

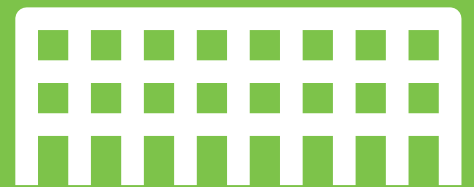


Proposal

2050 : Building-related Measures to Counteract Global Warming

Vision

Towards Carbon-Neutralization



December 2009



Preface

The five building-related associations^{*1} in Japan have conducted a variety of initiatives to cope with global environmental issues, including in the year 2000, the enactment of the “Architectural Charter for a Global Environment”. Since then, scientific knowledge regarding global warming has been accumulated, and social concern about this topic has continued to grow throughout Japan. Tackling this issue requires mid- and long-term efforts, while drawing up a concrete roadmap is a pressing need.

Since demographic, lifestyle, energy and resource issues are deeply connected to global warming, these must be the basic factors for constructing a sustainable society. Individual buildings, cities, and regions, being a part of the built environment, play a significant role thereupon. After consideration of domestic and international responses to global environmental problems, Japan’s seventeen building-related associations (i.e. *Architectural Institute of Japan, Japan Federation of Architects & Building Engineers Association, Japan Association of Architectural Firms, The Japan Institute of Architects, Building Contractors Society, The Society of Heating, Air-conditioning and Sanitary Engineers of Japan, Building and Equipment Life Cycle Association, The Institute of Electrical Installation Engineers of Japan, The Japan Federation of Housing Organizations, Japan Sustainable Building Consortium, The City Planning Institute of Japan, Japan Association for Real Estate Sciences, The Japan Wood Research Society, Institute for Building Environment and Energy Conservation, Japan Building Mechanical and Electrical Engineers Association, Association of Building Engineering and Equipment, and Japan Structural Consultants Association*) have sought mid- and long-term goals towards the year 2050 for buildings, cities, and regions. Based on the basic principles of the Architectural Charter for a Global Environment, which includes the key issues of 1) longevity, 2) symbiosis, 3) energy conservation, 4) resource conservation and cyclicity and 5) succession, the associations have begun to closely examine concrete architectural measures to counteract global warming.

Future buildings, cities and regions will determine the form of society in the future. Therefore, we hereby propose to start working together to achieve carbon-neutralization^{*2} of buildings and cities/regions for the sake of creating a low carbon society, and share with all the building-related stakeholders the goals of “Vision 2050: Building-related Measures to Counteract Global Warming ~ Towards Carbon-Neutralization”, stated hereinafter.

- *1 The five building-related associations: Architectural Institute of Japan, Japan Federation of Architects & Building Engineers Association, Japan Association of Architectural Firms, The Japan Institute of Architects, Building Contractors Society
- *2 “Carbon-neutral” refers to achieving zero carbon dioxide emissions by balancing a measured amount of carbon released with an equivalent amount sequestered or offset throughout a whole year. This is achieved by controlling energy demands, providing necessary energy by renewable resources, and/or combining the reduction of CO₂ emissions with other projects. Carbon neutral indicates being as close to the situation of zero CO₂ emissions as possible.
- *3 IPCC Intergovernmental Panel on Climate Change
- *4 ‘Backcasting’, as opposed to ‘forecasting’, involves envisioning a future scenario, and then tracing the needed steps back to the present.
- *5 ‘Building-related sector’ involves individual buildings, cities/regions, legislation and real estates.

II.

Proposal

In response to the warning set forth in IPCC^{*3}'s Forth Assessment Report, many countries from around the world have set a long term goal to reduce greenhouse gas emissions by 50% of the current level by the year 2050. Taking into consideration the limited carrying capacity of the earth, the "Backcasting"^{*4} method should be used to set goals for the future in order to strategically transform our market and society, which are closely related to architectural design and urban/regional planning.

In the course of making this transformation, developed countries must play a leading role and accept larger responsibilities and burdens. As mentioned above, IPCC's Forth Assessment Report stated that the building sector has the largest potential to contribute to short- and mid-term mitigation and prevention of global warming. This indicates that we, those involved in the building-related sector, are in the very position to lead the world in executing large scale measures to counteract global warming.

Therefore, in order to prevent the negative affects of global warming, we must do our best to implement the carbon-neutralization of buildings and cities/regions by minimizing CO₂e. Our goal is to carbon-neutralize new construction during the next 10 to 20 years, and then all buildings, including existing buildings, by the year 2050. A detailed outline of the strategies is as follows.

Goals

Carbon-Neutralization of Buildings, Cities and Regions

1 Promote the minimization of CO₂e from buildings during the next 10 to 20 years through the carbon-neutralization of new construction.

New buildings must be designed to minimize the energy required for construction and operation, and to maximize the utilization of renewable energy sources. The carbon-neutralization of buildings must also be promoted through long-life design using eco-materials, while at the same time being flexible for easy refurbishment in the future. It is possible to achieve this goal using existing technologies; however, efforts should be made to achieve the goal sooner through the promotion of technical developments to reduce costs and the development of institutions.

2 Promote the carbon-neutralization of all building-related sector^{*5}, including existing buildings, by the year 2050

Buildings, composing a considerable part of our social property, require relevant measures addressing not only new construction but also the enormous number of existing buildings through refurbishment. It is important as well to provide relevant social systems that enable us to use and maintain a building for a long time through refurbishment. That is, we promote the carbon-neutralization of all buildings by the year 2050 through refurbishments that will minimize the environmental impact during the life of the building. Considering the method of refurbishment developed at the design stage and in accordance with the building's objectives, this includes measures such as energy efficiency, adoption of renewable energy sources, and enhancement of durability.

