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Energy Efficient Strategies adopted in the City of Maribor, Slovenia

Abstract

The awareness of the necessity of energy saving strategies in the refurbishment of housing constructions has arisen in Slovenia recently, being encouraged by corresponding EU-strategies. The new Slovenian housing system along with institutional and governance changes has taken place since 1991. In this paper, special attention will be paid to newly introduced policies concerning energy efficiency of building constructions on the national level and the endeavours to refurbish the existing multi-family housing stock which represents the most problematic issue in terms of a long term investment perspective. Slovenia has not developed any special policy or legislation regarding sustainable refurbishment yet, either at the national, or at the local level. The City Municipality of Maribor is one of the most significant cases in Slovenia adopting the strategies for energy efficiency in public building sector. As a best practice model, the strategies of energy efficient refurbishment, based on the local energy concept and supported by financial mechanisms of public private partnership, will be presented.

Keywords

Housing, Refurbishment, Energy Efficiency, Maribor, Local Energy Concept, Public Intermunicipal Housing Fund.

Introduction (state of the art)

In Slovenia, the environmental problems and the impacts on climate change have launched new era of documents in compliance with the European Union (EU) guidelines, whose implementation is nevertheless dispersed among different sectors. In this specific situation, the existing housing stock historically depended on social circumstances from different points of view – those of organization, ownership and housing stock management. The latter is particularly clear for the housing stock built in the period of the former political system before 1991, to which Slovenia did not pay particular attention after the process of privatization of the public housing stock.

Since the independency in 1991, Slovenia supports the refurbishment strategies as a declarative part of the adopted sustainable development paradigm in all the development documents. The energy sector strategies and programmes should be realizable primarily on the local level where a broader cooperation frame work with different stakeholders ensures their implementation. Recommendations addressed to local authorities with a purpose of helping the latter establish environmentally-linked activities were already exposed in the Integrated Environmental Management Programme (2002), which opened room for the sustainable action. However, in recent circumstances the refurbishment processes

are highly complex and overlapping, and as such, they call for the integration of all stakeholders as driving forces for local governance. Some ideas and examples drawn from cases of similar economic and political background could be applied in Slovenia; nevertheless it seems crucial to examine the very particular historical and cultural reasons behind the housing development in the country with a special focus to public rental housing.

According to statistical data on construction of buildings (Census 2002), residential housing construction outnumbers that of non-housing one by almost twice the number of buildings. Another proof lies in the statistical profile of construction activities showing only a three-quarter share of new constructions and a mere 10 percent cut of refurbishment, reconstruction and maintenance (Sitar et al., 2005). Evaluation of the existing housing stock from the viewpoint of the need of refurbishment shows that a 7 percent share of all buildings are more than 30 years old.¹ There were 652,422 dwellings in Slovenia in 1991. The ratio of private stock to public stock had been 67 percent to 33 percent. During the two-year-privatisation-period from 1991 to 1993, a drastic shift in tenure structure occurred since more than 20 percent of the total housing stock changed from the public rental to the owner-occupied private sector. In 2002, there were 777,772 dwellings of which 92 percent were private, with half of them being situated in urban areas.

The refurbishment processes of housing faces difficulties due to several reasons. First, there is the lack on evaluable data concerning different housing issues generally. Second, the refurbishment procedures are hindered by problems arising from mixed ownership, insufficient informing, inadequate awareness and limited financial capacity of individual owners or tenants. Further on, there is a lot of housing management problems in organization and implementation in multi family housing schemes, and the role of housing managers is only slowly arising. Consequently, the refurbishment of public rental residential buildings owned by national or local housing funds is supposed to be the most appropriate issue for the introduction of the systematic approach based on the public-private partnership model.

Energy efficient refurbishment in figures and documents

According to statistics, the buildings are beside electricity generation and transport one of the the biggest consumers of primary energy (Novak, 2007). Sustainable energy efficient refurbishment of housing stock represents one of the key goals of European sustainable development vision. Slovenian legislation adopted early the paradigm in several documents, such as the Resolution on the National Energy Programme and in the National Programme for Encouraging Efficient Use and Renewable Energy Sources, among others. The Ministry of the Environment and Spatial Planning encourages directly or by Eco Fund certain activities and the incentives for investments into efficient use of energy in individual households, public and service sector, industry in the investments into environment friendly energy production (renewable energy sources, cogeneration systems), among others. In particular, the Ministry also supports the energy counselling and awareness raising, informing and energy user training or other target group

¹ Unfortunately there is neither any purpose-gathered data on the state of buildings or previous renovation works nor are there any measurable indicators for quality assessment. We can, upon empirical estimation, additionally classify as energy inefficient also buildings under 30 years of age which fall into the category of energy inefficiency predominantly because of poor technical and technological construction and lower energy standards set at the time of their construction.

training. In the last ten years, we have witnessed promising endeavours to harmonize legislation in the fields of environment protection, energy production and construction, with the urban planning field falling far behind.

