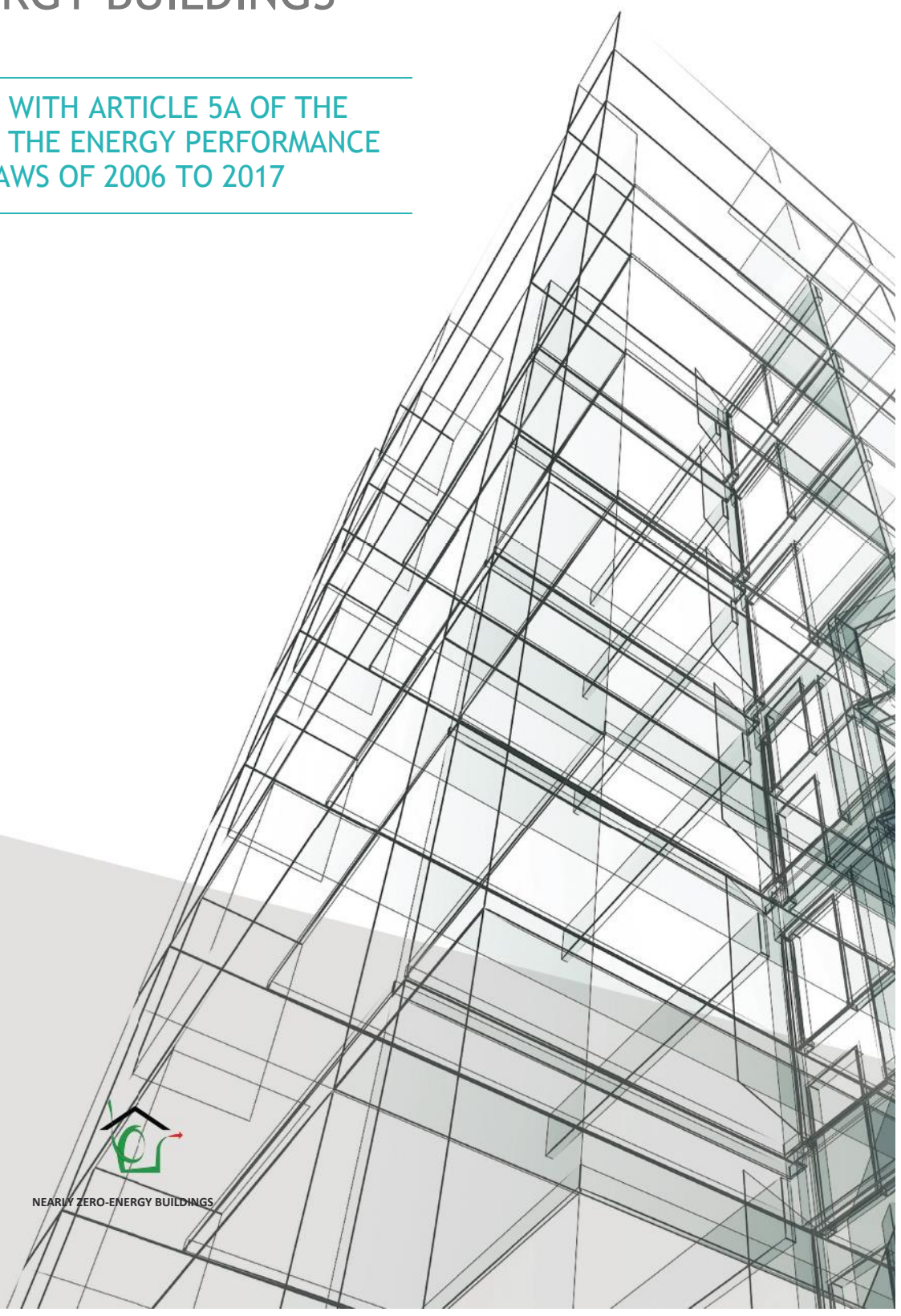
2nd NATIONAL PLAN

FOR INCREASING THE NUMBER OF NEARLY ZERO-ENERGY BUILDINGS (NZEBs)

IN ACCORDANCE WITH ARTICLE 5A OF THE REGULATION OF THE ENERGY PERFORMANCE OF BUILDINGS LAWS OF 2006 TO 2017



MINISTRY OF ENERGY, COMMERCE, INDUSTRY AND TOURISM

NEARLY ZERO-ENERGY BUILDINGS

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Chapter 1

INTRODUCTION

Directive 2010/31/EU on the energy performance of buildings sets out a number of measures aimed at utilising the large unused potential for energy savings in buildings. These also include a provision under which all new buildings must be nearly zero-energy buildings by 31 December 2020, whereas after 31 December 2018 all new buildings occupied or owned by public authorities must be nearly zero-energy buildings. This measure was transposed into the national legislation by Article 5A of the Regulation on the Energy Performance of Buildings Law of 2012 (Law 210(I)/2012). Said Law states that the Minister for Energy, Commerce, Industry and Tourism may by Decree specify 'the requirements and technical characteristics to be met by nearly zero-energy buildings'.

'Nearly zero-energy building' means a building that has a very high energy performance, as determined in accordance with the methodology used to calculate the energy performance of buildings, in which the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.

1.1 Energy policy and buildings

The indicative target set by Cyprus requires that the primary energy consumption in 2020 should not exceed 2.2 million tons of oil equivalent (TOE). Also, it is estimated on the basis of Article 7 of Directive 2012/27/EU on energy efficiency that end-use energy savings of 240 000 TOE should be ensured in the period 2014-2020. Also, in accordance with Article 5 of the above Directive, energy savings of 3.3 GWh per year should be ensured in the period 2014-2020 in buildings used by central government authorities. Furthermore, Cyprus must ensure that the share of renewable energy sources (RES) in final energy consumption is at least 13% by 2020. Directive 2009/28/EC on the promotion of the use of energy from renewable sources states: 'It will be incumbent upon Member States to make significant improvements in energy efficiency in all sectors in order more easily to achieve their targets for energy from renewable sources...' Therefore, the improvement of the energy performance of buildings, including through the promotion of NZEBs, is deemed necessary to achieve the above targets, taking into account in particular that almost one third of the final energy consumption is due to the buildings.

