EUSUSTEL

European Sustainable Electricity; Comprehensive Analysis of Future European Demand and Generation of European Electricity and its Security of Supply

---

WORK PACKAGE 1

County-wise Analysis

Subtask 1.1.b

THE NETHERLANDS

ir. L. Cosijns
Prof. Dr. Ir. W. D'haeseleer

August 2005

Division of Applied Mechanics and Energy Conversion
Department of Mechanical Engineering
Celestijnenlaan 300A
B-3001 Heverlee

1. Energy-related and socio-economic analysis: past, present and future

1.1. Factual information

1.1.1. Geography & population

The population of The Netherlands is16.3 x 10^6 people and 7.4 x 10^6 of households. It has a surface area of 41500km² with a coastline of 450 km and its scenery is dominantly flat. Surface height varies from -7 m (polders) till 300 m in the south-east. The Netherlands has a moderate sea climate with mild winters and cool summers. It has an annual number of 1530 hours of sunshine and 240 days of rainfall.

1.1.2. Economy

The GDP[1] of The Netherlands amounts to 460 x 10^9 euro of which almost two thirds is generated by the service sector. The contribution of the industry and agriculture amounts to respectively 25% and 2.5%.

1.1.3. Energy

The Netherlands has large domestic natural gas resources. The 'Groningen gas field' is the major field, but to protect its depletion, the government favours the smaller fields, promotes import and imposed a production cap for the Groningen field. Thanks to its unique exploitation flexibility, this field is perfect for balancing the demand between winter and summer (both on a Dutch as on a European scale). At the actual consumption rate, there will be gas available for more than 50 years.

The main energy balances and indicators are summarised in the table below (based on baseline scenario from [3]).

[PJ][2]	**2000**	**2005**	[PJ]	**2000**	**2005**
Gross Inland Consumption (=TPES)	**3165.12**	**3222.24**	**Final Energy Demand (TFC) by Sector**	**2082.78**	**2220.12**
Solids	335.16	225.96	Industry	571.2	573.72
Oil	1193.22	1214.22	Residential	431.76	459.48
Natural gas	1457.82	1573.32	Tertiary	499.38	530.04
Nuclear	42.42	39.48	Transport	580.44	656.88
Electricity	68.46	70.56	**Final Energy Demand (TFC) by Fuel**	**2082.78**	**2220.12**
Renewable energy forms	68.04	98.7	Solids	52.5	49.98

[1] A list with abbreviations can be found at the end of this document.

[2] Based on conversion 1toe = 42 x 10^9 J

Net Imports	**1438.08**	**1245.3**	Oil	680.4	770.28
Import Dependency [%]	**38.6**	**32.3**	Gas	839.58	847.14
Energy Intensity Indicators (1990 = 100)			Electricity	353.64	375.06
Industry (Energy on Value Added)	85.1	80.0	Heat	144.9	166.74
Residential (Energy on Private Income)	80.2	75.3	Other	11.76	10.92
Tertiary (Energy on Value Added)	89.7	83.7			
Transport (Energy on GDP)	100.7	102.3			

1.1.4. Electricity

The main electricity balances and indicators are summarised in the table below. The Netherlands is a net importer of electricity. It imports up to 20% of its total electricity consumption [3].

	2000	**2005**
Electricity Generation [TWhe]	**89.60**	**96.62**
Nuclear	3.93	3.66
Hydro & wind	0.97	3.55
Thermal (incl. biomass)	84.70	89.41
Electricity Generation [Gwe]	**22.75**	**26.55**
Nuclear	0.54	0.48
Hydro (pumping excluded)	0.04	0.04
Wind and solar	0.46	1.05
Thermal	21.72	24.99
Of which cogeneration units	8.87	10.05
Open cycle	13.26	13.19
Supercritical Polyvalent/Clean Coal and Lignite	0.00	0.00
Gas Turbines Combined Cycle	7.96	11.30
Small Gas Turbines	0.50	0.50
Fuel Cells	0.00	0.00
Geothermal Heat	0.00	0.00
Average efficiency for thermal electricity production [%]	**36.9**[3]	**42.2**

[3] This rather low average efficiency can be explained by the high share of cogeneration, and the way this is brought into account.

1.1.5. Environmental issues

The main balances and indicators concerning the CO_2-emissions are summarised in the table below [3].

