

EeB PPP Project Review

July 2012



FP7-funded projects under the 2010 and 2011 calls

PREPARED BY



Contents

	Demonstration of Energy Efficiency in Buildings		Demonstration of Very Low Energy New Buildings
4	BEEM-UP	48	BioBuild
6	E2ReBuild	49	BUILDSMART
8	School of the Future	50	DIRECTION
	Improving the Energy Efficiency of Historic Buildings in Urban Areas	51	NEED4B
10	3ENCULT	52	NEXT-buildings
	ICT for Energy-efficient Buildings and Spaces of Public Use		Energy saving technologies for buildings envelope retrofitting
12	ICT4E2B Forum	53	EASEE
14	EnRiMa	54	MEEFS
16	Sporte ²		Geo-clusters approach to support European energyefficiency goals
18	REViSITE	55	GE ² O
20	TIBUCON		ICT for Energy-efficient Buildings and Spaces of Public Use
22	SEEMPubS	56	BEAMS
24	HESMOS	57	CAMPUS21
	New Nanotechnology-based High Performance Insulation Systems	58	Cascade
26	NanoInsulate	59	IREEN
28	NANOPCM	60	KnohoIEM
30	COOL-Coverings	61	S4EeB
32	NANOFOAM	62	SEEDS
34	AEROCOINS		Materials for new energy efficient building components with reduced embodied energy
	New Technologies for Energy Efficiency at District Level	63	SUS-CON
36	FC-district		New efficient solutions for energy generation, storage and use related to space heating and domestic hot water in existing buildings
38	e-hub		EINSTEIN
	PPP Related FP7 Projects	64	HEAT4U
40	Clear-up		Operational Guidance for Life Cycle Assessment studies of the Energy Efficient Buildings Initiative
42	H ₂ SusBuild	66	EeBGuide
44	MESSIB	67	SEAM4US
46	Cost-Effective		Technologies for ensuring, monitoring and/or controlling a high quality indoor environments
		68	CETIEB
		69	INTASENSE

Foreword

I am pleased to introduce the second edition of the EeB PPP Project Review. This publication presents the progress of the projects* funded under FP7 Framework from 2010 and 2011 calls.

The vision of the Energy Efficient Buildings Association (E2BA) by 2030 is to have achieved an increase in collective research and innovation. This will allow the European building sector to mutate into a mature, innovative and energy efficient enabling industry. This includes delivering new or refurbished, user centric and affordable buildings/districts in line with national commitments towards 2050. By working according to quality standards that encompass the whole life cycle of any building, therefore guaranteeing durable building performance. This in turn will lead to an energy positive future.

The Energy-efficient Buildings (EeB) Public Private Partnership (PPP) is a joint initiative of the European Commission and the E2BA to promote research on new methods and technologies to reduce the energy footprint and CO₂ emissions related to new and retrofitted buildings across Europe. E2BA is an initiative that span out of the European Construction Technology Platform (ECTP).

The projects showcased in this Review are wide and varied, ranging from cost-effective super-insulating materials and multifunctional vacuum-insulating panels using nanotechnology to intelligent energy-management systems. The projects demonstrate scientific and technological excellence, and discuss approaches for dissemination and exploitation of results. Projects aim at introducing new products and processes into the market and some of them are already demonstrating potential for commercialisation.

The objective of the EeB PPP is not just as a financing instrument but is an effective mechanism of dialogue between industry and the European Commission services which is implemented in a true partnership, encompassing research, development and innovation activities.

We hope that this Review will help you to gain insight into current projects, and consider some of the potential challenges and solutions the EeB PPP is addressing.

Gaëtan Desruelles

President of the Energy Efficient Buildings Association (E2BA)

* The information on each project has been kindly provided by the project participants. Neither E2BA nor the European Commission, nor any third party can assume responsibility for any errors.

Building Energy Efficiency for Massive Market

BEEM-UP aims to 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.

Overview

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.

BEEM-UP takes an integral approach to overcome 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%.



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 energies.

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 75% reduction in net energy consumption in average
- Optimise advanced insulation and energy management solutions for cost-efficient application
- Create a protocol for further development to allow direct application in future projects

- Provide decision support tools to assess optimal investment across the housing stock
- Set the basis for large scale replication across Europe
- Increase stakeholder's capacity to meet the requirements of European building policies

Achievements to date

Common methodology for the retrofitting process.

An assessment methodology based on the three dimensions of ecology, economy and society has been implemented. This methodology supports holistic overall solutions for the three sites through performance indicators.

In order to visualise the performance of possible concepts, a software tool was designed that can identify pareto optimal overall solutions.

The methodology is being reviewed to publish in the International Journal of Life-cycle Assessment, currently the most prestigious international journal in this field.

Different indicator combinations produce different scenarios for each of the building sites. The selected strategies anticipate the following savings in energy use:

- 75% in Dutch pilot
- 71% in French pilot
- 76% in Swedish pilot



Retrofitting works

The retrofitting projects have already started in Sweden and Holland. Two of the eight Swedish buildings are already finished under passive house criteria.

A quality assurance system has been developed to ensure the quality of the retrofitting works in residential buildings and the retrofitting projects are being documented and evaluated by the consortium members.



For the building envelope optimisation with high performance insulation, 10 mock-up solutions have been developed and are under evaluation. Novel solutions for implementation of roof and floor solution are also under study.

Tenants' involvement strategy has been fundamental since the beginning of the retrofitting works. Several workshops have been organised in both locations to evaluate tenants' priorities and interests.

Impact

BEEM-UP will lead to the annual reduction of approximately 4GWh and 1041 Tonnes of CO₂ emissions.

It has been estimated that there are 5.8m dwellings with very similar conditions to those being retrofitted in the project.

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 MtCO₂ emissions during the next two years after the end of the project.

BEEM-UP is in line and will contribute to EU policies and standards.

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

PARTNERS

Coordinator: ACCIONA Infraestructuras, Spain

France: ICF Novedis, Nobatek

Germany: Basf Construction Chemicals, LUWOG CONSULT

Netherlands: Delft University, Dura Vermeer Groep, Eneco, Maastricht University, Stichting Woonbron

Portugal: Intelligent Sensing Anywhere

Spain: Bax & Wille, Instituto Tecnológico de Aragón, Mac Puar, Solintel

Sweden: Alingsåshem, Skanska Sverige, SP Sveriges Tekniska Forskningsinstitut

Switzerland: Eidgenössische Technische Hochschule Zürich, Siemens Schweiz

KEY FACTS

Start date: January 2011

Duration: 48 months

Total Budget: €7.7m

- 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

www.beem-up.eu

Industrialised energy-efficient retrofitting of residential buildings in cold climates

E2ReBuild investigates, promotes, and demonstrates, cost-effective and advanced energy-efficient retrofit strategies that create added value for existing residential buildings. The vision of E2ReBuild is to transform the retrofitting construction sector into an innovative, high-tech, energy-efficient industrialised sector. The project implements research and develops new retrofitting solutions regarding planning, design, technology, construction as well as operation and use of buildings. The E2ReBuild results are generated from seven projects in Finland, Sweden, the Netherlands, France, Germany and the UK.

Overview

Today, the retrofitting sector in Europe is characterised mainly by on-site production, which may be inefficient with regard to cost and construction time. Many hours are used in the construction process, where problems are often treated as unique and solved on site. Furthermore, the sector is negatively associated with poor quality as well as an unsafe and unhealthy working environment. Facing also the enormous need for reduced energy use and renovation of buildings from the post-war era, these problems are reasons why an industrial construction process for retrofitting is needed. Using well-designed, prefabricated elements, for example, can drastically reduce the construction time, and thus possibly also cost of retrofit projects, and minimise the social disturbance for tenants.

To meet the overall ambition of the project, E2ReBuild is designed to cover innovation in planning, design, technology, construction, operation and use of buildings. Seven demonstration building projects serve as prototypes for application, evaluation and monitoring of proposed technologies and

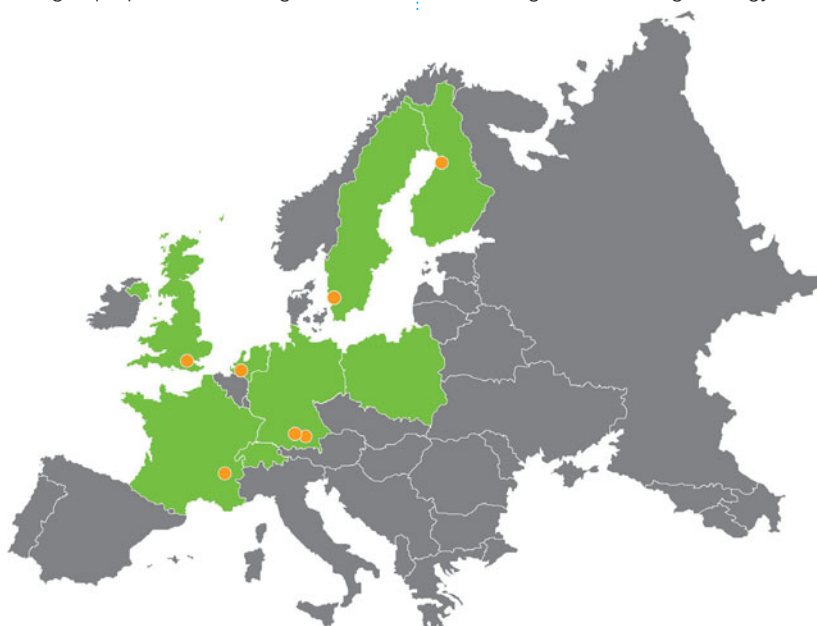
processes. The tools, methods and processes developed and refined by continuous feedback between research and demonstration will finally be integrated into an 'Industrial Platform for Energy Efficient Retrofitting' for large-scale market deployment.

Objectives

The aims of E2ReBuild are to a) investigate, promote and demonstrate cost-effective and advanced energy-efficient retrofit strategies and solutions that create added value for existing apartment buildings and endorse end-users to stay and build a dynamic society, and b) to create a holistic industrialised process that minimises technical and social disturbance for tenants and facilitates energy-efficient operation and use of the buildings including encouraging energy-efficient behaviour.

Achievements to date

Monitoring guidelines common for all E2ReBuild demonstrations have been developed. The guidelines define a common approach and unified methodology for the demonstrators and enables detailed metering and monitoring of the building's energy



E2ReBuild



performance and indoor environment including thermal comfort for tenants.

Guidelines on Preliminaries/Survey have also been developed based on the experiences of the Augsburg demonstration in Germany. These guidelines explain the surveying and planning process and give an overview of the features of a comprehensive digital survey, including the development of a fully featured 3D model for planning and production.

The seven demonstrators are at different stages of completion. The construction work in Roosendaal (NL), in Halmstad (SE) and in the Munich demonstration project (D) has finished and the monitoring periods have been initiated. The demonstration in Augsburg (D) is progressing as planned; the assembly of prefabricated façade elements is finalised and monitoring will commence shortly. The Voiron demonstration (F) is in its early construction phase and the work is progressing. The demonstrations in Thamesmead (UK) and Oulu (FI) are still in a planning and design phase. Construction work at these sites will start later this year.

One of the greatest challenges, and aims within E2ReBuild R&D, is to merge

technical innovations with behavioral aspects in the development of a retrofit design, using an understanding of the tenants' situation as a valuable resource. As part of the method development, a walkthrough evaluation was carried out in September 2011, as a case study in Halmstad. In Voiron, pre-construction tenant/owner visits have been organised as well as a walk-through-seminar held in April 2012.

Impact

E2ReBuild will enforce the notion with a common knowledge among branch actors such as builders, housing organisations, architects etc. that modern industrialised processes cannot only save money in reduced building and energy costs but also create functional, attractive and individual housing for a great number of Europeans. The industrialised process also minimises technical and social disturbance for the tenants as well as facilitates energy-efficient operation and use of the buildings, including encouraging energy-efficient behavior. Moreover, E2ReBuild will greatly contribute to improved working conditions as well as increase the attractiveness of the industry to workers.

PARTNERS

Coordinator: NCC AB, Sweden

Finland: Aalto University, NCC Rakennus Oy, PSOAS

France: Opac38

Germany: Gump & Maier, Lichtblau Architekten, GWG München, SchwörerHaus, WBG Augsburg, TUM - Technische Universität München

Netherlands: AlleeWonen, Trecodome

Poland: Mostostal

Sweden: Apartment Bostad Väst, SP Technical Research Institute of Sweden, White arkitekter

Switzerland: Empa, HSLU Hochschule Luzern Technik & Architektur

UK: Gallions Housing Association

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, studied and evaluated in seven 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

www.e2rebuild.eu

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.

Overview

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.

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 environments. 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





Achievements to date

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 School 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

By the end of June 2012 a summary report of the international knowledge concerning Energy Efficient School Buildings and High Indoor Comfort will be viewable on our website. A discussion platform on the EU portal BUILD UP (<http://www.buildup.eu/communities/schoolfuture>) and a report on the Assessment of the Indoor Environment–Occupant Questionnaire and Measurement Instructions will also be available.

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 four 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.

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

KEY FACTS

Start date: February 2011

Duration: 60 months

Total budget: €4.9m

- 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

The project 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 not only for structural protection in heritage buildings but also to improve the comfort of the building.

Overview

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 the release 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.

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 solutions will include available products as well as new developments by involved SMEs. Diagnosis and monitoring instruments will be defined, planning and evaluation

tools supporting the implementation will be developed as well as quality assurance and control of success of the energy retrofit measures.

Eight case studies allow the demonstration of the developed solutions, while giving (i) stimulus for the solution development and (ii) continuous feedback.

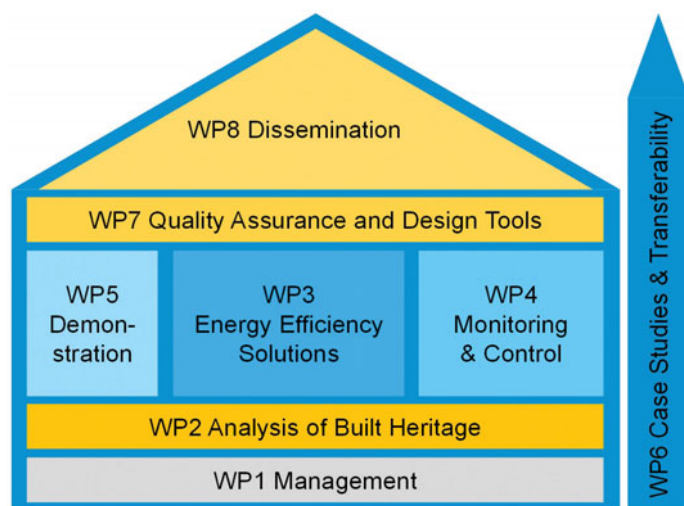
Achievements to date

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 energy efficiency solutions applicable to historic buildings and the elaboration of research questions in a multidisciplinary workshop. An analysis on the relation between historic buildings, EPBD and EPBD-related CEN standards is available on the website and proposals for the integration of historic buildings in EPBD are being discussed within the consortium and will be distributed to CEN EPBD working groups.

In parallel, diagnosis and monitoring system installations at case study buildings have mostly been concluded and support in design started. At the Waaghaus in Bolzano/Italy a prototype



High efficient window compatible with conservation restrictions



Structure of the project based on work packages

of the highly energy-efficient conservation-compatible window, which was developed in close multidisciplinary collaboration, has been installed.

Moreover, a further development of the capillary active internal insulation now under investigation in the Warehouse City in Potsdam, Germany will be installed there. Interior insulation and its failure safe integration was also an issue at the Strickbau in Appenzell/ Switzerland. For the Höttinger School/ Innsbruck a low impact ventilation system has been developed.

At the Palazzina della Viola in Bologna/ Italy the wireless sensor networks are demonstrated and at the Engineering School in Bejar/Spain the first version of the BMS system is being investigated. Comprehensive diagnosis has been documented for Palazzo d'Accursio in Bologna/Italy and the holistic design approach from the Materials Court in Copenhagen/Denmark was the starting point for the development of a Raumbuch integrating also energy related aspects.

Project results were presented at conferences and fairs, and are available on the project website.

Impact

3ENCULT allows significant energy saving in historic buildings. It leverages upon experience and solutions based on market products already available and further developing them for the use in historic buildings whilst addressing European energy policy.

The project leads to substantial CO₂ 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 CO₂ could be saved (3.6% of EU-27 emissions in 1990) by reducing these buildings energy demand (~855TWh) by Factor 4 (i.e. 75%).

3ENCULT improves living conditions within historic urban areas and fosters sustainable renovation and long-term conservation of our built heritage: 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.

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 Università di Bologna, Artemis

Netherlands: REHVA, TNO

Spain: Fundación Cartif, Grupo Unisolar

UK: Arup

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:

- Passive and active energy-retrofit solutions as well as diagnosis, monitoring and control instruments
- Criteria for the assessment of energy-efficiency measures regarding their conservation-compatibility and tools to support the multidisciplinary design approach
- eight case studies which will demonstrate and verify the approach and solutions

<http://www.3encult.eu>

ICT4E2B Forum

ICT4E2B Forum project brings together all relevant stakeholders involved in ICT systems and solutions for Energy Efficiency in Buildings. The project's community identified and reviewed the systems integration and research needs of ICT and construction. ICT4E2B Forum Technology roadmap will ease the implementation of innovative solutions and sharing of best practices across Europe.

Overview

Information and Communication Technologies (ICTs) offer great potential to achieve energy savings and CO₂ reduction targets in the building and construction sector in Europe. In some areas, like building automation and control, direct impacts of ICT on energy usage can already be seen. ICT has also significant indirect impacts in other areas. In order to exploit the potential of ICT there is a need to identify the most promising technologies. Future research efforts should be prioritised accordingly.

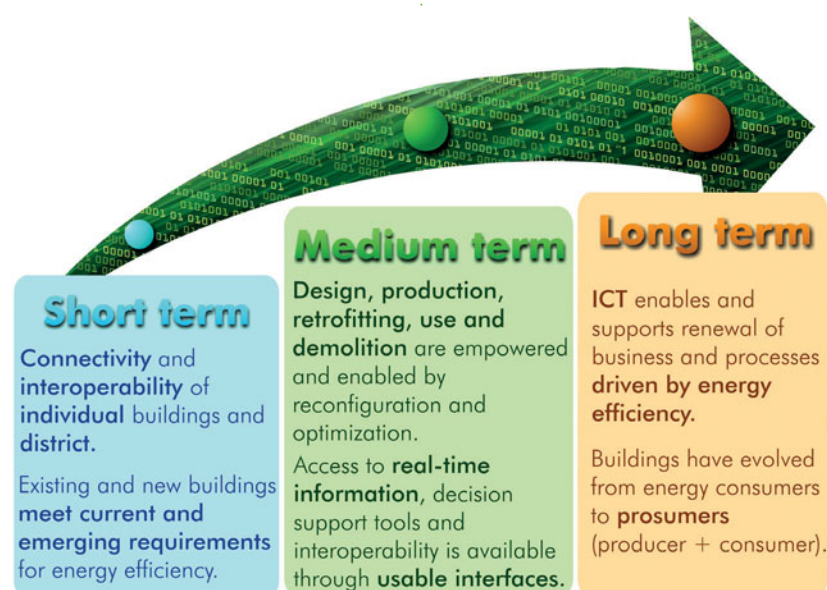
ICT4E2B Forum continued the work of the (Roadmap for ICT based solutions for Energy Efficient Buildings (REEB) project, by bringing together relevant stakeholders and reviewing the research and systems integration needs. Thus, ICT4E2B Forum project has widened the vision beyond the technical viewpoint to address also societal, economic, market, end-user and several other perspectives. ICT4E2B Forum has involved an active community through a set of workshops and a wide consultation. The result will be the development of a Roadmap focusing on five main

research areas of ICT applied to the energy efficiency of buildings.

