EBC
Energy in Buildings and Communities Programme

EBC NEWS

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EBC is a Technology Collaboration Programme of the International Energy Agency (IEA)

Constructing the New EBC Strategic Plan

Dear Reader

At the November 2017 EBC Executive Committee Meeting, I was honoured to be elected as the new Executive Committee Vice Chair for a three-year term. I have taken over from my colleague Takao Sawachi, who has taken on the role of Executive Committee Chair in the footsteps of Andreas Eckmanns, who steered the committee through a highly productive six year period of innovation and growth in the EBC research portfolio. At the June 2018 EBC Executive Committee meeting in Stockholm, we decide on our new Strategic Plan for the EBC Programme to serve as our guide for the next 5 years. The framework for the future priorities of the EBC Programme was developed through intensive discussions at a workshop in Ottawa in November 2017, also taking account of the outcomes of the Future Buildings Forum Think Tank Workshop, held in Singapore in October 2017. From there I have had the good fortune to work through to a final draft of the Strategic Plan with a small dedicated group of colleagues comprising Takao Sawachi (Chair, representing Japan), Rolf Moser (Switzerland) and Conny Rolén (Sweden). This Plan proposes a new set of high priority themes that address critical technologies and major challenges facing us in a carbon constrained world. In planning for future EBC Annexes, it also requires to consider carefully how the research proposed would impact on the real world situation and lead to the actual reduction or limitation of carbon emissions. This edition of EBC News leads on this subject with an article reviewing the build-up of investment in energy efficiency and energy research in Sweden. It further reports on four of our current projects which address the environmental assessment of buildings, net zero energy communities, the value of a competition and living lab platform and the benefits of district level building renovation. It concludes with an introduction to a new project on the deep renovation of historic buildings, which is a joint project with the IEA Solar Heating and Cooling (SHC) TCP, aiming to deliver the lowest possible energy demand and CO_2 emissions.

I hope you find this issue of EBC News enjoyable and stimulating.

Prof Paul Ruyssevelt
EBC Executive Committee Member for UK and Vice Chair

Cover picture: Backa Red, Swedish case study before (left) and after (right) renovation in EBC Annex 56 Cost-Effective Energy and CO_2 Emissions Optimization in Building Renovation

Source: Åke Blomsterberg, Lund University

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EBC Executive Committee Support Services Unit (ESSU), c/o AECOM Ltd
The Colmore Building
Colmore Circus Queensway
Birmingham B4 6AT
United Kingdom
+44 (0)121 262 1920
essu@iea-ebc.org

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Sweden Builds-Up Investment in Energy Research

Conny Rolén

Full deployment of energy efficiency measures is key to meeting national energy policy objectives in Sweden, including reaching ambitious goals for reducing energy use and climate change mitigation. Strong international collaborative research and innovation efforts are needed to make this happen.

The Government of Sweden has adopted a national target of achieving net zero emissions of greenhouse gases by 2045. Related to this, large scale and effective implementation of energy efficiency measures is essential to achieving the energy policy objectives. The cross-sectoral targets include 50% more efficient energy use by 2030 than in 2005 and 100% renewable energy production by 2040. To reach these goals, strong research and innovation activities are needed within the energy area. In 2018, the Swedish Government is investing SEK 850 million in increased renewable energy supplies, more efficient energy use, and enlarge energy and climate advisory services, with additional funding in 2019 and 2020.

Strategic measures are needed throughout the country to address energy use reductions and climate change mitigation. To this end, the national Government is also proposing to extend and expand state support for municipal energy and climate advisory services.

Research and innovation

Over the past 30 years the Swedish energy system has undergone major changes. The transition of the energy system has focused on renewable energy sources, security-of-supply and competitiveness. Research and innovation has played an important role in this transition.

In the most recent International Energy Agency (IEA) review of Swedish energy policy, it was concluded that the volume of Sweden's energy research and innovation normalised by gross domestic product (GDP) was above average for an IEA member country in 2011 (IEA 2013). The IEA also reported the Swedish funding system to be well organised and focused on the market introduction of new solutions. The review concluded that investments were based on Sweden's comparative advantages and that the various aspects of the innovation system demonstrated strong commitment. The strategy for research and innovation in the energy area was assessed in general to be well aligned with the overall energy policy and to contribute to strengthening the competitiveness of Swedish industry. However, various analyses previously published by the IEA have pointed to a strong need to expedite research, development, demonstration and market introduction of new, clean and efficient energy technologies and services.

The Energy Research Policy Bill

The 2016 Swedish Government policy bill targeting research and innovation in the energy area for ecological sustainability, competitiveness and security-of-supply summarises the Government intentions for research and innovation in the energy area for the period spanning 2017 to 2020. Over this period there is increased funding and investment to promote innovation, growth and export.

In the research policy bill, the Swedish Government has proposed to extend and augment investment in research and innovation by a total of SEK 620 million over the period 2017 to 2020. This means an injection of around a further SEK 1.6 billion from 2020 onwards, in comparison to around SEK 1.3 billion in 2016. This augmented funding enables greater ambitions within a number of urgent areas, such as interdisciplinary and cross-sectoral research and innovation, international collaboration, strategic innovation areas and equality within the future energy system.

