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THE DUTCH RENEWABLE ELECTRICITY MARKET IN 2003

An overview and evaluation of current changes in renewable electricity policy in the Netherlands

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Preface

Since the summer of 2002 ECN Policy Studies has been involved in the preparation of the new support framework for renewable electricity in the Netherlands by advising the Dutch Ministry of Economic Affairs with a study on the level and structure of support needed for various renewable electricity options. This report provides an overview of the recent policy developments. This report is published under the responsibility of ECN Policy Studies. The publication of this report is registered at ECN under project number 7.7515.03.01. The views expressed in this paper are the sole responsibility of the authors. For questions regarding this report you may contact Mr. Emiel van Sambeek via e-mail: vansambeek@ecn.nl, or by telephone: +31.224.564227.

Abstract

Since the opening of the Dutch retail market for renewable electricity in July 2001 the number of renewable electricity customers has increased from about 250,000 to approximately 1.4 million in January 2003. This surge in the demand for renewable electricity was caused mainly by favourable fiscal incentives for renewable electricity production and consumption and further stimulated the growth of the European green certificate market. However, there were several adverse effects associated with the Dutch support model for renewable electricity. The import of renewable electricity resulted in a considerable loss of tax revenues, while not effectively stimulating additional investments in the Netherlands or elsewhere. These adverse effects caused the government to review its renewables policy and subsequently led to the proposal of a new support mechanism in November 2002. This report describes the recently adopted policy changes. Finally, the new support mechanism is evaluated in the light of its stated policy objectives and the future harmonisation of the European renewable electricity market.

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SUMMARY

The favourable fiscal support for renewable electricity through an ecotax exemption on final electricity consumption and a production subsidy from the ecotax revenues, in combination with the opening of the retail market for renewable electricity led to a dramatic increase of the demand as of July 2001. As domestic supply was limited in the short run the majority of the demand growth was met through imports of renewable electricity. These imports, however, created several adverse effects, which recently led to changes in the renewable electricity policy framework.

The surge of renewable electricity imports primarily led to considerable tax revenue losses to the Dutch government. Furthermore, the fiscal incentives provided by the ecotax regulations in the Netherlands hardly stimulated additional capacity investments abroad. As imports principally came from existing installations, the additionality of the policy was very questionable. Moreover, competition from low-cost imports weakened the position of domestic producers and investors. Considering the above complications, the market anticipated changes of the policy framework. Thus the ecotax regulations no longer provided an effective long-term incentive for investment in renewable generating capacity in the Netherlands.

In November 2002 the anticipated policy changes came in the form of a proposal for an amendment to the Electricity Law of 1998, called 'environmental quality of electricity production' (MEP). The MEP aims to increase certainty to investors and improve the cost-effectiveness of renewable electricity support. The MEP provides for operating support through a combination of feed-in tariffs and a reduced ecotax exemption. The feed-in tariffs are financed through an annual levy on electricity connections. They are the primary means to increasing certainty for investors. The reduction of the ecotax exemption seeks to reduce the level of imports, while maintaining the dynamics of the renewable electricity market and associated green certificate trade.

Under the MEP the total level of operating support is determined by the sum of the MEP feed-in tariff and the value ecotax exemption. The government guarantees this total level of support for a period of 10 years after entering into operation. The table below gives an overview of the MEP feed-in tariffs, the ecotax exemption, and the total level of operating support per renewable electricity category.

Table S.1 *Categorisation and MEP feed-in tariffs for renewable electricity [€ct/kWh]*

Technology-energy source	MEP feed-in tariff	Ecotax exemption	Total support
Landfill gas and digestion	0	2.9	2.9
Pure biomass	4.8	2.9	7.7
Mixed streams[1]	2.9	0	2.9
Onshore wind[2]	4.9	2.9	7.8
Offshore wind	6.8	2.9	9.7
Stand-alone bio-energy installations < 50 MW_e	6.8	2.9	9.7
Solar photovoltaic	6.8	2.9	9.7
Wave energy, tidal energy	6.8	2.9	9.7
Hydropower	6.8	0	6.8

In the short run it is expected that imports will not diminish as a consequence of the reduction of the ecotax exemption. There is a vast supply of low-cost renewable electricity available in the

[1] Includes municipal solid waste. The MEP feed-in tariff is granted in proportion to the degree of biologically degradable material, and applies only to installations with a minimum total energy efficiency of 26%.
[2] During a maximum period of 10 years, up to 18,000 full load hours.

EU that can be imported to the Netherlands. In addition, in the short run imports are necessary to service renewable electricity demand in the Netherlands. Thus on the green certificate market domestic producers will continue to face competition from abroad. If the ecotax remains at its current level, imports are likely to diminish in the long run as other EU Member States increase their policy efforts to attain their 2010 renewable electricity targets under the Renewables directive. If the value of green certificates abroad rises above the level of the ecotax exemption, export of green certificates from the Netherlands may even become possible. This would undermine the effectiveness of the MEP in meeting the Dutch renewables targets.

ECN calculations demonstrate that a cost-effective strategy for attaining the Dutch 2010 renewables target would incorporate the possibility of importing. The level of imports is dependent on the policy framework in the Netherlands, support schemes in other EU Member States and the degree of harmonisation in the European renewable electricity market. Most other Member States have opted for renewables support schemes based on a quota obligation or feed-in tariffs. As the future of the ecotax exemption currently is subject of political discussion, the Dutch support scheme would be more likely to evolve into a pure feed-in system. This would close the doors to imports. Instead we recommend that a quota obligation is introduced. Such a quota system should be harmonised with Member States that have a similar system on a reciprocal basis. A quota system can give policy certainty with respect to the amount of renewable electricity consumed in the Netherlands and moreover captures the efficiency benefits of a green certificate market and international trade.

1. INTRODUCTION

1.1 Background

Since the opening of the Dutch retail market for renewable electricity in July 2001 the number of renewable electricity customers has increased from about 250,000 to approximately 1.4 million in January 2003 (www.greenprices.com). This dramatic increase in the demand for renewable electricity was caused mainly by a combination of two factors. First, a very favourable fiscal stimulation of renewable electricity production and consumption allowed suppliers to offer renewable electricity products at the same price as conventional electricity while covering the extra cost of renewable electricity relative to wholesale power prices. Second, the retail market for renewable electricity was opened in advance of the rest of the retail segment. Renewable electricity therefore became a primary tool in attracting new customers and establishing a retail brand. However, there are several adverse effects associated with the Dutch support model for renewable electricity. These adverse effects recently resulted in the introduction of a new support mechanism called the 'environmental quality of power production' (Milieukwaliteit Elektriciteitsproductie, MEP) for renewable electricity in the Netherlands.

