

First experiences from large scale co- gasification tests with refined biomass fuels

**Presentation at Central European Biomass Conference
International workshop: Torrefaction of biomass
17th January 2014, Graz, Austria**

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Production of **Solid Sustainable Energy Carriers**
from Biomass by Means of **TORrefaction**

SECTOR - Production of Solid Sustainable Energy Carriers from Biomass by Means of Torrefaction

A European R&D Project funded within the Seventh Framework Programme by the European Commission

Task 7.3 (Co-) gasification in entrained-flow gasifiers (-UmU-, Vattenfall, ECN)

[Vattenfall will carry out the co-gasification tests in the Buggenum Power Plant that is owned and operated by N.V. Nuon Energy (Nuon) which is a third party to Vattenfall.]



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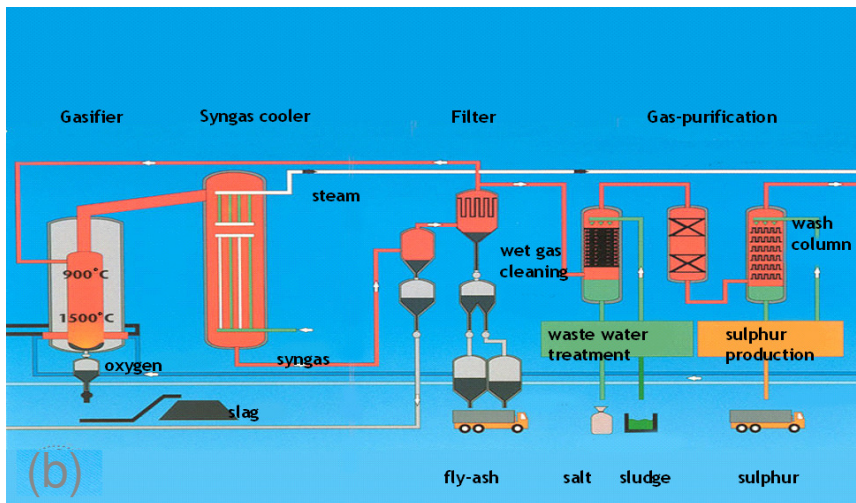
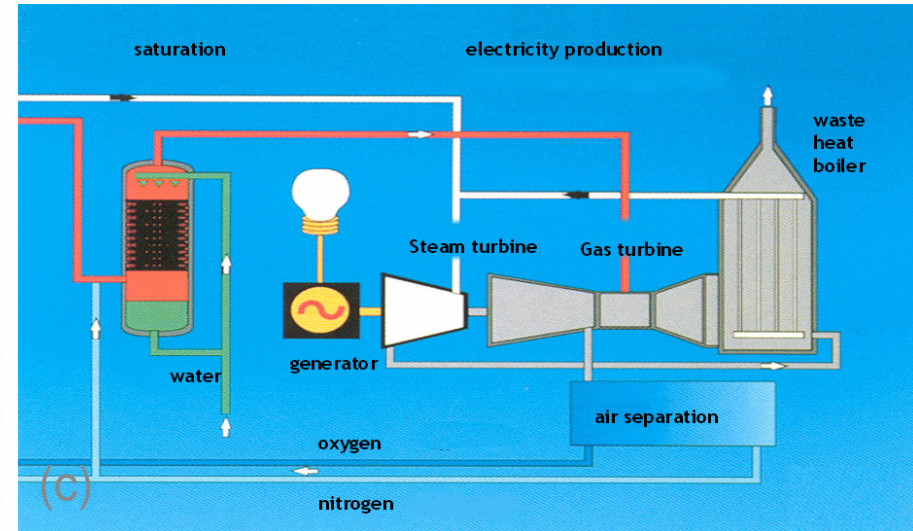
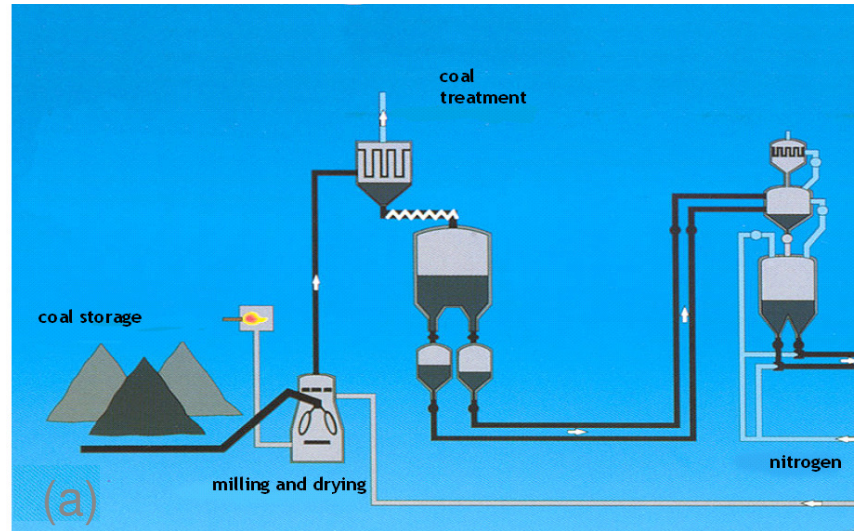
The research leading to these results has received funding from the European Union Seventh Framework Programme FP7/2007-2013 under grant agreement n° 282826

