

# Indaver Doel

## Waste-to-Energysite



- Rob Kruitwagen, regional manager Indaver Belgium
- Luc Crauwels, maintenance manager SVEX
- Indaver Doel - 24/09/2014

Closing material loops... as it's the only way.



# Contents

- **Indaver at a glance**
- **Waste-to-energy facilities at site Doel**
  - Fluidized bed incinerator
  - Grate incinerator & ash treatment

# Critical challenges

## Growing population, growing prosperity

*“With the number of middle-class consumers expected to rise by a further 3 billion by 2030, as our global population swells to 9 billion, demand for global resources will rise exponentially.”*

## Scarcity of resources

*“Turning resources into waste faster than waste can be turned back into resources puts us in global ecological overshoot, depleting the very resources on which human life and biodiversity depend.”*

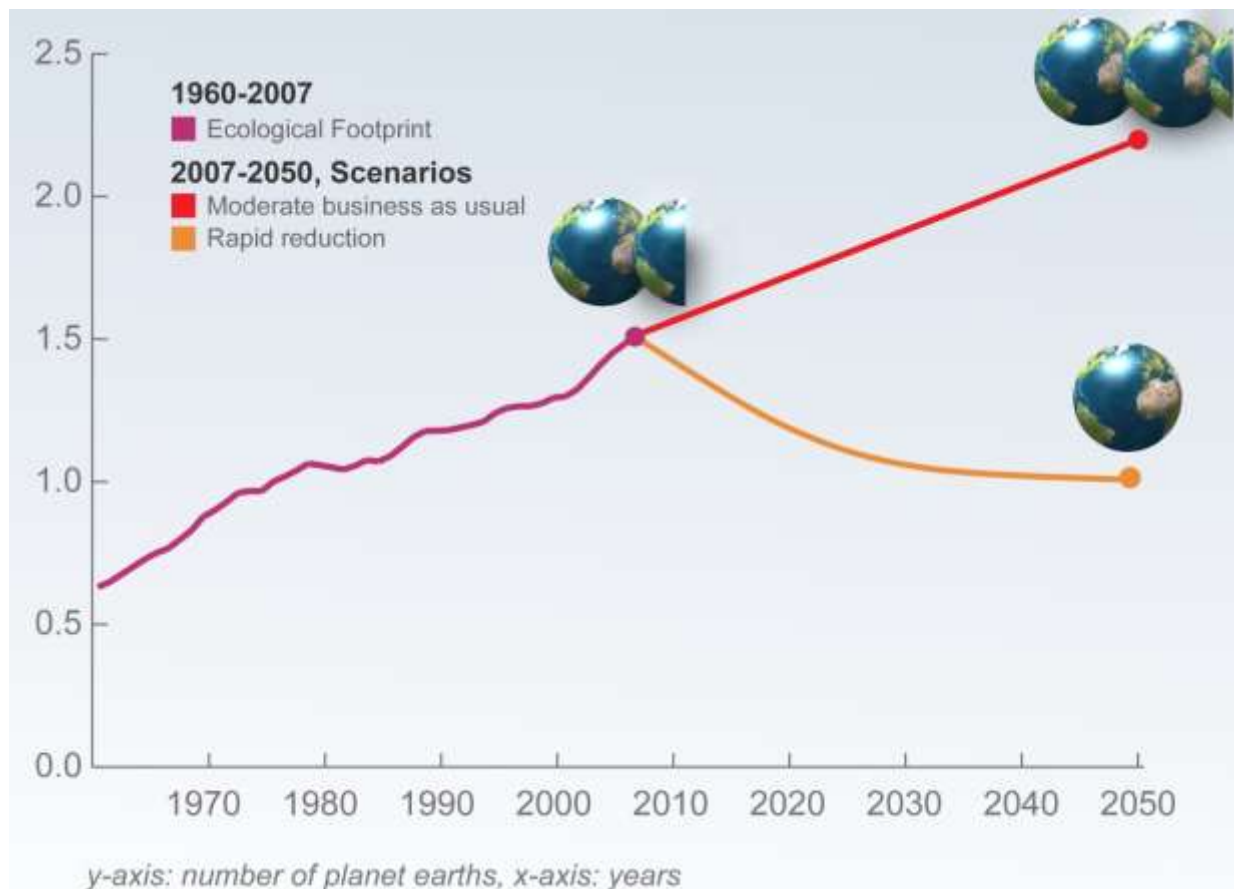
## Environmental impact

*“The global average concentrations of various greenhouse gases in the atmosphere have reached the highest levels ever recorded, and concentrations are increasing.”*

# Need for sustainable development !

“Today humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste.”

*(UN report, 2012)*



# Need for Sustainable Waste Management



*“We seek to close material loops in a low-carbon and energy-efficient way.*

*This is the only way to sustain prosperity and well-being in this world.”*

(Paul De Bruycker, CEO Indaver)



Leading the field  
in sustainable waste management

# Making authentic choices

**Value-based culture**

**Knowledge-driven organisation**



**Focused growth-oriented strategy**





# Value-based culture



Demonstrating concern for people, safety and the environment



Building relationships based on mutual trust



Ensuring transparency in communications and actions



Concentrating on achieving results



Continuously improving

# Knowledge-driven organisation

## Innovative technology

6 Centres of Excellence

## Innovative service concepts

4 Centres of Excellence

## Innovative client solutions

24 Business Teams

## Empowered employees

1700 Persons

Facts & Figures



**Individual**

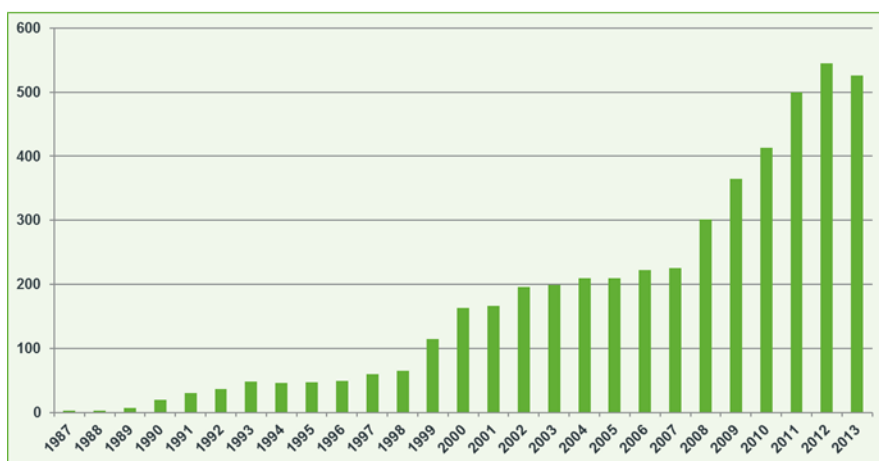
**Regional**

**International**



# Leading to strong persistent growth

## Operating income (in million Euro)



From 2012, operating income is based on proportional consolidation of Sleco and Svex.

