VRIJHANDELSOPTIEK

Vijfde Jaargang | Week 46 2009 | 09-11-2009 | Pagina 1

Fierce lobbying for sustainability may well be misleading

In recent weeks, various reports have been published which claimed that the construction of gas and coal plants were at the expense of the government's target to realise 20% of sustainable energy by 2020. This include among other reports prepared by Ecofys[1], CE Delft[2] and EDN[3]. The content of these reports however is questionable to say the least. This is disturbing as it appears to be a well-coordinated campaign against new construction projects of gas and coal plants. Worse is that the house of representatives (Tweede Kamer) seems to take their side in the matter. Economic Affairs has even indicated that it is taking the reports seriously[4]. This is sufficient grounds for this magazine to conduct a thorough analysis on the contents of these reports.

Dilemma between energy savings and sustainable generation

The press release of Foundation for Nature and Environment (SNM) has drawn a lot of attention in the media with their report "Sustainable Electricity Market?" by CE Delft. With catchy titles such as "Coal, coal and more coal", wind energy and biomass are smartly positioned as underdog. This must have contributed without doubt to the fact that there was enough support for a motion of the Green Left party to be adopted regarding a CO2 standard for new plants. The motion that imposes a maximum CO2 limit of 350 g/kWh seems to be based on the SNM press release.

This is probably lacking critical reflection as the message from CE is politically correct and fits in the Dutch tradition to label electricity producers as polluters. However the SNM press release is contradicting its own conclusion. It states that the electricity producers that invest in renewable energy end up cannibalizing the market. This should at least have raised the question how it is possible that excess capacity can exist at all.

Whatever the nature of the generation is, new plants always mean that some capacity will be destroyed elsewhere. If that's the reason why existing producers have no interest in investing in sustainable energy, then they would also have no interests in investing in conventional plants. The reason why CE has undertaken the research is in fact because of the large investments in these conventional plants. Therefore CE should at least investigate why this construction boom occurs and how a similar boom in renewable energy can be created.

Remarkably CE spends little time investigating on the biomass co-firing potential of coal plants. According to the sustainable report from CBS, 2.3 TWh of renewable energy was produced with coal plants in 2008. This represents 25% of all renewable energy produced in the Netherlands. New power plants are likely to contribute even further to renewable production.

The biggest shortcoming of the CE report is that it focuses exclusively on renewable energy. This way CE and sponsor SNM avoid talking about the dilemma between encouraging the development of renewable generation in the future, versus achieving energy savings with almost immediate effect. Between 2008 and 2015 a total of over 4,000 MW high-efficiency gas plants will be taken into operation. With efficiencies at about 58% this will thus realise huge energy savings, assuming decommissioning of older gas plants with efficiencies at approximately 41%. Based on 7600 hours of operations per year, this corresponds to almost 4.4 million tonnes of CO2 savings per year. That represents nearly 6% of the annual amount of allowances allocated to the Dutch industry under the EU ETS system.

Rejecting the construction of new power plants means missing the short term possibility to realise energy savings. It also means that the target of 20% renewable capacity will be harder to reach. The total energy consumption is indeed higher without the construction of new power plants, thus more renewable energy is needed to reach the limit of 20%. In fact the limit is even higher than 20%. It takes much more time indeed to realise sufficient renewable production capacity compared to the time needed to realise high-efficiency fossil fuel power plants. Rejecting new build conventional projects in order to create an additional incentive and accelerate the implementation of renewable energy projects, means that in the same timeframe some CO2 emissions could have been avoided. Even though policy makers and researchers focus on achieving future goals, this does not have any effect on the current CO2 emissions to the atmosphere which cause the greenhouse effect. Indeed, it is not the future CO2 emissions that are causing the greenhouse effect but the emissions that have already occurred. In

[1] http://www.milieudefensie.nl/klimaat/publicaties/onderzoek-ecofys-sde/attachment

[2] http://www.ce.nl/index.php?go=home.showPublicatie&id=978

[3] http://www.energiedialoog.nl/index.php?option=com_docman&task=cat_view&gid=46&Itemid=60

[4] On October 28 EZ has informed the house of representative (Tweede Kamer) about the government policy on coal plants. The letter reiterates that the interaction between renewable and fossil fuel electricity is being currently studied. In the spring of 2010, EZ's view on this matter as well as the policy implications will be published. By formulating vision and policy implications on this subject, EZ receive the input from the energy sector and civil society. EZ is looking in particular for the contributions of Regieorgaan Energietransitie, the Energie Dialoog Nederland and the Stichting Natuur & Milieu.

that respect, the opinion of CE is worse for the environment.