1.2 Objective of the report

The developments in the Dutch renewable electricity market have been followed with much interest by renewable electricity traders and producers across the EU for which the Dutch market was an attractive export market. Furthermore, as the Dutch support model is unique in Europe, policy makers, consultants and academics have also been closely following the developments. This report describes the recently adopted policy changes and the developments that brought about these changes. It is targeted at foreign traders, policy makers, academics and consultants that are trying to grapple with the rapidly changing and often complex renewable electricity policy framework in the Netherlands.

1.3 Outline of the report

The report starts with a brief outline of the renewable support mechanism in place between 1996 and 2003. Furthermore, a brief analysis of the problems that led up to the current policy changes is given. Consequently the new renewables support framework will be described. Finally, the report concludes with a preliminary evaluation of the new renewable electricity support framework.

2. RENEWABLE ELECTRICITY POLICY IN THE NETHERLANDS FROM 1996 TILL 2003

2.1 Introduction

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 based on avoided cost, direct subsidies, fiscal investment incentives, and a system benefits charge. As a consequence of the greening of the tax system in the mid-nineties the ecotax or regulatory energy tax (REB) on final energy consumption was introduced in 1996. Renewable electricity consumption was 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. The avoided cost based feed-in tariffs for electricity are gradually phased out as the electricity market is opened to competition. The system benefits charges (MAP) have been abolished at the end of 2000. Other policy mechanisms such as fiscal investment incentives (depreciation allowances) 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 and retail supply of renewable electricity. The market for non-renewable retail customers is scheduled to be opened in January 2004.

2.2 Renewable energy policy targets

Under the EU Renewable Electricity directive the Netherlands was allocated an indicative renewable electricity target of 9% of total electricity consumption in 2010 (European Commission, 2001). In addition, the Dutch government had previously established renewable energy targets in the context of the implementation of the Kyoto Protocol (Ministry of VROM, 1999). In 1995 the government established the long-term target for the penetration of renewable energy of 10% of final energy consumption in 2020 (Ministry of Economic Affairs, 1997). This is equivalent to approximately 17% of total electricity consumption by that time. In view of the greenhouse gas emissions reduction targets for the first commitment period under the Kyoto Protocol the government formulated an intermediate target of 5% of total energy consumption in 2010. This is estimated to be the equivalent of 8.5% of electricity consumption.

Since the opening of the Dutch retail market for renewable electricity in July 2001 the number of renewable electricity customers has increased from about 250,000 to approximately 1.4 million in January 2003. This surge in renewable electricity demand was mainly due to the abovementioned ecotax exemption and production incentive. Encouraged by the success of the renewable electricity market the Dutch government decided that it would seek to achieve its renewable electricity targets on the basis of a voluntary market for renewable electricity (Ministry of Economic Affairs, 2002).

2.3 Description of the regulatory energy tax

The regulatory energy tax or ecotax (Regulerende Energie Belasting, REB) was introduced in 1996 by an amendment to the Law on Environmental Taxes (Wet Belastingen op Milieugrondslag, Wbm). The ecotax established a partial shift in taxation from income taxes to taxes on environmentally damaging activities.

The Regulatory energy tax comprises an energy levy or ecotax on the final consumption of electricity and natural gas. The primary objective of this policy scheme is to stimulate energy conservation by raising the price of energy for small and medium-size customers. The ecotax is collected by the energy supply companies and consequently passed on to the tax authorities. Since its introduction in 1996, the ecotax has been raised several times. The current ecotax on electricity is 6 €ct/kWh, see Table 2.1.

Table 2.1 *Regulatory energy tax (REB) for electricity per user category [€ct/kWh]*

Electricity consumption [kWh]	1996	1997	1998	1999	2000	2001	2002
0-800	0	0	0	0	0	5.83	6.01
800-10000	1.34	1.34	1.34	2.25	3.72	5.83	6.01
10000-50000	1.34	1.34	1.34	1.47	1.61	1.94	2.00
50000-10 mln	0	0	0	0.10	0.22	0.59	0.61
> 10 mln	0	0	0	0	0	0	0
Production subsidy	1.34	1.34	1.34	1.47	1.61	1.94	2.00

In addition to stimulating energy conservation the ecotax is also the primary instrument for promoting the production and consumption of renewable electricity. The consumption incentive arises from the ecotax exemption for the consumption of renewable electricity (nil tariff, Wbm article 36i). This exemption can be claimed by electricity supply companies by surrendering green certificates to the tax authorities. The amount of green certificates has to match the sum of the supplier's renewable electricity supply contracts with their customers. The production incentive arises from a production subsidy (Wbm article 36o) that is passed on to renewable producers by the electricity supply companies from the proceeds of the ecotax paid by non-renewable energy consumers. In 2002 the production subsidy was 2 €ct/kWh. Both the ecotax exemption and the production subsidy apply to electricity from all renewable energy sources, except for waste incineration. Hydropower is excluded from the ecotax exemption since January 2002. Furthermore, both domestic production and imported renewable electricity is eligible for this support. Figure 2.1 explains the relationship between the green certificate system and renewable electricity support based on the ecotax.

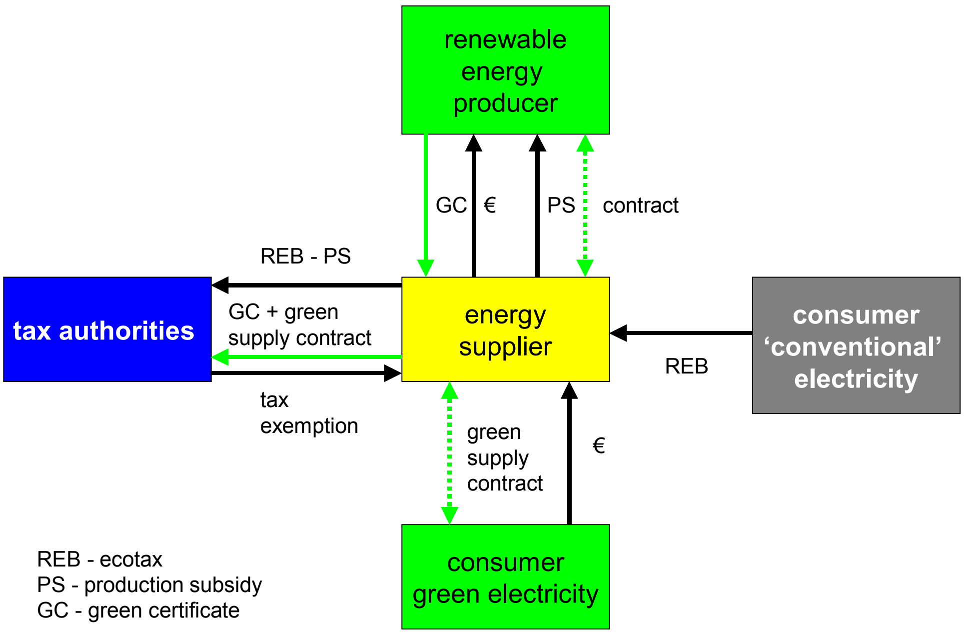

Figure 2.1 *Relation between the Dutch green certificate system and the ecotax*

Electricity suppliers collect the ecotax (REB) from conventional electricity customers. Green electricity customers pay a premium (€) for the green electricity but do not pay the ecotax

(REB). The suppliers buy enough green certificates (GC) from renewable generators to match their supply of renewable electricity to green customers. Furthermore, based on the power purchase contract between the supplier and the renewable generator, the supplier may grant a production subsidy (PS) to the renewable generator from the ecotax revenues. The supplier transfers the total amount of ecotax collected from its customers minus the sum of the production subsidies to renewable generators (REB - PS) to the tax authorities. Moreover, in order to claim the ecotax exemption on renewable electricity consumption the supplier surrenders its green supply contracts along with a matching supply of green certificates (GC) to the tax authorities.

