

## IEA DSM agreement task 17 workshop on integration of DR, DG, energy storages and smart grid technologies

Petten, Holland, 9<sup>th</sup> July 2008

### Participants:

Name	Background
Rene Kamphuis, ECN	Dutch country expert. Has worked in several projects with embedded generation and renewable energy sources and in related ICT questions. Works in group of intelligent energy management.
Albert van der Molen, Stedin, NL	Works with natural gas.
Daan Six, Vito, Belgium	Works as scientific researcher at the Energy Technology department at Vito (Flemish Institute for Technological Research, based in Belgium) since the beginning of this year, academic background Commercial Engineering University of Antwerp. Relevant experience: Energy market, pricing mechanisms, technical-economic feasibility studies for energy technologies, micro-chp (business cases) in Flanders, and PV. Also responsible for Vito's participation in IEA Enard (smart grids).
Paula Souto Perez, University of Leuven, Belgium	Graduated in Electrical Engineering in 2005 in the University of Vigo, Spain, with specialization in electrical engineering. Since 2006 she is a research assistant in the research group ELECTA of the K.U. Leuven (Belgium), working towards a Ph.D. Her fields of interest are wind power and its relation with grid stability in Europe.
Fritz Oostvoorn, ECN	Manager of European Policy Studies. Has extensive experience in leading EU projects on distributed energy resources integration and gas infrastructure issues.
Frans Nieuwenhout, ECN	Frans Nieuwenhout has a degree in physics and has been working for 18 years at ECN in the field of energy planning in developing countries and solar energy applications. Currently his focus is on intermittency and integration of renewables in electricity networks.
Hyeong Jung Kim, Kemco	responsible of DSM policy of Korea.

Seungchan Chang, Kemco,	Korean country expert. Chief Manager of Energy Policy Office in Korea Energy Management Corporation. Works with energy efficiency and demand side management. He studied Electric Power Systems and Economics at Hong-Ik University in Seoul, and since then he has interested in the demand side management of energy. He has worked at KEMCO since 1996.
Carlos Madina, Labein	Spanish representative of the task. Works at Labein, a private research centre. Interests in integrating renewable energy sources and demand response into the grid. Working with Red Eléctrica (TSO of Spain).
Rob P. Kool, Senternovem, NL	Has been active as strategy developer and manager of a range of topics like municipal sustainability, district heating and energy efficiency within the built environment. Since 2005 he's manager of international teams within the <a href="#">Directorate of Energy and Climate Change</a> . At present he is heading the Energy & Climate Cooperation Europe Team. This team is working world wide on Long Term Agreement projects and on the <a href="#">International Energy Program (PEI)</a> of the Ministry of Economic Affairs.
Bart Roossien, ECN	Got his master's degree in applied physics two years ago from the University of Groningen, The Netherlands. Since then he has been working at ECN in the group of Intelligent Energy Grids, where he works on several topics related to smart grids.
Olaf Pruissen, ECN	
Peter van der Lag, ECN	
A.J. van der Welle, ECN	
Giancarlo Scorsoni, GSE	Italian country expert.
Alison Silverstein	American country expert. Works as private consultant to DOE. Has previously worked for utilities and regulators. Expertise in electricity transmission, smart grids, demand response, renewables integration, etc.
Seppo Kärkkäinen, VTT, Finland	Operating agent of the task. Has worked a long time with DSM and EU projects at VTT, IEA DSM Agreement EXCO for 15 years. Currently works as research professor.
Corentin Evens, VTT	Assistant to the operating agent.
Anna-Kaisa Karppinen, Merinova technology center	Finnish country expert. Has worked with power electronics as researcher, now as project engineer.
Jussi Ikäheimo, VTT	Has worked with electricity trade, district heating, DSM and wind power for 8 years. Assistant to the operating agent.

### Minutes:

The workshop started at 9:00 at ECN premises in Petten. Seppo Kärkkäinen, the operating agent of the IEA DSM task 17, introduced the task and its objectives: to collect data from countries and present a comprehensive report. In this event we expect some feedback to our first results. This is the first phase of IEA task. There will be continuation; ideas and proposals for the next task are welcome. In the end of September we will make a proposal to IEA about the continuation. In the new work there will be a new group of countries, each country in IEA DSM program can decide to join.