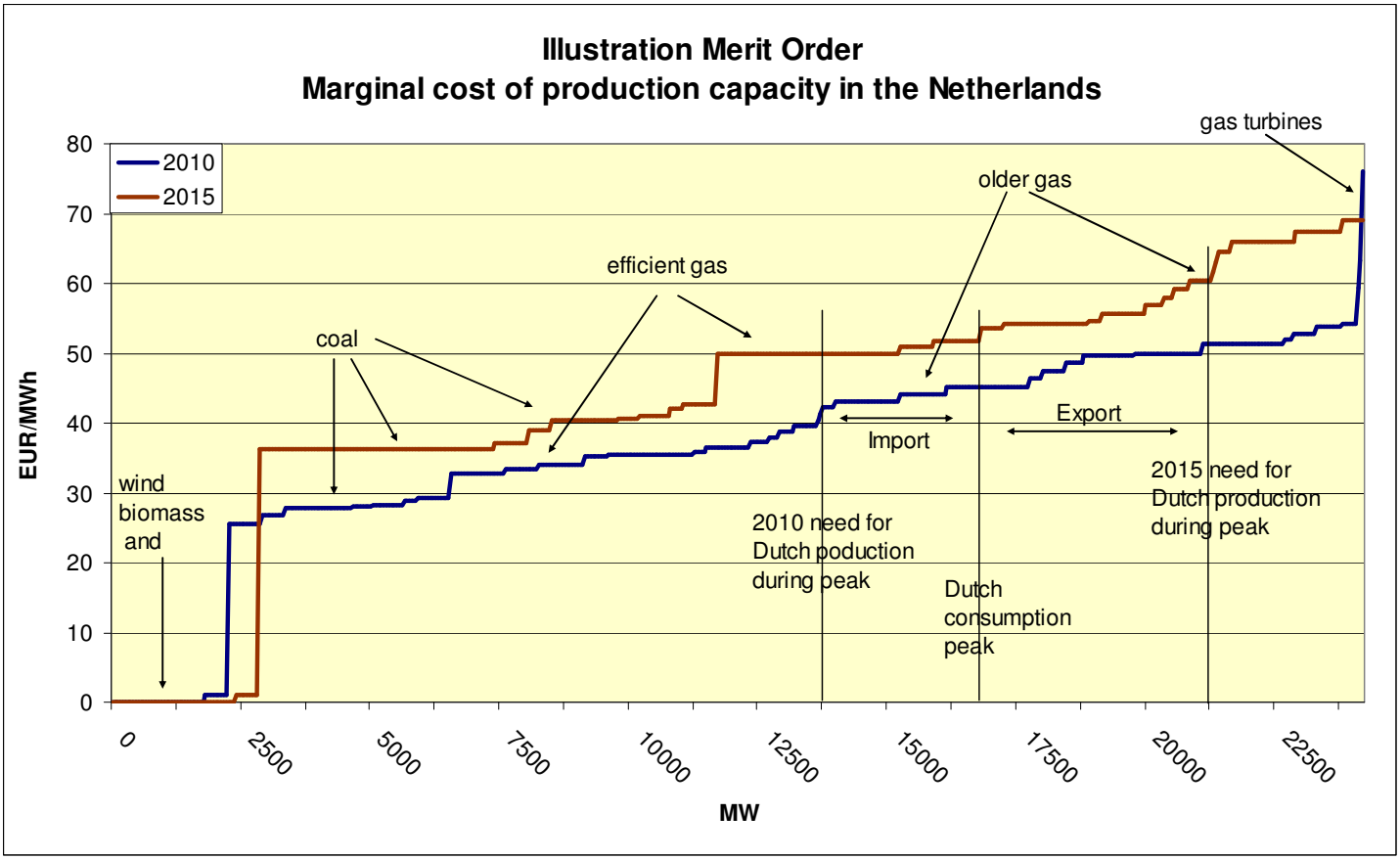

Figure 1: merit order NL production; source: market analysis SLEA

The 350 g/kWh limit is at odds with the need for flexible capacity

The report recognizes that a growing share of renewable capacity creates a growing need for flexibility among the conventional producers. This need arises on one hand because wind capacity output can be managed only to a limited extent. Secondly, the need for flexibility is mainly the result of the emphasis quantity when it comes to renewable capacity. The quality of the renewable capacity plays no role. This responsibility is transferred to the generation by conventional capacity.
Electricity producers recognize the economic importance of flexibility and adapt as much as possible the design of power plants to that effect. Ramp rates and more cycling plants require more energy than if these plants were running stable at full load. Higher energy consumption to balance the system also means more CO2 emissions per kWh generated than when operating at full load.

At 58% efficiency rate a gas plant remains just below 350 grams CO2 per kWh. Depending on the conditions and design, the CO2 emission rate can go up to 450 g/kWh. However with a large amount of renewable energy, it is necessary that conventional plants are able to ramp down to minimum load. Therefore it is precisely in the interest of the development of renewable production that conventional power plants are allowed to emit more CO2 per kWh than the limit of 350 g/kWh proposed by the Green Left party. If the government decides to follow the motion of Green Left, exceeding the 350 g/kWh limit should remain possible. Strict application of the emission limit would seriously limit the ability to develop wind energy.

The merit order: a snapshot

A common way of ranking electricity plants is via the so-called merit order. Plants are ordered according to their marginal costs. The figure below illustrates such a ranking. It uses the best estimates of the nominal

capacity and full load efficiency of Dutch power plants[5]. The graph gives detailed insight of the expected minimum term rates.

The merit order is using many underlying assumptions. Among the most important ones are the prices of coal, gas and CO2 emissions. The main costs are efficiencies, fuel and CO2. In Figure 1, 11 EUR/MWh[6] is assumed as marginal cost for coal and 19 EUR/MWh for gas. For 2015, these rates are set at 16 EUR/MWh for coal and 29 EUR/MWh for gas. These amounts are generally derived from the forward prices of the moment.