Willem Alexander Centrale Buggenum



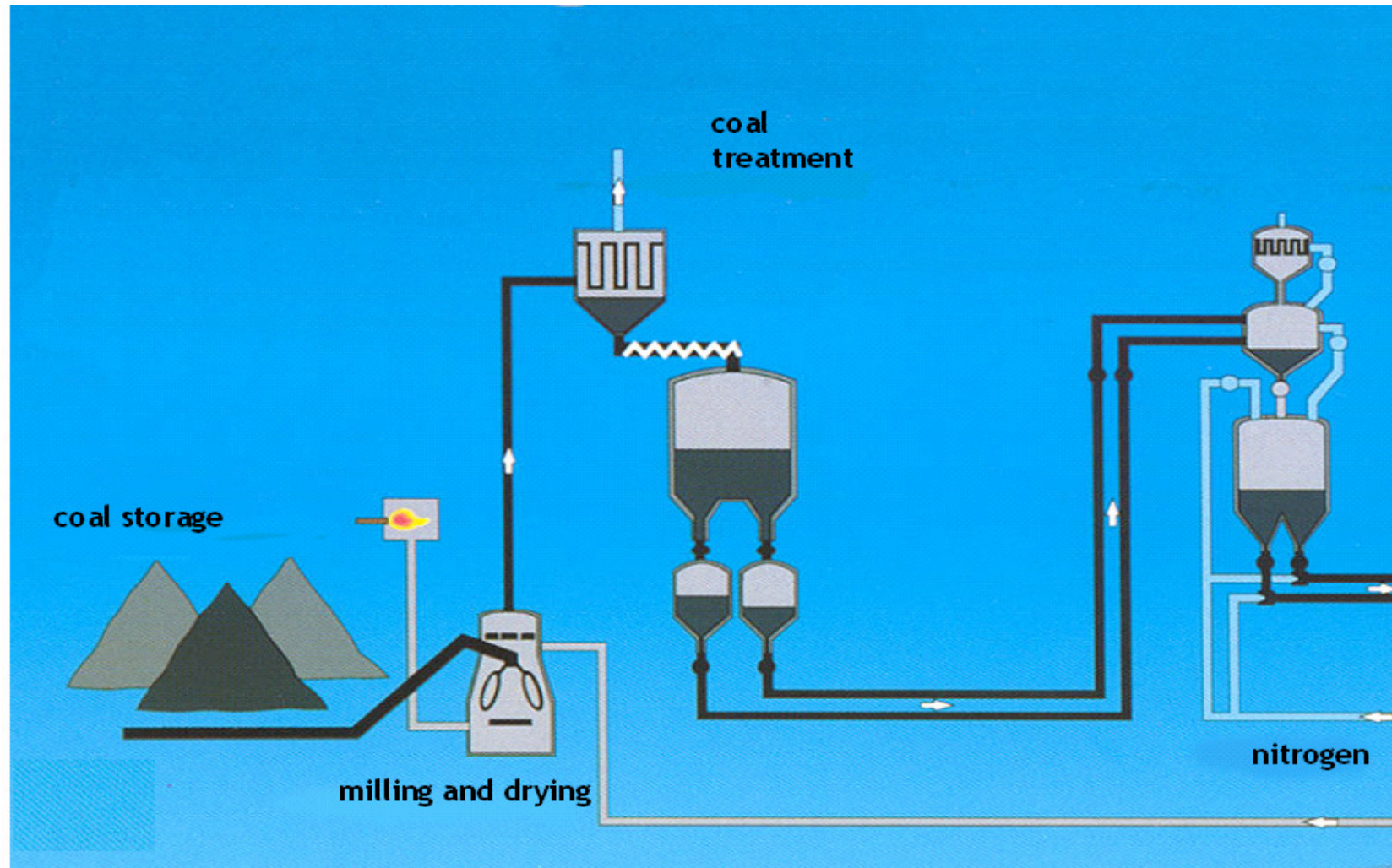
- A 253 MW_(el) power plant, entered service in 1993 as a coal gasification demonstration plant
- Hard coal as main fuel but continuous co- gasification of saw dust up to 15% (wt.
- Co- gasification of thermally treated wood was tested at the plant:
 - Torrefaction product: ~1500 tons
 - Steam explosion product: ~5000 tons
- The plant closed down at April 1st 2013.

