



The impact of the implementation of the European Energy Performance of Buildings Directive on the European building stock: The case of the Cyprus Land Development Corporation



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ABSTRACT

The building sector constitutes one of the three major energy consumers. To this end it comes as no surprise the fact that initiatives and policies in the field of energy saving focus on this sector in order to improve the energy performance of societies. The reduction of the energy consumption of dwellings becomes more important when social housing buildings are discussed, not only due to the fact that they constitute a major part of the European building stock, but also because the main concept of these buildings is that they are used by low income or vulnerable social classes. The main aim of this study is to discuss the impact of the implementation of the energy performance of the EU buildings Directive on the energy performance of the Cyprus Land Development Corporation buildings, which is the main social housing association of Cyprus. For this purpose the building stock of the corporation was studied, and detailed analysis of the actual performance and of the structural and thermal features of the considered dwellings was performed. This study produced well justified conclusions concerning the decrease of the energy consumption of Cyprus social housing corporation buildings, as well as important findings concerning the appropriate indicators which should be used in the case of the analysis of buildings energy performance. Further findings of this study include the considerations of the end-energy use for the reliable comparison between the energy habits and the lifestyle of social housing occupants, and the importance of exploiting social housing buildings both for proving the effectiveness of building related energy policies, as well as to introduce novel future relevant policies.

1. Introduction

Since 1976, several policies have been adopted by the European Union (EU) towards reducing the energy consumption of the building sector. The Energy Performance of Buildings Directive (EPBD) dominates the development in the field of energy policies in Europe since 2002. The nature of this Directive, as well as the fact that it has been adopted and implemented by all 28 European Union Member States justifies its importance in the field of energy saving in buildings. Although several energy saving measures in the building sector have been adopted in central and northern European countries since the mid-1970's, in the European south, actual measures were not adopted until the implementation of the EPBD. The reason for this time delay is due to the fact that in the European south, subtropical climatic conditions prevail, thus the energy consumption for heating is significantly

reduced compared to the “cold northern region”.

Although the implementation of the EPBD has been steadily progressing in all EU member states, there are cases in which the effectiveness of this policy is under discussion. Social-housing associations buildings present one of these cases. Social housing corporations are aimed to provide dwellings to low-income families, either for renting or purchasing. Both cases entail the design and construction of low-cost buildings, a requirement which in some cases is in contrast with the fact that energy efficient constructions may require higher construction expenditure and advanced building services which also cost more. Additionally, the lifestyle of the occupants, as well as their educational level may be an obstacle either to the acceptance of energy saving habits, or to understand the importance of reducing the energy consumption of their dwelling. However social-housing buildings constitute a good case study, both to demonstrate the effectiveness of

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energy saving policies and to promote novel energy saving measures for the buildings sector.

This study aims to analyse the impact of the EPBD implementation on the building stock of a European member state, Cyprus, and particularly on the buildings constructed by its social housing corporation. Following this introductory part, the second section of this study focuses on the policies implemented in Europe since the mid-1970's towards reducing the energy consumption of the building sector. Particular emphasis is given to the present framework, namely the energy performance of buildings Directive, the main features of which are presented and elucidated. In this study the current challenges in the energy performance of public housing association is introduced and discussed, based on previous studies found in the literature. The methodology applied in this study is presented and discussed in the third section. This is done by analysing the structural and thermal features of the Cyprus Land Development Corporation (CLDC) buildings, carried out by the implementation of a questionnaire survey. The main findings of this study are presented and discussed in Section 4. The sampling rationale is explained, and the information retrieved from the considered dwellings is presented. The analysis of the actual energy performance of the investigated buildings, as well as the appropriate indicators to classify the energy behaviour are also extracted. The conclusions of this study, as well as the policy implications of the main findings are presented in the last section. Additionally, [Supplemental material](#) concerning the building stock of CLDC, as well as the analysis of the questionnaire responses is provided.

The innovation of this study lies in the fact that this is the first work that analyses the energy performance of the building stock, of a social housing organization in south-eastern Europe, following the adoption of the Energy Performance of Buildings Directive (EPBD). The conclusions of this study are expected to be particularly important, especially for policymakers, in relation to future decisions and guidelines for this field of policy. The findings of this report are also expected to support the effort to meet the major challenges that all European countries will face in relation to the adoption of energy efficiency policies for buildings.

