REDEFINING ELECTRICITY – TOWARDS NEW EQUILIBRIA BETWEEN COMMERCIAL AND ENVIRONMENTAL INTERESTS IN LIBERALISED POWER MARKETS

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The liberalised electricity market has driven most power companies to position electricity as a bulk product with price as the principal competitive feature, not the least in the Nordic electricity market. This went hand in hand with a market design which implied a very large degree of detachment between wholesale and retail price formation. This constellation proves gradually more problematic both for reasons of balanced price formation and (momentary) security of supply as well as for reasons of environmental policy effectiveness. The paper intends to demonstrate that DSM and product differentiation in electricity markets work very well together and help to redress value added of electricity in such a way which may lead to better second best solutions for stakeholders concerned. The paper will discuss features of market design as well as of product redesign.

1. INTRODUCTION

The Nordic power market stands as an example of a quite successful electricity market liberalisation. The Nordic electricity market has realised many of the advantages that are typically spelled out in textbooks on infrastructure economics. In the autumn of 2002 and the winter 2002/2003 hydro power availability was very low whilst winter temperatures repeatedly plunged for long periods. The result was an unprecedented period of almost continuously extremely high price levels, maximum allowable import flows from all bordering countries (Germany, Poland and Russia), network load levels up to the brink of system failure, and production stops in some of the heavy industries. Prices only started to approach normal levels in late spring of 2003. However, another rather dry summer prevented a complete replenishment of the hydro reservoirs. As a consequence prices remained rather high during the summer of 2003. In addition Norwegian power companies were more careful with selling in the 2003 summer in order to reduce the risk on severe shortages (and high prices) for the next winter.

While acknowledging the success, it seems nonetheless necessary to repair various flaws in the current market design. A key problem is the virtually absent link in Finland and Sweden between price formation in the wholesale market and the price levels in the retail market (with the exception of those large end-users that have access to the wholesale market). This absence is a sign of a broader problem. Namely that electricity is seen as a basic facility that should be made available as plenty as needed at low prices. Such an approach often leads sooner or later to the testing of the system boundaries. Furthermore, this approach is self-defeating in a liberalised electricity market. Even though in Norway a part of the retail prices follows wholesale price developments more closely and with much less delay, nonetheless the same paradigm with respect to the product electricity prevails.
One answer to the above problem is the (re)introduction of demand side management (DSM), including time-of-day (ToD) pricing and trying to differentiate the ‘product’ electricity instead of selling it only as a bulk product. At the same time this would mean that various decision criteria in the electricity market would fit much better with sustainable policy objectives. In the following sections we first explain the supply and demand situation in the Nordic power market. Subsequently, we show what the consequences are of the detachment of the wholesale and retail market and how DSM can bring relief, not only in the Nordic region but also elsewhere. Subsequently, we discuss the awkward situation in which the electricity (distribution and supply) companies presently find themselves and why branding seems to a promising strategy to break away from the current prisoners’ dilemma. We conclude with a few summarising observations and recommendations. The repairs in the markets have to be accompanied by repairs in the product placement. These changes in product placement have to be embedded in a reassessed understanding of the value of electricity, not only in its direct measurement for power customers, but also for society and the environment at large.

2. NORDIC POWER MARKET INADEQUACIES

The electricity supply to end users is mostly handled by distribution companies. Some large industrial users have direct access to the wholesale market through their power trade subsidiaries. Both large industrial users and distribution companies buy a part of their electricity via medium or long term bilateral contracts at negotiated prices. The rest (what is uncertain or could vary substantially) is bought from the power exchange, at the going price.

In order to incite new investors there should be prospects for sufficient hours per year in which the new capacity can compete with existing capacity and import. Since the prices vary over the day one can take as a simple guideline that in the Nordpool area monthly average prices should be at least 27 Euro/MWh during a prolonged period. The average price in 2002 for Finland was 27.3 Euro/MWh and hovers around 30 Euro/MWh in 2003 (winter extremes excluded). It means that now investors get seriously interested in new capacity although the prospect of an addition of an 1300 MW nuclear unit in 2009/2010 and possibilities to import more Russian power will make them cautious regarding the size of the capacity additions. Furthermore, observing the extreme price levels necessary to arrive at average price levels that are sufficiently inviting, it incites questions about the quality of the forward signalling function of the exchange for medium to long term purposes.

