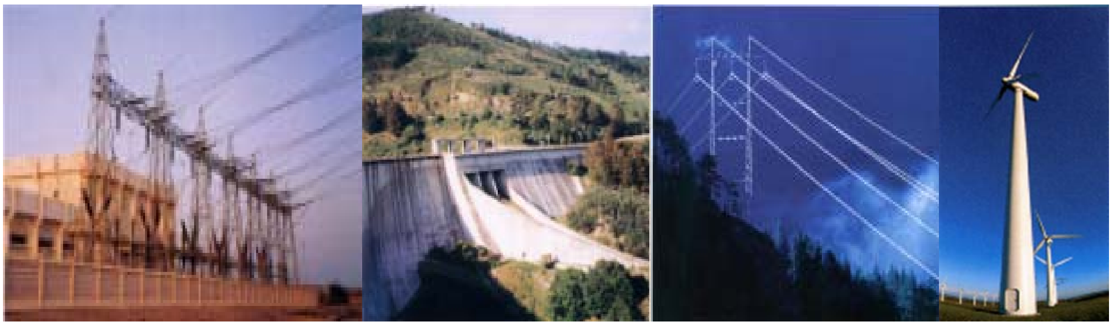
Netherlands Country Report



Innovative Electricity Markets to Incorporate Variable Production

to

IEA – Renewable Energy Technology Deployment

May 2008

IPA Energy + Water Consulting

COWI A/S

SGA Energy

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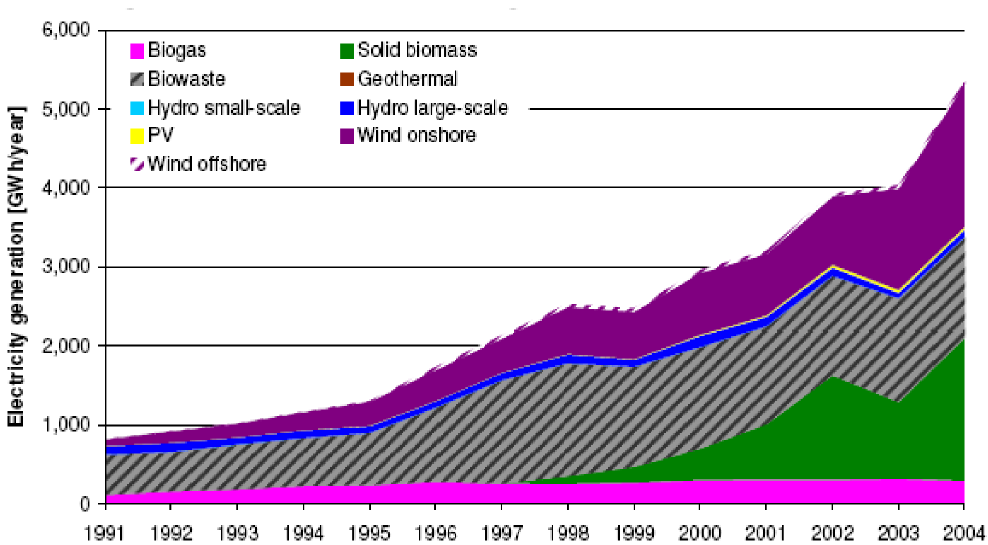
1 MARKET MECHANISMS

This section provides an overview of the operation of renewable generation within the Netherlands power market.

1.1 Renewable Generation Capacity

The majority of renewable generation in the Netherlands comes from biomass (including co-firing, biogas and biowaste) and wind. In 2006, the renewable electricity generation share was 7.6 TWh or 6.5% of total electricity consumption. Out of this a large proportion (2.7TWh) was from wind [1]. Figure 1 shows the proportion of energy generation from each renewable source.

Figure 1: Netherlands electricity generation from renewable sources by type [2]



Decentralised production is very significant in the Netherlands, and about half of total electricity generation is from large CHP plants supplying electricity to local distribution networks. Renewable generation capacity in 2005 was 1,741MW, steadily rising from 284MW in 1990 and 911MW in 2000 [2].

According to the EU Directive, the RES-E share of the Netherlands should reach 9% of the gross electricity consumption in 2010. The coalition agreement of February 2007 set a national target level of energy from sustainable generation sources to 20% by 2020.

In 2002, the BLOW[1] agreement on land-based wind energy was made between the central government and regional authorities with the aim of achieving at least 1,500MW wind capacity by 2010 and each province was assigned a specific target. The target has already been achieved, as the total capacity of wind in August 2007

[1] Bestuursovereenkomst Landelijke Ontwikkeling Windenergie

was 1,655MW (including a 108MW offshore Windfarm in the North Sea). A further 284MW is under construction and should be completed by 2008 [3].

The Government initially had set a target for 7,500 MW of wind generation by 2020 (some 6,000 MW of it offshore). However, various factors, including the publication of a social cost-benefit analysis by CPB and ECN in 2005, led them to abandon this target.

Onshore wind energy requires an environmental license and a construction license. The criteria vary across municipalities. Depending on the context, other licenses might need to be obtained from public bodies (e.g. for construction of wind turbines near embankments, nature reserves, airports, railways or areas with gas pipelines). Wind farms larger than 15MW require an Environmental Impact Assessment (EIA), evaluating the costs and benefits of the wind farm against other alternative projects [4].

For offshore wind energy installations, a license is required for the construction, operation and later decommissioning of the wind farm. An EIA is obligatory. Criteria focus on marine traffic safety, environment and the value of the natural habitat. The license includes not only the turbines but also cables and transformation substations [5].

1.2 Renewable Generation Size

It is not customary in the Netherlands to distinguish between transmission and distribution networks. Instead the distinction is between national and regional networks. Whereas in other European countries voltages of 220 kV and above are usually called transmission and anything below distribution, in the Netherlands lines above 110 kV are called national and lines below are called regional.

Wind farms up to some tens of MW are connected to the regional system. Above this scale they are connected to the national system.

Both national and regional generators can sell their electricity on the wholesale electricity market. However, regional distributed generation is not allowed to offer balancing capacity in the balancing market and it cannot be compensated for providing ancillary services to the grid operator.

The remainder of this document focuses on the arrangements for generation connected to the national transmission network.

1.3 Renewable Generation and Power Markets

There are no special arrangements in the Dutch power markets for renewable generation: renewable generation is treated the same as conventional generation and has to interact with and operate within the rules of the Dutch power markets. Specific characteristics of the Dutch power market include:

- Traded Market

Counterparties can trade power either bilaterally, through brokers or through exchanges. Non-physical players may also be involved in the traded market.

- Self despatch

  Program Responsible Parties (PRPs) decide individually how much power they physically plan to inject and/or withdraw from the system.

- Notification

  Program Responsible Parties (PRPs) have to notify their traded position and planned physical position to the system operator TenneT at a specified point in time.

- Balancing Settlement

  Counterparties are incentivised to balance their physical and contractual positions. Imbalances between these positions are subject to imbalance charges. There is a different imbalance price depending on whether the counterparty is long or short (in relation to their physical and notified position).

- Balancing Market

  There is a balancing market, in which counterparties can submit bids/offers to change their physical flows, allowing the system operator to balance the system in real time.

- Transmission Access & Charging

  Transmission Access is normally firm and charges are levied based on reinforcement work required by the TSO. However, in certain defined regions the TSO has begun to offer non-firm access prior to full reinforcement work under the “runback scenario”.

1.4 Degree of Centralisation

There is no central agency within the Dutch power markets managing the development, operation or marketing of renewable generation projects. It is the responsibility of individual private developers to identify suitable sites for renewable generation, obtain relevant approvals to allow construction and develop and operate the site. The scheduling and trading of generation output is the responsibility of the operator. As a result renewable energy generators take the responsibility for the short and long term trading of their generation output. A central agency (set up by the TSO) does exist to purchase renewable support mechanism certificates.

1.5 Support Mechanisms

Renewable generation receives value for its output by selling power to other market participants. Projects may elect to enter into long term off-take contracts or to trade output in the power markets. Thus, renewable generation should achieve a price related to the power market price for its output. In addition to the market value of the power produced there are support mechanisms designed to increase the value of renewable generation.

