

February 2009

HORIZON SCANNING SR019

## HSE Horizon Scanning

### Biomass

#### Issue

The potential health and safety implications of the rise in the use of biomass in the UK.

Status: Active monitoring
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#### Background

Biomass can be described as renewable organic materials such as wood, grasses crops and waste material that can be converted into heat, electricity, fuel and feedstock for the chemical industry.<sup>1</sup>

In May 2007 the UK Government published its UK Biomass Strategy coupled with the Government's Energy White Paper. This strategy states that the Government wants to realise a major expansion in the use and supply of biomass to contribute to climate change and energy policy goals, including:

- A EU target of 20% renewable energy by 2020
- The UK's Climate Change Act, which imposes a legal obligation on future governments to cut carbon dioxide pollution by 80% or more by 2050<sup>2</sup>
- the Renewable Transport Fuel Obligation programme (from April 2008) of 5% of UK forecourt fuel to come from renewable sources by 2010.

In addition the introduction of biomass will assist in achieving security of UK energy supply.<sup>3</sup>

In order to meet these goals there is a requirement for a major increase in UK biomass production. The UK Biomass Strategy states that this could be done by:

- Sourcing an additional 1 million dry tonnes of wood per annum
- Increasing the amounts of perennial energy crops in the UK to up to 17% of total UK arable land (1 million hectares)
- Increased supply from organic waste materials (e.g. manures)<sup>4</sup>

According to BERR biomass could create many jobs in the UK and help reduce declining employment in the agriculture sector. It is thought that at least 300,000 jobs related to biomass fuel production could be created in Europe by 2020.<sup>5</sup>

There are three main types of biomass:

*Dependant Resources:* e.g. forest waste, straw, slurry, wood wastes: the waste and co-products from the agricultural, commercial and industrial activities.

*Non-food or Dedicated Energy Crops:* e.g. elephant grass (miscanthus), coppice, exclusively grown for conversion to biomass fuels.

*Multi-functional Crops:* different parts of the crop used to make different energy types, e.g. corn ears for bioethanol and wheat for electricity production.<sup>6</sup>

<sup>1</sup> [www.drivingethanol.org/ethanol\\_facts/glossary.aspx](http://www.drivingethanol.org/ethanol_facts/glossary.aspx)

<sup>2</sup> <http://www.defra.gov.uk/environment/climatechange/uk/legislation/>

<sup>3</sup> <http://www.dft.gov.uk/pgr/roads/environment/rfo/aboutrfo>

<sup>4</sup> <http://www.defra.gov.uk/Environment/climatechange/uk/energy/renewablefuel/pdf/ukbiomassstrategy-0507.pdf>

<sup>5</sup> <http://www.berr.gov.uk/energy/sources/renewables/explained/biomass/community/page17019.html>

<sup>6</sup> <http://www.berr.gov.uk/energy/sources/renewables/explained/biomass/page16690.html>

There are various methods to convert biomass into electricity, heat, fuels and chemical feedstock these include:

*Direct Combustion:* heating water or to generate steam to drive a turbine for electricity generation (Large biomass power stations are appearing and are planned)<sup>7</sup> Additionally existing large coal-fired power stations can sometimes burn biomass along with coal, this process is known as 'co-firing'.<sup>8</sup> This has been trialled using small amounts of biomass at Drax power station who aim to use 10% rising to potentially 20% biomass co-fired with coal.<sup>9</sup>

*Gasification:* solid biomass converted by heat into a combustible gas

*Pyrolysis:* heating biomass without oxygen, producing a combustible gas or liquid

*Fermentation/Distillation processes:* e.g. sugar/biomass conversion to bioethanol (e.g. British Sugar is producing bioethanol up to 70 million litres/yr)<sup>10</sup> and there are other proposals in the pipeline, including for butanol production.

*Esterification/Transesterification processes:* vegetable oil conversion to biodiesel (there are a number of different-sized producers in the UK)<sup>11</sup>

*Anaerobic Digestion:* the bacterial breakdown of organic waste into CO<sub>2</sub> and methane (biogas)<sup>8</sup> Sewage and Landfill gas can also be burnt as an energy source.