2. Theoretical background

2.1. Energy efficiency of buildings policy evolution in Europe

The European Union has adopted policies in the field of energy saving in the building sector since the mid-1970s, following the October 1973 oil crisis, when the members of the Organization of Arab Petroleum Exporting Countries proclaimed an oil embargo. In September 1974 resolution concerning a new energy policy strategy for the Community, the Council accepted as an objective the 'reduction of the rate of growth of internal consumption by measures for using energy rationally and economically without jeopardizing social and economic growth objectives' (European Council, 1974). In May 1976 a council recommendation on the rational use of energy in the heating systems of existing buildings was published (European Council, 1976). In this recommendation, specific energy saving measures for existing buildings which are not occupied all the time and existing residential accommodation were introduced, including information such as indoor temperatures of the considered spaces. Additionally, measures for the maintenance and inspection of heating systems as well as suggestions for improving the efficiency of hot-water systems in residential buildings were proposed. This recommendation introduced for the first time the necessity for periodical inspection and service of heating systems with a capacity of 35 kW and above. In October 1977 a new recommendation on the regulation of space heating, the production of domestic hot water and the metering of heat in new buildings (77/712/EEC) was issued with further guidelines and suggestions in this field (European Council, 1977), including maximum temperatures for domestic hot water, and the use of building automation systems to

regulate heating in buildings.

The first Directive of the European Union on the energy performance of buildings was published in 1993, entitled Council Directive to limit carbon dioxide emissions by improving energy efficiency (SAVE) (European Council, 1993). The purpose of this Directive was the achievement by Member States of the objective of limiting carbon dioxide emissions by improving energy efficiency in the following fields:

- energy certification of buildings and the thermal insulation of new buildings,
- the billing of heating, air-conditioning and hot water costs on the basis of actual consumption
- third-party financing for energy efficiency investments in the public sector
- regular inspection of boilers,
- energy audits of undertakings with high energy consumption.

This Directive was followed by the 2002 Directive on the energy performance of buildings (European Parliament and European Council, 2002). The 2002 Directive was much more detailed compared to the 1993 one, and introduced additional elements such as the necessity for adoption of a joint energy performance of buildings calculation methodology, the definition of energy performance of buildings minimum requirements and specific energy performance measures for new and existing buildings. The 2002 Directive also adopted much more specific provisions for the energy performance certification of buildings. In this Directive revised conditions for the inspection of boilers were applied, and for the first time the requirement for the inspection of air conditioning systems was introduced. It is noteworthy to indicate that all policies until the beginning of the new millennium did not consider cooling as an important energy consumption sector, whereas the expansion of EU to the south and the inclusion of countries such as Spain, Portugal, Greece, Cyprus and Malta revised the approach of the council. Member States brought into force the laws, regulations and administrative provisions necessary to comply with this Directive on January 2006 the latest.

2.2. Present European Policy on the Energy Performance of Buildings

The 2010 Energy Performance of Buildings Directive (EPBD) (European Parliament and European Council, 2010) and the 2012 Energy Efficiency Directive (European Parliament and European Council, 2012) constitute at present the main European legislations concerning the reduction of the energy consumption of the building sector.

Under the EPBD the following provisions are included:

- the energy class of the energy performance certificate of buildings must be announced in all advertisements for the sale or rental of new or existing buildings
- the EU member states should establish an inspection scheme for both heating and air conditioning systems
- all new buildings in the European Union must be nearly zero energy buildings by December 2020, and by December 2018 for public buildings
- the EU countries must set minimum energy performance requirements for new buildings and for buildings that will undergo major renovation and for the replacement or retrofit of building elements, including heating and cooling systems, roofs, walls, etc.
- the EU countries should draw up lists of national financial measures and tools to support the improvement of the energy efficiency of buildings

The main novel element of the existing Directive and the major challenge of the European energy policy is the achievement of the nearly zero energy buildings targets. The nearly zero energy building is defined as the building which has a very high energy performance and

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