

Liberalisation of the energy markets: an outlook towards 2010

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Paper prepared for the 25th Annual International Conference of the IAEE (International Association of Energy Economics), Aberdeen, Scotland, UK, June 26-29, 2002

Abstract

This outlook assesses the effects of energy market liberalisation on prices, production and consumption in 2010. Although the outlook concerns the development in the Netherlands, it is formulated within the context of the European energy market. Will the liberalisation of the European energy markets affect energy efficiency improvement in production of electricity and use of energy? How will energy prices develop after liberalisation of the energy sector? To which degree is energy use affected by energy market liberalisation compared with the influence of economic growth?

The answers to these questions are given by means of a model of the European energy market and some scenario's. The model simulates the European natural gas market, the European electricity market and the competition between energy traders in the Netherlands. The scenario's consists of a base line scenario, in which moderate competition is assumed, a sharp competition scenario, a weak competition scenario and a scenario with low economic growth.

The key conclusion is that more competition at the energy markets will result in lower energy prices, but that the effect on energy use is relative small compared with the sensitivity of energy use to economic growth.

Key words: energy markets, energy models, The Netherlands, Europe/ JEL codes: D43, Q41, Q42

1 Introduction

European energy markets are subject to structural changes since the liberalisation process proceeded some years ago. National and regional monopolies active as vertical integrated utilities are disappearing, giving space to market oriented production and trade firms, with transport, as natural monopoly, staying a regulated activity. One of the expectations concerning the energy market liberalisation is that it will result in declining energy prices. After all, liberalisation of the market should lead to decreasing monopoly power of the current suppliers and increasing efficiency. Declining mark ups and production costs will be the result.

There is little doubt that increasing competition will be an incentive for producers to increase efficiency. This is what actually happened in for example the United Kingdom and Germany when the liberalisation of the energy markets was implemented. Questionable however are the effects of liberalisation on market power. Historical evidence on the electricity sector supports the hypothesis of a positive relation between market

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power (measured by the Herfindahl and Hirshmann-index), mark ups and end user prices. In order to assess the effects of liberalisation on energy prices and energy use, one has to determine the chance that market power will increase further and offset the price effects of efficiency improvements.

This outlook presents such an assessment. The analysis is executed by using of a model of the European energy market, consisting of a module of the European natural gas market (Kingma et al., 2002), a module of the European electricity market (Mannaerts et al., 2002) and a module of the Dutch trade and transport of energy (Lijesen, 2002). The first two mentioned modules are both Cournot-models with physical restrictions in the field of transmission capacity and production capacity. The domestic trade and transport model is a Bertrand-model with two-part tariffs. This module is used in combination with a model of the Dutch energy demand, being a top-down model, with a putty-semi putty production structure, in which bottom-up information is used (Koopmans et al., 1999).

By means of two competition scenario's, the sensitivity of energy prices, production and consumption to different market conditions is analysed. In the 'sharp competition' scenario the number of producers and traders is larger and the international transport capacity is more extensive than in the base line scenario. The opposite is the case in the 'weak competition' scenario. The base line scenario simulates a moderate competition on the European energy markets.

This paper is organised as follows. Section 2 describes the major factors behind the competition on the natural European gas market, the European electricity market and between traders in the Netherlands. The outlook methodology is described in section 3, paying attention to the definition of the scenario's and the modelling of the energy markets. Section 4 presents the energy market outlook towards 2010 for the base line scenario and the two competition scenario's. The papers ends with an analysis of energy use sensitivity to competition relative to economic growth.

2 Developments at the energy markets

2.1 Natural gas market

In the past, before the European Union directive concerning energy market liberalisation was implemented, national monopolistic suppliers based the natural gas price for end users on the price of alternative fuels. Suppliers used this "market value" principle to maximize their revenues (see Correlje and Odell, 2000). The absence, until recently, of low-priced supply from other sources to the European market, created the opportunity to maintain this pricing policy. Low levels of competition gave suppliers thus the opportunity to fix the gas price at a high level, skimming the consumer surplus.

In a liberalised market, however, gas to gas competition will emerge, with the gas price being determined by costs of depletion and transportation, transportation capacities, depletion of existing fields and

development of new fields, developments at the demand side and prices of alternative fuels. The effects of these factors on prices are as follows.

