INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

THE NETHERLANDS

2008 Review

OECD

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The energy policies of the Netherlands play an important role in ensuring energy security not only on a national level but in all of north-west Europe. The country's strategic location makes it an important transit and trade hub for natural gas, oil and electricity. Furthermore, it has important natural gas production and a large oil refining industry. To enhance continental energy security, the government takes a leadership role in natural gas and electricity market development, pushing forward important policies to better integrate and harmonise the existing national and regional markets. One of the world's leaders in energy research and development (R&D) management, the Netherlands is further increasing its R&D on energy technologies.

With sound policies already in place, the Netherlands has recently announced its intention to create an even more sustainable energy future. As part of this pledge, the government has set ambitious targets: to increase the share of renewables in the energy mix to 20% by 2020; to make a 2% annual efficiency improvement; and to lower greenhouse gas emissions by 30% by 2020 from the 1990 level. These objectives will not be easy to achieve. To ensure their attainment, the Netherlands will need not only well-designed policies but also their timely and effective implementation.

This review analyses the energy challenges facing the Netherlands and provides critiques and recommendations for further policy improvements. For example, it urges the government to provide policy continuity – such as in promotion regimes for renewable energy – to underpin a sustainable investment climate. It also highlights the need for closer co-ordination among national, regional and local authorities.

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The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-eight of the OECD thirty member countries. The basic aims of the IEA are:

- To maintain and improve systems for coping with oil supply disruptions.
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations.
- To operate a permanent information system on the international oil market.
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use.
- To promote international collaboration on energy technology.
- To assist in the integration of environmental and energy policies.

The IEA member countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. The European Commission also participates in the work of the IEA.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of thirty democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.
The European Commission takes part in the work of the OECD.

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EXECUTIVE SUMMARY

The Netherlands, a north-west European country, has an advanced economy, a modern energy system and well-developed energy markets. The country's strategic location makes it an important transit and trade hub for natural gas, oil and electricity. The country also has significant natural gas production and a large oil-refining industry. To further enhance continental energy security, the government takes a leadership role in the development of electricity and natural gas markets, pushing forward important policies, market design regulations and infrastructure to better integrate and harmonise the existing national and regional markets. Recently, the government has addressed the global challenge to confront climate change and create a sustainable energy future, setting ambitious targets for improved energy efficiency, greater deployment of renewable energy and reduced carbon dioxide emissions. To meet its own goals – as laid out in its Clean & Efficient programme, in the *Energy Report 2008* strategy and in the Energy Transition framework – the government has proposed strong policies and measures and increased the budget, particularly for energy research and development. The IEA applauds these efforts, and urges the government to continue on this certainly difficult, necessary and, ultimately, rewarding path. Now that the government has set out its policy framework, attention must turn to the challenging task of implementation.

BUILDING ON A SOUND POLICY-SETTING FRAMEWORK

Sound energy policy necessarily involves balancing energy security, environmental sustainability and economic growth (the so called "3 Es"). Dutch policy making has explicitly confronted these three pillars. The policies that the government has laid out in its recent Clean & Efficient programme, in the *Energy Report 2008* strategy and in the Energy Transition framework continue to balance these challenges. Furthermore, the policy-setting framework clearly identifies the need to co-ordinate policies and measures across ministries and platforms, a notoriously complex and difficult task to which the IEA encourages the government to continue to pay close attention. With respect to the Energy Transition framework, it is key that it include an international component; successful development of technological solutions to the sustainability challenge requires international collaboration along with domestic efforts.

The IEA urges the government in taking forward its policies to have particular regard to the need for policy continuity, clarity and decisiveness. The most notable case of the lack of policy continuity is the government's promotion regime for renewable energy. The old scheme ended abruptly in 2006. A new programme came into effect over a year after the previous regime had ended. Such stop-start policies drastically undermine the effectiveness of the financial support the government provides and harm the long-term development of renewables. Policies need to be stable and of a sufficient term to underpin a sustainable investment climate.

Turning to policy clarity, there are some concerns that the complex layers of efficiency and climate policies – particularly the benchmarking covenants, long-term agreements and the European Union Emissions Trading Scheme (EU-ETS) – may produce sub-optimal results in the industrial sector.

Policy decisiveness should also be enhanced. Noting the success and benefits of the Dutch polder model[1] of policy collaboration and consultation, the IEA nonetheless urges the government to be more decisive where possible. A key example is on nuclear power. It is commendable that the government is beginning to consider whether nuclear could play a larger role in the country's future energy mix. Delaying a final decision until after 2011, while leaving time to build consensus, also leaves uncertainty about a technology that requires significant lead time to be planned, built and go on line. The government should come to a clearer position as early as possible, using the time to 2011 to create the necessary building blocks and regulatory framework to allow for a timely decision to be taken.

COMPLEMENTARY, NOT COMPETING, SUSTAINABILITY TARGETS

The government has recently laid out an ambitious energy and climate agenda under its Clean & Efficient programme and its *Energy Report 2008* strategy. This agenda calls for a 30% reduction in greenhouse gas (GHG) emissions from 1990 levels, 20% renewables in the energy mix, annual energy efficiency improvements of 2% (double the current rate) and completing a big step in the transition towards a more sustainable energy system by 2020. These targets are closely linked to, but more ambitious than, the proposed 20-20-20 targets for the EU.[2] The IEA is pleased to see the government set such bold targets, but has some reservations that the piling on of different

1. The traditional Dutch polder model is characterised by consensus decision making. The key characteristic of the polder model is tripartite dialogue and consultations among unions, employers and the government.
2. The 20-20-20 by 2020 targets include: *i)* Reducing GHG emissions by 20% from 2005 levels; *ii)* Increasing the share of renewable energy in energy consumption to 20%; *iii)* Increasing energy efficiency to reduce energy demand by 20% from business-as-usual level in 2020.

targets could lead to less-than-optimal results. The government is encouraged to ensure that the targets complement each other. Taken together, the targets should help to achieve the overall greenhouse gas target, and not increase the complexity and cost of achieving it.

When considering new targets in the future, the government should continue to undertake the necessary cost-effectiveness evaluations and ensure coherence with current strategies and targets. It should avoid as much as possible political pressure to set targets or goals without undertaking these steps.

TACKLING AMBITIOUS SUSTAINABILITY CHALLENGES AND TARGETS

The Dutch government has set out clear targets to address sustainability challenges. It should now quickly put in place the bold – and potentially painful – policies and measures that will allow the country to achieve these targets. These fast-approaching targets require even more active government and policy co-ordination and co-operation than is already in place in the Netherlands. The government must continue to ensure that such collaboration across ministries and between local, regional and national authorities begins as early as possible in policy development, and continues during the implementation phase. Not only will these ambitious targets require extra attention to collaboration at the outset, but they will also require a phase shift in intensity of the policies and measures necessary to achieve them. The government also needs to implement these policies quickly. Successful implementation and meeting sustainability goals will also require continued, active and open dialogue with the public.

KEY RECOMMENDATIONS

The government of the Netherlands should:

- *Build on the sound policy-setting environment in place by enhancing policy stability and continuity, as well as timely decision making.*
- *Proceed carefully with its suite of sustainability targets, and consider elevating the carbon dioxide target to primacy, using other targets to guide the country to success.*
- *Remain aware that the ambitious sustainability goals that have been set will require effective government co-ordination, early implementation of policies and potentially painful policy choices.*

PART I

POLICY ANALYSIS

Figure 1

Map of the Netherlands

The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: IEA.

The Netherlands has advanced energy policies and a very modern market and economy. A prominent producer of natural gas in Europe, the country also serves as a hub for energy trade and transit – a role that could expand in the future. Its gas and electricity markets are liberalised, with the gas and electricity grids both owned and operated by independent, state-owned companies unbundled from other parts of the supply chain. The government has recently laid out an ambitious energy and climate agenda under its Clean & Efficient programme and its *Energy Report 2008*. This agenda calls for a 30% reduction in greenhouse gas emissions by 2020 from 1990 levels, 20% renewables in the energy mix, annual energy efficiency improvements of 2% (double the current rate) and completing a big step in the transition towards a more sustainable energy system by 2020. Coal-fired power plants with carbon capture and storage (CCS) are foreseen to play a very prominent role in the country's energy mix in 2030. The future for nuclear, which provided 3.5% of electricity in 2006, is less clear.

COUNTRY OVERVIEW

A small, mostly low-lying country in north-west Europe, the Netherlands borders Belgium and Germany and has over 450 km of coastline along the North Sea. With a total land area of about 42 000 square kilometres (km^2), the Netherlands is similar in size to Switzerland, Denmark or New Jersey (see Figure 1). The climate is largely temperate, with cool summers and mild winters. Arable land covers about 20% of the total area.

With over 16 million inhabitants, the Netherlands has the 25th highest population density in the world and the highest density in the OECD. The country's annual population growth rate is 0.21%. The three largest cities in the Netherlands – Amsterdam, Rotterdam and the Hague – each have fewer than 750 000 inhabitants.

With an estimated GDP of USD 436 billion in 2007,[3] the Netherlands is the seventh-largest economy in Europe (about a quarter of the size of Germany). Because of its geographical location, the country functions as a transport hub for the continent. The industrial sector is driven in large part by food processing, chemicals, petroleum refining and electrical machinery. Since hydrocarbons were discovered in the middle of the last century, the country has had significant production of fossil fuels, primarily natural gas.

The Netherlands – *Nederland* in Dutch – is a constitutional monarchy with a bicameral legislature (the First Chamber and Second Chamber or *Eerste Kamer*

3. In 2000 USD, *i.e.* at year 2000 prices and exchange rates. On average in 2007, USD 1 = EUR 0.73.

and *Tweede Kamer*). Queen Beatrix is the head of State. Prime Minister Jan Peter Balkenende, who has been in office since 2002, is the head of the government and was installed by Queen Beatrix. He currently leads the fourth Balkenende cabinet (Balkenende IV), installed in February 2007, which is a coalition cabinet made up of the Christian Democratic Appeal (CDA), the Labour Party (PvdA) and Christian Union (CU), which is set to remain in office until 2011.

SUPPLY-DEMAND BALANCE

SUPPLY

As detailed in Table 1 and Figure 2, the Netherlands' total primary energy supply (TPES) was over 83 million tonnes of oil equivalent (Mtoe) in 2007, a 9% increase from 2000 and a 24% increase from 1990. The TPES has been growing steadily since the mid-1980s, with a few ups and downs. In particular, it dropped in 2005-2006 mainly because of the unusually mild winter, which resulted in lower demand. The fuel mix is dominated by natural gas and oil, about 40% each, with 10% coming from coal. Biomass makes up over 3% of TPES and nuclear provides just over 1%. Other renewables make up a negligible share of TPES, at 0.3%.

Table 1

Supply-Demand Balance, 2006

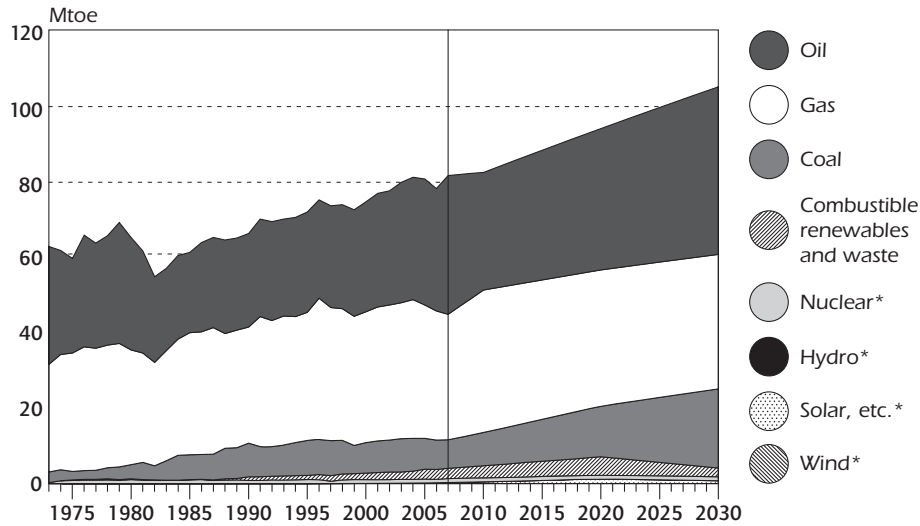
Unit : Mtoe	*TOTAL*	*Gas*	*Oil*	*Coal*	*Nuclear*	*Combustible renewables and waste*	*Wind*	*Electricity*
Supply								
Production	60.8	55.4	2.1	0.0	0.9	2.1	0.2	0.0
Net Imports	19.5	-21.1	30.2	8.0	0.0	0.5	0.0	1.8
Total primary energy supply	**80.1**	**34.2**	**32.4**	**7.8**	**0.9**	**2.7**	**0.2**	**1.8**
Share (%)	*100.0*	*42.7*	*40.4*	*9.8*	*1.1*	*3.3*	*0.3*	*2.3*
Demand								
Electricity generation	8.5	4.9	0.2	2.3	0.3	0.6	0.2	
Industrial consumption[1]	23.9	7.7	10.1	0.8	0.0	0.1	0.0	3.6
Transport	15.6	0.0	15.4	0.0	0.0	0.0	0.0	0.1
Residential	10.0	7.4	0.1	0.0	0.0	0.2	0.0	2.1
Other final consumption[2]	11.8	6.8	0.8	0.0	0.0	0.1	0.0	3.3
Total final consumption	**61.3**	**21.9**	**26.5**	**0.9**	**0.0**	**0.5**	**0.0**	**9.1**

1. Includes non-energy use.
2. Includes commercial, public service, agricultural, fishing and other non-specified sectors.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2008.

Figure 2

Total Primary Energy Supply, 1973 to 2030



* negligible.

Note: The forecast to 2030 was prepared by the Energy Research Centre of the Netherlands (ECN) on the basis of the global economy scenario. In this scenario, it is assumed that oil and gas prices are high while coal prices remain relatively low. The scenario assumes that the existing government policies will be implemented until 2020 but it does not take into account any new government policies that may be implemented after 2020. These assumptions explain the rapid increase in coal demand and the decrease in the share of renewables after 2020. However, if the government continues its policies to support renewables, the energy mix will look different from what it is in this forecast. ECN is developing another forecast based on an alternative scenario.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2008 and country submission.

Coal makes up over 9% of TPES in 2007[4], up from 4.6% in 1973. The share of oil in TPES has fallen from almost 50% in 1973 to about 37-40% in 2000-2006, and started growing again in 2007. The share of natural gas grew from around 45% in 1973 to over 52% in 1985 and gradually declined to about 40% in 2007.

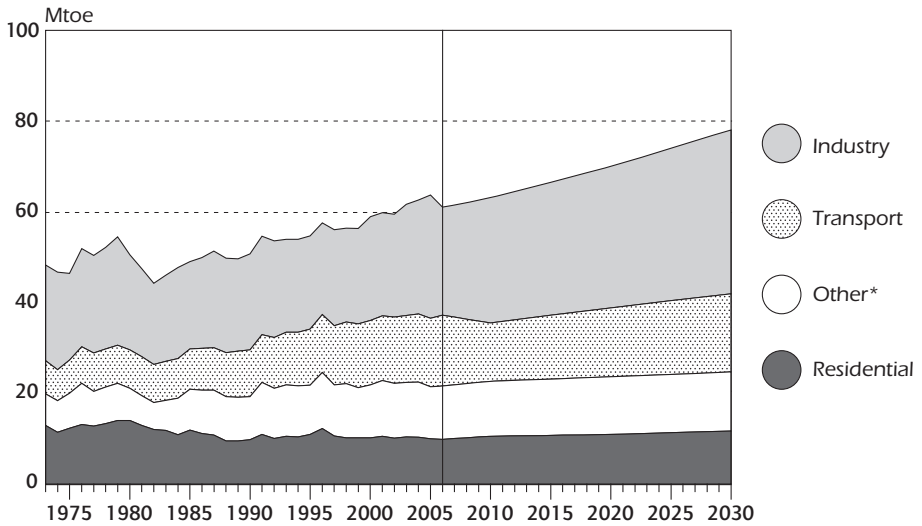
DEMAND

Total final consumption (TFC) in the Netherlands was over 61 Mtoe in 2006 (see Figure 3). Almost 40% of all consumption was in the industrial sector (including non-energy use). The next largest share of consumption, 25%, was in the transport sector. The residential sector used 16%, with the remainder (19%) in commercial and other sectors. These shares have remained steady since the 1990s.

4. Data for 2007 are provisional.

Figure 3

Total Final Consumption by Sector, 1973 to 2030



* includes commercial, public service, agricultural, fishing and other non-specified sectors.
Sources: Energy Balances of OECD Countries, IEA/OECD Paris, 2008 and country submission.

ELECTRICITY GENERATION

In 2007, over 100 terawatt-hours (TWh) of electricity was generated in the Netherlands, a 15% increase from 2000 and a 44% increase from 1990.[5] As shown in Figure 15 in Chapter 6, almost 60% of electricity came from natural gas in 2006. Coal accounted for 27% of generation. Biomass fuelled 7% of total generation and nuclear another 3.5%. The share of wind was 2.8%, more than quadrupling from 2000.

GOVERNMENT, REGULATORY INSTITUTIONS AND OTHER ORGANISATIONS

The Ministry of Economic Affairs is the lead entity responsible for energy policy in the Netherlands. The Ministry of Agriculture, Nature and Food Quality; the Ministry of Transport, Public Works and Water Management; and the Ministry of Housing, Spatial Planning and the Environment are also closely involved in energy and environmental policy.

The Office of Energy Regulation *(Energiekamer)* is charged with regulation and oversight duties stemming from the Electricity Act and Gas Act. The *Energiekamer* is responsible for the following tasks, among others:

5. 2007 data are provisional.

- Issuing supply licences for the supply of electricity and gas to captive consumers.

- Determining tariff structures and conditions for the transmission of electricity.

- Determining guidelines for tariffs and conditions with regard to access to gas transmission pipelines and gas storage installations and, if necessary, issuing binding instructions.

- Determining transmission tariffs for electricity and gas, including the discount (price cap) aimed at promoting the efficient operation of the electricity grid and gas networks.

- Supervision of compliance with the Electricity Act and Gas Act.

The *Energiekamer* operates as a chamber within the Netherlands Competition Authority (NMa), having a status different from other departments of the NMa. Although the *Energiekamer* is organisationally subordinate to the director-general of the NMa, it has its own enumerated powers.

The NMa is responsible for the implementation of the Competition Act, which also applies to the energy sectors. It enforces the prohibition on cartels and on abuse of dominant positions. It also assesses mergers and acquisitions. The Ministry of Economic Affairs funds the Netherlands Competition Authority. A small part of the NMa budget is financed by energy companies through fees assessed for permit applications. Since July 2005, the NMa has operated as an autonomous administrative authority *(Zelfstandig Bestuursorgaan)* headed by a board of directors. The members of the board are appointed by the Minister of Economic Affairs.

TenneT, a fully state-owned company, is the transmission system operator and administrator of the Dutch high-voltage electricity grid. In addition to managing the grid, TenneT also monitors the reliability and continuity of the electricity supply. Gas Transport Services B.V. (GTS), also a fully state-owned company, is the national transmission operator and responsible for the management, operation and development of the gas transport system.

SenterNovem is an agency of the Dutch Ministry of Economic Affairs, which promotes sustainable development and innovation, both within the Netherlands and abroad. SenterNovem comes from a merger of Senter and Novem in 2004, both agencies under the Ministry of Economic Affairs, designed to bring together knowledge of innovation, energy, climate, the environment and living conditions. SenterNovem directs programmes and projects designed to help reduce Dutch dependence on fossil fuels. In particular, it explores options for renewable energy sources and assists the government in such investments. SenterNovem is tasked by the Ministry of Economic Affairs with the implementation of the country's renewable electricity promotion schemes. It

grants subsidies based on certificates issued by CertiQ (see below). It also establishes and manages long-term agreements between the government and energy-intensive companies to promote energy savings, and works to modify building practices to enhance the efficiency of buildings. It also directs programmes and projects aimed at reducing climate change by monitoring and reducing emissions of CO_2 and non-CO_2 greenhouse gases.

CertiQ, a subsidiary of TenneT, is responsible for certifying the sustainable generation of electricity on behalf of the Dutch government. It issues "guarantees of origin" for "green" electricity produced from biomass, wind, hydro and solar energy. It also provides certificates for combined heat and power (CHP).

The Energy Research Centre of the Netherlands (ECN) is the largest research centre in the Netherlands in the field of energy. It links fundamental research at universities with appliance of knowledge and technologies in practice. It is also the main institute that provides the Dutch government with forecasts of the developments in energy demand and supply, CO_2 emissions and energy efficiency.

KEY ENERGY POLICIES

The Netherlands' energy policy strives for a clean, affordable and reliable energy system. Many of the country's policy goals derive from the EU level. For example, EU law sets requirements for electricity and natural gas markets, and for energy efficiency in appliances and buildings. As an EU member, the Netherlands has non-binding targets for energy efficiency and for the shares of renewable energy in TPES, electricity supply and transport fuels. It also has binding targets for total greenhouse gas (GHG) emissions and, through the European Union Emissions Trading Scheme (EU-ETS), for CO_2 emissions from heavy industry and power and heat generation.

In December 2007, the Dutch government released its white paper on the Clean & Efficient programme, which lays out the national climate policy framework. Under this programme, the government has established four primary targets:

- Reducing greenhouse gas emissions by 30% from the 1990 level by 2020.
- Increasing the share of renewables in the energy mix by 20% by 2020.
- Achieving annual energy efficiency improvements of 2% by 2020.
- Making a big step in the transition towards a more sustainable energy system by 2020.

These targets are in line with the EU targets for 2020:

- Reducing GHG emissions by 20% from the 2005 level (by 30% if other major economies join in).
- Increasing the share of renewables in energy consumption to 20%.
- Increasing energy efficiency to reduce energy demand by 20% from business-as-usual level in 2020.

Another key policy document is the Energy Report, prepared every four years and setting out the country's energy and environmental policy framework. In June 2008, the government released its *Energy Report 2008*, which lays out the government's energy strategy through 2011 and a long-term vision to 2050. It calls for a clean, affordable and reliable energy system. It also sees the need for energy co-operation, technical breakthroughs, changes in behaviour and adjustments to the energy infrastructure if a sustainable energy supply is to be developed for the long term. *The Energy Report 2008* also foresees further development of the Netherlands as a hub for energy and other imports, especially natural gas. It also sees a role for the country to play in developing European energy sources and environmental technologies in a sustainable manner. Policies on industry and energy innovation make up a critical piece of the government policy framework. Under its innovation agenda, the government plans to provide over EUR 900 million in 2008-2011 for R&D and demonstration projects and other innovation activities.

Some of the aspects of the government's outlook to 2050 are:

- Expansion of smaller-scale energy technologies, including renewables.
- Expansion of coal-fired power plants with carbon dioxide capture and storage (CCS).
- Development of a new generation of nuclear power stations.
- Transition from passenger vehicles fuelled by gasoline and diesel to those fuelled by electricity, biofuels or hydrogen.
- Dramatic reduction in the energy needs of buildings.
- Development of more sustainable heat for use in industry.

The *Energy Report 2008* does not specifically call for or reject new nuclear power plants. Instead, it describes several scenarios – with and without new nuclear – to facilitate decision making by the next government (scheduled to replace the current government in 2011). The coalition agreement of the current government rules out building any nuclear plants before 2011.

Additionally, the government has developed an Energy Transition framework to achieve the transition to a more sustainable energy future. Energy Transition

is an initiative of six Dutch ministries[6] and is implemented in co-operation with market participants, scientific and civil organisations, and government agencies. Energy Transition focuses on seven technology areas or platforms (see Chapter 9 for more details).

Developing carbon dioxide capture and storage (CCS) technologies is one of the government priorities. The government finances R&D in this area (see Chapter 9), although it has postponed a decision on allocating funding for storage because of NIMBY ("not in my backyard") concerns.

In developing its energy policies and measures, the government makes extensive use of cost-effectiveness evaluation, both *ex ante* and *ex post*. All proposed policies are analysed carefully, taking on board discussions with all relevant stakeholders. Energy policy development in the Netherlands follows the traditional Dutch polder model, characterised by consensus decision making. The key characteristic of the polder model is tripartite dialogue and consultations among unions, employers and the government. While the polder model allows developing solid policies through consensus building, it is sometimes criticised as a particularly slow decision-making process.

ENERGY TAXES AND SUBSIDIES

A number of taxes and subsidies are in place affecting energy consumption and production in the Netherlands.

The energy investment allowance is a tax deduction for investments in energy-saving equipment and renewable energy. Through this programme, implemented jointly by SenterNovem and the tax authorities, Dutch companies investing in energy-efficient equipment and renewable energy sources can deduct 44% of such investments from their taxable profit. The programme has a maximum annual budget ceiling of EUR 139 million.

The Green Funds scheme encourages projects that have a positive effect on the environment. Under this programme, the government offers a tax advantage to "green" savers and investors, allowing banks to offer loans at lower interest rates. Examples of projects that would qualify are sustainably built houses, wind farms and organic agricultural businesses. The scheme is run collectively by the Ministry of Housing, Spatial Planning and the Environment; the Ministry of Finance; and the Ministry of Agriculture, Nature and Food Quality. The Ministry of Housing, Spatial Planning and the Environment co-ordinates the implementation of the scheme. SenterNovem and the Ministry of Agriculture, Nature and Food Quality's implementation

6. Ministries of Economic Affairs; Housing, Spatial Planning and the Environment; Agriculture, Nature and Food Quality; Transport, Public Works and Water Management; Foreign Affairs; and Finance.

department are responsible for evaluating the projects. If a project is approved, these organisations also issue green certificates on behalf of the minister.

Under the government's 2008 tax plan *(Belastingplan 2008)*, some additional fiscal measures have been implemented, including:

- Flight tax on air tickets.
- More strongly differentiated passenger vehicle taxes on private cars.
- Restricted increase of the electricity tax.
- Increased taxes on diesel fuel.
- Bonuses for very efficient company cars.

The Energy Research Subsidy programme, which is implemented by SenterNovem, aims to initiate and support innovation and research in the fields of energy efficiency and sustainable energy (see Chapter 9).

SDE (*stimulering duurzame energieproductie*, stimulation of sustainable energy production) is the government's promotion scheme for renewable energy and combined heat and power. It effectively modifies and replaces two earlier aid schemes, known collectively as MEP (*milieukwaliteit van elektriciteitsproductie*, environmental quality of electricity production). These subsidies are discussed in more detail in Chapter 7.

CRITIQUE

Although the Netherlands already has sound policies in place, it has recently announced its intention to become one of the most energy-efficient economies in the European Union. As part of this pledge, the government has set some ambitious targets for 2020: to increase renewables in the energy mix to 20%, to make a 2% annual efficiency improvement and to lower greenhouse gas emissions by 30%. These are not easy goals and the IEA commends the Netherlands for creating and accepting these challenges. Given the Netherlands' important role on the European energy scene, the country's decision gives greater impetus to the European and international community to enhance efforts towards a more sustainable energy future.

Having established a sound energy policy framework, the government is actively engaged in evaluating its medium- and long-term energy future, through both the Clean & Efficient programme that looks to 2020 and the *Energy Report 2008* that looks to 2050. Furthermore, the Energy Transition framework seeks to co-ordinate the policies and measures across six ministries and seven platforms – a necessary but complex and difficult task. In short, the

government is effectively addressing key challenges: to secure energy supply, develop a sustainable energy future and maintain economic competitiveness.

Areas for improvement include enhancing continuity, clarity and decisiveness in policy making. The need for continuity is most notable in the case of the feed-in tariff for renewables, described more fully in Chapter 7, which abruptly ended in 2006 and restarted in April 2008. This stop-start situation harms the overall effectiveness of the policy – whether or not it was perfect. Policies also need to be of a sufficient duration to underpin a sound investment climate.

With respect to clarity, more work could be done to itemise exactly which policies are intended to achieve which results. For example, the current complexity of the different requirements of the benchmarking covenants, the long-term energy efficiency agreements and the EU-ETS (described in Chapter 3) may produce sub-optimal results. Established targets are another area that may require simplification. The Netherlands has shown determination in tackling its sustainability ambitions. However, there are some concerns that the piling on of different targets could undermine the effectiveness of the most important one –– the GHG emissions target. The targets to increase the supply of renewables will help stimulate the market, and the targets to improve energy efficiency annually will also help drive improvements in energy intensity. The IEA urges the government to make sure that these other targets are designed to facilitate achievement of the overall GHG emissions target, but do not raise the complexity and the cost of achieving it. In the future, when considering additional targets, the government should avoid political pressure to set targets or goals without undertaking the necessary cost-effectiveness evaluations and ensuring coherence with the current strategies and goals.

Policy decisiveness should also be a priority. A key example is nuclear power. The IEA is pleased to see the government begin to consider whether nuclear could play a larger role in the country's future energy mix. Putting the decision off until after 2011, while leaving time to build consensus, also leaves uncertainty about a technology that requires significant lead time to be planned, built and go on line. The IEA urges the government to come to a clearer position as early as possible, using the time to 2011 to create the necessary regulatory framework to allow for a timely decision to be taken.

Another example concerns transport policy. As discussed more fully in Chapter 3, the policies being developed in the transport sector have many very good aspects. The IEA urges the government to work to quickly implement the suite of proposals – perhaps leaving open the possibility to tweak the policies as necessary (without allowing too much uncertainty for the public and industry).

In general, the government is taking steps to set a clear framework for carbon dioxide capture and storage (CCS). While still under development, CCS is a promising technology that requires active support, and the government has shown initiative in this area. At the same time, the IEA urges the government

to tread carefully. Fall-back scenarios that make room for a future without CCS must always be considered.

The government has set out its policy framework, and now the focus must turn to the difficult task of implementation. As the government is well aware, developing ambitious strategies and policies is easier than implementing them. Similarly to other countries, the Netherlands now faces the challenge of making the ambitious agendas a reality. Overall, the government has rightly continued to make effective implementation a priority.

While there is very good co-ordination across various ministries and entities, as seen in the development of the Clean & Efficient programme, the *Energy Report 2008* and the Energy Transition framework, the ambitious and fast-approaching targets require even closer attention to co-ordination and co-operation. The government should ensure that such collaboration across ministries and between local, regional and national authorities begins as early as possible in policy development and continues during the implementation phase. Furthermore, meeting the targets will require quick and potentially painful implementation of policies. Successful implementation and meeting sustainability goals will also require continued, active and open dialogue with the public.

The government evaluates all proposed policies very carefully, taking on board discussions with all relevant stakeholders. This is a very sound approach. The traditional Dutch polder model of collaboration and consultation is successful in developing solid, well-designed policies. It also allows for decisions to be accepted by all relevant parties. But at the same time the polder model can be characterised by a particularly slow decision-making process. This can lead to long delays in the adoption and implementation of urgently needed policies and measures. From this point of view, perfection could be the enemy of the good. The IEA is pleased to see – particularly through the Energy Transition framework – that the Dutch government takes steps to be more decisive when necessary. The government has appropriately sought to find a balance between the long tradition of consensus building and the current need for more decisive and prompt decision making.

RECOMMENDATIONS

The government of the Netherlands should:

- *Build on the sound policy-setting environment in place by:*
  - *Enhancing continuity and stability of policies.*
  - *Ensuring that policies are implemented on a sufficiently long-term scale to underpin sound decisions in the private sector.*
  - *Working towards more timely and effective decision making, with due attention to public and political consultation.*

- *Proceed carefully with the suite of sustainability targets in place, and consider elevating the carbon dioxide target to primacy, with other targets in place to guide the country to success.*

- *Remain aware that the ambitious sustainability goals that have been set will require:*
  - *Enhanced early and ongoing co-ordination across various ministries and entities, particularly when developing the necessary policies.*
  - *Early implementation of a suite of new and stronger policies.*
  - *Potentially painful policy choices that need to be clearly explained to the public and stakeholders for implementation to be successful.*

- *Remain cognisant that carbon capture and storage, along with other future technologies, is one potential technology among others, and that various scenarios for the future fuel mix must be envisioned.*

The Netherlands is aiming to become a world leader in the field of sustainable energy policies. With respect to climate change, it has set a very ambitious target: a 30% reduction in GHG emissions by 2020 compared to 1990 levels. It is also a leading country in using the Kyoto flexibility mechanisms. The Netherlands already places a high priority on energy efficiency, for reasons of both energy security and climate change. The country has set ambitious targets for energy efficiency improvement: 2% annually – more than twice the current rate of 0.9%. The Netherlands' energy efficiency policy is increasingly guided by EU requirements. To comply with these requirements and meet its own goals, the government has introduced a number of policies to stimulate energy efficiency in industry, buildings, transport and appliances.

