ELEP

european local electricity production

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WORK PACKAGE 4

Deliverable 4.3

Detailed policy recommendations identifying how the scope and wording of Directive 2002/91/EC can be widened to enable all DG and RES systems to be considered as a means of providing energy efficiency improvements to new and old buildings.

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Intelligent Energy Europe

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1. INTRODUCTION

The Directive 2002/91/EC of the European Parliament and of the Council on Energy Performance of Buildings (Buildings Directive) of 16th December 2002, recognises energy efficiency and demand management as important tools to act in improving energy performance of buildings.

The Buildings Directive also considers Distributed Generation (DG) solutions for building efficiency improvements, which is relevant for the DG market development. However, the scope and wording is not always making available the full potential and benefits of these technologies. For example, the Directive focuses only on CHP and "greener" technologies. However, several other DG solutions have the potential to offer benefits to the buildings' energy performance as well as to the overall electricity system when applied to or nearby buildings. The Directive also defines a minimum building size to be considered for the application of the energy performance requirements. These requirements are compulsory for new buildings with a useful floor area over 1000 m² and for existing buildings with a useful floor area over 1000 m² subject to renovation for an amount of more than 25% of the building's value. Such a limit excludes a significant part of the buildings stock in the European Union, particularly in the household sector, which is very representative.

The present report is part of the ELEP project Work Package 4 and aims at compiling recommendations in order to widen up the scope of the Buildings Directive in order to enable all DG and RES systems to be considered as a means of providing energy efficiency improvements to new and old buildings. It is a natural result from the analysis done in previous reports namely D4.1 and D4.2 from Work Package 4. The first aimed at making a detailed review of the Buildings Directive in light of the Distributed Generation issues and its deployment in EU. The second compiles a series of detailed case studies that were identified and were presented with the aim to demonstrate how DG technologies of different types could be applied in different buildings and in different conditions to improve energy efficiency and reduce global CO_2 emissions.

2. POLICY RECOMMENDATIONS REGARDING DIRECTIVE 2002/91/EC

Amendment of the Buildings Directive is foreseen within Article 11 of the Directive that should be done in light of the experience gained over its implementation in the Member States and based on the experience on the installation of the more "conventional" DG and RES applications as well as the new, highly efficient and promising DG technologies. In spite of the still very limited real-world application of these emerging DG technologies, the potential for energy efficiency improvements provided by these technologies in the future is substantial and was therefore considered in the previous WP4 analysis.

Within the Work package 4 of the ELEP Project a few actions were identified as ways of further DG and RES deployment within the building environment, and these are:

2.1 Centralised power generation efficiency – Methodology and reference values

Large power plants usually present higher power generation efficiencies than smaller power plants based on the same technology due to scale effects. However, large power plants are often operated at partial load, which has a negative impact on their electricity generation efficiencies and partially explains the differences found between their nominal efficiencies and their real operating efficiencies. Moreover, system and network losses usually account for more than 10% of the gross power generated in central power plants.

Considering that the positive influence that may be expected from the installation of DG solutions in buildings is strictly related with energy efficiency and consequent reduction of CO_2 emissions from electricity generation, the employment of correct evaluation methodologies and the comparison with realistic reference values (for instance regarding the referential centralised electricity generation) is crucial for a good evaluation of that DG positive influence. It is therefore of extreme importance not only to use an accurate methodology but also to consider well defined reference values, as for example for network transmission and distribution losses, that should be correctly chosen and considered when evaluating the impact of installing a certain DG solution in a certain building.

The current wording of Buildings Directive should be improved in order to provide more information and detail on the framework of the methodology for calculation of the energy performance of buildings, particularly in what respects to the evaluation of the influence of local electricity production by means DG solutions.

2.2 Existing buildings versus new buildings

There is the need recognised by several institutions and organisations working at European level to consider within the aim of the Directive existing buildings as well as new ones, namely covered by the dispositions of Article 5. It is necessary to raise the performance of existing buildings to a level that should be as close as possible to that of new buildings. In case of major renovations, cogeneration and renewable energy should also be examined.