*Converting biomass to feedstock for the chemical industry:* as an alternative to using oil

*Conversion of Algal biomass to transport fuels:* there are a number of start-up companies around the world, including Cellena (part-owned by Shell) attempting to commercialise this sustainable technology.<sup>12</sup> On 23 October 2008 the UK Carbon Trust put out a call for proposals for the Algal Biofuels Challenge. This was set up to support the development and commercialisation of algae biofuel technologies in the UK by 2020, with potential funding up to £26 million.<sup>13</sup>

## Implications

The processes described are well-understood therefore current HSE regulation and strategy should be adequate to cope with a rise in biomass use. However there could be a number of implications for health and safety from an increase in the use of biomass in the UK over the next 10 years. These include:

- Increased collection of wood from managed and unmanaged woodland. Forestry occupations already have a very high injury and fatal accident rate<sup>14</sup>.
- High temperatures and sometimes high pressures are used in pyrolysis (350-550°C) and gasification (over 700°C). There is a potential issue with increased variability of gas constitution from biomass compared to fossil fuels.<sup>15</sup>
- Increased collection and distribution of biomass. The recycling sector has one of the highest injury and fatal accident rates.
- There is some evidence that biomass can present a potential fire or explosion risk. If the biomass is not stored well it could constitute a microbiological or chemical health risk.<sup>15</sup> Increasing use of land for crops (Agriculture) e.g. elephant grass. This may mean farmers switching to growing energy crops with limited or no experience. Other potential issues could be use of ageing equipment, equipment sharing or training issues. There could also be respiratory health effects from exposure to new or existing crops. Recycling of laminates and chipboard may present a dust explosion risk due to their high resin content and brittle nature.
- There may be potential land use planning issues from the use of biogas e.g. landfill generators. Use of biogas boilers commercially and in schools is set to increase under government plans<sup>4</sup>. Potential risks could include gas leaks or explosions.

<sup>7</sup> <http://news.bbc.co.uk/1/hi/england/bristol/7571001.stm>

<sup>8</sup> <http://www.communities.gov.uk/documents/planningandbuilding/pdf/147447.pdf>

<sup>9</sup> <http://www.guardian.co.uk/environment/2008/may/20/renewableenergy.alternativeenergy>

<sup>10</sup> <http://www.britishsugar.co.uk/RVE29c095ba629149d391ce49792e8ab37b...aspx>

<sup>11</sup> <http://www.therenewableenergycentre.co.uk/biomass-and-biofuel/biodiesel-and-bioethanol-fuel-producers/>

<sup>12</sup> <http://earth2tech.com/2008/03/27/15-algae-startups-bringing-pond-scum-to-fuel-tanks>

<sup>13</sup> <http://www.carbontrust.co.uk/technology/directedresearch/algae.htm>

<sup>14</sup> <http://www.hse.gov.uk/pubns/indg278.pdf>

<sup>15</sup> <http://www.hse.gov.uk/consult/condocs/energyreview/energyreport.pdf>

- Since June 2007 there is no need to register, submit returns or pay duty if biodiesel production is less than 2500 litres/year.<sup>16</sup> Therefore there is the potential for a large increase in domestic production (there are number of home biodiesel kits available<sup>17</sup>) and on-farm production. There are significant health and safety concerns as the process involves a number of hazardous chemicals that have toxic or corrosive effects or pose a fire and explosion risk. HSE has produced some guidance on the domestic production of biodiesel.<sup>18</sup>
- Increased collection, transport and use of large amounts of slurries and manures for energy production. Potential risks include: falls into slurries/manures, fume exposure microbiological risks and biogas explosions.

### **Recommendation**

For HSE to take into account the potential implications above in its future plans and resourcing.

*Sam Bradbrook, Futures Team, January 2009*

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<sup>16</sup> <http://www.timesonline.co.uk/tol/news/environment/article3489640.ece>

<sup>17</sup> <http://www.google.co.uk/search?hl=en&q=biodiesel+kits&meta=>

<sup>18</sup> <http://www.hse.gov.uk/pubns/biodiesel.htm>