



Country update biogas in The Netherlands April 2008

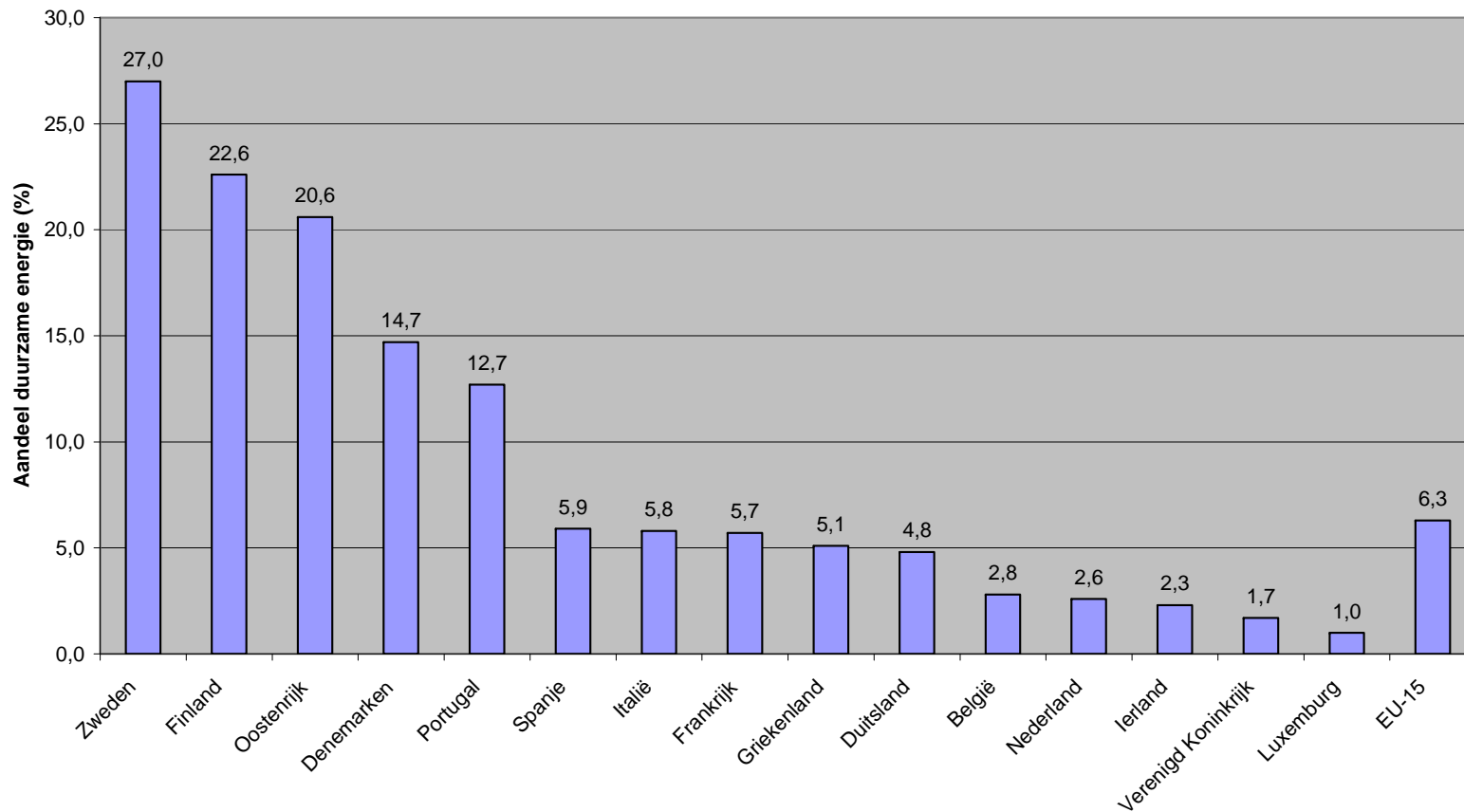
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SenterNovem

