



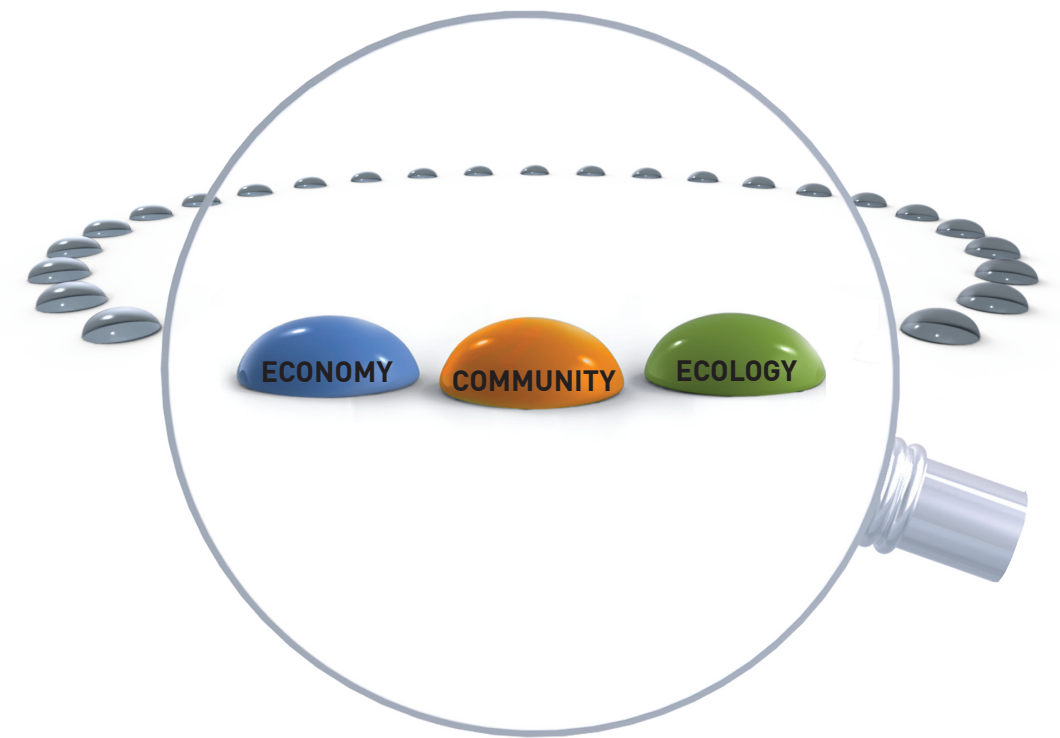
## Longlife 2

### Development of standards, criteria, specifications

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Report on sustainable buildings, engineering and technology standards, administrative, legal and tendering procedures, economical and financial models, assessment of sustainability, life cycle and operating costs.

Basis for prototype design





2

## Longlife

Sustainable, energy efficient and resource saving, residential buildings in consideration of unified procedures and new and adapted technologies

Project in the Baltic Sea Region Programme 2007-2013



## Development of standards, criteria, specifications



TU Berlin Publicationen

Edited by Prof. Dr.-Ing. Klaus Rückert, Longlife lead partner and Longlife project partners

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## Content

1.	Acknowledgement	6
2.	Contribution	7
3.	Abstract	8
4.	Introduction	14
5.	Summary - Overview	15
6.	Methods	19
7.	Workshops, meetings, events	21
8.	Design program and benchmarks	23
8.1	Engineering and building technology standards	24
8.2	Method of planning, permit and tendering procedures	64
8.3	Economical and financial basis, industry and quality	77
9.	Comparison of certification systems (DGNB/LEED, BREEAM.....)	96
9.1	Engineering and building technology standards	98
9.2	Method of planning, permit and tendering procedures	108
9.3	Economical and financial basis, industry and quality	110
10.	Results from external expertises	114
10.1	Engineering and building technology standards	115
10.2	Method of planning, permit and tendering procedures	207
10.3	Economical and financial basis, industry and quality	226
11.	References	310
12.	Glossary	327
13.	Abbreviation	343

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## 2. Contribution

### Longlife Partners

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### 3. Abstract

Energy and Cost Efficiency as the key characteristics of the sustainability have been the main consideration of different parts of research represented in the Longlife 2 Report.

Longlife 2 Report is in fact the final result of work package 4 “Developments of Standards and Criteria for Sustainable Building and Construction”.

Work package 4 was created based on the work package 3 “Analysis and comparison of state of technology, administration and legal procedures, financial situation, demographic needs, similarities and differences in the participant countries: Denmark, Germany, Lithuania, Poland and Russia”.

Three competence teams from each participant country studied, analyzed and examined these concepts from different point of view and introduced a framework to define the fundamental concepts of sustainability.

This crucial phase of project based on the objectives and activities of each team could be described as follow:

Team 1 “Engineering and Building Technology standards” and related expertise emphasized on the most architectural solutions and characteristics of sustainability in very wide spectrum. That is realized through adaptable methods of design, typology, standards, assessment systems, proper and available materials with the best physical features, the most efficient and advanced structures and technologies in order to have the most possible energy and resource saving beside the less life cycle cost of the residential building.

Team 2 “Method of planning permit and tendering Procedure” and its expertise from another point of view worked on the legal and administrative aspects of sustainability and examining possibility and capacity of each involved country to realize sustainable construction.

Team 3 “Economical and Financial basis, Industry and quality” and its related expertise explained and examined the adequate and necessary tools for implementation of sustainability regarding present market and financial conditions of each of the involved country.

The Longlife 2 Report is supposed to prepare essential know-how “Guideline of common standards and criteria” for work package 5 “Designing the Sustainable Prototype” and provide the necessary benchmarks for construction phase of Longlife sustainable building “Pilot Projects”. That could be adapted to each involved country despite of various differences in planning procedure, structural and technological level and financial, administrative and legal circumstances.

