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Rüdiger Lohse · Alexander Zhivov

Deep Energy Retrofit Guide for Public Buildings

Business and Financial Models



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Preface

The International Energy Agency

The International Energy Agency (IEA) was established in 1974 within the framework of the Organization for Economic Cooperation and Development to implement an international energy programme. The basic aim of the IEA is to foster international cooperation among the 29 IEA participating countries and to increase energy security through energy research, development, and demonstration in the fields of technologies for energy efficiency and renewable energy sources.

The IEA Energy in Buildings and Communities Programme

The IEA coordinates international energy research and development (R&D) activities through a comprehensive portfolio of Technology Collaboration Programmes. The mission of the IEA Energy in Buildings and Communities (IEA EBC) Programme is to develop and facilitate the integration of technologies and processes for energy efficiency and conservation into healthy, low emission, and sustainable buildings and communities through innovation and research. (Until March 2013, the IEA EBC Programme was known as the IEA Energy in Buildings and Community Systems Programme, ECBCS.)

The R&D strategies of the IEA EBC Programme are derived from research drivers, national programmes within IEA countries, and the IEA Future Buildings Forum Think Tank Workshops. These R&D strategies aim to exploit technological opportunities to save energy in the buildings sector, and to remove technical obstacles to market penetration of new energy-efficient technologies. The R&D strategies apply to residential, commercial, and office buildings and community systems, and will impact the building industry in five areas of focus for R&D activities:

- Integrated planning and building design;
- Building energy systems;
- Building envelope;
- Community-scale methods;
- Real building energy use.

The Executive Committee

Overall control of the IEA EBC Programme is maintained by an Executive Committee, which not only monitors existing projects, but also identifies new strategic areas in which collaborative efforts may be beneficial. As the Programme is based on a contract with the IEA, the projects are legally established as Annexes to the IEA EBC Implementing Agreement. At the present time, the following projects have been initiated by the IEA EBC Executive Committee, with completed projects identified by (*):

- Annex 1: Load Energy Determination of Buildings (*)
- Annex 2: Ekistics and Advanced Community Energy Systems (*)
- Annex 3: Energy Conservation in Residential Buildings (*)
- Annex 4: Glasgow Commercial Building Monitoring (*)
- Annex 5: Air Infiltration and Ventilation Centre
- Annex 6: Energy Systems and Design of Communities (*)
- Annex 7: Local Government Energy Planning (*)
- Annex 8: Inhabitants Behavior with Regard to Ventilation (*)
- Annex 9: Minimum Ventilation Rates (*)
- Annex 10: Building HVAC System Simulation (*)
- Annex 11: Energy Auditing (*)
- Annex 12: Windows and Fenestration (*)
- Annex 13: Energy Management in Hospitals (*)
- Annex 14: Condensation and Energy (*)
- Annex 15: Energy Efficiency in Schools (*)
- Annex 16: BEMS 1–User Interfaces and System Integration (*)
- Annex 17: BEMS 2–Evaluation and Emulation Techniques (*)
- Annex 18: Demand Controlled Ventilation Systems (*)
- Annex 19: Low Slope Roof Systems (*)
- Annex 20: Air Flow Patterns within Buildings (*)
- Annex 21: Thermal Modeling (*)
- Annex 22: Energy Efficient Communities (*)
- Annex 23: Multi-Zone Air Flow Modeling (COMIS) (*)
- Annex 24: Heat, Air and Moisture Transfer in Envelopes (*)
- Annex 25: Real time HVAC Simulation (*)
- Annex 26: Energy Efficient Ventilation of Large Enclosures (*)
- Annex 27: Evaluation and Demonstration of Domestic Ventilation Systems (*)

- Annex 28: Low Energy Cooling Systems (*)
- Annex 29: Daylight in Buildings (*)
- Annex 30: Bringing Simulation to Application (*)
- Annex 31: Energy-Related Environmental Impact of Buildings (*)
- Annex 32: Integral Building Envelope Performance Assessment (*)
- Annex 33: Advanced Local Energy Planning (*)
- Annex 34: Computer-Aided Evaluation of HVAC System Performance (*)
- Annex 35: Design of Energy Efficient Hybrid Ventilation (HYBVENT) (*)
- Annex 36: Retrofitting of Educational Buildings (*)
- Annex 37: Low Exergy Systems for Heating and Cooling of Buildings (LowEx) (*)
- Annex 38: Solar Sustainable Housing (*)
- Annex 39: High Performance Insulation Systems (*)
- Annex 40: Building Commissioning to Improve Energy Performance (*)
- Annex 41: Whole Building Heat, Air and Moisture Response (MOIST-ENG) (*)
- Annex 42: The Simulation of Building-Integrated Fuel Cell and Other Cogeneration Systems (FC+COGEN-SIM) (*)
- Annex 43: Testing and Validation of Building Energy Simulation Tools (*)
- Annex 44: Integrating Environmentally Responsive Elements in Buildings (*)
- Annex 45: Energy Efficient Electric Lighting for Buildings (*)
- Annex 46: Holistic Assessment Tool-kit on Energy Efficient Retrofit Measures for Government Buildings (EnERGo) (*)
- Annex 47: Cost-Effective Commissioning for Existing and Low Energy Buildings (*)
- Annex 48: Heat Pumping and Reversible Air-Conditioning (*)
- Annex 49: Low Exergy Systems for High Performance Buildings and Communities (*)
- Annex 50: Prefabricated Systems for Low Energy Renovation of Residential Buildings (*)
- Annex 51: Energy Efficient Communities (*)
- Annex 52: Towards Net Zero Energy Solar Buildings (*)
- Annex 53: Total Energy Use in Buildings: Analysis and Evaluation Methods (*)
- Annex 54: Integration of Micro-Generation and Related Energy Technologies in Buildings (*)
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- Annex 56: Cost-Effective Energy and CO₂ Emissions Optimization in Building Renovation
- Annex 57: Evaluation of Embodied Energy and CO₂ Equivalent Emissions for Building Construction (*)
- Annex 58: Reliable Building Energy Performance Characterization Based on Full Scale Dynamic Measurements (*)
- Annex 59: High Temperature Cooling and Low Temperature Heating in Buildings (*)
- Annex 60: New Generation Computational Tools for Building and Community Energy Systems

- Annex 61: Business and Technical Concepts for Deep Energy Retrofit of Public Buildings
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- Annex 70: Energy Epidemiology: Analysis of Real Building Energy Use at Scale
- Annex 71: Building Energy Performance Assessment Based on In-situ Measurements
- Annex 72: Assessing Life Cycle Related Environmental Impacts Caused by Buildings
- Annex 73: Towards Net Zero Energy Resilient Public Communities
- Annex 74: Energy Endeavor
- Annex 75: Cost-Effective Building Renovation at District Level Combining Energy Efficiency and Renewables
- Working Group—Energy Efficiency in Educational Buildings (*)
- Working Group—Indicators of Energy Efficiency in Cold Climate Buildings (*)
- Working Group—Annex 36 Extension: The Energy Concept Adviser (*)
- Working Group—HVAC Energy Calculation Methodologies for Non-residential Buildings of America.

Additional copies of this report may be obtained from: www.iea-ebc.org; essu@eia-ebc.org.

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