

# THE **FICHTNER** GROUP

## UK EfW & Biomass Markets & Technologies

An Engineering Consultant's Perspective

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## Introduction & contents

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- Drivers for EfW & biomass projects
- EfW & biomass capacities – existing and under development
- Thermal treatment technologies
- Flue gas treatment technologies
- Lime usage & alternatives



## Drivers for EfW projects

- Landfill diversion and BMW landfill targets, landfill tax
- Planning challenges
- Competing solutions
  - Mechanical, biological and heat treatment – for MSW
    - Track record
    - Material offtake risks & costs – RDF, CLO, autoclave fibre
    - Sensitivity to input waste compositions
    - Political & public acceptability
- Waste suppliers
  - Waste PFI projects
  - Other WDA waste supply contracts
  - Commercial and industrial waste

## Drivers for EfW projects

### ➤ Renewable energy incentives

#### ➤ ROCs

##### ➤ Gasification & pyrolysis

- 1 ROC/MWh for standard gasification
- 2 ROCs/MWh for advanced gasification
- Fuel sampling
- Syngas sampling

##### ➤ CHP – to be replaced by the RHI

#### ➤ RHI

- Requires a reliable heat demand close to the plant
- Legislation unclear - plants using MSW + non MSW might not qualify
- These incentives can significantly increase the revenues for an EfW project
- Very few EfW projects qualify for these incentives

## Drivers for biomass projects

- Planning challenges
- Fuel
  - Generally need to pay for it
  - Mainly wood chips/pellets – virgin or waste wood
  - Other – straw, chicken litter, energy crops
  - Usually cleaner and easier fuel
    - Less stringent emissions standards
    - Cheaper flue gas treatment
    - Less stress on plant and equipment
  - Security of fuel supplies a challenge

## Drivers for biomass projects

- Renewable energy incentives
  - ROCs & RHI - stronger than for EfW
    - Higher renewable energy content – greater ROC/RHI benefit
    - ROCs through biomass route without gasification, pyrolysis or CHP
  - Other – CCL, EU ETS etc
  - Regulatory uncertainty
- Finance

