

THE NETHERLANDS COUNTRY REPORT

Berend Vreugdenhil

Golden CO, USA
8 May 2013

www.ecn.nl

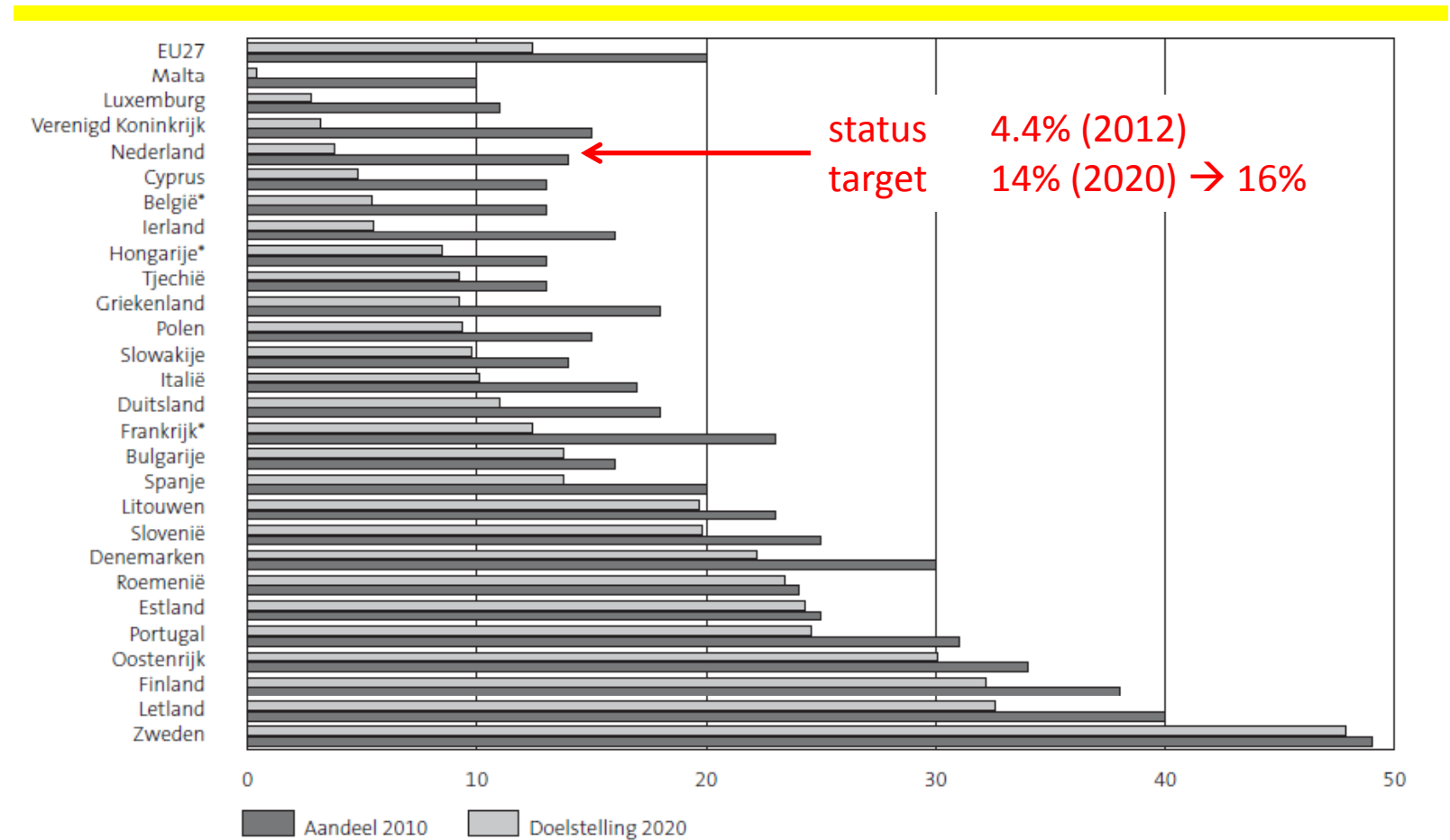
NETHERLANDS

- EU renewable target 2020 translates to 14% for the Netherlands, new government (5 November 2012) increased the target to 16%
- Total final energy: 4.3% (2011) and 4.4 (2012) renewable, of which is 74% is from biomass
- Power sector: 10% renewable, of which is 60% is from biomass