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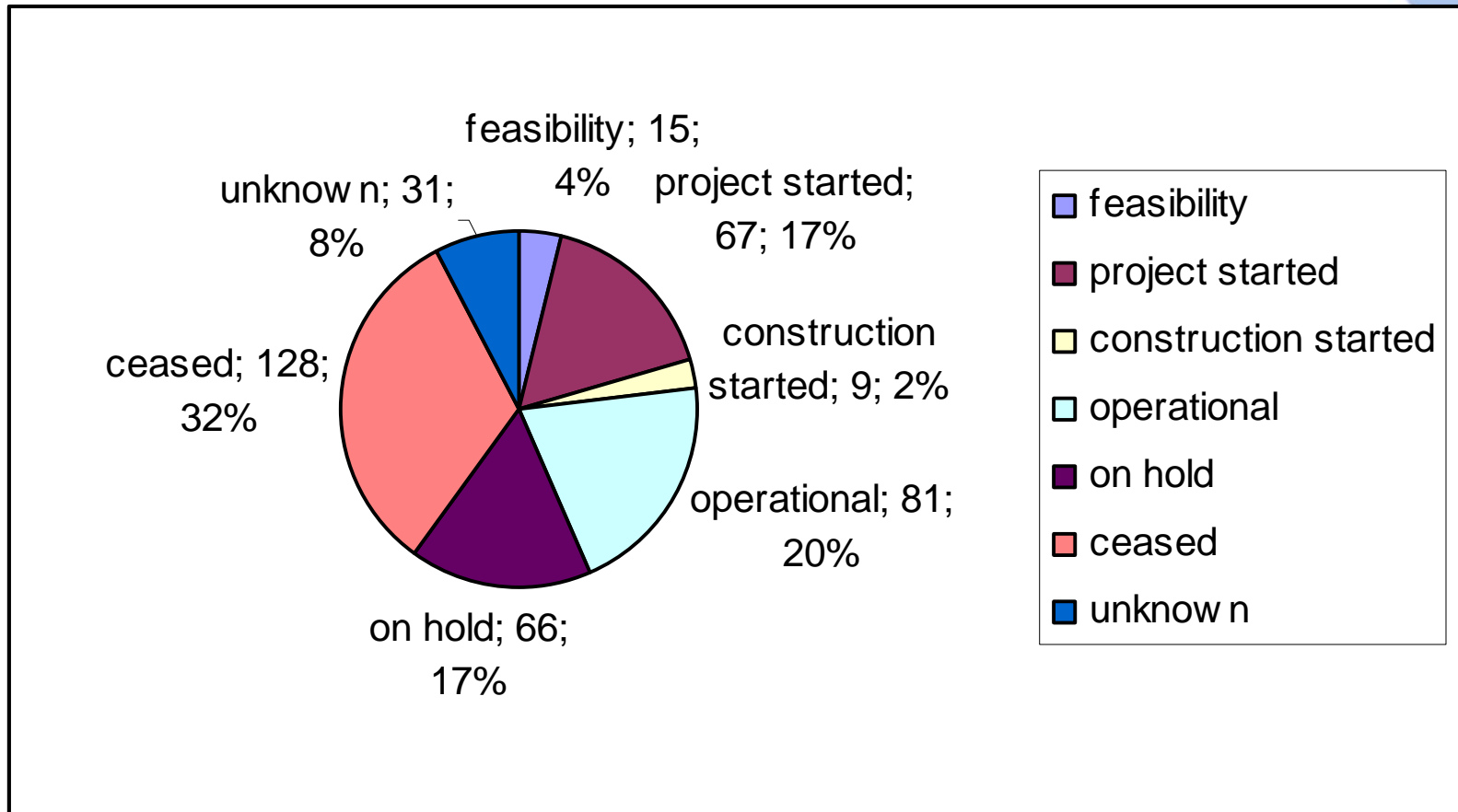
- Renewable energy situation in the Netherlands
- Development in number of bio-energy plants
- Sustainability criteria
- Green Gas approach and experience in the Netherlands
- New subsidy-programma for renewable energy (SDE)
- Other developments

