

Contract EIE/04/175/S07.38664

ELEP – European Local Electricity Production

WORK PACKAGE 4

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

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11th of May 2006



Supported by the
European Commission under the
Intelligent Energy - Europe
Programme

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1. SUMMARY OF OBJECTIVES AND CONTENTS OF DIRECTIVE 2002/91/EC

1.1. 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, came into force on 4th January 2003. According to the principles of Subsidiarity at Community Level, the basis of this Directive are established but the detailed implementation should be left to member States to adapt to their particular situation.

The Buildings Directive addresses the main fact that both residential and tertiary sector of the EU, most of which are buildings (approximately 160 million buildings) account for more than 40% of final energy consumption, and expanding, which brings special concerns over the issues of environmental protection, the use of fossil fuels, and the carbon dioxide emissions. Under the burden sharing agreements of the Kyoto Protocol, the EU is responsible to reduce and control its CO₂ emissions and this Directive is intended to serve as a tool to comply with this commitment. The implementation of the Buildings Directive, as from 2006, will permit a gain estimated at some 41 Mtoe (Megatons of oil equivalent) between now and 2020¹.

In its Preamble, the Buildings Directive recognises energy efficiency and demand management as important tools to act in improving energy performance of buildings. Passive strategies should also be given priority in order to enhance thermal performance of buildings, especially in the Summer period. Moreover, heating, cooling and ventilation installations should be designed and built in such a way that the amount of energy required would be low.

As umbrella methodology, the Buildings Directive promotes acting over buildings to be renovated as well as in new buildings above certain size and establishes a common approach that includes thermal insulation, lighting, heating, cooling, application of renewable energies and the design of the building. Qualified or accredited independent experts are foreseen to assess the proposed solutions to enhance energy performance and issue energy certificates.

Developing a EU common approach to energy certification will not only contribute to development of benchmarks but also 'introduce transparency for prospective owners or users with regard to energy performance in the Community property market'. This will also allow making more valid comparative assessments of running costs of likely buildings within the EU.

The objective of this paper is to make a detailed review of the Buildings Directive in light of the Distributed Generation (DG) issues and its deployment in EU. In this order, a thorough analysis of

¹ Green Paper on Energy Efficiency

the Buildings Directive covered issues and structure as well as an overview of the current status of transposition of the Directive in the Member States is done. Then it is discussed and analysed the complementary measures and initiatives taken on behalf of the European Commission in line with the promotion and creation of conditions for DG implementation. Finally, comments on the scope and possible arms of amendment of the Buildings Directive are discussed, both in technology and energy policy terms.

1.2. Objective (Article 1)

The objective of the Buildings Directive is to lay down the following requirements:

- (a) a methodology for calculating the integrated energy performance of buildings;
- (b) minimum requirements on the energy performance of buildings;
- (c) minimum requirements on the energy performance of large existing buildings being renovated;
- (d) energy certification of buildings;
- (e) regular inspection of boilers and of air conditioners.

1.3. Adoption of a Methodology (Article 3)

This article requires that every Member State Government applies a methodology which calculates the energy performance of buildings. These calculations shall include at least the following aspects:

- (a) thermal characteristics of the building (shell and internal partitions, etc.). These characteristics may also include air-tightness;
- (b) heating installation and hot water supply, including their insulation characteristics;
- (c) air-conditioning installation;
- (d) ventilation;
- (e) built-in lighting installation (mainly the non-residential sector);
- (f) position and orientation of buildings, including outdoor climate;
- (g) passive solar systems and solar protection;
- (h) natural ventilation;
- (i) indoor climatic conditions, including the designed indoor climate.

The positive influence of the following aspects shall, where relevant in this calculation, be taken into account:

- (a) active solar systems and other heating and electricity systems based on renewable energy sources;

- (b) electricity produced by CHP;
- (c) district or block heating and cooling systems;
- (d) natural lighting.

For the purpose of this calculation buildings should be adequately classified into categories such as:

- (a) single-family houses of different types;
- (b) apartment blocks;
- (c) offices;
- (d) education buildings;
- (e) hospitals;
- (f) hotels and restaurants;
- (g) sports facilities;
- (h) wholesale and retail trade services buildings;
- (i) other types of energy-consuming buildings.

This methodology is set either at national or regional level. The energy performance of a building should be expressed in a transparent manner and may include a CO₂ emission indicator.

1.4. Setting of energy performance requirements (Article 4)

Minimum energy performance of buildings requirements should be based on the methodology of the Buildings Directive. These requirements should take into account general indoor climate conditions, in order to avoid possible negative effects such as inadequate ventilation, as well as local conditions and the designated function and the age of the building.

When setting requirements, governments may differentiate between new and existing buildings, and different categories of buildings. These requirements must be reviewed at least every five years, and updated to reflect technical progress.

The following categories of buildings may not be subject to the requirements set:

- buildings and monuments officially protected for their historical or architectural merit;
- buildings used as places of worship and for religious activities;
- temporary buildings with a planned time of use less than 2 years
- industrial sites;
- workshops and non-residential agricultural buildings covered by a national sectoral agreement on energy performance;
- residential buildings which are intended to be used less than 4 months of the year;

- Stand-alone buildings with a total useful floor area of less than 50m².

1.5. New buildings and existing buildings (Article 5 and Article 6)

For new buildings with a total useful floor area over 1000 m², Member States shall ensure that the technical, environmental and economic feasibility of alternative systems such as:

- decentralised energy supply systems based on renewable energy,
- CHP,
- district or block heating or cooling, if available,
- heat pumps, under certain conditions, are considered and are taken into account before construction starts in accordance with national rules.

Existing buildings with a useful floor area over 1000m² that undergo major renovation their energy performance should be upgraded in order to meet the minimum requirements (set in accordance with Article 4), so far as it is technically, functionally and economically feasible. The requirements may be set either for the renovated building as a whole or for the renovated systems or components when these are part of a renovation to be carried out within a limited time period.

1.6. Energy performance certificates (Article 7)

Whenever a building is constructed, sold or rented out, an energy performance certificate should be made available. This can be to the owner or by the owner to the buyer or tenant. This certificate shall not be older than 10 years.

For apartments or units designed for separate use, certification may be based either on a common certification of the whole building for blocks with a common heating system, or on the assessment of another representative apartment in the same block.

In order to make possible for consumers to compare and assess the energy performance of different buildings, the energy performance certificate shall include the reference values such as current legal standards and benchmarks. The certificate shall be accompanied by recommendations for the cost-effective improvement of the energy performance.

The objective of the certificates shall be limited to the provision of information. Any effects of these certificates in terms of legal proceedings shall be decided in accordance with national legislation.