	2000	2005
CO_2-emissions [Mt of CO_2]	**165.6**	**164.6**
Electricity and Steam production	48.9	45.5
Energy Branch	13.1	12.9
Industry	24.7	20.5
Residential	18.9	19.9
Tertiary	19.5	20.2
Transport	40.5	45.5
CO_2-emissions Index (1990 = 100)	**108.3**	**107.7**
Carbon intensity [t of CO_2/toe of GIC]	**2.20**	**2.15**
CO_2-emissions/Capita [t of CO_2/inhabitant]	**10.40**	**10.01**
CO_2-emissions to GDP [t of CO_2/MEUR '00]	**412.9**	**368.4**
Carbon Intensity indicators		
Electricity and Steam production [t of CO_2/MWh]	0.41	0.31
Final energy demand [t of CO_2/toe]	2.09	2.01
Industry	1.81	1.50
Residential	1.84	1.82
Tertiary	1.64	1.60
Transport	2.93	2.91

1.2. Trends [1]

Growth rates [% per year]	'73-'79	'79-'90	'90-'01	'01-'02	'02-'10
TPES	**1.7**	**-0.3**	**1.4**	**0.8**	**0.5**
Coal	2.4	9.4	-0.6	0.6	-0.4
Oil	0.4	-2.4	1.8	0.9	0.5
Gas	2.4	-0.6	1.3	0.8	0.3
Comb. Renewables & Wastes	-	10.3	5.1	9.4	7.8
Nuclear	21.0	0.0	1.2	-1.5	0.2
Hydro	-	-	2.0	10.0	7.8
Geothermal	-	-	-	-	-
Solar/Wind/Other	-	-	-	8.8	14.9
TFC	**2.0**	**-0.7**	**1.5**	**-0.6**	**1.2**
Electricity Consumption	4.4	2.3	2.8	0.3	1.9
Energy Production	4.4	-1.8	0.0	-0.8	-0.2

Net Oil Imports	1.0	-4.1	2.9	-4.5	1.9
GDP	2.6	2.2	2.8	0.2	2.5
Growth in the TPES/GDP Ratio	-0.9	-2.5	-1.3	0.6	-1.9
Growth in the TFC/GDP Ratio	-0.6	-2.8	-1.2	-0.8	-1.3

2. Energy studies

As the moment of writing, a major energy study is going on in The Netherlands. Results are not available yet.

3. Policy

3.1. General framework

In spite of the liberalisation of the energy market, there still remain some dominant players in the energy sector. On the gas market - more specific on the wholesale trade - there is lack of competition, because of the dominant position of the company "Gasunie". Even though there a possibility to trade gas on a wholesale level at "TTF – Title Transfer Capacity", the importance of this market place is only small on national scale. Besides that, the Gasunie has a dominant position in offering flexibility services (= interception of peaks and lows)

3.2. Electricity policy

On the international level, currently there is an overcapacity of electricity generation. This results in low prices and a bad investment climate, which leads towards the maintenance of existing power plants instead of building new ones. As The Netherlands is a net importer, and both of its neighbouring countries (namely Belgium and Germany) foresee a nuclear phase out, The Netherlands has to be conscious of this changing situation on time.

Mid 2002, The Netherlands counts up to 10000 MW in cogeneration units; which is approximately 40% of its production park. In recent years, due to changing electricity and gas prices, in combination with the decrease of fiscal advantages for cogeneration units, the number of cogeneration units stagnates. All power plants which are foreseen to be build are based on gas technologies. At the moment of writing, The Netherlands has only a limited interest in coal technologies.

3.3. Environmental policy

As a consequence of the Kyoto-protocol, The Netherlands has to reduce its CO_2-emission by 6% till 2008 – 2012 compared with 1990 level. Nowadays there is a strong link between the economic expansion and the CO_2-emissions. To reach the Kyoto goal, an unbundling of both parameters will be necessary. Because of the expected economic evolution – increase of service sector and decrease of agriculture, energy and building sector – the pressure on the environment will automatically decline. Anyhow, reaching the Kyoto-target stays a big challenge.