1.5.1 Source Specific Premium Tariffs

In July 2003 the Environmental Quality of Electricity Production scheme (Milieukwaliteit Elektriciteits Productie or MEP scheme) was introduced to encourage investment in sustainable energy. Under the MEP scheme, Dutch producers of renewable electricity feeding into the public grid received a fixed fee per kWh for a guaranteed period of ten years. The subsidy was intended to cover only the proportion of cost that is not covered by the market price for electricity. This is distinct from a standard feed-in tariff as generators receive the variable market price or their energy, plus a fixed feed-in component. The value of the tariff differed for each type of renewable generation. For example, off-shore wind received the highest subsidy.

The subsidy is financed by all electricity consumers who pay a levy specifically for this scheme. These tariffs are adjusted annually and tradable certificates are used to claim the feed-in tariffs. A central organisation, CertiQ, issues the certificates and EnerQ (set up by the TSO TenneT) pays out their value.

MEP was set to zero for all new renewables projects in August 2006. The former Dutch Economic Affairs Minister Joop Wijn, said that the goal of 9% sustainable electricity by 2010 would be reached with current submitted projects, so there was no need for continued MEP subsidies. This caused objections from the industry as investors had expected that the MEP would be gradually limited over time and scale, rather than being abolished outright.

In September 2006, Joop Wijn bowed to political pressure and agreed to partially reinstate MEP. €270 million was allocated for new small-scale renewable production projects. The government also promised to make €70 million available to compensate companies that have incurred costs in expectation of receiving subsidies.

The budget for new small-scale renewable projects was increased to €326million in total in May 2007. This amount has been re-allocated from the unused portion of the funds intended to compensate companies for incurred costs due to the cancellation of MEP subsidies. 57 projects have met conditions under the current scheme and will be funded from this amount [6].

The new coalition government embarked on a follow-up programme to the MEP scheme in April 2007, with an expected implementation date of spring 2008[7].

In July 2007, the Ministerial Council agreed on a draft version of the "Stimulation for Sustainable Energy Generation" programme ("Ontwerpbesluit stimulering duurzame energieproductie", SDE) to replace MEP. The subsidy system will vary annually, unlike MEP and will depend on annual energy market prices (therefore representing the difference between the generation cost and market price). [8] [9] [2] The draft focuses on long-term investment security where the timespan for subsidy payment will depend on the technological lifetime of the installation. The announcements on specific categories that will be eligible for support and decision criteria for granting subsidies are unlikely to be before the beginning of 2008.

1.5.2 Energy Tax Exemption

Until 2003, renewable generators were exempt from the Regulating Energy Tax levy (Regulerende Energie Belasting, REB).

With the introduction of the MEP in 2003, the full exemption from REB for renewable energy was replaced by an obligation to pay half the rate paid by thermal generation.. In 2004 the tax rate for renewable electricity was raised again and by 2005 renewable energy was taxed at the same rate as energy from fossil fuels.

To compensate for the reduced REB incentive, the subsidy rates in MEP were raised each time the REB tax incentive was lowered.

1.5.3 Guarantees of Origin and Fuel Mix Disclosure

The green electricity market opened in July 2001, significantly before the complete opening of the electricity market in July 2004. In December 2006 there were 2.4 million customers purchasing green electricity in the Netherlands. This is a drop from 3 million in December 2004, as prior to full market opening, the tax incentive meant the sale price of green electricity was cheaper than standard energy. Since then, the prices for green and standard electricity have aligned [10].

It has been mandatory for electricity suppliers to disclose their generation mix since January 2005. The fuel mix of Dutch energy suppliers is based on:

- Own generation mix: fuel mix is known
- Direct contract with generator: fuel mix is known

[2] Where energy prices are higher, subsidies will be lower and vice versa.

- Purchase from third parties/traders (the APX/OTC/import market): mix is not known and country average is used, which is calculated by an independent consultant.

This fuel mix information is provided in the form of a label to all electricity consumers.

Rather than devise a new Renewable Energy Guarantee of Origin (REGO) system for fuel mix disclosure, existing MEP certificates are used as most renewable and CHP plants are already accredited.

1.6 Trading

The Netherlands is a net importer of electricity. Their annual consumption was 94.7 TWh in 2006, of which 21.5 TWh was imported from Germany and Belgium. Power is traded on an hourly basis.

Electricity can be traded through the following mechanisms:

- Bilateral contracts

  Bilateral contracts between generators and suppliers are normally limited to a maximum period of one to two years due to the relative uncertainty in the market.

- OTC (over the counter) market

  In the OTC market, standardized quantities of electricity are traded, often through brokers and may be bought and sold many times through various intermediaries.

- OTC Endex

  The Endex trading platform was introduced in 2003. It publishes a list of prices for standard OTC products.

- APX (Amsterdam Power Exchange) day-ahead market

  APX is the hourly spot power market. Daily spot imports through the interconnectors are traded on this market and largely determine the volume of power traded.

- APX intraday market

  The intra-day APX market was introduced in September 2006 and allows trading once the day-ahead market has closed. Gate closure is 2 hours prior to delivery and power can be traded at 15 minute intervals.

- Balancing market

  See Section 1.9 and 1.10, which discuss imbalance settlement and system balancing respectively.

- Cross border capacity

  The capacity on interconnectors is allocated via an auction. This is regulated and can be auctioned for a term of year-ahead, month-ahead and day-ahead. The capacity can subsequently be re-sold.

Most electricity is traded on long term markets such as OTC and Endex. Liquidity is limited; the volume of electricity traded on APX in 2006 was 16% of gross consumption. In 2006, there were 29 participants actively trading on APX. Of these the five largest had a market share of 60-70% [11].

The financial guarantees required to participate on the APX market mean that to date there are no wind generators that are individually registered as an APX-member. In practice wind generators only enter the APX market through an existing APX member [11].

1.7 Despatch

Program Responsible Parties (PRPs) submit an electricity program to TenneT (the TSO) for the energy they will deliver by 12 noon on the day before. Technically a PRP can be a supplier, generator, consumer or trader. In practice, the financial and technical requirements of being a PRP-participant mean that to date no wind generators are registered individually, although it is permissible. Instead, wind power is part of a PRP's larger portfolio and based on day-ahead wind forecasts.

There are no special rules for the despatch or curtailment of wind and other renewable generation.

1.8 Notification

In the day-ahead market (APX), participants have to notify their purchase or sell bids and offer before 10 am on the day before the day of delivery.

For each hour, a market clearing price and market clearing volume is determined. Under APX, because the marginal costs for wind are near-zero it is automatically first on the merit order. Wind acts as a price taker in the market and will receive the market clearing price [11].

The Program Responsible Parties (PRPs) inform the TSO, TenneT, of all the transactions they have entered into for the following day in their Energy Program. The Program can be modified up to one hour prior to actual delivery.

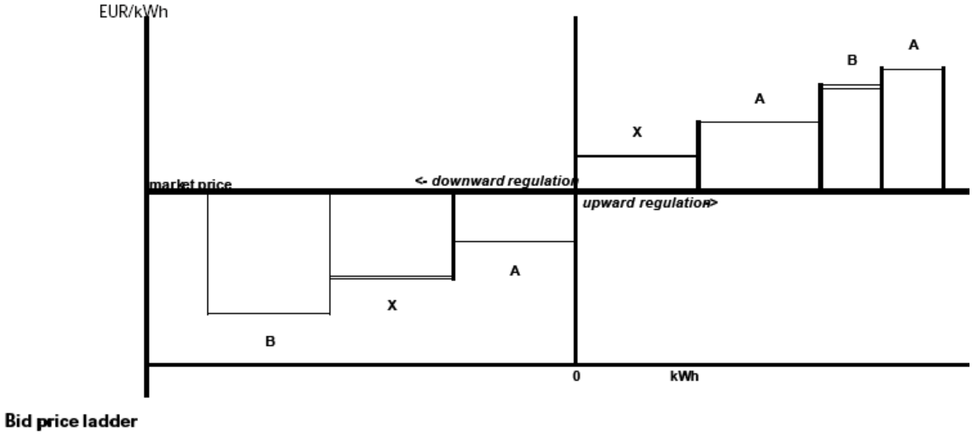
1.9 Imbalance Settlement

The difference between the Energy Program and actual measured volumes is the imbalance for a PRP.

TenneT contracts for balancing power (such as emergency reserve). They receive bids for regulating and reserve power and place these bids in a merit order (bid price ladder), including ramp-up and ramp-down prices.

Purchased regulating and reserve power sets the upward and downward despatch price.

Figure 2: Calculating the despatch price



There is provision for an "incentive charge" as well as the imbalance price, although at present this is set at zero. Changes in the incentive component are required to be made on the basis of objective factors reflecting the operation of the system (height and frequency of imbalance). This charge is intended to magnify the impact of the imbalance price.