The Swedish Energy Agency

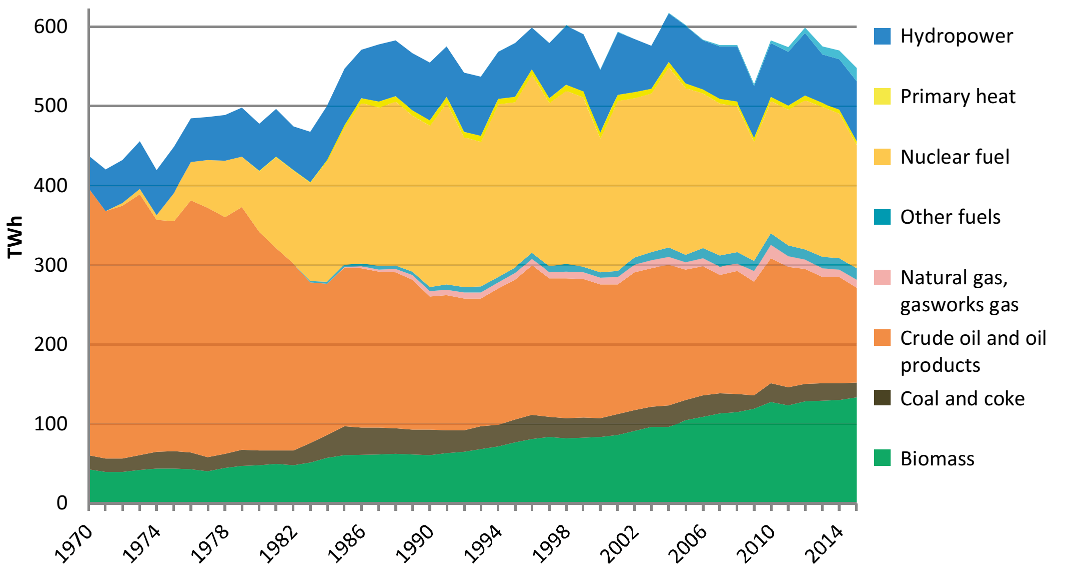
The Swedish Energy Agency works towards realising a sustainable energy system, combining ecological sustainability, competitiveness and security of supply. The research and innovation that the Agency supports includes the whole innovation system: fundamental research, applied research and development, demonstration, commercialisation and dissemination of research-based knowledge and results. In its research and innovation strategy for 2017 to 2020, the Agency has highlighted five important challenges in achieving a sustainable energy system. These five interlinked challenges are to:

- create an entirely renewable energy system;
- ensure a flexible and robust energy system that provides a reliable energy supply;
- create a resource-efficient society;
- increase efforts in innovations for employment and climate;
- enable interaction within the energy system.

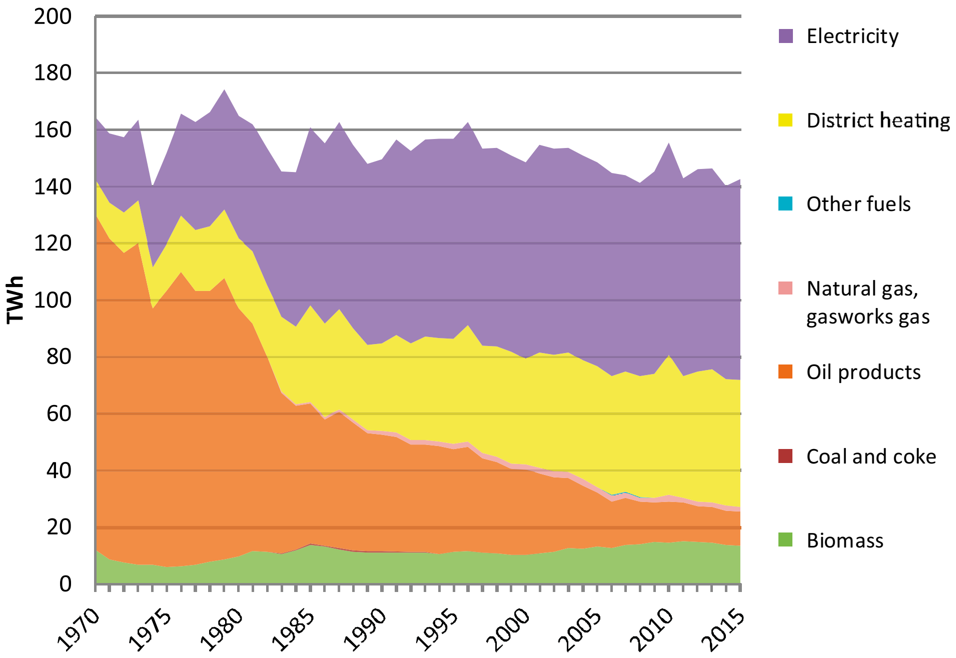
The Swedish Energy Agency has organised efforts to meet these challenges into nine thematic areas, including the Transport System, Bioenergy, Electricity Production and the Electricity System, Industry, Business Development and Commercialisation. Their thematic areas that are particularly relevant for the built environment are as follows:

- Buildings in the Energy System, encompassing the entire energy use of buildings over the entire life cycle, as well as the interactions of buildings and users in city districts or entire cities;
- Sustainable Society, encompassing spatial planning and integration of society's different types of infrastructure, with a focus on energy system solutions for a sustainable society;
- International Collaboration, encompassing initiatives to promote Swedish research and innovation through international collaboration, as well as efforts to promote the competitiveness of Swedish research and innovation on international markets;
- General Energy System Studies that analyse the development of the energy system from a holistic perspective.