The transferring of energy directives to the fields of planning and construction is well defined by two up-to-date acts on national level setting minimum standards as far energy efficient construction is concerned. Complex building refurbishment is defined as an opportunity for energy labelling of the buildings as well as introducing energy labels, which is seen as a new instrument of stimulation for energy efficiency.

Slovenia has made the first few steps in strengthening the energy efficient refurbishment of the existing buildings, with the exception of some individual projects and partly carried out action plans in the framework of certain European environmental projects run. There has been a non-systematic locally-based realization of complex refurbishment stimulated by national financial aid, while as a rule refurbishment tends to be the subject to individual action of investors. Major incentive for renovation was of technological nature, focusing on improving thermal efficiency. It is unfortunately not being carried out on multi-family buildings which lack appropriate quality of bearing construction, of technologies and techniques and thus consume enormous amounts of energy for heating. However, in the area of housing constructions there are major opportunities to reduce negative environmental impacts.

In order to reach national target goals, i.e. annual energy savings of 1 per cent, we will undoubtedly have to remove a number of other obstacles, such as insufficient informing on the actual costs of refurbishment and the available technologies, insufficient qualifications of energy services providers etc. Consequently, the sustainable energy efficient refurbishment on the local level features overlapping of strategic guidelines due to different interests of individual sectors, all of which increases the need of an integral approach in local governance. The realization of energy efficient interventions performed on the existing buildings is being enabled on the basis of the new of public-private partnerships, being introduced lately. There are few municipalities which have thus been preparing appropriate programmes and projects and have been successfully applying for EU-financial grants. Requirements based on the European standards will probably undergo some transformations in the form of supplements. Beside, national incentives to stimulate research and development in the field of energy efficiency and renewable sources are expected to be more effective in the future.

The successful model of the integral approach to complex energy efficiency-based refurbishment of the existing housing stock is the best practice case of the City Municipality of Maribor.

Experiences of energy efficient strategies in the City Municipality of Maribor

Maribor with 111,340 inhabitants and the area of 148 km² is the economic, administrative and cultural centre of the Podravje Region. It is a regional administration, education, health services, media, financial institutions centre, etc.

In the 1990s, the city and its urban region experienced one of the deepest economic recessions in their history, which was followed by decline in the population growth, in the number of work places, in new investments etc. By the middle of the 1990s, the unemployment rate had grown to almost a quarter of the

total active population, which was followed by periods of improvement; e.g. its September 2008 rate was only 6.3 percent but in March 2009 it raised up to the 2.1 percent.

Maribor has been characterised by negative net migration since 1991, which is mainly due to decreased migration of workers from the former Yugoslav Republic. The stagnation of population is also reflected in the decreasing number of households, especially in the town centre. In addition, the ageing index outnumbers the Slovenian average by 50 percent (Horvat, 2006).

The transformation of an old industrial town to a modern sustainable community was characterized by extreme complexity. One of the most significant economic forces is the building construction sector. In the field of housing the production in the prosperous economic period of the 1960s and 1970s reached approximately 10,000 dwellings per year, with a considerable decrease taking place after 1991. The changes in the national system of housing provision caused an extreme shortage of rental non-profit housing in Maribor region. The waiting list of applicants, mostly young people and families who are not able to solve the housing problem in any other way, are still extremely long.

	Total number of dwellings	Before 1970	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001+	Dwellings not yet refurbished
Slovenia	777,772	20,089	9,812	15,944	15,308	20,918	30,475	69,248	32,395	563,583
Maribor	48,038	575	360	561	697	1,119	2,124	5,652	2,849	34,101

Figure 6: Number of dwellings according to the year of the last refurbishment in Slovenia / Maribor, Census 2002

Another fact that needs consideration is the ownership scheme; 88 per cent of dwellings in Maribor are privately-owned, which means that the motivation for a more complex refurbishment as well as its feasibility depends largely on the financial capacity of individual owners or other users. The share of public dwellings is considerably larger than the share of other types which can be estimated in light of social structure of the population. (Figure 7).

The dynamic housing construction activities even after 1991 led to present the share of households in non-profit dwellings which is considerably higher than the average of Slovenia (Figure 8a, 8b). However, our findings show that public rental housing sector with almost 5,000 dwellings represents a realistic potential to develop the systematic approach to the integral energy efficiency-based refurbishment.