Renewable energy situation in the Netherlands

Aandeel duurzame energie in EU-15 in 2005 volgens input methode



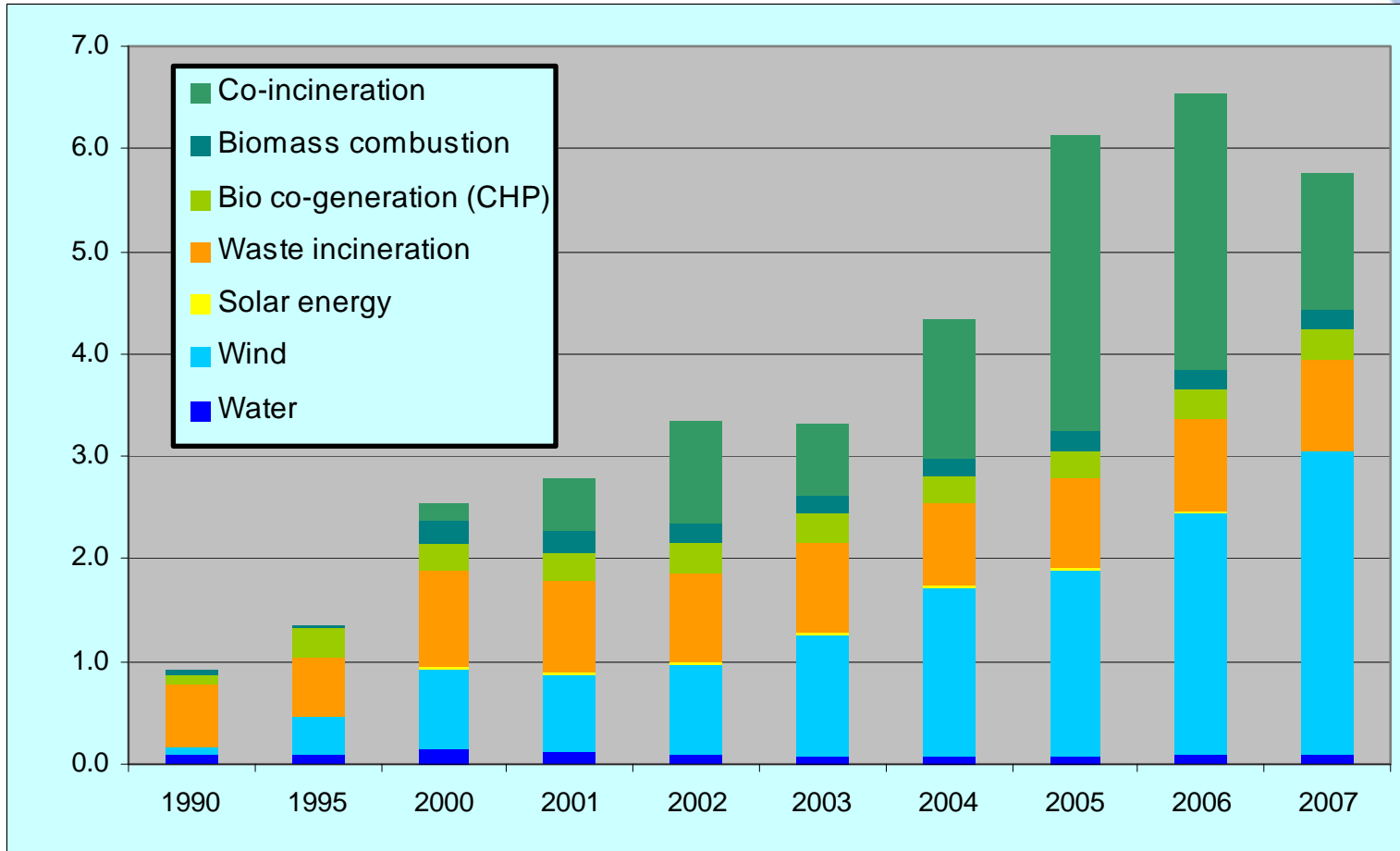
Project phase of small-scale bioenergy projects (status end 2007)



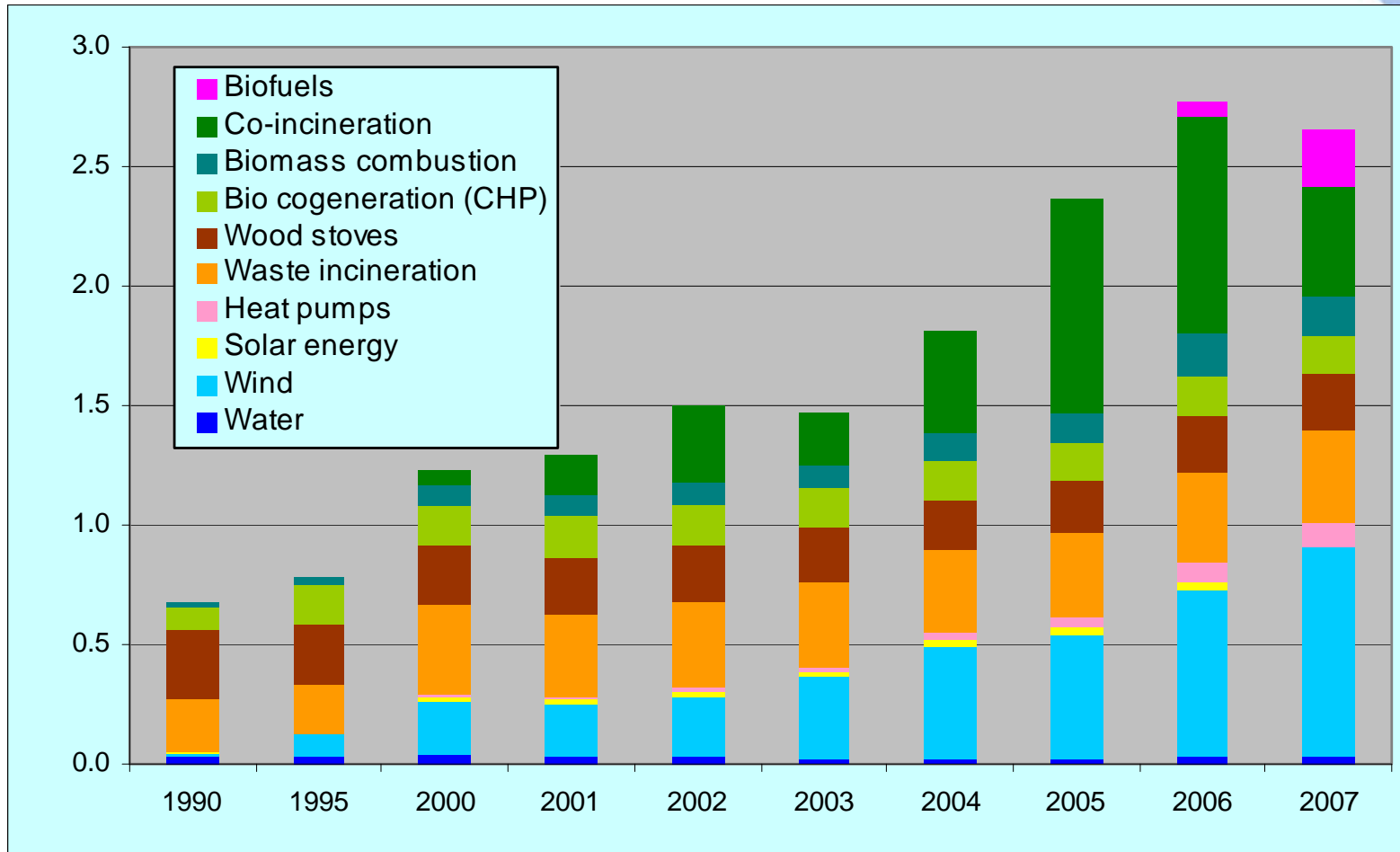
Development in number of small scale bioenergy plants (< 10 MWe) in operation

