EeMAP
Energy efficient Mortgages Action Plan

CREATING AN ENERGY EFFICIENT MORTGAGE FOR EUROPE

BUILDING ASSESSMENT BRIEFING: CROATIA

CROATIA GREEN BUILDING COUNCIL
HRVATSKI SAVJET ZA ZELENU GRADNJU

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ABOUT THE CROATIA GREEN BUILDING COUNCIL

Croatia Green Building Council (CGBC) was formed in 2009 by 24 reputable companies and institutions as a non-profit organisation. The initiative for all its activities comes from the CGBC members and partners, who are also the ones to manage these activities.

The association has pursued its goal of being the leader in transformation of the Croatian construction and real estate markets towards sustainability, by promoting green building programmes and technologies, as well as integrating the available and obtained knowledge, experience and insights into design, construction and management of buildings in Croatia.

There are currently more than 100 active members from different areas (business, the public sector, academia) in our association. The Croatia Green Building Council is also an established member of the World Green Building Council and its European network.

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TABLE OF CONTENTS

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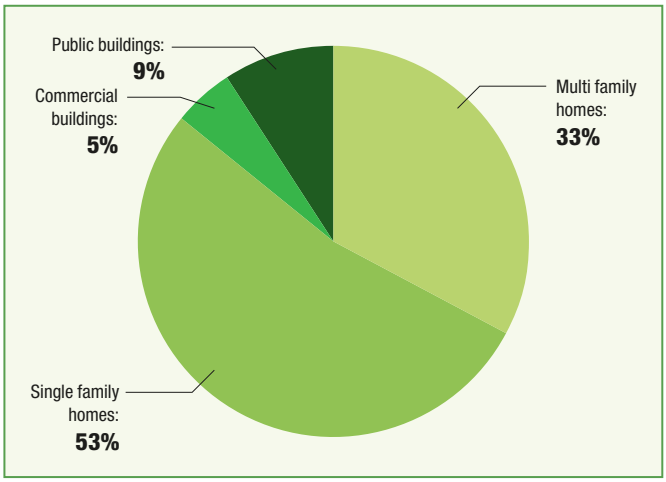
www.energyefficientmortgages.eu

INTRODUCTION

Energy security and climate change adaptation and mitigation largely depend on considerable improvement of the energy efficiency of buildings. Individual EU countries have set a 20% energy saving target by 2020. Furthermore, the European Union has set a long-term target of reducing CO_2 emissions from the building sector by 80–95% by the year 2050.

NATIONAL BUILDING STOCK OVERVIEW

The Croatian building stock includes 887,321 buildings with a total floor area of 192,519,039 m^2 and 86% of these buildings are residential. This stock is separated into 4 types by building use: I. Multi-family homes, II. Single family homes, III. Public buildings and IV: Commercial buildings.



Residential buildings in Croatia by ages

AGE OF BUILD	MORE FAMILY HOUSES		FAMILY HOUSES	
	Number	Surface (m^2)	Number	Surface (m^2)
From 1940.	37,201	5,830,983	64,391	10,092,805
1941. - 1970.	85,959	13,473,337	151,507	23,747,572
1971. - 1980.	59,882	10,398,113	93,109	16,167,887
1981. - 1987.	44,434	9,401,527	68,348	14,461,473
1988. - 2005.	38,358	8,177,401	75,615	16,120,249
2006. - 2009.	18,256	6,199,252	13,762	4,673,079
2010. - 2011.	6,600	1,957,449	4,976	1,475,551
TOTAL	**290,689**	**55,438,063**	**471,708**	**86,738,615**

