EeB PPP Project Review

JULY 2011

FP7-funded projects under the first call

Prepared by

E2B Energy Efficient Buildings

ECTP European Construction Technology Platform

Foreword

I am pleased to introduce the EeB PPP Project Review 2011. This publication showcases 22 projects currently funded under FP7 Framework.

The Energy-efficient Buildings (EeB) Public Private Partnership (PPP) is a joint initiative of the European Commission and the private sector to promote research on new methods and technologies to reduce the energy footprint and CO_2 emissions related to new and renovated buildings across Europe.

The Energy Efficient Buildings European Initiative (E2B EI) was set up by the European Construction Technology Platform (ECTP) to help the construction industry address climate change, reach the European Commission-set 2020 targets and achieve energy-neutral buildings and districts by 2050. The construction industry is a large contributor to CO_2 emissions, with buildings responsible for 40% of the total European energy consumption.

In close coordination, the European Commission's Directorate Generals for Research and Innovation (DG RTD), Information Society and Media (DG INFSO) and Energy (DG ENER) are devoting €515 million under the 7th Framework Programme for Research, Technology Development and Demonstration (FP7) over the period 2010 to 2013. The projects presented in this brochure received FP7 funding under the FP7-2010-NMP-ENV-ENERGY-ICT-EeB call.

Stakeholders from the whole value chain have joined the Energy Efficient Buildings Association (E2BA) which is the industrial interlocutor of the European Commission in the EeB PPP.

The aim of this brochure is to support the dissemination of information on this important European initiative.

We hope this Review will help you to learn more about launched projects, the activities of the association and our journey towards energy efficiency in Europe.

Gaëtan Desruelles

President of the Energy Efficient Buildings Association (E2BA)

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Building Energy Efficiency for Massive Market Uptake

Beem-Up will demonstrate the economic, social and technical feasibility of retrofitting to drastically reduce energy consumption in existing buildings, and lay the ground for market uptake. The project involves key expertise to implement and demonstrate innovative building and energy management approaches. It improves energy efficiency in existing buildings, obtaining better indoor comfort conditions.

Introduction

One of the most cost effective measures to transform Europe into a low-carbon economy is to address the existing building stock. Beem-Up brings a strong consortium of complementary background and expertise to demonstrate the technical, social and economic feasibility of energy efficient retrofitting in existing residential buildings.

Several key challenges stand in the way of transforming the existing housing stock: a lack of easily accessible stock, expensive pilots and little knowledge on how occupants accept innovative solutions. Beem-Up takes an integral approach to overcome these barriers through three ambitious retrofitting projects in Sweden, the Netherlands and France. The project is aiming to retrofit 340 dwellings with an average net energy reduction of 75%.

Partners

Coordinator: Acciona, Spain

France: NOBATEK, ICF Novedis | **Germany:** BASF, LUWOCO | **Netherlands:** Delft University, DVBD, ENECO, Maastricht University, WOONBRON | **Portugal:** ISA | **Spain:** BWCV, Instituto Tecnológico de Aragón, MPLIFTS, SOLINTEL | **Sweden:** AHEM, SKANSKA, SP | **Switzerland:** ETH Zurich, SIEMENS

Objectives

The overall objective of the project is to develop and demonstrate cost effective and high-performance renovation of existing residential buildings, drastically reducing the energy consumption, while ensuring a comfortable and healthy living environment, favouring the integration of renewable energy.

Additional scientific and technical objectives:

- Define, implement and enhance an integral global approach to energy efficient retrofitting
- Implement three retrofitting projects to achieve at least 76% reduction in net energy consumption in average (HVAC, lighting and domestic hot water, including RES)
- Optimise advanced insulation and energy management standard solutions for cost-efficient application in the demonstration projects
- Create a protocol for further development to allow for direct application in future retrofitting projects addition
- Provide decision support tools to assess optimal investment across the housing stock
- Set the basis for large-scale replication of the demonstrated concept across Europe
- Increase stakeholder's capacity to meet the requirements of European building policy

Methodology

The approach of the project is based on gradual integration of building blocks and stakeholders that set the foundation for large scale uptake of energy efficient retrofitting through:

- An adaptable integrated design process
- Innovative and tailored solutions for each site and further replication
- Retrofitting works
- Monitoring and evaluation

www.beem-up.eu

- Occupant involvement and behaviour monitoring for actual energy savings and increased social value
- Future exploitation and replication strategy
- Continuous, coherent, dissemination and training

To address the difference in local conditions, BEEM-UP deals with both the complete retrofitting process applied to 3 sites and the way it can be adapted to any retrofitting project across Europe, optimising energy efficiency and costs.

The majority of the research activities are executed in parallel by different teams at each demonstration site. However, a common methodology has been deployed with regular interchange of experience and results for consistency.

Expected deliverables

Within the different phases of the project, a set of deliverables have been defined. The main outcomes of the project will be:

- An energy audit and pre-occupancy evaluation of current dwelling conditions and prioritisation of changes
- Creation of the project's web site where the evolution of the project will be followed
- Simulation and selection of optimal technical and economic solutions for an energy efficient retrofitting demonstration for each building
- Common guideline for the monitoring programme and Specific monitoring programmes for each site
- Retrofit of three buildings (Alingsås, Delft and Paris)
- Intermediate reporting of monitoring results in all 3 sites
- Replication strategy for Eastern Europe
- Post-occupancy report including tenant behaviour and suggestions for technology adaptation
- Final version of the protocol for improved integrated design methodology for renovation
- Final reporting of monitoring results in all 3 sites
- Contribution to EU database monitoring programme
- Awareness, dissemination, exploitation and replication strategy

Impact

Beem-Up will lead to the annual reduction of approximately 4GWh and 1041 tonnes of CO_2 emissions

Looking at just the 3 countries involved with pilot sites (France, Sweden and the Netherlands), it has been estimated that there are 5.8 million dwellings with very similar conditions to those being retrofitted in the project.

It is estimated that an early implementation of the project concept would accelerate 2-4% of the energy efficient renovation of residential buildings. This would contribute to reduce about 7,5 Mtoe the energy consumption and 6,5 $MtCO_2$ emissions during the next 5 years after the end of the project.

Beem-Up is in line and will contribute to EU policies and standards such as the European Committee for Standardisation CEN TC 350, Sustainable Construction Works and International Standards ISO TC 59/SC17.

The project supports the transformation of the construction sector from a resource to a knowledge intensive industry.

Key facts

Start date: January 2011
Duration: 48 months
Total budget: €7.6m

- Develop and demonstrate cost-effective and high performance renovation of existing residential multi-family buildings, drastically reducing the energy consumption
- Ensure a comfortable and healthy living environment and favour the integration of renewable energy

Industrialised Energy Efficient Retrofitting of Residential Buildings in Cold Climates

The vision of E2ReBuild is to transform the retrofitting construction sector from the current craft and resource based construction towards an innovative, high-tech, energy-efficient industrialised sector. In this project, new retrofit solutions in planning, design, technology, construction, operation and use of buildings are implemented, researched and evaluated. Solutions are demonstrated in 7 projects in Finland, Sweden, the Netherlands, France, Germany and the UK.

Introduction

Today, the building industry in Europe is characterised by on-site production, which may not be cost and production time efficient. The construction process is very time consuming and problems are often treated as unique and solved on-site.

A large proportion of residential buildings from the post war era in Europe are in need of renovation. These problems are why an industrial construction process for retrofitting is needed. In E2Rebuild, we are aiming to speed up the development towards a more energy-efficient, attractive and safe construction and building sector, through a holistic, industrialised process.

Building on previous results from national and European research projects and energy efficient full-scale retrofitting projects, a project consortium was formed.

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Demonstration building in Roosendaal, the Netherlands, before retrofit.

© Chiel Boonstra/Trecodome

Demonstration building in Roosendaal, the Netherlands, after retrofit.

Partners

Coordinator: NCC AB, Sweden

Finland: Aalto University, NCC Rakennus Oy, PSOAS | **France:** Opac38 | **Germany:** Gumpp & Maier, Lichtblau Architekten, GWG München, SchwörerHaus, WBG Augsburg, TUM - Technische Universität München | **Netherlands:** AlleeWonen, Trecodome | **Sweden:** Apartment Bostad Väst, SP Technical Research Institute of Sweden, White arkitekter | **Switzerland:** Empa, HSLU Hochschule Luzern Technik & Architektur | **Poland:** Mostostal Warszawa | **UK:** Gallions Housing Association

Objectives

E2ReBuild investigates, promotes, and demonstrates, cost-effective and advanced energy-efficient retrofit strategies that create added value for existing apartment buildings. Buildings that are the fast-track, low-cost residential houses built everywhere in Europe in the period 1946-1980.

The project focuses on establishing and demonstrating sustainable renovation solutions that will reduce energy use. The targeted reduction fulfils national limit values for new buildings, in accordance with the Energy Performance of Buildings Directives (for 2010). This aims to reduce the space heat use by about 75%.

E2ReBuild focuses on creating a holistic industrialised process that aims to minimise technical and social disturbance for tenants. It also facilitates energy efficient operation and use of the buildings, including encouraging energy efficient behaviour.

Methodology

To meet the holistic ambition of the project, E2ReBuild is designed to cover innovation in planning, design, technology, construction, operation and use of buildings. The 7 full-scale demonstration building projects serve as prototypes for application, evaluation and monitoring of proposed technologies and processes. The demonstrations are in different stages of completion, from early planning to near completion.

E2ReBuild

www.e2rebuild.eu

From the start of the project, tools, methods and processes are developed and refined by continuous evaluation and feedback between research and demonstration. Knowledge transfer is central to E2ReBuild, as lack of knowledge is identified as one of the most difficult barriers for successful sustainable retrofitting activities. The work carried out in research, development and demonstrations will finally be integrated in an industrial platform for energy efficient retrofitting, providing a concept with tools and processes for energy and cost-efficient retrofitting.

Expected deliverables

E2ReBuild will develop holistic retrofit strategies with added value and high replication potential for relevant building types, creating a formalised process for the early integration of production planning, cost estimation, design and socio-architectural parameters. The project will also create a user-friendly, web-based decision tool which allows for the evaluation of simple repair measures, sustainable retrofitting concepts, or building reconstruction, at an early design stage.

E2ReBuild will significantly advance the production methods by moving activities from the construction site to a factory setting with better working conditions in a safer working environment. Solutions will also be developped for added value prefabricated building envelopes, including the integration of HVAC technologies and solar active components on the basis of existing construction methods.

Guidelines for survey, off-site production, and on-site assembly and logistics will be established, based on studies of optimisation and standardisation of the digital workflow throughout the whole process chain. For the operation and use of retrofitted buildings we will monitor and measure tenant behaviour and the buildings energy use, resulting in guidelines to tenants as well as operators.

The collected data will be forwarded to the EU database. Finally an Industrial Platform for Energy Efficient Retrofitting, integrating the results achieved in the demonstrations as well as the RTD work, will be created. E2ReBuild is still in a start-up phase and most deliverables are scheduled for the last month of the project.

Impact

The vision of E2ReBuild is to transform the retrofitting construction sector into an innovative, high-tech, energy-efficient industrialised sector. The project will supply standardised flexible, cost effective, energy saving strategies for retrofitting a major part of the European building stock constructed and built in the post war era.

The industrialised process minimises technical and social disturbance for tenants and facilitates energy-efficient operation and use of the buildings, including encouraging energy-efficient behaviour. The bad reputation of industrialised construction for creating monotonous living environments, often associated with social problems, will be washed away and replaced with a common knowledge among builders, housing organisations, architects etc. that an industrialised process can save both costs and energy as well as create functional, attractive and individual housing for millions of people.

As the building manufacturing industry will move a significant proportion of their activities from the construction site to a factory environment, accident incidence rates will be dramatically lower. Through the creation of new working environments and a new knowledge-based reduced service industry E2ReBuild will therefore greatly contribute to improved working conditions as well as increase the attractiveness of the industry to workers.

Key facts

Start date: January 2011
Duration: 42 months
Total budget: €8m

- Industrialised energy efficient retrofitting of residential buildings in cold climates
- New retrofit solutions in planning, design, technology, construction, operation and use of buildings are implemented, researched and evaluated in 7 demonstration projects
- The demonstrations represent typical building typologies from the period 1946-1980
- The aim is to reduce the energy use in these buildings, through an industrialised, replicable process and at the same time create attractive living environments for tenants and better working environments for workers, at a lower cost

School of the Future: Towards Zero Emission with High Performance Indoor Environment

The aim of the project is to design, realise and communicate good examples of future high performance buildings. Both, the energy and the indoor environment performance of the demonstration buildings under different European climates will be greatly improved due to holistic retrofits of the building envelope, the service systems, the integration of renewables and management systems.

Introduction

Societal values are strongly formed by public models, this is also true for buildings. It is easier to gain people's attention for the need for change, to significantly increase the quantity and quality of energy efficient retrofits in Europe, when public authorities have a good approach.

It is therefore important to demonstrate exemplary solutions at frequently used public buildings like schools. Europe is dependent on having high-quality education spaces for its future generation. The use of public buildings as frontrunners will help to increase the market penetration of high performance retrofit approaches. The 100% carbon-free school building has to become the standard of the future.

Partners

Coordinator: Fraunhofer-IBP, Germany

Denmark: Cenergia Energy Consultants, Aalborg Universitet - SBi, Ballerup Kommune, Saint-Gobain Isover, Schneider Electric Building Denmark AS | **Germany:** Fraunhofer Institute for Building Physics, Landeshauptstadt Stuttgart
Italy: ENEA, Comune di Cesena, Aldes
Norway: Stiftelsen SINTEF, Drammen Eiendom, Glass og Fasadeforeningen

Objectives

The objectives of the project are as follows:

- Develop people's consciousness to save energy by exemplary realisations of highly energy-efficient retrofit projects of school buildings. These will lead the way to carbon-free approaches whilst improving indoor environment. This approach will be promoted as the school of the future
- Demonstrate that significant energy savings can be achieved with limited additional costs (<100 €/m²). This will motivate other actors in the sector to multiply the concepts
- Cut back on reservations against innovative energy saving retrofit concepts in public building administrations by providing reliable information on energy saving potentials and costs
- Develop national and European benchmarking systems including estimation of potentials for innovative, cost-efficient energy retrofit strategies

Methodology

The concept of the School of the Future project consists of 3 main parts.

Firstly, the design, demonstration and evaluation of highly energy efficient retrofitting of schools in 4 different European countries with different climates.

After that the project will develop guidelines and tools building upon existing knowledge and tools applicable throughout the EU countries.

At the end of the project the emphasis will be on dissemination of results, guidelines and tools including also training activities

The design, demonstration and evaluation of the school retrofits will tackle 2 major challenges at the same time: energy saving and indoor environment quality. Already at the start during the collection of existing knowledge the 2 different impacts of the retrofit have been taken into account. A knowledge database and a community at BUILD UP have been set up within the project starting phase.

SCHOOL OF THE FUTURE

www.school-of-the-future.eu
(September 2011)

Expected deliverables

The project will result in 27 deliverables which can be divided into smaller single deliverables (e.g. design report, building diary, training material, presentations and conference sessions, publications etc). Some deliverables are starting points or milestones for other project results meaning that there is a strong interaction between the work packages and the project results. The Schools of the Future project will deliver:

- Insight into the energy level that is achievable by retrofitting schools and other types of buildings – high performance is possible and feasible
- New up-to-date guidelines and tools for energy-efficient and high-indoor-environment-quality renovation of school buildings
- Early development of technologies towards improved energy efficiency by the industry partners
- Increased awareness about energy-efficient building renovation and the important issue of indoor environment to improve pupils' performance

Impact

The expected impact of the project is as follows:

Large-scale market deployment before 2020: it can be expected that the high performance school building retrofits will be multiplied within the next decade. Demonstration projects are essential to the further tightening of minimum energy performance requirements to develop the building practice.

Acceleration of the uptake of retrofitting: success stories presented in demonstration building reports, the information tool, the project website and other dissemination channels will motivate other actors to start similar projects on energy efficient retrofits.

Offering cost-efficient highly energy-efficient retrofit practices: the demo buildings, technology screening, retrofit guidelines, information tools, training sessions, website, presentations at conferences, etc. disseminate the cost and energy-efficient retrofit practice. The guidelines will even show ways for further steps towards zero-emission schools.

Creation of best practice examples: the 4 demonstration buildings will be best-practice examples. Additional national best-practice examples and beyond will be used as background information and also presented in the information tool. Those case studies will be taken from national programmes which also include energy-surplus schools.

