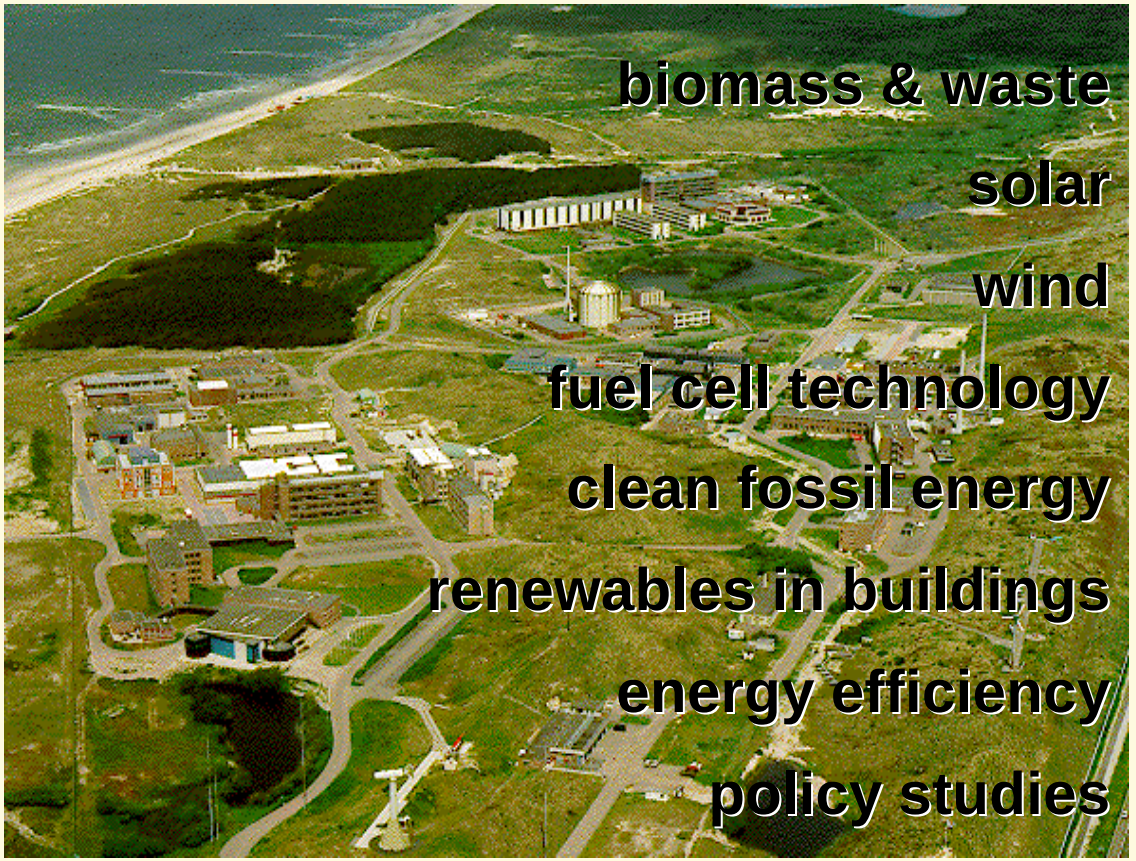
WASTE GASIFICATION

CFB and SWR

Bram van der Drift ECN, the Netherlands



CONTENTS:

- introduction
- CFB
- SWR
- conclusions

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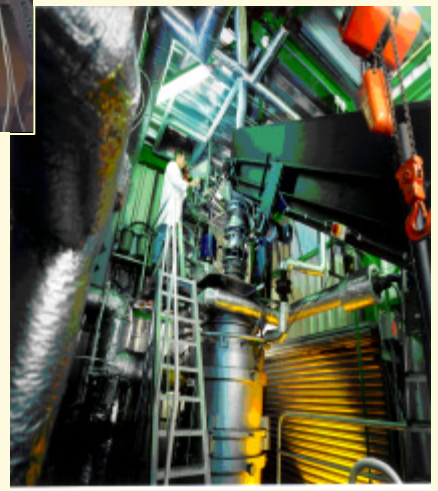
gasification facilities

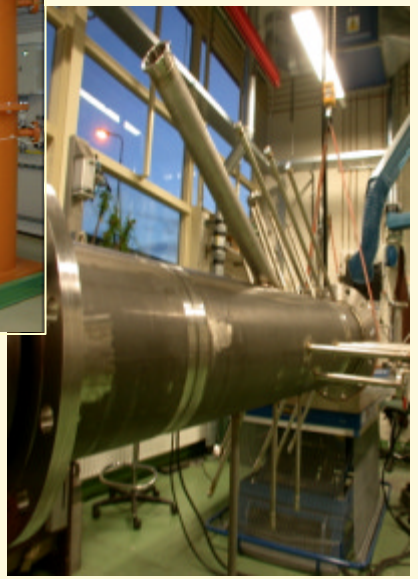
100 kg/h CFB gasifier

1 kg/h BFB gasifier

5 kg/h screw gasifier



40 kg/h downdraft gasifier



5 kg/h BFB or indirect gasifier

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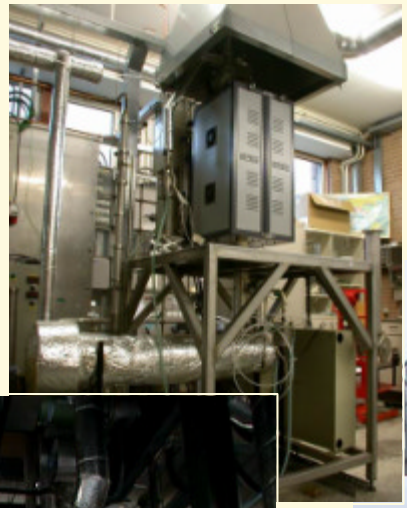
gas cleaning facilities