PRPs causing imbalance will pay for it and the imbalance price is determined for each situation. The imbalance price is set in 15 minute time intervals.

- **Where TenneT has only regulated downwards:**
    - **Long in a long market:** If a PRP supplies more electricity than programmed in a situation of over supply they pay the downward despatch price (plus the incentive charge).
    - **Short in a long market:** If a market party supplies less electricity than programmed in a situation of over supply they pay the downward despatch price (less the incentive charge).

- **Where TenneT has only regulated upwards:**
    - **Short in a short market:** If a market party supplies less electricity than programmed in a situation of under supply they pay the upward despatch price (plus the incentive charge).
    - **Long in a short market:** If a PRP supplies more electricity than specified in its E-program in a situation of general under supply to the grid they receive the upward despatch price (less the incentive charge).

- **Where TenneT has regulated both upwards and downwards in response to grid constraints:**
  - **Long in a constrained market:** If a PRP supplies more electricity than specified in its E-program they receive the downward dispatch price (less the incentive charge).
  - **Short in a constrained market:** If a PRP supplies less electricity than specified in its E-program they pay the upward regulation price (plus the incentive charge)

- **Where TenneT has neither regulated upwards nor downwards:**

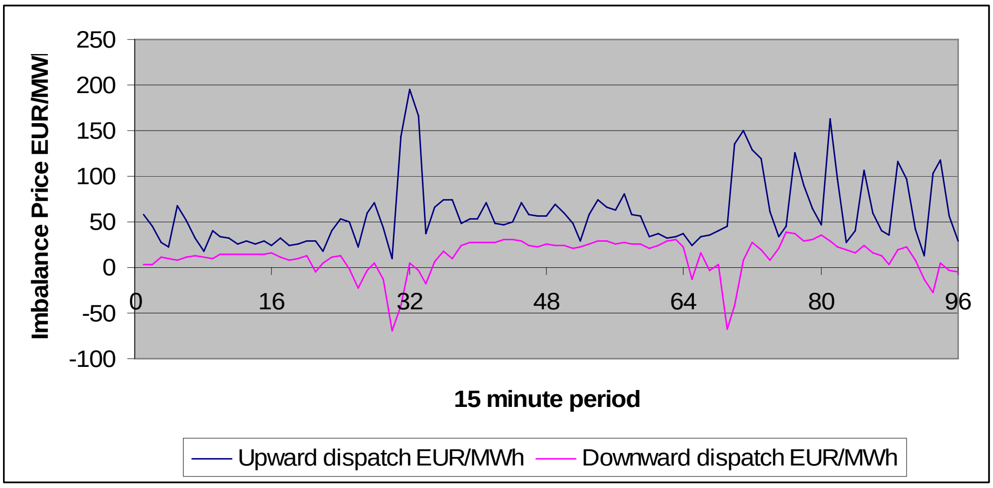
  The price of imbalance when the system is in balance is the average of the lowest bid to TenneT for regulation upwards and the highest bid for regulation downwards.

  - **Long in a balanced market:** If a PRP supplies more electricity than specified in its E-program they receive the imbalance price (less the incentive)
  - **Short in a balanced market:** If a PRP supplies less electricity than specified in its E-program they pay the imbalance price (plus the incentive)

In the event that a PRP has sold regulating power to TenneT in a specific 15 minute program time unit (PTO), the E-program of that PRP will be increased or decreased by the volume of upward/downward regulating capacity requested, thus enabling correct calculation of the imbalance. TenneT settles the requested volume of balancing and/or reserve power with the supplier in a separate transaction [12].

Examples of upward and downward despatch prices are shown in Figure 3.

Figure 3: January 2006 Imbalance prices [13]



The balancing mechanism presents a risk to variable generators such as wind. This is because the sale and buy prices in the market are not symmetrical – the price received for over-generating is lower than the price paid for under-generating. This risk will be managed by the PRP and the generator will be charged a balancing fee. At present for a single wind generator with modern wind forecasting these costs are on average 10-15% of the spot market price [11].

1.10 System Balancing

PRPs are responsible for balancing their portfolio in advance through their various transactions. PRPs account for their transactions in Programs (T-programs for consumption or production per connection, E programs for the balance and the specifications compiled per PRP). E-programs are the basis for balancing and have to be provided to TenneT by 12 noon on the day before, although they can be altered or amended up to one hour prior to actual delivery. TennetT then ensures that power balances in real time on a 15 minute basis. To do this TenneT contracts for balancing power (such as emergency reserve).

The standing cost of contracting for reserve/control power is passed through to consumers through a system services tariff. The costs for regulating power required due to a party being out of balance is recovered from the PRPs through imbalance charges.

In view of the fact that program deviations are mostly penalized, the PRP will normally try to minimize them. It can do this by buying/selling power and submitting program amendments up to an hour before real time. The buying and selling of power can be conducted through various markets, including the intraday market. Once the PRP has made detailed agreements, all parties involved will submit new E-Programs to TenneT and the imbalance will cease. TenneT must receive consistent changes from all PRPs involved in a transaction.

TenneT and the other grid companies see to it that the actual production and consumption is metered per PRP. TenneT settles the discrepancies between program and actual quality and invoices or pays PRPs as appropriate.

1.10.1 Balancing Variable/Wind Generation

A technical challenge associated with the integration of wind-powered production capacity is supply-demand balancing. A study by KEMA and the Technical University of Delft has shown that, in the context of second-to-second and minute-to-minute balancing, the impact of 6,000 MW of wind capacity can probably be managed adequately within the present system, since with this amount of installed capacity a drop is less significant than the failure of a large power plant [14].

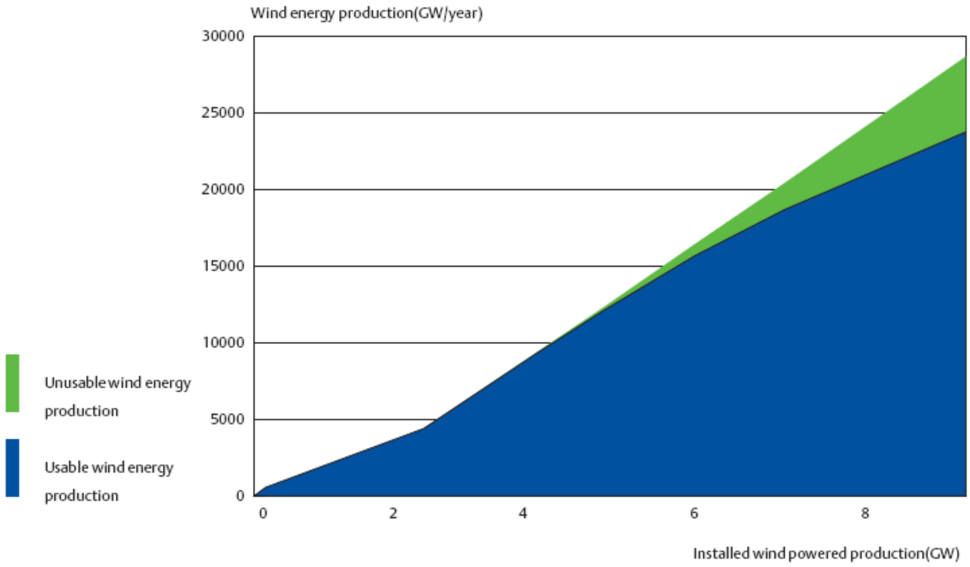
Where real time supply-demand balancing is concerned, TenneT manages the unpredictability associated with wind power within the system, so that supply and demand can be kept in balance at all times. The principle that they follow is that all forms of generation continue to be treated equally.

Therefore, they follow a "causer pays" principle in system balancing (see Section 1.9).

TenneT and the Technical University of Delft have together undertaken an exploratory simulation study. The analysis indicates that, as wind-generation increases "minimum-load problems"[3] are more likely to occur. This results in a increase in unused wind energy.

Given an overall wind-powered production capacity of between 2,000 and 4,000 MW, the problems are minimal and can be addressed by operational measures. However, if the installed capacity exceeds 4,000 MW, the amount of unusable wind power production is sufficiently great (see diagram below) that additional systematic responses are required. Solutions that have been suggested include the installation of heat buffers or auxiliary thermal boilers at combined heat and power plants, the application of load management techniques or the use of energy storage systems.

