S U S T E L N E T

Policy and Regulatory Roadmaps for the Integration of Distributed Generation and the Development of Sustainable Electricity Networks

REGULATION OF DISTRIBUTED GENERATION

A European Policy Paper on the Integration of Distributed Generation in the Internal Electricity Market

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Abstract
In the SUSTELNET project criteria and guidelines have been developed that can create a level playing field in electricity markets between distributed generation (DG) and large scale power generation and will improve the network and market access of DG and electricity supply from renewable energy resources (RES). This report focuses on the European dimensions of DG regulation. The key findings of the SUSTELNET project are compared with the EU legislation, i.e. the current Electricity, Renewables and CHP Directives. Additional EU policy, regulation and initiatives are identified that can help Member States in developing future economically efficient and sustainable electricity supply systems.

CONTENTS

PREFACE

Technological developments and EU targets for penetration of renewable energy sources (RES) and greenhouse gas (GHG) reduction are decentralising electricity infrastructure and services. Although liberalisation and internationalisation of the European electricity market has resulted in efforts to harmonise transmission pricing and regulation, no initiative exists to consider the opening up and regulation of distribution networks to ensure effective participation of RES and distributed generation (DG) in the internal market. The SUSTELNET research project provides the analytical background and organisational foundation for a regulatory process that satisfies this need.

Within the SUSTELNET research project, a consortium of 10 research organisations analysed the technical, socio-economic and institutional dynamics of the European electricity supply system and markets. This has increased the understanding of the structure of the current European electricity sector and its socio-economic and institutional environment. The underlying patterns thus identified have provided the boundary conditions and levers for policy development to reach long term RES and GHG targets (2020-2030 timeframe). Consequently analysis was made as to what regulatory actions are needed in the short-to-medium term to reach the existing medium-term goals for 2010 as well as likely scenarios for longer-term goals.

Regulatory Road Maps
The main objective of the SUSTELNET project was to develop regulatory road maps for the transition to an electricity market and network structure that creates a level playing field between centralised and decentralised generation and network development. Furthermore, the regulatory road maps will facilitate the integration of RES, within the framework of the liberalisation of the EU electricity market.

Participatory Process
To deliver a fully operational road map, a participatory regulatory process was initiated throughout this project. This process will bring together electricity regulators and policy makers, distribution and supply companies, as well as representatives from other relevant institutions with the final objective of enhancing implementation of DG.

Newly Associated States
The SUSTELNET project also anticipates the enlargement of the EU by providing support to the Newly Associated States (NAS) with the preparation of a regulatory framework and thus also with the implementation of EU Directives on energy liberalisation and renewable energy in four Accession Countries (The Czech Republic, Poland, Hungary and Slovakia).

Project Structure
The SUSTELNET project was divided into two phases. During the first phase, the analytical phase, three background studies were produced:
- Long- term dynamics of electricity supply systems in the European Union.
- Review of the current electricity policy and regulation in the European Union and selected Member States.
- Review of technical options and constraints for the integration of distributed generation in electricity networks.

In the second phase, the participatory regulatory process phase, two activities took place, during which there were extensive interactions with regulators, utilities, policy makers and other relevant actors:

- Development of a normative framework: criteria for, and benchmark of distribution network regulation.
- Development of policy and regulatory road maps.

This Report

This report was produced during the participatory regulatory process phase of the project and focuses on the European dimensions of DG regulation.

1 INTRODUCTION

1.1 Distributed Generation

The concept of distributed generation (DG) entails a wide range of technologies, applications and effects on electricity network management. Strategically sited DG resources[1] can complement the existing electricity infrastructure, relieve network congestion, provide ancillary services and improve reliability. Furthermore, the modularity of DG can offer enhanced flexibility in electricity system planning through the possibility to defer lumpy investments in centralised generation, as well as transmission and distribution upgrades. On the other hand the integration of DG with intermittent loads, such as wind energy, solar energy and in some cases combined heat and power[2], may pose additional challenges to system balancing. Additionally, an increased level of DG requires a transition from centralised control and system management by few actors to a control system that allows and co-ordinates decentralised decision making by many actors.