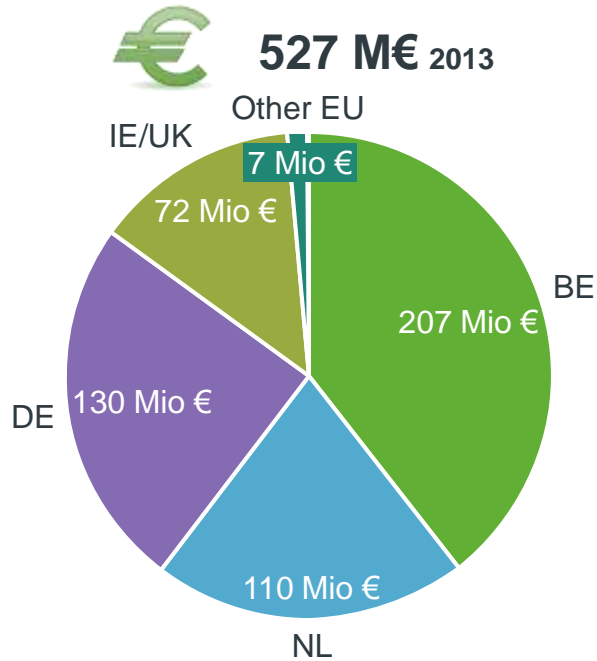
## Financial results (in million Euro)

2013

<b>Operating income</b>	<b>526,4</b>
<b>Operating charges</b>	<b>480,3</b>
<b>EBITDA*</b>	<b>107,6</b>
<b>Operating results (EBIT)</b>	<b>53,0</b>
<b>Profit after tax</b>	<b>40,0</b>
<b>Equity capital</b>	<b>347,1</b>

\* EBITDA: earnings before interest + taxes + net depreciation + amortisation + IAS 19 employee benefits including charges and costs + share in profits of minority interests – the part of the capacity rights paid in advance in the result

# Indaver is a solid company

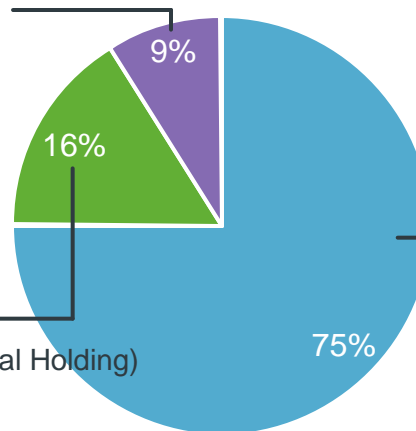


1700

## Industrial shareholders

- Solvay
- BASF
- Bayer
- Borealis
- Janssen Pharmaceutica
- Tessenderlo Chemie

**VMH**  
(Flemish Environmental Holding)



**DELTA nv**  
(Dutch multi-utility company)

# Indaver's waste-to-energy facilities in Europe



## Belgium

Doel: grate incinerators, fluidized bed incinerators

Antwerp: rotary kilns

## Germany

Biebesheim: rotary kilns

Hamburg: rotary kilns

## Ireland

Meath: grate incinerators

# Towards a European Recycling Society

5 mill. tonnes/year

40%

## Sustainable Material Valorisation



40%

## Sustainable Energy Valorisation (Waste-to-Energy)



20%

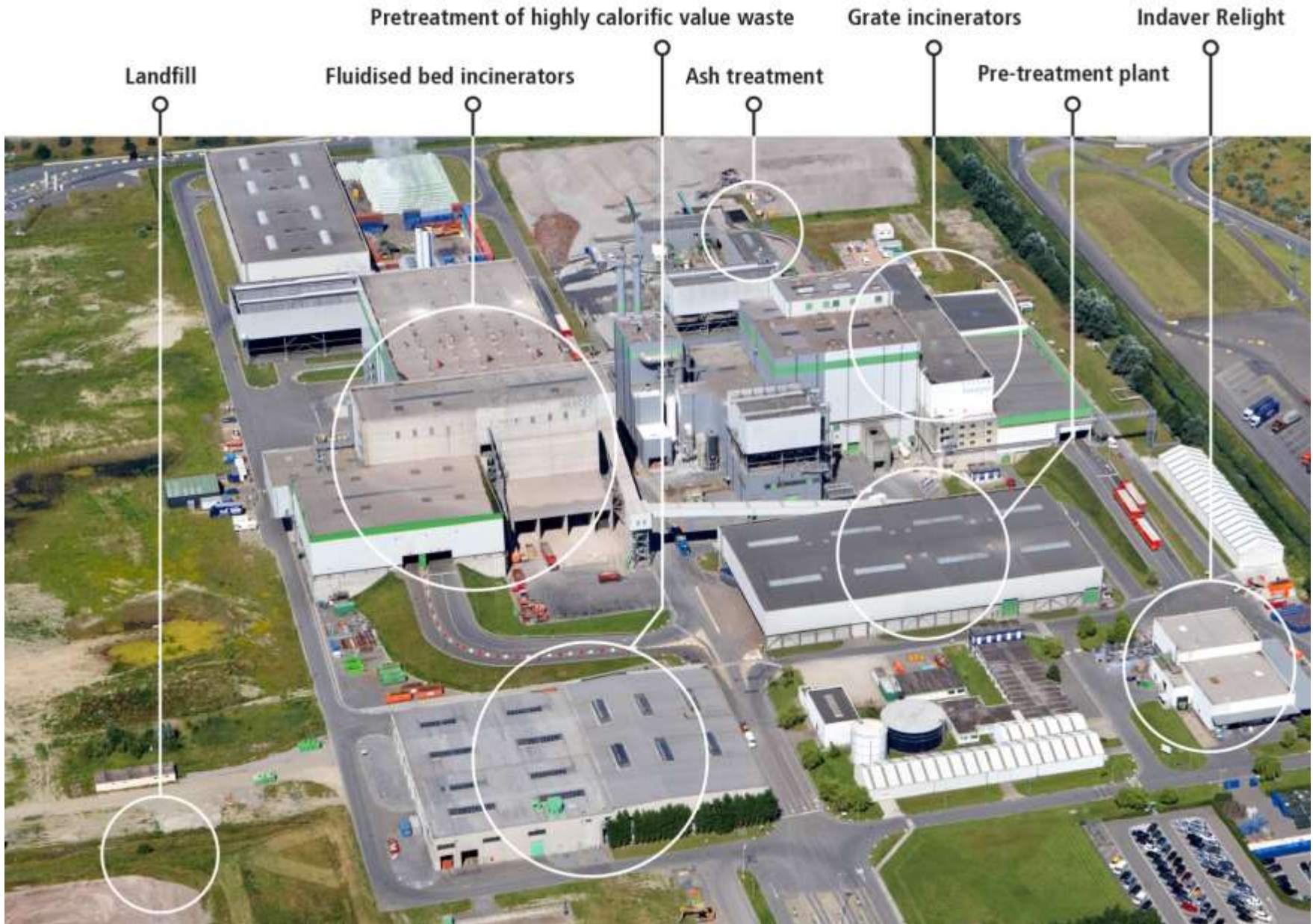
## Permanent, Safe Storage and Neutralisation