Figure 4: Usable wind energy production as a function of the installed wind-powered production capacity [14]



A high proportion of the Netherlands' generating capacity consists of combined heat and power (CHP) units. Reductions in the electrical output of the CHP facilities can be achieved by shutting such units down or by firing up thermal boilers. Therefore in the Netherlands, higher levels of wind power penetration may cause an increase in heat production at thermal units.

Another consequence of increased variable generation could be that that the size of the reserve required in the system has to be increased in order to absorb the fluctuations in output. This in turn means that more units have to be operated under partial load.

[3] In periods when load is low, the total generation may exceed demand. Under such minimum-load situations, variable production may need to be reduced.

2 CROSS BORDER TRADING

The Netherlands has the capability to import/export to Belgium and Germany, and trade will shortly be taken up with Norway.

Overall the Netherlands is a net importer of electricity, about 20% of its annual consumption was imported in 2006.

2.1 Current Cross Border Flows

In its capacity as administrator of the national high-voltage grid, TenneT manages the cross-border interconnections with Belgium and Germany (synchronous, alternating current) and Norway (asynchronous, direct current).

In determining the capacity to be made available, TenneT takes the following factors into account: the physical properties and availability of the connections and the underlying grids, maintenance of a so-called ‘single failure reserve’ (n-1 criterion), reserving capacity for mutual aid and assistance for neighbouring TSOs, and the expected electricity transmissions across the European grid.

Apart from the NorNed cable, which is due to come online in March 2008, the transmission grid currently has five cross-border interconnections: two with Belgium and three with Germany with a total physical capacity of 7500 MW (Table 1).

Table 1 Existing International Interconnections [15]

FROM	TO	Type AC/DC Single/Double	U,kV	P,MVA
Meeden (Nl)	Diele (D)	AC double + PSTs	380	2 x 1000
Hengelo (Nl)	Gronau (D)	AC double	380	2 x 1790
Maasbracht (Nl)	Rommerskirchen/Siersdorf (D)	AC double	380	2 x 1710
Maasbracht (Nl)	Gramme/Meerhout (B)	AC double	380	1 x 1350/1 x 1420
Geertruidenberg (Nl)	Zandvliet (B)	AC single	380	1 x 1645
Borssele (Nl)	Zandvliet (B)	AC single via 380/150 kV transformers	380	1 x 450

The total sum of the capacity is 14 865 MVA. Taking into consideration the actual flows in Germany, Belgium and the Netherlands, the (N-1) reserve margin and the TRM (300 MW) a total cross-border capacity of 3850 MW (ATC) is available for the market.

2.1.1 Congestion on Interconnectors

Congestion on the interconnectors is caused by insufficient physical capacity on the one hand, and by sub-optimal outcomes associated with the current system of capacity allocation on the other hand.

The interconnectors with Germany are fully utilised 20% of the time and interconnection capacity with Belgium 19% of the time. It is not possible to import more power during those hours. There is also unexploited potential. Available import capacity is not always fully utilised at times when electricity prices elsewhere are lower. For 50% of the hours in which the Dutch electricity price is higher than in Germany or France, there is under utilisation of interconnection capacity.

2.1.2 Netherlands-Germany

Capacity:	Germany to Netherlands	4000* (4870)
	Netherlands to Germany	3900* (4817)

* Depends on wind situation in Germany

Meeden – Diele

In 2006, aggregate flow into the Netherlands from Germany was 3,665 GWh and aggregate flow into Germany from the Netherlands was 285 GWh [16].

Hengelo – Gronau

In 2006, aggregate flow into the Netherlands from Germany was 6,248 GWh and aggregate flow into Germany from the Netherlands was 12 GWh [16].

Maasbracht – Rommerskirchen/ Siersdorf

In 2006, aggregate flow into the Netherlands from Germany was 9,347 GWh and aggregate flow into Germany from the Netherlands was 27 GWh [16].

2.1.3 Netherlands-Belgium

Capacity:	Netherlands to Belgium	1900 MW
	Belgium to Netherlands	2000 MW

Maasbracht – Meerhout/Graemme

In 2006, aggregate flow into the Netherlands from Belgium was 2,817 GWh and aggregate flow into Belgium from the Netherlands was 3,769 GWh [16].

Zandvliet – Geertruidenberg/ Borssele

In 2006, aggregate flow into the Netherlands from Belgium 1,614 GWh and aggregate flow into Belgium from the Netherlands was 1,305 GWh [16].

2.1.4 Netherlands – Norway

The NorNed project saw the installation of a submarine high-voltage cable which interconnects the Dutch and Norwegian electricity grids. With a total length of 580 kilometres, the NorNed cable has a capacity of 700 megawatts (MW).

A fault occurred on the cable before Christmas 2007 and operation to repair the NorNed cable has been hindered by enduring poor weather conditions.

Start of low power testing is aimed for March 2008. The NorNed cable between Norway and the Netherlands may become available for trading of electricity in April, however progress is still dependant on weather conditions.

This report nevertheless includes the NorNed trading rules which were finalized in February 2008.

2.1.5 Potential Future Interconnector Capacity

As regards transmission capacity investments on the Dutch borders, two projects are under consideration: the BritNed link to the Netherlands (covered in the GB section), and a new interconnector between between Doetinchem (Netherlands) and Niederrhein (Germany). This interconnection has been proposed to increase the capacity available for transfer between the two systems.

However, continuing congestion on the Dutch interconnectors is not only subject to investments in the interconnectors but also within neighbouring countries. TenneT [14] identifies the following projects:

- Installation of phase shifters in the Belgian grid, planned for December 2007. Joint Dutch/Belgian analyses suggest that this upgrade will increase the capacity for power importation to the Benelux by at least 300 MW. This forecast was endorsed by Elia in its development plan for the period 2003 to 2010.
- Possible commissioning in 2007 of phase shifters in E.on's transmission grid in northern Germany. Although this move is intended primarily to ease problems within the German grid, it is also likely to facilitate the exportation of power to the Netherlands. However, it is difficult to ascertain whether benefits will be experienced under all circumstances.
- Creation of a 380-kV north-south link in Germany. The Deutsche Energie-Agentur (German Energy Agency, or DENA) published a study entitled 'Planning of the Grid Integration of Wind Energy in Germany Onshore and Offshore up to the Year 2020' [17], which suggested that the creation by 2012 of a robust link between northern and southern Germany would be of fundamental significance for the distribution of power from wind farms in northern Germany. If this link is realised, it is reasonable to suppose it will increase the safe transmission capacity of the Dutch-German interconnectors. However, it is not certain that the project will go ahead within the

suggested time frame. The level of public opposition met during the licensing procedure may be of particular significance in this regard.

2.2 Cross Border Capacity Mechanisms

Capacity is allocated through explicit and implicit auctions organised in collaboration with the foreign TSOs.

2.2.1 Netherlands – Belgium - Germany

In spring 2000 the four Transmission System Operators (the Belgian ELIA System Operator NV, the Dutch TenneT and RWE and E.on Netz from Germany) implemented the joint auctioning of cross border electricity transfer capacity through TSO Auction BV (a wholly owned subsidiary of TenneT).

The TSOs of France (RTE), Belgium (Elia) and the Netherlands (TenneT) allocate the available daily capacities through the market coupling mechanism which is operated by the electricity exchanges of France (Powernext), Belgium (Belpex) and the Netherlands (APX).

- ***Products and Auction Procedure***

  The available capacity for the auctions is jointly determined by the involved TSOs and given to the TSO Auction Office.

  The available capacity is allocated to the various auctions in a prescribed manner. Capacity is offered in units of 1 MW with a minimum of 1 unit. Capacity for annual and monthly terms can be profiled on a day-by-day basis throughout the term at the time of purchase, and likewise the capacity for day transports is can be bought in an hourly profile.

  Market parties bid for both import and export capacity in explicit annual, monthly and day-ahead auctions. (On the Belgian-Dutch border, daily auctions are implicit). If there is sufficient transmission capacity to meet demand in full, the price for this capacity (the clearing price) is €0. In the event of scarcity, that is if the demand for capacity exceeds the supply of capacity, the clearing price is equal to the lowest offer accepted.

- ***Resell or Transfer***

  TSO Auction BV allows participants to return or to transfer obtained capacity.

  When a participant has obtained capacity at and auction for a term of a month or a year, which they subsequently do not wish to use, the participant can transfer the capacity (or a part of it) to another registered participant or resell capacity to TSO Auction. Capacity resold to TSO Auction will be added to the capacity available to be sold within subsequent the monthly or daily auctions. Any revenues from the resold capacity will be passed back to the original purchaser.

