

11. The Netherlands

For a more detailed discussion of energy consumption patterns and energy policy in the Netherlands see *Lower Carbon Futures*.

11.1 Households

Basic household data for the Netherlands is given in Table 11.1. In 1997, around 92,000 new dwellings were built, giving a total estimated stock of 6,262,000 dwellings at the end of 1997 (BAK, 1997).

Table 11. 1: Household data (Netherlands)

		Year	Source
Number of households	6,692,000	1998	CBS, 1998
Number of households in 2010	7,414,000	2010	CBS, 1998
Average household size	2.3	1996	Eurostat, 1998
% 1-person households	33%	1998	CBS, 1998
Average floor area	105 m ²	1995	BEK, 1995
% owner-occupying households	48%	1994	Eurostat, 1998
% in single houses	68%	1994	Eurostat, 1998

11.2 Natural gas

The Netherlands has extensive domestic reserves of natural gas. These were first discovered in 1959, and provided the impetus for the conversion of continental town gas networks to natural gas. The extent of the natural gas network, which is one of the most finely meshed in the world, and supplies the vast majority of Dutch households (Figure 11.1), is sometimes attributed to the abundance of indigenous gas (Estrada *et al.*, 1995). However, the town gas network had already achieved extensive penetration, and in 1962 was supplying 2,291,000 (76%) of the 3,005,000 households in the Netherlands with town gas (DGM 1995). The Dutch had achieved well over 90% penetration of the domestic market for gas heating and cooking by the end of the 1970s (Mabro and Wybrew-Bond, 1999). Further growth of the gas distribution network is not expected (Ecofys, 1998).

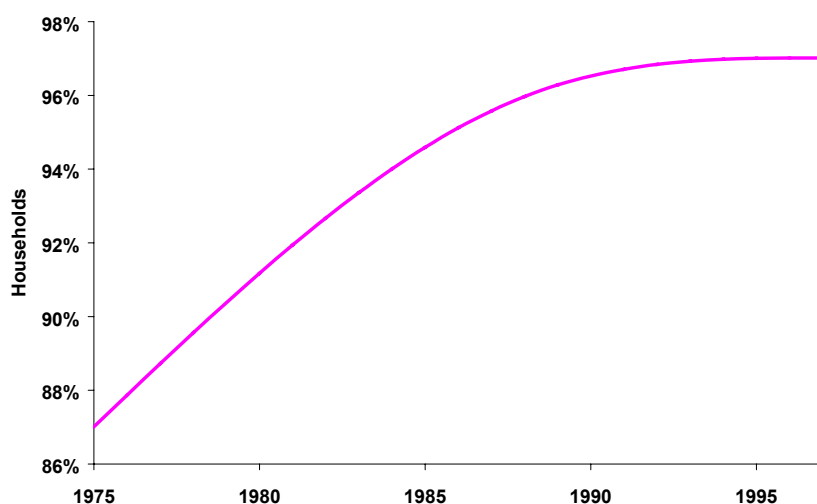


Figure 11. 1: Expansion of the low pressure gas distribution network in the Netherlands

Source: Ecofys, 1998 (DGM, 1995)

The gas is supplied by Nederlandse Gasunie, and distributed by around 34 companies (Table 11.2). Energy distribution companies in the Netherlands generally supply more than one energy product (electricity, gas, heat) and are usually involved in water supply as well (EnergieNed, 1998; Ecofys, 1998).

Table 11. 2: Natural gas (Netherlands)

		Year	Source
Number of connected households	6,491,000*	1997	EnergieNed, 1998
Proportion of connected households	97%	1997	EnergieNed, 1998
% Population living in gas supply area	99%	1997	IGU, 1998
Number of gas distribution companies	34	1997	Ecofys, 1998

* Small consumers

11.3 Domestic energy market

The Dutch domestic energy market is dominated to a large extent by natural gas, which accounted for more than 80% of total domestic sector energy consumption in 1996 (Table 11.3).

Table 11. 3: Fuel consumption profile for the Dutch domestic sector

Fuel type	TWh	%
Coal	0.1	<1
Oil	1.5	1
Natural gas	117.3	82
Combustibles, renewables and waste	1.6	1
Electricity	20.0	14
District heating	2.2	2
Total	142.8	100

Source: IEA/OECD, 1998a

In 1997, the domestic sector consumed 116 TWh of natural gas, almost half (49%) of total natural gas consumption by all customers. Households also consumed around 25% of total national electricity consumption, and 40% of distributed heat (Ecofys, 1998).

