EBC

Energy in Buildings and Communities Programme

EBC NEWS

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iea Energy Technology Network

Efficiency at Home is More Than a Drop in the Ocean

Dear Reader,

Did you ever participate in a promotional campaign run by your local energy supplier? I did so last year: The campaign challenged customers to use 10% less electricity than the year before and so win €100! How could I resist? Having just installed high efficiency pumps in our heating system, I quickly equipped our new seawater aquarium with really expensive LED lights. Soon I was regularly absorbed by the counter on our power meter, a really electrifying experience! At least I lost some weight: running around our house switching off the lights and music after my daughter and her friends had gone out, as usual forgetting to do so.

Unfortunately, the reduction I achieved was less than 10%. Nevertheless I learned a lot, identifying some inefficient appliances and systems in our household and, for example, about the power needed to run an efficient seawater aquarium - more than 50W, about 0.3W per litre of water. Competitive energy is certainly something that can inspire us, helping to change our minds and our behaviour.

To likewise put energy into strengthening the visibility and effectiveness of our R&D Programme, we have recently created a Sub-Committee for Communications and Technology Transfer. It is our goal to make it easier for you to identify relevant topics and also to keep you better informed with new features about current issues and trends. Perhaps we should launch a competition too?

I really hope that you find the current edition of our newsletter interesting, with information on the improving energy performance of buildings in Ireland, a summary of our new Strategic Plan and a report on the outcomes from the latest Future Buildings Forum Think Tank Workshop. Introductions to some new international EBC projects are also provided, with work starting on how to better simulate low energy systems for building and communities, financial and technical concepts for energy retrofits emphasising the need for new business models, and ventilative cooling to eliminate cooling need and reduce overheating risk.

Markus Kratz
EBC Communications and Technology Transfer Sub-Committee Chair

Cover pictures - Top: BESRaC near zero energy dwelling, Clonkill, Co. Westmeath. Source: Ken Finegan, Newspics Photography. Bottom: Dundalk Institute of Technology – energy efficiency retrofit project. Source: Sustainable Energy Authority of Ireland

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Improving Energy Performance in Irish Buildings

Kevin O'Rourke and Prof J Owen Lewis

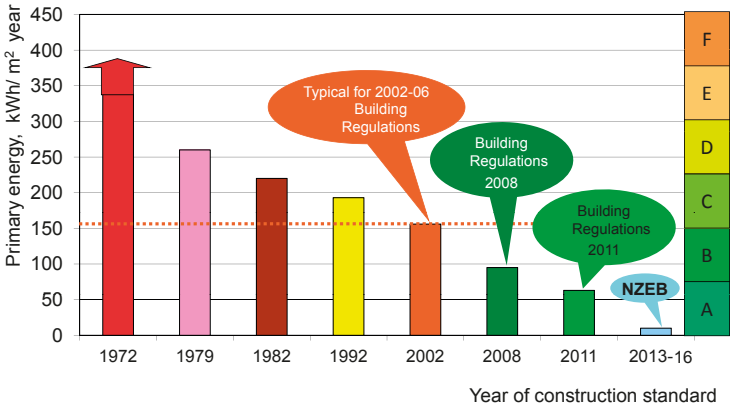
By regulation, certification and renovation, Ireland has made strong advances in recent years to improve the energy performance of its buildings. With change, progress is possible.

Ireland has a long term ambition to achieve 'near zero' energy use across its building stock. With this objective, it has already strengthened existing residential building requirements to approach this level, supported by appropriate quality guidelines and standards. Not only have these regulatory changes been introduced, but also average energy use per dwelling and associated CO_2 emissions have already fallen by 18% and 22% respectively in the five year period up to 2011. During the same period, nearly 20% of the national building stock has received energy certification, while energy efficiency upgrading of around 250 thousand buildings has taken place. Factors influencing the reduction in energy use and CO_2 emissions include:

- improved energy performance of new dwellings;
- significant energy efficiency upgrading activity stimulated by incentives, by energy price increases, and quality of life factors;
- possibly some level of operating behaviour change;
- decarbonisation of the heat and power supply sectors.

As a European Union member state, the implementation in Ireland of the Energy Performance of Buildings Directive (EPBD) provides a primary context for developments in relation to energy in buildings. Since 2006, strong progress has been made in putting into practice the requirements of the original EPBD, including those for energy performance and certification, with the momentum continuing by transposing and implementing the 2010 EPBD Recast.

Energy rating of newbuild Irish housing: indicative trends over four decades



Long term progression of energy performance improvements for new dwellings towards a 'near zero' standard, with indicative Building Energy Rating bands shown alongside. The 2011 review resulted in a 60% decrease in the energy requirements relative to the 2006 standards. Note this figure is based on the original specification before energy efficiency upgrading.

New regulated energy performance requirements

New energy performance requirements have been established for both residential and non-residential buildings. These are based on EN 13790 compliant calculation methodologies: The Dwelling Energy Assessment Procedure (DEAP) and Non-dwelling Energy Assessment Procedure (NEAP) frameworks are used to calculate primary energy use and associated CO_2 emissions for space heating and, where applicable, cooling, ventilation, associated motive power and lighting under standardised conditions of use.