Objectives

ICT4E2B Forum aims at updating the previously developed technology roadmaps, but 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's team has identified and classified the building sector specific priorities. Then ICT4E2B Forum has enabled communication and competences/knowledge sharing between experts in different sectors that are joining their forces in order to achieve fundamental improvements in energy-efficient buildings. All this coordination work supports the definition of future research directions as well as the combination of different efforts, while reaching consensus on the roadmap.



The ICT4E2B Vision



Achievements to date

For each of the five areas, detailed roadmaps were developed and details are available in ICT4E2B Forum website (<http://www.ict4e2b.eu/teaser/documents>). The ICT4E2B Forum vision for ICT supported energy-efficiency of buildings in the short, medium, and long-term can be summarised as follows:

- **Short term:** ICT enables the connectivity and interoperability of individual buildings and networks. ICT will be used to ensure that existing and new buildings meet the current and emerging requirements for energy efficiency defined in relation to the surrounding infrastructure and climate
- **Medium term:** Design, production, retrofitting, use and demolition are empowered and enabled by re-configuration, optimization, and access to real-time information, decision support tools and interoperability in easy to use interfaces
- **Long term:** ICT enables and supports renewal of business and processes driven by energy-efficiency. Buildings have evolved from energy consumers to "prosumers" (producer + consumer)

Impact

As a coordination action ICT4E2B Forum is creating a direct impact by building a dynamic community representing both ICT, construction and energy players as well as public stakeholders and authorities, sharing and validating future needs and able to influence 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. ICT4E2B Forum will also provide dissemination routes about RTD and best practices in this area, fostering the creation of value networks among ICT, construction and energy companies and public stakeholders for successful implementation at buildings, neighbourhood and larger city level.

PARTNERS

Coordinator: D'Appolonia, Italy
Finland: VTT
Italy: D'Appolonia
Germany: SAP
Poland: Mostostal Warszawa
Spain: Atos Research
Sweden: Schneider Electric

KEY FACTS

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

- ICT4E2B Forum project has created a dynamic community representing ICT, construction and energy players
- The project has allowed public stakeholders and authorities to validate future needs and identify future development routes for research and innovation on energy efficiency in the built environment
- Main result of ICT4E2B Forum project will be a validated technology roadmap on ICT for energy-efficient building

www.ict4e2b.eu



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 CO₂ emissions 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.

Overview

EnRiMa will 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 CO₂ 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 CO₂ 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 status quo. Finally, the DSS will inform policymakers about the response of building operators to proposed regulation as it may be run under various settings.

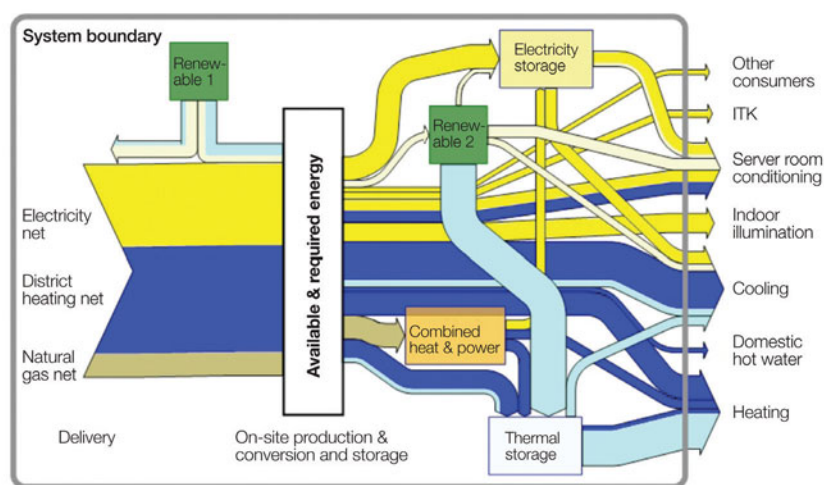
Objectives

EnRiMa will 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

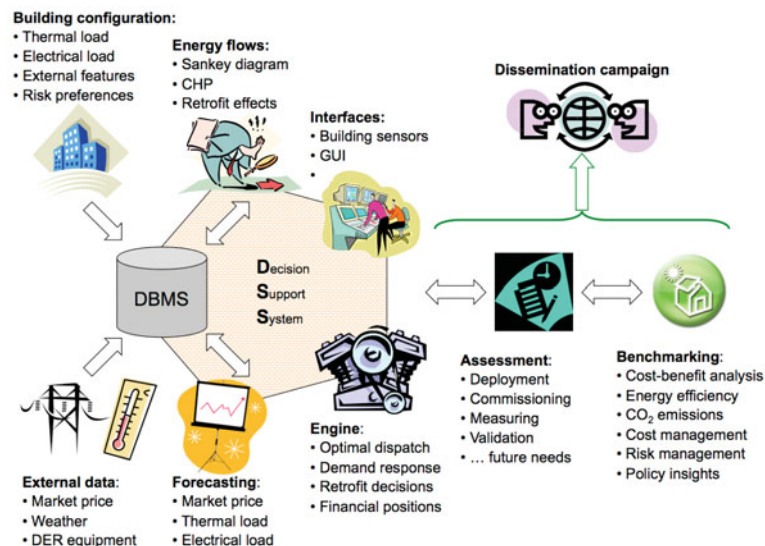
building energy efficiency in the most cost-effective manner based on their tolerance for comfort and risk. The DSS will be seamlessly integrated with existing IT for controlling each site's energy sub-systems, thereby facilitating the operators' real time on-site generation dispatch, off-site energy 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 subsystems, in order to meet forthcoming EU targets for reducing CO₂ emissions.

Achievements to date

The EnRiMa project has proceeded as planned in order to complete the requirement assessment, energy-flow models, scenario generation, and symbolic model specification. Consequently, the partners have gained a solid understanding of the user requirements at the test sites and have formulated two types of decision making problems, operational and strategic. In the former, the building's envelope and installed technologies are fixed, while building physics and system thermodynamics are modelled in more detail than in existing state of the art research. This enables operational



Sankey diagram



EnRiMa concept

decisions to be made that focus on user comfort directly rather than on consumption. Preliminary results for test sites in Austria and Spain indicate that energy consumption may be reduced by 10% as a result of operational optimisation. By contrast, the strategic problem takes a long-term view by determining how on-site equipment should be installed and building retrofits implemented. Since such decisions may have to be made under various types of uncertainties, EnRiMa partners also developed a scenario generation tool that will enable a stochastic optimisation and explore hedging decisions, e.g., via forward markets. Thus, the symbolic model specification of the DSS is ready for validation in the next phase of the project, which will also see the development of a user interface and integration of the DSS with the sites' existing ICT infrastructures.

Impact

Impact of EnRiMa will be namely in three fronts:

- Reduction of energy consumption and CO₂ emissions, 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 graphical user interface. 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

- Open a market for ICT-based customised solutions integrating numerous products from different vendors. Services range 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
- Establish a collaboration framework between the ICT industry and buildings and construction sectors. This collaboration is aimed at exploiting 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

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: Hidrocarburo Energía, Universidad Rey Juan Carlos

Sweden: Stockholm University

UK: University College London

KEY FACTS

Start date: October 2010

Duration: 42 months

Total budget: €3.5m

- Develop an interdisciplinary decision support for operators to help them to meet their needs in a more efficient, less costly, and less CO₂ – 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 CO₂ emissions reduction
- Improve energy efficiency and subsystem integration in line with EU targets

<http://www.enrima-project.eu>

Energy-efficiency for european sport facilities

This project is challenging the world of sport facilities to improve their energy efficiency. Through the development of smart metering, integrated control systems, intelligent optimisation strategies and multi-facility benchmarking dedicated to sport facilities, this project aims to deliver 30% energy savings and CO₂ emission reductions with an return on investment of five years.

Overview

The European Sport and Recreation Building Stock accounts for about 1.5m buildings in Europe. They represent a significant portion of the overall building stock and consume a disproportionate amount of energy (6-8%). Sports facilities are unique due to:

- 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, and the like)
- how they are owned and managed
- they can encompass large open spaces (multiple buildings, complexes, parking areas, lighting, etc.)

With this background, the aim of Sporte² 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. Considering this particular type of facilities (large court areas, swimming pools), the maintaining of comfort conditions will be one of the main objectives together with the energy consumption.

Objectives

Sporte² will develop four scalable and integrated modules based on ICT solutions. They are:

- How: Smart Metering – understanding energy flows
- When: Integrated Control – the ability to actuate sourcing 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 four modules builds on people's familiarity with 'who, what, when, where, why, and how' to facilitate development, marketing and exploitation. Each module will represent a standalone 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.

Achievements to date

Sporte² is client and pilot focused. The first step of the project involved completing energy audits and a study of the energy consumption patterns at each of the three project pilots: Fidia Sport (Italy), Sport Complex





PARTNERS

Coordinator :D'Appolonia, Italy

Greece: Schneider Electric

Italy: FIDIA Sport, STARING, University Politecnicadelle Marche

Portugal: Intelligent Sensing Anywhere (ISA), SELF Energy

Spain: EMTESPORT, TECNALIA

KEY FACTS

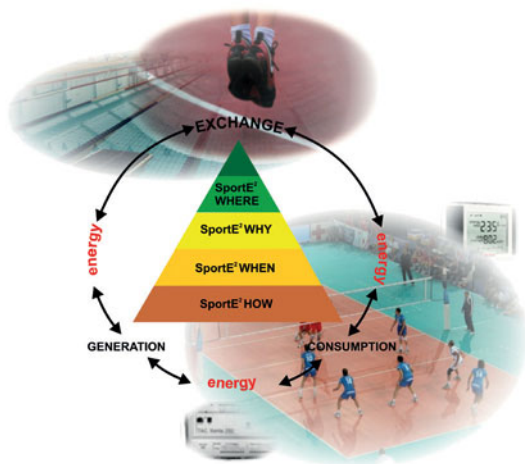
Starting date: September 2010

Duration: 36 months

Total budget: €4.7m

- SportE² will develop, integrate, test (KUBIK), and validate in three Pilot Locations four scalable modules formed on a 30% reduction in energy consumption and CO₂ 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

www.sporte2.eu



Santa Maria De Lamas (Portugal), and the Extbarri Municipal Sport Centre (Spain). These facilities vary in size, number of buildings, and client base. Energy bills vary from approximately €50k per year to €250k per year with an Olympic swimming pool dominating the energy consumption at the largest energy consuming facility. Development of the four modules is currently underway and smart metering has been installed in the first of the pilot facilities. Module prototypes and optimisation scenarios will be tested at Tecnalia's KUBIK facility over the upcoming months. The first project reports can be found on the Sporte² website (www.sporte2.eu).

Impact

Sporte² will deliver the four Sporte² modules, a methodology to employ them, and a replication plan to achieve impact. The three pilot activities will provide case studies and smaller success stories are being published on the webpage continuously as they occur. With respect to the project timeline, module development and operational optimisation scenarios are being built in year one, pre-control monitoring, system installation, and the beginning of pilot activities with control actions occur during year two, and pilot activities conclude and the exploitation base is prepared in year three. 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 programme? What indicators should I be using to assess my facility and energy savings program?

Sporte² will introduce sport facilities to the concept of energy efficiency. Due to their high energy consumption and the fact that they are linked by leagues, associations, and teams, sport facilities are an excellent sector for energy savings. Through the activities and the people that pass through our sport facilities, there is an opportunity to educate and inspire energy-efficient behaviour changes. Because such facilities host numerous youth activities, there is the means to positively impact future generations.

As a way of reaching beyond consortium activities, Sporte² has started the 'Friend of Sporte²' campaign inviting other facilities to share their experiences and follow project results. To date, Euroleague Basketball, B-Zone Fitness, and QuantaVillage have taken the challenge. Project dissemination activities are also boosted by consortium member, Olympic medallist, and basketball 'hall of famer' Pier Luigi Marzorati of STARING Engineering, an architectural studio focused on green design strategies.

Roadmap enabling vision and strategy in ict-enabled energy-efficiency

Energy-efficiency is paramount in ensuring the energy-security and sustainability of Europe, and Information and Communication Technology (ICT) has a fundamental role to play in delivering that energy efficiency. However, while the enabling role of ICT is clear, understanding which technologies are best positioned to deliver meaningful impact is less clear, as is understanding where future research and associated funding should be directed.

REViSITE is a coordinated action, part-funded by the European Commission (EC). The project focus is to promote cross-sectoral synergies to understand the best technologies to positively impact on sustainability goals and to identify cross-sectoral research priorities covering the domains of Grids, Manufacturing, Buildings, and Lighting.

Overview

Often industry bodies act as the custodians of the Research and Technology Development (RTD) strategy for their respective sectors. The Grid, Buildings, Manufacturing, and Lighting sectors are no different, with a number of European Technologies Platforms (ETPs), such as SMARTGRIDS, ECTP, ARTEMIS, MANUFUTURE, and PHOTONICS21, representing their respective RTD interests. Aside from ETPs, many other initiatives lobbying to shape future research also exist. So, given the existence of such sectoral initiatives, there was a justifiable need for a cross-sectoral effort in identifying complementary areas for ICT for Energy Efficiency (ICT4EE) research trajectories.

Objectives

The aims/objectives of REViSITE are listed below in order to capitalise on its potential benefits in the domain of ICT4EE:

- Multidisciplinary community to promote cross-sectoral ICT4EE i.e. the project looked to leverage the heuristic and domain expertise of different stakeholders
- Common means of assessing the impact of ICTs on energy efficiency i.e. a generic means of identifying and assessing across the four target sectors
- Cross-sectoral ICT4EE Roadmap including – the Vision, the Strategic Research Agenda (SRA) and its associated Implementation Action Plan (IAP) i.e. where should ICT4EE research focus and who should do what in supporting that research effort
- Set of recommendations for standards to address interoperability barriers to ICT4EE



**Multi-disciplinary Strategic Research Agenda
for ICT-enabled Energy Efficiency**

2012



Achievements to date

The main results of REViSITE are listed below:

- The REViSITE cross sectoral community: It is composed of more than 100 experts coming for the concerned sectors. This community has been interacting with the consortium all along the project duration. It has been moved to the European Commission Energy Efficiency Collaboration Space
- The SMARTT Taxonomy: Before making comparisons across domains, it was essential to speak a common technical language. A common taxonomy and so-called SMARTT taxonomy was developed, which comprised six high-level categories and 23 sub-categories, which together were deemed to cover the scope of the ICT4EE domain
- Strategic Research Agenda (SRA): The SMARTT taxonomy was used as an integrative classification system and as a framing structure for the Multidisciplinary SRA, which aimed to identify how to move from the current 'state-of-the-art' towards the 2020 vision. The Multi disciplinary SRA, essentially consisted of six 'roadmap' tables aligned to the SMARTT categories and sub-categories. Each table briefly described:
 - The ICT that is currently seen as state-of-the-art in each sub-category
 - Short (~3 years to industrial usage-adaptation / take-up / ...) / Medium (~6 years – development of new applications) / Long (~9years – radical technical development) -terms priorities
 - Vision (desirable future situation based on currently foreseen developments)
- Implementation Action Plan (IAP): The REViSITE IAP focused on identifying potential call themes/text and on stakeholder-specific actions. Having established a menu of 23 potential ICT4EE research trajectories, attention turned to formulating the work into a format that clearly

identified the 'target outcomes', 'expected impacts', and potential 'actionable items'. The interim output of the REViSITE IAP was 23 succinct tables that detailed:

- The scope of each RTD topic
- The target outcomes pertaining to any future research funding call
- Expected impacts of achieving the identified target outcomes
- Specific recommendations for various stakeholders
- Proposed Recommendations for Standards: The REViSITE consortium issued also a dedicated deliverable focusing on recommendations for new standards to overcome interoperability barriers, centred on specific actions of relevance to Standards Organisations. The five recommendations issued are listed below:
 1. Extension of Existing Ontologies for Energy Efficiency
 2. Energy Performance Indicators (Metrics)
 3. Product Catalogues that Include Energy Dynamics
 4. Data Exchange Protocols
 5. Harmonisation and Extension of the IEC Ontology

Impact

The main impact has been to identify, consolidate and promote the common RTD priorities for ICT4EE in several industry sectors.

PARTNERS

Coordinator: Loughborough University, UK

Finland: VTT Technical Research Centre

France: Centre Scientifique & Technique du Bâtiment, France

Germany: The Fraunhofer Institute for Production Systems and Design Technology IPK

Ireland: Intel Labs Europe

Italy: Innova SpA

Netherlands: KEMA consulting

KEY FACTS

Start date: February 2010

Duration: 27 months

Total Budget: €1.2m

- Issued a cross-sectoral Roadmap under the common umbrella of ICT for Energy Efficiency
- Adopted a life-cycle approach to develop a methodology and a common taxonomy to align the sectoral RTD topics under a common structure
- Developed and interacted with a cross sectoral community of experts coming from the four considered sectors to elaborate and validate its Roadmap

www.revisite.eu

Self-powered wireless sensor network for HVAC system energy improvement

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.

Overview

The project is divided in four 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 two 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.

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 two 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.





Achievements to date

An energy-efficient and flexible MAC protocol has been designed. The MAC protocol takes into account the special constraints of the TIBUCON scenario and shares the load of the network.

This way each device's participation in the communication depends on its own available/remaining energy and capabilities.

The first version of the sensor nodes has been fully produced and tested. Thanks to these tests, different issues related to the energy consumption and efficiency of the harvested module has been identified. New design choices have been made for the second version in order to improve the overall efficiency of the sensor nodes. Additionally, the final version of the gateways' HW is already tested and ready for deployment.

Test deployments have been made, both in lab and real scenarios. The data gathered helped in the validation of the system and provided the team with preliminary and valuable data to build the thermal simulations.

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 CO₂ 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.

PARTNERS

Coordinator: Mostostal Warszawa, Poland.

Belgium: Katholieke Hogeschool Kempen

Poland: E&L Architects

Spain: Tekniker-IK4, Giroa, part of Dalkia Group.

UK: University of Southampton

KEY FACTS

Start date: September 2010

Duration: 36 months

Total budget: €2.4m

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

www.tibucon.eu

Smart energy-efficient middleware for public spaces

With this project we want to address the reduction of energy usage and CO₂ footprint in existing public buildings and spaces without significant construction works. This is done through intelligent ICT-based service monitoring and energy consumption management. During the project we are giving special attention to historical buildings in order to avoid damage by extensive retrofitting.

