INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

THE NETHERLANDS 2000 REVIEW

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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-four* of the OECD's twenty-nine 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 assist in the integration of environmental and energy policies.

** IEA Member countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States. The European Commission also takes part in the work of the IEA.*

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- To achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- To contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- To contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and the Republic of Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

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SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

In the Netherlands, the potential tension between the search for low energy prices through competition and environmental imperatives is perhaps more visible than in any other IEA country. Dutch voters are very environmentally minded, and the government reflects their concern in setting very ambitious targets for carbon dioxide emissions, energy efficiency improvements and the share of renewables in the energy mix. The country aims at increasing the share of renewables from 1 per cent in 1995 to 5 per cent in 2010 and 10 per cent in 2020.

Surveys show that a sufficiently large part of the Dutch population would agree to pay extra for clean and renewable energy to meet the targets without additional compulsory measures on the demand side. For this reason, the government has abandoned the idea of a mandatory green certificates scheme that was under discussion during the last IEA in-depth review. The challenge the government must now overcome to meet its renewables target lies on the supply side; it must raise the acceptance of renewable installations in a small, densely populated country. Some of the solutions carry significantly higher cost and are controversial, such as the off-shore wind parks now planned in some locations.

To meet its climate change commitments, the country must reduce its greenhouse gas emissions from 1990 levels by 6 per cent by the end of the first budget period in 2008-2012. This means a reduction of 50 million tonnes of carbon dioxide equivalent, half of it at home and the other half abroad, using flexibility mechanisms in the Kyoto Protocol. The government has put together a programme that can achieve this, as well as a back-up plan if the target is not reached and a long-term plan that maps out the policy beyond 2010. The basic climate change programme and the back-up plan are very well researched. They contain cost-effective and realistic measures. The government had the foresight to rule out some highly cost-effective measures that are politically unacceptable, such as the more radical approaches to bring about modal shift in the transport sector. The long-term plan contains innovative but economic ways to reduce greenhouse gas emissions.

But the Netherlands is also very market-oriented. Competition is being introduced in both the power and the gas industries. In both industries full retail competition was initially to be introduced in 2007, but the deadline has recently been moved up to 2004, much earlier than required under the EU Directives.

The vast Groningen field is one of the biggest gas fields in IEA Europe. Through its unique capability to act as a swing supplier, this field has importance far beyond Dutch borders. To preserve this field, the government has developed what has become known as the small fields policy. One challenge for the government is to preserve the small fields policy in the potentially highly competitive new gas market.

Pressure at the Groningen field is now declining, and the Netherlands has begun importing gas from Russia. This may raise concern about security of supply, an issue the government well recognises. Security of supply policy has become more flexible in recent years. The requirement for the Dutch gas industry to demonstrate 25 years of indigenous supplies for the domestic market is no longer an obligatory condition for the granting of gas export licenses. The government is striving for a European-wide solution to gas security concerns, a strategy that seems well adapted to the development of a competitive European gas market.

Competition was introduced to the Dutch power market in 1998. With the necessary institutions and secondary legislation now in place, the market has become very competitive. There is vigorous electricity trade as well as foreign direct investment. Three of the country's four large generators have been sold to foreign investors. Despite the existence of overcapacity in the Dutch power generation market, the demand for power imports is such that interconnector capacity is vastly oversubscribed. Efficient rules for the allocation of interconnector capacity need to be established in co-operation with the Netherlands' European neighbours. Recent developments show encouraging signs in the right direction.

RECOMMENDATIONS

The government should:

Energy Market and Energy Policy

- ☐ Maintain the current balance between economic efficiency goals and environmental considerations.
- ☐ Proceed with market opening in the electricity and gas markets as swiftly as possible.
- ☐ Continue the current approach to tax reform, especially the re-distribution of revenues to taxpayers if further tax increases prove necessary to achieve both economic and environmental objectives.
- ☐ Decide whether there should be any limits to energy tax increases, and if so, what they should be.
- ☐ Decide how much diversification in the power industry is necessary, taking into account that the market consists of the entire European Union. Monitor the market.

Energy and the Environment

- ☐ Continue to monitor energy market and emissions trends closely and continue to respond to them in a flexible way.

☐ Continue to adjust policies to what is realistically feasible and continue to shift to low-cost, politically acceptable measures as much as possible. Use public awareness campaigns to highlight difficult choices.

☐ Speed up the development and introduction of the voluntary green certificates trading scheme. Such schemes require much attention to detail and consultation with participants. More concrete rules must be proposed soon if the deadline for start-up in 2001 is to be met.

☐ Make use by all possible means of consumers' and voters' willingness to pay for environmentally benign renewable energy sources, while ensuring efficient, low-cost supply of these energies and addressing acceptance problems.

Fossil Fuels

☐ Maintain its policy of liberalising the gas market in pragmatic steps while trying to retain the benefits of the previous gas policy.

☐ Ensure that the safeguard provisions for non-discrimination contained in the Netherlands Gas Act are fully implemented and supported by adequate resources.

☐ Review and reconsider the terms for exploration of small fields with a view to improving the conditions for those activities and stimulating the continued development of small fields.

☐ Pursue the current adjustments in mining law and policy. Monitor future exploration and development activities.

☐ Encourage gas companies to continue their rapid adaptation to competition. Work towards eliminating the last remaining inefficiencies in gas price structures, especially those relating to capacity charges and tariffs for smaller retail customers.

☐ Work towards a European solution for long-term security of supply.

Electricity

☐ Ensure that no further concentration occurs in the generation market.

☐ Closely monitor competition in the generation market, especially with a view toward identifying, and if necessary limiting, the potential incumbent's advantage that the four centralised generators may enjoy through system overcapacity and their privileged access to interconnector capacity.

☐ Carefully weigh the costs and benefits of CHP expansion. Make the costs as transparent as the benefits.

☐ Ensure that transmission grid development allows a fully open market, in particular with respect to cross-border trade. Continue to strive for a European solution. Continue to encourage possible solutions with adjacent countries and monitor the effectiveness of TenneT and the transmission tariff in bringing about appropriate investments and technical improvements.

☐ Clarify the criteria used for attributing interconnector capacity and make them available to the interested public. Strive to develop and phase in a market-based allocation mechanism as soon as possible.

Energy Technology and R&D

☐ Maintain its research and development policy well in line with its overall energy policy objectives.

☐ Continue to allocate efforts and funds in a balanced way among popular and less popular but potentially promising technology options.

☐ Continue the excellent co-operation between public and private sector research institutions.

2

ORGANISATION OF THE REVIEW

An IEA review team visited the Netherlands in November 1999 to review the country's energy policies. This report was drafted on the basis of information received during, prior to and after the visit, including the Dutch Government's official response to the IEA's 1999 policy questionnaire and the views expressed by various parties during the visit. The main author of the review is Gudrun Lammers. The team greatly appreciated the openness and co-operation shown by everyone it met.

The members of the team were:

Mr. Bertrand de l'Épinois
(Team Leader)
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Ministry of Petroleum and Energy
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(EU Observer)
Commission of the European Communities
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Mr. Olivier Appert
(IEA Secretariat)
Director, Long-Term Office
International Energy Agency

Ms. Gudrun Lammers
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International Energy Agency

The team held discussions with the following organisations:

- The Ministry of Economic Affairs (Minez);
- The Ministry of Housing, Spatial Planning and the Environment;
- The Ministry of Finance;
- The Dutch Competition Authority (NMa);
- The Dutch Electricity Regulator (DTe);
- The Energy Research Institute (ECN);
- Natuur & Milieu;
- The National Association for Energy Production and Distribution (EnergieNed);
- The District Heating Association (Cogen Nederland);
- The Association of the Chemical Industry (VNCI);
- The Large Electricity Users' Association (VEMW);
- The Dutch Employers' Organisation (VNO/NCW);
- The Consumers' Association (Consumentenbond);
- EPON;
- Gasunie;
- NAM;
- PNEM/MEGA;
- Shell Netherlands;
- TenneT;
- The Amsterdam Power Exchange (APX);
- Essent.

3

ENERGY MARKET AND ENERGY POLICY

OVERVIEW

Governments strive to reach numerous, often conflicting objectives. In energy policy, the principal tension has been between the striving for economic efficiency and low-cost energy on the one hand, and the desire to limit energy demand growth for environmental reasons on the other. This tension is not new: air pollution became a political issue three decades ago, followed swiftly by controversy on nuclear power, and about 12 years ago by the largest environmental problem so far, climate change.

In the Netherlands, the tension between these objectives is particularly visible. The country has a very strong and vocal environmental movement, and concern for the environment is one of the dominant mainstream policy issues. Yet economic development and growth are also very important in the Netherlands, which has a century-old tradition of domestic and international free trade.

The strong interest in Dutch society for both issues has forced successive governments to press ahead in both areas, striving to reconcile the conflicting objectives as much as possible. The problem is intensified by two international commitments: the Kyoto Protocol and the European Union Gas and Electricity Directives. One requires the country to reduce its greenhouse gas emissions from 1990 levels by 6 per cent by 2008 to 2012.[1] The other requires it to open 33 per cent of its electricity and natural gas markets by 2003 and 2009, respectively. The Dutch government intends to go much further, striving to open the markets by 100 per cent as early as 2004.

Thus the government finds itself in a situation where it is attempting to lower energy prices, especially in the gas and electricity markets, through (and for) competition, while raising prices through energy taxes, national allowances trading schemes, and, less visibly but not less effectively, through regulation and voluntary agreements. It is fair to ask whether the ultimate consumer will benefit from energy market liberalisation at all, or whether the attempts to increase economic efficiency are not doomed from the outset. On the other hand, it raises the question whether reaching stringent environmental objectives is possible in a free-market environment. The Dutch example may shed some light on these questions and may provide useful insights as to how far a government can combine economic growth and environmental protection, and to what degree one goal has to be given up to obtain the other.

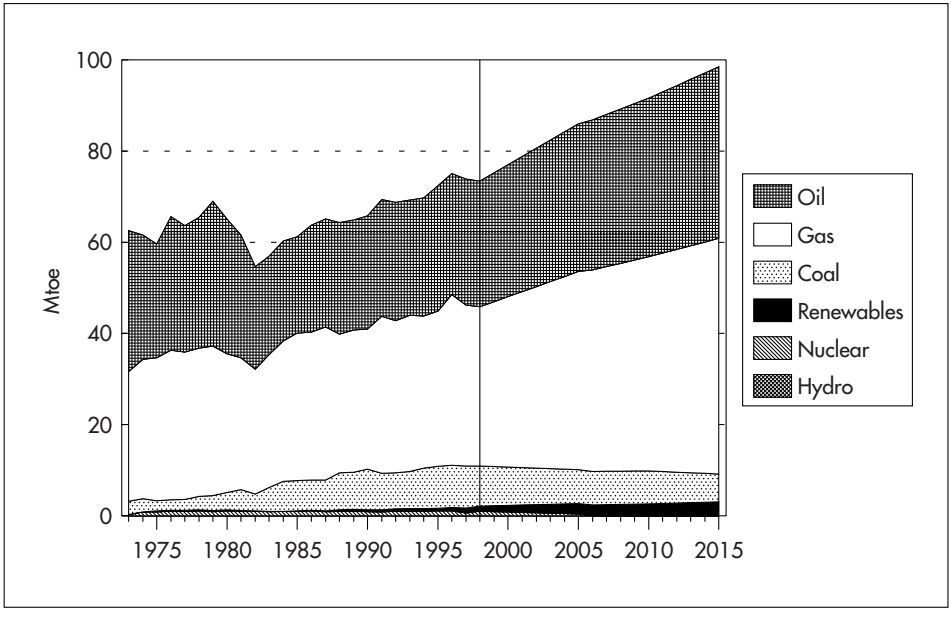
1. This figures derives not from the Kyoto Protocol directly but from the European Union target and its internal burden sharing mechanism.

Supply

Figure 1 shows Total Primary Energy Supply (TPES) in the Netherlands between 1973 and 2015. The graph is almost entirely dominated by fossil fuels. The Netherlands is not endowed with a large-scale non-fossil energy resource such as hydro power that could provide a carbon-free base supply of energy. The Netherlands, as its name[2] suggests, lacks the altitude necessary for dams or even significant run-of-the-river hydro.

The small amount of nuclear energy in the Netherlands comes from a small commercial nuclear power plant, the Borssele reactor (450 MW). There is general public resistance to nuclear power. The 55 MW Dodewaard research reactor was closed in 1994. The

Figure 1
Total Primary Energy Supply, 1973 to 2015



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

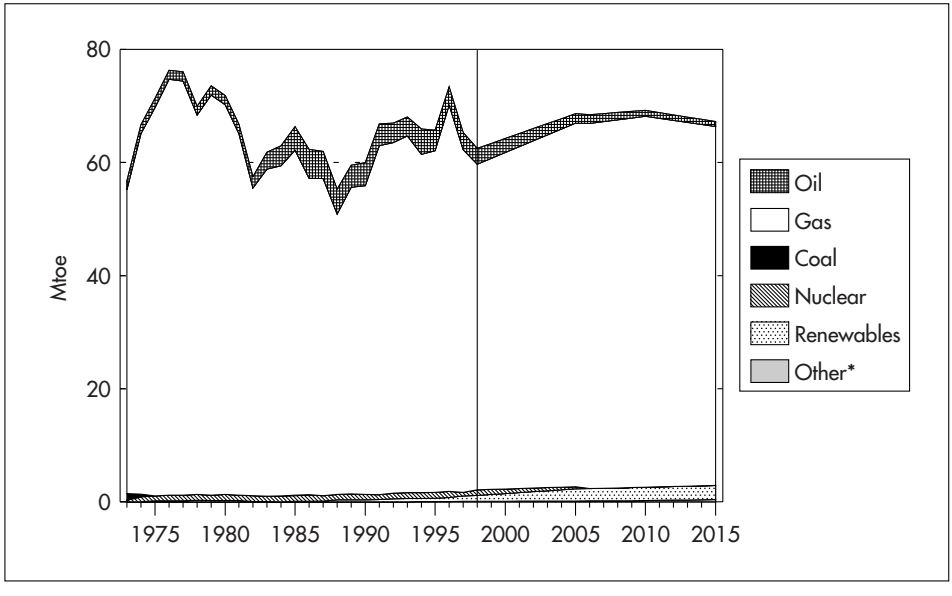
2. The country's English name 'the Netherlands' stems from its Dutch name Nederland, meaning Low Countries. A significant share of the country's surface actually lies below sea level, protected by dikes, and some was even re-claimed from the sea (the polders). The country's geographic situation was also the origin of the famous Dutch windmills that covered much of Dutch territory from the late Middle Ages onwards. Together with an extensive system of drainage ditches, the windmills were used to prevent or reverse salt water infiltration.
The Netherlands has, of course, very large water courses, such as the huge estuary of the rivers Schelde and Rhine. However, run-of-the-river hydro requires narrower rivers over somewhat sloping terrain for sufficiently fast flow rates to carry sufficient amounts of energy.

Borssele reactor was due to shut down in 1997. In 1995, the owner of the reactor, the power company EPZ, attempted to obtain an extension of Borssele's lifetime beyond 25 years, to 2007. This move followed what was becoming an increasingly widespread practice among IEA countries. It created a major public controversy. Eventually, the government decided to extend the reactor's operating licence, but also introduced a time limit for operation, until 2004. The amendment containing the limit was recently overthrown by an administrative court on a technical point. The government still intends to shut down the reactor in 2004. It is highly unlikely that there will be any new nuclear power plant in the Netherlands in the foreseeable future.

In contrast, the Netherlands has the second largest natural gas reserves in IEA Europe, closely following Norway. A large part of this resource is concentrated in the huge Groningen gas field, which, together with the Norwegian Troll field, is the largest gas field in IEA Europe. The country also has (much smaller) oil reserves. Rotterdam and Amsterdam are two of the three biggest harbours in continental Europe, allowing large imports of coal and oil. Dutch prices for imported coal are the lowest in Europe, and prices of oil landed in Rotterdam are among the most frequently used reference prices in the European market.

Figure 2 illustrates the overwhelming importance of natural gas in Dutch energy production. Whereas nuclear generation will disappear in the next few years, the government hopes to increase considerably the demand for and the production of energy from renewables.

Figure 2
Energy Production by Fuel, 1973 to 2015



* Includes solar, wind, tide, wave and ambient heat used in heat pumps.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

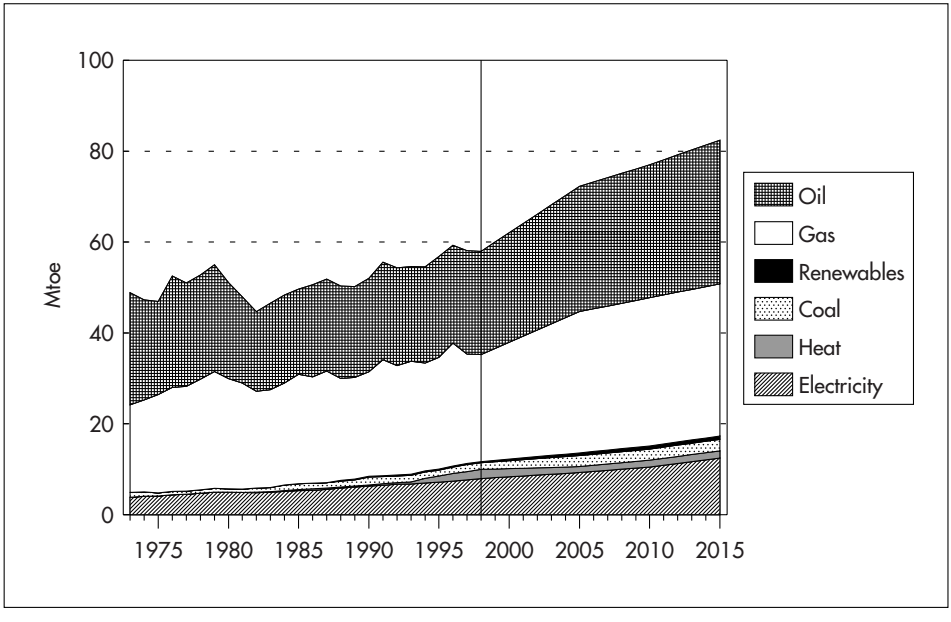
Demand

Energy demand in the Netherlands shows a long-term increasing trend and is not expected to level off in the coming 15 years, as shown in Figure 3 and Figure 4. Natural gas accounts for almost 40 per cent of Total Final Consumption (TFC) of energy. Within the IEA, only Hungary has a comparable gas share, but in contrast to Hungary, this share is expected to grow in the Netherlands (to 43 per cent in 2005). Natural gas penetration is the highest in the world. Practically every office, factory and dwelling is connected to the gas grid, and the average share of gas in power generation is 60 per cent.

The share of industrial energy consumption is relatively high at about 40 per cent. But Figure 4 also shows a comparatively large share of 'other' consumption. This category includes agriculture and is larger than usual due to the scale on which horticulture is carried out in heated greenhouses in the Netherlands. Dutch greenhouse growers supply a significant share of the European market in cut flowers, pot plants and vegetables. They account for a significant amount of combined heat and power production using natural gas.

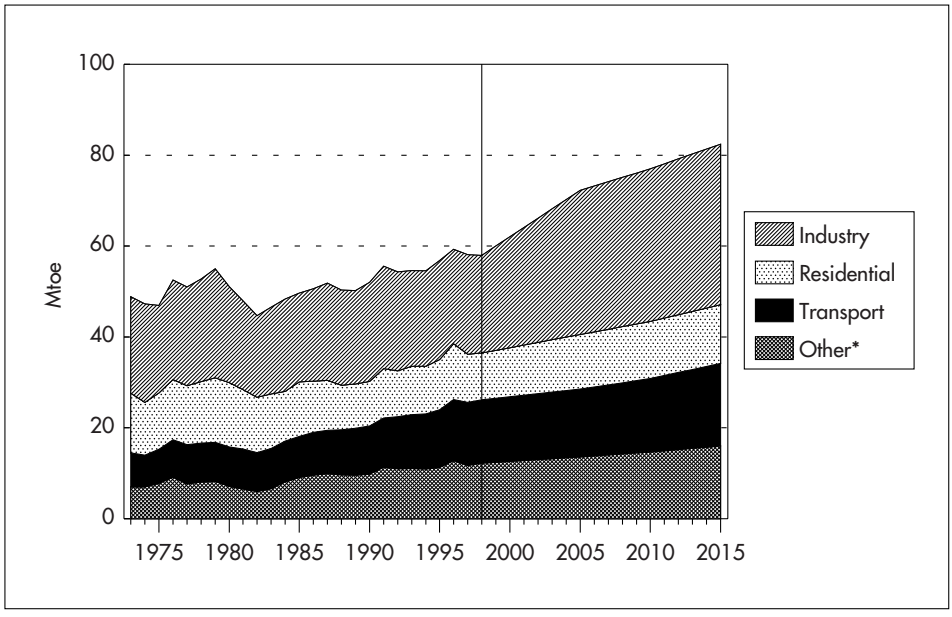
Energy intensity is determined partly by energy efficiency and partly by GDP development, including structural effects such as shifts between sectors and changes in lifestyle. Due to the Netherlands' high degree of industrialisation and its industrial structure, energy intensity is significantly higher than the average for IEA

Figure 3
Total Final Consumption by Fuel, 1973 to 2015



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Figure 4
Total Final Consumption by Sector, 1973 to 2015



* Includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

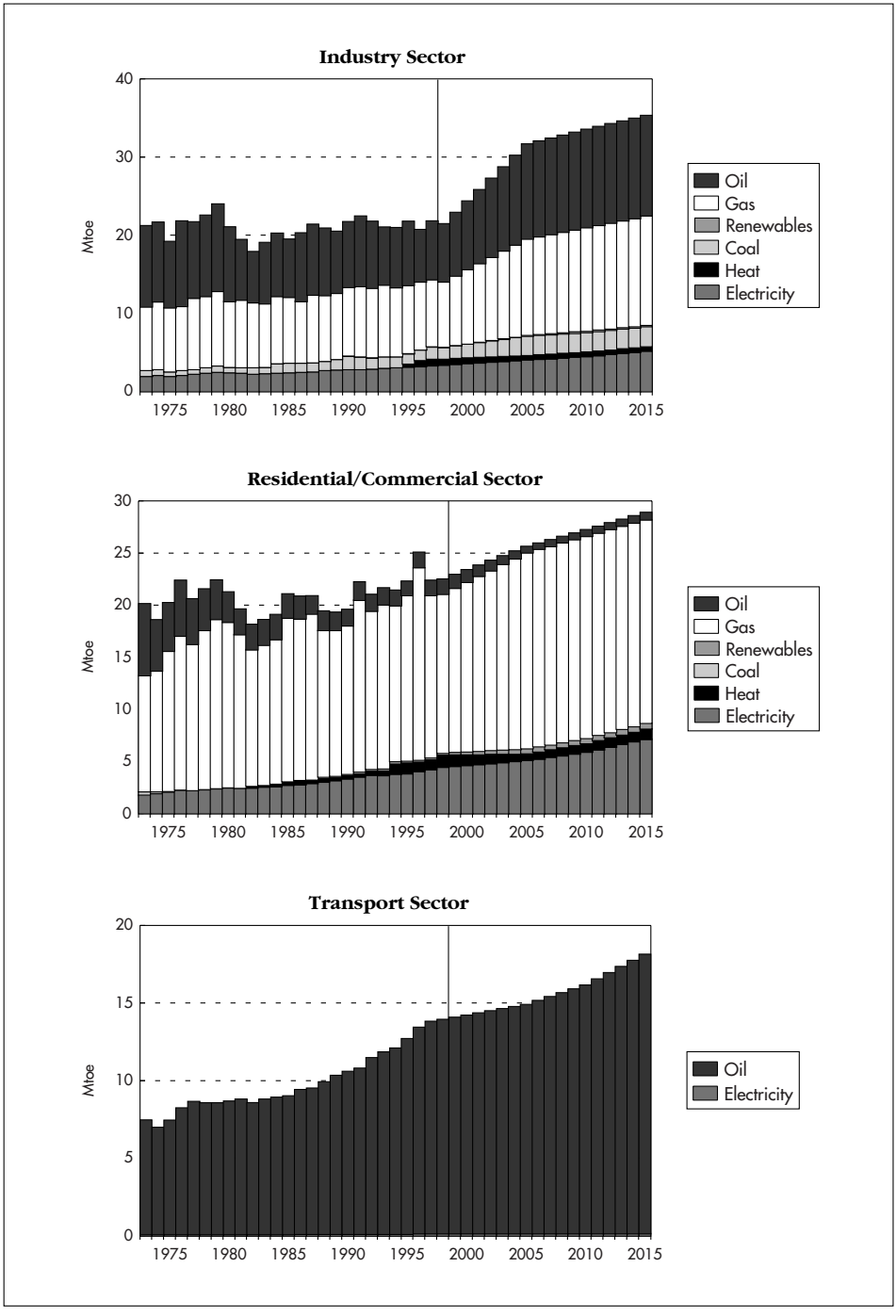
Europe, except in the transport sector. As in most other IEA countries, energy intensity is on a long-term declining trend in the Netherlands. The decline in energy intensity was particularly strong after the second oil crisis of 1979. The decline since 1996 has also been somewhat stronger than the long-term trend.

Energy intensity is closely monitored in the Netherlands. According to the Central Planning Bureau, average overall energy intensity decreased by 1.2 per cent per year in the period 1991-1997. Temperature-corrected final energy consumption increased by 1.3 per cent per year, GNP increased by 2.5 per cent per year. The increase in energy consumption was the highest in the transport sector and is largely attributable to increasing mobility. In the period 1991-1997, the estimated level of energy efficiency increased by 1.4 per cent per year, including an estimated dematerialisation effect of some 0.1 per cent per year.

ENERGY POLICY

The key objectives for Dutch energy policy are set out in the Third White Paper on Energy Policy (Parliamentary Document II 1995/1996, 24,525, nos. 1 and 2). The White Paper aims at achieving a sustainable energy economy within competitive energy markets. In particular, it strives to:

Figure 5
Final Consumption by Sector and Fuel, 1973 to 2015



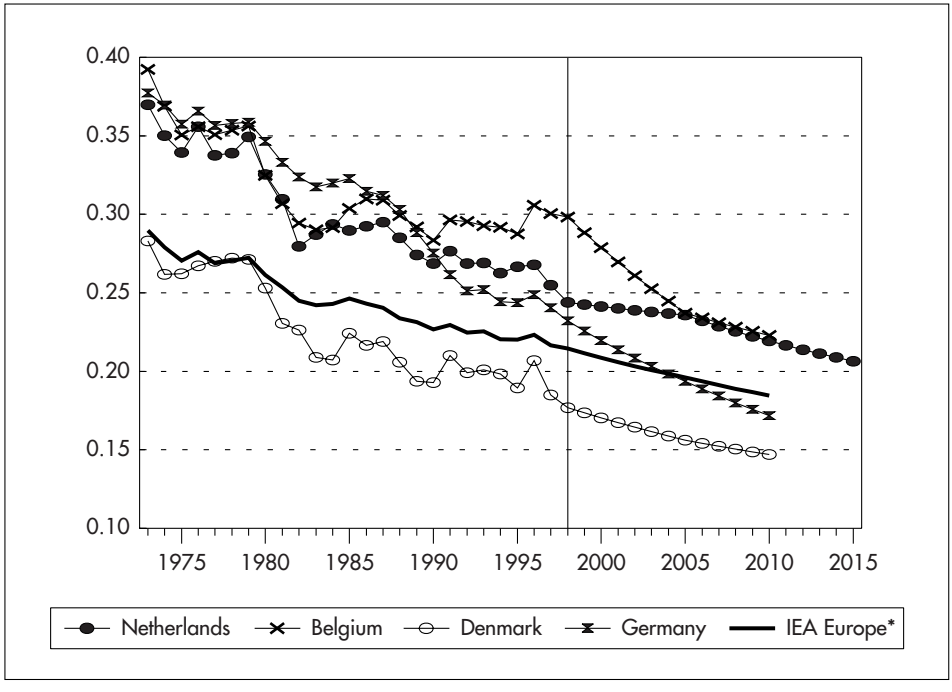
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

- Improve energy efficiency by one third by 2020.
- Increase the share of renewable energy in total primary energy supply from 1 per cent in 1995 to 10 per cent in 2020.
- Shift policy instruments from the supply side to the demand side.
- Re-define the government's function in energy markets to increase the role of market forces.
- Gradually liberalise the electricity and gas markets for all consumers, while protecting captive customers during the transition period.
- Liberalise energy import and export as required in the EU context.

In November 1999 another important policy document, the Energy Report, was published. The main points in this document are:

- Acceleration of electricity and gas market liberalisation.
- Reconfirmation of goals for energy efficiency and renewables.

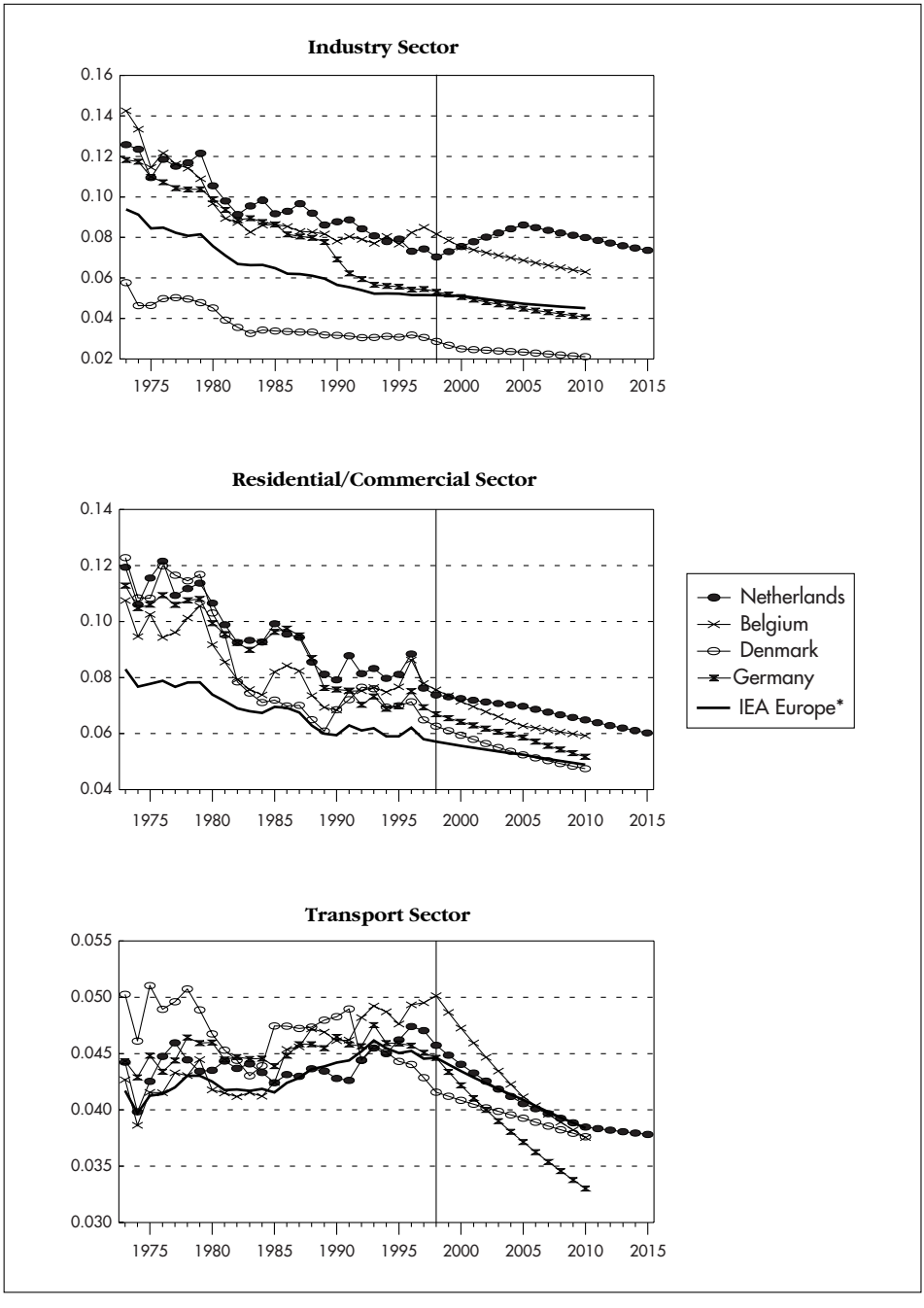
Figure 6
Energy Intensity in the Netherlands and in Other Selected IEA Countries, 1973 to 2015



* Excluding Spain and Norway from 2001 onwards.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Figure 7

Energy Intensity by Sector in the Netherlands and in Other Selected IEA Countries, 1973 to 2015



* Excluding Spain and Norway from 2001 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

- Establishment of an intermediate goal of 5 per cent for renewables in 2010.