The current wording of the Buildings Directive should be improved by including in Article 6 the same dispositions of Article 5. Member States shall ensure that the technical, environmental and economic feasibility of altenative systems such as:
- decentralised energy supply based on renewable energy or conventional energies,
- CHP
- district or block heating or cooling, if available,
- heat pumps, under certain conditions,
is considered and is taken into account before renovation.

2.3 Buildings size

The Buildings Directive defines a minimum indicative size to be considered for the application of these requirements. Requirements are compulsory for new buildings with a useful floor area over 1000 m² (*Article 5*) and for existing buildings with a useful floor area over 1000 m² subject to renovation for an amount of more than 25% of the building's value (*Article 6*). Member States would be allowed to include smaller buildings in their requirements but the minimal obligation only concerns buildings over the 1000 m² limit. In the household sector such a limit excludes an important part of the buildings stock in the European Union. Over a total EU-15 building stock of more than 20 billion m², single-family houses represent almost one half and multi family houses below 1000 m² represent about one sixth of the total. The limit of 1000 m² excludes thus significantly more than half of the buildings stock from the application of the Buildings Directive, which therefore considerably reduces the potential of energy savings through this Directive.
The case studies also demonstrated that considerable primary energy and CO_2 emissions' savings can also be obtained by deploying DG solutions in buildings below 1.000 m^2.

The current wording of the Buildings Directive should be improved by lowering the indicative size to be considered for the application of the requirements of the Directive over 200 m^2 both for new and existing buildings using a simplified calculation method.

2.4 Distributed Generation Solutions

The Buildings Directive enforces the need for considering some DG solutions for building efficiency improvements, focusing only on CHP and “greener” technologies. However, several other DG solutions have the potential to offer benefits to the buildings’ energy performance as well as to the electricity system as a whole when applied to or nearby buildings, but these solutions are being neglected in the current scope of the Directive. The case of boiler replacement or retrofit should also incentive the assessment of CHP or renewable energy use, of course under a cost-effective perspective.

Furthermore, DG solutions may provide other important services beyond energy supply. The concept of DG refers to electricity generation at or nearby the site of its final consumption, using small scale systems interconnected to or isolated from the electricity distribution systems, regardless of the technology used. There are multiple applications and services that can be provided by DG solutions when applied to or nearby buildings. These applications and services include those resumed in table 1.

Many of these technologies are nowadays available in the market, while others are emerging technologies, which are still in an early stage of commercialisation or still under development. The DG technologies can be classified according to the source of energy used or the energy conversion process in which they are based.

Renewable energy based DG technologies include solar photovoltaic, wind energy converters, reciprocating internal combustion engines, steam turbines, gas turbines and Stirling engines. Among these technologies, steam turbines and Stirling engines present the particular characteristic of using external heat sources, which gives them very high energy source flexibility, being able, for example, to produce electricity from solar thermal energy, biomass or biogas.

In what concerns emerging technologies, these include, among others, fuel cells stacks, fuel cell / gas turbine hybrid systems and combined gas turbine / organic Rankine cycle systems, which offer the potential to significantly increase the efficiency and reduce the environmental impact of electricity generation from renewable or fossil energy sources.

