CONSULTATION QUESTIONS

Flexibility at Distribution Level (see sections 2.2 and 2.3)

1. What are, in your opinion, the main drivers for flexibility use by DSOs going to be in the coming years?

The response to this consultation fully incorporates the vision of the SmartNet Horizon2020 project (http://smartnet-project.eu/), which aims at comparing several different TSO-DSO interaction schemes and different real-time market architectures with the aim of finding out which solution would deliver the best compromise between costs and benefits for the system. Through the project website (http://smartnet-project.eu/publications/), all finalized public deliverables are available for download and specific forms are available to collect external feedback.
The answer to this consultation was drafted by the SmartNet project coordinator with the contribution of all Work Package leaders.

The following elements already present in the power system today, will in the next few years increasingly act as drivers for acquiring flexibility services in the distribution grid. Taking advantage of the most recent technologies, DSOs will dispose of more effective instruments to face the newest challenges of distribution grid management in a cost-effective way:

- The fast increase of the penetration of variable RES generation (often located in the distribution segment), due to its dependence on less predictable and sometimes local meteorological situations, e.g. clouds for solar-based generation, asks for increased agility of the power system to deal with imbalance or congestion as well as voltage deviations and other aspects affecting power quality. Distribution systems are characterized by structures and control architectures that, currently, do not naturally match with a system-level way of thinking and require local actions to deal with the upcoming challenges.
- New technologies, enabling also distribution resources to provide flexibilities services, are becoming more and more competitive with traditional network reinforcement/expansion under several aspects (such as cost-effectiveness, energy efficiency, public opinion, environmental impact, time to be activated).
- Subjects connected to the distribution grid and contributing possibly to local network management could become active also in bidding in real time markets for providing ancillary services for the whole system, thus increasing (or maintaining) real time market liquidity and guaranteeing cost-effective activation of the needed reserve. This can be done provided that the actions of TSO and DSO are duly coordinated, hence the interest to analyse the performances of several coordination schemes, main goal of SmartNet (see deliverable D1.3: http://smartnet-project.eu/wp content/uploads/2016/12/D1.3_20161202_V1.0.pdf).
- The possibility of new subjects, in particular flexible load, to ensure revenues by selling services to the system contributes to create new market players with a positive impact on the competitiveness.
- Integration of new technologies, such as Electric Vehicles (electrification of transport), or more widespread integration of heat pumps (electrification of building heating), could cause significant disruptive effects on the network if not managed in a flexible way.
- Allowing significantly higher levels of renewable generation penetration and reduced curtailment could be very beneficial, especially in remote or islanded systems.

As a side note, the potential future role of DSOs with respect to flexibility use has also been analysed in the evolvDSO project, which can probably be considered as the closest predecessor of the project SmartNet. The public deliverable D1.4 section 2.2 and 2.3 explains future evolutions and tendencies with respect to the changing roles of DSOs and system flexibility (available on: http://www.evolvdso.eu/getattachment/6f0142bf-0e66-470c-a724-4a8cbe9c8d5c/Deliverable-1-4.aspx).

2. Please provide any alternative definitions for flexibility that you think capture the focus of this paper.

In the CEER consultation paper, flexibility is defined as "*the capacity of the system to respond to changes that may affect the balance of supply and demand at all times*". This definition appears to

be exhaustive since all the requested services have the final goal of maintaining the safe operation of the grid, which means that the balance between supply and demand is constantly satisfied with adequate stability margins. However, more precisely, one could define flexibility as "*the capacity of the system to respond to changes that may affect the resilience of the system*". Resilience, in fact, is supported by several (interdependent) services for which a wide spectrum of flexibilities might be requested (see SmartNet deliverable D1.1, available on: http://smartnet-project.eu/wp-content/uploads/2016/12/D1-1_20161220_V1.0.pdf).
In addition, flexibility can be also at "individual level" corresponding, in this case, to "the capacity of individual grid users and/or technology to change their behaviour in response to indirect or direct requests for supporting the resilience of the system".
Furthermore, flexibility can be regarded as additional capacity that can reduce curtailment of renewable generation at times of low demand.