For buildings with a useful floor area over 1000m² used by public authorities or by institutions providing public services, an energy certificate, not older than 10 years, is placed in a prominent

place clearly visible to the public. In addition the range of recommended and current indoor temperatures and other relevant climatic factors may also be clearly displayed.

1.7. Inspection of boilers and air conditionings (Article 8 and Article 9)

In order to reduce energy consumption, governments have two options. The first option is to set regular inspection of boilers fired by non-renewable liquid or solid fuel of an effective rated output of 20 kW to 100 kW. Such inspection may also be applied to boilers using other fuels. Boilers of an effective rated output of more than 100 kW shall be inspected at least once every two years. For gas boilers, this period may be extended to four years.

Measures to a one-off inspection of the whole heating installation should be established for systems with boilers with a rated output of more than 20 kW and older than 15 years. This must include an assessment of the boiler efficiency and size compared to the heating requirements of the building. Advice must be provided to the users on the replacement of the boilers, other modifications to the heating system and on alternative solutions.

The second option is for governments to ensure that there is adequate provision of advice to users on the replacement of the boilers, other modifications to the heating system and on alternative solutions, which may include assessment of the efficiency and appropriate size of the boiler. No regular time scale is required for such advice. However, if governments do choose this means of complying, they have to produce a report every two years showing how this achieves as much as implementing this Article under the first option given.

Governments must establish regular inspections of all air conditioning systems with an effective rated output of more than 12 kW. These inspections must include an assessment of the efficiency and sizing of the air conditioning, compared to the cooling requirements of the building.

1.8. Independent experts (Article 10)

Governments must ensure that certification of buildings, the drafting of the accompanying recommendations and the inspection of boilers and air conditioning systems are carried out in an independent manner. This work must be done by qualified and/or accredited experts, whether operating as sole traders or employed by public or private enterprise bodies.

2. CURRENT STATUS

2.1. Transposition into National Laws of Member States

Member States should have brought into force the laws, regulations and administrative provisions necessary to comply with this Directive until last January 4th 2006. In the cases where there is a lack of qualified and/or accredited experts, Member States may have an additional period of three years to implement this Directive.

2.2. European Building Performance Directive Concerted Action

The Buildings Directive poses significant difficulties to the Member States in terms of the practical details of the transposition, which needed to be overcome. The European Commission has consequently established an initiative aiming at harmonisation of procedures on a voluntary basis. This initiative takes the form of a Concerted Action (CA), which has the objective of promoting the dialogue between the Member States.

Within the global objective consisting in sharing the information and experiences between countries, the program has the following specific objectives:

- To discuss and to prepare a structure for the energy certification of buildings to maximize similarities and reduce the range of different options selected by the MS;
- To discuss and prepare a coherent basis for the methodologies for inspection of heating boilers and air-conditioning equipment;
- To discuss and prepare ways to implement adequate schemes for accreditation of energy audit and inspection experts in Member States;
- To discuss criteria for the implementation of common methodologies for calculation of the energy performance of buildings.

To reach this goal, the Concerted Action is structured on four working groups, related to these four core themes:

Theme 1: Certification of buildings

Theme 2: Inspection of boilers and air-conditioning systems

Theme 3: Procedural aspects for energy performance characterisation

Theme 4: Specifications and training requirements for experts and inspectors

The Concerted Action working plan is being developed between January 2005 and June 2007. It congregates participants from 25 countries: 23 Member States, Bulgaria and Norway. Czech

Republic, Luxemburg and Malta are not participating. The participants are national governmental ministries or governmental affiliated institutions that are in charge of preparing the technical, legal and administrative framework for the transposition of the Buildings Directive in their own country.

2.3. Review of progress

The Buildings Directive requires the implementation of a set of measures, which are promoting the revision of the buildings regulations of each EU countries, putting in place a robust certification scheme and the necessary arrangements for it to become operative in all public buildings, as well as private buildings visited by the public.

According to the coordinator of the Concerted Action it was clear since the beginning that most Member States were facing a serious challenge and many difficulties to transpose and implement the Buildings Directive. The status of implementation on the deadline day for transposition, 4th January 2006, is quite disappointing, as only a few member States have already developed their framework of implementation. With almost no fieldwork on certification and inspections expected during 2006, it will be difficult to learn lessons and have ideas for the future.

By 4th January 2006 only nine countries had notified the European Commission on the state of transposition of the Directive. And these were:

- Belgium that has partly transposed;
- Denmark;
- Germany;
- Italy – that is not going to respect the Directive except for new buildings;
- Lithuania;
- Latvia;
- Austria (partially);
- Poland, and
- Slovak Republic.

All the remaining countries haven't provided EU a formal report on the status of implementation².

Bellow is described the status of the implementation of the Buildings Directive at national level in Member States where some steps were already taken (information taken from the Buildings Directive Concerted Action web site on 11th May 2006, based on the *webzines* issued monthly between April 2005 and April 2006):

² Source: oral conversation with a member of the Buildings Directive Concerted Action.

▪ **France**

Enhancement of requirements for new buildings refers to the solid experience of the French calculation method that has been implemented since 2000. Its fitting to the annex of the European directive is planned for the 2nd semester of 2005.

Approach for existing buildings consists of two stages. First, we will set up the following rule: construction elements shall be replaced by energy efficient products. Next year, a current study of characterisation of energy retrofittings for a typology of existing dwellings will provide us with conclusions helping us to create a regulation for larger retrofittings, as planned by the directive. The difficulty is to keep it simple but regulate quickly.

For energy certificates, the French law was adopted in 2004. Further laws for implementation are currently being discussed by the French parliament.

▪ **Cyprus**

On April 1st 2005, the Ministry of Commerce, Industry and Tourism applied for technical assistance to TAIEX for the implementation of the Buildings Directive.

The authority chosen to provide the assistance to the Government of Cyprus is ADENE the Portuguese Energy Agency. The topics that will be examined during the visit are the following:

- *Advice on the transposition of Buildings Directive into national legislation and on the selection of critical parameters that best suit local conditions from among a range of different options available in BUILDINGS DIRECTIVE;*
- *Advice on the methodology (or methodologies) needed for calculating the energy performance of new and/or existing residential and non-residential buildings and evaluating different associated software and the identification of the parameters that have to be adjusted to local climatic conditions and building practices;*
- *Practical training on the use of the Portuguese software (or other appropriate software) for calculating the energy performance of buildings. Use of the software for actual calculations for typical Cypriot residential and non-residential buildings.*
- *Advice on the setting of minimum energy performance requirements for the various categories of buildings in Cyprus;*
- *Assessment of the various EN or prEN standards developed by CEN in order to facilitate the implementation of Buildings Directive. Interrelation of these standards with existing methodologies.*

The meetings will be held between the 2 experts and Energy Officers from the Ministry of Commerce, Industry and Tourism and the Cyprus Institute of Energy. Meetings with various subcommittees that work on each topic have also been planned.