GASREIP : water based gas cleaning



thermal cracker

wet ESP

high-T filter

OLGA: oil based gas cleaning

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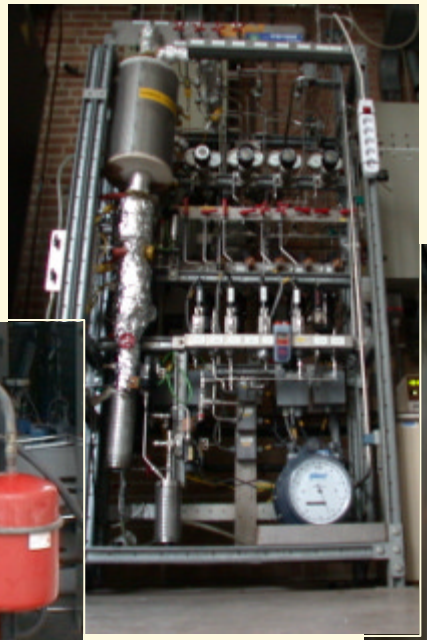
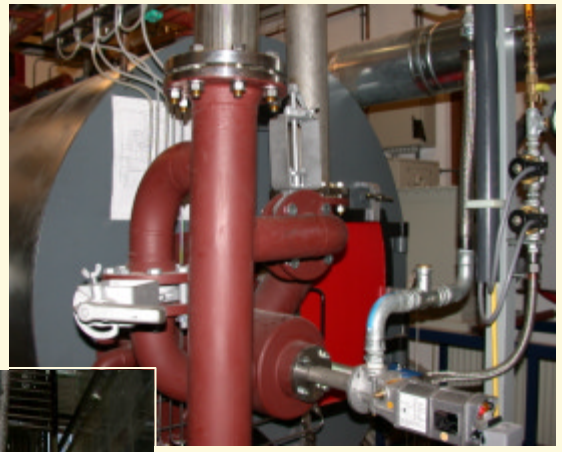
gas utilisation facilities

flare

Fischer-Tropsch/SNG reactor



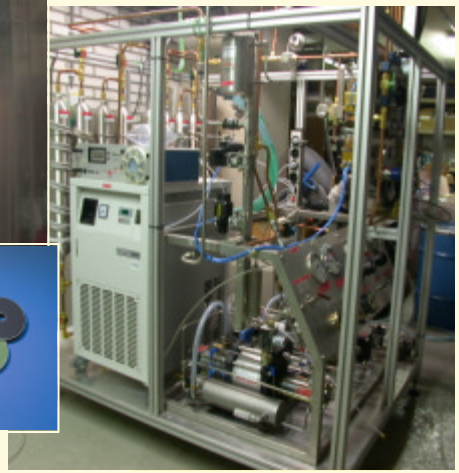
boiler



gas engine

SOFC

gas compression



WASTE GASIFICATION

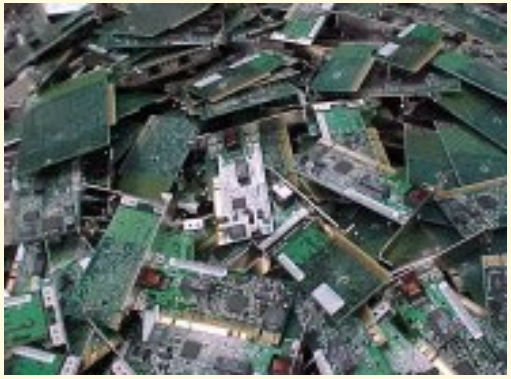
CFB fuel:

- high calorific
- uniform

demolition wood

SWR fuel:

- high calorific
- high ash
- high metal



electronic scrap

CFB: circulating fluidised bed
SWR: solid waste resourcer

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CFB GASIFICATION

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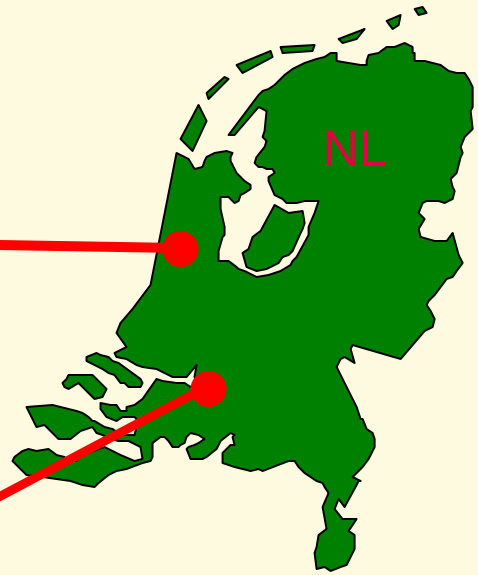
- test unit
- many fuels: demolition wood, railroad sleepers, plywood, chicken manure, grass, straw, ….
- fuel input: 0.5 MW_{th}
- various gas cleaning options

ESSENT

- co-firing in 600 MW_e PF-coal boiler (+ESP+deSO_x)
- demolition wood
- fuel input: 85 MW_{th}
- electricity output: ca. 30 MW_e
- CFB-gasifier by Lurgi



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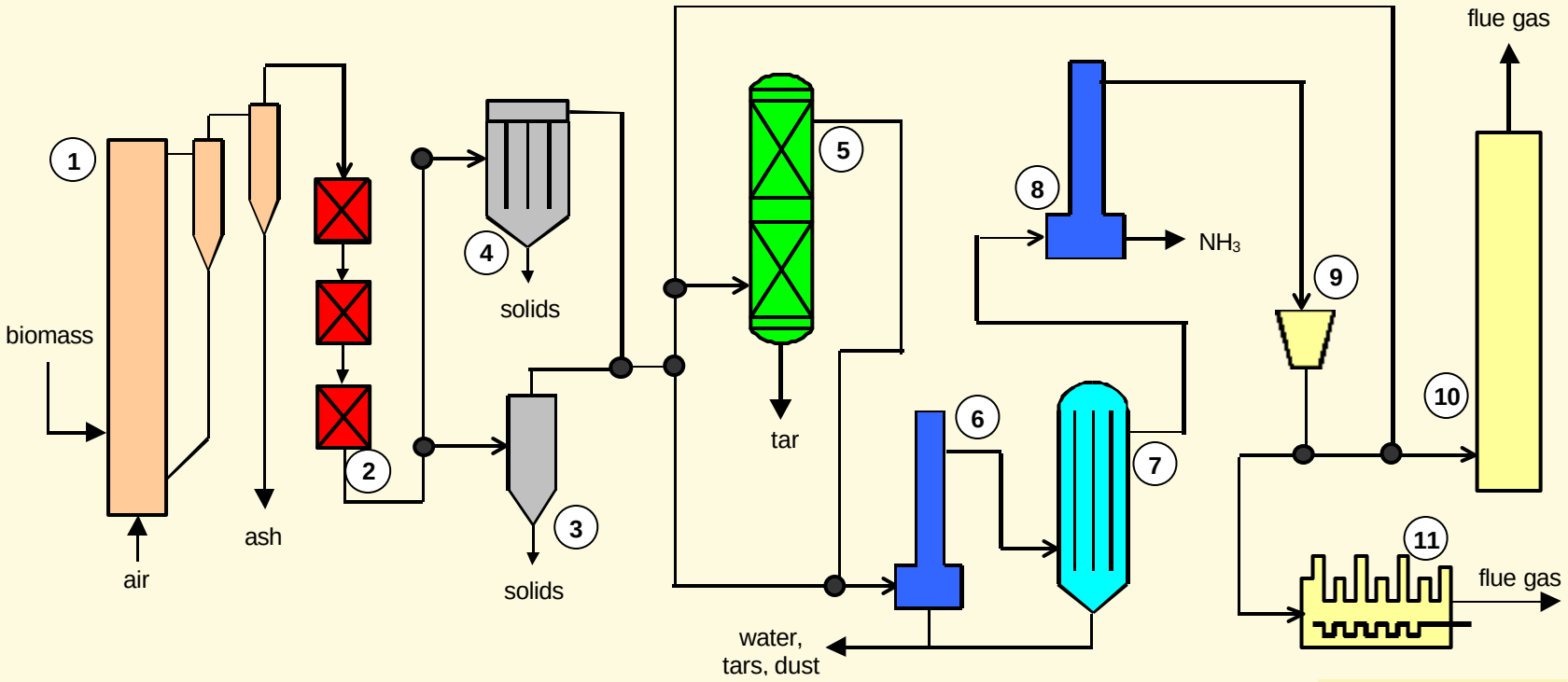
ECN CFB GASIFIER
pilot scale system



