S U S T E L N E T

Policy and Regulatory Roadmaps for the Integration of Distributed Generation and the Development of Sustainable Electricity Networks

REVIEW OF CURRENT ELECTRICITY POLICY AND REGULATION

Dutch Study Case

February 2003

ECN

energy-innovation

A.F. Wals

E. Cross

E.J.W. van Sambeek

Acknowledgement

Support of the European Commission

The SUSTELNET project is supported by the European Commission under the 5th RTD Framework Programme within the thematic programme 'Energy, Environment and Sustainable Development' under the contract No. ENK5-CT2001-00577. The report is registered under ECN project number 7.7396.

This document or any other document produced within the SUSTELNET project does not represent the opinion of the European Commission. Neither the European Commission, nor any person acting on behalf of the Commission, is responsible for the use that might be made of the information arising from the SUSTELNET project.

SUSTELNET project partners in EU Member States:

- Energy research Centre of the Netherlands (ECN), Petten, The Netherlands (co-ordinator).
- University of Warwick, Coventry, UK.
- Öko-Institut, Freiburg, Germany.
- Fondazione Eni- Enerico Mattei (FEEM), Milano, Italy.
- Tech-Wise A/S, Fredericia, Denmark.
- Institut für ZukunftsEnergieSysteme (IZES), Saarbrücken, Germany.

SUSTELNET project partners in Newly Associated States:

- Enviros, Prague, Czech Republic.
- The Polish National Energy Conservation Agency (KAPE), Warsaw, Poland.
- Hungarian Environmental Economics Centre (MAKK), Budapest, Hungary.
- EGU Power Research Institute, Bratislava, Slovakia.

Other organisations contributing to the SUSTELNET project:

- Eindhoven University of Technology / Foundation for the History of Technology, Eindhoven, The Netherland
- Eltra, Fredericia, Denmark.

For further information:

- www.sustelnet.net

Mr. Martin J.J. Scheepers
Energy research Centre of the Netherlands (ECN)
Phone: + 31 224 564436
E-mail: info@sustelnet.net

Abstract

This report identifies the main factors at play with regard to the interaction of distributed generation with the regulatory framework of the Netherlands. Furthermore, it identifies the barriers that the current Dutch regulatory framework raises to block the greater penetration of distributed generation. It's content follows a pro forma so that all issues for each country are discussed in the same order.

CONTENTS

Preface

Technological developments and EU targets for penetration of renewable energy sources (RES) and greenhouse gas (GHG) reduction are decentralising electricity infrastructure and services. Although liberalisation and internationalisation of the European electricity market has resulted in efforts to harmonise transmission pricing and regulation, no initiative exists to consider the opening up and regulation of distribution networks to ensure effective participation of RES and distributed generation (DG) in the internal market. The SUSTELNET research project provides the analytical background and organisational foundation for a regulatory process that satisfies this need.

Within the SUSTELNET research project, a consortium of 10 research organisations analysed the technical, socio-economic and institutional dynamics of the European electricity supply system and markets. This has increased the understanding of the structure of the current European electricity sector and its socio-economic and institutional environment. The underlying patterns thus identified have provided the boundary conditions and levers for policy development to reach long term RES and GHG targets (2020-2030 timeframe). Consequently analysis was made as to what regulatory actions are needed in the short-to-medium term to reach the existing medium-term goals for 2010 as well as likely scenarios for longer-term goals.

Regulatory Road Maps

The main objective of the SUSTELNET project was to develop regulatory road maps for the transition to an electricity market and network structure that creates a level playing field between centralised and decentralised generation and network development. Furthermore, the regulatory road maps will facilitate the integration of RES, within the framework of the liberalisation of the EU electricity market.

Participatory Process

To deliver a fully operational road map, a participatory regulatory process was initiated throughout this project. This process will bring together electricity regulators and policy makers, distribution and supply companies, as well as representatives from other relevant institutions with the final objective of enhancing implementation of DG.

Newly Associated States

The SUSTELNET project also anticipates the enlargement of the EU by providing support to the Newly Associated States (NAS) with the preparation of a regulatory framework and thus also with the implementation of EU Directives on energy liberalisation and renewable energy in four Accession Countries (The Czech Republic, Poland, Hungary and Slovakia).

Project Structure

The SUSTELNET project was divided into two phases. During the first phase, the analytical phase, three background studies were produced:

- Long- term dynamics of electricity supply systems in the European Union.
- Review of the current electricity policy and regulation in the European Union and in Member States.
- Review of technical options and constraints for the integration of distributed generation in electricity networks.

In the second phase, the participatory regulatory process phase two activities took place, during which there were extensive interactions with regulators, utilities, policy makers and other relevant actors:

- Development of a normative framework: criteria for, and benchmark of distribution network regulation.
- Development of policy and regulatory road maps.

This Report

This report was produced during the analytical phase of the project and is part of the review of the current electricity policy and regulation in the European Union and in Member States.

1 INTRODUCTION

The Dutch electricity market is currently confronted with two issues that have increasingly dominated the international energy agenda during the last decades of the 20th century. These two issues are the liberalisation of energy sectors on the one hand and the fulfilment of environmental targets put forward in the national and international policy arena on the other hand.

Concerning the liberalisation of the electricity sector, in July 1998 a new Dutch Electricity Act was adopted, replacing the 1989 Electricity Law. According to the new Dutch Electricity Act, all consumers must be able to choose their electricity supplier as of 1 January 2004. In respect to the fulfilment of environmental targets, in March 1997, the Dutch Ministry of Economic affairs issued a White Paper on Renewable Energy that was updated later in 1999, in a paper called the Renewable in Progress. According to these documents, the Netherlands aims to cover 5% of the energy demand from renewable sources by the year 2010 and a 10% by 2020. However, the Dutch Minister of Economic Affairs recently agreed, with regard to European policy, to increase the part of renewable electricity in total Dutch consumption to 9% by the year 2010. Furthermore, the promotion of CHP is considered important by the Dutch government, due to energy conservation reasons. Although no specific targets have been laid down, co-generation is currently being supported by a number of financial instruments to also help with the fulfilment of the environmental targets.

In a liberalised market, the correct regulation of the distribution network is a necessary condition to the development of a sustainable energy sector in general and the fulfilment of the environmental targets in particular. This report analyses the current affairs of the distribution regulation, directly liking its effect on distributed generation (DG).

2 STRUCTURE OF THE DUTCH ELECTRICITY MARKET

2.1 Opening of the market

According to the 1998 Dutch Electricity Act, the Dutch electricity market has to be liberalised in phases as regards the eligibility of consumers to choose their suppliers. The scheduled market opening is in line with the Electricity Directive 96/92/EC. Table 2.1 shows which customers sectors will be free in the choice of their supplier and at which date. Consumers from renewable electricity sources are officially able to choose their supplier since 1 July 2001.

Table 2.1 *Scheme for liberalising the energy market*

Type of customer	Open as of	Number of customers	Electricity demand in 1995 [%]
Electricity			
Annual use > 2 MW	1998	650	33
Annual use < 2 MW			
Connection > 3.8 Ampère	2002	59,000	29
Connection < 3.8 Ampère	2004	7,000,000	38
Renewable electricity	July 2001		

Under the new rules, access to both the high-voltage grid and the distribution network is regulated on the basis of a regulated Third Party Access (rTPA). In accordance with this framework, entry should be free and non-discriminatory. A special bureau (Dienst Toezicht en Uitvoering Energie, DTe) has been set-up as the system regulator, which will supervise and regulate the implementation of the new Electricity Law. DTe is a specific chamber within the Dutch competition authority. Because household consumers and small businesses will only be free to choose their suppliers in 2004 (see Table 2.1), DTe is also in charge of supervising the tariffs set by the supplying companies in the sell of electricity to the captive consumers.

2.2 Renewable energy and CHP in the Netherlands

In the Netherlands, there has been broad interest in renewable energy and CHP for several decades already. This interest originally arose from the idea that fossil fuel reserves are finite. Attention has shifted in the last few years to the prevention of environmentally harmful emissions, especially CO_2.

