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Performance Based Building Thematic Network
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EAST EUROPEAN REGIONAL PLATFORM

PeBBu Regional Platform 3

FINAL REGIONAL PLATFORM REPORT

authors
Mr. Karoly Matolcsy
EMI, Hungary

Mr. Gábor Tiderenczl
EMI, Hungary

Report / cover design, editing
Ms. Mansi Jasuja
CIBdf, The Netherlands

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Performance Based Building Network (PeBBu) is a thematic network funded under the European Commission's (EU) 5th framework – Competitive and Sustainable Growth and has been operational from October 2001 till September 2005. This project has been managed by CIBdf, The Netherlands. The PeBBu Network has been facilitating in enhancing the existing performance based building research and activities by networking with the main European stakeholders and other international stakeholders. The network has also been producing synergistic results for dissemination and adaptation of performance based building and construction. More than 60 organisations worldwide have been participating in the PeBBu Network.

CIBdf (PeBBu) Secretariat
Kruisplein 25-G
3014 DB Rotterdam
The Netherlands
Email: secretariat@cibworld.nl

PeBBu Coordinator:
Wim BAKENS
wim.bakens@cibworld.nl

PeBBu Programme Manager:
Mansi JASUJA
mansijasuja@hotmail.com
mansi.jasuja@cibworld.nl

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FOREWORD

The **PeBBu Regional Platforms** have been established in the participating EU and EU Associated countries to stimulate and facilitate the national PeBBu activities, to make an input of typical national and regional characteristics into the international programming of projects and to prepare for the necessary future national implementation activities.

The countries represented in the **PeBBu Regional Platform from East Europe** (EEP) are **Bulgaria, Czech Republic, Hungary, Poland and Slovakia**. East Europe is a very special region of Europe due of its unique historical, political, educational, and economical conditions. In most of the East European countries, the concept of PBB is quite new and mainly present in regulation/legislation and/or research. A wider implementation in practice is a major challenge in the region.

A major task of the Platform was the preparation of this Status Report while another Report was made for the NAS (Newly Associating States of Europe). Comparing the East European Regional Platform's Status Report of PeBBu with the NAS Status Report, the **EEP Status Report focuses on regional aspects, describing status in each country** and **based more on national reports and status in the countries.** The NAS Status Report provides many further PBB related information for these countries and focuses on status and the common features as a consequence of the common historical background and analyses the situation related to historical periods as the time of socialism; the transition period and the present time after the EU accession. Vision to the future and overall strategies of PBB implementation is also described in the NAS Status Report. Thus, the two reports complement each other and **a complete overview of the status and future of PBB of the EEP/NAS countries is provided by the EEP Status Report and the NAS Status Report together**.
This Report also gives a detailed description of the status of PBB of the EEP countries considering the **PeBBu scientific domains & other domain areas** and the **new PeBBU tasks** (CPD, CRISP, Decision Support Toolkit).
On the **annexes** a list of EEP participants and the **PeBBU RTD Agenda of the EEP countries** is presented. In the Annexes also the Status of PBB in several **EEP priority themes** is described as: housing, durability, energy, recycling and maintenance.

The report was prepared on the bases of the lessons learned from the international PeBBu workshops and from the special PeBBu EEP workshops. EEP task members were contributed in all stage. The **National Status Reports** were the most important documents used for the preparation of this report. PeBBu documents, relevant literature and the scientific background of the task leaders were also utilized. The authors wish to **thank the participants** of the EEP Platform, especially **Mrs. Evelina Stoykova (BG), Mr. Peter Matiasovsy (SK), Mr. Milos Kalousek (CZ) and Mr. Piotr Bartkiewicz (PL)** for their valuable inputs and discussions. Special thanks are due **Mrs. Mansi Jasuja** PeBBu Programme Manager (NL) who assisted all workshops and the preparation of this report.

Karoly Matolcsy
EMI, Hungary
Task Leader of East European Platform
mat.k@emi.hu

Gábor Tiderenczl
EMI, Hungary
Support to Task Leaders of East European Platform
GTideren@emi.hu

EXECUTIVE SUMMARY

The **similar historical background** after the 2nd World War of the countries that are members of the East-European Regional Platform of PeBBu determined the opportunities and the barriers of spreading the PBB concept in the region. All of the EEP countries belonged to the **former soviet block** and after the systems' changing went to a **transition period** with new kind of difficulties. Several **common barriers** were defined in the EEP countries partly related to the time of socialism and others related to the transition period. Some of the barriers has national feature but most of them has rather a regional character. The **EU extension provides new opportunities** also for PBB in these countries, but some new barriers can emerge as well.

The strong barriers of the **artificial social, political and economical system before 1990** had a consequence of **overall poorness** comparing to the western countries. As regards the **practice of construction**, mass production of high rise concrete block houses, the low wages of architects and professionals, the ad hoc improvisation character and low quality of execution, the domestic feature and low quality of the building material industry all **worked against the Performance Based approach**. Lack of row materials and building products were general. The standardization process was based on opportunities of East-European cooperation, user requirements were not considered.

After the collapse of the soviet systems **in the transition period privatisation** of the domestic building industry was rather fast and **international big companies** became new owners and realized large investments. These International companies basically make their research and development at the home country, and rarely invest in research in the new countries. SMEs became dominant in the design and engineering practice. The **state withdraw from the building market**, housing subsidies was dramatically cut, state investments became rare and low budgeted, inflation was dramatically high (over 30 %). As a consequence, **building industry has been declined**. Ministries responsible for the building sector were ceased and the responsibility for the sector spread to several other ministries with the consequence of inefficient problem solving. There is a great backlog in building maintenance and retrofitting**.** The segregation and fragmentation in building construction industry and the traditional approach to build as cheap as possible makes a rather great **increase in building failures**, basically in the residential sector, where the builders are mostly not professionals. Housing promotion is very low in all countries, the majority of the new dwellings are still built in do it yourself practice or by black workmanship. **Black market** is very high in the building products field as well, partly due to the relatively high VAT.

The **conservatism of the construction sector doesn't promote innovation** and change. **Best Practice examples are not directly related to performance**, and as investment in building is risky, lot of **inventor want to rely rather on proved and safe solutions**. There is a **low demand for the construction work** in the domestic market. **Smaller enterprises have no financial reserves** and **neither bank credits are available** for them, which causes a high risk in surviving. The consequence is the **decrease in the competitiveness** in the construction market. Another special barrier is that older generation suffers from **lacking speaking ability in foreign languages**, English is very rarely spoken by the generation older than 40 years. That makes a strong barrier in implementing PBB materials not in domestic language.

As regards the **general status of PBB** in the EEP countries**,** building activities are the **least performance-based among the PeBBu regions** but after the EU extension it is expected that also the introduction of the performance concept will accelerate.

In Bulgaria the concept of PBB is quite new and mainly present in regulation/legislation and research. Most of the building codes and regulations are performance based and in the first stage of the building process stakeholders work with performance-based tools. However later in the process the strictly prescriptive detailed design allows only few possibilities for the contractor. **In Hungary** the performance concept is known from 1971 and several research projects have been directed to PBB. **In Poland** the idea of the performance concept has appeared in scientific consideration on the break of the 1980's/90's. Although the philosophy of the performance concept was carried from the Directive CPD 89/196/EEC to the Polish Building Code, practical implementation of performance demands remained away from the concept. **In Slovakia** since 1992 in the Building Code the requirements have been issued from the EEC Council Directive of 21/12/1988. The current research activities concerning the PBB are separated in particular fields of interest. The attempt to a more complex approach is reflected in the development and application of the methodologies of the energetic and environmental audits.

In the countries of the EEP in the construction practice the successful PBB usually depends explicitly on the **responsibility and possibilities of all decisive partners and on their quality**, but mainly on architect - client cooperation. The construction participants ordinary do not work in interdisciplinary teams and do not approach the construction in a wider context. The most important field, where the performance concept has been introduced is the **technical approval** of innovative products and related testing work. The most important fields, where further actions are needed are the design, procurement, budding and the control of the execution work in the platform's countries. Entering the EU in 2004 May, the **harmonization processes** in the region's countries become more and more intensive. **CPD** determines the codes and decrees in all countries. The base would be the nominated Institutes of the countries for notification, which can act as a bridgehead of PBB.

A more general application of PBB would have several **advantages and opportunities** in the countries of the EEP, like the stimulation of new materials, techniques and competition, better performance of buildings, reduction of cost and risk and failures, more freedom and less barrier in design, more correlation with users' requirements, etc. However, **strong barriers** are still against PBB. It is hard to achieve a breakthrough in habits joint to prescriptive regulations. There is a significant need for education and training and it takes a lot of time to become familiar with the performance-based approach. Other barriers are the lack of relevant indicators and testing methods, the lack of holistic life-cycle approach, the interest of producers, the financial barriers, the weak credit systems, the segregation and fragmentation of design, engineering and construction or the attachment to traditionalism and routine.

The **EU extension** can strongly influence many fields and so the construction sector in the countries of the EEP, most of them already member of the EU. **New opportunities and support of PBB** can be related to the free transfer of goods, services, information and people, more possibilities for innovations, more competitiveness, duty free prizes, more open society, European standardization, education and research support, minimisation of regional and social differences, etc. On the other hand, **also some new barriers can emerge with the EU extension**, like market deformations (temporary), the influence of strong interest groups, cartel agreements among producers, State budget deficit restriction, new tax policies, etc. **Obligations** are another aspect that comes with the EU extension and these should be considered rather as opportunities.

The necessity to **improve legislative framework** in the construction arise an excellent **opportunity to implement the PBB** approach. This opportunity could be very well detected in the widespread implementation and **success of CPD** in these countries. It is a strong believe of experts, that the **increasing competition** in the market will lead to a better understanding of performance based approach for the building industry.

As regards the EEP status of PBB in the PeBBu Domains, in **Domain I Life Performance of Construction Materials and Components**, today every type of the new and most up-to-date products are available on the Region's building market, however in the practice of construction still a lot of

low quality items are applied because of their low prizes. For assuring the quality of building materials and products, a product evaluation system has been developed gradually in the Region. The product evaluation system is realized in a technical specification system and in a certification of conformity system. The issue of durability is addressed in every country on a different way, however a comprehensive approach to the creation of Reference Service Life data has not been developed so far in the Region. The factor method is not yet applied in the Region. The works in ISO will impact and will direct the national efforts towards life performance of construction materials and components.

Issues related to **Domain 2 indoor Environment** has not been really considered in the design process in the region, in spite of the increasing problems of indoor air quality due to more airtight buildings, open-burning heating equipments, moulds due to cold bridges, increasing level of indoor pollutants and emissions together with the lack of proper ventilation. Conditions for indoor environment in almost all countries are determined by legal and technical regulations but it is not controlled and buildings are typically designed for minimum permissible level. There are great differences in the Region in considering the problems of indoor environment, but we can say, that generally thermal comfort has priority.

Concerning **Domain 3 Design of Building**, the years of the 1990's the former large state project designer companies divided into small design offices with few persons in the Region. Use of CAD systems became widespread, however the lack of control, the application of routine solutions, precipitation, the need of low construction cost are against performance-based design. Although several prominent buildings have been realized in the latest years, the former practice of do-it-yourselves still determine attitudes and austere buildings are constructed simply in possession of building permit without specification and implementation plans. Altogether, a stronger control of technical and environmental performance and that of architectural quality should be necessary. It is up to the architects and engineers to educate their clients in terms of PBB.

As regards **Domain 6 "Legal & Procurement Practices"** it has been an acute problem in the construction sector, that after 1989 the former Ministries of Construction and Urban Development was ceased in all countries in the Region and the responsibility for the sector was distributed among 3-8 ministries. Housing policy has been especially inefficient almost in every country due to the low level of responsibility and the state withdrawal from housing subsidization became very relevant. The traditional steps are involved in and create the structure of the model contracts on the building design and realization. Ideally, one person responsible for its success – a building manager, having the mandate of a client, manages the procurement process. The application of performance criteria depends in particular cases on the building manager, which is individual from case to case. External influence will become important as a result of the implementation of new EU Directives and international obligations and this may require perhaps radical changes in the legislation documents. Consequently, it will be necessary to find a common framework for these provisions.

Concerning **Domain 7 "Regulations",** the regulatory framework in the countries of the region is composed of the Act on Construction and the Act on Construction products; National Technical Standards, European Standards (EN) and International Standards (ISO). Most of the EN and ISO are implemented in the region. The local authorities issue building permissions. Standards (mandatory / advisory) are related to special issues of the building regulations. CPD is the base document in all countries, its implementation is almost completed. Although the performance concept has been integrated in the Building Regulation in many areas in the region, the national standardization process is still rather weak. Harmonization process with EU standards goes fast in the Region.

As regards **Domain 9 "Innovation",** after 1989 as large construction companies and central programs, also large research institutes were ceased and financial funds radically decreased. Although several research programs has been conducted related to PBB during decades, the application of innovation has several barriers like the common attitude of builders, the lack of R&D capacities of construction companies and the lack of governmental support and other financial resources. Great part of the innovative products comes out of the international research but there are excellent innovations also in the region. In practice the

implementation of innovative technologies in construction sector meets many obstacles. As regards research and development, there is a strong financial barrier for R&D throughout the whole region. Among the many research priorities related to PBB are the development of indicators and measurement/testing methods, economic impact analysis of PBB, building diagnostics, LCA and issues of durability, adaptability and maintenance, ecological & healthy buildings, demonstrating models for better cooperation, etc.

As regards the **other domains**, the development of the **built environment** is strongly influenced by the contradictory process of sub-urbanization and urbanization. New development plans, large scale panel reconstruction and urban renewal programs are needed. Regarding **organization and management,** construction enterprises have consistently begun to build the quality management systems and environmental management systems in the region. In the issue of **information and documentation**, although the number and availability of information materials are rapidly increasing, complex information on a performance bases is still not available in the region. The traditional procurement model is still dominant.

Concerning the domain of **fire-safety engineering**, this topic has a high recognition in the region where also up-to-date fire testing laboratories are operating. Also the issue of **accessibility** gains increasing recognition in the region, regulations already contain mandatory items of accessibility to keep for public buildings. **Facility management** is a domain where lot of development is needed, the major problem area is the privatized and declining building stock of the former local authorities' housing. As regards the domain of **energy and water management**, the thermal modernization of the poorly insulated existing buildings is the main challenge currently. The concept of **sustainable construction** and environmentally friendly design is relatively new in the region and awareness of it should be increased. To assess the environmental performance of buildings performance rating and labelling systems and uniform definition of performance parameters and indicators are needed. Concerning the domain of **education and training** the lack of finance has been a strong barrier after the political changes. On the other side the participation in international programs provided new opportunities. As regards the **intelligent building** concept, is mainly applied in the latest, most up-to-date buildings in the region and as a realisation of the user's expectations could be one of the platform to adapt the performance base approach. However, it is currently more a technologically oriented issue. In the domain of **structural design & engineering**, safety of construction is defined in all countries in the Building Code as the first essential – performance–based - requirement. The performance of load bearing structures of buildings is addressed very strictly in the regulations in the region

As regards the **new PeBBu tasks, CPD** was known from the time of origin in the region and some principle like Essential Requirements came in law in the middle of the 90's. However there is no control of implementation. CPD should be performance based and assessment based. CPD is an obligation and a good possibility in breakthrough in these countries related to PBB. The EU funded thematic network **CRISP**, Construction and City Related Sustainability Indicators has several outcomes that can be strongly related to PeBBu. To develop and use relevant indicators and indicator systems has special importance in order to measure the performance of buildings or elements of buildings. The Hungarian member of PeBBu, ÉMI npc was participating also in the CRISP network and established a national platform, the success of which can be a good example and inspiration for **establishing PeBBu national platforms. Decision Support Toolkit** would be an important tool to be presented to the fragmented stakeholders and this can provide also better information and understanding. There is a need for more information about this system.

Concerning the **envisaged future implementation of PBB** in the Region, in general only some participants of the construction design process are aware of PBB importance in practice. The construction companies formulate the need of PBB as the need of the complex quality of construction, which should be provided by the quality management. The barriers of wider PBB application in practice are seen in the cases when the particular construction participants do not consider the construction and its results as one complex system. The liability and responsibility is supposed to be a dominant factor enhancing the PBB. The increase of the education and knowledge level and the level of a systemic approach in the construction

process are also fundamental conditions. The role and the quality of an architect is fundamental in the environment where the main criteria of a client's decision-making has economical character.

Strategies for a wider PBB implementation in EEP countries can be developed on the bases of the State of the Art analysis. Related to the issues of **building materials and techniques**, improving durability of constructions, developing new materials and techniques and increasing the use of local materials are priority aims. In the **energy** domain it is important to improve the energy-efficiency of buildings, to implement Energy Performance Directive, BEM and Building Energy Pass. The domain of **indoor environment** should have high priority. Regarding **building design and the construction process**, it is important to increase the level of cooperation, communication and tenant/user participation in decision-making during the whole construction process on performance bases. Further aims are to increase environmental sustainability, to develop and apply quality management and environmental management systems, to develop and apply efficient Decision Support Systems, to improve the transparency of tendering and to apply Post-Occupancy Evaluations. As regards **legal & procurement practices and regulations** main strategies are to develop national standardization processes and building regulations on performance bases, to work out efficient and more responsible construction and housing policies, to increase the quantity and quality of residential buildings and to develop complex programs for building renovation and urban renewal. Concerning **innovation and R&D**, governments should increasingly promote this domain. Priority issues are to develop performance indicators, measurement, testing, monitoring and simulation tools and efficient control systems of technical and environmental performance and architectural quality. Some strategies related to **social and economic aspects** are to implement efficient housing subsidy systems, to decrease financial barriers of construction, to increase the availability of bank credits and to develop the methods of building insurance. **Other priority issues** are to spread the concept of intelligent buildings, to improve the visual/architectural quality of buildings and the built environment, to integrate PBB thinking in education and training and to take benefit from the dynamic building industry.

