Biomass Heating

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BRISTOL

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Wood Energy Ltd

- Wood Energy Ltd are a leading UK provider of biomass boilers with over c.62,000kW of capacity and over 210 projects to date across UK since 2002
- Winner of the Ashden Awards 2007-2008 for Sustainable Energy in the UK
- Exclusive Distributors of Binder GmbH boilers 200-5,000kW. A leading Austrian medium & large scale biomass boiler manufacturer since 1982 with over 1,000MW of capacity world wide
- Exclusive Distributors of Hargassner GmbH boilers 10-200kW. A leading Austrian wood chip and wood pellet boiler manufacturer since 1984 with over 38,000 systems in operation across Europe
Example projects

- Domestic 10/15/25kW
- Small commercial 25-500kW
- Hotels 50-500kW
- Rural Estates 50-500kW
- Public Buildings + district heating 300kW-1.0MW
- Secondary schools 400kW-1.0MW
- Hospitals 500kW-3.0MW
- Process Heat 1MW-10MW
Wood Energy Ltd – Sample biomass heating projects

- Strabane Mills 1.6MW (steam)
- National Assembly Wales 400kW
- Devon County Hall 840kW
- Trelowarren Estate 300kW
- 6 x Newcastle Schools 1.7MW
- Pilgrim Hospital 3MW (steam)
- Park 25 840kW
- HMP Lewis 200kW
- RM Poole 500kW
Technology

Size of Systems

En-Tech 10 – 45kW
Pellet only

Hargassner 10 – 200kW
Pellet & Chip

Binder 200 – 5000kW+
Pellet & Chip
Drivers for Wood Fuel Heating

- Carbon reduction
- Reducing running costs
- Reducing reliance on imported fossil fuels

87% CO₂ savings compared with gas,
91% savings compared with oil
Wood Fuel Options

Wood Pellets
- High density, low moisture content
- Tanker delivery – flows similar to a liquid
- Allows simple above ground storage
- Substantial number of manufacturers in UK

Wood Chip
- Generally locally sourced - sawmill residues, forestry residues, energy crops...
- Significantly lower cost per unit of energy compared with wood pellet and fossil fuels
- Low bulk density
- Handling needs to be designed efficiently
Wood Fuel Options

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<tr>
<th>Moisture</th>
<th>Wood Pellets</th>
<th>Wood Chips</th>
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<td>&lt;10%</td>
<td>20-50%</td>
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<tr>
<th>Size</th>
<th>Wood Pellets</th>
<th>Wood Chips</th>
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<tr>
<td>Typically 6mm diameter</td>
<td>Variable</td>
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<th>Bulk density</th>
<th>Wood Pellets</th>
<th>Wood Chips</th>
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<tr>
<td>650kg/m³</td>
<td>200-250kg/m³</td>
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<th>Energy per tonne</th>
<th>Wood Pellets</th>
<th>Wood Chips</th>
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<tr>
<td>5,000kWh/tonne</td>
<td>2,250-3,750kWh/tonne</td>
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<th>Energy per m³</th>
<th>Wood Pellets</th>
<th>Wood Chips</th>
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<tbody>
<tr>
<td>3,250kWh/m³</td>
<td>850kWh/m³</td>
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<th>Energy per m³ RATIO</th>
<th>Wood Pellets</th>
<th>Wood Chips</th>
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Pellet Storage

Main options

Internal masonry store

External Pellet silo
Design Features of a Biomass Boiler

* High Efficiency
  Typical full load and part load efficiencies c. 90%+

* Clean Air Act Exempted
  Conforms to all statuary emissions and efficiency criteria

* Automatic Ignition and Capacity Control
  Has auto-ignition and the ability to modulate the boiler output

* Low Maintenance
  Features such as automatic heat exchanger tube cleaning system
  and automatic de-ashing
Boiler Technology - emphasis on low maintenance

- Automatic ash removal from the boiler
- High-velocity air cleaning system
- Cyclone to remove fly-ash from the emissions
- Lambda sensor with automatic adjustment to fuel type
Advanced Filter Technology: Ceramic Filters

Cyclones reduce particle emission levels to typically below 50mg/m³. Although this is fully compliant with current legislation, it is likely in urban areas, with the expansion of biomass (adding to other emitters – mainly cars) more stringent limits will be introduced.

A relative new technology to the biomass industry – Ceramic Filter – has been introduced to a number of biomass boiler installations [WEL were the first UK company to introduce the technology on 3 installations in 2008].