The portfolio for the thematic area Buildings in the Energy System includes a number of different programmes that also require co-funding from industry. Development towards a sustainable energy system cannot be achieved solely by technological



Total energy supply by energy commodity 1970-2015. The Swedish energy system is partly based on nationally produced renewable energy sources, such as hydropower, biofuels and wind. A large proportion of the energy supply is however still provided by the import of nuclear and fossil fuels. Since the mid-1980s, the total supply to the Swedish energy system has remained at a level between 550 TWh to 600 TWh. In 2015, the amount of energy supplied amounted to 548 TWh.
Source: Swedish Energy Agency and Statistics, Sweden



Energy use in the residential and service sector 1970-2015. In terms of statistics on the Swedish energy system, final energy end uses are traditionally stratified into three consumer segments; industrial, residential and service, and transportation. The residential and service sector accounts for almost 40% of Sweden's total energy use. The residential and service sector consumes energy primarily in the form of district heating / cooling, electricity and biofuels. Around 90% of the energy use in this segment comprises the energy requirements of residential and non-residential buildings. In 2015, energy use within the sector was 143 TWh, with over half of this due to space heating and domestic hot water at 76 TWh.
Source: Swedish Energy Agency and Statistics, Sweden

development, but must also include the actors in society. Structures such as governance, planning issues and the behaviours and habits of actors are central aspects alongside technological developments.

The Swedish Government has given the Energy Agency together with the national Innovation Agency and the Swedish Research Council Formas the task to carry out the initiative 'Strategic Innovation Areas During 2017-2020'. Some of the funded programmes within this are contained in the buildings and energy area.

International initiatives

The research and innovation efforts in Sweden are co-ordinated in joint initiatives with other countries. There is collaboration within the Nordic countries, via the European Union, and also globally through the IEA, as well as bilaterally. Within the IEA, Sweden is active within more than 20 different Technology Collaboration Programmes (TCPs), among them all of those that are buildings-related, including the present one, 'Energy in Buildings and Communities' (EBC). The TCPs are intended to make research operations more effective, drive technology monitoring, avoid duplication of effort, and assist with technology transfer. Swedish researchers have been and remain active participants in many of the projects that are carried out within the TCPs.

Sweden also actively participates within the IEA at all other levels. In part, this is to closely follow developments in the global energy arena, to safeguard Swedish interests, and to ensure that IEA efforts are run in ways that are supported by the Swedish Energy Agency. In addition, other Swedish agencies, universities and commerce, participate in IEA work.

Further information

www.government.se/press-releases/2017/09/government-making-broad-investments-in-energy/
www.iea.org/countries/membercountries/sweden/
www.energimyndigheten.se/en/innovations-r--d/

Conny Rolén is a Senior Research Officer in Formas, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning.

Environmental Assessment of Buildings

Current Project: EBC Annex 72

Laura Tschümperlin and Rolf Frischknecht

A round robin test to assess the greenhouse gas emissions and other environmental impacts of a set of reference buildings is helping to identify the differences in national building assessment approaches.

The inclusion of environmental information in investment decisions for buildings is crucial given the consequential environmental impacts during a building's operation phase lasting at least several decades. The aim of the international EBC research project, 'Annex 72: Assessing Life Cycle Related Environmental Impacts Caused by Buildings', is to help stakeholders to reduce the primary energy demand, greenhouse gas emissions and environmental impacts along the entire life cycle (manufacturing, construction, operation and end-of-life) of different building types, both new build and retrofitted. A harmonized methodology on how to assess these indicators along the life cycle of buildings, guidance on how to implement such information into building information and planning tools, as well as methods for the development of specific environmental benchmarks for different types of buildings are being provided. If feasible, the latter may also include proposed region-specific, or national benchmark values for different types of buildings. Furthermore, case studies are being conducted to establish empirical benchmarks and to validate the benchmarks defined based on the developed methods.

The 2226 Office reference building

The '2226 Office', located in Lustenau, Austria, is being used as one of the reference buildings to evaluate existing national assessment methods within the project. This building is further being used as an example to demonstrate how life cycle assessment can be used to optimize the carbon footprint of the construction and operation phases and thus to minimize the overall carbon footprint of a building. It was built in 2013 and is of thermally heavyweight construction. In some ways it is a typical low-tech building, but one that has been designed and constructed according to the central idea of creating 'atmosphere instead of machine'. Thanks to its compact building shape, small and cleverly situated windows and the high thermal storage capacity of the 70 cm thick outer walls in composite masonry, it does not require any additional thermal insulation and can completely dispense with active heating and air-conditioning. This greatly reduces the amount of building services technology required. This has positive impacts on the construction phase and almost certainly on maintenance requirements during the operation phase.