- ***Capacity Rights: "use it or loose it"***

  Interconnector users that have purchased capacity on the monthly or yearly auctions are obliged to notify TenneT at the latest by 0800 hrs on the day prior to the transmission whether they intend to use the capacity.

  Capacity which is not nominated is made available for the day-ahead auction without compensation.

  Parties who have been allocated import capacity on the day-ahead auction are obliged to offer the same quantity of electricity on the Dutch side of the border on the Amsterdam Power Exchange spot market, the APX. Any capacity which is not sold on the APX reverts to TenneT.

2.2.2 Netherlands – Norway

The originally intended market coupling between the power exchanges Nord Pool Spot and APX cannot be implemented immediately because Gate Closure Times need to be harmonized. Statnett and TenneT have therefore decided to develop an explicit auction as a temporary trading solution for the NorNed cable for which approval by Dutch regulator DTe has been obtained. Difficulties persist as regards the unwillingness of the Belgian and French exchanges to share data with NorNed.

The auction time schedule will be as follows:

The transfer capacity available for nomination on the day of execution is published on the auction websites no later than 09.15 hrs of the preceding auction day (D-1). Bids can be filed until 09.45 hrs. The results of an auction are published on the auction website no later than 10.15 hrs, immediately after each bidder has been informed individually of the result of its bid or bids, as the case may be.

The NorNed parties seek to realise a full market coupling across the NorNed interconnector between the Nordic day-ahead market and the Central West European (CWE) market coupling, by January 2009. Statnett and TenneT are requesting the necessary approvals from the respective authorities in Norway and in the Netherlands, to implement the intended temporary explicit auction trading solution for NorNed. The approvals from the authorities are necessary conditions to go live.

2.3 Cross Border Trading

The importation of power into the Dutch market is currently attractive because of the availability of production facilities with lower variable costs outside of the Netherlands, particularly in France (nuclear plants) and Germany (coal-fired plants). The power from these facilities displaces power produced more expensively at Dutch natural gas-fired plants.

Capacity is closely reconciled with the Belgian and German TSOs on a daily basis, as the grids exert significant influence on one another and the expected load flows on the cross-border interconnections co-depend on the generation scenarios in the various countries.

In general, congestion occurs for imports from Germany and Belgium towards the Netherlands. The prices in this direction are generally high.

For exports there is generally little or no congestion.

- ***Auction Timetable***

  Day Auction
  In the Day Auction participants can obtain capacity per hour for the next day. Every morning at 8.30am the available capacity is published. At 9.00am on D-1 the actual auction takes place. The prices are formed and the capacity divided. Participants will be informed about their results before 9.30am.

  Month Auction
  Every tenth working day of the month there is a monthly auction. The auction is electronic in order to obtain capacity for the next month. The capacity will be obtained for every hour of the month.

  A few days before the auction participants can send in their bids. These bids have to be in before noon the day of the auction. Within two working days after the auction participants will be informed about the outcome.

  Year Auction
  At the end of the year, an auction is held for the capacity of next year. At this auction participants will obtain capacity for every hour of the next year.

- ***Future Outlook***

  Market coupling between the Netherlands, Belgium and France, Germany and Luxemburg (Central Western European Region) has been planned for 1 January 2009 by the Memorandum of Understanding in the Central Western European region. This was signed on 6 June 2007.

  Market coupling between these four markets would achieve gate closure harmonisation and market coupling of the CWE region at

12:00 CET (as recently confirmed), while removing the hurdle for market coupling across the NorNed cable with the Nordic region. This would eventually allow deeper integration of markets in this region, improving competition and market liquidity.

2.4 Renewable Support Mechanisms

2.4.1 Netherlands

The Netherlands phased out the Green Certificates scheme in 2004 with the introduction of Guarantees of Origin certificates which are also tradable.

2.4.2 Belgium – Green Certificates

The federal and Flemish governments have developed regulations under which the system operators have to buy green certificates at a set minimum price. Elia then sells the green certificates on to the market, giving suppliers the chance to purchase any certificates they are missing. A green certificate is written proof that 1 MWh of electricity is generated using renewable energy sources such as water, wind and the sun. The certificates are issued by the authorities. To date, Elia has sold green certificates to the market seven times. The price indicates the market value of the certificates [18].

2.4.3 Germany

The German Renewable Energy Sources Act (EEG) is valid within the German economic zone. As the main support mechanisms within this law, the feed-in tariff, priority grid access and purchase obligation, is applicable to generators and TSOs within the German network only, cross-border trading of electricity is hence not affected by this law.

2.4.4 Norway

In Norway, support levels are low even though most electricity production is based on renewable energy sources. There is an established goal of introducing a minimum of 3 TWh of wind power by 2010. This goal was originally accompanied by a support scheme, however this scheme has since been phased out. While lobbying has taken place for a tradable Green Certificates Scheme, negotiations to this end broke down in 2006. Instead, a feed-in tariff is being introduced.

2.5 Utilisation for Variable Generation

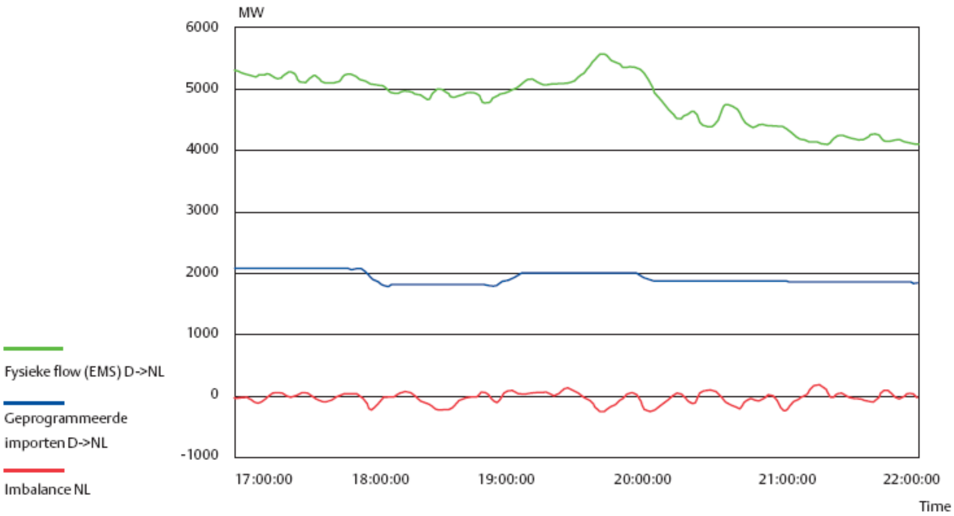
TenneT already has to deal with occasional undesirable load situations brought about by the high concentration of wind-powered production capacity in northern

Germany. The limitations of northern Germany's power grid are such that, when a lot of wind power enters the grid, considerable loads are placed on both the local infrastructure and the cross-border links between the Netherlands and Germany.

The Belgian HV grid, which is interconnected with France, The Netherlands and Germany, often experiences transit power flows. Consequently, the capacity of the grid to absorb wind power is partly determined by the transit flows to and from these three countries.