- The costs of depletion differ significantly between the various fields supplying to the European market. Production costs are very low in the onshore “Groningen”-field in the Netherlands and relative high in the offshore fields of Norway and the United Kingdom. Natural gas from Russia and Algeria have average production costs, but relative high transportation costs, due to the long distance to the European consumer markets respectively the need to ship the gas liquified. A decline of the Dutch market share, especially of the cheap Groningen gas, will therefore increase the average depletion costs of gas supplied to the European market.
- The extension of the international transportation capacity, combined with Third Party Access to the grid and the creation of hubs (marketplaces) in the short term are the most evident realization of the idea of gas market opening. This development increases the gas to gas competition, with declining mark ups of suppliers and declining end user prices as results.
- Before the end of this decade, British natural gas fields will be depleted. Current declining production in the UK is a signal of the coming depletion. This fact will affect the European gas market, as the UK is a large consumption country, accounting for about one quarter of European gas consumption.
- Another price increasing factor is the increasing share of gas consumption in total energy consumption. End users, like power plants, industries and the residential sector, in various European countries will continue in substituting oil and coal for natural gas in order to decrease environmental effects of energy use.
- Due to the existing substitution possibilities between natural gas and other energy carriers in various applications, gas price will still be partly related to prices of alternative fuels.

Summarizing, the opening of the gas market will probably decrease natural gas prices, while the increasing gas consumption and the coming depletion of the UK fields will have an increasing effect. The question remains what the overall effect is.

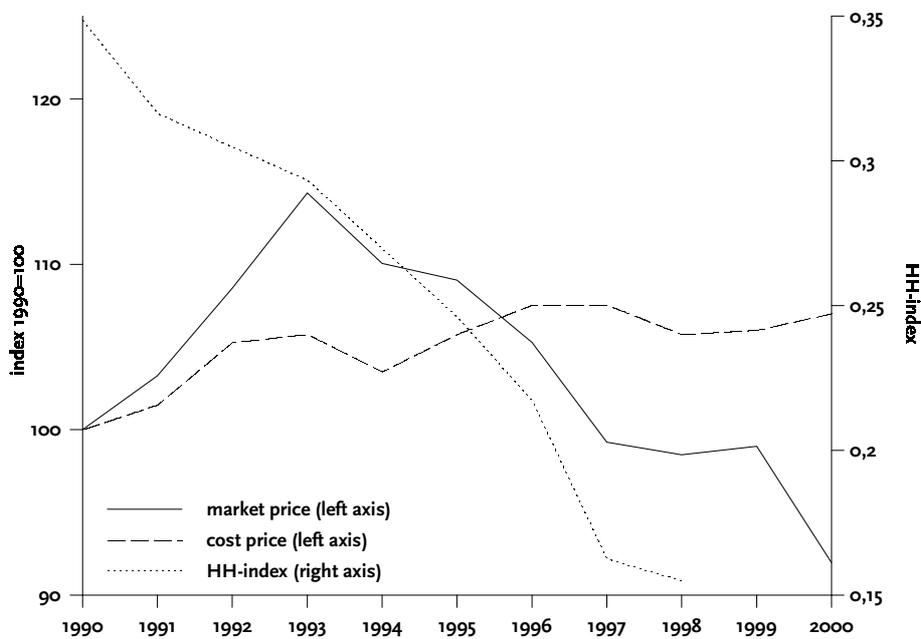
2.2 Electricity market

National state-owned monopolies dominated until recently the production of electricity. This production was rather inefficient due to the absence of competition. Empirical evidence from the United Kingdom shows a positive relation between liberalisation of the electricity markets and the improvement of energy efficiency. Since the implementation of the “Electricity Act” in 1989, productivity of the power sector improved with annual 1½%. Liberalisation of the electricity sector in other countries will probably also result in an increased energy efficiency, although the increase may be slower, for example in the Netherlands, due to the higher efficiency at the start of the liberalisation process. Whether the efficiency improvement will be passed on to end users, is till now an open question, depending on the market power of producers.

Developments with regard to the concentration at the supply side and to the size of the international transportation capacities determine the degree of competition on the electricity market and hence the producer’s market power.

The freedom of electricity generation has attracted some new entrants, such as oil companies. However, the main result of the entrepreneurial freedom has been a wave of mergers, acquisitions and share purchases in Europe, especially in Germany and the United Kingdom. E.g. state owned monopoly giants such as EdF have acquired large interests in foreign electricity generators. These developments interfere with a competitive market and create opportunities for market power. Indeed, the UK example shows that in case of high concentration of privatized electricity generation companies the liberalisation of electricity demand leads to higher instead of lower electricity prices (see figure 2.1). Regulatory authorities forced the incumbent producers to disinvest capacity. Moreover, foreign producers were encouraged to supply electricity through the inter-connector on the British electricity market. These measures crumbled the concentration on the electricity market: the Herfindahl-Hirschmann-index (HH-index) decreased from 0.35 (high concentration) to 0.15 (moderate concentration)². At the same time electricity prices declined with 20%. This emphasises the considerable effect of market power on end user prices.

