



## EcoEnergy Group

### Energy from Waste Facility

October 2008

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## PROPOSAL OVERVIEW

### Introduction

The proposal is for the development of an Energy from Waste (EfW) facility based in the local authority area with an initial input capacity of 400,000 tonnes per annum.

Energy from Waste is an energy recovery process using thermal treatments that turns general waste, which would normally be deposited into landfill, into electricity and heat.

The energy can be captured and used in district and industrial heating schemes and, as it does not come from fossil fuel sources & is readily available, the energy is largely carbon neutral.

The EfW plant will utilise only pre-sorted municipal solid waste (MSW) and commercial and industrial waste from the local authority area, and will consist of the following:

- 300,000 tonnes pa of municipal solid waste
- 100,000 tonnes pa of commercial and industrial waste

### Financials

The UK EfW market requires a further 180 EfW plants to be installed to satisfy demand, worth an estimated £1.57bn in annual revenue.

The capital cost of the facility, including land, building & equipment costs, will be £215m.

### EfW Benefits

- Adhere to EU Directives
- Comply with UK Legislation
- Entry into the new & growing £1.57bn annual EfW industry
- Environmentally sound source of fuel (pre-sorted waste)
- Renewable energy generation 24/7, 365 per annum
- Employment creation
- Secure energy supply
- Reduce landfill dependency
- Cost effective waste treatment facility
- Reduce air pollution / greenhouse gas emissions
- Enhance countryside landscape by diverting waste from landfill
- Crucial part of a sustainable waste management system

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## **Energy from Waste Factsheet**

### ***Facility***

Energy from Waste (EfW) plant that is specifically designed to recovery energy – electricity & heat – from general municipal & commercial waste with a two stream, 400,000 tonnes per annum capacity

There will be a Visitors Centre providing community waste minimisation and recycling education programmes and exhibition space.

### ***Site Area***

The site will extend up to 25 acres, including amenity & landscaping areas, and is easily accessible from both road and rail.

### ***Dimensions***

270 metres long, varying from 20 – 70 metres wide and from 18m – 60 m in height.

The chimney stack will be 75 metres in height, as measured from base level, of which 45 metres will be above the building.

### ***Construction***

To begin in 2009 / 2010, subject to planning consent, construction and commissioning will take approximately eighteen months to two years. The facility will be fully operational in 2011 / 2012.

### ***Total Investment***

The design and build costs for the EfW plant is £215 million.

### ***Employment***

Up to 150 temporary construction jobs will be created during the design & build phase

80 full & part time staff will be employed at the facility once it is up and running

### ***Carbon Footprint***

This EfW plant will eliminate the need for approx 200,000 tonnes of coal, or a super tanker of oil a year, to generate the equivalent amount of power



## Energy from Waste Factsheet

### *Waste Footprint*

The EfW facility will process 300,000 tonnes of household & 100,000 tonnes of commercial waste each year delivered from local refuse transfer stations and directly in refuse collection vehicles from households.

Residues left over from the EfW process (up to 30%), such as ash will be taken away to be recycled (typically > 25%) or landfilled (typically < 5%).

### *Power*

The facility will produce approximately 24MW of electricity from the waste, with excess power to be supplied into the National Grid. This will be enough to power up to 24,000 homes.



## The Market Drivers for EfW

The need to expand UK Energy from Waste capacity is primarily derived from:

- EU Waste Legislation & Directives
- UK Policies: Integrated Waste Management Strategy
- UK Incentive & Penalty Schemes
- Energy Generation & Markets
- Renewable Energy

An additional reason is energy security & the generation of renewable energy. That is, the by-product of the EfW treatment process is energy recovery. The electricity and/or heat that is generated provides an inexpensive, and by its nature, renewable source of energy that is exported to the local community via the National Grid.

## EU Waste Legislation & Directives

The introduction of legislation from both the European Union & the UK Government relating to general and specific waste management policies and directives.

The legislation aims to promote diverting waste away from landfill and also the implementation of efficient waste energy recovery technologies.

