CGE Engineering

# Energy recovery

## Waste to Energy

*Waste converted into an energy source*

*Dott. Ing. Dante Salimbeni*

**Problems solved by WTE plants**

**No illegal waste disposal**

**No need of landfills**

# Main advantages brought by WTE plants

**Know-how improvement**

**Environmental improvement**

**Energy recovery**

**Pay investment**

***High-tech*** **employment development**

## What is “Waste to Energy”?

The most hygienic, environmentally friendly and cost-effective technology for converting unusable waste into useful energy.

# Cost-effective catchment area of waste

chemical waste

300 km

200 km

100 km

50 km

biomass

industrial waste

wood waste


used oil

special waste

municipal solid waste

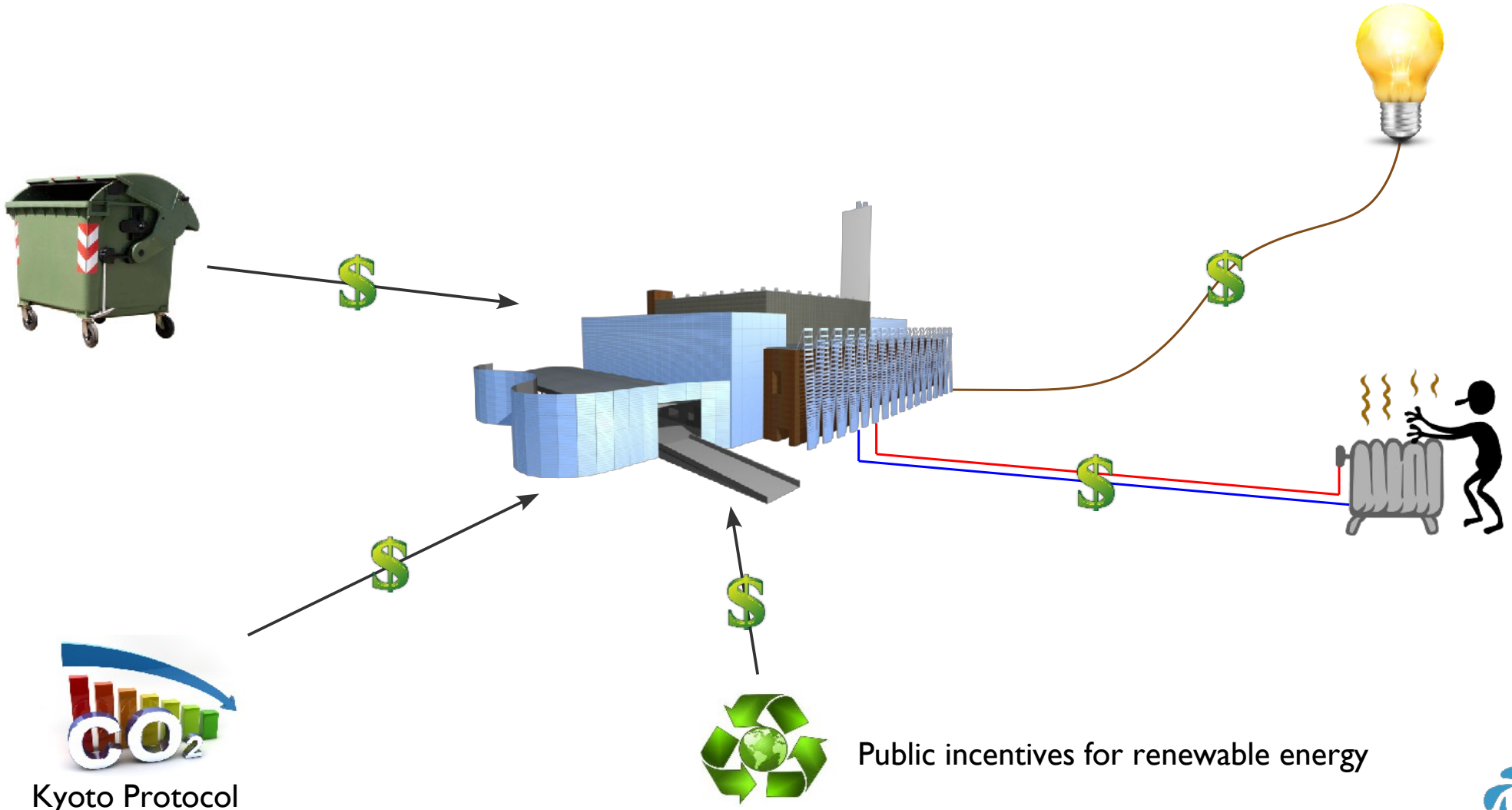
sewage sludge

hospital waste

bacteriological waste

tires

# Profitability



# Electricity produced

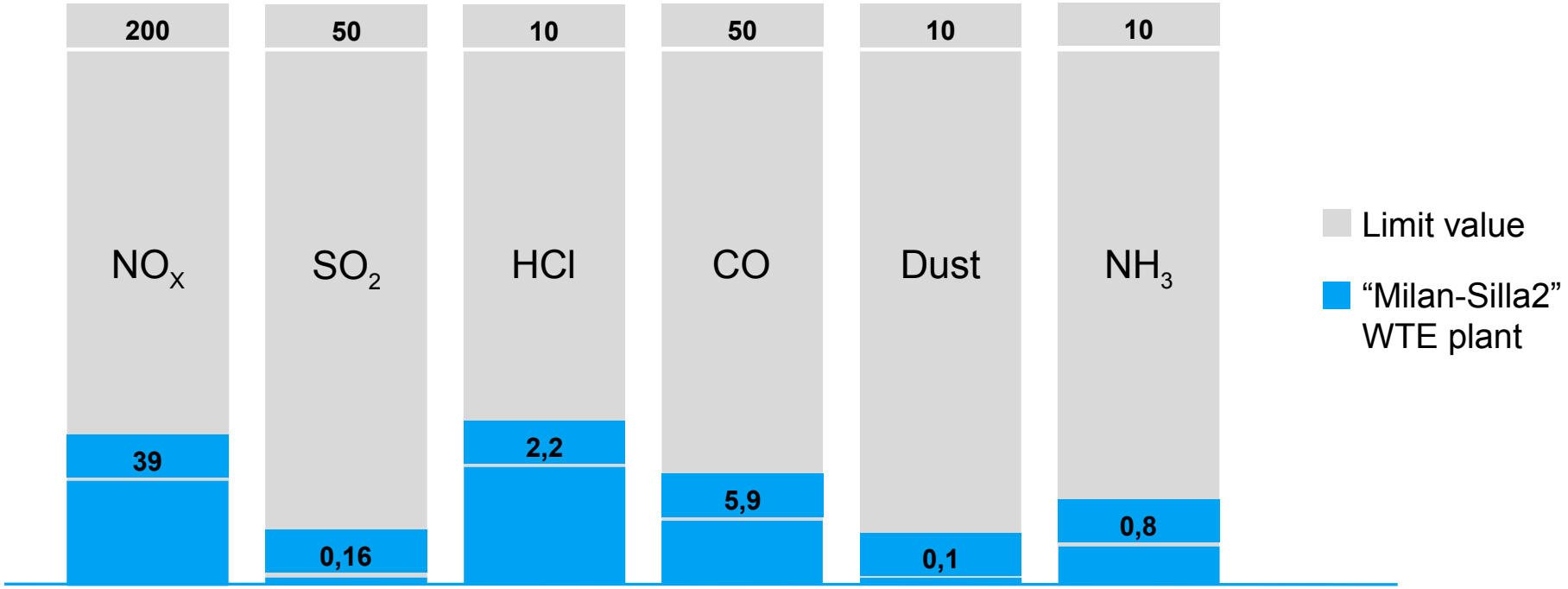
# Heat recovered

1 kg waste

8 warm showers (3 min, 32°C)

# Gas emissions

Macro-pollutants [mg/Nm$^3$]



# Gas emissions

Micro-pollutants [mg/Nm$^3$]

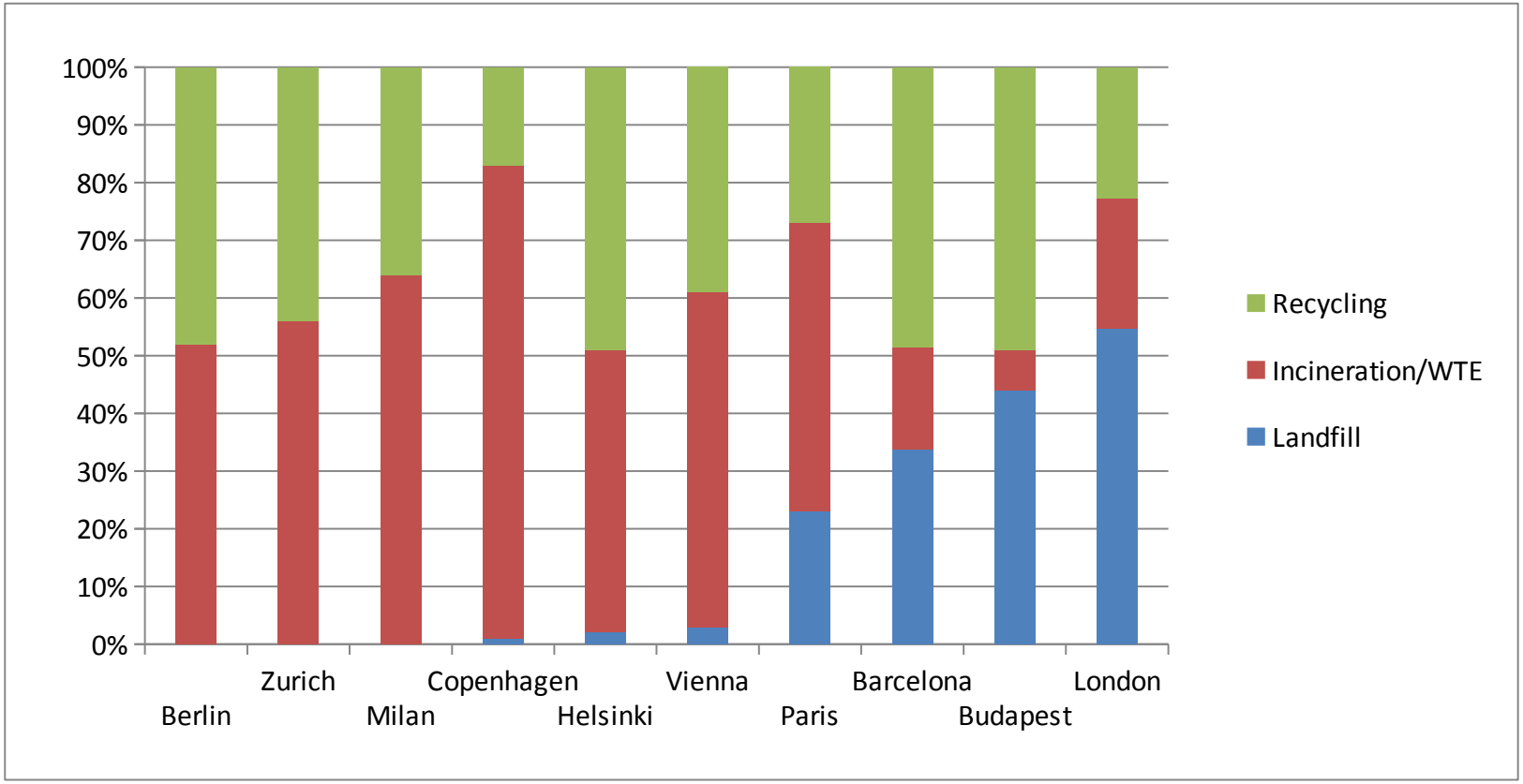
| Parameters | "Milan-Silla2" WTE plant | Limit value |
|---|---|---|
| Polycyclic Aromatic Hydrocarbons | < 0,00003 | 0,01 |
| Dioxins and furans (PCDD+PCDF) | 0,0009 x 10-6 | 0,1 x 10-6 |
| Cadmium + Thallium | < 0,0013 | 0,05 |
| Mercury | < 0,006 | 0,05 |
| Nickel | < 0,001 | 0,1 |
| Metals (Sb+As+Pb+Cr+Co+Cu+ Mn+Ni+V+Sn) | < 0,0115 | 0,5 |

