Energy-efficient Buildings
EeB PPP Project Review

December 2014

European funded projects under EeB PPP (2010-2013)

PREPARED BY

[Logos]
I am pleased to introduce the fourth edition of the EeB PPP Project Review. This publication presents the progress of 110 funded projects* within the EeB PPP under the 7th Framework Programme (FP7) for 2010, 2011, 2012 and 2013.

The Energy-efficient Buildings (EeB) Public Private Partnership (PPP) is a joint initiative of the European Commission (EC) and the Energy Efficient Buildings Association (E2BA) which span out of the European Construction Technology Platform (ECTP). This initiative aims to promote research on new methods and technologies to reduce the energy footprint and CO\(_2\) emissions related to new and retrofitted buildings across Europe. The EeB PPP was set up under FP7 and recognises the importance of research in Europe to achieve Europe’s targets of job creation and competitiveness, and to maintain leadership in the global knowledge economy. During Horizon 2020, a contractual PPP has been agreed between the E2BA and the European Commission to continue investing in research and innovation.

This edition of the EeB PPP Project Review aims to highlight the current and potential impact of the projects that are currently running. It illustrates the diverse research approaches and the importance of developing all aspects of the building sector as we strive towards our 2020 goals for energy and carbon emissions. The research projects respond to EU priorities for new technologies, tools and systems, materials, information and communication technologies and retrofitting and renovation methodologies in order to achieve energy-efficient buildings. The projects demonstrate scientific and technological excellence across all levels from early stage conception through to demonstration of the potential for commercialisation. This edition includes 34 new projects responding to the 2013 FP7 call, which are presented in this edition after the projects responding to the 2010-2011-2012 FP7 calls.

The E2BA strives to realise the vision of creating a high-tech building industry that turns energy efficiency into a sustainable business. In line with Horizon 2020, the EeB PPP aims to develop ground-breaking, affordable solutions at building and district scale, connecting to future smart cities and major European initiatives. They should also maximise impact for the users and society as a whole.

We hope this Review will be interesting and informative and that the holistic approach taken by the EC and industry towards achieving an energy efficient building sector will inspire readers.

**Emmanuel Forest**
President of the Energy Efficient Buildings Association (E2BA)

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* 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.
## Projects from 2010, 2011 and 2012 Calls

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## Projects from 2013 Call

### Design, decision and support tools for energy efficient buildings, districts and cities

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- Design4Energy
- ECODISTR-ICT
- eeEmbedded
- FASUDIR
- HOLISTEEC
- READY4SmartCities

### Nanotechnology-based and advanced materials for energy efficient buildings

- ADAPTIWALL
- BRIMEE
- ELISSA
- FoAM-BUILD
- MF-Retrofit
- SESBE

### Solutions for healthier indoor environment in energy efficient buildings

- ECO-SEE
- H-HOUSE
- OSIRYS

### Deep energy renovation of existing buildings

- A2PBEER
- BRICKER
- CommONEnergy
- EcoShopping
- RESSEEPE

### Energy performance monitoring and management of energy efficient buildings

- Energy IN TIME
- PERFORMER
- TRIBUTE

### Energy performance monitoring and management at district and city levels

- CITYOPT
- CoSSMic
- DIMMER
- e-balance
- STREAMER

### Deep energy renovation of districts and smart energy efficient solutions for cities

- CITYFiED
- INDICATE
- SINFONIA
Projects from 2010, 2011 and 2012 Calls
HESMOS
ICT platform for holistic energy efficiency simulation and lifecycle management

Public use facilities built and operated as public-private partnership projects provide unique opportunities for energy savings and carbon reduction due to the close, long-term client-contractor relationships which enables the design, construction and operation to be understood as a holistic lifecycle. However, the highly disruptive information flows currently collected from multiple sources provide substantial barriers in achieving more efficient results for energy optimisation. The industry requires interoperable engineering tools for energy and cost simulation studies for any stage of the building lifecycle, in order to help with decision making.

HESMOS uses integrated design facility management and sophisticated energy performance simulation to achieve an industry-driven holistic approach for the optimisation of energy performance and carbon emission reduction, whilst balancing investment, maintenance and reinvestment costs.

It aims to close the gap between Building Automation Systems (BAS) and Building Information Modelling (BIM) based energy simulations and performance management applications so that complex simulations can be created in multiple lifecycle phases, from early design to facility operation and refurbishment. This will be achieved by integrating a web-based Integrated Virtual Energy Lab (IVEL) which will provide energy simulations and performance monitoring. Ensuring interoperability between energy tools, BIM and cost calculation tools on the basis of a common information framework will extend current BIM capabilities to an energy enhanced multi-model (eeBIM).

ICT4E2B Forum
European stakeholders’ forum to explore further research and integration of ICT systems for energy efficiency in buildings

The ICT4E2B Forum project brought together all the relevant stakeholders involved in ICT systems and solutions for energy efficiency in buildings in order to achieve EU climate and energy objectives.

The identified project community reviewed the needs of ICT in construction in terms of research and system integration and developed the ICT4E2B’s Forum Technology roadmap. The roadmap will ease the implementation of innovative solutions and facilitate the sharing of best practice across Europe.

The ICT4E2B Forum project provided a better understanding of the importance of ICT in improving energy efficiency in buildings. It demonstrated the value of ICT systems in providing continuous and precise information to decision makers.

The project aimed to encourage closer dialogue and more active cooperation between researchers, end-users, practitioners, building owners, technology suppliers, and software engineers. The work carried out built on previously completed research from the REEB project. The intention was to update the existing REEB roadmap which consisted of a vision Strategic Research Agenda (SRA) and an Implementation Activity Plan. The roadmap was developed through workshops, community building activities and web-based questionnaires. A significant group of stakeholders was involved in these development stages. Results from the ICT4E2B project were disseminated and over 16 000 people were reached. The project mobilised a €500 000 investment from project partners.
EeBGuide

Operational guidance for life cycle assessment studies of the energy-efficient buildings initiative

Current research in the field of energy-efficient buildings has resulted in a number of solutions to improve building performance. A Life Cycle Assessment (LCA) is often used to assess the degree of improvement that these solutions bring. However, the reliability of LCAs is questionable if studies are not comparable and if the method for decision support is not backed up with suitable evidence. The EeBGuide project has developed guidance for the preparation of LCA studies for energy-efficient buildings and building products based on existing standards, guidelines and the International Reference Life Cycle Data System Handbook. The EeBGuide provides pragmatic and relevant guidance to practitioners and construction experts on how to move forward in the field of LCA towards comparative, meaningful results both within individual studies and across them. The focus of the EeBGuide particularly concentrates on case studies and operational guidance for easy application.

All outcomes were critically reviewed by independent external reviewers and a public consultation was held to ensure quality. The core elements of the guide were published as an interactive, web-based tool. This online tool has been visited by more than 18,000 people since the project was completed. LCA software companies have been consulted in order to implement parts of the EeBGuide. The EeBGuide provides a bridge between research and LCAs in the construction sector.

GE\textsuperscript{2}O

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

Buildings account for 40% of Europe’s energy use and a third of its greenhouse gas emissions. Improving energy efficiency measures in the built environment is therefore of great importance in responding to climate change and EU 2020 goals. In this framework experts acknowledge that relevant stakeholders, such as large industrial players, SMEs, research centres, NGOs etc., must be brought together to work in close cooperation. The imperative to adapt energy-efficient solutions to regional and local scales is also recognised.

The GE\textsuperscript{2}O project aims to develop a geo-cluster mapping tool consisting of a multi-dimensional and dynamic Geographic Information System (GIS) in order to help identify similarities across the EU. The tool enables its users to combine single or multiple parameters, organised in homogeneous layers and sub-layers which address both technological and non-technological aspects. By combining various parameters, users will be able to identify virtual trans-national areas where strong similarities are found in terms of climate, construction typologies, energy prices and regulations.

In addition, the project strives to establish stakeholder communities across identified European, virtual, transnational areas that are interested in the continuous growth and exchange of structured information. GE\textsuperscript{2}O also seeks to develop an extensive shared workspace and a knowledge repository to support networking among these communities.
IREEN
ICT roadmap for energy-efficient neighbourhoods

IREEN envisions neighbourhoods using smart, efficient systems to distribute and manage energy in order to maximise environmental and social benefits for all users. Sustainability is the ultimate goal as cities struggle with climate change and energy demand. In addition, cities face changes in population, demographics, congestion and pressure on key resources. To succeed in the future, communities will need systems that maximise opportunities offered by ICT that can support energy-efficient neighbourhoods. The IREEN roadmap demonstrates the ways in which technology can support energy efficiency decisions at a neighbourhood level and contribute to the sustainability agenda. It is a research and strategy document aimed at informing future policy and programmes.

The roadmap makes a series of recommendations with the intention of guiding stakeholders towards key areas of development. These include the simulation, modelling, analysis, monitoring and visualisation of entire districts; data analytics and the integration of “big data”; energy brokering; neighbourhood management systems; models for performance metrics; assessment models, including economic analysis; tools for management and integration and sharing of power from renewable energy sources and interconnection to smart grids; advanced control systems to balancing loads; and methods to estimate and validate the impacts of ICT on energy efficiency.

Energy efficiency is paramount in ensuring the energy security and sustainability of Europe. While the enabling role of ICT is clear, understanding which technologies are best positioned to deliver meaningful impact is less so. REViSITE brings together a multidisciplinary community to promote cross-sectoral ICT-enabled Energy Efficiency (ICT4EE) have positive impact on sustainability goals and to identify research priorities. The community engaged more than 100 experts across four sectors; grids, manufacturing, buildings, and lighting.

To provide a common means of assessing the impact of ICTs on energy efficiency a SMARTT taxonomy was established. This comprised six high-level categories and 23 sub-categories covering the scope of the ICT4EE domain. It enabled quantified assessments of energy usage to be made and flagged areas for improvement.

A Strategic Research Agenda (SRA) was created to help transfer learnings from one sector to another. It consisted of six ‘roadmap’ tables aligned to the SMARTT categories and sub-categories and an implementation action plan. This plan focused on identifying potential call themes and stakeholder-specific actions. Recommendations for standards were made to help overcome interoperability barriers, with a focus on specific actions of relevance to Standards Organisations. These were identified as paramount issues for realising the potential offered by ICT.
NewBEE

Novel business model generator for energy efficiency in construction and retrofitting

NewBEE is developing an innovative methodology and ICT platform to support energy efficient retrofitting projects by Small and Medium Enterprises (SMEs). NewBEE will support SMEs by providing access to competitive knowledge about emerging retrofitting technologies. It proposes new organisational and business models to allow construction SMEs to create an alliance of stakeholders. This will enable them to compete with large contractors.

NewBEE’s ICT solution includes a marketplace, pre-assessment tool, energy performance assessment and business model assessment. 

• The marketplace helps organise and maintain collaborative business networks. It enables building owners to place calls for proposals and SMEs to identify retrofitting opportunities.

• The pre-assessment tool helps building owners evaluate a range of relevant technologies that are available and estimates their costs and possible financing implications. This will enable technical and financial options to be evaluated in order to minimise the payback period and maximise the return on investment.

• The energy performance assessment assists professional users by providing a detailed assessment of the technologies and financial options available for a particular scenario, taking into account the building type, financial models and country-specific issues.

• The business model assessment helps SMEs improve their business strategy by allowing them to search for good business concepts and models. It also provides a step-by-step guide on how to develop a business model.

PROFICIENT

Collective self-organised housing

Collective Self-Organised (CSO) housing refers to a group of people who act together to organise the processes for the formation, requirement definition, planning, design, implementation and maintenance of their own housing project. PROFICIENT responds to this rapidly increasing EU-wide trend in order to boost the quality and the scale of energy-efficient buildings. In the CSO process, the long-term impact of energy-efficient buildings is guaranteed by the end-users’ own awareness and commitment to a sustainable, built environment. It also provides new business opportunities for Small and Medium Enterprises (SMEs), acting as alternatives to large construction companies.

PROFICIENT aims to facilitate energy-efficient CSO housing, by helping to organise CSOs and SMEs, and bring them together in an e-marketplace. The e-marketplace will be imbedded in a web-based CSO housing platform and will offer tools for both CSOs and SMEs. It will also provide business models for Energy Services Companies (ESCOs). Project outcomes will be empirically validated through contacts with local and national projects, such as Lancaster Cohousing in the UK, energy-neutral districts in the Netherlands, and the sustainable refurbishment of high-rise residential building complexes in Hungary and the Czech Republic. Impact will be assured by the establishment of Communities of Practice, through which project results will be disseminated.
UMBRELLA
Business model innovation for high performance buildings supported by whole life optimisation

UMBRELLA will address the organisational issues and barriers, in the context of sustainability within the built environment through a user friendly and intuitive web decision support tool. The web tool will offer energy-efficient solutions together with adaptable business models to suit the bespoke needs of the user and their specified building. This can be applied to any building at any stage of design or use. The tool will be designed with two offerings: a free version and a commercial version. The free version will offer a limited selection of solutions using template building typologies. The commercial offering will take the user beyond the basic analysis, delving into more complex scenarios and will recommend solutions based on a very detailed and accurate representation of the user’s building.

For a greater socio-economic impact, specific countries will be targeted based on the floor area per country. The selected countries, in order of floor area, are Germany, France, the United Kingdom, Italy, Spain and Poland. UMBRELLA will target 2% of the EU building stock within 5 years of the commercialisation of project deliverables. This will result in an increase in the market share of energy-efficient solutions of 15% within five years and will result in CO2 reductions of 3.096 Mtoe per year.

KEY FACTS
Start date: September 2012
Duration: 36 months
Total budget (€): 3.9M
Website: www.umbrella-project.eu
Coordinator: IES, UK

AEROCOINs
Aerogel-based composite/hybrid nanomaterials for cost-effective building superinsulation systems

In the context of global climate control policies, improving the energy efficiency of existing buildings presents a major challenge worldwide. The AEROCOINs project aims to use super-insulating aerogels to reduce heating and cooling demands in existing buildings. It will contribute significantly to the realisation of future goals focused on reducing energy consumption.

The main goal of AEROCOINs is to develop a new class of aerogel-based material to improve the thermal insulating performance of buildings and which can be handled on construction sites. The innovative combination of sol-gel science and nanotechnology can greatly advance the design and development of novel super-insulating aerogels.

The AEROCOINs project has successfully created a new strategy for the preparation of mechanically reinforced aerogel-based materials that are thermally super-insulating, An ambient drying process for large aerogel boards has been developed and a prototype for a novel building component based on the developed aerogel-like material has been designed and fabricated. The component should be compatible with conventional construction installations where the envelope is part of the buildings. The thermal as well as the structural and mechanical performance of the component will be demonstrated under real conditions.

KEY FACTS
Start date: June 2011
Duration: 48 months
Total budget (€): 4.3M
Website: www.aerocoins.eu
Coordinator: TECNALIA, Spain
The COOL-Coverings project aims to develop a novel and cost-effective range of nanotechnology enabled insulation materials to improve the energy efficiency of buildings. The technical strategy consists of developing nanotechnologies that significantly improve the Near Infrared (NIR) reflection capabilities of existing covering products for roofs and facades while maintaining the traditional colours.

The "Cool" materials, with enhanced reflecting and emitting properties, will guarantee several benefits for building owners and the environment. These include a reduction in cooling energy demand and energy peaks, an improvement in indoor comfort and material durability, and the mitigation of the urban heat island phenomenon.

The innovative range of multifunctional nano-based materials for the building envelope with improved NIR reflectance (+30%), includes ceramic tiles; acrylic paints with additional functions such as water repellence, lower thermal conductivity and improved algae resistance; bituminous membrane with improved algae resistance, waterproofness, lightness and mechanical resistance.

The portfolio is the result of a partnership between leading researchers and industrial players, with the aim of developing and demonstrating a range of innovative products for the building industry. The consortium has extracted expertise from industrial and research partners in order to obtain a full characterisation of the aforementioned materials in all aspects ranging from risk assessment and performance evaluation (thermal properties, durability etc.) to economical and sustainability analysis (market analysis and life-cycle assessment).

HIPIN
High performance insulation based on nanostructure encapsulation of air

The main aim of the HIPIN project was to develop a sustainable and cost-effective technology to produce a nanostructured aerogel that could be used to improve the thermal efficiency of buildings. The aerogel has been incorporated into paint, plaster and panel applications which can be used in both retrofit and new constructions.

