EBC NEWS

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EBC is a programme of the International Energy Agency (IEA)

Mining Megatrends for Negawatts

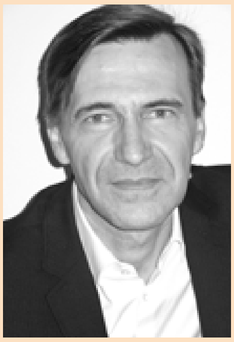
Dear Reader,

Futurology identifies megatrends that seem to characterize changes to human society. One very relevant megatrend that underlines the importance of the IEA-EBC R&D Programme is urban growth. Another is connectivity: that everything goes 'e'. We are getting more familiar with using electronic versions of books, letters and notes. 'e-readers', 'emails', 'e-newsletters' are now very familiar to us and 'big data' is a kind of synonym for a new source to create wellbeing via information. We are willing to spread our data in a way our ancestors would never have imagined.

To save energy, energy management solutions need data to enable facility managers to create comfortable indoor conditions using various parameters, such as occupancy patterns and weather forecasts. The efforts South Korea needs to implement green building certification and market activation are based on availability of data - For more about this, see opposite.

No wonder that our R&D Programme has been discussing the introduction of newsletter announcements by email, as this eases dissemination and in just a few seconds enables us to reach our target groups worldwide to spread word about the ambitious goals of ongoing IEA-EBC projects. In this respect, we have decided to follow a megatrend as we have agreed that the advantages are convincing and is not only economically feasible. Starting with this edition, we hope you continue to find our work interesting and relevant, prompted by our new email announcements.

I have identified an additional trend that can be described as the 'dominance of profitability': It bothers me when physicists or engineers admit that their newly developed device is more energy efficient and sustainable, but is not profitable in the expected period. Profitability as a predominant criterion in technological development neither leads to better instruments, nor to greater efficiency. Transforming our energy system needs an open multi-criteria based decision making process and social consensus. I hope that within this newsletter we can broaden this point of view by giving examples from the various IEA-EBC projects and their added value!



Markus Kratz
EBC Communications and Technology Transfer Sub-Committee Chair

Cover picture: The first Korean zero carbon multi-family house (Zero Carbon Green Home), built in 2013 in GoYang
Source: Korea Institute of Civil Engineering and Building Technology

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Reducing GHG Emissions from Buildings in South Korea

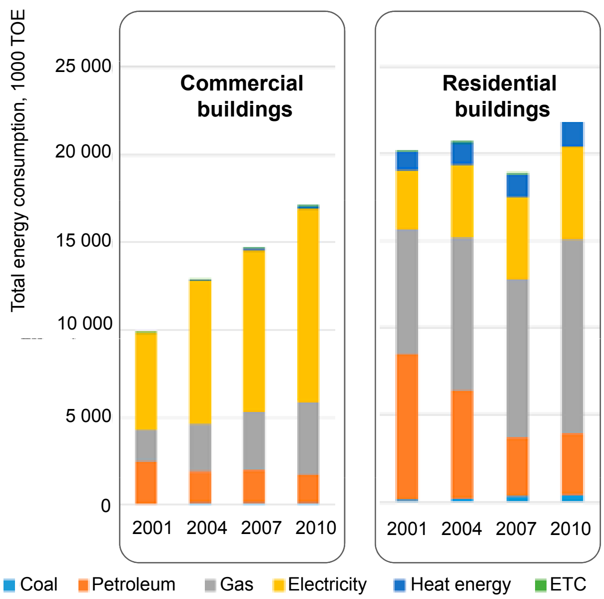
Seung-eon Lee

The Government of South Korea is strongly encouraging diversified high performance energy systems and renewables for new and remodelled buildings. To meet the GHG reduction target for 2030, a wide range of energy policies will support rapid deployment of zero energy buildings.

In 2011, the Government of South Korea announced new plans for comprehensive greenhouse gas (GHG) reductions, including tougher energy conservation standards for buildings. Alongside this, South Korea is also diversifying its energy supplies through the promotion of technological development and application of new energy and renewable energy sources. The term 'new energy' means hydrogen, fuel cells and energy converted from existing fossil fuels, while 'renewable energy' includes solar, wind, ocean, hydropower, geothermal, bio-organisms, waste and so on. Nuclear power is not covered by national new or renewable energy policies, but is currently an important source of electricity and will continue to be so in the future. It is expected to contribute 24% to the total national electricity supply, along with 20% from new and renewable sources by 2029.

To meet the new legal standards for buildings and to contribute to achieving the overall national energy saving goals, high performance building energy codes have been imposed. From 2017, the thermal envelope aspects of these codes will equal the insulation standards associated with Passive Houses, and later on these will be exceeded.

Energy consumption in the buildings sector



Total energy consumption in the residential sector has been relatively stable since 2001. But in the commercial sector, the total has been rapidly increasing with growing numbers of buildings, as well as expansion of the numbers of electrical appliances and of cooling demand.
Source : Yearbook of Energy Statistics (KEEI)

It is expected that the use of the high-performance thermal envelopes and building services systems, coupled with renewable energy supply systems, will realize the nation's goal of mandatory delivery of zero energy dwellings. To this end, a co-ordinated set of public policy instruments have been introduced to achieve this goal, comprised of:

- periodic strengthening of the Energy Conservation Design Standards for Buildings, implemented through revisions to the building energy codes,
- expansion of the existing building energy efficiency certification system,
- the Green Building Certification programme, and
- the creation of the Supporting Green Building in the Market Activation Act.

