

THE NETHERLANDS COUNTRY REPORT

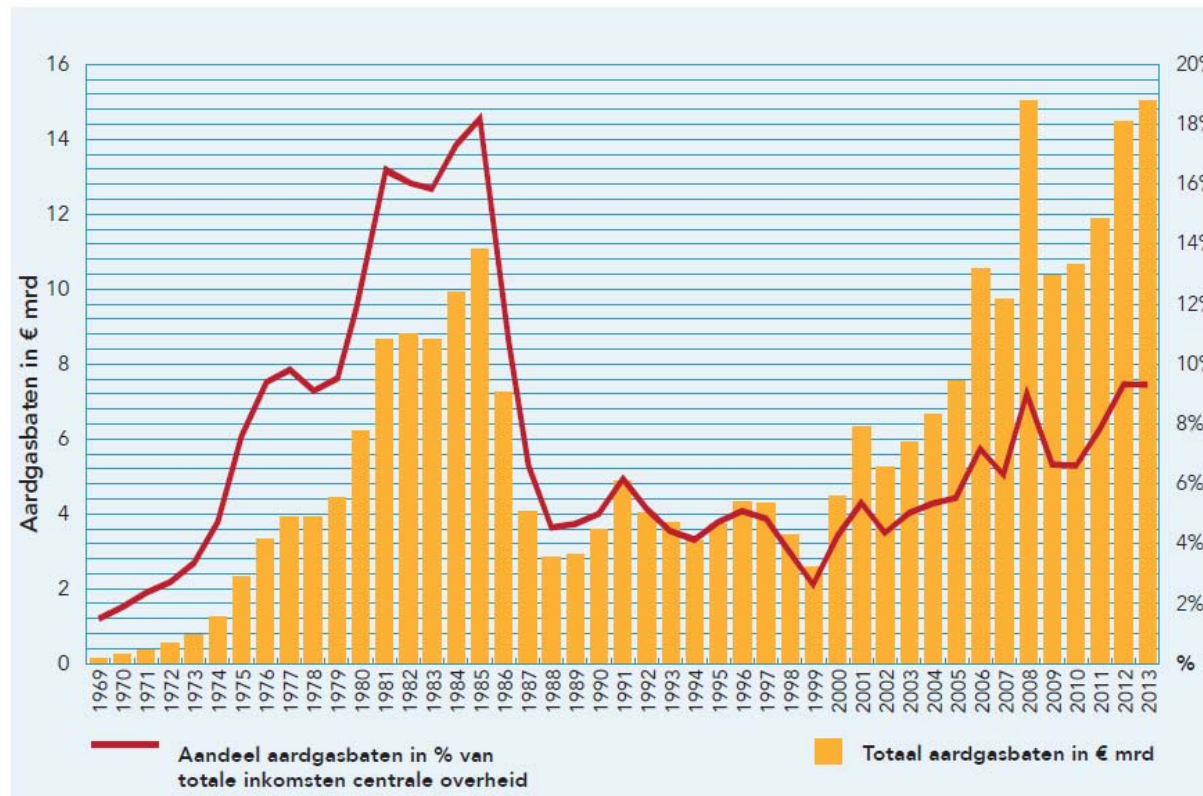
Bram van der Drift

Ponferrada, Spain
11-13 May 2015

www.ecn.nl

NATURAL GAS MAKES MONEY

Opbrengsten gaswinning. (Bron: CBS Statline)



Bars: natural gas income in NL in billion Euro's (left axis)

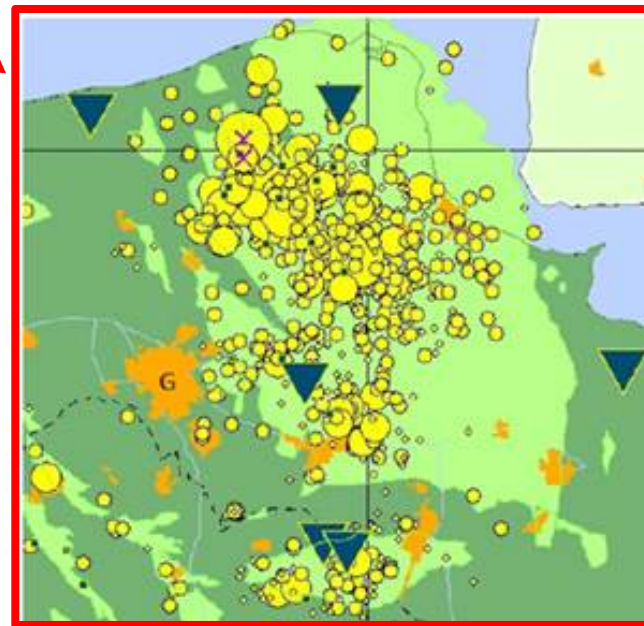
Red line: natural gas income as % of total NL income (right axis)

