D3.3: Attitudes of market actors to the demonstration projects

Author:	Mr. Carlos Madina
Company:	Labein
Address:	Parque Tecnológico de Bizkaia, c/Geldo, Edificio 700 E48160 - Derio Spain
E-mail:	cmadina@labein.es
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Further Authors:	Mr. Iñaki Laresgoiti, Dr. Miguel Ángel Sanz (Labein) Mr. Frede Hvelplund (Aalborg University) Mr. Anders Andersen (EMD International) Dr. Aikaterini Fragaki, Dr. David Toke (Uniersity of Birmingham) Mr. Peter Ritter (EMD Deutschland) Dr. Krzysztof Wojdyga, Ms. Malgorzata Kwestarz (Warsaw University of Technology) Mr. Heiki Tammoja, Mr. Olaf Terno (Tallin University of Technology)

Abstract: This document presents the vision that the actors active in different markets have about wind power, CHP and the combined use of both technologies so that electricity imbalances can be reduced. The markets considered are those of the countries participating in the project, that is, Spain, Denmark, UK, Germany, Poland and Estonia.

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1. INTRODUCTION

Attitudes by market actors and general market trading conditions will affect the possibilities for demonstration, promotion and dissemination of our practices, tools and systems. Are regulators and system operators in the different countries open to the sort of balancing techniques advanced by this project? How do actors, such as trade associations, see the role of our systems being? Besides, the perceived impact of the balancing techniques on the balance sheets of CHP and wind power operators will be of crucial importance.

This document presents the opinions of different market actors in each of the countries under analysis, including system operators (both transmission and distribution), wind and CHP producers, aggregators, regulators, NGOs and traders.

In order to determine the attitudes of market actors, different information sources were used:

- Interviews
- Phone conversations
- Mail surveys
- Official reports (without direct contact)

A questionnaire was prepared to be used in interviews and mail surveys and it can be found in Annex I.

For further details on the duties and rights of the different actors, see deliverable *D3.2: Potential for access to electricity markets for the demonstration projects in the different country-case studies*.

2. ATTITUDES OF SPANISH ACTORS

In order to know the attitudes of actors who participate in the Spanish market, four actors were interviewed.

The interviewed actors covered a wide range of roles, including:

- The Transmission System Operator: Red Eléctrica de España – REE
- One of the main Distribution System Operators: Iberdrola
- A CHP/wind distributed producer owned by a public body: Ente Vasco de la Energía – EVE (Basque Energy Agency)
- An aggregator of wind farms who belongs to the same group as a wind turbine producer and a wind farm promoter: Wind to Market

2.1. Transmission System Operator

Spanish external dependency on fossil fuels makes necessary the use of autochthonous resources, as much as possible. Therefore, renewable energy sources, including wind energy, must be promoted. Besides, Spain is becoming one of the world-leading countries in technological development linked to wind energy, so wind energy is very beneficial for the Spanish economy. On the other hand, environmental pressures derived from Kyoto Protocol foster the use of non-fossil energy sources, such as wind.

Based on all these reasons, the Spanish Transmission System Operator has a positive attitude towards wind energy, and would like to integrate as much wind capacity as possible, compatible with the system security. Nevertheless, they see some problems in the present Spanish regulatory framework and would like more wind farm promoters' implication.

Spanish regulation concerning the interconnection of distributed generation to the grid was issued on 1985. In that period, the contribution of distributed generation to the electricity supply was marginal, so it was required to disconnect from the grid when voltage sags happened. The first wind farms in Spain were developed following that standard. As wind capacity increased, however, the Transmission System Operator requested a change in the connection requirements, so that wind farms were able to overcome voltage sags. The reason for this request is that in some transmission grid nodes, there is as much capacity as 2 GW. If a voltage sag occurs and all that capacity goes out of the grid, as the old regulation required, the power system would not be able to keep the stability. Besides, Spain has not enough interconnection capacity with other countries; Morocco is a small power system, and uses that AC interconnection to guarantee its own grid's stability; the addition of Portugal has almost no effect in the islanded situation of the Iberian power system; and the expansion of the electrical interconnections with France are delayed for decades. Nowadays, it is planned an increase in the interconnection capacity with France, in order to really integrate Spain and Portugal in the European Internal Electricity Market, but support from other countries is not enough at the moment, so that Spanish Transmission System Operator has to manage the system, almost, on its own.

Wind farms will receive a bonus if they install or have installed the required equipment or generator's adaptation to bear a pre-determined kind of voltage sag. However, the improvement of the fault ride-through capability is not mandatory and depends on the promoter's choice.

The other main request by the Transmission System Operator refers to a delegated dispatching centre. Wind power cannot be seen as distributed generation in Spain, because several wind farms are usually connected to the grid at the same node. Those grid nodes do not have consumption most of the times, since wind farms are usually located at the top of hills, so that wind power not only does not help reducing the need for transmission lines, but it also needs new specific developments. Each grid node is dimensioned to accept a certain electricity generation amount, but wind power is very intermittent, so that they usually want to install more capacity than the capacity that the grid node could accept, alleging that it is very difficult that all the wind farms will produce at top capacity at the same moment.

In the past, the Transmission System Operator accepted including more capacity than the designed amount in some grid nodes. When wind production is reaching the capacity limit of the transformers, the Transmission System Operator asks wind producers to disconnect part of their farms, to guarantee the system security. Without a delegated dispatching centre, wind producers are not reachable, so they might not act as the Transmission System Operator would need.

Besides, there are more than 300 wind farms in Spain, so it is very difficult for the Transmission System Operator to communicate with all of them. This problem will be solved with a delegated dispatching centre. There are some delegated dispatching centres, such as those owned by utilities or by main wind power promoters.

Small investors, though, are not able to install their own dispatching centres, and do not want to be included in dispatching centres operated by big companies, because they think that their interest will be damaged. As a consequence, they ask the Transmission System Operator to create and operate a last-resource dispatching centre. However, the regulatory framework hinders this possibility, so the Transmission System Operator asks renewable producers' associations to create and operate this dispatching centre.

Other problems caused by wind energy are reactive power consumption and forecasting errors. These problems, though, are not as important as the disconnection of capacity as a result of a voltage sag, or the lack of a delegated dispatching centre.

As a consequence, they see the solutions proposed in DESIRE very positive to their system operation. Everything which is dispatchable, predictable, and able to overcome voltage sags is positive for them. Nevertheless, the wind capacity and the CHP capacity to be balanced should be located in the same grid node, so that they could offer a real advantage to the system, because, that way, there would be no electricity flow through the grid to balance their production.

This is difficult, because wind capacity is not distributed in distribution networks, but it is dispersed through transmission networks. Besides, it is usually located on top of hills of rural areas, where there is no consumption to pay for CHP capacity. What is more, in Spain, there is no district heating networks, and CHP does not use heat storage, which makes it difficult to use the balancing techniques proposed in DESIRE. They also see a problem in the CHP capacity needed to balance the installed wind capacity in Spain (more than 9 GW).