In the last few years, the average temperature-corrected household consumption of natural gas has been decreasing, largely as a result of improved home insulation and efficiency improvements in space heating systems, particularly the introduction of condensing boilers. Average household electricity consumption has increased since 1988 (Figure 11.3). This is largely due to the demand for increased comfort which is evident in the increasing penetration of household appliances (EnergieNed, 1998; BEK, 1996; BAK, 1997).

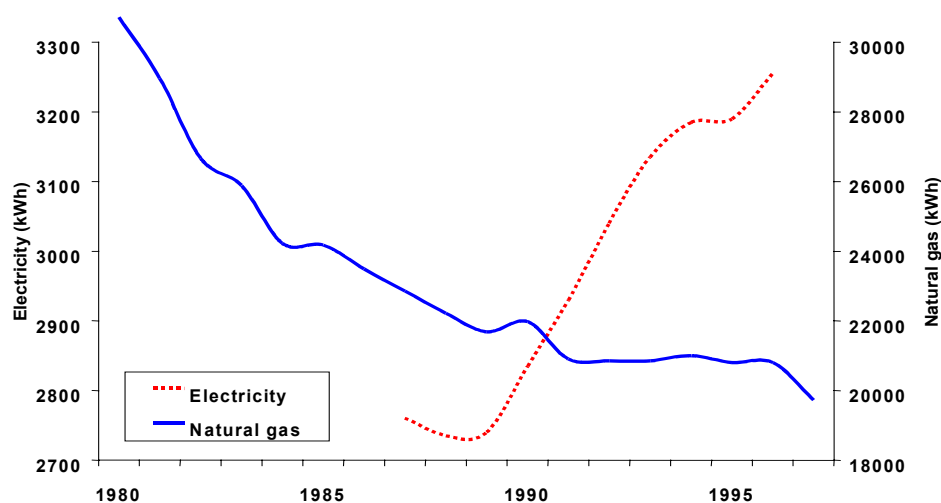


Figure 11. 2: Average household consumption (kWh per annum) of electricity (1987-1996) and natural gas* (1980-1997) (Netherlands)

* Natural gas data converted from m³ using formula: 1m³ = 35.17 MJ Gross Calorific Value (EnergieNed, 1999)

Source: BEK, 1996; BAK, 1997

Although overall household gas consumption is falling, increasing demands for comfort have led to a rise in the use of gas for domestic hot water. Water heating accounted for just under 10% of household natural gas consumption in 1980, and now accounts for almost 19% (Table 11.4).

Table 11. 4: Breakdown of domestic consumption of electricity and natural gas (%) by major end-use (Netherlands)

Fuel type	Year	Space heating	Water heating	Cooking	Other
Natural gas	1997	79.2	18.0	2.8	0.0
Electricity	1996	1.7	15.7	4.4	78.2

Source: BEK, 1996; BAK, 1997

Energy represents only a very small proportion of the average household expenditure in the Netherlands, compared with other EU countries, and household energy prices are among the lowest in Europe. The Netherlands is, however, one of the few countries to have a specific environmental tax geared to reducing CO₂ emissions. The purpose of this Regulatory Energy Tax, applied to natural gas and electricity used by small consumers since 1996, is to reduce CO₂ emissions by between 1.7 million and 2.7 million tonnes per year through decreased consumption and the use of renewables (IEA/OECD, 1998a). An increasing number of electricity companies are offering green electricity, produced from sustainable fuels (mostly wind, with some landfill gas, cogeneration and hydro), at a higher rate. In 1996, there were around 16,000 customers of green electricity, and this number rose to about 45,000 in 1997. Green electricity sales rose from around 35 GWh in 1996, to around 95 GWh in 1997 (EnergieNed, 1998). The share of renewables in electricity generation and in total primary energy consumption in 1996 was very small. In that year, natural gas had a 55% share in total electricity generation, coal over 30%, and hydro less than 0.1% (IEA/OECD, 1998b).

