Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation

MEETING MINUTES OF

Advisory Board

February 2nd, 2017

Espoo (Finland)

Organizer: Gianluigi Migliavacca (RSE)

Compiler: Marco Rossi (RSE)

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Meeting Info

Meeting Title	SmartNet Advisory Board
Date (and Time)	February 2nd, 2017
Type of meeting	Physical
Location	Espoo (Finland)
Organiser(s)	Gianluigi Migliavacca (RSE)
WP (if relevant)	

1 LIST OF PARTICIPANTS

Participant list

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2 MEETING AGENDA

9:00-9.40 Overview of the main results of the first project year (by: Gianluigi Migliavacca, RSE)

9:40-10.20 Present status of the three project pilots (by: Carlos Madina, TECNALIA)

10.20-11.00 The aggregator role and its operative modalities (by: Milana Plecas, University of Strathclyde; companion paper)

11.00-11.40 ICT architectures to acquire ancillary services from distribution (by: Seppo Horsmanheimo, VTT; companion paper)

11:40-12:30 Free debate with stakeholders

3 DISCUSSIONS

3.1 TSO-DSO coordination for accommodating ancillary services from distribution networks

Gianluigi Migliavacca briefly presented the activities and the main outcomes related to the TSO-DSO coordination schemes investigated in SmartNet. After the presentation, the following discussions have been opened:

Discussion A – WP1
Participants: Daan Six (VITO), Gianluigi Migliavacca (RSE), Giacomo Viganò (RSE), Peter Nemcek (Cybergrid)
In some countries (e.g. in Austria) a clear distinction between transmission level and distribution level flexibilities is done. In particular, it is currently usual to aggregate distribution resources in order to exploit their flexibility in ancillary services market. The role of SmartNet is the investigation of different coordination schemes that allow distribution network participation to these markets. In particular, the challenge in creating a competitiveness between distribution and transmission is one of the key objectives of the projects. Country specific aspects and regulation will be taken into account (for Italy, Denmark and Spain).

Discussion B – WP1
Participants: Daan Six (VITO), Gianluigi Migliavacca (RSE), Andrew Burgess (CEER), Francisco Reis (REN)
Regulators are very interested in investigations aimed at identifying the different TSO-DSO interaction modalities. In particular, the main interests concern the ways in which the scenario can affect the interactions as well as the potential conflicts of interests that may results from the TSO-DSO coordination schemes. SmartNet deals with these issues and the investigation aimed at defining the coordination schemes has taken into account the potential conflicts of interests (coordination scheme D seems the most promising one whenever involving an independent market operator). In addition, the investigated TSO-DSO coordination schemes have been designed on the basis of the most recent network codes (i.e. the one released by ENTSO-E – see chapter 3 of D1.3). Finally, different scenarios will be also simulated (one of each country) in order to investigate how the different coordination schemes behave.

3.2 Comparison of the national cases in a simulation environment and laboratory testing

Gianluigi Migliavacca presented the main WP4 approach (based on simulation and laboratory testing) that will be used in order to validate the SmartNet concepts. The same work package, on the basis of the experiments results and dedicate Cost-Benefit Analysis, will also provide indications on which coordination scheme is expected to have the highest potential in the three considered countries (Italy, Denmark and Spain). This activities are currently in progress and the main outcomes will be presented during the next Advisory Board meeting.

3.3 SmartNet website

Gianluigi Migliavacca reminded to the members of the Advisory Board that three deliverables can be already downloaded from the SmartNet website:

- D1.1 – Ancillary service provision by RES and DSM connected at distribution level in the future power system
- D1.3 – Basic models for TSO-DSO coordination
- D3.1 – ICT requirements specification

Some of these deliverable already include the results of Advisory Board consultation. However, additional feedbacks can be collected through the website.

3.4 Physical pilots realization

Carlos Madina, leader of WP5, presented an aerial view of the three pilots investigated in SmartNet. The different control and monitoring architectures have been presented for each pilot and, on the basis of the TSO-DSO coordination schemes investigated by WP1, the interactions between distribution and transmission have been categorized. A discussion for each pilot have been opened:

Discussion C – WP5 – Pilot A (Italy)
Participants: Carlos Madina (TECNALIA), Gianluigi Migliavacca (RSE), Jesus Varela (IBERDROLA), Francisco Reis (REN), Giacomo Petretto (ENEL)
The Italian Pilot is located in the Alps region (Val Aurina), approximately on border between Italy and Austria. The distribution network under test counts several hydro power plants with high potential in participating to ancillary services. The main challenges faced by the pilot consist in the active contribution of renewable resources to voltage regulation and power/frequency regulation, covering also related issues such as the

observability of the network and the real time aggregation of distribution information to be transmitted from DSO to TSO.
Depending on the service (voltage regulation, energy balancing, etc.) different coordination schemes are investigated. In particular, in alignment with the Italian regulation authority view, the implementation of coordination scheme A (Centralized Ancillary Services Market model) represents the main objective of the pilot activity.

Discussion D – WP5 – Pilot B (Denmark)
Participants: Carlos Madina (TECNALIA), Gianluigi Migliavacca (RSE), Miguel Marroquin (ONE), Giacomo Petretto (ENEL), Peter Nemcek (Cybergrid)
The Danish Pilot deals with the aggregation of small flexible units in order to provide power ancillary services such as distribution grid congestion management and energy balancing of fluctuating wind power. These units are represented by several indoor swimming pools which, thanks to a flexible temperature regulation, can modify their energy absorption according to a control signal. The control is managed by a single control signal (price) sent by the aggregator who decide the bids and the price on the basis of the past experienced responsiveness of flexible units.

