsius, from which the user would extract as much as necessary to satisfy their personal demand. No water is removed from the heat main, only the heat extracted from it. The amount of heat likely to be generated by the facility is around 70 Mega Watts.

### **2.3 Scheme Feasibility**

#### **2.3.1 General Principles**

The feasibility of a CHP scheme relies on a consistent market for the heat supplied by the plant. In order to determine the existing potential market for heat in the Cardiff area, a baseline assessment was carried out which involved looking at facilities in the local area such as industry, hospitals, schools, local authority housing and large commercial premises, all of which could provide an essential base load for the proposed CHP scheme. The possible heat demand accrued by these customers was then considered.

The study was carried out with five key considerations taken into account:

- potential heat users
- retrofitting
- feasibility of obtaining planning for connection

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<sup>6</sup> [www.renewableenergyworld.net](http://www.renewableenergyworld.net)

<sup>7</sup> Ofgem average electricity use per household

- potential cost
- disruption

The outputs which were considered most viable were those situated within close proximity to the site, and which used fairly large amounts of heat, preferably with 24 hour demand. These types of user are deemed to be more economically viable as the cost of pipeline can be up to £1000 per metre, thus short pipelines carrying large amounts of heat are most cost-effective, and also cause the least disruption during the installation process as compared to a large number of smaller pipelines.

As most of the potential heat users were existing buildings, the cost and ease of retrofitting was also considered in assessing the feasibility, and large centrally heated buildings were considered to have better potential as retrofitting to an already existing large central heating system is much easier and cheaper than to several small systems. The preferred option is the integration of a CHP scheme into a new development as it is being built. As such, the following are deemed to be the best potential outputs:

- Industry;
- education facilities;
- amenity facilities (including leisure centres, swimming pools and hospitals);
- commercial properties and Offices;
- hotels and communal residences; and
- high-density residential areas.

The success of the CHP scheme relies on an adequate heat demand throughout the day, and to achieve this, heat demand from users with different heat demand profiles to represent a good heat demand throughout the day and night is preferable to an uneven load.

### **2.3.2 Scope of Search**

A radius of 5km from the site was chosen as the area to search for potential users. As the site at Trident Park is situated close to both Cardiff city centre and Cardiff Bay, the 5km radius area encapsulated much of the City of Cardiff, as well as parts of Penarth and Llandough, in the Vale of Glamorgan. This area contains approximately 150,000 residents<sup>8</sup> and 145,000 employees within a significant number of premises with potential for CHP, while maintaining a realistic distance for pipelines in terms of costs and planning implications.

Consideration was also given to the potential to supply energy to the most significant energy users in the region. These included Dow Corning Chemical Works (8km to the west in Barry) and Georgia Pacific Paper Mill (40km to the north-west in Maesteg). However, the distances involved, and given the potential technical issues of heat loss, no further consideration was given to the export of energy to facilities in excess of 5km from the application site.

Future developments were also investigated in terms of their potential for CHP to be integrated into their structure from new. This included consulting with Cardiff Council, and reviewing local plans to determine the location and nature of any planned future developments.

Once all of the potential users were established, those which presented the highest potential were contacted initially by letter to establish if there was a need. If a positive response was received from those contacted, either a meeting was set up to discuss the project and the

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<sup>8</sup> Census 2001

specific issues relating to the CHP scheme, or a briefing note containing further specific information was sent.

## **3.0 BASELINE ASSESSMENT**

### **3.1 Introduction**

Cardiff contains a considerable amount of industrial, commercial and residential property, all within a fairly compact area.

The site is situated in the Cardiff Bay/Docks area, which contains a large amount of heavy and light industry. The Bay area has also been largely redeveloped over the last 20 years and now contains a considerable amount of commercial development and mid to high-rise residential apartment buildings, all of which present some potential for CHP. The area also contains a number of public buildings such as the Wales Millennium Centre, the National Assembly for Wales's buildings and the Cardiff County Council buildings.

Much of Cardiff's commercial property is contained within the 5km radius from the site, including the City Centre, which contains many offices, shopping centres, cinemas, theatres, the Millennium Stadium among other buildings.

There are a number of other industrial and commercial areas situated within the search area and the majority of Cardiff University, as well as other university buildings and Halls of Residence for which the potential for heat use was also assessed.