Key facts

Start date: February 2011
Duration: 60 months
Total budget: €4.9m

- 100% carbon-free school building setting the standard for the future
- Reduction of the total energy use > factor 3
- Reduction of the heating energy use > 75%
- Improvement of the indoor environment quality (air, daylight, acoustic, thermal comfort)
- Demonstration that such big energy savings can be achieved with limited additional costs (<100 €/m²)
- Development of national and European benchmarking systems including estimation of potentials for innovative, cost-efficient energy retrofit strategies

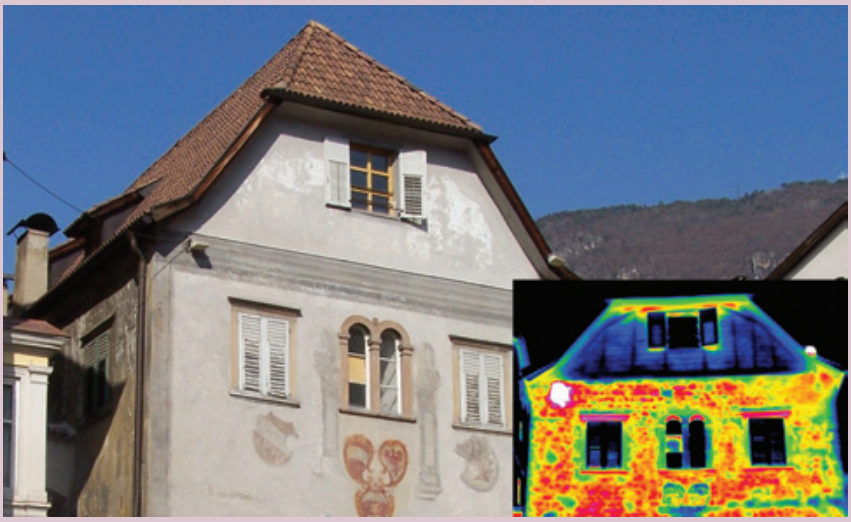
Efficient Energy for Cultural Heritage

3ENCULT bridges the gap between conservation of historic buildings and climate protection. Historic buildings will only survive if maintained as a living space. Energy efficient retrofit is important for structural protection in heritage buildings but retrofitting can also improve the comfort of the building.

Introduction

There are numerous historic buildings in European cities, towns and villages. Historic centres and quarters add uniqueness to our cities and are a living symbol of Europe's rich cultural heritage and diversity.

Historic buildings are an area where the high level of energy inefficiency is contributing to a huge percentage of greenhouse gas emissions. With climate change posing a real and urgent threat to people, environment and historic buildings, it is necessary to have an improved approach to their refurbishment.



Thermography of the Public Weigh House in Bolzano/Bozen (Italy)

Objectives

3ENCULT demonstrates the feasibility of "Factor 4" to "Factor 10" reduction in energy demand, based on the case and heritage value. The main objective of the project is the development of passive and active solutions for conservation and energy-efficient retrofit.

The retrofit will include available products as well as new developments by involved SMEs, such as the definition of diagnosis and monitoring instruments, the long-term monitoring also for Indoor Environmental Quality (IEQ) controlling, the planning and evaluation tools and concepts supporting the implementation, and the quality assurance and control of success of the energy retrofit measures. Guidelines are to be disseminated to scientific and public communities.

Partners

Coordinator: EURAC Research, Italy

Austria: Bartenbach Lichtlabor, Universität Innsbruck | **Belgium:** youris.com | **Czechoslovakia:** ATREA s.r.o. | **Denmark:** The Royal Danish Academy of Fine Arts | **France:** Menuseries Andre | **Germany:** ICLEI, Remmers, TU Dresden, TU Darmstadt, IDK – Institut für Diagnostik und Konservierung an Denkmalen, Passivhaus Institut | **Italy:** Comune di Bologna, Alma Mater Studiorum Universita di Bologna, Artemis, Elettronica Gelbison | **Netherlands:** REHVA, TNO | **Spain:** Cartif, Grupo Unisolar | **UK:** Arup

Methodology

The project starts with analysis of the challenges of the project and the need for comprehensive diagnosis. Following that, it investigates the technical solutions for the energy enhancement as well as smart monitoring and control.

The project allows the demonstration of the developed solutions, while giving (i) stimulus for the solution development and (ii) successive feedback. 3ENCULT also gathers the development of design tools, quality assurance within and after the project as well as contributions to standards and knowledge transfer. Dissemination of results to a wide range of stakeholders is a key part of the project.

The project is well underway and achievements to date include the analysis of demand from a conservation point of view, review of the state-of-the-art of energy efficiency solution applicable to historic buildings and the elaboration of research questions in a multidisciplinary workshop. In parallel, diagnosis and monitoring system installation at a case study building have started. Project concept and early results were presented at conferences and first videos for the Video News Release have been taken.

Expected deliverables

The developed solutions and new products will be presented through different channels:

- Handbook with design guidelines for planners & FAQ platform
- University and professionals training
- Presentation at conferences
- Publications in journals

www.3encult.eu

- Study tours to case study sites
- Workshops and e-guidelines for local governments
- e-Newsletter

From the end of the second year the virtual library will be online and updated regularly. The project will contribute to setting up CEN (European Centre for Standardisation) standards and develop a calculation tool and criteria for certification of historic buildings. Wireless sensor networks & Building Management System (BMS) will be integrated with conservation issues.

Public deliverables to date include the website, which is updated regularly, the first flyer and several presentations at conferences as well as the above cited demand analysis and state of the art energy efficiency solutions.

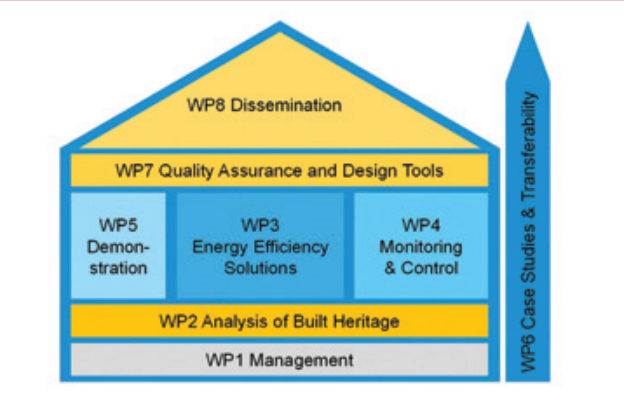
Impact

3ENCULT allows significant energy saving in historic buildings, leveraging upon experience and solutions based on market products already available and further developing them for the use in historic buildings.

The project leads to substantial CO_2 reduction: 14% of EU-buildings were constructed before 1919, 26% before 1945. Although only a certain amount of these buildings are listed, they have historical significance and should be treated with care. More than 180Mt of CO_2 could be saved (3.6% of EU-27 emissions in 1990) by reducing the buildings' energy demand (~855TWh) by Factor 4 (i.e. 75%). 3ENCULT improves living conditions within historic urban areas and leads to improved quality management of historic cities. Local Governments for Sustainability, European Secretariat (ICLEI Europe) is working with committed local governments on replicable factors to be fed back to the Leipzig charter process.

The project fosters sustainable renovation and long term conservation of our built heritage in accordance with the ECTP Focus Area Cultural Heritage (FACH) vision highlights. Real protection of Cultural Heritage can be achieved by integrating in everyday life and preserving the basis for cultural tourism, a significant economic factor in Europe. 3ENCULT contributes to Europe's Economic Recovery, triggering smart investment as formulated in the European Recovery Plan both supporting action 9 (radically reducing energy consumption) and action 6 (demanding targets). Demonstration and guidelines on how to use existing products and materials will support a large number of construction enterprises across Europe. However specific technical solutions are developed with a number of innovative European enterprises.

3ENCULT contributes to European Energy Policy, supporting (i) EU 2020 goals, (ii) integration of historic buildings in the Energy Performance Building Directive (EPBD) (iii) CEN TC346 on cultural property and 2nd generation CEN standards related to EPBD, and (iv) Renewable Energy Sources Integration.



Structure of the project based on work packages

Key facts

Start date: October 2010
Duration: 42 months
Total budget: €6.6m

The FP7-project 3ENCULT bridges the gap between conservation and climate protection. Conservation, technical and urban development experts, industry partners and stakeholder associations work on:

- Criteria for the assessment of energy-efficiency measures regarding their conservation-compatibility
- Diagnosis, monitoring and control instruments
- Passive and active energy-retrofit solutions
- Regulation framework
- 8 case studies will demonstrate and verify the solutions

ICT4E2B Forum

ICT4E2B Forum aims to bring together all relevant stakeholders involved in ICT systems and solutions for Energy Efficiency in Buildings. Our community looks to identify and review the needs of ICT and Construction in terms of research and systems integration. It also accelerates implementation of innovative solutions and sharing of best practices and roadmap results.

Introduction

It is widely recognised that the great energy saving potential based on ICT technologies should be considered over the whole life-cycle of the built environment. However, the large set of ICT technologies and the wide possible uses, means it is necessary to consider which ones to prioritise, and identify the most cost effective and promising technologies to develop.

Having identified this need, ICT4E2B Forum bases its roadmapping activities on the REEB project (Roadmap for ICT enabled energy efficient buildings), a project that developed a high-level roadmap on ICT research and technology for energy efficient buildings. ICT4E2B Forum builds upon this work and makes use of community building activities. The project aims to promote a better understanding, closer dialogue and a more active cooperation in the building sector.

Partners

Coordinator: D'Appolonia, Italy

Finland: VTT | **Germany:** SAP | **Poland:** Mostostal Warszawa | **Spain:** Atos Origin | **Sweden:** Schneider Electric

Objectives

ICT4E2B Forum project not only aims at updating the previously developed technology roadmaps. It also has the objective of integrating a wider vision about ICT for energy efficient buildings from different perspectives such as those related with society, economy, market and end-users point of view.

Therefore, the project aims to identify the building sector specific priorities, and then organise them into a structured classification. This exercise enables communication and competences/knowledge sharing between experts in different sectors to achieve fundamental improvements in energy efficient buildings. All this coordination work aims to define future research directions as well as focus efforts, whilst favouring consensus building.

Methodology

An illustration of the methodology is shown in the chart representing the roadmap approach of ICT4E2B Forum. The grey items represent external contributions beyond the consortium.

First activities are devoted to the review of the taxonomy of 5 key research and technology areas, namely: tools for integrated design and production, intelligent and integrated control, user awareness and decision support, energy management and trading, and integration technologies.

www.ict4e2b.eu

After that a review of Scientific and Industrial State of the Art areas was completed and the project identified the most interesting current research, technology and development topics. The work involves organising scenario workshops with experts and consequent elaboration of results gathered during the workshops. The informal approach of the expert workshops allows participants to express their own vision of future ICTs and use scenarios.

Expected deliverables

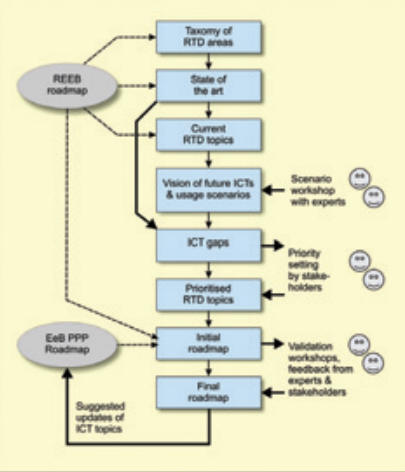
ICT4E2B Forum objective is to build a community of stakeholders and deliver a validated technology roadmap on ICT for Energy Efficient Buildings. The project aims to do this by identifying a shared vision on challenges, multidisciplinary efforts required and non technological barriers for successful market take up across Europe.

One of the first deliverables released in the course of ICT4E2B Forum project has been the set up of a web portal and a collaborative work space for community building, fostering interactions among different stakeholders. This offers the access to three collaborative spaces dedicated to: Energy Efficiency Data Models, ICT4E2B Forum Roadmapping, and the projects' local and regional initiatives. Each website makes available for its members a set of services such as a wiki, a calendar, a discussion forum, a blog and a common space where documents can be shared and reviewed.

Impact

As a coordination action ICT4E2B Forum will have indirect impact by creating a dynamic community representing both ICT, construction and energy players as well as public stakeholders and authorities. The project shares and validates future needs and influences future development routes for research and innovation in this multidisciplinary field.

Opportunities offered by ICT and open standards for design, systems integration, operation, services and holistic business models in general will be highlighted. The project will also provide dissemination routes for RTD and best practice in this area. This will foster the creation of value networks among ICT, construction and energy companies and public stakeholders for successful technology implementation at buildings, neighbourhood and larger city level.



Key facts

Start date: September 2010
Duration: 26 months
Total budget: €1.4m

- ICT4E2B Forum project will create a dynamic community representing both ICT, construction and energy players
- The project will allow public stakeholders and authorities to validate future needs and identify future development routes for research and innovation in this multidisciplinary field of energy efficiency in the built environment
- A validated technology roadmap will be delivered on ICT for energy-efficient buildings

Energy Efficiency and Risk Management in Public Buildings

Deregulation of energy sectors provides challenges and opportunities alike for operators of public buildings. Exposure to energy prices and CO_2 emission restrictions create incentives to adopt more energy-efficient technologies. Yet, market and technological uncertainty necessitate decision support for risk management. EnRiMa will facilitate this transition to more energy-efficient public buildings via an optimisation-based Decision Support System.

Introduction

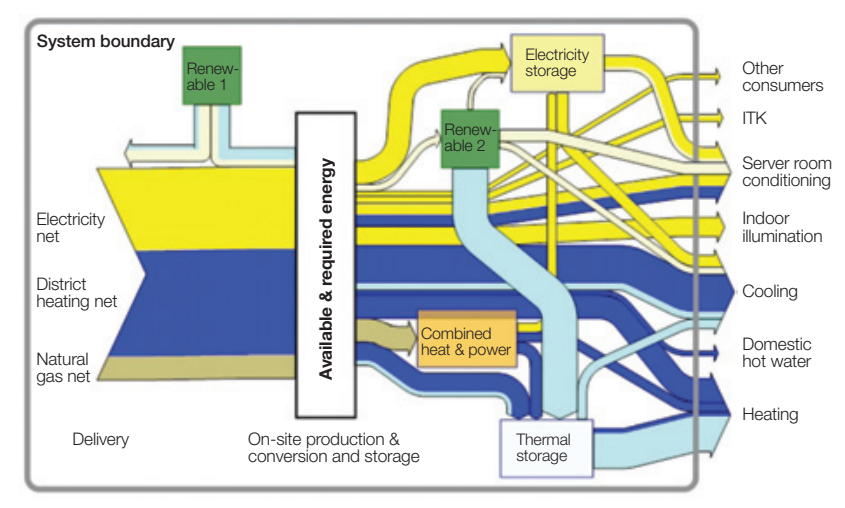
EnRiMa aims to develop a Decision Support System (DSS) to enable operators to manage energy flows in public buildings, which will deliver a holistic solution for meeting their energy needs in a more efficient, less costly, and less CO_2 intensive manner subject to comfort tolerances and long-term risk preferences. Such decision support is crucial as the EU faces the challenge of improving energy sustainability, reducing CO_2 emissions and increasing the share of renewable energy technologies.

A DSS for managing conflicting goals such as cost minimisation and energy-efficiency improvement while accounting for risk would be an enhancement to the current situation. Finally, the DSS will inform policymakers about the response of building operators to proposed regulation as it may be run under various settings.

Partners

Coordinator: Afzal Siddiqui, UK

Austria: International Institute for Applied Systems Analysis and the Centre for Energy and Innovative Technologies | **Belgium:** Minerva Consulting and Communication | **Norway:** SINTEF Group | **Spain:** Hidrocantábrico Energía, Universidad Rey Juan Carlos | **Sweden:** Stockholm University | **UK:** University College London



Sankey Diagram

Objectives

EnRiMa aims to integrate interdisciplinary knowledge into a state-of-the-art DSS for operators of public buildings. By providing integrated management of conflicting goals such as cost minimisation, meeting energy, efficiency, and emission-reduction requirements as well as risk management, the proposed DSS will enable operators to improve building energy efficiency in the most cost-effective manner based on their tolerance for comfort and risk.