THE NATURAL GAS PROBLEM

earthquakes in the Netherlands



40 bcm/y on-shore results in earthquakes,
something needs to be done



Legend

- Location and magnitude of earthquake
- × Locations of February 8th and 9th 2013 earthquakes (most recent earthquakes when image was generated)
- Gas field
- Urban areas
- G City of Groningen
- ▼ Seismic station with seismometer in borehole
- Seismic station with accelerometer

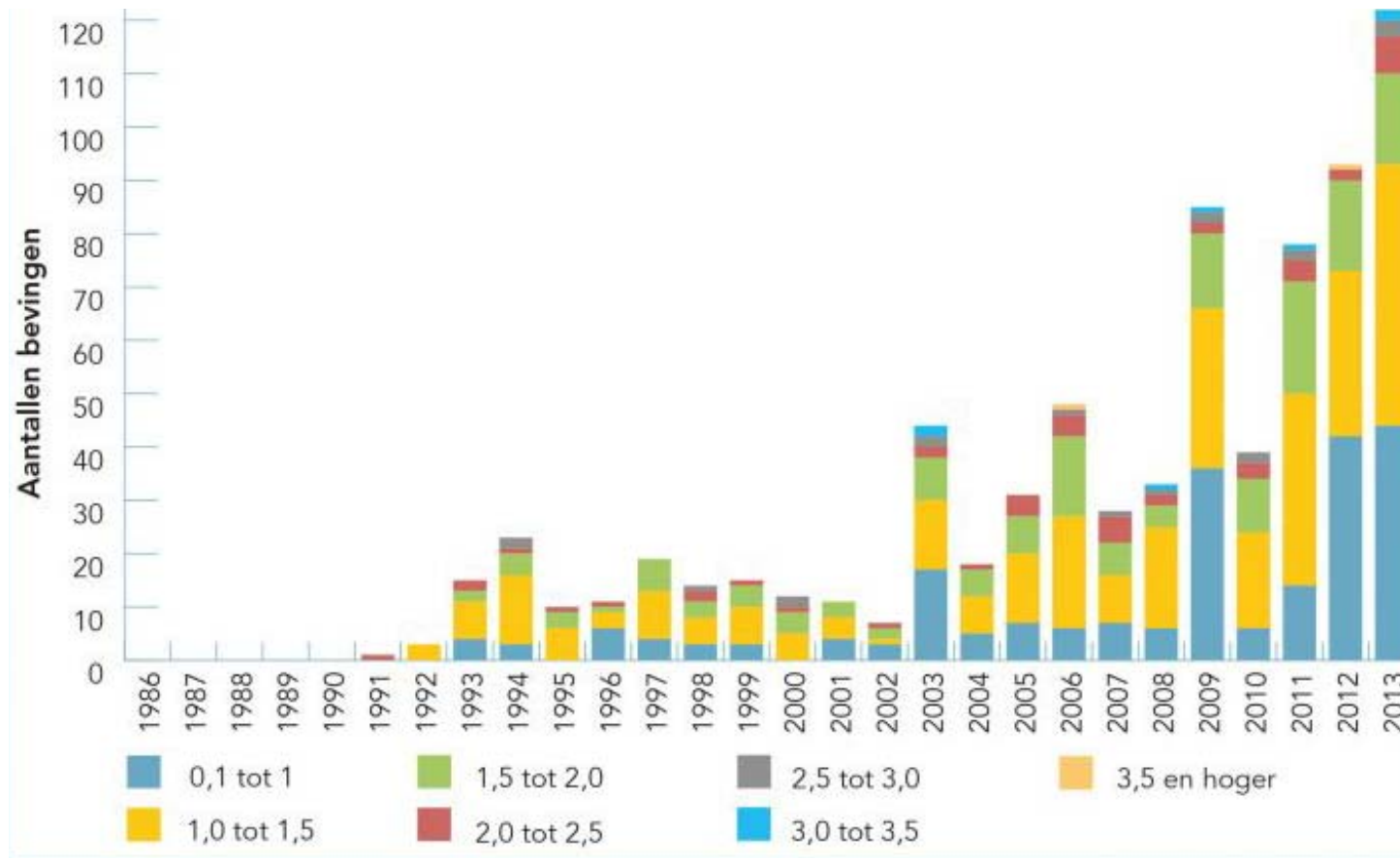


Source: KNMI (2013c, modified).