▪ **Denmark**

On 16 June 2005, the Danish Parliament unanimously approved a new law on Energy Savings in Buildings. The law will implement the requirements in articles 7, 8, 9 and 10 in the Buildings Directive (articles concerning certification, inspection & experts).

On many points, the new law will go further than the minimum requirements in the directive and will require regular energy labelling of all public buildings every 5 years, regular energy labelling of all large buildings (more than 1.000 m² gross area) for trade and services as well as large blocks with flats. For building and apartment for sale or rent the energy labelling will only be valid for 5 years. Energy labelling will include inspection, certification and advising. For new buildings inspection and certification will be used to ensure fulfilment of building codes.

All oil boilers will be regular inspected every one or two year and all heating systems will be included in the 15-year inspection, regardless of the size of the boiler.

On 17 June 2005, new Energy Requirements were published for both the Buildings Regulations for Small Houses and for the General Building Regulations.

The new Requirements will implement articles 3, 4, 5 and 6 in the Buildings Directive (articles concerning methodology, requirements, new buildings & existing buildings).

The new requirements will come into force by 1 of January 2006 and will be based on a new method for calculation of energy performance in buildings. The requirements will reduce energy consumption by 25-30 % in new buildings and will set requirements for larger renovations and improvements in all buildings. Along with the new requirements new Low Energy Classes on 75 % and 50 % of general energy consumption will be introduced as well. All new buildings have to be labelled to ensure fulfilment of the requirements.

▪ **Greece**

Considerable work, towards the calculation and certification of energy performance of buildings, has been completed in Greece over the past six years.

The national compliance act with the SAVE 93/76 Directive (i.e. the JMD 21475/4707/1998) had instituted:

- *The elaboration of a new Regulation for Energy Efficiency in Buildings, which has been already drafted (KOXEE, 2003),*
- *The implementation of energy auditing activities for buildings, according to another act, the Regulation for Energy Audits, issued in 1999. Furthermore, the authorisation process for potential energy auditors has been prescribed to form a separate legal act .*

The above framework is pending minor upgrading, review and official approval by the governmental authorities, to follow the mandates of Buildings Directive and is expected to be contained within the forthcoming national legislation of compliance with the Directive.

Within the framework of the Buildings Directive implementation, the Ministry of Development has formed a committee having as tasks to steer the application of the Directive issues, to produce and assess supporting regulatory documentation and to make summary proposals to the government in order to structure the new legal system of compliance with Buildings Directive. During regular weekly meetings the committee analyses topics of performance calculation methodology, energy certification procedures and energy experts-auditors-HVAC equipment inspectors.

▪ **Finland**

Three working groups published their drafts on the new legislation for implementing the Buildings Directive on 14 June 2005. The proposals are open for public consultation until August 22.

The drafts include amendments to the existing Land Use and Building Act. More detailed building regulations for describing the calculation methodology and levels of energy performance requirements will be given in Finland's National Building Code. According to the draft law on energy certification, all building owners, except those of buildings mentioned in Article 4.3 of the Buildings Directive, should have an energy certificate that is no more than 10 years old, at the time of construction, sale or rent of a building.

Existing public, office and retail buildings, apartment buildings and single-family houses will have different transition periods. If a building has had an energy audit within the 10 years before the commencement date of the certificate obligation, the audit report will replace the certificate. A voluntary approach is suggested instead of mandatory boiler inspection. Air-conditioning systems must be inspected every 10 years.

- **Germany**

On July 8th 2005 the German Federal Council approved the changing of the Energy Saving Law. This smoothed the way for the amendment of the Energy Saving Ordinance that is needed for the complete implementation of the Buildings Directive in Germany. The Energy Saving Law authorises the Federal Government to adopt ordinances concerning energy saving measures such as the Energy Saving Ordinance (EnEV) that for example regulates the maximum energy consumption of buildings.

The existing EnEV, which was introduced in 2002 and amended in parts in 2004, already covered many requirements of the Buildings Directive such as a holistic approach that considered building construction as well as technical systems. The amendment of the EnEV will introduce energy certification for existing buildings, regulations on energy efficiency of air-conditioning systems and lighting and meet all requirements of the Buildings Directive. For non-residential buildings, the new EnEV will refer to the new German standard DIN V 18599 for the calculation method.

- **Sweden**

The Government decided on 9th February 2006 to refer the proposed law to the Council on Legislation (Lagrådet), which will ensure that it does not conflict with existing legislation. After approval from the Council, the Government Bill will be presented to the Parliament, and the approval to become an Act is expected to happen during the summer. Complementary directions and regulations will define the rules regarding the content of the declaration as well as the requirements for the energy experts. The Act is expected to enter into force by 1st October 2006.

Regarding its content, the proposal follows most of the suggestions made by the two State Public Inquiries reported in previous editions of the webzine. The most relevant difference introduced in the proposed law is the inclusion of indoor environment aspects, as made evident by the title of the proposed law. According to the new proposal, the energy certificate will also inform if the obligatory ventilation control inspection has been performed and if the radon content has been measured.

In order to cope with the lack of certified independent energy experts, the full implementation of the Buildings Directive will be done in the following progressive way:

- *All “special buildings”, e.g. buildings where public services are provided or that have many visitors, with more than 1000 m², and multi-family residential buildings are required to be certified by the 31st December 2008;*
- *Certification of all buildings will be mandatory from 1st January 2009 whenever buildings are constructed, sold or rented out;*
- *Inspection of air-conditioning systems will start on 1st January 2009.*

- **Bulgaria**

The process of certification of buildings aims at the evaluation and assurance of building relevance to the regulatory requirements for energy efficiency as well as to the implementation of energy saving measures for improvement of energy performance of buildings.

The scope of ECB consists of:

- *Rules and conditions for certification of buildings for energy efficiency;*
- *Two Categories of Certificates;*
- *Requirements for Certificate contents;*
- *Control over the activity of buildings' certification.*

Since March, 2005 a new regulatory instrument that defines technical requirements for energy conservation and heat retention in buildings was enforced. The ordinance includes methodology for defining annual energy consumption, taking into account: heat losses through the building structures and windows, heat gains of internal source and solar radiation, climatic data, and other specific requirements for buildings, etc.

- **Italy**

On August 19th 2005, the Legislative Decree providing the national transposition of Buildings Directive rules in Italy was signed by the President of the Republic. This signature followed technical consultation of Regional and National Government representatives and parliamentary approval on some specific aspects. The text provides new requirements for building performance and gives the government 120 days to provide regulations on new methods for determining such performance. The main simplification introduced is that certification will be required for all new buildings and for those submitted to major renovation also in case of rental or sale, excluding the other existing buildings.

- **United Kingdom**

The Government announced on March 9 that it will strengthen the Code for Sustainable Homes alongside the introduction of new tougher building regulations, in order to address climate change.