# Contents

- Indaver at a glance
- Indaver's waste-to-energy facilities in Europe
- **Waste-to-energy facilities at site Doel**
  - Fluidized bed incinerator
  - Grate incinerator & ash treatment

# Indaver Doel





# Indaver site Doel capacities W2E

- Grate incinerator
  - 400.000 tonnes/year
  - Thermal treatment of non-hazardous, non-recyclable household and similar commercial waste
  - Energy recovery: electricity and steam
  - Materials recovery (ash treatment)  
=> secondary raw materials
  
- Fluidized bed incinerator (SLECO)
  - Non-recyclable solid waste, sludge from water purification units, industrial sludge
  - 600.000 tonnes/year
    - 2/3 solid waste
    - 1/3 sludge

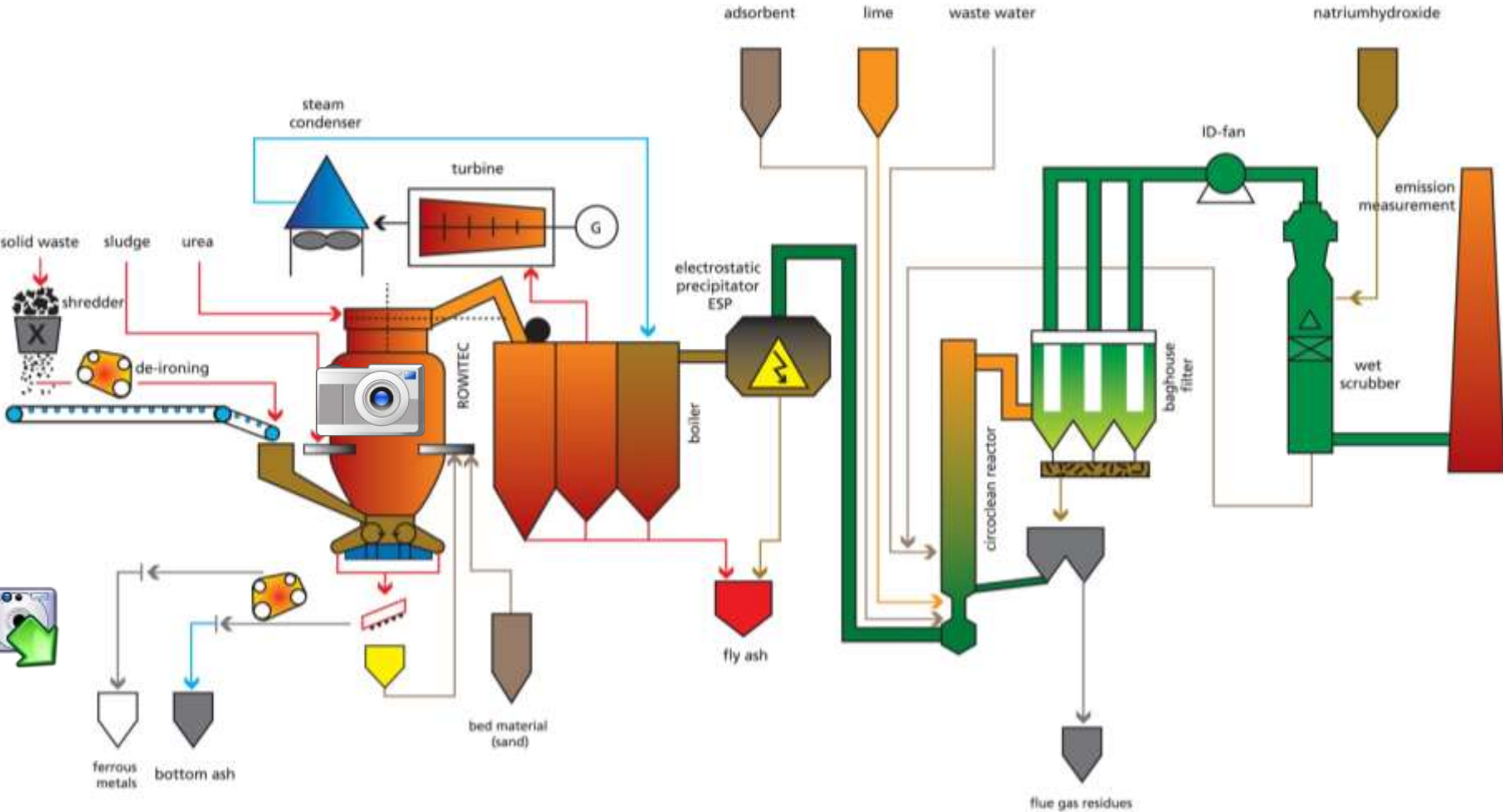


# Fluidized bed incinerator

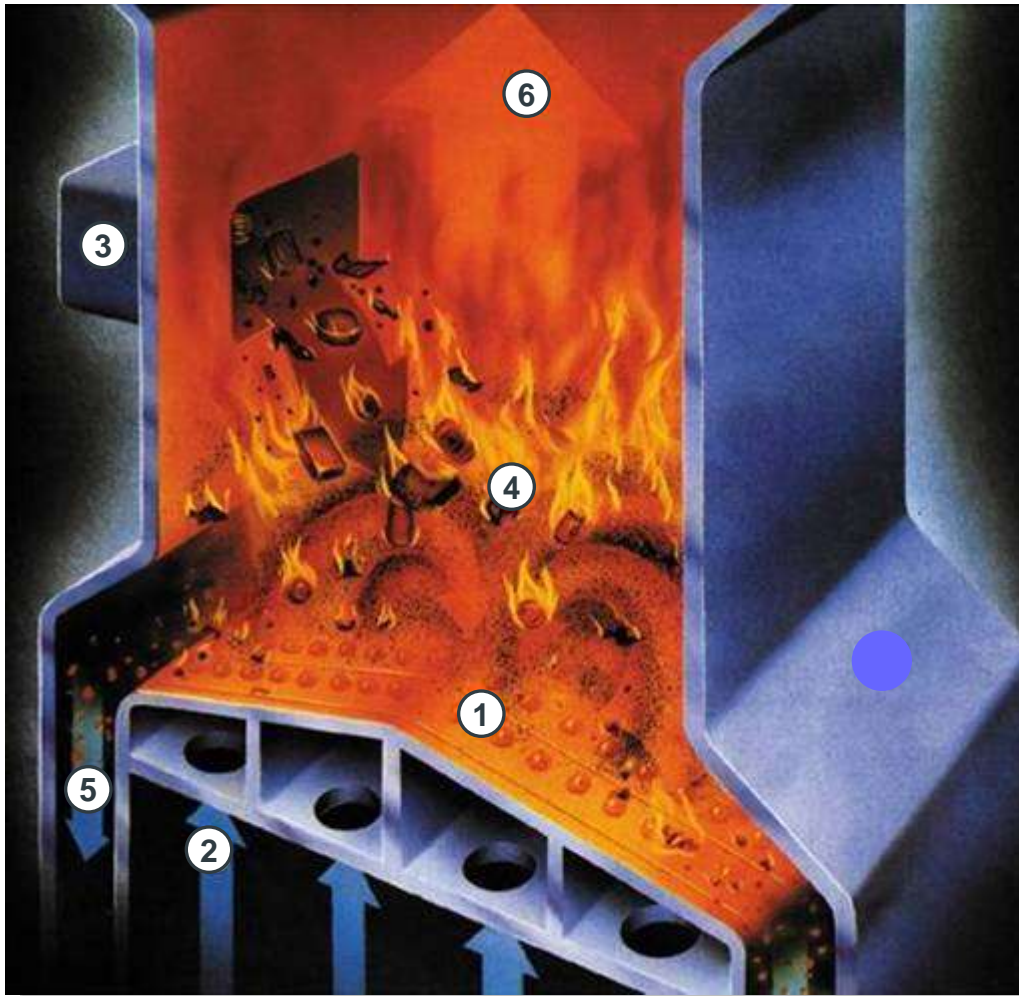
- Fluidized bed technology = Best Available Technique for combined treatment of non-recoverable waste and sludge
  - Maximum energy recovery and intensive flue gas purification
  - Largest facility of this type in Europe
  - Indaver and Sita Belgium: joint-venture 50/50 in Sleco and Svex
- 
- SLECO: **owner** of the fluidized bed incinerator
  - SVEX: responsible for **operating** all waste-to-energy facilities on site



# Fluidized bed incinerator: treatment diagram



# Fluidized bed incinerator: treatment process



1. Incineration takes place on a bed of swirling sand
2. Hot primary air is blown through the sand bed from below
3. Waste is fed into the oven on top of the sand bed
4. Secondary air is added over the top for complete combustion
5. Screws withdraw the sand and bottom ash from the incinerator. Sand is screened and reused.
6. Flue gases set out on their way through the flue gas purification system