EARTHQUAKES



increasing number and severity (Richter)





THE NATURAL GAS PROBLEM

earthquakes in the Netherlands



Minister admits that safety has not been given sufficient attention.

GRONINGEN - Het kabinet erkent dat er de afgelopen jaren bij de gaswinning in Groningen te weinig aandacht is geweest voor de veiligheid van Groningers. Minister Henk Kamp (Economische Zaken) zei maandag voor RTV Noord dat het kabinet dat betreurt.

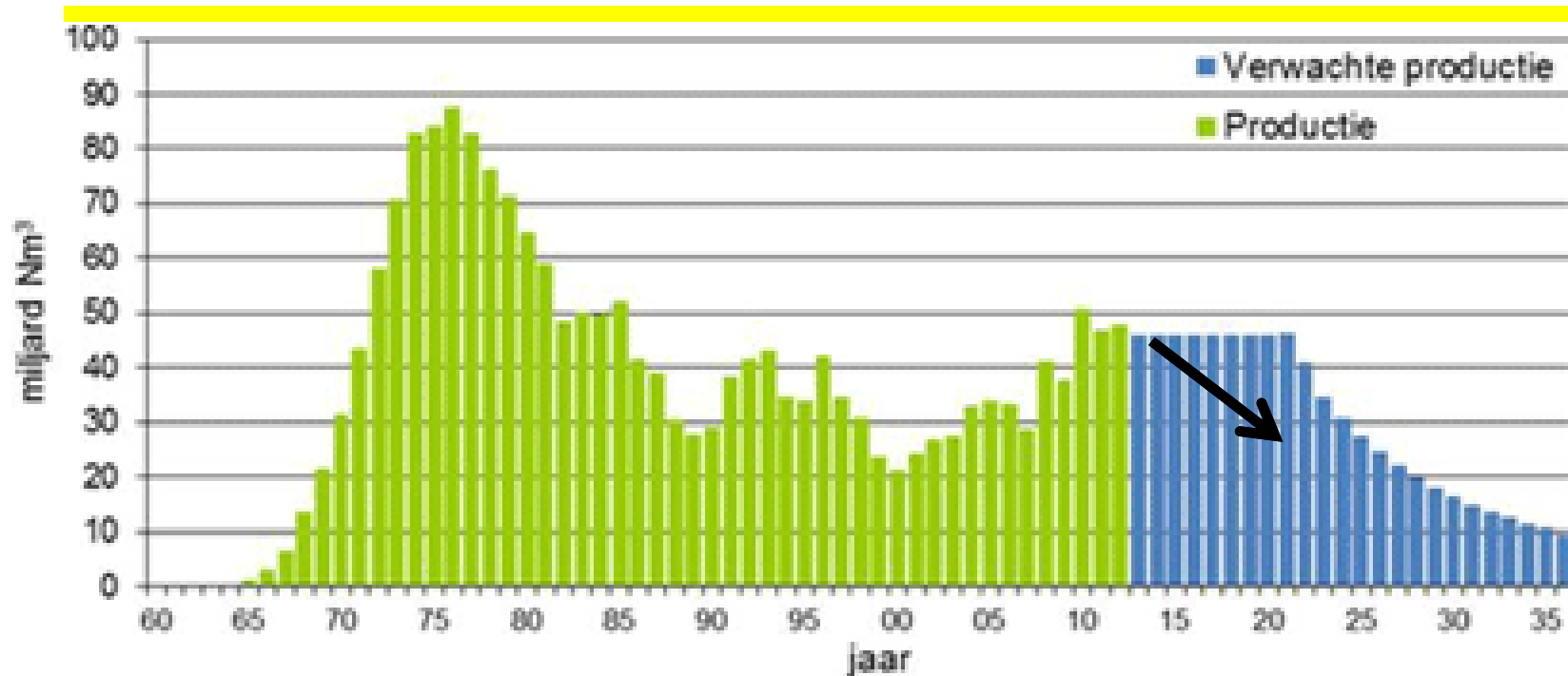
Kamp reageerde daar op het het vorige maand verschenen rapport van de Onderzoeksraad voor de Veiligheid naar de gaswinning in Groningen.