2.2.1 Renewable energy

Initially, political interest for renewable energy resulted in the promotion of R&D activities. Actual implementation objectives came later. In spite of this, the share of renewable energy in the Dutch energy supply is marginal. Its share has been stable for years at about 1% of total energy supply. The policy intention, see Table 2.2, has been to increase this share starting with 3% of electricity consumption in the year 2000 to 9% in 2010. For 2020 the objective is to reach 10% of total energy consumption. The last objective corresponds with a 17% share of the electricity supply being generated from renewable sources.

Table 2.2 *Energy related policy goals in the Netherlands*

Subject	Goal	Year
Renewables	3% of electricity consumption	2000
	9% of energy consumption	2010
	10% of energy consumption (≈17% of electricity)	2020
Energy efficiency improvement	1.7% per year	till 2000
	33%	2020
Greenhouse gases (Kyoto)	-6% w.r.t. 1990	2010

Before the start of the liberalisation of the electricity market between 1998 and 2000 renewable energy support came from a mix of instruments ranging from feed-in tariffs, direct subsidies, fiscal investment incentives and a system benefits charge (MAP levy). The funds collected through the system benefits charge were used to implement renewable energy projects by the energy supply companies that collected the charges. As a consequence of the greening of the tax system in the mid-nineties, the ecotax on final energy consumption was introduced in 1996. Renewable electricity consumption is exempt from the ecotax. Moreover, producers of renewable electricity receive a production incentive from the ecotax funds collected from non-renewable electricity consumers. Since 1996 this fiscal stimulation has become the dominant policy instrument to promote renewable electricity. Feed-in tariffs are gradually phased out as the electricity market is opened to competition. The system benefits charges have been abolished at the end of 2000. Other policy mechanisms such as fiscal investment incentives still remain. In July 2001 the market for renewable electricity was opened to all customers. A tradable green certificate system was set up for the verification, registration and tracking of renewable electricity and to facilitate the trade in renewable electricity. The main incentive for customers to switch to renewable electricity is the exemption from the ecotax, which currently amounts to 6 eurocents per kWh. The ecotax exemption is claimed by the supply companies on behalf of their customers by surrendering a green certificate to the tax authorities. While the ecotax support framework has been very successful in stimulating the development of a booming renewable electricity market in the Netherlands, it has not been very effective in stimulating new investments in renewable energy projects in the Netherlands. There are two main reasons for this. The first is that the favourable ecotax regulations have attracted large volumes of renewable electricity imports from other countries. This results in an incredible outflow of tax revenues from the Netherlands. Most of this tax money goes to existing installations and do not solicit investment in additional renewable capacity. Therefore the current ecotax support framework is politically unstable and is likely to be changed on short notice. This policy uncertainty has had a depressing effect on investments. The second problem in renewable energy policy in the Netherlands is environmental legislation, and in particular the siting problems for wind. To resolve this issue the Dutch national government made an agreement with provincial and municipal governments that the latter would appoint designated sites for wind energy development for which streamlined planning procedures apply. This policy only entered into effect last year and the results will have to be seen in the coming years.

2.2.2 CHP

The government has been aware of the importance of co-generation with respect to energy conservation since 1978. As such, co-generation has been an important subject within the national energy policy for years. In 1987, a programme was established by the Ministry of Economic Affairs to promote co-generation. This promotion programme consisted of, among other things, an investment subsidy, a special gas tariff and a feed-in tariff for returned electricity, which was coupled to the requirement that it would be purchased by distribution companies (that was also the case before 1987, but the tariffs were quite low). The promotional measures created an attractive investment climate for the combined production of electricity and heat. The Electricity Law implemented in 1989 was very important for the growth of CHP capacity in the 1990s, as distribution firms were allowed to operate CHP plants (alone or in a joint venture with an industrial partner). Furthermore, it became more attractive to dimension the CHP plants on the heat demand.

The growth of the co-generation potential got off to a good start: at the end of 1993, the existing capacity was 3,000 MW. By the end of 1997, this had increased to 7,000 MW. This enormous growth of co-generation contributed to a nation-wide over-capacity of electrical power. The government reacted to this by discontinuing the investment subsidy for co-generation. In 1995, the organisations representing the distribution and production interests reacted to the (threat of) over-capacity by agreeing upon a moratorium. Since that time, energy distribution companies are required to contract their purchase of electricity from the producers before the beginning of each year. This way, the growth of co-generation slowed down to some degree.

The liberalisation of the electricity market obliges CHP to compete with large-scale electric power plants. In 1999 there was a slight increase in the use of CHP for electricity production while in 2000, mainly as a consequence of relatively high gas prices, there was a decrease. In order not to jeopardise energy savings, the Ministry of Economic Affairs has taken measures to provide extra financial support for the development and construction of CHP plants.

2.3 The Dutch transmission and distribution sector

According to the 1998 Electricity Act, a monopoly will prevail in the case of the transmission of electricity. An independent transmission system operator, Tennet, is owner and responsible for the management of the Dutch high-voltage grid (380 kV and 220 kV), which links-up the various regional electricity grids and connects them to the European grid. The former Sep[1] established Tennet in October 1998, and is state owned since October 2001. In addition, there are the Distribution Network Operators (DNOs), shown in Table 2.3 and Figure 2.1, which own and manage the middle voltage (MV) and low voltage (LV) grids (<150 kV and > 0.4 kV). The grid management must legally be distinct from the supply companies; nevertheless the DNOs are still part of the same holding as the supply firms; as Table 2.3 also shows.

[1] The Sep was an organisation formed by the four biggest electricity producers: EPON (Electrabel), EPZ(Essent), UNA (Reliant), EZH (E.On).

Table 2.3 *Energy Companies and DNOs in the Netherlands*

Province	Energy Company	Distribution Network Operators
Groningen	Essent Energie Noord NV	Essent Netwerk Noord NV
Friesland	NV NUON Energielevering i.o.	NuonNet i.o.
	NV ENECO	ENECO NetBeheer BV
	Essent Energie Friesland NW-ZO NV	Essent Netwerk Friesland NW-ZO NV
Drenthe	NV RENDO	RENDO Netbeheer BV
	Essent Energie Noord NV	Esent Netwerk Noord NV
Overijssel	Centraal Overijsselse Nutsbedrijven NV	Netbeheerder Centraal Overijssel BV
	Essent Energie Noord NV	Essent Netwerk Noord NV
Flevoland	NV NUON Energielevering i.o.	NuonNet i.o.
Gelderland	NV NUON Energielevering i.o.	NuonNet i.o.
Noord-Holland	Energie Noord West NV	NuonNet i.o.
	ENECO Energie Zuid-Kennemerland	BV Netbeheer Zuid-Kennemerland
Zuid-Holland	Energie Delftland NV	EdelNet Delfland BV
	ENECO Energie Midden-Holland NV	Netbeheer Midden-Holland BV
	NV Nutsbedrijf Westland	
	NV ENECO	Westland Energie Infrastructuur BV
	NV ONS Energie	ENECO NetBeheer BV
	NV ENECO	ONS Netbeheer BV
		BV Transportnet Zuid-Holland
Utrecht	REMU Levering BV	Elektriciteitsnetbeheer Utrecht BV
Zeeland	NV DELTA Nutsbedrijven	DELTA Netwerkbedrijf BV
Noord-Brabant	NV Nutsbedrijf Regio Eindhoven	ENET Eindhoven BV
	Essent Energie Brabant BV	Essent Netwerk Brabant BV
Limburg	EnerMosane NV	InfraMosane NV
	Essent Energie Limburg BV	Essent Netwerk Limburg BV
	ENECO Energie Weert NV	Netbeheer Nutsbedrijven Weert NV

Source: www.nma-dte.nl

2.3.1 Ownership of DNOs

In the last decades many mergers among utilities have taken place, which reduced the number to about 13 firms. The ownership of the electricity networks still remains in the hands of public shareholders (provincial and local governments), however the privatisation of the firms by the government is currently being discussed.