Summarising, wind power creates some problems to the Transmission System Operator, which could be reduced by using balancing techniques from DESIRE, but CHP and wind should be located at the same grid node. However, present conditions of CHP in Spain offer little opportunities to use these techniques.

2.2. Distribution System Operator

The Distribution System Operator contacted was Iberdrola Distribución, the Distribution System Operator belonging to Iberdrola, one of the two main Spanish utilities.

This Distribution System Operator thinks that wind energy is positive for the society as a whole, because it reduces the total energy cost, it is environmentally-friendly and it is a clean energy. On the other hand, the main disadvantage of wind energy is that it is expensive, and the bonus it receives must be paid by every electricity consumer. Nevertheless, they think that wind energy should be promoted, and that present fostering mechanism is correct.

In Spain, wind farms are connected at transmission and distribution levels, approximately, with a 50% share, although new capacity tends to connect at transmission level. When wind capacity is connected at distribution level, the investor must contact the Distribution System Operator and ask for a connection point – at transmission level, the process is the same, but contacting the Transmission System Operator – which must be given, unless capacity constraints appear in the network. The management of these connection requirements is one of the problems that wind power poses on Distribution System Operators.

If wind producers sell their electricity output to the Distribution System Operator, the Distribution System Operator is responsible for managing the electricity, for making forecasts and for paying for unbalances. Wind farm owners must forecast their electricity output if their capacity is above 10 MW, and they will have to pay for their unbalances from January 1, 2006, as long as the unbalance is higher than the 20%. Nowadays, they do not have to pay for imbalances, so some wind producers forget about forecasts and offer at any moment the 50% of its installed capacity, so that overall are inside the 20% unbalance most of the times. This is a problem for the Transmission System Operator and for the Distribution System Operator, because they cannot trust these wind promoters. Distribution System Operators are last-resource suppliers in Spain, so they have to buy electricity in the market. The electricity to be purchased is the expected demand minus the production from wind farms and other renewable energy sources and CHP. If wind production forecast is not trustworthy, the Distribution System Operator has to develop forecasting methods, in order to reduce its unbalances. Nevertheless, it sees a good attitude of most wind farm promoters, in order to solve present problems.

Besides, wind power fluctuation, when it is not due to voltage sags or other special contingencies, affects power-frequency regulation and market mechanisms, so the Transmission System Operator has to use as many ways as possible in order to reduce its influence, including primary and secondary regulation, intradaily markets, etc.

In addition, these fluctuations also create local voltage changes and possible overloads in distribution networks, which, due to their local characteristics, must be compensated at a local level.

Another problem of wind power is that it has saturated distribution grids, so wind capacity is hindering the development of other renewable energy sources, such as sun, small hydro or biomass.

CHP is seen as very positive, because it is a distributed generation, located in the points of consumption and, therefore, reduces the needs for investments in the network. Besides, it is dispatchable, so it helps in operating the network. CHP creates no problem to the DSO and, as a result, it is a very good technology for them, and they think that it should be promoted.

They think that there is no district heating in Spain, and that heat accumulators are not used for CHP. Consequently, they think that a better option would be to balance wind energy with other technologies, rather than by using CHP. They only see the balancing technique possible at a small scale, with a wind farm and a CHP plant located at the same grid node, and each CHP plant balancing one or two wind farms, that is, a one-to-one relationship. The reason for this constraint is that communication technologies are not as fast as needed in order to balance wind power fluctuations, and that for large-scale balancing, Spain has a lot of pumped storage hydro power plants, which are able to compensate wind power fluctuations much faster than CHP. In fact, Iberdrola owns several pumped storage hydro power plants, and uses them to compensate the fluctuations of their wind farms.

Another possible option is the use of solar thermo-electric plants, with heat accumulators to balance wind power fluctuations. Nowadays, solar thermo-electric technology is not much developed in Spain, but it is expected to face a big boom in coming years. This technology uses thermal storage to produce electricity, so that it is quite well suited for the balancing systems proposed in DESIRE, although solar thermal technology must be developed a bit more.

Summarising, the attitude towards wind and CHP is positive, but they do not see the balancing techniques proposed here as the most effective ones. They think that big pumped hydro plants and solar thermal plants are best suited for balancing wind production, even if the techniques proposed can help in reducing the influence of wind power fluctuation.

2.3. Distributed Producer

The Ente Vasco de la Energía – EVE is the Basque public body for energy. It promotes projects based on renewable energy sources and energy-efficient technologies.

They see wind power as very positive, for the benefits it gives to the society, such as the reduction of environmental impact, the reduction of need for external imports of fossil fuels, and the benefits it offers as distributed generation. Most of their generation is sold to the Distribution System Operator, so they do not have to pay for unbalances, and they do not have to make a financial guarantee to make the market operator sure that they will pay for their unbalances. The only problems that wind energy creates to the society are the visual impact and the lack of accurate forecasts, but benefits exceed problems.

They also see CHP as a good technology, because it reduces the need for external imports, it increases energy efficiency and because it is a distributed generation. The problems created are derived from plant operation and those intrinsic to distributed generation, but benefits are much higher.

They do not think that heat accumulators are used in Spain, because CHP is mostly linked to industrial processes, and the plants are dimensioned to satisfy heat demand. Another problem for balancing techniques proposed in DESIRE is that weather conditions are not as severe as in other European countries, so there is not as much heat demand as to pay for installing heat accumulators. If appropriate conditions were given, they think that these techniques would be a good solution to solve the problems created by wind energy. Those conditions include good R&D Programmes and investment subsidies, to pay for the costs of installing the necessary equipment. In general, their attitude to these balancing techniques is positive, but weather and socioeconomic conditions make its implementation difficult.

2.4. Aggregator

The aggregator contacted was Wind To Market, a company included in Gamesa Group, the main wind power equipment manufacturer in Spain, and one of the most important investors in wind power. Opposite to some other vertically-integrated corporations, Gamesa has a close relationship between all of its members. As a result, the investing company benefits from the technological development of the manufacturing area, and uses the knowledge of the aggregator to operate wind farms. As a consequence, answers were given for both the aggregation division and the wind farm investing division.

