



CHP QA

# Waste and Biomass Fired CHP

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# Talk Coverage (Biomass and waste Schemes)

- Fuel Types
- ECAs for additional equipment
- LECs
- Scheme Boundaries

# Fuel Inputs

- Conventional Fuels
  - Natural gas
  - LPG
  - Gas Oil
  - Other Commercial Fuel Oils
  - Coal and Coke

# Fuel Inputs

## ➤ Alternative Fuels

- By-Product Gases
- Biogas
- Waste Gas or Heat
- Liquid Biofuels
- Liquid Waste
- Biomass or Solid Waste
- Wood Fuels



# Fuel Inputs

- Alternative Fuels
  - By-Product Gases

products from industrial processes (blast furnace gas, coke oven gas and refinery fuel gas), which may include constituents such as hydrogen, ethane, propane etc

# Fuel Inputs

## ➤ Alternative Fuels

### ➤ By-Product Gases

### ➤ Biogas

gas produced by the anaerobic digestion (AD) of biological materials (such as sewage gas, landfill gas, food processing waste, pharmaceutical waste and municipal waste)



Source: Farmers Weekly/Bedfordia

# Fuel Inputs

## ➤ Alternative Fuels

➤ By-Product Gases

➤ Biogas

➤ Waste Gas or Heat

▪ waste gases (such as carbon monoxide or volatile organic compounds), or

▪ waste heat (such as the exhaust gas from high temperature processes, or as a product of exothermic chemical reactions)



# Fuel Inputs

## ➤ Alternative Fuels

- By-Product Gases
- Biogas
- Waste Gas or Heat
- **Liquid Biofuels**



Manufactured liquid biofuels as defined in the EU Biofuels Directive (such as **biodiesel**, **bioethanol**)

# Fuel Inputs

## ➤ Alternative Fuels

- By-Product Gases
- Biogas
- Waste Gas or Heat
- Liquid Biofuels
- **Liquid Waste**

Material of biological or non-biological origin from domestic and industrial activity (such as Tallow, Fats and biological oils, solvents, tank washings, recycled used oil and refinery asphaltic oil)

# Fuel Inputs

## ➤ Alternative Fuels

- By-Product Gases
- Biogas
- Waste Gas or Heat
- Liquid Biofuels
- Liquid Waste
- Biomass or Solid Waste

- Such as ....
- energy crops,
  - waste wood,
  - municipal solid waste,
  - industrial solid waste,
  - hospital waste,
  - agricultural residues,
    - straw,
    - and sewage treatment residues



# Fuel Inputs

- Alternative Fuels
  - By-Product Gases
  - Biogas
  - Waste Gas or Heat
  - Liquid Biofuels
  - Liquid Waste
  - Biomass or Solid Waste
  - **Wood Fuels**

Commercial-grade wood fuels (such as

- clean woodchips,
- logs and wood pellets,

but **specifically excluding energy crops and waste wood, which are classed as biomass**)



# Alternative Fuels – Energy Inputs

- All CHPQA analysis is based on Gross Calorific Value GCV
- This is to be in an **as-fired** condition  
 $GCV_{(af)}$  or  $GCV_{(ar)}$  (as received)
- $GCV_{ar} = GCV_{dry} \times (100-m)/100$   
 where m = moisture (as received), weight %
- Knowing moisture and hydrogen content, it is possible to convert between GCV and NCV

# Alternative Fuels – Energy Inputs

Chip QA



## Wood Fuel Calorific Values

Dry Net CV	MJ/kg	18.3
Hydrogen % (dry)	Wt %	6.00
Latent heat of vaporisation of water	MJ/kg	2.442

Moisture = moisture / (moisture + dry wood)	wt %	0	10	20	30	40
Net CV (as received)	MJ/kg	18.300	16.226	14.152	12.077	10.003
Hydrogen content (as received)	wt %	6.0	5.4	4.8	4.2	3.6
Gross CV (as received)	MJ/kg	19.608	17.648	15.687	13.726	11.765
Dry Gross CV	MJ/kg	19.608	19.608	19.608	19.608	19.608
Gross/Net CV (dry)		1.071	1.071	1.071	1.071	1.071
Gross/Net CV (as received)		1.071	1.088	1.108	1.136	1.176

