Energetic Refurbishment Replication Strategy for Eastern European Countries

BEEM-UP

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BEEM-UP

Building Energy Efficiency for Massive market UPtake

Integrated Project

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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Table of contents

Abbreviations

EC	European Commission
EE	Energy efficiency
EEAP	Energy Efficiency Action Plan
EEP	Energy efficiency policy
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
ESD	Effort Sharing Decision
ETH Zurich	Swiss Federal Institute of Technology
ETS	Emissions Trading System
EU ETS	European Union Emissions Trading System
FiT	Feed-in Tariff
GDP	Gross Domestic Product
GHG	Greenhouse Gas
nZEB	Nearly Zero Energy Buildings
OECD	Organization for Economic Cooperation and Development
QCA	Qualitative Content Analysis
RES	Renewable Energy Resources
SEDA	Sustainable Energy Development Agency
SWA	Strength-Weakness Analysis
UNFCCC	United Nations Framework Convention on Climate Change

List of tables

List of figures

Report review

The report in hand has been reviewed by experts of the investigated countries. We thank the reviewers for their feedback and their contribution to the report's validity.

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Chapter 1 Introduction

In its “Road map for moving to a competitive low carbon economy in 2050” (EC 2011) the European Commission established a long-term objective of decreasing the CO_2-emission levels for the building sector by 88%-91% in 2050, compared to 1990 levels. To achieve this target especially the existing building stock needs to be addressed and reduce its energy use in the long term. The BEEM UP pilot sites in France, the Netherlands and Sweden have successfully proven that an energy reduction for space heating and hot water in multifamily buildings of up to 75% is technically and economically feasible through ambitious refurbishment measures (http://www.beem-up.eu).

These pilot sites are certainly lighthouse projects, but it is obvious at the same time that such ambitious measures are not applicable to the entire European building stock. As stated in the EURIMA report *Building renovation in Europe - what are the choices?* “…[the] increased building renovation with a high level of energy efficiency faces various barriers for implementation, such as the need for upfront financing, investor/user conflict, necessary capacity building etc.” (Boermans et al. 2012, p. 11). The various barriers are our primary area of analysis in this report with a specific focus on building refurbishment in Eastern Europe.

While there are plenty of studies available on success stories and lessons learned in Northern and Western Europe, there has been significantly less published on refurbishment experiences and/or more theoretical studies in Eastern Europe, a region with ca. 3.566 Mio. m^2 of heated floor area which is around 13% of the entire European Building stock (Boermans et al. 2012, p. 16).

1.1 Goals

ETH Zurich (until June 2012) and Chalmers (from July 2012 onwards) took the lead to develop a strategy for replication of the BEEM-UP concept from the three pilot sites in Northern and Western Europe to Eastern Europe. Therefore a methodological approach has been developed (see chapter 2) and applied to seven Eastern European countries (see chapter 3). In cooperation with knowledge carriers in these seven countries and based on intensive desk research, main barriers have been identified that BEEM-UP would need to overcome to successfully replicate the concept in Eastern Europe. The study provides an overview of the identified bottlenecks for each of the investigated countries and finally, provides a proposal for a strategy of how to achieve a meaningful exploitation potential under the country specific circumstances observed for the Eastern European countries as a whole.

1.2 Scope

The European Union, which is characterized by a strong polarity between East and West in terms of economic prosperity and social development, needs to overcome these inequalities and accept a direction towards a common sustainable future. Eastern European countries face severe local but at the same time globally influential economic and environmental problems, stemming from inefficient and polluting energy systems which require urgent action. Nevertheless, in order to achieve permanent improvement of the present situation, a deeper understanding of its entwined and multi-dimensional aspects is needed.

Eastern European countries possess remarkable potential for leap frogging, which can be realized by effective energy efficiency improvements and renewable energy technologies. Direct application of such practices imported from west unfortunately appears to be hindered by the local context, which is still relatively less developed compared to the western one. That is the main goal of this report - to understand, distinguish and precisely locate the driving obstacles behind successful implementation of energy efficiency practices.

The geographical scope of the current report therefore spreads over Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia as outlined further in the report (figure 1).

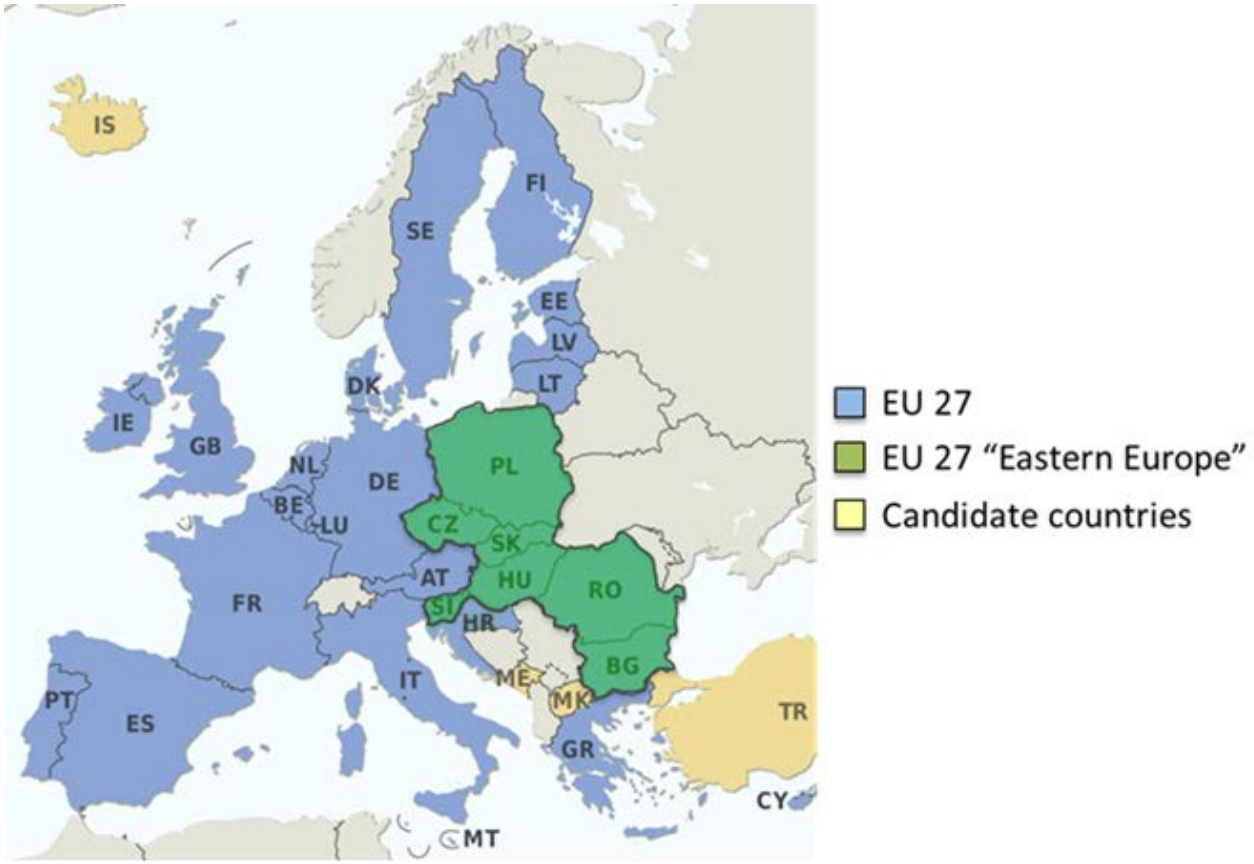

Figure 1: Target countries in Eastern Europe (visualized in green).

Chapter 2 Methodological approach

This project uses extensive literature sources collected through collaboration with many specialists in various fields related to the building industry and sustainable development. Universities and stakeholders are invited to contribute by providing useful information from their local contexts. One important aspect of the report's evolution is that it receives feedback before the final formulation of content. Thus information is multi-layered, constantly updated, firmly theoretically grounded and possessing a rich variety of viewpoints.

This study aims to identify factors that contribute to the success and hampering of a massive market uptake in Eastern European Countries of the BEEM UP refurbishment measures applied to the pilot sites in France, the Netherlands and Sweden. The central question of the study is: which are the context specific strengths and weaknesses of energetic refurbishment measures? The research draws on the lessons learned from various sources of information in Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic and Slovenia.