Ministers have approved new building regulations which set mandatory standards that every new home must meet. The regulations, which will come into effect on 6 April, raise the energy efficiency of new buildings by 40 per cent, compared to 2002. They will also improve compliance by introducing air pressure testing for new buildings.

In addition, energy efficiency ratings - which form one component of the Code - will be made mandatory for new homes and existing homes. The ratings will be included in energy performance certificates set out to EU standards.

- **Latvia**

The law on the energy performance of buildings will be the framework law for implementation of the Directive 2002/91/EC, but the Regulations of the Cabinet of Ministers will integrate CEN standards and provide detailed methodology, energy classes, certification procedures for buildings and independent experts.

Current energy performance requirements for the design of building elements for new and renovated buildings are defined in the Latvian Building Code LBN 002-01 "Heat Engineering of the envelopes of buildings" which entered into force on 1st January 2003. The regulation defines thermal resistance values to be used for calculating heat loss of buildings.

- **Slovak Republic**

The new law was approved by Parliament on 8 November 2005 and will enter into effect on 1 January 2006, with full application as of 1 January 2008.

- **Belgium (Flemish Region)**

Since the 1st of January 2006, every building application for the creation of new buildings which are heated or cooled for people (living, working ...) has to satisfy the energy performance and indoor climate conditions requirements and new procedures. This means that a reporter has to be appointed prior to execution. This person calculates the energy performance (E-level) of the building after finalisation and submits this proof that the building is in order with the regulation six months after commissioning. The energy performance certificate is also prepared at the same time.

▪ **Hungary:**

The planned structure of the Regulation in Hungary consists of:

- *Governmental order (framework);*
- *Ministerial orders (State Office of Housing and Building - general rules of design and certification & Ministry of Economy and Transport - boilers and AC inspection);*

Annexes: Calculation methods, Conventional input data, Requirements and Certification methods. This structure facilitates the easy and flexible updating of the methods and requirements.

The above-listed Annexes are ready and published. Their drafts were presented in January 2005 for open discussion, the complete material was published and discussed by a considerable number of professionals in September, by the end of October the material was available and the State Office of Housing and Building collected the comments. After having evaluated the feedback, the final version was published in November. Nevertheless, these annexes cannot enter into force without the orders. The drafts of the orders were being circulated among all Ministries and relevant bodies since May 2005, however no consensus has yet been reached.

▪ **The Netherlands**

The Netherlands is to take a decision soon on how to implement the remaining obligations from the EU Directive on the energy performance of buildings. It will then become clear how and when energy certificates for buildings and inspections of certain central-heating boilers and air-conditioning units are to be implemented. The Directive is intended to lead to improved energy performance of the buildings in the European Union. Minister Dekker of Housing, Spatial Planning and the Environment has informed the European Commission to this effect in a letter.

▪ **Portugal**

The new building regulations, approved January 26, 2006 by the Council of Ministers, have been endorsed by the President and published in the Official Journal on April 4, 2006. The new Regulations thus come into effect on July 3, 2006, for every new building license requested after that date.

Certificates for new Buildings and major renovations only become required after January 1, 2007. The details about how Certification will be implemented must be set by 3 December 2006. ADENE, the Portuguese Energy Agency, will be in charge of the Certification System and is currently preparing the required regulations.

▪ **Poland**

Some existing regulations have been indicated as a partly implementing Directive and a set of new regulations projects as a complete transposition of Directives have been posted on the ministry's web site for public consultations.

The founding higher rank act it is a project of the Parliamentary Act on energy assessment system of buildings and on inspections of some installations within a scope of energy efficiency. There are ongoing formal public and inter-ministerial consultations.

After the broad consultations, the Council of Ministries shall accept the final versions of regulation at the beginning of June, and will designate it to Parliament for further procedures. The forecasted date of the President's signature is August 2006.

Predicted completion of works on secondary legislation - August 2006.

Predicted date of starting the implementation of assessment system - September 2006

From the information available shown above it is clear that still many Member States are lagging behind in what concerns the implementation of the Directive. Moreover, from what is understood from oral discussion the application of Article 5 is not a nuclear subject of the transposition of the Directive.

A further analysis of the state of transposition of the Buildings Directive could be possible in the near future as the European Commission has recently created "The building platform", an initiative that should make available updated information on the Directive implementation in the Member States as well as to give technical support to the European Commission under this subject.

3. RELATIONSHIP WITH OTHER DIRECTIVES AND OTHER EU INITIATIVES

There is several criticism on the Buildings Directive as it is not focused enough, leaves out an important share of buildings, does not sufficiently promote the use of renewable energies, etc. These arguments will be analysed further ahead in this document. However, there are a group of European Directives already adopted and still to be adopted, as well as other initiatives that have a close relationship with the area of intervention of the Buildings Directive. It is considered that a thorough analysis of these instruments could give a clearer view of the current initiatives taken at European level and to better assess the grounds on where the BUILDINGS DIRECTIVE could be further amended and/or improved.

3.1. Renewable Energy Directive

The Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market aims at doubling the proportion of renewable energy from 6% to 12% of primary energy supply in the EU by 2010. Within the Directive it is defined the term renewable energy sources and established a certification system for electricity generated from renewables.

The expected dynamism imposed by the energy performance requirements of the EPBD and the renewable electricity production Directive will hopefully encourage the construction industry and their suppliers to develop intelligent options to improve the energy performance of buildings, either by optimising the energy saving measures and technologies for the production of heat and electricity from renewable energy sources.

The Renewable Energy Directive aims at contributing to improve the security of energy supply and to reduce CO₂ emissions both by using its potential for electricity production and for heating/cooling. The main technologies that could have a strong enhancement in the renewable electricity market are the photovoltaics, small biomass cogeneration, the use of Stirling engines and small scale wind energy.

In order to have an impact on the electricity supply a multitude of projects of this type at the buildings level should come up within the next years, which would imply significant movements within the legislative, financing and certification frameworks of Member States. An example of a successful programme of renewable electricity generation in buildings is the “1000 solar roofs programme”, where the German government assumed a leadership role in supporting distributed PV systems grid-connected, sized at 1-5 kWp fielded on residential rooftops, with up to 70% cost-sharing from the authorities. This programme was then followed by the also successful 100 000

solar roof programme. Nowadays there is in place in Germany the renewable energy act aiming at creating the framework to reach the green electricity target for this country.

3.2. New electricity Directive

The Directive 2003/54/EC of 26th of June on the common rules for the internal market in electricity already contains an incentive for Member States and national regulatory authorities to promote DG by taking account of its benefits for the transmission and distribution networks in the form of long-term avoided investment costs. Furthermore, Member States are obliged to ensure that authorisation procedures for this type of generation take account of its small-scale nature and therefore potentially limited impact.