The goals that were described through the “Longlife 1 Report” were emphasized based on the similarities identified through questionnaires, have been made reachable. Therefore process of achieving benchmarks, summaries and explanation concerning every proposed individual question in the “Longlife 1 Report” has got vital importance throughout the “Longlife 2 Report”.

Defining Longlife Performance Pass<sup>®</sup> and its main criteria and characteristics has been made one of the main objectives of Longlife, because the process of dissemination and evaluation of the sustainability has got crucial importance.

### 3.1. Abstract in Danish – Resumé

Bæredygtighedens primære kendetegn, energi- og omkostningseffektivitet, har haft stor bevågenhed i de forskellige dele af den forskning, som præsenteres i Longlife 2 Rapport.

Longlife 2 Rapport er slutresultatet af arbejdsplan 4 "Udvikling af normer og kriterier for bæredygtige bygninger".

Arbejdsplan 4 blev udarbejdet på basis af arbejdsplan 3 "Analyse og sammenligning af teknologi, administrative og juridiske procedurer, finansiel situation, demografiske behov - ligheder og forskelle i deltagerlandene Danmark, Tyskland, Litauen, Polen og Rusland".

Tre kompetencegrupper fra hvert deltagerland studerede, analyserede og undersøgte koncepterne bag energi- og omkostningseffektiviteten fra forskellige synsvinkler og introducerede en struktur, som skal danne basis for definitionen af de grundlæggende bæredygtighedskoncepter.

Denne vigtige fase i projektet var baseret på hver gruppes målsætninger og aktiviteter og kan beskrives således:

Gruppe 1 "Standarder for ingeniørarbejde og konstruktionsteknologi" og de tilknyttede eksperter fokuserede på et stort spektrum af arkitektoniske løsninger og særlige kendetegn på bæredygtighed. Arbejdet blev gennemført ved brug af designmetoder, typologi, standarder, vurderingsmetoder, hensigtsmæssige og tilgængelige materialer med de bedste fysiske egenskaber, de mest effektive og avancerede sammensætninger og teknologier, for at opnå de størst mulige energi- og ressourcebesparelser, samt færre omkostninger til beboelsejendomme i hele deres levetid.

Gruppe 2 "Metode vedrørende planlægning, byggetilladelser og udbudsprocedurer" og de tilknyttede eksperter arbejdede med bæredygtighedens juridiske og administrative aspekter og undersøgte de enkelte deltagerlandes muligheder og forudsætninger for at skabe bæredygtigt byggeri.

Gruppe 3 "Økonomisk og finansielt grundlag, byggeindustri og kvalitet" og de tilknyttede eksperter forklarede og undersøgte de redskaber, som er egnede til og nødvendige for at implementere bæredygtighed under hensyntagen til de eksisterende markedsforhold og de finansielle forudsætninger i de enkelte deltagerlande.

Den foreliggende Longlife 2 Rapport har til hensigt at præsentere vigtig knowhow i en "Vejledning om fælles standarder og kriterier" som grundlag for arbejdsplan 5 "Udvikling af en bæredygtig prototype" og stille de krav, som er nødvendige for det egentlige byggeri af "pilotprojekterne". Disse krav skal kunne tilpasses alle deltagerlandene uanset forskelle i planlægningsprocedurer, strukturelle og teknologiske niveauer og finansielle, administrative og juridiske forhold.

De mål, som er beskrevet i "Longlife 1 Rapport" er understreget på basis af arbejdet i arbejdsplan 4, bl.a. ved hjælp af spørgeskemaer, og er derved gjort realiserbare. Processen med at skabe et sammenligningsgrundlag, sammenfatninger og forklaringer vedrørende hvert eneste spørgsmål i "Longlife 1 Rapport" har været af stor betydning for arbejdet med "Longlife 2 Rapport".

Definitionen af et Longlife Performance Pass<sup>®</sup> er bevaret, og dets primære kriterier og karakteristika er blevet gjort til nogle af Longlife projektets vigtigste mål, fordi selve det at formidle og evaluere bæredygtigheden er erkendt af afgørende betydning.

### 3.2. Abstract in German – Kurzfassung

Energie- und Kosteneffizienz als Schlüsselmerkmale der Nachhaltigkeit sind die Hauptthemen dieses Longlife 2 Forschungsberichtes, der das Endergebnis des Arbeitspaketes 4 „Entwicklung gemeinsamer Standards, Anforderungen, Kriterien für nachhaltiges Bauens“ darstellt.

Das Arbeitspaket 4 basiert auf dem vorherigen Arbeitspaket 3 „Analyse und Vergleich im Bezug auf den Stand der Technik, die administrativen und rechtlichen Verfahren, die finanzielle Situation, die demographischen Belange, Unterschiede und Gemeinsamkeiten in den folgenden Partnerländer: Dänemark, Deutschland, Litauen, Polen und Russland“.

Drei Kompetenzteams aus allen Teilnahmeländer haben energie- und kosteneffiziente Konzepte aus verschiedener Sichtweise studiert, analysiert und geprüft und ein System eingeführt, um die grundlegenden nachhaltigen Konzepte zu definieren.

Diese entscheidende Projektphase basiert auf den Zielen und Tätigkeiten der einzelnen Teams und kann wie folgt beschrieben werden:

Team 1 „Bautechnische Standards“ und die dazugehörige externe Expertise haben ein weites Spektrum architektonischer Lösungen und Kennzeichnungen der Nachhaltigkeit umrissen: Entwurfsmethoden, Typologieauswahl, Bewertungssysteme und passende und verfügbare Baumaterialien mit den besten physikalischen Eigenschaften, effiziente und fortschrittliche Konstruktionen und Technologien. Dies ermöglicht eine Energie- und Ressourceneinsparung mit gleichzeitiger Minimierung der Lebenszykluskosten des Wohngebäudes.