For Gamesa, wind energy is its main business, so that they are at the front of any technological development, such as voltage sag support, reactive compensation, forecasting… Wind power allows the aggregator to have a bigger portfolio of installations, making the management of the total output easier. Besides, the aggregator obtains a good knowledge of the market, which reduces unbalances. As a result, the investing division benefits from this knowledge and can take risks, which increase the value of their wind farms. Obviously, they are in favour of wind energy, and try to make it as similar to central thermal power plants as possible, so that the problems created to the Transmission System Operator are reduced. They have no problems with wind energy, since they see those problems as challenges for their business, and overcoming those challenges increases their ability to compete in the market. Other problems created by wind energy must be solved by disseminating knowledge and in working groups with the rest of involved actors, so that difficulties can be overcome between all of them. They think that Spanish feed-in tariff system is a good example for other countries, because it offered attractive bonuses and a high security for wind energy when the technology was not mature, and now that technological development has happened, it offers higher benefits by entering the market, where the risk is also higher.

They think that it is very important to have a good relationship between all the participants in the market, and, therefore, they agree with Transmission System Operator's requirements on voltage sag support, delegated dispatching, reactive compensation, forecasting, etc.

They do not aggregate CHP, because CHP producers prefer to stay receiving a fixed payment rather than entering the market. The reason is that they have a risk with gas price, and biomass CHP technology is not mature enough to enter the market. They think that CHP may help in demand management, but not nowadays, because regulation does not allow to. At present, CHP can balance wind production, but, since they are not connected at the same node, they think that the problem is not really solved. In Spain, market actors can balance the production from their entire portfolio at a system level, that is, a CHP plant can balance a wind farm located at 800 km. From the perspective of the market, it might have a sense, because, the market knows the total amount of electricity to be generated and consumed at any moment. But from a technical point of view, there is no sense in doing that. If the wind farm is located in a high-generation area and the CHP in a high-consumption area, and if wind power generation increases, there is no point in reducing CHP generation, because it would be harmful for the system; the required action would be the reduction of generation in the area in which excess wind power is being generated. Although it is helpful for their business, this aggregator does not agree with this regulation. They are also quite sceptical about some CHP plants, which are supposed to use heat for their industrial process, and their main economic activity is selling electricity. They see distributed CHP as a good way of reducing demand, but current regulatory framework does not allow doing so, unless certain conditions are met, and they think that a change in regulation should be made to improve the efficiency of the system.

They do not think that heat accumulators are used in Spain, due to weather conditions. Besides, they think that wind power is able to solve its own problems, without the need for CHP. In case of external aid would be needed, they would opt for hydro to compensate unbalances. Nevertheless, they would be interested in using the balancing techniques proposed in DESIRE if they demonstrate an economic performance, and if they were used in the same grid node.

3. ATTITUDES OF DANISH ACTORS

The attitudes of actors who participate in the Danish market were determined through interviews or by reading their reports.

The analysed actors covered a wide range of roles, including:

- The Transmission System Operator in West Denmark: Eltra (now being owned by Energinet.dk
- Regulators: the Ministry of energy and the Danish Energy Regulatory Authority – DERA
- NGOs/researchers: Danish Ecological Council

3.1. Transmission System Operator

The actor contacted was the Transmission System Operator in West Denmark, Eltra (now being owned by the Danish State company Energinet.dk).

Eltra is responsible for the main tasks:

- Ensuring the physical operation of the system in the short and long term
- Administering market access and planning market function
- Planning, developing and operating the overall transmission grid and the international interconnections

As a starting point, wind energy makes all of these tasks more complicated. But in addition to this, Eltra is responsible for ensuring that the electricity system lives up to the energy policies pursued in Denmark. Development of wind energy is an important part of these energy policies, because it is an important mean of reducing CO_2.

To solve some of the technical problems caused by wind energy, Eltra has prepared new rules for connecting wind turbines, both wind turbines connected to grids with voltages below 100 kV (primarily land-based wind turbines) and wind turbines connected to grids with voltages above 100 kV (primarily offshore wind farms). These new rules will be used in connection with the Danish Energy Authority's invitation of tenders for the new offshore wind farms at Horns Rev and Rødsand.

The next 200 MW offshore wind farm at Horns Rev makes it necessary to start a thorough planning of expansion of the high-voltage grid in Western Jutland.

Emergency plans are put in effect in situations with low consumption, with a high level of wind power production and with limited access to neighbouring areas. This is done very primitively by sending a text message to selected generators. The plans also make it possible to stop a small number of wind turbines.

The wind production from Horns Rev varies a lot. Production varies from 50 per cent to 100 per cent of the nominal capacity if the wind speed increases from approx. 9 to 11.5 metres per second (in practice, from 80 to 160 MW). Such changes in wind speed are normal and can happen within few minutes.

The variations place considerable demands on the flexibility of the rest of the system. It is therefore essential that the focus is directed at regulating properties when preparing the terms for connection of future wind farms. The need for regulation will become considerably greater if several wind farms are placed in the same location.

Often wind production increases the problems of grid congestion (called grid bottlenecks). The NordPool Elspot market is handling these grid congestions. In other words, Elspot is a market place where energy and capacity are combined into one simultaneous auction.

Until now, decentralised CHP has caused problems for the electrical system, because decentralised CHP has enjoyed priority access to the grid at politically fixed prices – thereby often contributing materially to the balance problem. As from January 1, 2005, this has changed slightly as all local units over 10 MW – in reality approximately half of the local CHP-based electricity production – must now be sold in the market. In two years' time, this requirement will apply to all units over 5 MW. Even though the local production will largely be governed by market signals, Eltra is retaining its emergency plans, which make it possible to stop selected plants in critical periods. This will make Western Denmark less dependent on help from neighbouring areas.

The large share of wind power in Western Denmark requires flexible solutions to ensure the necessary balance between production and consumption. Interaction with the neighbouring areas is important for a smoothly operating market, but also for being able to create a physical balance between consumption and production in critical situations. The balancing is achieved via the regulating power market, in which generators, against payment, offer to change their production relative to the plan. Eltra collaborates with the other Nordic system operators on the delivery of regulating power and Eltra is currently working to become integrated into the Nordic regulating power market. However, due to the congestion on the transmission lines to Norway and Sweden, there are times when it is physically impossible to obtain regulating power in the Nordic region. With a view to ensuring the availability of resources, Eltra therefore enters into agreements concerning regulating power with suppliers in Western Denmark.

Eltra has since January 1, 2004 bought regulating reserves via EU tenders. Since April 1, 2004, the tenders have been monthly. These reserves receive a capacity payment per MW for being on standby to deliver a certain volume of power to the regulating power market. In this way, these reserves guarantee a minimum supply in the regulating power market which enables Eltra to maintain a security of supply and comply with all international obligations. The energy company Elsam was virtually the only bidder in 2004. Nevertheless, the open EU tenders have had a considerable signal value. Purchase of reserves resulted in enquiries, and at the end of 2004 Eltra concluded an agreement with a player on the delivery of upward regulation reserves. The player is establishing a 25 MW gas turbine plant in Esbjerg in West Denmark. This marks the first establishment of production units on market terms following the liberalisation of the Danish electricity sector. Furthermore, a framework agreement has been signed with the same player concerning the pooling of emergency power units in Western Denmark for use as upward regulation reserves.