As a result, the Regulatory energy tax supported electricity produced from renewable energy sources up to 8 €ct/kWh, i.e. 6 €ct/kWh from tax exemption and 2 €ct/kWh from the production subsidy. The combined ecotax exemption and production subsidy enable energy suppliers to offer renewable electricity at the same price as conventional electricity, thus removing any financial barrier for customers to switch from conventional to renewable electricity. This has provided a strong boost for the development of the renewable electricity market in the Netherlands.

2.4 Adverse effects of the regulatory energy tax

The Regulatory energy tax has proven to be an effective means for stimulating the demand for renewable electricity. However, this policy instrument also entailed some important adverse effects. These adverse effects principally emanate from the fact that imports of renewable electricity are also eligible for the ecotax exemption and the production subsidy.[3] The high level of support has made the Dutch renewable electricity market a very attractive export market for foreign producers of renewable electricity. As the domestic renewable electricity production is not sufficient to cover the ongoing growth of demand, a large proportion of this demand is met through imports. The total volume of renewable electricity imports increased from 1.4 TWh in 2000 to approximately 7.5 TWh in 2001 (Kroon, 2002). The total cost of avoided tax revenues in 2001 to support renewable electricity is currently estimated at 205 million Euro: 23 million Euro as a consequence of the ecotax exemption and 182 million Euro from the production subsidy (Parliament, 2002), of which the majority goes to imports. During 2002 the import of renewable electricity has increased further, as partly reflected in the green certificate statistics (www.groencertificatenbeheer.nl).

However, fiscal support in the Netherlands has not led to investments in additional production facilities abroad. Most of the imported renewable electricity came from existing plants that - in absence of the higher-value Dutch market - would have operated under their national renewables support scheme and/or supplied their electricity to their national markets. In this way, the growing demand for renewable electricity in the Netherlands will only lead to redirecting electricity flows to its national renewable electricity market, instead of realisation of additional production capacity abroad. Another problem associated with the Dutch reliance on renewable electricity imports is that this supply may be uncertain in the longer run, if these electricity flows are needed by the exporting countries themselves to fulfil their own national renewable energy targets.

Moreover, considering the high level of support, the high cost of renewable electricity imports and the lack of additionality of imports, investors in the Netherlands started to anticipate changes in the support framework. Thus the ecotax-based support framework could not provide the long-term revenue security needed for investments in new renewable energy projects. In addition, domestic producers had to compete against lower cost imports. The resulting reluctance

[3] Import of renewable electricity is subject to certain conditions. Most importantly, the country of origin must fulfil the reciprocity criterion for trading electricity with the Netherlands. In 2002 imports from the following countries were eligible: Austria, Finland, Germany, Norway, Sweden, and the UK. Furthermore, the electricity needs to be physically imported. This is to be demonstrated through the purchase and use of capacity rights on the cross-border interconnections. Moreover, as of January 2002 hydropower was no longer eligible for the ecotax exemption.

of investors to start new projects under the uncertain ecotax regulation was further exacerbated by spatial planning and licensing restrictions. As a consequence the ecotax regulations were ineffective in stimulating new domestic supply.[4] To counter these reinforcing adverse effects policy changes indeed became necessary.

4 An in more depth analysis of the problems in renewable electricity policy is given in 'The European Dimension of National Renewable Electricity Policy Making: An analysis of the Dutch experience', Van Sambeek (2002).

3. THE NEW RENEWABLE ELECTRICITY SUPPORT FRAMEWORK

3.1 Introduction

The Ministry of Economic Affairs identified the outflow of tax revenues and the lack of long-term price certainty for domestic investors as an obstacle to achieving its long-term renewable energy and climate change targets in its Energy Report of February 2002 (Ministry of Economic Affairs, 2002). This report marked the start of a policy process that led to a proposal for a new policy framework for renewable electricity. The proposal followed a policy package that aimed to achieve large cuts in the government budget as a consequence of the downturn of the economy. As indicated before, the Ministry has consistently considered voluntary demand as the main instrument for attaining the 2010 consumption target, thus implying a continuation and further stimulation of the retail market for renewable electricity. This led to a proposal for an amendment to the Electricity Law of 1998 called ‘environmental quality of power production’ (Milieukwaliteit Elektriciteitsproductie, MEP)[5] in conjunction with a lowering of the ecotax exemption and the abolishment of the production subsidy. The lowering of the ecotax exemption from 6 to 2,9 €ct/kWh is set to reduce tax losses due to imports, while maintaining a consumption incentive in order to stimulate the retail market for renewable electricity. In order to provide security for investors the amendment to the Electricity Law of 1998 introduces feed-in tariffs for domestic producers. Thus this proposal represents a shift of emphasis on demand stimulation through the ecotax exemption to a more supply-oriented scheme with feed-in tariffs in the MEP. The total level of support is determined by the feed-in tariffs and the ecotax exemption. The details of the MEP proposal are outlined below.

3.2 General architecture of the new support framework

3.2.1 Role of the renewable electricity producer

The general architecture of the new support framework is best explained by first considering the position of the producer. The producer derives its income from three main sources of revenue: the electricity market, the green certificate market and the MEP feed-in tariff. The producer sells its electricity on the electricity market like any other electricity producer. In addition, based on its production the producer receives green certificates (GC) from the Green Certificate Body and sells these green certificates on the green certificate market at a market price. Finally, based on its metered output the producer receives a MEP feed-in tariff from the national transmission system operator, TenneT. Figure 3.1 provides a schematic overview of the structure of the new support framework and the MEP. The components of Figure 3.1 are further explained in the following paragraphs.

