EBC ANNEX 64

LowEx Communities

Optimised Performance of Community Energy Supply Systems with Exergy Principles

Annex Text

Operating Agent

Dietrich Schmidt
Fraunhofer-Institute for Building Physics
Gottschalkstrasse 28a
DE-34127 Kassel
Germany

Phone: +49 561 804 1871
Fax +49 561 804 3187
E-mail: dietrich.schmidt@ibp.fraunhofer.de

Table of Contents

EBC Annex 64: LowEx Communities-
Optimised Performance of Energy Supply Systems with Exergy Principles

EBC Annex 64: LowEx Communities - Optimised Performance of Community Energy Supply Systems with Exergy Principles

1 Description of Technical Sector and Definition

The energy demand of communities for heating and cooling is responsible for more than one third of the final energy consumption in Europe and worldwide. Commonly this energy is provided through different fossil fuel based systems. These combustion processes cause greenhouse gas (GHG) emissions and are regarded as one of the core challenge in fighting climate change and energy transition. National and international agreements (e.g. the European 20-20-20-targets or the Kyoto protocol) limit the GHG emissions of industrialized countries respectively for climate protection. Country specific targets are meant to facilitate the practical implementation of measures. While a lot has already been achieved, especially regarding the share of renewables in the electricity system, there are still large potentials in the heating and cooling sector and on the community scale. Exploiting these potentials and synergies demands an overall analysis and holistic understanding of conversion processes within communities.

Communities are characterised by a wide range of energy demands in different sectors, for instance heating and cooling demands, and lighting and ventilation in the building stock. Different energy qualities levels (as part of exergy) are required as heat or cold flows or as electricity and fuels. On the community level there is the possibility of supplying this energy through different sources; for instance, through roof-top photovoltaics as high-exergy electricity or as low-temperature heat from geothermal sources. The fluctuating electricity supply from decentralised renewable electricity production poses both chances and challenges for future community energy systems. The interaction between (matched) energy demand and available (fluctuating) energy sources at different quality levels (exergy factor), especially for heating and cooling supplies, has to be solved at a local level, within the community.

To identify potential savings and synergies a holistic analysis of energy flows is necessary. This allows the detection of available quality levels. These are taken into account, from generation to final use, to significantly reduce the share of primary or high-grade fossil energy used and to optimise exergy efficiency. In practical implementation, advanced technologies must be adapted and further developed to realise the identified potentials. At the same time, as the use of high quality energy for heating and cooling is reduced, there is more reason to apply integral approaches in regards to other processes in which energy/exergy is used in communities.

The results of the finished ECBCS Annex 49 “Low Exergy Systems for High-Performance Buildings and Communities” emphasise the great potentials in exergy management. For this reason the results achieved in ECBCS Annex 49 provides the necessary basis for exergetic investigations which will be performed within the framework of this project. Experiences and case studies from ECBCS Annex 51 “Energy efficient communities” show the opportunities in targeting the community scale. Both annexes, as several others in the scope of finished and on-going IEA activities, have delivered fruitful input for an extended scope and working process for this annex.

1.1 The LowEx Approach for Communities

Basically, the physical property “exergy” can be described as a product of energy and “energy quality”. *The higher the temperature of a heat flow is above reference temperature, the higher the energy quality*. To simplify thermodynamic principals for the scope of this activity it can be stated that: *the lower the temperature of a thermal energy supply flow for heating, the lower its energy quality is and, therefore, the associated exergy flow*[1]. In this way exergy can be used to optimise the efficiency of a community supply system. This is called the low exergy (LowEx) approach. The LowEx approach entails matching the quality levels of energy supply and demand in order to optimise the utilisation of high-value energy resources, such as combustible fuels, and minimise energy losses and irreversible dissipation (internal losses).

On the community scale, different types of supply systems require different supply temperatures. To obtain the maximum output from a given primary energy flow, different temperature levels can be cascaded according to the requirements of the building typology and technology. This demands an intelligent arrangement and management of the temperature levels and flows within the system. Bi-directional concepts and short term storage can be elements of a system which is not only energy efficient, but also exergy efficient. As high-exergy resource electricity plays a special role within the evaluation processes, it is feasible, on an exergy basis, to weigh the impact of extra electricity use, for instance for pumping or ventilation, on a thermodynamically correct basis against the heat and cold applications. On this basis, a discussion on a proper and workable set of indicators will have to be held to reflect aspects of renewable and non-renewable electricity and fluctuating supply in electrical energy systems.