# Fluidized bed incinerator: mass balance

## Fluidised bed incinerators Doel – Mass balance

2013

### IN

Waste 585,738 tonnes

#### Energy

Heating oil 1,266 tonnes

Steam 179,706 GJ

Electricity 74,080 MWh

#### Flue gas cleaning additives

Quicklime 9,634 tonnes

NaOH 416 tonnes

Adsorbent for dioxins and heavy metals 541 tonnes

DeNOx reagent 999 tonnes

#### Incinerator additives

Sand 4,527 tonnes

#### Water

Mains water 231,782 m<sup>3</sup>

Recycled rainwater 44,403 m<sup>3</sup>



### OUT

#### Emissions to atmosphere

Flue gases 2,574,447,578 Nm<sup>3</sup>

#### Energy

Energy 3,826,908 GJ

#### Water discharged

Wastewater 0 m<sup>3</sup>

#### Residual products

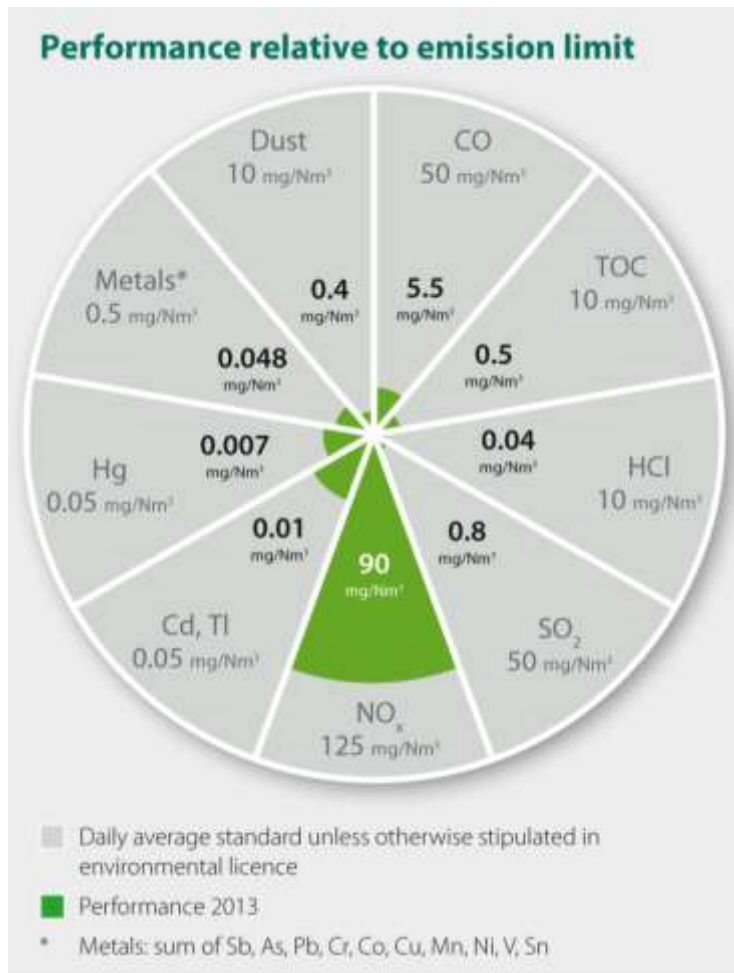
Bottom ash 31,341 tonnes

Electrostatic filter and boiler ash 78,593 tonnes

Flue gas cleaning residue 16,747 tonnes

Scrap (incinerator quality + pre-treatment) 14,623 tonnes

# Fluidized bed incinerators: performance (2013)



Daily average standard unless otherwise stipulated in environmental licence

Performance 2013

Emission limits in mg/Nm<sup>3</sup>

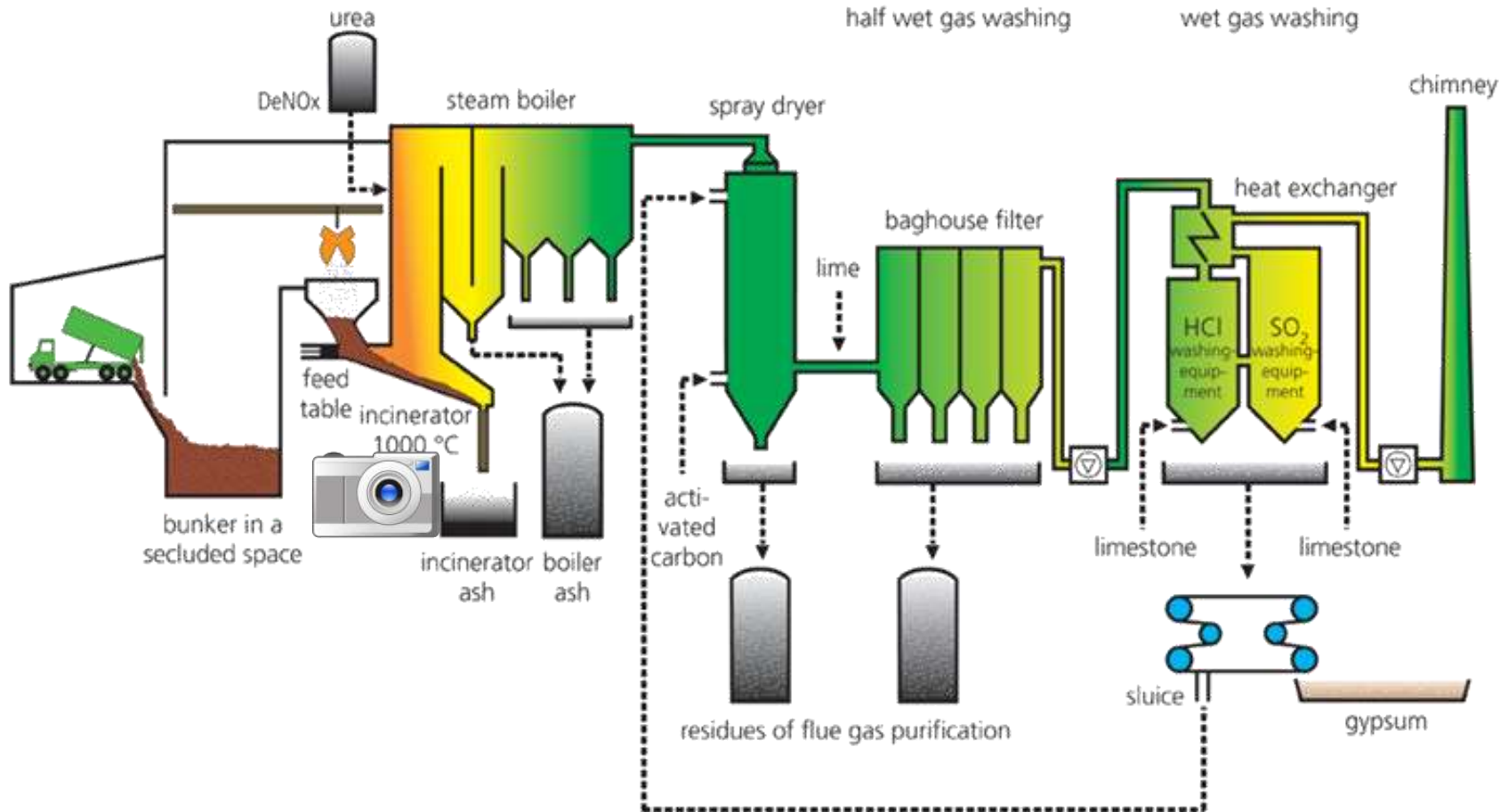
(+/- 15 % lower than EU-limits)

\* Metals: sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Sn

# Grate incinerator



# Grate incinerator: treatment diagram





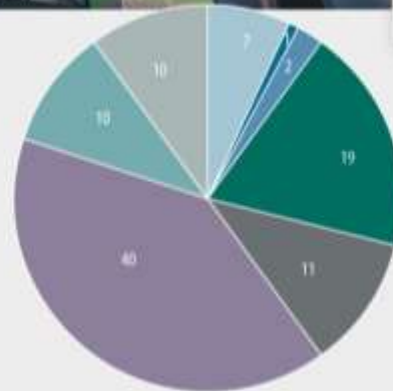
# Grate incinerator: mass balance + Ash treatment: materials recovery

## Mass balance

IN	
Waste	414,318 tonnes
<b>Energy</b>	
Heating oil	548 tonnes
Steam	38,472 GJ
Electricity	43,283 MWh
<b>Additives</b>	
Quicklime	2,162 tonnes
Limestone	2,436 tonnes
Adsorbent for dioxins and heavy metals	204 tonnes
DeNOx reagent	1,176 tonnes
<b>Water</b>	
Mains water	192,896 m <sup>3</sup>
Rainwater	16,525 m <sup>3</sup>



