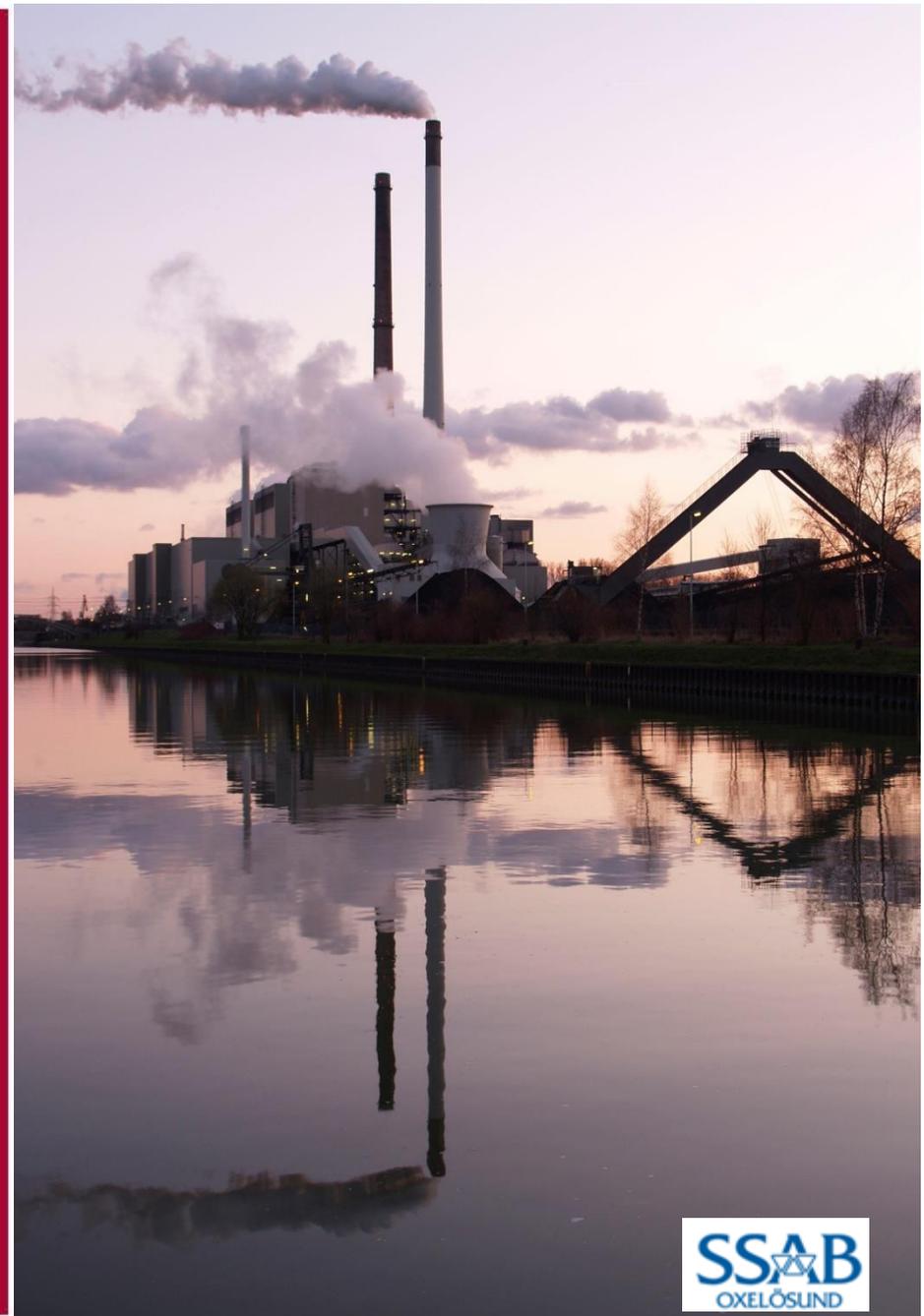


HARDOX[®]
WEAR PLATE

Coal Power Plants

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SSAB
OXELÖSUND

Coal powerstation = mechanical processing of raw materials and by-products

- Brown coal powerstation processes yearly ca 6500 tons raw materials and by-products per 1 MW of the power.
- This figure is rather approximate value and depends namely on quality of the coal and on the actual power during the year. For the black coal power stations, the amount of processed material is substantially lower. Almost 50%.