The open tenders and the plant in Esbjerg are, furthermore, a clear signal to decentralised CHP units that participating in the reserve market is attractive. Eltra will endeavour to develop the tender procedure with a view to allowing as many suppliers as possible to bid.

3.2. Regulator

3.2.1. Ministry of Energy

In June 2005 the Ministry of Energy published “Energy strategy 2025”, where some main principles and policies were outlined.

It should be emphasised that the long-run goal is to switch from fossil fuels to renewable energy sources. It is the aspiration to make this change by means of the market. Regarding the question of fluctuating energy supply in an energy system with a high proportion of renewable energy, it seems that the Government also expects that this problem will be solved at the market. In order to make the market work better and in order to solve the problem of fluctuating energy sources, the Government plans to expand the electricity transmission capacity. This transmission capacity should be expanded by the state-owned transmission company outside any market regime. Furthermore the Government intends to establish an action plan for flexible electricity consumption, and to change the taxation structure so that it becomes easier to sell wind power electricity at the heat market.

Regarding the long-run, there is an intention of supporting research within hydrogen technology for transportation. If this is successful, it might, by means of hydrogen storage systems, solve some of the fluctuation challenges.

Concluding: the Government believes that fossil fuels should be replaced by renewable energy on a long-term basis, but this should be done by the market. Regarding the fluctuation challenges, the government so far plans to solve these by investing in increased transmission capacity in combination with flexible electricity consumption and by establishing possibilities for selling some of the wind power at the heat market.

3.2.2. The Danish Energy Regulatory Authority – DERA

DERA is the independent energy market regulation authority established on January 1st, 2000 to monitor and supervise the monopoly enterprises in the energy sector, including electricity, natural gas and district heating. Replacing the former Electricity Price Committee and the Gas & Heating Price Committee, the work of DERA aims at making energy markets transparent and economically efficient and securing energy supply to final customers at fair prices. DERA members are appointed by the Danish Minister of Transport and Energy for a four-year period.

DERA regulates prices, terms of supply and access to transmission and distribution networks. It furthermore aims at supporting structural development in the energy sector, as well as it supports improvements of efficiency (not clear if economic or energy-wise). The regulation authority works to facilitate Nordic and European co-operation among regulators.

The DERA board meets monthly to decide upon cases brought forward by companies, organisations and private people. These cases typically reflect imminent problems in legislation and regulation. Among the cases, there are the appeal of a group of private customers against grid- and system tariffs, the petition of private producers against administration fees, or the distribution of system costs. In the year 2004, DERA processed 873 new cases. Decisions made by DERA may be appealed to the Energy Board of Appeal.

DERA's secretariat is managed by the Danish Competition Authority (Konkurrencestyrelsen) under the Ministry of Economy. One of the three divisions, the electricity division, focuses at electricity, Energinet.dk (the national Transmission System Operator), co-ordination of Council of European Energy Regulators (CEER) and the Forum of Nordic Energy Regulators' (NordReg) work, including submission of hearings and distribution of cases, etc.

DERA is an administrative unit having no political attitudes towards either fossil fuels or renewable energy, but their way of administrating the energy law might influence the market forces and, thus, how the conditions for flexible energy systems are designed at the market. The main change in the administration of DERA develops in a process of practice, where complaints from the different market actors are treated.

So far, no complaints have been made to DERA aimed at the misuse of monopolies in the electricity sector. The opening of the Danish power market has been largely trouble-free. On the issue of the regulation power market, no specific complaints or appeals have been brought forward to DERA, with the exception of the power trading company DV-Energi, owned by the association of wind turbine owners (DV), who has appealed to the two Transmission System Operators (Eltra and Elkraft System) about the high administration fees for selling electricity under market conditions.

DERA did not have much authority to actually change things to begin with, but it has been good at claiming power. Some relevant cases would in fact be administered by the Competition Authority. In case actual decisions are required, the Danish Energy Authority under the Ministry of Transport and Energy has the executive power.

Among the appeals, there are the complaint of independent power traders such as DLE – the farmer co-operatives' power trading company – about access to meter data, which is essential for non-monopoly power trading. Other cases concern the lack of transparency in a few power trading companies, where typically the monopoly activities were not clearly separated from the open market activities.

The association of co-generation stations – Danske Kraftvarmeværkers Forening (DKV) – is about to establish a co-operation on offering regulation power to the market. A note on this has been on the agenda of a preparatory meeting of DERA recently.

Several complaints have been posted regarding the lack of efficiency of energy traders, e.g. by the Association of power end-users. Efficiency is required according to paragraph 72 of the Bill on Electricity. A few cases are about the misuse of PSO-information for commercial activities. A current, yet unsettled case is about the organisation of the new national Transmission System Operator energinet.dk.

Concluding, regarding DERA's activities, one cannot say that the market design process, in which DERA is an important actor, is at present in any way systematically supporting the establishment of incitements to foster the establishment of flexible energy systems which are able to solve the coming challenges of increasingly fluctuating energy systems. So, the aspiration of the Government that the market will solve these problems does not seem to be in a process of fulfilment.

3.2.3. NGOs/Researchers

The Danish Ecological Council is a nongovernmental organisation dealing with a wide range of ecological problems. In 2005, it published a new report which discussed the present Danish energy policy. It is called From “Energy strategy 2005” to “Energy plan 2050” (Det Økologiske råd 2005), indicating that the present energy strategy is too short-term in its aspirations.

In this report, there is a high degree of consciousness regarding the problems of regulating an energy system with a high percentage of renewable energy. The ecological council has the opinion that this regulation problem should be taken systematically into consideration in the energy planning procedure. The main attitude is that the challenge of fluctuating energy systems should mainly be solved regionally, and that a “solution” based on expansion of transmission capacity is not sustainable in the long-run, both due to the bad economy in the “transmission” solution, and because wind power will also be developed in our neighbour countries, making the transmission/export solution unsustainable in the long-run. This means that the necessary economic incitements supporting the regional technological systems supplying the needed flexibility energy system should be implemented, for instance:

- The establishment of incitements fostering flexible electricity consumption.
- The establishment of incitements which promote heat pumps in connection with heat storage systems and flexible cogeneration units.

Concluding, one can say that the problem underlying here is that the market does not solve the fluctuation challenge, and that it is necessary a systematic energy policy within this area.

