Fuel preparation
Phil White, MCIWM
Introduction: Fuel preparation

- Primary fuel for thermal WtE
  - Untreated residual MSW and commercial waste
  - Conventional grate WtE copes with a wide range
- Other WtE requires more homogeneous or specified feedstock
  - Advanced thermal
  - Cement kilns
  - Biomass energy
- Significant differences – by location and over time:

- Preparing fuel
  - RDF (no defined pre-treatment; basic processing)
  - SRF (quality spec)
- Range of technologies and processes
  - Some single streams (e.g. wood, tyres) need limited treatment
Fuel Preparation

Fuel preparation

- Mechanical Biological Treatment (MBT) & Biodrying
  - Refuse Derived Fuel
  - Solid Recovered Fuel
- Materials Recycling Facilities (MRF)
  - Refuse Derived Fuel
- Physical processing (e.g. tyres, wood)
Refuse Derived Fuel vs Solid Recovered Fuel

RDF

- No universal standards – any fuel from waste treatment
- Composition and properties can vary significantly
- Generally used in conventional WtE
- Advantages - mass loss (transport), recycling, boost CV

SRF

- Meets national or international standards (e.g. EN 15359)
- High certainly for market
- Typically higher CV than RDF
- Substitute for fossil fuels in industrial processes (e.g. cement)
Solid Recovered Fuel (SRF) – Example Specification

Particle Size:
- < 5 mm in at least one dimension
- < 35 mm in at least two dimensions

Moisture Content:
- < 15% by dry weight

Calorific Value:
- 17-22 MJ/kg (gross dry basis)

Composition:
- Free of metal, glass and rubble

Chemical Compounds:
- < 0.9 % chlorine by weight
- < 0.5 % sulphur by weight
Automated technologies and manual picking to separate recyclable materials
- ‘Clean’ MRF processes separately collected mixed dry recyclables into high quality recyclate
- ‘Dirty’ MRF processes residual waste to extract and separate recyclable materials… with a residue

Low complexity, low cost, understood

Residual waste after dirty MRF – potential RDF or further treatment

Technologies include:
- Bag openers
- Screens (size separation)
- Ballistic separators (3D / 2D separation)
- Hand sorting
- Magnets (ferrous metals)
- Eddy-current separators (non-ferrous)
- Optical sorters (e.g. separate plastic polymers)
- Shredders, compactors and balers
Fuel preparation – Tyres, Wood Biomass

- Physical processing
- Process steps depend on, for example:
  - Feedstock quality & contamination
  - User specification
  - Process requirements
- Potential processes:
  - Shredding
  - Metals separation
  - Moisture control
  - Pelletising
- Wood pellets: EN Plus quality certification
  - CV, moisture content
  - Physical (dimensions, bulk density, ash)
  - Chemical (metals, sulphur, chlorine)
Mechanical Biological Treatment
Mechanical Biological Treatment (MBT) is a general term for a combination of mechanical sorting and biological treatment of MSW or similar waste streams.

During the mechanical part of MBT, waste particles are reduced in size and/or waste is separated into various fractions based on screen sizes. Specific fractions may be removed, e.g., ferrous metals by magnets.

The main aim is to remove valuable recyclables, remove materials unsuitable for biological treatment, and homogenise the physical and chemical properties of the remaining fraction.

The biological stage may include composting, biodrying, or Anaerobic Digestion.

**Fuel pretreatment: Mechanical Biological Treatment (MBT)**

**Inputs**
- Residual waste from households and commercial and industrial wastes

**Outputs**
- Recyclables, Compost/Digestate, Refuse Derived Fuel

**Shanks Group plc Biodrying**

- **Frog Island, London, UK**
- £100 Million Capex
- 360,000 tonnes per annum
- Commenced operations 2007
- Diverts 67% of MSW from landfill
- Eco Deco biodrying technology (Italy)
Sri Lanka Waste Characteristics

Waste-to-Energy Research and Technology Council

Colombo, 2015
Refuse Derived Fuel (RDF) – Key issues

Key issues:
- Pests
- Odour
- Leachate
- Fire

Controls:
- Baling & wrapping
- Condition monitoring
- Planning of storage areas
- Fire mitigation
- Stock control
- Remove fines
MBT – Advantages and Disadvantages

**Advantages**
- Combines proven and well established technologies
- Highly deployed (>350 major MBT facilities in EU)
- Maximise recycling
- High quality RDF / SRF
- Divert biodegradable waste from landfill (reduce methane)
- Renewable energy (AD variant)
- Can build in flexibility to respond to changing inputs
- Fully enclosed limits odour

**Disadvantages**
- Low quality outputs
- Difficulty finding long term viable recyclate markets
- May still result in a fraction for landfill
- High Capex and Opex
- Less flexible to composition change in maturing collection system
- Several technical / commercial failures of significant UK PFI schemes
- AD variant high technical risk
- Effluent treatment / disposal required (AD variant)
- High energy (water) use
SRF for Cement Manufacturing – Kingdom of Saudi Arabia

- Riyadh planned integrated waste management facility
- Rapidly growing economy
  - High pace construction sector
  - c. 3.5 M tonnes residual MSW/C&I
- Proposed single site:
  - Recycling and treatment facilities
  - Relocated major cement works
- Integrated cross-sector approach
  - Cement industry very high energy use
  - Substitute fuel offsets fossil fuel use
- Cement industry can accept SRF from:
  - Residual waste, tyres, waste oils & solvents, biofuels etc.
  - Specification to protect product (e.g. Cl sensitivity)
  - Up to 95% substitution of fossil fuel
- Other opportunities – lime and magnesium oxide production