Figure 2.1 Concentration in the electricity sector and the electricity price for the industry, United Kingdom.



The concentration at the supply side depends not only on the concentration of domestic production, but also on the contribution in total supply of decentralized production and imports. Expansion of the international transportation capacity and the decentralized production, by means of CHPP (Combined Heat Power Production) will counteract concentration between domestic producers. This effect can however be neutralized by international mergers and acquisitions, resulting in a few dominant producers at European level. An

² Local production and imports included.

adequate market regulation policy seems therefore to be necessary to prevent powerful European electricity producers, strategically influencing supply and hence prices (see e.g. Haas et al., 2001).

2.3 Trade

Retail trade in energy is primarily a national and regional activity. A study of the Dutch retail market is therefore sufficient to study the effects of liberalisation on energy prices and consumption in the Netherlands.

Several market segments have already opened up in the Netherlands, providing us with valuable insights into the coming opening of residential markets. Very large electricity users have free choice of suppliers since 1999. Although little is known about shifts in market shares and the content of individual contracts, the general impression is that prices have come down considerably.

At the opening of the large user segment of the market for natural gas, the Netherlands' main wholesaler Gasunie lost a quarter of its market share, mainly to suppliers from the UK. At that time, in 1999 and 2000, UK gas prices were considerably lower than those at the continent, giving a strong incentive for users to switch. Some competition for medium-sized users has also developed at regional retail markets, albeit less spectacular.

The opening of the market for green electricity for all users is also very illustrative, maybe even more so than the opening of markets for large users, which hardly involves retail. Prior to the opening, the four large retailers started advertising campaigns to enlarge their brand familiarity and to push their green image. Each of the retailers started attracting new customers outside their own region and a few new retailers entered the market. Although retailers competed, end users prices were hardly affected. This may probably be due to the fact that buyers of green energy are less price sensitive. Advertisement campaigns focussed on the 'green image' rather than on prices. Another reason for not lowering prices may be that green generating capacity is scarce, as is import capacity.

In January 2002, the market for medium-sized electricity and gas users opened up as well, causing 20 percent of the customers in this range to switch suppliers. The general picture looks familiar: the four large retailers enter each others region and the same entrants appear in the market place. The similarities with the opening of the market for green electricity are striking and suggest a pattern that is likely to repeat in 2004, when all customers will become free to choose their supplier.

3 Outlook methodology

3.1 Scenario's

The effects of liberalisation of European energy markets on energy prices, production and consumption are uncertain due to the early stage of the process. To cope with the uncertainty we developed two competition scenario's. These scenario's are compared to a base line scenario in which there is a moderate increase of competition.

The 'sharp' competition scenario is characterized by an increase in the number of producers and traders at the natural gas market and the electricity market, an extension of the international transportation capacity in both markets and decreasing marginal gas depletion costs in Russia.

The 'weak' competition scenario shows a decrease in the number of producers and traders and a reduction in the transportation capacity, compared to the base line scenario. In addition, the linkage of the gas price to the oil price is maintained in this scenario.

The effects of these competition scenario's are compared to a low economic growth scenario, with moderate competition, in order to assess the relative importance of the competition effects on energy use.

3.2 Modelling the energy markets

For analysis and forecast purposes, CPB developed last year a model of the European energy market. This model consists of three modules, a module of the European natural gas market, a module of the European electricity market and a module of the domestic trade and transport of those two energy carriers.

The gas model describes the European natural gas market as a Cournot-market with physical restrictions in depletion- and transport capacities and available reserves (Kingma et al., 2002). The supply side of the model consists of the main gas producing countries supplying to the European market (Norway, the Netherlands, United Kingdom, Russia and Algeria). The demand side is modelled at a more aggregate level, distinguishing only the Netherlands and the rest of the Europe. Within the near future, however, we will formulate the demand equations at country level. The distinction between summer and winter market is already implemented in the current description of the market.

The electricity model contains also a Cournot description of the European market with physical restrictions, distinguishing between two production regions and two consuming regions (the Netherlands and the rest of Europe) (Mannaerts et al., 2002). The different generation techniques (conventional, fired with oil, gas or coal; nuclear, hydro and renewable) constitute the supply side. The physical restrictions in production consists of production constraints in the short term and transportation capacity limits. The distinction between peak and off-peak consumption is also implemented in this model.