In conclusion, the importance of the Regional Platforms was clearly showed on the various PeBBu workshops and events. The national situation of the EEP countries **show similar characteristics and problems of the countries** in the region partly originated from **regional, climatic factors** and partly from the **similar historical backgrounds**. Relatively **small number of best practice examples of PBB** can be seen in the region and still **plenty of barriers** are against PBB. The **EU extension** has a significant **positive effect on PBB** in the region. **Obligations** are an important aspect that comes with the EU extension. **Dissemination of the PBB concept** and **raising the awareness** of it is important in all countries of the region. **National PeBBu Platforms** would be important to develop in order to raise the awareness of PBB and overcome the barriers of languages in the participating countries.

CONTENTS

Introduction

CHAPTER 1

1 INTRODUCTION

1.1 Role of Regional Platforms in the PeBBu Network

The **PeBBu concept "Performance Based Building** (PBB) is the practice of thinking and working in terms of ends rather than means', as applied to building and constructing." Therefore, the basis of all building activities should be the performance of the building in use rather than the prescription of how the building is to be constructed.

In addition to the international research and dissemination projects that are part of the PeBBu Programme, **regional and national activities** were necessary in preparation of the actual implementation of the principles of PBB. It was envisaged that such regional and national activities would be aligned as much as possible with the international PeBBu activities.

The **PeBBu Regional Platforms** have been established in the participating EU and EU Associated countries to:

- Stimulate and facilitate the - programming and coordination of - such national activities;
- Facilitate the input of typical national and regional characteristics into the international programming of projects;
- Prepare for the necessary future national implementation activities.

The following **four EU Regions** are defined. Per Region the participating countries as included in the PeBBu Network as to be funded by the EU, are mentioned. For three of those Regional Platforms an objective is to attract additional - new PeBBu Members in - countries in the region to the PeBBu Network.

- **Region 1 - North Europe**
  Sweden, Finland, Denmark, Norway, Lithuania - additional countries to attract: Latvia and Estonia
- **Region 2 - West/Central Europe**
  Belgium, UK, Ireland, Netherlands, France, Germany - additional countries to attract: Switzerland and Austria
- **Region 3 - East Europe**
  Hungary , Poland, Czech Republic, Slovakia, Bulgaria - additional countries to attract: Romania
- **Region 4 - Mediterranean Europe**
  Italy, Spain, Portugal, Greece, Israel, Slovenia, Croatia

National contact persons are participating in these Regional Platforms as "representatives" of stakeholders in the national communities of principal building owners and of the national design, construction and standards and regulatory communities.

Overall Scope and Objectives for all four Regional Platforms:

The overall objectives for the PeBBu Network are:

- to stimulate and pro-actively facilitate the international dissemination and implementation of PBB - Performance Based Building in building and construction practice, and in this context: to maximize the contribution to this by the international R&D.

In this context the specific objectives for each of the four Regional Platforms are:

- to stimulate and facilitate a maximal alignment between the international PeBBu activities and national research and dissemination activities concerning the development and implementation of PBB in the countries that participate in PeBBu, through
- stimulation and facilitation of the programming of such national activities
- facilitation of the input of typical national and regional characteristics into the international programming of the international PeBBu activities
- preparation for future national PBB implementation activities, including the national dissemination of PeBBu results,

and in support of achieving those objectives:

- to initiate and facilitate the establishment of National or Transnational PeBBu Platforms in the region, which includes:
- support to defining the scope and objectives of such platforms
- support to the establishment of required financial support structures for such platforms in collaboration with the PeBBu Secretariat and aiming for international financial support from the EU and other international sources
- support to regional, transnational and national PeBBu related events.

1.2 The East European Regional Platform of PeBBu

The countries represented in the **PeBBu Regional Platform from East Europe** are **Bulgaria, Czech Republic, Hungary, Poland and Slovakia**. East Europe is a very special region of Europe due of its unique historical, political, educational, and economical conditions. In most of the East European countries, the concept of PBB is quite new and mainly present in regulation/legislation and/or research.

There are **many barriers to the widespread adoption of PBB** in the East European region. Amongst others some are:

- Seasonal factors/ fluctuations in construction market
- High production costs due to a high interest rates
- Uncertainty in liability and responsibility
- Lack of holistic approach (project, building, usability, demolition, influence on environment etc.) for building
- Lack of cooperation between construction professionals
- Low investment cost mentality (however life-cycle costs are starting to be being considered)
- Low level of R&D investments
- Lack of relevant indicators and appropriate methods of measurements and testing
- No common language across the whole region (although communication is possible)

On the other hand, there are also **some opportunities**:

- New building products from foreign international companies are available to NAS countries
- Increase of the education and knowledge in recent times
- Post-Occupancy Evaluation tools can offer more correlation with users' requirements, resulting in cost-effective functional solutions
- Innovation in materials, technical solutions and competition can result lower construction costs
- More consciousness of performance requirements can have an effect of reducing construction failures

1.3 Methodology of the EEP's Work

This report was prepared on the basis of:

- National State of the Art Reports
- PeBBu workshops
- Special PeBBu EEP workshops
- PeBBu documents
- Contribution of the PeBBu EEP members
- Relevant literature
- Scientific background of the task leaders

The East European Regional Platform of the PeBBu network held its **1st Workshop in Budapest, 28th March 2003**. On this workshop the participants started to analyse the situation of the construction sector in their countries and the status of Performance Based Building (PBB).

Bulgaria, Czech Republic, Hungary, Poland and Slovakia made its detailed **National State of the Arts report** about PBB implementation in their countries. That gives contribution for the International State of the Art Report, but meanwhile gives possibility for a better trans-national analysis as well. Besides phone conversation, e-mail and personal meeting has served to a better understanding of the common feature of PBB. The **first version of the EEP State of the Art Report** was prepared by the task leader with the contribution and comments of all partners.

The Platform members had a discussion of the Platform's work on the International PeBBu workshop in **Manchester** on the **13th of January 2004.**

The Platform held its **2nd Workshop** also **in Budapest, 8-9th July 2004**. On this workshop the national situations were presented and discussed focusing on the domains and on best practices of PBB. After this, specific domain related questions and SotA of the new Tasks (CPD, CRISP, Decision Support Tools) in the platform's countries were discussed, PeBBu opportunities after the EU extension were outlined, research **mapping** in the region and national platforms were discussed and an example of the Hungarian CRISP platform presented. Suggestions for further development of 1'st Regional Platform Status Report were also collected. On the meeting **Romania was represented as observer** invited by the task leader. After the 2nd workshop the 2nd version of the EEP State of the Art was prepared by the task leader with the contribution and comments of all partners.

The **3rd EEP workshop** was organized in the **11th and 12th of April 2005 in Bratislava**. On this workshop special priority themes were defined and tasks related to tem were discussed (housing; durability; energy; indoor comfort, recycling and renovation). Discussion was made about envisaged future implementation of PBB in the region, ideas, solutions, visions and actions were presented and discussed. Best practice examples of PBB were also presented. Dissemination strategies and the role of universities in dissemination were discussed and main action points were agreed.

The **4th and last EEP workshop** was organized in the **21st and 22nd of July 2005 in Sofia**. On this workshop the task members presented the worked out priority themes defined on the Bratislava workshop. Further best-practice examples were presented as well. The differences in content and approach of the NAS Report and the EEP Report were discussed, final PeBBu tasks and necessary contributions were discussed and approved. After preparing the "final draft" of the EEP Status Report, it was sent for commenting to all partners and also to the PeBBu Domain leaders. After integrating all received comments, the **final version of the EEP Status Report** was prepared during August 2005.

Background Description of Construction in the Region

CHAPTER 2

2 BACKGROUND DESCRIPTION OF CONSTRUCTION IN THE REGION

2.1 Historical Development of the Construction Sector in the Region

The countries belonging to the East-European Regional Platform of PeBBu has had **similar historical background after the 2nd World War** which have a **strong influence to the application and barriers of Performance Based Building** (further on: PBB) concept. The Platforms' members defined several common barriers of the countries, each belonged to the **former soviet block**. Some of these barriers were related with that time, some of them are related to the **transition period**. There are barriers, which has national feature, and one can find barriers, which are certainly general in most of the countries and have **rather a regional character.**

Barriers related the time **before 1990** were in one hand **economical** - that means low GDP, backlog from WWII heavy causalities, the contribution payment to the Sovietunion, the rather closed and unbalanced market, the unrealistic prize-setting, the COCOM rule prohibiting importing high technology from developed countries, etc. - all that means **overall poorness** comparing to the western countries. In the other hand, **some barriers come from the systems** as well, like the **standardization** that was **based on East-European cooperation**, and based mainly on the opportunities, and not on the real user requirements.

In the period **1950 – 1990** in the countries of the Region the construction industry was divided into the **dominant state and minor private sectors**. The private sector was oriented to the construction of single-family residential houses in small towns and villages realised by the do-it-yourself way. In this construction activities the traditional empirical methods were applied and the construction process was based on the implementation of a verified traditional empiric solutions. The roots of this conservative approach are living up to now.

Mass production of high rise concrete block houses - based mostly on Russian models - also worked against the Performance Based approach, and still bring a lot of problems related to indoor air quality, inadequate heating systems, improper windows, etc.

In most countries the **engineering and architectural work was very underpaid**, which influenced the quality of the planning process. General was the feature that **construction in site neglected even the actual plan**, and the building was built as the contractor wished, mostly in much lower quality, as it was planned.

The **building material industry** was at that time mainly **domestic**, and the quality of the building products was rather low - correlating to the low prize as well. Lack of row material and building products were general, often one could buy building products just in the black market or for extra money.

2.2 The Construction Sector After the Political Changes of 1989-90

After the collapse of the soviet systems all countries started their own life, facing to a lot of similar problems. Due to the lack of the capital, **privatisation of the domestic building industry** was rather fast. The new owners are basically **international big companies** like Lafarge, Holcim, Pfleiderer, Saint Gobain, etc. Rather large investments have been realized in new plants, frequently green field investments (currently the greatest growing in Poland), but there are lot of transaction towards gaining only new market, even closing the old factories. These International companies basically make their **research and development at the home country**, and rarely invest in research in the new countries. That led to a big recession in UNI research fields based on domestic industry in the eighteens as well.

The **state withdraw from the building market, housing subsidies was dramatically cut, state investments became rare and low budgeted, inflation was dramatically high** (over 30 %). As a consequence **building industry has been declined** and some development has been started only recently. **Housing promotion is very low** in all countries, the majority of the new dwellings are still built in **do it yourself practice** or by black workmanship. **Black market** is very high in the building products field as well, partly due to the relatively high VAT on building products.

As the state withdraw itself from the construction field, **Ministries specialised for building construction and urban development were ceased**, and the **responsibility for the sector was spread** in different ministries. (In Hungary for example in the recent time there were seven ministries dealing with housing matters). Due to the lack of the relevant and concentrated governmental body standardisation, housing policy, state subsidy systems have been working quite inefficient, and a lot of money that was formerly spent in the building sector was given to other politically "hotter" areas as social security of pensioners or to subsidizing depriving heavy industry or agriculture.

The big construction companies and the **giant architectural and planning companies were substituted by smaller enterprises**. These **SMEs** are much better organized and quality driven, although they basically suffer from lack of capital and delayed payments. The information of general development, which was organized by the greater firms, was not an option for SMEs, and fighting in the first years just for remaining alive, they concentrate the sources on the most necessary fields. **Innovation** in this aspect was and still **is not a keen issue**.

In the building sector there is a **great backlog in maintenance and retrofitting**. Some houses have not ever been restored after the WW II. **Pure thermal insulation** at walls, windows and roofs still remains as a bad heritage related to the low budget principle, however some countries start to implement higher energy conservation policy.

Segregation and fragmentation in building construction industry became more relevant. There is an intention to **spare on the cost of organization and general contracting**, meanwhile SMEs working on their special fields doesn't take attention on the other works, or the building as a whole. That makes a rather **great increase in building failures**, basically in the residential sector, where the builders are mostly not professionals.

In traditional building the **building process** remains still **an improvisation on site** due to spare with good construction plans and skills in general contracting. Also characteristic is the general approach to built **as cheap as possible** disregarding the life cycle cost of the building. There is a great discrepancy in planning process as well, for most of the time relevant stakeholders doesn't feel important to play active role in the design phase. The **demonstration projects are very rare** and the information about them is generally rather weak.

In the Technical Universities the lack of capital and state subsidy decrease radically the possibility of University teachers to obtain funds for international cooperation, meanwhile working or studying abroad became a real option. Most university teachers run a private office or company, which conflicts in time with their university works. Also the **low payment in the university and for engineering** in general does not create a good background for better design and innovation.

Older generation suffers from **lacking speaking ability in foreign languages**. In the platform most of the countries have Slavic language, and more or less understand each other, meanwhile Hungary has a unique language. Traditionally the second language of the people was Russian or German, **English is very rarely spoken by the generation older than 40 years**. That makes **a strong barrier in implementing PBB materials not in domestic language**.

There are some **national barriers** as well. In some countries, like in Hungary or in Slovakia, there are definite differences in the economical situation between the capital, the medium towns and the countryside, and even great differences between east and west of the countries. These differences correspond to the GDP, the unemployment rate, and the general behaviour of the people in the region. There are rather great **regional differences** in Poland too. These differences could be fund in the information fields as well, however the Internet society makes a lot of effort to equalize these differences.

There are some barriers that are related to general matters, not specific in the Platform. The **conservatism of the construction sector doesn't sponsor innovation** and change and don't want higher risk arising from new ways. As the opportunities are arising, performance requirements are also changing, and simply the acute performance requirements could lead to a poorer opportunity of taking later new challenges from the reserve or multifunction of the systems. **Best Practice examples are not directly related to performance**, and as investment in building is risky, lot of **inventor want to rely on proved and safe solutions** rather than implementing something never existed before. Also bad examples of innovation and the still slow reaction for pitfalls detected at the follow up process are warning the investors to choose the safer alternatives.

One of the main contemporary problems of the construction industry is the **low demand for the construction work** in the domestic market. The most significant sector of this decline is the residential sector, oriented predominantly to the maintenance, adaptation and renovation works at present. The consequence of it is that the **smaller enterprises have no financial reserves** and not satisfactorily diversified production, which causes the problem of their further existence. The consequence is the **decrease in the competitiveness** in the construction market. The similar expectations are in export, expressed by the loss of the markets with subsequent decrease of the quantity.

The **construction companies define the following barriers of the desirable production increase**: great competition, seasonal factors, high production costs (e.g. due to a high interest rates), low potential demand and the **difficult availability of a bank credit**. According to the opinion of construction enterprises, the banks are not willing to invest into such a risk sector as the construction industry is. The solution could be the governmental guarantee of the given credit. However the general solution - the agreement among the construction companies, government, and financial institutions still does not exist.

In Poland for example the **construction sector is the arena for competition between many companies** owned by international as well as domestic capital. Additionally, there are plenty of small national firms, but few biggest players generate the majority of the sector's output. At present, almost 309 thousands enterprises operate in the sector and almost 930 thousands people are employed by construction firms. More than 95% of the firms employ up to 20 persons. In order to meet increasing competition firms merge into holdings and groups. Large companies, which employ above 100 persons account for only 0.5% of all enterprises, generate more than 34% of the overall sector's output.

Figure 1. Examples of new architecture in Warsaw, Poland

Architects: Stefan Kurylowicz; Tadeusz Spychala

The General Status of PBB in the EEP Countries

CHAPTER 3

3 The General Status of PBB in the EEP Countries

3.1 Status of PBB in the EEP Countries

In Bulgaria the concept of **PBB is quite new and mainly present in regulation/legislation and research**. Most of the **building codes and regulations are performance based. In the first stage of the building process** (client brief and preliminary design) all stakeholders work with **performance-based tools**. **Later** in the process, at the permit plan level this performance approach is much weaker, and the **strictly prescriptive detailed design** allows only few possibilities for the contractor. Also the complexity of the project frequently suffers from the late appointment of all players like contractors or subcontractors.

In Hungary the **first initiations** to deal with the application of performance concept in building have been given at the symposium organised by CIB S56 (Light weight constructions) in Budapest **in 1971**. Further impulses has been added to this initiation by the participation of the researchers of the former ÉTI (Hungarian Building Research Institute) in a Delphy-study led by VTT concerning the deeper explication of this concept. Afterwards **several research projects** had been directed directly or partly to the study of the special aspects of the performance concept in relation to its application in building. The former ÉTI and later ÉMI had actively participated in the work of the CIB W60 (Performance Concept in Building). Drawing on these sources action has been taken to validation of this concept in the Hungarian standardization, were prescriptive standards were prevailing.

In Poland the idea of the performance concept, understood as a method of expressing expectations in relation to buildings, has appeared in scientific consideration on the **break of the 1980's/90's** following the announcement of the ECE UN study 'The compendium of the model requirements for building regulations'. This conception, allowing the confrontation of the operational advantages (health, security, comfort) with the traditional approach to design and building erection, was at that time treated as a fascinating possibility of forming the building industry of the future. Yet the lack of vision as to the possibility of bringing into life this way of formulating requirements was unfavourable to the generalisation of this approach. Admittedly the fundamental requirements formulated according to the ***performance concept* philosophy** were carried **from the Directive CPD 89/196/EEC** to the Polish Building Code, however in the face of lack of generalisation of the realisation and control of the principles stated in Interpretative Documents, practical implementation of performance demands remained away from the concept.

