GEODE Position Paper on Smart Grids

GEODE Working Group Smart Grids

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Purpose of paper

The purpose of this paper is to give the view of **GEODE** on the implementation of Smart Grids and how it affects the DSOs as well as the end consumer. Although the Smart Grid will impact both the Transmission Network as well as the Distribution Network, this paper mainly concerns the electricity Distribution Network.

The paper analyses the changing role of the DSOs due to the new role and responsibilities.

The analysis will further look at the consumer benefits from deployment of Smart Grid and why Smart Grid is necessary in order to have a flexible, economic, accessible and reliable grid in the future. The consumer in this paper encompasses households and small and medium businesses (SME) as well as these entities as “prosumers” (electricity producing consumers).

The paper presents the need for funding in order for the DSOs to be able to make the necessary investments in Research & Development and Demonstration projects in the area of Smart Grids.

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Executive Summary

Today there is little debate as to whether or not Smart Grids are needed. The necessity of Smart Grids seems obvious to most stakeholders. **GEODE** believes that the implementation of Smart Grids is crucial and strongly supports the development of Smart Grids.

Policy and legislation are the main drivers for Smart Grids in Europe. The climate change and the need to reduce the carbon dioxide levels lie very much behind EU Energy and Climate Packages setting out ambitious targets for 2020. This in turn drives, in Europe, the increased focus on renewable energy sources (RES), distributed generation (DG), the focus on electrical vehicles (EV) and the more efficient use of energy. What is clear is that Smart Grids are a prerequisite for the climate ambitions.

The consumer's requirements on services will be different and higher than today's, regardless of whether Smart Grids are introduced or not. The consumer of the future will have different needs and demands, e.g. electrical vehicles and micro-generation, which will create new challenges for the grid. The expected growth of for example micro-generation will also create the need for new business models.

With the Smart Grid however the service levels of today can be maintained, or even increased, even with the introduction of new requirements.

There is no doubt that the cost for the consumer, given the expected quality of supply, will increase. The cost will be significantly higher if the network is developed in a traditional way, rather than in a smart way. But even with a Smart Grid, the costs of tomorrow will be higher than today but less than if nothing is done.

The Smart Grid of the future encompasses a large number of building blocks. Some Smart Grid functionalities can be implemented pretty much as "stand-alone" components. Others form a larger eco-system where the different parts together create an integrated solution.

Smart Metering[1] is a very important part of the Smart Grid. In order to create the foundation for Smart Grids, Smart Meters should be in place. Thus exploiting beneficial synergies with Smart Meters will be vital in the deployment of Smart Grids. It has to be taken into consideration that

[1] GEODE Position Paper on Smart Metering, November 2009. Download from www.geode-eu.org

Smart Meters functionalities contribute to the operation of the grid, the deployment and understanding of Electrical Vehicles and Distributed Generation.

With the advancement of Smart Grids, comes the need for different skills and new expertise within the industry. New demands will be placed on the traditional school and university system as well as on different kinds of training institutes which should be set up to meet the future demands. Closer co-operation between the DSOs and universities and other technical institutions will be required.

The consumer will be able to be more active and participate in the market to a greater extent if Smart Grids are implemented.

In order to integrate renewables, the grid must be flexible and able to handle everything from large scale wind generated power to micro-generation.

The grid of the future must also be accessible for all stakeholders, from large scale producers to micro-producers as well as to all consumers.

For the grid to be economical it must also be operated and extended in an efficient and effective way. More intelligence in the grid is a prerequisite for this.

Furthermore the grid must continue to be reliable and have a low level of outages.

GEODE considers that consumer benefits arising from Smart Grids' implementation can be classified in six areas or trends. These are

- Higher participation of the consumer by improving the electricity market
- Increased use of renewable energy sources
- Increased efficiency when using electricity
- Increased use of Electric Vehicles
- Advancement of micro-generation
- Avoid and minimize outages

In order to create the Flexible, Economic, Accessible and Reliable Grid of the future, a number of high level services will have to be introduced. These are:

- Enabling and encouraging stronger and more direct involvement of consumers in their energy usage
- Enabling the network to integrate users with new requirements
- Ensuring network security, system control and quality of supply
- Improving market functioning and customer service
- Enhancing efficiency in day-to-day grid operation
- Enabling better planning of future network investment

For these services there are both providers, such as TSOs and DSOs as well as primary beneficiaries, such as consumers, suppliers and producers.

For all of these services the DSOs must be involved, either as the single responsible party or in co-operation with other market actors.

It is quite clear that without the involvement and proactivity of the DSOs, there will not be a Smart Grid.

The view of **GEODE** is that the deployment of Smart Grids is the responsibility of the TSOs and DSOs while electricity consumers, suppliers and producers are the ultimate beneficiaries of its deployment.

The introduction of Smart Grids will drastically change the role of the DSO and bring new tasks and responsibilities. The DSO must co-operate with suppliers, generators, customers and TSOs in a new way, creating new processes. New commercial and financial arrangements must be put in place between various actors in the market. It appears that it is the DSO who will have to face the biggest challenges in order that Smart Grids become a reality.