3.2.2 MEP feed-in tariff

In accordance with the MEP, producers of electricity from renewable energy sources can apply for a feed-in tariff. The MEP feed-in tariff is disbursed by the national transmission system operator, TenneT. Once TenneT has approved the application from a producer, the producer receives a contract under which it receives the MEP feed-in tariff. The level of the MEP feed-in tariff is fixed at the level of the tariff in the first year that the MEP tariff was requested for a duration of maximum 10 years following the start of operation of an installation. The tariffs are

[5] While the MEP proposal also covers ‘climate neutral’ fossil-based electricity and CHP, this report only discusses the elements of the MEP proposal that apply to renewable energy sources.

differentiated according to renewable energy technologies and sources (see Section 4.2). Neither the level, nor the development of the tariffs is fixed by law. However, the law does contain a maximum feed-in tariff, which is set at 7 €ct/kWh (Article 72p). The tariffs will be determined annually by the Ministry of Economic Affairs in a Ministerial Regulation. The total level of operating support is determined by the sum of the MEP feed-in tariff and the ecotax exemption. The government guarantees this total level of support for a period of 10 years after the installation enters into operation. This means that future changes in the level of the ecotax exemption will be compensated by an equivalent adjustment of the MEP feed-in tariff such that the overall level of support remains the same for any single producer.

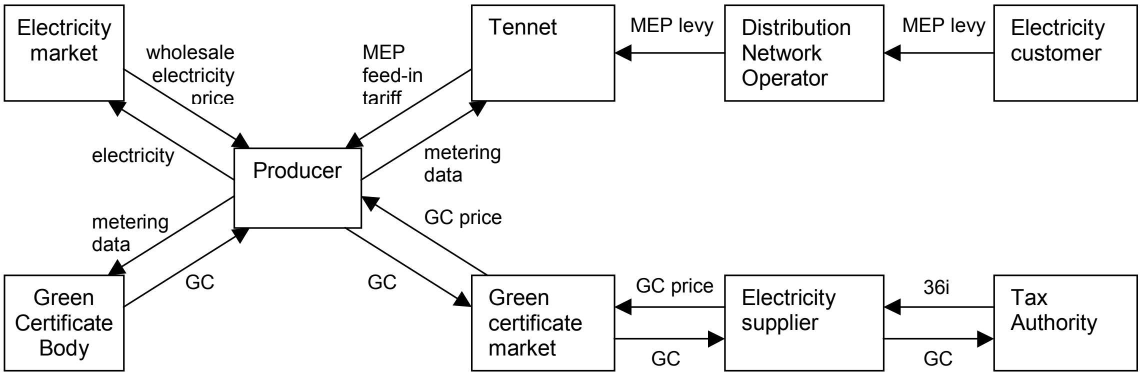

Figure 3.1 *Architecture of the MEP proposal*

3.2.3 Financing of the MEP

The MEP feed-in tariffs are financed through an annual MEP levy on all connections to the electricity grid in the Netherlands. The MEP levy is essentially a type of system benefits charge that is collected by the distribution network operators and consequently passed on to the national transmission system operator. The levy amounts to € 34 per connection in 2003 and is increased to € 40 in 2006. The annual increases of the MEP levy are represented in Table 3.1. The burden of the MEP levy on final energy consumers is compensated by an equivalent reduction in annual ecotax charges. The MEP is therefore financially neutral to electricity customers.

Table 3.1 *Indicative MEP budget for the period 2003-2006*

	2003	2004	2005	2006
Total budget [mln Euro][6]	258	281	298	316
Budget for renewable electricity [Euro]	141	164	181	199
Number of connections[7]	7.53	7.63	7.73	7.83
Tariff [Euro]	34	37	39	40

3.2.4 The role of distribution network operators

The distribution network operators are responsible for the collection of the MEP levy from the customers connected to their grid. The distribution network operators are not allowed to withhold any money as a compensation for the costs of performing this additional task. Furthermore, they are obliged to inform the operator of the transmission system on their levy revenues each quarter. Moreover, as the distribution network operators remain responsible for the metering of the electricity from renewable plants that is delivered into their grid, and for the verification of

[6] The total budget does not only include the production of renewable electricity, but Combined heat and power generation (CHP) and production of climate-neutral fossil energy carriers as well.
[7] Future estimates are based on an annual growth of 1.3%.

the renewable status of energy plants. The Dutch energy regulator (Dte, Dienst uitvoering en toezicht energie), supervises compliance with the provisions of the MEP.

3.2.5 Role of the national transmission system operator

The operator of the national transmission system, TenneT, plays a central role in the MEP system. The MEP assigns to TenneT the responsibility for the operation of the MEP subsidy scheme. For this purpose TenneT will get the status of an autonomous administrative body under the responsibility of the Ministry of Economic Affairs. TenneT is fully owned by the Dutch government.

TenneT's tasks include the monthly collection of the MEP levies from the distribution network operators and the allocation of the MEP feed-in tariffs to renewable electricity producers. TenneT also decides on the eligibility of renewable electricity plants for receiving the MEP feed-in tariffs.

In addition to its functions under the MEP the TenneT continues to fulfil the function of issuing body for the Dutch green certificate system.

3.2.6 The green certificate market

As under the previous support framework a renewable electricity producer is granted green certificates (GC) for the electricity it delivers to the grid. These green certificates can be traded on the green certificate market to provide additional income to renewable generators. The demand for green certificates comes from electricity suppliers who can use the green certificates to claim the ecotax exemption (36I). As indicated above, the ecotax exemption will be lowered from 6 €ct/kWh in 2002 to 2.9 €ct/kWh as the MEP enters into force. Thus the maximum value of a green certificate in the Netherlands amounts to 2.9 €ct/kWh. As the green certificates associated with foreign renewable electricity are also eligible for the ecotax exemption, domestic producers compete with foreign producers on the green certificate market. Hence, the market price of green certificates depends of the level of the ecotax exemption and the competition from foreign sources. Furthermore, in the long run the price of green certificates also depends on the market expectations with regard to the continuity of the proposed Dutch policy framework.

3.2.7 Eligibility

Wind energy, bio-energy (including waste incineration, landfill gas, and digestion), hydropower, solar PV and wave and tidal energy are eligible for support through the MEP. Furthermore, the producer must be connected to the Dutch electricity grid. Moreover, the installation for the production of renewable electricity must be maintained and exploited for at least 10 years. The subsidy may be withdrawn if the installation is not put into use within 3 years after the subsidy was granted. Finally, only installations that went into operation after the 1st of January 1996 are eligible under the MEP. This coincides with the entry into force of the ecotax exemption for renewable electricity. The period that an eligible installation has been in operation before the application for the MEP feed-in tariff is subtracted from the 10-year period that the installation may receive support under the MEP. After expiry of the MEP support period an installation remains eligible for the ecotax exemption.

4. RENEWABLE ELECTRICITY FEED-IN TARIFFS

On assignment of the Dutch Ministry of Economic Affairs, ECN Policy Studies and KEMA investigated the categorisation and financial gap of renewable electricity options. Based on the results of this research and subsequent stakeholder consultation, the Ministry of Economic Affairs established the categorisation and tariffs for renewable electricity under the MEP proposal. This chapter will outline how this categorisation and the different tariffs for various renewable electricity options have been determined.