Team 2 „Baugenehmigungsmethoden und Ausschreibungsprozeduren“ und die dazugehörige externe Expertise haben die baurechtlichen und administrativen Aspekte der Nachhaltigkeit erarbeitet und die Möglichkeiten und Kapazitäten für nachhaltiges Bauen in jedem beteiligten Partnerland betrachtet.

Team 3 „Bauwirtschaftliche und ökonomische Grundlagen, Industrie und Qualität“ und die dazugehörigen externen Expertisen haben die angemessenen und benötigten Instrumente für die Ausführung der Nachhaltigkeit im Bezug auf den gegenwärtigen Markt und die finanziellen Bedingungen in jedem Partnerland entwickelt.

Der Longlife 2 Forschungsbericht „Richtlinie für einheitliche Standards und Kriterien für nachhaltigen Wohnungsbau“ soll grundlegendes Wissen für das nächste Arbeitspaket 5 „Entwerfen eines Prototypes“ vorbereiten und die erforderlichen Richtwerte für die Konstruktionsphase des Longlife „Pilotprojektes“ festlegen. Der Prototyp muss in jedem Land angepasst werden, weil Unterschiede bestehen im Planungsverfahren, auf Konstruktions- und technischer Ebene sowie bei finanziellen, administrativen und rechtlichen Rahmenbedingungen.

Auf der Grundlage des im Longlife 1 Bericht entstandenen allgemeinen Fragenbogens werden ausgewählte Aspekte vertieft und als Richtwerte zu gemeinsamen Standards entwickelt.

Der Longlife Performance Pass<sup>®</sup> als Hauptziel des Projektes vereint und bewertet diese Standards mit seinen Hauptkriterien und Kennzeichnungen, um die Nachhaltigkeit in zukünftigen Wohnbauprojekten bemessen und vergleichen zu können.

### 3.3. Abstract in Lithuanian – Santrauka

Energinis ir kainos efektyvumas yra pagrindinės subalansuotos statybos charakteristikos, kurioms skirtas ypatingas dėmesys ataskaitoje „Longlife 2 report“. Ši ataskaita yra 4-ojo darbo paketo „Subalansuotos statybos ir konstrukcijų standartų bei kriterijų vystymas“ rezultatas.

4-asis darbo paketas remiasi 3-ojo darbo paketo „Technologijų būklės, administracinių ir teisinių procedūrų, finansinės situacijos, demografinių poreikių panašumų ir skirtumų šalyse dalyvėse: Danijoje, Vokietijoje, Lietuvoje, Lenkijoje ir Rusijoje analizė ir palyginimas“ rezultatais .

Trys atitinkamų specialistų grupės iš kiekvienos projekto partnerių šalies skirtingais aspektais tyrė, analizavo ir testavo šias koncepcijas ir pateikė struktūrą, apibūdinančią pagrindinius subalansuotos statybos kriterijus. Šis projekto etapas yra paremtas kiekvienos specialistų grupės atitinkamais tikslais ir vykdytomis veiklomis, kurios yra apibūdintos žemiau:

1-oji grupė „Techniniai reikalavimai ir statybų technologijų standartai“ atliko tyrimus ir išskyrė plataus spektro architektūrinius sprendinius ir subalansuotos statybos charakteristikas. Tai pasiekta pasitelkiant adaptyvius projektinius sprendimus, pastatų tipologiją, standartus, vertinimo sistemas, tinkamų fizinių charakteristikų statybines medžiagas ir jų prieinamumą, pažangius ir efektyviausius konstrukcinius sprendimus bei technologijas. To pasekoje gautas efektyviausias energijos bei jos resursų vartojimo (taupymo) rezultatas orientuojantis į minimalią pastato gyvavimo ciklo kainą.

2-oji tyrimų grupė „Statybos leidimo ir rangos darbų konkurso procedūros metodai“ teisiniais ir administraciniais subalansuotos statybos aspektais ištyrė projekte dalvaujančių šalių galimybes kokybiškai realizuoti tokius objektus.

3-oji tyrimų grupė „Ekonominė ir finansinė bazė, industrija ir kokybė“ ištyrė ir išaiškino, kurios priemonės yra reikalingos subalansuotai statybai vystyti, atsižvelgiant į esamą rinkos ir finansinės būklės situaciją kiekvienoje šalyje dalyvėje.

Ši ataskaita yra skirta sukurti „know-how“ „Nurodymus pagal galiojančius standartus ir kriterijus“ 5-ajam darbo paketui „Subalansuoto pastato prototipo projektavimas“ ir pateikti atitinkamas gaires Longlife subalansuotų pastatų „pilotinių projektų“ statybai . Tai bus taikytina kiekvienoje šalyje dalyvėje, nežiūrint į statybų planavimo procedūrų, konstrukcijų ir technologijų lygio, finansinių, administracinių ir teisinių procedūrų padėtį.

Tikslai, aprašyti ataskaitoje „Longlife 1 Report“, tapo pasiekiami, kai klausimynų pagalba buvo nustatyti panašumai tarp partnerių šalių. Gairės, santraukos ir kiekvieno individualaus aspekto paaiškinimai ataskaitoje „Longlife 1 Report“ įgavo itin didelę svarbą ataskaitoje „Longlife 2 Report“.

Subalansuotos statybos idejų sklaida ir jo vertinimas įgijo lemiamą svarbą. Dėl to vienas pagrindinių Longlife tikslų yra jo energinio naudingumo sertifikavimo (paso) esminių vertinimo kriterijų ir charakteristikų apsprendimas.

### 3.4. Abstract in Polish – Streszczenie

Efektywność Energetyczna i Ekonomiczna, jako podstawowe miary zrównoważenia budynków, były głównym tematem rozważań i analiz przedstawionych w drugim raporcie programu Longlife (Longlife 2 Report).

Drugi raport programu Longlife jest efektem końcowym etapu WP4 „Opracowanie standardów i kryteriów dla budynków zrównoważonych”.