- De-bottlenecking the supply of renewable energy.

- Introduction of a green certificate system.

The Kyoto Protocol in 1997 added another important energy policy objective, namely to reduce greenhouse gas emissions by 6 per cent from 1990 levels by 2010.

The energy efficiency target set in the White Paper required an average increase in energy efficiency of 1.6 per cent per year to 2020. During the 1990-1997 period, the growth of energy efficiency averaged 1.4 per cent per year. This means that the end result may fall somewhat short of the objective. It does not mean, however, that the energy efficiency policy has been ineffective since some of the assumptions that underpin the projections of the White Paper and that have a large impact on the outcome, such as economic growth, the level of energy prices and European policy, have not developed as anticipated.

Whereas energy savings in industry proved to be higher than expected, savings in the residential/ commercial sector, agriculture, transport and construction were below the targets set in the White Paper. Also, the energy efficiency improvements will not be fully achieved because some of the methods to achieve them could not be implemented as anticipated. A recently adopted revised building code for new buildings, for example, is not as strict as initially intended, and energy performance standards for existing buildings will be voluntary instead of mandatory. Government forecasts[3] project that this may lead to CO_2 emissions savings of 7.6 million tonnes instead of the 10 million tonnes which were expected.

Market forces also limit what can be achieved. The White Paper foresaw a total combined heat and power (CHP) generation capacity of 15,000 MW in 2010. At the end of 1997, more than half of this capacity (7,800 MW) was already in place, largely due to strong government support programmes and joint ventures between industry and public utilities. This is already a very large amount of CHP capacity and contributed significantly to overcapacity in the electricity market. Bringing about even larger overcapacity in a liberalising power market appeared neither feasible nor desirable. Consequently, recent assessments revised the expectations downwards to less, and more realistic CHP expansion by 2010.

In view of the Kyoto target, efforts to limit greenhouse gas emissions had to be stepped up beyond what was foreseen in the 1995/96 White Paper. The Dutch government responded to this challenge by shifting its policy away from an exclusive focus on CO_2 to an approach addressing all six major greenhouse gases. It also developed an innovative approach to greenhouse gas abatement that includes a basic package of measures, a back-up plan in case the basic plan does not yield the required results, and a long-term package that attempts to develop measures for the time period beyond 2010.[4]

3. See the Climate Change section in the chapter Energy and the Environment.
4. These measures are described in the chapter Energy and Environment.

In a recently published Energy Conservation Action Plan, the government describes the concrete measures it is taking or will take in the three years to 2002 to implement the basic package. This package increases the annual rate of energy efficiency improvement from 1.6 per cent, as in the 1995/96 White Paper, to 2 per cent per year. The objective was restated in the government's 1999 Energy Report (Energierapport 1999).

Given the experience of the recent past, this goal appears too ambitious. This does not imply failure of government policy but is simply an effect of energy market parameters, such as lower-than-expected energy prices that are less favourable for energy efficiency. This has not led the Dutch government to abandon its objectives but rather to reinforce its efforts and to seek new ways to achieve them. At present, the government is monitoring developments closely and striving to adapt its policy to market conditions.

It is not yet clear whether the renewables objective will be reached. The share of renewables in TPES had doubled from 1995 to about 2 per cent in 1998, but further efforts will have to be made to reach 10 per cent by 2020, or even the interim goal of 5 per cent in 2010. The government is aware of the enormous costs and inelasticity of renewables supply that limit their potential in the short run. In the long run, the costs of renewable options are likely to drop. But impending liberalisation also lowers the costs and prices of gas and electricity. To reach the goal of 10 per cent renewable energy in 2020, its cost has to drop more rapidly than that of non-renewable energies, unless its competitivity is enhanced through measures such as taxation or subsidies.

With the Electricity Act of 1998 and the Natural Gas Bill of 1999, liberalisation of the electricity and gas markets has begun to take form. Both markets were scheduled to be fully open by 2007. In November 1999 the Minister of Economic Affairs instructed her ministry to investigate the possibility of accelerating full market opening to 2003. In early 2000, the decision was taken to open both markets fully by 2004.

ENERGY TAXATION

The government levies a number of taxes on energy. In addition to producing revenue, these taxes have an environmental purpose. Apart from VAT, there are

- Excise taxes on mineral oils (1998 revenue: ƒ 10.8 billion).
- The environmental tax on fuels (1998 revenue: ƒ 1.4 billion).
- The uranium tax.
- The regulatory energy tax (1998 revenue: ƒ 1.9 billion)[5].

5. In comparison, the total tax revenue of the Dutch government in 1998 was ƒ 180 billion.

These taxes are the result of several changes to energy taxation in the Netherlands. Before 1988, there were three different environmental taxes on energy: the air pollution charge, the road traffic noise charge and the charge on chemical waste. Revenues from these taxes were used for environmental protection. In 1988, these three taxes were combined into a fuel charge. In 1992, the environmental tax on fuels was introduced. It was based 50 per cent on the energy content of fuels and 50 per cent on their carbon content. Its revenue has been part of the general budget since July 1992.

The environmental fuel tax is levied on all fossil fuels. For mineral oils, it is levied together with excise duties. For natural gas and coal it is collected at the wellhead or point of import. The fuel tax on natural gas has a degressive tariff: above 10 million cubic metres (mcm) per year the tariff is 65 per cent of the tariff up to 10 mcm per year.

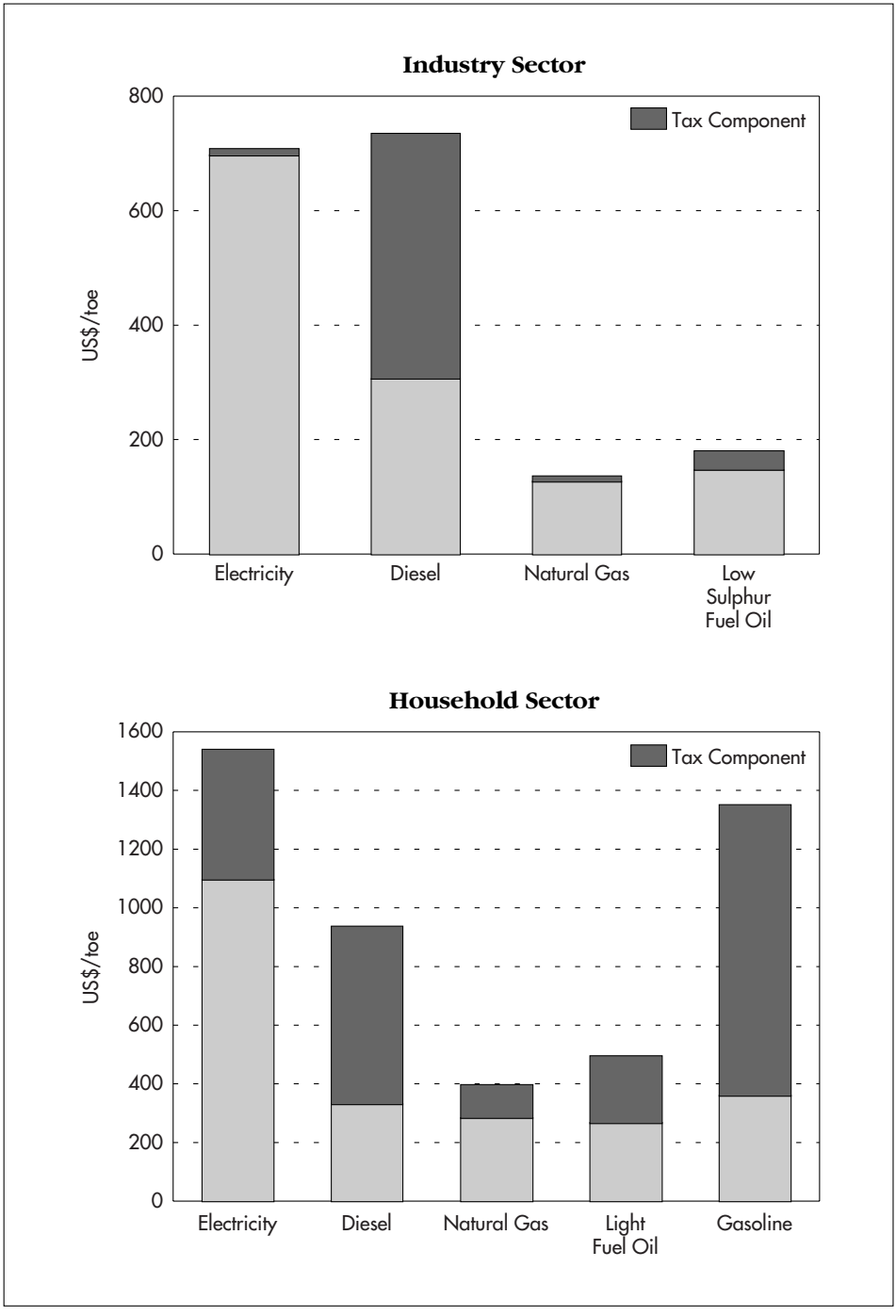
The tax is an input tax for electricity producers. It is levied on coal and natural gas, but not on imported electricity. Nor is there a refund for exported electricity. The uranium tax became effective in 1997 to ensure that nuclear electricity be treated the same as fossil generation.

The regulatory energy tax came into effect on 1 January 1996. The purpose of this tax is to provide financial incentives for energy conservation and the reduction of CO_2 emissions. It is also part of an environmental tax reform to shift the tax burden away from direct taxes, e.g. on labour, towards indirect taxes, especially on environmentally harmful goods and services. The regulatory energy tax does not contribute to the general budget. Revenues are recycled to taxpayers in the form of relief from other taxes.

For households, this relief takes the form of a lower income tax rate in the lowest income bracket, an increase in the tax-free allowance, and a higher standard deduction for senior citizens. Businesses are taxed at a reduced corporate rate. Small independent businesses benefit from a higher standard deduction.

The tax includes a tax-free allowance: the first 800 cubic metres of gas and the first 800 kWh of electricity consumed are not taxed. The tax is an output tax for electricity producers, as it is levied on electricity itself. It is levied only on electricity used in the Netherlands; electricity exports and electricity in transit are not subject to this tax. Natural gas use for electricity generation is exempt to avoid double taxation, since electricity generation from gas is taxed. Natural gas use in greenhouses is currently not taxed; in future it will be taxed at a low but increasing rate. The tax will be degressive, and large consumption above certain ceilings will be taxed at a zero rate to protect the competitive position of Dutch industries. In September 2000, the Dutch government intends to submit a bill to Parliament that abolishes the tax-free allowance. Instead, consumers would have to pay from the first units of energy consumption onwards, but would obtain a reimbursement of the tax. During the first year, this amount would correspond to the amount exempted under the tax-free allowance, but in following years this could change.

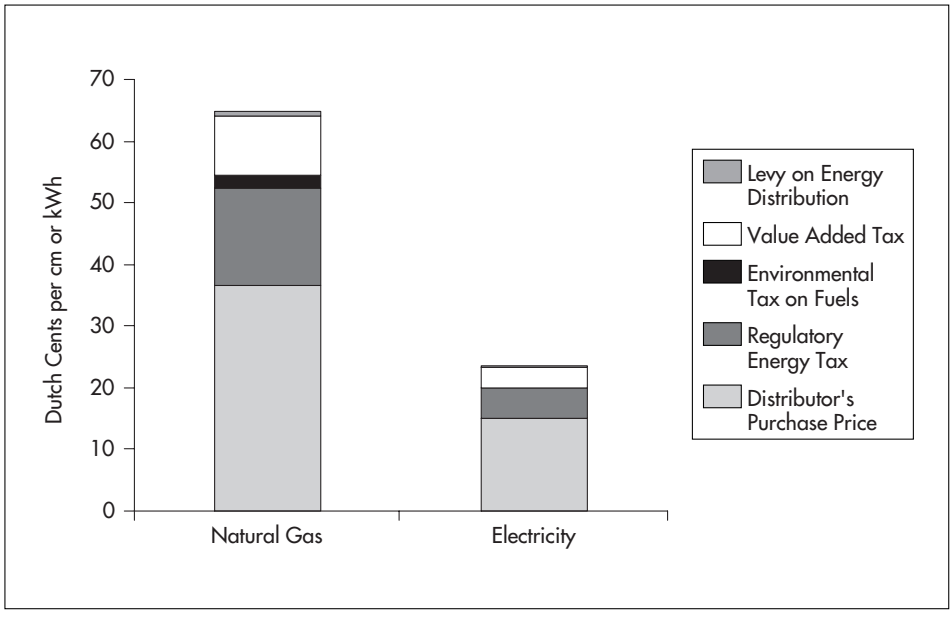
Figure 8
Fuel Prices and Taxes for Households and Industry, 1998



Source: IEA.

Figure 9

Residential End User Prices and Taxes for Electricity and Gas, 1999



Source: Ministry of Economic Affairs (Minez).

The regulatory energy tax was phased in and only reached its full effect in 1998. However, in that same year, the Dutch government decided to double energy taxes (regulatory energy tax and environmental tax on fuels) over the next three years from *f* 3.4 billion of revenue per year to *f* 6.8 billion in 2001. In practice, the increase applies almost solely to the regulatory energy tax (estimated revenue in 2001: *f* 5.4 billion) and not to the environmental tax on fuels (revenue in 2001: *f* 1.5 billion). The tax burden of this increase is to be shared proportionally between households and industries: 68 per cent for households and 32 per cent for industries.

About 85 per cent of the revenue from the increase will be used to lower direct taxes paid by households and industries. The remaining 15 per cent will be used to promote energy efficiency. For industries, *f* 300 million will be used mainly for tax credits for investments in energy-saving equipment. Households can apply for support to investment in energy-efficient appliances such as refrigerators and washing machines, and investments in insulation such as double glazing and roof insulation (Energy Premium scheme). They can get free advice on which investments in their homes are most effective in reducing energy consumption. *f* 200 million per year is available for this scheme, including the advice.

In connection with the decision to put 32 per cent of the tax burden on industries under the new system, tax ceilings were raised: from a yearly consumption of 170,000 cubic metres and 50,000 kWh to 1 mcm and 10 million kWh. Previously,

medium-sized industries would have had to pay tax for their consumption up to 170,000 cubic metres of gas and 50,000 kWh of electricity, but not beyond. Now, they have to pay tax up to the new, higher ceilings, but not beyond. As of 1 January 1999, all energy taxes and excise duties are indexed to inflation.

Table 1
Regulatory Energy Tax on Natural Gas
exclusive of VAT, Natural gas (cubic metres) in cents per unit

	Tariff 1998	*Increase 1999 (incl. Indexing)*	*Tariff 1999*	*Increase 2000 (incl. Indexing)*	*Tariff 2000*
0-800	0	0	0	0	0
800 - 5,000	9.53	6.45	15.98	4.84	20.82
5,000 - 170,000	9.53	0.91	10.44	1.00	11.44
170,000 – 1 million	0	0.71	0.71	0.83	1.54
Above 1 million	0	0	0	0	0

Source: Ministry of Finance.

Table 2
Regulatory Energy Tax on Electricity
exclusive of VAT, Electricity (kWh) in cents per unit

	Tariff 1998	*Increase 1999 (incl. Indexing)*	*Tariff 1999*	*Increase 2000 (incl. Indexing)*	*Tariff 2000*
0-800	0	0	0	0	0
800 – 10,000	2.95	2.00	4.95	3.25	8.20
10,000 – 50,000	2.95	0.28	3.23	0.32	3.54
50,000 - 10 million	0	0.22	0.22	0.26	0.48
Above 10 million	0	0	0	0	0

Source: Ministry of Finance.

CRITIQUE

The Dutch government makes extreme efforts to reconcile economic efficiency and environmental concerns. The Netherlands was not a pioneer in the introduction of competition in the gas and electricity markets, considering that market opening has been under discussion in the EU since 1985, and that the first competitive power markets date back to the beginning of the 1990s. The Netherlands ranks among those countries in Europe that have been slowest in introducing competition in the electricity market. This may well be due to the fact that decision-making in the Netherlands is largely consensus-based and therefore generally relatively slow-moving – discussions about market opening were held very early on. The current government recognises this very clearly, and has put the liberalisation effort on a faster track. In the next few years liberalisation might move very quickly. If this

happens, the Netherlands will more than make up for the delay – the country will be among the front runners of liberalisation in Europe.

In contrast, moves to protect the environment have a long tradition in the Netherlands, as illustrated in the section Energy Taxation, and policies in this area have been adopted rather swiftly. This suggests that environmental protection has for a long time carried more weight in government energy policy than economic efficiency. So long as this accurately reflected the concerns of voters and did not create trade barriers, and so long as voters were sufficiently informed to assess correctly the capacity of the economy to absorb the cost of such choices, in short, so long as these choices were *economically* sustainable, the government simply carried out its (difficult) task of reconciling potentially conflicting goals.

The situation has changed in the last few years. Instead of simply being a useful idea, introduction of effective competition is now obligatory under the EU Directives on gas and electricity. And since economic efficiency is also an important objective for the Dutch government, it has decided to open the markets wider and faster than required. The decision to speed up full market opening from 2007 to 2004 is a commendable initiative.

These actions also suggest that there is now a better balance between the two policy objectives of economic efficiency and environmental protection. But they also highlight the potential areas of conflict. The Netherlands is a small open economy surrounded by countries with different policies. The scope for independent policy is fairly small, and competitive markets strictly limit what is feasible domestically.

The government finds itself in a situation where it has to step up energy efficiency measures almost continually to keep pace with the results of the liberalising markets. Energy taxation has risen significantly over the last few years and a further significant increase is under way. The government needs to reflect upon the possible limits of this strategy, whether it is desirable to tax away all or a large part of the price reductions brought about by competition in order to meet energy efficiency and CO_2 targets.

At the moment, the government is addressing these issues efficiently, by shifting taxes away from income and corporate taxes towards energy. The government appears to be aware that energy price rises tend to have regressive distributional effects, that they particularly affect the less wealthy strata of society. Special attention is given to channelling the revenue from energy taxes towards these income groups, as well as towards measures for CO_2 emissions reduction.

There is also some concern regarding diversification of the Dutch energy market, especially the electricity market. The Netherlands already has the highest share of gas-based power generation in the world. The competitive power market may well not contribute to diversification. In addition, the government's CO_2 objectives and strategy require the existing coal-fired power plants to switch to biomass or gas by 2010. Nuclear power is unpopular and is scheduled to disappear from the Dutch

market. The government needs to monitor developments and consider whether an even higher share of power generation from natural gas is an acceptable outcome. If not, measures to promote diversification should be developed.

RECOMMENDATIONS

The government should:

- ☐ Maintain the current balance between economic efficiency goals and environmental considerations.
- ☐ Proceed with market opening in the electricity and gas markets as swiftly as possible.
- ☐ Continue the current approach to tax reform, especially the re-distribution of revenues to taxpayers if further tax increases prove necessary to achieve both economic and environmental objectives.
- ☐ Decide whether there should be any limits to energy tax increases, and if so, what they should be.
- ☐ Decide how much diversification in the power industry is necessary, taking into account that the market consists of the entire European Union. Monitor the market.

4

ENERGY AND THE ENVIRONMENT

CLIMATE CHANGE

Under the Kyoto Protocol and the EU burden sharing agreement based on it, the Netherlands is obliged to reduce CO_2 and non-CO_2 greenhouse gases by 6 per cent in the first budget period 2008 to 2012. Prior to the adoption of the Kyoto Protocol in 1997, the Netherlands only had a CO_2 target. Due to strong CO_2 emissions growth between 1990 and 1997, the country adopted a six gases approach. At present, greenhouse gas emissions are up 15 per cent compared to 1990.

The 6 per cent reduction target requires Dutch CO_2 emissions to be 50 million tonnes per year below what they would be in the 2008 to 2012 budget period if policies were to remain unchanged. This figure is derived from the government's White Paper on Climate Policy, issued in June 1999.

The White Paper itself is based on three long-term scenarios for the next 25 years, published in 1997 by the Netherlands' Bureau of Economic Policy Analysis (CPB). One of them, the global competition (GC) scenario, is the official reference for energy and climate policy. GC is a business-as-usual scenario assuming rapid energy demand expansion due to relatively strong GDP growth (3.3 per cent per year on average), a high degree of international competition, liberalised energy markets and relatively high oil prices ($28/barrel by 2020). The relatively high price assumptions stem from a pessimistic view above the possibility of making the Former Soviet Union's vast energy resources available for the world. Economic growth and high energy prices led to a relatively high degree of energy efficiency improvement (1.6 per cent per year on average) and continuing restructuring of the Dutch economy. Energy use continues to grow, however, by 1.4 per cent per year on average.

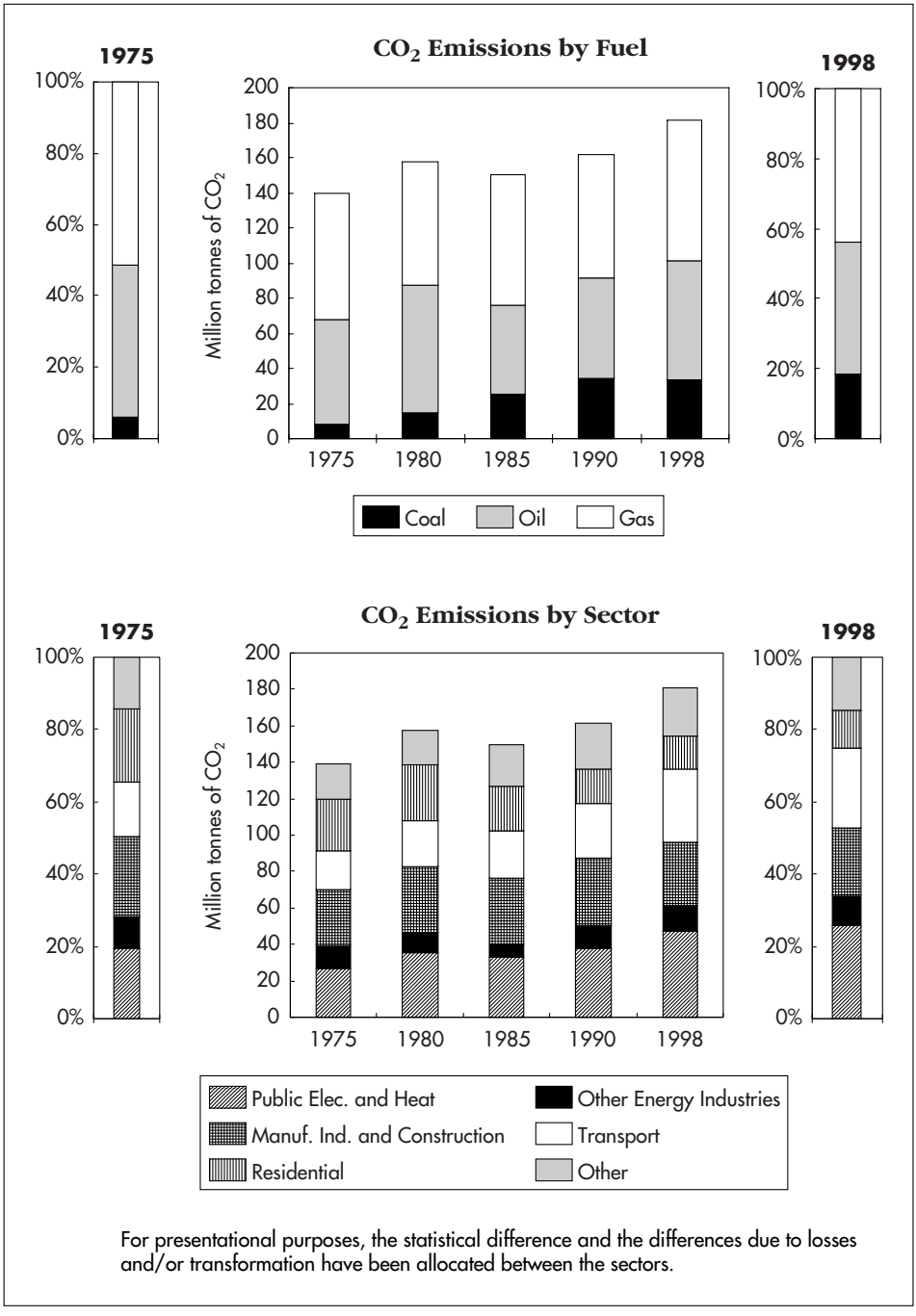
The global competition scenario projects emissions of 259 million tonnes of CO_2 equivalent[6] in 2010. The scenario was subsequently updated to include new policies that had been adopted, with 256 million tonnes of CO_2 as the basic assumption of the market outcome if no further government action is taken. In terms of forecasting CO_2 emissions, this scenario is relatively pessimistic, but the Dutch government chose it on purpose to be on the safe side.

Emissions in 1990 were 219 million tonnes of CO_2 equivalent. Emissions forecast for 2010 are 256 million tonnes. A six percent reduction gives an emissions target of 206 million tonnes. This means that there is a "policy shortfall" of 50 million tonnes per year in the budget period that needs to be addressed. 37 million tonnes stem from emissions growth over 1990, and 13 million tonnes are reductions below the 1990 baseline. The reference year for CO_2 is 1990; for other greenhouse gases the reference year is 1995.

6. Six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6), expressed as CO_2 equivalent.

Figure 10

Energy-Related Carbon Dioxide Emissions by Fuel and by Sector, 1975 to 1998



For presentational purposes, the statistical difference and the differences due to losses and/or transformation have been allocated between the sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Table 3
CO_2 Emissions Reductions for the Netherlands
Kyoto Target

	Million Tonnes of CO_2 Equivalent
Reference level 1990/95	219
Projected emissions in 2010 in global competition scenario	259
Projected emissions in 2010 including the first phase of the CO_2 reduction plan	256
Emissions target including 6 per cent reduction	206
Policy shortfall	50

Source: Ministry of Housing, Spatial Planning and the Environment: *The Netherlands' Climate Policy Implementation Plan*, The Hague, June 1999.

A May 1998 update to the Second Netherlands' National Communication on Climate Change Policies[7] stated that between 1990 and 1996 the CO_2 equivalent of the six gases rose by 6.9 per cent (temperature-corrected figure). This was to a large degree due to the 7.6 per cent increase in CO_2 emissions, which stemmed mainly from the transport and power generation sectors. In 1996, CO_2 contributed 75 per cent to total CO_2 equivalent emissions. Between 1990 and 1997, CO_2 alone rose by 11 per cent.

The 1999 White Paper on Climate Policy also contains emissions growth forecasts for each sector. It states that by 2010, emissions in the industrial sector will grow by 33 per cent, in the energy sector by 24 per cent, in the transport sector by 15 per cent, and in the residential sector by 9 per cent, unless extra policy measures are adopted. Based on these forecasts and expected reduction potentials in the sectors, sectoral emissions reductions targets were formulated, as detailed in Table 4 below.

Table 4
Projected Emissions and Reduction Targets per Sector
Million tonnes of CO_2 equivalent

Sector	*Emissions Forecast in 2010 (no extra policy)*	*Reduction in 2010*
Industry	89 (33 per cent)	10 (11.2 per cent)
Energy	61 (24 per cent)	8 (13.1 per cent)
Agriculture	28 (11 per cent)	2 (7 per cent)
Transport	40 (15 per cent)	3 (7.4 per cent)
Households	23 (9 per cent)	2.3 (10 per cent)
Services, government	12 (5 per cent)	1 (8.3 per cent)
Others	6 (3 per cent)	–

Source: Ministry of Housing, Spatial Planning and the Environment: *The Netherlands' Climate Policy Implementation Plan*, The Hague, June 1999.

7. Ministry of Housing, Spatial Planning and the Environment et al.: *Update of the Second Netherlands' National Communication on Climate Change Policies*, The Hague, May 1998.

The Dutch government has decided that it will attempt to make up half of the policy shortfall (25 million tonnes per year) abroad, by means of Joint Implementation, Clean Development Mechanisms and Emissions Trading. The government expects that during the 6th Conference of Parties to the Kyoto Protocol, hosted by the Netherlands in November 2000, work plans will be issued that will clarify the detailed implementation of these instruments.

For the 25 million tonnes of domestic reduction, the government has developed a package approach: a basic package of control measures to be put into effect immediately and a reserve package which can be activated later if it becomes clear that the basic package is unlikely to yield the required results. This requires a special policy decision. At two moments in time, in 2002 (end of the current government term) and in 2005 (fixed in the Kyoto Protocol), evaluations will be carried out to see whether the basic package is effective or whether the reserve package has to be activated. In addition, a third package, called innovation package, has been developed. This package is meant to provide an early indication of possible policies after 2010.

The three packages have the following characteristics:

- The basic package contains measures that were spread over all sectors and gases. About 70 per cent of the anticipated savings are to stem from CO_2 reduction and 30 per cent from the reduction of other greenhouse gases. Table 5 shows the areas which are targeted in the basic package and the contribution they are expected to make to the emissions reduction objective of 25 million tonnes of CO_2. The individual measures used under this package are discussed in the sections Energy Efficiency and Renewable Energy Sources.

  Measures had to be cost-effective to qualify. To determine whether they were, two sets of costing methods were used: a national costs method to determine the costs and benefits for the whole country and an end-user cost method to determine costs and benefits to end users. The national method used a discount rate of 3 to 5 per cent and import prices for energy. The end-user method used much higher discount rates of 15 per cent for industry and 8 per cent for all others, to reflect their shorter planning horizons. Price assumptions were based on actual end-user prices including taxes and distribution margins. This allowed eliminating options that show large societal benefits but little potential for actual implementation because of long pay-back periods. Also, very unpopular measures, such as the more radical approaches to modal shift in the transport sector, were eliminated, even if they showed high savings potential and negative societal cost. The "softer", less intrusive measures that were retained for the transport sector are the only measures to show societal benefits because they also reduce air pollution, noise and accidents.

- The reserve package is intended to provide a safety net in case the results of the basic package are insufficient. If it becomes clear in 2002 and/or 2005 that further action is necessary, the reserve package, or other measures, can be implemented. Activating the reserve package requires an additional political decision.

Table 5
Target Areas of the Basic Package for CO_2 Reduction

	CO_2 Reduction (million tonnes per year)	*Societal Costs (million f per year in 2020)*	*End-User Costs (million f per year in 2020)*
Non- CO_2 greenhouse gases	8	140	220
Energy efficiency	9	665	250
Transport	2-3	–475	0
Renewable energies and power plants	6	660	920
Total	**25**	**990**	**1,390**

Source: Ministry of Housing, Spatial Planning and the Environment.

The principal actions under the reserve package are the next best measures in terms of cost and effectiveness following those in the basic package. These measures are a further rise of the regulatory energy tax beyond what is already approved, a rise in the excise duty on motor fuels, underground storage of CO_2 from large industrial sources, a reduction of N_2O in the chemical industry and reduction of methane emissions in the fertiliser industry. The N_2O measure allows reducing emissions by 10 million tonnes of CO_2 equivalent but depends on the development of a catalyst, research for which has started.

