



Deliverable 0.3: Report on raising public participation and awareness

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Abstract: This report demonstrates the involvement of other actors in the project. It is described how other actors beyond the Consortium have been involved in raising public awareness and exploring the wider societal implications of the project work.



Raising public participation and awareness

DESIRE has aimed at influencing all key market actors, i.e. operators and developers of CHP and wind power, leading energy utilities, energy distributors and transmission system operators (TSOs), through the project. The primary target group of DESIRE comprises present and future owners and operators of small CHP plants, who perform the actual regulation. Through the specific case studies in Germany, Denmark and the UK, the selected plants have gained experience and have served as important partners in the dissemination of the project. The secondary target group consists of wind turbine operators, TSOs and public authorities, who influence the regulation of the markets on which the CHP plants will operate. Discussions have been held with public officials and trade associations in order to encourage the utilisation of our techniques. The sections below describe the involvement of the target groups in each country.

1. Denmark

1.1 Current situation

In Denmark, the attitudes towards renewable energy and the challenge of integrating fluctuating electricity productions vary among the different actors on the market. Through a series of means, **the TSO Energinet.dk** aims at integrating wind power and small CHP plants under the market terms of the liberalised electricity sector. With respect to CHP plants, Energinet.dk endeavours to develop the tender procedure with a view to allowing as many suppliers as possible to bid. The TSO has also – in a parallel process – started the pilot projects regarding the transformation of the distribution network into a fundamentally different lay-out: the cell structure. According to this structure, smaller regions (e.g. at the 60 kV level) are equipped with advanced communication systems connecting all producers and major consumers. These newly developed systems enable the region to perform local balancing of production and consumption and – eventually – to keep the supply going in situations with voltage break-downs at the higher levels of the transmission and distribution system. The TSO is aware of the potentials of this development with regard to the development of the advanced market functions mentioned above. **The Danish government** supports the aim that fossil fuels should be replaced by renewable energy on a long-term basis, but expresses that this replacement should be determined by the market. The government plans to meet the fluctuation challenges by investing in increased transmission capacity and flexible electricity consumption and establishing possibilities for selling wind power on the heat market (using electrical boilers and heat pumps). **The Danish Energy Regulatory Authority** is an important actor in the market design process. At present, this process is not systematically supporting the establishment of flexible energy systems which can meet the challenges of increasingly fluctuating electricity productions. Finally, the non-governmental organisation **The Danish Ecological Council** demonstrates a high degree of consciousness regarding the problems of regulating an energy system with a high percentage of renewable energy. The main attitude is that the problems of fluctuating electricity productions should be solved regionally, supported by a systematic energy policy within this area.

1.2 Means taken to raise public participation and awareness during the project

On-line presentation of data

A very important method to raise public participation and awareness during the project has been to show the operation of the two Danish CHP plants online. When visiting the DESIRE home page, you can see the immediate productions at the production units. In addition to this, you can see the present content in the thermal store, the heat received from industrial plants and the heat delivered to town, including the temperatures at which the heat is delivered. On the online home page, you can also choose to see historical productions of the plants.

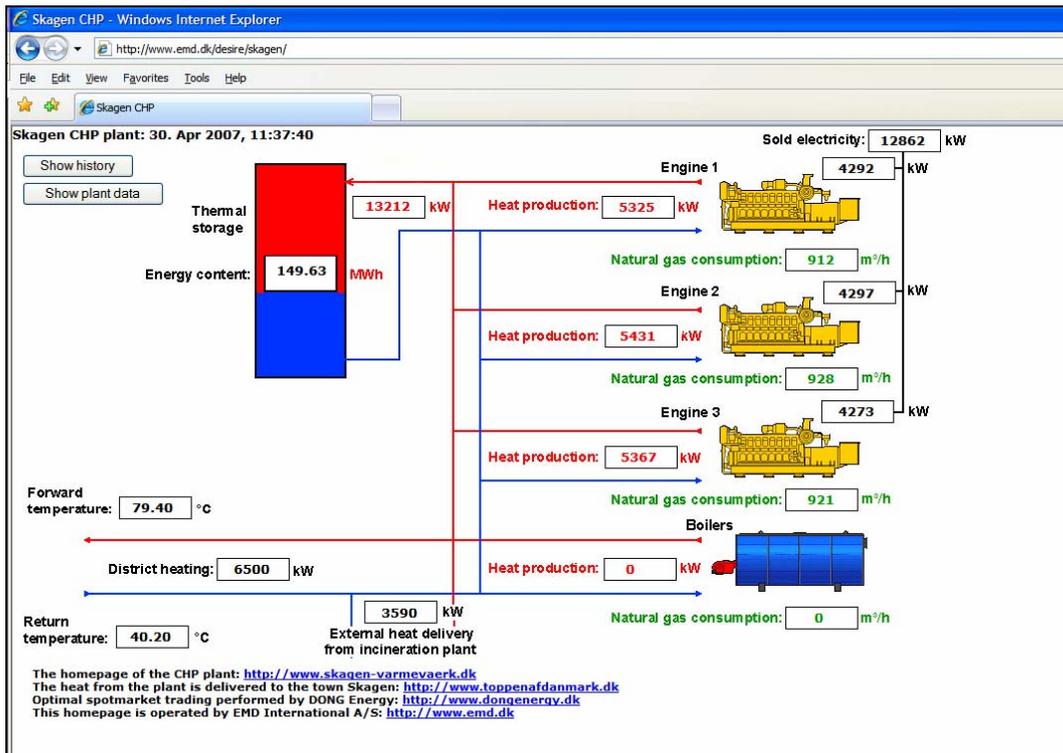


Fig.1: The home page shows the immediate productions of the three CHP engines at Skagen CHP plant, indicating that all of the units have won production on the spot market at this hour.

