CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

EPBD implementation in Cyprus

STATUS AT THE END OF 2012

1. Introduction

The Law for the Regulation of the Energy Performance of Buildings 2006 (L.142(I)/2006), is the legal document upon which the transposition of the Energy Performance of Buildings Directive (EPBD) in Cyprus is based on. The implementation of the EPBD started in 2007 with setting minimum requirements for the building envelope, and has been fully implemented in 2009 with the launching of the Energy Performance Certificate (EPC) and the inspection of air-conditioning systems and heating systems with boilers. In 2012, the House of Representatives passed an amendment of the Law for the Regulation of the Energy Performance of Buildings 2006, for the transposition of the recast EPBD in Cyprus.

This report presents an overview of the current status of implementation of the EPBD in Cyprus.

2. Energy performance requirements

The first attempt to introduce energy conservation in buildings was the preparation of a voluntary CYS98:1999 Standard for the Insulation and Rational Use of Energy in Dwellings. However, the implementation of the EPBD in Cyprus was the first attempt ever made to regulate the energy consumption in buildings. The Ministerial Order for the Minimum Energy Performance Requirements of 2007 made only the thermal insulation of the elements of the building envelope mandatory. The second Ministerial Order of 2009 keeps the same maximum U-values for the elements of the building envelope, but makes the requirements more stringent as it regulates the building as one whole entity. The calculation of the cost-optimal levels of the minimum Energy Performance (EP) requirements is expected to indicate the untapped energy saving, and a new Ministerial Order for the Minimum Energy Performance Requirements is expected to be issued, after the cost-optimal calculation will be finished in March 2013.

2.1 Progress and current status

The Ministerial Order for the Minimum Energy Performance Requirements of 2007 included only maximum U-values for roof, external wall, doors, windows and floors above unheated spaces and floors in contact with the external environment. The requirements of the Ministerial Order of 2007 are shown in Table 1.

In 2009, a new Ministerial Order for the Minimum Energy Performance Requirements was issued. It keeps the same maximum U-values for the building envelope, but introduces the following new requirements:

> The calculation of the average U-value (or U-mean) takes into account the U-value of each element of the building element and its corresponding surface

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Table 1: Minimum EP requirements for new buildings and all buildings above 1,000 m² that undergo a major renovation (Ministerial Order of 2007).

Description	U-value ($W/m^2.K$)	Comments
Horizontal structural elements of the building envelope	≤0.75	
Wall and structural elements of the building envelope	≤0.85	Not applied to passive systems
Windows and doors of the building envelope	≤3.8	Not applied to shop windows
Floor in contact with unheated spaces	≤2.0	

Figure 1: Minimum EP requirements for new buildings and all buildings above 1,000 m² that undergo a major renovation (Ministerial Order of 2007).