CLIMATE CHANGE

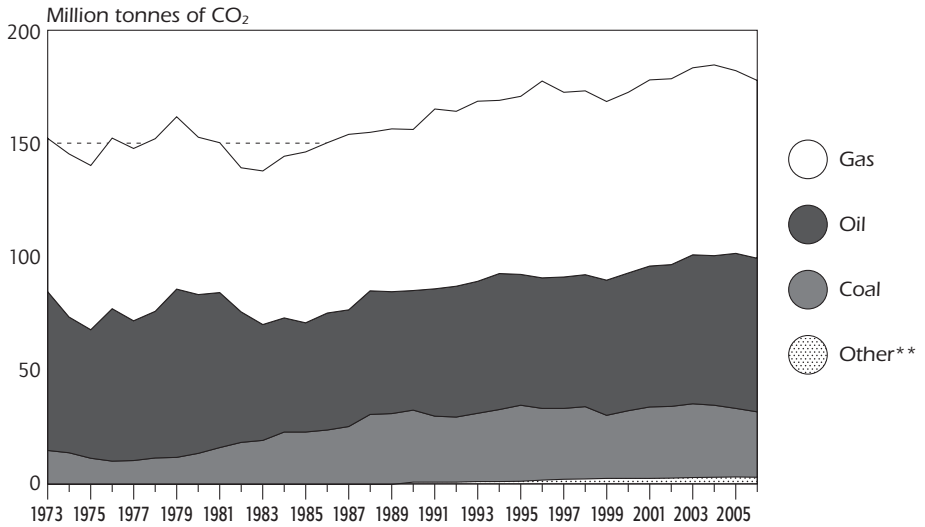
CARBON DIOXIDE EMISSIONS PROFILE

As detailed in Figure 4 and Table 2, the Netherlands' total CO_2 emissions from fuel combustion were growing until 2004 and started to decline in 2005. Overall, these emissions rose by 29% between 1990 and 2006. In total, the Netherlands' energy-related emissions were 178 million tonnes of CO_2 ($MtCO_2$) in 2006. Nearly all of the increase since 1990 is due to rising use of oil and natural gas. Some small increases come from emissions from biomass. Emissions from oil consumption have grown by nearly 29% between 1990 and 2006, and are expected to grow by another 37% between 2006 and 2030. While emissions from coal consumption have declined (-9% between 1990 and 2006), they are expected to climb by an additional 170% between 2006 and 2030. Overall, without additional policies, emissions are projected to increase by over 44% in 2030.

From a sector perspective, as detailed in Figure 5, CO_2 emissions from fuel combustion have mostly increased in the transport sector (36%) and the electricity and heat sector (21%) relative to 1990 levels. In 2006, the largest CO_2-emitting sector from fuel combustion was the electricity and heat sector (30%), followed by the manufacturing industries and construction sector (21%), the transport sector (20%), other sectors including the residential sector (20%) and other energy industries (*i.e.* beyond electricity and heat production, 9%).

Figure 4

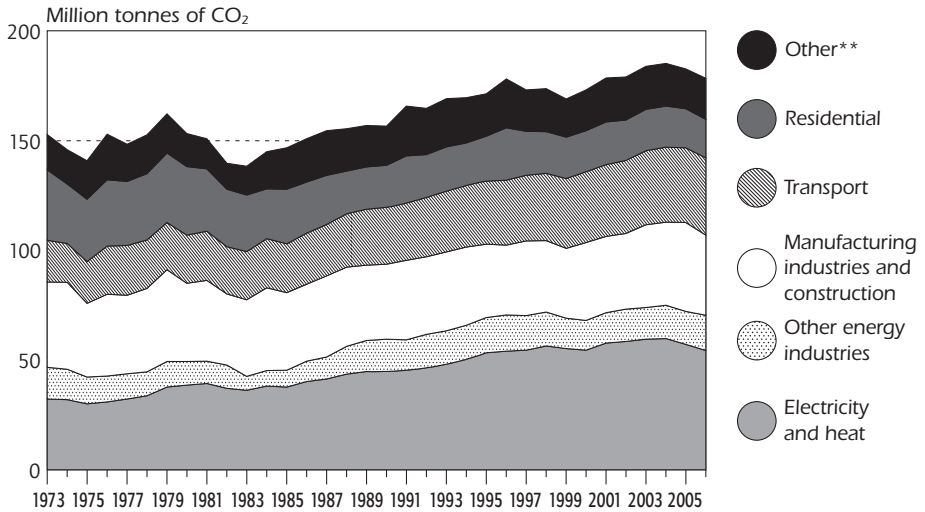
CO_2 Emissions by Fuel*, 1973 to 2006



* estimated using the IPCC Sectoral Approach.
** includes industrial waste and non-renewable municipal waste.
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2008.

Figure 5

CO_2 Emissions by Sector*, 1973 to 2006



* estimated using the IPCC Sectoral Approach.
** includes emissions from commercial and public services, agriculture/forestry and fishing.
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2008.

Table 2

Energy-Related CO_2 Emissions by Fuel*, 1970 to 2030

Unit: $MtCO_2$	*Oil*	*Coal*	*Natural gas*	*Other***	*Total*
1970	73.09	18.89	36.05	0	128.03
1980	70.00	13.76	69.39	0	153.15
1990	52.74	31.82	70.98	1.05	156.59
2000	60.69	29.94	79.83	2.63	173.09
2001	62.23	31.55	82.11	2.65	178.54
2002	62.50	31.68	81.98	2.83	178.99
2003	65.78	32.55	82.47	3.07	183.86
2004	66.02	31.74	84.19	3.19	185.14
2005	68.46	30.28	80.64	3.26	182.64
2006	67.84	28.85	78.49	3.13	178.31
2010	65.35	32.61	88.30	3.13	189.39
2030	92.95	77.95	83.33	3.13	257.35
Share in 2006 (%)	*38.0*	*16.2*	*44.0*	*1.8*	
Change (1990-2006), %	*28.6*	*-9.3*	*10.6*	*198.1*	*13.9*
Projected change (2006-2030), %	*37.0*	*170.2*	*6.2*	*0.0*	*44.3*
Average annual growth rate (1990-2000), %	*1.4*	*-0.6*	*1.2*	*9.6*	*1.0*
Average annual growth rate (2000-2006), %	*1.9*	*-0.6*	*-0.3*	*2.9*	*0.5*
Average projected annual growth rate (2006-2030), %	*1.3*	*4.2*	*0.3*	*0.0*	*1.5*

* estimated using the IPCC Sectoral Approach.
** includes industrial waste and non-renewable municipal waste.
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2008 and country submission.

KYOTO TARGET

Under the Kyoto Protocol and the EU burden-sharing agreement, the Netherlands has an objective of a 6% reduction of greenhouse gas emissions compared to 1990 levels (annual emissions for the period 2008 to 2012 should be around 202 $MtCO_2$-eq compared to 214 $MtCO_2$-eq in 1990). In 2005, the country's total GHG emissions stabilised approximately at 214 $MtCO_2$-eq. Therefore, more action is needed to comply with the Kyoto Protocol and the burden-sharing agreement over the 2008-2012 commitment period.

CLIMATE CHANGE POLICY

The relevant legislation guiding efforts to reduce greenhouse gas emissions is the National Climate Policy Implementation Plan (NCPIP), issued in two parts in 1999 and 2000. NCPIP I and II state that half of the Dutch commitment will be achieved through domestic policies, and the other half will be met in co-operation with other countries through the use of flexibility mechanisms. NCPIP I covers the domestic targets, while NCPIP II outlines the country's

Kyoto flexibility mechanisms strategy. An annual reduction of 20.26 $MtCO_2$-eq is expected to come from domestic measures, particularly from the industrial and power sectors covered under the EU Emissions Trading Scheme (EU-ETS). The extensive use of the project-based flexibility mechanisms is planned to obtain an average annual reduction of 16.5 $MtCO_2$-eq.[7] The Netherlands is actively engaged in the credit procurement process.

The government, installed in February 2007, has also set further objectives for greenhouse gas reduction by 2020 (a 30% reduction with respect to 1990 levels) under its Clean & Efficient programme.

Institutional arrangements

- With the start of the new government in 2007, the responsibilities between the ministries have shifted. While the Ministry of Housing, Spatial Planning and the Environment (VROM) retains primary responsibility for the overall climate goal, as well as energy efficiency and renewable energy goals, every sectoral ministry is responsible for the implementation of the climate policy in its own sector. As a result:
- The Ministry of Finance is in charge of the green taxation policy.
- The Ministry of Transport, Public Works and Water Management as well as the Ministry of Housing, Spatial Planning and the Environment are responsible for policies in the transport sector.
- The Ministry of Housing, Spatial Planning and the Environment is responsible for measures in the building sector.
- The Ministry of Agriculture, Nature and Food Quality (LNV) is responsible for measures in the agricultural sector.
- The Ministry of Economic Affairs is in charge of all measures that cover industry and energy sectors.

This inter-ministerial agreement provides a system with clearly defined responsibilities for meeting the domestic target. Furthermore, an agreement between the central government and the regional and local governments has been signed. In this agreement the regional and local authorities highlighted

7. In 1999, the forecasted emission in the business-as-usual scenario in 2010 was 242 $MtCO_2$-eq per year. As laid out in the National Climate Policy Implementation Plans, the annual objective of 40 $MtCO_2$-eq to achieve the reduction goals was divided between domestic action and reductions through the use of Kyoto's flexibility mechanisms, joint implementation (JI) and the clean development mechanism (CDM). Originally, both domestic actions and the use of flexibility mechanisms were to achieve the same emissions reduction objective (*i.e.* 20 $MtCO_2$-eq per annum). However, in light of lower emission levels than previously anticipated, the objective of the flexibility mechanisms was lowered to 16.5 $MtCO_2$-eq annually (or 65 $MtCO_2$-eq over the first Kyoto Protocol compliance period 2008-2012).

their climate policy ambitions in light of the new, more stringent national climate objectives. Nonetheless, no specific target for the local and regional governments exists; they are autonomous in setting their own ambitions.

Policies and objectives

According to the latest forecasts, projected emissions with existing policies and measures in 2010 will reach approximately 221 $MtCO_2$-eq, which is 19 $MtCO_2$-eq above the 2008-2012 target of 202 $MtCO_2$-eq per year.

The National Climate Policy Implementation Plan I states that half of the Dutch commitment will be achieved through domestic policies. Table 3 provides an overview of the policies and measures that were already in place or planned before the publication of the Clean & Efficient programme. Most of these policies and measures are related to improved energy efficiency. In the industry and power sectors, the primary means of achieving emissions reductions is through the EU-ETS. In the commercial sector, which is not covered by the EU-ETS, long-term agreements and benchmarking agreements are the primary means of achieving emissions reductions. There are also some smaller programmes to promote energy-efficient equipment. In the transport sector, the biggest sources of emissions reductions are from energy taxes to promote the fuel economy of vehicles and differentiated taxation regimes for the purchase of new vehicles.

Other important Cpolicies to reduce CO_2 emissions include improvements to the energy performance of buildings, efficiency improvements in equipment (see Energy Efficiency in this chapter), reductions in the CO_2-intensity of the power sector (Chapter 6), the promotion of renewables (Chapter 7) and carbon dioxide capture and storage (CCS) (Chapters 5 and 9).

Emissions trading

Domestic trading

In September 2006, the Netherlands submitted to the EU its proposed national allocation plan (NAP) for emissions under the EU-ETS for the second trading period. It was accepted with some modifications in January 2007. The plan allocates 85.8 $MtCO_2$-eq per year to energy and industrial facilities during the Kyoto Protocol's first commitment period. This is 4.6 $MtCO_2$-eq less (about 5%) than initially proposed by the Netherlands. It represents a 10% reduction from the 86.4-$MtCO_2$ allocation given from 2005 to 2007. The Netherlands is reserving 6.4 $MtCO_2$-eq for new entrants to energy and industrial sectors (included in the 85.8 $MtCO_2$-eq), and has decided to auction 4% of the total amount of allowances.

The specific allocations to facilities covered by the EU-ETS have been approved by the Dutch Parliament. The distribution of allowances was as far as possible

Table 3

Policies and Measures in the Kyoto Protocol Target Achievement Plan

Cluster	*GHG affected*	*Objective and/or activity affected*	*Estimate of mitigation impact per year, in $MtCO_2$-eq.*		
			2005	*2010*	*2015*
Energy sector					
Combined heat and power (CHP)	CO_2	Encourage construction and use of CHP by lowering investment costs and operating costs	1.0	1.9	1.6
Renewable energy	CO_2	5% renewable energy in 2010 and 10% in 2020; 9% renewable electricity in 2010	1.5	4.1	9.4
CO_2 emissions trading	CO_2	Reduce CO_2 emissions from large energy-intensive companies in most cost-effective way	0.3	1.1	3.6
Low-methane oil and gas production and distribution	CH_4	Reduce CH_4 emissions from oil and gas production by 10% in 2000 relative to 1990	0.3	0.3	0.3
Industry sector					
Energy efficiency	CO_2	Promote energy conservation and efficient use of energy	0.9	1.4	2.1
CO_2 emissions trading	CO_2	Cost optimisation of CO_2 reduction efforts	0	0.3	0.5
Low HFC/HCFC production	HFC	Reduction in emissions of HFCs	1.9	1.9	1.9
Low PFC aluminium production	PFC	Reduction in emissions of PFCs	1.1	1.1	1.1
Low N_2O nitric acid production	N_2O	Reduction in emissions of N_2O	–	3.6	4.0
Reduction programme for non-CO_2 gases	HFC/PFC	Reduction of F-gas emissions from car air-conditioning systems and industrial cooling installations; reduction in F-gas emissions from products and semiconductor industry	0.5	1.0	1.0
Transport sector					
Fuel efficiency through technical vehicle measures	CO_2	Increasing fuel efficiency and reducing CO_2 emissions through technical vehicle measures	0.2	0.4	0.4
Fuel efficiency through driving behaviour and discouraging vehicle use	CO_2	Increasing fuel efficiency and reducing CO_2 emissions through optimisation of driving behaviour; discouraging vehicle use through logistical improvements; reducing congestion	0.5	0.9	0.9
Other	CO_2	Raise revenue; reduce CO_2 emissions through investments in material target: 2% in 2007 and 5.75% in 2010; increase use of natural gas as automotive fuel	0.1	0.1	0.1

Table 3

Policies and Measures in the Kyoto Protocol Target Achievement Plan *(continued)*

Cluster	*GHG affected*	*Objective and/or activity affected*	*Estimate of mitigation impact per year, in $MtCO_2$-eq.*		
			2005	*2010*	*2015*
Agriculture sector					
Combined heat and power (CHP)	CO_2	Encourage construction and use of CHP by lowering investment costs and operating costs	1.0	1.9	1.6
Energy savings in greenhouse horticulture	CO_2	Increase energy efficiency by 65% 1980-2010	0.2	0.4	0.8
Livestock reduction	CH_4	–	0.1	0.3	0.15
Manure management	CH_4, N_2O	Reduce nitrates in soil and emissions of NH3	0.4	0.6	0.3
Waste sector					
Landfill policy	CH_4		3.0	4.0	5.0
Building sector					
Energy performance of new buildings	CO_2	Improve energy performance of new residential and non-residential buildings	0.3	1.1	2.2
Retrofit existing buildings	CO_2	Improve energy performance of existing residential and non-residential buildings	0.5	1.0	1.5
Energy efficiency appliances	CO_2	Improve market penetration of energy-efficient appliances	0.3	0.6	0.8
Total			**13.0**	**22.5**	**33.6**

Notes: CO_2 – carbon dioxide; CH_4 – methane; HFC – hydrofluorocarbon; HCFC – hydrochlorofluorocarbon; PFC – perfluorocarbon; N_2O – nitrous oxide; NH_3 – ammonia.
Source: Country submission.

tailored to covenants between the government and industrial companies on improving the latter's energy efficiency (for more details see the section on Energy Efficiency below). In setting the allocation levels in its second NAP, the basic allocation formula is A = HE x GF x EE x C, where:

A = allocation to an individual installation
HE = historic emissions (an average of three out of five years from 2001 to 2005[8])
GF = growth factor

8. Under an agreement with industry, the three years out of these five years with the highest emissions are used. The agreement, which raises the emissions ceiling, was reached to account for irregular production during the reference period.

EE = relevant energy efficiency factor[9]
C = compliance factor to remain within total ceiling

International purchases

Purchases of emission credits from the international market can be used to offset domestic emissions above the Kyoto target. The Kyoto Protocol provides for several so-called flexibility mechanisms to assist Annex I parties (developed countries) in meeting their Kyoto emissions targets in the most cost-effective manner possible. The Netherlands intends to make use of all the three mechanisms, described in Box 1.

Box 1

Kyoto Protocol Flexibility Mechanisms

- *Joint implementation* (JI), a project-based mechanism, allows Annex I parties to the Kyoto Protocol to fund emission-reducing or offsetting projects in other Annex I parties and then to apply the resulting emissions reduction units (ERUs) towards meeting their own Kyoto target.
- *Clean development mechanism* (CDM), also a project-based flexibility mechanism, allows Annex I parties to fund emission-reducing or offsetting projects in non-Annex I parties (typically developing countries) and then to apply the resulting certified emissions reductions (CERs) towards their own Kyoto targets.
- *Emissions trading* can be used by Annex I parties in addition to the two project-based mechanisms. Under this mechanism, an Annex I party purchases emission units from another Annex I party (or an authorised legal entity from within that party) and applies these units towards meeting its own target. Generally speaking, these units are assigned amount units (AAUs), though some other forms of emission units may also be traded. In the case of AAUs, they do not arise from particular projects; rather, if an AAU is sold to another country, the sale increases the total emissions reduction the selling country must achieve by an equal amount.

The Netherlands has been one of the largest governmental buyers of project credits under the Kyoto Protocol. This strategy was adopted by the Parliament in the spring of 2000 under the second National Climate Policy Implementation

9. The EE factor is derived from the target of both covenants. If a company performs better than the target, it gets a higher EE factor; if a company performs less than agreed on the EE factor, it will be lower. The range is between 0.85 and 1.1 (a factor of 1 means that the EE factor has no influence on the outcome). A company that performs better than the target agreed on in the covenants obtains more allowances and vice versa. In this way, the early action of a company is taken into account. All data are based on verified monitoring reports.

Plan. The Netherlands has not set specific targets for each of the Kyoto flexibility mechanisms. Its strategy has been to start implementation and evaluate the progress in 2002, 2005 and 2010. While the government has currently fulfilled its target and halted additional purchases, it will assess its plan again in 2010, and if it is off track to achieve the necessary reductions, it might re-enter the market. Budgets have been allocated for JI and CDM reductions at a ratio of 1:2. Decision-making responsibility for CDM rests with the Ministry of Housing, Spatial Planning and the Environment. Decision-making responsibility for JI rests with the Ministry of Economic Affairs.

By September 2008, the Netherlands had contracted emissions reduction credits beyond its 65 $MtCO_2$-eq cumulative objective. Table 4 outlines signed international greenhouse gas credit contracts.

Table 4

Summary of International Greenhouse Gas Credit Contracts

(situation as of September 2008)

	Clean development mechanism (CDM) Purchases (contracted) $MtCO_2$	*Joint implementation (JI)* Purchases (contracted) $MtCO_2$
Tenders through SenterNovem	around 1.8	15.5
Contracts with multilateral and regional financial institutions	46.3	8.5
Contracts with private financial institutions	2.7	-
Participation in carbon funds	around 0.2	around 2
Bilateral purchase agreement	0	-
Total	**Around 51**	**26**

Sources: Ministry of Housing, Spatial Planning and the Environment (VROM) and Ministry of Economic Affairs, personal communication.

Beyond 2012, the government has announced its aim to reach its target of cutting emissions by 30% below 1990 levels by 2020 through domestic efforts alone, instead of purchasing carbon credits through CDM and JI projects.

Compensation for energy-intensive industry

The government is considering plans to compensate Dutch industry exposed to higher electricity prices as a result of the EU-ETS, considering two possible options. One is a partial free allocation of EU-ETS CO_2 allowances based on the average electricity use of a sector and the average CO_2 content of electricity. The second option is a direct financial compensation for increase in costs related to electricity use.

AIR QUALITY

On air quality, measures are being considered to further limit local air pollution, such as through traffic congestion policies (*i.e.* road pricing), taking account of the country's high nitrous oxide and particulate matter levels and the country's need to comply with the standards set in European air quality directives.

ENERGY EFFICIENCY

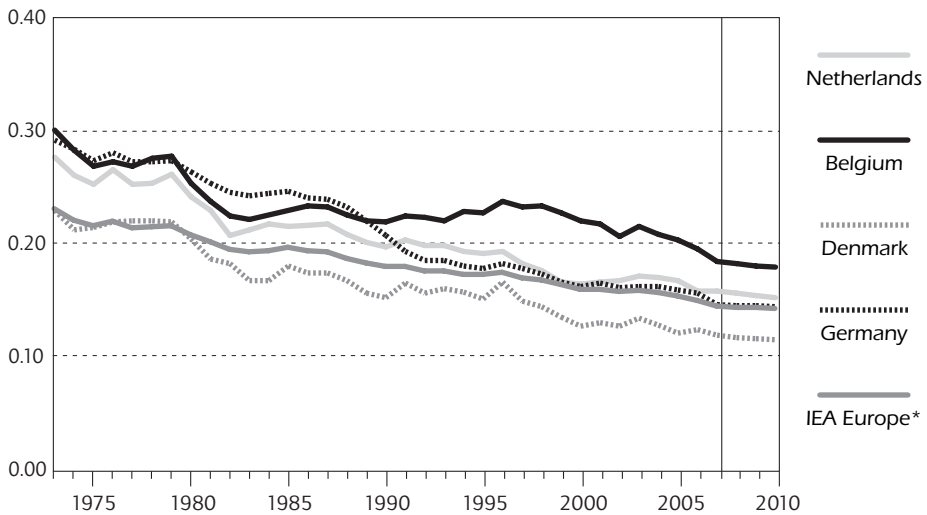
TRENDS IN ENERGY EFFICIENCY

As detailed in Figure 6, energy intensity – the amount of energy used in a country per unit of gross domestic product (GDP) – is higher in the Netherlands than the average in IEA Europe (by about 6% in 2006 and by nearly 10% in 2007, according to preliminary 2007 data). This is mainly due to the higher concentration of energy-intensive industry, including refineries and chemicals. Energy intensity has been on a declining trend since 2003, a trend that is expected to continue through 2010, likely resulting in an energy intensity that is in line with the European average.

Figure 6

Energy Intensity in the Netherlands and in Other Selected IEA Member Countries, 1973 to 2010

(toe per thousand USD at 2000 prices and purchasing power parities)



* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries,* IEA/OECD Paris, 2008; *National Accounts of OECD Countries*, OECD Paris, 2008 and country submissions.

The government's estimates show that the country's annual improvements in energy efficiency have been declining somewhat, moving from an average improvement of 1.2% per year between 1995 and 2000 to 0.9% per year between 1995 and 2005.

KEY INSTITUTIONS

The responsibility for energy efficiency policies is divided among four ministries. The Ministry for Economic Affairs is the lead government entity for the general energy efficiency policy and for measures in the industrial and energy sectors. The Ministry for Spatial Planning, Housing and the Environment is responsible for energy efficiency in buildings and the Ministries for Transport and for Agriculture, Nature and Food Quality are responsible for energy efficiency in the transport and agricultural sectors respectively.

SenterNovem, the Dutch Agency for Energy and the Environment, is the lead implementing agency for energy efficiency. The agency acts as an intermediary between energy users and the government to stimulate sustainable development in the field of energy and the environment. It assists participants on both technical and organisational levels, and advises on energy efficiency solutions that improve environmental performance and contribute to companies' economic viability.

The Energy Research Centre of the Netherlands provides the government with forecasts of the developments in CO_2 emissions and energy efficiency.

POLICIES AND MEASURES

Policy framework and objectives

Under its Clean & Efficient programme, the Netherlands has set ambitious targets: an annual energy efficiency improvement of 2% – more than twice the current rate of 0.9%. Analysis conducted by the Energy Research Centre of the Netherlands (ECN) indicates that these targets are achievable, assuming strict standards for appliances and vehicles and a price of at least EUR 50 per tonne of CO_2.

In designing its mix of policy measures, the government took into consideration cost-effectiveness criteria. In 2010, the energy and climate policies will be evaluated to see whether the country is on track to meet its 2020 policy goals, whether the policy measures are effective and how costs have evolved since the policies' implementation.

Budget

To achieve these goals, the government plans to spend EUR 274 to 314 million per year in 2008-2011 on energy efficiency measures. The total planned expenditure over the period 2008-2011 is about EUR 1.2 billion, including EUR 642 million for tax schemes, EUR 214 million for buildings, EUR 150 million for agriculture and horticulture, EUR 64.5 million for industry, and EUR 47 million for transport.[10] This will be about 40% higher than the budget spending on energy efficiency in the previous years.

Cross-cutting policies

The key cross-cutting policies and measures to enhance energy efficiency in the Netherlands include:

- Tax mechanisms, including tax deductions for energy investments (see Chapter 2)
- Instruments to spur energy innovation: *i)* under the Energy Transition platforms; *ii)* through fundamental research and market introduction subsidies (see Chapter 9).
- Voluntary covenants (long-term agreements and benchmarking agreements) with industry, the tertiary sector, transport, agriculture and some companies in the energy sector.

INDUSTRY

The EU-ETS indirectly encourages energy efficiency improvements in the sectors covered by the scheme. The main instruments to stimulate energy efficiency in the sectors not covered by the EU-ETS are long-term agreements and benchmarking agreements.

Long-term agreements and benchmarking agreements

The government has been signing voluntary covenants, or long-term agreements (LTAs), with various sectors – industry, services, transport and agriculture – since the early 1990s. After the first round of agreements (LTA1) ended in 2000, a second round of agreements (LTA2) was introduced, running through 2012. LTA2 covenants are signed by industrial companies, four ministries[11], the provincial authorities, the Association of Dutch Local Authorities and relevant trade associations. The Environment Protection Act assigns an important role to provincial and municipal authorities in running the LTA2

10. Source: *Energy Report 2008*.
11. The Ministries of Economic Affairs; of Agriculture, Nature and Food Quality; of Transport, Public Works and Water Management; and of Spatial Planning, Housing and the Environment.

agreements. Under this arrangement, municipal and provincial authorities oversee energy consumption of companies within their boundaries through licensing and licence enforcement procedures, and are responsible for enforcing the long-term agreements. In the case when a sector does not achieve its defined targets, it falls under the Environment Protection Act where penalties can be levied.

Currently, 902 companies participate in the LTA2, including 700 industrial companies and 198 companies in the food sector. In total, about 18.5% of Dutch energy consumption is covered by the agreements, equivalent to about 131 petajoules. (LTA1 had covered about 13% of total Dutch energy consumption.)

In addition to LTAs, the Dutch government concluded an Energy Efficiency Benchmarking Covenant with industry on 6 July 1999. In this covenant, the energy-intensive industry pledges to be among the world leaders in terms of energy efficiency for processing installations by no later than 2012. The covenant was signed by companies, the Ministers of Economic Affairs and of Housing, Spatial Planning and the Environment, the Inter-Provincial Consultative Forum (IPO) on behalf of the provinces. Industry is represented by the Confederation of the Netherlands Industry and Employers and by organisations from various industrial sectors and the electricity production sector.

Companies affiliate themselves to the covenant by means of a Declaration of Participation. Nearly all large energy-intensive companies (including the electricity sector) located in the Netherlands joined the covenant. In total the covenant benchmarking covers nearly 80% of the energy use of industry and nearly 100% of the electricity sector.

To meet the long-term goals of the Clean & Efficient programme, the government has set very ambitious targets in its proposed revisions to the long-term agreements (LTA3) and to the Benchmarking agreement that is expected to take effect in 2008 and to cover the industrial sector. (There will be other agreements to cover the tertiary, transport, agricutural and energy sectors). Within these revised long-term agreements, the government is considering an average energy efficiency improvement target of 30% in 2020 compared to 2005, and 50% in 2030. Under the LTA3 as currently proposed, municipal and provincial authorities would continue to be responsible for enforcing the long-term agreements, levying penalties under the Environment Protection Act and improving enforcement.

SenterNovem conducts extensive monitoring and evaluation of LTAs. The most recent evaluation, which looks at 2006 results, shows that LTA2 participants jointly improved their energy efficiency by 1.9% (see Table 5).

Table 5

Results from Long-Term Agreements (LTA2), 2001 to 2006

Sector	*Primary energy 2006 (PJ)*	*Avoided CO_2 emissions TEEI[1] 2001-2006 (kt)*	*TEEI 2006 vs. 2005 (%)*	*Measures in 2006 (PJ)[2]*
Railway transport	13.1	1 035	1.0	0.8
Industrial sectors[3]	106.6	3 413	1.8	9.4
Food industry[4]	44.6	692	2.7	1.6
Total LTA2	**164.3**	**5 140**	**1.9**	**11.8**

Notes: Agriculture is not included because the cluster makes use of a different monitoring system.

1. TEEI is total energy efficiency improvement.
2. The energy management measures concern the new measures taken in 2006. The saving contributes to the TEEI, but is not the only factor that affects this.
3. Industrial sectors include: asphalt; chemical; fine ceramics; foundries; coarse ceramics industry; laundry industry; sand-limestone and cellular concrete industry; refrigeration and cold-storage sector; non-ferrous metal industry; oil and gas production industry; surface treatment industry; non branch-related industry; rubber and plastics processing industry; tank storage industry; carpet industry; textile industry; university medical centres.
4. Food industry includes: potato processing; cocoa industry; vegetable and fruit processing; coffee roasting; margarine, fats and oils production; flour manufacturers; meat processing; dairy.

Source: *Long-term agreements on energy efficiency in the Netherlands – Results of 2006*, SenterNovem, November 2007, Table 1, pp. 8-9.

However, while the targets set in the agreements with industry have been met or exceeded, a 2006 evaluation of the covenants with the energy sector shows that its energy intensity has increased since 2000 and that this sector has not met the targets in the covenants. This indicates that the EU-ETS may have not provided sufficient incentives to the energy sector companies to meet their energy efficiency targets.

RESIDENTIAL AND COMMERCIAL SECTORS

Existing and planned measures to stimulate energy efficiency in the residential, commercial and other sectors include:

- Energy Performance standards and Energy Certificates for buildings
- "More with Less" plan *(Meer met Minder)* for the housing sector
- Green Funds scheme (see section on Energy Taxes in Chapter 2)
- Energy efficiency standards and labelling under the EU's Eco-Design Directive
- Covenants with housing corporations

Buildings

Under the EU Directive on the energy performance of buildings, the Netherlands is required to adopt a national framework to improve energy performance of new and existing buildings. By mid-2008, the Netherlands had transposed the directive only partially, lagging behind in terms of certification and inspection. It is expected to fully implement the directive by January 2009.

The Dutch government has undertaken to revise its buildings performance standards. The Energy Transition Platform for the Built Environment, together with energy providers, housing corporations and the construction sector, has initiated the "More with Less" plan, which is being implemented from 2008 onwards. This voluntary plan is aimed at energy savings in existing buildings (residential as well as commercial and industrial buildings), the implementation of which will lead to an energy efficiency improvement in around 500 000 buildings of 20 to 30% through 2011. From 2012 on, 300 000 buildings will be added annually. The government will make a financial contribution to this plan, which will provide financial incentives for upgrades. The government is also developing an energy performance certificate scheme and providing energy performance advice services.

For new buildings, the energy performance coefficient[12] is being tightened considerably from 0.8 to 0.6 in 2011 and to 0.4 in 2015, with the aim of reducing fossil fuel use by 50%.

The government estimates that the compliance rate with building code regulations is about 70%. This is approximately in line with the average rate in other IEA countries. Higher compliance rates can be achieved through better control and enforcement.

The government was considering signing a covenant with the Dutch housing corporations to stimulate energy savings in buildings. Housing corporations play a key role in the Netherlands, owning about 35% of dwellings. In 2007, Aedea, the Dutch Association for Housing Corporations, issued a statement promising to reduce energy consumption in buildings by 20% by 2018. Such efforts are vital for the residential sector, given that tenants are not allowed to make major changes in their dwellings, so it is owners who are responsible for energy efficiency improvements.

Appliances

Mandatory energy labelling of domestic appliances is based on the EU directives.[13] It covers lamps, ovens, refrigerators, freezers, washing machines,

12. Energy performance coefficients are the key component of energy performance standards. This type of regulation for setting energy efficiency standards for buildings generally sets a total energy consumption or CO_2 emissions maximum per unit area.
13. For further information on the EU energy efficiency legislation, see *IEA Energy Policy Review: The European Union*, OECD/IEA Paris, 2008

tumble-dryers and dishwashers. Appliances are classified from A to G, where class A is for the most energy-efficient appliances. In 2004, two new classes were introduced: compared to class A, electricity use in class A+ is 25% lower and in class A++ 40% lower.

In the coming years, minimum energy efficiency standards for appliances will be introduced in the Netherlands and other EU member states. These standards will be set by EU Regulations that are to be based on the Eco-Design Directive (2005/32/EC). At this stage, the EU Commission has plans for proposing such standards for 19 product groups.

TRANSPORT

To improve transport efficiency, the government seeks to stimulate uptake of more fuel-efficient vehicles, more efficient driving habits and reduced traffic in urban areas. Sales of more energy-efficient vehicles are stimulated through sales tax differentiation depending on the energy efficiency label of the car. Road pricing is still under discussion, with first steps being taken to introduce the system in 2011. The new road pricing system is expected to gradually replace the current road tax or *Motorrijtuigenbelasting* (MRB) and the sales tax or *Belasting Personenauto's en Motoren* (BPM). Under the new system, car users will pay charges for the use of roadways per kilometre driven; therefore those who drive less will be paying less and those who drive more will be paying more. The charges will be higher during busy hours to contribute to a more intelligent use of road capacity. The charges will also be differentiated according to the environmental characteristics of vehicles to promote environment-friendly cars. The money collected via these charges will be used for the construction, the administration and maintenance of the road infrastructure.[14]

Under its eco-driving initiative, the government seeks to reduce greenhouse gas emissions from the sector by 1 $MtCO_2$ annually by 2010 (the current annual reduction rate is 0.1 $MtCO_2$). There are three key components to this initiative:

- Private vehicles: Encouraging more efficient driving behaviour ("eco-driving").
- Trains: More efficient travelling on rail (from 2002 to 2006, there was a 5% improvement in energy efficiency).
- Inland shipping: The goal is to improve eco-driving in inland waterways by 5% from 2007 to 2010.