Etap WP4 został oparty na wynikach etapu poprzedzającego - WP3 „Analiza i porównanie technologii, procedur prawnych i administracyjnych, sytuacji finansowej, potrzeb demograficznych, podobieństw i różnic pomiędzy państwami partnerskimi: Danią, Niemcami, Litwą, Polską i Rosją”.

Po analizie i ocenie szeregu koncepcji zwiększających efektywność energetyczną i kosztową inwestycji, trzy zespoły kompetencyjne z poszczególnych państw przedstawiły zarys podstawowych koncepcji zrównoważonego budownictwa.

Ten kluczowy etap projektu w oparciu o cele i działania każdego zespołu kompetencyjnego można opisać następująco:

Zespół nr 1 - „Rozwiązania konstrukcyjne i standardy technologiczne budynków” - stworzył szeroką charakterystykę budynku zrównoważonego oraz wybrał najbardziej odpowiednie metody stworzenia jego projektu. Należy tu wymienić przede wszystkim adaptacyjne metody projektowania, kształtowania typologii, standardów, systemów oceny, wyboru odpowiednich materiałów budowlanych oraz zaawansowanych technologii w celu minimalizacji zapotrzebowania na energię i redukcji kosztów życia budynku.

Zespół nr 2 - „Procedury uzyskania pozwolenia na budowę, procedury przetargowe oraz metody planowania” - pracował nad prawnymi i administracyjnymi aspektami zrównoważenia. Zespół dokonał także oceny możliwości wdrożenia idei zrównoważonego budownictwa w poszczególnych krajach partnerskich.

Zespół nr 3 - „Podstawy ekonomiczne i finansowe budowy” - opracował ekspertyzę dotyczącą narzędzi finansowych niezbędnych do implementacji idei zrównoważonego budownictwa w krajach partnerskich przy uwzględnieniu ich uwarunkowań lokalnych.

Ten raport został stworzony w celu dostarczenia niezbędnej wiedzy dotyczącej wytycznych dla wspólnych standardów i kryteriów dla kolejnego etapu, jakim jest WP5 „Projekt zrównoważonego budynku prototypowego”. Ponadto raport ma umożliwić stworzenie niezbędnych systemów oceny konstrukcyjnej fazy budowy prototypów Longlife. Wspomniane kryteria i systemy ocen powinny zostać zaadaptowane w każdym z krajów partnerskich pomimo istnienia pewnych różnic w procedurach na poziomie planistycznym, projektowym i technologicznym, a także różnych okoliczności finansowych, administracyjnych i prawnych.

Cele opisane w raporcie nr 1 projektu Longlife („Longlife 1 Report”) stały się możliwe do osiągnięcia dzięki wynikom kwestionariuszy, które pozwoliły zidentyfikować występujące podobieństwa i różnice pomiędzy krajami. Dlatego też kontynuacja pracy nad kryteriami oceny, podsumowaniem i wyjaśnieniem wszystkich kwestii poruszonych w raporcie nr 1 jest istotnym elementem raportu Longlife nr 2 („Longlife 2 Report”).

W związku z potrzebą rozpowszechnienia i rozwinięcia idei budownictwa zrównoważonego, definicja kryteriów jakości budynków stała się jednym z podstawowych celów projektu Longlife.

### 3.5. Abstract in Russian – Краткое описание

Ключевые характеристики жизнеустойчивости - энергетическая и экономическая эффективность являлись основным предметом исследования в различных частях отчета 2 проекта Лонглайф, который является конечным результатом рабочего пакета «Разработка стандартов и критериев для жизнеустойчивого строительства».

Рабочий пакет номер 4 был создан на основе рабочего пакета 3 «Анализ и сравнение в области технологий, административных и правовых процедур, финансового положения, демографических потребностей, сходства и различия в странах-участницах: Дания, Германия, Литва, Польша и Россия».

Различные компетентные группы из каждой участвующей в проекте страны рассматривали, анализировали и исследовали энерго- и экономически эффективные концепты с различных точек зрения и представили основу для определения фундаментального жизнеустойчивого концепта.

Эта ответственная фаза проекта основана на целях и сфер деятельности каждой из команд:

Команда 1 «Инженерные и строительные технологии, строительные нормы» и соответствующая ей экспертиза были сфокусированы в основном на разработке архитектурных решений и определении жизнеустойчивости в достаточно широком спектре. Все это было осуществлено с помощью приемлемых методов проектирования, выбора типологии, стандарта, системы оценки, подходящих и доступных строительных материалов с наилучшими физическими свойствами, наиболее эффективных и прогрессивных конструкций и технологий с целью достижения максимально возможного энерго- и ресурсосбережения, сокращая стоимость жизненного цикла жилого здания.

Команда 2 «Методы выдачи разрешения на строительство и проведения тендеров» и соответствующие эксперты работали над правовыми и административными аспектами жизнеустойчивости и исследовали способности достижения жизнеустойчивого строительства для каждой участвующей в проекте страны.

Команда 3 «Экономические и финансовые основы, индустрия и качество» и соответствующая экспертиза исследовали и изложили необходимые эффективные средства для осуществления «жизнеустойчивости» относительно существующего рынка и финансовых условий каждой задействованной стране.

Данный отчет нацелен на подготовку основополагающих научно-технических знаний для следующего рабочего пакета 5 «Проектирование прототипа» и предоставление необходимых эталонов для этапов строительства «жизнеустойчивого» дома Лонглайф «Пилотный проект».

Он мог бы быть адаптирован в каждой стране-участнице несмотря на несколько различий при планировании, на техническом и конструкционном уровне, а также учитывая финансовые, административные и правовые условия.

Цель, касающаяся общности между странами-участниками, описанная в отчете номер 1 стала достигнута прежде всего благодаря опроснику.