The introduction of Smart Grids will necessitate closer co-operation between the TSOs and the DSOs. The TSOs and DSOs must significantly enhance the exchange of information and coordination, embracing activities such as power flow management, voltage control, alarm surveillance and fault management, in order to be able to maintain a reliable and stable system.

Data handling is a necessity when creating a Smart Grid and operating Smart Meters. It is crucial that the data is handled in a correct and safe manner and is made available for all stakeholders as authorised by the customer according to contract or by law.

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GEODE suggests distinguishing between technical data (e.g. the current network load) and personal data (e.g. names and addresses of the consumer). It is not necessary to know the personal data to manage a Smart Grid. A Law should clearly define the term technical data and allow the relevant stakeholders to use this data for the purpose of managing the smart grid. To possess, use and forward personal data should only be allowed when necessary e.g. to fulfil a contractual obligation or with the agreement of the person concerned.

Regulators have a central role to play 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.

A rethinking of the popular (RPI-X) regulation models, focusing on short term cost reductions, has to happen. The settlement of an adequate long-run predictable investment and innovation friendly regulatory framework is essential to incentivise and enable network operators to be part of R&D&D-projects to develop and adopt Smart Grid solutions, integrate new and best technologies and to make the necessary reinvestments of the conventional grid components (transformers, cables, etc.).

The settlement of an adequate framework at national level is essential to incentivize network operators to adopt Smart Grid solutions and integrate new and best technologies It is important that roles and responsibilities as regards Smart Grids are clearly defined.

New regulation on granting of permits should be put in place to avoid existing regulatory barriers that hinder the construction of new power lines or new production facilities. Authorisation and planning procedures need to be faster and simplified.

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. Network companies, TSOs and DSOs, are legally requested to deploy some parts of the new Smart Grid, while grid users, consumers and producers are among the ultimate beneficiaries of the deployment. As benefits are shared along the value chain, including the end consumer, the cost has to be distributed as well.

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Incentives must be provided to the DSOs in order for the Smart Grid to become a reality. There are two ways GEODE sees that costs can be covered. It can be trough funding made available on a European or national level, or it can be allowed for in the grid tariffs or it can be a combination of both.

The DSOs play a crucial role in the development of the Smart Grids on the distribution side, but for the DSOs to be able to participate in this development to the extent that is needed, funding for research and demonstration projects must be made available to all network operators regardless of their size. This can then come from the EU or from Member States funds or from the tariffs set by the regulatory authorities.

It is very likely that if cost recovery is not assured to the DSOs, there will be no Smart Grid.

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European Drivers for the Smart Grid

Policy and legislation are the main drivers for Smart Grids. Climate change and the need to reduce carbon dioxide lie very much behind EU Energy and Climate Packages setting out ambitious targets for 2020. This in turn drives, in Europe, the increased focus on renewable energy sources, distributed generation, the focus on electric vehicles and the more efficient use of energy. What is clear is that Smart Grids are a prerequisite for the climate ambitions.

Other drivers include the existing restrictions in transmission and distribution grids of Europe as well as bottlenecks in transmission and limited production capacity creating peak demand problems. The increased consumption of electricity further enhances the peak demand issues.

New consumers needs will also become a strong driver. Electric Vehicles and Micro-generation are two examples.

Restrictions on the building of new transmission and distribution lines also drive the need to increase the capacity in a smarter way in already existing grids. The introduction of new technology creates the possibility to implement smarter solutions for the future reducing some of the needs for investments in new grids.

These drivers all combine to drive the necessity as well as the possibility for a Smarter Grid.

Status of Smart Grids

Today there is little debate as to whether or not Smart Grids are needed. The necessity of Smart Grids seems obvious to most stakeholders.

Smart Grid is a very “hot” topic and is being discussed widely. A large number of papers have been written on the subject and many conferences on Smart Grids are held around the world. Legislators, network companies, energy suppliers, hard and software suppliers are just a few of the stakeholders that are actively working on this topic.

A Smart Grid is an electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to ensure an economically efficient,

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sustainable power system with low losses and high levels of quality and security of supply and safety[2].

Traditionally grid power flows in only one direction while the grids of tomorrow, Smart Grids, must allow electricity to flow bi-directional and enable a parallel flow of information. Today's electricity grids must evolve into Smart Grids as a process within which electricity grids are being improved to meet the needs of current and future consumers. Smart Grids through the use of new and existing technology can transform the way in which electricity is produced, transmitted and consumed.

Traditionally the production in the network has been consumption led. That will have to change to some extent and consumption will have to become more production led.

The consumer's requirements on services will be different and higher than today's, regardless of whether Smart Grids are introduced or not. The consumer of the future will have different needs and demands, e.g. electrical vehicles and micro-generation, which will create new challenges for the grid. The expected growth of for example micro-generation will also create the need for new business models.

