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MASTER'S THESIS

FINANCIAL INSTRUMENTS FOR IMPROVING ENERGY EFFICIENCY OF EXISTING RESIDENTIAL BUILDINGS: CASE STUDY OF CROATIA

Ljubljana, September 2015 MATEJA JALŠOVEC

AUTHORSHIP STATEMENT

The undersigned Mateja Jalšovec, a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), declare that I am the author of the master's thesis entitled Financial instrument for improving energy efficiency on existing residential buildings: case study of Croatia, written under supervision of Andreja Cirman.

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INTRODUCTION

The building sector is the largest consumer of energy in Europe, accounting for nearly 40% of the total consumption and 36% of the greenhouse gas emissions (European Commission, 2013a). While the new buildings have a tendency of high-energy performance, the existing ones are the source of high-energy emissions and in need for a renovation work. With their potential to deliver high energy and CO2 savings, energy efficient buildings can play a pivotal role in a sustainable, low carbon future (Atanasiu, & Kouloumpi, 2013). Energy savings are among the fastest, highest impacting and most cost-effective ways of reducing greenhouse gases emissions (hereinafter: GHG). Low cost energy efficiency measures have long been regarded as the 'low-hanging fruit' in delivering a clean energy economy. Investing in energy efficiency (hereinafter: EE) presents a unique combination of advantages: increasing energy security, economic sensitivity, lowering energy consumption and bettering the environment. In addition, labour requirements to implement EE measures could result in the creation of number of jobs in the new low-carbon economy. Europe's Energy Efficiency Plan expects to create up to 2 million jobs, improve industrial competitiveness and generate financial savings of up to EUR 1000 per household every year (European Commission, 2011b). As such, EE measures provide the additional comparative advantage of offering short and long-term benefits.

Speaking in economic language, it is a win-win situation: through aggressive energy conservation policies, we can both save money and reduce negative externalities associated with energy use. According to Allcott and Greenstone (2012), government intervention to improve EE can improve welfare for two reasons. First, the consumption of fossil fuels, which comprise the majority of our current energy sources, causes externalities such as climate change and harm to human health. Second, other forces such as imperfect information may cause consumers and firms to forgo profitable investment in EE. These forces, which are referred to as "investment inefficiencies", create what is popularly called Energy Efficiency Gap: a wedge between current level of energy demand and level of demand that would be realized if energy efficient technology would be used.

Even with high and volatile energy prices, energy security issues and awareness of impact on climate change, there is a mixed picture of actual demand for energy efficiency. Despite the proven cost-effective opportunity to reduce energy consumption, a significant proportion of the EE improvement potential is still not being realized. A key reason for this relates to the financing issues. Financial barriers include the initial cost barrier, long payback time, high transaction costs, and risk exposure. Furthermore, lack of knowledge among finance providers about EE prevents customers from accessing capital, and the absence of standardized measurement and verification practice further increases transaction costs (Guertler et al., 2013). The two market failures, energy use externalities and investment inefficiencies, have to be addressed by a proper EE policy and it is the role of public authorities to design measures that will overcome persistent barriers and stipulate demand for EE.

The actual situation is being improved since EE has moved up in political agenda in recent years. Specific savings target of Europe's "20-20-20 by 2020" strategy, agreed by European

Union heads of state and government at 2007 summit, shows that the political leadership has recognized the benefits of investing in low carbon economy and by doing so will improve the development and sustainability of overall economy. The results are already noticeable - greenhouse gas emissions in 2012 decreased by 18% relative to emissions in 1990 and are expected to reduce further to 24% lower than in 1990 by 2020 because of current policies (European Commission, 2014, p. 2). In addition, the International Energy Agency estimated that in 2011 global EE investments across all sectors totaled up to USD 300bn representing an emerging market opportunity for businesses and investors.

The purpose of this master thesis is to contribute to understanding of the importance of energy efficiency finance programmes as the main link that is connecting citizens facing financial constraints but willing to lower their carbon footprint with available funding provided by financial institutions. Croatia is especially interesting for this research right now because the recent accession to the EU brought new laws, directives and requirements on field of energy efficiency that have to be applied into its national programs. Under the Energy Efficiency Directive 2012/27/EU every member state is required to submit National Energy Efficiency Action Plans (hereinafter: NEEAP) which targets are to set out significant energy efficient improvement measures and expected and/or achieved energy savings. In the NEEAPs member states must establish a long-term strategy for mobilizing investment in the renovation of the national building stock, including policies and measures to stimulate cost-effective deep renovations (European Commission, 2013a). Since the first NEEAP in Croatia did not provide the desired results for residential building retrofit, a lot of attention is placed on the current 2nd NEEAP. Based on 2nd NEEAP the current National Programs for multi-dwelling building and family houses renovation were developed and are officially in force since beginning of 2014. These programmes are the focal point of the research.

The focus will be placed on Croatia and analysis of their current finance programmes for improving EE for residential buildings with a comparison of programmes of two other countries. The two countries used for comparison purposes are Germany, as the leader in EE finance and Slovenia, as an EU member state most similar to Croatia. The main research question of the thesis is whether the current national programmes are designed in the best suitable way, i.e. followed by the best and most similar practices and are they going to financially incentivize the citizens in the most effective way to invest in EE more vigorously than they did till now.

In relation to that, the goal of this thesis is to examine the availability (or lack of), impact and effectiveness of EE finance programmes for residential buildings, to identify advantages and disadvantages and in which way can they be improved in order to stimulate more investments in EE while simultaneously providing the best conditions for the citizens.

The research question is going to be answered in three steps:

1. A comprehensive analysis of EE programmes for residential buildings in Croatia, Germany and Slovenia in order to identify viable financing options.

2. Development of structured barrier and SWOT analysis for each country's programme.

3. Interpretation of the results by SWOT analysis and benchmarking barriers.

4. Conclusion with identifying space for improvement in Croatia by considering best foreign practices.

A summarized EE program description is provided for each country, with emphasize on financing options. Naturally, in the case of Croatia, a more detailed description of the program is provided due to focus of the thesis. For better comparison, all prices in Croatia are converted from Croatian *kuna* to Euro. After each country's programme description, a SWOT analysis is attained, to get a structured view on advantages and disadvantages, potential opportunities for improvement and possible liabilities. Based on the EE programme information and SWOT analysis, a set of benchmark indicators is set in order to evaluate the best practices on an international level. The refined data is later the base for answering the main research question, i.e. are the financing conditions of paramount importance and is the new European regulation going to help to improve those numbers.

The descriptive method, which is used in the thesis, is based on researching literature concerning EE and financial instruments. The EU acts – Energy Efficiency Directive, Directive on Energy Performance of Buildings, Energy Efficiency Plan and various reports from European Commission are used to provide background information about policies and implemented measures, as well as information about financing options and the usage of EU funds. Relevant research papers with case studies of best practices are also explored to get a better picture of all the available financial options and supportive measures and for comparison of effects and success rate of different kinds of programs. For the case of Croatia, the current National Program for Residential Building Renovation and Household Renovation, as well as the previous programs for residential sector, are the core reference on analyzing the market, recognizing main barriers and obstacles, and identifying possible opportunities to improve the efficiency of the market.

The thesis is divided in two major parts. The first part of the thesis is focused on general description of energy efficiency market, barriers, current legislation, and financial instruments in use. The first chapter defines energy efficiency market and reveals most significant economic and financial barriers for implementing EE. The second chapter gives an insight on European legislation on energy efficiency, with an emphasis on current Directives and all the requirements that each member state is obligated to fulfil. An overview of existing financial instruments, both conventional and innovative, is presented in the third chapter, as well as the role of international institutions in financing EE:

The second part of the thesis is an analysis of current EE programmes for Croatia and selected countries. Chapters four and five are in depth analysis of EE programmes in Germany and Slovenia followed by an assessment of the strengths and weaknesses of each programme. Croatia, as the focus of the thesis is described in more detailed manner. Therefore, chapter six provides a macroeconomic framework, the residential building overview and existing energy policies in Croatia. EE programmes for family houses and multi-dwelling buildings are described separately. Chapter seven provides a cross-country assessment and comparison in order to identify the best solutions and practices with a meaningful interpretation of obtained

data in regards to the main research question and suggestions for improving the current EE programmes in Croatia. The thesis is ending with a conclusion and closing remarks

1 UNDERSTANDING THE MARKET FOR ENERGY EFFICIENCY

Our civilization runs on energy and our unrenewable energy resources are finite. Increasing demand is diminishing our unrenewable energy supplies on a much faster pace than we anticipated. Therefore reducing energy consumption by increasing EE as well as switching to renewable sources, are some of the critical issues society is facing today. The oil crisis that erupted in 1973, followed by spiking energy prices and shortages of petroleum, has led to the realization that world's energy resources might not be enough to keep up with humankind's consumption. Dating back from ancient history man strived to do more with less and this imperative preserved until today when man faced with the finite unrenewable energy sources tries to maintain its present lifestyle by using less energy. The concept of EE strongly became popular in 1970s when some of the countries realized the potential of saving energy. Pioneer in promoting energy efficiency was the state of California in USA that began implementing EE measures, such as building codes and appliance standards, in the mid 1970-s.

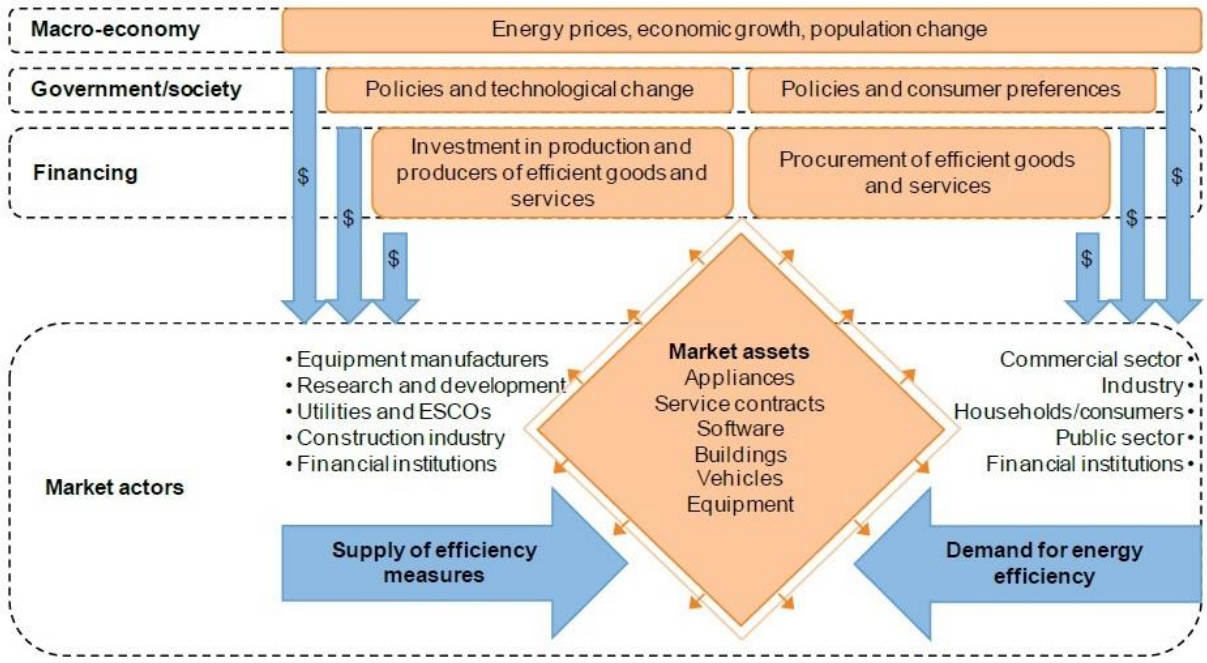
But what does "energy efficiency" exactly means? Efficiency refers to the ratio of benefits to expenses and therefore EE describes the ratio between the benefits gained and the energy used (Irrek W. & Thomas, S., 2008, p. 1). To put in a different context, the goal of EE is to reduce the amount of required energy to perform the same task through technology-based measures. It is important not to confuse EE with renewable energies, because it is not a source of energy supply that is in question here. However, it provides similar benefits so it may be regarded as an alternative to greater supply. In Croatian legislation (Act on Energy Efficiency), the improvement of EE is defined as "decrease of energy consumption, that is a direct consequence of implementation of EE technologies, systems and products, and application of renewable sources of energy for complete or partial coverage of own energy consumption", so it includes the effects of renewable energy sources as well.

To measure the overall progress in EE improvements, energy efficiency indicators are being used. They help policy makers to assess where energy savings can be made, to forecast future energy consumption and give information on trends in past energy consumption. According to the International Energy Agency (OECD/IEA, 2014, p.18), there are variety of EE indicators and to use them efficiently, indicators should be calculated at the most disaggregated end-use level in order to represent accurate EE improvements. One of the most common indicators is **energy intensity**, defined as the amount of gross inland consumption of energy divided by nominal GDP. The metric unit is kg of oil equivalent per 1000 EUR. Lower energy intensity means greater energy efficiency. This indicator has to be interpreted very carefully because it is determined by many factors (size of the country, climate, wealth, structure of the economy, etc.) and not just energy efficiency (OECD/IEA 2014, p.17).

An increase in EE in buildings can be achieved by actions seeking to save the energy, such as thermal insulation of buildings, efficient heating systems, optimization of ventilating and air-conditioning systems. Technically, instalments of renewable energy sources is not consider as a measure of EE, but since national programmes are financing this measures under EE programmes, they will also be integrated in the analysis. In majority of cases implementation of energy savings actions leads to positive results associated with cost savings and positive ecological benefits. Additionally, two effects can emerge - on one side, there is a positive **multiplier effect**, which is characterized by generating further energy savings when individual or an entity copies action from other individual or entity that is already reaping the benefits of EE investment. On the other side, if the investment in insulation of the walls leads to greater feeling of EE home, owners may tend to increase the room temperature after renovation and that would diminish to some extent the positive impact of the EE investment. Consumers could also be less concerned about turning the lights off if their home is lit with LED lighting. This negative effect is so called **rebound effect**. However, rebound effects in buildings are usually small, so the net savings remain.

EE market is an important emerging market that is gaining a strong momentum in this era of environmentally aware consumers and leaders. The International Energy Agency (OECD/IEA, 2013, p. 1) reports that combined investment of public sector, multilateral financial and private institutions in 2011 was estimated to be around USD 300 billion.

Figure 1: The market for energy efficiency



Source: OECD/IEA, *Energy Efficiency Market Report: Executive Summary*, 2013.

Figure 1 is a scheme of the market for energy efficiency. It outlines the most influencing factors, role of government and financial institutions and all the actors and market assets that are essential part of the market for EE. The market is composed of many market actors who demand more efficient provision of energy services, and those that supply the necessary

goods and *know-how* to deliver this greater efficiency (OECD/IEA, 2013, p. 2.). The main consumers in the market include governments, businesses and individuals that perform activities, which cover all energy-consuming sector of the economy. On the supply side of contribution of EE measures are the corporate entities such as financial institutions, construction industry, equipment manufacturers, as well as public utility companies and Energy Service Companies (hereinafter: ESCO). Providing efficiency measures, they can obtain profit in order to satisfy the needs of the actors from the demand field, which comprises of commercial sector, industry, households/consumers, public sector and financial institutions. It is evident that financial institutions with presence on both side of supply and demand, represent one of the most essential contributor for developing the EE market. Market for energy efficiency is mainly measured on three principals (OECD/IEA, 2013, p. 2.):

- Investment in energy efficiency : direct public expenditure, investments by private sector, investment stimulated through government policies and programmes, investment funded by commercial banks, consumer spending,
- Avoided demand for energy, or energy savings coming from this investments – generally measured in the units of energy avoided, such as million tons of oil equivalent (Mtoe) or gigawatt hour (Gwh),
- Monetary value of the savings.

The influence on the market starts from the highest macro-economic level, which entails the volatility of energy prices, the pace of economic growth and change in population. Energy prices are one of the key factors driving expansion of energy efficient markets (OECD/IEA, 2013, p.8). The volatility in energy prices over the past decades has made people more selective when deciding to buy a house or an appliance. Individuals realized that investing more would be overcompensated throughout a longer time horizon and their risk exposure to increasing energy prices would be lowered due to the higher investment. On the other side, subsidizing energy prices, i.e. artificially reducing the price consumers pay for energy, does not provide any incentives to invest in energy efficiency. World population is another factor that may seem insignificant, but poses a paramount influence for developing a more effective market for EE. Increasing population means increasing consumption, and increasing consumption leads to greater demand and reduced supply of energy. In this time when people and the economy are so dependent on energy, EE is the best solution for reducing this progressive trend.

The world leaders acknowledge the importance of this new market and embrace it with implementation of new policies aimed to stimulate investment in EE. Alongside with energy prices, policy interventions represents one of the main driver for energy efficient market, and reducing market barriers that are impeding investments in EE is another goal for policy makers to achieve. These barriers and market failures include "high transaction costs, information failure, and lack of technical or institutional capacity, all of which dilute the effect of price signals on the demand for energy services and the corresponding demand for energy savings" (OECD/IEA, 2013, p.5)." Therefore, policies have been essential to stimulating demand for energy efficiency, hence, governments and regulatory authorities use

different approaches with regards to different concerns, such as concerns over energy security, imports, climate change or economic development. It should be also emphasized that different countries bear different socio-economic conditions and resource endowments and concerning this, specific policies and measures should be constructed in a best suitable way.

Until this day, a successful mix of regulation and information awareness prompted different measures with the goal of stimulating the energy efficiency market. The developed measures have to be applied on appliances, service contracts, buildings, vehicles, equipment and they include: standards and labelling for a range of energy-using products, energy assessments and soft financing, energy efficiency obligations placed on energy suppliers.

Financing represents the first hurdle to EE investments and as such, it must be overtaken with proper policy measures and recognition from the financial markets that investments in EE have higher and less risky rate of return as well as opportunities of creating a low carbon economy. The most important role of financial institutions is to provide lower interest rates, easy accessibility to loans and overall better conditions for financing in order to encourage consumers to invest in EE. The main issue that has to be addressed is the need to incorporate future energy savings into credit assessment in order to support lower financing costs. Financial institutions as the backbone of the economies should contemplate the idea of integrating environmental and social criteria into their lending, financing and investment decisions.

According to the IEA, there is still a vast untapped amount of energy savings that can be realized through cost-effective energy efficiency measures and by removing market barriers. An additional 900 Mtoe, beyond those reductions generated from current and announced policy interventions, could reduce total primary energy supply in 2020 (OECD/IEA, 2013). This additional 900 Mtoe is equivalent to USD 458 billion in consumer energy expenditure. Market for energy efficiency will thrive in medium term, but it should be stressed out that a lot of potential depends on policies and will of market participants to synchronize their actions to stimulate investments.

1.1 Barriers to energy efficiency investments

The existing building stock represent a vast potential for energy savings and despite the cost-effective opportunities to reduce consumption, the creation of energy efficiency gap represents a serious threat to the successfulness of corresponding policies and incentives.

The main question being asked when it comes to incorporating EE on a much greater scale is why so little has been done, despite all available potential. This can be contributed to barriers that are influencing consumer's decisions. To effectively increase EE investments, barriers have to be identified in order to overcome them. Based on numerous studies consumers invest in upgrades of their buildings (homes) for safety, aesthetics, comfort, health, reliability, convenience and status reasons (Buildings Performance Institute Europe, 2010, p. 13). The reason why EE is still not on priority list for consumers lies in the fact that slow returns on EE

investment are still perceived not beneficial as compared to the cost of other factors and the fact that energy prices are still relatively low. It is important to overview and assess residential building sector as a unique market segment, since it is characterized by a set of specific obstacles.