Carbon footprinting for construction and operation

According to life cycle assessment of the 2226 Office based on the Swiss approach, its greenhouse gas emissions would be 8.75 kg/m^2 during construction and 3.51 kg/(m^2·year) during operation, each normalised by building floor area energy area and for the operational emissions also by year (60 years service life). The proportion of openings in the façade is moderate at around 24% of the area, including windows, doors, and ventilation flaps. Of the total greenhouse gas emissions due to construction, the original manufacturing of windows accounts for only 4%, whereas outer walls account for 18%, inner walls 16%, ceilings 11%, the roof 9%, flooring 9%, panelling 14%, ceiling 4%, the foundation plates 5% and building services systems 10%. The low impacts regarding the operation phase of the 2226 Office is mainly due to the avoided use

Focusing on the essentials, the 2226 Office, in Lustenau, Austria, serves as one of the reference buildings in EBC Annex 72 to test national assessment approaches as a basis for their possible eventual harmonisation. Source: archphoto, inc. © Baumschlager Eberle Architekten

of active space heating and air conditioning systems. Accordingly, of the total greenhouse gas emissions arising from other operating energy end uses during operation, electric lighting and appliances together constitute 86%, the provision of domestic hot water 10% and ventilation 4%. While there is no energy-saving LED system installed to provide lighting, in practice this serves as a source of heat during prolonged periods of cold weather. The electric lighting is therefore likely to be operated more intensively and for longer periods than would be necessary solely for room illuminance. Moreover, domestic hot water is produced directly by electricity and is not solved in an energy-efficient way. The greenhouse gas emissions and other environmental impacts of the 2226 Office are being assessed during a round robin test by several participating organisations using their national approaches. The differences in results are being analysed and the need for harmonisation identified. It will be interesting to see how much their results differ and to understand the reasons why.

Comparisons to national benchmarks

As an example, the greenhouse gas emissions of the 2226 Office are being tested against two Swiss benchmarks, which are the values for emissions of the construction and the operation phase for new office buildings, as defined by Technical Bulletin SIA 2040 'Energy Efficiency Path' (published in 2011 and 2017 respectively by Schweizerischer Ingenieur- und Architektenverein, SIA). These benchmark values are both normalised by building floor area energy area and by year. The value for new office buildings for the construction phase is set at 10 kg/m^2 and for the operation phase at 4 kg/(m^2·year). These are aligned with the Swiss 2050 milestone target to achieve a '2000-Watt Society'.

The reference case of the 2226 Office shows that pathways which strongly reduce the need for active building services can be practical and meet demanding targets. Optimisation of design efforts to reduce environmental impacts during construction and operation should be determined through project-specific life cycle assessments. To assist with decision making, this project is also creating guidelines to define optimal ratios between environmental impacts caused by investments in construction materials and equipment with costs incurred during the operation phase.

Further information

www.iea-ebc.org

Towards Net Zero Energy Resilient Public Communities

Current Project: EBC Annex 73

Alexander Zhivov and Rüdiger Lohse

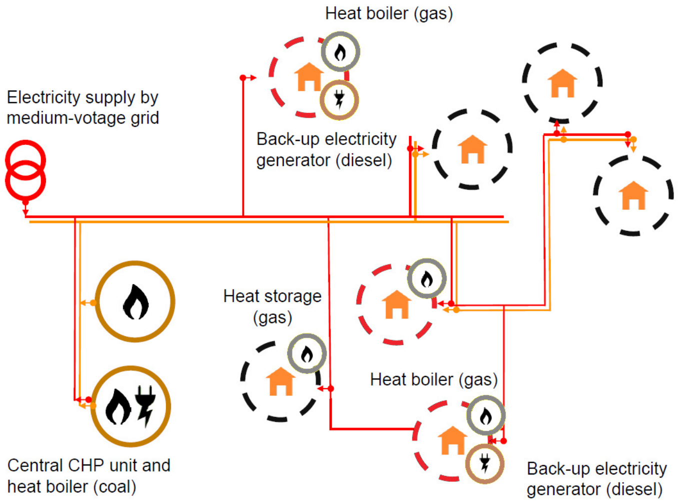
An enhanced energy masterplanning methodology is being developed with supporting tools to address resilience of energy supply solutions that also meet net zero energy community targets.

Until recently, many planners of public communities (military bases, hospitals, and so on) have generally addressed energy systems for new facilities on an individual building basis, without proper consideration of community-wide goals relevant to energy sources, renewables, storage, or future energy generation needs. Because new construction projects and retrofits of public buildings do not typically address energy needs beyond the minimum building code requirements, it can be difficult to achieve community-level targets when approached on a building-by-building basis.

