**A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfillment of the Degree of Master of Sciences**

# Building codes as a Policy Instrument for Improvement of Energy Efficiency in Building Sector: Barriers and Incentives. Case study of Belarus.

**Katsiaryna Shelkovich**

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**Author's declaration**

No portion of this work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

**Katsiaryna SHELKOVICH**

**Key words: energy efficiency, buildings, building codes, Belarus.**

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**THE CENTRAL EUROPEAN UNIVERSITY**

**ABSTRACT OF THE THESIS** submitted by:

Katsiaryna SHELKOVICH

for the degree of Master of Science and entitled: Building codes as a Policy Instrument for Improvement of Energy Efficiency in Building Sector: Barriers and Incentives. Case study of Belarus.

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Belarus is facing unprecedented energy challenges which are a result of dependency of imported energy carriers, high energy intensity of all sectors of economy, and enormous energy losses due to energy inefficiency. Belarus can and must implement all available policy tools aiming at reduction of energy losses, which will not only result in significant economic benefits, but also contribute to greenhouse emissions reduction and help to combat climate change. Building sector, including old buildings constructed at Soviet period with no attention to energy efficiency issues, has enormous potential for energy savings. Taking into consideration poor past experience of building traditions, it is evident that there's a strong need to make changes aimed at reduction of energy consumption of both old and new buildings. Energy efficiency building codes in Belarus are at the early stage of introduction.

Therefore there is a need of evaluating the process of building codes design and introduction in order to identify barriers and incentives for compliance and develop recommendations for improvement of the process.

The research aims at assessment of the process of building codes design and implementation in Belarus. The main objective of this study is to analyze the process of building codes design, identify and categorize the barriers for the successful policy tool implementation and develop recommendations how these barriers can overcome. The expected outcome of the study is development of recommendations for improvement of the process of building codes implementation in Belarus.

# 1 Introduction

The focus of the society on the impacts of climate change, challenges associated with energy supply and constant increase of energy prices show the necessity to implement energy saving measures in all sectors of economy in order to contribute to sustainable development. The need is stressed in a number of international agreements and conventions, including the Kyoto Protocol as well as the United Nations Framework Convention on Climate Change (URL: http://europa.eu/legislation_summaries/environment/tackling_climate_change/l28060_en.htm.)

Building codes are considered an effective tool for improvement of energy efficiency in new and existing buildings, which also contribute to greenhouse gas emissions reduction from buildings and helps to mitigate climate change (OECD 2003).

It is well known that the Republic of Belarus is a former soviet state with economy in transition, and building codes system inherited from Soviet Union in which energy efficiency was not properly considered. The process of introduction of energy efficiency building codes system for energy efficiency in building sector is under development. Therefore there is a need of evaluating the process of building codes design and implication in order to identify barriers and incentives for compliance and develop recommendations for improvement of the process.

Belarus is an industrialized economy, which is greatly dependent on imports of raw materials and fossil fuels (oil and gas) from Russia. Thus Belarus is facing serious challenges regarding energy supply. Energy is considered to be the "fundamental system-forming and life-supporting sector" of any state or society. It influences directly the productive capacity and economic development of a country, "social health" of the people, living standards and the environmental situation in the country; in other words, it is a core component of sustainable development (Khurs [?]).

The research aims at critical assessment of effectiveness of building codes as a policy tool for improvement energy efficiency in building sector. The main objective of this study is to critically analyze the process of building codes design, implementation and compliance processes in Belarus, categorize barriers towards the policy tool effective implementation and identify presence of incentives for compliance for different stakeholders in the existing institutional framework. The expected outcome of the study is development of recommendations for improvement of the process of building codes implementation in Belarus.

The choice of the country is not random, but predetermined by researcher's familiarity with the local environment which stipulated the research be more successful than in other countries. The case study of Belarus was interesting from scientific point of view as the country with limited experience of constructing energy-efficient buildings and implementation of policies for enhancing energy-efficiency is nowadays experiencing a period of transition from Soviet building traditions towards European ones. As stated in "The Integrated Program on Design, Construction and Renovation of Energy Efficient Residence Buildings in the republic of Belarus for the Period of 2009-2010 and the prospect of 2020" all new buildings starting from 2020 will be constructed according to the national building codes harmonized with European Directive. The plan sounds even more unrealistic given the fact that some Belarusian experts (Kuzmichyou R., personal communication) claim that the state of things in building sector regarding energy efficiency is from 5 – 20 years behind Europe.

# 2 Methodology

## 2.1 Research methods

The aims and objectives of the study were addressed by means of application of the following research methods, which for better accuracy were divided into several stages and fulfilled in the fixed order.

First of all literature review was conducted to ensure the ground of the research and determine key questions and unresolved problems in the sphere of promotion of energy efficiency in building sector worldwide and, particularly, in the target country, with focus on building codes as a policy instrument. The aim of the literature review was also to provide brief insights into the specific conditions that triggered reformation\development of policies for energy efficiency in building sector in the chosen country.

Secondly, institutional and legislative framework of the policy design, enforcement and implementation in Belarus was described and analysed.

Thirdly, interviews with the people involved into building codes design, implementation and enforcement was conducted.

The fourth stage was devoted to critical assessment of the process of building codes design, implementation and enforcement in the chosen country and the results of the assessment are comprised the "Discussion" stage of the study.

In the fifth stage a list of recommendations based on data obtained was developed. The recommendations that have been developed address areas of improvements in the process of design and implementation of building codes in Belarus.

## 2.2 Interviews design

The interviews with the experts involved into building codes design, implementation and enforcement were conducted using a set of open-ended questions to obtain information on the process of building codes design, implementation and compliance. The interviewees were involved into discussion on the subject of effectiveness of the building codes as a policy tool for enhancing energy efficiency in building sector, existing barriers towards effective policy implementation and incentives for compliance. The questions included but were not limited to:

1. Does introduction of building codes that address energy efficiency implicate affordability of energy? Do the higher energy-efficiency requirements balance energy efficiency with affordability?
2. What are possible incentives for introduction\compliance of building codes by building companies?
3. What are the economic costs/benefits for diff. stakeholders?
4. In what way will introduction of building codes influence energy bills?
5. How fast will be (if it will) the extra cost to build a home to the new higher energy-efficiency standards recovered through reduced energy bills?
6. Does existing legislation cover both the technical standards that need to be met and the procedures that need to be followed?
7. What will be the general procedure for building project approval?
8. How can be information on new standards obtained by general public/building companies?
9. Can different stakeholders (tenants/business sector) participate in the process of decision-making/planning/standards' design?
10. Are all the requirements for energy efficiency improvements should be met or is there a possibility to choose among different options?
11. What are the criteria to choose among different options to meet new energy efficiency targets?
12. Among different options to meet new energy efficiency targets what are the methods for defining their cost-effectiveness?

13. Are new building codes/ energy efficiency targets mandatory for all the buildings or only those determined to be energy-efficient (according to the plan of construction energy efficient residence buildings announced in the Integrated Program till the year 2020).
14. What is the situation with commercial\public\single-family buildings?
15. What are the procedures to assure compliance with new energy efficiency standards?
16. What specialists were involved into design of new codes\energy efficiency standards?
17. How was the baseline situation regarding energy efficiency in building sector assessed?
18. What are the results of this assessment?
19. What is energy consumption reduction target?
20. What is GHG emissions reduction target? Does new/baseline building code address GHG emissions problem?
21. Is there a possibility for individuals (tenants) to benefit from the possibilities described in the Integrated Program other than to buy an apartment in a newly constructed energy efficient building? What actions should be taken by individuals to obtain these improvements, reduce their energy consumption and energy bills?
22. How private sector will be involved (if will)?
23. Why alternative energy sources (renewable) are not addressed in the Integrated Program?
24. What are the barriers for energy efficiency improvements in building sector?
25. What are the barriers for effective implementation of new building codes?
26. What were the barriers for implementation of baseline building codes?
27. How would you classify/rank these barriers according to there importance?
28. How were/will be these barriers assessed and what was/will be done to overcome them?
29. What are (possible) financial sources of investment into development of energy efficient technologies in building sector?

30. What economic and financial mechanisms/incentives exist/can be used to promote energy efficiency technologies in residential and commercial buildings by private sector (business sector) and owners?
31. How would you estimate the quality of new building codes?

The respondents for the interviews were chosen so that all the stakeholders were represented, such as research institutions, NGOs, business, building companies, ministries and government. A key selection criterion was the respondents' competence in the field of building design and construction, energy efficiency, building codes design and implementation.

The interview process was logically organized into three parts: introduction, main part and conclusion.

During the introduction the interviewees were informed about the aims of the research, and asked about permission for audio record of their answers and their preferences regarding confidentiality of their responses

During main part of the interviews the interviewees were asked a set of open-ended questions to obtain information on the process of building codes design, implementation and compliance.

Were asked to express their opinions and give recommendations for improvement of the process of the process of building codes design, implementation.

Table 1. The List of the Interviewees

| N. | Name | Organization | Position |
|---|---|---|---|
| 1. | Yevgeny Shirokov | Belarusan branch of the International Academy of Ecology, Minsk<br>Head of Belarusian Division of the International Academy of Ecology, Head of Belarusian HABITAT Center | President |
| 2. | Natallia Andreyenka | NGO “Ecoproject Partnership” | Project manager |
| 3. | Konstantin Kolomietc | Minsk Business Union<br>Ministry of Economy, Research institute, зав. секцией | Vice-President |
| 4. | Victor Okushko | Department for Energy Efficiency of the State Committee on Standardization | Director |
| 5. | Vasiliy Ustinchick | Open Joint-Stock Building Company “10 UNR”, supervisory body | Deputy Director |
| 6. | Evgeniy Lobanow | NGO “Center for Environmental Solutions” | Project manager |
| 7. | Anatoly Nichkasov | The Ministry Of Architecture and Construction | Minister, Chairperson of the Board |
| 8. | Vitaliy A. Gutkouskiy | Limited Liability Company “JUNiR-invest”, Minsk Unitary Enterprise "Gosstroyexpertiza" | Deputy Director, Chief Project Engineer, Doctor of |

| | | | |
|---|---|---|---|
| | | | Technical Sciences |
| 9. | Roman V. Kuzmichyou | Republican unitary enterprise "Institute NIPTIS of a name of Ataev S.S, Ministry of Architecture and Construction | Deputy Director |

# 3 Literature Review

## 3.1 Iimprovement of Energy efficiency in building sector as a solution of energy dilemma of Belarus

Belarus is an industrialized economy, which is greatly dependent on imports of raw materials and fossil fuels (oil and gas) from Russia. Apparently, it's the only one of post-soviet states that didn't undergo transformation toward market economy (IEA [?]). Having major oil and gas pipelines going trough the country (the main line of the Druzhba oil pipeline runs through Belarus; as well as the Yamal-Europe gas pipeline) Belarus is an important transit country (about 20% of Russian gas exports to Central and Western Europe go through Belarus) . Russia having strong will of setting Russian neo-empire and interest in economic hierarchy over Belarus is seeking to gain greater control of all these assets(IEA [?]).

Belarusian industrialized economy that didn't undergo transformation toward market economy like other post-soviet republics and thus doesn't attract much foreign investment today, is characterised by heavy energy intensity and strong dependence on imports of raw materials and energy from Russia(IEA [?]).

The aforementioned conditions stipulated rigorous actions of Belarusian government aimed at ensuring country's energy security by reforming energy sector. The reforms are supposed to raise financing through attracting investments into energy sector, improve sector's efficiency through its modernization and reduce excessive dependence on imported Russian energy trough diversification of energy supply; particularly the focus is on enlargement of domestic energy resources and development of alternative electricity supply (IDECAR 2006).