DSO Uses for Flexibility (see section 2.4)

3. Should DSOs be encouraged to use flexibility to manage the distribution network where this is more efficient than reinforcing the network? Please provide an explanation.

For all the reasons already explained in the answer to Question 1, it is surely very important that DSOs are encouraged to use flexibility wherever available and more cost-effective than traditional network investments (gird reinforcement). This cost effectiveness, of course, should be evaluated from a holistic power system point of view: thus not only in terms of benefits for the network, but also from a EU citizens' perspective. At the same time, regulatory provisions and market architectures should be fit for ensuring that these flexibility sources are retrieved in an affordable way and that exercise of market power is discouraged. At the same time, mechanisms for retrieving flexibility services (either through market or by contract) should ensure that the typical constraints of flexibility providers are fully taken into account, which could have an impact on the market architecture itself. For instance, market clearing algorithms foreseeing a rolling time horizon encompassing several clearing sessions could help on one side taking into account forecasts of future availability while on the other side ensuring flexibility providers a reliable indication on future dispatching opportunities.
It is also important to clarify whether DSOs should procure system services for their own area or be also responsible, in coordination with TSOs, for the procurement of flexibility for the whole system (participation in the balancing market, etc.). A vision of DSO procurement limited to the mere distribution horizon can be reductive insofar local demand for these services (e.g. for congestion management) is not expected to ensure a sufficient market liquidity. In order to improve market liquidity, conditions to provide the different ancillary services should not be particularly demanding (e.g. minimum bid size should be carefully selected), while TSO and DSO requirements must be met (so that technical characteristics of the bids must be selected to really help system operators solve issues).

4. Should all sources of flexibility be treated equally in the market and by system operators?

They should be equally treated in the spirit of level playing field but specificities and constraints of the different generation technologies and demand typologies should also be duly taken into account in order to ensure an efficient and fair procurement mechanism. In practice, flexibilities should first be identified on the basis of the actual needs of the system (which normally has a correspondent regulated market product) and later be specified in such a way that there is sufficient differentiation (but not fragmentation) so that different technologies can offer their services according to the different product specs while ensuring sufficient liquidity in that market segment.
Even considering that services addressed to distribution systems are fairly different with respect to the ones procured at transmission level, experience from TSOs could provide a good starting point when evaluating how to allow different DER technologies to participate in the provision of different flexibility services.

5. Are there any uses for flexibility that you think we have missed and should be considered? If yes, please provide an explanation.

All the main services for which flexibility services could be required at distribution level are listed in the consultation document. However, please don't forget that flexibility providers located in distribution could also provide services for the whole system. In that case, system balancing, voltage control and congestion management at transmission level, have also to be listed. Moreover, from a system perspective, certain local flexibility could serve multiple purposes at the same time.
Extending to system-scale the range of services for which distribution resources could be involved, it would also allow to identify further services for which flexibility could be profitably used. This means that requirements of existing services may change. Employing flexibility for local black start and operation of isolated parts of the distribution grids would allow to improve the resilience and security of supply.

6. Do you think it is important for Member States to establish standardised EU definitions of the various flexibility products, to facilitate market participation in flexibility use at distribution level?
If, maybe in a second phase, it is possible that a common procedure for cross-border ancillary services procurement is carried out, as also stated in the NCEB by ENTSO-E as a final target, it is of paramount importance that all Member States implement the same flexibility products and the same procurement rules so as to avoid any kind of distortion. Of course, such standardization should in any case be carried out while preserving a limited parametrization capability at national level so as to allow to accommodate existing structural differences.
Finally, any kind of side-incentivisation mechanisms (e.g. to renewables) should in principle be eliminated or, whenever not possible, aligned among the Member States. In addition, standardisation may better support development of new innovative solutions, as it will enable more/better revenue opportunities to their developers.
At distribution level, the diversity across the EU landscape is high and distribution grids, as well as DSOs are developing at different paces. Therefore, there is currently not yet one-size-fits-all solution. In practice, it can be expected that further harmonisation of markets will take place on transmission level, while basic core principles for flexibility at distribution grid could be strived for on distribution grid level although different implementations might be in a first stage required to bring this emerging use into practice.