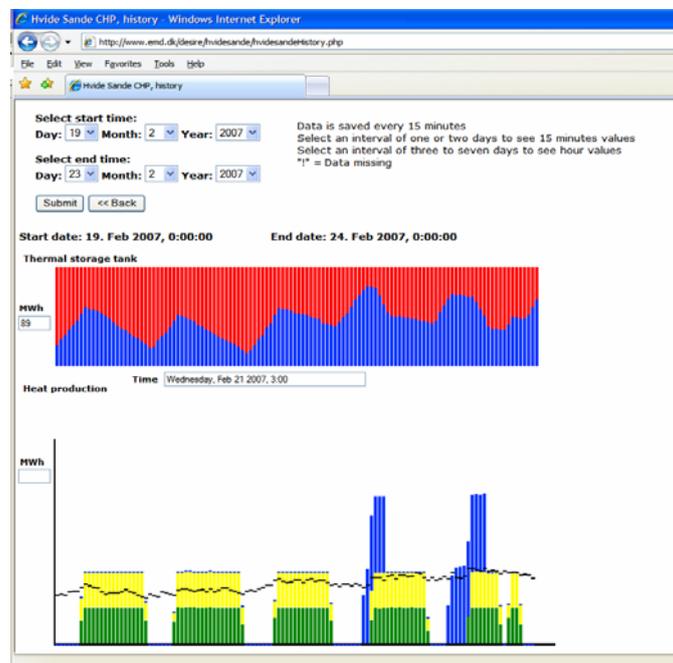


Fig.2: The home page shows the historical productions in 5 days in February 2007 of Hvide Sande CHP plant, being one of the two Danish CHP plants participating in the DESIRE project.

On the online home pages of Hvide Sande and Skagen CHP plants, it is also possible to see plant data, showing typical data for the flexible CHP plants promoted in the DESIRE project.

The online presentation of data from the CHP plants in Hvide Sande and Skagen is possible due to the co-operation with these two plants. The two plants have been profoundly involved in the project work through the test and demonstration of the techniques developed in the project. Through the home pages, these CHP plants contribute to a continued dissemination of results to the main actors on the Danish market, as well as the general public.

Energy Year 2006

The Danish Society of Engineers appointed 2006 the “Energy Year”. Throughout the year, more than 40 seminars were held during which 1600 participants discussed and designed a model for the future energy system of Denmark, putting emphasis on energy efficiency, CO₂ reduction, and industrial development. The large series of events raised the general public attention towards renewable energy and created a forum in which all actors involved could present and discuss new technologies. The DESIRE project was presented in this forum. Thus, the methods, tools and results developed in DESIRE were presented to the primary target group of the project, i.e. owners and operators of small CHP plants, as well as to the secondary target group of wind turbine operators, TSOs and public authorities.

In relation to the Energy Year 2006, new proposals of integrating renewable energy were presented to political parties, who were encouraged to utilise the techniques developed with DESIRE. In addition to this, great press coverage gave rise to public attention and placed renewable energy at the top of the agenda among the public in general.

Courses

On 5 February 2007, the Danish District Heating Association (www.danskfjernvarme.dk) held the course “In depth with the electricity market” (Gå i dybden med elmarkedet). Course participants were the managers of CHP plants in Denmark. At the course, EMD presented the results of DESIRE and informed the group about the bidding methods on the spot market and the regulating power market.

On 12 March 2007, The Danish Society of Engineers (www.ida.dk) organized a course on the electricity market for their members. EMD was invited to present the results and methods of the DESIRE project at the course.

The local energy and environmental office in the region of Himmerland (www.sek.dk) held a meeting at a local CHP plant on 26 March 2007. Members of this NGO were invited to visit this plant and EMD presented the results and methods of the DESIRE project to these members.

Thus, through the co-operation with CHP plants and the online presentation of data, the main target group of DESIRE has been involved in the project work and the dissemination of results. Through the courses held to relevant actors, the project methods and results have been presented and the awareness of these techniques has been raised among managers of CHP plants, engineers, and NGO members.

Energy Camp and presentations

In May 2005, when the project was initiated, the paper “The Benefit of integrated Energy and Transportation CO₂ Emission Control Strategies” was presented at the Energy Conference hosted by Risø National Laboratory in Denmark. Later this paper was published in “Transport Policies”, acknowledging the succeeding research which was made possible by DESIRE.

In September 2005, Ebbe Münster contributed to an ex-auditorio discussion in the Danish Parliament. With reference to DESIRE, Ebbe Münster explained the low potential of nuclear

power for the balancing of fluctuating electricity production and presented other solutions to members of the Parliament.

In November 2005, Anders N. Andersen presented the balancing techniques of DESIRE at the DESIRE Seminar in Birmingham.

In January 2006, The Danish Society of Engineers held a conference on “Technological Innovation”. The preliminary results of DESIRE were presented at the conference.

In March 2006, The Danish Society of Engineers headed a meeting on “Energy Trader”. DESIRE was discussed at the meeting. Following this meeting, Ebbe Münster was invited to take part in the writing of a paper to be presented at the Meeting in the Committee of Energy Policy in the Danish Parliament, March 29th, 2006, regarding intelligent electricity meters and DSM.

In May 2006, the DESIRE project was presented to German stakeholders at the DESIRE seminar in Kassel.

In October 2006, Henrik Lund referred to the results of DESIRE in his presentation of Danish energy policy at the annual conference of the Danish district heating industry. The presentation was followed by media coverage in the trade magazine of the industry.

In November 2006, the Energy Camp organized by the Danish Energy Association was attended by 48 participants from all branches of the Danish energy sector. During 30 hours, the participants discussed and defined six energy concepts which shall contribute to the solution of climate change problems in the world, as well as strengthen the European energy market. The results and techniques of the DESIRE project were also presented and discussed in this forum.

Also in November 2006, the results of DESIRE were presented at a Danish conference on Renewable Energy for power and transport, arranged by the Confederation of Danish Industries and Risø National Laboratory. Furthermore, the results were discussed at a public meeting on wind power at Risø National Laboratory.

In February 2007, another public meeting on wind power was held and the results of DESIRE were discussed in a new forum.

In January 2007, Poul Alberg Østergaard referred to the results of DESIRE in his presentation of co-generation at the POWERGEN Middle East Conference in Bahrain. An article was also included in the conference proceedings.

In May 2007, a seminar on ‘Price flexible electricity consumption’ arranged by the Danish TSO, Energinet.dk, and the Confederation of Danish Industries was attended. The importance of coordinating the establishment of new communication networks was discussed with representatives of the TSO. These networks should include all decentralised electricity producers and major consumers between the two purposes: a) securing stability and balance in smaller regions of the transmission grid (cells), and b) enabling fast and effective online markets for the balancing of fluctuating electricity producers. Relevant links and documents were exchanged.