1.2 Current state of play in terms of buildings

In 2013, approximately 300 000 homes were used as permanent dwellings, broken down as follows: 120 000 detached houses, 65 000 terraced houses, 110 000 apartments and 8 000 other types of buildings (Zingheri, P. 2016). Forty per cent (40%) of those homes were built before 1981 and fifty-four per cent (54%) were built between 1981 and 2006, i.e. before any minimum energy performance requirements were adopted (Zingheri, P. 2016). Therefore, a poor to medium energy performance rating can be assigned to most homes, as the building owners did not take any energy savings measures in the construction of the building, while some home owners took savings measures afterwards, taking advantage mostly of the relevant aid schemes implemented by the Special Fund for

Renewable Energy Sources (RES) and Energy Savings (ES). Based on available statistics, 49% of the homes have not taken any energy savings measures and only 12% have used some form of heat insulation on the building envelope. The situation is slightly better in terms of door and window frames, as 38% of the homes have used double glazing (Energy Service of the Ministry of Energy, Commerce, Industry and Tourism, 2014).

As regards buildings in the tertiary sector (private and public), there were an estimated 30 000 buildings with a total floor area of more than 9 million m^2 in 2013. Office buildings (public and private) represent 39% of the total number of buildings, and buildings in the accommodation sector (hotels, tourist establishments and restaurants) represent 25%. Most of them (83%) were built before the first minimum energy performance requirements were adopted (Zingheri P., 2016).

Chapter 2

DEFINITION OF 'NEARLY ZERO-ENERGY BUILDING' (NZEB)

The Regulation on the Energy Performance of Buildings (Requirements and technical characteristics that must be met by a nearly zero-energy building) Decree of 2014 (RAA 366/2014) sets out the requirements that must be met by a building in order to be classified as NZEB. Before these requirements were determined, a study was prepared by an expert hired by the Ministry of Energy, Commerce, Industry and Tourism on the definition of NZEB in the residential sector. The study looked into the optimisation of the design parameters, construction materials, technical systems and renewable energy sources systems which would ensure the construction of a NZEB. Detached houses, apartment blocks and terraced houses were looked into, in the four meteorological areas of Cyprus. The financial aspect of NZEBs was also looked into from the building owner's perspective (EXERGIA SA, 2012).

A draft decree was prepared on the basis of that study and taking into account any NZEB designs available at the time. A public consultation followed, which was conducted through a public hearing and the two advisory committees: the advisory committee for the promotion of energy savings in buildings and the promotion of nearly zero-energy buildings and the advisory committee for following up on the implementation of the Regulation on the Energy Performance of Buildings Decrees, as adopted on the basis of the Regulation on the Energy Performance of Buildings Laws, in which all stakeholders are represented.

RAA 366/2014 was adopted on 1 August 2014, specifying the maximum permissible primary energy consumption and the minimum share of renewable energy sources in energy consumption. It also laid down more stringent requirements regarding thermal insulation levels compared to the minimum energy performance requirements currently in force for new buildings. As regards office buildings, there is a maximum permissible installed power in place to meet lighting needs.

Table 1

Requirements and technical characteristics that must be met by a nearly zero-energy building, as laid down in RAA 366/2014

	Requirements	
1	Energy efficiency class in the energy performance certificate of a building.	A
2	Maximum primary energy consumption in residential buildings, as determined in accordance with the methodology used to calculate the energy performance of buildings.	100 kWh per m^2 per year
3	Maximum primary energy consumption in non-residential buildings, as determined in accordance with the methodology used to calculate the energy performance of buildings.	125 kWh per m^2 per year
4	Maximum energy demand for heating for residential buildings.	15 kWh per m^2 per year
5	At least 25% of total primary energy consumption, as determined in accordance with the methodology used to calculate the energy performance of buildings, comes from renewable energy sources.	
6	Maximum mean U-value for walls and load-carrying elements (pillars, beams and load-carrying walls) which are part of the building envelope.	0.4 W/m^2K
7	Maximum mean U-value for horizontal building elements (floors in a pilotis, floors in a cantilever, terraces, roofs) and ceilings which are part of the building envelope.	0.4 W/m^2K
8	Maximum mean U-value for (door and window) frames which are part of the building envelope. Excluding shop windows.	2.25 W/m^2K
9	Maximum mean installed lighting power for office buildings.	10 W/m^2

Adopting a definition of NZEB is deemed to be a significant measure for promoting these buildings, as it specifies the energy performance level for all new buildings after 2020, while at the same time providing all people currently engaged in the construction or renovation of buildings with a standard of increased energy efficiency in relation to the mandatory minimum energy performance requirements, which they may apply even now if they so wish.

Chapter 3

INTERMEDIATE TARGETS FOR IMPROVING THE ENERGY PERFORMANCE OF NEW BUILDINGS

The first attempt to adopt energy savings measures for buildings was made by adopting the CYS98:1999 national standard in 1999. In accordance with that standard, the U-value for opaque structures should be lower than 1 W/m^{2}K. Conformity to the standard was optional. However, from 2004 to 2007, when the minimum energy performance requirements were adopted, conformity thereto was a precondition for aid to be granted under the energy savings measures by the Special Fund for RES and ES. The aid schemes of the Special Fund for RES and ES entered into force in February 2004, and an estimated EUR 67 million was granted as an economic incentive to implement energy savings and renewable energy measures in buildings, such as heat insulation, frames, energy efficient lighting, heat recovery, automation and RES systems in air conditioning and heating (Energy Service of the Ministry of Energy, Commerce, Industry and Tourism, 2014). The mandatory energy performance improvement of new buildings was adopted upon transposition of Directive 2002/91/EC on the energy performance of buildings and the setting of minimum energy performance requirements.