The insight that a merit order brings is limited because the real dispatch of a plant is a dynamic process. For example, most plants are at least 8 to 16% of the time not available. Also, weather conditions or technical failures can lead to having less power available than the known nominated capacity and/or that efficiency decreases. This means that the real merit order has steeper ascending marginal costs than the one illustrated in Figure 1.

In an ideal market and at 100% availability, the market price is supposed to lie at the intersection of demand and supply. To illustrate this, two situations are shown on Figure 1: the need for Dutch production in 2010 during peak hours assuming that approximately 3000 MW is imported and the need for Dutch production in 2015 where 5000 MW is exported. These assumptions are based on the general expectation that the Netherlands should become an exporter of electricity in the near future. Furthermore, wind has been included in Figure 1 at one third of its nominal capacity at zero EUR/MWh marginal cost[7]. For 2010, 1750 MW of new efficient gas is assumed. Comparing to 2008, the 2015 total production in the Netherlands is assumed to increase with 4600 MW of new coal plants and 4400 MW of new CCGT units.

The merit order shown in Figure 1 is only a snapshot. Most of the factors are dynamic. These dynamics increase the closer we get to the time of delivery. Ultimately, actual production is optimized against the short-term rates. Beside plant availability and must-run obligations due to heat supply, the dispatch situation in the last days and hours plays an important role, as well as the expected production in the coming hours and days. Market prices may thus momentarily be significantly lower than what can be expected under the merit order analysis. Conversely, producers will try to recover the off-peak losses during the peak hours.

The outcome of the merit order analysis is also greatly influenced by assumptions about wind energy and commitment of cross border capacity. When wind energy is highly available, curves are shifting several thousand MW to the right. When wind energy is not available, curves shift thousands MW to the left. The influence of wind is surpassed by the impact of import and/or export, although the direction of cross border prices is determined and not all interconnectors have to flow in the same direction.

