

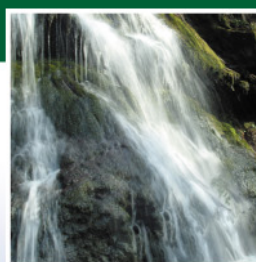


ELREN

European Leader+ Renewable Energy Network



Carlow LEADER
Rural Development Co. Ltd.



Chapter 16

Country Report – The Netherlands



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16 Country Report – The Netherlands

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16.1 Policy and Legislation

This section provides an overview of the policy and legislation relevant to the production of renewable electricity (RES-E), renewable heat (RES-H) and biofuels.

Learning objectives

This chapter should provide you with key national policy and legislation relevant to renewable energy in the Netherlands. After studying this chapter you should be able to answer the following questions:

- Do national targets for renewable energy exist? Is there one global target or do sector-specific targets for electricity, heat and biofuels exist? Are the targets short- or long-term? Does something like a national strategy for renewable energy exist?
- What kind of support instruments are in place for the different sectors? Feed-in or premium tariffs, quota obligations, investment subsidies or tax reliefs?
- What is in brief the status of the renewable energy market?
- Which are the key institutions relevant to the renewable energy sector?

Renewable energy targets

The Dutch climate policy contains a global target of 10% renewable energy by 2020 with an interim indicative target of 5% by 2010. Particularly wind energy and biomass have to achieve this target. (*Derde Energie Nota (Third Energy Memorandum; Ministry of Housing, Spatial Planning and the Environment)*)

The RES-E target to be achieved by the Netherlands in 2010 is 9% of gross electricity consumption, which is achievable with current growth rates.

As of 2007 all Dutch fuel suppliers will have an obligation to supply 2% biofuels. The share will increase to 5.75% in 2010. This obligation serves to meet the targets set by the European Union.

Status renewable energy market

Up to 2003 the Dutch market for renewable electricity was characterised by high support and market openness, which resulted in a large increase of green power consumption. As the Dutch support scheme (tax exemption for RES-E) was also open for electricity from renewable sources produced abroad, it led to high imports of already existing RES production as well. As it did not give sufficient incentives for an increase of domestic RES-E production the policy support scheme was heavily criticised and accordingly revised. A new support scheme (premium tariffs) has been in operation since July 2003, which led to increasing investments and deployment of RE, but the premium tariffs were put at zero in August 2006. After the elections (at the end of 2006) the new government will have to decide about the future support scheme. Investments in renewable energy are heavily affected due to the political uncertainty about renewable energy support.

The number of households in the Netherlands consuming green power is 2.8 million which is extraordinarily high compared to other European countries. Competition in green pricing and green power supplies has been fierce in the wake of the opening-up of the green power market in July 2001.

Concerning heating and cooling from RES only biomass shows a significant degree of utilisation at the present stage.

Due to a tax relief and the proposed obligation for biofuels as of 2007, some fuel companies started to offer gasoline with a 2% share of ethanol in 2006.

Main supporting policies

Renewable Electricity

As of 1 July 2003, the new policy programme MEP (Environmental Quality of Power Generation) to support RES-E has been in operation. This includes source specific premium tariffs that are paid for 10 years on top of the market price for electricity. Premium tariffs should not be confused with feed-in tariffs, which include the market value of electricity, and thus are the only income source for RES-E producers. Where RES-E is produced for own consumption it is also possible to just sell the surplus electricity.

Premium tariffs are adjusted every year. In May 2005 feed-in tariffs for large scale pure biomass (>50 MWe) and offshore wind were temporarily set at zero. The reason was due to lack of finance due to the strong development of offshore wind farms in particular. The available budget is financed through a charge for every electricity consumer, this charge is always defined one year in advance. The premium tariffs of the MEP scheme were rated at zero in August 2006 by the Ministry of Economic Affairs for all new applicant projects. This was due to the expectation by the ministry that the RES-E target for the Netherlands would be reached if all projects that already applied for the MEP were realised. After the parliamentary elections (at the end of 2006) the new government will probably re-introduce some form of support, but no decisions on this topic are made yet.

The premium tariffs as applicable up to August 2006 are given in Table 16.1 below.

Technology	€/MWh
Mixed biomass and waste	36
Wind on-shore	65
Wind off-shore	97
Pure biomass large scale > 50 MWe	66
Pure biomass small scale < 50 MWe	97
PV, tidal and wave, hydro	97

Table 16.1 Premium tariffs as applicable up to August 2006

The responsible body for the administration of the premium tariffs (MEP) is EnerQ (see end of this chapter for contact details).

Up to the end of 2004 RES-E was exempted from the energy tax. The energy tax exemption for RES-E was abolished on 1 January 2005. The premium feed-in tariffs for 2005 were increased to compensate for this abolishment.

Tradable MEP certificates are generated along with every unit of renewable electricity, although their value does not vary – they are worth the level of the premium feed-in tariff and are used to claim the feed-in tariff. MEP certificates are separate from guarantees of origin.

The system for Guarantee of Origin (GoO) is introduced by renaming the former green certificate system to a Guarantee of Origin system. The Guarantee of Origin system is fully compatible with the Renewable Energy Certificate System (RECS) that is internationally used for voluntary green power consumption. Imports are still allowed (foreign Guarantee of Origin or RECS certificates), but are not eligible for the premium tariff.

Companies investing in RES-E can subtract the investments in renewables from their profit tax (tax relief = Energie Investerings Aftrek).

Renewable Heat

Several support instruments exist for RES-H. Investment subsidies are available through the CO₂ reduction plan (available budget is limited). Investments from companies can also be compensated through a tax relief (Energie Investerings Aftrek). For Combined Heat and Power (CHP) the MEP applies, which was described above for RES-E. Tariffs for new installations varied in 2006 between 18 and 33 €/MWh, depending on technology and size.

Biofuels

In the past, biofuels have been stimulated only by R&D funds. In 2006 biofuels receive a tax relief, allowing fuel suppliers to sell fuel with a 2%-share of biofuels for the same price as normal fuel. As of 2007 all Dutch fuel suppliers will have an obligation to blend 2% biofuels in normal fuels. The share will have to increase to 5.75% in 2010.

Unbundling

The transmission systems for electricity is totally separated and owned by the national government as separate companies (ownership unbundling). The distribution networks are currently legally separate from the supply businesses.

Key factors

The political instability in the past and resulting uncertainty on future energy support programmes resulted in withholding new renewable energy investments. The new system, the MEP scheme (premium tariffs), has improved investment conditions, although the short duration of up to 10 years of the tariffs provided is still criticised. The MEP scheme (premium tariffs) was abolished in August 2006 which again causes huge uncertainty in the renewables sector and will slow down development significantly.

Relevant institutions

Ministerie van Economische Zaken (EZ - Ministry of Economic Affairs)

Responsible for support schemes

www.minez.nl

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer
(VROM - Ministry of Housing, Spatial Planning and the Environment)

EnerQ

Administrating body for the MEP support scheme (feed-in premium)

www.enerq.nl

CertiQ

Issuing body for the Guarantee of Origin and MEP certificates

www.certiq.nl

SenterNovem

Agency of the Ministry of Economic Affairs

Implements policy in the field of sustainable development and innovation
(thus including renewable energy) on behalf of the government

www.senternovem.nl

ECN (Energy Research Centre of the Netherlands)

Most important energy research centre in the Netherlands; Covering everything from fundamental technological research to policy studies.

www.ecn.nl

Technical universities of Delft and Eindhoven

Relevant research on RE

www.tudelft.nl

www.tue.nl

16.2 Overview of RE Technologies

Learning objectives

This section should help you to become more familiar with the specific national situation of the different renewable energy technologies. After studying this chapter you should be able to answer the following questions:

- Which are the relevant technologies in terms of current production and future potential?

- Which technologies have the potential to contribute significantly to an increase of renewable energy use? Which problems need to be overcome to realise this growth?
- What are the key characteristics of the different technologies?

16.2.1 Overview of installed capacity and potential

This section provides an overview of the installed capacity and the potential of all technologies used for the production of renewable electricity (RES-E), renewable heat (RES-H) and biofuels. Interpretation and details can be found in the technology-specific sections.

RES-E Technology	1997 [GWh]	2004 [GWh]	Av. Annual growth [%]
Biogas	251	290	2%
Solid Biomass	4	1,815	140%
Biowaste	1,311	1,275	0%
Geothermal electricity	0	0	-
Hydro large-scale	91	95	1%
Hydro small-scale	1	0	-100%
Photovoltaics	1	34	70%
Wind on-shore	344	1,745	25%
Wind off-shore	40	40	0%
Total	2,133	5,385	14%
Share of total consumption [%]	3.5%	4.70%	

Table 16.2 Renewable electricity production in NL in 1997 and 2004 in GWh

RES-H Technology	Penetration 1997 (ktoe)	Penetration 2004 (ktoe)	Av. Annual growth [%]
Biomass heat	296	382	4%
Solar thermal heat	6	15	15%
Geothermal heat incl. heat pumps	0	31	-

Table 16.3 Production of renewable heat in NL in 1997 and 2004 in ktoe

	Penetration 1997 (ktoe)	Penetration 2005 (ktoe)	Av. Annual growth [%]
Liquid Biofuels	0	4	n.a.

Table 16.4 Production of Biofuels in NL in 1997 and 2005 in ktoe

Sources: Member State reports, EUR'Observer, Eurostat, national statistics, industry associations and other sources

Figure 16.1 below compares the achieved potential in 2003 to the feasible potential until 2020. For the feasible potential it is assumed that those RES support policies that have shown in the past to be the most effective ones, are applied throughout the EU. The feasible potential is below the technical potential as it takes into account barriers to potential growth. Barriers are for example grid extension constraints, non-transparent markets or lack of societal acceptance for new plants.