Следовательно процесс достижения эталонов, выводов и пояснений, касающихся каждого предложенного в первом Лонглайф отчете вопроса, имели решающее значение при создании второго отчета. При этом дефиниция Longlife Performance Pass © и его основных критериев и характеристик, как одна из главных целей проекта Лонглайф, играет значительную роль в процессе распространения и оценки жизнеустойчивых идей.

## 4. Introduction

Generally speaking, sustainable development has been defined in the various way as wise, caution and logical utilization of resources, where the economic, cultural, social and environmental issues are its four basic pillars.

Despite of all international program, efforts and global performance regarding development plans based on sustainable considerations, monitoring projects are presenting yet the overusing natural resources and increasing energy consumptions in different ways.

Considering this basic and fundamental issue, Longlife project, a Baltic Sea project has been started with the Agenda of; Sustainable, energy efficient and resource saving Residential Prototype in consideration of unified procedure and advanced technology in countries around Baltic Sea.

As the main aim project focused on the optimization of methods of construction, adapts and implements advanced technologies for constructing Residential buildings and harmonizing building procedure between involved countries, in order to reduce energy consumption and cost through whole life cycle of building.

During the first phase as it is already explained in the first report; Longlife analyzed and compared the state of art for Energy Efficiency; Sustainability and Resource saving, through Life cycle cost efficiency of building, while keeping adoptable and affordable qualities in Prototype residential building in whole participant countries.

In the present phase "Report" Longlife has developed common standards, criteria and specification for a sustainable, resource saving residential building. Here the main objective have been to achieve unified procedures for energy efficiency, sustainable construction, resource saving approaches and reduction of Life cycle cost of buildings in one hand and simplification of the path for "transnational Planner, Investors and Administration" to realize European Union in other hand.

As mentioned before third phase -in form of WP5- will consisted of the designing of Prototype building, based on the provided "Common Standards" applicable on the whole procedure of planning, construction and performance regarding various administrative, legal and tendering frame work of participant countries.

As principal approach; the working methods have been based on "Triple helix", namely; Three transnational competence teams, "Universities, Administrations and Housing Companies", that each part is composed of five members from participant countries "Denmark, Germany, Lithuania; Poland and Russia". Whole group are working jointly and through whole process of project, an approach that has realized the "transnational co working between fifteen different project partners.

Berlin University of Technology, faculty VI, Institute of Architecture, Department Design and Structure is the lead partner. Longlife has started in January 2009 and still will finish in January 2012.

## 5. Summary - Overview

During last decade the essential topics of sustainability namely: “climate change”, ever growing “energy consumption and its environmental, social and economic consequences”, “resource saving policies and its necessities” has got crucial importance. Insofar as EU- Parliament issues resolutions such as: “reducing energy consumption about 20% till 2020” and described a “Strategic Goals” and objectives such as:

1. Moving towards a low carbon energy system
2. Ensuring security of energy supply for all
3. Ensuring that the first two goals also strengthen the EU's competitiveness and deliver energy to all consumers at affordable prices.

Among the last objectives; “Energy- efficient Building, “EeB” described that high energy efficient innovative technologies and measures might resulting in very low energy building, where the total annual energy consumption of the buildings should not exceed 60 kWh/m<sup>2</sup>/ year ( primary energy).

Therefore immense team of researchers from different disciplines, engineers with different technical background, as well as staff from implementations and legal sectors have got involved in these topics from various points of view.

Since enlargement of European Union and central position of “Baltic Sea” as the EU’s internal sea, “Baltic Sea Region” has got critical importance in researches as strategic point in EU.

The **EU Strategy for the Baltic Sea Region** contributes to more intensive cooperation between the Baltic countries and shapes the region into a regional cooperation model for the whole EU. The most important strategy for the Baltic Sea Region is creating a complex common development strategy for a macro-region of this type. Where is observed as highly heterogeneous area in economic, environmental and cultural terms, yet the countries concerned share many common resources and demonstrate considerable interdependence.

The interdependence, along with the need to confront similar challenges, is an important justification for joint action within the framework of the strategy for the Baltic Sea Region.

Following this strategy, Longlife project was established to introduce “ Sustainable, energy efficiency and resource saving residential building in consideration of unified procedures and new and adapted technologies” in Baltic Sea Region. Longlife is a project contributing to the “Flagship” projects of “European Union” that covers the flagship project "Anticipate regional and local impacts of climate change through research".

Longlife project strategic goals are as follow:

- Reducing annual energy consumption of residential buildings down to 40 kWh /m<sup>2</sup>/year
- Reducing Life cycle cost of residential buildings
- Optimizing regional typologies of building and construction methods
- Developing, transferring and adapting and implementing new technologies
- Harmonizing country- specific planning and other procedure in order to improve sustainability of buildings

The first publication of Project, Longlife 1 Report “Analysis and Comparison” focused on the analysis of state of technology, administration and legal procedures, financial situation, demographic needs, similarities and differences in the participating countries.

Based on the findings and results of Longlife 1 Report “Analysis and Comparison”, Longlife 2 report “Development of Standards, Criteria, Specifications” paid attention to developing standards, criteria, specifications and guidelines.

The final stage is developing a catalogue of the methods, procedures, technologies, materials and elements, as the necessary tools for developing Longlife Prototype. The prototype that in turn would be the fundamental of Longlife pilot projects.

To achieve this crucial goal and its tool “Guidelines and Catalogue” three competence teams with the support of appropriate external expertises have been studying, analysing and preparing group of scientifically rich reports to specifying Longlife main topic from different point of view.