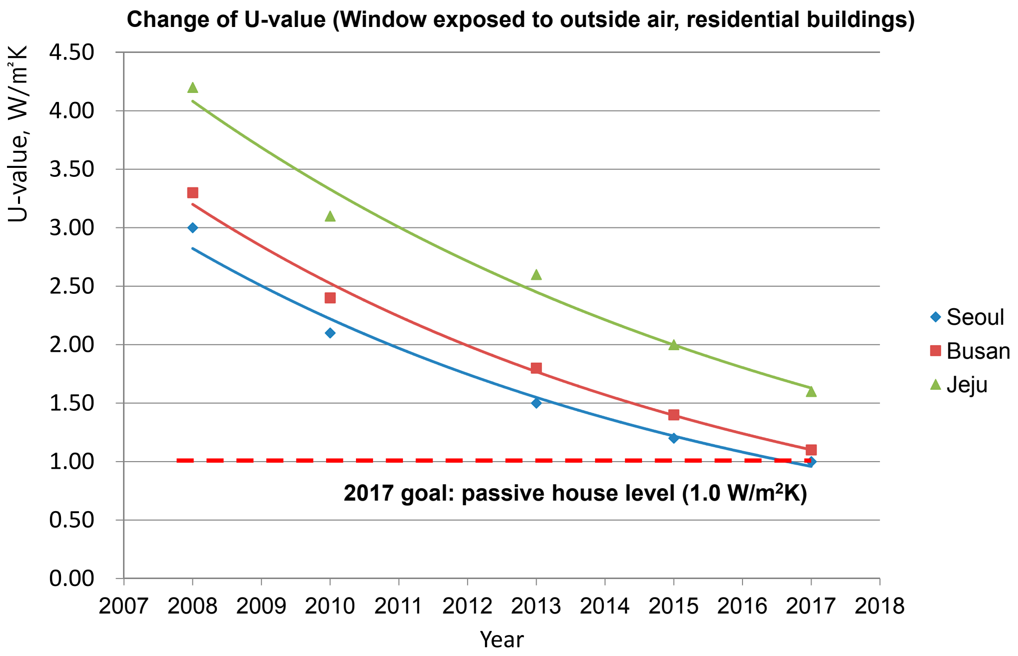
Periodic strengthening of energy saving design criteria for buildings

The first building code in South Korea requiring thermal insulation was established in 1977. Building energy codes for different types of buildings were subsequently introduced in the 1980s and the 1990s, which were eventually unified in 2001.

This set of building energy codes, which has since been updated several times, is mandatory for all new building construction. To obtain a construction permit, the owner must submit an energy saving plan for the building to the local authority in charge of building code compliance. Such plans are reviewed and approved by local authorities, with support if needed from other specialist bodies including the Korea Energy Agency.

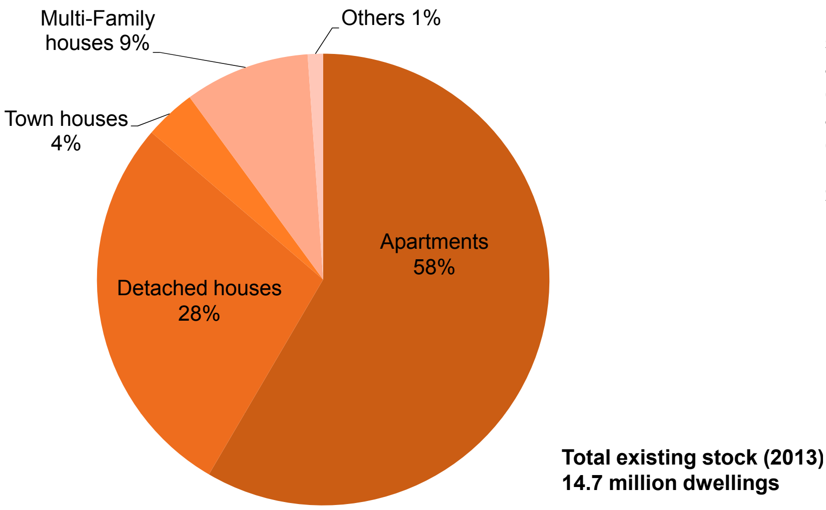
By setting and revising the building codes for energy conservation, usually in 3-year cycles, the insulation standards for external walls, roofs, and ground floors for new buildings have been enhanced and the insulation levels for windows and doors has increased by 20% in every revision. In addition to the strengthened insulation standards, the Government has been requiring higher permitted standards for buildings to expand the use of high efficiency lighting, boilers, freezers, and so on. From 2011, new Energy Conservation Design Standards were introduced to enforce building energy codes. These limit the maximum total building energy use based on the results of energy simulation at the planning stage, and are supported by a tool known as ECO2.

Recent strengthening of residential thermal envelope requirements in the building energy code



Requirements for building envelope U-values have recently been strengthened every 2 to 3 years to meet the goal of the Passive House standard from 2017.
Source: Korea Institute of Civil Engineering and Building Technology

The residential building stock in South Korea



In South Korea, about 58% of the existing dwelling stock consists of high-density and high-rise apartments with at least five floors, followed by detached houses (28%), multi-family houses (9%), and town houses (4%). However, more than 70% of new housing is currently built as multi-dwelling units.
Source: Korea National Statistics Office 2013

After the 'Low Carbon, Green Growth' strategy was declared in 2009, the GHG reduction goal has been defined for the buildings sector. Also, policies and technological standards will be strengthened with the goal of delivering zero energy dwellings from 2025, along with mandatory zero energy commercial buildings by 2030. With this in mind, legally binding energy reduction targets have been set for all new residential buildings, with the 'Passive House' as the first in force from 2017 (a 60% reduction over the 2009 building energy code), and with 'Zero Energy House' as the second in force from 2025 (a 100% reduction over the 2009 building energy code for major energy uses).