Raw materials:

- - **Coal**
- - **Limestone** for flue gas desulfurization. Coal contains ca 1% - 5% sulfur.

By-products:

- - **Slag**. Coal contains 10% - 35% ash. After burning the coal the ash is distributed to slag and fly-ash. Ca 1/3 goes to slag, 2/3 goes to fly-ash.
- - **Fly-ash**
- - **Gypsum** (hydrogen calcium sulphat)



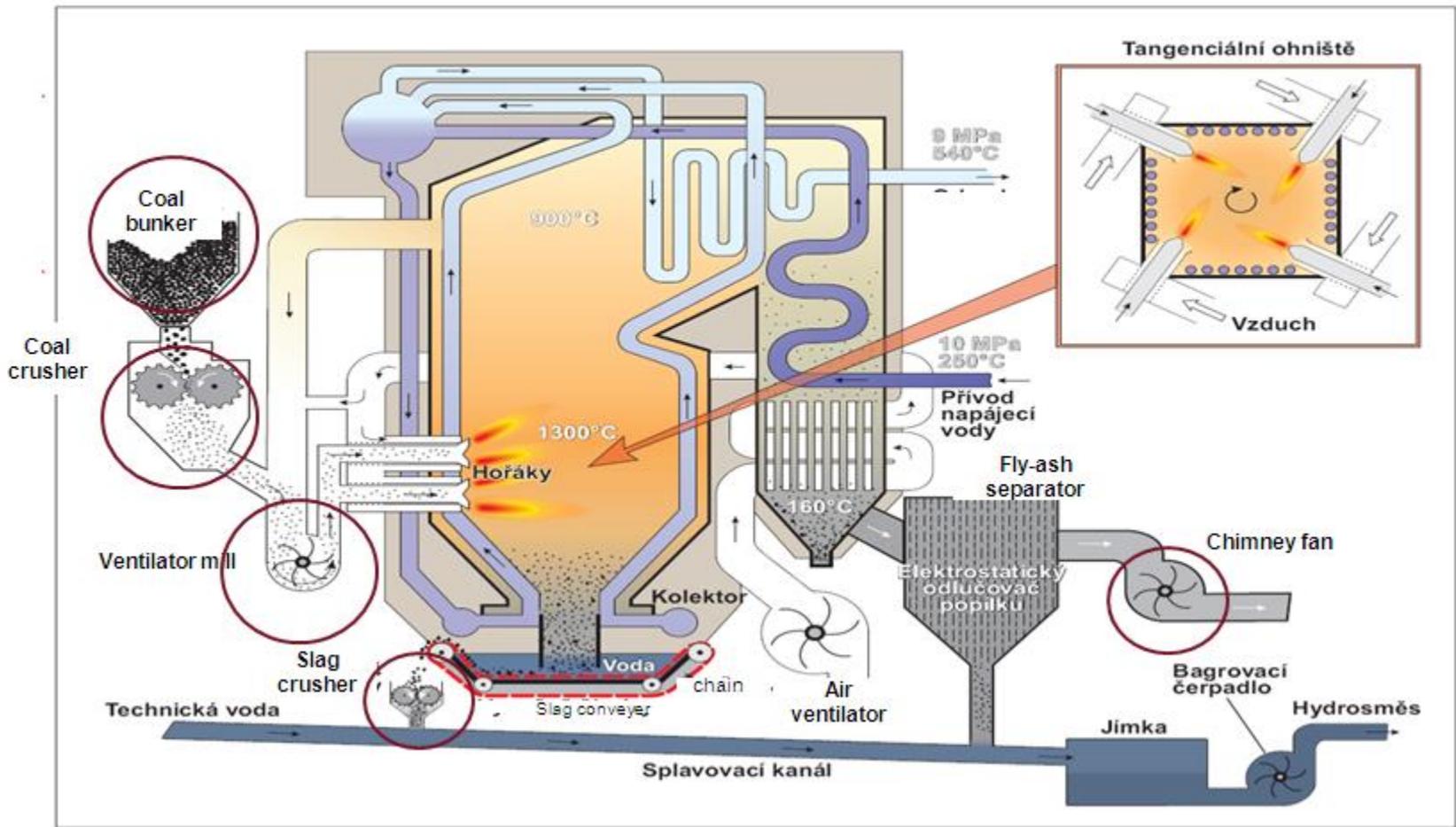
400 MW BROWN COAL POWERSTATION

ANNUAL CONSUMPTION / PRODUCTION
(roughly):

- 2.000.000 tons coal
- 112.500 tons limestone
- 94.000 tons slag
- 188.000 tons fly-ash
