# BEST AVAILABLE TECHNOLOGIES (BAT)

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# BEST AVAILABLE TECHNIQUE (BAT) IN EU

- Best Available Techniques (BAT) Reference Document on waste incineration, August 2006 (BREF)
- Collection of information about techniques and operational experience, among others best available operational emission levels (BATOEL) – not emission limit value (ELV)
- Carried out under Article 16(2) of Council Directive 96/61/EC (IPPC Directive) to be used when permitting WTE facilities
- BAT is not just lowest possible, also a matter of costs and local circumstances
- 63 questions shall be answered according BREF

# BAT QUESTIONS EXAMPLES

| BAT No. |
| --- |
| 1. the selection of an installation design that is suited to the characteristics of the waste received, as described in 4.1.1 and 4.2.1 and 4.2.3 |
| 2. the maintenance of the site in a generally tidy and clean state, as described in 4.1.2 |
| 3. to maintain all equipment in good working order, and to carry out maintenance inspections and preventative maintenance in order to achieve this |
| 4. to establish and maintain quality controls over the waste input, according to the types of waste that may be received at the installation, as described in:<br>4.1.3.1 Establishing installation input limitations and identifying key risks, and<br>4.1.3.2 Communication with waste suppliers to improve incoming waste quality control, and<br>4.1.3.3 Controlling waste feed quality on the incinerator site, and<br>4.1.3.4 Checking, sampling and testing incoming wastes, and<br>4.1.3.5 Detectors for radioactive materials. |
| 5. the storage of wastes according to a risk assessment of their properties, such that the risk of potentially polluting released is minimised. In general it is BAT to store waste in areas that have sealed and resistant surfaces, with controlled and separated drainage as described in 4.1.4.1. |
| 6. to use techniques and procedures to restrict and manage waste storage times, as described in 4.1.4.2, in order to generally reduce the risk of releases from storage of waste/container deterioration, and of processing difficulties that may arise. In general it is BAT to:<br>• prevent the volumes of wastes stored from becoming too large for the storage provided<br>• in so far as is practicable, control and manage deliveries by communication with waste suppliers, etc. |
| 7. to minimise the release of odour (and other potential fugitive releases) from bulk waste storage areas (including tanks and bunkers, but excluding small volume wastes stored in containers) and waste pre-treatment areas by passing the extracted atmosphere to the incinerator for combustion (see 4.1.4.4).<br><br>In addition it is also considered to be BAT to make provision for the control of odour (and other potential fugitive releases) when the incinerator is not available (e.g. during maintenance) by:<br>a. avoiding waste storage overload, and/or<br>b. extracting the relevant atmosphere via an alternative odour control system |
| 8. the segregation of the storage of wastes according to a risk assessment of their chemical and physical characteristics to allow safe storage and processing, as described in 4.1.4.5 |
| 9. the clear labelling of wastes that are stored in containers such that they may continually be identified, as described in 4.1.4.6. |

# NEW REVISON OF BREF

- Revision of the BREF will begin early 2014 and is expected to last until end 2015/2016
- Waste Incineration Directive (WID) sets the Emission Limit Values (ELV) for WTE facilities
- The WID has been integrated (1:1) in the Industrial Emission Directive (IED)
- The ELVs are valid until the new BREF is published then the BREF shall be reflected in the new ELVs – but BREF is reporting the BATOEL?

# EU BREF - BATOEL

| Parameter | Unit | BATOEL | |
|---|---|---|---|
| | | daily average | ½-hour average 100 % |
| Dust | $mg/Nm^3$ | 1-5 | 1-20 |
| HCl | $mg/Nm^3$ | 1-8 | 1-50 |
| HF | $mg/Nm^3$ | <1 | <2 |
| $SO_2 + SO_3$ | $mg/Nm^3$ | 1-40 | 1-150 |
| $NO_x$ as $NO_2$ | $mg/Nm^3$ | 120-180[1])<br>40-100[2]) | 3-350[1])<br>40-300[2]) |
| | | **Result of spot sampling** | |
| $NH_3$ | $mg/Nm^3$ | <10 | |
| Cd + Tl | $mg/Nm^3$ | 0.005-0.05 | |
| Σ 9 metals | $mg/Nm^3$ | 0.005-0.5 | |
| Hg | $mg/Nm^3$ | <0.05 | |
| Dioxins, TEQ | $ng/Nm^3$ | 0.01-0.1 | |

[1]) With SNCR. [2]) With SCR

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# COMPARISON WID - BATOEL

| Comparison WID and BATOEL $mg/Nm^3$ | | |
|---|---|---|
| Component | 24 h Dir. | 24 h BREF |
| Dust | 10 | 1-5 |
| $SO_2$ | 50 | 1-40 |
| HCl | 10 | 1-8 |
| $NO_X$ SCR<br>$NO_X$ SNCR | 200<br>200 | 40-100<br>120-180 |