Other tools and supporting documents have also been published covering acceptable construction details, air permeability testing, a database of performance data for mechanical ventilation systems, a database of seasonal efficiencies of heating appliances including solar thermal, a database of acceptable renewable energy products, guidance on heating and domestic hot water services, and a code of practice for solar heating installations.

In addition to overall performance targets, maximum transmission heat loss limits remain in place for individual building elements, and oil or gas fired boilers must achieve a minimum seasonal efficiency of 90%. A minimum of either 10 kWh/m^2·year thermal or 4 kWh/m^2·year electrical energy is required to be supplied from renewable energy sources or combined heat and power. Since 2005, nationally accredited training courses have been developed for renewable energy system installers and a registered list of installers has been maintained.

Energy performance certification

The Sustainable Energy Authority of Ireland (SEAI) administers the Building Energy Rating (BER) system, and has established a range of provisions. These include the DEAP and NEAP calculation methodologies and software, a central database of BERs, rules for training and registration of BER assessors, rules for BER publication, rules for maintenance of records, a code of practice, a quality assurance (QA) regime, disciplinary and complaints code, helpline facilities and promotion of the scheme. QA is regarded as a vital reputational issue to give the market confidence in the certificates published, and is resourced accordingly.

New and existing buildings are assessed using a calculated 'asset rating', conforming to EN ISO 13790, based on the same methodologies as used for assessing compliance with energy performance requirements. These calculations similarly relate to primary energy use and associated CO_2 emissions for space heating and, where applicable, to cooling, ventilation, associated motive power and lighting.

A national programme for energy efficiency renovation of buildings

The Better Energy Programme was established in 2009 and is aimed at supporting energy efficiency upgrades to buildings and facilities in all end use sectors. To date, there are four strands of the programme, respectively aimed at private households investing in home improvements, low income housing, business and public sector buildings and facilities, and communities. Across the programme, over €315 million has been provided in support funding, to date leveraging investments of €500 million in 230 thousand buildings, with estimated annual energy cost savings of over €135 million. Early studies have indicated that the lifetime savings from such investments are typically valued at five times the cost of the initial investment; thus leading to an estimated cumulative energy bill saving of €2.5 billion over the lifetime of the technologies installed.

A code of practice for energy efficiency retrofitting / renovation of dwellings provides practical and comprehensive guidance on upgrading the energy efficiency of building elements, and also addresses building services with a high energy impact, such as heating and lighting systems and components.

Next steps to zero energy

Ireland has already had considerable success in establishing ambitious energy performance requirements, introducing a robust and widely recognised Building Energy Rating system and completing energy efficiency upgrading for a large group of existing buildings. But, a number of challenges remain and plans are therefore necessary to further strengthen the implementation of the EPBD in Ireland. Plans for further developments include:

- adopting and implementing a methodology for setting new cost-optimal performance standards;
- establishment of, training for and enforcement of the 'nearly-zero energy buildings' definition;
- achieving robust compliance for new buildings

and major renovations;
- achieving robust compliance and enforcement across the property rental market;
- strengthening the functionality and guidance value of advisory reports accompanying BERs;
- continuous maintenance and functionality improvements of the DEAP and NEAP software tools;
- achieving growing market leverage of BERs towards energy efficiency upgrading investments, through informational, financial and institutional measures.

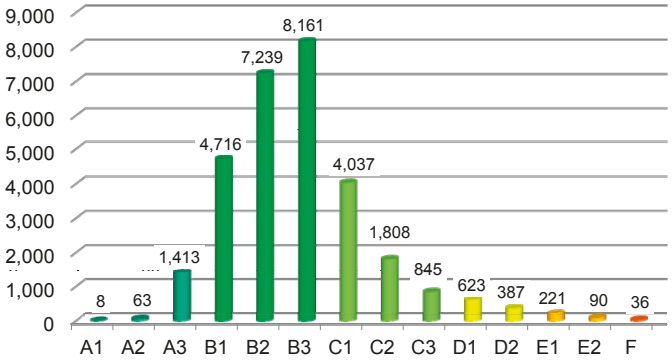
Enhanced advisory reports are to be developed for both types of BER, along with a 'lighter' assessment method for common typologies in the housing sector. The Better Energy Financing (BEF) scheme will include a phasing strategy for full retrofit of the dwelling. Improved coherence will be sought between the approaches taken by the smaller contractors typically involved. Furthermore, all assessments, reports and quotations will be lodged onto a central database. Customers will be given insurance-backed guarantees under the scheme, requiring strict QA systems to be put in place.

A framework for meeting the near zero energy buildings (NZEB) requirements of the EPBD has been prepared, including work on detailed NZEB performance standards, giving a clear indication to industry of future regulatory requirements. A voluntary NZEB standard is in place for new dwellings and this will become mandatory by 2020. For a typical dwelling, this is expected to equate to 45 kWh/m^2 · year primary energy, a very significant proportion of which will be covered from renewables. By 2020, subject to cost-optimal calculations, it is proposed that all new buildings other than dwellings in Ireland will achieve a 50% to 60% aggregated improvement. Within the public sector, all buildings must be NZEB by 2018 and a roadmap is currently being developed to detail how this will be achieved.