For the period till 2010, The Netherlands emphasises on the potential of biomass as the main domestic contributor to reduce the CO_2-emissions. It is not the aim to use biomass power plants as stand-alone power plants (because of its restricted potential), but to use it as an extra fuel in coal-fired power plants (up to 30% replacement of coal by biomass till 2010 – 475 MWe from biomass[4]). By this measure[5], The Netherlands hopes to bring the emissions of the coal-fired plants to an emission level equal to gas fired plants by 2008 [5]-[9].

[4] Domestic biomass resources (waste and fertilizer included) are estimated at 168 PJ in 2005 and 177 PJ in 2010 [9]

[5] In combination with a partial substitution of coal by natural gas and an increasing power plants efficiency.

Though, already now, wind power plays a role in the strategy to reach the 9% target – of total consumption produced by renewable energy sources – The Netherlands starts really to rely on its potential (both on- and offshore) on the longer term, after 2010. By 2010, The Netherlands aims to install 1500 MW in wind power (mainly onshore) and by 2020, 6000 MW offshore. To reach this target, The Netherlands focuses on a regional approach to search for appropriate locations and to reduce the administrative inconvenience instead of national (complicated and long-running) procedures.

In the past, The Netherlands used measures to stimulate the demand side towards the use of more RES: fiscal measures, Regulating Energy Tax (= REB)… Although the rate of RES increased, those measures seemed not to be efficient as mostly free riders enjoyed the financial advantages and RES-import instead of RES-production increased. Besides that, it is important to not have contrary effects of the measures that are taken. The Netherlands does not want to affect the competition position of their companies; neither does it want a shifting of their energy users to other (EU) countries. For that, The Netherlands stresses on the importance of measures on the international and EU-level.

To tackle the wrong incentives, the government decided to change it strategy towards a stimulation of the production side by the use of a production fee. The MEP-fee[6] covers up to 50% of the non-profitable part of sustainable electricity production methods (compared with the production cost by classical methods). By this, investors can be made sure of their investments.

By all these measures The Netherlands introduces a transition to a more sustainable energy housekeeping. Anyhow, due to the combination of an increasing electricity use, less electricity import and more mobility, since 1990 CO_2-emissions have annually raised 1%, whilst the overall amount of GHG stabilised.

On the long term, The Netherlands maintains their ambitions, but on the short term, despite the efforts that are done, it is not sufficient to reach the Kyoto targets in a cost-effective way. The Netherlands needs to take other measures. Besides the promotion of wind power, the voluntary covenants, the internalisation of the environmental costs, the decision to keep the Borssele nuclear power plant running and the stimulation of an energy research policy, The Netherlands decided to rely for 50% of its CO_2-reduction on international flexible mechanisms[7]. The European emission trading system, which was introduced at January, 1st of 2005, plays an important role in that. As The Netherlands counts for half of its reductions on foreign efforts, it is important that those foreign goals on emission-reductions are reached and monitored.

For reaching the long term goals, which are not yet specified clearly, but which will probably mounts up to an emission reduction of 40 to 60% for Western Europe, compared to the 1990's level, The Netherlands depends on strong international cooperation, technological development of low and zero emission applications and climate-neutral (fossil) energy carriers. Financial resources to sustain this development will be dependent of the economic climate.

[6] MEP = Milieukwaliteit Elektriciteit Productie (Environmental quality Electricity Production)

[7] Flexible mechanisms: Joint Implementation, Clean Development Mechanisms and Emission Trading

4. References & Bibliography

[1] IEA, The Netherlands 2004 Review
[2] IEA, The Netherlands 2004 Compendium
[3] European Energy and Transport, trends to 2030
[4] www.cbs.nl
[5] TenneT, Capaciteitsplan 2003-2009, November 2002
[6] Economie, energie, en milieu: een verkenning tot 2010, CPB, 2002
[7] Vaste waarden, nieuwe normen; Milieubeleid 2002 – 2006; Ministerie van VROM; 2002
[8] Referentieramingen energie en emissies 2005 – 2020; ECN; March 2005
[9] Energie Markt Trends 2001; ECN; October 2001

5. Abbreviations

CCGT - Combined Cycle Gas Turbine (steam and gas)
GDP – Gross Domestic Product
GIC – Gross Inland Consumption
MEP - Milieukwaliteit Elektriciteit Productie (Environmental quality Electricity Production)
REB - Regulating Energy Tax
RES - Renewable Energy Sources
TFC – Total Final Consumption
TPES – Total Primary Energy Supply
TTF – Title Transfer Capacity