Typical barriers to improving EE for homes include (Buildings Performance Institute Europe, 2010, p. 13):

High transaction costs – are associated with time and effort that have to be invested in order to get enough information about available options regarding improvements and loan conditions. Afterwards consumers must apply for a loan and arrange for the work to be done. These processes are time consuming and may be perceived not to be worth the returns in terms of energy savings (Fuller, 2008, p. 2).

Institutional barriers: Existing laws and practices can present a substantial hurdle when it comes to implementing EE improvements. For example, ambiguities in the legal standing of apartment owner association and onerous decision making due to a large number of decision makers.

Lack of information: Many consumers do not know how to implement EE measures or comprehend the benefits, both financial and environmental, of an EE project, and in that context, information failure affects this kind of projects in various ways. Kempton argues that in residential sector the perception that EE requires large financial sacrifices has been persistent for decades (Kempton et al., 1985)). In addition, the lack of customer awareness of the benefits of EE reinforces the challenge posed by consumer behaviors and habits that are hard to change. In a study in 1995, researchers Eto and Golove showed that it takes on average more than 10 years to dramatically change consumer tastes (Golove & Eto, 1996). Combined with typical penetration rates for new technologies, which oscillate between three to four years, the ambiguity associated with EE investments for residential sector is inevitable.

Energy prices: Biased prices can also mislead consumers. Energy, as a public good, often tends to be heavily subsidized. Levine and Hirst assert that excessive subsidization of energy prices can distort the markets, and prevent consumers from receiving accurate price signals that reflect true marginal cost of the energy being used (Levin & Hirst, 1994). In this way, EE technologies are far less attractive in regions where oil and gas are heavily subsidized.

Lack of trained personnel or technical or managerial expertise: The absence of adequately trained and educated actors on EE markets, leads to situation where suppliers, manufacturers, promoters and financiers alike, do not possess required skills to successfully promote EE to their customers.

Uncertainty associated with energy savings: Energy savings can never be accurately anticipated for an individual home. Installation of a set of measures can, on average, produce a predictable level of savings, but the presence of various factors, which affect the consumption in the long run, make it impossible to perfectly predict energy savings. The existence of different ex-ante methods of evaluation and absence of a common quantification method for energy savings makes it more difficult to conduct a traditional cost benefit

analysis (De T'Serclaes, 2007, p. 15). In relation to reasons mentioned above, both investors and customers often tend to stay away from EE investment.

Split incentives: The principal agent issue is specific to the building context, in this case also called the landlord/tenant problem. In most cases, the owner and the occupier of the house (or apartment) are a different person. Since the occupier of the house or tenant is the one who is paying the utility bills, it is not in the interest of the owner (or landlord) to install the most energy efficient equipment if the benefits are not going to the person making the investment, so he/she is opting for the one with minimal cost. This often means that equipment with relatively low energy efficiency is installed. On the other hand, tenant, as a non-permanent occupier of the house is also not willing to invest in EE equipment, since he/she is not able to take own investment with them in case of location transfer. To define this, split incentives occur when the owner or landlord does not directly receive benefits from a measure invested in (Buildings Performance Institute Europe, 2010, p. 14). Therefore, investing in EE is not a natural move for either actor.

1.2 Financial Barriers

The most significant barriers that are hampering the uptake on EE on existing buildings are related to financing this sort of investments. They include (Buildings Performance Institute Europe, 2010, p. 15):

Initial cost: When it comes to investing in EE, access to capital is the first hurdle that prevents the investment. Because investment in EE is not essential to people's well-being and needs, they rather postpone it and invest in things of higher priority. In addition, when consumers do decide to invest in EE, studies show that, even when assured they are buying a longer-life product, they tend to stick to the least efficient one, because of the low initial cost (Brown, 2001). In addition, for some low-income residents, the difficulty of obtaining the initial capital is insurmountable (De T'Serclaes, 2007).

Interest rates: Interest rates are applied according to the riskiness of the investment. Since EE investments tend to be perceived riskier due to the uncertainty surrounding evaluation methods, higher discount rate are justified based on this notion. In addition, EE equipment is highly specific to site or application, which consequently implies illiquidity of certain investments, leading to higher interest rate (Rezessy & Bertoldi, 2010, p. 2). However, looking from another standpoint, EE investments can also be perceived as not risky at all. Ultimately, it reduces one's exposure to the volatility of energy prices and lowers the utility bills, which in turn contributes to borrower's net cash flow. Rezessy and Bertoldi in their 2010 report to European Commission stress out "energy cost savings should be incorporated into lender's analysis of free cash flow and ability of borrowers and end-users to meet debt service payment". Consequently, since cash flow from energy savings is still not perceived as revenue, financial institutions are discouraged from entering the market.

Payback time: By definition, payback time indicates the average time it takes investors to get back their initially invested funds. EE investments come at disadvantage regarding this indicator, since it is necessary at least seven to eight years on average to break even (De T'Serclaes, 2007). Comparing with stock market turnover, which can decrease to as little as three years on average, financiers opt for investments that are more classical. IEA stresses out that payback time is an inappropriate measure in building sector context because it doesn't take into account that building's lifetime usually exceeds 30 years or more, therefore it does not take in consideration benefits accrued after payback time such as an increase in overall well-being, health conditions, or job improvement in cost/benefit analysis (OECD/IEA, 2008).

Lack of financier awareness: Financiers are usually not trained on EE issues and naturally, they do not promote EE projects. Customers, who are deprived of obtaining qualified advice from financial experts, consequently, tend to stay away from EE improvements.

The overall problem with financing EE is that it does not fit the traditional financial framework. Financial barriers worth mentioning as well are: the absence of standardized measurement and verification practice, individual nature of every single project blocks the standardization and replicability, the relatively small project size increases transaction costs and turns away larger investors, the evaluation methods do not provide standard way of factoring in the risk. In order to overcome them, investors need to shift their perception about EE investments. They need to stop perceiving it as classical infrastructure instrument and start looking at it as a tool, which enables customers to protect themselves from volatility of energy prices. This is a type of investment that enables consumers to consume less energy, hence, it lowers their utility bills, improves their net cash flow and is friendly to the environment.

All of the above-mentioned barriers are acting in a way that prevents residents to behave in a economically optimal way. That is why governments and private sectors are introducing policies and programs that help to overcome this hurdles.

2 EUROPEAN LEGISLATION FOR ENERGY EFFICIENCY

In the next section, European legislation regarding energy efficiency and energy performance of the building will be discussed in detail. It is important to be acquainted with the EU legislation concerning this field, because every member state has to follow and oblige to requirements coming from Brussels, especially for the purpose of achieving target energy savings. Therefore, brief summary and most important measures of Directive on Energy Performance of Buildings 2010/31/EU and Energy Efficiency Directive 2012/27/EU are presented.

Reducing energy consumption is one of the main goals of EU and by putting energy savings and energy efficiency among its top priorities, European Union proved the leadership position in paving a way to more sustainable and low carbon future. Setting up ambitious goal of saving 20% of primary energy consumption, increasing the share of renewable energy by 20%

and reducing GHG emissions for 20% by 2020 on 19 October 2006 the Commission adopted the Action Plan for Energy Efficiency: Realizing the Potential. The initial plan was substituted with Energy Efficiency Plan (hereinafter EE Plan) in 2011. It provided an outline for a coherent framework of legislation, policies and measures regarding the potential savings and proposed a selection of cost-effective energy efficiency improvements initiative to be put in place. The Commission recognized the initial problem of financing, so the EE plan includes measures regarding financing and incentives with a purpose of facilitating investment designed to boost energy efficiency. So, ever since 2006 the EU is advising the private sector to provide financing opportunities that are tailor made for specific sectors, instructing the national bodies to remove legal barriers to shared savings, third-party financing and energy performance contracting, but the results to this point on are still not satisfactory to reaching the initial targets of the Action Plan.

In January 2014, European Commission stated that the EU will probably miss the goal of saving 20% of primary energy consumption, but it should be noted that this provision is not legally binding for the member states (European Commission, 2014, p. 7). Nevertheless, it has provided a significant momentum to the efforts of reducing energy consumption and facilitated agreements on strong measures, in particular the Energy Efficiency Directive.

According to the EE Plan, one sector distinguishes itself more than any other based on its final energy consumption and that is the building sector. Building sector is divided into two groups: residential (households) and commercial (tertiary) buildings. Residential buildings consume up to 26,27 % of total energy and cost-effective energy saving potential is estimated to be around 27%. On the other hand, commercial buildings use 14,73 % of total energy and their energy saving potential is close to 30% (Action Plan for Energy Efficiency, 2006, p. 6, figure 2). The two building sectors combined, account for more than 40% of total energy consumption in EU and together can bring the highest potential savings.

2.1 Energy Efficiency Directive 2012/27/EU

Reducing the negative impact of energy sector on the environment, increasing the EU energy independency and improving energy end-use efficiency and energy services were some of the most important reasons why Directive 2006/32/EC was developed. Improved energy end-use efficiency makes it possible to exploit potential cost-effective energy savings in an economically efficient way. In addition, move towards more energy-efficient technologies boosts Community's innovativeness and competitiveness (Official Journal of the EU, no. L 114, p. 64) and creates a stronger incentives for the demand side of the market for energy efficiency. According to the Directive, member states are obliged to adopt and achieve an indicative energy saving target of 9% by 2016 (arbitrary target in relation to the base consumption from year 2001 to year 2006) in the framework of a National Energy Efficiency Action Plan (hereinafter: NEEAP). The Directive enforced member states to prepare NEEAPs every three years and proposed NEEAP should cover all significant EE improvement measures and expected/or achieved energy savings.

On 25 October 2012, the EU adopted the new Directive 2012/27/EU on energy efficiency (hereinafter: EED) substituting the Directive 2006/32/EC. The EED mandates that majority of its provision have to be implemented by the member state by June 2014. Since the latest forecasts showed that EU is not on track with fulfilling its 20% EE targets, new Directive should bring forward measures to step up the use of energy more efficiently and to tap the considerable potential for higher energy savings in buildings, transport, products and processes. With this Directive, a common framework of measures for the promotion of EE within the Union was established in order to achieve the Union's 20% of energy reduction goal by 2020. Focus was placed on three measures: legal obligation to establish energy saving schemes in all Member States, public sector to lead by example and major energy savings for consumers.

One of the aims of this Directive is to stimulate stronger incentives for the demand side for EE and public sector plays a vital role in it. Therefore, public sector should set up a good example by integrating EE improvements into its investments and operating budgets. The repealed Directive 2006/32/EC has already stated that each member state should establish at least one fund as a support for achieving national energy savings target. The fund should subsidize the implementation of programs and measures, which encourage EE measures. Such measures include the promotion of energy auditing, financial instruments for energy savings and, where applicable, improved metering and informative billing. From the financial perspective, fund may provide for grants, loans and financial guarantees, and member state must ensure that instruments are available to interested parties. Regarding promotion of energy auditing, high-quality energy auditing systems have to be developed by member states for all final customers aimed at determining which measures can be taken to improve energy efficiency. This is equivalent to the certification obtained under the Directive on Energy Performance of Buildings, as well as improved measuring which entails instalments of individual meters (where possible) that accurately reflect the final customer's actual energy consumption.

The Energy Efficiency Directive also states, "Member states and regions should be encouraged to make full use of the Structural funds and the Cohesion funds to trigger investments in EE improvement measures". This means ensuring an appropriate share of EU funding for financing projects and activities related to reaching targets set out in EED. Simultaneously, while combating with financial hurdles, EED is also addressing the issue of tenant/landlord problem in article 19 where it asks member states to remove the split incentive barrier.

Deep renovations are specifically encouraged under Article 4 in Energy Efficiency Directive through the requirement for member states to establish long-term strategies for the renovation of national building stocks covering all building types, including residential and commercial buildings, whether in private, public or mixed ownership. The so called "National renovation roadmaps" is a part of each member states NEEAPs. The key components are presented in the **Figure** below.

Figure 2: Key component of the Renovation Roadmaps for existing buildings

Source: Official Journal of the European Union no. 315/1, *Directive 2012/27/EU on Energy Efficiency*, Article 4, 2012.

An overview of the existing building stock needs to present a detailed assessment of building categories and age bands, type of ownership and tenure, and location split. Based on the existing building stock, the cost-effective measures for both EE and renewable energy sources need to be provided, with a special focus on deep renovations. Member states must ensure adequate financial resources and the best way to achieve this is by working closely with stakeholders from building and finance sector. Energy savings and economic benefits are essential for quantitative purposes of keeping eye on the target and achieving goals.

2.2 Directive on Energy Performance of Buildings 2010/31/EU

The building sector is expanding and it was forecasted that by year 2050, 70% of world's population will be living in the cities, which logically entails higher energy consumption. One option to reduce energy consumption is energy efficiency – getting more of the energy we use and cutting the amount of energy we waste. The EU policies and strategies acknowledge the importance of building renovation as a key element in reaching the climate and long-term energy goals, therefore, the building sector is considered in all EU's energy, climate and resource efficiency related strategies by 2050:

- The **EU Roadmap** for moving to a competitive low carbon economy in 2050 (European Commission, 2011a) identified the need of reducing carbon emissions in residential and services sectors by 88-91% by 2050 compared to 1990 levels.
- The **Energy Roadmap 2050** (European Commission, 2011b) concludes that "higher energy efficiency potential in new and existing buildings is key in reaching a sustainable energy future in the EU, contributing significantly to the reduction of energy demand, the security of energy supply and the increase of competitiveness".
- The **Roadmap for a Resource Efficient Europe** (European Commission, 2011c) identified buildings among the three key sectors responsible for 70-80% of all environmental impacts. Therefore, better construction and use of buildings in the EU

would influence 42% of the final energy consumption, about 35% of the carbon emissions, more than 50% of all extracted materials and could save up to 30% of water consumption.

The European policy framework for buildings gained a strong momentum after adoption of Directive on Energy Performance of Buildings (Directive 2002/91/EC) in 2002. After recast in 2010 in order to make the target goals more ambitious, the main legislative instrument is Energy Performance of Buildings Directive 2010/31/EU (EPBD), where primary goal is reinforcement of implementation of necessary measures to achieve appointed goals in performance of public, commercial and residential buildings. Alongside with Energy Efficiency Directive, the recast Energy Performance Building Directive, sets out numerous requirements to the member state such as: energy performance certification for all buildings, minimum energy performance requirements for new and existing buildings, inspection regimes for boilers and air conditioning plants, and on top of that by the year 2021, member state have to ensure that all the new buildings are nearly-zero energy buildings.

When evaluating the best actions introduced by EPBD, energy performance certification stands out as the most efficient one. The measure has been introduced in January 2006, but because different speeds of implementation for each member state, the final deadline to put it into force was January 2009. According to the EPBD, energy performance certificates issued by independent energy auditors must include information on the energy needs/consumption of a building including reference values in order to make it possible to compare and assess the energy performance of the building by prospective buyers, tenants, owners, occupiers, investors, etc. Energy performance contracts must also include recommendations for cost-effective improvement options to raise the rating of the building. In most countries, ratings are expressed on a letter scale (e.g. A to G, where A is very efficient and G is very inefficient). The basic idea behind certificates is to inform the involved actors to integrate EE in newly constructed buildings or to inform the occupiers about possible improvements to reduce energy costs in the case of existing buildings. This approach is best for avoiding "lock in", i.e. "a situation in which the installation of certain energy improvements in a building make the subsequent installation of additional measure necessary to achieve deeper savings more difficult, technically impossible or financially not viable." (Guetler et al, 2013, p. 8)

Based on the study by European Commission (Bio Intelligence Service, 2013), results show that information provided by certificates make investments in EE more attractive and it also positively affects sales and rental prices of the buildings indicating that better EE is rewarded in the market. The future beneficial purpose of certificates is their possible incorporation in the credit assessment process to more desirable financing conditions for the consumers.

3 OVERVIEW OF EXISTING FINANCIAL INSTRUMENTS

Under Article 2 of the European Commission Financial Regulation, financial instruments are defined as "measures of financial support provided on a complementary basis from the budget in order to address one or more policy objectives of the Union. Such instruments may take the form of loans, guarantees, equity or quasi equity investments, or other risk sharing instruments, and may, where appropriate, be combined with grants."

For the purpose of the thesis, the financial instruments are divided in two groups: conventional and innovative financing. In the group of conventional instruments, included are grants, soft loans and tax incentives. The innovative FI include third party financing, obligation schemes and on-bill financing or popularly known as "pay as you save" model.

EU offers funding opportunities through its Structural and Cohesion funds. It is important to acknowledge their importance and mention it as a way for new (and poorer) member state to use it as a way to trigger EE investments.

3.1 Conventional financing

Soft loans, grants and fiscal incentives became popular in 1970s. The oil crisis persuaded governments and public officials to put more emphasis on financing measures that made people less dependent on volatility of energy prices.

3.1.1 Loans

The most straightforward approach to financing EE is a conventional loan from an institutional lender in the private sector. It is the simplest form of debt financing: it is an agreement to lend a principal sum for a fix period of time, to be repaid by a certain date and with an interest calculated as percentage of the principal sum per year and other transaction costs (Rezessy & Bertoldi, 2010, p. 8). This is a mature and widely available financial vehicle, but medium to high interest rates do not offer any incentives for residential sector to invest in it. In order to kick-start the market and get the attention from the citizens, governments or private institutions, offer financing schemes with significantly lower interest rates, the so called **soft loans**. Typically, soft rates tend to be fixed over a certain period of time and usually they range from 1% to 5%.

In most cases, schemes are built through public-private partnerships where the government provides fiscal incentive to the commercial bank, which in turn offers soft rate to the customer (OECD/IEA, 2008). The subsidized interest rate or credit risk support provided by the state budget or local authority to banks offering low interest rate is a measure of fiscal policy. Soft loans are often combined with grants and subsidies, in order to make efficiency improvements even more appealing and cost-effective to citizens. Pioneer in soft loans is France's PREVair scheme, where in 1992 a private bank voluntarily reduced its profit margin in an effort to

promote eco-friendly homes and eco-friendly renovation of existing homes. Over years, PREVair evolved in public-private partnership and reduced interest rates of 2,75 % (instead of 4% for regular 15-year loan) were additionally reduced to 1,75% per loan. Since 2009 in France is also possible to receive no-interest loan for renovation of your home, called *eco-mortage.*

3.1.2 Grants

Grants are non-repayable funds disbursed by one party, often a government department, corporation, foundation or trust, to a recipient, such as business or individual. Most grants are made to fund a specific project and require some level of compliance and reporting (EC Financial Regulation). According to Buildings Performance Institute Europe's report from 2010, grants as economic incentives are generally applied when government assess that absence of needed capital on the market will not provide the optimal level of EE investments. The grants may be financed directly through the state or local authority budget or hypothecated taxes (Maio, 2012). Hypothecation of a tax is dedication of the revenue from a specific tax for a particular expenditure purpose. Grants are targeted at households, industrial or other energy consumers to pay for a part or all of the cost associated with introducing an EE measure, e.g. enhanced building insulation.

Some of the grant advantages are (Paulou et al., 2014, p. 63):

- Versatile instruments and can be used to achieve a variety of policy objectives (e.g. target specific end-users to meet social policy objectives);
- Encourage uptake of innovative and beyond cost-optimal measures;
- Enable EE measures to be identified as priorities by policy makers to be implemented;
- Choice of attaching additional conditions to stimulate further private investments (e.g. requirement of simultaneously implementing another EE measure);
- Flexible mechanism that can be used in combination with other financial instrument;
- Suitable for economically depressed areas, immature or financially constrained markets;
- Allowing a temporary shift in the market by filling an immediate financial gap.

Nevertheless, there are also some risks surrounding grant financing, such as risk of not achieving the desired outcome or the risk of overspending if grant process is not carefully managed. In addition, little transparency and performance control and tendency towards overpriced solution, are as well considered as downsides of grants. Even though grants provide a strong temporary shift in the market, the impact is not created for longer periods. Also, the problem of "**free rider**" arises, as people who would have made the investment even without the incentive, benefit from the grant scheme.

