European Network of
Transmission System Operators
for Electricity

DEMAND CONNECTION CODE

CALL FOR STAKEHOLDER INPUT

FEEDBACK DOCUMENT

1 GUIDANCE

This feedback document is used in the „DCC - Call for Stakeholder Input" as published on 5 April 2012 on the ENTSO-E website. It lists all questions raised in this Call and allows to provide answers in a structured format. Please use only this feedback document to formulate your responses which facilitates handling of responses by ENTSO-E and understanding by other stakeholders afterwards.

You are welcome to send additional information that supports your responses. In that case, please clearly refer in the foreseen text boxes to the supporting document where relevant. Please also provide the key message or data which is relevant in the foreseen text box in this feedback document.

Based on your background and your possible interaction with the Demand Connection Code, you are welcome to only respond to those questions you consider to be of relevance to you. In case a joint response is given on behalf of several organizations, please indicate this clearly in Section 2 (Respondent Coordinates).

In order for your responses to be taken into consideration in the further development of the Demand Connection Code, you are requested to send the completed form to consultations@entsoe.eu by **9 May 2012**. All responses will be published shortly afterwards.

On behalf of ENTSO-E, we wish to thank you for your contribution.

2 RESPONDENT COORDINATES

Organization name(s)	**EDF**
How would you describe your type of organization(s)?[1]	Energy company
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Response submission date	

[1] Please try to be as specific as possible, e.g. Association, DSO, Industrial Customer, Research Institute, Regulator, …

3 QUESTIONS

Section 1.2.2 – Options to increase RES penetration in the System

1.1. What is your view of the high level analysis presented in Table 2?

Table 2 presents the pros and cons of the various possible players for providing system services (conventional generators, RES generators, storage systems and demand facilities). We believe that :

- It gives a good overview about the various solutions for providing system services. However, we think that a presentation ranking pros and cons for each solution is not sufficient to conclude on whether or not a solution should be implemented or strengthened. Our perception is that the increasing need for system services will not be solved by focusing on one particular solution, but with a healthy mix of solutions. Each solution should participate, to an extend depending on its own merits and feasibility (depending on location, public acceptance, national support mechanisms, political support, technological maturity, …). In general, we recommend the establishment of rules ensuring a fair and non discriminatory treatment of all solutions, which in itself allows for the most cost efficient solutions to arise.
- As all players should take part, RES generators should also take their share of contribution to system services as their development is mentioned to be the main cause of higher needs for system services/reserves. Moreover, the provision of such services is mentioned to be too costly by this type of generation. This might be the case as of today, but scenarios of RES providing reserves at a low (market) price should be considered.
- Simply asserting that the provision of system services by demand facilities is relatively inexpensive needs to be motivated and justified by a sound cost benefit analysis, taking into account all the relevant impacts. The qualitative analysis of the table is indeed not sufficient. Solutions need to be compared in terms of costs and benefits for the community, and should be treated on this same quantitative ground. On a day to day basis, the use of a device rather than another should be based on its own quantitative benefits and costs. For instance, it is most of the time more expensive to use RES generators rather than synchronous generators to provide frequency system services. However, when the system is very constrained (and it should be the case on a regular basis in the future), the fact that RES may also procure system services will also be helpful for the community.
- The assumption that the use of RES for system services would be detrimental to CO_2 also needs to be confirmed. Considering the energy mix in France for example (consisting of nuclear, thermal, hydro and other RES), it is not the case.
- Regarding storage systems, it is obvious that it is not possible to build current technology in all areas. Consequently, these devices cannot be the only solution to fulfill balancing requirements for the system. However, the fact that these devices are very useful for the management of electrical systems may be taken into account, and the development of such equipments should be encouraged.
- Regarding demand facilities (notably at household level), the fact that the availability of resources cannot always be guaranteed must be taken into account.