# Comparison of ultra-thin particles emissions

Ultra-thin particles < 0,1 µm [number of particles / $cm^3$]

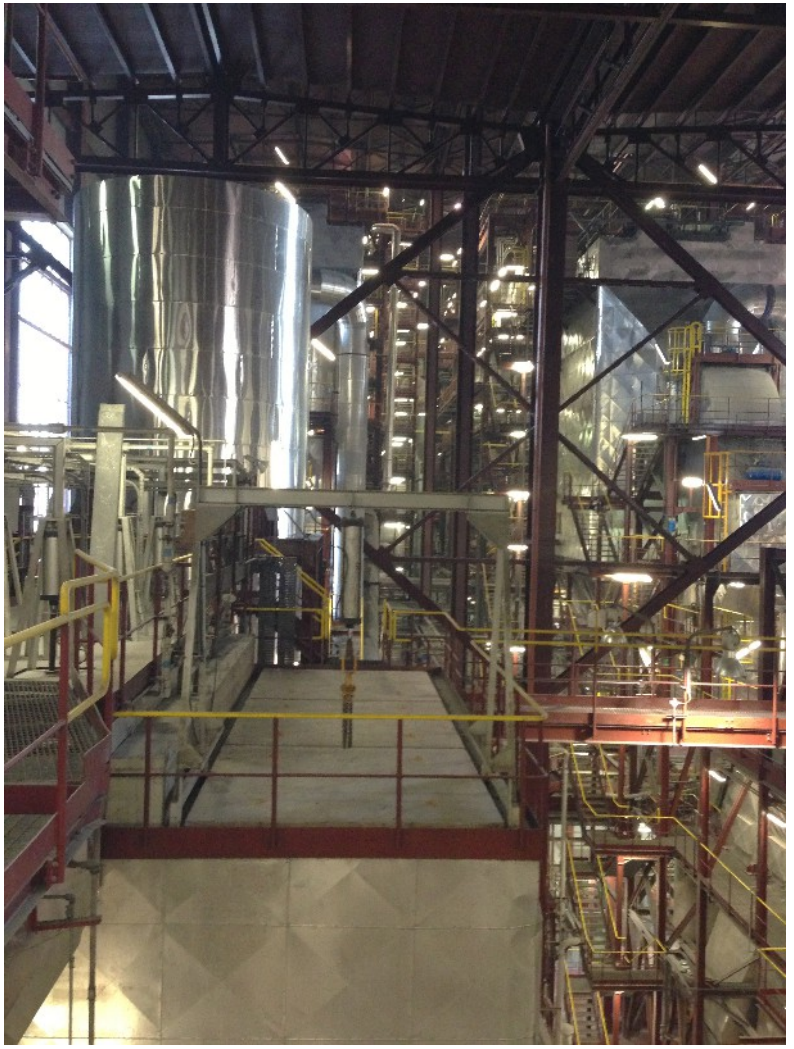
| | |
|---|---|
| Wood domestic fireplace | 81’000 |
| Diesel fuel heater | 67’000 |
| Wood pellet heater | 52’000 |
| “Milan-Silla2” WTE plant | 18 |
| Milan downtown air | 32 |