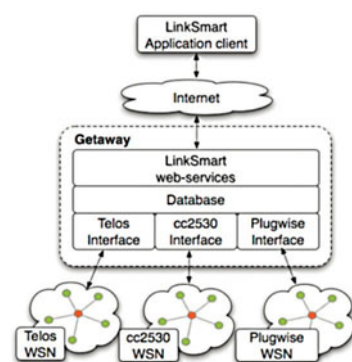
Overview

SEEMPubS provides the control of appliances in order to optimise energy usage without compromising comfort or convenience and offers decision makers strategies and tools needed to plan energy-saving measures. SEEMPubS makes use of service-oriented middleware (Linksmart, previously Hydra) for embedded systems and creates services and applications across heterogeneous devices to develop an energy-aware platform. The SEEMPubS platform provides the functionality and tools to add energy efficiency features to monitor dynamic sensor data in real time, taking advantage of natural resources and controlling the operation of both passive and active environmental systems. The objective is to ensure the best possible comfort conditions with the most efficient use of energy.

Objectives

SEEMPubS aims include:

- Developing 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
- Implementing 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



Software infrastructure scheme to handle heterogeneous wireless sensor networks

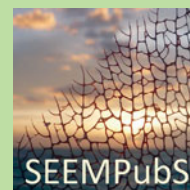
buildings and open public spaces

- Raising people's awareness for energy efficiency in public spaces
- Providing multi-dimensional visualisation starting from a BIM of parameters of building operations and data sharing from technical systems.
- Validating the developed monitoring system through an iterative methodology
- Translating the most significant research results achieved within the project into a model for existing buildings and public spaces in Europe
- Disseminating and exploiting 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

Achievements to date

Working in an interdisciplinary way the project has:

- designed a new building management system and implemented the Linksmart middleware to allow the integration of products from different vendors based on different communication protocols and to offer services from design of integrated systems to the optimisation of operation and maintenance phases
- tested dynamic simulations for each case study to estimate the annual energy demand for lighting and HVAC systems and the potential energy savings due to more efficient control strategies
- realised a building information model of each building in order to test and optimise interoperability between architectural and energetic software
- personalised data visualization for different end users by a dedicated web portal, and uses Augmented Reality associated with QR code as interactive communication solution to develop an efficient and user-friendly Facility Management process-based on BIM, leveraging on human awareness and competence.



Impact

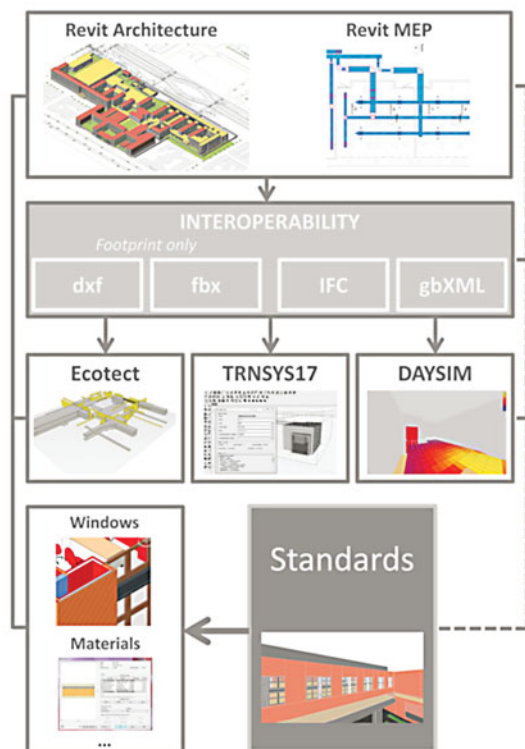
The SEEMPubS project aims at achieving a more sustainable and efficient way of consuming energy. In particular, it addresses the implementation of an ICT system for energy measurement and accounting to manage energy intensity downwards and productivity upwards. The project focuses on existing and historical public buildings and spaces without significant civil works.

In this context, the expected impacts of the project are the following:

- Contribute to open 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
- Establish 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

- Radically reduce energy consumption and CO₂ emissions, in line with policy to facilitate the transition to an energy-efficient, low-carbon economy through ICT



Due to the complexity and the heterogeneity of the architectural technologies and solutions, only collaborative research based on BIM and interoperability can help the use of the data

PARTNERS

Coordinator: Politecnico di Torino, Italy

Belgium: Katholieke Universiteit Leuven

France: Sinovia SA, Université Claude Bernard Lyon 1

Germany: Fraunhofer-FIT

Italy: Centro Ricerche Fiat, Istituto Superiore Mario Boella, STMicroelectronics

Sweden: CNet Svenska AB

KEY FACTS

Start date: September 2010

Duration: 36 months

Total budget: €2.9m

- SEEMPubS aims at putting decision makers and building administrators into control to effortlessly optimise energy efficiency in existing buildings by ICT technologies

<http://seempubs.polito.it/>

ICT Platform for holistic energy efficiency simulation and Life-cycle Management of public use facilities

The project aims to achieve an industry driven holistic approach for sustainable optimisation of energy performance and CO₂ emissions reduction. The approach includes integrated design, facility management and simulation, while balancing investment, maintenance and reinvestment costs. Existing fragmented building and environmental data will be linked into an integrated framework so that complex energy simulations and performance monitoring can be done in all life-cycle phases where potential for energy savings exists.

Overview

HESMOS anticipates that public use facilities will have a leading role in energy efficiency and sustainability. Such facilities are typically developed as Public-Private-Partnership (PPP) projects. This has the advantage that design, construction and operation is managed by one responsible company as a holistic life-cycle, and that decision making is no longer driven by individual phases. It leads to a strong industry demand for integrated ICT tools that would allow energy and cost simulation studies for decision making already at the early design phase, and further on throughout the facility life-cycle on a sound, continuously enriched information model.

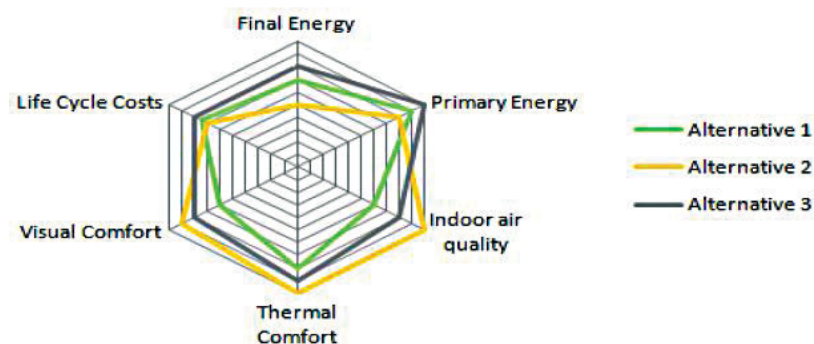
HESMOS sets out to meet this industry demand by developing an innovative service-based Integrated Virtual Energy Laboratory (IVEL). It will bring together various energy-related ICT services and tools on the basis of a common multi-model information framework extending the operability of the current BIM standard, IFC. HESMOS develops a new life-cycle process model, details the information exchanges and the needed modelling extensions and interoperability functions. The project also provides a flexible and extensible service-oriented architecture integrating a set of model management services, CAD, FM, energy simulation,

monitoring, pre- and post-processing tools, and an nD Navigator enabling web-based access to the platform for a broad range of decision makers. The overall platform is being validated on two real building sites by the end-user partners.

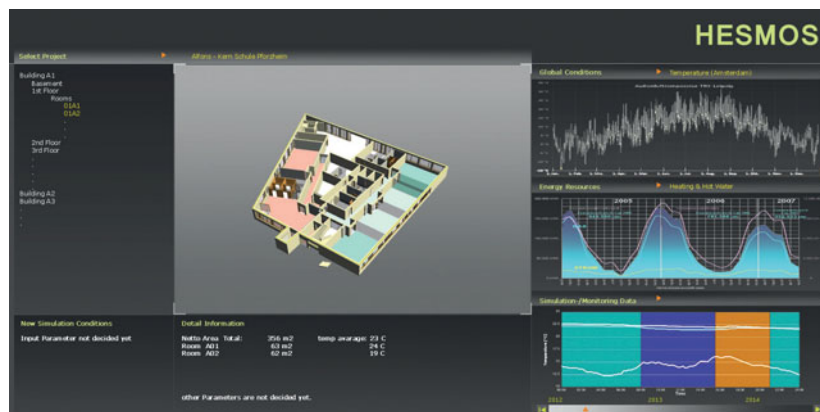
Objectives

The goal of HESMOS is to provide for efficient and reliable energy simulation and decision making in all design, refurbishment and retrofitting phases where large energy saving potential exists. This is achieved by:

- Extending existing BIM-CAD, FM, energy simulation and cost calculation tools to enable seamless exchange of all required data in the overall life-cycle process
- Developing new BIM-based applications for visualising building performance and displaying impacts of changed building/space parameters
- Developing new BIM-based web services to enable fast study of design and retrofitting alternatives concerning energy performance and total costs



Example of energy related Key Performance Indicators



nD Navigator image

Achievements to date

During the first year the work has been focused on the specification of an energy optimised life-cycle process, the conceptual development of the HESMOS modelling framework and the distributed HESMOS architecture. In the current second year the emphasis is on the planned implementation and enhancement of the IVEL services and tools. Among these is a BIM management toolbox with more than 60 functions for model filtering, transformation and management.

A good example from the developed toolbox is the conversion to second level space boundaries done within IFC. Other examples include BIM enhanced energy simulation tools re-engineered as web services, extended BIM-CAD and BIM-FM systems and a new web-based nD Navigator enabling various BIM-based views on the energy performance of a facility. The fast examination of alternatives for quick and informed decision making on the basis of the elaborated energy key performance indicators (eKPIs) has also been studied.

Impact

To date, buildings are responsible for 40% of the EU's energy consumption and 36% of its CO₂ emissions. Hence, energy-efficiency of buildings is a key to achieving the EU Climate and Energy objectives, and provides the opportunity to create new jobs. HESMOS will contribute to the realisation of these EU-wide objectives.

The main impact is on facilities of public use. A holistic simulation-based view from design to operation will be developed enabling cost-effective, fast and efficient decision making and optimised life-cycle. In addition, a more efficient energy mix will be made possible improving energy performance, reducing emissions and costs, enabling sustainable planning.

PARTNERS

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

Finland: Insinööri Oy
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, represented by BAM Utiliteitsbouw BV and BAM Deutschland AG

Slovakia: Nemetschek Slovensko S.R.O.

UK: AEC3 Ltd.

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 and CO₂ savings, investment and operational costs
- Integrate all required information resources into a common multi-model framework by extending current BIM to a coherent energy-efficient BIM environment
- Close the gap between Building Information Modelling (BIM) and Building Automation Systems (BAS) so that energy and cost related decisions can be made efficiently in all life-cycle phases
- Connect through IVEL CAD, FM and specialised energy tools and enhance industry actors' energy efficiency competences

www.hesmos.eu

Development of nanotechnology-based insulation systems

NanoInsulate develops 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.

Overview

The application of nanotechnology-based thermal insulation systems materials in the EU Construction and Modern Buildings sector is increasingly becoming popular within the European Union. This has been largely driven by environmental concerns and an increase in service requirements; it has been reported that significant heat losses through inadequate building insulation/poor-performing insulation systems is responsible for 40% of total EU energy consumption.

This is a significant contributor to greenhouse gas emissions, approximately 36% of the EU's total CO₂ emissions. Therefore reducing this level of energy consumption i.e. by improving the performance of thermal insulation systems, during the whole life-cycle of the buildings is an effective action against climate change. Other environmental drivers deemed as important within the sector include the need to increase recyclability levels and a determined move towards more sustainable products and processes.

Systems based on nanostructured materials do potentially offer far superior thermal and mechanical properties than modern insulation systems. Among these nanostructured materials, inorganic silica aerogels and organic nanoporous materials are characterised with very low thermal conductivities, i.e. 0.005-0.015 W/m.K. The barriers to rapid wide scale commercialisation of these materials however is integrating these materials with added functionality into products suitable for use in buildings using low-cost/high-volume sustainable processes.

Technological concepts developed by one of the consortium partners had shown that these nanostructured materials can be enveloped in high barrier films to produce VIP systems. Preliminary experimental studies had shown that these thin and lightweight nano-based vacuum insulation systems can be four times more energy-efficient than commercial counterparts. The project aims to develop the necessary materials (aerogels, nanofoams), encapsulation/mixing technologies, barrier films, models, life-cycle analysis, demonstration and pilot process technologies to develop robust and efficient VIPs.

Objectives

The expected objectives of the project 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.



Achievements to date

- Synthesised novel nanostructured translucent composites of silica aerogels with the polymer PDMS(OH) by a new deposition technique. This is a new material which warrants a patent application
- Developed new open porous monolithic materials. The lowest thermal conductivity of the VIPs reached by using this material is 5.3 mW/m.K.
- Produced high-barrier films with gas and water vapor transmission rates in the range of 10-3 cm³/(m².d.bar) and g/m².d (at 23 °C, 85% RH) . The lower permeation rates will result in increased service life making VIPs suitable for use in construction sector
- Finalise the design and specification of VIP production line for the demonstration of a continuous cost-effective VIP manufacturing route
- Selected demonstration sites in Algete, Spain and Warszawa, Poland, in order to demonstrate the significant commercial and market applicability of the insulation materials developed

Impact

- Nanolnsulate develops highly energy-efficient VIPs using novel low-cost high-volume sustainable processes, thereby addressing the zero-carbon targets for the construction sector
- Innovative manufacturing processes developed 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 increases the use of highly functional nano-materials within the sector
- New durable lightweight panel systems exhibit thermal and mechanical properties far exceeding those presently on the market, 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 Nanolnsulate. This is thanks to the increased transnational R&D collaboration and the exploitation of the concept solutions after project completion



PARTNERS

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

KEY FACTS

Start date: July 2010

Duration: 48 months

Total budget: €6m

- Nanolnsulate is a €6m European project developing innovative durable, robust, cost-effective VIPs. VIPs incorporate new nanotechnology-based core materials and high-barrier films, resulting in panels that are up to four times more energy-efficient than current solutions
- These new systems provide product lifetimes in excess of 50 years suitable for a variety of new-build and retrofit applications. Resistance to physical and climatic damage is a key characteristic
- Six industrial partners and four research organisations from seven countries come together to engineer novel solutions suitable for scaling up and to reduce manufacturing costs below 50% of current costs

<http://www.nanolnsulate.eu>

New advanced insulation phase change materials

Buildings are responsible for more than 20% of CO₂ emissions. Thermal insulation is one of the key solutions in reducing energy consumption. The NANOPCM project provides an innovative and highly technical solution to increase the thermal inertia of the envelope in a cost-effective way without increasing the mass or the space.

Overview

The increase in the level of greenhouse emissions and the climb in fuel prices support 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 are needed due to the time dependency of solar radiation.

As energy accessibility and demand often do not match, thermal energy storage plays a crucial role to take advantage of solar radiation in buildings. Latent heat thermal energy storage via phase change materials (PCMs) is particularly attractive due to its ability to provide high-energy storage density. Unfortunately, prior to the large scale application of this technology, it is necessary to resolve several drawbacks at the research and development stage and also to reduce cost for massive applications.

The project will focus on development and manufacturing of nanotechnology based PCMs and its integration into smart insulation materials with enhanced thermal and mechanical properties. Overall production costs will be reduced making wide scale commercial applications feasible by pilot plant production implementation at real scale.

Objectives

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

- Design and develop (synthesise) new low-cost form stable thermal storage component based on the anchorage at nanoscale of organic PCMs between the polymeric chains of selected polymer with improved conductivity incorporating nanoparticles

- Design and develop new thermal insulation inorganic nanofoam with thermal storage capacity
- Improve organic phase change microcapsules with the incorporation of high thermal conductive nano-materials which will provide better thermal transfer to the PCM inside the capsule
- Test and validate the developed materials by incorporating the NANOPCM materials in a real scale insulation prototype to measure insulation improvements
- Complete the environmental monitoring, recycling, cost analysis and safety/risks analysis of the introduction of the new PCM composite materials in innovative insulation systems
- Demonstrate the viability of production of the developed materials at pilot plant scale

Achievements to date

The research activities carried out to date have resulted in a number of key results:

- Development of form-stable PCM using polyethylene glycol of different molecular weights and thermoset resins
- Obtaining stable dispersion of nanoparticles (CuO, Al₂O₃, CNF) in melting PCM with and without reactive groups: PEG and paraffines
- Microencapsulation of fatty acids by spray drying techniques and thermoplastic shells
- Incorporation of carbon nanofibres in the synthesis of microcapsules of PCM by spray drying
- Incorporation of PCM microcapsules in the production of polyurethane foams: study of chemical compatibility and dispersion

The second stage of the project is the production of the materials developed in pilot plant scale. Results related to this phase include:

- Study of the feasibility of the process: mass, energy and economic balance.
- Pre-design of the pilot plant



PARTNERS

Coordinator: Acciona, Spain

Germany: Active Space Technologies

Italy: DIAD Group

Poland: Purinova

Spain: Tekniker, University of Castilla la Mancha

UK: PCM Products Ltd.

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



Pilot Plant for microcapsules PCM production

- Design of the main and auxiliary equipment
- Construction of the pilot plant

Impact

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 consumption could be reduced. That means 189 Mtoe every year. If the improvements proposed in NANOPCM project are applied, the total savings could rise to 297 Mtoe/year. The use of smart thermal insulation with storage capacity in building walls and window

joints carried out by NANOPCM consortium contributes to reduce the energy consumption and the annual energy cost for end-users.

A cluster of the projects involved in the same EeB call has been created, Common activities are being carried out such as two Demo Parks in Spain and Poland with the prototypes of the materials/technologies developed in all the projects. This will support the sharing of technologies and comparison of behaviours and will help to improve the interaction between projects and results.



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-effective range of nanotechnology improved coatings, which aims to reduce heat transfer to indoor spaces by developing high Near Infrared Reflecting (NIR) nanomaterials for envelope application.

Overview

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.

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

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.

Achievements to date

COOL-Coverings is structured in seven workpackages. WP1 covered 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 nano-structured oxides are currently being carried out.

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.

Life-cycle 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.

Demonstration is going to be worked out in a clustered approach within NANO-E2B CLUSTER, where several NMP-EeB projects collaborate in demonstration, standardisation and dissemination activities. Several mock up-down-scaled demonstration buildings will be implemented in two locations in order to compare the contribution to energy efficiency of each material developed as well as its synergic action.

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 (32m 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



Cluster Algete demo park

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 New N

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

<http://www.coolcoverings.org/>

NANOFOAM

New nanotechnology 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.