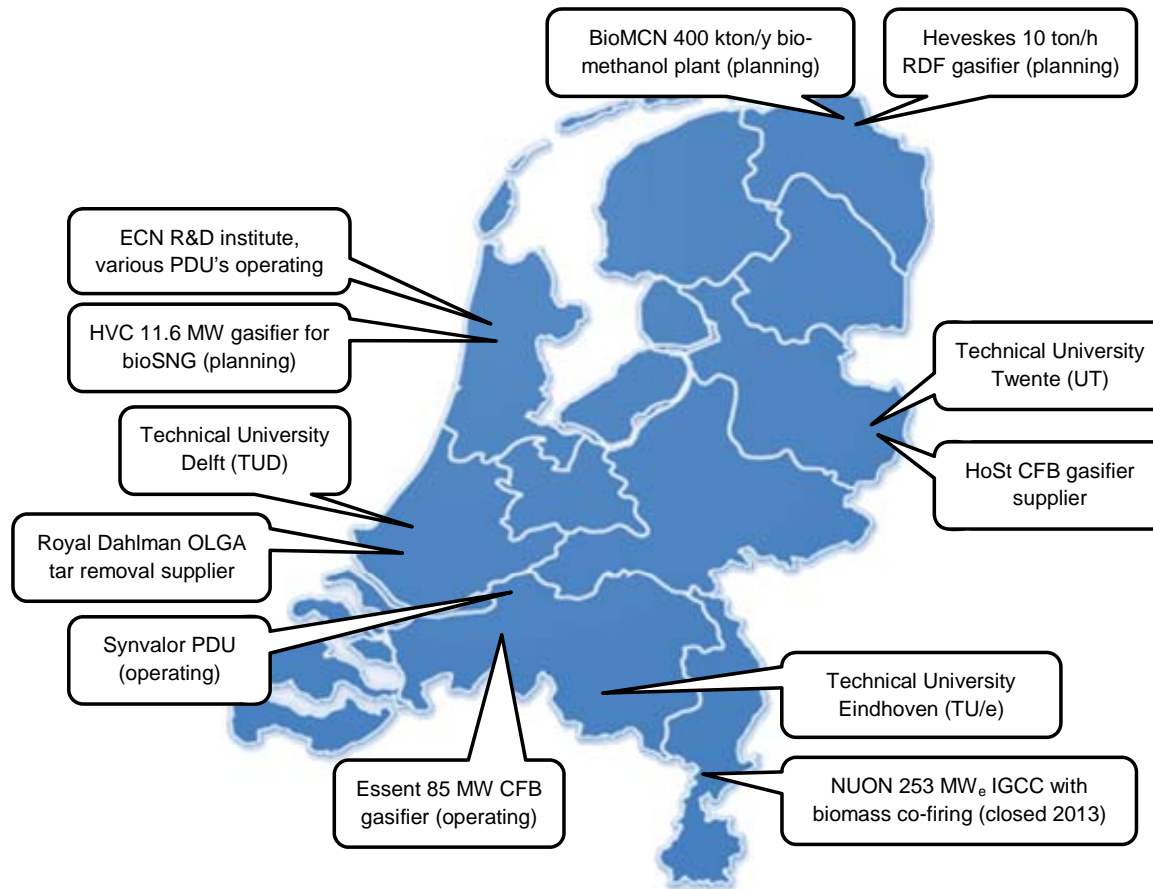


RENEWABLE ENERGY

status 2010 and target 2020



BIOMASS GASIFICATION in NL

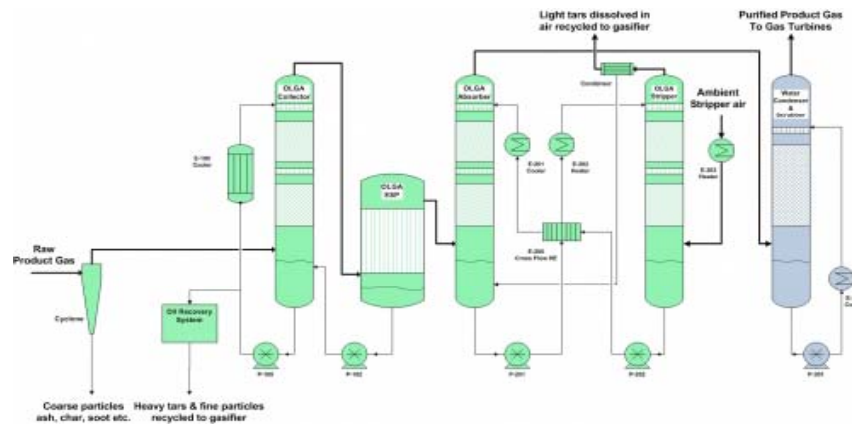


NUON/VATTENFALL

- IGCC 253 MWe started in 1993, coal-fired
- Biomass co-firing since 2002
- Co-firing tests up to 70% biomass with “refined pellets” (torrefied or steam exploded): successful, limits mainly upstream
- Plant officially closed 1 April 2013 due to financial reasons: low power price and high production costs (140 persons)
- *A test facility for large-scale biofuel production is lost ...*