<u>See hereunder our detailed amendments to table 2 :</u>

Option	Pros	Contrs
synchronous conventional	• No significant change from	• Cost of constraining off RES and on synchronous generation

generators are required to provide the most significant system services	today • *100 % CO2 free production with hydro or nuclear power plants* • *Supports RES integration* • *Reliability* • *Easy to control*	when synchronous plant are not needed by the market • CO2 emissions *when simultaneously RES generation is constrained off and conventional generation (if not 100% CO2 free) constrained on* • ~~100% CO2 free production can only be achieved with nuclear and CCS~~ • Risk of a lack of system services in the future if only this option is followed
RES generators to provide their share of the system services	• *Supports RES integration* • No additional CO2 emissions for voltage support services • *When RES generation exceeds demand, no additional CO2 emissions,* • *Highly reliable as the risk is spread* • *No risk of lack of system services in the future if this option complements the contribution of conventional generation* • *Refined and targetted support for RES*	• In order to create headroom to provide the service, RES has to be constrained (and therefore wasted) with additional CO2 emissions *when demand exceeds RES production and when gas or coal plants replace it* • Embedded generation needs to be fully controlled (difficult with dispersed small units) • *Cost of full control on small units (PV)*
extensive building of storage systems	• Only limited CO2 emissions (from less than 100% cycle efficiency) • Supports RES integration	• New storage systems have to be built Europe wide Feasibility of building storage is not given in all areas • High environmental impact to build large storage systems
Demand Facilities provide their share of system services	• No additional CO2 emissions *(to be proved - it depends on demand postponement)* • Supports RES integration • Services have the potential to be provided at low cost *(to be demonstrated after inclusion of all costs)* and no or minimum consumer inconvenience • Highly reliable as the risk is spread • Consumers are enabled to participate in the electricity market~~, take action to reduce CO2 and will pay less~~ *(and should get a remuneration for the service provided)*	• Public perception of possible inconvenience • Public acceptance • *Customer rewarding* • DSOs need to contribute more towards managing a system with high RES (e.g. voltage) • *Uncertainty about consumer behavior and real-time service availability* • *Effectiveness, as for the others means, needs to be fully controlled (very difficult with millions of dispersed small units)* • *Complex market structures (relations: TSO – DSO – Balance responsible party – Supplier)* • *Cost of de-optimizing the sourcing by suppliers* • *Imbalance charges for the balance responsible parties*

1.2. What is your view of the conclusion that the "Benefits from demand side response (DSR) are clear and that DSR has the potential not only to be relatively inexpensive, but also supports the EU goals to integrate RES and to empower customers to participate in the energy market"?

EDF and EDF Luminus consider that DSR should be developed, being one of the technical possibilities providing system services, as long as benefits to the community are proved to be higher than the costs incurred. However, section 1 does not permit to conclude that there are clear benefits with this solution.

The solution shall be implemented in a way that enables the TSOs to compare system services offered by the various solutions described in table 2. This should result in offers made in a similar way as for the other solution, taking into account all the costs involved for the various stakeholders (the service provider, the consumer, the energy supplier, the balancing responsible, the TSO/DSO, etc.).

DSR and providing this service for transmission and distribution system support should therefore be a voluntary choice of the grid user, based on his own technological and economical assessment. In order to promote this choice, a proper and well functioning market design (leading to value discovery ad creation) should be developed, in particular taking into account costs of energy suppliers and costs of TSO/DSO controls.

All solutions will then be put on the same playing field: activation of orders following merit order, effective metering to control the accuracy of the answer, market-based remuneration, etc.

Section 2.2 – Level of Detail

2.2.1. What is your view on ENTSO-E's interpretation of the level of detail required in the NC DCC?

The network codes should be limited to those issues that have critical or significant impact on both cross border trade or related market integration issues and secure operation of the system, and they should allow for sufficient flexibility at Member States' level to specify technical parameters that reflect national requirements via national grid codes.

We would like to warn against requirements that sometimes go far beyond cross-border impacts or do not have a clearly demonstrated impact on the system.

It may be argued that all technical requirements have some impact on cross border trade. However, in reality, many of the technical parameters will have no significant impact and could proceed satisfactorily with limited harmonization.

Too detailed technical requirements can also lead to technological barriers and can hinder or block further development of new solutions. One should avoid imposing certain technological solutions. Requirements should be limited to the access or connection point to the grid, and should not determine the technical or technological solutions beyond this point in the electrical installation of the grid user.