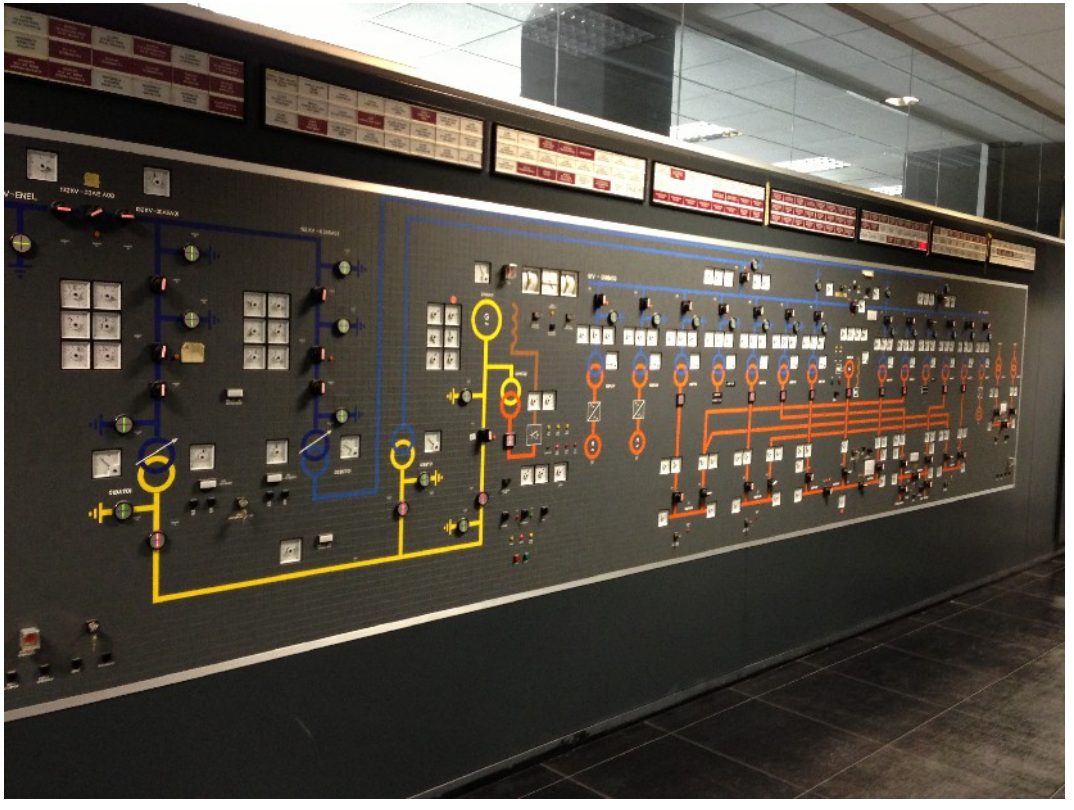
# WASTE DISPOSAL modalities in the main European cities

