

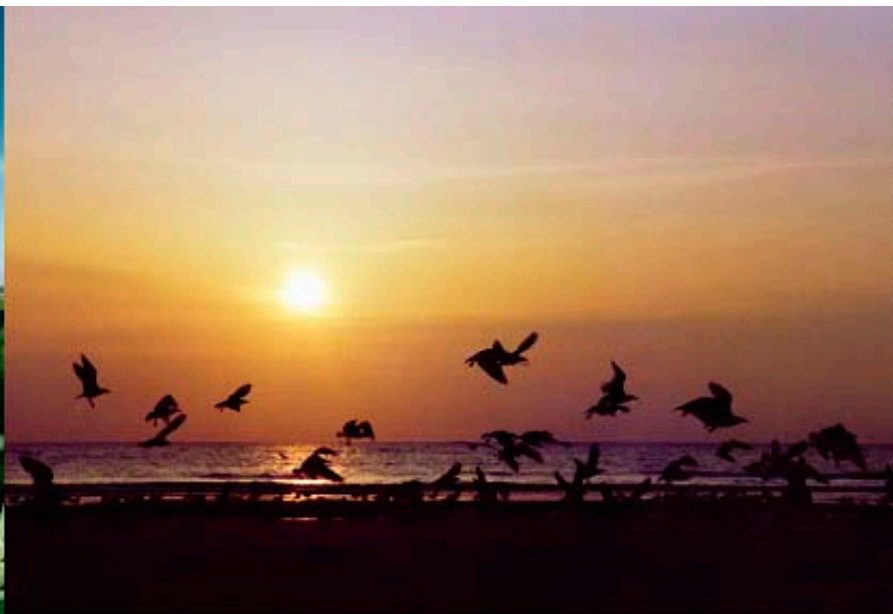


Energy research Centre of the Netherlands

# COUNTRY REPORT the NETHERLANDS

Bram van der Drift

Breda, 2 November 2009



## HOST

### *the Netherlands (Tzum)*

- 3 MW<sub>th</sub> 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<sub>th</sub> CFB gasifier, cooler, cyclones, OLGAs by Dahlman, NH<sub>3</sub>-scrubber, gas engine
- chicken manure (now generally dumped)
- April 2010: ready

# DAHLMAN

## *Portugal*

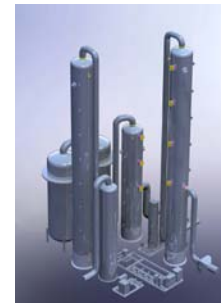
- 3 MW<sub>th</sub> CFB gasifier by HoSt, cooler, cyclones, OLGA, NH<sub>3</sub>-scrubber, gas engine
- chicken manure (now generally dumped)
- April 2010: ready