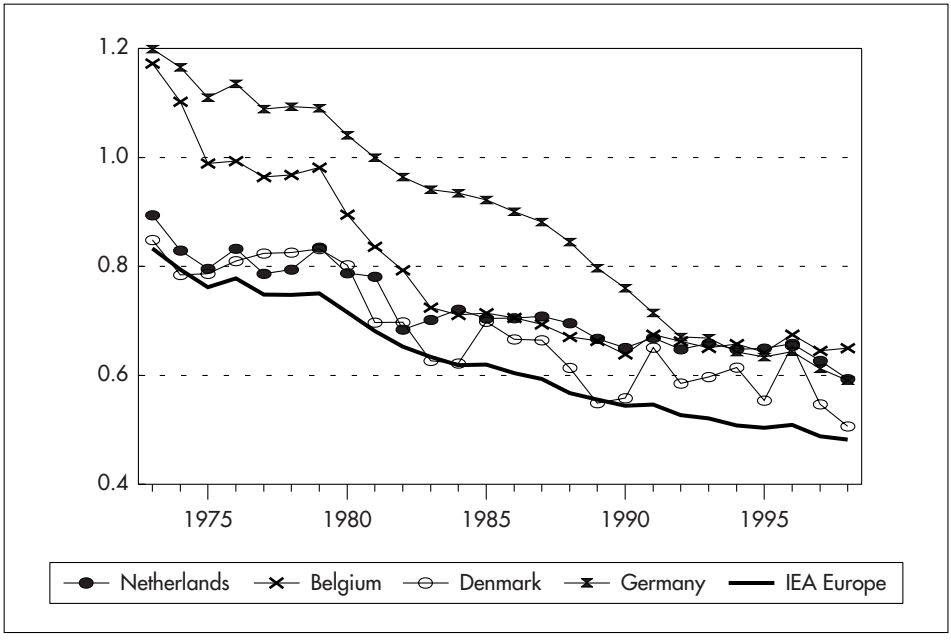
Underground storage of CO_2 was estimated to be a cost-effective measure under the assumption that resource scarcity is not a problem in terms of energy. If it is, energy efficiency (e.g. avoidance of consumption) carries a double benefit: it reduces scarcity and reduces environmental effects. If scarcity is not a problem, only the environmental effects have to be addressed and an "end-of-pipe" approach may be sufficient. In light of the most recent estimates of global energy reserves, especially gas hydrates, the Ministry of Housing, Spatial Planning and the Environment considers that energy may well not be as scarce as anticipated.[8] The Ministry of Housing, Spatial Planning and the Environment concludes that CO_2 storage in underground aquifers or empty gas fields may be a cost-effective measure, especially when the CO_2 can be obtained as a pure gas stream in large quantities from a production process, such as ammonia production in the fertiliser industry. The government has initiated a programme called the CO_2 buffer project to

8. Global economically recoverable reserves of fossil fuels are estimated to total about 1,000 billion tonnes of carbon, representing more than the current total carbon content of the atmosphere (about 770 billion tonnes or 374 ppm in 1994), and about 165 times annual global carbon emissions due to fossil fuel use. Conventional fossil resources that are recoverable but not economic at current prices are many times larger, amounting to 3,500 billion tonnes or five times the current concentration in the atmosphere. This implies that the objectives of the Climate Convention, i.e. stabilising the current carbon concentration in the atmosphere, will impose limits on fossil fuel use long before resource scarcity will. See Ministry of Housing, Spatial Planning and the Environment: *The Netherlands' Climate Policy Implementation Plan*, The Hague, June 1999.

investigate means of increasing carbon sinks. In the framework of this project, it intends to study US and Norwegian experiences in this field. Results are due in 2001, in time for the first evaluation for the reserve package.

- The innovation package attempts to look at technologies and policy instruments that can become effective beyond the first budget period. It anticipates that the possibilities of reducing emissions of non-CO_2 gases will have been largely exploited after 2010. Its emphasis lies on "climate neutral" technology and energy carriers such as hydrogen and biofuels, and on emissions trading, because by the time of its implementation there will be more experience with the flexibility mechanisms. In this longer term package, CO_2 storage also plays a role.

Figure 11
Energy-Related CO_2 Emissions per GDP in the Netherlands and in Other Selected IEA Countries
(Kilogrammes CO_2/US$ using 1990 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

RESPONSE POLICIES

Energy Efficiency

End-Use Efficiency

Energy efficiency policy has a long tradition in the Netherlands. Efficiency measures are carried out for a variety of reasons ranging from climate change and

air pollution to export opportunities for domestic industry, economic development and energy security.

Current measures to stimulate energy efficiency comprise the full range of instruments available to governments: legislation, fiscal instruments, voluntary agreements and communication and information measures. Existing measures will be intensified or complemented by the measures in the basic climate change package. Table 6 provides an overview of the types of measures currently in place.

Much of the responsibility for energy efficiency policy in recent years has lain with the Ministry of Economic Affairs, which had primary responsibility for tax incentives, long-term agreements, the regulatory energy tax and public information and awareness campaigns. Other ministries had an important role, especially the Ministry of Housing, Spatial Planning and the Environment.

The role of the Ministry of Economic Affairs is increasingly becoming an initiating and co-ordinating role. The government's intention, mentioned in the Action Programme for Energy Conservation, is a clear allocation of responsibilities to different ministries directly involved. This implies that the Ministry of Economic Affairs is to be primarily responsible for energy efficiency improvements in the industrial and commercial sectors. The Ministry of Housing, Spatial Planning and Environment is to become responsible for energy efficiency in the residential and public sector. The Ministry for Transport, Public Works and Water Management and the Ministry for Agriculture, Nature Management and Fisheries and the Ministry of Finance are involved in numerous fiscal measures to stimulate energy conservation and renewables. A re-shuffling of responsibilities in Spring 2000 greatly furthered these objectives.

Energy efficiency objectives are not a new phenomenon in the Netherlands; successive governments have developed and used such targets for more than two decades. The current key efficiency goals are set out in the Third White Paper on Energy Policy of 1995/1996 and the documents based on it. The Third White Paper on Energy Policy provided for an increase in energy efficiency by one third by 2020. In the government's global competition scenario, the efficiency measures adopted by 1997, as well as the assumption of high energy prices, together yielded an average annual rate of energy efficiency improvement of 1.6 per cent between 1995 and 2020. This compares with an actual annual energy efficiency improvement of 1.4 per cent in the period 1990 to 1997, including an estimated de-materialisation effect of 0.1 per cent per annum. Energy savings in the residential and commercial sector, in agriculture, in transport and in construction were below the targets set in the 1995/96 White Paper. Consumption rose fastest in the transport sector, due to increased demand for mobility. Savings in industry proved to be higher than expected.

However, the Netherlands' objective under the Kyoto Protocol required strengthening the efficiency target. This led to the development of the Energy Conservation White Paper (EBN), which was presented to and adopted by Parliament in 1998. The Conservation White Paper reviews the possibilities for intensifying energy efficiency efforts in the period up to 2010 with a view to reaching the government's CO_2 objective. It concludes that the rate of energy conservation could

be increased by about 0.4 per cent per year over the 1.6 per cent that was already anticipated, to 2 per cent per year. This increase is to be achieved via new or intensified measures, including higher taxation. The feasibility of this target is uncertain, as the outcome will be depend on factors beyond government control, such as economic growth, the level of energy prices and European Union policies in this area.

Based on the Conservation White Paper, the 1999 Tax Plan, and the 1999 Action Programme on Climate Change Policy, a shorter-term Energy Conservation Action Programme 1999-2000 was developed and presented in May 1999. The Action Programme is a more concrete elaboration of the objectives of the White Paper. It sets out the contributions that are expected from the different sectors of the economy and the various target groups in the 1999-2000 period. It also describes the government instruments that will be deployed in this period.

The Action Programme emphasises the importance of energy monitoring. The Dutch government attaches considerable importance to the systematic collection and processing of data relating to energy conservation. This can show whether the Action Programme is on track and whether its ambitions will be realised. Monitoring is to take place on three levels: national (macro), the end-users or sectors (meso) and on the level of measures or instruments (micro).

The government allocated a budget of *f* 690 million to the Energy Conservation Action Programme in 1999. This is to rise to around *f* 910 million in 2001. In the same year, fiscal incentives for energy efficiency will total *f* 300 million for companies and *f* 200 million for households. This is twice what the government spent on energy efficiency in 1998. Ultimately, about one quarter of the budget will be spent for subsidies and three quarters will be spent for tax incentives. These monies do not include funding of the CO_2 reduction plan.

For the implementation of the CO_2 reduction plan, an additional 1 billion Dutch guilders per annum were set aside. The initial amount was *f* 720 million in 1996; another *f* 250 million were added later. The plan includes two subsidy schemes. One is the Ministry of Economic Affairs' Decree on CO_2 Reduction Plan Subsidies. This includes a number of sub-programmes: industrial residual heat, heat pumps, advanced heat and power, process integration, energy-intensive industry, drying/baking/melting/membranes, and construction and wood. The other scheme is the Ministry of the Environment's investment contribution scheme for non-industrial residual heat infrastructure. Resources are also available for transport projects with a strong energy conservation element.

Energy efficiency policy is to be based primarily on voluntary agreements and self-regulation by the targeted sectors, supported by financial and fiscal incentives for efficiency investments. Measures for energy-intensive sectors that have to compete on an international level are principally based on the covenant approach (benchmarking and long-term agreements on energy efficiency). The key tools for other sectors, not exposed to international competition, are the regulatory energy tax and levies, advice and regulation.

Table 6
Current Energy Efficiency Policy Instruments

Legislation	*Long-term Agreements (Meerjarenafspraken, MJAs) and other Covenants*
• Households: building standards (EPN) • Industry: permits	• Benchmarking Covenant • Long-term agreements with industry (31 agreements at end-1998) • Long-term agreements with greenhouse growers and the services sector (12 agreements at end-1998)
Fiscal	*Communication and Information*
• Energy tax and tax exemption for green electricity • Subsidies • Tax incentives • Free depreciation of environmental investment (VAMIL), • Energy investment tax relief (EIA) • Green investment	• Information campaigns • Perspective project

Source: Ministry of Housing, Spatial Planning and the Environment.

Energy-intensive industry consists of companies consuming more than 12 thousand tonnes of oil equivalent per site. This category covers some 180 companies, including the power generation sector. These companies often operate in an internationally competitive market and account for some 38 per cent of total Dutch energy consumption. Energy is an input factor that contributes 7-20 per cent to the companies' total production costs. By 1997, energy-intensive industry had realised average energy savings of 14.5 per cent in comparison with 1989.

The main instruments for dealing with energy-intensive industry are tax incentives, long-term agreements, programmes on breakthrough technologies, and the so-called Benchmarking Covenant (Benchmarking Agreement). The government believes that a very important contribution to industrial energy savings was made by the long-term voluntary agreements (MJAs). 1989 is the reference year for long-term agreements, since 29 of the existing 31 agreements were concluded at that time, covering 90 per cent of industrial energy demand in 1989. MJAs were also concluded with companies in the services sector. It was estimated that all MJAs together improved energy efficiency by an average of 2.9 per cent per year between 1989 and 1997. The agreements expired in 1998 and there is now a programme to sign up companies again. The vast majority of companies has re-subscribed to such agreements, and the government estimates that their targets for 2000 will be met.

The Benchmark Covenant is a voluntary agreement by which the energy-intensive industries in the Netherlands have committed themselves to meet 'best in the world'

standards for energy efficiency in processing plants. This means that they must be as energy-efficient as the most energy-efficient comparable facilities that exist in the year 2012. However, they need not go beyond their best competitor's energy efficiency record; it will be sufficient to equal the best competitor's level. In return, the industries will not be burdened with extra national measures aimed specifically at reducing CO_2 emissions. The Benchmarking Covenant is a new energy efficiency measure forming part of the basic package of CO_2 measures.

The funding programmes for breakthrough technologies are the SPIRIT (breakthrough technologies for industrial energy conservation) and the BTS (joint projects between companies and research institutes) programmes. These are multi-annual programmes to stimulate the development and market acceptance of new technologies.

The basic package of CO_2 measures comprises one voluntary agreement that specifically targets coal-fired power plants. In this agreement, generators committed themselves to limit their CO_2 emissions by 2010 to what they would be if natural gas instead of coal were the input fuel today. In return, the government committed itself to convert the current tax on input fuels to an output tax on electricity that would also be levied on electricity imports. The background of this measure is that about 2,500 MW of the existing coal capacity is double-fired and can also use gas, although at lower thermal efficiency. Furthermore, coal can be partly replaced by biomass.

Medium-sized industry consists of companies with an annual energy consumption between about 2,400 and 12,000 tonnes of oil equivalent per industrial site. This category comprises about 300 companies. The main measures applied to this sector are tax incentives and multi-annual voluntary agreements. The government has contracted such agreements with more than 40 industrial and non-industrial sectors in recent years. Many of these agreements expire in 2000. In the coming years, a total of 17 agreements are expected to be renewed and five new ones will be contracted. The new voluntary agreements will focus mainly on the larger energy consumers, and will include some new features. For example, agreements will better reflect each individual company's situation. Measures will have an internal rate of return of at least 15 per cent, corresponding to a recovery period of five years or less for investments. As of 2001, a standardised and improved monitoring system will be in effect.

In the agricultural sector, fiscal measures and voluntary agreements are used to stimulate CHP development as well as utilisation of third party residual heat. There is also a programme designed to encourage the use of CO_2 as a growth agent in the greenhouse sector.

Measures for the transport sector focus on three areas: higher fuel efficiency in cars, driving behaviour and reduction of mobility demand. The first item focuses on tax incentives for the purchase of more fuel-efficient cars, on energy labelling, and on an agreement between the European Commission and the European car industry. This agreement already exists; its objective is to reduce CO_2 emissions per kilometre driven by 25 per cent in 2008 compared to 1995. Due to the slow

turnover of the car fleet, the net effect will, of course, be limited. The Dutch government is currently pressing for a stronger commitment.

The government intends to influence driving behaviour through more stringent enforcement of speed limits, increased tyre pressure, and in-car instruments such as cruise control and econo-meters. Increased tyre pressure reduces fuel consumption by reducing friction between the car and the road surface and is expected to contribute 0.3 million tonnes of CO_2 savings. At present, tyre pressure is too low in about half of all cars. Driving behaviour of truck drivers is targeted with in-company training and education courses.

Reduction of mobility demand is to be achieved through fiscal incentives such as road pricing, or changed tax provisions for travelling expenses, commuter travel, and the use of company cars. The plan also comprises longer-term measures such as energy-efficient physical planning. This involves transport performance measures per location, parking policy at local level and the design of corridors at national level. It also includes a programme for road freight transport. These measures all form part of the basic package to reduce CO_2 emissions. The reserve package encompasses somewhat more intrusive action such as reducing current speed limits to 100 km/h.

The services sector comprises a very heterogeneous group of companies, including companies with branch offices (banks, insurance companies etc.) and intermediate and retail trade. In addition to global tax incentives, the major instruments to promote energy efficiency are long-term agreements (MJAs), an energy performance standard (EPN) and a programme called Energy Performance Advice (EPA).

Long-term agreements have been contracted with banks, insurance companies, airlines, Amsterdam's Schiphol Airport and the Dutch railway company. The government estimates that these MJA's are on schedule. Wherever possible and relevant, new MJA's are to include additional conditions on logistics, transport management and the use of renewable energy. The EPN performance standard applies to new utility buildings. This standard was tightened as of 1 January 2000, raising the energy conservation target by 10 per cent. The EPA programme is an energy auditing programme for existing buildings. It uses energy scanning methods and spells out recommendations for energy efficiency improvements.

In the residential sector, the key instruments to stimulate energy efficiency are the regulatory energy tax, EPA and EPN. The first of three annual steps towards increasing the existing regulatory energy tax was taken in 1999, as provided in the 1999 Tax Plan. Some of the additional revenues from this increase will be used to finance the Energy Premium scheme. This scheme provides a grant for buyers of energy-efficient appliances. For the time being this mainly involves the so-called 'A-label' or comparable appliances. Consumers who buy energy-efficient appliances and who take energy conservation measures in their home receive support under this scheme. The energy companies, which collect the regulatory energy tax via their energy bills, are to implement the programme. A total sum of *f* 200 million per year has been allocated for the scheme as from 1999.

Energy Performance Advice for existing residential properties is under preparation. This advice will show which measures can best be taken, the energy savings that will result and the costs. The EPA and the results achieved will be evaluated in the year 2003. Progress will be monitored for this purpose and will also provide information on the energy position at existing Dutch buildings. Further steps to fulfil the efficiency potential in existing buildings will then be determined on the basis of the outcomes.

The Energy Performance Standard is laid down in the Building Act. At present, the requirements for new residential properties is 1.2, which means that buildings must be designed in such a way that no more than 1,200 cubic metres of natural gas will be required each year for heating, hot water and cooking in a standard-size dwelling.[9] The EPN requirement was tightened to 1.0 as of 1 January 2000.

Energy conservation policy on appliances focuses on levelling off the rising trend in electricity consumption. The aim is to improve the energy efficiency of appliances by an average of 1.8 per cent per year between 1995 and 2010. The policy makes a distinction between the supply, purchase and use of appliances.

Transformation Efficiency

A number of the energy efficiency measures currently in force in the Netherlands are directed not at end-use efficiency but at the efficiency of transforming primary energy into final forms of energy. The application of the Benchmark Covenant to the electricity supply industry is one example. The use of combined heat and power production (CHP), however, offers by far the greatest potential for increasing transformation efficiency.

The Third White Paper on Energy Policy of 1995/1996 set out an extremely ambitious objective for CHP: By 2010, 15,000 MW of CHP capacity were to be installed. This objective is repeated in the 1998 Energy Conservation White Paper (EBN) and forms part of the global competition scenario and thus the Dutch basket of measures for reaching the Kyoto target. An interim target of 8,000 MW of CHP capacity producing 30 per cent of power generation was set for the year 2000.

This capacity increase, which represents more than four times the installed CHP capacity in 1990, was to be stimulated through a multitude of incentives and support measures, including both general tax incentives and also a range of measures specifically targeted at CHP investment and the sale of surplus electricity to the power grid. These measures are described in detail in the section The "Decentralised" Market in the chapter on Electricity.

At the end of 1997, this plan had led to the construction of 7,800 MW of CHP capacity: 52 per cent of this was industrial CHP, 16 per cent was used in greenhouse horticulture and 32 per cent was used for district heating. While the

9. Much of Dutch housing is of standard (similar) size.

interim objective for 2000 was clearly within reach, even this amount of capacity had created massive overcapacity in the power industry. In light of this overcapacity, and the imminent liberalisation of the power industry required under the EU Electricity Directive, most of the specific measures were phased out at the end of 1997. In the agricultural sector, fiscal measures are still used to stimulate CHP development. However, lower electricity prices in the competitive market and a recent 15-20 per cent increase in investment costs for new CHP are thought to further limit the prospects for new CHP. Consequently, the government has revised its expectations regarding the contribution of CHP. It now expects capacity to reach 8,000 MW in 2000, but to increase only very slightly thereafter.

Renewable Energy Sources

According to the accounting method used by the Dutch government, renewable energy sources currently contribute some 1.3 Mtoe or 2 per cent to Dutch primary energy supply (1998). Over 90 per cent of this amount stems from combustible renewables and wastes. Table 7 details the contribution of individual renewables to Dutch energy supply.

Table 7
The Contribution of Renewable Energy Resources*
Tonnes of oil equivalent

	1990	*1998*
Hydro	16,955	19,820
Wind	10,985	126,564
Photovoltaics	0.00	716
Solar thermal	1,910	7,164
Heat pumps	n.a.	4,059
Heat/cold adjustment	239	4,059
Biomass and waste combustion	418,139	649,536
Total	**448,228**	**811,918**

Source: Ministry of Economic Affairs.

* Using the measurement method in the "Protocol for the Monitoring of Sustainable Energies", which is relatively restrictive. Another method, set out in the Third White Paper on Energy, yields higher values. Following this other method, the value for 1998 is 1,321,280 tonnes of oil equivalent.

In line with the renewables objective of the Third White Paper on Energy Policy of 1995/96, i.e. to increase the contribution of renewables from 1 per cent in 1995 to 10 per cent in 2020, the basic package of the CO_2 reduction plan and the Renewable Energy Action Programme 1997-2000 set an interim target of 5 per cent by 2010. This requires gaining another 3 per cent between now and the end of the first budget period. The global competition scenario predicts that with the methods currently in place, the share of renewables in total primary energy supply will only grow to 3 per cent.

In its 1999 Energy Report (Energierapport 1999), the government developed a plan to add the missing 2 per cent. The government intends to spend 166 million Dutch guilders, an extra 55 million per year, on R&D and demonstration programmes concerning renewables.

Perhaps more importantly, a consumer survey showed that ultimate consumers in the Netherlands are very willing to pay for additional supply of renewable energy, e.g. through mechanisms such as green electricity pricing. This willingness to pay higher prices for renewables is such that the renewables objective can in principle be met and even exceeded by 40-50 per cent in 2010, provided of course that consumers behave as they say in the survey.

Another result that emerged from the government's research is that renewable energy supply cannot be increased rapidly enough to meet this additional demand unless support measures are adopted. Supply is inelastic for a multitude of reasons, including citizens' reluctance to accept facilities such as wind turbines in their neighbourhood.[10] The available solutions, e.g. off-shore wind parks, are considerably more expensive. Consequently, the government expects only 50 MW of additional wind capacity on shore by 2010, but some 100 MW near shore. The wind potential farther off shore was estimated at 4,000 to 6,000 MW, but the costs are much higher and unsolved technical questions remain.

Biomass and waste combustion are affected by the same factors, despite being the main contributors to renewable energy today. Waste incineration in particular is difficult to expand, due to its potential air emissions. Again, more acceptable forms needed for expansion of supply are more expensive. Also, refuse collection has to be organised in such a way that combustible wastes are extracted more efficiently from the overall amount of waste. Efforts to this effect are announced in the Energy Report 1999.

The government is currently developing mechanisms to improve the elasticity of renewables supply. These include developing financial support schemes for more expensive but more acceptable projects. Other support mechanisms include a "green certificates" trading system, described in the following section, to be launched in early 2001 and further action to "de-bottleneck" development of renewables. In the long run, the costs of renewable options are expected to drop. Hence, the government expects that the goal of 10 per cent renewable energy sources in total consumption in 2020 can be reached.

Allowances Trading

The new electricity and gas liberalisation laws both contain provisions for the establishment of a "green certificates" trading scheme. Under such a scheme, all ultimate gas and electricity consumers would acquire a certain number of "green certificates", depending on their total consumption. Whereas a mandatory scheme

10. This is known as the "Nimby" problem ("not in my backyard").

was under discussion, the current government prefers a voluntary certificates system. These certificates could be used to finance energy-efficient technologies and renewables projects. Emissions permits would be made tradable either when the scheme begins or shortly afterwards. The market for green certificates is to begin operating in 2001.

Details of the proposal, which has been under discussion for more than five years, are being developed. The system will require an organisation that acts as a "green energy" bank to issue certificates to producers, register transactions, and collect the certificates again from consumers. Figure 12 shows the possible features of such a system.

A possible model for the green certificates trading scheme is the "green label" system now operated by the energy distribution companies. The system supports their mutual goal regarding a renewable energy target. It is a closed system only involving the energy distribution companies. The green labels are tradable.

Another example is a plan under way in the Ministry of Housing, Spatial Planning and the Environment regarding a trading scheme for NO_x emissions in the energy sector. The scheme intends to reduce these emissions by 55 per cent in 2005 compared to 1995 levels. A further 25 per cent reduction is aimed for by 2010. Facilities that emit NO_x will be able to sell their emissions reduction surpluses to others who cannot meet the required reductions. Trading is to occur on an annual basis. A NO_x Exchange Board will be formed and enter into contract with the parties concerned.

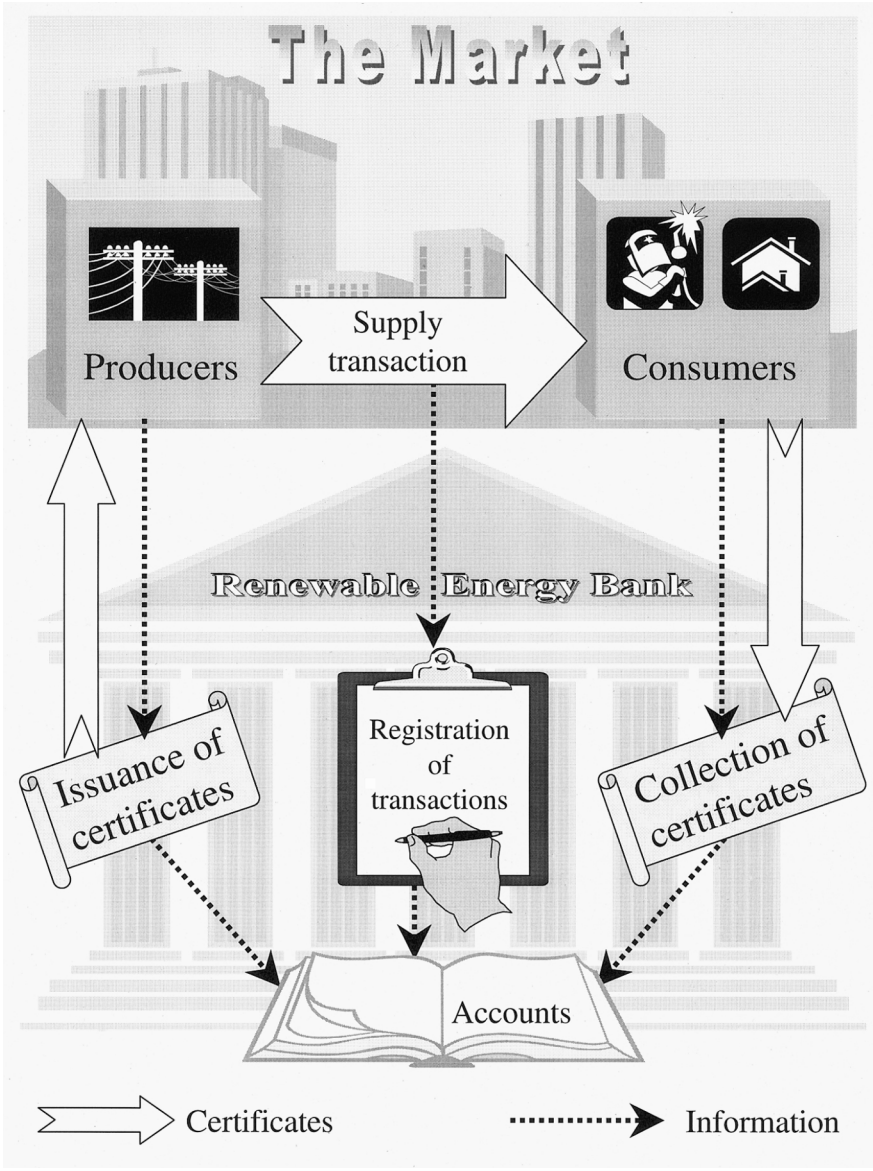
CRITIQUE

The Netherlands has a very strong and vocal environmental movement and environmental considerations are also one of the dominant mainstream policy concerns. Consequently, the Dutch government has involved itself very strongly in the climate change debate. The government has clear and very ambitious objectives in accordance with its international commitments under the Kyoto Protocol and the EU burden sharing mechanism. The government is adhering to these objectives and striving to reach them even though policy observers and decision-makers are beginning to express doubts about their feasibility: A recent European Union forecast[11] concludes that under business-as-usual assumptions, a 7 per cent increase in energy-related CO_2 emissions is likely to occur in the EU instead of the aimed-for 8 per cent reduction.

Observation of energy demand trends in the Netherlands makes it clear that these ambitious objectives may well not be completely reached in the established time

11. European Commission/Directorate-General for Energy: *European Union Energy Outlook to 2020*. The Shared Analysis Project, Energy in Europe Special Issue, November 1999.

Figure 12
Green Certificates Trading System



Source: Ministry of Economic Affairs.

frames. The Dutch government is fully aware of this, due to extensive monitoring of energy trends. The Netherlands is no exception in this area: this is the case in most other IEA countries as well.

The government has so far responded to these challenges in a remarkably flexible way. When it became clear in the mid-1990s that an exclusive CO_2 target would be very difficult to reach, the target was changed to incorporate non-CO_2 greenhouse gases, which appear to offer a less costly, though limited opportunity to reduce emissions. This new target was incorporated into the country's menu of reduction measures and in this respect, the Netherlands appears to be ahead of policy development in the European Union. The EU has only recently drawn the conclusion[12] that greenhouse gases not related to the energy sector must be taken into consideration.

Flexibility and determination to reach the targets also find their expression in the design of the CO_2 reduction programme. The programme effectively tackles the task in three steps, starting with the basic programme, which comprises the steps the government favours due to their relatively low cost and political and social acceptability. The reserve package is a contingency plan that would come into play if the basic programme does not fulfil its objectives.

Developing a contingency plan today is a prudent decision, since even the measures of the basic programme involve massive intervention in the energy market. This is best illustrated by the support programme for combined heat and power production.[13] Despite the support for environmental protection in the population, the government cannot be certain that the policy measures required to meet the objectives will actually be adopted. Recently, a set of building standards that were meant to be mandatory were in fact adopted as voluntary standards; this kind of shift has a noticeable effect on predicted CO_2 emissions. The decision to start developing today a long-term programme for the period after 2010 is equally prudent: it reduces the probability that the Dutch voter and consumer will be exposed to unpleasant surprises along the way.

The innovation package and the reserve package contain a very unconventional, innovative measure based on recent developments in the approach to resource scarcity, namely CO_2 storage. While the exact cost, risks and technical issues of this approach are not yet fully clear, it is wise to begin exploring them today. The transformation necessary to stabilise greenhouse gas concentrations in the atmosphere is very far-reaching. All possible approaches should be explored because they might all be necessary eventually.

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12. European Commission/Directorate-General for Energy: *Economic Foundations for Energy Policy*. The Shared Analysis Project, Energy in Europe Special Issue, December 1999. Although non CO_2 emissions account for only 20 per cent of the EU's total emissions, including them appears to offer ways of alleviating the burden. An 18 per cent reduction of the two major non-energy greenhouse gases, methane and N_2O, could decrease the necessity for reducing energy-related CO_2 emissions from –8 per cent to about –5 per cent.
13. See section The "Decentralised" Market in the chapter on Electricity.

It is commendable that in principle the mechanisms for achieving the targets are market-oriented and, in many cases, relatively light-handed. A notable exception is the CHP support programme that was in force until 1997. In light of the altered market conditions, especially in the electricity market, the CHP objectives were considered unattainable for the time being. The government has responded flexibly by re-assessing the objectives and adjusting the corresponding timetables. The planned green certificates and emissions trading schemes are likely to be fully compatible with the liberalised electricity and gas markets.

However, the allowances trading schemes under development for the Dutch market are progressing slowly. Emissions trading schemes were developed more than 10 years ago and have been in use elsewhere for almost the same length of time. The Dutch government should accelerate their implementation because they might become one of the most important means for environmentally-oriented government influence once the markets have become fully competitive and when costs and prices have fallen to their ultimate levels. So far, many governments and regulators have underestimated the effectiveness of competition in reducing costs. Rapidly dropping end-user prices or producer costs will quickly put renewables and energy-efficient technologies at a significant economic disadvantage, unless they too can benefit under competition. Recent developments indicate that the Dutch government is aware of these issues: the development of the trading scheme has been put on a faster track.