- 169.000 tons gypsum

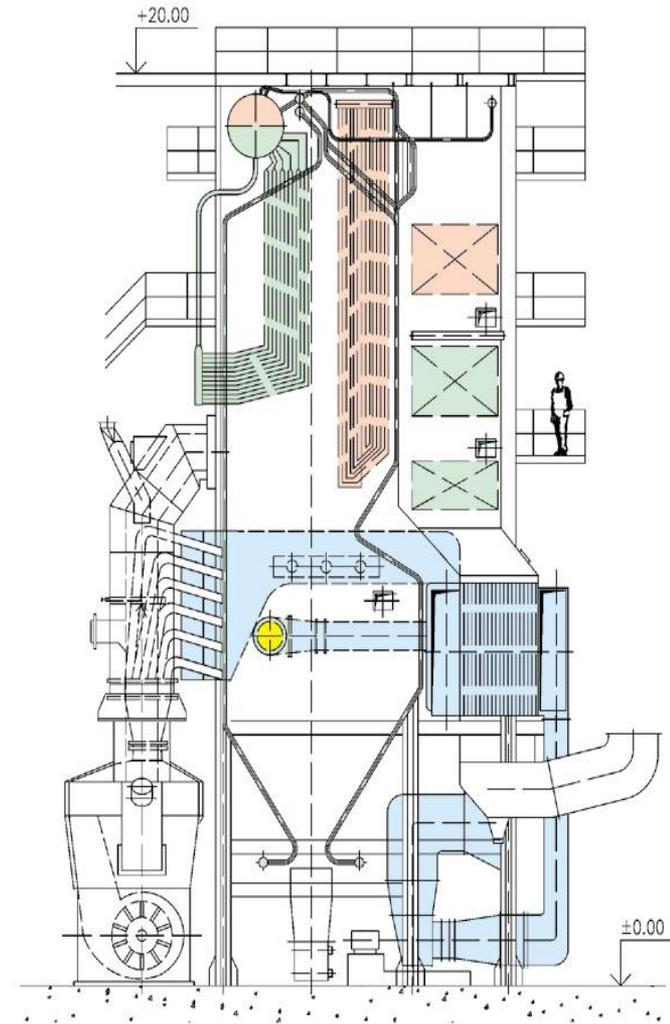


Material flow - burning



Coal processing

- Grain size of the input coal is ca 30 mm – 100 mm. All coal has to be crushed to final granularity 0 – 2 mm.
- The crushing is normally provided in 2 stages (2 different types of crushers). First stage is usually hammer crusher. Second stage is normally ventilator mill or ball mill.
- Coal is not just coal! Coal contains ca 30% of another minerals (quartz, pyrit, illit, ortoklas, plagioklas, chlorit). These minerals are responsible for wear.