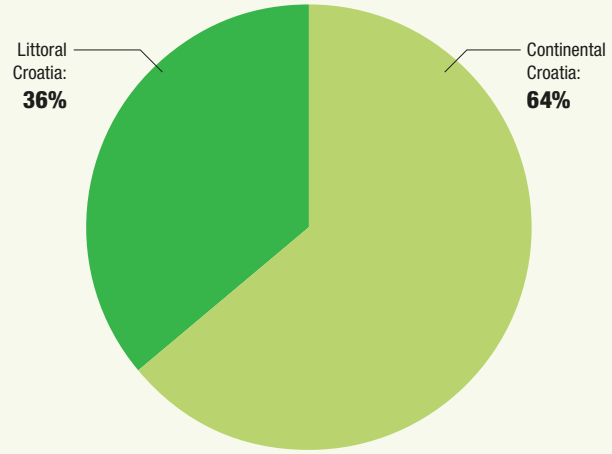
Non residential buildings in Croatia by ages

AGE OF BUILD	COMMERCIAL BUILDINGS		PUBLIC BUILDINGS	
	Number	Surface (m^2)	Number	Surface (m^2)
From 1940.	2,338	1,498,159	12,365	1,545,813
1941. - 1970.	12,587	8,064,602	22,525	2,815,845
1971. - 1980.	6,733	5,251,934	19,021	1,882,000
1981. - 1987.	4,323	5,108,279	10,158	2,152,000
1988. - 2005.	10,596	8,107,287	11,059	2,722,497
2006. - 2009.	6,199	6,352,000	3,673	2,073,747
2010. - 2011.	1,952	2,158,198	1,395	610,000
TOTAL	**44,728**	**36,540,459**	**80,196**	**13,801,902**

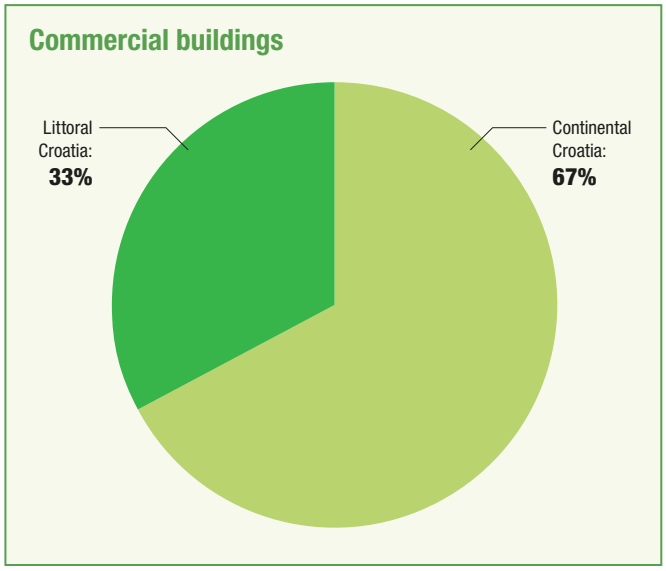
The chart below shows the distribution of the total building stock according to these four types.

For the purpose of calculating annual energy needs for heating and cooling, and other obligations under the Energy Performance of Buildings Directive (EPBD), the territory of Croatia is divided into two climate regions with the standard, i.e. reference climate data. All localities in the Republic of Croatia with 2,200 or more heating degree days* per year are classified as continental Croatia, while all localities with less than 2,200 heating degree days per year are classified as littoral, i.e. coastal Croatia.

Residential buildings



* Heating degree days are used to evaluate the energy consumption for heating in buildings. One degree day indicates a fall of one degree below a specified outdoor temperature (usually determined by the typical temperature where heating is not needed) for one day.



Of the total existing building stock in Croatia, 573,943 buildings, with a total floor area of 125,153,161 m^2 are in continental Croatia, and 313,378 buildings with a total floor area of 67,365,879 m^2 are in littoral Croatia.

ENERGY PERFORMANCE OF THE BUILDING STOCK

SINGLE FAMILY HOMES

A single-family home is defined as a residential detached building with one or maximum two apartments. Typical single-family houses constructed before 1970 in the continental area were built of solid brick, and made of natural stone in the littoral climate zone. The roof is typically wooden and the floor is concrete, mostly without thermal insulation. Hollow brick (continental area) or hollow concrete blocks (littoral area) and concrete beams were used from the 1970s until 1986. Thermal insulation on walls was very rarely applied. The wider application of thermal insulation began after 1986.