3.1 Developments in terms of minimum energy performance requirements for new buildings

The requirements for new buildings and building units are laid down in the Regulation on the Energy Performance of Buildings (Minimum energy performance requirements for buildings) Decree, as adopted by the Minister for Energy, Commerce, Industry and Tourism under Article 15(1) of the Regulation on the Energy Performance of Buildings Laws of 2006 to 2012 and published in the Cyprus Government Gazette. In adopting the Decree, the Minister consulted with the advisory committee for the promotion of energy savings in buildings and the promotion of nearly zero-energy buildings, as set up under the above Laws.

The first Minimum Energy Performance Requirements Decree, as adopted on 21 December 2007, laid down maximum permissible U-values for new buildings, thus making the thermal insulation of the building envelope and double glazing in external frames essentially mandatory.

As of 1 January 2010, an additional minimum energy performance requirement was added to the effect that all new buildings should be classified as a minimum under energy class B in the energy performance certificate. This fostered the application of better thermal insulation than that provided for by the requirements for individual building elements. Moreover, the installation of a solar hot water production system was made mandatory for all new homes, and the fitting of a standby installation for the use of renewable power systems was made mandatory for all new buildings.

By the Decree of 2013, the maximum U-values were reduced by approximately 15%, while a maximum shade factor for windows was adopted for the first time. This factor is the product of the sunlight reduction factor by a fixed shade multiplied by the external movable shade and the sunlight transmission through the glazing. The Decree states that at least 3% of total energy consumption in non-residential buildings must originate from renewable energy sources.

In 2016, the U-values for the building envelope were further reduced aiming to have the cost-benefit ratio over the life cycle of the building reach its cost-optimal level, i.e. close to the NZEB requirements, as laid down in RAA 366/2014. The minimum percentage of total energy consumption that must originate from renewable sources was also increased significantly both for residential and non-residential buildings. The new minimum energy performance requirements entered into force on 1 January 2017 and are deemed to constitute the last and decisive step towards a smooth transition to NZEBs.

Table 2

Developments in terms of minimum energy performance requirements for new buildings and building units, and comparison thereof against the NZEB requirements[1]

	Minimum energy performance requirements Decree of 2007 (RAA 568/2007) In force since **21.12.2007**	**Minimum energy performance requirements Decree of 2009 (RAA 446/2009)** In force since **1.1.2010**	**Minimum energy performance requirements Decree of 2013 (RAA 432/2013)** In force since **11.12.2013**	**Minimum energy performance requirements Decree of 2016 (RAA 119/2016 and RAA 379/2016)** In force since **1.1.2017**	**NZEB requirements (RAA 366/2014)**
Walls and load-carrying structure (maximum U-value)	0.85 W/m^{2}K	0.85 W/m^{2}K	0.72 W/m^{2}K	0.4[2] W/m^{2}K	0.4 W/m^{2}K
Roof and exposed floors (maximum U-value)	0.75 W/m^{2}K	0.75 W/m^{2}K	0.63 W/m^{2}K	0.4W/m^{2}K	0.4 W/m^{2}K
Door and window frames (maximum U-value)	3.8 W/m^{2}K	3.8 W/m^{2}K	3.23 W/m^{2}K	2.9 W/m^{2}K	2.25 W/m^{2}K
Maximum mean U-value for the building envelope, except for horizontal elements		1. 1.3 W/m^2 K for residential buildings 2. 1.8 W/m^2 K for non-residential buildings	1. 1.3 W/m2 K for residential buildings 2. 1.8 W/m2 K for non-residential buildings		
Maximum shade factor for frames	-	-	0.63	0.63	-
Maximum mean installed lighting power for office buildings	-	-	-	10 W/m^2	10 W/m^2

[1] The Regulation on the Energy Performance of Buildings (Minimum energy performance requirements) Decree of 2015 (RAA 359/2015) was adopted on 30 October 2015. However, it did not modify the requirements set out in RAA 432/2013, but only repealed certain definitions.

[2] Alternatively, the U-value may reach 0.6 W/m^{2}K, however, provided that the maximum mean U-value for frames does not exceed 2.5 W/m^{2}K.

Renewable energy sources (RES)		1. Installation of a solar hot water production system in homes. 2. Standby installation for the use of renewable power systems.	1. Installation of a solar hot water production system in homes. 2. At least 3% of total primary energy consumption must originate from RES in non-residential buildings.	1. At least 25% of total primary energy consumption must originate from RES in detached houses. 2. At least 3% of total primary energy consumption must originate from RES in residential building units. 3. At least 7% of total primary energy consumption must originate from RES in non-residential buildings.	At least 25% of total primary energy consumption must originate from RES in all buildings.
Minimum energy efficiency class in the energy performance certificate	-	B	B	B	A
Maximum primary energy consumption, as determined in accordance with the methodology used to calculate the energy performance of buildings	-	-	-	-	100 kWh per m^2 per year for residential buildings 125 kWh per m^2 per year for non-residential buildings
Maximum energy demand for heating in residential buildings	-	-	-	-	15 kWh per m^2 per year

3.2 Cost-optimal levels of minimum energy performance requirements and NZEBs

The cost-optimal levels of minimum energy performance requirements were calculated in April 2013 in accordance with Article 5 of Directive 2010/31/EU (Ministry of Commerce, Industry and Energy, Tourism, 2013). The calculation aimed to find out whether the minimum energy performance requirements in force at the time (RAA 446/2009) were significantly different from the optimal levels and whether corrective action had to be taken. Considering the results of the calculation from the investor's perspective and for the types of buildings for which calculations were made, i.e. detached houses, apartment blocks and offices, the main conclusions that can be reached for new buildings are (Ministry of Commerce, Industry and Energy, Tourism, 2013):

1. Energy class B is within cost-optimal levels.
2. Investing in lower U-values primarily for the roof and secondarily for the walls is the optimal way to reduce energy consumption.
3. A shading strategy appears to be significant for all types of buildings. However, cost-effectiveness may vary depending on the shading measure implemented.
4. In office buildings, energy consumption for lighting represents a major part of the energy consumption. Installing efficient lighting systems and, above all, making sure that these systems are correctly designed constitute an important measure given that the extra initial cost is relatively small for a new building.
5. Installing photovoltaic systems in conjunction with implementing energy savings measures is best practice that requires no subsidy, as it is combined with existing measures, i.e. net metering and autoproduction.