	2006	2007
Gasifiers (small scale demoplants)	2	2
(Co)-firing plants	14	15
Anaerobic Digesters	40	64
Total capacity	66 MWe	86 MWe

Sustainable electricity production as % of total electricity consumption (y-axis)



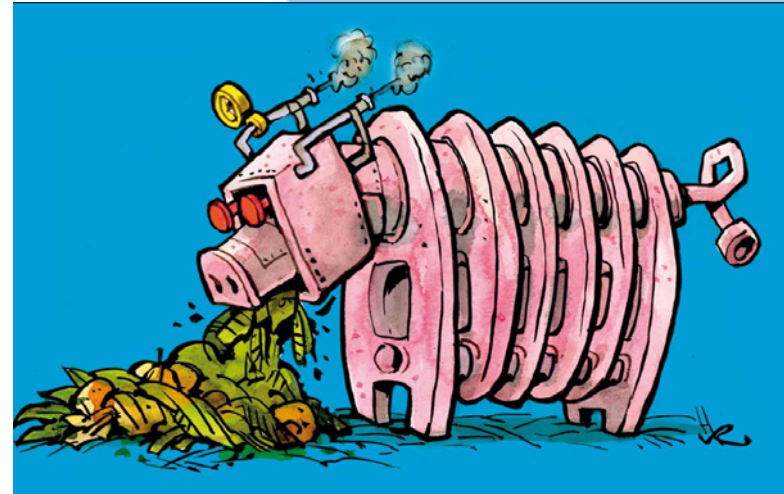
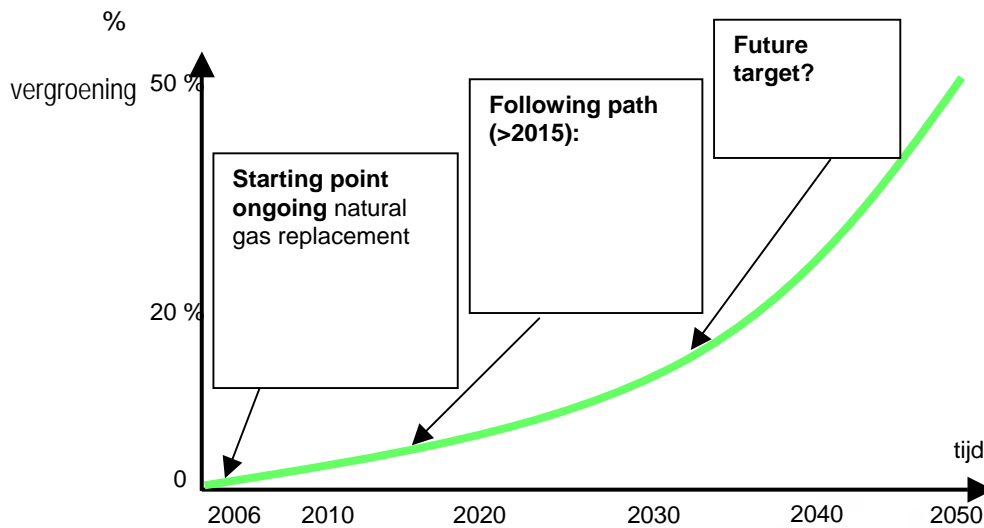
Sustainable energy as avoided primary energy, in % of total consumption