Table 1 – Applications and Services Provided by Distributed Generation (GRI, USA, 1999)

Services Provided	Combined Heat and Power	Standby Power	Peak-Shaving	Grid Support	Stand Alone
Energy	Simultaneous production of electricity and useful heat provides low cost energy to customers	Energy production is minimal and a small part of overall value	Provides alternative to high cost peak period energy	Reduces line losses, can be important in remote or congested parts of the T&D system	Must provide customer full requirements
Capacity	Provides capacity when running	Customer reserve capacity	Avoids high peak period system capacity costs	Can help to avoid T&D capacity constraints	Must provide customer full requirements
System Reserve	If the system is running at full load, by definition there is no reserve	Possible extension of current applications, but not part of most current standby systems	Could provide spinning and standby reserve during off-peak periods	Could provide spinning and standby reserve during off-peak periods	Must provide customer full requirements
Reliability	Systems are generally as reliable or more than individual utility generators. Synchronous generators increase customer reliability by 90+% but don't contribute materially to system reliability	The primary purpose of these systems is to approach 100% reliability for health and safety reasons and to avoid economic losses from grid power outages	Increases customer reliability and can be part of a utility program to reduce shortage based outages	Increases reliability due to supply shortages, T&D constraints, and storm related outages	Must provide customer full requirements
Power Quality	Provides customer some protection from grid problems; can be part of a premium quality customer system	Not a primary issue but can be part of a premium quality customer system	May help customer to avoid voltage sags and brownouts that occur during system emergencies	Can be used for power factor correction and voltage support	Must provide customer full requirements
Back-up Service	For every 1% drop in generator availability, the system requires 87 hours of back-up service. Back-up for maintenance during off-peak periods, but forced outages can occur anytime	The system is the back-up service so separate back-up service is not required	Peak-shaving can be an extension of back-up service	Grid support enhances T&D system in general, not specific to back-up service	Must provide customer full requirements

The DG solutions currently included in the scope of the Directive present very important benefits to the building's energy performance, but other DG solutions that carry the potential of further benefits should not be neglected, especially in those cases where no economic feasibility exists for the deployment of CHP or renewables-based Distributed Generation. The "technology constrain" imposed by the Buildings Directive seems to limit the potential of energy savings in comparison with the wider potential offered by alternative energy systems integrated in buildings.

The case studies developed in this Work Package demonstrated that considerable primary energy and CO_2 emissions' savings can be obtained by deploying different types of DG technologies.

The wording of the Buildings Directive should be improved by including not only renewable energy source or combined heat and power types of DG systems, but also conventional and emerging technologies, operating in different generation modes.

3. OTHER ISSUES

3.1 Local Impact of Emissions from Distributed Generation

While the Buildings Directive enforces Member States to adopt methodologies in order to evaluate the positive influence of integrating electricity systems based on renewable energy sources and CHP in or nearby buildings, there is no expressed concern regarding the local impact that the emissions from these last systems may have in urban environments. Nevertheless, several EU countries have already specific emissions regulations for CHP units, even for small size plants (e.g. Germany and Switzerland).

A rapid growth in the penetration and deployment of DG solutions is predicted by many energy specialists around the world, but only recently researchers and regulators started to assess the significance of this expansion with regard to local air quality and public health in urban areas.

Based on the findings of a study recently carried out by the University of California Energy Institute, which assumes that the most mature DG technologies (i.e. the combustion-based ones) will capture much of the early market, there is reason to caution against local impact of emissions from these types of DG technologies, due to the increased exposure potential these units present.

Therefore, in order to be protective of public health, the potential for increased exposures should be considered if air pollutant-emitting DG technologies are sited in densely populated areas. This consideration would be especially relevant during a Buildings Directive review as well as of emissions standards review.

3.2 Other Energy policy measures

Beyond the already proposed amendments there is a set of different policy measures and mechanisms that can be encouraged **within the objectives of the Buildings Directive**, and could therefore be considered in a future revision. These mechanisms, described below, would also contribute to place in evidence the benefits provided by DG when applied in buildings.

White certificates

Energy efficiency certificates (currently known by white certificates) are a market based instrument used to promote the implementation of energy efficiency measures and to give a market value to be tradable. Energy suppliers have to support and implement energy efficiency actions. White certificates could also be bought by the utilities from others who exceed their target. Examples of measures that could be used to achieve targets are the interventions in insulation, heating, lighting and appliances. It is believed that white certificates promote more cost effective delivery of energy efficiency and could also promote associated sustainable energy technologies as DG systems.

