

Power Generation from Biomass in the United Kingdom

Guido Droste, Evonik New Energies

London, 2007 October 11



EVONIK
INDUSTRIES

- 1. UK Waste situation ↔ EU directives**
- 2. Various technical aspects**
- 3. Carbon & emission savings**
- 4. Possible savings**

The EU Landfill directive



According to the EU Landfill directive the following quotas have been stipulated for the UK:

- By 2010 reduce biodegradable waste to landfill to 75% of that produced in 1995 (base year)
- By 2013 reduce biodegradable waste to landfill to 50% of that produced in 1995 (base year)
- By 2020 reduce biodegradable waste to landfill to 35% of that produced in 1995 (base year)

UK waste management situation



- With appr 33 mill tonnes p.a. of waste landfilled the UK runs No. 1 in the EU
- Estimated 8-10 mill tonnes of waste wood p.a. produced in the UK
- About 1-1.5 mill tonnes of clean waste wood goes to board mills, power plants etc.
- So, about **7-9 mill tonnes p.a. of waste wood goes to landfill**
- Making that appr 18% of total landfilling
- Majority of that wood is contaminated, some is hazardous

Compared to fossil: renewable energy still needs support



- Renewable Obligation Certificates (rocs)
- Climate Change Levy Exemption Certificates (lecs)
- Enhanced Capital Allowances
- Exemption from Uniform Business Rates
- EU- ETS –Emission trading scheme for carbon

1. UK Waste situation ↔ EU directives
2. Various technical aspects
3. Carbon & emission savings
4. Possible savings

Waste- wood = biomass?



- Waste wood is indeed eligible as biomass:

The Renewables Obligation Order (2002) says: “**Biomass**... .. means a fuel used in a generating station... .. is derived from plant or animal matter or substances derived directly or indirectly therefrom (**whether or not such matter or substances are waste**)..“

Problems with waste wood as fuel



- Collection, sorting and delivery: waste wood has a low density
- Comparatively low calorific value
- Not uniform
- Some fractions are hazardous

Available technology



- Practically the only technology available to dispose of such large volumes of waste wood is incineration

- Large scale gasification of biomass is not an alternative:
Thermoselect, Siemens-Schwel-Brenn-Verf., Noell-Konversion: all started very promising – and technically / economically failed.

- E.g. Finland as one of the EU top users of wood / biomass largely uses incineration and steam / power generation ever since

Compliant technology



Evonik reference Biomass CHP plants are compliant with:

- EU Waste Incineration Directive (WID)
- EU large combustion plant directive (normally for plants with >50 MWt output)

Our Biomass CHP can and must achieve:

- Environment Agency Good Practise
- Local authority planning permission
- Ash disposal

What else is required for CHP



Suitable heat dump loads

- Systems must be heat-led for high efficiency and for CHPQA

Grid connection:

- Is paramount both in capacity and in costs

1. UK Waste situation ↔ EU directives
2. Various technical aspects
3. **Carbon & emission savings**
4. Possible savings

100,000 tonnes pa. of wood to landfill...



- Momentarily only ~70% of the methane produced by decomposition is flared or used for power generation
- Appr. 30% of the CH₄ is discharged into the environment –among other gases
- Global Warming Potential in the **first 20 yrs**: 1 tonne CH₄ ⇔ 62 tonnes CO₂
- DEFRA says: 1 tonne MSW → ~68 kg CH₄
- → So, with each 100,000 tonnes wood landfilled in one year the equivalent of 126,500 tonnes CO₂ is vented into the air per annum.
- With 20 years life of a plant that is **2.5 mill tonnes of CO₂e**

Substitution for fossil fuel



- Base load coal = 0.3 kg/kWhe
- 20 MWhe → 6 tonnes CO₂ per operating hour
- → appr 47,000 tonnes CO₂ per year or
- → appr **935,000 tonnes of CO₂e over 20 years**

1. UK Waste situation ↔ EU directives
2. Various technical aspects
3. Carbon & emission savings
4. Possible savings

Translate German plants...



SUMMARY OF EVONIK BIOMASS PLANTS

NAME	OUTPUT MWe (nominal)	WASTE HEAT MWt	BIOMASS FUEL tonnes p.a
Neuwied	7.5	15.0	62,000
Grossaitingen	5.1	0.0	45,000
Neufahrn	5.1	10.0	55,000
Werl	0.5	2.0	6,000
Ilmenau	5.1	10.0	55,000
Traunreut	5.0	18.5	60,000
Buchenbach	1.2	3.3	10,000
Dresden	7.0	17.5	70,000
Buchen	7.5	8.0	60,000
Lunen	20.0	0.0	135,000
TOTAL:	64.0	84.3	558,000

...into UK savings:



Base as seen in the last slide: **558,000 tonnes waste wood p.a.:**

- Waste to landfill penalty saved : $558,000 \text{ t/a} \cdot 150 \text{ £/t} = \text{£83.7 mill p.a.}$
- CH_4 saved by avoiding landfills: $558,000 \text{ t/a} \cdot 0.068 \cdot 30\% \cdot 62 \text{ GWP}$
 $= \text{706,000 tCO}_2\text{e p.a.}$
- Power from fossil fuel substituted: $64 \text{ MWe} \cdot 7,500 \text{ hrs} \cdot 0.3 = \text{144,000 t CO}_2\text{e p.a.}$
- Heat from fossil fuel substituted: $84.3 \text{ MWt} \cdot 7,500 \text{ hrs} / 75\% \cdot 0.19$
 $= \text{160,000 t CO}_2\text{e p.a.}$
- **Fossil fuel substitution 20 yrs (life of plant) = 6 mill tonnes CO₂e**

Meeting UK Climate Change Targets



- EU target: 20% Reduction

-Can only be achieved with biogas and/ or nuclear. UK currently about 4-5%

- UK Kyoto target is to save 12 mill tonnes CO₂e p.a. by 2010:

-If 7 mill tonnes of waste wood was used as biomass fuel CHP

-Then 1.4 mill tonnes CO₂e p.a. can be saved

11.5% of carbon reduction target p.a.

(Source: HMG Climate Change Programme 2006)

Thank you very much.



EVONIK
INDUSTRIES