Brief reviews on each part of the Longlife Report two “Development of Standards, Criteria, Specifications” are as follow:

**Team 1 of Longlife project” Engineering and Building Technology standards”** under the leadership of “Gdansk University of Technology” provided findings in three different levels:

- 1- The questionnaires of Longlife 1 Report “Analysis and Comparison” resulted and ended up with the indicators or benchmarks with specific concentration to the regulations and rules. Some of the most important findings are as follow:
  - Type of the residential building: detached, multi-storey apartments’ with min. 4 levels
  - Size / area and ratio in % of each apartment: from 1 room to 5 rooms’ apartment. A great variety of apartments is recommended.
  - Common requirements for living spaces: Standardization of living requirements with regional differences. The  $m^2$  per person can be set at a maximum to assure sustainability
  - Organisation of living area/sleeping area: Functional separation of living and sleeping areas is recommended. Entrance should be placed in living area rather than sleeping area
- 2- Research with following key findings:
  - Global energy situation forces to increase consumption of renewable energy resources.
  - Normative “ $e_r$ ” coefficient value of fossil fuel and renewable energy resources for design of low energy residential building should be used and normative regulations of this coefficient should be made.
  - The proposed regulatory criteria  $e_r = 2$  value for the year 2015 is suggested.
- 3- External expertise with three reports focused on :
  - Report one: Identification and documentation of existing assessment,
  - Report two: Comparison concerning indicator catalogues, methods of weighting and scoring
  - Report three: Outline of a framework for a Longlife certification scheme”. Third report provided an initial outline of a generic framework for a Longlife assessment, certification and communication scheme for sustainable construction through the variety of tools.

**Team 2 of Longlife Project “Method of planning permit and tendering procedure “** under the leadership of Roskilde Municipality provided findings as follow:

- 1- The questionnaire of Longlife 1 Report “Analysis and Comparison” developed to the series of benchmarks with following topics as spotlight:
  - currently applied planning methods
  - Building permit rules

- Tendering rules and laws
  - Construction process
  - Conditions and habits of operating / facility management
  - Commercial parameters, housing industry key data, urban
- 2- To facilitate the cooperation between the participants the lead partner of team 2 “Roskilde Municipality “ developed a questionnaire in the form of a wish list for the 6 main head-lines under this thematic area:
- Planning
  - Building requirements
  - Tendering
  - Supervision
  - Inspection
  - Incentives
- 3- The wish list and the answers and comments received from the participants shows the measures which would developed a guideline for administrative, legal and tendering procedures including a framework to harmonise administrative and legal procedures to be used by administrations and planners.
- 4- The external expertise by focusing on the “Comparison of the legal framework in Germany, Denmark, Poland and Lithuania” supported research process of team 2 “Method of planning permit and tendering procedure”.

It begins with an overview of the European legal framework related to sustainability requirements. Then respective building laws in Denmark, Germany, Lithuania and Poland are introduced. Despite the complexity of Legal sustainability requirements and building permit procedures; the following key findings are recommended:

- Legal sustainability requirements and building permit procedure is very complex
- The motivation for shaping a legal framework for sustainability in the housing sector is growing
- The the implementation of the European Performance of Buildings Directive is a great milestone in terms of promoting energy efficiency
- The Member States are also endeavoring to enhance their performance
- Municipalities may take in important role in going beyond national and European standards by setting stricter requirements on a local level.
- Facilitating and encouraging local initiatives -Municipalities- may contribute to the promotion of sustainability in the housing sector and trigger creative and innovative solutions
- All of the countries examined are on a promising track, although the goals set by the EU are fairly demanding, so there is no reason to slow down in their efforts.

**Team 3 “Economic and Financial basis, Industry and quality”** under the Leadership of “ProPotsdam GmbH” following the other teams provided findings such as:

- 1- Based on the analysis of questionnaires of Longlife 1 Report “Analysis and Comparison”, the configuration of the “Longlife- Pilot- Project” is divided into steps. Some of them are as follow:
  - Step1: Description of common characteristics of the pilot projects
    - i. Appropriate building with 4 storeys
    - ii. 30-40 apartments
    - iii. Size of apartments with variation of 50 m<sup>2</sup> , 70-80 m<sup>2</sup> and 85- 120 m<sup>2</sup>
  - Step 2: Description of energy standard suitable for each country
    - i. The concept of the „Passive House“ with the yearly primary energy demand of about 40 kWh/m<sup>2</sup> per year could be a common denominator
    - ii. In all countries are no legal restrictions for maximum CO<sub>2</sub>-emission.
  - Step 3: maximum construction costs
    - i. An average value as a basis for the pilot project is as gross rent (incl. operating cost and heating) between 7 and 10 €/m<sup>2</sup> and as net rent between 7 and 8 €/m<sup>2</sup>.
    - ii. Maintenance costs are included in the net rent and the data for operating costs ranges from 0,4 €/m<sup>2</sup> (Lithuania) to 3,00 €/m<sup>2</sup> (Poland) monthly
    - iii. The prices for construction costs show an extraordinary variety between the different countries. While Denmark and Germany are calculating with about 2.500 €/m<sup>2</sup>, Lithuania and Poland name about 500 €/m<sup>2</sup>
    - iv. The property share is between 49 and 482 €/m<sup>2</sup> but averages around 190 €/m<sup>2</sup>
  
- 2- Improving the energy efficiency of residential buildings is identified by several studies as one of the cheapest ways to save (fossil) energy and cut CO<sub>2</sub>-emissions The external expertise imposed the crucial question why supposedly cost-effective measures, providing net benefits to the investor, are not taken by the relevant actors in the building sector; it ended up to the following recommendations:
  - Prevailing market conditions and behavioural patterns of individual decision-makers may inhibit the realization of higher energy efficiency levels that would yield net gains for the investor in the long-run.
  - The difference between the actually realized level of energy efficiency and the level deemed optimal creates the so-called energy efficiency gap. In order to overcome the various market barriers a policy package comprising diverse instruments is required. No single policy instrument can capture the entire potential of cost-effective energy efficiency improvements in the residential buildings sector.
  - Rational environmental and climate policy has to balance the benefits and costs of policy action. The optimal level of efficiency is that which is consistent with efficient overall resource use, including efficient use of government resources required for the implementation of environmental policy.
  - Reaching an economically optimal level of energy efficiency regularly does not imply to maximize the technically feasible level of energy efficiency.
  - The optimal energy efficiency level and the appropriate energy policy strategy to achieve it differ across countries or even regions according to the diverging underlying circumstances (e.g., climate, availability of resources and technologies, institutional structures, etc.).