The DSS aspires to be seamlessly integrated with the existing Information CommunicationsTechnology (ICT) for controlling each site's energy sub-systems, thereby facilitating the operators' real-time on-site generation dispatch, off-site energy purchases from diverse sources, and open positions in energy markets. The DSS will also enable long-term planning aimed at increasing energy efficiency, specifically analysis of retrofits and/or expansion of on-site energy sub-systems, in order to meet forthcoming EU targets for reducing CO_2 emissions.

Methodology

Starting with a requirement analysis, the project proposes to model each site's energy flows via Sankey diagrams. Currently, EnRiMa are finalising this phase of the project in order to formulate energy-balance constraints that will be constraints in the stochastic optimisation. The project will include the possibility of financial instruments to hedge risk where possible.

The DSS aims to support analysis of such trading opportunities and other means for the operator to manage its energy system in real time subject to risk criteria. Consequently, the DSS will include scenarios of energy prices and loads that will be linked with the stochastic optimisation model. By solving the stochastic optimisation problem periodically with energy-balance and risk constraints, the project aims to provide a real-time optimal policy for the operator to follow while considering its long-term capacity expansion goals.

EnRiMa
Energy Efficiency and Risk Management in Public Buildings

www.enrima-project.eu

Expected deliverables

The project has 3 phases: requirement analysis and symbolic model specification, prototype of the DSS, and validation and final version of the DSS. Ultimately, the main deliverable is a DSS Engine with a Graphical User Interface (GUI) that will enable seamless operation of a building's energy system in order to improve energy efficiency at minimum cost and subject to risk criteria.

Important intermediate deliverables are a requirement assessment on the test sites, mathematical formulation of energy-balance constraints, scenario generation of energy prices and loads, symbolic model specification, DSS Engine prototype, quantification of benefits from the EnRiMa DSS, and an advisory report about long-term capacity expansion.

Concurrently, a substantial dissemination and exploitation campaign will run to ensure that potential users of EnRiMa are aware of its benefits. The major deliverables to achieve this objective are a website, communication, dissemination and exploitation plans. To date, the website has been launched and the preliminary communication and dissemination plan along with the requirement assessment are approaching completion.

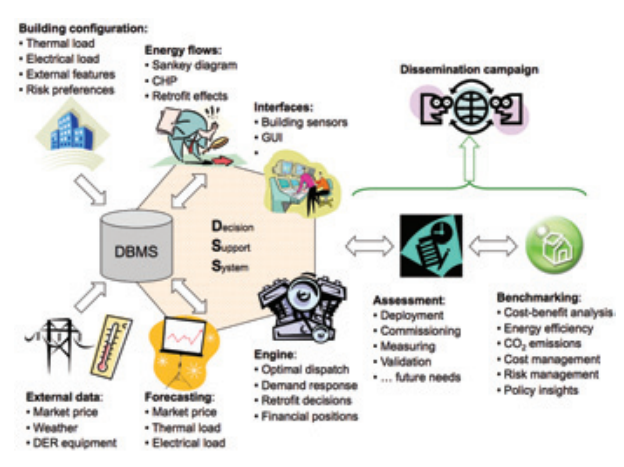
Impact

EnRiMa aims to have 3 main areas of impact:

Firstly, to achieve a radical reduction of energy consumption and CO_2 emissions, in line with EU policy for facilitating the transition to an energy-efficient economy through ICT. This will be achieved by a stochastic optimisation approach that integrates modelling of energy flows, uncertainty in energy prices and loads, and a GUI. The DSS will be developed and tested using data from real sites, thereby ensuring its relevance and robustness in meeting future energy challenges via ICT.

Secondly, to open the market for ICT-based customised solutions integrating numerous products from different vendors and offering services from design of integrated systems to the operation and maintenance phases. A market analysis in the final phase of the project will quantify the benefits of the DSS and gauge the size of the market to be exploited.

Thirdly, establish a collaboration framework between the ICT and buildings and construction sectors this collaboration aims to exploite opportunities for the development of ICT-based systems in compliance with the Energy Performance of Buildings Directive. Involvement of stakeholders with links to industry and policymaking along with the partners' dissemination activities via the E2B and other outlets will ensure that the work is relevant to society's needs.



EnRiMa Concept

Key facts

Start date: October 2010
Duration: 42 months
Total budget: €3.4 million

- Develop an interdisciplinary decision support for operators to help them to meet their needs in a more efficient, less costly, and less CO_2 – intensive manner
- Enhance the existing methodology for modelling energy flows in buildings with recent advances in efficient management of uncertainty
- Facilitate the operators' on-site generation dispatch, off-site energy purchases from diverse sources, and open positions in energy markets
- Enable long-term planning aimed at increasing energy efficiency, specifically analysis of retrofits and/or expansion of on-site energy sub-systems in order to meet forthcoming EU targets for CO_2 emissions reduction
- Improve energy efficiency and sub-system integration in line with EU targets

Energy Efficiency for European Sport Facilities

SportE^2 challenges the world of sport facilities to improve their energy efficiency. Through the development of optimisation strategies, smart metering, integrated control system, and intelligent control strategies dedicated to sport facilities, this project aims to deliver 30% energy savings and CO_2 emission reductions with a return on investment of 5 years.

Introduction

The European Sport and Recreation Building Stock accounts for about 1.5 Million buildings in Europe. This represents a significant portion of the overall building stock and consume a disproportionate amount of energy (6-8%). Sports facilities have unique qualities including:

- Their energy demand profiles: timing and peaks
- Usage patterns: long periods of low use and then short periods of high use sporting event
- Comfort and ventilation requirements
- Facility characteristics e.g. swimming pools, indoor courts, saunas, etc.
- How they are owned and managed
- They can encompass large open spaces, multiple buildings, complexes, parking areas, lighting, etc.

Considering these factors the aim of SPORTE^2 is to develop an integrated, modular, and scalable ICT system to manage energy consumption, generation, and exchange locally and within the larger context of the smart grid/neighbourhood.

Partners

Coordinator: D'Appolonia, Italy

Greece: Schneider Electric | **Italy:** Università Politecnica delle Marche, Fidia Sport, Staring Engineering | **Portugal:** ISA, SELF Energy | **Spain:** EMTE Sport, Tecnalia

Objectives

SportE^2 aims to develop four scalable and integrated modules based on ICT solutions, these include:

- How: Smart Metering – understanding energy flows
- When: Integrated Control – the ability to actuate souring and settings
- Why: Optimal decision making – intelligent and optimal operational strategies
- Where: Multi-facility management tool – a portal for multi-facility managers

The structure and naming of the 4 modules builds on people's familiarity with who, what, when, where, why, and how to facilitate development, marketing and exploitation. Each module will represent an individual product and service.

How they are put together will depend upon the specific needs of the particular facility being considered. The approach and system is appropriate for both new and existing facilities. Swimming pools and large court areas are in particular large energy consumers.

Methodology

SportE^2 is client and pilot focused. The project initiated energy audits and a study of the energy consumption patterns at each of the 3 project pilots: Fidia Sport (Italy), Sport Complex Santa Maria De Lamas (Portugal), and the Extebarri Municipal Sport Centre (Spain).

These facilities vary in size, the number of buildings, and client base. Energy bills vary from approximately €50k per year to €250kper year with an olympic swimming pool dominating the energy consumption at the largest energy consuming facility.

Module prototypes and optimisation scenarios are to be tested at Tecnalia's KUBIK.

Sporte²
Energy Efficiency for European Sport Facilities

www.sporte2.eu

Expected deliverables

SportE² aims to deliver four SportE² modules, a methodology to employ them, and a replication plan to achieve impact. The project timeline, module development and operational optimisation scenarios are developed in year 1, pre-control monitoring, system installation, and the beginning of pilot activities with control actions occur during year 2, and pilot activities conclude and the exploitation base is prepared in year 3.

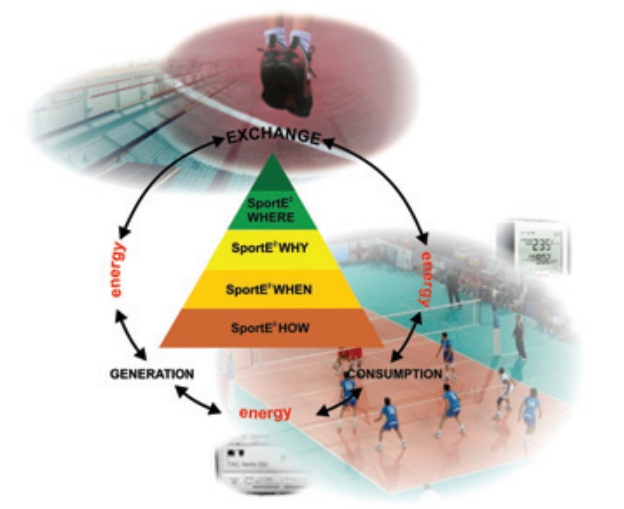
From this project, sport facility owners and managers should expect to answer questions like: How and when am I consuming energy? How do I compare to other facilities? Is anything abnormal? What best practices should I be aware of? If I want to invest in energy efficiency measures, what should I do? What operational strategies can save me energy? How can a centralised and integrated control system improve my facility? How can I start an energy savings program? What indicators should I be using to assess my facility and energy savings programme?

Impact

SportE² aims to engage the world of sport facilities with the issue of energy efficiency. The industry is high energy consuming and is linked by leagues, associations, and teams. Sport facilities are therefore an excellent sector for energy savings. If we can make a difference across these buildings at large, the impact will be high.

Through activities and the people that use the sport facilities, there is the opportunity to educate and inspire energy efficient behavioural changes by example. Because such facilities host numerous youth activities, it presents a way to positively impact future generations. To get beyond consortium activities, SportE² has started the Friends of SportE² campaign inviting other facilities to share their experiences and follow project results.

To date, Euroleague Basketball, B-Zone Fitness, and Quanta Village have taken-up the challenge. Project dissemination activities are also boosted by consortium members such as Olympic medalist and basketball player Pier Luigi Marzorati of Staring Engineering, an architectural studio focused on green design strategies.



Key facts

Start date: September 2010
Duration: 36 months
Total budget: €4.7m

- SportE² will develop, integrate, test (KUBIK), and validate in 3 Pilot Locations 4 scalable modules formed on a 30% reduction in energy consumption and CO_2 emissions
- The modules will deliver smart metering, integrated control, intelligent and optimal decision making, and a multi facility management portal dedicated specifically to the needs of sport facilities

Self Powered Wireless Sensor Network for HVAC System Energy Improvement

The project focuses on the concept that a better knowledge of current building conditions can lead to decision making and control strategies. However, gathering this data could be expensive due to the cost of installation and maintenance of sensors. TIBUCON proposes a cheaper solution based on Self Powered Multi Magnitude Wireless Sensor Networks.

Introduction

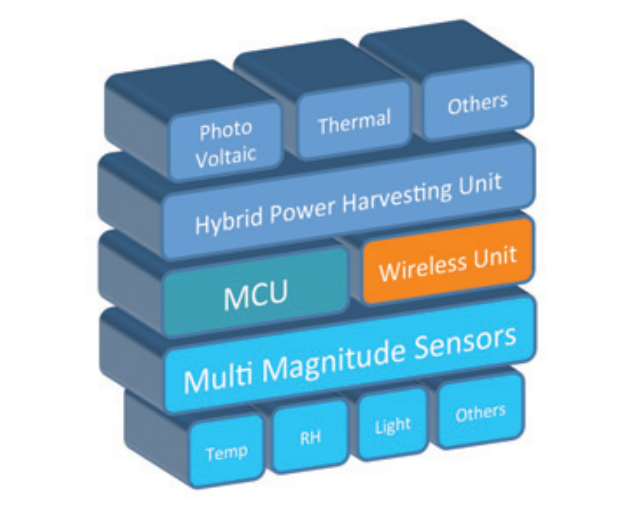
The project focuses on the space heating and cooling aspects, proposing a solution beyond the existing wireless based HVAC control systems, derived from the use of Self Powered Multi Magnitude Wireless Sensor Network (SP-MM-WSN) for building thermal condition monitoring.

The network completely avoids the use of cables and removable batteries, thanks to the combination of extremely energy efficient wireless communication technology, ultra low power electronics, and power harvesting. The use of SP-MM-WSN results in an easy to deploy and maintenance free building monitoring system that makes it the ideal candidate for either new or existing HVAC installations.

Partners

Coordinator: Mostostal Warszawa, Poland

Belgium: Katholieke Hogeschool Kempen | **Poland:** E&L Architects | **Spain:** Tekniker-IK4, Giroa, part of Dalkia Group



Modular design for SP-MM-Wireless Sensor

Objectives

The project aims to reduce energy consumption through HVAC system performance enhancement. This is achieved thanks to an ICT based building integral wireless connectivity system that can support the building condition monitoring, and real time control and actuating scheme. The 2 main objectives of the project are to:

- Empower old and new building monitoring through extremely cost effective SP-MM-WS
- Development thermal simulations of the heating system and to continuously compare them with the data from the sensors

This real time comparison between measured and simulated outputs can be used to monitor the thermal comfort of the inhabitants and the dynamic behaviour of the HVAC, so that system faults can be detected and energy spoilage can be avoided. Depending on the situation, the results are to be passed to the building manager or the building users, so they can undertake the necessary actions.

Methodology

The project is divided in 4 main phases. The first phase has been oriented to bring together the experts, stakeholders and end-users in ICT, Construction and Energy present in the consortium to define and establish the main basis and facts for a successful solution development. This first phase paves the way for the second phase, which addresses the main technological developments such as the SP-MM-WSN design, and the building models and simulations.

At the beginning of the third phase, the TIBUCON solution will be deployed in 2 buildings. The selected pilot test beds are a new office building in Poland and an existing group of apartment buildings in Spain. During this third phase the performance of TIBUCON solution will be measured under real working conditions. Based on these results, conclusions will be drawn for an effective business model development.

www.tibucon.eu

Expected deliverables

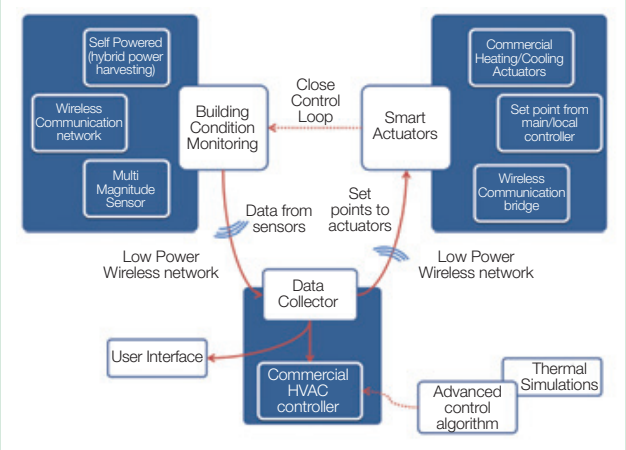
TIBUCON provides different types of deliverables aligned with the different technical areas of the project: ICT, construction, and building automation. There is a key deliverable which deals with the main principles for including TIBUCON-like solutions in the design flow of new buildings, and for retrofitting existing ones. There is also a set of deliverables related to the sensor unit itself, including the hardware design, communication protocols and high level data models descriptions. In addition, gateway units will be provided for connecting TIBUCON nodes to the main BMS systems in buildings. First versions of all these units will be available during this year. In addition, some work in line with the definition of novel HVAC control approaches, that makes the most of TIBUCON's distributed monitoring will be published. Finally, after deploying the system, and having it running for a year, the performance measurements, along with the initial business model and exploitation plans will be delivered.

Impact

The main objective of the TIBUCON project proposal is the efficiency improvement of both used and newly installed HVAC system. The possibility of using the solution in HVAC system retrofitting guarantees an enormous potential consumer market, significant energy use and CO_2 emissions abatement.

Since the HVAC systems are one of the main energy consumers within a building, the ESCOs often base their solution on the HVAC improvements. Therefore a solution like TIBUCON is a big help for ESCOs due to its cost saving and flexibility. Its introduction in the ESCOs toolbox will result in more competitive solutions that will easily enter residential and tertiary energy improvement markets.

Additionally, the wireless and maintenance free technology offered by TIBUCON solution will help construction companies to increase the technological level of their product range. The cost reduction in HVAC system deployment and its improved energy consumption and thermal comfort performance will help companies to increase their competitiveness and thus their market share.