Discussion E – WP5 – Pilot C (Spain)
Participants: Carlos Madina (TECNALIA), Gianluigi Migliavacca (RSE), Miguel Marroquin (ONE), Giacomo Petretto (ENEL), Francisco Reis (REN), Konstantin Faller
The Spanish Pilot tests the innovative concept of the SmartNet coordination scheme C (share balancing responsibility model) in which also the distribution network operator is Balancing Responsibility Party. This role consists in guarantee a fixed power exchange profile between distribution and transmission and the DSO has to manage (by means of a dedicated balancing market) the distribution flexibilities in order to achieve this goal. In the Spanish Pilot, the main source of flexibility is represented by the Vodafone's radio base stations which, thanks to their internal backup storage systems, offer great potentiality in terms of demand response. In addition to the balancing of the distribution network, the pilot also deals with congestion management and other kind of flexibilities (such as electric vehicles). These devices are controlled by an aggregator who, on the basis of the basis of the status of the units (which are constantly monitored), sends bids to the real time balancing market and disaggregates the power set points for each controllable device.

3.5 Aggregation of ancillary services from distributed energy resources

Milana Plecas, active on the investigations concerning distributed resources aggregation, presented the main results of WP2 activities on aggregation criteria. Aspects such as the resource typologies and their aggregation algorithms have been showed. After the presentation, the following discussions have been opened:

Discussion F – WP2
Participants: Milana Plecas (USTRATH), Gianluigi Migliavacca (RSE), Carlos Madina (TECNALIA), Miguel Marroquin (ONE), Peter Nemcek (Cybergrid), Konstantin Faller

SmartNet aggregation models have been developed in order to be implemented in the simulation platform (some concepts are extended to Danish and Spanish pilots). This modeling considers the technical challenges but does not take into account how the commercial strategy influences the aggregation process. In fact, different devices might have different commercial/economic objectives in being aggregated (industries are looking for profits, households for lower bids) and, simultaneously, aggregation provides more tangible advantages when it is performed for simultaneous participation in different markets.

Discussion G – WP2
Participants: Milana Plecas (USTRATH), Gianluigi Migliavacca (RSE), Marco Rossi (RSE), Daan Six (VITO), Miguel Marroquin (ONE), Jesus Varela (IBERDROLA), Andrew Burgess (CEER)
The aggregation process has to deal with the uncertainties related to the responsiveness of aggregated devices. This happens especially for price-base aggregation (indirect demand response) which is based on the voluntary participation of customers who have also different dynamics in responding to price signal variations. Potential futures see the development of appliances that automatically react to price variations, leading the system to a more precise response, close to the one of direct control. This problematic has also a relevant impact on how the reserve provided by aggregated quantities can be measured/estimated. It is clear that aggregation is making the system reserve dimensioning more complex. In order to improve the aggregation process, incentivization mechanisms can be also foreseen (having considered that they may have an impact on the final customers' bill as well as interact with the market dynamic in a negative way by biasing the resulting price signals). Having considered all these aspects, it is still unclear who would be the responsible of balancing the deviations due to aggregation uncertainty. One of the possibilities is represented by the network operator (this is the case of coordination scheme C in which also DSOs have balancing responsibilities) that can intervene on the balancing by performing another market clearing iteration or by acting on secondary reserves. There are also potential situations in which network operators, in addition to third party's resources, have their own energy flexibilities that can be devoted to the management of these unforeseen situations. Of course, this last scenario leads to potential conflicts of interests (network operators can preferentially allow the participation of their own units to ancillary services markets – that transform regulated subjects into regular market players and could pave the way for possible gaming actions) and should be carefully investigated by regulatory authorities.

3.6 Communication and ICT requirements

Seppo Horsmansheimo, leader of WP3, presented the main outcomes of the SmartNet activities on communication and ICT requirements for the provision of ancillary services from distribution network. The presentation shown how the ICT requirements have been defined on the basis of a standardized design process which considers the outcomes of WP1 investigations (TSO-DSO coordination schemes). After the presentation, the following discussions have been opened:

Discussion H – WP3
Participants: Seppo Horsmanheimo (VTT), Gianluigi Migliavacca (RSE), Marco Rossi (RSE), Peter Nemcek (Cybergrid), Jesus Varela (IBERDROLA), Stefano Tadiello (CISCO), Giacomo Della Croce (SELTA)

SmartNet has investigated different communication technologies and protocols aimed at supporting the operation of the network and the participation of distribution resources to the ancillary services market. The state of the art has been deeply analyzed (see deliverable D3.1) and extended to the system needs for the application of SmartNet concepts (see deliverable D3.2). The practical experience matured on physical demonstration projects has been considered a valuable input and it is the main basis for WP3 investigation, taking into account the time evolution of the technology (i.e. 5G for wireless communication). However, having considered the proximity of 2030, limited revolution in communication for power technology is expected and the newest solutions (such as Block Chain technology) have not been included in the investigation.
Another important aspect is represented by the possibility of alternatively exploiting different technologies for the same communication channel. On the other side, having considered the practical experience/habits of the network operators and other power system actors, the already used technology is often the preferred one, in spite of more advanced technologies that may require the complete rebuilt of the ICT infrastructure.

Discussion I – WP3
Participants: Seppo Horsmanheimo (VTT), Gianluigi Migliavacca (RSE), Francisco Reis (REN)
SmartNet is also defining the design procedures for communication technology aimed at implement the interactions required by the proposed TSO DSO coordination schemes. The design process is, of course, subject to optimization and the objective function takes into consideration several aspects: capital and operational costs, flexibility in reconfiguration, coverage area, security, etc. Another important aspect is concerning the hierarchy of the different ancillary services which may play a role in the communication priorities (depending on the technology).