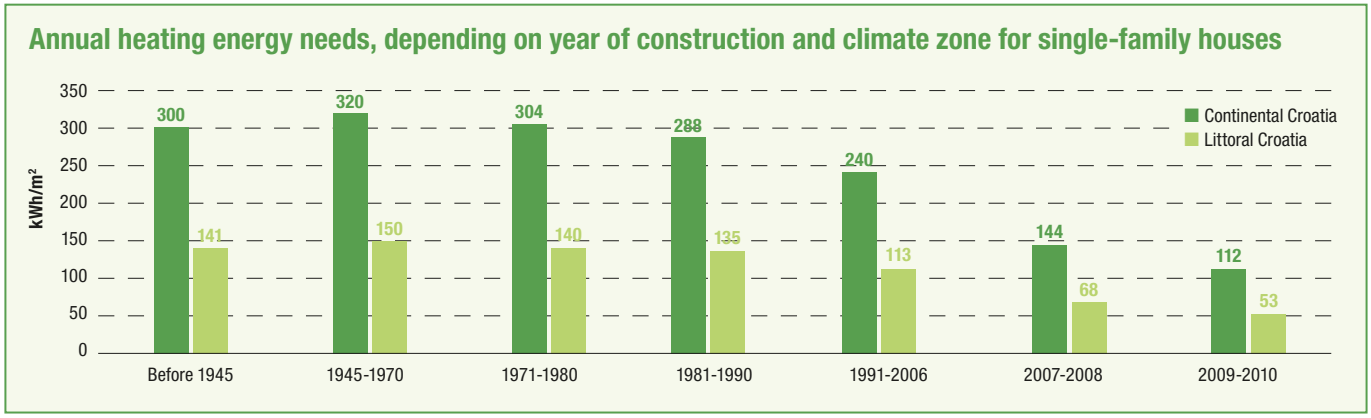
The specific energy needs for space heating of houses built before 1986 goes up to 320 kWh/m^2 per year in the continental area and up to 150 kWh/m^2 per year in the littoral area.

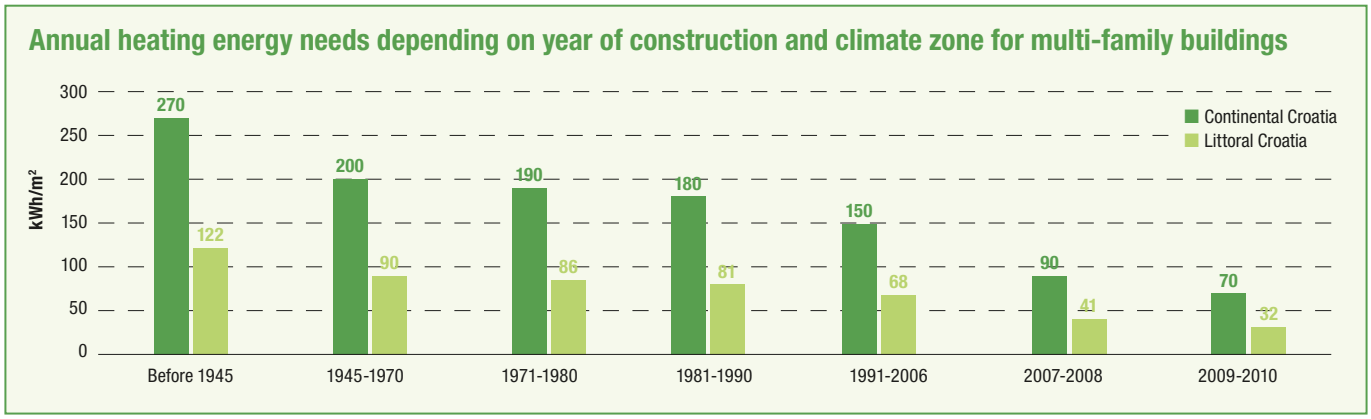
MULTI-FAMILY BUILDINGS

Multi-family residential buildings are considered as a residential building with three or more apartments managed by a building facility manager, who is a legal or natural person, in accordance with the Act on Ownership and Other Property Rights. A typical multi-family home built before 1970 in the continental area was built of solid brick, plastered on both sides. Buildings built in the littoral zone are typically made of reinforced concrete plastered on both sides. The roof is usually wooden and the floor is concrete, mostly without thermal insulation. The windows are wooden framed with single glazing.

