ECN

Energy research Centre of the Netherlands

COUNTRY REPORT the NETHERLANDS

Bram van der Drift

Breda, 2 November 2009

HOST

the Netherlands (Tzum)

- 3 MW_{th} CFB gasifier, cooler, cyclones, boiler, steam turbine, flue gas cleaning: bag house filter
- chicken manure
- now only used for test campaigns for future customers

Portugal

- 3 MW_{th} CFB gasifier, cooler, cyclones, OLGA by Dahlman, NH_3-scrubber, gas engine
- chicken manure (now generally dumped)
- April 2010: ready

DAHLMAN

Portugal

- 3 MW_{th} CFB gasifier by HoSt, cooler, cyclones, OLGA, NH_3-scrubber, gas engine
- chicken manure (now generally dumped)
- April 2010: ready

DAHLMAN

OLGA flexibility

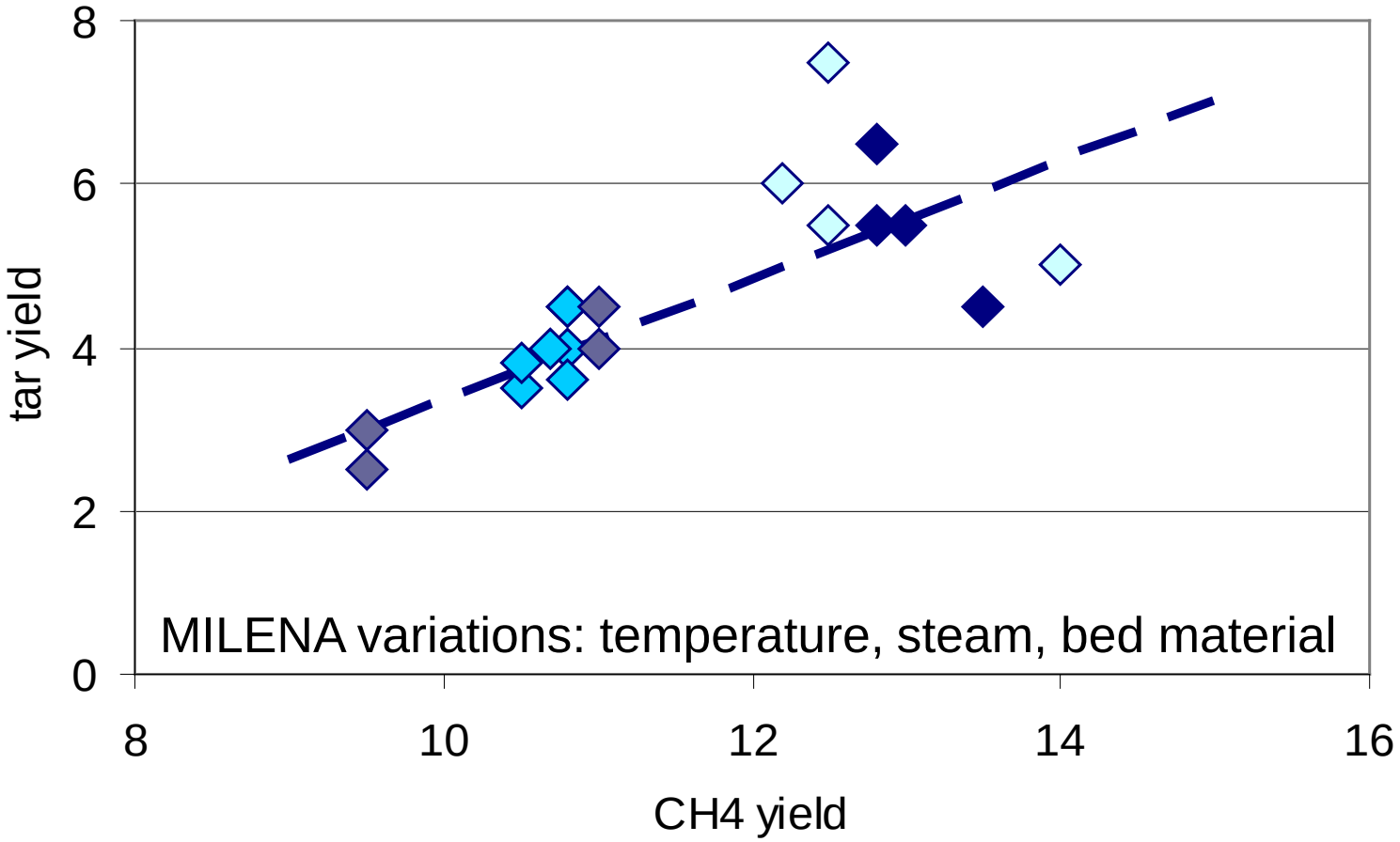
- gasifier: BFB, CFB, indirect (MILENA), PRMe
- fuel: wood, chicken manure, RDF, …
- tar IN: tested up to 40 g/Nm^3
- tar OUT: tar dew point below 0°C
- removal of: tar, particles, dioxins, … but no methane
- size: 2 Nnm^3/h … 20 000 Nm^3/h