4.1 Categorisation of renewable electricity technologies

4.1.1 Criteria for the categorisation and tariff setting of renewable electricity options

The starting point for the categorisation of renewable electricity options is a classification based on the various renewable energy sources used: solar energy, wind energy (onshore and offshore), bio-energy (including waste incineration, digestion and landfill gas), hydropower, and wave and tidal energy. As there are many degrees of freedom in establishing a categorisation of renewable electricity options a set of criteria was formulated in order to guide this categorisation and the establishment of the tariffs associated with each category. These criteria are:

Efficiency - the degree of free-riding should be limited to a minimum. The total level of support for a category of renewable electricity should therefore be within a narrow range of the cost of renewable electricity options that fall under a category.

Effectiveness - the level of support should provide a sufficiently high incentive to solicit new investments.

Cost-based tariffs - the total level of support per category is based on the additional cost of renewable energy options relative to the value of electricity on the wholesale market.

Cost-effectiveness - the budget should be spent as cost-effectively as possible. This means that the cost of the marginal renewable electricity option necessary to reach the renewable targets determines the maximum level of the tariffs for all categories. In the Netherlands offshore wind is considered the marginal option for attaining the renewables targets.

Transparency and simplicity - the categorisation should be as simple and transparent as possible in order to provide maximum clarity on the eligibility of and level of support for renewable energy installations. Categories should be clearly demarcated and unambiguously defined.

Practicality - the definitions of the categories should be in line with common definitions in the framework of other policies and the definition of renewable electricity in the Renewables directive. Moreover, the categorisation should capture the kind of projects that the market is currently interested in to develop.

4.1.2 Categorisation of bio-energy options

Bio-energy covers a broad range of fuels, technologies, and scales. Therefore, a further classification of bio-energy options was deemed necessary. To provide some guidance to this categorisation a conceptual categorisation of bio-energy options was made (see Table 4.1).

Table 4.1 *Main categories for energy from biomass and waste*

Characteristic	Stand-alone bio-energy installations	Waste incineration installations	Co-firing in existing power plants
Type of fuel	Pure biomass[8]	Mixed streams	Pure biomass and mixed streams
Fuel cost	0 up to high	Negative	Negative up to high
Type of installation	Stand-alone	Stand-alone	Co-firing in power plants
Type of energy	Mostly electricity and heat (CHP)	Mostly electricity	Electricity only
Scale	Small to medium	Medium to large	Large
Type of project	Newly built	Extension, alteration	Extension

For a further categorisation of bio-energy options and tariff setting, the following considerations are taken into account. First of all, biomass should be converted to electricity as efficiently as possible. Therefore, the size of the installation and the technology used have not been taken into account. Choice of scale and technology will be entirely left to the market. An exception is made for stand-alone bio-energy installations with an installed electric capacity below 50 MW_e (see Section 4.2.3). Such stand-alone installations distinguish themselves through a smaller scale than the utilisation of biomass in waste incineration installations, power plants, and large stand-alone bio-energy installations (> 50 MW_e). This is linked to the fact that autonomous bio-energy installations are usually Combined heat and power (CHP) facilities, whose size is primarily determined by the consumption of heat. Furthermore, considering that mixed streams are not eligible for the ecotax exemption, a distinction needs to be made between pure biomass and mixed streams. Pure biomass is eligible for the ecotax exemption (Wbm art. 36i). The categorisation and resulting feed-in tariff must be made independent from fuel costs as much as possible. These may fluctuate strongly and they are dependent on developments on the European and world biomass and waste market.

4.2 Final categorisation and producer compensations for renewable electricity

The level of the MEP feed-in tariffs is based on the financial gap between the cost of renewable electricity and the value of the electricity on the wholesale market. This financial gap is calculated with a standard discounted cash flow model. The financial gap of a broad range of renewable electricity projects was calculated. Data from actual and proposed projects in the Netherlands was used to define the input assumptions for these calculations. The resulting range of financial gaps - along with the above-mentioned criteria - led to the categorisation of renewable electricity options under the MEP. The level of the MEP feed-in tariff per category is determined by subtracting the value of the ecotax exemption from the financial gap of renewable electricity generation within a certain category. In 2003, the ecotax exemption will amount to 2.9 €ct/kWh and will be adjusted to inflation each year. Table 4.2 presents the final categorisation of renewable electricity options and the associated MEP tariffs that were adopted in Parliament on the 18th of December 2002. These tariffs will be formally confirmed by a Ministerial Regulation in the beginning of 2003. For each category the proposed MEP feed-in tariffs and the ecotax exemption are given. The total level of support is obtained by adding the MEP feed-in tariff and the ecotax exemption. As indicated before the total level of support is guaranteed for a period of 10 years for a producer that has a contract with TenneT regarding the MEP feed-in tariffs.

[8] This refers to biomass that consists of more than 97% biologically degradable material.

Table 4.2 *Categorisation and MEP feed-in tariffs for renewable electricity [€ct/kWh]*

Technology-energy source	MEP feed-in tariff	Ecotax exemption	Total support
Landfill gas and digestion	0	2.9	2.9
Pure biomass	4.8	2.9	7.7
Mixed streams[9]	2.9	0	2.9
Onshore wind[10]	4.9	2.9	7.8
Offshore wind	6.8	2.9	9.7
Stand-alone bio-energy installations < 50 MW_e	6.8	2.9	9.7
Solar photovoltaic	6.8	2.9	9.7
Wave energy, tidal energy	6.8	2.9	9.7
Hydropower	6.8	0	6.8

4.2.1 Pure biomass in power plants

Electricity produced from biomass covers a broad range of technology and feedstock options. The financial gaps of biomass projects vary greatly depending on the type of biomass feedstock and conversion technology used. Certain options have a very high financial gap, whereas others are profitable without any support. To minimise the degree of free-riding the calculation of the MEP feed-in tariff for electricity produced from biomass should be based on a technology and feedstock choice that is in accordance with current and long-term market developments. In the short to medium term uncontaminated pure biomass will be the preferred feedstock for direct co-firing in power plants. This option requires relatively little investment and carries relatively little technological and environmental risk. Furthermore, uncontaminated pure biomass feedstocks are more eligible from a marketing point of view.

The alternatives of using more contaminated pure biomass and mixed streams through indirect co-firing or gasification in power plants seem less promising in the short run. Using contaminated material may cause corrosion, thus creating operational risks. Moreover, additional environmental measures will be required and the plant will increase its vulnerability to more stringent environmental regulation in the future. Finally, investment costs for indirect co-firing and gasification of contaminated pure biomass and mixed streams is high compared to direct co-firing technology. As direct co-firing of uncontaminated pure biomass is likely to be the most favoured technology and feedstock choice, this has been used as the basis for the calculation of the MEP feed-in tariff for electricity generation from pure biomass (small stand-alone bio-energy installations excluded).

