GEODE Position Paper on Demand Response (DR)

The purpose of this paper is to give **GEODE's** view on Demand Response implementation and how this will involve electricity consumers[1]. It will show the areas in which the DSO's must be involved. Other issues to be considered when implementing Demand Response are also addressed.

1.- Introduction:

Demand Response (DR) can be described according to the Communication on Smart Grids adopted by the Commission on the 12th April 2011 as "the mechanisms to manage consumer consumption in response to supply conditions".[2]

Demand Response will therefore be facilitated by the implementation of Smart Grids. The EC Smart Grid Task Force defines Smart Grids as "electricity networks that can efficiently integrate the behavior and actions of all users connected to it –generators, consumers and those that do both- in order to ensure an economically efficient, sustainable power system with low losses and high quality and security of supply and safety".[3]

GEODE considers the concept of Demand Side Management as being part of the Demand Response scheme. Demand Side Management refers to the direct load control of devices and interruptible load which aim to affect both timing and level of electricity demand. It responds to a price or a technical signal.

Demand Response is part of energy efficiency measures. It provides for a range of new services and functions that will enable not only the reduction of the energy required during critical periods as peak demand, but also savings in overall annual electricity consumption through facilitating changes in consumer behaviour. In consequence DR may defer or negate the need for network expansion or reinforcement which can lead to reduced costs for the consumer.

Furthermore DR requires the active involvement of consumers. It should encourage them to become more active and adapt to new and smart consumption patterns, introducing flexibility to the way they consume electricity. They will potentially see lower electricity bills, will increase their awareness and participation in the market and will benefit from flexible load contracts.

Therefore DR should be made simple and accessible to consumers and to their needs. Otherwise such a competitive retail market model as envisaged by the European Commission[4] will not be developed. DR includes market offers such as time-of-use tariffs and dynamic rates or pricing.

[1] For the purposes of this paper the term consumer refers to domestic households and SMEs.
[2] See EC Communication on Smart Grids, COM (2011) 202 final, 12 April 2011, p. 8
[3] See EC Communication on Smart Grids, COM (2011) 202 final, 12 April 2011
[4] See EC Communication on Smart Grids, COM (2011) 202 final, 12 April 2011

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For these reasons **GEODE** considers that Demand Response is an essential component of a Smart Grid which will enable DSOs to efficiently manage the coming energy supply challenges. The involvement of the DSO is crucial in the development and implementation of Demand Response. The DSO needs to play an active role in the use of DR to facilitate for new renewable generation capacity and to avoid overload in the grid or in parts of it by introducing higher demand flexibility.

2.- Role of DSO

GEODE considers that the role of the DSO in the development and deployment of DR may be profoundly influenced by the decision energy authorities take as to where to vest the responsibility for managing and operating DR services. Whilst the DSO may seem to be the natural choice for assuming this role (as they have an intimate understanding of the operation and status of their own networks and in most cases own the smart meters in consumer homes, with exception of UK and Germany), the decision may be taken to vast DR operation in a third party organization.

DR really needs a more integrated market approach and DSOs should be allowed to become market players – not precluded from participation through regulatory boundary constraints.

As GEODE sees it the DSO will have a central role in DR, not only as a market participant but also as a facilitator of that market. DSOs have a key role to play in leveraging the opportunities from DR to manage distribution constraints. This will be especially important with high levels of variable and to some extend unpredictable generation (wind/solar).

The role of the DSO regarding DR can be broken down into three aspects:

a) To ensure security and quality of supply while DR is utilized by other market actors.

b) To provide information to the different market actors enabling DR to be used as effectively as possible.

c) To use DR to ensure their networks operate in the most efficient, economic and secure manner possible.

a) DSOs duty is to ensure the security and quality of energy supplied via their networks:

In a scenario in which DR is carried out by market actors and acting independently from DSOs (e.g. via a centralized communications provider that sends DR signals to smart meters/appliances in consumers' homes or commercial aggregators), the grid may be affected (potentially to quite a large

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degree) by the reduction or increase in energy demand, that could create distribution constraints.

