

BIOMASS IN THE COMMUNITY

CHOICE & LOCALISATION OF BIOMASS

Do you need
electricity &
heat?



CHP

Combined heat and power

Fuelled by:

- Waste oils (UCO, WVO)
- Pure plant oils (PPO)
- Biodiesel
- Dedicated generator fuels

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CHP

(combined heat and power)

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Do you need
heat only?



Biomass heating

Fuelled by:

- Wood chip
- Wood pellets
- Grass pellets
- Straw pellets
- 'Exotic' biomass

Diesel-engine CHP

ADVANTAGES:

- Diesel generators – tried & tested.
- Very efficient – up to 85% energy capture.
- Use grid as back-up.
- Trigeneration – cooling / chilling instead of heating.
- Biodiesel / Generator Fuel / PPO to EN standards.
- Small footprint of equipment – ideal for community schemes.
- Easy fuel handling / storage.
- Excellent Carbon reduction figures.

DISADVANTAGES:

- Fuel supply chain issues & fluctuating commodity prices.
- Warranty issues, although becoming less of a problem.
- Cost / payback – competing with biodiesel industry for feedstock.
- Grid connection time & cost.
- Availability of finance due to all of above ‘perceived risks’.



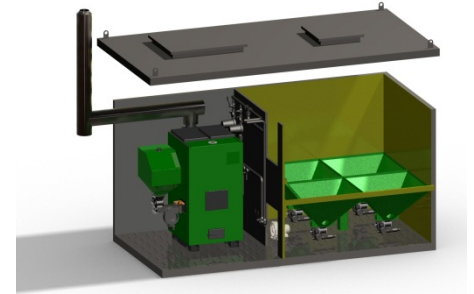
Biomass heating

ADVANTAGES:

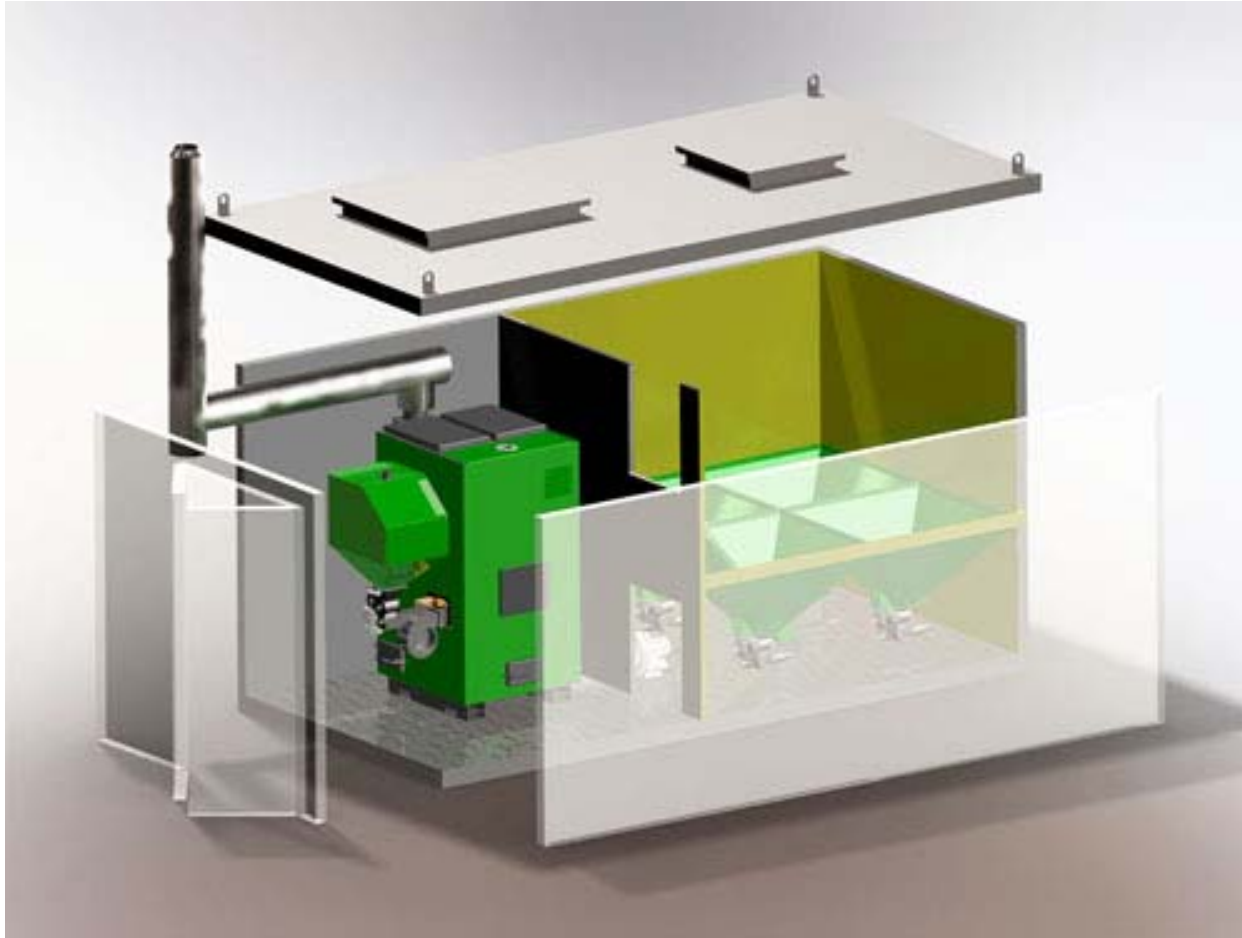
- Large choice of biomass boilers.
- Tried & tested in Baltics, Scandinavia, Germany & Austria.
- Lower capital cost than CHP.
- Capital costs falling in a growing market – more competition.
- Can be integrated into existing building infrastructure.
- “Heat in a box” containerised systems – ideal for community schemes.