Building-centric planning also falls short of delivering community-level resilience. Over recent decades, the frequencies and durations of regional power outages from weather, man-made events, and ageing infrastructure have increased. For example, major disruptions of electrical and thermal energy supplies have degraded critical mission capabilities and caused significant economic impacts.

Significant additional energy savings and increased energy security can be realized by considering holistic solutions for the heating, cooling and power needs of communities, comprising collections of buildings. And while building code requirements may focus on 'hardening' (making more resilient) to specific threats, in a multi-building community only a few of these may be considered as 'mission-critical'. Furthermore, hardening is only one aspect of resilience. Recovery and adaptation should also be addressed as part of truly effective resilient energy solutions.

Therefore, there is a need to develop a highly resilient 'backbone' of energy systems to maintain critical operations effectively during such extended power outages over a range of potential scenarios. Planning and execution of for such systems also needs to support minimization of costs for providing energy security.



An exemplary energy supply system in a military base with mission-critical facilities including redundant heat and / or electricity supplies (marked in red). The project is developing a standalone calculation module to model thermal and electrical network characteristics and to perform system optimization, including energy security and resilience aspects. This has standardized inputs and outputs for use with existing community planning tools and helps to easily visualize different scenarios to support resilience decision making.
Source: EBC Annex 73

Towards resilient public communities

In response, the international EBC research project, 'Annex 73: Towards Net Zero Energy Resilient Public Communities' is developing guidelines and tools that support the planning of net zero energy resilient public communities and that are easy to understand and execute. The project is creating a set of internationally recognized definitions for common goals to inform energy masterplanners and to create a common framework for energy masterplanning. It is also summarising or referencing available information on resilience targets for selected 'mission-critical' facilities and is addressing their performance under common threats, such as flooding, storms, earthquake, physical attack, and so on. To set the boundaries for the project, the team has adopted the following definitions of 'net zero energy community' and 'energy resilient community' respectively:

"The term 'net zero energy community' denotes an energy configuration in which the amount of fossil fuel-based energy used over the course of a year is equal to the amount of energy from renewable energy sources that are exported from this community to a power or thermal grid for external users' consumption. Under this definition, net zero balance includes a combination of thermal and electrical energies presented in terms of primary (source) energy used."

"An 'energy resilient community' provides energy services required for mission-critical facilities (for example hospitals, data centres, shelters, dining facilities, and so on) by planning for, withstanding, adapting to, and recovering from disruptions, both natural and man-made. The prioritization of energy services under limited resources is based on a multi-scenario, all-hazards view of how energy services lead to mission achievement for these facilities."

The project is collecting information on existing modelling tools appropriate for community-wide energy planning and is identifying how each tool fits into the overall process. Focusing on resilience, the aim is to show how this can be addressed in an energy masterplan.

It is developing a calculation module to model thermal and electrical network characteristics (capacity, losses, cost, and resilience) and to perform system optimizations, including energy security and resilience aspects. This supports making the choice between decentralized heating and / or cooling and emergency power supply scenarios for individual buildings, and centralised options for whole communities, neighbourhoods, or building clusters that depends largely on local drivers, for example, energy demand densities, existing networks, building systems configurations, and so on. The selection can also depend on critical operations or mission assurance needs. As a result, the feasibility of scenarios must be evaluated holistically, considering both economic factors and energy optimization.

An example of a '4th generation' district energy system: an important part of the project is focusing on collecting examples of successful masterplans that have been adapted for implementation and partially implemented. Lessons-learned from analysing these case studies are being used to develop guidance for net zero energy masterplanning and to contribute to development of business, legal and financial aspects.
Source: Ramboll

This project is combining the analysis of micro- and district-energy grid technologies with modelling and analytical tools to improve planning and design approaches that enhance installation and community resilience to energy disruption, and that better ensure mission capabilities and critical services during extended energy outages. The planned final project outcomes include the following:

- a guide for net zero energy planning in public and military building communities,
- a calculation module that will enhance and be compatible with existing energy masterplanning tools,
- a book of case studies including examples of energy master plans, and
- results of several realized or partially realized projects.

Further information

www.iea-ebc.org

Competition and Living Lab Platform

Current Project: EBC Annex 74

Karsten Voss

Competitions can be used to stimulate innovation and the next generation workforce, as well as to generate public visibility of sustainable architecture and building science. Living labs with building prototypes allow for valuable tangibility and testing of innovative ideas.