The capacity of today's grid has been designed such that they can accommodate the maximum demand consumers currently place on them. When other market actors than DSOs utilize DR, particularly when this is done due to energy prices (e.g. when there is an abundance of wind generation and energy prices fall encouraging users to consume more energy) there is a risk that this may coincide with existing times of grid peak demand for that particular section of the network which may in turn introduce a risk of overloading.

In a scenario such as the one described, the DSO will need to influence the demand being placed on the grid. This could be done via price signals (e.g. time-of-use tariffs) or DR initiated by the DSO.

This will also create some new demands from the DSOs to be able to facilitate the market of DR:

- Information about planned market activities, e.g. expected/predictable substantial energy price drops.
- Grant the DSO the responsibility to decide if the DR can/cannot be executed on their grid to maintain security of supply.
- Information about market operations to be able to do predictions of the returning load after DR.

b) DSOs provide information to market actors in an efficient and neutral way so the end-customer can obtain DR products that are as effective and efficient as possible:

The DSO may need to provide:

- Information of DR to suppliers and customers
- Status of the grid, can DR be 'safely' executed or not. Again, this could be accomplished via the provision of actual network loading information or via price signals.

In order for DR to be successful in this scenario some investment will need to be undertaken by the DSO:

- Smart meters will need to be installed.
- Some smart grid-type ICT will need to be installed within the DSO networks.
- DR software will need to be developed and implemented.
- Renewal and extension of the existing grid components.

c) DSOs use of DR to defer or possibly negate network reinforcement investment:

If DSOs can use DR to manage the peak demand on their networks there is potential to defer or avoid costly network reinforcement work (i.e. putting more cable into the ground). The savings from these deferred investments would then

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be passed onto consumers via their network tariffs. Additionally TSOs will be seeking to maximize the efficient use of their networks in much the same way, and allowing DSOs to use DR will allow the DSO to assist the TSO in providing ancillary services to them (i.e. STOR and even frequency response).

There are some challenges ahead; high demand on the grid will not necessarily coincide with lack of production or high prices on the electricity market.

Therefore there is a need for cooperation and coordination between suppliers/aggregators and DSOs as it is likely to be suppliers that are offering DR products/tariffs to customers. There is also a need to understand the value offered by on-demand reduction of power demand from a TSO perspective – what value would a TSO place on the ability of a DSO to reduce their network demand upon request?

In addition to the above the DSO may choose to utilize DR to manage their networks during times of abnormal system conditions. In a (probably emergency) situation where the TSO requests the DSO dramatically reduce demand levels this traditionally might be accomplished by DSOs switching off groups of customers at the substation level. DR may provide a mechanism for achieving these levels of immediate demand reduction in emergency situations whilst minimizing the impact on the consumer (i.e. their demand is reduced rather than disconnected entirely).

GEODE believes that many of the grid operation decisions as a consequence of DR should be made by the DSOs because of their ability to quickly and efficiently access information about the status of their own networks. There is a risk of delays in the operation of DR if decisions have to be made by parties other than the DSO, primarily because of the need to understand the local network loading conditions before reducing or increasing demand.

To conclude, there are several reasons why DR should be carried out on DSO level:

- Effective and secure DR will require the exchange of large volumes of data, most of which is already held by the DSO in most of the European countries.
- DSOs already have a close relationship with their domestic customers, and this is where DR can most effectively be utilised.
- As regulated activity, DSOs are the only existing neutral stakeholders in the energy supply chain and are obliged to operate in a non-discriminatory manner without showing favour to any particular market actor.
- DSOs are already collecting large volumes of data on the operation and status of their networks and Smart Grid/DR data would likely be a relatively easy and natural extension to these datasets.

3.- Issues to be considered:

In order to provide maximal benefit of the Implementation of the Demand Response, there are certain issues to be considered to make it all work.

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- T**he interest of the customers to participate in a DR-program is a precondition for success**. Clear economic incentives, without decreasing the convenience for customers regarding electricity consumption, are necessary.

  Price signals send by suppliers, DSOs, etc. will incentivise customer participation in the DR market.