The EC Waste framework Directive (2006/12/EC) – Article 3 – states that Member States should:

- firstly look to prevent or reduce waste production
- secondly undertake: - the recovery of waste by recycling, re-use or reclamation  
- the use of waste as a source of energy

Also, the EU Landfill Directive – Article 5 - states that Member States should reduce Biodegradable Municipal Waste (BMW) by the following levels:

- by 2010 reduce BMW to landfill to 75% of 1995 level
- by 2013 reduce BMW to landfill to 50% of 1995 level
- by 2020 reduce BMW to landfill to 35% of 1995 level

## UK Policies: Integrated Waste Management Strategy

In the UK, the National Waste Strategy: Scotland (NWS), published in 1999, sets out a framework for sustainable waste management in Scotland and marks a fundamental change in the way waste is managed. The National Waste Plan (2003) outlines how the NWS will be put into action objectives for waste management, and involves:

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## The Market Drivers for EfW

1. **Prevention & Minimisation:** wherever possible, waste should be avoided or reduced, by using fewer resources, and by using them more efficiently.
2. **Re-Use:** products should be reused, to prevent the extraction and subsequent waste of more resources.
3. **Recycling & Composting:** although recycling requires energy and produces wastes, it does save energy and prevent the extraction of new resources to some extent.
4. **Energy Recovery:** many wastes have an energy value, which we can extract and use as electricity and / or heat.
5. **Landfill:** this should be the last option considered, and should only be used when no more material or energy value can be extracted.

When waste cannot be prevented, minimised, reused, recycled or composted, it must be managed effectively & efficiently. The National Waste Plan identifies the Best Practicable Environment Option (BPEO) to divert waste from landfill – this includes energy recovery. Energy is a valuable resource, and its recovery from waste should always be considered prior to landfill.

## UK Incentive & Penalty Schemes

In order to achieve waste targets, the government has put in place two principal measures effectively seeking to divert waste away from landfill by fiscal measures:

- Landfill Allowance Trading Scheme (LATS)

The LATS specifies (to 2020) an annual quantity of biodegradable MSW that each Waste Disposal Authority (WDA), or group of WDAs where they have pooled their allowances, may dispose of at landfill.

The allowances decrease each year and, in combination, set an allowance which ensures the country meets the target year allowances.

For every tonne in excess of their annual allowance, the WDA will be required to either purchase additional allowances from authorities with excess LATS allowances (subject to conditions) or pay a financial penalty of £150;

- Landfill Tax

The landfill tax regime which introduced (in 1996) an escalating tax payable on every tonne of waste disposed of within a licensed landfill.

For non-hazardous waste (the majority of the MSW and C&I waste stream) the tax is presently £32 per tonne.

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## The Market Drivers for EfW

The Chancellor's Budget March 2007 (and in line with industry expectation) substantially increased the level of tax. It will now rise at a rate of £8 per annum from the 01st April 2008 until at least 2010 / 2011. At this rate landfill tax will reach a level of £48 per annum in 2010.

In combination, the LATS penalty and landfill tax would mean that any WDA disposing of biodegradable MSW to landfill in 2010, beyond its permitted allowance, would, for every tonne, pay:

- a) the cost of disposal;
- b) £150 LATS penalty, or the purchase cost of traded LATS Allowances;
- c) £48 landfill tax.

The recent increase in landfill cost mirrors the past trend of the government seeking to reduce landfilling through fiscal measures. And this trend is likely to continue.

Taking into account the option that the government may seek to recharge a share of any fines it is charged by the EU for failure to comply with the Landfill Directive, the cost of depositing of biodegradable MSW at landfill may cost between £220 and £250 per tonne.

As a consequence industry and commerce will be driven to managing waste further up the hierarchy requiring waste to be processed for further treatment/disposal. In terms of residual waste (that remaining after recycling and composting) this will be waste treatment with energy recovery. The principal proven form of such treatment is within an EfW plant.

## Energy Generation Markets

The wholesale energy markets and associated energy prices are tied to the price of oil. As the price of oil increases due to rises in demand and oil speculation, so does the wholesale price of gas & electricity.

The result of these dramatic increases have seen wholesale electricity prices triple to 8 pence per unit in little over 12 months along with gas prices almost quadrupling to 9 pence per unit in the same period.