Based on the above conclusions, the minimum energy performance requirements were revised initially in 2013 (RAA 432/2013) and then in 2016 (RAA 119/2016).

Although NZEBs need not achieve cost-optimal levels, the calculation of cost-optimal levels of minimum energy performance requirements has allowed to look into the construction of NZEBs from the investor's perspective. The results have shown that the NZEBs deviate from cost-optimal levels (i.e. the minimum energy performance requirements in force as of 1 January 2017), but they still have a significant economic value over the life cycle of the building as compared to applying no requirements at all (Ministry of Commerce, Industry and Energy, Tourism, 2013).

The results of the calculation were based on the financial data of the period concerned, such as the energy costs, the construction costs and the discount rate. Given that these parameters are variable, the calculation must be repeated in 2018. The new calculation will trigger a review of the minimum energy performance requirements and will show whether they are in line with the requirements for NZEBs.

Chapter 4

POLICIES AND MEASURES FOR THE PROMOTION OF NZEBs IN NEW BUILDINGS AND BUILDINGS UNDERGOING MAJOR RENOVATION

NZEBs are a wholly new concept for professionals in the building industry as well as for building owners, both in terms of design and construction. It is true, therefore, that apart from the minimum energy performance requirements, further measures are also required to improve the skills of building designers and developers and to introduce NZEBs to the general public. Increasing NZEB-related knowledge and skills among professionals and consumers is encouraged through incentives, training measures, information measures and research programmes.

4.1 Incentives

Upon discontinuation of the aid schemes for the implementation of energy savings measures in buildings through the Special Fund for RES and ES in 2013, a new aid scheme was put in place in 2014 to encourage households and small and medium-sized enterprises (SMEs) to adopt energy efficiency and renewable energy measures. The 'Save & Upgrade' programme finances major renovation of homes and buildings owned or used by SMEs, which had requested a building permit before 21 December 2007, i.e. before the entry into force of the minimum energy performance requirements. The programme has a budget of EUR 15.3 million for the period 2014-2020 for SMEs and EUR 16.5 million for households and is co-financed by the European Regional Development Fund (ERDF) for SMEs or by the Union's Cohesion Fund (CF) for households.

As opposed to the previous aid scheme for individual intervention measures, the new scheme provides financial support for a set of measures aimed to upgrade the building to a minimum increased energy efficiency level. The largest aid amount is granted to buildings undergoing renovation to become NZEBs, i.e. those that achieve conformity to RAA 366/2014. An estimated 106 existing homes will be upgraded to NZEBs from the date of the initial call issued under the 'Save & Upgrade' programme. On the basis of the assessment of the results of the first call to be issued by the Directorate-General for European Programmes, Coordination and Development, the plan will be revised and a second call will follow.

Another incentive is Order No 1 of 2014, as issued by the Minister for Interior on the basis of the Town and Country Planning Law. In accordance with the Order, in the case of new buildings and buildings undergoing renovation, it is possible to increase the building rate by 5% for energy class A buildings, and at least 25% of their total energy needs will be covered from renewable energy sources, i.e. at least two of the criteria laid down for NZEBs must be met (Order No 1 of 2014: Use of renewable energy sources; in accordance with Article 6 of the Town and Country Planning Law). To date, seventeen applications have been submitted to the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism to verify conformity to the requirements laid down in the Order. Most of the cases relate to new large buildings.

4.2 Information measures

The energy performance information available to building users and professionals in the building sector has significantly improved due to the measures taken in recent years, such as the minimum energy performance requirements and the energy performance certificates. However, NZEBs are a new topic for the construction industry, let alone for the general public.

In recognition of the fact that architects and engineers are responsible for the implementation of NZEBs, the Energy Service has issued a 'Technical guide on nearly zero-energy buildings'. The guide aims to facilitate the project design team in looking into the most important NZEB design parameters. Plans are also being made to revise the 'Guide on the thermal insulation of buildings', which sets out the method used to calculate U-values and the specific heat capacity, also referring to thermal insulation techniques. The revision will include clear-cut references to NZEBs.

With regard to the general public, the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism has published an information leaflet, promoted both in hard copy and electronic format by the Energy Service as well as through other related stakeholders, such as the Technical Chamber of Cyprus and the Cyprus Energy Agency. In the context of its overall effort for more effective communication with the public, the Energy Service has been using the social media in order, among other things, to promote NZEBs, and is setting up a new website on NZEBs. At the same time, the Service is organising or participating in information workshops on NZEBs intended for specific target groups, such as consumer associations.

The Energy Service of the Ministry of Energy, Commerce, Industry and Tourism has secured technical assistance from the Joint Research Centre (JRC) including, among other things, proposals for providing consumers and stakeholders with information on NZEBs. There is also technical assistance obtained from the Gesellschaft für Internationale Zusammenarbeit (GIZ) for planning an information campaign on energy efficiency. The aim is to provide appropriate and timely information, adapted to each specific target group, such as households, undertakings, local authorities, etc. NZEBs are an integral part of that information campaign. The results of the study will be used as a criterion for the information measures to be implemented afterwards.

4.3 Training measures

Providing training on NZEBs to all professional groups involved in the construction industry and the real estate market is a fundamental measure for promoting NZEB principles in new and existing buildings.

The level of knowledge of engineers and architects regarding the energy performance of buildings has improved significantly thanks to the training and examination of qualified experts, heating system inspectors, air-conditioning system inspectors and energy auditors. In the effort made to integrate NZEBs in the field of knowledge of the independent experts concerned, the syllabus on which qualified experts are examined was modified in 2015 to include NZEB topics. Also, in the context of the training and examinations of energy auditors and heating system inspectors, reference is made to the legislative framework for NZEBs.