Capturing the above aspects in an all-encompassing and consistent definition of DG is a big challenge. For the SUSTELNET project, however, it is sufficient to define DG as generation capacity that is connected to the distribution system.

Against the background of the ongoing process of European electricity market liberalisation and concerns regarding the security of energy supply, the main drivers for the increase of the level of DG capacity in the medium-term are the targets set in the Renewables and CHP directive, as well as the development of new small-scale generation technologies. Although the RES and CHP targets will not be met entirely with DG, they will nevertheless constitute a significant increase of DG relative to the current level. In the longer run broader environmental concerns are expected to maintain the impetus for the expansion of DG. Currently RES and CHP are dependent on non-market based support mechanisms. These support mechanisms, however, should not be used to compensate for regulatory and electricity market imperfections[3] in the short term.

1.2 The SUSTELNET project

The objectives of SUSTELNET are to:

- Analyse the long-term technical and socio-economic dynamics that underlie the changes in the architecture of the European electricity infrastructure and markets.
- Develop national road maps for the development of regulation to facilitate the integration of RES and distributed generation.
- Establish a participatory process on the regulation of distribution networks in the EU, involving distribution and supply companies, national regulators and national and EU policy makers.

Over the last two years the project team - consisting of 12 research institutes from 5 EU Member States and 4 Accession Countries - has been working in close contact with regulators and

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[1] Distributed energy resources may consist of generation capacity, electricity storage devices, load management and energy efficiency measures. The SUSTELNET project has focused on generation capacity, including renewable electricity. Demand side management resources have not been considered in the SUSTELNET project.

[2] The intermittent character of CHP units may follow from their dependency on heat demand.

[3] The imperfections referred to in this context are imperfections in the market and regulatory design or in the functioning of the electricity market. In this context we do not refer to the imperfection of not internalising (environmental) externalities in the electricity market.

national stakeholders to analyse the barriers to the integration of DG and to develop regulatory strategies to counter these barriers.

The SUSTELNET project has focused on electricity market integration issues. These issues are separate from the support mechanisms that may apply to CHP and RES and that seek to stimulate the penetration of these sources in the electricity mix or that seek to compensate for the lack of internalisation of (environmental) externalities in energy prices. Often such support mechanisms are based on principles that place renewables and CHP outside the market or shield them from particular market mechanisms. It is the view of the SUSTELNET project that while support mechanisms are necessary to stimulate the growth of environmentally benign electricity sources, these support mechanisms should not lead to market distortions. Moreover, as the share of renewables and CHP increases it becomes more important to integrate these sources in the market mechanisms that define investment, operations and management in the electricity sector.

1.3 Level playing field

Despite the economic benefits that are often attributed to DG these benefits have not formed a significant driver for the increase of DG. This can be explained by the fact that in general there is no level playing field between centralised and distributed generation, because the economic values of DG are often hardly recognised in markets and regulation. A level playing field entails markets and regulation that provide neutral incentives to centralised versus distributed generation. This requires that all the values of DG (positive or negative) are recognised, and that appropriate mechanisms are set up to put a monetary value to these values. Furthermore, incentives should be provided to network operators and generators to exploit these values in the best possible way. A complication in establishing such a level playing field is that the values of DG are often ambiguous (they can be positive or negative) and difficult to measure and monitarize.

It is recognised that the provision of non-discriminatory incentives and proper valuation of benefits and cost associated with distributed and centralised generation alone may not result in a level playing field in the long run. It is also recognized that in some countries path dependencies in the electricity infrastructure may create a certain degree of bias towards centralised generation. For example, the DSOs may not be equipped to integrate DG or the transmission and distribution network may not be suitable to absorb a large amount of DG. It may therefore be granted to temporarily tilt the playing field slightly in favour of DG to overcome such path dependencies in order to create a level playing field in the longer run. Thus a level playing field should balance long-term and short-term benefits and costs of the electricity infrastructure. The SUSTELNET project has sought to resolve such issues within the regulatory and electricity market context rather than trying to influence the level playing field through support mechanisms. A transition to a sustainable energy future as a whole and the accompanying policy instruments that would be needed to effect such a transition are not addressed within SUSTELNET. The focus here is on establishing a regulatory and market system that will accommodate and facilitate this transition against the least cost to society.