Dagblad van het Noorden sprak na het interview van Kamp op RTV Noord met enkele belangrijke partijen. De reacties waren niet mals.

PRODUCTION WILL BE REDUCED



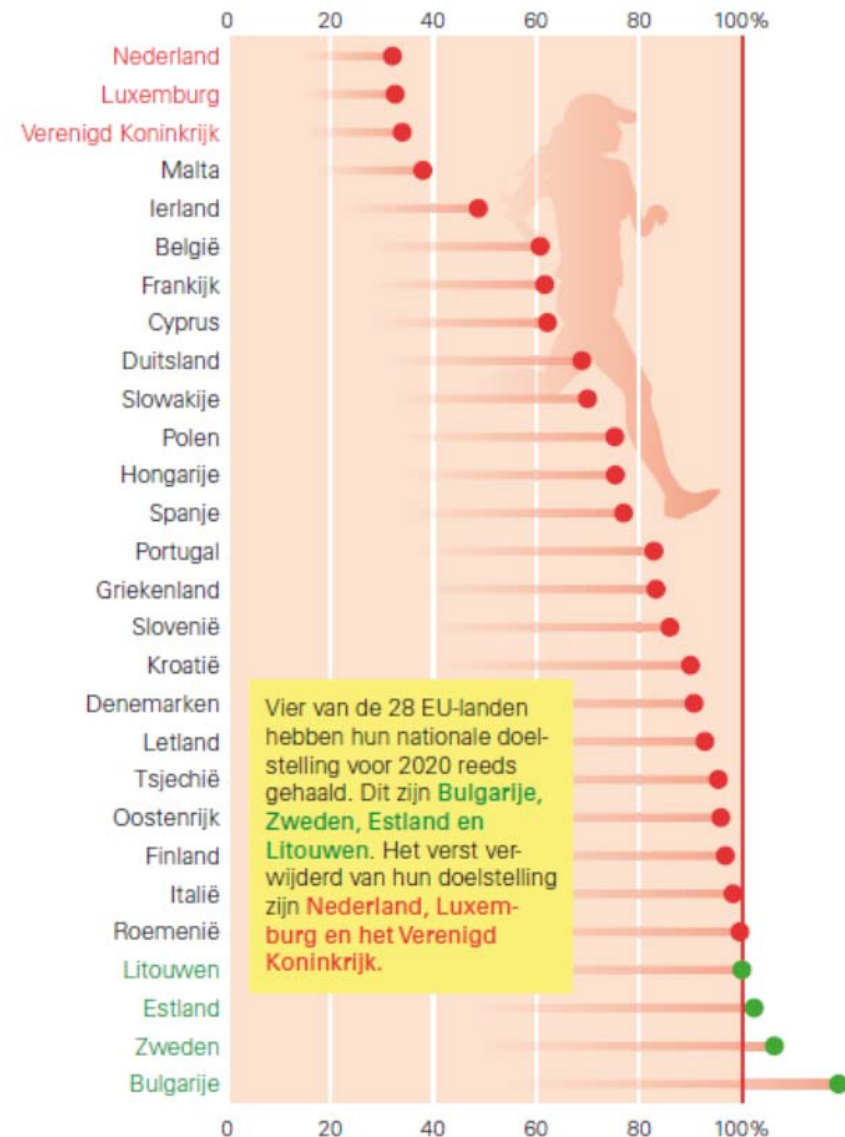
Groningen gas field (Slochteren)