The focus of the current reforms on policies for improvement energy efficiency in building sector is explained by high level of energy consumption in the sector. In 2007,

Belarus Total Final Consumption (TFC) of energy was 20237 ktoe (IEA). The analyses of sectoral energy consumption demonstrate that residential and industry sectors are responsible for the largest amount of energy consumption (5972 and 5664 ktoe), then comes transport sector (2295 ktoe) and commercial and public services (1589 ktoe).

Total final energy consumption by source demonstrate that heat and electricity are by far the most important energy sources for final consumption for the year 2007 (2468 and 5494 ktoe) The analyses of energy consumption by sector demonstrates relatively high energy consumption by residential sector (5972 ktoe). The data under discussion is presented in Table 1.

Table 2. Energy Balance for Belarus in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis (2007).

| UPPLY and CONSUMPTION | Coal and Peat | Crude Oil | Petroleum Products | Gas | Nuclear | Hydro | Geothermal, Solar, etc. | Combustible Renewables and Waste | Electricity | Heat | Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | 609 | 1769 | 0 | 167 | 0 | 3 | 0 | 1461 | 0 | 0 | **4009** |
| Imports | 96 | 20136 | 1297 | 17118 | 0 | 0 | 0 | 0 | 809 | 0 | **39456** |
| Exports | -80 | -855 | -14325 | 0 | 0 | 0 | 0 | 0 | -435 | 0 | **-15696** |
| International Marine Bunkers** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| International Aviation Bunkers** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Stock Changes | -74 | 422 | -131 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | **279** |
| TPES | 550 | 21472 | -13160 | 17348 | 0 | 3 | 0 | 1461 | 374 | 0 | **28047** |
| Transfers | 0 | 0 | -41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-41** |
| Statistical Differences | 6 | -16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-10** |
| Electricity Plants | 0 | 0 | -15 | -3753 | 0 | -3 | 0 | 0 | 1463 | 0 | **-2309** |
| CHP Plants | -19 | 0 | -56 | -5909 | 0 | 0 | 0 | -51 | 1275 | 3298 | **-1464** |
| Heat Plants | -108 | 0 | -300 | -2969 | 0 | 0 | 0 | -452 | 0 | 3170 | **-658** |
| Gas Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Petroleum Refineries | 0 | -19411 | 18856 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-555** |
| Coal Transformation | -6 | 0 | 0 | 0 | 0 | 0 | 0 | -4 | 0 | 0 | **-10** |
| Liquefaction Plants | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Other Transformation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Own Use | -13 | 0 | -513 | 0 | 0 | 0 | 0 | -22 | -322 | -358 | **-1228** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Distribution Losses | -44 | -385 | -14 | -154 | 0 | 0 | 0 | 0 | -320 | -617 | **-1534** |
| TFC | 367 | 1659 | 4756 | 4562 | 0 | 0 | 0 | 931 | 2468 | 5494 | **20237** |
| Industry sector | 57 | 0 | 564 | 1692 | 0 | 0 | 0 | 157 | 1214 | 1980 | **5664** |
| Transport sector | 7 | 0 | 1698 | 432 | 0 | 0 | 0 | 0 | 157 | 0 | **2295** |
| Other sectors | 293 | 0 | 2041 | 1258 | 0 | 0 | 0 | 773 | 1097 | 3514 | **8976** |
| Residential | 231 | 0 | 1214 | 1199 | 0 | 0 | 0 | 580 | 517 | 2230 | **5972** |
| Commercial and Public Services | 2 | 0 | 4 | 3 | 0 | 0 | 0 | 155 | 297 | 1127 | **1589** |
| Agriculture / Forestry | 3 | 0 | 760 | 40 | 0 | 0 | 0 | 37 | 123 | 157 | **1120** |
| Fishing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |

Source: http://www.iea.org/stats/pdf_graphs/BYELEC.pdf

Among different options of securing energy supply, improvement of energy efficiency is considered to be the most sound, cost-effective and "fast-track" strategy, because "each unit of energy saved is equal to an equivalent unit of energy generated" (Government of the PRB 2008). The strategy claims it to have a huge potential not only to contribute to energy security, but also to mitigate a wide range of environmental problems associated with usage of fossil fuels. Improvement of energy efficiency in building sector in Belarus has a huge potential for energy savings, therefore it can be considered a "hidden energy resource" and can be considered a feasible solution for limited energy supply, which is the case in Belarus since the breakdown of Soviet Union (IDECAR 2006).

## 3.2 Potential for improvements of energy efficiency in building sector in Belarus

To support aforementioned, it's necessary to say that housing stock in Belarus consumes "35-40% of the total amount of the energy used for heating and hot water supply" (Wit-Rusland 2010). According to the findings of the research conducted by the experts of the Project, total housing space for the end of 2008 accounted for 220 million square meters of residential buildings. This number includes also 170 million square meters of residential buildings of so-cold "soviet era", which were constructed before 1994.

The building traditions of all soviet countries are characterised by low attention to energy efficiency of all dwellings due to unlimited indigenous energy resources. According to the research (Wit-Rusland 2010) the energy consumption of the buildings constructed before 1994 accounts for 150-200 kWh/m2, which makes the residential sector one of the major consumers of energy.

Table 3 gives general information on differences in energy consumption of the buildings constructed before 1993 and after 1993. It's possible to conclude, that new buildings, constructed fter 1993 have significant improvements regarding energy efficiency. Since that time 50 million square m2 of residence buildings had been constructed. Table 3 represents comparative information regarding type of the buildings (constructed before or after 1993), total building space and heat consumption in both types of buildings.

Table 3. Energy consumption of old housing stock and new buildings.

| Type of building | Total housing space, mln. $m^2$ | Specific heat consumption rate, kWh/$m^2$ per year | Total heat consumption, mln. kWh/$m^2$ per year |
|---|---|---|---|
| Old housing stock (constructed before 1993) | 170 | 150 | 25,500 |
| New buildings (constructed after 1993) | 50 | 100 | 5,000 |

(Source: Scientific and Design Institute of Construction, 2005 – more research will be carried out under the PPG)

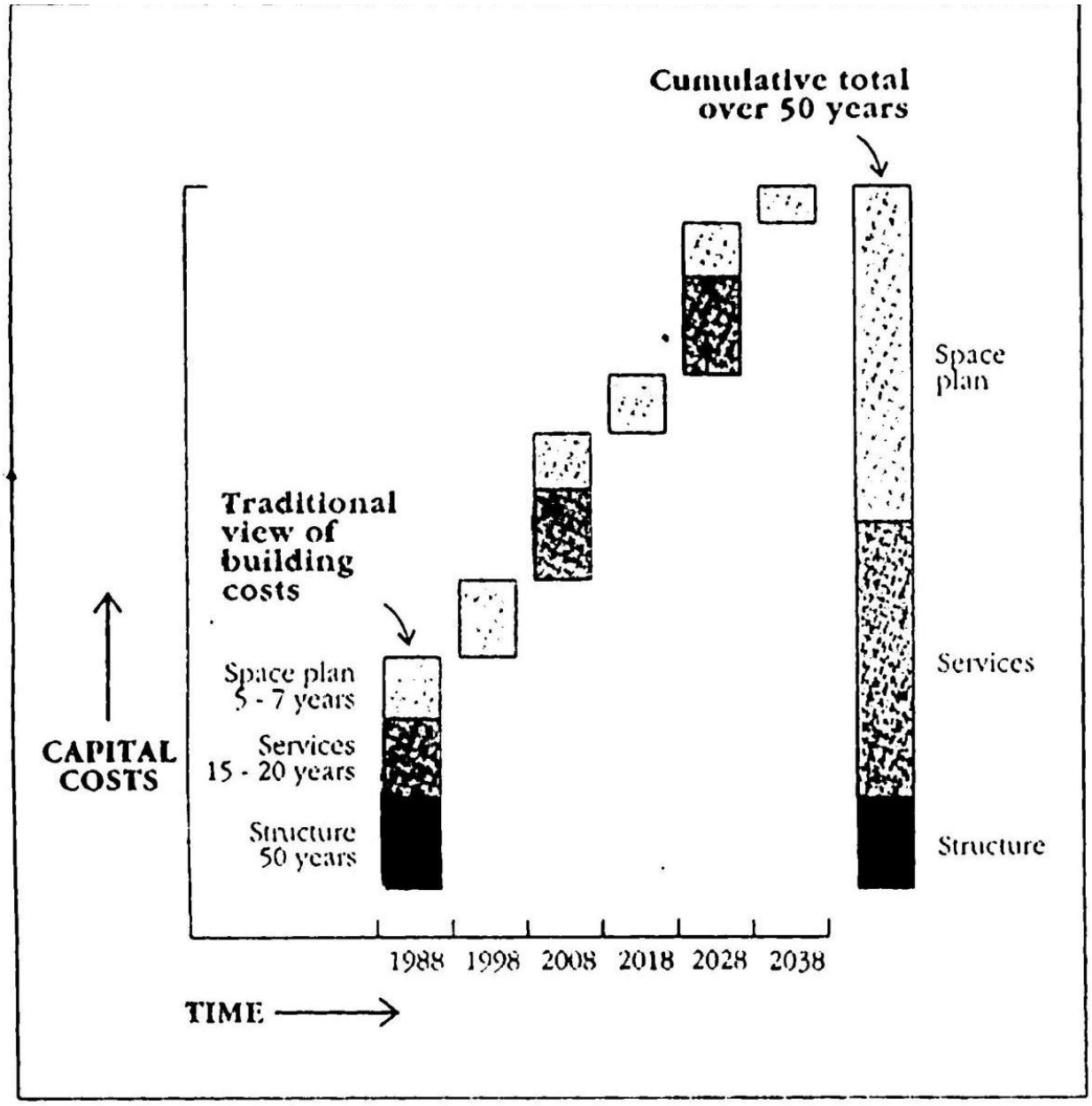
From the Table 3 it's seen that the housing stock constructed before 1993 has the greatest potential for energy efficiency improvement. Still the greatest attention from Belarus' government in this regard is paid to new buildings, which can be treated as illogical decision (Government of the Republic of Belarus. 2009). The explanation of this irrationality is the fact that during former 10 years thermal rehabilitation activities of existing buildings have been ongoing (UNDP/GEF 2010). Unfortunately, there was no research regarding effectiveness of aforementioned activities, therefore the reasons of focus on new buildings are not well grounded in the case of Belarus. On the other hand, given the fact that the buildings lifetime is approximately 100 years, the choice of new buildings as target for energy efficiency improvement is logical. The rationale of policies of energy efficiency improvement for new buildings is discussed in IEA information paper "Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings". The authors of the study argue that energy efficiency improvement in new buildings may be achieved easier than in existing building stock. This approach is more cost-effective and, more importantly, allows wider choice of technical solutions because some method of improving energy efficiency are not possible in existing buildings or restrained by long time to pass before regular refurbishment (approximately 40 years). Given the long time of buildings' operational phase, the authors of the paper also underlined the crucial role of new building stock in formation of the whole building sector's energy consumption in comparison with other sector components.

The importance of energy efficiency in new buildings in Belarus is intensified by the government construction plan. It is planned to construct 48 millions square meters of residence buildings between 2011 and 2015, which is almost twice as much as between 2005 and 2010 (the total surface area of constructed buildings was 26,7 square meters) (Semenkevich [?]). According to IEA information paper "Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings", in the countries with high construction activities the energy savings are going to have greater impact on the economic situation. In this conditions energy efficiency measures in new buildings can be very cost effective.

