How much energy can be conserved and how?

The role of energy conservation related businesses and cross-cutting technologies

Impulse by German and Japanese GJETC Members

The role of energy efficiency for current and long term climate protection policies and the energy transition in Japan and Germany

Toshiharu Ikaga
Professor, Head of Department of System Design Engineering,
Faculty of Science and Technology, Keio University

Ikaga Lab., Keio University
Japan’s Target : 40% reduction for buildings

COP21 Paris agreement: GHG in 2030 compared to 2013

Increase of CO₂ Emissions since 1990

1990 2000 2010 2020 2030

Commercial Bldg.
Residential Bldg.
Transport
Industry

103%
54%
9%
-14%
103%
54%
9%
-14%
40%
39%
27%
-7%
-40%


Keio’s Co-Evo House LCCO₂ 0%  
Designed by Keio University

Yusuhara Town Hall, LCCO₂ 60%  
Designed by Keio University

Ikaga Lab., Keio University
This research was supported by the Ministry of Land Infrastructure and Transport as a part of "Research project on household energy consumption in Japan (Project leader: Prof. Shuzo Murakami), and the global environment research fund (GERF) prepared by the Ministry of Environment as a part of the "Japan low carbon society scenarios toward 2050 (Project leader: Dr. Shuzo Nishioka)."
Life Cycle Carbon-Minus Housing Project

Ministry of Land, Infrastructure, Transport and Tourism since 2009

Chair: Dr S. MURAKAMI
Chair of LCCO₂ WG: T. IKAGA

Cutting trees
Manufacturing architectural materials
Construction
Occupation
Demolition

Harvesting
Ordinary Housing
Operation (CO₂ reduction by PV, Solar Heater, Biomass Energy, etc.)

CO₂ emission [t-CO₂]

LCCM Housing

Time [year]

Demolition
Renovation
Construction

Recycling
Final disposal

Ikaga Lab., Keio University
Yusuhara Town Hall

CASBEE ***** LCCO$_2$ -40%

2 x 600kW Turbines

Keio Univ 21 COE Research Project
Architectural Design: Prof. K. KUMA, Keio Univ.
Env. & Mec. Design: Prof. T. IKAGA, Keio Univ.

GFA= 2970m$^2$
Completed in Aug 2006

Ikaga Lab., Keio University
Zero Energy & Wellness Bldgs in Japan

**YANMAR** Head office/ 2014
CASBEE: S/ Designed by Nikken Sekkei

**DAIKIN** Technology and Innovation Center/ 2015
CASBEE: S/ LEED-NC: Platinum/ Designed by Nikken Sekkei

Ikaga Lab., Keio University
Zero Energy & Wellness Bldgs in Japan

CASBEE: S / LEED-NC: Platinum
Comprehensive Assessment System for Built Environment Efficiency

**1-1 建物概要**

<table>
<thead>
<tr>
<th>建物名目</th>
<th>松田病院建替計画</th>
<th>階数</th>
<th>地上5F</th>
</tr>
</thead>
<tbody>
<tr>
<td>建設地</td>
<td>名古屋市西区枇杷島一丁目1102-2</td>
<td>構造</td>
<td>RC造</td>
</tr>
<tr>
<td>用途地域</td>
<td>第一種住居地域、商業地域、防火地域</td>
<td>地域区分</td>
<td>地域区分IV</td>
</tr>
<tr>
<td>気候区分</td>
<td></td>
<td>平均居住人員</td>
<td>350人</td>
</tr>
<tr>
<td>建物用途</td>
<td>病院</td>
<td>年間使用時間</td>
<td>8,760時間/年</td>
</tr>
<tr>
<td>竣工年</td>
<td>2014年6月</td>
<td>評価の段階</td>
<td>基本設計段階評価</td>
</tr>
<tr>
<td>敷地面積</td>
<td>2,284㎡</td>
<td>評価の実施日</td>
<td>2011年6月13日</td>
</tr>
<tr>
<td>建築面積</td>
<td>1,630㎡</td>
<td>作成者</td>
<td>作成者</td>
</tr>
<tr>
<td>延床面積</td>
<td>5,276㎡</td>
<td>確認日</td>
<td>確認者</td>
</tr>
</tbody>
</table>