14. Website of the Ministry of Transport, Public Works and Water Management, http://www.verkeerenwaterstaat.nl

Limiting maximum speed is also used as a means to reduce fuel consumption. In 2004 and 2005 the maximum speed limit in many areas was reduced from 120 km/h to 100 km/h, and speed control was reinforced.

Forthcoming EU legislation that targets CO_2 emissions from new vehicles will also guide Dutch policy on transport efficiency in the next decade.

CRITIQUE

The white paper on the Clean & Efficient programme sets very ambitious targets on climate and energy policy, including energy efficiency policy. Meeting the climate change challenge will require bold action by countries, and thus the IEA is pleased to see the Netherlands develop a long-term vision aimed at increased energy efficiency and lower greenhouse gas emissions. Among the considerations in forming the mix of policies in the Clean & Efficient programme were cost-effectiveness criteria, with an interim check built into the system in 2010 to ensure that the country is on track to meet its 2020 policy goals, determine whether the policy measures are effective and see how costs have evolved since the policies' implementation. Such attention to cost-effectiveness is commendable.

In the second commitment period under the Kyoto Protocol, 2008 to 2012, the Netherlands is relying on the Protocol's flexibility mechanisms: the clean development mechanism (CDM), join implementation (JI), and international emissions trading. The IEA is pleased to see the government take aggressive and early action on these mechanisms, because they can deliver cost-effective reductions, but they need sufficient time to implement. While the government has currently fulfilled its target and halted additional purchases, it will assess its plan again in 2010, and if it is off track to achieve the necessary reductions, it might re-enter the market. However, because of intensified competition, the prices of emissions reduction rights stemming from flexibility mechanisms have risen considerably. In case the country does not meet the emissions reductions underlined in the domestic policies, the government will need to set aside sufficient budget to purchase the corresponding credits in order to be in compliance with its Kyoto targets.

The Netherlands should continue to co-ordinate and integrate environmental policy with respect to energy-intensive industry. The government is currently considering plans to support Dutch industry, looking at two possible options: financial compensation for electricity cost increases, and a free allocation of EU-ETS allowances based on the average electricity use or CO_2 emissions of the particular sector. These plans are of concern as supporting companies with high electricity consumption is at cross-purposes with the government's existing policies to promote energy efficiency in the industrial sector. Should the government decide to compensate energy-intensive industry for higher

electricity prices, it should do so in a way that does not undermine the target of improving energy efficiency.

Turning to air quality, the government is considering measures to further limit local air pollution, such as congestion management (*i.e.* road pricing). These efforts are welcome, especially considering the Netherlands' high levels of nitrous oxide and particulate matter and the country's need to comply with the standards set in European air quality directives.

As in all countries covered by the EU-ETS, the government should continue to work to develop an appropriate policy mix for the non-trading sectors (*e.g.* housing, transport). It is more difficult to develop, monitor and quantify the benefits of policies in these areas, but they can deliver some of the lowest-cost, longest-lived and largest benefits.

Energy efficiency is rightfully one of the priorities for the government. Nevertheless, the energy intensity of the Dutch economy is still slightly higher than the OECD Europe average and the annual efficiency gains have decreased since 2004. In response, the government has set very ambitious targets in its proposed revisions to the third round of long-term agreements (LTA3). They aim for an energy efficiency improvement of 30% in 2020 compared to 2005, and 50% in 2030. Furthermore, in its Clean & Efficient programme, the government has set a target of an average 2% annual energy efficiency improvement through 2020 (a 2.3% annual improvement from 2011). Achieving these targets will not be possible without significant improvements in efficiency in the industrial sector, which is the largest consuming sector in the country (about a third of primary demand in 2006), and thus the government's efforts in this area are particularly commendable. The IEA urges the government to continue to work towards enhanced efficiency across various sectors, with particular emphasis paid to implementing the 25 energy efficiency recommendations the IEA presented to the G8 in July 2008 (see Box 2).

Box 2

IEA G8 Energy Efficiency Recommendations

At the Group of Eight* (G8) Summit in 2005 in Gleneagles, Scotland, the G8 countries asked the IEA to assist in developing and implementing energy efficiency policies. Responding to this request, the IEA subsequently prepared a set of energy efficiency policy recommendations covering 25 fields of action across seven priority areas: cross-sectoral activities,

* The Group of Eight is an international forum for the governments of Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States.

buildings, appliances, lighting, transport, industry and power utilities. These 25 recommendations were presented to the G8 at the Summit in Hokkaido, Japan in July 2008. The fields of action are outlined below.

1. The IEA recommends action on energy efficiency *across sectors*. In particular, the IEA calls for action on:

- Measures for increasing investment in energy efficiency.
- National energy efficiency strategies and goals.
- Compliance, monitoring, enforcement and evaluation of energy efficiency measures.
- Energy efficiency indicators.
- Monitoring and reporting progress with implementing the IEA energy efficiency recommendations themselves.

2. *Buildings* account for about 40% of energy used in most countries. To save a significant portion of this energy, the IEA recommends action on:

- Building codes for new buildings.
- "Passive energy houses" and zero-energy buildings.
- Policy packages to promote energy efficiency in existing buildings.
- Building certification schemes.
- Energy efficiency improvements in glazed areas.

3. *Appliances and equipment* represent one of the fastest growing energy loads in most countries. The IEA recommends action on:

- Mandatory energy performance requirements or labels.
- Low-power modes, including stand-by power, for electronic and networked equipment.
- Televisions and set-top boxes.
- Energy performance test standards and measurement protocols.

4. Saving energy by adopting efficient *lighting* technology is very cost effective. The IEA recommends action on:

- Best practice lighting and the phase-out of incandescent bulbs.
- Ensuring least-cost lighting in non-residential buildings and the phase-out of inefficient fuel-based lighting.

5. About 60% of world oil is consumed in the *transport* sector. To achieve significant savings in this sector, the IEA recommends action on:

- Fuel-efficient tyres.
- Mandatory fuel efficiency standards for light-duty vehicles.

../..

- Fuel economy of heavy-duty vehicles.
- Eco-driving.

6. In order to improve energy efficiency in *industry*, action is needed on:

- Collection of high-quality energy efficiency data for industry.
- Energy performance of electric motors.
- Assistance in developing energy management capability.
- Policy packages to promote energy efficiency in small and medium-sized enterprises.

7. *Energy utilities* can play an important role in promoting energy efficiency. Action is needed to promote:

- Utility end-use energy efficiency schemes.

Implementation of IEA energy efficiency recommendations can lead to huge cost-effective energy and CO_2 savings. The IEA estimates that, if implemented globally without delay, the proposed actions could save around 8.2 $GtCO_2$/year by 2030. This is equivalent to one-fifth of global energy-related CO_2 emissions in 2030 under the IEA reference scenario, in which no new policies are adopted or implemented. Taken together, these measures set out an ambitious road-map for improving energy efficiency on a global scale.

* The Group of Eight is an international forum for the governments of Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States.

Since the 1990s, the Netherlands has relied on voluntary agreements and benchmarking covenants with various sectors as part of its energy efficiency policy. The IEA is pleased to see very promising results from the long-term agreements with industry, where energy intensity has improved. The government should ensure that these improvements are evaluated against a business-as-usual baseline, taking into account improvements that would have taken place anyway without the agreements. The 2006 results indicate that the energy intensity of the energy sector covered by these covenants has increased since 2000, and the targets in the covenants have not been met. In light of this, the government must ensure that appropriate incentives and penalties exist in the sectors under these covenants, particularly given the country's increasingly ambitious energy efficiency targets.

The second set of long-term agreements, LTA2, assigns a prominent role to provincial and municipal authorities, making them responsible for enforcing some agreements and, when a sector does not achieve its defined targets, levying the appropriate penalties. The IEA is concerned, however, that the

local authorities are not properly enforcing the agreements. If provincial and municipal authorities retain the same responsibilities under the forthcoming LTA3, there will be risk that the covenants will not be enforced properly. The government should ensure that the competent authorities enforce these agreements. The government has put in place very good policies governing monitoring and evaluation and now it should ensure that effective policies are in place for compliance and enforcement.

In the building sector, more stringent policies have come into force for both existing and new buildings under the government *Clean & Efficient* programme. Energy performance standards will be tightened progressively for new buildings, with the aim to increase the energy efficiency of new houses by 50% in 2015 and of new non-housing buildings in 2017, as compared to 2007. Although there are also policies implemented that cover retrofits of existing buildings in this plan, coverage will not be comprehensive. With a stock of more than two million buildings in the country, the plan will only cover 500 000 through 2011, with 300 000 added annually from 2012. As with voluntary agreements, another important aspect of energy efficiency in the building sector is monitoring, enforcement and compliance. With a compliance rate of about 70%, there is room for further improvements in the Netherlands as well as in other IEA countries. Along with all countries, the government should continue to focus on cost-effective ways to achieve higher compliance levels, including considering an enhanced penalty system. Ensuring that the authorities responsible for this area have the right incentives to effectively undertake compliance will be critical.

To improve transport efficiency, the government has introduced tax and other fiscal measures on fuel and vehicles, vehicle labelling and the promotion of efficient driving habits. The government should continue to build on its achievements in this sector. For example, the road pricing system that is expected to be introduced in 2012 provides an opportunity not only to reduce traffic congestion, but also to encourage energy savings. Overall, the government should continue to enhance fiscal incentives that drive customers towards more efficient vehicles and more efficient transportation choices. This will be achieved both through implementation of EU directives and could be supplemented by additional policies, such as those being implemented in Finland. The Finnish government has recently introduced a revised taxation scheme that differentiates taxes and registration fees based on vehicle efficiency. Differentiated taxation could be used in the Netherlands to raise funds for the improvement of the services offered by energy-efficient transportation modes, such as public transport and rail. In this case, an appropriate cost-benefit analysis would be needed.

RECOMMENDATIONS

The government of the Netherlands should:

- *Continue to pursue projects under the Kyoto flexibility mechanisms and allocate the necessary funding.*
- *Ensure that climate policy is not misused to achieve other policy goals; in particular, the effectiveness of the EU-ETS should not be undermined by any policies to compensate energy-intensive industries for higher electricity prices.*
- *Continue to push towards cost-effective solutions to reduce emissions in the non-trading sectors (*e.g. *buildings and transport), and make greater use of fiscal measures and other incentives where appropriate.*
- *Ensure that appropriate incentives exist for sectors covered by long-term agreements and benchmarking covenants to meet their ambitious energy efficiency targets.*
- *Ensure that the competent authorities properly enforce long-term agreements on energy efficiency.*
- *Improve policies on the energy performance of buildings by expanding coverage to include more retrofits of existing buildings and by ensuring that the authorities responsible for compliance undertake effective monitoring and enforcement.*
- *Implement the proposed traffic congestion plan, as this will help reduce regional air pollution levels and will encourage energy savings.*
- *Continue to implement enhanced efficiency policy in the transport sector, using market-based and other fiscal incentives to encourage people to make more efficient and environment-friendly transportation choices.*

The Netherlands' energy security is enhanced by its domestic production of natural gas, its position as a transit hub in north-west Europe and its role as a major oil-refining centre in Europe. It also provides storage services to the market, though oil and gas storage has become tight recently. With extensive pipeline and transmission connections, the country can take advantage of an integrated network of supply options. Its strategic location also enhances energy security throughout Europe. Efforts to ensure well-functioning, open, harmonised and integrated gas and electricity markets in continental Europe benefit security of supply in the Netherlands and the continent. Going forward, supply diversity may increase, with larger volumes of electricity supply coming from coal-fired power plants (with carbon capture and storage), as well as smaller, more decentralised power plants, particularly those using renewables. The government is evaluating the future role of nuclear, which currently makes up 4% of electricity generation, but no decision on nuclear will be taken until after 2011.

OIL

With minimal oil production, the Netherlands relies on imports for nearly all its oil consumption. Imports come from a large number of countries, but three countries dominate; Russia, Saudi Arabia and Norway together account for about 60% of imports. The country's energy security is enhanced by its position as a key import and transit hub for oil trade. In addition, the Netherlands is a major player in oil refining, with significant product exports from the Rotterdam area.

Under its Oil Stockpiling Act of 2001, the government puts emphasis on public emergency oil stocks held by the Central Organisation of Oil Stockholding (COVA), its national stockholding agency. About 85% of the IEA 90-day oil stockholding obligation is met by public stocks held by COVA. Currently, total stocks of COVA and industry combined are well above the 90-day requirement, averaging about 160 days in 2007 and reaching nearly 200 days in 2008.

Large volumes of oil stocks are held for other countries in the Rotterdam area under bilateral agreements, exploiting storage capacity in the Netherlands. However, the storage market is currently tight and COVA is facing difficulties finding additional storage capacity in the country. Lack of access to land in the Rotterdam port appears to be one of the key hindrances to expansion of storage capacity.

NATURAL GAS

Historically, domestic gas production has played a key role in ensuring the Netherlands' and European energy security. Domestic reserves and production are now in decline, but the Netherlands wishes to maintain a leading role in European gas markets through enhanced gas trading and by providing gas flexibility through increased storage capacity. The Netherlands has the ambition of becoming a gas hub or roundabout in north-western Europe.

The Netherlands' strategy for many decades has been focused on preserving the long-term potential of its gas industry. The government introduced targeted policies to reduce the depletion rate of its major gas field in Groningen. It limited national gas sales through a gas pricing policy and by imposing a reduction of gas use in the power sector. The government also implemented the small fields' policy which encouraged exploration of and production from other fields in the Dutch territory at the expense of production from Groningen. These policies are described in more detail in Chapter 5.

The present gas policy aims at the diversification and the security of supplies through proactive investment in new infrastructure assets to bring additional volumes of gas to the Dutch market. A major change in the supply profile of the Dutch market, and of northern European gas markets, has been the decision to promote the building of liquefied natural gas (LNG) terminals, in a market area well supplied by indigenous production and pipeline imports. Of the three existing projects, the most advanced is the project led by the Gas Access to Europe (GATE) consortium (including Gasunie) at the Port of Rotterdam. There are ongoing efforts to contract volumes of LNG from countries in North Africa and the Middle East. There are also efforts to diversify gas imports, which now mainly come from Russia and Norway. The BBL pipeline between Balgzand in the Netherlands and Bacton in the United Kingdom, potentially supplying the UK with Russian gas, is another example of this search for preserving the value of the Dutch gas network, by transforming it from an exporter's system to a transit and trade pipeline system. The extension to Germany with the takeover of the transportation division of BEB shows the willingness to consolidate the gas roundabout not only within the territory of the Netherlands, but on a broader north-western level as well.

ELECTRICITY

Electricity security in the Netherlands benefits from the country's interconnections with neighbouring countries. It is also expanding interconnection capacity with Norway, the United Kingdom and Germany. In addition to supporting physical market integration, the Dutch government is a promoter of expanding regional market integration in Europe. Under the Pentalateral Forum, which it set up with its neighbouring countries,

governments, transmission system operators, regulators, power exchanges and market parties participate to enhance market functioning and coupling. The Forum's objective is to improve co-operation in the field of cross-border exchange and create one homogeneous wholesale market.

The country's current energy strategy and policy framework, as outlined in its Clean & Efficient programme, in the *Energy Report 2008* and in the Energy Transition framework, foresee development of a more decentralised electricity grid with a larger set of mostly smaller, more diverse sources. Intermittent renewables, primarily solar and wind, are set to grow in importance. Coal-fired power generation is foreseen to play a major role in the future electricity supply mix, assuming that technologies will be developed to dramatically limit carbon dioxide emissions. The government is exploring whether nuclear, which currently makes up 4% of electricity production, could have a larger role in the future. However, no decision will be taken until after 2011.

TECHNOLOGY DEVELOPMENT

R&D is at the centre of the government's Clean & Efficient programme, along with the *Energy Report 2008* and its Energy Transition framework. Under its innovation agenda, the government plans to provide more than EUR 900 million over the period 2008-2012 for innovations contributing to the transition to sustainable energy management.

CRITIQUE

The interpretation of energy security in the Netherlands has changed over time. In the 1990s, the problem was equated primarily with dependence on oil imports. Today, the interpretation has broadened to include a set of complex vulnerability issues, such as the challenges of climate change or the impacts of underinvestment that could result from the complex dynamics of today's energy markets. A special issue is the increasing contribution of wind and solar and its integration into the energy system, where backup systems may be necessary to avoid adverse consequences for energy security. To address these issues, the government has made collaboration and leadership in the international and European arenas a priority, a policy that should continue.

Aware of the growing global energy challenges, the government has begun to give more weight to energy security as one of the main pillars of its energy policy, in light of the declining role of domestic natural gas production and the importance of competitiveness and the environment. Concern over energy security underpins a wide variety of energy policies, such as further fostering energy efficiency, increasing the market share of renewable energies, market strengthening and energy diplomacy.

Energy security is enhanced by diversity. Therefore the IEA urges the government to continue its energy policy-making process, keeping open as many options as possible in terms of fuel choices, import and production sources, transportation routes and demand patterns. Fostering this diversity will require that the government clearly set out the regulatory framework – with the proper safety, environment and other conditions – for allowing various energy technologies to move forward. Nuclear power, carbon capture and storage and offshore wind are particular technologies where the framework has not yet been decided, inhibiting investment in these – and, if necessary, alternative – technologies.

Certainly, in many cases absolute regulatory clarity is not immediately possible because of remaining technological uncertainties related to particular technologies. The government should continue to press forward in both a domestic and international context on creating this clarity. The Dutch government – along with Norway and other countries – is particularly well-positioned to take a leadership role in developing carbon dioxide capture and storage (CCS). In the case of CCS, the government should tread carefully, ensuring that a sustainable energy future can be achieved whether or not CCS can actually deliver its potential benefits. With respect to nuclear, the government is considering the potential benefits of having a larger share of electricity come from this technology. The government should continue to move forward on the policy debate, with the aim of taking a decision and setting a stable policy framework as quickly as possible.

As the Dutch government is well aware, the complex challenges of energy security cannot be solved by Dutch policy alone. Energy R&D is critical for ensuring continued and long-term energy security. R&D is at the centre of the government's Clean & Efficient programme, *Energy Report 2008* and Energy Transition framework. The IEA is pleased to note that the government is intensifying its support for research and development of technologies (on both the supply and demand sides) that can further diversify energy sources and increase the elasticity of energy supply and demand in order to maintain the overall ability of the energy system to react to new and unforeseen market conditions.

Turning to the oil market, product trade volumes have shown a spectacular increase in recent years, but there have been negligible additions to storage capacity. As a result, the storage market in the Rotterdam area is characterised by growing tightness, giving rise to some concerns on security of supply. The government should help ensure that the country's role as a major supplier to regional markets is not jeopardised by possible impediments to the extension of storage capacity. Lack of access to land in the Rotterdam port appears to be one of the key hindrances to expansion, and the government should ensure that there are no undue regulatory barriers to expansion, of course taking into account environmental and other concerns.

The IEA commends the government on consistently meeting its own IEA stockholding requirement, as well as holding large volumes of stocks for other countries under bilateral agreements. However, the recent tightness in the storage market may have an impact on emergency stockholding and COVA, the national oil stockholding agency, is already facing difficulties finding additional storage capacity in the country.

RECOMMENDATIONS

The government of the Netherlands should:

- *Keep as many options open as possible for the long-term energy mix.*
- *Provide a clear regulatory framework – such as for nuclear, carbon capture and storage, wind and biomass – to encourage investment and enhance energy security.*
- *Continue to view energy security not only from a domestic perspective, but also in the context of international and European realities, including climate change, gas and electricity market integration and a rapidly expanding global energy demand.*
- *Continue to support research and development of technologies and policies that can further diversify energy sources and options in order to increase the robustness and flexibility of both the supply and demand sides of the energy system.*
- *Ensure that any necessary extension of oil storage capacity is not hampered by undue limitations on expansion in the Rotterdam port area, or other undue regulatory barriers.*

PART II

SECTOR ANALYSIS

The Netherlands is a major producer and exporter of natural gas and refined oil products. Since its discovery in the middle of last century, natural gas remains a key fuel in the country, fuelling over half of its electricity generation. Though there is significant state ownership, the gas market is liberalised, and a hub is emerging that strengthens the country's role as a major trade and transit network. In order to preserve the long-term security of the large Groningen gas field, a small fields policy is in place to ensure that gas is developed at more marginal sites. A leading refiner, the country continues to export large volumes of refined oil products to Europe, with refining mostly centred near the Rotterdam area. Current projections call for large increases of coal-fired generation by 2030. Realising these projections while limiting the environmental impact would likely call for significant reliance on carbon capture and storage (CCS) technology; developing the technology and the appropriate legal and regulatory framework is a key priority of the government.

HYDROCARBON EXPLORATION AND PRODUCTION

NATURAL GAS

Dutch natural gas production has been pivotal to the development of gas markets in north-western Europe since the 1950s, as the Netherlands started exporting gas to neighbouring countries shortly after the discovery of the Groningen field, and the first inter-state pipelines in Europe were built for this purpose.

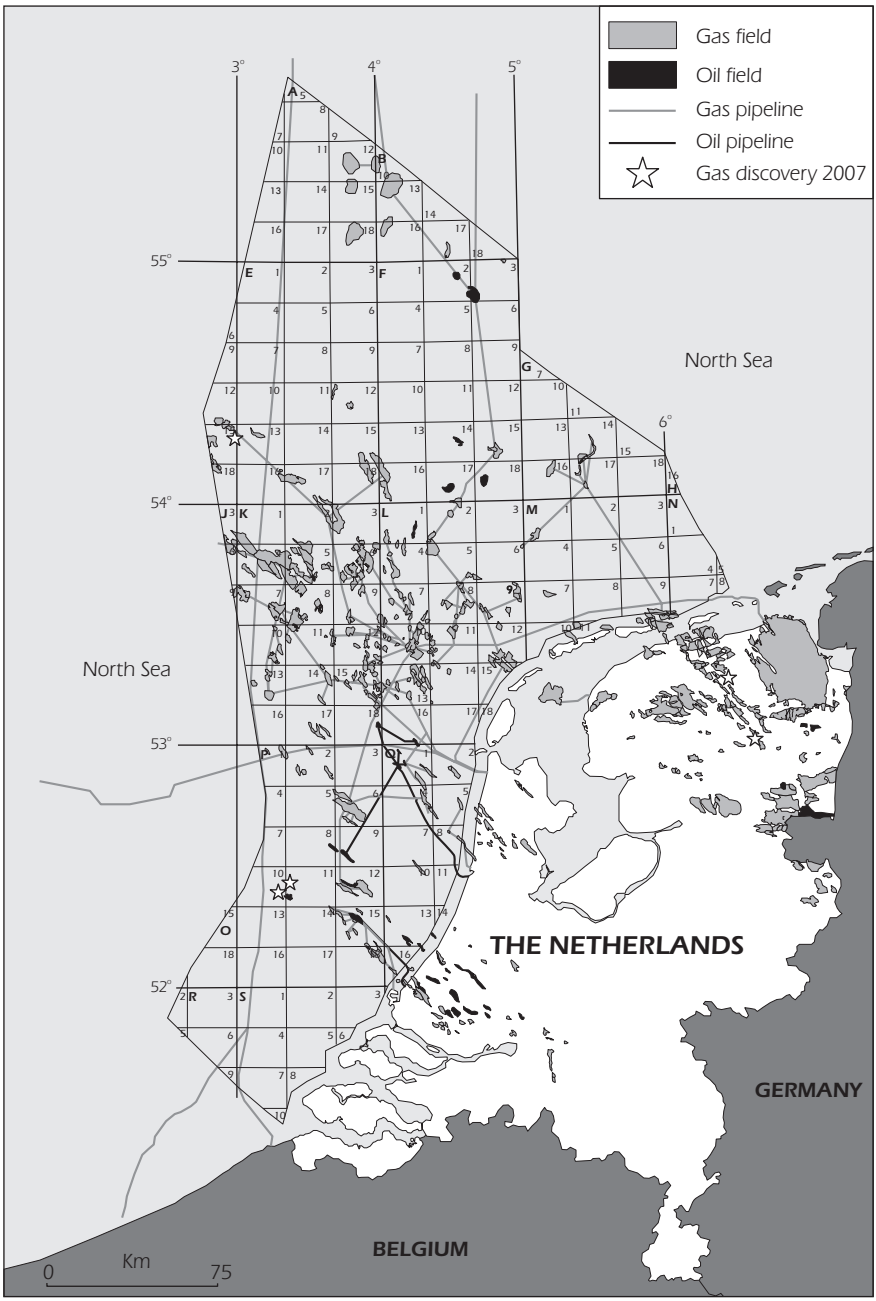
Since the 1950s, the Netherlands has produced nearly 3 trillion cubic metres (tcm) of natural gas. In 2008, remaining gas resources were estimated at 1 390 billion cubic metres (bcm). Over 1 000 bcm of these resources reside in the Groningen accumulation, with 117 bcm in other onshore accumulations and 198 bcm on the continental shelf. Additional reserves of around 100 bcm exist, but need enhanced technology to be brought to markets efficiently. However, some of these reserves are situated in environmentally sensitive areas (*e.g.* in the Dutch Wadden Sea).[15] Figure 7 shows the main oil and gas fields in the Netherlands.

The Netherlands produces two types of natural gas, one with a low-range calorific value below 10.5 kWh/m³ (L-gas), mainly from Groningen, and one with a high calorific value from 10.5 to 12.8 kWh/m³ (H-gas), from smaller fields. H-gas and L-gas must be transported on separate networks.

15. *Oil and Gas in the Netherlands,* Annual Review Exploration and Production 2007, The Hague, June 2008.

Figure 7

Map of Oil and Gas Fields in the Netherlands



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

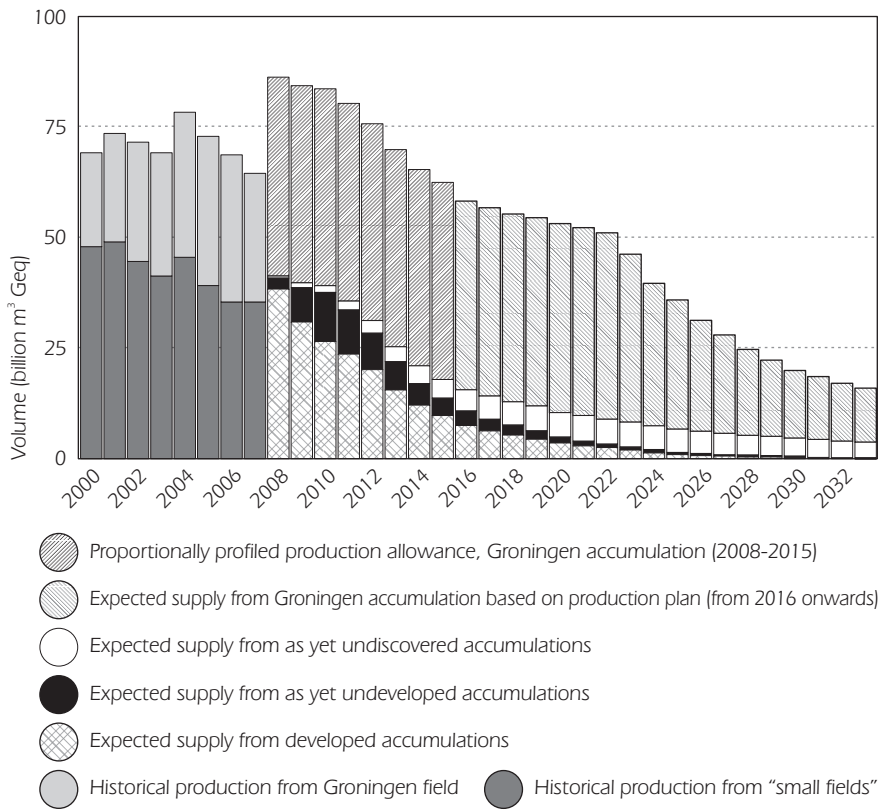
Source: *Oil and Gas in the Netherlands*, Annual Review Exploration and Production 2007.

In 2007, the overall production of natural gas was 76.3 bcm, or nearly one-quarter of domestic production in OECD Europe. Gas output from the Netherlands has been slowly declining since the 1980s, and is expected to continue on this trend in the long term (Figure 8).

Future production levels are linked to a Dutch gas policy provision, which limits Groningen total output to 425 bcm Groningen-equivalent gas (Geq) from 2006 to 2015. This cap is designed to ensure that Groningen is utilised as swing supply, and that small fields remain viable assets (see below). The flexibility role for the Groningen field necessarily implies some uncertainty over its annual output over this period. On average, the annual contribution of Groningen through 2015 is estimated to be 44.3 bcm-Geq. Figure 8 provides actual production from 2000 to 2006 and estimates through 2030.

Figure 8

Domestic Gas Production, 2000 to 2033



Source: *Oil and Gas in the Netherlands*, Annual Review Exploration and Production 2007. The Hague, June 2008.

The small fields policy, introduced in 1973, requires that the incumbent supplying company (Gasunie, and now GasTerra) purchase gas from marginal wells at a price that ensures its competitiveness on the market. This policy effectively introduced the swing position for the Groningen field, as it gives priority to gas from small fields. The small fields policy has had the positive effect of substantially increasing gas reserves over the last decades. However, at present, production from small fields is declining rapidly. Currently, an amendment to the small fields policy allows all parties to buy gas from small fields, making Dutch gas market regulations compatible with EU gas liberalisation directives. The government is exploring the possibility of providing all parties with the right to explore, exploit and use partially depleted gas fields, salt caverns and other underground geologic structures for enhanced gas recovery by smaller companies, underground gas storage and, potentially, carbon capture and storage.

The rate of exploration has slowed: 31 wells were drilled in 2007 for oil and gas, in comparison with 39 in 2006. Of these, 21 were production wells, 3 were appraisal wells and 7 were exploration wells. Of the exploration wells, five struck gas, indicating a technical success ratio of 71%, an improvement from recent years.

The government has taken several initiatives to enhance exploration and production activities. It has been quite successful in its approach to facilitate gas production in the sensitive Waddenzee area. After several years of negotiation with all parties involved, both permits to explore and to produce could be given and the government itself created a fund to improve environmental quality in the area and to stimulate regional initiatives aimed at sustainability. The government is expected to sign a covenant with the mining industry, which formulates procedures for fallow acreage and fields, but as of late September 2008, signing was still pending.

Currently the government encourages the major Dutch producer, NAM, and other gas producing companies to sell their licences for the fields that are not being actively developed (so-called "sleeping" licences).[16] Furthermore, the government expects to put forward a bill to Parliament allowing the Minister of Economic Affairs to reduce the size of a licence area when a licence holder is not active in this geographic part of its licence. Streamlining and shortening of licence procedures are expected to take place in 2009 with new legislation that requires only one licence for several aspects relating to environmental and local regulations (under the *Wet Algemene Bepalingen Omgevingsrecht*, or WABO regulation). Finally, a decision will be taken on a possible financial incentive for the development of very marginal fields (so-called "stranded fields") on the continental shelf.

16. When the government asks companies to sell "sleeping licences" they usually do it because of the fear to lose the licence. The government can revoke a licence but it has never done it.

OIL

The Netherlands' oil production declined steadily over the last years. In 2006 total domestic production dropped to 2 million metric tonnes, down from 4.1 Mt in 1990 and 2.3 Mt in 2005. This decline was reversed in 2007 with start-up at the De Ruyter field: estimated production reached 3.5 Mt in that year. Higher prices and advances in well and steam-injection technologies provide an incentive to develop new or decommissioned oilfields. For example, Shell and ExxonMobil plan to redevelop the Schoonebeekfield, abandoned in 1996, for restart in 2010. A further 120 million barrels of oil is expected to be recovered over 25 years.

The Dutch government estimates the expected oil reserves at 36.6 mcm or 230 million barrels (mb) as of 1 January 2008, including 23.6 mcm (148 mb) inland and 13 mcm (81 mb) on the continental shelf.

Oil production in the Netherlands is governed by the Mining Act, which entered into force in 2003.[17] In general, the regime for oil exploration and development is the same as for natural gas.

NATURAL GAS

DEMAND

The Dutch gas market is very mature, with the highest penetration rate of gas in OECD Europe. Almost all space heating is from gas, and nearly 60% of electricity is from gas-fired generation, thus causing a strong seasonal pattern in gas use. In 2007, total consumption of natural gas was 46.4 bcm, of which final consumption was nearly two-thirds, the rest being used for electricity and heat generation, and for other energy uses. In 2006, the industrial sector consumed 11 bcm, with the residential sector using 10 bcm and the commercial/public sector and agriculture/fishing consuming another 10 bcm.

Nearly all domestic customers use blended low-calorific gas, while industry and power generators use mostly high-calorific gas. Some L-gas used by final consumers comes from H-gas, having been converted to L-gas in blending stations. L-gas is also exported through dedicated transmission pipelines to customers in Belgium, France and Germany.

The outlook for future consumption is linked to the evolution of environmental and upstream policies. Several existing scenarios show either total demand reaching a plateau to 2020 and remaining approximately at current levels, or a drop in demand after 2010.

17. For more details, see *Energy Policies of the IEA Countries: The Netherlands 2004 Review,* OECD/IEA Paris, 2004.

MARKET STRUCTURE

The natural gas industry in the Netherlands developed in the 1960s following a significant discovery of gas in the province of Groningen. The industry structure of the Dutch gas market has evolved, since then, from joint management of gas production and exports by the State and the oil majors Shell and Exxon, to a highly developed gas market with multiple players, well advanced in the process of liberalisation. Nevertheless, the legacy of the *Gasgebouw* – the historical industry structure (Box 3), with its centrepiece, the Groningen field – still plays a pivotal role in the gas market.