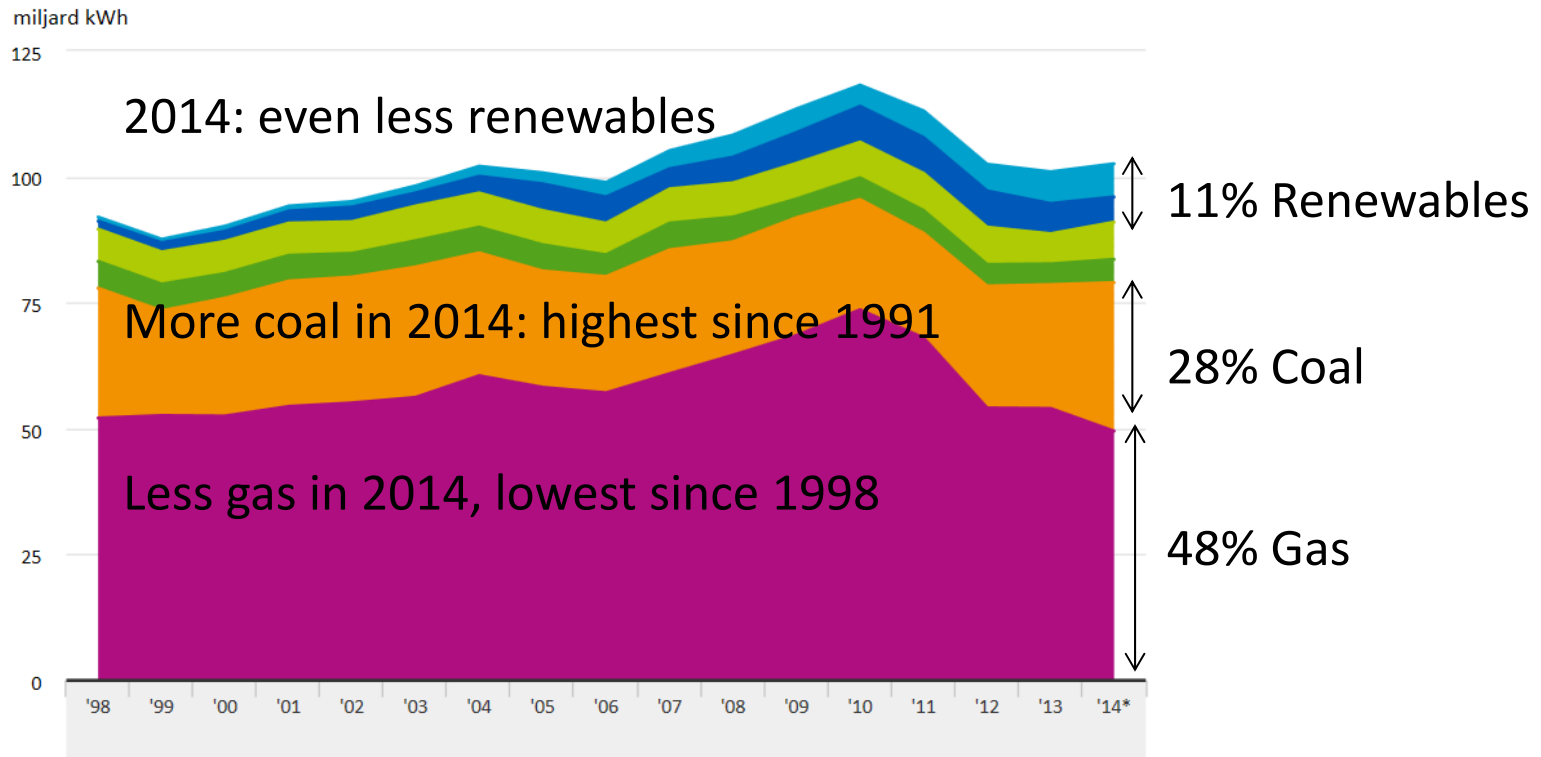
Political decisions, limits set on production volumes: Mar2014: max 42.5 bcm/y
Dec2014: max 39.4 bcm/y
9Feb2015: max 16.5 bcm H1-2015

NL is a WINNER...