### **3.2 Potential Heat Users in the Search Area**

#### **3.2.1 Industry**

There are fifteen large-scale industrial units and estates identified that could potentially use the heat from the CHP facility; these are detailed below (see Dwg No. 1 for locations):

- Celsa Steelworks, East Moors Road and Rover Way (1 & 2)
- Associated British Ports, Cardiff Docks (3)
- Portmanmoor Road Industrial Estate (4)
- Seaview Industrial Estate (5)
- Guardian Industrial Estate (6)
- Clydesmuir Industrial Estate (7)
- Taymuir Green Industrial Estate (8)
- Dominion Way Industrial Estate (9)
- Nettlefold Road Industrial Units (10)
- S A Brain Brewery (11)
- Industrial packaging works, Penarth Road (12)
- Llandough Trading Estate (13)
- Dow Corning (14)
- CMC Steel (15)

#### **3.2.2 Amenity**

This included sports and leisure facilities as well as hospitals, museums, public buildings and government buildings. The locations of the following properties are included on Drawing 2.

##### *Leisure Facilities*

There are 2 council run swimming pools identified in the search area, along with 2 leisure centres without swimming pools. Swimming pools have a high heat load during opening hours as the large volume of water in a pool requires a large amount of heat to keep it at a correct temperature. All of the sports and leisure facilities have a reasonable heat load associated with hot showers and heating of facilities as well. (See Drawing 2 for Locations)

- Council Leisure Centres
  - Eastern Leisure Centre (17)
  - Maindy swimming pool (19)
  - STAR Leisure Centre, Splott Road (23)
  - Channel View Leisure Centre, Jim Driscoll Way (31)
  - Cogan Leisure Centre, Penarth (37)
  - Splott swimming pool (38)
- Private Leisure Centres
  - David Lloyd Leisure and Fitness Centre, Ipswich Road (18)
  - Welsh Institute of Sport, Sophia Gardens (28)
  - Esporta Gym, Ocean Way (35)
  - Laguna Health and Spa, Greyfriars Road (36)
  - Cardiff International Sports Village Pool (39)

#### *Hospitals*

There are several Hospitals within the search area as detailed below:

- University Hospital of Wales, Heath (16)
- Cardiff Royal Infirmary, Newport Road (22)
- St. David's Hospital, Canton (24)
- Royal Hamadryad Hospital, Butetown (32)
- Llandough Hospital (34)

#### *Public Buildings*

- The Welsh Assembly Government Offices, Cathays Park (20)
- Cardiff County Council offices at County Hall (14) and City Hall (21)
- The National Museum of Wales (21)
- HM Prison, Cardiff (25)
- The Millennium Stadium (26)
- Cardiff Central Station (27)
- The Wales Millennium Centre (30)
- The National Assembly of Wales Offices and Senedd Building (33)
- In addition to consideration of these specific locations, discussions were held with the Energy Managers of both Cardiff and Vale of Glamorgan Councils.

### **3.2.3 Commercial**

#### *Shopping Centres and Supermarkets*

There is a large amount of commercial activity within the search area. The largest and most viable areas were identified as potential heat users. These are listed below (see Drawing 3 for locations):

- Tesco Extra stores at Pengam Green (50) and Gabalfa (41)
- Sainsbury's stores at Colchester Avenue (42) and Queen Street (43)
- St. David's shopping centre – 40,000 m<sup>2</sup> (44)
- St. David's 2 shopping centre (under construction) – 90,000 m<sup>2</sup> (45)
- IKEA (48)
- Asda store, Ferry Road (51)
- Morrisons Supermarket, Cardiff Bay (52)
- Mermaid Quay shopping centre (53)
- Red Dragon Centre, Atlantic Wharf (54)
- Cardiff Bus (55)
- Maritime Court (56)

#### *Large Office Property*

There is a large amount of commercial activity in Cardiff, and a number of the larger sites were considered suitable for CHP, including:

- Companies House, Crown Way (40)
- The Royal Mail Sorting office at Penarth Road (47)
- Eversheds / ING Direct Offices, Callaghan Square (49)

#### **3.2.4 Residential**

Cardiff Bay has recently seen some significant redevelopment in the form of low to medium rise residential buildings into which CHP could be integrated without large amounts of disruption or cost. There were a number of existing or proposed developments that were identified as being suitable (see Drawing 4 for locations):

- Century Wharf, Dumballs Road (partially completed) – Will Total over 600 apartments and town houses (60)
- Celestia, Falcon Drive – 457 apartments (61)
- Adventurer's Quay, Pierhead Road – 227 apartments (62)
- Ocean Reach, Havannah Street – 49 Apartments (63)
- Prospect Place, Ferry Road – Currently over 400 apartments (65)
- Queensgate South – 150 apartments (67)
- WaterQuarter, Hemingway Road – 172 apartments (68)
- Moorhead Close, Lewis Road (currently under construction) – Over 100 apartments (69)

There were a number of residential buildings in the city centre which were also identified as suitable for CHP utilisation. These were as follows:

- Landmark Place – 281 apartments (57)
- Golate Court – 50 apartments (58)
- Altolusso, Bute Terrace – 293 apartments (59)

Approaches were also made to various local Housing Associations and Cardiff Council about the suitability of supplying housing in the area.

