Ricardo
Energy & Environment

Fuel preparation

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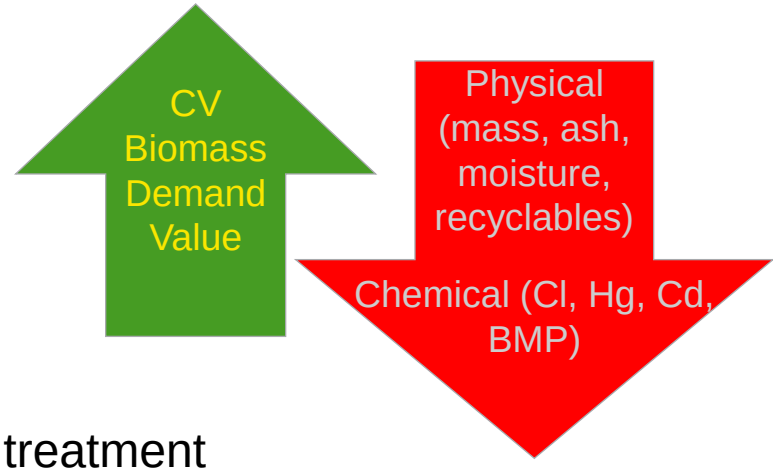
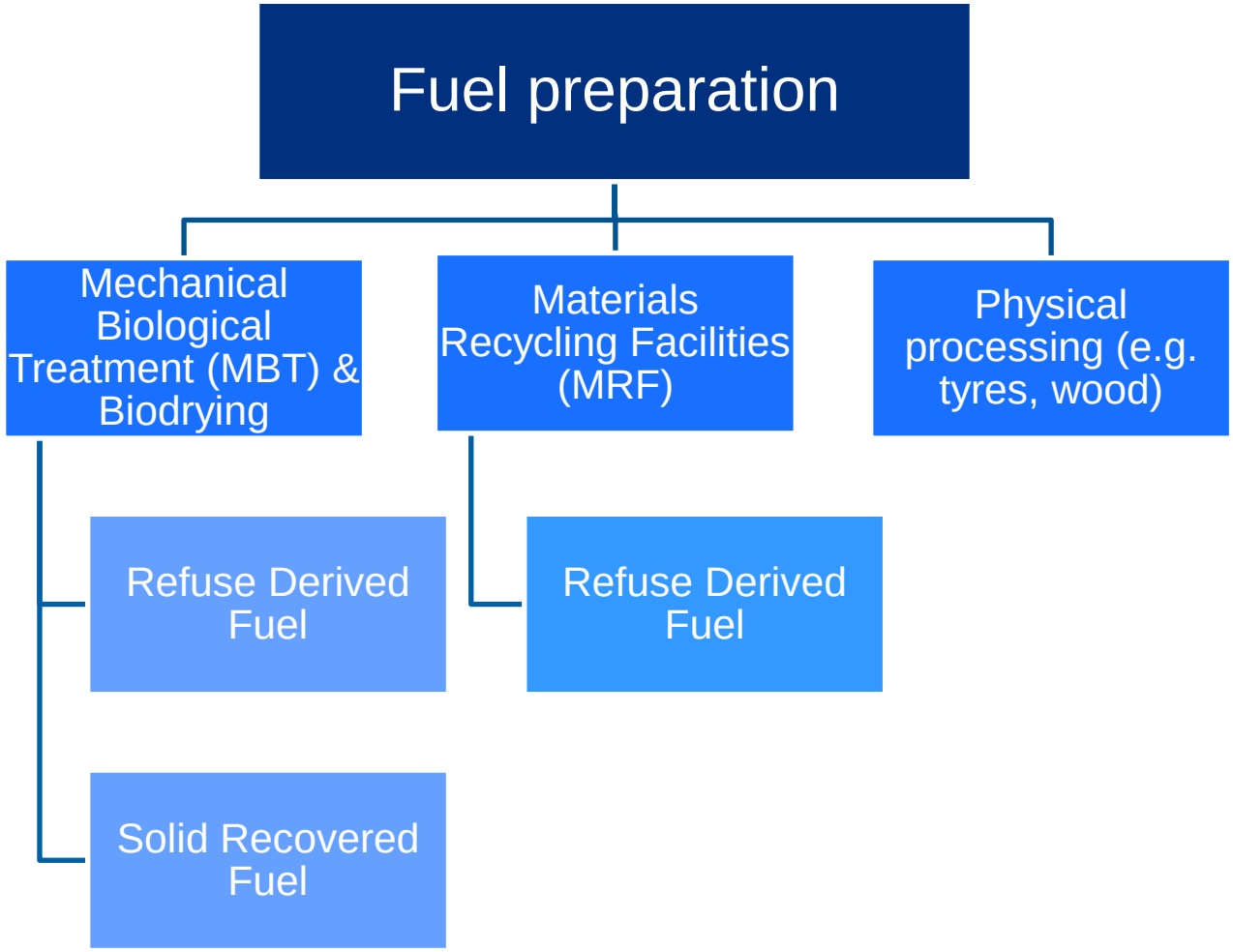
Introduction: Fuel preparation