Netherlands are farthest off from Renewable Energy target



POWER PRODUCTION *in the Netherlands*



Wind, zon en water Biomassa Kernenergie en overig
Andere fossiele brandstoffen Steenkool Aardgas

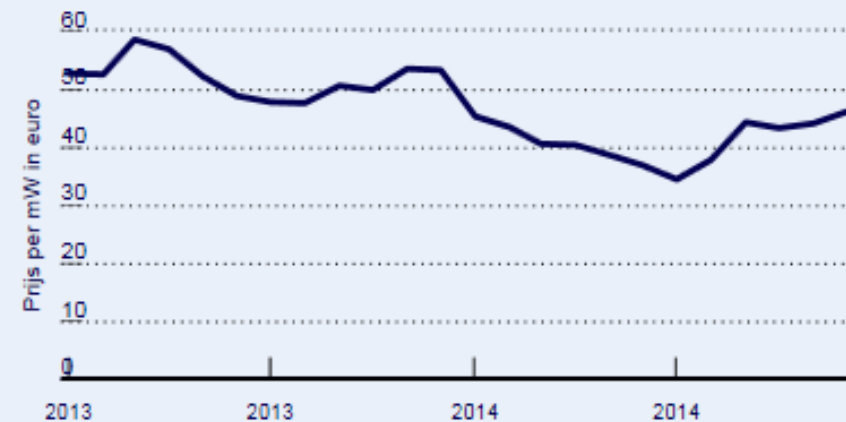
POWER PRICE DROPS

in the Netherlands



- 2013: 52 €/MWh
- 2014: 41 €/MWh
- Reasons:
 - more interconnections and cheap power from Germany and Norway,
 - additional production capacity (3 new coal power plants)

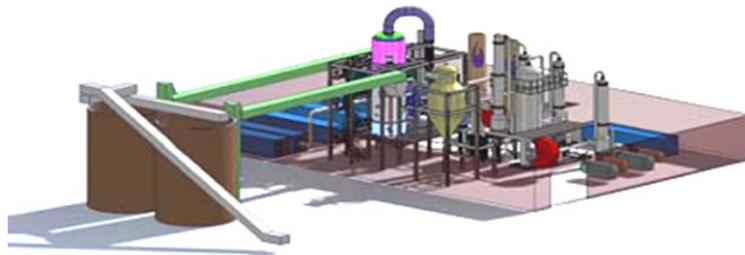
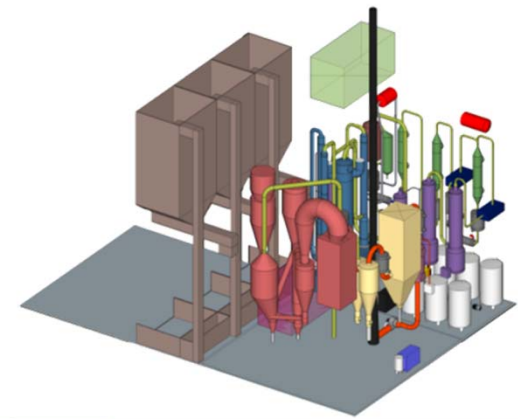
In 2014 was de prijs van een megawatt elektriciteit gemiddeld twintig procent lager dan in 2013. De laagste prijs in 2014 was 34 euro.



Bron: [TenneT](#) - © NU.nl/Shannon Bakker

GREEN GAS SUBSIDIES

- Up to 0.118 €/kWh (1.16 €/m³) in 2015
- Results in initiatives:
 - 4 MW (input) demo plant in Alkmaar or Delfzijl by Gasunie, Dahlman, ECN
 - 14 MW (input), 4 plants in Zutphen and other locations
 - 25 MW (input) in Delfzijl by Torrgas, gas for industry