Box 3

Historical Overview of the Dutch Gas Industry and Market

Gas was discovered in the province of Groningen in 1959 by NAM (*Nederlandse Aardolie Maatschappij*), a joint-venture between a subsidiary of Shell called BPM (*Bataafse Petroleum Maatschappij*), and the Standard Oil Company of New Jersey (later to become Exxon). Created in 1947, NAM had already discovered a number of moderately sized oil and gas fields in the Netherlands. NAM and the Dutch government started negotiations in 1960, with the size of the Groningen field estimated at 60 billion cubic metres (bcm). In the following years, this number was re-estimated several times, before the final size was confirmed at 2 600 bcm, 30 years later. In 1963, Gasunie was created, a 50/50 public-private partnership between the government, and Shell and Exxon, for the transportation and marketing of Dutch gas.

In the mid-1970s, production from other, smaller fields came on stream as a consequence of the so-called "small fields policy" introduced in 1973.

Historically, natural gas was priced according to the "market value" principle, ensuring that gas remained competitive to alternative fuels. In addition, gas production was monitored and planned jointly with the government. The development of the gas network and the choice of premium markets for gas sales were part of government policy, and specific measures to encourage residential gas usage were also promoted.

The *Gasgebouw* was progressively restructured, and in 2005 the incumbent was split into an infrastructure company, retaining the historical name Gasunie, and a trading and supply venture, GasTerra.

In the Netherlands there are about 18 000 large users and 6.7 million small gas users, of which 6.5 million are households. The gas market was liberalised in July 2004, with supply and management of the gas networks legally

separated. Gasunie, a Dutch infrastructure company fully owned by the State, owns and operates the gas transportation network through its affiliate Gas Transport Services B.V. (GTS). A trading and supply company GasTerra, which is half owned by the State (10% directly and 40% through EBN, a state-owned company) and half by Shell and Exxon (25% each) sells domestically produced gas in the Netherlands. GasTerra remains the major player in the wholesale market, with a share of nearly 60%. GasTerra is also very active on the European gas market, and has import contracts with suppliers from Russia, Norway and Germany.

On the upstream side, NAM (Shell and ExxonMobil each own half) is the largest gas producer and is notably in charge of the Groningen field. Several other oil and gas producers operate small fields onshore and offshore in the North Sea.

Downstream, four distribution and supply companies dominate the market with more than 85% of retail market share: Essent, Eneco, Nuon and Delta, owned by provinces and municipal governments. In early 2008, there were 31 companies with a licence to supply gas to residential customers and small and medium-sized enterprises (SMEs) with annual consumption under 170 000 cm. The government is proposing to lower the current 170 000 cm level, giving wholesalers access to more customers without requiring a special licence.

For the last several years, the government has been backing a proposal to enforce ownership unbundling of distribution companies, in order to prevent the sale of distribution pipelines to private owners if the retail companies were to be privatised. The distribution companies have been waging a legal battle in opposition to this proposal. The law was approved by the Dutch Parliament in November 2006. According to this law, distribution assets must be fully separated from trading activity by 2011, and cannot be sold to private ventures.

The Dutch gas market is regulated under the Natural Gas Act. The Office of Energy Regulation (*Energiekamer*), the regulatory body responsible for the natural gas market, operates as a chamber within the Netherlands Competition Authority (NMa). More information on these institutions is available in Chapter 2. The regulator approves investments in network infrastructure on an *ex post* basis. Investments by the national transmission system operator are currently based on a two-year period of "open seasons" organised by the transmission system operator.

Consumer switching

On average, between 0.5% and 1% of customers switch suppliers each month. Since liberalisation in July 2004, 18% of domestic customers and SMEs have switched gas supplier (including users that have switched more than once).

Switching rates increased in the first half of 2007, probably as a result of heavy media attention to energy tariffs. The percentage of switching by large industrial users is higher (partly because freedom of choice was introduced already years before 2004), but there are no recent data available.

As discussed in Chapter 6 on electricity, the set-up of the system for allocation and reconciliation of metered data is complex, causing delays in the confirmation of allocations. The metering market is free in the Netherlands, and intermediaries have been created to gather and dispatch all metering data. However, the industry and the regulator seem to agree that a new market model is needed, and implementation is now being discussed. The new model would apply a capacity tariff for network use, instead of a tariff based on consumption, simplifying the process of allocation, reconciliation and billing. It would also enhance simplicity of the administrative process, since distribution system operators would no longer need metering data. The current plan is to install smart meters at the same time in households, which is made easier if distribution system operators are no longer involved in metering and which would enhance competition in the retail market, enabling competition in services, not only in prices.

With the liberalisation of the Dutch gas market, the length of GasTerra's supply contracts with customers has shortened, to avoid the risk of allegations of use of market power when customers are bound for a long period. With the growing level of imports from new market players to supply the Dutch market, it is difficult to estimate the level of long-term contracts in the market.

INFRASTRUCTURE

Domestic gas network

Gas Transport Services B.V. (GTS) has been the operator of the national transmission system since July 2004. GTS is a 100% affiliate of N.V. Nederlandse Gasunie, and responsible for all national infrastructure operation and development. The Dutch gas network comprises 11 500 km of pipelines, 52 entry points (35 from Dutch gas fields and 17 from networks in neighbouring countries), 1 100 delivery stations, 23 export stations and 9 compressor stations. Figure 9 shows key elements of this network. In 2007, 95.7 bcm of natural gas was transported, including locally produced gas and transit for other countries. Prices for transport and distribution services by third parties are regulated; they are settled on the basis of an entry-exit model. The balancing system in place is structured to penalise shippers whose gas shipments deviate from scheduled flows (as opposed to other countries that have put in place less punitive balancing regimes). This may deter new entrants from supplying some customers in the market (notably smaller customers). This is one of the reasons why GTS, in co-operation with market parties, is currently developing a new balancing system.

Figure 9

Map of Natural Gas Infrastructure

The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: IEA.

LNG

The Netherlands aims to reinforce regional gas flows by transforming its gas network into a crossroad or gas hub within the north-west European gas market area. The new gas strategy promotes construction of LNG regasification facilities in the country in order to strengthen its already diverse and flexible supply portfolio.

At present, four LNG regasification terminals are planned – three in the port of Rotterdam (two onshore and one offshore) and one in Eemshaven, north of Groningen. The construction of the GATE terminal in Rotterdam, promoted by Gasunie, started in June 2008. The project promoted by Eneco (LionGas), in the Port of Rotterdam, has a unique feature of combining an 840-MW gas-fired power plant with the terminal. This project is a joint venture with International Power, a British power producer. Waste heat from the power plant could be used in the terminal's process. See Box 4 for further information on proposed LNG terminals in the Netherlands.

Network extensions and regional integration

As part of the strategy to reinforce regional gas flows, two recent significant extensions of the Dutch gas network have been achieved. First, the Balgzand-Bacton Line (BBL) pipeline connecting the Netherlands directly to the United Kingdom, and providing a potential link with Russian gas to the United Kingdom and Ireland, was commissioned in December 2006. BBL has a capacity of 15 bcm per year, of which 8 bcm per year are tied up in a long-term contract whereby GasTerra supplies Centrica in the United Kingdom. Currently, the pipeline is not capable of reverse flows from the UK to the Netherlands. However, gas can flow indirectly from the United Kingdom to the Title Transfer Facility (TTF) via Zeebrugge using the 6 bcm per year Zebra pipeline. The Zebra pipeline connects the Dutch-Belgium border point Zelzate to the Dutch high-pressure grid and was created in 2001 by two Dutch utilities (Essent and Delta) in order to import gas from the United Kingdom. Recently, Gazprom received a 9% stake in the BBL pipeline, offering in exchange 9% in the Nord Stream pipeline project to Gasunie.[18]

In 2007, Gasunie announced a takeover of the transportation division of BEB in Germany. BEB operates 3 100 km of gas pipelines in northern Germany. Operation of the grid, as well as dispatch and marketing services will be performed by the newly founded Gasunie Deutschland Services GmbH. The hub managed by BEB, BEB P.V., which has historically been the most developed hub in Germany, has an entry point at Emden and also receives

18. For more details on pipeline developments in Europe, see *Natural Gas Market Review*, IEA/OECD Paris, 2008.

Box 4

Proposed LNG Terminals in the Netherlands

The Gas Access to Europe (GATE) project received a final investment decision from its sponsors Gasunie and Vopak in December 2007, after securing capacity commitments from the electric power utility Essent, Denmark's Dong and Econgas, a subsidiary of Austria's OMV for 3 bcm per year each. In August 2008, a similar long-term agreement for annual throughput of 3 bcm was signed with E.On Ruhrgas. The 12 bcm per year initial capacity is scheduled to be operational in the second half of 2011. The four capacity holders have a 5% equity share in the terminal. The remaining 80% of shares are held by Gasunie and Vopak. A second stage is also being considered to expand to 16 bcm per year.

The LionGas project promoted by the terminal developer 4Gas, which is designed to receive 9 bcm annually and be operational around 2011, received interest from south-west German power generator EnBW and Dutch utility Eneco in 2007, who signed memoranda of understanding to reserve 3 bcm per year and 2 bcm per year capacities, respectively, plus equity. The project has also received a positive response to its environmental impact statement from government regulators.

TAQA, the national energy company of Abu Dhabi in the United Arab Emirates, announced in February 2007 plans to build an LNG installation off the coast near Rotterdam, utilising on-board regasification technology and offshore depleted gas fields for gas storage. The company said in December 2007 that if there was sufficient interest shown through its open season, the project would move to selecting an engineering contractor, with first cargoes anticipated in 2010. If the level of interest is high, the project could use a floating storage and regasification unit (FSRU).

Gasunie and Vopak have also joined Essent in the 10-12 bcm per year terminal planned for the Port of Eemshaven near Groningen in December 2007, replacing the previous partner ConocoPhillips who withdrew from the project in September 2007.

Sources: *Natural Gas Market Review,* OECD/IEA Paris, September 2008; industry sources.

gas through the Danish-German Deudan pipeline. An integration of the Dutch and BEB transport systems would be beneficial for the development of the north-west European gas market and, in the short term, this merger could boost liquidity on both BEB and TTF trading hubs.

Gas storage

There are four storage sites in the Netherlands and three more planned (Table 6). This storage is largely under long-term contract by GasTerra. Prices for storage services are negotiated. Downstream players like Essent and Nuon use storage capacity in Germany.

Existing storage capacity, just over 5 bcm, is relatively small compared to the size of the market (around 10% of total demand, less than half the current ratio in Germany). This is due mainly to the historical role of swing supply from the Groningen gas field. With the entry of new players in the market, and the capping of Groningen output, new storage is needed in order to allow workable competition between suppliers, and to increase security of supply for customers. Currently, there are plans to expand the existing H-gas capacity of Grijpskerk to 3 bcm and Groningen-quality gas of Norg to 10 bcm. Table 6 details existing and projected storage in the Netherlands.

IMPORTS AND EXPORTS

Despite declining domestic production, the Netherlands remains a net exporter of gas in Europe, as it has been for four decades. While production rates declined, the volumes exported increased from 35 bcm in 1973 to 55.6 bcm in 2007, as the Netherlands started importing and transiting gas from Norway to continental markets. At present, the Netherlands imports gas from Norway, the United Kingdom, Russia and Denmark; H-gas exports from the Netherlands are contracted for European consumers, including Italian, German, British and Swiss; L-gas exports flow to France, Belgium and Germany.

In 2006, the transmission system operator recorded 982 TWh (100 bcm) of gas entering the system, of which 23% was imports and 77% domestic production, and 972 TWh (99 bcm) exiting, of which 55% was for export and 45% for domestic consumption. The exact origin of imports is difficult to determine for gas entering the Dutch network from Belgium and Germany, the probable origin being Russia and Norway. British gas from the North Sea is imported through Zelzate. In total, Gas Infrastructure Europe (GIE) quotes an entry capacity in the Dutch gas system of 51 bcm per year. Exit capacity, for both H- and L-gas, is estimated at 126.8 bcm.

HUB TRADING

The spot market in the Netherlands is organised around the Title Transfer Facility (TTF) operated by GTS. Total trade recorded by GTS in 2007 amounted to 29.7 bcm, of which 8.0 bcm was physically nominated, indicating a churn

Table 6

Existing and Projected Storage Capacity

Facility name	*Storage system operator*	*Technical storage capacity (mcm)*	*Peak withdrawal capacity (mcm per day)*	*Peak injection capacity (mcm per day)*	*Third-party access (TPA)*	*Type*
Grijpskerk	NAM	1 500 (+1 500 expansion planned)	55	12	N	Gas field (not depleted)
Norg (Langelo)	NAM	3 000 (+7 000 expansion planned)	55	24	N.A.	Gas field (not depleted)
Maasvlakte	Gasunie	78	31	0.25	N.A.	LNG peak shaving
Alkmaar	TAQA Energy BV	500	36	3.6	N	Depleted gas field
Bergermeer	TAQA Energy BV	3 200	–	–	–	Project/ depleted
Zuidwending I (Groningen)	Zuidwending aardgasbuffer	180	–	–	–	Project/ salt cavity
Zuidwending II (Groningen)	Zuidwending aardgasbuffer	540	–	–	–	Project/ salt cavity

Notes: Technical capacity figures are firm capacity commercially offered (sold or unsold). Part of the capacity listed includes capacity reserved for the transmission system operator and production. Technical storage capacity, as defined by the "Guidelines for Good TPA Practice for Storage System Operators" (GGPSSO), is maximum capacity that can be offered to storage users excluding capacity for storage system operators' operational needs. TPA: N = negotiated access, N.A. = not applicable, – = information not available.

Sources: Gas Infrastructure Europe, industry sources.

rate (*i.e.* the ratio of traded gas to physical gas consumption) of 3.7. However, many trade deals are not recorded by GTS. A combination of data sets based on broker information details total trade in 2006 of 98 bcm (213% of total market), implying a churn rate of 15.5.

The geographical span of the Dutch TTF has a similar design to that of the UK's national balancing point (NBP). However, it is more complex, with 50 separate entry points into the system and 1 100 exit points, compared to the NBP's 8 entry and 14 exit points. Moreover, there is only limited access to quality conversion facilities, sub-dividing the Dutch gas market between the historically important Groningen gas and gas from other sources. This means that the design of the Dutch gas market in reality is somewhere in between the virtual NBP and the physical Zeebrugge hub, with respect to standardisation and ease with which gas can be moved to different parts of the system.[19]

TTF has experienced an increase in liquidity over the last two years and prices closely track those of the NBP, following the arrival of the BBL pipeline connecting the United Kingdom and the Netherlands in November 2006 (see Figure 10).[20] TTF has been considered the most active continental European market in recent years, and in January 2008 it surpassed Zeebrugge on traded volume for the first time. Traded and physical delivered volumes in January 2008 were double the figures for January 2007. In addition, TTF has the most active European forward market, with different financial players, in which gas is traded up to several years into the future.

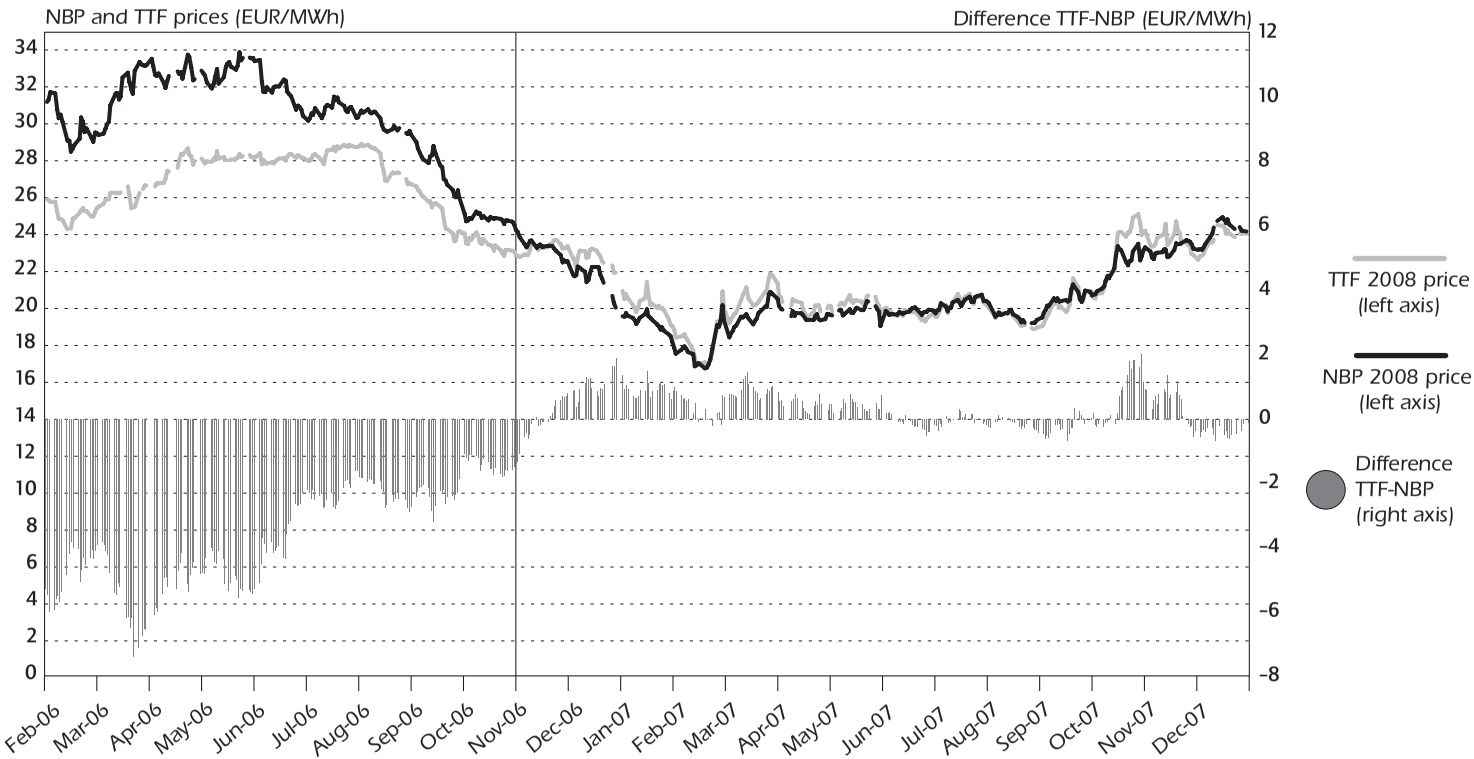
It is reasonable to assume that the emergence of the TTF implies that TTF prices will be considered as the benchmark price in the Netherlands in the near future. Preliminary results of a recent survey among industrial gas users in the Netherlands indicate that 70% of industrial users compare oil-based prices with the prices charged at the TTF on a daily basis. When oil-indexed gas prices are significantly above TTF prices, it becomes more attractive for market participants to buy their gas at TTF prices. During 2007, such a price differential in favour of the TTF existed for year-ahead products for several months in succession. As a result, there has been substantial pressure on gas companies to alter their domestic oil-based pricing strategy in order to become competitive.[21]

In reaction to this market pressure, GasTerra added a new pricing product to its domestic product portfolio in June 2007. GasTerra now offers gas at a gas-indexed price, based on TTF month-ahead prices. Argus Media Ltd. and Heren Energy monthly indices are taken as the basis for the indexation, as the market deems these indices as transparent, public and respected. GasTerra

19. For further details on hub trading, see the IEA information paper *Development of Competitive Gas Trading in Continental Europe,* May 2008.
20. *Natural Gas Market Review*, IEA/OECD Paris, 2008.
21. It is not surprising that this pressure did not exist in 2006, when the level of year-ahead oil-indexed gas prices did not exceed the level of year-ahead TTF prices.

Figure 10

TTF and NBP Prices Before and After Start of the BBL Interconnector, 2006 to 2008



Source: *Natural Gas Market Review*, IEA/OECD Paris, 2008.

anticipated selling approximately 10% of its domestic sales volume at TTF-indexed prices in 2007 for 2008; sales figures at the end of 2007 showed GasTerra's estimations were reasonably accurate. In 2008, GasTerra was considering whether it could extend the product range further.

TTF, as well as NBP, have benefited from direct connection to the North Sea gas fields, being linked directly to onshore and offshore gas production pipelines at the Dutch shoreline from British, Danish, German and Dutch fields. In addition, large volumes can also be imported into the Dutch market from Germany, where the Emden/Dornum area just across the border receives Norwegian gas from three major North Sea pipelines.

All exchanges in Europe offer an electronic trading platform where traders can post bids and offers. For example, in the United Kingdom, physical futures trading takes place for month-ahead and forward contracts on the Intercontinental Exchange (ICE), while within-day and day-ahead trading is conducted on Amsterdam Power Exchange (APX). A similar set-up exists for TTF trading, where European Energy Derivatives Exchange (ENDEX) offers curve trading, while day-ahead trading can be done on APX.

SECURITY OF SUPPLY

Domestic reserves and production are in decline, but the Netherlands wishes to maintain a leading role in European gas markets through enhanced gas trading and by providing gas flexibility through increased storage capacity. The Netherlands has the ambition of becoming a gas hub or roundabout in north-western Europe. As noted in Chapter 4, the present gas policy aims at the diversification and the security of supplies through proactive investment in new infrastructure assets to bring additional volumes of gas to the Dutch market. The government promotes the building of LNG terminals and makes efforts to diversify pipeline gas imports.

OIL

SUPPLY-DEMAND BALANCE

Total primary energy supply (TPES) of oil was 36.8 Mtoe in 2007, an increase of 13% from 2006 (see Table 7).[22] At 3 Mtoe in 2007, domestic production accounts for 8% of total supply. In 2006, the largest share of oil supply went to the transportation sector, just under 50%. Just under a third of oil is used in the industrial sector, both for energy production and for non-energy purposes (*e.g.* as a direct manufacturing input).

22. This increase is partly due to a structural change in the figures of the aromates. Since 2007, the non-energy aromates (with a net export) are left out of the Dutch figures. Also since 2007, sea fishery is included in the inland use.

Table 7

Oil Supply-Demand Balance, 1970 to 2030

Unit: Mtoe	*1970*	*1980*	*1990*	*2000*	*2003*	*2004*	*2005*	*2006*	*2007**	*2010*	*2020*	*2030*	*Change 2000-2006*	*Change 2006-2030*
Supply														
Domestic production	2.0	1.6	4.1	2.4	3.2	3.0	2.3	2.1	3.0	1.7	1.3	0.3	-14.1%	-85.1%
Imports (net of exports)	37.3	38.2	31.2	42.3	41.6	44.9	48.8	47.6	49.1	46.5	57.2	69.4	12.5%	45.7%
Other	-9.9	-10.0	-10.5	-15.6	-12.8	-15.4	-17.7	-17.3	-15.3	-17.1	-21.0	-25.3	11.0%	46.2%
Total primary energy supply	**29.4**	**29.8**	**24.7**	**29.1**	**32.0**	**32.4**	**33.4**	**32.4**	**36.8**	**31.2**	**37.5**	**44.4**	**11.2%**	**37.0%**
Demand														
Electricity and heat production	3.1	5.1	0.7	0.7	0.6	0.6	0.6	0.6	n.a.	2.3	3.4	4.3	-13.9%	636.3%
Industrial consumption**	7.8	9.4	8.1	9.1	10.9	10.9	12.4	10.1	n.a.	12.4	14.0	17.1	11.4%	68.9%
Transport	6.0	8.4	10.2	14.1	14.6	14.9	15.0	15.4	n.a.	12.6	15.0	17.0	9.6%	10.2%
Residential consumption	5.5	1.4	0.2	0.1	0.1	0.1	0.1	0.1	n.a.	0.1	0.1	0.1	49.2%	-2.3%
Other final consumption***	1.5	1.5	0.9	0.8	0.8	0.8	0.9	0.8	n.a.	0.8	0.9	0.9	5.9%	10.4%
Other	5.4	3.9	4.5	4.4	5.0	5.1	4.5	5.3	n.a.	2.9	4.1	5.0	19.9%	-6.4%
Total consumption	**29.4**	**29.8**	**24.7**	**29.1**	**32.0**	**32.4**	**33.4**	**32.4**	**0.0**	**31.2**	**37.5**	**44.4**	**11.2%**	**37.0%**

*2007 estimated.

**includes non-energy use.

***includes commercial, public service, agricultural, fishing and other non-specified sectors.

Note: The projected increase in electricity generation from oil in 2030 is due to the expected growth of the petrochemical industry which creates gas as a by-product of oil during production process. This by-product gas, which is accounted for in oil statistics, is used by many petrochemical companies for generating electricity.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2008 and country submission.

INDUSTRY STRUCTURE

Refineries

The Netherlands has significant refining capacity, much of which is located in the Rotterdam port area, and is a major exporter of refined products (see Figure 11 and Figure 12). The total capacity is just above 1.2 million barrels per day, with capacity utilisation averaging around 83% in recent years. Dutch refineries are owned by Shell, Nerefco (BP), ExxonMobil, KPE and Total. Distillation capacity has been rather stable in recent years, though utilisation rates have been relatively low. The Netherlands has a relatively large and export-oriented petrochemical sector, which is very integrated with the refinery sector. In the petrochemical sector, key players include DSM, Sabic, Shell Chemie, Exxon Chemical and DOW Chemical.

Shell reports that it will make a large investment in the refinery and chemical complex in Moerdijk in the coming years, in order to enhance its competitiveness. The upgrade to the facility will allow its naphtha cracker to crack hydrowax as well, with production expected to start in the first quarter of 2009. The wax feedstocks will come from the other Shell refinery sites in Europe.

Retail market

There are about 3 750 retail filling stations, about 2 300 of which sell liquefied petroleum gas (LPG). Because of concerns about insufficient competition in the retail gasoline sector, the government implemented measures such as auctioning filling stations on motorways in order to encourage new entrants and to increase competition in the retail fuel market.

PRICES AND TAXES

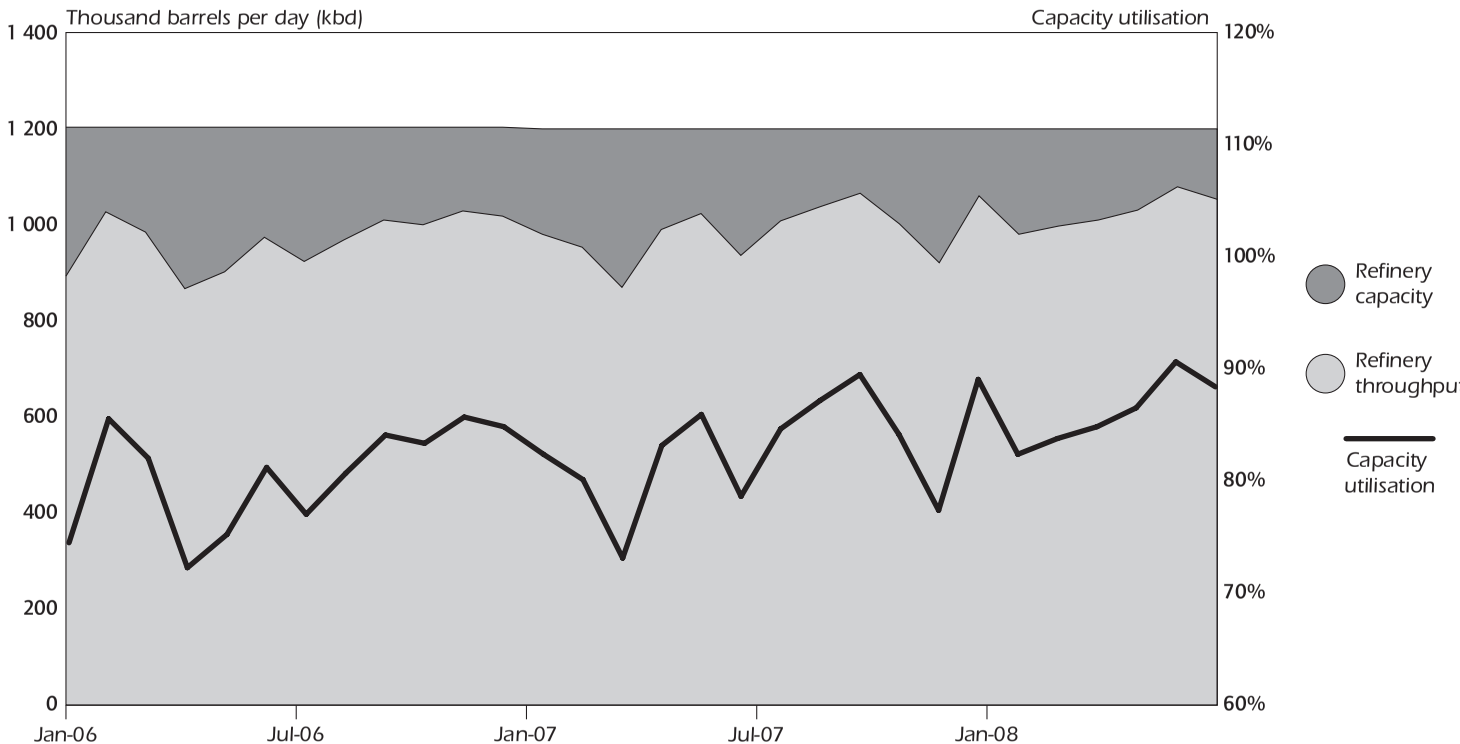
With relatively high taxes, gasoline prices in the Netherlands are among the highest in the IEA (see Figure 13).

DATA QUALITY

The Dutch government has been in the process of improving its oil data reporting system for the last year. Recent data submissions have therefore been of more variable quality than seen in the past; however, the enormous efforts being made in improving the system are about to draw to a close. New data will be issued as well as historical revisions. This will certainly result in better reporting and will improve historical data in the near future.

Figure 11

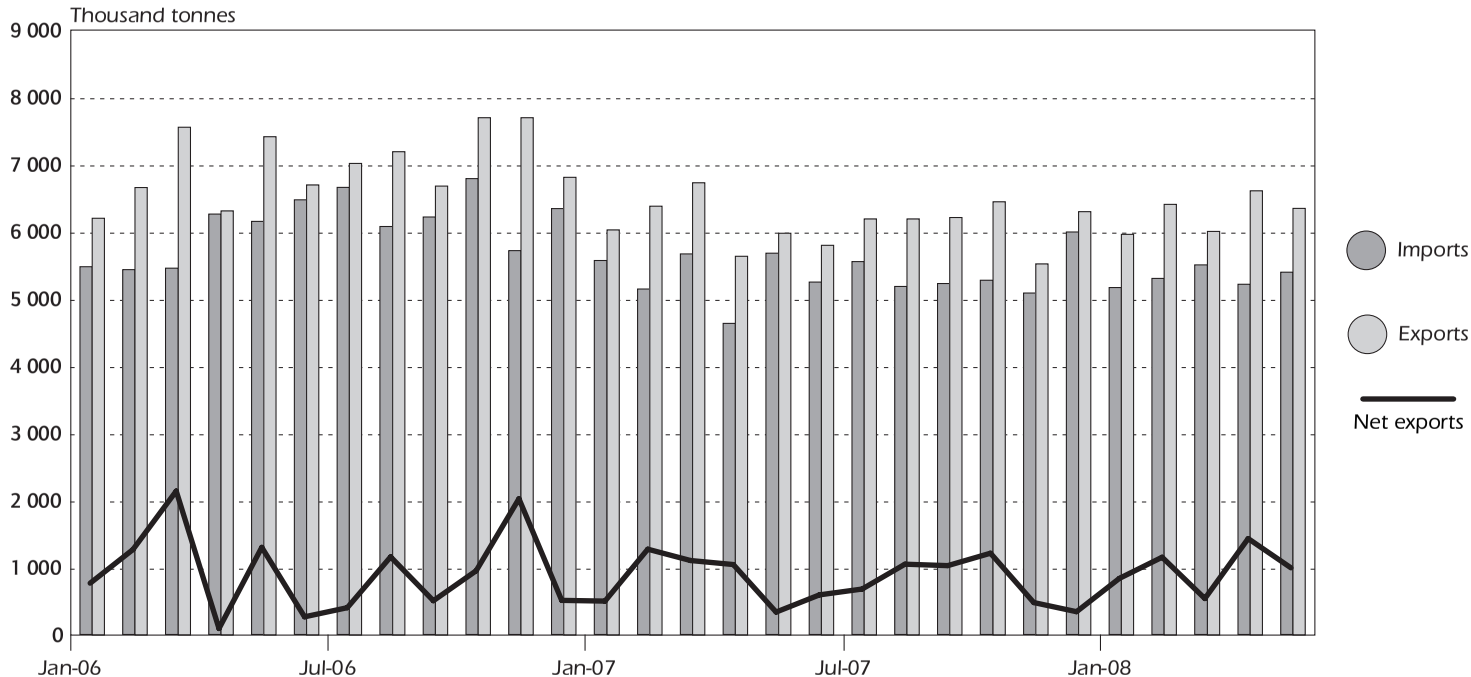
Refinery Throughput, Capacity and Utilisation, 2006 to 2008



Source: *Monthly Oil Statistics*, IEA/OECD Paris, 2008.