Precursors for aerogels have been developed which enable stronger aerogels to be manufactured by a cost-competitive process with a thermal conductivity at least 10 times lower than commonly used construction insulation materials. Optimised methods for the incorporation of the aerogel into the paint, plaster, and panel insulation systems and its installation on building walls have been developed. A demonstrator for all three applications has been completed at one of the partner’s facilities. A life-cycle assessment model has been developed for the aerogel as well as the three products containing the aerogel.
NanoinInsulate
Development of nanotechnology-based insulation systems

The application of nanotechnology-based thermal insulation systems and materials is gaining popularity within the EU construction sector, largely driven by environmental concerns. Significant heat losses through inadequate or poorly performing building insulation systems are responsible for 40% of total energy consumption and approximately 36% of CO₂ emissions in the EU. Reducing energy consumption by improving the performance of thermal insulation systems during the whole life-cycle of the building is therefore a worthwhile action in the fight against climate change.

NanoinInsulate developed durable, cost-effective, opaque and transparent Vacuum Insulation Panels (VIPs) incorporating new nanotechnology-based core materials, such as nanofoams and aerogel composites, and new nanotechnology-based high-barrier films. Opaque and translucent VIPs produced with new organic nanofoam and inorganic silica aerogel cores, respectively, are characterised by low thermal conductivities, 0.004-0.009 W/m K. It has been demonstrated in Madrid and Warsaw that new opaque panels have up to four times higher insulation capacity than conventional polyurethane foam insulation. Energy savings of around 25% per year have been achieved, resulting in a decrease in CO₂ emissions of 20%. These VIPs are suitable for new and existing buildings with a product lifespan of over 50 years. Integrating these materials into building products using low cost or high volume sustainable processes still remains a challenge preventing rapid, wide-scale commercialisation.

NANOPCM
New advanced insulation phase change materials

The aim of the NANOPCM project was to develop, produce and implement low cost insulation materials able to store heat through the use of Phase Change Material (PCM) and nanotechnology.

Results achieved within the project have been used as the starting point for further investigations which aim to increase the percentage of PCM in the matrix to enhance material thermal performance. The weight of PCM in the panels developed after the completion of NANOPCM represented 30% of the overall panel weight, a three-fold increase compared to panels from the NANOPCM project. They also boasted a lower thickness (∼3cm), which resulted in a volume reduction of 25%. This thickness reduction implies an increase in density (11.5kg m⁻³ vs 72kg m⁻³), which guarantees a high insulation performance in less space.

A test-cell was refurbished with the new materials to monitor the thermal behaviour over three weeks. Results showed thermal waves relaxing due to the PCM’s latent heat conversion and rising material thermal inertia which softened indoor temperatures, demonstrating suitability for the summer season. Laboratory tests showed higher thermal conductivity, explaining the higher “thermal permeability” of the internal walls of the test-cell.

ACCIONA is currently trying to reduce the thermal conductivity of the new panels without affecting the quantity of PCM in the matrix, in order to obtain better nighttime results.

**KEY FACTS**

**Start date:** July 2010  
**Duration:** 48 months  
**Total budget (€):** 6M  
**Website:** [www.nanoinsulate.eu](http://www.nanoinsulate.eu)  
**Coordinator:** KINGSSPAN, Ireland  
**Partners:** Germany: BASF, Fraunhofer, va-Q-tec.  

**Spanish mock-up with opaque VIPs**

**NANOPCM**

Test cell refurbished with the new panels  
(Sept 2014)

**KEY FACTS**

**Start date:** June 2010  
**Duration:** 36 months  
**Total budget (€):** 3.5M  
**Coordinator:** ACCIONA, Spain  

**New advanced insulation phase change materials**
BioBuild

High-performance, economical and sustainable biocomposite building materials

BioBuild will use biocomposite materials to reduce the embodied energy in building facades and internal partition systems by at least 50% compared to current materials, with no loss of performance or increase in cost.

Biocomposites have low embodied energy because they contain fibres and resins derived from biomass. The stiffness to weight ratio of such composites can be similar to glass fibre reinforced polymers, making them useful for various construction applications. Degradation by moisture and poor performance in fire tests, particularly in comparison to traditional materials, has limited the overall performance of bio-composites. BioBuild seeks to resolve this by developing treatments and coatings that improve and protect the fibres used. Cork and biobased foams have also been used to improve the thermal and acoustic insulation performance of the materials. BioBuild panels will be manufactured by infusion, vacuum bagging and compression moulding.

Outcomes of the project will be low cost, lightweight, durable and sustainable bio-composite building systems that meet technical and environmental regulations. Case study components are currently being manufactured at full-scale. These include an external wall panel, a cladding system, an internal partition kit and a suspended ceiling. A full life-cycle analysis will be completed to evaluate the environmental impact of the project.

LEEMA

Low embodied energy, advanced materials and insulating masonry components for energy-efficient buildings

The concept of energy use in buildings, such as heating and lighting, and the need to reduce it is becoming increasingly familiar. However, the energy needed to create the building itself, which for an average household is equivalent to about 15 years of operational energy consumption, is often overlooked. The development of low embodied energy construction materials with improved performance will directly improve the sustainability of buildings.

Within the LEEMA project a range of new insulation products are being developed which are suitable for both new and retrofitted buildings. These include loose filling materials, Fesco®, foam and fibre boards and bricks with advanced insulation properties. The production of these insulation materials is based on intelligent use of inert, “zero-embodied energy” wastes originating from industrial mineral exploitation such as perlite, and industrial by-products.

Outcomes of the project will be low cost, high-performance, economical and sustainable bio-composite building materials and 3I products.

A comparison of the embodied energy of current building materials and the 3I products
Current state-of-the-art concrete products used in the construction industry are generally based on traditional cement and natural aggregates. SUS-CON products differ radically as both the binder and the aggregates are derived from waste materials. The binders (geopolymers) are based on alkali activated aluminosilicate wastes such as slag, fly ash and mineral tailings while the lightweight aggregates are based on recycled municipal waste electrical and electronic equipment, polyurethane foams, tyre rubber and geopolymer wastes. The combination of these two novel constituents results in the production of lightweight construction materials with low embodied energy and increased thermal insulation and acoustic properties, suitable for both ready mixed and pre-cast applications.

The SUS-CON project is expected to result in a series of multi-functional, commercial, waste-based products which will be characterised by a high degree of innovation, low energy and CO$_2$ footprint and by a high added value for the end-users. The developed concrete will be used to produce energy-efficient building components like façade panels, masonry blocks, floor screed and floor screed underlay. The project results, while setting-up a novel low-cost material for producing energy-efficient buildings components, will also contribute to solving the issue of “waste pressure” on towns and will help reduce the consumption of non-renewable, natural raw materials.

HarWin

Harvesting solar energy with multifunctional glass-polymer windows

Buildings are responsible for 40% of Europe’s energy use. Their energy consumption can be significantly reduced, however, by optimising heat accumulation and reducing heat loss through the building’s windows and façade. HarWin aims to design possible solutions for the next generation of window to address these issues. The proposed design will also increase the degree of sunlight penetration into the building which has been recognised as an important asset for technical and cultural progress in human societies.

The design is based on materials which have never been used before in glazing. The new laminated composites are made from thin glass panels joined together with newly developed transparent polymer-composite sheets containing glass particles. The role of these particles is to provide optimised visual, thermal and sound characteristics as well as mechanical reinforcement. The proposed design aims to decouple the material properties responsible for light transmission from those that provide heat and sound insulation.

This new type of polymer-glass composite material used for glazing will provide heat and noise control, whilst the lightweight frame provides important weight savings. The use of phase changing materials will improve energy efficiency whilst materials for wavelength conversion will enhance visible light transmission. A lifecycle environmental assessment will be carried out to assess the reduction in energy and material consumption that these windows achieve.
MEM4WIN

Ultra-thin glass membranes for advanced, adjustable and affordable quadruple glazed windows for zero-energy buildings

The thermal performance of windows is critical to the energy performance of buildings. MEM4WIN aims to develop a modular window concept which provides weight and cost savings, reduces the heat transfer coefficient and contains a number of smart features which control and harvest energy. The new design of window will have a high impact due to its affordability, suitability to both residential and office buildings as well as new constructions and the retrofitting of older buildings, and all climate types.

MEM4WIN will introduce a novel, insulated glass unit for quadruple glazing which contains ultra-thin glass membranes. The insulated glass unit will be incorporated into frameless, openable windows which can be directly incorporated into façades. The new design will be capable of achieving a heat transfer coefficient of 0.3W/m²K, a weight reduction of more than 50% and a cost reduction of 20%. The project will implement ink-jet printed Organic Photovoltaics and fully integrated solar thermal collectors for energy harvesting, and micro-mirror arrays for energy control and advanced daylighting. Fabrication costs will be reduced by replacing conventional and cost intensive materials used for contacts such as indium tin oxide and silver with graphene. The suitability of the modular component and new materials will be validated in a fully functional demonstrator.

SmartBlind

Development of an active film for smart windows with inkjet method. Application to a building component: autonomous smart device

The SmartBlind consortium aims to produce a hybrid flexible film and energy saving window, with single or multiple panes, for the construction and renovation markets. The consortium brings together many disciplines including polymer chemistry and physics, electronics, modelling, building engineering and architecture from public and private research ecosystems to promote the autonomous system.

The aim of the SmartBlind project is to produce a new window which boasts a weight reduction of 50% when compared to glass windows, and maintains transparency and flexibility. The project will improve the optical response time of windows while enabling larger panes to be used. It will integrate an electronic control system with an embedded power source and will guarantee a low-cost, industrial solution which will be adaptable to large and shaped surfaces.

Technical impacts such as the weight reduction and the switch control of large panes with small response times have already been obtained. The new printing methods of active optical materials can be used in fields other than buildings. Aspects such as comfort and energy saving as well as market and product employment are currently being addressed. Expected energy savings will be examined. The hybrid flexible film and the windows with simple or multiple panes will allow new building and renovation markets to be reached.

MEM4WIN

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<tr>
<td>Start date: September 2012</td>
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<td>Duration: 36 months</td>
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<td>Total budget: €6.2M</td>
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<td>Website: <a href="http://www.smartblind-project.eu">www.smartblind-project.eu</a></td>
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SmartBlind

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<td>Start date: October 2012</td>
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<td>Duration: 42 months</td>
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<td>Website: <a href="http://www.mem4win.com">www.mem4win.com</a></td>
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First small size prototype of the SmartBlind smart window at the SmartBlind 18 month meeting attended by Ms Levy, European Project Officer
WINSMART
Smart, lightweight, cost-effective and energy-efficient windows based on novel material combinations

WINSMART aims to create the window of the future. The new window will be designed to be sustainable, lightweight and smart and will have a low heat loss value (u-value). Reducing energy consumption and carbon emissions are top priorities for the building and construction industry. In response to these targets, the WINSMART project focuses on window design as windows are responsible for up to 60% of the total energy loss from buildings. Windows with low u-values can substantially reduce energy losses and save costs.

WINSMART targets significant technological advancements within three key areas: glazing production technology, frame manufacturing, and optical control mechanisms. A cornerstone of the WINSMART project is the use of a vacuum to produce thin, lightweight glazing with very low u-values. The WINSMART project will improve current state-of-the-art production technology by laser welding glass panes together in a vacuum in order to achieve the desired characteristics. The prototype window produced within the WINSMART project will weigh 50% less than current windows. It will also have a u-value of 0.3 W/m²K, low embodied energy, and will be slim and cost effective. The potential impact of projects like WINSMART on energy savings is enormous both for Europe as a whole and for the individual consumer.

WINSMART

Clean and resource-efficient buildings for real life

The clean-up consortium brings nanomaterials from the lab into real applications, developing sensors and control strategies for optimal interaction. By integrating these new components into real buildings, clean-up aims to achieve substantial savings in operational energy use while maintaining a high quality environment for the building’s occupants.

With a focus on refurbishment, clean-up solutions improve the energy performance of windows, building envelopes and air handling, heating, ventilation and lighting systems. Through the development of nano-materials and new control algorithms, the solutions improve indoor air quality, thermal comfort and lighting.

Clean-up has developed innovative technologies for new and retrofitted buildings which will enter the market in the next few years. These include:

- Cheap and energy-efficient volatile organic compound (CO₂ equivalent) monitoring systems which monitor the indoor air quality. As building regulations and airtightness standards become more stringent, this will be an important challenge.
- Smart electrochromic glazing with a high potential for energy efficiency, especially for curtain walls of high rise office buildings
- Ultra efficient insulation with vacuum insulated panels which can be adapted for various refurbishment cases

The successful integration of these new technologies in the building energy management system will enable more efficient control and will improve indoor comfort for users.
CETIEB

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

Retrofitting existing building stock to meet EU targets for energy efficiency by 2020 and 2050 will lead to increasingly airtight buildings which will affect the quality of the indoor environment. Through the use of innovative passive materials, CETIEB developed cost-effective sensor systems with integrated energy-efficient control systems to detect and measure indoor environmental parameters.

The main objective of CETIEB was to develop monitoring systems capable of detecting indoor environmental comfort and health parameters. The project also aimed to optimise the quality of the indoor environment and energy efficiency through the use of control systems and an innovative lightweight insulation plaster system containing photo-catalytic and phase change materials for thermal storage, plant based air bio-filters and active air flow controlling components. A 3D model of the indoor environment was created for the assessment and validation of monitored data in order to optimise the control parameters and systems.

A number of new technologies were developed within the project. They include an improved natural light guiding system and cost-effective monitoring systems with advanced sensors used to detect volatile organic compounds, CO₂ and light, and an infrared vision system to monitor thermal comfort parameters. Parameters for the quality of the indoor environment were identified and a European cluster for Indoor Environment Quality was initiated. Guidelines for retrofitting were also created.

INTASENSE

Integrated air quality sensor for energy-efficient environmental control

Space heating accounts for more than 50% of the energy consumed in public and residential buildings in the EU. The careful management of air flow within a building can help reduce this energy demand and can be achieved by controlling the inlet fresh air and exhaust air, maximising air re-circulation and minimising the amount of fresh air which is often drawn in through a heat exchanger. However, this generally reduces the air quality.

INTASENSE has developed an integrated system using novel sensors for volatile organic compounds, particulates and combustion gasses. The integration of these separate units into a low-cost high-performance unit was the key focus of the project. It has been achieved by utilising advances in microfluidic gas handling systems for controlled sampling, the development of a bespoke wide-area wireless network platform, and packaging and manufacturing expertise for the disparate technologies.

The project combined advanced detection technologies producing an air quality sensing system with advanced capabilities to provide low cost comprehensive monitoring of key airborne pollutants. It developed a smart air quality sensing system that can interface intelligently with existing ventilation and air treatment systems to optimise energy efficiency while maintaining an acceptable air quality. It has also improved the health, quality of life and productivity of EU citizens by providing the means to limit citizens’ exposure to poor quality indoor air.

Principle sketch and picture of the developed plant based air bio-filter.

KEY FACTS

Start date: October 2011
Duration: 36 months
Total budget (€): 3.5M
Website: www.cetieb.eu
Coordinator: University of Stuttgart, Germany

Schematic of INTASENSE integrated air quality sensor

KEY FACTS

Start date: October 2011
Duration: 36 months
Total budget (€): 3.3M
Website: www.intasense.eu
Coordinator: C-Tech Innovation Ltd, United Kingdom
NANO-HVAC

Novel nano-enabled energy-efficient and safe HVAC ducts and systems contributing to a healthier indoor environment

Heating, Ventilation and Air Conditioning (HVAC) systems represent almost 33% of the energy use in commercial facilities (14% space heating, 10% space cooling and 9% ventilation). Cooling trends are expected to increase due to climate change and the increased presence of heat releasing equipment in buildings. Ventilation is of concern for safety reasons as in many industrial and commercial buildings such as hospitals, long-term care facilities and other institutional structures, only 10-15% of indoor air is fresh with the remaining being recirculated air. This is generally due to energy efficiency considerations. However, these buildings are environments where large numbers of people spend many hours each day. They are therefore potentially exposed to low quality air which can lead to the increased presence of allergies or even respiratory diseases. In this context there is urgent need for novel energy efficient and safe HVAC solutions which are able to provide healthier indoor environments.

