

Background paper for the 7th US-EU Energy Regulators Round Table,
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CLIMATE CHANGE – Impact on energy regulation and infrastructure

Introduction

The present paper presents some of the challenges to infrastructure and raises some of the problems for energy regulators resulting from measures aimed at meeting political environmental targets. The paper discusses possible solutions, with examples from the European Union (EU) but which could also be applicable to the US. The impact on the regulator and on network investment can vary depending on the type of promotion system for renewables chosen by countries - market-based or state aid-based.

The areas discussed are:

- The role of the regulator in meeting environmental goals
- The need to promote reserve generation
- Promotion of renewables from a market perspective
- The impact of renewables on energy regulation and on network investment

The role of the regulator for meeting environmental goals

The national energy regulator must set its goals and develop its activities, while also complying with the environmental goals the government/politicians have set up, including e.g. quantitative targets regarding energy efficiency, and establishing rules which are instrumental to promoting the generation of power from renewable sources.

In general terms, the role of the energy regulator in helping to meet environmental goals is primarily to contribute to efficient energy markets, which means:

- ensuring the reliability and quality of energy supply
- promoting energy efficiency
- safeguarding consumer interests

- guaranteeing access to the infrastructure (networks) for all suppliers (and even giving priority to renewable energy producers)

At European level, the EU Directives – based on political priorities - constitute the legal framework within which the national authorities must ensure that citizens and industries are getting fair, competitive energy prices, through efficient energy markets. Renewables are not currently given priority, by law, when connecting new power plants and feeding the energy into the networks. However, as explained below, new provisions on priority treatment of renewables are currently being negotiated within the EU institutions and are expected to be adopted by year's end.

At the March 2007 European Council, EU Member States endorsed a set of targets for addressing ***climate package***. As a result, a package of proposals (known as the 'Green Package' for a new European energy policy integrating climate change issues) was published on 23 January 2008. The March 2007 agreement includes a commitment to:

- * reduce greenhouse gas emissions by at least 20 % by 2020
- * the target 20 % of renewable energy consumption by 2020
- * the target 10% biofuels used in transports by 2020

EU Directives require national regulators to ensure that sufficient investments are achieved in power plants as well as in transmission capacity, in order to guarantee the reliability of power and gas supply, and to make sure that renewable power will have access to the networks.

The Green Package includes proposals on a new EU emissions trading scheme with a European (not national) cap, auctioning of allowances: to generate reductions in GHG of 21%; new national targets to achieve a 10% GHG reduction in non ETS sectors; a framework to promote the development of CO₂ capture and storage; new guidelines on state aid for environmental protection; an update on the implementation of the Energy Efficiency Action Plan; and a new directive to reach the 20% renewable energy target and 10% biofuels target. These proposals include clauses on how to give priority to connecting renewable power plants to the networks. If such requirements are set up it might be necessary also to promote both investments in grids and in reserve capacity. However, CEER has warned EU legislators to take care to avoid inadvertently compromising system security, discriminating against conventional producers in liberalised energy markets or imposing disproportionate costs for end-consumers.

The need to promote reserve generation

Nordic cooperation in the field of electricity began half a century ago, when Sweden, Norway, Denmark and Finland became aware of how they could benefit from a high degree of "complementarity" in power generation and the trade of surpluses or shortages of power – rather than building expensive additional domestic generation capacity.

This regional cooperation, called *Nordel*, has continued and been expanded, although its character has changed since the introduction of the electricity market reforms in the 1990s. Today the four major Nordic countries share a common power market. *Nordel* has drawn up guidelines for a more uniform handling of the reserve generation issue in the Nordic region. Different approaches to this problem do, however, exist in the four countries involved, due to different domestic circumstances.

Domestically the issue of reserve generation has so far been solved on an interim basis; for example the TSO in Sweden and Finland is vested with the responsibility of keeping a certain amount of reserve capacity every year.

This arrangement is not seen as a final solution to the reserve generation problem. But is— as mentioned above — an interim solution, which has been extended a couple of times, until 2011. The Swedish power industry advocates a permanent solution where the **government** takes on this responsibility. However, so far the government has preferred a **market-solution** to the problem.