Expansion of the existing building energy efficiency certification system

The Government of South Korea is making ongoing efforts to improve the energy efficiency of buildings. As part of these efforts, energy efficiency certificates have been issued to buildings that meet certain criteria since August 2001. These certificates are now implemented to encourage new and existing buildings to adopt energy saving facilities and equipment from the start of construction.
Buildings receive a certified rating between '1+++' (good) and '7' (poor). Certificates incentivise building owners by providing them with tax reductions (on property registration and property taxes, environment improvement tax and so on) and relaxations to building codes, such as floor area ratios, height restrictions, landscape area ratios that are important factors for building owners.

The Green Building Certification programme

The Green Building Certification programme evaluates influential environmental factors, such as whole life resource efficiency and pollution reduction, during materials production, design, construction, maintenance, and disposal. As such, enhancement of environmental performance is the driving force for reducing energy consumption and GHG emissions.
Evaluation criteria within the programme cover about 40 items in seven different categories, including land use and transportation, energy and pollution, materials and resources, water, management, ecology and indoor environment. Implemented in 2002, this certification is applied to completed buildings. But, at the request of the building owner a pre-completion certificate may be issued at design stage. Certificates are valid for five years and have to be renewed after that. Initially, the programme was limited to apartments. However, this has been now expanded to all building types, including offices, schools, residential accommodation, multiple unit complexes and others. Moreover, to expand the programme, the Government of South Korea has allowed the relaxation of certain construction requirements, such as lowering real estate taxes on acquisition and registration, maximum

floor area ratios, minimum areas for garden spaces, and maximum building heights.

Supporting Green Building Activation in the Market Act

To stimulate low energy and carbon green construction, legislation has been created that forms the basis of comprehensive and systematic plans to fully describe the life cycle of green buildings on a step-by-step basis. The 'Supporting Green building Activation in the Market Act' is a kind of umbrella instrument to underpin all energy and green building regulations. This Act contains an article requiring that energy information relating to a building should be communicated via an integrated energy management system, and an energy consumption verification system for buildings should be introduced and included in real estate transactions as data become available. In addition, the Act includes an article requiring building remodelling guidelines to be produced for specific purposes and applied technology for construction should be developed and deployed, promoting a greener vision for existing buildings.

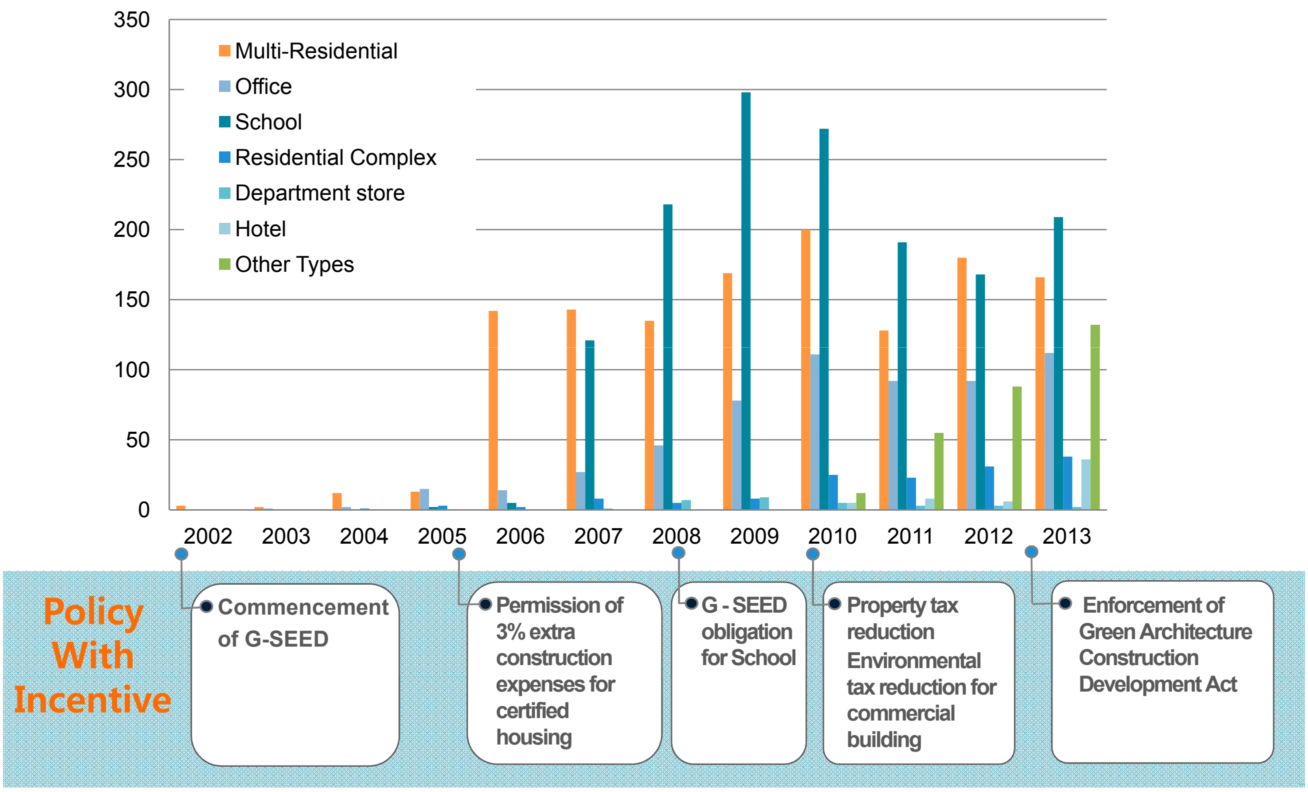
A million green homes

Through the combined impact of all of the above policies and with the goal of delivering one million green homes by 2020, the Government of South Korea is systematically encouraging the use of new and renewable energy sources for all newly constructed and remodelled buildings. The later requirements for zero energy buildings firmly cement their plans.