The NANO-HVAC project aims to address this major challenge through a set of anti-microbial and anti-allergic solutions and strategies which will also increase indoor comfort. The NANO-HVAC prototype is currently being implemented in a demonstrator to assess its energy performance against a prototype developed with conventional ducts. The insulation performance of the ducts will be evaluated in terms of temperature distribution and energy savings.

H2SusBuild

Development of a clean and energy self-sustaining building

Improving energy efficiency, reducing greenhouse gas emissions and raising the proportion of energy produced from renewables are key priorities set out in the EU’s ambitious 20-20-20 climate and energy targets for 2020. It is essential that the building sector contributes to these goals.

H2SusBuild has developed a self-sustainable and zero-carbon emission energy system, in which hydrogen is used as an energy supply in the case of an energy shortage from renewables, thus compensating for their intermittent nature. Photovoltaic panels and wind turbines are used to harvest primary energy that is either directly applied to cover a building’s contingent loads or converted into hydrogen through water electrolysis in the case of excess renewable energy availability. In the case of a renewable energy shortage, the stored hydrogen can then be applied as a green fuel to produce combined heating and electricity by means of fuel cells or to supplement the building’s heating demand not covered by the fuel cells through direct combustion.

The safe operation of the system was demonstrated in a full-scale building in Lavrion, Greece. The use of an intelligent energy and device management system, building on optimised operational strategies, ensures a secure, stable and continuous operation by coordinating the system components, renewable energy technologies and the electricity grid.

KEY FACTS

Start date: October 2008
Duration: 48 months
Total budget (€): 6.6M
Website: www.h2susbuild.ntua.gr
Coordinator: Coordinator: D’Appolonia, Italy.

H2SusBuild

Novel nano-enabled energy-efficient and safe HVAC ducts and systems contributing to a healthier indoor environment

Test of the volatile organic content removal for the NANO-HVAC system

KEY FACTS

Start date: September 2012
Duration: 36 months
Total budget (€): 2.8M
Website: www.nanohvac.eu
Coordinator: Vento NV, Belgium

NANO-HVAC

Novel nano-enabled energy-efficient and safe HVAC ducts and systems contributing to a healthier indoor environment

View of the Lavrion demo installation
**FC-DISTRICT**

New micro-combined heat and power network technologies for energy-efficient and sustainable districts.

The FC-DISTRICT system optimises and implements an innovative energy production and distribution concept for sustainable and energy-efficient districts. The main principle of the FC-DISTRICT system is based on the dynamic heat exchange between buildings, distribution systems and the customer. This has been achieved through the development of a number of products: a micro-combined heat and power (μ-CHP) unit, district heating pipes with improved insulation, new External Thermal Insulation Compound Systems (ETICS), a food waste collection tank for anaerobic digestion, and a wireless/hybrid communication network.

Within the project, buildings are fitted with μ-CHP Solid Oxide Fuel Cells (SOFCs) for energy production. These work in conjunction with improved thermal storage and building insulation systems. The μ-CHP produces 1kW\textsubscript{el} and 2.75kW\textsubscript{th} of energy and units are fed with natural gas and/or biogas. A food waste self-thickening tank has also been developed to promote the localised production of biofuels.

The piping and district heating networks developed within the project have seen a reduction in energy loss of 200kW over the 100km pipeline. Advanced insulation materials are used to improve the thermal response of the pipe. The developed FC-DISTRICT system has achieved a district level energy balance.

**MESSIB**

Multi-energy storage system integrated in buildings

International policies and trends have stressed the necessity of shifting from energy models based on centralised power plants to distributed production; from dissipation to conservation of energy, from fossil fuels to renewables and from production side to demand side management. Energy storage systems allow the matching of production with loads in terms of time, power and energy. This enables heating, ventilation and air conditioning systems to be based on calculated base loads instead of peak power.

MESSIB combines four different types of storage for heat and electricity in order to optimise energy efficiency, reduce the load of the building and therefore create a self-sustainable building. The concept focused on the following elements:

- Phase Change Materials (PCMs) – micro encapsulation of salt hydrates and paraffin; computational tools for energetic behaviour
- Borehole – grouting material for increased ground conductivity and heat exchanger with reduced thermal resistivity
- Flywheel – 50 000 rpm flywheel, with magnetic bearing, vacuum carcase and orthotropic rotor
- Vanadium Redox Flow battery – new stack material combined with a new design for enhanced efficiency
- Integrated control system – predictive algorithms based on weather forecast and simulation with dynamic software
- Computational tool – for PCM behaviour, borehole productivity, flywheel energy balance and battery control

The scalable modular system can be integrated into new and existing constructions and can be exploited in smart cities.

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**KEY FACTS**

**FC-DISTRICT**

- Start date: September 2010
- Duration: 48 months
- Total budget (€): 11.8M
- Website: [www.fc-district.eu](http://www.fc-district.eu)
- Coordinator: Mostostal Warszawa SA, Poland

**MESSIB**

- Start date: March 2009
- Duration: 48 months
- Total budget (€): 8.5M
- Website: [www.messib.eu](http://www.messib.eu)
- Coordinator: ACCIONA, Spain
**EINSTEIN**

Effective integration on seasonal thermal energy storage systems in existing buildings

Energy use in buildings accounts for approximately 40% of the EU’s energy consumption with space heating and domestic hot water representing the largest portion. The objective of the EINSTEIN project is to develop, evaluate and demonstrate a low energy heating system based on Seasonal Thermal Energy Storage (STES) systems in combination with heat pumps for space heating and domestic hot water requirements. The system will be used in existing buildings to drastically reduce energy consumption.

The STES systems will allow solar energy used to heat water in the summer to be stored and used in the winter. Hot water can be used either directly for water and space heating or by means of an innovative heat pump developed as part of the project. The integration of the STES system and heat pumps is one of the main breakthroughs of the EINSTEIN project. The heat pump can work at higher temperatures than commercial heat pumps. The technology is being validated in two demonstrators, one in Spain at the building level and one in Poland at the district level.

A decision support tool is being developed to help potential users decide if a STES system, using solar collectors and heat pumps, is technically and economically feasible for a particular scenario. New business and cost models are being developed to exploit the developed technology.

**HEAT4U**

Gas absorption heat pump solution for existing residential building

HEAT4U’s main concept is to develop Gas Absorption Heat Pump (GAHP) technology, enabling its cost-effective application in existing residential buildings. The project managed to overcome a number of technical and non-technical barriers which currently prevent its application in single family houses and small multi-storey buildings.

Frequently, the upgrade of envelope insulation is subject to constraints such as historical heritage, availability of space, tenant relocation and more general cost and time issues. A more viable solution therefore is to focus on the heating plant of buildings. However, current solutions are not always suitable or cost effective for existing buildings. A multi-local parametric analysis confirms that the new GAHP technology offers major energy savings and economic, environmental and infrastructural advantages over competing systems with regard to the heating supply of existing building stock.

The feasibility of technical specifications has been assessed using measurements from a preliminary conceptual prototype. This prototype was designed specifically to develop and validate the architecture and viability of this project. The prototype demonstrated that values for efficiency are maintained at levels justifying the use of this equipment in residential, single use applications. A set of units have been successfully installed. They reached the anticipated energy and cost savings and environmental benefits during field test trials. GAHP technology is ready for market deployment and implementation in existing residential dwellings.
The humidity treatment of air conditioning is crucial in order to achieve a satisfactory internal air quality. Traditional Heating, Ventilation and Air Conditioning (HVAC) solutions are not efficient or economically viable for applications with a low sensible heat ratio (SHR) because of the wasted energy used to reheat the air after dehumidifying it. The nanoCOOL system presents an innovative solution based on a liquid desiccant cycle with an adapted conventional air cooling system.

The project will tackle all aspects of the HVAC system and will demonstrate that through the implementation of the proposed technology, reductions in energy consumption of up to 50% can be achieved compared to current, conventional, commercially available systems.

The EnE-HVAC project implements new nanotechnology approaches for HVAC applications in order to achieve significant energy savings. These new technologies include nanostructured coatings as well as sol-gels and Physical Vapour Deposition (PVD) coatings to increase heat transfer, nanofluids to improve the transportation of heat and nanotechnological coatings with anti-freezing properties to limit over-icing of heat exchangers.

Research which focused on nanomaterials has been carried out for the exchangers. An extruded polypropylene tubes bundle has been used for the internally refrigerated absorber and regenerator. The bundle has received plasma treatment nanocoating to improve the wettablity of the polypropylene. Research has also focused on the development of a polymeric matrix composite including graphene nanoparticles for a plate heat exchanger.

The nanoCOOL project will reduce energy consumption in air conditioning systems for the mentioned application as well as other applications in which temperature and humidity need to be controlled in an appropriate way.

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Buildsmart
Energy-efficient solutions ready for market

Buildsmart aims to demonstrate and mainstream innovative and cost-effective techniques for constructing very low energy buildings for various climates. Five large-scale residential and non-residential buildings, which are being constructed across Sweden and Spain will be used as demonstrators. These varied conditions will provide a broad overview of other areas within the EU and will therefore facilitate deployment and the exploitation of outcomes. The energy performance of the demonstrators will be monitored at least one year after construction has been completed.

The 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 installation that minimises energy use
- Techniques for minimising cooling needs such as efficient windows and shading equipment

Buildsmart project partners visiting the German demonstrator, NuOffice, in Munich

In each case the feasibility of mainstreaming these innovative techniques will be studied. They will be analysed from a systems perspective, taking into consideration the whole energy system. Energy needs for the different technology choices as well as life cycle costs will be calculated. New incentives will also be developed and implemented to increase the involvement of inhabitants, highlighting how they can benefit from lower energy costs and an improved environment. Technologies which display live energy use data will be used to educate homeowners, employees and the public as a means to influence their behavioural patterns.

The new hotel building in downtown Malmo acting as one of the demonstrators

DIRECTION
Demonstration at European level of innovative and replicable effective solutions for very low-energy new buildings

DIRECTION aims to create a framework to demonstrate and disseminate innovative and cost-effective, energy efficiency technologies for low energy new builds. Based on the analysis of suitable energy efficiency technologies and their technical and economic viability, the demonstration activity draws on three new builds located in Spain, Italy and Germany. Each building deploys a set of innovative measures, from constructive elements for energy optimisation, to highly efficient energy equipment and advanced energy management. The buildings are being monitored for expected energy consumption and CO₂ emission reductions which are set at more than 50% and 60% respectively.

The DIRECTION project is organised into the following phases: energy efficiency measuring, analysis, modelling, simulation, demonstration buildings construction, systems and facilities commissioning and testing, monitoring, data acquisition, and energy performance and savings assessment. The project also includes one year of monitoring under normal operational requirements for the validation phase. In parallel, DIRECTION deploys an ambitious dissemination plan using multiple channels, including local, national and European stakeholders who will be kept up to date on the progress and outcomes from the demonstrators.

The DIRECTION project has completed 29 of the 55 deliverables, covering aspects such as BIM, metering and monitoring, control strategies, BMS, and performance analysis for the envelope and systems. A best practices book will be also generated.

DIRECTION project partners visiting the German demonstrator, NuOffice, in Munich

DIRECTION project partners visiting the German demonstrator, NuOffice, in Munich

KEY FACTS
Start date: January 2012
Duration: 48 months
Total budget (€): 6.95M
Website: www.direction-fp7.eu
Coordinator: Fundación CARTIF, Spain
Partners: Belgium: yours.com GEIE; Germany: Domagk Gewerbepark, FACT GmbH & Co KG; Fraunhofer Institute for Building Physics, Italy; Claudio Lucchin & architetti associati, EnginSoft SpA; EURAC, Province of Bolzano, Spain; 1A Ingenieros, DRAGADOS.
NEED4B
New energy efficient demonstration for buildings

NEED4B develops an open and easily replicable methodology for designing, constructing and operating low energy new buildings, aimed at a large market uptake. The NEED4B methodology is validated and refined through the construction of 27 000m$^2$ spread across five demonstration sites covering different climatic zones, building types and uses. This ensures the reliability of results and guarantees impact in the construction sector.

All buildings have a common target, to consume less than 60 kWh/m$^2$ per year of energy. This target is addressed through the selection and integration of the most suitable innovative and cost-effective solutions and energy-efficient technologies for each of the buildings, addressing all areas of the building design. The solutions integrated in the buildings have been selected using BIM, integrated project delivery, life-cycle assessment or carbon methodologies and energy performance simulation software, and will establish a feedback process. NEED4B will deliver recommendations and guidelines which will be adapted to different stakeholders.

An ambitious dissemination plan has been created which includes a number of demonstrators which ensures the project’s visibility and impact within the European construction sector. A two-and-a-half year monitoring programme will be deployed to evaluate the benefits and impact. Plans will also be developed to obtain new business models to overcome current market barriers.

NEXT-Buildings
NEXT-Buildings status summer 2014

The NEXT-Buildings project focuses on the demonstration of low-energy, affordable buildings with the aim of achieving net zero-carbon/energy or better. The project is based on selected successful cities and actors in the CONCERTO programme. In addition to buildings, the project also covers active components in overall energy systems including smart technologies and ICT as well as energy exchanges with the overall supply. Solutions will reduce CO$_2$ at negative net or no overall cost.

In Amsterdam, development is based on the requirement that all new build areas need to be energy-neutral. The focus is on collective self-organised development for which there has been ample interest. Land-sell agreements have been signed and construction work for a school and several building lots has started. Monitoring activities are being prepared. In Lyon, the new Hikari building is developed in the successful Confluence area. The developer, Bouygues Immobilier, completed the concrete work in the summer of 2014. In Helsingborg the project moved from the original site to Kvarteret Isbanan. Design work is in progress and construction should start at the end of 2014.

Reports have been produced on the technological developments of transmission controllable glazing and dual function photovoltaics. A prototype of the insulating photovoltaic panel has also been created. The impact of all demonstrators will be to showcase the possibilities of low-cost carbon reduction.
In high-rise buildings high fractions of energy demand can only be met with renewable energy sources if the façade is used for energy conversion in conjunction with the roof. This is extremely important given the European energy targets which require all new buildings to be nearly zero-energy buildings by 2020.

To reach these goals the efficiency, especially of existing buildings, needs to increase and the remaining energy demand should be covered by renewable sources. One of the major challenges in achieving these goals, however, is the large number of buildings which need to be renovated. This requires large investments and more labour for construction than is currently available. Additionally, in many cases current processes and components for energy-harvesting in the building skin are not ready for widespread and cost-effective implementation.

A fundamental transformation of the construction sector is necessary to streamline the current, fragmented responsibilities and to develop business models which are attractive for third-party financing. This “great transition” will be required in the near future if it is to have a significant effect on energy reduction targets, however these changes will be virtually unavoidable. The new façade components, business models and technical concepts developed within this project and demonstrated in two pilot buildings will contribute to achieving the energy reduction targets.

3ENCULT

Efficient energy for EU cultural heritage

3ENCULT bridged the gap between the conservation of historic buildings and climate protection. Historic buildings are the trademark of many European towns and will only survive if maintained as living space. EU buildings dating from before 1945 make up 26% of the EU building stock. A reduction in energy demand by a factor of four in these buildings would result in savings of over 180 Mt CO$_2$ (3.6% of EU27 emissions in 1990).

3ENCULT demonstrated that energy retrofit is achievable in historic buildings whilst respecting their heritage value. Retrofitting improves comfort, reduces energy demand and is important for structural protection. A multi-disciplinary approach guaranteed the implementation of high quality interventions, targeted and adapted to the specific case of each unique historic building.

The project proposed a pool of solutions and guidance including a handbook with design guidelines, technical solutions for planners, new and enhanced products, guides for local governments, and position papers and support for policy and standards (EPBD, CEN TC 346).

Tested products include an energy efficient conservation-compatible window, capillary active internal insulation, a low-impact ventilation system based on the active overflow principle, and an LED-based wall-washer for conservation-compatible, high-quality and low-impact lighting. Wireless sensor networks along with the first version of a dedicated BMS system have also been demonstrated.

KEY FACTS

Start date: October 2008  
Duration: 48 months  
Total budget (€): 10.7M  
Website: www.cost-effective-renewables.eu  
Coordinator: Fraunhofer ISE, Germany  
The E2ReBuild project was successfully completed. Seven demonstration projects in six countries were realised, a total of 25,000 m² of energy renovated buildings. Due to the introduction of industrial manufacturing methods and standardised retrofit measures the project can be easily replicated.