A level playing field requires that electricity networks reconfigure into active networks, and that DSOs[4] evolve from passive organisations into more proactive businesses. In other words, DSOs should become active and innovative entrepreneurs that would facilitate and profit from the connection of DG where this is beneficial to the overall electricity system. In addition, DSOs should provide spatially and temporally differentiated incentives for optimal investment and management of DG with a view to maximising overall customer benefits.

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[4] In other SUSTELNET reports the term Distribution Network Operator (DNO) was used. In line with the wording of the new Electricity Directive (2003/54/EC) the term Distribution System Operator (DSO) is used in this paper.

1.4 A European Policy Paper

Despite that DG is connected to local or regional distribution networks the integration of DG in networks and the electricity markets has several European dimensions related to e.g. market access, security of supply and the functions of TSOs and DSOs. While the Renewables, CHP and the new Electricity directive address some important concerns relating to the integration of DG, their coverage of issues is not complete. Moreover, the general terms of the directives' provisions regarding the integration of DG would require further guidance with respect to their implementation in regulation at the national level.

This paper therefore focuses on the following issues:

- European dimension of DG regulatory issues.
- Interpretation, implementation and monitoring of DG related provisions in the directives.
- Additional EU policy, regulation and initiatives required relative to the current directives.

The recommendations in this paper are to a large extent based on a total of nine national road maps for the development of a level playing field for DG. These road maps have been elaborated and discussed in conjunction with national regulators and stakeholders and are therefore closely linked to ongoing policy processes at the national level[5]. Finally, the recommendations in this paper are elaborated within the current framework of institutions, laws and regulations at the EU level.

[5] At the time the national roadmaps were elaborated the proposals for the amended Electricity Directive had not yet been implemented at the national level. The implementation of the new Electricity Directive is therefore not explicitly addressed in these national roadmaps. In this European policy paper we do, however, explicitly discuss the relation between our recommendations and the policy framework provided by the new Electricity Directive.

2 KEY FINDINGS OF THE SUSTELNET PROJECT

2.1 The role of DSOs

As the responsible agent for managing the electricity and information exchange between generation and consumption at the distribution level and the interface with the transmission level DSOs have a key role in providing access to the network, network services and to electricity markets for DG. It is therefore that much of the SUSTELNET project's attention has gone out to analysing the potential role of DSOs in providing a level playing field for DG. The management of electricity distribution networks is considered a natural monopoly. To avoid undue extraction of monopoly rents regulation has focused on separating network management from generation and consumption interests and on improving the economic efficiency of network management through revenue and price controls. This regulation has left DSOs to focus on cutting cost and leaves them little flexibility to create value and revenues through innovative investment, operations and services. As indicated before, DG may have several values that can be advantageous or disadvantageous to DSOs. However, the current regulatory framework does not have an incentive for the DSO to incorporate these values in its business model. In order to facilitate the integration of DG DSOs should make a transition to 'active' management of their networks.

The current regulatory frameworks reaffirm the role of DSOs as 'passive' institutions that transport electricity from centralised generation and transmission to decentral consumption. To facilitate the integration of DG DSOs should become 'active'. An 'active' DSO provides market access to DG by acting as a market facilitator and it provides several network and ancillary services through intelligent management of the network. This includes the incorporation of advanced information exchange between generation and consumption, the provision of ancillary services at the distribution level, management of the network to provide network reliability and controllability, and improve customer benefits and cost-effectiveness. Currently such services are partly provided at the centralised level by TSOs.