## EfW & biomass capacities – existing & planned

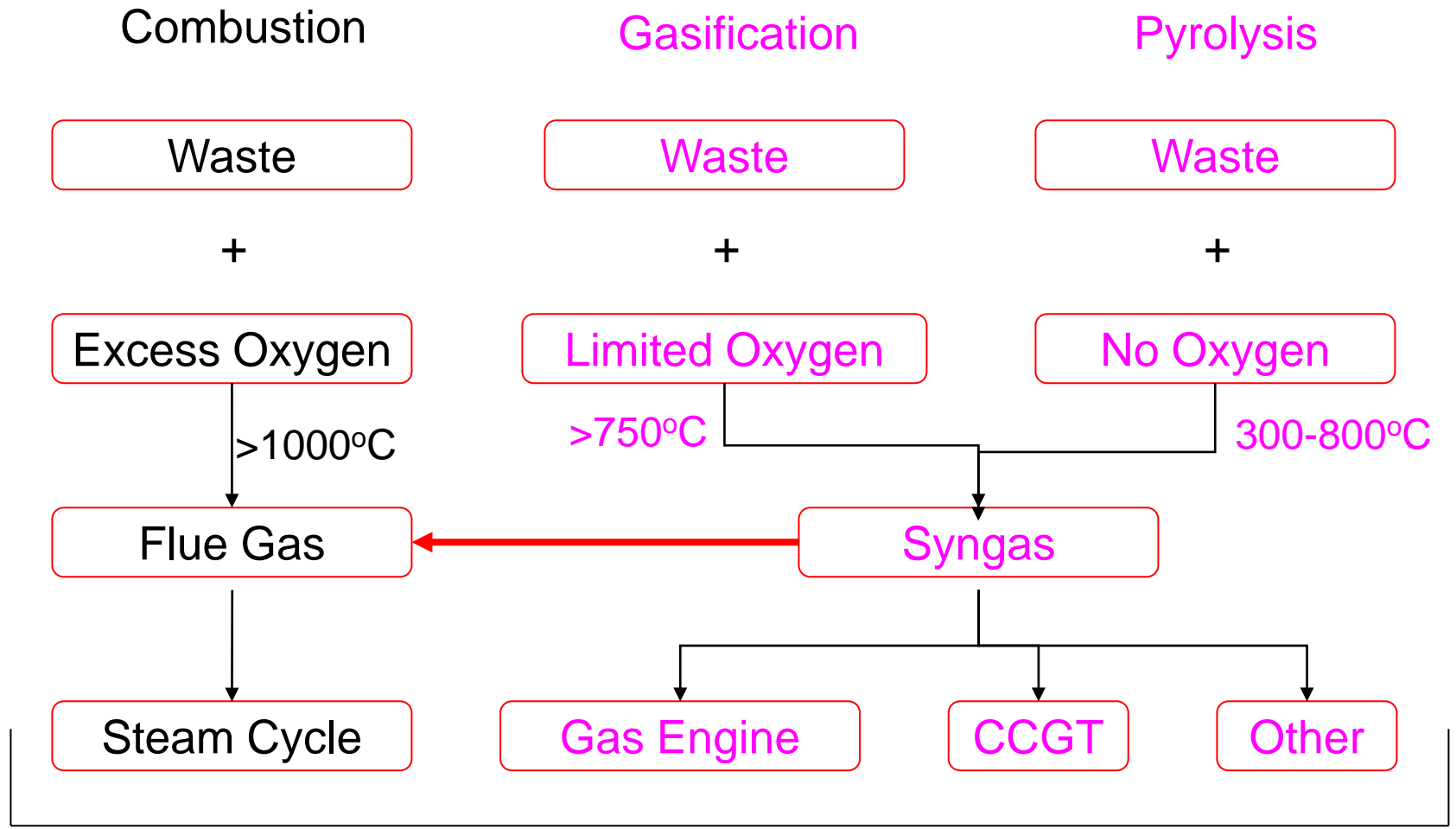
### ➤ EfW – MSW or RDF derived from MSW

- 26 operational plants - 5,000,000 tpa capacity
- 9 plants under development/construction – 2,100,000 tpa capacity
- Lots of activity but total capacity likely to plateau in few years

### ➤ Biomass

- UK renewable energy road map
  - Electricity – 2.5 GW (11.9 TWh/year) in 2010 could rise to 6 GW by 2020
  - Heat – 12.4 TWh/year in 2010 could rise to 50 TWh/year by 2020
- Fichtner aware of:
  - 80+ power or CHP projects under development – total capacity >7.5 GW
  - Plus other smaller heat only schemes
- Lots of interest but not all developments will come to fruition