“Article 23 – Regulatory authorities: Member States shall designate one or more competent bodies with the function of regulatory authorities. These authorities shall be wholly independent from the interests of the electricity industry. They shall, through the application of this Article, at least be responsible for ensuring non-discrimination, effective competition and the efficient functioning of the market, monitoring in particular: (...) (f) the terms, conditions and tariffs for connecting new producers of 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, DG and combined heat and power”.

3.3. Cogeneration Directive

The Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market was issued on 11 February 2004. It promotes the generation of electricity by cogeneration units that produce less than 50 MWe. The Directive requires that Member States analyse the national potential for “high-efficiency cogeneration” and the barriers to achieving this potential. Moreover, Member States must ensure that the origin of electricity produced by cogeneration can be guaranteed.

In the Directive it is defined the concept of “High-efficiency cogeneration” that would correspond to an energy saving of 10% compared to separate heat and power production for new plants, 5% energy saving for existing plants and 0-5% energy saving for units using renewable energy sources or with a capacity below 1 MWe.

The Directive intends to facilitate the grid access for electricity from cogeneration, from smaller cogeneration plants producing less than 1 MWe or plants using renewable energy sources but subject to notification to the Commission [number (27) of the preamble]. The European Commission and the Member States technical experts should establish harmonised efficiency

reference values for the separate production of electricity and heat, and to review threshold values for cogeneration efficiency and primary energy savings.

Apart from the specific reference under point (10) of the preamble to the EPBD as one of the supporting justifications to the issuing of this Directive, under point (20), it is specifically referenced the use of micro-cogeneration and distributed cogeneration in supplying isolated areas or limited residential, commercial or industrial demands.

Moreover, for practical reasons and based on the fact that the use of the heat output for different purposes requires different temperature levels of the heat, cogeneration could be divided into classes such as: 'industrial cogeneration', 'heating cogeneration' and 'agricultural cogeneration', [point (31) of preamble].

Under Article 8 of the Directive it is stated that Member States may particularly facilitate access to the grid system of electricity produced from high efficiency cogeneration from small scale and micro-cogeneration units. Finally, under Annex III, it is referred that the production from small scale and micro cogeneration units providing primary energy savings may qualify as high efficiency cogeneration.

It could be said that both the EPBD and the cogeneration Directive are crossly supported and are important sustainers of European energy policy. As the cogeneration technologies that would benefit from an expansion of the implementation of the EPBD are in the micro and small-scale segment of the market (internal combustion engines, Stirling engines, microturbines and fuel cells), a significant advancement is necessary. The late transposition and implementation of these two Directives is damaging the deployment of cogeneration and the improvement of energy efficiency in buildings.

3.4. Eco-design requirements for Energy-using products Directive

The Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 on establishing a framework for the setting of Eco-design requirements for Energy Using Products creates a framework to integrate environmental aspects into the design of energy-using products. These are defined as equipment dependent on energy input to work as intended and examples could be:

- Gas and oil fired central heating boilers,
- Room air conditioners,
- Central heating circulators,
- Street lighting,
- Domestic refrigerators and freezers,

- Domestic dishwashers,
- Vacuum cleaners,
- Copiers,
- Televisions,
- Personal computers.

The Energy Using Products will have to be designed according to certain requirements, e.g. the product's entire life cycle and environmental impact. These requirements will be set out in future implementing measures to be decided by the European Commission, but there is an expected saving of about 20% to 30% in environmental impacts for most of the products taking into consideration the least life-cycle costs. Therefore, manufacturers of sub-components will have to provide information on the environmental impact of parts of these products.

The Directive requires that the European Commission prepares the implementing measures for a pre-defined list of products one year after the Directive enters into force, and one horizontal implementing measure to cover stand-by mode losses of a group of products. A first implementation measure is not expected until 2007. Member States have until 11/8/07 to transpose it into their national laws.

3.5. Heat from Renewable Energy Sources (RES-H Directive)

According to a group of institutions that undersigned a declaration for a European Directive to promote renewable heating and cooling, they state that the Buildings Directive "supports the use of heat from renewables however it is not focused enough. It is said that the Buildings Directive does not apply to existing buildings <1000m², where a large potential for renewable energy sources heat (RES-H) lies. It will substantially support energy efficiency measures in the next decade. However, sustainability in the heating and cooling sector cannot be achieved only by reducing consumption. It is also necessary to switch production to renewable energies". They continue, "the Directive must have a clear purpose, namely to increase the share of renewable energy in the heating and cooling sector, as almost 50% of the final energy consumption in Europe is used for the heating needs of buildings, for domestic hot water production and for heating in industrial processes. Heat is the largest consumer of energy, being greater than electricity or transport. Renewable heating sources (solar thermal, geothermal, biomass) have a huge potential for growth and can replace substantial amounts of fossil fuels and electricity currently used for heating purposes.

The expected measure on heat from renewable energy sources would address targets, support schemes, certification procedures for heat from renewable energy sources (such as solar, biomass and geothermal). Would also look at the potential contribution of biomass fuels, establishment of efficiency criteria for biomass and the installations using this source, equipment,

and labelling. There is a need to set targets and the role of voluntary commitments by the industry. This measure is expected to be proposed by the third quarter of 2006 and to have the final adoption by the first half 2008. The European Parliaments' Energy Committee voted on 26/1/2006 to a call for:

- a) a Directive which sets a minimum of 20% share of renewable energy sources for heating and cooling in the EU by 2020,
- b) Member States to set national targets to help them advance towards the overall 20% target, and,
- c) Member States to set up action plans for achieving their national targets.

Members of the European Parliament also call for any support schemes to be limited in time and gradually reduced, and for the development of an EU-wide eco-label schemes for heating and cooling systems. The European Parliament endorsed the resolution on 14/2/06 and Commissioner Piebalgs confirmed that legislation in the field would be proposed by CEC before the end of 2006.

3.6. Energy services Directive

A Directive on energy end-use efficiency and energy services (Energy Services Directive) was adopted on the 5th April 2006.

The Directive has the objective of increasing end-use energy efficiency, using a number of operational measures, including the development of a market for energy services. The proposal covers the retail supply and distribution of extensive net-bound energy carriers, such as electricity and natural gas, together with other important energy types, such as district heating, heating fuel, coal and lignite, forestry and agricultural energy products and transport fuels.

The Energy Services Directive, focusing on the promotion of end-use efficiency, should be regarded as a necessary instrument to complement the recently adopted legislation on the opening of the internal energy market, which mainly leads to efficiency improvements on the supply side. By the envisaged efficiency improvements, the proposal will contribute to the mitigation of greenhouse gas emissions in view of meeting the EU's Kyoto emission reduction target of -8% in 2008-2012, as well as the individual targets of the acceding states, and to improving the European Union's security of supply as underlined in the Commission's Green Paper "Towards a European Strategy for Energy Supply".