The Associations approached included:

- United Welsh Housing Association
- Cadwyn Housing Association
- Hafod Housing Association
- Wales and West Housing Association
- Linc-Cymru Housing Association
- Taff Housing Association

### **3.2.5 Education Facilities**

There were 19 schools identified within the 5km radius as well as one 6<sup>th</sup> Form College and several university buildings and campuses, mainly associated with Cardiff University, but also with the University of Wales Institute, Cardiff (UWIC), and The University of Glamorgan. The details of these are listed below (See Drawing 5 for Locations):

#### *Universities and Colleges*

- Cardiff University
  - Colum Road Campus (75)
  - Cathays Park Campus (76)
  - Queens Buildings, Newport Road (84)
- The University of Glamorgan ATRium Building, Adam Street (80)
- University of Wales Institute, Cardiff
  - Llandaff Campus (72)
  - Colchester Avenue Campus (74)
  - Cyncoed Campus (81)
- Coleg Glan Hafren, City Road (78)

#### *Schools*

Only schools with 750 or more pupils were considered large enough for a heat network to be cost effective:

- Cardiff Council schools
  - Llanedeyrn High School – 750 Pupils (70)
  - St. Teilo's CW High School – 1200 pupils (71)
  - Cathays High School – 900 Pupils (73)
  - Willows High School – 800 Pupils (78)
  - Fitzalan High School – 1400 Pupils (79)
- Vale of Glamorgan Council Schools
  - Stanwell Comprehensive, Penarth – 1600 Pupils (83)
  - St. Cyres Comprehensive, Penarth – 1500 Pupils (82).

### 3.2.6 Hotels and Communal Residences

#### Hotels

There are a number of Hotels in the Cardiff Bay and City Centre area, many of which are large and if heated centrally would provide ideal outputs for Trident Park CHP. These are detailed below: (see Drawing No. 6)

SLR Ref	Hotel Name	No. of Rooms
95	Angel Hotel, Castle Street	102
101	Etap Hotel, Tyndall Street	157
105	Express by Holiday Inn, Longuiel Close	108
106	Future Inn, Hemingway Road	197
89	Hilton Hotel	197
94	Holiday Inn, Castle Street	157
93	Ibis Hotel, Churchill Way	78
97	Marriott Hotel, Mill Lane	184
91	Mercure "Holland House" Hotel, Newport Road	150
103	Mercure "The Lodge" Hotel, Tyndall Street	165
102	Novotel, Schooner Way	138
87	Park Inn, Llanedeyrn	132
90	Park Plaza, Greyfriars Road	129
88	Premier Inn Cardiff, Roath, Ipswich Road	162
104	Premier Inn Cardiff South, Keen Road	97
98	Radisson SAS Hotel (under construction)	215
107	St. David's Hotel and Spa	132
99	The Big Sleep Hotel, Bute Terrace	85
96	The Royal Hotel, St. Mary Street	64
92	Thistle Hotel Cardiff, Park Place	140

### *Communal Residences*

There are a number of Student Halls in Cardiff due to the large population of around 20,000 full time students in the Universities in Cardiff. Cardiff University currently has some 5,000 study bedrooms in fourteen residences, the largest of which are:

- Cardiff University Talybont Halls (85)
- Cardiff University Birchwood Road Halls (86)
- Ty Pont Hearn Student Halls (100)
- Allensbank House Student halls (108)

## **4.0 FUTURE DEVELOPMENT**

Integration of CHP into new developments is generally considered to be better than retrofitting to buildings that are already in place, as the communal heating system can be built into the buildings design and disruption to the normal operation of the building and extra costs are avoided. It is therefore sensible to investigate any proposed developments within the search area that would provide a potential use for CHP.

A number of future developments were identified by looking at press coverage and planning permissions granted by Cardiff County Council. The council was also approached regarding planned redevelopment areas in the local plan in order to assess the scope of integrating CHP into any new development. The future developments with the highest potential are listed below. The developers of each of these sites were also contacted.