The hollow brick (continental climate zone) or reinforced concrete (both climate zones) and concrete beams were used from the 1970s until 2005 with an additional 2 – 4 cm of thermal insulation. The wider application of thermal insulation began after 1986. The outer walls of buildings constructed after 2006 have an additional 8 – 15 cm insulation, and windows are usually wooden with double glazing.

The specific energy consumption for space heating of houses built before 1970 goes up to 270 kWh/m^2 per year in the continental climate zone and up to 120 kWh/m^2 per year in the littoral climate zone.





LEGISLATIVE FRAMEWORK

The performance of buildings and energy efficiency are mostly regulated in The Energy Efficiency Act. In accordance with EU requirements, Croatia compiles national energy efficiency action plans (NEEAP) every three years. NEEAPs oblige the Government to prepare a long-term national strategy (LTNS) on renovation of the national building stock up to 2050 and revise those strategies every three years. There are four different national renovation programmes which provide subsidies for different types of building: public buildings, commercial buildings, multi-apartment buildings and family houses. The diagram below visually explains the hierarchy of the national strategic documents.

EED 2012/27/EU, Art. 4. → ENERGY EFFICIENCY ACT, Art. 10

↓

National Energy Efficiency Action Plans

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Long-term strategy - renovation of the national building stock up to 2050

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National Program of energy renovation of Buildings

public buildings 2014-2015; 2016-2020	commercial buildings 2014-2020
multi-residential buildings 2014-2020	single family homes

↓

Revision of version of the Long-term strategy 2014 – every 3 years

LONG TERM NATIONAL STRATEGY

The Long Term National Strategy (LTNS) aims to:

- Provide guidelines for a well-planned, realistic and ambitious approach to energy renovation of buildings
- Find incentive measures for investment in the renovation of existing buildings, the sector with the greatest potential for energy savings
- Find measures for cost-effective deep renovation

A building owner can combine different energy efficiency measures of the LTNS for renovation of existing buildings, depending on the potential for renovation. When implementing measures, it is always important to achieve better energy efficiency performance than required by the building regulations, if the owner wants to receive subsidies from the relevant Renovation Programme. Measures that are commonly combined are:

- External envelope renovation of buildings
- Heating system replacement
- Use of renewable energy sources: e.g. solar panels, pellet-fuelled boilers, pyrolytic boilers, geothermal heat pumps
- Reduction of water consumption

The Republic of Croatia has recently revised the LTNS to address the following areas in the future:

1. To find incentives for investments in the reconstruction of existing buildings
2. To set a timeline for intervention
3. To provide a quantification of expected energy savings in each scenario
4. To determine the economic-energy optimum renovation model – for cost-effective integral renovation
5. To address private financial schemes
6. To identify priority sectors in order to focus on investments with greatest impact
7. To consider the private financial sector in the strategy

In order to select the optimal renovation method for each building category, in view of the currently applicable technical and financial parameters, five possible models of sustainable building renovation have been considered. These are based on the technical options of implementing various energy efficiency (EE) measures and renewable energy sources (RES) for each building category, as well as the scope of the measure packages for the five proposed sustainable renovation models for each of the four building categories.

Croatia has already implemented a definition of nZEB. This definition includes a numerical indicator for primary energy use in kwh/m2 per year and for the share of renewables. The maximum permissible values for annual primary energy use per unit of usable surface area of the building depend on the purpose of the building (eg. residential, office, hospital, etc) and the climate zone. The share of on-site renewables must be at least 20%.