In fact, with oil prices (at current record levels) of approx \$100 a barrel, and with the industry forecast for the price to peak at \$200 a barrel, the wholesale energy prices are only set to increase.

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## The Market Drivers for EfW

However, due to their design and operational efficiency, EfW plants can capitalise on this turmoil as the facilities can generate electricity and/or heat 24 hours a day, 365 days a year at a relatively low base cost per unit.

### Energy Generation

EfW plants will be further in demand due to the fact that many UK power generation plant operations will be restricted under the EU Large Combustion Directive.

This places strict limits on the SO<sub>x</sub>, NO<sub>x</sub> and particulate emissions of power stations from 2008 and qualifying plants have the right to opt into or out of the LCP Directive.

Those plants that opt out will be restricted to 20,000 hours of operation in total from 2008, with enforced closure by the end of 2015.

### Renewable Energy

The Biomass Action Plan for Scotland, 2007, in accordance with the EU Biomass Action Plan, sets out the coordinated programme for the need for and the development of the biomass sector in Scotland. According to the Plan, sources of biomass include:

- FORESTRY
- AGRICULTURE
- WASTE

Specifically, residual waste, which is left after as much recyclable / compostable material as possible is extracted, should be used for energy recovery.

Government Energy White Paper – May 2007 - "The UK government is to support so-called emerging technologies for renewable power generation by offering them two ROCs per MWh". This includes "advanced conversion technologies" like anaerobic digestion, gasification and pyrolysis plants, which can use waste to generate energy.

Under the Renewables Obligation (Scotland) Order 2006 only waste containing 90% or more biomass will be eligible to receive Renewable Obligation Certificates. However, exceptions to this rule include the biomass element of waste treated by advanced conversion technologies such as gasification, or in combined heat and power plants.

Both of these qualifying technologies are used in EfW plants.

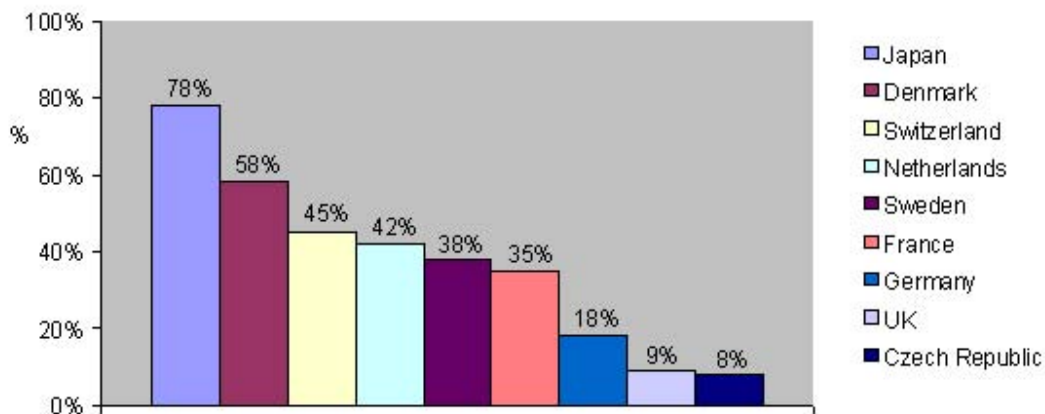


## Market Potential

Recovering Energy from Waste is only now beginning to be established in the UK, but is expanding rapidly. EfW is a unique niche in power generation & renewable energy and provides considerable scope for growth.

However, waste energy recovery technology has been embraced by most other European countries, and others worldwide, for many, many years.

In fact, in comparison to other major industrialised nations, the UK recovers a relatively small amount of energy from waste - as a percentage of total waste created – amounting to a conversion factor of only 9%: Illustration: Energy recovered as a % of total waste:



Indeed, other European countries have demonstrated that high rates of reduction & recycling, can co-exist with the extraction of Energy from Waste. Illustration: EfW as part of an integrated waste management system:

COUNTRY	% RECYCLED	% EFW	% LANDFILLED
Austria	44	18	32
Denmark	30	58	12
France	14	27	58
Germany	21	36	43
Netherlands	37	41	22
Sweden	32	35	33
Switzerland	39	47	14
<b>UK</b>	<b>15</b>	<b>9</b>	<b>78</b>

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**Market Potential**

As the example, Denmark and Switzerland have among the highest contributions from EfW, but also have among the highest recycling rates, with countries such as France increasing recycling at the expense of landfilling.