Moreover, investment into energy efficiency in new building stock is justified by the fact that "over fifty years the changes within a building cost three times more than the original building" (University of Oslo 2010). It means that careful and smart design of building structure with special attention to energy efficiency achieved through implementation of building codes can help to achieve significant savings during operational phase, because the building structure is not likely to undergo significant changes during buildings lifetime in comparison with other building components such as services and space plan.

Picture 1 demonstrates Life Cycle Costing of a building during a fifty-year period: "the Structure expenditure is overwhelmed by the cumulative financial consequences of three generations of Services and ten generations of Space plan changes. It proves that "architecture is actually of very little significance – it's nugatory" (Duffy and Tenoy 1989).

Picture 1. Life Cycle Costing of a Building.




Source: Duffy, F. and Tenoy, A. 1989. DEGW. The changing city. Bullstrode: London

Although the aforementioned information justifies the choice of the new buildings as the main target for energy efficiency improvement, it doesn't eliminate the potential for improvement in existing buildings. Moreover, it takes significant amount of time for new building stock to demonstrate energy savings through energy efficiency improvements

(IEA 2005b), especially it's the case in the countries where old building stock represents the major share, like in Belarus. Therefore, focus of the policy tool on new buildings only will have a limiting effect, and it is highly recommended to consider renovation works during the design of the building codes (EURIMA 2006).

## 3.3 Building codes as a policy tool for improvement of energy efficiency

The choice of the policy tool for energy efficiency improvement in the building sector in Belarus was predetermined by the country's historical development and previous experience with regulatory mechanisms in all sectors of state economy, including building sector. After the collapse of Soviet Union Belarus underwent partial transition towards market economy. The state preserved most of the features of centrally planned economy with government control over all state sectors (ETF 2009). Building codes in Belarus (so called SNIPs or GOSTs) were inherited from Soviet period and did not include minimum requirements for energy efficiency. Nowadays Belarus is experiencing transformation of its building codes attempting to incorporate energy efficiency requirements into national building codes and harmonize them with European building codes.

### 3.3.1 Building codes: definition and scope

The concept of building codes is addressed in most of the research literature on improvement of energy efficiency in building sector. Due to a relatively short period of experience with application of building codes to improve energy efficiency in buildings (from 60 years to 0, depending on a country); the literature available on this topic is limited.

Building codes is a regulatory and control policy instrument that regulates the construction or refurbishment of a building, which is also widely used for improving energy efficiency (OECD 2003).
Regarding the definition of building codes it's necessary to specify whether those are general buildings codes or energy-efficiency building codes.

General building codes or standards for new buildings are defined as "a set of rules which address construction safety, fire safety, and occupant health of constructed objects" (IEA 2008). Historically building codes were designed and implemented as a response to fires and natural disasters, to minimize the effect of possible disasters. In comparison with this type of building code, energy efficiency regulations are relatively a new tool.

Energy efficiency building codes, either mandatory or voluntary, set minimum requirements for energy efficiency for all residence or public buildings, or for both, and nowadays are often incorporated into national regular building codes (ACEEE 2010). According to the report, first energy efficiency building codes were related with regulations on occupants' health and addressed insulation, which helped to reduce health problems from air infiltration or moisture or, in the case with countries in cold regions, better insulation helped to prevent diseases connected with inadequate heating of living space. To summarise, the first energy efficiency building codes were introduced as a measure to improve comfort of buildings.

The oil crises of 1973 triggered development of energy efficiency of building codes as a measure to reduce energy consumption in building sector. OECD countries either introduced energy efficiency building codes, or significantly raised the requirements (ADEME 2004).

Nowadays energy efficiency building codes exist in most OECD countries and are being introduced in the developing world as a measure to improve comfort of a building, reduce energy consumptions and CO2 emissions and therefore contribute to combating climate change.

Energy efficiency regulations are either incorporated into regular building codes, or exist as a separate regulation tool (ADEME 2004).

The benefit of incorporation of energy efficiency building codes into regular standards is considerable energy savings during operational phase of a building. If energy efficiency is not addressed during construction of a building, the opportunity for energy savings is lost due to additional costs associated with introduction of energy-efficient measures during operational phase of the building (ADEME 2004).

Energy efficiency building codes underwent evolution from simple standards of building components to more advanced and complex standards (ADEME 2004). They can be classified into several categories regarding

a) in what segments of a building or installations energy efficiency is regulated

b) how energy requirements are formulated (IEA 2008).

Traditionally building codes regulated efficiency of the building envelope, but more complex regulations can also address energy end-use equipment and other components of a construction including "different part of the heating, cooling and ventilation system "(IEA 2008). Still regulation of energy efficiency in the building envelope, which includes external walls, floor, ground deck, windows and doors, remain the main target of building codes. The inclusion of a cellar depends on whether it's heated or not; thermal bridges can be also included into building envelope.

The next level of energy efficiency regulations address HVAC system, which include Heating, Ventilation, and Cooling (Air Conditioning) and aims at maintaining comfortable and healthy indoor climate. Other installations and renewable energy are addressed in a limited number of building regulations, but the final aim is to include all these elements into building codes as it would help to achieve higher level of energy savings and balance energy consumption in all building elements.

There are options among different methods of minimum energy requirements formulation. IEA (2008) classifies building codes into following types: prescriptive, trade-off, model buildings, energy frame and performance:

- Prescriptive building codes set different energy efficiency targets for each single component of a construction. Each target is rigid and should be achieved according with the prescription.
- Trade-off building codes are similar to prescriptive, but the difference is that constructors and designers can achieve better or worse targets than are stated in the requirements.
- In "model building" type of building codes calculations for a model buildings are made according to established requirements. Actual building should aim at reaching the values in a model building.
- Energy frame method "establishes maximum energy loss" which an actual building should not exceed.
- Performance-based building codes establish total requirements of energy consumption of a building. It can be also based on permissible levels of CO2 emissions from a building
- There is a practice of combining different which results in hybrid or mixed models. Hybrids allow designers and constructors greater flexibility and freedom as they can choose a more simple or complex method, depending on a specific situation. Most widely used combinations are energy frame + prescriptive type, prescriptive +energy performance +\or energy frame (it's possible to choose any), performance + prescriptive. Hybrids allow designers and constructors greater flexibility and freedom as they can choose a more simple or complex method, depending on a specific situation.

Slightly different approach to classification of energy efficiency regulations is described in (ADEME 2004). The authors classify building codes into the following categories: envelope component approach, overall envelope approach, limitation of heating/cooling demand and energy performance standard.

- Envelope component approach refers to establishes maximum heat transfer through different parts of a building.
- Overall envelope approach uses the same approach, but regarding the whole building shell.
- Limitation of heating/cooling demand takes into consideration losses and gains from ventilation, passive solar energy and internal heating system. It establishes maximum demand either for a cubic or square meter of leaving space.
- Energy performance standard uses integration approach and considers the whole building together with HVAC system, water heating system; in some cases it even includes elevators and pumps (e.g. EU building Directive).

Some authors (Köppel and Ürge-Vorsatz 2007) avoid complex classification and limit the existing building codes to two types: **prescriptive** and **overall performance-based codes**. This simplification can be explained by the fact that the abovementioned types can be considered as basis for majority of energy-efficiency regulations worldwide due to easy implementation process of prescriptive codes (Gann *et al.* 1998) or creation of better incentives for innovation (Hui 2002).

It's highly challenging to identify which type of building code is better, because each of them has its weak and strong sides.

Some of them do not require complicated calculations and are easy to understand (efficiency based codes). Some can significantly reduce costs on sight but result in increased costs for energy efficiency due to overoptimization of certain construction parts (prescriptive method). Greater flexibility of achieving energy efficiency can be achieved through application of trade-off method. The advantage of the latter is absence of advanced calculations. Flexibility, but on the other hand need in more complicated calculations, increase with application of energy frame and energy performance models.

To achieve better results in energy savings and high compliance with the codes the choice of the type of building codes should be determined by every country's specific needs, the level of experience of policy-makers and designers, and development of the building industry (IEA 2008).

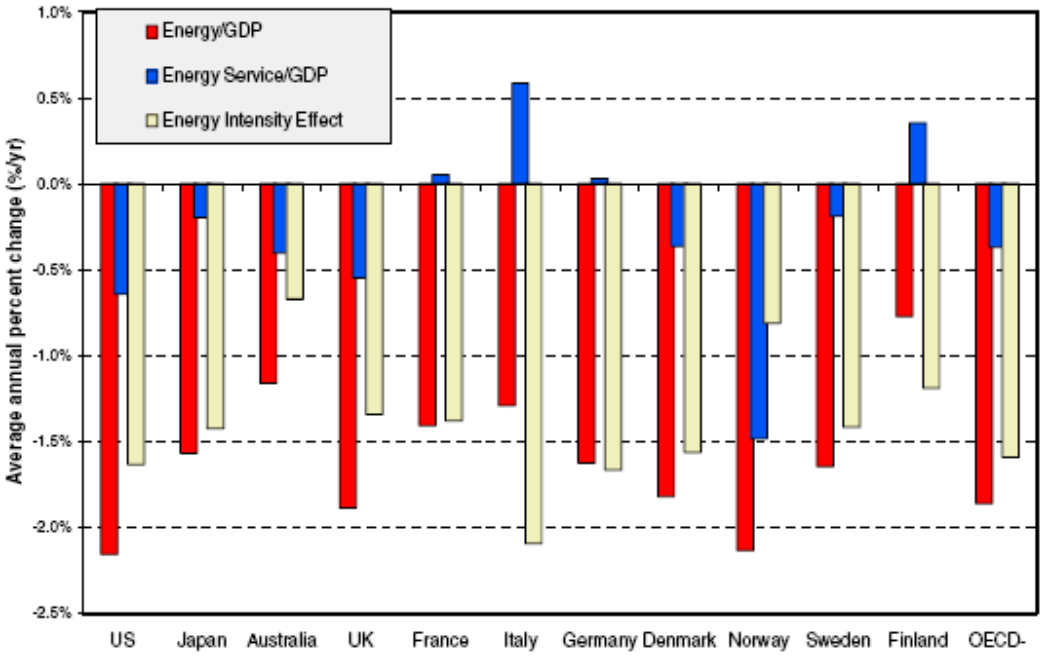
### 3.3.2 Effectiveness of the policy tool. Barriers and success factors

Effectiveness of energy efficiency policies is a highly debatable issue, which received strong criticism from the policy opponents from most IEA countries, although the overall energy consumptions in these countries has significantly reduced mostly due to application of energy efficiency policies, including building codes (IEA 2005).

The decline of energy intensity was proved by the research conducted by International Energy Agency which aimed to analyze "how much of the decline of energy intensity was due to energy efficiency improvements and how much was due to structural changes" (IEA 2005).

Figure 1 demonstrates the result of the analyses and proves that reduction of energy intensity was achieved mainly due to energy efficiency improvements (see "the intensity effect" bars in the graph), rather than structural change (see "energy service/GDP in the graph) (IEA 2005).