Tibucon system architecture for improving the efficiency of new HVAC installations

Key facts

Start date: September 2010
Duration: 36 months
Total budget: €2.4 million

- Use of SP.MM.WSN to set a maintenance free building monitoring system for HVAC instilations
- The solution is suitable for new and existing buildings
- The system will be tested in the office building in Poland and in 4 different residential buildings in Spain

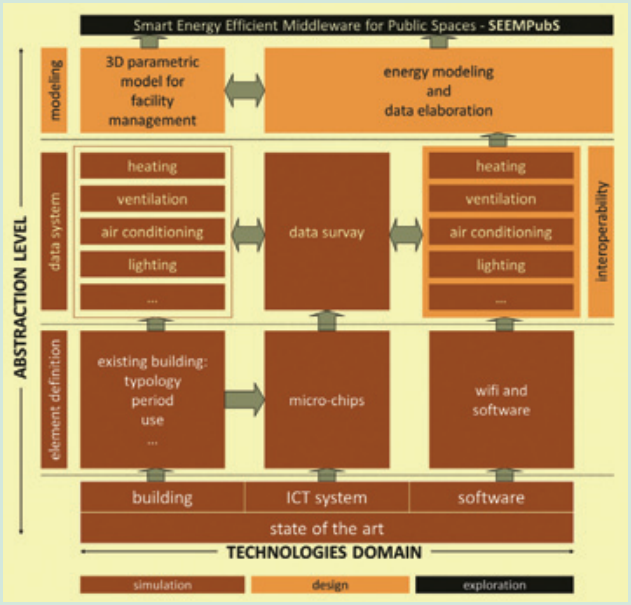
Smart Energy Efficient Middleware for Public Spaces

This project aims to address the reduction of energy usage and CO_2 footprint in existing public buildings and spaces without significant construction works, by an intelligent ICT-based service monitoring and by managing the energy consumption. Special attention is to be given to historical buildings in order to avoid damage by extensive retrofitting.

Introduction

SEEMPubS provides the control of appliances in order to optimise energy usage without compromising comfort or convenience. The project offers decision makers strategies and tools needed to plan energy saving measures. The project makes use of service oriented middleware for embedded systems that are being developed in the Hydra project and capitalize on its potential to create services and applications across heterogeneous devices to develop an energy aware platform.

The SEEMPubS platform provides the necessary functionality and tools to add energy efficiency features to monitor dynamic sensor data in real time. It takes advantage of natural resources and controls the operation of both passive and active environmental systems to ensure the best possible comfort conditions with the most efficient use of energy.



SEEMPubS diagram

Partners

Coordinator: Politecnico di Torini, Italy

Belgium: Katholieke Universiteit Leuven | **France:** Universite Claude Bernard Lyon 1, Sinovia SA | **Germany:** Fraunhofer-FIT | **Italy:** Centro Ricerche Fiat, Istituto Superiore Mario Boella, STMicroelectronics | **Sweden:** CNet Svenska AB

Objectives

The project aims to:

- Develop an integrated electronic system to monitor different building models, technical building services, electronic devices and operations in order to optimise and integrate all maintenance functions
- Implement an interoperable web-based software solution for real-time energy performance monitoring and control of lighting, heating, ventilation and air conditioning services through wireless sensor networks in existing buildings and open public spaces
- Raise people's awareness for energy efficiency in public spaces
- Provide multi-dimensional visualisation of parameters of building operations and data sharing from technical systems
- Validate the developed monitoring system through an iterative methodology
- Translate the most significant research results achieved within the project into a model for existing buildings and public spaces in Europe
- Disseminate and exploit the project results according to a strategy based on several awareness-creation means and to the specific business and market targets of the individual partners

Methodology

SEEMPubS uses an iterative approach, the first cycle leads to the first application at a demonstrator in the Politecnico di Torino campus and is mainly a basic evaluation and validation phase. The second cycle leads to services and applications in these public spaces. The third cycle verifies the efficiency of the resources spent in relation to the accuracy and completeness with the project's goals.

http://seempubs.polito.it/

In each cycle, the prototype services and applications are enhanced. The goal of this procedure focuses not only on the evolution of the applications and services, but also on the refinement of scenarios, requirements, specification and implementation of the SEEMPubS platform. This iterative process ensures the gradual approximation to SEEMPubS with simultaneous consideration of all stakeholders needs. As the project is committed to user-centered design, this approach ensures that the developers as well as end-users will always be involved.

Expected deliverables

SEEMPubS has a total of 53 deliverables. 25 are Public, 3 are Confidential, only for members of the consortium including the Commission Services, and 25 are restricted to a group specified by the consortium (including the Commission Services).

Completed deliverables include: the building definition (criteria, methodologies and description of the selected buildings), the initial specification of the intelligent control system and the initial prototype of the SEEMPubS platform.

The main deliverables will be related to the intelligent sensor network, the device ontology, the intelligent context energy awareness service framework and user community portal, and the development and application of components for monitoring sensors systems as well as the data format definition, the data transfer by microchips and nanosensors, and the thermal and lighting analysis and simulation.

Impact

The SEEMPubS project aims to achieve a more sustainable and efficient way of consuming energy. In particular, it will address the implementation of an ICT system for energy measurement and accounting, for managing energy intensity downwards and productivity upwards in existing and historical public buildings and spaces without significant civil works. In this context, the expected impacts of the project include:

- Contribution to the opening of a market for ICT based customised solutions integrating numerous products from different vendors and offering services from design of integrated systems to the operation and maintenance phases.
- Establishment of a collaboration framework between the ICT and buildings and construction sectors aimed at exploiting opportunities for the development of ICT based systems in compliance with the Energy Performance of Buildings Directive.
- Radical reduction of energy consumption and CO_2 emissions, in line with the policy framework for facilitating the transition to an energy efficient, low carbon economy through ICT.

Key facts

Start date: September 2010
Duration: 36 months
Total budget: €2.9m

- SEEMPubS specifically addresses reduction in energy usage and CO_2 footprint in existing public buildings and spaces without significant constructions works, by an intelligent ICT-based service monitoring and management of energy consumption
- The SEEMPubS platform will provide the necessary functionality and tools for achieving energy efficiency in public spaces by real-time monitoring of dynamic sensor data and controlling the operation of both passive and active environmental systems to ensure the best possible comfort conditions with the most efficient use of energy
- SEEMPubS aims at putting decision makers and building administrators into control to effortlessly optimize energy efficiency in existing buildings by ICT technologies

4-dimensional chart of the main elements that are interconnected in the SEEMPubS project

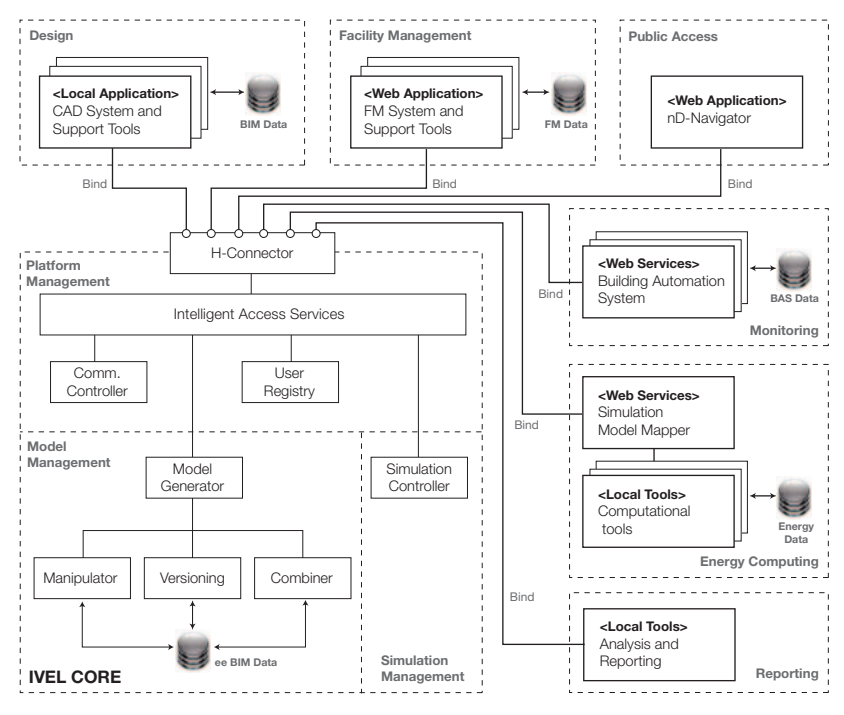
ICT Platform for Holistic Energy Efficiency Simulation and Lifecycle Management

HESMOS will achieve an industry-driven holistic approach for sustainable optimisation of energy performance and CO_2 emissions reduction through integrated design and simulation, while balancing investment, maintenance and reinvestment costs. Fragmented existing intelligent building data will be linked so that a complex lifecycle simulation can be done in phases with the largest potential for energy savings.

Introduction

HESMOS anticipates that public use facilities have to have a leading role in energy efficiency and sustainability. They are not being used continuously (e.g. public halls, schools, shopping malls) and often have open and surrounding spaces that are substantial energy consumers and buffers.

Public use facilities are managed as Build-Operate-Transfer (BOT) or Public, Private, Partnership (PPP) projects. This has the advantage that design, construction and operation is understood as a holistic life-cycle. Optimisation is no longer driven by individual phases with often considerable negative impacts to other phases. This leads the industry to request integrated concurrent engineering tools that allow energy and cost simulation studies for decision making at design phase.



HESMOS System Architecture

Partners

Coordinator: Technische Universität Dresden-Institute of Construction Informatics, Germany

Finland: Insinooritoimisto Olof Granlund Oy | **Germany:** Technische Universität Dresden: Institute of Construction Informatics, Institute of Building Climatology, Chair of Technical Information Systems, Obermeyer Planen + Beraten GmbH | **Netherlands:** Royal BAM Group NV | **Slovakia:** NEMETSCHEK Slovensko, S.R.O. | **UK:** AEC3 Ltd

Objectives

The objective of the project is to reduce the complexity of lifecycle simulation in all design, refurbishment and retrofitting phases where the largest energy saving potential exists. This will be achieved by:

- Extending existing Building Information Modelling (BIM), energy simulation and cost calculation tools, for seamless exchange of required data
- Integrating energy simulation tools into the design and facilities management (FM) process, so that BIM-Computer Aided Design (CAD) and FM tools can be used as building energy simulator and gap identifier
- Developing new applications for visualising building performance and displaying impacts of changed building/space parameters
- Developing cockpit functionality in BIM-CAD to provide feedback on the impact of design parameters on lifecycle energy performance
- Extending BIM-CAD to model and manage buildings and surrounding areas
- Extending BIM-CAD web services to act as Integrated Virtual Energy Laboratory (IVEL), enabling the study of design and retrofitting alternatives concerning energy performance and total costs

www.hesmos.eu

Methodology

The overall strategy of HESMOS is to use and enhance existing BIM-based tools, with the use of up-to date information obtained from sensing and other ICT-based intelligent building sub-system networks. These are to be complemented by specialised energy and cost-related models, services and tools and appropriate Graphic User Interfaces (GUI) and navigation capabilities. This elements contribute to develop an innovative *Integrated Virtual Energy Laboratory* (IVEL) that can be used by a large range of users for a variety of purposes.

The principal architecture of the envisaged platform is shown in the diagram. After the analysis of the impacts on energy consumption and emissions of public use facilities the project aims to develop the different components of HESMOS. These components include the platform architecture, interoperability concepts and implementation of model based ICT integration, enhancement for existing tools and new tools.

Expected deliverables

The project has 6 key goals:

1. Define requirements and user scenarios based on the studied impacts on energy consumption of public facilities and specify the HESMOS architecture.
2. Develop the first prototype of the energy efficient BIM-CAD extension and identify key performance indicators (KPIs) for the validation.
3. Prototype and review services and tools. Identify new risks and specify fallback actions. The basic service oriented architecture (SOA) system is configured and deployed.
4. Finalise and fine tune the software prototypes. The fully integrated IVEL prototype runs with all integrated components.
5. Make the nD Navigator fully operational. Draft the final exploitation plans.
6. Perform pilot demonstrators and evaluate final results. Conduct the final workshop and the final review.

Impact

The construction industry is the biggest industrial employer in Europe but it is fragmented. The energy saving potential for new buildings is about 40%, whereas for existing buildings this may increase up to 80%. The building stock is consuming 40-50% of the total energy in Europe and causes about 30% of the carbon emission. HESMOS will considerably contribute to achieve the mandate of the Action Plan on Energy Efficiency in Europe and contribute to energy independency.

The impact of HESMOS will be achieved on the domain of PPP and BOT projects of facilities of public use. A holistic view from design to operation allows to explore a life-cycle optimum in terms of energy efficiency and costs. The project aims to achieve a more efficient energy management and mix of energy. This results in increased energy efficiency, reduced emissions and costs and more sustainable planning capability of PPP and BOT providers.

Key facts

Start date: September 2010
Duration: 36 months
Total budget: €4.6m

- Provide advanced simulation capabilities to decision makers in the whole life-cycle of buildings, taking into account energy savings, investment and life-cycle costs
- Integrate a Virtual Laboratory to connect CAD and energy efficiency tools in order to enhance building industry actor's energy efficiency competences
- Close the gap between Building Information Modelling (BIM) and Building Automation Systems (BAS) so that decisions can be made economically (energy & cost related) in all life-cycle phases
- Integrate surrounding areas extending current BIM to energy efficient BIM
- The product is an Integrated Virtual Energy Laboratory (IVEL)

Development of Nanotechnology-based Insulation Systems

NanoInsulate will develop durable, robust, cost-effective opaque and transparent vacuum insulation panels (VIPs). VIPs will incorporate new nanotechnology-based core materials, such as nanofoams and aerogel composites and high-barrier films, resulting in panels that are up to four times more energy efficient than currently available solutions. These new systems will provide product lifetimes over 50 years for new and existing buildings.

Introduction

The successful entry of new nanotechnology-based insulation products to the transportation and refrigeration fields indicates that innovative insulation products should be explored in the building sector. Buildings account for over 40% of all energy usage. The development and use of VIPs is particularly advantageous as they are not only 3 to 4 times more energy efficient than conventional commercial counterparts, but also they are thinner and lighter therefore, more resource-efficient than standard insulation systems. In addition, they are suitable for new and existing buildings, where installation space and simple component design are a priority. Robustness, long term performance and lower cost are key to success in the construction field.

Partners

Coordinator: KINGSPAN , Ireland

Germany: Va-Q-Tec, Fraunhofer, BASF
Turkey: Koç University | **Israel:** Hanita | **Spain:** Gaiker, Acciona | **Sweden:** Airglass | **UK:** Pera

Objectives

The specific objectives and aims of the proposal are to develop robust new functional nanotechnology-based high energy efficient VIPs using novel low cost/high volume sustainable processes. The project contributes to address the zero-carbon drivers of the EU Construction sector. These new lightweight/thin panel-systems will have in-service lifetimes, thermal and mechanical properties far exceeding those presently on the market, achieving the following:

- Advance research and technical development in the field of energy-efficient sustainable products with added functionality and processes
- Increase competitiveness of EU enterprises, large and small, through enhancing transnational research and technological collaboration
- Demonstrate energy-efficiency savings, leading to significant reductions in EU energy consumption and greenhouse gas emissions from both new and retrofitted buildings

Methodology

The overall scope of the project includes an early scientific research phase, which lays the foundation for a technology integration phase that culminates in functional VIP concept solutions. The project also demonstrates the panels in use, completes a lifecycle assessment (LCA) and in-service costing exercise.

Additional work plans have also been designed to monitor and manage the project and to demonstrate the project's results to the wider end-user community. The sequence of work packages takes into account the necessary interdependencies between the R&D, integration, demonstration, in-servicing and LCA tasks.

The scientific and technological objectives are defined and focused on the development of next-generation nanotechnology-based thermal insulation systems in a cost-effective eco-sustainable manner for building and construction applications.