Actual on-going projects and analysed cases show the potential in terms of improved energy efficiency and GHG emissions reductions. Some successful conducted studies indicate a cost reduction potential for innovative low temperature heat grid community solutions based on the exergy thinking concept of about 10-18% and a CO_2 free heat delivery process. These promising cases are analysed in detail and described in the output of the annex.

2 Scope and Objectives

2.1 Scope

The scope of the annex covers the improvement of energy conversion chains on a community level, using an exergy basis as the primary indicator. The project follows the hypothesis that by optimising the exergy chains, the overall system performance can be improved and CO_2 emissions can be reduced. In particular, the method of exergy analyses has been found to provide the most accurate and insightful assessment of the thermodynamic features for any process as well as offering a clear, quantitative indication of both the irreversibilities and the degree of correspondence between the resources used and the end-use energy flows.

In comparison to plain energy analysis, exergy based system optimisation facilitates the integration of renewable heat and cold sources that are most often available at fairly

[1] Assuming the amount of energy transferred remains constant.

low temperatures. The optimal integration of decentralised supply modules of heat and cold enables the realisation of smart bi-directional supply chains in the heat and cold supply systems similar to 'smart-grid' approaches for the electricity sector.

For conducting investigations on community level system boundaries have to be defined. The exact definition of the boundaries of the area to be examined (building, group of buildings, block, quarter or community) depends on the objectives of the corresponding project. Furthermore, the definition of system boundaries depends on whether the studied system is on the demand or generation side. The definition and characterization of the boundary conditions for demand structures (e.g. single building with characteristic system components) takes place within investigations of Subtask A (please refer Subtask A: Demand optimised Profiles (Business Models)). The definition and characterization of the boundary conditions for supply structures (e.g. Combination and clustering of generation technologies) takes place within the framework of Subtask B (please refer Subtask B: Sources and Supply). The definition of the boundary conditions for building groups (e.g. Blocks, Quarters) or communities takes place within the framework of Subtask C (see Subtask C: Model cities). In Subtask C system boundaries of Subtask A and Subtask B are merged. The following figure shows examples of system boundaries of the demand and the generation side.

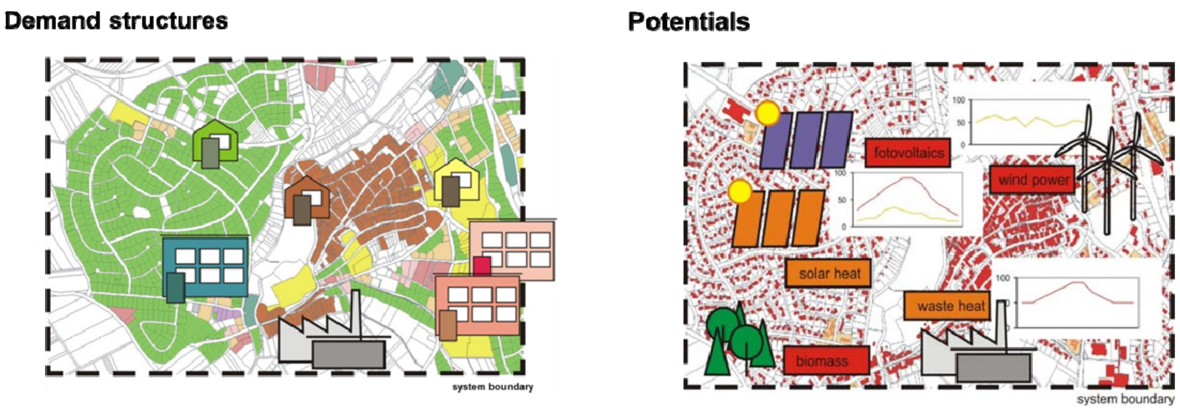


Fig. 1: The boundary of the systems which are studied. Demand structures of different buildings and buildings groups (left). Sources and supply structures (right) adapted for supply of demand side.

The Annex 64 focuses on both the 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 but to evaluate the practical application of low-exergy approaches on a community scale. Thereby, the annex shall contribute to technology development, the understanding of system synergies and existing implementation barriers.