The strong ambitions of the government in the environmental area are nowhere clearer than in the field of renewables. The Netherlands is not a country blessed with an easily accessible, ample renewables potential. Hydro power plays almost no role at all. Still, the Netherlands has a comparatively high renewables target. The one resource the government can rely on is the strong support of the population for renewable energy, expressed in people's ample willingness to pay higher prices for renewables. The government seems to be making good use of this support, addressing obstacles where they arise.

The task of reducing greenhouse gas emissions to the required extent and in the required time frame is not easy. The Dutch government appears to be doing whatever is realistically possible to achieve these targets. When targets were missed in the past, the government often responded by stepping up its efforts and by adapting its policy instruments. As necessary during liberalisation, the government is withdrawing from the energy market to a certain degree. The target may not be reached under these circumstances. The government should prepare itself for further setbacks, continue to monitor market trends, and continue to respond flexibly.

RECOMMENDATIONS

The government should:

- ☐ Continue to monitor energy market and emissions trends closely and continue to respond to them in a flexible way.

- ☐ Continue to adjust policies to what is realistically feasible and continue to shift to low-cost, politically acceptable measures as much as possible. Use public awareness campaigns to highlight difficult choices.

- ☐ Speed up the development and introduction of the voluntary green certificates trading scheme. Such schemes require much attention to detail and consultation with participants. More concrete rules must be proposed soon if the deadline for start-up in 2001 is to be met.

- ☐ Make use by all possible means of consumers' and voters' willingness to pay for environmentally benign renewable energy sources, while ensuring efficient, low-cost supply of these energies and addressing acceptance problems.

5

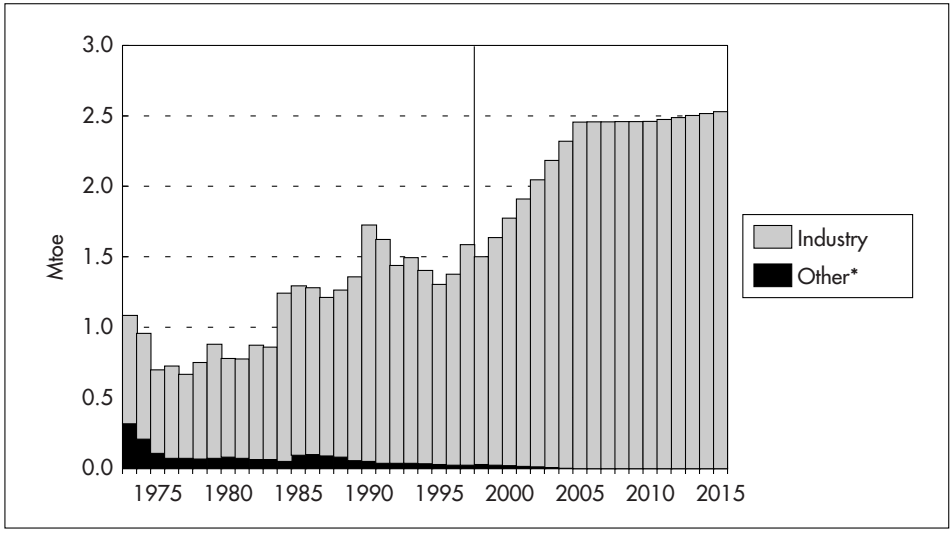
FOSSIL FUELS

COAL

The availability of inexpensive coal is optimal in the Netherlands due to the very good harbour logistics. In particular, the Rotterdam and Amsterdam harbours have large sites for stockpiling and blending. Since 1992, further improvements in logistics have allowed blending of coal of very different qualities. In 1994, the co-called "battle coal" programme was introduced. Under this programme, very cheap coal of inferior quality is blended with higher-quality coal to yield an acceptable blend. Taken together with a well-managed buying policy, this programme results in the lowest coal prices in Europe. "Battle coal" can be used in Dutch power stations because special efforts have been made to enable them to use a wide range of coal qualities while continuing to achieve environmental standards.

As elsewhere in IEA countries, power generation is the last major coal-consuming sector. The most recent expansion of Holland's coal-based generating capacity was completed in 1994, when 630 MW came on stream in the "centralised" segment power market.[14] At the same time, the 253 MW integrated coal gasification combined cycle (IGCC) plant at Buggenum was nearing completion. Plans to

Figure 13
Coal Consumption by Sector, 1973 to 2015



* Includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

14. See the Electricity chapter.

expand the electricity generation by another 600 MW IGCC plant were postponed, partly due to high cost.

Despite low coal prices, the economic prospects for new coal-based electricity generation are poor in the medium term. The investment costs for new coal plants are much higher than investments in gas plants; consequently, no new investment is presently expected in coal-fired electricity generation. Many of the existing coal-fired installations can use natural gas in dual-firing mode, although at significantly lower thermal efficiency than in advanced gas-fired installations.

Liberalisation of the electricity market accelerates the reaction of the market to cost conditions. Previously, coal capacity was built as a consequence of central planning and fuel diversification was explicitly taken into account. Individual power generators now have to formulate their own diversification strategy, which may include maintaining a certain amount of coal capacity, but may also rely on other mechanisms, such as diversification of suppliers instead of fuels. Coal-based capacity, about 40 per cent of total capacity today, is thus believed to have reached its maximum in the current economic circumstances.

The need to reduce CO_2 emissions also has an adverse impact on coal use. It led to the introduction of a tax on CO_2 emissions from fuel used for electricity generation. This tax is differentiated between fossil fuels and is highest for coal. Under the Kyoto Protocol, the Netherlands is required to reduce CO_2 emissions further. Following negotiations with electricity generators, agreement to reduce the use of coal for power generation was chosen among several options.

The government's objective is for the emissions from coal-fired plants in 2010 to be the same as if the capacity were gas-fired. This measure is expected to save 6 million of the 25 million tonnes of CO_2 to which the Netherlands has committed itself. Provided there is sufficient progress towards this objective, the fuel input tax will be transformed into an electricity output tax, including imported electricity, which will guarantee a level playing field in the competitive market.

OIL

Overview

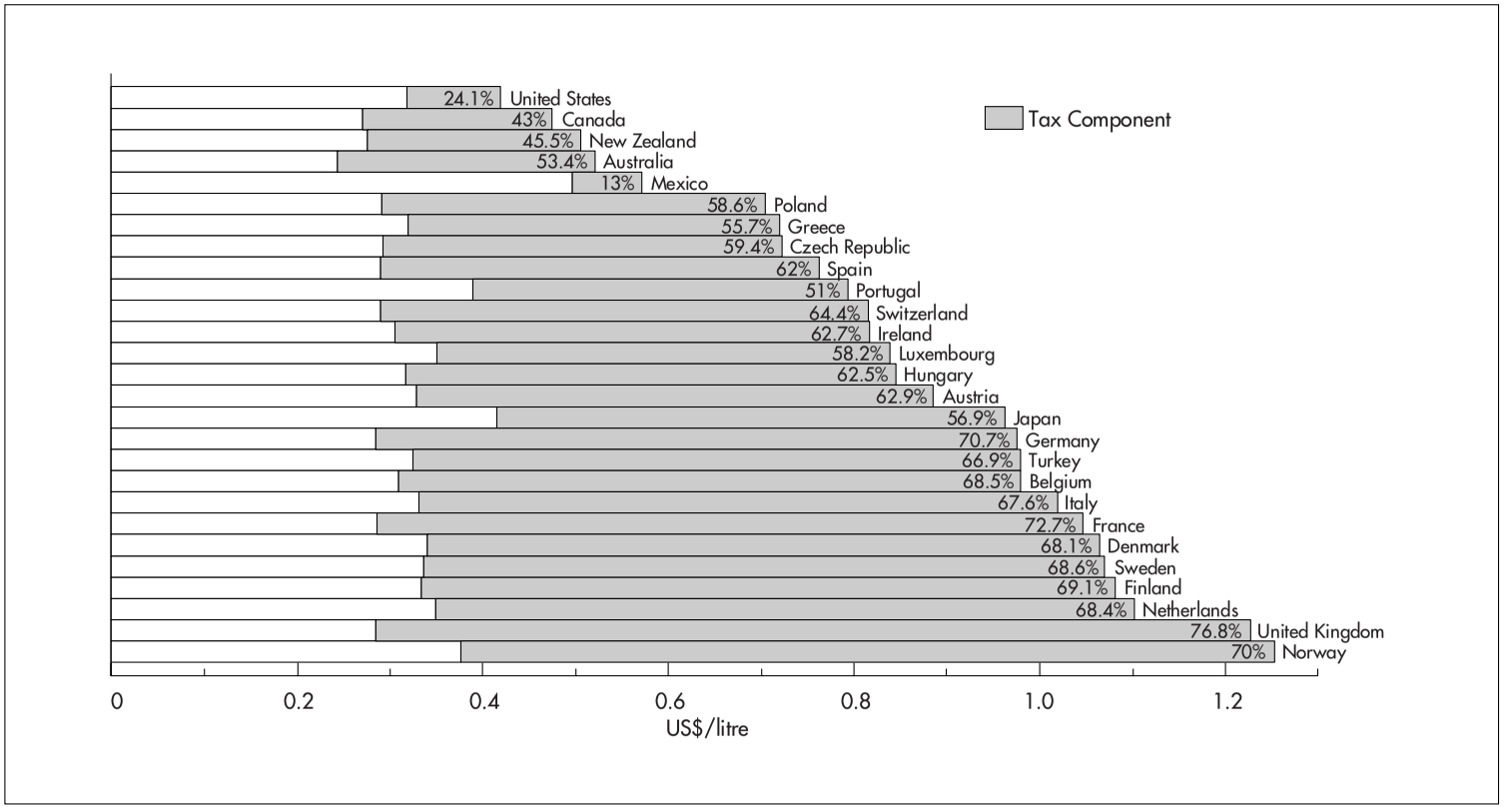
The Netherlands has no special policies for upstream oil development, import or export of crude oil or oil products, or for the refining industry. The refining industry is regarded and treated like any other Dutch industry.

The recent low oil prices and a very low refinery margin in Europe gave rise to the present period of strategic alliances between the major oil companies. In 1997, BP and Mobil Oil joined forces in the European downstream markets. 1998 saw the global merger between BP and Amoco. Recently, Exxon and Mobil announced their intention to merge their companies. That merger will influence the co-operation between BP and Mobil and may thus affect the downstream market in the

Figure 14

OECD Automotive Fuel Prices and Taxes

2nd Quarter 1999



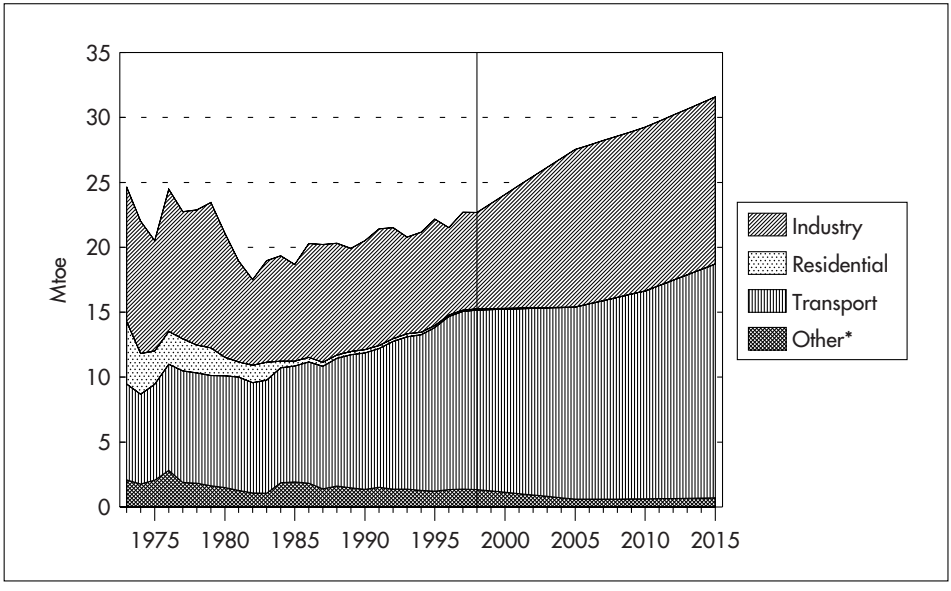
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Netherlands. The alliance between BP and Amoco and the recent merger between the French oil companies TotalFina and Elf might affect the ownership of the Dutch refineries. At present, the effect on the Total refinery and on the Nerefco refinery (61 per cent owned by BP) are not known.

Due, in part, to historical allocation policies for filling stations on motorways, the major oil companies have gained a disproportionally large market position in the retail market. At present, new policies are under preparation to improve market accessibility for new parties. Thus, the government is aiming at a better balance in market forces resulting in more price competition. The possibility to conclude perpetual leases of sites for petrol stations on motorways, previously common practice, was abolished. Sites will now be auctioned off once every 15 years. The details of the new policy are to be finalised by January 2001.

Automotive fuels and oil product specifications are subjects of great interest in the Netherlands, due to their environmental effects. In 1997, a study was conducted to determine an optimum fuel mix for Dutch road transport in the year 2010. Criteria for this study were cost-effectiveness and environmental effects of fuel mix changes. In the Third National Environmental Policy Plan, published in February 1998, the government proposed the planned fuel mix for seven vehicle categories in the year 2010. This is set out in Table 8. Implementation is in progress. The purchase tax for diesel cars was increased by *f* 2000 and the road tax for last-generation LPG cars was lowered. Plans for buses and other vehicle categories are still under discussion.

Figure 15
Final Consumption of Oil by Sector



* Includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Regular updates of the study are foreseen to take account of new technological developments and changes in assessments of polluting compounds.

In early 1999, a new, experimental type of petrol called Pura was introduced to the Dutch market. This fuel already meets the EU specifications for 2005. Pura is available at certain service stations, at an extra price of 9 cents per litre. Tax incentives for cleaner fuels and vehicles and a schedule for their phase-in by 2005 are currently under study. The schedule will depend on when new vehicles using cleaner fuels become available.

Table 8
A Scenario for Automotive Fuel Use in 2010

	Share of vehicles using					
	Diesel		*Petrol*		*LPG/CNG**	
	1997	*2010*	*1997*	*2010*	*1997*	*2010*
City buses and coaches	99	25-40	-	-	1	60-75
Distribution trucks	100	40-70	-	-	-	30-60
Refuse collection vehicles	100	40-60	-	-	-	40-60
Other trucks	100	100	-	-	-	-
Light commercial vehicles	91	40-60	7	40- 50	2	2-10
Passenger cars	11	5	82	88- 85	7	7-10
Taxis	55	20-30	15	40-50	30	30-40
Fuel shares (mass)	57	43-46	36	45- 43	7	9-14

* CNG = compressed natural gas.
Source: Ministry of Economic Affairs.

Emergency Preparedness

The Dutch government is in the process of reformulating its emergency preparedness policy within the framework of its international obligations: the IEP agreement with the IEA and the Directives of the EU. With respect to emergency stock obligations, the government intends to make better use of the industry stocks that are available in the Netherlands. Demand restraint measures will be reduced in number and will be scaled to the possibilities of the European Internal Market. The government believes that the Netherlands can and should rely more on market forces in times of crisis.

NATURAL GAS

Market Overview

Industry Structure

The Dutch natural gas industry was developed in the early 1960s following the discovery of the large Groningen gas field by NAM (Nederlandse Aardolie

Maatschappij B.V., a joint venture of Royal Dutch/Shell and Esso established in 1947). In order to develop and exploit the Groningen field, the Dutch government adopted the DePous[15] Memorandum (Parliamentary Document 1961/62, 6767, no. 1) in 1962. This document and several agreements based on it were to remain the only official documents governing the structure of the gas industry; no legislation was enacted until recently. Other much smaller fields were discovered at the beginning of the seventies, an increasing number off shore. A Natural Gas Act came into force in June 2000.

A fully state-owned company called DSM (De StaatsMijnen, Dutch State Mines) that had already been active in coal mining from the beginning of the 20th century was chosen to represent the Dutch state's energy interests in the development of the natural gas industry, notably its shareholding in energy companies and its participation in concessions and licences for the extraction of oil and gas. DSM was privatised in 1989 as a chemicals group; upon privatisation, the state's energy interests were transferred to the newly-formed and fully state-owned Energie Beheer Nederland B.V.[16] (EBN). DSM manages EBN on behalf of the government for a fee.

On the basis of the DePous memorandum, a joint venture agreement (Maatschap), concluded in 1963 between DSM and NAM, put Maatschap/Gasunie[17] in charge of developing and exploiting the Groningen field. The concession for this field is held by NAM. NAM is the operator, but gas extraction is managed under the authority of the Maatschap. The Groningen field started producing the same year.

As of 1974/75, production from other, much smaller fields came on stream, increasingly on the continental shelf. Development of these small fields was due to an explicit policy decision known as the "small fields policy", developed in the context of the first oil crisis and a 1974 White Paper on Energy. Due to this policy, the Groningen field was used as a swing supplier for the Netherlands, as well as for other European countries. This small fields policy has to date added the equivalent of some 50 per cent of the original size of Groningen to Dutch gas production. Annual production from the Groningen field has fallen from its peak of over 80 bcm in 1976 to 50 bcm or below since 1981.Today, some 13 companies produce natural gas from one or several fields. NAM is by far the largest producer, accounting for 75-80 per cent of total production in the Netherlands. The Groningen field alone yields 46 per cent of total Dutch production (1998 figure).

Following a government decision and also on the basis of the DePous Memorandum, Gasunie (N.V.[18] Nederlandse Gasunie) was created in 1963 as the central organisation for gas transportation and marketing in the Netherlands. Gasunie is half privately-owned, to equal parts by Shell (25 per cent) and by Esso (25 per cent). The Dutch state owns a 10 per cent stake directly and a 40 per cent

15. The document was named after the Minister of Economic Affairs of the time.
16. B.V. = Besloten Vennootschap, private law company with limited liability.
17. Gasunie is described below.
18 . N.V. = Naamloze Vennootschap, private law joint stock company.

stake through EBN. Gasunie owns and operates the entire onshore high-pressure pipeline grid, but not the offshore grid, which was developed later. Until recently, Gasunie purchased all gas sold in the Netherlands and supplied it to gas distribution companies or directly to large consumers.

Gas distribution underwent a dramatic transformation between the mid-1980s and the mid-1990s. Before 1985, there were some 158 gas distribution companies, some of which were very small. Most of them were under direct municipal authority. Due to government policy and legislation, a massive concentration process occurred in the following decade, with as few as 34 distribution companies left in 1995. By 1999, the number had decreased further to under 30 companies. All distribution companies existing today are private-law joint stock companies (Namlooze Venootschap), but in nearly all cases their shares are still held by the municipalities. Currently, there is an increasing trend toward integration with other infrastructure industries, especially electricity and heat distribution, but also with water supply, refuse collection and telecommunication. 19 companies distribute gas and other energies; only 7 are pure gas distributors. Figure 16 illustrates the structure of the Dutch gas industry.

Natural Gas Demand

The Netherlands has the highest level of natural gas penetration in the world. Virtually every home, office and factory is connected to the gas grid; in the residential sector the figure is 97 per cent. In 1998, gas accounted for 47 per cent of Dutch TPES. This share is expected to increase to over 50 per cent in 2015. In 1996, the country had some 6,474,000 gas customers that fell into the following categories:

- Some 150 bulk customers, including the chemical, paper and dairy industries, as well as gas-based power generation. These customers consumed more than 170,000 cubic metres (cm) of gas per year and together accounted for approximately 46 per cent of gas demand in 1996.

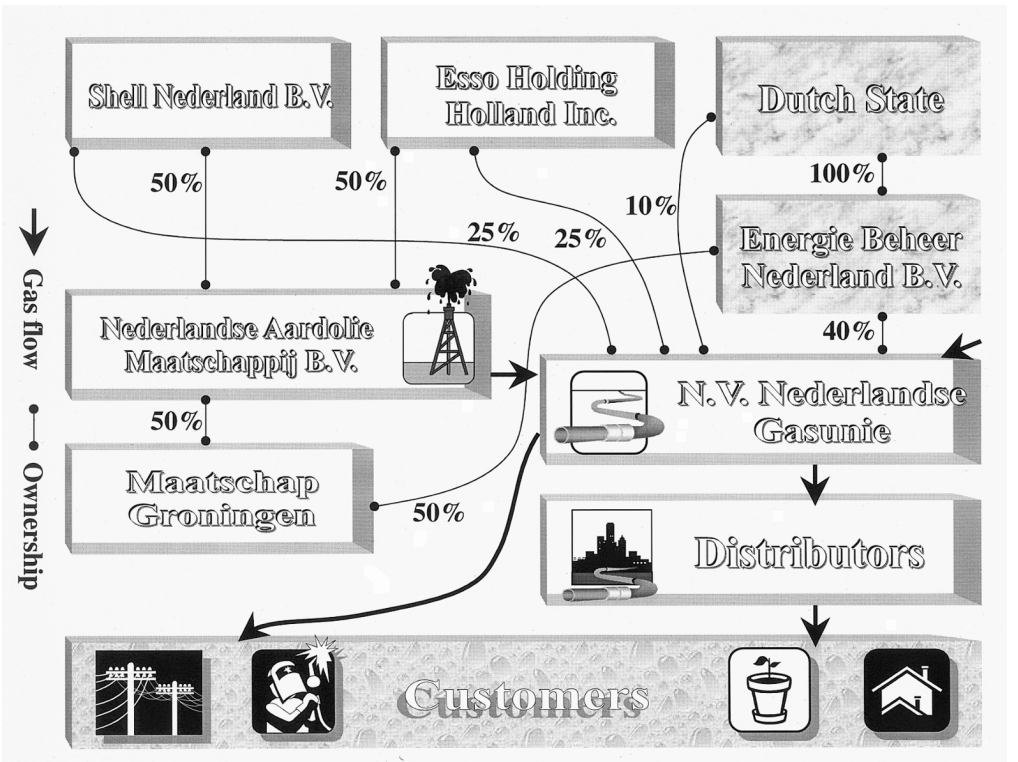
- Some 16,000 small-scale industrial and services consumers, including larger greenhouse growers. This group encompasses consumers with an annual demand below 170,000 cm of gas and consumed some 16 per cent of all gas sold in the Netherlands in 1996.

- Some 6,458,000 small users, of which 9 per cent were district heating companies and 91 per cent were households and small businesses. A very large part of gas consumption in this category is for space heating. Residential customers, for example, use 97 per cent of their gas for space and water heating. Small users consumed about 38 per cent of all gas in 1996.

Figure 17 shows the development of gas consumption by sector over the last years. It confirms that total gas demand has remained on a stable trend of relatively slow growth for a long time. The future prospects for natural gas point to significant further growth: total primary supply of gas is forecast to increase from 34.9 Mtoe

Figure 16

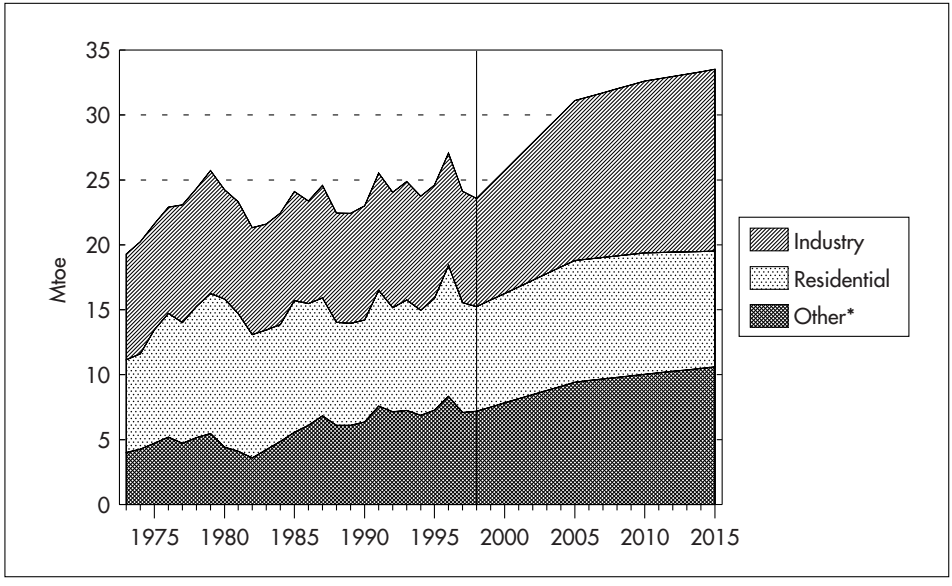
The Structure of the Dutch Gas Industry



Source: Gasunie.

in 1998 to 51.7 Mtoe in 2015. This results from a mix of sectoral trends. Gasunie expects demand in the residential sector to grow only very slowly, whereas gas demand from greenhouse growers is expected to decline, due to restructuring in the greenhouse sector and a reduction in the area under glass. In contrast, gas demand for power generation is forecast to grow from 6.5 bcm in 1998 to more than 10 bcm in 2015. Industrial gas demand is expected to grow from 17.2 bcm in 1998 to 22.5 bcm in 2015; this increase will be caused largely by the anticipated rise in gas use for decentralised combined heat and power generation from 9 bcm in 1998 to more than 14 bcm in 2015.

Figure 17
Natural Gas Demand by Sector
TFC, Mtoe



* Includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Production and Exploration

The Netherlands has the second-largest natural gas reserves in IEA Europe, closely following Norway. A large part of this resource is concentrated in the huge Groningen gas field, which, together with the Norwegian Troll field, is the largest gas field in IEA Europe: at 1 January 1999, total remaining proven gas reserves were 1,771 bcm. The Groningen field alone accounted for 63 per cent of these reserves, as well as for 46 per cent of total Dutch production and 69 per cent of onshore production. On 1 January 1999, the Netherlands had 166 producing gas fields besides the Groningen field. The vast majority of these were small.[19]

19. See Figure 22.

As shown in Figure 21, production from Groningen rose exponentially between 1963 and 1972, but as of 1973 production from small fields grew very significantly. Offshore production began in 1976; in 1998 it amounted to about one-third of total production. This occurred due to the "small fields policy", introduced in 1973. The purpose of this policy was to encourage production form other, smaller fields to prolong the life of the Groningen field. The policy was facilitated by the fact that the Groningen field had unique flexibility, with deliverability ranging between zero and 500 million cubic metres per day, enough to cope with the extreme variations between summer and winter demand in the Netherlands and also in the wider European context. This flexibility allowed the use of Groningen as a swing field, and explains the variations in its production shown in Figure 21.

NAM sells all its Groningen gas to Gasunie in accordance with the 1963 concession. Groningen is responsible for just under half of NAM's total production. Gasunie gives preference to purchasing non-Groningen gas, thus guaranteeing that smaller producers can sell their gas immediately, without queuing, and at high load factors. Also, the government's take on Groningen gas, which is comparatively cheap, is much higher than from other fields, e.g. through a special remittance tax on NAM's revenues from sales of Groningen gas. These measures strongly encouraged development of and production from small fields. Until the mid-1990s, producers had to offer gas they intended to sell in the Netherlands to Gasunie first. This was only a right of first refusal, as producers were not legally required to sell their gas to Gasunie. But the sales arrangements for small fields were so advantageous that gas producers hardly sold their gas elsewhere.

Since the pressure in the Groningen field, and with it the field's flexibility, has begun to decline, three underground storage (UGS) facilities were constructed in its vicinity:

- Grijpskerk UGS, which became operational in 1996. It has a working volume of 1.5 to 3 bcm and a daily unloading capacity of 80 to 120 million cubic metres (mcm).

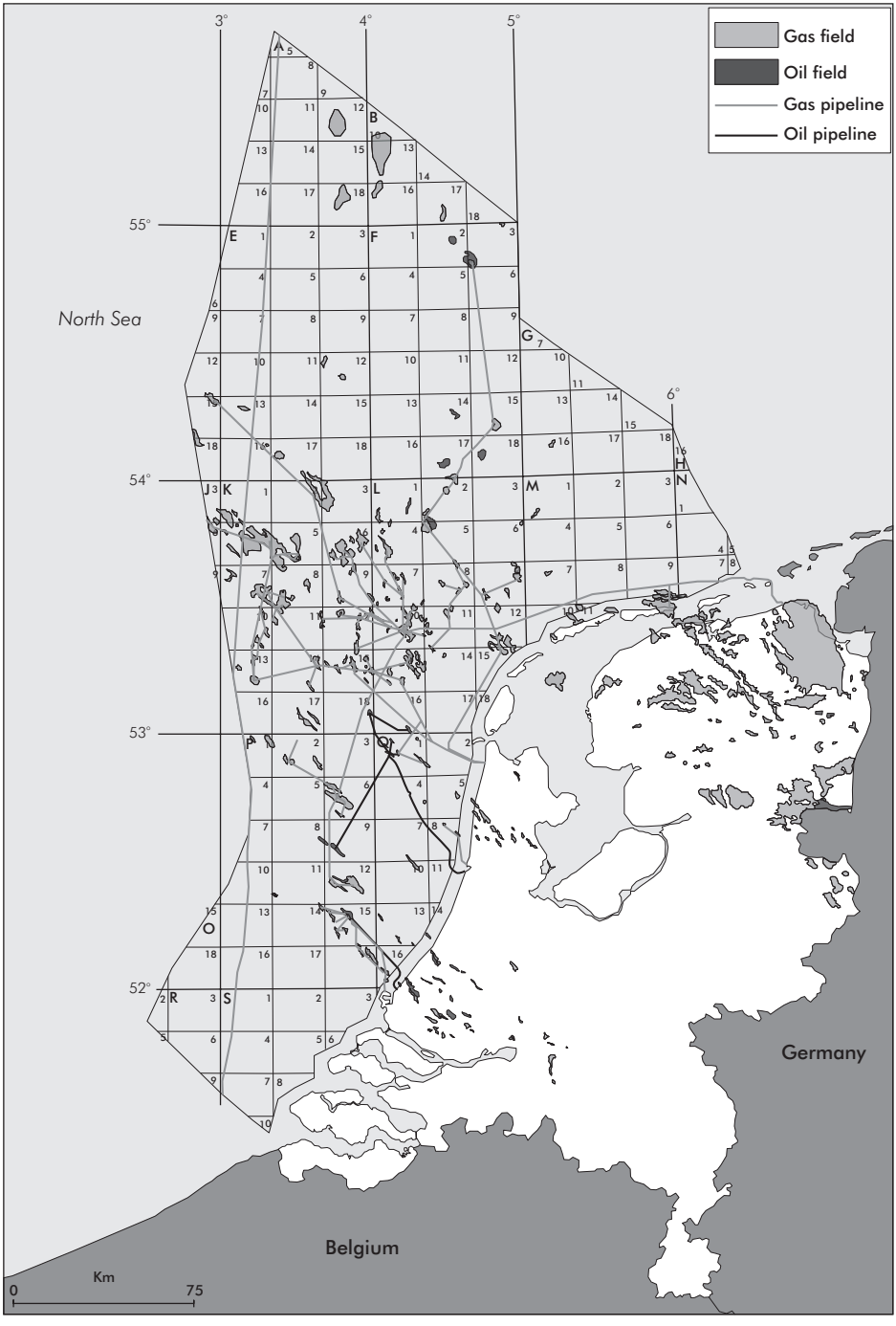
- Norg UGS, which came on stream in 1997 with a working volume of 3 to 4.5 bcm and a daily unloading capacity of 80 to 100 mcm.

- A third UGS facility at Alkmaar which began operating in 1997.

NAM and Gasunie are also installing compressors at the Groningen field. The first of these, on the Tjuchem well cluster, entered service in 1998. Others are to follow as of 2000. Additional storage capacity may also have to be developed.