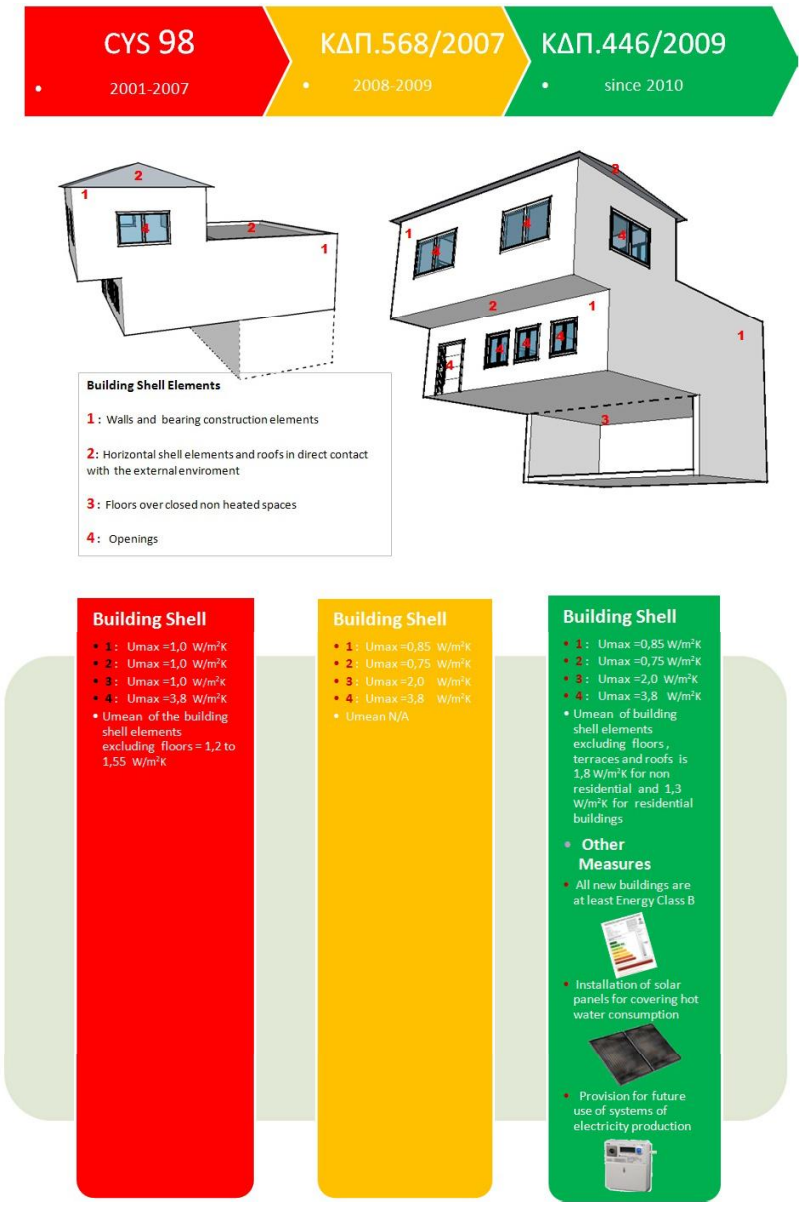


Table 2: Predetermined U-values for the reference building.

Exposed element	**U-value (W/m².K)** (residential)	**U-value (W/m².K)** (non-residential)
Roofs[1] (irrespective of pitch)	0.6375	0.6375
Walls	0.7225	0.7225
Floors	0.6375	0.6375
Ground floors	1.6	1.6
Windows, roof windows, roof lights, and pedestrian doors	3.23	3.23
Vehicle access and similar large doors	Same as real building	Same as real building

[1] *Any part of a roof having a pitch greater or equal to 70° is considered as a wall*

area and averaged over the whole area of the building envelope. The roof and the floor are not included in this calculation.

> The B energy category, as a minimum requirement, is achieved only if the building needs the same or less primary energy than the reference building. The reference building has predetermined energy performance characteristics like U-values, thermal mass and technical systems, as described in Table 2.

The Ministerial Order for the Minimum Energy Performance Requirements of 2009 also introduced requirements for integrating Renewable Energy Sources (RES) in the building. The Ministerial Order requires that a solar thermal system for the production of hot water is installed, according to the 'Technical Guide for the Installation of Solar Thermal Systems', in all new residential buildings. The installation of solar thermal systems for the production of hot water in residential buildings was already a common practice in Cyprus. However, the Ministerial Order not only made it mandatory for all new residential buildings, but it also regulated some technical parameters of the solar thermal system, including the size of the system according to the needs for hot water in the building. Additionally, all new buildings must have the necessary infrastructure pre-installed in case the future owner decides to install photovoltaic (PV) panels to produce electricity. Table 3 shows the additional minimum requirements set by the Ministerial Order of 2009 and Figure 1 shows the gradual advancement of the minimum EP requirements.

2.2 Format of national transposition and implementation of existing regulations

The methodology for calculating the energy performance is defined by the Ministerial Order of 2009 and it is described in the following documents:

> Guide of Thermal Insulation of Buildings (2nd Edition).
> Methodology for Calculating the Energy Performance of Buildings.

The 'Guide of Thermal Insulation of Buildings' was first issued in 2007 in order to guide engineers and architects to calculate U-values and inform them on different insulation techniques. The 2nd Edition (Figure 2), published in 2010, included more detailed calculation methods for U-values and parameters related to thermal mass.

Description	U-value ($W/m^2.K$)	Comments
Average U-value not including floors and roofs	≤1.3 residential ≤1.8 non-residential	
Energy class on the EPC B or better		
Installation of solar thermal systems in all new residential buildings according to the 'Technical Guide for the Instalment of Solar Thermal Systems'		It is subject to restrictions and requirements set by the Department of Spatial Planning and Housing
Installation of the needed infrastructure for the future installation of RES electricity production systems		

Table 3: Minimum EP requirements for new buildings and all buildings above 1,000 m^2 that undergo a major renovation (Ministerial Order of 2009).