A qualitative meta-performance evaluation of the programs is carried out. Our methodological approach combines expert interviews with local key actors with a document review of refurbishment related, mainly internal material. A Qualitative Content Analysis (QCA) is conducted on the materials. Good-practice factors for evaluations via refurbishment activities are used to assess the material, and a Strength Weakness Analysis (SWA) is carried out. Results are presented in comparison with their context and city characteristics, and a generalization that links the strength identified to generic variables is conducted.

A QCA (Mayring, 2003) is used for the analysis of both the expert statements and the manifold text material. QCA aims to concentrate the text material through paraphrasing, generalization to higher levels of abstraction, and bundling and reductions based on pre-defined rules. A hexagonal model (figure 2) describing requirements for refurbishment measures forms the basis for the QCA. It is composed of the categories hardware (availability of materials and technologies), software (know-how, information and other user-based factors), orgware (institutional and organizational elements), polware (political conditions), finware (budgets) and ecoware (socio-cultural aspects of the local context). In a first QCA, good-practice factors for the SWA (following in a later step) were developed through an inductive process and categorized according the hexagonal model. In a second QCA, the inductive process was aiming at the reduction of the material concerning the characteristics of the country specific refurbishment activities.

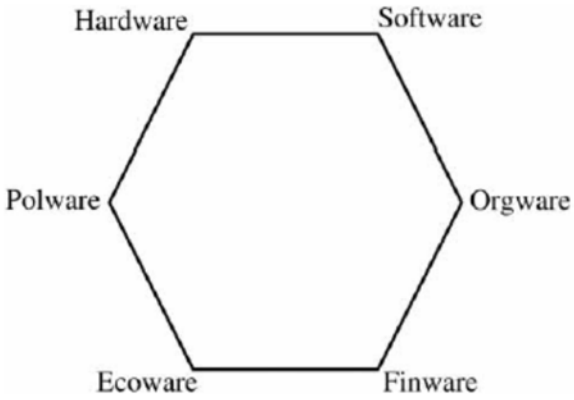

Figure 2: Hexagonal typology for the analysis of requirements and constraints of indicator development/ implementation (Krank et al. 2010, p. 735). These characteristics included, for example, detailed descriptions of accomplished refurbishment measures in combination with statements why an expert considers this process to be an asset or a disadvantage.

Chapter 3 Findings by country

3.1 Bulgaria

- **General information:**

Population (in Mio.): 7'284'552 / 2013 (Eurostat)

Density (people per km²): 69.40 / 2012 (World Bank)

- **Hardware**

Table 1: Heated floor area per m² (TABULA)

Building period	Single family houses and terraced houses (1000m²)	Apartment blocks and multifamily houses (1000m²)	Heated area (1000m²)
Until 1949	433,9	4,2	3209,7
1950-1959	347,5	4,7	3065,5
1960-1969	381,2	12,2	3424,4
1970-1979	240,8	14,2	2219,6
1980-1989	198,9	13,1	1845,3
1990-1999	96,9	7,9	912,6
2000-2011	74,1	13	758,8
Total	1773,2	69,4	15435,8

Table 2: Electricity and heat production mix (IEA, 2011)

Production from	Electricity (GWh)	Heat (TJ)
Coal and peat	27537	22838
Oil	137	3057
Gas	2077	28390
Nuclear	16314	922
Biofuels	56	233
Waste	0	0
Hydropower	3691	0
Geothermal	0	0
Solar PV	101	0
Solar thermal	0	0
Wind	861	0
Tide	0	0
Other sources	23	2992
Total Production	**50797**	**58432**
Residential Consumption	**10912**	**15047**

Housing stock:

The overall impression of the Bulgarian housing stock is of a relatively low standard. A need for major renovation, even in the most modern stock, is detected due to low construction works' and materials' quality and failing maintenance.

Almost all of the privately owned dwellings (~ 97% of all dwellings) are owner occupied. More than 50% of the occupiers do not have sufficient income to cover the current costs of service. The engineering networks are broadly developed but unreliable and financially inaccessible (Georgiev, 2012, p. 1).

- **Software**

To date there is no information strategy concerning particular energy efficiency policy (EEP) in buildings. "Without proper awareness the public opinion may become distorted and the future introduction of renewable energy sources (RES) and EEP may be wrongly perceived as a threat to households, leading to greater expense and costs" (Atanasiu et al, 2012, p. 66). Indeed a project, financed by the European Social Fund and the Bulgarian state budget aimed to improving transparency and reputation of The Sustainable Energy Development Agency (SEDA) responsible for the implementation of EPBD and to establish monitoring of the results of it (Naydenov, 2012, p.8).

A main barrier to increasing awareness is the lack of financial support, which leads to improperly implemented information activities. There is a strong need for capacity building as well, especially among engineers and architects. Most universities are not yet ready to provide an adequate education and postgraduate qualification in energy efficiency related topics. "Therefore it will be necessary to improve the existing educational curriculum in the near future" (Atanasiu et al, 2012a, p 67).

Energy Performance Certificate (EPC) and the nearly Zero Energy Buildings (nZEB) have been introduced in Bulgaria.

Currently there is no shortage of workers in the traditional construction professions. However, a shortage of 20% is expected by the end of 2020, as well as a need for additional qualification in the field of so called "green skills". Table 3 shows the development of the energy efficiency related technologies market, which can be considered in predicting the future demand of qualified workers (Atanasiu et al, 2012a, p 19).

Table 3: Energy efficiency related technologies market (Atanasiu et al, 2012a, p. 66)

	Insulation materials	**Ventilation systems with heat recovery**	**Triple glazed windows**	**Heat pumps**	**Pellet boilers**	**Solar thermal systems**	**PV**
Actual market	Existing	Very small	Small	Small	Small	Existing	Very small
Demand in % of new nZEB	100,00%	90,00%	100,00%	~50 %	~50 %	~15%	>75%
Required growth of market	High	Very high	Very high	High	High	Normal	Very high

- **Orgware**

The Minister of Economy, Energy and Tourism approves all EE policy topics and energy services, elaborated and proposed by SEDA. The two institutions work together to coordinate the examination material and the evaluation for obtaining a Quality Expert degree.

The Ministry of Regional Development and Public Work is responsible for the overall development of Bulgarian regions. It initiated the National Programme for Refurbishment of Residential Buildings in the Republic of Bulgaria 2005-2020 (Naydenov, 2012, p.1).

Since 97% of dwellings in Bulgaria are privately owned there was a need for a Homeowners Association to be created. Today it is a legal body, eligible to access to renovation funds and subsidies and it handles common maintenance issues.

- **Finware**

There is an extensive amount of Operative programms and projects in the field of EE, however they are not reported to have led to an increase of refurbishment projects. Main reason for that is low affordability of market solutions for consumers.

Electricity tariffs are the lowest for the European Union (EU), which makes the country unattractive for investors. However, the tariffs are already a challenge for many Bulgarian households.

Bulgaria uses a low-determined feed-in-tariff (FiT) to promote electricity produced from RES and from high-efficiency co- generation plants which feed into the public grid. However, the concept of FiT is not well enough defined in terms of legislation to be convincing (Skovholt, 2010, p.146).

- **Ecoware**

Assessments of climate change policies in Bulgaria for 2013 show controversial results. Progress has been made in energy efficiency and green investment, but other actions such as energy infrastructure development and RES have been slowed down (Dreblow et al, 2013a, p12).

Though Bulgaria is guaranteed to meet its Kyoto targets on Greenhouse Gas (GHG) and non-Emissions Trading Scheme (ETS), it remains the most energy intensive economy in the EU. Emissions from energy use, industrial processes, and agriculture dropped between 55 and 80% until 2011 compared to the 1990 level. Nevertheless, emissions from energy supply are increasing again since 2000. Emissions from transport increased by almost 20% between 1990 and 2011 (Dreblow et al, 2013a, p2).

The share of Renewable energy increased its share in gross final energy consumption from 9.5% to 13.8% for the period 2005 - 2010. However, there are no officially published 10-year grid development plans for the distribution grid (Dreblow et al, 2013a, p13).

- **Polware**

The overall impression is that EEP receives little attention in Bulgaria. Energy policy focuses on nuclear and coal. If the 2001-2005 average is taken as a baseline, it becomes obvious that Bulgaria has not made considerable progress in its consumption. The reductions between 2006-2009 have been nullified by increases in the past two years. Bulgaria has the lowest electricity prices in EU and that is pointed out as the condition, most “hampering” EE development (Dreblow et al, 2013a, p13).