- Supplier of OLGA tar removal technology
- Recently granted waste-to-energy project in UK by ETI (Energy Technologies Institute): 7 MWe, MILENA gasification and OLGA tar removal
 - Phase 1 ongoing (3 projects, 2.8M£)
 - Phase 2 starts early 2014 (1 project), in operation 2016
 - http://www.eti.co.uk/news/article/eti_announces_shortlist_of_companies_in_2.8m_competition_to_design_energy_f

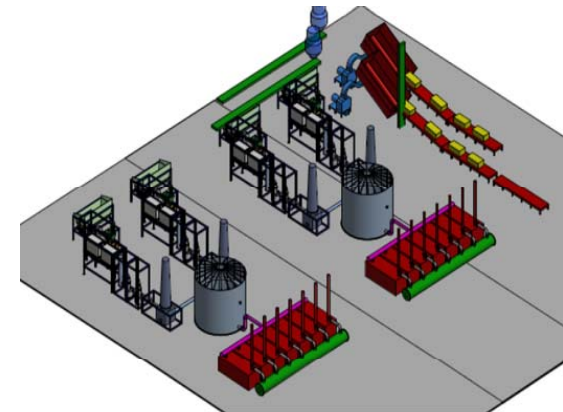


SYNVALOR
www.synvalor.com

 Synvalor

 ECN

- Development of multi-stage vortex reactor for gasification
- 50 kW_e PDU tested with grass, wood, reed, digestion residue
- Working on two plants in Europe



TORRGAS

www.torrgas.nl

torrgas



- Technology for gasification of torrefied biomass
- Based on torroidal reactor design: Torbed technology
- Granted a Dutch subsidy for 10-15 MW (input) gasification plant



Topell torrefaction demo-plant in Duiven (NL)

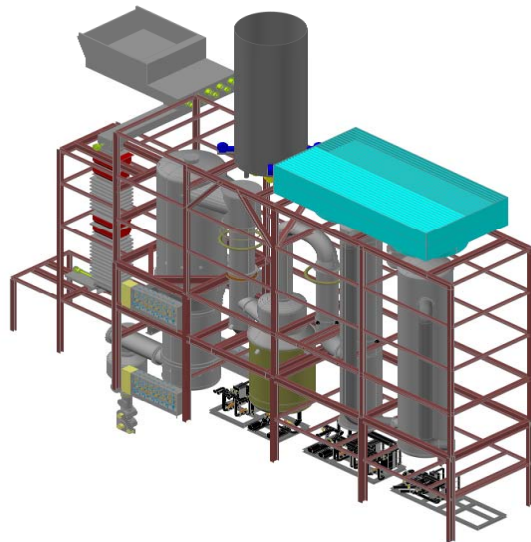


HEVESKES

www.heveskesenergy.nl



- Technology: oxygen driven JFE waste gasification technology
- Feedstock will be high-caloric waste (RDF) and biomass
- Granted a Dutch subsidy for 10 ton/h RDF gasification plant, start production 2014

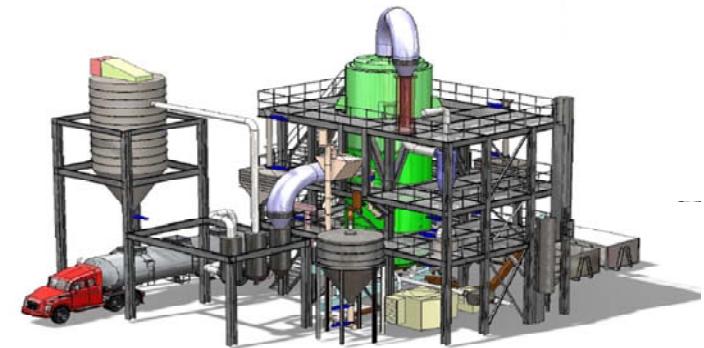


HVC

www.hvcgroep.nl



- 12 MW (waste wood input) plant in preparation, based on MILENA gasification and OLGA tar removal and aiming to develop Green Gas technology, location Alkmaar
- Consortium: HVC, Gasunie, Royal Dahlman, ECN, province of Noord-Holland
- First step: steam production, start construction 2013, start 2014
- Second step: additional gas cleaning and SNG production
- Target: 50-100 MW plant Green Gas plants



HOST

www.host.nl



- Supplier of CFB gasification technology
- Granted a Dutch subsidy for 3 ton/h paper-rejects gasification plant (paper mill location in NL)
- Paper rejects: 40% biomass, 55% plastics, 5% inert



OTHER

- Essent/RWE: 80 MW CFB gasifier on waste wood for indirect co-firing into 600 MWe coal-fired power plant, feed-in tariff will stop end-2013, exploring ways to continue operation with cheaper fuels
- BioMCN (www.bioMCN.eu): 150 kton/y bio-methanol production from glycerin; additional 400 kton/y bio-methanol plant (“woodspirit”: wood torrefaction – Siemens entrained flow gasifier), 199 MEuro granted by NER300