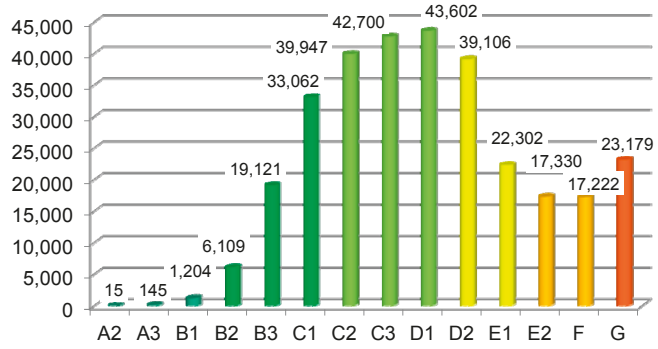
Further information

www.seai.ie/Your_Building

New dwellings



Existing dwellings



The BER consists of a label on a seven band linear scale ranging from A (best) to G (worst), including sub-divisions for bands higher than F. This scale is based on primary energy use under standard conditions for space heating and cooling, ventilation, water heating, lighting and associated pumps and fans. In the case of a dwelling, the position on the scale is proportionate to the calculated absolute primary energy intensity of the building, with each full band having a width of 75kWh/m^2 · year. For other building types, the BER is proportionate to the ratio of calculated primary energy of the building compared with a reference building. A secondary scale shows a CO_2 rating in relation to these same energy uses. BERs are published online in a central database, which includes a live tool showing over 400 thousand BERs registered to date.

New EBC Strategic Plan

Takao Sawachi

EBC's new Strategic Plan sets out the international collaborative research urgently needed to achieve near-zero primary energy use in buildings, by on site production, consumption and management.

The 26 member countries of the IEA Energy in Buildings and Communities (EBC) Programme share many research and development requirements that are necessary to support more effective policies to improve building energy performance. The Programme's common understanding of the R&D needs to support such policies is provided by the new EBC Strategic Plan, effective for the period March 2014 to February 2019. In the five years since the creation of the previous EBC Strategic Plan for 2007 to 2012, the buildings sector has become widely recognized as having a large potential to reduce its energy use and related carbon dioxide emissions at relatively low cost in comparison with other sectors. Further, an IEA Future Buildings Forum Think Tank Workshop was held in April 2013 during the development of the new Strategic Plan, the outcomes of which have been built upon (see page 9).

Understanding the current environment

The IEA Energy Technology Perspectives '2°C Scenario' (2DS) is the climate change mitigation scenario under which the globally agreed target limiting the average global temperature increase to 2°C in 2050 would be met. 2DS is the primary focus of the Energy Technology Perspectives 2012, in which the following three areas have been identified as essential to achieving it:

– decentralized, but highly integrated smarter energy systems,
– transforming and decarbonizing electricity systems, and
– dramatic improvement of energy efficiency.

Among these, the third is the most relevant to buildings and communities. While R&D programmes for the building sector are being planned, the socio-economic characteristics of the sector should be understood and need to be reflected in the outputs. The new Plan also recognizes the key barriers and challenges for the sector.

The vision and mission of EBC

EBC's vision is that *by 2030, near-zero primary energy use and carbon dioxide emissions solutions have been adopted in new buildings and communities, and a wide range of reliable technical solutions have made been available for the existing building stock.*

EBC's mission is *to accelerate the transformation of the built environment towards more energy efficient and sustainable buildings and communities, by the development and dissemination of knowledge and technologies through international collaborative research and innovation.*

High priority themes

The EBC Executive Committee is creating ideas and themes for new research projects on the basis of the new Strategic Plan. It explains that the following are high priority research themes to support its vision and mission for the coming five year period:

1. Integrated planning and building design
2. Building energy systems
3. Building envelope
4. Community scale methods
5. Real building energy use

Integrated planning and building design

The realisation of optimised combinations of building envelopes and building energy systems is still an unresolved topic. Practitioners need to be provided with transparent and reliable technical information on a

wide range of key components, including building envelopes and systems. Integrated planning is also a key element for transforming the existing building stock into a sustainable state. Therefore, technologies, tools and concepts for holistic building renovation are required. Methods and technologies for retrofit of buildings should be cost effective, have large scale replicability and should appeal to end-users in other aspects such as comfort and health. In the future, as operational energy consumption in buildings is reduced, the relative weight of energy use and CO_2 emissions in processes other than operation will increase. Although there are already different methods to obtain data for embodied energy and CO_2, the best method or combination of methods needs to be investigated and a common understanding of how to achieve practical and reliable solutions needs to be developed.

Building energy systems

Heating, ventilating and air-conditioning systems in buildings have one of the largest potentials for energy saving by improving integrated design methods, energy efficient components, control methods, and commissioning. Due to the large variety of such systems, there are difficulties both in standardizing design methods for them and utilizing standards for individual components to estimate energy use by whole systems.

Building envelope

Inward and outward heat flows can be controlled by the building envelope, and the indoor thermal environment can be maintained. In service sector buildings with large internal heat gains, such as offices and department stores, the design of the envelope has to be optimized, taking into consideration not only thermal loads, but also the quality of the thermal environment in perimeter zones.