(1) 500 kW_{th} circulating fluidised bed (CFB) gasifier; (2) three-stage gas cooler to cool to ~300/350°C; (3) cyclone at 300°C; (4) hot gas filter with sinter metal candles at ~350°C; (5) OLGA tar removal unit; (6) water (NH_3) scrubber; (7) wet Electro-Static Precipitator (ESP); (8) stripper; (9) booster; (10) low-NOx-burner; and (11) gas engine or SOFC or Fischer-Tropsch reactor. The black circles indicate valves.

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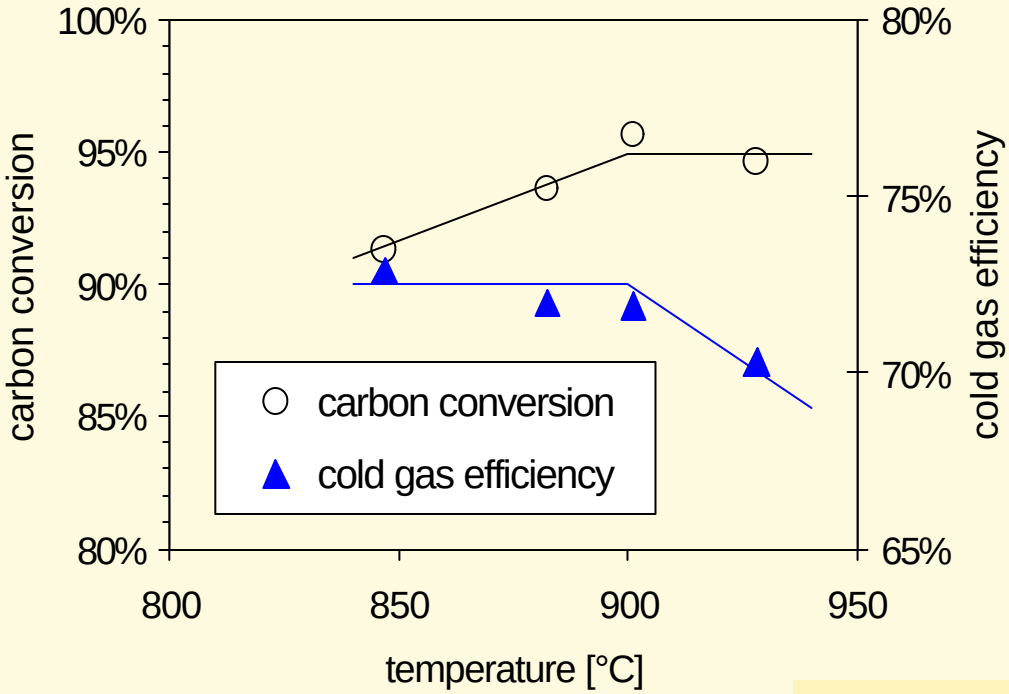
ECN CFB GASIFIER
research

TEMPERATURE:
- efficiency
- conversion
- tar problems
- agglomeration



source: report
ECN-C-02-095

ECN

ECN CFB GASIFIER
research

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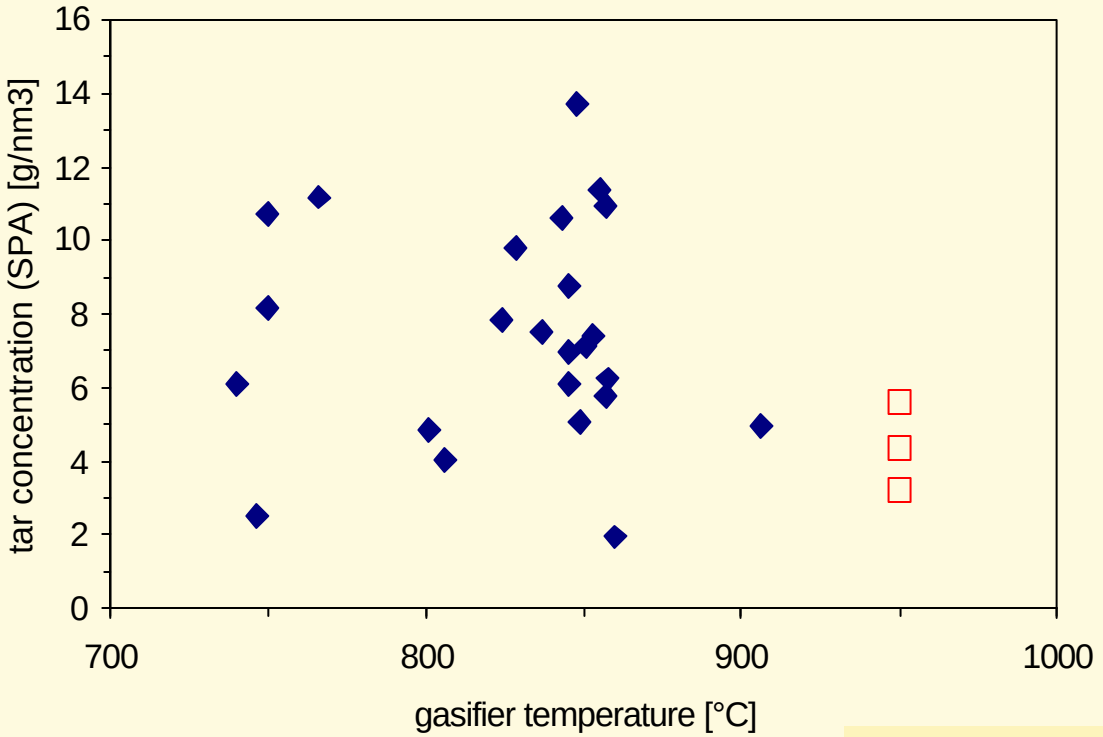
- agglomeration