Overview

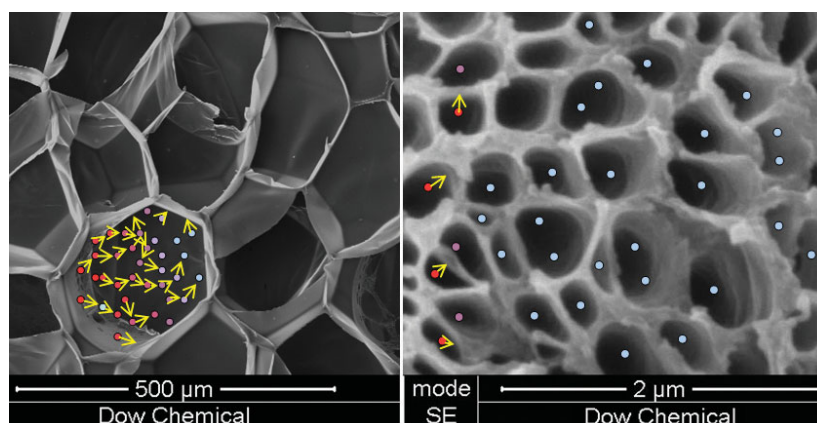
The heating and cooling of buildings accounts for approximately 40% percent of the overall energy consumption in Europe. Current commercialised insulating materials for building and construction have long-term thermal conductivity values between 23 and 45 mW/mK. Achieving future requirements for lower 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.

Objectives

The projects objectives are:

- Develop an innovative high-performing Nanostructured polymeric foam, employing a low Global Warming Potential (GWP) blowing agent such as CO₂
- 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



SEM images of nanofoams



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 of 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.

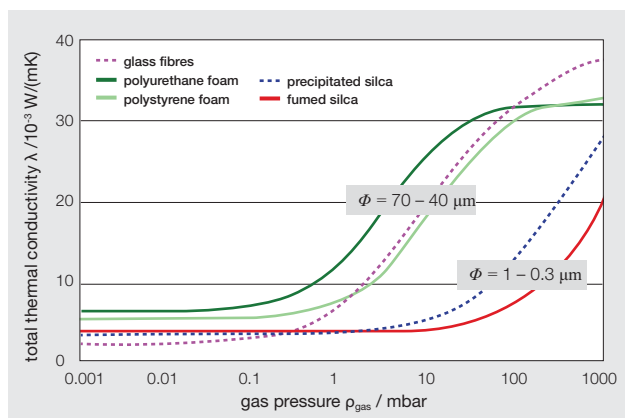
The consortium partners will examine with more detail the fundamental and advanced approaches that can be used for producing Nanofoams. A wide number of polymer systems, nano-additives and environmentally friendly and sustainable foaming agents will be screened together with investigation of the feasibility of some production processes or strategies for creating nucleated nanostructured 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 CO₂ 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.



Thermal conductivity vs gas pressure for different materials

PARTNERS

Coordinator: DOW Europe GmbH, Switzerland

Germany: ZAE Bayern, CABA

France: CSTB

KEY FACTS

Start date: January 2012

Duration: 36 months

Total budget: €3.3m

- The consortium aims to develop in the next three years an innovative high-performing nanostructured thermoplastic foam, employing a low GWP blowing agent such as CO₂
- 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/hybrid nanomaterials for cost-effective building super insulation systems

The AEROCOINS project aims to create a new class of strong, super-insulating aerogel composite hybrid materials. This involves overcoming the two major obstacles which have endured for so long and have prevented a more wide-spread use of silica-based aerogels insulation components in the building industry:

- Strengthening of silica aerogels by coupling with cellulosic polymers and/or incorporation of cellulose-based nanomaterials.
- Lowering the production cost of these composite hybrid aerogel materials via ambient pressure drying and 'continuous' production technology.

Acting on these two material and process incentives, new super-insulating aerogel-like materials with improved thermo-mechanical properties will be synthesised at the laboratory scale. Later on the materials will be developed at the pilot scale. Finally, an elaboration concept for cost-effective mass production will be laid out for further pre-industrial development.

Overview

Buildings in Europe account for approximately 40% of the total global energy demand and hence come with a CO₂ footprint of a similar magnitude. The International Energy Agency (IEA) proposes a 77% reduction of CO₂ emissions by 2050. In order to support IEA targets, the energy consumption in buildings must be cut by 60% by 2050.

Improving the energy efficiency of buildings is indeed one of the most promising ways to save significant amounts of energy. The AEROCOINS project proposes to enhance the thermal performance of the insulation layer in the building envelope for a given layer thickness. Novel materials based on organic-inorganic hybrid aerogels will be designed and developed combining nanotechnology and sol-gel chemistry techniques.

Silica aerogels are the most widely studied class of aerogel materials and are nowadays commercially used in building insulation. They are mesoporous, nanostructured solids with extremely high specific surface area (up

to $>900\text{m}^2\text{g}^{-1}$) and the lowest thermal conductivity known to man for solids ($\lambda < 0.015\text{Wm}^{-1}\text{K}^{-1}$ at ambient conditions). However, aside from the high production cost, they are mechanically weak and tend to dust formation.

Objectives

The main scientific and technical objectives are of the AEROCOINS project include:

- Synthesise and elaborate novel, mechanically strong and superinsulating silica aerogel-based materials via an ambient drying process
- Design and fabricate 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



Kubik by TECNALIA

- Obtain a definition of the global performance of the component in different representative building typologies taking into consideration the Service Life Cost Analysis

Methodology and achievements to date

AEROCOINS technical work packages are the following:

- WP1 – Synthesis of reinforced superinsulating aerogels: focusing on the design and synthesis of novel superinsulating silica-based aerogels
- WP2 – Drying and thermal conductivity optimisation: dealing with the development of a robust and efficient drying process for the preparation of superinsulating aerogel boards
- WP3 – Pilot scale material fabrication: focused on the upscaling of the fabrication of superinsulating aerogel boards
- WP4 – Aerogel-based component manufacturing: dealing with the design and fabrication of new superinsulating building components for retrofitting installations
- WP5 – Building integration and validation: dealing 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



SiO₂ Aerogel ARMINES/MINES ParisTech

AEROCOINS project has been running for 12 months and important technical developments have been performed related to the elaboration and development of a composite/hybrid aerogel material focused on:

Synthesis of 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 ($\lambda < 0.018 \text{ Wm}^{-1}\text{K}^{-1}$) by polymeric cross-linking and/or nanodispersion concepts based on use of cellulosic species

Developing an ambient drying process: minimising evaporation-induced shrinkage by optimised fine-coupling between materials (silylation chemistry of the silica network and strengthening techniques) and process parameters (drying rate, etc.)

Impact

The successful completion of all AEROCOINS objectives is expected to:

- Provide new high-performance solutions to the insulation industry with the ultimate goal to contribute to a reduction of the energy demand/consumption in buildings
- Develop of a new class of insulation component offering a tremendous economic potential for the world fast growing aerogel insulating business.
- Grow the use of aerogels thanks to falling aerogel prices and supporting the sector as the saved space will be able to largely compensate for the extra cost



PARTNERS

Coordinator: Tecnalia, Spain

France: Armines, PCAS, Separex

Finland: VTT

Germany: ZAE Bayern

Poland: Politechnika lodzka

Spain: Acciona

Switzerland: EMPA

KEY FACTS

Start date: June 2011

Duration: 48 months

Total budget: €4.3m

- Superinsulating silica aerogel-based materials
- Crosslinking and nanodispersion as reinforcement strategies

www.aerocoins.eu

New μ -CHP network technologies for energy-efficient and sustainable districts

The project optimises and implements an innovative energy production and distribution concept for sustainable and energy-efficient districts. The concept is based on a number of technologies: dynamic heat exchange between buildings exploiting SOFC based micro-CHP units for energy production; improved thermal storage, building and piping insulation; biogas production from food wastes; smart control and hybrid wireless network systems.

Overview

FC-DISTRICT addresses refurbished and/or new 'energy autonomous' districts, exploiting decentralised co-generation coupled with optimised building and district heat storage and intelligent district distribution networks. Continuous Solid Oxide Fuel Cells (SOFCs) operation along with effective in-building and district load control is expected to reduce annual primary energy consumption at district level up to 60%. Demonstration will be carried out in Spain, Greece and Poland in three phases: unit, building and district.

Objectives

The FC-DISTRICT objectives are:
Develop a high temperature SOFC with versatile fuel processor and optimised

Integrate Food Waste Disposal units with anaerobic digesters to produce biogas.

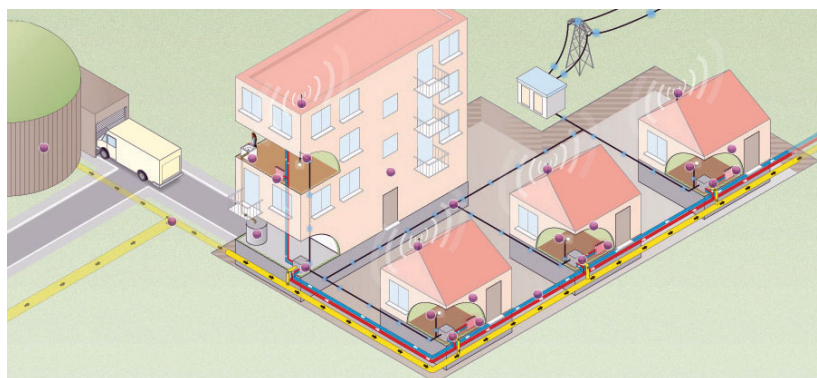
Implement an 'Intelligent Heat Network' equipped with smart control and hybrid wireless network systems.

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.

Achievements to date

Micro-CHP System

The novel SOFC based micro-CHP unit has been designed to fulfil the relevant European technological and market requirements (return of investment of five to seven years). It utilises a planar



The FC-DISTRICT concept: Intelligent Heat Network with SOFC micro-CHP units

peripheries making possible successful integration with district networks. Combined Heat and Power (CHP) production and efficient fuel use results in reductions in carbon emissions and costs and reduces losses over transmission and distribution lines. It offsets the use of centrally-generated electricity from the grid and allows local voltage regulation.

Develop and implement advanced, durable and cost-effective insulation materials for improved building and district piping thermal response.

SOFC stack operating on Catalytic Partial Oxidation (CPOX) reformed NG and biogas and nominally provides 1.5 kW_{el} and 2.75 kW_{th}. The targeted electrical efficiency is over 30% and overall efficiency over 90% with a modulation range of approximately 1:3. Major peripheral components (CPOX reformer, inverter etc) and most important balance of plant components (post-combustor for the anode exhaust gas, high-temperature plate-type heat exchangers and heat recovery unit) have been developed and tested.



ETIC Systems

Innovative External Thermal Insulation Compound Systems (ETICS) based on Vacuum Insulation Panel (VIP) and Aerogel technologies coupled with Dry Wall Construction techniques are developed. The target is to maintain thermal performance, offering significantly reduced insulation thickness. In 2012, the new ETICS will be installed, tested and monitored at a demo site in Greece.

New pipes

The new heat distribution pipeline concept is based on combining Vacuum Insulation Panels (VIP) and polyurethane (PUR) in a hybrid insulated pipe. Results have shown that this configuration can reduce power requirements by 15-20% under constant temperature conditions. The production process development focuses on a twin pipe configuration (two service pipes in one casing pipe) with VIP.

Innovative biogas tanks

A prototype anaerobic digester has been developed to investigate tank working conditions, discharge and thickening control system. The tank is a crucial element of the district waste collection system and represents the first step for further biogas generation in anaerobic digestion facilities. The target is to integrate the production of biogas through the introduction of upgraded wastes into centralised anaerobic digesters.

Wireless communication system

A prototype hybrid network is developed and implemented. A ranked communication strategy is necessary to achieve the desired performance. The most appropriate communication standard has been chosen and successfully installed in the Polish district demo site. The system allows control of fuel cell units, heat demand, fuel supply and other devices at the district level.

Impact

The project will deliver new products for the European energy (SOFC), construction (ETICS, pipes, biogas tanks) and ICT (wireless networks) markets.

The implementation of 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". Districts 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, or municipal regions. Up-to-date simulations have shown a possible primary energy saving up to 50% at district scale.

Additional energy and cost benefits will arise from possible income from the local ESCO in case of electricity surplus and possible taxes reduction stemming from reduced CO₂ emissions and/or from reduced district wastes.

PARTNERS

Coordinator: Mostostal Warszawa S.A., Poland

Belgium: Intesa SanPaolo Eurodesk

Germany: TU-BAF, KNAUF Gips, EBZ, sunfire

Greece: NTUA, KNAUF Gypsoptia ABEE

Italy: D'Appolonia, ecofast

Netherlands: ECN, vito

Poland: Mostostal, IEN

Portugal: IST

Romania: OVM ICCPET

Spain: ACCIONA, FAGOR, ikerlan, SOLINTEL M&P

Sweden: CUT, SP, POWERPIPE

UK: rinicom

KEY FACTS

Start date: September 2010

Duration: 48 months

Total budget: €11.8m

- Optimised thermal power management at building and district level via dynamic heat exchange between buildings
- 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
- District level demonstration in Poland proves the concept, targeting up to 60% reduction in primary energy use and acts as model for heat-optimised districts

<http://www.fc-district.eu>

Energy-hub for residential and commercial districts and transport

A new type of district energy infrastructure is being developed including advanced systems for matching supply and demand of energy (heat, cold and electricity) and incorporating advanced heat storage technologies such as TCM's (Thermo-Chemical Materials). The technology will be demonstrated at full scale in the district of Tweewaters, Belgium.

Overview

To achieve low-energy or even energy-neutral districts, the share of renewable energy must increase drastically over present levels. Accommodating a large supplier of renewable energy, such as a large wind turbine, in the existing energy infrastructure is hampered by the fluctuating character of the energy supply. As a result, renewable energy supply is either too large or too small to cover the instantaneous energy demand. Both smart energy management systems and energy storage are essential to meet this challenge.

Objectives

The objective of the E-hub project is to maximise the amount of renewable energy in a district by matching energy demand and supply, by shifting the demand of heat pumps, refrigerators or washing machines. Excess renewable heat can be stored in advanced Thermo-Chemical Materials (TCM) or boreholes for prolonged periods with few heat losses. An important element is the acceptance of such an advanced energy system by energy suppliers and users alike. Therefore, developing new

business models and service concepts that are attractive to all stakeholders is crucial.

The E-hub energy system will be demonstrated in the district of Tweewaters in Leuven, Belgium. In addition, four scenario studies will be carried out to assess the feasibility of an E-hub type of system in the districts of Amsterdam, Freiburg, Palermo and Dalian (China).

Achievements to date

In work package 1 the team identified a number of model districts that will be used to assess the feasibility of E-hub energy systems. The team also studied the characteristics of current energy supply systems.

In work package 2, partner TPG measured performance curves (e.g. electrical efficiency at part load) of different pieces of cogeneration equipment such as a 100 kW_e microturbine, a 20 kW_e internal combustion engine and a 100 kW_{cool} absorption cooler. This data is very useful as intermittent and part load operation of equipment will be much more frequent than in



Full-scale demonstration at the newly developed district of Tweewaters in Leuven, Belgium



conventional systems. The team also produced conceptual designs of E-hub systems for the model districts that will be the subject of detailed simulations in later stages of the project.

In work package 3 the team is investigating three types of thermal storage: underground storage, thermochemical storage and distributed storage, the latter using individual storage vessels in dwellings instead of single centralised heat storage. TNO and ECN each built and tested a 15-20 litre prototype thermo-chemical reactor, while VITO is building a test rig to study distributed storage in their laboratory.

Development of a software architecture for an energy management system is the subject of work package 4. Current research is focusing on the development of a multi-commodity matcher, combining the management of heat, electricity (and possibly cold). This is a particular challenge when the commodities are linked, e.g. when using cogeneration.

The full-scale demonstration (in work package 5) in the newly developed district of Tweewaters in Leuven Belgium is well underway, as shown in the picture left.

In work package 6 on business models, the team has produced a study on stakeholders and value chains and work is ongoing on interviewing stakeholders to identify novel business and service models.

Impact

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

The share of renewable energy from wind, biomass and solar energy will grow substantially. Application of energy buffers and intelligent energy management systems are essential to match demand and supply of energy to deal with the fluctuating nature of renewable energy supply.

Energy, being an increasingly scarce commodity, is expected to be subject to a price differentiation, replacing the flat rate in use today. Energy will be more expensive in times of shortage 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. This system therefore is well prepared for future price differentiation.

PARTNERS

Coordinator: TNO, The Netherlands
Belgium: Ertzberg, ISPE, VITO
Finland: VTT
France: EDF
Germany: Fraunhofer-ISE, HSW
Italy: CESTEC, D'Appolonia, University of Genoa
Netherlands: ECN, TNO
Poland: Mostostal
Spain: Acciona, Solintel
UK: ICAX

KEY FACTS

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

- Development of energy management system
- Development of advanced thermo-chemical heat storage
- Full scale demonstration at the district of Tweewaters in Leuven, Belgium

www.e-hub.org

Clean and resource-efficient buildings for real life

The project presents a holistic approach to creating good indoor environments in buildings whilst reducing their operational energy use. Development and novel use of nanomaterials and new control algorithms improve the energy performance of windows, building envelopes, air handling, heating, ventilation and lighting systems, and provide improved indoor environments. Solutions are designed both for new buildings and for retrofitting of existing buildings.

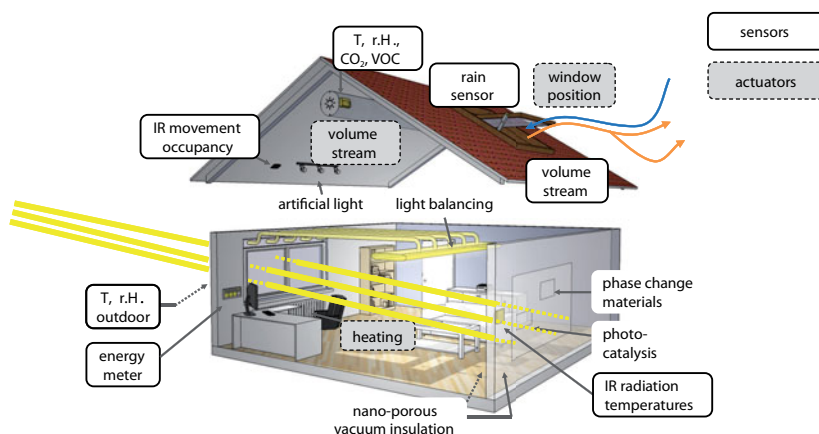
Overview

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 CO₂ emissions, it is imperative to reduce energy consumption. As a cross-over from material science to the construction industry, clear-up brings nanomaterials from the lab into real applications. It develops sensors and control strategies for an optimal interaction and finally integrates these new components into real buildings.

Objectives

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

- Windows: Clear-up 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: Clear-up uses photocatalytic materials for air purification and micro-porous vacuum insulation in combination with phase change materials to passively control temperature
- Air Conditioning: Clear-up advances strategies for demand controlled ventilation and improved air quality.
- Sensors and control: new sensors are in development, their use is optimised for the operation of smart windows, demand-controlled ventilation and catalytic air purification



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



Achievements to Date

Commissioning, testing and monitoring was carried out in a laboratory environment, a test building and a demonstrator building. The first part of the subsystem tests is now finished and the analysis of the results has allowed fine-tuning on the installation of the components and the software. Some additional tests are now being conducted, especially on the subsystem light in order to develop a daylight balancing concept.

One test-bed was foreseen in the project proposal, but after first studies it was decided to implement two different test-beds. The first one mainly deals with indoor air quality and ventilation strategies in office building meeting rooms. The second one comprises six identical office rooms, equipped with different parts of the studied components of Clear-Up, one of them only equipped with monitoring equipment to serve as reference rooms. Tests have started to compare the different impacts on the energy efficiency as well as the human perception of the indoor air quality.