One important prerequisite for a working market-based solution is sufficient flexibility on both the supply side and demand-side of the market, but especially on the demand side. When the national TSO in Sweden was given the responsibility to keep the capacity reserve in 2001, this prerequisite did not exist. Conditions have improved somewhat through close cooperation with industry in order to get contracts on the demand side. Still, more flexibility is required for an efficient market-based solution to work.

By the end of this year, the Swedish regulator must propose to the government a long term solution to the reserve capacity issue. We will probably end up with a proposal to prolong the present arrangement another eight to ten years, but with a gradual reduction of the reserve capacity kept by the Swedish TSO, while at the same time stimulating the market actors to take adequate measures to increase demand-side flexibility.

One way to increase demand-side flexibility could be to introduce a legal requirement for negotiated *consumer reduction* in capacity, another solution could be to encourage *more metering on an hourly basis*, with all Swedish consumers' meters read every hour.

There are also ongoing discussions on the possibility of having reserve energy traded at the spot market of the Nordic power exchange Nordpool.

Promotion of renewables from a market perspective

Due to different national resources and backgrounds and discrepancies in the politico-economic framework, there are considerable variations in how different European countries have implemented the 2001 EU Directive on Electricity from

Renewable Energy Sources. The two major support systems chosen by a vast majority of European countries are **feed-in tariffs** and **green certificates**.

When evaluating the **effectiveness** and **cost efficiency** of the two support systems, and also the level of support given by various EU Member States to renewables like wind power, biofuels etc., it is important to note that the national renewable energy resources can vary significantly between the different states, as can the level of the support given to renewables. CEER is currently preparing a status review of the renewable and energy efficiency support schemes in the European Union.

An assessment of the effectiveness of the various support systems depends of the criteria used. If e.g. building more wind power capacity is the foremost priority, the feed-in tariff system seems to have shown the best results so far in leading wind power countries like Denmark, Germany and Spain. Feed-in tariffs, however, imply a higher risk of over-funding of renewables than in a market-based system like green certificates, which in turn represents a higher risk for investors. Experience of the green certificate system is shorter than that of feed-in tariffs, and thus perhaps less conclusive.

Most European countries have introduced systems promoting renewable power generation with feed-in tariffs. In Sweden, however, the goal has been to opt for a support system that could be harmonised with the already well-functioning, competitive electricity market, i.e. a system that would neither over-fund, nor under-fund renewable power generation, and which would not distort the competition between various fuels. Therefore, in Sweden there is a market-based green certificate system and public subsidies have been abandoned.

Another method for contributing to meeting climate change objectives is through the use of **combined heat and power generation (CHP, or cogeneration)** in cooperation with renewable energy sources. Like several other countries in Northern Europe, Sweden has a high potential of forestry biomass available, and due to the cold climate, district heating has an important share in energy supply. CHP can improve the competitiveness of biomass considerably. In Sweden, where biofuels represent 75 % of renewables, the introduction of the green certificate system has resulted in a rapid expansion of biofuel-based CHP generation capacity. This in turn has resulted in fewer constraints on the electricity system, since electricity for heating to a very large extent has been replaced by biofuelled district heating.

The green certificate system has shown itself to be an efficient instrument to promote wind power. The construction of new wind power farms has increased in a spectacular way in recent years.

How does the green certificate system work in Sweden, for example? Briefly it can be described as follows (without going into details):

- **producers** with eligible renewable power plants **are granted one certificate per MWh power generated;**
- power **suppliers and certain consumers** (including residential consumers) are **obliged to buy a certain no. of certificates**, corresponding to **an annual quota** (percentage) of their consumption;
- a market place is organized, where the trade takes place;
- failure to comply with the quota obligation is penalized.

Thus, a market situation is established, and the pricing of the certificates is subject to the signals of the market. The eligible renewables are wind power, solar energy, biofuels, geothermal energy, wave energy (incl. tidal), small-scale hydro power plants and, if they exist, larger power plants are upgraded/expanded.

The average additional revenue for the generator of eligible renewable power plants has initially been as much as 65-70 % higher than the average market (spot) price for electricity.

The green certificate system was introduced in 2003 and will remain in force until 2030, according to a decision by the Swedish Parliament. The quotas which consumers and suppliers must fulfil with green certificates will vary from initially 7,4% to 17,9 % during the peak years of the period the system will be in force. The quotas will gradually be lowered to 4,2 % in the final year of 2030.

The impact of renewables on energy regulation and on network investment

Connecting new renewable power plants requires an expansion of the existing networks and investments in additional transmission capacity. Who regulates this issue and who pays the cost for it?