The vision of E2ReBuild was to transform the retrofitting construction sector from current craft-based and resource-based construction into an innovative, high-tech, energy-efficient industrialised sector. The project results prove that E2ReBuild created notable impact in various areas.

Scalable examples have been provided that highlight the changes required to turn the current inefficient methods of working into a “win-win” situation for all involved. The project has improved the design process for holistic renovation concepts and demonstrated that added value can be achieved by optimising the use of space, improving comfort and through the integration of advanced technologies. The project has proved that retrofitting can be done in an efficient manner by minimising energy use and waste during construction and operation and improving the quality of the indoor environment.

The tools, methods and processes proposed in the E2ReBuild project have been integrated into an Industrial Platform for Energy Efficient Retrofitting for large scale market deployment. The project has enabled the European Retrofit Advisor, a new design and decision tool for renovation strategies, to be further developed.

BEEM-UP
Building energy efficiency for massive market uptake

BEEM-UP adopts an integrated approach to overcome barriers presented by three ambitious retrofitting projects in Sweden, the Netherlands and France. Preliminary results from the three pilot sites have highlighted the success of the developments to date within the project.

The demonstrator located in Paris, France is owned by ICF Novedis. The technology package selected for the retrofit is expected to provide energy efficiency beyond the BEEM-UP target with an estimated energy demand reduction of 76%, of which 89% is from space heating. The recuperation of wastewater heat increases the total energy savings to 80%. Following refurbishment, the building will not only be energy-efficient but its overall functionality will be enhanced.

The demonstrator in Delft, the Netherlands is owned by Woonbron. Energy demand is expected to be reduced by around 77% depending on the type of dwelling and tenant choices. Preliminary results show that most flats reached the Energy label A after the retrofit.

The demonstrator in Alingsås, Sweden is owned by Alingsåshem. Following the policy on environmental, economic and social sustainability, Alingsåshem decided to undertake a major internal and external reconstruction using passive house techniques. Simulations performed according to the interventions have anticipated overall energy use reductions of 76% and heating energy reductions of 99%. Preliminary data from monitoring the first BEEM-UP block recorded an energy reduction of 83%.

BEEM-UP
Key facts
Start date: January 2010
Duration: 48 months
Total budget (€): 7.7M
Website: www.beem-up.eu
Coordinator: ACCIONA Infraestructuras, Spain
Switzerland: ETH Zurich, Siemens.

Building energy efficiency for massive market uptake

E2ReBuild
Impressive replication potential

The E2ReBuild project was successfully completed. Seven demonstration projects in six countries were realised, a total of 25,000 m² of energy renovated buildings. Due to the introduction of industrial manufacturing methods and standardised retrofit measures the project can be easily replicated.

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E2ReBuild
Key facts
Start date: January 2011
Duration (months): 42 months
Total budget (€): 8M
Website: www.e2rebuild.eu
Coordinator: NCC AB, Sweden
School of the Future
School of the Future - Towards zero emissions with high performance indoor environment

The aim of the School of the Future project is to design, realise and communicate good examples of future, high performance buildings. The energy performance and the indoor comfort of four demonstration school buildings in different European climates have been greatly improved. This has been achieved through the holistic retrofit of the building envelope and service systems, including the integration of renewables and management systems.

The project is raising people’s consciousness to save energy through the exemplary realisation of high energy-efficient retrofit projects focusing on school buildings. It also demonstrates that significant energy savings can be achieved with limited additional costs (< 100 €/m²) which will motivate other actors in the sector to replicate the concepts. Reliable information on energy and cost saving potentials will eliminate reservations about innovative energy saving retrofit concepts.

Project outcomes are already available and include:
- Four retrofitted school buildings which are documented in a design phase report and in building diaries
- A database of international knowledge on energy-efficient school buildings and high indoor comfort
- A report on the assessment of the indoor environment including an occupant questionnaire and measurement instructions
- A technology screening report analysing the impact of various renovation measures for the building envelope, building service systems and renewable energy

EASEE
Envelope approach to improve sustainability and energy efficiency in existing multi-storey multi-owner residential buildings

In line with current European energy targets the EASEE project proposes a new approach to façade retrofitting of residential multi-storey buildings by boosting the application of sustainable and cost-efficient solutions. The project focuses on cavity walls and the building envelope, both external and internal.

For the external envelope, custom prefabricated panels with built-in insulation have been developed. This overcomes the labour intensive retrofitting procedure based on ‘wet’ processes while also guaranteeing installation without scaffolding. A dedicated mould capable of casting such panels was designed which brings benefits for manufacturers by improving their expertise while also widening their market.

For the cavity, an innovative synthetic Perlite has been produced and technology for the hydrophobation of expanded Perlite particles has been developed. This improves insulation durability without diminishing thermal conductivity.

For the inner envelope, three innovative solutions: Perlite boards, aerogel wallpaper and aerogel boards have been designed, ensuring a good performance to cost ratio, easy installation and aesthetics.

To optimise building retrofitting, a dedicated Retrofitting Planner has been developed. The Planner provides a holistic evaluation of the façade or building envelope through 3D simulation software.

The project results are being tested as a façade in Italy and on three demonstration buildings in Poland, Italy and Spain.
Two and a half years into the project, the consortium has completed the development and design phases of the work and is moving into the demonstration phase. The detailed design for nine technological units has been completed, including insulation, a green façade, a ventilated façade, solar protection and a glazed, building-integrated photovoltaics and solar thermal collector. An advanced passive solar protector and energy absorption auto mobile unit, and an advanced passive solar collector and ventilation module have also been devised. This new and innovative façade system is designed to increase the energy efficiency of residential buildings in Europe.

The standardised façade system modules and panels, along with its structure, have been dimensioned and designed in detail. Technical units for the demonstration building and their distribution on the façade have also been selected. The most suitable unit configuration has been devised for the project which will enable the best energy performance balance of heating and cooling loads in different climate conditions. A suitable manufacturing process for a thermoplastic composite material that will match mechanical and fire resistant requirements has also been found. The demonstration will be carried out on a social housing building in Merida, Spain. Building performance will be monitored pre and post system implementation and the final results will be presented at the end of 2015.

**MEEFS Retrofitting**

Multifunctional energy efficient façade system for building retrofitting

In the construction sector progress in technologies and solutions to improve Energy Efficiency (EE) in buildings do not reach small and medium-sized enterprises (SMEs). ee-WiSE studies the main barriers which are hindering EE in Mediterranean countries. Barriers include the training of construction professionals in retrofit technologies, occupant financial support in order to invest in retrofit technologies and the training of traditional craftsmen on EE retrofitting innovations. The origin of these needs relies on the lack of a correct knowledge transfer between agents in the building retrofitting value chain.

The analysis of the agents’ behaviour and their knowledge transfer requirements led to the development of an ee-WiSE EE Knowledge Transfer Framework (KTF). The tool promotes the sharing of EE knowledge amongst agents and is designed as an interactive platform where users can find EE content classified by topic. The topics include skills and awareness, knowledge management, Research and Development approach, as well as financial, institutional and administrative matters. Detailed guidelines provide registered users with information on the best examples of EE material and how to share it. The published content can be filtered and rated. The KTF has been tested in validation workshops in seven Mediterranean countries and was well received by all the different profiles.

**ee-WiSE**

Knowledge transfer framework for energy efficient building retrofitting in the Mediterranean area

In the construction sector progress in technologies and solutions to improve Energy Efficiency (EE) in buildings do not reach small and medium-sized enterprises (SMEs). ee-WiSE studies the main barriers which are hindering EE in Mediterranean countries. Barriers include the training of construction professionals in retrofit technologies, occupant financial support in order to invest in retrofit technologies and the training of traditional craftsmen on EE retrofitting innovations. The origin of these needs relies on the lack of a correct knowledge transfer between agents in the building retrofitting value chain.

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ENBUS

Energising the building sector

The construction, maintenance and operation of buildings are some of Europe’s most energy consuming activities. The ENBUS project aims to improve this area by increasing awareness, strengthening incentives and improving access to information about energy efficiency within the building supply chain. The focus is on the stakeholders who influence the choice of technologies, materials, processes and design philosophies.

The project is centred on a series of seminars and workshops, and the launch of an iPhone App in parallel to the Green Market Place on the ENBUS webpage. The iPhone App can be used to search for specific products or features and offers users a new way to access information about energy-efficient technologies and products. The App uses Simplified Energy Profiles (SEPs) which are developed in the project. The SEP is an easy way to compare and rate the energy efficiency of a product using data from the company that markets the product. The ENBUS project compiles this data and makes it accessible to as many recipients as possible through the iPhone App and on the Green Market Place. The ENBUS prototype focuses on a few product groups, including windows, heating, ventilation and insulation and is provided for family houses and apartment houses under renovation in two climate zones.

HERB

The holistic energy-efficient retrofit of buildings project

Europe is facing a tremendous challenge in relation to the energy consumption of its housing stock. Buildings consume about 40% of total final energy requirements on the continent and in the context of all the end-use sectors, they are the largest (followed by transport with 33%).

In Europe, new homes have to be built in compliance with demanding energy efficiency regulations. The benefits will however accrue slowly as it will take several decades before such houses form a significant proportion of the stock. The major challenge is retrofitting existing, energy-inefficient homes to meet 21st century standards within the constraints enforced by structures built in the 19th and 20th centuries.

Key to achieving this goal is understanding the process of selecting and integrating various technologies from the many available. A truly holistic approach is required to optimise the performance for different building types, climates and socio-economic conditions.

The HERB project has been established to develop and demonstrate new and innovative energy-efficient technologies and solutions for retrofitting older buildings. These will be installed and their performance will be monitored in a number of typical residential buildings in EU countries.
iNSPiRe

Development of systemic packages for deep energy renovation of residential and tertiary buildings including envelope and systems

The objective of iNSPiRe is to tackle the problem of high energy consumption in buildings by producing systemic renovation packages that can be applied to residential and tertiary buildings. The project adopts a holistic approach to renovation to achieve energy consumption savings in all possible aspects of a building.

The renovation packages developed by iNSPiRe aim to reduce the primary energy consumption of a building to lower than 50kWh/m²/year. The packages are designed to be suitable for a variety of climates and to ensure optimum comfort for the building users. iNSPiRe is currently developing multifunctional renovation kits which facilitate the implementation of the renovation packages. These will be launched to market at the end of the project. The innovative nature of the kits covers envelope technologies, energy generation systems and energy distribution systems. The kits integrate different retrofit components into prefabricated building envelopes, including heating, ventilation and air conditioning systems, lighting and shading systems, piping and air-ducts, and energy generation systems. The kits have been designed for both residential and office buildings. One or more can be used to facilitate retrofit projects. The technologies and renovation approaches developed by the iNSPiRe project will be installed and tested in three case studies, two residential and one office building, in Germany, Spain and Italy.

RetroKit

Toolboxes for systemic retrofitting

Residential buildings that date between 1945 and 1980, a period in Europe which witnessed increased construction activity after WW2, have the largest energy demand. Most of them now require retrofitting or refurbishment interventions. RetroKit targets ageing, multifamily, residential buildings which represent more than half of the European building stock and consume between 65% and 80% of the total energy consumption of buildings in the EU.

RetroKit aims to develop and demonstrate multifunctional, modular, low cost and easy to install prefabricated modules for systemic retrofitting of these residential buildings. The modules will integrate efficient energy use systems and renewable energy sources and will be validated in three pilot buildings in Spain, Germany and The Netherlands. RetroKit targets the social, technological, industrial, and economic barriers that obstruct most efficient retrofit solutions. It will develop a retrofit toolbox based on modular and multifunctional prefabricated solutions with integrated heating, ventilation and air conditioning, electricity, ICT and renewable energy technologies to upgrade residential building envelopes. The RetroKit approach will streamline the value chain, enabling customised mass production, industrial scale-up, and efficient construction processes for manufacturers, integrators, installers and contractors. The RetroKit approach will significantly increase the EU retrofitting rate and contribute to EU energy efficiency commitments.

Key Facts

**Start date**: October 2012  
**Duration**: 48 months  
**Total budget (€)**: 7.49M  
**Website**: www.inspirefp7.eu  
**Coordinator**: EURAC, Italy  

Sorption collector providing warm and cold air, to be integrated into a metal-glass façade module for office applications.

The demonstrator building in Madrid where some of the RetroKit solutions are installed and monitored is almost complete.

Key Facts

**Start date**: September 2012  
**Duration**: 48 months  
**Total budget (€)**: 10M  
**Website**: www.retrokitproject.eu  
**Coordinator**: D’Appolonia, Italy  
**EnRiMa**

**Energy Efficiency and Risk Management in Public Buildings**

EnRiMa developed a Decision Support System (DSS) to enable operators to manage energy flows in public buildings. The system provides a holistic solution to meet 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 for improving energy sustainability, reducing CO₂ emissions, and increasing the share of renewable energy technologies.

The DSS contains two optimisation modules – one for short-term operational decisions and another for long-term strategic decisions. The operational model optimises the usage of on-site and purchased energy given desired indoor temperature ranges. Optimisation is based on the characteristics of the building and its installed equipment. Decisions are typically made on an hourly basis one day ahead.

The strategic model analyses on-site technology investments and building retrofits over several years. In addition, the model makes use of estimations for future energy pricing to advise about which technologies to buy and when to buy them. Decision support is provided on annual basis for the next decade.

The project achieved audited energy savings of 8% for short-term optimisation and 15% for long-term optimisation. The integration of the DSS with building energy management systems together with a commercialisation strategy has positioned EnRiMa at the forefront of the market for this kind of product.

**SEEMPubS**

**Smart energy efficient middleware for public spaces**

The SEEMPubS project aimed to reduce the carbon footprint and energy usage of existing public buildings and spaces through intelligent ICT-based service monitoring and energy consumption management. The approach was particularly suited to historical buildings where it is fundamental that damage caused by extensive retrofitting is avoided.

The SEEMPubS project aimed to optimise comfort conditions through efficient energy use by developing an energy-aware platform. The platform was designed using service-oriented middleware such as Linksmart which allowed products with different communication protocols and different vendors to be integrated. An interoperable web-based software solution monitored real-time energy performance and provided control for the operation of both passive and active environmental systems, including lighting and heating, ventilation and air conditioning services through wireless sensor networks. The monitoring system was validated via an iterative process. Dynamic simulations for each case study were designed and tested in order to estimate the annual energy demand of the integrated systems and identify potential energy savings through the use of efficient control strategies.

The project results were presented through a multi-dimensional visualisation which could be personalised for different end users through a dedicated web portal. Augmented reality associated with QR codes provided an interactive communication solution and a user-friendly facility management process based on BIM.

**SEEMPubS**

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<td><strong>Duration:</strong> 36 months</td>
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<td><strong>Website:</strong> <a href="http://www.seempubs.polito.it">www.seempubs.polito.it</a></td>
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<td><strong>Coordinator:</strong> Politecnico di Torino, Italy</td>
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**EnRiMa**

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<td><strong>Duration:</strong> 42 months</td>
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<td><strong>Coordinator (see comment below):</strong> Stockholm University, Sweden</td>
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**SportE²**

**Intelligent Management System to integrate and control energy generation, and consumption for European sport and recreation buildings**

The European sport and recreation building stock accounts for around 1.5M buildings in Europe. It represents a significant portion of the overall building stock yet consumes a disproportionate amount of energy (6-8%). Sport facilities have unique characteristics including energy demand profiles (timing and peaks), comfort and ventilation requirements, ownership and management, and the type of large open spaces they encompass (multiple buildings, complexes, parking areas, lighting, etc).

SportE² developed an integrated, modular, and scalable ICT system to optimise energy consumption and generation. Several solutions were developed to address specific issues concerning these facilities such as optimal heating, ventilating and air conditioning management, flexible equipment scheduling and optimisation of air and water treatment to reach higher comfort conditions with lower energy consumption. The system was preliminarily tested in Kubik, a full scale lab-facility in Spain. It was then installed in three existing buildings, each with different requirements; the Fidia Sport in Italy where monitoring and control was not installed, the Extebarri Municipal Sport Centre in Spain which contained an existing BMS, and Sport Complex Santa Maria De Lamas in Portugal which contained manual controls for complex subsystems.

Results from the three pilot case studies demonstrated that the SportE² project achieved on average a 30% reduction in energy, as a combination of electrical and thermal energy, and CO₂ emission reductions where applicable.

