



# Biomass Community Heating



*Past experience and future opportunity with the  
Renewable Heat Incentive (RHI)*

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# Econergy Ltd: The Company

- UK leader in design & supply of complete biomass heating solutions
  - Founded 1999
  - > 500 projects sold to date
  - > 80 schools, colleges etc.
  - 10KW to 2MW systems
  - 19% owned by British Gas
- Econergy offering
  - Biomass boilers
  - Turnkey solution design & supply
  - District heating
  - Biomass heat supply
- Commercial market sectors
  - Schools, social housing, hospitals, universities, leisure centres, care homes, rural developments, offices, supermarkets, greenhouses etc.
- Domestic boilers
  - Increasingly via installer network



**Chessington Community College**  
Royal Borough of Kingston

**Rocks Green, Shropshire**  
91 house new build community heating





# Econergy customers include

## **Government Departments**

Forestry Commission (14)  
DEFRA  
Foreign and Commonwealth Office  
MOD

## **Hospitals & Care Homes**

Royal Victoria Hospital, Fife  
Royal Cornwall Hospital  
Cyon Valley Hospital, Wales  
Birtley House Care Home  
Oxon Care Home

## **Local Council Offices**

Worcestershire County Hall  
Southwark Council, London  
Maidstone Council  
Bradford City Hall

## **Leisure**

Bowood Golf Club & Spa  
Doncaster Leisure Centre  
Telford Leisure centre & theatre  
Paignton Zoo Crocodile Farm  
The Living Rainforest

## **Social Housing District Heating**

Sheffield Homes (4)  
Berneslai Homes, Barnsley (6)  
Doncaster Homes  
South Shropshire Housing Association  
Bromford Corinthia Housing Association  
Birmingham Council  
Stockport Homes  
Wolverhampton Homes

## **Education**

Bristol Council Schools (6)  
Barnsley Council Schools (8)  
University of Cambridge  
South Lanarkshire Council schools (3)  
Suffolk Council schools (4)  
National Star College  
Berkshire College of Agriculture  
Royal College of Agriculture

## **Rural Developments**

Duchy of Cornwall (4)  
Aske Estate (4)  
Kevin McCloud

## **Charities**

National Trust (12)  
RSPB

## **Domestic**

### **Commercial**

Marks & Spencer  
Wessex Water  
Skipton Building Society  
The Co-operative Group

### **Contractors**

Balfour Beatty  
NG Bailey  
Crown House  
Kier Group  
Skanska  
John Laing  
Lorne Stewart  
Mitie  
Hayden Young  
Crest Nicolson  
Sir Robert McAlpine  
Briggs & Forrester  
Dodd Group  
Warings  
T Clarke  
Interserve  
BAM



# Renewable Heat Market...

## ...a recoiled spring

- 15% of UK's energy to come from renewable sources by 2020
- 12% of heating from renewable sources by 2020 including:
  - 110,000 commercial and public sector installations by 2020
    - **25 % of total heat capacity in these sectors**
  - 11,000 industrial installations
  - < 1% of heat today from renewable sources
- Heating accounts for 47% of UK's CO2 emissions
  - 69% gas, 10% oil, 14% electricity
  - 2 million homes on oil
    - a key target segment for renewable heat
- Biomass heating likely to be 40% to 60% of renewable heat

=> Renewable Heat Incentive (RHI) to be introduced in July 2011 to support non-domestic installations



# Biomass Energy... is moving into focus

***"We see a crucial role for sustainable bio-energy at all scales because of its versatility in producing heat, electricity and transport biofuels. Biomass is potentially the single most important renewable energy resource..... We are currently using only 10% of potential woody biomass and I will keep banging the drum for all the advantages "***

**Chris Huhne, UK Secretary of State for Energy, Dec 2010**

***By 2020, the UK could have access to about 1,800 PJ of bioenergy supply; this is equivalent to 20% of current primary energy demand in the UK, and would meet the level of demand estimated in the UK Renewable Energy Strategy (DECC 2009).***

**UK Bioenergy Report to DECC March 2011**

**AEA, Biomass Energy Centre, Oxford Economics, Forest Research**

***"Policies that concentrated more on cheaper renewables such as biomass and less on offshore wind and solar, would make things less expensive"***

**The Economist, 21<sup>st</sup> May 2011**



# Non-Domestic RHI for Biomass heating from July 2011

A cash tariff (p/kWh) for useful renewable heat delivered for plant owners....