3.1.3 Fiscal incentives

Fiscal incentives are another way of governments encouraging the market actors to invest in EE by lowering the taxes paid by consumers investing in EE of buildings. The measures include fiscal schemes through tax reduction/exemption and tax credits, or through VAT reduction (Maio, 2012, p. 19). Fiscal benefits are adjusted based on the ambition of the retrofit and the resulting energy savings.

Buildings Performance Institute of Europe (Maio, 2012, p. 19) identified that in 2011, 14 out of 27 member states in EU had on-going fiscal incentives in place linked to investment for increasing EE in buildings. Out of 25 reported measures, majority of fiscal incentives were used in the form of tax deduction (13), followed by reduced VAT (8) and tax credits (4). Majority of them were targeting existing residential buildings.

3.2 Innovative financing

Innovative financing is important because they operate with minimal role or in complete absence of the government funding. Two main examples are Energy Performance Contracting and Energy Efficiency Obligations Schemes. This type of financing if used properly can ensure a long-term financial support that often cannot be guaranteed by national governments.

3.2.1 Energy performance contracting/third party financing

Article 2 of EED defines Energy Performance Contracting (hereinafter: EPC) as "a contractual arrangement between the beneficiary and the provider (normally an energy service company) of an energy efficiency improvement measure, where investment in that measure are paid in relation to a contractually agreed level of energy efficiency improvement". In other words, EPC is a form of creative financing which allows funding EE upgrades from cost reduction. An energy service company (hereinafter: ESCO) is a company offering EPC. The ESCO model is highly integrated in the public and commercial buildings, but market for residential sector is still underdeveloped. Bertoldi et al. (2013) identified relatively small size of the projects, i.e. high transaction costs for ESCOs relative to small amount of energy cost, as the main obstacle hampering the uptake of the market next to all the barriers. As a solution, they mention the successful process of pooling together a number of buildings in the city of Berlin.

3.2.2 Energy Efficiency Obligations Schemes/White Certificates

Energy efficiency obligations schemes, also known as white certificates, are founded on utilities' obligation to foster EE improvements through achieving a defined amount of energy savings over the obligation period. They are deemed as financial instruments due to their leverage effect on investments and creation of additional cash flow. In USA, the EE obligations have been evolving since 1970s and in Europe since 1990s. However, only few countries in Europe reported on having the scheme implemented (Maio, 2012). Nevertheless, the recent inclusion of EE obligation schemes in the new Energy Efficiency Directive poses a significant step, which may contribute to the increase of the funding. However, the article 7 of Energy Efficiency Directive offers member states a choice of attaining energy efficiency targets by using energy efficiency obligation schemes or alternative policy measures, or both. Hence, it is not an obligatory measure.

3.2.3 On-bill repayment

On-bill financing refers to a financing product that is serviced by or in partnership with a utility company for EE or renewable energies retrofits in a building and repaid by the customer on his or her monthly utility bill (Bell, 2011). It allows the customer to pay back part or all of the cost of their EE improvements with the money saved on their monthly utility bill, or in some cases via their local property tax. Because customers are quick to realize the economic benefits of energy savings, this type of financing is the best practice when it comes to removing the initial cost barrier.

However, within basic framework, there are no on-bill financing programs that are exactly the same. Diversity of utility and regulatory structures, the specific needs of different communities and the differing legal and regulatory landscapes of states are some of the factors that are paramount to the design of the on-bill repayment scheme. The on-bill programmes are currently in pilot stages and market penetration is still low. Nevertheless, they are generally seen as successful, with low default rates and borrowing costs.

3.3 International institutions

On European level, there are three key institutions that play pivotal role in financing improvements in energy performance of buildings: the European Investment Bank (EIB), European Bank for Reconstruction and Development (EBRD) and European Union itself with its Structural and Cohesion funds.

EIB, as a bank owned and representing the interests of EU, provides the public and private sector with a wide range of financial instruments for projects, which contribute to furthering EU policy objectives. As such, EE holds an important place, since climate action is at the top

of EIB's agenda. In 2014 EIB invested EUR 19 billion in climate action projects and EUR 2,2 billion (12%) were dedicated to EE sector (European investment bank). EIB offers intermediate lending, including framework loans available through financial intermediaries in the banking sector or through public authorities, public-private partnerships or energy service companies.

In 2015, EIB presented the Private Finance for Energy Efficiency scheme. The initiative aims to encourage local banks in a number of European countries to increase lending for energy efficiency projects by both providing long-term low-cost loans and credit risk protection to financial intermediaries, as well as improving lending expertise in the sector. The new initiative is implemented in cooperation with European Commission and will provide EUR 80 million for credit risk protection of EE loan portfolios and technical assistance (European Investment Bank, 2015).

ELENA (European Local Energy Assistance) and JESSICA (Joint European Support for Sustainable Investment in City Areas) are Programs in which EIB has a managing and participatory role in order to support project preparation and operation. ELENA helps local and regional authorities in preparation of large-scale EE and renewable energy projects, while JESSICA uses existing Structural Fund grant allocations to support urban development including EE projects.

EBRD was created for the sole purpose to support the development of market economies in countries under former communist regimes. The basic forms of direct financing are realized through loans that are tailored to meet particular requirement of the project; equity investments with minimal interference in management activities and guarantees to ease the borrower's access to financing. Through initiative called the Sustainable Energy Initiative, ERBD invested EUR 8,8 billion from 2006 to 2011 in 464 sustainable energy projects in 29 countries (Maio, 2012, p. 30). Over the years, the bank was very active in providing financing in projects that improve the performance of district heating systems and helped fund Third Party Financing companies in new member states.

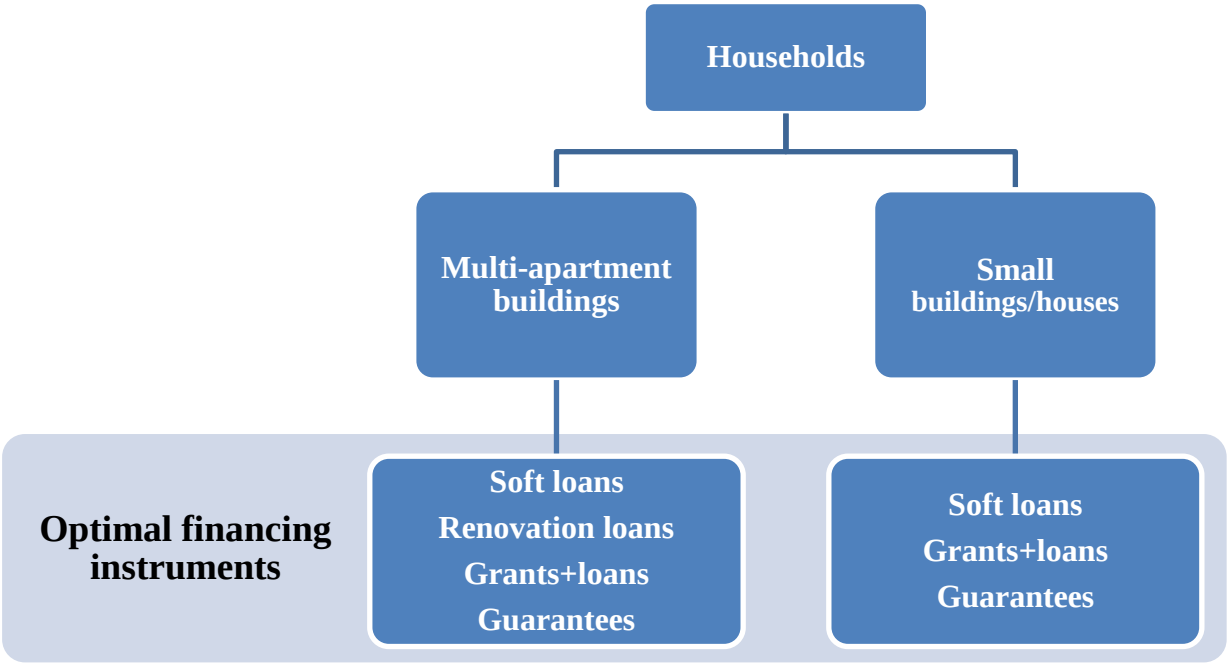
On **European Union** level, the Cohesion Policy fund was in 2007-2013 Financial framework the main source for EE and renewable energy investments – collectively termed sustainable energy by the EU - in public, commercial and existing housing. Cohesion Policy provides the framework for promoting economic growth, sustainable development, prosperity, and social integration across all 28 Member States. The process to implement a program for financing the energy renovation of the buildings using Cohesion Policy funding consist of three parts – program design, program implementation and program management and evaluation. In designing the program it is essential to (Blom, 2014, p. 14):

- establish program and set out objectives and priorities,
- assess the national/local context and legislation,
- define eligible buildings and final recipients,
- define targeted level of renovation and energy savings,

- choose financing instruments,
- choose accompanying activities,
- develop program objectives and indicators.

The development of indicators and measurement and verification plans is important in order to monitor the progress and successfulness of the program. To ensure the effective usage of Cohesion funds and to reach the objectives of their programs, every member state must select appropriate financial instruments depending on local context, type of building and final recipient targeted. Eliminating public and commercial (private companies) buildings, the decision-support diagram for private households is presented in **Figure 3**.

Figure 3: Decision support diagram for optimal financing instrument selection



Source: *Financing the energy renovation of buildings with Cohesion Policy funding*, 2014.

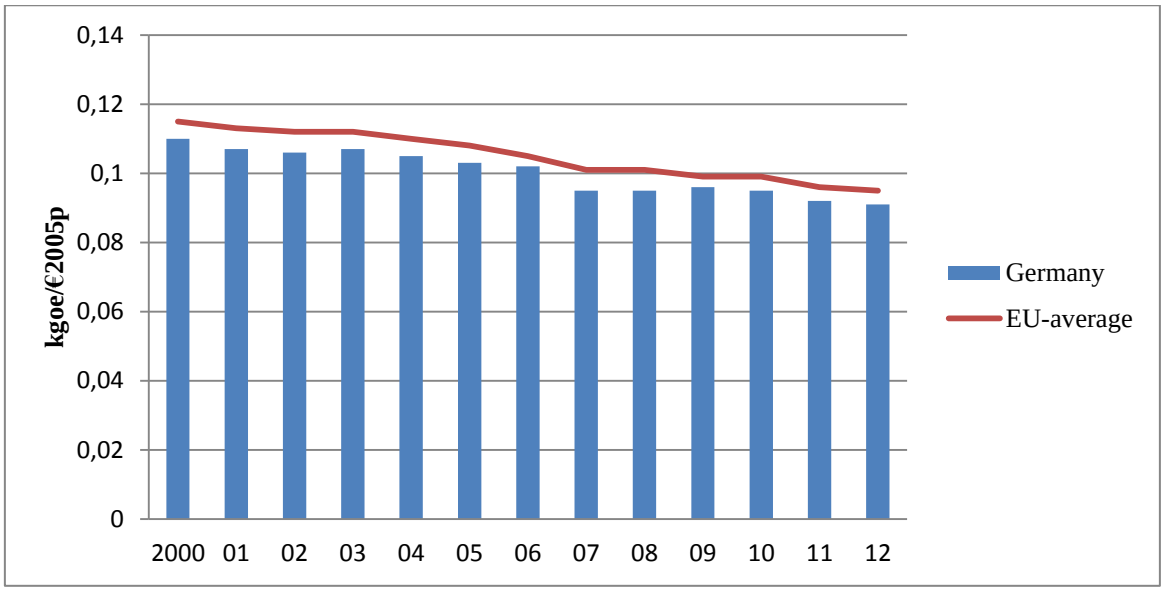
Under optimal financial instrument, soft loans and grants are essential for the functioning of the programs in order to bypass the market failures. However, in the name of efficient market functioning, the EU stresses out that market mechanism such as EE obligation schemes, energy service companies, etc. should be considered before public funding as an option to create energy savings.

A total of EUR 10 billion was allocated for EE improvements in 2007-2013 period and some member states and regions used Cohesion Policy in a much greater extent than the others (Blom, 2014). Grants and non-refundable grants were the most commonly used tools to support development of sustainable energy projects. However, efficiency, sustainability and overall reach of these instruments have raised some concerns. The usage of soft loans is increasing and authorities should be aiming on combining non-refundable grants with conventional or soft loans and credit guarantees.

4 GERMANY

Germany, as Europe's largest economy and no. 4 in the world is considered to be the powerhouse of Europe with a population of 82 million people. GDP per capita in 2013 was EUR 33.300, i.e. 30% more than the EU-28 average. Even before the Energy Efficiency Directive was adopted, Germany had a wide range of instruments for increasing energy efficiency.

Figure 4: Final energy intensity at purchasing power parities* in Germany, 2000-2012



Note: GDP is converted into a common currency, using purchasing power parities instead of exchange rates to eliminate the difference in price level

Source: *Odysee-Mure,* 2015.

Figure 4 shows the final energy intensity trend expressed in ODEX index for the whole economy at 2005 prices per kilogram of oil equivalent (kgoe), comparing Germany with EU average. It is evident that Germany is consistent in reducing energy intensity of its economy and is ahead of EU average. Even in the period of crisis, they maintained the trend. Overall, EE has an important role in German economy.

EE has a long history in Germany: measures for thermal wall insulation were already implemented in 1978; in the 90s, architects and engineers who embarked on EE projects, were subsidized by German government. In the last decade, the German activity in the field of EE was even more intensified: taxes on carbon emissions, additional legislation defining minimum energy performance standards and financial incentives to encourage these investments were introduced. Simultaneously, numerous promotional and educational campaigns are held in order to provide information and advice to the public.

Main institutions responsible for development and implementation of energy efficient policies and targets are German Bank for Reconstruction (ger. *Kreditanstalt für Wiederaufbau,* hereinafter KfW), German Federal Office for Economic Affairs and Export Control (ger.

Bundesamt für Wirtschaft und Ausfuhrkontrole) and German Energy Agency (ger. *Deutsche Energie Agentur*).

KfW, as a public bank owned jointly by Federal Government and the regional government, introduced in 1996 energy-efficient construction and refurbishment programme. The underlying logic of the programme is the following: the KfW raises capital from financial markets and then transfers this capital, via commercial banks to applicants, who receive long-term loans with significantly lower fixed interest rates. The low interest rates are possible thanks to German's AAA rating and the guarantee from the Federal State. The idea behind soft loan is their cost-efficiency over the interest rates subsidies and because the costs are spread over a longer period, there is not a large pressure on the federal budget (Guetler P., 2013). The funding is available for all market participants, starting from individuals, public bodies, collective households and enterprises. The KfW has several programs targeting either residential or public sector, but for this research paper only programmes targeting residential sector are being addressed.

German Federal Office for Economic Affairs and Export Control is responsible for promotion and funding of energy audits and renewable energy technologies, while the role of German Energy Agency is to increase the overall awareness about the EE benefits and encourage behavior change shift in the eyes of the citizens. The goal is being achieved through different measures: energy hotline and internet platform, energy savings guidelines and other promotional activities to provide information about how to increase EE.

4.1 Soft Loans

KfW's Energy-efficient Renovation Loan (*ger. Energieeffizient Sanieren – Kredit)* or also known as program 151 is targeting existing residential multi-dwelling buildings and houses. Through this program, the applicant receives a long-term low-interest loan specifically targeted at EE with a fixed interest rate and repayment-free start-up years. The program is offered to everyone who is investing to make an older residential house/building more energy-efficient or purchasing a newly refurbished home, under the condition that the house was built before 1995. The loan is eligible to citizens living in houses, as well to those living in multi-dwelling buildings. The applicants living in multi-dwelling buildings have an option of pooling together loans, but they are individually liable for their own loans.

When modernizing there are two approaches: Either the building is subjected to a **full renovation** to attain an EE standard set out in the German Energy Conservation Ordinance (ger. *EnEv*), i.e. an Efficiency House (ger. *Effizienzhaus*) or individual measure or combination of measures are implemented to increase efficiency**. KfW Efficiency House** is defined by German Energy Agency. It is used as technical standard, with an aim to translate complicated EE regulation into an understandable measure. KfW has defined five levels of support for a KfW Efficiency House - 55, 70, 85, 100, 115. Differently assigned numbers are expressing energy use of the house compared to that of a new house meeting EE standard -

the house meeting the standard is Efficiency House 100. Efficiency House 115 is using 15% more energy and Efficiency House 85 is using 15% less energy than a new house.

Under the term **individual measures** the following improvements are considered: thermal insulation of walls, roof and floor space; replacement of windows and exterior doors; replacement or optimization of existing heating system; replacement or installation of ventilation system. The maximum possible amount of loan to be received for a full house unit[1] renovation (KfW Efficiency House) is EUR 75.000, while EUR 50.000 is the maximum for individual EE measures per house unit.

The advantages of attaining the KfW Efficiency House standard lies in the fact that applicant are, after the completion of the renovation, eligible to receive subsidies defined as a percentage of the loan that does not have to be repaid. The more energy-efficient house, the more attractive is the subsidy. For example, if a consumer decides to invest in KfW Efficiency House 55, he/she is eligible to get a subsidy of 22,5% of the loan, amounting to maximum of EUR 16.875. The house with lowest EE grade, i.e. House 115 is eligible for repayment bonus of 7,5% of the loan, which is equivalent of EUR 5.625 if the amount of the loan is EUR 75.000.

Table 1: KfW Efficiency House standard and subsidy levels

KfW Efficiency house type	Amount of loan repayment subsidy
KfW Efficiency house 55	22,5% of the loan, up to EUR 16.875 per housing unit
KfW Efficiency house 70	17,5% of the loan, up to EUR 13.125 per housing unit
KfW Efficiency house 85	12,5% of the loan, up to EUR 9.375 per housing unit
KfW Efficiency house 100	10% of the loan, up to EUR 7.500 per housing unit
KfW Efficiency house 115	7,5% of the loan, up to EUR 5.625 per housing unit

Source: *KfW's Energy Efficient Renovation Loan*, 2015.

The effective interest rate[2] for all loans is 0,75% p.a. This interest rate is fixed for all loans, regardless of their duration, for exactly 10 years. After 10 years, the banks hold the right to adjust the interest rate according to the situation on the market. In addition to that, bank is offering possibility to pay only interest rate without the principal (moratorium) for the first 5 years[3] of the loan, depending on the overall duration. On the web page of KfW, it is also possible to calculate basic repayment plan. Although KfW provides interest rates reduction, the actual lending goes through commercial banks, which bear the risk of default. As such, they are allowed to charge an additional margin that reflects their handling costs and risk exposure. The margin is capped at 0,75% (Guetler et al, 2013)

Before investment in house renovation, every housing unit goes through obligatory energy audit. Energy auditing is important because it allows customers to invest in measures or combination of measures that provide the highest energy savings. Energy savings have to be

[1] The term „house unit" is defined by KfW as a residential area with separate entrance, kitchen and a toilet
[2] Effective yearly interest rate shows the actual price of a loan financing. It comprises from nominal interest rate and additional costs.
[3] This condition is valid for loans with duration more than 20 years

verified by an approved energy assessor before funding can be drawn from KfW. Under the program "On-site Consultation" (ger. *Vor-Ort-Beratung*), the German Federal Office for Economic Affairs and Export Control is giving grants for energy audits by qualified experts. In 2011, the Federal Ministry for Economic Affairs and Energy, the Federal Office of Economics and Export Control and the KfW decided to set up a nationwide database of qualified energy efficiency experts in order to guarantee the quality of energy consulting and energy-efficient construction and refurbishment measures that qualify for funding. Hence, only experts with certain qualifications are eligible for entry in the Database of Energy Efficiency Experts. On top of this, the experts are required to submit evidence of practical work experience and advanced training every two years. In 2014, 10.000 experts were reported in the database. In the case of one- and two-family homes, grants can be up to 60% with a maximum of EUR 800. For buildings with at least three apartments, the grant can be up to 1.100 Euro or 60% of auditing costs; and additional EUR 500 can be obtained for a home owners consultation with a purpose of elaboration energy audit report.