Impact

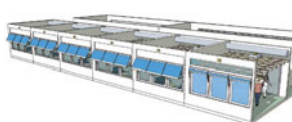
Clear-up aims to achieve substantial savings in operational energy use without negative consequences on high-quality environments for building occupants. Clear-up solutions can bring improvements with respect to light, indoor air, and thermal comfort in special for building retrofit:

- **Light:** Electrochromic windows which switch transparency maintaining a view of the outside, may help future work environments to become more comfortable while reducing the risk of over-heating. Light guides will increase natural light and create a healthier environment while keeping energy demands for artificial lighting low
- **Air:** Ventilation issues are manifold. We need adequate ventilation for a healthy environment, but it also plays an important role in heating and cooling. Clear-up will develop smart algorithms for demand-controlled ventilation based on gas sensors. Photocatalytic paints may reduce the indoor pollution, and the needed ventilation rates. Ventilation is also used for unloading thermal buffers of phase change materials
- **Temperature:** Insulation issues play an important role in energy refurbishment. Clear-up promotes vacuum insulation panels especially for applications where space is limited and phase change materials alter to passively control temperature

UN Climate Summit
Demonstrator: 'show and tell'



Extended testbed
Integration of all subsystems & control systems



Hall of residence demonstrator
12 months data from all subsystems



Buildings and timeline

PARTNERS

Coordinator: University of Tübingen, Germany

Belgium: Belgian Building Research Institute

Czech Republic: Czech Technical University in Prague, Saint-Gobain Weber Terranova a.s.

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 GmbH, Saint-Gobain Weber GmbH, Porextherm Dämmstoffe GmbH, Siemens Corporate Technology, Steinbeis Transfer Centre AO Action

Greece: FORTH Foundation of Research and Technology Hellas

Hungary: Budapest University of Technology and Economics

Italy: European Commission, DG Joint Research Centre, Institute for Health and Consumer Protection

Sweden: Uppsala University, Ångström Laboratory

Switzerland: Siemens Building Technology

Spain: ACCIONA Real Estate

KEY FACTS

Start date: November 2008

Duration: 48 months

Total budget: €8.3m

- 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 life-cycle approach
- Tests in laboratory, simulated test rooms, real-life test beds, and building demonstrators

www.clear-up.eu

Development of a clear and energy self-sustained building

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

Overview

More than 40% of the energy consumed in the EU is used to cover the needs for heating, cooling and electricity in buildings and the major part of this energy is produced from imported fossil fuels. Moreover, 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 increasing the use of RES to cover buildings' energy needs. There is a need to identify the However, in order to ensure the continuous operation of energy systems based on RES a way to compensate their intermittent nature needs to be identified.

Objectives

The H₂SusBuild project aims at developing a self-sustainable and zero-carbon emission hybrid energy system, in which the storage of hydrogen provides for the energy supply in case of energy shortage from RES. With this respect, 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 in form of pressurised gas and consumed on-demand in order to produce combined heat and electricity in case of shortage of renewable energy.

Accordingly, RES technologies are used to harvest primary energy to be directly applied to cover the building's contingent loads. In case of excess renewable energy availability, the excess energy is converted to hydrogen to be used as energy storage medium. In case of renewable energy shortage, the stored hydrogen is applied as green fuel in order to cover the building's electric power and heat demand. This is done through combined heat and power generation by means of fuel cells and by direct combustion for additional heat production when needed.



Hydrogen storage and distribution grid



Achievements to date

This hybrid energy system has been installed in a real building environment in order to demonstrate technical feasibility and safety. The concept had been initially demonstrated through a reduced-scale prototype installation focusing on satisfying the electrical energy demand of a target indicative 150m² surface area dedicated to office use. More recently, the reduced-scale prototype installation has been scaled up to a full-scale hybrid energy system demonstrator to satisfy the electrical and thermal energy demand of a building of circa 600 m² surface area, which is located in Lavrion, Greece.

Part of the work has been dedicated to achieving the safe design of the overall hybrid energy system. This included upgrading the demonstration building's facilities to host the full-scale installation, which includes, the hydrogen generation, storage and consumption technologies, as well as the hydrogen distribution grid. A Safety and Protection System, integrating flame detectors, heat detectors, smoke detectors, and hydrogen gas detectors, has been installed. Last but not

least, the coordination is enabled by an Energy Management and Control System that enables synergistic operation of the various hybrid energy system components with the RES. This optimised system manages collaboration of the RES with the public electrical supply grid, minimising the use of the grid.

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. The project aims, first of all to demonstrate the technical feasibility of achieving installation and coordinated/ synergistic operation of such a system within a real building environment. The project will also assess the appropriateness of safety measures contributing to develop guidelines for the use of hydrogen technologies in buildings.



Fuel cells based 20kW micro-cogeneration system

PARTNERS

Coordinator: D'Appolonia S.p.A., Italy

Germany: CirComp GmbH, Institut für Verbundwerkstoffe GmbH

Greece: Centre for Renewable Energy Sources, National Technical University of Athens, Schneider Electric SA

Italy: CAVE S.r.l., ICI Caldaie S.p.A., Idrogen2 S.r.l., S.C.A.M.E. Sistemi S.r.l.

Netherlands: Van Berkel & Bos U.N. Studio BV

Norway: Det Norske Veritas AS

Poland: Decsoft Spółka Akcyjna

Spain: Acciona Infraestructuras SA, Ikerlan Sociedad Cooperativa

Sweden: Catator AB, Skanska Nya Hem AB

UK: The University Court of the University of St Andrews

KEY FACTS

Start date: October 2008

Duration: 48 months

Total budget: €9.9m

- In September 2011, a full-scale demonstrator of the H₂SusBuild hybrid energy system was installed in a real building environment
- The H₂SusBuild hybrid energy system will allow demonstrating to what extent hydrogen storage can be applied to balance the intermittent nature of RES technologies
- H₂SusBuild will allow assessing appropriateness of safety measures put in place in order to ensure a safe environment despite the use of hydrogen

<http://www.h2susbuild.ntua.gr/>

Multi-source energy storage system integrated in buildings

Energy storage is the way to conserve energy in one form and release it when needed in the same or another form. It is used to store both thermal (heat and cold) and electrical energy by electrochemical, electrical, mechanical and thermal methods.

The objective of the project is the development, evaluation and demonstration of an affordable Multi-source Energy Storage System Integrated in Buildings (MESSIB), 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.

MESSIB 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. Energy storage has critical roles to play in securing our energy future.

Overview

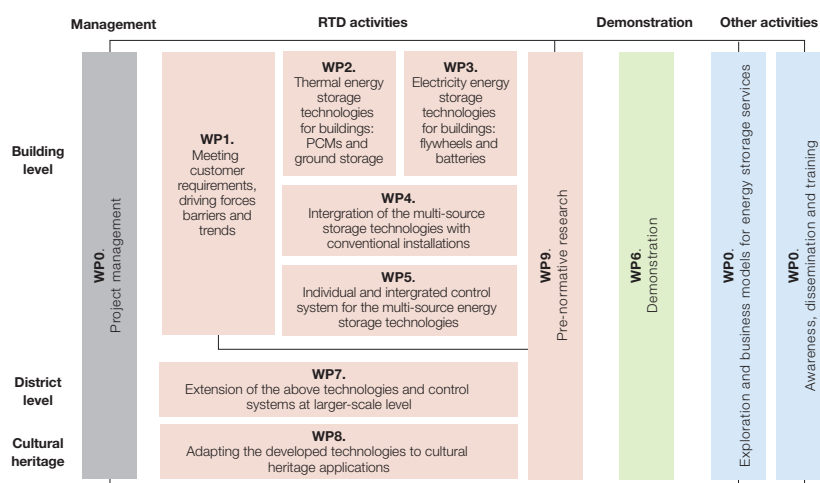
Promoting energy efficiency and integration of renewable energy sources in buildings in the European Union has gained prominence with the adoption of the Directive on the energy performance of buildings in 2003 (recasted 2010).

Distributed Energy Resources (DER) meaning distributed energy generation combined with energy storage and active management of distribution networks contribute to improving energy efficiency, quality and security of supply,

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 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



Structure of the MESSIB project

and avoiding network reinforcement. MESSIB will contribute to facilitate the way to implement DER at building and district level.

Energy storage technologies are a strategic and necessary component for the efficient utilisation of RES and energy conservation. The basic idea behind energy storage in buildings is to provide a buffer to balance fluctuations in supply and demand.

more durable vanadium redox flow batteries 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.

Achievements to date

The thermal energy storage (new PCM/ Phase Change Slurries and ground storage), electrical energy storage (Flywheels and vanadium redox flow batteries) technologies, and smart energy management system have been developed. The technologies and systems are being tested in the lab and then integrated with conventional installations in three demo sites. Activities related to the extension to a district level and their adaptation to Cultural Heritage applications have started.

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 \$16trillion, according to the International Energy Agency. In Europe alone, some €500billion worth of investment is needed to upgrade the electricity transmission and distribution infrastructure. This investment could be reduced with the adoption of MESSIB 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 two decades.



PARTNERS

Coordinator: Silvio Vitali-Nari, ACCIONA

Finland: UPONOR, VTT

France: CSTB

Germany: BASF, FRAUNHOFER - ISE, FRAUNHOFER - ISC, KNAUF KG, USTUTT

Greece: NTUA.HMCS, KNAUF GYPSOPIA

Italy: CNR - ISAC, GESTA, D'Appolonia

Netherlands: WANSDRONK

Poland: MOSTOSTAL

Slovenia: CCS, ROBOTINA

Spain: Acciona, AIDICO, TECNALIA-LAB, ZIGOR, TEKNIKER.

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.

www.messib.eu

Resource and cost-effective integration of renewables in existing high-rise buildings

In the Cost Effective project, 21 European partners cooperate to develop concepts and components therein to convert the façades of existing 'high-rise buildings' into multifunctional, energy gaining components. The aim is to maximise impact on the energy conservation potential in the EU25 and the associated CO₂ emissions mitigation.

Overview

The use of renewable energy in the building sector is today dominated by the application of solar domestic hot water and PV systems in single-family houses. In order to significantly increase the use of renewable energy in the building sector, concepts have to be developed for large buildings. In these buildings, high fractions of the energy demand can only be met with 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.

Objectives

In 2009 the regulatory framework and the business environment for the construction sector has changed significantly in order to reduce the CO₂ emissions of existing and new buildings. 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 concepts 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.



Façade-integrated natural ventilation system with heat recovery



The project helps to improve the sustainability of the components supply industry of the construction sector through the development of new products and improved productivity through highly integrated products. The link between the construction industry and the highly innovative renewable energy industry will help to improve the position of the suppliers, especially in the façade sector.

Achievements to date

Within the Cost Effective project, a set of five of new multifunctional façade components and systems has been successfully developed:

- transparent solar thermal collector;
- air-heating vacuum tube collector
- angle-selective transmittance BIPV-component
- façade integrated natural ventilation system with heat recovery
- solar assisted decentralised heat pump system

Prototypes have been produced and initial performances have been assessed in labs. An inventory of the high-rise building stock in Europe has been completed. This inventory resulted in the definition of four building categories from highest to lowest energy saving potential. Integrated technical concepts for energy-efficient refurbishment of high-rise buildings have been developed for each of the four building categories. The concepts combine already-proved solutions such as thermal insulation of opaque façades or efficient artificial lighting with new multifunctional façade components and systems.

Field tests are under way in two pilot projects (in Spain and in Slovenia) to demonstrate and assess the performance of the new integrated concepts and some of the new components.

Impact

In EU-25, office buildings account for approximately 1000m m² floor area. Approximately 67% of these buildings are high-rise and 75% are more than 10 years old. With an average annual energy consumption of 110 kWh/m² for heating and 60 kWh/m² 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 9m tonnes of CO₂ emissions. Even a small part of this saving potential represents a large impact.

The new components will increase the competitiveness of European manufacturers by adding value to their product portfolio 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 1500m m². This corresponds to a market volume of more than €300bn. A small portion of this market segment represents a large market volume.

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: TNO

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

KEY FACTS

Start date: October 2008

Duration: 48 months

Total budget: €1m

- Development of 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 five new multifunctional façade components which combine standard features and the use of renewable energy resources
- Development of new business and cost models which consider the whole life-cycle of a building and which incorporate the benefits from reduced running costs and greenhouse-gas emissions

www.cost-effective-renewables.eu

BioBuild

High-performance, economical and sustainable biocomposite building materials

The aim of BioBuild is to use biocomposite materials to reduce the embodied energy in building façade and internal partition systems by at least 50%, compared with current materials, with no increase in cost.

Overview

Biocomposites generally have lower embodied energy than conventional construction materials because they are based on natural fibres and resins derived from biological material. They can also have mechanical properties similar to glass fibre reinforced polymers (GRP), making them a useful material for a range of construction application. Biocomposites are not currently used for outdoor applications because they are prone to degradation by moisture. The project will develop biocomposites capable of offering 40 years' outdoor durability by protecting the fibres using treatments and coatings.

Objectives

The result of the project will be low-cost, lightweight, durable and sustainable biocomposite building systems, based on panels, profiles, frames and sandwich structures, with full technical and environmental validation. Case study components of these systems will be manufactured full-scale and used to build a demonstration unit. An additional objective is to produce a biocomposite design guide providing best practice advice to designers.

Expected deliverables

- Identify standards, key materials, processes and outline the specification for the case study components
- Resin/fibre properties characterisation; composite system feasibility assessment; fibre moisture resistance enhancement
- In-mould coatings development; adhesive and joining systems development; sandwich structures development; analysis of assembly properties
- Sample panels from tooling; sample panels from continuous processing; sample panels or profiles from semi-continuous processing; process monitoring achieved; application ready product development
- Design integration review; external and internal panel and profile systems design; joining technologies development; small-scale demonstrator units construction
- Interim biocomposite evaluation = testing of lab-scale systems; manufacture of full-size test rigs; definitive testing of full-scale demonstrator unit
- Design, manufacture and installation of curtain wall system and modular panels, internal partitions and window frames. Combine the new technologies in a single demonstrator unit
- Report on environmental benchmarking; report on health evaluation; report on the prioritisation of environmental and cost improvement; report on final eco-efficiency impact evaluation
- Report on project dissemination; website set up complete; report on industrial interest group; report on exploitation planning and execution; workshops delivered
- Project internet and periodic reporting



PARTNERS

Coordinator: NetComposites UK

Belgium: KU Leuven, TransFurans Chemicals

Denmark: 3XN

Germany: Arup, IVW

Italy: Cimteclab

Netherlands: DSM Resins, SHR, TNO, Holland Composites Industrials

Portugal: Amorim Cork Composites, LNEC

Spain: Acciona

UK: Exel Composites

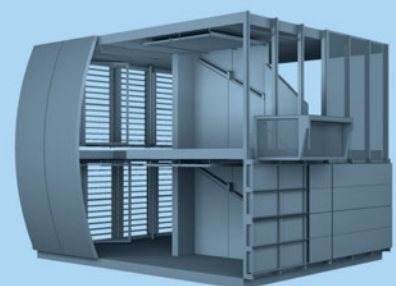
KEY FACTS

Start date: December 2011

Duration: 42 months

Total budget: €8m

www.biobuildproject.eu



The current conceptual design for the demonstrator unit

BUILDSMART

Energy-efficient solutions ready for the market

Eleven large-scale residential and nonresidential buildings are to be constructed across various climate zones in Europe using innovative and cost-effective techniques and methods. New technologies displaying live energy use data will be used to educate the homeowners, employees and the public as a means to influence their behavioral patterns. In addition, the possibility of mainstreaming the examples above will be studied.

Overview

This project looks at a number of very low-energy and non-residential buildings in three different countries, representing buildings in various climate situations, different cultural aspects and different technologies. This is representative of similar areas in EU with different climatic zones and will facilitate deployment and exploitation of this project.

Objectives

The objective of the Buildsmart project is to demonstrate and mainstream innovative and cost-effective techniques and methods for constructing very low-energy buildings in various climates. Residential and non-residential new buildings in Sweden, Ireland and Spain will participate in the project. The total gross floor space of the buildings will be 81.300m².

New forms of incentives will be developed and implemented to increase the involvement of the inhabitants where the inhabitants can actually benefit from lower energy costs and a better environment.

Expected deliverables

Sweden: In Malmö, a hotel and a residential building in the concert, congress and hotel area in the city centre will be erected and showcased. In the Hyllie area a number of residential and non-residential buildings such as a municipal nursery school will be constructed.

Ireland: In Dublin, in Dominick Street Lower Development, a mix of residential and commercial units will be raised and showcased.

Basque: In the Portugalete municipality in Greater Bilbao, a three-block residential building of five floors will be erected and showcased.

All actions implemented will be analysed out of a system perspective, where the whole energy system is included. The calculation the primary energy need for different technology choices as well as its life-cycle costs.

BUILDSMART
Energy efficient solutions ready for market

PARTNERS

Coordinator: City of Malmö, Sweden
Ireland: CODEMA, Dublin City Council
Spain: Basque Government, FCC Construcción, Tecnalia
Sweden: Ikano Bostad, IVL – Svenska Miljöinstitutet, NCC Boende, PEAB Sverige, Roth Fastigheter, Skanska

KEY FACTS

Start date: December 2011
Duration: 45 months
Total budget: €8.6m

The included large scale-demonstration buildings are characterised by the following innovative techniques:

- Energy-efficient building envelopes with high air tightness and low-energy losses
- Energy-efficient installations creating a minimised energy use
- Techniques for minimising the cooling need such as efficient windows and shading equipment

www.buildsmart-energy.eu



DIRECTION

Demonstration of very-low-energy new buildings

This project aims to create a framework for demonstration and dissemination of innovative and cost-effective energy-efficiency technologies for the very-low-energy new buildings.

Overview

DIRECTION was launched on January 2012 to explore how to enhance the overall energy-efficiency of a building and achieve a consumption level of primary energy lower than 60kWh per m² per year. Building and construction engineers, architects, energy researchers, IT specialists and public authorities will work together to demonstrate in three different sites in Europe how to achieve such ambitious goal. The sites are located in Valladolid (ES), Bolzano (IT) and Munich (DE).

Objectives

Based on the analysis of suitable energy-efficiency technologies and their technical and economic viability, the demonstration activity will be deployed in three new buildings. In each of them a set of innovative measures such as construction elements for energy optimisation, highly-efficient energy equipment and advanced energy management will be applied. Energy consumption reduction of more than 50% and CO₂ emission reduction of more than 60% are expected.

The project will be completed in several phases:

- Energy-efficiency measures analysis
- Demonstration buildings construction
- Monitoring and energy performance and savings assessing plan, including simulation and modelling tasks
- Systems and facilities commissioning and testing

- At least one year of monitoring in normal operation
- Dissemination plan implementation

The work plan reflects these phases with some dedicated to demonstration and other to develop a methodology for energy performance assessment, data acquisition, reporting and building models.

In parallel DIRECTION will deploy an ambitious dissemination plan. Local, national and European stakeholders including public authorities, users and citizens at large will be kept up to date about the progress and the outcomes of the demonstrations.