Figure 12

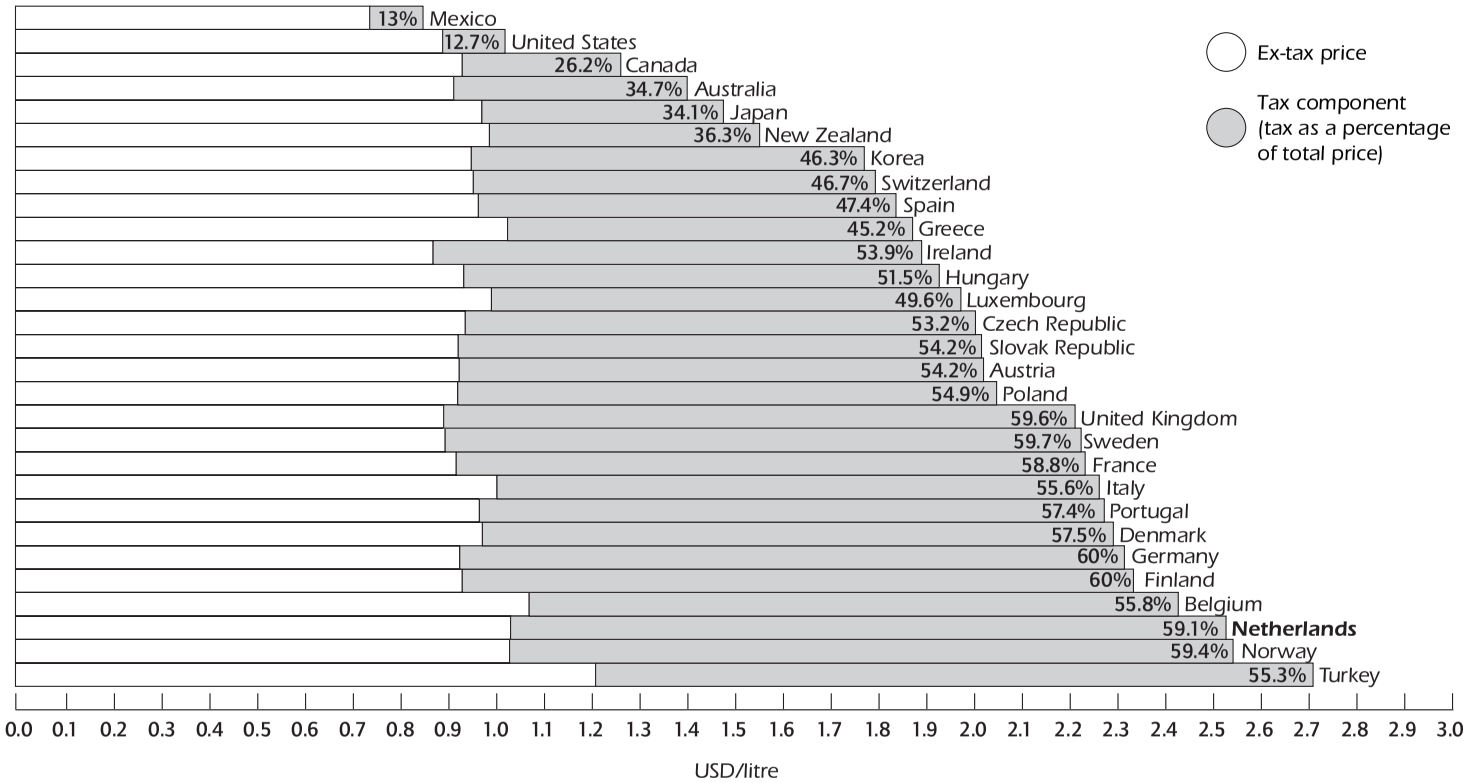
Product Imports and Exports, 2006 to 2008



Source: *Monthly Oil Statistics*, IEA/OECD Paris, 2008.

Figure 13

OECD Unleaded Gasoline Prices and Taxes, Second Quarter 2008



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2008.

Table 8

Coal Consumption by Sector, 1980 to 2006

Unit: ktoe	*1980*	*1990*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*Change 1990-2006*	*Change 2000-2006*
Electricity and heat generation	1 813	5 806	5 744	6 043	6 071	6 208	5 936	5 594	5 407	-7	-6
Share (%)	*48*	*65*	*71*	*72*	*72*	*70*	*68*	*68*	*69*		
Industry sector	693	1 328	798	800	807	826	944	898	841	-37	5
Share (%)	*18*	*15*	*10*	*10*	*10*	*9*	*11*	*11*	*11*		
Coal transformation*	1 203	1 748	1 482	1 544	1 565	1 773	1 786	1 670	1 507	-14	2
Share (%)	*32*	*20*	*18*	*18*	*18*	*20*	*21*	*20*	*19*		
Residential, commercial, other sectors	82	52	27	33	30	29	33	33	29	-44	5
Share (%)	*2*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Total consumption	**3 791**	**8 934**	**8 052**	**8 420**	**8 472**	**8 836**	**8 700**	**8 195**	**7 784**	**-13**	**-3**

*includes losses from coke ovens and blast furnaces as well as own use in the transformation sector.

Source: *Energy Balances of OECD Countries,* IEA/OECD Paris, 2008.

COAL

SUPPLY-DEMAND BALANCE

Total coal consumption in the Netherlands has slightly declined in recent years. It was 7.8 million tonnes (Mt) in 2006, a 13% decline from 1990 and a 3% decline from 2000. The majority of the Netherlands' coal consumption is for electricity and heat production, followed by the coal transformation sector and industry (see Table 8).

Over 90% of steam coal was imported from four countries in 2006: South Africa (35%), Colombia (32%), Indonesia (17%) and Russia (8%). Almost all coking coal comes from five countries: Australia (32%), the United States (28%), Venezuela (18%), Canada (13%) and Russia (8%).

COAL POWER PLANT EFFICIENCY

Design efficiency of Dutch coal-fired power plants is high, between 39% and 43%, reflecting the relatively modern coal-fired fleet (see Table 9). The annual operational efficiency of these plants is lower although exact data are not available. When looking at net output for a lower heating value (LHV) plant, the world average is around 33% and the OECD average is around 36% for annual operational efficiency. The world's best plants can achieve annual operational efficiencies of 47% (as in Denmark).[23]

Table 9

Coal Power Plant Efficiency, 2007

Owner	*Location*	*Operation start year*	*Capacity (MW)*	*Type*	*Design efficiency**
		Existing capacity			
Electrabel	Gelderland	1981	602	PC	39%
Nuon	Hemweg	1994	630	PC	43%
E.ON	Maasvlakte**	1987	520	PC	40%
E.ON	Maasvlakte**	1988	520	PC	40%
EPZ	Borssele	1987	413	PC	40%
Essent	Geertruidenberg	1980	645	PC	41%
Essent	Geertruidenberg	1993	600	PC	43%
Nuon	Buggenum	1994	253	IGCC	43%
		Planned capacity			
Electrabel	Maasvlakte	2011	750	USC	46%
E.ON	Maasvlakte	2011	1 080	USC	46%
RWE	Eemshaven	2011	1 080	USC	46%

* net output for a lower heating value (LHV). ** The Maasvlakte power plant has two identical units of 520 MW, built in 1975/1976 and designed to use natural gas and oil as fuels. Following a 1983 decision, the plant was converted into a coal-fired power plant, and the two units started their operation in 1987 and 1988 respectively. PC = pulverised coal. IGCC = integrated gasification combined cycle. USC = ultra-supercritical.

Source: Country submission.

23. *Prospects of Upgrading or Replacement of Older Coal-Fired Stations*, IEA/OECD Paris, forthcoming.

CARBON CAPTURE AND STORAGE

As discussed in Chapter 6, the government foresees that coal's importance in the electricity sector will rise through 2030. In order for both this forecast to materialise and climate change policy goals to be met, clean coal technology will be required. For this reason, the Dutch government has made development of carbon capture and storage (CCS) a priority. It has developed a national project CATO (CO_2 Capture, Transport and Storage). Chapter 9 provides more information about R&D on CCS.

In addition to taking an active role in technology development, the government is also actively involved in developing a sound legal and regulatory framework, a necessary precondition for the technology deployment. The government envisions that in the future, new coal-fired power stations will be constructed with CCS facilities. It sees clean fossil fuels as a transitional technology on the way to renewable energy production. To that end, the government plans to make agreements with operators of new coal-fired power stations concerning reduced CO_2 emissions. From 2015 onwards, large reductions will have to be achieved in power stations.

The Netherlands shows great potential for CCS, given the country's concentrated industrial base and number of potential CO_2 storage fields, owing in part to hydrocarbon production activities. CATO estimates CO_2 storage capacity in the Netherlands to be larger than 13 $GtCO_2$, including the Groningen and North Sea gas fields (over 10 Gt); aquifers in the north, south-east, south-west and the North Sea (1 Gt); and deep coal wells (1 Gt). Figure 14 shows a system analysis by CATO of potential CO_2 infrastructure in the Netherlands.

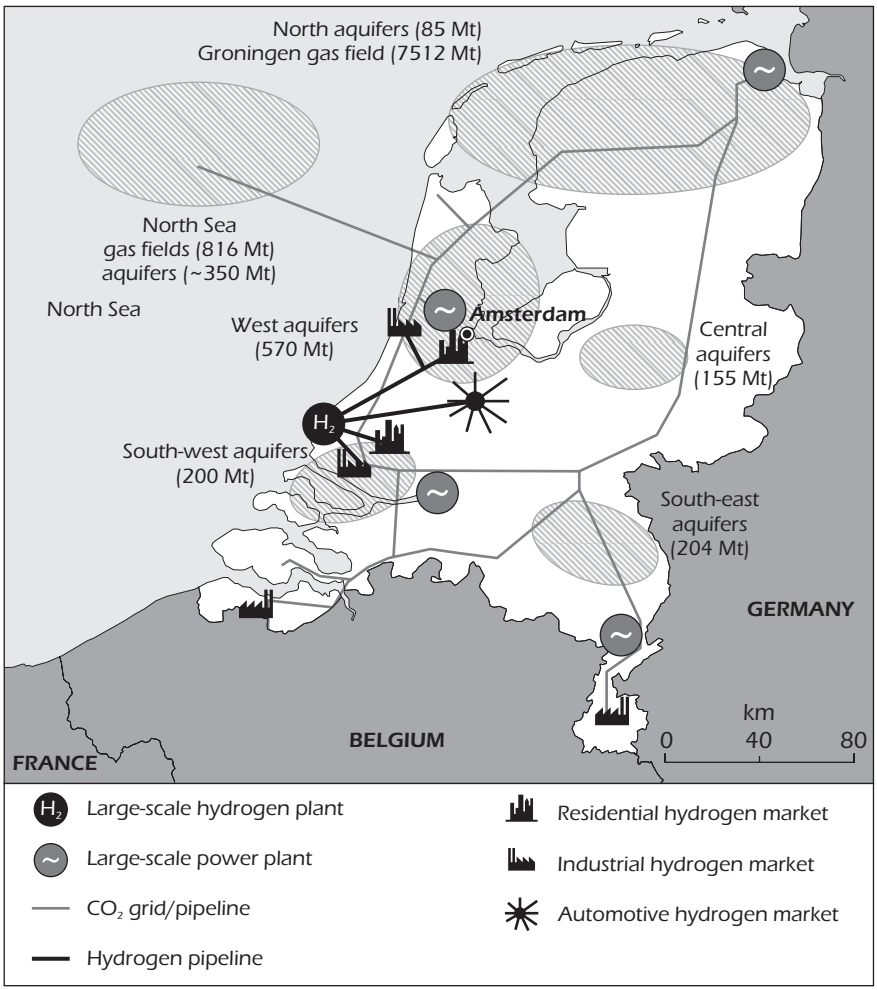
Working with the energy and industrial sector, the government has created a CCS task force that is developing a vision and approach to the implementation of CCS. It has also formed an internal government CCS team that involves the Ministries of Energy, Environment, Transport and SenterNovem. It is also taking a lead internationally, along with Norway, the United Kingdom and Saudi Arabia, on driving international collaboration and development of a sound legal and regulatory framework. However, key financing issues of large-scale demonstration activities have not been solved yet.

There are three CO_2 capture projects funded by the Dutch government at EUR 10 million, for a total government expenditure of EUR 30 million. These include the Nuon IGCC multi-fuel project and EnecoGen's Cryogenic project, which uses liquefied natural gas (LNG) in a combined-cycle gas turbine and freezes the flue gases, with a goal of expanding to an 850-MW gas-fired power plant with CO_2 storage. The GDF-Netherlands project at the depleted K-12B gas field is the world's first pure CO_2-enhanced natural gas recovery project using CO_2 injection. The gas produced from an offshore field 100 km from the Den Helder coast has 13% CO_2 content, which is reduced to 2% using amines. The separated CO_2 is injected into a deep (3 900 m) storage reservoir. The first

two phases (2004-2006) included a demonstration period with injection of 20 $ktCO_2$ per year. Scale-up will include a third injection phase of up to 480 $ktCO_2$ per year.[24]

Figure 14

Potential CCS Infrastructures



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: CATO Project.

24. Source: *Carbon Dioxide Capture and Storage*: *A Key Carbon Abatement Option*, IEA/OECD Paris, 2008, based on information from the Ministry of Economic Affairs, 2008; Lysen, 2007; Schreurs, 2008; Mulders, 2007; De Kler, 2007; GESTCO, 2004.

The Netherlands plays an important role as a producer of natural gas, a transit country for oil and gas, a refining centre for oil products and a storage hub for oil for north-western Europe, underpinning security of supply throughout the region. In fact, data indicate that the role of the country as an oil hub may be growing, supporting energy security further in the Netherlands and Europe. As regards natural gas, the cap on the Groningen field and the small fields policy have both proven to be successful in increasing transparency and prolonging the valuable swing capacity of the Groningen field. However, there is still a window of opportunity to enhance gas production from small fields as there is now access to the right infrastructure and equipment. The IEA is pleased to see the activities under way to make gas production in the Waddenzee area possible and encourages the government to continue to look for possibilities to produce gas from additional smaller fields.

Under its Energy Transition framework, coal-fired power plants with carbon capture and storage (CCS), along with more efficient coal-fired power plants, are seen as forming one possible transition path to a sustainable energy future. For carbon capture and storage to have a viable future and help set the Netherlands, and the world, on a sustainable path that includes coal, the legal and regulatory framework, particularly liability questions, needs to be decided. Given both its geologic resources (depleted aquifers and gas fields) and its position as a gas supplier, it is commendable that the Netherlands take a leadership role in trying to build global consensus on a liability and regulatory solution for CCS. Along with Norway and other countries, the Netherlands is well positioned to move forward in this dialogue. In general, the government is taking steps to set a clear framework for CCS, and doing so as quickly as possible – though the government has postponed a decision on allocating funding for storage because of NIMBY ("not in my backyard") concerns.

A major gas producer, the Netherlands produces small amounts of oil. High oil prices and technological developments may provide incentives to develop new or decommissioned fields. Nevertheless, import dependence, now above 95%, is unlikely to decrease in the future. In spite of existing policies to moderate demand (*e.g.* tax measures, mandatory use of biofuels, promotion of eco-driving), oil consumption has continued to increase in both absolute and relative terms in recent years. Oil is expected to overtake natural gas in the share of primary energy supply by 2020. A high share of oil is used as a feedstock in the chemical industry, constraining the potential of energy efficiency measures. This makes it all the more important that the government continue efforts to curb oil use in other sectors, particularly the transport sector, as discussed in Chapter 3. Not only would this help reduce dependence on imported oil, but it would also contribute to meeting the Netherlands' ambitious CO_2 reduction target.

In general, there is room for improvement in the quality of oil data submitted to the IEA and the IEA is pleased to see the government's efforts in this

area. Although the high prices are mostly due to tightness in the market, the submission of final user (pump) prices to the IEA and the European Commission is slightly overstating the level of prices observed in the market. In the short term, the current data reporting system, which is based on advised prices and run by the Ministry of Economic Affairs, will be replaced by a new system that will be run by the Dutch Statistics Organisation (CBS) and which will include more direct market-oriented price observations. The IEA encourages the government to continue to evaluate its data collection and verification systems, and to ensure that high-quality, timely and consistent data are submitted to the IEA.

Turning to the gas sector, one concern is that a large part of gas produced in the Netherlands is still supplied by one company. It is commendable that NAM, the largest oil and gas company, is required to "return" the small field it is not using. The government should continue to encourage expanding open access to small fields to ensure competition. In addition, enhancing access to unused transportation capacity should be considered, such as by introducing gas release programmes or other mechanisms to allocate unused, available capacity.

The Netherlands is working to create a gas roundabout, which would be a major step not only for security of natural gas supply in Europe but also to help integrate the north-west European market. Further grid investments are nevertheless needed to ensure security of supply and the proper functioning of the gas market. In order to attract this necessary investment, it may be prudent to consider *ex ante* consultation and approval procedures by the regulator for some investments, particularly large-scale investments by independent grid operators. The right rate of return on investment will also need to continue to be evaluated. Currently, investments are based on two-year "open seasons" organised by the transmission system operator, which may not be an adequate lead time. If the market or the regulator signals the earlier need for investments, the possibility of organising an interim open season should be encouraged.

To that effect, the independence of the regulator has to be maintained at all times and even be strengthened. In fact, the strength of the regulator might be enhanced by granting it more powers to monitor the market, control the competitiveness of the market, advise or propose measures and programmes that increase competition and, finally, regulate network profits fairly. Furthermore, the government should continue to evaluate the benefits of and drawbacks to a joint competition authority and energy regulator. Such a structure allows much greater collaboration and co-ordination, but may impede independence, such as with *ex ante* and *ex post* regulatory approval issues.

While a very sound regulatory framework is already in place, some additional adaptations would increase and secure competition. The government should continue to investigate the possibility to provide all parties with the right to explore, exploit and use partially depleted gas fields, salt caverns and other underground geologic structures for enhanced gas recovery by smaller companies, underground gas storage and, potentially, carbon capture and

storage. The balancing system currently in place should also be enhanced to create a low-cost regime that is not punitive to new entrants and smaller shippers. A transparent, cost-reflective billing system should also be developed. Finally, the development of the Title Transfer Facility has underpinned liquidity in the market. The IEA encourages the government to continue to monitor use of the TTF and consider developing policies that drive greater use of this mechanism as it enhances transparency, liquidity and competition.

The government should also continue to ensure a smooth integration of low-calorific gas (L-gas) and high-calorific gas (H-gas) infrastructures, in part by taking into account regional developments. Investment decisions on blending or conversion facilities will need to be taken with all concerned suppliers and consumers in the area. The government should continue to ensure that this dual-layer market does not impede effective competition, as some players may not have access to blending stations and cannot offer different qualities of gas as the market would require. The regulator should also monitor the flexibility in the L-gas market.

RECOMMENDATIONS

The government of the Netherlands should:

- *Continue to take a lead in a domestic and international context on clarifying the legal, liability and regulatory framework for carbon capture and storage as it is critical for the long-term viability of coal-fired power generation.*
- *Maintain its efforts to dampen domestic oil demand, particularly in the transport sector, through industrial energy efficiency and, if possible, fuel switching.*
- *Continue to monitor the development of competition in the fuel retail sector and take further measures as necessary to ensure sufficient competition.*
- *Keep improving oil data collection and verification processes.*
- *Continue work to create the necessary environment for the effective installation of a gas roundabout as an instrument for greater liquidity, competition and integration of the north-west European market.*
- *Keep improving the regulatory framework so that it encourages and facilitates investments in infrastructure, including interconnectors, quality conversion facilities and gas storage, such as by:*
  - *Considering* ex ante *approval and consultation procedures by the regulator for necessary and large-scale grid investments by independent network companies.*
  - *Continuing to evaluate the rates guaranteed for returns on investment.*

- *Enhance the effectiveness of the regulator, such as by providing the resources necessary to obtain sufficient technical knowledge, human capital, equipment and information.*
- *Continue efforts to provide greater access for parties to explore and use partially depleted gas fields, salt caverns and other underground geologic structures for enhanced gas recovery, underground gas storage and, potentially, carbon storage.*
- *Work to install a low-cost balancing regime that is not unduly punitive on new entrants and small shippers.*
- *Work towards increasing the liquidity provided by the Title Transfer Facility by encouraging greater use of the mechanism.*
- *Continue work to develop a small fields policy that ensures open access to all participants, particularly in light of the window of opportunity that now exists with access to the necessary equipment and infrastructure.*
- *Develop a transparent, cost-reflective billing system for retail customers.*
- *Ensure a smooth transition from low-calorific gas (L-gas) to high-calorific gas (H-gas) by taking into account regional developments, and make sure that the dual-layer market does not impede effective competition, and trade and transit of gas.*

Liberalisation of the Dutch electricity sector began in the late 1990s. In general, functioning of the market is good and improving, with relatively high liquidity in the wholesale power market. The transmission network is owned and operated by TenneT, a state-owned enterprise, and thus fully ownership-unbundled from competitive parts of the business. Recent reform efforts have focused on enhanced metering data processes, partially in an effort to ease customer switching and facilitate demand response. The lion's share of electricity generation, almost 60%, is fuelled by natural gas and four generators dominate the market, together managing 65% of the country's installed generating capacity. A relatively large share of electricity comes from combined heat and power (CHP) plants, often owned by smaller companies, including new entrants.

SUPPLY AND DEMAND

CAPACITY

The Netherlands' total installed power generating capacity is about 23 GW in 2006. As shown in Table 11, about three-fourths of capacity comes from steam turbines and combined heat and power (CHP). Renewables (without waste) account for over 7% of total capacity but provided only 3% of total generation in 2006. Nuclear capacity is slightly over 2% of the total but because of its high capacity factor, the share of nuclear in total generation was 3.5% in 2006 and around 4% in 2007.

Significant new generating capacity (over 13 GW) has been proposed to come on-line from 2008 to 2014, as detailed in Table 10, although not all proposed projects will be completed.

Table 10

Projected New Thermal Generating Capacity, 2008 to 2014

Location/company	*Capacity in MW*	*Planned operation*	*Fuel*
Eemshaven/Electrabel	125	2008	Gas
Lelystad/Electrabel	900	2009	Gas
Borssele/Delta	870	2009	Gas
Intergen	419	2010	Gas

Table 10

Projected New Thermal Generating Capacity, 2008 to 2014

(continued)

Location/company	*Capacity in MW*	*Planned operation*	*Fuel*
Enecogen	840	2010	Gas
Sas van Gent/Delta	82	2010	Biomass/gas
Nuon (first phase)	350	2011	Gas
RWE (first phase)	800	2011	Coal/biomass
Advanced Power	1 200	2011	Gas
n.u.*	600	2011	Gas
Moerdijk/Essent	430	2011	Gas
Schoonebeek/NAM	130	2011	Gas
Maasbracht/Essent	650	2011	Gas
RWE (second phase)	800	2012	Coal/biomass
Electrabel (first unit)	800	2012	Coal/biomass
Maasvlakte/E.ON	1 050	2012	Coal/biomass
Electrabel (first unit)	800	2012	Coal/biomass
Nuon (second phase)	1 050	2014	Coal/biomass/gas
Bergum/Electrabel	454	2014	Gas
Delfzijl/Aldel	115	2014	Biomass/gas
Geertruidenberg/Essent	800	2014	Coal/biomass

*n.u. – name unknown.

Source: Country submission.

ELECTRICITY GENERATION

As shown in Figure 15, power generation is dominated by natural gas, which has an almost 60% share in 2007. Natural gas has fuelled more than half of the Netherlands' electricity generation since the early 1980s – down from nearly three-quarters in the 1970s. Just over a quarter of generation comes from coal. With respect to renewables, over 5% comes from biomass, with

Table 11

Generating Capacity, 2006

Type of installation	*Capacity, MWe*	*Share of capacity, %*	*Electricity production, MWh*	*Share of generation, %*	*Capacity factor **
Gas turbine	1 288	5.6	6 211 296	6.3	55.1%
Gas motors	2 396	10.4	6 259 237	6.3	29.8%
Steam turbines (mostly coal and gas)	9 470	41.2	39 045 534	39.5	47.1%
CHP (mostly gas)	7 597	33.1	40 775 810	41.3	61.3%
Nuclear	510	2.2	3 469 439	3.5	77.7%
Hydropower	37	0.2	105 199	0.1	32.5%
Wind turbine	1 559	6.8	2 734 000	2.8	20.0%
Solar energy	53	0.2	35 223	0.04	7.6%
Other	72	0.3	198 883	0.2	31.5%
Total	**22 982**	**100**	**98 834 621**	**100**	**49.1%**

*Capacity factor = Production/(Capacity × 24 x 365)%.

Note: The government does not have capacity figures for CHP and steam turbines broken down by fuel, though most CHP plants run on natural gas and most steam turbines use coal and natural gas.

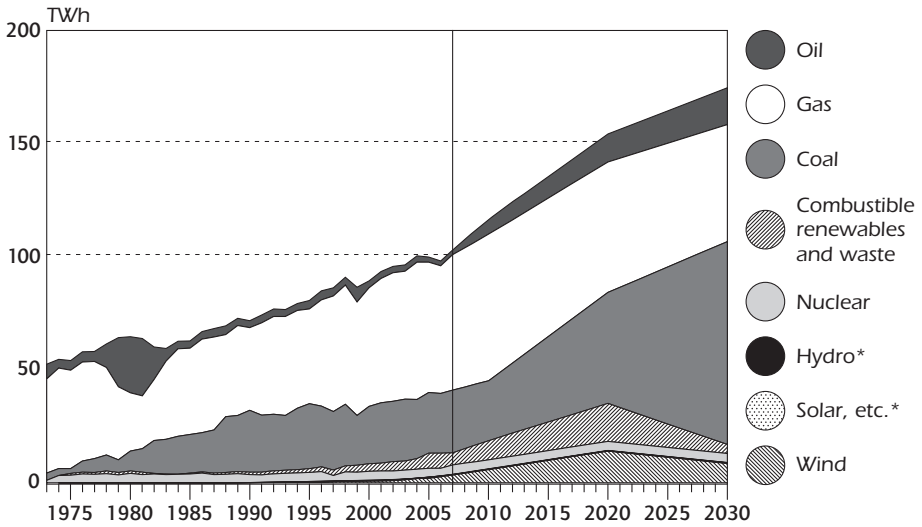
Source: Country submission.

less than 4% from other renewable sources. The nuclear reactor at Borssele in Zeeland continues to provide a small amount of power – 4% in 2007 – as it has since 1973. (In addition, approximately 5% of Dutch electricity supply is provided by imported nuclear power, which is not included in domestic statistics reported here.)

According to government projections based on the so-called "global economy scenario", the share of coal-fired generation is expected to increase substantially between 2007 and 2030, rising from just over a quarter to over half of all generation. Over the same period, natural gas will fall to less than 30% of generation. This change in the fuel mix is expected to happen if the existing government policies are not extended beyond 2020. The construction of new coal-fired power plants is expected, driven by relatively low coal prices, supposedly with technological capability to implement CCS.

Figure 15

Electricity Generation by Source, 1973 to 2030



* negligible.

Note: The forecast to 2030 was prepared by ECN on the basis of the global economy scenario. In this scenario, it is assumed that oil and gas prices are high while coal prices remain relatively low. The scenario assumes that the existing government policies will be implemented until 2020 but it does not take into account any new policies that may be implemented after 2020. These assumptions explain the rapid increase in coal demand and the decrease in the share of renewables after 2020. However, if the government continues its policies to support renewables, the energy mix will look different from what it does in this forecast. ECN is developing another forecast based on an alternative scenario.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2008 and country submission.

IMPORTS

A net importer, the Netherlands has imported 23 to 27 TWh of electricity per year and exported 5.4 to 5.9 TWh per year over the last several years. In 2006, the country's net imports were particularly high: over 21 TWh, equivalent to about 20% of total final consumption.

DEMAND

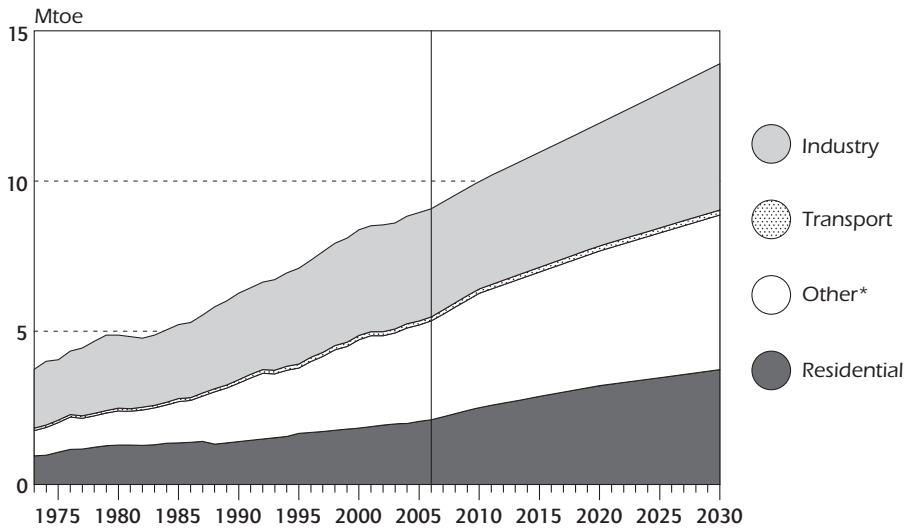
As shown in Figure 16, industry is still the largest electricity-consuming sector with almost 40% in 2006, a decrease from over 45% in 1990. Most of this decrease has been replaced by an increase in the share going to sectors classified as "other", including commercial, public service, agricultural and fishing. Combined, these sectors had over 35% of total final consumption of electricity. The residential share covered over 23% in 2006, a slight increase from 1990.

Final consumption of electricity is expected to grow at an average rate of approximately 2% per year until 2015, slowing down to about 1.5% per year by 2025-2030 (Figure 16).

Peak demand was 18.4 GW in 2006, and shows an annual increase of about 2.5%. In recent years, the summer peak, in August, has increased and is now competing with the Netherlands' traditional winter peak in December. Peak load levels are expected to increase further. New policies to enhance demand-side management may, over time, counter this effect.

Figure 16

Final Consumption of Electricity by Sector, 1973 to 2030



* includes commercial, public service, agricultural, fishing and other non-specified sectors.
Sources: *Energy Balances of OECD Countries,* IEA/OECD Paris, 2008 and country submission.

ELECTRICITY MARKET OVERVIEW

The Dutch electricity sector began the process of market liberalisation in the late 1990s. Prior to this, the market had been dominated by four companies that co-operated together through a joint-stock company, SEP. SEP's primary role was to co-ordinate electricity production and planning of new plants. It was dissolved in 2001.

The country's transmission system operator (TSO), TenneT, was established in 1998. At present, TenneT is ownership-unbundled from other parts of the supply chain and fully owned by the State. It is responsible for ensuring the stability and reliability of the electricity grid, carrying out load balancing in

the Dutch system and with neighbouring countries, and maintaining the high-voltage grid in good condition to allow access and maximum capacity use. TenneT is also the majority owner (74.5%) of APX, the short-term trading exchange for gas and electricity.

Following market liberalisation, the four original generators continued to dominate the market, although there has been significant new entry and two of the four were acquired by foreign utilities.

The retail market was fully liberalised on 1 July 2004, with all retail customers free to choose their own electricity supplier. At the same time, legal unbundling of supply and distribution network operations was instituted.

The Dutch regulator for electricity is the Office of Energy Regulation (*Energiekamer*), which is a separate chamber of the Netherlands Competition Authority (*Nederlandse Mededingingsautoriteit*, NMa). Further information on NMa and the *Energiekamer* is available in Chapter 2.

Wholesale buyers and sellers of electricity can transact in various markets in the Netherlands. In general, the market does not require that all electricity be sold through a centralised pool. The various market places in the wholesale electricity market are:

- the bilateral market (forward and spot)
- the over-the-counter (OTC) market (forward and spot)
- European Energy Derivatives Exchange (ENDEX) (forward)
- Amsterdam Power Exchange (APX) (spot)
- TenneT (balancing)

Producers and suppliers can agree to contract specifications among themselves, including the size, duration and term of electricity supplies. Forward contracts are most commonly traded in the bilateral market, but some spot contracts (*e.g.* day-ahead, intraday) are also concluded. Standardised contracts are available in the OTC market and on APX and ENDEX exchanges. For standard volumes of electricity, contracts are available in these market places with different durations and for multiple terms. In the OTC market, brokers match demand and supply for forward and spot electricity contracts. Parties can trade on the exchanges without brokers as intermediaries. Forward electricity contracts are traded on ENDEX, an electronic trading platform, both for physical and financial products. The APX electronic trading platform was established for the spot electricity market. In this market, individual hourly prices are established according to an auction. In addition, there is a balancing market for control and reserve power (*e.g.* power needed to balance the system very close or in real time). This market is maintained by TenneT, the manager of the national high-voltage grid.

Electricity trading on the exchanges seems to be increasing in the past years. In comparison to 2005, 2006 spot trading volume on APX was 17% higher – 19.2 TWh. Given this greater liquidity, the price sensitivity of additional demand bids is lower than in previous years. Forward trading on ENDEX has also risen, increasing by 25% in 2006 over 2005 to 131.3 TWh. A shift can be seen from OTC clearing to trading on the futures exchange (launched in 2005); trade in standardised OTC contracts has decreased by almost 40%. According to earlier analysis, the total churn rate (*i.e.* the ratio of traded electricity to physical electricity consumption) of the Dutch electricity market is estimated at 3 to 4, giving an estimated total annual trade of about 400 TWh.