In Slovakia building performance is regulated on three basic levels: 1. legal acts, 2. regulations, 3. standards. **Since 1992 in the Building Code** the requirements have been issued **from the EEC Council Directive** of December 21, 1988. "On the approximation of laws, regulations and administrative provisions of the member states relating to construction products. 89/106/EEC." are included. The directive is also implemented into the Act No. 90/1998 in version 521/2001 on the construction products. The current **research activities** concerning the PBB are separated in particular fields of interest in Slovakia, e.g. the indoor environment measurements and the inhabitants' behaviour monitoring, thermal, energy and visual performance simulations, the coupled hydrothermal and durability performance modelling, creating of the material properties and climatic databases for the modelling and simulations. The attempt to a more complex approach is reflected for example in a development and application of the methodologies of the **energetic and environmental audits**. The current fundamental and applied research is carried out at the several institutions. The research results are expressed in the education process partly. The contemporary quality of education can be considered not satisfactory for a more complex and systemic PBB approach. A qualification in the construction is narrowly specialised, characterised by a small adaptability.

The education structure does not correspond to the required structure of knowledge. However a new educational system has been prepared at the Faculty of Civil Engineering, University of Technology in Bratislava, applying new approaches towards the building design focused on the complex evaluation of construction process.

3.2 Implementation of the Performance Concept in the Region

In the countries of the East European Platform in the construction practice the **successful PBB usually depends explicitly on the responsibility and possibilities of all decisive partners and on their quality, but mainly on architect - client cooperation**, which is individual from case to case. No general tool how to provide it has been created up to now. The **construction participants** ordinary **do not work in interdisciplinary teams** and do not approach the construction in a wider context, they do not focus on complex conditions of design, manufacture, use, maintenance, refurbishment, demolition, recycling, etc. in their projects. The narrow orientation and specialisation and no use of alternative or variant solutions is still dominant.

The most important field, where the **performance concept** has been introduced is the **technical approval** of innovative products and related testing work. The most important fields, where further actions are needed are the design, procurement, budding and the control of the execution work in the platform's countries.

Entering the EU in 2004 May, the **harmonization processes** in the region's countries become more and more intensive. **Construction Product Directive determines the codes and decrees** in all countries, waiting just for some modification arising from the full membership of the countries. The base would be the **nominated Institutes** of the countries for notification as ITB in Poland, TZUS in Czech Rep. TSUS in Slovakia, ZAG in Slovenia, EMI in Hungary. These Institutes can **act as a bridgehead of Performance Based Building** regarding their background and essential role in the certification, testing and attestation of conformity processes.

Barriers & Opportunities of PBB implementation

CHAPTER 4

4 BARRIERS & OPPORTUNITIES OF PBB IMPLEMENTATION

4.1 Advantages and Opportunities of PBB Implementation in the Region

A more general application of PBB would have several **advantages and opportunities** in the countries of the East-European Regional Platform of PeBBu. The following examples can be highlighted:

- PBB can **stimulate innovative, new materials** on the market, new **technical solution**s and as well more **competition**.
- By spreading the concept of PBB, buildings, building components and products can have a **better performance** in several issues (e.g. durability, safety, health, etc.) resulting the **reduction of cost and risk** as well.
- More consciousness of performance requirements can have an effect of **reducing construction failures**;
- **More freedom and less barrier in design** solutions can result in higher concern of cost-effectiveness;
- By using Post-Occupancy Evaluation tools, PBB can offer **more correlation with users' requirements** and this can result more cost-effective functional solutions; etc.

However, due to the historical background, development and the status of the construction sector, still many barriers of PBB are existing in the countries of the platform.

4.2 Major Barriers of PBB Implementation in the Region

Some **major barriers** to a more comprehensive adoption of PBB are the followings:

- It is **hard to achieve a breakthrough in habits** joint to prescriptive regulations.
- There is a significant **need for education and training** different stakeholders, like designers, researchers, building officials, and building certifiers. It takes a **lot of time to become familiar with the performance-based approach.**
- The **lack of relevant indicators and appropriate methods of measurements and testing** on several areas for measuring building performance.
- **Lack of holistic approach for the whole life building cycle**
- Sometimes the **interest of producers** is against PBB (e.g. the majority of building products have a week performance in sustainability issues, in ecological and health aspects.)
- A main barrier of application is the **financial barrier** (clients insist on low cost rather than good quality/life cycle cost evaluation)
- Domestic **innovation sources are very low**, both state and industry radically withdraw of giving work for University or academic research centres.
- **Low housing promotion** gives negative influence for the building industry.
- **Weak credit systems**, delayed payments and extremely high black works are not a good soil for quality works.
- **Segregation and fragmentation of design, engineering and construction** helps for prescriptive communication.

- Many building projects (especially detailing) are universal (designers apply ready deemed to satisfy solutions).
- **Attachment to traditionalism and routine** among construction professionals plus dislike any non-technological activities.

4.3 Barriers and Opportunities of PBB Implementation After the EU Extension

The **EU extension** can strongly influence many fields and so the construction sector in the countries of the EEP, most of them already member of the EU and also the other countries (Bulgaria and Romania) are waiting for association.

The following items can provide **new opportunities and support PBB** and the PeBBu infrastructure:

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- The EU extension made possible the **free transfer of goods, services, information and people** on a free market area.
- **More possibilities for innovations** – **SME's have dominant role** (more national enterprises in SME's) – small, but aboriginal and original innovations are welcomed
- **More competitiveness** – opportunities for each partner on the market
- **Duty free prizes**
- **Open society**: accessibility of information (long-term aspect)
- **Education** systems influenced by the EU
- **European standardization**
- **Education and research support** (European Research Area)
- **Minimisation of regional and social differences**
- Regional development and growth
- Promotion of new ideas (technologies)

On the other hand, also **some new barriers can emerge with the EU extension**, like:

- **Market deformations** (temporary effects)
- **Influence of strong interest groups** on international level
- **Cartel agreements** among producers
- **State budget deficit restriction**
- **New tax policies**
- Still **governmental preference** of specific sectors

Obligations are another aspect that comes with the EU extension (e.g. Energy Performance Directive). As regards obligations, an attitude is characteristic in these countries that generally the first idea has been not how to match requirements but how to avoid them. Now this attitude has to change and these obligations **should be considered rather as opportunities**. There is a possibility to make benefits of obligation of performance-based thinking.

It is easy to take the **standards** and translate it in the local context (in language and putting it in the legislation), but this does not ensure implementation yet. Training is necessary to explain 'why the new legislation' etc. **Commentary** for translated standards is also necessary. The **incentive** for this can come from different directions, e.g. in Romania from government and Hungary from private sector. Incentives can be from the market or from the regulation as well. Subsidy systems can also work (if you invest money, you get some money).

Contribution of the Region to the PeBBu Scientific Domains

CHAPTER 5

5 CONTRIBUTION OF THE REGION TO THE PEBBU SCIENTIFIC DOMAINS

5.1 Domain 1: Life Performance of Construction Materials and Components

Today every type of the new and most **up-to-date products** are available on the Region's building market. Quality has been improved significantly during the last 10 years (e.g. new thermal insulated windows and premixed plaster appeared). The performance of the **domestic products** of building elements increased as well, **however still low quality items** - and often without certificate of quality - are presented on the market because of their low prices.

For assuring the quality of building materials and products, a **product evaluation system** has been developed gradually in the Region. The product evaluation system is realized in a **technical specification system** and in a **certification of conformity system**.

Technical specifications include:

- **National Standards** (incl. Adapted ENs) issued by the National Standards Institution and
- **Technical Approvals for construction products** issued by State owned testing Institute as ÉMI in Hungary, ITB in Poland, TZUS in Czech Republic, TSUS in Slovakia, ZAG in Slovenia. Most of them have observer status in EOTA and full member in UEAtc. ITB and EMI are members of ENBRI.

Approved bodies realize **attestation of conformity** as well.

As regards the focus of Domain 1, the requirements of **service life**, currently obligatory "**time of serviceability**" is prescribed for particular building constructions and products (11/1985. VI.22. Collective Departmental Order) **in Hungary**. The given time (generally 5 or 10 years) is equal to the time limit of the loss of right in **assertion of claim in guarantees** (responsibility). Nowadays there is an increasing need for using fewer resources, thus increasing the service life of buildings and its components. In **research** activities several projects are related to the topic of **durability**. In spite of the raising awareness about the importance of durability, relatively **few reference service life data** are available. For estimating service life of building structures and components, like for example that of load bearing structures, components of building facades, roof coverings or sanitary equipments, some methods of expert evaluation, design guidelines, recommendations of producers and undertaking guarantees are used.

In Bulgaria the problem of service life has been discussed since long time. Concrete **structures are tested at each stage for durability and stability**. In Bulgaria an **assessment is done after 25 years**. Materials have guarantee for 100 years.

In Slovakia several **research** has been done related to the issue of durability. The topics of future research are seen in **innovated concretes** and **new composites** with mineralogical matrix based on the cements of a new generation and their engineering properties, in thermal-insulation composites with mineral matrix based on industrial solid wastes.

In Poland the European Construction Products Directive, CPD (Council Directive 89/106/EEC), which states that the Essential Requirements on constructed works should be met during the intended working life of the building is, as the other EU Directive, on a way to be implemented, by adjusting existing regulations. Some general statements are already included there, but the structure of legislation and lack of monitoring and control procedures causes that, even existing requirements are not met in a practice. In Poland it is

necessary to test the methods but only for stability not for durability. For a major rebuild / changes, an analysis is necessary.

In the Czech Republic few publications exist in the topic. Some research projects in the university dealing with the FM are ongoing. Generally, the **consideration on service life issue is minor.**

In Romania the concern of durability depends on the material to be used and the project. **In case of reconstruction works a state assessment** is obligatory. Experts tell if it is in a good condition or not. People do not want to deal with durability.

Altogether, a comprehensive approach to the creation of Reference Service Life data has not been developed so far in the Region. The factor method is not yet applied in the Region.

The new ISO initiative called into being new Sub-Committee 17 of TC59 Sustainable Construction with working groups: Principles and Terminology, Environmental Declaration of Building Products, Framework of Assessment of Environmental Performance of Buildings, Sustainability Indicators. The SC 17 has been revived on request of SC 3 and other SC from TC59 as the **Environmental Performance** attracts a high interest worldwide. Poland is an "O" member of SC17 and will establish a mirror Committee in 2004 becoming the "P: member.

The **works in ISO** will impact and will direct the national efforts towards life performance of construction materials and components.

5.2 Domain 2: Indoor Environment

Indoor air quality (all non-thermal attributes of the air of comfort spaces which influence humans' comfort) and other impacts related to healthy buildings and the sick-building syndrome **has not been really considered in the design** process in the region.

The quality of indoor air is worse than before as a consequence of more efficient insulation and inadequate ventilation. Well-insulated windows and new wall constructions detain air circulation. In addition, **open-burning heating equipments**, which are used mostly in houses, extract oxygen from the air. The prescribed airflow can't be achieved without additional special solutions.

On the other hand, even though wall construction elements with good heat-technical characteristics are widely used, they are often applied without appropriate attention and "**cold-bridges**" form in consequence. As a result of the humidity collection on these surfaces **moulds** appear and worse air quality. Another problem of indoor air quality are the widely used **chemicals**. Parquet enamels, PVC floors, plastic doors and windows, glues, paints emit decomposition products (organic solvents), which can be concentrated in the air in the lack of above mentioned natural ventilation system. Moulding is a general failure due to the **lack of proper ventilation.**

There are **great differences in the Region** in this field. In Slovakia, more than 90% of buildings have central heating, meanwhile in Hungary only more than 50%.

Conditions for indoor environment in almost all countries are determined by **legal and technical regulations**. The **indoor temperature** in areas used for long-term stay is regulated. There are legal regulations containing requirements on the maximum concentration of NO_x, CO, particles, SO_2, HCHO, NH_3, C_7H_8, xylene, styrene, tetrachlorethylene, CS_2, H_2S, asbestos and the concentration of bacteria as well as moulds and pathogenic and non-pathogenic organisms. Also most of the countries a **minimal ventilation** are determined.

It is worth to point out however, that many of the detailed requirements set minimum or maximum permissible values, vast majority of designers use them as the designing values. It means that **buildings are typically designed for minimum permissible level**. Probably the most important reason of this is the investors' intention to minimise investment costs. Other important thing is **ineffective control system** that even in case of building that obviously does not meet the requirements is not able to prove the fault and to punish designer of builder.

As a result of energy saving and indoor temperature decrease the problems with **moulds growth** very often occur in dwelling houses with thermal bridges in external walls, especially on top stores. The process of refurbishment of dwelling houses is subsidized by the state. **In Slovakia** there is the regulation concerning operation of the State Fund for the Development of Housing in which credit conditions for thermal protection of buildings are determined. The current research is oriented mainly to day lighting, indoor environment simulations, creating the outdoor boundary conditions databases and to the problems of building refurbishment.

In Poland indoor environment engineering is rather new part of the construction process but its components have been present in traditional construction process for many years. The most important role in traditional construction process took thermal comfort, acoustics and day lightning. This is probably the reason why the quality of their regulation is better than others: pretty well defined objectives, verified by building tradition set of detailed requirements, permissible values based on extensive experimental studies and precise procedures of verification. Items that arisen lately, as the indoor environment problems like air quality or visual comfort are definitely worse treated by Polish construction law system.

A best practice example for careful indoor environment design in new construction is a commercial office building, the "**Tulipan House**" in Warsaw. Light, space, care for the natural environment, flexibility and comfort are the main features of the building. Special features will be sustainability and energy efficiency. The goal is to achieve 30% energy saving compared to a standard building and to use renewable energy sources to 50% of the total energy-use for indoor climate.

Figure 2. Best practice example: the "Tulipan House" in Warsaw, Poland

Thermal insulation has been the key point for all buildings for the last 10 years in Poland. Now approach is changing due to the clients. The polish standards are not yet good in this field. However, indoor air quality is a popular problem, especially in case of office buildings, hospitals, schools, etc. There is some general information on detailed perspective on quality of air, etc. Investors like to take the minimum of that, but there is a lot of interest in this problem. CO poisoning is a big problem. In Poland, for offices, the market just changed the approach to this problem (in office construction it is an often used condition, there is a big pressure on this subject). In Poland there are building classes. One of the questions to the clients is: what level of comfort would you like?

Because of limited resources devoted to **scientific research**, Polish scientists are forced to undertake **rather general conceptual and literature studies and computer simulation** than extensive complex measurements. Polish research projects that may be regarded as partially addressing performance of buildings were devoted to development of simulation software for buildings (thermal analysis, migration of pollutants, moisture transport etc.). Several serious projects were devoted to identification of indoor environment parameters in different types of buildings. Usually conclusions of the research projects stated that law system does not support construction of buildings that fulfil expectation of users.

In Slovakia architects like to deal with the topic of indoor environment since it enables them to use different forms. However, computational tools are expensive and not accessible to smaller architects' offices. They are interested in the implementation of it since indoor environment offers comfort and energy saving to clients. Increasing conflicts are e.g. in field of window size tendency to make it small (since good windows are expensive) but these conflicts with day lighting standards. Clients are aware of indoor environment requirements but this conflicts with cost.

In Bulgaria all domains have similar requirement. If client requires higher indoor comfort, it is technically possible. From 1999 there is a new requirement of insulation for walls, but it is still very bad for windows. In practice minimum requirements are to be met. For north side – a minimum requirement is specified. **Health, safety, thermal comfort, thermal insulation are the main points**, which are important. There is a stress on increasing the performance of the envelope but it depends totally on the client. Sometimes, client is just interested in the form and then everything follows from that. There is not enough awareness of the users / clients about the need for good indoor environment. The main problem is that clients are not educated, their interests are financial, quality is less important (floor area and location has priority).

In the Czech Republic there is a **new standard for thermal protection** of building, walls and windows. The required U-values are up-to-date. (Have 2 values for each structure. Walls: 0.3 and windows: 1.8. Especially the frames have to be 2.0 compared to 2,7 in last year.) There are strong problems with ventilation and air quality. It is not an essential criterion for clients when buying a house. Sometimes they realise later. Because of new thermo pan windows problem of condensation have occurred.

In Hungary up to this time, the design for indoor environment has been focused to the **key parameters of indoor comfort**, especially thermal comfort, acoustic comfort, illumination and visual comfort. There are lots of **problems with ventilation, open-burning heating equipments, mould** (due to heat bridges), and chemicals. Attention can be divided between rich clients and poor clients and the demand for indoor environment depends on the funds available.

In Romania the topic of **indoor environment is prioritised**. This is because the indoor environment quality was very low and this was much needed. It's very hard to make better environment in an existing dwelling. Usually they try to solve problems by new thermo pan windows (which became very popular by now), but they realize later that the problem was not finished.

5.3 Domain 3. Design of Buildings

In the years of the 1990's the former large state project designer companies divided into **small design offices** with few persons in the Region. Generally design teams are incomplete: representation of the most professional fields is precluded.

Some **characteristic features** in the design process are:

- **Computer aided design (CAD)** as one of the most positive achievement of the R&D.
- Precipitation, **lack of the required control** levels, failures due to the small size.

Due to investors' requirement, design offices aim at **increasing the beneficial place proportion** per building site (land use). The floor-space of the flats is decreasing in the course of profit pursuit. **Austere buildings** are constructed simply in possession of building permit **without specification and implementation plans**.