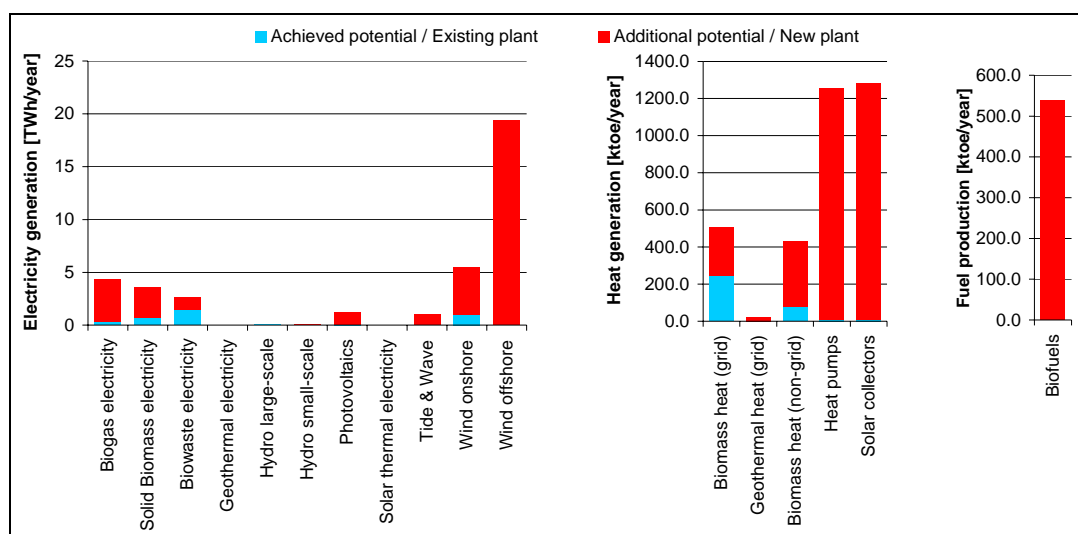


Figure 16.1 Achieved potential in 2003 compared to additional potential up to 2020 (FORRES)

Renewable energy in greenhouses

An application especially relevant to the Netherlands is the use of renewable energy in greenhouses. Greenhouses consume a considerable share of primary energy in the Netherlands and the potential for the deployment of several renewable energy technologies is high.

The branch organisation “Productschap Tuinbouw” (www.tuinbouw.nl) together with the Ministry for agriculture, nature and food quality (www.minlnv.nl) finances the program “Kas als energiebron” (“Greenhouse as energy source” - www.kasalsenergiebron.nl). The aim of the program is al-

most energy-neutral greenhouses by 2020. The program foresees increased activities in six areas, amongst others:

- Production of solar energy (production of heat, cold, electricity)
- Use of biofuels (in combined heat and power plants)
- Use of geothermal heat
- Use of renewable electricity

16.2.2 Solar heat

Background

Long term agreements for the implementation of solar heat systems made between the Dutch government, solar industry and energy utilities have led to a considerable growth of solar thermal heat from 1994 onwards. Over the last few years growth has considerably slowed down due to changing support conditions.

National potential

As solar thermal heat depends on direct radiation, the potential obviously is much lower than in southern European regions. The potential to 2020 is estimated to be about 1,300 ktoe/year, which is still huge compared to both the currently installed capacity and the biomass heat potential.

National installed capacity

In 2004 about 15 ktoe of Solar thermal heat was produced. This is relatively small compared to biomass heat production.

Characteristic features of the technology in the particular country

Due to specific regulation, solar thermal systems in the Netherlands have to be designed in a special way: Liquids containing anti-freeze used to transport heat away from the collector have to be kept separate from the rest of the heating circuit. Thus not all systems produced abroad can be used in the Netherlands.

About 10,000 household solar thermal systems are sold annually. Only a few companies are specialised in solar thermal. Building companies are also active in installing solar thermal systems. Interest from potential installation companies is low as solar thermal is not seen as a growth market.

Energy utility ENECO is active in leasing out large solar thermal systems, which has the advantage that tax relief applies (Energie Investerings Aftrek).

Barriers to adoption

Main barriers are lack of financial support and public awareness. In houses not owned by the occupant one also faces the user-investor-dilemma: The landlord who would have to invest in a solar thermal system often does not have any (financial) advantage from the investment.

Government supports

Investment subsidies are available through the CO₂ reduction plan (available budget is limited). Investments from companies can also be compensated through a tax relief (Energie Investerings Aftrek). Provinces and municipalities also have subsidy programmes in place.

Case studies

Case studies in Dutch language can be found on the following website:

<http://www.hollandsolar.nl/nld/zonnewarmte/index.htm>

16.2.3 Photovoltaic

Background

Photovoltaics have quite a long history in the Dutch RE sector, especially in research which used to be cutting edge since the 1980ies. Actual deployment of photovoltaics increased rapidly for some years when due to favorable financial support lots of PV was installed by private households. The big energy utilities used to play an important role in this. Due to changed support

conditions this development has slowed down significantly which also affects research and development negatively.

National potential

The potential to 2020 is about 1 TWh/year, which is rather small compared to the wind and biomass potential. The conditions for Photovoltaic throughout the Benelux countries can be seen from Figure 16.2 below.

Yearly sum of global irradiation received by optimally-inclined PV modules
Belgium, Netherlands, and Luxembourg

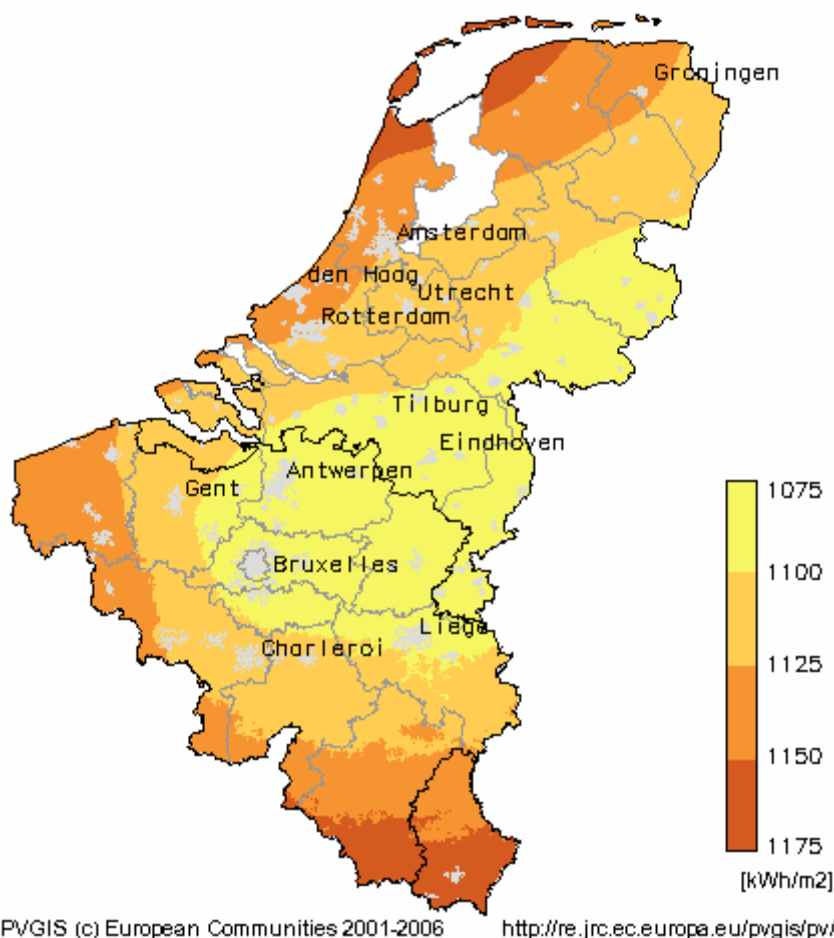


Figure 16.2 Yearly sum of global irradiation in the Benelux (PVGIS)

National installed capacity

Electricity production from photovoltaic has increased from 1 GWh in 1997 to 34 GWh in 2004 which was a quite impressive growth, but growth rates have slowed down substantially.

Characteristic features of the technology in the particular country

Lots of research is done at ECN, TU Delft and TU Eindhoven (see policy section for details of these institutions). The focus is on improved efficiency of the silicon technology and further development of the thin-film technology, but also some more fundamental research is conducted.

Barriers to adoption

The main barrier to adoption is currently the high cost and low support for photovoltaic technology. This can be clearly seen from the fact that a more vibrant market existed when better support conditions were in place in the past.

Government supports

Under the discontinued support system MEP photovoltaic received a premium of 97 Euro/MWh on top of the value of the electricity produced.

Financial viability

Financial viability of several RES-E technologies in all EU countries has recently been analysed in an EU funded research project. When comparing costs and support levels among the countries, one has to make sure to deal with comparable quantities. In particular, the support level in each country needs to be normalised according to the duration of support in each country, e.g. the duration of green certificates in Italy is only 12 years compared to 20 years for guaranteed feed-in tariffs in Germany. The support level under each instrument has therefore been normalised to a common duration of 15 years. The conversion between the country-specific duration and the harmonised support duration of 15 years is performed assuming a 6.6% interest rate.

Figure 16.3 below shows price ranges (average to maximum support) for direct support of photovoltaic electricity in EU-15 Member States (average tariffs are indicative) compared to the long-term marginal generation costs (minimum to average costs).