One should also consider that far reaching and very detailed requirements can also impact the economical and/or industrial activities beyond a connection point, leading to loss of productivity, efficiency and/or competitiveness.

We welcome the ENTSO-E view that all users must be *allowed* to be significant grid user in the context of DSR. We therefore dare to assume that the requirements only apply when the grid user makes the explicit choice to supply grid supporting services with DSR and therefore is willing to adapt his installations for this agreement. In addition, whenever an impact on any third party (supplier, DSO, balance responsible party, etc.) is identified, their prior agreement should be required.

Section 3 – Requirements of NC DCC in Light of future Challenges

3.1. Can equitable treatment be assured if the NC DCC includes only high-level requirements, with national legislative required to set specific requirements in each country? If so, how could equality in burden sharing be achieved in synchronous areas and across Europe?

x	Yes
	No

Pursuing equitable treatment is essential. However, maintaining security of supply, supporting the completion and functioning of the internal market in electricity and cross-border trade, including delivering benefits to the customers and facilitating the EU's targets for penetration of renewable generation should also be considered when establishing requirements.
In fact, excessive harmonization may prove counter-productive in many cases, due to the differing characteristics and technical requirements of individual national electricity systems.
In addition, the fact that the code will not be revised before several years must be taken into account: changing the requirements would not be that easy.

3.2. In your opinion, is there any other new topic that should be included in the NC DCC?

x	Yes
	No

DSR effectiveness relies on the actual behaviour of consumers. The fact that they can take part to the electricity market is a good thing. However, it also brings new challenges to cope with. For instance, it is much easier to check the activation of a conventional plant rather than the modulation of consumers' consumption. Indeed, beyond the aggregation of numerous distributed capacities, a major issue is the lack of consumption programmes and of the corresponding effective consumption data (remotely metered load curve). The modulation of consumption cannot - unlike for conventional generation - be measured as it is not programmed.
In fact, as long as smart meters have not been deployed, network operators do not have any load curve to start controlling changes in consumption. Therefore, in the short term, there is no solution enabling network operators to check that the service has been really provided.
Nevertheless, in order for each solution to be on the same playing field, there is a need to try and find a solution that can be controlled as efficiently as the other solutions. For instance, EDF thinks that some principals about monitoring and metering should be part of the code, this point being crucial to ensure the effectiveness of the DSR solution.
Furthermore, whenever any other party has to support extra-costs, these should be taken into account, and their agreement should be mandatory and clearly exposed in the NC DCC.

Section 3.1 – Demand Side Response delivering Reserve Services

Questions based on the different available options put forth in section 7.1.1 in Appendix 1

3.1.1. What is your view of the analysis presented on the challenge ahead associated with reduced availability of reserve services from synchronous generators at time of high RES production?

EDF and EDF Luminus share the view on the challenge ahead, and agree that DSR should be part of the solution whenever its benefits are proved to be higher than the costs in-

curred for the community.

3.1.2. Is there any class of users that should be excluded from providing these reserve services?

	Yes
x	No
It should be a free choice and requirements should only apply when this choice is made. Requirements for DSR should not be a precondition to connect to the grid.	

3.1.3. What would be the technical and economical limits to the development of DSR for industrial customers, commercial premises and Closed Distribution Network operators?

DSR can impact productivity, scheduling, efficiency, competitiveness, work place comfort… and often requires deep penetration in the industrial processes and management. Communicating, monitoring, metering will also incur heavy costs. These costs, being part of the solution, need to be taken into account, and may limit the development of DSR. More precisely, the recovery of the costs related to the control carried out by network operators and of all the costs related to the electricity supply must be taken into account. In this respect, for those customers who want to participate, the prior agreement of their supplier is *de facto* essential.

3.1.4. In Appendix 1, options for the provision of mitigating the shortfall of reserves are given, are there any comparable alternative options other than the ones provided in Appendix 1?

	Yes
x	No

3.1.5. What would be the typical cost to equip one appliance (e.g. a washing machine or a heat pump controller) under each of the 3 alternatives?