The Smart Grid will facilitate the use of renewable energy sources, particularly distributed generation. Increased efficiency in the grid should be possible to achieve, which will benefit the consumers.

The Smart Grid will offset some of the peak-demand problems, and will thus be important for providing better service to the consumers.

With the Smart Grid the service levels of today can be kept, or even increased, even with the introduction of new requirements.

Smart Grids are not ends in themselves; they are enablers and will differ in character according to local circumstances.

Consumer benefits of today are high and delivered to a low cost. It is likely that the cost for the consumer, given the expected quality of supply, will increase. The cost will be significantly higher if the network is developed in a traditional way, rather than in a smart way. But even with a Smart Grid, the costs of tomorrow will be higher than today but less than if nothing is done.

[2] Definition used by ERGEG on ERGEG's Position Paper on Smart Grids. Ref: E09-EQS-30-04; 10 December 2009.

Up to know there are only limited pilot experiences of Smart Grids deployment and a large scale deployment has not yet taken place. A widespread implementation of Smart Grids could take place during the next decade. According to the IEA, 600 b€ will be invested to deploy power networks by 2030, 50% spent on generation and 50% on distribution and transmission.

In some countries such as the United States it is the Federal Government that drives the advancement of Smart Grids. President Obama has earmarked 3.4 billion USD to the development of Smart Grids. The Federal Government has allocated an additional 3 billion USD to programs that will encourage the installation of Smart Meters and customer systems (that will allow for communication between utilities and consumers) as well as projects that will integrate the power grid and components that will work with the grid, such as Smart Meters, smart thermostats, appliances, automated substations, plug-in hybrid vehicles and renewable energy sources.

The European Electricity Grid Initiative (EEGI) under the SET-Plan launched on 4th June 2010 its implementation plan. It proposes an integrated TSO/DSO package of R&D and demonstration pilot projects for electricity networks with a budget of €2billion over ten years, covering the expected participation of regulated networks, market players, research centres and universities. From these projects, some priority projects should start urgently in the period 2010-2012. The investment in the priority projects is estimated at 1b€.

The new electricity and gas internal market Directives[3] contained in the EU's Third Energy Package adopted in July 2009, encourages the promotion of Smart Grids in addition to the support for intelligent networks in the Renewables Directive[4].

To facilitate and support the process of and EU-wide Smart Grid implementation, the European Commission decided to set up a Task Force on Smart Grids in November 2009 with the participation of all relevant institutional actors and market stakeholders. Its ultimate goal is to

[3] Directive 2009/72/EC of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, and Directive 2009/73/EC concerning common rules for the internal market in gas and repealing Directive 2003/55/EC.

[4] Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources, amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

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coordinate the first steps towards the implementation of Smart Grids. It aims to ensure EU-wide, consistent, cost-effective, efficient and fair implementation of Smart Grids.

A Smart Grid employs innovative products and services together with intelligent monitoring, control, communication, and self-healing technologies in order to:

- Better facilitate the connection and operation of generators of all sizes and technologies;
- Allow consumers to play a part in optimising the operation of the system;
- Provide consumers with greater information and options for choice of supply;
- Significantly reduce the environmental impact of the whole electricity supply system;
- Maintain or even improve the existing high levels of system reliability, quality and security of supply;
- Maintain and improve the existing services efficiently;
- Foster market integration towards European integrated market.

The Smart Grid of the future encompasses a large number of building blocks. Some Smart Grid functionalities can be implemented pretty much as “stand-alone” components. Others form a larger eco-system where the different parts together create an integrated solution.

- ***Smart Meters – the foundation for Smart Grids***

In order to create the foundation for Smart Grids, Smart Meters should be in place. Smart Meters are one of the underlying elements for the Smart Grid development and a key tool for Smart Grids. Thus exploiting beneficial synergies with Smart Meters will be vital in the deployment of Smart Grids. If the utilities are already in the planning stage of Smart Metering roll-out and they take a strategic point of view of the investment and plan early for the Smart Grid functionalities, it will be beneficial. It has to be taken into consideration that Smart Meters functionalities contribute to the operation of the grid, the deployment and understanding of Electrical Vehicles and Distributed Generation.

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- ***The future of electrical supply***

The electricity supply in today's Europe is good; the existing grid offers high quality deliveries of power. The amount of outages is fairly low, quality of voltage is high and prices are low.

Electricity generation in the EU-27 has continued to grow. Total electricity production in the EU-27 has during the period 1990 to 2007 grown from 2584 to 3362 TWh. Generation from renewables was in 2007 525 TWh[5]. In 2007 the share of renewable electricity in gross electricity consumption in the EU-27 was 15.6% compared to 11.9% in 1990. The substantial increase in the total amount of renewable electricity generation was partially off-set by the increase in consumption. The generation mix will change in accordance with the EU goals of 20/20/20.

Higher demands on the grid have been put forward by consumers and legislators, an example of this is a more secure grid that can cope with harsher weather conditions. As a result many grid companies have started to move more of their cables underground.