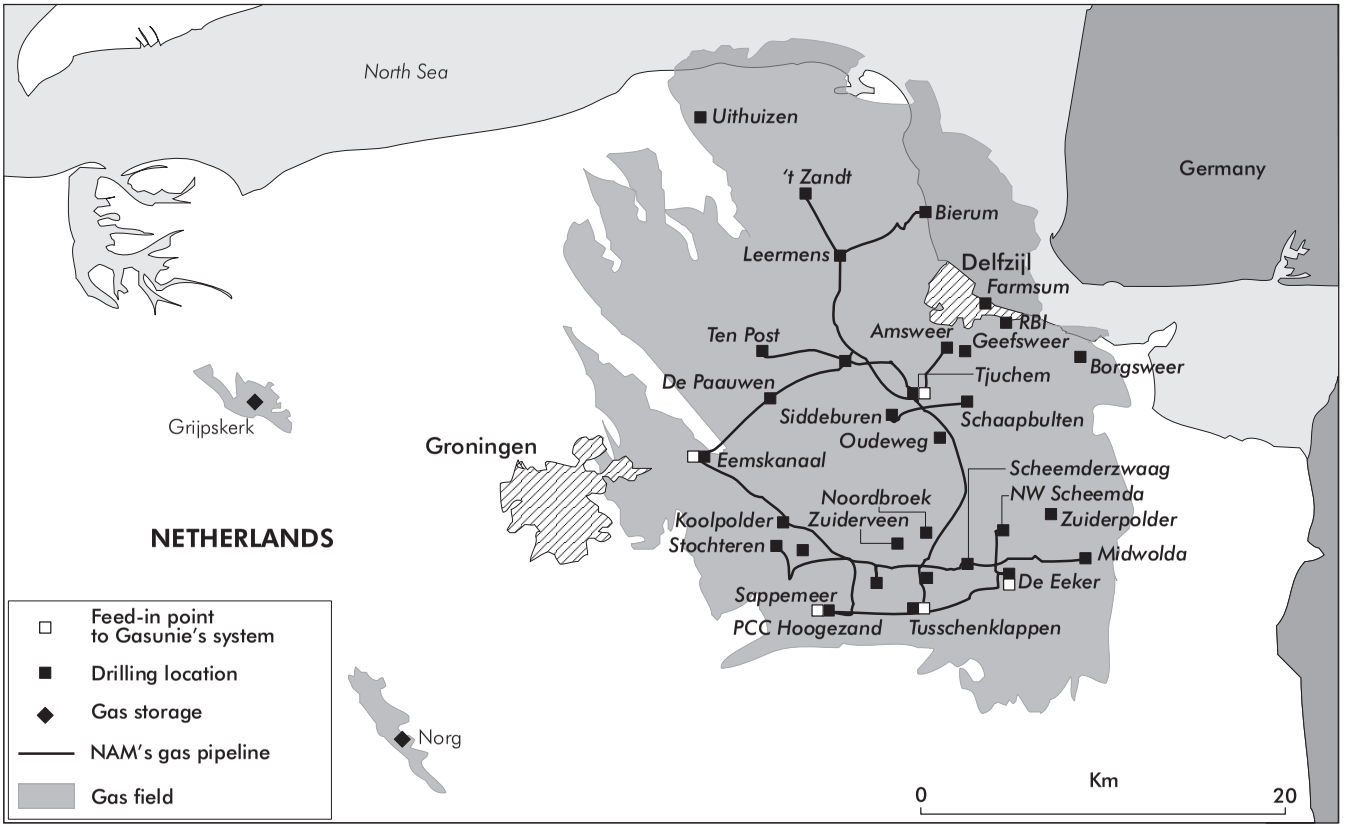
With these facilities, the Groningen system now has a flexibility of 450 mcm per day, 70 per cent of which is provided by the Groningen field and 30 per cent by underground storage. This translates into annual sales volumes above 40 bcm, 90 per cent of which are directly from the well and 10 per cent from storage. Apart from the fact that Groningen is thus a balance field for capacity and volume, it is also a balance field for gas quality. Groningen gas contains more nitrogen than gas from

Figure 18
Dutch Small Fields Policy



Source: Gasunie.

Figure 19
The Groningen System

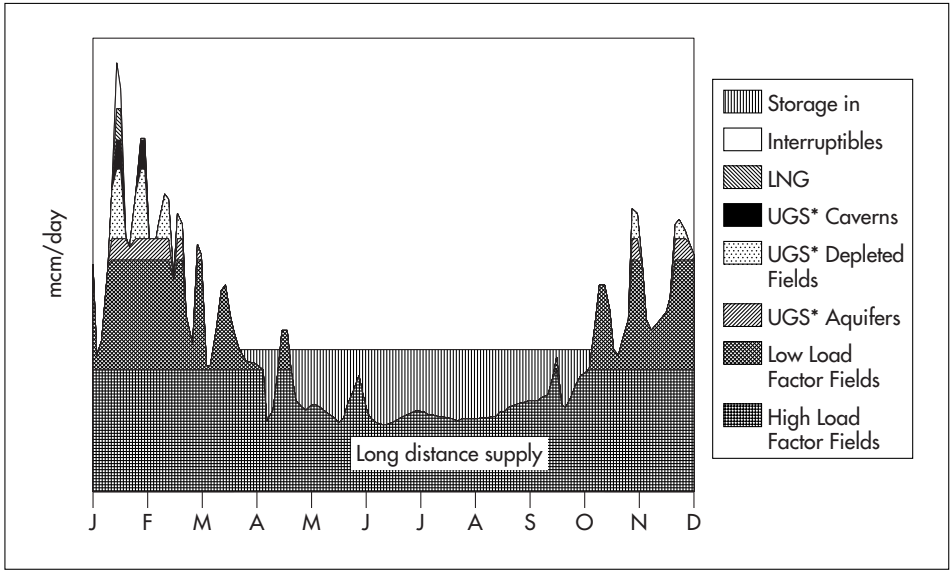


Source: NAM.

other fields, both onshore and offshore, and therefore has lower calorific value. This necessitates two separate pipeline systems and gas blending. Blending consists of adding nitrogen to high calorific gas to produce low calorific gas ready for distribution and supply. Figure 19 shows the Groningen gas field and the Grijpskerk and Norg storage sites.

In addition to the swing capacity of the Groningen system, now bolstered by underground storage, the Dutch gas industry addresses the pronounced seasonality of its annual offtake pattern through interruptible contracts with the power industry. These contracts foresee gas supply interruptions when the temperature falls below –5 degrees C. Figure 20 shows a stylised annual consumption curve for the Dutch gas industry and the measures implemented to supply the required capacity.

Figure 20
Annual Consumption Pattern and Capacity Measures in the Netherlands



* Underground storage.
Source: NAM.

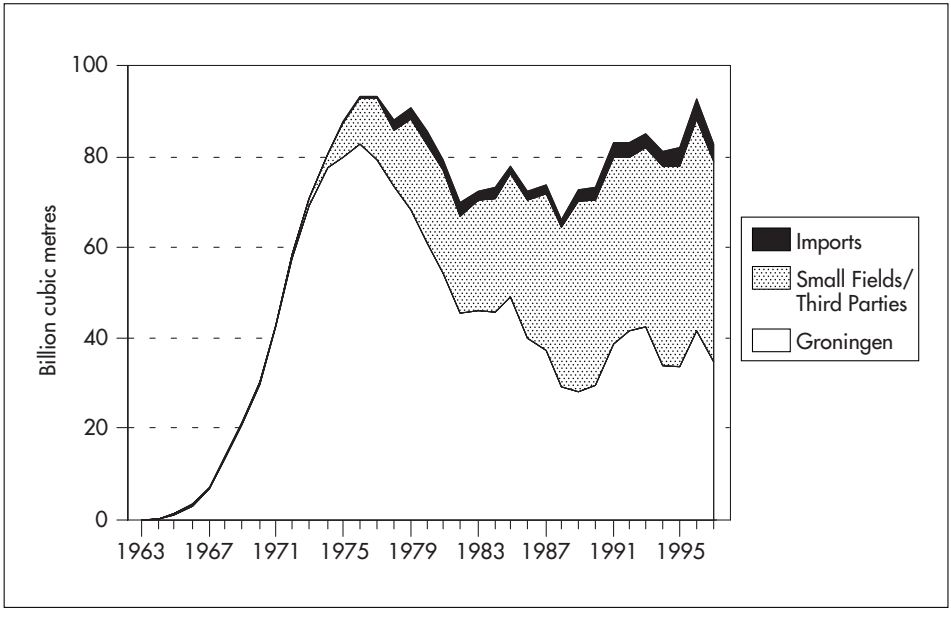
Remaining expected gas reserves were estimated to be 1,893 bcm in 1999. This figure includes total proven reserves, with most of the difference stemming from a large number of small gas fields of 3 to 4 bcm or less. 162 gas fields were proven but not yet producing, 72 onshore and 90 offshore. These new fields contained approximately 310 bcm of natural gas, of which some 50 bcm were classified uneconomic because of size, location, productibility or gas composition, or a combination of these factors. Figure 22 shows the size distribution of all proven gas

fields, based on expected initial reserves and including the Groningen gas field. The recoverable volume of natural gas which may be discovered as a result of exploration (commonly referred to as futures) is estimated between 210 and 430 bcm. The extent and speed at which this estimated volume of gas futures can be proven and brought on stream will very much depend on future exploration efforts and economic factors.

Since the mid-1980s, exploration for oil and gas, especially off shore, has followed a declining trend. Between 1992 and 1995, this trend accelerated and in 1995 exploration and evaluation drilling had fallen below their 1974 levels. To reverse this trend and encourage hydrocarbon exploration and development, the Dutch government put into effect a package of financial and tax incentives in 1995 and 1996, including depreciation at will, lower overall royalties and EBN participation in exploration activities. This led to increased exploration activity in the three following years.

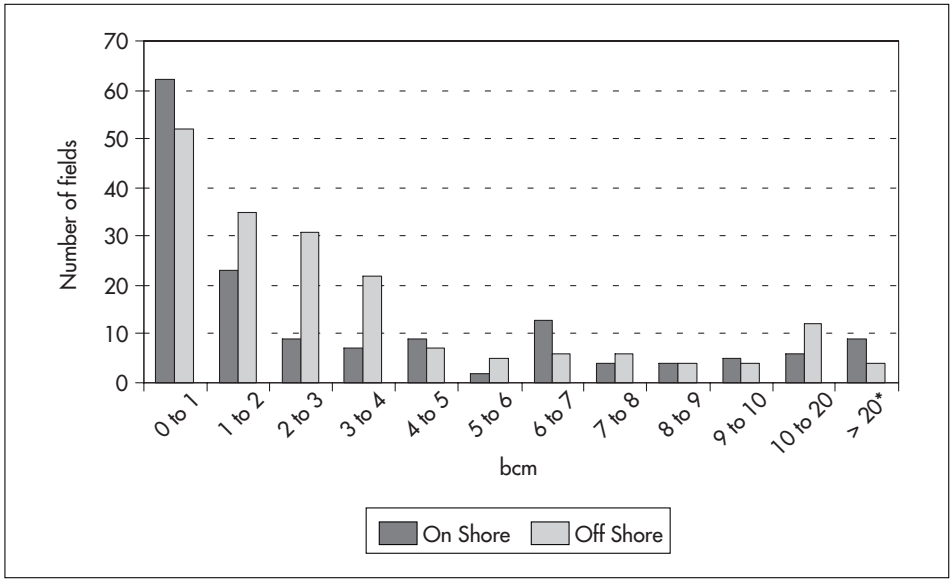
However, due to low oil prices, drilling activities dropped considerably in 1999. These trends caused concern in the Dutch gas industry, but also in the government. The government considers there are a number of factors aside from the role of Groningen that favour future gas production in the Netherlands. The Netherlands is a well-established gas-producing area close to the major consumers in north western Europe, there is substantial existing infrastructure, and the relatively

Figure 21
Production from Groningen and Small Fields, 1963 to 1997
(bcm)



Source: Gasunie.

Figure 22
Size Distribution of Dutch Gas Fields
All fields, based on expected initial reserves in bcm



* Includes Groningen field, > 100 bcm.
Source: Ministry of Economic Affairs.

shallow offshore waters allow low-cost development of gas fields. Nevertheless, the government is aware of a number of factors that might hamper future production. The small size of new fields is a given, but the government considers that its own involvement in the upstream gas business may also have contributed to an unfavourable mining climate and that additional measures may be necessary to improve it.

The role of EBN in particular has been under discussion for several years. EBN can take a share in gas projects once they have matured to the development stage, their development has been approved by the government, and production licences are granted. EBN then takes either a 40 per cent or a 50 per cent stake, depending on the regime, and has to contribute correspondingly to further development costs of the project.

Since 1994, EBN has also had to contribute to exploration costs to the same degree. The initial risk and cost of exploration are fully borne by the private investor, but costs are reimbursed by EBN if exploration is successful; the state does not reimburse unsuccessful exploration. EBN helps reduce some of the risk inherent in the upstream gas business, but only comes in once the biggest risk, that of exploration, has already been borne by private companies. The gas industry criticised this distribution of risk before 1993; since 1994, EBN has participated in continued exploration activities in areas covered by the production licences. The

Dutch government is aware that this set-up is not likely to help attract future exploration activities once competition brings lower gas prices.

The comparatively high government take is thought to be another important factor hampering future exploration activities. The government take consists of royalties, the State Profit Share (SPS) and the so-called Bonus. Royalty rates for licences granted between 1967 and 1995 were 16 per cent nominally, although effective rates lay between 0 per cent and 6 per cent. However, in all major European gas producing regions competing for investment, notably in Norway, the UK and in Denmark, royalties have been abolished for new fields, or will be abolished for existing fields. There are several regimes for the SPS, which can amount to up to 50 per cent of profits excluding government levies and taxes. The Bonus is due as soon as companies obtain an exploration licence, which has an adverse effect on up-front economics of gas projects.

In addition to these potential economic obstacles to the development of new gas fields, there is also an environmental obstacle. A large number of new fields are located in the wadden sea, which is a protected wildlife habitat. There is currently a legal dispute between environmental organisations and companies regarding development of these fields. If new drilling were to be banned in the wadden sea, this would affect 25 to 30 per cent of future gas resources and have a serious impact on the small fields policy.

In order to address some of these issues and to modernise existing legislation laid out in numerous acts dating back to 1810, the Minister of Economic Affairs submitted a proposal to Parliament for an amended Mining Act on 23 September 1998. The Bill governs both onshore and offshore operations. The licence application and grant system remains practically unchanged.

The bill incorporates a new system of remittances which is to supersede the existing remittance arrangement. Under the new system, the Bonus would be abolished, the SPS regimes simplified and turned into a single regime, and the possibilities of consolidating the SPS with corporate income tax would be increased. Under the new law, there would only be two different financial regimes: one for offshore and one for onshore operations. In addition to reduced complexity and administrative burden, the new system represents a neutral shift or slight lessening of the companies' financial burden. Further changes in the tax regime to improve the mining climate have been announced. The Minister of Economic Affairs is to submit concrete proposals in the near future.

Transportation and Trade

In principle, the construction of pipelines is not subject to legal restrictions such as concessions or licences and there is no statutory right to transport. In practice, however, Gasunie was granted a concession for laying onshore high-pressure pipelines on 12 December 1963, and the government expressly reserved the right to grant similar concessions to other parties. For a long time, Gasunie had a de facto monopoly on onshore gas transportation.

In contrast, Gasunie has no stake in the offshore (gathering) pipelines, which are partly privately owned. The Noordgastransport pipeline (NGT) is owned by Placid Oil (60 per cent) and DSM Energie (40 per cent); the Westgastransport pipeline (WGT) is owned by EBN (40 per cent), NAM (31 per cent), Wintershall (20.1 per cent) and CLAM (8.9 per cent) and operated by Wintershall. The Nordelijke Offshore Gastransportleiding (NOGAT) is owned by EBN (45 per cent), NAM (30 per cent) and the Petronord Group (25 per cent). The Petronord Group itself is owned by Elf Petroland and Total Marine. Figure 23 shows the Dutch onshore pipeline system. Note the different pipelines for high and low calorific gas.

Since the mid-1990s, a certain degree of competition has developed in the gas transportation system. Some of the main offshore pipelines started allowing third party access, and in the South of the Netherlands there was some investment in the onshore high-pressure grid by other parties, including the construction of the Zebra pipeline. Following the government's 1995/96 Third White Paper on Energy and demands by the distribution companies and large industrial consumers, Gasunie started offering negotiated access to its transportation system in 1999.

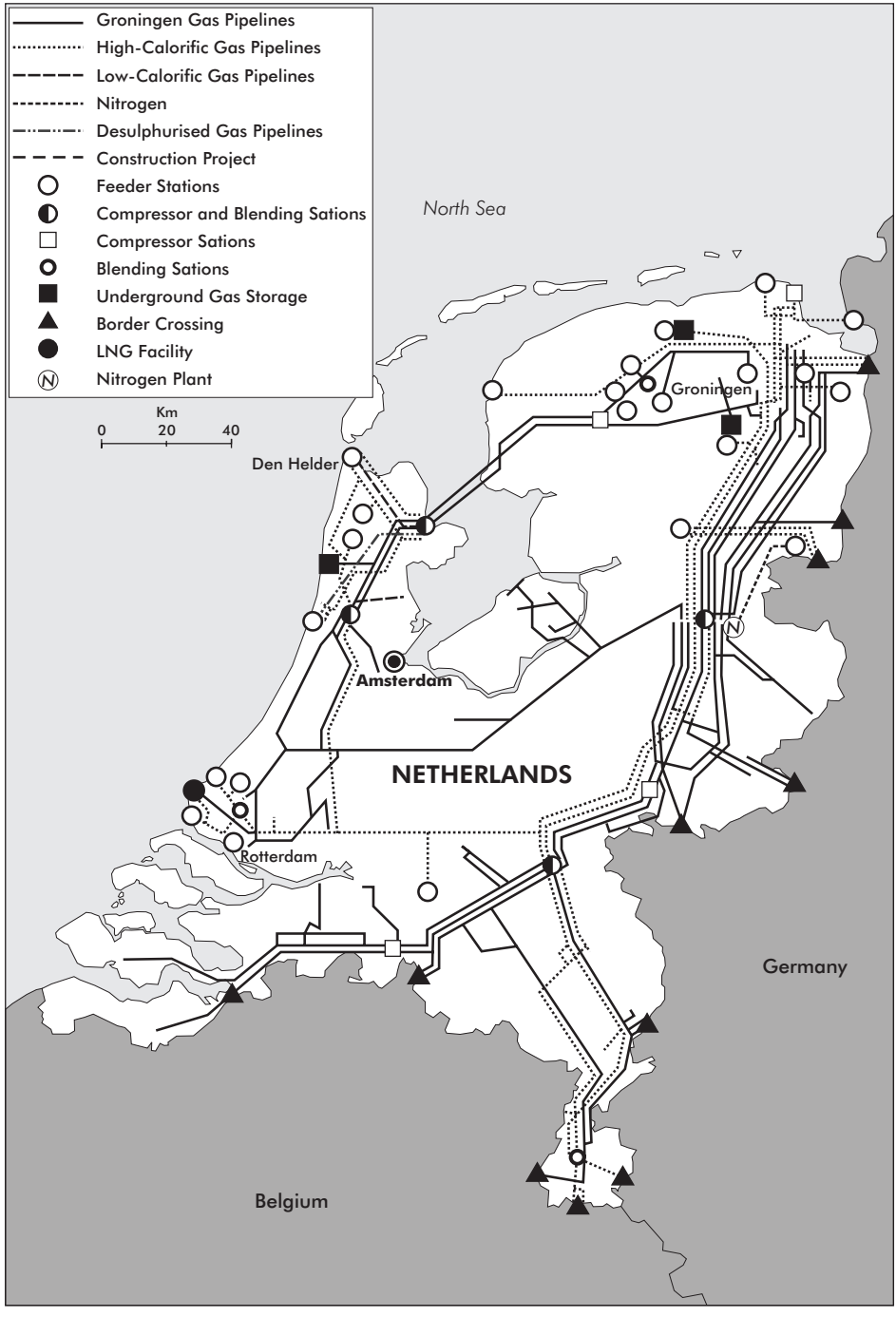
As a major gas producer, the Netherlands exports part of its gas, but also imports gas and provides gas transit for other countries. Gasunie can import gas with the approval of the Minister for Economic Affairs; there are no formal restrictions for imports by others. Sep, the former power company and co-ordinating body for Dutch electricity generators, concluded a gas import contract with Norway in 1989. Supplies began at the end of 1994 at a level of 3 bcm and rose to 6 bcm in 1998. Sep is currently renegotiating this contract on behalf of its shareholders, since the terms of the contract are above current market prices.

According to the terms of the original agreement between the Dutch government and Gasunie, Gasunie has the responsibility to regularly prepare gas marketing plans that set out the reserve situation, expected demand, imports and exports for 25 years ahead. The plans were submitted to the Minister of Economic Affairs for approval. Until recently, Gasunie had to demonstrate that it was capable of supplying the entire Dutch market for this 25-year period and had to reserve the corresponding volumes for the domestic market; the remainder was available for export and imports (within the boundaries of overall depletion rate ceilings). The recent reforms[20] aim at doing away with the marketing plan and the corresponding restrictions on exports and replacing them with a system of annual reporting, including forecasts for 20 years ahead. Table 9 details Gasunie's gas trade in 1994 and 1998, both in the Dutch home market and abroad. It shows that nearly half of its gas sales were exports, mainly to Germany, which took 58 per cent of Dutch exports in 1998. In addition to the volumes listed in Table 9, some 9 bcm of gas transited the Netherlands in 1998.

Since the interconnector pipeline linking Bacton in the UK and Zeebrugge in Belgium came into service in October 1998, British gas has been purchased by

20. See section The Path of Reform.

Figure 23
The Dutch Natural Gas Transportation System



Source: Gasunie.

Gasunie and other customers in the southern Netherlands. Several medium-term contracts for British gas were signed in recent years for a total of about 11 bcm per annum to be delivered to continental Europe over the next five to eight years. The interconnector has a capacity of 12 bcm per year. However, due to an industry-wide trend towards short-term contracts, the flow of gas through the interconnector came to a standstill and in December 1998 was reversed, with gas flowing from the European mainland to the UK. Such reversals of flow direction are expected to occur more frequently in the future. Notwithstanding these reversals, Dutch purchase volumes have been the equivalent of about 4 bcm per year since the interconnector became operational. Imports of Russian gas from Gazprom are also due to start soon. Gasunie concluded a 20-year contract for the purchase of 4 bcm per year, to start in 2001.

Under its existing export contracts, Gasunie is committed to deliver a total of 815 bcm. This translates into annual deliveries of nearly 40 bcm in the next few years. Deliveries are expected to rise to 45 bcm by 2010 and then taper off as current contracts begin to expire. The contracts run for 15 or 20 years at most. Since Gasunie offers not only volumes but also capacity, the annual off-take volumes in its export contracts allow some flexibility. Backup supply agreements with Germany and Belgium cover additional capacities of around 20 bcm, bringing possible total annual exports to about 60 bcm. The Netherlands' pipeline system allows physical exports of 80 bcm per year. Production capacity can more than match this amount, although declining pressure of the Groningen field will change this situation unless production from smaller fields can close the gap.

Table 9
Gasunie's Domestic and Foreign Gas Trade

Gasunie's Purchases in bcm (per cent)			*Gasunie's Sales in bcm (per cent)*		
Year	*1994*	*1998*	*Year*	*1994*	*1998*
Groningen	34.5 (42)	23.1 (29)	Home market	43.8 (53)	43.4 (54)
Other Dutch fields	44.3 (54)	52.7 (66)	Exports, of which to:	38.3 (47)	36.4 (46)
			Germany	22.6	21.1
			France	4.8	5.7
Imports	3.3 (4)	4 (5)	Belgium	5.4	5.6
			Italy	4.9	3.3
			Switzerland	0.6	0.7
Total	**82.1 *(100)***	**79.8 *(100)***	**Total**	**82.1 *(100)***	**79.8 *(100)***

Source: Gasunie.

Distribution and Retail Supply

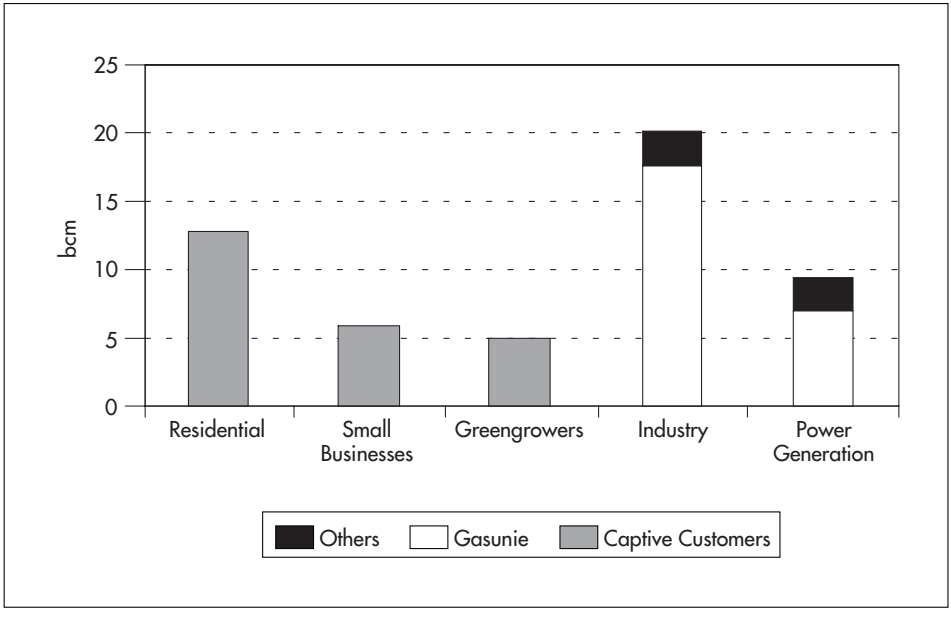
Gas distribution and supply is in the hands of both Gasunie and the more than 30 gas distribution companies. Gasunie supplies some 400 large customers in the

Netherlands, including large retail customers and the distribution companies themselves.

In the retail market, customers taking above 2 to 5 mcm per annum used to be served by Gasunie, with the remainder served by the distribution companies. In the beginning of the 1990s, this limit was raised to 10 mcm for new customers. Consequently, Gasunie had a retail market share of 40 per cent in 1996, supplying the bulk of power stations (12 per cent market share) and large industrial clients (28 per cent market share). Distribution companies supplied small, including residential users (36 per cent market share), greenhouse growers (10 per cent), district heating plants (2 per cent), and some larger clients (8 per cent), for an overall market share of 56 per cent. Third parties supplied 4 per cent of the market, even in 1996.

In 1998, Gasunie sold 24 bcm to gas distributors and 19.4 bcm to its direct customers. Meanwhile, Gasunie's market share in the retail market has come under pressure from other suppliers. Figure 24 shows Gasunie's market share per customer category in 1999.

Figure 24
Gasunie's Market Share per Customer Category, 1999



Source: Gasunie.

Most of the Dutch distribution companies are integrated companies, also supplying other forms of energy, especially electricity and/or heat, and often other services as well. This group of integrated distributors includes the largest gas distribution companies in the Netherlands.

The gas distributors are organised in an association called EnergieNed (Vereniging van Energiedistributiebedrijven in Nederland). EnergieNed used to negotiate gas purchase contracts with Gasunie collectively. In fact, both organisations concluded a contract called the Standard Agreement, which provided a framework for the individual contracts that were concluded between Gasunie and the distributors. The Standard Agreement foresaw exclusive purchases from Gasunie, but also Gasunie's duty to deliver unlimited quantities of gas. By the same token, the Standard Agreement determined the possibilities for gas distributors to import gas themselves. The Standard Agreement and the contracts based on it offered four different "streams" of gas for four different types of customers (small customers, large customers, greenhouse growers and CHP customers) at four different prices. The contracts usually had terms of five years (for large industrial customers) to 10 years (for small consumers). Prices were renegotiated every three years. There were no take-or-pay obligations and unlimited volume flexibility was allowed at no extra cost.

The prices paid by distributors to Gasunie, as well as all other prices throughout the supply chain, have historically been based on the "market value principle". This principle uses price ceilings above which end users would switch to substitution energies. For small consumers below 170,000 cubic metres the substitution energy is gas oil, whereas for customers above this threshold, it is heavy fuel oil. Through a pre-established formula, cost elements covering the distributors' operating costs as well as a profit margin are deducted, yielding the city gate price which is paid to Gasunie by distributors. The larger the customer, the more closely his price mirrored the price of the substitution energy. This pricing principle also applied in Gasunie's sales to its direct customers and was the basis of the "net-back" prices paid by Gasunie to producers.

According to the 1974 Natural Gas Prices Law (Wet Aardgasprijzen), the Minister of Economic Affairs was authorised to set minimum prices to ensure that market prices reflect the market value of gas, although these minimum prices must not exceed market value. Market value expressly includes both the domestic and export markets. Under Article 5 of the law, the Minister can even make binding recommendations to individual gas companies on their tariffs. The new Gas Bill of June 2000 revokes these provisions for distributors and Gasunie.

Sales prices to retail customers served by the distribution companies have so far typically consisted of three elements: a one-off connection charge, a flat standing charge to cover the cost of maintaining the customer's connection, and a consumption charge with a graduated series of tariff zones.

With the onset of some competition in the sector, practices in the industry have changed over the past few years. Today, Gasunie negotiates mainly with individual distribution and supply companies and in some cases with purchase consortia, and has developed a menu of differentiated prices for different services.[21]

21. See section The Path of Reform.

Security of Supply

The Standard Agreement and the other existing contracts between Gasunie and the distributors compel Gasunie to supply unlimited amounts of gas and thus ensure security of supply. Gasunie scales its required delivery capacity according to a predetermined maximum demand level. This maximum demand is calculated on a statistical basis, using the capacity contracted for by Gasunie's direct customers, including foreign customers, as well as demand from the smaller customers supplied by distributors. In the latter case, maximum demand is calculated based on an assumed effective minimum temperature (including wind chill) of –17 degrees C. The possibility of technical malfunction is also taken into account.

Covering this demand in the short term requires that Gasunie be able to supply up to 640 to 650 million cubic metres of gas per day. This can currently be achieved by using 200 mcm from non-Groningen fields, 120 to 130 mcm from the storage facilities at Langelo, Grijpskerk and Alkmaar, 30 mcm from the LNG facility at Maasvlakte, and 290 mcm from the Groningen field. Gasunie anticipates deliverability from non-Groningen fields to decline after 2004, but this effect will be more than compensated for by the construction of additional compressors at the Groningen field and some additional storage to come into service as of 2001. Thus, deliverability is expected to reach a peak of slightly over 700 mcm per day in the winter 2011/2012.

Regarding long-term security of supply, the total expected reserves available to Gasunie on 1 January 1999 were 2,450 bcm. As detailed in its last marketing plan, Gasunie expects cumulated sales of approximately 2,050 bcm by 1 January 2024, leaving expected reserves of 400 bcm at the end of the planing period. Of these cumulative sales, some 1,225 bcm are sales in the Dutch market and 825 bcm are exports. Based on these calculations, Gasunie concludes that it will be able to provide full security of supply for the entire planning period.

The Path of Reform

Reform Process and Legislation

As noted in the chapter Energy Market and Energy Policy, striving for competition in the Dutch energy market began with the government's White Paper issued in December 1995. This was followed up in 1997 by a discussion paper entitled "Gas Flows", which addressed the specifics of gas market reform. Following the adoption of the European Gas Directive (Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 *concerning common rules for the internal market in natural gas*), the Dutch government developed a draft bill entitled Draft Regulations Governing the Transport and Supply of Gas, in short the Netherlands Gas Act, in 1998.

The bill is designed to transpose the European Gas Directive into Dutch law and is the first piece of legislation relating to natural gas transportation and supply in the Netherlands. It was submitted to the Dutch competition authorities, the European Commission and the World Trade Organisation and was published on 26 January

1999 for consultation by the general public.[22] It was submitted to the Dutch Parliament on 30 March 1999. By June 2000, both Chambers of the Dutch Parliament had adopted the Gas Act. It came into effect in August 2000.