The holder of the network concession (for line or area) where a new power plant is located is obliged to connect the power plant to the network, unless special circumstances can be referred to. The connection fee shall be cost-reflective and “reasonable”, and is subject to regulation/supervision by the regulator.

In Sweden, the additional revenue that the power producer gets from the green certificates shall cover the cost of connecting the new power plant to the network. In other countries in Europe, the feed-in tariff includes this cost. As wind power is in a very expansive period and many projects concern (expensive) off-shore wind parks, there is an ongoing discussion of whether the most costly connections should be subsidized, e.g. through a fund set up to this end.

With the present support system (green certificates), wind power generation is predicted to reach a level close to 6 % of Sweden’s power generation by 2020, or 9 TWh. A recent proposal by the Swedish Energy Agency would increase the percentage of wind power to 20 % by 2020, corresponding to 20 % of all power generated. What consequences would such a larger-scale expansion of wind

power generation in Sweden lead to for the transmission grid, the balancing function, the need for more reserve generation, and what would be the costs? A new report from the Swedish TSO, Svenska Kraftnät, analyses the alternatives for the expansion of wind power generation and their consequences. A brief summary of the conclusions drawn would be:

- * Much more regulating power will be needed (with the 30 TWh alternative considerably much more); if the available hydro resources will not be enough, then by wind power itself, or on the consumer side;
- * Up to the level of 10 TWh, the national transmission grid will, in principle, Have enough capacity, if only major power plants/windparks are connected; above this level, investments in reinforcements and increased capacity will be needed;
- * The increasing unpredictability of power generation will affect the major domestic constraints in the transmission system and also influence foreign power trade in a negative way;
- * The total costs for increased investments and increased costs for balancing and regulating the power system are estimated at 25 billion SEK (approx. 3.5 billion US dollars), which can be compared to the total investment costs for 30 TWh wind power, amounting to 150 billion SEK (approx. 20 billion US dollars).

Another issue for the regulator is whether to include in the revenue cap the investments costs for renewables, without restrictions, when setting the tariffs for a regulatory period. Should these investments be handled separately?

As mentioned earlier, the Green Package includes proposals for measures to be taken by individual Member States to develop the network infrastructure in order to promote future development of renewable power generation. Member States would be required to guarantee access to the network and give priority to the transmission of renewable power.

In addition, the draft Directive on renewables requires the transmission and distribution power companies to draw up and publish standardised rules for how costs shall be distributed for the connection to the network and network maintenance.

The issue of the *intermittency* of renewable power sources has come to the fore in recent years, due to the spectacular expansion of wind power in the European Union – primarily in Germany, Spain and Denmark, but also in many other countries, including Sweden. Some major recent outages or incidents in Western Europe are, at least partially, said to be caused by this problem.

In Northern Europe, Denmark has been able to build an impressive wind power generation capacity, representing a world-record level of 20% of total power generation. Denmark has been able to rely, heavily, on the long Nordic tradition of power trade, where neighbours Norway and Sweden have a high percentage of easily regulated hydro power generation - Sweden about 50% and Norway as much as 99 % - in order to balance and 'back-up' its wind power.

For the time being, this issue is perhaps not as "urgent" in the Nordic countries, but still it is an issue that has yet to be resolved at a wider European level, and as wind power generation is rapidly expanding on the European continent, the issue will remain a top priority in the years to come.

One issue worth discussing is the possibility of integrating the potential balancing capacity in Norway into the wider European power system. If the countries benefiting from such a solution could agree on how to finance further cables from Norway to the continent, the possibility of exploiting the Norwegian hydro power more efficiently for European system security purposes could contribute to resolving balance problems resulting from new wind power capacity being connected to the European power system.

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Questions

- Is it desirable in the long run to have different support systems in integrated markets like the European Union or the United States? How would this affect efficiency in the energy market?
- Which approach would be the most successful to reach the political targets for renewables - a marketbased or a state-aidbased approach for investments in grids and in reserve and balancing capacity?
- Should the regulator include without restrictions the investments costs for renewables in the revenue cap when setting the tariffs for a regulatory period. Should these investments be handled separately?
- Will the electricity system inevitably become more vulnerable, when renewables increase their share of power supply? Which are the optimal solutions to balance an increasing vulnerability?