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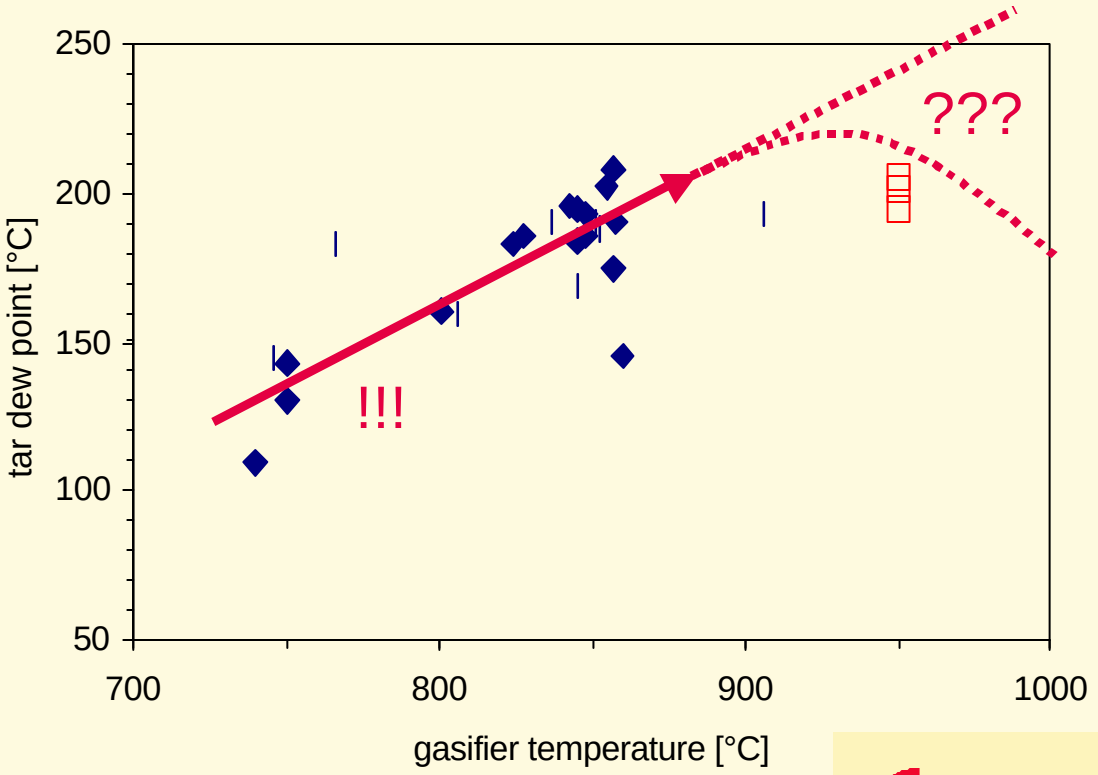

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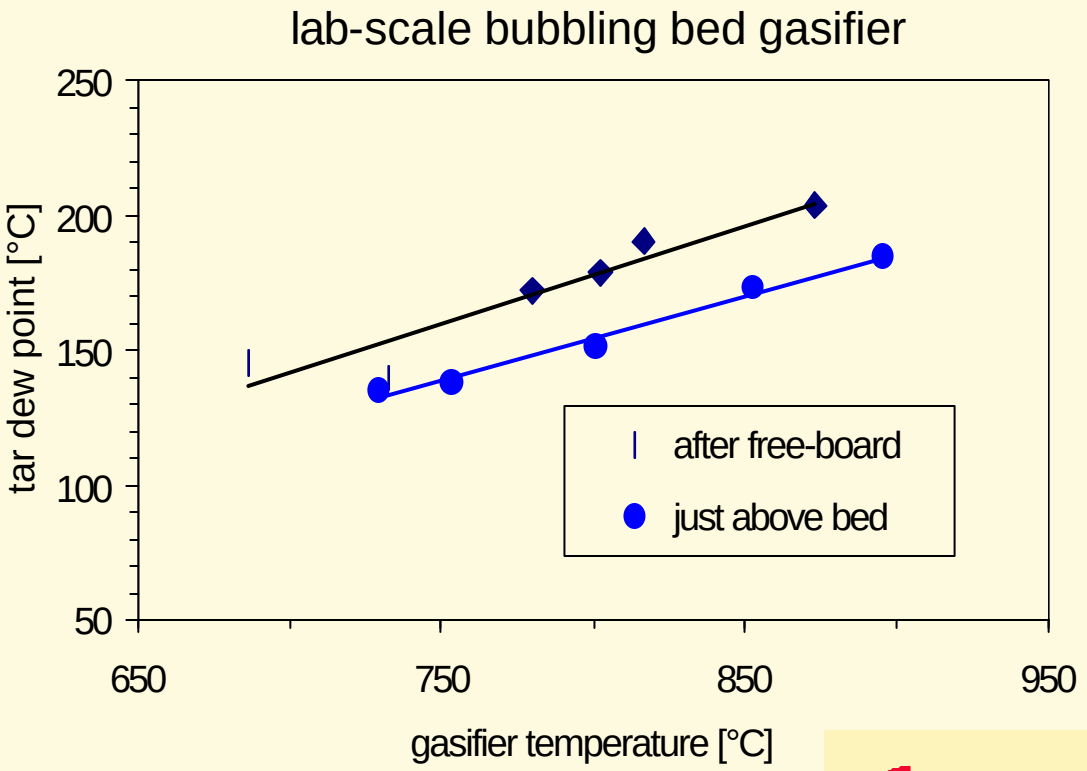

ECN

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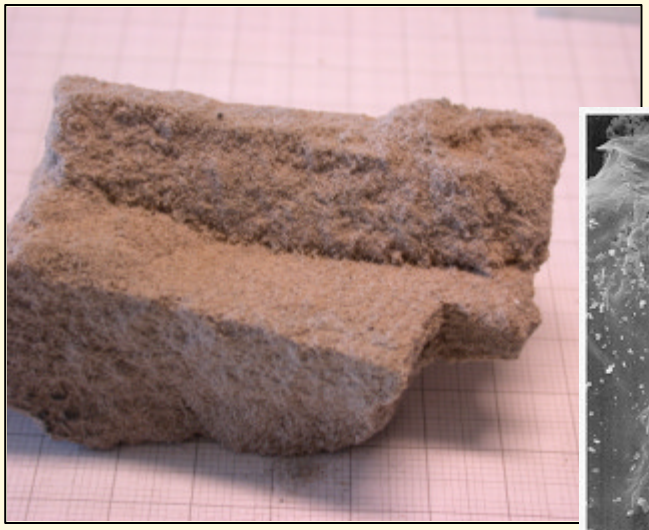

