

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

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The H2020 SmartNet project

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Agenda

- Motivation, set up and consortium of the project SmartNet
- Year 1 Year 2 Year 3
- Five TSO-DSO coordination schemes
- Proposed AS market design
- Layout of three project pilots (Italy, Denmark, Spain)
- Some preliminary regulatory reflections

Motivations

- Increased reserve needs due to explosion of variable RES
- Opportunities from new DER in distribution?
- Five key questions:

Which ancillary services could		How the architectures of	
be provided from entities		dispatching services markets	
located in distribution networks		should be consequently revised	
Which optimized modalities for		What ICT on distribution-trans-	
managing the network at the		mission border to guarantee	
TSO-DSO interface		observability and control	
	Which implications on the on- going market coupling process		

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"Some actions can have a negative cross-network effect. For instance, TSO use of distributed resources for balancing purposes has the potential to exacerbate DSO constraints. Equally, whilst DSO use of innovative solutions, such as active network management, can deliver benefits to customers, if not managed properly they may in some cases counteract actions taken by the TSO" (CEER Position Paper on the Future DSO and TSO Relationship – Ref. C16-DS-26-04 – 21.09.2016)

Article 32 Tasks of distribution system operators in the use of flexibility

Member States shall provide the necessary regulatory framework to allow and incentivise distribution system operators to procure services in order to improve efficiencies in the operation and development of the distribution system, including local congestion management. In particular, regulatory frameworks shall enable distribution system operators to procure services from resources such as distributed generation, demand response or storage and consider energy efficiency measures, which may supplant the need to upgrade or replace electricity capacity and which support the efficient and secure operation of the distribution system. Distribution system operators shall procure these services according to transparent, non-discriminatory and market based procedures.

Distribution system operators shall define standardised market products for the services procured ensuring effective participation of all market participants including

renewable energy sources, de operators shall exchange all n system operators in order to e secure and efficient operatio

EC (2016) Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on common rules for the internal market in electricity Winter package assigns a role to DSOs for local congestion management, but not for balancing

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- architectures for optimized interaction between TSOs and DSOs in managing the purchase of ancillary services from subjects located in distribution.
- three national cases (Italy, Denmark, Spain);
- ad hoc simulation platform (physical network, market and ICT)
- **CBA** to assess which TSO-DSO coordination scheme is optimal for the three countries.
- use of full replica lab to test performance of real controller devices.
- three physical pilots to demonstrate capability to monitor and control distribution by TSO and flexibility services that can be offered by distribution (thermal inertia of indoor swimming pools, distributed storage of radio-base stations).

Project video: https://vimeo.com/220969294/73d98edde6

Web site http://SmartNet-Project.eu





About SmartNet

The SmartNet project





Year 1 - Year 2 - Year 3





TSO-DSO coordination schemes





Proposed Market Design

- Considered services: balancing and congestion management at transmission (HV) and distribution level (MV), including voltage constraint at MV
- Rolling optimization concept: Results for the first time step are a firm decision. Results for the next time steps are advisory decisions.
- Network representation: DC approximation for HV, SOCP for MV
- Market products: implementation of typical constraints of flexibility providers (extension to multi-period bids with temporal and logical







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Aims and goals of the Pilots





Realisation of three complementary pilots to evaluate the performance of different TSO-DSO interactions under different market structures.

Coordination with laboratory simulations to bridge the gap between present real-world implementation and the opportunities envisaged for the future.







Identify & remove barriers to facilitate the way to the pan-European market for ancillary services.





Centralised TSO control in high-DER area





Italian context: Energy situation SmartNet



Needs to improve the infrastructure for monitoring and control of MV and LV levels

🗱 Terna Rete Italia 🤄 Cona 🚺 SELTA SIEMENS 🕷

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Pilot A: Distribution monitoring and control SmartNet



Aggregation of information in RT at TSO-DSO interconnection (HV/MV transformer)

Voltage regulation by generators connected at HV and **MV** levels

Power-frequency regulation / balancing by generators connected at HV and MV levels 12

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Common TSO-DSO market with pool flexibility





Smart Energy Operating System SmartNet



Pilot B: Ancillary services from swimming pools







Shared responsibility with base station flexibility



Spanish context





2030 Transmission adequacy (TYNDP'16) http://tyndp.entsoe.eu/exec-report/



Poor interconnections

Big contribution by highly-variable RES production



Pilot C: Ancillary services from radio-base stations





Some preliminary regulatory reflections

- If the contribution from entities in distribution will grow, DSOs should **implement real time network monitoring** and TSOs could need to **share with DSOs part of responsibility** for the provision of AS.
- Whatever coordination scheme is implemented, it is important that that actions taken by the TSO and DSO don't cause counteracting effects (e.g. between local congestion management and balancing) – see CEER Position Paper on Future DSO-TSO Relationship
- between the different AS markets, "**common marketplace**" (see ENTSO-E working paper on Distributed Flexibility and the value of TSO/DSO cooperation) is preferable in order to avoid duplicating bids and avoiding double activations.
- before implementing a separate market for a given AS, it should be attentively considered if it can be **sufficiently liquid** (e.g. local congestion management in distribution).
- new AS architectures should **integrate with on-going transnational integration process** (ENTSO-E platforms): sharing reserve between Countries is a key for allowing further RES integration.
- a **balance** has to be sought for between local optimality (e.g. for a given Country) and the implementation of a harmonized pan-European design.
- smaller DSOs have to integrate their efforts in order to be fit for the new responsibilities.
- **real-time market architectures** must take into account the characteristics/constraints of the potential flexibility providers connected to distribution grids
- **aggregators** must be able to provide a simplified interface towards the market, hiding details of flexibility providers, and deliver efficient price signals to incentivize participation from distribution.
- **viable business models** must be available for all market participants, including DERs, aggregators and other customers.
- **network planning** will also have to facilitate better utilization of RES exploiting flexibility.

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Thank You

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