Moreover, in the context of the 'SouthZEB' research programme, the Department of Mechanical Engineering and Materials Science and Engineering of the Cyprus University of Technology organised a total of ten seminars under the general theme of NZEBs. The 'SouthZEB' programme aims to prepare engineers and architects engaging in the design of buildings for impending changes and building design as such, in South EU countries in particular (SOUTHZEB, n.d.). The Cyprus University of Technology has undertaken to train

a small group of instructors, who will in turn be able to train other engineers/ architects in this respect. To date, there are 14 instructors who have trained 120 engineers and architects in NZEB design, 82 of whom were granted a certificate of successful attendance following an examination. The seminars are organised under the auspices of the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism.

The MENS project is financed by the EU Framework Programme Horizon2020, which aims to provide professionals in the building sector (architects, civil engineers, electrical engineers, etc.) with NZEB training, with the emphasis placed on the renovation of existing buildings. In particular, the MENS project aims to increase the NZEB-related knowledge and skills of 1 800 professionals in 10 countries, including Cyprus. 50% of those persons should be women or unemployed. The 30-month-long project aims to set up an interdisciplinary training programme focusing on actual cases of buildings. The training activities of the project include a (postgraduate) university course, e-learning and webinars, as well as training meetings and workshops for the actual case study of buildings. Since January 2016, more than 60 persons have been trained in Cyprus and a total of more than 120 persons, all professionals in the building sector, were informed by taking part in project activities. The training course is available at the University of Cyprus. The Cypriot body responsible for the implementation of the 'MENS' project in Cyprus is the Research Centre for Sustainable Energy 'FOS' of the University of Cyprus.

Professionals engaging in the installation of building elements, technical systems and RES systems in buildings are also very important for the implementation of NZEBs. According to the roadmap developed in the context of the 'Build up skills – Pillar I' initiative, there is a need to provide 'green' training to at least 4 500 workers for 13 different skills until 2020, to achieve the national targets for the energy performance of buildings (Build up skills, 2013). Having regard to the roadmap, the bodies responsible for the implementation of the project 'WE-Qualify: Improve skills and qualifications in the building workforce relating to the energy performance of buildings' completed the planning and trial implementation of five training courses for three different skills: (i) installation of thermal insulation, (ii) installation of frames and sunlight protection systems, and (iii) installation and maintenance of biomass systems. The main objective of the WE-Qualify project is to assist the construction sector in Cyprus to address the lack of skills among the workforce in relation to the construction of energy-efficient buildings, and to contribute towards the attainment of the targets for promoting renewable energy technologies.

The WE-Qualify project, which is co-financed by the 'Intelligent Energy Europe' programme through the 'Build-up skills – Pillar II' initiative, started its operations in November 2013 and was completed in October 2016. The following pilot training courses were implemented under the programme: three courses for thermal insulation installers, one course for frame and sunlight protection system installers, and one course for installers of small-scale biomass boilers and heaters.

As regards legislation and in the context of implementing Directive 2009/28/EC on the promotion of the use of energy from renewable sources, a certification system has been established for installers of small-scale RES systems carrying out the installation and/or maintenance of small-scale biomass boilers and heaters and/or photovoltaic and solar thermal systems and/or shallow geothermal systems and heat pumps. To date, a training provider for photovoltaic system installers and another one for installers of small-scale biomass boilers and heaters has been authorised. In addition to that, the Energy Service has, following consultation with the stakeholders, prepared regulations setting out the qualifications and obligations of installers of heating, air conditioning, major ventilation and hot water production systems. Both the existing arrangements and those planned aim to improve the skills of installers and, therefore, the quality of the installations in buildings, as this is essential in NZEBs.

4.4 Exemplary role of the public sector

Energy upgrade works have started since 2013 in buildings owned and used by the central government, under the 'ENERGEIN' project. The project included the major renovation of two buildings and the implementation of individual energy savings and renewable energy measures in another two buildings. By virtue of the Decision of the Council of Ministers of 14 April 2016, a Committee was set up for upgrading the energy performance of buildings used by central government authorities, comprising representatives of the Department of Public Works, the Department of Electrical and Mechanical Services, the Directorate of Control of the Ministry of Transport, Communications and Works and the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism. The mandate given to the committee includes both the energy upgrading of existing buildings owned and used by the central public administration, with a view to complying with the obligation under Article 5 of Directive 2012/27/EU, and proposing measures to promote the NZEB principles in public buildings in a financially and technically optimal way. The committee should prepare an annual report to inform the Minister for Transport, Communications and Works and the Minister for Energy, Commerce, Industry and Tourism on the progress made in achieving the national target for energy savings in public buildings (excerpt from the minutes of the Council of Ministers meeting of 13 April 2016, Decision No 80 534).

4.5 NZEB research in Cyprus

Significant work has been carried out in recent years by universities and other research institutions in respect of NZEBs and, in particular, how the relevant principles can be implemented in an optimal way in Cyprus. The Energy Service supports such initiatives, mainly by issuing opinions on the policy implemented by the Republic of Cyprus in the energy sector, as well as on the dissemination of the results. Moreover, the results of these projects are also used as feedback to improve the existing NZEB arrangements and incentives. Following are some NZEB research projects, while we should also stress that other research programmes relating to the energy performance of buildings are being, or have been, implemented.

Efforts to secure research programmes are still being made by stakeholder organisations, and additional research projects may be implemented by 2020.

The European research project IEE EPISCOPE (Energy Performance Indicator Tracking Schemes for the Continuous Optimisation of Refurbishment Processes in European Housing Stocks) aims to consider the most effective methods for the energy upgrading of residential buildings, including scenarios for major renovation into NZEBs. Seventeen (17) Member States take part in the project, including Cyprus, its partner being the University of Cyprus (IEE Project EPISCOPE, n.d.).