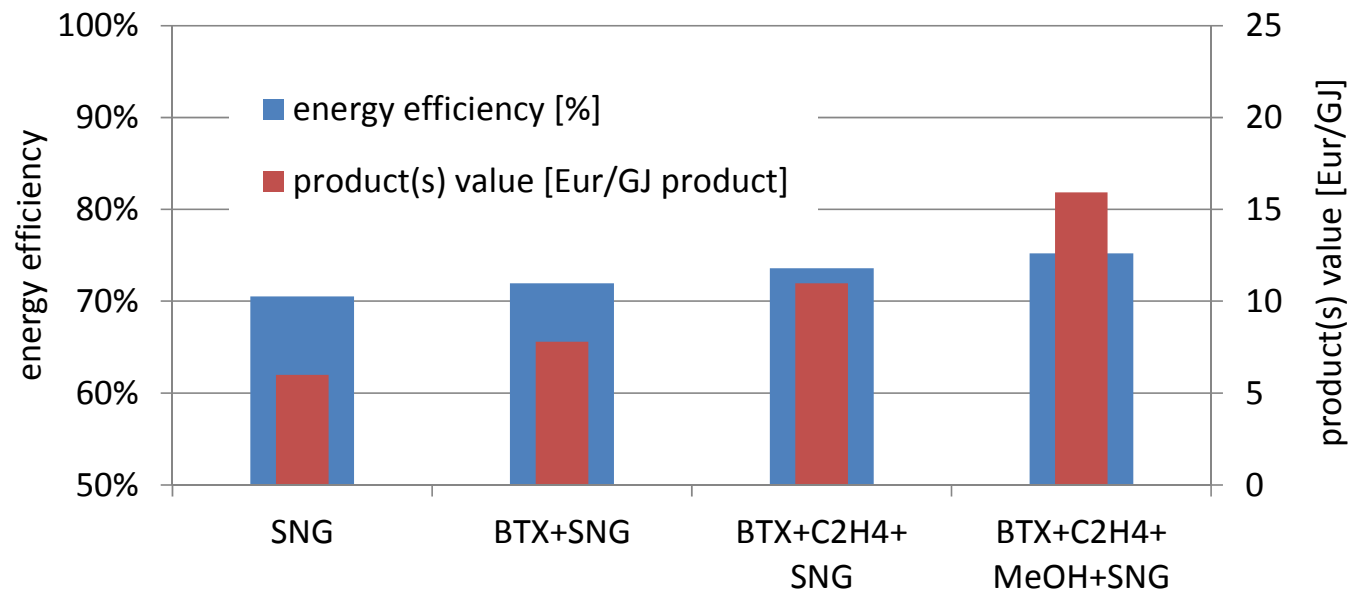
ECN

- New:
 - MILENA tests successful for low-grade (high-ash) coal gasification
 - MILENA appears to be suitable for in-bed tar reduction
 - TARA technology for simpler gas cooling, tar dew point reduction $<100^{\circ}\text{C}$
 - Complete system biomass-to-methane ready at lab-scale: MILENA, OLGA, and series of reactors (up to 10 bar)



ECN

- Co-production of green chemicals increases overall efficiency AND increases product value
- ECN started BTX and ethylene separation technology and concept development



SNG: Synthetic Natural Gas; BTX: mainly benzene; C2H4: ethylene; MeOH: methanol

UNIVERSITIES

PhD thesis published



University of Twente
Enschede - The Netherlands



TU Delft
Delft University of Technology

-
- Kiran Kumar (tar condensation, cooler fouling):
<http://alexandria.tue.nl/extra2/724551.pdf>
 - Liselotte Verhoeven (tar reduction with radicals):
<http://alexandria.tue.nl/extra2/719415.pdf>
 - Carlos Vilela (primary methods for tar reduction):
<http://www.tue.nl/publicatie/ep/p/d/ep-uid/273574/>
 - Christiaan van der Meijden (MILENA technology):
<http://www.ecn.nl/docs/library/report/2010/b10016.pdf>
 - Pavlina Nanou (“self gasification”: high methane yield): :
<http://dx.doi.org/10.3990/1.9789036535434>
 - Marcin Siedlecki (steam/oxygen CFB gasification):
<http://discover.tudelft.nl:8888/recordview/view?recordId=aleph%3A000905492&language=nl>
 - Xiangmei Meng (sulfur, tar, and char in fluidized bed gasification):
<http://discover.tudelft.nl:8888/recordview/view?recordId=aleph%3A000917626&language=nl>

MORE INFORMATION

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publications: www.ecn.nl/publications

fuel 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 / www.bioCNG.com