# Types of thermal technologies – overview

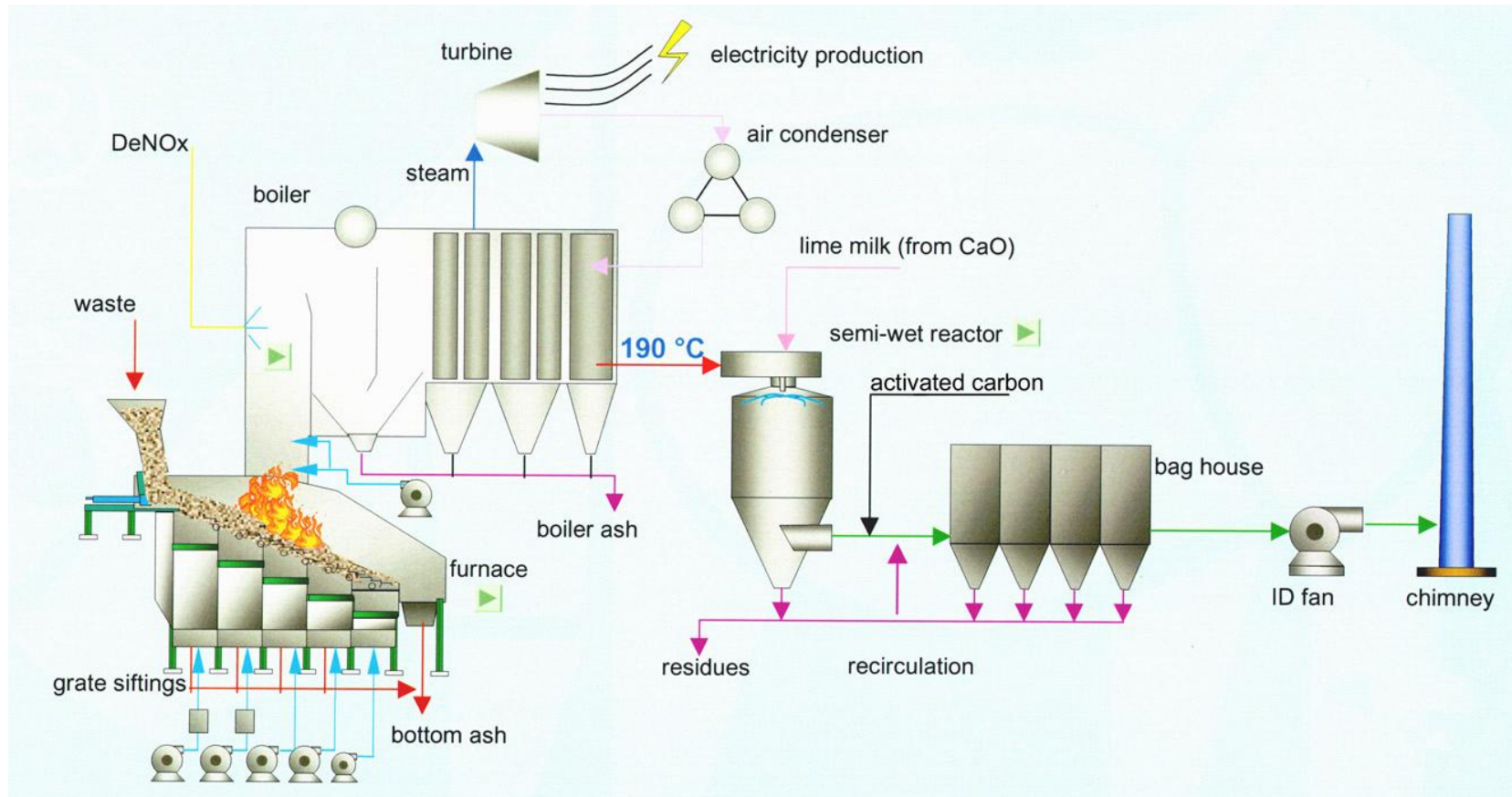


All classed as "incineration" under WID if waste fuel

## Types of thermal technologies – combustion

- Commercially proven systems available
- Vast majority of EfW & biomass plants are based on these systems
- Incinerators not popular but some political support
- Most are scaleable technologies - economies of scale
- Costs
  - £120/tonne for 100,000 tonnes/year plant
  - £70/tonne for 400,000 tonnes/year plant
- Furnace types
  - Moving grate
  - Fluidised beds – recirculating & bubbling
  - Use in existing power stations
  - Other

# Types of thermal technologies – moving grate example



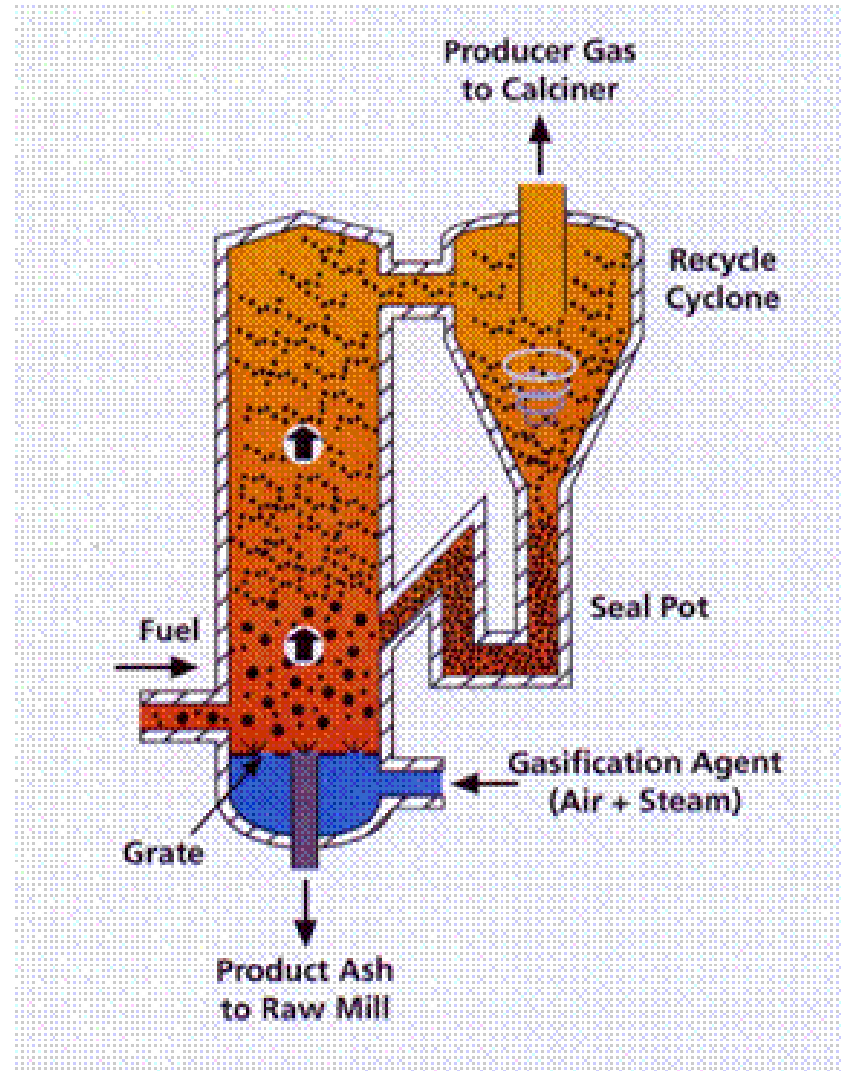
## Types of thermal technologies – gasification & pyrolysis