INDUSTRY STRUCTURE

GENERATION

The five largest producers of electricity in the Netherlands are Electrabel, Essent, Nuon, E.ON Benelux and Delta, which together manage over 70% of the installed capacity. For the remaining generators, a large part of their capacity is in CHP, particularly distributed generation. EnergieNed, an organisation of energy companies, reported the following installed generating capacity for the five largest generators in 2007, with estimates of peak-hour market shares:

- Essent: 4 760 MW of capacity (21% market share during peak hours)
- Electrabel: 4 710 MW (22% market share during peak hours)
- Nuon: 4 307 MW (16% market share during peak hours)
- E.ON Benelux: 1 770 MW (9% market share during peak hours)
- Delta: 715 MW (4% market share during peak hours)

In addition to the five largest producers, there are a lot of smaller companies active in the market. Some are resellers with network activities that have not been merged into larger companies with generation, and some are new entrants who operate without a network or their own production. Some new entrants are considering constructing their own generating capacity.

RETAIL AND DISTRIBUTION

There are 39 companies with a licence to supply electricity to residential customers and small and medium-sized enterprises (SMEs). The three largest companies are Essent, Nuon and Eneco. Their market share was 80% in July 2007. This market share has gone up mainly because of a takeover by Eneco of a smaller supplier. These three companies are fully owned by provinces and

local governments. New entrant Oxxio (Centrica-owned) is the fourth-largest supplier. The approximate market shares of retail companies are:

- Nuon: 30 to 40%
- Essent: 20 to 30%
- Eneco: 20 to 30%
- Oxxio (part of Centrica): up to 10%
- RWE: up to 10%
- Others: up to 10%

The Dutch government has recently imposed ownership-unbundling of distribution system operators from production and supply activities, to be required from January 2011. Before the passage of this law, numerous takeovers took place, mainly concerning the local supply and distribution companies. For instance, RWE took over the regional utilities in Helmond (Obragas) and Haarlem (Haarlemmermeergas), E.ON took over NRE Energy in Eindhoven and DONG took over Intergas, which is based in Breda. Most recently, Electrabel, which was only a producer and supplier for industrial customers, took over the supply branch of Rendo and Cogas, two regional suppliers in the north-eastern part of the country, with the aim to enter the retail market in the Netherlands.

Customer switching

Switching rates are generally 0.5% to 1.0% per month, a rate that the government considers low. Since liberalisation in July 2004, 21% of residential and SME users have switched electricity supplier. Between July 2006 and June 2007, 7% of all consumers switched supplier, a percentage that is slightly higher than in the previous 12-month period. Switching rates increased in the first half of 2007, probably because of price volatility and heavy media attention to energy tariffs. According to anecdotal evidence, switching rates of large industrial users are higher, but no recent data are available. Box 5 details the current customer switching process. NMa monitors the performance of suppliers, periodically publishing score cards with key indicators, including information about how long it takes to switch suppliers; a very high percentage of switches by all suppliers are completed on time.

Demand response, including reform of customer switching regulations

Industrial and residential users are free to choose their own contract or pricing scheme. Currently, real-time pricing is only available to industrial users. However, this might change with the introduction of smart meters – meters capable of remotely measuring electricity consumption in real time, as well as transmitting real-time pricing information to customers. In September 2007,

the government proposed rolling out smart meters to all 7 million residential customers in the Netherlands by 2013, but this law was not approved. The current plan is to install meters in new buildings and public housing corporations' buildings. Two years later the benefits of the smart meters will be evaluated and if the results are positive, meters will be rolled out to all other residential customers.

Box 5

Current Customer Switching Process

The current switching system is rather complicated. If a customer wants to switch electricity supplier, he/she must authorise the new supplier to request the necessary information and take any necessary actions. The new supplier then places a request with the network operator for a switch. Generally, the switch must be completed within five working days. If the new supplier sends meter data to the distribution company within ten days of the switch, the distribution company uses actual consumption for billing. Otherwise, it uses an estimate. The estimate or a validated meter reading is sent to both the former and new suppliers in relation to the billing process.

The new supplier must also submit a request to switch the customer to the grid manager and send the meter reading as soon as possible, up to a maximum of 15 working days after the switch date. Immediately after receiving the switch request, the grid manager carries out a number of checks (*e.g.* whether the application was submitted at least five days before the intended date of the switch). If the result of the checks is positive, the grid manager confirms acceptance of the switch, at the latest on the working day after receipt of the notification of the switch from the former and the new suppliers. At that moment, the grid manager also enters the change into the connection register. The grid manager passes on the meter reading as soon as possible, but at the latest 30 working days after the date of the switch, to both the former and the new suppliers. The grid manager also notifies the former supplier of the consumption so that he can draw up the final invoice.

Source: Country submission.

Currently, time-of-use pricing, where prices are predetermined but vary according to the time of day or the season, are mainly available for industrial users. Residential users are generally offered only day- and night-time pricing (*i.e.* profile pricing) at present. Expectations are that with smart metering, time-of-use tariff schemes will become commercially attractive in the small user market as well. In both the residential user and business user markets, the government has observed

the development of joint purchasing of energy, which has, in many cases, led to stronger purchasing power and lower tariffs.

The government considers the existing system for allocation and reconciliation of metered data to be very complicated, causing delays in the confirmation of allocations and, potentially, inhibiting customer switching and long-term demand response. Industry and the regulator have generally agreed that a new market model is necessary for reconciliation of meter data. A new model has been proposed and implementation is now being discussed. The primary principle of the new market model is to give responsibility for managing the switching procedure to the retail supplier, taking it away from the grid operator. In addition, applying a capacity tariff for network use, instead of a tariff based on consumption, would simplify the process of allocation, reconciliation and, thus, billing. This would enhance simplicity of the administrative process since the distribution system operators (DSOs) would no longer need metering data. The plan is to install smart metering at the same time in households, which is made easier since the DSOs are not involved in metering any more. This would enhance competition in this market segment, enabling competition for services and not only prices.

TRANSMISSION

Transmission network

TenneT is the owner and operator of the medium- and high-voltage grid in the Netherlands (see Figure 17). Responsibility for 150-kV and 220-kV lines was transferred from regional grid operators to TenneT on 1 January 2008, enabling TenneT to optimise the integral transmission grid. In terms of new projects or upgrades, progress is made in the planning of the R380-project, a new 380-kV connection between Rotterdam-Maasvlakte and Beverwijk, which is now scheduled for 2010. Reinforcements are also set to be completed on the 220-kV grid in Groningen. In 2008, it is expected to start physical planning for a new 380-kV connection between Groningen and Zwolle.

Network access

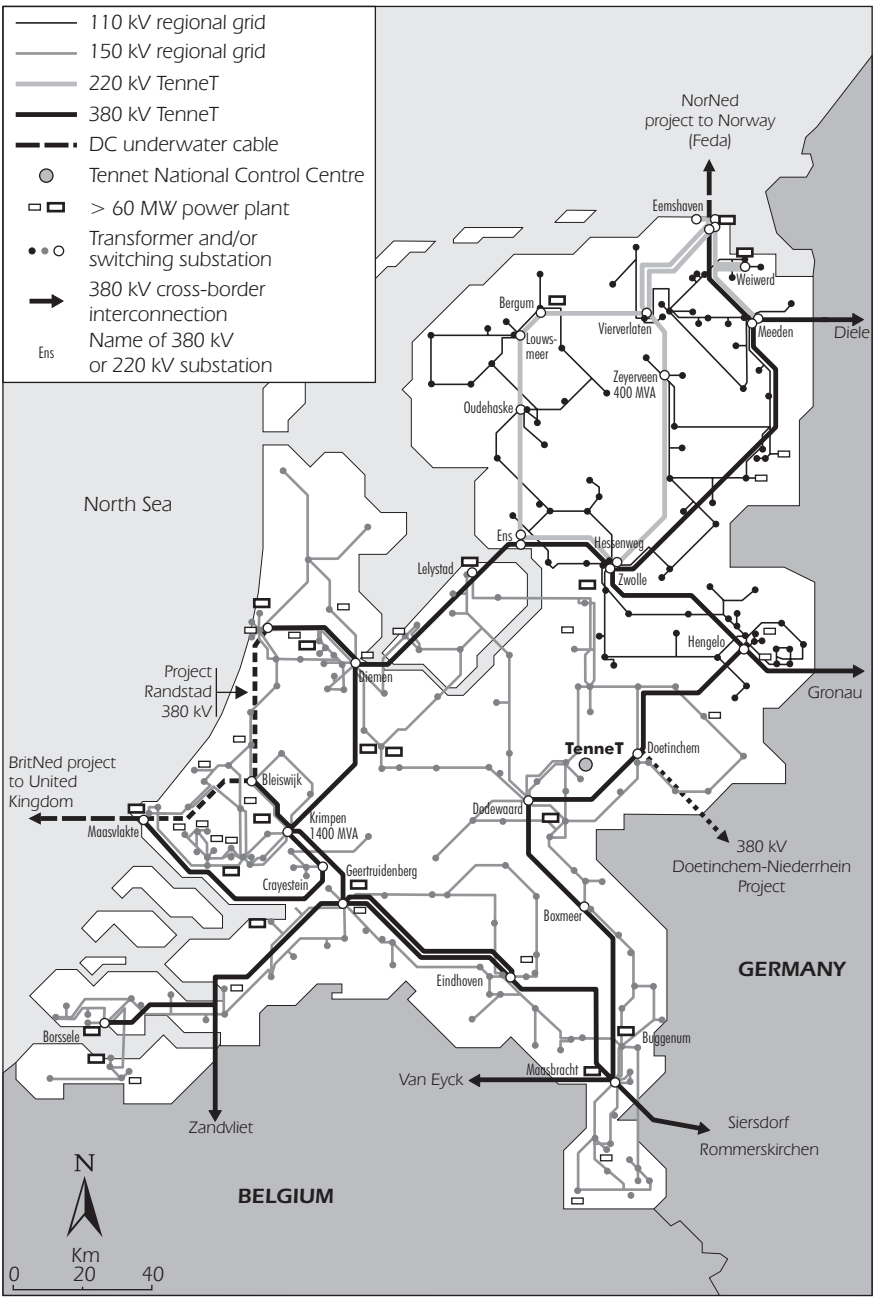
Network access is based on regulated third-party access (TPA) tariffs, in accordance with the Electricity Act. Network operators calculate the tariffs, which are subject to approval by the *Energiekamer*. TenneT and distribution system operators are obliged to offer every connected party transport service, which includes transporting electricity from producers to users, using the grid, solving transport restrictions, compensating for any losses and maintaining the grid voltage and other attributes.

Cross-border transmission lines

The Netherlands currently has cross-border connections with Germany and Belgium. Under normal circumstances, there are 3 600 MW of interconnection capacity available to the market at these connections, rising under favourable

Figure 17

Map of the Medium- and High-Voltage Electricity Grid



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: TenneT.

conditions to 3 850 MW. The maximum rated physical capacity is 4 700 MW. However, all TSOs hold reserves at the border, for example to manage transit flows caused by wind energy production in northern Germany, which limits available capacity below the maximum rated capacity. Market players acquire import capacity through auctions held by their TSOs.

The Dutch government sees increasing the interconnection capacity with neighbouring countries as an important part of the policy to create a single market in continental Europe. To that end, the most advanced project is the interconnection cable between the Netherlands and Norway. Construction of the 700-MW NorNed cable was completed in 2007. It was put to use on 5 May 2008 and was officially opened on 11 September 2008. Another cable in progress is the interconnector with the United Kingdom, the so-called BritNed cable. According to TenneT, this 1 000-MW sub-sea cable will be available in 2010. In addition, TenneT is planning to expand its interconnection capacity with Germany. A new cable between Doetinchem and Wesel will add approximately 1 500 MW. Current plans call for the cable to be ready in 2013.

Congestion

Transmission congestion on the Dutch grid is rare; when it does occur, it is resolved by grid operators. Congestion on cross-border interconnectors occurs more regularly. As over a fifth of domestic consumption is imported, cross-border congestion management is critical for operation of the Dutch wholesale market. In general, cross-border congestion occurs in the direction of imports (*i.e.* from Germany or Belgium towards the Netherlands). In particular, systematic congestion often occurs when there is increased wind power production in northern Germany; congestion of north-to-south electricity transmission in Germany causes so-called loop-flows through the Dutch transmission network, creating bottlenecks at Dutch cross-border interconnections. As a result, TSOs maintain larger reserves at cross-border interconnections, limiting the import capacity available to the market.

The day-ahead market coupling on the Dutch-Belgian border ensures efficient use of available capacity. Implementation of a market coupling regime in the whole region (including on the Dutch-German border) is foreseen to be implemented from January 2009 according to a memorandum of understanding signed by the five countries in the region (Belgium, France, Germany, Luxembourg and the Netherlands). Market coupling is expected on the Dutch-Norwegian interconnector (NorNed) together with the implementation of coupling in the whole region.

New network connections

New capacity is connected to the grid on a first-come, first-served basis. When capacity limitations arise, new plants are the first to be required to decrease production in favour of existing plants with older transportation rights.

However, this approach has led to problems with new plants, mainly small sustainable plants (*e.g.* wind, CHP), as larger plants contracted capacity during their planning procedures. To manage these difficulties, a new policy was announced in December 2007, which calls for all new capacity to be connected as soon as possible. When and where congestion occurs, grid operators will use a congestion management system to allocate the capacity to the power plants. Furthermore, this system will allow sustainable power plants to gain transportation rights over thermal power plants.

According to a study on the integration of wind power, the government estimates that up to 15 000 MW could be added to the Dutch grid without significant adverse consequences.

Grid planning and expansion

Under the Electricity Act, every other year TenneT must issue a grid plan, which describes any required additional transport capacity, as well as possible grid bottlenecks for the medium- to long-term period. The most recent plan is the Quality and Capacity Plan 2008-2014 *(Kwaliteits- en Capaciteitsplan 2008-2014*), issued in February 2008. The plan takes account of all proposed new power plants in the Netherlands – noting that not all proposed projects will be built – and lays out four possible scenarios. It describes various grid configurations for the four scenarios, at the same time identifying grid configurations that could be adopted to prevent bottlenecks arising from the various scenarios. The report notes the difficulty of matching the time horizon of grid planning to the time horizon of new power plant construction in the Netherlands. Whereas generation can be planned and built in three to five years, development and expansion of the high-voltage transmission grid takes even more than the seven-year planning horizon of the grid planning report, underscoring the need for co-operation among all stakeholders in grid development.

Results from TenneT's four scenarios suggest that:

- Electricity load in the Netherlands in 2030 will mainly remain focussed on the centre and west of the country.
- Market integration will lead to a substantial increase in trade, which will, in turn, lead to an increase in fluctuations of transmission over longer distances.
- An increased number of electricity consumers will generate electricity themselves (*i.e.* through decentralised or distributed generation).
- Energy producers will establish power plants on a limited number of coastal locations or have electricity enter the country through international connections.

To respond to the findings of its scenarios, TenneT sees the need for increased transmission capacity, even if overall demand remains the same. Instead of the "electricity motorways" currently in place, TenneT sees the need for a strong 380-kV transmission ring around the load in the centre and west of the country, with short connections to demand or production as spokes off the ring.

Under current regulations, all new infrastructure investment undertaken by TenneT is subject to *ex post* regulatory approval by the *Energiekamer*. The government is considering implementing *ex ante* approval for large projects in order to create stronger incentives for strengthening the network for the longer term.

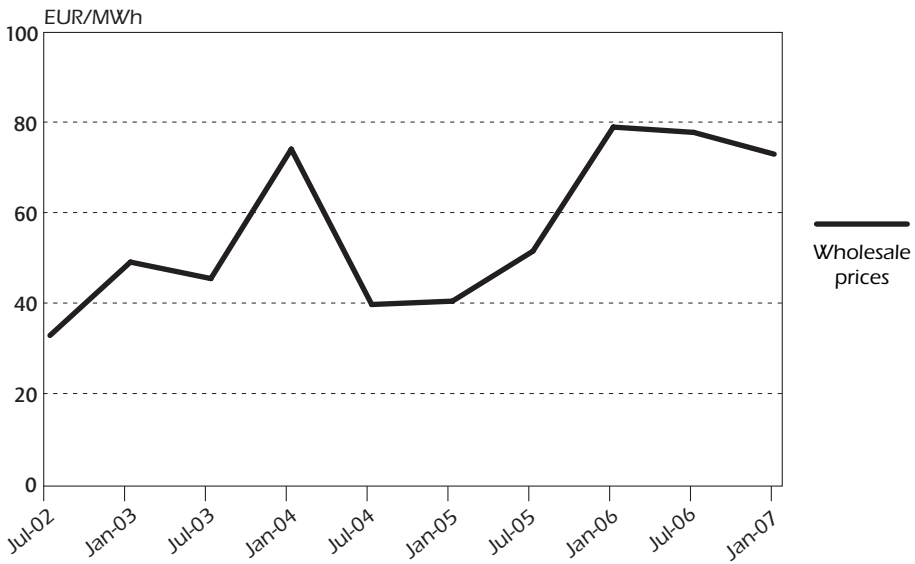
PRICES AND TARIFFS

WHOLESALE PRICES

The wholesale energy market does not have any price caps or floors. Figure 18 shows half-yearly OTC wholesale prices since 2002. Wholesale power prices have risen steeply since 2004, peaking in early 2006. Figure 19 shows average prices from APX, the power exchange. The general price level has been increasing since 2002, though average annual prices dropped in 2004 and 2007.

Figure 18

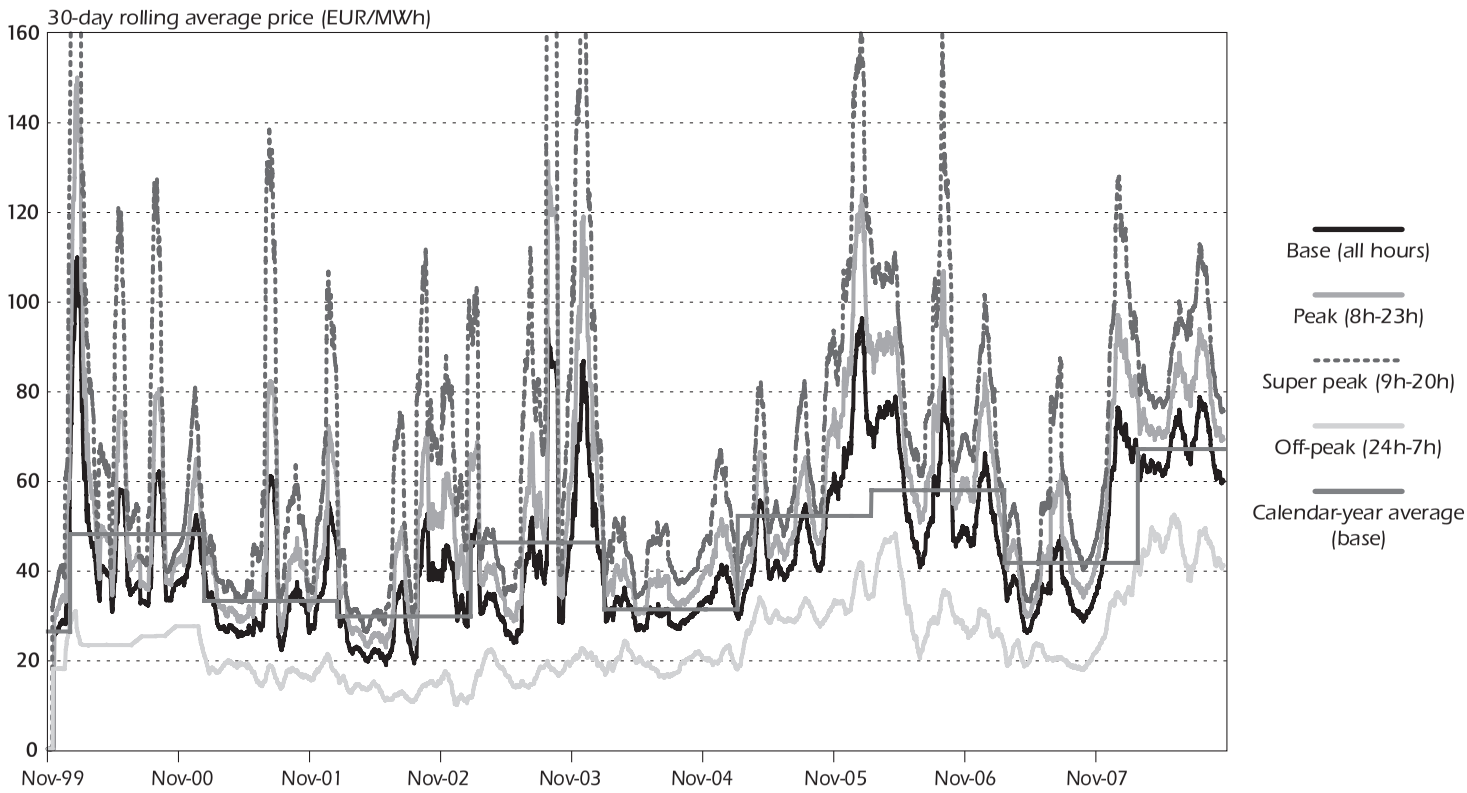
Average Half-Yearly OTC Wholesale Prices, 2002 to 2007



Source: Country submission.

Figure 19

APX Power Prices, 1999 to 2007



Source: APX Group.

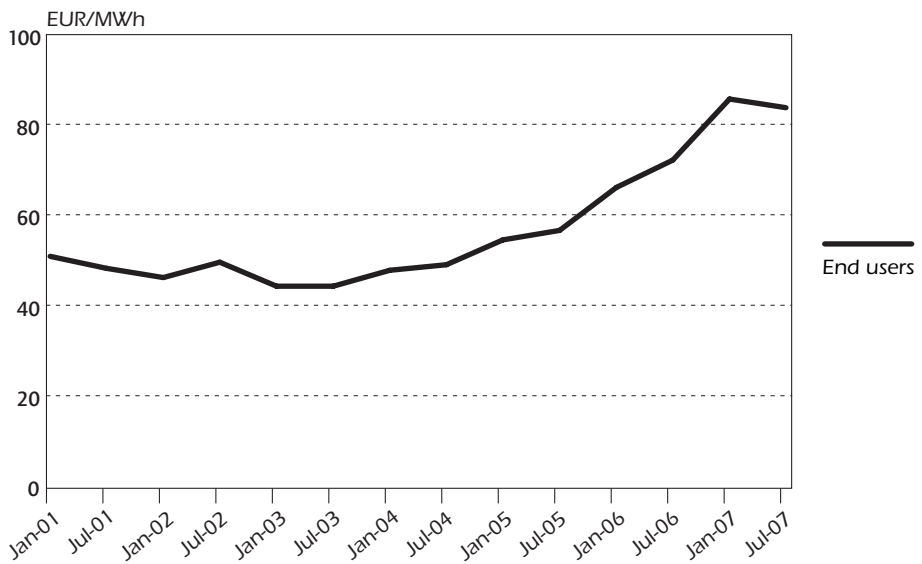
RETAIL PRICES AND TARIFFS

On the retail side, a so-called safety net exists; the national regulator has the statutory task to see that prices charged to consumers are reasonable. All retail tariffs must be approved in advance by the regulator. If a tariff is found to be unreasonable, the regulator can impose a tariff on the supplier. This has never been necessary.

Figure 20 shows retail prices to end-use customers since 2001. As with wholesale prices, retail prices have exhibited a relatively steady increase since 2004, though there is a lag; prices did not peak for residential customers until 2007.

Figure 20

Average Half-Yearly End-User Prices, 2001 to 2007



Source: Country submission.

CRITIQUE

The IEA praises the Netherlands for the work done to date to develop a competitive, liquid electricity market. An independent regulator is in place. Regulated third-party access has been established. The ownership of the grid operator is unbundled from the other, competitive parts of the supply chain. The government is also active in further developing physical and market interconnections with its neighbours – understanding that integration will improve the competitive environment and bring with it the full benefits of liberalisation. The government and the regulator are actively tackling the

market's remaining challenges, recognising that market reform is a process and not an event. In the spirit of building on this sound foundation and commitment to continued improvement, the IEA offers a few recommendations and observations.

Government forecasts show that the shares of gas, biomass and wind in electricity generation are expected to decline dramatically and the share of coal to grow between now and 2030, if the government does not put in place active policies, especially after 2020. This highlights the need for an effective long-term energy policy. The sharp increase in coal use could be counter-productive given the country's ambitious climate change agenda. For both outcomes to be met simultaneously – increases in CO_2-rich fuels and declines in CO_2 emissions – carbon capture and storage (CCS) technologies would need to be widely deployed. While a promising technology, it is still under development and the ability to deploy it widely and successfully is not assured. The government should ensure that long-term planning for the electricity fuel mix does not rely solely on one technology.

While the wholesale market is functioning reasonably well, the lack of competition in the retail market is an area of concern. Customer switching rates are relatively low. To enhance competition – both by lowering barriers to entry and by facilitating expansion – a new market model is being developed that will give responsibility for managing the switching procedure to the retail supplier, taking it away from the grid operator. The intention is to give the retail suppliers the right incentives to make switching occur more quickly and more smoothly. The IEA commends the government for tackling this issue with a novel solution. The government should continue to monitor this new mechanism, paying close attention to any anti-competitive effects of a retail supplier – particularly a large incumbent – having sole access to customer data until a customer has switched supplier. There may also be room to improve the current requirement that retail prices be approved in advance by the regulator. This inhibits development of innovative demand-side contracts and solutions – solutions that can help ensure security of supply.

It is positive that the government is moving forward with large-scale roll-out of smart meters. The IEA encourages cost-effective introduction of this technology, as it will allow the demand side of the market to participate directly, which can be the best means to counter any market power, reduce peak demand, lower prices and enhance energy security. Finally, the government and regulator should continue their work to develop a more transparent, cost-reflective billing system.

Siting and permitting for new electricity infrastructure is a thorny task in all countries. Local regulations and powers, maritime law, regional planning processes, safety regulations – all of these aspects should be addressed in democratic societies. Like other countries, the Netherlands sees the need to streamline the overall siting and permitting process. The IEA urges the

government to make this a priority, and to continue to engage the public in a dialogue that highlights the competing needs of energy security, environmental quality and sustainability, economic efficiency and personal demands for particular standards of living.

Grid planning in the Netherlands, as elsewhere, requires active co-ordination at the regional, national and international levels. There should also be particular attention paid to ensuring that one actor or entity – perhaps the regulator – has the right incentives to and responsibility for ensuring that grid planning is consistent and co-ordinated. Activities undertaken by different actors – transmission or distribution grid operators – can deviate from their intentions if they are not implemented in a co-ordinated and transparent manner. To that end, the IEA is pleased to see the medium- to long-term grid planning requirements in place, and urges the government to ensure they are well integrated with the distribution level as well.

With respect to developing enhanced cross-border grid capacity, the Netherlands should continue to support solutions that bring harmonisation of regulatory and rate policy, as well as greater co-ordination of long-term grid planning. One area of concern, however, is the relatively short planning horizon used by TenneT, the grid operator, for domestic transmission upgrades and expansion – just seven years. As noted by TenneT and others, expansion of the high-voltage network infrastructure is a very lengthy process, often lasting more than a decade. The IEA encourages the government to expand the planning horizon that TenneT uses, to at least ten or fifteen years.

Grid infrastructure is the backbone of an effective, competitive electricity market. There is an ongoing debate about proper investment incentives. Should approval for big projects come *ex post* when their economics can be reviewed or should it come *ex ante* to give investors the necessary security to make the large capital investment? There is no silver bullet to solve this dilemma. However, there is room – as the Dutch government seems to be considering – to allow for *ex ante* approval, perhaps for only a subset of an investment, for large projects deemed necessary by the regulator and undertaken by independent grid companies. The IEA encourages the government to explore this possibility fully and give objective guidance to the regulator in the form of clear regulations.

RECOMMENDATIONS

The government of the Netherlands should:

- *Monitor closely the new market model to improve competition in the retail electricity market and modify it if necessary. Develop a transparent, cost-reflective billing system for retail customers.*

- *Continue to evaluate long-term electricity supply and demand scenarios, with a view to decarbonising the generation mix and ensuring that it is consistent with both overall climate goals and realistic future technology options.*
- *Continue to enhance the regulatory framework to facilitate demand response for all customers, such as through the cost-effective roll-out of smart metering.*
- *Ensure the regulator has sufficient expertise and resources to review regional, national and international grid planning – both at the transmission and distribution levels – in an integrated and consistent manner.*
- *Continue work to streamline the siting and permitting of new electricity infrastructure through collaboration with all relevant authorities.*
- *Consider lengthening the grid planning time horizon used by TenneT, the network operator, to at least ten or fifteen years.*
- *Continue to take a leadership role in the international dialogue to develop a regional European grid, including increased interconnection capacity where necessary and improved market-based cross-border allocation mechanisms.*
- *Keep evaluating the need for* ex ante *approval of some large-scale infrastructure investments from independent grid companies.*

The Netherlands has set ambitious targets for renewables in its overall energy mix, with a goal for them to make up 20% of total energy supply by 2020. Given that renewables account for just 2.8% of total energy supply in 2007, this is a challenging goal to meet. To work towards it, the government has recently revised its primary promotion scheme for renewable energy. The previous scheme was halted in 2006 and the new one, which took effect in April 2008, provides a guaranteed floor price to generators, paid for partly by revenue from the electricity market, with any shortfall covered by a dedicated government fund. Unlike the previous scheme, annual expenditures per technology are capped.

SUPPLY-DEMAND BALANCE

PRIMARY ENERGY SUPPLY

Renewables provided 2.8 % of total primary energy supply (TPES) in 2007, an increase of almost 85% from 2000 (see Table 12). The lion's share – more than 85% – comes from biomass, mainly co-firing in coal plants, with smaller volumes used in small combined heat and power plants (CHP). Wind provides almost 13% of renewables-based supply. Very small shares currently come from solar and hydro. Starting from low levels, supplies from wind and solar photovoltaics (PV) have been growing quickly since 2000 – more than quadrupling. Compared to the 28 IEA member countries, the Netherlands has the sixth-lowest share of renewables in its TPES (see Figure 21), partly explained by the lack of large-scale hydro in the country.

ELECTRICITY GENERATION

As demonstrated in Figure 15 in Chapter 6, nearly 9% of Dutch electricity production came from renewables and waste in 2007, with the absolute amount being two times higher than in 2000. Generation from renewables is roughly split between biomass, mostly co-fired in coal plants, and wind generation. Hydro and solar PV provide negligible amounts of power, though the amount of solar PV is increasing rapidly. Wind has quadrupled since 2000. In 2006, the Netherlands had the ninth-lowest share of renewables in its electricity sector of all 28 IEA countries (see Figure 22), largely owing to its relatively small share of hydro in the overall fuel mix. However, the country had the eighth-largest share of wind of IEA countries and the fourth-highest share of biomass.

Table 12

TPES from Renewable Energy, 1970 to 2007

Unit: ktoe	*Biomass**	*Wind*	*Solar thermal*	*Hydro*	*Solar PV*	*All renewables*	*All energy sources*
1970	0.0	0.0	0.0	0.0	0.0	0.0	49 640.0
1980	227.0	0.0	0.0	0.0	0.0	227.0	65 285.2
1990	710.7	4.8	2.1	7.3	0.0	725.0	67 121.6
2000	1 159.1	71.3	10.9	12.2	0.7	1 254.2	76 404.2
2001	1 229.7	71.0	12.6	10.1	1.1	1 324.4	78 516.1
2002	1 354.6	81.4	14.4	9.5	1.5	1 461.3	79 113.3
2003	1 275.5	113.3	15.9	6.2	2.7	1 413.7	81 413.9
2004	1 485.6	160.6	17.6	8.2	2.8	1 674.8	82 661.4
2005	1 904.0	177.8	18.8	7.6	2.9	2 111.0	82 381.2
2006	1 968.0	235.0	19.4	9.1	3.0	2 234.6	80 115.7
2007**	1 980.4	295.6	20.4	9.4	3.1	2 308.9	83 233.3
Share of renewables-based supply (2007**), %	85.8	12.8	0.9	0.4	0.1	–	–
Share of total TPES (2007**), %	2.4	0.4	0.0	0.0%	0.0	2.8	–
Growth (2000-2007**), %	70.9	314.6	87.1	–23.2	350.0	84.1	8.9

* excludes industrial and non-renewable municipal waste.