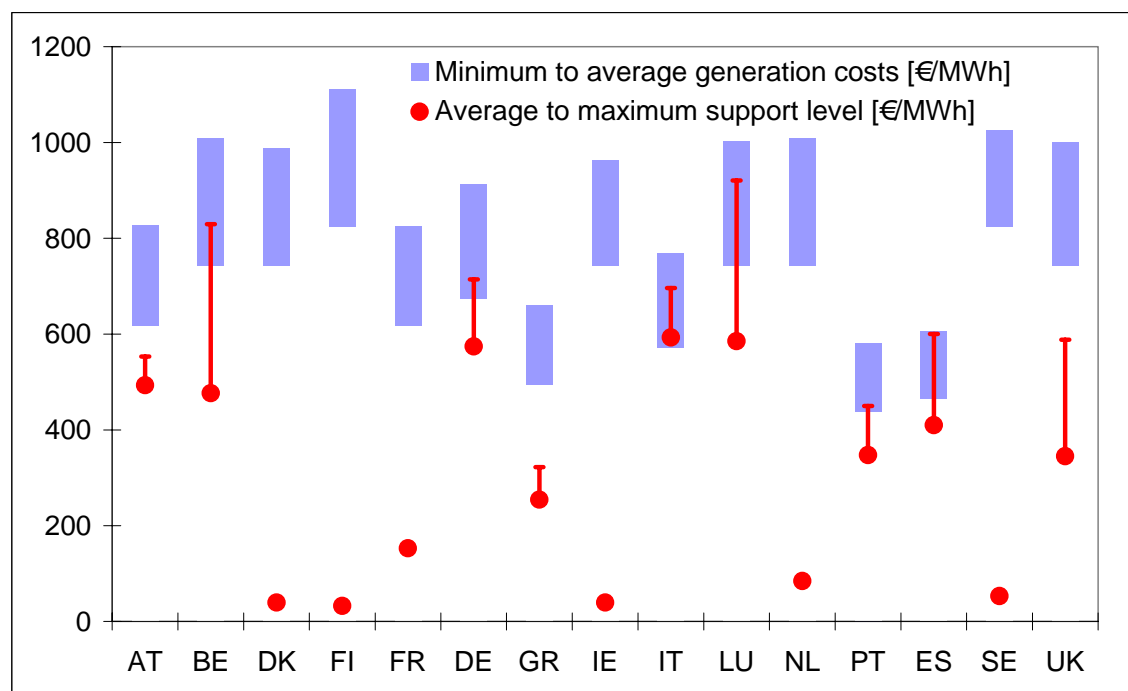


Figure 16.3 Price ranges for photovoltaic in EU-15 Member States compared to support levels
(European Commission 2005)

The figure shows that even under the support system MEP – which is currently discontinued - photovoltaic projects were financially not viable.

Case studies

An extensive case study on a newly built suburb of Amersfoort with 1MWp integrated in the buildings including lessons learnt is provided in Annex 1.

Relevant organizations for the Dutch solar energy sector

Holland Solar

Industry association for solar thermal and photovoltaic energy

<http://www.hollandsolar.nl>

Relevant Dutch producers/suppliers are:

- Scheuten – module productions and system supplier, part of glass whole-sale company
- Oskomera – system house, focus on façade integration, part of building company
- Ecostream – whole production chain
- Stroomwerk – system house
- Sunfactory – system house
- Ubbink – module production
- Solland – cell production

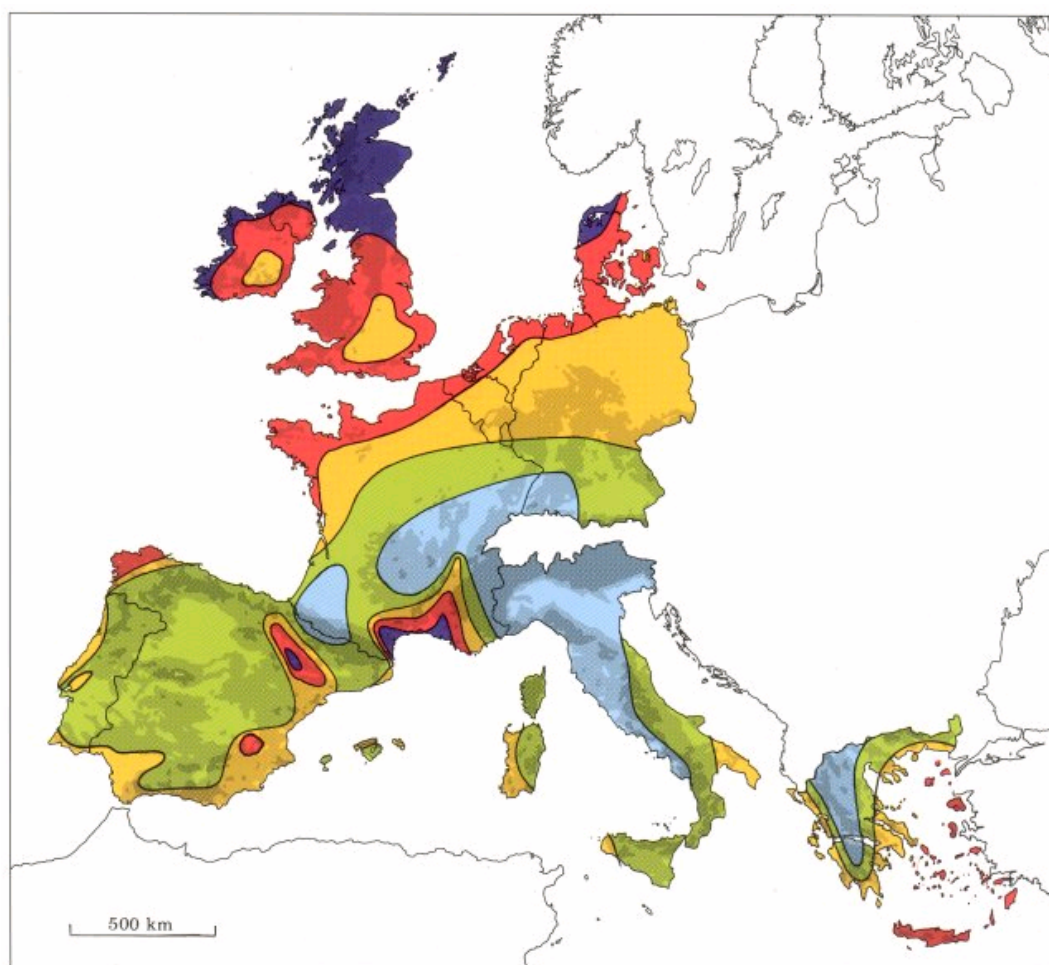
16.2.4 Wind

Background

The Netherlands have a long history in the use of wind energy and had a lively industry and an important position in research in past years. But the domestic industry always suffered from frequently changing support conditions and lengthy permission procedures for wind projects in the home market and thus lost its international relevance. The development in offshore wind energy might cause some new industry initiatives while research, both on and offshore, is still internationally relevant.

National potential

The onshore potential is estimated to be about 5 TWh/yr to 2020, which is about twice the currently installed capacity. The offshore potential is almost 20 TWh/yr. Figure 16.4 below shows the wind conditions in the Netherlands compared to other parts of Western Europe.



Wind resources ¹ at 50 metres above ground level for five different topographic conditions										
	Sheltered terrain ²		Open plain ³		At a sea coast ⁴		Open sea ⁵		Hills and ridges ⁶	
	m s ⁻¹	Wm ⁻²	m s ⁻¹	Wm ⁻²	m s ⁻¹	Wm ⁻²	m s ⁻¹	Wm ⁻²	m s ⁻¹	Wm ⁻²
	> 6.0	> 250	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 11.5	> 1800
	5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
	4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
	3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0- 8.5	400- 700
	< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 7.0	< 400

Figure 16.4 Wind potential in Western Europe (European Wind Atlas)

National installed capacity

With 2,731 GWh produced in 2005 (1,745 GWh in 2004) the Netherlands is ranked fourth in Europe in terms of wind power production, in front of the UK. The first offshore wind farm (108 MW) will be erected in 2006, while the second offshore wind farm (120 MW) is expected to be erected in early 2008.

The following Table 16.5 provides an overview over the offshore wind projects currently under development.

Name and location	Installed capacity	Project developers	Expected to be operational by
Noordzeewind 8 km offshore Egmond aan Zee	108 MW 36 Vestas turbines (V90) of 3 MW	Nuon and Shell	End 2006
North Sea Q7 23 km offshore IJmuiden	120 MW 60 Vestas turbines (V80) of 2 MW	Econcern and Eneco	Spring 2008
Up to September 2006, 9 project developers started administrative procedures for 65 wind farms in the North Sea (200-500 MW each).			
Website Noordzeewind: http://www.noordzeewind.nl			
Website Q7: http://www.q7wind.nl			

Table 16.5 Overview of offshore wind projects currently under development

Characteristic features of the technology in the particular country

The Netherlands has experience in offshore technologies which can be applied to offshore wind energy. An example is the specialised knowledge and technology for the installation of offshore wind farms.

All wind turbines have to be imported, as no wind turbines are manufactured in the Netherlands any longer. However, in 2005 *DarwinD* was founded, a company focused on the development and construction of a pure offshore wind turbine. Rationale behind this concept is that offshore wind turbines have to fulfill other requirements than onshore wind turbines: For example simple installation and maintenance is more important, while noise is less relevant.

Another new and interesting issue is the development of small, urban wind turbines.

Barriers to adoption

Lead times for authorisation of onshore wind projects can be very long, but improvements to the administrative procedures are currently under discussion.

Development of new wind projects is endangered due to lack of financial support (see below).

Relevant policy and legislation at the national level specific to the technology

Concerning wind energy the BLOW covenant (*Bestuursvereenkomst Landelijke Ontwikkeling Windenergie; Policy agreement national wind energy development; Ministry of Economic Affairs*) is of importance. In July 2001 an agreement was signed between the National Government, the Provincial Authorities and the umbrella-organisation for the Local Authorities. This agreement means that in 2010 a capacity of 1500 MW wind energy power has to be installed on land. In 2020 a capacity of 6000 MW wind energy has to be installed offshore. The BLOW covenant leads to wind strategy plans of the provinces. In wind strategy plans it is indicated how the Provincial Government envisages to reach the target for wind energy development.

Government supports

In May 2005 premium tariffs for offshore wind were temporarily set at zero. The reason was a lack of budget due to strong development of offshore wind parks (available budget is financed through a fee for every electricity consumer, which is always defined one year ahead). This sudden change in policy has created new uncertainty in the market. The support for other technologies was also stopped in August 2006.