11.4 Space heating

The market share of natural gas for space heating in the Netherlands is extremely high compared to other countries (Table 11.5). The majority (78%) of households with gas-fired space heating systems have a central heating boiler (IER, 1998), and gas-fired central heating systems have been installed in 92% of dwellings constructed after 1990. Of the estimated 4,670,000 households with individual central heating

systems, 63% have boilers which are also used for domestic hot water, and 37% have boilers used for space heating only (BAK, 1997). Around 10% of all boilers are estimated to be 20 years old or more.

Table 11. 5: Ownership of space heating systems by fuel type, Netherlands

Fuel type	% Households	Year	Source
Natural gas	97	1997	EnergieNed, 1998
District heating	3	1996	BEK, 1996

Condensing boilers were first introduced in the late 1970s. At first they were not popular because they were difficult to control. Subsidy programmes throughout the 1980s and the 1990s, however, have improved the situation to the extent that condensing boilers now have a 60% share of the Dutch boiler market (Ecofys, 1999), and a household penetration level of 30% (Table 11.6). The Netherlands provides the largest EU market for this appliance.

Table 11. 6: Ownership of space heating systems, by system type (various data), Netherlands

System type	% Households	Year	Source
Natural gas-fired central heating	76	1997	BAK, 1997
Individual central heating	71	1997	BAK, 1997
Conventional boiler (natural gas)	44	1997	BAK, 1997
Condensing boiler (natural gas)	30	1999	Ecofys, 1999
Open fire or stove	13	1997	BAK, 1997
Additional space heating appliance	13	1996	BEK, 1996
Collective space heating	11	1997	BAK, 1997

Table 11.7 shows the estimated national consumption of electricity and gas for space heating in the Netherlands. The electricity consumption estimates include electric space heaters and electrical equipment associated with gas-fired space heating systems (e.g. central heating pump).

Table 11. 7: Estimated national consumption of electricity and natural gas for space heating, Netherlands

Fuel type	TWh	Year	Note
Natural gas	83.0*	1997	All gas-fired space heating systems
Electricity	1.7†	1996	Includes hot water from central heating systems
Electricity	0.3	1995	Excludes hot water from central heating systems

* Natural gas data converted from m³ using formula: 1m³ = 35.17 MJ Gross Calorific Value (EnergieNed, 1999)

† Calculated using 1996 ownership, power and hours of usage per space heating appliance type as in BEK 1996

Source: BEK, 1996; BAK, 1997

As mentioned above, the fall in average household consumption of natural gas between 1980 and 1997 was due to the fall in space heating consumption as a result of the introduction of condensing boilers and improvements in home insulation (EnergieNed, 1998). BAK (1997) established the strong correlation between the age of a dwelling with individual central heating, and the average annual consumption of natural gas.

11.5 Water heating

Despite the large share of natural gas-fired space heating, a large proportion of households use separate natural gas-fired instantaneous water heaters (Table 11.8), i.e., not connected to the central heating system (GasTec, 1996). However, the traditionally strong share of instantaneous water heaters is giving way to

combined space and water heating boilers, especially condensing boilers. In 1997, 39% of households used separate instantaneous gas water heaters in 1991, compared to 53% in 1991 (EnergieNed, 1998).

Table 11. 8: Ownership of water heating systems, by fuel type (Netherlands)

Fuel type	% Households	Year	Source
Natural gas	89	1997	EnergieNed, 1998
Electricity	16.7	1995	EVA, 1998

Linkage of the space and water heating systems has become more and more popular, growing from 20% in 1988 to 50% in 1997 (Table 11.9) (EnergieNed, 1998). Combined space and water heating boilers have also been installed in 88% of dwellings constructed since 1990 (BAK, 1997). Part of this transition is due to the increased comfort levels associated with having larger hot water appliances (EnergieNed, 1998). In 1995, an estimated 16.7% of Dutch households (around 1 million) had electric water heating (EVA, 1998b). In 1997, 14% of households owned more than one water heating appliance (BAK, 1997). For further detail on water heating in the Netherlands see *Lower Carbon Futures*.

Table 11. 9: Ownership of water heating systems, by system type (various data) (Netherlands)

System type	% Households	Year	Source
Hot water from gas central heating, of which:	57	1998	Lower Carbon Futures
Gas-fired instantaneous water heater, of which:	39	1997	EnergieNed, 1998
<i>in bathroom</i>	16	1997	BAK, 1997
<i>In kitchen</i>	23	1997	BAK, 1997
Gas-fired storage water heater	3	1997	BAK, 1997
Electric storage water heater, of which:	16	1997	BAK, 1997
<20 litres vol.	8.2	1996	BEK, 1996
>20 litres vol.	9.4	1996	BEK, 1996
Electric instantaneous water heater	5.2	1996	BEK, 1996
Collective (inc. district heating)	6	1997	BAK, 1997

Not surprisingly, given these ownership levels, natural gas is by far the most important fuel for water heating in the Netherlands (Table 11.10).