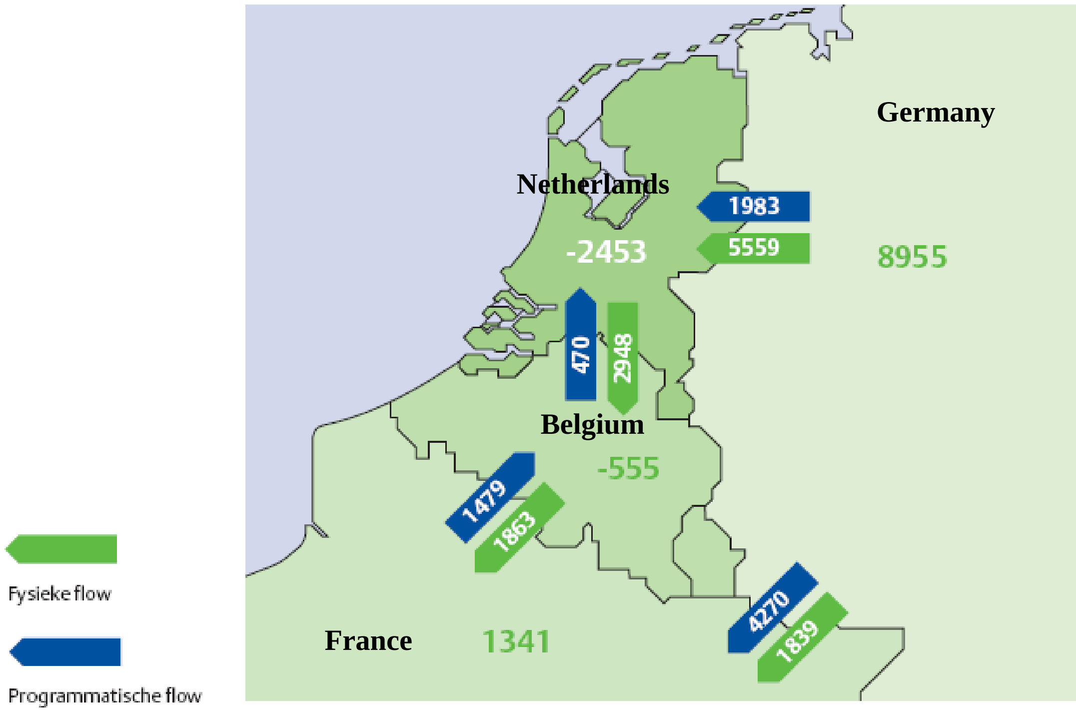
As the following graph (Figure 1) illustrates, actual transmissions over the cross-border links can deviate from programmed imports by a factor of almost three. This leads to transit flows that go from Germany, via the Netherlands to Belgium/France, and finally return partially to Germany (Figure 2).

Figure 5: Divergence of actual cross-border flows (green) from programmed imports (blue) from Germany[4]



[4] Situation on 11 March 2005, between 5pm and midnight [14]

Figure 6 Physical and programmed flows to and from the Netherlands[5]



The current Dutch interconnections should be able to cope with a capacity of 4,700MW available to the market. However, this remains academic for the time being due to bottlenecks in the grids in other countries resulting from the impact of strong load flow fluctuations in the North-western European grid. These fluctuations are due to the injection by the many wind turbines in Northern Germany of inherently variable output, which is determined by wind force in real time. Fluctuations can also sometimes occur due to the dispatch of conventional generation units that can at times vary quite a bit from their pre-real time schedules, in the surrounding countries. All these factors affect the load flows in the various transmission grids and thus, the transit flows that enter the Netherlands via one interconnector and leave the country via another. This is causing the margin of available capacity on the interconnections to be effectively reduced. The upgrading of the internal grids in Germany and Belgium will thus have a positive impact on the available cross-border transmission capacity.

2.5.1 Alternative Congestion Management Methods

To prevent problems with transit flows in the short term, TenneT [14] decided to keep additional capacity available on the cross-border links when forecast wind power production in Germany is between 8,000 and 12,000 MW.

At the operational level, it is also possible to adjust the grid configuration or to use the phase shifters at Meeden to distribute the flows as efficiently

[5] Situation on 11 March 2005, 19.40h [14]

as possible amongst the various interconnectors between the Netherlands and Germany.

Finally, transit flows can be managed by means of cross-border redispatch. This measure is used when it appears from operational preparations that the overall Dutch-German interconnector capacity is insufficient to cope in the event of a fault on one of the crossborder interconnections. Cross-border redispatch involves reducing the output of power plants on one side of the border and increasing the output of those on the other side, in order to exert a positive influence on transmissions.

While these measures are intended as temporary solutions, a more permanent solution would depend on upgrading Germany's high-voltage transmission grid.

3 GRID PLANNING

This section investigates some of the issues associated with integrating renewables within the transmission and distribution grid.

The Electricity Act 1998 regulates operational activities relevant to exploiting the electricity networks. In the Netherlands, separate companies are charged with operating these networks. In the Netherlands there are currently 22 network administrators, including TenneT, the state-owned Transmission System Operator (TSO) and regional network operators.

In its Energy Report 2005, 'Nu voor later' ('Now for Later'), the Dutch government proposed working with the private sector to set the country on a transitional path towards a sustainable energy supply system. Within this sustainable system, (offshore) wind energy is to play a leading role. The government initially envisaged the creation of a sustainable energy supply system with 7,500 MW of installed wind-powered production capacity (some 6,000 MW of it offshore) by 2020. However, various factors, including the publication of a social cost benefit analysis by CPB and ECN in 2005, persuaded the government to abandon this target and adopt a more phased approach to the development of wind farms.

Nevertheless, the expectation is that, over the next ten years, substantial progress will be made along the transitional path, through the creation of wind-powered production capacity off the Dutch coast.

3.1 Grid Investment

TenneT is the Dutch Transmission System Operator with the responsibility of monitoring the continuity and security of the electricity supply in the Netherlands. As part of this function they invest in the national transmission grid and take care of its administration.

This includes the maintenance of the grid, grid planning, advice on possible new installations to be constructed and monitoring whether the grid needs to be altered.

TenneT manages the infrastructure of the Netherlands 380 kV and 220 kV grid and the cross border connections. In addition, from the 1st January 2008, TenneT became legally responsible for the management of all high-voltage networks from 110 kilovolt (kV) and higher. The reasoning behind transferring the 110 kV networks is that, when managed by one independent party, a more targeted investment in the national grid can be realised. With the transition of the 110kV network to TenneT, the number of high-voltage connections managed by TenneT will triple from 3,000 to 9,000 kilometres.

In its 5 year Quality and Capacity Plan [14], TenneT is required to set out:

- quality targets

- demonstrate that it may be presumed to have an effective quality management system for its transmission service
- demonstrate that it may be presumed to have sufficient capacity to meet the overall demand for the transmission of electricity.

In the formulation of this Quality and Capacity Plan, TenneT is guided by the ministerial regulations ‘Kwaliteitsaspecten netbeheer elektriciteit en gas’ (‘Quality Aspects of Electricity and Gas Grid Management’) and the Office of Energy Regulation’s draft policy guidelines ‘Beoordelingssystematiek voor het kwaliteitsbeheersingssysteem en het kwaliteits- en capaciteitsdocument van de netbeheerder elektriciteit en de netbeheerder gas’ (‘System for the Assessment of the Quality Management Systems Operated by and the Quality and Capacity Documents Published by the Electricity and Gas Grid operators’).

When planning (long term) for the development of the transmission grid TenneT bases its view on different scenarios:

It is anticipated that, at some point in the future, the energy supply sector will have to deal with a significant decline in the availability of fossil fuels. Furthermore, existing trends in the development of sustainable energy sources will eventually begin to have a major influence on the structure of the energy supply system.

In line with the CPB report ‘Assessing Four Futures for Energy Markets and Climate Change’, the long-term scenarios, from the 2006-2012 Quality and Capacity Plan, are broadly based on the following relationships between energy consumption, the economy, the environment and the availability of fossil fuels.

3.1.1 Recovering the cost of capital of grid assets: regulation of TenneT’s revenue requirement

TenneT is regulated by the Dutch Competition Authority, which determines it’s allowed revenues over 3 (or at most 5) year periods. The competition authority is authorized to set the tariffs each year to ensure that TenneT does operate in a manner which is not efficient enough, does not set its tariffs too high and does not discriminate between various types of consumers

The system for regulating TenneT is based on the system of turnover regulation. Two components are important in the regulation of TenneT's turnover: (1) a 'sales component' and (2) a 'cost component'. These components are explained below in more detail.

The first component of regulation is the 'sales component'. With regard to this component, there is no direct link within the method of regulation between volume (sales) and grid costs. It is difficult for TenneT to control fluctuations in sales, while these fluctuations may result in considerable changes in turnover without accompanying changes in costs. By including the 'sales component' in the method of regulation, TenneT no longer incurs 'volume risk'. In concrete terms, this means that TenneT's total allowed revenues are independent of the sales to parties connected to the national high voltage grid. Any variances between the allowed and realised total revenues as a result of differences between the expected volume parameters and the realised sales are included in the tariffs of the following year or in the tariffs of numerous years if the difference is too great. The 'sales component' is therefore the component which determines that TenneT is subject to turnover regulation.