Moisture = moisture / (moisture + dry wood)	wt %	50	60	70	80	90
Net CV (as received)	MJ/kg	7.929	5.855	3.781	1.706	-0.368
Hydrogen content (as received)	wt %	3.0	2.4	1.8	1.2	0.6
Gross CV (as received)	MJ/kg	9.804	7.843	5.883	3.922	1.961
Dry Gross CV	MJ/kg	19.608	19.608	19.608	19.608	19.608
Gross/Net CV (dry)		1.071	1.071	1.071	1.071	1.071
Gross/Net CV (as received)		1.237	1.340	1.556	2.298	N/A

# Alternative Fuels – Energy Inputs

## Example:

200 tonnes of wet wood with 60% moisture.

$$\text{Energy input} = \text{GCV (ar)} * \text{Mass (ar)}$$

$$= 7.843 * 200 / 3.6$$

$$= 435.7 \text{ MWh}$$

OR

$$\text{Energy input} = \text{GCV}_{\text{dry}} * \text{Mass}_{\text{dry}}$$

$$= 19.608 * \{(100-60)/100\} * 200 / 3.6$$

$$= 435.7 \text{ MWh}$$

Wood Fuel Calorific Values						
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# Use of CHPQA to obtain ECA's

- ECA for CHP is based on the **whole package not individual item**
- Must be **certified by CHPQA**
- Must Achieve the **Power Efficiency Threshold**
- ECA Claim is based on Qualifying Power Capacity (**QPC/TPC**)
- Scheme specific **no type approval/product certification route- must identify heat load**
- **E E Cert may be withdrawn** and ECA repaid if Scheme is not built to the design certificated

# Threshold Criteria for ECA's

	QI Threshold	Power Efficiency Threshold
All new or upgraded Schemes <b>Except</b> for the special cases below	$\geq 105$ under MaxHeat Conditions	$\geq 20\%$ under long term annual operation
New or upgraded Schemes that use <b>only</b> biomass or solid or liquid waste fuels	$\geq 105$ under MaxHeat Conditions	$\geq 10\%$ under long term annual operation
New or upgraded Schemes that use part biomass or solid or liquid waste fuels (See note below)	$\geq 105$ under MaxHeat Conditions	$\geq (20 - 10 \times Fw) \%$ under long term annual operation

**Note:** Fw = fraction of total energy inputs as biomass plus solid waste plus liquid waste fuels

# CHP Plant & Machinery that qualify for ECAs

- Installed as part of a CHP Scheme Certified by CHPQA
- List available in CHPQA GN 42 and now also includes equipment eligible **only** if waste to energy scheme firing Solid Recovered Fuel (SRF).

# ECA – CHP Criteria List

- Equipment on list qualifies as Plant and Machinery
- Fuel storage, processing and management
- Prime movers (whether used for electrical generation or direct mechanical drive)
- Electrical generation equipment
- Heat recovery and utilisation equipment
- Supplementary (back-up and top-up) heat
- Management of combustion products and waste heat from prime movers and supplementary
- heat equipment
- Steam or heat network
- Water treatment (for water entering or being released from the system)
- Ancillary equipment necessary to the operation of a Scheme
- Noise and vibration control
- Access to allow maintenance or inspection