Process Scheme WAC Buggenum

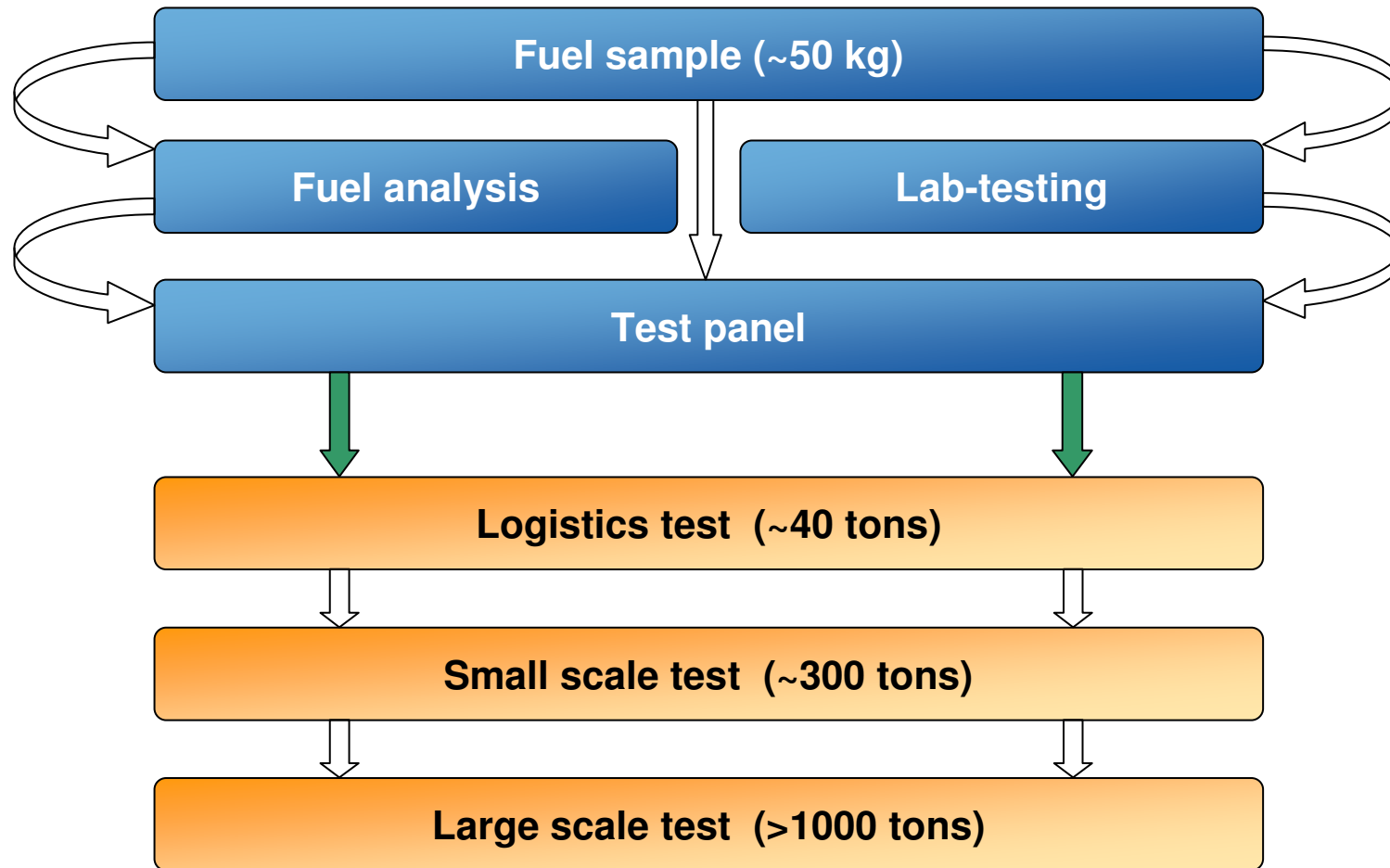


- a) Fuel handling/ preparation
- b) Gasification/ gas cleaning