**Figure 1. Changes in energy per GDP decomposed into changes in energy service per GDP and energy intensity effect, 1973-1998**



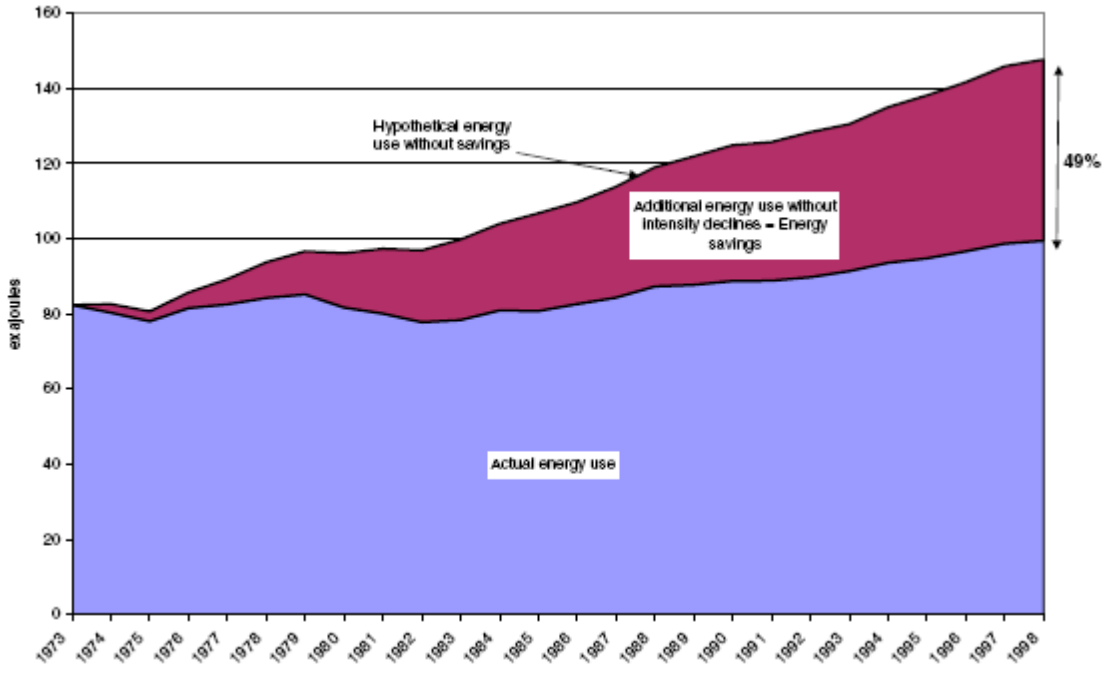

**Source: IEA 2004**

Nevertheless the critics of energy efficiency policies consider them ineffective and sometimes claim them to be a failure. The authors of IEA report (2005) collected and analyzed the most popular critique of energy efficiency policies:

- Rebound effect
- Technological development which will enhance energy efficiency in natural way
- Low discount rate
- Difficulties associated with estimations of energy savings
- Increased use of energy in OECD countries
- Unfairness of some of the policies which discriminate non-participants (e.g. ratepayer- or taxpayer-funded energy efficiency programmes)
- Financial barriers are considered to be a myth used for justification when policies do not work

To disprove each of the criticism advocates of energy efficiency policies have conducted an explicit study and concluded that most of them are "based on superficial linkages rather than rigorous analysis" (IEA 2005). The authors of the report argue that although the overall energy use is increasing, the critics more than inadequately depict the real situation, as energy efficiency policies significantly slow down the process and result in significant energy savings if compare with business-as-usual scenario without applied policies (see Figure 2).

**Figure 2. Actual energy use and hypothetical energy use without intensity reductions in 11**
**OECD countries (IEA 2004)**




**Source: IEA 2004**

Energy efficiency building codes as a policy tool applied to improve energy efficiency in new and existing buildings is also a subject to criticism regarding its effectiveness. As any policy tool it has strong and weak sides regarding effectiveness in energy savings, cost-effectiveness of application and compliance rate. The effectiveness of building codes

vary greatly not only from country to country but even from town, triggering a lot of discussions on possible explanations of this phenomenon.

Among different countries implementing building codes comparatively significant result on energy savings from application of the policy tool was achieved by the USA, where energy consumption in buildings reduced by 0.57 EJ during 10 years of application of building codes from 1990 to 2000 (Geller et al, 2006). In the example of Japan, the policy mechanism was not that effective and resulted in lower energy savings (Nadel 2004).
The energy saving results achieved through implementation of building codes in developing countries are often lower than in the developed world (Deringer *et al*.2004). Moreover, the result often depends not only the country, but even on the location, as the example of China demonstrates better compliance rate with building codes in bigger cities than in small towns (Huang 2007).

The phenomenon is explained by presence of incentives or barriers towards effective building codes implementation, which differ from country to country and arise from specific countries' economic, social, and institutional environments (Koeppel *et al* 2007). According to estimation, the number of barriers in building sector is significantly higher than in any other sector of economy (IPCC 2007).

On one hand, policy instruments are developed to overcome these barriers, on the other hand implementation of the policy tools designed often turns to be less effective due to barriers that hinder effective implementation and reduce compliance rate (Koeppel, and Ürge-Vorsatz 2007). The diversity of barriers to energy efficiency improvements is presented in Table 3. For easier perception and understanding of the nature of the barriers they are divided into categories which are followed by definitions and examples.

Table 4. Taxonomy of barriers that hinder the penetration of energy-efficient technologies/practices in the buildings sector

| Barrier categories | Definition | Examples |
|---|---|---|
| Financial costs/benefits | Ratio of investment cost to value of energy savings | Higher up-front costs for more efficient equipment<br>Lack of access to financing<br>Energy subsidies<br>Lack of internalisation of environmental, health, and other external costs |
| Hidden costs/benefits | Cost or risks (real or perceived) that are not captured directly in financial flows | Costs and risks due to potential incompatibilities, performance risks, transaction costs, etc.<br>Poor power quality, particularly in some developing countries |
| Market failures | Market structures and constraints that prevent the consistent trade-off between specific energy-efficient investment and the energy saving benefits | Limitations of the typical building design process<br>Fragmented market structure<br>Landlord/tenant split and misplaced incentives<br>Administrative and regulatory barriers (e.g. in the incorporation of distributed generation technologies)<br>Imperfect information |
| Behavioural and organisational non-optimalities | Behavioural characteristics of individuals and organisational characteristics of companies that hinder energy-efficiency technologies and practices | Tendency to ignore small opportunities for energy conservation<br>Organisational failures (e.g. internal split incentives)<br>Non-payment and electricity theft<br>Tradition, behaviour, lack of awareness, and lifestyle<br>Corruption |

Sources: IPCC 2007, Carbon Trust 2005.

As it was already stated, different policy tools are designed to address and overcome the barriers towards energy efficiency improvements in building sector. Each policy instrument is designed as a specific remedy for a particular barrier, but the best result can achieved when policy tools are applied in policy packages (Koeppel, and Ürge-Vorsatz 2007).

Table 4 describes the barriers toward energy efficiency and proposes existing policy tools as remedies that could help to overcome the barriers.

Table 5. Barriers to energy efficiency, and policy instruments as remedies.

| Barrier categories | Definition | Examples | Countries* | Possible remedies* | References |
|---|---|---|---|---|---|
| Economic/ financial barriers | Ratio of investment cost to value of energy savings | Higher up-front costs for more efficient equipment<br>Lack of access to financing<br>Energy subsidies<br>Lack of internalisation of environmental, health, and other external costs | Most countries<br><br>Especially developing, but also developed countries | Fiscal and economic instruments, such as tax rebates, Kyoto Flexibility Mechanisms, subsidised loans, regulatory instruments. Or energy price increase, removal of energy price subsidies | Deringer *et al.* 2004 Carbon Trust 2005, IPCC 2007 |
| Hidden costs/ benefits | Cost or risks (real or perceived) that are not captured directly in financial flows | Costs and risks due to potential incompatibilities, performance risks, transaction costs, etc.<br>Poor power quality, particularly in some developing countries | All countries | Appliance standards, building codes (to overcome high transaction costs), EPC/ ESCOs, public leadership programmes | Carbon Trust 2005, IPCC 2007 |
| Market failures | Market structures and constraints that prevent a consistent trade-off between specific energy efficiency investment and energy-saving benefits | Limitations of the typical building design process<br>Fragmented market structure<br>Landlord/tenant split and misplaced incentives<br>Administrative and regulatory barriers (e.g. in the incorporation of distributed generation technologies)<br>Imperfect information<br>Unavailability of energy-efficiency equipment locally | All countries | Fiscal instruments and incentives<br>Product standards<br>Regulatory-normative<br>Regulatory-informative<br>Economic instruments<br>Technology transfer, mechanisms | Carbon Trust 2005, IPCC 2007 |
| Behavioural and organisatio nal barriers | Behavioural characteristics of individuals and companies that hinder energy efficiency technologies and practices | Tendency to ignore small energy saving opportunities<br>Organisational failures (e.g. internal split incentives)<br>Non-payment and electricity theft<br>Tradition, behaviour and lifestyle, Corruption<br>Transition in energy expertise: Loss of traditional knowledge and non-suitability of Western techniques | Developed countries<br><br>Developing countries | Support, information and voluntary action: Voluntary agreements<br><br>Information and training programmes | Carbon Trust 2005, Deringer *et al.* 2004, IPCC 2007 |
| Information barriers* | Lack of information provided on energy-saving potentials | Lack of awareness of consumers, building managers, construction companies, politicians | Especially develop-ping, but also deve-loped countries | Awareness-raising campaigns, Training of building professionals, regulatory-informative | Carbon Trust 2005, Yao *et al.* 2005, Evander *et al.* 2004 |

| | | | | | |
|---|---|---|---|---|---|
| Political and structural barriers* | Structural characteristics of the political, economic, energy system which make energy-efficiency investment difficult | Process of drafting local legislation is slow<br>Gaps between regions at different economic level<br>Insufficient enforcement of standards<br>Lack of detailed guidelines, tools and experts<br>Lack of incentives for energy efficiency investments<br>Lack of governance leadership/ interest<br>Lack of equipment testing/ certification<br>Inadequate energy service levels | Most developing (and some developed) countries | Enhance implementation of standards<br><br>Incentive policy encouraging energy efficiency building design, Enhance international co-operation and technology transfer, Public leadership programmes | Yao *et al.* 2005<br>Deringer *et al.* 2004 |

Sources: Köppel and Ürge-Vorsatz (2007).

According to the table effective remedies can be developed and successfully used to address different types of economic or financial barriers, such as energy subsidies, lack of internalisation of environment, health and other external costs, costs and risks due to potential incompatibilities, transaction costs. Regulatory-normative mechanisms are also considered successful for overcoming different market failures, which prevent "trade-off between specific energy efficiency investment and energy-saving benefits" (IPCC 2007), and political and structural barriers, responsible for the difficulties for energy-efficiency investment (Deringer et al, 2004). Still, due to a variety of barriers in every country it is recommended to apply policies in policy packages (Koeppel, and Ürge-Vorsatz 2007).

As it was already mentioned effectiveness of building codes mostly depends on how successful the process of implementation of the tool is and how well different barriers towards effective implementation of the policy tool are addressed. To address the barriers adequately first of all their presence should be diagnosed, and then remedies for treatment of the barriers should be developed (Koeppel, and Ürge-Vorsatz 2007).

Table 5 gives a summary of barriers towards effective implementation of building, examples of emission reduction and cost-effectiveness, advantages of the policy tool and factors for successful implementation.

Table 6: Summary Table for building codes

| Emission reduction examples | Cost-effectiveness examples | Barriers | Remedies | Advantages | Factors for success |
|---|---|---|---|---|---|
| Cn: 1% of total electricity in Hkg saved<br>UK: 7% less energy use in housing<br>US: 15-16% of baseline, 79.6 $MtCO_2$ in 2000<br>EU: up to 60% for new buildings, 35-45 MtCO s | NL: from -189$/$tCO_2$ to -5$/$tCO_2$ for end-users, 46-109$/ $tCO_2$ for society | - Lack of compliance<br>- Rebound effect | Better enforcement through inspection Combination with incentives | -Lowers transaction costs<br>- very effective | - Regular update of standards<br>- Adaptation to local context<br>- Training/Capacity building<br>- Demonstration programs |

Source: Köppel and Ürge-Vorsatz (2007).