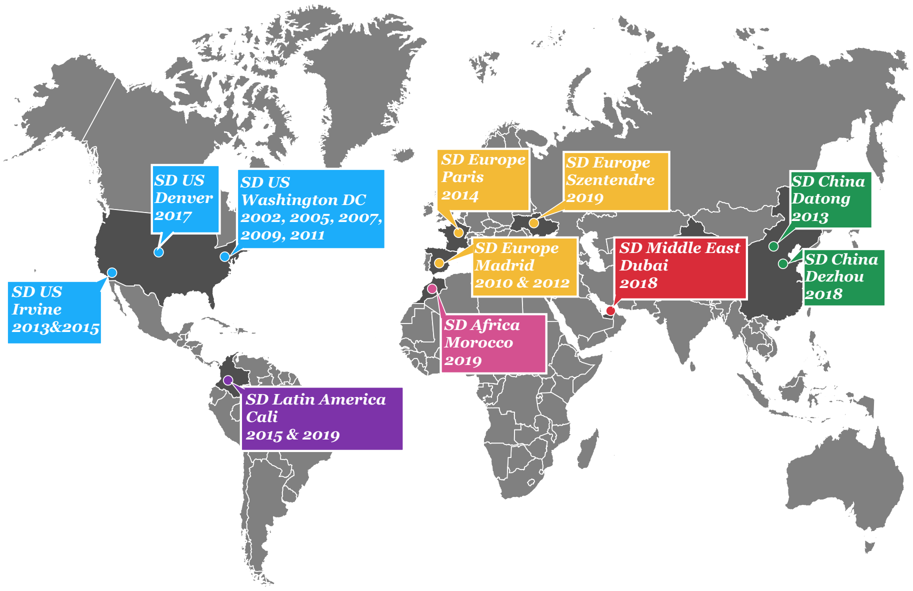
The starting point for the international EBC research project 'Annex 74: Competition and Living Lab Platform' is the success story of the Solar Decathlon. The Solar Decathlon is an international student competition based on an initiative of the U.S. Department of Energy started in 2000. In this competition, universities from all over the world design, build and operate solar-powered houses designed to meet the rules of ten contests, hence the name 'Decathlon'. It is the only student competition worldwide addressing the realization and performance assessment of buildings and not only the design. It is also a powerful, real-world experience for students to prepare for careers in clean energy and building design. During the competition's final phase, each interdisciplinary team assembles its house in a common Solar Village that lends itself to an engaging and inspiring public event. The final phase includes a public exhibition and a head-to-head competition that involves monitoring and judging across the ten contests.

Living Lab Low3 in Barcelona, Spain, is based on the competition entry of the Polytechnic University of Catalonia in the Solar Decathlon Europe 2010 competition. Solar Decathlon Europe is stewarded by the Energy Endeavour Foundation, who are contributing to EBC Annex 74.
Source: livinglab-low3.blogspot.de

Many of the experimental houses are studied as 'living labs' when transferred back to their home universities. Living labs are characterized by a user-centered testing, research and innovation approach. This format intensively stimulates research and education by supplying valuable experience, monitoring data and user feedback. The interdisciplinary approach stimulates integrated education crossing disciplines and faculties. The present project forms a think-tank with an initial focus on the education of the next generation of architects and engineers.

The project scope: exchange, evolution and education

In contrast to the competitions in the USA, Solar Decathlon events elsewhere have required new organizational structures for each competition. In this respect, the "Proclamation of Madrid" was agreed in 2010 by a group of Solar Decathlon Europe organizers and participants, who began discussions on the future evolution of the competition, with regard to its content and form. The process underlined that as a starting point for this evolution, an authorized international



The Solar Decathlon competitions held world wide: 13 competitions have been conducted up to 2017, with eight in the USA, three in Europe, one in China and one in Colombia. The United Arab Emirates and Morocco, both hot climates, will hold competitions in the near future. Source: University Wuppertal

platform was required, linking worldwide activities and experiences.

In terms of form, content and financing, the evolution of the format of existing and future competitions can benefit from an information platform for exchange, thus ensuring continuity of know-how. This project forms the EBC-initiated platform, mapping and linking the competition and living lab experiences worldwide and working towards improving existing competition formats, as well as developing new ones. It intends to stimulate the technological knowledge, the scientific level and the architectural quality within future competitions and living labs based on the development of a systematic knowledge platform and on links to knowledge from previous and current activities in related IEA Technology Collaboration Programmes (TCPs). In turn, competitions and living labs provide potential new formats for dissemination activities in the TCPs.

Project structure and planned outcomes

The three-year project is structured as a knowledge platform focusing on the following cross-cutting aspects:

- Science and technology: To acquire a more solid connection with innovative architecture and research in building science, the project aims to develop a framework to collaborate with existing and future TCP projects and integrate these research endeavours into future competition concepts. Given that there is a trend towards monitoring the experimental houses for increasingly extended periods of time (as living labs), there are a variety of tests, monitoring protocols and sequences that may be implemented.
- Competitions and living labs: This will act as a 'think tank' for the creation of innovative and useful competition ideas, as well as living lab experiences. The goal is to learn from previous competitions and existing living labs to improve and influence the direction and content of further ones, and also to inform new competition formats and living labs initiatives around the world.
- Communication: Communication and dissemination are of major importance for the success of competitions. Experience underlines that it is not sufficient to simply act during the event duration, but to be regularly and consistently linked to the general public, energy policy stakeholders, and to the scientific community.

The project deliverables are planned as listed below:

- a Web-based competition knowledge platform,
- a technology and innovation evaluation report,
- a post-competition living lab scenarios report,
- monitoring and documentation templates,
- guides for competition rules, criteria and organization, and
- materials for education.