Table 2.4 *Energy firms that also own DNOs in the Netherlands in 2001*

Network firm	Production [MW]	Connections Electricity	Gas	Heat
COGAS	2.3	50,000	125,000	885
NV DELTA Nutsbedrijven	1426	188,000	171,000	1,000
NV ENECO*	-	1251,000	1229,000	37,000
Energiebedrijf Midden-Holland NV		87,000	78,000	23
NV NUON**	1101	2,609,000	2,017,000	57000
NV Nutsbedrijf Regio Eindhoven	6.8	99,000	176,000	600
NV Nutsbedrijven Maastricht	3.6	45,000	47,000	730
NV ONS Energie		38,000	34,000	
Essent NV	2649	2320,000	1681,000	44,000
Remu NV	36.6	491,000	364,000	38,000
NV RENDO		30,000	95,000	
Westland Energie NV	104	47,000	46,000	

*Including Energie Delfland, Gasbedrijf Midden-Kennemerland, Nutsbedrijf Amstelland, Gasbedrijf Noord-Oost Friesland, Nutsbedrijven Weert.
**Including GGR-Gas (Merged, July 2000).
Source: Energiened.

Large differences regarding the size of the utilities (also owners of DNOs) exist, as Table 2.4 and Figure 2.1 shows. Some of them are small and still attached to one town or region, but most of them cover large regions. In the Netherlands, DNOs have to be legally unbundled from energy firms that own (or partly own) generation and retail companies. In other words, while legal, management and account unbundling of the different businesses is required ownership separation is not. For example Essent, an energy holding, owns a retail firm with the same name, a DNO and the production firm EPZ. It is also important to mention that all the energy supply and distribution utilities co-operate in their branch organisation EnergieNed.[2]

Figure 2.1 *Regional distribution of the five largest energy distribution companies*

Concerning the retail sector, as a result of recent mergers a more concentrated industrial structure exists. However it still remains relatively non-concentrated compared to supply markets in other Member States.[3] The market share of the biggest firm is around 35%, while the market

[2] Information on this organisation can be found at www.energiened.nl.
[3] Electricity Liberalisation Indicators in Europe. European Commission, 2001.

share of the largest three firms total approximately 80% of the total market. More specifically in terms of number of connections, three supplying companies Essent, Nuon and Eneco cover 85% of the electricity market, 76% of the gas market and 79% of the heat market.

3 THE GOVERNANCE STRUCTURE OF THE DUTCH ELECTRICITY SECTOR

Pursuant to various legislative acts dating from about 1997, the regulatory regime applicable to the Dutch electricity sector has been evolving from a bilateral 'arm's length' relationship between the Ministry of Economic Affairs (the 'Ministry') and the largely self-regulating, collaborative industry into an more dynamic regime, featuring an energy regulator (*Dienst uitvoering en toezicht Energie*, or DTe) integrated within the Dutch Competition Authority (*Nederlands mededingingsautoriteit*, or NMa). This tripartite construction of the Ministry, the regulator, and the competition authority, sometimes referred to as a 'one-stop shop', is at present working in synergy to assert its powers over an electricity sector comprised of numerous companies of an increasingly independent and international character.

Under the 1997 Competition Act, NMa operates under the responsibility of the Ministry, who lays down in published policy rules the general instructions on the performance of the tasks assigned to the director general of NMa. These general instructions may relate in whole or in part to how the director general should consider interests other than economic ones. In individual cases, these instructions must be in writing. Annual reporting obligations apply to both NMa (to the Minister) and the Minister (to the Parliament) on these activities and instructions.

NMa has proven itself to be active in the energy sector, having notified the oil companies in 2001 regarding a prohibition on certain vertical restraints and having established that Gasunie has abused its dominant position on the market for gas transmission (announced in April 2002). NMa has also subsequently issued a general consultation document as a starting point for assessment of future concentrations in the energy sector, concluding that the Dutch electricity sector is still a national market and will be treated as such by NMa in assessing future concentrations.

As a separate 'chamber' of NMa since 1 July 1999 and sharing the same premises since the end of 1998, DTe is organisationally subordinate to the director general of NMa, but has its own enumerated powers and a status distinct from other departments of NMa, as reflected in the issuance of a joint NMA/DTe annual report in 1999. In DTe's own annual report of 2000, it is noted that the 'chamber model results in synergy', namely that "the concepts relating to competition are interpreted unambiguously" in implementing the Electricity Act of 1998 and the Gas Act of 2000, and that "optimal use may be made of the knowledge and information available within NMA/DTe" subject to confidentiality requirements.

The size of DTe is relatively small compared to the regulator of England for example. As of March 2002, about 50 people work for DTe. This includes 15 people in the regulation department, 9 in supervision, 6 in infrastructure, 4 within the Market surveillance committee and the rest as staff and management.

In general, DTe conducts the following activities:

- Taking decisions on electricity and gas tariffs.
- Granting licenses for the supply of electricity and gas to captive consumers.
- Developing guidelines and requirements relating to tariffs, customer relations, and service quality.
- Monitoring compliance with various technical codes and tariff guidelines.
- Issuing binding instructions on market participants and imposing orders subject to a penalty.
- Providing advice, upon request, to the Minister, under the 1998 Electricity Act, as amended.
- Providing public information.
- Participating in international regulators' associations and activities.

DTe was formally incorporated into NMa as of 1 July 1999, when the relevant enabling provisions of the 1998 Electricity Act came into force. Similar to the 1997 Competition Act, these enabling provisions require that DTe operates on the responsibility of the Minister, who lays down in published policy rules the general instructions on the performance of the tasks assigned to the director of DTe under the Electricity and Gas Acts. However, before issuing such instructions, the Minister must consult with the director general of NMa to allow for his opinion to be given.

The tripartite construction has been elaborated further under the 1998 Electricity Act by providing the director general of NMa formal powers relating to DTe, such as the power to issue general and special instructions with regard to the exercise of the functions of the duties and powers assigned to DTe, if the director general considers that a definition of terms used in the application of the Competition Act must be given. Moreover, the dispute-settlement function envisaged under the EU Electricity Directive relating to contracts and negotiations on network access (Art. 20(3)) has been assigned to the director general of NMa, not to DTe.

Tariff-setting powers under the 1998 Electricity Act are divided between the Minister and DTe. In general, the Act assigns DTe the power to fix network charges (rate structure and conditions), taking into account the proposals presented by the network companies, as well as other criteria set forth in the Act. The Minister has a duty to establish maximum supply tariffs for captive customers under Article 58 of the Act.

Because of strong fluctuations on the electricity markets in the Netherlands in June and July 2001, DTe and NMa established a market surveillance committee (MSC) in mid-2001. This Committee analyses the operation of the liberalised electricity market in the Netherlands and gives both requested as well as unsolicited advice to DTe and NMa on improvements to the operation of market forces.

Unlike some EU Member States, the 1998 Electricity Act does not define a specific role for consumer protection organisations or consumer committees. However, consultation options are preserved under Article 33, which requires the network managers to hold joint consultations with organisations representing parties on the electricity market regarding tariff structures and conditions. Conclusions made about the views raised by such organisations must then be forwarded by the grid managers to the DTe in the form of a joint statement attached to their proposal on tariff structures. In addition, the Director of DTe is obliged to consult with ‘organisations representing captive customers’, as well as the licence holders, in regard to the setting of the discount to promote efficient operations under the price cap mechanism (Art. 58(3)). After the elimination of the captive market, it is not clear whether the required consultation with consumer organisations under Article 58(3) would still apply.

The Act also does not address energy planning involving local governmental authorities. It expressly prohibits the provincial and municipal authorities from issuing regulations on the generation and transmission of electricity.

More formal changes to the governmental framework for electricity regulation are anticipated. In its 2000 Annual Report, DTe stated that NMa/DTe is expected to become an independent administrative body. This would naturally change its relationship with the Ministry. Independence may also require additional clarification of the relationship of DTe to other governmental entities and within NMa itself. The formulation of the powers and duties to be assigned to an independent energy regulator in the Netherlands will undoubtedly reflect the ongoing discussion at EU level on the proposals to amend the Electricity Directive, particularly with respect to the role of regulatory authorities.

In assessing the ‘regulatory culture’ for the Dutch electricity sector, the historical development of the regulatory regime should be appreciated. Prior to the establishment of the DTe, the industry was largely self-regulated whereby the SEP, the now defunct coordinating body for power production and transmission, played a quasi-regulatory role. The Ministry of Economic Affairs historically was at arm's length from the operation of the electricity supply industry, and it described itself as such as recently as 1990.