Seppo also told about our data collection: general questionnaires and case studies (pilot projects) and country reports. We have collected these into IEA DSM agreement website, which is open for country experts. He explained the planned schedule of the workshop.

Rene Kamphuis introduced ECN. ECN is the biggest independent energy research institute in Holland. Originally for nuclear research, location is on the shore because of abundance of cooling water. There is still nuclear research but it is fraction of what it was before. ECN tries to bridge the gap between pure research and practical applications. There is also a policy study department, located in Amsterdam. Intelligent energy management group focuses on electricity storage, grid connection, power quality and intelligent supply and demand matching.

According to Rene, in distributed generation (DG) penetration the first stage is accommodation, where DG is accommodated in the current grid. DG is treated as negative demand and central control is unchanged. In the next stage bi-directional flow of power is possible, then also bi-directional flow of information is necessary. In third stage, there will be more autonomous sub-networks and the central controller becomes a coordinator.

After Rene's presentation Seppo showed some introductory slides of IEA DSM agreement work. DSM program started in 1993, with 20 participating countries. The programmes's work has been divided into two clusters, which concern themselves with load shape and load level (energy conservation). Totally 18 tasks (projects) are monitored by the executive committee, which is common to all tasks. For a new task, minimum number of participant countries is four.

Our task objectives in task 17 are to study how to achieve the optimal integration of flexible demand with DG, energy storages and smart grids, and achieve synergies. The task contains four subtasks. These are:

- 1) Information collection by country experts,
- 2) processing of collected information into a state-of-the-art report,
- 3) workshop about integration of DR (demand response), DG (distributed generation), energy storages and smart grids and
- 4) preparation of final report.

### **Spanish presentation**

Carlos Madina presented the Spanish situation. He showed a diagram of the Spanish electricity system. Market has been open to competition after the law 54/1997. Some activities such as transmission and distribution remain monopolies. There is common market with Portugal; sometimes (in case of transmission constraints) market is split into two. In organized electricity trading there are six "intraday" trading sessions each day and one day-ahead trading session. Demand peaks take place both in summer and winter. Madrid is a consumption "black hole", i.e. there is much more consumption than generation.

Special regime (royal decree 661/2007) includes RES, CHP and waste up to 50 MW. There are two options for selling special regime generation: guaranteed price or market price + premium. All new wind turbines must have a defined fault ride-through capability. For old ones deadline for compliance 1.1.2010. The turbines must be able to withstand voltage dip of 80 % for 0.5 seconds. Electricity supply is competitive and only low-voltage consumers can now get electricity at a regulated price.

### **Austrian presentation**

Next presentation was about Austria. The Austrian expert Matthias Stifter was not present so the slides were presented by Corentin Evens, VTT. There is a feed-in tariff for wind power. Electricity price has more than doubled in a few years. Wind power generation has increased considerably in past 7 years. A few case studies, collected by the expert, were shown. Demand response (DR) potential in Austria is high enough to cope with "future requirements". Austria has started its own smart grid platform. It is quite similar to Germany and some other countries where they try to integrate DG and flexible loads into the system.

### **Presentation about electric vehicles and heat pumps in Holland**

Next presentation was by Frans Nieuwenhout, ECN, about electric vehicles and heat pumps. Main issue in the future is integration of intermittent renewables. DR is one solution to the issue. He showed a simulated output of 10 GW of wind power and a day-ahead forecast for the same capacity for one week. Changes can be abrupt and forecast errors are often 1000–2000 MW. In Holland households' night price is usually 2/3 of day price (time-of-use tariff). Now load shifting can be done with hot-water storages and washing machines. He mentioned different options of supply-demand management, including higher ramp rates of generation and choices for generation mix of conventional generation, stronger interconnections (random variations in generation and load often balance each other, similarly to the "trunk effect" in telecommunications), and demand response.

According to Frans in 10–20 years demand by heat pumps and PHEV (plug-in electric vehicles) could fill 20 % of the night demand valley in Holland.