As a result of these presentations awareness has been raised among the main stakeholders on the Danish market as well as in a wider international forum. The results of DESIRE have been incorporated into an actual national context and have influenced the development of the energy

field in a positive way. All the mentioned presentations were followed by a successful dialogue and exchange of knowledge and ideas. DESIRE has contributed greatly to this exchange.

1.3 Future strategy

The online presentation of the operation of the two Danish CHP plants will be maintained.

In WP1, it is demonstrated that when a major proportion of electricity is produced by wind turbines, significant and desirable socio-economic and environmental benefits can be achieved by building flexible CHP plants, matching the wind turbines in capacity. These plants must be equipped with sufficient capacity of CHP, heat pump and thermal store. A typical mix of capacities for a well balanced future system in West Denmark with an increased amount of wind power (5000 MW) is exemplified by the following figures: 1500 MWe of CHP with 350 MWe of heat pumps and 25 GWh of heat stores.

A Danish heat pump demonstration programme is needed. A first step has been made, since Aalborg University, EMD and other Danish partners have received public funding for building heat pumps at two decentralised CHP plants and demonstrating how these heat pumps will be operated on the spot market and the regulating power market. The relevant actors will be involved through courses and the online demonstration of the participating plants.

2. Germany

2.1 Current situation

The growth of Renewable Energies (RE) in Germany is quiet successful due to the law for RE, "Erneuerbaren Energien Gesetz", with fixed tariffs up to 20 years, which contributes significantly to the reduction of investment risks. The additional payment for the RE beyond the market price of electricity will be paid by all consumers. The investments in RE, except for hydro power, were mainly made by small enterprises (SME). The additional demand of regulation power to balance the fluctuating feed-in of the RE is also included in the additional amount for RE paid by the consumers. At present, a daily fixed band of RE power has to be considered by all power distributors in their distribution area. The difference between the real feed in of RE and the daily band is balanced by the four big TSOs (RWE Transportnetz Strom GmbH, EnBW Transportnetze AG, Vattenfall Europe Transmission GmbH, E.ON Netz GmbH). For these balancing tasks, no transparency and no open market exist. Flexible CHP or other smaller plants cannot participate in balancing RE in Germany. The only effect of the RE is that it influences the price on the spot market. In periods with continuous electricity demand and, at the same time, increasing volume of feed-in of the RE, the price on the spot market will decrease. Therefore, the main market actors use wind prognosis for the trade of energy on the spot market. The volume of power variation caused by the RE is too low in relation to the demand of energy reserve, so at the moment there is no demand for balancing techniques for the feed-in of RE. But independently of the feed-in of RE balancing techniques there is the demand to use the benefit between cheap night prices to the expensive day prices. Typical power plants in this regard are hydro power storage plants and hydro pumped storage power plants. Other flexible plants who can balance the variation during a day are gas turbines. To handle the balance problems EnBW planned a gas turbine with pressed air storages. But no long-term strategies for the high penetration of RE have been developed from political side.

The development of CHP is not as successful as the RE. The plan was to increase the electricity production of CHP to 25% of total. At present, CHP has a portion of 13%. An examination of the correct development of CHP in Germany was supposed to be done until the end of 2004. But the government has neglected this despite the low growth. At present, a new law for CHP is under preparation.

The liberalised electricity market is not working well in Germany because the four big power companies with their subsidiary companies own the grid and 80% of the generation plants. They have a kind of monopolistic status. Germany has one of the highest electricity tariffs (without taxes) in Europe. The prequalification and the required volume to participate on the regulating power market were too high, so mainly the big four power companies participate in the Primary and Secondary power reserves market. Considering these facts, the government passed a new energy law in 2005 (Energiewirtschaftsgesetz). After this new law, in 2006, a lot of new regulations and recommendations have been published. This new situation makes the tertiary regulating power market (Minuten reserve) more feasible to balancing techniques from smaller companies such as CHP operators. At present, it is not yet clear which influence the new laws and regulations will really have and if the goals will be met. The first effect is a decrease of the kilowatt hour price in Minuten reserve. In the past, the kilowatt hour rate of Minuten reserve was too expensive and the call for Minuten Reserve had been only a few minutes per year. For the TSO, the energy price was cheaper for the plants with secondary power reserve. But the secondary reserve will be offered twice a year and mainly be provided by only a few suppliers which will be owned by the big power companies. So far, no functioning trade with lots of participants has been established on the regulating power market. Now with fewer requirements for the prequalification on the Minuten Reserve, new plants such as aggregated CHP plants can offer Minuten Reserve. Additionally, a new open and transparent intraday market has been created on the European Energy Exchange. To the CHP operators, this also offers new possibilities of participating in the balancing tasks. But up to now the volume has not been high enough to lead to liquidity on the intraday market.

Similar to the DESIRE project, the companies STEAG (fifth biggest generation company in Germany), BET (Büro für Energiewirtschaft und technische Planung GmbH) and EUS GmbH seize power plants and consumers together as a virtual power plant in order to participate in the spot or regulating power market and get some additional income. Partly, they also integrate heat or other kinds of storages in the operation strategy to make the virtual power plant more flexible. All these companies aim at making decentralised power plants more feasible with the existing liberalised market conditions, but they do not consider RE at all.

On the other hand, Germany needs new power plants up to 40 GW, because the lifetime of some of the existing plants runs out and the old government had made an agreement to gradually switch off nuclear power plants. The nuclear plants today have a portion of 25% of the total power consumption. In total, by 2030, half of all existing power plants will have to be replaced. As for the RE, additional to the existing 20.000MW wind power plants, 60.000 MW Offshore Wind power is planned in Germany and thus, a new demand for balancing techniques will be produced. The actual prognosis for feed-in of RE is from 62,1 TWh/year in 2005 to 151 TWh/year in 2020. This is approximately 25% of the existing electricity demand. So the government has now the possibility to make the right decisions to develop a new energy mix with low CO₂ emissions and high flexibility for the next power generation with high penetration of RE. Considering the European and German goal to expand the CHP and the coming demand of balancing techniques, the conditions for the development of flexible CHP plants are good. Only the huge influence and the political power of the big power companies, their unwillingness to reform the traditional structures of energy supply avoid a progressive development. So unfortunately some big new coal and gas-fired plants were approved and new coal-fired plants with CO₂ deposition are presently being planned.