# ECA – Additional Items

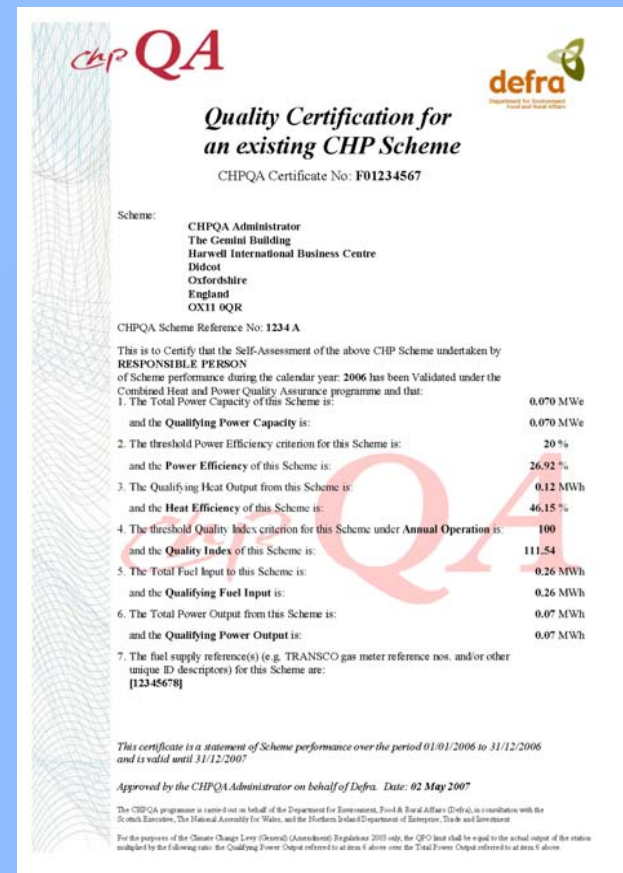
- Crainage inside SRF storage bunker
- Plasma Convertor
- SynGas cleanup equipment
- SynGas compressor
- Furnace/Boiler (fired or heat recovery)
- Sand storage (if CFB boilers being used)
- Continuous Emission Monitoring (CEM) equipment
- Ash and FGT residue collection equipment
- Ash and FGT residue disposal transfer equipment

# ECA for SRF equipment?

- For **SRF firing**, need to demonstrate throughput  $\geq 50\%$  of rated capacity in any one tax year
- Have to do this for **five consecutive** years or **forfeit monetary** value of ECA

# Use of CHPQA to obtain LEC's

- LECs are available on both
  - qualifying fuel inputs and
  - qualifying power outputs
  - as certified by CHPQA