- c) Steam and Electricity generation

Process Scheme WAC Buggenum



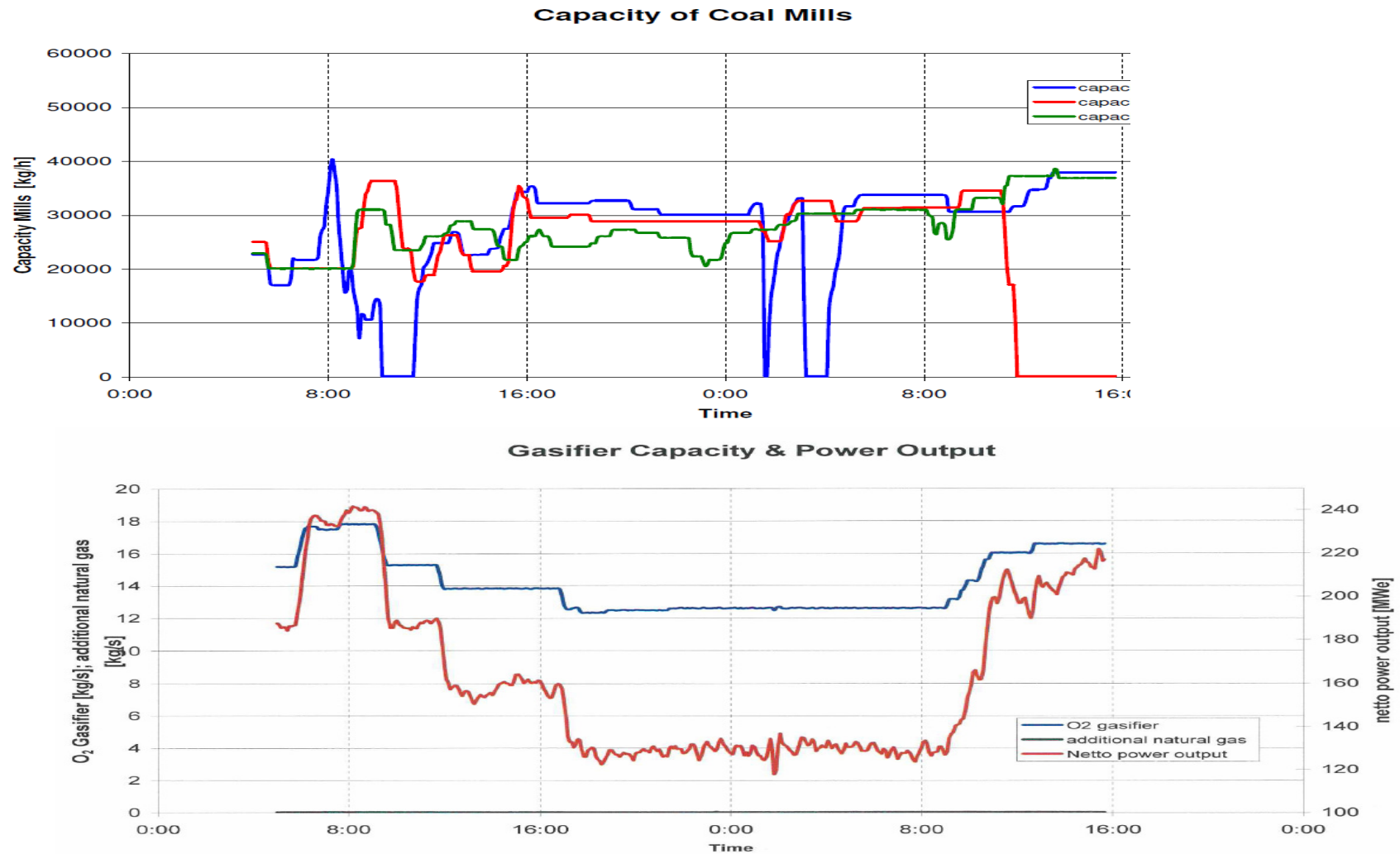
Test campaign – Test protocol for new fuels