Security of supply is expected to be improved because energy efficiency measures will reduce energy demand and thus lessen import dependence. Improved energy efficiency will also allow more rapid intervention if necessary to shift or reduce peak loads on the infrastructure of grid-bound energy, such as electricity.

The Directive covers all end-users, except those exempted from the Emissions Trading Scheme. Provides support for setting up specialist energy services companies (e.g. lighting, heating, cooling). Sets an indicative energy saving target of 9% over the first 9 years of application of the Directive (2008-2017). During this period Member States are required to prepare three national energy efficiency action plans, the first one being due by 30/6/07. Requires improved consumer information and better metering and billing of energy consumption. Requires the European Commission to develop a harmonised bottom-up calculation model.

3.7. Energy efficiency initiative – Green Paper

The *Green Paper on Energy Efficiency or Doing More with Less* was adopted on 22 June 2005 and considers measures for improving energy efficiency in Member States in accordance with the competitiveness targets of the Lisbon Agenda, environmental impacts, security of supply and the Kyoto commitments within the 2020 horizon.

In order to enhance the energy efficiency in EU, the Green Paper is organised in two parts: a first one approaching the obstacles to improving energy efficiency and another proposing an EU initiative.

Among the issues covered in this document, buildings gather the attention in a separated chapter. There it is stated that:

- it is a task of the Commission to provide the member States with the necessary tools for developing the framework for an integrated calculated methodology of the energy performance of buildings;
- Mandatory standards should be considered in a future amended version of the Directive;
- Member States are responsible for facilitating the financing for following up the recommendations for the cost-effective improvement of the buildings energy performance;
- The proposal for the extension of the Buildings Directive to buildings with less than 1000m², being renovated;
- There is still some work to do on the basis of how could be coupled the energy efficiency measures with cost effectiveness and to be workable.

As other measures concerned in the Green Paper related to the energy use in buildings are stated:

- **Cogeneration:** The Member States have to implement the Directive promoting the use of high efficiency co-generation by February 2006. They should ensure that the best possible use is made of this technology. In addition, they could stimulate further progress in developing co-generation technologies not only in respect of energy efficiency and fuel

flexibility but also with the aim of reducing construction costs. Member States could equally further explore and develop co-generation technologies which can increase the use of renewable sources.

- **District heating:** Most Member States of the EU-25 have district heating systems, and especially in the new ones in Central Europe with transition economies, this is a very common means of providing heat, especially to households. District heating, if managed well, can be environmentally friendly. It is estimated that even just those district heating and co-generation facilities, including industrial applications, already existing, may save 3-4% in primary energy use as compared with separate production.
- **Promotion of Distributed Generation:** DG is normally much closer to useful outlets also for the heat which is lost in conventional generation, so increasing heat recovery opportunities, which dramatically improves fuel efficiency. Streamlining and reduction of the regulatory load of authorisation procedures for DG is therefore required: national authorities, regulators and local and regional authorities need to make this happen.
- **Financing:** The main problem to be solved is how to finance the upgrading of old district heating systems. To this end, the financial institutions such as the European Investment Bank need to be further mobilised to enable financing for energy efficiency measures in district heating.
- **Energy Services:** Encouraging electricity and gas providers to offer an energy service (i.e. agreeing to heat a house to an agreed temperature and to provide lighting services) rather than simply providing energy is a good way to promote energy efficiency. Under such arrangements the energy provider has an economic interest that the property is energy efficient and that necessary investments are made. Otherwise, electricity and gas companies have an economic interest that such investments are not made, because they sell more energy.
- **White certificates:** White certificate systems have been partially implemented in Italy and the UK, are under preparation in France, and are being considered in the Netherlands. These are systems where suppliers or distributors are obliged to undertake energy efficiency measures for final users. Certificates corroborate the amount saved, giving both energy value and lifetime. Such certificates can, in principle, be exchanged and traded. If the contracted parties cannot then submit their allocated share of certificates, they can be required to pay fines that may exceed the estimated market value.
- **Public procurement:** Many technologies exist for improving energy efficiency. The problem is that, for some of new energy efficient technologies, the market is not significant

enough to allowing offsetting a greater development and production cost through increased numbers of sales. Purchasing by all public authorities should be concerned, by national authorities but also European institutions, because the latter should point the way by example and open up new markets for products which use less energy.

On a working document of the European Parliament rapporteur on the Energy Efficiency Green Paper, it is additionally referred that “other measures could be taken in smaller scale renovations such as the installation of the so-called "smart meters" that allow consumers to have real-time figures of their real consumption or gas boilers "top boxes" that can lead to a reduction in emissions and costs of producing hot water of up to 40%”.

As a sum up, as possible solutions to the energy efficiency enhancement in EU, the amendment of the existing Buildings Directive to cover buildings smaller than 1000m², the extension of the energy labelling Directive to the issues covered by the eco design and efficiency in energy using products, the assessment of the potential to promote EU-wide the use of White Certificates, the development of new public purchasing rules, and the wide application of the energy services concept, among others, should support the objective of reducing its energy consumption by 20% from 2005 levels by 2020.

3.8. Energy Efficiency Action Plan

The expected Commission Communication on an Action Plan on energy efficiency would define the actions to be taken at EU level to achieve, by 2020, a 20% energy saving. It is going to be built on the Green Paper on Energy Efficiency. The possible ways to improve energy efficiency in the EU are outlined as the revision of the energy efficiency of buildings Directive, promotion of modern lighting, revision of the energy labelling Directive, EU-wide promotion of white certificates, information campaigns for consumers, among others.

As consultations on the Green Paper are currently ongoing, based on stakeholders' contributions, and the opinions of the European Parliament and the Council, the European Commission would proceed with the finalisation of the action plan, which should be formally presented in June 2006.

3.9. Biomass action plan

In the *Biomass Action Plan* (Communication from the Commission) it is referred that according to what is stated in the Buildings Directive the Member States should take into consideration the use of "heating and electricity systems based on renewable energy sources". However the importance given to the biomass should be decided by each Member State. Moreover, for buildings larger than 1000 m² feasibility studies should be carried out in order to assess the

possibility on the use of decentralised energy systems. These could be based on the use of biomass and on CHP. This could be an interesting option in several Member States.

As suggestions for the amendment of the Directive, the *Biomass Action Plan* refers:

- *“ensure that calculation procedures allow greater weight and more active promotion to be given to biomass heating and other forms of renewable energy;*
- *reducing the thresholds in the directive so that many more new buildings would have to be considered for renewable energy before construction starts, and many more renovation projects would need to meet minimum efficiency requirements based on energy performance calculations that include the positive influence of renewable energy sources, including biomass;*
- *setting EU-wide minimum energy performance standards and criteria that could also promote the use of biomass where it is technically feasible and economically interesting.”*

4. COMMENTS ON THE CURRENT SCOPE OF THE DIRECTIVE

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. Some countries are already applying specific energy efficiency instruments that serve as a complement to the initiative of the Buildings Directive, while other countries have them underway. Nevertheless a revision of the current scope of the Buildings Directive considering possible improvements and reinforcements should be discussed.