In the future the power system will go from centralized power generation to centralized and distributed power generation. The power flow has historically been one directional; with intermittent renewable power generation and consumers acting as producers the power flow will be multi directional. Furthermore the generation of today follows the load demand, with a market that has tools to inform and influence consumers as to when to use electricity, the load will to a greater extent be adapted to production.

As the need for electricity in general as well as renewable energy will grow, as mentioned above, there will be new challenges for the grids of Europe that will put higher demands on grid companies. The focus on the services that the companies offer will be more intense. The discussion on Smart Grids is a start and evidence of this.

- ***New demands for skills and expertise***

With the advancement of Smart Grids, comes the need for different skills and new expertise within the industry. This gives rise to the question of how to ensure that there will be enough and sufficient human resources, trained and well skilled. Competent people, who can, in the end, manage to deliver according to set standards.

[5] EU Energy figures 2010. DG ENER

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With the introduction of research and development as part of normal business for utilities, skills within product development is needed. The more advanced technology, e.g. ITC, will also need a different background than that which has been the norm in the industry.

New demands will be placed on the traditional school and university system as well as on different kinds of training institutes which should be set up to meet the future demands. There will be a need for cross functional work between several stakeholders to resolve this future situation and the need for skilled human resources.

Closer co-operation between the DSOs and universities and other technical institutions will be required.

Consumer Benefits from Smart Grid

The electricity supply of Today's Europe is good but the future contains possibilities and challenges that will put higher demands on grid companies.

In order to integrate renewables, the grid must be flexible and able to handle everything, from large scale wind generated power to micro-generation. The grid of the future must also be accessible for all stakeholders, from large scale producers to micro-producers as well as all consumers.

For the grid to be economical it must also be operated and extended in an efficient and effective way. More intelligence in the grid is a prerequisite for this.

Furthermore the grid must continue to be reliable and have a low level of outages. Underground of the grid to handle harsher weather conditions is one method of ensuring this.

The underlined concepts above in the text; flexible, accessible, economical and reliable will be used in this section when describing the development of European electricity supply to the consumer.

The consumer benefits section is described in six areas or trends that **GEODE** consider important for the consumer:

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- Greater participation of the consumer by improving the electricity market
- Increased use of renewable energy sources
- Increased efficiency when using electricity
- Increased use of Electric Vehicles
- Advancement of micro-generation
- Avoiding and minimize outages

The function of the electricity market of today is fairly good. Consumers are able to change supplier and can often affect the electricity cost by changing behaviour or implement more energy efficient household appliances. These are areas that can be improved and strengthened further by implementing the concept of Smart Grids.

The Smart Grid provides functionalities that strengthen the information supply to the consumer and render possible time-of-use tariffs based on more frequent measurements. The consumer will know more about prices and their consumption patter. The consumer will have more information and is able to choose when to consume energy and thereby be able to avoid high prices or use a greater amount of energy when the price is low. This will probably create a market based on supply and demand to a greater extent than today.

Within the EU customers frequently move house. The possibility to remotely connect/disconnect meters gives safer, faster and easier service to the customers in conjunction with moving house. By implementing this functionality the consumer will enjoy a more flexible and economic grid.

GEODE welcomes an increased use of renewable energy sources (RES). The consumer can choose from a broader spectrum of electricity production and the amount of actors on the market will probably be higher than today. The increased implementation of renewables will put new demands on the grid operators and a new approach to operating the grid is needed.

The Smart Grid provides functionalities like power storage and smart meters. The power storage, which in the future can for example be an electric car, can compensate for expensive margin production, lack of regulating power or bottle necks in the grid. This can contribute to minimizing the outages and to a more efficient and economic electricity market.

The frequent metering will give more information to the consumers. The consumer is thereby able to be more active and reduce their consumption

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if the production planning was wrong or production prediction from RES is low. The consumers will hereby have a grid that is more flexible, economic and reliable.

Grid companies today understand that their customers want and need to be more energy efficient. There are many examples of energy companies that offer energy efficiency services to their costumers, even if it means that deliveries will be smaller. In the long term grid companies need customers that are energy efficient and competitive. As electricity consumption is growing on the whole, a more efficient customer will actually benefit both the customer and the DSO, in the reduced need for further investments.

New tools will be needed for the design and establishment of new distributed architecture, which in turn provides new and innovative possibilities for the planning and operation of the grid. Deployment of metering in transformers creates an overview of losses in the grid and makes it possible to optimize cables and make better decisions when planning the grid. These functionalities will reduce the cost or make the cost of investments in the grid increase more slowly.

Renewal of the existing infrastructure instead of building out new is easier to understand, and probably cheaper for all customers. The functions thereby make the grid more economic for the customer.

The grid of today can handle an increased use of electric vehicles (EV). The demand of charging poles is still low and easily met by the grid companies. The Smart Grid provides more frequent measurements in the grid, which gives additional data about the distribution network. The DSO can from this information learn how the moving load behaves and is able to plan and build the grid more effectively based on this information.