Explicit analyses of all barriers towards building codes effective implementation and potential to overcome these barriers in developing countries is presented in Table 6.

Table 7: Barriers and possible remedies for energy efficiency building codes (EEBC)

| | | Potential for Overcoming Barriers (H=High, M=Medium, 0= no impact on barriers) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| EEBC Implementation Activities | | Barriers | | | | | | | | |
| | | Strong first cost bias | Access to building financing | Lack of long-term donor commitment | Lack of Government Champion | Lack of efficient products | Lack of testing & certification | Limited local energy expertise | Lack of awareness and tools | Potential Abuses |
| 1 | Promulgation | H | 0 | H | H | 0 | 0 | 0 | 0 | H |
| 2 | Compliance Process | 0 | 0 | H | 0 | 0 | 0 | 0 | H | 0 |
| 3 | EEBC Administration and Enforcement Structure | H | 0 | H | 0 | M | M | 0 | H | 0 |
| 4 | Training and Capacity Building | 0 | 0 | H | 0 | 0 | 0 | H | H | 0 |
| 5 | Outreach and Public Information Programs | 0 | 0 | H | H | 0 | 0 | M | H | H |
| 6 | Estimate Energy savings and cost effectiveness | 0 | 0 | H | M | M | 0 | M | H | M |
| 7 | Market Transformation Programs | H | H | H | 0 | H | M | H | H | 0 |
| 8 | Multiple Demonstration Buildings | H | M | M | M | H | M | H | H | M |

Source: Deringer *et al*. 2004

Although efforts put to achieve compliance with building codes can be enormous, and enforcing compliance can be costly, it is justified by the overall benefit for occupants' in the form of reduced energy bill and improved comfort condition, and for governments in the form of significant energy savings (ACEEE 2010).

To achieve best results implementation should be prepared and carefully enforced. Further on, regular monitoring and updates of the building codes are necessary (Koeppel *et al* 2007).

# 4 Results

## 4.1 Introduction

Previous chapters related with the theory of building codes design and implementation.
The purpose of this chapter is to critically analyze the process of energy efficiency building codes design and implementation in Belarus. The chapter includes information on institutional and legislation framework of the policy design, enforcement and implementation in Belarus, and as well as assessment of barriers towards effective policy tool implementation, incentives for compliance and factors for successful implementation. The main source of information for this chapter are interviews conducted with experts, legislative documents and official web-sites of Belarus Ministries, Committees and other official bodies involved into the process of design and implementation of building codes.

## 4.2 Review of institutional, legislation and regulatory framework for the policy design and implementation

### 4.2.1 Institutional Framework

According to UNECE (2010) the main institutional bodies involved into the process of design and implementation of energy efficiency policy in building sector (particularly, building codes) are:

- The President of the Republic of Belarus
- The National Assembly
- Council of Ministers of the Republic of Belarus
- Prime Minister of the Republic of Belarus
- Deputy Prime Ministers of the Republic of Belarus
- Presidium of the Council of Ministers of the Republic of Belarus
- Ministries

- *Ministry of Architecture and Construction*
- *Ministry of Economy*
- *Ministry of Energy*
- *Ministry of Finance*
- *Ministry of Housing and Communal Services*
- *Ministry of Industry*
- *Ministry of Natural Resources and Environmental Protection*

- State Committees of the Republic of Belarus
  - *State Committee on Standardization*
    - *Department for Energy Efficiency of the State Committee on Standardization*
    - *Department for Construction Inspection and Surveillance*
      - *Inspectorates for Construction Inspection and Surveillance*
      - *Unitary Enterprises "Gosstroyexpertiza"*
- Agencies Subordinate to the Council of Ministers of the Republic of Belarus
- Local Administration Bodies:
  - *Regional executive committees*
  - *Municipal executive committees*
  - *Township executive committees*
  - *Rural executive committees*



**The role of the President**

The **President**, the Head of the State issues Decrees, Directives, Instructions and Orders, including those related with energy efficiency, which enter into force as state regulations. The legal documents are legally binding through Constitution of the Republic of Belarus. The President of the State either directly or indirectly (through established institutions) performs control over observance of legal documents. The President also approves funding of the projects and programs for energy efficiency improvement (UNECE 2010).

**The role of the National Assembly**

The **National Assembly** of the Republic of Belarus (or the Parliament) is a legislative and representative institution, which is in charge of basic principles o the state's environmental and energy policies. The issue and preparation of state regulation on energy efficiency is realized through active participation of the National Assembly (UNECE 2010).

**The role of the Council of Ministers**

The Council of Ministers of the Republic of Belarus is the main institution of the government of the state. It's performs executive functions, and its responsibilities include implementation of state policies and programs, and coordination of all the activities performed by Ministries and other institutions of state administration involved into policy implementation. The Council of Ministers is also responsible for evaluation of reports on implementation of state energy efficiency policy submitted by the Department for Energy Efficiency of the State Committee for Standardization. The Council of Ministers is the body to approve specific assignments in the framework of implementation of energy efficiency policy prepared by the Department for Energy Efficiency.

The Council of Ministers is in charge of setting specific duties according to approved targets to other subordinate institutional bodies, such as Ministries and Departments concerned, so called branch regulation structure, Regional Authorities and the Minsk city Executive Council (territorial regulation structure) (UNECE 2010).

Further on, each Ministry and Regional Authority includes special Departments and Committees, which are responsible for implementation of the assignments in sphere of their responsibility. They also assign subordinate bodies, institutions and enterprises to incorporate "in their business plans energy efficiency goals and plans that will enable them to meet their targets" (UNECE 2010).

The Ministries and Committees directly involved into the process of energy efficiency policy design and implementation are Ministry of Economy, Ministry of Finance, Ministry of Energy, Ministry of Housing of Communal Services, Ministry of Architecture and Construction and State Committee of Standardization.

**The role of the Ministry of Energy**

Being the main institutional policymaker in the energy sector in Belarus, the Ministry of Energy is in charge of Preparation and implementation of the general framework in the energy sector (UNECE 2010).

**The role of the Ministry of Economy**

The main responsibility of the Ministry of Economy in the sphere of energy policymaking is setting and regulating of energy tariffs for final energy users (Economic commission for Europe. Policy reforms for energy efficiency investments). It also controls the process of implementation of projects and programs related with energy efficiency improvement and reports to the Government and the President on the achievements of the implementation of the programs. The Ministry's duty, as well as the Ministry of Finance, is determination and approval of funding of national energy efficiency programs and projects (UNECE 2010).

**The role of the Ministry of Finance**

As it was already mentioned, the Ministry of Finance is responsible for determination and approval of funding of national energy efficiency programs and projects (UNECE 2010).

**The role of the Ministry of Natural Resources and Environmental Protection**

Regulation of exploitation of natural resources and provision of environmental protection through following state ecology policy are the main responsibilities of the Ministry of Natural Resources and Natural Protection. The Ministry is in charge of control over of activities in the sphere of energy efficiency improvement (UNECE 2010).

**The role of the Ministry of Housing and Communal Services**

The Ministry of Housing and Communal Services is in charge of design and application of the national policy of housing and communal services (heating system, replacement of old pipes, regular refurbishment of buildings, improvement), and implementation of energy efficiency improvement measures in new and existing building stock (UNECE 2010).

**The role of the Ministry of Architecture and Construction**

The Ministry of Architecture is and Construction is responsible for research and development activities in the sphere of improvement of energy efficiency in building sector, design, construction and refurbishment of energy efficient buildings, upgrading of existing building codes and harmonizing them with the European Directive, and overall control over proper implementation of projects and programs in the sphere of energy efficiency improvement in building sector. The Ministry is subordinate to the Council of Ministers and therefore reports on the achievements in the respective fields to the Council of Ministers (Government of the Republic of Belarus 2009).

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**The role of the Local Administration Bodies**

Local administration bodies (regional executive committees, municipal executive committees, township executive committees, rural executive committees*)* have a possibility to conduct initiatives in the field of energy efficiency on regional and municipality level. Moreover, local administration bodies are obliged to realize assignments in sphere of energy efficiency and report to respective bodies on the achieved results (UNECE 2010)..

**The role of the State Committee on Standardization**

The State Committee for Standardization of Belarus (Gosstandart) is the result of fusion of three institutions:

-Committee for standardization metrology and certification under the Council of Ministers of the Republic of Belarus

-Committee for energy efficiency under the Council of Ministers of the Republic of Belarus

-Department of the state constructional surveillance under the Ministry of Architecture and Construction of the Republic of Belarus.

The fusion of the institutions was established according to the Decree N. 289 of the President of the Republic of Belarus in 2006 "On the structure of the Government of the Republic of Belarus".

According to the official site of the Committee, the State Committee for Standardization carries out state general policy "in technical regulation, standardization, metrology, conformity assessment, energy efficiency, on implementation of surveillance in construction and compliance of projects and estimates with regulations and standards, as well as supervision of rational use of fuel, electric and heat energy".

The Department For Energy Efficiency of the State Committee for Standardization is the main administrative body which carries out implementation as well as monitoring of state policy on energy efficiency, particularly, in building sector, including supervision of "rational use of fuel, heat and electrical power" (UNECE 2010).

The Department of Energy Efficiency of the State Committee of Standardization is the institution to which responsible sections of Ministries, Departments and Regional, District and City Executive Committees and enterprises report on conducted assignments. The task of the Department of Energy Efficiency is also to conduct follow-up of realized programs and check the reports regarding the results; the overall progress is reported by the Department of Energy efficiency to the Council of Ministers (UNECE 2010).

There are also six regional Divisions of the Department of energy Efficiency and the capital city Division which coordinate all the activities in the field of energy efficiency on regional, district and city level. The Divisions realize monitoring and follow-up of the activities on energy efficiency at regional level (UNECE 2010).

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### 4.2.2 Legislation and regulatory framework

The main legal documents that frame state energy policy are as follows:

1) Energy Program of the Republic of Belarus for the period up to 2010 (approved in 1992)
2) Three state Republic Programs for energy savings:

- State Republic program for energy savings for the period from1996 to 2000
- State Republic program for energy savings for the period from 2001 to 2005
- State Republic program for energy savings for the period from 2005 to 2010
-

The programs aimed at reduction of energy intensity and underlined the need of development of renewable energy sources in Belarus. The specific aim directly related with energy efficiency in building sector was "reduction of energy consumption in the residential sector and in heat supply utilities" (UNECE 2010).

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3) The Law of the Republic of Belarus on Power Saving (adopted in 1998) according to which "a complex of national programs was elaborated and a national energy saving monitoring and administration system was established" (UNECE 2010).
4) The Conception of Energy Security and Increased Energy dependence in Belarus, 2006-2010 (adopted in August 2005)

5) The Strategy of the Energy Security of the Republic of Belarus until the year 2020 (Decree N. 433 of 17 September 2007)
6) Directive N. 3 of the President of Belarus "Economy and Thrift - the Main Factors of Economic Security of the State" (Decree N. 3 of 14 June 2007)

7) Development Program of System of Technical Rate Setting, Standardization and Compliance Assessment in the Energy Saving Field, which aims at development and upgrade of technical standards and norms in energy efficiency field. The Program stipulates that the "state standards comply with the international and European standards and EU Directives" (UNECE 2010).

