



**ENERGY  
INNOVATIONS**  
ENGINEERING BIOMASS SOLUTIONS



# Biomass Heating Systems

Marc Lyon | Energy Innovations (UK) Ltd

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)



**ENERGY  
INNOVATIONS**  
ENGINEERING BIOMASS SOLUTIONS

**GILLES**  
BIOMASS HEATING

## 1.1. Uses of Biomass for Energy

### Gasification



- Gasification is a process that converts organic materials into combustible gases, which can be cleaned and burnt or expanded to produce energy.

### Power / Heat & Power



- Pure power generation only up to 40% efficient.
- Combined Heat & Power makes use of waste heat and has much higher overall efficiencies.
- Industrial scale installations – 100MW plus.

### Pure Heat



- Most efficient use of biomass fuel which is a limited resource.
- Smaller scale installations – 10kW to 10MW

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## Biomass for Heat



- Most effective use of biomass
- Smaller scale installations 10kW – 10MW

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## Biomass Fuels for Heat in the UK



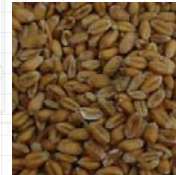
- **Logs**
- Least processed fuel
- No boiler automation



- **Wood Chips**
- Least processed fuel for automated systems
- Cheap but bulky fuel
- 1T = 4-5m<sup>3</sup> @ 30% moisture
- 1000 litre oil = 3 Tonne chip = 12m<sup>3</sup> chip



- **Wood Pellets**
- More processed fuel
- Very convenient; compact; good handling characteristics.
- 1T = 1.4m<sup>3</sup>
- 1000 litre oil = 2.25 Tonne pellet = 3.15m<sup>3</sup> pellet



- **Wheat Grains**
- Food vs. fuel debate
- Bad combustion characteristics
- Acidic emissions shorten life of system and compromise green credentials.



- **Other Residues**
- Specific Cases
- One off large scale projects
- Combustion not necessarily best solution.
- Anaerobic Digestion?

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

#### 4.0. Fuel Costs used in this Presentation

	Cost (as charged)	Calorific Value kWh/unit	Energy Cost p/kWh
Heating Oil	60 pence per litre	10.8 kWh/litre	5.09 p/kWh
Wood Pellet (bagged)	225 £ per tonne	4.7 MWh/T	4.79 p/kWh
Wood Pellet (blown >5T)	200 £ per tonne	4.7 MWh/T	4.25 p/kWh
Wood Pellet (bulk tipped)	160 £ per tonne	4.7 MWh/T	3.40 p/kWh
Wood Chip (small scale specialist delivery)	110 £ per tonne	3.5 MWh/T	3.14 p/kWh
Wood Chip (tractor and trailer delivery)	90 £ per tonne	3.5 MWh/T	2.57 p/kWh
Wood Chip (bulk delivery)	80 £ per tonne	3.5 MWh/T	2.28 p/kWh
Wood Chip (own production)	50 £ per tonne	3.5 MWh/T	1.43 p/kWh

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

#### Biomass Heating - Why

##### Environmental Reasons



- Nearly carbon neutral process
- Therefore ~100% carbon offset vs. fossil fuel.
- Use of own resources – in house process

##### Cost Savings



- Running costs can be as low as 1/3 of an oil system
- Capital cost must be considered – can be high but well specified / well designed systems will pay back quickly

##### Government Incentive



- Renewable Heat Incentive
- Similar to FIT for renewable electricity
- Scheme Implementation November 2011
- Tariff Rates:
  - 0 – 200kW – 8.3 pence p/kWh on Tier 1.
  - 2.1 pence p/kWh on Tier 2.
  - 200 – 1000kW – 5.1 pence p/kWh Tier 1.
  - 2.1 pence p/kWh on Tier 2.
  - >1MW - 1.0 pence p/kWh.

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## Biomass Heating - Why

### Non-Domestic Payment Example

#### GILLES HPK-RA 550kW Woodchip Boiler



**Actual Peak load** = 25% x 8,760 hours per annum = 2190 hours.

**Total kWh per annum** = 2190 x 550kW = 1,204,500kWh

**Tier 1** = 1314 x 550kW = 722,700kWh

**Tier 1 annual RHI Payment** = 722,700kWh x 5.1 pence = £36,857.70

**Tier 2 annual RHI Payment** = 1,204,500kWh – 722,700kWh = 481,800kWh x 2.1 pence = £10,117.80

**Total annual RHI Payment** = £36857.70 + £10,117.80 = **£46,975.50**

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## Biomass - Where



- **Urban / Suburban**
- Space constraints lead to difficult, potentially expensive projects
- Not ideal for Biomass
- District Heating?



- **Small Rural**
- <30kW – Pellet boiler with day hopper.
- 30-50kW – Pellet Boiler with bulk store hopper.
- RHI will be v. important.