**2-1 建築物の環境効率 (BEEランク&チャート)**

BEE = 1.6

**2-2 ライフサイクルCO₂（温室化影響チャート）**

標準計算

- ① 参照行
- ② 建築物の取組み
- ③ 上記①+②以外の
- ④ 取組

このグラフは、LR3中の「地球温暖化への配慮」の内容を、一般的な建物（参照行）と比べたライフサイクルCO₂排出量の目安で示したもので、(kg-CO₂/年・㎡)

**2-3 大項目の評価（レーダーチャート）**

- Q1 室内環境
- Q2 サー ビス性能
- Q3 室外環境
- LR1 エネルギー
- LR2 負 荷
- LR3 敷地外環境

Ikaga Lab., Keio University
In any sales advertisement of submitted buildings, the evaluation result is mandatorily advised to be indicated by the following local governments:

- Osaka C., Osaka P., Yokohama C., Kawasaki C., Kanagawa P., Sakai C., Kobe C., Kumamoto P., and Kashiwa C.

C.=City, P.= Prefecture
A Case Study City of Urban Infrastructure Initiative
World Business Council for Sustainable Development

http://www.wbcsd.org/iiikobereport.aspx
Assessment on Kobe from 1990 to 2025

by Urban Infrastructure Initiative, World Business Council for Sustainable Development

Good 100

Recovery from the devastating disaster

2025 (Future goal)

2000

1995

1995

Huge earthquake

http://www.wbcsd.org/uiikobereport.aspx
CASBEE-City (Worldwide Use Version)

Tokyo
Population 9,077,177

1. Location
2. Built Environment Efficiency (BEE chart)
3. Assessment results for main items (bar chart)
4. Assessment results for each SDG (radar chart)

ISO37120 indicators
Sustainable development of communities
- Indicators for city services and quality of life

CASBEE-City
- Pilot version for worldwide use -

BEE=
Score for Q
Score for L

Population: 9,077,177

SDG 1. NO POVERTY
SDG 2. ZERO HUNGER
SDG 3. GOOD HEALTH AND WELL-BEING
SDG 4. QUALITY EDUCATION
SDG 5. GENDER EQUALITY
SDG 6. CLEAN WATER AND SANITATION
SDG 7. AFFORDABLE AND CLEAN ENERGY
SDG 8. DECENT WORK AND ECONOMIC GROWTH
SDG 9. INDUSTRY, INNOVATION AND INFRASTRUCTURE
SDG 10. REDUCED INEQUALITIES
SDG 11. SUSTAINABLE CITIES AND COMMUNITIES
SDG 12. RESPONSIBLE CONSUMPTION AND PRODUCTION
SDG 13. CLIMATE ACTION
SDG 14. LIFE BELOW WATER
SDG 15. LIFE ON LAND
SDG 16. PEACE AND STRONG INSTITUTIONS

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City Assessment using CASBEE

Good

100

BEE \((Q/L)\)

3.0

1.5

1.0

Sustainable

S

A

B+

B−

Score for Q

50

0

0

50

100

Unsustainable

Score for L

Good

Poor

0.5

Japan

Singapore

Malaysia

East Asia (n=7)

South East Asia (n=4)

South America (n=3)

North/Middle America (n=12)

Europe (n=11)

Oceania (n=4)
Chapter 9 Building

9.7 Co-benefits, risks and spillovers
  9.7.1 Overview
  9.7.2 Socio-economic effects
    9.7.2.1 Impacts on employment
    9.7.2.2 Energy security
    9.7.2.3 Benefits related to workplace productivity
    9.7.2.4 Rebound effects
    9.7.2.5 Fuel poverty alleviation
  9.7.3 Environmental and health effects
    9.7.3.1 Health co-benefits due to improved indoor conditions
    9.7.3.2 Health and environmental co-benefits due to reduced outdoor air pollution
    9.7.3.3 Other environmental benefits