Sustainability criteria as a basis for future stimulation bioenergyprojects: Selection of Themes

- **Greenhouse gas balance in the production chain**
- **Competition with food, local energy supply, medicines and construction materials**
- **Biodiversity**
- **Environment**
- **Economic prosperity**
- **Well-being**

Ambition for Green Gas



- Short term target: Replacement of natural gas by upgraded biogas 1-3%
- Midterm target: 8-12% replacement of natural gas in 2020 (4 billion Nm³/y), inclusive SNG production from biomass
- Long term: Upscaling to 50% replacement of natural gas by green gas in het gasgrid

Green House Gas Balance

- Minimum net reduction of GHG 50-70% in comparison with energyproduction bases on fossil fuel
- Minimum net emission reduction of 30% for the production of first generation biofuels in transport.
- Setting up an CO₂-tool for calculation of these net emission effects by different energyconversions.
- Preliminary calculations shows that this minimum criteria can be met by biogasproduction with digestion. Critical point is methaneslip in CHP and end storage.

Energy transition platforms



Transition approach by discussion platforms:

info: <http://www.senternovem.nl/EnergyTransition/Index.asp>

- Sustainable Mobility Platform
- Biobased Raw Material Platform
- New Gas Platform (with working group on Green Gas)
- Platform for Chain Efficiency
- Sustainable Electricity Supply Platform
- Energy in the Built Environment Platform

Different technologies for biogasupgrading available

- VPSA
- membrane
- air washing
- cryogenic

Info: Brochure: Upgrading to natural gas quality;
From biogas to green gas



Creative Energy
Energy Transition

Upgrading to natural gas quality From biogas to green gas

Biogas is produced by fermentation of a mixture that includes crop waste, liquid waste streams and maize, often in combination with manure. Nowadays, biogas is mainly used to produce electricity. But there is a more sustainable and more efficient option: upgrading the biogas and returning it to the gas grid. Biogas that has been upgraded to natural gas quality is called 'green gas'.

The Netherlands depends on natural gas for around 50% of its primary energy supply. There is therefore a lot of work left to be done to achieve 20% sustainable energy and a 30% reduction in greenhouse gas emissions (such as CO₂, methane and nitrous oxide) by 2020, as defined by the EU and the Balkenende IV government. The obvious solution is to use the Netherlands' experience as a gas-producing country to achieve these targets.

The Netherlands as a green gas country
The Netherlands has a great deal of knowledge and expertise in relation to gas. It also has an excellent gas infrastructure, which is capable of transporting more energy than the electricity grid. In addition, the Netherlands has biomass at its disposal in the form of waste flows, including those from agriculture and the food industry, and it has ports that can be used to import biomass.

This means that green gas has great potential as an economic engine. This is already being proved in practice: Dutch companies are often forerunners in the development of upgrading techniques for biogas and the supply of green gas is an attractive option for producers of biogas. It is also possible to use upgraded biogas as vehicle fuel.

Green gas has added value
The promotion of sustainable energy by the government will in the future be based on the level of sustainability, which is better for green gas than for electricity production through fermentation. Green gas is the cleanest option: the net reduction in CO₂ emissions is much greater.

CLEAN PROFITS IN ZWIGGELTE
In the province of Drenthe, a number of farmers have formed the Central Drenthe Biogas Cooperative (Coöperatie Biogas Rivierland Drenthe) to jointly produce sustainable energy. They opted to ferment biomass, in this case mainly manure. The cooperative intends to upgrade the biogas produced to natural gas quality, so that it can be supplied to the natural gas grid as green gas.

Present Biogas upgrading projects in the Netherlands

Location	Method	Since	Production 2003 m ³ /y
Tilburg	Waterwash	1985	2.784.440
Nuenen	PSA	1985	3.082.795
Wijster	PSA	1985	3.927.550
Collendoorn	Membrane	1993	201.106
Beverwijk	Membrane	2006	(160 m ³ /hr) 1.280.000

- Upcoming project “de Marke” smale scale biogaswashing

Activities in preparation Green Gas implementation

- Development of a: “Groen gas boek”; see www.groengasboek.nl
- Investigation gasgrid companies
- Vision document of the energytransition working group: Green Gas: Let’s give full gas!
- Backgrounddocumentation: Gasquality requirements
- Strategic exploration study on digestion
- Symposia and workshops
- Demonstration Projects
 - de Marke: 18 Nm³/h
 - Biogast: 80 Nm³/h