4. ATTITUDES OF BRITISH ACTORS

In the UK case, the attitudes of actors were determined by reports and phone conversations. The analysed actors are:

- The Transmission System Operator: National Grid Company – NGC
- Distribution System Operators
- Regulator: Office of Gas and Electricity Management – OFGEM
- Energy Trader: Smartest Energy
- Wind producer: British Wind Energy Association

4.1. Transmission System Operator

The transmission system is operated by the National Grid Company (NGC). They are keen to encourage CHP operators to offer reserve capacity to their short-term reserves market. This is part of the balancing mechanism (BM) that supplies a small part of the electricity required to balance the market. In practice, in the British electricity system, most of the balancing is done, in effect, by the main electricity suppliers, who are required to balance their supply with sufficient generation. However, the balancing mechanism ensures that the margins of supply and demand are matched. The short-term operating reserve market is in fact fairly illiquid, with the large bulk of the 3 or so GW that is seriously offered for reserve purposes being contracted. The plant can be as small as 3 MW and, in addition to this, NGC will accept a combination of plant that can make up 3 MW, provided that the plant will be dispatched as one unit.

The formulation of the New Electricity Arrangement (NETA), which was introduced in 2001, was widely criticised for having the effect of imposing unreasonable (effective) penalties on intermittent generators like wind power. However, NGC was comfortable with the arrangements being altered so that wind power companies (and others) could declare their production up to 1 hour before gate closure, rather than 3 hours in the original design. This has alleviated, although not removed, the problems faced by fluctuating renewable energy supplies.

NGC is keen to encourage flexible reserve options that can accommodate fluctuating renewable electricity, especially in view of the fact that such supplies are likely to increase over the coming years. However, it is anticipated that current market arrangements are sufficient to deal with any problems that are likely to occur in the next few years.

NGC has a duty to help integrate renewable energy supplies. To this end, it is busy trying to upgrade the transmission system in Scotland in order to do two things. First, to upgrade the North Scotland to South Scotland transmission line from 132 kV to 400 kV. Second, it is proposing to upgrade the transmission lines that carry power further to the South into England. This process involves lengthy planning consultations and controversy concerning overhead power lines.

There is also an ongoing discussion about how NGC can accommodate Round 2 of the offshore wind power programme. The income streams for generators associated with the Government's Renewables Obligation mechanism are not quite high enough to ensure completion of the Round 2 programme. In order to alleviate this situation, the Government has proposed that the cost of the transmission be paid for out of transmission charges borne by electricity consumers in general.

4.2. Distribution Network Operators

The remit of the 15 Distribution Network Operators in the UK is limited to the provision of workable distribution systems allowing reliable electricity services at minimum cost. They have a statutory duty to connect up decentralised generation, but there is no duty to ensure that it is done at a particular cost. Indeed, wind power and CHP developers have frequently complained that Distribution Network Operators have given excessive quotes for connection, which have been greatly reduced after having been challenged. In defence of the Distribution Network Operators, it can also be said that they are often in a position where several prospective generators have applied for connection on lines that would need strengthening if all of the projects materialised. In addition, the Distribution Network Operators do not know what is going to happen in between giving the original estimates and the projects actually coming on line, since there are often long delays between these two events. Distribution Network Operators have a duty only to present estimates for a 30-day period. However, it is also alleged that sometimes Distribution Network Operators can find cheaper means of resolving problems than they may propose in making connection proposals and estimates.

On the other hand, Distribution Network Operators have expressed enthusiasm to take advantage of incentives for them to assist the development of embedded generation. For example, the North East Distribution Network Operator (CE Electric UK) has engaged in a research project that is supported by the Department of trade and Industry in the area of RPZs.

4.3. Regulator

The Regulation of the electricity system is undertaken by the Office of Gas and Electricity Management – OFGEM. Since OFGEM are mandated by law to incorporate environmental objectives into their consideration of pricing and other policies, they have a duty to consider how sustainable energy technologies, such as wind power and good quality CHP, can best be accommodated in the electricity system. However, these considerations have to be done in the context of best possible competitive practices in order to deliver electricity and gas services at the lowest possible cost.

OFGEM are responsible for monitoring the Renewables Obligation (RO), which gives incentives to wind power and other renewable energy generators. They have had a central role in considering changes to the Renewables Obligation in the current review of the arrangements. OFGEM is also involved in monitoring and actively in setting up particular initiatives to promote the development of embedded generation. Embedded generation is generation that produces directly into the distribution system. This has potential advantages in strengthening the local electricity supply system. CHP, and also wind power, is an important type of embedded generation, so measures to promote this generation will also help the development of CHP. OFGEM set in motion a process of promoting embedded generation. Three types of initiatives have flowed from this work. First, there have been changes to the distribution price control, so that distribution network operators are now allowed to pass through to consumers investment costs of achieving savings through reducing demands on the grid infrastructure through measures such as encouragement of embedded generation. Second, there is an innovation funding incentive. This may involve funding trial equipment that can assist in embedded generation. The funding of software to help manage CHP plant with accumulators in the British system would be an example of this. Third, there is the registered power zone concept. This involves funding of innovation of a project or projects in particular zones that have been earmarked for innovation.

4.4. Wind Producer

The British Wind Energy Association (BWEA) is keen to investigate all plausible means of balancing fluctuating wind power supplies. To that extent, it supports initiatives such as DESIRE. However, the BWEA believes that there are various options available for balancing wind output and balancing through CHP units is only one of them.

Currently, the BWEA is working to defend the Renewables Obligation and also to ensure that offshore wind power developments are properly funded, in particular through subsidisation of Round 2 grid connection. The BWEA hopes that the Government will convert its 'aspiration' for 20 per cent of renewable energy by 2020 into a firm target applied to the Renewables Obligation.

4.5. Energy Trader

Smartest Energy is a leading so-called 'consolidator' in the UK's electricity market. This means that it works to pull together a number of otherwise small CHP and renewable energy generators in order to reduce their exposure to the 'imbalance' penalties associated with trading on the UK electricity markets. Smartest Energy's portfolio is around 1 000 MW, which itself is significant, in that this represents over 1 per cent of UK generating capacity.

Electricity traders must produce or supply what they predict, or else suffer imbalance charges. Smartest Energy's activities aim to achieve the objective of reducing this imbalance risk for independent generators of all commercial (i.e. non-domestic) sizes. In effect, anything over 30 kWe (and which therefore needs a half hour meter) can be dealt with by the company.

Smartest Energy treats its clients as 'negative demand'. In doing this, the expensive procedure of complying with the electricity markets Balancing and Settlement Code is avoided. Indeed, charges are avoided. In return, Smartest Energy can deliver something that is close to the market price for the power they are generating. However, in the case of the smaller customers, it may be too much effort to produce a fully tuned half hour by half hour price schedule. A CHP-scheme of around 1 MWe may be given a simplified price schedule of, say, four different prices for summer and winter, peak and off peak prices. In the case of wind power, there is likely to be a discount of 10-15 per cent on the market price of energy as represented by power exchange prices. Currently, Smartest Energy already deals with a number of traders in the biomass field and it is hoping to extend its portfolio of wind power operators in the future as the capacity of wind power is increased.

