

/9. Beacon conference. Energy Tower



/ Programme

- Presentation of KARA/NOVEREN and WtE facility
- Experience with Martin Vario grate
- Experience with LAB and MAN
- Architecture

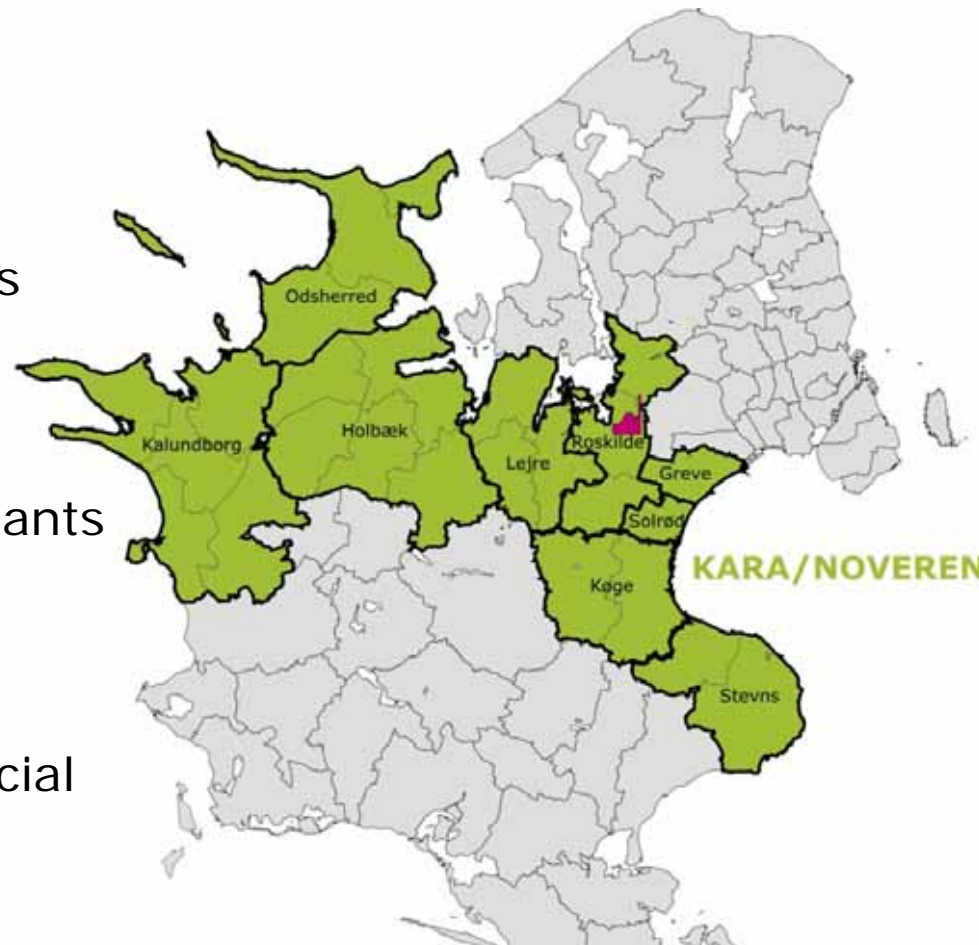


/ Merger 01.01.2007

9 municipalities

400,000 inhabitants

20,000 commercial
businesses



K/N is an
intermunicipal
waste
management
company



/ KARA/NOVEREN

Recycling

60 people



Waste-to-Energy