2.2 Objectives and Challenges

The main objective of the annex is to demonstrate the potential of low exergy thinking on a community level as energy and cost efficient solution in achieving 100% renewable and GHG emission-free energy systems. The intention is to reach these goals by providing and collecting suitable assessment methods (e.g. holistic balancing methods). Furthermore it is planned to provide guidelines, recommendations, best-practice examples and background material for designers and decision makers in the fields of building, energy production/supply and politics.

During the course of this activity, the aim is to develop and improve means for increasing the overall energy and exergy efficiency of communities through demand adapted supply and inclusion of renewable energy sources. Therefore the central focus of all considerations is thermal energy at different exergy levels. Electrical energy will be taken into account as auxiliary energy. Electricity from a renewable fluctuating supply should be discussed as a contribution to the heat and cold supply of a community if it is thermally stored (e.g. storage tanks or usage of the building mass) and used for heating or cooling purposes (e.g. heat pumps).

In the annex consortium a discussion on appropriate additional indicators, supplementing the exergy assessment should be initialised to come to a common understanding of how to weigh high-exergy electricity for heating and cooling purposes under the preconditions of local availability. Another objective is the application of exergy analysis as a basis for providing tools, guidelines, recommendations, best-practice examples and background material for designers and decision makers in the fields of low exergy generation, low exergy distribution and low exergy consumption.

Central challenges in achieving the objectives are the identification of the most promising and efficient technical solutions for practical implementation and aspects of future network management and business models for distribution and operation. Aspects of transition management and policy will ensure the feasibility. A close cooperation with related IEA Annexes is planned.

Summarising following objectives and challenges will be considered within the framework of the Annex:

- **Application and further development of the low exergy (LowEx) approach**
  - Enlargement of LowEx approach for communities
  - Demonstrate the potential of low exergy thinking on a community level
  - Increasing the overall energy and exergy efficiency of communities
- **Identification and application of promising and technical solutions**
  - Integration of LowEx system components (generation, distribution and supply)
  - Practical implementation and aspects of future network management
  - Business models for distribution and operation
- **Providing assessment methods and tools**
  - Application of exergy analysis as a basis for providing tools
  - Collection and merging of suitable assessment methods
  - Development of assessment tools and methods for various stages of planning
- **Knowledge transfer**
  - National workshops and special conference contributions
  - Guidebook which will be electronically available
  - Scientific publications in journals and on conferences

2.3 Benefits

The advantages of the application of the LowEx approach in the holistic assessment of a community are diverse:

Customers benefit in various ways. First of all, the use of low exergy sources ensures a good comfort level and a sustainable supply. Customers do not have to worry about maintenance, fuel supply and optimal operation of heating systems.

The environment benefits from the exergy concept. The total GHG emissions in communities can be substantially reduced as a result of the use of more efficient energy conversion processes. This new concept supports the setup of sustainable structures and secure energy systems for future developments on the community scale.

From an **economical** point of view, high price stability can be expected due to the use of locally available, renewable, or surplus heat energy sources. An additional advantage of this is a lower dependency on foreign fuel supplies. The high overall system performance that can be achieved by using low temperature sources would lead to reduced resource consumption and therefore lower costs for fuels. This would also increase price stability and could potentially provide heat at very competitive prices.

The following three main target groups of the proposed annex benefit in different ways from the annex:

The energy supply and technology industry will get development ideas for future products, business models and services in the field of dynamic energy supply systems. With the breaking down of traditional centralised top-down solutions in energy supply, new fields of business can be created in combination with overall system improvement.

Project developer and housing companies as potential customers from the above mentioned industries will benefit from innovative and more efficient technologies, as well as from improved business concepts.

Communities will profit from the improved and more differentiated understanding of their local potentials and supply options. Greater local energy autonomy and impulses for local economy can support communities in regaining strategic competence in long-term development issues in the energy sector.

2.4 Research Issues

Applying the exergy concept to communities leads to new research topics. The annex addresses the following research items:

- What are the general conditions for a sustainable supply in connection with decentralised energy production?
- What optimisation strategies for low exergy distribution and community technology system configurations can be identified?
- Which consequences result from the different dynamic characteristics of heat and cold sources?
- A holistic system approach requires the analysis of dependencies between energy generation, energy distribution and energy consumption. What feedback and response routines of the building to the grid and the energy production strategies are necessary to optimise the system?
- How does the exergetic optimisation of a cities energy system contribute to an overall optimisation in terms of CO_2 and costs?