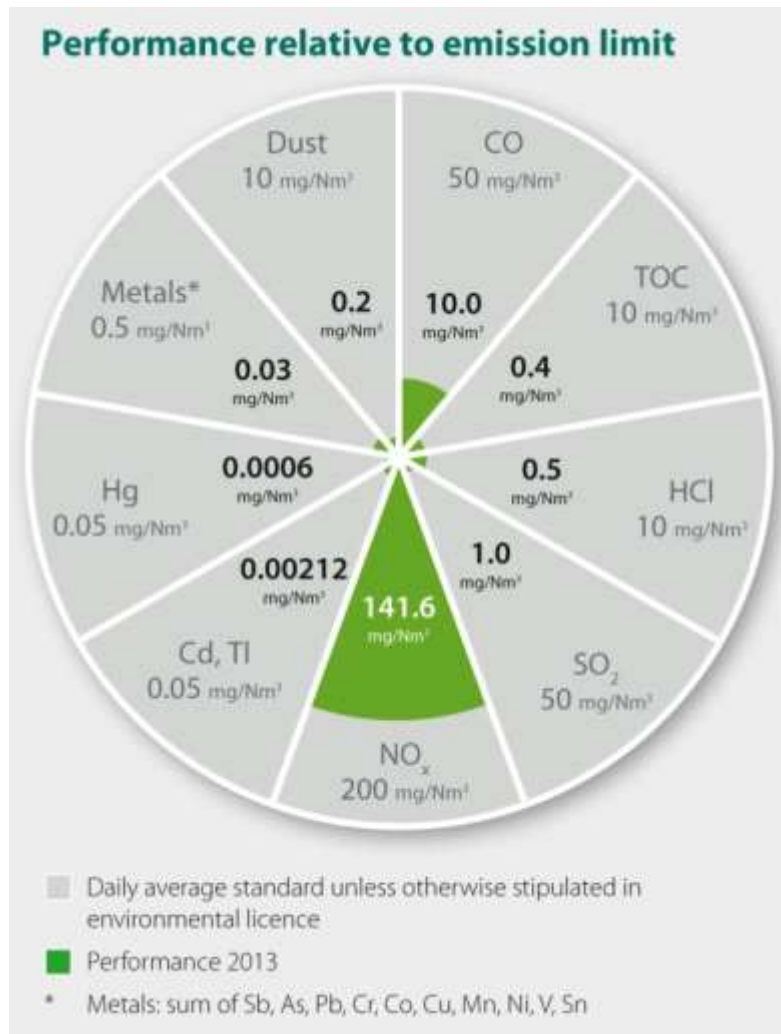
OUT	
<b>Emissions to atmosphere</b>	
Flue gases	2,215,508,167 Nm <sup>3</sup>
<b>Energy</b>	
Energy	3,491,543 GJ
<b>Water discharged</b>	
Wastewater	0 m <sup>3</sup>
<b>Residual products</b>	
Bottom ash (*)	93,050 tonnes
Boiler ash	8,740 tonnes
Flue gas cleaning residue	11,284 tonnes
Gypsum	953 tonnes



(\*) Composition of the bottom ash:

Ferrous fraction	7%
Non-ferrous fraction	1%
Weak magnetic fraction	2%
Granulate 6-50 mm	19%
Granulate 2-6 mm	11%
Sand fraction 0.67-2 mm	40%
Filter cake / sludge fraction < 0.67 mm	10%
Residual fraction	10%

# Grate incinerator: performance



Emission limits in mg/Nm<sup>3</sup>  
(+/- 15 % lower than EU-limits)

## Site Doel : energy recovery

Turbine	max. capac.	max. steam input
Grate incinerators 1 & 2	22 MW	100 tonnes/h
Grate incinerator 3	24 MW	110 tonnes/h
Fluidized bed incinerator	41 MW	185 tonnes/h
<b>Total</b>	<b>87 MW</b>	<b>395 tonnes/h</b>

Delivery of **electricity** to approx.  
170.000 households

+

Delivery of **steam** to neighbouring  
company Ineos:  
30 tonnes/h



## Ash treatment



- treatment of bottom ash from grate incinerators (residues of thermal treatment)
- Started up in 2000