Lack of transparency in decision making remains a widespread problem and it is likely that past cases of misuse of EU funds have damaged the credibility and the image of Bulgaria among

foreign investors. Moreover, “frequent amendments of existing regulations and a strong regulatory proliferation result in uncertainty and confusion among investors and project developers” (Skovholt, 2010, p.145).

No specific action for monitoring of implementation of EPC progress is detected. The lack of sanctions or penalties for companies that do not conduct energy audits and do not implement the necessary follow-up measures also points out the lack of respect of existing policy. ”Experts are nonetheless concerned about the lack of an overall strategy for tackling energy efficiency in the residential sector” (Schüle et al, 2013a, p.6).

- **Country summary**

Bulgaria demonstrates commitment to EU recommendation and requirements. However, actual results are insufficiently successful. Green technologies implication remains rather isolated and unpopular.

Main barriers detected are lack of funding, lack of coordination among institutions, irrelevant secondary legislation, lack of transparency and trust in EE related organizations and activities, insufficient monitoring.

3.2 Czech Republic

- **General information:**

Population (in Mio.): 10'516'125 / 2013 (Eurostat)

Density (people per km²): 135.89 / 2011 (World Bank)

- **Hardware**

Table 4: Heated floor area per m² (TABULA)

Building period	Single family houses and terraced houses (1000 m²)	Apartment blocks and multifamily houses (1000 m²)
Until 1949	17365,6	8543,5
1920-1945	23163,7	12099,4
1946-1980	48639,9	70648,2
1981-1990	18615,9	24370,9
1991-2001	16695,2	8218
Total	124480,3	123879,9

Table 5: Electricity and heat production mix (IEA, 2011)

Production from	Electricity (GWh)	Heat (TJ)
Coal and peat	49888	84381
Oil	99	1357
Gas	1171	29010
Nuclear	28283	919
Biofuels	2615	3291
Waste	155	2695
Hydropower	2664	0
Geothermal	0	0
Solar PV	2182	0
Solar thermal	0	0
Wind	397	0
Tide	0	0
Other sources	0	1664
Total Production	**87454**	**123317**
Residential Consumption	**14200**	**43390**

Housing stock:

Quality of housing stock in Czech Republic is assessed as satisfactory. Specific for the Czech Republic is a quite high quantity of historical buildings. Approximately 40’000 buildings are protected by law as monuments; this has to be taken into account when planning renovation projects (Mančík et al, 2013, p. 73-81). The concrete panel structures of multi-family buildings constructed in the 1970's have mostly a bad EE performance – due to a low level of insulation (Zahradnik et al, 2012, p.9). Moreover, these structures are usually bad maintained over a long period of time which results in a decrease of financial and utility value. Experts as well as building

users have been criticizing the quality of huge multi-residential panel building districts developed since the 1960's. These buildings (approximately one half) have been renovated in the recent 20 years (External Thermal Insulation Composite Systems, new windows, roof insulations, renovations of heating systems, new balconies, etc.). Some of the early renovations (with thin thermal insulation layers) will soon be due for another remake. This will be a challenging technical, socio-economic and environmental topic.

66% of the building stock is privately owned. The heterogeneity of flat owners in multi-residential buildings causes delays in some renovation projects, as interests differ and it is difficult to find a consensus.

Non-residential buildings featuring curtain wall facades built between 1950's and 1980's (schools, administrative buildings, police and fire stations and healthcare buildings) have been experiencing glass unit failures, water leakages, problems with occupant comfort and some series produced in the Czech Republic also contained health-damaging asbestos (Tywoniak et al, *2014*).

- **Software**

There is quite a high initiative of builders, investors and citizens to build environmentally friendly and low energy houses as well as government initiatives for reconstructing panel buildings. However no strategy for sustainable construction as a whole exists.

Though EPC has been introduced in Czech Republic, no official state campaign supporting the Energy Performance in Buildings Directive (EPBD2) implementation is available. Some informational campaigns (IMPLEMENT project) are run on a local level by energy consulting companies or professional associations (Pejter et al, 2012, p.5).

In reaction to EPBD2 requirements for cost-optimum levels, based on local analyses, the Government Act 78/2013 has tightened the requirements on average U-values of envelopes of new buildings and existing buildings' extensions by approximately 20%. Further, the Act also sets U-values for nearly zero energy buildings (2020) and primary energy evaluation (non-renewable) will be compulsory from 2015 onwards.

Education in energy efficient and sustainable buildings is provided at several levels. Further, information is provided by specific professional associations:

- Guild for Thermal Insulation of Buildings (provides technological guidelines and consulting services)
- Passive House Centre (promotion and info campaigns on passive housing including renovations)
- Society of Environmental Engineering (providing workshops and info campaigns on building services)

Besides several others, two foreign certification schemes are commercially available on the Czech market: The British BREEAM and the American LEED (and recently there are some attempts to introduce the German DGNB). The only fully localized tool providing assessment according to EU and national standards is SBToolCZ. Certification is provided by the national certification bodies.

- **Orgware**

The Ministry of Industry and Trade of the Czech Republic is administrating the construction sector. It elaborates all policies, related to renewable sources of energy and to EE. It collaborates with CzechInvest, which replaced the energy efficiency agency. Generally consulting various stakeholders on the State Energy Policy is on the agenda of the government which is assessed as positive trend (IEA, 2010a, p31). However, human capacity and experience in EE needs to be increased.

Urban development and housing is administered by the Ministry of Regional Development of the Czech Republic. Another important actor is the Ministry of Environment of the Czech Republic which is dealing with sustainable development. Its main responsibility is the State Environmental Fund (PEEREA, 2004).

The third national Energy Efficiency Action Plan (2014) includes a chapter on buildings.

A broad and efficient network of local advisory agencies is characteristic for the Czech Republic.

- **Finware**

There are subsidies for specific projects, tax relief for some technologies, compulsory energy auditing, and optimization concepts of housing estate complexes, consultation, education and training. Czech Republic is reported to have received the largest amount of funds from the Cohesion Fund and the European Regional Development Fund for EE measures for the 2007-2013 programme period (Dreblow et al, 2013b, p.1).

Programmes are needed, especially in the industrial and transport sector. Barriers are detected to the effective operation of third party financing schemes and to the possibilities of more energy efficiency projects being funded.

Major concern remains the panel buildings because of the scale of the problem and the costs of improvement. A number of programmes in the field have been introduced by The Ministry of Regional Development (State Housing Development Fund, program Panel 2013+).

The Green Savings Programme, run by the Ministry of the Environment, recently started a third round of call (http://www.novazelenausporam.cz/en/). The programme's objective is to reduce greenhouse gas emissions by improving energy efficiency of buildings, supporting residential development in the case of very low energy performance and the efficient use of energy sources. The financing comes form state sale of carbon offsets.

- **Ecoware**

Czech Republic is expected to meet its Kyoto target on GHG emissions and overachieve its non-ETS target.

Emissions dropped significantly during the 1990s thanks to industry restructuring following the disintegration of the centrally planned economy. Further reduction was achieved through lowering energy intensity in buildings and greater penetration of energy saving appliances and lighting. However, emissions in the industry sector have increased since 2007 mainly due to the high share of coal (Dreblow et al, 2013b, p.2). Air pollution is a serious concern (IEA, 2010a, p.39).

- **Polware**

Although the Czech Republic's energy policy is closely aligning to EU requirements, its climate and energy policy strongly focuses on nuclear power and political support to renewable energy is in decline (Dreblow et al, 2013b, p.1). The reputation of renewable energy has been flawed by too slow corrections of feed-in tariffs after a significant drop in PV installations prices. The generous direct financial support in the meantime lead to an exceptional boom of PV installations (also some MW installations in the countryside) and a subsequent rise of electricity prices for all customers (contribution for RE is included in regular electricity prices). In reaction to the situation the government introduced a special tax on PV production, which led to further discretization of RE production in public opinion. The national policy aims to meet the promised RE production targets, but not more.

There is no governmental initiative or overall policy to issue a national strategy on sustainable construction. However, there is an alliance by leading trade associations that supports energy efficient construction, Chance for Buildings (see http://www.sanceprobudovy.cz/english-section/about-us), which is recognized by the new national government (2014).

Good policy examples however are the design of the government framework in the Czech public sector, public procurement related to guidelines to responsibilities and requirements for purchasing and replacing equipment, which is based on a list of energy efficient products, public buildings measures (Schüle et al, 2013b, p.7).