NanoInsulate

www.nanoinsulate.eu

Expected deliverables

Deliverables from NanoInsulate include:

- Develop novel nanostructured transparent composites of silica aerogels with polymers with extremely low thermal conductivity having superior mechanical properties to conventional silica aerogel panels
- Develop a suite of innovative nanostructured cost-effective nanofoams. The project will undertake investigations at laboratory scale to synthesise characterise and relate the chemical and physical structure of the materials to their resultant properties. Novel nanostructured mechanically-stable core materials of organic nanoporous foams will be produced using low cost production processes, with very low thermal conductivities
- Investigate the development of novel film barriers that will have significantly reduced gas permeation rates compared with conventional barriers; lower permeation rates will result in increased service life making them suitable for use in the construction sector
- Produce innovative VIP designs and novel VIP production methods for robustness and lower cost on a semi-industrial scale. This needs to be backed by powerful simulation tools that will effectively integrate the nanostructured core and barrier materials
- Validate model systems developed against powder-derived VIP systems and showcase at demonstration sites across the EU, in a number of different scenarios; this will demonstrate the significant commercial and market applicability

Impact

- NanoInsulate will develop integrated nanotechnology-based highly energy-efficient opaque and transparent VIPs using novel low-cost high-volume sustainable processes, thereby addressing the zero-carbon targets for the construction sector
- Innovative manufacturing processes developed will reduce the current high level of capital and operating costs for the wide-scale exploitation of the technology. Sustainable pilot scale manufacturing of derived nano-solutions will increase the use of highly functional nanomaterials within the sector
- New durable lightweight thin-panel systems will exhibit thermal and mechanical properties far exceeding those presently on the market (e.g. up to 4 times more energy efficient), thereby reducing heat losses, energy demand, and increasing indoor comfort
- The project will provide 40% business growth opportunities to the large and small business involved in Nanoinsulate, thanks to the increased transnational R&D collaboration and the exploitation of the concept solutions after project completion
- Significant reductions in EU energy consumption and green house gas (GHG) emissions from new and existing buildings benefiting society at large

Key facts

Start date: July 2010
Duration: 48 months
Total budget: €6m

- NanoInsulate is a €6m European project developing innovative durable, robust, cost-effective opaque and transparent VIPs
- VIPs incorporate new nanotechnology-based core materials (such as nanofoams and aerogel composites) and high-barrier films, resulting in panels that are up to four times more energy efficient than current solutions
- These new systems will provide product lifetimes in excess of 50 years suitable for a variety of new-build and retrofit applications. Robustness (resistance to physical and climatic damage) is a key characteristic
- 6 industrial and 4 research based partners from seven countries will come together to engineer novel solutions suitable for scaling up
- Reduce manufacturing costs to below 50% of current costs (based on design value over 50 years and production rates above 5 million m^2/year)

New Advanced Insulation Phase Change Materials

Buildings are responsible for a large amount of CO_2 emissions. Thermal insulation is one of the key solutions in reducing energy consumption. The NANOPCM project gives an innovative and highly technical, cost effective solution to increasing the thermal inertia of the envelope without increasing either the mass or the space.

Introduction

The increase in the level of greenhouse emissions, and the climb in fuel prices, supports efforts to look for a more effective use of renewable energy sources. Solar thermal energy is considered to be one of the most promising energy sources, but some technical improvements must be done, as solar radiation is a time dependent parameter.

As energy accessibility and demand often do not match, thermal energy storage plays a crucial role to take advantage of solar radiation in buildings. It can be stored as sensible heat, latent heat or heat of reaction. Latent heat storage via phase change materials is particularly attractive due to its ability to provide high-density energy storage.

Partners

Coordinator: Acciona, Spain

Germany: Active Space Technologies | **Italy:** DIAD Group | **Lithuania:** BK Agentura | **Poland:** Purinova | **Spain:** Tekniker, UCLM | **UK:** PCM Products Ltd.

Objectives

The overall objective of the project is the development, implementation, production, and demonstration of low cost and improved Phase Change Materials (PCMs) for new high performance insulation components in existing buildings. For this purpose, different technical innovations will be carried out during NANOPCM.

This includes a new, low cost, form stable, thermal storage component based on the anchorage at nanoscale of organic PCMs between the polymeric chains of selected polymers. This involves new thermal insulation, inorganic nanofoam with thermal storage capacity created through impregnation with organic/inorganic PCMs.

Thermal behaviour improvement of the materials developed with the introduction of high thermal conductive nanomaterials (Carbon Nanotube (CNT) or Carbon Nanofibres (CNF)) inside their structures and improved organic phase change microcapsules with the incorporation of high thermal conductive nanomaterials in the shell, will provide better thermal transfer to the PCM inside the capsule.

Methodology

Developments will be achieved through 8 work packages. WP1 is dedicated to project management. The aim of WP2 is the design and development of organic form-stable PCM, with improved conductivity incorporating nanoparticles. The objective of WP3 is to design and develop a nanoporous material in which selected organic/inorganic PCMs will be embedded.

WP4 is related to the characterization and simulation of the developed materials. WP5 is focused on the study of the lifecycle, the recycling possibilities and the minimization of the process cost. WP6 is dedicated to validating developed materials through prototype constructions, by measuring the NanoPCM insulation performance. The aim of WP7 is to demonstrate the viability of the production of the developed materials at a pilot plant scale. WP8 is to disseminate the results.

NANO PCM
New AdvaNced InsulatIOn Phase Change Materials

www.nanopcm.eu

Expected deliverables

Throughout the project there are established deliverables and milestones necessary to program the project. With regards to material synthesis, expected outcomes include:

- Process optimisation design of conductive nanomaterials incorporation to PCM microcapsules
- Selection and preparation of inorganic phase change nanocomposites
- Selection and preparation of Hybrid Phase Change nanocomposites

Testing of developed materials and synthesis will take place later on in the project as well as LCA issues studied. The following characterisation deliverables are expected:

- Assessment of the thermal behaviour of developed materials
- Safety and Risk assessment of the new PCM materials as constructive elements
- Assessment of the performance of new advanced insulation phase change materials
- Pilot Plant scale up study and recommendations

Finally, it will be necessary to demonstrate industrial production viability as well as probe efficiency of developed materials in a real building. Deliverables at this stage include:

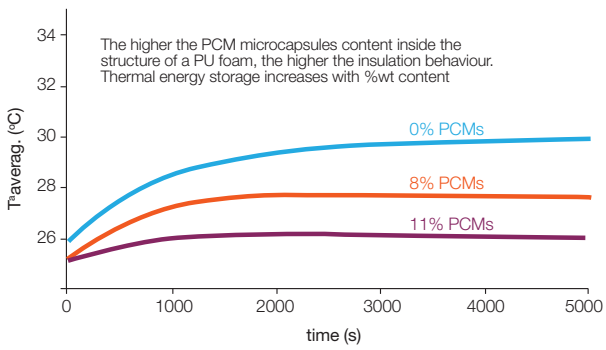
- Pilot Plant design, construction and start up
- Refurbishment of a real apartment and office
- Monitoring and evaluation of refurbishment results

Impact

NANOPCM will have a significant financial and technological impact on the insulation sector of the EU as well as on EU construction, manufacturing and material sectors. The European energy consumption in 2010 was predicted to be 1970 Mtoe and a total of 450 Mtoe will be used in building space heating.

Using current insulation systems, 42% of the energy could be saved. That means 189 Mtoe every year. If the improvements proposed in NANOPCM project are implemented, the total savings could rise to 297 Mtoe/year. The use of smart thermal insulation with storage capacity in building walls and windows joints carried out by NANOPCM consortium, contributes to reduce the energy consumption and the annual energy cost for end-users. The materials to be used throughout the project, such as glycerine, are residual by-products of other industries.

The project aims to reduce the cost of nanotechnology-based insulation systems and make their wide scale commercial application feasible. NANOPCM will support SMEs in different ways. It will improve their products, increasing their market share and their R&D capabilities based on the shared knowledge and the built-up experience.



Key facts

Start date: June 2010
Duration: 36 months
Total budget: €3.5m

- Development, implementation, production and demonstration of low cost and improved Phase Change Materials (PCMs) for new high performance insulation components in existing buildings
- Inclusion of nanomaterials inside PCM
- Demonstrate the viability of production of the new materials at pilot plant scale
- Evaluate the performance of the developed materials in existing buildings

Development of a Novel Cost-effective Nanotech Coatings

In order for the European buildings to improve their energy efficiency, the construction materials industry must develop new associated products. COOL-Coverings addresses an integrated envelope strategy, developing a novel and cost-effectvie range of nanotechnology improved coatings, which aims to reduce heat transfer to indoor spaces by developing high Near Infrared Reflecting nanomaterials for envelope application.

Introduction

Today, primary energy use in the built environment accounts for about 40% of total EU energy consumption. Cooling is a major energy consumer in commercial buildings although the demand for cooling in residential buildings is continuously rising. Although Italy and Spain are the main energy users for cooling, forecasts suggest an overall growth across the whole of Europe, reaching 160 GWh per year by 2010.

The COOL-Coverings Project will develop a novel and cost-effective range of nanotech enabled insulation materials to improve building envelope energy efficiency, in retrofitting or new constructions.

The technical strategy will develop highly-reflective nano-based materials that significantly improve the (NIR) reflection capabilities of existing covering products i.e. paints, roof membranes and façade ceramic tiles.

Partners

Coordinator: KERABEN, Spain

Finland: Finnish Institute of Occupational Health | **Germany:** ACTIVE, BÖRNER | **Greece:** National Technical University of Athens, NanoPhos | **Italy:** D'Appolonia, Università Politecnica delle Marche, MBN CSGI| **Netherlands:** TNO | **Poland:** Mostostal Warszawa | **Spain:** Instituto de Tecnología Cerámica | **Switzerland:** IRIS

Objectives

The project will develop a set of outdoor covering materials to achieve the following objectives:

- External walls – NIR reflecting paints enabled by new nanocrystalline metal oxides
- Façades – ceramics using a new nanotechnological-based NIR reflecting inorganic coating
- Roof – an already existing 3D textile membrane incorporating a nanotechnological-based NIR reflecting coating
- Internal walls – NIR-Reflecting nanocrystalline oxides so that a reflection range may cover the radiation from indoor heating systems

All these NIR reflective products will be based on nano materials, and beneath the final construction products a set of nanostructured oxides will be engineered to give the expected NIR reflective capabilities to the final building products.

Methodology

COOL-Coverings is structured in 7 workpackages. WP1 covers the conceptual design phase, while WP2 represents the core of the Research Activity. Subsequent packages address the development of the respective innovation areas: roof, walls and tiles. WP3 concerns the development of new reflective tiles, while (in parallel) WP4 will focus on walls and membrane coatings. WP4 is a unique task including two different materials because it relates to nanotechnology, while WP3 is more specific and innovative because it develops a new concept of reflective tiles. WP6 and WP7 concentrate on the modelling and testing of an integrated solution to demonstrate the validity of the whole project and proceeds through to commercialisation.

First draft Market Analysis on the basic State of Technological Art has been completed. The research activities to develop the NIR-reflecting nanostructured oxides are currently being carried out.

www.coolcoverings.org

Expected deliverables

In total 31 deliverables are scheduled for the project. To date, several deliverables have been completed, mainly corresponding to the analysis and design phase, as well as the administration and setting up of the partnership and internal communication infrastructures.
The main technical deliverables are development and optimisation of:

- Novel roofing membrane with NIR-reflecting properties on the outer layer, enabled by a combination of nanotechnology and multifunctional materials
- Improved NIR reflecting outdoor paints enabled by nanocrystalline metal oxides
- New nanotechnological-based NIR-reflecting inorganic coatings, applicable to façade ceramics

These results will have associated deliverables which significantly increase the added value of the project results.

Lifecycle cost analysis allows further viability checks of product service concepts, in particular the increased costs associated with monitoring services which allow the prompt check of material performances and allow cost effective interventions for retrofitting.

There is full compatibility with current manufacturing, installation and refurbishment practices to foster direct and quick transfer of results both in new and existing buildings, in residential and commercial sectors.

2 pilot scale demonstrators of COOL-Coverings will be realised in 2 different environments in both cool and warmer climates.

Impact

COOL-Coverings is driven by Industrial partners with RTD capabilities to develop advanced construction materials for a specific application area (open air envelopes). This takes advantage of nanotechnologies and the need for cost effectiveness.

COOL-Coverings addresses a strongly SME-based sector (construction) and develops innovative building products focusing economic and technical limitations of these SME's either involved in its manufacturing or its installation. Furthermore, the overall project has been developed taking into account the following EC recommendations about energy performance in buildings, as well as the EeB PPP Roadmap for future research projects:

- Construction is a huge sector (32 million jobs) heavily affected by the crisis: COOL-Coverings provides integrated, economic and easy to install covering solutions for energy efficient new buildings
- Present rate of construction of new buildings is below 2%, therefore it is of utmost importance that COOL-Coverings tackles strongly refurbishment by developing construction systems fully applicable on existing buildings
- Strong impact is needed at EU level via effective dissemination and exploitation of high performance insulation/solar reflection building materials
- The integrated, multidisciplinary and holistic approach is fully reflected in the overall project objectives and setup of the project consortium

Key facts

Start date: June 2010
Duration: 36 months
Total budget: €3m

- High NIR-reflective paint membranes and tiles for outdoor application based in inorganic nanostructured materials, independent of colour
- Manufactured and installed using conventional technologies
- Applicable to new and existing buildings

New NANO-technology Based High Performance Insulation Foam System

Nanofoam project aims at developing novel nanotechnology-based high performance insulation systems to improve energy efficiency of new and existing buildings.

Introduction

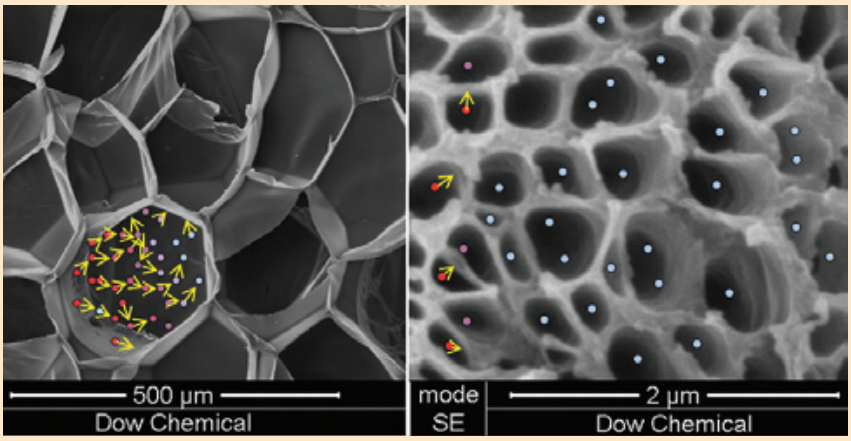
The heating and cooling of buildings accounts for approximately 40% percent of the overall energy consumption in Europe. Current commercialised insulating materials for building and construction have long-term thermal conductivity values between 23 and 45 mW/mK Achieving future requirements for lower energy consumption as described in the European Energy Performance of Buildings Directive (EPBD) requires a significant increase of thickness of conventional insulators.

This will cause impractical design problems and cost increases in the building industry. High performance insulating materials available today are either not cost-effective and are too fragile to meet the durability needs that are critical for mainstream building products.

Partners

Coordinator: DOW Europe GmbH, Switzerland

Germany: ZAE Bayern, CABA | **France:** CSTB



Heat transfer through gas molecules collisions – in a Nanofoam (right), intermolecular collisions are not effective due to reduced number of gas molecules in the pores

Objectives

The projects objectives are:

- Develop an innovative high-performing Nanostructured polymeric foam, employing a low Global Warming Potential (GWP) blowing agent such as CO_2
- Have a lower thermal conductivity and superior properties (mechanical, fire resistance, moisture/fungi resistance) than commercial insulation products at a competitive price
- Evaluate and test the compliance of this technology with respect to current standards and environmental, health and safety regulations in real scale settings (laboratory rooms or real dwellings)
- Assess the full technical, economic and environmental performance of the novel engineered insulation Nanofoam for its commercial implementation on the market in new buildings and for retrofitting of old ones

Methodology

The methodology includes doing a study about chemical additives, production processes and technologies to be investigated to engineer and produce Nanofoams. The project will identify the qualitative and quantitative methodologies for characterising and modelling the morphological, mechanical, chemical and physical properties of polymeric Nanofoam, in multiple formulations.

These formulations will include different polymeric materials, foaming agents, additives/nano-additives. Nanofoam will also study the foaming processes which can be used to produce nano-structured foams. The project will validate the chemistry and structure of Nanofoams and the corresponding heat transfer models through laboratory screening experiments. This gives an iterative fine-tuning of the formulation chemistry and foaming process in order to obtain the desired and optimised Nano-structure, properties and functionalities.

Expected deliverables

Deliverables will address the feasibility of using certain chemicals, the production conditions and the technologies to engineer and produce Nanofoams. The final outcome of the proof-of-concept phase will be the demonstration of the chemistry and laboratory process for producing an innovative Nanofoam with pore size around 100nm and uniformly distributed porosity greater than 80%. The Nanofoam will also be fully characterised and will be designed to have excellent mechanical, fire and moisture and fungi resistance properties.