Tariff name	Eligible Technology	Eligible size kW nominal output thermal	Tariff rate* (pence/kWh)	Tariff duration (years)	Support calculation
Small biomass	Solid biomass (includes: wood chip, wood pellet, wood logs)	Up to 199 kW	Tier 1: 7.6 Tier 2: 1.9	20	Metered Tier 1 applies annually up to tier break, tier 2 above the tier break. The tier break is 1,314hr x installed capacity (kW)
Medium Biomass		200 kW to 999 kW	Tier 1: 4.7 Tier 2: 1.9		
Large Biomass		1000 kW and above	2.6		Metering

- Detailed rules on eligibility, compliance, inspection and enforcement to ensure that only useful heat is rewarded



# Ennerdale, Doncaster Homes

## - potential RHI funding scenario

- Retrofit existing gas community heating scheme
  - 132 bungalows, 40 flats
  - 3.9m kWhs fuel @ 2.4p/kWh = 2.7m kWhs heat 3.4p/kWh
  - 1.2 MW peak load
- Econergy supply: replace central gas boiler with biomass
  - Design & M&E supply
  - Main contractor (inc CDM)
  - Froling 500KW chip boiler
  - £340,000 capital
  - Commissioned Sept 2009
- Biomass Heat
  - 1.5 mKWhs heat @ 2.9p/kWh
    - 510 TPA wood chip (30% mc)
- RHI benefit (chip = gas price)
  - **£47,500 RHI payment pa**
  - **7 yr payback**



Froling 500KW boiler delivery  
into retrofit energy centre



# Retrofit Biomass Heating: Key Design Considerations

- What are the customer's objectives ?
- Feasibility - financial, logistics...
- Heat demand profile, layout of buildings, boiler & buffer sizing
- Wood fuel selection, logistics and sourcing
- **Space and access** for biomass boiler plant (new build / retrofit)
- **Air Quality**: boiler installation and flue design
- Other planning considerations and approvals (visual, **traffic**....)
- Hydraulics and controls philosophy

## Biomass Heating Life Time Cost (e.g.)

500KW, 1.5m kWhs pa, 30 yr life  
£1.8 million lifetime cost of which:

- boiler & feed system	5%
- total installed cost	15%
- maintenance	10%
- wood fuel cost	70%

Design for  
minimum cost  
over lifetime

*\* Particularly important in urban context*



# Which fuel type ?

Wood chip	Wood pellet	Logs
<p><b>Fuel cost: 2.0 – 3.5 p/KWh</b> 10KW to 10MW</p> <p><b>Low energy density</b> <b>(600KWh/m3)</b></p> <p>Automatic feed for 24x7 hour operation</p> <p>Medium /large scale operation is most economic</p>	<p><b>Fuel cost: 3.5 - 5 p/KWh</b> 10KW to 1000KW</p> <p><b>High energy density</b> <b>(3450KWh/m3)</b></p> <p>Can transport long distances</p> <p>Fuel “flows”</p> <p>Fuel delivered by blower – fuel store generally simpler &amp; cheaper</p>	<p><b>Fuel cost: 1.5 - 4 p/KWh</b> 15 to 70KW</p> <p>Easy to handle</p> <p>Known &amp; existing supply chain</p> <p>Can produce from small scale wood land</p>
<p><u>Considerations</u></p> <p>Need local supplier</p> <p>Quality can be variable</p> <p>Fuel reception design is key &amp; can be expensive</p> <p>Fuel does not flow &amp; is difficult to handle</p>	<p><u>Considerations</u></p> <p>Pellet quality is critical</p> <p>Cost</p> <p>Need large scale production to keep costs down</p> <p>Unlikely to be local</p>	<p><u>Considerations</u></p> <p>Need to load manually at least once per day</p> <p>Only suitable for small scale</p>





# Wood fuel delivery and storage

Capital cost vs. fuel supply cost



- 1) Underground bunker (Chip)
- 2) Blown delivery (Pellet / Chip)



- 3) Scissor lift trailer (Chip)
- 4) Hook lift bin (Chip)





# Wood fuel sources and sustainability

## Are there enough trees ?

- 2020 UK Government Biomass Heat Target: 38TWh
  - **Requires 11 million tonnes per annum of wood fuel: >> £1 billion pa**
- Wood fuel sources (1)
  - Forestry & sawmill residues, arboricultural arisings, under managed woodland, incl. domestic pellets: 3-4 m tpa possible by 2020
  - Wood pellets:
    - >300,000 tonnes of pellet now produced in the UK – c. 90% of this is exported !
    - Very substantial supply, not believed to be a limited if imports included
      - eg. >£6 billion of wood products are currently imported into the UK
  - Energy crops: short rotation forestry, willow, poplar etc: c.700,000 hectares by 2020 possible (>9m tpa)
  - Recycled waste wood: > 4m tpa available now (industrial plant only)
- Low carbon, sustainable sourcing is essential
  - Criteria for legal and sustainable sourcing already defined for central Gov procurement
  - RHI requires sustainability reporting (2011) and compliance criteria (2013)for biomass plant for size of 1MW+