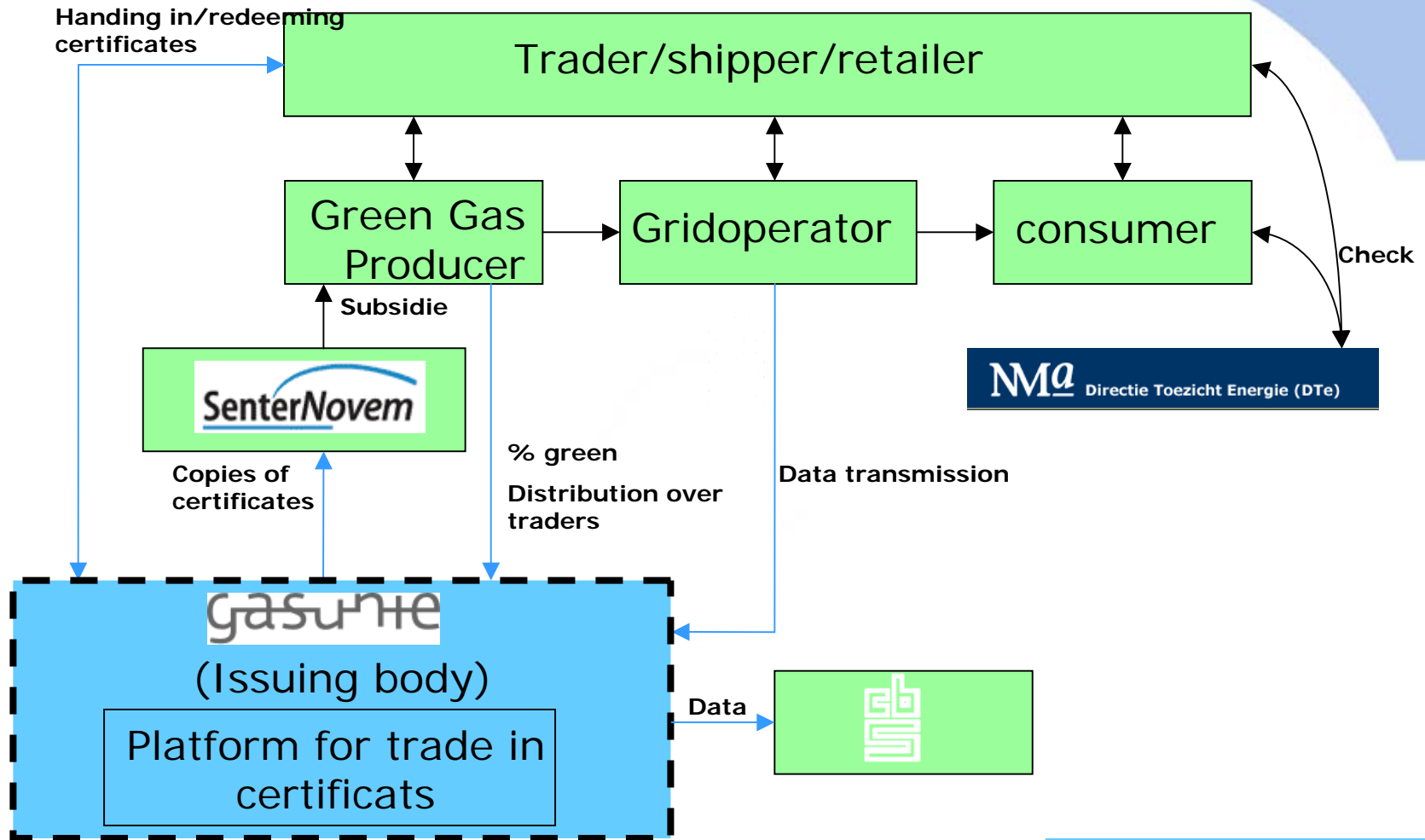
Kwaliteitscomponent	Conform advies Gastec	
	Grenswaarde	eenheid
Calorische bovenwaarde	31,6 – 38,7	MJ/nm ³
Wobbe-index	43,46 – 44,41	MJ/nm ³
Waterdauwpunt	-10(8 bar)	°C
Temperatuur in te voeden gas	0-20	°C
Zwavel (totaal)	45	mg/nm ³
Anorganisch gebonden zwavel (H ₂ S)	5	mg/nm ³
Mercaptanen	10	mg/nm ³
Odorantgehalte (THT)	>10, nom 18<40	mg/nm ³
Ammoniak	3	mg/nm ³
Chloorhoudende verbindingen	50	mg/nm ³
Fluorhoudende verbindingen	25	mg/nm ³
Waterstofchloride (HCL)	1	ppm
Waterstofcyanide (HCN)	10	ppm
Koolmonoxide (CO)	1	Mol%
Kooldioxide in droge gasnetten (CO ₂)	6	Mol%
BTX (benzeen, toluen, xyleen)	500	ppm
Aromatische koolwaterstoffen	1	Mol%
Zuurstof in droge gasnetten	0,5 (3)	Mol%
Waterstof	12	Vol%/nm ³
Methaangetal	>80	-
stof	Technisch vrij	-
Siloxanen	5	ppm
Ruikbaarheid (geodoriseerd biogas)	voldoende	