43 people



Landfill/Biogas/Biomass

7 people



Administration

20 people



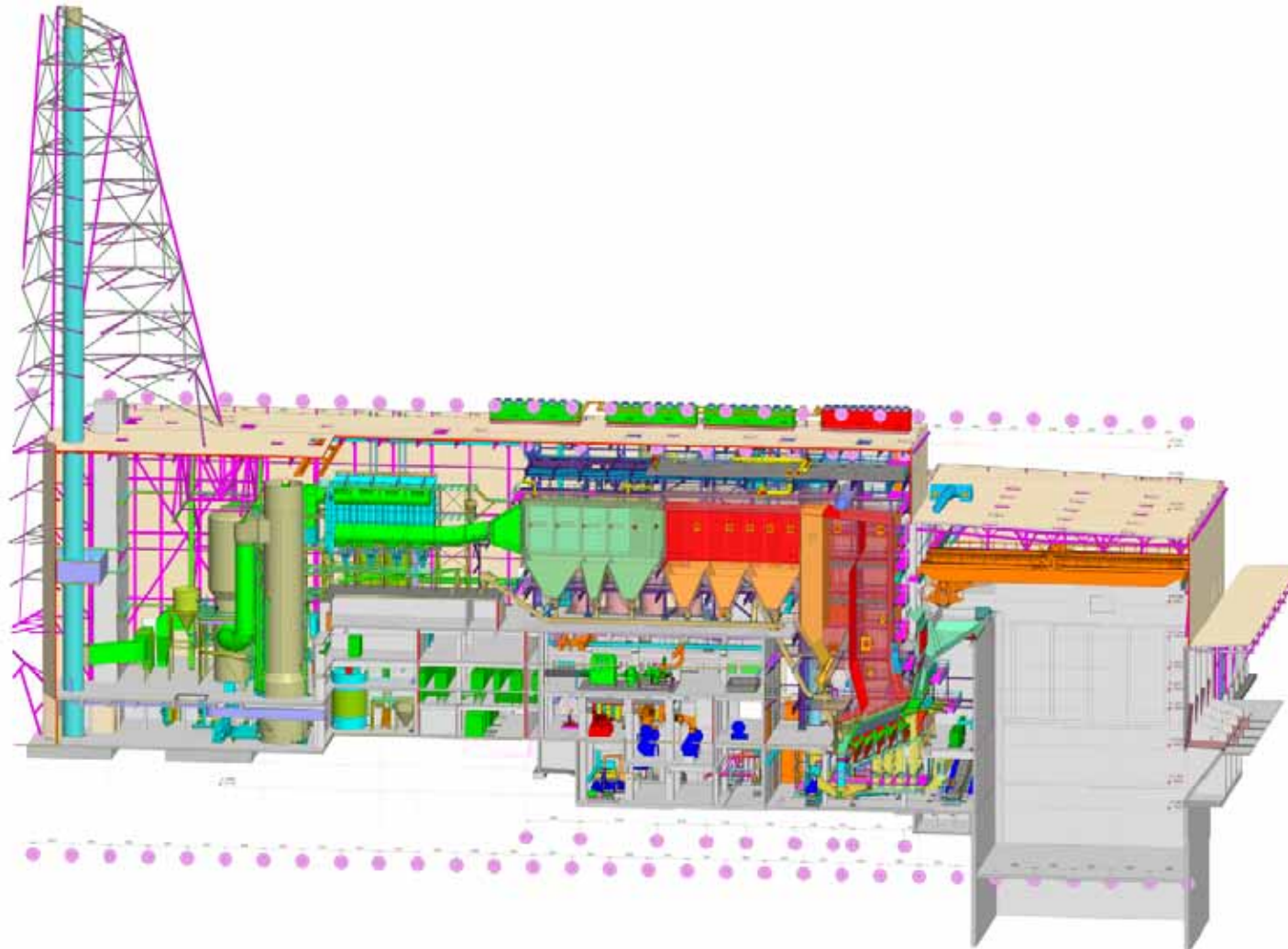
/ Waste-to-Energy



/ Treatment capacity in Roskilde

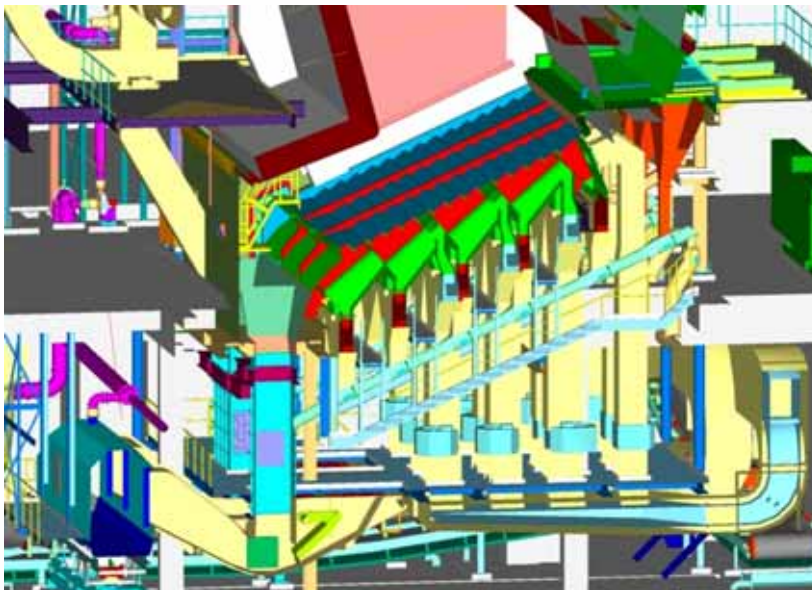
- Line 5 (20 tonnes/hour) from 1999 (W+E/Martin). Combined Heat and Power (CHP).
- Energy tower (25 tonnes/hour) from 2013. CHP.
- Treatment of approx. 350,000 tonnes/year
- Import of RDF from Ireland and the UK