In the UK, EfW makes one of the lowest contributions to the total waste management infrastructure among the European countries, but the UK also has one of the lowest recycling rates.

Therefore, not only is the UK recycling rate at a level where both recycling and EfW can co-exist without the latter “crowding out” the former, the UK market for EfW facilities is in fact in it’s infancy.

Yet, studies and analysis by The Institute of Environmental Management and Assessment (IEMA) - a not-for-profit membership organisation established to promote best practice standards in environmental management, auditing and assessment – calculates that the anticipated UK market for EfW plants and their associated energy products is calculated in excess of **£1.57bn per annum**.

The most up to analysis of the renewable energy sector, determines that the UK requires a total of 180 new EfW plants to meet satisfy anticipated demand created by legislative demands for diverting waste from landfill & renewable energy generation targets.

IEMA Annual Conference, June 2008:

**Table E: The potential EfW market for different technologies in the UK**

	Number of new plants needed	Potential Annual Market	Total Capacity Outlay
Biological Anaerobic Digestion	288	£400M	£1.44 Billion
Gasification/Pyrolysis & Conventional Mass Burn Incineration “Technology Mix”.	180	£1.57 Billion	£13.6 Billion
Total Biological & Thermal Treatment	468	£1.97 Billion	£15.04 Billion



## EfW Plant Design & Layout

The proposal is for the development of an Energy from Waste (EfW) facility based in the local authority area with an initial input capacity of 400,000 tonnes per annum.

The plant will actually have full planning consent for a total of three waste stream lines and capacity of 600,000 tonnes per annum, but it is intended that the facility will be built in a staged manner with initial construction of two lines providing 400,000 tonnes per annum capacity. The third line would be constructed & installed to meet required demand.

The EfW plant will be owned and operated by the EcoEnergy Group and will meet all UK & European legislation including the requirements of the Waste Incineration Directive (WID) (2000/76/EC) and the Pollution Prevention and Control (PPC) Permit required by the Pollution Prevention and Control (PPC) (Scotland) Regulations 2000.

The plans commissioned by EcoEnergy are below:

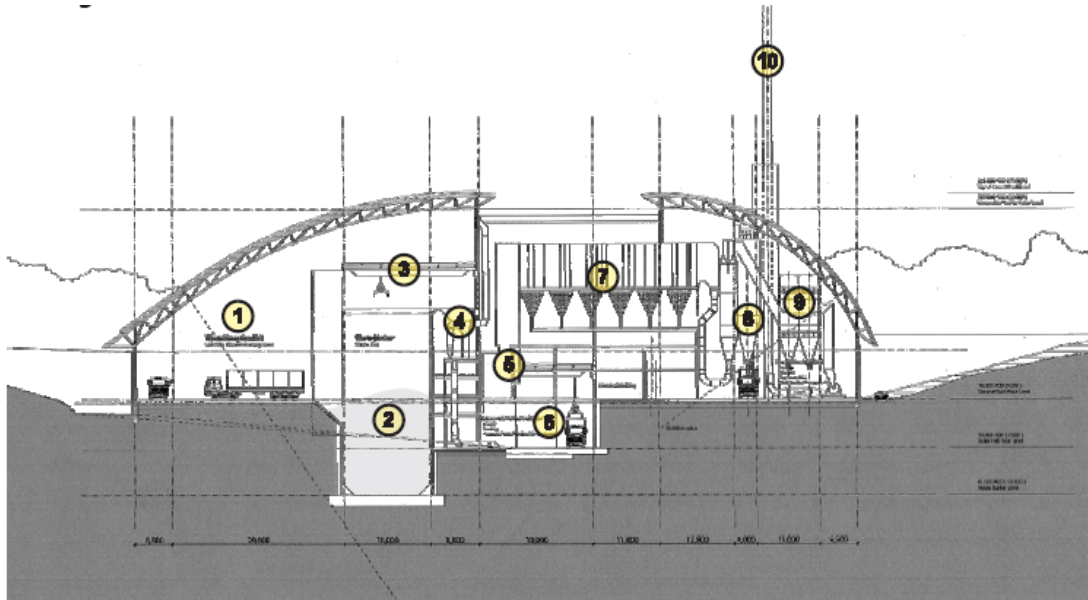


The EfW plant will require a site area of between 20-85 acres, in industrially zoned brownfield land.