- **Country summary**

EEP are relatively more affordable and popular among Czech Republic citizens, mainly due to the large amount of “green jobs” created recently. However, energy efficiency remains less important than energy security, and related European directives are even regarded as a burden by some politicians.

3.3 Hungary

- **General information:**

Population (in Mio.): 9'908'798 / 2013 (Eurostat)

Density (people per km²): 110.15 / 2011 (World Bank)

- **Hardware**

Table 6: Heated floor area per m² (TABULA)

Heating	SFH(1flat)	SFH(2-3flats)	MFH(4-9flats)	MFH(1>10 flats)
No heating	16,3	863	78	15
District heating	4,7	540	3	26,7
Central heating	-	3,67	1,9	4,2
Flat heating	1.090.540	45,7	23,2	14,5
Room heating	1.257.801	29,5	15,9	14
Total	2.369.266	80,3	44	59,4

Table 7: Electricity and heat production mix (IEA, 2011)

Production from	Electricity (GWh)	Heat (TJ)
Coal and peat	6573	7081
Oil	144	233
Gas	10738	37443
Nuclear	15685	508
Biofuels	1740	2870
Waste	254	844
Hydropower	222	0
Geothermal	0	271
Solar PV	1	0
Solar thermal	0	5
Wind	626	0
Tide	0	0
Other sources	0	0
Total Production	**35983**	**49255**
Residential Consumption	**11312**	**22139**

Housing stock:

The quality of the housing stock in Hungary is in general assessed as not satisfactory. Panel buildings have bad energetic characteristics and related to their energy management, there is a lack of individual meters to allow regulation of consumption. However, until 2007, 190‘000 flats of the existing 820‘000 flats were reconstructed within the Panel Program. Until 2020, another 380‘000 flats are foreseen to be reconstructed.

From 2000 on, Hungary aims to increase the significance of social rental housing and to modernize the existing housing stock. The proportion of public rental housing is only 4%, compared to 20-40% in the older member states of EU (Hegedüs, 2009, p13-14).

Due to the privatization of the Hungarian construction companies by western European multi-national companies after the political changes, the materials, structures, and technologies used in larger, urban construction work apply to the standards in Western Europe (PRC, 2011, p.4).

- **Software**

An energy efficiency network is planned to disseminate information, raise awareness, contribute to energy strategies of the country and establish a knowledge base. The implementation of EPBD involved a very intensive information campaign funded by the government, and the establishment of EPC is in progress (Zöld, 2009).

- **Orgware**

Energy efficiency policy competence is split between three ministries, whose cooperation and communication are perceived as insufficient (Schüle et al, 2013c, p.6).

The Ministry of National Development has the main responsibility in the field of EE. It prepares the National Energy efficiency Action Plan, implements the policies and measures sated in the plan, and monitors their effectiveness.

The Hungarian Energy Center, created in 2000, organizes tenders for projects in the field of EE, as well as managing the energy statistics system, evaluating and consulting EE projects (IEA, 2010b, p.36).

- **Finware**

More than 50% of experts state that the lack of financing is the greatest barrier to EEP. Concern for the lack of a longer term policy and financing frameworks exists. The access to bank loans is limited by the fact that the size of typical energy efficiency investments is usually too small for banks to offer attractive or acceptable terms (Schüle et al, 2013c, p.6).

- **Ecoware**

Hungary is expected to meet and overachieve both its Kyoto and non-ETS targets through domestic emissions reductions directly.

Emissions from energy supply and use have been reduced by nearly 30 and 50%, respectively, between 1990 and 2011. This was due to the reduced economic activity following Hungary's transition to a market-economy, an increased share of renewable and nuclear power in the energy supply, efficiency measures taken in the residential sector and the shift from coal to gas, increased share of renewable and nuclear power in energy supply In contrast, emissions from transport have grown by more than a third between 1990 and 2011, resulting from a shift from public transport to private vehicles (Dreblow et al, 2013c, p.3).

- **Polware**

In Hungary, EEP is currently not a major focus.

Information on the media on climate change policies cover mostly the policy development on international and European level, they comment sparsely on national policies. If measures to support EE or RE are in focus, usually this is not in a climate change context but rather in an economic development context. Main aims in this case are to secure low energy prices for the

industry and the population and to guarantee energy supply security by decreasing dependency on Russia (Dreblow et al, 2013c, p.1).

Current policy priorities center on nuclear power. “After taking office in 2011, the state secretary for climate and energy expressed his conviction that Hungary is not ready for an extensive expansion of renewable energy and that the country’s potential in the electricity sector lies in nuclear and fossil fuels” (Dreblow et al, 2013c, p.2).

Hungarian government has expressed a firm intention to broaden and secure state control over the energy markets. Experience from other countries shows that to set a moratorium on electricity and gas prices and to regulate the end-user prices at a too low level makes the sector unpopular for investors and therefore challenges the security of supply over a long time (IEA, 2010b, p.22).

- **Country summary**

Energy security remains the main concern in Hungary and EEP is regarded as a burden to the economy and therefore rather formally implemented. This results in an insufficient number of actual legislation and funding programmes.

3.4 Poland

- **General information:**

Population (in Mio.): 38'533'299 / 2013 (Eurostat)
Density (people per km²): 125.52 / 2010 (World Bank)

- **Hardware**

Table 8: Heated floor area per m² (TABULA)

	Construction period	Number of buildings	Number of apartments	Living space (1000m²)	Tabula reference area (1000m²)
SFH	Up to 1944	865.913	865.913	69.424.228	63.870.290
	1945- 1970	1.168.340	1.168.340	95.621.198	87.971.502
	1971 - 2002	1.831.142	1.831.142	218.138.583	200.687.496
	2002-2010	496.269	496.269	59.552.280	456.671
TH	Up to 1944	156.206	312.412	20.486.590	18.847.663
	1945- 1970	114.042	228.084	14.889.989	13.698.790
	1971 - 2002	108.890	217.780	16.676.935	15.342.780
	2002-2010	4.487	308.974	27.807.660	15.065.572
MFH1	Up to 1944	176.859	867.558	46.506.695	40.460.825
	1945- 1970	42.166	200.347	10.343.469	8.998.818
	1971 - 2002	32.310	160.784	9.487.010	8.253.669
	2002-2010	33.370	286.507	21.488.025	13.958.621
MFH2	Up to 1944	42.444	700.719	35.462.223	30.852.134
	1945- 1970	42.994	1.574.491	67.325.934	58.573.563
	1971 - 2002	85.965	3.585.142	185.664.884	161.528.449
	2002-2010	13.931	617.800	43.246.000	27.949.272
total		5.215.328	13.422.262	942.121.703	766.516.144

Table 9: Electricity and heat production mix (IEA, 2011)

Production from	**Electricity (GWh)**	**Heat (TJ)**
Coal and peat	141443	265734
Oil	2453	6006
Gas	5821	19179
Nuclear	0	0
Biofuels	7602	15361
Waste	263	2556
Hydropower	2761	0
Geothermal	0	271
Solar PV	0	0
Solar thermal	0	0
Wind	3205	0
Tide	0	0
Other sources	0	946
Total Production	**163548**	**309782**
Residential Consumption	**28258**	**175000**

Housing stock:

The Polish housing sector is one of the country's most problematic issues, which are mainly based on quantitative and qualitative deficits.

Approx. 50% of residential buildings were built before 1970, and around 87% before 1989. Those built before 1990 have poor energy performance, and often there is a lack of sophisticated controls and metering. Polish households spend about 12% of their budget on energy, compared to an average of 4% across the EU (Atanasiu et al, 2012b, p. 3).

Around 75% of the residential dwellings in Poland are owner-occupied. Housing association are developing and clarifying their structure and now they have the status of the most significant players in Poland's residential sector (Atanasiu et al, 2012b, p 69).

- **Software:**

There is still a significant need for awareness and capacity building in Poland, even though EPC and other energy efficiency technologies are successfully implemented.

Table 10 shows the development of the energy efficiency related technologies market, which is strongly related with the future demand of qualified workers. There are many installers at the moment in Poland offering solar panel systems. The popularity has grown rapidly from 2010 due to offered subsidies. However, PV installations are small and off grid and usually installed in buildings subsidized by EU – there is no PV technology for single family, multi - family and public buildings (Atanasiu et al, 2012b, p.68).