It can be inferred from Figure 1 that the fear for price drops is unjustified. Prices are expected to be significantly higher in 2015 than in 2010 only because of rising fuel prices on the wholesale market. That price increase occurs even when the demand for electricity in the Netherlands remains the same. The general expectation is that the Netherlands will go from being an importer of electricity to being an exporter. If that is the case, electricity prices in 2015 will be even higher compared to the case when the Netherlands continues to be an importer of electricity.

The merit order also shows that the fear of dumping is unfounded. It is quite common that some plants have remaining available capacity on top of the actual demand. Operators of these plants have no interest in selling at dumping prices because their marginal costs are generally (significantly) higher than the market prices. These plants are only used in case of extremely high demand or if many plants producing cheaper power are not available.

Decommissioning is hardly relevant

The reports stated above are insisting on the fact that only a small amount of plants are being decommissioned. It refers to the report from TenneT regarding security of supply. Producers have indicated to TenneT that 2300 MW should be decommissioned by 2016. In conjunction with the new construction projects and available interconnectors, TenneT concludes that there can be real overcapacity. That is to say that the installed capacity can be higher than the total domestic demand and export potential.

TenneT rightly investigates this possibility as transmission system operator. TenneT is responsible for the interconnectors and can expect to be hold

[5] In the graph wind is 1/3rd of the nominal capacity recorded at zero EUR/MWh marginal costs. In reality however marginal costs for subsidized windmills is -96 EUR / MWh. In 2010, 1750 MW new efficient gas is assumed. Compared to 2008 the production facilities in 2015 assumed to be expanded with 4600 MW new coal and 4400 new CCGT units.

[6] This refers to the short term avoidable cost of fuel, CO2 emission and operation maintenance.

[7] However in reality, for subsidised windmills a marginal cost of - 96 EUR/MWh is applied.

accountable in case of shortfalls in capacity. In the EDN report TenneT's concern is used as an argument to support the statement that excess capacity will lead to lower prices. As the findings in the previous article demonstrate, that argument does not hold.

TenneT relies on the statement of producers' decommissioning. This statement is probably very conservative. Until it is not absolutely certain that "overcapacity" will occur, there is no need for early closure notification. Keeping old plants running can perhaps influence decommissioning of competitors' plants. Eventually producers make an economic calculation and plants close once there is a high degree of probability that the expected revenue will be lower than the expected costs.

The real challenge: upward dispatch potential

The fact that renewable energy and fossil fuel are increasingly conflicting with each other is often illustrated by annual load duration curves. Through a descending demand curve of 8760 hours, it is easily shown that demand during the night is too low to absorb 10,000 MW of wind energy, let alone the remaining subsidized renewable generation and must-run plants used for district heating.

Working with such load duration curves like EDN does is a dangerous simplification of the real challenge in power generation. The so-called 'minimum load problem "is not so much that the demand is insufficient for absorbing the supply, but more that it is difficult to keep enough plants operating able to keep up with the rising demand between 7 and 9 A.M. This is illustrated in the graph below, Figure 2.

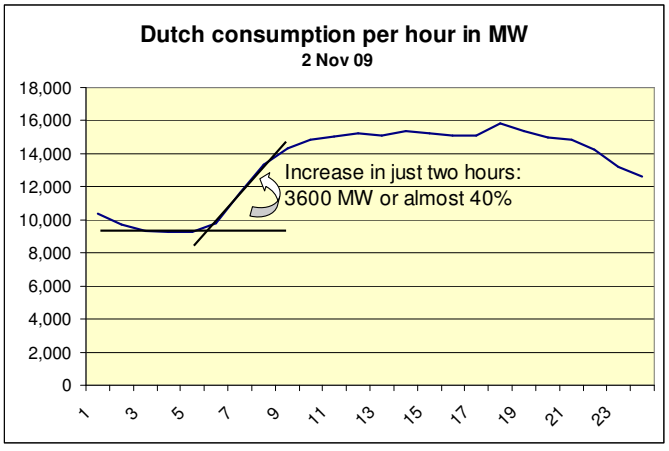

Figure 2: daily consumption per hour; source: TenneT[8], analysis SLEA

The figure includes an estimate of consumption in the Netherlands based on TenneT's data. From 6 AM to 7 AM demand rises by nearly 20% and from 8 AM it still increases by an additional 20%. In total, there is almost 3600 MW extra capacity needed in only 2 hours time. Some of that extra demand can be met by rapid start units such as gas engines. An important part of the growing demand however needs to be supplied with units that are already in operation. As the amount of "uncontrollable" production increases during the night, it becomes more difficult to continue sufficient generation from units that are able to ramp up sufficiently fast.