DAHLMAN

OLGA creates freedom



BIO-MCN

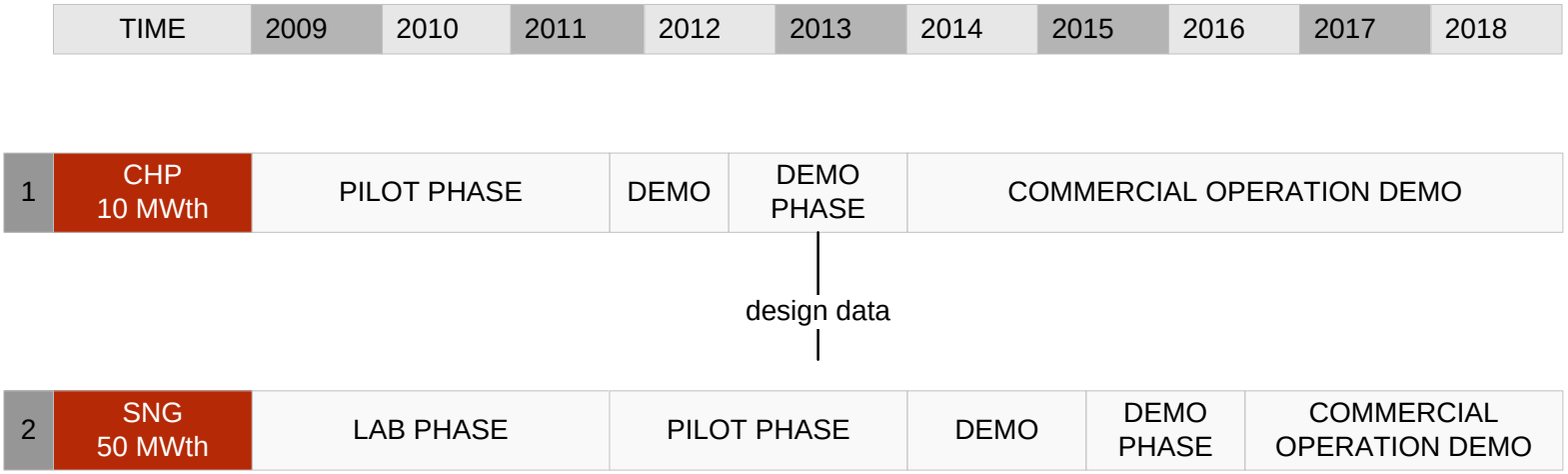
- trials with 5% glycerin in natural gas, co-reforming with natural gas, 20 kton/y bio-methanol
- full-scale glycerin distillation purification, 50% glycerin in natural gas, 200 kton/y bio-methanol started summer 2009: limited capacity
- now modify bottle neck, expected to operate full capacity December 2009
- 2nd generation biofuel plant: 180 MW_{MeOH} or 5 PJ/y !

NUON and ESSENT

- NUON: Wednesday
- Essent: Thursday

HVC

- MSW incineration for power/heat (existing)
- demolition wood CFB boiler for power/heat (existing)
- digestion for power/heat (existing)
- digestion for SNG 40 bar (ready mid 2010)
- gasification for SNG (MILENA and OLGA based):