Gasquality requirements for gasgrid injection in Dutch gaslaw; since nov. 22th 2006

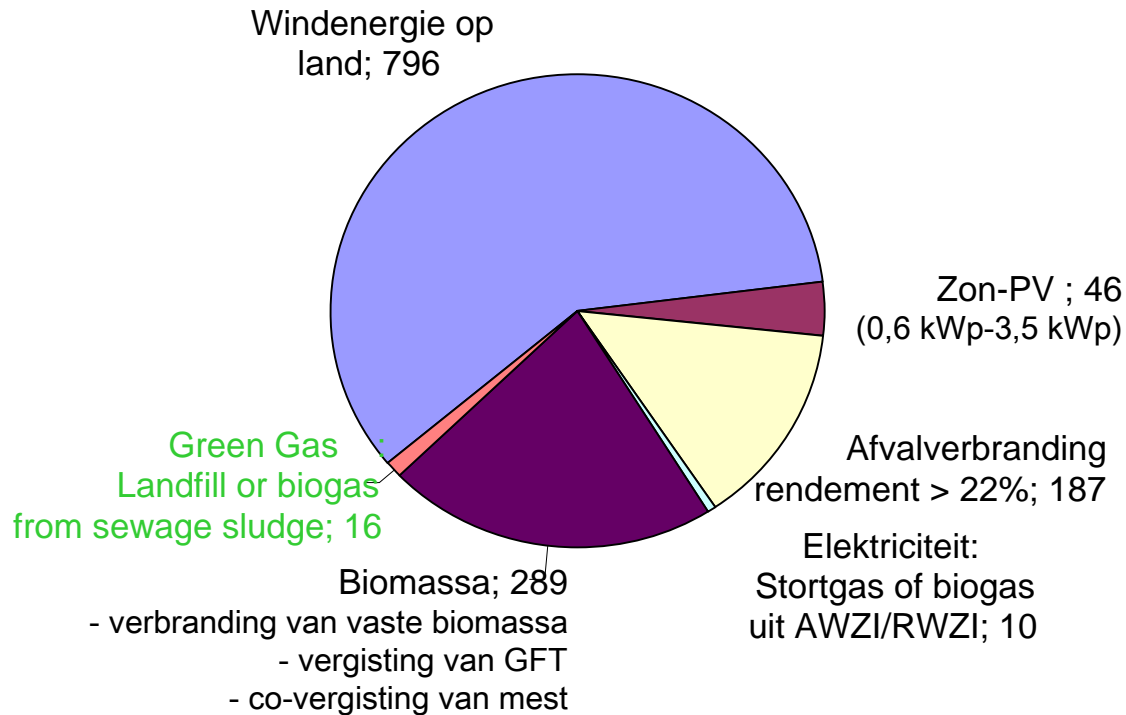
Problems to solve for gas grid injection

- Quality assurance
Items: influence of bacteria, influence of fosfines, gridcorrosion
- Balancing the grid
- Certification system: for Green Gas
Independentsy between production and consumption of green gas by creating a virtual market system
- (local) grid capacity