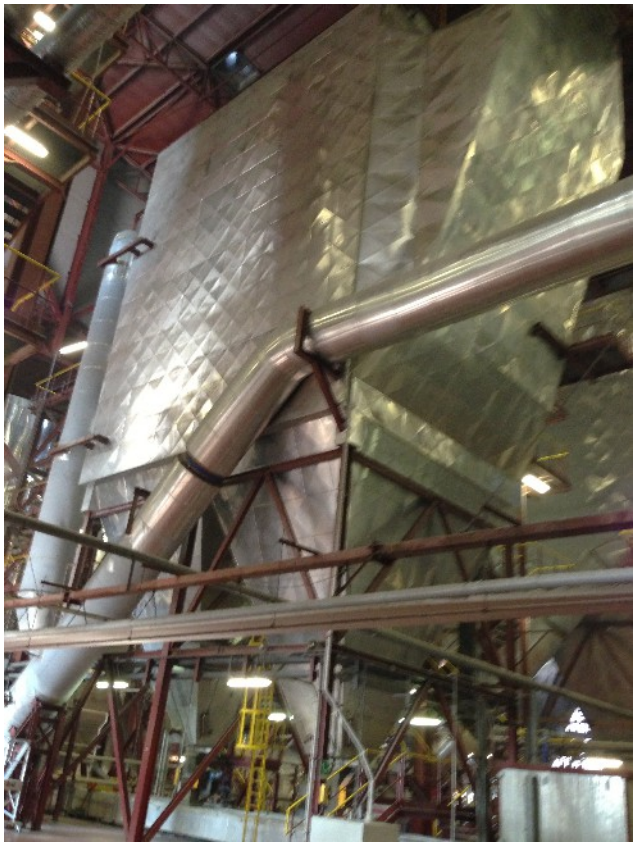



BSL/Lloyd's Register - International Study on Waste Management, 2009

**MILAN**

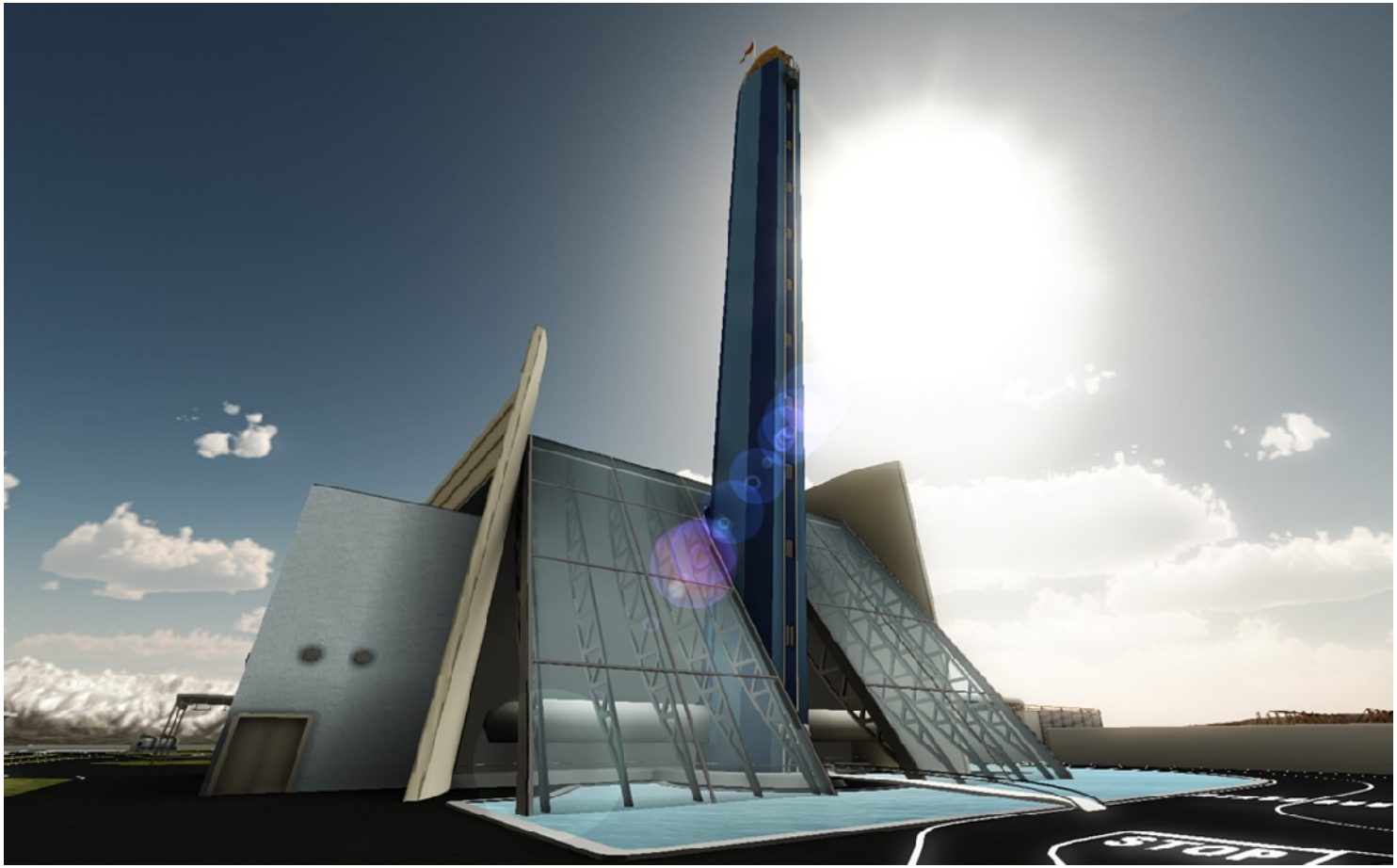




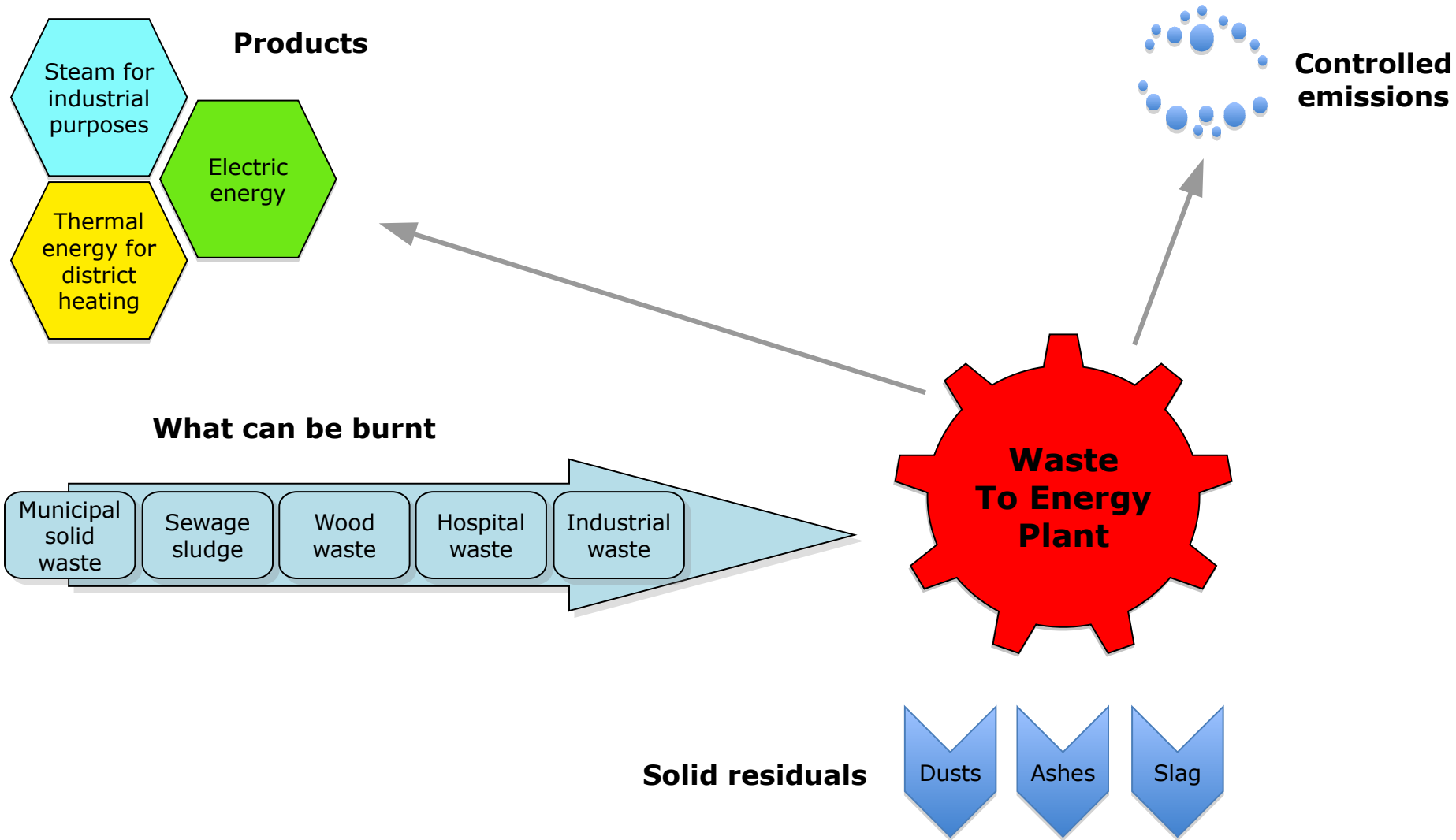


**BRESCIA**

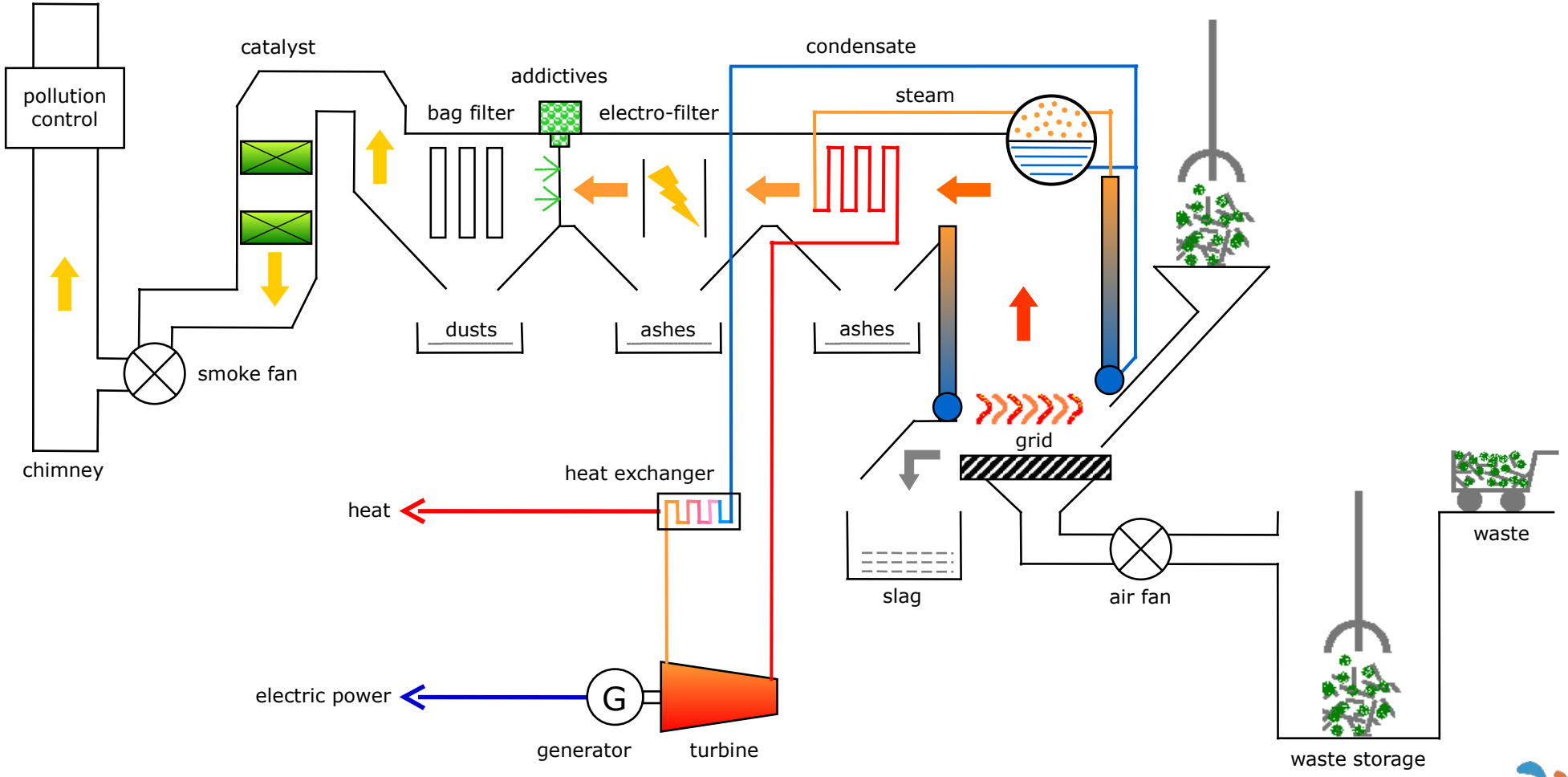
**TURIN**



# WTE plant fuels, products and by-products



# The BEST TECHNOLOGY for energy and environment



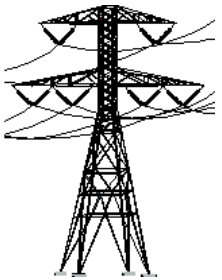
# Waste to Energy plant

Waste
66 ton/h (180 MWt)
500'000 ton/year

**WTE plant**

55 MWe

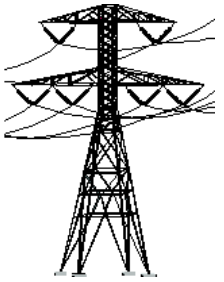
6 MWe (internal consumption)