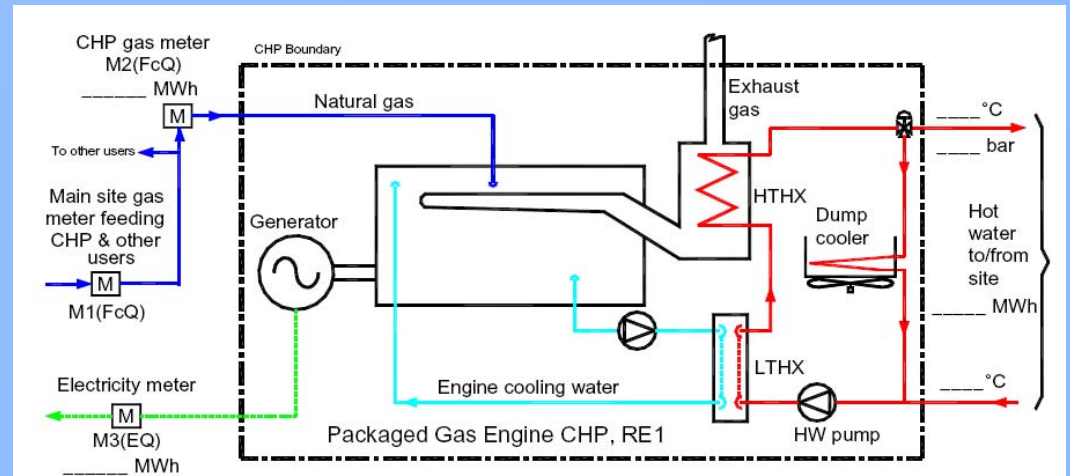


# LECs

- Schemes must be
  - Certified by CHPQA
  - Possess SoS certificate

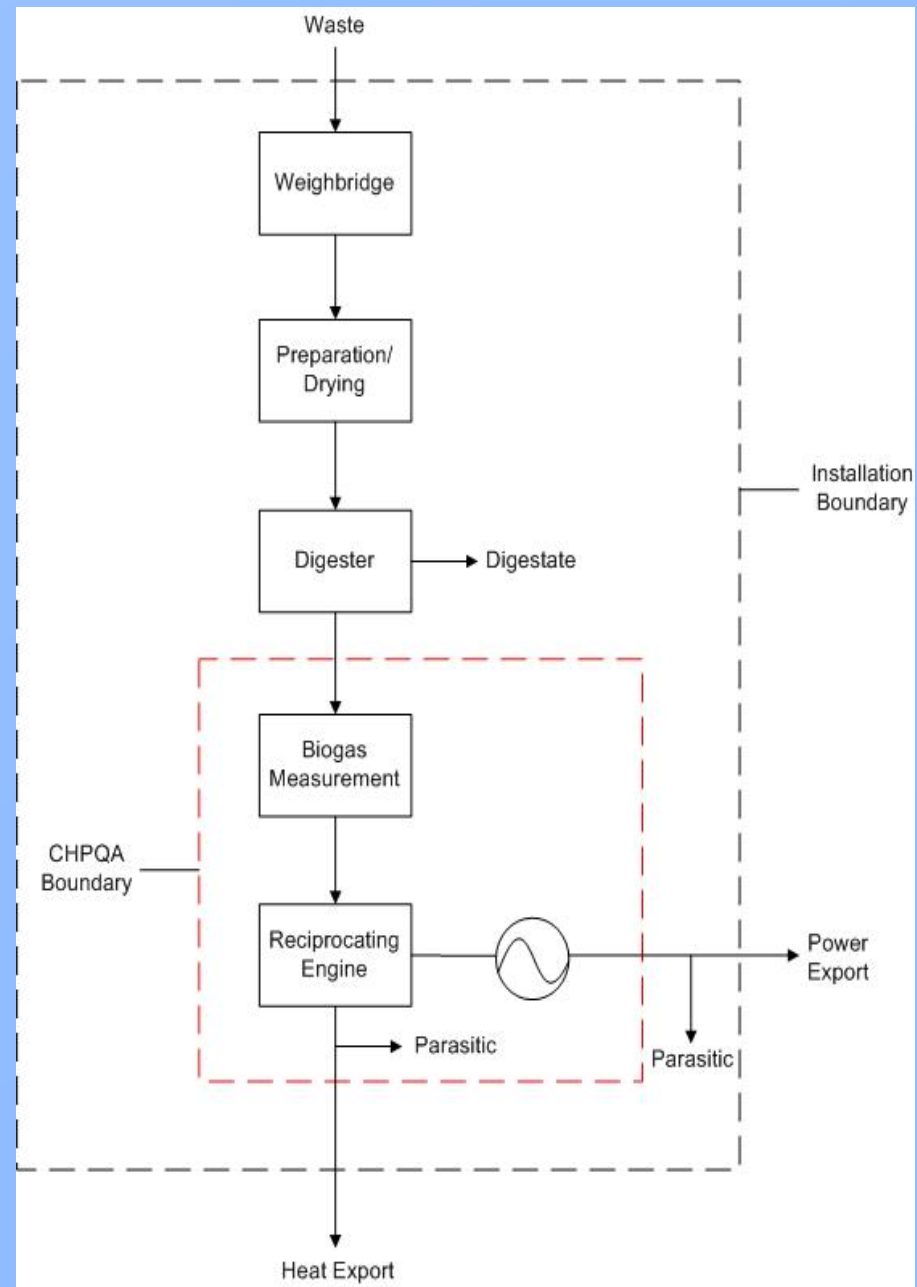
# Scheme Boundaries

- CHPQA allows applicants to propose their own scheme boundaries to suit prime movers, auxiliary equipment, performance etc