- ROC incentive – single or double ROCs
- Same emissions limits as for conventional combustion
- Generally lower energy efficiency compared to combustion
- Generally lower capacity, modular designs
- Some waste authorities will accept them but not combustion
- Technology types
  - Grate based – staged combustion (reasonable track record)
  - Fluidised beds
  - Updraft, downdraft, hybrid
  - Rotary kilns
  - Heated tubes
  - Fast pyrolysis
  - Plasma gasification
  - Batch systems

## Types of thermal technologies – gasification & pyrolysis

- Potential for non power generation uses
  - Production of liquid fuels or chemical feed stocks
  - Use of syngas as fuel for industrial processes
- Costs
  - Technology specific
  - Insufficient reliable cost database for most technologies
  - Small technology providers tendency to under estimate costs
- Main challenge is not syngas production but cleaning & utilisation
- Lots of interest but most have limited or no track record

# Types of thermal technologies – gasification & pyrolysis



Lurgi Gasifier

# Types of thermal technologies – gasification & pyrolysis

## ENERGY FROM WASTE PLANT



- 1 Waste bunker
- 2 Shredder
- 3 Metal extraction conveyor
- 4 Fuel crane
- 5 Fuel bunker
- 6 Hopper
- 7 Primary chamber (Gasification)
- 8 Secondary chamber (High temperature oxidation)
- 9 Heat recovery steam generator (HRSG)
- 10 Lime and carbon silo
- 11 Bag house filter
- 12 Filter residue silo
- 13 Flue gas fan
- 14 Chimney
- 15 Bottom ash extraction
- 16 Steam turbine
- 17 Air cooled condenser



Energos process

## Flue gas treatment - technologies

- **Dioxins, furans and heavy metals**
  - Activated carbon (PAC)
  - Wet scrubbing – generally not for EfW & biomass plants
- **Acid gas removal**
  - Lime – dry, semi dry, economiser dry
    - By far most common in UK
    - Dry
    - Semi-dry
    - Economiser dry
    - Other

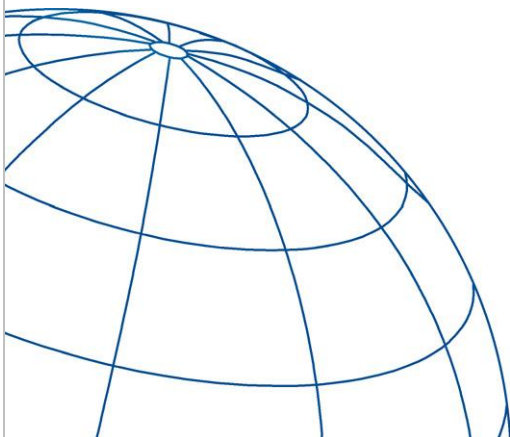
## Flue gas treatment - technologies

- Acid gas removal
  - Sodium bicarbonate
    - Very rare in UK – generally limited to small clinical waste incinerators
    - Operating temperature
      - PAC prefers lower temp,
      - Bicarb prefers higher temp
      - Two stage systems
    - Potential to recycle bicarb from residues - not yet in UK
    - Bicarb residues for soluble than lime residues – leachability
  - Wet scrubbing
    - Generally not for EfW or biomass plants
    - May be proposed as part of package for syngas cleaning

## Types of FGT technologies – lime usage

- **Residual MSW EfW – nominal consumption rates for standard lime**
  - Approx 18 kg “standard lime” per tonne waste
  - Lime demand depends on various factors
    - Grade of lime – standard or special
    - Type of FGT system
    - Acid gases in flue gas – input waste composition
    - Competition from AD & non-EfW solutions
    - Competition from bicarb or wet scrubbing systems – currently minimal
    - Impact of syngas cleaning on lime demand – e.g. H<sub>2</sub>S removal
- **Other wastes and fuels**
  - Depends on waste/fuel composition (esp Cl & S content)

**Thank You for Listening**



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