PBB is partly applied in the design process of buildings in the Region. As regards new headquarters of companies, banks, commercial, office and other public buildings, there are several **examples with high value of performance and architecture**, however some mass production character – regardless of the local character, urban structure and the environment - of certain retail buildings invested by international chains can be also widely seen (e.g. TESCO, METRO, Auchan, etc.)

As regards **housing**, **some innovative examples of high level of architectural performance** exist, **but most of the family houses still reflect** the forms and techniques of the former self-built, or **do it yourself practice** Innovative solutions are seldom realised. However, wooden-frame houses are also spreading (that was not used traditionally), although the majority of them with no special architectural value. In larger scale housing investments (apartment houses, 'residential parks') for selling out flats, the main important aspect is **low construction cost**, which is a serious barrier of realizing performance requirements. However, some of them are built in high quality of architecture.

Figure 3. Best practice examples of housing projects in Budapest, Hungary (2000-2004)

Multi-dwelling building , Buda hills
architect: L. Kuknyó

Block of urban dwellings, Óbuda
architect: Á. Marillai

Multidwelling building, Pasarét
architect: L. Váncza

Altogether, a **stronger control of technical and environmental performance** and that of **architectural quality** should be necessary. (Regulations now focus only on technical parameters, and aspects as location on site, built-in area, building height, etc, however in some districts of Budapest and major cities a jury of architects evaluate also the quality of architectural appearance.)

PBD is applied on medium scale in **Slovakia**. The **routine traditional solutions** are still commonly used. Until now the innovative solutions are taken as risky, expensive and time consuming. In many cases the poor and very expensive solutions are produced. These solutions are often taken from **abroad catalogues**. This phenomenon could be partly explained by the low competitive level in the architect community.

On the other hand the PBB status in the region is influenced by **low level of the clients knowledge and experience**. It is **up to the architects and engineers to educate their clients** in terms of

PBB. At present the PBB has dominant role in the **refurbishment and upgrading** activities. This concerns also the modern buildings constructed at the end of the 20th century characterised by the low level of their performance. The characteristic feature is that the building materials producers try to offer and propagate typical constructional details solutions composed of their own products.

5.4 Domain 6: Legal & Procurement Practices

The building affairs belong to the **public administrational proceedings** also in this region. **Act is the main legal instrument** of the regulation system. It has been an acute problem in the construction sector, that **after 1989 the former Ministries of Construction and Urban Development was ceased** in all countries in the Region and the **responsibility for the sector was distributed among 3-8 ministries** depending on the actual government's policy. The consequence of this was that it has been quite **difficult to handle** any problem related to construction.

Housing policy has been especially **inefficient** almost in every country due to the low level of responsibility. Attempts were made to establish central governmental bodies in all countries, but still the strength of them are rather small. **Poland** seems to lead the development in housing by introducing **new social housing companies** (TBS) and **housing benefit systems**. There are rather detailed good suggestions in the new housing policy in **Czech Republic** and there is a short term (five year) Housing Policy Strategy in **Slovakia**, however the implementation seems to be in both countries behind the expected ideas. **In Hungary** the government is expected to develop a new Housing Policy. Generally it should be stated, that **state withdrawal from housing subsidization** are very relevant, however most of the governments realized the problem and now they try to turn the trend back.

The changes during the last 10 years and the current situation in the construction industry have been reflected also in the **procurement process**, mainly in the quality of its particular steps and elements. The classical scheme of this process in the Region consists of the following steps (according to a building code): collection of information on wider relationships, brief, design, production, maintenance, adaptation, refurbishment and asanation. These steps are involved in and create the structure of the **model contracts** on the building design and realization.

Ideally, one person responsible for its success – a **building manager**, having the mandate of a client, **manages the procurement process**. The particular details of the steps inherently contain the requirements to **performance criteria**. However the level of their **application depends in particular cases on the building manager** - his cooperation with architect, designer, contractor and his communication with the client. This approach is **individual from case to case**, and its quality has been strongly influenced by the changed economical situation in the construction industry and particular performance criteria and relevant information are taken into consideration with different weight. The tendering restrictions according to the public procurement represent the real problems in a construction practice.

It should be expected in the coming future, that **external influence** would become important as a result of the implementation of **new EU Directives and international obligations**. The requirement to evaluate the environmental impacts, the application of the most advanced techniques (BAT), ecological and power labelling of buildings, the decisions of the conference of EU construction ministers concerning the definition of basis for construction development in tune with the principles of sustainable development will **require perhaps radical changes in the legislation documents**. Consequently, it will be necessary to find a **common framework** for these provisions, while the PeBBu network may become a bridge between the requirements and the implementation possibilities. This means that it is **necessary:**

- to develop a prospective, consistent **national construction policy and strategy** of its implementation. This could provide a plan for defining unequivocal legislative proposals in the construction sector.
- to provide conditions allowing the design scope and **control principles** before putting a building into service, required for the construction permit.
- to **identify the role of PeBBu** in the sustainable development strategy and define tasks that have to be carried out in this context.
- to define **framework outlines of law, based on the performance idea**, including the energy performance of building, in line with Directive 2002/91/EC and developing the principles of combining the existing, traditionally accepted regulations with the new generation of requirements.

5.5 Domain 7: Regulation

Building Regulations are developed in the Region partly by the competent **governmental institutions**, as far as laws and decrees are concerned, and partly by the **National Standards Institution**, as far as standards are concerned.

The **regulatory framework** in the countries of the region is composed of the Act on Construction and the Act on Construction products; National Technical Standards, European Standards (EN) and International Standards (ISO). Most of the EN and ISO are implemented in the region. Gradually EN-Standards and their implements will substitute the majority of technical standards.

The **regulations aim**: to ensure safe and healthy living conditions for all the inhabitants; to protect the civil rights of inhabitants, to protect the environment and secure the efficient and economic use of land, water, forests and other natural resources, to provide accessibility for vulnerable and disabled people in buildings and built environment, to preserve national heritage.

Regulations are applied from the governmental level, however some additional requirements can be added or some modifications can be done on the local level. The local authorities issue building permissions.

Permission is needed for all kind of building activities (municipal level). **Local authorities'** departments are responsible for providing building permissions for all building projects and they control whether a building is in compliance with Building Regulations (especially built up area, dimensions, height of the building and in some locations or districts aesthetical quality is controlled by a professional jury). **Inspectors** from local authorities inspect the buildings before providing permission for putting to use.

Standards are related to special issues of the building regulations. The Building Act, governmental and ministerial decrees and the standards they refer on are mandatory to keep, while other standards are advisory. **CPD is the base document** in all countries, its **implementation is almost completed**. (See later)

Although the **performance concept** has been integrated in the Building Regulation in many areas in the region, like building constructions, fire protection, acoustics, road and bridge construction etc., the **national standardization process is still rather weak** due to the bad economical situation of that standardization area.

Regulations are partly performance based in the region. In some countries, e.g. in Hungary a performance-based regulatory system has been introduced step by step from the 70's (International initiatives, like the work of CIB W60 group motivated the introduction of such kind of regulations.)

Harmonization process with EU standards goes fast in the Region even though the quality certificate laboratories has some difficulties with following the changes concerning the requirement standards.

5.6 Domain 8: Innovation

Before 1990 the **innovation** in the Regions' construction industry was **regulated centrally by the government** and realized by the large subsidized research institutions and by the departments for technical development in construction companies. The function and importance of those institutions has decreased as the innovation in market conditions is more influenced by the imported materials and components. After the markets were opened the innovation became more notable. Mainly the Academic Research Workshops, Higher Educational Institutions, Innovation Parks, and Institutions for quality control exercise research activities today.

Many **research programs** were conducted during decades **related to performance issues** and also performance-based regulations in the region. However the **application** of innovation **has several barriers**. The **common attitude of builders** is a major barrier, as traditional way of construction and traditional techniques are highly preferred in order to minimise risk and maximise profitability in construction. Also there is a **strong financial barrier in R&D** activities and innovation.

All **governmental bodies** in the Region declare strong support for innovations and modern technologies. From the other hand, science, **research and development is subsidised only at very low level** of the State budget. Industry is either simply too weak to invest serious money in R&D, or makes innovation at theirs homeland. In spite of this, each year some new innovative technologies in the construction sector appear. However, it should be mentioned that many innovations are implemented by foreign companies.

Great part of **the innovative products** comes **out of the international research** but there are excellent results in the Region too. One of the best fields e.g. is CAD, like ARCHICAD of Graphisoft in Hungary.

In practice the **implementation of innovative technologies** in construction sector meets **many obstacles**. The building regulation system consists of performance criteria as well as number of prescriptive requirements, which have been formulated having in mind traditional technologies. Very often new technologies do not fulfil these prescriptive requirements however they meet the essential performance criteria. In some countries construction law does not allow investors to apply these technologies even if their performance had been earlier proved by scientific methods.

In the 2nd workshop of the East European Regional Platform there was a discussion about the status of research in the EEP countries. In this workshop the following question was raised: How is R&D funded in the region? The discussion highlighted that there was a **strong financial barrier for R&D throughout the whole region**. In **Slovakia** only 0.3% of the GDP is for research (almost the lowest in the region, there is some press to the government to change this). In **Bulgaria** most of the research institutes are dealing with design. The Bulgarian Academy of Sciences and universities conduct research. Researches are mainly connected to building materials. In the University of Sofia there is a change program of students and ideas with another countries. In **Poland** the strategy plans for Polish society say to reach 3% of GDP for research (EU aims) but at this moment the figure is less than 0.5%. Polish industry is too weak to invest serious money in R&D. Now there are serious grants on the building market. One of the pluses of joining EU is that if you get some money from the EU, you also get money from the committee so this promotes proactive approach from individuals to work with EU research projects. In the **Czech Republic** 0,8-0,9 % of the GDP is going for research. The Ministry of Education provide grants for universities. In **Romania** less than 0.1% of GDP is spent on research. Some research is funded by the academy. The time given to

implement the funded research is very short, sometimes just a month and there is no time for development! There is no use of research. **In Hungary** 0.7-0.8% of GDP is on research which is planned to rise to 1,5%. It is on low level now and it is realised by the governments that this is so. Hungary is traditionally strong in research. There is a strong Academy of Sciences. In recent years R&D has been started to be financed, though the system is very administrative. A research fund has been established (0,1% of turnover from each company is collected). There is a tax relief system for research. Tendering for European funding has also started.

Contribution of the Region to Other Domain Areas

CHAPTER 6

6 CONTRIBUTION OF THE REGION TO OTHER DOMAIN AREAS

6.1 Domain 4: Built Environment

In number of proposed elements of the Built Environment the goals may be defined not only by investor/user but also by different levels of local governments, province/state authorities, state government, international protocols, agreements etc.

Typically, the international interest concentrates on the worldwide or continent level. State interest is expressed basically at state and province levels. **Town, commune or town quarters** are typical areas of **local communities' regulations**. Investor usually expresses expectations according to architecture of the building and development of the site and of course interior of the building. Many interests of external participants of the construction process are defined as spatial plans at national, regional and local level. However sometimes governments defines binding national requirements even at very low level e.g. in building codes.

The items of the domain questionnaire are the mix of environmental impact assessment and urban related issues. They are wider and go beyond the agreed scope of **building impact on built environment**. We restricted consideration to these elements, which are building oriented, so the consideration like food, education, eco-tourism, urban safety and some others are excluded from our considerations.

An **increasing** proportion of European **population** - currently more than 50% - is **living in cities**. This tendency is connected in Europe and also in the Region with leaving the cities in large numbers, with the symptom of **sub-urbanization**. This indicates the loss of prestige of urban areas and at the same time - besides its advantages - this phenomenon can call for the **deterioration of inner city area** and the increase of unfavourable social processes. At the same time, the **demand for good quality urban living** would require opposite urban processes and this is proved by the tendencies that can be observed all over the world.

The privatised and the still-local governments' housing stock together have lost half of its value since 1990 in several countries in the Region (data from Hungary). The deterioration of the general technical condition and within other factors the elevations of the buildings brings about the general deterioration (slums) of the environment and large parts of the cities. The living quality is damaged also by air pollution and noise. Thus, increased attention should be paid for **renew, maintain and operate** these **existing buildings**, especially in case the building is part of the cultural heritage, has aesthetical or historical value.

Complex urban renewal programs are needed in the major cities of the region. Some **best practice examples** can be already seen in the region, like the renewal of the historical inner city of Warsaw or the urban renewal of Ferencváros in Budapest, where the back part of former deteriorated housing blocks with small, dark and unhealthy internal courtyards were demolished and the remaining renovated building parts were joined together around newly created large internal gardens.

Figure 4. Best practice example of urban renewal program in Ferencváros, Budapest, Hungary.

Great number of the **housing stock** was built in the time of socialism in the Region. During this time, getting a flat was seen as a basic human right with the concomitant of mass housing and its well-documented consequences. The future of large panel blocks and its environment from this period are another major challenge today. Large-scale panel reconstruction programs are needed and proposed by the governments.

In some countries as regulating the development of the built environment, the national organisations for buildings has the main organizational role together with local governments. Concepts for detailed **development plans** containing protection of the built environment too, are required and initiated in these countries. The realization of this work is delaying in lack of financial funds.

The basic rules, concerning the creation of the built environment are listed in the **Building Acts**. The development based on them should create the preconditions to provide the sustained harmony of all natural, civilization and cultural values in a region, especially considering the protection of environment and its main components – soil, water and air.

6.2 Domain 5: Organization & Management

Construction enterprises have consistently begun to build the **quality management systems** in the countries of the region. After acquirement of quality certificate and after some time they begin to build **environmental management system**, as next competitive advantage. The result is achievement of **next certificate**. Into third of certified systems there is a **lack of another certificate in safety systems**. At the present time the certification of quality systems in the Region pass the revised standard EN ISO 9001:2001. Revised standards ISO family 9000:2000 support the implementation and keeping of management system of any organization in that manner, in order to it improve permanently efficiency and in order to concern with demands of all interested participants too. The **public policy** in the environment field, in much larger degree, effects company activity by different laws and instructions, which company has to keep. The systemic approach to these consequential responsibilities assurance provides the environmental management system of company. Companies, which have established the quality management system have not problem with creating the environmental management system.

The breadth of the use of the performance concept in building construction organisation and management in the region is still nominal.

The **decisions in building** construction process are **based on the investment costs**. Usually the cheapest designers and engineers are acquired and the same goes for selecting the construction company. When the life-cycle costs of an office space are calculated, it can easily be concluded, the investment cost is not that important. At some of the modern office buildings salaries of the stuff are a little bigger issue than the investment cost. Some papers suggest that adding occupant satisfaction and productivity by providing a well performing space is much more important than saving money in design and construction phase. The construction market in the Region is still waiting for development of modern systems supporting building organization and management.

6.3 Domain 9: Information and Documentation

For information several **professional journals and periodicals** are issued in the relevant field in the countries of the region. Publishers and chambers are very active in this field. Beside these, **various information materials**, as handbooks, catalogues, web pages, CD-s, prospects of building-products, etc, assist the work of the participants of the construction process. However, **complex information on a performance bases is still not available** for designers, investors or builders. There are some tools for **performance simulation** (e.g. for thermal performance for buildings), but these tools are not used in practical design.

The absence of specific performance contract documents, providing the performance-oriented model, means that in the Region the trends of **traditional procurement model** are dominant. In practice the performance criteria complexity principles in a construction process are often influenced by the level of information flows among particular partners, by the interests of construction enterprises and by the availability of necessary financial means.

Besides the procurement structure there is also the need to evaluate the weight and impact of the particular information flows during the whole procurement process and to analyse them from the aspect of their significance at particular steps. The main barriers to the performance approach in information and documentation are seen: in the **lack of a complex system of construction information** in comparison with the previous period, in the **incompleteness of the widely available knowledge, tools and databases for the complex performance simulations** and in the lack of the stimulation/funding/competitiveness.

6.4 Fire Safety Engineering

Fire safety gains a **high recognition** as it has a direct influence on inhabitants. ITB (Poland) and ÉMI (Hungary) possess the **Fire Testing Laboratory** accredited by European Group of Official Laboratories for Fire Testing. These Labs are issuing certificates and approvals of materials and building elements from fire safety point of view.

The regulations in Poland and Hungary are prescriptive, but some elements of performance approach are used in design, construction and management processes. It forecasted that the process of implementation of performance requirements in Europe would take 10 years, however fireman generally aware of performance based criteria.

In Hungary it is allowed to use performance concept in evacuation calculation and the fire risk analysis.

In the Czech Republic this domain is regulated by the Act No. 314/2001 on the fire protection and the Regulation of MV SR No. 288/2000 by which technical requirements for fire safety related to construction and usage of construction sites are specified (valid only for new buildings).

6.5 Accessibility

For the last 10 years the approach to accessibility has been changing in the countries of the Region. The rights of the disabled (especially mobility) persons are represented in the mind of people and in legal issues.

Regulations are dealing with provision and location of information, the necessary space for access in barrier-free design, turning radius for wheelchair users, barrier-free door use, barrier-free ramps, stairs, elevators, toilets, location of certain tools and devices. For **public buildings several items are mandatory** to keep, however only few residential buildings are constructed on the bases of accessibility.

The **criteria of accessibility in detail are specified** in all countries on general technical requirements to construction and on the general technical requirements to the buildings utilized by disabled persons. The requirements to the buildings occupied by disabled persons are subdivided into specific parts concerning the provision of the access, local communication and public area, the solution of the residential house and other residential buildings, the flat of specific purpose, one family house of specific purpose and the building with a protected working place, the solution of non residential building and the engineering structure in the parts suited for public use.

In Poland some part of the Regulation at the accessibility have got a **performance nature**. Much more detailed requirements of the designed buildings have descriptive base – for example gates in the enclosures, stairs and ramps, shape and dimensions of the bathrooms, halls and garages.