# AIR POLLUTION CONTROL SOLUTIONS

| FGT- efficiency | System complexity | Consumables and residues | Process concept | Investment | Operating cost |
|---|---|---|---|---|---|
| ↓ | ↓ | ↑ | Dry, lime | ↓ | ↑ |
| | | | Dry, bicarbonate | | |
| | | | Semi-dry, lime | | |
| | | | Dry/wet combined (lime) | | |
| | | | Wet (limestone) | | |

# De-NOx PROCESSES

## SCR

- Reaction at catalyst surface
- 430° F - 480° F (220-250° C)
- Emission 15-70 ppm NOx (20-50 mg/Nm3)
- More expensive
- Large footprint
- By-effect: Dioxin removal

## SNCR

- Thermal reaction in flue gas
- Temperature 1560-1650°F (850 - 900°C)
- Emission 70-100 ppm NOx (100-150 mg/Nm3)
- Less expensive
- Small footprint
- Risk for ammonia slip

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# COPENHAGEN WASTE TO ENERGY PLANT

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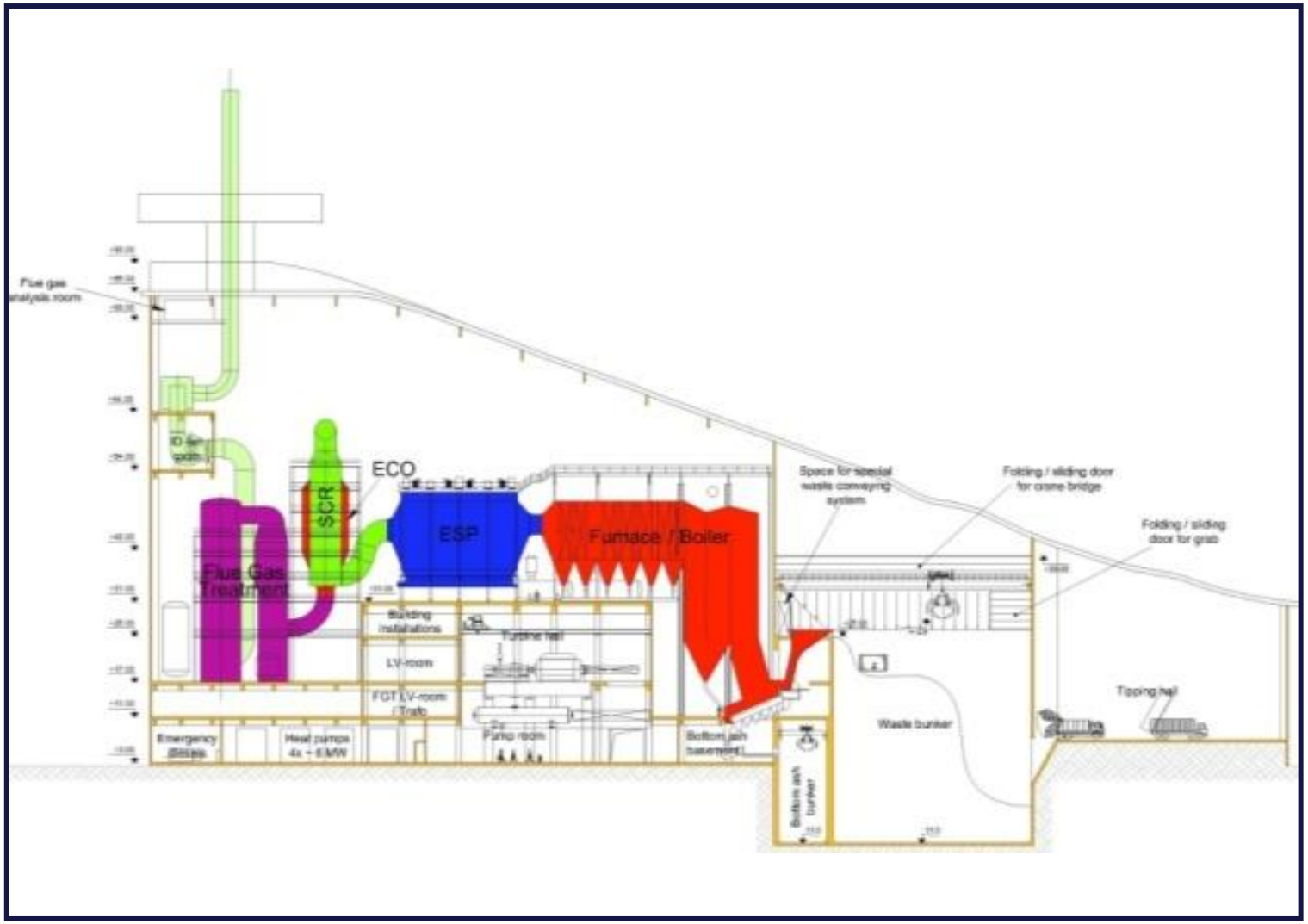
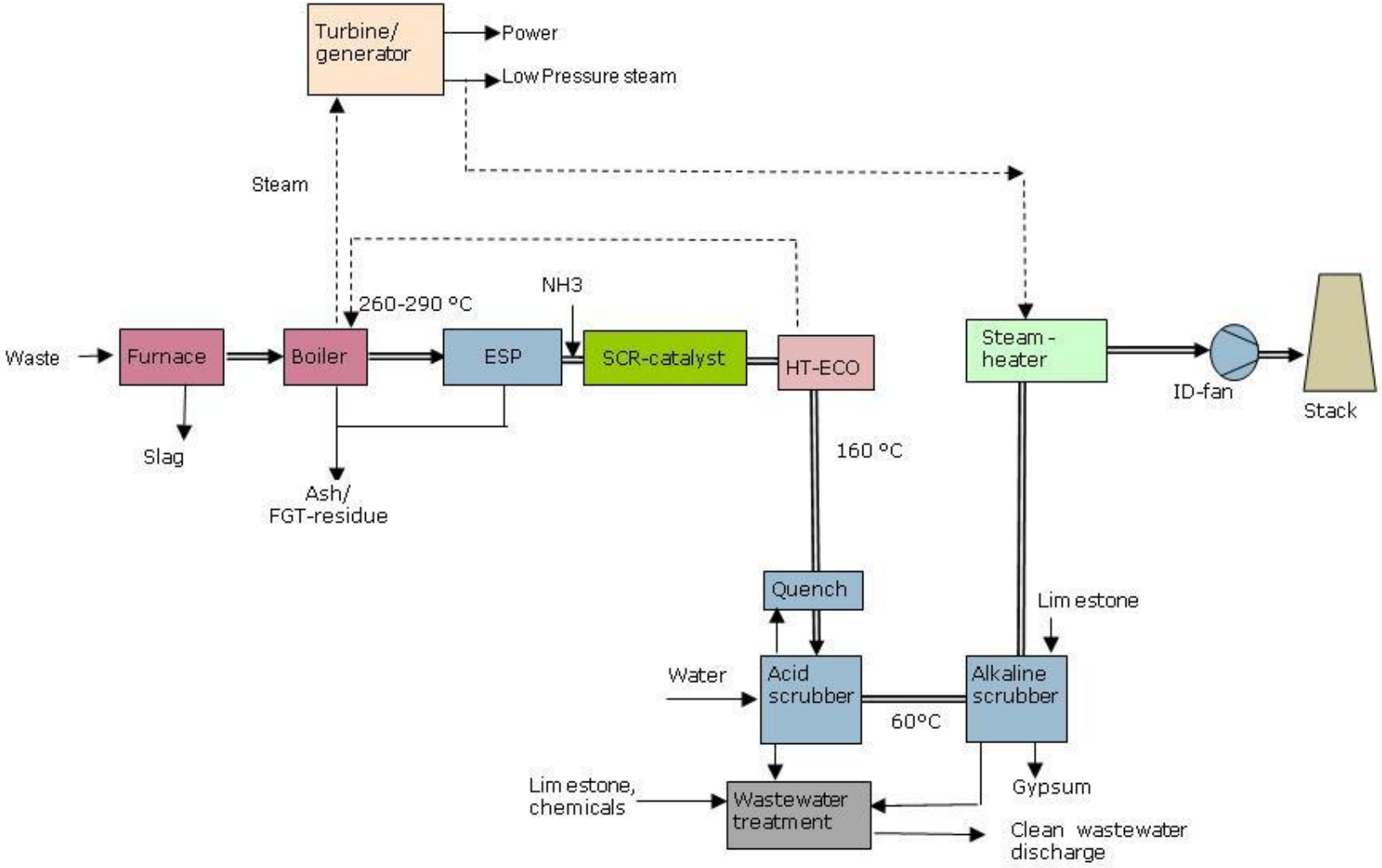
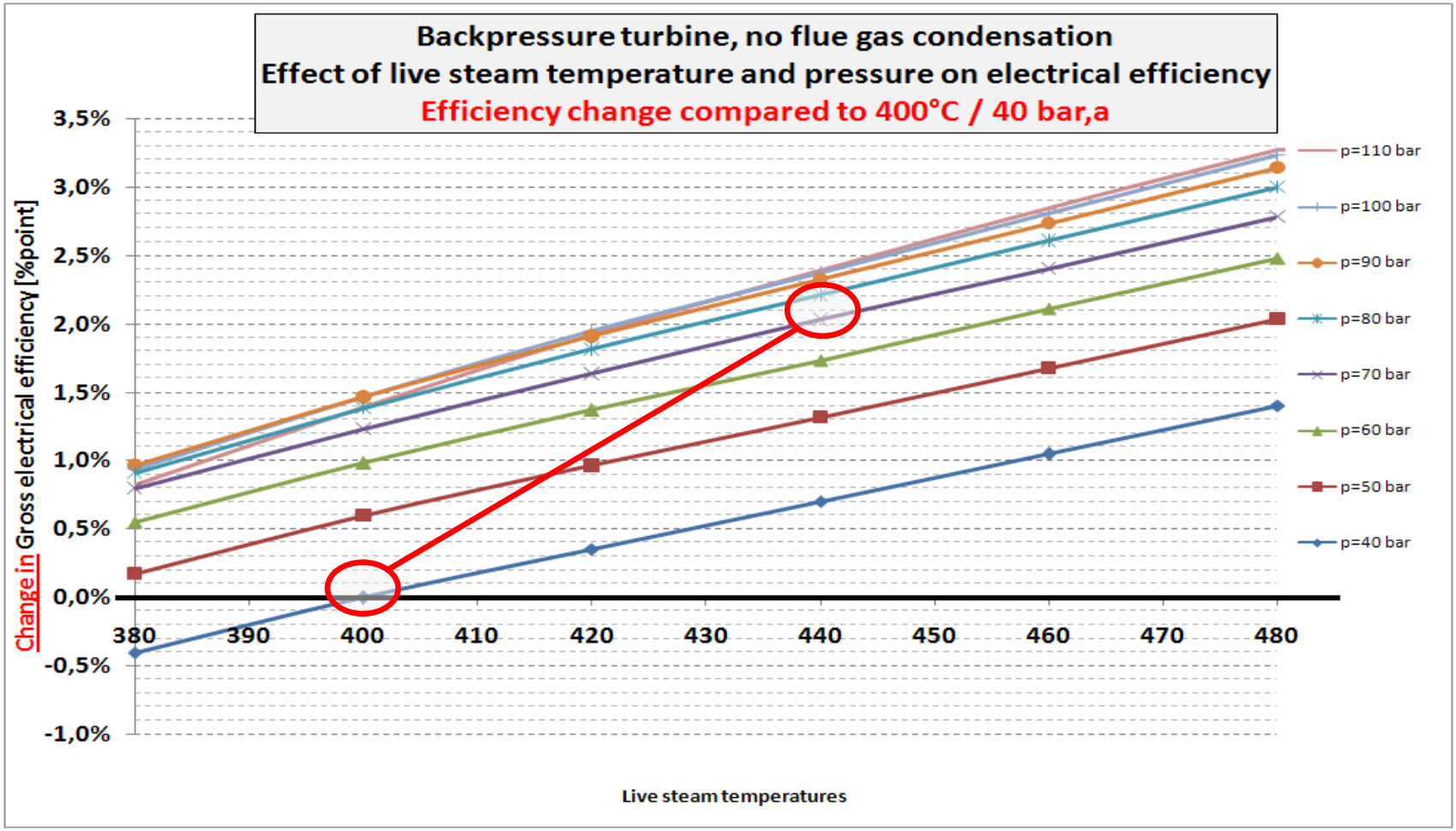
# TECHNOLOGY CHOSEN FOR COPENHAGEN