Expected deliverables

DIRECTION project will produce a total of 55 deliverables, all public, at first as planning, then as a results report including: BIM, metering and monitoring projects, control strategies, BMS, performance analysis for both envelope and systems, etc. A best practice book will finally be generated.



PARTNERS

Coordinator: Fundación CARTIF. Spain

Belgium: youris.com G.E.I.E.

Germany: Domagk Gewerbepark, FACIT GmbH und Co. KG, Fraunhofer Institute for Building Physics

Italy: Claudio Lucchin & architetti associate, Enginsoft SpA, EURAC, Province of Bolzano

Spain: 1A Ingenieros DRAGADOS

KEY FACTS

Start date: January 2012

Duration: 48 months

Total budget: €6.95m

- Three new buildings will be used as pilots, deploying in each one a set of very innovative measures, constructive elements for energy optimisation, high-efficient equipment and advanced energy management
- The project will create a global dissemination framework, through the implementation of a multichannel approach

www.direction-fp7.eu



Demonstrates general work scheme

NEED4B

New Energy Efficiency Demonstration for Buildings

The project will develop an open and easily replicable methodology for designing, constructing, and operating new low-energy buildings, for large market uptake. NEED4B methodology will be validated and refined by a strong demonstration programme, envisaging the construction of 27,000m². Spread among five demo sites covering different climatic zones, buildings types and uses.

Overview

The building sector is the highest energy consumer in the EU. In order to drastically reduce its energy consumption and associated GHG emissions, the European Directive 2010/31/UE establishes that all new-builds must reach near-zero-energy consumption levels by year 2020.

In this context, there is a needed to adopt strong energy efficiency advances in the new construction projects, as well as associated process and business strategies that result into a large-scale market deployment of energy-efficient buildings. NEED4B involves key expertise to demonstrate the technical, social and economic feasibility of this challenge.

Objectives

The overall objective of the project is to develop a new replicable methodological approach for designing, constructing and operating very-low-energy new buildings. This methodology will be validated and enriched by the experience gathered in a series of demonstration buildings to be constructed in five European countries.

The variety of typologies and uses as well as their location in different climates, contributes to the results of the project being so broadly applicable across Europe. All buildings have a common target of achieving an energy consumption lower than 60kWh/m² year. This target will be possible thanks to the selection and integration of the most suitable set of innovative and cost-effective energy-efficient solutions and technologies for each of the buildings.

Expected deliverables

NEED4B will deliver recommendations and guidelines adapted to different types of stakeholders.

An ambitious dissemination plan has been foreseen, as the demonstrators have been carefully selected to ensure the project's visibility and impact within the European construction sector. An extensive monitoring phase lasting 2.5 years will be deployed in order to eventually evaluate the benefits and impacts achieved in the project.

Exploitation plans will be developed so as to obtain new business models that overcome current market barriers and failures.



PARTNERS

Coordinator: CIRCE, Spain

Belgium: Format D2, Intesa SanPaolo Eurodesk, M5, Université de Mons, Vue Sur Mons

Italy: D'Appolonia, Imprima Costruzioni

Spain: Acciona Infraestructuras, Ingeniería y Control Electrónico, Universidad de Zaragoza

Sweden: Derome, SP

Turkey: BG MIMARLIK, Fiba Holding, Özyegin University

KEY FACTS

Start date: February 2012

Duration: 72 months

Total budget: €9.5m

- Adopting new methodological approach for energy-efficient buildings design, construction and operation
- Use of 27,000m² spread among five very low-energy new demonstration sites
- Aim to achieve 65% energy savings in the buildings and 832 tonnes of CO₂ saved each year

www.need4b.eu

NEXT-Buildings

NEXT-Buildings project focuses on the demonstration of very-low-energy, affordable, buildings. The ambition is net zero carbon/energy or better. The project paves the way for large-scale implementation of energy neutral buildings/neighbourhoods as foreseen in the Energy Performance of Buildings directive. The pilots are running more than five years ahead of the goal of the EU, to have energy-neutral new build dwellings by the start of 2019.

Overview

This project is based on some of the most successful cities and actors in the CONCERTO programme. They want to demonstrate the next generation of low-energy buildings. These are not only buildings, but also active components in overall energy systems including smart technologies and ICT as well as energy exchange with the overall supply. The solutions will reduce CO₂ at negative or no cost. The common approach is: reduce demand, sustainable heat and use of local renewables for residual demand.

The three pilots (in Amsterdam, Lyon and Helsingborgshem) have a total gross floor area of about 50,000m².

Objectives

The overall project objective is the demonstration of affordable and well-integrated net zero energy and active buildings in the urban environment. This means that the project is to develop new products, elements and technologies offering the possibility to build low-energy dwellings in a more efficient way in terms of energy consumption, costs and replication. Themes that have special focus are dealing with heat recovery and control, inhabitants' feedback, enhanced monitoring, and building integration of renewables. Four new products are investigated and developed, ranging from clever combination of existing technologies to development of new technologies.

Expected deliverables

Planned deliverables are the completed demo sites and the performance results. In addition, there are reports on the technological developments, user behavior and financial aspects.

The communication and dissemination of results and experience from this project, aim to raise awareness regarding energy-efficient buildings and to convince various market players of the cost-effectiveness of low-energy buildings. The dissemination of NEXT-Buildings will be at all levels (European, national and local).



PARTNERS

Coordinator: KEMA Nederland BV, Netherlands

Denmark: COWI A/S

France: SPLA Lyon Confluence; HESPUL

Germany: University of Kassel

Netherlands: Gemeente Amsterdam, Stadsdeel West; Vrije Universiteit Amsterdam (IVM); Liander N.V.

Sweden: Helsingborgshem; BKAB Boende Komfort

Switzerland: Ecole Polytechnique Federale De Lausanne

KEY FACTS

Start date: January 2012

Duration: 72 months

Total budget: €8.5m

- The ambition of the demonstration sites is net zero carbon/energy or better. The solutions will reduce CO₂ at negative or no cost seen in a total perspective
- Transmission controllable windows and BIPV are being developed
- Monitoring, dissemination, mutual learning and experience exchange are key elements of the project

www.next-buildings.com

Envelope Approach to improve Sustainability and Energy-Efficiency in existing multi-storey multi-owner residential buildings

Residential buildings dated between 1925 and 1975 were constructed in an era where there was little or no consciousness of the need to design for energy efficiency and therefore have the largest energy demand.

EASEE will address this issue by developing a new holistic approach for the envelope retrofitting based on innovative technical solutions for the outer envelope, for the cavity wall and for the interiors. This will ensure an important reduction of energy demand as well as of the discomforts for the occupants during retrofitting, thanks to the use of simplified dry construction processes.

Overview

More than half of European buildings were built before 1975 and 10m of them are residential multi-storey buildings with distributed ownership. These buildings present common interesting features from the architectural and structural point of view, often having a linear façade with some 3D architectural patterns as well as cavity walls. A large part of this existing stock still has to be insulated and vertical envelope is the key point to achieve energy efficiency.

Objectives

The final goal of the project is to improve the energy performance of existing residential building stock. For this purpose, the project will develop a new holistic approach to envelope retrofitting based on a combination of pre-fabricated components to be installed without wet finishing on site,

novel insulation approaches for the cavity wall and innovative insulating solutions for the interiors.

EASEE will focus on the three main components of the envelope, namely the outer façade, the cavity walls and the interiors. For each of these parts, a range of novel solutions will be developed, to be combined according to the characteristics of the building to be retrofitted as well as to other non-technical parameters as for example cost and maintenance. Retrofitting options will be ranked through a Retrofitting Planner, which will help owners and construction SMEs to select the optimal solutions in terms of expected energy saving, cost and impact on the occupants.

Expected deliverables

EASEE main expected deliverables are:

- Innovative pre-fabricated panels with built-in insulation, reproducing the aesthetic of the original façade
- A new range of insulating inorganic materials for the cavity wall based on natural and synthetic perlite
- Innovative insulating solutions for the interiors, based on a combination of technical textiles, coatings and high-performance plasters
- A Retrofitting Planner, providing specifications for component manufacturing as well as information on the best combination of retrofitting solutions for the specific building in terms of initial investment, expected savings, performances
- All technical solutions are expected to be ready by March 2014. The Retrofitting Planner will be available by September 2014



PARTNERS

Coordinator: Imprima Costruzioni srl, Italy.

Belgium: Building Performance Institute of Europe

Czech Republic: Imprima Construction Cz a.s.

Italy: Politecnico di Milano, D'Appolonia SpA, Magnetti Building Solutions, STAM srl, Halfen srl, European Consortium of Anchors Producers

Germany: Schwenk GmbH

Greece: National Technical University of Athens, S&B Industrial Minerals

Poland: Pre-Fasada, CIM-MES Projekt sp zoo, Ridan sp zoo

Spain: Ancodarg SL

Switzerland: EMPA

UK: IES Integrated Environmental Solutions

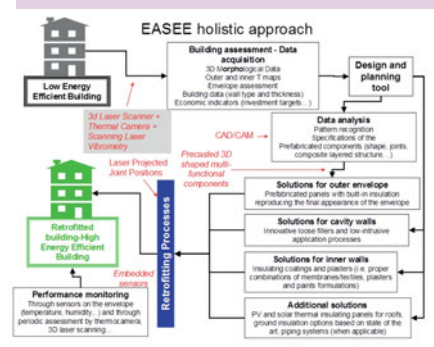
KEY FACTS

Start date: March 2012

Duration: 48 months

Total budget: €5m

- Develop a new holistic approach to energy-efficient envelope retrofitting based on a combination of pre-fabricated components for the outer envelope, novel loose fillers for the cavity wall and innovative solutions for the interiors
- Achieve, in existing multi-family buildings, the energy performance of new buildings according to the national regulations, in terms of transmittance



MEEFS

Multifunctional energy efficient façade system for building retrofitting

The project aims to develop, evaluate and demonstrate an innovative energy-efficient multifunctional façade system geared towards the residential building sector across Europe.

Overview

Most façade solutions available in the market only offer thermal insulation and are rather uniform in terms of applicability to different types of buildings and different façade orientations. Climate and energy needs are also not properly considered and they make little use of innovative passive and active technologies.

Objectives

The result should bring a flexible and modular solution. It is flexible as it could be adapted to different architectonic configurations, typologies and modular as a system that combines different technological solutions. It will be manufactured on composite materials (FRP – Fibre Reinforced Polymer), looking for its lightness.

Energy-efficient panels and modules integrated in the façade will include a particular technology for reducing energy demand of the building or for supplying energy by means of RES. Two new energy-efficient modules will be developed: Advanced Passive Solar Protector and Energy Absorption auto mobile unit, Advanced Passive Solar Collector and Ventilation Module.

It will be based on new industrialised constructive system with non-intrusive installation. This will allow personalised configurations for each façade typology, orientation and local climate conditions, always using standardised panels and technological modules. It will be cost-effective in service life.

The solution will be demonstrated and evaluated in a real building in Spain, in a region with a continental climate, where extreme conditions in summer up to (>35°C) and in winter (<0°C), covering the different seasons.

Expected deliverables

MEEFS project proposes façade products and an innovative effective renovation solution of the building stock. The combination of advanced active solutions with efficient passive design, materials, energy management and new business models will offer a unique opportunity of reducing building energy consumption without requiring mayor capital investment from the inhabitants.



PARTNERS

Coordinator: ACCIONA Infraestructuras, Spain.

Belgium: Greenovate! Europe.

Finland: Teknologian Tutkimuskeskus VTT. Israel: Technion – Israel Institute of Technology

France: CQFD Composites SARL, TBC Générateurs D'innovation. Italy: AntWorks SRL, Vipiemme Solar SRL

Germany: Fraunhofer-Gesellschaft zur Foerderung der angewandten Forschung E.V.

Greece: G.K. Rizakos Anonimi Biotechniki Emporiki Techniki Etairia – ABETE, National Technical University of Athens

Poland: TPF Spółka z ograniczona odpowiedzialnoscia - E&L Architects, SKA Polska Sp. z o.o.

Spain: Fundación Tecnalia Research & Innovation, Advanced Simulation Technologies, Consejería de Fomento - Junta de Extremadura

KEY FACTS

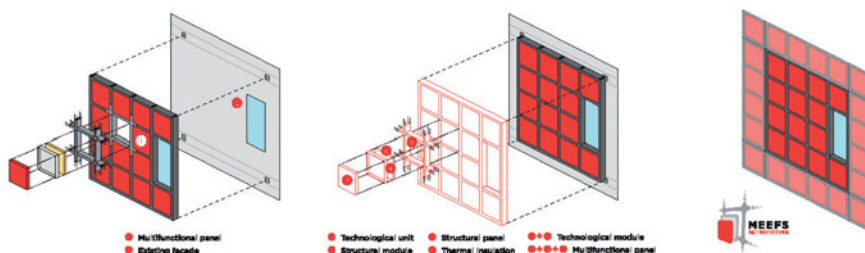
Start date: January 2012

Duration: 4 years

Budget: €9.9m

- Develop an energy-efficient multifunctional façade system geared towards the residential building sector
- Produce flexible and modular solution to different architectonic configurations and technologies
- Utilise new industrialised constructive system with non-intrusive installation

www.meefs-retrofitting.eu



Design and construction process

Geo-clustering to deploy the potential of energy-efficient buildings across EU

The project aims at the establishment of a stakeholders' community across the European virtual transnational areas identified. The project will support the definition of a coherent set of solutions in energy efficiency in the built environment, tackling both technological and non-technological barriers, and maximising the business potentials.

Overview

Experts acknowledge that energy efficiency in the built environment would require the definition of holistic solutions which are optimised at European scale but adapted to local and regional conditions and specificities.

This requires research in systemic approaches, flexible and modular solutions which necessarily involve large industrial players in close cooperation with SMEs and research centres, as well as other relevant stakeholders. The present lack of such approaches and solutions form a major bottleneck for massive application of novel solutions and the creation of knowledge-based jobs.

In this framework, the concept of geo-clusters firstly introduced by E2BA

is highly relevant, being virtual transnational areas where strong similarities are found in terms of climate, culture and behaviour, construction typologies, economy, energy price and policies and gross domestic product, to name a few.

Objectives

GE20 focuses on maximising impact through proper definition of requirements and specifications for technology development and integration, as well as the fine tuning of demonstration actions. The project will leverage the expected outcomes thanks to non-technological aspects which will be instrumental for the full take-up of the geo-clusters concept.

The methodology defined within GE20 project will be validating with two pilot clusters: 'Mediterranean arc' and 'Benelux cluster'.

Expected deliverables

GE20 objective is to create a multi-dimensional and dynamic tool to support the definition of a coherent set of solutions in energy efficiency in the built environment. This project aims at establish a stakeholders community across the European geo-cluster. One of the first deliverables is to identify and characterise a first set of layers gathering homogeneous indicators and parameters identified during the analysis of existing knowledge and information. These layers represent the basis to compare the main features of geo-clusters and they will be the pillars of the multi-dimensional maps.



PARTNERS

Coordinator: CSTB, France.

Belgium: BBRI, E2BA

Czech Republic: TZUS

Italy: POLIMI, D'Appolonia

Luxembourg: ARCELOR MITTAL

Netherlands: TNO

Poland: ASM.

Slovenia: ZAG

Spain: ACCIONA

UK: IFS

KEY FACTS

Start date: January 2012

Duration: 48 months

Total budget: €1.2m

- Establishment of a stakeholders' community across the European geo-cluster interested in the continuous growth and exchange of structured information
- Development of an extensive shared workspace and a knowledge repository to support networking of the above community
- Creation of a multi-dimensional and dynamic tool to support the definition of a coherent set of solutions in energy efficiency in the built environment

<http://www.geocluster.eu/>

Buildings energy advance management system

The project's strategic goal is the development of an advanced integrated management system which enables energy efficiency in buildings and special infrastructures from a holistic perspective.

Overview

By means of a decentralised architecture, BEAMS will enable new mechanisms to extend current building management systems and achieve higher degrees of efficiency.

This system will rely on an open interoperability gateway that allows the control of already identified heterogeneous subsystems acting as sources and loads. Some of them are typically present in spaces of public use, such as public lighting or ventilation and air conditioning and others, will become widely adopted in the next years, such as renewable sources or electric vehicles.

The solution proposed will not only support the human operator of the building or facility to achieve higher efficiency in the use of energy, but it will also open new opportunities to third parties – such as Energy Service Companies (ESCOs), utilities and grid operators. The mentioned third parties need and will benefit from interacting with BEAMS management system through the interoperability gateway in order to improve the quality and efficiency of the service – both inside and outside the perimeter of the facility.

Objectives

BEAMS strategic goal is specified into a set of scientific and technical objectives:

- Definition of common ontology, information models and interfaces to facilitate industry deployment and

adoption by end-user, operators, designers, ESCOs, and system integrators.

- Inclusion of new Greening Energy Positive Tools as Renewable Sources (RES) and Electrical Vehicles (EV) to locally balance the load inside the considered system and support the grid.
- Development of a highly configurable open gateway to interact with ICT solutions from different vendors. The gateway will not only allow the building operator to optimise its service, but also will open new management opportunities.
- Design and implementation of a facility management environment, which will include:
 - A smart control algorithm with learning capabilities
 - A decision support and simulation tool
 - An energy efficiency balanced score card
- Validation and demonstration of the project results in two different pilot sites:
 - FC Barcelona's stadium
 - The campus of the University of Salento

Expected deliverables

The project will address the previously identified objectives and will deliver:

- The common ontology, information models and interfaces in Summer 2012
- The greening energy positive tools beginning 2013
- The open gateway in Summer 2013
- The facility management environment beginning 2014

With these elements the large demonstrations and evaluation will be run during the first semester of 2014.



PARTNERS

Coordinator: ETRA INVEstigacion y Desarrollo SA, Spain

Germany: Fraunhofer Iwes Advancing Energy Systems

Greece: Institute Of Communications & Computer Systems, National Technical University Of Athens

Italy: Thales Italia Spa, Università del Salento

Spain: Barcelona Digital, Sodexo Facility Management

KEY FACTS

Start date: October 2011

Duration: 30 months

Total budget: €2.7m

- Propose an open gateway to interface with the energy subsystems within a facility
- Develop a facility management environment to monitor and control the energy processes of heterogeneous facilities
- Validate its results at the FC Barcelona's stadium and the campus of the University of Salento

www.ict-beams.eu



CAMPUS21

Control and Automation Management of Buildings and Public Spaces for the 21st century

The project will develop, deploy and test an integrated methodology and platform supporting the synergistic usage of existing ICT-subsystems, including energy, building, and security systems. Rather than installing new control systems, CAMPUS21 is focussed on improving the integration and energy performance of existing systems in buildings and on campuses in public spaces. Solutions are developed for three demonstration sites in three different climates.

Overview

It brings together the expertise of national research centres from Germany (telecommunications), Ireland (IT in active energy controls, artificial intelligence), Austria (building physics), and Spain (IT). Public Authorities contribute their management experience together with the process expertise from multiple industry sectors, such as Construction and Facilities Management, Building Services Systems Manufacturers and Energy Providers. CAMPUS21 will explore not only technical solutions, but also will develop business models and economic solutions to ensure the maximum commercial impact of the project.