The government's jurisdiction over the electricity supply industry historically has been somewhat uncertain. This is attributable to fact that it never owned or, until relatively recently, never even licensed many of the electricity undertakings. The battle for control of the regulatory playing field was most pronounced in the period 1914 to 1920, during which time the provincial and municipal authorities exerted their dominance over the emerging industry and the state failed to establish a state electricity company.

During the 1980s and most of the 1990s, there seemed to be a degree of disconnection between government's legal framework and the industry practice. The long periods of debate over energy legislation (the 1989 Electricity Act followed a fifteen-year debate and the Energy Distribution Act floundered for years) was indicative of the uncertainty that prevailed prior to adoption of the 1998 Electricity Act. This Act reflects the fact that the electricity undertakings had to concede certain aspects of their self-regulating power to the government, a situation in sharp contrast to the position of a government that is privatising a state-owned enterprise, as took place in the United Kingdom.

4 DNO INCENTIVISATION

The pricing system implemented to regulate the transmission and distribution network can, directly or indirectly, influence the deployment of distributed generation in a liberalised electricity sector. Typically, regulation of DNOs is designed to favour centralised generation. However, in the search for an efficient liberalised market, the regulation of networks should provide neutral incentives to all types of generation. This chapter reviews the regulatory system in place in the Netherlands and analyses its impact on DG.

4.1 Regulated revenues: the price cap system

As the 1998 Electricity Act dictates, vertically integrated firms have to carry out legal and management separation between the generation, retail and distribution activities. While in the first two sectors competition has to be promoted in order to achieve efficiency, the distribution activities have to be directly regulated because it has characteristics of a natural monopoly. As a result, the Dutch government implemented, since the year 2000, a price cap system to regulate tariffs charged by DNOs. The regulation mechanism put in place is an incentive type of regulation that uses a benchmark in order to provide companies with incentives to act in an efficient manner[4]. The system establishes the maximum tariffs firms can charge for their services during the regulatory period that lasts from 2000 until 2004.

As indicated in the formula below, the tariff reductions per year, under the price cap system depend on the x-factor (x_t) and the inflation index (cpi). The x-factor is the discount to promote an efficient operation by network firms and is determined on the basis of a number of assumptions over the potential efficiency improvements. It aims at directing all firms to the efficient frontier by the year 2004. The initial tariffs set in the year 2000 were based on the tariffs of 1996. The reason for this is that 1996 was the last year that the electricity sector had no information about the upcoming implementation of new electricity legislation, i.e. tariffs were then cost-based. Firms at that stage did not have the incentives to overstate costs.

$$P_t = \left(1 + \frac{cpi - x_t}{100}\right) P_{t-1}$$

Apart from the individual x-factor that depends of the characteristics of each firm, a yearly shift of 2% in the efficiency frontier was set in the Netherlands. This shift relates to general cost reductions caused by the rate of technological improvement of the network.

Table 4.1 *Revenue in each grid*

Voltage level	Revenue kW:kWh
EHV, HV, TV	100:0
MV	50:50
LV	16:84
LV <3*25A	0:100

As Figure 4.1 shows, the x-factors are transmitted to the tariffs. The tariffs are calculated by the DNOs, based on the Tariff Code, and must be approved by DTe (see Principles of Distribution Charging). The revenue collected depends on the voltage of the network. As Table 4.1 shows,

[4] Benchmarking can be broadly defined as the comparison of a firm's actual performance against some pre-defined reference or benchmark performance (Jamasb, Nillsen, Pollitt, 2003).

the higher the voltage level, the higher the percentage of the revenue depends on the capacity and not the units distributed. In other words, the bigger the customer the higher the fixed revenues become for the DNOs.

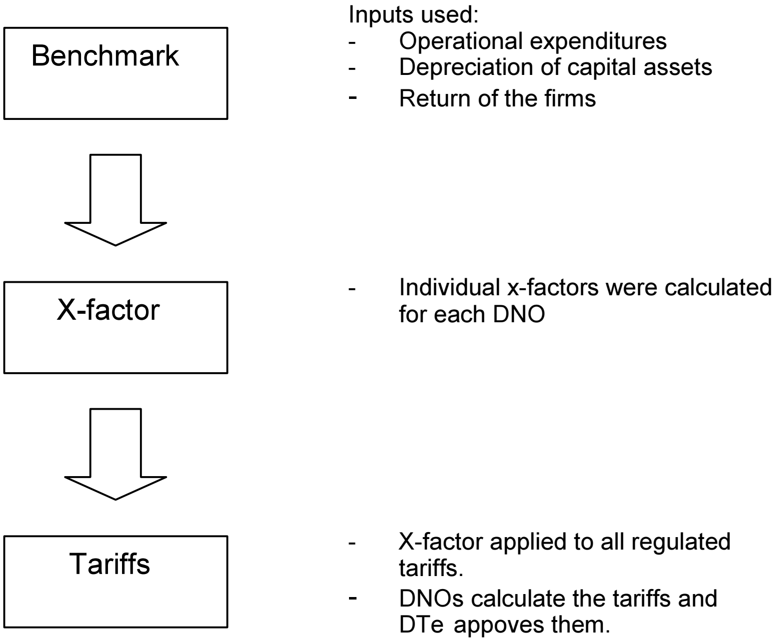

Figure 4.1 *Determination of X-factor and revenue collection*

4.2 Benchmarking

As previously stated, the main objective of the price-cap system is to improve efficiency by rewarding good performance. The way the actual performance is measured is relative to some predefined benchmark.[5] In the Netherlands, the benchmark was calculated with the help a DEA[6] model. DTe believes that the total controllable costs (operational and capital expenditures) are the appropriate measure of input for the benchmarking process, rather than the operational and maintenance costs only. Consequently, by comparing performance on the basis of total controllable revenue, DTe provides the DNOs with incentives to reduce operational costs and also not to over-invest and to plan network expansion in an optimal way.

The fact that the asset base is considered in the benchmarking for the x-factor goes in line with DTe's intended policy of light handed regulation. DTe, consequently, only has to look at the cash flow of the firms, without the need of gathering detailed information. If a certain rate of return for investments in capital costs would be guaranteed to the DNOs, the regulator would be faced with an significant resource consuming job of calculating and verifying that the declared costs of the investments undertaken are genuine.

[5] For an empirical analysis of benchmarking methods see Jamasb, Pollitt 2000.

[6] Under the Data Envelopment Analysis (DEA), an efficiency frontier for the considered group is calculated; the frontier provides a yardstick against which to judge the comparative performance of all other firms that do not lie on the efficiency frontier. DEA also allows for decomposition of efficiency score into scale efficiency (e.g. the catch-up component) and technical efficiency (e.g. shift in frontier) (Jamasb, Pollitt, 2000).

4.3 Costs

The costs of DNOs are related to the costs needed to:

- Run the network (operation and maintenance, capital costs).
- Meet certain performance standards.
- Investments in future cost reductions.

The three of them are closely related and can overlap (For a more detailed explanation of cost structure of DNOs, see principles of distribution charging).

4.4 Performance-based standards

The Dutch electricity act included an article that explicitly mentions the responsibilities the DNOs have when managing the networks. According to article 16 of the 1998 Electricity Act, DNOs are responsible of:

- Ensuring the operation and maintenance of their grids.
- Ensuring, in the most efficient manner, the safety and reliability of the grids and of the transmission of electricity across the grids.
- Maintaining sufficient reserve capacity for the transmission of electricity.

Nevertheless, the price-cap system implemented in the current regulatory period has a basic flaw. As no real binding quality regulations are in place, DNOs are on the one hand encouraged to reduce their quality of supply by cutting investments, maintenance or personnel with the aim of increasing profits, but on the other hand are not encouraged to keep quality levels sound. A way of preventing the reduction of the quality of supply is by implementing performance-based standards. The standards here studied are divided into those concerning the quality of transactions between DNOs and their customers, and those about the quality of the system.