Further information

www.iea-ebc.org

The Benefits of District-Level Building Renovation

Current Project: EBC Annex 75

Manuela Almeida, Roman Bolliger and Ricardo Barbosa

Finding the balance between renewable energy supplies and energy efficiency measures for the renovation of the existing stock towards low-emissions and low-energy buildings is more complex at district level than for individual buildings, but this may bring larger benefits.

In most industrialised countries, the transformation of the existing stock in cities towards low-greenhouse gas emissions and low-energy buildings is particularly demanding, where many buildings continue to rely heavily on heat supplied by fossil fuels. However, there is increasing evidence that there are specific opportunities to take advantage of district-level solutions at urban scale. Given the limited availability of financial resources and the large investments needed to transform cities' energy use for buildings, the identification of cost-effective strategies is of paramount importance to accelerate the necessary transition towards low-emissions and low-energy districts. In this context, it is important to explore the potential of cost-effective renovation interventions at district level. This is the objective of the international EBC research project, 'Annex 75: Cost-effective Building Renovation at District Level Combining Energy Efficiency and Renewables'.

Buildings versus districts

Renovation interventions towards low-emissions and low-energy buildings at a district level present new and advantageous opportunities when compared to the renovation of single buildings. Depending on the characteristics of the buildings in a district, significant economies of scale for energy efficiency measures can emerge, due to aggregated demands and synergies in construction procurement, processes and planning. In addition, there is an opportunity to benefit from centralized renewable energy approaches, as opposed to uncoordinated decentralized approaches. Such centralized approaches can therefore be attractive ways of reducing greenhouse gas emissions and non-renewable primary energy use.

However, whereas at the level of individual buildings, synergies between energy efficiency measures and installation of renewable energy systems can be achieved relative straightforwardly, such synergies are not necessarily available in the case of district level solutions, which depend on the existing heating systems and synchronization of buildings´ renovation cycles. Furthermore, there are various options available, of which it may not be clear which are the most cost-effective. For example, district heating systems, which aim to make use of the large untapped potential of low-temperature environmental heat sources, can harness ambient heat, either through central high-temperature heat pumps, or through low-temperature systems that circulate cool water allowing each building to extract energy from it through decentralized heat pumps. Nevertheless, some synergies can be expected. In particular, the provision of low-temperature district heating systems to groups of existing buildings may benefit from important synergies when combined with energy efficiency measures applied to building envelopes, as heat pumps work more efficiently when the temperature differences between the heat sources and the target temperatures of the buildings' heat distribution systems are lower.

Another related issue concerns the availability of heat storage facilities. Contrary to a single building intervention, in which space would normally be limited to the building floor space, at district level the options are wider. There may be more room for different types of heat storage, such as seasonal facilities to collect solar thermal energy in the summer when it is more abundant and then deliver it in the winter.

Main project outcomes

By the end of the project, it is intended to create a flexible methodology, supported by efficient tools, to identify cost-effective strategies for renovating urban districts to significantly reduce greenhouse gas emissions and energy use. The methodology is being supplemented by the identification and documentation of good practice examples showing strategies for transforming existing urban districts into low-energy and low-emissions districts. Additionally, it is also producing guidelines for policy makers and energy-related companies on how to encourage the market uptake of cost-effective strategies combining energy efficiency measures and renewable energy measures. Guidelines are also being produced for building owners and investors about cost-effective district-level solutions.

Further information

www.iea-ebc.org

Nyhavn Neighbourhood, Copenhagen, Denmark, as seen from the air.
Source: Colourbox

EBC International Projects

New Projects

EBC Annex 76 / SHC Task 59: Deep Renovation of Historic Buildings Towards Lowest Possible Energy Demand and CO_2 Emissions

Contact: Alexandra Troi
Alexandra.Troi@eurac.edu

In many industrialised countries, historic buildings make up a considerable fraction of the building stock. They are the landmarks of numerous cities, and will only survive if maintained as living spaces. This means that to save this heritage for future generations, we need to find conservation-compatible energy retrofit approaches and solutions, which allow preservation of historic and aesthetic values, while increasing comfort, lowering energy bills and minimizing environmental impacts. But, conventional energy saving measures are often incompatible with preserving the character of historic buildings. Nevertheless, their energy performance can be improved considerably if a package of retrofit measures specifically suited to a selected building is identified. Therefore, the main objectives of this new project are to develop a solid knowledge base on how to save energy through renovation of historic and protected buildings in a cost-efficient way and to identify replicable procedures on how experts can work together with integrated design to maintain both the heritage value of a building and at the same time make it energy efficient. To reach the project's objectives, the IEA Solar Heating and Cooling-led team will co-operate with EBC and the IEA Photovoltaic Power Systems Technology Collaboration Programme (TCP).