DISADVANTAGES:

- Still fuel supply chain issues & price volatility.
- Low density fuel – must be localised to be truly sustainable.
- Carbon content of heat only 25% that of electricity.



Typical system



Main components:

- Boiler
- Fuel hopper / store
- Automated fuel feed to boiler
- Pipes/pumps/heat exchanger
- Automatic control system
- Flue.

Size of system

- 'Typical' council office building would use 500,000 – 800,000 kWh of heat per year.
- Which is about 108 mt – 175 mt per annum of wood pellets.
- Traffic volume - 6 to 11 bulk deliveries per year.
- Will require a 300 kW boiler to cope with peak winter demand.
- Typical cost installed £150,000 - £200,000
- RHI income would be about £30,000 - £39,000 per annum.
- Carbon saving could be expected to be 60+ mt per annum.



(Design operating life of a typical boiler is 5000 hrs per year for 10 years)

Hints on choice of biomass boiler

- Even if a boiler is 'multi-fuel' remember you may have to change the fuel handling system (eg wood chips / wood pellets are physically very different from each other).
 - True multi-fuel boilers are hard to find due to very real differences in ash and chlorine content of fuels (eg straw) requiring very different combustion parameters.
 - Check the claims of the manufacturer and if possible go see an installation running on the fuel you intend to use.
 - Always go for automatic ignition and automated cleaning in the built environment.
 - Quality of pellet can really affect the performance of the boiler – excess dust can be a real problem. Worth paying extra for quality. Pellet certification scheme now coming in.
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Biomass fuel choice



Wood chip - Ideal if you have your own.

Wood pellets - Waste wood / sawmill residue / dedicated biomass crops.

Straw pellets – UK’s biggest biomass source, local & sustainable?

Grass pellets – Miscanthus / Switchgrass/ Canary Grass
has potential to be local & sustainable.