	Total	Owner, co-owner	Tenant in non-profit housing	Tenant in for-profit employer housing	Subtenant	User	Other
Slovenia	678,950	558,203	44,208	10,731	7,015	55,734	3,059
Maribor	43,702	32,973	4,525	1,196	704	4,197	107

Figure 8b: Number of households by ownership and use of dwellings, Slovenia / Maribor, Census 2002

Potential Instruments for Energy efficiency in the Building Sector

Recently, Slovenia is suffering the shortage of system tools in the fields of political, economic and consequently, spatial development. The last few decades have revealed necessity to put forth a lot of effort in assuring a broader framework which would offer in future some realistic opportunities for a complex sustainable development on local level. Housing economy has thus gained legal basis in the fields of new constructions and building refurbishment. Economic circumstances along with a shortage of residential housing had in fact stimulated a preference for new constructions market which reversed recently to a complete standstill due to the present global crisis. The need for complex refurbishment of the existing housing stock as a new tool represents a realistic opportunity for the launch of various activities integrating energy efficiency measures in all segments of economic, social and cultural development.

Urban Development Plan

Sustainable urban development has been a leading spatial documents' topic of the City Municipality of Maribor since 1990s. The changed economic and social circumstances were significantly characterized by private real estate ownership in the independent state. In 1995, the new urban development plan was the very first product of the new generation of urban plans in Slovenian history. The plan is currently being revised by striving to highlight the energy efficiency as one of the major goals of long-term sustainable development.

Municipality Environmental Protection Programme

A shortage of system-based solutions in the field of spatial planning the City Municipality of Maribor covered by development concepts in the field of environmental protection in the 1990s. The Municipality environmental protection programme adopted in 2007 upon the 1999 Local Agenda 21 linked the energy performance with that of construction and urban environment. Stressing the refurbishment of the existing housing stock the programme primarily aims at reducing energy consumption, with priority being given to publicly-owned housing. It regulates compulsory data gathering and its monitoring along with the introduction of the energy label for publicly-owned buildings and those belonging to the Municipality. Moreover, it encourages framing of a spatially efficient energy concept, applicable locally and also to a broader region. By informing the interested parties, it raises their awareness, introduces financial stimulation in the form of loans for energy efficient buildings, grants subsidies for energy efficient appliances etc. A long period of a rather inactive policy on the local level is being followed by an era of certain changes leading to a more efficient usage of financial aid provided by different European funds.

Local Energy Concept

Local energy concept (LEC) adopted in 2009 has served as a basis for the action plan in the field of energy efficient supply within the municipality and a broader region. Energy audits applying a specialist methodology were therefore carried out; their results helped to form a set of measures in public buildings with highest energy consumption. By introducing a system of energy management, data on energy consumption and the relevant costs had to be gathered and analysed. They serve as a basic tool to estimate energy costs of a single building and the entire set of buildings. Target-oriented energy consumption monitoring, using the

method of regression, shows the possibilities of reducing energy consumption, which embraces lower costs and lower CO₂ emission.

LEC was prepared by the *Energy Agency of Podravje (EnergaP)*, a company founded by the Municipality and co-financed by European Commission in 2006, which has recently played an important part in public awareness activities focused on energy efficient refurbishment. The establishment of the EnergaP presents one of the local community efforts to put forward the principles of the sustainable energy efficient supply in existing buildings. It aims at offering specialist support on energy management to all interested stakeholders. It coordinates and implements the goals set by LEC by organising the workshops on methodologies used in energy performance audits of buildings, on minimum thermal performance requirements for new constructions and on those of a more comprehensive refurbishment of larger existing public buildings. A considerable emphasis is laid on heating systems, i.e. on regular inspection of boilers and other devices, on evaluation of heating systems whose boilers are more than 15 years old. It aims at informing about new approaches to be taken and models to be used in achieving energy efficiency, such as energy bookkeeping which is planned to be introduced in all public buildings in the municipality. The estimated 20 percent decrease in energy consumption is a realistic goal to be reached in the near future. Another task of the EnergaP is a systematic set-up of a database on all energy sources, on their supply and consumption. A central data gathering system has already been introduced in 63 public buildings (schools and nurseries). The launch of an energy management system makes room for taking energy efficiency measures with highest energy saving performance and designing an efficient building refurbishment plan.