/ Basic layout



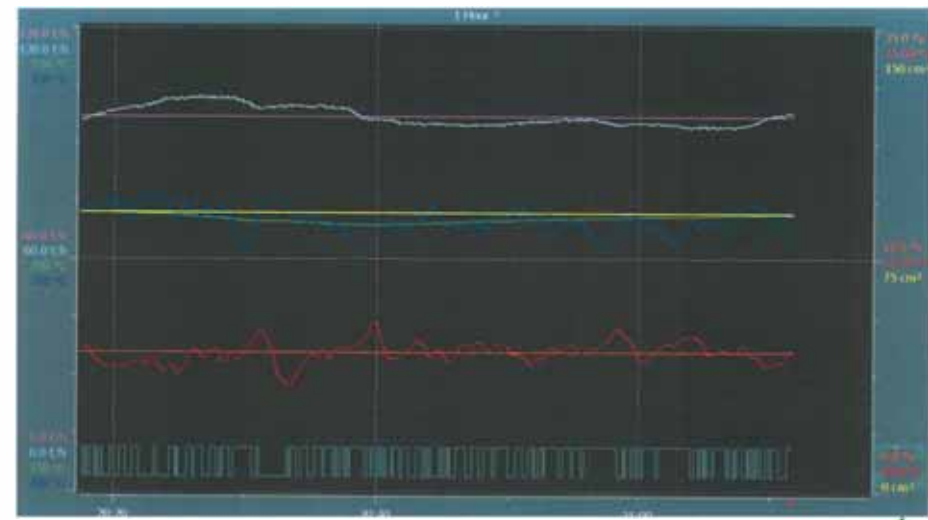
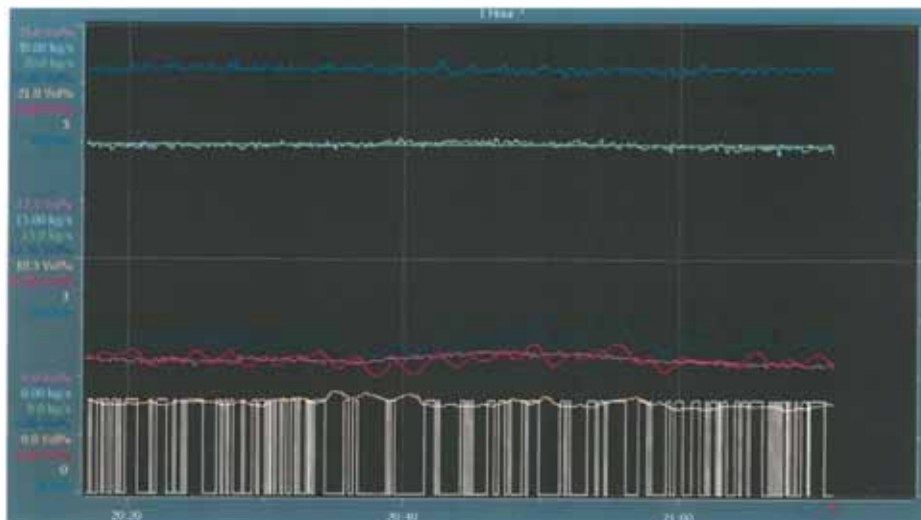
/ Grate and boiler

- Supplier: MARTIN GmbH, Munich (D). Reference no. 375
- Grate: 4 runs, with 3 sections (Vario)
- Boiler 50 bar, 425 degrees
- A lot of inconel. Area with rear ventilated tiles
- Automatic boiler washing and pneumatic rapping
- SNCR (120 mg/Nm³ guaranteed. Actual is 60 mg/Nm³)
- Absorption cooling based on DH