## DAHLMAN

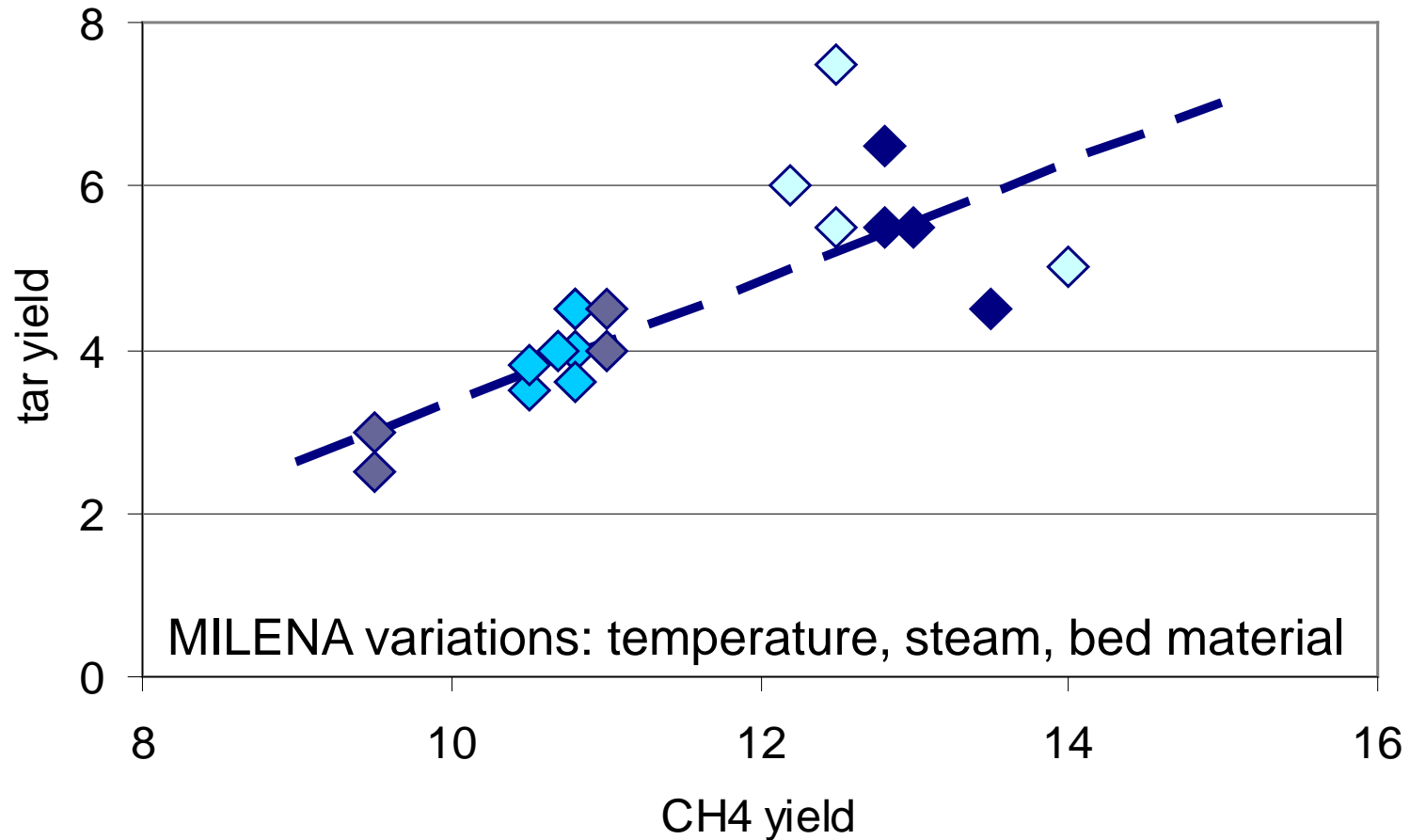
### *OLGA flexibility*

- gasifier: BFB, CFB, indirect (MILENA), PRMe
- fuel: wood, chicken manure, RDF, ...
- tar IN: tested up to 40 g/Nm<sup>3</sup>
- tar OUT: tar dew point below 0°C
- removal of: tar, particles, dioxins, ... but no methane
- size: 2 Nm<sup>3</sup>/h ... 20 000 Nm<sup>3</sup>/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
- 2<sup>nd</sup> generation biofuel plant: 180 MW<sub>MeOH</sub> or 5 PJ/y !