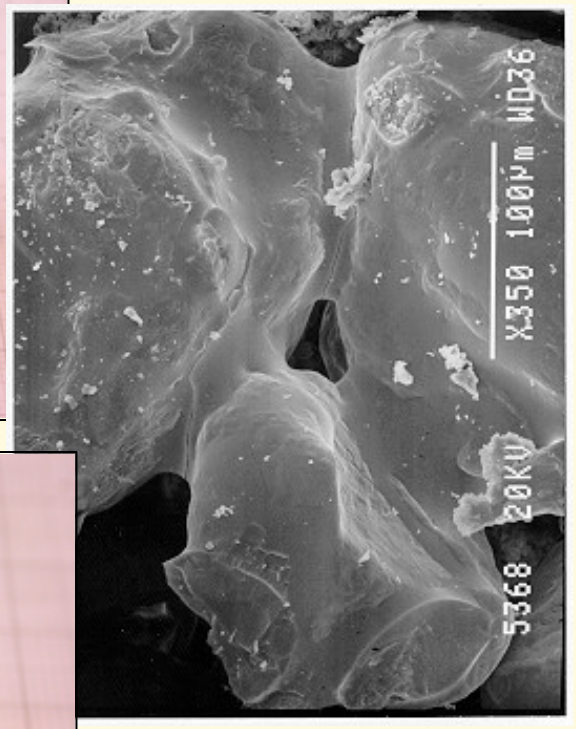

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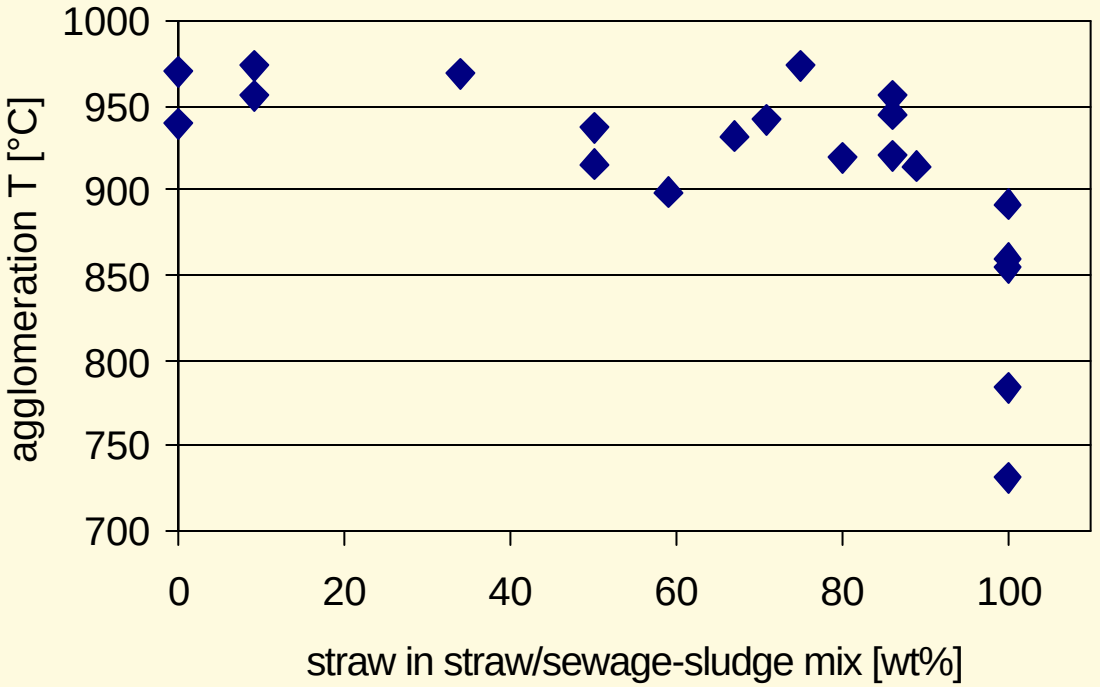