A Smart Grid needs to facilitate and handle easy access to the grid and thereby contribute to the creation of a market based on reduction of power or input to the grid from small scale generation or power storages such as EV. The use of EV together with a Smart Grid will make the grid more flexible, economic, accessible and reliable for the customer.

The advancement of micro generation is diverse between European countries and depends partly on different legislation on subsidies to producers and prosumers. The grids of today are well prepared for incorporating micro generation but there are areas to improve; the connection of micro generation can be made more effective and easy. Furthermore, deployment of micro generation in large numbers will affect

the operation of the grid and as a consequence the grid owner needs to know more about the state of the grid.

The Smart Grid provides two-way communication on meters that give information regarding the end points on the distribution network. This will make it possible to control and obtain the most secure operating state of the grid. Products to facilitate access for the prosumer to the grid need to be developed. Furthermore the network information systems and metering system need to be integrated to transform the data in the meters to information for the grid operators. The solutions will give the consumers and prosumers a more flexible, economic, accessible and reliable grid.

The grids of today have a low amount of outages. The consumers and grid companies want them to be even fewer. When implementing more RES and micro generation in the grid and at the same time increasing the consumption, there are areas that have to be analysed with regard to avoiding and minimizing outages.

The Smart Grid provides services like remote control and monitoring of wind/solar farms. Moreover it provides enhanced security applications to account for intermittent RES. Energy storage systems which are a part of the Smart Grid will help to control step power changes, obtain voltage control, obtain grid stability during and after faults and contribute to the frequency regulation. A smart meter gives consumers better control over their consumption and thereby helps the consumer to be more active and participate in the market. These type of Smart Grids solutions will give the consumer a more economic and reliable grid.

High Level Services in the Smart Grid

In order to create the Flexible, Economic, Accessible and Reliable grid of the future, a number of services will have to be introduced. For these services while the provider is mainly the DSO, the beneficiaries involve other actors in the value chain as such as suppliers, generators and consumers.

A provider of a service is a participant that is responsible for a service alone or in combination with other participants. Primary beneficiaries are participants that require or directly benefit from the services, recognizing that the full benefits from these services are shared among a much wider group of participants.

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The high level services of Smart Distribution Grids listed below have been defined and agreed by Expert Group 1 of the EC Task Force on Smart Grids, which **GEODE** has participated in defining and supports. Under these 6 services 33 functionalities are described.

These Services and functionalities that are defined represent the basis that Smart Grids are expected to offer to all electrical network users in Europe over time. The implementation of the services allowed by functionalities must be deployed according to the present situation of each Member State.

The following represents a list of the broad services envisaged, showing the provider of the service and the primary beneficiaries[6]. For all of these services the DSOs must be involved, either as the single provider or in co-operation with other market actors.

It is quite clear that without the involvement and proactivity of all the DSOs, small and medium ones as well as the large ones, there will not be a Smart Grid.

A. <u>Enabling the network to integrate users with new requirements</u>

Outcome: Guarantee the integration of distributed energy resources (both large and small-scale stochastic renewable generation, heat pumps, electric vehicles and storage) connected to the distribution network.

Provider: DSOs
Primary beneficiaries: Generators, consumers (including mobile consumers), storage owners.

B. <u>Enhancing efficiency in day-to-day grid operation</u>

Outcome: Optimise the operation of distribution assets and improve the efficiency of the network through enhanced automation, monitoring, protection and real time operation. Faster fault identification/resolution will help improve continuity of supply levels.

Better understanding and management of technical and non-technical losses, and optimised asset maintenance activities based on detailed operational information.

[6] Final Deliverable, Expert Group 1 – Functionalities of Smart Grids and Smart Meters of EC Task Force for the implementation of Smart Grids. September 2010

Provider: DSOs, metering operators
Primary beneficiaries: Consumers, generators, suppliers, DSOs.

C. <u>Ensuring network security, system control and quality of supply</u>

Outcome: Foster system security through an intelligent and more effective control of distributed energy resources, ancillary back-up reserves and other ancillary services. Maximise the capability of the network to manage intermittent generation, without adversely affecting quality of supply parameters.

Provider: DSOs, aggregators, suppliers.
Primary beneficiaries: Generators, consumers, aggregators, DSOs, TSOs.

D. <u>Enabling better planning of future network investment</u>

Outcome: Collection and use of data to enable more accurate modeling of networks especially at LV level, also taking into account new grid users, in order to optimise infrastructure requirements and so reduce their environmental impact. Introduction of new methodologies for more 'active' distribution, exploiting active and reactive control capabilities of distributed energy resources.

Provider: DSOs, metering operators.
Primary beneficiaries: Consumers, generators, storage owners.

E. <u>Improving market functioning and customer service</u>

Outcome: Increase the performance and reliability of current market processes through improved data and data flows between market participants, and so enhance customer experience.