Due to its cross-sectoral partnership CAMPUS21 includes the whole supply chain. It contributes with ground-breaking innovation to the

establishment of world-class infrastructures and the economic recovery plan of the European Union.

Objectives

The key technological innovations of CAMPUS21 include:

- Integration concepts for energy-management systems including the related middleware components
- Methodologies for intelligent, optimised control of building services systems
- Algorithms and tools to support load-balancing between renewable micro-generation, storage systems, and energy consuming devices in buildings and public spaces

This is complemented by the development of key business elements, including:

- New business models for integrated energy management and the underpinning novel procurement schemes
- The development of Performance Metrics and a holistic Evaluation Concept for Systems' Integration

Expected deliverables

Integration methodology and platform to support building performance analysis resulting in:

- Monitoring concepts and system performance analysis
- Middleware
- Managing control and load balancing components
- Procurement and business models for systems integration and building renovation.

CAMPUS21 uses existing demonstrators and living laboratories for research and validation of energy and cost savings:

- A large university campus in Cork, Ireland
- A multi-purpose sports arena in Frankfurt, Germany
- An indoor sports complex in Valladolid, Spain



PARTNERS

Coordinator: IRUSE Group, University College Cork, Ireland

Austria: Technical University Vienna

Germany: HSG Zander

Ireland: 4C Group UCC, Electricity Supply Board, Sirius, United Technologies Research Centre

Netherlands: BAM

Spain: Fundación CARTIF, Valladolid City Council

UK: NEC

KEY FACTS

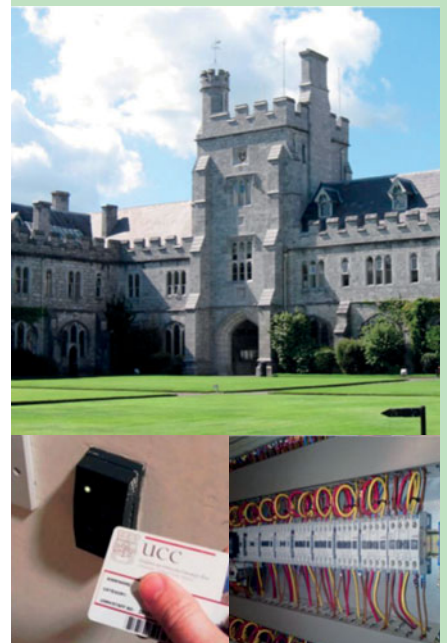
Start date: September 2011

Duration: 36 months

Budget: €3.9m

- CAMPUS21 will develop a hardware/software platform and demonstrate cost-effective and high-performance savings on distinct public demonstration sites

<http://zuse.ucc.ie/campus21/>



ICT for energy-efficient airports

Airports consume as much energy as small cities. CASCADE project will help to reduce their energy needs by developing an ISO 50001 Energy Management Action System, supported by advanced Fault Detection and Diagnosis (FDD).

Overview

Airports are responsible for a considerable amount of energy consumption and CO₂ emissions: the typical electricity consumption of a major airport lies between 100-300 GWh/year which amounts to the consumption of 30,000 to 100,000 households. Airport managers have to cope with complex buildings and advanced ICT and energy systems.

At the same time, they are under pressure to save energy and reduce their CO₂ emissions. New ICT solutions capable of integrating with various existing systems are needed to improve the energy monitoring of airport buildings.

A significant part of the energy consumption results from poor performance of energy systems like chillers, air handling units and lightings. Currently operating Building Automation and Management Systems are often not designed to perform a detailed energy monitoring by detecting faults at an early stage, leading to energy losses. The CASCADE project develops a new ISO 50001 Energy Management System supported by FDD that can integrate with existing systems for the reduction of energy consumption and CO₂ emissions of energy systems at airports.



Malpensa Airport

Objectives

The objectives of the CASCADE project are:

- Engage the airports, determine their needs, collect data on their operation and equipment to characterise their energy operation and to identify savings potentials
- Develop and integrate ICT technologies with existing energy systems
- Apply FDD algorithms coupled to an ISO 50001 Energy Management System that links actors and actions
- Reach 20% energy savings on targeted systems and a three years ROI
- Develop, implement and validate the solution in two big airports: Roma Fiumicino and Milano Malpensa

Expected deliverables

The main deliverable of the CASCADE project is an ISO 50001-based Energy Action Management System supported by FDD algorithms. This tool will integrate existing ICT solutions as well as new features and will be tested and validated at both pilot airports.

A targeted review of airport energy operation at both macro and pilot levels will be delivered in the first year and will set the baseline for the implementation of the CASCADE solution. Methodology and replication plans will be delivered to achieve a high impact and leverage on the support from Airport Council International Europe which provides a direct exploitation channel to over 400 European airports.



PARTNERS

Coordinator: Fraunhofer ISE, Germany

Germany: PSE AG.

Ireland: Enerit Limited, National University of Ireland, Galway

Italy: Aeroporti di Roma Spa, D'Appolonia S.p.A, SEA, Sensus Mi Italia S.r.L

Serbia: Institut Mihajlo Pupin

KEY FACTS

Start date: October 2011

Duration: 36 months

Total budget: €3.8m

- Up to 20% energy savings can be achieved at airports through innovative ICT solution
- CASCADE technology is demonstrated at two major airports: Roma Fiumicino and Milano Malpensa
- Results can be replicated to other airports or buildings

www.cascade-eu.org

IREEN

ICT Roadmap for Energy Efficient Neighbourhoods

The project will examine how technology can be used for energy efficiency and improved performance in neighbourhoods. The project will develop a roadmap for ICT-enabled energy-efficient neighbourhoods, taking into account buildings, transport, energy production and distribution.

Overview

IREEN is intended to be a contributor to the EU leadership in ICT-enabled energy efficiency through intelligent solutions. It will support the achievement of Europe's objective to save 20% of energy consumption by 2020 by widening take up of ICT-based energy systems and services for the future energy-neutral and energy-positive buildings.

The project aims to deliver a comprehensive strategy for European-scale innovation and take-up in the field of technology for energy efficiency and performance for large areas including neighbourhoods and extended urban/rural communities. It will examine ways in which energy-positive buildings, and by extension districts and neighbourhoods can be developed. Energy positive is the capacity to generate more power than needed by consuming low-energy or reduced energy over the life-cycle.

As well as identifying multidisciplinary stakeholders and partnerships, looking at drivers and gaps, operational support and future policies, the project will develop a roadmap. The roadmap will link and prioritise actions through the innovation life-cycle. An Advisory Experts Group from across Europe will work with the project consortium to

validate the outcomes as well as acting as a catalyst for implementation.

Implementation is through:

- Engaging European and other international experts and stakeholders in real and virtual hearings. The project will host collaborative workshops on the continuous elaboration and assessment of the innovation strategy and roadmap with experts and stakeholders representing the entire value-chain.
- Working with the IREEN Expert Advisory Group.
- Supporting the Smart Cities European Innovation Partnership.
- The production and dissemination of results describing state-of-the-art supply-side solutions and best practices, demand-side visions and scenarios, and step-by-step user-driven and business-oriented implementation.
- The assessment and validation of project results by stakeholder communities, prioritisation of research, experimentations and pilot projects, take-up and deployment in the market and standardisation activities.

Objectives

The objective is to develop a comprehensive strategy for European-scale innovation and take-up in the field of ICT for energy efficiency and performance in large areas.

Expected deliverables

A roadmap for the use of technology in energy-efficient neighbourhoods.

PARTNERS

Coordinator: Manchester City Council UK

Austria: Austrian Institute of Technology

Finland: Technical Research Centre of Finland - VTT

France: Centre Scientifique et Technique du Bâtiment - CSTB

Netherlands: City of Amsterdam

Spain: Atos Origin, Acciona Infraestructuras, D'Appolonia S.p.a -DAPP

KEY FACTS

Start date: September 2011

Duration: 24 months

Total budget: €1.5m

www.ireenproject.eu



The KnoholEM project focuses on the development of knowledge-based energy management and control of buildings via the use of BIM, in order to create real-time 'building in the loop' visualisation and management systems for facilities managers.

Overview

The KnoholEM project reduces energy consumption of buildings by intelligently interlinking it to building and specific processes and use cases, to the energy-consuming (and producing) devices as well as to specific users and user energy-consuming behavior. The solution synchronises M&E devices with occupancy of the premises and the outdoor weather conditions, in order to identify energy-wasting and energy-saving potential. Accordingly, the intelligent energy management solution will have a graphic representation of the 3D-geometry and interior of the respective office environment, to increase its usability and user friendliness.

The solution shall be applicable in any type of public building in different European countries and shall be run-able on real-time hardware controllers installed in the building.

The intelligent energy management framework to be engineered in this project will achieve energy efficiency through:

- Avoidance of energy wasting (as it is caused, for example, by superfluous illumination, heating or cooling, or simultaneous heating and cooling)
- Intelligent coordination of building facilities (like the combination of sunblind adjustment with ventilation or air conditioning utilisation), as well as by
- Optimisation of the building's total power consumption through intelligent coordination of the entirety of building activities and use cases that take place in the building's facilities.

Objectives

The objectives of this project are to develop a functional energy-oriented building model complemented by a corresponding generic building ontology and specific building behavioural models for each of the demonstrator projects completed by a building-specific ontology. This will be achieved by definition and engineering of hardware and firmware for real-time communication and optimisation of energy in building, development of interactive virtual reality smart building simulator and user-in-the-loop management system. Delivery of KnoholEM application to five buildings to show-case the solutions and validate the resultant energy savings

Expected deliverables

- Develop standardised building and user interactive functional models
- Further development of energy-friendly IFC specification
- Development of specific building models
- Development of control algorithms
- Development of control hardware to embed data models
- Development of real-time building in the loop control for energy managers
- The KnoholEmM solution will be applied to five demonstration buildings in Spain and the Netherlands
- Significant reduction of energy consumption
- Knowledge base for intelligent energy management systems
- Integrative building life-cycle view for a seamless building model



PARTNERS

Project Coordinators: BRE (Building Research Establishment), Wales, UK, KIT (Karlsruher Institute of Technology), Germany

Germany: SEZ (Steinbeis Innovation gGmbH), Stuttgart

Ireland: TCD (Trinity College Dublin)

Italy: CETMA Brindisi, Matrix Spa Conversano, Tera S.R.L. Conversano

Netherlands: WSZ (Woningstichting de Zaligheden), Eersel, HHS (Haagse Hogeschool), The Hague, SH (Stichting Smart Homes), Eersel

Spain: ISOTROL Sevilla, BDigital, Barcelona

UK: CU (Cardiff University), Cardiff

KEY FACTS

Start Date: September 2011

Duration: 36 months

Budget: €4.5m

- BIM based energy management solution for buildings
- Development of real time user in the loop energy management system
- Reduction of 20% of energy-consumption via the application of the KnoholEM solution

www.knoholem.eu



Sounds for Energy-Efficient Buildings

The project will develop and deliver a prototype to optimise the Building Management Systems (BMS).

This will be achieved by acquiring, identifying, monitoring, and adding the parameter of 'occupancy level' in buildings and surroundings in order to optimise consumptions of energy for HVAC, lighting and other existent production and consumption systems, maintaining users' comfort.

This will be executed through the integration of a low-cost novel network of audio sensors with other building sensing and controls and the improvement of the strategies and algorithms of automation and conditioning. These will be deployed, calibrated and validated in two shopping malls and one international airport in real operational situations. These will demonstrate that energy savings and benefits justify the investment, providing new market solutions and supporting reduction of climate change.

Overview

Energy efficiency is one of the keys to achieve reduced CO₂ GHG emissions and the fact that the construction market, in which residential and non-residential buildings is the largest economic sector, is the highest energy consumer in the EU (about 40%). HVAC systems, together with street and commercial lighting account for more than 60% of electricity usage in office buildings within the EU. In this context, the S4EeB project builds a simple and cheap sound-based ICT solution for energy-efficient Buildings.



Shopping Centre Madrid

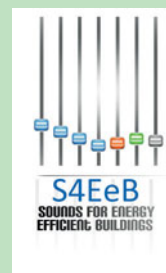
Objectives

The project aims at conducting systematic development and integration of tools for monitoring and processing sounds and noises for an accurate determination of the types of occupancy and activities inside and outside smart buildings in order to improve the Building Energy Management systems, optimising the energy-efficiency in buildings.

Expected deliverables

The S4EeB website was published, deliverables including in WP2: Specifications and requirements and WP3: Building sensing for occupancy monitoring, are under development.

A methodology for developing the simulation models of the zones where the S4EeB platform will be implemented was delivered.



PARTNERS

Coordinator: Solintel M&P, Spain

Austria: Austrian Institute of Technology

Germany: Fraunhofer Institute for Digital Media Technology, Institute for Microelectronic & Mechatronic Systems

Italy: D'Appolonia SPA, Società per Azioni Esercizi Aeroportuali

Netherlands: CORIO N.V.

KEY FACTS

Start Date: October 2011

Duration: 36 months

Total Budget: €3.95m

- S4EeB will develop a prototype to optimise the existent BMS by means of adding the occupancy level in buildings and surroundings, improving the energy-efficiency in buildings
- The S4EeB platform will integrate HVAC and lighting systems, will interoperate with other ICT-based subsystems and will be capable of learning from previous operations and situations. The control and management of automation systems will be based on advanced algorithms
- S4EeB will record and report the control operations, quantify the energy savings, total cost of operation, CO₂ footprint reduction and calculate the return of investment and pay-back of the investment

www.s4eeb.org



Self learning energy-efficient buildings and open spaces

The project develops a novel self-learning energy-efficient buildings and open spaces facility management system-particularly suitable for retrofitting of existing buildings. The system will allow buildings to maintain user comfort whilst minimising energy consumption and CO₂ emissions.

Overview

SEEDS project aims to improve energy efficiency in new and existing buildings, which encompasses the most diverse, largest and most cost-effective mitigation opportunities in buildings. ICT tools for the management of energy use in buildings and open spaces will be developed to achieve such energy reduction goal.

Objectives

This project develops an innovative Building Energy Management System (BEMS) suitable for buildings and group of buildings and surrounding open spaces. The main objectives are:

- Development of a modelling methodology for a wide spectrum of building types and energy systems and subsystems
- Development of behaviour models for different energy systems and subsystems
- Development of a network of Wireless Intelligent Sensors and Actuators (WISA) and implementation of communication middleware and configuration for the WISA
- Development and refinement of any time self-learning and optimisation algorithms able to cope with the requirements of energy management systems

- Validation of the technologies in two validation pilots: an office building in Madrid (Spain) and part of University of Stavanger campus (Norway).

Expected deliverables

Deliverables can be broken into nine work packages:

WP1: 'Requirement analysis and building design' sets the basis for future developments.

WP2: 'System behavior models and library generation' provides several deliverables focusing on the modeling methodology and energy control strategy and including a model library.

WP3: 'Wireless intelligent sensors and actuators network (WISAN)'.

WP4: 'WISAN communication infrastructure' provide reports and prototypes on sensors/actuators nodes suitable for building monitoring and control.

WP5: 'Self learning and global optimisation' provides several deliverables on the development of self-learning and optimisation algorithms for the energy modeling and management of buildings and surrounding open spaces.

WP6: 'Graphical User Interface (GUI)' produces and issues deliverables on the prototype to allow the user communicating with energy models, sensors/actuators and control strategy as well as other control systems that may be in the building.

WP7: 'Validation of the technologies.

Case studies' produces a report describing the results achieved in each validation pilot.

WP8: 'Energy balance and environment impact', looks at best practice and lessons learned on validation methodology and impact assessment.

WP9: 'Dissemination and exploitation plan' provides the website and reports on dissemination and exploitation activities.

PARTNERS

Coordinator: Cemos, Spain

Germany: Fraunhofer IIS/EAS, NSC GmbH, FASA AG

Norway: University of Stavanger

Spain: Software for Critical Systems, Fundacion Cidaut, Ferrovial Agroman S.A.

UK: University of Salford

KEY FACTS

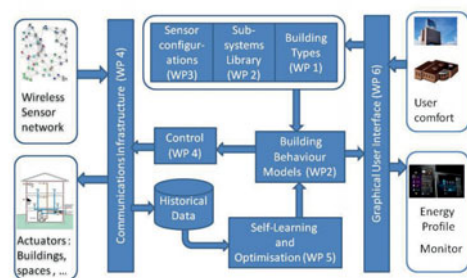
Start date: September 2011

Duration: 36 months

Total budget: €4m

- Develop Building Energy Management Systems for retrofitting of buildings and districts
- Implement innovative behaviour modelling based on measurements, self-learning and statistics
- Use of optimisation and self-learning techniques both in the energy system modelling and in the control strategy
- Use of wireless technologies and communication middleware

www.seeds-fp7.eu



SUS-CON

The project aims at integrating waste materials in the production cycle of concrete, for both ready-mixed and pre-cast applications. The result is an innovative light-weight, eco-compatible and cost-effective construction material, made by all-waste raw materials and characterised by enhanced thermal insulation performances, low embodied energy and low-carbon footprint.

Overview

The concrete industry plays a pre-dominant role in the huge environmental impact of the Construction sector. The binder is responsible for high energy consumption and CO₂ emissions, while the aggregates have the highest impact on the concrete thermal resistance which, in turn, heavily affects the energy consumption of the building in service.

Preliminary test results demonstrated the possibility, on the one hand, to reduce the embodied energy and CO₂ footprint of concrete by totally replacing the current binders by novel ones (geo-polymers). The geo-polymers are made of waste or by-products only to produce light thermally-efficient aggregates completely composed of waste.

This framework led to the SUS-CON project idea of boosting and linking the two research lines (binders and aggregates), developing an innovative light-weight all-waste concrete, on the basis of a new design model, based on particle packing optimisation routine.



Objectives

The main goal of the project is to develop novel technologies to integrate wastes in the production cycle of lightweight concrete, acting on both the main concrete components (binder and aggregates).

The result is an all-waste and energy-efficient material for both ready-mixed and pre-cast applications. The focus will be on waste materials that are currently causing huge socio-economic problems and which are, at the same time, available in quantities large enough for feeding the concrete industry. This will lead to improve the sustainability and cost-effectiveness of concrete, as well as reducing the environmental/social impact of waste.

Expected deliverables

The project objectives will be achieved through intermediate deliverables including:

- EU overview of the candidate waste materials
- Efficient processes to produce light-weight concrete aggregates from the different solid-waste materials
- Technology for complete substitution of Portland cement with waste alternative binders
- Design methodology for all-waste concrete
- Working procedures
- Pilot plants
- Decision-support tool
- Application guidelines



PARTNERS

Coordinator: CETMA, Italy.

Germany: BASF, Fraunhofer IBP.

Greece: National Technical University Of Athens, S&B Minerals.

Italy: Centro Riciclo Vedelago, Magnetti Building, TUV Italia, Consorzio TRE

Netherlands: TNO.

Portugal: CeNTI.

Romania: Iridex.

Spain: Acciona.

Taiwan: National Taiwan University of Science and Technology.

Turkey: Iston

UK: Queen's University of Belfast.

KEY FACTS

Start date: January 2012

Duration: 48 months

Total budget: €7.2m

- Candidate waste materials: municipal solid waste, tyres, WEEE, ashes, sludges, slags, etc
- LCA approach throughout the whole project development.