KfW's Energy efficient Renovation – Heating loan (ger. *Energieeffizient Sanieren – Ergänzungskredit*) or programme 167 is specialized in financing **heating systems based on renewable energies** for natural persons. The eligible heating systems are based on solar collectors, biomass, heat pumps and heating systems based on combination of renewable and fossil energy. In KfW Energy-efficient renovation program, the main precondition is that the house was built before year 1995, and for the credit program 167 it is important that the heating system was installed before 01.01.2009. The duration of the loan is from 4 years up to 10 years, with an effective interest rate of 1,00% (before 2015 it was 1,41%) that is fixed for the whole 10 years and the maximum amount of EUR 50.000 per housing unit. To improve own liquidity, a natural person can opt for a principal repayment moratorium for one or two years. After the heating system installation, a natural person can also apply for grants offered by Federal Office of Economics and Export Control. The only precondition is that sum of loan and grant is not higher than the overall investment costs.

KfW also offers Renewable Energy Programme (ger. *Erneubaren Energien – Kredit 274*) for stimulating investments in generating electricity from solar energy (photovoltaic), biomass, wind energy, hydropower and geothermal energy; and generating electricity and heat from renewable energy (combined heat and power stations). This credit line is open to natural persons, with a prerequisite of feeding the generated electricity/heat into the grid. Because of this condition, the private individuals are *de facto* becoming entrepreneurs. Since this credit line is also offered to enterprises and investment funds, the maximal amount is EUR 25 million.

The effective interest rate in this case is dependable on the creditworthiness of a private individual and the duration of the loan, but starting from 1.36% effective interest rate. The creditworthiness is divided in 10 different classes – with A being the least risky and I being the most risky. Consequently, an individual with an A rating is suitable to attain the lowest effective interest rate ranging from 1,36% to 2,57% for a 5- or a 30 year loan respectively. The interest rate is fixed, regardless of the loan duration, for exactly 10 years. For loans with

duration that is exceeding 10 years, in some cases the interest rate can be fixed for the entire loan period.

4.2 Grants

Grants for natural persons in Germany for investments in EE of their homes are also offered through KfW's Grant programme (*ger. Investitionzuschuss – program 430*), but only for EE measures, not including renewable energies. The conditions for receiving grants are similar to the ones for soft loans. Once again, the investment in higher KfW Efficiency Standard House is awarded with higher grants. The usage of an energy audit is obligatory, because the auditor can, after house inspection, automatically let customers know if they are eligible for KfW's grants. If they are, auditor's letter of guarantee is essential for grant application.

For example, if an individual is prepared to invest in highest level of EE of his home (Type 55), the grant can be 25% of eligible costs, with a maximum of EUR 18.750 if the investment is EUR 75.000 worth. The lowest grant that is feasible for KfW Efficiency House 115 is up to EUR 7.500 per home, or equivalent of 10% of eligible costs. Individual measures can receive grants in amount of 10% of eligible costs, with maximum of EUR 5.000. The overview is provided in the **table 2**.

Table 2: Overview of the 430 Programme grant scheme

KfW Efficiency house type	Funds od disposal
KfW Efficiency house 55	25% of the eligible costs, up to EUR 18.750 per housing unit
KfW Efficiency house 70	20% of the eligible costs, up to EUR 15.000 per housing unit
KfW Efficiency house 85	15% of the eligible costs, up to EUR 11.250 per housing unit
KfW Efficiency house 100	12,5% of the eligible costs, up to EUR 9.375 per housing unit
KfW Efficiency house 115	10% of the eligible costs, up to EUR 7.500 per housing unit
Individual measure	10% of the eligible costs, up to EUR 5.000 per housing unit

Source: *KfW's Grant programme*, 2015.

It is important to stress out that the grant is transferred onto individual's account after completion of the renovation measures in maximum of three months' time and in the meantime the bank is offering their Construction Support Grants (ger. *Baubegleitung– program 431*) in conjunction with their renovation and grant programs (programs 151 and 430). Support grants offer 50% cost repayment (up to EUR 4.000) to mitigate the financial burdens of investment for the citizens, because it is presumed that the citizens are not taking loans.

Grants for renewable energies are not offered through KfW, but through German Federal Office for Economic Affairs and Export Control. Their major focus is to promote renewable energies in order to conserve the limited resources of fossil fuels and contribute to environmental and climate protection. Grants are available for heating systems on renewable energies– heat pumps, solar collectors, and biomass-heating installation, for all installation

implemented before 1.1.2009. The grants are granted according to the square meter of the residential space.

Regarding solar collector, the funding for 40 m² gross solar collector surface is 90 Euro per square meter, with minimum grant of 1.500 Euro (i.e. a house has to have at least 17 m² of gross solar collector surface) and a maximum of 3.600 Euro. This option is most suitable for single homes. Multi-dwelling buildings are eligible for grants ranging from 3.600 to 18.000 Euro, for gross collector surfaces from 20 to 100 m² respectively. By comparing eligible grants, it shows that funding for multi-dwelling buildings is 180 Euro per m². Grants for biomass heating systems are ranging from 1.400 Euro to 3.600 Euro, depending on the power of the equipment, with a calculation basis of 36 Euro per kWh (maximum of 100 kWh). Heating pump's grants are ranging from 1.300 Euro to 12.300 Euro, depending on the type and the size of the heat pump.

On the German Federal Office for Economic Affairs and Export Control's web page, it is also possible to calculate the amount of grant that is possible to receive with every type of investment. As mentioned earlier, these grants can be attained in combination with KfW's credit program 167.

4.3 Innovative Financing

Germany is deemed as one of the largest and most developed markets for energy services in the EU. In Germany, their national legislation defines four basic contracting models: energy supply contracting, energy saving contracting, management contracting and financial contracting. In the 3rd National Energy Efficiency Action Plan in Germany it is estimated that the entire energy contracting market was worth approximately 3 to 4 billion EUR in 2013, with a strong growing forecast for the upcoming years. There are around 500 companies (contractors) in Germany offering contracting services: approximately 55-60% of the providers are energy supply companies, around 30-35% are original energy service providers and 10% are other providers.

The most significant example of energy performance contracting is the Berlin Energy Agency model. The agency pools together around 20 buildings and initiates procurement for ESCO. The building owners do not incur any costs, since the ESCO covers its costs through savings achieved through reduction of energy consumption in the period of 8 to 12 years. This type of model has been replicated and transferred on other municipalities.

As far as EE obligation schemes goes, there is a pressing debate on whether to implement white certificates into the national energy programme or not, since such a system would create excessive administrative costs. Pursuant to the Article 7 of Energy Efficiency Directive, Germany is using the possibility of achieving its EE savings targets by using alternative measure, so the EE obligation scheme is currently not a priority.

Even tough On-bill model of financing is recognized by the regional banking authority Deutsche Bank as a new potential way to improve EE, until this day it is not present on the German market for EE.

4.4 Analysis according to barriers, financial instruments and programme results

Table 3 provides an overall assessment of typical barriers to EE in Germany with an intensity level and short description of the current state.

Table 3: Analysis of typical barriers in Germany

Type of barrier	Level of barrier intensity	Analysis of the current state
High transaction costs	Low	Information for every specific EE renovation or installment of renewable energy sources is in detail explained on KfW's website, with loans available in every commercial bank.
Institutional barriers	Low	A clear legal framework and tight regulation at the national level, requiring energy efficiency upgrades to buildings and increased use of renewable energy sources. Under the German Tenancy law, apartment owners in multi-dwelling buildings should meet 75% owner consensus for building renovation.
Lack of information	Medium	Providing energy saving information and advice is one of the pillars of EE policy in Germany. Information, promotion, and behavior change, working through regional and local bodies, developing enforceable standards through Energy Performance Certificates, and supporting model projects all over Germany are spreading the amount of beneficial information on EE investment. Still, 3rd NEEAP perceives this barrier as one of the main challenges to address even strongly in the future.
Energy prices	Low	Germany does not provide any subsidies on non-renewable energy sources
Lack of trained personal	Low	Since its establishment in 2011, the nationwide database of qualified energy efficiency experts marks 10.000 experts in the field of EE.
Uncertainty associated with energy savings	Medium	Regulatory measures such as the introduction of the Energy Saving Ordinance in the housing/buildings sector, lowers uncertainties associated with energy savings. However, ex-ante assessment of energy savings is never accurate.
Split incentives	Medium	The current Tenancy law offers the landlord the opportunity to raise the annual rent by 11% of the renovation costs, in order to make appropriate investments (2nd National Energy Efficiency Action plan, p. 99). However, these savings are often not sufficient

		to compensate for the renovation costs attributable to tenants, which are usually not exclusively related to energy saving measures.

In general, Germany managed to minimize barriers to EE, but barriers such as lack of information and split incentives still remain as main challenges in the upcoming years. Regarding financial barriers, as shown in **table 4**, the most important barriers, initial cost and interest rates, have been minimized. Payback time is a factor on which the governmental policy cannot directly influence. In the future, when EE loans and grants are going to be perceived as common financial instruments, the measurement and verification practice will probably be standardized.

Table 4: Analysis of financial barriers in Germany

Type of barrier	Level of barrier intensity	Analysis of the current state
Initial Cost	Low	Financial incentives are offered through investment subsidies (grants) and soft loans to reduce the initial cost barrier. These are provided via a public investment bank sponsored by the German government and German Federal Office for Economic Affairs and Export Control.
Interest rates	Low	Through KfW programmes, interest rates for EE investment are starting from 0,75%.
Payback time	Medium	Soft loans and grants are reducing the payback time, but with the higher size of the investment, the estimated time of return on investment is being prolonged as well.
Lack of financier awareness	Low	Promotional activities of German government in collaboration with commercial banks enabled a high level of positive awareness about the benefits of EE investments.

EE programmes are now in force for two decades in Germany and accordingly, the results are measured in high numbers. Even though there are no comprehensive published data on the overall level, the last numbers indicate that by the end of 2012, German government has subsidized the energy-efficient renovation or construction of close to three million apartments to the tune of EUR 115 billion (German Energy Agency, 2015). There are 40,5 million dwellings in Germany (2010), hence 7,4 % of the total dwellings in Germany.

The level of Federal funding has varied throughout the programmes lifetime. The initial allocation of EUR 200 million in 2000 intended to cover the period up to the end of 2003 was used up within the first year. The funding level subsequently increased and in 2010, EUR 800 million was allocated to KfW specifically for energy programmes (Guetler et al, 2013). Average carbon savings per year was reported to be around 0,5 Mtoe. Guetler et al. estimate that in recent year between 200.000 and 300.000 jobs were created or protected each year and

in 2011, for every EUR 1 of public money spent on the EE programmes, over EUR 15 were invested in construction and renovation. That same year, more than EUR 4 went back to public finances in taxes and savings.

Table 5 shows a brief overview of conventional financial measures present on the German market today. As already mentioned, Germany recognized soft loans and grants as instruments for successful removal of initial cost barrier and they are present on the German market for many years.

Table 5: Overview of conventional financial measures in Germany

Type of measure	Availability	Brief description
Soft Loans	+	Available through KfW's Energy Efficient Renovation/Heating loans and renewable Energy Programme
Grants	+	Grants for EE measure are available through KfW's Grant Programme and grants for renewable energies are offered through German Federal Office for Economic Affairs and Export Control
Fiscal incentives	-	No fiscal incentives

Currently there is no tax relief program in use in Germany, but there was a strong call to implement tax incentive regime for energy-efficient renovations from the Alliance for Energy Efficiency in Buildings (ger. *Allianz für Gebäude-Energie-Effizienz*). They believe tax relieves will provide stronger incentives for EE modernization of existing buildings. However, the planned tax relief in worth of EUR 1 billion over a period of 10 years was declined because the German government could not reach a consensus on the issue (German Energy Blog, 2015).

As of 2015, following the policy decision to increase the EE renovation rate in order to attain the 2020 goals, the interest rates for soft loans have fallen from 1,00% to 0,75% effective interest rate for Program 151. The interest rates from Program 167 or Loans for heating systems have been reduced as well, from 1,41% to 1,00% effective interest rate. KfW also increased the percentage on subsidy repayments on loans for additional 5 percentage points. For example, before it was possible to get from 2,5% to 17,5% of loan write-off in the form of subsidy and as of 2015, this was increased from 7,5 to 22,5%, according to the type of KfW Efficiency house. Regarding grants, they were also increased for additional 5 percentage points. This proves that Germany is doing everything to ensure that the 2020 energy and climate objectives are met.

The strongest advantage of the German EE model is the low interest financing, accessibility and *user-friendly* approach. The programme is designed to overcome high initial investment cost and long payback periods. With their systematic description and availability of all information online, it is possible to get instantly information for the specific type of

investment just by selecting preferences and without getting lost in the vast area of unnecessary additional information. This significantly reduces the high transaction cost barrier, because it makes people more willing to explore their possibilities. Accessibility to the funding throughout the year enables citizens to plan and execute renovation when they find it the most suitable.

Table 6: SWOT analysis of EE programmes in Germany

Strengths	Weaknesses
- Available loan and grant scheme, with a possibility of combining both of them - Focus on interest subsidized loans - Advantages of inclusion of commercial banks – no distortion of competition, diversification of risk - Accessibility all the time (no public calls) - KfW Efficiency House as brand for energy efficiency –creates visibility and transparency - Strengthening economy by allowing only certified energy auditors and construction companies to work within the programme framework - Stimulating deep renovation by linking loan subsidies and grants with KfW Efficiency House standard - Loan conditions also applicable to people who bought houses/apartments that went under renovation – stimulating renovation and reintegration of older houses/buildings	- In order to initiate renovation of multi-dwelling buildings, owners need to take loans individually which represent a hurdle in project initiation and coordination - Underdeveloped regions do not have additional benefits - The complexity of "landlord-tenant" legislation
Opportunities	**Threats**
- Introduction of tax incentives - Further development of market for energy services and introduction of white certificates	- General uncertainties regarding volatile energy prices and overall effectiveness of EE measures

Long history of EE in Germany is evident in the SWOT analysis (**table 6)**, where strengths rightly outnumber the weaknesses. Germany's EE programme has already become a world benchmark when it comes to sustainable economy based on renewable energy sources and EE investments. The programmes that are in motion are without doubt very wisely structured and are maximally incentivizing citizens to invest in EE with their low interest loans and supporting grants.

The funds are available all year round and in every bank, with concisely explained information on KfW's and German Federal Office for Economic Affairs and Export Control's web sites. The initial cost barrier is reduced to minimum with soft loans, various support

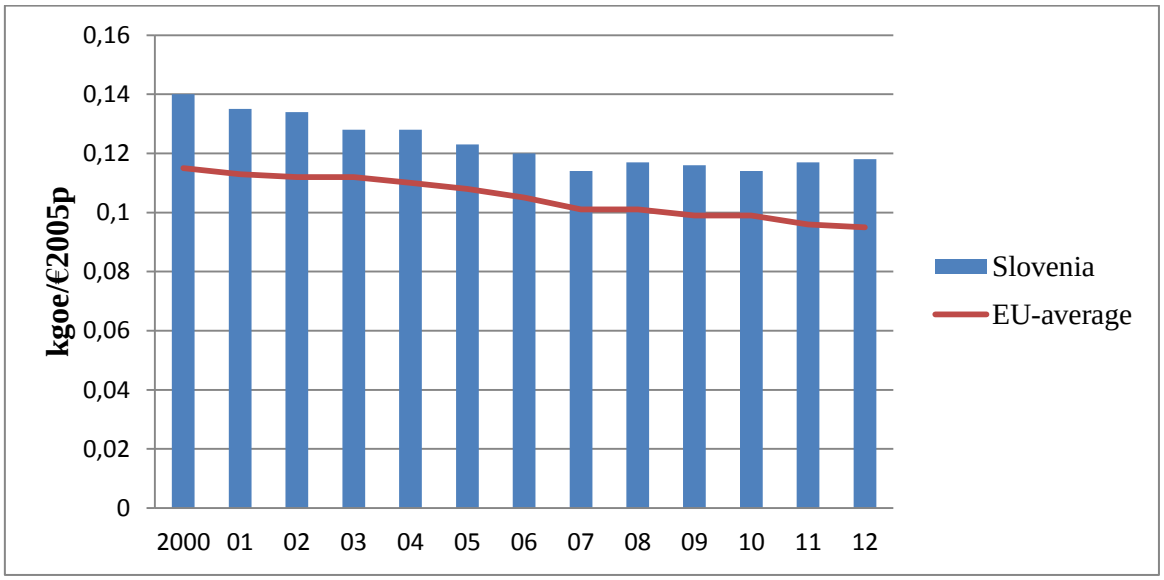
grants and combination of both of them. Majority of Germans are acquainted with their options through KfW Efficiency house, which has become a brand for EE. Certification of energy auditors and construction companies has as well contributed to the overall popularity by engaging all key stakeholders. Germans have recognized that information is crucial to raise awareness. The level of programme sophistication is noticeable through their deep renovation incentives that are linked with higher grants and higher loan write-offs. One of the specialties is also the option of giving out loans with subsidized interest rates to natural persons for buying houses or apartments that were EE renovated. In this way, they are stimulating renovation and reintegration of older houses and buildings.

However, there are still some issues to be worked on. In the case of multi-dwelling buildings, applicants need to apply individually and pool together a number of loans to initiate a renovation, which can be perceived as an obstacle when it comes to initiation and coordination of the project. This issue can be characterized as the main weakness alongside with the fact that underdeveloped regions do not get any privileges. Germany feels that it can improve their EE programmes even further by introducing tax incentives and encouraging development of market for energy services, which represent their main opportunities. Still, uncertainties associated with volatile energy prices pose a threat that is not possible to control.

5 SLOVENIA

Slovenia, as the first former member of Yugoslavia to enter EU, is classified into the group of economically developed countries. With a population of 2 million people and a GDP per capita of 17.100 EUR in 2013, Slovenia is quite ahead from the rest of the Balkan countries.

Figure 5: Final energy intensity at purchasing power parities in Slovenia, 2000-2012



Note: GDP is converted into a common currency, using purchasing power parities instead of exchange rates to eliminate the difference in price level

Source: *Odysee-Mure*, 2015.

Figure 5 shows the final energy intensity trend expressed in ODEX index for the whole economy at 2005 prices per kilogram of oil equivalent (kgoe), comparing Slovenia with EU average. The graph clearly shows that from 2008, the trend is downwards and Slovenia is quite behind the EU in EE.

Slovenia has the EE programme in place through their governmental Eko fund (sln. *Eko Sklad*), whose primary function is to offer favorable loans, grants and guarantees for private houses, buildings and commercial sector. The program started operating in 1996 when Slovenia government was granted a loan from World Bank and today it is based on special dedicated funds (hypothecated taxes) and credit lines extended by the European Investment Bank.

Slovenia has set up a well-balanced policy package for residential houses and buildings. To help citizens comply with these standards, economic and financial support has been made available. Regulations provide orientation for energy efficient spatial planning and make it compulsory that the calculation of heating costs in multi-dwelling buildings reflects the actual consumption. Energy advice network (slo. *EN SVET*) offers free advice in 48 offices throughout the country. Eko Fund subsidizes energy audits. Furthermore, the government drew up in 2009 a proposed scheme for low-income households, where the social security

component is included in tenders for the allocation of grants to citizens for energy rehabilitation of older multi-dwelling buildings inhabited by a large number of low-income households. The level of the financial incentive for socially disadvantaged citizens that submitted adequate proof amounted to 100% of the granted investment costs.