There are approximately 80 heat pump suppliers and some 250 specialized installers. The actual market for heat pumps is small since the use of biomass boilers with biomass as a fuel is a much cheaper solutions. Besides that, heat pumps are not generally considered as the best solution by Polish experts. This is because of the higher cost of the technology and the Polish energy mix, which results not in any case in emission reductions. In 2012, there were only two accredited passive house planners in Poland (Atanasiu et al, 2012b, p 70).

Table 10: Energy efficiency related technologies market (Atanasiu et al, 2012b, p 68)

	Insulation materials	**Ventilation systems with heat recovery**	**Triple glazed windows**	**Heat pumps**	**Pellet boilers**	**Solar thermal systems**	**PV**
Actual market	Existing	Very small	Small	Very small	Existing	According to demand	Very small
Demand in % of new nZEB	100,00%	90,00%	100,00%	~40 %	~60 %	~15%	>75%
Required growth of market	High	Very high	Very high	Very high	High	Normal	Very high

- **Orgware**

Main responsibility of The Ministry of Environment is to carry out tasks under the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol. Within the Ministry, the Department of Climate Change and Atmosphere Protection inspects policy strategies and climate programmes, works out the rules on emissions trading, evaluates joint implementation projects and allocates the emission allowances. The Ministry of Economy cooperates with the Ministry of Environment in accomplishing climate policies under the UNFCCC. The Ministry of Infrastructure

carries the responsibility for environmental and climate policies particularly in the transport and construction sectors (IEA, 2010c, p.39).

While on a national level efforts and willingness to improve EE is not very evident, there is more regional activities supporting EE improvement, like the refurbishment strategy of the city of Warsaw.

- **Finware:**

Poland has an efficient means to support energy efficiency investments through the Regional Funds for Environmental Protection and Water Management which offer soft loans, direct subsidies and subsidized interest rates for energy efficiency projects. Further there are diverse bilateral programmes as well as EU operational programmes providing grants and the Green Investment Scheme offering grants and subsidized loans (Panek et al, 2014, p.7-19).

Different financing schemes are implemented in Poland supporting EE and RES measurements. The four main schemes are (Panek et al, 2014, p.7-19): The Regional Fund for Environmental Protection and Water Management (direct subsidies, preferential loans, subsidized interest rates on commercial loans from the Bank Ochrony Środowiska), Loans with Thermomodernization and Renovation Bonus (loans with grants from Bank Gospodarstwa Krajowego), the Regional Operational Programmes of the European Union (grants), and the Green Investment Scheme (grants and subsidized loans). The scheme “Loans with Thermomodernization and Renovation Bonus” is active since 1999 and provides subsidies to the loans allocated to thermal refurbishment measures in buildings. Up to now, this scheme has been used by around 30‘000 building owners.

- **Ecoware:**

The country is on track to meet its Kyoto targets. However, Poland’s energy intensity is more than double compared to the EU average. Emissions have been reduced by more than 25% since 1990 due to the economic downturn in the 1990s. In contrast, emissions from transport increased by more than 130% since 1990, mainly due to the growing number of private cars.

Energy for heating could be reduced by more than 80% therefore the building sector holds a large reduction potential (Delbow et al, 2013d, p.39). As coal is still the most common source of space heating, a reduction in space heat demand results in very high GHG savings.

- **Polware:**

EEP is not a significant issue for Polish decision makers or Polish society. Poland even opposes more ambitious GHG reduction targets and the further development of climate change policies – it has also not transposed several climate and energy related EU directives into its law system.

Poland’s Energy Policy up to 2030 lists climate-friendly goals for the energy sector (such as reducing the energy-intensiveness of the economy, construction of highly efficient power plants, promotion of RES and the reduction of losses during transmission), but there is little evidence of those goals being pursued.

An energy policy priority is the independence from Russia. This is one of the main reasons behind the Polish government’s strong support for the coal and nuclear industry, as well as its hopes for shale gas resources (Delbow et al, 2013d, p.1-3).

- **Country summary**

The biggest barrier towards EEP is political commitment, rather than funding, as is the case with the rest of the countries in focus. Poland's policy is centered on energy independence mainly through development of nuclear power stations and coal industry. Nevertheless, on a regional and local scale, attempts of improving EE are limited by available budgets and unresolved property issues.

Poland remains hostile towards more exigent GHG requirements. At the same time, the residential sector shows potential for realization of up to 80% of savings through energy efficiency retrofitting.

3.5 Romania

- **General information:**

Population (in Mio.): 20'020'074 / 2013 (Eurostat)

Density (people per km²): 93.18 / 2010 (World Bank)

- **Hardware**

Heated floor area per m²: na

Table 11: Electricity mix and Heat (IEA, 2011)

Production from	Electricity (GWh)	Heat (TJ)
Coal and peat	24803	25412
Oil	769	8176
Gas	8365	63169
Nuclear	11747	0
Biofuels	198	2083
Waste	0	13
Hydropower	14946	0
Geothermal	0	7
Solar PV	1	0
Solar thermal	0	0
Wind	1388	0
Tide	0	0
Other sources	0	0
Total Production	**62217**	**98860**
Residential Consumption	**42714**	**69546**

Housing stock:

Romanian housing stock is of a relatively low quality.

Approximately 53% of residential buildings were built before 1970, and more than 90% before 1989, all having an energy performance level between 150-400kWh/m2. There are a great number of buildings in need of renovation or with an overdue lifetime (Atanasiu et al, 2012c, p.3). Constructing with adobe without respect for any regulations is still present (Margarit, 2012 p.3).

Most of the buildings are private property – 97% (Atanasiu et al, 2012d, p.12).

- **Software:**

The gaps identified until now are mainly of a qualitative nature and relate to the increasing need for technology application and the general reduction of the qualified workforce (Atanasiu et al, 2012c, p.62).

Anticipating improvements in building codes, energy certificates should be prepared for the upcoming market uptake of very low-energy buildings. With rising requirements on building energy certification and expert capacity, implementation issues may appear (Atanasiu et al, 2012c, p.62).

So far, there is no fully coherent system in place to ensure the qualification of the building workforce relating to energy efficient technologies. The National Qualification Framework is being adapted to align with the European Qualifications Framework. BUILD UP Skills Romania (ROBUST) is a project working in the same sector. Table 12 shows the development of the market of several energy efficiency related technologies, which could give an idea of where future shortages might occur (Atanasiu et al, 2012c, p.62).

Table 12: Energy efficiency related technologies market (Atanasiu et al, 2012c, p.62)

	Insulation materials	**Ventilation systems with heat recovery**	**Triple glazed windows**	**Heat pumps**	**Pellet boilers**	**Solar thermal systems**	**PV**
Actual market	No data available	Very small	Very small	Very small	Very small	According to demand	Very small
Demand in % of new nZEB	100,00%	100,00%	100,00%	~50 %	~50 %	>15%	>75%
Required growth of market	No data	Very high	No data	Very high	No data	Normal	Very high

- **Orgware**

No major administrative barriers to the development of EE and RES projects in Romania are detected (Skovholt, 2010, p.233).

However, poor administrative capacity is a core concern for Romania. Generally, public administration is characterized by an inconsistent legal framework, low levels of inter-ministerial cooperation and excessive bureaucracy. It is undermined by a lack of skills, a lack of transparency in staff recruitment and high management turnover rates (European Commission, 2013, p.5).

- **Finware**

There are no major economic or financial barriers to the development of EE and RES in Romania (Skovholt, 2010, p.233).

However, financing remains the greatest obstacle towards energy efficiency. “The public sector disposes of very limited financial resources for investing in energy efficiency. Measures foreseen in the legislation and action plans cannot be implemented due to lack of budgets” (Schüle, 2013e, p.6).

Some of the financial programmes available in the residential sector include tax reduction and financial support for multi-family buildings. For example, The Government Emergency Order No 18/2009 has the goal of promoting the increase of energy performance of multi-family blocks of flats built between 1950 and 1990, and Government Emergency Order No 69/2010 focuses on the thermal rehabilitation of residential buildings using funds from bank loans granted under a government guarantee. This second act should ensure the non-discriminatory access of owners’ associations and natural persons acting as owners of single-family residential buildings to bank loans granted under a government guarantee and having a subsidized interest rate for the thermal rehabilitation of buildings. An additional support mechanism is the CASA VERDE (Green House) program, favoring the implementation of renewable energy systems for heating and hot water in buildings (Atanasiu et al, 2012c, p.19).

- **Ecoware:**

Romania is expected to definitely meet its Kyoto target through direct domestic emissions reductions.