‘Exotic’ biomass – palm kernel shell / rice husk / sunflower husk / bagasse
Really for the ‘industrial’ power stations eg. Drax

Biomass characteristics

Typical energy values:

Typical values	Moisture content	Net calorific value	Energy density	Bulk density	Energy by volume	Energy density
	%	MJ/kg	kWh/kg	kg/m ³	MJ/m ³	kWh/m ³
Wood chip	20% - 30%	12.4	3.4	160 - 250	3,100	850
Wood pellet	8% - 12%	16.9	4.8	650	11,000	3,120
Miscanthus	8% - 10%	17	4.8	500	8,500	2,400
Wheat straw pellet	8% - 10%	16	4.4	600	9,600	2,640
RCG pellet	8% - 10%	16.2	4.5	650	10,530	2,925

Critical parameters:

Ash – important factor in maintenance frequency / cleaning intervals. Automated cleaning is desirable. ‘Industrial grade’ wood pellets can have ash content up to 5%. Premium pellets are 0.5% to 1%. Ash = slag = cleaning & operating problems.

Chlorides – cause corrosion of equipment. <300 ppm desirable, as low as possible.

Wood Chip

ADVANTAGES:

- Lowest carbon footprint.
- Can be locally sourced - sustainable.
- Can be cheap.
- Creates local employment.
- Basic equipment required for production – low capital start-up.



DISADVANTAGES:

- Variable quality especially moisture content.
- “Sticky” difficult to handle (who is & cleaning & maintaining equipment?).
- Low energy value – large storage area or many deliveries required.

Wood Pellets



ADVANTAGES:

- Consistent quality to a specification.
- Easy to handle, free-flowing product – better for automated feeding of boiler.
- Can be bulk-blown into hopper.
- High energy value – less deliveries / smaller storage area.
- Low Ash = Easier maintenance of boiler.

DISADVANTAGES:

- Higher carbon footprint than wood chip (production energy)
- Requires special pelleting equipment
 - higher capital cost if you want to do it yourself



Localisation of biomass

- Reduce fuel poverty
- Support the rural community
- Create employment
- Create a green hub
- True sustainability / low carbon future
- Fuel security (price and volume)

Potential crops:

1. Willow (short rotation coppice)
2. Miscanthus (elephant grass)
3. Reed canary grass

SRC - Willow

Plant for 20 – 30 years. Harvest every 2-3 years.



ADVANTAGES:

- Ideally suited to UK climate and grows in a variety of soil types.

DISADVANTAGES:

- Expensive to establish (although 50% grant available from Natural England).
- Requires special harvesting equipment.
- Can be difficult to dry adequately after harvesting.
- Inflexible – it's there for 30 years.



Miscanthus

ADVANTAGES:

- High yields per Ha (15mt – 18mt).



DISADVANTAGES:

- Not natural to UK – no long-term study on environmental effects.
- Expensive to establish (although 50% grant available from Natural England).
- Requires special planting equipment.
- Requires special harvesting equipment.
- Mixed results in UK from last few years.



Reed Canary Grass

ADVANTAGES:

- Native to UK.
- Easy to plant & harvest – no special equipment.
- A farm contractor can grow it – ideal for absentee landowners or ‘non-farmers’.
- Low capital start-up (seed + fertilizer only).
- Tried & tested in Finland over 30,000 ha*
- Ideal for near water courses, game cover crop, conservation at field margins.
- Grows well on marginal soil & brownfield sites**.
- Pelletises well.

DISADVANTAGES:

- Lower yield per Ha than Miscanthus (50% less).



* Separate presentation available ** Teesside University Research 2010

Pelleting plants

- Typical pellet plant minimum viable size is 5000 mt per annum.
- 5000 mt of RCG is about 645 hectares
- 25 farmers growing 25 Ha = 1 pellet plant
- 30 mile radius of plant to reduce carbon footprint
- Cost of plant about £150,000 bought-in (less if own engineering).



Typical small scale plant



Typical larger scale plant

Links & References

Biomass Energy Centre:

<http://www.biomassenergycentre.org.uk>

National Non Food Crops Centre (NNFC):

<http://www.nnfcc.co.uk>

Carbon Trust / Siemens loan scheme for heating systems:

<http://www.energyefficiencyfinancing.co.uk>

THE END

THANK YOU!

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