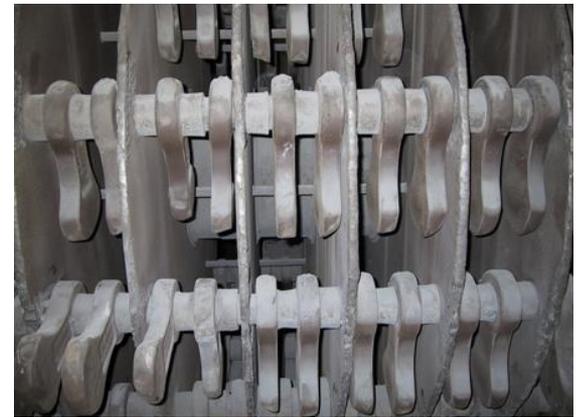


Coal processing – the crushers

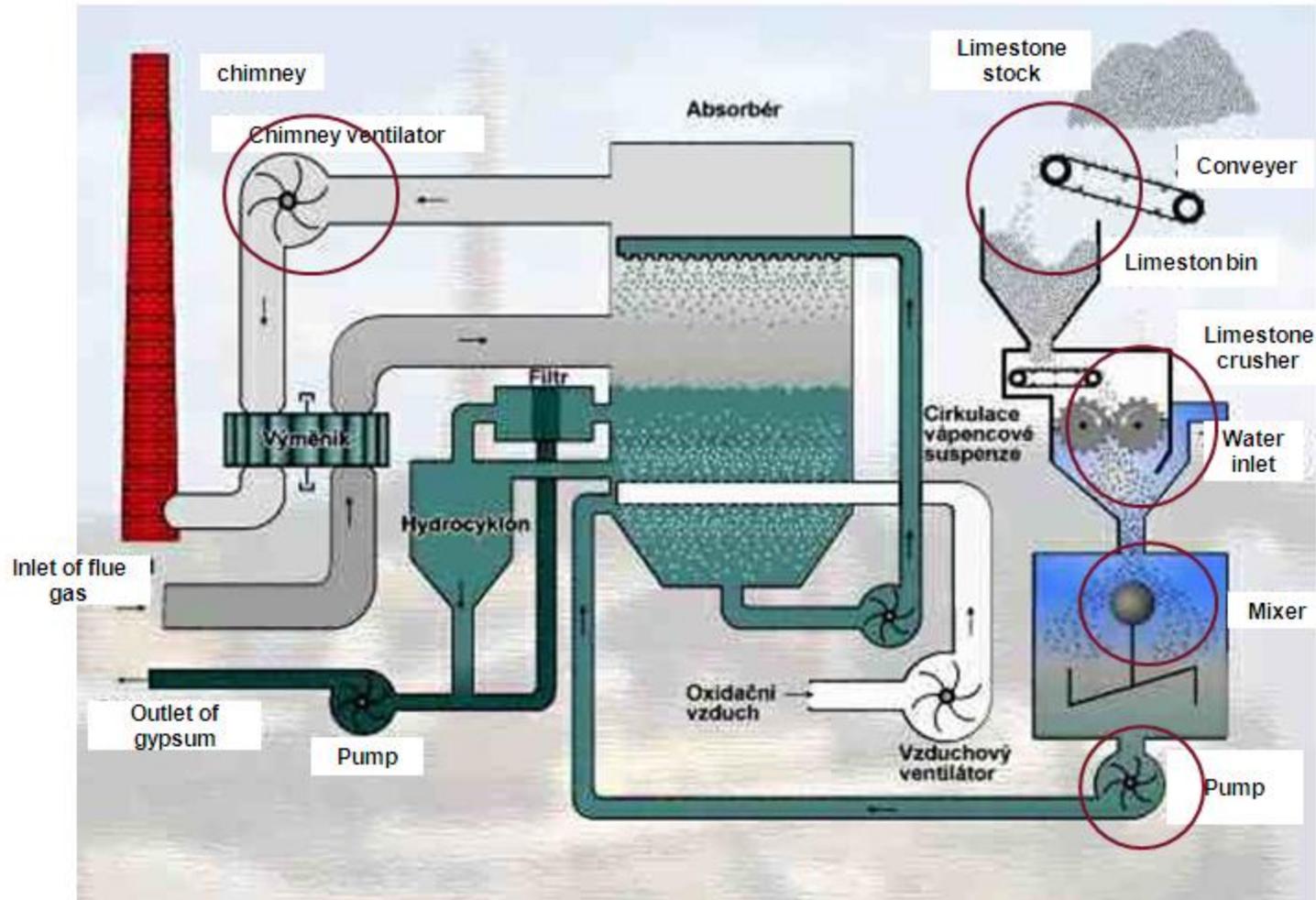
Hammer crusher. The hammers are usually from 12%Mn cast steel. Thickness 50 mm – 120 mm. It is supposed that HARDOX 500 will have approximately the same lifetime as 12%Mn. HARDOX 500 will be better.