In this order, DG could be an important tool towards the achievement of energy savings and increasing energy efficiency through white certificates. However targets, mechanisms and incentives would have to be created and the market for energy services developed at Member-States level.

Financing and fiscal instruments

Several studies and analysis refer that the Buildings Directive does not give sufficient incentives to the implementation of energy efficiency measures in buildings besides the regulatory and certification framework. The refurbishment programmes as well as the implementation of DG technologies could be supported by reduced interest rates on loans and subsidies.

However a careful programme of implementation of these should be put in place in order not to distort the supply side technologies and the quality of services. Moreover, value added tax should be lowered to a minimum value for products that increase energy efficiency in buildings or serve as a carrier of renewable energy.

The creation of specific public revolving funds for the implementation of DG technologies could be another option for the promotion of actions in the refurbishment of the buildings sector. Other financial incentives such as the increase of rental fees by landlords up to a certain maximum after energy efficiency refurbishments are done.

Energy services

There are energy services companies (“ESCOs”) that supply energy efficiency solutions and are then getting paid by the energy savings achieved. These companies may act on simply reducing energy consumption, on passive solutions or in the implementation of efficient energy technologies, such as DG projects. As these companies are still in an early stage of development in Europe, they still require policy support either in the form of dissemination of their activities,

development of quality standards, and access to finance. The further development of the ESCO industry could greatly contribute to the implementation of many additional DG cost-effective projects, and can play an important role in demand side management. An improved relationship between the Buildings Directive and the Directive on Energy End-use Efficiency and Energy Services is envisaged.

Application of mandatory standards

The creation and application of mandatory standards namely in what concerns the subjects related to DG is an urgent and necessary work. CEN is leading several working groups for the development of standards related to the Buildings Directive, however it should be guaranteed that energy efficient technologies as well as small-scale renewable energies are covered in this work.

The main topic areas developed under the European Buildings Directive Platform are the following:

- Standards dealing with heating and cooling,
- Standards dealing with lighting,
- Standards dealing with thermal insulation and energy calculation,
- Standards dealing with ventilation in buildings, and
- Standards dealing with control.

Under none of these issues is specifically addressed DG.

The standardization of the connection charging to the grid and related administrative procedures, as studied under the ELEP project should be strongly supported, in order to avoid lack of use of these technologies by means of the bureaucratic heavy burden.

4. CONCLUSIONS

Under the principle of Subsidiarity, the Buildings Directive enforces every Member State to define minimum requirements on the energy performance of buildings enabling each Member State to have different requirements for new and existing buildings and for different types of buildings. Those requirements must of course take into account the outdoor conditions, which vary considerably from one country to another within the European Union. This is the main reason why the Directive leaves the precise definition of the technical requirements to the decision of each Member State. Nevertheless a revision of the current scope of the Buildings Directive done under the current project revealed that its scope is still limited in order to encourage the full deployment of DG technologies and solutions. The current scope of the Buildings Directive is not fully taking into consideration the buildings' energy performance benefits that can be provided by DG

solutions beyond those based on CHP and renewable energy sources, and the size of buildings within the scope of this Directive, and should therefore be revised and widened up to better capture the potential benefits of DG solutions.

5. REFERENCES

Reports

[1] ELEP - Deliverable 4.1: Detailed review of the 2002/91/EC Directive focusing on identifying the current scope for deploying generic Distributed Generation solutions for energy efficiency improvement in new buildings. May 2006.

[2] ELEP - Deliverable 4.2: Case studies detailing the improvements that can be made in energy efficiency and emissions terms in new and old buildings through DG deployment. February 2007.

Legislation

[3] Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.

[4] Directive 2006/32/EC of the European Parliament and of the Council of 5th April 2006 on energy end-use efficiency and energy services.

Web sites

[5] EBPD Buildings Platform – www.buildingsplatform.org