6.6 Facility Management

Facility means making something easier or more comfortable, and the word may here refer to either a building, or its part, it can also mean a piece of equipment operating in the building or in the open. This is very close to performance-based approach. Facility Management gives an answer to the performance-based question - "What is the best operating solution for human expectation in the building"

The strong process of **privatisation** after the political changes has had serious consequences in maintenance and facilities management in the countries of the region. In the housing sector, privatisation resulted the **rapid decline of the stock of former local authorities' housing**. This rental dwelling stock almost disappeared. After buying the dwellings, the majority of users had no more money for renovation and maintenance and the majority of this stock run down and became slums. There are a lot of problems with facilities management for this stock.

The facility management is applied in the **group of the owners** of the buildings of different age, technical state and equipment. A development of housing and its financing has undergone a series of changes, reflected in the number but also in the structure of housing units. The individual owners are grouping now into **associations of the flat owners**. Several block of owner occupied flats are managed by **special companies or housing corporations**, that are facility management companies. At present all economic, facility management companies perform **technical and administrative-custodian activities** for the great real estate owners and for the associations of flat owners. **New acts** are regulating their operation and organization. In spite of foreign experience most of the owners pay not satisfactory attention to this domain in comparison with the attention paid to their main activities. Still the role of facilities management is continuously increasing in the Region.

In **Poland** the very **fast development of facility management** has been one of the most important changes in the Construction sector in last 10 years. According to estimates Facility Management should still expand about 30% a year during the next few years. Right now we can see consolidation progress of the branch, (facility managers and the companies working for the facility managers: the consultants, service firms

and producers). The latest trends tend to increase the building's value and its role in the Polish business - (the building is often the contribution in kind in the business); it is expected that the building management will become an important part of the business operations.

6.7 Energy and Water Management

It is obvious that **thermal modernisation of existing buildings** and modernisation of their systems to reduce energy and water consumption is most urgent in the region. In this process there is a chance to balance housing deficiency with new, sustainable buildings.

Contrary to the other branches of the economy, where a technology can be changed after 10-15 years (e.g. the cars, at which the real physical life-time is not longer or an environment destructive source can be neutralised with one concentrated action), the situation in building sector is much harder:
- in one hand for a huge amount dispersedly settled households there are neither technical nor economical possibilities to implement measures with one concentrated action,
- on the other hand the **buildings' physical lifetime** is about 100 years, thus the changes and the increasing of the proportion of new buildings are very slow.
This means that the **architect's decisions** can influence a country's energy, economical and ecological position even for a century and the present situation is mostly determined by the building activity of many previous decades! It must be seen, that besides of the new buildings the **energy conscious retrofit** of the existing ones is of prevailing importance.

According to the data the majority of the houses are **poorly insulated** in the countries of the region. The other problem is the moderate thermal insulation level of the block of flats built with industrialized technologies. We should take seriously into consideration energy conservation measures even if there hadn't been any ageing in the physical state of the building stock.

The **energy management** is regulated by the acts on energetics, with the consequent regulations by which the way of the heat measurement and supply is specified. The Acts on water regulates the **water management**, with consequent regulations about the execution of certain provisions related to the water act.

In **Slovakia** the energy management is regulated by the act 70/1998 on energetics, with the consequent regulation 15/1999 by which the way of the heat measurement and supply is specified. The implementation of the Act on energetics and the education and training are provided by the Slovak Energetic Agency established by the Ministry of Economy. The water management is regulated by the Acts 184/2002 on water, with consequent regulation No. 556/2002 about the execution of certain provisions related to the water act.

In **Poland** in order to help to overcome problems of modernisation of the building stock, the government introduced special financial mechanism to improve the investors' ability to undertake the investment in energy saving measures.

6.8 Environmental Sustainability

The concept of **sustainable construction** and environmentally friendly design is **relatively new** in the Region. Although there are some prominent practical examples (as "sun-houses', the so-called autonomous house, new kind of mud or mud-brick constructions, etc.) and also significant research works, the precondition of spreading the concept would be the raising of the professions' and the public's awareness and attitude. Some aspects of sustainability, especially those addressing energy performance of buildings, are represented in the Building Regulations.

Environmental sustainability is understood as the environmental performance of buildings and their products. During the last ten years considerable research has been focused on the development of systems to **assess the environmental performance** of buildings. Several of these systems have gone to the next step, to result in a labelling system that indicates clearly the building's approximate performance to end users. It is best to say "approximate", since building performance includes many factors, only some of which are measurable in an exact sense.

Researchers and government agencies are viewing **performance rating and labelling systems** as one of the best methods of moving the performance benchmarks in the marketplace towards a higher level of performance. There is a growing realization that a major jump in performance levels, at least in market economies, will depend on changes in market demand, and that such change cannot occur until building investors and tenants have access to a relatively simple method that allows them to identify buildings that perform to a higher standard.

The advantages of having a global standard for building performance assessment and labelling cannot be over-emphasized. If meaningful information about performance is to be exchanged between countries, then a **uniform definition of performance parameters and indicators** must be developed, even if the calculation tools providing data on, for example, energy consumption and emissions vary between countries. Further, the rapid growth of global corporations, and their desire to work to a common standard, gives this work a significant commercial importance in the medium term.

Some urgent tasks related to environmental sustainability in the region:

- To **raise the public's awareness** and form the social outlook on "sustainable development and construction".
- To identify a set of measurable **sustainability indicators** for the building sector and handle them together with "ill-defined" problems, non- or less-measurable aspects with a proper ranking of related issues. To rank and benchmark a number of indicators for measuring sustainability issues in building projects.
- Establishing **practical measure**s for improving the performance of buildings and construction against the defined indicators and other aspects.

6.9 Education & Training

The idea of performance-based building is still not very popular among construction sector stakeholders. The level of understanding of the PeBBu idea is the highest in the group of scientists connected with construction industry. Other groups have some knowledge in the fields gained during learning about EU regulation system in construction or learning about construction products directive (CPD).

The **Building Performance Concept was very soon introduced in higher education and research** in the region thanks to the good cooperation during the seventies and early eighties. The opportunities of the universities changed rather radically in the transition period. In the first phase, almost all governmental linked bodies or Institutes (like academic institutes, building research institutes) suffered from the **lack of money**, as the State withdrew itself from all field of the economy and society, which needed financial subsidy but did not have promising very fast payback. Neither education, which is from its nature a long-term investment, nor research got the necessary support from the budget, which caused also the closing of some institutions. On the other hand Universities started to get benefits from participating in **international programs** like Tempus, or later Leonardo. With the decreasing support for international activities it became more difficult for UNIs to participate on conferences or starting its own research programs. A lot of laboratories stopped their developments or were closed because of the lack of finance. Industry withdrew a lot of field – mainly in the building sector – by giving jobs to the universities, finding a

more economical way to finance direct the teachers by their private companies. That makes UNI teachers' status less popular and challenging.

The university education related to building and construction is provided by **technical universities** at the faculties of civil engineering and the faculties of architecture. The universities oriented e.g. to the wood and transportation construction play a specific role in education. The education on the secondary schools gives a traditional information and knowledge. There is a need **to improve the general level of education** in the region, and also to make more training related to PBB.

The items of **PBB** are currently more intensively discussed at scientific and technical conferences, courses organised by different professionals' associations and during regular and postgraduate courses organised at the Technical Universities. Of course professionals who go in for the exams allowing them to play independent roles in construction process (certification system) have to know about these new regulations too.

However, it should be pointed out that above comments regard rather limited group of the most active professionals and that their knowledge covers only part of the much wider idea of performance based buildings.

6.10 Intelligent Buildings

The intelligent building concept is mainly applied in the latest, **most up-to-date buildings** in the region, especially in **banks**, in **headquarters of foreign companies** and in **various office and industrial buildings**. The intelligent buildings concept covers the area of **heat sources, heating control, cold sources, air conditioning, control systems, i.e. complex regulation of energy systems, protection and fire protection system, locking systems, energy consumption measurement, CCTV**. The idea of IB looks compatible with a performance base approach as the building intelligence responds to user needs. Certainly this concept will spread in the region.

The **performance approach in the intelligent buildings** could give answer to several questions:

- what services (functions) can be currently offered by intelligent building,
- how intelligent building should be designed in case the investor does not know who will be the future user,
- how the investment process should be organised in the very same case,
- how much does the intelligent systems in building cost,
- progress trends in user needs and technical solutions,
- how the building installations retrofit should be effectively organised in a way to install intelligent systems,
- the scope of necessary services required by current user or tenant and the ones he wants to pay for (it concerns the clarification of necessary services and systems).

The "Intelligent Building" as a realisation of the user's expectations **could be one of the platform to adapt the performance base approach, however it is currently more technologically oriented** issue then serving the basic understanding of PeBBu.

6.11 Structural Design & Engineering

In all countries of the region **Building Code defines the essential requirements** for buildings. The first and one of the most important is **safety of construction**. That is good example of the **performance-based** requirement. In most of the countries the regulations are prescriptive, but some elements of performance approach are used in design, construction and management processes.

Some of the **requirements concerning structural design** are performance based: i.e. Buildings and devices connected with them should be designed and executed into such way, to avoid: 1) destruction of the whole or parts of building, 2) dislocations and deformations about inadmissible sizes, 3) damage of part of buildings, connections or installed equipment in result of considerable dislocations of elements of construction.

Currently, the **performance of load bearing structures** of buildings is addressed very strictly in the regulations in the region.

Contribution of the Region to New PeBBu Tasks

CHAPTER 7

7 CONTRIBUTION OF THE REGION TO NEW PEBBU TASKS

7.1 Construction Products Directive (CPD)

CPD was known from the time of origin in the region and some principle like **Essential Requirements** came in law in the middle of the 90's. However there is **no control of implementation** and also misunderstanding can be very dangerous. **CPD should be performance based and assessment based**.

CPD is an obligation and a good possibility in breakthrough in these countries related to PBB. It is assumed, that in the near future CPD will entirely introduced in all countries. We assumed, that all countries would notify national institutes for EOTA, since majority have observer member status. We should add however, that CPD working still related more to the **product level**, and only partly at building level.

In the Czech Republic CPD has been transformed into the Czech law by national harmonisation directive No. 190/2002 Sb. where are requirements for building components with sign CE. In fact not so much components are certified.

Generally it could be stated, that CPD could act as the one of the best **catalizator of Performance Based Building** in the Region. CPD is strongly related to PBB and has an obvious positive effect. Appropriate **testing methods** to prove the conformity with the requirements should be developed.

7.2 Relationship with CRISP

The EU funded **thematic network CRISP**, **Construction and City Related Sustainability Indicators** has several outcomes that can be strongly **related to PeBBu**. The background of CRISP was a statement according to which there was a strong need to **harmonise the ways of measuring** the various aspects and criteria of sustainable development in the construction field. For this the "next step should be to reach a more consensus vision through a global common model and to **set up indicators** and policies to translate this vision into reality„. An indicator is a variable which helps to measure a given aspect / criteria of sustainable construction (a synthetic variable, giving indications, describing or measuring the state of a phenomenon or a situation, or in other word a conceptual tool, expressed in clear and precise terms, that measures progress towards an objective ; they provide a measurement unit through which modelling and monitoring can be conducted).

The CRISP network has developed a **complex database of construction and city related indicators and systems of indicators**. This database is available in the CRISP web site and there is a searching system operating on it for finding the particular indicators.

The Hungarian member of PeBBu, **ÉMI npc was participating** also in this network and created also a **national platform** for supporting this work. In Hungary a working-group with around 30 professionals was established for working out a Hungarian National system of constructed related sustainability indicators connected to CRISP. This national platform had its own database and developed close to 300 indicators and 13 systems. The work of this national platform was introduced on the 2nd workshop of this PeBBu regional platform as an example of potential national platforms.

As regards the relationships of PeBBu with CRISP, to develop and use relevant indicators and indicator systems has special importance in order **to measure the performance of buildings or elements of buildings**.

7.3 Decision Support Toolkit

The main question of decision support toolkit is **whether it exists or is it a demand** in the region.

In **Bulgaria** for example energy certification will be compulsory. Labelling and decision support could be handled together.

In **Romania** the overall certification is a good idea rather than certification of components. Since January in Romania, the energy certification will be necessary. We could tie decision-making toolkit and labelling of houses together.

The **fragmentation of stakeholders** impacts decision-making. This would be **an important tool to be presented to all stakeholders** and this can provide also better information and understanding. It could be useful also for **general contractors**. However there are **conflicting interests** e.g. contractor wants to finish as soon as possible and client wants it to be good.

There is a **need for more information** about this system before being able to comment in detail. And then this can be used at a national level, translated to universities etc. Maybe some other stakeholders such as industry can be interested in this area.

Future of PBB Implementation in the Region

CHAPTER 8

8 FUTURE OF PBB IMPLEMENTATION IN THE REGION

8.1 The Envisaged Future Implementation of PBB in the Region

In the Region **professionals feel the importance of wider introduction of PBB**. The development of a long-term thinking in life-cycle terms (that is not really existing now) and also the new ownership structures will probably strengthen the opportunities of PBB. Also a larger part of the young can gain experiences abroad in this field. Hopefully also R&D activities will have a larger emphasis.

In general only some participants of the construction design process are aware of PBB importance in practice. The complex PBB is exercised by the main architects or by the engineering organisations coordinating all participants of the construction process.

The **construction companies formulate the need of PBB** as the need of the **complex quality** of construction, which should be provided by the **quality management**. **The barriers of wider PBB application** in practice are seen in the cases when the particular **construction participants do not consider the construction and its results as one complex system**. The reason of this barrier is the lack of professionalism, responsibility and ability to cooperate as well as the lack of the adequate knowledge.

The **liability and responsibility** is supposed to be a dominant factor enhancing the PBB. In practice it is defined as the relationship of the construction process partners to profession, client, process, products and environment. Or by other words as the quality of people participating at all stages of the construction. **Third party certification** will support the environment of liability and responsibility. The need to prove the project documentation by an independent party is formulated by the clients many times.

The **increase of the education and knowledge level** is a fundamental condition of the progress in this area. The architects and engineers should have a stronger feeling of the system: inhabitants - building structures and services - environment. It can be said that the level of a **systemic approach** in the construction process gives the degree of PBB practice.

The sudden decrease of the governmental participation in the construction sector and the increase of the construction cost after 1990 influenced the liberty of design itself relatively. The **investor began to be a dominant partner** in the process and one of **the main criteria for a client making decision** on a construction or purchase of building **is of economical character**. In such a case **the role and the quality of an architect** is considered to be fundamental. Simultaneously the construction industry traditionally forces its own interests, issuing from the natural effort of companies to sell the own products. It is accompanied by the promotion of their definitive catalogue "ideal" constructional solutions of "the best materials" among the architects.

The necessity to **improve legislative framework** in the construction arise an excellent **opportunity to implement the PBB** approach**.** This opportunity could be very well detected in the widespread implementation and **success of CPD** in these countries**.**

It is a strong believe of experts, that the **increasing competition** in the market will lead to a better understanding of performance based approach for the building industry.

The extended **participation** of the Region **in EU 5th and 6th Framework programs**, and its benefit also in the demonstration projects, helps a lot to underline the importance for better designing and contracting in the building process.

8.2 Strategies of PBB Implementation

Strategies for a wider PBB implementation in EEP countries can be developed on the bases of the State of the Art analysis. The common problems and the similar situation of the platform's countries determine **common needs and strategies** for developments as follows:

Building materials and techniques:

- to develop and apply **new innovative materials** (e.g. like transparent concrete; thin high efficiency heat insulations, etc.)
- to **improve durability** of building materials and structures
- to increase the application of **local materials**
- to implement **building whole life cycle approach** and to apply **LCA tools**
- to develop techniques allowing **rapid construction** and decreased demand for workmanship
- to achieve international manufacturer companies to produce the same **quality products** in EEP countries than in home countries

Energy and indoor environment:

- to **improve the energy-efficiency** of buildings, **decrease energy consumption**
- to **increase the efficiency of energy production**
- to implement **Energy Performance Directive**
- to implement the **BEM Building Energy Management** system
- to implement **Building Energy Pass**
- to improve **indoor environment** of buildings. H**ealthy building** should be a priority topic

Building design and the construction process:

- to **increase the level of cooperation and communication** of stakeholders in the construction process, to develop **information channels**
- to increase the level of **tenant/user participation in decision making** during the whole construction process on performance bases and to give higher priority to clients' / users' needs. **Client driven solutions** should be developed, it is important to make the client interested and better informed.
- to raise the **awareness** of the designers and the public **for PBB**
- to increase **environmental sustainability and the awareness** of it, to develop and apply **quality management systems** and **environmental management systems**
- to develop and apply efficient **Decision Support Systems** in the construction process
- to develop construction **process coordination and optimisation**, to provide **more information** and to **improve the transparency of tendering**
- **Post-Occupancy Evaluations** should be used in order to meet user's requirements and increase performance.

Legal & procurement practices and regulations:

- to **develop national standardization processes** and building **regulations** on performance bases. Effort on regulation, legislation & control should be increased. More national support is needed in regulation and legislation.

- to work out efficient and more responsible **construction policies** and **housing policies** by relevant ministries, ministerial bodies and authorities
- to **increase the quantity and quality of residential buildings**, to implement the system of **HQI** (Housing Quality Indicators)
- to develop **complex programs for building renovation and urban renewal**

Innovation, R&D:

- to **promote innovation and research** by the governments and to increase the participation in international research
- to develop **performance based indicators, measurement, testing, monitoring and simulation tools** for evaluating the quality of building products, constructions, buildings, the construction process and the built environment
- to develop an efficient **control system of technical and environmental performance** and **architectural quality**. **Building classes** and **building certification** should have larger emphases.

