IEA Implementing Agreement on Demand Side Management Technologies and Programmes

Task XVII

Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages

Task definition: final version

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13.8.2007

1 Motivation

Energy policies in various countries are promoting energy efficiency, distributed generation (DG) and renewable energy resources (RES) which is resulted in an increasing share of DG and especially intermittent (only partly controllable) type of DG like wind power, solar, small hydro and CHP (small and micro-CHP). This kind of nonpredictable electricity generation is causing increasing problems in electrical networks (both in local distribution networks and transmission networks including cross-border networks). The development of active networks and smartgrid-concepts is the basic solution to get networks adapted to the increase of DG.

Similar problems can be seen at market: national and local balances between supply and demand are difficult to manage due to this kind of generation which can increase the electricity cost of actors having intermittent DG in their supply portfolio.

Another problem related to the market is also how to increase the possibilities to get small-scale (intermittent) DG into the market because it consists of small dispersed units.

From the system point of view DG has two goals to be integrated: network management point of view and energy market objectives. Also time frames are different: network management is long term activity (e.g. voltage control) whereas trading has short term goals.

One solution to decrease the problems caused by the intermittent nature of some DG is to add energy storages into the systems (centralised or distributed storages (DS)). Another way is to use flexibility in electricity consumption (demand response DR). In this sense distributed generation (DG), distributed energy storages (DS) and demand response (DR) can be seen as an integrated distributed energy resource (DER). Combining the different characteristics of these resources is essential in increasing the value of DG in the energy market.

IEA has several implementing agreements dealing with DG (wind, photovoltaic, chp,…), energy storage and DSM. Main approaches in this respect are going on inside Wind Implementing Agreement dealing with the power systems operation with a large amount of wind power and integration of wind and hydro as well as in a new IA dealing with network aspects (ENARD). Inside IEA DSM Agreement there are several Tasks (especially tasks VIII, XI, XIII and XV) in load shape cluster where DG is included as a resource for DR, but the question how to handle the integrated distributed energy resources in not actually studied.

The figure 1 below describes the general nature of the integrated system at the distribution network and market level. Similar situation exists also at transmission system level where large windfarms are connected to the system.

The figure shows how different types of customers with distributed energy resources are connected physically to the network in the point of common coupling (PCC). The connected DER can be loads, distributed generation, energy storages or combination of these. These resources are also connected to the market either directly selling and buying electricity and related services or indirectly through aggregators (this is called local trading strategies LTS in the figure).