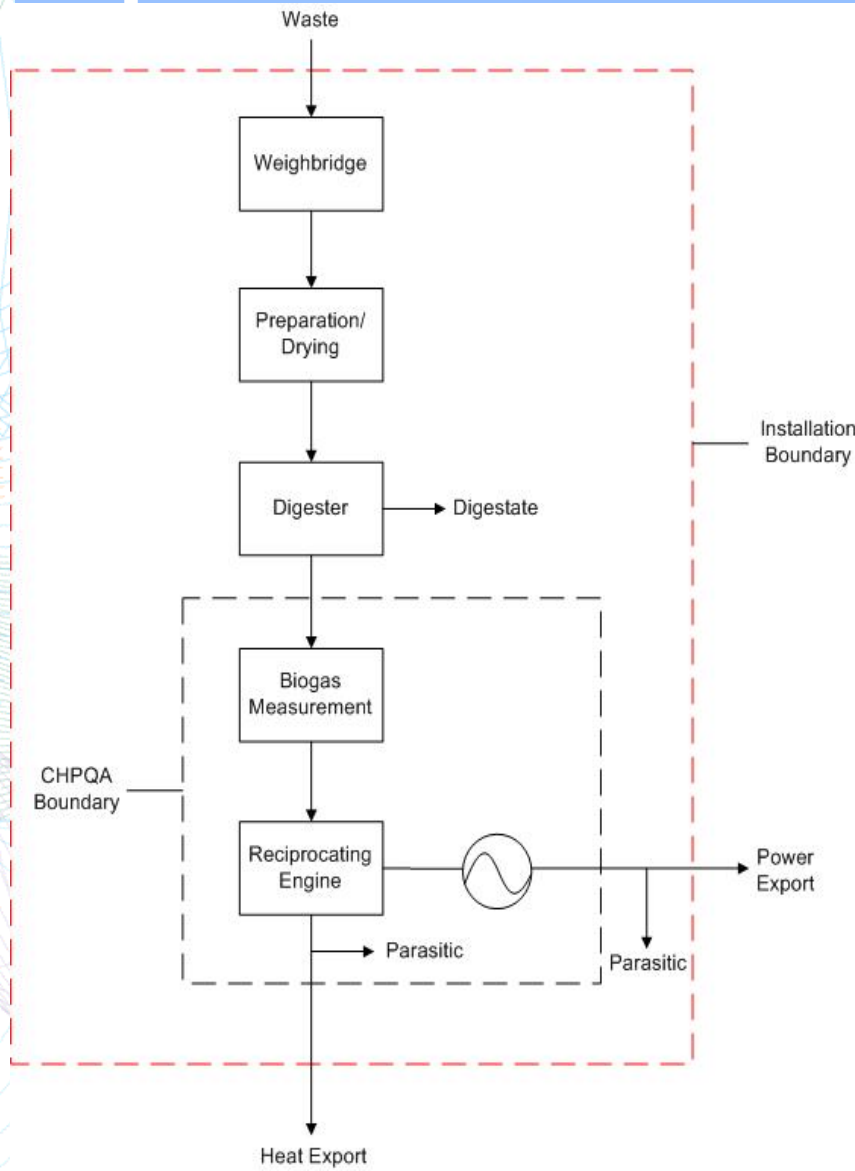


# Scheme Boundaries – Fuel Input

- For biogas fired schemes, the fuel input boundary should normally be drawn at the gas inlet to RE
- Should use the Biogas QI formula



# Scheme Boundaries – Fuel Input



- However, for some gasification processes, the analysis of syngas is extremely difficult and it may be better to measure solid waste at gasifier input
- In these cases can use the solid waste QI formula

# Scheme Boundaries – Useful Heat

## ➤ Definition of useful heat

....*The heat from a CHP Scheme delivered to **satisfy an Economically Justifiable demand for heat or cooling***

...*For biomass and solid waste schemes the **heat used for drying may be classified as Useful Heat,**.....*

...*only if it can be demonstrated that such a use is **an economically justifiable option***

# CHPQA Contact details

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