- What unused synergies in demand and supply structures can be exploited for exergy optimisation?
- How can local renewable energy sources be optimally integrated from an exergy perspective?
- What existing innovative technologies are necessary for future optimised energy systems on the community scale?
- What control strategies for community supply systems help in reducing the overall exergy demand?
- What opportunities arise from the use of constantly available renewable energy sources such as deep geothermal heat or industrial waste heat?
- How can the fluctuation of some renewable energy sources, such as solar thermal supply systems and renewable electricity production from solar radiation and wind, be dealt with in the most sensible way?
- What role can a combined exergy/energy analysis for community supply structures and buildings play when taking interactions into account?

3 Means

To accomplish these objectives, participants will research developments within the general framework of the following five subtasks. Figure 1 shows the structure of the five subtasks. The community and the energy supply system are directly connected by the final energy conversion process. Nonetheless, the distribution concept for exergy has to be fixed at a community level.

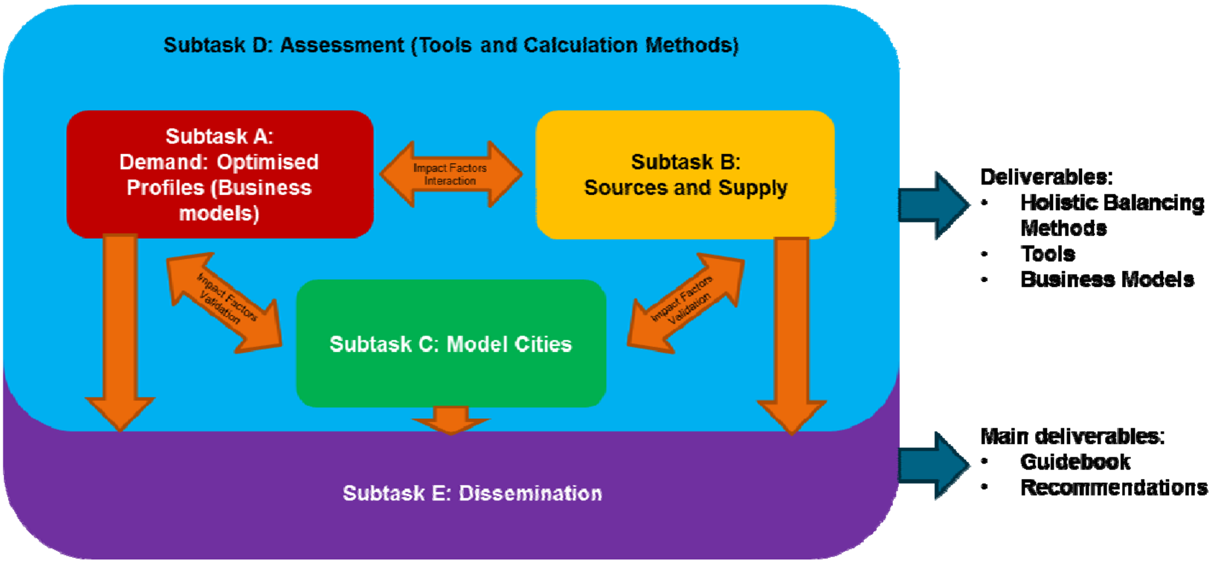


Fig. 2: Subtask structure

3.1 Subtask A: Demand optimised Profiles (Business Models)

Objective

Energy demands currently are commonly supplied by centralised or decentralised systems designed and optimised for single demand profile. Therefore, energy demands of several yet different building types should be combined to pave the way for utilisation of unused synergies within existing communal building and supply structures. Subtask A is strongly focused on the demand of single buildings as part of multifarious community supply systems. As part of the work, the previously developed the exergetic assessment methods from IEA ECBCS Annex 49 will be applied and further developed. The focus here is particularly on so-called LowEx system distribution and supply concepts of different building classes. For this reason the optimisation potentials of heating and cooling tasks of buildings as well as building groups as one part of multifarious community supply systems.

Main work items:

- Comprehensive and holistic consideration of buildings as a part of the community energy chain
- Taking different building demand into account (matching quality demand)
- Integration of LowEx technologies (Input from IEA ECBCS Annex 49 and Annex 37)
- Integration of knowledge and experiences from ECBCS Annex 51
- Identification of challenges from: “now”, “2020” and “2050”

Subtask A provides the necessary framework for more detailed exergy analyses applied to single building demands on community scale. Furthermore this subtask is strongly connected to Subtask B, because it delivers significant impact factors for holistic assessment mentioned in Subtask D.