The research project 'Geothermal energy systems in NZEBs' looked into the possibility of using a combination of a soil heat pump and photovoltaic systems in the Cypriot building sector from an energy, environmental and financial point of view, as well as on how these can contribute towards the achievement of NZEB targets. The project was implemented by the University of Cyprus and was financed by the Cyprus Research Promotion Foundation.

The project 'Nearly Zero-Energy Sports Facilities – n0e Sport Facilities' aims to assess the current state of play in terms of energy in 18 sports facilities in the EU and to the determine and implement innovative technological solutions for energy savings, aiming to save more than 50% of the current energy consumption. As a result, the 'n0e sport facilities' project promotes the creation of nearly zero-energy sports facilities through the design and the promotion of an integrated renovation package for sports facilities, including all the available energy savings methods/ measures and utilising renewable energy technologies. Three or four pilot sports facilities have been chosen in each

country participating in the programme, to propose and implement energy efficiency improvement measures. The municipal swimming pool in Aglandjia, the sports facilities of the Chalkanoras Idaliou Club, the municipal swimming pool of Nicosia and the Sports Centre of Kition in Larnaca were chosen in Cyprus. The project is implemented in Cyprus by the Cyprus Energy Agency.

The ZERO-PLUS project is financed by Horizon 2020 and started on 1 October 2015, while it is expected to be completed by 30 September 2019. It relates to the development and implementation of integrated energy-efficient agglomerations, including NZEBs. These agglomerations will be developed in four areas in Europe, one of them in Cyprus. The system will consist of innovative solutions for both the building envelope and the production and management of energy at building and agglomeration levels. The project aims to reduce the total use of energy by an average of 0-20kWh/m2 per year (compared to the current average of 70-230kWh/m2), as well as to migrate from NZEBs to nearly zero-energy agglomerations, in which energy loads and resources are optimally managed. Furthermore, 50kWh/m2 per year is expected to be produced from renewable energy sources by the use of innovative energy generation technologies. The aim is that the costs of the above system are reduced at least by 16% compared to the current costs. The Cyprus Institute and Cyprus Vassiliou Ltd are the Cypriot participants in the project (concerning the ZERO-PLUS, n.d. project).

Chapter 5

ADDITIONAL INFORMATION

Other NZEB promotion measures are also taken and planned and, despite not being directly linked to NZEBs, contribute indirectly towards increasing the number of such buildings. Following is a list of the most important measures.

The 'Solar energy for all' programme started in 2013, aiming to promote photovoltaic installations for meeting own electricity needs. Up until the end of 2015, it was possible to install a photovoltaic system with a maximum capacity of 3kW in homes. In December 2015, the programme was revised to include all types of buildings and to increase the maximum permissible capacity of the photovoltaic system to 5kW. Where these systems are installed, the electricity consumed by the building is offset against that generated by the photovoltaic system (net metering). It is also possible to install larger photovoltaic systems (10kW to 10MW), in which case offsetting takes place every 20 minutes. The 'Solar energy for all' programme is a strong synergy for the promotion of NZEBs, as it helps fulfil the obligation for renewable energy production in the building. To date, more than 11 000 photovoltaic systems have been installed in buildings using the net metering method, and the aim is to have another 70MW installed by 2020, which corresponds to 15 000 buildings.

A significant development is the progress made in the field of energy audits and energy services. On the basis of regulations adopted in 2012, the training and authorisation of energy auditors started in the second half of 2013. Energy auditing offers a more integrated approach than that of the three other independent experts in the field of the energy performance of buildings (qualified experts, air-conditioning system inspectors and heating system inspectors), as it must be based on updated and measurable operating data regarding energy consumption in the building and must include a detailed overview of the characteristics of that consumption. This enables building owners and would-be investors to consider the energy upgrade options available, including renovation into NZEBs. Periodic energy audits are mandatory for large undertakings, as an energy audit must be carried out by 5 December 2015 and must be repeated every four years thereafter. As large undertakings represent only a small part of Cypriot undertakings, the number of energy audits to be carried out mainly depends on demand and supply on the market. The regulations on energy service providers (ESPs) were adopted in April 2014 to increase confidence in energy audits among stakeholders as well as in the alternative ways of financing energy savings measures resulting from energy audits, by means of energy performance contracting (EPC). To date, there are 61 energy auditors for buildings and 24 ESPs.

To further enhance energy efficiency in companies, and private and public organisations, the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism is promoting the institution of 'energy manager'. Energy management training has been provided to individuals since 2014 through the 'European Energy Managers' (EUREM) training programme. To further strengthen and disseminate energy management, the Energy Service prepared, following consultation with the stakeholders, a decree specifying the training and duties of energy managers. As provided for by the decree, an energy manager's duties include, among other things, proposing actions and making recommendations to an organisation's management for reducing energy consumption. This helps promote increased energy efficiency on a voluntary basis, also promoting NZEBs, through a company's, organisation's or government authority's own procedures too.

Choosing appropriate technical systems in a NZEB may entail a greater challenge than in a conventional building, as the needs to be met are relatively small and this has to be done in the most efficient manner without compromising comfort. To partially comply with Article 8 of Directive 2010/31/EU, the Energy Service has issued technical guides on energy performance requirements and the adjustment and control of the technical building systems which are installed in existing buildings. Despite the guides' primary aim being to lay down requirements for existing buildings only insofar as this is technically, functionally and economically feasible, they may also serve as standards of good practice, providing solutions for streamlined design, installation and use of technical systems in NZEBs.

Chapter 6

POTENTIAL IMPROVEMENTS

The current financial support policy for improving the energy performance of buildings and promoting NZEBs largely depends on State subsidisation. Please note that certain deficiencies in the previous aid scheme of the Special Fund for RES and ES are addressed in the 'Save & Upgrade' programme. For example, the 'Save & Upgrade' programme provides for major renovation financing, meaning that the buildings included in the current scheme are not at risk of 'blocking' the entire energy savings potential of the building. Furthermore, the provision for participation of the qualified experts and energy auditors in the scheme boosts energy efficiency in the market and promotes a holistic and cost-effective approach when measures are chosen for intervention in each building (Economidou, M. (2016), Financing energy efficiency in buildings in Cyprus - JRC Technical Report).