source: report
ECN-C-99-090

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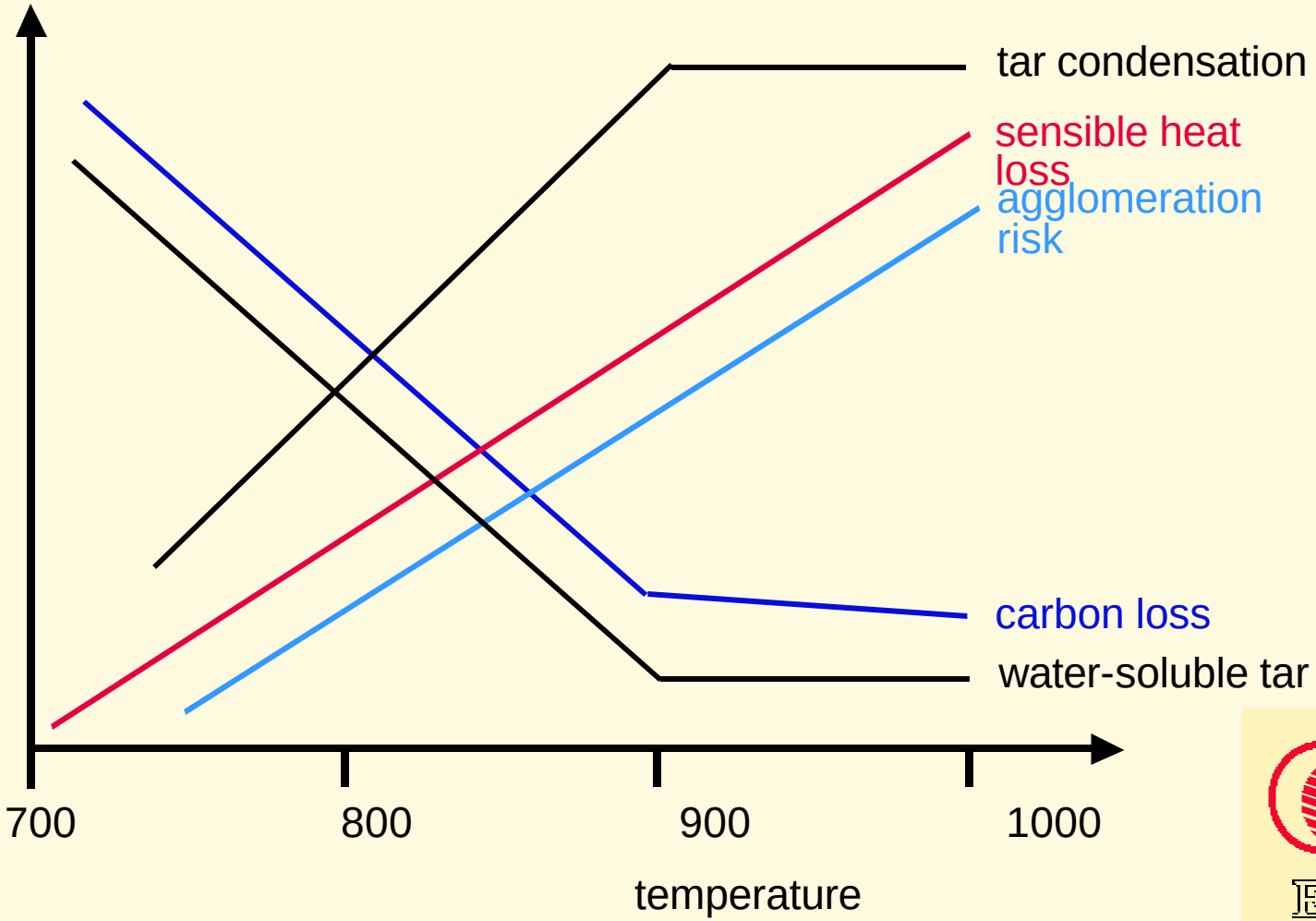
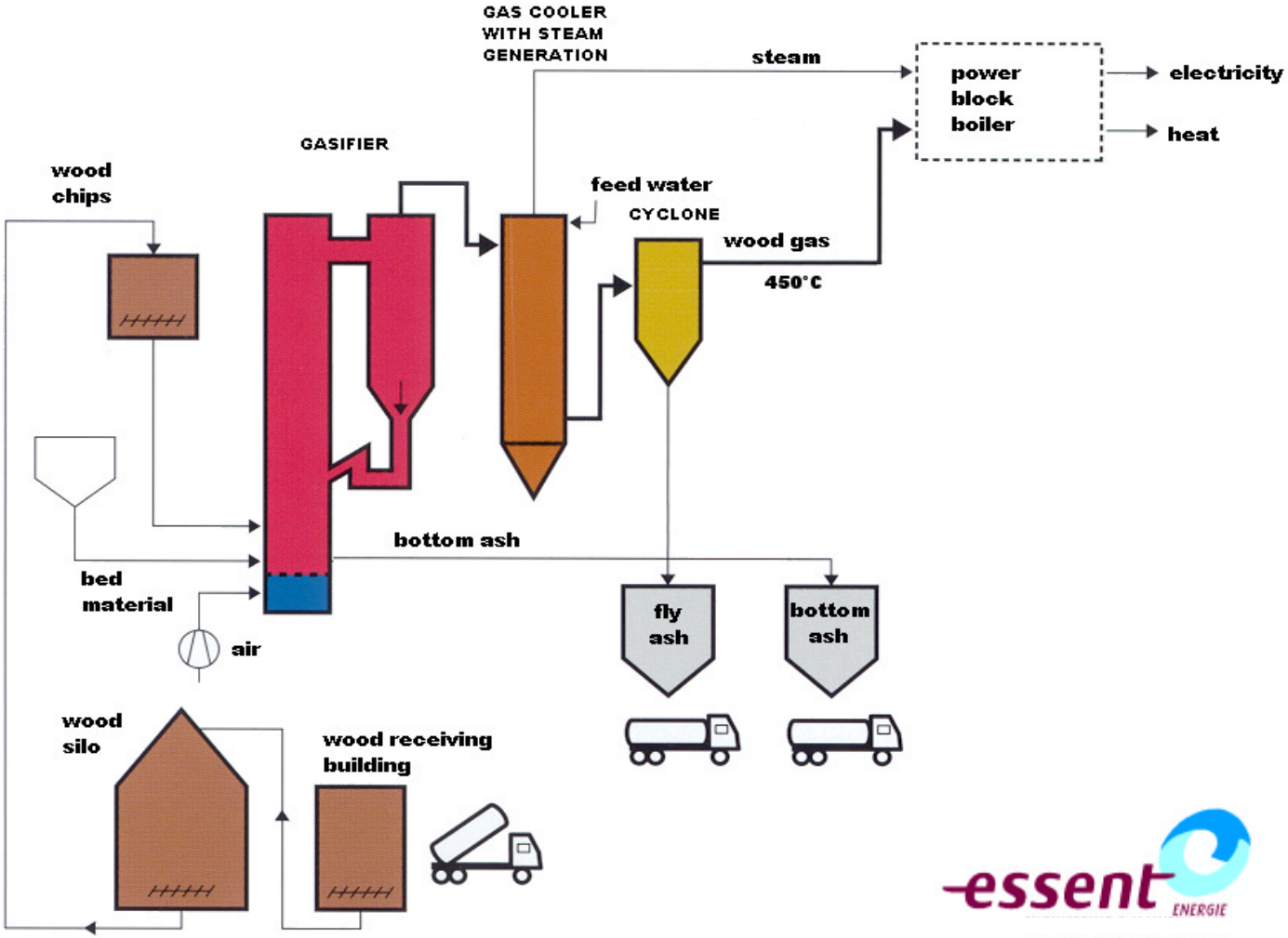
ECN CFB GASIFIER

best temperature….



ECN

ESSENT CFB GASIFIER *system*



ECN

ESSENT CFB GASIFIER

essent ENERGIE

ECN

ESSENT CFB GASIFIER
status

original design:

- assumption: N is critical (NO_x)
- cooling (200°C), filter, water scrubbing, tar removal, etc

presently:

- NH_3-removal not necessary
- cooling (450°C) and cyclone
- 1500 h total gasification time
- longest run: 5 days