Figure 1 provides an overview of the marginal and total production cost per MWh of Finnish supply options including import. TC stands for total cost and MC for marginal cost of production. The curved cloud of dark dots are observations of realised Finnish production levels in autumn/winter 2002 at hours of particular Nordpool exchange price levels (in fact base load, day load and peak price levels at working days). The lines represent estimated functions on how production by time of day reacted on ToD prices (Perrels and Kemppi, 2003). It appears that there are two regimes in the Finnish part of Nordpool. The switching point of the regime depends on the availability of hydro capacity in Nordpool. In autumn/winter 2002 it lies near 10500 MW consumption (and around 9600 MW production). When loads are lower the price level varies roughly between 20 and 30 Euro. This means that producers on average just earn their total cost per MWh back. Beyond 9600 MW prices have to increase considerably more to incite a similar sized increment in momentary production in comparison to the lower loads price regime. Evidently price competition diminishes in the second regime. Beyond 11000 MW (approx. 12000 MW consumption) prices start to rise substantially above total cost per MWh, even of (most of) the marginal production capacity. Eventually, the very high prices (> 50

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1 The exact price level varies for the kind of unit considered. Taking gas fired combined cycled as default (since it flexible) the level is even higher. Furthermore, emission trade will raise the cost per MWh with 4-7 Euro in case of gas combined cycle.
Euro/MWh) relate no longer to marginal production cost, but to the opportunity cost of switching off industrial installations (primarily in Norway).

An analysis of the momentary production response to (ToD) exchange prices showed that the price elasticity was about 0.66 in the low load regime and 0.27 in the high load price regime (Perrels and Kemppi, 2003). For the summer period of 2003 the exercise was repeated. The insufficient replenishment of the hydro reservoirs during Spring 2003 and the subsequent warm summer kept prices fairly high and consequently the price elasticity in the summer period was about the same as in the winter 2002/2003\(^2\).

Figure 1. Comparison of Nordpool price levels and marginal & total-incremental production cost per MWh

All in all it seems that the price signal of Nordpool is relevant for the optimal short run allocation of generation resources and also contributed to reduction in over-capacity during the past years. However, the detachment of wholesale prices from end-use prices for most of the consumers, notably in Sweden and Finland, has taken out the possibility to have demand reacting timely to scarcity signals as conveyed by the Nordpool price. The delayed demand reaction, due to delayed tariff rises (see figure 2), may even contribute to pig-cycle phenomena, which means that by the time producers get their added capacity on line consumers have started to slow down or even stop demand growth due to the tariff rises. This would result in significant drops in the Nordpool price level, which on the one hand may cause trouble to investors, but on the other hand increases the margins for power sellers to end users (as they had risen the tariffs and can buy part of the power cheaply). In a next phase this may ignite a new round of competition among sellers to attract clients on the basis of reduced tariffs. Subsequently, demand (growth) will start to increase again, until the next tight situation with very high prices is reached.

Figure 2 not only shows the detachment between wholesale and retail market pricing, but also that already in 2001 and even more so in 2002 households with electric heating got their electricity below the average wholesale market price, i.e. below opportunity cost. The implications are that either distribution companies are making considerable losses or other customers are in

\(^2\) Elasticities varied within the summer period, among others due to capacity availability variations resulting from maintenance schedules. In Perrels and Kemppi (2003) more estimations are discussed.
fact cross-subsidising households with electric heating. The situation is even more distorted, since a significant part of the unanticipated extra demand in 2002 which distribution companies are compelled to cover by expensive purchases from the exchange is due to extra electric heating. This in turn helps to raise the prices on the exchange. Yet, the electric heating users do not notice anything from the extra cost they incur.