Energy Efficient Management

Individual projects of the existing public buildings are carried out within public-private partnership schemes which imply specific types of cooperation, e. g. Contract Energy Management (CEM). The CEM opens a possibility for energy efficiency projects even in cases of insufficient financial means since the financial impact in the form of energy savings affects all contracting parties - the owner, the contractor, and the tenant who might experience a slightly lower profit. Such models make room for investments into renewal of heating, ventilation, air-conditioning, cooling and other devices. In this way, it makes use of available potentials for energy saving, in terms of not only planning and new devices installation but also financing, operation management and controlling, servicing and maintenance, troubleshooting, as well as different kinds of motivation of energy users.

CEM is a temporary agreement between the owner of a building and a private company providing energy performance services as the contractor. The owner refunds the contractor's investment through period-based instalments for energy delivery. Another way of refunding is to share energy savings. The presented way of service performance is of invaluable importance for energy users' motivation; moreover, it relieves the owner's financial situation and ensures positive environmental impacts-decreased use of energy sources and less CO₂ emissions.

Inspection of Energy Consumption in Public Buildings

Inspection of energy consumption represents an important tool that enables the users to measure proper variables in a span of time, to compare the figures, and to exercise surveillance of energy use. The system enables the interested parties to measure energy flows as well as energy efficiency. EnergaP is researching a new models appearing to support well-known methodologies tested in a certain number of European countries that make use of ICT methods and instruments. Since the EU adopted Communication on mobilising Information and Communication Technologies to facilitate the transition to an energy-efficient low-carbon economy, new approaches to the cost savings focus on the behavioural change in the way to empower citizens and businesses to act by providing them with reliable data about their energy consumption. A new Central Communications body will be established to operate on all meter reading data. Up to the British government they believe that in this way it will be possible to save around 2 percent in the energy use.²

Energy Efficient Refurbishment in Public Housing Fund

In the framework of energy management the EnergaP tends to extend its activities to other public institutions in the municipality. Recently, it has been focusing on refurbishment of social housing, in cooperation with *The Public Intermunicipal Housing Fund* (PIHF), an institution founded by the Municipality of Maribor and 5 neighbouring municipalities in 2002. The PIHF manages its housing stock, consisting of non-profit and profit dwellings of different age and standards. It also acts as the main provider of public rental housing in Maribor and the surrounded municipalities.

The integral refurbishment of the housing stock certainly is one of the most complex and delicate projects, facing numerous obstacles described beforehand. The problems of the public rental housing stock are showing an extreme age diversity of the buildings by average age of 40 years. Over the last few decades, there has been significant improvement in construction standards although some of them, e.g. thermal insulation and windows related standards saw their definition only by Regulations on efficient use of energy in buildings in 2008. One could infer that buildings whose construction took place in the last 10 years boast of higher energy efficiency, which is unfortunately not the case owing to the insufficient quality of architectural design and realization. The consequence was extremely bad results of the energy use metering.

In accordance with the Housing Act (2003) and the National Housing Programme 2000-2009, the PIHF prepared its own housing constructions programme which was subsequently adopted by the Municipal Council. The realization of programmes is mostly hindered by difficulties in reaching a consensus for any kind of maintenance or refurbishment action, caused by the mixed ownership problems, generally. Furthermore, depending on the current unfavourable financial situation the PIHF has even been considering the off-sale of the oldest share of its stock, with the purchase of new dwellings being limited to energy efficient buildings (the 2009 public call). The Fund's estimation goes in favour of refurbishment in cases of its predominant or exclusive ownership.

Pilot Refurbishment Project

² <http://news.bbc.co.uk/1/hi/business/8042716.stm> (May 28, 2009)

Along with the Agency and with respect to LEC, the PIHF is planning to carry out a type of pilot project similar to that of energy efficient refurbishment of schools and nurseries whose first positive results are undoubtedly convincing. However, the already approved 2009 PIHF programme has not provided financial means for the housing stock refurbishment, which has not dissuaded from an energy efficient refurbishment-focused analysis of the residential buildings run by the PIHF.

The first analysis has already been carried out and will serve as a basis for the pilot project action plan. The PIHF chose 14 multi-family residential buildings out of its housing stock for the purpose of the project. Its selection criterion was the predominant ownership of the Fund which ensures the consensus about the realization of a refurbishment method on the basis of the owner's decision and in cooperation with the interested stakeholders, following the model of public-private partnership. The housing blocks were constructed in the recent era and their average age is 12 years. However, they fail to meet the current requirements of energy efficient construction from two points of view, the technological and that of energy performance. The PIHF has thus already made first steps by financing the study on technical defects of buildings in Veljka Vlahoviča Street performed by the Materials Research Laboratory of the Faculty of Civil Engineering at the University of Maribor.