Because the functions of TSOs and DSOs partly overlap or where the actions of either operator affects the other, it is also found that there should be better co-ordination between the two in operational management and long-term system planning. In this way network planning and management can take place in a more integrated manner, making sure that all options and resources are used in the most optimal way in order to provide network services and to improve and where necessary expand the network[6].

As regards the separation of network management and generation it is believed that legal unbundling of network management is sufficient and at the same time crucial to guarantee transparent market access for DG to the energy and ancillary services markets. However, as we have not proposed detailed regulatory formulas we have not fully explored the limitations that legal unbundling may have for the penetration of DG.

2.2 Innovation

Regulation focuses mostly on bringing the cost down. This drive to cut cost, however, may cause cost to increase in the long run if insufficient investment in innovating the network infrastructure and management takes place. Because the revenues diminish over time the reward for innovation may also decrease, while the risk inherent in innovation projects remains high.

[6] Although the importance of TSO-DSO co-ordination was recognised in the SUSTELNET project, it has not been researched in much detail, as the project primarily focuses on DSO issues.

Hence there are little gains from investing in innovation, such as increased profits or increased market share. It is therefore argued that special regulatory arrangements should be made to allow DSOs to experiment with innovations that improve the standard of service to its customers and to allow financial reward if an innovation is successfully implemented. This would also allow DSOs to come up with innovative solutions for integrating DG in the network. In view of the above argument for ‘active’ DSOs innovations in the field of ICT are key. One potential example of how innovations can be incorporated in the regulatory framework may be the UK Power Zones. However, regulation on Power Zones has only recently been implemented and its success remains to be evaluated.

2.3 Network access

In economic terms network access is defined by connection charges. In order to establish a level playing field these connection charges should not discriminate between centralised and distributed generation. Furthermore, they should capture the benefits and cost associated with the connection of DG in an appropriate way. Finally, it is believed that the network has a public good nature and that therefore open access under fair conditions should always be ensured.

There are two principle ways of connection charging: (1) shallow charging, (2) deep charging. Under deep charging all the cost and benefits associated with the connection of a plant (such as grid reinforcements beyond the point of connection) are charged to the connecting generator, while under shallow charging only the direct cost of the connection from the plant to the network are charged. Shallow connection charges are more in line with the notion of the network as a public good. Moreover, they are easy to implement. Deep charges on the other hand are difficult to establish, because they require very precise knowledge on the *additional* short and long-term cost or benefits of a connection to the network, as well as clear rules on sharing these cost and benefits among the users of the system. An objective calculation and fair allocation of costs and benefits with deep charging is hard to establish. Shallow charges are therefore the preferred option in SUSTELNET. At the same time shallow charges allow a temporary tilting of the level playing field in favour of DG as discussed in section 1.3.

Localised incentives can be given to stimulate optimal siting of DG in the network. These localised incentives can be made to reflect the long-term cost and benefits of connections to the network. It is recommended that such a localised incentive is provided through an entry charge for delivering electricity to the network. However, it should be remarked that localised incentives in the electricity prices and network tariffs are only one of a broad range of local factors that determine the siting of a DG unit. Therefore the effectiveness of this instrument to induce investment in specific places while disincentivising investment in other places may be limited.

Not all benefits associated with DG have to be fully passed on to the DG operator, but enough for a DG investor to invest at a location where this can be beneficial to the system. Part of the benefit may be retained by the DSO. This provides an incentive to incorporate DG in the network planning and management in a creative way. Also part of the benefit may be passed on to the final electricity customers.

2.4 Market access

As stated above an ‘active’ DSO should facilitate market access for DG. The markets involved are both the wholesale power market and the ancillary services markets, such as balancing and reserve power, and reactive power and voltage support. In most regulatory systems the TSO is the single buyer of ancillary services at the transmission level. The DSOs are mandatory buyers of the services that the TSO has bought on their behalf. The cost of these ancillary services are passed on through the use of system charges. In the case of balancing power responsible parties are mandatory buyers of a balancing market operated by the TSO. DG often has no access to the balancing market. In order to allow for a more intelligent manner of managing the network and providing network services the following two regulatory changes are necessary with respect to market access issues:

1. Allow DSOs the flexibility to procure ancillary services from other sources than mandated centralised markets operated by the TSOs, e.g. from DG operators in their service territory.
2. Facilitate the direct participation of DG in ancillary services markets at the central level, such as balancing markets.