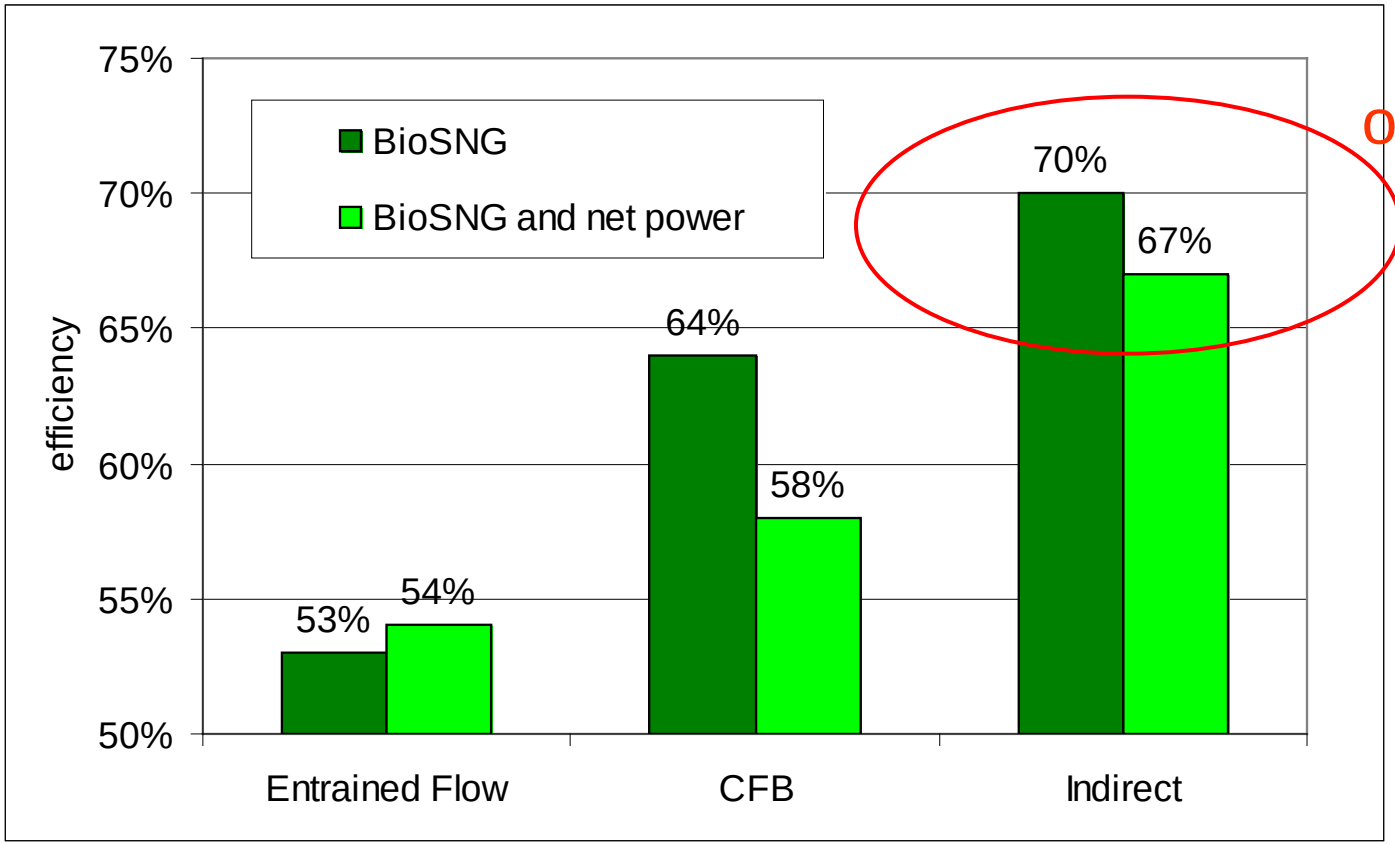
ECN

- *MILENA-OLGA*:
  - successfully tested at pilot scale (200 Nm^3/h) in August 2009
  - next test with demolition wood in December 2009
  - basic engineering 10 MW demo at HVC started

- *SNG*:
  - lab-scale facility available
  - next test (200 h) now
  - system for 70% efficiency…

ECN

System biomass-to-SNG:



our choice

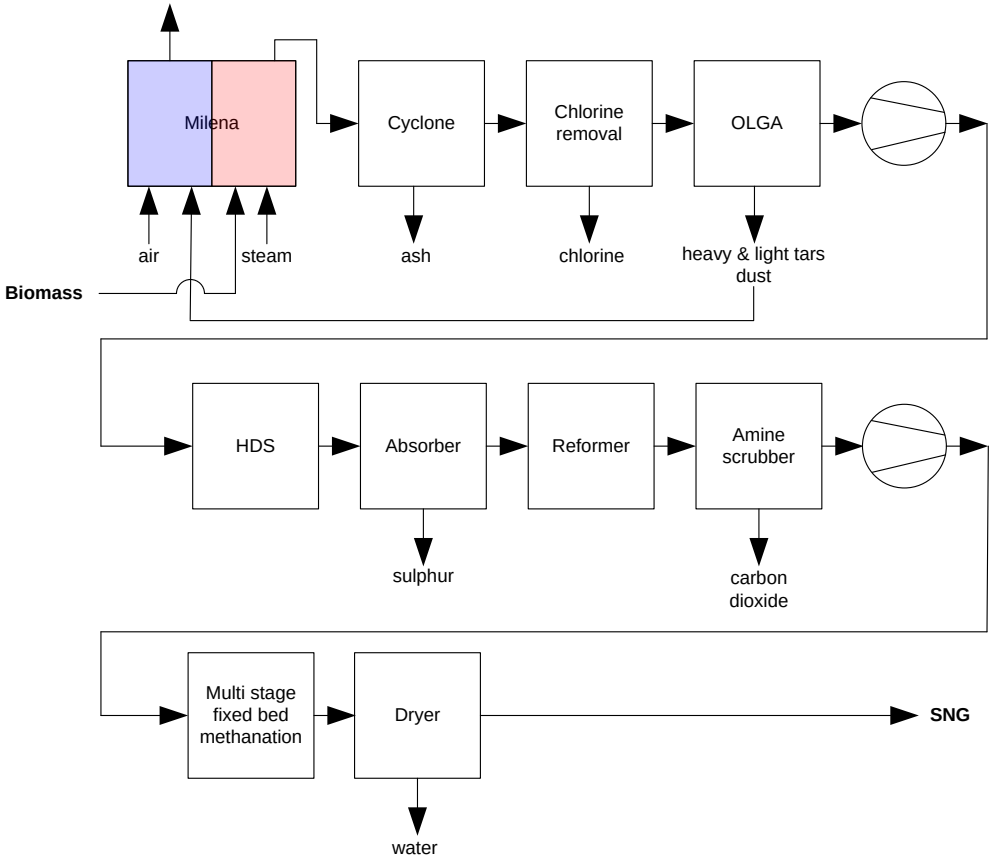
ECN

System biomass-to-SNG:

1. MILENA: full conversion, fuel flexible, high methane
2. OLGA: removes high tar load, no methane removal
3. other gas cleaning: no water condensation, no removal of valuable (energy-containing) components
4. methanation: “commercial”
5. upgrading: commercial

ECN

System biomass-to-SNG:



ECN

MILENA for biomass and lignite:

- lab-scale MILENA gasifier, air blown, ~5 kg/h
- can be CO_2-neutral in BioSNG system with up to 35% lignite
- composition:

	wood	lignite
C [wt% daf]	49%	66%
S [wt% daf]	0.02%	0.31%
ash [wt% dry]	1%	4%
volatiles [wt% daf]	84%	59%

ECN

MILENA for biomass and lignite:

Lignite in mix	[wt-%]	0%	28%	55%
CO	[vol-% dr.]	37	31	23
H_2	[vol-% dr.]	21	29	36
CO_2	[vol-% dr.]	19	21	23
CH_4	[vol-% dr.]	12	11	8
C_2H_2	[vol-% dr.]	0.43	0.37	0.21
C_2H_4	[vol-% dr.]	4.6	3.8	2.9
Tar	[g/m3 dr.]	30	26	16
H2S	[ppmV dr.]	49	360	330
COS	[ppmV dr.]	3	24	35
Thiophene	[ppmV dr.]	10	39	47

ECN

two interesting publications:

- R.W.R. Zwart, Gas Cleaning Downstream Biomass Gasification – status report 2009, : http://www.ecn.nl/docs/library/report/2008/e08078.pdf

- L.P.L.M. Rabou *et al*, Tar In Biomass Producer Gas: An Enduring Challenge, Energy and Fuels, 2009

MORE INFORMATION

Bram van der Drift

e: vanderdrift@ecn.nl
t: +31 224 56 4515
w: www.ecn.nl

PO Box 1
NL 1755 ZG Petten
the Netherlands

publications: www.ecn.nl/publications
composition database: www.phyllis.nl
tar dew point calculator: www.thersites.nl
IEA bioenergy/gasification: www.ieatask33.org
Milena indirect gasifier: www.milenatechnology.com
OLGA: www.olgatechnology.com / www.renewableenergy.nl
SNG: www.bioSNG.com and www.bioCNG.com