SET2010 - 9th International Conference on Sustainable Energy Technologies; Shanghai, China.
24-27 August, 2010

Longlife
Analysis and comparison of the standards, criteria and specifications for a sustainable, resource saving residential building in Baltic Sea Region (Oral Presentation)

Gang Liu[1], Ingo Nolte[1], Anna Potapova[1], Sophie Michel[1] and Klaus Rückert[1]

[1]Faculty VI, Department of Architecture, Chair Design and Structure, Technische Universität Berlin, Berlin, Germany
Maria-ilona.kiefel@campus.tu-berlin.de , www.longlife-world.eu

ABSTRACT: Environmental aspects are becoming key features in the design when it comes to constructing modern, sustainable residential buildings. In an effort to rationalize procedures and practices, the project Longlife has conducted a comparative review of these issues among the countries Denmark, Germany, Lithuania, Poland and Russia (associated organizations) in the Baltic Sea Region.
The countries involved have shared knowledge and experiences with each other about how their respective building processes operate, which are collated and analysed. There are differences and similarities in the state of technology, administrative and legal procedures, financial situation and demographic needs. Regarding environmentally friendly residential construction, one of the objectives of Longlife was to minimize these differences across the Baltic Sea Region.
This initial comparative stage covers planning, building permit and tendering procedures, practices for developing and operating housing and construction technologies. Longlife project partners work in three competence teams to use the special knowledge and experiences of the cooperation in a public private partnership.
Longlife project analyses the engineering and technology standards in the participating countries; shows the comparison and investigations of administration procedures, laws, tendering rules; provides a general, specific overview about economical issues, sustainability and quality aspects.
This paper reflects the currently most applicable features of the participating countries' processes and is basis for the next work package: development of standards, criteria and specifications for a sustainable residential building.

Keywords: energy efficiency, sustainability, building simulation, renewable energy, building life cycle

1. INTRODUCTION

Longlife[1] - Sustainable, energy efficient and resource saving residential buildings with consideration of unified procedures and new and adapted technologies - is a project, part financed by the European Union. Longlife will develop practices, innovative technologies, unified procedures and guidelines for the design of a prototype of a sustainable, energy efficient and resource saving residential building in the Baltic Sea Region[2].

The five Longlife project partner countries (Denmark, Germany, Lithuania, Poland and Russia) from the Baltic Sea Region are working together to optimize methods for buildings and construction, adapt and implement new technologies and harmonize building procedures.

These will lead to reduction of the energy consumption and minimize the operational costs during the building's lifecycle. Longlife will also tackle financing of sustainable residential buildings through various EU funds; the above mentioned knowledge definitely can and should be applicable in other countries.

This paper will show the overview on the analysis and comparison of the Longlife project WP3 (work package 3), which reports on the analysis of state of technology, administration and legal procedures, financial situation, demographic needs, similarities and differences in the participating countries, and is basis for the next work package (WP4): development of standards, criteria and specifications for a sustainable residential building.

2. STRUCTURE

2.1 Work package

Longlife has five work packages: WP1 project management, WP2 communications and information, WP3 analysis and comparison, WP4 development of standards and WP5 prototype design (Figure 1).

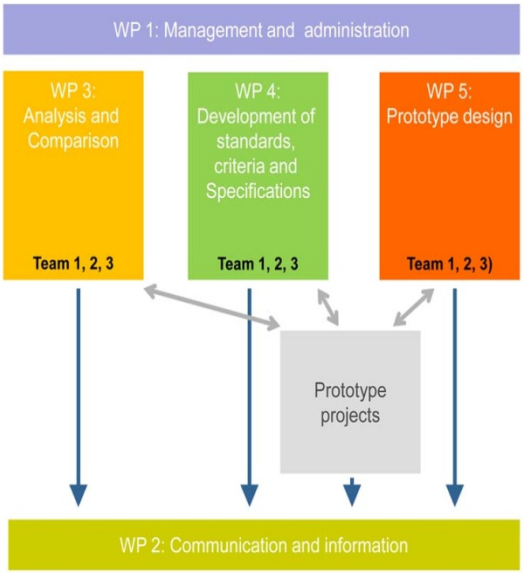

Figure 1: Relationship between 5 work packages of Longlife project [3]

2.2 Work structure

The work is always divided into three activities which will be worked on by three transnational competence teams which consist of the appropriate specialists of each country (see Figure 2). All partner countries are represented in every competence team. Each partner is contributing in each activity and therefore working for the whole project period.