4.1. Type and size of buildings considered

On a first level it should be referred that there is the need recognised by several institutions and organisations working at European level to consider existing buildings as well as new ones, covered by *Article 5*. It is necessary to raise their performance 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 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*).

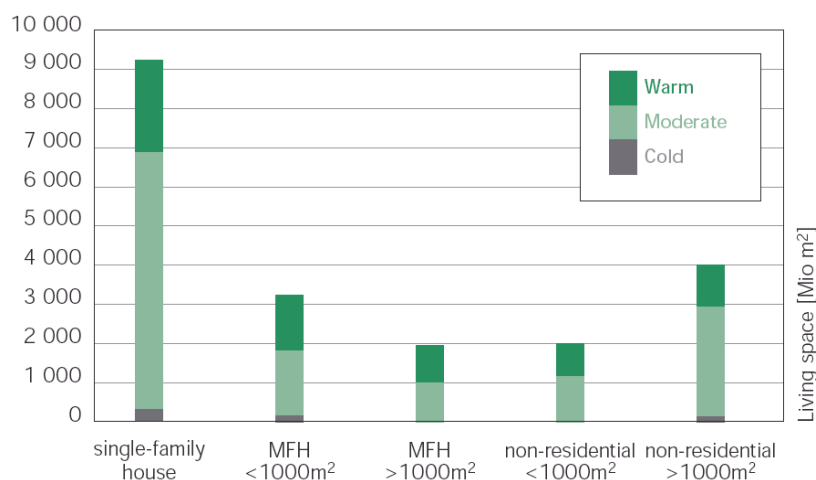


Figure 1 – Living areas of climate zones and house-types for EU-15 buildings stock (ECOFYS, 2004)

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, as can be seen in figure 1.

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 Buildings Directive also gives indications on the buildings that should not be taken into account for the definition of requirements (*Article 4*). In spite of the fact that industrial buildings may require thermal and lighting comfort for the workers as well as the services buildings do, the industrial sector is never mentioned. It is understandable that the housing of industrial processes cannot be submitted to the same energy performance requirements as household and tertiary buildings. However, in terms of comfort and indoor ambient quality it could be considered that a large potential on energy savings are available.

Global Emission savings perspective

ECOFYS has developed in 2004 and 2005 two studies on the impact of the application of the Buildings Directive on the CO₂ emissions reductions. It analyses the impact of the Buildings Directive and possible extensions to the building types on heating and cooling related CO₂ emissions and economics. As a conclusion, although the main saving potential found is lying on insulation actions on the existing buildings stock, reference is made to the need to generate the remaining demand from renewable energy sources and to use fossil fuels as efficiently as possible. In general terms, the studies refer that the solution lies on the coupling of energy-efficiency measures with general retrofit measures.

ECOFYS also strongly advocates the need to widen up the extension of the Buildings Directive to the renovation of buildings larger than 200 m². The impact on the CO₂ emission savings of this measure is calculated:

“The model calculations conducted in the course of this study confirmed that the European Directive on Energy Performance of Buildings will have a significant effect on the CO₂ emissions by reducing the heating energy demand of buildings. The main contributor to the total of 725 Mt/a of CO₂ emissions from the EU-15 building stock in 2002 is the residential sector (77%) while the remaining 23% originates from non-

residential buildings. In the residential sector, single-family houses represent the largest group responsible for 60% of the total CO₂ emissions equivalent to 435 Mt/a.

It was found that the main potential for CO₂ emission reduction lies in the heating energy consumption of the existing building stock thus confirming earlier studies. If all retrofit measures in the scope of the Directive were realised immediately for the complete residential and non-residential building stock the overall CO₂ emission savings would add up to 82 Mt/a. An additional saving potential compared to the Directive of 69 Mt/a would be created if the scope of the Directive was extended to cover retrofit measures in multi-family dwellings (200-1000m²) and non-residential buildings smaller than 1000m² used floor space. In addition including the large group of single-family dwellings would lead to a potential for additional CO₂ emission reductions compared to the Directive of 316 Mt/a.”

Moreover in the new Member States there is an urgent and very strong need to perform refurbishment actions. These will have a significant impact on energy consumption if measures are taken. Although district heating was quite popular in the new Member States, especially during the communist period, the lack of maintenance has led to a state of high level of production and distribution losses. Strong improvement of the boilers systems, CHP systems and large scale district heating plants can lead to 3 to 5 times saving potential.

Table 1 – CO₂ emissions in NEW-8 building stock 2002 without and with improved district heating networks. (ECOFYS, 2005)

CO ₂ Emissions	Baltic Republics Mt/a	Poland Mt/a	CZ-HU-SL-SK Mt/a	NEW 8 Mt/a
Building stock new-8 2002 - Current DH	6	70	45	121
Building stock new-8 2002 - Improved DH	5	60	42	106

This analysis shows that the minimum overall CO₂ emission savings would add up to 15Mt/a, if all the measures in the scope of the Buildings Directive were implemented at once for the completed residential and non-residential New-8 Member States building Stock.

4.2. Distributed Generation Solutions

The Buildings Directive makes significant progress in terms of the need for considering some DG solutions for building efficiency improvements, but it 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 electricity system as a whole when applied in 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, as will be described next.

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 in or nearby buildings. These applications and services include those resumed in table 2.

Table 2 – 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

Several different technologies may be suitable for DG applications in or nearby buildings. 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 and wind energy converters. In both cases electricity generation is based on the conversion of some form of renewable energy.

There are also other DG technologies that may use renewable energy sources such as biomass or biogas to produce electricity through a combustion process. However, these electricity generation technologies are, in most cases, used to produce electricity from fossil fuels like natural gas. These technologies include 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.

The liberalisation of electricity markets that is occurring a little all over the world brought a renewed interest to the development of efficient and clean small scale electricity generation technologies. Considerable investments are being made by major manufacturers of generating equipment with the aim of bringing new efficient and clean technologies to the market. These emerging technologies 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.

Several small scale DG technologies present higher electricity generation efficiency than the best central plants nowadays available, even without considering the use of residual heat in cogeneration applications. A comparison between electricity generation efficiencies is presented in figure 2 for several electricity generation technologies.