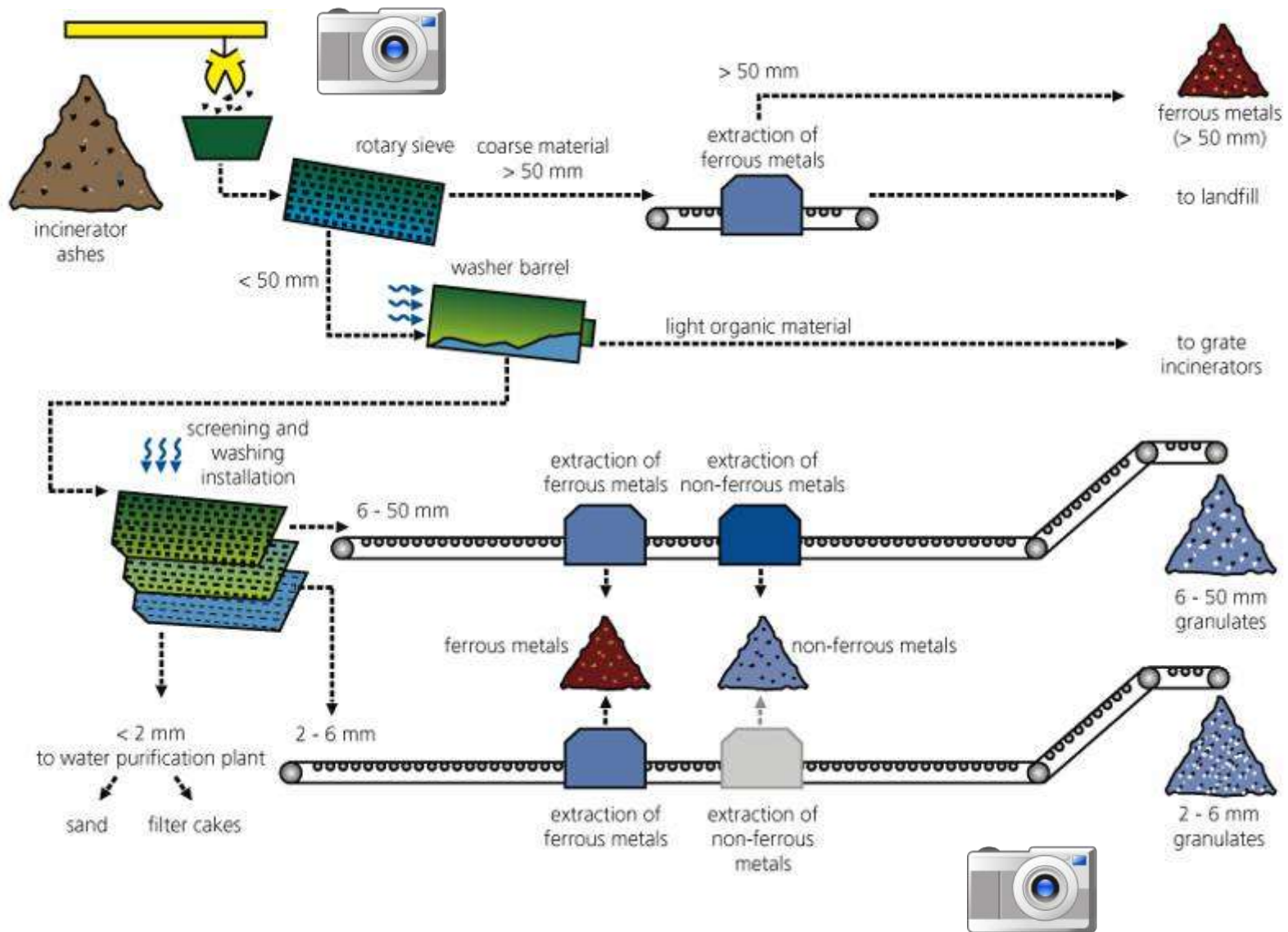
# Bottom ash recycling plant

## Technology: wet process

- sieving
  - metals & stones are removed using a robust bar-sieve
  - separation on granular size
- separating of F / NF metals
- washing
  - separation by flotation



# Ash treatment: treatment diagram





raw bottom ash



Fraction 0-2 mm