According to the abovementioned documents the main concern of the energy strategy of the Republic of Belarus is ensuring security of energy supply through diversification of energy supply sources, efficient use of Belarus' geo-political position as a transit country between Russia and the European Union, and reduction of energy intensity of Belarus' economy through improvement of energy efficiency, which is possible to achieve by means of improvement of the state's deteriorated energy system and efficient use of energy savings.

The need for improvement of energy efficiency, particularly, improvement of energy efficiency in building sector, was reflected in a number of strategy and policy documents as well as programs and action plans, which either directly or indirectly address energy efficiency in building sector. The body responsible for policies regarding energy efficiency is the Department of Energy Efficiency of the State Committee for Standardization. The main legal documents that address this issue are as follows:

1) The Law on Energy Saving (1998) which sets the regulatory framework for development of energy efficiency in the state
2) The National Program on Energy Saving for the period of 2006-2010 (Resolution N. 137 of 2 February 2006)
3) Main Directions of National Spatial Planning Policy for the Period of 2006-2010 (2006)
4) Ministerial plans for particular industries

5) Municipal Programs on Housing Renovation, which prescribe measures for refurbishment and improvement o energy efficiency of existing housing stock in Belarus
6) The Integrated Program on Design, Construction and Renovation of Energy Efficient Residence Buildings in the Republic of Belarus for the Period of 2009-2010 and the prospect of 2020
7) The Resolution N. 706 (1 June 2009 )of the Council of Ministers on Adoption of The Integrated Program on Design, Construction and Renovation of Energy Efficient Residence Buildings in the Republic of Belarus for the Period of 2009-2010 and the prospect of 2020

**The Frame of the Program on Design, Construction and Renovation of Energy Efficient Residence Buildings**

The Integrated Program on Design, Construction and Renovation of Energy Efficient Residence Buildings in the Republic of Belarus for the Period of 2009-2010 and the Prospect of 2020 (further - the Program) is the first legal document in Belarus which frames energy efficiency policy in building sector. The Program was developed by Ministry of Housing and Communal Services, Ministry of Architecture and Construction, State Committee on Standardization, Department for Energy Efficiency of the State Committee on Standardization, Ministry of Energy, Ministry of Industry, Regional executive committees, Municipal executive committees and other stakeholders (Government of the Republic of Belarus, 2009) .

The key priorities of the Program are to improve energy efficiency in the building sector which will result in decrease of energy use during the operational phase of buildings and improvement comfort conditions.

According to the Program (Government of the Republic of Belarus, 2009) buildings are considered to be energy efficient if energy consumption for heating does not exceed 60 kWh/m2 up to the year 2020 and with energy consumption 30-40 kWh/m2 after 2020.

The other energy efficiency indicators of the Program are as follows:

Thermal resistance of exterior walls – 3.2 m2*C/W
Thermal resistance of combined coverings, attic overlaps and passage overlaps - 6.0 m2*C/W
Thermal resistance of overlaps over unheated basements and technical underground cellars – 2.5 m2*C/W (Government of the Republic of Belarus, 2009)

For effective implementation of the Program (Government of the Republic of Belarus, 2009) the process of implementation is logically divided into 3 blocks:

- measures for provision of construction of energy efficient residential buildings for 2009-2010 and the prospect of 2020 (upgrade of existing building codes, research and development for ensuring construction and refurbishment according to new energy efficiency building codes, construction and refurbishment of energy efficient residential buildings; Annex 1),
- expected volume of construction of energy efficient buildings for the period 2009-2015 (Annex 2)
- regional plan of construction of energy efficient buildings for the period 2009-2015 and the prospect of 2020 (Annex 3).

The Program presents evaluation of current state of energy efficiency in building sector and stipulates the need for improvement in this field, stating, that transition towards construction of energy efficient buildings is the most feasible solution of current problems in building sector (high level of energy consumption, ineffective ventilation systems, inadequate comfort conditions) (Government of the Republic of Belarus, 2009) .

The main aim of the implementation of the Program is reduction of energy consumption for heating to the level of 60 kWh/m2 up to the year 2020 and to the level of 30-40 kWh/m2 after 2020. These targets are planned to be achieved by means of application of modern architectural and technological solutions (Government of the Republic of Belarus, 2009).

The Program (Government of the Republic of Belarus, 2009) stipulates to:

- improve existing building codes (SNIPs and GOSTs)
- adopt new production practices to provide technological base for construction of energy efficient buildings
- develop new approaches towards energy efficient buildings' design in order to meet new energy efficiency requirements
- introduce energy passports for buildings
- improve the quality of construction process
- ensure regular monitoring during the process of construction and first three years of operation of energy efficient buildings
- introduce practice of individual record of heat consumption in flats (in each apartment instead of in the whole building) and individual payment system

The duties and responsibilities as well as institutions and bodies in charge of them are presented in Table 8.

Table 8. Institutions and Bodies Responsible for Implementation of the Program

| N. | Institution | Duties and responsibilities | Time frame |
|---|---|---|---|
| 1 | Ministry of Architecture and Construction | 1.Submit annual reports on implementation of the Program to the Council of Ministers | 25 March each year |
| | | 2.Provide control over proper implementation of the Program | During the whole period |
| | | 3.Improvement of existing building codes | June 2009-June 2010 |
| | | 4.Research and development | June 2009-December 2010 |
| | | 3.Construction and refurbishment | 2010-2020 |

| | | | |
|---|---|---|---|
| 2 | Ministry of Housing and Communal Services | 1.Improvement of existing building codes | June 2009-June 2010 |
| | | 2.Research and development | June 2009-December 2010 |
| | | | |
| | | 3.Construction and refurbishment | 2010-2020 |
| 3 | Ministry of Energy | 1. Research and development | June 2009-December 2010 |
| 4 | Ministry of Industry | 1. Research and development | June 2009-December 2010 |
| | | 2.Construction and refurbishment | 2010-2020 |
| 5 | State Committee on Standardization | 1.Improvement of existing building codes | June 2009-June 2010 |
| | | 2. Research and development | June 2009-December 2010 |
| | | | |
| 7 | Regional executive committees | 1.Submit annual reports on implementation of the Program to the Ministry of Architecture and Construction | 15 March each year |
| | | 2.Research and development | June 2009-December 2010 |
| | | 3.Construction and refurbishment | 2010-2020 |

| | | | |
|---|---|---|---|
| 8 | Municipal executive committees | 1.Submit annual reports on implementation of the Program to the Ministry of Architecture and Construction | 15 March each year |
| | | 2. Research and development | June 2009-December 2010 |
| | | 3.Construction and refurbishment | 2010-2020 |
| 9 | National Academy of Sciences of Belarus | 1. Research and development | June 2009-December 2010 |

**Financing of the realization of the Program**

As stated in the Integrated Program (Government of the Republic of Belarus, 2009), the main sources of financing of the measures on implementation of the Program are:

- National and Regional budgets
- State target funds
- Funds of manufacturing enterprises
- Other investments

Financing of improvement of technical building codes is covered by Innovation Fund of Ministry of Architecture and Construction. The budget is estimated to 555 million Belarusian rubles.

The budget of research and development measures is estimated to 2870 million Belarusian rubles and will be covered by Innovation Fund of Ministry of Architecture and Construction(Government of the Republic of Belarus, 2009).

Financing of launching of production of new constructing materials and engineering equipment for energy efficient buildings will be also covered by Innovation Fund. The

production of new constructing materials and engineering equipment for energy efficient buildings will be financed by manufacturing enterprises and other investors(Government of the Republic of Belarus, 2009).

Financing of the measures on design, construction or refurbishment of energy efficient residence buildings is appointed annually according to estimated financing of construction\refurbishment of residence buildings stipulated by the plan on construction measures adopted by the Decision of the Council of Ministers and National Bank of the Republic of Belarus (Government of the Republic of Belarus 2009).

**Expected outcomes**

According to the Program, the transition towards energy efficient construction practices will result in significant energy savings for heating during operational phase of the residence buildings. The energy savings are estimated to 178 tonnes of oil equivalent and the total surface of new energy efficient buildings is estimated to 10.18 million square meters. Apart from energy savings, the consumers will benefit from improved comfort and indoor climate of new energy efficient residence buildings (Government of the Republic of Belarus 2009).

Accomplishment of these goals requires significant administrative effort for improvement of legislation framework for energy efficiency in building sector, development of complementary regulation in this field, creation of a system of incentives for compliance with building codes and mechanisms for overcoming barriers towards successful implementation of new building codes. All this requires mobilization of all sectors of economy related to energy efficiency, constructing process, and of course, very large investments in all spheres. Moreover, the Program doesn't determine measures for successful policy implementation, and doesn't touch upon budget for realization of these measures (Government of the Republic of Belarus 2009).

## 4.3 Results of the interviews conducted with experts related to the process of energy efficiency improvement in Belarus

Current chapter presents the results of the interviews conducted with the people, involved into the process of building codes design, implementation and enforcement in Belarus. The interviewees are represented by experts from government sector, R&D organizations, NGOs, private sector and construction companies and give their critical opinion on the measures on energy efficiency improvement in building sector.

The interviewee's responses are presented below, while the names and positions of the interviewees are provided in the "Methodology" section of the present research. The analyses of the interviews are conducted in the "Discussion" section of the present research.

### 4.3.1 Government sector

*Anatoly Nichkasov, Minister, Chairperson of the Board, The Ministry Of Architecture and Construction.*

According to Mr. Nichkasov, the need of transition to a new system of standardisation in the building sector is trigged by the desire of Belarus of economic integration with Europe. The integration would help to increase exports of goods and services to the world market, as well as to contribute to the creation of favourable investment climate in the country. This would attract investors interested in build new facilities in the country of social, industrial and residential infrastructure.

Belarus is known to be preparing to join the WTO (World Trade Organization). One of the conditions of entry into the organization is the presence of national technical legal regulations identical with similar international and European norms and standards.

Belarus approved by over 220 European standards for building materials and products, methods of testing in the field of construction industry. Thus, our exporting companies today have the right to apply the CE marking to their products such insulation materials, cement, lime, glass, and a wide range of metal products, ceramics and concrete.

Regarding the problems of new building codes Mr. Nichkasov mentioned their over-regulation and over-specification. This is the main difference from the European standards, which have only general requirements and the constructors have a greater degree of flexibility in technical solutions.

The Ministry organized systematic work for harmonization of national regulations with European ones. The headquarters headed by the Minister is set up; weekly meetings are held at which the results of the work are carefully examined.

The adoption of new regulation is only the initial stage. The most difficult task is practical implementation of the regulations. Both construction companies and industrial enterprises have to adapt new realities. In this regard, a comprehensive program was developed, implementation of which depends on all the specialists of the complex.

The program consists of four main sections. It starts with the harmonization of national regulations with EU standards, the second is the adoption and implementation of the Eurocodes and European standards in the practice of design and construction, and the third is organization of training, retraining and advanced training of professionals of the building sector. The fourth section is introduction of European standards at the enterprises of the construction industry.

*Victor Okushko, Director of the Department for Energy Efficiency of the State Committee on Standardization.*

Mr. Okusko stated that responsible organizations face serious difficulties regarding implementation and compliance with the new regulations. The problems occur in the

industrial sector, which is not ready to provide construction materials satisfying new needs. Some of the industrial companies even requested grace period to adapt their production facilities to new requirements. Due to such problems there is a need to delay the implementation of the program. Because of the policy of import substitution practiced in Belarus, there is a need to go through the process of adaptation and retrofitting of national building industry in order to avoid import of building materials from abroad. Soft and slow implementation of the program gives a possibility to industry to introduce new technologies that would satisfy the new standards.

At the stage of the Program's development the needs of building companies are taken into consideration. Their representatives have a possibility to express their opinion at regular meetings.