## 6. Methods

Longlife has formed three transnational competence teams and five national units or regional teams.

The cooperation between the three transnational competence teams – science, politics and economy - team 1, team 2 and team 3 – it is enable to work in an integrative style and as **triple helix**.

Through the public-private partnership (PPP) composition - the cooperation science, politics and economy - team 1, team 2 and team 3 - it is also possible to move the project aims faster and closed.

All participating countries - Denmark, Germany, Lithuania, Poland and Russia - have members in the three transnational competence teams:

Science - team 1: technology, energy, planning

Politics - team 2: administration procedures

Economy - team 3: industry, costs, financing, quality

Team 1 consists of universities; team 2 consists of administration as well as Housing and urban development agencies and team 3 consists of investors and building societies. In the figure below the triple helix is imaged to show the three competence teams and five national units.

TEAMS		regional team	regional team	regional team	regional team	regional team
		GERMANY	POLAND	LITHUANIA	RUSSIA	DENMARK
transnational specialist	<b>TEAM 1</b> technology energy planning	Berlin Institute of Technology	Gdansk University of Technology	Vilnius Gediminas Technical University	St. Petersburg State University of Architecture and Civil Engineering	Cenergia
	<b>TEAM 2</b> administrative procedures	Center of Competence for Major Housing Estates	Municipality of Gdynia	Housing and Urban Development Agency	Joint stock company 'Hypothecary Agency of Leningrad oblast'	Municipality of Roskilde
	<b>TEAM 3</b> industry cost quality	Pro Potsdam GmbH	Municipality of Gdynia	Building Planning Systematics Center	North-West Inter-Regional Center AVOK	Building Association of Zealand

All involved countries work in the three competence teams. All project partners work at the same time in the same work-package; they are divided in the three competence teams. They share the knowledge in the national units. All three competence teams have a team leader for the whole duration of the project. The work-package leader is responsible to coordinate the work in the competence team between the partners from the involved countries. As well, each work-package has a work-package leader.

The lead partner, the work-package leaders and the team leaders follow the Longlife project Structure.

In the work package 3 Analysis and comparison the aim was to develop a comparable base of international information of the five participating countries and to show the building process in Denmark, Germany, Lithuania, Poland and Russia during the entire life cycle of the building, the similarities and differences in an easy comparison chart according to the three transnational competence teams.

For this a questionnaire was jointly developed in the three transnational competence teams - Engineering and building technology standards, administration tools, method of planning, permit and tendering procedures and economical and financial basis, industry and quality.

This questionnaire was filled out by all project partners and later brought together by the Lead Partner, Berlin Institute of Technology, Institute of Architecture, Department Design and Structure, Germany and the work package leader, Gdansk University of Technology, Department of Fundamentals of Building and Material Engineering, Poland.

Two parts of the output are developed in order to compare the answers. The first part is a chart filled out with short answers to be able to compare easily the contributed information. The second part is an annex with detailed information of the three competence teams sorted by participating countries to get an overview of the national processes and standards.

In a last step we formulated in columns summaries and benchmarks, which will be used as the basis for comparison of sustainability for the next work package – Development of standards, criteria and specifications for a sustainable, resource saving residential building – to deepen specific information that we'll need to design a prototype residential building.

We provided with a virtual project room an access to the project's work results, to discuss the steps and news and to have the possibility for up-and download documents for all project partners.

The work package 4 "Development of standards, criteria, specifications" followed the structure of questionnaire and developed the benchmarks to design a Longlife prototype building.

## 7. Workshops, meetings, events

- Workshop 23-25 September 2009 Roskilde, Denmark
- Workshop 17-21 January 2010 Vilnius, Lithuania
- Workshop, 20 April 2010, an additional workshop for team 1, 2 and 3 in Berlin, Germany
- Video Conference. Weekly base between teams, started in April 2010
- Longlife design class, first session 14 April 2010, Berlin, Germany

The goal of the design class was designing a prototype of a sustainable, energy efficient residential building in Potsdam, whereas environmental aspects, ecological materials and structural design approaches were the main objectives of the design process.

- Official handover the Longlife 1 Report to the Vice Chairman, Housing & Building national Research Center ( HBRC), 19-21 May 2010, Egypt
- Workshop and Team Meetings, 23 June 2010, St. Petersburg, Russia
- Longlife 2010 International Conference St. Petersburg, 24 June 2010, St. Petersburg, Russia

The International Conference in St. Petersburg was the project midterm conference. The International Conference worked in three sessions and started the cooperation with Russian Universities, engineers, architects, administrations, housing associations and buildings companies to implement new technologies to reduce energy consumption and minimize the operational costs in the buildings life cycle.

Session 1: Presentation of current results of the Longlife project

Session 2: Intersections between Longlife and other projects in the field of sustainability in the Baltic Sea Region

Session 3: Information from Russian engineers, architects, municipalities, representatives of housing associations and building companies how to reach sustainability

Through the International Conference in St. Petersburg, project Longlife presented the result, the process etc., shared and exchanged ideas, technologies and experiences with researchers, engineers, government officers and company delegates.

- The Meeting and signing Memorandum between the five projects in the Baltic Sea Region Programme 2007-2013 ,24 June 2010  
During the Longlife 2010 International Conference in St. Petersburg, Russia on 24 June 2010, the five projects have exchanged information and knowledge, according to the same basic objective to enhance the awareness for sustainability. They discussed the possibility to work together further, and agreed to suggest their project partners to enhance the cooperation between these projects in the future and to inform about the proceedings and the results. This can be a step for further developing the Baltic Sea Region towards a model region for sustainability in Europe.

- Longlife design class, final presentation 15 July 2010
- Longlife Design Class, Press Release 19 July 2010

Twenty-two students worked in seven groups for four month and designed a sustainable, energy and cost efficient Prototype Residential Building.