** 2007 data are estimated.

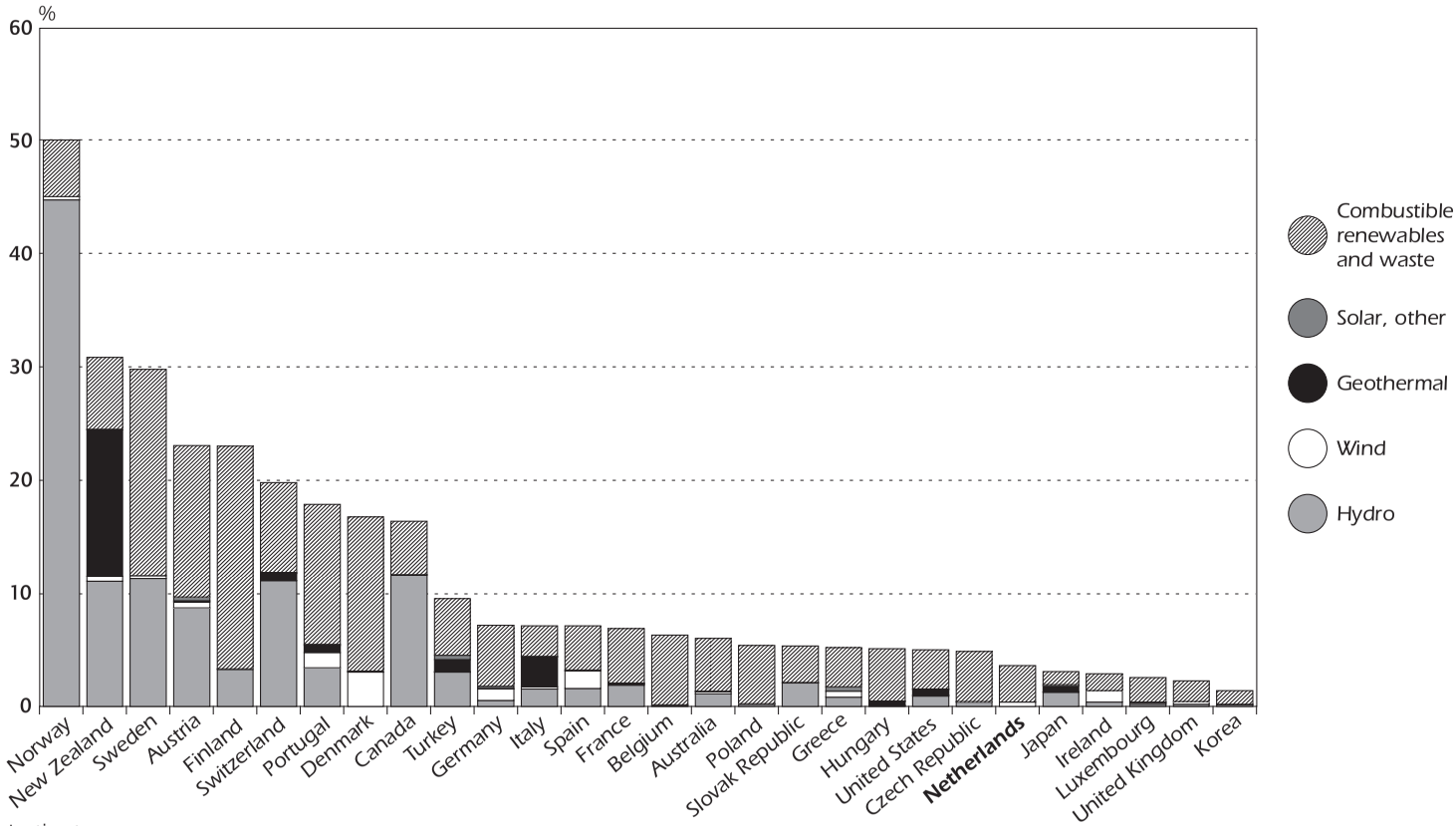
Source: *Energy Balances of OECD Countries,* IEA/OECD Paris, 2008.

TRANSPORT

In 2006, about 0.4% of road consumption came from biofuels, the fourteenth-highest share in the IEA. Preliminary data of the Dutch Statistics Organisation (CBS) show a strong increase in biofuels between 2006 and 2007– to up to 2% of total fuel consumption in road transport.

Figure 21

Renewable Energy as a Percentage of Total Primary Energy Supply in IEA Member Countries, 2007*

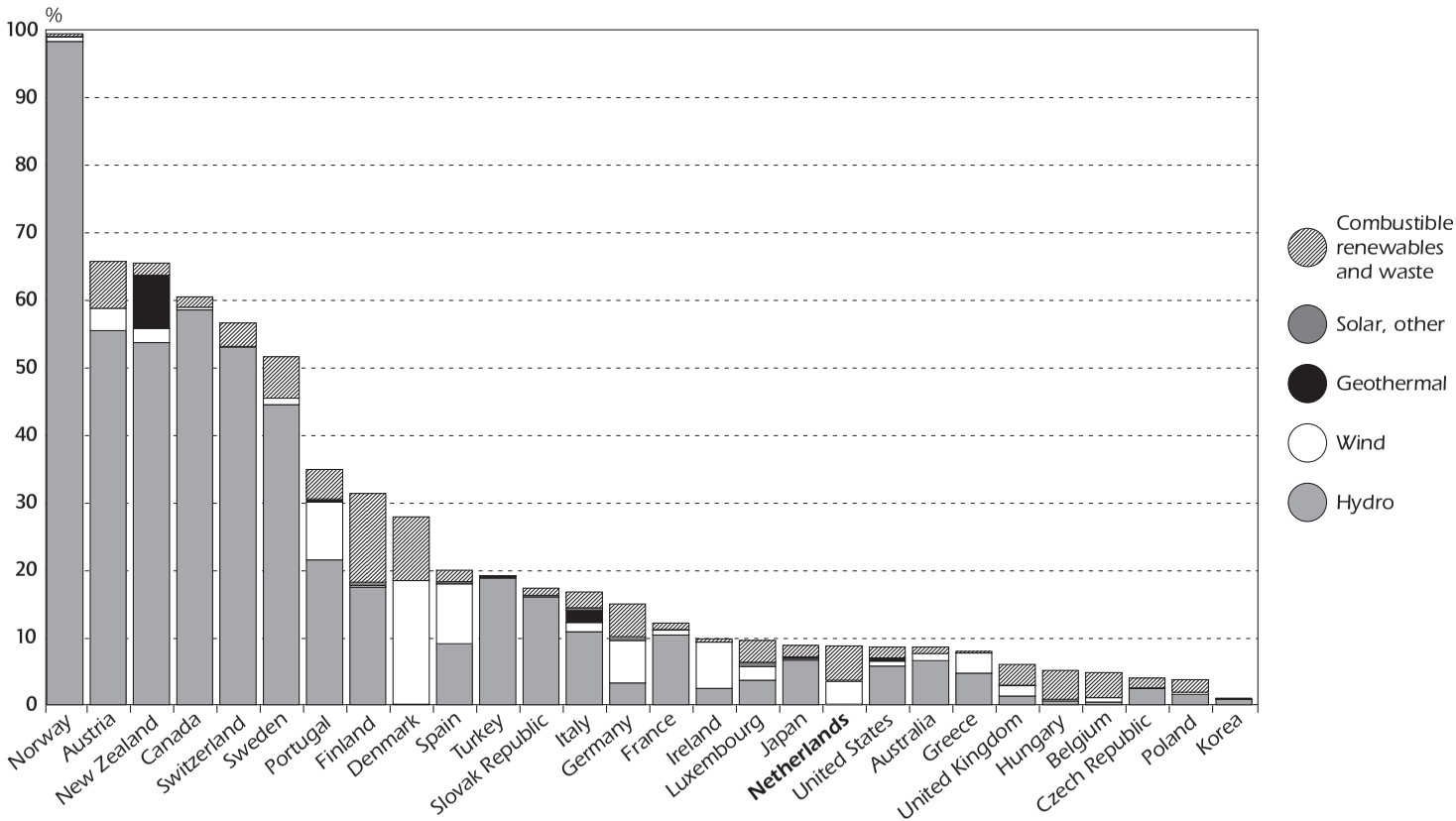


*estimates.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2008.

Figure 22

Electricity Generation from Renewable Energy as a Percentage of All Generation in IEA Member Countries, 2007*



*estimates.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2008.

Table 13

Electricity Generation from Renewables, 1970 to 2007

Unit: GWh	*Biomass**	*Wind*	*Hydro*	*Solar PV*	*All renewables*	*All energy sources*
1970	0	0	0	0	0	40 858
1980	1 024	0	0	0	1 024	64 806
1990	660	56	85	0	801	71 938
2000	2 015	829	142	8	2 994	89 652
2001	2 358	825	117	13	3 313	93 781
2002	2 905	946	110	17	3 978	96 065
2003	2 548	1 318	72	31	3 969	96 763
2004	3 325	1 867	95	33	5 320	100 770
2005	5 276	2 067	88	34	7 465	100 219
2006	5 195	2 733	106	35	8 069	98 393
2007**	3 907	3 437	109	36	7 489	103 395
Share of renewables-based electricity (2007**), %	52.2	45.9	1.5	0.5	–	–
Share of total TPES (2007**), %	3.8	3.3	0.1	0.0	7.2	–
Growth (2000-2007**), %	93.9	314.6	–23.2	350.0	150.1	15.3

* excludes industrial and non-renewable municipal waste.

** 2007 data are estimated.

Sources: *Renewables Information,* IEA/OECD Paris, 2008 and country submission.

POLICIES AND MEASURES

A varied set of policies and measures are in place to help the Netherlands achieve its renewables targets for 2020. Many of these policies and measures are outlined as part of the overall climate strategy in Chapter 3, and investment incentives are described in Chapter 2. This chapter focuses mainly on two key policies to promote renewables – a premium scheme for renewable electricity and heat, and a mixing obligation for biofuels in the transport sector.

TARGETS AND OBJECTIVES

Under its Clean & Efficient programme, the Dutch government has set a goal for renewables to provide 20% of total energy supply by 2020. This goes further than the proposed national target of 14% renewables in total energy consumption by 2020 under the overall EU target of 20%. These EU targets, and a specific binding target of 10% biofuels in the transport sector by 2020, were proposed by the EU Commission in January 2008, and at the time of writing (November 2008), they were still pending revision and final adoption by the EU member states and the European Parliament. The Energy Research Centre of the Netherlands (ECN) has evaluated the country's ability to reach the overall 20% target. It has concluded that renewable energy can meet just over 17% of total energy supply, under the assumption that biofuels account for 20% of total fuel use and that approximately 35% of electricity is renewables-based.

ELECTRICITY AND HEAT

The previous support scheme in place for renewable electricity generation was MEP (*milieukwaliteit van elektriciteitsproductie,* environmental quality of electricity production), which came into force in July 2003 and ran until August 2006. MEP subsidised costs for renewable electricity generators through a premium on top of the electricity price for the extra "green" costs of renewable generation. In effect, MEP functioned as a differentiated premium scheme; producers were provided a fixed subsidy per kilowatt-hour, depending on technology, which was earned on top of the revenue earned for the sale of the electricity in the wholesale market. To equalise promotion across technologies, the government set the premium by estimating the difference between the production cost of the renewable energy technology and the average selling price of power generated from fossil fuels.

The subsidies in 2006 ranged from a low of 1.3 eurocents per kWh for landfill gas and digestion to 9.7 eurocents per kWh for offshore wind, solar PV, small biomass, hydro and wave power. Onshore wind, large biomass and mixed biomass received premiums between these rates. Only installations established after 1 January 1996 were eligible. The premium was paid for all electricity produced by eligible installations for ten years. While new rates were established by the government each year to take into account expected cost reductions for renewables, particular installations received constant premiums based on the rate in place when the installation was accepted into the scheme.

Financial support was divided between new renewable energy technologies and CHP (including CHP fired by biomass). The scheme was financed by an annual levy on all connections to the electricity grid in the Netherlands, collected by distribution system operators and transferred to the TSO. On 18 August 2007, the Dutch government decided to suspend the programme and stop granting aid for new projects on the basis that the goal of the scheme had been met (9% of renewable electricity generation in 2010). The scheme did not have a financial or capacity cap; all projects that met the requirements were eligible to be subsidised under the scheme.

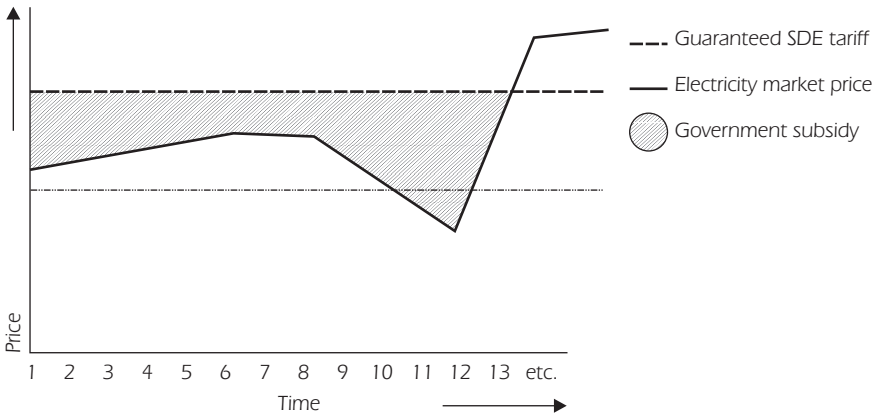
Following suspension of MEP, a new scheme was developed; SDE (*stimulering duurzame energieproductie,* stimulation of sustainable energy production) was introduced in April 2008. The new scheme covers a smaller subset of technologies, with hydro and some biomass excluded, but it is expanded beyond electricity, with biogas production included. Owing to concerns about the sustainability of biomass production, as well as the impact of biomass promotion on food and other prices, the government has decided to introduce sustainability criteria, in co-operation with the European Commission.

The new scheme is a "modified feed-in tariff" scheme rather than a premium scheme.[25] A fixed subsidy is guaranteed, as in a feed-in tariff, with an option for a higher price per kWh if the electricity price goes above the subsidy ceiling. In effect, renewable electricity generators are guaranteed a certain price per kWh. If the electricity price is below that ceiling, then the generators are paid the difference by the government. If the market price is at or above the ceiling, the generator receives no government subsidy. In short, the subsidy itself has a ceiling and the price paid to generators has a floor; generators can only be paid above the subsidy ceiling if the electricity price goes above the ceiling. Figure 23 provides a schematic of the SDE's modified feed-in tariff scheme.

25. With traditional premium schemes, generators receive a fixed premium above the electricity price; the premium does not vary according to the electricity price or other factors. With traditional feed-in tariffs, generators are paid a fixed rate; the electricity market price does not factor into the feed-in tariff rate once the rate has been set. Under SDE, generators are paid a fixed minimum price, as in a feed-in tariff. They get more if the market price is above this minimum rate. The scheme only resembles a premium system if and when the market electricity price goes below the minimum price. In this case, the subsidy covers the difference. For this reason, the scheme is referred to in this report as a modified feed-in tariff.

Figure 23

Variability of SDE Subsidy According to Electricity Market Price



Source: Country submission.

Table 14 provides an overview of how the government subsidy is calculated, including an estimate of the subsidies given to each technology in 2008. As the subsidies are based on actual market prices, actual subsidies are likely to be different from those presented in column 3 of Table 14.[26] The government plans to re-evaluate the subsidy calculation each year in light of changes to renewable electricity production costs and other factors, so subsidy estimates for future years are not available. In 2008 and 2009 there will be no subsidy for offshore wind. The first tender will be in 2010.

The funding structure and details differ between MEP and SDE in two key ways. First, in SDE, annual expenditures are capped by technology. Table 15 provides a breakdown of the capacity and expenditure cap by technology. The final column shows the annual expenditure maximum, which includes expenditures for projects begun from 2008 to 2011. In other words, while it does not include expenditures from MEP, it is not only a cap for projects begun in that particular year, but an aggregate cap for all years. The second key difference in the funding structure is that MEP had been funded mainly by an annual levy on grid connections, whereas SDE is fully financed by direct government support.

26. The subsidy is paid in advance on the basis of an estimation of the electricity price in the next year, which is afterwards corrected for the effective (annual and average) electricity price.

Table 14

SDE Categories and Expected Subsidies in 2008

Government estimate of...		*Base price ...the costs to generate 1 unit (kWh or Nm³) from the technology*	*Correction factor ...expected income from the sale of electricity or gas in the market*	*Subsidy ...what it will pay generators in 2008 (base price – correction factor)*
Wind on land	EUR/kWh	0.088	0.06	0.028
Offshore wind	EUR/kWh	Undecided*	Undecided*	Undecided*
Electricity generation from sewage-sourced biogas and waste water installations and dumps	EUR/kWh	0.058	0.067	0.00**
Biogas from sewage and waste water installations and dumps	EUR/Nm³	0.277	0.21	0.07
Waste incineration with an energy efficiency of at least 22% (higher efficiencies = higher subsidies)	EUR/kWh	0.067	0.067	0.00**
Biomass CHP, co-digestion of waste from the food industry and manure	EUR/kWh	0.12	0.067	0.053
Small-scale solar PV (0.6 kW_p-3.5 kW_p)	EUR/kWh	0.564	0.234***	0.33

* First tentative calculations for offshore wind will be published in February 2009. Final decision expected between September and November 2009.

** The subsidy for these categories is expected to be zero as the wholesale market price in 2008 is expected to be higher than the estimated cost of the technology.

*** The expected correction factor for solar PV is higher than for other categories because the electricity price for end-use customers (23.4 eurocents/kWh) is used, whereas in other categories the wholesale electricity price is used.

Source: Country submission.

Table 15

SDE Budget and Maximum Capacity by Category, 2008 to 2011

	Installed power in 2008 (MW)	*Estimate of new power to be committed through SDE (MW)**				*Annual expenditure cap for new power (2008-2011)***
		2008	*2009*	*2010*	*2011*	*EUR million*
Wind on land	2 000	500	600	450	520	129
Offshore wind	228	0	200	0	250	119
Electricity generation from sewage-sourced biogas and waste water installations and dumps	62	8	8	7	7	0
Biogas from sewage and waste water installations and dumps	0	5	0	5	0	1
Waste incineration with an energy efficiency of at least 22% (higher efficiencies = higher subsidies)	429	70	60	30	0	0
Biomass CHP, co-digestion of waste from the food industry and manure	152	40	40	40	40	68
Small-scale solar PV (0.6 kWp-3.5 kWp)	52	10	15	20	25	19
Total						**336**

* These are government projections of new capacity to be installed in 2008-2011 given the available budget.

**This is in addition to expenditures being paid under the old MEP regime (approximately EUR 700 million in 2007).

Source: Country submission.

TRANSPORT[27]

Under the EU Directive 2003/30/EC, the Netherlands has an indicative (*i.e.* non-binding) target to provide 5.75% of road transport fuels from renewable sources by 2010. To reach this objective, the government has implemented a number of measures. In 2006, a tax incentive – a reduction in excise duty – was introduced for mixing 2% biofuels (bioethanol, biodiesel or bioETBE[28]) with conventional fuels. In 2006, biofuels – mixed or unmixed – and other renewables accounted for 0.3% of the road fuel market.

27. This section is based on the Netherlands' submission to the European Commission: *Report for 2007 under Article 4(1) of Directive 2003/30/EC on the Promotion of the Use of Biofuels or Other Renewable Fuels for Transport.*
28. ETBE: ethyl-tertio-butyl-ether.

At the end of 2006, the Dutch Cabinet earmarked EUR 60 million in grants for projects in the field of innovative biofuels. This scheme has been extended to run until 2010. Companies that intend to invest in projects focussing on innovative or improved production of biofuels for transport and will incur extra costs for reducing CO_2 emissions may qualify for grants. Besides investment projects, the programme also supports projects for applications or uses that reduce CO_2 emissions in transport.

In 2007, the government issued a decree on biofuels in road transport. This decree obliged oil companies and traders to deliver 2% (in terms of energy value) of their petrol and diesel sales in the Netherlands in the form of biofuels. According to formal reports by oil companies and traders to the Dutch government, biofuels and other renewable fuels accounted for 2% of total road transport fuels in 2007.

CRITIQUE

While the share of renewables today is relatively low compared to most European countries, the Netherlands has set a very ambitious and challenging goal of 20% renewables in primary energy supply by 2020 – a goal that, if met, will support a long-term renewables market in Europe and internationally. The introduction of renewables is generally well thought through by the government, and will be carried out step by step with continued evaluations and ongoing development of appropriate instruments. The strategy is complex and involves several ministries, but efforts have been made to create an efficient decision-making process.

The government recognises that several uncertain factors influence the ability to reach the country's goal. These vary from factors mostly out of the control of the government, such as the pace at which technologies become economically viable, to others on which the government has a significant influence. For example, deployment of offshore wind power – one of the most promising technologies in the Netherlands – is to a large extent in the hands of public authorities. Extensive and timely efforts are needed by several ministries and institutions. First, the government needs to come to a decision on the modified feed-in tariff rate provided to offshore wind. It will entail extensive dialogue with maritime, local and other authorities over siting, permitting, water access and many other areas. Successful deployment of offshore wind will also require putting in place a clear policy that details who pays the costs of grid interconnections. It is a challenging task, but if the government intends to achieve its goals for offshore wind deployment, it will need to settle these issues as quickly as possible, which will require making the issue a government priority.

The government must also create a stable and long-term framework for renewables support in order to underpin investment by the industry. The

private sector needs to be sure which support scheme will be in place to properly conduct investment planning. Learning from the mistakes of its previous differentiated premium scheme, MEP, which abruptly stopped in 2006 having achieved short-term capacity targets, the government is now working to provide the stability that is necessary – and the IEA applauds this effort as stop-stop policies severely undermine private-sector investment and technology development. However, there are concerns that the financing structure of the new modified feed-in tariff scheme, SDE, will not enhance long-term stability of the policy. As currently designed, subsidies guaranteed to generators of renewable electricity come from dedicated government budgets, not from taxes or levies that, once established, are more independent from the political process. In general, other countries try to insulate funding for renewables promotion from the political process by sourcing it from additions to the electricity price. This is also more economically rational, as smaller users of electricity contribute less to the cost of renewables promotion while larger users contribute more, in line with their impact on the system.

In addition, the new plan calls for the government to re-evaluate the subsidy calculation annually, thus revising and setting the modified feed-in tariff only one year in advance of when a project is commissioned. This does not provide sufficient lead time for long-term planning by investors in renewables. There are also concerns that it leaves open a risk for undue outside influence because the feed-in rates are decided so frequently. The government should consider putting in place a rate schedule with predetermined declination rates, while certainly continuing to analyse the system to ensure that it is working properly and that the government is not overpaying for renewables.

As the European Union comes closer to its 2020 goal of 20% renewables in final energy demand, and as the continental electricity market continues to become more integrated across countries, the various renewables markets will also need to become more integrated. If this does not occur, large inefficiencies can emerge as a result of severe market fragmentation – both between the different renewables promotion schemes of various countries and between the "regular" electricity market and the renewables electricity market. The IEA urges the government to develop a clear medium-term plan – if possible in close co-operation with neighbouring countries – to integrate the new modified feed-in tariff scheme into a more market-based system, particularly for more mature technologies. If the Netherlands meets its very ambitious goal, renewable electricity will be a sizeable share of the overall Dutch electricity market. Completely segmenting it from the market will reduce the competitiveness and liquidity of the electricity market, reduce the effectiveness of the EU-ETS to have its price signal run through the economy, inhibit market development of technologies and could raise overall costs. Governments need to actively discuss how to introduce, in a clear and coherent manner, an integrated market-based system across Europe. Ideally, this would result in a clear timeline to move from the modified feed-in tariff scheme to

a market-based system that integrates renewables with the electricity system and allows integration of Dutch renewables with the evolving European market.

Achieving the ambitious renewables target will require substantial investment in grid upgrades and expansions. The government should continue working to ensure that this required investment occurs in a timely manner, at adequate levels and in the right locations.

Turning to biomass, as in a number of IEA countries, there are fears that the use of biofuels for energy purposes using existing technologies in some cases may not be possible and that its expanded use would require imports that are produced in unsustainable ways. Furthermore, there are questions about the impact of greater consumption of biofuels on domestic and international food markets because of growing demand for crops like corn or sugar cane. Nevertheless, the potential benefits of biofuels – reduced CO_2 emissions, reduced oil imports, greater supply diversity, greater energy import diversity – merit their continued analysis, particularly with respect to second-generation biofuels.

RECOMMENDATIONS

The government of the Netherlands should:

- *Clarify responsibility among government ministries and agencies and implement an integrated planning process in a timely manner so that the private sector can make investments in renewables, especially offshore wind.*
- *Consider developing a support mechanism for the modified feed-in tariff scheme, or any other scheme, that is financed independently from the public budget.*
- *Move from a modified feed-in tariff for each technology that is developed on an annual basis only one year in advance towards a system where the tariff rates are set further in advance in order to provide more long-term investor stability.*
- *Develop a plan for the longer term to move towards a market-based renewables promotion scheme that allows integration of renewables with the evolving electricity market – and thus the CO_2 price signal imposed through the EU-ETS – and Dutch renewables with the European renewables sector.*
- *Analyse further the potential for cost-effective and sustainable production, import and use of biomass in electricity and biofuels in transport, with a view to second-generation bioenergy.*

Nuclear plays a small but steady part in Dutch energy supply, with the Borssele plant providing about 4% of the country's electricity. Originally slated to close in 2013, an agreement was reached in 2006 to extend the plant's lifetime to 2033. Discussion and analysis is ongoing regarding expansion of nuclear generation in years to come, although the coalition agreement of the present government rules out building any new nuclear plant before 2011.

OVERVIEW

The Netherlands has a small, but long-standing, nuclear programme. There is a single operating pressurised water reactor (PWR) at Borssele in Zeeland, with a capacity of 482 megawatts of electric capacity (MW_e) built by Siemens. The plant achieved a capacity factor of over 94% in 2007, providing about 4.1% of the country's total electricity. In addition, approximately 5% of Dutch electricity supply is provided by imported nuclear electricity.

Borssele has been in operation since 1973 and, following a government decision in 2002, was expected to close in 2013, at the end of its original design lifetime. However, in 2006 the government reached an agreement with Borssele's operator, EPZ, and the utilities Essent and Delta (each holding 50% of EPZ), which will allow the plant to remain in operation until 2033, provided that it continues to meet high safety and operating standards. Under this agreement, Essent and Delta agreed to make additional reductions in their carbon dioxide emissions and to provide EUR 250 million for sustainable energy research. The agreement has been approved by Parliament.

NUCLEAR POLICY

With the future of the Borssele plant apparently settled, the possibility of future expansion of nuclear capacity is now being discussed. The present debate is about whether to keep open the option of expanding nuclear capacity, or to rule out any new nuclear capacity until at least 2030. Given that it is expected to take up to 15 years from the decision to build a new nuclear plant to the start of electricity generation, initial steps will need to be taken in the next few years if additional nuclear capacity is to be in operation by about 2025.

A fact-finding study carried out by the Energy Research Centre of the Netherlands (ECN) found that nuclear power expansion could make a

significant contribution to meeting greenhouse gas emissions targets in a cost-effective manner, as well as to increasing the diversity of electricity supply sources. In 2006, the government asked two advisory bodies, the General Energy Council (AER) and the Social and Economic Council (SER), to consider and report on the future energy mix. AER and SER produced their reports in early 2008. Both organisations found that, under certain conditions, nuclear could have a role to play in meeting policy objectives on greenhouse gas emissions, security of supply and energy affordability. They recommended that nuclear policy be further considered as part of a planned 2010 review of energy and climate change policy.

Under the *Energy Report 2008*, the government does not specifically call for or reject new nuclear power plants, but rules out any decision being taken on nuclear during the current government (scheduled to end in 2011).

The government has proposed some revisions to the Nuclear Energy Act. These would make the Ministry of Housing, Spatial Planning and the Environment (VROM) the sole licensing authority and set a 40-year limit on the duration of licences. They would also set requirements for the financing of decommissioning, and allow the government to decide on whether spent fuel should continue to be reprocessed. However, Parliament has not yet debated these proposed amendments.

NUCLEAR FUEL CYCLE AND RADIOACTIVE WASTE

The principal fuel cycle activity in the Netherlands is enrichment. With Germany and the United Kingdom, the country is a one-third partner in Urenco, one of the leading enrichment companies worldwide. In the Netherlands, Urenco operates a large plant at Almelo in Overijssel. Along with other Urenco plants, the Almelo operation is being expanded. Urenco was recently granted an increase in licensed capacity from 3 700 to 4 500 thousand separative work units; actual capacity will be expanded gradually up to the new limit over the next several years. Urenco supplies enrichment services to around 40 utilities in some 17 countries in Europe, North America and East Asia.

The main operations of the Enrichment Technology Company (ETC), a 50:50 joint-venture established in 2006 between Urenco and AREVA of France, are also located at Almelo. ETC now manufactures the centrifuges used in all Urenco and AREVA enrichment plants, including new plants in France and the United States, and is also responsible for research and development.

A policy of reprocessing spent nuclear fuel has been in effect since the nuclear programme began, and until 2006 fuel from Borssele was sent to the reprocessing plant of AREVA at La Hague in France. However, changes to the French environmental law in 2006 mean that an amendment to a treaty

between the two countries is needed to continue sending spent fuel to France. This is awaiting approval by the Dutch Parliament. Meanwhile, spent fuel is being temporarily stored at Borssele.

The return of vitrified high-level waste (HLW) from the reprocessing of Dutch spent fuel began in 2004; this is stored in the HABOG[29] facility located at Vlissingen-Oost, close to Borssele. The present capacity of HABOG is sufficient for all the HLW from spent fuel arising from operation of Borssele to 2015. For operation after this date, an extension to HABOG or a new facility will be required, depending on whether the policy of reprocessing is maintained.

A state-owned company, the Central Organisation for Radioactive Waste (COVRA), is responsible for the treatment and storage of all radioactive wastes. It operates the Vlissingen-Oost site, which hosts facilities for the conditioning and storage of low- and intermediate-level wastes, as well as the HABOG facility. Present policy is for all types of waste to be stored for an extended period at Vlissingen-Oost pending final decisions on eventual disposal.

RESEARCH AND DEVELOPMENT

The Netherlands continues to play an active role in nuclear research and development, principally through the Nuclear Research and Consultancy Group (NRG), which is wholly owned by the Energy Research Centre of the Netherlands. The main nuclear research centre, based at Petten in north Holland, carries out work principally in the fields of materials, nuclear safety, nuclear fuel testing, safeguards and nuclear fusion.

The Petten site also hosts the European Commission's Joint Research Centre, which includes a high-flux reactor (HFR) of 45 megawatts of thermal capacity (MW_{th}). Although owned by the EC, since 2005 this has been operated by NRG on a partly commercial basis, raising 35% of its budget through the production of radioisotopes for medical and industrial applications. It is an important supplier of medical isotopes to other European countries.

CRITIQUE

Since the last IEA in-depth review in 2004, the government has reached an agreement with the owners of the Borssele nuclear power plant that should allow the plant to continue to operate until 2033. This is a welcome development that should ensure a small domestic nuclear contribution to energy supply for the medium term, complementing the continuing contribution from imported nuclear power.

29. HABOG: *Hoogradioactief Afval Behandelings- en Opslag Gebouw.*

Although the coalition agreement of the present government rules out building any new nuclear plant before 2011, debate continues within the government on taking preparatory steps for a possible expansion of nuclear capacity after 2020. These would include amending the Nuclear Energy Act and establishing other preconditions for new nuclear development. Maintaining the country's nuclear expertise and research infrastructure will also be important in this regard. The planned 2010 review of energy and climate change policy is expected to be the next major step in the decision-making process. If nuclear is to make an increased contribution to energy supply by 2025, a firm decision to support new nuclear construction will need to be taken soon after the 2010 review.

The Netherlands has a liberalised electricity market. For any expansion of nuclear power to take place, a sound business case would have to be established for the necessary investment by utilities and other investors. Prerequisites for this would include broad political support, stable policy and legal frameworks, and an efficient and predictable licensing process. Achieving these will require the government to promote a national debate on the future role of nuclear power so that a clear and settled policy can be adopted on which investment decisions can be based.

RECOMMENDATIONS

The government of the Netherlands should:

- *Take the necessary steps to allow for the possible expansion of nuclear capacity, given its potentially important role in meeting objectives for emissions reductions, security of energy supply and energy affordability.*
- *Work towards a broad political consensus on the future role of nuclear power and the conditions under which it could make a larger contribution to meeting overall energy and environmental policy goals.*
- *Maintain the country's nuclear expertise and research infrastructure, in particular to support any future nuclear expansion.*

PART III

ENERGY TECHNOLOGY

ENERGY RESEARCH & DEVELOPMENT

Energy R&D funding has been on an upward trend in the Netherlands since 2003 and is set to increase dramatically following the release of an updated Dutch energy strategy (*Energy Report 2008*), building on the framework already in place through the Energy Transition programme and the Innovation Agenda. The increase mainly concerns demonstration projects. In recent years, renewables and energy efficiency have received the largest share of the total energy R&D budget. At present, carbon dioxide capture and storage (CCS) is a new and growing area of public R&D funding.

OVERVIEW

R&D PRIORITIES

Energy has been identified as one of the Netherlands' twelve research themes. In addition to an Energy Research Strategy, the Netherlands has introduced an Energy Transition framework, outlined in Chapter 2. The Energy Transition, with a focus on shorter-term innovation, involves six government ministries and is being led and managed by the inter-ministerial Energy Transition Programme Directorate. This directorate bases its innovation programme and funding requests (approximately EUR 450 million for the duration of the four-year programme) on seven technology platforms, developed primarily by private-sector and research community participants. These platforms, or energy themes, supported the development of the government's Clean & Efficient programme to 2020, its Energy Transition framework to 2050, its Innovation Agenda and the government's recent *Energy Report 2008*. The seven platforms, also called "transition platforms" are:

- *Green raw materials:* production and use of plant-based materials, including biofuels.
- *New gas and clean fossil fuels:* more efficient applications of natural gas and other fossil fuels. The platform also includes the development of synthetic natural gas (SNG), biogas and hydrogen.
- *Sustainable electricity supply:* developing new, clean and reliable sources of electricity, such as offshore wind, solar or biomass-based electricity.
- *Sustainable mobility:* accelerating market deployment of alternative motor fuels, such as natural gas and biofuels, as well as new, environmentally

clean vehicles (for example, hydrogen-powered). Sustainable mobility also focusses on vehicle guidance systems to prevent traffic jams.

- *Chain efficiency:* tackling energy use at the chain level – organising industrial production chains more intelligently.
- *The built environment:* making heating and cooling of buildings more sustainable and climate-neutral. This platform aims at introducing new technologies, including solar heating and underground heat and cold storage.
- *Greenhouses as energy sources:* reducing fossil fuel use in the Dutch greenhouse horticulture sector. As from 2020, this sector intends to practice climate-neutral growing in newly constructed greenhouses. Greenhouses are expected to strongly reduce their use of fossil fuels, to enhance the use of geothermal energy and to become net suppliers of renewables-based heat and electricity.