The control on the compliance with the standards is conducted by State construction watchdog and State expertise review. The projects that do not comply with the new building codes in respect energy efficiency will not be approved. This is the only means to stimulate energy efficient buildings construction, as shareholders are not interested in investing into energy efficient construction due to a long pay-back period.

Mr. Okusko denies presence of any barriers towards the effective implementation of new building codes. Those companies which will not be able to comply with the standards will not get construction permission.



### *4.3.2* R&D

*Roman V. Kuzmichyou, Deputy Director Republican unitary enterprise "Institute NIPTIS of a name of Ataev S.S, Ministry of Architecture and Construction*

Mr. Kuzmichyou stated that the process of development of building codes is not always effective due to subjectivity of:

1) Developers/policymakers.

2) Experts, approving the developed standards. The developers of the standards have a possibility to choose between experts, who would conduct peer review and approval of the document. Logically they choose those who would support their ideas rather than opponents. In the result the developed standards are ratified without any independent peer review.
3) Scientists. Numerous errors occur in theoretical and scientific approaches as well as in calculations. Different scientists have different positions, influenced not by scientific truth but by lobbyism of industrial companies. As the result there too many unnecessary standards and regulations, which were developed only in the result of lobbyism of industrial enterprises.

The main difficulty of compliance to the regulations is connected with their number. The disadvantage of the regulations is that the requirements often contradict each other and as a result of designers face difficulties in undergoing expert review of construction projects. The expert review is based on huge number of regulations, often contradicting each other. In such a situation technically advanced projects with cheap and energy-efficient solutions can receive no approval as it's next to impossible to comply with all existing regulations.

In this situation the best way out is to directly refer to European standards and the Eurocode, skipping the Belarusian construction regulations. However, the design process according to Eurocode causes even greater problems. The Eurocode was translated into Russian without any adaptations to Belarusian reality. Most problems occur due to the mismatch of terminology.

Another problem is related with the order of insulating measures. The buildings are renovated individually and not in entire neighborhoods. The heat supply is regulated at CHP for the whole heating district and cannot be controlled in individual houses. Due to aforementioned the renovation measures improve only comfort conditions and actual energy savings are insignificant.

One more actual problem of the quality of energy efficiency building codes is lobbyism of industrial companies. Raising the problem of energy efficiency improvement created competition among the manufacturers of insulation materials, which triggered lobbyism of their products by overstating the coefficients of thermal insulation (the procedure of laboratory tests was violated to get better results, respectively). As a result, according to Belarusian standards insulation materials have inadequate coefficients of thermal resistance.

E.g. There was made a decision to increase the value of thermal resistance for gas silicate from 2 to 3.2 W/(m2 · °C). The new value was achieved not by means of wall thickness increase (it remained 40 cm), but rather by modification of theoretical calculations (fraud of laboratory tests). The targeted value of thermal resistance was achieved thanks to the change of conditions of laboratory test procedures. In the result energy savings are nominal rather than actual. The energy saving effect is very insignificant, and basically it is on paper.

The specialists of NIPTIS are aware of this situation but failed to influence the adoption of appropriate techniques for measuring the coefficients of building materials. The table of materials properties remains the same, because the revision would "result in a scandal" because too many interests are involved, starting with manufacturers of building materials and finishing with the entire state system.

There is no real possibility to conduct control on the actual thermal resistance of walls, because this value cannot be measured in real-life conditions. The value depends on the properties of materials, which are measured in laboratories in specific conditions. The conditions of laboratory tests can be changed purposefully in order to receive targeted values. To put it straightforward this is the case of fraud in improvement of energy efficiency standards. There is no possibility to prove the fraud other than to assess the standards calculation methodology, which is not being done due to resistance of interested parties.

Nevertheless qualified specialists attempt at applying the correct thickness of insulation when conducting insulation measures. However, there is always a risk that expert evaluation wouldn't approve such projects, since it implies the overrun of fixed budget, which is another barrier towards energy efficiency in buildings.

In this case, the expert evaluation of construction/renovation projects becomes a barrier towards the improvement of energy efficiency. One should realize that it's not expert evaluation procedure to be blamed as experts only follow the prescriptions. The real cause of the problem is in the gaps in the scientific approaches applied as well as in the calculation methodologies.

The conclusion is the following: the transition to the new standards exists only on paper, although in reality the construction is conducted according to the standards. Such a situation leads to very insignificant improvements regarding actual energy savings.

*Vitaliy A. Gutkouskiy; Deputy Director, Chief Project Engineer, Doctor of Technical Sciences, Deputy Director, Chief Project Engineer, Doctor of Technical Sciences.*

According to Mr. Gutkouskiy, the problems that exist in the field of energy efficiency in buildings are of bureaucratic nature. The numerous officials involved into the process of building codes design and implementation unthinkingly perform their duties and follow orders. Their priority is reporting and the quality of monitoring of the process of introduction and implementation of the standards is not prioritized.

The quality of the standards leaves much to be desired. For example, on the 25 of May 2009 the Ministry of Architecture and Construction subdued to the Council of Ministers adopted changes to heating and ventilation standard. According to the new standard the energy consumption in new energy efficient buildings should not exceed is 40 KW/m2 per year. In this case the term "per year" is not applicable. It's more correct to make calculations per a heating season, which comprises 198 days in Belarus. In June 2009 the Council of Ministers issued a Resolution, determining the aims and objectives, and

criteria in the sphere of energy efficiency. According to this document the energy consumption in energy efficient buildings doesn't exceed 60 KW/m2 per year. In the result we have two documents with 1.5 divergence of energy efficiency standards issued almost simultaneously. The reason for such contradictions in regulations is lack of coordination of officials' actions and objectives.

The aforementioned Resolution was directed to the Ministry of Architecture and Construction for implementation. The Ministry failed to perform any active actions or measures on implementation of the Resolution.

Another problem is that the regulations take into account only energy used for heating and ventilation. The use of electric energy is not addressed. Yet electricity is actively used in heating and ventilation processes. In the result we save energy on heating and ventilation but at the same time the overuse of electricity which is not addressed by the standards.

Some of the incentives to stimulate energy efficiency do exist nowadays, for example bank loans on preferential conditions for building of energy efficient apartments. Other possible tools are methods of enforcement, penalties, installation of energy meters. One of the barriers is existence of cross-subsidization of energy prices.

Another problem that exists is rejection of modern technologies in the field of energy efficient. For example, heat pumps, that proved to be more effective, than conventional heating practices, are not used of Belarus. The reason for that is discrepancy of prices for heat and electricity, recovered by conventional methods of burning fossil fuel. The electricity price in the country is 5 times overstated in comparison with world prices. As geothermal energy is recovered with application of electricity, the price of the recovered energy (taking into account the electricity used) is much higher than the heat, generated at heat plants. The reason for such misbalance of energy prices is existence of some conventional practices and interests, which are not being reconsidered.

One more barrier towards energy efficiency measures in building sector is inability of tenants and owners to influence policy-making. Another barrier, as it was already mentioned, are inadequately low energy prices for population, which results in too long pay-back period of energy efficiency investments.

The main problem of policymaking in Belarus is that the focus is on politics, personal interests and standard procedures, rather than economic efficiency. The particular problem of building sector is negligent attitude and lack proficiency of builders and other specialists, which results in costly building practices.

Lack of financial motivation is also a problem. Around 80% of all people are employed in government sector, where everyone receives a fixed salary regardless working productivity. Here we face the so-called "the problem of commons".

### 4.3.3 Building companies, representatives of business sector

*Vasiliy Ustinchick, Deputy Director, Open Joint-Stock Building Company "10 UNR", supervisory body.*

Mr. Ustinchick stressed difficulties related with understanding Belarusian bureaucratic system regarding energy efficiency in buildings. He claimed, that the adopted regulations contradict each other. In 2009, the Council of Ministers adopted the Resolution to make building standards more rigorous. According to the Resolution the allowed energy consumption for heating and ventilation is 60 KW/m2 per year starting with July 2010 to the year of 2020. In the same year there was another document adopted with the norm 40 KW/m2 per year. Some documents declare immediate shift to energy efficient construction (that all newly constructed buildings must comply with the norms), while others declare graduate transition.

Another problem that Mr. Ustinchick mentioned was lack of interest from the side of officials to building companies voluntary actions in the field of improvement of energy efficiency. The regular conferences devoted to energy efficiency issues are not attended by representatives from the Ministry of Architecture and Construction, or Department of Energy efficiency, or other involved institutions.

Starting with the year of 1996 the company Mr. Ustinchick works at had introduced and effectively exercised energy efficiency practices that satisfied the adopted standards. The officials letters sent to administrations with proposals of construction of energy efficient buildings were ignored.

The visible results of the adopted Program on Energy Efficient Construction are 4 experimental buildings. One of the buildings is constructed for scientific purposes, which doesn't seem to be a feasible approach to invest into developing of the technologies which already exist and have already been implemented in foreign countries.

*Konstantin Kolomietc, Vice-President, Minsk Business Union, Ministry of Economy, Research institute.*

One of the barriers towards energy efficiency in buildings, according to Mr. Kolomietc, is the fact, that population is demotivated by presence of high subsidies of payments for central heating.

Another barrier on the way of introduction of novel energy efficient technologies is conservativeness of building industry. In Belarus the construction process is subdued to official plans, which prescribe how many buildings and of what type should be built. In addition to the bureaucratic and administrative barriers there's also limited technological potential of Belarusian companies. There is a need of technological improvements in all sectors of economy, which requires investments, which are limited in Belarus, and also take a long period of time. The reason for gradual introduction of new energy efficiency standards is lack of investments in building sector.

Another problem worth mentioning is absence of preferences in energy-efficient housing among average Belarusian people. The cost of energy efficient buildings is approximately 10% higher.
There are several options how the barriers can be overcome.

Banks are willing to provide preferential loans for construction of energy-efficient buildings, but there are no incentives from the Government\ National Bank of the Republic of Belarus. Therefore nowadays banks provide only loans at market interest rates for energy efficiency needs.

One more barrier is institutional disintegration. The problem of the agencies involved in energy efficiency policies design and implementation (Energy Department) is lack of finances: they exclusively govern the standards and don't have financial power for implementation of the standards. Under such conditions, the operation of agencies becomes inefficient as the agency is unable sustain the required amount of energy-efficient buildings construction. The problem is absence of integration with financial institutions.

### 4.3.4 NGOs

*Natallia Andreyenka, Project manager, NGO "Ecoproject Partnership"*

According to Ms. Andreyenka the Program on design of Energy Efficient Residence Buildings the building frames energy efficiency policy in building sector, starting with the year 2012 all new buildings should comply with new standards. The energy used in experimental buildings that have already been constructed according to new standards insignificantly exceeds the planned energy consumption.

The cost of the apartments in energy efficient buildings is to some extent higher than of regular apartments. The barrier that Ms. Andreyenka mentioned is lack of integration of the process of energy efficiency building into bank system of the country.

*Evgeniy Lobanow, Project manager, NGO "Center for Environmental Solutions"*

At the interview Mr. Lobanov underlined, that the activity of NGOs in Belarus focuses on the work with general public therefore the problem of design and implementation of building codes is not the target area of Mr. Lobanov's organization. The policies are implemented in top-down approach only and general public cannot influence the process. The absence of tools of stimulation of energy efficient behavior of general public is a serious barrier towards energy efficiency in Belarus in general, not only in building sector.