Provider: Suppliers (with applications and services providers), power exchange platform providers, DSOs, metering operators.
Primary beneficiaries: Consumers, suppliers, applications and services providers.

F. <u>Enabling and encouraging stronger and more direct involvement of consumers in their energy usage</u>

Outcome: Foster greater consumption awareness taking advantage of smart metering systems and improved customer

information, in order to allow consumers to modify their behaviour according to price and load signals and related information. Promote the active participation of all actors to the electricity market, through demand response programmes and a more effective management of the variable and non-programmable generation. Obtain the consequent system benefits: peak reduction, reduced network investments, ability to integrate more intermittent generation

Provider:	Suppliers (with metering operators and DSOs), ESCOs.
Primary beneficiaries:	Consumers, generators.

The new role and responsibilities for the DSO

The view of **GEODE** is that the deployment of Smart Grids is the responsibility of the TSOs and DSOs while electricity consumers, suppliers and producers are the ultimate beneficiaries of its deployment.

The introduction of Smart Grids will drastically change the role of all the DSOs, small and medium as well as the large ones, and bring new tasks and responsibilities. The DSO must co-operate with suppliers, generators, customers and TSOs in a new way, creating new processes. New commercial and financial arrangements must be put in place between various actors in the market.

It appears that it is the DSO who will have to face the biggest challenges so that Smart Grids become a reality. The reasons include;

- Management and operation of the Smart Grid, with increased intelligence and an increased amount of data handling.
- Growing distributed generation, active management of demand, local storage and electric vehicles (EV) will impact the DSO infrastructure. Thus the DSO will have to be an active participant in all such R&D&D projects.
- As more fluctuating distributed generation will feed into the distribution system, gathering and handling the data about the state of the distribution system will be one key issue for the DSO. The DSO will in effect act as a data hub.
- Attention will need to be paid to ensure that all privacy and system security recommendations will be adhered to. Ownership of the

data, length of time data is stored, etc… will all need to be addressed in an appropriate way.

- DSOs will have to handle large amounts of consumption information from the Smart Meters.
- The DSOs, together with the retailers, will have to develop transparent and easily understandable rules for Demand Side Response.
- The data collected will enable the DSOs to fulfil their duty in relation to the overall grid stability and operational security, given that more and more distributed generation will be connected to the distribution grid.
- DSOs have to invest in new "smart" technology and ICT infrastructure.
- DSOs have to make the necessary reinvestments in the "conventional" components of the grids (transformers, cables, overhead lines) which still have to be the well-functioning backbone of the networks of the future.

In order to resolve the above challenges, the DSOs will have to continue upgrading their grid infrastructure, control centres and educating their employees accordingly.

Impact of growing Distributed Generation

Growing Distributed Generation also poses operational and control challenges for the traditionally designed and operated distribution grids. Challenges include voltage and reactive power management, maintaining system stability and operational security.

Therefore DSOs will have to become much more involved in relation to innovative voltage control, power flow management, dynamic circuit ratings etc. It will resemble the responsibilities of the TSO in the transmission grid of today. These include:

- maintaining operational security and quality of supply,
- enabling the new operations at the distribution level (including non-discriminatory and effective real-time grid capacity monitoring and management of injections / withdrawals),
- market based congestion management,
- support energy efficiency and integration of renewables on the producer side by setting harmonized and non-discriminatory rules and codes

The Distributed Generators must contribute to keeping the system stable and operationally secure.

Closer co-operation between TSO and DSO

The introduction of Smart Grids will necessitate closer co-operation between the TSOs and the DSOs. The TSOs and DSOs must significantly enhance the exchange of information and coordination, embracing activities such as power flow management, voltage control, alarm surveillance & fault management, in order to be able to maintain a reliable and stable system.

Strong coordination between transmission and distribution will be needed especially for issues concerning demand and operation but in general any distributed energy resource (small PV, EV, etc.), to ensure the suitable contribution of local resources to the global system security.

The TSOs will have to provide more support and communication of data to the DSOs, but will also require more specific information from the DSOs, especially with more distributed generation coming from the distribution grids. In order to achieve this, both TSOs and DSOs need to ensure that the standards they implement for communication and data exchange are compatible.

It also follows that the TSOs will have to gradually redesign power system control as well as market information management relating to forecasting the overall system load in conjunction with the DSOs.

At the same time, the DSOs will have to strengthen their role in providing the required data relating to the distributed generation, local storage and electric vehicles within the distribution grid.

The future cooperation between different TSOs and between TSOs and DSOs, will include reporting of actual power and energy values for all participants in the new market places down to distribution level for settlement but also for data analysis for planning (active or automatised).

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The Role of the Regulator

According to Electricity Directive 2009/72/EC, Article 36a), national regulatory authorities are responsible for promoting a secure electricity market and for ensuring appropriate conditions for the effective and reliable operation of electricity networks. It means they should promote and support with the adequate legal framework the deployment of Smart Grids.