- **Medium to Large Rural (+ rural district)**
- 50 – 150kW – woodchip boiler
- Local or own fuel source important
- These are solid, economically viable biomass jobs.
- Payback times 5 – 7 years



- **Large Commercial**
- 150 – 2000kW
- Commercially specified and procured construction projects
- Sometimes only 10% renewables obligation is addressed
- Large, central heat load so ideal for biomass projects if properly specified / designed / installed



- **Community Heating**
- 150 – 5000kW
- Ranges from 2 or 3 houses to hundreds of houses
- Excellent application for biomass as proven in Europe.
- Large schemes starting to be specified for UK new build.

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## Biomass - When

### Now!

- High fossil fuel costs, set to rise
- Where self sufficiency / fuel security can be achieved. Rural projects with own fuel source
- Renewable Heat Incentive

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

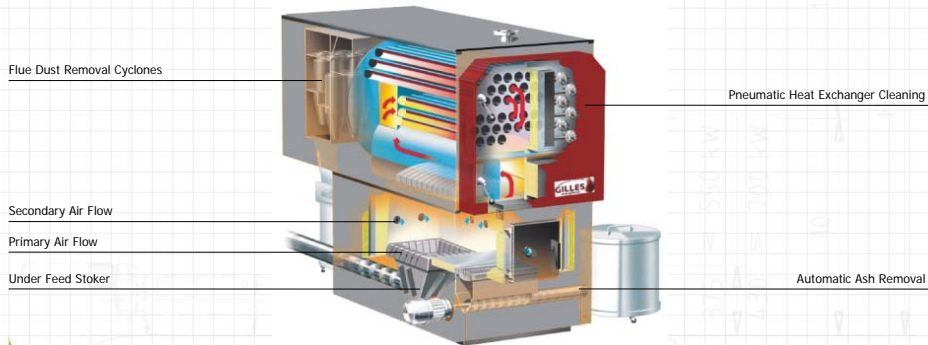
## Gilles HPKI-K Industrial Heating Plant

- boilers from 0.15 – 6MW example shown here is 0.36MW
- suitable for woodchips, pellets, sawdust, shavings, bark and much more
- fully automatic ignition, ash removal and pneumatic heat exchanger cleaning
- integrated exhaust ash removal cyclones
- under fed static furnace.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

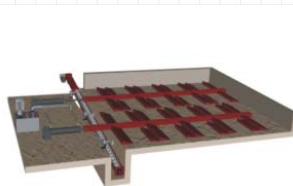
Gilles HPKI-K Industrial Heating Plant



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

Gilles Fuel Transfer Equipment

A push floor system for use with larger industrial boilers



A hinged arm sweep collector in a 22 cubic metre hopper for woodchip



Cell wheel



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## 12.0. Heat Metering Solutions

- Ultrasonic heat meters can be used to determine kWh throughput used for billing purposes and RHI payment calculation
- Heat Meter positioning carefully controlled within RHI regulations
- Plant Room schematic and an independent report must be supplied during accreditation process with regards to heat meter positioning



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

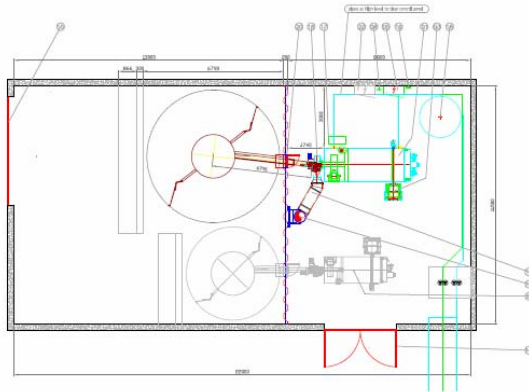
## Energy Innovations Approach to a Biomass Project Where do we start? – Site Survey...

- Once we have an idea of the required boiler size, the next thing is to identify the fuel strategy. This will dictate a number of factors including fuel store size, location and configuration.
- Consider proximity to buildings and pipe runs.
- Flues and chimneys – can have a bearing on boiler location.  
Chimney Heights / LAQM / Planning
- At this stage, once costs have been identified, we will look at system feasibility, payback periods and CO<sub>2</sub> savings.

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

### Fuel Stores - An existing building

This must have good eaves height to allow trailers / fork lifts to tip.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

### Fuel Stores - Above Ground Storage

An above ground storage hopper is suitable for a high-tipped delivery or loading with a fork-lift or front end loader.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)



Fuel Stores – Below Ground Storage



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

Fuel Stores - Blown Deliveries

...usually seen as a last resort.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

Blown deliveries

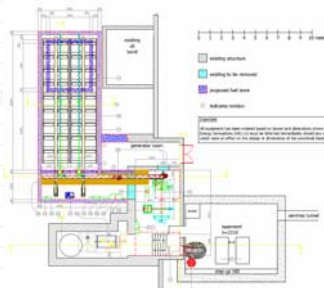
If site constraints are such that blown deliveries are the only option, then it is most likely that the project will be more suited to wood pellet than woodchip.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

Project stage - Design

- In House CAD
- In House Mechanical Design
- Takes a project from concept to installation



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

### Project stage - Installation (District Heating)

Energy Innovations is able to undertake installation of district heating pipe work through the use of its specialist equipment and trained staff.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

### Project stage - Boiler system installation

- all of our boiler positioning, assembly and commissioning is carried out "in house" by our own engineers
- pipe fitting / plumbing is generally sub-contracted.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

Project stage - System Commissioning

- experienced in-house electrical and boiler commissioning engineers
- PC-based graphical interface to all system parameters (a key commissioning tool)
- integrated overall commissioning strategy facilitated by a close partnership with Gilles.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

Support from Energy Innovations

All Systems incorporate remote access link for monitoring and remote maintenance.