### **4.1 Commercial**

The new international sports village, of which the Bay Pointe development is a part, is planned to contain a sporting arena, a “snow box” for snow and ice sports, a canoe slalom course as well as retail premises and the existing swimming pool. Together, this would be a very large user of energy and the use of CHP would support a strong “green” image for the city of Cardiff. Other employment sites with existing planning permission or applications in progress include:

- part of the Roath Basin Development (64)
- the Leckwith Redevelopment including the new Cardiff City/Cardiff Blues stadium and ASDA store (46)

### **4.2 Residential**

Cardiff Bay especially is an area of large scale continued regeneration and as part of this there is a considerable amount of residential development planned for the future, including:

- Bay Pointe, a development of 1000 units in 3 high rise blocks forming part of the new International sports village (66)
- Roath Basin Development, another development of 1000 units, along with 110,000 square metres of office space and 11,000 square metres of retail. This development is within 1 km of Trident Park and therefore well located use of surplus heat. (64)

### **4.3 Local Plan Designations**

The new Cardiff Local Development Plan is currently in an early stage of development, with no decision made as to the likely direction of expansion of the city, or of possible sites for development within the city. Candidate sites have been submitted to Cardiff County Council, but no indication of preferred sites has been made. These potential development sites have not been considered at this stage, but will be monitored for future opportunities.

## **5.0 CONSULTATIONS**

### **5.1 Introduction**

Approaches were made to all of the potential users identified in sections 3 and 4, and shown on Dwg's 1 to 6. Drawing 7 illustrates the location of all of the potential heat users contacted. The letters sent set out general information about the proposed development and the possibilities that exist for District Heating. A Sample Letter is included at Appendix 1. The following represents those organisations that have subsequently contacted SLR.

### **5.2 Public Organisations**

#### **5.2.1 *The Welsh Assembly Government***

Representatives of the Welsh Assembly Government (WAG) were approached in order to discuss the issue of district heating provision in Cardiff from a “top down” perspective, which could provide a more strategic approach and provide a greater opportunity to realise the potential of the scheme.

A meeting was held with a number of representatives from the WAG in July 2008. The conclusion reached at the meeting was that the potential existed to maximise the use of heat from the site, but that there are a number of infrastructure and supply issues that need to be addressed.

#### **5.2.2 *Cardiff Council***

A meeting was held in April 2008 with Cardiff Council's Energy Manager. The Energy Manager is responsible for reducing the carbon emissions from non-domestic council property and waste by 60%, the figure that the Council has committed itself to achieve by 2018<sup>9</sup>.

The purpose of the meeting was to determine the demand for heat throughout the Council's estate including offices, schools and leisure centres.

The Council had recently been investigating the possibility of using heat from an industrial facility that generated surplus heat with help from the Carbon Trust, although this plan never came to fruition. It was thought that the potential energy savings that could arise from using the CHP at Trident Park could make a significant step towards reducing carbon emissions to the level that the council has committed itself to. The location of two of the secondary schools within close proximity of the two Council-run swimming pools was also noted as this would help to keep the infrastructure required cost effective.

#### **5.2.3 *Vale of Glamorgan Council***

A general discussion with the Vale Energy Manager was conducted in May 2008. The meeting concluded that the potential for the use of any output from the EfW facility was limited by the distance (5km plus) of any significant Council user in the Vale of Glamorgan from the site.

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<sup>9</sup> <http://www.cardiff.gov.uk/content.asp?id=5257&d1=0>

## **5.3 Proposed Developments**

### **5.3.1 Roath Basin Development**

The Roath Basin site is situated some 800m from the Trident Park site, (No. 8 on Dwg 1), and covers an area of approximately 15 Hectares.

A preliminary meeting was held with the representatives of Igloo Regeneration, the Welsh Assembly Government's preferred developer for the Roath Basin development. Igloo Regeneration is a "socially responsible property investment" company, and as such environmental sustainability is at the heart of Igloo's investment policy<sup>10</sup>, with the express aim of reducing the CO<sub>2</sub> emissions of Igloo's schemes. The policy states that schemes should achieve a 60% reduction in CO<sub>2</sub> levels against a benchmark of 1997 figures, which could be achieved by the use of heat from CHP.

The proposed development at Roath Basin includes in excess of 1000 residential properties, 11,000sqm of commercial floor space, and significant retail and leisure opportunities.