Within the current financial support schemes intermittent renewable electricity sources are often granted priority access. Also the new Electricity Directive explicitly creates the possibility to grant priority access to CHP and renewable electricity. Priority access may be an effective means of improving market access for renewables in the early stages of development. However, as the level of intermittent renewables in the generation mix increases the cost of such measures to the sector and ultimately the consumer also increases. At the same time priority access does not offer any incentives to reduce these balancing cost by mitigating intermittency and to develop and apply new technology that may reduce the intermittency. If in the long-run integration of intermittent renewables in the electricity system increases, it is considered necessary that renewables participate in the balancing market, first by having their imbalances settled in the balancing market and later – as controllability improves – as a possible provider of balancing power.

2.5 Locational signals

The benefits and cost of DG to the electricity system depend on the time and location of connection and generation. In order to maximise the benefits and minimise the cost, geographically differentiated incentives should be provided to DG operators. Incentives such as geographically differentiated entry charges that are set in relation with the long-term cost or benefits of a connection can be used to induce optimal siting. Although, as noted before, this is only one of the local factors in determining the location of DG investment. At the same time some type of congestion pricing, such as nodal spot pricing, can be used to stimulate optimal dispatch of DG in the short-run. Thus, through a combination of incentives of entry charges and congestion pricing both long and short-term signals can be given for optimal investment and network management.

2.6 Allocation of costs and benefits

Of course locational signals can only be given if some of the costs and benefits of generation at a point in the network can actually be measured and attributed to a single connection. The same applies to the value of ancillary services. Certain benefits cannot be established per individual generator. However, it can be established that a certain level of DG penetration can provide an overall measurable benefit to the network. In such cases a proxy incentive to DG can be established by the DSO that approximates the joint benefit of the sum of all DG up to a certain level. Thus a distinction should be made between the values that can be measured and monetarised at the individual plant level and those that can not.

As for the allocation of the benefits and cost through the various incentives proposed above, they could be shared between the DSO and the DG operator in such a way that the DG operator has sufficient incentive to invest and operate its plant in the most efficient manner and that the DSO has an incentive to integrate DG into its network planning and operations. This means that the full benefits or cost are not attributed to either the DG operator or DSO alone.

3 EU POLICY IN RELATION TO DISTRIBUTED GENERATION

EU policy in relation to DG is principally defined by the Electricity Directive (2003/54/EC), the Renewables Directive (2001/77/EC) and the CHP Directive (2004/8/EC). Furthermore, the current discussions on locational signals and entry charges at the TSO level in the Florence process have parallels with the kind of discussion that is needed in this regard at the DSO level. Below we discuss the extent to which the key findings of the SUSTELNET project are addressed in these directives and policy discussions and – if not - whether the issue should be addressed at the European level.

3.1 The role of DSOs

Although the definition and functions of DSOs are addressed in the Electricity Directive, the regulation that incentivises the delivery of these functions by DSOs is considered a matter of national discretion. It is appropriate that EU legislation focuses on the functionalities of DSOs in stead of trying to deal with the exact regulation of DSOs, as there is no standard format for DSO regulation that 'fits all'. Hence the provisions in the directives leave a lot of room for various ways of implementing regulation to ensure that the targeted DSO functions are provided. The SUSTELNET project concludes that DSO regulation should move in the direction of a multi-driver regulation, under which the DSO revenues are dependent on the performance measurement of a DSO with respect to a number of performance indicators. It would be advisable to monitor the effectiveness of different regulatory models in different Member States to ensure the market participation of DG and the degree to which multi-driver regulation is employed.