  Then on the one hand suppliers want to offer, enabled through smart metering systems, innovative tariff products (e.g. to react on market developments) in order to optimize their portfolio and, on the other hand, DSOs want to send price signals to customers to optimize the utilization of the local grid and secure system stability.

  This situation has the potential to produce contradicting price signals to the customer. A regulation is required to avoid confusing situations for the customer and to consider the interests of the different parties (especially DSOs and suppliers).

- An increasing number of decentralized generators and "prosumers", electric vehicles, etc. are a new challenge and therefore neither considered in the implemented grid tariff schemes nor in the regulation models. The key figure for planning and dimensioning electricity grids is the expected load (kW) of customers. A capacity (kW) based tariff component including time of use aspects can be a step forward towards a cost and future oriented cause-fair tariff system.

  In **GEODE**´s view flexible grid tariffs using the opportunities and functionalities of smart metering systems are an essential tool for DSOs to cope with the future challenges. Member States should have the freedom to choose an adequate flexible grid tariff structure in accordance with local needs.

- Old fashioned, but still used, DR-tools are ripple-control systems (operated by DSOs) to directly control load of domestic customers in combination with so called interruptible tariffs. The historical objective in a vertically integrated electricity world was to shift load in "valleys", without provoking inconveniencies for the customers, to minimize extension and reinforcement of the electricity grid and to minimize the need for peak load on the production side.

  Today in an unbundled electricity market the DSOs and the suppliers follow different interests, their tasks and responsibilities are more or less decoupled. E.g. typically there is no direct correlation between negative prices on the power exchange mainly driven by injection of wind parks in the North Sea and conditions of a local distribution grid e.g. in Munich.

- **DR needs a more integrated market approach and consequences of uncoordinated only market driven DR activities may be:**

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- DR has potential to provoke high simultaneity in behaviour of network customers (e.g. negative prices on the power exchange) and thus additional load peaks.

- Congestions in the grid may happen. Therefore a better and more active monitoring of the grid situation according to request from market partners offers or customers can occur.

- Additional reinforcement or extension of grid components may be required.

o Additional peak loads cause additional network losses (DSOs are forced to reduce network losses).
DR is an important tool for DSOs to cope with future challenges like the integration of huge numbers of decentralized generators. Especially direct load control measures (demand storage), e.g. to control charging processes of Electric Vehicles, are an essential tool to operate the electricity distribution grid in a secure, reliable and cost effective manner.

o In the liberalized electricity market DSOs are responsible for ensuring a secure, reliable and efficient electricity distribution system. To fulfill this task an alignment in advance (pre-check) of market driven DR activities by the DSOs should be obligatory (the compatibility with local grid constraints can only be assessed/judged by the DSO). This is in line with the recommendation of Expert Group 3 of Task Force Smart Grids of the EC[5].

In that context DSOs should play a central role as a kind of coordinator/facilitator (information hub, etc.) to ensure the reliability and stability of the system while safeguarding commercial interests of other market actors and customers.

[5] *Interfaces Recommendation #6: EG3 recommends that consumers, generators and those who do both, cooperate with traders and suppliers (possibly via aggregators) and establish their participation in any kind of market places under contractual arrangements pre-defined with the related DSOs. This will resemble the way how the "large" market participants and generators participate in the wholesale market and cooperate with the TSOs today. They will have to deliver information on their planned market activities to the DSO and the TSO, depending on their kind of participation.*

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- The implementation of **Smart Meter and Smart Grids** are the pre condition for that, so the energy can be measured, settled and priced at least hourly and grid conditions can be monitored and managed in an adequate manner[6].

  The DSO is the most vital party in assuring the development and implementation of Smart Grids. Given the large number of functionalities that have to be implemented in the grid and that the responsibility for many of these fall upon the DSOs, it is very clear that without the proactive participation of the DSOs, there will be very little progress in the implementation of Smart Grids.