The Act foresees an opening of the gas market for competition in three distinct steps (Section 1):

- All customers consuming 10 mcm of gas or more per annum are to be allowed to choose their supplier as of 2000. This corresponds to 45 per cent of Dutch gas sales.

- As of 1 January 2002, all customers with an annual consumption of 170,000 cubic metres or more can enter the competitive market. These consumers account for 65 per cent of the Dutch market.

- By 1 January 2007, all gas consumers were to be eligible for competition. The bill explicitly states that the deadline for this first step can be changed (Section 1). In December 1999, the Minister of Economic Affairs began investigating the possibility of accelerating complete market opening to 2003. In Spring 2000, it was decided to move market opening forward to 2004.

The EU Gas Directive requires all customers with a consumption above 25 mcm per year to be made eligible during the first step of opening, i.e. by mid-2000. But opening must also amount to at least 20 per cent of the gas market. This means that in most cases smaller consumers must also be admitted. The second step requires opening of at least 28 per cent of the market by 2004, and the third step at least 33 per cent of the market by 2009.

Two points should be noted regarding the first step of market opening. First, the Netherlands has chosen to set the threshold for the first step at 10 mcm instead of the 25 mcm stipulated in the Directive. The size distribution of its gas consumers is such that extending the opening to 10 mcm yields a difference of only 1 per cent in market share.

Second, under Article 18 of the Directive, all gas-fired power generators, irrespective of their annual consumption level, must be made eligible in the first step of market opening. However, minimum thresholds may be established for electricity generators using combined heat and power production (CHP), provided this does not conflict with the general opening required for the first step. The government has chosen to open the market to CHP producers in line with the general opening; small CHP producers will thus not benefit from the immediate opening foreseen for all other gas-based power producers.

The method of access to the pipeline network is negotiated Third Party Access (negTPA) (Section 5 of the draft Netherlands Gas Act). The access requirement also

22. It is available on the Internet at http://info.minez.nl/ezenglish/ .

applies to production pipelines on the continental shelf under Dutch competition law. However, local gathering pipelines in the upstream part of the business are not affected (Section 8).

The Dutch government has opted for negTPA as opposed to regulated Third Party Access (regTPA) for a number of reasons. Foremost among these is the belief that there is no fundamental difference between negTPA and regTPA, provided the rules and the institutional set-up are appropriate, and that the two systems can, and will, converge eventually. In addition, the government aims at reducing regulatory intervention to a minimum. It also sees negTPA as more fitting for a mixed public and private ownership structure and better adapted to international practice, especially in neighbouring countries like Germany. The following provisions in the Act are supposed to safeguard non-discrimination:

- The rules for negotiated grid access make explicit reference to Dutch competition law, and the Dutch Competition Authority (Nederlandse Mededingingsautoriteit, NMa) is the body responsible for dispute settlement.

- The electricity regulator DTe is to monitor the gas industry regarding possible anti-competitive behaviour and can initiate procedures independent of plaintiff action. The Ministry of Economic Affairs monitors policy-relevant behaviour such as security of supply (Section 34).

- NMa and the Minister of Economic Affairs enjoy information disclosure rights with respect to the gas business, including the right to investigate companies' accounts and their administrative procedures (Sections 4, 24 and 25).

- Pipeline access can be denied on grounds of lack of capacity or unacceptable financial impact on the transportation company (Section 6). However, third parties are entitled to construct their own pipelines. Extensions of the infrastructure can be awarded to third parties via public tendering (Section 28).

- Interested parties can appeal against NMa rulings to the Regulatory Industrial Organisation Appeals Court (Section 35).

- The gas companies are required by law to design and use non-discriminatory, reasonable and transparent tariffs for transportation, storage and ancillary services, and have to publish indicative tariffs for these services (Section 4).

- Accounts for transport, storage and trading have to be separated (Sections 22 and 23).

- Companies are required by law to allocate costs according to the actual use of resources.

- Companies are required by law to erect "Chinese walls" between their separate activities to protect confidential business information; cross-subsidies are prohibited (Sections 26 and 27).

Moreover, additional rules are under development to ensure that

- Disputes are settled as fast as possible. Section 9 of the draft Netherlands Gas Act already states that the maximum time for an NMa ruling in a dispute is four months.

- Gas deliveries are not interrupted during dispute settlement procedures.

- Appropriate, transparent documentation is available regarding negotiations as well as the system of separate accounts.

The Dutch government discerns a trend in international gas trading for companies increasingly to buy transportation services separately from traded volumes and ancillary services. The government believes that this tendency has already given rise to the development of more differentiated tariffs and that it favours transparency in the market. Also, with the threat of investigation by the Competition Authority, the government believes that the largest suppliers have a particular interest in demonstrating that negotiated Third Party Access can be efficient. Four years after entry into force of the Netherlands Gas Act, the Minister of Economic Affairs is to carry out an appraisal of the effectiveness of the Act and submit a report to Parliament (Section 40).

During the transitional period when the gas business is not yet fully opened to competition, the distribution companies will supply those customer groups remaining captive for a number of years on the basis of licences granted by the Minister of Economic Affairs (Sections 11 to 14). Licencing had been used previously, but not uniformly for all distribution companies. Prices to captive customers are to be regulated by the Minister individually for each licence holder according to a relatively complex price cap formula (Sections 16 to 18).

The government intends to implement four sets of public service obligations. First, any gas company supplying small customers (below 170,000 cubic metres) will be required by law to ensure that it is effectively able to supply this market segment. Should the Minister of Economic Affairs have reason to believe that this is not the case, he can instruct the company in question to make provisions to that effect. If this entails extra expenditure, the costs or losses fall upon the company. This provision (Section 32) will be valid after the gas market is fully open to competition. During the transitional period, supply to captive customers is based on supply licences, and licence holders have a duty to supply (Section 15). They must submit demand estimates and supply plans to the Minister (Section 19), who can instruct them to make the appropriate provisions (Section 20). Failure to comply with the licence provisions may lead to withdrawal of the supply licence (Section 21).

Second, in order to provide incentives for energy efficiency and renewable energy resources, gas consumers are required to buy the green certificates introduced by the Netherlands Power Act 1998. The larger the gas volumes a customer purchases, the more certificates he has to buy (Sections 29 and 30). Third, the Minister of Economic Affairs can designate customers, traders, suppliers, agreements and countries that require his approval for gas trade, subject to the provisions of the EU Gas Directive (Section 47). Gas transport companies must prepare annual reports on cross-border gas trade (Section 46).

On 2 December 1999, an amendment to the Gas Bill was submitted to Parliament requiring Gasunie to guarantee purchases on offer from small gas fields and to continue to use Groningen as swing supplier. This amendment constitutes legal confirmation of the long-standing small fields policy in the liberalised market. Continuation of this policy is considered necessary to secure full development of the Netherlands' indigenous gas resources and to contribute to European security of supply by bringing Dutch reserves to the European market.

Outcomes of Gas Market Reform

Because it began in 1995 with the Third White Paper on Energy, the reform of the Dutch gas sector is a process that market participants could anticipate for a relatively long time. Consequently, Gasunie has had the opportunity to prepare for competition and has made some use of this opportunity. The company has already offered negotiated access to its transportation system in recent years and has also developed a new system of transportation tariffs.

By September 1999, several large consumers had changed suppliers. This amounted to slightly more than 4 bcm per year, or 30 per cent of the large consumer segment. In addition, Gasunie signed three major contracts for gas transportation for third parties, and one competing pipeline (the Zebra pipeline) was in operation in the southern Netherlands.

Gasunie developed its new inland tariffs because the old, all-in-one tariffs were no longer compatible with the changing regulations, but also because the old tariffs allowed a certain degree of "free riding", notably because the cost of providing capacity, i.e. volume flexibility, was very insufficiently reflected in its tariffs, if at all.

The new system of tariffs, baptised Commodity Services System (CSS), contains separate price elements for gas: commodity, transport, and capacity. The commodity price itself includes quality conversion and back-up. It is slightly higher than the commodity prices of Gasunie's main competitors, but those prices exclude quality conversion and backup.

The transportation tariff that forms part of the CSS is relatively complex. The onshore high-pressure grid is essentially considered a ring rather than a long-distance, point-to-point system or a hub-and-spoke system. Its flows are also one-directional. For this reason, the tariff has been designed as a hybrid between a distance-related tariff and a postage-stamp tariff.[23] The tariff comprises a fixed entry

23. A distance-related tariff would be appropriate for point-to-point deliveries, because the tariff must reflect flows that actually occur. In a hub-and-spoke system, many transactions may not actually cause physical flows but are, for example, swaps. But when postage-stamp tariffs do not reflect actual flows, they lead to oversimplification, cross subsidies and pancaking. Pancaking occurs when gas transits several regions or countries with postage-stamp rates. These rates average the cost over the whole national infrastructure, not just the small part that transiting gas may actually use, and therefore include cross subsidies. This can lead to layering of excessively high transportation costs and can make trade unprofitable.

charge for all users "entering the ring". There are five entry points and the tariff increases with distance, but only up to a distance of 200 km, after which it stays flat. Pipeline diameter is not reflected in the tariff and there is no throughput charge. Gasunie offers the possibility of combining backhaul with forward haul. Regional and local low pressure (distribution) grids have multi-directional flows; therefore a postage-stamp tariff applies.

The capacity element is designed to reflect the cost of the various means of increased deliverability detailed in the section Security of Supply above. Balancing occurs hourly.

Under the CSS, Gasunie acts as a contract carrier, charging its transportation customers the same tariffs that it charges itself. It offers variable contract periods for deliveries within the current year. The CSS is posted on the Internet. Price levels are still based on the market value principle, i.e. the cost of substitutes. But the substitute for gas from Gasunie is now gas from other suppliers. Customers also benefit from economies of scale in the grid, and from cost reductions stemming from grid optimisation. These benefits are probably much greater than if they were to construct a pipeline of their own.

Gasunie reports that the shift from the old tariff system to the new one is neutral with respect to its average revenues. However, there are marked differences between consumer groups. Certain customers experience lower prices; for others the prices are higher. This depends mainly on the capacity element, i.e. the customers' load factor. Customers receiving gas 5,000 hours per year pay approximately the same as they used to for gas delivered to them by Gasunie, whereas at 7,000 hours per year the overall gas price (including the commodity) is noticeably lower. Customers who see their prices rise (by a maximum of almost 8 cents per cubic metre) and customers who see their prices decline (by a maximum of about 7 cents per cubic metre) are almost evenly distributed across the whole spectrum of demand volumes, although those who benefit outnumber the losers slightly.

The Netherlands Gas Act no longer contains any requirement for Gasunie or any other party to draw up resource depletion plans demonstrating long-term availability of gas, upon which the authorisation of gas exports would be contingent. In fact, in its 1997 "Gas Flows" document, the government had already announced that it no longer saw any reason to intervene in the market once a European gas market of sufficient liquidity and depth had developed. The government believes that this will be the case for the European internal market by 2007. It has therefore announced that it does not intend to take any steps to ensure long-term security of supply at the national level after 2007. Instead, it expects that such steps would be taken at EU level and has declared that it will actively work towards elaborating an overall EU gas security policy. This view is encouraged by the fact that the European Commission has already begun working on this issue. The long-term marketing plans formerly prepared by Gasunie for this purpose have been replaced by a requirement to report annually on the resource position.

CRITIQUE

In the explanatory memorandum to the draft Netherlands Gas Act, the government states that for a country that owns natural gas resources "... the national interest in the production of gas ... largely consists of the gas reserve position and the gas revenues accruing to the state". The Netherlands' gas policy prior to the current liberalisation effort was clearly marked by this approach.

The pricing policy permeating the entire gas market was the "market value" principle. This, along with the small fields policy, was seen by industry observers as one of the main reasons why investments in small fields occurred to the degree they did in the Netherlands. The market value principle was applied in a remarkably differentiated way to individual market segments, as reflected in the four different "streams" for four different consumer groups and the respective prices paid by distributors to Gasunie. The prices reflected the consumers' substitution possibilities to a much larger degree than they reflected cost, since the starting point was the user's willingness to pay. Figures for allowable costs were deducted backwards throughout the supply chain.

"Market value" or "net-back" pricing has long been common practice in the gas industry in the Netherlands and elsewhere. This system was believed to protect initial high-cost, high-risk investments in new production, transportation and distribution facilities. In analytical literature the system is known as price differentiation or price discrimination and is, in most circumstances, considered the most extreme form of monopoly behaviour, because it allocates the entire surplus, i.e. the difference between cost and market price, to the producer. In contrast, in competitive markets the benefit would in most circumstances be shared between producers (the so-called producer surplus) and the consumer (the consumer surplus). Full, effective competition would lead to market prices that equal marginal costs. "Market value" prices are higher, leading to less demand but more supply than competitive prices. The net effect is that field development is stimulated above and demand is reduced below what it would be at competitive prices. Together with the generally rather high take by the Dutch government, this policy has certainly boosted government revenues and ensured ample coverage of demand by supply, while probably leading to relatively slow depletion rates.

However, this type of resource management is not necessarily harmless. While it can certainly not be said that this policy led to depressed levels of gas consumption in the Netherlands – after all, the country has the highest gas penetration of the world – it has certainly led to welfare losses, because the monopoly prices reduced Dutch consumers' disposable income and thus depressed overall economic activity. Also, the (relatively many) losers in such a process tend to lose more than the (relatively few) winners win. This is generally referred to as the "dead-weight loss" from monopolistic pricing.

It is difficult to assess to what degree end user prices were too high. In the case of finite natural resources, marginal extraction costs are not the right indicator of what consumption of the resource really costs, since they do not take into account that

today's consumption reduces tomorrow's resource availability. Optimum depletion patterns require somewhat higher prices that rise with society's time preference rate, which may be approximated using long-run real interest rates. Optimally, governments adjust competitive prices upwards towards an ideal price path, notably using royalties and taxes. In this way, the resource never actually becomes physically exhausted; sufficient, though ever more expensive, supplies remain until the so-called "back-stop" energy, the substitution energy closest in price, becomes economically attractive.

It is only possible to know the exact mark-up over marginal cost if the total amount of the available resource is known with reasonable certainty. This of course is difficult in reality. Gas resource estimates in particular have often been revised upwards, and Gasunie's estimates of total expected gas reserves have undergone some pronounced swings over the years. While gas pricing is thus a very complex task, it is fair to say that the Dutch government has steered a very cautious course with respect to its resource, while taking the risk of withholding benefits from consumers.

While the government appears to have protected the overall resource more than adequately, the issue of capacity seems to have attracted somewhat less attention. The Groningen field had the rare capability of allowing great flexibility compared to the size of the nearby market. However, in the domestic market, price elements relating to this flexibility appear to have been almost entirely absent. This may have been because flexibility was simply a feature of the field and for a long time appeared to have no extra cost. Installation of storage facilities and compressors only began when pressure in the field was reduced.

However, capacity is also a finite resource – one that diminishes even more quickly than volume – and as such must have a price greater than zero. Gas volumes and capacity are substitutes to a certain degree and were linked from the beginning via pressure. While it is not entirely clear whether Groningen's flexibility might have been preserved longer with capacity pricing, it is clear that Gasunie's previous pricing system involved cross subsidies from high-load factor to low-load factor customers. In short, prices for volume were too high and prices for capacity too low or non-existent. This is likely to have benefited small customers such as residential users and disadvantaged certain large customers. Gasunie has recognised these cross subsidies and the opportunities for free riders to benefit from its previous pricing system and has eliminated cross subsidies in its new pricing system. This is highly commendable.

The small fields policy had at least as much influence on the Dutch gas market as the pricing policy. Gasunie's preferential purchasing policy provided strong incentive favouring the development of small fields and certainly led to the development of many more small fields than would otherwise have happened. This has contributed to saving volumes as well as capacity from the Groningen field without direct subsidies (apart from "market value" pricing), allowing the field to continue to play the vital role of swing supplier for the Netherlands and the rest of Europe. In this respect, the policy has been successful.

The issue now is whether this policy can be continued in a competitive regime. This is questionable. First, the "market value" principle cannot be maintained – or rather, the market value of gas will be determined by competing gas volumes rather than by substitute fuels. This will very probably translate into lower prices at production level and is likely to depress exploration and development. Under the new Mining Law, the government has already taken several measures that may counteract these effects to some degree.

Existing fields may be somewhat less affected by the move to competition, at least as long as they are covered by existing contracts or as long as Gasunie can maintain its purchasing policy. This depends crucially on the development of sales prices from all fields. At the moment, Gasunie appears to be able to charge prices that are equivalent to its competitors' prices.

The Netherlands has opted for comparatively rapid and far-reaching market opening. The three steps of market opening provided for initially in the draft Netherlands Gas Act already go significantly beyond the liberalisation effort required under the European Gas Directive. The Gas Directive requires at least 20 per cent of the gas market to be opened by mid-2000, at least 28 per cent by 2004, and at least 33 per cent by 2009. In contrast, the Netherlands was to open 45 per cent in 2000, 65 per cent in 2002, and 100 per cent in 2007. Following recent government initiatives, complete opening will even be brought forward to 2004. In addition, some third party access has already occurred and some large customers have already switched suppliers. The government's determination to introduce competition swiftly is beyond any doubt.

In contrast, the model of competition that was chosen is on the cautious side. Unlike the reforms in the electricity sector, the government has opted for negotiated, not regulated Third Party Access. One of the reasons the government gives for this choice is its interest in maintaining the resource position and government gas revenues as much as possible. Whether negotiated TPA helps to achieve this is open to debate.

Other arguments by the government carry more weight. Conceivably, there is less, or at least less generalised, regulatory intervention in the sector if grid access is based on negotiations. In all likelihood, the standard case of intervention by the Competition Authority would still be instigated by a plaintiff, even though the NMa explicitly has the right, and duty, to monitor and act on its own initiative. The possible drawback is that delays and hence transaction and information costs would be so great that many market players would be reluctant to take anti-trust action and only major violations of the non-discrimination requirement would be pursued. The Dutch government maintains that if properly implemented, negTPA and regTPA can eventually become similar.

In consultations with industry, several large gas customers such as the former Dutch Electricity Generating Board (Sep) expressed reservations as to the similarity of negTPA and regTPA. It is true that the best way of introducing competition into a network industry is complete vertical separation of the natural monopoly elements.

Vertical separation erodes both the incentive and the possibility to discriminate against others. As long as some vertical integration remains, the incentive to discriminate in one's own favour may well linger and the surveillance authorities must concentrate on eliminating that possibility. Regulated TPA requires continuing, resource-intensive, heavy-handed efforts to this end. Negotiated TPA calls for somewhat lighter-handed but perhaps less effective efforts.

It must be said, however, that the Dutch Gas Act and related documents feature a number of provisions that alleviate the fear of enormous delays and transaction costs in a dispute. The fact that gas must continue to flow during the dispute, that maximum time frames are set for dispute settlement, that all transactions and negotiations must be documented following pre-established rules, and that relatively far-reaching disclosure rights exist are likely to reduce the transaction cost of disputes. In fact, the Dutch government has regulated the dispute settlement process rather than the industry, which may result in a suitable compromise between regTPA and negTPA. For some larger disputes, this system may well turn out to be at least as resource-intensive as continuing regulation in the future. But the Netherlands' policy to liberalise the gas market in pragmatic steps while trying to retain the benefits of the previous gas policy are to be commended.

The overall outcome for the ultimate consumer in terms of gas prices is not entirely clear, especially for smaller consumers. The move towards competition leads, and has already led, to the reduction of several types of inefficiencies with opposing effects on small users' gas bills. It would not be surprising if much higher capacity payments overcompensated for lower, competitive volume rates. The consequences of Gasunie's new pricing system already demonstrate this effect. But even if many consumers would not see much difference, or would even have to pay more, dismantling of cross subsidies would at least give the right signals to consumers.

In the past, the Dutch government was concerned about maintaining security of supply and the current reforms have been carried out in the same spirit. Judging from Gasunie's last marketing plan, the Dutch reserve position will still be very solid over the next 25 years, despite the anticipated decline in the resource. In the liberalised gas market, lower gas prices may slow or halt the development of small gas fields.

In principle, this means little more than deferring the development of these fields to the future, to a time when resource scarcity and rising prices warrant their development, which may well be insurance that this resource will still exist. Once resource prices reach that higher level, the current infrastructure may no longer exist. This would drastically increase the cost of exploitation, making it questionable whether the resource would develop in the foreseeable future. The larger of the small fields might be developed, but the many smaller ones might never be exploited, as they are dependent on existing offshore infrastructure and on the flexibility of the Groningen field. It is the government's view that the current situation provides a unique opportunity to exploit these fields and that this warrants the continuation of the small fields policy.

The government's role may be most beneficial if restricted to monitoring future exploration and development activities. Monitoring will tell whether further modifications of the framework conditions for exploration, development and production are necessary.

Apart from these domestic issues, the government believes that as of 2007, security of supply within the EU internal market can be left to market forces, whereas ensuring security of supply from non-EU sources is an EU-wide task and should be tackled at that level. This consideration is sound and well-adapted to the integrating European market. The Dutch government should contribute to designing the appropriate policies. Measures for consumer protection and short-term security of supply are provided in the Gas Act. These actions are commendable and it is recommended that proper enforcement be ensured.

RECOMMENDATIONS

The government should:

- ☐ Maintain its policy of liberalising the gas market in pragmatic steps while trying to retain the benefits of the previous gas policy.
- ☐ Ensure that the safeguard provisions for non-discrimination contained in the Netherlands Gas Act are fully implemented and supported by adequate resources.
- ☐ Review and reconsider the terms for exploration of small fields with a view to improving the conditions for those activities and stimulating the continued development of small fields.
- ☐ Pursue the current adjustments in mining law and policy. Monitor future exploration and development activities.
- ☐ Encourage gas companies to continue their rapid adaptation to competition. Work towards eliminating the last remaining inefficiencies in gas price structures, especially those relating to capacity charges and tariffs for smaller retail customers.
- ☐ Work towards a European solution for long-term security of supply.

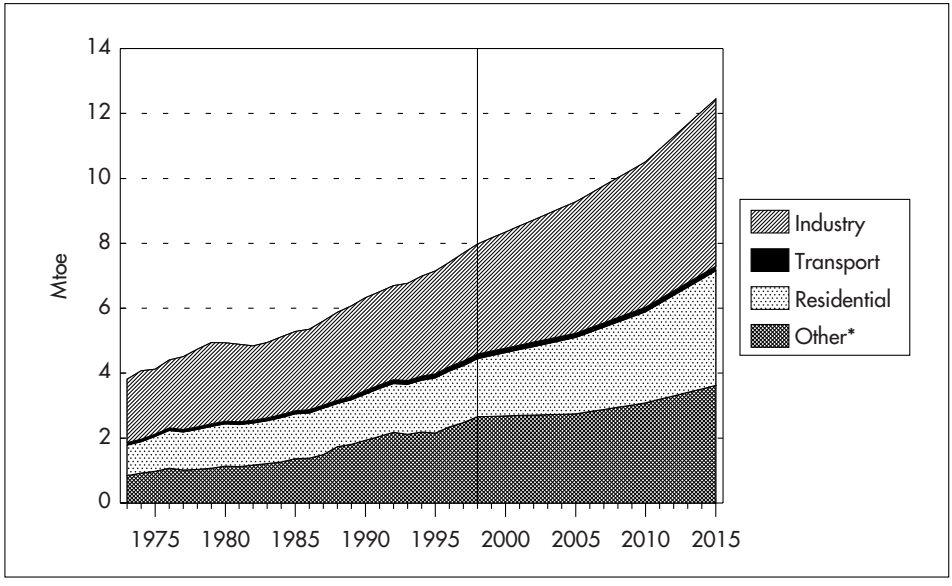
6

ELECTRICITY

MARKET OVERVIEW

As in most other IEA countries, electricity accounts for an increasing share in TFC and currently stands at 13.8 per cent. Figure 25 and Figure 26 detail electricity demand by sector and electricity generation by fuel in the Netherlands. Power generation from natural gas is particularly high: about 51.7 TWh or 56.7 per cent of total generation in 1998 (58.3 per cent in 1997). This is the highest share in the IEA, and perhaps the highest share in the world. Other energy inputs followed with 27.3 TWh (29.9 per cent) from coal, 3.8 TWh (4.2 per cent) from nuclear, 3.6 TWh (3.9 per cent) from oil and 4.6 TWh (5 per cent) from renewables. Renewable generation derived mainly from biomass, especially waste incineration, and wind. Hydro power has only negligible potential in the Netherlands and contributed only 0.1 per cent to total generation.

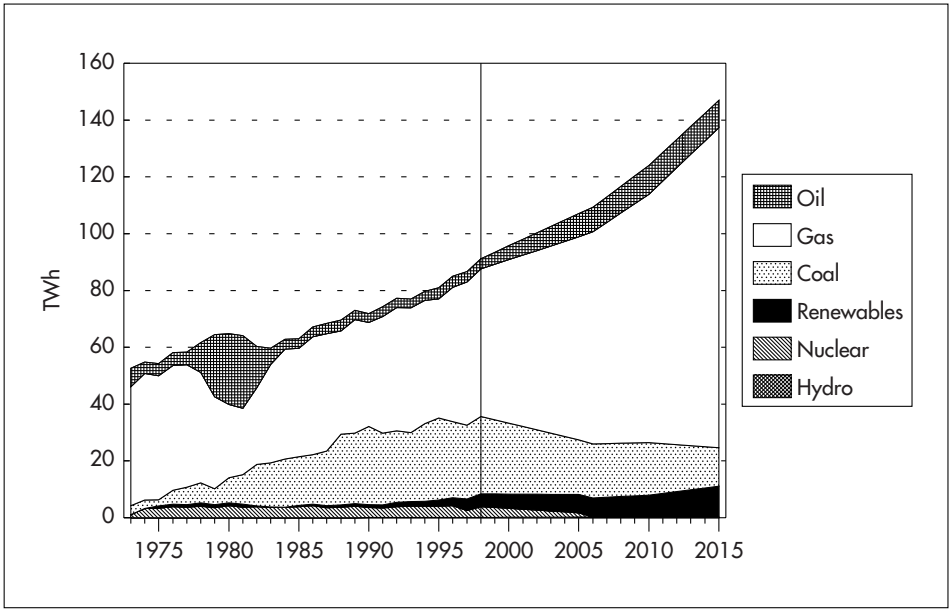
Figure 25
Electricity Demand by Sector, 1973 to 2015



* Includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

The Dutch electricity supply industry has gone through a process of concentration and regulatory reform, both moving at a relatively slow pace for the better part of the last 20 years, if not more. Simultaneously, the industry has been one of the main

Figure 26
Electricity Generation by Fuel, 1973 to 2015



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

targets of environmental policies and legislation. This section describes the industry structure prior to the 1998 Electricity Act, which is discussed in the section The Path of Reform.

The "Centralised" Market: Sep

Generation is very often divided into a "centralised" and a "decentralised" segment. The "centralised" segment comprises what is generally known as the public generation market. Here, electricity generation and/or transmission is the main business of the companies active in the market. The "decentralised" segment essentially refers to the market for combined heat and power production. This market is comparatively large and still growing. This growth is to a considerable degree due to government intervention aimed at improving transformation efficiency for environmental and energy security reasons.

The "centralised" generation market comprised some 17 major companies in 1985, 12 of which were vertically integrated into distribution and supply. By 1987, these had merged into five main companies and had begun separating their distribution and supply activities, due to government pressure for regulatory reform and greater efficiency. At the time of the last in-depth review in 1996, only four "centralised" electricity generators remained. These four generators are still in place and they

represented the entire "centralised" power generation market prior to 1999. They are owned by provincial or municipal governments or by distribution companies. The latter in turn are owned by governments at various levels.

There were also 71 independent distributors of differing size in 1985, many of which also distributed natural gas. Today, there are 23 electricity distributors supplying 7 million customers. All of these distributors also distribute gas and 11 of them distributed district heat as well. As already described in the Natural Gas chapter, there is continuing merger activity at the distribution level, leading to horizontal integration among network energies, but also with other network industries such as water distribution and cable television.

Table 10
The Four "Centralised" Generators, 1997

Name of generator	*Share of "centralised" capacity*	*Share of total capacity*
EPON (Elektriciteits-Produktiemaatschappij Oost- en Noord-Nederland N.V.) Northeast Netherlands	34 per cent	23 per cent
EPZ (Elektriciteits-Productiematschappij Zuid N.V.) South Netherlands	26 per cent	19 per cent
UNA (N.V. Energieproduktiebedrijf UNA) North Holland, Amsterdam and Utrecht	24 per cent	17 per cent
EZH (N.V. Electriciteitsbedrijf Zuid-Holland) South Holland, Rotterdam and The Hague	16 per cent	9 per cent
Total	**100 per cent**	**68 per cent***

Source: Ministry of Economic Affairs.

* Rounding may cause percentage totals to differ from sum totals. A small amount of capacity (0.254 GW) is held directly by Sep (not represented in table).

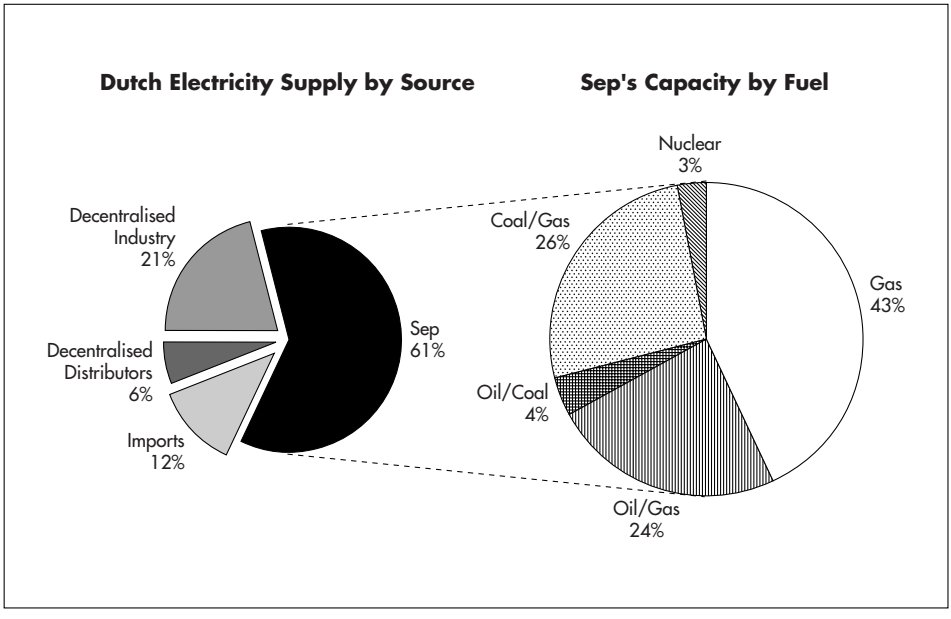
The four generators together have about 14.8 GW of capacity installed and generate some 61 per cent of total power supplied to the Dutch market. About 2,000 MW of the centralised capacity is combined heat and power (CHP) capacity. Before 1999, the four "centralised" companies co-operated through an organisation called Sep (Samenwerkende Elektriciteits-Produciebedrijven).

Figure 27 shows the sources of Dutch electricity supply and the fuel mix of Sep and its members. It is important to note that 54 per cent of the "centralised" generating capacity is double-fired capacity, which gives the system the ability to switch fuels

rapidly and at low cost in response to movements in relative prices or supply shortages of input fuels.

The role of nuclear in the Dutch power industry is limited. The Netherlands had two reactors, Dodewaard, a small (55 MW) research reactor, and Borssele (450 MW). Dodewaard was closed in 1994. As noted in the Energy Market and Energy Policy chapter, the Borssele reactor was due for shutdown in 1997. In 1995, the owner of the reactor, the power company EPZ, attempted to obtain an extension of Borssele's lifetime beyond 25 years, to 2007. In so doing, EPZ was following what was becoming an increasingly widespread practice throughout IEA countries. This attempt created a major public controversy. Eventually, the government decided to extend the reactor's operating license, but limited the extension to 2004. This limitation was recently overthrown by an administrative court. No further action has occurred to date, but the government still intends to shut the reactor down in 2004. It is highly unlikely that there will be any new nuclear power plant in the Netherlands in the foreseeable future.