Figure 2. Development of monthly average prices in Nordpool nodes and of Finnish end-user prices (energy part) in the period 1998-2002, in Euro/MWh (source: Finnish Electricity market Authority and Nordpool)

The paradigm of bulk electricity in a liberalised market (and starting from a situation with over-capacity) manoeuvred supply companies in a prisoners dilemma. Whereas these companies face wholesale price developments as depicted in figure 2 (and the marginal cost line in figure 3) they have committed themselves to their clientele by means of pricing as shown in figure 3. The demand curves for daytime and night time are vertical as wholesale price is not affecting demand at the moment when it occurs. The curves are drawn at points where they are intersecting the expected price volume combinations for average cost pricing (A and C) reflecting a liberalised wholesale market which started off with a barely affected retail market. It is directly clear from figure 3 that a disjunct pricing situation can occur (and indeed did occur) for daytime consumption when comparing marginal cost and average cost pricing levels. In this case a price C is charged at a moment that price D would have meant a commercially viable match of supply and demand.

The consequences of the detachment of the retail from wholesale power markets in connection with a low cost paradigm are:
- not so well predictable intermittent periods of over-capacity and tight capacity;
- discouragement to invest both with respect to timely new capacity and with respect to energy saving at the demand side, and therefore a challenge to maintain security of supply;
- discouragement to invest in generation capacity using renewable energy sources;
- increase of the costs and non-achievement risks of the carbon permit trade for the electricity sector.
The next sections provide some ideas for an integrated concept that contributes to getting a better grip on the above listed problems.

Figure 3. Retail pricing detached from marginal cost

3. PRODUCT REDEFINITION

3.1 Integrating elements

Re-attachment of the wholesale and retail markets requires a retail pricing scheme that reflects quicker and better the opportunity value of electricity in the wholesale market. In other words some easy to handle version of marginal cost pricing is to be (re)introduced. However, to reap the full benefits of such a rearrangement also the product placement of electricity needs revision. By doing so, it is possible to increase the utilisation of electricity savings incited by the new pricing scheme as well as to stimulate the use of electricity from renewable resources. In fact various of these ingredients are already available separately, at least in some countries. In the Nordic market mostly in Sweden. The ingredients are:

- Demand side management, including the use of marginal cost (load sensitive) pricing;
- Some kind of quasi markets to ensure market entry of renewable based electricity (such as RECS);
- Branding of electricity, including the use of eco-labels, but using more dimensions.

Electricity as a product could be differentiated in various ways, including by:

- **source of generation**, further distinguished by fuel, environmental impact, location of origin (import, own region) and producer or supplier characteristics;
- **degree of certainty** (certification quality, share of use guaranteed 0% - 100%), allowable switch off time, etc.)

The Californian crisis has spurred the introduction of experimental ToD schemes (Gülen and Michot Foss, 2002). One could just as well speak of a revival, since in the eighties of the previous century such schemes were experimented as well (Hirst, 1992). Also in Europe experiments have been carried out (see http://dsm.iea.org/) in the liberalised markets. Gülen and Michot Foss (2002) mention the fairly low response among small consumers to engage in ToD contracts.
This hints at the need for a wider more embedded DSM strategy than just price reform (see also next sections).

Notwithstanding the need for embedded programmes, cost advantages both to producers and consumers have to be significant enough to tap a larger potential, as usually only for the early adopters value added caused by other factors is the dominant driving force. Yet, for a start the understanding of these early adopters is essential to start off the product differentiation (see next sections). Branding promises to be an ingredient that assists to overcome the thresholds. Having created markets thanks to early adopters, the motivation to engage in DSM programmes will increase and spread, if electricity companies can identify substantial savings or other competitive advantages for customers (e.g. in comparison to buyers of ‘grey electricity’).