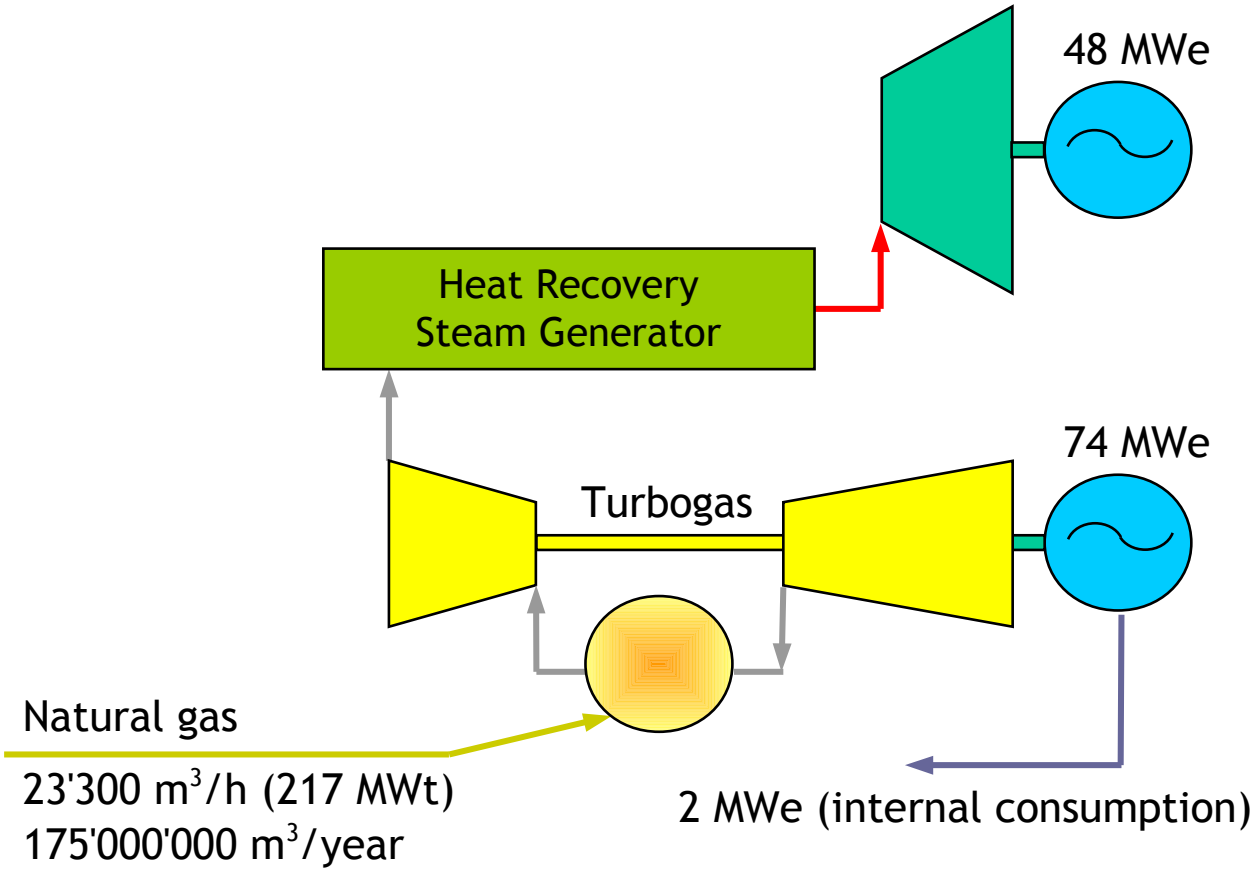


To the electric network
49 MWe
370'000 MWhe/year

To the thermal network
75 MWt
220'000 MWht/year

# Turbogas plant






To the electric network
120 MWe
900'000 MWhe/year

To the thermal network
25 MWt
75'000 MWht/year

# Waste to Energy + Turbogas plant

Waste
66 ton/h (180 MWt)
500'000 ton/year

**WTE plant**

Heat Recovery Steam Generator

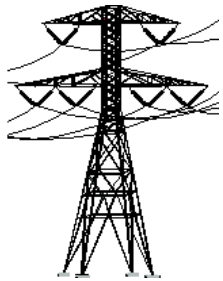
110 MWe

74 MWe

Turbogas

Natural gas
23'300 $m^3$/h (217 MWt)
175'000'000 $m^3$/year

7 MWe (internal consumption)



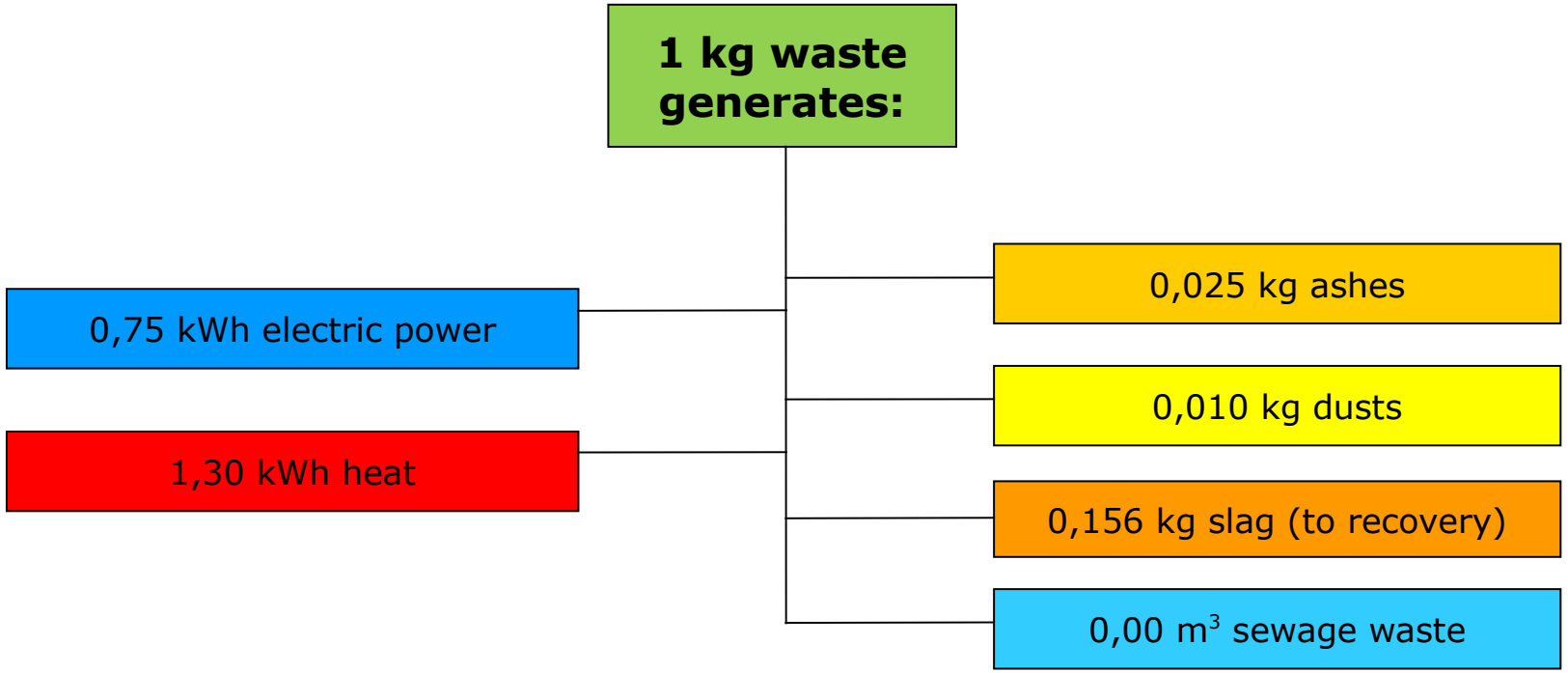
To the electric network
177 MWe
1'330'000 MWhe/year

To the thermal network
100 MWt
300'000 MWht/year