The new experience was that the students designed not only the architecture of a building but rather a complete concept. They used the new approach of integrated planning. The design process included environmental, ecological, resource saving and cost efficiency aspects. Also the development of an energy concept, energy requirements, and proper materials and optimized construction system were required, while still designing based on the principals of modern and timeless aesthetics.

- The meeting and finalization of agreement and Memorandum between the five projects in the Baltic Sea Region Programme 2007-2013, 24 June 2010
- SET2010, Shanghai, China 24-27 August 2010;  
Longlife has presented the project on the 9th International Conference on Sustainable Energy Technologies in Shanghai, China. It was very helpful that Gang Liu, TU Berlin, was the co speaker in Chinese language.

The SET Conference 2010 has covered a wide range of sustainable technologies. It was a good opportunity for Longlife to update the latest developments and applications on sustainable technologies.

The conference participants came from China, Germany, Taiwan, Korea, Japan, India, Sweden, Norway, Netherland, USA, Canada, Italy, UK, Iran, UAE, Portugal, Russia, Turkey, Switzerland, Chile and Brazil.

A lot of conference participants were very interesting in the project results, for example the requirements, standards and indicators for sustainability.

Longlife has also presented the exhibition about the Longlife design class and handed over to Professor Raffa Riffat, President of World Society of Sustainable Energy Technologies (WSSET). We decided to cooperate in the future very close. SET 2011 will take place in Turkey.

## 8. Design program and benchmarks

### 8.0 Introduction

This chapter is consisted of three parts that are forming the structure of report. A unique approach throughout the project; that in fact is a unifying tool to acting as the main line connecting wide range of topics of project together. The unifying parts are as follow:

Engineering and Building Technology Standards

Method of planning, Permit and tendering procedure

Economical and Financial basis, Industry and quality

In the first sub chapter, two main and fundamental parts are explained. While first part “Development of standards, criteria for sustainable and low energy residential building” is paying attention to the subtopics such as: concept and standardization of low energy building and the structure of energy resources demand, second part is consisted of the main founding of questionnaire of team 1 “as the Backbone of the project” and in the frame of Topic/ Subtopics, Benchmarks, variation/ tolerance and Comment/ recommendation is examined.

Under the second sub chapter the main founding of questionnaire of team 2 “Guideline for administrative, legal and tendering procedures” are explained and analyzed.

Under the sub part of third part the result of questionnaire of team 3 under the title of “Economical and financial basis, industry and quality” have been analyzed and examined.

## 8.1 Engineering and building technology standards

### 8.1.1 Overview

Development of society has come into such a stage that consumption of fossil fuel has become global problem. The solution of this problem could lei in various approaches such as: the increase of total effective consumption of energy resources, search for new ones, increase of known renewable energy resources consumption and etc. It is getting more evident that Society cannot exist to unlimited extent using finite energy resources. Therefore in order to protect environment from excess emissions and saving energy resources clean, green, energy efficient, passive, zero energy sustainable buildings are increasingly being constructed. Even though definitions of these buildings are merged, still their characteristic parameters are quite different, as an example, eco or green buildings can be not energy effective. Apparently, one of the reasons for this situation is that building assessment systems [DGNB, LEED, MINERGIE<sup>R</sup> and others] cover a very wide range of parameters, including energy efficiency. Therefore the energy efficient building regulations for energy demands in various countries differ a lot. The proposed technical parameters of the energy efficient buildings are described, which would help to standardize the identification and to make the definition of such buildings.

Structure of the energy production and consumption necessitates transformation. There are lots of scenarios of consumption development, where decrease of fossil fuel consumption and increase of renewable energy resources is mentioned. Fig. 1 presented by Shell and International Agency of Energy (IAE) shows energy production development of different fuel resources in overall fuel balance.

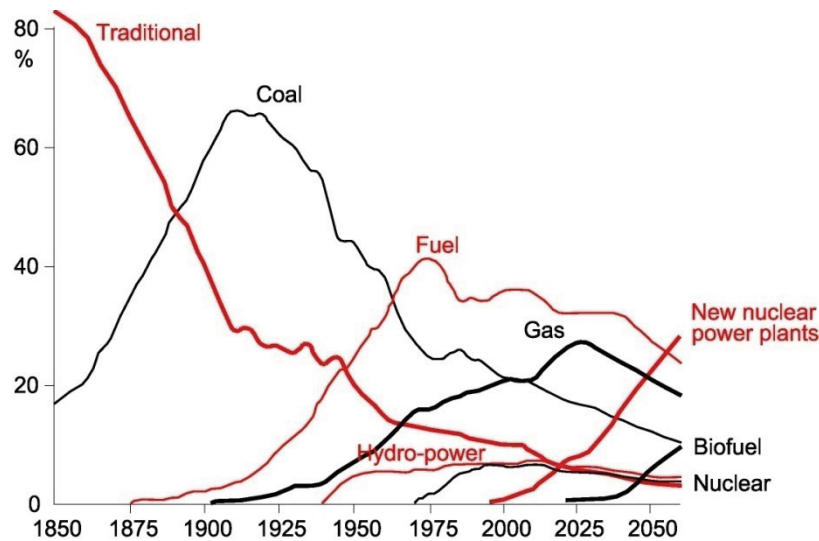


Fig. 1. Energy production development of different fuel resources in overall fuel balance

According to chart lines shown in Fig. 1, there was decrease of carbon consumption in the beginning of the XX-th c., when oil and gas were discovered. In 1980s there was decrease of oil extraction and in short time the decrease of gas extraction is expected. That is why increase of renewable energy resources development is expected and in overall it will make up to 30 % of all global fuel in 2050. In this respect there are more optimistic scenarios. Fig. 2 shows highly aspirated, but more realistic, the so called- AIP (Advanced International Policy) scenario presented by EREC-European Renewable Energy Council, 2009.