In Perrels and Kemppi (2003) a small example is provided regarding an estimate of the cost and benefit of a hypothetical DSM scheme in Finland. The modest DSM programme assumed there, would result in about 1.5 TWh saving, a reduced capacity need of 300 MW and prevented CO\textsubscript{2} emissions amounting to 0.44 MT. A more complete and integrated programme as advocated here will surely lead to appreciably higher savings.

### 3.2 Favourable side-effects on market functioning

An interesting side effect of the combined application of these instruments is that may also help to halt the increase of market power of the (re)emerging vertical integrates in the Nordic and other EU power markets. The combined scheme is more easy to adopt for local companies, for example because regional or local origin is itself a possible dimension to distinguish electricity brands. Also integration of DSM and localised renewable use in building design and management is more likely to be taken up by regional and local energy companies.

![Figure 4. Total cost per MWh by generation type combined with prevailing company type](image)

Legend: Comp.ROC price: computed price using return on investment of 10%; mixed: no dominant company type; v.i. vertically integrated
When considering the current supply mix and its ownership structure in Finland (figure 4), a larger portfolio of supply options not owned by large vertical integrates and the better possibilities for customers to single out the kind of electricity product they want, will to some degree reduce the price dominance of vertical integrates via their marginal fossil fuel capacity. In fact customers get better options to substitute betting on sometimes cheap electricity based on hydro or nuclear (and other times expensive), for more steadily priced power supply based on renewables, most probably in price range between CHP and coal (incl. CO\textsubscript{2} permit cost).

3.3 Repairing shortfalls in current renewable promotion schemes

Punishment and subsidies, which are the backbone of feed-in or certificate-based renewable or green energy / energy efficiency, are surely only a partial solution, a one edged sword. In the case of feed-in, unselective subsidies promote inefficient green production. In the case of certificate related targets, punitive scenarios promote minimalist production responses since the certificates have no clear end-use value, unless specific measures are taken to create that (such as the tax reduction in The Netherlands). For white certificates (energy saving certificates) the situation is even much more questionable, since it is hard to guarantee the validity of the lifetime of the (promised) savings during the lifetime of the certificate. Not to mention the risks for double counting and the relatively costly way to administer the white certificate system compared to inciting savings via DSM (Langness and Praetorius, 2003). In either case the result is electricity production that is not necessarily appreciated or prevented production which is unwarranted and thus the link between the demand and supply side for renewable or green energy is very weak. Below we will focus on certificate based systems, since these systems on the one hand are in principle compatible with a liberalised market and on the other hand have the best prospects to be linked up with product definition and branding efforts.

Demand side requirements need to be addressed if certificates are to be anything more than piecemeal customers should be incited to regularly think about the origin of energy within a purchasing-decision environment. Labels on bills will help this, but only when coupled to active decision –making situations. If people need to buy a fridge then they find themselves in an active decision-making situation. Most energy consumers do not feel they need to make such decisions with energy – it is deemed preferable to do nothing except when big saving opportunities occur and then green issues are marginal.

Unfortunately, the current (green) certificate systems, which can be market efficient, do not contain mechanisms to address these objectives. In fact, in a market where electricity suppliers can increase end-prices greatly and fairly freely (for most or all customers) regardless of whether the energy is green or not and in a market where marketing skill is limited and electricity suppliers have been ineffective at selling the green message (and commonly have little interest in it), it is unlikely that green certificates trading will be underwritten by a strong demand for energy saving / green energy.

When referring to a certificate system we do not mean national, often less transparent systems, instead a trusted European certification system (as RECS seems to aim at) is indispensable. Otherwise concerns remain that costs associated with certificate trading will be so excessive as to push up-end-prices (thus hurting industry and households), not to mention the concern regarding the integrity of certificates.
4. EXPERIENCES WITH BRANDING