Under the discontinued support system MEP wind energy received a premium of 65€/MWh (onshore) and 97 Euro/MWh (offshore) on top of the value of the electricity produced.

Companies investing in RES-E can subtract the investments in renewables from their profit tax (tax relief = *Energie Investerings Aftrek*).

Financial viability

Currently new projects are probably not viable due to government support being discontinued.

Figure 16.5 below shows price ranges (average to maximum support) for direct support of wind onshore in EU-15 Member States (average tariffs are indicative) compared to the long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years. See section on financial viability of photovoltaic projects for an explanation of this figure.

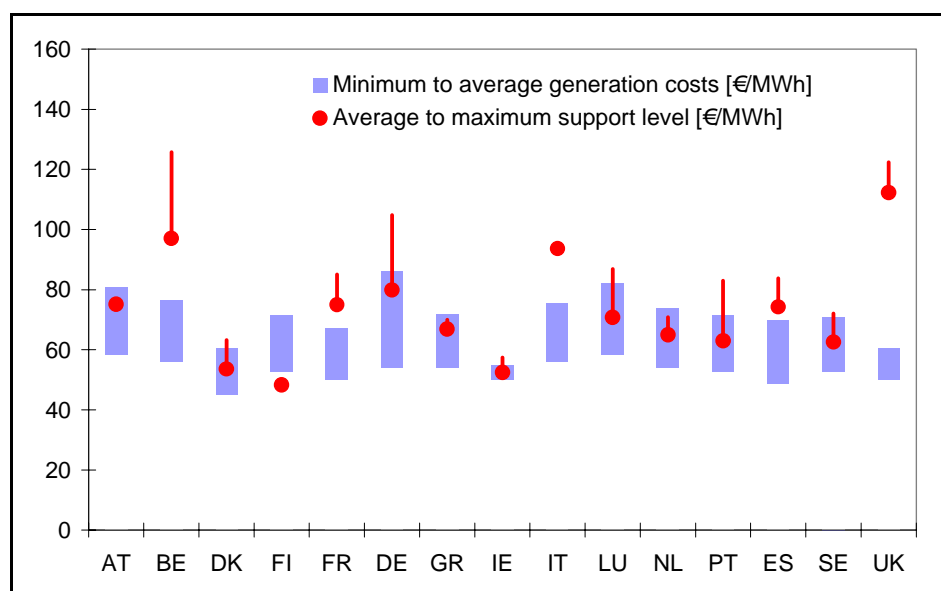


Figure 16.5 Price ranges for wind power in EU-15 Member States compared to support levels (European Commission 2005)

The figure shows that under the support system MEP – which is currently discontinued – it was possible to realise financially viable wind projects.

Case studies

In block Q7 of the Dutch Continental Shelf, some 23 kilometers offshore from IJmuiden the Offshore Wind farm Q7 is being built. The 120 MW (60 x 2 MW) wind farm will generate about 435 GWh annually. Some details are available in English and Dutch on the website www.q7wind.nl.

A detailed case study for a single wind turbine, initiated by the citizens of a suburb of the city of Breda is available in Dutch on the website www.kroetenwind.nl.

A power point slide show (in Dutch) presenting the seven year development and economics of a small wind park can be downloaded from the website www.ecowind.nl/downloads/Windpark%20De%20Locht%20-%20Kerkrade.pps

Relevant organisations for the Dutch wind energy sector

Nederlandse Wind Energie Associatie (NWEA)

Dutch lobby organisation for wind energy

<http://www.nwea.nl/>

FME-groep Windenergie

Organisation of Dutch wind turbine producers and component suppliers

<http://www.fme-wind.com>

Vereniging Particuliere Windturbine Exploitanten (PAWEX)

Organisation of independent wind turbine operators

<http://www.pawex.nl>

Nederlandse Windenergievereniging (NEWIN)

Dutch wind energy organisation

<http://www.newin.nl>

WE@Sea

Dutch offshore know-how consortium, including companies, research institutions and other organizations

<http://www.we-at-sea.org>

16.2.5 Hydro

Due to the Netherlands being almost completely flat, the hydropower potential is negligible. Besides very few existing projects with a total capacity of only 400 kW future deployment is neither planned nor likely.

16.2.6 Anaerobic Digestion

Background

Although electricity production from biogas has the highest potential of all bio-energy applications in the Netherlands, deployment and growth are still very small, especially compared to the utilisation of the potentials of other biomass technologies.

National potential

The potential for electricity production from biogas to 2020 is about five TWh/year.

National installed capacity

In 2004 290 GWh of electricity was produced from biogas. Growth rates have been very low over the last years. Figure 16.6 below shows the running biogas installations in October 2006. Biogas is produced in about 70 sewage treatment plants.

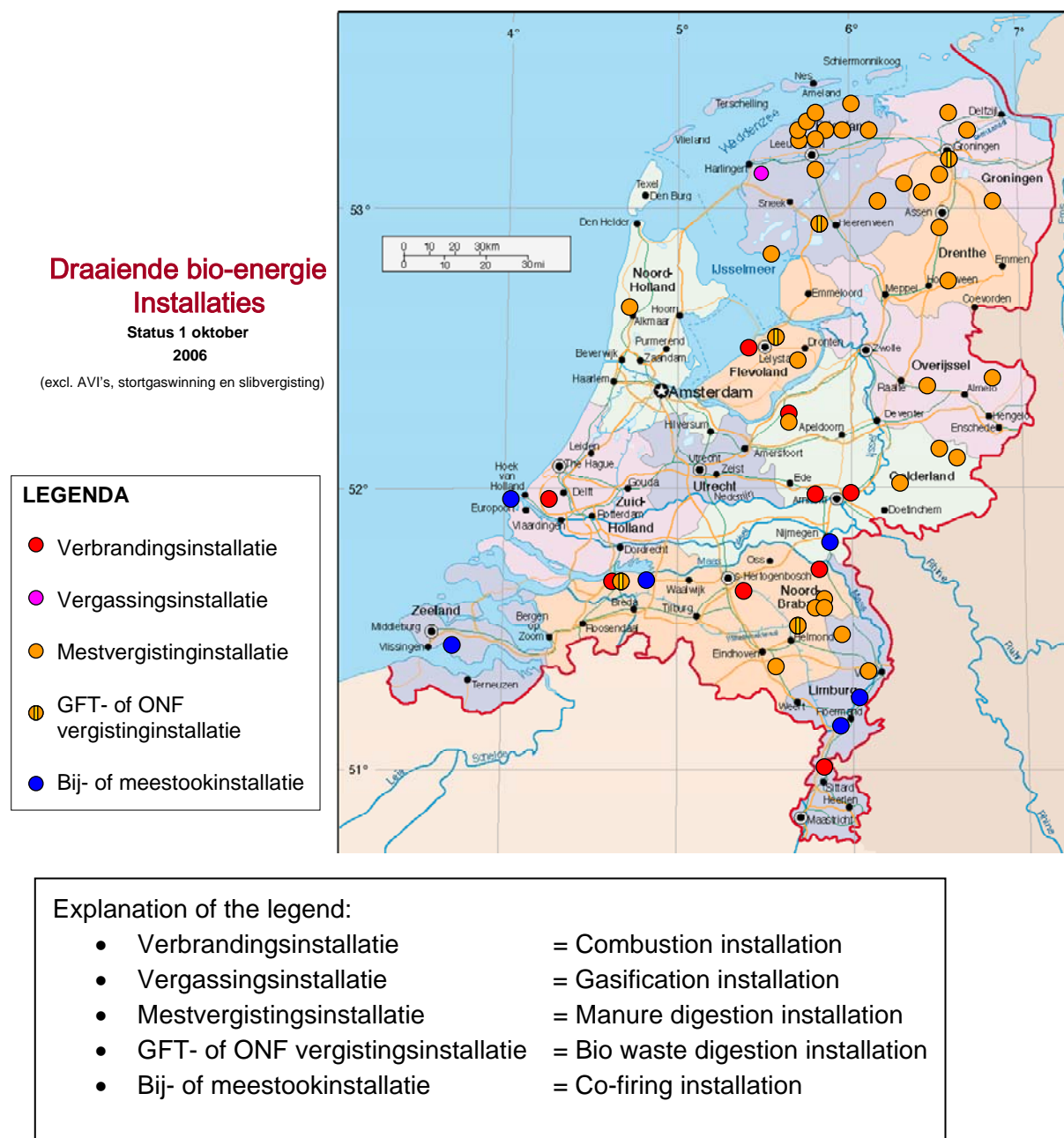


Figure 16.6 Operational biomass installations in October 2006

Characteristic features of the technology in the particular country

About 38% of the produced gas is landfill gas; another 38% is produced in sewage treatment plants, while 24% comes from other sources like agricultural plants. As cattle breeding is an important sector in the Netherlands, many anaerobic digestion plants are based on the anaerobic digestion of manure. At one site (Eindhoven) landfill gas is processed into the natural gas

grid, a process that is not widely used. Application of this process has also been under development at other sites, but development was stopped due to changes in energy taxation making these projects economically less favourable.

Relevant policy and legislation at the national level specific to the technology

In the discussions following the sudden abolishment of premium feed-in tariffs for all RES-E technologies in August 2006, an exception was made for small-scale anaerobic digestion projects already in preparation. A special regulation was adopted which guarantees the premium tariff for small-scale anaerobic digestion (< 2 MW) projects which were already in preparation in August 2006.

Barriers to adoption

Main barriers to adoption are administrative barriers (see also chapter 3), lack of financial support and low social acceptance by affected citizens due to worries about smell nuisance and increased traffic. The latter is also called NIMBy-ism (Not In My Backyard).

Government supports

Under the discontinued support system MEP biogas projects received a premium of 66 Euro/MWh (installations with a capacity of up to 50 MW) or 97 Euro/MWh (installations with a capacity of more than 50 MW) on top of the value of the electricity produced. See special rule above for small-scale anaerobic digestion (< 2 MW) projects.