Meeting the set energy renovation targets according to the nZEB standard requires the mobilisation of sizeable resources for investment and operating costs that are estimated to reach almost HRK 727 billion by 2050 (approximately €100 billion). The proposed pace of renovation will achieve an overall reduction in CO_2 emissions of 87% and achieve the goals set in the EU Energy Roadmap. Since the currently available sources of financing are insufficient to achieve the set goals, the introduction of new, innovative financing mechanisms, combining public and market instruments adjusted to a wide range of investors is proposed. EU Structural and Investment Funds will be the primary source of funds for removing barriers in the financial sector and will gradually enable a more intense involvement of financial institutions and private investors in the energy services market.

ENERGY PERFORMANCE OF BUILDINGS AND ENERGY PERFORMANCE CERTIFICATES

The implementation of the Energy Performance of Buildings Directive (EPBD) in Croatia started in 2005. The EPBD has been fully transposed into the national legislation, including the 2010 recast of the Directive. All new buildings must be built in accordance with the Energy Performance (EP) requirements of the Croatian legislation.

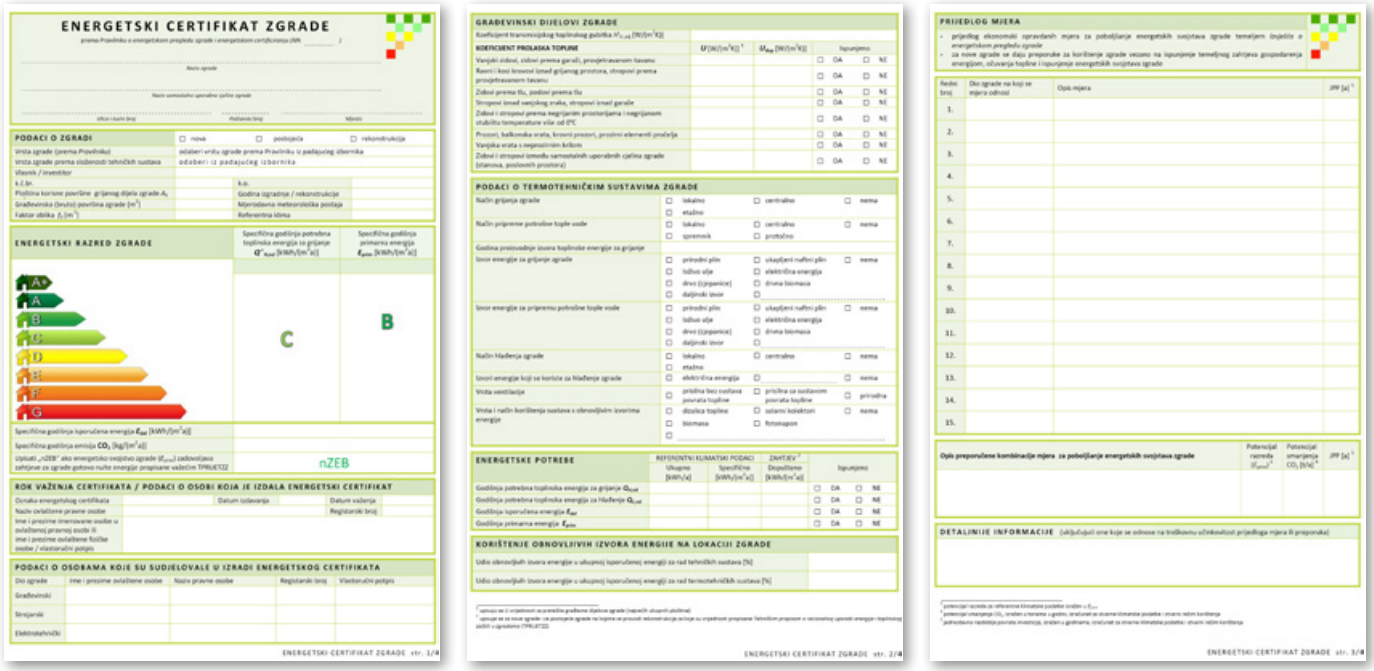
The energy performance certificate (EPC) of a building includes the determination of its energy class, taking into account its energy performance identified on the basis of a calculated specific annual energy need for heating only. The building is awarded one of eight energy classes, from A+ to G. The energy certificate contains recommendations of economically viable measures for the improvement of the energy performance.