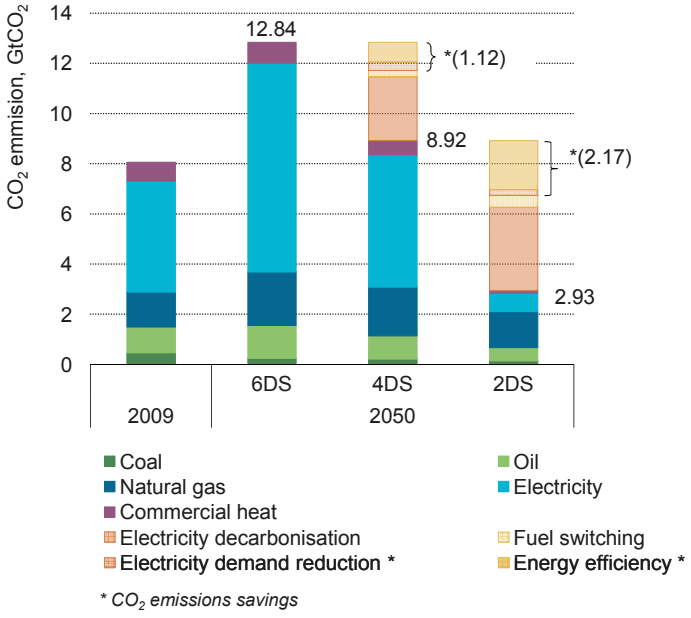
Air infiltration through the building envelope has a negative impact on heating and cooling loads, especially in cold climates and when forced air heating and cooling systems are used. Natural ventilation through the envelope, if it is well designed and fits with climatic conditions, can contribute to reducing the cooling load.

Community scale methods

Verification of energy saving effectiveness is necessary for advanced energy systems at a community scale. Technology demonstration at this scale is a good approach to verification. In this respect, it is necessary to:

- develop methods, tools and databases to evaluate and find ways to use low temperature heat sources and renewable energy sources,
- optimize energy exchange between buildings and community systems,

Buildings sector energy-related CO_2 emissions in 2009 and under different scenarios for 2050



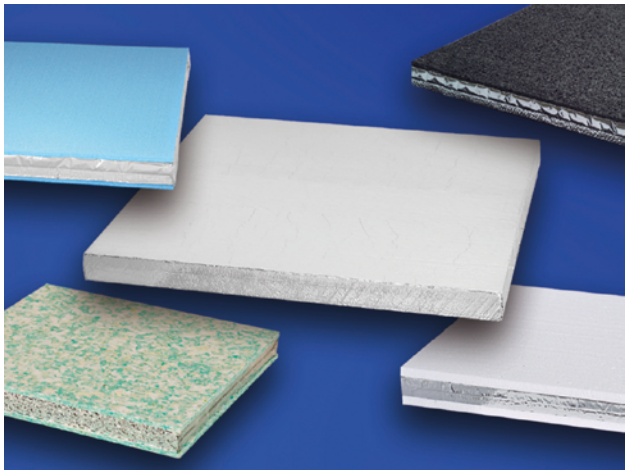
The global energy-related CO_2 emissions from the building sector in 2009 was 8.06 $GtCO_2$, which accounts for 26% of the total world-wide energy-related CO_2 emissions, including both OECD and Non-OECD countries (31 $GtCO_2$ according to IEA, 2012). According to 6DS (the scenario limiting the average global temperature increase to 6°C in 2050), which assumes only policies and actions that are currently in place continue, global buildings sector CO_2 emissions would increase to 12.84 $GtCO_2$. In 4DS (the scenario limiting the average global temperature increase to 4°C in 2050), which assumes currently planned policies and actions are introduced, with improvements in energy efficiency and electricity demand reduction, the reduction relative to 6DS is assumed to be 1.12 $GtCO_2$. In 2DS, the additional reduction relative to 4DS by "Energy efficiency" and "Energy demand reduction" is assumed to be 2.17 $GtCO_2$. The total necessary reduction by those two measures, which are most relevant to EBC, is 3.29 $GtCO_2$, which accounts for 26% of total CO_2 emissions in 6DS from the buildings sector caused by energy use. Such a 26% reduction in CO_2 emissions until 2050 is the target for the global buildings sector. For OECD countries a much higher target will have to be sought, such as delivering buildings with near-zero primary energy use and CO_2 emissions.

– improve information dissemination for municipalities, and
– support decision-making for local energy planning, integrating design and management through a holistic approach.

Decentralized, highly integrated, smarter energy systems and decarbonisation of electricity systems are considered in the Energy Technology Perspectives. On the buildings side, controllability of peak electricity demand by overall energy efficient design and by using co-generation, energy storage and photovoltaic generation is a high priority research theme to harmonise energy demands from buildings with community energy supply systems. The improvement of interactions between buildings and regional electricity and heat grids through energy production, storage and control including load management is a key research theme.

Real building energy use

Building energy performance and optimized design depend heavily upon how buildings are used. In the design of buildings, it is essential to optimize the design of the envelope and energy system by taking the building use into consideration. There is a fundamental need to develop building use knowledge bases, as well as about real energy consumption in buildings. The right metrics need to be determined and applied.