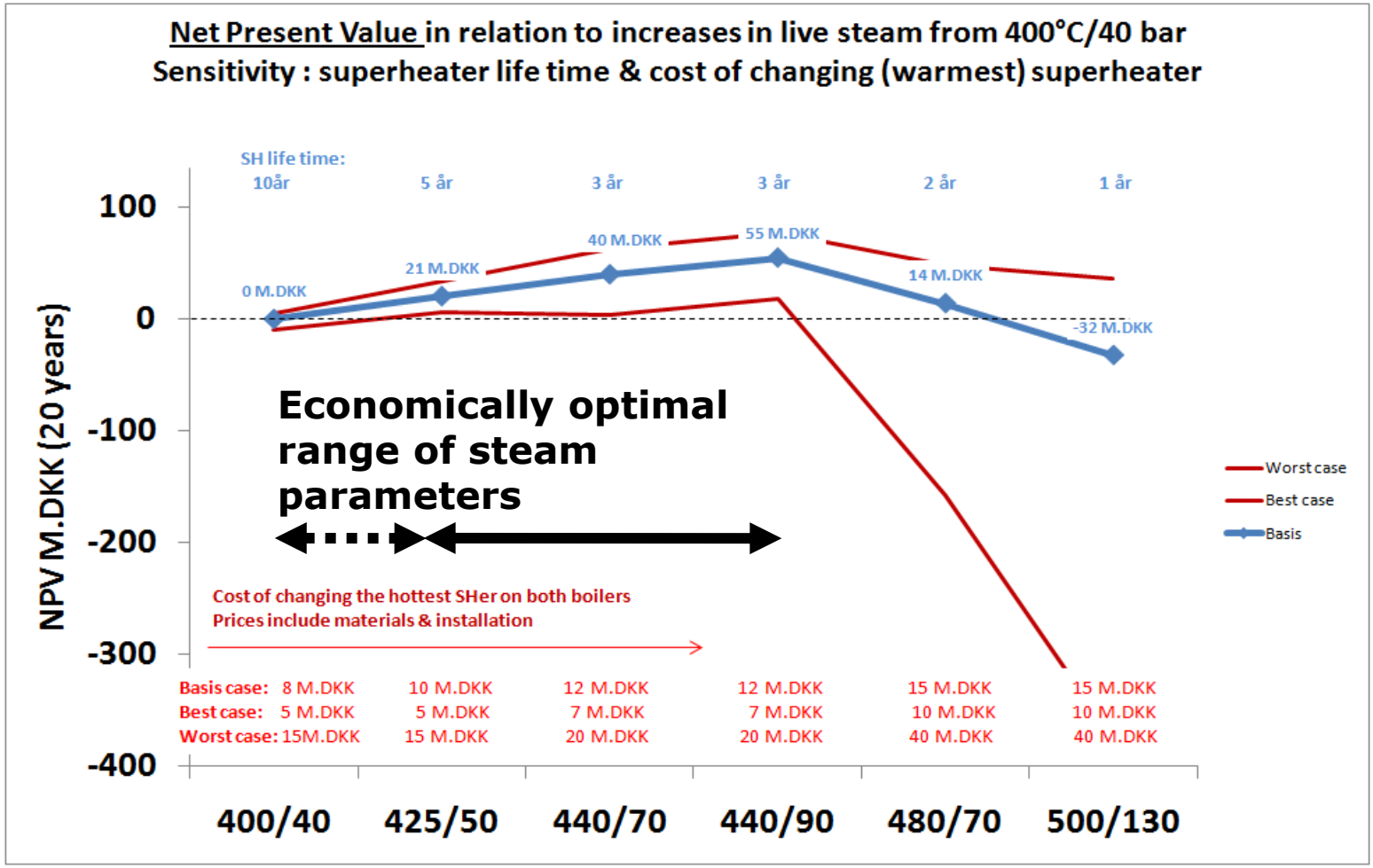
# AIR POLLUTION CONTROL SYSTEM



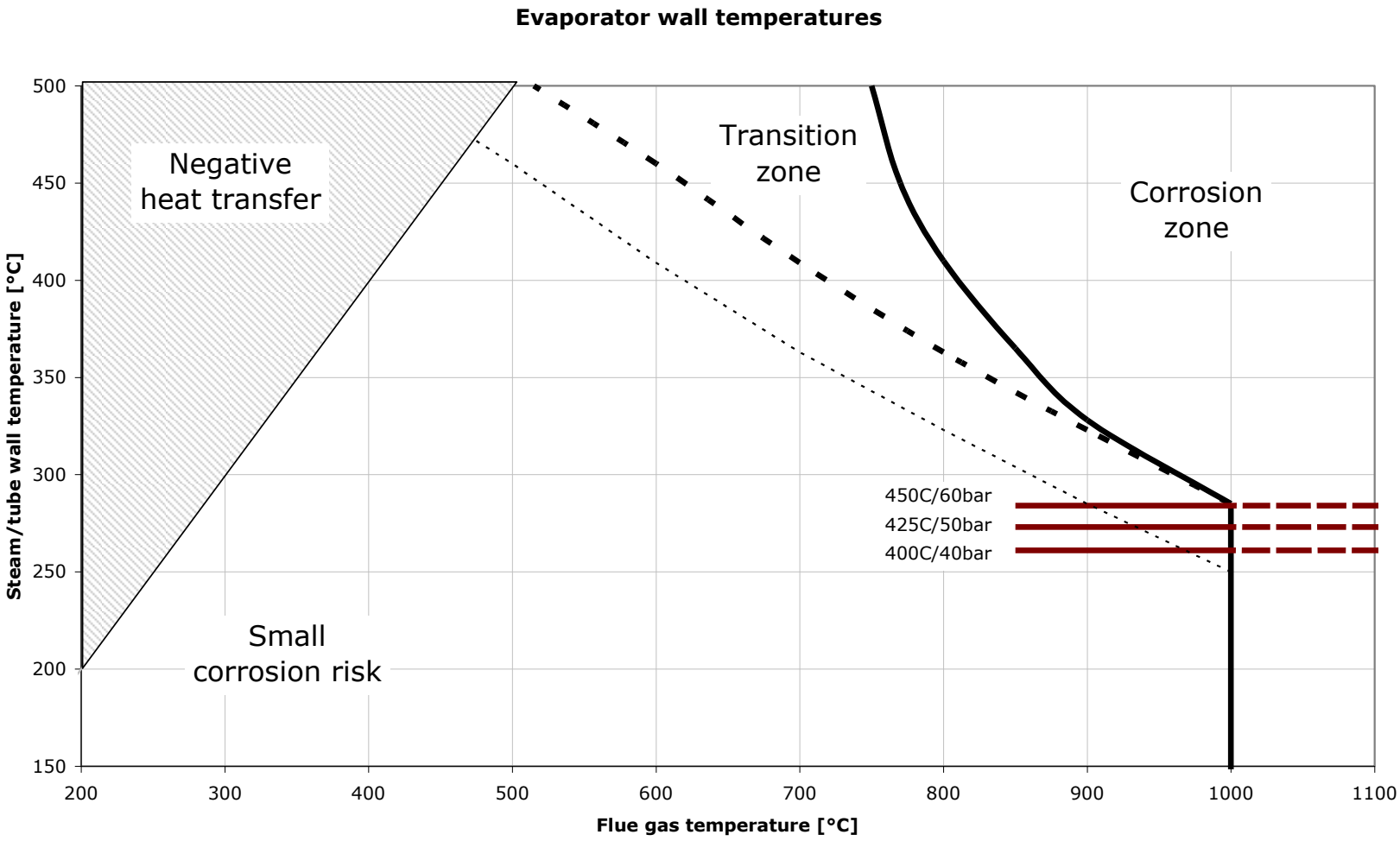
# ENERGY EFFICIENCY



# SELECTION OF OPTIMAL STEAM PARAMTERS

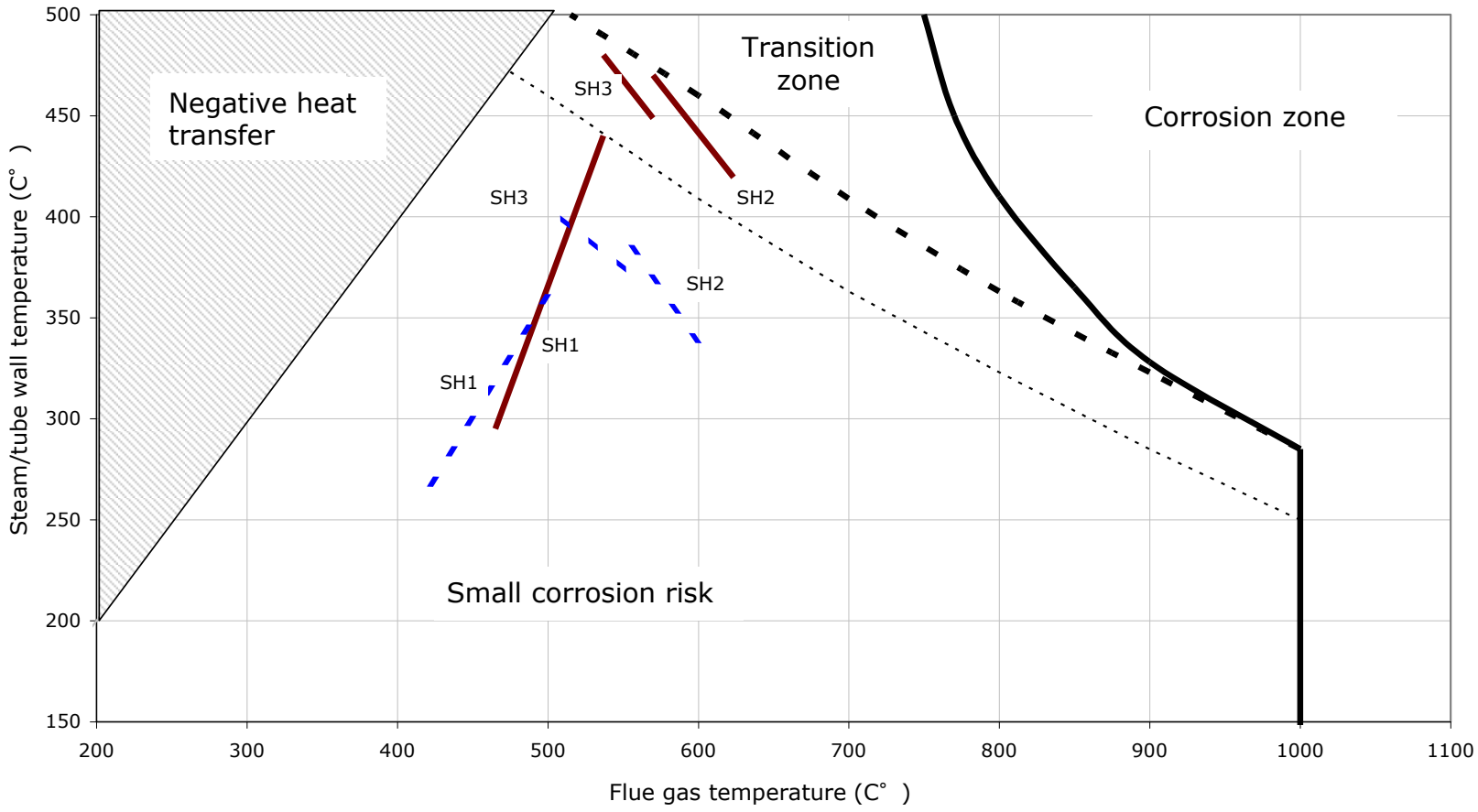