(1) Wood fuel sources: Supply estimated based on information from e4Tech reports to DECC 2009, Biomass Energy Strategy (DEFRA) 2007, Forestry Commission statistics (2009)



# Ensuring Air Quality

## Current Regulation

- Exempt appliances under the Clean Air Act (CAA) for smoke control zones or air quality management areas
- Part J Building regulations for flues
- Flue design according to CAA
- Local Authorities control emissions
  - *CAA: Flues need to be assessed for all boilers > 45kg/hr (c. 150kW)*
  - May need dispersion modelling
  - Advanced filters starting to be required (eg London, Sheffield)

## Emerging Regulation:

- UK Wide
  - New limits proposed in RHI from Oct 2012 onwards
    - 150 mg/MJ NOX (OK)
    - 30 mg/MJ (tight)
      - ie. not all MCS compliant domestic boilers
- Urban areas
  - May include in planning process (eg GLA, London)
  - May require advanced filters in all PM10 AQMAs (eg London)



# Biomass low emissions solution Sheffield Greenland District Heating

- Retrofit base load biomass community heating to 380 flats
- Two Froeling 500kW wood chip boilers (50%mc). Underground bunkers.
- Two ceramic filters; PM10 / PM2.5s << 5 g/GJ
- Part British Gas CERT funded





# Retrofit Domestic Tower Blocks - typical benefits

- e.g. 2 x 60 flat blocks
- Current insulation
  - none
- Current heating
  - electric storage
  - Gas/oil/coal communal
  - Gas individual
- Upgrade package
  - Cavity / solid wall insulation + windows
  - Biomass community heating
    - Single plant room with biomass & back-up gas feeding two tower blocks
  - Individual flat metering & controls





# Solution & Benefits

## 200 to 999kW biomass boiler

- Demand reduction per flat from insulation, metering & controls (eg 2 bed flat)...
  - from 12,000 - 20,000kwhs
  - to 6,000 - 8,000 kWh

=> 40 - 60% demand reduction

### **Walsall Housing Group**

*Current heating costs per flat £1,000 to £2,000 from surveys. Estimate this can be reduced to £500 to £700 for gas communal with insulation and less for pellet with RHI*

### Fuel cost saving for biomass+RHI

- RHI tier 1: 4.7 p/kWh
  - to repay capital difference
- RHI tier 2: 1.9 p/kWh
  - to compensate fuel price
- Fuel price comparisons
  - wood chip: 2.2 - 3.5 p/kWh
  - wood pellet: 3.5 - 4 p/kWh
  - gas 2 - 3 p/kWh
  - oil 5 - 7 p/kWh
  - electricity 8 to 12 p/kWh

### Example: pellet v. gas

- gas price = 2.5 p/kWh
- pellet price less tier 2 RHI  
= 3.75 - 1.90 = 1.75 p/kWh

=> Up to 25% fuel saving (v. gas)  
or up to 80% saving v. electricity



# Benefits of Biomass District Heating

- To Occupier
  - Easy to use & warm
  - Can control heat & bills
  - Reliability – full back-up
  - No annual boiler maintenance
  - Reduces risks (gas explosion, CO poisoning)
  - No flue
  - No gas mains
  - No fuel storage, manual handling or ash emptying (cf individual biomass boiler)
- To developer/operator
  - Best cost low carbon solution (with insulation)
  - Minimum in property maintenance
  - Consumer acceptance
  - Gas mains safety checks not required
  - Ease of planning: reduced emissions for air quality
  - Reliability: redundant central plant, site spare CIUs
  - Ease of central plant maintenance & remote monitoring



# Walsall Housing Group: Humphries and Severn (CERT)

- **Humphries House**
  - changing a communal gas fired heating and hot water system which serves 99 properties to a Bio-mass communal system.
  - external insulation
  - energy efficient lighting
- **Severn House**
  - changing 45 individual gas fired heating systems to run from the main communal Bio-mass boiler plant in Humphries Hse.
  - externally insulation.
  - double glazed windows.
  - energy efficient lighting