New R&D directions - A recently approved IEA-EBC project will continue to investigate potential long term benefits and risks of newly developed super-insulation materials such as vacuum insulation panels.
Source: Porextherm

The real energy use and effectiveness of technologies for energy saving have to be based on more accurate predictions of energy performance for buildings and community systems.

Collaboration within the IEA and beyond

The urgent need for the reduction of energy consumption in the buildings sector is relevant for a number of IEA R&D Programmes. At the building scale, collaboration with the Solar Heating and Cooling, Heat Pumping Technologies, Photovoltaic Power Systems and Efficient Electrical End-Use Equipment Programmes is needed. At the community scale, collaboration with the District Heating and Cooling, Demand Side Management, Energy Conservation through Energy Storage and Transportation Programmes is required.

In the European Union, energy efficiency in buildings is a major topic, for both policy and for R&D programmes. In terms of policy, the various energy Directives (Energy Performance of Buildings, Renewable Energies, Energy Efficiency, and so on) are having a major impact on the energy policies and action plans of all EU member states. So, they are also a major driver for many national research programmes and for standardisation. Given this context, it is important to actively seek close cooperation with appropriate European bodies. Collaboration with relevant technical committees in ISO, CEN and ASHRAE is also to be sought.

Dissemination of R&D outcomes

Dissemination of EBC research project outcomes is critical for their own purposes and for the Programme as a whole. The EBC website is a central instrument to disseminate outputs from such collaborative projects including full reports and comprehensible booklets. The quality of the contents needs to be constantly updated, maintained and improved. In addition, activities related to the project team's own dissemination channels and the AIVC Conferences are also very important for further disseminating the outputs from EBC research projects.

Further information

www.iea-ebc.org

Future Buildings Forum 2013

Think Tank Workshop Outcomes

Piet Heijnen

IEA Future Buildings Forum Think Tank Workshops are held periodically to give the IEA buildings-related R&D programmes an opportunity to generate new ideas and to coordinate their forwarding planning.

The 5th IEA Future Buildings Forum (FBF) Think Tank Workshop took place in the Netherlands on 11th and 12th April, 2013. Over a day and a half, 35 experts from 13 countries discussed how the built environment could be transformed by 2035 into a 'zero energy' state with low associated greenhouse emissions. Five of the IEA's buildings-related research and development programmes were represented, including EBC. The Workshop focused on the priorities necessary to transform the built environment and its supporting industries into a truly knowledge-based sector that meets all energy and environmental requirements.

Discussion themes

During the Workshop, discussions took place on the broad field of energy conservation in the built environment. These were structured into three main themes, namely:

- energy reduction,
- energy storage and management, and
- energy production.

Prof. Ronald Rovers gave the Keynote Speech, setting the scene for the discussions that followed. He sketched out a vision for a truly sustainable world in 2050. Given that by that time both materials and energy production may be 100% based on renewable sources, he concluded that the main bottleneck would be materials rather than energy production. So, the central questions for the discussions would be to first of all understand why we would most likely not succeed in achieving this without careful planning, and then decide what we would have to do to attain this goal. Following this, scene setting speeches about the three main themes were then given by Dr. Morad Atif, Prof. Halime Paksoy and Dr. Gerhard Stryi-Hipp. They provided an overview of existing technologies and trends, taking into account relevant existing R&D 'roadmaps'. After these presentations, three breakout groups discussed the main themes, each with a mixture of experts with different backgrounds.

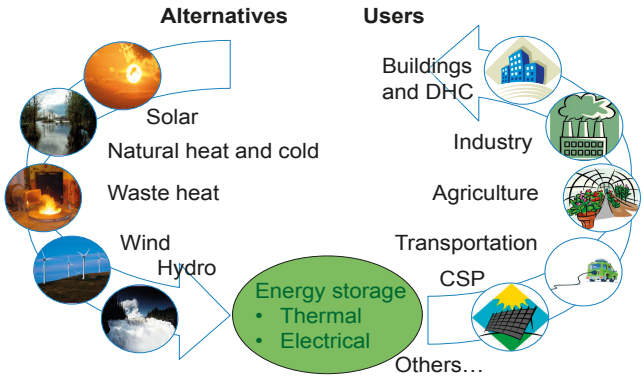
Workshops

During the first workshop sessions, the main barriers that can be expected in the near future in striving towards a zero energy built environment were discussed. The problems foreseen were divided into:

- political, social, environmental and legal barriers;
- economic barriers;
- technical barriers.

While the emphasis was on energy, it was noted that demand for potentially scarce materials might be more significant in the future. During the second workshop sessions, potential solutions for the problems identified were created. It is, of course, important to identify the full range of solutions that may contribute to the final desired energy situation, but it is not always within the remit of the IEA technology network to develop these (for example, economic or legal items). In the final sessions, the necessary technological activities to be addressed by the IEA buildings-related R&D programmes in the coming years were agreed.

Prof. Ronald Rovers: "In the end it's only external solar radiation that adds to energy quality on earth. And it's the land and / or space needed to capture and convert this radiation into useful energy, materials and food, and our intelligence to do so, which are decisive for our prosperity. This means land has the real value for our society."



Vision of Prof. Halime Paksoy: matching renewable energy supply and demand by storage.