The second component of the regulatory method is the 'cost component'. The point of departure in this regard is the principle of output management. The Board endeavours to intervene as little as possible in the specific decisions taken by TenneT's management. The 'cost component' of the method of regulation means that TenneT's tariffs only cover its efficient costs. The Board determines the efficient cost level. TenneT is then responsible for ensuring that its costs are brought into line with this level during the regulatory period. To stimulate TenneT to achieve the efficient cost level, an x factor is imposed on TenneT. The x factor represents the change in efficiency which TenneT can achieve annually during the regulatory period. If TenneT’s efficiency improvement exceeds the x factor, this results in higher profit for TenneT during the regulatory period. As a result, TenneT has an incentive to operate efficiently. In the next regulatory period, the increase in TenneT's efficiency will be expressed in lower tariffs.

To determine the x factor, each regulatory period the Board examines the extent to which TenneT operates efficiently. TenneT's cost structure is compared in this study to other national grid managers in Europe. The results of the research are included in this method decision.

The system of regulation applicable to TenneT is set out by the Board in a method decision. Following this, the x factor and the volume parameters applicable to TenneT are calculated on the basis of this method decision and are approved in two separate decisions. By means of these three decisions, the Board stimulates TenneT to operate as efficiently as possible, without this jeopardising the quality of the energy network. Ultimately the system of regulation results in tariffs which are based on efficient costs and in a grid of optimal quality. The system of regulation therefore simulates the effects of competition, despite the fact that an actual market does not exist.

3.2 Planning & Security Standards

A Grid Code has been constructed by the Office of Energy Regulation (DTe) based on the 1998 Dutch Electricity Act (Grid Code, 2006). This Grid Code contains a set of criteria for electricity generation units when connected to the grid. The Electricity Act (1998) stipulates that the joint grid administrators must submit proposals to the DTe detailing a tariff structure and a set of technical conditions (regulations) for grid administration. The Grid Code is one of these technical regulations. DTe evaluates the Grid Code proposal submitted by the grid administrators.

The Grid Code contains conditions for the conduct of grid administrators and their customers with respect to:

- the operation of the grids;
- the provision of a connection to the grid (connection service);
- the performance of electricity transmission across the grid (transmission service);
- cross-border transmissions.

The Grid Code contains the following design criteria for the 380-kV and 220-kV grid, including connected transformers for interfacing with the 150-kV and 110-kV grid:

Criterion A
'A fully operational grid must be capable of secure transmission of such input and output as the connected parties require, even if one network element fails (n-1 criterion).'

Criterion B
'In the event of any circuit, transformer, generating unit or bulk user being unavailable due to maintenance, such input and output as the connected parties require must be achievable even if one network element fails (n-1 criterion), allowance only having to be made for such input or output of generated loads as occur during the maintenance period.'

Criterion C
'In the event of failure of any circuit, transformer, any two generating units or any bulk user, it must be possible, even during peak load, to return the system to a condition where the n-1 criterion is satisfied by redispatching generation or other measures agreed in advance.'

For TenneT, a key technical challenge associated with the integration of wind-powered production capacity is supply-demand balancing. The increasing proportion of the overall power supply accounted for by wind energy has implications not only for second-to second and minute-to-minute supply-demand balancing (frequency regulation and programmed exchange maintenance), but also for forward supply-demand balancing (more than fifteen minutes ahead, load following and unit commitment).

Where second-to-second and minute-to-minute supply-demand balancing are concerned, the essential principle for TenneT is that the implications of the unpredictabilities associated with wind power are manageable within the system, so that supply and demand can be kept in balance at all times. In order to ensure that the balancing implications of wind-powered production capacity remain manageable, it is very important that all forms of generation continue to be treated equally. Hence, where all forms of electricity production are concerned, the principle of 'problem-instigator pays' has to apply in the context of supply-demand balancing. In the Netherlands, this means that under the Programme Responsibility System, wind farm owners must pay the costs of the unbalances they have caused.

In general, variable generators are treated the same as conventional plant. There is one exemption, however, which relates to the Dutch System Code (Availability of generation capacity for balance retention).

The following 2 articles do not apply to installed capacity that produces electricity from energy sources that cannot be regulated, i.e. wind energy and solar energy

- A connected party (>5MW) shall notify the network operator, for each programme time unit, of the regulating margin (in MW) of each of its generation units before 14:00 hrs on the day before the day the regulating margin concerns. In so doing the connected party shall make a distinction between the following categories:
  - capacity instantly available for balancing;
  - capacity that will be available within 15 minutes for;
  - capacity that will be available after a term of between 15 and 30 minutes for balancing;
  - capacity that will be available after a term of between 30 minutes and two hours for balancing;
  - capacity that will be available after a term of between two hours and eight hours for balancing.
- The connected party shall notify the network operator of the national high-voltage network of deviations of more than 10 MW per generation site immediately after such deviations become known.

3.3 Transmission Access & Charging

The regulator, DTe, safeguards general access to electricity (and gas) networks. Tariffs and conditions concerning access and transport, as set out by electricity network operators, should not discriminate between parties. DTe annually fixes access and transport tariffs for the regional electricity network operators. The Electricity Act deals with the connection to the grid. In general, network operators are legally bound to provide a connection (articles 16.1.e and 23). Article 23 only mentions tariffs and costs; it therefore does not guarantee the timeframe for connection nor possible technical or planning conditions.

For offshore projects, licenses are allocated on a first-come-first-serve basis, i.e. if a developer is the first to apply for a license at a specific location all subsequent applicants will be rejected [5]. After application has been granted, the developer normally has two “construction seasons” to finalise construction of the wind farm. A date will be set in the final license issued to the developer [5].

3.3.1 Grid Code Requirements

Connection to the transmission system requires meeting grid code requirements. The Grid Code covers the operation of the grids, the provision of a connection to the grid and the transmission of electricity via the grid. All generators are treated the same, there is no exemption for wind.

3.3.2 Transmission Connection

TenneT has carried out a joint study with the Technical University of Delft to calculate how much wind could be incorporated into the current grid system. Their conclusion was that the integration of more than 2,000 MW of wind-powered production capacity (on- and offshore) would be increasingly difficult. However, they found that as much as 4,000 MW could perhaps be accommodated by the market through further deployment of auxiliary boilers at combined heat and power plants. The study also indicated that if the installed wind-powered production capacity were to exceed 4,000 MW, the amount of unusable wind power would necessitate further modification of the grid.

3.3.3 Connection Charging

Connections under 10 MW are connected to the distribution system and pay a shallow[6] regulated average charge per metre.

Connections greater than 10 MW may be to the distribution system or transmission system, depending on the specific site. The charges they pay are negotiated and deep7. The connection tariff consists of two components:

- ***Initial connection tariff***

  Connections to TenneT's high-voltage grid are site specific, and therefore, the initial connection tariff varies between connections. As soon as the connection is completed, TenneT will send an invoice for the full initial connection tariff.

- ***Periodic connection tariff***

  The periodic connection tariff covers the costs of maintaining and, if necessary, replacing the connection. The periodic connection tariff is

[6] Shallow refers to connection charges that only pay for capital and maintenance costs of the connection itself but do not charge 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 system tariff or absorbed by the distribution companies.

[7] Deep refers to connection charges that cover all costs raised by connecting to the grid. They include 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/TSO.

an annual standing charge (€/year), which will vary by what transmission network they are connected to (110 kV, 150 kV, 220kVor 380 kV).

3.3.4 Transmission Access

TenneT provide connection to the transmission grid, take care of maintenance and repair any defects. In principle, anybody can apply to TenneT for a connection. In practice, connection to the 150, 220, or 380kV transmission grid is only required for larger generators (tens or hundreds of MW).

Only once a connection agreement has been signed by both parties, will TenneT start the work necessary to allow connection.

- ***Project Randstad380***

  On 13 October 2006, the Dutch cabinet authorized the commencement of the Randstad380 project. This involves the construction of two new 380-kV connections in the Randstad region. As a result, two ring-shaped structures will be developed in the 380-kV high-voltage grid in the northern and southern parts of the Randstad. Costing over €400 million, this is going to be the largest investment in the Dutch transmission grid since the early 1990s.

  This expansion of the high-voltage grid in the Randstad is necessary because the demand for electricity is rising due to an increase in the number of businesses and homes, developments in the ICT sector, modern greenhouse farming methods and increased household electricity consumption.

- ***Runback Scenario***

  Recently, several applications have been submitted for the establishment of connections for new generators, including large-scale offshore wind farms.

  TenneT will only be able to facilitate the desired transmission capacity after the south-ring of Project Randstad380 has been completed and is ready for use. Structural increase of the capacity in Eemshaven means that investments in the grid must be made, which involves a lengthy planning process.