Further information

www.keei.re.kr/keei/download/YES2014.pdf

Numbers of certified green buildings from 2002 to 2013



Implemented in 2002, the number of certified green buildings has rapidly expanded supported by various incentives.
Source: Korea Institute of Civil Engineering and Building Technology

Cost Effective Building Renovation

Current Project: EBC Annex 56

Manuela Almeida

Building owners and policy makers need recommendations for cost effective strategies to renovate existing buildings to very low energy performance levels.

The buildings sector in many industrialised countries has become an important target for reductions in energy use, related carbon dioxide (CO_2) emissions, and resource depletion due to its importance in these areas. While many energy policies in these countries focus mainly on new buildings, due to the low replacement rates of existing buildings it is crucial that their often poor energy performance is also improved.

In general, however, existing buildings may not be able to meet energy standards similar to those for new buildings due to design and construction constraints. But, achieving significant reductions of energy use and CO_2 emissions may not always require a highly efficient solution for the envelope, which sometimes involves complex construction work that discourages the owner. The use of renewable energy sources harvested on site may also be used to foster the reduction of non-renewable energy use and CO_2 emissions.

The main challenge is to understand how far it is possible to go with energy conservation and efficiency measures and at which point renewable energy generated on site becomes more cost effective. Therefore, a new methodology has been developed in the current EBC research project 'Annex 56: Cost Effective Energy and Carbon Dioxide Emissions Optimization in Building Renovation'.

This methodology can be used in the decision making process for energy-related renovation, allowing a cost effective balance to be found between energy use, CO_2 emissions and the overall added value achieved by the renovated building.

This new methodology is intended for evaluating and assessing cost effective renovation activities, optimizing energy use and CO_2 emissions reductions mainly in residential buildings, but also in non-residential buildings without complex HVAC technologies. It also takes into account the co-benefits and the overall added value of the building after the renovation process.

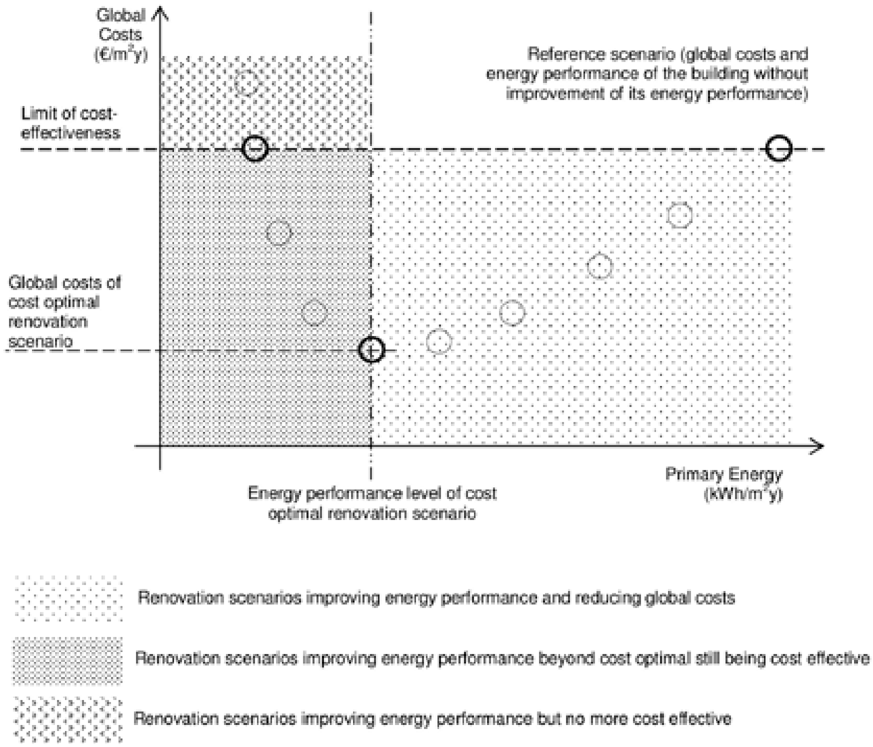
Recommendations for building owners and policy makers

The developed methodology has been used to investigate the balance between energy efficiency and renewable energy measures, to search for the most cost effective strategy to renovate several existing buildings from the participating countries using a life cycle cost (LCC) approach. These include real buildings that have undergone energy-related renovations, as well as generic archetypes that are characteristic of significant portions of the existing national building stocks. The use of the methodology has allowed recommendations to be made for the main project receptors, namely professional building owners and policy makers.