*Yevgeny Shirokov, President, Belarusan branch of the International Academy of Ecology, Minsk Head of Belarusian Division of the International Academy of Ecology, Head of Belarusian HABITAT Center*

The introduction of new standards in the field of energy efficiency in buildings is triggered by desire of Belarus to join WTO (World Trade Organization), which demands form Belarus to comply with certain requirements and economic parameters. Joining WTO implies increase of prices for energy carriers for Belarus, which, taking into account deteriorated and backward technologies, will result in enormous economic losses. In this situation introduction of new building codes is not effective measure for improvement of energy efficiency in buildings. The new standards are an effective measure only at business as usual scenario, which presupposes preservation of cross-subsidization of energy costs for population. According to Mr. Shirikov's predictions the situation will be deteriorating and the government will not be able to maintain the existing system.

Another critique of conventional energy-efficient building approach is disregard of the problem of high level materials toxicity, which leads to sick building syndrome.

Mr. Shirokov has developed and attempted to introduce in Belarus the practice of construction of straw-bale houses, which is a cost-effective, available, environmentally friendly and safe solution with better insulation properties than conventional construction methods.

Advantages of straw-bale construction over conventional building systems include the renewable nature of straw, cost, easy availability, and high insulation value. Mr. Shirikov's developments met rigorous opposition from building sector, which is explained by lobbyism of monopolies and conservativeness of building sector.

# 5 Discussion. Assessment of incentives and barriers towards energy efficiency in buildings

The following chapter presents the results the interviews with experts conducted during research period and presented in chapter 4.3. The chapter aims at systematization of success factors, as well as barriers towards implementation of new building codes in Belarus.

## 5.1 Preconditions for introduction of new building codes

The results of the interviews helped to identify the following factors that triggered the process of adoption of new standards in the field of energy efficiency in buildings. The harmonization of Belarusian national standards with international and European ones is a measure aimed at:

1) Economic integration with Europe to increase exports of Belarusian goods and services to the world market (Nichkasov pers. com).
2) Creation of favorable investment climate that would help to attract investors interested in building new facilities in the country of social, industrial and residential infrastructure (Nichkasov pers. com)..
3) Preparation to join the WTO (World Trade Organization) which requires presence of national technical legal regulations identical with similar international and European norms and standards (Nichkasov pers. com).

## 5.2 Barriers indentified and solutions for overcoming

The barriers identified during the interviews are presented in the Table 9. The barriers are followed by recommendations on their overcoming.

Table 9. Barriers and problems identified and recommendations of overcoming them.

| Barriers identified | Recommendations of overcoming the barrier | Type of a barrier |
|---|---|---|
| Over-regulation and over-specification of building codes, lack of flexibility which hinders application of innovative solutions and forces designers to stick to traditional ineffective practices (Nichkasov pers. comm.). | Incorporation of greater flexibility into the existing standards. Offering a choice between prescriptive and trade-off building codes, model buildings, etc. | Barrier associated with quality of the standards, |
| Technological unreadiness of construction companies and industrial enterprises to comply with new standards (Okusko pers. comm.). | Soft implementation of new requirements, support, information and voluntary actions, technology transfer actions, fiscal and economic instruments and incentives, introduction of product standardization. The aforementioned would stimulate national building industry and industrial companies to change their technological practices and adapt to new requirements. Organization of training, retraining and advanced training of professionals in | Technological barriers. |

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| | the building sector would facilitate the process. | |
| Lack of interest in investing into energy efficient construction due to a long pay-back period, presence of energy subsidies (Okusko pers. comm.). | Application of fiscal and economic instruments, offering subsidized loans, energy price increase. Awareness-raising campaigns.<br>Removal of cross-subsidization and introduction of market-based prices would stimulate interest in energy efficient buildings. | Economic and financial barriers |
| Inadequacy of building codes due to subjectivity of developer/policymaker, biased process of assessment, corruption (Kuzmichyou pers. comm.). | Revision of the standards. Introduction of independent peer review of designed policies/building codes by unbiased 3rd parties. | Quality of the standards, |
| Numerous errors in theoretical and scientific approaches as well as in calculations at the building codes' development stage. Different scientists have different positions, influenced not by scientific truth but by lobbyism of | Independent revision of the standards. | Quality of the standards, |

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| industrial companies. As the result we there are too many standards and regulations, which were developed only in the result of lobbyism of industrial enterprises (Kuzmichyou pers. comm.). | | |
| Difficulty in compliance with the standards related to their number. The requirements often contradict each other and as a result of designers face difficulties in undergoing expert review of construction projects. The expert review is based on huge number of regulations, often contradicting each other. In such a situation technically advanced projects with cheap and energy-efficient solutions can receive no approval as it's next to impossible to comply with all existing regulations.<br>Over-regulation, complexity of requirements. Lack of coordination of officials' | Reference to internationally recognized standards, for example, Eurocode.<br>Incorporation of greater flexibility into the existing standards. Offering a choice between prescriptive and trade-off building codes.<br><br>Reformation of bureaucratic system. | Quality of the standards<br>Institutional and administrative barrier |

| | | |
|---|---|---|
| actions and objectives (Kuzmichyou pers. comm.). | | |
| Cases of fraud at establishing numeric values of thermal resistance of insulation materials due to lobbyism of manufacturers of insulation materials. (Kuzmichyou pers. comm.). | Adoption of appropriate techniques for measuring the coefficients of building materials.<br>Revision of the table of materials properties. | Corruption |
| The numerous officials involved into the process of building codes design and implementation<br>unthinkingly perform their duties and follow orders. Their priority is reporting and the quality of monitoring of the process of introduction and implementation of the standards is not prioritized.<br>(Gutkouskiy pers. comm.). | Simplification of bureaucratic system, creation of job competition, financial stimulation. | Institutional and administrative barrier |
| Absence of modern technologies in the field of energy efficiency.<br>Misbalance of energy prices, presence of conventional practices. | Introduction of market-based principles and gradual reformation of the sector according to them. | Technological barriers |

| | | |
|---|---|---|
| (Gutkouskiy pers. comm.). | | |
| Negligent attitude and lack proficiency of builders and other specialists, which results in costly building practices. (Gutkouskiy pers. comm.). | Organization of training and retraining for specialists. | Barrier associated with lack of human capacities and professional skills |
| Inability of tenants and owners to influence policy-making (Gutkouskiy pers. comm.). | Empowerment of general public, education and informational campaigns | Institutional and administrative barrier. |
| Focus of policymaking on personal interests and standard procedures, rather than economic efficiency (Gutkouskiy pers. comm.). | Creation of a system of stimulation and punishment. Introduction of market-based principles | Institutional and administrative |
| Lack of integration between policy-makers and building companies, disinterest from the side of officials to building companies voluntary actions in the field of improvement of energy efficiency (Ustinchick pers. comm.). | Setting up dialogue between policy-makers and building companies. | Institutional and administrative barrier. |
| The population is demotivated by presence of | To establish market-based prices for heating | Economic barrier. |

| | | |
|---|---|---|
| high subsidies of payments for central heating. (Ustinchick pers. comm.). | | |
| Absence of preferences in energy-efficient housing among average Belarusian people (Kolomietc pers. comm.). | The population can be stimulated by offer of preferential loans for purchase/construction of energy efficient apartments. | Economic barrier |
| Absence of conditions stimulating banks to provide preferential loans for construction of energy-efficient buildings. Therefore nowadays banks provide only loans at market interest rates for energy efficiency needs (Kolomietc pers. comm.).<br>Lack of integration of the process of energy efficiency building into bank system of the country (Andreyenka pers. comm.). | National Bank determines monetary policy which should be agreed with the budget. The possible incentives are as follows: a) to cover a part of the interest rate for the construction of energy-efficient housing from the budget or b) reduce taxes for the construction of energy-efficient buildings. | Economic barrier<br>Institutional and administrative barrier. |
| Institutional disintegration. The problem of the agencies involved in energy efficiency policies design and implementation (Energy Department) is lack of finances: they | The solution is reformation of institutional structure, for example establishing of one agency with multiple functions, including standards design, implementation and | Institutional and administrative barrier. |

| | | |
|---|---|---|
| exclusively govern the standards and don't have financial power for implementation of the standards. Under such conditions, the operation of agencies becomes inefficient as the agency is unable sustain the required amount of energy-efficient buildings construction. The problem is absence of integration with financial institutions (Kolomietc pers. comm.). | monitoring, study of the best world technologies and global experience in the field of energy efficiency, allocation of financial sources, training of specialists, etc<br>Taking into account the aforementioned it is possible to conclude that for effective introduction of European standards must be accompanied by reform of institutional structures. | |
| Regulations do not address electricity. Electricity is actively used in heating and ventilation processes. In the result we save energy on heating and ventilation but at the same time the overuse of electricity which is not addressed by the standards (Gutkouskiy pers. comm.). | Reconsideration of the standards, internalization of electricity into the standards. | Quality of the standards |
| Fixed salary regardless working productivity. The problem of commons, lack of personal responsibility | Creation of a system of financial stimulation of employees. Development and application of a system | Behavioral barrier. |

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|---|---|---|
| (Gutkouskiy pers. comm.). | of penalties. | |
| The policies are implemented in top-down approach only and general public cannot influence the process (Lobanov pers. comm.). | Application of bottom-up approach of the policies implementation, involvement of the general public. | Institutional barrier |
| Introduction of new building codes with low energy efficiency requirements (annual heat consumption – 60 kWh/m2 per year) is not an effective measure for improvement of energy efficiency in buildings (Shirikov pers. comm.). | Transition towards construction of passive houses/green buildings, application of voluntary actions, model buildings. | Quality of the standards |
| The problem of materials toxicity is not addressed. Environmental, health costs are not internalized. (Shirikov pers. comm.). | Transition towards construction of passive houses/green buildings, application of voluntary actions, model buildings. | Quality of the standards |

# 6 Conclusion

The process of development of building codes in Belarus can be described as reconsideration of the requirements towards buildings construction process inherited from the Soviet period, and their adaptation and harmonization with Eurocode.

The framework of the research included identification of barriers towards design and implementation of energy efficiency building codes and recommendations on overcoming them.

The research identified a number of barriers during the process of building codes design as well as during the implementation process, which are associated with conventional command-and-control approach to the policy-making. The identified problems relate to the quality of the standards, behavioral factor, institutional and administrative barriers, economic and financial barriers. Among the most acute problems of improvement of energy efficiency are over-regulation and over-specification of building codes, lack of financial sources and deteriorated technological base of building industry, lobbyism of monopolies, stagnancy of bureaucratic system.

Unfortunately, the organizations, responsible for the implementation of the measures on improvement of energy efficiency are not performing their duties to the full extent. There is a problem of strong disintegration between institutions that design building codes, organizations entitled to implement them, bank system and end-users of building codes.

The factors under discussion decrease the effectiveness of the policy instrument under discussion. Taking into account the aforementioned it is possible to conclude that the effective introduction of building codes in Belarus must be accompanied by reformation of institutional system.

One of the problems associated with building codes quality is their prescriptive character. Although application of the prescriptive building codes might result in moderate energy savings, lack of flexibility hinder break-through technological solutions. It’s more

reasonable to adopt and implement the best foreign practices rather than invest into development of backward (according to the world standards) technologies, that a promoted by the adopted prescriptive building codes. There is a strong need for incorporation of greater flexibility into the existing standards, introduction of trade-off building codes, model buildings.

Despite the aforementioned problems, the implementation of the energy efficiency building codes is a profitable and reasonable measure. The modernization of the building sector requires huge investments which Belarus is lacking now. Soft and slow implementation of the adopted building codes is an adequate measure of improvement of energy efficiency in existing reality. The effectiveness of the building codes would increase if adequate tools have been implemented for facilitation of the new standards enforcement. The research identified absence of such tools and proved the necessity of their development and introduction.

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