Figure 2: Guide of Thermal Insulation of Buildings (2nd Edition).

Figure 3: Methodology for calculating the energy performance of buildings.

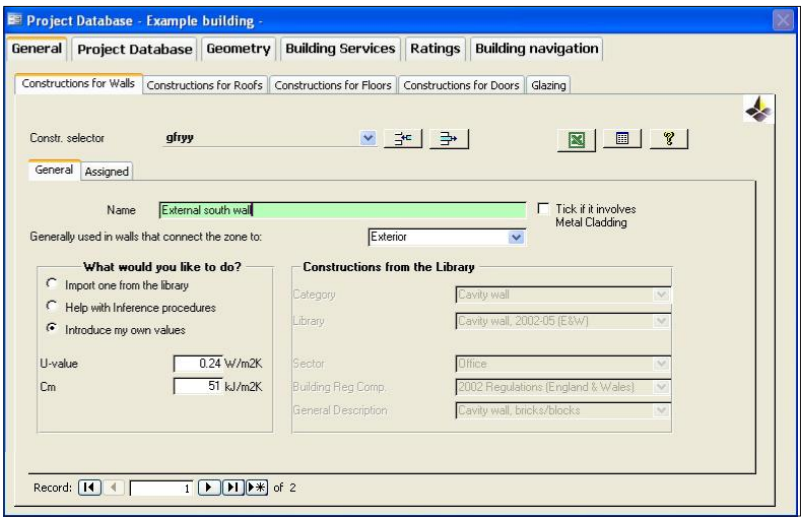
The 'Methodology for Calculating the Energy Performance of Buildings' (Figure 3) describes all the algorithms and assumptions used to calculate the energy consumption. It includes heating, cooling, domestic hot water (DHW) and lighting needs, expressed in terms of primary energy. Both documents are based on CEN standards, and they are both mandatory, to be used to calculate the energy performance of all buildings, existing and new. The calculation methodology is implemented with the software 'SBEMcy' (Figure 4), developed by the Energy Service of the Ministry of Commerce, Industry and Tourism. In 2012, the software named 'Eco-engine' was developed by the private sector, and was approved for calculating the energy performance of buildings and issuing Energy Performance Certificates (EPCs).

The implementation of minimum EP requirements is randomly checked by inspectors appointed by the Minister of Commerce, Industry and Tourism. According to the Law, these inspectors have the right to enter any building and construction site and inspect if the building complies with the minimum EP requirements. The inspectors report on a monthly basis to the Director of Energy Service and, in case of non-compliance, legal measures are taken against the building owners. The inspectors are also in close corporation with the building permit authorities which are kept informed for cases of non-compliance. So far, legal measures have been taken for seventeen cases (Figure 5).

2.3 Cost-optimal procedure for setting EP requirements

The calculation of the cost-optimal levels of minimum EP requirements is started with the definition of the reference buildings for new and existing single family houses, apartment buildings and office buildings. The reference buildings are either virtual or real, in an attempt to represent the average and typical building stock. Since there is no comprehensive database of the building stock, the relevant statistics by the Statistical Service of the Ministry of Economics were used instead. These statistics gave a good indication of the average size, shape, thermal insulation and technical systems used in existing and new buildings. Furthermore, the input of various stakeholders was used to develop the reference buildings. Energy efficiency measures were applied on the reference buildings. The energy savings resulting from each measure were calculated using the software for calculating the energy performance of buildings. The results derived were compared with the consumption of similar real buildings and adjustment factors were introduced where it was considered necessary. For the calculation, a cost database was developed with the collaboration of various stakeholders and data derived from government construction projects. So far, calculations have been performed for single family houses and governmental office buildings. The Energy Service has circulated among the various stakeholders a draft document for them to comment on the results and on the calculation process.

Figure 4: Software SBEMcy.