The Innovation Agenda includes more specific goals, including:

- Two carbon capture and storage demonstration plants in 2020.
- At least 100 000 carbon-neutral dwellings in 2020.
- Reducing energy use in public transport by 20% in 2020.
- Reducing energy use in industrial sectors by 50% in 2030.

Like many smaller countries, the Netherlands directs public R&D funding towards longer-term basic science research, leaving the deployment and commercialisation of energy technology largely to the private sector. In the case of CCS, however, the government is playing a larger role in later-stage deployment and commercialisation.

Generally, the Dutch government carefully evaluates cost-effectiveness of proposed policies before adopting and implementing them. However, it did not take full advantage of the *ex ante* evaluation of the Clean & Efficient programme done by the Energy Research Centre of the Netherlands (ECN). Since the Clean & Efficient programme has institutional, regulatory and technology implications, the country's energy R&D policy would have benefited from a more thorough analytical check-up.

ORGANISATIONAL OVERVIEW

A number of entities are involved in energy R&D programme formulation, funding and implementation. The Dutch government broadly classifies them into three categories: financiers, intermediaries and executors. The key institutions in each of these categories are:

- *Financiers*: the Ministry of Economic Affairs, the Ministry of the Environment and the Ministry of Education and Science. The Ministry of Economic Affairs has primary responsibility for formulating energy R&D policy, though it works in collaboration with the other two ministries.

- *Intermediaries*: SenterNovem, the National Organisation for Scientific Research (*Nederlandse Organisatie voor Wetenschappelijk Onderzoek, or NWO*) and the Technology Foundation STW (*Stichting Technische Wetenschappen*).

- *Executors*: private companies, universities and institutes, including ECN, the Netherlands Organisation for Applied Scientific Research (TNO), the Knowledge Centre for Wind Turbines, Materials and Constructions (WMC), the Foundation for Fundamental Research on Matter (FOM), etc.

The Agency for Energy and the Environment, SenterNovem, is the key intermediary agency for implementing the government policy on energy R&D. The agency works to promote sustainable development and innovation, both within the Netherlands and abroad. It is also the primary energy R&D liaison to international forums, including the EU, the IEA and foreign governments. As described in Chapter 3, SenterNovem also acts as an intermediary between energy users and governing bodies in the implementation of voluntary agreements with industry on energy efficiency.

The Energy Research Centre of the Netherlands (ECN) is the largest research centre in the Netherlands in the field of energy, with about 900 employees. It is financed primarily through national and European government funds. It was classified as a "task institute" by the Wijffels Commission in 2004 and thus its programme is largely determined by policy direction from the Dutch government, though some privately financed research continues to be carried out. In addition to carrying out its own research in house, ECN also partners with outside academic and research institutes in the Netherlands and abroad.

FUNDING

The Ministry of Economic Affairs is the largest financier for energy R&D in the Netherlands, consistently providing around 90% of the total budget in recent years. Figure 24 illustrates the distribution of funds over the various priority areas. In 2005 and 2006, energy efficiency and renewable energy received the greatest amounts of funding.

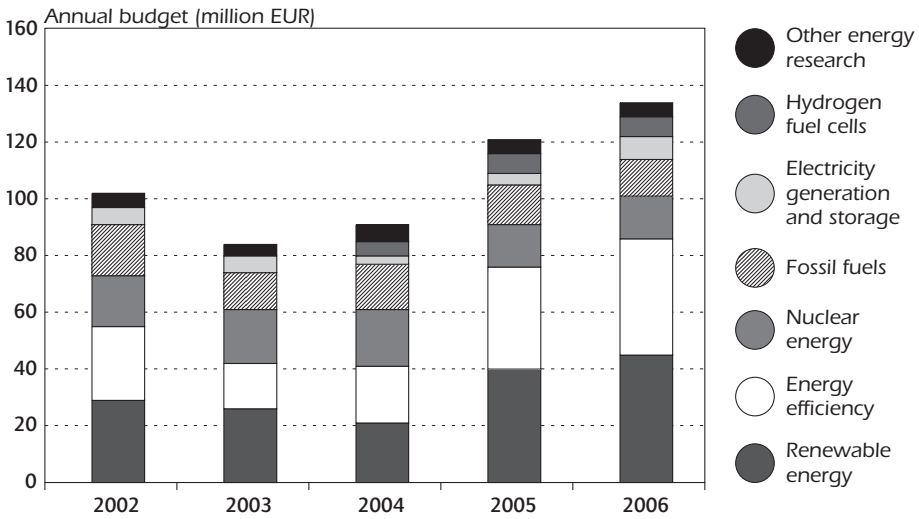
In light of the government's ambitious goals for 2020 (2% annual energy efficiency improvements, 20% renewables in the energy mix and 30% reduction in GHG emissions), the government has increased the annual budget for energy and climate policy. According to the *Energy Report*

2008, the government plans to spend over EUR 900 million on energy innovation (including R&D and demonstration) over the period 2008-2011.

Energy research is conducted by various research and academic institutes, universities and companies. In 2005 and 2006, institutes received nearly 50% of the available public funds for energy research, companies about 40% and universities the remaining 10%.

Figure 24

Energy R&D Funding by Research Area, 2002 to 2006



Source: Country submission.

R&D ACTIVITIES

Under its Clean & Efficient programme, the Netherlands has a number of energy R&D programmes in place on renewable energy and energy efficiency technologies. The Innovation Agenda largely concerns carbon capture and storage. This programme is described in detail below.

CARBON CAPTURE AND STORAGE

The Netherlands presses forward with R&D on carbon capture and storage (CCS). It is working to realise a number of large CCS demonstration projects, with the goal of fully developing the technology for deployment on all new and appropriate existing coal-fired power stations. Chapter 5 describes the Netherlands' CCS policy in more detail.

R&D on CCS and deployment activities are carried out under the national CATO (CO_2 Capture, Transport and Storage) project, which is funded with over EUR 25 million from 2004 to 2008. CATO is co-ordinated by the Utrecht Centre for Energy Research and has 17 industrial and academic partners. Its work includes systems analysis, CO_2 capture, CO_2 storage and outreach. A related programme focussing on the transition to sustainable use of fossil fuels is co-ordinated by Utrecht University and includes system analysis and public opinion surveys. In addition, Dutch research institutes and companies are leading a number of European projects, including RECOPOL, CO_2REMOVE and the European Zero Emissions Technology Platform.

INTERNATIONAL COLLABORATION

International collaboration is a key feature of Dutch energy R&D, both from the perspective of the government policy and the work of Dutch implementing agencies.

The Netherlands is a signatory to 20 IEA energy technology research groups, or Implementing Agreements (IAs). In conformity with their national R&D policies, participation in these international groups concerns energy efficiency (in buildings, electricity, industry and transport) and renewable energy technologies. The Netherlands is also involved in IAs covering greenhouse gas reduction through the efficient use of coal and carbon sequestration, as well as energy technology modelling and energy R&D information exchange.

Since 2005, the Netherlands has been holding regular co-ordination meetings designed to strengthen and align R&D policy between the national actors (Ministry of the Economic Affairs, SenterNovem and ECN) and the international R&D efforts carried out through the IEA Implementing Agreements, the IEA Committee on Energy Research and Technology, its working parties and *ad hoc* groups. SenterNovem currently chairs the IEA *Ad Hoc* Group on R&D Priority Setting.

The Netherlands and SenterNovem participate in eight energy-related European research area networks and ten energy technology platforms, including the ERA-NET[30] activities and Energy Technology Platforms, the EU's Seventh Research Framework Programme (*e.g.* Joint Technology Initiatives on hydrogen), Euratom and the Strategic Energy Plan (SET). SenterNovem is also strong in the ERA-NET-INNER[31], which is an effort to improve linkages

30. ERA-NET is an EU scheme established to step up the co-operation and co-ordination of research activities carried out at national or regional level in the EU member states and associated states through: *i)* the networking and *ii)* the mutual opening of national and regional research programmes.
31. INNER (Innovative Energy Research) is a project aiming to establish co-operation between European national research programmes that stimulate innovative energy research.

between basic science and applied energy research throughout Europe. Strong regional cross-border links are being built, such as with some German *Länder* (regions) on solar, hydrogen and biomass.

The Netherlands also supports – and designs – R&D and deployment initiatives in many other international arenas. One example is the SenterNovem windpower project, implemented under the clean development mechanism. It involves the installation of 22 turbines (25.8 MW of power) at Huitengxile, in the autonomous region of Inner Mongolia in the People's Republic of China. SenterNovem will purchase the emissions reductions generated by this project.

PUBLIC-PRIVATE PARTNERSHIPS

The R&D Promotion Act (Law on the Stimulation of Research and Development, or the WBSO) provides a fiscal incentive for companies, knowledge centres and self-employed persons who perform R&D: technical/scientific research, the development of technologically new physical products or physical production processes, and the development of technologically new software.

In 2005 the total estimated[32] energy R&D investment in the private sector that benefited from fiscal stimulation amounted to EUR 221 million. Nearly two-thirds of that R&D is performed by large industrial companies, with the remainder carried out by small and medium-sized enterprises. A relatively substantial amount of the total private R&D (20%) is performed within the agriculture and mining sectors.

The seven transition platforms listed above are built on public-private partnerships. As described in Figure 25, the government sees its funding for R&D as a leverage for increasing private funding over time.

CRITIQUE

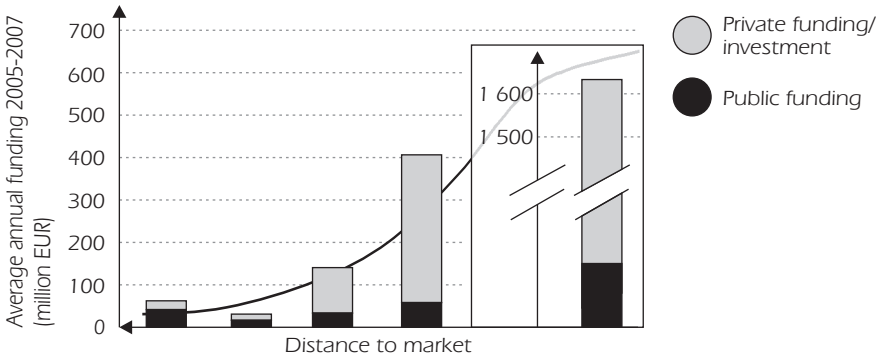
The Netherlands enjoys a strong international reputation for its energy R&D, driven in part by its strong funding record and its history of active international collaboration. Building on this, the IEA is pleased to see that the government is considering additional increases in current R&D funding, as this will support the achievement of its aggressive long-term targets for energy efficiency, greenhouse gas mitigation and renewable energy technology deployment. Government energy R&D funding is directed mostly towards long-term research, leaving the deployment and commercialisation of

32. On the basis of the projected costs of the R&D proposals of the companies benefiting from the fiscal stimulation measure of the WBSO.

technology largely to the private sector. However, to successfully achieve the aggressive sustainability targets, the government may need to engage in more applied, shorter-term research.

Figure 25

Leveraging Public Funding



Long-term R&D	Market-driven R&D	Demo projects	Unique opportunities	**Total**	Energy investment tax rebate
10	10	120	350	**490**	1500
40	10	20	50	**120**	150

Source: SenterNovem.

While cost-effectiveness evaluation is generally a very prominent part of Dutch policy development, the current Clean & Efficient programme did not fully benefit from an analytical check, from ECN in particular, before being released. There is a concern that the government is not taking full advantage of the analytical tools available to it – and may not do so in the future – to assess the effectiveness and coherence of its programmes as well as the institutional, regulatory and technology implications that such analyses can raise. The IEA urges the government to make such analytical checks on its R&D policies an important part of future revisions to the Clean & Efficient programme – and all long-term policy formulations.

Hydrocarbon use will remain high for the foreseeable future in the Netherlands, particularly in electric power generation as well as in other energy-intensive industries. To help address the high levels of CO_2 emissions associated with the combustion of hydrocarbons, carbon dioxide capture and storage has been identified as a priority area for research and international collaboration. This is a positive first step. The Netherlands is well positioned to play a key role in developing this technology given its geology, geography and experience with hydrocarbon exploration and production, and the IEA applauds the Dutch efforts in this area. The government should continue to leverage its R&D efforts by pooling risk, resources and activities with technology partners in other countries.

RECOMMENDATIONS

The government of the Netherlands should:

- *Review, on an ongoing basis, the balance between market-based technology programmes and longer-term R&D in light of pressure to reach shorter-term sustainability targets.*
- *Ensure that the country's technology strategy is consistent with its long-term 2050 energy strategy by conducting proper analysis on the timing and extent of the deployment of potential new technologies.*
- *Continue to contribute to R&D and early demonstration on carbon dioxide capture and storage, and consider extending the support to large-scale demonstration projects.*
- *Continue to enhance international engagement in science and technology, through multilateral partnerships as well as through bilateral arrangements.*

PART IV

ANNEXES

ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The *Shared Goals*, which were adopted by the IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews conducted by the IEA. The *Shared Goals* are set up in Annex C.

REVIEW TEAM

The in-depth review team visited The Hague and Rijswijk from 17 to 21 March 2008. The team met with government officials, energy suppliers, interest groups and various other organisations. This report was drafted on the basis of these meetings, the government response to the IEA energy policy questionnaire and other information. The team is grateful for co-operation and hospitality of the many people it met during the visit. Thanks to their openness and candour, the visit was highly productive and enjoyable. In particular, the team wishes to thank the staff of the Dutch Ministry of Economic Affairs for their professionalism and hard work in preparing and co-ordinating the review process.

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Jolanka Fisher managed the review and drafted the report with the exception of Chapter 8 on Nuclear Power, drafted by Martin Taylor, the section on Climate Change in Chapter 3 which was drafted by Julia Reinaud, and the section on Natural Gas in Chapter 5, which benefited from Ian Cronshaw's and Margarita Pirovska's contributions. Elena Merle-Beral finalised the report and prepared it for publication, with the help of Takatoshi Kano. Monica Petit and Bertrand Sadin prepared the figures. Yasmina Abdelilah and Erdinç Pinar provided support on statistics. Viviane Consoli provided editorial assistance.

ORGANISATIONS VISITED

The team held discussions with the following energy and environment stakeholders:

- Amsterdam Power Exchange (APX)
- Association for Energy, Environment and Water (*Vereniging voor Energie, Milieu en Water*, VEMW)
- Association for Market Functioning in Energy (*Vereniging voor Marktwerking in Energie*, VME)
- Consumers Association (*Consumentenbond*)
- EnergieNed
- Energy Research Centre of the Netherlands (*Energieonderzoek Centrum Nederland*, ECN)
- European Energy Derivatives Exchange (ENDEX)
- Free Trade Association for Electricity and Gas (*Vrijhandels Organisatie voor Elektriciteit en Ga*s, VOEG)
- GasTerra
- Greenchoice
- Ministry of Agriculture, Nature and Food Quality (*Ministerie van Landbouw, Natuur en Voedselkwaliteit*, LNV)
- Ministry of Economic Affairs (*Ministerie van Economische Zaken*)
- Ministry of Housing, Spatial Planning and the Environment (*Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer*, VROM)
- Ministry of Transport, Public Works and Water Management (*Ministerie van Verkeer en Waterstaat*)

- NAM (*Nederlandse Aardolie Maatschappij* B.V.)
- Netherlands Competition Authority (*Nederlandse Mededingingsautoriteit*, NMa)
- Netherlands Society for Nature and Environment (*Stichting Natuur en Milieu*)
- N.V. Nederlandse Gasunie
- SenterNovem, Agency for Energy and the Environment
- Shell Nederland B.V.
- TenneT Holding B.V.
- Windunie

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2005	2006	2010	2020	2030
TOTAL PRODUCTION		**56.8**	**60.5**	**61.9**	**60.8**	**57.9**	**48.5**	**36.2**
Coal		1.1	–	–	–	–	–	–
Oil		1.6	4.1	2.3	2.1	1.7	1.3	0.3
Gas		53.7	54.6	56.2	55.4	51.4	40.1	31.8
Comb. Renewables & Waste[1]		–	0.9	2.0	2.1	3.2	4.8	2.3
Nuclear		0.3	0.9	1.0	0.9	1.0	1.0	1.0
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Wind		–	0.0	0.2	0.2	0.5	1.2	0.7
Geothermal		–	–	–	–	–	–	–
Solar/Other		–	0.0	0.0	0.0	0.0	0.1	0.1
TOTAL NET IMPORTS[2]		**6.4**	**6.8**	**21.5**	**18.8**	**25.7**	**45.9**	**69.6**
Coal	Exports	1.4	2.3	4.7	5.8	5.9	4.9	4.9
	Imports	2.9	11.7	13.0	13.1	14.7	18.3	25.9
	Net Imports	1.5	9.5	8.3	7.3	8.8	13.4	21.0
Oil	Exports	41.8	59.2	78.0	85.0	116.3	122.5	132.9
	Imports	83.5	90.4	126.8	132.6	162.9	179.7	202.3
	Bunkers	11.5	10.8	16.8	17.4	17.1	21.0	25.3
	Net Imports	30.2	20.3	32.0	30.2	29.5	36.2	44.1
Gas	Exports	25.3	25.8	37.4	39.2	45.2	43.7	35.8
	Imports	–	2.0	16.4	18.0	31.6	39.8	39.7
	Net Imports	–25.3	–23.8	–20.9	–21.1	–13.6	–3.9	3.9
Electricity	Exports	0.1	0.0	0.5	0.5	0.7	1.3	1.0
	Imports	0.0	0.8	2.0	2.4	1.8	1.4	1.6
	Net Imports	–0.1	0.8	1.6	1.8	1.1	0.2	0.5
TOTAL STOCK CHANGES		**–0.3**	**–0.2**	**–1.0**	**0.6**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**62.8**	**67.1**	**82.4**	**80.3**	**83.7**	**94.4**	**105.8**
Coal		2.9	8.9	8.2	7.9	8.8	13.4	21.0
Peat		–	–	–	–	–	–	–
Oil		31.2	24.7	33.4	32.4	31.2	37.5	44.4
Gas		28.5	30.8	35.3	34.2	37.8	36.1	35.7
Comb. Renewables & Waste[1]		–	0.9	2.6	2.7	3.2	4.8	2.3
Nuclear		0.3	0.9	1.0	0.9	1.0	1.0	1.0
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Wind		–	0.0	0.2	0.2	0.5	1.2	0.7
Geothermal		–	–	–	–	–	–	–
Solar/Other		–	0.0	0.0	0.0	0.0	0.1	0.1
Electricity Trade[3]		–0.1	0.8	1.6	1.8	1.1	0.2	0.5
Shares (%)								
Coal		*4.6*	*13.3*	*9.9*	*9.9*	*10.5*	*14.2*	*19.9*
Peat		–	–	–	–	–	–	–
Oil		*49.8*	*36.8*	*40.6*	*40.4*	*37.3*	*39.7*	*42.0*
Gas		*45.4*	*45.9*	*42.9*	*42.7*	*45.2*	*38.3*	*33.7*
Comb. Renewables & Waste		–	*1.4*	*3.2*	*3.3*	*3.8*	*5.1*	*2.2*
Nuclear		*0.5*	*1.4*	*1.3*	*1.1*	*1.3*	*1.1*	*1.0*
Hydro		–	–	–	–	–	–	–
Wind		–	–	*0.2*	*0.3*	*0.6*	*1.3*	*0.7*
Geothermal		–	–	–	–	–	–	–
Solar/Other		–	–	*0.1*	–	–	*0.1*	*0.1*
Electricity Trade		*–0.2*	*1.2*	*1.9*	*2.3*	*1.3*	*0.2*	*0.5*

0 is negligible, – is nil, .. is not available

The Dutch government uses the Global Economy scenario as its reference scenario. However, this scenario assumes minimal government interference in energy and climate policy after 2020. Because of this, the forecasts for 2030 (such as the energy use and development of renewables) do not reflect future policies.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2005	2006	2010	2020	2030
TFC	**48.4**	**50.9**	**63.9**	**61.2**	**63.3**	**70.2**	**78.3**
Coal	1.1	1.4	0.9	0.9	1.0	1.2	1.2
Peat	–	–	–	–	–	–	–
Oil	24.3	19.5	28.3	26.5	25.9	30.0	35.2
Gas	19.3	23.0	22.3	21.9	22.3	23.1	24.1
Comb. Renewables & Waste[1]	–	0.4	0.4	0.5	0.2	0.2	0.2
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	0.0	0.0	0.0	0.0	0.1	0.1
Electricity	3.8	6.3	9.0	9.1	10.0	11.9	13.9
Heat	–	0.3	3.0	2.4	3.7	3.7	3.7
Shares (%)							
Coal	*2.2*	*2.7*	*1.5*	*1.4*	*1.6*	*1.6*	*1.5*
Peat	–	–	–	–	–	–	–
Oil	*50.1*	*38.4*	*44.3*	*43.3*	*41.0*	*42.8*	*44.9*
Gas	*39.8*	*45.2*	*34.9*	*35.7*	*35.3*	*32.9*	*30.7*
Comb. Renewables & Waste	–	*0.7*	*0.6*	*0.8*	*0.4*	*0.4*	*0.3*
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	–	–	–	–	*0.1*	*0.1*
Electricity	*7.9*	*12.4*	*14.1*	*14.9*	*15.8*	*17.0*	*17.8*
Heat	–	*0.6*	*4.7*	*4.0*	*5.9*	*5.2*	*4.7*
TOTAL INDUSTRY[4]	**21.1**	**21.1**	**27.2**	**23.9**	**27.6**	**31.1**	**36.2**
Coal	0.8	1.3	0.9	0.8	1.0	1.2	1.2
Peat	–	–	–	–	–	–	–
Oil	10.2	8.1	12.4	10.1	12.4	14.0	17.1
Gas	8.1	8.8	8.2	7.7	7.7	9.0	10.2
Comb. Renewables & Waste[1]	–	0.0	0.1	0.1	0.0	0.0	0.0
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	–	–	–	–	–	–
Electricity	2.0	2.9	3.6	3.6	3.6	4.1	4.8
Heat	–	–	2.0	1.5	2.9	2.8	2.9
Shares (%)							
Coal	*3.6*	*6.3*	*3.3*	*3.5*	*3.7*	*3.7*	*3.2*
Peat	–	–	–	–	–	–	–
Oil	*48.5*	*38.4*	*45.5*	*42.5*	*44.9*	*45.1*	*47.4*
Gas	*38.6*	*41.6*	*30.1*	*32.1*	*27.9*	*29.0*	*28.1*
Comb. Renewables & Waste	–	*0.2*	*0.4*	*0.6*	*0.1*	*0.1*	*0.1*
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	–	–	–	–	–	–
Electricity	*9.3*	*13.5*	*13.1*	*15.0*	*12.9*	*13.0*	*13.4*
Heat	–	–	*7.5*	*6.3*	*10.6*	*9.1*	7.9
TRANSPORT	**7.3**	**10.3**	**15.1**	**15.6**	**12.8**	**15.3**	**17.3**
TOTAL OTHER SECTORS[5]	**20.0**	**19.4**	**21.6**	**21.8**	**22.8**	**23.8**	**24.8**
Coal	0.3	0.1	0.0	0.0	–	–	–
Peat	–	–	–	–	–	–	–
Oil	6.8	1.2	0.9	0.9	0.9	1.0	1.0
Gas	11.1	14.2	14.1	14.2	14.5	14.0	13.8
Comb. Renewables & Waste[1]	–	0.3	0.3	0.3	0.2	0.2	0.2
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	0.0	0.0	0.0	0.0	0.1	0.1
Electricity	1.8	3.4	5.3	5.4	6.3	7.7	8.9
Heat	–	0.3	1.0	0.9	0.8	0.8	0.8
Shares (%)							
Coal	*1.6*	*0.3*	*0.2*	*0.1*	–	–	–
Peat	–	–	–	–	–	–	–
Oil	*33.9*	*6.1*	*4.4*	*4.2*	*4.1*	*4.1*	*4.1*
Gas	*55.6*	*73.1*	*65.3*	*65.1*	*63.7*	*58.8*	*55.6*
Comb. Renewables & Waste	–	*1.7*	*1.3*	*1.3*	*1.0*	*0.9*	*0.9*
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	–	*0.1*	*0.1*	*0.1*	*0.3*	*0.3*
Electricity	*8.9*	*17.3*	*24.4*	*24.8*	*27.7*	*32.5*	*35.9*
Heat	–	*1.6*	*4.4*	*4.3*	*3.5*	*3.4*	*3.3*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2005	2006	2010	2020	2030
ELECTRICITY GENERATION[6]							
INPUT (Mtoe)	**12.0**	**15.1**	**21.2**	**20.3**	**26.3**	**32.4**	**35.9**
OUTPUT (Mtoe)	**4.5**	**6.2**	**8.6**	**8.5**	**10.1**	**13.3**	**15.1**
(TWh gross)	52.6	71.9	100.2	98.4	117.0	154.8	175.4
Output Shares (%)							
Coal	*6.0*	*38.3*	*26.9*	*26.9*	*22.7*	*31.8*	*51.4*
Peat	–	–	–	–	–	–	–
Oil	*12.3*	*4.3*	*2.3*	*2.1*	*5.7*	*8.0*	*9.4*
Gas	*79.5*	*50.9*	*57.7*	*57.6*	*55.6*	*37.4*	*29.6*
Comb. Renewables & Waste	–	*1.5*	*6.7*	*6.7*	*7.4*	*10.9*	*2.3*
Nuclear	*2.1*	*4.9*	*4.0*	*3.5*	*3.4*	*2.6*	*2.3*
Hydro	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Wind	–	*0.1*	*2.1*	*2.8*	*5.0*	*9.1*	*4.9*
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	–	*0.3*	*0.2*	*0.1*	*0.1*	*0.1*
TOTAL LOSSES	**15.0**	**16.1**	**18.4**	**18.9**	**20.4**	**24.2**	**27.5**
of which:							
Electricity and Heat Generation[7]	7.5	8.6	8.8	8.8	11.9	14.4	16.3
Other Transformation	2.3	1.5	1.9	2.3	2.4	3.0	3.4
Own Use and Losses[8]	5.3	6.0	7.7	7.8	6.0	6.8	7.8
Statistical Differences	**–0.7**	**0.1**	**0.1**	**0.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	2005	2006	2010	2020	2030
GDP (billion 2000 USD)	192.61	284.85	407.95	419.60	471.46	620.38	771.4
Population (millions)	13.44	14.95	16.32	16.42	16.83	17.88	18.9
TPES/GDP[9]	0.33	0.24	0.20	0.19	0.18	0.15	0.14
Energy Production/TPES	0.90	0.90	0.75	0.76	0.69	0.51	0.34
Per Capita TPES[10]	4.67	4.49	5.05	4.89	4.97	5.28	5.60
Oil Supply/GDP[9]	0.16	0.07	0.08	0.07	0.06	0.06	0.06
TFC/GDP[9]	0.25	0.18	0.16	0.15	0.13	0.11	0.10
Per Capita TFC[10]	3.61	3.41	3.92	3.73	3.76	3.93	4.15
Energy-related CO_2 Emissions ($MtCO_2$)[11]	152.7	156.6	182.6	178.3	188.8	215.0	256.0
CO_2 Emissions from Bunkers ($MtCO_2$)	39.0	38.6	64.0	66.1	66.4	82.9	100.3

GROWTH RATES (% per year)

	73–79	79–90	90–05	05–06	06–10	10–20	20–30
TPES	1.7	–0.3	1.4	–2.6	1.0	1.2	1.1
Coal	2.4	9.5	–0.6	–3.4	2.7	4.3	4.6
Peat	–	–	–	–	–	–	–
Oil	0.4	–2.3	2.0	–3.0	–0.9	1.9	1.7
Gas	2.4	–0.6	0.9	–3.0	2.5	–0.4	–0.1
Comb. Renewables & Waste	–	13.0	7.1	1.3	4.8	4.2	–7.2
Nuclear	21.0	0.0	0.9	–13.2	3.7	–	–
Hydro	–	–	0.9	12.5	9.6	–	–
Wind	–	–	26.9	32.0	21.1	9.1	–4.8
Geothermal	–	–	–	–	–	–	–
Solar/Other	–	–	22.9	–20.5	–9.0	12.9	1.1
TFC	2.0	–0.6	1.5	–4.2	0.8	1.0	1.1
Electricity Consumption	4.4	2.3	2.4	1.4	2.4	1.8	1.5
Energy Production	4.4	–1.8	0.1	–1.8	–1.2	–1.8	–2.9
Net Oil Imports	1.0	–4.1	3.1	–5.4	–0.6	2.1	2.0
GDP	2.6	2.2	2.4	2.9	3.0	2.8	2.2
Growth in the TPES/GDP Ratio	–0.9	–2.4	–1.0	–5.4	–1.9	–1.5	–1.0
Growth in the TFC/GDP Ratio	–0.5	–2.7	–0.9	–7.0	–2.1	–1.7	–1.1

Please note: Rounding may cause totals to differ from the sum of the elements.

FOOTNOTES TO ENERGY BALANCES AND KEY STATISTICAL DATA

1. Combustible renewables and waste comprises solid biomass, liquid biomass, biogas, and municipal waste. Data are often based on partial surveys and may not be comparable between countries.

2. In addition to coal, oil, gas and electricity, total net imports also include peat, combustible renewables and waste and trade of heat.

3. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.

4. Industry includes non-energy use.

5. Other sectors includes residential, commercial, public services, agriculture, forestry, fishing and other non-specified sectors.

6. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.

7. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 33% for nuclear and 100% for hydro, wind and photovoltaic.

8. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.

9. Toe per thousand US dollars at 2000 prices and exchange rates.

10. Toe per person.

11. "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach from *the Revised 1996 IPCC Guidelines*. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2006 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The 28 member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1. **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydropower, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the "polluter pays principle".

4. **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA members wish to retain and improve

* The 28 member countries of the IEA are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland (since November 2008), Portugal, the Slovak Republic (since November 2007), Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. **Continued research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

AAU	assigned amount unit
APX	Amsterdam Power Exchange
BBL	Balgzand–Bacton Line
bcm	billion cubic metres
CATO	CO_2 Capture, Transport and Storage
CBS	the Dutch Statistics Organisation
CCS	carbon dioxide capture and storage
CDM	clean development mechanism
CER	certified emissions reduction
CH_4	methane
CHP	combined heat and power
cm	cubic metres
CO_2	carbon dioxide
COVA	Central Organisation for Oil Stockholding
DSO	distribution system operator
ECN	Energy Research Centre of the Netherlands
ENDEX	European Energy Derivatives Exchange (Amsterdam–based)
ERU	emissions reduction unit

ETC	enrichment technology company
EU	European Union
EU–ETS	EU Emissions Trading Scheme
EUR	euro (currency)
GATE	Gas Access to Europe
GDP	gross domestic product
G8	Group of Eight (Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United states)
Geq	Groningen–equivalent
GHG	greenhouse gas
GIE	Gas Infrastructure Europe
GTS	Gas Transport Services
GW	gigawatt, or 1 Watt × 10^9
HABOG	*(Hoogradioactief Afval Behandelings- en Opslag Gebouw)* – Dutch nuclear high–level waste storage facility
H–gas	gas with high calorific value
HFC	hydrofluorocarbon
HLW	high–level waste
IEA	International Energy Agency
IGCC	integrated gasification combined cycle
JI	joint implementation
kWh	kilowatt–hour , or 1 watt × 1 hour × 10^3
L–gas	gas with low calorific value

LHV	lower heating value
LNG	liquefied natural gas
LNV	Ministry of Agriculture, Nature and Food Quality
LPG	liquefied petroleum gas
LTA	long-term agreement
m^2	square metre
mb	million barrels
mcm	million cubic metres
MEP	*(milieukwaliteit van elektriciteitsproductie, environmental quality of electricity production*), Dutch support scheme for renewable energy
Mt	million tonnes
$MtCO_{2-eq}$	million tonnes of CO_2-equivalent
Mtoe	million tonnes of oil equivalent, see toe
MW	megawatt, or 1 watt × 10^6
MWh	megawatt-hour, or 1 watt × 1 hour × 10^6
NAM	(*Nederlandse Aardolie Maatschappij*) -major Dutch oil and gas company
NAP	National Allocation Plan
NBP	National Balancing Point
NCPIP	National Climate Policy Implementation Plan
NIMBY	"not in my backyard"
NMa	Netherlands Competition Authority
NO_2	nitrogen dioxide
NRG	Nuclear Research and Consultancy Group
NWO	National Organisation for Scientific Research
OECD	Organisation for Economic Cooperation and Development

OTC	over-the-counter
PC	pulverised coal
PFCs	perfluorocompounds
PJ	petajoule, or 1 joule × 10^{15}
PV	photovoltaic
R&D	research and development
SDE	(*stimulering duurzame energieproductie, stimulation of sustainable energy production*), Dutch promotion scheme for renewable energy and CHP
SMEs	small and medium-sized enterprises
t	tonne
TFC	total final energy consumption
TEEI	total energy efficiency improvement
toe	tonne of oil equivalent, defined as 10^7 kcal
TPA	third-party access
TPES	total primary energy supply
TSO	transmission system operator
TTF	Title Transfer Facility
UNFCCC	United Nations Framework Convention on Climate Change
USC	ultra-supercritical
VROM	(*Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer*) –Ministry of Housing, Spatial Planning and the Environment

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