Ventilator mill. It works at higher temperatures (200 – 400 °C). Erosion instead of abrasion. For the impact desks is used everything (from S355 to high Cr cast iron). HARDOX 500, 15 mm were successful as liner plates.

Ball mill. Coal is crushed by balls which are run up by special wear resistant cast lining. Just entry part is potential application for HARDOX. (HX500, 12 mm)



Material flow - desulfurization



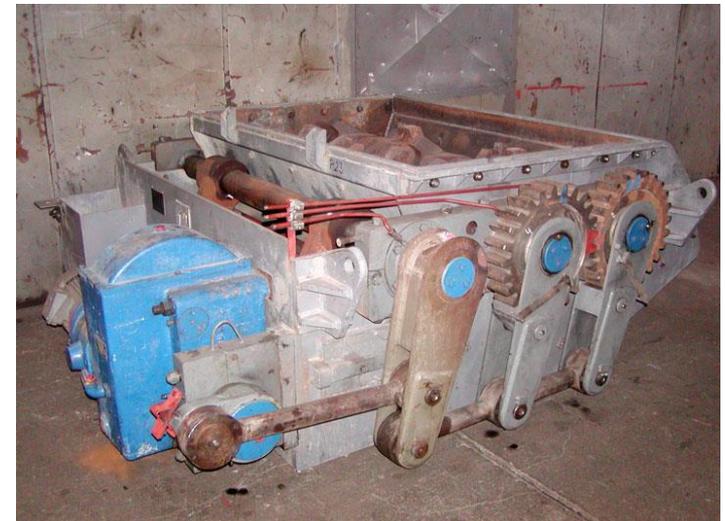
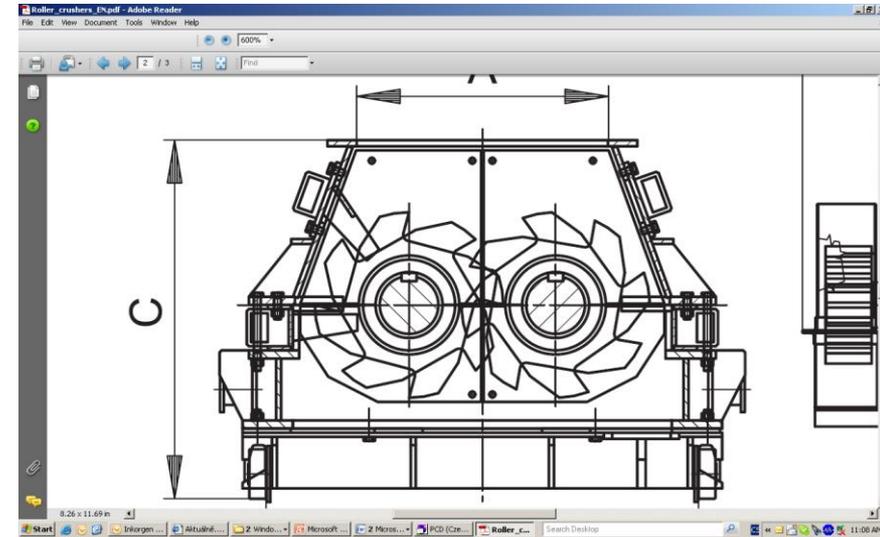
Limestone processing

- The crushing is normally provided in 2 stages (2 different types of crushers). First stage is usually hammer crusher. Second stage is normally ball mill.
- Hammer crusher. The hammers are usually from 12%Mn cast steel. Thickness 50 mm – 120 mm. It is supposed that HARDOX 500 will have approximately the same lifetime as 12%Mn. HARDOX 550 will be better.
- Ball mill. Coal is crushed by balls which are run up by special wear resistant cast lining. Just entry part is potential application for HARDOX. (HX500, 12 mm)
- Limestone contains quartz!!! Ca 5% - 30%. The quartz will decide about lifetime.