# CORROSION IN EVAPORATOR PART



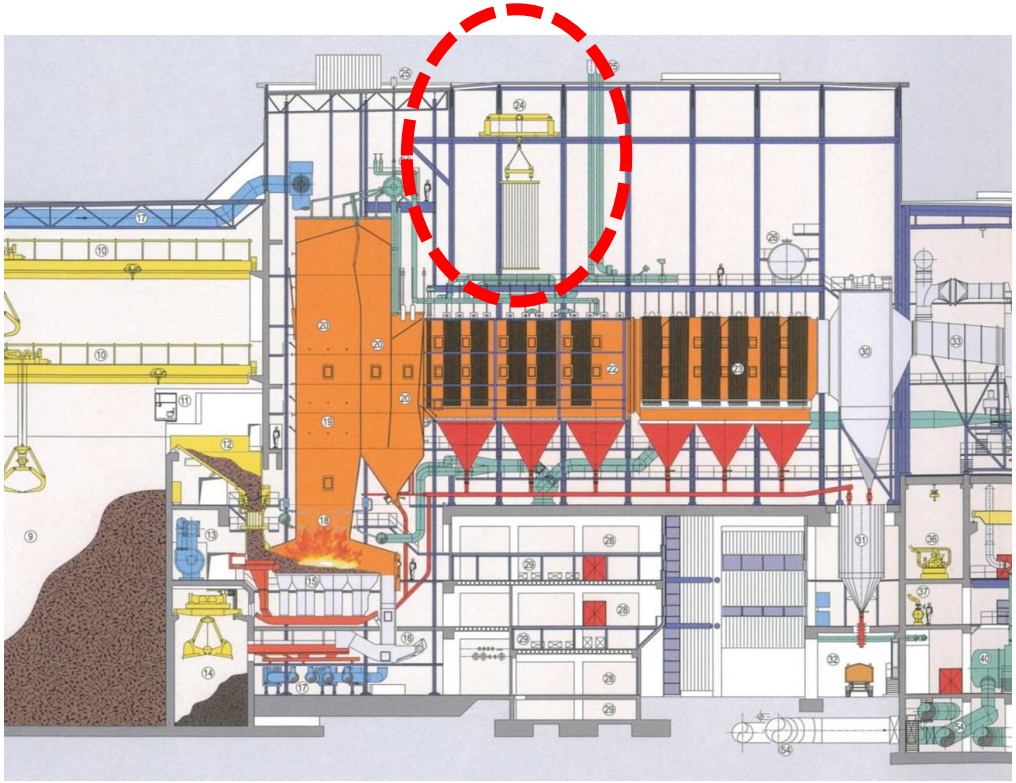
# CORROSION IN SUPERHEATERS

Super heater configuration 400C/40bar and 480C/70bar (with drum steam cooling)



# MEASURES TAKEN TO PREVENT CORROSION

- Super-heaters are considered as wear parts (layout prepared for fast exchange)
- Better protection of boiler wall in the evaporator section
- Better steel quality of super heaters