Financial viability

Figure 16.7 below shows price ranges (average to maximum support) for direct support of agricultural biogas in the EU-15 member states (average tariffs are indicative) compared to the long-term marginal generation costs

(minimum to average costs). See section on financial viability of photovoltaic projects for an explanation of this figure.

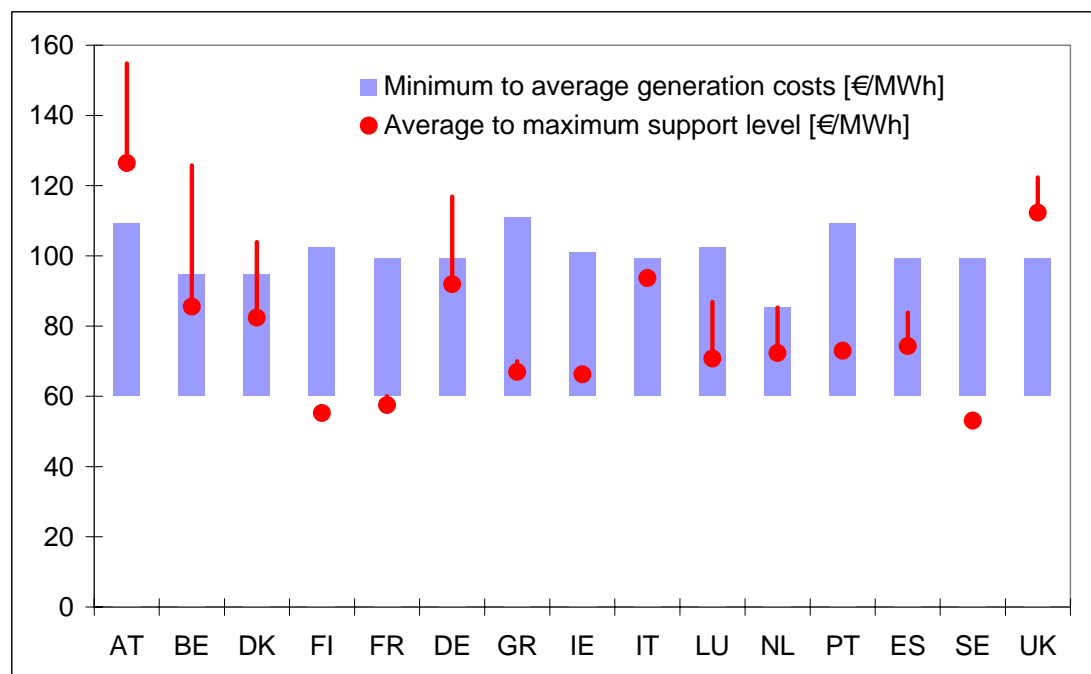


Figure 16.7 Price ranges for electricity from biogas in EU-15 Member States compared to support levels
(European Commission 2005)

The figure shows that under the support system MEP – which is currently discontinued – it was possible to realise financially viable biogas projects

Case studies

The Ministry for economic affairs published a book with detailed examples and experiences on several kinds of small-scale biomass/biogas projects in the Netherlands. The book is available as a PDF or can be ordered as hard-copy from the following website:

www.senternovem.nl/duurzameenergie/bioenergie/informatie/Bioenergie_van_eigen_bodem.asp

Relevant institutions

See section 16.2.7

16.2.7 Wood Fuel

Background

Electricity production from solid biomass became the most important Dutch RES-E source between 1997 and 2004. Note that a substantial part of the biomass covered under *solid biomass* in table 2 in chapter 2.1 is imported palm oil.

Co-firing in coal power plants owned by major utilities is the main reason for this development. In the future the market for small/mid-scale stand-alone and CHP biomass plants is expected to grow. The port of Rotterdam – being the largest in the world – plays an important role for biomass imports and distribution.

National potential

The potential for electricity production from solid biomass is about 4 TWh/year to 2020, which is about twice the current production. The potential for biomass heat production is about 900 ktoe/year, which would be an increase by 130% compared with current production.

National installed capacity

In 2004 1.8 TWh of electricity was produced from solid biomass. Compared to 1997 when virtually nothing was produced, this is a huge growth. The amount of heat produced from biomass in 2004 was 382 ktoe.

Characteristic features of the technology in the particular country

Co-firing has been the main trend in the past, which included also substantial amounts of imported palm oil - this sector has been developed by the major utilities. The largest biomass user is Essent, with worldwide experience in both biomass trade and biomass conversion. Other energy companies like Electrabel, Nuon and Eon also co-fire biomass. New dedicated biomass plants are planned by waste companies AVR and HVC. Due to this development, research has focused on the special technological problems of co-firing

in coal power plants. Large scale boilers for large size heat production are built by the Dutch company Kara, other boilers are imported.

Government supports

Under the discontinued support system MEP solid biomass projects received a premium of 66 Euro/MWh (installations with a capacity of up to 50 MW) or 97 Euro/MWh (installations with a capacity of more than 50 MW) on top of the value of the electricity produced.

Financial viability

Figure 16.8 below shows price ranges (average to maximum support) for supported biomass electricity production from forestry residues in EU-15 member states (average tariffs are indicative) compared to the long-term marginal generation costs (minimum to average costs). See section on financial viability of wind projects for an explanation of this figure.

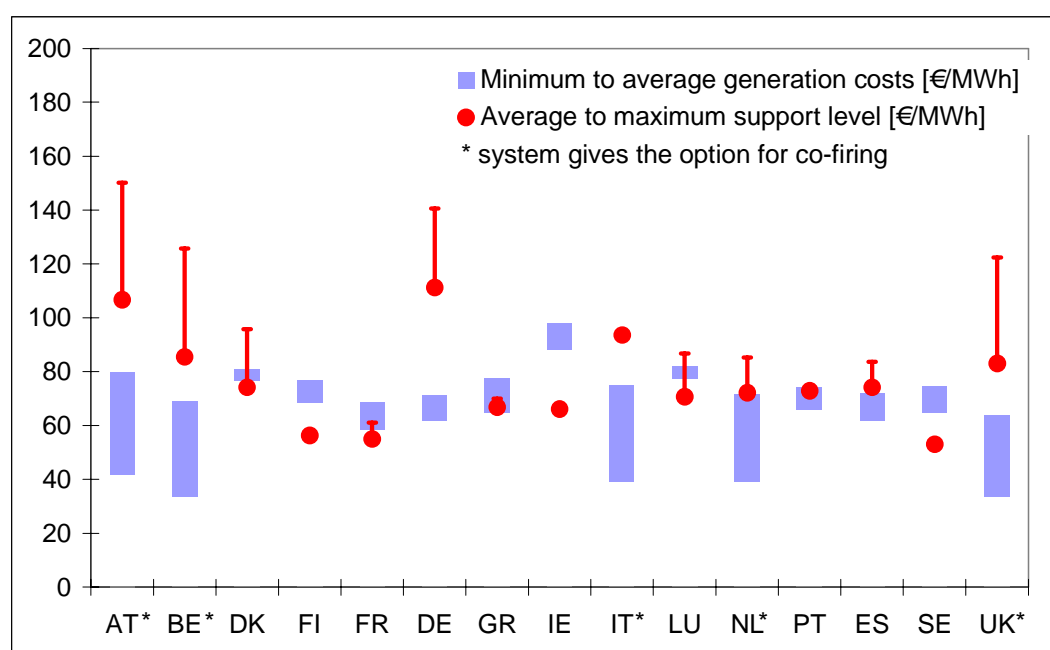


Figure 16.8 Price ranges for electricity from forestry residues in EU-15 Member States compared to support levels
(European Commission)

The figure shows that under the support system MEP – which is currently discontinued – it was possible to realise financially viable biomass projects.

Case studies

The Ministry for economic affairs published a book with detailed examples and experiences on several kinds of small-scale biomass/biogas projects in the Netherlands. The book is available as a pdf or can be ordered as hard-copy from the following website:

www.senternovem.nl/duurzameenergie/bioenergie/informatie/Bioenergie_van_eigen_bodem.asp

Relevant organizations for the Dutch biomass sector

Stichting platform bioenergie

Industry association for the biomass sector (including biogas)

www.platformbioenergie.nl

Biogas International

www.biogas.nl

Besides ECN, TU Delft and TU Eindhoven (mentioned in policy section), relevant R&D is conducted at:

Biomass Technology Group (BTG)

www.btgworld.com

Netherlands Organisation for Applied Scientific Research (TNO)

Department Quality of life – Applied biotechnology

www.tno.nl

16.2.8 Liquid Biofuels

Background

There is very little production of biofuels in the Netherlands but the market is growing quickly, especially due to the EU biofuel targets. Currently only bio-ethanol is produced.

The port of Rotterdam is the largest port in the world for the import of oil in the world. A major activity is the import of crude oil, treatment in the port area, and export of refined transport fuels. This offers opportunities for biofuel production.

National potential

The Dutch potential for biofuel production is estimated to be more than 500 ktoe/year in 2020, which is more than 100 times the current production. This number is still small compared to for example the German production of 1,800 ktoe in 2005.

National installed capacity

There is very little production of biofuels in the Netherlands. Bio-ethanol production has decreased between 2004 and 2005 to about 4 ktoe. However in the coming years strong growth is expected (see below).

Characteristic features of the technology in the particular country

The main reason for biomass support policy in the Netherlands is the EU bio-fuel targets and greenhouse gas reduction targets under the Kyoto protocol. This is in contradiction to other countries like France and Germany where rural development has been the key driver. Thus these countries have made more support available in past years which lead to a much faster development.

The Dutch biofuel market is limited to bio-ethanol (ETBE). One of the Dutch producers of ethanol of agricultural origin is Nedalco.