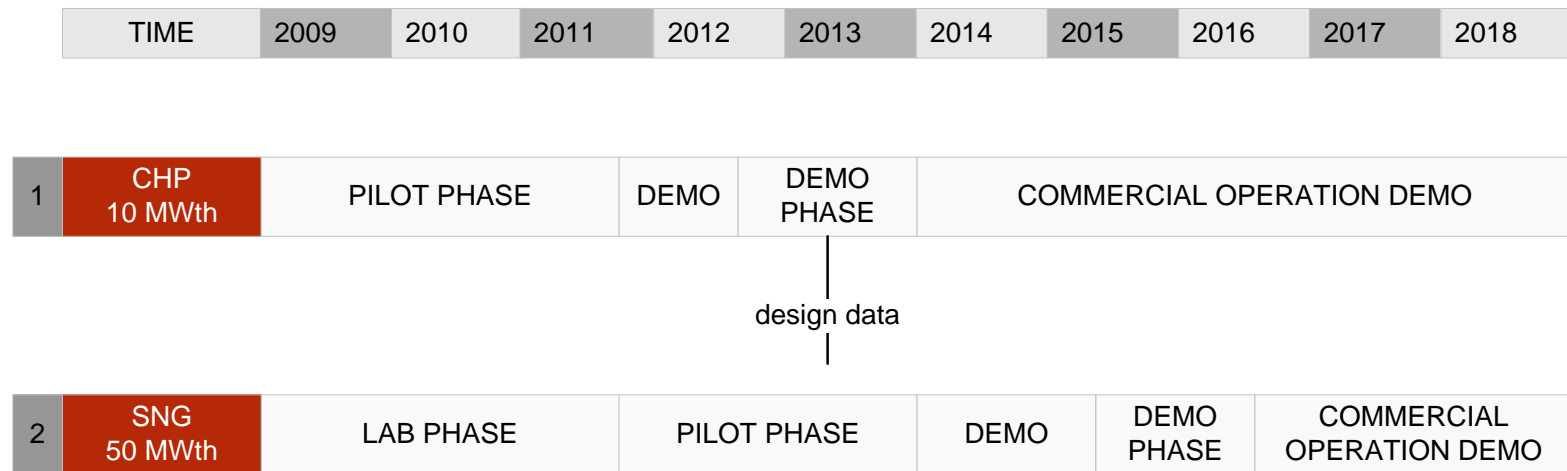


## NUON and ESSENT

- 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):

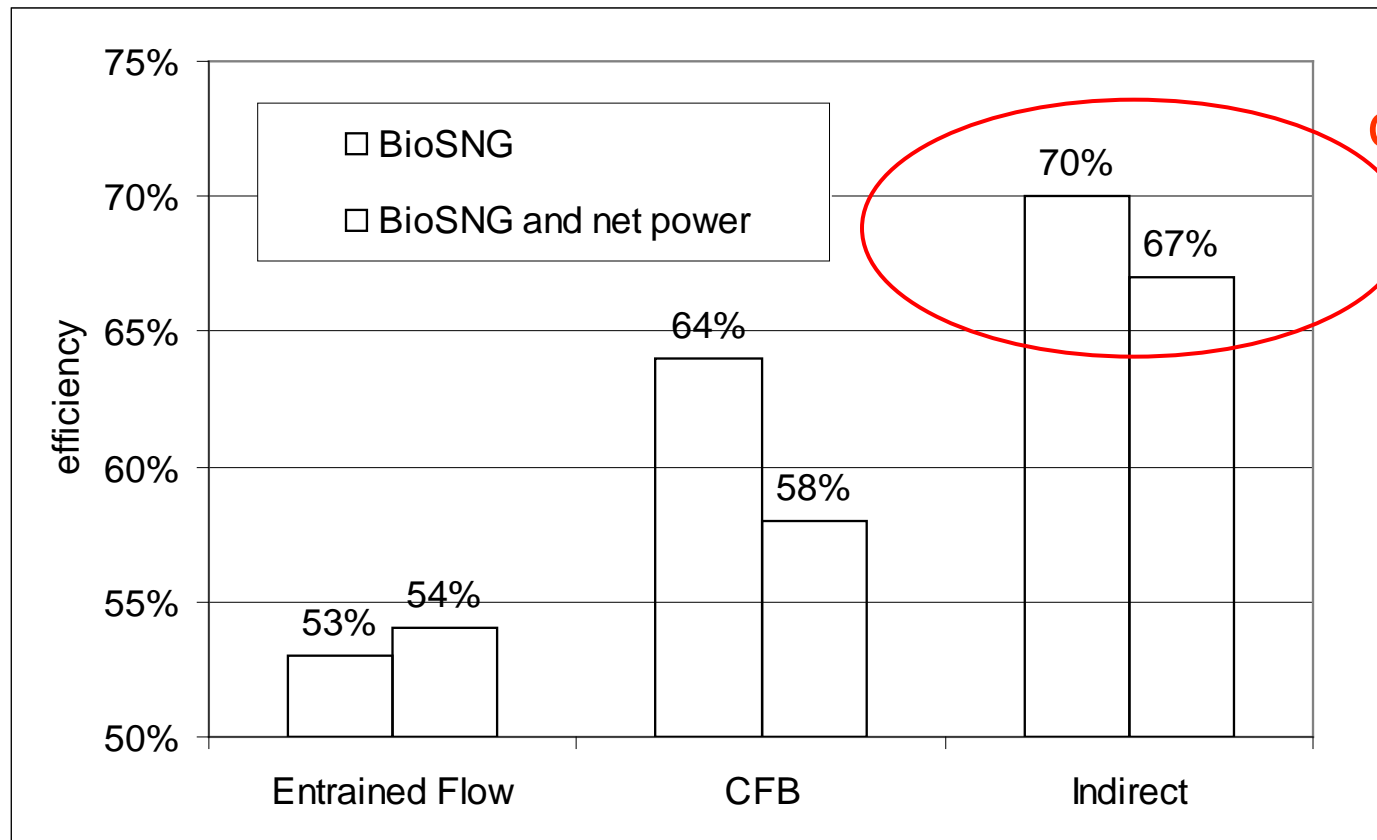


## ECN

- *MILENA-OLGA*:
  - successfully tested at pilot scale (200 Nm<sup>3</sup>/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