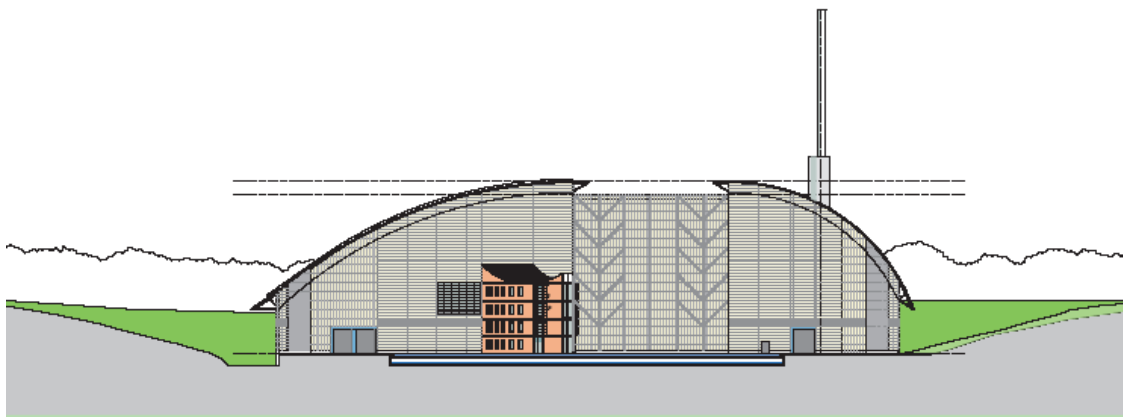
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## EfW Plant Design & Layout



- 1) waste reception hall
- 2) refuse bunker
- 3) the plant crane
- 4) feed hopper
- 5) a moving grate
- 6) ash collection
- 7) boiler & steam generator
- 8) waste steam recirculation
- 9) gas cleaning system
- 10) chimney stack



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## EfW Plant Operations

**Inputs** Municipal Solid Waste (MSW), Commercial & Industrial Waste (CIW), and Refuse Derived Fuel (RDF) are brought to the EfW facility.

**Process** Waste is collected and delivered to the site where it is deposited in a bunker and mixed by an overhead crane to ensure a more consistent and even calorific mix.

The waste is deposited into a hopper which feeds the furnace where it is burned at high temperatures.

**Outputs** Superheated steam produced during combustion will pass through a boiler system thus recovering the heat from the exhaust gases. This steam will be used to drive a turbo-generator that produces electricity, which will be exported to the local power distribution network and heat recovered

Gases are thoroughly cleaned to well below safe emission limits using a range of emission control systems before they are emitted to the atmosphere. All emissions are continuously monitored. Residue filtered particles are collected and sent to special waste landfill.

The unburned residue left after burning the waste, known as bottom ash, is stabilised by being quenched with recycled water and is deposited into a tank. Magnets extract and remove any ferrous metals from the ash for recycling,

Any remaining ash is recycled and reprocessed into a secondary aggregate for use in construction.

Typically, 1 tonne of MSW processed by the EfW plant produces approximately:

- 3%-6% of specialist waste for landfill
- 20%-30% of bottom ash for secondary aggregate recycling, or general landfill
- 3%-5% of metals extracted from bottom ash for recycling
- electricity and heat recovery of which 85% is available (after EfW plant usage) to residential & commercial power consumers
- emissions: which are all below EU & UK legislative limits
- waste water for treatment via the plant sewage treatment system



### EfW Plant: Energy Output

The plant has been designed to process a throughput of 400,000 tonnes over 8,000 productive hours per annum.

The plant will be capable of burning materials with an average net calorific value (cv) between 7500kJ/kg and 12500kJ/kg. The initial average net cv is expected to be approximately 9200kJ/kg.