The latest valid technical regulation on energy economy and heat retention in buildings (OG 128/15) determines a whole new approach to EPCs. The new regulation has foreseen the determination of the energy class on the basis of calculated primary energy demand (E_{prim}) for heating, cooling, ventilation, domestic hot water and lighting. The full implementation of this latest regulation started from the October 1st 2017.

The energy certification of buildings started in 2010. Since then and up to July 2017, more than 160,000 energy certificates have been issued. The obligation of the EPC is applied to both residential buildings and non-residential buildings. It is valid for new buildings, existing buildings being sold, rented or leased, and public buildings with usable floor area above 250 m^2.

The first and second page of the EPC contain details of the building, owner and authorized energy assessor as well as the energy class of the building. The third page contains recommendations of economically viable measures for improving the energy performance of the building with a calculated simple payback period. The EPC is valid for 10 years. Each issued EPC must be accompanied by an Energy Audit Report. The Energy Audit Report gives an overview of the baseline conditions (building envelope, technical systems, energy and water consumptions and costs, and greenhouse gas emissions), as well as estimated energy consumption after implementation of recommended measures. To date there is no research to show the effectiveness of these recommendations in practice or the final payback of the investment.

EPCs may only be issued by qualified experts. The conditions and criteria for experts performing energy audits and energy certification of buildings are prescribed by the law. The authorization requires successful completion of the training programme, as well as the obligation to attend additional training courses once per year. The prerequisite for attending the initial training programme is an engineering degree in the field of architecture, civil engineering, mechanical engineering or electrical engineering and



Example of new EPC visual form (from October 2017)

at least five years of professional working experience. The validity of the authorization is 5 years. For quality assurance purposes, independent control of issued EPCs is carried out. This control is carried out by persons authorized by the Ministry of Construction and Physical Planning.

All data on issued EPCs are kept and maintained by the Ministry of Construction and Physical Planning in the database (called IEC), however the database is still not publicly available. A software solution has been developed for on-line data entry and electronic EPC issuance.

ENERGY PERFORMANCE REQUIREMENTS FOR NEW BUILDINGS

The energy performance requirements for new buildings differ with regard to internal temperature, their purpose (residential and non-residential) and their size. The regulation determines limits on the maximum permitted useful and primary energy for space heating, cooling, domestic hot water and ventilation for residential buildings and the portion of renewable energy in the total primary energy consumption. The limits are prescribed for family houses and for apartment buildings separately. This latest Technical Regulation entered into force on June 1st 2016.

The technical requirements for rational use of energy and thermal protection of the building are determined based on three metrics. There is a limit on the permitted annual energy needs per unit of usable floor area (Q''H,nd [kWh/m^2 per year]), which ensures a minimum level of thermal performance of the building envelope. Secondly, there is a limit on the permissible annual delivered energy (E_{del} [kWh/m^2 per year]). This ensures minimum standards of efficiency for the building technical systems are met and also accounts for any on-site renewable energy sources. Finally there is also a limit on the annual primary energy (E_{prim} [kWh/m^2 per year]) which accounts for the impacts of the entire energy system which supplies the building, including energy generation efficiency, on and off-site renewable energy, distribution losses and so forth. The limits are set based on cost-optimal levels.

PREDICTING ENERGY PERFORMANCE

There are three main possibilities for calculating energy savings in Croatia:

1. Using the Monitoring and Verification Methodology. This methodology is prescribed in the National Ordinance on Monitoring and Verification of Energy Savings.
2. Using the calculated data before and after renovation. This data is taken from the main design and EPC and is prepared by trained and authorised experts as described on pages 6 and 7. There must also be an evidence based on formal documentation.
3. Using measured energy data. Energy consumption is measured by the metering system and this is used to estimate the savings that a particular energy saving measure would achieve. This is still not commonly used in Croatia, because the other two options are much simpler and equally acceptable.