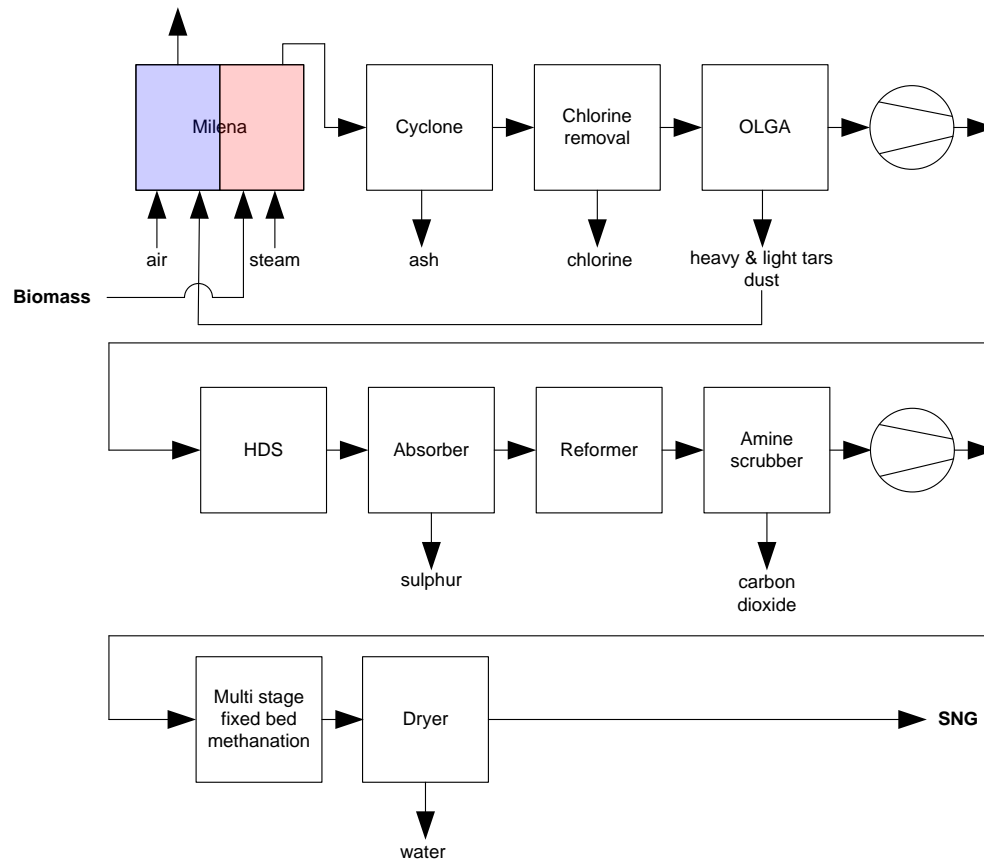
## ECN

### *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<sub>2</sub>-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 <sub>2</sub>	[vol-% dr.]	21	29	36
CO <sub>2</sub>	[vol-% dr.]	19	21	23
CH <sub>4</sub>	[vol-% dr.]	12	11	8
C <sub>2</sub> H <sub>2</sub>	[vol-% dr.]	0.43	0.37	0.21
C <sub>2</sub> H <sub>4</sub>	[vol-% dr.]	4.6	3.8	2.9
Tar	[g/m <sup>3</sup> dr.]	30	26	16
H <sub>2</sub> S	[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](mailto:vanderdrift@ecn.nl)

t: +31 224 56 4515

w: [www.ecn.nl](http://www.ecn.nl)

PO Box 1

NL 1755 ZG Petten

the Netherlands

publications: [www.ecn.nl/publications](http://www.ecn.nl/publications)

composition database: [www.phyllis.nl](http://www.phyllis.nl)

tar dew point calculator: [www.thersites.nl](http://www.thersites.nl)

IEA bioenergy/gasification: [www.ieatask33.org](http://www.ieatask33.org)

Milena indirect gasifier: [www.milenatechnology.com](http://www.milenatechnology.com)

OLGA: [www.olgatechnology.com](http://www.olgatechnology.com) / [www.renewableenergy.nl](http://www.renewableenergy.nl)

SNG: [www.bioSNG.com](http://www.bioSNG.com) and [www.bioCNG.com](http://www.bioCNG.com)