Total emissions decreased by around 50% between 1990 and 2011. The sharpest decrease was reported in the 1990s, reflecting the economic downturn driven by the transition to a market economy.

Transport is the only sector that showed increasing emissions between 1990 and 2011 (Dreblow et al, 2013e, p.2).

- **Polware:**

Romania has the largest share of national energy resources among the project countries, therefore concerns for energy security are the lowest. This opens the possibility to focus the energy policy on energy efficiency and renewable energies. At the same time, however, it contains the risk of not having the need to enforce EE (and RE). Generally EEP receives somewhat moderate attention in Romania.

Positive measures are being taken to reduce GHG emissions and facilitate green growth, as evidenced by various clean energy efficiency policies and the finalization of the National Climate Change Strategy. However, strategies generally focus on adaptation to climate change impacts rather than on climate change mitigation and green growth. Where there is a focus on energy efficiency and new energy generation capacities, it is mostly due to the fact that energy generation and distribution systems have already exceeded their lifespans and need to be updated.

An interesting project, related to green growth is the demonstration project in Turcen mentioned in connection with Carbon Capturing System (CCS) research (Dreblow et al, 2013e, p.1).

- **Country summary:**

Financing and coordination among government institutions are the main barriers to EE in Romania.

Good practices are a result mainly of the need to maintain climate changes or to renovate buildings and systems with overdue life spans rather than of a conscious recognition of the need for environmentally friendly incentives. This present renovation need on a large scale offers the opportunity to achieve significant reductions e.g. in space heat demand and GHG emissions, respectively.

3.6 Slovak Republic

- **General information:**

Population (in Mio.): 5'410'836 / 2013 (Eurostat)

Density (people per km²): 112.92 /2010 (World Bank)

- **Hardware**

Heated floor area per m²: na

Table 13: Electricity mix and Heat (IEA, 2011)

Production from	Electricity (GWh)	Heat (TJ)
Coal and peat	4038	11313
Oil	586	5286
Gas	3150	20060
Nuclear	15411	2210
Biofuels	795	4402
Waste	50	290
Hydropower	4146	0
Geothermal	0	104
Solar PV	397	0
Solar thermal	0	2
Wind	5	0
Tide	0	0
Other sources	78	80
Total production	**28656**	**43747**
Residental Consumption	**24812**	**32133**

Housing stock:

The Slovak Republic housing stock is of seemingly high quality and is relatively new – on average 36 years old.

However, a large portion of the housing stock (mainly apartment blocks) requires renovation and modernization of structural and equipment elements. “The Slovak energy infrastructure is aging and will require investment in replacement or modernization, particularly when economic growth recovers, leading to increasing energy demand. Large parts of the building stock and the public vehicle fleet are also aging.” (IEA, 2010d, p.46)

About 60% of the housing stock is in private ownership, consisting primarily of houses located in smaller towns and villages.

- **Software**

EPC is introduced in Slovak Republic as in the other project countries, however some difference exists: Two specialists are needed to prepare an EPC for a family house or an apartment building, and four are involved in the case of a building with a cooling system.

Academic and research institutions, non-governmental organizations, and associations of interested groups are involved in the process of developing policies and measures to mitigate climate change (Sternova, 2012).

However, consumer information on efficiency is lacking – most of all information on energy performance of buildings. Furthermore, the government does not provide local implementers or industry with the technical training necessary to follow the mentioned policies (IEA, 2010d, p.58).

- **Orgware**

Energy efficiency policy implementation is ensured by**:** central bodies of state administration, bodies of state administration, public organizations and local administration. Key figures are The Ministry of Environment, the ministry's Department of Climate Change Policy and Economic Instruments, The Slovak Environmental Agency**,** The Slovak Inspectorate of the Environment, and The Slovak Innovation and Energy Agency (PEEREA, 2008, p.45).

Slovakian Republic authorities claim that the main barrier to the work of the EE related institutions is the lack of crucial instruments, such as legislative tools, monitoring systems, relevant data and information. This combines with the insufficient experience, knowledge, and awareness of the persons responsible for implementing energy efficiency measures at various stages (European Commission, 2014, p.176).

- **Finware:**

Several funds related to EEP are devoted to the same objective, which reduces cost-effectiveness of support and may lead to a misallocation of resources (IEA, 2010d, p.42).

Most of the savings assumed in the first Slovakian Energy Efficiency Action Plan (EEAP) rely on the establishment of the Energy Efficiency Fund. Since it was not implemented, measures outlined in the first EEAP have been canceled, mainly in the building and industrial sector.No alternative solutions were provided (European Commission, 2014, p.174).

The financing scheme for housing development is state supported and provides support for the building, reconstruction and renovation of multi-family buildings and single family houses. Loans and grants are the medium of support offered, with a greater emphasis on loans (IEA, 2010d, p.42).

- **Ecoware:**

A very positive practice in Slovak Republic is the decoupling of economic growth from the growth in GHG emissions. So far, meeting its international commitments for emissions reductions has not been particularly challenging (IEA, 2010d). The Slovak Republic is going to meet its Kyoto target through direct domestic emissions reductions. Nevertheless, it ranks among the ten most GHG-intensive economies in the Organization for Economic Cooperation and Development (OECD) (Dreblow et al, 2013f)

Total emissions decreased by 37% between 1990 and 2011, mainly driven by the structural changes in the transition to a market economy, the declining economic activity in the 1990s, and more recently to improved energy efficiency in buildings. Only emissions from transport reported an increase of 27% between 1990 and 2010 driven by the growing number of passenger cars and freight road transport (Dreblow et al, 2013f).

- **Polware**

Currently, environmental criteria and EE issues in the public realm are not explicitly addressed in national legislation. There is a need for decisions on how environmental considerations can be practically applied within the frame of valid legislation and international agreements. The opportunity of anticipated economic growth and related investments should be seized in order to progress towards a low-carbon and less energy intensive economy.

Instead of this, the government of Prime Minister Alexandr Fico took the decision to dissolve the Ministry of Environment on ground of cutting costs during the economic crisis. Therefore, the Minister sent a clear signal that the environment is not among his top priorities. The Ministry was subsequently reinstated by his successor in office Iveta Radičová, whose government, by contrast generally showed a stronger interest in climate related issues (Dreblow et al., 2013f, p.1)

The Slovak Republic succeeded to keep the balance between preventing price increases and ensuring a steady development of the renewable industry – by not introducing moratoriums on renewable energy for example (Dreblow et al, 2013f, p.2).

- **Country summary:**

Meeting current energy efficiency requirements was never a challenge for the Slovak Republic, which accounts for the fact that ambition in the EEP is rather low. Experts are very critical of the Slovak EEP and the progress made since the last monitoring reports. Moreover, the substantial lack of monitoring and progress data reporting stipulates more precise evaluations and recommendations.

3.7 Slovenia

- **General information:**

Population (in Mio.): 2'058'821 / 2013 (Eurostat)

Density (people per km²): 101.72 / 2010 (World Bank)

- **Hardware**

Table 14: Heated floor area per m² (TABULA)

	Number of buildings	Number of apartments	Living space in 1000m²	TABULA referance area in 1000m²
Building stock total	518.598	852.693	67.164	73.881

Table 15: Electricity mix and Heat (IEA, 2011)

Production from	Electricity (GWh)	Heat (TJ)
Coal and peat	5307	5606
Oil	16	147
Gas	489	2849
Nuclear	6215	0
Biofuels	254	1016
Waste	8	80
Hydropower	3703	0
Geothermal	0	47
Solar PV	65	0
Solar thermal	0	0
Wind	0	0
Tide	0	0
Other sources	0	0
Total production	**16057**	**9745**
Residential Consumption	**3211**	**3742**

Housing stock:

The building stock in Slovenia is in relatively good condition, even though the majority of buildings is quite old. 59% of all buildings were built before 1975, 31% between 1975 and 1990 and 10% after 1990. Only the ones built after 1990 can be expected to have a good thermal insulation. Nowadays more than 92% of the dwellings in Slovenia are privately owned. More than half of Slovenia's final energy consumption results from household's space heat demand (SOLARGE, 2005, p.6-9).

- **Software**

The Ministry of Economy provides detailed information about energy efficiency related topics, for example, about the implementation of EPBD. Information campaigns are generally carefully conducted (Zavrl et al, 2012, p.10).