  In order to be able to connect new capacity despite grid restrictions, TenneT has devised a temporary solution called the 'runback scenario'. By carrying out a number of investments in new connections at an accelerated pace and by taking additional investments in the underlying 150 kV grid, they can connect new generators on a non-firm basis. The runback scenario means that generators agree to possible transmission restrictions.

Once the south-ring of Project Randstad380 is completed and ready for use, the 'runback scenario' will be cancelled and the parties that used it will be able to generate under a standard firm connection agreement.

3.3.5 Transmission Charging

There were originally two different transmission fees, one for electricity generators and one for consumers. Generators larger than 10MW paid the uniform national producer transport tariff (Landelijke Uniform Producenten transporttarief, LUP) for the power they fed into the 'national' transmission grid (the 150 and 110 kV grids as well as the 380 and 220 kV grids).

The energy regulator DTe decided to set LUP to zero as of 1 July 2004. It was felt that Dutch electricity producers faced a competitive disadvantage because producers from neighbouring countries (Belgium, Germany, France) did not have to pay a similar charge.

Currently, all transmission UoS costs are borne by consumers of electricity.

3.3.6 Transmission Losses

In the existing regulatory system in the Netherlands, costs raised by network losses are considered as non-controllable and therefore socialised.

On 20 April 2005, new regulation introduced a tariff for minimising grid losses (Regeling Uitgespaarde Netverliezen, RUN). Through RUN, distributed generation with an annual electricity production of 150 MWh or more receives compensation for minimising TenneT's grid losses. In 2007 RUN was set at €0.47365 per MWh. RUN was paid by the DSOs (netbeheerders).

However, Dutch energy companies Eneco and Energiened filed a legal case claiming that RUN constituted unlawful discrimination against one form of energy generation (i.e. preferring distributed over centralised generation). Their claim was that this government subsidy interfered with free market principles of the energy market. As a result, RUN was revoked in July 2007.

ANNEX A – ABBREVIATIONS

Acronym	Definition
APX	Amsterdam Power Exchange
BLOW	Bestuursovereenkomst Landelijke Ontwikkeling Windenergie
CEE	Central Eastern Europe
CHP	Combined Heat and Power
CWE	Central Western Europe
DNO	Distribution Network Operator
DTe	Office of Energy Regulation
EC	European Commission
EIA	Environmental Impact Assessment
ETSO	European Transmission System Operators: ETSO is an International Association of TSOs.
EU	European Union
EWIS	European Wind Integration Study, initiated by the European Transmission System Operators
GB	Great Britain: includes England, Scotland and Wales
GW	Gigawatt = 1,000,000 kW (unit of power/ capacity)
GWh	Gigawatt hour = 1,000,000 kWh (unit of energy)
ICT	Information and Communications Technology
IEA	International Energy Agency
kW	Kilowatt = 1,000 Watts (unit of power/ capacity)
kWh	Kilowatt hour = 1,000 Watt hours (unit of energy)
LUP	Uniform national producer transport tariff (Landelijke Uniform Producenten transporttarief)
MEP	Environmental Quality of Electricity Production scheme (Milieukwaliteit Elektriciteits Productie)
MW	Megawatt = 1,000 kW (unit of power/ capacity)
MWh	Megawatt hour = 1,000 kWh (unit of energy)
NTC	Net Transfer Capacity
PRP	Programme Responsible Party
PTR	Physical Transmission Rights
REB	Regulating Energy Tax levy (Regulerende Energie Belasting)
RES-E	Electricity generated from Renewable Energy Sources

Acronym	Definition
RETD	Renewable Energy Technology Deployment
SDE	Sustainable Energy Generation programme (ontwerpbesluit Stimulering Duurzame Energieproductie)
SO	System Operator
TSO	Transmission System Operator
TWh	Terrawatt Hour = 1,000 MWh (unit of energy)
UCTE	Union for the Co-ordination of Transmission of Electricity. The association of transmission system operators in continental Europe.
UK	United Kingdom: Includes England, Scotland, Wales and Northern Ireland

ANNEX B – GLOSSARY

Term	Definition
Bilateral	Trades or other contracts between two participants, for example a generator and supplier.
Capacity	Cf. Energy, Power. The maximum ability of a generating station to generate an amount of electricity in a given time. Measured in units of power (kW). The actual energy generated is dependant on the load factor.
Clip Size	The minimum size of interconnection capacity contracts.
Credit Cover	The cash or other financial security that must be provided.
Day Ahead	The day prior to the day that is being traded for or balanced.
Deep Connection Costs	Cf. Shallow Connection Costs. The costs of reinforcing and upgrading the wider network to enable additional generation or demand to be connected.
Energy	Cf. Power, Capacity. Formally defined as the ability for a system to do work. In the case of an electrical energy this is measured in kWh. Energy cannot be stored in the transmission network, so at any given time the total energy generated must equal the total energy demand and total losses (due to heating of wires etc.) This is known as balancing the system.
Gate Closure	The last time at which energy can be traded before the markets are closed. Balancing trades may take place closer to real time on a separate balancing market.
Great Britain	England, Scotland and Wales (excludes Northern Ireland)
Group Processing	This means that the grid operator puts applicants into a queue and groups them into areas or zones. Reinforcement is then carried out on selected zones to accommodate the applicants in that zone. There is no guaranteed timescale for connection.
Intraday	Within the day that is being traded for or balanced.
Ireland	The term Ireland refers to the state of Ireland (Eire), which excludes Northern Ireland. Within this document we have usually referred to “the island of Ireland” or “all-island” to include both Eire and Northern Ireland. For clarity, the state of Ireland is referred to as Eire throughout.
Load Factor	Also may be known as a capacity factor. The ratio of the actual energy output of a power plant over a period of time and its energy output if it had operated a full capacity of that time period. For example, an onshore wind farm might have a load factor of 30-40%. This means that on average it generates at 35% of its capacity, although at any given time it may be generating anywhere between 0% and 100% of its total capacity.
Locational	Cf. Postage Stamp. Differentiated by geographical location. For example, in the case of transmission charging, this typically will mean higher charges further from demand centres.

Term	Definition
Long	Cf. Short. Where a participant has more generation than is required to balance their demand (including losses where applicable)
Main Price	Cf. Reverse Price. The balancing price where a participant is out of balance in the same direction as the market, for example a participant that is “short” when the market is “short”.
Merit Order	The order that a system operator will place generators in based on the costs to deliver a certain quantity of generation. Those generators that will allow the forecast demand to be met at the lowest costs (subject to system constraints) are described as being in the merit order and are despatched.
Postage Stamp	Cf. Locational. Uniform, equal throughout the network.
Power	Cf. Energy, Capacity. Power is the ability to create energy in a given time, and can be expressed in the following equation: $Power(kW) = \frac{Energy(kWh)}{Time(h)}$
Price Maker	Cf. Price Taker. In the context of an electricity pool, a price making generator will submit a number of bids/offers indicating how much electricity they would be prepared to despatch at a given price. The system operator will place the generators in order of cost to determine which plants will be despatched.
Price Taker	Cf. Price Maker. In the context of an electricity pool, a price taking generator will not submit a bid or will submit a bid at zero. This means it will always be despatched (subject to system constraints) and will receive the pool price. Price taking generators include variable generators with low marginal costs, such as wind.
Real Time	The actual time period that energy is being traded for or balanced.
Reverse Price	Cf. Main Price. The balancing price where a participant is out of balance in the opposite direction to the market, for example a participant that is “short” when the market is “long”.
Shallow Connection Costs	Cf. Deep Connection Costs. The costs of physically connecting a generator to the nearest appropriate point in the transmission network, this may typically be the closest substation. This does not include costs associated with any required reinforcements to the wider transmission network.
Short	Cf. Long. Where a participant has less generation than is required to balance their demand (including losses where applicable)
Supplier	Normally used to describe a retail electricity supplier that sells electricity to final consumers, this can include domestic, commercial and industrial consumers
United Kingdom	Includes England, Scotland, Wales and Northern Ireland
Vertical Integration	Vertical integration is the degree to which a firm owns its upstream suppliers and its downstream buyers. For example, within the electricity industry this can be used to describe the situation where a parent company owns both an electricity retail supplier and generator.

ANNEX C – REFERENCES

Number	Reference
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2	European Commission website http://ec.europa.eu
3	Wind Energy Statistics Netherlands (website home.planet.nl/~windsh/statistiek.html)
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12	TenneT: Program Responsibility, 20 August 2002
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