**TIBUCON**

**Self Powered Wireless Sensor Network for HVAC System Energy Improvement**

The focus of the TIBUCON project was to develop a system which would enable building owners to improve comfort levels in offices while reducing energy costs and optimising the heating, ventilating and air conditioning systems. This was achieved by designing self-powered, wireless sensors to measure the local air temperature and detect occupancy. The absence of cables and batteries facilitated the installation process and reduced costs. Bridges were designed that wirelessly communicated with other components and controlled actuators within the system. This was validated in two demonstrators: a residential building in Spain and an office building in Poland. Software was developed to control and monitor the heating and cooling in the two demonstrators.

The demonstrator in Spain focused on monitoring tools which would help the energy service company improve the heating system configuration. An open loop TIBUCON control system combined with a new flow direction switch, provided energy savings above 5% and comfort improvements of about 25%. Energy savings can be increased further to between 20 and 50%, while maintaining comfort levels, by closing the control loop and using additional actuators.

The building in Poland was equipped with set point control software which implemented variable comfort bands and optimal start-up timing. Deployment of the TIBUCON system produced heating consumption savings of nearly 15% and demonstrated improvements in comfort of about 43%.
CASCADEx

ICT for energy-efficient airports

Airports consume as much energy as small cities. The CASCADE project helps to reduce their energy requirements by developing an ISO 50001 energy management action system which is supported by advanced Fault Detection and Diagnosis (FDD). The CASCADE solution is currently being tested by a multidisciplinary team in collaboration with two major European airport hubs: Rome Fiumicino and Milan Malpensa.

The CASCADE solution is data driven. It extracts information on the energy efficiency of heating, ventilation and air conditioning systems from the airport’s Building Automation Systems (BAS). It then generates an appropriate corrective action for the energy action plan if a faulty operation is detected.

CASCADE developed an FDD supported visualisation and energy management platform. Data from BAS and advanced data logging systems were transferred over the last six months to the CASCADE servers and analysed by algorithms and energy specialists. Initial results from Rome Fiumicino airport revealed that potential energy savings, estimated to be about 500MWh, can be achieved by replacing faulty sensors, and optimising the operation schedules and the sequence of components in the large air handling units which provide the airport terminal with fresh and conditioned air. Additionally, CASCADE is using an ontology based metadata layer which offers a common semantic. This is required to increase interoperability and provide data transfer between systems.

**KEY FACTS**

- **Start date:** October 2011
- **Duration:** 36 months
- **Total budget (€):** 3.9M
- **Website:** [www.cascade-eu.org](http://www.cascade-eu.org)
- **Coordinator:** Fraunhofer ISE, Germany

KnoholEM

Knowledge-based energy management for public buildings through holistic information modelling and 3D visualisation

The KnoholEM project provides an online based solution for improving the energy consumption of public buildings. The solution is unique as it can be implemented in buildings with Building Management Systems (BMS) installed, which means energy loss has already been optimised. KnoholEM aims to develop an intelligent energy management solution that will considerably reduce energy consumption, both by systematically avoiding energy wastage in buildings and by the knowledge-based holistic optimisation of energy consumption.

The KnoholEM concept integrates an intelligent analysis of both simulated and monitored (close to real-time) data while also taking into account the particular specifics of each building and its inhabitants’ comfort. The project succeeds in ensuring greater sustainability of the system by developing a simplistic methodology. This enables the KnoholEM system to be integrated regardless of the building’s complexity.

The project contributes to encouraging further use of the IFC standard and provides a unique user oriented approach for energy management. Notifications are sent to the Facility Manager (FM) in the case of energy loss or unusual behaviour. Recommendations are also provided on how to decrease current consumption or improve energy efficiency. This supports the FM in deciding which are the most important criteria, for example reduction of costs, electricity or heating control.

**KEY FACTS**

- **Start date:** September 2011
- **Duration:** 36 months
- **Total budget (€):** 4.46M
- **Website:** [www.knoholem.eu](http://www.knoholem.eu)
- **Coordinator:** Building Research Establishment Ltd, United Kingdom
- **Partners:** Germany: Karlsruher Institut für Technologie, Steinbeis Innovation gGmbH. Ireland: Trinity College Dublin, Galway. Italy: CETMA, Matrix Spa, Tera SRL. The Netherlands: Stichting Smart Homes, Woningstichting de Zaligheden, Haagse Hogeschool. UK: Cardiff University, Spain: Isotrol, BDigital.

De Haagse Hogeschool (The Hague University of Applied Sciences) in the Netherlands
SEAM4US
Sustainable energy management for underground stations

SEAM4US aims to reduce the energy consumption of underground transport systems by implementing advanced ICT technologies for the optimal control of ventilation, air conditioning and lighting systems while maintaining user comfort. This will be achieved 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. A number of systems will be employed, including an audio and sensor system for listening and sensing, an acoustic processing system for detecting acoustic events and learning from this information in order to distinguish levels of occupancy and types of activity, and a management system for monitoring and optimising the strategies and algorithms for the control of the building automation system.

SEAM4US will be deployed, calibrated and validated in real operational situations in three demonstrators. Two are Spanish shopping malls: Principe Pio in Madrid and Maremagnum in Barcelona. One is an Italian international airport: Linate in Milan. Through the implementation of the SEAM4US solution energy use will be reduced by 15% per year and CO₂ emissions will be reduced by 57% per year.

The deployment of SEAM4US technology requires low investment in absolute terms, with a payback period between three to five years. A very flexible product packet arrangement decreases the financial impact further, providing a scalable implementation with modular components that grant proportional energy savings. The SEAM4US technology is complementary to the standard technologies already implemented in the control systems of metro stations such as surveillance CCTV, proportional-integral-derivative controlled mechanical ventilation, dimming lighting systems and locally controlled escalators. It can therefore be applied to any public underground and overhead space.

The potential market of the SEAM4US technology is huge. It encompasses directly the worldwide set of about eight thousands metro stations, and indirectly any underground and overground public space.

S4ECoB
Making intelligent use of sounds in order to improve the energy control of buildings

S4ECoB aims to build an innovative ICT solution for energy-efficient buildings to optimise the existent Building Energy Management systems (BEMs). This will be done by acquiring, identifying and adding occupancy level parameters for buildings and surroundings to enhance operations and eliminate the unnecessary energy consumption of heating, ventilation, air conditioning and lighting systems while maintaining user comfort. This will be achieved 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. A number of systems will be employed, including an audio and sensor system for listening and sensing, an acoustic processing system for detecting acoustic events and learning from this information in order to distinguish levels of occupancy and types of activity, and a management system for monitoring and optimising the strategies and algorithms for the control of the building automation system.

S4ECoB will be deployed, calibrated and validated in real operational situations in three demonstrators. Two are Spanish shopping malls: Principe Pio in Madrid and Maremagnum in Barcelona. One is an Italian international airport: Linate in Milan. Through the implementation of the S4ECoB solution energy use will be reduced by 15% per year and CO₂ emissions will be reduced by 57% per year.

The deployment of S4ECoB technology requires low investment in absolute terms, with a payback period between three to five years. A very flexible product packet arrangement decreases the financial impact further, providing a scalable implementation with modular components that grant proportional energy savings. The S4ECoB technology is complementary to the standard technologies already implemented in the control systems of metro stations such as surveillance CCTV, proportional-integral-derivative controlled mechanical ventilation, dimming lighting systems and locally controlled escalators. It can therefore be applied to any public underground and overhead space.

The potential market of the S4ECoB technology is huge. It encompasses directly the worldwide set of about eight thousands metro stations, and indirectly any underground and overground public space.
E-hub
Energy-hub for residential and commercial districts

To achieve low energy or energy neutral districts, the share of on-site renewable energy must increase drastically above present levels. The local use of a large renewable supply such as a photovoltaic panel array or a large wind turbine is complicated due to the fluctuating nature of the energy supply. Both smart energy management systems and energy storage are crucial in resolving this issue.

The objective of E-hub was to maximise the local use of renewable energy in a district by matching energy demand and supply. Through the intelligent control of equipment, the demand of heat pumps and appliances such as washing machines can be gradually shifted. Excess renewable heat can be stored in advanced Thermo-Chemical Materials (TCM) in distributed storage vessels or boreholes for prolonged periods with minimal heat loss.

The E-hub energy system was demonstrated in Tweewaters in Leuven, Belgium. The acceptance of such advanced energy systems by users is critical. The application of the energy system was therefore evaluated through user interviews.

In addition, a lab demonstration took place at the University of Genoa. Four scenario studies were also carried out to assess the feasibility of an E-hub type system in the districts of Amsterdam in the Netherlands, Freiburg in Germany, Bergamo in Italy and Dalian in China.

BEAMS
Building energy advanced management system

BEAMS has developed an advanced, integrated management system which considers energy efficiency in buildings and infrastructure from a holistic perspective. The project studies interior spaces, public spaces and the interaction of the overall compound with the grid.

Through the use of a decentralised architecture, BEAMS enables new mechanisms to be extended to current building management systems, achieving higher degrees of efficiency. The solution relies on an open interoperability gateway which controls and connects already identified heterogeneous subsystems acting as sources and loads in the facilities. These systems are typically found in lighting or air conditioning and ventilation systems. However, they are likely to be widely adopted for renewable sources or electric vehicles in the future.

The proposed solution supports the human operator of the building or facility in improving the efficiency of energy usage. The solution also offers an opportunity for third parties, such as energy service companies, utilities and grid operators to interact with the BEAMS management system through the interoperability gateway. This improves the quality and efficiency of the service both inside and outside the facility or building. Barcelona football club hosted the main demonstrator for this project at their stadium and service area which included the basketball pavilion, museum, parking spaces and training facilities.
Campus 21
Control and automation management of buildings and public spaces for the 21st century

Campus 21 focuses on the energy-efficient operation of public buildings. The project will develop a hardware-software platform for load-balancing, advanced control, and building performance analysis which will be complemented by innovative business and procurement models. Due to its cross-sectorial membership, Campus 21 spans the entire innovation chain.

Campus 21 has completed the installation of integrated energy systems, based on related middleware components, at two demonstration sites with experiments continuing over the 2014/15 winter season. The experiments focus on:
- Load-balancing systems for a district heating system empowered by Combined Heat and Power (CHP)
- Load-balancing of thermal energy for the operation of stadiums and event arenas exploiting weather forecast data and available thermal mass
- Advanced control for buildings with co-generation from renewables, integrated thermal mass and extensive exploitation of passive management scenarios
- Advanced control at room-level exploiting the understanding of user behaviour (presence detection, magnetic sensor windows, doors, access control systems) and the local climatic context

A holistic evaluation framework has been developed and published, primarily comprising performance indicators in four areas: the quality of comfort delivered to clients, the quality of how services systems are operated, the intensity at which facilities are used, and the energy used and carbon released to provide services and comfort levels. Performance indicators can be accumulated to create key performance indicators.

SEEDS
Self-learning energy-efficient buildings and open spaces

SEEDS has created an optimal energy and comfort management system for large tertiary buildings. It has developed a Building Energy Management System (BEMS) which optimises energy behaviour and comfort conditions in the building and surrounding open spaces. SEEDS performs detailed modelling of the energy consumption of heating, ventilation, air conditioning and refrigeration equipment using an extensive and re-usable facility model library based on Industry Foundation Classes (IFC).

SEEDS implements an innovative predictive control strategy based on sensor measurements and self-learning techniques. This methodology takes into account the properties of a building and its energy behaviour without the need for an architecture model (usually in BIM) of the building. SEEDS can be easily applied to the energy-aware upgrading/optimisation of existing building services systems and to the retrofitting of old buildings which may lack construction details necessary for traditional systems. Moreover, the use of wireless technologies enables easy and fast deployment.

The SEEDS software for any building is automatically generated based on the creation of a SEEDS Microsoft Access database which is partly based on IFC while also making use of the facility model library developed within the project. This is one of the core features of the project and ensures its applicability to any building.

SEEDS key facts
Start date: September 2011
Duration: 42 months
Total budget (€): 4M
Website: www.seeds-fp7.eu
Coordinator: CEMOSA, Spain
AMBASSADOR
Flexible buildings to make eco-friendly districts.

The purpose of the AMBASSADOR project is to study, develop and experiment with systems and tools aimed at optimising energy usage in the perimeter of a district. These tools will manage energy flows by predicting and mastering energy consumption and production.

In order to meet the ambitious EU targets of achieving clean and secure energy, it is essential that the use of available tools is optimised. A wide range of technologies and methods exist to improve energy efficiency, reduce emissions and turn renewable energy into viable energy sources. However, research has only concentrated on stand-alone buildings which are dependent on their immediate environment. A new approach is required to optimise these technologies and exploit their energy saving potential, starting at the building level and extending to a district level, taking into account district players.

During the course of the AMBASSADOR project a district-wide holistic energy optimisation system will be introduced. This will take advantage of possible shared usage of local energy production and storage in addition to complementing energy consumption profiles. Management system functionalities will be developed to optimise building energy consumption. Selected functions or services proposed by the system will then be validated through a number of scenarios in three validation sites situated in France, Greece and the UK.

COOPERaTE
Control and optimisation for energy positive neighbourhoods

Buildings are responsible for 40% of energy consumption and 36% of CO₂ emissions in Europe. Improving the energy consumption and holistic performance of buildings and neighbourhood systems is an effective way of fighting climate change. While energy efficiency in buildings has been the focus of a range of research programmes, energy management at neighbourhood level is still a relatively unexplored field despite its high energy saving potential.

COOPERaTE aims to reduce CO₂ emissions and optimise the use of energy in neighbourhoods through the design of a suitable cloud platform. The platform will host various energy management systems and decision support services for participating buildings or facilities in a neighbourhood. It provides industry with the ability to not only deliver energy management services but also to accommodate the interoperability with other services such as security, transport, traffic etc., depending on the needs of the specific neighbourhoods.

The concept has been implemented in two test sites and is currently being validated. The two test sites have diverse features including various renewable energy sources and different neighbourhood usages such as business, residential, recreational and research. By integrating local energy sources and storage, both thermal and electrical, and by regulating energy beyond single buildings, the project aims to create a roadmap for energy positive neighbourhoods.

COOPERaTE

Start date: October 2012
Duration: 36 months
Total budget (€): 3.6M
Website: www.cooperate-fp7.eu
Coordinator: RWTH Aachen University, Germany
Partners: France: Bouygues Energies & Services, EMBIX, Ireland; CIT, Intel Ireland, UTRC Ireland, UK; University of Manchester.

KEY FACTS

Start date: November 2012
Duration: 48 months
Total budget (€): 9.8M
Website: www.ambassador-fp7.eu
Coordinator: Schneider Electric Industries SAS, France

Flexible buildings to make eco-friendly districts.

Cases of typical use

AMBA

ASSADOR

French COOPERaTE test site: the Bouygues Challenger campus (© Bouygues)

KEY FACTS

Start date: November 2012
Duration: 48 months
Total budget (€): 9.8M
Website: www.ambassador-fp7.eu
Coordinator: Schneider Electric Industries SAS, France

Flexible buildings to make eco-friendly districts.
E+

New systems, technologies and operation models based on ICTs for the management of energy positive and proactive neighbourhoods.

The construction sector is one of the main energy consumers in Europe and is responsible for 40% of energy demand. The sector also produces 36% of Europe’s total CO2 emissions. The aim of the E+ project is to bring together industry actors from ICT, energy and construction sectors to holistically manage, control and optimise energy use at neighbourhood level. Through the development of a control system for energy management and associated new business and operation models, energy consumption and CO2 emissions can be reduced.

ICT tools will enable energy systems located in European neighbourhoods, including renewable energy sources, stationary storage devices, electric vehicle charging infrastructure, district heating networks, building loads, etc to be managed holistically. E+ proposes to achieve energy efficiency targets through the use of district energy storage, the creation of bi-directional energy flows and by reducing energy losses in power flows through the proximity of energy generation to consumption. CO2 emissions will be reduced by using local renewable resources as the main supply of energy and through the large scale deployment of electric vehicles.

The project is being demonstrated in two pilot studies, one in Málaga, Spain, and the second in Mons, Belgium, in order to assess the energy operation according to the E+ concept.