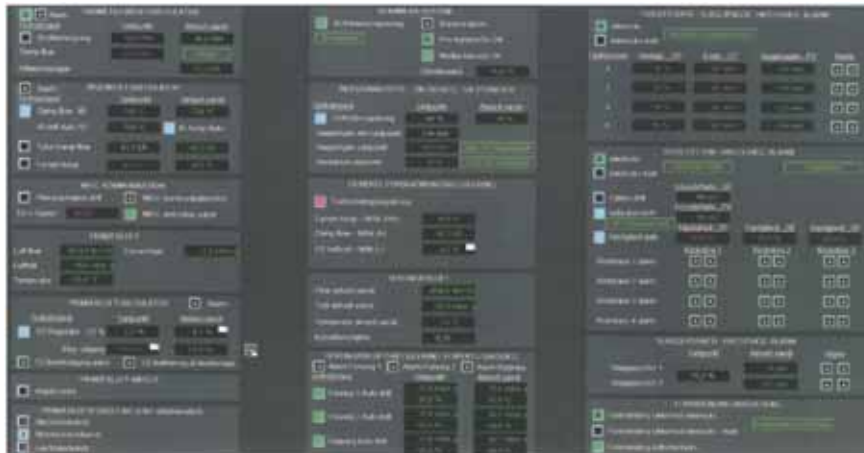
/ Experience with Martin Vario grate

- Availability very high (>8,000h/year). 97% throughput (tonnes/h) since PAC, including all planned and unplanned stops
- Can handle all kinds of waste fractions, but change slowly
- Steam production. 97% average including short stops and DH limitations. Very lively heat uptake, due to Inconel (race horse)



/ Experience with Martin Vario grate

- Combustion control (Temperature, O2 and IR camera)



Hastighed Sætpunkt Ristebane - Individuel drift			
	Drev 1	Drev 2	Drev 3
Ristebane 1	10,0 %	11,7 %	10,0 %
Ristebane 2	23,3 %	16,7 %	10,0 %
Ristebane 3	10,0 %	10,0 %	10,0 %
Ristebane 4	23,3 %	10,0 %	10,0 %

- Much safety and interlocks. Operator interface in two levels?
- Annual revision is a lot of work. Until now changed 3+16 grate bars in two-year guarantee period.
- Hangers in waste chute. Watch out for automatic crane with large grab

/ Flue gas cleaning

- Supplier: LAB SA, Lyon (F)
- Bag house filter after the boiler, followed by economiser, quench/HCl scrubber, SO₂ limestone scrubber, condensing scrubber and aglo filter
- Wet and dry cleaning for dioxins possible
- Traditional waste water treatment
- Vacuum band filter replaced by centrifuge



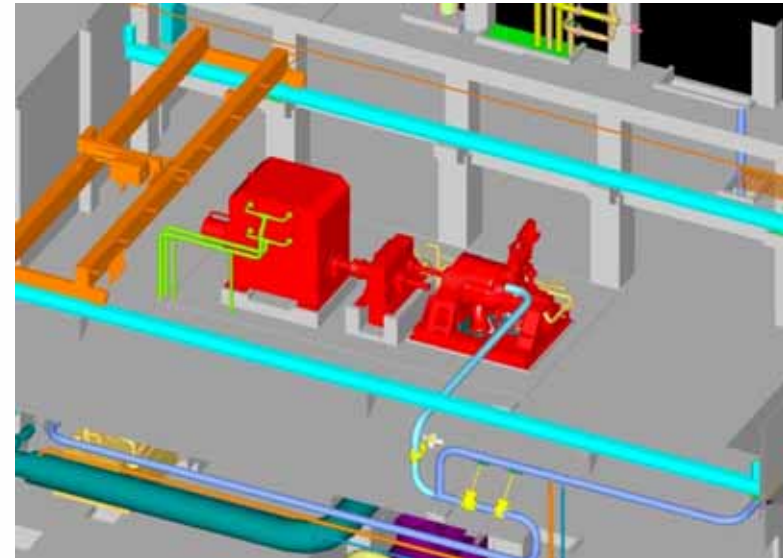
/ Experience with LAB wet flue gas cleaning

1. No emissions, neither flue gas nor waste water
 2. No emissions
 3. No emissions
-
- Beware of the memory effect
 - Still working on ash blockings in the bag house filter chutes
 - Still working to achieve normal service for the WWT