The trade and transport module, in combination with a model of the Dutch energy demand, describes the competition between wholesale and retail traders in the Netherlands as a two-part competition, in which unit prices follow input prices and standing charges are subject to competition (Lijesen 2002). The energy transport is treated as a regulated activity, with tariffs based on transportation costs.

The three modules are related with each other by means of demand functions and energy prices. Developments at for example the European natural gas market, like the depletion of gas fields somewhere in Europe, affects the gas price and hence the production costs of gas fired power plants, with as result rising electricity prices for end users.

4.1 Base line scenario

In the base line scenario, natural gas prices in Europe will decline, due to the increasing competition on European level and the weakening of the current oil-price linkage. The price decline in the Netherlands will be larger than on average in other European countries, because of the current dominant position of 'Gasunie' in this country. Small end users face a smaller price decline than larger end users, since the demand of the former group is concentrated in the winter season, in which scarcity is relative high, while the consumption of large users, like gas fired power plants, is rather flat during the year.

The Dutch suppliers will loose share at the home market: imports increase with about 5% yearly, while domestic consumption is allmost constant. The increasing gas consumption in other European countries gives Dutch producers the opportunity to expand their exports. As a result, total depletion in the Netherlands will stay at the current level of about 70 billion m³ (see table 4.1).

Electricity unit prices will show a slightly rising pattern. This pattern results from increasing market power of producers on the one side and decreasing marginal production costs on the other side. The average end user price (including standing charges) will however decline, especially residential's, due to the competition between traders. Due to increasing electricity consumption and the restricted, although increasing, import transportation capacity, domestic production will show a strong increase.

Table 4.1 Energy market results of base line scenario and two competition scenario's (Netherlands, 2002-2010)

	Base line scenario (absolute quantities)		Sharp competition	Weak competition
	2002	2010	% deviation in 2010 from base line scenario	
Natural gas market (billion m ³)				
- depletion	69.2	71.7	-10¼	8½
- import	17.8	26.5	9¼	-13½
- export	42.3	49.8	-14½	10
- domestic consumption	44.7	48.8	1	-2¼
Electricity market (billion kWh)				
- production	89	108	0	-7¼
- import	23	29	-1	26
- export	3	6	-9½	2
- domestic consumption	109	132	¼	-¾
Energy prices ^a				
- natural gas (€ct/m ³)				
- small users	45.1	41	-5¾	16¼
- large users	12.7	10.4	-7¼	39¼
- electricity (€ct/kWh)				
- small users	16.7	16.1	-6¾	11½
- large users	5.3	5.4	-4¾	9¾

^a End user prices, including energy taxes, VAT and standing charges

4.2 Competition scenario's

When competition on the natural gas market sharpens due to international transportation capacity extension and decreasing production costs of Russian gas, the imports in the Netherlands in 2010 will be about 10% higher than in the base line scenario (see table 4.1). Dutch exports to Europe will decline, just as the total depletion in the Netherlands. The end user gas prices in 2010 are about 6% lower than in the base line scenario.

The opposite effects emerge when the competition is weak. The increase in market power of the suppliers results in much higher end user prices, based on the oil price linkage, and hence lower total gas consumption. The market share of the domestic supplier increases, due to slackening imports, while Dutch exports grow strongly. Total depletion in the Netherlands in 2010 is in this scenario about 10% higher than in the base line scenario.

The higher gas prices in the weak competition scenario decreases the competitiveness of gas fired power plants. Dutch electricity production, which is dominated by these generation techniques, will therefore face a decline in production, while imports of electricity, generated by coal fired and nuclear power plants, will increase strongly. The end user electricity prices rise in this scenario not only due to the input (gas) price increase, but also as result of the decreasing competition between electricity producers. Small user's and large user's electricity prices in 2010 are about 10% higher than in the base line scenario.

4.3 Decomposition of energy use development

Economic growth, structural changes within the economy and energy efficiency improvements together determine the growth rate of energy use. In the last decade, economic growth appears to be a significant factor behind energy use in the Netherlands. Dutch economy grew in the period 1990-1998 on average with 2½%, while total domestic energy use increased yearly with 1¼% (see table 4.2). The decline in energy intensity in this period was solely the result of efficiency improvements; structural changes had no effect on the total Dutch energy use.

In the current decade, however, economic growth's effect on energy use will be much smaller due to counteracting forces. In the base line scenario, the Dutch economy is growing with 2¾% a year, while the energy use increases with no more than 1% a year. The declining elasticity between economic growth and energy use results from the relative large structural changes. The share of industry within the total economy and the share of energy intensive sectors, like base chemicals and base metal, within industry are declining.