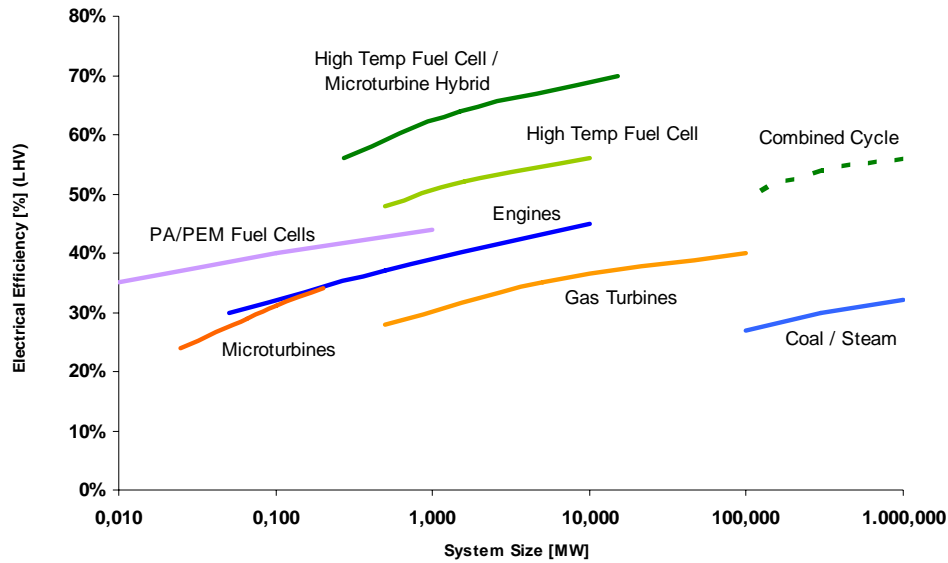


Figure 2 – Indicative electricity generation efficiencies for several technologies

The Buildings Directive does not consider several DG technologies that may provide benefits for building's energy performance, as is the case of fuel cells and hybrid systems. Even more "conventional" generation systems present electrical efficiencies that can compete with centralised systems in many situations. For example, modern gas engines are nowadays characterised by electrical efficiencies of up to 45% in the 5 to 10 MW power range, which is comparable to a centralised system based on gas turbine combined cycle power plants if losses in the transmission and distribution lines are taken into account.

In conclusion, 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 should therefore be revised and widened to better capture the potential benefits of DG solutions.

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.

4.3. Definitions and Technical Concepts

The current Buildings Directive presents a short list with basic definitions for the main technical concepts related with the Directive's scope of application. These include simple definitions, for example, for "building", "energy performance of a building" or "CHP", among a few others.

When considering today's vast existing technical solutions for energy efficient construction, energy equipment or energy systems that are used in buildings, it appears that the definitions and technical concepts present in the Buildings Directive may not be sufficient to adequately serve the purpose of the Directive.

Furthermore, the few existing definitions are not as clear as desired, leaving space for misinterpretation and uncertainties. The definition of "building" is one example of that: *"a roof construction having walls, for which energy is used to condition the indoor climate; a building may refer to a building as a whole or parts thereof that have been designed or altered to be used separately"*.

4.4. Methodology and reference values

In its current wording the Buildings Directive enforces Member States to adopt and apply a methodology for calculation of the energy performance of buildings on the basis of a general framework set out in the annex of the Directive. This general framework, however, merely states that the positive influence of local electricity production by means of renewable energy sources or CHP should be taken into account when evaluating the energy performance of the buildings. No methodology is in fact proposed or enforced by the Buildings Directive to Member States, who should develop their own methodologies according to these Directive's general guidelines.

The Buildings Directive states that the technical, environmental and economic feasibility of the above referred DG solutions should be considered and taken into account before construction starts. However the criteria to decide for or against the installation of those DG solutions is not indicated in the Directive, leaving that decision to the Member.

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 CO₂ 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 could 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.

4.5. 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.

4.6. Other Energy policy measures

Beyond the already proposed amendments there is a set of different policy measures and mechanisms that can be encouraged on behalf 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.

4.6.1. 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.

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.

4.6.2. Financing

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 new energy 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 new energy 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.

4.7. 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 cogeneration projects, and small renewable energy 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 decentralised generation cost-effective projects, and can play an important role in demand side management.

4.8. 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 a working group 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 standardization of the connection charging to the grid and procedures, as studied under the ELEP project should be strongly supported, in order to avoid lack of use of these technologies by means of its heavy burden.

5. AMENDMENT OF THE DIRECTIVE ACCORDING TO ARTICLE 11

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. Already a few actions are identified as possible ways of further work development and these are:

- Possible complementary measures referring to renovations in buildings with a total useful floor area less than 1000m²;
- General incentives for further energy efficiency measures in buildings.

The study of these issues will be further developed in a next step of the Work Package 4 of the ELEP project. Nevertheless, a first indication of the considered necessary steps to further improve the deployment of energy efficiency in Buildings in general and the DG in particular, under the umbrella of the Directive are:

- Type and size of buildings considered;
- Distributed Generation Solutions considered;
- Definitions and Technical concepts;
- Energy performance evaluation methodologies and reference values;
- Local impact of emissions from Distributed Generation solutions;
- Encouraging energy policy measures.

6. CONCLUSIONS

In this document it was reviewed in detail the EU initiative of the Buildings Directive in light of the deployment of the distributed generation solutions. For that, a thorough analysis of the Directive principles, methodologies and definitions was done, as well as an assessment of other complementary EU Directives and measures. After consulting the European Performance of Buildings Directive Concerted Action we came to the conclusion that the transposition process to Member States Law is lagging behind and that it is a complex and slow process. The methodologies to be applied in each country are, in most of the situations not clear and still under discussion internally. In this order, to take conclusions from field work it will be hard and almost impossible in the near future. Moreover, from oral discussion with national representatives it became clear that the concerns raised under Article 5 of the directive are not a nuclear issue within the Member States work of transposition. Therefore, distributed generation in the form of CHP and the use of renewable energies is lead to a secondary issue.

Then, a study of the main reports and position papers issued on the buildings directive has shown that the main areas where this EU initiative could be further improved or amended, taking in consideration the interests for the deployment of the Distributed Generation. These were related not only with the widening up of the scope of the Directive towards buildings with smaller useful areas (under 1000 m²), but also the expressed inclusion of incentives to the use of distributed generation solutions in buildings. It was referred that not only CHP mode and renewable energy sources should be considered, but also it should be taken profit of other services that these options could provide: peak shaving, grid support, reliability, etc. Moreover, there are other policy instruments and tools that could be defined as means of implementation of the Buildings Directive and that should be organised and implemented with the objective of further improve the deployment of these technologies and solutions as well as the improvement of the energy efficiency in buildings.

In a next report of the ELEP project (under Work Package 4), there will be done specific propositions to amend the European Performance of Buildings Directive, having in mind the improvement of energy efficiency in buildings and the deployment of distributed generation solutions.

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