**E+ key facts**

- **Start date**: November 2012
- **Duration**: 42 months
- **Total budget (€)**: 5M
- **Website**: www.eplusproject.eu
- **Coordinator**: Circe, Spain

EEPOS

Energy management and decision support systems for energy positive neighbourhoods

EEPOS is a research and development project which aims to develop tools for energy optimisation and end user involvement in order to deliver energy positive neighbourhoods. A new system for energy management and automated load control at neighbourhood level will shift controllable loads by matching local electricity generation and consumption. This will manage congestion and increase energy efficiency. The developed business models will benefit both the electricity stakeholders and the heating supply chain.

The new EEPOS services will be transparent for both customers and energy providers and will support the exchange of information. An information platform with user interfaces for different stakeholders will improve the accessibility and availability of relevant information. This will increase customers’ awareness of energy consumption about which they will be able to make decisions. It will motivate users to reduce energy costs, especially if their comfort is not compromised, by shifting energy loads which will in turn reduce energy peaks in the grid.

The developed energy management and decision support systems will be validated in two demonstration projects in Helsinki, Finland, and Lünenfeld, Germany. A simulation based virtual demonstration study will also be carried out for the municipality of Asparrena in Spain. The three demonstration sites are located in different climate zones and are characterised by different energy generation and consumption patterns.

**EEPOS key facts**

- **Start date**: October 2012
- **Duration**: 36 months
- **Total budget (€)**: 4.1M
- **Website**: www.eepos-project.eu
- **Coordinator**: VTT Technical Research Centre of Finland
- **Partners**: Austria: AIT Austrian Institute of Technology GmbH. Finland: Caverion Suomi Oy, Fatman Oy, Germany: Ennovatis GmbH, European Distributed Energy Resources Laboratories eV; Spain: Ayuntamiento De Asparrena, Solintel Milpa SL.
EPIC-HUB

Energy positive neighbourhoods infrastructure middleware based on Energy Hub concept

The EPIC-HUB project aims to achieve energy savings of up to 25% and reduce greenhouse gas emissions by 20% by leveraging the energy potential of neighbourhoods. These ambitious targets will be reached by increasing the performance and efficiency of various channels at either neighbourhood or district level. These channels include energy monitoring functionalities capable of providing real-time information on energy consumption and carbon emissions. Energy compensation schemes are apt at exploiting the generation of energy from renewable energy systems. Finally, the re-utilisation of existing ICT infrastructure and the interoperability of new ones tends to minimise the overall overhead and integration effort related to ICT solutions.

EPIC-HUB will combine the Energy-Hub approach with the development of a fully-interoperable middleware solution. The Energy-Hub model identifies and optimises the interactions between different input energy sources in order to satisfy electricity and heating/cooling demands. EPIC-HUB will tackle energy efficiency, self-generation, and emission reduction. It will exploit the excess energy generated and the unused storage potential often available at the neighbourhood community level.

The adaptability of the EPIC-HUB approach will be demonstrated in pilot studies taking place in the Port of Genoa in Italy, Belgrade Airport in Serbia and the Bilbao Exhibition in Spain. These sites involve their respective neighbourhoods and will demonstrate how critical infrastructures can benefit from innovative energy management.

IDEAS

Intelligent neighbourhood energy allocation and supervision

The IDEAS project aims to develop and validate the technologies and business models required for the cost-effective and incremental implementation of Energy Positive Neighbourhoods (EPNs). These include:

- A neighbourhood energy management tool to optimise energy production and consumption
- User interfaces to engage communities and individuals in the operation of energy positive neighbourhoods
- A decision support urban planning tool to optimise the planning of neighbourhood energy infrastructures
- Business models to underpin EPNs that engage end users, public authorities and utility companies

These tools will be demonstrated at two sites as part of a university campus in Bordeaux, France, and in a newly built residential area in Porvoo, Finland.

In the medium to short term the project will contribute to the incremental rollout of EPNs at the demonstration sites, support the rollout of the real-time energy management tool to the whole Skaftkärr area, in which the Finnish Demo site is situated and inform the renovation of the campus at the University of Bordeaux in France.

In the long term the project will contribute to the opening of a market for ICT-based district/community energy management systems, the establishment of a collaboration framework between the ICT sector, the buildings and construction sector and the energy sector, and a quantifiable and significant reduction of energy consumption and CO₂ emissions achieved through ICT.
NRG4Cast

Energy Forecasting

NRG4Cast is developing real-time management, analytics and forecasting services for energy distribution networks in urban/rural communities. The aim of the project is to develop advanced solutions for predicting the behaviour of local energy networks, energy demand, network failures, short-term trends in energy prices and long-term trends in national and local energy policies.

NRG4Cast will analyse information on energy demand and consumption, environmental data and energy price data in order to provide accurate predictions at multiple levels. This will empower end-users in their participation within the smartgrid environment. Different users of the system will have different objectives: citizens may refer to the system to plan the home usage of high consumption appliances and charges for electric vehicles, while a local utilities company may use the system to offer flexible pricing based on supply and demand, events and incentives.

The final result of the NRG4Cast project will be a software pipeline, which integrates services for monitoring, anomaly detection, route cause analysis, trend detection, forecasting and optimisation. The NRG4Cast solution will be tested on at least two energy networks which include interrelated use cases, public lighting systems, city districts, campuses and electric vehicles. The developed pipeline and toolkit will also be applicable to other energy domains so the project will not only impact energy consumption and energy price predictions but also device networks.

Odysseus

Open dynamic system for saving energy in urban spaces

The aim of Odysseus is to develop an Open Dynamic System (ODYS) to manage holistically the dynamic supply, demand and storage of energy in urban areas. The project has identified and specified the requirements for a number of pilot studies which support the Odysseus strategic approach. The pilot studies focus on neighbourhood and building levels and are located in the cities of Rome and Manchester. A validation methodology based on the ICT-PSP methodology, which calculates and records energy saving results, has been created. It can be customised to the case studies by linking the ‘as-is’ with the ‘to-be’ scenarios. The Odysseus framework architecture has been proposed based on a cloud solution which specifies the key components and service-orientated architecture building blocks. Generic concepts of the Odysseus dynamic Energy Profile Card (dEPC) ontology have been defined along with their related business models. This was in order to identify generic patterns in energy use at building and neighbourhood levels. A dEPC is the functional and technical description of an energy node covering both static and dynamic information. Key components of the Odysseus platform have been set-up, including the Geographic Information System (GIS) and semantic services. They contain the proof of concept for the dEPC ontology and initial steps on the CityGML ADE extension, a common information model for the representation of 3D urban objects.

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NRG4Cast system and selected pilots

KEY FACTS

Start date: December 2013
Duration: 36 months
Total budget (€): 3.7M
Website: www.nrg4cast.org
Coordinator: Institut Jozef Stefan (JSI), Slovenia

Odysseus architectural framework: Logical view

KEY FACTS

Start date: November 2012
Duration: 36 months
Total budget (€): 3.7M
Website: www.odysseus-project.eu
Coordinator: Telvent, Spain
RESILIENT

Orchestrating Renewable Integrated Generation in Neighbourhoods

The potential of renewable generation to achieve carbon emission savings is severely restricted by the fact that renewable supply is often poorly aligned with energy demand. However, at the community or neighbourhood level, significant opportunities exist for optimising the alignment of renewable supply with community demand.

RESILIENT’s primary objective is to demonstrate that through the use of the RESILIENT smart ICT architecture, significant increases in energy efficiency and reductions in carbon emissions can be achieved for large and small groups of buildings. RESILIENT does not target reductions in total energy use but rather the optimisation of the use of locally generated renewables thus reducing the need to import fossil fuel derived energy.

RESILIENT addresses the disparity between energy supply and energy demand by integrating consumption and generation subsystems at a community scale. Predictive algorithms have been developed that will allow energy loads to be shifted to better match local renewable energy generation and thus increase energy efficiency and reduce carbon emissions. Loads will either be actuated automatically or building occupants will act upon information provided by the RESILIENT system. Monitoring and actuating equipment has been deployed in three communities: Damanhur in Italy, Findhorn in Scotland and Tamera in Portugal. The RESILIENT approach will address community goals for cost, carbon footprint and other objectives.

RESILIENT concept for the district model showing thermal, electric energy and gas flows

ORIGIN

Orchestrating Renewable Integrated Generation in Neighbourhoods

The ORIGIN system helps match community electricity demand with renewable electricity generation

ORIGIN’s primary objective is to demonstrate that through the use of the ORIGIN smart ICT architecture, significant increases in energy efficiency and reductions in carbon emissions can be achieved for large and small groups of buildings. ORIGIN does not target reductions in total energy use but rather the optimisation of the use of locally generated renewables thus reducing the need to import fossil fuel derived energy.

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ORIGIN concept for the district model showing thermal, electric energy and gas flows

KEY FACTS

Start date: November 2012
Duration: 36 months
Total budget (€): 4M
Website: www.origin-concept.eu/
Coordinator: Heriot-Watt University, United Kingdom
Partners: Germany: Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung eV. Italy: Solera SCRL. Portugal: IOS – Peace Research Centre LDA, Portugal, ISA. Spain: Instituto Tecnologico De Informatica. UK: Findhorn Foundation College LBG, University of Strathclyde.

KEY FACTS

Start date: September 2012
Duration: 48 months
Total budget (€): 8.1M
Website: www.resilient-project.eu
Coordinator: D’Appolonia SpA., Italy
The objective of the SmartKYE project is to improve energy efficiency and optimise energy usage in neighbourhoods. SmartKYE aims to reduce energy usage by approximately 25%. This will be achieved through the development of an advanced, integrated, management system which will consider energy efficiency in neighbourhoods from a holistic perspective. The energy management systems will be deployed in districts that are consuming or producing energy, and which currently use an isolated IT management solution. The new solution will enable them to share data and services through an open platform among themselves and with external third parties. This enables the design and development of higher level applications such as the SmartKYE Cockpits. The SmartKYE Cockpits are able to process real-time data and generate valuable analytics. These findings can be used to influence the business and monitoring and control strategies that operate a district, or a subset of the deployed energy services. The deployment of the open platform proposed by SmartKYE will provide a more granular and accurate tool to respond to emergency situations without actually interrupting the service. On the other hand, the more granular solution proposed by SmartKYE enables a finer control of the quality of service which is managed by energy service companies.

**EFFESUS**

Energy efficiency for EU historic districts’ sustainability

EFFESUS is researching the energy efficiency and sustainability of European historic urban districts and developing measures and tools to help improve these properties whilst protecting the heritage value of the district. Historic urban districts are an integral part of European cultural identity and heritage. Improving their energy efficiency will help protect this heritage for future generations.

The main output of EFFESUS is a Decision Support System which will help users to make informed decisions about suitable improvement measures for historic urban districts. The tool supports the user in selecting strategies at urban scale to achieve significant energy savings, indoor climate improvements and carbon emission reductions. The decision making will be supported by a multiscale spatial data model, a categorisation of historic buildings and districts and a repository of energy-efficient retrofit solutions. The project will develop and implement new and adapted technologies and systems which are cost-effective and compatible with the historic context, including insulating mortars, radiant reflective coatings, aerogel insulation and secondary window solutions and intelligent energy management systems. EFFESUS will demonstrate the applicability of its technical developments and the suitability of its software tool in seven real case studies. The project results from EFFESUS will be widely disseminated throughout Europe so as to engage with as large an audience as possible.
EU-GUGLE

European cities serving as green urban gate towards leadership in sustainable energy

EU-GUGLE aims to demonstrate the feasibility of nearly-zero energy building renovation models, with a view to triggering large-scale, Europe-wide replication in smart cities and communities by 2020. A total of 226,000m² of living space will be renovated within six EU-GUGLE smart districts. The objective of the renovation is to achieve primary energy savings between 40 to 80% per pilot district and to increase its share of renewable energy by 25% by 2018. The six pilot cities and two associated cities are working together to combine the latest research on smart renovation for groups of buildings at district level. This knowledge will be used to implement a balanced mix of technical, socio-economic and financial solutions adapted to local needs.

After 18 months the EU-GUGLE project has refurbished 301 dwellings (28,023m²) with work currently on-going in another 325 dwellings (27,029m²). All aspects of the renovation process are being monitored and evaluated, from the energy performance of the renovated buildings to the financing schemes selected by the municipalities and the citizen engagement strategies. More than 50 workshops and dissemination activities have been carried out with citizens, stakeholders and technical experts. The “My Smart City District” campaign, which includes a knowledge transfer network created to exchange information on Smart cities, has been created in collaboration with the R2CITIES, ZENN and SINFONIA projects.

R2CITIES

Renovation of residential urban spaces: towards nearly zero energy cities.

R2CITIES aims to develop an open and easily replicable strategy for designing, constructing, and managing large scale residential district renovation projects in order to achieve nearly zero-energy cities. The integrated and systemic design approach proposed in R2CITIES is expected to favour large interventions with economies of scale. It will cover districts as a whole instead of dealing with isolated buildings. It will focus on energy efficiency and cost effectiveness and will create new business models. The R2CITIES framework will be validated by a strong demonstration programme including the renovation of 57,000m² in three cities, all committed to the Smart Cities challenges and objectives: Valladolid in Spain, Genoa in Italy and Kartal in Istanbul.

In the first year, the R2CITIES methodology was released which focused on district audit, design and negotiation phases. An energy audit of the three residential districts was completed and district sustainability indicators were defined to standardise the quantification of the pre-and-post retrofitting status. Studies of cost-effective solutions were carried out focusing on the feasibility of the individual Energy Conservation Measures (ECM), the cost-effectiveness considering the district as a whole, and the financial analysis of individual ECMs and the intervention as a whole. The Measurement and Verification plan, based on the Internal Performance Measurement Verification Protocol at district level, was also deployed. These activities were completed, exploited and disseminated.
URB-Grade

Decision support tool for retrofitting a district towards the district as a service

The URB-Grade project will design, develop and validate a platform for city planning and decision making. The platform will collect data from heterogeneous distributed sensors, open data sources and survey based data. It will the process these using complex event processing techniques to generate relevant information which will be available over a common cloud-based service platform.

The platform has been designed to overcome the challenges of multi-tenancy and scalability. It will support the connection of multiple users and will be capable of dealing with multiple languages. The acquisition of heterogeneous data in different data formats and with different intensities, based on the data source and pilot study it has come from, will be presented in a homogeneous way. To ensure reliable and credible data, added value information, based on the raw data of the pilot sites, will be created by the computation engine together with analytic services and prediction modules. The platform will be scalable to ensure that it is capable of supporting strategic planning and using big and constantly growing amounts of data.

The platform will help quantify and reduce CO\textsubscript{2} emissions and will enable sustainable public decision-making. It will foster the introduction of energy saving components or new devices which will provide energy savings, cost reductions and new skills in the energy sector.

ZenN

nearly Zero-energy Neighbourhoods

Low energy retrofitting at district scale has proved to be a complex challenge, although one where big gains can be achieved. The ZenN project’s main objectives are to maximise these gains by providing best-practice examples as well as leveraging lessons learnt to ensure maximum replication potential. The ZenN approach is being implemented in six demonstration sites located in Sweden, Spain, Norway and France which focus on near zero-energy renovation projects at neighbourhood scale. Retrofitting work has already started in most of the demonstrators triggering positive feedback from users and tenants, even before the monitoring of the building services has begun. In some of them the short-term replication opportunities are visible. Improvements in quality of life and energy consumption reductions are yet to be measured within the project, but their impact is becoming apparent as retrofitting work progresses.

The complexities inherent with large-scale retrofitting actions, especially from the management side, such as budget constraints and project timeline changes, have become evident. The experience gained by the project team in dealing with them has reinforced the importance of providing improvements in the social and economic aspects of large-scale residential retrofitting. Expected outcomes of ZenN in this area will help enhance the replication potential not only within the participating cities and countries but also in Europe as a whole.

ZenN

nearly Zero-energy Neighbourhoods
Projects from 2013 Call
BESOS
Building energy decision support systems for smart cities

BESOS proposes to develop an advanced, integrated, management system which considers energy efficiency in smart cities from a holistic perspective. Energy-efficient Smart cities rely on highly heterogeneous already deployed infrastructure and services, eg, public lighting system, urban heating system, public buildings, electric vehicles, micro-generation etc. These systems which consume and produce energy are typically managed by isolated Energy Management Systems.

The BESOS project aims to develop this system in order to share data and services through an open trustworthy platform with external third parties in order to achieve advanced coordinated energy saving strategies. This enables the design and development of higher level tools such as the Business Balanced Score Card and the decision support system cockpit which are able to process real-time data and generate valuable analysis. The results from the analysis will be used to influence businesses’ Monitoring and Control strategies that operate a smart city.