Effective Integration of seasonal thermal energy storage systems in existing buildings

The project aims to develop low-energy heating system based on renewable energy and high-efficient generation technologies for existing buildings. The project is focused on Seasonal Thermal Energy Storage (STES), which will make possible to drastically reduce primary energy consumption of buildings.

Overview

Energy use in buildings accounts for approximately 40% of EU energy consumption. Energy efficiency in new buildings is important, but existing building stock is the main target. Existing buildings, however, are characterised by particular requirements and constraints that are not present in new buildings and that require new developments and adaptation of existing technologies.

In order to fulfil the most recent EU directives, solutions for a drastic reduction in primary energy consumption are required. Space heating and domestic hot water (DHW) represent the largest part of energy use in buildings nowadays, thus solar thermal energy seems to be one of the most promising heat source. Seasonal storage is the only way to get high solar fraction values.

Objectives

The overall objective of the project mentioned above is achieved by:

- Technological developments for STES systems adaptation for existing buildings and integration with the built environment

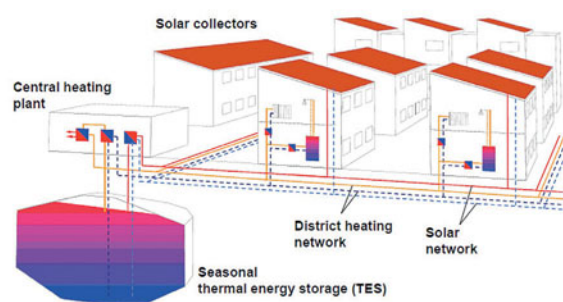
- Development of a novel, high-efficiency, cost-effective and compact heat pump suitable for existing buildings and optimised for higher temperature heat sources such as STES systems
- Development of new business and cost models which consider the entire life-cycle of a building and incorporate the benefits of reduced operating costs; a decision support tool will help the planners to find the best technology to install in each particular case.
- Development of integrated building concept. As cost-effectiveness is one of the main aspects to be considered in building retrofitting, a methodology and a software tool for most cost-effective global energy intervention framework definition for building retrofitting will be developed.

Expected deliverables

Although the project is mainly focused on STES technologies, state-of-the-art passive (building envelope) and active (HVAC) systems for building retrofitting are also analysed. The objective is to develop a methodology for most cost-effective global energy intervention framework definition for retrofitting considering both state-of-the-art and innovative energy solutions.

To develop design guidelines for STES systems for retrofitting applications for all Europe is another deliverable of the project. All the results obtained from the research work carried out within the project will be included in a Decision Support Tool. It will be a useful tool for stakeholders for selection, design and evaluation of STES systems.

Two pilot plants will be designed and built: one in Spain at building level and another one in Poland at district level.



PARTNERS

Coordinator: Tecnalia, Spain

Bulgaria: Architectural Spies

Germany: Solites

Italy: D'Appolonia, Icop

Netherlands: TNO

Poland: Mostostal, Cim-mes, MAE

Spain: Acciona, Airlan, Girotze, Fomento San Sebastian, Arteaga Foundation

Sweden: Scandinavian Homes

UK: University of Ulster

KEY FACTS

Start date: January 2012

Duration: 48 months

Total budget: €9m

- Develop low-energy heating system for existing buildings to drastically reduce primary energy consumption.
- Explore heating system based on Seasonal Thermal Energy Storage (STES) in combination with high-efficiency heat pumps.
- Construct two pilot plants at building and district level.

www.einstein-project.eu

HEAT4U

Gas absorption heat pump solution for existing residential buildings

The HEAT4U project main concept is to further develop the Gas Absorption Heat Pump (GAHP) technology to allow its cost-effective application in existing residential buildings. The proposers have identified in the GAHP a technology that can effectively contribute to address the European demand for reduction of energy consumption and environmental impact in existing residential buildings.

Overview

Residential buildings represent 60% of the building stock and the area where most of the potential to drastically reduce energy use and CO₂ emissions lies. In order to meet energy efficiency targets, these require acting both on envelope and on energy use systems, mainly heating and DHW equipment that representing 51% of energy use in this sector. Frequently the upgrade of the envelope insulation is subject to constraints and acting on the heating plant is the only viable option. Currently solutions are not always suitable or cost-effective in existing buildings (radiators, DHW, solar radiation in winter).

Therefore to accelerate the improvement in energy efficiency and in the use of renewable energy in the residential building, a specifically designed solution needs to be made available. HEAT4U is an Industry-led project whose main objective is to develop a Gas Absorption Heat Pump (GAHP) solution with efficiency on primary energy of 165% (EN12309) to allow a

cost-effective use of renewable energy in existing residential building for heating and DHW services. The project is conceived to overcome a number of technological and non-technological barriers which currently prevent GAHP application in single-family houses or small multi-storey buildings.

Objectives

HEAT4U main objectives are:

- Development of GAHP Appliance with specifications suitable for the residential market (10 – 25 kW)
- Integration of the GAHP technology in existing heating and DHW architectures
- Field testing, lab testing, modelling and simulation of GAHP technology, enabling the optimal design in different building operating conditions
- Dissemination activity to promote the awareness of the benefits of the GAHP technology

Expected deliverables

Within the different phases of the project, a set of 25 deliverables have been defined. The main outcomes of the project will be: a multi-local parametric analysis aimed at identifying the specific engineering requirements of GAHP Systems for most relevant European homogenous areas. The defined parameters will be used as input in the GAHP Appliance development phase (WP2) and in the GAHP System development phase (WP3), common test protocol for GAHP Appliance and System for lab test and field test, prototypes of GAHP Appliance and GAHP System and reports about performance of GAHP Appliance and GAHP System during lab test and field test, decision Support System tool, for planners and installers, capable to assess the degree of compatibility of GAHP with the proposed heating applications and to provide expected performance figures in terms of economic, environmental, and energy benefits, Risk Assessment Report, Labelling and Certification of the GAHP, Life-cycle Assessment and Life-cycle Cost Analysis

NEW EFFICIENT SOLUTIONS
FOR ENERGY GENERATION, STORAGE AND USE
RELATED TO SPACE HEATING AND
DOMESTIC HOT WATER IN EXISTING BUILDINGS



PARTNERS

Coordinator: Robur SpA, Italy

France: GDF Suez, GrDF

Germany: Bosch thermotechnik GMBH, E. On, Fraunhofer

Italy: Pininfarina, ENEA, Politecnico di Milano, D'Appolonia, CF Consulting

Poland: Flowair

Slovenia: Zavod Za Gradbenistvo Slovenije

UK: British Gas

KEY FACTS

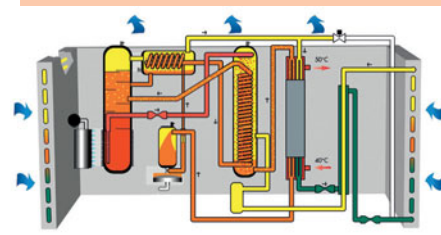
Start date: November 2011

Duration: 36 months

Total budget: €9.5m

- Develop a Gas Absorption Heat Pump (GAHP) solution with efficiency on primary energy of 165% (EN12309) to allow a cost-effective use of renewable energy in existing residential building for heating and DHW services
- Overcome a number of technological and non-technological barriers (awareness, norms, training, etc.) which currently prevent GAHP application in single family houses or small multi-storey buildings

<http://www.heat4u.eu>





Operational guidance for life-cycle assessment studies of the Energy-Efficient Buildings initiative

The European research project EeBGuide develops metrics and guidance for the preparation of Life-cycle Assessment (LCA) studies for energy-efficient buildings and building products. LCA is used to assess the environmental benefits of new technologies. The EeBGuide manuals and guidance will support LCA practitioners to obtain comparative results in their work.

Overview

Current research in the field of energy-efficient buildings develops sophisticated solutions to improve buildings' performances. To assess the degree of improvement, Life-cycle Assessment (LCA) is used as supporting research. In addition to this, LCA may be utilised in early project stages to guide researchers to the environmentally most preferable solutions.

This potential diminishes, if LCA studies are not comparative across project borders and if confidence in the method for decision support is not given. The EeBGuide projects sets guidelines for how to include LCA in research projects, but moreover, how to consistently conduct LCA studies of (both, new and existing) buildings and construction products. To allow for different scopes for the LCA studies, different study types are defined, covering three levels of complexity.

On this basis, provisions how to conduct LCA studies and guidance on how to implement these metrics are developed. The basis for these are

existing standards such as ISO 14040 and 14044, EN 15804 and 15978 and the ILCD handbook. The extensive involvement of LCA experts and an extensive public consultation will assure the quality of the document. The outcome is a contribution to harmonising LCA metrics and will help practitioners to improve the overall quality of LCA studies. Case studies will prove the applicability of this guidance document and training materials will support its dissemination.

Objectives

The objectives of the project are as follows:

- Harmonise standards (ILCD Handbook, CEN TC 350)
- Involvement of all relevant stakeholders to assure acceptance and applicability
- Guidance document that is accepted by practitioners and quality assured
- Broad dissemination among LCA practitioners and industry
- Verification by case studies
- A website as a central information hub on the operational guidance on LCA Interactive guidance document
- Illustrating a way to include LCA in early project stages

Expected deliverables

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

- A list of important LCA aspects for each life-cycle stage
- A final interactive guidance document.
- Several case study results
- A report on findings of case studies.
- Training material in three languages
- Two training courses including feedback evaluation
- Video tutorials, dissemination illustrations and descriptions

PARTNERS

Coordinator: Fraunhofer Institute for Building Physics IBP, Germany.

France: Centre Scientifique et Technique du Batiment

Germany: PE International

Spain: Escola Superior de Comerç Internacional

Sweden: Prof. Ch. Sjöström Consultancy

UK: BRE Global Limited

KEY FACTS

Start date: November 2011

Duration: 12 months

Total Budget: €8m

- Bridges the gap between the different LCA standards and the ILCD Handbook and provides guidance for LCA practitioners
- Applicability is proved by several case studies
- Training materials and templates will support practitioners by following LCA studies

<http://www.eebguide.eu/>



Copyright: Fraunhofer Institute for Building Physics (IBP), Department Life Cycle Engineering, Jan Paul Lindner 2011

SEAM4US

Sustainable Energy Management for Underground Stations

This project aims to reduce energy consumption required for operating the subsystems of underground public spaces, like metro stations. This is achieved through exploring new intelligent technologies that, by means of pervasive sensor networks are able to create rich representations of the environment. They create usage profiles that allow the implementation of proactive and adaptive control policies for subsystems and passengers.

Overview

Underground transportation systems are big energy consumers (e.g. 63,1m kWh/year), and have significant impacts on energy consumption on a regional scale. One third of a networks energy requirement is used for operating metro stations subsystems and surroundings. These include ventilation, vertical transportation and lightning. Although a relatively small percentage of energy can be saved with an optimal management of the aforementioned subsystems, a large energy saving in absolute terms can be obtained.



Objectives

The project's main objective is the optimisation of the energy management of the underground spaces through optimal control. Optimality is achieved by exploiting synergies with the external environmental climate and interaction with end users. SEAM4US technology is based on the ability to predict near-future states of the underground environment.

This allows the implementation of proactive control policies for energy saving. Every 5% energy saving achieved by SEAM4US, in non-traction electricity energy consumption in the Barcelona network in one year, is equivalent to the quantity of electricity consumed in over 1400 households.

Expected deliverables

The project's main outcomes will be the creation of technologies for optimised integrated energy management and the development of a decision support system to drive mid-term investments. SEAM4US will integrate additional energy metering and sensor-actuator networks with existing systems (e.g. surveillance, passenger information and train scheduling), by means of middleware as abstraction layer, to acquire grounded user, environmental and scheduling data. The data set will update and enable a set of intelligent adaptive energy consumption and environmental models to support proactive and optimal control policies of metro stations.



PARTNERS

Coordinator: Cofely Italia S.p.A., Italy

Finland: Teknologian Tutkimuskeskus, VTT

Germany: Fraunhofer- Gesellschaft FIT, University of Kassel

Italy: Università Politecnica delle Marche

Netherlands: Almende

Spain: Universitat Politecnica de Catalunya, Ferrocarril Metropolita de Barcelona

Sweden: CNet Svenska AB

KEY FACTS

Start Date: October 2011

Duration: 36 months

Total Budget: €4.1m

- Development of intelligent technologies capable of adapting to dynamic environments by learning model and control parameters from past experience
- Implementation of a pilot in the Passeig de Gràcia metro station in Barcelona, involving optimal control of ventilation, lighting and passenger movement
- Implementation of solutions that can be scaled up to whole network dimension

<http://seam4us.eu/>

**PARTNERS**

Coordinator: University of Stuttgart, Germany

France: CEA INES

Germany: Fraunhofer IPM, InfraTec GmbH, Schwenk Putz und Mörteltechnik GmbH, TTI GmbH – TGU Smartmote

Greece: S&B Industrial Minerals S.A.

Ireland: DW EcoCo

Italy: Consorzio TRE, RED S.R.L., Stam S.R.L., Università Politecnica delle Marche

Spain: FCC Construcción S.A., Solintel

KEY FACTS

Start date: October 2011

Duration: 36 months

Total budget: €3.5m

- Advanced monitoring of health and comfort related parameters in indoor environments.
- Development of cost-effective active and passive measures
- 3D-simulation models with full integration of air pollutants including sources and sinks
- Strong participation of technological oriented SMEs

www.cetieb.eu

Cost-effective tools for better indoor environment in retrofitted energy-efficient buildings

CETIEB develops cost-effective, innovative solutions for better monitoring indoor environment quality and investigates active and passive systems to improve. The focus lies on developing cost-effective solutions to ensure a wide application of the resulting systems.

Overview

The Energy Performance of Buildings Directive (EPBD) leads to energy-efficient buildings. In the future, net-zero-energy buildings will be the state of the art. However, refurbishment of existing buildings to an energy-efficient standard leads to tight buildings and affects the indoor climate and users are not adapted to this new situation. The air exchange rates could be lower than required if no mechanical ventilation is installed or the system performance is not optimised. There is clearly a need for developing new methods for continuous detection of indoor pollution considering all key factors and for studying and identifying the best systems that allow an efficient control of the indoor environment.



MEMS based micro spectrometer module and spectral response (from InfraTec)

Objectives

CETIEB addresses three main objectives:

- Development of monitoring systems (wireless and/or partly wired) to detect insufficient comfort and health factor. A modular version will be developed to allow end users to make a quick check of the indoor air quality
- Development of control systems for indoor environments which could be based on passive elements like cost-effective photo catalytic materials or phase change materials and active systems which control the air flow rates based on the monitored data. In addition, plant based systems will be tested
- Modelling of indoor environments to assess and validate monitored data and to optimise the control parameters and systems for energy-efficiency

Expected Deliverables

CETIEB main deliverables include:

- Cost-effective and simple to use monitoring systems that allow monitoring a large variety of indoor environmental factors. Systems will include sensors for environmental factors relevant to health and well-being such as the detection of volatile organic compounds
- Active systems to control natural ventilation whilst improving indoor air quality and optimising air flow in buildings
- Novel, cost-effective, nano-functional structured surfaces based on TiO_2 contributing to a cleaner and healthier environment by oxidizing and safely removing air pollutants and pathogenic microorganisms from air and building surfaces
- Provision of 3D-simulation models with full integration of air pollutants including sources and sinks to jointly simulate thermal comfort and health

Integrated air-quality sensor for energy-efficient environmental control

The INTASENSE project aims to develop a low-cost, comprehensive, air-quality monitoring system which can detect the main pollutants that contribute to poor indoor air quality (volatile organic compounds (VOCs), combustion gases and particulates).

Overview

It is estimated that the pollutants responsible for poor air quality cause nearly 2.5m premature deaths per year world-wide. Significantly, around 1.5m of these deaths are due to polluted indoor air, and it is suggested that poor indoor air quality may pose a significant health risk to more than half of the world's population. Due to its link with industrialisation, societal health problems associated with poor air quality disproportionately affects developed and developing nations – it is estimated that air pollution is responsible for the premature deaths of 370,000 EU citizens annually, with average life expectancy reduced by nearly nine months.

The INTASENSE project will integrate a number of micro- and nano-sensing technologies onto a common detection platform with shared air-handling and pre-conditioning infrastructure to produce a low-cost miniaturised system that can comprehensively measure air quality, and identify the nature and form of pollutants.

Objectives

- To combine advanced detection technologies to produce an air quality sensing system with advanced capabilities to provide low-costs comprehensive monitoring of key airborne pollutants

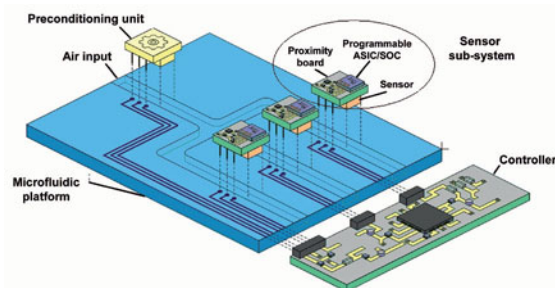
- To develop a smart air-quality sensing system that can interface intelligently with existing ventilation and air treatments systems to optimise energy efficiency while maintain acceptable air quality
- To improve the health, quality of life and productivity of EU citizens by providing the means to limit citizens' exposure to poor-quality indoor air

Expected Deliverables

There are 25 formal Deliverables associated with the INTASENSE project.

Broadly these can be divided into three main groups:

- Hardware deliverables; early hardware deliverables are the individual prototype sensor modules for VOC and combustion gas detection and the prototype particulates detection module and the support platform for servicing these modules (due month 18). These are combined into a prototype laboratory unit with wireless capability (month 21). This forms the basis for the final demonstration unit for us in field trials (reported Month 36)
- Specification, design and regulatory deliverables; these are mainly reports supporting the hardware development within INTASENSE. Early deliverables are associated with an assessment of regulatory drivers, establishment of key target pollutants and setting performance specification for the prototypes. Later deliverables are associated with risk and impact assessments
- Dissemination, exploitation and management deliverables; these are deliverables which support the smooth delivery of project activities and ensure that the project outputs are disseminated and to support the future commercialisation and exploitation of project results



PARTNERS

Coordinator: C-Tech Innovation Ltd UK

Germany: Technische Universität Ilmenau
Institut für Mikro- und Nano-technologien

Netherlands: U.C. Technologies BV

Spain: Centro de Estudios e Investigaciones Técnicas (CEIT), Advantico Sistemas y Servicios

Switzerland: Centre Suisse d'Electronique et de Microtechnique S.A. (CSEM)

UK: Gooch & Housego (Torquay) Ltd, Lancaster University

KEY FACTS

Start date: October 2011

Duration: 36 months

Total budget: €3.3m

Key facts of project:

- Exposure to poor indoor air quality predominately affects developed and rapidly developing economies and is thought to be responsible for around 1.5m premature deaths world-wide
- Remediation action to improve indoor air quality is often relatively easy to implement particularly in energy-efficient buildings where air flow is carefully managed
- The INTASENSE air quality monitor will detect key individual pollutants from each of the main pollutant categories – VOCs, combustion gases and particulates

www.intasense.eu

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