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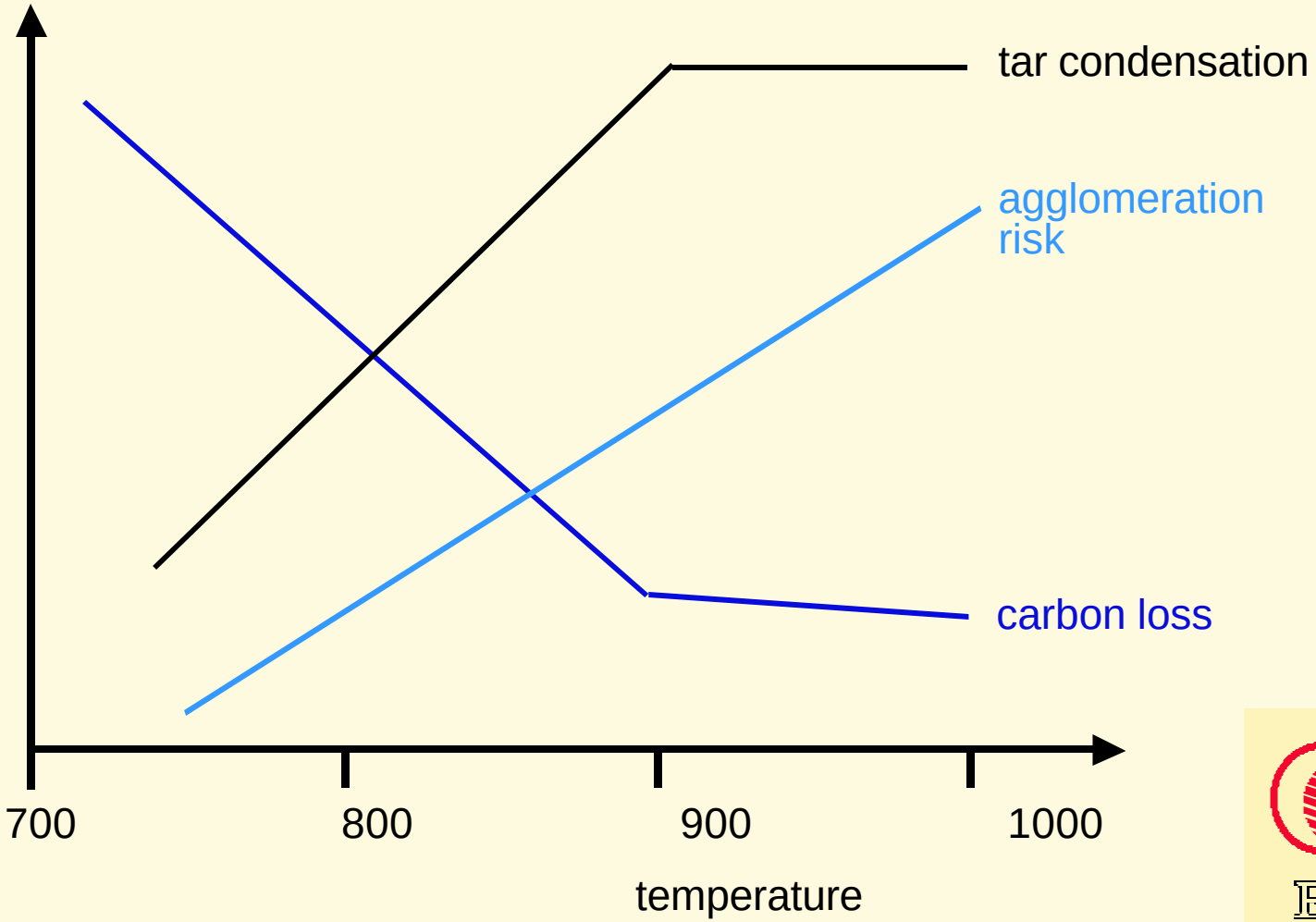
ECN CFB GASIFIER

best temperature….ESSENT



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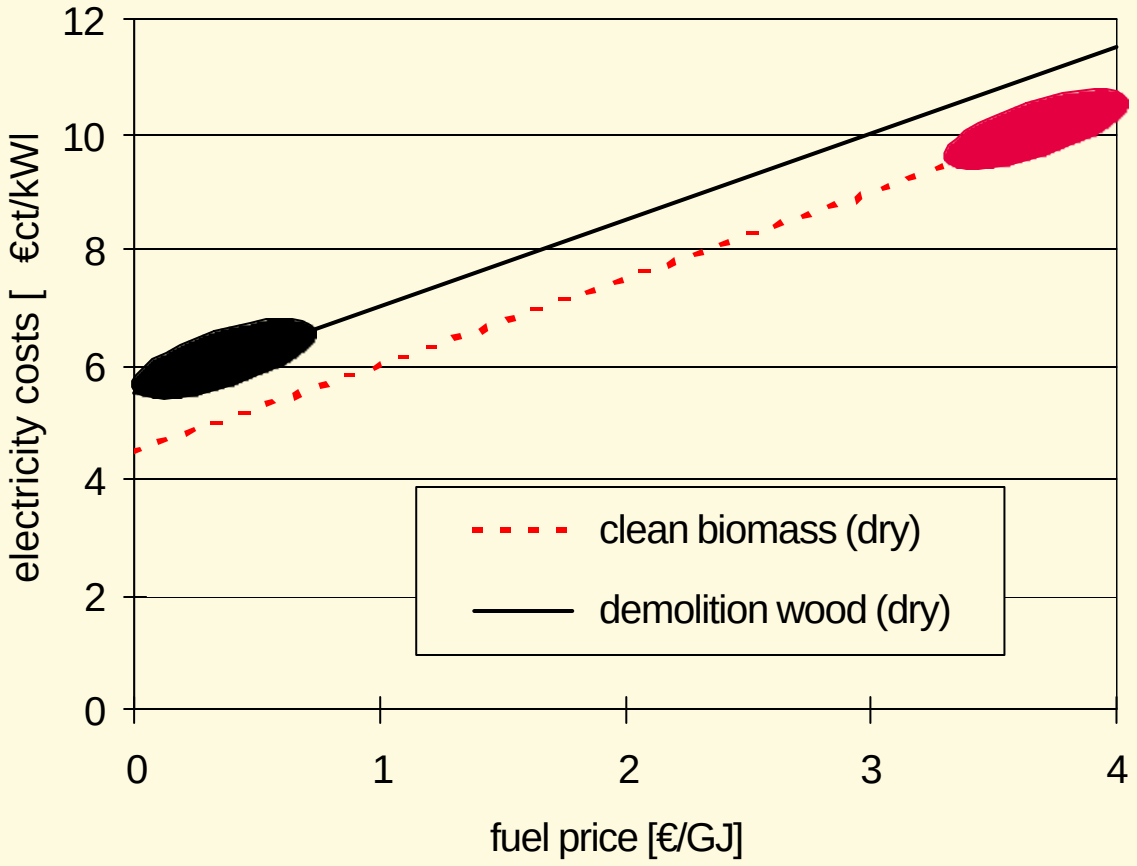
CFB GASIFIER
fuel price