Figure 4.1 presents an indication of the financial gap of co-firing in power plants as a function of the available potential of pure biomass, comprising mainly clean wood residues and by-products from forestry and horticulture. There is a substantial potential for electricity generation from biomass at costs ranging from negative to 2 €/GJ. However, it is questionable whether these biomass streams are actually available for contracting on the market. Imported biomass can be contracted more easily, and there is a large potential of imported biomass at prices between 3 and 6 €/GJ. As the international biomass market is still in development, prices may be higher and supply may be restricted on the short term, for the next two to four years. On the longer term, supply will no longer be limited and the potential is expected to be available at a price of around 4 €/GJ. In order to avoid large degrees of free-riding and in accordance with the long-term price development for uncontaminated pure biomass the MEP tariff was initially calculated on the basis of a biomass price of 4 €/GJ. At this fuel price the financial gap of co-firing is 5.3 €ct/kWh. Subtracting the ecotax exemption of 2.9 €ct/kWh, yields a MEP feed-in tariff of 2.4 €ct/kWh. Because fuel prices are higher in the short run this tariff was later increased to

9 Includes MSW. The MEP feed-in tariff is granted in proportion to the degree of biologically degradable material. The production subsidy only applies to installations with a minimum total energy efficiency of 26%.

10 During a maximum period of 10 years, up to 18,000 full load hours.

4.8 €ct/kWh for the coming 3 years. After the first 3 years the tariff will be reduced. The options for a further tariff differentiation of bio-energy are currently being researched.

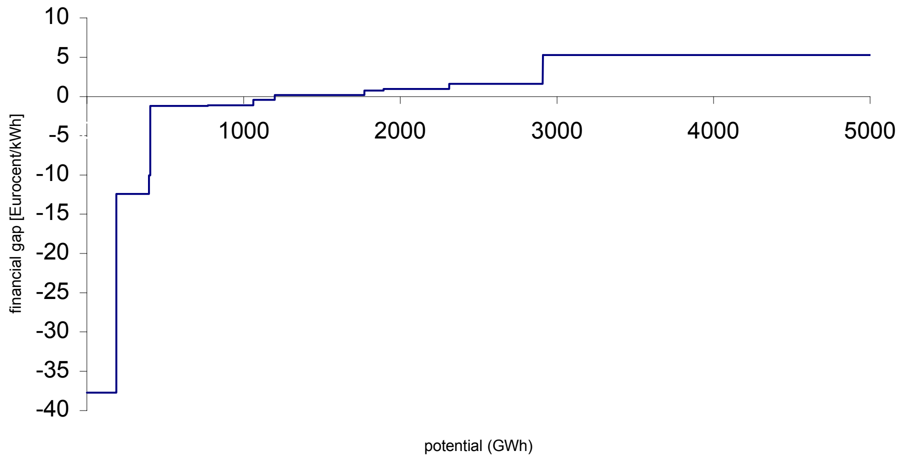

Figure 4.1 *Indicative financial gaps and potential of pure biomass generation in the Netherlands (based on Annex A of the Marsroute study (Novem, 2000))*

4.2.2 Mixed streams in waste incineration installations and power plants

In order to guarantee equal opportunities for both waste incineration installations and power plants to acquire mixed streams, no distinction is made between in these two sectors for processing mixed streams. In practice, highly heterogeneous streams with a very negative price will be used in waste incineration installations. Less heterogeneous streams with less negative prices will be co-fired in power plants. For the biologically degradable part of mixed streams the producer compensation is set at 2.9 €ct/kWh. The MEP feed-in tariff for electricity produced by mixed streams is higher according to the proportion of biodegradable material. Assuming a biologically degradable fraction of 50%, waste incineration installations will receive a feed-in tariff of around 1.45 €ct/kWh. In order to reduce free-riding by waste incineration installations and possible impacts on the waste tariffs as much as possible, the production subsidy only applies to installations with a minimum overall energetic efficiency of 26%.

4.2.3 Stand-alone bio-energy installations < 50 MW_e

Generally, small-scale stand-alone bio-energy installations have higher financial gaps than the maximum MEP feed-in tariff as determined by the financial gap of offshore wind energy. Therefore, they have been allocated the highest subsidy of 6.8 €ct/kWh. In most cases, these installations will also be eligible for the ecotax exemption, as they generally use pure biomass.

4.2.4 Digestion

Landfill gas and digestion have a negative financial gap, meaning that these options are often profitable without additional support. As these options remain eligible for the ecotax exemption, they are not supported further with a MEP feed-in tariff.

4.2.5 Onshore wind energy

The financial gap for wind power proves to be very sensitive to the number of full load hours per year.[11] At a given subsidy for a period of 10 years, the profitability of wind projects may vary to a large extent, depending on the wind regime. The Dutch government has an agreement with the provinces that sets targets of wind energy capacity per province in 2010. Consequently, the MEP feed-in tariff must allow the development of wind energy projects in provinces with much differing wind regimes. From the point of view of ensuring simplicity and transparency of the MEP a uniform tariff was preferred. However, a uniform MEP feed-in tariff may lead to free-riding for the best wind locations, while less favourable sites will not be profitable. Thus only certain provinces would be able to meet their targets.

In order to reduce these effects and still provide sufficient security to various wind projects with a bandwidth of full load hours, a maximum number of full load hours that is eligible for production subsidy has been set at 18,000 for a period of 10 years. This is a little bit lower than the average number of full load hours per year, for a period of 10 years. This measure at the same time provides an incentive for producers to achieve the highest possible production level and it prevents free-riding of installations with a higher number of full load hours.

4.2.6 Offshore wind energy

Offshore wind is the marginal renewable electricity option that sets the highest level of subsidy through the MEP, because, in terms of cost - after biomass and onshore wind - offshore wind holds most promise in providing a large future contribution to the Dutch renewable energy target. The financial gap of offshore wind energy was calculated at 9.7 €ct/kWh. Consequently, the MEP feed-in tariff is set at 6.8 €ct/kWh.

4.2.7 Hydropower, solar PV, wave and tidal energy

Hydropower and solar PV have very high financial gaps. Even if the ecotax exemption is taken into account, this gap is higher than the maximum tariff. The MEP feed-in tariff for these sources is therefore set at 6.8 €ct/kWh, i.e. the highest category. The same tariff is applied to wave and tidal energy. Although the financial gaps for these options have not been calculated, it can be assumed that these will be higher than 6.8 €ct/kWh.

[11] The number of full load hours is determined by the annual energy production of the wind turbine (in kWh) divided by the nominal capacity (in kW). The number of full load hours indicates the number of hours that the turbine would have operated at its maximum capacity in one year. The nominal capacity is the maximum power the turbine can achieve at a given combination of rotor and generator size.