Table 11. 10: National consumption of energy for domestic water heating, 1998

Fuel type	TWh	Year	Source
Natural gas	17.4	1998	Lower Carbon Futures
Electricity	2.4	1998	Lower Carbon Futures
Collective water heating systems (inc. district heating)	2.1	1997	BAK, 1997

11.6 Cooking

Although natural gas is popular for hob cooking, electricity is the most common fuel for the main oven (Table 11.11). The Netherlands is unusual among European countries for a relatively high level of ownership of combi microwave ovens, which is a microwave oven with a conventional cooking function (although these are becoming more popular in Germany as auxiliary cooking appliances). Fuel-switching trends for ovens have been quite rapid: gas oven ownership has halved, and the number of electric ovens doubled, over a period of around 10 years (Kasanen, 1999).

The penetration of gas ovens is expected to continue to fall due to the consumer perception that electric ovens have better standards of performance, more features and more effective self-cleaning cycles than gas ovens (BEK, 1996; VHK, pers. comm.). Consumer perceptions are reversed, however, concerning electric and natural gas-fired hobs.

Table 11. 11: Ownership of cooking equipment by appliance type, the Netherlands, 1996

Appliance type	% Households
Electric cooker (electric oven + electric hob)	7
Natural gas cooker (gas oven + gas hob)	21
Mixed fuel cooker (electric oven + gas hob)	25
Separate electric hob	9
Separate gas hob	39
Separate electric oven	35
Separate combi microwave oven	24
Microwave oven	42

Source: BEK, 1996; BAK, 1997

The gas consumed in food preparation has remained fairly constant over the past 15 years (EnergieNed, 1998). National energy consumption values from *Lower Carbon Futures* are given in Table 11.12. Average household oven consumption of both electricity and gas is relatively low (Kasanen, 1999).

Table 11. 12: National energy consumption for cooking, 1998

Fuel type	GWh
Electricity (including small cooking appliances)	1,590
Natural gas	2,170

Source: *Lower Carbon Futures*

11.7 Appliances and lighting

Ownership of appliances and lighting is given in full for the Netherlands in *Lower Carbon Futures*. A summary of some key appliances is given in Table 11.13.

Table 11. 13: Ownership of domestic electrical appliances, the Netherlands, 1998

Appliance type	% households
Fridge	63
Freezer	48
Fridge-freezer	41
Washing machine	95
Tumble dryer	56
Dishwasher	25
Microwave	72
TV	98
VCR	84

Source: *Lower Carbon Futures*

Total electricity consumption for lights and appliances (not including cooking) in 1998 was 17.1 TWh. For further details see *Lower Carbon Futures*.

11.8 Policies and programmes for domestic energy efficiency

In the Energy Savings Action Programme 1999-2002 of the Ministry of Economic Affairs, the ambitious level for energy efficiency improvement of appliances in households is set at 1.8% per year for the period 1995 to 2010.

The energy distribution companies adopted an Environmental Action Plan (MAP) in 1991, with the objective of reducing CO₂ emissions caused by energy consumption by 3% by 2000. The measures undertaken included stimulating energy conservation in homes, utility buildings and industry, and

promoting more efficient production techniques (e.g. co-generation and sustainable energy). To finance this, most energy companies have applied the MAP levy since 1991 on all domestic and small business consumers. The MAP-levy will cease at the end of 2000.

A new environmental tax, the REB, was applied first in 1996 in a limited fashion, excluding most domestic consumers from paying the tax. In 1999 all energy users were brought under the same progressive tax regime. The REB is partly returned in reduced income tax – i.e., not all the income is used to finance efficiency measures. The collection of REB and the payment of the energy contribution will be carried out by the energy companies. Energy efficient domestic appliances have been subsidised from 1 November 1999, with money raised from REB. The budget for the domestic sector is over 100 million Euro per year for A-label appliances and efficiency measures in buildings (e.g., insulation measures).