The main actors and experts in Germany do not present a very enthusiastic estimation of the demand of flexible power plants, at the moment. The energy market in Germany is very complex and the different interests of the companies make it very difficult to develop a clear electricity strategy with a high share of renewable energy for the next generation. There is a conflict between the small SMEs with RE and the big power companies with their totally

different interests. Among the parties in conflict there are also some new energy traders, industry and the smaller delivery companies and also politicians. This situation dominates the public discussion and the politicians do not pass clear recommendations and laws to reconstruct the energy generation in Germany. At this state, more fundamental challenges have to be met, before the demand of the flexible power plant is in front.

But generally nobody doubts the benefit and the demand of flexible power generation in the future, e.g. CHP with thermal stores. With the existing unstable conditions produced by the government and the unforeseeable development of fuel prices, CO₂ quotas and electricity prices, the risks are high and thus long-term investments are inhibited. E.g. the BTB (innovative CHP delivering company Berlin) made some analyses on investing in thermal stores for their gas CHP plants. They really want to invest in thermal stores. But after several months, the gas price increased more than the coal price and after that it was more feasible to BTB to operate their coal-fired plant. They considered themselves lucky not having invested in thermal stores. Nevertheless, in many cases, the investment in thermal stores and their implementation in the control management can produce an economic benefit with easy pay back time under 3 years.

2.2 Means taken to raise public participation and awareness during the project

The contents and objectives of the DESIRE project were presented at different conferences and will be published in main magazines for CHP and energy market. In April 2006, the software developed with DESIRE and the objectives of the project were presented at a workshop in Dortmund attended by representatives of the energy sector, industry and NGOs. The results and contents of DESIRE were presented in November 2006 at the yearly congress of the German association for CHP (B.KWK). They were also presented in Februar 2007 at the conference for Stadtwerke organised by the BHKW-Consult. Additionally, in the newsletter of the BHKW-consult the issue of DESIRE and balancing techniques were described including the links to the DESIRE web pages. This newsletter will be sent to more than 10,000 recipients. The results of DESIRE have also been published in the magazine "Sonne Wind und Wärme" as well as in the magazine "Energy and Management". The B.KWK and BHKW-Consult are the main actors in the CHP activities in Germany. The participants at the conferences were CHP operators and planners, politicians, lawyers, consultants, the EU commissar (Guido de Wilt), manufacturers, members of the government, scientists from the universities and institutes and the association of the industry (VIK). Furthermore, an article by John Sievers will be published in Solarzeitalter in September 2007 and an article about 50% wind energy integration by cogeneration with large heat stores is also scheduled for publishing both on VDI Nachrichten and Eurosolar/Sonnen site.

2.3 Future strategy

The future strategy should focus on the different types of target groups. First of all, the correlation between high penetration of RE and the demand of flexible power plants and flexible consumers has to be shown to the politicians. As a second step, the alternatives of big (storage) power plants have to be described as well as the huge benefit created by realising these flexible power plants with a high number of CHP plants in combination with low CO₂ emissions. Additionally, the dependence of most CHP plants on natural gas could be reduced in the future through the feed-in of biogas in the gas pipelines. The politicians could initiate a kind of master plan which should involve all actors of the power generation, transmission and consumption, to meet all the needed goals for the power future with less CO₂ emissions, more independency on the international power market and less atomic risks.

The fixed goal to expand the RE and the planned offshore wind farms makes the development of more balancing techniques inevitable. The scientists confirm the general demand but first Germany has to make clear decisions concerning the energy policy. Independently of the feed-in

of RE, the price on the spot market varies so much that balancing techniques of CHP, which do not operate permanently, have an economic benefit if they are more flexible. This effect will increase when the influence of RE on the spot market price also increases, when RE increase and when their variation is directly coupled with the spot market and no longer handled by the TSO as a daily band. Then, in the short and long term, the different possibilities for balancing techniques will automatically be more in focus. The following list gives some important aspects as for the development of balancing techniques, CHP plants and RE:

- In general, the old tradition of central power plants with low efficiency and static consumers has to be changed. Intelligent, decentralised and flexible generation units and consumers are needed. With existing communication technologies new kinds of power systems are possible.
- The electrical power market has to become more transparent in order to increase the competition and to give easier access for new participants, such as smaller CHP operators.
- New investments should be permitted only in decentralised power plants with high efficiency and heat distribution. The demand on flexibility and balancing techniques will increase automatically but could be a condition for the permission.
- The CO₂ quotas could be a good sanction to make the CHP more feasible, but not if the CO₂ allowances are given away for free, as was done in the last allocation periods.
- Detailed analysis for many CHP plants, if thermal stores and sale on the spot market makes the operation more economical. Typical examples should be presented in technical magazines and conferences.
- Incentives for CHP to reduce the risks for long-term investments are needed. The investments in CHP need long-term securities, similar to those existing for RE.
- Denmark is a very good example with high penetration of wind power, decentralized CHP and a functional and transparent balancing system with the spot and regulation power market. Denmark is one step ahead and shows how the different goals of the EU for the power supply can be realised in future, with a high portion of RE, high efficiency with decentralized CHP and low costs for regulation power. The promotion of the Danish example could help to rebuild the electrical power system in Germany.

3. United Kingdom

3.1 Current situation

As a result of the DESIRE initiative, the concept of balancing fluctuating renewable energy supplies using CHP with thermal stores is now known well within the CHP community. This is being spread to the wider planning and NGO networks. Dissemination of modelling results is demonstrating the possibilities for practical utilisation of such techniques to benefit the growth of CHP and community heating in the UK. The British transmission system is operated by **the National Grid Company (NGC)**. NGC is keen to encourage flexible reserve options that can accommodate fluctuating renewable electricity. NGC has a duty to help integrate renewable energy supplies. **The Distribution Network Operators** are limited by their selection duty and are often accused of giving excessive quotes for connection. However, Distribution Network Operators have also expressed enthusiasm to assist the development of embedded generation. **The Office of Gas and Electricity Management (OFGEM)** regulates the electricity system. OFGEM has a duty to consider how sustainable energy technologies can be accommodated in the electricity system, taking into consideration the best possible competitive practices in order to deliver electricity and gas services at the lowest possible costs. **The British Wind Energy Association (BWEA)** is keen to investigate all plausible means of balancing fluctuating wind power supplies and thus supports the aim of DESIRE as one option for balancing wind output.