However, ensuring maximum investment requires a higher share of private financing and solutions that are based on market mechanisms. Therefore, NZEB projects must meet the different criteria that are mandatory for financing from the financial sector. Also, the banking sector must become acquainted with the concept of NZEBs and the economic parameters of the buildings. The technical report entitled 'Financing energy efficiency in Cyprus, Status across the EU and recommendations, JRC Reports', as prepared by the JRC for the Ministry of Energy, Commerce, Industry and Tourism, provides details on the existing financial incentives and assesses their financial and technical efficiency to date. A greater mobilisation of private capital is very important, also in line with said technical aid, and proposals for improving the situation are being made. This parameter will be reconsidered in the impending restructuring of the 'Save & Upgrade' programme in view of the second call to be issued.

Events were also organised, where commercial banks were informed of matters relating to the energy performance of buildings both by the Energy Service and by professionals in the field. The aim is to intensify these contacts and the exchange of views in order to find solutions satisfying all stakeholders, including building owners.

To date, training and information on NZEBs are provided primarily to architects and engineers, as well as to installers to a lesser extent. However, a contribution can be made towards the promotion of NZEBs by other groups of professionals too, which are currently receiving no or very little information on the subject. The most important groups are real estate agents, property evaluators and construction material and technical system suppliers. The technical assistance received by the Ministry of Energy, Commerce, Industry and Tourism from the JRC and the GIZ is also expected to contribute towards finding appropriate communication channels for better informing these groups.

NZEBs require higher levels of thermal insulation and possibly, in many cases, the implementation of sunlight protection measures, such as external shades, cantilevers, etc. These measures tend to reduce the amount of usable space available in a building or the distance from adjacent buildings. As building construction is subject to town planning restrictions, discussing the issue with the direct stakeholders, i.e. the Department of Town Planning and Housing and architects, will stress the extent of the problem and point to the implementation of corrective measures as appropriate.

Conformity to the NZEB requirements laid down in RAA 366/2014 can only be achieved through the methodology used to calculate the energy performance of buildings. Various case studies and surveys have indicated that the actual energy consumption is lower than

calculated, the largest deviation being observed in cooling. This is due to various reasons, the most important one being that the current methodology used to calculate the energy performance of buildings does not take into account measures that help reduce cooling needs, such as roof-mounted fans and a building design that favours natural cooling. The contribution of such measures towards reducing the energy spent on cooling cannot be calculated at this stage, as the calculation procedures concerned are not specified in the relevant EU standards. Moreover, EU standards do not allow for calculating the renewable energy derived from high-efficiency heat pumps. As a result, there are certain savings measures which are not adequately encouraged and it may be impossible to effectively implement an overall requirement concerning energy demand for cooling similar to that in place for heating. Cyprus looks forward to a solution to the problem through the new standards prepared by the European Committee for Standardisation (CEN).

ANNEXES

ANNEX A

The Regulation on the Energy Performance of Buildings (Requirements and technical characteristics that must be met by a nearly zero-energy building) Decree of 2014 (RAA 366/2014)

GOVERNMENT GAZETTE

OF THE REPUBLIC OF CYPRUS

APPENDIX THREE

PART I

REGULATORY ADMINISTRATIVE ACTS

Number 4806	Friday, 1 August 2014	1475

Number 366

THE REGULATION ON THE ENERGY PERFORMANCE OF BUILDINGS LAWS OF 2006 TO 2012

Decree under Articles 5A and 19(3)(g)

Preamble Official Journal of the EU: L153, 18.6.2010, P. 65.	To better transpose Article 9(2) of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings,
142(I) of 2006, 30(I) of 2009 210 (I) of 2012.	the Minister for Commerce, Industry and Tourism, exercising the powers conferred on him under Articles 5A and 19(3)(g) of the Regulation on the Energy Performance of Buildings Laws of 2006 to 2012, hereby adopts the following Decree.
Short title.	1. This Decree shall be referred to as the Regulation on the Energy Performance of Buildings (Requirements and technical characteristics that must be met by a nearly zero-energy building) Decree of 2014.
Interpretation.	2.-(1) In this Decree, unless the context requires otherwise:
	‘energy demand’ means the energy that a technical building system must provide to ensure indoor heating comfort conditions;
	‘maximum mean installed lighting power’ means the result of the calculation made by the method specified in the guide on heat insulation issued by the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism;

'maximum mean U-value for (door and window) frames which are part of the building envelope' means the result of the calculation made by the method specified in the guide on heat insulation issued by the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism;

'maximum mean U-value for horizontal building elements (floors in a pilotis, floors in a cantilever, terraces, roofs) and ceilings which are part of the building envelope' means the result of the calculation made by the method specified in the guide on heat insulation issued by the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism;

'maximum mean U-value for walls and loading-carrying elements (pillars, beams and load-carrying walls) which are part of the building envelope' means the result of the calculation made by the method specified in the guide on heat insulation issued by the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism;

142(1) of 2006 ▫ 30(1) of 2009 ▫ 210(1) of 2012.

'Law' means the Regulation on the Energy Performance of Buildings Laws of 2006 to 2012.

(2) Any terms which are not specifically defined herein shall have the meaning ascribed to them by the law.

Requirements for zero-energy buildings. Government Gazette, Annex Three (I): 11.12.2013. Table.

3. To classify a building as a nearly zero-energy building, it must conform to:

(a) the minimum energy performance requirements for buildings, as laid down in the Regulation on the Energy Performance of Buildings (Minimum energy performance requirements for buildings) Decree of 2013, as amended or replaced each time; and

(b) the requirements and technical characteristics laid down in the table, which are included in the national plans issued by the competent authority.