Ceramic Filters can reduce PM₁₀ and PM₂.₅ boiler emissions to below 1mg/m³ i.e. between 1 and 2 orders of magnitude better.
Wood chip & wood pellet boilers since 1984
No. 1 in Austria below 100kW
40,000 units in the field
State-of-the-art production facility
Wood Energy Ltd

Automatic Ash removal

Refractory-based Furnace

Serial autom. Boiler cleaning system

Automatic fly ash removal

Refactory-based Furnace

Speed controlled exhaust fan with vacuum control

Automatic Ash removal

Heat exchanger

WTH 70, 80, 100
Automatic Ash removal

- Boiler cleaning
- Fly ash removal
- Grate ash removal
- Central Ash removal

Only one motor for all applications
Boiler Sizing

Define what you are trying to achieve with the biomass boiler?

- Biomass boiler to provide 100% capacity?
- Provide a base load with biomass?
- Achieve % carbon savings?
- Provide minimum renewable energy percentage?
Use of Accumulator Tanks

Reasons for employing an Accumulator Tank

• Avoiding boiler cycling under low load conditions
• Where load exceeds the boiler’s MCR
Example – Real Time Graphical Display

Graphics Package
- remote monitoring
- educational options
- trend monitoring
NAW Parliament Building, Wales

A 400kW Binder wood chip boiler commissioned October 2005
Sized to supply 100% of peak demand with gas standby
County Hall, Exeter Devon

- 840kW Binder boiler commissioned 2009
- Wood chip supplied by Forest Fuels
- Below ground fuel store
- Lead boiler supplying c. 80% of heat demand
- Saving c. 400tCO$_2$/year
Trelowarren, Cornwall

300kW wood chip boiler heating “Eco timeshares”, restaurant and open air swimming pool.
Penmorfa District Heating, Ceredigion

- County Council Offices, sheltered Housing & Nursing Home on small district heating system
- Small district heating loop fuelled by 550kW wood-boiler and 250kW oil for peaking and standby
Batsford Estate, Gloucestershire

- Commissioned 2006
- 300kW Binder boiler
- 6,000L Accumulator tank
- Rotary extraction system within main fuel store
Blaise Nursery, Bristol 2006

400kW step-grate boiler + 8,000L AT heating glass houses

Full range of biomass fuels including “waste wood” from households and park arisings with high leaf and bark material and high moisture content
RMB Poole Wood Fired Boiler

500kW Binder wood chip boiler

Maximum moisture 35% + G50 (large chip size)

MTHW boiler (Max 120°C)

Constraints - the wood boiler required to fit into the existing boiler house

Wood chip boiler will provide all heat and hot water except in extreme weather. Estimated to provide 80% of annual demand.

Fuel handling system based on a hook bin delivery system
RMB Poole Wood Fired Boiler
Containerised Boiler Plant

- Pipe-work and electrical works factory fitted
- Short installation times
- Large potential savings on boiler house and civil costs
Manor House Hotel, N.Ireland

500kW pellet boiler heating an 81 bedroom hotel and swimming pool.

The system is fully containerized.

Commissioned May 2006
Carno Community Centre, Wales

45kW fully containerised system
Supported under LCBP
Archway School, Stroud

- Commissioned Jan 2008
- 500kW Binder boiler
- 8,000L Accumulator tank
- Hook bin wood chip storage

Photograph (top right) shows the hook bin fuel storage unit in position supplying wood chip fuel to the boiler. The system has a wooden fence surround.

Wood fuel supply by Gloucestershire Wood Fuels Ltd
Newcastle BSF Schools (phase 1)

Walbottle Campus 840kW – Ro Ro bins storage solution
Business Park 25, Redhill Surrey

220 houses and apartments served from a single energy centre via a district heating network.

Biomass boiler was commissioned in January 2009
Heat provided by single 840kW Binder wood chip boiler via 2 x 20,000L buffer tanks ≅ 1000kWh of stored energy
Single 800kW gas boiler as stand-by
The boiler house and fuel store are both subterranean on a single level
220mm auger system running the length of the walking floor

Discharges chip into a second transport auger which feeds wood chip into the stoker auger and into the boiler

Wood chip delivered by tipper lorry via one of 3 fuel store doors
Wood Chip Fuel

Fuel store has a hydraulic walking floor 6.4 m by 7m
Total gross volume 180m$^3$. 
Plas Crug 1.6MW

Large District Heating System in Wales
Step-grate for 50% mc fuel
G100 wood fuel specification
Hydraulic walking floor System
Questions?

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