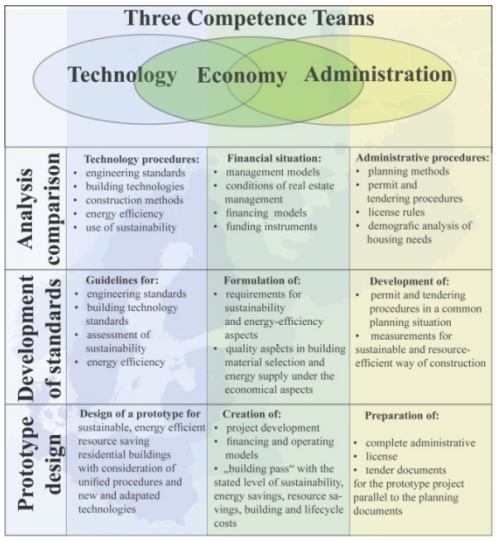

Figure 2: Work and project structure [4]

Team 1 deals generally with engineering standards, building technology and planning and consists of universities; Team 2 deals generally with administration procedures, permit rules, tendering and laws and consists of administration and state structures; Team 3 deals generally with the economical basis, as well as with project development, project management and project financing and consist of investors and building societies.

All involved countries work in the three competence teams, all the project partners' work at the same time in the same work package, as it is showed in the figure 3:

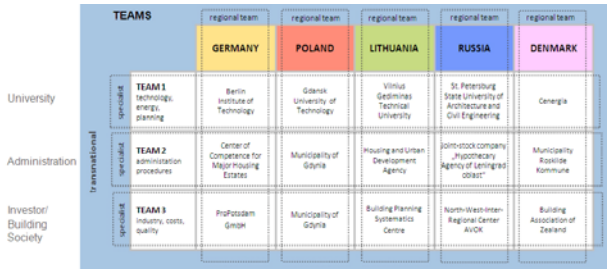

Figure 3: Work and project structure [4]

2.3 Project structure

Existing procedures for planning permit and tendering, practices for developing and operating housing and technologies for construction of buildings are gathered and analyzed for the participating countries in WP3. This comparative overview (the No. 1 output (Figure 4)) will lead to added transnational value.

In WP4 requirements and guidelines will be jointly developed to improve the existing procedures, practices and technologies to new, innovative and higher standards under the aspects of energy efficiency, sustainability, resource saving buildings and low lifecycle costs. The No. 2 output in form of a guideline for sustainable, energy efficient residential building is an added transnational value. It is intended to be used by authorities, chambers, association etc. for future legislation and as a definition of basic standards.

The developed requirements, procedures and technologies will be jointly implemented in a prototype residential building in WP5. This will be done in a "bottom up" approach – start from the existing level and improve in little steps - and a "top down" approach – define the state of the art. Finally the prototype will be adapted in each country based on their specific requirements.

Figure 4: No. 1 output, Longlife report 1, Analysis and comparison [4]

3. ANALYSIS AND COMPARISON

As the basis, the complete methodical investigation of the current status of all participating countries from the following three main issues will be developed.

It includes investigation, analysis, review and comparison of current engineering standards and technologies for building, planning methods, permits and bidding process, project management and project financing model. At the same time, questionnaire was used as a common development basis for the analysis and comparison.

3.1. Engineering and building technology standards

In this issue, analysis, comparisons and methodical investigations are finished in the partner countries.

The following aspects are the main investigation fields: architectural/urban design; structural design; energy standards; building materials; buildings physics; technical facilities (Heating, Ventilation and Air Conditioning); definition of quality standards "Energy performance building pass"; quality of building process and integration of sustainable aspects; quality of site. The partners according to the current situation answered the different questions in the questionnaire, as Table 1.