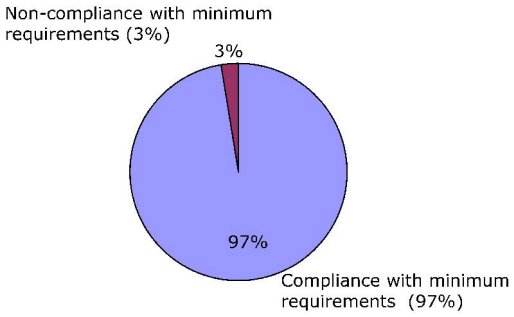
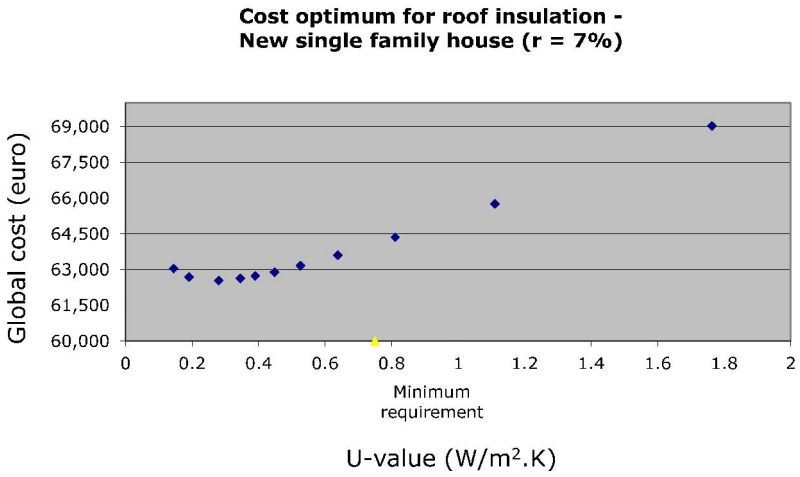


Figure 5: Inspections of buildings for compliance with the minimum EP requirements, performed by appointed inspectors between 2010 and 2012.

Figure 6: Graphical result from calculating the cost-optimal level for the minimum requirement of roof insulation in new single family houses.



The goal is to have inputs from as many professionals engaged in the construction industry as possible. The first draft document indicates the untapped energy saving in building elements such as roofs and walls. The preliminary calculations for houses and office buildings show that the current minimum U-value for walls shall be lowered by 15% to reach cost-optimal levels, and by more than 30% in the case of roofs (Figure 6).

2.4 Action plan for progression to NZEB

In September 2012, the Ministry of Commerce, Industry and Tourism submitted the Nearly Zero-Energy Buildings (NZEB) Action Plan to the European Commission. For the purpose of setting the definition of the NZEB in Cyprus, the Energy Service ordered an in depth study of the potential of energy saving in the three most commonly used categories of residential buildings:

> detached two storey houses;
> terraced houses;
> apartments on building blocks.

This study covered all the four climatic zones of the country, as defined in the Methodology for Calculating the Energy Performance of Buildings. The study indicated the following requirements and technical parameters for a building to be considered a NZEB:

> for residential buildings, the primary energy consumption must not exceed 180 kWh/m².year, and at least 25% must be covered from RES (Table 4);
> for non-residential buildings the primary energy consumption must not exceed 210 kWh/m².year, and at least 25% must be covered from RES.

The National Action Plan identifies the following actions to be taken until 2015 in order to increase the number of NZEBs in Cyprus:

> Preparation of a technical guide based on the results of the study on the energy saving potentials in NZEBs. The Technical Guide shall include the minimum requirements for NZEBs in Cyprus, as well as technical and construction guidance in order to facilitate the design and construction of the building. The application of the Technical Guide will be on a voluntary basis and will be upgraded continuously. It will remain in use even after the enforcement of the application of NZEBs by law.
> Residential and non-residential pilot applications of NZEBs are planned to be constructed. The Energy Service, since

Table 4: Technical requirements and specification for residential NZEBs.

1	Maximum primary energy consumption before the contribution of RES (kWh/m².year)	180
2	Minimum contribution of RES	25%
3	Maximum U-value of roof (W/m².K)	0.41
4	Maximum U-value of wall (W/m².K)	0.49
5	Maximum U-value of window (W/m².K)	2.8
	Maximum U-value of floor in contact with the external environment (W/m².K)	0.41
6	Solar Protection of Openings	External shading with movable shutters with G-value for the system (shutter and glass) at least 0.3 for the summer months Shutters with thermal insulation (U value =1.1W/m².K)
7	Natural ventilation/cooling	Natural ventilation with fresh air rate as defined in the national methodology for the certification of the energy performance of buildings. Provision for fresh air for night cooling at least 1,330 m³/h in living spaces, and 730 m³/h in bedrooms.