- 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:

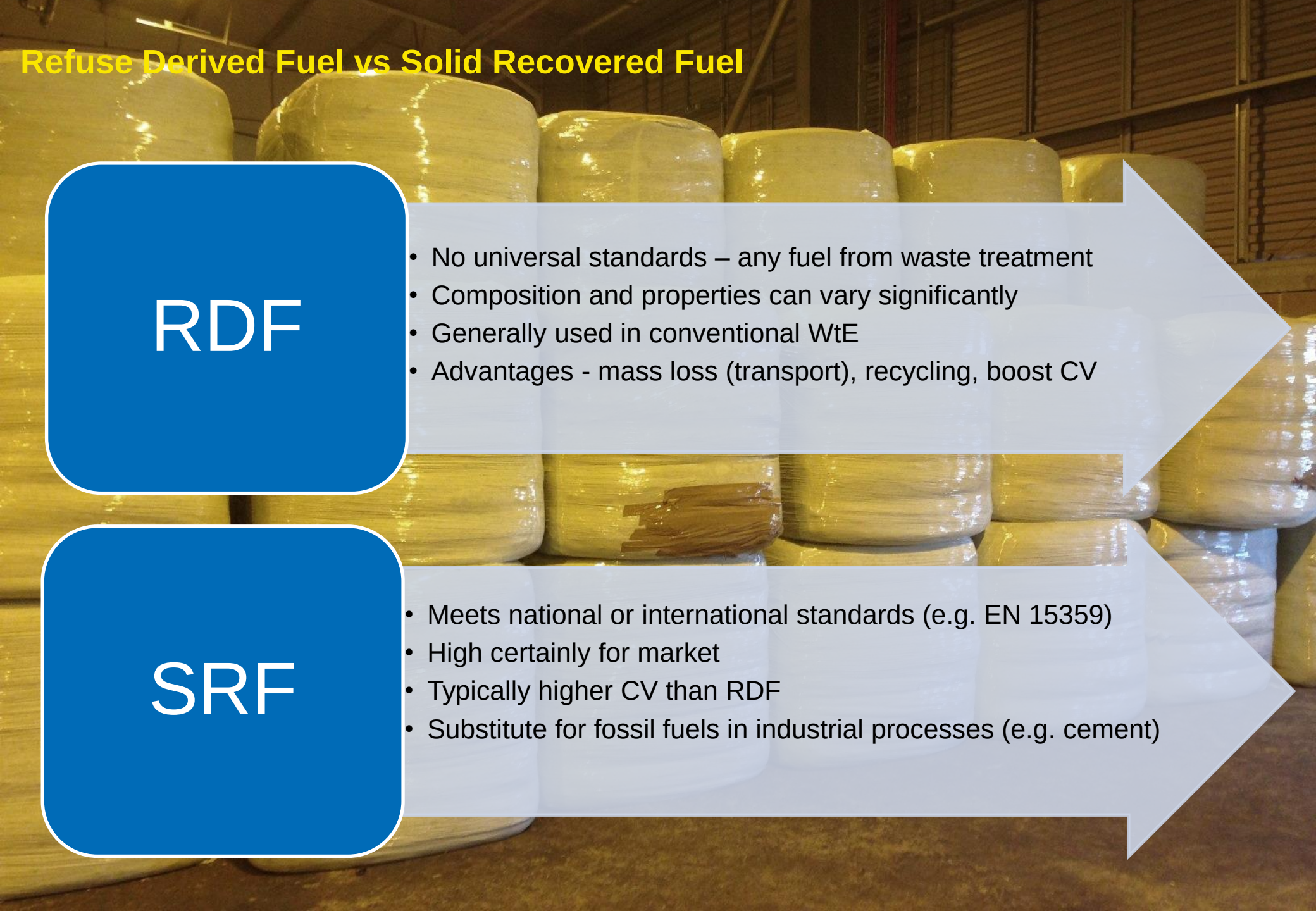


- Preparing fuel
  - RDF (no defined pre-treatment; basic processing)
  - SRF (quality spec)
- Range of technologies and processes
  - Some single streams (e.g. wood, tyres) need limited treatment