This information should be delivered by the manufacturers. Not only the cost to equip appliances should be considered but also the cost of communicating, monitoring, metering, data management, personnel cost, … to make these solutions work. The global cost of DSR is more that the cost to equip one appliance (and probably *much* more). A whole information system is for example necessary to drive the activation of the reserve from the TSO level to the appliance. Further studies are therefore mandatory in order to deliver reliable figures. (alternatives 2 and 3): one should consider that specific standards for electrical equipments in Europe will have an economical impact on suppliers and manufacturer of electric equipments but also on the households and companies that will have to purchase and use these equipments. One can doubt that the objective of the Connection Framework Guidelines and the Network Code was to introduce new technical standards for household appliances. This impact should be carefully and extensively assessed.

3.1.6. What form and level of incentive do you believe is required to encourage consumers not to switch the reserve off under option 1 and 2?

A general level cannot be given. It will depend on the activities of the grid user and its dependence upon electricity. The level of the incentive also depends on the process itself: frequency of activation, period of solicitation, level of inconvenience.

3.1.7. Considering the cost and consequences of the alternatives, do you support use of DSR for this purpose?

DSR is an interesting issue, but the cost and the way it will be carried out have to be fur-

ther investigated.

3.1.8. Which of the 3 DSR alternatives (1, 2 or 3) would be your preferred option to achieve the greatest societal benefit and for what reason?

Alternative 2 is probably the best for customers : comparison between equipments will be easier, and the use will not be mandatory. As acceptance by customers and energy suppliers is a necessity, this alternative is our preferred one.

3.1.9. If the services proposed here are provided, what further uses of these technical capabilities (see Appendix 1) would be most beneficial and why?

If demand facilities are equipped so as to be able to provide reserve services, this flexibility might also be used by suppliers or aggregators to reduce peaks or intervene on the intraday or balancing markets. Considering that currently only 1 to 3% of the generation capacity and volumes is actually used for reserve services, DSR will be most beneficial (for end users) when applied to search the lowest marginal generation cost and shift consumption to these periods (Time of Use). Also consider that application of Time of Use will lead to a better coverage of the RES generation by consumption (considering that RES have the lowest marginal cost) reducing the need for reserves. Hence, DSR resources are subject to competition between TSOs, retailers and ESCOs and there is no evidence that TSO should be given any priority on those (see option 4).

Section 3.2 – Demand Side Response delivering System Frequency Control

Questions based on the different options outlined in Appendix 2:

Regarding the DSR application related to temperature controlled demand to deliver a smarter, robust and a more user friendly LFDD-capability to avoid frequency collapse and hence contain the impact of rare events with large system frequency excursions:

3.2.1. Do you agree with the conclusion to apply this service universally using European Standards proposed as a result of the initial CBA based on Irish data?

	Yes
x	No

Actually, the Irish and UK cases are two particular cases in terms of system frequency variations. The CBA should be completed with a detailed analysis of requirements in interconnected systems with lower probability of extreme events and lower procurement costs for primary and secondary reserve. Shedding loads is effective for stopping a decrease in the frequency when an outage occurs. Therefore, due to its instantaneous action, it is probably more effective than an action of a generation unit. Nevertheless, because its action is usually irreversible, it could constitute a constraint for the secondary control as it is currently performed in the interconnected systems. Probably, the calculation of Area Control Error shall be modified to take into account the loads shed to provide primary control and also the secondary control will not consider the disconnection of those loads as disturbances. The secondary control requires the monitoring of those loads used for primary control and an automatic control of their reconnection

3.2.2. ENTSO-E believes this service can be introduced for new appliances (and temperature controllers) without any detectable difference to the primary purpose of the service of the appliance. Can you share any specific knowledge or experience and associated data you may have on this topic?

	Yes
	No
This information should be provided by manufacturers.	