- **Orgware:**

The Department of Efficient Energy Use and Use of Renewable Energy Sources within the Ministry responsible for energy (the Ministry of Infrastructure and Spatial Planning) is responsible for the implementation of national programmes for energy efficiency in industry, buildings and transport. The Environmental Fund of the Republic of Slovenia (Eco-fund) is the institution which promotes environmental investments and supports the Department of Efficient Energy and Use of Renewable Energy Sources (MURE-ODYSSEE, 2010, p.9).

- **Finware**

The main barrier to energy efficiency in Slovenia remains lack of budget.

However, existing funds are assessed to be partly or very effective, which is the most positive feedback on this instrument that was received across the countries studied (Schüle et al, 2013g, p.6). EE is promoted in Slovenia manly through low-interest loans and non-refundable financial incentives. They are available to commercial applicants and private citizens via application through a government-affiliated administrative organization known as the Environmental Public Fund (Eco Fund). The Ministry of Infrastructure and Spatial Planning runs two longstanding subsidy programmes regarding the use of wood biomass: the DOLB for district heating systems and the KNLB for central heating. Slovenia's other main support for renewables is a feed-in tariff (Dreblow et al, 2013g, p.8-9)

Sustainable use of energy is a development priority in Slovenia. Main topics being addressed are: energy refurbishment of existing buildings and sustainable new buildings in the public sector, effective use of electricity in the industrial, public and tertiary sectors, innovative systems for local energy supply, large and medium district heating networks based on RES ad CHP, demonstration projects, dissemination of related information, and use of an energy advisory service. Cohesion Fund financing is being used for these priority topics in the form of non-returnable subsidies.

- **Ecoware**

Slovenia is not likely to meet its Kyoto target through direct domestic emissions reductions. However Slovenia can rely on the Effort Sharing Decision (ESD) agreement, according to which, Slovenia can increase its emissions not covered by the EU ETS by 4% compared to 2005 by the year 2020.

In 2011, Slovenia emitted about 6% more than in 1990. Emissions from energy supply decreased in the early 1990s due to the transition to a market economy, but reached 1990 levels again in 2003 and almost haven't changed since then. Transport is the second most emitting sector. Emissions doubled since 1990 reflecting the shift from public transport to private motor vehicle use (Dreblow et al, 2013g, p.2).

- **Polware**

Climate change policy has not been a priority in Slovenia recently. This is due mainly to the the financial crisis which causes the country to focus on other concerns since 2009. However, public debate about environmental issues is ongoing and relatively lively.

The perception of "green growth" as an economic priority is mixed. Environmental and energy concerns are certainly important, but there is no influential institution promoting the concept nationally – for example, Slovenia does not have a Green Party in the Parliament.

Slovenia's energy system shows a high level of renewable energy use. Total end-use energy consumption in 2010 from renewable sources was 19.8%, which makes Slovenia very likeable to

meet its 2020 target of 25%. Consumption of electricity from RES is reported to be also high in 2010 at approximately 33%, even though it is down from a peak of almost 37% in 2009.

Slovenia makes heavy use of tax policy in order to achieve environmental aims. The country has introduced a carbon tax in1996 for the CO2 emissions resulting from combustion of fossil fuels and incineration of combustible organic substances. Slovenia holds implicit tax rate on energy above the EU average at approximately €184 per ton of oil equivalent. This places Slovenia in first place among EU member states in terms of energy tax revenue as a proportion of the Gross Domestic Product (GDP) (3.1%). if combined with above-average energy intensity. Environmental taxes are at 3.6% of GDP – the 3rd-highest in the EU (Dreblow et al, 2013g).

- **Country summary:**

In contrast to the other project countries, Slovenia's EEP progress is assessed as overall positive, especially in the transport sector. Although transport emissions progressively rise - this is characteristic for all project countries - improvements in this sector are better structured and overall give better results in comparison with the other project countries.

The main problem to consider remains the lack of funding. The implementation of EPBD is criticized as being rather slow.

Chapter 4 Discussion and proposal of a replication strategy

Table 16: Comparison of the project countries

HOUSING	BG	CZ	HU	PO	RO	SC	SI
Heated floor area/m²							
Electricity production/ GWh	27537/coal	40888/coal	15865 /nuclear	141443/ coal	24803 coal	15422 nuclear	6215 nuclear
Heat production/TJ	22838/coal	84381/coal	37443/gas	265734/coal	63619/gas	20060/gas	5606/gas
Housing quality	rather low	rather good	very low	very low	rather low	good	good
Privately owned/%	97,00%	66,00%	94,00%	75,00%	84,00%	60,00%	92,00%
Localities	50% of owners have insufficient income to cover cost of service		12% “dwellings without comfort”	12,00% of the budget is spent on energy	Continuing construction with adobe out of all regulations	rather new - average age is 36 years	rather old
Barriers	1. Need of renovation 2. Deteriorating quality of panel buildings stock 3. Aging housing stock 4. High % of private ownership						
Solution	1. Development of Homeowners associations. 2. Government subsidies 3. EU monitoring and funding						
SOFTWARE	BG	CZ	HU	PO	RO	SC	SI
Information strategy	no	no	no	no	no	no	no
Need of capacity building	yes	yes	yes	yes	yes	yes	yes
EPC	yes	yes	yes	yes	yes	yes	yes
Localities	low trust in SEDA	Good local info network	Carefully implemented EPBD	Negative campaign		Lack of proper monitoring of progress	Rather slow implementation of EPBD
Barriers	1. Lack of funding 2. Lack of interest and awareness raising 3. Insufficient coordination among institutions involved in energy efficiency 4. Insufficient monitoring of the results						
Solution	1. EU monitoring and funding 2. Strategy for national information campaign						

ORGWARE	BG	CZ	HU	PO	RO	SC	SI
Developed institutional network	yes	yes	yes	yes	yes	yes	yes
Localities	Housing association				Housing association		
Barriers	1. Lack of funding 2. Lack of monitoring of the work of the institutions 3. Lack of stuff capacity						
Solution	1. EU monitoring and funding						
FINWARE	BG	CZ	HU	PO	RO	SC	SI
Availability of funding	insufficient	insufficient	insufficient	insufficient	insufficient	insufficient	insufficient
Adequacy of funding schemes	insufficient	insufficient	insufficient	insufficient	insufficient	insufficient	good
Barriers	1. Lack of political commitment 2. Lack of information 3. Lack of funding 4. Low financial standard						
Solution	1. Raising awareness of the saving potential of energy efficiency technologies. 2. Subsidizing energy technologies on a European level in order to make them affordable for all EU member countries. 3. EU funding and monitoring						
ECOWARE	BG	CZ	HU	PO	RO	SC	SI
Kyoto target	yes	yes	yes	yes	yes	yes	no
Non ETS target	yes	yes	yes	yes	yes	yes	no
RES target to be met by 2020/%	16,00%	13,50%	15,00%	15,00%	38,00%	10,00%	25,00%
Energy intensity	highest	high	high	high	3rd highest	high	high
Localities	Need of special attention in the transport sector	Need of special attention in the transport sector	Need of special attention in the transport sector	Need of special attention in the transport sector	Need of special attention in the transport sector	Need of special attention in the transport sector	Good progress in the transport sector
Barriers	1. Controversial results in intensity reduction 2. Reduction in energy intensity mainly due to the restructuring during the transition to market economy and the world financial crisis 3. Often formal engagement with sustainable development and ecology						
Solutions	1. Raising awareness						

POLWARE	BG	CZ	HU	PO	RO	SC	SI
Long term political strategy	no	no	no	no	no	no	no
Commitment to the idea of sustainable development	low	low, even negative	low, even negative	low, even negative	low	rather low	high
Localities	Discredit of the FiT politics	Energy security concerns	Energy security concerns	Energy security concerns	Most energy independent		Relatively high energy and environmental taxes
Barriers	1. Concerns for energy security 2. Unaffordability of RES technologies 3. RES technologies are generally relatively unpopular						
Solutions	1. Awareness raising 2. EU directives, monitoring and funding						

Themes the project countries have in common:

- an urgent need of investments in energy efficiency and renewable energy sources
- socialistic past of similar length (40-50 years), impact and consequences
- challenges of sustainable development receive similar level of attention in the project countries
- political activities aiming to conform to the European Union sustainable development directive

Economy:

- Most of the reviewed countries have a per capita GDP above the world's average, however Bulgaria and Romania are still well below that indicator.
- All of the project countries have significant dependency on energy imports.
- The project countries can be characterized by a process of deregulation and liberalization of their energy markets with electricity markets having the highest degree of progress and gas and heat markets falling behind.
- Large hydropower stations and wood are major contributors to renewable energy generation, while other renewable energy sources have a negligible share.