DSOs Accessing Flexibility (see section 2.1)
7. Should regulators seek a regulatory framework that can accommodate a range of models that would enable DSOs to access and use flexibility, while ensuring that competition and markets are not unduly distorted?
We agree that all the indicated models are viable and we think that the three principles indicated on page 27-28 of the consultation document should lead to the choice of the appropriate mechanism. Of course, each mechanism has its limitations and more research focused on these aspects is needed as certain models exclude or impact on the others severely:

- Rule-based approach should still be implemented in grid codes to make sure that the design and dimensioning of the devices of the customer and systems of the DSO enable flexibility and supporting data communication and metering. (e.g. rules related to frequency responses and their controllability, national smart metering system requirements, etc.). However the rule-based approach alone is not adequate, because it cannot take into account differences regarding the time and place (for which network characteristics and constraints may change).
- Connection agreements can sometimes be efficient, even considering that preliminary negotiation tends to dramatically impact on the connection time and potentially compromises the equal treatment of the flexibility providers. However, the increasing complexity of the network will likely require flexible agreement (non-firm contracts) since the capacity of the network in delivering services from remote areas to the system may vary depending on the location of the resources and the time evolution of the system.
- Static network tariffs are widely applied but in practice they have not been efficient in managing network loading, because they do not fit to the dynamic nature of the power flows due to variable RES and demand. Dynamic network tariffs proved to work reasonably well in some pilots in managing grid constraints. The main arguments against dynamic network

tariffs has been that they do not treat customers equally with respect to the access to the centralised energy market (closer analysis reveals that in the presence of severe network constraints the static tariff models may often be even worse in this respect).

- The strength of market based mechanisms is that they in principle allocate scarce distribution capacity in a fair and efficient way to many market actors that are competing in centralised energy and reserve markets. The weaknesses and challenges for market based solutions for provision of flexibility for the grid is the ICT burden and a substantial risk that there are periods of inadequate demand or supply flexibility volumes (liquidity) in the markets. Nonetheless, market procurement mechanisms seem to be the best suited in order to allow the bidding flexibility providers reveal the right flexibility value. However, no mechanism that could act a distortion of the market should be in force, e.g. side incentivisation mechanism to certain categories of potential flexibility providers. At the same time, the market rules should be able to take into account limitations and constraints of the flexibility providing technologies in order to accurately consider the resources capabilities and to optimally activate them according to their potential. Potential exercise of market power should be discouraged.

8. What do you consider to be the key benefits and key risks of particular models (rules-based, network tariffs, connection agreements, and market-based)?

Rules based mechanisms risk to be opaque and not allow a good flexibility price revealing. Tariffs are not a competitive mechanism and if not well tuned could have distortive effects or be ineffective. Connection agreements are also maybe technically efficient but potentially not price efficient. In general, the different models score differently in terms of:

- complexity for implementation;
- market/regulatory focus;
- governance needs by a regulatory on the actions of a DSO;
- interaction requirements with TSOs;
- impact in different timeframes and thus relationship towards uncertainty of the future.

9. What are the relative merits of a contracting strategy (competitive or otherwise) versus a real-time market approach to procurement of flexibility? Is the latter approach practicable?

Contracts are a viable way to procure services but have (as for the case of nowadays “bilateral-based” markets) the problem of not providing a price reference for the participants. This could be mitigated by transparency rules for DSOs. A mixed mechanism (partially based on contracts and partially on markets) could potentially be also possible but the risk is that contracts reduce markets liquidity with a possible price increase on the market.

10. Are there any models that would enable DSOs to improve system flexibility that you think we have missed and should be considered?

11. Are there case study examples of approaches to improve flexibility on the system that you think should be considered in this work? If so, please provide a summary of the key information and findings.