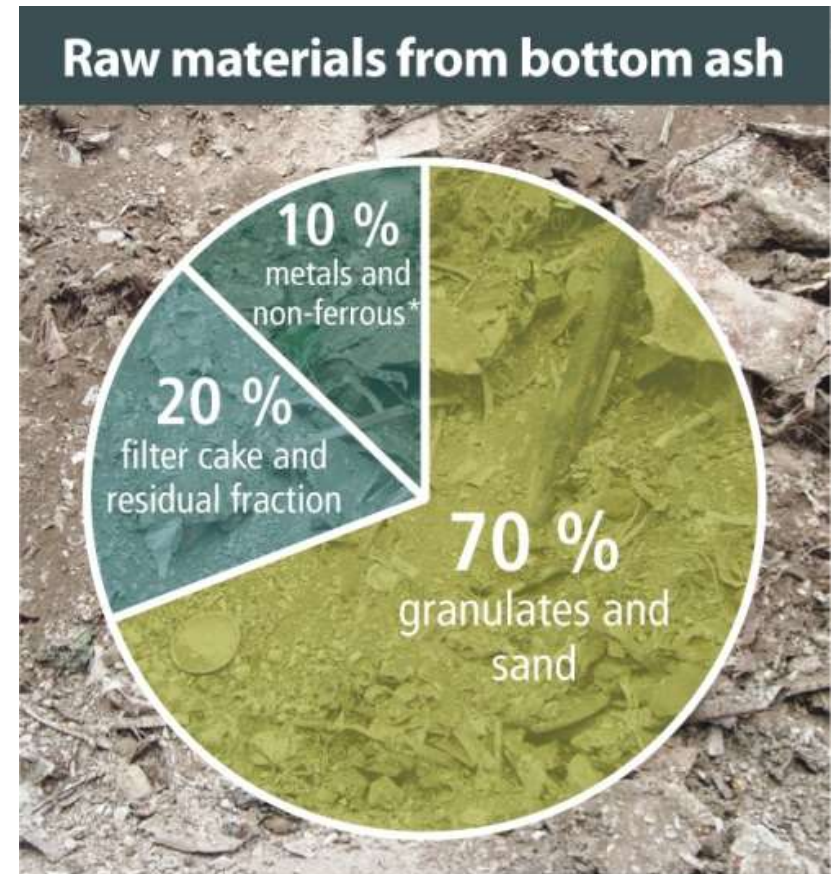
Fraction 2-6 mm



Fraction 6-50 mm

# Application of different fractions

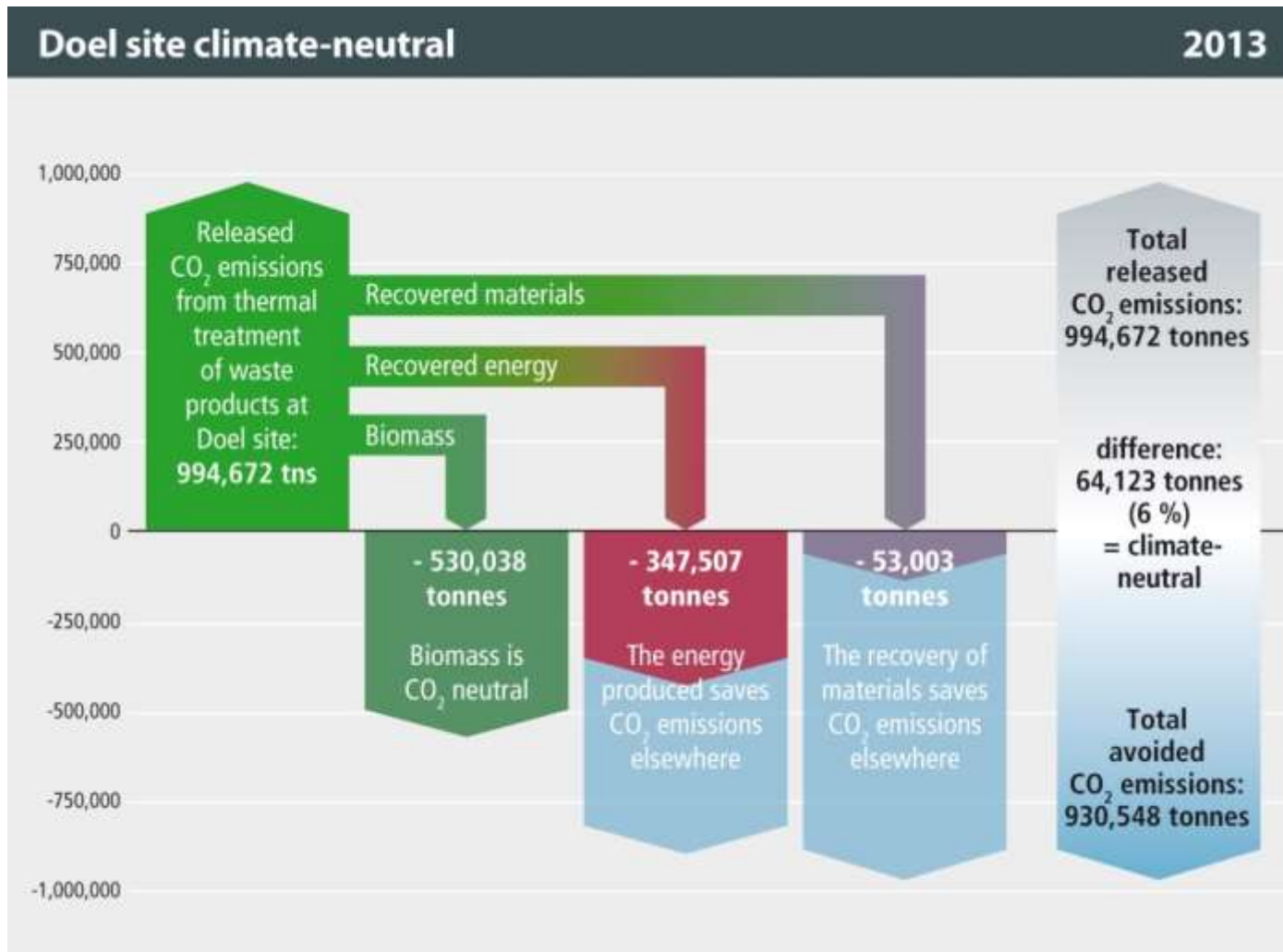
- Scrap (F/NF metals) => recycling
- Granulates => useful application
  - **0-2 mm** → stability application on landfills (drainage)
  - **2-6 mm and 6-50 mm** → road construction