Social and economic aspects:

- to implement **efficient housing subsidy systems** for increasing housing promotion
- to **decrease financial barriers** causing several technical problems in construction, to **increase the availability of bank credits**
- to develop the methods and practice of **building insurance**
- to develop more efficient methods for **training and education** of professionals and working force

Other priority issues:

- to spread the concept of **intelligent buildings** and to increase safety, security, indoor comfort and cost reduction by the application of intelligent solutions
- to **improve the visual/architectural quality** of buildings and the built environment
- to integrate **PBB thinking in education and training.** Training should be conducted in order to implement standards. It is necessary to explain 'why the new legislation' etc.
- to take benefit from the dynamic building industry

It is highly relevant to approach all these strategies on performance bases.

8.3 Dissemination Strategies of PeBBu

In the East European Region the following main dissemination strategies of the PeBBu project can be outlined:

National Platforms:

- ÉMI npc has started to establish a PeBBu National Platform with different stakeholders (Manufacturers' Associations, Contractors' Associations, Housing Developers, Architect's Offices,
- Local Authorities, Universities). The aim is to achieve a better influence and targeted subsidies in the area of performance based regulations.

Education and training:

- PBB education in the university courses (In Hungary for example the Budapest University of Technology and Economics (BUTE) at the Faculty of Architecture and the Faculty of Civil EngineeringUniversity of Pécs, University of Gy□ , etc.)
- PBB in training activities organized in the countries (e.g. in ÉMI).
- Summer school for young research scientists (PhD students and young doctors) to exchange experiences and to establish new research teams

Conferences and workshops:

- various national and international conferences and workshops organized partners' institutes
- national and international conferences and workshops with participation of PeBBU task members
- meetings of other EU supported projects organized in the EEP countries

Publications:

- Magazines and technical journals dealing with building, architecture and design National report send to key institutions responsible for building sector (on national languages)Web publications on web-sites well-known by architects and civil engineers (e.g. www. epiteszforum.hu)web-sites managed by the EEP task members (e.g. www.emi.hu)
- CIB publications

Conclusions

9 CONCLUSIONS

The importance of the Regional Platforms was clearly showed on the various PeBBu workshops and events. As regards the **contribution of the East European Regional Platform** to the PeBBu work, in conclusion, the following main points can be highlighted.

The national situation of the EEP countries **show similar characteristics and problems of the countries in the region** partly originated from **regional, climatic factors** and partly from the **similar historical backgrounds** (many NAS countries in the Platform). For example a dominant state sector and mass production of housing before the political changes; a growing market with new techniques & materials, foreign investors and variety of stakeholders after the changes are common features. Some **national characteristics** can be also seen.

Relatively **small number of best practice examples of PBB** can be seen in the region. Project Time from conception to implementation is very short and this is a **barrier of PBB** in the region. Standards and the implementation of them should be also improved.

As regards the **high priority PeBBu domains**, more attention is needed on **durability**, service-life method and thinking in **life cycle terms**. As regards the domain of **indoor climate**, mainly thermal comfort has had priority till now in most of the region's countries. Ventilation and indoor air quality are main problem areas. To improve them has a value on the market. There is a special importance to deal more with aspects of healthy buildings and **environmentally conscious construction**.

Research activities are generally **under-financed** in the region, in spite of **strong research traditions** in several countries (e.g. Hungary, Czech Republic). The EU extension provides also new opportunities for research funding.

The **EU extension** has a significant **positive effect on PBB** in the region (free transfer of goods, services, information and people, more possibilities for innovations, more competitiveness, more open society, research support, etc.) On the other side, **some barriers** can be also raised (due to tax policies, cartel agreements, etc.). **Obligations** are an important aspect that comes with the EU extension. **Training** has special importance in order to live with the opportunities. **Dissemination of the PBB concept** and **raising the awareness** of is important in all countries of the region.

New PeBBu tasks mean also **new opportunities** in the region. More information is needed about CPD, CRISP and Decision Support Toolkits. **CPD** is implemented in the EEP countries. CPD is strongly related to PBB and has an obvious positive effect. Appropriate testing methods to prove the conformity with the requirements should be developed. As regards the relationships with **CRISP**, to develop and use relevant indicators and indicator systems has special importance in order to measure the performance of buildings or elements of buildings. The main question of **Decision Support Toolkit** is whether it exists or is it a demand in the region.

National PeBBu Platforms would be important to be developed in order to raise the awareness of PBB and overcome the barriers of languages in the participating countries. The Hungarian National Platform of CRISP can be a good example of such kind of work.

Further Remark:

This report is complemented by the PeBBu NAS Status Report, in which more information about the EEP countries is provided, more detailed strategies, vision, conclusion and also several best practice examples are presented.

Annexes

10 ANNEXES

10.1 Annex 1. EEP Members and Participants

Contacts Task 15: Regional Platform 3 East Europe					
Country	**Last name**	**First name**	**Task**	**Organisation**	**e-mail address**
Hungary	Bánky	Tamás	Task Leader	ÉMI	tbanky@emi.hu
Hungary	Tiderenczl	Gábor	Support to Task Leader	ÉMI	gtideren@emi.hu
Hungary	Matolcsy	Károly	Support to Task Leader	ÉMI	mat.k@mail.emi.hu
Netherlands	Jasuja	Mansi	Network Secretariat	CIBdf - CIB Development Foundation	mansi.jasuja@cibworld.nl mansijasuja@hotmail.com
Belgium	Parthoens	Johan	Guest at Meeting	Belgian Building Research Institute	johan.parthoens@bbri.be
Bulgaria	Stoykova	Evelina	Task Member	Sofia Energy Centre Ltd.	estoykova@sec.bg
Canada	Szigeti	Françoise	Guest at Meeting	ICF	fs-gd@icf-cebe.com
Czech Republic	Kalousek	Milos	Task Member	Brno University of Technology	kalousek.m@fce.vutbr.cz
Czech Republic	Netopilová	Miroslava	EX Task Member	VSB - Technical University of Ostrava	radmila.jelinkova@vsb.cz
Hungary	Budavari	Zoltan	Guest at Meeting	ÉMI	z.budavari@emi.hu
Hungary	Csirszka	Erika	Guest at Meeting	ÉMI	ecsirszka@emi.hu
Hungary	Kassay	Jeno	Guest at Meeting	Hungarian Federation of Roofing Constr.	kassay@emsz.hu
Hungary	Makovenyi	Ferenc	Guest at Meeting	Szent Istvan University	m.ferenc@nextra.hu
Hungary	Becker	Gabor	Guest at Meeting	TU Budapest	becker@arch.
Hungary	Fulop	Zsuzsa	Guest at Meeting	TU Budapest	zsfulop@epsz.bme.hu
Hungary	Szoboszlai	Mihaly	Guest at Meeting	TU Budapest	
Hungary	Velosy	Andras	Guest at Meeting	XELLA	avelosy@intermail.hu
Ireland	Murray	Philip	Guest at Meeting	Dublin Institute of Technology	Philip.Murray@dit.ie
Lithuania	Lepkova	Natalija	Guest at Meeting	Vilnius Gediminas Technical University	natalija.lepkova@st.vtu.lt
Lithuania	Trinkunas	Vaidotas	Guest at Meeting	Vilnius Gediminas Technical University	vaidotas.trinkunas@st.vtu.lt
Poland	Stelmachowicz-Panyza	Dominika	Guest at Meeting	ASM Market Research & Analysis Centre Ltd.	d.pawyza@asm-poland.com.pl
Poland	Swiezawska	Beta	Guest at Meeting	ASM Market Research & Analysis Centre Ltd.	k.swiezawska@asm-poland.com.pl
Poland	Koc	Darivsz	EX Task Member	The Polish National Energy Conservation Agency	dkoc@kape.gov.pl
Poland	Bartkiewicz	Piotr	Task Member	Warsaw University of Technology	Piotr.Bartkiewicz@is.pw.edu.pl
Poland	Panek	Aleksander	EX Task Member	Warsaw University of Technology	apanek@nape.pl
Poland	Sowa	Jerzy	Guest at Meeting	Warsaw University of Technology	Jerzy.Sowa@is.pw.edu.pl
Romania	Kun	Agota	Guest at Meeting	TU Kolozvar	kunago@yahoo.com
Romania	Szabo	Balint	Guest at Meeting	TU Kolozvar	bszabo@transylvaniatrust.ro

Romania	Krizsan	Imola	Guest at Meeting	Utilitas	i.kriszan@transylvaniatrust.ro
Slovakia	Matiasovsky	Peter	Task Member	Institute of Construction and Architecture	usarmat@savba.sk
Slovakia	Hermanská	Beáta	Guest at Meeting	Slovak University of Technology	beatrix_h@pobox.sk
Slovakia	Puskár	Anton	Guest at Meeting	Slovak University of Technology	puskar@us.svf.stuba.sk
Slovakia	Durica	Pavol	Guest at Meeting	Technical University	pavol.durica@tuke.sk
Slovakia	Hurna	Sona	Guest at Meeting	Technical University	sona.hurna@tuke.sk
Slovakia	Merjavá	Veronika	Guest at Meeting	Technical University	veronika.merjava@tuke.sk
Slovenia	Bosiljkov	Vlatko	Replacement for a Task Member	ZAG - Slovenian National Building and Civil Engineering Institute	vlatko.bosiljkov@zag.si
Slovenia	Tomazevic	Miha	EX Task Member	ZAG - Slovenian National Building and Civil Engineering Institute	miha.tomazevic@zag.si
Sweden	Skarendahl	Åke	Guest at Meeting	Swedish Construction Sector Innovation Centre	ake.skarendahl@bic.nu

10.2 Annex 2. RTD Agenda of the East European Regional Platform

Nr.	RTD issue related to PeBBu Domains (D1-D8) and Priority themes (P1-P3)	Priority	Related Domains & themes
1	**D1: Life Performance of Building Materials and components**		
1.1	Integrating **performance issues in quality assurance and in diagnostics** and renewing the building stock	1	
1.2.	Improving **durability and life performance** of building materials and components	2	P3
1.3.	Assessing impact of **energy-efficient measures** on the building structure	1	P2
1.4.	Benchmarking / finding relevant **LCC or LCA tools** for the NAS situations and organising a comprehensive database	1	
1.5.	Promotion of **local materials, methods and systems**	2	D7
1.6.	**Recycling / reusing** of building materials and components	2	P3
2	**D2: Indoor Environment**		
2.1.	Addressing issues of **ecological and healthy buildings** by performance criteria, improving indoor and outdoor air quality, indoor comfort and microclimate	1	
2.2.	Assessing impact of **energy-efficient measures** on indoor environment	1	P2
2.3.	Resolve conflicts between having a good **insulated** building and **efficient ventilation**	1	P2
2.4.	Resolve conflicts between **acoustic needs and other performances** (e.g. thermal conditions, visual comfort, etc.)	2	P2
2.5.	Database about **harmful as well as healthy** materials to be further developed	1	
3	**D3: Design of Buildings**		
3.1.	Approving **design solutions** and construction works on a performance basis	2	
3.2.	**Testing performance based design** and tools for comparing design solutions	1	
3.3.	Benchmarking / finding relevant **LCC or LCA tools for testing** how design solutions allow **adaptability and flexibility of buildings** in the NAS situations	1	D1
3.4.	Developing **Intelligent buildings** (BMS) and integrated systems (including monitoring and management of buildings)	2	
3.5.	Incorporating **safety aspects** of operation and maintenance in building design	1	
3.6.	Providing **higher architectural value** of buildings and the built environment and **evaluating** aesthetical / architectural quality	1	
4.	**D6: Legal and Procurement Practices**		
4.1.	**Demonstration models for better cooperation** of the	1	

	stakeholders in the building process on the basis of higher performance achievement		
4.2.	Developing **efficient and reasonable safety systems** and relevant regulations	I	
4.3.	Integrating **and evaluating sustainability** issues in the legal and procurement practices	I	
4.4.	Providing a good balance between **real testing and simulation** of performance issues, developing tools for validation	I	
5.	**D7: Regulations**		
5.1.	Improving **building regulations on performance basis**, better understanding and defining of the economic impact of performance based regulations	I	
5.2.	Developing concepts for defining the **performance limits at certain** - traditional and widely used - **materials, technologies and structures** and create relevant performance targets, requirements and regulations.	2	D8
5.3.	Develop **housing regulations** for the NAS context to match with the housing regulation systems of the north/western European countries	I	P1
6	**D8: Innovation**		
6.1.	Developing **financial and institutional support systems** for stimulating innovation in building and construction	I	D6, D7
6.2.	Promoting the best practice examples and **demonstration activities**	I	
6.3.	**Developing regional networking** to promote innovation	I	
7	**P1: Housing**		
7.1.	Developing tools and methods for improving **housing affordability**	I	D6, D7, D8
7.2.	Improving the **complex performance of housing projects** (regarding flexibility, privacy, accessibility, energy-efficiency, durability, sustainability, mobility, safety and security, value of use and aesthetics, etc.)	I	All
7.3.	Developing new programmes and systems for sustainable **social / non-profit rental housing**	I	D6, D7
8.	**P2: Energy**		
8.1.	Improving thermal performance, **energy-efficiency and water management** in building	I	
8.2.	Further research on **renewable sources of energy** to find cheaper, reliable and efficient solutions	I	
8.3.	Increasing awareness via **pilot projects** of demonstrating the use of renewable energies (heat pump, solar, PV, bio-gas)	I	
8.4.	Informing clients / users about **energy-efficient solutions** and promoting them to use	I	
8,5,	Making a **road map** for the coming 10 years for **increasing the energy performance**	2	
8.6.	Wider implementation of **heat recuperators**	2	
9.	**P3: Renovation and Recycling**		
9,1,	Improving techniques and organization of **construction waste management**	I	
9.2.	Developing **new recyclable materials as well as**	I	D1

	materials from recycled raw materials.		
9.3.	Improving system for **non-destructive diagnostic methods**		
10.	**General issues (Cross-cutting)**		
10.1.	Developing and applying new **methods of measurements, testing and verification** and appropriate **indicators** related to complex performance issues	1	
10.2.	Further development of performance related methods, technical solutions and regulations in **structural engineering** and **fire safety engineering**	2	D1
10.3.	Improving the **sustainability of urban environments** and settlements	1	
10.4.	Addressing performance criteria of **life-cycle issues, durability, adaptability and maintenance** on a higher level	1	D1, D3, P3
10.5.	Developing decision support toolkit to **assess the building condition with regards to it's future**: to assist decision-making regarding demolition contra renovation of buildings (including condition of materials and structures, space, user needs, real estate value etc.)	1	D1, P3
10.6.	Creating conditions for making **flexible, adaptable designs and improving functional performances** (open design) via appropriate regulations, education of building professionals, informing users/clients	1	D3, D7
11.	Other issues		
11.1.	**Whole-Life Education** of PBB ideas for all building and construction students and professionals	1	
11.2.	Teaching **PBB principles from primary school level**	2	

10.3 Annex 3. Priority Themes of the EEP

10.3.1 Status and Strategies in EEP Priority Theme: Housing

by Gabor Tiderenczl, ÉMI npc, Hungary

10.3.1.1 Background of housing in the EEP region

This section summarizes the development, main features and PBB related issues of housing in the East-European region on the bases of information from the countries of the East European Regional Platform of the PeBBu network. Housing is a priority theme in the region and in the EEP countries: Hungary, Poland, Bulgaria, Slovakia and the Czech Republic.

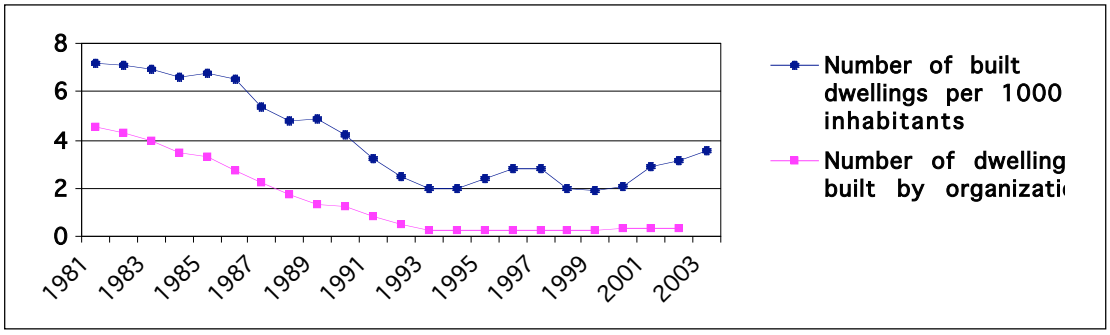
A significant part of the **housing stock** was **built in the time of socialism** in the EEP's region. During this time, getting a flat was seen as a basic human right with the concomitant of mass housing and its well-documented consequences. In that time the term "social housing" presupposed the care of the State but was marked by gross unfairness of distribution. Some strata of the society could get a flat while others were neglected. Some social criteria were applied to "deserving cases".

Figure 1: Typical large-panel housing estates in the Slovakia.

a.) Housing estate planned for 140 000 inhabitants (20 000 flats). At present 117 000 inhabitants.
b.) Renovated large panel terrace house in Bratislava
Architects: Petrzalka Architects Stanislav Talas and Jozef Chovanec
Years of construction 1975 - 1986

The transition from the state-controlled economy to the market economy has had significant consequences also in the field of **housing.** The **state withdraw from the building market, housing subsidies was dramatically cut,** state investments became rare and low budgeted, **inflation was dramatically high** (over 30 %). Residential construction declined to around 1/3 of the figure of mid 80-ies and **housing promotion is still very low** in most of the countries.