Recommendations for professional building owners are as follows:

- Whenever a building's envelope or services systems needs renovation to restore their functionality, it is a good opportunity to improve the energy performance of that element since the extra costs will be easily recovered through energy savings.
- When a conventional heating system has to be replaced, switching to a renewable energy supply is often not only environmentally advisable, but can also be economically attractive.
- Replacement of a heating system is an excellent opportunity to also carry out renovation measures on the building envelope, because the more energy

Identification of cost optimal and cost effective levels of energy performance



A generic graphical representation of life cycle cost evaluation is shown. The project focuses on the measures with energy performance beyond the cost optimal renovation scenarios, approaching the zero energy and the zero CO_2 emissions levels. The goal is to start with the cost optimal approach and then to go further, balancing energy efficiency measures and the use of renewable energy sources cost effectively to reach the lowest energy use and CO_2 emissions level, the lowest embodied energy in materials and the most achievable co-benefits associated with renovation. Source: EBC Annex 56

efficient a building is, the smaller the heating system's size can be.

- Building renovation should always integrate improvements of the buildings envelope to a minimum level according to the local climate in order to assure comfort and to prevent damage resulting from hygrothermal problems.
- It is better to improve the energy performance of several elements of the envelope at the same time than to maximize the performance of a single element at high cost.
- To obtain the largest possible impact, it is advisable to go beyond cost optimality, to the most ambitious renovation package that is still cost effective compared to the reference case. This generally allows additional benefits to be obtained that enhance the added value to the building.

Recommendations for policy makers are listed below:

- Any situation when a building is renovated represents an opportunity to improve its energy performance. Standards and incentives should focus on these situations to promote optimized interventions.
- Standards should promote a switch to renewable energy sources when heating systems are replaced, and incentives should be designed for cases where such a change would not be cost-effective from a life-cycle perspective for a private investor.
- Standards and incentives should promote the combination of renovation measures on the building envelope with replacement of the heating system, to make sure that reductions in energy use and CO_2 emissions are achieved most cost efficiently.
- Standards and incentives should be designed towards cost effectiveness rather than cost optimality to achieve a sufficiently sustainable development of the building stock.
- Considering that a major concern regarding energy use in buildings is due to the mitigation of climate change, it is advisable to introduce a target to reach nearly zero energy-related CO_2 emissions in building renovation and combine standards and incentives to reach that target.

Further information

www.iea-ebc.org

Creating Reliable Building Energy Models

Current Project: EBC Annex 58

Paul Strachan, Matthias Kersken and Staf Roels

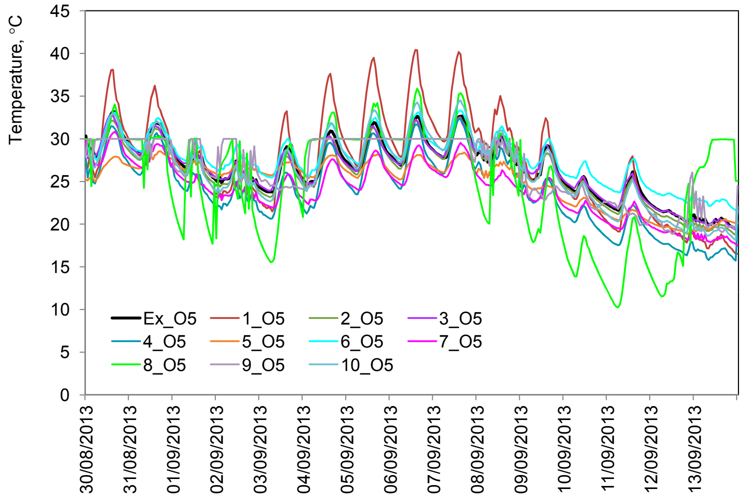
Building energy simulations are routinely used for predicting energy performance and thermal environments. But indications to the contrary suggest their reliability needs to be checked and demonstrated.

There is significant evidence that the real as-built energy performance of buildings may deviate appreciably from the theoretically designed performance. There are many reasons for this, particularly the influence of occupant behaviour. However, other factors include knowledge of the building fabric and of ventilation, heating and cooling systems, and our ability to model these correctly. The current EBC research project, 'Annex 58: Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements', is helping to overcome this concern.

The research undertaken has been based on the premise that full scale performance characterisation of buildings can help to bridge the gap between theoretical predictions and real life. It has involved checking the reliability of detailed dynamic energy simulation programs, commonly used in practice and research for predicting the energy performance and the thermal environment for buildings. One aspect of the project has specifically focused on carrying out empirical validation experiments on full scale buildings and comparing the measured results with predictions.

Lack of high quality experimental data

At the project outset, there was known to be a marked lack of high quality datasets from real buildings (as opposed to test cells) suitable for validating dynamic



A living room at the Twin Houses, a Fraunhofer IBP experimental facility (left). Test house O5 ROLBS experimental data (right) for living room temperatures (Ex_O5), with simulated results from 10 programs (1_O5 to 10_O5). The timeline comparisons show some simulated results are clearly erroneous, but others give good levels of agreement overall. No simulation program predicted the temperature in every room and in every period to within 1°C, although two came close.
Sources: Annex 58 (left), DOI: 10.1080/19401493.2015.1064480 (right)

energy simulation programs. So, in its early stages, an appraisal of available test facilities for empirical validation was conducted. This concluded that the number of high quality test facilities has recently increased. From these, the Fraunhofer IBP Twin Houses experimental facility at Holzkirchen, Germany, was selected. Two experiments were conducted there during the project: in summer 2013 and in spring 2014.

A comprehensive validation methodology was adopted for these experiments. This comprised experimental design, developing a detailed specification, undertaking blind validation in which modelling teams were only given boundary conditions and asked to predict internal conditions, results analysis, a second phase of modelling after all measured data were released, and re-analysis. In fact, over 20 modelling teams followed the experimental specifications and submitted predictions using a range of commercial and research programs.