Figure 27
Electricity Supply and Fuel Mix, 1998



Source: Ministry of Economic Affairs (Minez).

Until recently, one of Sep's most important tasks was to own and operate the high-voltage transmission grid. In fact, the company has a statutory monopoly on the operation of the 380 kV and 220 kV network. The high-voltage grid has five interconnections with neighbouring countries, all of them at 380 kV level. Total nameplate interconnection capacity is about 12,000 MW, equalling peak demand.

However, operational limits are much lower, approximately 3,500 to 4,000 MW. Figure 28 shows the Dutch electricity grid.[24]

Until 1998, Sep enjoyed a statutory monopoly on imports. In 1998, Sep imported some 13 per cent of total Dutch power sales, mostly from France and Germany. Sep also owns a small amount (254 MW) of generation, including the integrated coal gasification combined cycle plant at Buggenum, which is a demonstration plant. Since Sep controlled both central generation and imports, it controlled nearly three quarters (74 per cent) of the Dutch power market in 1998.

Sep was actually formed as an industry association after World War II by the then much greater number of public electricity companies. Over time it took on an increasingly important centralised and commercial role in the Dutch power sector. It began carrying out power plant dispatch as well as long-term capacity planning and countrywide co-ordination of fuel use. Since 1987, Sep has been a joint stock company owned by its members. In the same year, Sep began operating a countrywide price pooling mechanism, the national basic tariff (landelijke basistarief, LBT), which aimed at forming one national power market with one wholesale market price for electricity. Previously, the Dutch power market had been very fragmented, with large price discrepancies between the then vertically integrated power companies. Under the national basic tariff system, Sep bought the utilities' power at their disparate generating costs, pooled them into the LBT, and sold the power back to utilities or independent distributors.

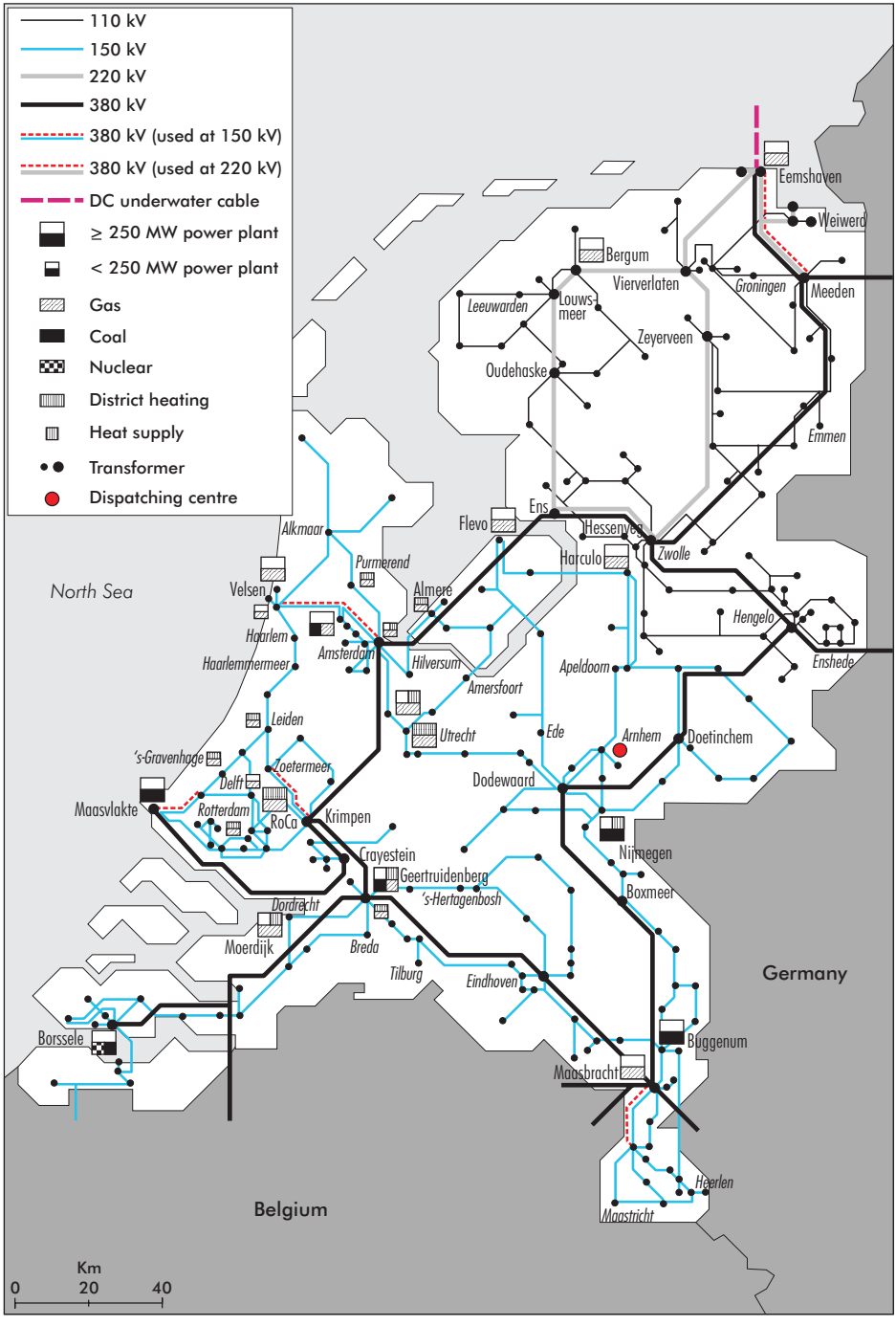
This integrative role that Sep played to an increasing degree over the last two decades has led to considerable cost savings. In 1982, for example, Sep introduced a system of country wide co-ordinated use of input fuels called the "landelijke economische optimalisatie" (countrywide economic optimisation, LEO). Instead of leaving fuel input decisions to each individual utility, this system made use for the first time of co-ordinated fuel switching following price movements, thus using the flexibility of the dual-firing capacity to the fullest. It was estimated in 1989 that the introduction of this system alone led to savings of 50 million guilders.[25] Savings from other measures may have been even larger.

In 1989 a new Electricity Act was adopted with the purpose of improving the efficiency of the power industry and promoting combined heat and power production. The Act strengthened the existing co-operation among the centralised producers through Sep and made this co-operation a legal obligation in order to reduce costs through economies of scale. It also introduced a certain degree of competition to the market by allowing large end users of 20 GWh per annum or

24. It is not customary either in Dutch law or other documents to distinguish between transmission and distribution networks. The distinction is made between national and regional networks. Whereas in other European countries voltages of 220 kV and above are usually called transmission and anything below distribution, in the Netherlands lines above 110 kV are called national and lines below are called regional.

25. Ketting, N. G.: De praktijkconsequenties van de nieuwe Elektriciteitswet voor de elektriciteitsproducent, *Elektrotechniek*. 67, Nr. 2, February 1989.

Figure 28
The Dutch Electricity Network, 1999



Source: TenneT.

more to buy electricity from a distribution/supply company of their choice, and even to import electricity. In practice, very little use was made of these provisions. Distributors' prices did not differ much because the national basic tariff was still used. Transmission prices were not transparent and transaction costs were perceived as high.

The Act also established strict criteria for entry into the central generation market. Central power generation required a licence, which specified a minimum size of 2,500 MW of capacity. This is more than the current size of the central generator EZH, which means that any new entrant would have had to enter the market at a prohibitive size. New centralised power stations above 25 MW required Sep's approval, ministerial approval based on procedures such as environmental impact assessments, and parliamentary review. In contrast to the tight regulation of the centralised market, the decentralised market had the advantage of lighter administrative procedures. The 1989 Electricity Act strongly encouraged CHP generation through a comparatively light regulatory burden for new CHP investment and through a range of support measures detailed below.

In the mid-1990s it became clear that further reform was necessary. Throughout the ensuing reform process, which would eventually lead to the enactment of the 1998 Electricity Act,[26] the government felt that the market structure of the centralised segment needed further change. The cost savings realised through co-operation within Sep and the desire to establish the Dutch power industry as a strong player in the European internal electricity market prompted the government to strive for a merger of the four "centralised" generators. In any case, they were already operating like a single company due to the co-ordination through Sep.

At the time of the last in-depth review, which advised against it, initial steps toward this merger had been taken. These steps included consultations with the companies concerned, which favoured the idea in principle. In 1998, a new Competition Law was adopted and NMa carried out an initial investigation into the merger. Its initial ruling concluded that the merger would have significant potential to limit competition in the Dutch power market, and that further investigation was needed. The Minister of Economic Affairs would have had the power to overrule NMa's decision eventually, but there were also disagreements among the four generators over financial and governance issues. The merger was abandoned in April 1998.

The "Decentralised" Market

The "decentralised" segment of the Dutch power market comprised some 7,800 MW of CHP capacity at the end of 1997, amounting to 34 per cent of installed capacity. Decentralised CHP capacity is expected to increase in the future. In addition, there

26. The 1998 Electricity Act is described in the section The Path of Reform.

is a small amount of renewable capacity. The most important in this respect are waste incinerators and wind turbines, but there are also very small amounts of hydro and photovoltaic systems. The total of non-CHP decentralised capacity is 800 MW. Decentralised CHP producers supply about half of their generation to the public grid. Altogether, decentralised generation accounts for 26 per cent of total electricity supply.

As indicated in Figure 27, industry has a relatively large share in "decentralised" power generation and supply. Industrial autoproduction has been comparatively large for a long time and has traditionally been dominated by CHP. Already in the early 1980s, almost 90 per cent of all industrial autoproduction was CHP. Whereas autoproduction has shown a long-term declining trend almost everywhere else in IEA Europe, both its total amount and its share in Dutch electricity supply continued to increase. This increase chiefly occurred in combined heat and power generation.

This development is to a large part due to a long standing tradition of government support. Following the 1989 reform of the Dutch electricity supply industry, the development of decentralised CHP accelerated significantly. The 1989 Electricity Act contained a variety of incentives for CHP. These expired when the Act expired in July 1998. The incentive measures included:

- An obligation on the centralised system to buy surplus electricity from CHP plants at avoided cost. Avoided cost was set equal to the full cost of new central generating facilities. This requirement was in force until 1995.

- Government subsidies of up to 17.5 per cent of capital investment.

- Favourable natural gas pricing for small-scale CHP until 2002.

- An exemption from paying for reserve capacity and ancillary services until 1997.

These support measures caused vigorous investment in decentralised CHP facilities throughout the 1990s, often by energy distributors entering into joint ventures with private companies. As a result, total installed CHP capacity today is nearly five times as high as in 1990. The Second Memorandum on Energy Conservation (SMEC) adopted in 1993 set the target for CHP at 8,000 MW and 30 per cent of generation by 2000. This objective will very probably be reached.

The number of new CHP plants was such that Sep had to limit output from existing, economic baseload plants to accommodate overcapacity from the expensive new CHP plants. This led to under-utilised capacity and higher unit cost. Prices, which would normally fall in a market with overcapacity, instead rose to recover Sep's higher unit costs. Higher Sep prices in turn encouraged decentralised suppliers to develop more CHP. Meanwhile, the incentive mechanisms were dismantled. At the end of 1999, there had not yet been a significant decline in the number of new CHP projects.

THE PATH OF REFORM

Reform Process and Legislation

As in the gas industry, the starting point for the most recent reforms in the Dutch electricity supply industry was the 1995/96 Third White Paper on Energy Policy. This document was strongly influenced by the European Union Directive on the internal electricity market (Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 *concerning common rules for the internal market in electricity*). At that time, the Directive was still being elaborated. The White Paper stated that greater competition in the electricity supply industry was both inevitable and desirable, that environmental compatibility and sustainability had to be ensured, and that the Dutch power industry had to be given the time and means to hold its own in the competitive European power market.

Based on these principles, the Netherlands Electricity Act, entitled Rules Relating to the Production, Transport, and Supply of Electricity, was developed. All provisions of the Act entered into force on 1 August 1998 except those relating to tariffs and technical requirements for network access and those relating to supply conditions for captive customers. The latter provisions were amended twice, in December 1998 and July 1999. Entry into force of the amendments occurred via Royal Decree in June 1999 (Stb. 1999, 261).

Market opening occurs in three steps:

- All customers with capacity above 2 MW per connection were free to chose their supplier from the European market as well as from other countries, starting on 1 January 1999. This corresponds to approximately one-third of the total number of power consumers in the Netherlands.

- As of 1 January 2002, all consumers with a total maximum transmission value of more than 3 * 80 amperes, or about 50 kW, become eligible. This brings the degree of market opening to roughly two-thirds of all electricity customers.

- As of 1 January 2007, all electricity consumers in the Netherlands are eligible for the competitive power market. As she did in the gas industry, the Minister of Economic Affairs recently accelerated this step, now scheduled to occur in 2004.

The first step of market opening goes somewhat, and the following steps go very significantly beyond the requirements of the EU Directive. The Directive stipulates that by February 1999, *at least*[27] all consumers above 100 GWh had to be free to purchase electricity from suppliers in the European Union, and that by 2000, all

27. At the same time, a larger part of the market had to be opened. The exact percentage of minimum market opening was to be determined by the European Commission using a reference customer size of 40 GWh per annum. This market share has now been determined to be 26.48 per cent.

customers above 20 GWh[28] annual consumption had to be eligible. However, the Dutch government makes use of the Directive's authorisation to exercise reciprocity. Consumers below the 20 GWh threshold can only import electricity if the Minister of Economic Affairs approves, and this approval is granted only if the same category of consumers is eligible for competition in the country of origin.

The method of grid access is regulated Third Party Access. The Electricity Act and its amendments stipulate that access conditions and grid prices are to be controlled by a regulatory body, the Electricity Act Administration and Supervision Department (Dienst Toezicht en Uitvoering Elektriciteitswet, DTe). The DTe and its tasks are described in the box The Electricity Regulator. Disputes relating to refusal of access or refusal to purchase are settled by NMa, as are disputes over contracts.

In accordance with the EU Directive, the Act requires independent system operators for the transmission network and the regional distribution networks. These operators must be organised as private law limited or joint stock companies (B.V. or N.V.) and must be fully independent of industry interests. The system operators' board members are not allowed to be directly or indirectly affiliated with producers, suppliers, or shareholders in the relevant network. The Minister of Economic Affairs must approve nominations to the transmission grid operator's supervisory board.

Functional unbundling of the transmission system operator from generators, distributors and suppliers thus exists. Under Article 10 of the Electricity Act 1998, all generators who own transmission lines must form separate legal entities (B.V. or N.V.). Article 44 of the 22 June 1999 Amendment states that electricity supply companies have to unbundle the accounts of captive customers. There are, however, no provisions for general accounting unbundling of generation, distribution and supply activities.

During the period up to 2004 when there are still captive consumers, their supply requires a licence. The licence carries a number of obligations, such as the obligation to supply captive customers at prices regulated by the Minister of Economic Affairs. Suppliers also have to be able to demonstrate to the Minister of Economic Affairs that they have made sufficient provisions to cover captive consumption. Failing this, the Minister can instruct licencees to take the appropriate steps at their own cost, or revoke their licence.

Power generation is not subject to economic regulation. New generating capacity merely requires a technical authorisation from the Ministry of Housing, Spacial Planning and the Environment or subordinate authorities, depending on the size of the project.

The government intends to apply a number of public service obligations mainly related to energy efficiency, renewables and CHP. First, as in the new Natural Gas

28. This figure, again, is merely a reference for calculating an EU-wide degree of minimum market opening, which is estimated to be approximately 28 per cent.

Act, electricity consumers are required to buy a number of green certificates corresponding to a fixed share of their electricity consumption. Second, captive customers who own small-scale CHP facilities under 2 MW of capacity are entitled to sell their surplus power to their licenced supplier, who has to buy this power. Large-scale CHP is expected to be competitive in the liberalised market.

The Electricity Regulator

The Dutch electricity regulator is called the Electricity Act Administration and Supervision Department (Dienst Toezicht en Uitvoering, Elektriciteitswet, DTe). According to Article 5 of the Netherlands Electricity Act 1998, the regulator comes under the direct authority of the Minister of Economic Affairs.

The June 1999 Amendment stipulates that the regulator is to operate as a department of the Netherlands Competition Authority (Nederlandse Mededingingsautoriteit, NMa). NMa has a staff of 120. It too derives its power from the Minister of Economic Affairs and the Minister can issue general instructions relating to NMa's electricity regulation (Article 6).

In practice, DTe has operated under the authority of the Ministry of Economic Affairs but as a part of NMa since its creation in August 1998. The Minister will continue to appoint the Director of DTe directly. Currently, DTe is to be limited to a staff of 15. This is seen as sufficient because of synergistic effects with NMa's staff.

DTe's tasks are:

- Setting tariff structures and maximum price levels for transmission, connection and the provision of ancillary services. The tariffs must be published.
- Evaluating the work and efficiency of network operators once every two years based on the information and data they are obliged to provide. Notifying the Minister of Economic Affairs if a network operator is inefficient or incapable of providing transmission through the network it manages.
- Once every two years, evaluating the holders of supply licences to captive consumers, based on the information and data they are obliged to make available. Notifying the Minister of Economic Affairs if a licensee is inefficient or incapable of supplying customers he is obliged to supply.
- Advising the Minister on the appointment of network operators, issuance of supply licences, and tariffs for captive consumers.

Market Structure and Modus Operandi

TenneT

As required by EU and Dutch legislation, an independent transmission system operator had to be established. This function is now carried out by a company called TenneT. TenneT has 210 staff and began operation in October 1998. It is a private law limited liability company (B.V.) owned by Sep N.V., but it acts as an independent entity with its own legal status, statutes and advisory board. Although Sep is still owned by the centralised generators, the government does not consider that there is contradiction between Sep's ownership of TenneT and the provisions of the Electricity Act.

Sep is no longer the co-ordinator of the centralised power market. Its only remaining function at present is to own TenneT. As the owner and operator of the Dutch high-voltage grid and as the system operator responsible for system balance and stability, TenneT has taken over many of Sep's previous functions in terms of the operation of the national grid. The difference is that today there is no centralised economic optimisation of the whole centralised power system, and that the economic side of power trade can be carried out competitively through direct contracts or the Amsterdam Power Exchange (see below). Sep is still the owner of the grid, but its influence is strictly limited by the provisions of the Electricity Act 1998 and the secondary legislation enacted in 1999. The government intends to obtain a majority shareholding in TenneT of 50 per cent plus one share in the future. The details of implementation are still to be discussed in Parliament.

Several documents spell out TenneT's duties and the concrete functioning of the Dutch electricity market. They were developed in consultation with market participants in 1999. The most important of these are a Tariff Code (TarievenCode), a Metering Code (MeetCode) and a System Code (SysteemCode). DTe supervises the application of these codes. The System Code in particular defines TenneT's operation of the Dutch power system. TenneT's duties are to

- Ensure the stability and reliability of the Dutch electricity system.
- Carry out load balancing in the Dutch system and with neighbouring countries.
- Maintain the high voltage grid in good working order to allow access and maximum capacity utilisation.
- Facilitate power market transactions between market participants.
- Allocate grid capacity and apply transmission prices to all market participants in a non-discriminatory, transparent and verifiable manner.
- Constantly optimise the infrastructure in relation to technological and economic developments;
- Apply the transmission prices established in the Tariff Code.

The Electricity Act 1998 and the System or Grid Code adopted in November 1999 set out the manner in which TenneT has to allocate the capacity of the five interconnectors with the surrounding countries (Article 5.6.). In mid-November 1999, DTe finalised the allocation procedure for transmission capacity using cross-border interconnections, now part of the Grid Code. The Electricity Act 1998 and the Grid Code stipulate that reservations for transmission or interconnector capacity can only be made on the basis of existing contracts concluded by an end user or a licencee supplying captive consumers.

In accordance with the technical rules of the Grid Code, a maximum of 3,500 MW was available for commercial export, import and transit transactions, out of the nameplate interconnection capacity of 12,000 MW. Of this capacity, TenneT set aside 300 MW for international technical assistance in maintaining grid stability, as agreed among transmission system operators in the UCTE.[29] Following the Grid Code's rules for allocation of commercial capacity, DTe reserved 2,300 MW of interconnector capacity for Sep's long-term power import contracts with foreign suppliers (1,500 MW), and for one-year contracts with others (800 MW). The remainder of some 900 MW was set aside for the electricity spot market organisation, the Amsterdam Power Exchange. During the previous year, 1,150 MW had been earmarked for annual contracts and 500 MW for the spot market (250 MW for APX and 250 MW for bilateral transactions).

To obtain capacity for the year 2000, interested parties had to submit their request by 19 November 1999. The maximum permissible amount per application was set at 800 MW. TenneT received 604 requests for import capacity, totalling more than 350,000 MW, and no requests for export or transit. After the requests were capped at the maximum permissible amount, the total was 275,000 MW. The applicants were then asked to produce proof of a supply contract with a licence holder or end user. Thus, 90 requests totalling about 15,000 MW[30] were attributed on the basis of the principle of proportionality set out in the Grid Code. Despite great time pressure, all applicants were notified of the definitive allocation on 1 December 1999. The outcome meant that for every 100 MW requested, approximately 5.3 MW were granted. The criterion for deciding was evenness of the load duration curve of imports. TenneT is aware that the allocation method is cumbersome and lacks transparency, especially at times of strong demand for interconnector capacity. The company is trying to increase the available interconnector capacity over time. For the 2001 capacity allocation round, TenneT has submitted a proposal for an auctioning method and has signed a memorandum of understanding with its German and Belgian counterparts for auctions for cross border capacity.

29. Union for the Co-ordination of Transmission of Electricity.
30. The total interconnector capacity of 3,500 MW is what is available at any one moment in time. The granted capacity of 15,000 MW is a summation of capacities used at different moments. For this reason the latter figure can exceed the former. Following is a hypothetical example for illustration: if a steel mill sought to import 3,500 MW only on weekdays and an amusement park sought to import 500 MW only on weekends, TenneT would have received requests totally of 4 000 MW.

APX

The Amsterdam Power Exchange (APX) is the Dutch spot market for electricity. It was formed in 1998 and started operating in May 1999 as a fully independent private company for electricity trade. Its ownership is dominated by institutional investors. Domestic and foreign producers, consumers, traders and suppliers are allowed to trade. However, as explained above, the reciprocity clause applies. APX currently has some 30 members. The majority is foreign and includes most major European electric utilities.

APX is a non-mandatory, bilateral pool, based on the Nordpool model. It currently offers day-ahead (forward) trading with hourly prices and minimum volumes of 100 kWh. But other products such as longer-term forward trading and futures are under development. At present, the share of electricity sold in the Netherlands through APX is fairly small, i.e. about 5 per cent. This is partly due to the scarcity of import capacity as described above. APX aspires to become the main European power exchange.

Generation

Three of the four centralised generators have now been acquired by foreign utilities. UNA announced its intention to sell its shares to the American company Reliant Energy in March 1999; in September of the same year this decision was approved by the Minister of Economic Affairs. In November 1999, the current shareholders of EPON, the energy supply utilities groups EDON Group N.V. (50 per cent) and NUON N.V. (50 per cent), announced that they would sell 80 per cent of EPON's shares to the Belgian power company Electrabel. The Dutch bank ING was to buy the remaining 20 per cent. The share transfer occurred in January 2000. EZH was acquired by the German power company PreussenElektra.

Distribution and Supply

Following the obligation set out in the Electricity Act, network-owning utilities had to form separate legal entities for their transmission operation and register these entities with the Minister of Economic Affairs by 24 October 1999. By that date, 24 network companies were registered. These are listed in Table 11. 23 of the companies owning these distribution operations applied for and obtained a licence for the supply of captive customers in 1999, covering the entire territory of the Netherlands. The only exception was Sep.

At present, there are two opposite movements of vertical integration and separation. Some electricity suppliers are taking over generating companies (like Essent, a merger of PNEM, MEGA and EDON), while others (like NUON, a merger of NUON, ENW, EWR and Gamog) are concentrating on the core business of electricity supply and shedding non-electricity activities.

Table 11
Network Operators in the Dutch Electricity Market

Name of network company	*Location*	*Owner*
B.V. Netbeheer Zuid-Kennemerland	Heemstede	N.V. Energiebedrijf Zuid-Kennemerland
B.V. Transportnet Zuid-Holland	Voorburg	B.V. Transportnet Zuid-Holland
DELTA Netwerkbedrijf B.V.	Middelburg	N.V. DELTA Nutsbedrijven
EdelNet Delfland B.V.	Delft	Energie Delfland N.V.
Electriciteitsnetbeheer Utrecht B.V.	Utrecht	N.V. Regionale Energiemaatschappij Utrecht
ENECO Netbeheer B.V.	Rotterdam	N.V. ENECO
ENET Eindhoven B.V.	Eindhoven	N.V. Nutsbedrijf Regio Eindhoven
EWR Netbeheer B.V.	Katwijk aan Zee	EWR N.V
InfraMosane N.V.	Maastricht	EnerMosane N.V.
MEGA Limburg netwerk B.V.	Landgraaf	N.V. MEGA Limburg
MEGA Limburg netwerk B.V. (Heerlen)	Landgraaf	N.V. MEGA Limburg
N.V. Continuon Netbeheer	Arnhem	N.V. NUON
N.V. EDON Netwerk	Groningen	N.V. EDON
N.V. FRIGEM Netwerk	Leeuwarden	N.V. FRIGEM
Netbeheer Midden-Holland B.V.	Gouda	Energiebedrijf Midden-Holland N.V
Netbeheer Nutsbedrijven Weert N.V.	Weert	Nutsbedrijven Weert N.V
Netbeheerder Centraal Overijssel B.V.	Almelo	Centraal Overijsselse Nutsbedrijven N.V.
Noord West Net	Haarlem	Energie Noord West N.V.
ONS Netbeheer B.V.	Schiedam	N.V. ONS Energie
PNEM Netwerk B.V.	's-Hertogenbosch	N.V. PNEM
RENDO Netbeheer B.V.	Hoogeveen	N.V. RENDO
TenneT B.V.	Arnhem	Sep
Westland Energie Infrastructuur B.V.	Poeldijk	N.V. Nutsbedrijf Westland

Source: DTe.

Regulation

Network Pricing and Supply of Captive Consumers

The secondary legislation based on the 1998 Electricity Act sets down a number of rules and provisions that clarify the structure of transmission tariffs as well as access conditions. Article 25 of the 1999 amendment requires that network tariffs to consumers contain a connection fee, a transportation fee and a fee for system (ancillary) services, to be paid by all consumers of network services. The transportation fee is to be independent of distance or location; thus it is a postage stamp-tariff.

As provided for in the legislation, the Minister asked all grid-owning electricity companies to submit proposals for these tariff elements. Based on these proposals,

the Tariff Code (TarievenCode) was developed and issued as a Ministerial Decree on 30 September 1999. The Metering Code (MeetCode) and the System Code (SysteemCode) were developed in the same manner as the Tariff Code. The Tariff Code sets out the following rules for network tariffs.

The connection fee covers the cost of connection and consists of a lump sum payment upon connection and a monthly connection charge. The system services fee covers the cost of reserve capacity and ancillary services.

There are two different transmission fees, one for electricity generators and one for consumers. Producers pay the so-called uniform national producer transport tariff (landelijke uniform producenten transporttarief, LUP) for the power they feed into the 'national' transmission grid. In the Netherlands, the 150 and 110 kV grids as well as the 380 and 220 kV grids are considered to be part of the high-voltage 'national' grid. Below the 110 kV threshold, networks are considered to be regional grids. The LUP is to cover all cost elements that are considered to vary with the number of kWh transmitted. These cost elements are:

- Depreciation of existing network infrastructure.
- A reasonable rate of return on network investment.
- New investment in and maintenance of grid infrastructure.
- Network losses, reactive power, transformation cost and losses, etc.

The LUP is calculated by dividing 25 per cent of the total sum of these four cost elements by the total number of kWh transmitted.

Distributors and large consumers taking power from the transmission grid pay a different and more complex transmission rate. It contains a constant price element, designed to cover fixed costs such as meter reading and data processing, but also a fee to cover the system operator's administrative costs.

In addition, distributors and large consumers pay a transmission price element that varies with quantity, meant to cover the remaining 75 per cent of the four cost elements. This price element involves a relatively complex "cascading" system meant to allocate the cost of using the various voltage levels of the grid, depending on the amount of power transported. Following this system, a consumer "shipping" 100 MW over a part of the grid is assumed to use higher voltage levels, and pays more, than a consumer causing the transfer of 1 MW. The resulting tariff, the *transport-afhankelijke verbruikers transporttarief* (TAVT), has six different categories according to consumers' voltage levels, ranging from 380 kV down to 0.4 kV.

Maximum price levels for transmission are set by the Director of DTe. They are determined through a multi-annual RPI-X price cap and include an element of benchmarking. A similar price cap formula exists for captive consumers, based on

the supply licences. The Minister of Economic Affairs sets these price caps. The new pricing system entered into force on 1 January 2000. The prices for 1999 were still determined under the old system in 1998: they were proposed by the power companies and approved by the Minister of Economic Affairs.

Stranded Cost

The 1998 Electricity Act and its amendments also foresee a mechanism for stranded cost recovery. The Dutch government has identified a number of supply sources that are likely to have above-market prices in the competitive market. Among these are:

- District-heating contracts.
- Power purchase agreements between producers and distributors.
- International power (and gas) purchase agreements.
- The coal gasification plant Demkolec in Buggenum.

In the framework of the EU notification requirements relating to state aid, Dutch authorities have notified the European Commission that these facilities and/or contracts are likely to come up for stranded cost recovery. Further work is currently under way to determine how stranded costs are to be measured and reimbursed. The government favours a levy on the transmission tariff to raise funds for these reimbursements.

CRITIQUE

The power industry in the Netherlands has been fragmented for a very long time. Whereas in many European countries, vertically and horizontally integrated companies were formed after World War II, reaping the benefits of increased productive efficiency through economies of scale and large integrated markets, the Dutch power industry approached this point only after a gradual process of concentration and integration through Sep. Therefore the industry was characterised by relatively weak productive efficiency for a long time.

The integration process was still going on towards the end of the 1980s, when the attention of policy-makers and market players shifted to the even greater benefits of opening the European electricity market to competition. The Dutch government allowed some competition relatively early on in 1989. Subsequently, the government strove to complete the concentration process at generation level by merging the four remaining centralised generators into one company.

The decision to abandon this merger must be commended. In the early 1990s, the four generators were in any case already operating like one company due to Sep.

More importantly, competition ensures even higher productive efficiency than concentration because it puts more pressure on costs. On top of that, competition also ensures allocative efficiency because it exerts downward pressure on end-user prices. Had the merger been carried out, 74 per cent of domestic generation and 61 per cent of domestic supply would have been in the hands of one company.

The only competition would have come from decentralised generation and imports. Yet a significant part of the smaller CHP capacity entered the market with major government support and cannot be expected to be fully viable under competitive conditions. The government has implicitly acknowledged this by repealing the support measures and by announcing that some of this capacity is eligible for stranded cost recovery. Also, the usable interconnection capacity to the Netherlands' neighbours is much smaller than nameplate capacity and allows only very limited imports that are not under the control of the centralised generators.

The striving of subsequent governments to increase the Dutch power industry's economic efficiency was only one of the two major policy objectives for the sector. The other one was to reduce the environmental impact of power generation. Combined heat and power production drastically increases transformation efficiency of primary fuels into electricity and thereby reduces all adverse effects of fossil fuel use, ranging from most forms of air pollution to carbon dioxide emissions to lessening of energy security. The government is acutely aware that the easy availability of relatively inexpensive domestic gas has led to a lack of diversification in the fuel mix: with almost 60 per cent of power generation, the Netherlands has the highest gas share in the world.