Several projects are planned for both bio-ethanol and biodiesel production. Table 16.6 and Table 16.6 below provide an overview of companies involved, locations, capacities and envisaged commissioning dates. Note that the cumulated planned capacities exceed the national potential given above. This can be explained by use of imported feedstock in the planned projects.

Company	Location	Capacity (kton/year)	Expected commissioning
Biovalue	Eemshaven	66	2007
Argos oil	Pernis	n.a.	n.a.
Vopak	Botlek	400	2007
Heros	Sluiskil	250	n.a.
Vierhouten Vet	Kampen	60	2007
BeWa	Moerdijk	8-16	n.a.
Sunoil	Emmen	30	2006
Heros/ Rosendaal Energy	Sluiskil	250	n.a.
Rendac	Son	2	n.a.

Table 16.6 Planned biodiesel projects

Company	Location	Capacity (kton/year)	Expected commissioning
Bio Ethanol Rotterdam	Rotterdam	100	n.a.
Blue Ocean Associates	Amsterdam	110	End 2007
Nedalco	Sas van Gent	175	2008

Table 16.7 Planned bioethanol projects

Barriers to adoption

In the past the main barrier was lack of financial support. This will be overcome with new support policies in order to reach EU biofuel targets.

Government supports

In the past, biofuels have been stimulated only by R&D funds. In 2006 biofuels receive tax relief, allowing fuel suppliers to sell fuel with a 2%-share of

biofuels for the same price as normal fuel. As of 2007 all Dutch fuel suppliers will have an obligation to blend 2% biofuels in normal fuels. The share will have to increase to 5.75% in 2010.

Moreover the government spends 60 million Euro on innovation in biofuels, especially for the development of 2nd generation biofuel processes which use agricultural residues instead of energy crops and are thus environmentally more beneficial.

16.3 Planning and Consultation

This section provides an overview of the administrative procedures for renewable energy projects. An overview of the relevant legislation and authorities is given, while procedures from a project developer's point of view are explained for wind and biomass projects.

Learning objectives

After studying this section you should be able to answer the following questions:

- What are the main steps in obtaining the necessary permits for realising a renewable energy project?
- Which institutions are/should be involved?
- How is the public involved in planning procedures? How can project developers contribute to policy relevant to renewable energy projects?

Governments in The Netherlands can be divided into three layers:

1. National Authority;
2. Provincial Authority (Province);
3. Local Authority (Municipality).

National Authority

Ministries involved in renewable energy are:

Ministry of Economic Affairs (EZ) sets up the RES-E target and takes care of subsidies and fiscal measures.

Ministry of Housing, Spatial Planning and the Environment (VROM) is responsible for spatial planning. They ask (and if necessary, force) Local Authorities to create the potential for RE development in the municipality. They also oversee environmental issues such as the Kyoto Protocol and are responsible for regulation and legislation of environmental laws; VROM are also mainly responsible for waste policy in the Netherlands (concerning biomass).

Ministry of Agriculture and Fisheries (LNV) is responsible for nature conservation and can thus restrict placement near nature areas or bird grazing areas. It also is the formal authority if initiatives are to be constructed near the Waddenzee, the national and internationally protected sea in the North. The Ministry of Agriculture and Fisheries also determines the manure policy in the Netherlands, partially based on EU directives. Farmers face restrictions concerning the amount of minerals that may be spread over fields through manure spreading. If manure is to be spread over the land only those co-digestion products that are included in a regularly updated list are allowed to be put in manure digesters (with too much co-substrates like agricultural residues the waste product of digestion is not considered to be manure anymore).

Ministry of Defence owns much ground which is suitable for wind energy placement.

In the Fifth Policy Document on Spatial Planning (5th policy document) – this is the instrument of the National Government to steer spatial policy –the following reference is made about wind energy (Figure 16.9):

Figure 16.9 Wind energy criteria in spatial planning

By forming a possible location for a wind energy park on land, the following criteria have to be considered:

- *If possible, concentrate wind turbines on lines and clusters.*
- *If possible, combine wind turbines with industrial sites, rail-, high-, and / or waterways. Because of their size, wind turbines can not be placed individually in the landscape near farms.*
- *Preferably siting of wind turbines in young and large-scale developed landscapes.*
- *Preferably siting of wind turbines on the border of open areas in the landscape. Note: the effect of a visual fence around an open area has to be avoided.*
- *New wind turbines can not be placed in open landscapes, unless they fit in the landscape very well and if they are essential to achieve the targets from the BLOW agreement.*
- *For the siting of wind turbines in “green contour areas” applies the “no, unless...”-consideration.*

For biomass a Biomass Action Plan has been developed. Biomass is an important area within national energy policy, like for example green or sustainable feedstock (for use in chemical industry, transport fuels, etc.).

The biofuels directive of the EU is also implemented in the Netherlands, although not much has happened yet. For the year 2006 a tax exemption was given to biodiesel and bio-ethanol. For the next years the expectation is that an obligation will be set to reach the 5.75% in 2010.

Provincial Authority (Province)

The Provincial Authorities have to incorporate national policies in regional plans. In the POP (Provinciaal Omgevings Plan = Provincial Environment Plan) and/or in the regional plan (= het streekplan), the Provincial Government decides, based on spatial criteria, on which locations wind energy development is possible. On the other hand, the Provincial Authority can protect areas from wind energy development. Furthermore the Provincial Authorities have the jurisdiction to put conditions on the development of wind energy (parks). A regional plan has no judicial authority. However the zoning plans developed by local authorities, do have judicial authority and have to correspond to regional plans. Both plans are published for consultation and are open to administrative appeal.

An example of preconditions for wind energy development in a regional plan is shown in the box below (Figure 16.10). It concerns a regional plan of the Province Overijssel.

Figure 16.10 Preconditions for wind energy development (example)

Summarising, the provincial policy in the region plan is:

- *Solitaire wind turbines only are allowed on or near industrial sites.*
- *The Provincial Authority can co-operate on wind turbine clusters via a policy-departure-procedure of the regional plan. The following applies:*
 - *Wind turbines are not allowed in the EHS (Ecologische hoofdstructuur; Ecological main structure is a protected area). It is not allowed to develop wind turbines in meadow-bird- and goose-protecting areas, except nearby highways and / or railways through those area's that already are disturbing birds.*
 - *The wind turbines have to fit properly into the landscape via a link between the wind turbines with the built environment or rail- and highways.*

In wind energy development, at provincial level, two different strategies are common:

1. A strategy that leaves space for bottom-up initiatives; from the Local Authorities or from market-parties or from a combination of both. This strategy is suitable for smaller projects.
2. A strategy of provincial orchestrated project planning, which subsequently by mutual agreement with Local Authorities is being adjusted and refined. This strategy is more suitable for large-scale projects (top-down strategy).

National policies let provinces work out their own “wind strategy plans” (plan-nen van aanpak). In a “wind strategy plan” it must be made clear how the Provincial Authority is thinking to meet its wind energy target.

In case of larger initiatives – especially concerning biomass projects - the provincial government will be the formal authority for application of the environmental permit and connected permit procedures (for example permit for water extraction or dumping of process water in a river).

Since a lot of wind projects are planned and realised on ground owned by the district water board (who look after highways, water pumps and dikes) or the

department of public works (takes care of smaller dikes), both the boards could set up criteria for placement of wind turbines and bring forward these criteria during the environmental permission process.

For sites under the responsibility of the national water board (Rijkswaterstaat - which is an executive agency of the Ministry of Transport and *Waterstaat*) special rules apply (“De Beleidsregel voor het plaatsen van windturbines op, in of over rijkswaterstaatswerken”).

Depending on certain capacity levels and expected environmental impact an Environmental Impact Assessment (EIA, Milieu Effect Rapportage – MER) needs to be conducted as well as a permit application. This EIA is guided by the EIA commission (Commissie MER), which will consist of several full time EIA members and will be supported by chosen experts concerning the planned initiative. The EIA procedure is connected to the permit application procedure. The formal authority for the permit application has close contact with the EIA commission. Usually an EIA should be conducted first, delivering a basis for the choice of the most environmental-friendly alternative for the planned project. The results of the EIA are used as the basis of the permit application and help the formal authority in their judgement. With an approved EIA comes official advice from the EIA commission towards the formal authority.

Local Authority (Municipality)

Decisions on the placement of wind turbines is being done through the Local Authorities (Municipality). Local Authorities are obliged to make zoning plans. A zoning plan (bestemmingsplan) is the most important planning tool in the Netherlands. Future use of ground is being restricted in zoning plans. Possibilities for wind energy development can be created in a zoning plan. The Local Authority is also the authorised institute to check the initiatives – from the private investors – on the local policy. Initiators always have to deal with the Local Government. Even if the formal authority for the environmental permit is

the Provincial Government, the building permit still needs to be applied for at the local government level. They also determine safety issues like the fire prevention plan in cooperation with the local or regional fire departments.

In Dutch spatial planning the Local Authorities do have primacy. This also holds true for wind energy planning. With the building- and environmental permit, the Local or Provincial Authorities have the legal instruments whereby initiatives can be stopped or continued. Thereby, Local or Provincial Authorities can beforehand select locations where wind energy development is allowed under certain preconditions and mark these locations in zoning plans. The authorities also can establish further demands and directives which the planned initiatives have to fulfil. Where projects affect several municipalities visually, inter local-workgroups are established.

Bottlenecks in wind energy development at the local level are the limited capacity of knowledge (in wind energy) and a shortage of personnel. Furthermore, Local Authorities are confronted with pressure from initiators, the Provincial and National Governments and local citizens or other stakeholders. Often opposite interests are involved. In case of insufficient possibilities for wind energy development in the local zoning plans, the Provincial Authority has the possibility to take the place of the Local Authority and to assign areas for wind energy development in the zoning plans.