Society:

Some influential features of the project countries' societies can be noticed, which mainly stem from their socialist pasts:

- Relatively low overall trust in political institutions resulting in suspicion towards the attempts of the government to introduce new approaches for sustainable development.
- Heritage of socialist, multifamily, high-rise residential buildings that are characterized by similar architectural values, construction manners, and present condition of maintenance.
- A large share of buildings constructed mainly between the 1960s-90's, characterized by a growing need for retrofitting.
- Predominantly individual ownership of residences, which inhibits to a great extent the development of a unified, large-scale approach to managing common building areas and dealing with problems of retrofitting and EE.
- Financial difficulties due to predominantly low income levels.

Politics:

- Main policy driver related to energy use in buildings is the EPBD, implemented in 2002 and recast in 2010 with more ambitious provisions. This is the main convention through which requirements for certification (EPC), inspections, training or renovations are introduced in member states. Europe attempts to make use of EPBD as a unified platform for coordinating energy efficient policies. However, this will not be achievable so long as EU legislation only partially covers the field of building renovation.
- Available financial programmes are a significant part of the politics towards increasing building energy performance. Though an extensive amount of financial schemes are reported, their implementation has so far achieved “business–as usual” results. Very few financial instruments provide enough funding for deep renovations.

The identified common themes described above help to define certain barriers to investments in EE projects. These barriers can be divided into three main categories: institutional, economic, and capacitive.

INSTITUTIONAL BARRIERS

The lack of transparent and trustworthy organizational system is a major issue in the project countries. Cooperation is lacking among the different ministries and agencies involved in energy policies at both the national and local level. This is the result of stronger involvement with and allegiance to the policies of parties they belong to, rather than to the national policies. Sudden disruptions due to regulatory instability and discontinuity caused by frequent and uncoordinated updates of current policies bring sense of chaos. Such a chaotic atmosphere consequently produces a feeling of apathy, lack of concern and suspicion towards new political initiatives. People tend to expect innovations to have an unsuccessful outcome or at least to be introduced with a lot of unpredictable mistakes. As a result, involvement with new initiatives by default is regarded as too risky. Research shows that there exists a lack of secondary legislation and operational instructions, tools, standards, and procedures necessary to implement primary legislation. Even more burdening are the numerous bureaucratic obstacles placed on new projects, such as non-transparent administrative and authorization procedures.

There is lack of public procurement guidelines for the acquisition of energy efficient equipment and the request of provision of energy services to public entities, and there is inefficient or limited use of public tendering processes for energy efficiency and renewable energy projects. In addition, unresolved property issues in multi-residential apartment buildings and the significant fragmentation of land property limit profoundly the feasibility of energy efficiency investments in the housing sector at the scale of the individual resident.

ECONOMIC BARRIERS

A number of economic policy approaches currently used in project countries need to be reviewed and improved.
Traditional routes of state intervention in price formation have been through creating artificially low tariffs for final customers and cross subsidies between customer segments. Such incentives limit the profitability of energy efficiency projects and create an unfavorable investment climate.

Environmental costs of the energy supply are often not taken into account, and this inhibits evolution towards more responsible behaviour of the final customer. Most of the major energy companies are public owned, causing an unresolvable conflict of interest between profitability and pursuit of political benefits through popular, social pricing policy.

The funding system also still requires a lot of elaboration. Availability of public funds is insufficient, and the developed premium tariffs are often not operational and of a limited extent since they apply

only to certain technologies or have restrictive requirements. EE funds, if they are operational, have limited resources. Alternative measures such as dedicated credit lines providing soft loans, tax exemptions, or support schemes for third-party financing are often not in place.

Banks themselves do not contribute to mitigating the problem - they apply high interest rates to medium and long term loans and restrictive requirements for collaterals.

As a consequence of all these economic barriers, the size of the energy efficiency and renewable energy projects remains rather small. This results in high evaluation and transaction costs per project.

CAPACITIVE BARRIERS

Inefficiency in policy and the economy results in a lack of awareness and interest in energy efficiency issues in the societies of the project countries. Sustainable development is still regarded as a rather exotic domain, foreign to the very initial concerns of everyday life. Consequently, a societal lack of interest diminishes the value of sustainable development as an issue in political strategies.

A lack of professional skills is reported with all stakeholders involved in identification, development, financing and implementation of energy efficiency and renewable energy projects:

- Policy level: insufficient political commitment to implement the necessary policy reforms and lack of qualified human resources among local authorities who are to realize the identified projects.
- Economic level: Lack of experience within commercial banks in financing energy efficiency and renewable energy projects and lack of knowledge for possible economic benefits arising from energy efficiency and renewable energy projects.
- Societal level: Lack of training and educational opportunities for conducting energy audits.
- Failure to identify attractive project opportunities and preparing bankable project proposals.
- Consumer level: Energy is regarded more as a public service than a valuable good, which is difficult to change unless this implies a tangible improvement of the living standard.

Appendix

Table 17: A summary of the current financial programmes in Eastern Europe (Economidu et al, 2013, p.92)

	Grants, Subsidies, Funds	**Loans**	**Tax Incentives, Levies, etc.**	**Obligations, White Certificates**	**Audits**	**3rd party finance, ESCOs**	**Other**
Bulgaria	Existing bldg.	Residential and Public bldgs.	Class A or B new built				
Czech Republic	All	Public bldgs.				Existing Residential buildings	
Hungary	Existing bldgs.		Planned				
Poland	Public Sector	Existing bldgs.		Introduced 2013 (but of no significance)			
Romania	Residential bldgs.						
Slovak Republic	Existing bldgs.	Existing bldgs.					
Slovenia	Private Residential and Public Sector	Private homes				Public Residential	

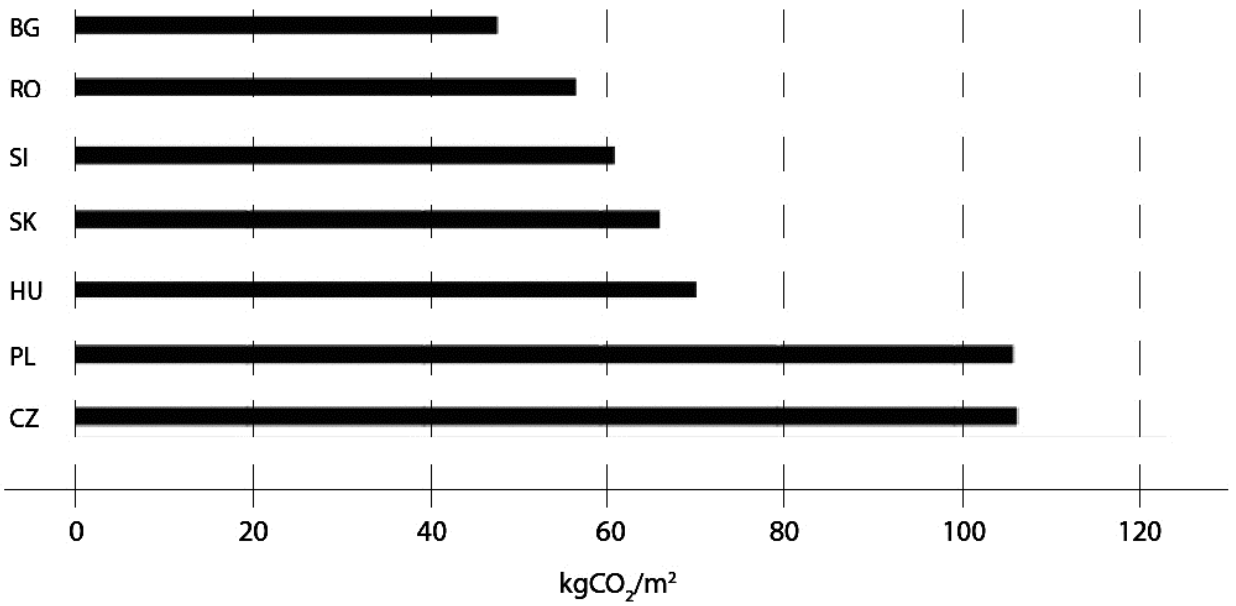

Figure 3: CO2 emission per useful area (Economidu et al, 2011, p. 44)

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