Example[9]
If half of the increase in demand can be covered by rapidly starting units, then the units that are already running should be able to ramp up by 20%. If half of the units are unable to ramp upwards then the remaining units should be able to ramp up to cover 40%. If 2/3 is not able to ramp up, the remaining units should be able to cover 60%. If the not controllable units (unable to ramp up) have a high probability to have a low production between 6 and 8 AM, for example due to a reduction in wind flows, then extra reserve capacity is required to be able to cope with this reduction beside the increase in demand. If all demand during the night is being supplied by non controllable sources, then the demand rise must be covered by units with short start times.

EDN makes the following reproach to electricity producers <quote> *At times when wind blows and large amounts of wind power are on the grid, negative electricity prices are expected: anyone who off-takes power receives a payment, because it may sometimes be cheaper for a conventional producer to keep a plant running and sell electricity at negative prices than to ramp down to zero and restart again.* <unquote> With respect to the increase in demand in the morning, the word because can be misleading. It may very well be that negative prices have to be accepted as the only way to be able to ramp up in the morning. This will generally only happen if the prices are high enough during the day to make up for the losses incurred during the night. The trade-off between running or stopping and restarting is

[8] TenneT publishes hourly rates based on approximately 75% of the installed capacity. In the graph TenneT's rates are thus increased by 33%. On quarterly basis, increase can be even steaper but the data are not known by SLEA.

[9] Cross border wordt in het rekenvoorbeeld genegeerd, maar interconnectoren zullen prijsgedreven het probleem versterken of juist verlichten.

also made by electricity producers when the hourly rates are still positive but below the marginal costs.

The criticism EDN addresses to electricity producers who are losing money by running on negative prices, shows the bias of EDN's approach. The fact that the question: "Why wind energy is produced when prices are negative?" is not asked is characteristic of this bias. Why is one producing a product which needs more money to sell it? The answer is of course because the government provides subsidies at times where producing from wind is inappropriate. EDN would be adorned if they would support a more sensible use of the taxpayers' money.

The importance of interchangeability

EDN is making an improper joke about the "overcapacity" by suggesting that electricity producers will make every effort to unload their electricity: "a one year contract will get you to choose between a free Jacuzzi, a water bed or an electric patio heater". First EDN ignores with this joke, the fact that individual producers and suppliers are not so much focused on absolute prices level, but more on margin. Second, EDN diverts from a possible solution for surplus wind energy during windy nights and weekends. When electricity prices are extremely low, there is of course a benefit to make from temporarily exchanging gas appliances (e.g. central heating boilers and steam boilers) for electricity appliances.

Gas can be kept in underground storages much more easily than wind power can be stored. Unfortunately the market is focused on gas use rather than promoting smart use of electricity. The foundation Slim with Gas (Stichting Slim met Gas) is an example of this. This foundation, whose secretariat is conducted by CE Delft, promotes among other things the micro-CHP (combined heat and power) i.e. HRE. These installations run the risk of contributing to electricity surplus precisely during off-peak hours and are thus creating additional tension with wind energy. It would be really smart if HRE would be adjusted so that no electricity can be produced when the electricity price is lower than the gas price (both based on MWh). It would be even smarter if precisely at these moments electricity would be consumed instead of burning gas.

Several initiatives to increase interchangeability of electricity and heat supply can be already found in the market. Partnerships between waste incinerators (AVI) and natural gas fired (city) heating are good examples of this. These initiatives make sense because providing heat instead of electricity with an AVI as well as with a CHP can lead to electricity consumption to be reduced as well as gas. Unfortunately, the reports of CE Delft and EDN give a strong focus on finding controlling solutions for the government. A more useful approach would be to pay more attention to potential solutions that the market can pick up itself, with or without the removal of limitations by the government.