Empirical validation experiment on full scale buildings

The Twin Houses are relatively simple houses, but with realistic dimensions. Preliminary testing showed they had similar airtightness and heat loss characteristics. One important feature of the designed experiment was to use two essentially identical buildings in a side-by-side configuration, with slightly different experimental set-ups. In this way, not only absolute comparisons of measured temperatures and heat fluxes with the predictions could be made, but also measured and predicted differences between the two buildings could be compared.

The test houses were highly instrumented; detailed climate measurements were also made on-site. The experiment was divided into four periods, preceded by an initialization phase for a total test period of almost two months, scheduled as follows:

- In the initialization phase, both buildings were heated to a constant temperature of 30°C to obtain identical and well defined initial conditions.
- In the first period, the room air temperatures were kept constant at a nominal 30°C with the required heating power controlled by a building management system. The measured temperatures were provided as inputs to the modellers, who then predicted the required heating power.
- In the second period, a 'randomly ordered logarithmic binary sequence' (ROLBS) for heat inputs into the living room was enacted. The use of a pseudo-random sequence of heat injections ensured that the solar and heat inputs were uncorrelated, which helps to disaggregate the fabric heat transfer and solar gains in the subsequent analysis. The ROLBS was customised to cover the expected time constants of the Twin Houses - large in this case - as the houses contained a significant amount of thermal mass. The ROLBS heat inputs were provided to the modellers, who then predicted the resulting temperatures.
- The third period was a constant temperature period in order to re-initialise the two houses to the same state. The controlled temperature level was set at 25°C. Again, the measured indoor air temperatures were provided to modellers.
- In the fourth period, the indoor temperatures were free floating with no artificial heat sources, with the modellers expected to predict the internal temperatures.

Project outcome

The main outcome from the study is a set of detailed experimental specifications, augmented by feedback from the modellers, and the detailed experimental results datasets. All of these have been made available through open access arrangements. The resulting specifications and datasets can be used by developers of new building energy simulation programs, or by those extending existing programs to test their predictions. They can help to identify program deficiencies and can be used for training. They also form a dataset for testing system identification methods to identify key building performance characteristics, such as overall heat loss and solar aperture. The experiments described here have already been applied for these purposes. In addition, software vendors can use the outcomes to provide evidence of prediction reliability.

The first validation experiment results have been published in an open access paper (DOI: 10.1080/19401493.2015.1064480). The dataset and experimental specification are also available online (DOI: 10.15129/8a86bbbb-7be8-4a87-be76-0372985ea228). Information about the second experiment will be published in the near future.

Further information

www.iea-ebc.org

A New Approach to Cooling and Heating in Buildings

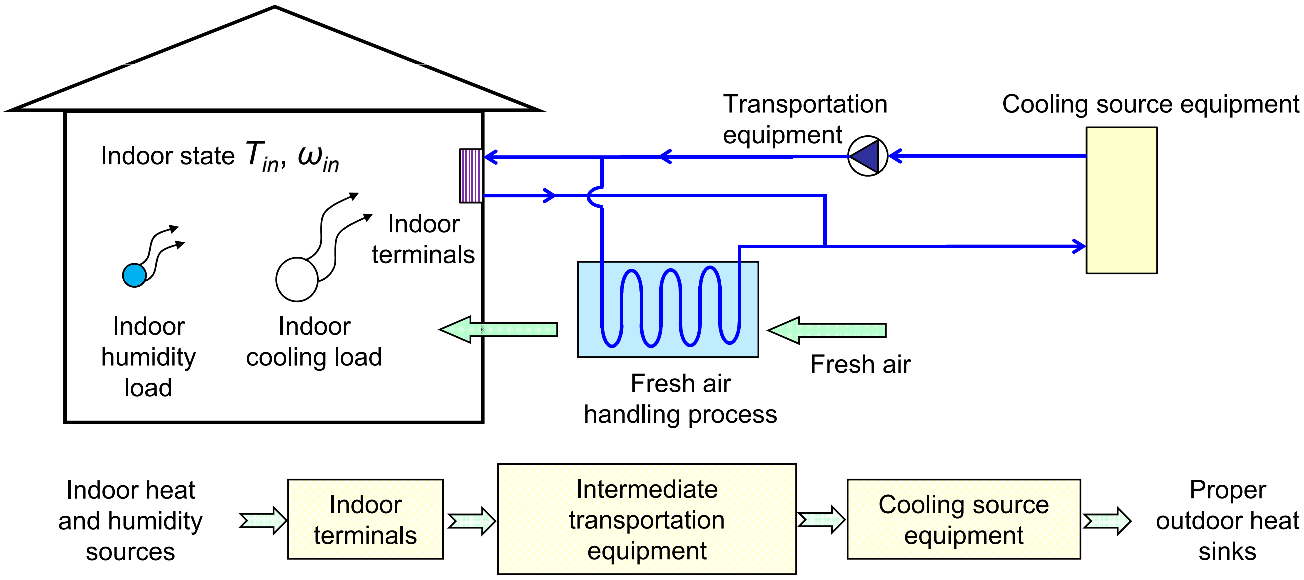
Current Project: EBC Annex 59

Yi Jiang, Xiaohua Liu and Lun Zhang

By reducing the designed temperature differences within HVAC systems, overall energy performance can be improved. Applying the new idea of entransy is showing its potential.