Artist impression of 14 MW wood-to-SNG plant in Zutphen, the Netherlands

ECN bioSNG DEVELOPMENTS



MILENA gasifier



OLGA tar removal



HDS reactor



*Further gas
cleaning*



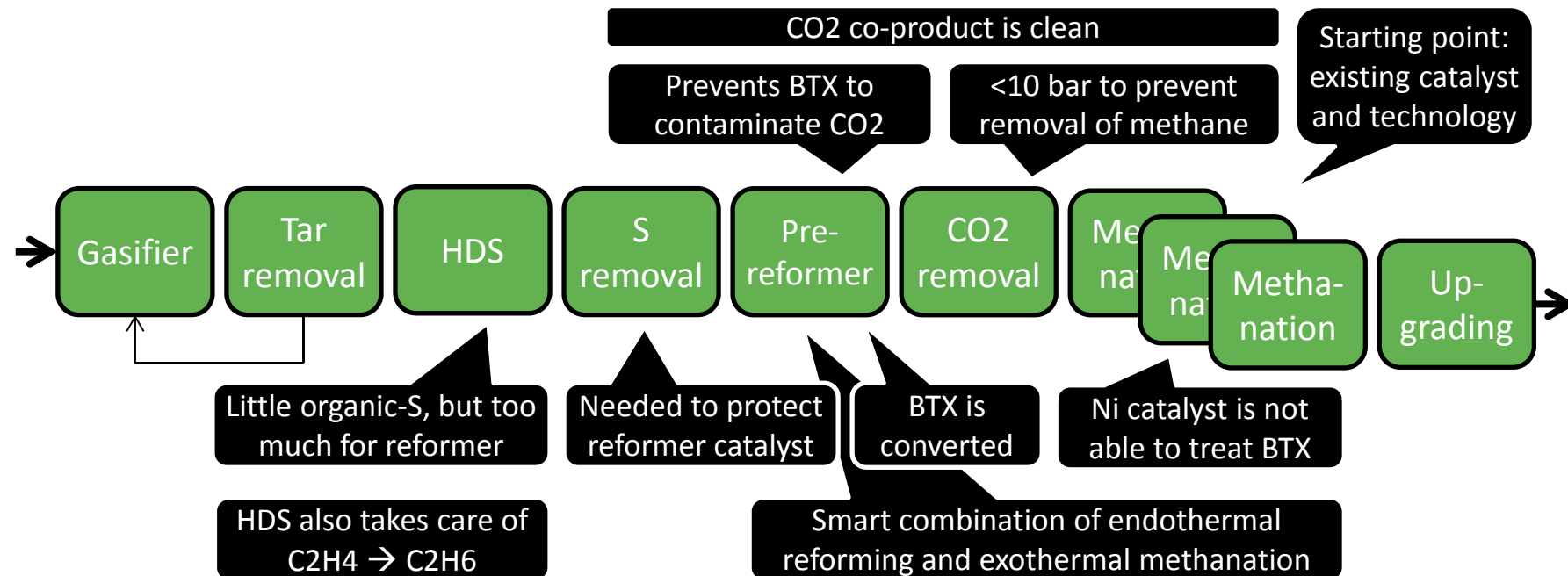
*Methanation
reactors*

70% energy efficiency from wood to bioSNG

BASE CASE bioSNG PROCESS



the ECN choices and IP



Gasifier: Fluidized Bed Gasifier operating at temperature below 1000°C

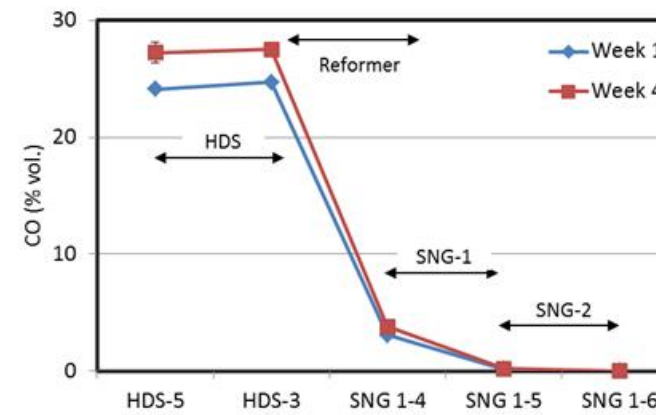
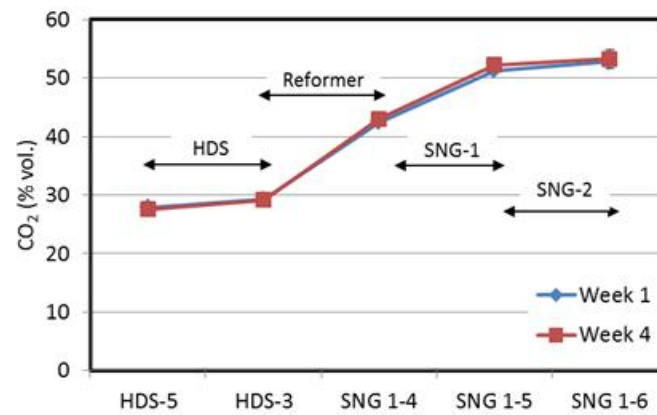
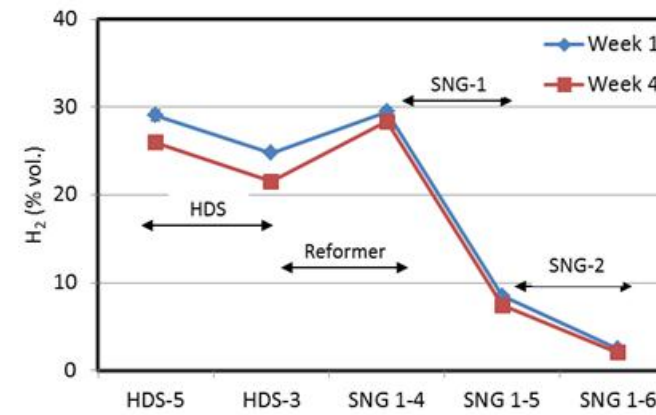
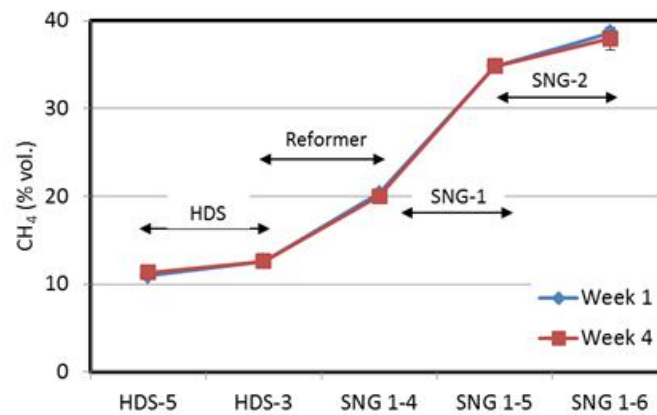
HDS: HydroDeSulphurization (converting organic S molecules into H_2S)