Regarding the use of the temperature controlled demand beyond LFDD-capability for <u>frequency response</u>, following assumptions are taken:

- Primary performance of the temperature controlled function is not effected (operating within the same temperature tolerances);
- Conditions of near total absence of synchronous generators during windy / sunny conditions;
- Moderate demand for synchronous areas with extreme real-time RES penetration (initially expected in Ireland and GB)

Three DSR alternatives have been identified (with a fourth alternative being 'do nothing'):

- Alternative 1: Voluntary service capability – mandatory usage
- Alternative 2: Voluntary service capability – voluntary use
- Alternative 3: Capability as standard, with mandatory delivery

3.2.3. If this further DSR for temperature controlled demand is introduced should this be arranged by each nation rather than at European level and if so should there be a requirement for **harmonising** within a synchronous area in order to provide burden sharing?

x	Yes
	No
As needs are likely to differ significantly from a synchronous area to another, solutions should be adjusted to the context and we consider that decisions should be made at the national level. However, we agree that some kind of harmonization is needed withing synchronous areas in terms of demand/generation behaviour when facing sudden frequency events.	

3.2.4. Are the **types of demand** suggested in Appendix 2 the most appropriate to provide this service giving continuous response to system frequency deviation away from the target frequency (50.0Hz)?

	Yes
	No

3.2.5. Please provide comments on the **specific data** used in the initial CBA presented.

3.2.6. The initial CBA indicates that alternative 1 may be able to provide the required services quicker than alternatives 2 and 3 (due to higher uptake). Do you have any comments about this **conclusion** and the underpinning **assumptions**, including

- 20% uptake for voluntary service capability;
- Increased unit cost for lower volume and supplying more than one option;
- The costs identified.

Providing frequency control with demand may require changes in terms of the actual frequency control schemes (see also comment 3.2.1), whose costs must be taken into account.

Section 3.3 – Reactive Power Exchange Capabilities

Questions on general reactive capability based on the Appendix 3:

3.3.1. General questions

a. Do you agree that increasing displacement of synchronous generation is a significant new challenge?

x	Yes
	No

b. Do you agree that a review of existing requirements is needed, to take into account the new challenges mentioned above in Section 1.2 and 1.3?

x	Yes
	No

c. Do you agree with the conclusion from the initial CBAs (Ireland & GB) that the societal benefits are greater for reactive management to occur closer to the reactive demand? In either case please provide the rational with supporting evidence where available on the aspects of the conclusion of the CBA that you agree or do not agree with.

	Yes
x	No
Planning the compensation at the transmission level also allows benefits of mutualisation, which are not considered in the initial CBAs presenting particular cases of single bus compensation.	

3.3.2. Question specifically relevant for DSO connections

a. Do you agree that the development of cables and embedded generation introduce further challenges regarding reactive power control, including risk of high voltage during minimum demand?

x	Yes
	No

b. Is it reasonable to ask DSOs to avoid adding to the problem of high voltage on the transmission system during minimum demand by avoiding injecting reactive power at these times?

x	Yes
	No
ENTSO-E should clarify at what voltage levels the interface is and what are the TSO's needs in terms of compensation.	

3.3.3. What is your view on the most appropriate way forward, including but not limited to the following options:

- Do nothing. Leave the TSO to sort out reactive balancing. The CBA of the transmission located reactive capability option in the CBA is relevant here.
- General limit on power factor at transmission to distribution interface, e.g. better than 0.90 or 0.95, with the value set in each country by each TSO subject to public consultation and NRA decision or an equivalent process as provided by the applicable legal framework, such as the definition of a limit in MVAr.
- As in the previous point except the power factor limit set on a local (or zone basis) by the TSO following CBA & consultation / NRA decision.
- Total separation between distribution and transmission reactive flows (i.e. 0 MVAr at the interface).
- The DSO at network exit points treated in the same way as generation is treated in network entry points with the DSO expected to regulate voltage continuously. Should this be limited to slow time scales of minutes (e.g. achieved by means including transformer tapping) or extended to fast acting reactive power support for disturbed conditions?
- Establishment of full reactive markets (e.g. in zones) encompassing DSO contributions as exist in some countries with respect to generation today?

Section 3.4 – Voltage Withstand Capabilities

3.4.1. Do you agree with the analysis concerning the need of voltage withstand capabilities?

	Yes
x	No
Overvoltage and voltage dips are generally the result of incidents or interventions on the grid. ENTSO-E promotes voltage withstand capabilities but does not put guarantees on operating conditions in return.	

3.4.2. What are the technical limitations to voltage withstand capabilities in your Demand Units in option iii?

3.4.3. What are the technical limitations to voltage withstand capabilities in your Demand Facility or Distribution Network in option iv?