/ Turbine

- Supplier: MAN Diesel & turbo, Hamburg (D)
- Traditional turbine with two district heating condensers
- Pre-heating of feed water
- 18.9 MW electricity, 52.1 MW heat without flue gas condensation



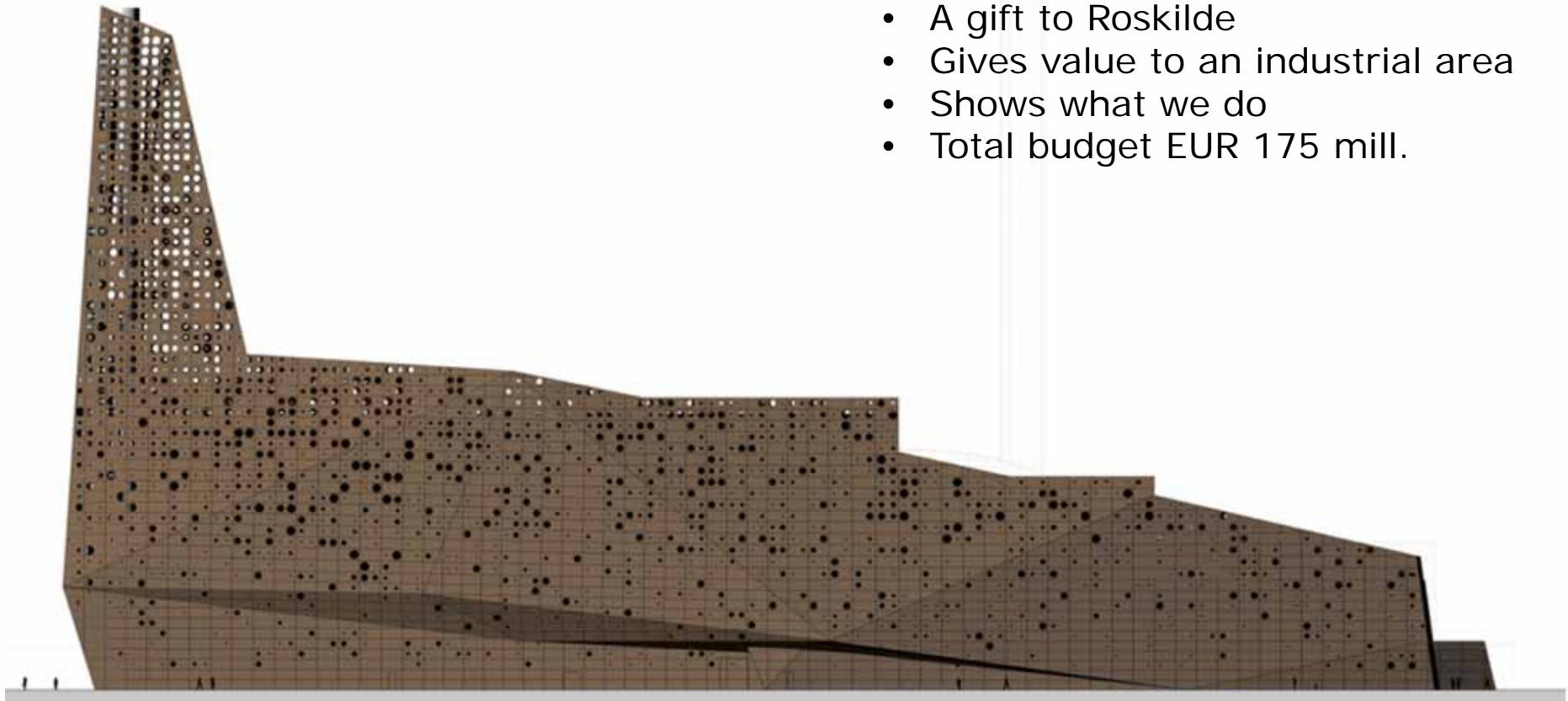
/ Experience MAN turbine

- Generally no problems
- Easy to operate

- Leaking by-pass valve (production failure) resulted in ventilation problems in the turbine
- MAN Diesel & Turbo reacted extremely responsibly, and changed broken turbine blades swiftly

/ Architecture, Energy Tower

- International competition
- A gift to Roskilde
- Gives value to an industrial area
- Shows what we do
- Total budget EUR 175 mill.







/ Thank you for your attention

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