3.2 Subtask B: Sources and Supply

Objective

Development and identification of concepts allowing a flexible supply of different demands with maximum share of local and renewable energy sources. Thereby chances for an efficient use of decentralized renewable-energy based systems such as CHP units, heat pumps and solar thermal collector fields as well as surplus heat (secondary energy) are enhanced. In this context, an all electrical supply and the use of heat pumps for the heating and cooling of the building stock is a promising option, too. Electrical energy from fluctuating energy sources will only be considered if they are thermally stored (e.g. storage tanks or usage of the building mass) and used for heating or cooling purposes (e.g. heat pumps). In this case only, an exergetic assessment is required and the signified contribution to greenhouse gas reduction is available.

Main work items:

- Identification of available sources for supply
- Identification of suitable storage technologies
- Integration of LowExergy sources (high share of RES and special consideration of (low temperature) DH technologies)
- Taking fluctuations from different sources into account
- Shows the dynamic matching of available energy sources with existing demands (e.g. space heating and cooling).
- In case of community heat supply by using district heating technologies integration of knowledge and experience (e.g. IEA DHC Annex TS1, IEA DHC Annex X)
- Identification of challenges from: “now”, “2020” and “2050”

Subtask B provides the necessary framework for more detailed exergy analyses applied to sources and supply within communities. Furthermore this subtask is strongly connected to Subtask A, because it delivers significant impact factors for holistic assessment mentioned in Subtask D.

3.3 Subtask C: Model cities

Objective

Within the framework of this Subtask the realisation and development of “model cities” respectively case studies (requires input from participants e.g. from ECBCS Annex 51), are imaginable. In this case it is advisable to ask about further usage of existing and available technologies. However it is necessary to consider the replacement of technologies as well as development and integration of technologies. The subtask is also focused on the interfaces between an advanced generation and supply of thermal energy on one hand, and, on the other hand, the optimised demand management within the community. The holistic systematic approach is the key issue within the subtask to prevent the introduction sub-optimal systems.

Main work items:

- Identification of appropriate strategies and technologies with great potential for promoting integration between supply and demand.
- Identification of best practise examples
- Identification of case studies
- Integration of knowledge an experiences from e.g. ECBCS Annex 51 (Case Studies)

The core issue in Subtask C is the identification of best practise examples of innovative techniques of communities based on input of Case Studies from the participants. It should be shown that the application of the LowEx Approach is an innovation driver for community systems. On the one hand, improvement potential and technological breakthrough needs will be addressed, while, on the other hand, system engineering and analysis will be examined. Subtask D needs also input from Subtask A and B.

3.4 Subtask D: Assessment methodology

Objective

The main objective is to collect and further development of existing (exergy) assessment methods. This step is used to identify the most appropriate method (e.g. Excel Tools or Simulations Tools) for each user group. Based on the respective method it should be possible to display various stages of planning or design of buildings, groups of buildings and community supply systems. Resulting Subtask D is strongly focused on overall methodology for whole systems. In particular, the further development of approaches from ECBCS Annex 37 and Annex 49 is pursued here. In addition to these objectives, it is possible to develop a simplified approach or to identify new approaches. All method should contribute to a more flexible, efficient and renewable energy supply in community systems (e.g. building interactions with supply structures and other buildings).

Main work items:

- Proposal for consistent assessment methodology for building energy systems
- Collections of existing Tools and Methods
- Integration of LowEx assessment methods (Input from IEA ECBCS Annex 49 and Annex 37)
- Enlargement of the assessment methodology at community level

The results of Subtasks A, B and C will be provided as input to the joint activity in Subtask D. Advanced modelling and implementation of combined dynamic exergy and energy analyses will show the potential of new technologies. Furthermore, investigations of storage systems will provide an optimized implementation strategy.

3.5 Subtask E: Dissemination

Objective

The focus of this subtask is to collect and distribute information on on-going and finished work. This includes the set-up of an information platform and the organisation of seminars and workshops.

Main Work Items

- Initiation of demonstration projects and development of new activity formats between research and business.
- Documentation of best practice examples.
- Brochure, website and seminars/workshops.
- Design guide.