The drawback of CHP is that its economics are very site-specific, depending on factors such as an appropriate heat load. Where the appropriate baseload heat demand is missing, CHP electricity generation can be very costly, especially if used for district heating.

In a country like Finland, where some space heating is needed almost year-round and many energy-intensive industries need both power and steam, it is not surprising that CHP now accounts for 30 per cent of electricity generation – the economics are very favourable.[31] The Netherlands has had the same objective in a different setting. Consequently, the support needed to bring this capacity into existence had to be much larger. The measures taken under the 1989 Electricity Act indeed provided massive support. But some of the support measures that had been used prior to 1989 had even been stronger. In 1987, for example, investment subsidies for CHP amounted to up to 25 per cent for industrial CHP and up to 40 per cent for small-scale suppliers (including households).

Under such circumstances, it is not surprising that Dutch CHP capacity has grown vigorously, and that the 30 per cent target is within reach. Ultimately, it is up to the

31. It should be noted, though, that even in Finland certain forms of CHP have received government support.

Dutch citizen and voter to decide what value should be attributed to environmental protection and energy security, and so far the subsidies have enjoyed wide support. However, the voters are also taxpayers and consumers, and as such they must be properly informed of the costs of such policies. In the Netherlands, the costs go significantly beyond the monetary outlays from the government budget. They also include the higher electricity prices caused by the very high feed-in prices for CHP and by the fact that cheaper existing baseload capacity lies idle due to overcapacity. These less obvious costs are likely to become much more transparent over time as end-user competition is phased in.

In addition, support policies for CHP (or for renewables) must be market-compatible and non-discriminatory. Because the relevant mechanisms under the 1989 Act were phased out, this seems to be the case for new capacity. However, those earlier mechanisms have left the centralised generators with a lot of overcapacity, some of which is inexpensive baseload capacity. This gives them as incumbents an important advantage they can use against new entrants. The government should consider mechanisms to reduce the incumbents' advantage.

Another issue that potentially restricts competition and needs to be resolved in the competitive power market is the small amount of import capacity available for non-incumbents. Despite the ample nameplate interconnection of 12,000 MW, only 900 MW could be made available for APX and only 800 MW for one-year contracts. Clearly this is insufficient: the desire to import electricity was so great that the capacity was more than 20 times oversubscribed.

The issue has several dimensions. First, the actually available interconnector capacity of 3,500 to 4,000 MW is considerably less than the thermal limit of 12,000 MW. This may well be due to the specific technical layout of the Dutch grid architecture and the grid configurations in Belgium and Germany.[32] The regulator should ensure that economic technical improvements (advanced switchgear, thyristors etc.) are introduced to allow operation of the grid closer to its thermal limit, and that the transmission tariff encourages these improvements and the necessary grid reinforcements.

Second, another part of the problem may be loop flows, i.e. power flows far away from the shortest path.[33] Efficient use of the transmission grid eventually requires that a mechanism be found to incorporate a price for loop flows into the transmission prices of all those who use the grid and who have an impact on it.

32. A major power line may, for example, only be operated up to the limit of the surrounding infrastructure. This is due to the "n-1 rule" for safe system operation. If the power line breaks down, it may "spill" its electricity into the surrounding lines, but if these lines have much lower capacity, this spillover may cause them to overload and also break down, thereby spreading the problem and eventually leading to a large-scale blackout.
33. The ultimate technical cause for loop flows is that electrical currents do not flow along any predetermined contractual path but along all possible parallel paths. The lower the resistance on any single path, the more power will flow along that path. A power line's resistance depends on how much power is already loaded on it.

Both parts of the problem require a European solution and a working group at EU level, the Association of European Transmission System Operators (ETSO), has been established to tackle these issues. The apparent weakness of the interconnectors may well be due to the absence of an internationally co-ordinated transmission pricing mechanism that takes into account grid externalities on the European scale.

Third, there may have been an element of gaming in the capacity allocation round for 2000, potentially encouraged by the relatively cumbersome allocation rules. Companies had an incentive to ask for as much capacity as possible, and it appears that some even founded subsidiaries for no other purpose than to be able to request more interconnector capacity. To eliminate the incentives for gaming, a transparent, market-based allocation mechanism should be phased in as soon as possible. The auctioning method that TenneT suggests for the 2001 allocation round is promising, as it rations capacity through price, forcing companies that ask for a lot of capacity to pay a proportionate amount of money for it. Following consultation with market players, it appears that most parties favour this system.

Fourth, the strong demand for interconnector capacity follows from the strong import demand, which is itself caused by the price differential between the Dutch market and the surrounding markets. Over time, this price differential should shrink,[34] and with it the demand for interconnector capacity. It is therefore important to balance the benefits from trade against its costs. The auctioning method should show whether market prices for interconnector capacity lie consistently above the long-term marginal cost of interconnector reinforcement; if this is the case, TenneT should invest in increased capacity. Despite the large discrepancy between the commercially available capacity and the thermal limit, the Netherlands is relatively well interconnected. As long as a market situation is clearly and recognisably exceptional, it should not lead to overbuilding of capacity. The auctioning method is more economically efficient than the previous rationing system, and is likely to contribute much to clarifying these issues.

In any case, the Dutch government should ensure that transmission grid development allows a fully open market, in particular with respect to cross-border trade. Finding a market-compatible pricing mechanism at European level is important for the Dutch market. The government should promote a European solution. In this respect, Dutch membership in ETSO is a commendable initiative. Furthermore, the government should encourage possible interim solutions with its direct neighbours and monitor the effectiveness of TenneT and the Dutch transmission tariff in bringing about the appropriate investment.

There are encouraging signs that such a development is under way. TenneT co-operates intensively with its Belgian and German colleagues and has recently obtained an agreement with the German network operator RWE-Netz to eliminate a grid bottleneck on the interconnector Maasbracht-Germany; as of September

34. For example, many industry observers doubt that power prices in Germany will remain permanently as low as at present.

2000, the capacity of this connection will be increased by 400 MW to 3,900 MW. The fact that a memorandum of understanding on cross-border infrastructure auctioning was signed with the relevant Belgian and German transmission system operators is also encouraging.

Notwithstanding the detailed points made so far, the Dutch government has taken bold steps to liberalise the electricity market, steps that go significantly beyond the EU Directive. The institutions and mechanisms needed to operate a fully liberalised electricity market are presently going through the final stages of development. Some of the current mechanisms may have to undergo revision as competition progresses. For example, in the longer run, the postage-stamp transmission tariff currently in force for electricity transmission may be found to oversimplify network conditions and fail to reflect congestion. It may have to be replaced by a more realistic but less straightforward pricing system. Experience will tell whether the authority of the Minister of Economic Affairs over both the regulator and the competition authority opens the door to excessive government influence, or whether the regulatory discretion this offers is used in a prudent and judicious manner. Adjustments will probably have to be made along the way, but with the reforms carried out in 1998 and 1999, the decisive steps for introducing vigorous competition have been taken.

RECOMMENDATIONS

The government should:

- ☐ Ensure that no further concentration occurs in the generation market.
- ☐ Closely monitor competition in the generation market, especially with a view toward identifying, and if necessary limiting, the potential incumbent's advantage that the four centralised generators may enjoy through system overcapacity and their privileged access to interconnector capacity.
- ☐ Carefully weigh the costs and benefits of CHP expansion. Make the costs as transparent as the benefits.
- ☐ Ensure that transmission grid development allows a fully open market, in particular with respect to cross-border trade. Continue to strive for a European solution. Continue to encourage possible solutions with adjacent countries and monitor the effectiveness of TenneT and the transmission tariff in bringing about appropriate investments and technical improvements.
- ☐ Clarify the criteria used for attributing interconnector capacity and make them available to the interested public. Strive to develop and phase in a market-based allocation mechanism as soon as possible.

7

ENERGY TECHNOLOGY AND R&D

OVERVIEW

Government expenditure on research, development and demonstration has grown over the last years, reaching a total of *f* 321 million in 1998. The Ministry of Economic Affairs provides the largest share of the funding (68 per cent), followed by the Ministry of Education, Culture and Sciences, the Ministry of Physical Planning, Housing and the Environment and the Ministry of Agriculture, Nature Management and Fisheries.

Energy research and demonstration policy is based on priorities set by the government in the Third White Paper on Energy Policy, the 1998 Renewable Energy Action Programme, the 1999 Energy Conservation Action Programme, and the 1998 paper on Energy Research in the Netherlands. Policy is guided by international agreements, especially the Kyoto target and EU burden sharing. Government research, development and demonstration funding is allocated as follows:

Table 12
Government Expenditure for Energy Research, Development and Demonstration in the Netherlands, 1998

Research area	*Funding in millions of Dutch Guilders (f)*
Energy efficiency	122
Fossil fuels	24
Renewables	77
Nuclear	39
Power and storage	32
Systems analysis	17
Other	10
Total	**321**

Source: Ministry of Economic Affairs.

Energy efficiency is strongly promoted in the Netherlands. Subsidies, information campaigns, demonstration projects, long-term agreements and legislation are used to convince end users to implement energy saving measures. This causes strong demand for research in this field. Most of the research in renewables concentrates on solar energy, wind energy and energy from biomass. Important focuses of this research are cost reduction, performance and acceptance by end users.

System analysis is important for the implementation phase of technologies. Most of the renewable and clean technologies are in, or near, the implementation phase.

Hence this field is gaining importance. Research in the field of power storage and conversion is crucial for two of the renewable energy sources that are expected to become important in the Netherlands: wind and photovoltaics. Interest in non-technical research is growing, since the obstacles to the implementation of energy conservation or renewable technologies are becoming less and less technological.

Research on fossil fuels focuses on clean ways to extract energy from these sources. Research in nuclear energy is centred on safety of plants and transport, the handling of nuclear waste and new reactor types. Nuclear electricity generation is disappearing from the Netherlands due to lack of public acceptance. Continuing research provides a way not to lose the technology. Thus, nuclear energy will remain an option for the Netherlands once safety and waste problems are solved.

A relatively large number of organisations carry out energy research in the Netherlands. The organisations are independent from each other, but they interact strongly where their interests overlap. The government promotes co-operation between these organisations. The programmes of all institutes are subject to periodical evaluations by independent parties. In these evaluations, results, goals and efficiency are examined.

Novem is the most important intermediary agency for implementing research, development and demonstration policy. Novem runs programmes in the fields of sustainable construction, living and working, sustainable energy (CO_2 reduction, new fuels, heat pumps, waste and biomass, energy storage in aquifers, solar energy and wind), sustainable processes (energy efficiency and environment) and mobility. Novem is also a funding organisation for research projects, studies, demonstration projects and implementation projects. Novem's budget totals f 130 million, with f 90 million for research and development and f 40 million for demonstration. Dissemination of knowledge is also an important part of the Novem programme.

Senter is an intermediary agency for the Ministry of Economic Affairs. Its programme focuses on industry. In relation to energy, it finances research and demonstration projects, mostly in the field of efficiency. Senter plays a role as information provider for Dutch industry.

NWO is the intermediary organisation that funds university research. Because this research is mostly basic, the exact amount of energy-related research is not clear. Universities perform a large part of Dutch energy research. Funding of this research comes from the Ministry of Education, Culture and Sciences, through NWO.

The Energy Research Center of the Netherlands (ECN) is a research institute that focuses on long-term research and mid-term development in the fields of energy and related services and knowledge transfer. The research programme is set according to government guidelines. Many of the individual projects are performed in co-operation with external investors. The programme comprises energy efficiency, policy studies, solar, wind, biomass, nuclear energy, fossil fuels, conversion and environment. Internationally, ECN is a leading institute in several fields such as solar energy and wind technology. Its total budget is around f 190 million, of which

f 60 million is direct support from the government. Additional funding is provided by the EU, Novem and industry.

TNO is an institute for applied natural sciences. It provides services and performs research in areas ranging from kitchen appliances to military subjects. It receives financing for general activities and for research in specific fields. Government funds for sustainable processes, energy and material use amount to f 22 million. TNO supplements its funding by forming partnerships with commercial companies. In the field of energy research,TNO concentrates on biomass, energy efficiency, energy storage and energy from waste.

KEMA is the research institute of the Dutch electricity sector. In 1998, KEMA merged its nuclear research with ECN. KEMA is expected to be strongly affected by changes in the demand for research caused by the liberalisation of the gas and electricity markets.

Gastec is a gas-related research institute. Gastec performs research in the fields of gas infrastructure, hydrogen, CHP, domestic solar heat and energy end use. As with KEMA, liberalisation will strongly affect this institute. The Dutch gas company Gasunie has a research department that focuses on mining and transport of gas.

SDE is a large, new consortium of several universities, knowledge institutes, energy companies and industry. In 1999, SDE started several research projects, concentrating on biomass and system integration. The government is helping finance SDE for the next three years.

Several companies in the Netherlands perform energy research and industry co-operates with the institutes described. An example is the HTU pilot plant, opened in October 1999, where biomass is converted into fuels and chemicals.

CRITIQUE

Energy technology research, development, deployment and demonstration is carried out by a large number of organisations in the Netherlands and, remarkably, benefits from growing government expenditure at a time when most governments and private companies are reducing research budgets. This in itself does not yet constitute a commendable attainment; efforts must be weighed against achievements.

But even with this reservation, Dutch R&D policy stands out as successful. The research is well aligned with the government's energy policy objectives – it shows a marked emphasis on energy efficiency and renewables – that are themselves well aligned with voter preferences. Nevertheless, the government wisely maintains research in less popular technologies that keep options open for the future, especially nuclear energy. Unorthodox but potentially very economic approaches such as carbon sequestration are not neglected.

Co-operation between public and private sector research organisations appears to function well and research efforts seem to be complementary to a large degree. The Dutch government would be well advised to maintain its research and development policy on its current successful path.

RECOMMENDATIONS

The government should:

- ☐ Maintain its research and development policy well in line with its overall energy policy objectives.
- ☐ Continue to allocate efforts and funds in a balanced way among popular and less popular but potentially promising technology options.
- ☐ Continue the excellent co-operation between public and private sector research institutions.

A

ANNEX

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1997	1998	2005	2010	2015
TOTAL PRODUCTION		**56.8**	**60.0**	**65.3**	**62.5**	**68.6**	**69.3**	**67.2**
Coal [1]		1.1	–	–	–	–	–	–
Oil		1.6	4.1	3.0	2.8	1.7	1.1	0.8
Gas		53.7	54.6	60.6	57.6	64.3	65.6	63.5
Comb. Renewables & Wastes [2]		–	0.4	1.0	1.0	2.1	2.4	2.5
Nuclear		0.3	0.9	0.6	1.0	0.4	–	–
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	–	–	–	–	–	0.0
Solar/Wind/Other [3]		–	0.0	0.1	0.1	0.2	0.2	0.4
TOTAL NET IMPORTS [4]		**6.0**	**6.8**	**11.0**	**11.3**	**18.0**	**22.9**	**31.9**
Coal [1]	Exports	1.4	2.2	2.9	5.4	1.7	0.7	0.7
	Imports	2.9	11.6	13.4	13.8	9.1	8.0	6.8
	Net Imports	1.5	9.4	10.5	8.3	7.4	7.3	6.1
Oil	Exports	42.4	59.8	63.0	62.9	40.8	43.9	43.7
	Imports	83.8	91.1	99.8	99.8	87.0	95.2	100.5
	Bunkers	11.6	10.9	12.2	12.3	15.5	17.7	20.0
	Net Imports	29.8	20.4	24.6	24.6	30.7	33.7	36.8
Gas	Exports	25.3	25.8	30.4	27.8	29.9	29.9	23.9
	Imports	–	2.0	5.2	5.2	9.1	11.3	12.1
	Net Imports	–25.3	–23.8	–25.2	–22.7	–20.8	–18.6	–11.8
Electricity	Exports	0.1	0.0	0.0	0.0	0.0	–	–
	Imports	0.0	0.8	1.1	1.1	0.7	0.6	0.6
	Net Imports	–0.1	0.8	1.1	1.0	0.7	0.6	0.6
TOTAL STOCK CHANGES		**–0.3**	**–0.2**	**–1.4**	**0.6**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**62.4**	**66.6**	**74.9**	**74.4**	**86.7**	**92.2**	**99.1**
Coal [1]		2.9	8.9	9.2	8.8	7.4	7.3	6.1
Oil		30.9	24.8	27.6	27.5	32.7	34.7	37.6
Gas		28.5	30.8	35.3	34.9	43.5	47.0	51.7
Comb. Renewables & Wastes [2]		–	0.4	1.0	1.0	2.1	2.4	2.6
Nuclear		0.3	0.9	0.6	1.0	0.4	–	–
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	–	–	–	–	–	0.0
Solar/Wind/Other [3]		–	0.0	0.1	0.1	0.2	0.2	0.4
Electricity Trade [5]		–0.1	0.8	1.1	1.0	0.74	0.6	0.6
Shares (%)								
Coal		*4.6*	*13.4*	*12.3*	*11.8*	*8.6*	*7.9*	*6.2*
Oil		*49.5*	*37.2*	*36.8*	*37.0*	*37.4*	*37.7*	*37.9*
Gas		*45.6*	*46.3*	*47.2*	*47.0*	*50.2*	*51.0*	*52.1*
Comb. Renewables & Wastes		*–*	*0.6*	*1.3*	*1.4*	*2.5*	*2.6*	*2.7*
Nuclear		*0.5*	*1.4*	*0.8*	*1.3*	*0.4*	*–*	*–*
Hydro		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other		*–*	*–*	*0.1*	*0.1*	*0.2*	*0.2*	*0.4*
Electricity Trade		*–0.2*	*1.2*	*1.4*	*1.4*	*0.8*	*0.6*	*0.6*

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

Please note: Forecast data for 2005 are based on the 1998 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1997	1998	2005	2010	2015
TFC	**48.8**	**52.0**	**58.1**	**58.0**	**72.3**	**77.0**	**82.4**
Coal[1]	1.1	1.7	1.6	1.5	2.5	2.5	2.5
Oil	24.7	20.5	22.7	22.7	27.5	29.2	31.6
Gas	19.3	23.0	24.1	23.6	31.1	32.6	33.5
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	0.6	0.6	0.7
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.0	0.1
Electricity	3.8	6.3	7.7	8.0	9.3	10.5	12.4
Heat	–	0.2	1.8	2.0	1.3	1.5	1.6
Shares (%)							
Coal	*2.2*	*3.3*	*2.7*	*2.6*	*3.4*	*3.2*	*3.1*
Oil	*50.5*	*39.5*	*39.1*	*39.2*	*38.1*	*38.0*	*38.3*
Gas	*39.5*	*44.2*	*41.5*	*40.7*	*43.1*	*42.4*	*40.7*
Comb. Renewables & Wastes	–	*0.3*	*0.4*	*0.4*	*0.8*	*0.8*	*0.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	*0.1*
Electricity	*7.8*	*12.2*	*13.3*	*13.8*	*12.8*	*13.7*	*15.1*
Heat	–	*0.5*	*3.0*	*3.4*	*1.8*	*1.9*	*2.0*
TOTAL INDUSTRY[6]	**21.2**	**21.7**	**21.8**	**21.5**	**31.7**	**33.6**	**35.3**
Coal[1]	0.8	1.7	1.6	1.5	2.5	2.5	2.5
Oil	10.4	8.4	7.5	7.4	12.1	12.6	12.9
Gas	8.1	8.8	8.6	8.3	12.3	13.2	14.0
Comb. Renewables & Wastes[2]	–	0.0	0.0	0.0	0.1	0.2	0.2
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	0.0	0.0	–
Electricity	2.0	2.9	3.3	3.4	4.0	4.5	5.1
Heat	–	–	0.8	0.8	0.6	0.6	0.6
Shares (%)							
Coal	*3.6*	*7.7*	*7.1*	*6.9*	*7.8*	*7.3*	*7.2*
Oil	*48.8*	*38.6*	*34.5*	*34.6*	*38.3*	*37.5*	*36.4*
Gas	*38.4*	*40.4*	*39.2*	*38.8*	*38.8*	*39.4*	*39.6*
Comb. Renewables & Wastes	–	*0.1*	*0.1*	*0.2*	*0.3*	*0.6*	*0.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*9.2*	*13.1*	*15.2*	*15.8*	*12.8*	*13.3*	*14.6*
Heat	–	–	*3.8*	*3.8*	*2.0*	*1.9*	*1.8*
TRANSPORT[7]	**7.5**	**10.6**	**13.8**	**14.0**	**14.9**	**16.2**	**18.2**
TOTAL OTHER SECTORS[8]	**20.2**	**19.6**	**22.4**	**22.5**	**25.7**	**27.3**	**28.9**
Coal[1]	0.3	0.1	0.0	0.0	–	–	–
Oil	6.9	1.6	1.5	1.4	0.6	0.6	0.7
Gas	11.1	14.2	15.6	15.2	18.8	19.4	19.5
Comb. Renewables & Wastes[2]	–	0.1	0.2	0.2	0.4	0.5	0.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.0	0.1
Electricity	1.8	3.4	4.2	4.4	5.1	5.9	7.2
Heat	–	0.2	0.9	1.2	0.7	0.9	1.0
Shares (%)							
Coal	*1.6*	*0.3*	*0.1*	*0.1*	–	–	–
Oil	*34.2*	*8.3*	*6.6*	*6.4*	*2.4*	*2.3*	*2.5*
Gas	*55.3*	*72.4*	*69.4*	*67.7*	*73.3*	*71.1*	*67.5*
Comb. Renewables & Wastes	–	*0.7*	*0.8*	*0.8*	*1.7*	*1.7*	*1.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.1*	*0.1*	*0.2*
Electricity	*8.8*	*17.1*	*18.9*	*19.8*	*19.9*	*21.6*	*24.7*
Heat	–	*1.2*	*4.1*	*5.2*	*2.6*	*3.2*	*3.4*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1997	1998	2005	2010	2015
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.0**	**15.0**	**18.7**	**19.2**	**17.9**	**19.7**	**20.6**
OUTPUT (Mtoe)	**4.5**	**6.2**	**7.5**	**7.8**	**9.2**	**10.7**	**12.6**
(TWh gross)	52.6	71.9	86.7	91.2	107.1	124.0	146.9
Output Shares (%)							
Coal	*6.0*	*38.3*	*30.0*	*29.9*	*17.9*	*14.9*	*9.2*
Oil	*12.3*	*4.3*	*4.2*	*3.9*	*7.6*	*8.1*	*6.5*
Gas	*79.5*	*51.0*	*58.3*	*57.0*	*66.8*	*70.5*	*76.7*
Comb. Renewables & Wastes	*–*	*1.3*	*3.9*	*4.0*	*4.7*	*4.6*	*4.7*
Nuclear	*2.1*	*4.9*	*2.8*	*4.2*	*1.4*	*–*	*–*
Hydro	*–*	*0.2*	*0.1*	*0.1*	*0.2*	*0.2*	*0.1*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*0.1*	*0.8*	*0.9*	*1.3*	*1.7*	*2.8*
TOTAL LOSSES	**14.3**	**15.3**	**17.3**	**17.5**	**14.4**	**15.2**	**16.7**
of which:							
Electricity and Heat Generation[10]	7.5	8.6	9.2	9.1	7.5	7.4	6.5
Other Transformation	1.6	1.0	1.3	1.7	1.2	1.8	2.0
Own Use and Losses[11]	5.2	5.7	6.8	6.8	5.7	5.9	8.2
Statistical Differences	**–0.7**	**–0.7**	**–0.5**	**–1.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1997	1998	2005	2010	2015
GDP (billion 1990 US$)	193.21	283.67	336.46	349.27	420.87	480.84	549.36
Population (millions)	13.44	14.95	15.61	15.70	15.99	16.09	16.47
TPES/GDP[12]	0.32	0.23	0.22	0.21	0.21	0.19	0.18
Energy Production/TPES	0.91	0.90	0.87	0.84	0.79	0.75	0.68
Per Capita TPES[13]	4.65	4.45	4.80	4.74	5.42	5.73	6.02
Oil Supply/GDP[12]	0.16	0.09	0.08	0.08	0.08	0.07	0.07
TFC/GDP[12]	0.25	0.18	0.17	0.17	0.17	0.16	0.15
Per Capita TFC[13]	3.64	3.48	3.72	3.69	4.52	4.79	5.00
Energy–related CO_2 Emissions (Mt CO_2)[14]	151.0	161.3	184.3	181.1	197.1	209.0	221.1
CO_2 Emissions from Bunkers (Mt CO_2)	36.9	34.5	38.6	38.9	49.2	56.1	63.2

GROWTH RATES (% per year)

	73–79	79–90	90–97	97–98	98–05	05–10	10–15
TPES	1.7	–0.3	1.7	–0.7	2.2	1.2	1.5
Coal	2.4	9.4	0.5	–4.5	–2.4	–0.4	–3.4
Oil	0.4	–2.2	1.5	–0.3	2.4	1.4	1.6
Gas	2.4	–0.6	2.0	–1.1	3.2	1.6	1.9
Comb. Renewables & Wastes	–	4.0	14.6	6.1	10.8	2.0	2.2
Nuclear	21.0	0.0	–5.2	58.3	–12.7	–	–
Hydro	–	–	–3.1	12.5	11.3	–1.1	2.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	41.8	24.6	8.5	7.1	13.9
TFC	2.0	–0.5	1.6	–0.2	3.2	1.3	1.4
Electricity Consumption	4.4	2.3	2.9	3.6	2.2	2.5	3.4
Energy Production	4.4	–1.8	1.2	–4.3	1.3	0.2	–0.6
Net Oil Imports	1.0	–3.9	2.7	0.0	3.2	1.8	1.8
GDP	2.6	2.1	2.5	3.8	2.7	2.7	2.7
Growth in the TPES/GDP Ratio	–0.9	–2.4	–0.8	–4.3	–0.5	–1.4	–1.2
Growth in the TFC/GDP Ratio	–0.6	–2.6	–0.8	–3.9	0.5	–1.4	–1.3

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

Footnotes to Energy Balances and Key Statistical Data

1. Includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases, peat is shown separately.
2. Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Other includes tide, wave and ambient heat used in heat pumps.
4. Total net imports include combustible renewables and waste.
5. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
6. Includes non-energy use.
7. Includes less than 1% non-oil fuels.
8. Includes residential, commercial, public service and agricultural sectors.
9. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
10. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.
11. 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.
12. Toe per thousand US dollars at 1990 prices and exchange rates.
13. Toe per person.
14. "Energy-related CO_2 emissions" specifically means CO_2 from the combustion of the fossil fuel components of TPES (i.e. coal and coal products, peat, crude oil and derived products and natural gas), while CO_2 emissions from the remaining components of TPES (i.e. electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO_2 emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA and, as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1998 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.

B

ANNEX

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The 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 hydro power, 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

* Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

IEA Members wish to retain and improve 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.)

C

ANNEX

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.

AC	alternating current.
APX	Amsterdam Power Exchange
BP	British Petroleum.
bcm	billion cubic metres.
b/d	barrels per day.
B.V.	Besloten Vennootschap, private law limited liability company.
cal	calorie.
CCGT	combined-cycle gas turbine.
CERT	Committee on Energy Research and Technology of the IEA.
CFCs	chlorofluorocarbons.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used.
CNG	compressed natural gas.
CO	carbon monoxide.
CO_2	carbon dioxide.
cm	Cubic metre.
DC	direct current.
DH	district heating.
DSM	De StaatsMijnen (Dutch State Mines).
DSO	distribution system operator.
DTe	Dienst Toezicht en Uitvoering Elektriciteitswet (Electricity Act Administration and Supervision Department), the Dutch electricity regulator.
EBN	Energie Beheer Nederland (Netherlands Energy Corporation).
ECU	European Currency Unit.
EFTA	Europe Free Trade Association: Iceland, Norway, Switzerland and Liechtenstein.

EIA	environmental impact assessment.
EPA	energy performance advice.
EPON	Elektriciteits-Produktiemaatschappij Oost- en Noord-Nederland (Electricity Generation Company Eastern and Northern Netherlands).
EPN	energy performance standards.
EPZ	Elektriciteits-Produktiemaatschappij Zuid (Electricity Generation Company South).
ETSO	Association of European Transmission System Operators.
EU	The European Union, whose members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Euro	European currency (€).
EZH	Elektriciteitsbedrijf Zuid-Holland (Electricity Works of Southern Holland).
FCCC	Framework Convention on Climate Change.
FSU	Former Soviet Union.
GDP	gross domestic product.
GNP	gross national product.
GEF	Global Environmental Facility.
GJ	gigajoule, or 1 joule $\times 10^9$.
Guilder	Dutch currency (*f*). One Dutch Guilder was the equivalent of US$ 0.488 and € 0.4538 in 1999.
GW	gigawatt, or 1 watt $\times 10^9$.
GWh	gigawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^9$.
IAEA	International Atomic Energy Agency.
IEA	International Energy Agency whose Members are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.
IEP	International Energy Programme, one of the founding documents of the IEA.
IGCC	integrated coal gasification combined cycle plant.
IPCC	International Panel on Climate Change.
ISO	independent system operator.

J	joule; a joule is the work done when the point of application of a force of one newton is displaced through a distance of one metre in the direction of the force (a newton is defined as the force needed to accelerate a kilogram by one metre per second). In electrical units, it is the energy dissipated by one watt in a second.
kV	kilo-Volt, or one Volt $\times 10^3$.
kWh	kilowatt-hour, or one kilowatt $\times$ one hour, or one watt $\times$ one hour $\times 10^3$.
LBT	landelijke basistarief (national basic tariff).
LDC	local distribution companies.
LEO	landelijke economische optimalisatie (countrywide economic optimalisation).
LNG	liquefied natural gas.
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature.
LUP	landelijke uniform producenten transporttarief (uniform national producer transport tariff).
mcm	million cubic metres.
Minez	Ministerie van Economische Zaken (Ministry of Economic Affairs).
MJA	Meerjarenafspraken. Long-term agreements for energy efficiency improvements in industry and other sectors.
Mt	million tonnes.
Mtoe	millions of tonnes of oil equivalent; see toe.
MW	megawatt of electricity, or 1 Watt $\times 10^6$.
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$.
NAM	Nederlandse Aardolie Matschappij (Netherlands Petroleum Company).
NATO	the North Atlantic Treaty Organisation.
NEA	the Nuclear Energy Agency of the OECD.
negTPA	negotiated Third Party Access.
NMa	Nederlandse Mededingingsautoriteit (Netherlands Competition Authority).
NO_x	nitrogen oxides.
N.V.	Naamloze Vennootschap, private law joint stock company.

OECD	Organisation for Economic Co-operation and Development.
PJ	Petajoule, or 1 Joule × 10^{15}.
ppm	parts per million.
PPP	Purchasing power parity: the rate of currency conversion that equalises the purchasing power of different currencies, i.e. estimates the differences in price levels between different countries.
regTPA	regulated Third Party Access.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
SB	Single Buyer.
Sep	Samenwerkende Elektriciteits-Productiebedrijven (Co-operating Electricity Production Companies), the former Dutch electricity generating board.
SLT	Standing Group on Long-Term Co-operation of the IEA.
SO_2	sulphur dioxide.
TFC	total final consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
toe	tonne of oil equivalent, defined as 10^7 kcal.
TOP	take-or-pay contract.
TPA	third party access.
TPES	total primary energy supply.
TSO	transmission system operator.
TW	terawatt, or 1 watt × 10^{12}.
TWh	terawatt × one hour, or one watt × one hour × 10^{12}.
UGS	underground storage (of natural gas).
UN	the United Nations Organisation.
UNA	Energieproductiebedrijf UNA (Energy Production Company Utrecht, Northern Holland and Amsterdam).
VAT	Value Added Tax.
VOCs	volatile organic compounds.
WANO	World Association of Nuclear Operators.

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