Heating, ventilation and air conditioning (HVAC) systems can maintain the indoor environmental quality in buildings, including air temperature, humidity and indoor air quality levels. But, energy efficient design for these systems has not always been given high importance. For this reason, the current EBC research project 'Annex 59: High Temperature Cooling and Low Temperature Heating in Buildings' is developing novel HVAC systems with fully utilized sources of heat and cold, high efficiency transportation and appropriate indoor terminals. Within the project, a new thermodynamic concept is being applied to HVAC system design, 'entransy', which quantifies heat transfer potential. Entransy is transported during heat transfer processes, when it also dissipates. The extent to which it dissipates is strongly dependent on temperature differences, and by minimising these, processes can be made more energy efficient. To achieve this, the project is characterising temperature differences throughout HVAC systems and within the indoor spaces that they serve, and is concluding how these can be minimized in highly energy efficient buildings. In fact, temperature differences within HVAC systems can be classified into three types, arising from:

– heat and moisture exchange,
– heat transmission through fluid media, and



The main processes in an active air conditioning system. This contains a series of processes, including collection, transport and cooling source equipment.
Source: EBC Annex 59

– thermal mixing losses in indoor spaces due to indoor terminal devices.

To remove heat from an indoor source to an outdoor sink during cooling, a series of processes are necessary for central air conditioning systems. Entransy dissipation from each process contributes to the total dissipation in the whole system. For a certain heat rejection rate, reducing thermal driving force losses and entransy dissipation in each section will play a role in decreasing the total entransy dissipation. This results in an improvement in the total system performance.
The purpose of supplying outdoor air is to meet occupant health and comfort needs. Due to different indoor environmental requirements, supply of outdoor air may add to cooling, heating, dehumidification or humidification loads. Furthermore, the supplied air can also help to remove indoor moisture. So, consideration of outdoor air handling and air humidity handling processes is a key aspect of achieving high temperature cooling and low temperature heating in buildings.
Furthermore, to improve the energy performance of humid air handling processes using solid or liquid desiccants, it is recommended that such processes should maintain constant humidity mixing ratio (or relative humidity), rather than maintaining constant enthalpy. In fact, it has been found that constructing a multi-stage process for humid air treatment is a feasible approach. This either increases the required cooling source temperature for the condensation dehumidification method, or lowers the required regeneration heating source temperature for the desiccant dehumidification method.

Project case studies

In depth investigations of HVAC system performance and indoor thermal environments have been conducted in the project based on a model reference office building and several real case study buildings covering different building types and climatic conditions. On-site measurements have been made for buildings adopting high temperature cooling or low temperature heating including at:

- Bayer Diegem in Belgium
- two terminals at Xi'an airport in P.R. China
- Shandong Antaeus Office Building in P.R. China
- Energy-plus house in Denmark
- EWHA Women's University Campus Center in South Korea
- Pilot system at Nagoya University with a desiccant device in Japan.

Further information

www.iea-ebc.org

Case study buildings of high temperature cooling and low temperature heating systems. Clockwise from top left: Bayer Diegem in Belgium, EWHA Women's University Campus Center in South Korea, Energy-plus house in Denmark, Danish Solar Decathlon House in Denmark, Xi'an airport Terminal 2 in P.R. China, a campus building of Nagoya University in Japan, Museum of Earthquake Reduction in Japan, Xi'an airport Terminal 3 in P.R. China.
Source: EBC Annex 59

Energy Flexible Buildings

Current Project: EBC Annex 67

Søren Østergaard Jensen

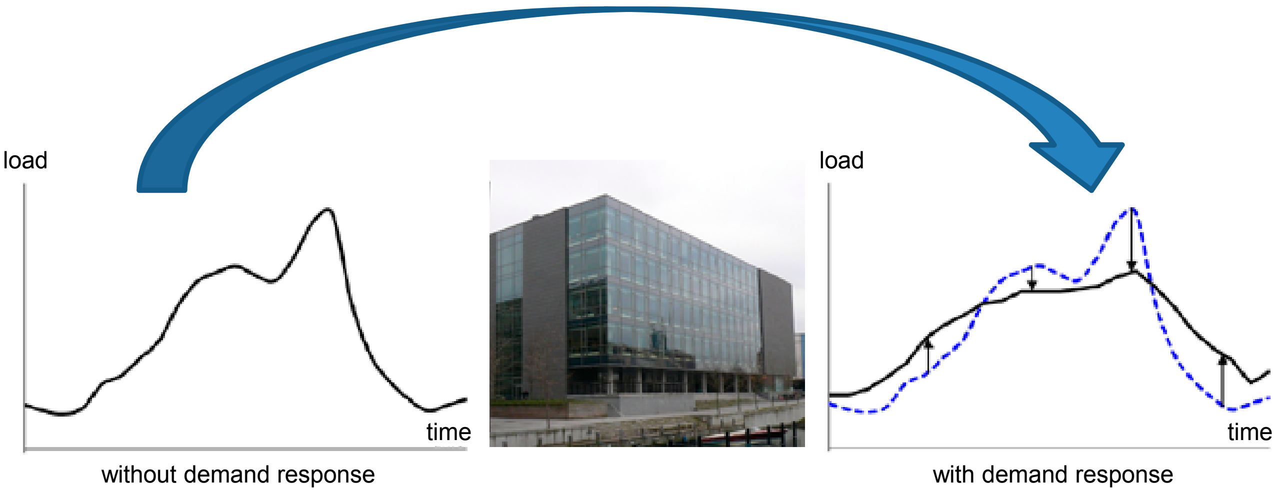
Energy flexible buildings can manage their demand and on-site generation to reduce their burden on energy networks and so can assist with large scale deployment of renewable energy sources.