SUSTELNET also emphasizes the importance of legal unbundling as intended by the Electricity Directive. As the requirement of legal unbundling is already incorporated in the new Electricity Directive no additional measures are needed at the European level, except a close monitoring of the implementation of this provision.

3.2 Innovation

Stimulating innovation in the management of electricity networks through the design of regulatory schemes is primarily a national issue and accordingly it is not considered in the directives. However, in future amendments to the Electricity Directive it may be desirable to include a provision that links the necessity to advance network innovations to the functions of the DSO and TSO. Furthermore, it can be considered a regulator's task to provide an appropriate regulatory framework to stimulate network innovations. In addition, innovation and the diffusion of knowledge from innovations may be stimulated through the EU research programmes.

3.3 Network access

Network access for DG has a clear European dimension, as it directly impacts on the access of DG to the energy markets and thus the level of competition in the internal market. Moreover, if integrated in the electricity infrastructure and markets in a controllable way DG can contribute to security of supply by enhancing the reserve capacity. Thus the first step of providing access to the network is crucial.

While the RES and CHP directive focus on relatively short-term problems and cost of providing access for renewables and CHP to the network the SUSTELNET key findings are more linked to the long-term integration of DG in the electricity infrastructure and the joint optimisation of investment in networks and generation. To provide efficient long-term incentives shallow connection charges are recommended in combination with geographically differentiated entry charges. This is also in line with article 6-7 of the Electricity Directive, which requires that ‘when planning the development of the distribution network, energy efficiency/demand-side management measures and/or *distributed generation* that might supplant the need to upgrade or replace electricity capacity shall be considered by the distribution system operator’. A DSO can use entry charges to indicate where in the network it would want more DG to be connected, or alternatively where the cost of new connections would be high.

Of course entry charges can strongly impact the competition between generators. This is also the subject of current discussions on entry charges in the Florance process and is why this discussion should be broadened to include entry charges and locational signals on the distribution level.

3.4 Market access

The degree of market access for DG has several EU dimensions. First market access should be considered in conjunction with the entry charges for network access discussed above. Second, access to the electricity market is important. We recommend that some form of congestion pricing should be implemented both at the transmission and at the distribution level, preferably in the form of nodal spot prices. To ensure optimal dispatch of DG units they should at least have access to price information and they should have the security that their energy production or consumption is settled against these prices. The task of calculating and communicating nodal spot prices can be attributed to both TSOs and DSOs.

In the Electricity directive the provision of ancillary services to DSOs is considered a responsibility of the TSO. In order to allow DG to effectively participate in ancillary services markets it is necessary that they can participate in the ancillary services markets operated by the TSOs and that DSOs are given flexibility to purchase ancillary services from other sources than those dispatched by the TSO. The first option would require the TSO to extend its control to the distribution level, the second option would basically share the responsibility for the provision of ancillary services between TSOs and DSOs. This sharing or decentralising of responsibility is in line with the concept of active network management by DSOs as discussed before. Moreover article 14-5 of the Electricity Directive is going in this direction. It states that DSOs ‘shall procure the energy they use to cover energy losses and reserve capacity in their system according to transparent, non-discriminatory and market based procedures, whenever they have this function.’

As for the particular case of balancing and dispatching the Electricity Directive allows a Member State to require the transmission or distribution system operator to ‘give priority to generating installations using renewable energy sources or waste or producing combined heat and power.’ This means that these sources are exempted from their balancing duties and hence do not receive an incentive to reduce their intermittency. Up to a certain level this will not cause any problems in managing the network, but for the long-run integration of a significant share of DG and renewables in general into electricity systems the issue of intermittency and controllability in view of maintaining system balance has to be tackled. Therefore it is necessary that operators receive an incentive to reduce imbalances. Moreover, DG that is ‘controllable’ can be used to correct (local) imbalances by the DSO or TSO. In line with the provision on energy losses above and the concept of an ‘active DSO’ the DSO can also be made responsible for maintaining system balance within its service territory. This could result in the possibility for DSOs to purchase balancing power from DG units on their network or from the centralised balancing market operated by the TSO. While this option is acknowledged in article 6-6[7] of the

[7] Article 6 - Authorization procedure for new capacity

Electricity Directive it seems that this provision focuses primarily on ensuring that no conflicts of interest arise in the purchasing of balancing services, rather than giving direction to the opening up of ancillary services and balancing markets. Alternatively, the TSO and DSO could work together to provide access for DG to the supply side of the balancing market.