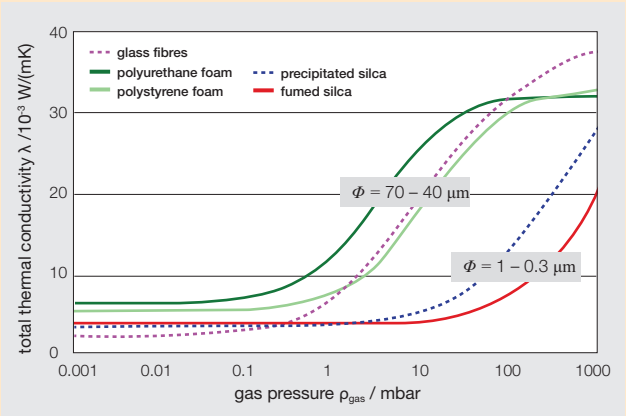
The consortium partners will examine with more detail the fundamental and advanced approaches that can be used for producing Nanofoams. A wide number of polymer systems, nano-additives and environmentally-friendly and sustainable foaming agents will be screened together with investigation of the feasibility of some production processes or strategies for creating nucleated nano-structured materials.

The R&D scoping will include collection and study of the most up-to-date literature on the physical and chemical properties of advanced polymeric nano-materials and results from laboratory research. The most interesting findings for the project scope will be reproduced and tested in laboratory by project partners.

Impact

The development of the Nanofoam as described above will greatly enhance the adoption of high energy efficiency standards in new and existing buildings. In particular, Nanofoam will alleviate some of the perceived drawbacks that limit the use of current insulation products and methods for high energy efficiency in buildings, such as space restrictions due to construction specifics (e.g. cavities, windows, internal space of the room) or use restrictions due to adjacent areas (e.g. width of pavement, estate limitations).

Achieving very high energy efficiency in new buildings and, especially, in existing buildings, is a key step to reach EU energy and CO_2 emission reduction targets. Every solution that enables high insulation efficiency together with easier design and installation, good durability, fire resistance properties at reasonable cost has the potential to act as a catalyst to the necessary upgrade of the building stock in Europe.



Key facts

Start date: In negotiation
Duration: 36 months
Total budget: €3.3m

- The consortium aims to develop in the next 3 years an innovative high-performing nanostructured thermoplastic foam, employing a low GWP blowing agent such as CO_2
- It has a lower thermal conductivity than commercial insulation products at a competitive price, while meeting European building code requirements (mechanical, fire resistance, moisture/fungi resistance)

Aerogel Based Composite Nanomaterials for Cost-effective Building

AEROCOINs proposes to create a new superinsulating material by overcoming two major obstacles which have prevented a wide spread use of silica-based aerogel super-insulation components in the building envelope. These obstacles are the mechanical weakness of silica aerogels and its high cost.

Introduction

In the current context of global climate control policies, improving the energy efficiency of buildings represents a great potential for energy savings. The thermal resistance of the insulation layer in the building envelope can be enhanced by significantly increasing its thickness. Another approach is decreasing the thermal conductivity of the insulation using new superinsulation components or materials.

Aerogels are light weight, nanoporous solids perfect for thermal insulation with the lowest thermal conductivity ever known ($\lambda < 0.012$ W/mK) in ambient conditions. AEROCOINs proposes a clever combination of sol-gel science and nanotechnology that can greatly advance in the design and development of novel superinsulating aerogels materials.

Objectives

The main goal of the AEROCOINs project is to develop a new composite/hybrid aerogel material to improve the thermal insulating performance of existing buildings aiming at reducing their energy demands. The main objectives are:

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Aerogel Material

- Synthesise and elaborate novel, mechanically strong and superinsulating silica aerogel-based materials via an ambient drying process
- Design and fabricate a highly efficient and robust building components (based on the developed aerogel composite and/or hybrid material) for its implementation in the external part of the envelope of existing buildings
- Demonstrate the significant cost reduction of the commercial production of superinsulating aerogel-like materials and the associated components
- Demonstrate the thermal, structural and mechanical performance of the superinsulating component under real conditions
- To obtain a definition of the global performance of the component in different representative building typologies taking into consideration the Service Life Cost Analysis

Methodology

AEROCOINs project contains work packages addressing specific technical objectives, one of them devoted to dissemination and exploitation issues the last one to management activities.

- WP1 – Synthesis of reinforced superinsulating aerogels is focused on the design and synthesis of novel superinsulating silica-based aerogels
- WP2 – Drying and thermal conductivity optimisation deals with the development of a robust and efficient drying process for the preparation of superinsulating aerogel boards
- WP3 – Pilot scale material fabrication is focused on the upscaling of the fabrication of superinsulating aerogel boards
- WP4 – Aerogel-based component manufacturing deals with the design and fabrication of new superinsulating building components for retrofitting installations

Partners

Coordinator: TECNALIA, Spain

France: Armines, PCAS, Separex | **Finland:** VTT | **Germany:** ZAE | **Poland:** Politechnika Lodzka | **Spain:** Acciona | **Switzerland:** EMPA

www.aerocoins.eu
(September 2011)

- **WP5 – Building integration and validation** deals with energy efficiency demonstration activities and its main objective is the integration of the component in a demonstrator building to validate its performance (thermal, mechanical and structural) under real conditions

Expected deliverables

The main expected deliverables from the AEROCOINs project are as follows.

Related to the elaboration and development of a composite/hybrid aerogel material:

- Obtain a reinforced aerogel-based thermally superinsulating material: improving mechanical properties (by a factor of 100 compared to conventional silica aerogel) while maintaining a low thermal conductivity ($\lambda < 0.018$W/mK) by polymeric cross-linking and/or nanodispersion concepts based on use of cellulosic species
- Develop an ambient drying process: minimising evaporation-induced shrinkage by optimized fine-coupling between materials (sylilation chemistry of the silica network and strengthening techniques) and process parameters (drying rate, etc.)

Related to the design and development of the insulation façade construction component:

- Design and fabricate a novel building component prototype based on the developed aerogel-like material. The component should be compatible with conventional construction installations where the envelope is part of the buildings
- Design a cost-effective continuous industrial-level process for the production of the aerogel-like material boards

Related to the validation of the efficiency of the insulation façade component and building integration:

- Demonstrate the thermal performance of the highly insulating component under real conditions
- Demonstrate the structural and mechanical performance of the insulating component under real conditions

Impact

AEROCOINs project results will have a high impact on the thermal insulation market. The world´s insulation market is growing at a projected rate around 5% until 2012. The aerogel insulation market share is 5%.

The great advantage of aerogels from a marketing point of view is the tremendous growth rates (50% to 75%). The business benefit potential is great and there is imminent need for superinsulation products. Due to an increase in building code requirements in many European countries and a rise in retrofitting activities there is a high demand for outstanding insulation materials for buildings applications.

AEROCOINs project results will help Europe to save energy and contribute to the low-carbon economy. The energy saving estimate if AEROCOINs project outputs are implemented (by CALENER software prediction tool) are: reduction of 30% of overall energy consumption and 25% of CO_2 emissions whilst maintaining indoor comfort.

AEROCOINs project results will bring significant savings for European citizens´s household energy bills. Application of the AEROCOINs Aerogel superinsulation component to existing buildings for 2020 (227 million dwellings) will provide an average economical saving up to €30,000 m/year (assuming energy cost of 0.06€/kWh[2]).

Key facts

Start date: June 2011
Duration: 48 months
Total budget: €4.3m

- Superinsulating silica aerogel-based materials
- Crosslinking and Nanodispersion as reinforcement strategies
- Demonstrate performance of insulating components
- Reduction of 30% of overall energy consumption and 25% of CO_2 emissions
- Could save up to €30,000m/year in energy

Kubik by Tecnalia

New µ-CHP Network Technologies for Energy Efficient and Sustainable Districts

FC-DISTRICT optimises and implements an innovative energy production and distribution concept for sustainable and energy efficient districts. The concept is based on dynamic heat exchange between buildings exploiting a micro-combined heat and power solid oxide fuel cell system for energy production. This includes improved thermal storage, building and piping insulation, biogas production from food wastes, smart control and hybrid wireless network systems.

Introduction

FC-DISTRICT integrates an innovative midterm energy technology – Solid Oxide Fuel Cell (SOFC), with heat management at building and district level (building thermal storage coupled with intelligent distribution networks). It aims to serve the economic, ecological and sustainability needs of the consumer. Such micro-co-generation systems, generating both heat and electricity locally with efficient fuel use, reduce loss over long transmission and distribution lines.

These systems also offset the use of centrally generated electricity from the grid, allow local voltage regulation and increase the ability to add small units instead of a larger one during peak load conditions. The holistic energy management proposed in this project is expected to reduce annual primary energy consumption at district level up to 60%. Demonstration is taking place in Spain, Greece and Poland in three phases, unit, building and district.

Partners

Coordinator: Mostostal Warszawa, Poland

Belgium: IntesaSanpaolo | **Greece:** Knauf, National Technical University of Athens | **Germany:** EBZ, Knauf, Technische Universitaet Bergakademie Freiberg | **Italy:** D'Appolonia, Ecofast | **Netherlands:** VITO, Stichting Energieonderzoek Centrum | **Poland:** Instytut Energetyki, | **Portugal:** Instituto Superior Tecnico | **Romania:** Institut Oskar von Miller | **Spain:** Acciona, Fagor, Ikerlan, Solintel | **Sweden:** Chalmers Tekniska Hoegskola, Powerpipe Systems, SP | **UK:** Rinicom

Objectives

The overall objective of the FC-DISTRICT project is to optimise and implement an innovative energy production and distribution concept for refurbished and/or new energy autonomous districts. This is to be achieved by exploiting decentralised co-generation coupled with optimised building and district heat storage and distribution networks. Technological objectives include:

- Develop a high temperature SOFC with versatile fuel processor for gas reforming and optimised peripheries making possible successful integration with district networks
- Develop and implement advanced, durable and cost effective insulation materials for improved building and district piping thermal response
- Integrate Food Waste Disposers (FWDs) with anaerobic digesters to produce biogas
- Implement an Intelligent Heat Network equipped with smart control and hybrid wireless network systems
- Optimise and tailor the characteristics of the energy and power distribution systems to meet the energy and power demand of various building and district typologies

Methodology

The first SOFC unit is being tested in Spain at the beginning of 2012. The expected results include adaptation, optimisation and manufacturing of a number of units able to deliver up to 1.7kW electricity and up to 3kW thermal power, at 30% net electrical efficiency, allowing tri-generative use at building level and inter-connection with a district heat distribution system.

One of the optimised SOFC units is to be demonstrated in a low energy building in Greece, featuring innovative thermal storage and insulation components. The project aims to prove energy management capabilities of the SOFC and its integration with building thermal storage.

www.fc-district.eu

The Intelligent District Heat Network comprises a number of dispersed SOFCs and optimised piping with interconnections and control procedures, as well as a prototype hybrid communication network. This is to be implemented in Poland and aims to act as a case study for a heat optimised district, demonstrating the link between energy consumption at building and district level.

Expected deliverables

The FC-DISTRICT project aims to introduce a new paradigm in energy efficiency by developing systems, materials, technologies and methodologies specifically intended for integration at district level. The project strives to prove and demonstrate the following:

The proposed micro-grid/heat network arrangement of dispersed micro-CHPs, aims to lead not only to significant reduction in power transmission loss and heat dissipation loss, but also to ensure direct energy savings at both building and district levels, offering significant savings in CO_2 emissions.

SOFC micro-CHP systems can lead up to 60% reduction in primary energy use at district level when combined with appropriate building thermal storage, materials and district heating technologies and that are fully compatible with the integration of renewable energy from wastes.

The new insulation systems aim to meet requirements of high-performance residential buildings, characterised by a very low space heating load (about 15 kWh/m^{2}a) and peak load typically below 10 W/m^2.

FWDs can be used to monitor the amount of wastes and potential biogas production at district level. New district management business and service models for the consumer to achieve economic, ecologic and sustainability targets.

Impact

The vision of the project is to develop technologies for green districts, where energy is effectively and efficiently produced, distributed, monitored, controlled and consumed.

Preliminary computations have shown a possible primary energy saving up to 60% at district scale. This figure accounts for continuous operation of SOFCs, in conjunction with effective in-building load control and ensures operation cost reduction at building level. The return on investment for a SOFC unit is anticipated to be realised within 5-7 years.

Additional energy and cost benefits will arise from advanced district heating pipe network (i.e. novel insulation materials, pipe diameter minimisation, optimal operational mode). This is possible for use of locally produced biogas and income from the local ESCO in case of electricity surplus. This could result in anticipated tax reduction stemming from reduced CO_2 emissions and/or from reduced district wastes.

The FC-DISTRICT concept will achieve building energy and power autonomy via demand-flexible balance at district level and will be appropriate for a wide typology of districts. These could include a typical housing estate, isolated rural communities, mixed suburban environments, academic or public communities such as universities or schools, commercial areas, industrial sites and trading estates, municipalities, etc.

Key facts

Start date: September 2010
Duration: 48 months
Total budget: €11.8m

- The project aims to create new micro-CHP network technologies for energy efficient and sustainable districts
- Scope is to optimise thermal power management at building and district level via dynamic heat exchange between buildings
- Exploitation of an innovative micro-CHP SOFC system for energy production, coupled with improved building thermal storage and insulation, advanced district heating piping, biogas production from food wastes, smart control and hybrid wireless network systems
- Demonstration undertaken in Spain, Greece and Poland in three phases unit, building and district
- Large scale demonstration in Poland proves the concept, targeting up to 60% reduction in primary energy use, and acts as model for heat-optimised districts, demonstrating the link between energy consumption at building level and district

Energy-Hub for Residential and Commercial Districts and Transport

A new type of energy infrastructure for a district including an advanced system for matching supply and demand of energy (heat, cold and power) and incorporating advanced heat storage technologies such as Thermo Chemical Materials. Full-scale demonstration of the technology is to be used in the district of Tweewaters, Belgium.

Introduction

The contribution of renewable energy on district level is still modest and can presently be accommodated in the existing energy infrastructure without great problems. In cases where the contribution of renewables is the same as the contribution of fossil fuels eg when using (large) wind turbines, a particular problem is the fluctuating character of the energy supply, with the effect that it does not match the energy demand.

This may occur in the short term, when peak electricity production by PV cells occurs around noon, while the electricity demand is mostly in the morning and evening. It can also be a long term mismatch such as solar heat harvested in summertime, when the need for heat is mostly in wintertime.

Partners

Coordinator: TNO, Netherlands

Belgium: Ertzberg, Electrawinds, ISPE, VITO | **Finland:** VTT | **France:** EDF | **Germany:** H.S.W., Fraunhofer-Gesellschaft | **Italy:** D'Appolonia, CESTEC, University of Genova | **Netherlands:** ECN, TNO | **Poland:** Mostostal Warszawa| **Spain:** Acciona, Solintel | **UK:** ICAX

Scale model of the demonstration site in the district of Tweewaters, Belgium

Objectives

The objective of the project is to maximise the amount of renewable energy in a district by matching energy demand and supply by intelligent charging of electric vehicles or postponing the demand for refrigerators or washing machines. Excess renewable heat can be stored in advanced Thermo-Chemical Materials (TCM) for prolonged periods without heat losses.

An important element is acceptance of such an advanced energy supply system by the users. The development of new business models and service concepts that are attractive to both the suppliers and the users is crucial.

The E-hub energy system is to be demonstrated in the Tweewaters district in Leuven, Belgium. In addition, 3 to 4 scenario studies intend to be carried out to assess the feasibility of an E-hub type of system in different districts (Amsterdam, Netherlands; Freiburg, Germany and Dalian China).

Methodology

In WP1 the project aims to identify a number of model districts that are used to assess the feasibility of an E-hub energy infrastructure. Load profiles are to generated, performance curves (e.g. efficiency at part load) are to be measured by different pieces of equipment in WP2, while novel heat storage e.g. using Phase Change Materials (PCMs) are developed and modelled. Business models are to be developed in WP6. The methodology is outlined in the chart on the right

Using all information generated, the district is simulated in Matlab simulink to optimise the intelligent control system such as the Powermatcher®, Intelligator® and Heatmatcher software. The control system is demonstrated on full scale at the Tweewaters project in Leuven, Belgium.

Expected deliverables

The main deliverables of WP1 are around the identification of model districts, production of load profiles thereof and an evaluation methodology to assess the impact of the E-hub energy infrastructure.