Figure 2. The trends in number of built dwellings per 1000 inhabitants, and the number of dwellings built by organizations in the housing sphere (mainly state investments) from 1981 to 2000 in Hungary.



On the bases of Yearbooks of Housing Statistics (Hungarian Central Statistical Office)

10.3.1.2 Barriers of the development of the housing stock and PBB in housing:

Many dwellings are still built in **do it yourself practice** or by black workmanship. **Low skilled workers, low workmanship, low onsite safety, lack of quality inspection and lack of a competitive market** often characterize housing construction.

The **privatization of the public housing stock** started in 1990 when new owners could buy their flats at a very low price, but did not have the financial capacity to do the necessary renovation. In this way the former public housing stock deteriorated and lost about half of its value. The rental dwelling stock almost disappeared. There are a lot of problems with facilities management for this stock. The ownership structure of the dwelling stock became extremely unbalanced in several countries. In Hungary more than 96% of the dwelling stock is in private ownership and more than 93 % of the dwelling stock is owner occupied.

The average family in the region's countries can hardly afford the price of a decent home, which would cost about 6-8 years total household income. A gap between supply and demand and – because of the increasing gap between housing prices and household incomes - a **constant problem of housing affordability** emerged. Lack of reasonable credit system, **improper rental sector, too high owner occupied sector** (mainly in Hungary, Slovakia, Slovenia and Lithuania), extremely low rent in the remained public sector and the decreased and not relevant subsidy systems sustain this bad situation.

The housing system of these countries suffers from under-financing, bad structure and a **state participation and subsidy systems** which **does not consider quality aspects**. Also the **strong and relevant bodies in the governments** (Ministry of Housing / Building Affairs, or strong independent office) **are generally missing**.

10.3.1.3 Opportunities of housing development and PBB in housing:

Most of the countries, like Lithuania, Czech Republic and Poland has Best Practise oriented strategy and knowledge, and even started to built new structures, meanwhile Hungary, Slovakia and Bulgaria has no overall and European Best Practise based systems. However, also good examples can be seen. Warsaw for example shows a very dynamic development in the last years. For the reaching of the average level of EU in the apartment provision, the intensity of construction of 5 to 6 apartments per 1000 inhabitants per year would be required as a long-term perspective. Some intergovernmental programs like Matra (NL) in Hungary, Danish know-how transfer in Lithuania, HLM know-how transfer (SK and Cz) started to run in the region.

For creating a new rental housing stock based on the features of rental housing in the former EU countries (the practice of housing associations), there are some new initiatives and laws in some countries, as in Poland or in the Czech Republic. In Hungary in 2000 a new social housing program has been started for increasing the amount of local authority dwellings, however this is not significant in quantity regarding the whole housing stock. (Also the amount of private rental housing is extremely low with 2,5 % of the dwelling stock.) There would be a large need for a new non-profit rental housing program based on the practice of housing associations (like in Austria, Denmark, The Netherlands, etc.)

10.3.1.4 The performance of the housing stock in the EEP countries

Approximately half of the housing units in the NAS and EEP countries are in dwelling houses and the rest are family houses. Detached and semi-detached family houses are dominating in Hungary. Poland has the largest rate of multi-dwelling houses. As regards *building technologies*, brick and stone wall structures are dominating in every country, especially in the building stock built before 1960. From 1960 concrete-based constructions and industrialized technologies became widely used in all countries. The future of large panel blocks and its environment from this period are another major challenge today. Large-scale panel reconstruction programs are needed and proposed by the governments.

In general economic background of the countries strongly determines housing conditions. In Hungary, and so in other countries in the region, many housing experts point out, that **housing problem is related here mostly to problems of quality**. Though for decades posters and slogans proclaimed that the main value was the human being, exactly when housing, the living place of people was addressed, the real needs of people were neglected. During the period of socialism the dominating technocracy, the pure quantitative – and not qualitative – requirements resulted in a relatively large number of new housing units, however mostly without considering the real human needs of the users.

The problem of housing quality still exists, though in another dimension. This includes either the **low quality of execution** in case of family investments in own family houses constructed with very limited budget or the **low architectural and / or functional quality** of luxury family houses built by the new rich, and also the low quality of several multi-dwelling houses built by construction enterprises for selling. Thus, a significant part of new constructed houses cannot meet up-to-date performance requirements, not to speak about the issues of sustainability. Currently, only the building regulations prescribe some quality requirements, however these regulations hardly deal with more complex requirements of a living environment, with environmental and health aspects, with the issue of architectural quality and harmony of the built environment. **Performance based regulations are not implemented in practice** and the control is missing as well. The requirements of the CPD are considered more as recommendations and there are no tools to enforce them and to measure the real performance of its issues. Current housing policies are generally addressing **mainly quantitative aims** (as 40000 new housing units/year in Hungary) and this consequently has a risk of inadequate quality.

Table 1. The main indicators of dwelling stock in the NAS countries (including the EEP countries)

Country	*Dwellings per 1000 inhabitants, 1990*	*Dwellings per 1000 inhabitants, 1999*	*Share of dwellings with bath or shower, 2001, %*	*Distribution of dwelling stock, 1999, %*		
				owner occupied	*private rental*	*social rental*
Bulgaria	377	421	75	92	5	3
Cyprus	374	418	92	..	..	..
Czech Rep.	352	427	84	49	7	24
Estonia	..	455	67	..	..	..
Poland	289	309	87	54	..	..
Latvia	358	401	67	..	..	..
Lithuania	310	372	68	..	..	..
Hungary	372	409	90	92	3	5
Slovakia	310	318	90	78	..	..
Slovenia	343	360	92	88	..	..

Source: Yearbook of housing statistics 2003, Hungarian Central Statistical Office, 2004.

Also statistics show that still a ***significant part of the dwelling stock cannot meet basic quality requirements*** *in most countries of the region. Still many dwellings are without most or without any modern appliances, without piped water, without drainage, without premise for bathing, without WC or in mud construction building without foundation. However, the data shows, that during last years the rapid improvement has taken place in several countries, for example in Poland, Hungary, Slovakia and the Czech Republic.*

As regards **thermal performance** of the dwelling stock, according to the data the **majority of the houses are poorly insulated** in the region. About 80% of the family houses have poor thermal insulation. The other problem is the moderate thermal insulation level of the block of flats built with industrialized technologies. Here problems are related mostly to the joints and to the heat bridges. We should take seriously into consideration energy conservation measures even if there hadn't been any ageing in the physical state of the building stock.

Figure 3. Panel housing blocks as demo-buildings for the SOLANOVA project in Dunaújváros, Hungary (Solar-supported, integrated eco-efficient renovation of large residential buildings and heat-supply-systems - EU FP5 R&D project)

Regarding indoor air quality in dwellings, the **design for indoor environment** in the region **has been focused mainly to the key parameters of indoor comfort**, especially thermal comfort, acoustic comfort, illumination and visual comfort. However, indoor air quality (all non-thermal attributes of the air of comfort spaces which influence humans' comfort) and other impacts related to healthy buildings and the sick-building syndrome was not really considered in the design process.

The **concept of sustainable construction and environmentally-friendly design is also relatively new** in the region. Although there are scientific researches and some prominent practical examples in housing, the precondition of spreading the concept would be the raising of the professions' and the public's awareness and attitude. Some aspects of sustainability, especially those addressing energy performance of buildings, are represented in the Building Regulations in all countries.

10.3.1.5 Best practice examples of housing in the region

As the market type building demand became dominant in the region, the **private clients started to act also as a source of Performance Based Building** due to the **"greater benefit on a reasonable prize" principle**. The private investors also started to think on a lifecycle bases. The **"architectural performance" has a dominant role** in a number of examples as well. Some aspects of sustainability and ecological performance are also considered. This kind of thinking is especially characteristic in the construction of **residential parks** in highly frequented areas, like the Buda hills in Budapest or in **high-quality family houses** in Hungary. Other best practice examples are from Slovakia and from the Czech Republic.

Figure 4. Examples of new housing projects in Slovakia

Housing complex in Kramare, Slovakia,

New block of flats in Bratislava,
Liscie udolie (~1995)

Figure 5. Examples of "Residential Parks" in Budapest and the surroundings, Hungary

Csillagvölgy residential park, Budapest
architects: VM Müvek, M. Miltényi & L. Váncza

Nagykovácsi apartman residential park
architects: Erick van Egeraat & associates

Nádorliget residential park, Budapest
architects: J. Vonnák & associates

Figure 6. Examples of new housing projects in the Czech Republic

ING housing project in Prague
Architect: Safer Hajek

Wooden residential building in Sinleruv
Mlyn architects oris Drbal & Jiri Deyl

Figure 7. Energy-efficient housing projects in Poland

Energy Efficiency Project, Krakow
A World Bank project to assist MPEC district heating company

Energy Efficiency Project, Gdansk

Figure 8. Examples of high-quality family houses in Hungary

Semi-detached vacation house, Balaton
Architect: J. Vonnák
2004

Family house, Budapest
Architect: Z. Tima

Family house, Adyliget, Budapest
architect: J. Tótpál & I. Nagy

Figure 9. Examples of high-quality family houses in the Czech Republic

Vila v Roudnici nad Labem
Architect:
Ladislava Lábuse, Martina Matisky & Dagmar Prášilové

Family house in Nebusice
Architect:
Petr Kalny & Petr Franta

Figure 10. Example of new batchelor flats in traditional environmer

Batchelor Flats, Pécs
Architect: M. Pelényi

10.3.2 Status and Strategies in EEP Priority Theme: Durability

by Peter Matiasovsky, SAS, Slovakia

10.3.2.1 State of the art

In the EEP countries the **building structures are divided into three groups** from the constructional and technological aspects. In the first group there are the structures and parts, at which the maintenance is not considered during they lifespan, assuming that they are not deteriorated and are made of high durability materials. Here the load-bearing structures belong. In the second group there are the structures and their parts at which the maintenance is carried out by the continual replacement, in parts. Here the external plasters, flooring and roofing belong. In the third group there are the structures and their parts, which are replaced instantaneously in the whole range and at the time when they have lost their ability to fulfill their function, or in such an extent that it is economically more efficient to replace them. The painting, finishing, the equipment of non-technological character, etc belong to this group.

This **division in practice was significantly deformed with the construction and facilities management quality** in the past. The short durability materials, low work quality, poor housing conditions, vandalism, lack of effective response to maintenance requests can be vastly improved if management is carried out at local level at present.
In estimating a building on present cost, the buildings maintenance is usually ignored, or at least formally considered. Many materials that require frequent renewal or maintenance have a far higher life-cycle cost, than others that cost much more initially but require no maintenance. For owners who are likely to retain a building for its entire estimated useful life – e.g. 80 years – it would be sensible to make the decision of the choice of material on the basis of the lowest life-cycle cost. The decision is however influenced by the fact that money is in short supply or by the fact that the manager who will reap the benefit of a wise initial investment will be somebody else. For the owners of a private house, it may be actually be unwise to use life-cycle costing. The average period of occupancy in western countries is about 7 years and the sale price of a house is significantly higher. Within the comparison in the EEP countries the owners expect to remain in the house for the rest of his life, therefore on the other hand, they would benefit from the use of durable materials provided they can find the money for the higher initial cost, which is ordinary not easy.

At present any type of the **new and most up-to-date products** are available on the East European construction market. Quality has been improved significantly during the last 10 years. The performance of the domestic products of building elements increased as well, however still low quality items - and often without certificate of quality - are presented on the market because of their low prices.

For assuring the quality of building materials and products, a **product evaluation system** has been developed gradually in the region. The product evaluation system is realized in a technical specification system and in a certification of conformity system.

The need of the independence and existence of mechanisms precluding the assertion of subjective interests have been formulated. The implementation of the **European Standards** (EN), particularly of the EN 1990 "Basis of Structural Design", would conform to the established reliability standard of the design of structures in EEC. Still a little used approach – risk analysis, probabilistic optimisation, plan of inspections and maintenance based on the cost assessment would be integrated.

At present, the building structures are designed mainly according to the **original national standards**. The domestic investors accept also the preliminary EN regulation. The foreign investors assert Eurocodes or American Standards. It is assumed that the complete set of Eurocodes will be in operation till the year 2012.

10.3.2.2 Performance requirements

Already in the nineties of the 20th century in the Building code the requirements issuing from the **EEC Council directive** of December 21, 1988. "On the approximation of laws, regulations and administrative provisions of the member states relating to construction products. 89/106/EEC." were included. The directive is also implemented into the acts on the construction products where the performance requirements are related to the period of expected existence of a building.

Durability is defined as the quality of maintaining satisfactory aesthetic, economic and functional performance for the useful life of the structure or element. It is the time limit of appearance and effectiveness, either expressed in a number of years – lifespan or given as a comparison with the anticipated life of a building, structures or elements.

The durability of an object, structure or element is not defined by any directive in the EEP countries. The **lifespan is mostly expressed in relation to the purpose** for which the object has been built. Approximately the lifespan of public buildings is 100 – 150 years and large panel buildings 80 years. At some industrial buildings in an aggressive environment, with an intensive performance, a bad or none maintenance or wrong reparations this period is significantly shorter, only 15 – 20 years. The orientation data on the lifespan of objects and some structures are in Table 1. The figures do not differ significantly in NAS (Table 2).

Table. 1 Orientation data on the lifespan of objects and some structures

Object or structure type	Lifespan in years
Apartment buildings - traditional	100
Apartment buildings – large panel	80
Apartment buildings – wooden	40
Makeshifts	10
Foundations	100
Walls – thick	80
Walls – thin	80
Staircases	80
Ceilings	80
Floors	40
Roofing	80
Finishing	40
Insulations and sealing	15
Services	40

Table. 2 Approximate lifespan of main load-bearing reinforced concrete elements in some EEP countries

Load-bearing element	Hungary	Poland	Former Czechoslovakia
Foundations	150		120
Columns		120-150	100
Walls			100
Floors		90-130	80-100
Staircases	100	100	70-100
Balconies	100		60-80
Roofs	100	100-120	80

More accurate is to consider the lifespan as a variable under supposed changing conditions in time. The building structures performance requirements are permanently increasing or changing. It includes not only the change of load but mainly the change of the environment to the influence of which is the structure exposed.

10.3.2.3 Indicators

In time the buildings are changing, the initial values of their performance indicators are changing to worse by the dating, as well as by the wearing out.

In the **lifespan estimation** the mean yearly costs of the object are considered, including the investment, operation and maintenance costs. Hence the lifespan is the time during which the purchase cost due to the wearing out decreases to zero. For the estimation for a whole building it is not possible to set the exact time limit, as different building elements can be in different state. So at the renovation the designer should know the lifespan of particular structural parts.

In the EEP countries two main approaches are being taken as means of **ascertaining building durability behaviour**: **non-destructive monitoring in situ and laboratory testing**. The first approach includes: visual assessment of anomalies, recording movements and strains, monitoring levels of humidity, locating steel reinforcement, etc. The second approach concerns tests of the material or component. The tests may be to determine: exact composition, conformance to standards, behaviour in conjunction with other materials/components, behaviour under adverse conditions. Tests of compressive or tensile strength serve as a good guide to durability.

10.3.2.4 Tools

The performance of building materials is predicted by their **exposition to the weather for a period of time**, weathering in the region. An **accelerated testing** is often used to give this figure. But in frequent cases the routine or modified durability tests cannot give satisfactory information about the probable material behaviour in real conditions. The only really durability test is one in which the material is exposed to the weather for a reasonable period of time.

The **computer simulation tools** are used for the long-term performance predictions, using the material parameters obtained from testing. These methods with high requirements to technical infrastructure are in development.

The **diagnostics and data gathering** mainly in civic structures are performed in the EEP countries by the organisations arising after 1993 as succession of the disintegrated branch research institutes. In spite of the raising awareness about the importance of durability, relatively few reference service life databases are available. For estimating service lives of building structures and components, like for example that of load-bearing structures, components of building facades, roof coverings or sanitary equipments, some methods of expert evaluation, design guidelines, recommendations of producers and undertaking guarantees are used. The factor method, however, is practically not yet applied in the region.

After the physical assessment of the existing building the next stage is to **offer and evaluate the options about further steps**. The appraisal of options is a complex activity. As this is not solely determined by its physical state the factors influencing the building's future are: use, comfort, ease and cost of maintenance, alternative social needs, land value, moneys available, suitability for repair/upgrading/adaptation. The economic, functional, social and legal factors will, in the final analysis determine the option taken. In taking that options the management and maintenance of the solution should be built in.

10.3.2.5 Best/worst practice examples

The **main factors resulting the short lifespan** of structure in the EEP countries are: the low durability construction materials, the wrong construction concepts, the static problems, the influence of environment and the poor maintenance. The lifespan and reliability of materials are dependent on three main factors: the used material, the performing influences and the evaluation criteria.
The **failures are differentiated** to: the aesthetic, environmental and stability ones. In general three sources of defects are mentioned: the lack of qualification, a non-satisfactory check and maintenance, imperfect economical conditions of owner.

From the comprehensive analyses of the **defects occurring in the past** it results the knowledge that predominantly the following circumstances have a large share on them: non-respecting of the basic design and technological principles, work in winter period, the use of new materials, structures and technologies without proper check of their reliability.

In the **last period the following sources of defects** can be listed: The construction companies have not the adequate knowledge on materials and technology, at the assessment of existing buildings the consideration the period of construction is missing. Some problems result from a low professional respect, when the architectural design is inconsistent with the basic building physical principles. Further defects and failures are caused by the underestimation of a building place survey.