Regulators have a central role to play 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. **GEODE** does not however see a need for further legislation at EU level.

The settlement of an adequate framework on national level is essential to incentivize network operators to adopt Smart Grid solutions and integrate new and best technologies. It is important that roles and responsibilities with regard to Smart Grids are clearly defined.

What is required is a long-term predictable regulatory framework at national level, in order that for DSOs to have clarity about the cost recovery of investments. It should include adequate incentives for investments in

- economic and technical efficiency,
- quality of supply,
- "smartness" of the electricity grids and
- energy efficiency [7].

A re-thinking of the current incentive based regulation models (RPI-X), focusing on short term cost-reductions, needs to take place to facilitate the deployment of Smart Grids – the regulation has to become smarter. It is especially important for national regulators to progress towards an investment and innovation friendly regulatory framework:

- Investment friendly in order to be able to invest in technical equipment and ICT-infrastructure enabling the implementation of intelligent solutions and to make the necessary reinvestments of the

[7] Expert Group 3 Deliverable – Final Draft – Roles & Responsibilities of Actors in Smart Grids Deployment. 20 October 2010. EC Task Force for the implementation of Smart Grids.

"conventional" components of the grids (transformers, cables) which still has to be the well-functioning backbone of the networks of the future – the smart grids.

- Innovation friendly in order for DSOs to have the possibility of demonstrating a stronger commitment to R&D and demonstration projects to be part of the creation process of the electricity networks of the future in good time.

It is important that regulators should not impose specific smart solutions to network operators, instead they should leave them to manage their business in the most appropriate way.

New regulation on granting of permits should be put in place to avoid existing regulatory barriers that hinder the construction of new power lines or new production facilities. Authorisation and planning procedures need to be faster and simplified.

Data handling in the Smart Grid

Data handling is a necessity when creating a Smart Grid and operating Smart Meters. It is crucial that the data is handled in a correct and safe manner and is made available for all stakeholders as authorised by the customer according to contract or by law.

DSOs will in most Member States be responsible for gathering consumption data (through meter readings) and dispatching it in a swift, reliable and non-discriminatory way to licensed service providers (suppliers, aggregators, etc.) thereby safeguarding confidentiality of information by restricting the ability of third parties to access it.

To ensure data safety and security within an intelligent network a clear division of roles and responsibilities regarding ownership, possession and access to data, read and change rights, etc. has to be defined.

GEODE suggests distinguishing between technical data (e.g. the current network load) and personal data (e.g. names and addresses of consumer). It is not necessary to possess personal data to manage a Smart Grid. A Law should clearly define the term technical data and allow the relevant stakeholders to use this data for the purposes of managing the smart grid. Possession, use and forwarding of personal data should

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only be allowed when necessary e.g. to fulfil a contractual obligation or with the agreement of the person concerned.

The cost issue

The business of the DSOs has been fairly static in the past compared with what will be necessary in the future. The operation of the Grid has of course developed, but the main building blocks of the grids are the same today as they always have been. Investments have often had a long time horizon and have been foreseeable.

With the need for Smart Grids, the DSO will need to invest in research, development and demonstration projects in new and very different ways. DSOs, being responsible for the secure operation of the electricity system, will need to lead the testing of new solutions through demonstration projects, as thi is the way to evaluate the benefits, estimate costs and lay the foundation for possible further deployment.

Investments will be substantial, the risks of new technology will be large and new competencies will have to be developed. New business models will have to be implemented and new actors will change the landscape of the business. Not all pilot projects will have the desired outcome, and many different solutions will have to be tested in order to find the optimal one. Investments will have to be made without a certain return on the investment. Thus the business of the DSO will be quite different in the future compared with today.

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. Network companies, TSOs and DSOs, are legally requested to deploy some parts of the new Smart Grid, while grid users, consumers and producers are among the ultimate beneficiaries of the deployment. As benefits are shared along the value chain, including the end consumer, the cost has to be distributed as well.

Incentives must be provided to the DSOs in order for the Smart Grid to become a reality.

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There are two ways **GEODE** sees that costs can be covered. It can be through funding made available on a European or national level, or it can be allowed for in the grid tariffs or it can be a combination of both.

In general the investment costs in the electricity grids are covered by the grid tariffs. How costs are going to be covered is an issue that should also be included specifically in the national legislation.

In addition to this DSOs should have the option to offer more flexibility in designing the grid tariffs. The growing number of “prosumers” is a new challenge and therefore not foreseen in the implemented tariff schemes. One consequence is that the energy delivered to customers is reduced and at the same time the grid tariffs (price per kWh) will increase in order for DSOs to be able to cover their “fixed” costs. We think an adequate tariff structure in accordance with local needs should be able to offer the option of using components depending on the energy consumed (kWh), the consumed load (kW), flat rates and time of use tariffs. That would be an important step towards a fair and future oriented grid tariff system.