To summarize, Slovenia has five EE programmes in place targeting residential buildings and houses (2nd Energy Efficiency Action Plan Slovenia, p. 26.):

1. Financial incentives for energy-efficient renovation and sustainable construction of residential buildings
2. Financial incentives for energy-efficient heating systems
3. Scheme of energy efficiency for low income households
4. Compulsory division and calculation of heating costs in multi-dwelling and other buildings according to actual consumption
5. Energy advice network for citizens

5.1 Soft loans

Soft loans were introduced to Slovene public in 2000, when the Eko fund started to offer soft loans for EE investments and utilization of renewable energy sources. Today, the maximum amount of the loan for an individual measures is EUR 20.000 and for investments that comprises at least three different EE or renewable energy source measure or a whole house renovation, the loan can go up to EUR 40.000. The maximum duration of the loan is 10 years, without offering principal free start up years. The effective interest rate is comprised from current tri month Euribor with addition of 1,5%, which is fixed for the whole amount of loan repayment. The Euribor taken into account at the time of the contract signing is valid for the whole year.

It is possible for a single house that more people apply independently from each other for a loan, but the maximum level is set at EUR 80.000 per house. The loans for single houses are distributed through only one commercial bank - Banka Koper d.d. The number of loans is limited by the amount of the overall funding, which for year 2013 was capped at EUR 6 million. The subsequent year the funding was, due to the great interest from the citizen's side, increased for additional 2 million EUR. Even though in 2014 only 50% of the fund on disposal was used, the funding stayed on the same level as in 2014. It is also possible to calculate monthly annuity on web page of Eko fund for informative purpose, if an individual is interested in taking a soft loan

Up until 2015 in the framework of a government backed programme only one commercial bank offered soft loans and as of 2015, it is possible to attain loans for EE renovation of

multi-dwelling buildings in selected commercial banks. This credit line was extended by the Slovenian bank for Export and Development in cooperation with European Investment Bank.

5.2 Grants

In coordination with National Energy Efficiency Action Plan, the grants for EE improvements and usage of renewable energy sources were first issued in 2008. Every year the Eko Fund issues two public calls for improving EE and utilization of RES - one for single homes and one for multi-dwelling buildings. All houses and buildings are eligible, regardless of their building year for installation of the heating system based on renewable energies. For implementation of EE measures, houses need to be built before 1.1.2003. In addition, houses and buildings built on areas with the accepted Directive for cleaner air can receive grants up to 50% of the investment.

The funding amount on disposal in 2014 for single homes was EUR 15 million and for multi-dwelling building EUR 6 million. In 2015, the funding for single homes were lowered on EUR 14 million and funding for multi-dwelling buildings was increased on EUR 8 million. The measures which are financed are heating system installation (solar collectors, heat pumps, biomass heating), windows and door replacement, thermal wall and roof insulation, installation of ventilation system, purchase of a passive house/apartment and overall house renovation. It is possible to get co-financing up **to three EE and renewable energy source measures**. Every single measure for improvement has its own granting rules and for family houses, the following ones are valid (Eko Fund, 2014):

- Solar heating system installation: Up to 25% of eligible costs. with maximum 3.000 EUR for plate collectors and 4.000 EUR for vacuum tube collectors.
- Biomass heating installation: Up to 25% of eligible costs, with maximum 2.000 EUR for biomass heating on pellets and 1.500 EUR for heating device on firewood.
- Heat pumps: Up to 25% of eligible costs - ranging from 1.000 to 2.500 EUR, depending on the quality of the pump.
- Windows and door replacement: Up to 25% of eligible costs, with maximum of 3.000 EUR.
- Thermal wall insulation: Up to 25% of eligible costs. For a single house maximum of 2.400 EUR and for two apartment house maximum of 1.800 EUR.
- Thermal roof and ceiling insulation: Up to 25% of eligible costs, maximum of 1.500 EUR.

Eko fund established also a scheme similar to the German Energy Conservation Ordinance standard. In the event of renovating a house in order to qualify for the highest possible standard, hence pooling together a maximum number of grants, the amount of co-financing can be 26.500 EUR and in the area of Clean air Directive up to 33.500 (Črnilogar, 2014).

Regarding multi-dwelling buildings, conditions for solar heating system installation and thermal wall, roof and ceiling insulation are the same. On the other side, grants for heating systems are significantly higher due to the large spaces they are required to heat. For central heating system based on biomass, the grants are 25% of eligible costs, ranging from 2.000 to 15.000 Euro, based on the power of the furnace. Heating pumps are eligible for grants in amount up to 6.000 Euro or 25% of eligible costs. The simplest measure is installation of thermostatic valves. For this measure, grants are available for 25% of eligible costs, not exceeding EUR 30 per valve.

5.3 Innovative Financing

Slovenia, where the first energy services emerged over a decade ago, now ranks among those countries with a poorly developed market, limited just to a few companies offering complex forms of energy services, such as energy contracting. Back in the 2002, Slovenia was among the countries that successfully replicated building pooling example with the cooperation of Berlin Energy Agency. Currently, there is a programme in development, which plans to trigger investment worth of 50 million of EUR on public buildings through Energy Performance Contracting in the city of Ljubljana (Berlin Energy Agency, 2012). Until now, the EPC model is only applicable to public and commercial buildings.

Slovenia already has an EE obligation scheme in place, according to the 2nd National Energy Efficiency Action Plan, in which the energy suppliers are obliged to achieve 1% annual savings. Measures are paid for by the Energy Efficiency contribution, which is a tax that all energy users pay. The existing EEO has been adapted to reflect the requirements of the EED, with the obligation on suppliers increased to 1,5% annual savings. Slovenia is one of the countries that are fulfilling its obligation to article 7 of Energy Efficiency Directive through a combination of EE obligation scheme and alternative policy measures. On-bill type of financing is not present on Slovenian market.

5.4 Analysis according to barriers, financial instruments and programme results

Based on analysis of typical barriers in **table 7** it is evident that Slovenia still needs to focus more attention on resolving general barriers to EE market.

Table 7: Analysis of typical barriers in Slovenia

Type of barrier	Level of barrier intensity	Analysis of the current state
High transaction costs	Medium	Applying for government backed EE programmes in Slovenia is a time consuming task with application process time from 90 to 150 days.
Institutional barriers	Medium	EU Legislation ensures minimal institutional barriers, however Slovenia still has not resolved the issue of apartment owner consensus regarding renovation of multi-dwelling buildings and it demands a 75-100% consensus from the apartment owners.
Lack of information	Medium	The informational and promotional activities are enhanced, with a major role played by the energy advice network ENSVET and the Eko Fund for promoting EE in households. Nevertheless, awareness of cost-effective energy saving opportunities could be stronger.
Energy prices	Low	Slovenia does not provide subsidies on non-renewable energy sources.
Lack of trained personal	Medium	Mandatory energy auditing and energy performance certification increased the supply of trained personal, but there is still need for trained personal
Uncertainty associated with energy savings	Low	The savings achieved through individual measures to increase energy efficiency are laid down in accordance with Energy Efficiency Directive using either the top-down method or bottom-up method.
Split incentives	High	Split incentives issue is not resolved.

The most significant barrier is linked with high transaction costs, where citizens need to wait from 90 to 150 days to get their application approved. As with other countries, the split incentives barrier is also one of the major obstacles.

Regarding financial barriers, Slovenian authorities recognized grants and subsidized interest rates as primary means to increase number of EE investments. However, the seasonality of the programmes does not provide an option to apply for the means all the time. There is only one commercial bank offering subsidized interest rates through government backed programmes. As for fiscal incentives, Slovenia has a reduced VAT rate for residential investment, so instead of paying 22% of VAT, residential investments only bear a rate of 9,5%.

Table 8: Analysis of financial barriers in Slovenia

Type of barrier	Level of barrier intensity	Analysis of the current state
Initial Cost	Medium	Non-refundable grants and soft loans lower the initial cost barrier. Since the means are offered periodically citizens do not have the chance of accessing the financial measures at all times.
Interest rates	Low	The Eko fund's soft loan programme offers relatively low interest rates
Payback time	Medium	The financial instruments in place are lowering the payback time
Lack of financier awareness	Medium	Slovenian banks have experience with EE lending. Up until 2015 in the framework of a government backed programme only one commercial bank offered soft loans and as of 2015, it is possible to attain loans for EE renovation of multi-dwelling buildings in selected commercial banks. This credit line was extended by the Slovenian bank for Export and Development.

In the period from 2008 to 2013 a total of EUR 92,3 million was given to the citizens in the form of grants – 28% went on thermal insulation, 19% on window renewal, 16% on biomass heating systems, 11% on heat pumps and 11% on solar collectors (Kovačić, 2014). On a yearly basis, the investments reduced energy consumption for 568 Gwh and lowered CO2 emissions for 90.000 t.

By the information stated above, one can conclude that every EE measure is covered by appropriate grants, but the biggest shortcoming is that the funding is limited and usually the grant applications are already closed before the summer. In 2013, Slovenian Eko Fund received 12.000 grant applications; 11.343 for single homes and 625 for multi-dwelling buildings were approved. In 2014, there were 9.400 application for single homes and 658 for multi-dwelling buildings, totaling 10.050 applications. The grants in 2014 for single homes were depleted in July and for multi-dwelling buildings in October (Eko Fund, 2014). Before year 2014, residents could obtain only one financial aid, either a grant or soft loan. Naturally, many residents opted out for grants. It was possible to combine soft loans with grants, only if the total cost of investment was exceeding EUR 10.000 (Eko Fund, 2013, p. 7). From 2014 this criteria was changed and it is now possible for the residents to apply for a grant and a soft loan, regardless of the investment costs. If both are approved, the amount of grant is after the completion of the renovation transferred to the bank for a repayment of the loan.

Construction sector is trying to keep up with the EE programmes and as a result, they are continuously informing their customers about recent public calls from Eco fund and are already introduced with all the necessary technical requirements of the measures that are

being financially covered. Eco fund as well recognized the benefits of providing good information to the citizens, so as of 2015 for every specific measure all the data is available on Eco fund's web site.

Table 9: SWOT analysis of EE programmes in Slovenia

Strengths	Weaknesses
- Available loan and grant scheme, with a possibility of combining both of them - Soft loans accessible through commercial banks - Incentivizing areas in need of greater environmental protection - Comprehensive Programme, with special focus on houses and multi-dwelling buildings - Financial scheme for low-income households - Fiscal incentives and EE obligation scheme	- Long application approval time - Seasonality of the programme; possible to apply only in the time of public calls - 75-100% owner consensus on multi-dwelling building renovation - no support to comprehensive renovations (e.g. progressive grants)
Opportunities	**Threats**
- Increase the effectiveness and speed of application process	- General uncertainties regarding volatile energy prices and overall effectiveness of EE measures

Years of experience made Slovenian Eco Fund an expert in promoting EE investments. Every year's depletion of grant funds is a proof that they are on the right track. Inclusion of all measures, incentivizing areas of greater environmental protection and specially designed programmes addressing both family and multi-dwelling buildings are all positive references to the Slovenian Eko Fund (**Table 9**). By enabling combination of loan and grant scheme in the recent years, they made EE investments even more attractive. The possibility of attaining loans for EE by commercial banks proves the readiness of officials to follow the best practices example.

Still, there are some issues to work on. The initial application process lasted around 90 days but from 2015 was extended to 150 days, which can be classified as one of the biggest downfall of the programme. Such a long waiting period not only discourages potential applicants, but also harms the construction sector. The public call usually opens around springtime, and if the applications are processed by the end of the summer, the whole process is stopped during the spring and summer period, which is the period when the construction sector is most active. Therefore, citizens need to apply one year in advance. Seasonality of the programmes and no fixed dates of the public calls are also disrupting citizen's trust in the institutional processes. One bank has a monopoly on the soft loans, which can be perceived as weaknesses since it distorts competition. Owner consensus is also one of the weaknesses that could be resolved with better regulation.

6 CROATIA

The Republic of Croatia, with the land area of 56.594 km², is situated in the southeastern part of Europe. With an estimated population of 4.3 million inhabitants and a 2013 gross domestic product (hereinafter: GDP) per capita of EUR 10.249 (40% of EU-28 average), Croatia is the youngest member of the EU.

Croatia has been in recession for the last five years. Over the course of this period, next to GDP contraction, the country experienced continued decline in household consumption and investment, as well as drop in exports. In January 2014, Croatia entered the EU's excessive deficit procedure due to the governmental deficit above 3% of GDP and general consolidated government debt that reached almost 70% of GDP in 2014, implying that the authorities should further impose austerity measures in line with EU requirements (European Commission, 2015). However, the banking system is well developed by regional standards, with a capital adequacy ratio[4] of 20,8% as of June 2014 (International Monetary Fund, 2014). Due to the reduction of income in private households, the number of loans attributed to the private sector has been in decline since mid-2012.

Table 10: GDP trend in Croatia

	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP (mil. EUR)	36.034	39.745	43.390	47.543	44.781	44.441	44.220	43.502	43.157
GDP growth (%)	4.3	4.9	5.1	2.1	-6.9	-2.3	-0.2	-2.2	-0.9

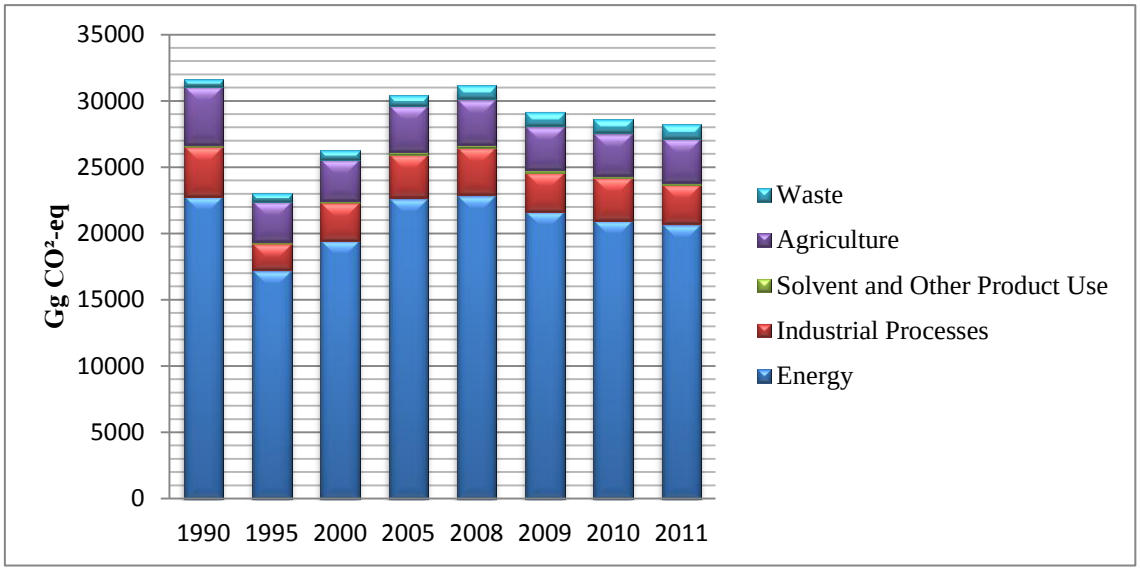
Source: *Statistical Yearbook of the Republic of Croatia*, 2014.

Energy system in Croatia holds one of the most important areas in development of the national economy. Therefore, its recognized weaknesses and opportunities have been incorporated in Croatian national Energy Strategy. In line with the EU 2020 strategy, one of the mail goals is to increase EE and the use of renewable energy sources, especially in final energy consumption, thus providing multiple benefits such as reduction of emissions, decrease in consumption and related expenses, increasing the security of supply and providing an opportunity for "green jobs".

Croatia with 28,3 Mt of GHG emissions in 2012 accounted for less than 0,1% of the world's total GHG emissions. Total GHG emissions, excluding outflows, in 2011 were 10,6% lower compared to 1990 (Croatian Environment Agency, 2014, p. 16). As for the trends, the GHG emissions dropped significantly in the 1991-1995 period due to the collapse of industry during the aggression against Croatia and Homeland War. From 1996 to 2007, emissions were steadily increasing; however, as of 2008 the decreasing trend is again present due to effects of economic crisis and increase in the renewable energy production. In terms of GHG emission sources, in 2011 the energy sector (including transport and industry) has the largest share (73,3%) followed by agriculture, industrial processes and waste

[4] Ratio of bank's capital to its risk

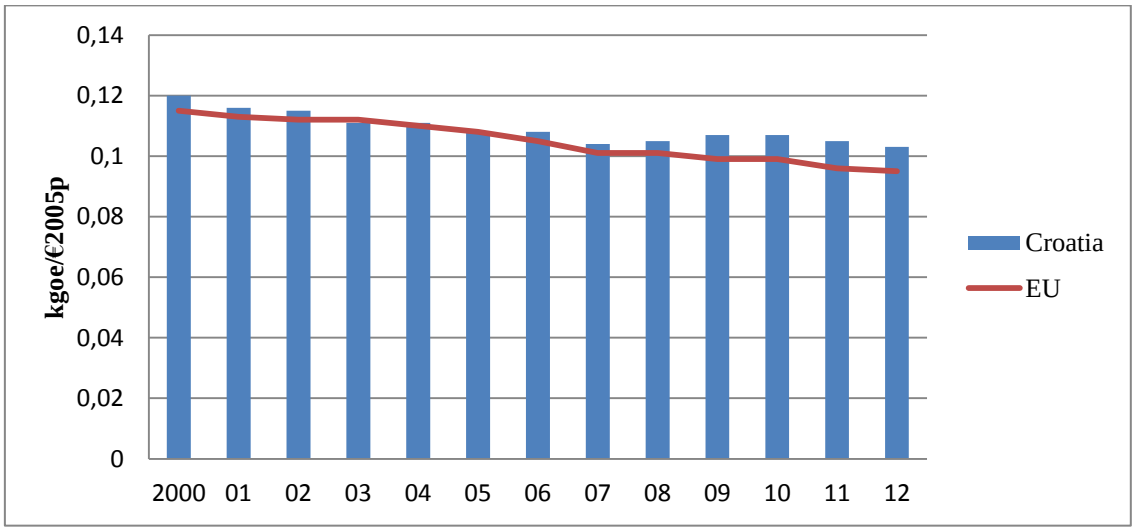
Figure 6: Trend of GHG emissions by sectors (1990-2011)



Source: *Croatian greenhouse gas inventory for the period 1990-2011*, table 2.3-1, p. 19.

Figure 7 shows the final energy intensity trend expressed in ODEX index for the whole economy at 2005 prices per kilogram of oil equivalent (kgoe), comparing Croatia with EU average. It is evident that until 2005, Croatia was following the decreasing trend in line with the EU average, but the crisis of 2008 reversed the trend in Croatia.

Figure 7: Final energy intensity at purchasing power parities* in Croatia, 2000-2012



Note: GDP is converted into a common currency, using purchasing power parities instead of exchange rates to eliminate the difference in price level

Source: *Odysee-Mure*, 2015.