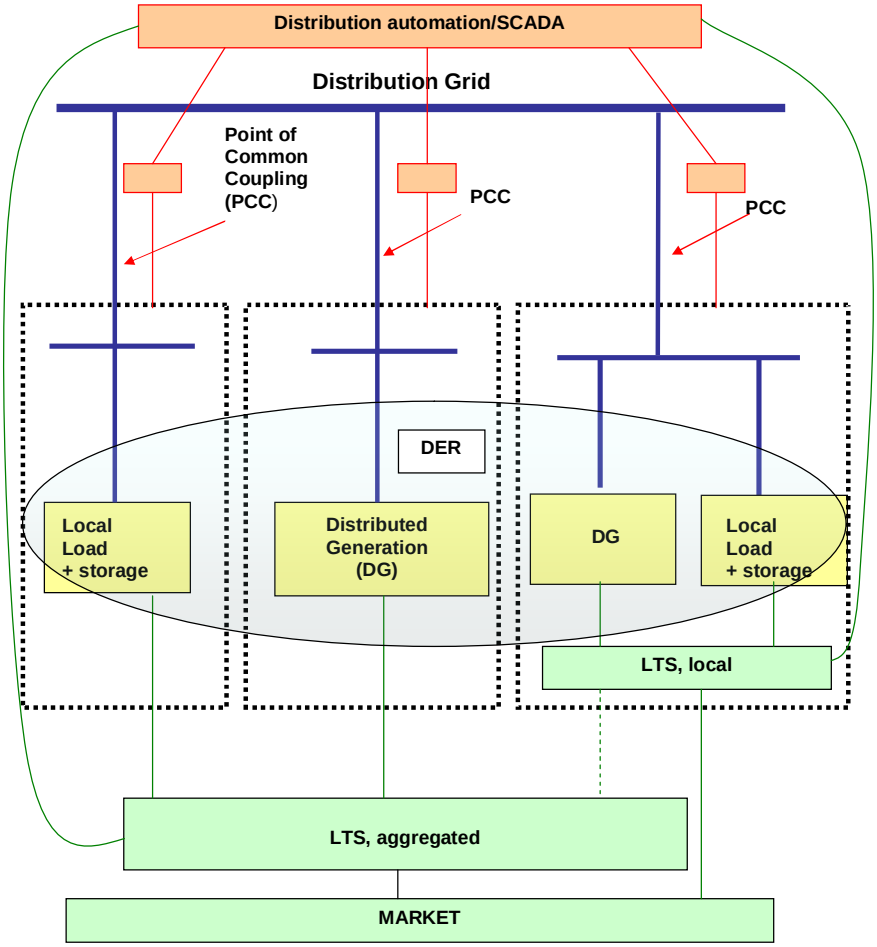

Figure1. Connection of DER into local distribution network and into market. Similar situation is valid also in transmission systems where large wind farms are connected into the grid and market.

2 Objectives

The main objective of the proposed Task is to study how to achieve the optimal integration of flexible demand (Demand Response, Demand Side Management) with Distributed Generation, energy storages and Smart Grids, and thus increase the value of Demand Response, Demand Side Management and Distributed Generation and decrease problems caused by intermittent distributed generation (mainly based on RES) in the physical electricity systems and at the electricity market. The Task deals with integration aspects both at local (distribution network and customer) level and at transmission system level where large wind farms are connected.

Thus the integration means in this connection

– how to optimally integrate and combine Demand Response and Energy Efficiency technologies with Distributed Generation, Storage and Smart Grids technologies, at different network levels (low, medium and high voltage)

– and how to combine the above mentioned technologies to ideally support the electricity networks and electricity market

The Task will provide the integration based solutions and examples on successful best practices to the problems defined above to the different stakeholders.

3 Approach

The first step in the Task is to carry out a scope study collecting information from the existing IEA Agreements, participating countries and other sources (research programmes, field experience, information collected through Cigre working groups, etc), analyse the information on the basis of the above mentioned objectives and synthesize the information to define the more detailed needs for the further work.

On the basis of the collected information a systematic analysis is carried out to produce the state of the art to the integrated approach of the utilisation of Demand Response and Energy Efficiency in combination with other DER aspects and barriers related to it and to define the detailed further work. Also the first set of best practices are produced.

This kind of approach presumes the co-operation between different IAs related to DG, storages, DSM and networks. Experts are needed from each area. Especially information exchange and coordination with Wind and ENARD is organised, and possibility to have common workshop is considered.

At the end of the scope study a workshop with the stakeholders will be arranged to get feedback and inputs from outside to the conclusion and the definition for the future work.

The first approximation for the duration of this scope study is one year.

4 Subtasks of the scope study

The first stage of the Task (the scope study) includes the following subtasks

Subtask 1: Information collection on the characteristics of different types of DER in the integrated solutions

The information to be collected and analysed is dealing with integrated solutions where energy efficiency/demand response is combined (or seen possible to combine) with at least one of the following technologies: distributed generation, energy storage or smart grid technology aspects (e.g. controllable On Load Tap Changer - OLTC). The exact definition of DG will be defined, but it includes both low and medium voltage level generation as well as large aggregated generation of small units at transmission system level (like wind farms). The information is collected both by the OA and country experts based on research, pilot projects, demonstrations and other experiences.

The information is collected from the different voltage levels. OA prepares a list of projects/public sources on the available information and prepares a draft of questionnaire to country experts. This is discussed at the first expert meeting and agreed how country experts proceed with the information collection.