5. OUTLOOK ON THE IMPLEMENTATION OF THE MEP

5.1 Implementation time-frame of the MEP

The MEP passed through Parliament on the 18th of December 2002 and is due to be reviewed in the Dutch Senate in early 2003. At the same time the MEP is scrutinised by the European Commission for compliance with the community guidelines on state aid for environmental protection (2001/C 37/03). If the MEP is approved by both the Senate and the European Commission it is expected that the MEP can enter into force by mid 2003. The preliminary MEP feed-in tariffs for 2003 have been established (see above) and will be enforced by a Ministerial Regulation in early 2003.

5.2 Interim regulations

Until the MEP enters into force several adjustments to the existing support framework based on the ecotax exemption and production subsidy will be implemented with a view to minimising the level of tax losses to foreign production. More specifically, as of the 1st of January 2003 biomass and hydro power will no longer be eligible for the production subsidy. At the same time the ecotax on renewable electricity is raised from nil to 1.75 €ct/kWh, while the ecotax itself is raised from 6.01 €ct/kWh to 6.39 €ct/kWh. Therefore, in the interim a nett ecotax exemption of 4.64 €ct/kWh applies.

6. EVALUATION OF THE MEP

6.1 Import and export of renewable electricity

The abolishment of the production subsidy pursuant article 36o of the Law on Environmental taxes, and the reduction of the ecotax exemption pursuant article 36i of the same law, are set to reduce the volume of import of renewable electricity and the concomitant level of avoided tax revenues. However, in the short run it is uncertain whether these measures will actually lead to a reduction of imports. Given that hydropower is excluded from the ecotax exemption the major source of imports is biomass from mostly Scandinavian countries. There is a large supply of this biomass power available at prices up to around 20 €/MWh. Thus, with an ecotax exemption of 29 €/MWh large volumes of renewable electricity can still be imported.

A requirement for the import of renewable electricity to the Netherlands is the purchase and use of cross-border interconnector capacity. In 2002 the prices in the auction for cross-border capacity were driven up by the production subsidy (36o).[12] Eliminating this production subsidy will cause the prices of cross-border capacity to fall to the 'natural' level as determined by the wholesale electricity market, thus reducing the cost of import of renewable electricity.

Only the electricity that is sold as a renewable electricity product to final customers is eligible for the ecotax exemption, while all renewable electricity was eligible for the production subsidy. A large supply of low-cost imports was competing for both the production subsidy and the tax exemption. As there is more supply internationally than demand in the Netherlands, not all imported renewable electricity could be retailed on the market as renewable electricity. Nevertheless, the production subsidy (20 €/MWh) in itself was high enough to attract large volumes of hydro and biomass power. With the abrogation of the production subsidy (36o) additional low-cost biomass power will be increasing the competition for the ecotax exemption. This may lead to a reduction of the prices of imported renewable electricity.

To ensure that foreign biomass-based generation meets the Dutch eligibility criteria for renewable electricity the Ministry of Economic Affairs has recently issued a Ministerial Regulation that imposes additional administrative requirements with regard to the certification of installations and their feedstock. These additional requirements may pose a barrier to further import of biomass power. In addition, transaction costs related to the trading of green certificates and the requirement to reserve cross-border interconnector capacity for imports may have a slightly moderating impact on the amount of imports.

In the longer run, as other countries increase their policy effort to attain their 2010 target under the EU Renewables directive, the value of renewable electricity in other countries will increase and it can be anticipated that export of renewable electricity to the Netherlands will diminish. In fact, when other Member States open their renewable electricity market to renewable electricity produced in the Netherlands, it is possible that Dutch producers or suppliers export their green certificates. The maximum value of green certificates in the Netherlands is set by the ecotax exemption, which is currently 29 €/MWh. If the value of green certificates in other Member States rises above this level export becomes a possibility. Effectively, the MEP feed-in tariff can be considered an export subsidy when the green certificate associated with the same electricity that was granted the MEP feed-in tariff is exported. Furthermore, as exported green certificates are not consumed in the Netherlands their production will not count for the fulfilment of the Dutch

[12] An in depth analysis of the effects of the production subsidy (36o) is provided in Newbery (2002). This analysis also demonstrates that the ecotax exemption (36i) is not likely to have an impact on the prices of cross-border interconnection capacity to the Netherlands.

target under the Renewables directive. Thus, if export becomes a possibility all Dutch electricity customers may end up paying (through the MEP levy) for an export subsidy (MEP feed-in tariff) on renewable electricity that does not contribute to attaining their own renewable electricity target.[13]

6.2 Allocation of the ecotax exemption

The total level of operating support to renewable generators is determined by the sum of the MEP feed-in tariff and the value of the ecotax exemption. In accordance with the European regulations on state aid the entire ecotax exemption of 2.9 €ct/kWh is attributed to the producers of renewable electricity in the calculation of the MEP feed-in tariffs. However, in practice not the entire ecotax exemption is passed on to producers.

The ecotax exemption is claimed by suppliers of renewable electricity on the basis of the green certificates they surrender to the tax authority. The ecotax exemption can only be claimed if the renewable electricity is sold as renewable electricity to a customer. Generally, renewable electricity is offered to retail customers at the same rate as conventional electricity. This implies that all additional cost of renewable electricity, including transaction cost plus a profit margin for the suppliers are covered by the total of subsidies. The transaction costs of selling renewable electricity on the retail market include green certificate trade, customer switch cost and marketing cost. To determine the portion of the ecotax exemption that is available to be passed on to producers of renewable electricity the above transaction cost, plus a margin for the supplier should be deducted from the ecotax exemption.

Furthermore, the degree to which the ecotax is passed on to producers is also dependent on the competition with renewable electricity imports. As indicated above, there is a large supply of cheap renewable electricity available in other Member States. In particular, domestic suppliers have to compete against biomass power from Scandinavia on the Dutch green certificate market. Low green certificate prices due to competition from imports may reduce the viability of new domestic investments and thus reinforce the trend of increasing imports.

To protect domestic production from competition from foreign sources the ecotax exemption can be lowered, while compensating domestic producers for this reduction through an equivalent increase of the MEP feed-in tariff. However, the principle beneficiaries of the ecotax exemption and import of renewable electricity are the suppliers. The smaller the ecotax the less scope there is for good margins on trading renewable electricity. Suppliers will therefore have less incentive to further promote the retail market for renewable electricity, and as a consequence it would become more difficult to meet the 2010 renewables target through the voluntary market.