Headline R&D items identified

Energy reduction

- There is still a need for new, cost effective technologies, which should be developed as integrated systems not separate products.
- System integration at several levels is important, including monitoring and control.
- There is a need for metrics for real data validation and standardised protocols, taking into account user behaviour.
- Technical capacity and knowledge about operation of different building types concerning building / user system interactions.
- Knowledge of user behaviour: Understanding smart meter experience, and in-house display impacts; providing education to users and appropriate support media.

Energy storage

- System dynamic modelling: Modelling needs to be based on system dynamics, simulations and should incorporate technical parameters, economic parameters, control strategies and management parameters.
- Multiple storage systems: Research is required to develop robust storage systems in which the interactions (thermal, chemical, and biological) with adjacent functions can be fully mapped out.
- Seasonal storage: This is used to balance the electricity grid when supplied with unpredictable renewable energy production such as wind and solar energy.
- Multifunctional facades: Facades provide climate and acoustic protection, daylight penetration, ventilation and potentially (renewable) energy production and storage.
- Time indifferent / compact storage: Thermo-chemical materials and reactors (TCM/TCR) are needed to reach a 7 to 8 'compactness to water' factor.

Energy production

- Data and methods to inform decision makers about energy systems for districts are needed.
- Business models: Targeted grouping of existing results and filling knowledge gaps are essential.
- System integration: The future could see an urban energy system based on 100% renewables and interactions between grids and between the building-, local- and regional levels.
- Development of standards is required.
- New technologies for retrofit solar facades should be developed.

Specific conclusions

To achieve the ambition to create a zero energy built environment by 2035, there is an enormous requirement for R&D within the remit of the various IEA buildings-related programmes. To this end, the Workshop outcomes have already formed a primary input for the new EBC Strategic Plan (see page 6). System integration is important on several levels, including the integration of energy systems in building elements, the integration of different installation technologies, and integration between local energy production and local or regional grids. This also requires close cooperation between the programmes. It is also evident that many non-technical problems must be solved. Not only economic problems need to be addressed, but also legal aspects and human behaviour. It is the responsibility of the IEA R&D programmes to draw attention to such barriers and to encourage other appropriate networks to address them: Both inside and outside of the IEA Network, collaboration is crucial!

Further information

For the outcomes report, please see: www.iea-ebc.org

Better Simulation of Low Energy Systems New Project: Annex 60

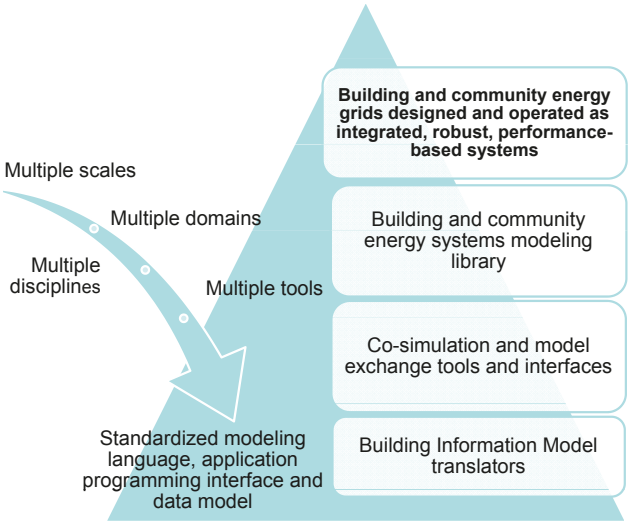
Michael Wetter and Christoph van Treeck

Users of building simulation need to rapidly test the performance of new technologies that promise to lead to very low energy systems.

The development of today's mainstream building simulation programs started decades ago. However, requirements for designing and operating low energy building and community systems have evolved faster than these programs. Consequently, current simulation programs often have a limited range of low energy technologies that can be analyzed. They primarily contain models of well established equipment and systems. Furthermore, implementing new models in these tools is only practical or possible by developers - a lengthy process - instead of program users. But, the latter are the ones who envision new energy concepts that need to be tested on a time scale dictated by their project schedule to reduce the risk of installing technologies that are not yet well understood.

The new EBC project, 'Annex 60: New Generation Computational Tools for Building and Community Energy Systems' is addressing this problem by developing computational tools that allow users to add new models to building simulation programs, share them among design tools, couple them with existing tools and embed them in building control systems for model-based operation.

The approach is to build upon the open source modelling language Modelica that enables rapid new model prototyping and to implement co-simulation interfaces based on the Functional Mockup Interface (FMI) standard. Using the FMI standard will allow the exchanging of models among different simulation tools and control systems. Alongside these, building information modelling (BIM) tools will be applied to shorten model generation time. The project output will be validated tool-chains that link BIM to energy modelling, building simulation to controls design tools, and design tools to operational tools. The use of these tools will be verified and demonstrated through case studies that optimize design and operation of building and community energy systems.



Overview of interrelationships between technical challenges and anticipated project outcomes.

Further information

www.iea-ebc.org

Business and Technical Concepts for Energy Retrofits

New Project: Annex 61

Alexander Zhivov and Rüdiger Lohse

Energy use in existing buildings can be significantly and cost effectively reduced by applying bundles of efficient technologies as part of major renovation works, but new business models are needed to put this into practice.