Indicative performance standards have presently been implemented in the Netherlands in order to regulate the quality of transactions between companies and their customers. These include minimum standards in responding to failure of suppliers, use of metering problems, on queries on charges and payments, and on execution of certain works. An important point is that DTe has not yet defined penalty payments when DNOs do not comply with the standards.

The quality of the system is presently also only monitored with indicative values. In other words, the regulator has put in place indicative values without prescriptive effects on zonal averages of minutes lost per client. The continuity of supply for each customer is not guaranteed through these norms. Furthermore no penalties or compensation to consumers are in place.

The regulator acknowledges the need for stringer performance-base standards. It is therefore expected that after 2003 the price cap system will be replaced by a performance-based yardstick system. Under that regulatory mechanism, on one side, an average x-factor will be applied to the whole sector and, on the other side, the revenue of firms will depend on a number of performance standards. The latter means that DNO’s will be rewarded economically when providing good quality services. For that DTe implemented a project called ‘The Price Quality Regulation System’, which aims at finding in the future regulatory system a more explicit relationship between quality and price.

4.5 Incentives provided to the DNOs

Under the current price cap system, firms that reduce costs more than what is dictated by the x-factor are able to earn higher profits. Conversely, firms whose costs are higher that the maximum tariffs see their profits decline. For both cases, this happens at least until the next tariff control period, which will take place in 2004.

On the one hand the DNOs objective, as of all profit-driven firms, is to maximise their share-holders value. Under the current regulatory system, this will occur when, both the operational expenditures and expenditures on capital assets are minimised. On the other hand, DNOs face restrictions in their minimising cost objectives, as (will) have to fulfil a number of performance-based standards.

More specifically, expenditures on capital assets can be divided into:
- Investments to increase the quality of the service.
- Investments to reduce future investments.
- Investments done because the law says so (for example connection costs).

Under current performance standards, quality of supply of DNOs is not effectively addressed as indicative performance standards are only put in place. As previously explained DNOs are not levied penalties when the standards are not achieved. Currently, firms are only encouraged to undertake the last two of the investments.

Two other important issues are also worth mentioning. The first one is that due to the unbundling of the sectors, a long-term cost minimisation policy through integrated resource planning cannot be achieved anymore. As the building of new generation decisions are detached from the managers from the grid, DNOs face constraints in determining how and where infrastructure developments should take place in the most efficient way.

The second one is the fact that DNOs are encouraged to minimise operational expenditures is anti-innovative. In other words, as the operational expenditures of the firms are benchmarked against other firms, none will invest resources in new technologies or managerial systems that are uncertain. This can also harm the development of DG.

5 PRINCIPLES OF DISTRIBUTION CHARGING

The total level of revenues for DNOs is determined through the price-cap system and collected via the tariffs. The Tariff Code lays down the basis of the general tariffs, based on which the DNOs calculate their particular tariffs. The x-factor is applied to all of the regulated tariffs (a tariff basket), and while DNOs calculate them, the tariffs have to be later approved by DTe.

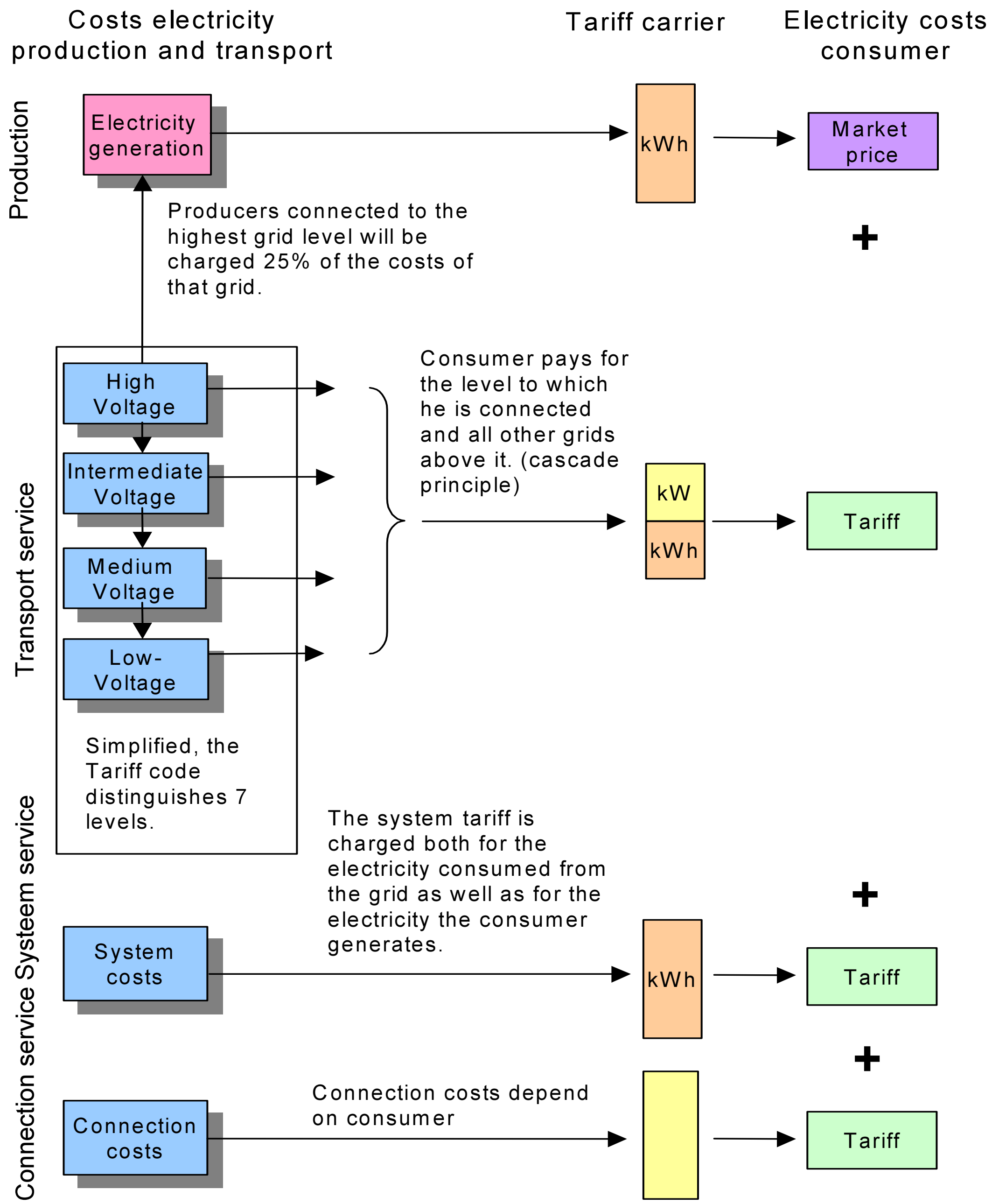

Figure 5.1 *Structure of the Tariff System in the Dutch Power Market*

Figure 5.1 describes the transmission and distribution tariff structure of the Dutch electricity sector. It shows how the costs, associated with transmission and distribution, are divided among the use of the system costs, the connection costs and the system costs. For the use of the system tariffs the cascade principle applies. According to the cascade principle, the costs of higher voltage grids are allocated to the users at lower voltage grids in proportion to their use of this higher voltage grid.

5.1 Connection tariff

Connection tariffs in the Netherlands depend on the type of connection. Connections until 10 MVA are shallow, regulated and averaged. Shallow is referred to connections charges that only pay for capital and maintenance costs of the connection itself but are not charged directly for other costs incurred by the network operators. In other words, possible adjustments, reinforcements and upgrades beyond the point of connection, which are necessary to facilitate the integration of the generator into the grid, are not paid by the users connecting to the grid. These indirect costs of grid adjustments are passed on to consumers through the use of the system tariff or absorbed by the distribution companies (see later). Furthermore, connection charges are set by the regulator and are not individually calculated but cover a different number of connection profiles.

Connections bigger than 10 MVA are negotiated and deep. Deep is referred to connection charges that cover all costs raised by connecting to the grid. They included the direct costs of connecting to the grid and all indirect costs raised inside the grid. Charges are determined through negotiation processes between users and the DNOs.