Further information

www.iea-ebc.org

Working Group on Cities and Communities

Contact: Helmut Strasser
helmut.strasser@salzburg.gv.at

The EBC project 'Annex 63: Implementation of Energy Strategies in Communities' has shown that cities face extensive challenges regarding transformation processes for their energy systems serving buildings, industry and transport, such as the creation of suitable decarbonisation strategies, the identification of effective implementation instruments and the assessment of costs and benefits. This project is working to improve this situation by integration of these urban issues into research conducted in the IEA Technology Collaboration Programmes (TCPs). The objectives of the project are to incorporate energy and resources related urban perspectives and needs into the often technology-focused research in the TCPs, as well as to support the system integration and linking of technologies in cities. Broad consensus exists that non-technological aspects are also essential to successfully support cities in their transformation processes.

Further information

www.iea-ebc.org

EBC International Projects

Current Projects

Working Group: HVAC Energy Calculation Methodologies for Non-residential Buildings
This project is analysing national energy calculation methodologies with the ultimate intent of securing good agreement between their results and energy use in reality.
Contact: Dr Takao Sawachi
tsawachi@kenken.go.jp

Annex 62: Ventilative Cooling
This project has developed design methods and tools related to cooling demand and risk of overheating in buildings and has proposed new energy efficient ventilative cooling solutions.
Contact: Prof Per Heiselberg
ph@civil.aau.dk

Annex 63: Implementation of Energy Strategies in Communities
This project is developing robust approaches for implementing community-scale optimized energy strategies.
Contact: Helmut Strasser
helmut.strasser@salzburg.gv.at

Annex 64: 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: Dr Dietrich Schmidt
dietrich.schmidt@iee.fraunhofer.de

Annex 65: Long-Term Performance of Super-Insulating Materials
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
daniel.quenard@cstb.fr

Annex 66: Definition and Simulation of Occupant Behavior in Buildings
The impact of occupant behaviour is being investigated to create quantitative descriptions and classifications, develop effective calculation methodologies, implement these within energy modelling tools, and demonstrate them with case studies.
Contact: Dr Da Yan, Dr Tianzhen Hong
yanda@tsinghua.edu.cn, thong@lbl.gov

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.
Contact: Søren Østergaard Jensen
sdj@teknologisk.dk

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
car@byg.dtu.dk

Annex 69: Strategy and Practice of Adaptive Thermal Comfort in Low Energy Buildings
The project is scientifically explaining 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.
Contact: Prof Yingxin Zhu, Prof Richard de Dear
zhuyx@tsinghua.edu.cn,
richard.dedear@sydney.edu.au

Annex 70: Building Energy Epidemiology: Analysis of Real Building Energy Use at Scale
This project is focusing on developing best practice methods for collecting, accessing, analyzing and developing models with empirical data of energy demand in buildings and communities.
Contact: Dr Ian Hamilton
i.hamilton@ucl.ac.uk

Annex 71: Building Energy Performance Assessment Based on In-situ Measurements
This project is advancing in-use monitoring to obtain reliable quality checks of routine building construction practice to guarantee that designed performance is obtained on site.
Contact: Prof Staf Roels
staf.roels@bwk.kuleuven.be

Annex 72: Assessing Life Cycle Related Environmental Impacts Caused by Buildings
The project is based on previous EBC research based on life cycle assessment to include in-use operational impacts and addresses environmental impacts in addition to primary energy demand and greenhouse gas emissions.
Contact: Rolf Frischknecht
frischknecht@treeze.ch

Annex 73: Towards Net Zero Energy Public Communities
The project is advancing 'near zero energy communities', to enhance existing masterplanning strategies and modelling tools, and expand their application with standardized country-specific building data on specific building types.
Contact: Dr Alexander M. Zhivov, Rüdiger Lohse
alexander.m.zhivov@erdc.usace.army.mil,
ruediger.lohse@kea-bw.de

Annex 74: Energy Endeavour
This initiative is benefitting from the lessons learned from the Solar Decathlon events worldwide, and is extending the format with new competitions and a series of networking events under a common umbrella.
Contact: Prof Karsten Voss, Prof Sergio Vega,
kvoss@uni-wuppertal.de,
sergio.vega@sdeurope.org

Annex 75: Cost-effective Building Renovation Strategies at District Level
The cost-effectiveness of methods combining energy efficiency and renewable energy measures are being clarified at the district level.
Contact: Dr Manuela Almeida
malmeida@civil.uminho.pt

Annex 76 / SHC Task 59: Deep Renovation of Historic Buildings
This project is examining conservation compatible energy retrofit approaches and solutions, which allow the preservation of historic and aesthetic values while increasing comfort, lowering energy bills and minimizing environmental impacts.
Contact: Dr Alexandra Troi
Alexandra.Troi@eurac.edu

Annex 77 / SHC Task 61: Integrated Solutions for Daylighting and Electric Lighting
This project is fostering the integration of daylight and electric lighting solutions with the benefits of higher user satisfaction and energy savings.
Contact: Dr.-Ing. Jan de Boer
jan.deboer@ibp.fraunhofer.de

Annex 5: Air Infiltration and Ventilation Centre
The AIVC carries out integrated, high impact dissemination activities, such as delivering webinars, workshops and technical papers.
Contact: Dr Peter Wouters
aivc@bbri.be

www.iea-ebc.org

EBC

Energy in Buildings and Communities Programme

EBC Executive Committee Members