3.5 Locational signals

Locational signals in electricity pricing are currently discussed in the Florence process on the transmission level. This discussion distinguishes between two dimensions of locational pricing: 1) horizontal signals, referring to price differentiation per location on the same voltage level, and 2) vertical signals, referring to price differentiation between voltage levels. While the current discussion concentrates on the transmission level, we believe that it should also include the distribution level, in order to ensure an optimal dispatch of DG units.

3.6 Allocation of costs and benefits

The Renewables and CHP directive both contain highly similar provisions regarding the requirement to TSOs and DSOs to set up and publish objective, transparent and non-disciminatory rules relating to the bearing of costs of technical adaptations, such as grid connections and reinforcements. Similar provisions apply to rules relating to the sharing of the cost of system installations, such as grid connections and reinforcements, between all producers benefiting from them. Furthermore, article 23-1-f of the Electricity Directive stipulates that the regulatory authority in each Member State shall monitor the terms, conditions and tariffs for *connecting new pr*oducers for electricity to guarantee that these are objective, transparent and non-discriminatory, *in particular taking full account of the costs and benefits of the various renewable energy sources technologies, distributed generation and combined heat and power.* Thus, the Electricity Directive goes further than the Renewables Directive by requiring that the full costs and *benefits* are taken into account in establishing the connection charges. However, in the Directive no explicit rules are set as to the charging mechanisms and the sharing of the cost and benefits. In this sense the SUSTELNET recommendations can serve as a guideline for implementing the directive at the national level and for the monitoring thereof.

4 RECOMMENDATIONS FOR EU POLICY

Non-discriminatory network access is a key precondition to a level playing field between centralised and distributed generation. To ensure non-discriminatory access to the network for distributed generation connection charges should be based on shallow connection costs. The current EU directives contain no provisions on the prescription of shallow or deep connection charges in national electricity regulation. However, it is stated in various directives that non-discriminatory access to the network shall be given to all generators.

Open access to wholesale electricity markets for distributed generation is already granted by the Electricity, RES and CHP Directives. The scope of market access should be broadened to include ancillary services. These services can be provided through market-based methods from both centralised and distributed plants, but are currently mostly sourced from centralised generation by TSOs and passed on to the DSOs, while distributed generators cannot offer ancillary services to the DSOs. In particular services related to balancing and power quality such as, reliability, reactive power and voltage support should be considered in this respect. It is recommended that the markets for ancillary services are opened up to distributed generators and that DSOs are given more flexibility in sourcing these services to meet their service obligations to their connected customers.

The benefits and cost of distributed generation to the electricity system are directly related to the geographical point of connection. It is therefore considered fair that these costs and benefits are somehow reflected in the use of system charges and electricity pricing to the distributed generator. More specifically, locational signals that take into account long-run system costs and benefits should be incorporated in an entry charge on top of the shallow connection charge. This entry charge may be positive in the case of cost to the system, or negative in the case that DG entails benefits to the system. Furthermore, systems of nodal spot pricing should be implemented to provide correct local valuation of the energy delivered to the network.

To facilitate the integration of DG in electricity networks DSOs have to endorse ‘active network management’. This active network management entails investment in innovations to improve network management, in particular in the field of ICT. The current regulatory frameworks often do not allow for DSOs to recover the cost of investments in innovation. It is therefore recommended that the Electricity Directive is amended to grant authority to national regulators to create a regulatory framework that provides an effective and efficient environment for investment in innovations. In view of the required innovations in network management EU policies should also seek to stimulate the exchange of knowledge in the field of DSO incentivisation and innovation in distribution networks.