2011, has been collaborating with the Cypriot Land Development Cooperation (CLDC) in designing and constructing new developments of semi-detached and terraced buildings, as well as apartments in order to be NZEBs. CLDC is a state owned cooperation and its mission is to assist low and medium income families to acquire a house. This action is subject to land development construction demand. Also, the Energy Service is working closely with the Technical Services of the Ministry of Education and Culture in order to design and construct the first NZE schools.

> Support research programs for the development, improvement or advancement of construction techniques.
> Compare the existing national methodology for the certification of the Energy Performance of Buildings with the certification of NZEBs. Further parameters are to be accounted for the latter, thus the existing methodology should be further developed in order to include the NZEB category. Once this is done, the software now in use for the certification of buildings will have to be improved or replaced in order to reflect the new methodology for the certification of NZEBs.
> Inform the Qualified Experts (QE) and the engineers of the building industry.
> Raise the awareness of the public.
> Design and announcement of a linear tightening of the minimum EP requirements leading to the 2020 NZEB.

3. Energy performance certificates

The implementation of the Energy Performance Certificate (EPC) in Cyprus took place in two phases. The first phase applied to the certification of residential buildings, new and existing, which started on the 1st of October 2009 as optional and became mandatory by the 1st of January 2010 by issuing the Ministerial Order for the Minimum Energy Performance Requirements of 2009. The second phase applied to the certification of commercial buildings, education buildings, office buildings and all other buildings that are not considered residential, new and existing, which became mandatory on the 1st of September 2010 by the same Ministerial Order.

3.1 Progress and current status on sale or rental of buildings

The main purpose of the EPC (Figure 7) is to give useful information considering the global energy performance of the building. The buildings are rated based on calculated consumption (asset rating) of primary energy per year (kWh/m^2.year) for a typical use of the building and according to the building type.

A central registry has been established since 2009 where all EPCs are registered before being issued. The QE sends the EPC, the calculations and the recommendations report via email. The Energy Service is responsible for maintaining the registry and performs sample checks on the quality of calculations submitted. There are several criteria to flag a certificate for a quality check, of which the most important ones are: issuing a certificate for the first time, recorded previous failure of the QE to perform calculations, and use of RES other than solar thermal.

Another form of controlling the quality of EPCs is focusing on improving QEs. The Energy Service calls randomly each QE for an audit. The audit usually takes place at the QE's workplace and it has the objective of checking if all the necessary documentation exists, but also of solving any questions and misunderstandings that the QE might have. There are cases where the audits have shown that the QE is not documenting all data necessary. In these cases, the QE gets a warning for compliance. If this is repeated, then the QE is taken out of the registry. Also, QEs that have been audited and found to be using false data on purpose are immediately taken out of the registry (Figures 8, 9 and 10).

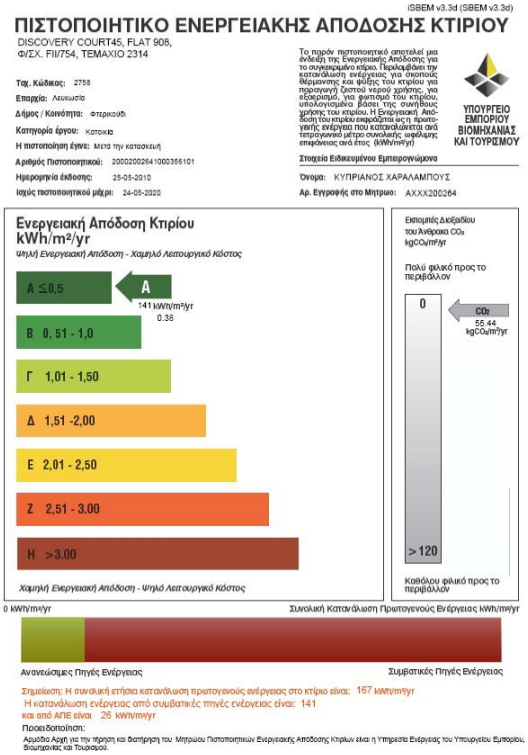


Figure 7: Energy Performance Certificate.