Article 2.2 of the Tariff Code outlines the costs covered by the connection tariff, which can be broken down in two components:
- the initial investment costs,
- maintenance costs.

Deep connection costs can pose a significant barrier to DG projects. As a result, and considering that connection costs discriminate between their sizes, big DG projects try to keep their connections profiles small enough to fall under the first tariffs. In other words, when connecting to the grid, big DG projects may realise a higher number of small 'shallow' connections instead of one big 'deep' connection.

DNOs have a monopoly on the building of the connection to the grid, and that has risen complaints by operators, especially wind park operators, and different consumers. They argue that this causes excessive high costs of connection charges, especially when generators are situated far away from the grid. The Dutch government intends to change the current regulatory framework, and consequently allow customers carry out the connection installations to the grid by their own means. Competition will be therefore promoted and reduction of costs expected.

5.2 The use of the system tariffs

5.2.1 T&D tariff

The T&D tariff covers the transmission dependent and independent costs incurred by the network operators. Article 3.2.2 of the Tariff code outlines the costs of the specific issues covered by the T&D tariff. Many are considered in the determination of the x-factor, i.e. the operational expenditures and the capital expenditures.

The transmission-dependent costs includes:
- depreciation charges of the grid infrastructure,
- a reasonable return on the capital,
- the costs of construction and maintenance the grid infrastructure,

- the costs of grid losses, resolving transmission constraints and maintaining the voltage and reactive power balance,
- the cascade costs of grids operating at higher voltage level,
- the operating costs relating to the above.

The transmission independent costs include the costs of meter reading and data management for the benefit of parties having a connection.

The transmission-dependent costs are allocated between producers and consumers. Producers that have connections at EHV and HV grid levels have to pay the National Uniform Producer Tariff (LUP), which accounts for the 25 percent of the sum of the total transmission dependent costs of these grids. Consumers have to pay for the rest of the transmission dependent costs in the EHV and HV (75%) grid levels plus the total of the costs in the lower voltage levels. This favours DG, as this type of generation is connected to middle and lower voltage levels grid. In other words, they do not have to pay for any transmission dependent costs.

The cascade principle allocates the transmission dependent costs from higher grid levels to lower grid levels in proportion to the lower voltage grid's share in the total take of energy and/or capacity from the higher voltage grid. Tariffs are transaction based, i.e. based on the invoiced electricity.

Losses

Distributed generation may increase or reduce losses in the system, consequently generating benefits or losses to the DNOs. In the existing regulatory system in the Netherlands, costs raised by network losses are considered as non-controllable and therefore socialised. The costs generated by network losses are passed to customers through the T&D tariff, which means that all extra costs incurred by the distribution firm through transmission losses are charged to consumers.

The Network Code allows DNOs to pass through benefits from distributed generation such as reduction of net losses and net investments, nevertheless in practice hardly any DNO uses this provision. This gave rise to complaints from various interest groups defending the position of distributed resources (mainly co-generation), such as industries, greenhouse horticulture and energy distribution companies. Prompted by these complaints, DTe organised a round table with DNOs and generators to look for an acceptable compensating mechanism for avoided net losses and net investments. As a result, a provision was brought forward (per January 1st 2002), which indicated that distributed generators connected to the medium voltage (MV) and low voltage (LV) systems[7], should receive compensation for reducing net losses. The provision has a temporary basis and, following some studies undertaken by ECN/KEMA, determined the amount to be of 0.1 €ct for every kWh dispatched into the LV and MV grids.

Investments

The connection of DG into the network may increase or avoid investments in the grid. When extra-investments should be performed, as sometimes connection costs in the Netherlands are shallow, the costs of them are not paid by the party connecting to the grid but either passed on to consumers through the T&D tariff or absorbed by DNOs. As tariffs are fixed under a price-cap regulatory system, the first case can occur when DNOs request to DTe for an ad-hoc increase in tariffs is accepted. This mechanism is stated in the Electricity Act, yet is normally turned down by the regulator. If the second case occurs DNOs may, as a result, be discouraged to let new producers connect to the grid, even though the law obliges them to do so.

[7] The Low Voltage (LV) net allows plants smaller than approx. 0.1 MW; the LV and medium voltage (MV) net between 0.1 MW and approx. 1 MW; the MV net between 1 MW and approx. 5 MW; the MV and high voltage (HV) between 5 MW and approx. 75 MW; and the HS net higher than approx. 75 MW.

DG can also avoid investments in the grid. Considering that distribution tariffs in the Dutch Power market are fixed for four-year periods (current period until 2003), DNOs will carry out the necessary investments as efficient as possible. DG can result an efficient option to avoid, for example, the upgrading of the certain grid area. However, under the current system, DNOs will not implement that option, because DNO's cannot own generation, and no signals (eg. Entry charges) are available for them to encourage the installation of DG is relevant areas. Furthermore, in the short-term, Dutch grid capacity at the DNO level suffers no constraints, making the shadow benefit of DG in this area small.

5.2.2 Reactive energy transmission tariff

Reactive power problems are currently not common in the Netherlands, nevertheless Article 3.9 of the Tariff Code includes a reactive energy transmission tariff, part of the transmission dependent tariff. The article outlines the costs covered by this tariff and states that two tariff-categories are applied to the reactive energy for consumers:

- consumers connected to a voltage level of 1 MV and over,
- consumers connected to a voltage level of less than 1 MV.

DNOs have no incentives in the Netherlands to solve the reactive energy problem in the most efficient way, either by optimising their reactive demand on the transmission system or by paying distributed generators to produce or absorb reactive power. In other words, the correct signals are not given to value the services distributed resources can provide.

5.3 System tariff

System services such as the costs incurred in operating the balancing market are charged in the form of a system tariff. Article 4.2 of the Tariff Code describes the issues covered by the system tariff:

- costs of reserve and regulating power,
- costs of black-start facilities,
- costs connected to the monitoring and maintenance of the robustness function of the 380/220 kV grid,
- the costs of other duties and activities for the benefit of the system management,
- internal operating costs in so far as these can be attributed to the system operator of the manager of the national high voltage network.

6 SYSTEM DISPATCH

6.1 Introduction

The market design has can also influence the market access of DG. The market access of distributed generation depends on issues like trading arrangements, the balancing mechanisms and transaction costs.

In the Netherlands, before the opening of the market, distributed generation (mostly cogeneration plants) received feed-in tariffs for their electricity produced. With the liberalisation of the electricity markets, DG no longer benefit from these specific remuneration fees and, as a result, have to trade the electricity produced in the wholesale market.

Decentralised trading arrangements were implemented in the Dutch power market when the new Dutch electricity act was put into force in 1998. The day-ahead market in the Amsterdam Power Exchange (APX), the bilateral Over the Counter (OTC) market and Tennet's balancing market, are the three main markets that exist where electricity is currently traded. The first two differ in the types of market design, contracts traded, liquidity and transparency. The third is a balancing market design to handle the deviations between actual demand and projected demand, as well as the under-generation and over-generation due to plant failures.

This section describes the different electricity markets in the Netherlands, i.e. the day-ahead APX market, the OTC market and the balancing market operated by Tennet, the Dutch transmission system operator, and analyses the influence of the market design on distributed resources.

6.2 APX

The APX was implemented by a number of interested market parties in order to create a trading place that would provide an indicative wholesale price of electricity in the Dutch market. The day-ahead market, which went live in May 1999, trades physical contracts. The trading system is based on a two-sided auction that sets a uniform market clearance price for every hour of the next day. More specifically, the market parties hand in the bids every morning and the equilibrium prices and quantities are calculated by around midday of the previous day of the dispatch. The price equals the equilibrium point where the supply and demand curves meet for each hour. The volume of electricity traded in the day-ahead market has been increasing steadily and has in some cases in 2002 reached around 18% of the total electricity.

6.2.1 Benefits of distributed generation

The access of DG to the APX can increase market liquidity and reduce market power from large producers in its day-ahead market. In July 2001 several price spikes were observed in the day-ahead market of the APX. Several sources[8] argued big producers were manipulating market prices. A more widely participation of DG into this market can help mitigate the exercise of market power by reducing its concentration levels and increasing competition.