By-products processing

- Slag has to be crushed to enable using it for another processing. Before crushing is slag cooled down by water, so the temperature is normally under 100°C.
- Slag contains SiO₂ (quartz), Al₂O₃, CaCO₃, Fe₂O₃. Majority is quartz.
- For the crushing are used roller crushers (see pictures). They are also called teeth crushers. For the teeth rolls can be used HARDOX 500, 550 or 600. Thickness 20 mm.
- Because of high content of quartz HX600 should be used. But we have also good experiences with HX500.



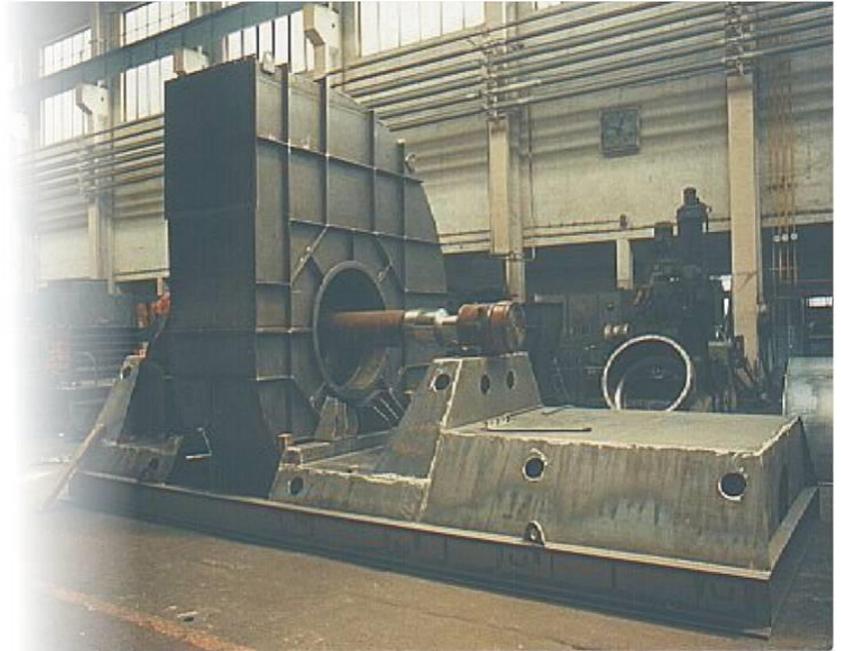
By-products processing

- By-products from desulfurization (gypsum) have to be also processed. Substantial part of the process is in wet condition, but also here could be HARDOX used. We have positive experiences with blades of compounder (HARDOX 500, 8 mm).
- Fly-ash is fine enough – no crushing. Nevertheless it has to be transported, mixed (with slag, gypsum).



Pipelines and ventilators

- More or less all coal and part of by-products are transporting in/from the steam generator (boiler) by pipeline. This means rather high wear.
- Type of wear is mostly (unfortunately) erosion. We havent enough knowledge to quantify erosion.
- Some parts of the pipeline system work in higher temperatures.
- We know HARDOX application in this area.



Summary

- Coal powerstation = mineral processing
- Dominant wear is probably due to quartz
- Hammers (hammer crushers) are potentially biggest consumer of HARDOX.
- Ventilator mills are also big potential, if we solve wear problems (erosion, temperature)
- Roll (teeth) crushers,= running business
- Power stations are using often external maintenance service. It means that also repairs of crushers (incl. spare parts) are provided by other firms.
- Maybe primarily Wear Parts business