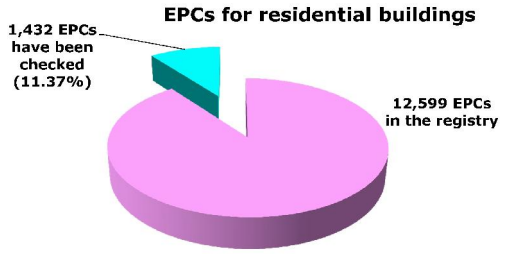


Figure 8: EPC calculations that have been checked for residential buildings.

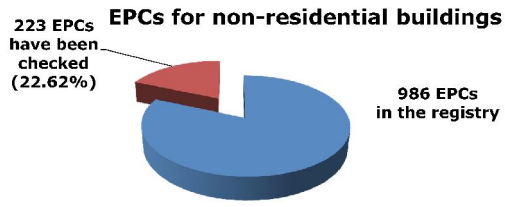


Figure 9: EPC calculations that have been checked for non-residential buildings.

Figure 10: Qualified Expert audit.

The responsibilities and the qualifications of the QEs are regulated by The Energy Performance of Buildings (Energy Certification for Buildings) Regulations of 2009, decree 164/2009. According to the Regulations, there are two levels of QEs: the residential buildings QEs and the non-residential buildings QEs. By the end of 2012, there are 337 QEs, from which 230 can issue EPCs only for residential buildings, and 107 for residential and non-residential buildings.

For the residential buildings, QEs must have the following qualifications:

> a degree in architecture, mechanical engineering, civil engineering or electrical engineering;
> three years of experience;
> pass an exam.

For the non-residential buildings, QEs must have the following qualifications:

> a degree in architecture, mechanical engineering, civil engineering or electrical engineering;
> six years of experience;
> pass an exam.

QEs qualified to issue certificates for non-residential buildings are also qualified to issue certificates for residential buildings. All QEs have to be registered in a central registry maintained by the Energy Service and they have to pay a 200 € registration fee, and then 100 € every year to renew their registration.

Figure 11: Guide for Certifying Existing Dwellings.

All existing, residential and non-residential buildings need to be certified when they are sold or rented. The building owner has to present an EPC to everyone who is interested in renting or buying. In all cases, the EPC must be accompanied by a recommendations report. Until August 2012, 13,617 EPCs were issued. 92% of them were issued for residential buildings, and only 5% were issued for existing buildings. The implementation of article 12 of the recast EPBD (Directive 2010/31/EU) — 'Mandatory inclusion of the energy label in advertisements' — is expected to strengthen the presence of an EPC when selling or renting a building.

For the certification of existing residential buildings, the Energy Service has issued the 'Guide for Certifying Existing Dwellings' (Figure 11) where the process of collecting data is described in detail. This technical guidance was considered necessary in order to assist QEs in certifying very old buildings where no documentation exists. Also, the Energy Service has developed a tool for calculating the cost-optimality of various energy efficiency measures applied in specific buildings. The tool is directed mainly to the QEs for use while producing recommendations. The calculation is based on the global cost as it is defined in (EU) Regulation No 244/2012, and the goal is to help the QEs better understand the impact of their recommendations, not only from the perspective of the payback period, but also in respect to the lifecycle of the building.

According to a survey made by the Energy Service among QEs, the majority of them charge between 2 € and 3 € per m^2 of the building's useful area for their work.

3.2 Progress and current status on public and large buildings visited by the public

As from the 1st of September 2010, all public buildings in Cyprus with more than 1,000 m^2 of floor area that are frequently visited by the public are required to display an energy certificate at the main entrance. The definition of public building includes every building that is used by a government body or by an organisation or company that is funded or controlled by the government. Buildings are defined as frequently visited when a service is provided to the public. This definition covers a large number of buildings in Cyprus and a lot of them have already been certified.