The results of Subtasks A, B, C and D are to be provided as input to the joint activity in Subtask E. All collected information and task-related results will be published via the different channels named in Chapter 3.5. A web-based information platform, open seminars and widespread scientific publications will provide sources of disseminating information. The plan is to condense the findings of Annex activities in order to simplify public access and use of the results.

The three main target groups of the Annex will be primary addressed by the following means:

- **Energy supply and technology industry**
  - National workshops for this target group
  - Special conference contributions
- **Project developer and housing companies**
  - National workshops for this target group
  - Special conference contributions
- **Decision makers within Communities:**
  - easy to understand guidebook as the main deliverable from the Annex
  - National workshops for this target group.

3.6 Expected Results

The primary deliverable of the annex is an easy to understand and practical, applicable design ***guidebook*** for key people in communities. It is to contain an executive summary for decision makers. Some key questions for the targeted group of people are:

- What are arguments for taking action in regards to a possible change of the energy system within the community?
- What shall be done with regard to the community's energy system?
- And, what should not be done?
- Does our community fulfil the conditions for the implementation of a new technology and, if not, what could we improve to allow for this in the future?

These questions will be answered in the guidebook, which is to be focussed on decision makers' point of view. This will cover issues on how to implement advanced supply technologies at a community level and how to optimise supply structures to ensure reduced costs for the system solution, while providing a high standard of comfort to the occupants of the buildings. So the guidebook is intended to support

- designers for integration of concepts into design strategies, systems and technological solutions.
- decision makers and urban planners to integrate low exergy technologies into energy transition strategic processes and policies.

This brochure will be published preferably both as a book via a publisher, and as an electronic publication.

More detailed results, which will be published as appendices or separate reports via the project homepage are intended to cover topics such as:

- Analysis concept and design guidelines with regard to the overall performance. This could include a possible classification of technologies in terms of performance, improvement potential and innovation prospects.
- Overview of the feasibility, efficiency potentials and impacts of integral energy system solutions for existing community settings, criteria for decision making in the project development phase.
- Analysis framework and open-platform software and tools for community energy system design and performance assessment.
- Summary of intelligent management and control strategies and system solutions for an efficient energy supply system at community level based on exergy principles.
- Set of existing and close to market systems and technological solutions and best integration into overall energy system design.
- Description of good practices and examples of system concepts, technologies, management and control strategies for maximum share of renewable energy sources and maximum efficiency of the energy and exergy potentials available.

The dissemination of documents and other information is to be focussed on providing practitioners with research results. Methods of information dissemination are to include conventional means such as presentations at workshops and practice articles. The project homepage will be used extensively to spread information. Publications may be written in English and in the languages of the participants' countries. However, the translation of the key findings into English will allow for a broader distribution of knowledge. A communication platform will be developed using local networks and energy related associations. Regular workshops will be organised in all participating countries to show the latest project results and to provide an exchange platform for the target audience. Some of the workshops might be organised within the framework of national or international conferences or symposia.

3.7 Annex Management

The annex is operated by the Operating Agent, Subtasks A, B, C and D. The subtasks are managed by subtask leaders. Subtask E is aimed to be managed by the Operating Agent.

4 Other Related Activities

As mentioned in Chapter 1 the International Society of Low Exergy Systems in Buildings (LowExNet) was founded by participants of the completed ECBCS Annexes 37 and 49. LowExNet members are working with issues raised in the named annex and have been presenting their results and findings in a number of workshops and seminars, mainly in the framework of international conferences within the field of building technology, building physics and building services. The LowExNet group offers a platform for discussion and information dissemination for the activities. To strengthen and expand the scientific collaboration in the LowEx field within the European Union, project applications within suitable programmes (e.g. COST Programme) are planned. From the involved experts contacts to initiatives as e.g. the European Energy Research Alliance (EERA) and the smart cities stakeholder forum. Furthermore, a close collaboration to the following related IEA activities has been established:

4.1 IEA ECBCS Annex 49: Low Exergy Systems for High-Performance Buildings and Communities

IEA ECBCS Annex 49 is based on an integral approach which includes the analysis and optimisation of the exergy consumption caused by heating and cooling systems, as well as in other processes where energy/exergy is used within the building stock. The low-exergy approach aims at satisfying the remaining thermal energy demand using only low quality energy.