This design will provide for a gross energy output of 24MW per hour.

Under normal operating conditions, with the plant running at a throughput of 50 tonnes per hour (400,000t / 8,000hrs), the electricity consumption of the plant is expected to be on average 15% of the gross output ie 3.6MW per hour

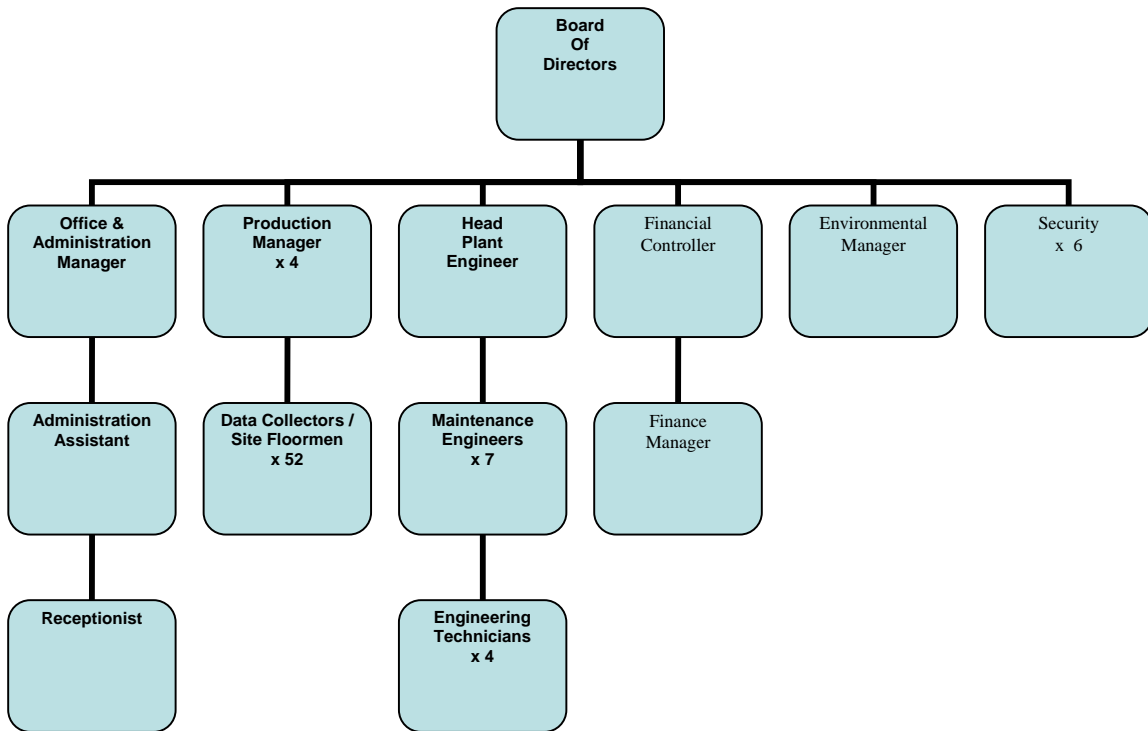
This equates to net energy generated of 20.4MWh, or 0.408 MWh per tonne of waste incinerated.

	Per Annum	Per Hour	Per Tonne
<b>Plant capacity (tonnes):</b>	<b>400,000</b>	<b>50</b>	<b>n/a</b>
<b>Energy capacity (MWh):</b>	<b>192,000</b>	<b>24</b>	<b>0.48</b>
<b>Plant consumption (MWh):</b>	<b>28,800</b>	<b>3.6</b>	<b>0.072</b>
<b>Net energy generated (MWh):</b>	<b>163,200</b>	<b>20.4</b>	<b>0.408</b>



### Organisation Chart

- up to 150 temporary construction jobs will be created during the design & build phase
- 80 staff will be permanently employed at the facility once it is operational.



Full training concerning operational issues and health & safety matters will be provided and documented both at the initial induction period, and on an on-going basis throughout the facilities life.



## Environmental Policy

EcoEnergy Group Ltd (EcoEnergy) recognises that how we manage our customers' and our own waste has an impact on the environment.