As of 2011, the final energy intensity is again lowering in line with the EU average. However, final energy intensity indicator should be taken with caution. When the economy is growing faster than energy consumption, i.e. when the GDP denominator is growing faster than the energy numerator, the energy intensity falls. On the other hand, in times of recession, when

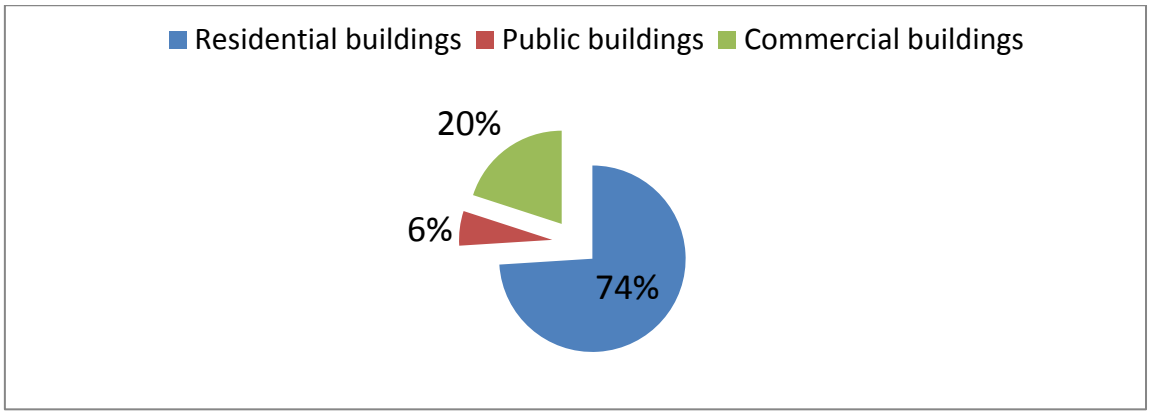
GDP tends to fall faster than energy consumption, the energy intensity ratio rises. So even when there is slight change in EE, the energy intensity indicator tends to show otherwise.

The highest share in final energy consumption holds the building sector (residential, commercial and public) with largest share amounting to 43% in 2011. Out of that figure, two thirds are attributed to the residential sector and one third to public and commercial (Energy outlook, 2013).

6.1 Overview of the building sector in Croatia

Building sector in Croatia consumes 43% of the total energy consumption. The residential building make three quarters (**figure 8**) of the total building number and as such are the primary target on EE improvements.

Figure 8: Overview of the building sector in Croatia in (%)



Source: *Programme of energy renovation of multi-dwelling buildings for period 2013-2020,* 2013

The residential building sector (total sum of all family houses and multi-dwelling buildings in Croatia) in Croatia can be disseminated according to:

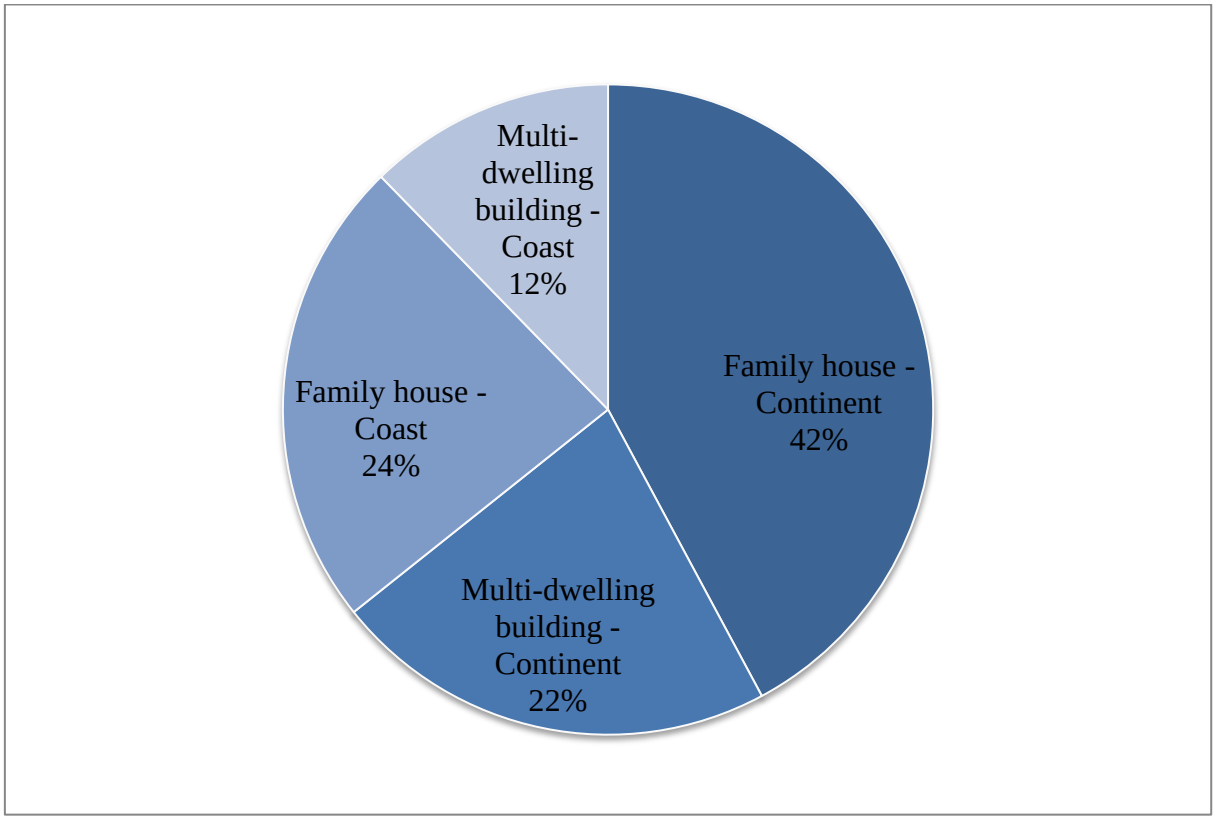
1. Climate conditions
2. Year of construction
3. Type of housing unit – family house or multi-dwelling building

The specific characteristic of Croatian building sector is the regional position in relation with the climate, which separates the country on two distinctive zones: Continental climate in the north and central part and Mediterranean climate along the coastal line.

The described position of the country with regard to the climate conditions makes the analysis and estimation of the possible energy savings in the building sector more complicated than it is the case in a country with a more or less same climate. For example in Croatia, yearly consumption of energy for heating purpose in the continental area is double of the amount that is consumed in the coastal area, whereas energy needed for cooling is the same in both

regions due to frequently increasing temperatures in the summer over the last decade(Ministry of construction and physical planning, 2014, p. 18).

Figure 9: Percentage of housing sector according to the building type and region

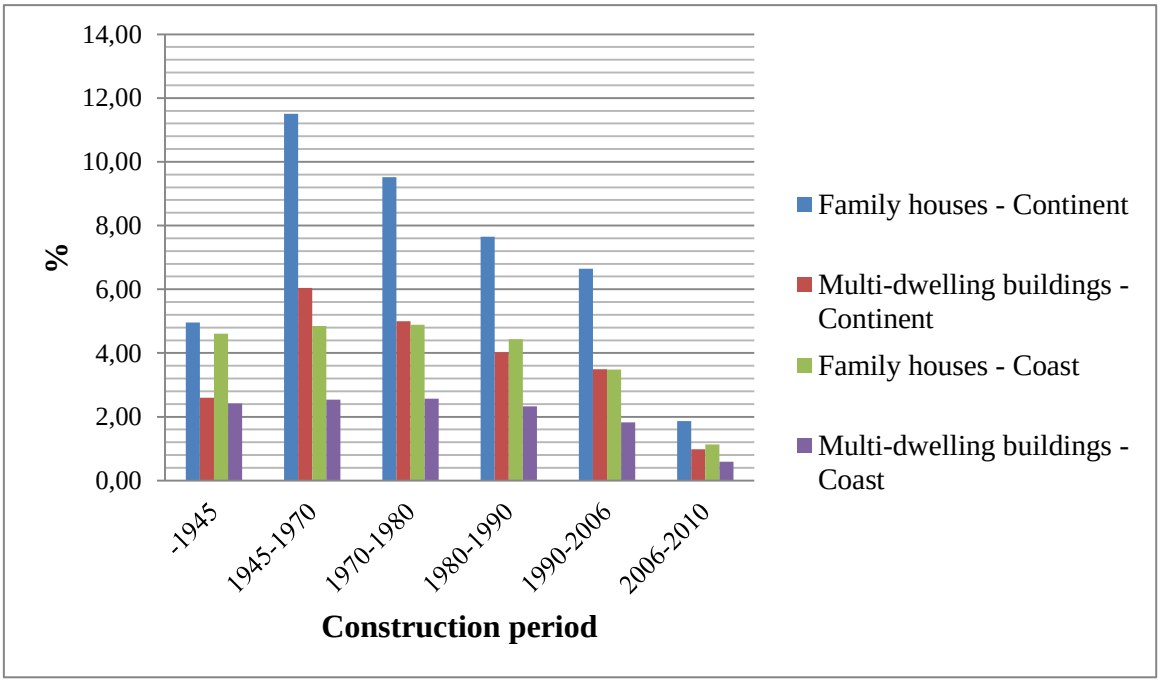


Source: Croatian Bureau of Statistics, Programme of energy renovation of multi-dwelling buildings for period 2013-2020

According to **figure 9 (**calculated from the table from appendix A) around 64% of the housing sector is allocated in the continental area and 36% in the coastal area. From another point of view, family houses represent 66% and multi-dwelling buildings around 34% of total housing sector, i.e. Croatia has almost double of share of family houses in relation to multi-dwelling buildings.

Next to the type of building and the location, year of construction is also of paramount importance. The year of construction offers a better understanding of the methods of construction and applied construction materials that are affecting the energy performance of the unit built, i.e. the level of energy used for heating and cooling. In addition, different technical prerequisite were in force during this periods, so it is important to stress out that before 1970 there was no regulation defining minimal thermal insulation (Ministry of Construction and Physical Planning, 2014). Gradually, regulation had been tightened up, and in 1987, appropriate thermal measures had been adopted.

Figure 10: Housing sector according to type of the building, construction period and location



Source: Croatian Bureau of Statistics, Programme of energy renovation of multi-dwelling buildings for period 2013-2020

Figure 10 shows the housing sector in Croatia according to type of the building, construction period and location. Buildings and houses constructed before 1970 amount to almost 40% of the total housing stock and together with new housing units from the period until 1990 represent a staggering 79,97 % of the total housing sector. The data presents a valid case for EE improvements, making all construction before 1970 primary target. The next in line is construction period until 1980 and all housing units built before 1987, when the current regulation regarding thermal insulation came in force.

As shown in **table 11**, the usage of energy in household for thermal purposes (heating, cooling and hot sanitary water preparation) is responsible for 70% of the total consumption, making it a priority in EE improvements.

Table 11: Final consumption of energy in households in 2010 according to their end use

Energy consumption in household according to their end use	Share in total end use energy consumption in %
Heating	56,56
Cooling	3,43
Warm consumable water preparation	10,63
Cooking	12,28
Lightning	2,86
Electrical devices	14,24

Source*: Ministry of Construction and Physical Planning,* 2014, p. 21

In the Croatian Housing Program, two different models according to two different climate types are constructed for a house without or with minimal thermal insulation. The goal is to determine all possible energy usage reductions by improving thermal and insulation characteristics of external envelope of the house. The parameters being used are today's characteristics of a house built in the period from 1945 to 1987. As mentioned earlier, this is the period with highest demand for energy performance improvements. The first model is based on a family house in continental area, while the second is focused on a family house in coastal region.

The following results would be attained (Ministry of construction and physical planning, 2014, p. 23): after renovation, the continental family house would advance from energy class G to energy class C. Reduction of heating energy per year would be 80% compared to an uninsulated house. In the case of a family house with same characteristics situated in the coastal area, the whole thermal insulation would bring 92% reduction in heating energy per year and the house would switch from E energy class to a passive standard, i.e. energy class A+. The large decrease is possible due to mild climate in the Adriatic region and because of the same thermal insulation that is being used in continental area, where conditions are considered more extreme.

6.2 Energy Efficiency Policy and Measures

In February 2013 the government of Croatia has ratified second NEEAP for the period from 2011 to 2013. The second NEEAP complies with Directive 2012/27/EU and it is based on National Program of the Republic of Croatia for energy efficiency for the period from 2008 to 2016, Strategy of energy development of the Republic of Croatia (Official Gazette no. 130/09) and Act on Energy Efficiency in direct consumption (Official Gazette 152/08, 55/12).

The imperative of the second NEEAP is to ensure the EE renovation of the existing building stock in Croatia. The ministry in charge - Ministry of construction and physical planning has an obligation to provide three different national renovation plans: for commercial, public and residential buildings. Furthermore, NEEAP stresses out financial contribution to the natural persons investing in measures of EE or renewable energy sources, making a fundamental reference in development of National programs for existing residential building renovation.

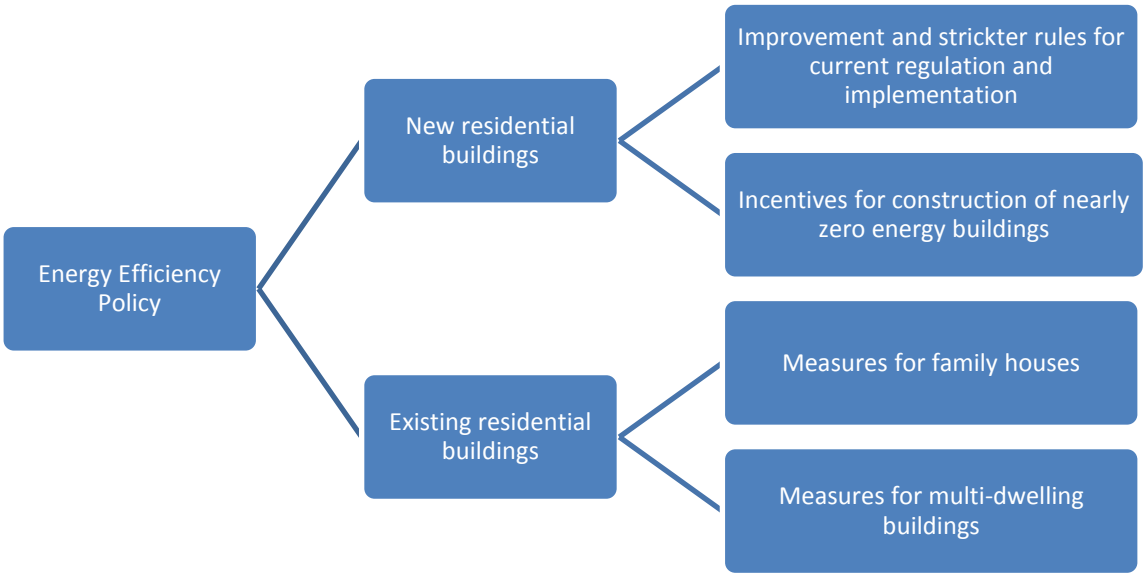
The National programs for renovation of existing residential buildings are being financed through two different streams – Environmental protection and Energy Efficiency Fund (hereinafter: EPEEF) and European Structural funds. EPEEF is a Croatian financial institution established in accordance with Environmental protection Act (Official Gazette 82/94,128/99) in 2004 in order to finance the preparation, implementation and development of projects and programmes in the field of preservation, sustainable use, environment protection, energy efficiency and the use of renewable energy sources. Until 2014, EPEEF co-financed EE renovation of nearly 1.000 houses and implementation of 3.200 renewable energy source systems. From 2004, the fund subsidized total investments in worth of EUR 3,15 million.

At the time of programs development, the European Financial Framework for 2014-2020 was still being in preparation and before the official confirmation of the framework, the programmes were initially funded only through funds from EPEEF. On 12th December 2014 the Financial Framework for 2014-2020 was officially confirmed from the EU side, meaning that the funding will go as planned in the programs. It is intended to use financial instruments for the planned investments and therefore it is expected for the European Investment Bank to carry out ex-ante assessment and provide assistance in establishment of the financing instrument in sectors including EE and renewable energy sources.

The Act on Energy Efficiency, which entered into force on 4th of December 2012, determines the method of contracting energy services in co-owned communities, i.e. multi-dwelling buildings through a contract on energy performance of the building. This is the first step on behalf of the Croatian government to include residential buildings on ESCO market.

The EE Policy in Croatia is segmented in two directions – first one is directed on new residential buildings and further development of legislation, in terms of prescribing stricter energy performance requirements for buildings and financial incentives for construction of nearly zero energy buildings. The second one is targeting existing residential buildings as a support in the renovation of existing buildings that will in the long run enhance energy performance characteristics of buildings and houses (**Figure 11**).

Figure 11: Energy efficiency policy for residential buildings in Croatia:



Source: *Programme of energy renovation of multi-dwelling buildings for period 2013-2020*, 2013 p. 32

Due to the technical differences, the policy for existing residential buildings is separated on family houses and multi-dwelling buildings. As of 2014, in accordance with article 4 of Energy Efficiency Directive and segmentation of EE policy for existing residential sector, Croatian government issued two programs. One is focusing on measures for family houses and the second one on multi-dwelling buildings. The aim of the programmes is to contribute to national carbon emissions reduction targets, renovating existing buildings in an EE way and to support the weakening construction industry. Croatia linked the introduction of new

measures to the EU Structural and Cohesion Funds for the years 2014-2020 that offers an attractive 23 windows of opportunity for energy efficiency investments in Member States.

For proper reporting on achieved savings, it is necessary to follow a verified methodology. So far, in Croatia Ordinance on the methodology for monitoring, measurement and verification of energy savings in the final energy consumption has been effective (Official Gazette 077/2012). This ordinance was done according to the guidelines of the Directive on energy services and it was necessary to draw up an ordinance according to the Directive on Energy Efficiency. The national System for monitoring, measurement and verification of energy savings was established in September 2014 and is responsible for development of a comprehensive information system for tracking and monitoring all activities in EE and evaluating energy savings.

6.3 Program of energy renovation of family houses

The Croatian government, the Ministry of environment protection and nature and Ministry of construction and physical planning have concluded in March 2014 the Programme of energy renovation of family houses for the period from 2014 to 2020 (hereinafter: Housing Renovation Program). In developing the Housing Renovation Program, result from project "Citizens participating in energy efficiency improvement" have been used in order to produce measures that would suit citizens the best (Ministry of construction and physical planning, 2014, p. 4). The aim of the Housing Renovation Program is to analyze consumption and EE in existing housing sector; to identify potentials and opportunities for decreasing consumption of energy in existing housing sector and to develop necessary steps and measures for improvement of EE in existing housing sector.

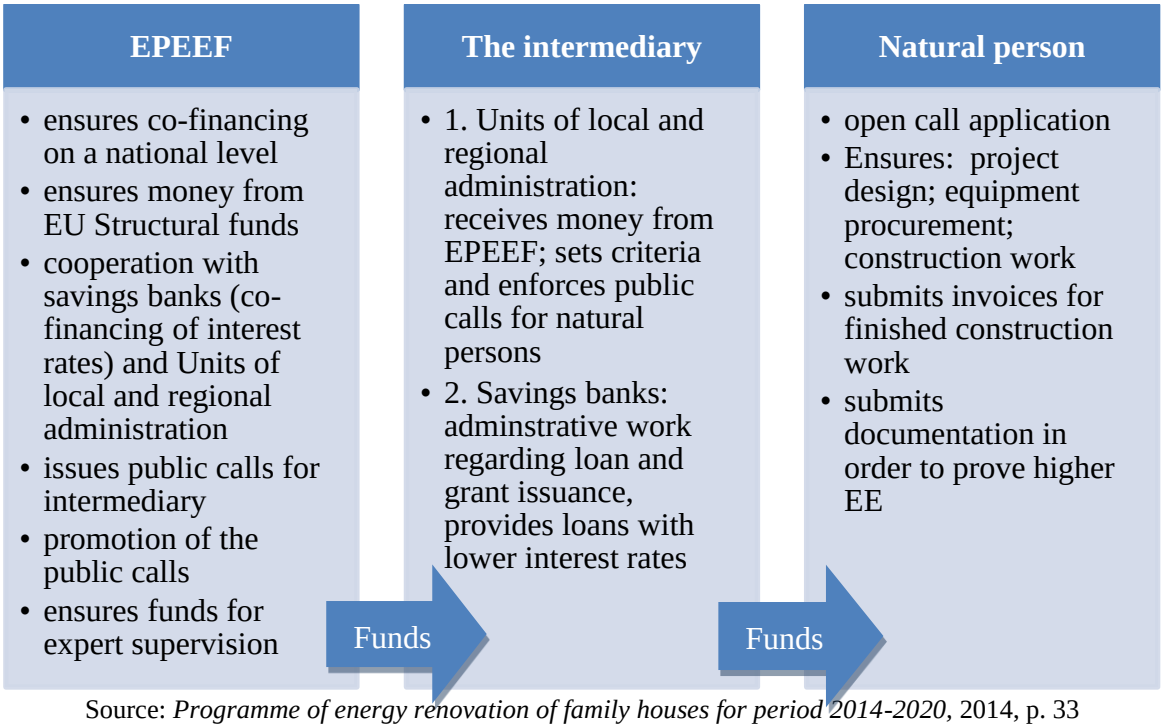
As of 2015, the single-family house is defined as a building on a separate construction area, with a gross surface area of no more than 600 m² and a maximum of three housing unit (Ministry of construction and physical planning, 2014, p. 4). The eligibility of houses is not dependent on the year of the construction, but rather on the thermal insulation factors and energy performance characteristics. Still, houses built in the period from 1945 to 1987 are on the priority list due to their low energy performance characteristics.

