

Evaluation of Embodied Energy and CO₂ Equivalent Emissions for Building Construction

ANNEX 57

The evaluation of energy use by buildings is becoming increasingly accurate, and has in many industrialised countries led to the design of more energy efficient building envelopes and systems, driven by more demanding standards and regulations. However, the fraction of the total life cycle energy use and CO₂ emissions caused by other life cycle stages, the embodied impacts, is significant, and growing.

Energy use and CO₂ emissions due to building construction and civil engineering works currently account for about 20% of global impacts, varying from typically 5% to 10% for industrialised countries and 10% to 30% in developing countries.

PROJECT OBJECTIVES

- 1 collect existing research results concerning embodied energy and CO₂ emissions due to building construction, analyze and then summarize them to present the state of the art,
- 2 develop guidelines for methods for evaluating embodied energy and CO₂ emissions resulting from building construction, and
- 3 develop guidelines for measures to design and construct buildings with less embodied energy and CO₂ emissions. building energy simulation tools.



Scenario	Standard	Resilient
Reference period (years)	50	100
EG (kg-CO ₂ /m ² year)	7.9	4.8
EC (kg-CO ₂ /m ² year)	89	60

Measures to reduce embodied greenhouse gases (EG) and embodied CO₂ emissions (EC) by prolongation of building life.
Source: © Henning Larsen Architects

The reduction of embodied energy and CO₂ emissions from buildings has the potential to decrease these values considerably. However, while this is increasingly recognized, current calculation approaches and methods vary greatly depending on the country and evaluator, and resulting in widely differing results.

Over the last five years, this major international research project has addressed this issue, with researchers from 18 countries working together to develop a detailed understanding of the multiple calculation methods and their interpretations. The project has also used the knowledge developed to present the information in a set of clear guidelines so that various practitioners can include this in their decision-making. The aim of the research has been the global reduction of embodied energy (EE) and equivalent CO₂ emissions (EC_{eq}) from buildings.

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 main receptors for the project outcomes are practitioners, such as designers and engineers of buildings and their components, as well as decision makers, including policy makers and building owners.

The following specific outcomes have been published:

- Final Project Report, including case studies from individual countries,
- Guidelines for Building Designers and Consultants, Policy Makers, Construction Product Manufacturers, Procurers and Educators, and
- Project Summary Report, outlining the technical and policy-relevant output from the project.

Project duration

Ongoing (2011 - 2016)

Operating Agent

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Participating countries

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Observer: Brazil, Finland

Further information

www.iea-ebc.org