Efficiency improvements by energy users in the base line scenario will be lower than in the past due to the lower energy prices (¾% against 1% in the last decade). The energy sectors increases, however, the efficiency of energy use under the influence of the stronger competition on the electricity markets. These two developments neutralize each other. Total energy efficiency improvement in The Netherlands in the base line scenario will therefore be on the last decade's level.

When economic growth during the current decade will be ½%-point lower than is assumed in the base line scenario, energy use will only increase with ¼% yearly. In a low growth scenario the effects of decreasing energy prices on energy efficiency are relative small due to the lower rate of investments, which makes that energy efficiency of energy use is still improving by 1% a year in the period considered. In the long term, energy efficiency improvement will also be lower in a low growth scenario.

Table 4.2 Decomposition of energy use in the Netherlands, 1990 - 2010

Components	1990–1998 yearly % changes	2003–2010	
		Low growth scenario	Base line scenario
Domestic use in primary terms	1¼	¼	1
Savings	-1¼	-1½	-1¼
of whom energy sector	-¼	-½	-½
energy users	-1	-1	-¾
Structural change	0	-½	-¾
Economic growth	2½	2¼	2¾

5

Conclusion

In the base line scenario Dutch energy use increases with 1% yearly from 2927 PJ in 2002 to 3180 PJ in 2010 (see figure 5.1). Changes in the level of economic growth affects energy use significantly: in a scenario with ½%-point lower annual growth, energy use in 2010 will be 3023 PJ, an annual growth rate of no more than ¼%.

Different scenario's concerning the degree of competition on energy markets affect energy use to a relative small degree. In the sharp competition scenario energy use in 2010 is about the same as in the base line scenario, while in the weak scenario, energy use annual increase is about ¾%. The explanation for the relative low effect of competition on energy use is that energy market competition affects wholesale prices. Less competition for example results in higher wholesales prices, but affects end user prices less because of the fixed components (like taxes and transportation costs) in the latter. These components determine in the Netherlands for about one half small users energy prices. Changes in wholesale prices will therefore be smoothed down in end user prices. This effect, in combination with the low price elasticities of energy demand, explains why competition at the energy markets will not affect much energy use.

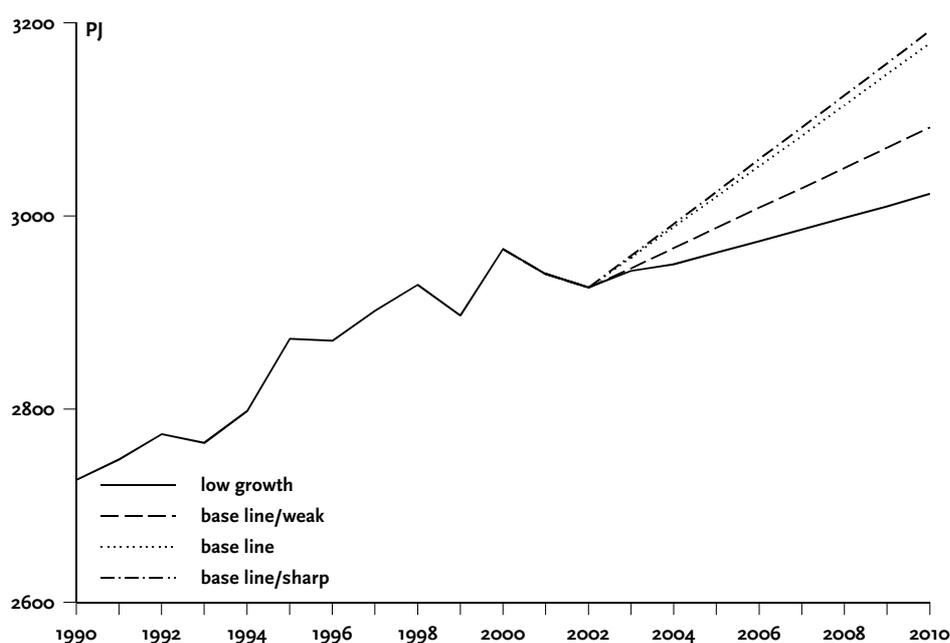


Figure 5.1 Energy use in The Netherlands, 1990-2010, in 4 scenario's

The conclusion of this outlook is therefore that energy use appears to be more sensitive to the level of economic growth than to the degree of competition at the energy markets.

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