Many electricity suppliers within the competitive context have focused substantial effort and resources towards the development of corporate brands. Yello Strom in Germany, Npower in the UK and Vattenfall as well as E.ON in Northern Europe are just a few of the companies which have developed their image substantially and successfully over the past few years. When it comes to the branding of the electricity product however, evidence of success is somewhat harder to find. It is not that there is a shortage of examples. The ‘Staywarm’ brand for instance was developed by TXU Energy in the UK as a special tariff designed for elderly electricity customers. This particular brand in fact defies any DSM logic, since it allows customers to use as much energy as they wish for a fixed yearly total cost. On a more sustainable note however, products such as the Dutch company Essent’s ‘Gamma’ show that branding can also be effectively applied to ‘green’ electricity products. In many cases suppliers of green electricity have strengthened their product brands through high profile co-operations with other powerfully branded organizations such as the Body Shop, Greenpeace and (in the UK), the RSPB (Royal Society for the Protection of Birds). In Finland ‘Norppa Sähkö’ can be mentioned and ‘Brå Miliöval’ in Sweden.

It can therefore be seen that there is no lack of branding as such within either the competitive electricity market in general or the market for green electricity products. Nevertheless, despite all this branding, some of it relatively successful, the overall uptake of value-added, branded electricity products has remained poor. In fact for instance, depending on exactly how ‘green electricity’ is defined, it can be argued that the Netherlands is the only country where more than one percent of customers have actively made a choice to purchase ‘green electricity’. Even in the Netherlands, whilst approximately one and a half million customers have been successfully encouraged to buy green electricity, tax breaks mean that most customers get the green electricity from their incumbent supplier at a similar price to standard (non-green) electricity. Thus even in the Netherlands the added value (in terms of the final price paid by the end customer) has ranged from negligible to perhaps 20%. Furthermore, the Dutch government announced in its 2004 budget the intention to dispose of the tax credits for green electricity buyers.

It should also be noted that branding has so far tended to focus predominantly on the small residential customer, with consequently almost negligible impact on the much larger industrial and commercial market. Although there is a strong case for the efficiency of marketing differentiated added value electricity related products to industrial and commercial customers, very little effort has generally been made so far. In Finland for instance, only about 300 businesses currently buy electricity which is sold to them as ‘green’. The situation is similar elsewhere.

If DSM is ever to be achieved through branding, a far deeper understanding of the issue is therefore required. Perhaps surprisingly though, whilst some academic literature has looked at ways of increasing demand for green electricity, the issue of adding value to green electricity has generally been treated in a rather stoic manner. In fact according to Wiser (1998) “Demand for green power is analogous to the voluntary provision of public goods” therefore presenting a challenge to the prevention of free riding, which - if not overcome - may lead to few ever paying more or much more for it (Radar & Norgaard, 1996; Greenprices 2001). There is up to now, an apparent absence of literature which has focused on understanding the linkage between demand for green electricity and ‘negawatts’ and the added value branding of it. Recent research at the University of Vaasa set out to fill some of this gap through looking at the business market for ‘green electricity’. Whilst this research focus covers only part of the issue, namely branding relating to green products and large users, it can provide detailed investigation, conceptualizations and considerations of at least one forum for DSM through branding. Furthermore, the WWF has argued that carbon savings of 56m tons would be generated if just 10% of European business energy consumption and 30% of public authority energy consumption met its Eugene renewable electricity criteria.
4.1 Some of the findings of the VaasaEMG study

Whilst understandably most businesses do not wish to pay more for green electricity, 38% of businesses which feel likely to buy green electricity in the near future consider price not to be particularly or at all important. Considering the lack of understanding and awareness by many businesses of the whole issue of green electricity, this seems to be a high number. Among the many potential reasons why a business might purchase green electricity at an added value price, it can be postulated that one key motive is the enhancement of the business’ corporate image.