As from 2008, for every public building there is one public employee appointed as responsible for saving energy in the workplace. These so called 'energy saving officers', are in close cooperation with the Energy Service that provides information and directions in order to assist them in promoting an energy saving culture for the building they work in. The 'energy saving officers' must every year submit to the Energy Service a report that includes measured energy consumption and measures taken to improve energy efficiency. So far, there are more than 400 'energy saving officers' from all kinds of public buildings, like office buildings, public schools and police stations.
The 'energy saving officer' also has the possibility to request the Energy Service to perform a brief energy audit of the public building that he/she is responsible for. In that case, an employee of the Energy Service is visiting the building. The visit includes collecting data related to the energy consumption, interviewing employees and inspecting the building facilities. A report with recommendations is then submitted by the Energy Service to the public authority using the building. So far, twenty six public buildings have gone through a brief audit.

The certification of public buildings with more than 500 m^2 that are frequently visited by the public, will be implemented by January 2013.
The amendment of the Law for the Regulation of the Energy Performance of Buildings 2006, L.142(I)/2006, introduces the option of issuing a certificate based on the operational rating for public buildings. Regulations regarding the methodology and rating of the operational certificate are expected to be issued during 2013.

3.3 Implementation of mandatory advertising requirement – status
Indicating the energy category of the EPC became mandatory in all commercial advertisements on the 28th of December 2012. Before the implementation, the Ministry of Commerce, Industry and Tourism has informed all relevant interest groups. In 2013, the Ministry is planning to make sample checks on the implementation of this requirement.
The Law allows the competent authority to impose a fine up to 30,000 € in case of non-compliance.

3.4 Information campaigns
The Energy Service has recognised the importance of informing both professionals of the building industry, as well as the general public in order to effectively implement the EPBD and its recast.

During the first phase, the focus was on training the building permit authorities, the majority of which are the municipalities. Training took place through several training sessions. Furthermore, a guide was issued, in order to assist the building authorities to effectively check if the buildings are complying with the EP requirements when their building permit is examined.

In the second phase, information campaigns were addressed to all parties involved in the building industry. The Energy Service organised or participated in seminars and presentations especially directed to professionals in the building industry. Some of these presentations were part of major events for the national building industry, like the 4th Conference of Land Development Companies in 2008, and the 5th Energy Saving Exhibition 'Save Energy 2009'. Presentations especially organised for professional organisations, so far have targeted the Cyprus Association Property Owners, the Cyprus Association of Property Estimators and the Property Consultants, the Cyprus Hotel Association and the Federation of Associations of Building Contractors of Cyprus.

Leaflets and advertising flyers informing the public about the EPC, as well as about the inspection of central heating systems with a boiler and air-conditioning systems, have been issued and made available in places where frequent services are offered to the public.
In 2011, an advertisement campaign addressing the EPC was also launched in the print media. The campaign covered the three largest newspapers in the country and lasted for two months (Figures 12 and 13).

4. Inspection requirements - heating systems, air-conditioning

Cyprus has chosen the option of inspections. Inspections of air-conditioning (AC) and heating systems began in 2010. The inspections of AC systems are combined with the requirements of the f-gas regulation, in order to make them more effective and to reduce the cost for the building owner. The inspections of heating systems are carried out by the Energy Service. In both cases, the inspector has to submit a report to the owner.

Figure 12: Advertisement of the EPC.

4.1 Progress and current status on heating systems

By the beginning of 2010, a total of 179 inspections were conducted for heating systems with a boiler of rated output above 20 kW. These inspections mainly covered households and public schools. They were carried out free of charge by qualified boiler inspectors on behalf of the Energy Service. A written report is filled out and submitted to the owner of the building after each inspection. Suggestions and recommendations for improving the efficiency of the boiler are included in the report.The methodology for the inspection of boilers is described in the 'Guide for the Inspection of Central Heating Systems with Boilers'. It is based on EN 15378 and covers all accessible parts of the heating system.

In 2012, an examination program in the form of an oral and a written exam was set by the Energy Service. Only those who pass the exam are authorised to conduct inspections and eligible to enter a registry. Institutes that are interested in becoming qualified organisations for organising the exams must apply to the Energy Service and meet the criteria set. The goal is that in 2013 the registered boiler inspectors will replace the inspectors so far performing inspections on behalf of the Energy Service.

Figure 13: Three page leaflet informing the public about the EPC.

4.2 Progress and current status on AC systems

Inspections of AC systems in Cyprus started on the 1st of October 2010. The Ministerial Order for the Inspection of Air-Conditioning systems makes the inspection of individual AC systems larger than 12 kW, and the inspection of AC systems that, adding together their nominal power in the same building, exceeds 50 kW, mandatory.