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TABLE
(paragraph 3)

	Requirements	
1	Energy efficiency class in the Energy Performance Certificate of a building	A
2	Maximum primary energy consumption in residential buildings, as determined in accordance with the methodology used to calculate the energy performance of buildings	100 kWh per square metre per year
3	Maximum primary energy consumption in non-residential buildings, as determined in accordance with the methodology used to calculate the energy performance of buildings	125 kWh per square metre per year
4	Maximum energy demand for heating in residential buildings	15 kWh per square metre per year
5	At least 25% of total primary energy consumption, as determined in accordance with the methodology used to calculate the energy performance of buildings, comes from renewable energy sources	
6	Maximum mean U-value for walls and load-carrying elements (pillars, beams and load-carrying walls) which are part of the building envelope.	0.4 W/m^2K

7	Maximum mean U-value for horizontal building elements (floors in a pilotis, floors in a cantilever, terraces, roofs) and ceilings which are part of the building envelope.	0.4 W/m^2K
8	Maximum mean U-value for (door and window) frames which are part of the building envelope. Excluding shop windows.	2.25 W/m^2K
9	Maximum mean installed lighting power for office buildings.	10 W/m^2

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Done on 23 July 2014.

GIORGOS LAKKOTRYPIS,

Minister for Energy, Commerce, Industry and Tourism.

ANNEX B

The most important measures taken to promote NZEBs between 2012 and 2015

Measure	Type of measure	Year of implementation	Intended primarily for:
Study on the definition of NZEB for different types of houses (EXERGIA S.A., Provision of consulting services for the definition of Nearly Zero Energy Residential Buildings in Cyprus, Contract No MCIT/ES/01/2011, May 2012)	Research	2012	Ministry of Energy, Commerce, Industry and Tourism (Energy Service), building designers
Determination of the qualifications, training and the duties of energy auditors (RAA 184/2012)	Legislation/training	2012	Architects and engineers
Calculation of cost-optimal levels of minimum energy performance requirements (Ministry of Energy, Commerce, Industry and Tourism, Calculations for setting minimum energy performance requirements at cost optimum levels according to Article 5 of Directive 2010/31/EU on the energy performance of buildings (recast), April 2013)	Legislation/research	2013	Ministry of Energy, Commerce, Industry and Tourism (Energy Service)
'Geothermal systems in NZEBs' research project	Research	2013-2015	Architects and engineers
Renovation of buildings owned and used by central government authorities in the context of the 'ENERGEIN' project	Exemplary role of the public sector	2013-2015	Central government authorities, general public
'Solar energy for all' programme, to promote photovoltaic systems	Incentives	2013-2015	Owners of new and existing buildings
Revision of minimum energy performance requirements	Legislation	2013	All stakeholders

Measure	Type of measure	Year of implementation	Intended primarily for:
Increasing the building rate for energy efficiency class A buildings, which meet at least 25% of energy consumption from RES	Incentives	2014-2020	Owners of new and existing buildings
Determination of the responsibilities of ESPs and of the procedure used for enrolment thereof in a register (RAA 210/2014)	Legislation	2014	Undertakings
Definition of NZEB by decree of the Minister for Energy, Commerce, Industry and Tourism (RAA 366/2014)	Legislation	2014	All stakeholders
Inclusion of NZEBs in the syllabus on which qualified experts are examined (RAA 419/2015)	Legislation/training	2015	Qualified experts
Determination of the qualifications, training and duties of small-scale RES system installers (RAA 374/2015)	Legislation/training	2015	RES installers
Technical guide on nearly zero-energy buildings	Information/training	2015	Building designers, qualified experts
'Save & Upgrade' programme for upgrading existing homes and buildings used by SMEs into NZEBs (first call)	Incentives	2015	Households and SMEs

ANNEX C

The most important measures already taken and planned to be taken to promote NZEBs between 2016 and 2020

Measure	Type of measure	Year of implementation	Intended primarily for:
Document on NZEBs	Information	2016	General public
Revision of minimum energy performance requirements (RAA 119/2016)	Legislation	2016	All stakeholders
'Save & Upgrade' programme for upgrading existing homes and buildings used by SMEs into NZEBs (first call)	Incentives	2016	Households and SMEs
Revision of the 'Guide on the thermal insulation of buildings'	Legislation/information/training	2017	Building designers, qualified experts
Guide laying down requirements for technical systems installed or upgraded in residential buildings and building units, and guide laying down requirements for technical devices installed or upgraded in non-residential buildings or building units	Legislation/information/training	2016	For technical building system designers and installers
Website of the Energy Service concerning NZEBs	Information	2017	General public
Determination of the qualifications, training and duties of technical building system installers	Legislation/training	2017	Technical system installers
Determination of the training and the duties of energy managers	Legislation/training	2016	Executives of undertakings and public organisations
EPISCOPE research programme	Research	2013-2016	Ministry of Energy, Commerce, Industry and Tourism (Energy Service), architects and engineers

Measure	Type of measure	Year of implementation	Intended primarily for:
'WE QUALIFY' project	Training	2013-2016	Installers of building envelope elements, technical systems and RES
'Nearly Zero Energy Sports Facilities' research programme	Research	2014-2016	Sports facility owners and managers, such as local authorities and sports clubs
'SouthZEB' project	Education/research	2015-2017	Building designers
'MENS' project	Education/research	2016-2017	Building designers, qualified experts
Renovation of buildings owned and used by central government authorities in the context of applying Article 5 of Directive 2012/27/EU	Exemplary role of the public sector	2016-2020	Central government authorities, general public
'Save & Upgrade' programme for upgrading existing homes and buildings used by SMEs into NZEBs (second call)	Incentives	2017-2020	Households and SMEs
Second calculation of cost-optimal levels of minimum energy performance requirements	Legislation/research	2018	Ministry of Energy, Commerce, Industry and Tourism (Energy Service)
Review and revision of minimum energy performance requirements	Legislation	2018-2020	All stakeholders
'ZERO-PLUS' research project	Research	2015-2019	Architects and engineers

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