[8] See Brattle report (www.tennet.nl), Market Surveillance Group DTe.

6.2.2 Transaction and information costs

Transactions and information costs are barriers that impede the participation of DG in the power exchange. For example, access fees contribute to transaction costs. Any market party that wants to trade in the APX has to pay an entrance fee of €12,500 one time and then €25,000 per year, which represents a significant sum for small generators.

The aggregation of many small distributed resources under the control of a single manager can be a condition to facilitate market entrance by reducing these transaction and information costs.

6.2.3 Demand side-bidding

The day-ahead market in the APX, is set-up as a two-sided auction market. Under this trading system the market demand curve is revealed as market clearing prices and quantities are determined as functions of the intersection of supply and demand specified for each hour. The revealed demand curve informs the owners of DG of periods of high value, and therefore provides them of valuable information in order to operate more efficiently. The participation of DG in the market is one aspect of demand-side bidding, as it can reduce the load to be served by central station dispatch.

6.3 OTC market

The OTC market in the Netherlands is made up of two markets, a hidden one and a relatively transparent one. The first market is opaque and trades through long-term bilateral contracts signed generally between producers and DNOs or non-captive consumers. The second market is more transparent and trading takes place between traders that are connected with one another through phones and screens that enable them to be continuously informed about the (electricity) supplied and demanded contracts. In the latter, trading is also based on bilateral transactions carried out with tailor-made contracts. Examples of these include, apart from day-ahead contracts, forward contracts, swaps and options. Firms such as Platts, Dow Jones and Argus report information about the OTC market obtained from a cross-section of traders. The reporting is done on a voluntary basis. While the information on prices is usually reliable, information on volumes traded generally is not.

6.3.1 Distributed resources contracted in the OTC market

In the Netherlands distributed resources that are independently owned and managed sell the produced electricity through the hidden OTC market. Owners of distributed generation plants, such as wind units or CHP plants, mainly contract through long-term bilateral contracts with retailers.

6.3.2 Multi-settlement markets

The Dutch wholesale market allows intra-day trading though the OTC market. Traders and brokers trade electricity until one hour before the dispatch of the electricity. After that time, existing imbalances have to be corrected through balancing market. Before, producers could only make final adjustments to their predicted output two hours in advance. Since March 2001, they can do it until one hour in advance in order to favour intermittent DG sources.

This type of market design, furthermore, supports demand-side responses that include DG. This can occur in the following way: If prices clear at very high levels in the day-ahead market, owners or managers of DG know in advance that it will be in their interest to reduce consumption and/or generate on-site, and sell the released power back into the wholesale market. The same is true if the day-ahead market clears at normal prices, but price spikes occurs for some reason the next day.

6.4 Balancing market

Tennet is responsible for resolving internal transmission constraints and maintaining the balance of the power system. Both issues are controlled through the E-program.

6.4.1 E-programming

To preserve the system balance in the Dutch power system the Programme Responsibility or E-program has been set up. The E-program is basically a system in which all market parties involved in the use of the network send on a daily basis their planned production, transport and use of electricity for the next day to Tennet. In other words, all market parties, or Programme Responsible Parties, have to declare scheduled market transaction per quarter of an hour for the next day. Using that information as a starting point Tennet can correct any imbalances or internal transmission constrains generated in the system.

Each market party involved can submit changes in an authorised E-programme if he observes or expects a deviation compared to the E-programme in the supply or sourcing of electricity. The energy transactions registered in the E-programme can also be changed because of commercial or contractual reasons. As previously mentioned, programme changes can be submitted until one hour before realisation.

6.4.2 Regulating, reserve and emergency power

If any deviations from the E-programmes exist, Tennet will automatically compensate the difference. The corrections are done with the Regulating, Reserve and Emergency power, which are traded in their respective markets. Table 6.1 outlines the most important characteristics of the three markets.

Table 6.1 *Regulating, Reserve and Emergency markets managed by Tennet*

	Amount [MW]	Objective/aim	Contract system	Technical specifications
Regulating power	250	• Preserving the balance of power demand and supply	Day-ahead bidding	• 7% Minimum regulating speed per minute • 30-Second reaction time
Reserve power	-	• Additional to regulating power • Preventing/resolving transmission constraints	Day-ahead bidding	• No response time applies to reserve power
Emergency power	300	• Preserving the system balance when no appropriate regulating and reserve power is left	Yearly contracts	• Has to be available within 30 minutes

The regulating and reserve markets are made up from bids tendered each day prior to the day of implementation. A single price ladder containing the full complement of regulating and reserve power is built from these bids. The price ladder, which includes upward and downward power, is used to create a dispatch ladder for regulating power, shown in Figure 6.1, and a dispatch ladder for reserve power. The ladders are used for solving internal transmission constraints and maintaining the system balance.

It is important to mention that according to the grid code the producers with a connection to the grid higher than 60 MW have to make available to Tennet the full complement of power they can generate or source. This electricity is considered as reserve power.

6.4.3 Internal transmission constraints

Transmission constraints can be resolved either by implementing grid measures or dispatching reserve power. If Tennet decides to solve the constraint through the latter method, upward regulation or/and downward regulation capacity is then used from the reserve price ladder.

The method implemented by Tennet to solve internal transmission constraints does not provide specific incentives to install additional generation capacity at appropriate congested locations to reduce transmission line constraints. A single market price exists in the Netherlands, and therefore transmission constraints are not explicitly signalled. As a result, the additional costs of upgrading the grid or the benefits of increasing generation in constrained sectors are distributed to all market participants. This system may lead to inefficiencies in the power sector, and discourages the implementation of DG.

6.4.4 Balancing of the system

Tennet's balancing market is used to correct temporal imbalances that arise in the system. Imbalances are solved mainly through the regulating power, yet can sometimes also be done through the reserve power. As described in Table 6.1, Tennet contracts 250 MW of regulating power through tendering bids. Suppliers of this electricity receive a fixed income from Tennet and a balancing price depending on whether the plant is dispatched (positively or negatively). The fix revenue component is financed through the system tariff. Trading is done in blocks of 15 minutes, and upward regulation or/and downward regulation capacity is used from the price ladder, depending on the situation that arises, to solve the imbalance. When no appropriate regulating and reserve power is left then emergency power is dispatched. An imbalance price is determined for each situation:

- If a market party supplies too much electricity (compared to its E-programme) in a situation of under balance he receives the upward regulation price, which is identical to the dispatch price of positive power in so far as no emergency power has been dispatched.
- If a market party supplies too much electricity in a situation of over balance he pays the downward regulation price, which is identical to the dispatch price of negative power.
- If a market party supplies to little electricity in a situation of under balance he pays the upward regulation price.
- If a market party supplies too little electricity in a situation of over balance he pays the downward regulation price.

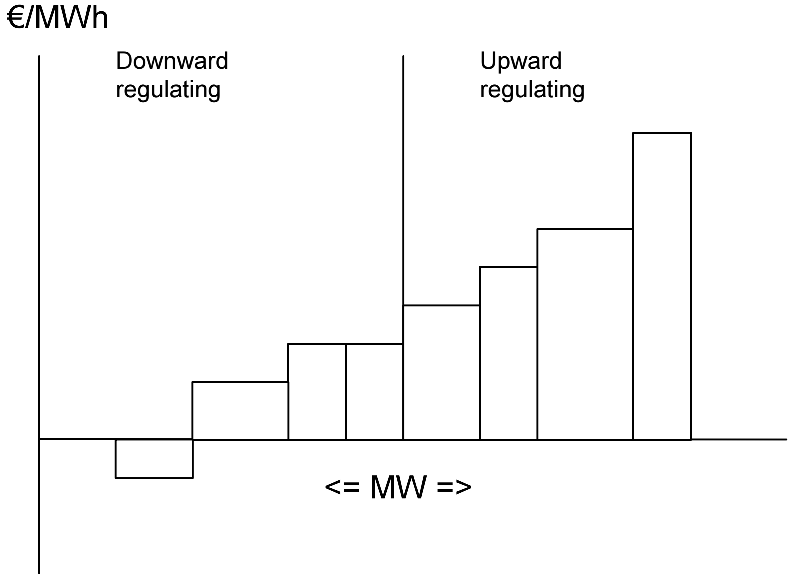

Figure 6.1 *The regulating price ladder of the balancing market*

Plants bid in the regulating, reserve and emergency markets are obliged to effect delivery as soon as Tennet requests to do so. If they fail to do so, the owners must pay a penalty.