The energy flexibility of a building is the ability to manage its demand and generation according to local climate conditions, user needs, and the requirements of the energy networks. Energy flexibility of buildings will thus allow for demand side management and load control, and through these mechanisms, demand response based on the requirements of the surrounding grids.

Currently, there is little overview or insight into how much energy flexibility different building types and their usage patterns are able to provide to future energy systems. So, the aim of the current EBC research project 'Annex 67: Energy Flexible Buildings' is to increase understanding and demonstrate the flexibility that buildings can provide to energy grids, and to identify critical aspects and possible solutions to manage such energy flexibility. In-depth knowledge of the level of energy flexibility that buildings may provide is crucial for the design of future smart grids and buildings. This knowledge is also necessary for companies when developing business cases for products and services supporting the roll out of smart grids. Furthermore, it gives important information for public policy makers and government bodies involved in shaping the direction of future energy systems.

Further information

www.iea-ebc.org



The energy flexibility of a building can be applied for peak shaving, i.e. high peaks in energy demand during the day are moved to periods with low usual energy demand.
Source: EBC Annex 67

EBC International Projects

Completed Project

Annex 54: Integration of Microgeneration and Related Technologies in Buildings

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Buildings and their occupants require energy for heating, cooling and operation of electric appliances and devices. Microgeneration technologies offer possibilities to provide these needs through small scale generation systems installed onsite. In combination with electrical and thermal energy storage and advanced control systems, microgeneration allows flexible operation of a building's energy supply systems.

During the project, state of the art models of microgeneration systems and key components were developed and implemented into a number of commonly used building performance simulation platforms. Country specific synthesis and analysis revealed general performance trends and factors affecting the viability of micro-generation systems and their appropriate deployment in buildings and communities. Support mechanisms to incentivize the adoption of microgeneration were analysed. As such, the project provides an overview of the impact of feed-in tariffs, grants and building regulations on the market penetration of microgeneration systems.

Looking into the future, microgeneration systems will operate in smart energy networks, communicating with other smart energy systems to optimize operation towards high efficiency and integration of renewable energy resources.

Further information

www.iea-ebc.org

The 12th REHVA World Congress – CLIMA2016 - EBC Technical Session Track

The 12th REHVA World Congress, CLIMA2016, will be held in Aalborg Denmark on 22nd -25th May, 2016. The scope of the Congress will be to offer researchers, industry, building owners, end users, consultants, engineers, architects, policy makers, etc, a platform for the exchange of scientific knowledge and innovative technical solutions. The special theme of the 12th Congress will focus on building and HVAC system performance in practice in relation to fulfilment of the intended design, their ability to fulfil the needs of the occupants and their interaction with the users in daily practice.

At the CLIMA 2016 Congress, EBC will organize a special track with technical sessions presenting the outcomes and research achievements of a number of its major international projects, as well as leading discussions in several workshops on meeting key challenges to research and technical development for energy efficient buildings and HVAC system performance.

The Danish HVAC Society, Danvak, are organizing and hosting the CLIMA 2016 Congress in cooperation with Aalborg University.
For more information: www.clima2016.org

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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 56 Cost-Effective Energy and CO_2 Emissions 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 Equivalent Emissions for Building Construction
The project is developing guidelines to improve understanding of evaluation methods, find better design and construction solutions with reduced embodied energy and related CO_2 and other GHG 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 knowledge, tools and networks to achieve reliable in-situ dynamic testing and data analysis methods to characterise the actual energy performance of components and whole buildings.
Contact: Prof Staf Roels
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Annex 59 High Temperature Cooling and Low Temperature Heating in Buildings
The project is improving 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 using the Modelica modelling language and Functional Mockup Interface standards.
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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 achieve energy savings of at least 50%.
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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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Annex 63 Implementation of Energy Strategies in Communities
This project is focusing on development of methods for implementation of optimized energy strategies at the scale of communities.
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Annex 64 LowEx Communities - Optimised Performance of Energy Supply Systems with Exergy Principles
This project is covering the improvement of energy conversion chains on a community scale, using an exergy basis as the primary indicator.
Contact: Dietrich Schmidt
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Annex 65 Long-Term Performance of Super-Insulating Materials in Building Components and Systems
This project is investigating potential long term benefits and risks of newly developed super insulation materials and systems and to provide guidelines for their optimal design and use.
Contact: Daniel Quenard
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Annex 66 Definition and Simulation of Occupant Behavior in Buildings
The impact of occupant behaviour on building performance is being investigated to create quantitative descriptions and classifications, develop effective calculation methodologies, implement these within building energy modelling tools, and demonstrate them with case studies.
Contact: Dr Da Yan, Dr Tianzhen Hong
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Annex 67 Energy Flexible Buildings
The aim of this project is to demonstrate how energy flexibility in buildings can provide generating capacity for energy grids, and to identify critical aspects and possible solutions to manage such flexibility.
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Annex 68: Design and Operational Strategies for High Indoor Air Quality in Low Energy Buildings
This project focuses on design options and operational strategies suitable for enhancing the energy performance of buildings, such as demand controlled ventilation, improvement of the building envelope by tightening and insulating products characterised by low pollutant emissions.
Contact: Prof Carsten Rode
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Annex 69: Strategy and Practice of Adaptive Thermal Comfort in Low Energy Buildings
The project provides a scientifically based explanation of the underlying mechanism of adaptive thermal comfort, and is applying and evaluating the thermal adaptation concept to reduce building energy consumption through design and control strategies.
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