Smartest Energy is a leading ‘consolidator’ on the UK electricity market. Smartest Energy has also expressed interest in the idea of co-production between wind power and CHP.

3.2 Means taken to raise public participation and awareness during the project

Discussions have been held with different officials of the Office of Gas and Electricity Management concerning the advantages of the use of CHP with thermal stores for encouraging decentralised generation and also a flexible means of incorporating fluctuating renewable energy sources into the grid (July 4th 2005 and 20th March 2007). Meetings and discussions have been held with the British Wind Energy Association (July 12th 2005, November 9th 2005, 24th March 2006) and also the Chair of the Renewable Committee of the Electricity Association (also a wind power developer) on 7th July 2006 concerning the benefits of co-production and development of CHP with thermal stores and incentives for CHP and wind power. Discussions have been held with representatives of GridCo about the implications of the DESIRE project (14th July 2005).

Discussions have been held with various officials of major electricity companies including RWENpower (18th May 2007) and Scottish and Southern Electricity (November 9th 2005) concerning their involvement in encouraging CHP with thermal stores. Discussions with Smartest Energy, a leading electricity ‘consolidator’ who deals with small CHP and wind power schemes, have been held (7th July 2005, 2nd June 2006). Various discussions with CHP developers and operators and consultants have been held at various conferences and events including meetings with the Combined Heat and Power Association (CHPA) on September 19th 2006, and November 16th 2006. Discussions have also been held with DEFRA officials, the Energy Saving Trust (November 9th 2006) and also Doug Parr from Greenpeace.

Presentations concerning incentives for wind power and CHP were given at the 2006 ENERGEX Conference in Stavanger, 12th – 15th June 2006; the Open University seminar on ‘Coping with variability; integrating renewables into the electricity system’ on January 24th 2006 and also to the two dissemination conferences organised by the University of Birmingham on behalf of the DESIRE project on November 9th 2005 and May 18th 2007. The conferences have been targeted at: CHP owners and operators, wind turbine operators, the NGC, distribution network operators, OFGEM, the BWEA, consolidators and suppliers such as Smartest Energy, academics, various actors seeking to develop the cost-effective entry of CHP into the power markets, and also local authority officers concerned with implementing sustainable energy policies as demanded by planning targets. Further details of these conferences:

DESIRE dissemination Conference held on November 9th 2006 in Birmingham, including papers from the University of Birmingham. This included speakers on balancing fluctuating wind electricity using CHP from PB Power, the University of Birmingham, and Spanish and Danish members of the DESIRE consortium.

DESIRE dissemination Conference held on May 18th 2007 in Birmingham, including papers from the University of Birmingham, CHP analysts, PB Power, the Combined Heat and Power Association and local authority representatives. The Conference discussed how CHP and community heating can be, and is being, cost-effectively implemented in the UK, and how this can be done using Danish systems of CHP with thermal stores to aggregate small CHP systems to sell surplus power on the grid. There was a discussion about how recent changes in planning regulations and ‘bottom-up’ action by local councils to promote decentralised and renewable energy systems promote the development of CHP and community heating.

Furthermore, a number of articles have been published and submitted. These have been mainly targeted at an academic audience, although the papers will influence the public policy theory context in which regulators such as OFGEM operate.

1. Toke, D, Fragaki, K., 'Balancing Act', *Energy Engineering*, February 2007, pp 30-31
2. Fragaki, A., Andersen, A., Toke, D., Optimal Design of Combined Heat and Power Plants Using Thermal Stores in the UK', submitted to *Energy Conversion and Management*
3. Fragaki, A, Green, R, Toke, D 'Incentives for CHP development in the UK: Analysis and evaluation of their relative importance', *Energy Policy*, 9 November 2005.
4. Fragaki, A, Anderson, A, Toke, D 'Modelling the impact of aggregation of small CHP with thermal stores to sell electricity on UK power markets' (under preparation)
5. Toke, D and Fragaki, A., (2007) 'How to implement Danish decentralised energy systems in the UK', Final Report of British contribution to EU FP6 DESIRE project.

Furthermore, an article summarising the interim research conclusions was sent to stakeholders in the UK in October 2006.

Interventions have also been made in the debate around reform of the Renewable Obligation. Dr Toke has spearheaded a lobby in favour of a feed-in tariff solution to the promotion of renewable energy. He has also engaged in the debate concerning microgeneration, suggesting that in the CHP field, the Danish gas-engine CHP/thermal store solution offers particularly good outcomes for low carbon results.

Future strategy

The future strategy in the UK will be oriented towards developing knowledge and then use of 'aggregated dispatch' techniques, as well as liaising with actors who are working in favour of sustainable energy strategies that will encourage CHP with thermal stores. The actors to whom the information will be disseminated include: owners and operators of CHP plant, wind turbine operators, the NGC, distribution network operators, OFGEM, the BWEA, Smartest Energy, academics, various actors seeking to develop the cost-effective entry of CHP into the power markets, and also local authority officers concerned with implementing sustainable energy policies as demanded by planning targets. Specifically:

1. Collaboration with companies such as Martin Energy to disseminate information regarding 'aggregated dispatch' techniques
 2. Collaboration with trade groups such as the CHPA and also DEFRA agencies to generate publications and dissemination meetings regarding the advantages of existing community CHP schemes that use thermal stores
 3. Collaboration with engineering companies such as Utilicom to plan schemes in anticipation of 'aggregated dispatch' methods, which include use of thermal stores and bigger plant than would otherwise be planned.
 4. Collaboration with planning officials and others involved in local government (including NGOs) to ensure that community CHP with thermal stores is an important part of local sustainable energy strategy, especially with regard to planning conditions for new buildings and refurbished buildings.
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1. A key means of doing this is the mounting of further modelling research programmes to demonstrate the practicality of 'aggregated dispatch' in British conditions by using virtual trading techniques on the UK power exchange markets. This can demonstrate

how small units can sell power to the power markets normally reserved for power stations. So far we have modelled this in general terms, but not demonstrated the working practicality of these processes in accordance with the UK's Balancing and Settlement Codes.