The goal of the programme is to successfully renovate approximately 2000 houses per year with annual energy savings of 56 Gwh, totaling around 400 Gwh by the end of 2020.

6.3.1 The organizational and financing structure of the programme

By the initial Housing Programme scheme, EPEEF is responsible for securing the money needed for grants, either through their own means or from Structural funds of EU and, as stated in the official Housing Programme, is in charge of ensuring better loan conditions (lower interest rate) for citizens through savings banks.

Figure 12: The Housing programme organizational scheme in 2014



Source: *Programme of energy renovation of family houses for period 2014-2020*, 2014, p. 33

Figure 12 depicts the organizational structure of the Housing Programme in 2014. The role of intermediary is assigned to Units of local and regional administration and savings banks. According to the scheme, public calls are issued in two rows. First, the EPEEF publishes the first public call for indirect co-financing for units of local and regional administration. After the successful application, units of local and regional administration obtain funds for co-financing projects of EE in their own territorial area and issue another public call for the natural persons. Persons willing to renovate their houses apply for the grant by submitting all the necessary documentation. The biggest disadvantage of this procedure is that if a unit of local or regional administration does not apply for the public call, automatically all the residents from that unit are not able to apply for the public call.

The role of savings banks as intermediary in 2014 application process was ambiguous as well. In the initial plan, savings banks were responsible for arranging the process of grant issuance and enabling lower interest rates for citizens without necessary financial means. However, it turned out that they did not provide lower interest rates and their only role was to process the grant application and by doing so, reducing the grant for their processing fees. This type of model has not been encountered in the other national programs and as such was removed from the application process in 2015.

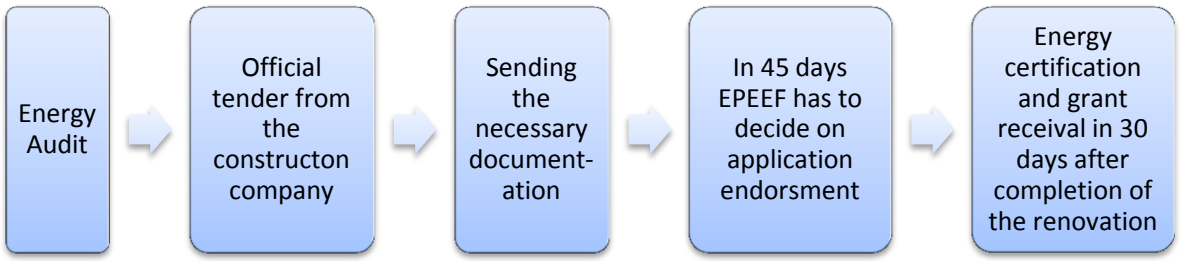
It is important to stress out that in 2014 preparation of the project design was not considered a justified cost and as such had to be covered by a natural person in order to fulfil open call application. In this way, owners of family houses were forced to invest their own financial means without knowing if they are going to receive the grant or not. These criteria made applying for governmental grants very difficult for people with weaker financial status. However, as of 2015 project design is no longer needed because mandatory pre-renovation energy audit is sufficient for applying for a grant.

The previous section described the process of 2014 in order to comprehend how the programme was initially designed and how many deficiency it had. The government recognized the areas that are problematic and as of 26th of March 2015 the following alteration were adopted into the Housing Program (Environmental protection and Energy Efficiency Fund, 2015):

- Nullification of the role of units of local and regional administration and savings banks in the application process - citizens apply directly to EPEEF for grants
- No option of soft loans
- Nullification of the obligatory preparation of project design. This is replaced by the obligatory energy audit prior the renovation and energy certification after the renovation
- Introduction of certified energy auditors, who will perform energy audits and certification subsidized entirely by EPEEF
- The initial energy audit[5] will be covered by the EPEEF, thus making it possible for every household to apply, regardless of their economic situation

Figure 13 depicts the new application process valid from 2015. Based on initial energy audit, the applicant receives recommendation on the best way to renovate its house. With newly established energy certificate, he/she contacts the construction company, which issues an official tender for construction work.

Figure 13: The new application process from 2015



Source: *Environmental Protection and Energy Efficiency Fund*, 2015

The collected documentation needs to be sent to EPEEF for official approval. In maximum of 45 days, EPEEF is required to decide if the application is approved or not. After completion of the renovation, with a newly established energy certificate being sent to EPEEF, the applicant receives the grant in 30 days period.

[5] Energy audit prices range from EUR 400 to 700, depending on the size of the house/apartament

The measures in the Housing Programme are grouped in two sections (Ministry of construction and physical planning, 2014, p. 35):

1. Energy efficiency measures:

a) Thermal envelope insulation

b) External window and door replacement

c) Replacement of existing heating systems on fossil fuels and electric energy with new systems with condensation or natural gas boilers

2. Measures for incentivizing usage of renewable energy sources

a) Solar heating collectors for sanitary hot water and heating

b) Geothermal heat pumps (ground-air, water-water and air-water) for sanitary water, heating and cooling

c) Biomass heating systems on pellets and wood-fired furnace for heating and sanitary water

d) Photovoltaic solar energy collectors for generating electricity

It is possible to attain all three measures of EE but only one measure of renewable energy sources. The funds that the EPEEF is providing are differently allocated based on the **type of measure** that is being implemented (whether EE measure or renewable energy source measure) and **the area** where the family house is located. The EPEEF is co-financing renovations with 40, 60 or 80%, depending on the location. The amount of funding is divided accordingly to three different groups (**table 12**).

Table 12: Maximal funds on disposal according to type of measure

Type of measure	**Funds on disposal**		
	40%	**60%**	**80%**
	(for all areas)	(Mountain area, second group of islands)	(Areas of special governmental care, first group of islands)
Thermal envelope insulation	Up to 3.950 EUR	Up to 5.900 EUR	Up to 7.900 EUR
Window and door replacement	Up to 3.950 EUR	Up to 5.900 EUR	Up to 7.900 EUR
Gas condensation heating system	Up to 1.600 EUR	Up to 2.400 EUR	Up to 3.200 EUR
RES	Up to 1.600 EUR	Up to 2.400 EUR	Up to 3.200 EUR
Maximal amount of funds for a single house	Up to 11.100 EUR	Up to 16.600 EUR	Up to 22.200 EUR

Source: *Programme of energy renovation of family houses for period 2014-2020*, 2014

Areas of special governmental care and first group of islands can get up to 80% from the EPEEF or maximum of EUR 22.200, second group of islands and mountain area is entitles to 60% or up to EUR 16.600 and the rest is eligible for 40% or up to maximum of EUR 11.100. In order to remain objective throughout the thesis, the area with 40% co-financing is going to be used as the basis for all comparison, since this is where the majority of houses and buildings reside.

Taking into consideration the numbers stated above, the maximal investment that is covered by EPEEF for renewable energy sources is up to EUR 4.000 and for single EE measures up to EUR 10.000. In 2014, units of local and regional administration had the obligation to ensure additional 10% of the investment on top of the initial grant level, but since that organizational structure did not prove to be the best solution, it was cancelled from the organizational structure.

Table 13 shows the average volume of the financial grants per year for EE measures and renewable energy sources that is presented in the official Housing Program. The data is based on an assumption that each year 2000 houses will be renovated, with a predicted total investment of EUR 27,3 million and a co-financing share from EPEEF of 34,22%. The largest share of grants or almost 50% of total approved grant will be given to exterior renovation, consisting of thermal envelope insulation and window and door replacement. The second one is increasing the share of renewable energy sources with EUR 3,15 million, because it is an integral part of achieving the quota of the share of renewable energy sources by 2020 that the EU is demanding from Member states and it ensures energy stability for citizens. Heating system replacement, where is predicted the most energy savings per year, is funded with EUR 1,6 million. **Table 13** shows that until 2020, with 56 Gwh of energy saved annually, the total of 392 Gwh of energy will be saved, which is equivalent to EUR 22,1 million.

Table 13: Overview of the proposed measures in the Housing Programme

Measure	**Investments per year** (in mil. EUR)	**Grants provided by EPEEF per year** (including EU funds)	**Energy savings per year** (Gwh)	**Amount of money saved per year** (in mill. of EUR)	**Saving of CO2 per year** (1.000 t)
Exterior renovation	11,5	4,6	15,2	0,85	4,24
Heating system replacement	5,3	1,6	27,3	1,54	6,44
RES	10,5	3,15	13,5	0,76	3,78
Total	27,.3	9,35	56	3,15	14,46

Source: *Programme of energy renovation of family houses for period 2014-2020,* 2014, p. 2

6.3.2 Results

Since the Housing Program time frame in 2014 was overlapping with the EU Financial Framework for 2014-2020, the means from Structural funds were available after confirmation of the operational programs for the new financial period and until then EPEEF was the sole contributor of the program. This was already evident during the first open call in 2014 where it was stated that the eligible measures are going to be funded with EUR 6,6 million, which is EUR 2,75 million short from the initially intended EUR 9,35 million. Due to catastrophic events caused by an extensive flooding in the summer of 2014, the overall support of the Program was increased from initial EUR 6,6 mil to EUR 21 million, which is three times more than intended (EPEEF). However, the final results from 2014 show that, instead of renovating the planned amount of 6.000 houses (after increasing the budget), with a budget of EUR 21 million, only 1.500 houses went into final procedure. The information wheatear the entire budget was used is not known.

The main criticism to the programme lies in the fact that almost 50% of units of local and regional administration did not apply for the grants in the first public call, disabling people the chance to apply for the grants. In Croatia, there are 429 municipalities, 127 cities and 20 counties. In 2014, only 100 municipalities, 69 cities and 11 counties applied for non-refundable grants. The problem at stake is obvious. The procedure for applying should be simplified and without intermediary. A natural person willing to invest in EE should apply directly to the source of the funds, hence EPEEF. To stress out the significance of this problem, it is suffice to say that capital city of Zagreb with a population of 800.000 people did not apply for the first round of public call. The officials recognized this problem as the main obstacle and as from 2015 the programme is centralized, i.e. the role of units of local and regional administration and savings banks as the intermediary is removed.

6.4 Programme of energy renovation of multi-dwelling buildings

Simultaneously with the development of the Housing renovation program, the Ministry of Construction and Physical Planning concluded in coordination with Croatian government the Program of energy renovation of multi-dwelling buildings for the period from 2014 to 2020 (hereinafter: Building renovation program). Identical to the Housing renovation program, the aim of the Building renovation program is to analyze consumption, identify potentials and opportunities for decreasing energy consumption and to develop the necessary measures for improvement of EE in existing multi-residential buildings.

A multi-residential building is defined in the terms of this programme as a building with more than 50% of the gross surface intended for residential purpose, which obtains three or more housing units and a building manager administrates it.

The goal of the programme is to annually renovate 500.000 m² building area built before 1987 with EE measure focused on reducing heating energy consumption and improving heating

systems. Installation of renewable energy sources is encouraged, but not defined as primary goal. The scope of renovation should ensure that the building reaches A, A+ or B energy class. It is planned that until 2020 with implemented measures a total of 1.498 Gwh of energy is going to be saved.

6.4.1 Organizational and financing structure of the programme

Since the EU is encouraging Member states on usage of Structural fund's means in order to stimulate EE investment, Croatia ensured a portion of the financial means from the EU Structural funds. The other part is provided by EPEEF, while the rest of the investment must be provided by the building reserves or a credit loan on the behalf of the building residents. Building that would achieve at least 30% reduction in heating energy consumption are considered eligible for the funding from the Building Renovation Programme, which is administrated by the EPEEF

Since majority of the buildings have multiple apartment owners, the person responsible for applying for the grant is the legally appointed building manager who applies directly to the EPEEF for non-returnable grants. In this way, the public call is avoiding interference of local and regional administration, which enables a higher degree of flexibility for applicants. There was a breakthrough in legislation in 2014, when Croatian parliament updated the Act on ownership, which enables building renovation with at least 51% of apartment owner consent. This was a huge hurdle in years before, because by law back then, all owners should have approved the building renovation and this was a highly unlikely situation.

The process of obtaining funds is possible in three steps. First, an obligatory energy audit is necessary to identify all possible energy savings, followed by comprehensive renovation design documentation and concluded with a building renovation. The programme helps in financing four different measures (Ministry of Construction and Physical Planning, 2014, p. 43):

- Energy audits and energy certificates (-40% of eligible costs)
- Design documentation for energy renovation (-100% of eligible costs)
- Building renovation (-40% of eligible costs)
- Individual thermal energy consumption measurement (-40% of eligible costs)

As it is the case in the Housing Programme, if the building is located in area of special governmental protection, the amount of grant can get up to 60 or 80%. The maximal investment covered by EPEEF is EUR 230.264, thus the maximal amount that a single multi-dwelling building in the special area can receive is capped at EUR 184.000 or 80% of the eligible costs.

Table 14 provides an expenditure overview that is forecasted by the Building renovation programme from May 2014. The forecasted total investment in building renovation per year is set to EUR 79,3 million, with an EPEEF contribution of EUR 33,1 million in the form of non-refundable grants. With the goal of renovating 500.000 m² of building area and EUR 33,1 million on disposal, the EPEEF established a grant scheme that finances investment on an average of EUR 66/m2.

Table 14: Overview of the measures in the Building renovation programme

Measure	Estimated investments per year (mill. EUR)	Grants provided by EPEEF (including EU funds) per year (mill. EUR)	Energy savings per year (Gwh)	Amount of money saved per year (mill. EUR)	Saving of CO2 per year (1000 t)
Energy audits and energy certificates	1,3	0,6	-	-	-
Project design for energy renovation	2,3	2,3	-	-	-
Building renovation	65,8	26,3	101,2	5,72	28,22
Individual thermal energy consumption measurement	9,8	3,9	112,9	6,38	33,89
Total	79,2	33,1	214,1	12,1	62,11
		42%			

Source: *Programme of energy renovation of multi-dwelling buildings for period 2014-2020*, 2014.

The biggest share goes to the building renovation with EUR 26,3 million, followed by instalment of individual thermostatic valves with EUR 3,9 million and design documentation and energy audits/certification with a total of EUR 2,9 million. If the programme would be successfully carried out through out seven years, the energy saved per year would be 214,1 Gwh or equivalent of EUR 12,2 million saved on energy bills.

6.4.2 Results

All the measures are financed with at least 40% of eligible costs from the EPEEF side, with the exception of the design documentation, which eligible costs are being 100% financed up

to EUR 4.600. Regarding design documentation, the problem that arises here is the fact that the amount of grant is not linked with the size of the building. For example, a three-floor building with 12 apartments would receive the same grant as a 20 floor building with 80 apartments. Clearly, the amount of grant should be linked with the floor space of each individual building. Up front energy audits and certificates are required due to the technical characteristics of buildings and are financed with 40% of eligible costs from EPEEF even though the building in the last round does not satisfy the rules for receiving grants. This explains why measures are grouped in 4 different sections – building renovation is a big and costly process which entails heavy investment that normal citizens perceive as to large for their own budget. By enabling grants for separated measures with a *step-by-step* process, citizens are able to overcome first hurdle of energy certification with more financial stability.

However, the results from 2014 are little poorer than expected. That does not mean the programme failed to achieve its targets, because we must keep in mind that forecasted sums were calculated including EU funds, which were not available from the beginning of the Building renovation programme. From EPEEF's 2014 report, 447 buildings received EUR 290.000 for energy audits and 245 buildings received EUR 1,06 million for project design documentation. From those, the final renovation in 2014 is approved for 82 buildings, which are financed with EUR 4,47 million or EUR 54.000 of grant per building on average. The total area covered by the renovation was not mentioned, but since is known that approximately 66 EUR/m² is granted, an estimate of 70.000 m² is calculated, which represents 14% of the initial target of 500.000 m². In total only EUR 5,82 million was invested through governmental side and the planned amount was EUR 33,1 million, i.e. less than 20% of the initial funds were actually distributed.

6.5 Innovative financing

The development of the energy services market was conducted through the adoption of the amendments to the Act on Efficient Energy Use in Final Consumption (Official gazette 152/08, 55/12, 101/13, 14/14), specifically by the adoption of the Decree on the contracting method and the implementation of energy performance contracts in the public sector. Even though the regulation focuses on public sector, its rules are also applicable on the commercial and residential sector. It is essential to emphasize that currently, Energy performance contracting is an instrument used on Croatian market for public buildings only. As of 2014, there is an informational campaign to raise awareness of target groups about the benefits and possibilities of implementing energy efficiency measures through energy services. This campaign also targets residential sector, hence, foundation for development of ESCO market for residential purposes is being laid.

In the 3rd NEEAP Croatia defined the achievement of national energy savings target of the Article 7 of the Energy Efficiency Directive through application of EE obligation scheme and alternative policy measures. However, the introduction of EE obligation scheme is planned for 2015. Croatian market for EE is still relatively young in comparison with other countries

and as such, implementation of innovative financing instrument as on-bill financing is still regarded as to advance. There is no mentioning of possible introduction in the near future.

6.6 Analysis according to barriers, financial instruments and results

The following **table 15** provides dissemination of barriers, both typical and financial, mentioned in the theoretical part, their level of intensity and short analysis of their current state. High transaction costs, lack of information and trained personal and split incentives are barriers that need to be addressed more strongly if Croatia wishes to strengthen the framework for EE investments.

Table 15: Analysis of typical barriers in Croatia

Type of barrier	Level of barrier intensity	Analysis of the current state
High transaction costs	Medium	This barrier has been significantly reduced due to grant process application endorsement in 30 days. However, loan applying is still a time consuming task for citizens in need of financial assistance.
Institutional barriers	Low	With the EU accession, this barrier has been reduced to minimum due to the legislation synchronization with the EU. The Act on ownership requires 51% consent from all apartment owners in order to renovate a multi-dwelling building.
Lack of information	Medium	The consumer awareness about the EE benefits has increased. EPEEF with the Ministry of Construction and Planning, as entities in charge, are hosting a lot of seminars and educational workshops in order to address this barrier and change the common perception about the EE investments. However, the scope of their reach is still not big enough.
Energy prices	Low	In the past non-renewable energy prices have been subsidized in Croatia. As of 2008 this type of subvention has gradually been removed, thus it does not represent a barrier for EE investments.
Lack of trained personal	Medium	The Directive on Energy Performance of Buildings has made a strong impact on the market. With obligatory energy performance certificate, many people recognized the shortage in the supply and decided to get educated on this field. However, there is still a 50% shortage of the needed labor force, so Croatia is participating in EU

		funded programmes BuildUp Skills and ConClip in order to increase the number of trained personal (Energy efficiency – an opportunity for growth, 2015).
Uncertainty associated with energy savings	Medium	As of September 2014, Croatia established a national System for monitoring, measurement and verification of energy savings. However, it is difficult to assess energy savings ex ante.
Split incentives	High	Split incentives are still not properly addressed.