Fuel Preparation



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

Fuel Pre-treatment: Materials Recovery Facilities (MRF)

- 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

MBT

Shredding

RDF

Recycling e.g.
Metals
Plastics
Aggregate

Biogas

Energy

Biological step
AD

Digestate
Land restoration
Landfill

And / or

Biological step
IVC

Mass
(moisture)

Air

RDF / SRF
Land restoration
Landfill

Biodrying (BMT)

Shredding

Mass (moisture)

Air

SRF

Mechanical step

Reject

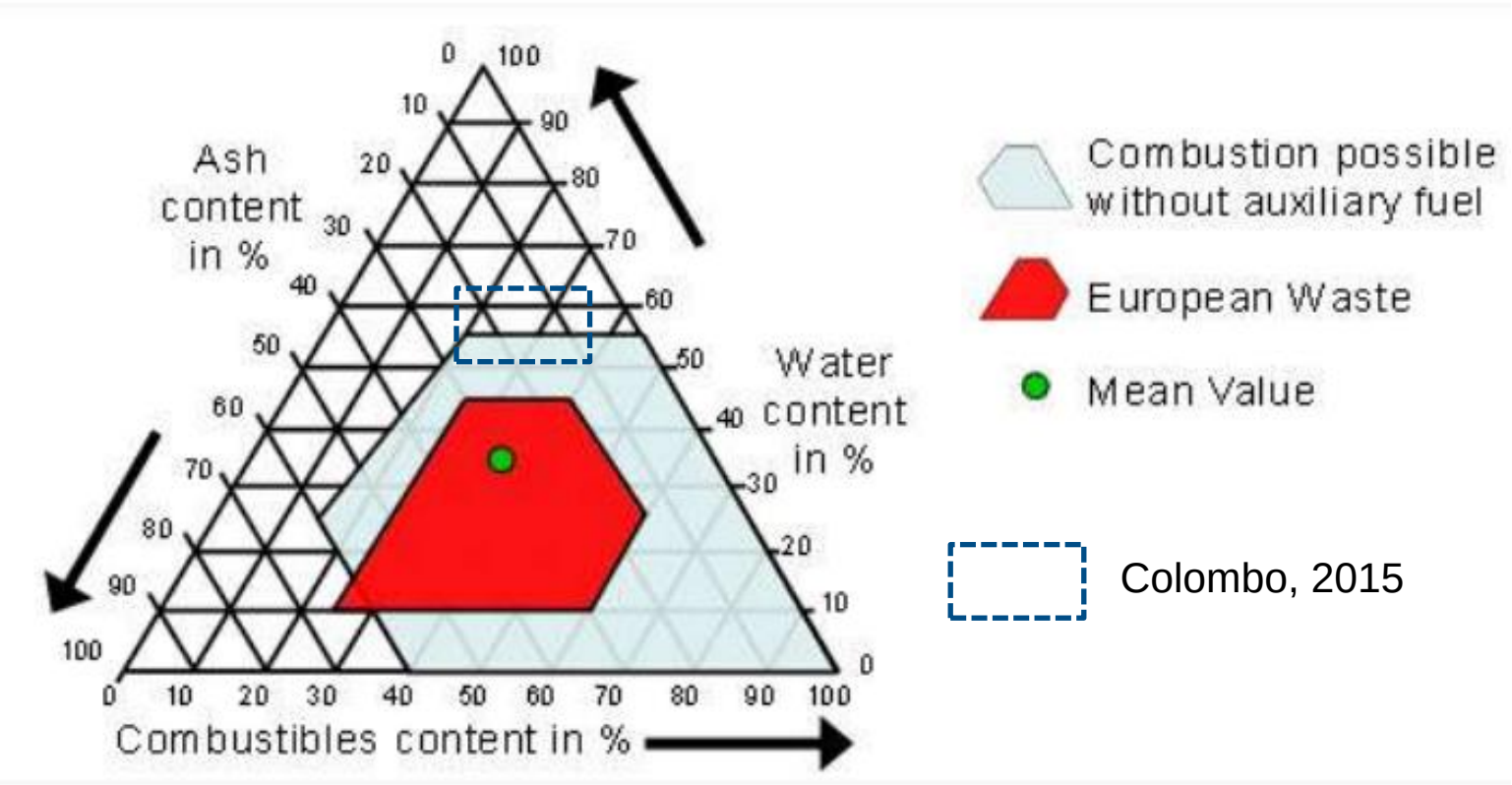
Recycling e.g.
Metals
Aggregate

Organic fraction

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



Source: http://www.wtert.eu/global/images/doki/Fuel_Triangle.PNG
Waste-to-Energy Research and Technology Council

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

- 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

Disadvantages

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