2. Outreach programmes concerned with advertising details of existing CHP plant with thermal stores needs to be organized. This will focus on those projects that are currently in operation. The material will focus on the advantages of using thermal stores in a community CHP context. Publications and meetings would be organized
3. Liaison with local government officials. Local Government officers are important in driving the planning process. They advise Councillors about what sort of development is sustainable according to the established planning policies.

4. Spain

4.1 Current situation

The Spanish TSO has a positive attitude towards wind energy and aims at integrating as much wind capacity as possible, compatible with the system security. Nevertheless, the TSO faces some problems in the present Spanish regulatory framework in relation to wind power. These problems could be reduced by using the balancing techniques from DESIRE, but wind power and CHP should then be located at the same grid node. Furthermore, the present conditions of CHP in Spain offer limited opportunities to use these techniques. **Iberdrola Distribución (ID), the Distribution System Operator** belonging to Iberdrola, one of the two main Spanish utilities, estimates that wind power is positive to society as a whole. ID focuses on the reduction of total energy costs and the environmental benefits and supports the promotion of wind power. CHP is seen as a very positive technology, since it is distributed generation, located in the points of consumption and thus reduces the need for investment in the network. However, ID only sees the balancing technique possible on a small scale, while on the large scale, it would be a better option to balance wind energy with other technologies. 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. This balancing technique is already applied in Spain to some extent. Another possible option would be the use of solar thermal electric plants with heat accumulators to balance wind power fluctuations. **The Basque Energy Agency EVE** promotes projects based on Renewable Energy sources and energy-efficient technologies. They see wind power as very positive due to its benefits related to the reduced environmental impacts, the reduced need for external imports of fossil fuels, and the distributed generation. EVE also sees CHP as a good technology for similar reasons. One problem related to the balancing techniques proposed is the fact that weather conditions in Spain are not as severe as in other European countries, and thus, there is not much heat demand to pay for installing heat accumulators. The aggregator **Wind To Market**, a company included in the wind power equipment producer **Gamesa Group**, is obviously in favour of wind energy. Wind To Market believes that wind power is able to solve its own problems without the need for CHP. 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. A change in regulation stopped the activity of Wind To Market as wind power aggregator, so Gamesa sold it to another company and now they act as market trading experts.

4.2 Means taken to raise public participation and awareness during the project

For the definition of market actors' attitudes, different interviews were held with relevant market actors. These interviews were, thus, the first dissemination activity carried out during the project. Four actors were interviewed, trying to reach the widest scope of dissemination.

First of all, the Basque Energy Agency, EVE, was contacted. Concerning their role as policy makers, they are in charge of developing energy programmes sponsored by the regional government and they also help the Spanish government when preparing new regulation. Besides, they act as energy producers, both wind power producers and CHP producers. For producing electricity from wind energy, they joined Iberdrola to create the company “Eólicas de Euskadi”, which is the main wind power producer in the Basque country. Regarding CHP production, they joined individual Basque industrial consumers to build up CHP plants in the facilities of those consumers.

Afterwards, Iberdrola was contacted. Iberdrola is the second biggest utility and the main wind power producer in Spain. In further interviews, people from generation and supply activities were also contacted, and they were informed about the project.

Then, Gamesa, the main wind turbine manufacturer in Spain and the second-ranking in the world, was interviewed. At that moment, they also acted as a wind power aggregator, but a change in regulation removed the possibility for them to aggregate wind farms.

The fourth interview was with Red Eléctrica de España, the Spanish transmission system operator.

In addition to these interviews, dissemination activities included conference presentations and further interviews.

The first conference presentation was held in Birmingham (UK), during a meeting arranged by the University of Birmingham, following a project meeting. At the meeting, different project partners, including Labein, presented the project, as well as some results, to relevant UK actors.

The second conference presentation was held in Barcelona (Spain), during the conference “Distribution Europe 2006”, where Labein presented the results from WP3 to representatives of main European utilities, system operators, electric equipment manufacturers and research centres, as well as representatives of the Commission and some other public institutions. During the conference, other main Spanish utilities were contacted and the project was presented. A general overview of the project was provided to Unión Fenosa (3rd Spanish utility) and Viesgo (5th Spanish utility) during the conference, and Endesa (the main Spanish utility) received a more detailed description in an interview appointed during the conference.

During the Bilbao project meeting, partners visited the Oiz wind farm, which is owned by “Eólicas de Euskadi”. While preparing the visit, the project was presented in an interview with the relevant staff.

The project has also been presented to Acciona and Gas Natural. Acciona is one of the biggest construction companies in Spain and the most important newcomer in the electricity market in Spain. Gas Natural is the main gas utility in Spain and the fifth biggest electricity producer in Spain (they produce more electricity than the fifth utility, which is Viesgo).

4.3 Future strategy

Future dissemination activities will include further interviews with relevant actors, such as Hidrocantábrico (the only utility not contacted yet) and associations of CHP producers (Cogen Spain, Autogeneradores de Energía Eléctrica – AAEE).

It is also Labein’s intention to continue the research in this field, by preparing a project for the National Research Plan, so that the economic and technical feasibility of the proposed techniques can be analysed in more detail.

Regarding the extrapolation of results, the DESIRE consortium was aimed at covering a geographical area as broad as possible. Therefore, Danish results could be used as an input for analysing Northern European countries, German results to cover Central Europe, British results for Western Europe and Polish-Estonian results for Eastern Europe. As for Spain, it can be used as an example of the implementation of wind-CHP virtual power plants in Southern Europe. Hence, if the integration of wind and CHP into a single virtual power plant proves to be feasible in Spain, results could be used as a first input for a feasibility analysis in other countries, such as Portugal, Italy, Greece or Croatia, and parts of others, such as Southern France.