The value of green electricity can also be multi-dimensional. In addition to its capacity to help businesses comply with their own ethical standards, it can assist businesses in other related ways. Swezey & Bird (2001) point out a number of motivations. For instance official pressures are often placed on businesses to meet global climate change targets; businesses may realise that customers sometimes prefer to buy from businesses that use green energy; community and public pressure and recognition do matter to many businesses; businesses with differentiated image based predominantly on environmentalism must back their words with green electricity purchasing actions; and employees’ performance may be measurably enhanced by a sense of pride resulting from the knowledge that their business has the right ethics. All these motives were clearly apparent within findings of the University of Vaasa’s research, for businesses which already purchase green electricity and also for those which have not yet done so. Furthermore, over 90% of businesses that have purchased green electricity are satisfied with their decision and most expect to purchase more, as a percentage of their total consumption, in the future.

Interestingly, the businesses which seem most commonly to have found real competitive benefit from their actions are those which seem to have managed to combine the various added value benefits under one ethical and publicly known umbrella. For such businesses which consider their ethics to be a corporate and competitive corner stone, the purchase of green electricity seems to be a natural step, but one which will only be taken if both the provider of the electricity and the source of the electricity are sufficiently ethically sound. Such businesses are usually knowledgeable about energy issues and therefore whilst not easily fooled by brands without substance, they tend to prefer to purchase their electricity from electricity suppliers which are at least as ethical as they are themselves. In such situations they are quite willing to pay significantly more (commonly around 20%) for their green electricity on the premise that the commercial benefits (added value) outweigh the added costs. Some interviewed companies provided proof of the commercial benefits reaped in this way.

Because there is great variation in the added value which different businesses perceive concerning the green electricity offering and since less than one third of businesses that buy green electricity consider price competitiveness to be very important, there should arguably be an opportunity to extensively apply price discrimination to the green electricity product. From a marketing perspective however, any such discrimination on a large scale would require that those businesses that are willing to pay more should be characterised in some way, possibly using categorizations similar to those described in the previous section of this paper and through the analysis of businesses which put less emphasis on price. In fact quantitative evidence suggests that larger businesses (in terms of employees) tend to be more price sensitive than smaller businesses and that businesses which follow and promote strict ethics generally appear to focus more on environmental quality of the electricity and even the locality of the electricity, thus limiting their choice and reducing their price sensitivity. Furthermore, qualitative (interview) evidence indicates that businesses which purchase only a small proportion of green electricity, or make relatively uninformed decisions (when suddenly presented with green offers having never before considered buying green), may generally be less sensitive to price. Qualitative evidence also suggests that businesses which are primarily concerned with labelled or certified electricity (more than understanding the real quality) seem less willing to pay for quality. Interestingly, of businesses feeling likely to buy green electricity, price tends to matter much less if image, public relations (PR) and marketing matter more to them. These less price sensitive market-
ing/image oriented businesses represent approximately 37% of those businesses which feel likely to buy green electricity.

5. CONCLUSIONS

As in many other liberalised markets the Nordic power market needs to reconnect pricing in retail markets to pricing in wholesale markets. To ignore this design flaw implies acceptance that the market will continue to alternate between over-capacity and shortage risks and consequently a substantial portion of the acclaimed efficiency of liberalisation gains get lost. Reparation of this design flaw in principle enables at the same time an improved achievement in energy savings and consequently sustainable policy objectives such as the reduction of CO2. Apparently sustainability policy and liberalised markets do not necessarily conflict, but this requires not only sensible policies but also a sensible market design.

Demand side management, marginal cost (load sensitive) pricing, promotion of renewables via trustworthy certificates, and labelling of electricity can be, and even should be, integrated into one scheme. Possibly the upcoming Energy Services Directive of the European Commission can offer a framework for such an approach.

When devising such schemes it should be realised there is a as yet largely untapped opportunity to greatly increase demand for value-added ‘green’ electricity from business users. Such businesses could and in many cases have been successfully encouraged to pay a significant cost-related premium for ‘green’ electricity. They do this on the premise that they are purchasing a range of commercial and ethical benefits relating to the ‘meaning’ of the electricity, in addition to the basic commodity itself. This ‘meaning’ relies heavily upon powerful branding. If such branding were successful on a large scale it could create a catalyst for a market where sustainable electricity is commonly desirable (and valuable).

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