Within the energy analysis first electricity and heating energy consumption from 2006 to 2008 have been examined. The results show an annual increase of 2.4 percent in electricity consumption. Since there are no experience-based standards in Slovenia, the comparison with Austrian data has been made, which revealed relatively high energy consumption of Slovene households. The subsequent heavy impact on family budgets classifies the selected buildings among energy inefficient ones. Their situation, however, is much better than that of public buildings.

The PIHF foresees to install the necessary electricity and heat meters to measure and regulate the use of energy. The newly equipped buildings would then be incorporated into the central energy management system of the municipality running that particular system. The monitoring and analysing the data will enable to plan short and long term measures aiming at reducing energy consumption. Moreover, placing joint public orders of energy supply along with the previously described measures could mean lower costs for the tenants. Namely, the existing system of charging lump-sum neither costs per household does nor make the tenants aware of their energy consumption responsibility. The installation of regulating and measuring devices enables the users to check their consumption on a daily basis, and invites them to act more rationally. Inspection systems can inform the users on their consumption compared even to that of their neighbour or the entire street; unusual deviation from an average consumption level sets an alarm which simultaneously helps discover potential faulty energy system operation.

The PIHF expectations at the municipal level focus on a central system energy management control and monitoring. Such central system enables the average consumption and deviation to be defined through energy cost savings on a daily basis, which makes energy saving adaptable to individual groups of users or even to individual buildings. Construction and technical parts will have to adapt to financial and other restrictions dictating a time-based per-segment refurbishment; e.g. window replacement as the first, being followed by building envelope refurbishment, roof and heating system refurbishment, etc. Anticipated

cost savings account allows an estimation of repayment periods of individual investments, which simplifies budget planning. Housing stock management and supervision of financial funds can thus be improved. The application of the system to the private sector is expected to take place early in the future.

Another concern arising from legislation requirements is the 25 percent use of renewable energy sources, which is rather limited in urban areas and calls for a special strategy and an action plan to meet the demands. Only after the data on energy use have been gathered a solving of this complex problem will become feasible, probably with comprehensive refurbishment planning for several buildings or parts of town.

The Energy Saving Best Practice Heating Model

The first phase of refurbishment will comprise heating energy supply, i.e. cost saving following the heating system replacement, based on the energy supply contracting model. Contract Energy Management (2008) represents a new model in Slovenia, based on the system of public-private ownership. Given the experience and the present financial crisis, the model described is likely to be the only acceptable one. Owing to certain indistinctive factors, it has been researched by groups of specialists in the sectors of public finances, legislation (public law) and energetics. Inspection and monitoring of the users is difficult to conduct since it requires considerable financial means; a further problem lies in the lack of the relevant legislation for penalty in case of inappropriate or energy inefficient handling. In Maribor, the system is being tested on schools and will probably undergo adaptation to suit the needs of financing social housing (i.e. non-profit housing) refurbishment.

Conclusion

Our estimation referring to possible realization of approved strategies, concepts and action plans related to introducing efficient use of energy into all segments of economic, social and environmental fields of activity within housing stock shows the existence of numerous impediments as well as opportunities. In addition, a new national energy programme is undergoing the necessary procedures to gain approval. The programme sets more strict energy requirements and will undoubtedly call for supplements to the Construction Act. Even though several models are being tested via successful projects of good practices, there are still many open issues opened. One of them is the achievement of the comprehensive energy efficient refurbishment model whose problem lies mostly in ensuring renewable sources.

It has been proved that building refurbishment calls for the focus on the non-profit housing sector where the problems of mixed ownership and related financial restrictions are less notable. The social housing sector means a great opportunity to revive building industry, as well, at least as far as larger towns and cities are concerned. Practice proves that in different circumstances of construction, depending on the age of buildings, the quality of a project, its implementation, and management require the following: each building or set of buildings in the neighbourhood or a larger residential area needs an individual approach to refurbishment process with a prior identification of the most energy-efficient investments. Awareness raising, training and technical support for all active stakeholders are therefore of utmost importance.

The state of Slovenia fails to keep pace with European strategies in preparing appropriate legislation, regulations, and methodology for the field of energy efficiency and the use of renewable energy sources. Consequently, Slovenian municipalities undertake refurbishment activities each in its own way, with no common national strategy, since the Regulations on efficient use of energy in buildings will take effect only on 1 July, 2009. Measures set in documents on the national level are rather of a theoretical nature, lacking the data on the existent state of buildings. Maribor is the first Slovenian municipality to have undertaken a systematic realization of the sustainable energy efficient refurbishment strategy and will probably serve as an example to be followed by the national level strategy.*

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