Smartest Energy has expressed interest in the idea of co-production between wind power and CHP. If contracts can be agreed between CHP plant and wind power plant, then a predictable flow of electricity can be generated which can reduce the imbalance charges that will have to be paid as a result of fluctuating wind power supplies. It needs to be emphasised here that it would be Smartest Energy who would be trading on the electricity markets, and not the co-producing CHP and wind power plant. They would have a contractual relationship with each other, and also with Smartest Energy, to produce energy to receive payments agreed between the co-producers and Smartest Energy.

5. ATTITUDES OF GERMAN ACTORS

In order to know the attitudes of the actors participating in the German market, four different actor's positions are presented. The descriptions are the results of diverse dialogues with several actors, conferences and written statements, news items and presentations of the several actors. The described standpoints cover a wide range of roles, including:

- The Transmission System Operator (TSO)
- A small Distribution System Operator (DSO) who also operates CHP and renewable energy sources: Stadtwerke Schwäbisch Hall
- A wind farm operator
- The view of the association of new energy suppliers: "Bund neuer Energieanbieter, BNE"

5.1. Transmission System Operator

The extension of CHP and renewable energy sources (mainly wind power from the economic view) is a public aim to reduce environment problems and to fulfil the goals of the Kyoto protocol. Due to the fact that the generation of electrical energy with renewable energy sources is a political and a public intention, the Transmission System Operator, as a company included in the four biggest energy utilities – whose share in electrical energy generation is 80% –, cannot prevent it. On the other hand, due to the peculiarity of the generation of the renewable energy sources, regulation power and capacity are required, which will also be offered by the partner companies of the Transmission System Operator. In the opinion of the Transmission System Operator, the limited possibility of a certain prognosis of wind power production for the next 24 hours is the main reason why so much regulation power and reserve are necessary. From the viewpoint of the Transmission System Operator, this is the reason why the price for electricity was increasing parallel to the growth of renewable energy sources in Germany.

The consortium of the four biggest utilities does not operate any big wind farm in Germany. Consequently, they do not see economic benefits of the high penetration of renewable energy sources. They only refer to necessary challenges to operate the grid with high penetration of renewable energy sources, such as:

- The direction of the load flow concerning the actual situation (load flow from the high voltage level to the low voltage level) will temporary turn around. Several grid components (protection devices, switches, etc.) are not designed for an inverse load flow direction.
- The traditional operation of the grid is not possible any more. The prediction of the feed-in of the renewable energy sources has to be included in the daily schedule of operation.
- During grid errors, e.g. short circuits or electric arcs, the conventional power plant will support the grid by rebuilding the grid. Older renewable energy sources (mainly wind turbines) cut off from the grid in case of a detected grid error and wait for a stable grid to connect again. Dealing with a high penetration of renewable energy sources, the normal power plants will not be able to create the stable grid again, in case a large share of wind plants disconnect from the grid. As a result, new guidelines dealing with big wind farms include the requirement that the wind turbines will also have to feed-in in case of a grid error.
- In rural areas with high penetration of wind farms and low consumption, there are some bottlenecks. To solve these problems the extension of the grid is being applied.

- For the extension of the big potential of offshore wind power, new high voltage transmission lines are necessary. The erection of new overhead lines is not in the interest of the affected people, so the proposal is very time consuming and it is difficult to get the permission.
- Renewable energy sources usually do not have a regulation possibility. Normally they feed-in the maximum value of the resource. However, with a high penetration of decentralised power plants, most of them should have a kind of (automatic) regulation to ensure grid stability.

To analyse the situation and the challenges for the future, the "Deutsche Energie Argentur" (DENA) organised an expert group of Transmission System Operator, Distribution System Operators, wind experts, institutes and manufacturers. Based on the prediction of the growth of wind power in the future, several load flow calculations were made to find out the necessary regulation power and new overhead lines. In spite of different opinions in the group based on diverse interests, there were a common result reported in the "DENA Grid Study" (Planning of the Grid Integration of Wind Energy in Germany Onshore and Offshore up to the Year 2020).

5.2. Distribution System Operator / CHP Producer

The Distribution System and CHP Operator contacted was Stadtwerke Schwäbisch Hall which is being involved in several roles in the energy market. The main roles are Distribution System Operator, CHP and small renewable energy sources generator, trader for other CHP generators and supplier for the consumers in their power-exchange balance groups. They use their CHP in several power-exchange balance groups to get the best economic benefit of their operation. Stadtwerke Schäbisch Hall is really interested in getting more flexibility, by operating CHP and keeping the balance in their power-exchange balance group. For the green energy market, they mainly purchase hydropower, but also wind power, from Austria. Hydro power with storage is one of the most flexible renewable energy sources to meet the load profile, but, to meet the exact load profile, they use their portfolio of CHP. They also use CHP to participate in the energy exchange, together with other "Stadtwerke" to sell and purchase energy. In practice, they use the generation of CHP flexible in several power-exchange balance groups to get the most economic operation. However, renewable energy sources produce only about 5% of the whole yearly demand for green electricity, so only small balancing problems appear in this balance group.

Stadtwerke Schwäbisch Hall takes the responsibility to supply environmentally-friendly energy, by using renewable energy sources in combination with a high penetration of CHP. The "Stadtwerke" operates only two small wind turbines with a total capacity of 1 MW, some small photovoltaic systems with 2 MW and hydro power systems with a capacity of 1.8 MW. Based on the rule that electricity from renewable energy sources and paid by the law "EEG" is not includable in the energy trade, they purchase green energy from foreign countries. In the daily practice, they use some kind of balance projects, which are not very flexible. Due to their own experience, they see that there is demand for these balance projects in the liberalised energy market. They are looking forward to the simulation results of DESIRE. For the promotion of CHP, Stadtwerke Schwäbisch Hall is very close to the association for CHP (Bundesverband Kraft Wärme Kopplung) and offers the sale of CHP power to other CHP generators. The CHP in Germany is designed on the base load of the heat demand in the summer time. This way, there is no heat accumulator in German CHP units. Up to now, the CHP operators do not see the advantage of heat accumulators. In order to promote the balance projects with CHP, examples have to be calculated, described and realised, so that people can be aware of these new possibilities.

5.3. Distributed Wind Power Producer

Most of the investors in wind farms are not only interested in the economic benefit but also in the environment-friendly generation of electrical energy. So, they are interested in the growth of wind power and renewable energy sources. Technically, they are influenced by other existing wind farms at different levels. First, if there are really close together, the farm losses reduce the annual yield and the electrical connection increase the grid effect (flicker, voltage drop, etc.). Besides, if wind farms can have bottlenecks in their grid area, they are influenced by each other. Bottlenecks are difficult to predict and yearly expected losses can not be calculated precisely. The operator of a wind farm is interested in generating as much electricity as possible. If their farm is being affected by grid management, as a result of the need to solve regional problems cause by bottlenecks, they will be really interested in having balance projects to reduce the financial losses resulting from disconnection. In practice, it has to be addressed whether there is enough CHP potential in the constrained grid branch, in order to realise such balance projects.