To fulfil the demand for renewable electricity in the short run and to meet the renewables target in the long run a certain level of import is necessary. Simulations using the REBUS model suggest that the EU equilibrium price for green certificates lies around 6 €ct/kWh in 2010. This price is the same level as the ecotax exemption in 2002. At this price it would be efficient for the Netherlands to import approximately 1.3 TWh of renewable electricity. In order for the Netherlands to attract these imports and achieve its targets in a cost-effective way the ecotax exemption should be raised in accordance with the value of renewable electricity in the EU market. This, however, requires very close fine-tuning of the level to the ecotax exemption to ever changing market conditions in the Europe. However, the ecotax exemption is divided among the producers and the suppliers of renewable electricity, while the MEP feed-in tariff goes solely to

[13] In the Admire-REBUS project modelling studies are currently being conducted at ECN Policy Studies to assess the interactions between renewable electricity policies in different countries and to derive price scenarios for green certificates in the EU. These studies will provide more insights into the development of the European renewable electricity market and the trading of renewable electricity on the Dutch market.

the producers. Thus the more support relies on the ecotax exemption the more uncertain the investment climate for producers.

6.3 Harmonisation of the EU renewable electricity market

In comparison with other Member States the Netherlands has chosen a unique combination of supply and demand stimulation through the MEP in combination with the ecotax exemption. This exceptional position may cause problems in the transition towards a harmonised EU market for renewable electricity.

Most other Member States have adopted either demand oriented policy instruments or a supply oriented instruments. The main demand oriented instrument is a quota obligation or renewable portfolio standard in combination with a tradable green certificate system. Such a system is in place in Belgium, the UK and Italy, and is planned in Sweden, Denmark, and potentially in Norway. The main instrument targeted toward the supply of renewable electricity is a feed-in tariff. Feed-in tariffs are in place in Germany, Spain, France, Denmark, Austria and Portugal. It is likely that the dominant renewable electricity policy instruments of the accession countries will fall in the same categories.

The EU renewables directive provides a framework for the future harmonisation of the internal market for renewable electricity. In view of the above preferences of countries to choose either a feed-in tariff or an obligation as their main instrument for the support of renewables harmonisation can broadly go in two directions: towards feed-in tariffs or quota obligations. Thus, the question arises how to harmonise the MEP tariffs plus ecotax exemption with a future feed-in or quota system and which should be the preferred option for the Netherlands. It would be difficult to harmonise the Dutch mix of supply and demand instruments in the MEP with a pure feed-in or quota system. Thus a choice for either of the two instruments needs to be made.

Ideally this choice would be based on the merits and disadvantages of both types of instruments in pursuing the policy goals of the Netherlands. Drawing from the implementation experiences in other countries the most important aspects of these instruments are the following. Providing the level is high enough, feed-in tariffs may be very effective in stimulating new investments in renewable generating capacity. Moreover, feed-in tariffs provide a strong investor security. Particularly in the early stages of development a feed-in tariff may therefore be granted to stimulate the growth of this sector. However, because a policy maker never has perfect information on the cost of generating options it is very difficult to set the level of feed-in tariffs at the level that will bring on exactly the generation that is required to attain the policy target in the longer run. The tariff will almost always be set too high or too low. This induces policy uncertainty with respect to the achievement of the targets and the financial implications of the support scheme. Moreover, price intervention inevitably leads to market distortions in both the renewable generation market as in related markets such as the market for biomass feedstocks. Furthermore, it should be noted that feed-in tariffs are not compatible with the liberalisation of the electricity market and the creation of an internal market for renewable electricity in the EU.

A quota system imposes an obligation on e.g. suppliers to meet a certain proportion of their electricity supplies with renewable electricity. In case of non-compliance a penalty will be imposed. The quotum can be set in accordance with the policy target. Providing the penalty is high enough to enforce compliance, a quota system gives certainty with respect to attaining the policy target. The market for renewable electricity in a quota system can be facilitated by a green certificate system. Thus efficiency is provided by the green certificate market, while effectiveness is ensured by the penalty. Moreover, green certificate markets hardly interfere with the electricity market and are therefore more compatible with electricity market liberalisation. Green certificates also provide a mechanism for international trade of renewable electricity and thereby facilitate the creation of an internal market for renewable electricity in the EU. It has been estimated that the total benefits of fully harmonised trade within the EU-15 amount to 15% of the cost relative to a situation in which no international trade is possible to meet the Member State targets (Voogt et al., 2001). For the Netherlands this would mean that it would import a significant portion of its target, thus increasing the efficiency of meeting the target.

The above considerations do not reflect the full spectrum of aspects that have to be taken into account in choosing a renewable electricity policy instrument. However, in any case the political process may overrule the instrument choice based on rational considerations. In this regard it is worth mentioning that the future of the ecotax exemption (36i) is currently subject to political debate. If it were to be abolished the Netherlands is effectively left with a feed-in tariff system, while the future of the retail market for renewable electricity remains uncertain. In view of the future harmonisation of the European renewable electricity market it can be questioned if this is a desirable development. In the authors' view the introduction of a quota system would be preferable to a feed-in system, principally because a quota system seems most fit to ensure that the targets are met in a cost-effective manner.

7. CONCLUSIONS AND RECOMMENDATIONS

In spite of the success of the green power retail market in the Netherlands the renewable electricity support mechanism that underpinned this success was critically flawed in two ways. First, the ecotax exemption on renewable electricity consumption attracted large volumes of renewable electricity imports, resulting in considerable losses of tax revenues to the Netherlands. Second, the uncertainty surrounding the continuity of the ecotax exemption resulted in a poor incentive for investments in domestic production.

The MEP was introduced to counter these adverse effects. The MEP consists of a combination of feed-in tariffs and a lowered ecotax exemption. The MEP feed-in tariffs are the primary means to increasing certainty to investors. The reduction of the ecotax exemption seeks to reduce the level of imports, while maintaining the dynamic of the renewable electricity market and associated green certificate trade.

In the short run it is expected that imports will not diminish as a consequence of the reduction of the ecotax exemption. There is a vast supply of low-cost renewable electricity available in the EU that can be imported to the Netherlands. In addition, in the short run imports are necessary to service renewable electricity demand in the Netherlands.

In the long run as other EU Member States increase their policy efforts to attain their 2010 indicative targets under the Renewables directive imports are likely to diminish. If the value of green certificates abroad exceeds the ecotax exemption, export of green certificates from the Netherlands may also be possible. This would undermine the effectiveness of the MEP in meeting the Dutch renewables targets.

From a cost-effectiveness point of view a certain level of import is desirable to attain the Dutch 2010 renewables target. With the MEP it would be impossible to attract sufficient imports in the long run by increasing the ecotax exemption and at the same time provide certainty to domestic investors.

The MEP is not in line with the trends of selection of support instruments for renewables in the EU. Most Member States have opted for renewables support schemes based on a quota obligation or feed-in tariffs. In view of the future harmonisation of the European renewable electricity market the Netherlands may need to make a choice between these two dominant instruments. While a transition to a feed-in system is most likely from the MEP, we recommend that a quota obligation be introduced. Such a quota system should be harmonised on a reciprocal basis with Member States that have a similar system. A quota system can provide a strong stimulus for investment in domestic renewable capacity. In addition, it captures the efficiency benefits of a green certificate market and international trade.

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