BTX: Benzene, Toluene, Xylene (~90%/9%/1% in case of fluidized bed gasification at ~800°C)

ECN bioSNG DEVELOPMENTS



500 hours tested successfully

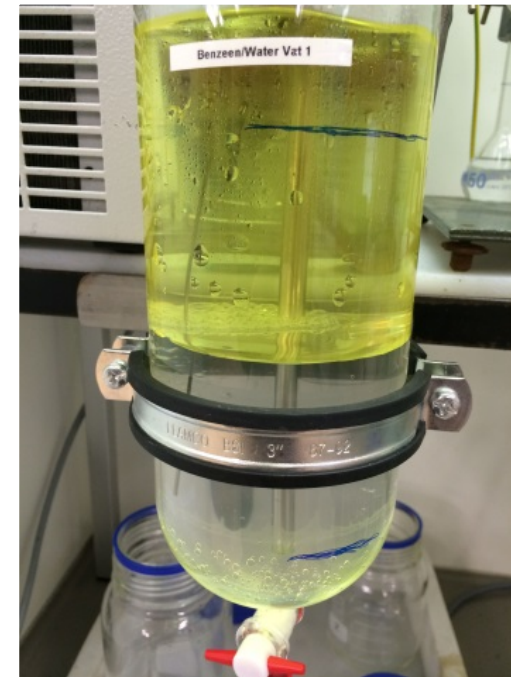
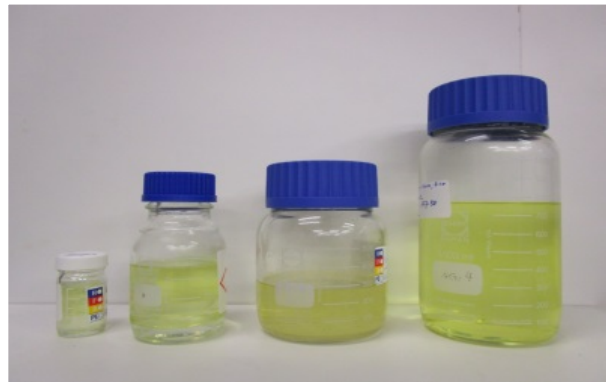


FURTHER AHEAD: BTX HARVEST

benzene, toluene, xylenes



- First step after OLGA tar removal
- Liquid BTX product: first liter in 2014
- >95% separation
- BTX = 90/9/1
- Simplifies downstream process to green gas
- Improves the business case for green gas



MORE INFORMATION

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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

BTX: www.bioBTX.com