The SmartNet project includes three physical pilots for testing specific technological solutions:

- Technical feasibility and requirements in terms of communication processes for the monitoring of the (distribution) network and enabling the participation of DER to ancillary services:
  - The Italian Pilot is focused on the implementation and testing of the communication infrastructure between TSO, DSO and DER units. The existing communication channels (TSO-DSO) have been upgraded and new infrastructures have been designed in order to allow DSO-DER communication.
- Capability of flexible demand to provide ancillary services for the system:
  - The Danish Pilot demonstrates the opportunities for making use of predictable demand to contribute to transmission and distribution grid operation. In particular, it is aimed at demonstrating the use of price signals to control the set-points of swimming pool heating systems in rental summer houses. Such price based control is expected to be

able to handle many of the issues arising in both T&D grids, as well as to balance wind power generation.

- The Spanish pilot is demonstrating the prospects for the DSO of using the flexibility of mobile phone base stations to reduce congestion in distribution grids, and to help the TSO maintain system balance by fixing an exchange schedule at the TSO-DSO connection point. With that purpose, the DSO organises a local market, where different aggregators offer their flexibility. Once cleared, the market aggregators perform direct control over the DER they manage and the DSO checks the compliance with local market results

For all the three pilots, the realization of the testing infrastructure is close to its finalization and the experimental activity (field tests) is expected to begin during Summer 2017.
We remain available to provide further information or for any question concerning the above-mentioned projects (info@smartnet-project.eu) .

DSOs Enabling Flexibility (see section 3.2)

12. Beyond impartial provision of data to market participants, do you consider that there any other tasks that DSOs should carry out to enable the competitive provision of and access to flexibility by others?

Different roles are possible for DSOs depending on the amount of responsibilities it is awarded with respect to the TSO. The project SmartNet has selected five reference coordination schemes that will be compared on the basis of costs and benefits in simulations referred to the time horizon 2030 for the three countries Denmark, Italy and Spain. The 5 coordination schemes are:

1. Centralized AS market model – The TSO contracts DER directly from DER owners connected to the DSO grid for AS purposes. The DSO can procure and use resources to solve local grid issues, but the procurement takes place in other timeframes (different from near real time, e.g. long term ahead) than the centralized AS market Local. Resources in distribution are subject to DSO pre-qualification to be allowed to bid into the centralized AS market.
2. Local AS market model - The TSO can contract DER indirectly, after the DSO, via a local market, has aggregated these resources and has transferred them to the TSO AS market.
3. Shared balancing responsibility model - The TSO transfers the balancing responsibility from the distribution grid to the DSO. The DSO has to respect a pre-defined schedule and uses local DER (obtained via a local market) to fulfil its balancing responsibilities. The pre-defined schedule is based on the nominations of the BRPs, possibly in combination with historical forecasts at each HV/MV interconnection point.
4. Common TSO-DSO AS market model - TSOs and DSOs contract DER in a common flexibility market. The main goal is the minimization of total procurement costs of flexibilities contracted by TSO and DSO.
5. Integrated flexibility market model - TSOs, DSOs and commercial market parties (CMPs) contract DER in a common flexibility market. TSOs and DSOs can both buy flexibility or sell previously contracted DER to the other market participants.

Details on the five schemes are available in the already quoted D1.3, already available for downloading on the SmartNet project web site.
Furthermore, the aforementioned evolvDSO project investigated possible roles for DSOs, as can be found in D1.4 (downloadable from: http://www.evolvdso.eu/getattachment/6f0142bf-0e66-470c-a724-4a8cbe9c8d5c/Deliverable-1-4.aspx)
and the roadmaps in D6.2 (downloadable from: http://www.evolvdso.eu/getattachment/55e27922-7b9b-4fd9-9ba5-83afbdc0e1e3/Deliverable-6-2.aspx)

DSOs Providing Flexibility (see section 3.3)

13. Do you think there are situations where DSOs should be allowed to provide flexibility beyond the distribution network component, where economically efficient to do so? Please provide reasoning for your answer.