For all three options, the National System for monitoring and verification (SMiV) should be used and this is explained further in the next section.

SMiV - NATIONAL SYSTEM FOR MONITORING AND VERIFICATION

There is a prescribed methodology for the reporting of energy savings. Without a systematic monitoring of the success of the implementation of the energy efficiency policy (through an information system) is not possible to accurately assess the achievement of energy savings that result from measures of incentive policies defined in NEEAP nor the activities that are induced by these measures. Work on the second NEEAP confirmed that without such platforms it is not possible to measure, report and evaluate the energy savings from all of the activities that were carried out. The task of developing such a platform was allocated to the Ministry of Economy and the Centre for Monitoring of Business Activities in Energy Sector and Investments.

The Ordinance on the Methodology for Monitoring, Measurement and Verification of Energy Savings in the Final Energy Consumption is currently in application in Croatia (Official Gazette 077/2012). In accordance with the methodology set out therein, a web application called SMiV was developed and put into operation in June 2014. The first training for users began in September 2014, which corresponded to the adoption of the new Act on Energy Efficiency that specifies SMiV as the approved national system for monitoring, measurement and verification of energy savings.

Data contained in SMiV is used for many energy savings calculations, analyses and ongoing monitoring of achieved national energy efficiency targets. SMiV is based on a bottom-up methodology (project by project) and is used at local and national levels to calculate energy savings in the three main sectors: Building, Industry and Transport. SMiV greatly simplifies the process of calculating energy efficiency savings through a simple user interface where users with basic IT skills can enter data on implemented measures.

MEASURING ENERGY PERFORMANCE

Smart metering is not common among consumers in Croatia, especially not in households. Nevertheless there are some information platforms which do provide benefits at a national level, like the National System for Monitoring and Verification of Energy Savings, Energy Management Information System and ESCO monitor.

EMIS- ENERGY MANAGEMENT INFORMATION SYSTEM

In Croatia, there is a national system for the management of energy and water use in public buildings. This is prescribed by the law and the National Agency for Real Estate (www.apn.hr), an official body which collects and maintains the data. The system is called Informacijski sustav za gospodarenje energijom (ISGE) or Energy Management Information (EMIS) System in English.

EMIS is intended primarily for monitoring and analysing data on consumption and costs of energy and water in public buildings, which are under the jurisdiction of municipalities, counties and the national government. Thus, EMIS is used to establish a national database on actual consumption of energy, and water in public buildings.

ESCO MONITOR

In Croatia, there are several smart metering tools, one is called ESCO Monitor – computer business software for energy management. ESCO Monitor is a computer support for energy efficiency optimization provided within the framework of a systematic energy management system. ESCO Monitor is oriented primarily towards commercial buildings.

The use of these kind of tools enables systematic monitoring of the energy consumption dynamics. The user can carry out analyses and planning of consumption, control and management, and there is often the function for early detection and alarms in case of changes in energy and water consumption, such as low energy efficiency, malfunctions and unexpected events.

ESCO Monitor, for example, can also be used to support investment planning and other energy efficiency improvement measures and making decisions. These could include investing in the energy supply system and investment measures to increase energy efficiency and achieve energy and economic savings. It also offers measurement and verification capabilities in accordance with the International Measurement and Verification Performance Protocol (IPMVP).

GOING BEYOND ENERGY

In Croatia, the market for international green building certification schemes is still not well developed. A higher interest and demand was registered during 2016 and 2017 and the market is expected to grow in the next five years.