5. Poland

5.1 Current situation

The production of electricity in Poland from wind farms is less than 1 % of the total production of electric power, mainly because of bad wind conditions. So the problem of balancing of electricity from wind farms hardly exists at present. In Poland, one can observe a great interest in renewable energy. In the beginning 2004, there was an installed capacity of about 100 MW wind power in Poland. Now, in 2007, the forecast for next year is very optimistic, because two new wind farms will be finished in the northern part of Poland on the Baltic Sea side; one of 60 MW near Kolobrzeg and the other of 40-50 MW near Ustka. The total capacity of wind farms will be app. 500 MW at the end of 2008. Due to the growth in the electricity production of wind turbines balancing problems will appear in local electricity grids. DESIRE prepares us for this situation. The knowledge and experience gained through the project will help us to identify problems and find good solutions like e.g. cooperation between wind farms and local small CHP units.

The **Polish Government** wishes to increase the production of electricity from renewable sources to nearly 8 % within the near future. This growth has to be achieved with private enterprises in cooperation with the public sector. The partnership regulations are presented below. Through DESIRE, **Warsaw Institute of Technology** disseminates this way of balancing the production of electric power from renewable sources (wind farms) with CHP through the presentations of results, solutions and experiences of other European countries to private businessmen, producers of energy, and representatives of state-owned energy plants.

The first legislation connecting to Private Public Partnership (PPP) was passed as an Act of 28 July 2005. Then in the next year, the following regulations were published:

1. Minister of Economy Regulation of 9 June 2006 on the Detailed Scope, Forms and Principles of Drawing up the Information Concerning Public-Private Partnership Contracts
2. Minister of Economy Regulation of 9 June 2006 on the Detailed Scope, Forms and Principles of Drawing Up the Information Concerning Public-Private Partnership Contracts
3. Minister of Economy Regulation of 21 June 2006 on Risks Related to Implementation of the Undertakings Within Public-Private Partnership
4. Minister of Finance Regulation of 30 June 2006 on the Essential Components of the Analysis for Public-Private Partnership Undertaking.

These legislations should activate PPP projects in Poland, but there are many unsolved problems. It is a very complicated procedure to make profitable analyses before investment, no transparent mechanisms of choosing the most optimize solutions exist and taxes are calculated in different ways for private and public partners. In this situation, by the writing of this report, no PPP project has been carried out. Moreover, the situation in the energy sector, especially in

the cooperation between wind farms and CHP plants, is far away compared to eg. Germany or Spain.

5.2 Means taken to raise public participation and awareness during the project

In Poland, the DESIRE project shows the direction of developing wind energy farms in East Europe, but also describes advantages and disadvantages of renewable energy like wind. The Polish Government has commissioned to a group of experts the elaboration of the document "Polish potential of cogeneration". In this elaboration, experts from Warsaw University of Technology have been involved, too. Many historical data, overviews of renewable energy and cogeneration sectors in Germany, Spain, Great Britain, and the ideas of possible ways of developing cogeneration energy sectors have been very helpful when describing and forecasting the role of cogeneration in the Polish energy sector. Conversely, information from the "Polish potential of cogeneration" was also used in DESIRE documents.

The purposes of foundation and the results of the DESIRE project were published on different conferences, where representatives of sciences, private businessmen, producers of energy, and representatives of state-owned energy plants were presented. In May 2006, we presented two papers describing the results of DESIRE at the I International Conference on Solar Energy and Ecobuildings in Solina, Poland. Both presentations were followed by articles in the conference proceedings. In September 2006, we presented an article based on DESIRE in the conference proceedings of the XV National Conference of District Heating in Poland and in the journal District Heating, Heating and Ventilation. In October 2006, we presented the project results in relation to the strategy for developing district heating in Poland at a Polish-Norwegian Seminar in Trondheim, Norway.

In our Centre at the Technical University of Warsaw, we lead a work related to the implementation of the EU Directive about high efficient cogeneration on order of a Polish Company of Professional Thermal Power. Small and medium heating plant systems have the sufficient technical and economic potential for new cogeneration systems. Conclusions and technical solutions from the DESIRE reports are taken into consideration in our work. The processed strategy will be presented in an executive document in the future.

5.3 Future strategy

The final results and experiences of countries from the DESIRE project will be presented at conferences as well as in scientific magazines. Seminars are forecasted for showing the purpose of the DESIRE project and the capabilities of balancing electric power produced by wind power stations with flexible CHP. The popularization of the DESIRE project will cause growth of production from renewable energy sources and the general consciousness of society will contribute to the wider utilization of renewable sources of energy in the future.

Now, there is an amendment to the Act of PPP, which changes the process of choosing private partners. The decision will depend on the analyses of effects between private offers (rival companies) and public in a situation when all investment will be done from only public finances. In businessmen's opinion (Law Newspaper 6.02.2007- *Gazeta Prawna*), this law is "dead". On the other hand, in a forecast of the Ministry of Economy, investments in PPP will get value about 4-5 10^9 PLN, and savings in the public sector will be at the level 400 10^6 PLN. Thus, in Poland, the energy sector has to wait for changing economy and legislation conditions, but the interest in projects of PPP is very big. Many investors tried the implementation of ESCO projects or investments in stocks and shares. These activities can be seen as a beginning of the PPP process.

It is impossible to describe any potential project of PPP according to the existing Polish law. There is no experience of project in formula PPP, so the first step will be preparing a pilot project to invest in other sectors than the energy sector. Probably, this will be the transport sector: the public highway and the Warsaw underground metro. Another sector is the public health care in cooperation with National Health Fund, investing in hospitals and medical equipment. A third sector is public building meaning municipal buildings. All of them are connected with the energy sector, but it is impossible to forecast projects of PPP which will involve electricity balancing and cooperation with RE.

According to the Polish Energy Law, all “gminas” in Poland are obligated to have a “Programme of developing gas, electricity and heat supply”. For many years, experts from Warsaw University of Technology have been involved in creating such plans. The experience from DESIRE will be used for elaborating new projects for Polish “gminas” in the future.

6. Estonia

6.1 Current situation

As main actors on the Estonian energy market two bodies could be considered – the state energy company **Eesti Energia**, who is the owner of the main power plants, all CHP included, and the **Ministry of Economic Affairs and Communication**, into whose administrative sphere the energy belongs. Also non-profit organisations like **Estonian Wind Energy Association**, **Estonian Bio-energy Association** and **Estonian Union of Cogeneration and District Heating** should be mentioned. The last mentioned non-profit organisations are clearly oriented towards spreading of the use of renewable energy sources. Also the state company Eesti Energia is investing into the building of small plants using renewable sources like wind, biogas and wood. Two of these plants are planned to be CHP plants. Also Eesti Energia is active in the restoration of old small hydro power plants. During last years, two of them are put into operation and some more are coming. The Ministry with its Energy Department does not play an active role in the planning of energy development in Estonia and is doing the legislative review mainly.