10.3.2.6 Research agenda, actions

The science of **predicting the life of materials and structures** in buildings is still just beginning to realize some answers. Without a precise knowledge of the durability behaviour and its prediction then it is very difficult to evaluate the design or renovation options.

Research and development are aimed to the innovation of **engineering properties of concretes and cements**. At the same time, important **economical and ecological aspects** are taken into consideration. The durability theme is tightly connected with theme of r**enovation**.

The **following actions** have been formulated within the durability theme framework:

- Addressing performance criteria for durability, adaptability, reliability and maintenance of building structures.
- Addressing issues of ecological performance criteria, e.g. scarce information is available about the influence of aggressive gases on the mechanical properties of concrete. Also the conflict between the long durability and the volume oéf sales has an ecological aspect.
- Development of new easy and fast methods and facilities for measurement, testing, assessment and verification.
- Development of appropriate monitoring ndicators and sensors related to performance issues.
- Specification of quality assurance, diagnostics and renewing of structures.
- To develop a comprehensive approach to the creation of Reference Service Life data Specification of economic aspects of performance based regulations.
- Evaluation of the technical state of panel buildings for renovation, reconstruction and modernization.
- Development of models and simulation tools for durability performance prediction.
- Development of specially designed materials for building renovation.

10.3.3 Status and Strategies in EEP Priority Theme: Energy

By Evelina Stoykova, Sofia Energy Centre, Bulgaria

10.3.3.1 Introduction

Until 1990, when in the East European countries started reforms toward the implementation of market economy, almost any attention was paid to the energy consumption in buildings. While an active policy for reduction of energy demand was introduced in current EU countries after the first world energy crisis in the 70ies and it was further promoted after the second oil crisis 1979-1980, in analysed NAS countries the impact of the first oil crisis on energy demand of housing stock was practically negligible. Only in 1980s new building standards were introduced in order to reduce the specific energy demand for heating through implementation of better thermal insulation in concrete panel block of flats.

The politic regarding the building sector, especially the dwelling buildings in towns, was oriented towards the erection of a maximum number of buildings in shortest time. On the other hand, there was a shortage of building materials, as well as choice as quantity. These circumstances lead to the construction of a huge number of multi-dwelling buildings erected with concrete panels. The dwellings erected in smaller towns or villages were mostly single-family house made on the scheme "do-it-yourself", often without any design and with the participation of relatives and friends as building workers.

Energy demand of housing stock also very much depends on type of heating. In general, it is higher in housing connected to district heating, which was mostly developed in Central and Eastern European countries and resulted in higher specific energy consumption in these countries as compared to EU countries.

The result of these politic is:

- Low quality buildings;
- High energy consumption for heating;
- High expenses for energy sources for heating;
- Low thermal comfort in the dwellings because;
- High expenses for maintenance.

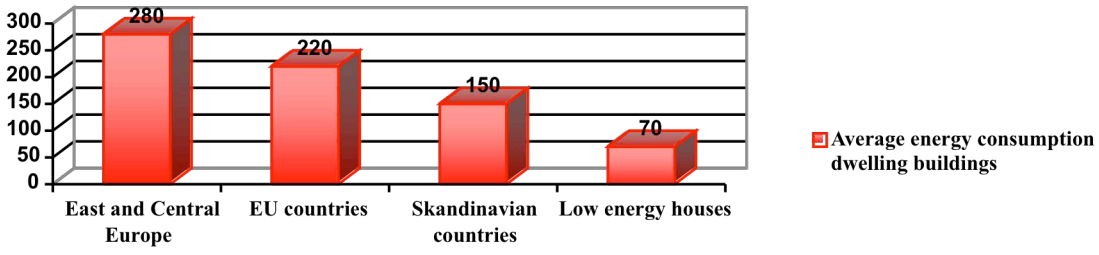


Figure 1. The average energy consumption of buildings

After 1990 economic and politic reforms started in the EEP countries. The process of accession to EU requires an improvement of the legislation and its harmonization with the EU standards.

In order to decrease the energy consumption in the building sector the European Parliament and the Council adopted " Directive 2002/91/EC" from 16/12/2002 for the energy efficiency of buildings.

The objective of this Directive is to promote the improvement of the energy performance of buildings within the Community, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. Following this Directive the authorities the EEP countries adopted new laws and standards for the improvement of the energy efficiency in the building stock. Most of these new regulations are laid down in performance terms in order to let more freedom to the clients, designers and builders when choosing building materials and technologies. The successful implementation of new standards into practice depends on the available incentives for this aim. These incentives can be financial supports or market demand. In most countries there are some state subsidies for the implementation of energy efficient measures at construction of new buildings or refurbishment of existing ones. The market demand depends on the requirements of the clients and the attitude of the designers.

As good practices we can point out the numerous projects for energy efficient buildings elaborated by enthusiastic engineers and architects. Unfortunately, many of these projects are not realized because either the lack of funding, or the lack of interest from the clients in this matter. As good practices we can also examine the work of many scientists, who are doing researches in this field for very low remunerations with the hope that some day their work will be appreciated. As worst practice can be examined the attitude of many experts from the authorities and designers, that look at these requirements from a formal point of view: "I have to do this part of the design only to get the approval from the authorities (not to realise energy savings)".

10.3.3.2 Main barriers of PBB approach related to the energy efficiency in buildings in the EEP countries

The following main barriers can be identified:

- Lack of efficient financial incentives for implementation of new technologies as: subsidies and tax alleviations;
- Lack of subsidies for R&D;
- Lack of awareness among the professionals and the end users;
- Increase of costs for design and construction.

10.3.3.3 Vision to the future implementation of energy efficient buildings in the EEP countries

The increase of prices of energy resources and the implementation of new regulations requiring more energy efficient buildings will lead to a wider implementation of energy efficient building materials and technologies. This should be supported by a PB approach that examines all aspects of the building including energy savings, environment impact and life-cycle cost. Such an approach could convince the client or the end user in the advantages of the proposed solutions. If the clients start to require a PB approach for their buildings, we could say that PeBBu is implemented!

Strategies and actions to realize the vision:

The strategy should include the involvement of all parties concerned in the implementation of energy efficient buildings and energy saving. To this aim the following actions should be launched:

- A large awareness raising campaign among the whole society is needed for the involvement of clients and end users of building;
- Training courses for professionals promoting PB approach and energy efficient solutions;
- Subsidies for the implementation of renewable energy sources and energy saving measures;

- Tax alleviations for new energy efficient and environmental friendly building materials and technologies;
- Subsidies for R&D projects;
- Improvement of the educational system and including new topics as: PB approach, life-cycle cost assessment, environmental impact assessment and energy efficiency.

10.3.3.4 Conclusions

The implementation of a new approach, like PeBBu, requires a long period of promotion, dissemination and testing. A successful implementation of energy efficient solutions in the building sector could be reached through a large awareness raising campaign among the whole society and the implementation of efficient financial instruments in the first 10 years.

10.3.4 Status and Strategies in EEP Priority Theme: Recycling and Renovation

By Milos Kalousek, Brno University, Czech Republic

10.3.4.1 Status of renovation and recycling in the EEP countries

Renovation:

Just only 2% of the of dwelling stock are built up in new construction in each year and renovation of the old buildings became a major challenge in the EEP countries. More than one third of residential houses are concrete blocks of flats constructed in the last 40 years. Thermal and structural performance of these old buildings is very low. Ex. EPBD is same for new and renovated buildings. One third of the dwelling stock were built in the last 30 years. Financial support from the Government are available in a limited extent (also from EU).

Figure 1 Renovation of concrete buildings

Recycling:

After 1990 there has been a rising production of all kind of waste. CO_2 emissions are related also to waste production.

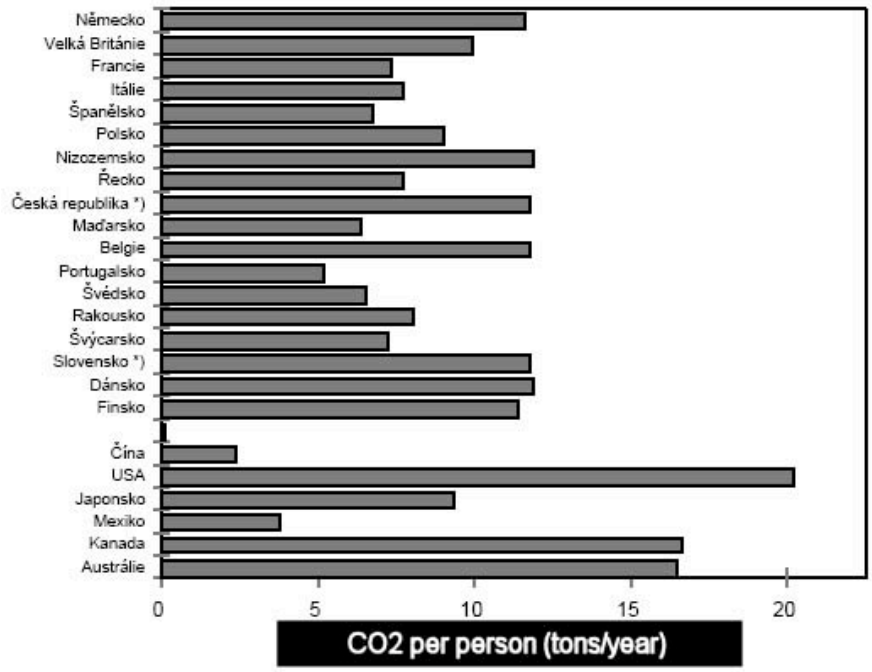


Figure 2 Production of CO2 (tons/year/person) [2]

10.3.4.2 Recycling – an essential phase of the life cycle

The total environmental impact of a building should be considered throughout its whole life, from raw material acquisition through production, use and disposal (CEN, EN ISO 14040, 1997). It is essential that the goal of optimisation efforts should be to keep structural materials in a closed material as long as possible cycle (the grey area in the Figure 3). Consequently, the required reduction of material and energy inputs (especially non-renewable sources) and negative outputs (emissions, wastes and other negative environmental impacts) can be achieved. The vital importance of maintenance, repair and renovation processes, which can increase the durability of building elements and the whole structure, is thus evident. **The recycling phases including inputs and outputs from and to other processes / industries, respectively, can represent a considerable contribution to the reduction of the total negative environmental impact of building construction.**

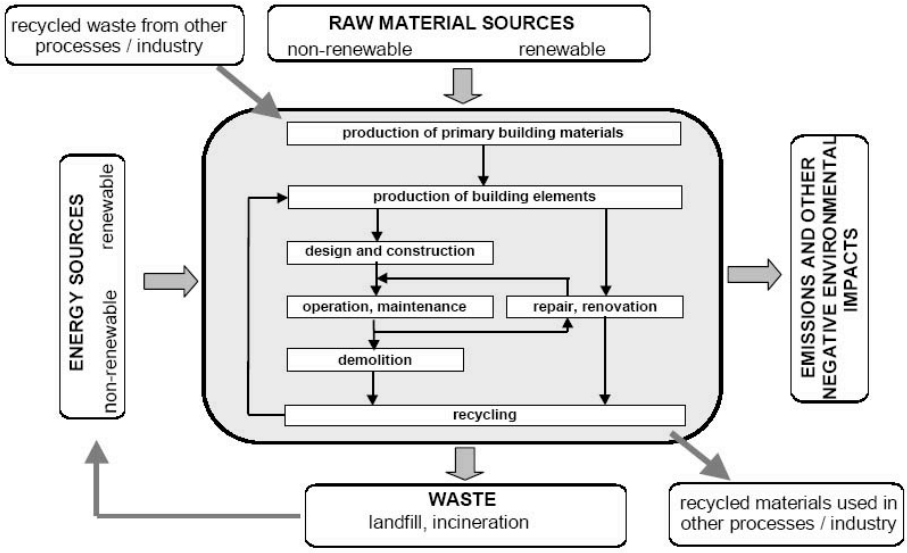


Figure 3. Life cycle of the building – material and energy flows and consequent environmental impacts [1]

The optimisation of material consumption, and/or replacement of traditional materials by others, cheaper or more readily available is not often adopted in the building industry because of the dominating use of large amounts of relatively cheap primary material sources. The reason is that the cost of the saved raw material often cannot cover the higher cost of the more demanding technology. However, the significance of use of recycled materials replacing natural non-renewable sources is evident.

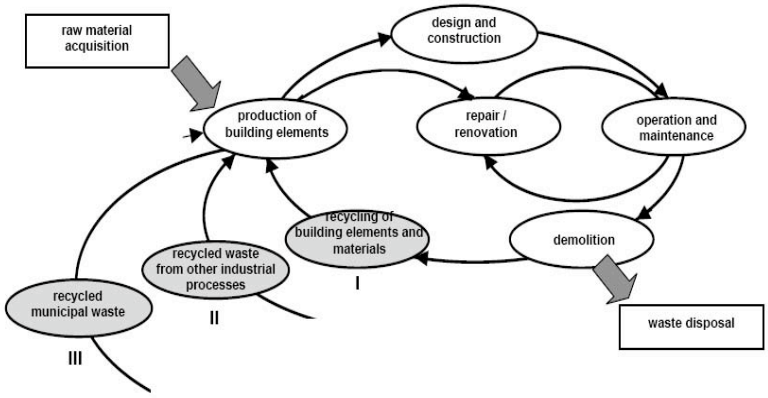


Figure 4 Use of recycled materials in the building cycle. Three sorts of recycled wastes can be used as a secondary raw material for production of building elements. [1]

Building construction typically uses large amounts of materials in relatively less demanding techniques. Therefore, there is high potential for the use of secondary materials obtained from recycling of waste generated by other industrial processes and from municipal waste – Figure 4. This approach enables primary materials to be kept in the material cycle (considering usually longer service life of the building compared to the service life of primary product) longer, thus reducing consumption of natural material sources and production of wastes. The technical value of recycled material is often lower than that of the material when first used in the primary product (down-cycling). Preference should be given to the high-value reuse of recycled materials replacing high-quality primary non-renewable raw materials. In some specific cases, new products from recycled waste can have a higher performance value in comparison with the primary product (up-cycling). The possibility of recycling of the new construction represents an important aspect that has to be considered. A feasible, effective and environmentally-sound recycling technique should be available for the specific case to avoid the necessity and uncertainty of development of a special recycling procedure. Preferably, the technology process should not limit the number of recycling cycles. An example in Figure 5 shows the potential of use of recycled plastic from throwaway bottles for production of plastic shell elements to be used as a permanent formwork in construction of ribbed or waffle RC floor slabs. The utility period of primary raw material could be thus prolonged several thousands times in comparison to waste disposal (incineration) of used plastic bottles in non-sorted municipal waste. [2]

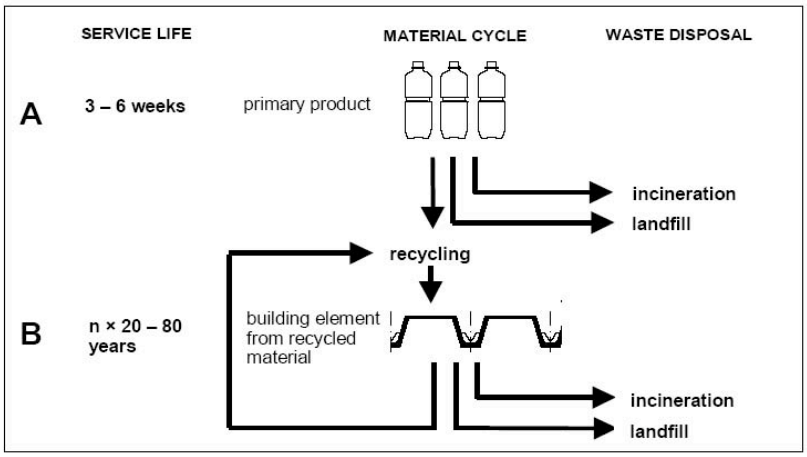


Figure 5 Life cycle of plastic throwaway bottles. A – without material recycling – lifetime 3 – 6 weeks, B – recycled plastic is used for production of building elements – lifetime n x 20 – 80 years

Figure 6 Building elements from plastic throwaway bottles

Main barriers of PBB approach related to the topic in the EEP countries:

- Old thinking - to make it the cheapest
- Short time and low cost of building
- Lack of knowledge of whole life cost

- Lack of innovative practice to lowering of maintenance cost
- Problem with liquidation and storing of waste
- Renovation is more expensive then new building
- Renovation of concrete buildings is problem with their short lifetime.

Vision to the future related to the topic in the EEP countries:

- Most of materials will be recyclable
- Increase the ratio of recycled and new materials
- Non waste industry (means building industry)
- More renovated buildings

Strategies and actions to realise the vision:

- Improving techniques and organization of construction waste management
- Developing of new recyclable materials as well as materials from recycled materials.
- Investigation of more renewable sources of materials
- Improving durability of materials
- Improving system for non-destructive diagnostic methods.
- Make new concepts of renovation for old buildings

10.3.4.3 Conclusions

The results of the long-term research have proved the possibility of the use of structural components from recycled waste in the building construction. The investigation was focused on reuse of municipal waste that is often disposed of or burned with corresponding negative impacts on the environment.

In the EEP countries it is possibility to renovate more buildings, but renovation is more expensive then new building. For renovation of concrete buildings short lifetime is a problem.

[1] CEN. 1997. EN ISO 14040 Environmental management – Life cycle assessment – Principles and framework, CEN, Brussels.
[2] Hájek P. 2000. Optimisation of Environmental Construction Impact of Composite RC Slabs, ILCDES 2000, Rilem PRO14, Helsinki