It is understood (at October 2008) that the legal agreements associated with the potential planning permission are yet to be signed. It is understood that these relate primarily to highways contributions and improvements.

It is understood that Igloo are also considering building the development to "Zero Carbon" standards, which would require significant renewable energy input.

At the time of the meeting (April 2008), it was expected that the first phase of the development would commence in late 2008 and be completed in 2009/10, with successive phases constructed over a subsequent eight year period. It is understood that the work has been delayed.

## **5.4 Amenity Development**

### **5.4.1 Cardiff International Sports Village Swimming Pool**

A positive response was received from Parkwood Leisure, the company that operates the pool, regarding heating for the water in the pool, and further consultation will be held when figures relating to cost and timescale have been determined. The pool is situated within the International Sports Village development, some 3km south west of the Trident Park site, and is denoted as no. 39 on Dwg No.2.

## **5.5 Retail Users**

### **5.5.1 Tesco Supermarkets**

Tesco Plc responded to the enquiry as to whether there would be a potential for heat use for heating and cooling in either of their stores. Consultations will continue once more details of the project including temperatures of heat mains and other factors have been ascertained.

Tesco is committed to reducing the energy used in the group's stores by 50% by 2010<sup>11</sup>, based on the 2000 energy use figures. Using CHP for absorption cooling (see trigeneration

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<sup>10</sup> [http://www.igloo.uk.net/media/dContent/mediaCentre/Footprint\\_-secure-.pdf](http://www.igloo.uk.net/media/dContent/mediaCentre/Footprint_-secure-.pdf)

<sup>11</sup> <http://www.tescocorporate.com/page.aspx?pointerid=1C15440123204039B5E0E86C7220B421>

above) in the Cardiff stores could represent a substantial reduction in energy use, contributing towards reaching the above target.

### **5.5.2 IKEA**

The Environmental Supervisor representing the store in Cardiff responded to the enquiry with an interest in using the heat from Trident Park on the premises.

IKEA has a strong environmental policy, which has committed itself to increasing energy efficiency by 25% based on 2005 levels<sup>12</sup>. The policy also includes the long term aim of running all of the IKEA stores on renewable energy, which could be achieved by using CHP from Trident Park.

The IKEA store in Cardiff is located in Grangetown, 2.8km west of the Trident Park Site denoted as no. 48 on Dwg No.3.

## **5.6 Academic Institutions**

### **5.6.1 University of Wales Institute, Cardiff (UWIC)**

The University of Wales Institute, Cardiff responded to the letter regarding the use of heat from Trident Park in their campuses across Cardiff. A meeting took place with members of the Estates Management department to discuss the proposal. UWIC has three campuses in Cardiff, along with a number of student residences. The campuses are denoted on the Educational user plan as no's. 72, 74 and 81.

The discussions held with UWIC considered the general principle of the development and the overall energy demands of the University.

### **5.6.2 Cardiff University**

A project is being undertaken by the University in collaboration with the Welsh Assembly Government as to the potential of the Cathays Park area to utilise CHP. The Cathays Park area of Cardiff is located immediately to the north of the City Centre and includes inter alia:

- City Hall (occupied by Cardiff Council);
- Central Police Station;
- National Museum of Wales;
- the majority of the Cardiff University campus;
- the Cardiff Magistrates and Crown Courts;
- Welsh Assembly Government offices; and
- Several Cardiff University residences.

The scope of the project being undertaken includes a review of current and forecast energy consumption within the study area, and the potential of the area to accommodate a bespoke

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<sup>12</sup> <http://www.ikea-group.ikea.com/?ID=709>

biomass-type CHP Facility (possibly in association with the expansion of the University in the Senghennydd Road area).

The meeting concluded that both parties would continue to inform each other as reports /proposals progressed.

## **5.7 Other Interest**

### **5.7.1 *Holiday Inn Express***

Monteacaute House Limited is the management company for the Holiday Inn Express in Cardiff. Further information regarding costs and timetables have been forwarded to Monteacaute, and it is hoped that a meeting could be set up in the near future. The Express Holiday Inn is situated to the west of Bute East Dock (Atlantic Wharf), around 1km from the site (Ref: 105).

### **5.7.2 *St. David's Shopping Centre***

A response was received from the owners of the St. David's Centre stating that the centre was currently heated on an individual store-by-store basis and thus would not be suitable or viable for adaption for heating by a centralised district heating system.