Deliverables in WP2 mostly concern performance evaluation of components of the E-hub energy infrastructure as well as technological specifications for such components.

WP3 looks to produce reports on the development of different types of heat storage technologies and their feasibility in an E-hub system. PCM's are particularly promising.

WP4 is the core of the project. Deliverables comprise the development of an energy control system and the simulation of its performance in the model districts identified in WP1.

WP5 deals with the full scale demonstration. Important deliverables are reports on the application of the research work developed in the previous work packages as well as studies on user behaviour and user acceptance.

WP6 aims to deliver reports on new business models and the application thereof in an E-hub type of system.

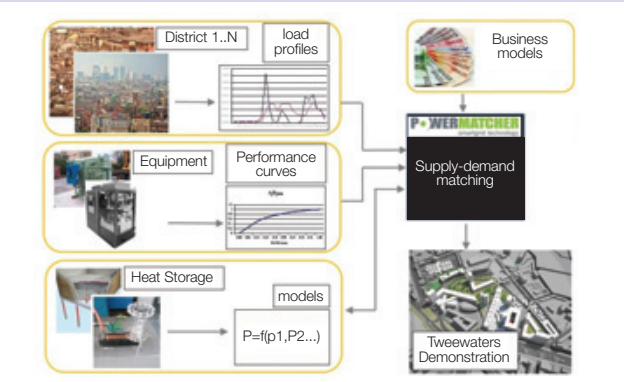
Finally, WP7 deals with dissemination including production of a website, brochures, conference papers and material for education and training.

Impact

Due to limited stock of fossil fuels and an increasing demand for energy, energy prices are expected to rise in the future. Considering also the increasing level of awareness of the public on the danger of greenhouse gas emissions and the stricter regulation on the matter, future energy supply systems are expected to change considerably.

The share of renewable energy such as wind energy, biomass and solar, the latter in the form of heat (using solar collectors) and power (using photovoltaic panels) will grow. However, renewable energy supply has a fluctuating nature and matching demand and supply is a challenge. Therefore, intelligent energy management systems are absolutely essential for accommodating large shares of renewables in the existing energy infrastructure.

In addition, energy, being a scarce commodity in the future, is expected to be subject to different price levels, rather than the flat rate in use today. Energy will be more expensive in times of shortages of supply and cheaper in times of abundant supply. Powermatcher® and similar software to be developed in the E-hub project already use a pricing mechanism, presently using artificial prices, to match the supply and demand of energy.



Outline of project methodology

Key facts

Start date: December 2010
Duration: 48 months
Total budget: €11.7m

- Smart grid type of energy infrastructure, based on matching supply and demand of heat, cold and electricity
- Development of compact heat storage technologies, in particular based on Thermo Chemical Materials
- Application of innovative business models
- Demonstration in the district of Tweewaters, Belgium

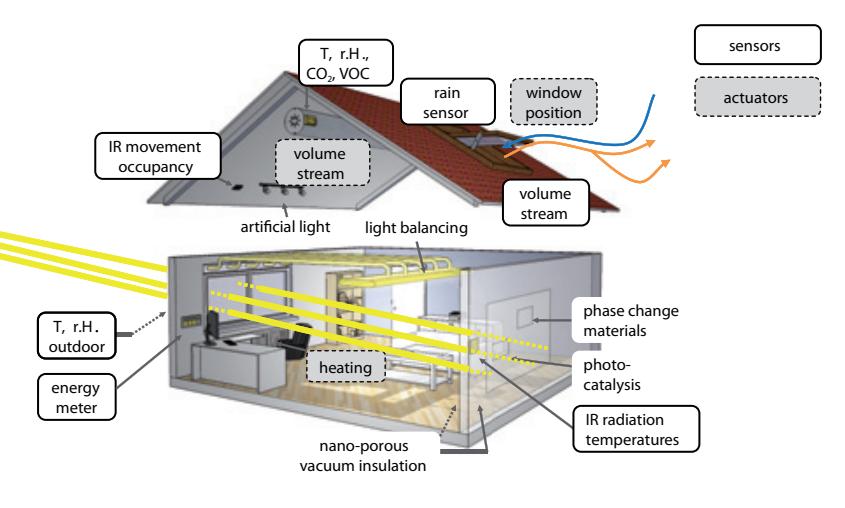
Clean and Resource Efficient Buildings for Real Life

Clear-up presents a holistic approach to creating good indoor environment in buildings whilst reducing their operational energy use. Development and novel use of nano-materials and new control algorithms improve the energy performance of windows, building envelopes, air handling, heating, ventilation and lighting systems, and provide improved a indoor environment. Solutions are designed both for new buildings and for retro-fitting existing ones.

Introduction

We spend 90% of our lives indoors. Providing the right environment takes energy and resources. With buildings responsible for up to 40% of European energy consumption and a third of CO_2 emissions, we are facing a need for energy reduction. As a contribution, clear-up aims to bring nanomaterials from the lab into real applications, develop sensors and control strategies for an optimal interaction, and integrates these new components into real buildings.

The foundation for the clear-up project was set within the gas sensing and material science community. First ideas were developed around demand-controlled ventilation and later on combined with a variety of nano and micro technology-enabled components. Today, Clear-up works as a cross-over from material science to the construction industry.



Clear-up technologies for energy-optimised control of indoor environment

Partners

Coordinator: Eberhard, Karls University of Tübingen, Germany

Belgium: Belgian Building Research Institute | **Czech Republic:** Saint-Gobain Weber Terranova a.s., Czech Technical University in Prague | **Denmark:** Technical University of Denmark, International Centre for Indoor Environment and Energy | **France:** Bouygues Construction, Centre Scientifique et Technique du Bâtiment | **Germany:** Fraunhofer Institute for Surface Engineering and Thin Films, Eberhard Karls University of Tübingen, Fraunhofer Institute for Solar Energy Systems, AppliedSensor, Saint-Gobain Weber, Porextherm Dämmstoffe, Siemens Corporate Technology, Steinbeis Transfer Centre AO Action | **Greece:** FORTH Foundation of Research and Technology Hellas | **Italy:** EC DG JRC - IHCP, CTG Italcementi | **Spain:** Acciona | **Sweden:** Uppsala University, Ångström Laboratory | **Switzerland:** Siemens Building Technology

Objectives

In practical terms, Clear-up addresses four key components of a building:

- **Windows:** advances the practical use of shutters and electrochromic windows for reducing the building's cooling load and along with light-guide technology, reduce the need for artificial lighting
- **Walls:** uses photocatalytic materials for air purification and micro-porous vacuum insulation in combination with phase change materials to passively control temperature
- **Air Conditioning:** advances strategies for demand controlled ventilation and improved air quality
- **Sensors and control:** Provide an underpinning technology for Clear-up's approach. New sensors are in development, their use is optimised for the operation of smart windows, demand controlled ventilation and catalytic air purification

Methodology

To generate viable solutions optimised in terms of energy and usability, the project aims to work on design and simulation, optimise nanomaterials in the lab to the component needs, test performance of components separately and in combination with subsystems, and integrate the components in real test buildings. Finally the project will demonstrate and discuss the clear-up benefits within the building community and investigate economic and resource-related aspects within a whole lifecycle approach.

All activities are conducted along the overall system design and integration in real buildings. A first and very important step is the choice of the test building. It must fit to requirements of installation, fulfil experimental constraints, enable easy access and allow widespread application as otherwise interpretation of results might become rather arbitrary.

www.clear-up.eu

Expected deliverables

Deliverables within clear-up range from designed nanomaterials fulfilling application-specific needs, prototype components ready for installation, control and monitoring strategies defined together with their interfaces for demonstration and implementation at real test building.

So far the major work on nanomaterials and prototype components has finished. Almost all components are ready for testing and have been installed at a first test building extended testbed consisting of 6 nearly identical office rooms. Control ad monitoring strategies including interface routines were set-up in December 2009 within a small demonstrator building and are now implemented in a more complex manner at the building management system at the chosen test building. Real life tests will be completed shortly in parallel to the set-up of a whole year demonstrator building in Spain.

Dissemination activities of clear-up aim to illustrate the overall concept. Through a number of workshops, the project aims to explore indoor environment issues with the community. In addition, feedback from building professionals will be fundamental once first results from the test bed and the whole lifecycle approach are available.

Impact

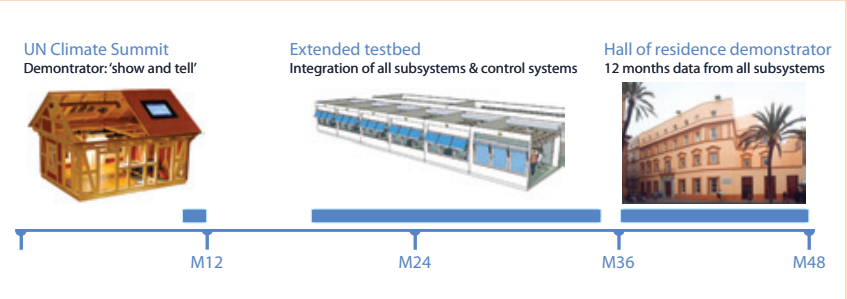
Clear-up aims to achieve substantial savings in operational energy use without negative consequences on high quality environment for building occupants.

With special attention to refurbishment, the project's vision is to develop solutions that can bring improvements on light, indoor air and thermal comfort:

Light: electrochromic windows with switching transparency while maintaining vision to the outside, may help future work environment becoming more comfortable while reducing the risk of over-heating. Light guides will increase natural light and will lead to a healthier and fresher environment while keeping energy demands for artificial lighting low.

Air: there are multiple ventilation issues. Ventilation is needed for a healthy environment, but it also plays a key role in heating and cooling. Clear-up is using smart algorithms for demand-controlled ventilation based on gas sensors. Photocatalytic paints may reduce the indoor pollution and therefore lower ventilation rates. Ventilation is also used for unloading thermal buffers of phase change materials.

Temperature: Insulation issues play a fundamental role in energy refurbishment. Clear-up promotes the use of vacuum insulation panels especially for applications where space is limited. The project applies phase change materials to passively control temperature.



Buildings and timeline

Key facts

Start date: November 2008
Duration: 48 months
Total budget: €12 million

- Integration of nano and micro technology-enabled components in a holistic approach
- Development of new building control strategies integrating active and passive elements
- Simulation and modelling along with economic and environmental analysis to address the business and resource aspects in a whole lifecycle approach
- Tests in laboratory, simulated test rooms, real-life test beds, and building demonstrators

Development of a Clean and Energy Self-sustained Building

The project aims to develop an intelligent, self-sustained and zero CO_2 emission hybrid energy system to cover electric, heating and cooling loads in buildings. Primary energy is harvested using renewable energy sources and directly used to cover contingent loads, while excess energy is converted into hydrogen to be used as an energy storage medium. Hydrogen is reconverted into electricity upon demand.

Introduction

More than 40% of the energy consumed in the EU is used to cover the needs for heating, cooling and electricity in buildings, with the major part of this energy being produced from imported fossil fuels. The building sector is a major contributor to Green-House Gas emissions.

To address these issues, the EC has set the targets of 20% cut in emissions, 20% improvement in energy efficiency and 20% increase in renewables by 2020. Accordingly, the trend in the buildings sector is to move towards using Renewable Energy Sources (RES) to cover buildings' energy needs. However, an appropriate way to balance the intermittent nature of RES is needed to ensure the continuous operation of energy systems.

Partners

Coordinator: D'Appolonia, Italy

Germany: Institut für Verbundwerkstoffe, Comat Composite Materials, CirComp | **Greece:** National Technical University of Athens, Schneider Electric, Centre for Renewable Energy Sources | **Italy:** SCAME Sistemi, IDROGEN2, ICI Caldaie, CAVE | **Netherlands:** Van berkel & Bos u.n. studio | **Norway:** Det Norske Veritas | **Poland:** Decsoft Spólka Akcyjna | **Spain:** Ikerlan Sociedad Cooperativa, Acciona | **Sweden:** Catator, Skanska | **UK:** University of St Andrews

Objectives

H2SusBuild aims to develop a self-sustainable and zero CO_2 emission hybrid energy system, in which the storage of hydrogen provides the energy supply in case of energy shortage from renewables. RES such as photovoltaic solar panels and wind power generators are coupled with water electrolysis for the production of hydrogen.

The produced hydrogen is stored as a pressurised gas and consumed on-demand in order to produce combined heat and electricity in case of shortage of renewable energy. The project aims to install this hybrid energy system in a real building environment in order to demonstrate the feasibility of this system in commercial or residential buildings. Not only from the perspective of technical feasibility but also from the safety point of view.

Methodology

The project aims to demonstrate the concept through two installations. A reduced scale installation focuses on satisfying the electrical energy demand of about 150 m^2 building surface area. A full scale installation focuses on satisfying the electrical as well as the thermal energy demand of a building surface area of about 600m^2.

The demo building hosts the installation, which includes the hydrogen generation, storage and consumption technologies, and the hydrogen distribution grid. This demo is planned in order to demonstrate that our work is dedicated to achieve a safe design of the overall hybrid energy system.

Parallel activities are being carried out to improve single technologies' performance and contribute to the improvement of the whole system efficiency. This includes the integration of components between themselves and the building environment in order to achieve a coordinated/synergistic interaction and guarantee safety.

www.h2susbuild.ntua.gr

Expected deliverables

The project advanced water electrolyser prototype is characterised by pressurised hydrogen production, higher efficiency, compactness and reduced cost. Other key deliverables are a Proton Exchange Membrane Fuel Cell (PEMFC) based micro-cogeneration prototype unit and a low-temperature Solid Oxide Fuel Cell (SOFC) stack.

Furthermore, aiming at both weight and cost reduction of conventional hydrogen storage technologies, the project is prototyping lightweight composite vessels for storing pressurised hydrogen along with a high productivity manufacturing process based on ring winding. A further fundamental achievement is the implementation of the reduced-scale hybrid energy system within the selected demo building in Lavrion Technological and Cultural Park (Greece). The prototype components are integrated with each other and with the building's utilities in order to verify their synergistic operation and evaluate the system's viability, efficiency and safety through monitoring over time.

The project also installed a safety and protection system, integrating, among others, hydrogen gas detectors. The project developed and installed an Energy Management and Control System (EMCS) to coordinate the operation of various components among themselves and with the building. Building on optimised operational strategies, the EMCS also manages collaboration of the RES with the public electricity grid, minimising use of the grid. In the forthcoming period, H2SusBuild will implement the full scale hybrid energy system.

Impact

The development of the H2SusBuild hybrid energy system will allow demonstrating to what extent hydrogen storage can be applied to balance the intermittent nature of RES technologies. Therefore, ensuring continuous operation of energy systems based on RES applied to cover the thermal as well as electrical energy needs of buildings. The project aims to demonstrate the technical feasibility of achieving installation and coordinated/synergistic operation of such a system within a real building environment.

H2SusBuild will assess the safety measures put in place in order to ensure the environment for inhabitants and provide guidelines for the use of hydrogen technologies in buildings. The project will look at the economic feasibility of applying this type of system in buildings.

The societal acceptance towards the use of hydrogen in buildings is to be examined. The use of developed simulation tools will allow understanding of which cases it will be possible to apply the proposed hybrid energy system according to local climate, building types, and site specification.

Key facts

Start date: October 2008
Duration: 48 months
Total budget: €9.9m

- Industry-driven initiative aimed at demonstrating the application of a hybrid energy system which integrates RES and uses hydrogen storage to balance their intermittent nature
- Examines the technical feasibility including safety
- Looks at business modelling and non technological barriers
- The network of project partners, particularly industrial partners, forms a complete supply chain with the potential to cover all steps needed to bring about commercialisation of the H2SusBuild system

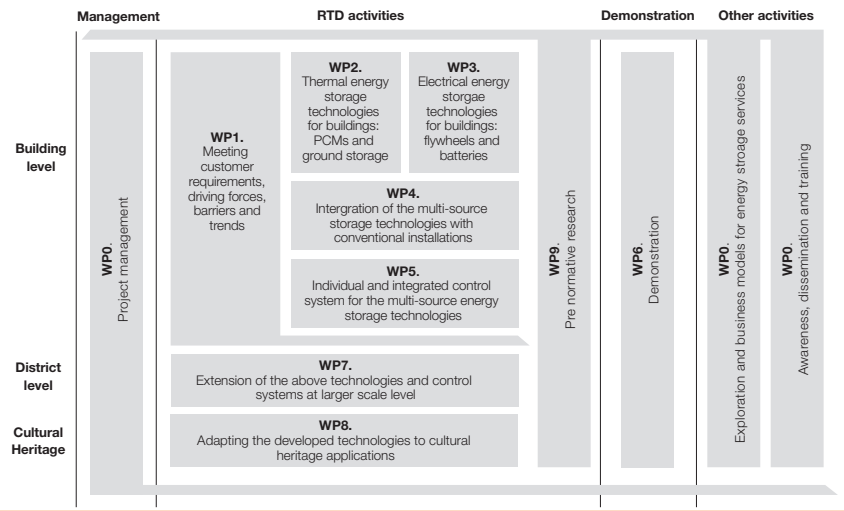
Multi-source Energy Storage System Integrated in Buildings

The objective of the project is the development, evaluation and demonstration of an affordable Multi-source Energy Storage System Integrated in Buildings, based on new materials, technologies and control systems. This will result in a significant reduction of energy consumption and active management of the building energy demand.