Flexible generation and load located in distribution could positively contribute to system ancillary services. However, in order to enable this, it could be necessary to enhance the role of the DSO:

the DSO knows the real status of the distribution networks and, when market is cleared, if bidding is also collected from entities connected to the distribution grids, all relevant constraints should be considered. A simple "neutral market facilitator" role for the DSO (similar to the pre-qualification process within SmartNet Centralized AS market model described in answer to Q12) could potentially turn out to be market distorting for distribution resources. More complex schemes, for which DSOs are involved in the market clearing initialization (where distribution flexibilities participate to both local and system services), would lead to dispatching results closer to the most efficient solution. This aspect grows in importance whenever the number of bidding subjects located in distribution grows and whenever the distribution network is not able to fully accommodate the actual volumes (as it is nowadays the case, but this could possibly not be true for the future). However, it would be also important to ensure that DSOs are not misusing their position if participating/engaging at TSO ancillary services.

14. Are there other examples where the DSO could provide flexibility to help to reduce the overall costs of the system?

Acquiring system services (balancing, congestion management, voltage support) from flexibility providers in distribution through the DSO could increase real time markets liquidity and contribute to reduce system costs.

Within the SmartNet project, we are going to verify this through scenarios targeting year 2030 for the three benchmark countries (Denmark, Italy and Spain). We will put in competition resources located in transmission (traditionally deputized to provide system ancillary services) with those in distribution and we are going to analyse to what extent the latter can contribute to price reduction for the acquisition of ancillary services.

Regulatory Framework (see section 4.1 and 4.2)

15. In principle, can the regulatory tools listed be used by regulators to remove barriers and facilitate the use of flexibility at distribution level?

The set of listed regulatory tools could all in principle be used in order to incentivize and facilitate the use of flexibility at distribution level. However, their actual efficacy would depend on implementation details. The adopted regulatory model should be neutral with respect to the different options, including new smart solutions such as utilisation of flexibilities (demand side management, storage and generation) as an alternative to investments in grid reinforcement. Unjustified favouring of one solution with respect to the other alternatives would not promote competitiveness, economic efficiency nor long term sustainability.

16. Are there particular tools that you think would be the most effective in achieving flexibility use at distribution level? Please provide reasoning for your answer.

17. Are there any other regulatory tools that have not been included and should be considered?

Using data from permanent power quality monitoring could be used in order to improve performance-based regulation. The DSOs should react reasonably fast when threats appear to the adequacy of the quality of supply with respect to the related standards. Customers that do not obey the standards and grid connection requirements should be warned and eventually penalized if they do not fix the problem. The DSO should strengthen the grid or use the alternative smart measures early enough, if there is a risk that voltage quality is violated in spite of customer compliance.

18. Should the regulatory framework allow different solutions and combinations of tools to address the specific needs of the network?

Regulatory Principles (see section 4.3)

19. Is a principles-based approach (rather than one-size-fits-all) the correct one for national regulators developing a framework for facilitating flexibility use by DSOs at distribution level?

20. Are the principles outlined appropriate? Are there any fundamental principles that you think are missing in order to deliver maximum benefit to customers?

To our knowledge the regulation does not allow local energy markets to manage local energy balance when the physical connection to the centralised energy markets is either missing or weak. Allowing this could be strategic for the future.

The involvement of distribution resources, such as demand side management, might have a relevant impact on the (dis)comfort of the final user. Even though remuneration schemes can be adapted in order to take into account such discomfort and its relevant costs are likely to be accounted for in market bids, experience shows that it is definitely more reliable to exploit flexibilities when they have no direct impact on the habits of the final users. For instance, a flexible temperature regulation of a building can be easily and efficiently performed without being perceived by the users if some “discomfort constraints” are respected. The same cannot be stated for other critical loads (lighting, entertainment, hoven, etc.) for which their usage (in terms of time and volume) is extremely correlated to the customers’ needs.

In addition, effects on fuel poverty should be considered, as less well-off customers may find themselves locked out from participation in flexibility schemes, leaving them on more expensive tariffs and feeling excluded.