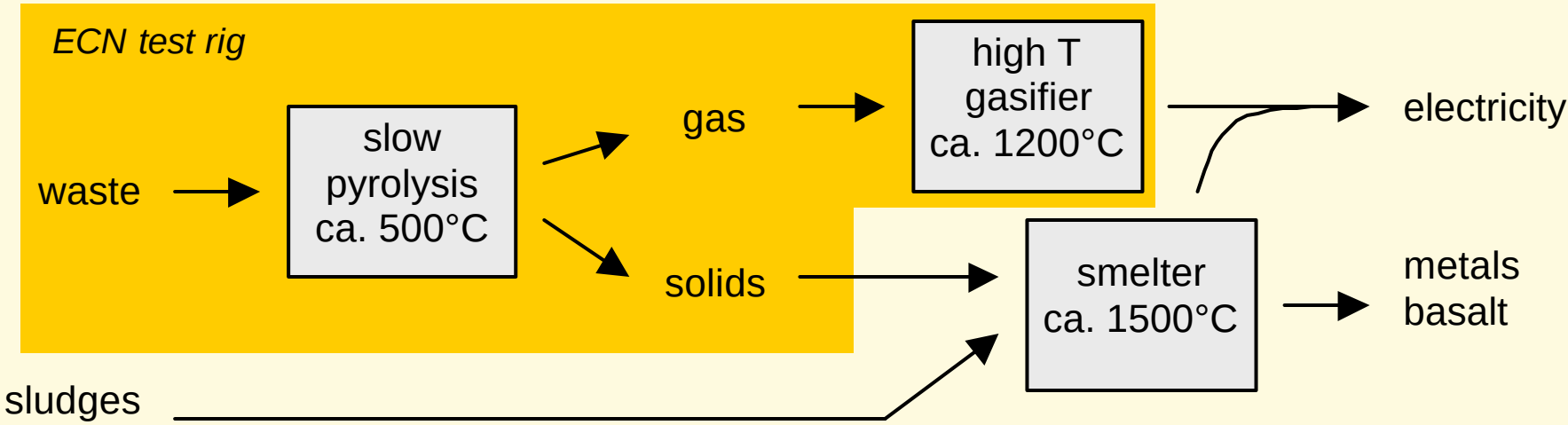
CHP

12 MW_{th}

source: report ECN-C-00-080

ECN

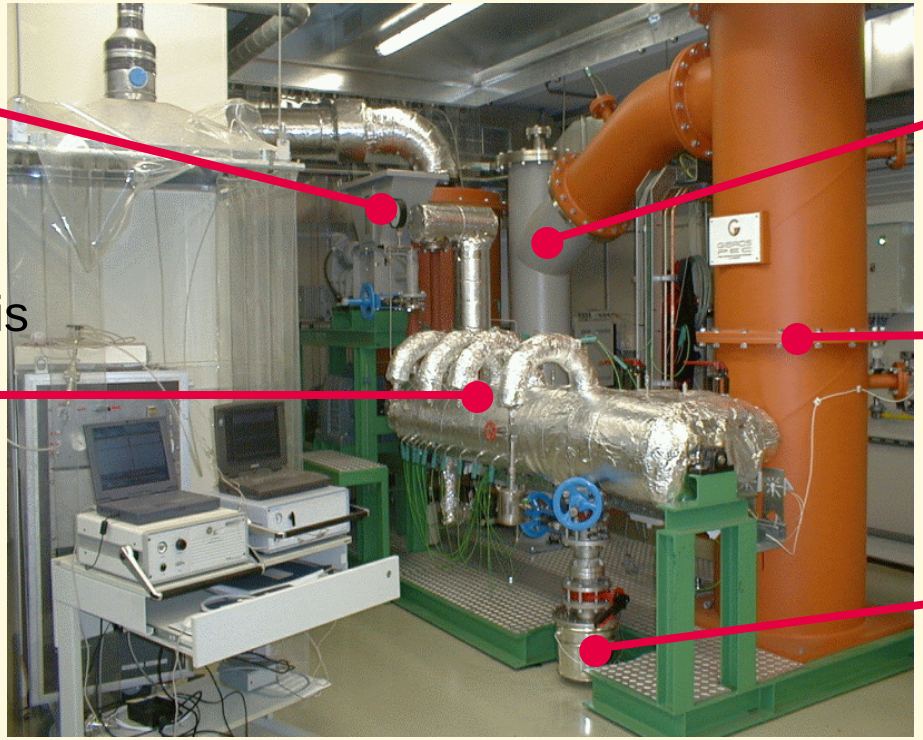
SWR: SOLID WASTE RESOURCER



- flexible fuel input, also chemical waste
- high-T gasifier removes all organic species
- marketable products

ECN

SWR
ECN test unit



fuels tested: wood, WEEE, RDF, ASR, coal, paper reject

syngas produced for Fischer-Tropsch and SOFC

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SWR
electronic waste Br recovery

	WEEE mix		TV backplates	
	concentration [mg/kg]	recovery in solids [wt%]	concentration [mg/kg]	recovery in solids [wt%]
Br	5100	4%	9700	1.5%
Cl	15900	5%	5400	1.5%
As	27	31%	198	31%
Ba	1761	93%	2548	
Ca	53504	111%	30906	
Cd	224	66%	512	63%
Cr	256	76%	672	
Cu	45428	345%	41664	
Fe	4116	54%	3545	
K	1292	33%	2385	
Mn	200	69%	232	
Mo	2	8%	2	2.5%
Ni	1387	260%	596	
Sb	668	2%	1201	0.4%
Sn	691	25%	202	10%
Sr	289	85%	254	
Zn	6014	146%	15231	

source: report ECN-C-01-110

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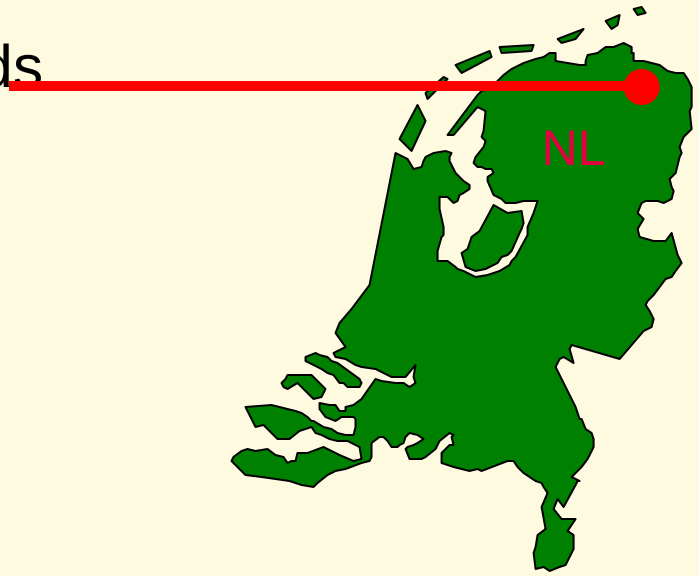
SWR
first commercial plant

location: Groningen, the Netherlands



in operation: 2005

fuels:

- demolition waste
- RDF
- chemical wastes
- sludges

capacity: 100 kton/year

supplier: RMH, Utrecht, the Netherlands
(Resource Management Holding)

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CONCLUSIONS

CFB gasification of biomass/waste:

- commercially available, proven technology
- fuel price dominant in econ. viability
- operational problems related to:
  - solids handling
  - tar-related fouling (cooler, …. filter, scrubber, compressor, …
  - agglomeration

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CONCLUSIONS

SWR two-stage gasification of waste:

- commercially available
- able to handle all kinds of (chemical) waste
- marketable products:
  - electricity
  - basalt
  - metals

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INFORMATION

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