Energy standards				
Denmark	Germany	Lithuania	Poland	Russia
There are requirements for maximum energy demand in new residential buildings for space heating, domestic hot water, cooling and pumps or fans. In new buildings must not exceed (70+2200)/A, kWh/m^{2}a Where A = treated floor area.	**EnEV - 2009** Calculation of primary energy demand of new buildings under normalized terms. There are two different certificates of demand or consumption of energy. An average heat consumption of about 35 - 90 kWh/m²a. KfW Efficiency House 70 < 60 kWh/m²a KfW Efficiency House 55 < 40 kWh/m²a Passive house < 15 kWh/m²a.	STR 2.01.01(6): 1999 "Essential requirements of the building. Energy saving and heat retention" STR 2.01.09: 2005 "Energy performance of buildings" STR 2.05.01:2005 "Thermal technique of the building envelope" Total energy consumption in dwellings per month, 2008: › 35 kWh/m2 - 22%; ~ 25 kWh/m2 - 56%; ~ 15 kWh/m - 17%; ~ 8 kWh/m2 - 5%	"**Technical conditions, which buildings and their location should meet**" - Section X: Energy saving and heat isolation; There are no requirements for maximum energy consumption. Value of new construction: 95-110KWh/m^2 a	**СНиП 23-02-2003**: "Thermal Performance of the buildings"; **ГОСТ 30494-96:** "Residential and public buildings. Microclimate parameters for indoor enclosures". The rules give information about specific heat consumption and required heat transfer. It varies between 70-125 kJ/(m2*K*day)

Table 1: National code for energy efficiency of buildings and the average heat consumption [4]

3.2 Administration procedures, licensing rules, tendering rules, laws

Building permit rules; tendering rules and laws; currently applied planning methods; conditions and habits of investing/funding; conditions and habits of operating/facility management; commercial parameters, housing industry key data, urban infrastructure and housing situation; demographic analysis of housing needs and the target groups of population are main aspect of this part of the questionnaire. the. Table 2, 3 and 4 show several questions and answers from this questionnaire:

Currently applied planning methods				
Denmark	Germany	Lithuania	Poland	Russia
The employees in the different institutions responsible for each level of the hierarchy mentioned below: Hierarchy in 4 levels: Country level, regional level, municipality level and local (area specific) level.	Required documentations for the establishment and change of buildings must be created by a property planner who is required documentation-entitled.	1. Participants of the Territorial planning (licenced specialists) 2. Participants of the construction works Builder, investigator, designer of a construction works, contractor of construction of a construction works, technical supervisor of construction of a construction works supplier...	Entitled to the planning is everyone, who have suitable building power and is a member of the polish engineer's , urban's or architect's chamber.	Only legal entities licensed to perform the respective types of works with subsequent examination of the documents by the State Architectural and Construction Supervision.

Table 2: Who is entitled to do the planning [4]

Building permit rules				
Denmark	Germany	Lithuania	Poland	Russia
From 1 to 3 months. No law forces a particular time	4 weeks if all default was kept	within 10 days from receipt of the Builder's application	65 days according to the building code	Application processing time 10 days.
Administration decides whether to charge or not. Normally the price is based on m² or m³.	for a normal single family house approximately 1.800€	free of charge	About 10€	Building permit is issued free of charge. The cost of the state examination has to be calculated by a special technique.

Table 3: How much time has the administration to finish the building permit? How much does it cost? [4]

Tendering rules and laws				
Denmark	Germany	Lithuania	Poland	Russia
Only in special situations,	A new building has to fulfill the EnEV 2009. Client can formulate criteria of sustainability.	No separate codes or requirements. Normative technical construction documents have to be confirmed.	No	Defined by terms of tendering in accordance with urban planning code and local regulations.

Table 4: Are there any codes or requirements which demand the confirmation of sustainability in tendering and placing? [4]

3.3 Economical and financial basis, industry and quality

A general and a specific overview in all partner countries on different level is clearly appeared, through the detailed comparison with the questionnaire with the following aspects: economical and financial issues; sustainability aspects; economical energy supply; housing development programs of the participating countries; management models, owner's structures; evaluation of current maintenance and operating costs; conditions of real estate management; benefit analyses for owners and investors; financing and funding instruments and mechanisms;. Furthermore further, it will be very useful for the project Longlife to make evaluation and formulation (Table 5, Figure 5 and Figure 6):

Sustainability aspects				
Denmark	Germany	Lithuania	Poland	Russia
Currently there is no financial supply.	The German financial institute "Kreditanstalt für Wiederaufbau" (KfW) supports two different types of "efficiency houses" , according to KfW the funds are provided up to 100% of the building costs but not more than 50.000 € per housing unit.	For new construction there is no financial support. But wind power and the modernization (maintenance) of buildings are supported.	A federal financial support for modernization (energy saving) of residential buildings.	No financial supports.