Deep energy retrofit of buildings requires the application of many technologies and measures, including those related to the building envelope, mechanical and lighting systems, energy generation and distribution, internal processes, and so on. While the implementation of some individual measures (for example, building envelope insulation, improved airtightness, or co-generation) can result in significant reductions in building heating and cooling loads or minimization of energy waste, such measures as well require significant investments and have long paybacks. However, when different technologies are implemented together, or 'bundled', they can result in high energy use reductions, require smaller investments, and consequently have faster paybacks. For example, building envelope improvements would result in downsizing mechanical and energy generation systems.

Despite their energy and cost savings potential, such bundles of energy efficient measures are seldom applied when buildings or building clusters are retrofitted. Decision makers and energy service companies (ESCOs) often lack knowledge about the synergy of different energy-saving measures available to them, or about the efficiencies and return on investment that such bundles of measures can yield. So, the new EBC project, 'Annex 61: Business and Technical Concepts for Deep Energy Retrofit of Public Buildings', is helping to resolve this situation.

In recent years, the Energy Savings Performance Contract (ESPC) has proven to be a very effective tool in some countries for implementing energy retrofit projects. Nevertheless, in many countries projects funded by ESPCs still do not form a significant proportion of the total investments made by public institutions for energy retrofits. The conventional wisdom is that ESPCs may not be an appropriate method to fund deep retrofits, because of the inherent technical risks and long paybacks. However, combining public and private financing, and the development of new financing models each offer the potential to significantly alter current ways of thinking.

The intention is to develop new business models within the project. This is based on the assumption that the conventional method, which separately evaluates individual energy conservation measures on a technical and economic basis, would underperform compared to a model based on an integrated bundled approach. The project will create business models taking into account differences between the terms of performance permitted in various countries (for example, 25 year terms in the USA). For instance, a new business model might address and price the risk associated with time. In other words, after a period of successful performance, the risk associated with future performance under the same contract would clearly be reduced, and thus, the associated pricing of that risk should fall.

Further information

www.iea-ebc.org

Ventilative Cooling

New Project: Annex 62

Prof Per Heiselberg

Eliminating cooling need and the risk of overheating through improved ventilation in new and existing buildings needs new solutions and design guidance, plus changes to products and regulations.

Evaluating and eliminating cooling need and the risk of overheating in buildings is required to address the increasing cooling challenges posed by new and renovated buildings, in moderate as well as in more extreme climates. Therefore, the new EBC project, 'Annex 62: Ventilative Cooling', is focusing on development of design methods and compliance tools related to this objective. It is also developing innovative energy efficient ventilative cooling solutions. The project is divided into three parts:

– 'Methods and Tools' is analysing, developing and evaluating suitable design methods and tools for prediction of cooling need, ventilative cooling performance and risk of overheating in buildings. This part is also providing guidelines for integration of ventilative cooling in energy performance calculation methods and regulation.
– 'Solutions' is investigating the cooling performance of existing mechanical, natural and hybrid ventilation systems and technologies and typical comfort control solutions as a starting point for extending the boundaries for their use.
– 'Case studies' is demonstrating the performance of ventilative cooling through analysis and evaluation of well-documented case studies.

Home for Life in Lystrup near Århus, Denmark. Source: www.velux.com

The project includes international participants from universities, research centres, manufacturers and suppliers of ventilation equipment. It is also cooperating with the international venticool platform for dissemination of research results. The outcome of the project will be guidelines for the energy-efficient reduction of the risk of overheating by ventilative cooling solutions and for the design and operation of ventilative cooling systems, in both residential and commercial buildings. It will also include recommendations for the integration of ventilative cooling into legislation, standards and design briefs, as well as in energy performance calculations and verification methods. The deliverables will include instructions for improvement of the ventilative cooling capacity of existing systems and for development of new ventilative cooling solutions, including their control strategies. The documented performance of ventilative cooling systems through analysis of case studies will promote the use of this technology in future high performance and conventional buildings.

Further information

www.iea-ebc.org
www.venticool.eu

EBC International Projects

Recently Approved Projects

Annex 63: Implementation of Energy Strategies in Communities

Contact: Helmut Strasser
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The outcomes from previously completed projects on energy optimization at a community scale showed that the transformation of approaches suitable for buildings to communities needs more than simply an up-scaling of individual building solutions. This newly approved project will therefore focus on development of standards for implementation of optimized energy strategies at the scale of communities. The project objectives will be:

- development of a methodology for the effective translation of a city's energy and CO_2 reduction goals to the community scale,
- optimization of policy instruments for the integration of energy and CO_2 reduction goals into ordinary urban planning,
- development of new techniques for stakeholder cooperation along with holistic business models, and
- creation of methods for the monitoring and evaluation of both energy-related criteria, as well as the effectiveness of policy instruments.

