

# Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance and Cost (RAP-RETRO)

## ANNEX 55

Nowadays, building energy use and durability issues are some of the most important topics in industrialised countries. Even though considerable progress has been achieved concerning new buildings and advanced building services, the buildings sector still generally accounts for the largest share of energy-related carbon dioxide (CO<sub>2</sub>) emissions. While in many industrialised countries, new buildings are constructed every year corresponding to approximately 1% of the existing building stock, commonly more than 50% of the building stock dates from before the first energy crisis in the 1970s. Hence, a large potential for energy savings and consequently CO<sub>2</sub> emissions reduction is presently available in the existing building stock.

Retrofit measures are therefore of the utmost importance for upgrading the building stock. But, many building owners are only interested in the initial capital cost. Looking at the risks associated with the actual performance of such measures and the costs incurred highlights the need for life cycle thinking. So, applicable calculation methods are required in this area. For this purpose, probability assessment in life cycle costing of solutions supports sound decision making relating to investments.

### PROJECT OBJECTIVES

- 1 develop and validate probabilistic methods and tools for prediction of energy use, lifecycle cost and functional performance based on assessment of energy retrofitting measures,
- 2 apply and demonstrate probabilistic methodologies on real life case studies to enhance energy savings, secure performance and apply cost analyses, and
- 3 create guidelines for practitioners, including assessment of common retrofitting techniques.

The project has significantly improved methods and tools for integrated evaluation and optimization of retrofitting measures, including energy efficiency, life cycle cost and durability. For decision makers, designers and practitioners, it has demonstrated the benefits of the renewal of the existing building stock and how to create reliable solutions.



Social housing in Porto, Portugal  
 Source: Vasco Freitas



Multi-family residential buildings north of Stockholm in Sweden  
 Source: Johan Stein

## INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) was established as an autonomous body within the Organisation for Economic Co-operation and Development (OECD) in 1974, with the purpose of strengthening co-operation in the vital area of energy policy. As one element of this programme, member countries take part in various energy research, development and demonstration activities. The Energy in Buildings and Communities Programme has co-ordinated various research projects associated with energy prediction, monitoring and energy efficiency measures in both new and existing buildings. The results have provided much valuable information about the state of the art of building analysis and have led to further IEA co-ordinated research.

## EBC VISION

By 2030, near-zero primary energy use and carbon dioxide emissions solutions have been adopted in new buildings and communities, and a wide range of reliable technical solutions have been made available for the existing building stock.

## EBC MISSION

To accelerate the transformation of the built environment towards more energy efficient and sustainable buildings and communities, by the development and dissemination of knowledge and technologies through international collaborative research and innovation.

## ACHIEVEMENTS

The project has delivered decision support data and has developed tools for evaluating energy retrofitting measures, focussing on residential building envelopes. These tools have been based on probabilistic methodologies. The main results of such probabilistic risk assessments are probabilities or likelihoods, i.e. quantities that show how many out of all the possible cases do or do not meet the desired performance.

## PRODUCTS

- Stochastic Data report
- Probabilistic Tools report
- Framework for Probabilistic Assessment of Performance of Retrofitted Building Envelopes report
- Practice and Guidelines report
- Guidelines for How to Use the Developed Framework for Practitioners report

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## Project duration

Completed (2010 - 2015)

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## Operating Agent

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## Participating countries

Austria, Belgium, Denmark, Germany, the Netherlands, Portugal, Sweden, United Kingdom, USA  
Observers: Brazil, Estonia, Slovakia

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## Further information

[www.iea-ebc.org](http://www.iea-ebc.org)

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