For the realisation of the IEA EBC Annex 64, the results of the finished IEA ECBCS Annex 49 offer an exergy calculation method (LowEx approach) as input. This approach was developed for the calculation of different energy qualities occurring in the built environment. The LowExergy approach offers the means to consistently specify energy sources (supply side) which fulfil the demand caused by buildings (demand side). Results from this project could help in the improvement community supply based on low exergy sources. In contrast to IEA EBC Annex 64 LowEx Communties, the main focus of IEA ECBCS Annex 49 is the demand side.

4.2 IEA ECBCS Annex 51: Energy Efficient Communities: Case Studies and Strategic Guidance for Urban Decision Makers

The objective of this annex is to evaluate case studies in 11 participating countries and to develop a Strategic Guidance for Urban Decision Makers. The main focus of this programme is to develop tools and instruments as well as strategies and institutional frameworks. Furthermore, gaps between technology, methods and models are to be identified.

The output and results of this programme are focused more on economic solutions than technical innovations. The distinction between Annex 51 and IEA ECBCS LowEx Communities is that ECBCS Annex 51 generally has a broader context. In contrast, the specific focus of Annex LowEx Communties is on developing technical solutions for the application of the LowEx approach (demand and supply side).

4.3 IEA EBC Annex 63: Implementation of energy strategies in communities

The overall objective of this annex is to develop standards for the implementation of optimised energy strategies at the scale of communities. These will contribute to a city´s energy and climate protection goals. While the city has the responsibility for both legal issues as well as for urban planning implementation at community scale means the involvement of local stakeholder and real investments. Since energy / CO_2-optimization itself is not sufficient criteria in urban planning processes, relevant co-benefits must be integrated systematically in decision making and planning process. Achievement of goals needs effective implementation. Since urban planning typically focuses at the community level a methodology for effective translation of a city´s energy / CO_2 goals to the community scale must be developed. Also required is the advancement and optimisation of policy instruments for the integration of energy / CO_2 goals into urban planning processes instead of having separate energy planning and urban planning processes. The proposed annex shall serve the needs of governments, urban decision makers and urban planning departments by guiding them with, on one hand a decision-matrix built on technology-strategies and, on the other hand the required instruments and process methodologies to implement the change .

The aim is to form a close cooperation with this annex. The coordinators of the annex proposals have already established a closed cooperation. Helmut Strasser joined the annex definition workshop on LowEx communities in Munich (September 2012). More cooperation is planned in joint working meetings and via the organisation of workshops.

4.4 IEA DHC Annex X: e.g. the 4th Generation District Heating project

The focus of the cost shared IEA DHC Annex X is to conduct research which will enable an optimal contribution of DHC and CHP towards a sustainable energy future. Four projects have currently been contracted under Annex X. The projects deal with the following topics: improving maintenance of DH systems, integrating renewable energy sources into heating grids, investigating fourth generation district heating, and developing a universal tool for a calculating individual primary energy factors and CO_2-emission coefficients for DH systems.

4.5 IEA DHC Annex TS1: Low Temperature District Heating for Future Energy Systems

This is the first Task-shared Annex in IEA DHC history. It allows member countries and sponsors to link national research to benefit from international developments.

The IEA DHC Annex TS1 aims to identify holistic and innovative approaches to supply communal low temperature heat. It is strongly targeted at DH technologies and the economic boundary conditions of this field of technology. The Annex TS1 is a framework that promotes the discussion of future heating networks with an international group of experts. The goal is to obtain a common development direction for the wide application of low temperature district heating systems in the near future. The gathered research which is to be collected within this Annex should contribute to establishing DH as a significant factor for the development of 100% renewable energy based communal energy systems in international research communities and in practice.

In general the proposed annex has a broader context with respect to all forms occurring thermal energy at the community level. In contrast to the proposed annex, the TS1 is strongly focused on usage of district heating technologies - the consideration of the LowEx approach is only secondary.