The exact form of the information collection will be defined at the first expert meeting, but information to be collected include at least

- technical information on the integrated use of DER (minimum requirement is DR or DSM in combination with one of the following technologies: DG, storages, Smart Grid Technologies)

- penetration levels of technologies

– market conditions

– economy

– impacts on different voltage and system levels

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Subtask 2: Analysis of the information collected and preliminary conclusions (state of the art)

On the basis of the collected information a draft synthesis report and preliminary conclusions are written down including

1. State of the art of integration of DER at customer, network, system and market level; pilot and research projects and actual applications

2. Why the integration is useful and what impacts it has (technical, market)

3. Preliminary conclusions on improvements needed to enhance the integration

4. Preparation of the workshop

The draft analysis and preparation of the workshop is done by OA with the assistance of country experts

Subtask 3: Feedback from the stakeholders: Workshop

An open workshop is arranged with stakeholders with the objectives

1. To collect additional information from the invited speakers

2. To get feedback on the preliminary conclusions

3. To get inputs for the future work

OA produces the workshop proceeding with the conclusions

Subtask 4: Final conclusions and the detailed definition of the further work

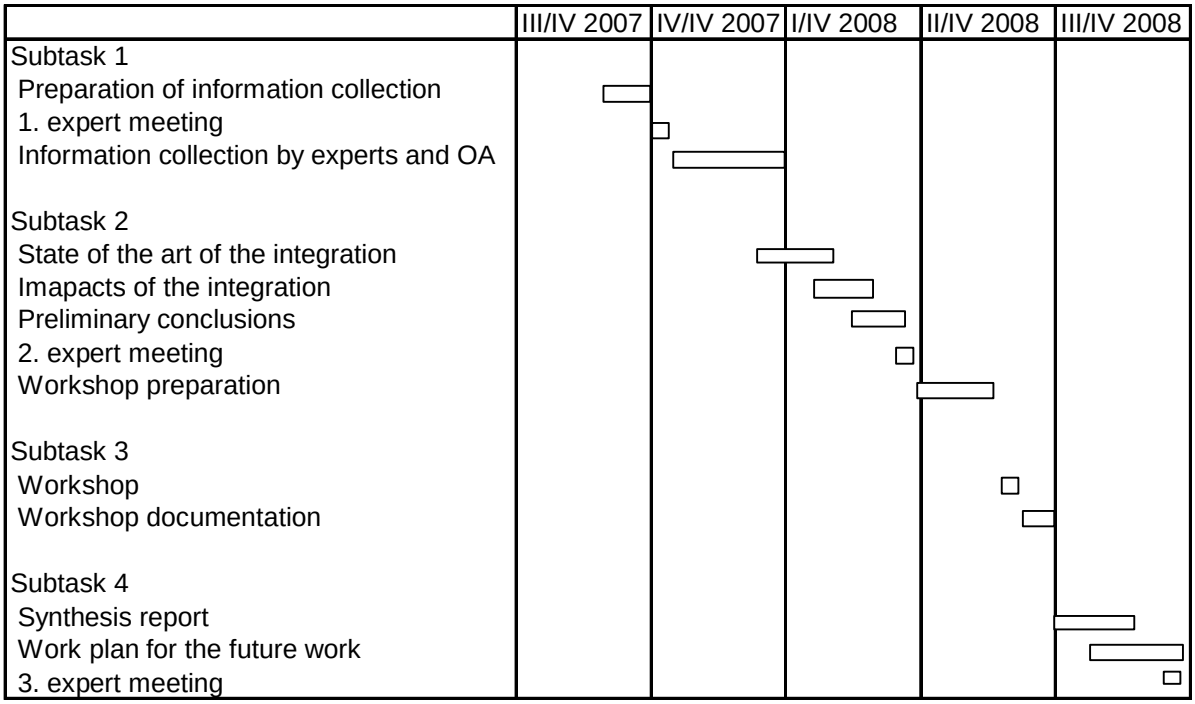
As a result of the previous subtask the final products of the scope study are produced including

1. The updated synthesis report with conclusions and first set of best practices

2. Detailed work plan for the additional work

The first product is mainly produced by OA with the assistance of country experts. The workplan is produced by the expert group with OA

5 Time schedule



6 Task deliverables

The main deliverables are

- State-of-the art report on the integration with conclusions and first set of best practices
- Workshop proceedings
- Detailed plan for the further work.

7 Estimated resources needed

Operating Agent

Personnel costs	75000 €
Travels	3000 €
Workshop	5000 €
Total	**83000 €**

Country experts 6 person-weeks