\* incl. weak magnetic fraction



# Indaver Doel's W2E facilities: climate-neutral



→ Balance = CO<sub>2</sub> neutral

## Energycluster project

- Indaver & SLECO wish to set up a heat network between their W2E-plants and a number of neighbouring companies
- Steam pipeline
  - 400° C / 40 bar
  - condensate pipe back to incinerators
  - total length: 8 km, supply and return
  - total investment cost: over 25 million euro
- strategic support from Flemish government: 10 million euro
- When fully realized, grid should result in CO2 emissions cut by 100.000 tonnes a year
- Grid should be operational in 2016



# Energycluster Scheldt Left bank

## Indaver / SLECO

- verwerken jaarlijks 1 miljoen ton huishoudelijk en vergelijkbaar bedrijfsafval.
- recupereren de warmte die bij de verbrandingsprocessen vrijkomt onder de vorm van stoom en stroom.



## Maatschappij Linker-Scheldeoever

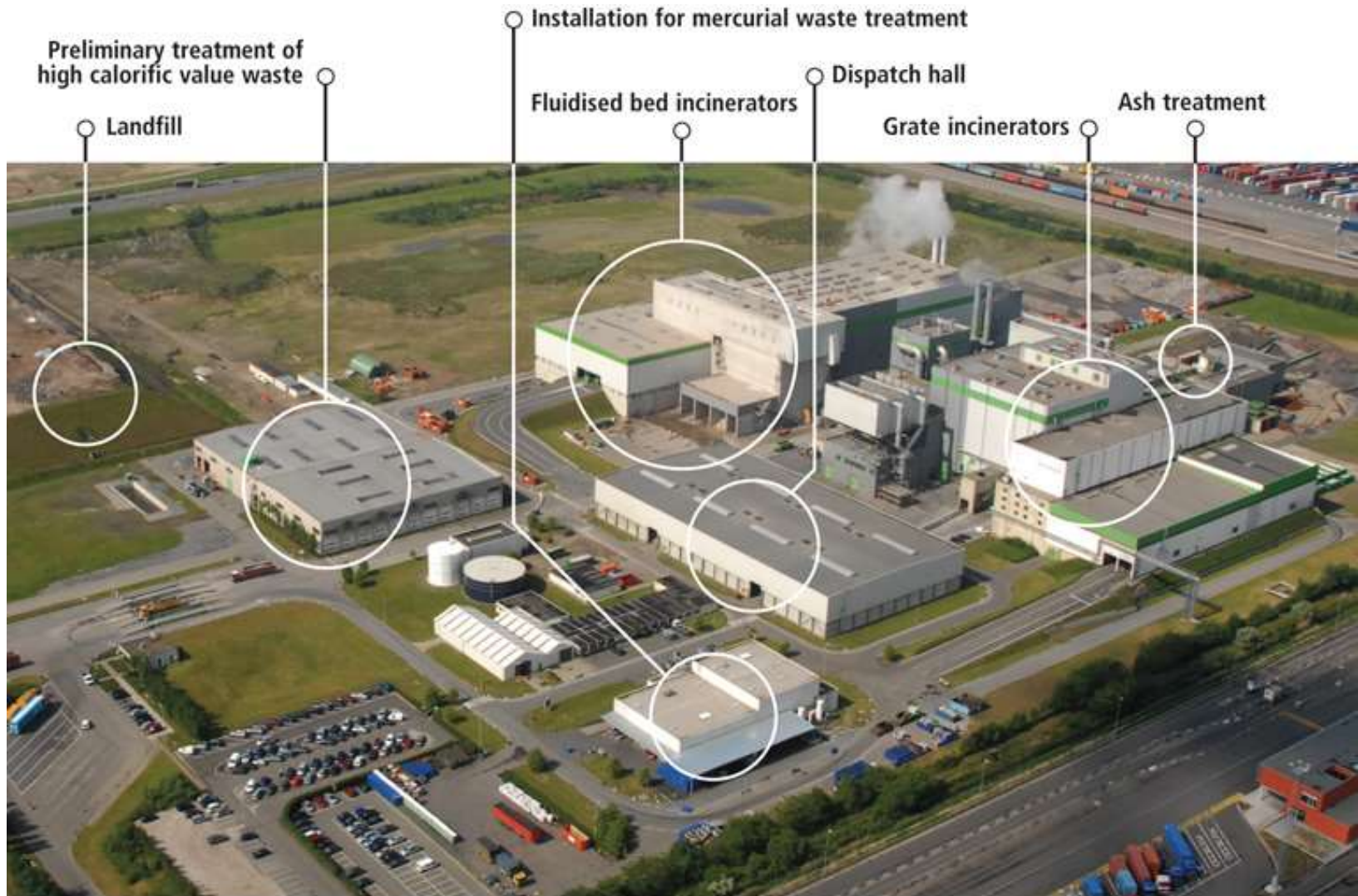
- staat in voor het beheer en grondbeleid van de Waaslandhaven,
- zorgt voor het bouwrijp maken van gronden, verleent concessies aan bedrijven,
- regelt onteigeningen en adviseert de overheid rond de uitbreiding van het havengebied.



potential users  
of the steam  
network in  
Waasland port



# Site visit



site visit



**INDAVER**







Ash treatment : granulate fraction 6 – 50 mm





Ash treatment : granulate fraction 2 – 6 mm



**Ash treatment : sand fraction**



Ash treatment : ferro fraction





