DAREED
Decision support advisor for innovative business models and user engagement for smart energy-efficient districts

The DAREED project aims to reduce energy consumption in buildings by using ICT and anticipates savings of between 7% and 10%. To achieve this DAREED will create a system capable of receiving information from various sources which will enable the energy consumption taking place at a neighbourhood level to be analysed. The system will then provide information and advice to citizens as well as utilities and public institutions about ways of reducing consumption. All stakeholders will be involved in the process of improving energy efficiency. The platform will enable citizens to become active in making decisions about their energy consumption with information accessible through mobile alerts, emails or other systems. The tools will also be used to help energy companies to define and validate their business strategies and pricing schemes, making them economically viable and, at the same time, promoting good practice in the use of energy.

Design4Energy
Building life-cycle evolutionary design methodology able to create energy-efficient buildings flexibly connected with the neighbourhood energy system

Current building design practices do not take into consideration energy demand or provide information for predicting future behaviour in terms of energy demand and material deterioration. Access to this kind of information is beneficial in the early stages of the design process.

The Design4Energy project aims to develop tools and methodologies in response to these issues which will assist in the design of energy-efficient buildings considering both short term and future performance. Important factors such as deterioration curves, technology evolution, climate, users and energy neighbourhood configurations will be evaluated and their impact on the Building Life Energy Performance will be quantified.

17 partners from 11 countries covering the whole building life cycle are involved in developing the innovative, evolutionary design methodology which will be applicable at an individual and neighbourhood level. It will enable stakeholders to make better decisions to optimise energy performance throughout the building’s life-cycle level, including operation and maintenance.
The key objective of ECODISTRICT-ICT is to support the sustainable renewal of urban districts. To achieve this, the ECODISTRICT-ICT team will develop a modular, open-source software platform to support the decision-making process of all stakeholders involved in district renovation. The platform will bring together the main decision makers in urban district transformation programs and their different perspectives and time scales, in order to achieve a coordinated approach that joins building retrofitting with district renovation. It will create economies of scale at a district level and enable the optimisation and prioritisation of decision making.

The software platform will enable true interdisciplinary assessments of district retrofitting. By connecting various modules in a user-friendly way, the ECODISTRICT-ICT decision support tool will provide trustworthy insights on retrofitting and renewal projects. It will assess the associated costs and benefits through the life-cycle of the buildings, as well as environmental and social impacts at a district level.

eeEmbedded
Collaborative holistic design laboratory and methodology for energy-efficient embedded buildings

eeEmbedded will develop an open BIM-based, holistic, collaborative design and simulation platform, a related holistic design methodology, an energy system information model and an integrated multi-model information management framework. These will contribute towards designing energy-efficient buildings and their optimal embedding in terms of energy, with surrounding buildings and energy systems at neighbourhood level.

The project will provide a new control and monitoring system based on hierarchically structured key design requirements and respective key performance indicators to support the complex design collaboration process. Knowledge-based detailing templates will enable energy simulations in the early design phases. BIM and ontology-based interoperability will provide a seamless holistic design process with distributed experts. The consistent integration of simulations in the virtual design office will allow the overall energy performance, CO₂ emissions, user behaviour, construction and facility operation, risks and lifecycle costs all to be taken into account, thereby extending the virtual design office into a real virtual design lab.

FASUDIR
Friendly and affordable sustainable urban districts retrofitting

The traditional approach to energy-efficient retrofitting in buildings often brings poor results in terms of urban sustainability, resource efficiency and economic return. Although district retrofitting is the most sustainable and cost-effective route, in most examples the decision making increases in complexity as the scale grows. This is worsened further by the fragmentation of the construction sector.

The FASUDIR project provides an Integrated Decision Support Tool (IDST) to help decision makers select the best energy retrofitting strategy in order to increase the sustainability of the whole district. The IDST will incorporate key actors and relevant networks at a district scale, and will ensure that new technologies for energy and resource efficient retrofitting are incorporated. With stakeholder feedback loops, training, and validation in three diverse urban areas, the IDST will be robust and applicable to the entire value chain.

**KEY FACTS**

**ECODISTRICT-ICT**

Start date: December 2013  
Duration: 36 months  
Total budget (€): 4.1M  
Website: www.ecodist-ict.eu  
Coordinator: VITO, Belgium  

**eeEmbedded**

Start date: October 2013  
Duration: 48 months  
Total budget (€): 11.1M  
Website: www.eeembedded.eu  
Coordinator: Technische Universität Dresden - Institute of Construction Informatics, Germany  

**FASUDIR**

Start date: September 2013  
Duration: 36 months  
Total budget (€): 4M  
Website: www.fasudir.eu  
Coordinator: Tecnalia, Spain  
HOLISTEEC

Holistic and optimised life-cycle integrated support for energy-efficient building design and construction

HOLISTEEC aims to provide the European architecture, engineering, construction and facilities management industry with a comprehensive design approach to improve energy efficiency in the built environment. The approach will take into account the whole building life-cycle and the influence of neighbourhoods. Using the HOLISTEEC design approach, all actors involved in buildings - architects, designers, contractors, owners, component suppliers, users and related public authorities - will be able to effectively interact in the design, construction, operation, and maintenance phases of a building design project. This approach will ensure the application of the best construction techniques, early detection of possible drawbacks and the prompt application of correction strategies which will help boost high quality new energy-efficient building design and construction. The HOLISTEEC platform and tools will be applied and demonstrated in four pilot projects. It will demonstrate the new holistic approach in different contexts and building project typologies, thus proving its potential for market replication.

KEY FACTS

Start date: October 2013
Duration: 48 months
Total budget (€): 48 M
Website: www.holisteeceu.eu
Coordinator: D’Appolonia, Italy
Partners: Finland: Sanaati-Kiinteistöt, Technologian Tukikoulutuslaitos VTT, France: Centre Scientifique et Technique Du Batiment, Commissariat A L’energie Atomique Et Aux Energeries Alternatives, Geomod. GDF-Suez, Germany: AIB-Institut für angewandte Bauinformatik, GEM Team Solutions, Technische Universität Dresden, Italy: STI Engineering, The Netherlands: Koninklijke Bam Groep, Poland: Bergamo Tecnologie, Spain: Acciona Infraestructuras, Cype Soft, Fundacion Tecnalia Research and Innovation, Pich-Aguilera Arquitectos, Slovakia: NEMETSOKE, Slovenia: National Taiwan University of Science and Technology, Taiwan: National Taiwan University of Science and Technology.

READY4SmartCities

ICT roadmap and data interoperability for energy systems in smart cities

READY4SmartCities aims to define a common data framework allowing full interoperability among different city systems, as well as a consistent vision on how ICT can support energy systems in Smart Cities. READY4SmartCities brings together relevant stakeholders including engineering specialists, ICT software, equipment and renewable energy system providers, energy and construction sector companies as well as municipality authorities for delivering the following:

- A new energy data ecosystem that will accommodate cross-domain data (climatic, occupation, pollution, etc) and will allow global-scale data to be exploited
- A set of ontologies relevant to energy efficiency in Smart Cities and related guidelines on how to use, publish and interchange data described according to those ontologies
- A holistic and shared vision, enabling city authorities and other relevant stakeholders to develop feasible action plans for the use of ICT-based solutions in energy systems in urban and rural communities

KEY FACTS

Start date: October 2013
Duration: 24 months
Total budget (€): 12 M
Website: www.ready4smartcities.eu
Coordinator: D’Appolonia SpA, Italy

ADAPTIWALL

Development of a multi-functional light-weight wall panel based on adaptive insulation and nanomaterials for energy efficient buildings

Energy efficient refurbishment in the construction industry is necessary in order to reach EU 2050 goals. Approximately 85% of residential buildings were built before 1990 with poor insulation. Consequently energy is wasted when operating auxiliary heating, ventilation and air conditioning installations. Current retrofitting increases the envelope thickness and can have negative consequences such as inappropriate airtightness, over-heating, poor ventilation and loss of space.

ADAPTIWALL resolves these issues by developing a multifunctional and climate-adaptive panel for use in retrofitting. The panel is composed of three elements: lightweight concrete with nano-additives for efficient thermal storage and load bearing capacity, adaptable materials for switchable thermal resistance and a total heat exchanger with a nanostructured membrane for temperature, moisture and anti-bacterial control.

ADAPTIWALL will also focus on enhancing the structural, fire safety and sound insulation properties of the panel. The novel system will be demonstrated and utilised in the European construction industry.

KEY FACTS

Start date: September 2013
Duration: 18 months
Total budget (€): 4 M
Website: www.adaptiwall.eu
Coordinator: TNO, the Netherlands
BRIMEE

Cost-effective and sustainable Bio-Renewable Indoor Materials with high potential for customisation and creative design

Besides good and consistent thermal and acoustic performance, a good quality, marketable insulation material should not degrade, pollute the indoor environment, shrink or settle. It should be self-extinguishing, cost-effective and safe to handle, while having a low embodied energy proven through a life-cycle assessment.

BRIMEE aims to develop insulation materials with enhanced insulation performance which addresses the above characteristics. The materials will reduce the buildings operational energy, significantly improving its energy performance, will not emit harmful substances and will absorb indoor pollutants. The innovation is based on a Nano-Cristalline Cellulose (NCC) based foam, strengthened with Furan, a naturally derived resin which provides the self-extinguishing features.

The BRIMEE product family will be applicable to the building envelope and interior partitions of both new and existing buildings. The largest market will be composed of buildings built before 1975 which require retrofitting. This market focus is in line with EU priorities and recent action plans and directives.

ELISSA

Energy-efficient lightweight-sustainable-safe-steel construction

ELISSA targets the development, testing, assessment and demonstration of nanotechnology-enhanced, lightweight, steel skeleton, drywall systems that provide improved thermal, vibration, seismic and fire performance. The selection of inorganic nanomaterials and microelectromechanical systems is based on their inherent thermal, damping and fire spread prevention properties. Vacuum insulation panels, aerogels and intumescent paints are used for insulation and thermal sealing. Nanostructured electrodes and nanostructured organic photovoltaics are used as part of an active damping device.

The implementation of inorganic nanomaterials and microelectromechanical systems into these new multifunctional, prefabricated drywall systems is achieved via the development of industrially friendly application methods and the use of new computational and design tools. These will be structurally tested and optimised as load bearing elements capable of resisting impacts ranging from weak vibrations through to severe earthquakes. Such elements will be integrated in energy-efficient, safe and sustainable, anti-seismic, steel frame, lightweight buildings which exploit nanomaterials and fulfill relevant EU building codes and local regulations.

FoAM-BUILD

Functional adaptive nanomaterials and technologies for energy efficient buildings

The most commonly used insulation strategy in the EU is External Thermal Insulation Composite Systems (ETICS). State-of-the-art ETICS require a thick layer of insulation material to achieve the desired thermal properties. This is resource intensive and results in increased greenhouse gas emissions. Many ETICS also incorporate persistent, bio-accumulative and toxic (PBT) substances and are therefore not sustainable. Façades are also vulnerable to moisture which decreases their service life and leads to the growth of microorganisms.

The objective of FoAM-BUILD is to overcome the limitations of these ETICS. A new thermoplastic particle foam with a nanostructure will be developed to achieve the targeted insulation behaviour. New, non-halogenated flame retardants will also be incorporated to avoid PBT substances. To avoid fungi and algae growth a moisture control system will be developed to respond to moisture by activating a ventilator system which will dry targeted areas of the façade.

**KEY FACTS**

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<th>Start date: July 2013</th>
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<td>Duration: 48 months</td>
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<td>Total budget (€): 5.7M</td>
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<td>Website: <a href="http://www.elissaproject.eu">www.elissaproject.eu</a></td>
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<td>Coordinator: National Technical University of Athens, Greece</td>
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<td>Website: <a href="http://www.foambuild.eu">www.foambuild.eu</a></td>
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<td>Coordinator: Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V., Germany</td>
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MF-Retrofit

Multifunctional facades of reduced thickness for fast and cost-effective retrofitting

In Europe more than 40% of the overall energy consumption and 36% of the overall CO₂ emissions are produced by buildings. On the other hand, only 1-1.5% of the European building stock is newly built each year and 1-3% of energy end-use per annum goes to the replacement of existing building stock, which means that the majority of energy is consumed by existing buildings. The MF-Retrofit project is addressing these issues by developing a lightweight, durable, cost-effective and high performance façade retrofitting panel. Its layered structure allows for separate but also synergistic function regarding high thermal and acoustic insulation, excellent mechanical properties, flame retardant properties and photocatalytic activity. The resulting panels will be substantially lighter, more durable and easy to install. The materials employed include polyurethane with bio-based content, aerogels, geopolymers, PCMs, photocatalytic coatings as well as fibre reinforced plastics with integrated nanomaterials.

SESBE

Smart elements for sustainable building envelopes

There is a growing demand for increased energy efficiency, safety and improved health of buildings. Precast façade elements made of concrete have a long tradition in the built environment. However, the design of these elements does not yet include many major breakthroughs in material development towards reduced weight and increased thermal efficiency. The SESBE project aims to develop lightweight precast façade elements using carbon fibre reinforced reactive powder concrete as structural material and aerogel modified foam concrete for the insulation layer. A new type of sealing tape for panel joints and façade openings and a new intumescent coating for anchorage systems will be developed. Nanomaterials and nanotechnology will be employed to custom design functional and performance properties such as easy-to-clean/self-cleaning surfaces, increased heat reflectivity by a heat reflective layer and moisture control in the insulation using nano-clays.

ECO-SEE

Eco-innovative, safe and energy efficient wall panels and materials for a healthier indoor environment

ECO-SEE will address an emerging health problem associated with modern low carbon buildings which are developed to be very airtight. This improves their energy efficiency and reduces their carbon footprint. However, these sealed environments have unexpected side effects, with research showing that build-up of potentially harmful chemicals in the air could have negative impacts on occupants.

The project studies the use of innovative eco-building materials to address poor air quality and improve energy efficiency. Highly insulated wall panels will be developed. The panels will be treated with novel chemical processes to capture volatile organic compounds and novel photocatalytic coatings to decompose harmful chemicals, preventing them from being released into the air. The project aims to deliver products with at least 15% lower embodied energy than traditional construction materials, 20% longer lifespan, and 20% lower build costs. By making better, cheaper products the research will offer a cost effective solution with potential for real market impact.
H-HOUSE
Healthy life with eco-innovative components for housing

An adequate building envelope should protect against moisture ingress, heat loss in winter, excessive heating in summer and noise. The H-HOUSE project aims to develop a number of building components for modern society where awareness for environmental aspects and living comfort are complementary. The concept focuses on components for the building envelope and building interiors, for both new build and renovation. The solutions will be durable, energy-efficient and affordable. Interior components should be able to buffer heat and humidity peaks, and prevent pollutants and noise.

H-HOUSE proposes innovative sustainable façade and partition walls based on earthen materials, optimised cementitious materials with modified surfaces and wooden/cellulose materials. An innovative modification of the materials will include energy-saving and air purifying aerogel granulates which will help to optimise indoor conditions. The concepts consider material properties, embodied energy, suitability to different environments, durability, cost-efficiency and the long-term improvement of energy efficiency in buildings.

OSIRYS
Forest based composites for façades and interior partitions to improve indoor air quality in new builds and restoration

OSIRYS aims to improve indoor environmental quality and energy efficiency by developing forest-based biocomposites for facades and interior partitions which can be applied in retrofitting and new building construction. Traditional construction building materials contribute contaminants such as Volatile Organic Compounds (VOCs), formaldehyde, particulates and fibres which reduce indoor air quality. The project will develop forest biocomposites with different functionalities able to meet the requisites of the Building Code and improve indoor air quality. This will be achieved by eliminating VOC and microorganisms, increasing thermal and acoustic insulation and controlling the breathability of the construction systems. Thermostet epoxy resin based on forest wastes and a thermoplastic lignin-based polymer are being reinforced with natural fibres. Cork granules are used to improve the insulation performance. Special attention is paid to the addition of additives, especially fire retardants, in order to ensure that the cost/processability/performance ratio is met.

A2PBEER
Affordable and adaptable public buildings through energy efficient retrofitting

Buildings are responsible for approximately 40% of the total energy consumed in Europe with non-residential buildings consuming 40% more than residential buildings. Energy efficient retrofitting is therefore an essential component in reaching EU 20-20-20 targets.