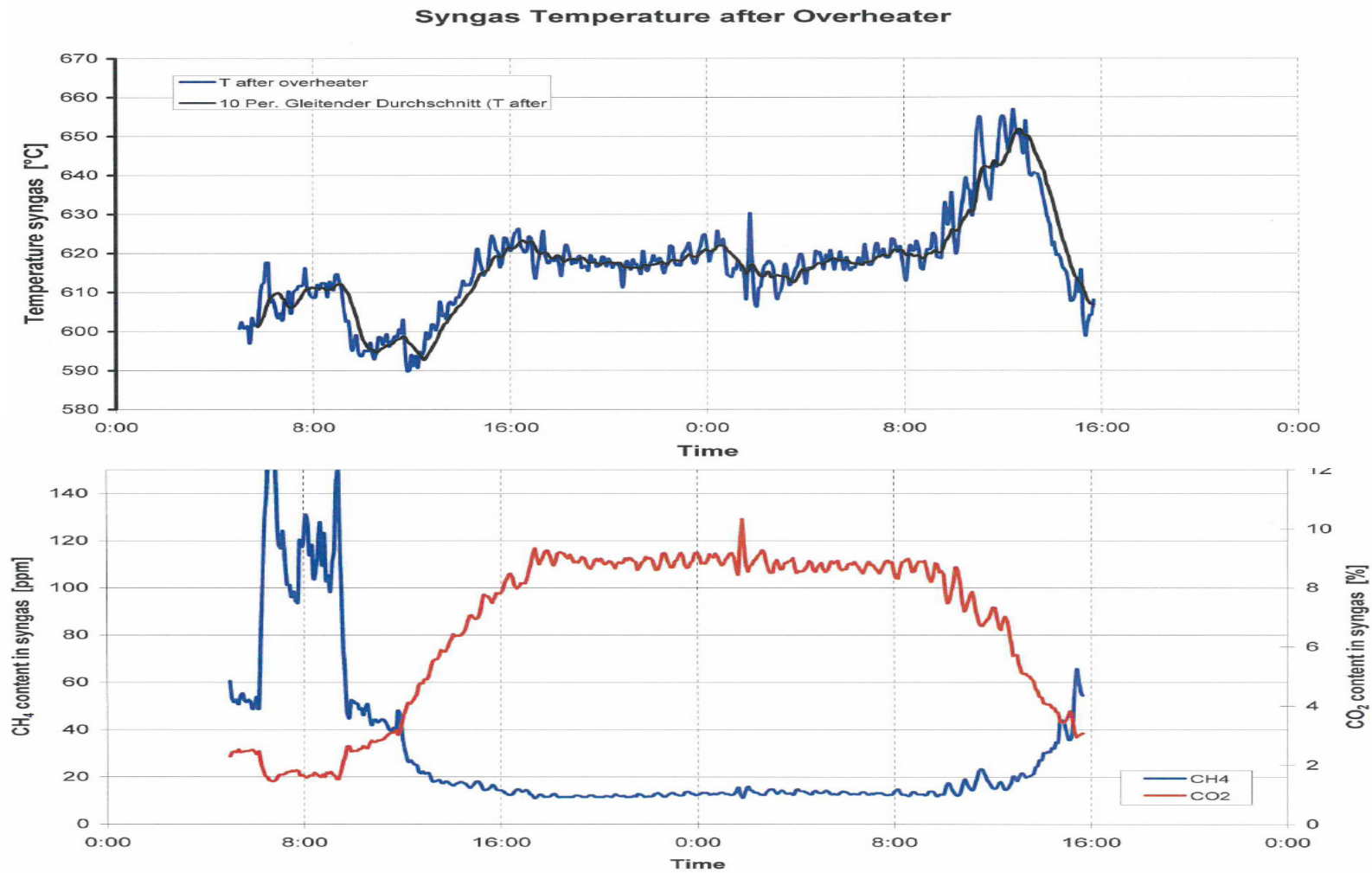
Excution

- Approximately 1200 tons of torrefied fuel was co- gasified together with hard coal in a ~24 hrs test campaign.
- The mixing rate was ~70% on energy basis.
 - Logistics
 - Milling
 - Off gas treatment of Coal Mill Dry installation
 - Sluicing
 - Nitrogen usage