Grid tariffs must allow for the increased cost of the R&D, as well as demonstration projects, along with the implementation of Smart Grids. Demonstration-projects are essential to develop, test and learn about characteristics of new intelligent solutions using innovative technology, the behaviour and needs of customers, hurdles and barriers to overcome, etc.

Engagement in demonstration projects of all relevant stakeholders, accompanied by an appropriate legal and regulatory framework, is a requirement as well as a first step to gaining potential benefits. As DSOs are essential in the deployment of SG it is necessary that all the DSOs, small and medium as well as large ones, are part of these demonstration projects.

The DSOs play a crucial role in the development of the Smart Grids on the distribution side. But for the DSOs to be able to participate in this development to the extent that is needed, funding on a national or a European level for research and demonstration projects must be made accessible to all network operators regardless of their size. The research and demonstration projects which are publicly funded should benefit to society and increase the level of knowledge and expertise within the industry as a whole as well as for all actors in the value chain.

It is very likely that if funds are not made available to the DSOs, there will be no Smart Grid.

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Conclusion

GEODE believes that the implementation of Smart Grids is crucial and strongly supports the development of Smart Grids.

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.

The introduction of Smart Grids will drastically change the role of the DSO and bring new tasks and responsibilities. The DSO must co-operate with suppliers, generators, customers and TSO in a new way, creating new processes. New commercial and financial arrangements must be put in place between various actors in the market.

Clear benefits exist for consumers from the introduction of Smart Grids. The cost for the consumers in the future will be higher than today if Smart Grids are not implemented, given the current level of service. Without the Smart Grid, the introduction of RES, EV, Micro-Generation and DG will be very costly, if not impossible.

In order to create the foundation for Smart Grids, the Smart Meters should be in place. Exploiting beneficial synergies with Smart Meters will be vital in the deployment of Smart Grids.

The view of **GEODE** is that the deployment of Smart Grids is the responsibility of the TSOs and DSOs while electricity consumers, suppliers and producers are the ultimate beneficiaries of its deployment.

Regulators have a central role to play 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.

Thus the cost of Smart Grids must be distributed along the value chain in the same manner that the benefits are distributed.

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It is vital that regulatory mechanisms and incentives supporting and assuring network operator investment and engagement in R&D&D-projects are put in place. The normal way is that the investment and operation costs in the electricity grids are fully covered by the grid tariffs.

Research and demonstration funds, regardless of if it is on a national or a European level, should be made accessible to all network operators regardless of their size.

New regulation on granting of permits should be put in place to avoid existing regulatory barriers that hinder the construction of new power lines or new production facilities.

It is very likely that if cost recovery is not assured to the DSOs, there will be no Smart Grid.

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Glossary

CONSUMER - in this paper encompasses households and small and medium businesses (SME) as well as these entities as prosumers (electricity producing consumers).

DISTRIBUTED GENERATION, (DG) – Decentralised generation which is characterized by the location close to the consumption / consumers.

DSO – Distribution System Operator, same as Distributor.

EEGI – European Electricity Grid Initiative.

ERGEG - ERGEG stands for the "European Regulators' Group for Electricity and Gas". ERGEG is a body of independent national energy regulatory authorities, which was set up by the European Commission as an Advisory Group to the Commission on energy issues.

ESCO – Energy Service Company.

EV – Electrical Vehicle

GEODE – “Groupement Européen des entreprises et Organismes de Distribution d’ Energie”. Founded in 1991 it is made up of European independent distribution companies of gas and electricity. The association represents more than 600 companies in 11 countries, both privately & publicly owned. These companies supply more than 100 million people.

IPROSUMER - Electricity producing consumer.

QUALITY COSTS – Cost resulting from imperfection in products, services, systems, or processes

RES – Renewable energy sources.

R&D&D project – Research & Development & Demonstration project.

SMART METER – This is a general definition for an electronic device that can measure the consumption of energy (electricity or gas) adding more information than a conventional meter (price schemes, interval data, quality of supply, etc...), and that can transmit data using a form of

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electronic communication. Similar meters, usually referred to as ‘time-of-use’ or ‘interval’ meters, have existed for years, but smart meters usually involve a different technology mix such as automated meter reading, automated meter management and a different application mix such as domotics, value-added services, etc...

SMART GRID – Is an electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to ensure economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety.

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References

GEODE Position Paper on Smart Metering, November 2009. Updated April 2010

ERGEG's Public Consultation on its Position Paper on Smart Grids. Ref. E09-EQS-30-04; 10 December 2009

ERGEG's Position Paper on Smart Grids. Ref. E10-EQS-38-05; 10 June 2010

Deliverables Expert Groups 1, 2 & 3 from September 2010, July 2010 and October 2010 respectively. European Commission Task Force for the implementation of Smart Grids.

European Technology Platform – Smart Grids. Strategic Deployment Document for Europe's Electricity Networks of the Future. April 2010

General Delegation: PR Advocats- París, 205- 08008 Barcelona - Spain - Tel. (34) 93 414 22 77- Fax (34) 93 209 53 07- e-mail: info@geode-eu.org