### **5.7.3 *PMG Estates***

Ongoing discussions have been taking place with PMG Estates, the owners of the remainder of the Trident Park redevelopment site, and of the Leckwith site. The Trident Park site represents the most convenient potential for heat use, and includes Maritime Court (Ref: 56) and CMC Steel (Ref: 15). Consultation has taken place and the potential of the scheme to be considered. The Leckwith site (Ref: 46), at around 3.5km from Trident Park also presents a good opportunity for heat use.

## 6.0 THE WAY FORWARD

The initial consultation process has resulted in a respectable number of positive responses given the preliminary nature of the enquiry, the absence of any planning application, permission details of infrastructure and business plan/costing.

A number of follow-up e-mails and letters have been sent, and the increased publicity as a result of the consultation exercise and the submission of the planning application is likely to increase interest in the scheme.

The key issues raised by respondents so far are:

- security of supply, in terms of the supply of waste to power the process, and with regards to operation of the facility by Viridor;
- the provision of the associated infrastructure particularly with regard to cost, maintenance and relationship with existing infrastructure;
- the cost of the power, and the mechanism for securing longer term supply contracts;
- the involvement of the public sector to act as a catalyst for implements to the scheme;
- the potential to integrate into a wider City-based scheme using other energy exporters.

The issues so far as Viridor are concerned generally mirror those of potential energy users. In addition, further work will be required:

- follow-up of initial respondents to address the issues raised;
- further chasing of other key potential users;
- additional liaison with public organisations, including WAG, Cardiff and Vale of Glamorgan Councils, and academic institutions;
- increases awareness of the potential benefits for the City;
- monitoring of as-yet unidentified users, and potential new development schemes;
- monitoring of other UK and European projects.

The long-term nature of the determination procurement and construction processes enable Viridor to position itself so that by the time the EfW is full operational (2014) the infrastructure and contracts can be put in place to enable the aspirations of the Company, the Welsh Assembly Government and Cardiff Council in respect of renewable sources of energy.

## **7.0 VIRIDOR'S EFW/CHP BACKGROUND<sup>13</sup>**

Viridor Waste Management currently has one operational incineration with heat recovery facility in the UK, at Derriford hospital in Exeter, as well as two Energy from Waste plants in the design and construction phase, both of which have plans to incorporate CHP, as detailed below.

### **7.1 Exeter CHP Plant, Devon**

Viridor has recently been given planning permission for a CHP plant in Exeter by Devon County Council. Viridor aims to provide renewable energy at a steady price, protected from the volatility of fossil fuel prices in the form of heat to nearby energy users, as well as feeding electricity to the National Grid.

The location of the plant offers the possibility of providing heat energy to a number of potential users, including a nearby rendering plant and a metal finishing company.

Discussions with these and other potential users are to be held with the intention of entering into commercial and technical agreements. As the development is still in its early stage, no final heat uses have been agreed but this is hoped to be brought to fruition in the near future.

### **7.2 Lakeside EfW CHP Facility, Colnbrook, Slough**

The Viridor site at Lakeside is currently under construction and is expected to be commissioned in mid 2008. The facility is designed to accept around 440,000 Tonnes of residual municipal waste per annum and produce around 30MW of electrical power which will be supplied to the national grid.

The facility will not have an operational facility to supply heat to nearby users from the outset; however the design of the facility is such that this is available for new development in the future. It is proposed that investigations and discussions into this will be ongoing.

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<sup>13</sup> Viridor Waste Management: [www.viridor-waste.co.uk](http://www.viridor-waste.co.uk)

## **GLOSSARY OF TERMS**

**CHP**            *Combined Heat and Power*

Where a single energy generation facility produces both electricity and useable heat.

**DEFRA**        *Department for Environment, Food and Rural Affairs*

The UK Government body responsible for issues regarding the Environment, Food and Rural Affairs.

**EfW**            *Energy from Waste*

The process of combustion of residual waste to produce electricity and/or heat for beneficial use by energy consumers.

**EU**             *European Union*

The political and economic union of twenty-seven member states, located primarily in Europe

**km**            *Kilometre*

**ROC**           *Renewable Obligation Certificate*

A system introduced by the UK government to encourage renewable energy production through credits for energy supply companies for reaching target levels and fines for failing to reach these.

**TW**            *TeraWatt*

International Standard unit of Power:  $1 \times 10^{12}$  watts (1,000,000,000,000W) where:

- **(th)**    thermal energy
- **(e)**    electrical energy

**UK**            *United Kingdom*

**WID**           *Waste Incineration Directive*

The EU legislation governing the incineration of waste including limits on emissions of polluting substances amongst other things.