Mill capacities and plant output



Temperature and gas composition



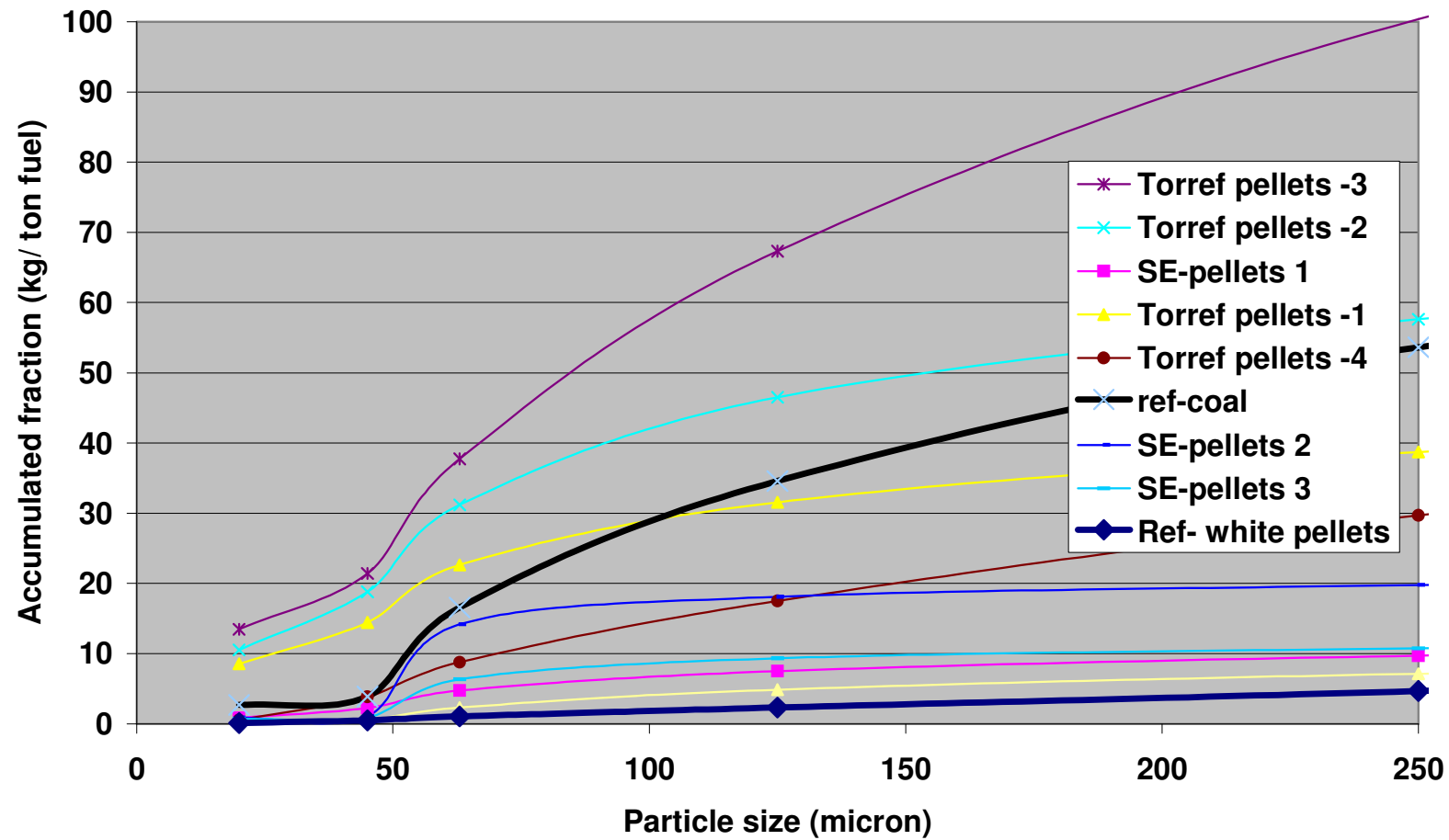
Main issue: dust formation



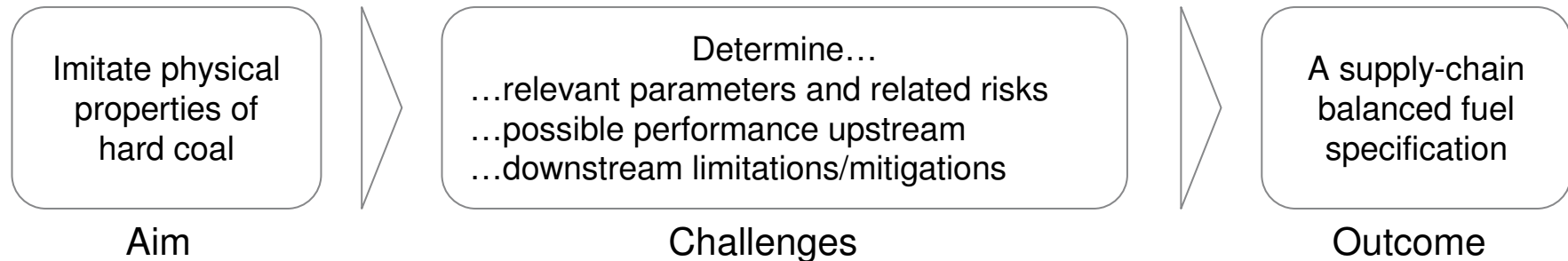
Large scale co-gasification | Nader Padban| PS International Torrefaction work shop _CEBC - 2014-01-17, Graz, Austria

Dust formation- Lab scale

Extended durability test: formation of fines (<250 micron)



Product quality: state of the art



Status

	Dust	Water resistance	Smell	Milling capacity	LHV (MJ/kg)
Steam explosion	✓/✓/✓	✓/✓/✓	✗ Open storage not accepted close to residential	✓ Derating at high load	18.5-20
Torrefaction	✗/✗/?	✓/✗/?	✓/?/?	-/✓/?	20-22.5

Note: Size of sign indicate size of test: lab/demo/full-scale

- Steam explosion fuel proven today, at relevant co-firing rate, with minor downstream modifications
- If dust problems solved for torrefaction, properties probably superior compared to steam explosion BUT at the cost of higher feedstock losses

Main conclusions

- Tested torrefied pellets had a lower mechanical durability than normal wood pellets resulting in a high dust formation during handling.
- The minimum ignition energy (MIE) for the dust from torrefied fuel was too low.
- Long term outdoor storage of torrefied material requires an improvement in weather and water resistance of the pellets.
- No big technical challenges were observed during conveying, sluicing and milling of the 70% mixture.
- It was estimated to be possible to achieve 90% of the plant nominal capacity without major modification in fuel feeding system.
- A higher heating value in the pellets was connected to better milling property but a less advantageous dust formation behavior.



Thank you for your attention!

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