# WTE EXPERIENCE WORLDWIDE

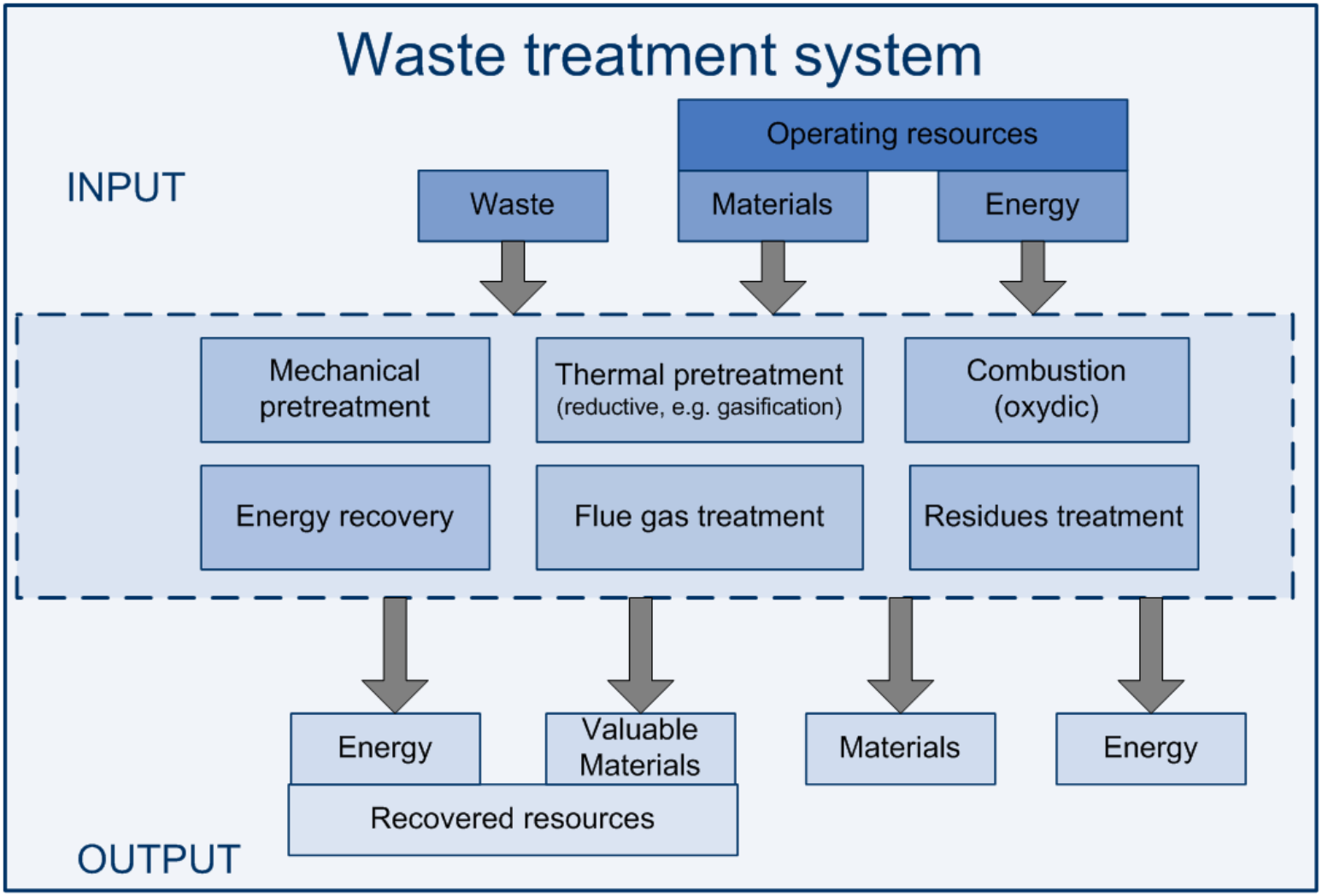
## Grate Technology

- Advanced technology
- Approx. 1,200 plants
- Normal size per combustion line is 200 - 1000 tpd
- Few worldwide recognized equipment manufacturers
- Electricity production (per tonne of waste) for MSW 0,6-0,65 MWh/tonne
- High availability >8,000 h/y
- Gate fee 40 - 120 USD/t

## Alternative Technologies

- Under development
- Number in commercial operation is unclear - but few
- Typical capacity 25-250 tpd
- Many (>100) suppliers, many relative small
- Electricity production around 0-0,5 MWh/tonne (difficult to get real data)
- Lower availability – 5,500 h/y
- Requires homogenious waste input
- Gate fee 300-500 USD/t

# REMEMBER THE COMPLETE SYSTEM



# RECOVERY OF METALS FROM BOTTOM ASH

- Metal recovery (Fe, Al)
- Recovery of precious metals – technically possible but dependent on market price for metals

# CONCLUSIONS

- The European WTE sector supports the BAT
- WTE is an increasing sector in EU (in particular in UK, East Europe, South Europe
- Hopefully documented and comparable data from alternative technologies
- Metal recovery from bottom ash will increase

# THANK YOU FOR YOUR ATTENTION!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