Table 5: How is the energy saving/ sustainable construction of residential buildings connected with any financial support? [4]

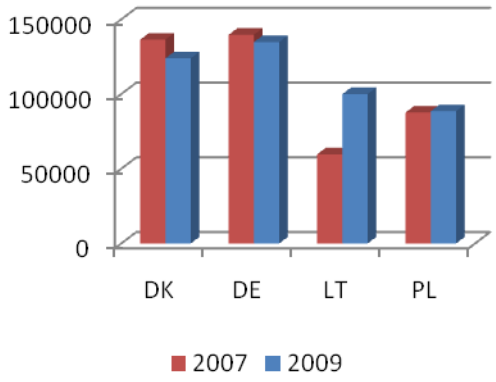

Figure 5: gas prices for household (in €/Gigajoule) [5]

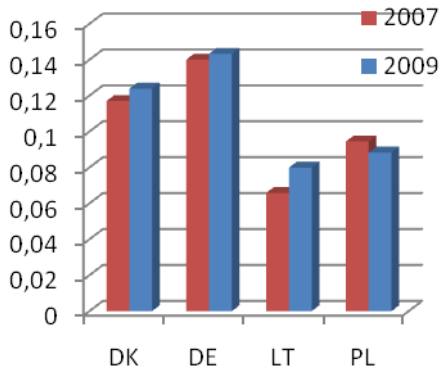

Figure 6: electricity prices for household (in €/KWh) [6]

4. DEVELOPMENT OF STANDARDS

The next step (WP4) of Longlife is development of standards, based on the results of the analysis and comparison, Longlife will develop guidelines (Figure 7) for energy efficiency, sustainability, resource saving buildings and low life-cycle-costs. In the guideline, the minimum requirements for sustainable buildings will be appointed: to be fulfilled in all the participating countries with their current state of technologies; to drop the energy consumption during the building's life cycle and to increase awareness of cost-effective public and private investments in the field of sustainable and energy efficient housing.

Furthermore, the focuses on energy efficiency, low building costs, low maintenance and operating costs, life cycle consideration, reduction of resources and energy saving, definition of a "green building" will be used as the common base and criteria in all partner countries for the design and implementation of the prototype residential building project. Appropriate and transferable investor and operating schemes as well as funding modes will be defined. They are also the basis for the design of the prototype residential building.

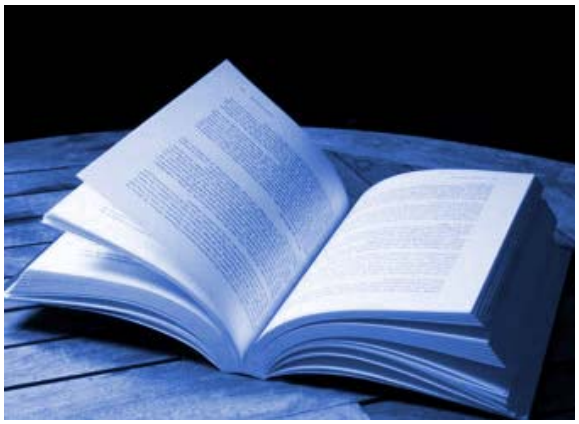

Figure 7: Output: European guideline for sustainable, energy efficient residential building [3]

5. PROTOTYPE DESIGN

Design of a prototype for sustainable, energy efficient and resource saving, residential building with consideration of unified procedures and new and adapted technologies is the core of WP5. The prototype residential building will be certificated with a Longlife performance pass as a sustainable building. The results of WP3 and WP4 (analysis, comparison, standards, criteria, specifications, methods and qualities) will be applied in the prototype project.

6. CONCLUSION

Through the development and share of the knowledge in the transnational context from Longlife teams, Longlife contributes to the EU Strategy for the Baltic Sea Region by developing solutions to adapt to climate change, in particular, by developing innovative and higher standards for sustainable and energy efficient buildings. The good practice solutions and innovative technologies should also be applied to other building types like kinder gardens, hospitals and offices.

REFERENCES

[1] www.longlife-world.eu
[2] Longlife, SET2009 - 8th International Conference on Sustainable Energy Technologies, Aachen, Germany
[3] TU Berlin, 2009, Interreg IVB Project, Baltic Sea Region, Longlife
[4] Rückert, Klaus; Longlife Lead Partner and Longlife Project Partners: Analysis and comparison. Band 1: Longlife, 2010. - 492 S., zahlr. Abb.u. Tab., A 4 ISBN 978-3-7983-2213-4
[5]http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00113&plugin=1
[6]http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00115&plugin=1