At present, the tariff for the electricity in Estonia is 1,28 EEK/kWh in daytime and 0.74 EEK/kWh during the night (23.00 – 07.00) time consumption. At the same time, Eesti Energia, who is the only player on the electricity market, is paying to the large power plants 0.35 EEK/kWh and to the wind electricity producers 1,01 EEK/kWh, according to the just adopted amendment to the Electricity Market Act. The same price will be paid to all producers generating electricity from renewable sources. For the electricity produced by CHP plants, Eesti Energia pays 0.5 EEK/kWh. These prices are paid independently of the production time. Such price arrangement drives the interest of possible investors towards an intensive development of CHP and power plants producing electricity and heat from renewable sources, however, it does not generate any interest of investors for developing CHP plants with energy stores. It should be mentioned that the efficiency of co-generation is commonly understood and plans are made for wider use of co-generation and replacement of central heating boiler houses by CHP plants. Despite present discussions about the use of energy storage at existing CHP plants, no efforts are being made to conduct a feasibility study of the energy store for the Iru CHP plant, where the building of the store could be easy and efficient.

6.2 Means taken to raise public participation and awareness during the project

TUT uses its position as the main builder of power engineers in Estonia, whose graduates hold leading positions in governmental and private companies and often communicate with the university staff. Among them are senior staff members of the Tallinn CHP plant and senior experts of the Estonian Power System “Eesti Energia”. Also TUT is organising different courses and seminars on the use of renewable energy sources, attended by members of the Estonian Wind Association, the Estonian Electrical Power Engineers Society etc. Members of the Energy

Department of the Estonian Ministry of Economic Affairs and Communication are often guests in the Power Engineering Faculty of TUT. Therefore, the people dealing with the technical side of energy development are practically included into the TUT target group of the given subject.

However, what we have not done is contacting possible investors. Ways must be found on how to contact the Estonian Chamber of Industry and Commerce and make them interested in the DESIRE results.

In February 2006, a paper was published in the local electro-technical journal “Elektriala” (Electrical field) about the balancing of wind turbines by CHP plants. The paper was targeted at electrical engineers holding leading positions in the government and business, in Eesti Energia in particular. The ideas of DESIRE were understood, but in general the public reaction was that our energy legislation is so different from the Danish one that we should re-write it completely, and for very steep changes in energy policy the public is not ready.

In September 2006, a seminar “The assisting role of co-generation for a power supply with renewable energies” was held at Tallinn University of Technology. John Sievers, Kassel University, gave a presentation of the main principles of the DESIRE project and upward and downward regulating possibilities. The seminar was attended by experts of the Energy Department of the Ministry of Economic Affairs and Communication, the Transmission System Operator, Distribution Network, Energy Market Inspectorate and university staff (Department of Electrical Power Engineering). The audience showed general interest and understanding of the problems presented. However, they did not show any enthusiasm on using energy stores in Estonia by given energy legislation. The result was practically the same as of our first paper.

In August 2006, a seminar was organised and, in September 2006, a paper on this seminar was published about heat and power co-generation in Estonia. The seminar was organised by the Ministry of Economic Affairs and Communication, the Energy Company “Eesti Energia” and Tallinn University of Technology and was targeted at the wide engineering and economy community, propagating wider use of cogeneration. At this seminar and thereafter in the paper, Heiki Tammoja underlined the possibilities and importance of DESIRE. However, the impact of the seminar and paper was in large the same as of the two means mentioned above. The general opinion expressed that as long as there will be paid feed-in tariff that is independent from the production time, the use of energy storages in CHP plants would hardly be feasible in Estonia.

6.3 Future strategy

As it was said, the leading role in changing existing legislation and public attitudes towards energy policy with it should be played by the Ministry of Economic Affairs and Communication. However, we cannot see any internal force or reason which should make this Ministry moving. The introduction of higher prices for peak electricity involves a general raise of electricity prices, which is an extremely unpopular undertaking for every political party. But this is a political decision, which should be made.

Therefore, it would be more effective to look for external forces, which could be used for the promotion of the DESIRE ideology in Estonia. It would be possible, if the EC approves the results of the DESIRE project and as a result of it, a Directive or at least a recommendation for the Member States will be adopted insisting that the member states should participate actively in the development of CHP-balanced wind farms. This could be a reason for the Estonian Ministry of Economic Affairs and Communication to initiate corresponding activities.

For the application of the principles and methods, stated and developed in the DESIRE project, the following should be made:

1. Develop an energy store efficiency model, containing possible peak-hour electricity price. On this model, the possible lower limits of peak-hour electricity price should be assessed, by which the building of energy store by CHP plants will be efficient.
2. Initiate a study on the expedient donations to the electricity prices, which could be paid to the electricity producers from the renewable sources in case of fully opened electricity market.
3. Organize wide public discussion of the results of both above-mentioned studies, in order to outline the main changes to be introduced into the Electricity Market Act.
4. Introduce the changes, and submit the amendments bill to the Parliament.

All these activities should be headed and conducted by the Ministry of Economic Affairs and Communication, with active participation of energy companies and universities. Without the active leading role of this Ministry hardly anything will change in the Estonian energy legislation

For the implementation mentioned above, first of all, there must be individual contacts with leading persons in the Energy Department of the Ministry of Economic Affairs and Communication in order to present the main results of the DESIRE project and advances of the use of CHP plants with energy stores to them. Secondly, the Electric Power Engineering Department of TUT (Heiki Tammoja) begins the elaboration of the energy development plan of Estonia for the following 15 years, in the near future. The experience and new ideas obtained during the DESIRE project will be laid down in the basis of this project.

Finally, a cooperation framework agreement has recently been signed between TUT and the company "Four Energy Ltd" for the research and development of fuel cell and wind energy. After signing this contract, the representatives of the company expressed interest in the application of energy stores in their future energy projects with CHP. This could be considered as our first direct result achieved through the dissemination of DESIRE ideas.