For that reason, they have a high interest in balancing projects to solve bottlenecks. If the results of DESIRE show the economic benefit of investigations in heat accumulators, they will realise some of these projects. However, this balance projects are not only focused on CHP. Maybe, another industrial consumer can connect some loads, in order to reduce the current level in the grid branch that presents the bottlenecks.

Based on the complaints that the wind power increases the need for regulation power and reserve, the wind farm operators are interested in reducing the demand for ancillary services or, at least, in reducing the prices of electrical energy for consumers, so that the image of wind power can be improved.

5.4. Association of “new” traders

In Germany, several new actors have established in the energy market of gas and electrical energy (e.g. Yellow Strom - partly nuclear power, Lichtblick - 100% RES)). Mainly, they are only electricity traders, without owning any network asset or generation plant. Some of these are located in foreign countries. The association of new energy traders (Bundeverband neuer Energieanbieter, bne) has about 30 members today. These members did not feel represented in the liberalised market by existing associations, so the association was founded in September 2002.

This group of traders is interested in offering the best and cheapest products for their customers and to use market possibilities. They criticise that there is no transparency in the regulating power market. For competitors, it is not documented which bidder won, which was the amount of regulation power and what was the price paid. The turnover in this market is about 1 billion Euros per year. It is estimated that the big four integrated utilities make a profit of hundreds of million Euros each year in this market. In addition, they claim that the regulation power market should be open over the border of the Transmission System Operators’ zones, to create competition between the big four players. As these big utilities generate 80% of the electricity and supply about 60 % of all electrical energy through their share on the distribution companies, the market is not liquid and the big actors can manipulate the prices on the market. With the new law – “Energiewirtschaftsgesetz” – several changes will come to get a more transparent market with more competition. However their work will give results in the next years.

The existing wind power in Germany did not concern directly the business of the “new” traders. It depends very much on the aim of the trader. In principle, they see the public demand to reduce the pollution of CO_2 and the dependence of the fuels.

In the magazine of the bne “compass 2 /2005” from beginning of 2005, they analysed the situation of the regulation power market and described the historical changes in combination of the growth of the wind power. They analysed the change of the demand and use of regulation power in the last years. In spite of the development of the wind power as a part of 5.5% of whole electrical energy in 2004, the demand on regulation power and reserve was stabile. Based on the available data, no increase in regulation power was discovered and the argument for the increase of the payment for the use of the grid because of the increase of the feed-in with wind power is not tenable.

To expand CHP with heat accumulator, they do not have a clear meaning, but to increase the flexibility of generation, they are looking forward of the results of the DESIRE project.

6. ATTITUDES OF POLISH ACTORS

At the end of 2005, production of electricity from renewable is very small – less than 3 %. The majority of this is produced in hydropower stations. Total installed wind power capacity is only 60 MW. There are two wind farms in the north-west part of Poland, whose capacities are 30 MW and 18 MW. The remaining 12 MW are distributed throughout Poland. It means that the economic situation for new investment in windmills is not good and real support from the government does not exist. State legislation (first from 1999 and next from 2000 and 2003) assumed the obligation to purchase all the electricity from renewable sources connected to the grid. The price for this electricity should be the same as the highest price in the tariff of the distribution company.

This mechanism from legislation has an essential disadvantage: not only did it not encourage distribution companies to connect new electricity resources from renewable, but, on the contrary, it also caused aversion to each new investment for the connection of renewable sources, since the connection of each new renewable generator increases the total costs of electricity purchase for end consumers. Installed wind capacity is not enough for creating problems to system operators, so they have a positive view of it. In fact, distribution companies prepare documents with technical conditions for new investors in renewable sources of electricity every year. The planned total volume of investments is about few thousands MW, but only rare investments are realised. It means that existing mechanisms for supporting renewable energy sources are ineffective. As a result, one could say that the government is not completely supporting this technology.

Regarding CHP, the government assumed the development of small cogeneration units under the document “National energy policy to the 2025”. The financial profitability of new CHP investments is an important requirement for the development of CHP sector. The existing price structure for fuels and electricity may be unprofitable for new investments in small natural gas CHP, because production costs are becoming higher than electricity price. This situation is connected to the decision of the President of the Energy Regulatory Office to cancel the approval for electricity tariffs by Regulator. Distribution System Operators were obligated to buy electricity produced in cogeneration, but the price proposed for electricity was to low to pay for production costs. At the moment, the government is working to integrate into national legislation the Directive 2004/8/EC of the European Parliament and the Council, dated 11th of February 2004, “related to the promotion of co-generation based on net heat consumption inside market”. This act may improve the economic conditions for new investments in small CHP.

7. ATTITUDES OF ESTONIAN ACTORS

The information for the Estonia was obtained from the Transmission System Operator.

Different use of energy sources is certainly accurate for every power system. “Power producing variety” will be keyword for the future Estonian power production and wind energy integration will help to improve power production variety. The target path is to increase the share of renewable energy sources in the electricity production up to 5.1% in year 2010. When looking at Estonian power system as whole, and for keeping in mind consumers’ best interest (electricity supply with best quality), it is obvious that wind energy integration range is quite short under present conditions. Estonian power system is one of the world’s worst systems for wind power integration: good wind conditions in the coastline and islands, but weak electric grids in those locations (lack of transmission capacity).

As wind energy is a quite new object in the Estonian energy sector, its complex interaction into the power system is a big challenge for the Transmission System Operator. However, wind farms in operation are giving us a good learning curve on how the wind turbines actually operate when integrated in the system and, thus, the Transmission System Operator can make adequate steps for wind integration into transmission grid (sufficient connection procedure, sufficient connection proposals, general wind farms monitoring and control etc.).

Estonian Transmission System Operator has to purchase all the electricity output from grid connected renewable energy sources and to pay a price which is currently two times higher than production price from fossil-fuelled power plants. Feed-in tariff differential is compensated by the Transmission System Operator, who passes it through to consumers. This is a problem, since the general consumers are not yet ready to buy electricity from wind turbines at higher prices.

Besides, Estonian large oil shale power plants are slow and they are not envisaged for the provision of regulating power for wind power. Therefore, new generation reserves are needed, but it is not clear who and with what means should do that. One thing for sure, the Transmission System Operator is not interested in paying for regulating power only from its own pocket.

As mentioned above, due to high feed-in tariff and the CO_2 emission business, there is a strong interest among investors and developers to build wind farms and seek higher profits. Consequently, there are lots of projects in progress in different part of Estonia, which will also be beneficial for landowners and generally for whole local community. Besides, wind energy industry has already established itself in Estonia (ABB manufactures some wind turbine parts etc.), which will certainly provide more jobs for local residents. Nevertheless, the common attitude of residents is “Yes why not install wind turbines, but, please, not into my backyard”.