The inspections can only be performed by inspectors of building services, who have to be registered in the corresponding registry of the Energy Service. Until the 1st of August 2011, the requirements for inspectors to become qualified were: a degree in mechanical engineering, membership to the Scientific and Technical Chamber of Cyprus (ETEK), and three years of related experience in designing and installing AC systems. After that date, two more requirements were added:

- certified for the installation, recovery, maintenance and repair regarding fluorinated gases according to regulation (EC) 842/2006;
- training in matters of health and safety related to AC installations.

The methodology for inspecting AC systems is described in the 'Guide for the Inspection of Air-Conditioning Systems' (Figure 14), and is based on EN 15240:2007. The document describes which data must be gathered, how checks should be performed and gives guidance on the recommendations.

The Energy Service implements a control system on the inspections of AC systems. According to The Energy Performance of Buildings (Inspection of Air-conditioning Systems) Regulations of 2009, decree 163/2009, the inspectors must inform the Energy Service which inspections they will perform, at least one week ahead of the schedule. This

enables the Energy Service to check on them during the inspection on a random basis. Also, the Energy Service frequently asks the inspectors to submit their inspection reports in order to check their quality.

Until the end of 2012, there were fifty-eight AC registered inspectors and thirty-one inspections performed.

5. Conclusions and future plans

The biggest challenge for Cyprus in 2013 is the full implementation of the recast Energy Performance of Buildings Directive (EPBD). The amendment of the Law for the Regulation of the Energy Performance of Buildings 2006, L.142(I)/2006, that was voted by the House of Representatives, was the product of a two year consultation process. The process for implementing the recast EPBD in Cyprus already started at the Committee for Consulting the Minister; where all relevant interest groups related to buildings, e.g., professional associations, governmental departments, and consumers participated. Then, a public consultation followed. The result is that the amendment law not only transposes the recast EPBD in Cyprus, but also completes gaps and weaknesses that were found from implementing the original EPBD. The most important fields of improvement are the following:

> The proper installation and maintenance of technical systems was not addressed in the previous legislation. Addressing this issue was judged essential by almost all stakeholders as a complement to inspections, and for effective implementation of articles 8 and 9 of the EPBD. The amendment law provides the legal basis for regulating the qualifications of installers of technical systems. These qualified installers will also be responsible for carrying out the adjustment and control of existing systems. A consultation between the Energy Service and the stakeholders, which started in 2012, is currently discussing the regulation of the qualifications of the installers and the processes for the installation and maintenance of heating systems with boilers. The air-conditioning (AC) systems will follow.

> The installation of high energy efficiency systems in new buildings and buildings that undergo major renovation is considered to have a lot of untapped potential. The technical, environmental and economic feasibility of those systems is now required for all new buildings and all buildings that undergo major renovation. The Energy Service is planning to develop tools for calculating the feasibility of installing such systems. The goal is to make it easy in terms of time and money spent, for the engineers and the building owners to have a clear picture of the benefits of installing an alternative system. The new legislation strengthens the availability of the feasibility study before construction starts, and also provides the legal basis for regulating the context of this study.

> The Law so far provided the authority for the Director of the Energy Service to assess fines only for not having an Energy Performance Certificate (EPC) issued. The amendment law regulates fines for every aspect of the EPBD, including, e.g., not conforming to the minimum Energy Performance (EP) requirements or to the inspections of heating and AC systems, and not stating the EP indicator in a commercial advertisement. The administrative fine can be as high as 30,000 €, instead of 8,000 € in the previous law, and guidelines for the implementation of the fines are planned to be developed in 2013.

During 2011, the building sector in Cyprus was responsible for 30% of the final energy consumption in the country, with a cost estimated to be around 600 M€. The implementation of the EPBD so far showed that new buildings that fulfil the minimum requirements use at least 50% less of the energy consumed by similar buildings of the existing building stock. The implementation of the recast EPBD is expected to gradually tighten the minimum EP requirements towards Nearly Zero-Energy Buildings (NZEB) and improve the energy efficiency of existing buildings, as well as the energy performance of technical systems.

Figure 14: Guide for the inspection of air-conditioning systems.

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