A2PBEER focuses on the retrofitting of public buildings as they represent 30% of non-residential buildings in Europe. The project aims to demonstrate that it is technically feasible and cost effective to reduce the current energy consumption of existing public buildings by more than 50%. A2PBEER will develop a systemic, replicable, energy efficient buildings’ retrofitting methodology to demonstrate that Net Zero Energy Building (NZEB) requirements can be achieved. The methodology will implement a combination of readily available, affordable, adaptable technologies and new solutions developed within the project.

The A2PBEER methodology will be demonstrated and validated in three real retrofitting projects across Europe. The project will mobilise retrofitting of the existing building stock in Europe through provision of building models for NZEB districts.
BRICKER

Total renovation strategies for energy reduction in public building stock

The BRICKER concept comprises a retrofitting solution package for existing public non-residential buildings which aims to reduce energy consumption beyond 50%. BRICKER will help public bodies to implement optimal retrofitting strategies, taking into consideration economic and financial constraints, latest developments in building know-how, innovative business models and continuous operation strategies.

The project focuses on:
- Envelope retrofitting solutions for energy demand reduction, achieved through made-to-measure façades, innovative insulation materials and high performance aerating windows
- Zero emission energy production technologies drawing on an Organic Rankine Cycle-based cogeneration system fed with locally available renewable sources, like biomass or solar
- The development of integration and operation strategies for the BRICKER technologies and guidance for design, commissioning and maintenance

The retrofitting solution package will be implemented in three real demonstration buildings, located in different countries and with different end-uses. Technology integration, guidance for implementation and technology transfer will be developed to maximise impact and replicability of the project.

CommONEnergy

Re-conceptualising shopping malls from consumerism to energy conservation

The CommONEnergy project aims to transform shopping malls into beacons of energy-efficient architecture and systems by re-conceptualising them through deep retrofitting. Innovative technologies and solution-sets, as well as methods and tools to support their implementation, are being developed as part of a Systemic Retrofitting Approach (SRA).

The SRA will include a modular, climate-responsive façade, the integration of vegetation into the envelope, a multi-functional smart coating, natural and artificial lighting, an intelligent building energy management system, short and long-term energy storage, energy production and distribution strategies and the integration of active air-conditioning and refrigeration components.

The solutions and approaches will be verified through demonstration projects in Italy, Norway and Spain. The proposed solution-sets will also be simulated in seven additional shopping malls across Europe. The overall objective is to significantly reduce energy consumption, improve comfort conditions and diminish environmental and social impacts while ensuring lean processes and short pay-back times.

EcoShopping

Energy-efficient and cost competitive retrofitting solutions for shopping buildings

EcoShopping aims to create a holistic retrofitting solution for commercial buildings which will reduce primary energy consumption to less than 80kWh/m² per year. It also aims to increase the share of renewable energy sources by more than 50% compared to current state-of-the-art, by considering end-user requirements and comfort parameters. The project intends to use and integrate available products, technologies and equipment to accurately monitor the environmental and occupancy parameters and to provide advanced control.

EcoShopping aims to increase the energy efficiency of commercial buildings by more than 50%. This will be achieved by improving insulation and lighting systems, integrating additional renewable energy system-based heating, ventilation and air conditioning (HVAC) systems, exploiting the building for thermal storage, developing an intelligent automation control unit and by developing maintenance and commissioning technologies. The EcoShopping platform will integrate existing HVAC systems and will interoperate with other ICT-based subsystems for security, protection, gas-detection, safety and comfort.
RESSEEPE

Retrofitting solutions and services for the enhancement of energy efficiency in public edification

RESSEEPE will bring together design and decision-making tools, innovative building fabric manufacturers and a strong demonstration programme to show how building performance can be improved through retrofitting. The core idea of the RESSEEPE project is to technically advance, adapt, demonstrate and assess a number of innovative retrofit technologies. The project was initiated to address the 160M buildings in the EU which collectively represent approximately 40% of the EU’s total energy consumption and 36% of the EU’s total CO₂ emissions. RESSEEPE focuses on renovating these existing public buildings to achieve energy savings and reduce CO₂ emissions. Initially 102 000m² of public buildings are expected to be renovated. This will increase to 205 000m² in the following years. The aim of the project is to reduce energy consumption by 50%. The RESSEEPE technologies will be validated in three demonstration-sites located in Coventry in the UK, Skellefteå in Sweden and Barcelona in Spain.

Energy IN TIME

Simulation-based control for energy efficiency building operation and maintenance

The operational stage of a building represents 80% of its life-cycle costs, of which 50% is due to energy use. Energy and cost saving strategies addressing the building’s operational phase will therefore have a major impact on building life-cycle costs.

Energy IN TIME will develop a smart energy simulation-based control method to reduce energy consumption in the operational stages of existing non-residential buildings. Its aim is to automate the generation of optimal operation plans tailored to the actual building and its users’ requirements.

New techniques will be developed to improve the lifetime and efficiency of energy equipment and installations based on the prediction of comfortable indoor conditions and user behaviour performance. The control of different buildings will be centralised in a single automated process which can also be operated remotely. The use of these methods to operate existing building energy management systems will result in a 20% saving in energy consumption.

PERFORMER

Portable, exhaustive, reliable, flexible and optimised approach to monitoring and evaluating building energy performance

The overall objective of the PERFORMER project is to identify, examine, and address the discrepancy between the predicted and actual energy performance of a building, and produce a commercially viable solution. A set of methodologies as well as an ICT platform involving a hardware and software architecture will be developed to achieve this. As well as physical outputs, the project will raise awareness and promote the importance of energy management continuity throughout a building’s lifecycle from the design phase to the operational stage. At the operational stage the PERFORMER solution will increase a building manager’s visibility of the energy performance of the building and will provide intelligent decision support, based on a comparison of simulated versus actual energy performance. PERFORMER will be demonstrated in a new high school in the UK, a new hotel in Poland, a refurbished hotel in Spain, and an office building in France.

KEY FACTS

**RESSEEPE**
- **Start date:** July 2013
- **Duration:** 48 months
- **Total budget:** 5.7M
- **Website:** www.resseepe-project.eu

**Energy IN TIME**
- **Start date:** October 2013
- **Duration:** 48 months
- **Total budget:** 7.7M
- **Website:** www.energyintime.eu

**PERFORMER**
- **Start date:** September 2013
- **Duration:** 48 months
- **Total budget:** 5.7M
- **Website:** www.performer-project.eu

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- **Duration:** 48 months
- **Total budget:** 5.7M
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**PERFORMER**
- **Start date:** September 2013
- **Duration:** 48 months
- **Total budget:** 5.7M
- **Website:** www.performer-project.eu
TRIBUTE

Take the energy bill back to the promised building performance

Whole Building Energy Performance Simulation (BEPS) models are being increasingly used as a method of information management throughout the life-cycle of energy-efficient buildings. However, today’s BEPS models are largely insufficient with significant discrepancies showing between the measured and computed building energy performance. TRIBUTE aims to minimise the gap between computed and measured energy performance by improving the predictive capability of a state-of-the-art commercial BEPS.

The project will also aim to extend the utilisation of the model to the commissioning and operation phases. The energy gap will be minimised by accessing real-time data for key building parameters, the ageing of the building and the impact of occupants, and automatically adapting the on-line, real-time BEPS to match these. TRIBUTE proposes a novel retrofit strategy that will be part of the improved BEPS in order to help meet building automation and control regulations and monitoring.

CITYOPT

Holistic simulation and optimisation of energy systems in Smart cities

The CITYOPT project will create a set of tools to support the planning, detailed design and operation of energy systems in urban districts. The project will address energy system optimisation for different life-cycle phases.

The tools developed within the project will bring together information and guidelines to support the design of scenarios and models for whole energy systems or specific sections. A user-centred design approach and an analysis of both user consumption behaviour and decision-making processes will help to further develop the simulated scenarios.

Results from the simulations, which are used as case studies, and operational results from field tests will be used to support the project. These outputs will demonstrate how alternative energy solution scenarios can be prioritised based on social, economic and environmental criteria. The importance of each of these criteria can be decided by the user. Stakeholders including end-users of the tools will be involved throughout the development process.

CoSSMic

Collaborating smart solar powered microgrids

CoSSMic aims to develop an innovative, autonomic multi-agent based ICT system to coordinate energy usage and storage in buildings at neighbourhood level. It accomplishes this by facilitating load shifting and the two-way exchange of energy with public power grids. The system will be governed by constraints set by the building’s inhabitants, using devices such as smartphones or touchpads. Weather forecasts and pricing signals provided by electric power retailers and public grid operators will also be taken into account.

The CoSSMic technology will yield significant benefits in terms of reduced power bills, CO₂ footprint, and peak loads on the public grid, thereby reducing the need for fossil fuel based backup production capacity. This approach will be demonstrated and assessed in trials in two testing regions, Konstanz in Germany and Caserta in Italy. The software will be provided as open source in order to enable the bottom up emergence of neighbourhood systems stimulated by achievable benefits.

KEY FACTS

TRIBUTE

- Start date: October 2013
- Duration: 48 months
- Total budget (€): 9.9M
- Coordinator: Centre Suisse d’Electronique et de Microtechnique SA, Switzerland

CITYOPT

- Start date: February 2014
- Duration: 36 months
- Total budget (€): 3.9M
- Website: www.cityopt.eu
- Coordinator: VTT Technical Research Centre, Finland

CoSSMic

- Start date: October 2013
- Duration: 36 months
- Total budget (€): 4.2M
- Website: www.cossmic.eu
- Coordinator: SINTEF, Norway
Portugal: EDP use and carbon emissions of healthcare districts

The aim of the project is to reduce the energy and real-time feedback about energy impact of user behaviours; the integration of Building Information Models (BIM) with real-time data and their extension at the district level (DIM); and new business models for energy traders and prosumers exploiting user energy profiling. The innovative system will be validated in both public (university campuses, schools) and private buildings in mixed urban districts in two different cities, Turin in Italy and Manchester in the United Kingdom.

ICT is a key player in tackling climate change with pervasive sensors and actuators able to efficiently control the whole energy chain (Smart Thermal/Electricity Grid). Advances in 3D modelling, visualisation and interaction technologies enable user profiling and real-time feedback which promote energy efficient behaviours. To unlock the potential of these technologies, the DIMMER project focuses on the interoperability of district energy production/consumption, environmental conditions and user feedback data; the exploitation of effective visual and web-based interfaces to provide pervasive

e-balance

Balancing energy production and consumption in energy-efficient smart neighbourhoods

Energy efficiency is crucial for the rational consumption of available resources and the reduction of CO₂ production. However, reducing energy consumption is only a part of the solution. Applying more environment-neutral or renewable energy sources without smart management systems may cause failures in the energy grid or cause energy wastage. Increased efficiency can be achieved by introducing intelligent solutions that combine the control of energy production and consumption.

The e-balance project will investigate the social, economic and technical aspects which currently affect the successful application of an intelligent solution and will propose a solution that satisfies the defined requirements. The social aspects related to the users’ acceptance and involvement, the economic aspects which relate to the business nature of the underlying ecosystem and the technical aspects will be investigated in order to achieve a mature and holistic solution.

DIMMER

District information modelling and management for energy reduction

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KEY FACTS

Start date: October 2013
Duration: 42 months
Total budget (€): 5.18M
Website: www.e-balance-project.eu
Coordinator: IHP GmbH, Germany

ST-Polito Società consortile arl, Università degli Studi di Torino, Sweden: Cnet Svenska AB, UK: Arup, Clicks and Linked LTD, Oldham Metropolitan Borough Council, The University of Manchester.

STREAMER

Semantics-driven design through geo and building information modelling for energy-efficient buildings integrated in mixed-use healthcare districts

Hospitals are energy-intensive buildings with considerable operational costs. However, healthcare districts are good examples of areas with integrated energy systems. The critical bottleneck that the STREAMER project addresses is the inadequacy of the existing design methodologies to create holistic Energy-efficient Building (EeB) solutions for newly designed and retrofitted buildings in healthcare districts.

The aim of the project is to reduce the energy use and carbon emissions of healthcare districts in the EU by 50% in the next 10 years. This will be achieved by enabling clients, architects, technical designers, contractors, building operators and occupants to design new and retrofitted energy-efficient buildings. These buildings will be integrated into the healthcare district energy systems using optimised semantic-driven design methods, interoperable tools and geo-information modelling (SIM–GIS). The project explores EeB frameworks and solutions, holistic design processes and tools to support the process. The developed methodology will be demonstrated and validated in four real cases studies.

KEY FACTS

Start date: September 2013
Duration: 48 months
Total budget (€): 11M
Website: www.streamer-project.eu
Coordinator: TNO, the Netherlands
Cities in Europe have a central role to play in the reduction of energy consumption and CO₂ emissions. In this context, the CITyFiED project aims to deliver a replicable, systemic and integrated strategy to help accelerate the transformation of European cities into Smart cities. This will be achieved through the development of an innovative methodology together with new business models for the energy-efficient renovation of cities at district level.

The project will be validated through extensive demonstrations in three cities: Laguna de Duero-Valladolid (Spain), Soma (Turkey) and Lund (Sweden). The demonstrators will involve retrofitting 261 380 m² of living space.

To maximise the impact and reach of the project results, a Community of Interest will be set up around the project involving 40 cities. A City Cluster will also be created, comprising 11 reference cities, to study the replication potential of the CITyFiED results.

KEY FACTS
Start date: April 2014
Duration: 60 months
Total budget (€): 46.8M
Website: www.cityfed.eu
Coordinator: Fundación CARTIF, Spain.

SINFONIA
Smart initiative of cities fully committed to invest in advanced large-scale energy solutions

The SINFONIA project will develop large-scale integrated solutions for energy-efficient districts, with a particular focus on the scalability and transferability of the proposed solutions. The project aims to achieve 40-50% primary energy savings and increase the share of renewables by 20% in two pioneer districts. This will be achieved through an integrated set of measures combining the retrofitting of more than 100 000m² of living surface, the optimisation of the electricity grid, and solutions for district heating and cooling. The solutions will be demonstrated in the cities of Bolzano and Innsbruck, with constant co-operation with a group of five early adopter cities: La Rochelle, Seville, Patos, Rosenheim, and Borás. To bridge the gap between demonstration and replication, SINFONIA will define a limited set of district typologies and corresponding refurbishment models. To ensure their scalability and transferability, these models and typologies will be tested and validated with all stakeholders, both public and private.

KEY FACTS
Start date: October 2013
Duration: 36 months
Total budget (€): 2.9M
Website: www.indicate-smartcities.eu
Coordinator: EES, UK
Partners: Ireland: Dundalk Institute of Technology, Future Analytics Consulting, South County Council, Trinity College Dublin. Italy: D’appolonia, Ente Ospedaliero Ospedali Galliera, Switzerland: ESPR R&D Center Zurich AG.

INDICATE
Indicator-based interactive decision support and information exchange platform for smart cities

INDICATE will develop a novel, city-wide decision support system which will consider all the major systems and activities relevant to developing energy-efficient cities. In order to create a ‘smart economy’, integrated, smart, urban planning tools are required. These will include architecture, masterplanning and detailed energy optimisation and environmental analysis tools.

The decision support tool will be applicable to all stages of urban development in a city and will be used to inform masterplanning and help in decision making. The tool will be able to identify the best technologies to be used for specific cases and will provide information on their economic and environmental impact on the urban environment. It will optimise existing smart technologies which will further reduce energy consumption and carbon emissions. End users of the tool are expected to include public bodies, city authorities, housing communities, private home and building owners, and technology and service providers.

KEY FACTS
Start date: June 2014
Duration: 60 months
Total budget (€): 43M
Website: www.sinfonia-smartcities.eu
Coordinator: SP Technical Research Institute of Sweden, Sweden
Partners: Austria: City of Innsbruck, Innsbruck Immobilien GmbH, Innsbruck-Kommunale Bewässerung, Liebherr, Neue Heimat Tirol, Strandort Agentur Immobilien GmbH, Innsbruck Kommunalbetriebe, City of Pafos, France: City of La Rochelle, CNEES, Steinbeis Innovation gGmbH, D’appolonia, Ente Ospedaliero Ospedali Galliera, ESPR R&D Center Zurich AG.

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