Introduction

MESS is composed by two thermal and two electrical storage systems, integrated with the building installations and an accompanying control system to manage the building energy demand. This new concept aims to reduce and smartly manage the electrical energy required from the grid favouring the wider use of renewable energy sources (RES) in any type of building and at district level.

The project aims to reduce raw material use for thermal performance and improve the indoor environment, and the quality and security of energy supply of the building. This approach is targeted to buildings including cultural heritage buildings and at district level. A significant reduction of the energy unit cost for end-users will be achieved.



Energy costs with/without MESS Technologies

Partners

Coordinator: Javier Grávalos Moreno, ACCIONA, Spain

Finland: UPONOR, VTT | **France:** CSTB | **Germany:** BASF, FRAUNHOFER - ISE, FRAUNHOFER - ISC, KNAUF KG, USTUTT | **Greece:** NTUA.HMCS, KNAUF GYPSOPIIA | **Italy:** CNR - ISAC, GESTA, D'Appolonia | **Netherlands:** WANSDRONK | **Poland:** MOSTOSTAL | **Slovenia:** CCS, ROBOTINA | **Spain:** Acciona, AIDICO, TECNALIA-LAB, ZIGOR, TEKNIKER

Objectives

The innovative elements that MESSIB is going to explore include the combination of thermal and electrical energy storage, and the combination of short and long term storage. New phase change materials and advance ground storage technology are studied.

The project explores composite materials (with nanomaterials) for flywheels (FW) to increase the storage capacity and adaptation of the whole system for use in buildings. Further aspects on energy storage that are being addressed are more durable vanadium redox flow batteries (VRB) improving vanadium stability and more compact system adapted for its use in buildings. In addition, integration of the storage systems and RES in the building with conventional installations and simulation tools are supporting implementation at design stage.

Advanced intelligent control systems to manage the energy demand of buildings by adapting the storage times and rates to the different customer energy demand profiles completes the objectives of the project.

Methodology

To achieve the objectives, the workplan is structured as follows:

- Review what is needed to meet the customer's needs and value chain requirements, look at the drivers, barriers and trends
- Design, manufacture and test a new thermal Energy storage System based on PCMs and ground storage
- Develop and test an electrical Energy storage system for buildings composed by Flywheels and Vanadium Redox Flow Batteries
- Look at the storage systems needed to be integrated with installations and electrical grid

MESSIB
Multi-source Energy Storage System Integrated in Buildings

www.messib.eu

- Develop a management system
- Demonstration activities
- Adapt the technologies to cultural heritage buildings applications
- Study pre-normative research
- Explore new business models
- Dissemination
- Feasibility study for the extension of the technologies to a real district level during the fourth year of the project

Expected deliverables

The different deliverables produced contribute to the quality, development and benefits achievable during the project. The analysis of the results is carried out through various steps:

Identify potential target buildings, with the right function and typology. This includes identification of potential stakeholders and technology. The concept is to define the basis for the development of the technologies in the corresponding market.

Define and develop electrical and thermal storage technologies, from design to manufacturing, in terms of capacity, application, manufacturing process, main characteristics and energy potential.

Integrate storage technologies into the building environment and HVAC facilities, through software tools for sizing the systems. Quantify the benefits achievable in terms of energy, cost saving, energy efficiency and green house gas (GHG) emissions reduction.

Demonstrate findings in 2 case studies. Exploit storage technologies and benefits from building to district level, in order to define new services, business models, new constructions and smart grid technologies, technological barriers and normative research.

Impact

The integration of energy storage systems in buildings will directly contribute to increase the energy efficiency of buildings, reducing their energy consumption and the environmental impact.

The widespread adoption of RES is mainly constrained by the variable and intermittent nature of their output. Their appropriate integration with MESS will allow greater market penetration, with associated primary energy and GHG emissions reductions. The environmental impact of electricity generation is heavily influenced by the operation of older and less efficient power plants, particularly for peak lopping purposes.

Global investments required in the energy sector for 2003 – 2030 are an estimated $16 trillion, according to the International Energy Agency. In Europe alone, some €500 billion worth of investment is needed to upgrade the electricity transmission and distribution infrastructure. This investment could be reduced with the adoption of MEESSIB in the building sector, due to a reduced need to cover peak loads and a less overloaded distribution and transmission network. Studies have found that adopting energy efficiency could half the electricity needed over next 2 decades.

Key facts

Start date: March 2009
Duration: 48 months
Total budget: €6m

- The overall objective of MESSIB project is the development, evaluation and demonstration of an affordable multi-source energy storage system (MESS) integrated into the building based on new materials, technologies and control systems
- This will result in significant reduction of the building's energy consumption and active management of the building energy demand
- One of the problems of the energy systems is the way to match the demand and the supply of the energy, the utilities must produce an amount of energy greater than the demand in order to guarantee the energy supply and to have a sufficient safety margin
- Energy storage is the way to conserve energy in one form and release it when needed in the same or another form and is used to store both thermal (heat and cold) and electrical energy by electrochemical, electrical, mechanical and thermal methods
- Energy storage has critical roles to play in securing our energy future

Resource and Cost Effective Integration of Renewables in Existing High-rise Buildings

The Cost Effective project aims to develop the concepts and components to convert the façades of existing high-rise buildings into multifunctional, energy gaining components that have a substantial effect on the energy conservation potential in the EU25 and the consequent CO_2 mitigation.

Introduction

The use of renewable energy in the building sector today is dominated by the application of solar, domestic hot water and photovltaic (PV) systems in single-family houses. In order to significantly increase the use of renewable energy in the building sector, concepts need to be devised for large buildings. In these buildings, high fractions of the energy demand can only be met by renewable energy sources, when the façade is used for energy conversion in addition to the roof. This is especially true for buildings with a small roof area compared to the floor area (high-rise buildings) and for existing buildings which generally have a higher energy demand than new buildings.

Partners

Coordinator: Fraunhofer ISE, Germany

France: EDF, Centre Scientifique et Technique du Bâtiment | **Germany:** PSE AG, BSW, Interpane, Sto AG, Kollektorfabrik, Universität Stuttgart | **Greece:** National and Kapodistrian University of Athens | **Italy:** Permasteelisa S.p.a., D'Appolonia S.p.A. | **Netherlands:** ECN, TNO, KOW Architectuur B.V. | **Poland:** ASM | **Slovenia:** Slovenian National Building and Civil Engineering Institute, Hidria | **Spain:** Acciona, Labein Tecnalia | **Sweden:** NIBE | **Switzerland:** IPB GmbH Ingenieurgesellschaft für Energie- & Gebäudetechnik, Emmer Pfenninger Partner AG

Objectives

Since 2009 the regulatory framework and the business environment for the construction sector has changed significantly in order to reduce the CO_2 emissions of existing and new buildings. It has been officially agreed within Europe that Net-Zero-Energy buildings are the goal for the future.

The Cost Effective European project can contribute to achieve this goal by developing and implementing new and highly advanced integrated cost-effective façade concepts. These are based on new multi-functional components and/or new combinations of improved existing technologies to maximise the potential of the building envelope's components.

The project helps to improve the sustainability of the supply industry in the construction sector – with its large environmental footprint – through the development of new products and improved productivity through highly integrated products. The link between the construction industry and the renewable industry will help to strengthen the role of suppliers in the façade sector.

Methodology

The Cost Effective project aims at converting façades of existing high-rise buildings into multifunctional, energy gaining components. This goal is achieved through:

- Forming integrated building concepts, suitable for a major share of the high-rise building stock, which can be characterised as the most cost-effective combinations of existing and/or newly developed components
- Development of new multi-functional façade components, which combine standard features and use of renewable energy resources

www.cost-effective-renewables.eu

- Development of new business and cost models which consider the whole lifecycle of a building and which incorporate the benefits from reduced running costs and greenhouse-gas emissions
- A decision support tool which helps the planners to find the best integrated building concept

Expected deliverables

5 new multifunctional façade components based on newly patented ideas are under development. The new components are being optimised for the high-rise building categories with the highest expected impact on CO_2 emissions and energy consumption. For example, a transparent solar thermal façade collector will simultaneously provide solar heat, protection against overheating and glare protection. This component will enable architects to create buildings with large areas where an outdoor view is possible, but with reduced cooling loads and with an energy-generating façade that can be used as a heat source for solar heating, cooling and hot water.

The new components particularly benefit from the application of nano-structured coatings and films which enhance their performance and durability due to antireflective, anti-soiling and seasonal shading functionality. The project results will be an important support for the European technology platforms: European Construction Technology Platform (ECTP), Renewable Heating and Cooling (RHC) and PV-platform, in which the project partners have a leading role.

Impact

In EU-25, office buildings account for approximately 1,000 million m^2 floor area. Of this sector, approximately 67% is high-rise and 75% is more than 10 years old. With an average annual energy consumption of 110 kWh/m^2 for heating and 60 kWh/m^2 for electricity, the potential for energy reduction is large (app. 60-70 PJ) as well as the potential for renewable heat and electricity generation by using the façades (approximately 50-60 PJ). In total this corresponds to a reduction of 9 million tons of CO_2 emissions. A small part of this saving will still have a large impact.

The new systems will increase the competitiveness of European manufacturers by adding value to their products and by reducing production and installation costs. The potential market targeted by the Cost Effective project in Europe is estimated at a façade area of more than 1,500 million m^2. This corresponds to a market volume of more than €300bn. Even capturing a small share of this market represents substantial revenue potential.

Key facts

Start date: October 2008
Duration: 48 months
Total budget: €10.7m

- High fractions of the energy demand of existing high rise buildings can only be met with renewable energy sources, when the façade is used for energy conversion in addition to the roof
- Convert façades of existing buildings into multifunctional, energy-gaining components
- Transparent solar thermal façade to provide solar heat, protection against overheating, and glare protection

Strategic Networking of RDI Programmes in Construction and Operation of Buildings

Eracobuild is a major tool to help national programme owners and managers from 22 Member States cooperate in increasing the sustainability of the built environment and the value of buildings for citizens. It contributes to the development of Research Development and Innovation (RDI) in the sector in the framework of the European Research Area.

Introduction

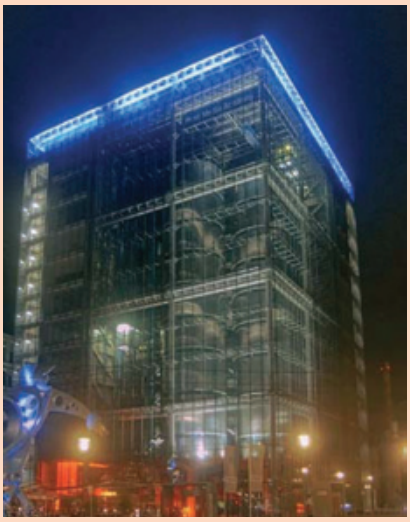
The construction sector plays an important role in every national economy in Europe. The built environment has direct impact on society regarding health, living conditions and employment.

The existing building stock is not only of great economic and cultural value for Europe but also, represents an enormous potential for saving energy and resources. European RDI in the sector is still fragmented despite new strategies being implemented through better organisation of the sector stakeholders e.g the European Construction Technology Platform (ECTP). There is a need for the national authorities in charge of RDI to improve their cooperation, through a relevant network of programme owners and managers.

Partners

Coordinator: CSTB, France, on behalf of MEDDTL, France

Austria: BMVIT, FFG, ÖGUT | **Croatia:** IGH, MZOS | **Belgium:** IWT | **Bulgaria:** ASDE | **Cyprus:** RPF | **Czech Republic:** TZUS Prague | **Denmark:** EBST | **Finland:** Tekes | **Germany:** BBR, TÜV | **Greece:** CRES, GSRT | **Hungary:** ÉMI | **Netherlands:** Ministry of VROM, NL Agency | **Norway:** RCN | **Nordic Region:** NICe | **Poland:** NCBiR | **Portugal:** FCT | **Romania:** UEFISCD | **Spain:** MICINN, CDTI | **Sweden:** Formas, IOS, SWEA | **Switzerland:** SFOE, BuH | **Turkey:** MPWS | **United Kingdom:** BIS, TSB



Objectives

Eracobuild aims to develop synergies between national programmes by sharing strategies and establishing joint programmes and projects. Eracobuild is a follow up initiative to Erabuild. Erabuild started in 2004 as a consortium of 8 countries sharing the knowledge and resources of 10 national construction research programmes.

The project has 35 partners from 22 different European countries. The aim is to build a durable cooperation between European funding bodies with the goal of increasing the impact of research on the sector. The project focuses on enhancing the quality in research and global performance of the construction industry.

Eracobuild represents national and regional funding programmes for research related to construction and operation of buildings. It provides a natural platform for the sector to find a financial match for their research needs. The project plays a key role in developing research infrastructure in the European Research Area.

Methodology

Eracobuild provides a platform for national and regional RDI programmes on construction and sustainably built environments to cooperate in joint calls and exchange knowledge. Eracobuild has defined two thematic frameworks for transnational cooperation:

- Sustainable renovation, aiming at improving the building quality and energy efficiency of the existing European building stock
- Value driven processes, aiming at improving supply chain and client integration and adding value to the processes and outcomes of the sector

Eracobuild is organised around 6 Work Packages dealing with strategy, joint programming, joint activity implementation, learning and improving, communication and dissemination and project management.

Eracobuild

www.eracobuild.eu

Eracobuild has established strong links with ECTP and more recently with the Energy Efficient Buildings Association (E2BA). The Strategic Research Agenda of ECTP was a major input to build up the strategy of Eracobuild. Its first transnational cooperation programme on sustainable renovation was also aligned with the E2BA Roadmap.

Expected deliverables

Erabuild and Eracobuild have issued 3 joint calls for tenders and 6 joint calls for proposals, resulting in more than 20 research projects jointly funded by several Members States. The main topics of the joint calls were:

- Managing information in construction
- Transformation through industrialisation
- Performance and benchmarking in real estate and construction
- Value driven processes
- Sustainable renovation

The purpose of the second call of Eracobuild was to generate joint research and innovation activities within sustainable renovation of the existing built environment. The call provided opportunities for researchers, industries and other organisations to take part in multilateral cooperation in that field.

The size of the call was €3.85m and 9 funding organisations participated. Project proposals were welcome to include partners from other countries. However, these partners had to finance their participation from other sources.

Additionally, several shadowing, clustering and parallel activities across countries were organised to allow exchanges of information between programme owners and managers about their topics of interest. There is interest to maintain the network after the end of the EC project (late 2011).

Impact

In order to achieve a sustainable built environment, the construction sector and national governments face some major challenges to transform attitudes and approaches and encourage RDI. Challenges include:

- Improve the quality and efficiency of processes
- Reduce the use of non-renewable resources increasing the recycling of waste products, and making the built environment more environmentally friendly
- Secure the access to healthy and safe buildings for people
- Make the sector more customer-oriented
- Utilise relevant communication technologies
- Involve SMEs in developing and adopting innovations
- Motivate and promoting change in a traditional industry

These major challenges influence the construction industry as well as national and EU policies. Research policies can be used as an important mean to meet these challenges. Eracobuild contributes to enhancing the impact of research activities both on societal aspects and on industrial innovation. It does so by improving cooperation between national programme owners and managers.

Key facts

Start date: November 2008
Duration: 36 months
Total budget: €2.3m

- ERABUILD and Eracobuild have issued 3 joint calls for tenders and 6 joint calls for proposals
- The project has supported more than 20 research projects jointly funded by several Members States
- Eracobuild represents national and regional funding programmes for research related to construction and operation of buildings

For more information on E2BA contact:

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