Annex 64: Optimized Performance of Community Energy Supply Systems with Exergy Principles

Contact: Dietrich Schmidt
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The scope of this project covers the improvement of energy conversion chains on a community scale, using an exergy basis as the primary indicator. The method of exergy analysis has been found to provide the most accurate and insightful assessment of the thermodynamic features for any process, as well as offering a clear and quantitative indication of both the irreversibility and the degree of correspondence between the resources used and the end-use energy flows.
It is focusing on both theoretical and methodological tools, as well as on modelling and on practical implementation aspects. The scope is clearly not to produce another sophisticated modelling tool, rather to evaluate the practical application of low-exergy approaches on a community scale. Thereby, the project will contribute to technological development, the understanding of system synergies and overcoming existing implementation barriers.

Annex 65: Long-Term Performance of Super-Insulation in Building Components and Systems

Contact: Daniel Quenard
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Current energy conservation standards often call for space saving insulation technologies, especially for building refurbishment. Therefore, new super insulating materials, such as types of vacuum insulation panels, gas filled panels and aerogel based products have been rapidly spreading in the building insulation market. They have become attractive alternatives that allow a reduction of the insulation thickness by as much as a factor of five. However, besides offering excellent insulation performance, these materials are relatively expensive and there is a lack of information on their durability under different thermo-hygric conditions.
The main aims of this research project are to investigate potential long term benefits and risks of newly developed super insulation materials and systems and to provide guidelines for their optimal design and use. The intended target audience of this project will be construction industry partners, architects and building designers, building owners and standardisation organisations.

EBC International Projects

Current Projects

Annex 5 Air Infiltration and Ventilation Centre

The AIVC carries out integrated, high impact dissemination activities with an in depth review process, such as delivering webinars, workshops and technical papers.
Contact: Dr Peter Wouters
aivc@bbri.be

Annex 51 Energy Efficient Communities

The project is specifically targeting local decision makers and stakeholders, who are not experts in energy planning. Guidance, case studies and a decision making tool are being produced to assist in implementing robust based approaches.
Contact: Reinhard Jank
reinhard.jank@Volkswohnung.com

Annex 52 Towards Net Zero Energy Solar Buildings (NZEBs)

The project is achieving a common understanding of net-zero, near net-zero and very low energy buildings concepts and is delivering a harmonized international definitions framework, tools, innovative solutions and industry guidelines.
Contact: Josef Ayoub
Josef.Ayoub@RNCan-NRCan.gc.ca

Annex 53 Total Energy Use in Buildings: Analysis and Evaluation Methods

Improved knowledge of the influence of different factors on energy use in buildings, particularly occupant behaviour, is essential to accurately assess short- and long-term energy saving measures, policies and technologies. The beneficiaries of the work are policy makers, energy services contracting companies, manufacturers and designers.
Contact: Prof Hiroshi Yoshino
yoshino@sabine.pln.archi.tohoku.ac.jp

Annex 54 Integration of Micro-generation and Related Energy Technologies in Buildings

A sound foundation for modelling small scale co-generation systems underpinned by extensive experimental validation has been established to explore how such systems may be optimally applied.
Contact: Dr Evgueniy Entchev
eentchev@nrcan.gc.ca

Annex 55 Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance and Cost

The project is providing decision support data and tools concerning energy retrofitting measures for software developers, engineers, consultants and construction product developers.
Contact: Dr Carl-Eric Hagentoft
carl-eric.hagentoft@chalmers.se

Annex 56 Cost-Effective Energy and CO_2 Emission Optimization in Building Renovation

The project is delivering accurate, understandable information and tools targeted to non-expert decision makers and real estate professionals.
Contact: Dr Manuela Almeida
malmeida@civil.uminho.pt

Annex 57 Evaluation of Embodied Energy and CO_2 Emissions for Building Construction

The project is developing guidelines to improve understanding of evaluation methods, with the goal of finding better design and construction solutions with reduced embodied energy and related CO_2 emissions.
Contact: Prof Tatsuo Oka
okatatsuo@e-mail.jp

Annex 58 Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements

The project is developing the necessary knowledge, tools and networks to achieve reliable in-situ dynamic testing and data analysis methods that can be used to characterise the actual energy performance of building components and whole buildings.
Contact: Prof Staf Roels
staf.roels@bwk.kuleuven.be

Annex 59 High Temperature Cooling and Low Temperature Heating in Buildings

The project aim is to improve current HVAC systems, by examining how to achieve high temperature cooling and low temperature heating by reducing temperature differences in heat transfer and energy transport processes.
Contact: Prof Yi Jiang
jiangyi@tsinghua.edu.cn

Annex 60 New Generation Computational Tools for Building and Community Energy Systems

The project is developing and demonstrating new generation computational tools for building and community energy systems based on the non-proprietary Modelica modelling language and Functional Mockup Interface standards.
Contact: Michael Wetter, Christoph van Treeck
mwetter@lbl.gov, treeck@e3d.rwth-aachen.de

Annex 61 Business and Technical Concepts for Deep Energy Retrofit of Public Buildings

The project aims to develop and demonstrate innovative bundles of measures for deep retrofit of typical public buildings to and achieve energy savings of at least 50%.
Contact: Dr Alexander M. Zhivov, Rüdiger Lohse
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Annex 62 Ventilative Cooling

This project is addressing the challenges and making recommendations through development of design methods and tools related to cooling demand and risk of overheating in buildings and through the development of new energy efficient ventilative cooling solutions.
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www.iea-ebc.org

EBC

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