Financial barriers, as the most significant barriers hampering the uptake of EE investments are analyzed in **table 16**. Initial cost barrier is the strongest barrier and in the case of Croatia is not properly addressed. Introduction of grants lowered its intensity, but there is a strong need for soft loans, because even though the grants lower the intensity of initial cost barrier, still there is high amount of capital that has to be invested upfront from the citizen's side and they have to wait if and when they get the grant.

Table 16: Analysis of financial barriers in Croatia

Type of barrier	Level of barrier intensity	Analysis of the current state
Initial Cost	High	A progress has been made with the introduction of grants, however no soft loans to mitigate the initial financial cost for citizens with weaker financial status.
Interest rates	High	Interest rates are not lower for EE investments
Payback time	Medium	With introduction of grants, the payback period was reduced. Still, the investments are costly and require a certain time to be paid off completely.
Lack of financier awareness	Medium	Still a pressing issue. Financial institutions are promoting green loans, but the level of interest rates is only slightly lower than the standard rates.

As for the financial sector, they acknowledge EE investment, but do not perceive it as an investment that ultimately lowers the borrower’s utility bills and improves it net cash flow, hence the interest rates are not significantly lower for EE investments and the level of financier awareness should be increased.

Table 17: Overview of conventional financial measures in Croatia

Type of financial measure	Availability	Brief description
Soft Loans	-	Not available
Grants	+	As of 2014 available through Housing and Building Renovation Programme
Fiscal incentives	-	No fiscal incentives

From conventional financial measure, Croatia currently has only one measure in circulation (**table 17**). Grants offer a temporary shift in the market by filling an immediate financial gap, but even in the EU guide (Financing the energy renovation of buildings with Cohesion Policy, 2014) suggest both grants and soft loans as essential financial instruments for the functioning of the EE programmes to bypass the market failures more efficiently. There are no fiscal incentives encouraging EE investments but there is a proposal for introduction of property tax in Croatia, which will consequently increase the value of the real estate. Since EE renovation is increasing the value of real estate, this increases the taxation. There should be an appropriate tax relief on property tax to reduce the negative effect.

After a comprehensive analysis of the both programmes, a number of strengths and weaknesses is presented in table x. One must keep in mind that the programmes are still in their early phase and strengths are normally outnumbered by weaknesses.

Table 18: SWOT analysis of EE programmes in Croatia

Strengths	Weaknesses
- Structured programmes specially targeting family houses and multi-dwelling buildings - Engagement of underdeveloped regions with increasing grant levels - Free energy audits for family houses (prices ranging from EUR 400 to 700)/ in multi-dwelling buildings grants for covering 40% of the audit - Short application procedure time	- Absence of soft loans - Free rider problem - grants are not linked to social and financial status - No progressive grant scheme that incentivizes deep renovation - Seasonality of the programme; possible to apply only in the time of public calls - Inconsistency of the programmes in regards to estimated forecasted level of funding - No certified construction companies/workers - Financial instability of the Programmes on a long turn basis - reliance only on grants - No innovative financing in the residential sector
Opportunities	**Threats**
- Increasing the number of EE investment by introduction of soft loans and fiscal incentives	- Programme dependence on EU funds - General uncertainties regarding volatile energy prices

Nevertheless, by changing the organizational structure of the Housing programme, where initial application procedure cut of a great number of citizens, some due regulatory obstacles and some because they perceived the application process as to complicated and long, EPEEF recognized the mistake and assured that in the following year the application process is simplified and all citizens can apply for the application process.

As mentioned in the table, strengths of EE programmes are: structuring programmes based on the needs of end user – a house owner or an apartment owner; engaging underdeveloped regions with higher grants; free energy audits for family houses and 40% covered by the multi-dwelling buildings. Lack of appropriate interest subsided loans could be characterized as the strongest remark. Grant approval on the basis of "who applies first gets the grant" without any linkage to social and financial status of the applicant can trigger the "free rider" problem**,** i.e. people who would invest in EE either way, but now they have stronger incentives to do it because they will be awarded with grants. In addition, the grant scheme is not set up in a way that incentivizes deeper renovation on a progressive scale – by offering a higher percentage of a grant if an individual decides to invest in more than one EE or renewable energy source measure.

Another issue is seasonality of the programmes or possibility of applying only in defined time frames. The public call is usually opened in springtime and in 2015 it was opened on 1st of May. By incorporating applying and application approval into the waiting time, it turns out that investments can be executed earliest in the summer or fall. By then, people who intended to renovate their homes, have already started the construction works and cannot apply for the grants.

The availability of the funds at the end of the year is a possible sign that the marketing and awareness campaign did not produce the impact that has been desired. Of course, this can also be addressed to citizen's financial inability to renovate at all. In regards to this, inconsistency of the estimation and actual usage of the funds was especially noticeable in the Building programme. The programmes need to engage more stakeholders in order to increase the awareness and promotion. EPEEF recognized this issue and as of 2015, there are certified energy auditors.

Logically, there is no sign of any of innovative financing since the market for EE is still young. The programmes rely largely on the EU funds and the schemes existence will be questioned after the end of the current EU Financial Framework in 2020.

7 DATA COMPARISON AND INTERPRETATION

The following section brings an overview of the general and financial barriers benchmarked against each other to analyze if a specific mix of barrier removal can improve the framework for EE investments. The countries are benchmarked against each other in a way that every barrier is graded according to the specific analysis for specific country that is presented in the previous chapters. The country with the lowest average grade indicates a country, which managed to surpass the barriers most effectively. From the three analyzed countries Germany with an average grade of 1,36, shows the highest effectiveness in surpassing the barriers, which does not come as a surprise since the country has a long history in EE.

Table 19: Overview of barrier intensity by countries

Type of barrier	Croatia	Germany	Slovenia
High transaction costs	2	1	3
Institutional barriers	1	1	2
Lack of information	2	2	2
Energy prices	1	1	1
Lack of trained personal	2	1	2
Uncertainty associated with energy savings	2	2	2
Split incentives	3	2	3
Initial Cost	3	1	2
Interest rates	3	1	1
Payback time	2	2	2
Lack of financier awareness	2	1	2
Total:	23	15	22
Average score (total/number of barriers):	2,09	1,36	2,00

*the numbers are indicating the level of barrier intensity: 1- low intensity, 2-medium intensity, 3- high intensity

Croatia and Slovenia achieved almost the same score with differences in high transaction cost, institutional, initial cost and interest rate barrier. The barriers that are almost effectively resolved are energy price barrier and to some extent institutional barrier. The reason behind of it is the overall synchronization and mandatory obedience to EU legislation. **Institutional barriers** are still persistent in Slovenia where the owners should meet 75-100% owner consensus regarding renovation of multi-dwelling buildings. The EU under the Energy Efficiency Directive demands also that each country has a **measurement system** for energy savings in place. All of the mentioned countries have already installed this measure, but there will always be ambiguities with *ex ante* energy savings forecasts because of the presence of various factors, which affect the consumption in the long run.

High transaction cost barrier, opposing invested time and effort with returns in terms of energy savings, is a barrier where German EE programme is most successful regarding

availability of financial means and access to needed information. The problem with Croatia and Slovenia is the lack of availability of the funds, i.e. funds are offered only through defined period of time. Even with all the effort taken by the government, responsible entities and market sector the general awareness about energy savings is still not on desired level. It is necessary to create awareness campaigns reaching larger pool of people and reduce ambiguities about the effectiveness of specific technologies in order to surpass the **lack of information** barrier. **Trained personal shortages** in Croatia and Slovenia exist in both the contractor market responsible for effective installation of energy saving measures, as well as in professional services, with few architects familiar with how to specify a low energy renovation. It is advised to follow German example and establish and expand regional renovation and consultation network of cooperating architects, planning experts and craftsmen. **Split incentives barrier** is the toughest barrier to surpass and only Germany took the initiative to regulate the market by amending Tenancy Law with provision that allows landlord to request tenants to pay a share of costs of energy renovation by increasing the annual rent.

Initial cost, as the most important financial barrier is recognized by all countries, especially Germany which offers soft loans and grants all year long. Slovenia's programme offers soft loans and grants as well, but the issue is that they are linked with public calls and in limited time period. Even though Croatia is subsidizing EE renovation with grants, to successfully remove the barrier an introduction of soft loans is needed. Moreover, in every country it is normal procedure that a natural person can obtain a grant only after the renovation has gone through. For persons in need of financial assistance, extending a loan is essential for a successful renovation. Germany and Slovenia with their soft loans, and loan-grant combination allow their citizens to finance the investment with quite low interest rates, ranging from 0,75% in Germany and approximately 2%[6] in Slovenia. Croatia is the only country that does not offer lower **interest rates** for EE investment, even though it was mentioned in the 2nd NEEAP as a prerequisite measure. The interest rates in Croatia are going from 5% and up. Automatically, citizens who need to take loans with high interest rates to renovate their houses do not get as much at the end as the ones who can make the renovation without the loan, because the interest rate takes a big portion of the grant.

Even though many energy savings measures are financially rational in that they have a positive net present value, the **time taken for the initial outlay** to be recouped is barrier that citizens perceive as to long given their current energy bills. The final effect is reduced by financial aids but the level of barrier intensity is continuing to be perceived as high.

Financial awareness regarding EE investments is the highest again in Germany because soft loans from national EE programme are offered and available in every commercial bank. Slovenia offers their government backed soft loans through only one commercial bank, but otherwise the banking sector offers the same market based interest rates for "green" loans. The financial awareness in Croatia for EE investment is on the medium level. The financial sector is offering loans for EE renovation, however the interest rates are only slightly lower than the market interest rates.

[6] 1,5%+3 month Euribor

Table 20: Overview of installed financial measures by countries

Type of financial measure	Croatia	Germany	Slovenia
Soft Loans	-	+	+
Grants	+	+	+
Fiscal incentives	-	-	+
Energy performance contracting	+	+	+
EE obligation schemes	-	-	+
On-bill repayment	-	-	-
Total	2/6	3/6	5/6

Table 20 provides an overview of installed financial measures in three countries. Slovenia is the only country that offers almost all above-mentioned measures, including fiscal incentives and EE obligation scheme. Paradoxically, according to the final energy intensity expressed in ODEX index for the whole economy, Slovenia's energy intensity is the highest from all countries. This leads to conclusion that to have an efficient EE programme one does not have to include all measures. The point is to make them, combined together, as effective as possible in surpassing barriers to EE market. Croatia and Germany are also planning to implement EE obligation schemes since in the future the EU will probably make this measure obligatory in order to achieve their 2020 targets.

Grants, as the most standardized measure for stimulating EE investments, and energy performance contracting are present in every country. Even though the Energy Efficiency Directive is stimulating development of energy service market on public, commercial and residential level, it should be emphasized that energy service market for residential buildings is to some extent only present in Germany. Labanca et al. (2015) in their latest article estimated market potential for EE service in the EU for the residential sector worth about EUR 190 million for investments with payback time of 3 years. At the same time, barriers such as high transaction costs relative to the amount of energy costs, high fragmentation of the market, split incentives, the rules regulating the decision process in multi-dwelling buildings, small size of each project and underdevelopment of the EE service market are main barriers hampering the uptake of EE service market for residential buildings. Pooling together a large number of buildings, allowing energy companies to offer specific EE services, establishing revolving funds or guarantee schemes for EE service providers, policies encouraging ESCO market development are some of the solutions mentioned by the authors in order to revive energy service market.

In USA, new and innovative models for financing EE are beginning to emerge, including on-bill repayment, which successfully addresses initial cost hurdle. High up-front investment from the utility to reform billing structures and difficulties associated with assuring the energy savings are still major weaknesses preventing investors and utilities to tap into this finance model. On-bill repayment is a type of innovative financial instrument that is not strongly supported by the EU in the Energy Efficiency Directive and it is evident that the countries are following the EU guidelines regarding financing EE investments.

To become self-sustaining is a challenge every financial programme faces. A scheme relying on the resources by the state or other funders may succeed in the short term, but in the long term can face uncertainty. Germany is prime example that you do not need grants to kick start EE investments. Focus on interest-subsidized loans has proven to be the right strategy that provides capital, incentives and has an effective leverage on government funds. On-lending distributional network through commercial banks enabled standardized methods of assessment, measurement and verification, which reduced transaction costs, because financiers do not need to spend more time evaluating every single project. Slovenia started their EE programme in the same way, by introducing soft loans. Even though they do not have AAA rating, with the help of European Investment Bank they set up a credit line and achieved the goal of providing residential area with interest-subsidized loans. As for Croatia, they started from the opposite side – by introducing grants. Despite generosity in grant percentage, a big question is being asked regarding financial sustainability of the programmes in the future, because this is the only programme that depends on the funds from EU.

The advantages of Croatian programmes compared to other three are: free energy audits for family houses, the shortest application procedure waiting time (30 days) and legislation enabling 51% owner consensus in renovation of multi-dwelling buildings. Comparing the grant funds on disposal in Croatia and Slovenia between family houses and multi-dwelling buildings it is evident that the above-mentioned legislation has its influence in the overall funding distribution. Croatia is focusing more on multi-dwelling buildings and Slovenia more on family houses, since it is harder to reach a 75 to 100% owner consensus in multi-dwelling buildings. In Slovenia in 2014, there were 9.400 application for family houses and 658 for multi-dwelling buildings. The applications in Croatia were 1.500 and 447, respectively. In Moreover, Croatia offers generous grant for multi-dwelling buildings with 40% investment coverage or a maximum of EUR 92.000. Multi-dwelling buildings from area of special governmental care can get up to EUR 184.000 of non-refundable grants.

When it comes to assessing the amount of grant that every house/buildings is eligible, Slovenia and Germany are using criteria in the form of EUR/m², so that the bigger the house/building, the larger the grant. In Croatian example, grants are linked with the total amount of investment, which begs the question if it is maybe better to link grants to space area, since an issue with grants for design documentation for multi-dwelling building has already emerged in Croatia.

An energy audit takes into account the interaction of different features within the building (such as heating, ventilation and insulation) and can identify most cost-efficient way of combining measures. As such, programmes with mandatory energy audits are considered a benchmark for a successful approach for avoiding "lock in" situation. Every country recognized that and integrated this step as a necessity for grant approval. However, the depth of renovation is stimulated differently in every country. Germany, with their KfW Efficiency house is the perfect example how to incentivize deep renovation that entails most cost-efficient improvements. It simplifies the complicated technical requirements into easy to understand terms and even awards citizens who decided to make their homes as much EE as

possible by offering percentage of the loan as a subsidy that does not need to be repaid if the house achieves a certain EE standard.

Informing citizens and engaging stakeholders is essential for any programme to thrive. Awareness and marketing campaign are the first step of acquainting possible end user and stakeholder of the possibilities offered to them. Every country has a proper campaign in place and with certification of energy auditors and construction companies; stakeholders are being engaged as well. Application procedure plays also an important role and it is recommended to be as short as possible. Croatia with only 30 days is the first to recognize this issue, whereas Slovenia with possibility of extending application process on 150 days appears not to be on the same page. The era of digitalization has made mandatory publishing information online. The same is happening also with official information. It is necessary to provide information online with a user-friendly approach, where end users can find the right information concerning their needs. This is already available in Slovenia and Germany, where citizens can obtain information through interactional approach based on their preferences.

To summarize, following is a list of suggestions for improvements in Croatia:

a) **Introduction of soft loans -** Both German and Slovenian example showed that on the long run soft loans are the most sustainable financial instrument and encourage citizens in the same way as non-refundable grants. Croatia should follow their lead and establish a financing line that is extended from European Investment Bank as in Slovenian case and offered to the citizens through commercial banks like in Germany.
b) **Engaging commercial financial institutions -** The government could engage the commercial financial institution to consider European Investment Bank's Private Finance for Energy Efficiency scheme for acquiring funds for long-term low-cost loans which can be subsequently offered to citizens for EE renovation loans.
c) **Availability of grants throughout the year -** Grant availability throughout the year would decrease the transaction costs associated with public calls that are usually to late and lead to difficulties in the timing of the renovation.
d) **Tax incentives in the form of reduced VAT on residential investment -** Lowering taxes on residential investments could further incentivize citizens, lower the level of grey economy and improve the situation of construction industry in Croatia.
e) **Certification of project designers and contractors -** Lack of trained personnel or technical expertise is considered as one of the crucial barriers to EE investment. By introducing certificates of this type, a strong signal would be sent to the public in order to gain more trust in EE solutions.
f) **Raising awareness of end users -** Croatia must consider providing information all year long through interactive online approach, where end users can find the right information concerning their needs and preferences. Energy advice network, on-site advice, energy savings calculators are some of the measures that can be implemented to raise awareness.
g) **Encouraging deep renovation -** To avoid "lock in" situation and to get maximum effectiveness from EE investments it is necessary to approach the situation with a more progressive grant scheme, especially with multi-dwelling buildings, where energy savings

would be the highest. In addition, establishing a brand standard similar to KfW Efficiency house would be an advantage.

h) **Linking grant amount with space area -** Linking grants with space area to ensure the fairness and equal treatment in the application process, especially in the multi-dwelling buildings.

CONCLUSION

Energy savings are among the fastest, highest affecting and most cost-effective ways of reducing greenhouse gas emissions. Low cost EE measures have long been regarded as the "low-hanging fruit" in delivering a clean energy economy. Considering the fact, that before 2014, in Croatia there was no fixed long-term programme in motion regarding EE, the progress that is being made now is of paramount significance. Though, it should be stressed out that without the EU regulation and mandatory obligations, implementation of the whole EE programme would probably be put on hold, considering the poor economic conditions in which is currently Croatia.

EE programmes in Croatia are still in an infant phase and additional time will be needed to develop a strong presence on the market and to make the programmes as effective as possible. Based on all the analysis provided throughout the thesis, we can conclude that Croatia followed general guidelines from EU and foreign best practices and developed a comprehensive programmes adapted to their own economic and social context that incentivizes citizens to invest in EE more vigorously than they otherwise would do. However, following the best foreign practices, the initial cost barrier, as the strongest obstacle hampering EE investment, should be supported also by establishing a financing line offering subsidized interest rates on EE renovation loans.

Designing a programme is a process that has to be constantly revised and adapted to the changes on the market. Croatia recognized the shortages of their initial programmes and incorporated adjusted changes in 2015, which is a sign of willingness to learn on own mistakes. Moreover, EE policy based on EU legislation stimulates removal of the barriers and Croatia sent a strong signal by tackling partially or completely initial cost, institutional, lack of information and high transaction cost barrier. However, the work has just started and there is still a lot more to learn and improve to achieve the level of effectiveness of the German EE programmes. With that in mind, it is still too early to expect a development of some innovative financial scheme. In order to implement innovative schemes that will be more financially sustainable on the long run, the existing programmes first need to be functioning properly in order to gain trust from the public.

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Appendix

Appendix A

Table 21: The total number of houses and buildings in Croatia according to the type of building, period of construction and climate region

	Continental side		Coastal side		%
	Family house	Multi-dwelling building	Family house	Multi-dwelling building	
	m²				
- 1945	7.386.473	3.878.546	6.875.252	3.610.110	14,60
1945 - 1970	17.154.155	9.007.436	7.219.824	3.791.040	24,95
1970 - 1980	14.185.327	7.448.541	7.293.915	3.829.945	21,98
1980 - 1990	11.403.249	5.987.706	6.619.686	3.475.915	18,45
1990 - 2006	9.906.457	5.201.759	5.183.586	2.721.837	15,44
2007 – 2010	2.791.970	1.466.030	1.685.804	885.196	4,58
Total	62.827.632	32.990.016	34.878.067	18.314.043	100

Source: Croatian Bureau of Statistics, Programme of energy renovation of multi-dwelling buildings for period 2013-2020