4.6 IEA SHC Task 52: Solar Thermal & Energy Economics in Urban Environments

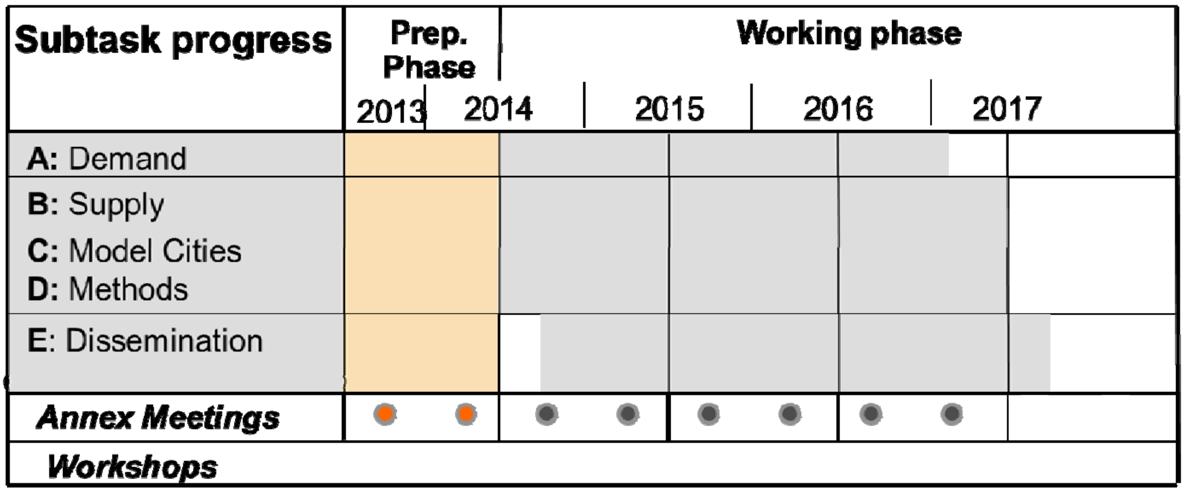
The SHC Task 52 focuses on the analysis of the future role of solar thermal in energy supply systems in urban environments. Based on energy economic analyses – reflecting future changes in the whole energy system – strategies and technical solutions as well as associated tools are to be developed. Good examples of the integration of solar thermal systems in urban energy systems will be developed and documented.

A close cooperation with this Task is aimed and an expert from the LowEx Communities Annex group attended the Task finding workshop. More cooperation is planned in joint working meetings or via the organisation of workshops.

5 Time Schedule

The Annex is expected to be initiated in June 2014, after a preparation phase of one year, and will continue for a period of three (3) years. The Annex will be concluded by the end of December 2017.

The following table represents the time schedule of each subtask process.



6 Funding

Participation in this annex requires a minimum effort of 12 person-months per country. Each participant's country is required to take part in at least one of the subtasks and it is recommended that all participants take part in Subtask E. Participation may partly involve funding allocated to a national activity, which falls substantially within the scope of work to be performed under this annex. In addition to providing the resources required for performing the work of the subtasks in which they are involved, all participants are required to provide the resources necessary for activities that are specifically collaborative in nature and are not meant to be part of a national program; for example, establishing common monitoring procedures, preparation for and participation in annex meetings, co-ordination with subtask participants, and contribution to documentation and information dissemination.

The meetings shall be hosted in turn by the various participants. The costs of organising and hosting meetings shall be borne by the host participant. Each participant will bear his/her own costs of travelling to the expert meetings.

The cost of publishing the reports and summary assessments shall be met by the Operating Agent(s).

7 Operating Agent(s) and Subtask Leaders

The role of operating agent (O.A.) for Annex 64 is taken by Germany, represented by Tekn. Dr. Dietrich Schmidt, Fraunhofer Institute for Building Physics.

Subtask A: José Antonio Sanchez, Swiss Federal Institute of Technology Zürich (ETH), Switzerland. (Back-up: Sabine Jansen, TU Delft, Netherlands.)

Subtask B: Forrest Meggers, Princeton University, USA

Subtask C: Ralf-Roman Schmidt Austrian Institute of Technology (AIT) Vienna, Austria

Subtask D: Åsa Hedman, Technical Research Centre of Finland (VTT), Finland

Subtask E. Dietrich Schmidt Fraunhofer Institute for Building Physics Kassel Branch (IBP), Germany

8 Participants

Interest in the project was during the 72nd ECBCS ExCo meeting in November 2012 in Bern/Switzerland and during the 73rd EBC ExCo meeting in June 2013 Rome/Italy expressed by:

Japan, Sweden, Austria, Denmark, Germany, Switzerland, R. Korea, P.R. China, Norway, Spain, France, the Netherlands and Belgium.

Experts from the following countries have strong interest in participating in this annex and have been involved in the preparation of this annex:

Austria, Denmark, Finland, Germany, Japan, R. Korea, Norway, Italy, Sweden, Switzerland, the Netherlands and USA.

Version: 10th of October 2014