Set up of the virtual trade system voor Green Gas certificates

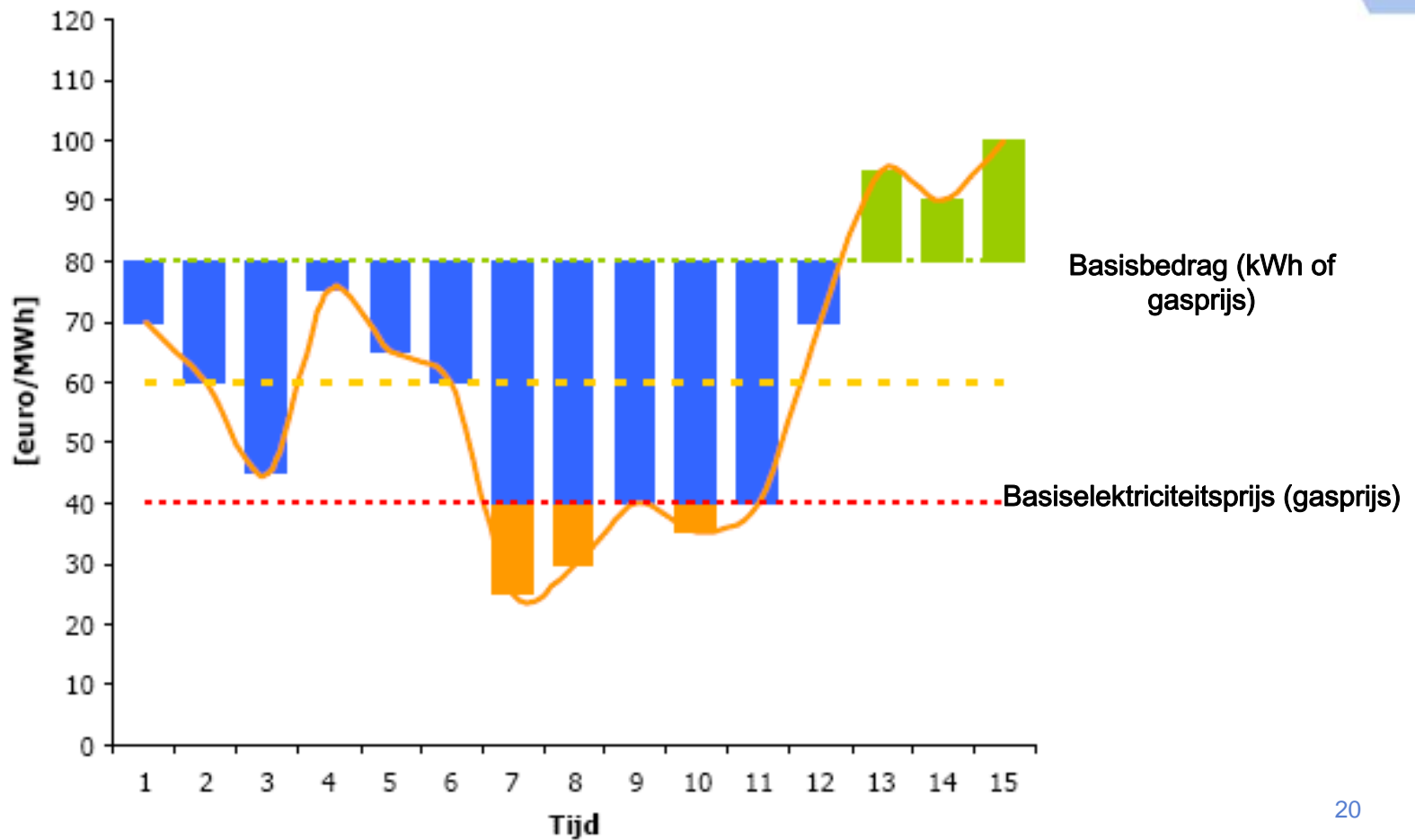


New subsidy programm for renewable energy: SDE Budget over 12 years: EUR 1.328 miljoen



Principles in the system for SDE-subsidies

example for total basic-electricityprice per MWh: 80 €/MWh en basic electricity income of 40 €/MWh per sold MWh



Subsidiebedragen SDE 2008

	Categorie	Basisbedrag	Correctie- bedrag	Verwacht subsidie- bedrag	Subsidie periode	Vollast- uren	Vermogen 2008 (MW)
1	Wind op land	€0,110 per kWh	€0,065 per kWh	€0,045 per kWh	15 jaar	1760	500
2	Elektriciteitsopwekking mbv RWZI/ AWZI/Stort-gas	€0,058 per kWh	€0,058 per kWh	€0 per kWh	12 jaar	8000	8
3	Groengasproductie mbv RWZI/ AWZI/Stort-gas	€0,277 per Nm ³ gas	€0,198 per Nm ³ gas	€0,079 per Nm ³ gas	12 jaar	8000	5
4	AVI's met een energetisch rendement hoger dan 22%	Basisbedrag op-lopend naar rato v/h energie rendement €0,115-0,137 per kWh	€0,121 per kWh	€0,00-€0,016 per kWh	15 jaar	3880	70
5	Verbranding vaste biomassa, vergisting GFT co-vergisting mest	€0,12 per kWh	€0,058 per kWh	€0,062 per kWh	12 jaar	8000	40
6	Kleinschalige Zon-PV-installaties (0,6 kWp – 3,5 kWp)	€0,564 per kWh	€0,234 per kWh	€0,33 per kWh	15 jaar	850	10

Other developments

- Publication of report: Let's give full gas!
- Several workshops about Green Gas
- Symposium at April 8 on Green Gas with all gasgridoperators
- Building a Green Gas certification system by Gasunie to support a virtual trade of Green Gas
- Starting up market for Green Gas by energy companies and other companies
- Starting initiatives for Green Gas filling stations all over the country