Procedures from the WIND project developer's point of view

The identification of a wind turbine location can proceed in two ways:

1. When an initiator spots a suitable site for wind energy development, he has to apply at the Local Authority for an environmental and a building permit and usually has to start a special procedure (Art. 19 procedure voor vrijstelling van het bestemmingsplan). If considered appropriate, the Local Authority can change the zoning plan (bottom-up strategy).
2. The Provincial or Local Authorities can make a Quick-scan (a study for locations possible for wind energy) and afterwards describe in a re-

gional plan and in a zoning plan which location is suitable for wind energy development. Initiators can anticipate on this zoning plan by requesting a building- and environmental permit. Now it is just for the Local Authority to submit the permits. In contrary to the first point it is not needed to change the zoning plan (top-down strategy).

To develop a wind site, the initiator usually tries in parallel to investigate availability of a specific site and the feasibility of obtaining all required permissions. This involves contacting ground owner(s) and eventually trying to buy or rent the required ground. The initiator sets up a design for the wind farm. He applies for the permits. In case an EIA is not required the permit-applications are being assessed through the Local Government (if an EIA is required, the initiator has to make this first). When the procedures are completed successfully, the financing of the wind farm needs to be arranged before the initiator can start to build the wind farm.

Property developers of wind energy have to contend with long planning procedures. If a wind site is going to be larger than 15 MW, the Local Authority decides whether an EIA is required or not. If an EIA is required the procedure is lengthened by between half and up to one year.

Another bottleneck are the opportunities to comment by a concerned party / stakeholder. If a stakeholder does not agree with the grant of the permits, he can lodge his complaints. Hereafter the stakeholder has the opportunity to appeal in court. This can take several years. Due to long and costly planning and court procedures developers of wind energy projects are discouraged. Experienced developers try to generate support before/during presentation of their plans, i.e. before opposition can rise.

Participation in the wind energy project of other parties is a development of the last few years. Because of the small amount of possible wind energy locations and the difficulty to get development of wind energy started and to create more public support, developers unite their “powers” to develop one

major wind energy park instead of different small wind parks. Also, developers give room for private participators, such as neighbours of the wind energy project.

Procedures from the BIOMASS project developer's point of view

In general it is considered best to have to apply for an environmental permit through the Local Government. This way the application process is kept "low profile" and there is less attention from environmental groups to object to the initiative, delaying the project development significantly. However, due to a permit application at a local level, citizens are involved more intensively which could lead to objections from their side. These objections are one of the main reasons for refusal of permits for smaller biomass projects in the Netherlands, especially when the projects involve chicken manure. Also, the Provincial Government is often better organised with specialised personnel on these energy related topics, where the Local Governments often need help from Provincial Government or need to be guided by the project developer, which can delay the process.

The main problem in the Netherlands with permit applications for biomass projects is the complex policy structure around it and the lack of legislation applying specifically to biomass for energy purposes. Biomass is most often seen as waste (only clean and fresh wood chips and pellets are not seen as waste) - and for waste projects the formal authority for the permit application is the Provincial Government. What is more, for waste projects with a conversion capacity of more than 100 ton/day an EIA is obliged (with a capacity of 50 ton/day a judgement application needs to be given to the EIA commission to determine whether an official EIA is needed).

Considering biomass as waste has also implications for the further legislation the project needs to comply with. A determination is made in the Netherlands between the so-called *white list biomass* and *yellow list biomass* for biomass combustion projects. White list biomass, as determined in the 'Besluit Ver-

branding Afvalstoffen' (Dutch transposition of the EC waste incineration directive) to be exempted from this law, contains cleaner biomass flows (consisting of both waste and non-waste biomass flows). For initiatives concerning white list biomass the emission standards are included within the BEES documents (Besluit Emissie Eisen Stookinstallaties). For the yellow list biomass initiatives the BVA is the obliged law containing stricter demands on emissions.

For every environmental theme (air quality, odour effects, noise impact, traffic impact, impact on soil, water quality, ecology, external safety, energy efficiency) there are guiding legal documents with maximum values that need to be met. Besides these national documents, a biomass project also needs to fulfil the requirements set in the European IPPC-directive. This directive consists of a list of so-called BREF document (best reference documents) in which the best available techniques are described per industrial sector (vertical BREF) or technical component (horizontal BREF).

For a project developer the action plan to develop a biomass project would consist of the following steps:

1. determine location, technique and biomass flows (form consortium with technology supplier but also with biomass supplier);
2. determine size and capacity in order to determine formal authority for environmental permit application and determine if an EIA procedure is necessary;
3. environmental permit application/ EIA (time period of 6 to 9 months, depending on objections of external parties); concurrently start EPC contracting;
4. building permit application and possibly subsidy application;
5. construction.

Opportunities to influence policies

Project developers, the general public and stakeholders have the possibility to influence spatial planning and thus to support or to hinder activities in a certain area. By far the most important instrument for this is the zoning plan, as any building permit has to comply with it. Before preparing a draft for the zoning plan, a municipality asks inhabitants to give their opinion. The way this is done is described in local rules. The municipality prepares the draft, considering local interests requirements and restrictions of higher level authorities (province, country) and the regional planning. Afterwards the draft of the zoning plan is published for 6 weeks and everybody is allowed to submit comments. The municipality can modify the plan based on the comments. Afterwards, the zoning plan is approved by a formal decision of the municipality, which is published during 6 weeks. Again there is a possibility for the public to submit thoughts/objections at *Gedeputeerde Staten*, the provincial authority that also has to approve the plan. After formal approval by *Gedeputeerde Staten* the decision is published again and during 6 weeks stakeholders have the opportunity to appeal at the *Raad van State*, the highest judicial authority in the Netherlands.

In an informal way stakeholders can try to lobby and present their plans to politicians. Generally, for concrete plans, i.e. when location and general characteristics of the plan are known, local politicians (municipality level) should be contacted first. The next higher level - the province - also is important, as they have to approve the zoning plan and of modifications the zoning plan.

16.4 References

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16.5 Annex 1 Case Study Photovoltaic

AIM AND GENERAL DESCRIPTION

The main goal of the project was to demonstrate the large-scale application of PV in an urbanised area through the realisation of 500 PV houses and a small number of public buildings with PV in the city of Amersfoort, The Netherlands.

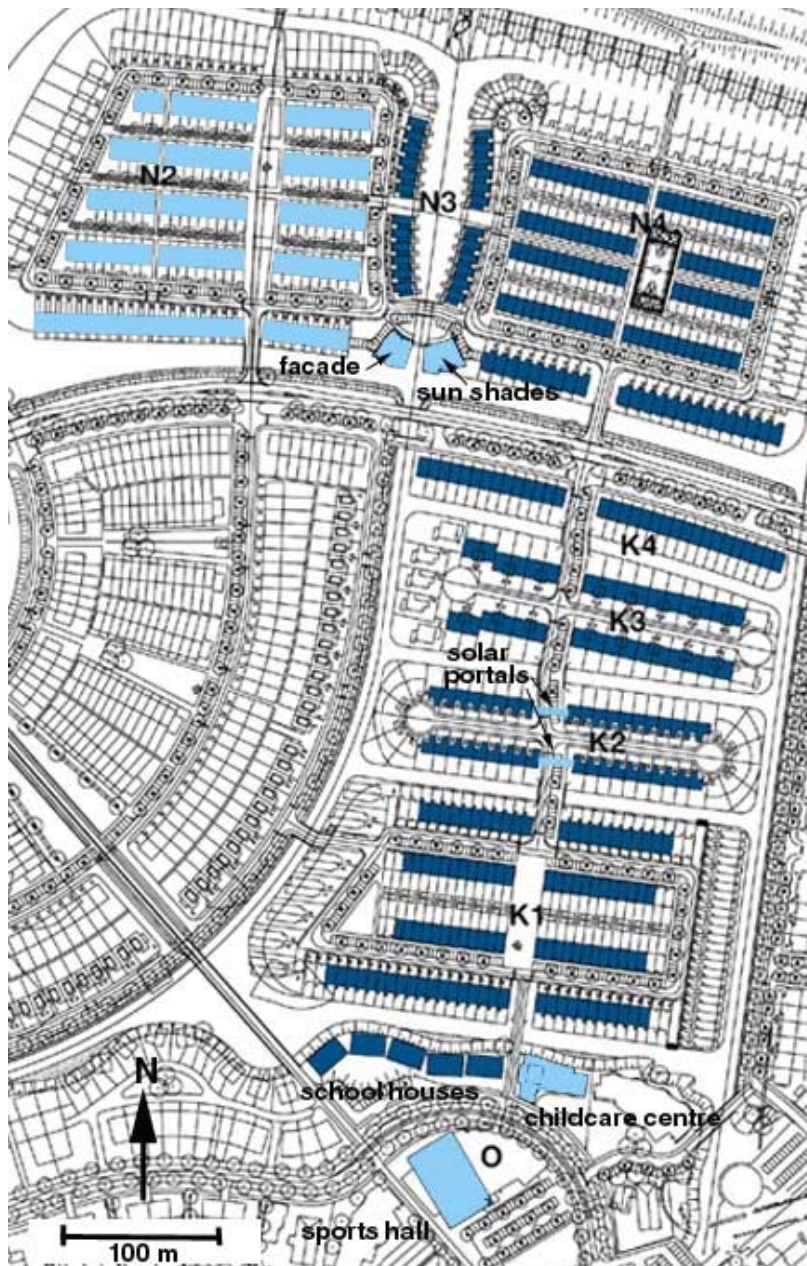
Description of the site

The 1 MW system has been realised on approximately 500 newly built houses grouped together in Nieuwland, Amersfoort's latest housing area. Amersfoort is a city in the centre of The Netherlands with 123000 inhabitants. The 1 MW project has been constructed in a single area of *Water Quarter*. Realisation of *Water Quarter* has taken place from 1997 to 2001. For the 1 MW PV system, a specific area of *Water Quarter* was selected. Approximately 90% of all houses in this area have been used for the PV project.

The figure on the next page shows a map of the 1 MW site. Buildings with PV are marked dark blue and light blue.