- In most Member States the implemented incentive based regulation models (like price cap = RPI-X) to set grid tariffs focus on short term cost reductions, leaving almost no room for innovation and are in general oriented on the past. These incentive based regulation models are NOT a facilitator of the deployment of Smart Grids. The pathway to a smarter future, having in mind the 20-20-20 targets, necessitates a paradigm shift of regulation methodology to set grid tariffs.

  National regulators play a central role as key facilitators of Smart Grids as "Smart Grids require Smart Regulation". The regulators need to be visionary in order to be able to construct regulation that will benefit the growth of the future Smart Grid without knowing today exactly how the grid of the future will operate.

  There is a need for regulatory principles that have to be taken into account, as follows
  - Sustainability
  - Future orientation
  - Investment and innovation friendliness

  Smart Grids imply huge investments and the network companies will never reap enough internal benefits from these investments to cover the costs of implementing a Smart Grid. **GEODE** believes that network companies have to be incentivised to pursue innovative and smart solutions. Clarity about cost recovery is essential. It is very likely that there will be no smart grids without a strong engagement of DSOs. In this context national regulators are the key facilitators of a smarter future – they have to empower DSOs to take an active part in developing smart grid solutions.

- New legislative proposals at European level are required (e.g. Annex to Directive 2009/72/EC). CEER is also working to provide recommendations to develop such a retail market. **GEODE** supports the need of a clear legal

[6] *See GEODE position papers on Smart Metering November 2009 and Smart Grids October 2010 at www.geode-eu.org*

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framework at European level as well as guidelines to be implemented in each Member State. There are still many open questions as, for instance, how will consumers be informed? Who will be responsible for what in the processes? How will cost for responsible party be covered? Prevention of emergency situations.

4.- Conclusions:

- Demand Response will be facilitated by the implementation of Smart Grids.
- Demand Response is part of energy efficiency measures. It provides for a range of new services and functions that will enable not only the reduction of the energy required during critical periods as peak demand, but also savings in overall annual electricity consumption through facilitating changes in consumer behaviour.
- DR really needs a more integrated market approach and DSOs should be allowed to become market players – not precluded from participation through regulatory boundary constraints.
- DR requires the active involvement of consumers. Therefore DR should be made simple and accessible to consumers and to their needs.
- **GEODE** considers that Demand Response is an essential component of a Smart Grid which will enable DSOs to efficiently manage the coming energy supply challenges. The involvement of the DSO is crucial in the DR implementation.
- The DSO will have a central role in DR, not only as a market participant but also as a facilitator of that market.
- The role of the DSO regarding DR can be broken down into three aspects:
    - to ensure security and quality of supply while DR is utilized by other market actors.
    - DSOs will provide information to the different market actors to enable DR to be used as effectively as possible.
    - DSOs may choose to use DR to ensure their networks operate in the most efficient, economic and secure manner possible.
- There are several reasons why DR should be carried out on DSO level:
    - Effective and secure DR will require the exchange of large volumes of data, most of which is already held by the DSO in most of the European countries.
    - DSOs already have a close relationship with their domestic customers, and this is where DR can most effectively be utilised.

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- As regulated activity, DSOs are the only existing neutral stakeholders in the energy supply chain and are obliged to operate in a non-discriminatory manner without showing favour to any particular market actor.
- DSOs are already collecting large volumes of data on the operation and status of their networks and Smart Grid/DR data would likely be a relatively easy and natural extension to these datasets

- A regulation is required to avoid confusing situations for the customer and to consider the interests of the different parties (especially DSOs and suppliers).
- Consequences of uncoordinated only market driven DR activities may be to provoke high simultaneity in behavior of network customers; congestions in the grid will happen; additional reinforcement or extension of grid components may be required; additional peak loads cause additional network losses (DSOs are forced to reduce network losses).
- In that context DSOs should play a central role as a kind of coordinator/facilitator (information hub, etc.) to ensure the reliability and stability of the system while safeguarding commercial interests of other market actors and customers.
- Regulatory principles such as sustainability, future orientation and investment and innovation friendliness should guide new regulation to benefit the growth of the future Smart Grid. National regulators are the key facilitators of a smarter future – they have to empower DSOs to take an active part in developing smart grid solutions, providing them clarity about cost recovery.

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