CHP is a good solution for the Transmission System Operator, since it provides more security of supply, more open transmission capacity and reduces electricity transmission losses, as long as they are installed near consumers. The problem is that the use of CHP is small at the moment, as it only receives feed-in tariff when using renewable energy sources, i.e. biomass. Besides, existing CHPs are quite slow, so they cannot compensate wind power fluctuations.

Consequently, Estonia does not present the appropriate conditions for using the balancing techniques proposed in our project, since CHP capacity is small and the technology used is slow. Nevertheless, the coastal area of Estonia seems to be a good place to install some kind of balancing, because it has a good wind resource and a weak grid, so a local balancing solution is needed, in order to increase the contribution from wind power.

8. CONCLUSIONS

General impression is that wind power and CHP are beneficial for national and European economies, so most actors have a positive attitude towards both technologies. On the other hand, wind power creates some problems in the management of transmission and distribution networks. The balancing techniques proposed in DESIRE seem to be suitable for solving the problems created by wind power, but they cannot be used in all the countries analysed.

For example, CHP in Spain is used by industrial consumers, so there is no heat accumulator and, as a result, the use of pumped hydro to balance wind power fluctuation appears to be a better solution. In Poland, there is not enough wind capacity as to create problems, so no solutions are required yet, but conditions to use CHP for balancing seem to be good. In Estonia, CHP technology is not suited for balancing, but the coastline would be a good location to use these balancing techniques if the appropriate technology was used. On the other hand, in Denmark and in Germany there seem to be more appropriate conditions for balancing wind power with CHP, since there is the required wind capacity, as well as CHP conditions. The UK has ambitious targets regarding wind power and CHP and these balancing techniques appear to be a good way of promoting both technologies at the same time.

As a result, contacted actors have positive attitudes towards DESIRE project. Nevertheless, their estimations of the ability that these techniques have to solve the problems created by wind energy are very different in the countries analysed. Some actors think that DESIRE can help solving wind power problems, but in other countries the impact of these balancing techniques is estimated to be quite low. Nevertheless, their general attitude is that they are looking forward to the results from DESIRE project.

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10. ANNEX I

GENERAL INFORMATION ABOUT THE COMPANY

1. Name of the company?

2. How many staff members are in your company?

3. What type of company is yours?

- Regulator ?
- Electricity transmission/TSO ?
- Electricity distribution/DSO ?
- Wind producer ?
- CHP producer ?
- Traditional/Central producer ?
- Supplier ?
- Trader ?
- Engineering company ?
- Researcher ?
- Other ?

Explain:

ATTITUDE TOWARDS WIND ENERGY

4. Does wind energy provide any benefit to your organisation?
   - Technical benefits Yes ? No ?
   - Market oriented benefits Yes ? No ?

? If yes. Which ones?
? If no. Why not?

5. And to the system/society as a whole?
   - Technical benefits Yes ? No ?
   - Market oriented benefits Yes ? No ?

? If yes. Which ones?
? If no. Why not?

6. Does wind energy cause any problem to your organisation?
   - Technical problems Yes ? No ?
   - Market oriented problems Yes ? No ?

? If yes. Which ones?
? If no. Why not?

7. And to the system/society as a whole?
   - Technical problems Yes ? No ?
   - Market oriented problems Yes ? No ?

? If yes. Which ones?
? If no. Why not?

8. How does your organisation solve technical problems caused by wind energy?

9. How does your organisation solve market oriented problems caused by wind energy?

10. What kind of regulatory issues apply to wind energy in your country?
? Feed-in tariff
? Green certificates/ROCs
? Other (Please, specify)

11. Should wind energy be promoted? Yes ? No ?
? If yes. Is the regulatory regime in your country appropriate? Why?
? If no. What would you propose?

ATTITUDE TOWARDS CHP

12. Does CHP provide any benefit to your organisation?
    - Technical benefits Yes ? No ?
    - Market oriented benefits Yes ? No ?

? If yes. Which ones?
? If no. Why not?

13. And to the system/society as a whole?
    - Technical benefits Yes ? No ?
    - Market oriented benefits Yes ? No ?

? If yes. Which ones?
? If no. Why not?

14. Does CHP cause any problem to your organisation?
    - Technical problems Yes ? No ?
    - Market oriented problems Yes ? No ?

? If yes. Which ones?
? If no. Why not?

15. And to the system/society as a whole?
    - Technical problems Yes ? No ?
    - Market oriented problems Yes ? No ?

? If yes. Which ones?
? If no. Why not?

16. How does your organisation solve technical problems caused by CHP?

17. How does your organisation solve market oriented problems caused by CHP?

18. What kind of regulatory issues apply to CHP in your country?
? Feed-in tariff
? Green certificates/ROCs
? Other (Please, specify)

19. Should CHP be promoted? Yes ? No ?
? If yes. Is the regulatory regime in your country appropriate? Why?
? If no. What would you propose?

ATTITUDE TOWARDS HEAT ACCUMULATORS AND OTHER MEANS OF INCREASED FLEXIBILITY

20. Are heat accumulators used in your country for CHP? Yes ? No ?
? If yes. How much?
? If no. Why not?

21. Do you think that heat accumulators, combined with CHP could help balancing wind production? Yes ? No ?
? If yes. To what extent?
? If no. Why not?

22. Do you think that the combined use of wind and CHP with heat accumulators can solve the problems caused to the system/society as a whole by wind energy or CHP?
- Technical problems Yes ? No ?
- Market oriented problems Yes ? No ?

? If yes. Which problems could be solved?
? If no. Why not?

23. Do you think that the combined use of wind and CHP with heat accumulators would increase the installed capacity of wind/CHP? Yes ? No ?
? If yes. How?
? If no. Why not?

24. Do you think that the combined use of wind and CHP with heat accumulators can solve the problems caused to your organisation by wind energy or CHP?
a) Technical problems Yes ? No ?
b) Market oriented problems Yes ? No ?
? If yes. How?
? If no. Why not?

25. Would the combined use of wind and CHP with heat accumulators cause any problem to your organisation?
    - Technical problems Yes ? No ?
    - Market oriented problems Yes ? No ?

? If yes. Which ones?
? If no. Why not?

26. And to the system/society as a whole?
    - Technical problems Yes ? No ?
    - Market oriented problems Yes ? No ?

? If yes. Which ones?
? If no. Why not?

27. How would you solve them?

28. Are you interested in using balancing techniques in your organisation?
    Yes ? No ?

? If no. Why not?

29. Should these balancing techniques be promoted?
    Yes ? No ?

? If yes. How?
? If no. Why not?