### **Rene's presentation**

Rene had a presentation about distributed renewables generation, demand response and storage. He showed annual market prices for Nordel (common system price of the Nordic countries) and western Denmark. The latter has more peaks. In Holland (APX-NL electricity exchange) the picture is quite different: there is a lot of variability during the day. He showed also the annual hourly heat demand of households. This resembles the prices on APX. In other words, running micro-chp according to heat demand also generates most electricity during peak prices. Micro-chp's are expected to rise to 100 000–200 000 in 10 years.

He showed that substation peak load could be reduced with micro-chp's by 50 %, by using a little bit larger thermostat temperature band, compared to fit-and-forget case with no coordination in which only the temperature setpoint deviation controls operation. This is result from a field-test configuration with 10 micro-chp's in households (every household had micro-chp).

He mentioned the "Integral" project, which is a European project. It has tests in Holland and Spain. Tenet is not involved in this project. It only manages the high-voltage and part of medium-voltage grids. Giancarlo mentioned that usually TSO is not in favor of losing some control. Rene said that the role of DSO will increase in future. Alison said that the price of micro-chp is too high for individuals. Rene said it is also possible to lease equipment. In Netherlands often the electricity supplier is also gas supplier (does not lose sales in case of gas-fired micro-chp).

## **Korean presentation**

Chang presented the Korean presentation. He went through DER overview in Korea. KPX is system operator and market operator. Producers above 200 kW must register to KPX. Kepco purchases all power from the KPX pool (KPX is called “cost-based pool”). There is such a feed-in tariff that the government pays the difference between pool price and feed-in tariffs. Above 100 kW DER connects to 22,0 kV distribution line, above 3 MW to 154 kV substation. There are no electricity market incentives for CHP. In Korea there is some negative opinions and information about CHP.

## **Frits van Oostvoom’s presentation**

Frits van Oostvoom told about Respond project. This is about reduction of effects of intermittency. How to find market-based responses to these effects? The project focuses on the whole spectrum from generation to demand side to find solutions. What are the regulatory instruments and policy to promote these response options? Of the negative impacts he mentioned lowering of average spot price, which creates problems for already installed plants. This of course comes from the way the spot price is calculated: marginal production cost cannot be the right price for plants with high fixed cost and low marginal cost. Philosophy of DSO's must change: they must act like TSO's and do active network management. Other solutions are DR, storage and flexible deployment of DG.

## **IEA Wind tasks and IEA Enard presentation**

Next Seppo presented IEA Wind tasks 24 and 25 (assess impact of wind on power system). DR is not considered in this agreement. Seppo then presented IEA Enard agreement task "DG system integration in distribution networks". Enard website <http://www.iea-enard.org> was mentioned. In Enard they call tasks "annexes", and subtasks "tasks". Annex 2 is in its starting phase.

Seppo went through the table of contents of our report. Alison mentioned that we should explain why intermittent production should be integrated. Seppo also went through one country questionnaire. He then presented some results of country comparisons from our report. The difference of power pool and power exchange was brought up. A suggestion from Korea was that we should include the year to which data refers with the statistical numbers in questionnaires.

## **Presentations about pilot projects and analysis tools**

Next we moved to pilot projects. Corentin Evens presented the pilot projects which we have collected (either country experts or VTT). He grouped these pilots into a few different groups. Seppo first showed the project card which we have asked country experts to fill in. There was a question about if microgrids, when present, enable more intermittent power generation (Alison). There are not too many test studies about microgrids, where they can actually work islanded or connected to the distribution grid. Paula mentioned that the problem with so few microgrids is not technical but regulatory.

Jussi Ikäheimo had a presentation about different software tools which can be used to analyze the effects of DR, DG and storages on the energy system. These were also grouped into a few different groups, including policy analysis, investment planning, operational optimization

(Alison called these tools security-constrained unit commitment (SCUC) programs), power system simulation, and forecasting. A list of different tools has been collected into our report.

Alison mentioned that demand response for commercial customers, for example gyms and restaurants, is mature in USA. Daan Six mentioned smart meters and that there is not too much information about these in our report. European smart meter alliance was mentioned. They have compared different definitions of "smart meter".

A few suggestions for improvement of our report were brought up. One comment was that user experiences and usability should be given more weight. Another suggestion: develop a vision of future and solve the problems which are on the way. We should also recognize that there may be technological or political changes which make our vision inaccurate. Rene suggested to visit stakeholders before the September Korea expert meeting to get suggestions for future work.