3.4.4. What would be the costs induced by such requirements in option ii, iii and iv?

3.4.5. Which alternative would you prefer? In case of option ii, iii or iv, shall the requirements be defined for all Demand Units/ Demand Facilities/ Distribution Networks or with specific voltage connection levels only?

Section 3.5 – Frequency Withstand Capabilities

3.5.1. Do you agree that certainty is required in the performance of elements in the electrical power system to ensure stable frequency operation and to minimise the cost of procuring frequency response?

	Yes
	No

3.5.2. Which option (i or ii) would you prefer and for which reason?

3.5.3. Please provide cost information to establish frequency withstand capability over the full range from 47.5 Hz to 51.5 Hz for Distribution Networks and Demand Facilities and explain which typical apparatus are needed.

3.5.4. Please provide cost information to establish frequency withstand capability over a limited range from 49 Hz to 51 Hz for Distribution Networks and Demand Facilities and explain which typical apparatus are needed.

3.5.5. Which frequency-sensitive installations do you have in your Distribution Networks or Demand Facility?

3.5.6. Please provide cost information to reinforce frequency-sensitive installations with frequency withstand capability over the full range from 47.5 Hz to 51.5 Hz.

3.5.7. Please provide cost information to reinforce frequency-sensitive installations with frequency withstand capability over a limited range from 49 Hz to 51 Hz.

4 ANY OTHER BUSINESS

Are there any other items or suggestions you wish to raise on the topic of the Demand Connection Code?

EDF and EDF Luminus welcome the opportunity to comment ENTSO-E's vision at this early stage as the scope and content of the document raises many questions and concerns.

1. Regarding general principles, we would like to recall that

- before setting requirements, system needs should be clearly stated
- the future NC should not result (again, i.e. grid connection for generators) in an arbitrary shift of responsibilities - and therefore costs - from TSOs on grid users.
- Requirements towards grid users should be well balanced with guarantees on operational conditions on the grid (voltage and frequency).

2. Regarding the scope of the document, the issues mentioned raise the question of whether ENTSO-E is entitled to develop provisions going beyond the interface with transmission networks (i.e. DSR within the distribution networks) that will be made mandatory after the comitology process.

- The definition of demand needs to be clarified (for instance what is the link between cross-border impact and equipment of all appliances at household level)
- The definition of the significant grid user should be clarified too
- Lack of clarity as ENTSO-E sometimes talks to grid users and or to interfaces with the transmission networks

3. One further issue is that the NC should explicitly mention that auxiliary supplies at generating plants and hydro pump storage facilities in pumping mode are not covered by this code but are dealt with within the NC Grid Connection for Generators.

4. ENTSO-E states that it wants to define the conditions for demand to participate in system services but does not intend to push forward any business model.

- Creating those conditions for DSR capability brings costs without the certainty of having these capabilities used and properly compensated.
- Furthermore, many questions raised are related to possible business models and economic impacts. Any extra-cost identified for any third party must be taken into account when considering the cost efficiency of DSR.
- In this respect, for reserve services for example, a financial mechanism should be set in order to enable the recovery of the extra-costs for the energy supply. This is also the case for balance responsible parties (costs for imbalances) and for TSOs/DSOs (costs for control).
- Rebound and report effects impacts on system balance should not be undervaluated in the analysis.

5. The cases illustrated in the CBAs are unfortunately not representative of nor applicable to the European continental synchronized system.

6. Remarks regarding the possible technical impacts of DSR to frequency control :

- Experiences in the world have so far shown that it is feasible (mostly "instantaneous contingency reserves" provided by heating and cooling processes, big industrial customers, etc.)
- However some services provided by demand cannot be considered as equivalent to those provided by generating units ; 1 MW of reserves by the demand is not equivalent to the reduction of 1 MW of reserve at the generating unit
- Rebound effect when reconnecting the demand, need for gradual reconnection
- Possible reduction of the overall network power frequency characteristic due to lowest reserves set on generating units, need for control
- Important distributed load shedding and stricter control by TSOs implies costs (IT systems, measurements)
- In cases of DSR to primary control, some misfunctionning in secondary control have been noticed.