# Best Available Technologies (BAT) emissions comparison

| Parameters | Limit value [mg/Nm$^3$] | BAT plant (IPPC 2006) [mg/Nm$^3$] | "Milan-Silla2" WTE plant (year 2010) [mg/Nm$^3$] |
|---|---|---|---|
| **$SO_2$** | 50 | 1-40 | 0,16 |
| **$NO_X$ (determined by measuring $NO_2$)** | 200 | 40-100 | 39,3 |
| **Dusts** | 10 | 1-5 | < 0,1 |
| **CO** | 50 | 5-30 | 5,9 |
| **HCl** | 10 | 1-8 | 2,2 |
| **$NH_3$** | 10 | < 10 | 0,8 |
| **TOC (Total Organic Carbon)** | 10 | 1-10 | 0,44 |
| **HF** | 1 | < 0,001 | < 0,0001 |
| **Cd+Tl** | 0,05 | 0,005-0,05 | < 0,00013 |
| **Hg** | 0,05 | 0,001-0,02 | < 0,006 |
| **As+Co+Cr+Cu+Mn+Ni+Pb+Sb** | 0,5 | 0,005-0,5 | < 0,0115 |
| **Dioxins and furans (PCDD+PCDF)** | 0,1 x $10^{-6}$ | 0,01-0,1 x $10^{-6}$ | 0,0009 x $10^{-6}$ |

# Energetic and mass balance



# THANK YOU

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