Ongoing service and maintenance throughout system life.

Advice and support on fuel and fuel suppliers.



[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

### 5.1. Example System: 900kW Woodchip District Heating

- **Boiler:** Gilles HPKI-K 900
- **Heat Output:** 900kW
- **Fuel:** G50, W30 Woodchip to ÖNORM M 7133 sourced from the estate
- **Fuel Storage:** Converted, disused grain store
- **Fuel Delivery Method:** Timber chipped and stored onsite  
Onsite handling with Tele-handler
- **Annual Heat Load:** 1,577MWh
- **Annual Fuel Requirement:** 563T
- **Annual Fuel Cost (yr.1):** £22,526 (@ £40/T) – 1.14p/kWh
- **CO2 saving (vs. heating oil):** 512T



- **Boiler Features:**
  - Automatic Ignition
  - Pneumatic Heat Exchanger Cleaning
  - Automatic Ash Removal
  - Integrated Flying Ash Removal by Multi-Cyclone Dust Separator
  - Data Logging, Diagnostics & Remote Maintenance by Broadband Internet
- **Systems Space Requirement:** 25m x 15m
- **Projected RHI for this scale of project:**
  - £55,631.00 (yr.1) (Medium Biomass)
  - Tier1: 4.9p/kWh
  - Tier2: 2.0p/kWh

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

### 13.2. Snape Maltings - 550kW Woodchip Boiler complete with Hydraulic Walking-Floor

- **Boiler:** Gilles HPKI-K 550
- **Heat Output:** 550kW
- **Fuel:** G50, W30 Woodchip to ÖNORM M 7133 sourced from the farm
- **Fuel Storage:** 150 m<sup>3</sup> underground bunker
- **Fuel Delivery Method:** Flexible direct tipped options incl. 100m<sup>2</sup> walking floor lorry
- **Annual Heat Load:** 964MWh
- **Annual Fuel Requirement:** 334T
- **Annual Fuel Cost (yr.1):** £24,090.00 (@ £70/T) – 2.0p/kWh
- **CO2 saving (vs. heating oil):** 313T/annum



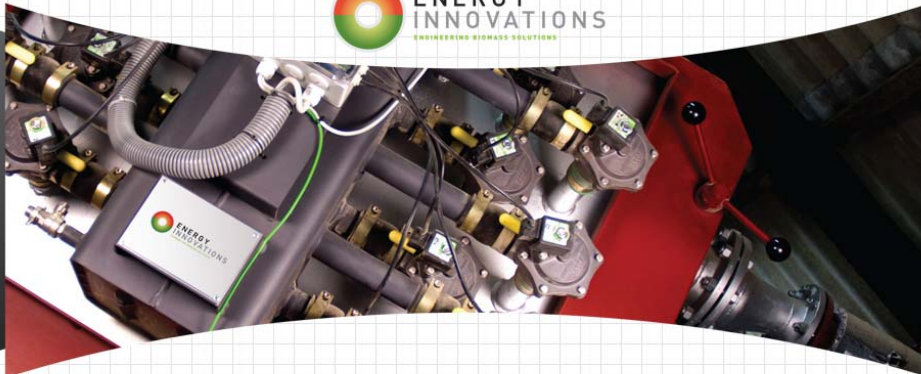
- **Boiler Features:**
  - Automatic Ignition
  - Pneumatic Heat Exchanger Cleaning
  - Automatic Ash Removal
  - Remote Maintenance via broadband
- **Systems Space Requirement:** 30m x 30m
- **Projected RHI for this scale of project:**
  - £40,241.00 (yr.1) (Medium Biomass)
  - Tier1: 4.9p/kWh
  - Tier2: 2.0p/kWh

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)

## Conclusions

- Modern wood-fuel boilers offer excellent clean, green, practical, carbon neutral heating.
- Wood chip systems can offer huge financial savings as well as making use of local fuel supplies, sometimes justifying improved woodland management.
- District heating should be considered where a number of properties can be supplied with heat from one central boiler.
- Government support makes the economics of these systems very attractive.

[www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)



## Biomass Heating Systems from Energy Innovations

**Design - Supply - Install - Maintain**  
**Domestic - Industrial - District**

- Huge cost savings from the most advanced biomass heating systems available
- Fuels include woodchip, wood pellets, shavings and much more
- Fully automated boilers and heating systems for practical heating solutions
- Domestic and Industrial applications from 10-6000kW

Environmentally Friendly Heating for the Future | T 01728 635 761 | [www.energyinnovationsuk.com](http://www.energyinnovationsuk.com)