6.4.5 Intermittence of distributed generation

Energy firms that contract with distributed generation are faced with a number of constraints, as production levels of these generators are generally uncertain. CHP plants owned by industries, for example, use most of the electricity produced and only supply surpluses of this product to the grid. The dispatch of this electricity is significantly uncertain. The case of wind is more extreme as production depends on highly variable wind levels.

Two different issues are important to mention from this balancing system that can be seen as benefiting intermittent DG. First is the fact that owners of intermittent DG can 'cover' themselves, as the Dutch wholesale market allows intra-day trading though the OTC market until one hour before the dispatch of the electricity. The other is the fact that the balancing market values the generation that helps the market positively, i.e. if a producer generates more than planned in an over balance market, it gets a positive price. This is one important advantage over the UK's NETA system.

7 CONCLUSIONS

The Dutch electricity market is currently confronted with the liberalisation of energy markets on the one hand and the fulfilment of environmental targets put forward in the national and international policy arena on the other hand. Under a liberalised market, the correct regulation of the distribution network is a necessary condition to the development of a sustainable energy sector in general and the fulfilment of the environmental targets in particular.

Governance

Pursuant to various legislative acts dating from about 1997, the regulatory regime applicable to the Dutch electricity sector has evolved into a dynamic regime, featuring an energy regulator (*Dienst uitvoering en toezicht Energie*, or DTe) integrated within the Dutch Competition Authority (*Nederlands mededingingsautoriteit*, or NMa).

In general, DTe conducts the following activities:

- Taking decisions on electricity and gas tariffs.
- Granting licenses for the supply of electricity and gas to captive consumers.
- Developing guidelines and requirements relating to tariffs, customer relations, and service quality.
- Monitoring compliance with various technical codes and tariff guidelines.
- Issuing binding instructions on market participants and imposing orders subject to a penalty.
- Providing advice, upon request, to the Minister, under the 1998 Electricity Act, as amended.
- Providing public information.

DNO Incentivisation

The pricing system that has been implemented to regulate the tariffs of DNOs has an impact on the development of distributed resources in the electricity sector. Under a liberalised market a level playing field has to be in place in order to give neutral incentives to both centralised and decentralised generation.

The Dutch government introduced a price cap system in order to regulate the tariffs charged by DNOs. The system establishes the maximum tariffs firms can charge for their services during the regulatory period, and the tariff reductions per year depend on the x-factor and the inflation index. The x-factor is the discount to promote an efficient operation by network firms. Some conclusions about the impact of this regulatory framework on DNOs are:

- The facts that the x-factors are calculated considering the operational and the capital expenditures means that both variables are benchmarked against other DNOs. This provides the firms with an incentive to minimise both expenditures in order to minimise costs and maximise benefits.
- Due to the unbundling of the sectors, a long-term cost minimisation policy through integrated resource planning cannot be achieved anymore. As the building of new generation decisions are detached from the managers from the grid, DNOs face constraints in determining how and where infrastructure developments should take place in the most efficient way.
- The fact that DNOs are encouraged to minimise operational and capital expenditures is anti-innovative. In other words, as the expenditures of the firms are benchmarked against other firms, none will invest resources in new technologies or managerial systems that are uncertain. This can harm the development of DG.

Distribution Charging

The level of revenues of DNOs is regulated through a price-cap system and collected through tariffs first calculated by DNOs and later approved by the regulator. The x-factor is applied to all of the regulated tariffs (a tariff basket. The tariffs are divided into the use of the connection, the use of the system, and the system tariffs. Some conclusions on the distribution charging and DG are:

- Connection tariffs in the Netherlands depend on the type of connection. Connections until 10 MVA are shallow, regulated and averaged. Shallow is referred to connections charges that only pay for capital and maintenance costs of the connection itself but are not charged directly for other costs incurred by the network operators. Connections bigger than 10 MVA are negotiated and deep. Deep is referred to connection charges that cover all costs raised by connecting to the grid. DNOs have a monopoly on the connection to the grid, and that has raised complaints by operators (specially wind park operators) and different consumers. The Dutch government intends to introduce competition into this activity.
- The connection of DG into the network may increase or avoid investments in the grid. When extra-investments should be performed and shallow connection costs apply, DNOs may, as a result, be discouraged to let new producers connect to the grid, even though the law obliges them to do so.
- Producers that have connections at EHV and HV grid levels have to pay the National Uniform Producer Tariff (LUP), which accounts for the 25 percent of the sum of the total transmission dependent costs of these grids. Consumers have to pay for the rest of the transmission dependent costs in the EHV and HV (75%) grid levels plus the total of the costs in the lower voltage levels. This favours DG, as this type of generation is connected to middle and lower voltage levels grid. In other words, they do not have to pay for any transmission dependent costs.
- Distributed generation may increase or reduce losses in the system, consequently generating benefits or losses to the DNOs. In the existing regulatory system in the Netherlands, costs raised by network losses are socialised. Nonetheless, DG connected to the medium voltage (MV) and low voltage (LV) systems receive a direct subsidy as compensation for reducing net losses (0.1 €ct/kWh dispatched into the grid).

System Dispatch

Decentralised trading arrangements were implemented in the Dutch power market when the new Dutch electricity act was put into force in 1998. As a result, the day-ahead market in the Amsterdam Power Exchange (APX), the bilateral Over the Counter (OTC) market and Tennet's balancing market, are the three main markets that exist where electricity is currently traded. Some conclusions about the system dispatch in the Netherlands and its impact on DG are:

- Access of distributed resources to the APX can increase market liquidity and reduce market power from large producers in its day-ahead market. However transactions costs and information costs are barriers that impede the participation of distributed resources in the power exchange. The aggregation of many small distributed resources under the control of a single manager can be a condition to facilitate market entrance.
- In the Netherlands distributed resources that are independently owned and managed sell the produced electricity through the closed OTC market. Owners of distributed generation plants, such as wind units or CHP plants, mainly contract through long-term bilateral contracts with retailers.
- Owners of intermittent DG can cover themselves, as the Dutch wholesale market allows intra-day trading though the OTC market until one hour before the dispatch of the electricity.
- The balancing market values the generation that helps the market positively, i.e. if a producer generates more than planned in an over balance market, it gets a positive price. This is one important advantage over the UK's NETA system.

REFERENCES

Achermann, T. (1999): *Distributed Power Generation in a Deregulated Market Environment*. Royal Institute of Technology.

APX web page: www.apx.nl.

Council of European Energy Regulators (2001): *Quality of Electricity Supply: Initial benchmarking on actual levels, standards and regulatory strategies*.

DTe (2000): *Guidelines for price cap regulation of the Dutch electricity sector, in the period from 2000 to 2003*. Office for Energy Regulation (DTe). Can be downloaded at www.dte.nl.

DTe (2000): *Tariff Code (Unauthorised Translation)*, Office for Energy Regulation (DTe). Can be downloaded at www.dte.nl.

ECN (2000): Energy Market Trends (EMT) 2000. Can be downloaded at www.ecn.nl.

ECN (2001): Energy Market Trends 2001. Can be downloaded at www.ecn.nl.

Jamasb, T. and Pollitt, M. (2000): *Benchmarking and Regulation of electricity Transmission and Distribution Utilities: Lessons from International Experience*. Cambridge University.

Jamasb, T. Nielsen, P., and Pollitt, M. (2003): *Strategic Behaviour under Regulation Benchmarking*. Cambridge University.

OFGEM (2002): *Distributed generation: price controls, incentives and connection charging. Further discussion, recommendations and future action*. Can be downloaded at www.ofgem.co.uk.

TenneT (2001): *The Imbalance Pricing System as at 1 January 2001*. Can be downloaded at www.tennet.nl.

Wenston, F. (2001): *Accommodating Distributed Resources in Wholesale Markets*. Regulated Assistance Project.