CROATIA SUSTAINABLE PROJECTS - 2016							*Period: January - December 2016*
Project Name	**Location (city)**	**Rating System LEED / BREAM / DGNB**	**Project Type**	**Building Construction m²**	**Project Start (year)**	**Project End (year)**	**Certified (Yes/In Progress)**
Eurocentar	Zagreb	BREEAM	Office Building	11.500	n/a	n/a	Yes
House of European Union	Zagreb	BREEAM	Office Building	2.000	2011	2013	Yes
Adris Business Centar	Zagreb	LEED	Office Building	22.850	2011	2014 (plan)	Yes
Zagreb Airport	Velika Gorica	LEED	Airport terminal	65.000	2013	2017	Yes
Lidl Velika Gorica	Velika Gorica	LEED	Retail and Office Building	13.000	2016	2018	In progress

CROATIA SUSTAINABLE PROJECTS - 2017							*Period: January - December 2017*
IKEA outlet	Zagreb	BREEAM	Commercial Building/Trade	—	2017	—	In progress
City Centre One	Zagreb West	DGNB	Commercial Building/Trade	—	2017	—	In progress
City Centre One	Zagreb East	DGNB	Commercial Building/Trade	—	2017	—	In progress
City Centre One	Split	DGNB	Commercial Building/Trade	—	2017	—	In progress
GTC Zagreb	Zagreb	LEED	Office Building	—	2017	—	In progress

When banks assess a property, they do not typically give much weight or significance to the energy performance certificate. However, some banks do offer better interest rates if the property has higher energy efficiency standards or the clients invest in low-energy, or passive standard buildings. The situation has improved following the introduction of a relatively new property valuation regulation, but there is still significant potential to increase the awareness and understanding within the banking sector (including risk managers and retail/corporate sales departments).

The wider use of international green building certificates has been promoted by Croatia Green Building Council (CGBC) since 2009. The certification process may only be carried out by companies that are accredited as auditors or certification consultants (they are usually CGBC members). These schemes are currently focussed mainly on commercial buildings due to low demand from the residential sector. CGBC does not offer or work on the certifications. The certification processes have proven to be too expensive for public building owners like the government or the municipalities and there is still a lack of knowledge and awareness about the benefits.

POTENTIAL BARRIERS

Whilst there are promising signs that green mortgages could be effective in the Croatian market, there are some barriers that need to be considered.

Even though Croatian banks are financially stable/liquid and it appears that they can offer better terms for energy efficiency projects, interest rates are currently very low, and it is difficult to expect any further reduction at this stage.

Credit ratings awarded by the international financial agencies for Croatia as well as the banks operating in the country are stable but still relatively poor in comparison to most European countries, see here: https://tradingeconomics.com/croatia/rating.

Boosted by the economic growth and yield pursuit, the Croatian real estate market recorded high investment volumes in 2016, continuing the upward trend which started in 2015. Investors were mostly focused on prime properties in retail and hotel sectors which led to yield compression.

The hotel and retail sectors also saw the majority of new developments in 2016. The prognosis for the Croatian real estate market is that there will be a return to the high investment volumes in 2017, underpinned by the economy's renewed strength, yield opportunities and improved investor sentiment. The office, retail and hotel sectors are expected to be most active in terms of investment and development volumes in the coming year.

CONCLUSIONS

Overall, it can be concluded that the main barriers are not only of a legislative and financial nature, but that the integral energy renovation of buildings is also largely hampered by the lack of information and motivation on the part of building owners, the public and other stakeholders.

Meeting the set energy renovation targets according to the nZEB standard requires a mobilisation of sizeable resources for investment and operating costs that are estimated to reach almost HRK 727 billion by 2050 (approximately €100bn). Since currently available sources of financing are insufficient to achieve the set goals, the introduction of new, innovative financing mechanisms, combining public and market instruments adjusted to a wide range of investors is proposed. EeMAP and energy efficient mortgages could therefore help meet this shortfall.

It is anticipated that EU Structural and Investment Funds will help remove barriers in the financial sector and will gradually enable a more intense involvement of financial institutions and private investors in the energy services market. At the moment it appears that Croatian banks are stable and could therefore offer better terms for energy efficiency projects, however the very low interest rates at present make any further reduction challenging.

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