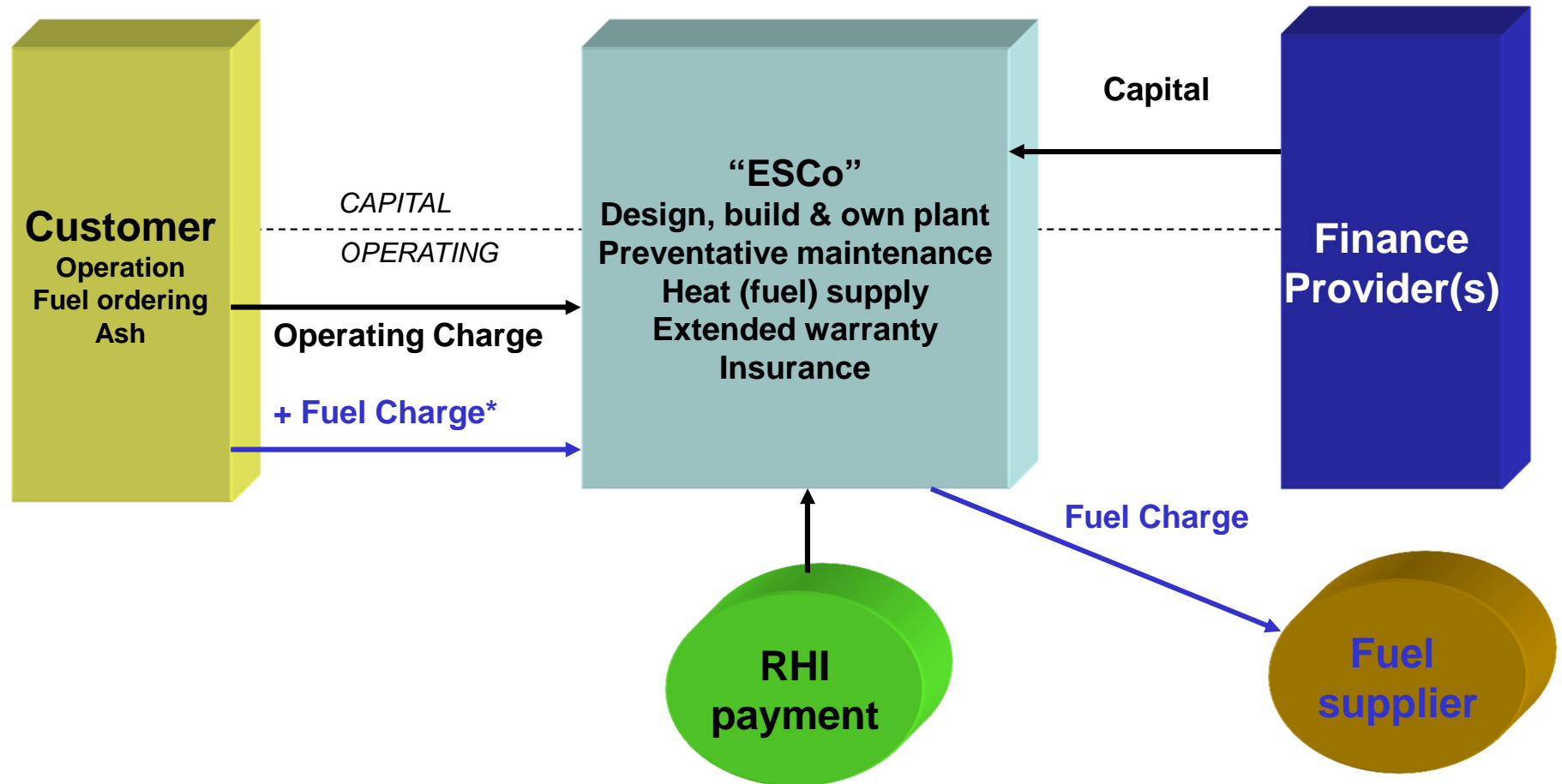
## ■also

- provision to feed any new build homes around the block
- work with supermarket to supply heat to new store
- saving approx 9,000 tonnes of CO<sub>2</sub> over the lifetime of the scheme for switching from gas to Bio-mass.





# RHI opens the door for various financing structures.....





## Further information and contacts

- Please call us for design and feasibility assistance
    - Budget costs, proof of concept layouts, technical assistance
  - More information
    - Website: Product & design information
    - Commercial: Econergy Biomass Heating Design Toolkit
    - Domestic: Econergy Pellet / Log Boiler UK Installation Guides for Plumbers
    - Environmental Protection UK: Biomass and Air Quality
    - Carbon Trust Biomass Heating Design Guide
  - Enquiry form on web-site [www.econergy.ltd.uk](http://www.econergy.ltd.uk)
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