We have a position of leadership in the UK's recycling and waste management industry and believe that our economic success goes hand-in-hand with our social and environmental performance.

### MANAGEMENT RESPONSIBILITY

EcoEnergy's Management Board will ensure that responsibility for environmental issues is clearly defined and understood throughout the company and that all activities are conducted in a manner designed to protect the environment from the risk of pollution.

### ENVIRONMENTAL LEGISLATION

EcoEnergy will comply with, and wherever possible exceed, existing environmental and other pertinent legislative requirements at all stages of our business activities/operations.

### STAKEHOLDER RELATIONS

EcoEnergy recognises the importance of our relationship with stakeholders – employees, the public, contractors, customers and shareholders. We will communicate this policy to them, report annually on our environmental performance and engage with stakeholders so as to understand and consider their expectations in the way that we manage our business.

### CONTINUAL IMPROVEMENT

EcoEnergy will measure and monitor progress by setting environmental objectives and targets to ensure continuous improvement in our environmental performance.

Through all aspects of our operations EcoEnergy will:

- Seek to minimise the environmental impact of transport use.
- Seek to reduce the amount of energy obtained through non-renewable resources, use energy efficiently and reduce greenhouse gas emissions.
- Seek to minimise the volume of waste generated and to maximise reuse, recycling and energy recovery from waste.
- Use suppliers or contractors that have environmental standards compatible with our own wherever possible.
- Implement ISO 14001 or other appropriate environmental management systems for all major sites and operations.
- Continually reassess all of the above in the light of changing technology, legislation, the precautionary principle, business requirements and best environmental practice.

**Signed:**        ***Bill Donnachie***                      Managing Director, EcoEnergy Group Ltd

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## Waste Targets

This National Waste Plan establishes the direction of the Scottish Executive's policies for sustainable waste management to 2020. Targets include:

- aim to stop growth in the amount of municipal waste produced by 2010
- reduce landfilling of municipal waste from around 90% to 30%
- recover energy from 14% of municipal waste

Over the period up to 2020 the planned outcomes in the Waste Plan sets out a radical change in the recovery of resources to be achieved by the waste management system, as illustrated:

## Scotland

Outcome	2002	2006	2010	2013	2020
Recycled %	4	17	24	29	35
Composted %	3	10	14	18	20
Converted to energy %	2	3	7	11	14
Landfilled %	91	70	55	42	31
Recycled mtpa	0.14	0.58	0.91	1.15	1.52
Composted mtpa	0.08	0.36	0.53	0.69	0.87
Converted to energy mtpa	0.07	0.12	0.24	0.43	0.61
Landfilled mtpa	2.94	2.43	2.08	1.67	1.36
Total arisings mtpa	3.23	3.48	3.76	3.94	4.36

## Glasgow

Table GCV1 Baseline Data and BPEO Targets for Municipal Waste in Glasgow and Clyde Valley

Baseline /Target Year	Municipal Waste Arising ('000 tpa)	Waste Recycled* (%)	Waste Composted (%)	Waste Treated by Other Recovery Technologies (%)	Waste Landfilled* (%)
2000	1,015	5	2	-	93
2010	1,237	28	8	-	64
2013	1,274	35	10	15	40
2020	1,366	40	15	20	25



#### Other Recovery Technologies

- Between 2002 and 2010, 125,000 tpa of mixed waste processing capacity is expected to be required. This would equate to two new MWPFs with approximately 60,000 tpa capacity each. After 2010, decisions on new MWPF capacity will be taken in conjunction with decisions on new MRF capacity and use of other waste recovery technologies.
- A decision on the use of other appropriate waste recovery technologies will be taken by 2006, with the facility(ies) to be operational by 2013. These other recovery technologies include processes such as thermal treatment, pyrolysis, gasification, anaerobic digestion, autoclaving, and other emerging waste treatment technologies. It is estimated that a capacity of 191,000 tpa is required. However, these other recovery technologies may not be required if recycling and composting alone can meet 2013 and 2020 Landfill Directive diversion targets. From 2013 an additional 82,100 tpa may be required which would require additional facilities if not met by modular addition to existing facilities. It is anticipated that the total installed capacity required would be 273,000 tpa.



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