Project history

Nieuwland was developed in a public-private partnership 'Overeem', in which the city Authorities worked together with property developers and construction companies in the development of the area. During the preparation of Nieuwland, by coincidence the local regional utility, REMU, was looking for opportunities to develop a number of PV projects as part of their green energy strategy. Prior to the 1 MW project, already a few smaller PV projects were carried out by REMU in the first sections of Nieuwland. These projects focused on getting familiar with the technology and with the process to work together with architects, property developers, contractors, PV industry and others involved in the realization of building integrated PV projects.



The urban designer worked out a design for this section that would allow for sufficient roof and façade surface facing south installing 1.3 MW PV. This meant that the original orientation of the canals had to be changed. Secondly, an information package was prepared for the property developers and architects involved in this section of Nieuwland. The development of this information package was one of the important aspects of the project - to learn how to

co-operate in a standard way with large numbers of developers and architects in large-scale projects. Most relevant section within the information package is a shortlist of technical requirements set forward by the project partners Ecofys, REMU and ENEL to take into consideration.

General features

The 1 MW project has been constructed on one-family houses, largely utilising a standardised PV design scheme. The PV arrays have been placed onto sloping roofs and on flat roofs. A limited number of houses have a special architectural design and consequently a non-standard PV design. In addition to the 1 MW project, public facilities in Nieuwland have been equipped with PV. Each subsystem has been procured and installed turnkey in parallel to the specific building project.

Ten architects, nine property developers and eight building companies have been involved in the housing project, each of them dealing with the design and realisation of one or more sections or subsections.

Standard PV system design

The average PV installation is made of 25 m² PV modules. All houses have universal electric designs as far as the PV system is concerned, including individual inverters located on either the attic or, in the case of houses with a flat roof, in the meter cabinet. The standard electric design reduces costs. Two separate electricity meters for PV generation and consumption have been installed in the meter cabinet. Formally, all generated energy passes the public grid before it is consumed. A construction like this has the flexibility that it can be applied independent of the ownership of the PV system. REMU has access to all PV systems. This was taken care of in the design of the houses and ensured in the arrangements laid down in the contracts between REMU and the occupants.

The inverters are located as close to the modules as possible so that cable losses are minimal. For houses with sloping roofs the inverter is placed in the attic and for houses with flat roofs in the cabinet for the central heating boiler.

Grid design

Some modifications to the standard electricity grid in Nieuwland were made in order to accommodate the PV systems. This was necessary in order to keep the line voltage in the range of 207-242 V, at times when the PV systems are feeding into the grid as well as in the evening hours during normal electricity demand.

Constructional aspects

The design of the houses was carried out in 1996. A set of requirements has been drawn by REMU and Ecofys, which had to be followed by the architects. Integration of the PV system into the building envelope was mandatory. The objective of the project was to use standard, well-proven, concepts provided by (PV) industry as much as possible. Further requirements include orientation and tilt angle of the PV arrays, avoidance of shading losses, the placement of inverter cabinets. System losses due to orientation, tilt angle and shading losses were not allowed to exceed 5%.

Integration in sloping roofs

Various integration systems have been used to mount the frame-less PV modules on the sloping roofs. All mounting systems applied have been designed to replace all functions, including water resistance, of normal roof tiles. The arrays have been mounted on standard wooden roof elements. These prefab elements are constructed as a sandwich of wood and insulating material and have a water resistant but damp open foil on top, to be absolutely sure no waters enters the house.

Flat roof systems

A large portion of the total PV power, 360 kWp in total, has been applied on flat roofs. In all flat roof systems plastic consoles have been used to support framed PV modules. The “ConSoles” are inexpensive and easy to handle. The tilt angle of a module on the ConSole is 25°. The flat roofs systems are hardly visible from the ground. The distribution of the ConSoles on the roofs has been such that negative effect due to shading will remain negligible.

User appliances and load

The systems are connected to the low-voltage distributions grid. The generated PV electricity is readily available for use in the houses or public buildings. The load patterns of some of the houses have been monitored. In general the electricity demand in The Netherlands is known to correlate with the PV supply patterns to a limited degree. It is expected that approximately 50% of the annual electricity demand of all the (650) households in the K, N and O sections are supplied by the 1MW PV system.

LESSONS LEARNED AND CONCLUSIONS

Feasibility

The 1 MW project has successfully demonstrated the feasibility, in a technical as well as in an organisational sense, of the implementation of large scale, building integrated PV systems on a district level. The 1MW project in Nieuwland is the first PV project in the built environment in The Netherlands with a size of the order of 1 MW installed PV power.

The average turnkey price was 6.90 Euro per Wp. However, since some special applications (e.g. the PV sun shades) were exceptionally expensive, the average price of the “standard” PV installations (on sloping and flat roofs) was 6.70 Euro/Wp.

Design review

The success of the project was founded in the urban design of Water Quarter. The streets have a east-west orientation, resulting in more than 80 % of the houses having a façade that has more or less south orientation. Most PV roofs and/or arrays have a fairly optimal orientation towards the sun, although some architectural designs were less PV-friendly, e.g. roofs with high tilt angles and façades with a high degree of shading.

During the architectural design phase a lot of attention was given to difficulties related to shading, chimneys, dimensions of roofs, gutters and rooftops. Architects needed a lot of information how to be able to handle these different aspects. For builders it was necessary to know what material they had to use for their roof underneath the PV. Since PV is not a fully proven and tested roofing material and the roofs are positioned on a critical angle, the roofs under the PV arrays were provided with a water-resistant, damp open foil.

In the review of the electric designs no significant problems occurred, thanks to the development of a standard design.

Building inspections

The water-resistant foils used proved to be very delicate, which is the reason why quality control in the construction phase has proven to be very important. Too often unprotected DC wires and insufficient fastened electric connections were found during inspections. Intensifying the intermediate inspections eventually reduced the occurrence of such hazardous situations. The conclusion is that intermediate inspections are and will remain a necessary part of any building process, regardless of whether or not a new technology is used.

Commissioning tests

Testing before commissioning has proven to be essential: various faults by the PV installers were detected and corrected before commissioning could

proceed. This led to a significant delay. The cause seems to be the insufficient knowledge and experience of PV with installers.

Organisational aspects

PV developers

This project has generated wide experience on how to develop projects like these with a complex organisational structure in which many parties are involved.

Firstly, the utility REMU, whose core business is to distribute and sell energy, has learned to act as a PV project developer. The major part of the PV installations has been realised under the supervision of REMU. The management for this part of the project was such that REMU operated in parallel with the property developers of the corresponding sections. This structure is quite unusual for property developers and has sometimes caused delays to the building process. A minor part of the PV installations has been realised by the property developer that acted on behalf of REMU. Here similar problems did not occur. For future project an organisational structure is preferable in which PV is realised by the property developer.

PV installers

The installer of PV equipment is a new player in the building process. Since the number of qualified PV installers is still limited, most installers were contracted for more than one section. However, some sections were built simultaneously, so that installers have not always been able to match their planning to those of the builders. In future large scale PV projects, when more installers are active in the field of PV and when PV will be a standard building component, this planning problem will probably not occur anymore.

Contracts with PV suppliers

The procurement and the contract negotiations with the PV suppliers may be improved on the following issues:

- **Guaranteed performance:** although the guaranteed annual yield was a selection criterion, the actual value of the annual yield as stated in the quotations has, unintentionally, not become a formal part of the contracts. After the contracts were signed, the PV contractors adjusted the values downwards. Moreover, this lower guaranteed annual yield was only agreed upon after long and tedious negotiations in an annex to the contract. Possible sanctions in case the yield is less than guaranteed are limited.
- **Service protocols in case of failures** (subject to the guarantee conditions) should be more elaborate, especially on procedures, response time and possible sanctions. Service from the PV suppliers was not always to full satisfaction of REMU.
- **Qualifications of PV roofs**, especially water-resistance, should be unambiguously defined in the contracts. In some cases the responsibility for leakage problems shifted to other parties than the PV suppliers due to unclear statements on this matter in the contracts.
- **Final payment to suppliers** should be made before the formal end date of the (subsidised) project. This means that the performance guarantee protocol should not provide in postponed payments (e.g. payment of the last term after a performance check period of one year), as it did in the case of BP Solarex.

Contracts with PV owners

Although the group of house owners who bought the PV systems from REMU has the contractual obligation to maintain the system, some house owners have already made plans to modify their house in a way that harms good functioning of the PV systems. These plans can probably be realised due to legal imperfections in the house purchase agreements with respect to PV maintenance. Furthermore, the community of Amersfoort should have been better informed about the risks of issuing building permits to PV house owners. This problem stresses the importance of appropriate communication between the PV developer and the local government and of adequate legisla-

tion. Agreements should be made concerning supervision of fulfilment of the maintenance obligations.

Acceptance of PV

The 1 MW project has increased the acceptance of building integrated PV, not only by the general public but also by professional parties like city developers, property developers, architects and building companies. PV is experienced positively by most potential house buyers because of its high-tech and environmental friendly image. Owners and occupants of PV houses consider their houses to be more special than the average normal house.

Utility issues

The distribution grid in the PV area, that was reinforced to be able to transport the PV power, has operated without any problem. Harmonic distortion of the grid voltage due to inverter interactions was observed. Reinforcement of the grid as determined from quantitative parameters (amount of PV, grid topology, grid component size), as was done in the project, is not sufficient to be sure that any harmonic distortion problem is avoided. Qualitative electric parameters of 10 kV/230 V transformers and PV inverters (induction, capacity, harmonics) must be involved in the grid design process as well.

Evaluation of the system concept

The distributed “one house-one inverter” concept has proven to be to be successful. Despite the large number of inverters, the system has been realised at the lowest costs possible. Installation was relatively easy thanks to the flexible design of the Sunmaster 2500 inverter. The systems are inherently safe thanks to the grid watcher in the inverters. Moreover the performance is quite good despite the relative small unit size (2 kW). Up to now the operation of the systems has led to no serious problems yet, apart from the constructional difficulties.