3 Promote carbon-neutralization of the surrounding city/region and society

In order to achieve the carbon-neutralization of a building, it is essential to understand the close relationship it has with its surrounding city/region. This includes consideration of the local climate, local geographical features, utilization of local resources, and closer cooperation with nearby economic activities and communities. Since a building is an important component of the region, the carbon-neutralization of buildings helps accelerate low-carbonization of the region as well. We promote, therefore, the carbon-neutralization of not only a single building but also its surrounding region and society.

Policy 1: How to plan, design, construct and operate carbon-neutral buildings

1 Design and operate buildings to minimize energy consumption

Buildings emit large amounts of CO₂ when consuming energy for heating and cooling, which can be significantly reduced through enhancing the environmental performance of the building envelop (e.g. insulation and sun-shading), and also through installation of state-of-the-art mechanical appliances (e.g. air-conditioners, lighting, hot water heaters and office appliances). These products have recently made remarkable progress in energy efficiency. In addition, the behavior of the building users contributes greatly to the reduction of CO₂e, through lifestyle changes and choosing efficient household electrical appliances. By integrating these energy-saving measures as intensively as possible into a building's design, energy consumption can be minimized without sacrificing comfort.

2 Design buildings to use renewable energy sources to provide the amount of energy consumed

Renewable energy sources include solar, wind, geothermal, hydraulic and biomass energy. The feasibility of renewable energy should be examined during the design stage of a building. Buildings should be equipped with demand and supply systems that utilize thermal renewable energy sources, especially solar energy. During the operational stage, minimizing energy consumption and changing to renewable energy sources can promote carbon-neutralization of buildings with the greatest reduction of CO₂e.

3 Design and operate a building to extend its lifespan

Carbon-neutralization of a building can also be promoted by extending a building's lifespan as long as possible, which avoids CO₂e originating from construction and disposal. This requires improving the physical performance of buildings through enhancing durability, seismic stability and disaster-prevention. In addition, flexible building design for the sake of future refurbishment (e.g. skeleton-infill building system) will help maximize utilization of the existing building structures and elements and also contribute to easy circulation of existing buildings

in the future real-estate market. Furthermore, the refurbishment of the existing building stock should be properly promoted to improve energy efficiency as well as to extend the lifespan of buildings.

4 Promote the utilization of eco-materials which reduces CO₂e

When choosing building materials and elements, eco-materials should be chosen, reducing CO₂e during manufacturing and transportation, as well as maximizing resource efficiency. The intensive use of wood also helps reduce the amount of carbon dioxide in the atmosphere by consequently increasing the amount of fixed carbon accumulated in building elements. From this same viewpoint, during the disposal stage of a building, reuse of building materials should also be promoted.

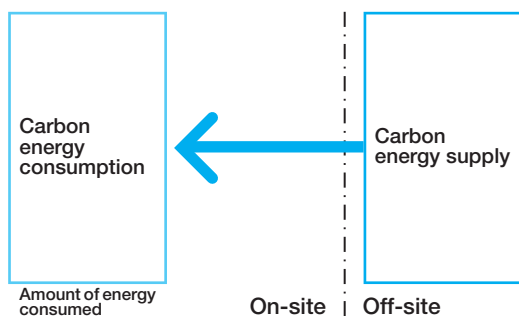
5 Plan to reduce off-site CO₂e when on-site CO₂e are irreducible

When carbon-neutralization of a building cannot be achieved on-site, complementary measures should be examined to reduce CO₂e off-site, which helps attain carbon-neutralization as a whole while maintaining flexibility in design. Carbon Credits for the procurement of off-site renewable energy sources and Certified Emission Reductions that allow buildings to manage reductions of CO₂e collectively are examples of economic systems that reduce off-site CO₂e when on-site CO₂e are irreducible.

6 Formulate and utilize a life-cycle management system applied consistently throughout the life of a building (e.g. from design, construction, operation, renovation to disposal)

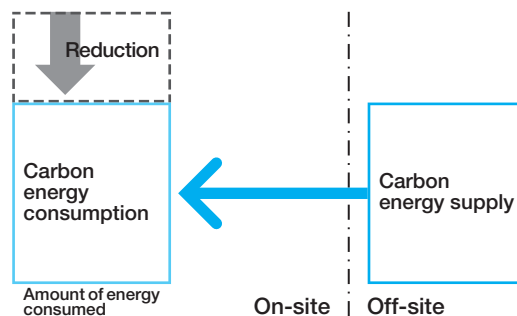
An effective lifecycle management system covering the life of a building, including design, construction, operation, renovation and disposal, should be developed and implemented. Use of a totally integrated building data-base will simplify management of the built environment. Carbon neutralization of buildings can be promoted through the development and implementation of such a coherent design and management process.

1 Conventional building



2 Energy efficient building

Reduce energy loads through energy efficient design, enhancing basic passive performance, choosing high efficient equipment, etc.



Policy 2: How to construct a carbon-neutral city/region and society

1 Promote measures even on urban and regional levels

The carbon-neutralization of a region and society, beyond that of a single building, should be promoted by means of comprehensive measures on urban and regional levels, addressing urban compaction, regional energy supply, utilization of unused and/or renewable energy, reduction of energy used for transportation, and measures to mitigate the heat island effect of urban areas^{*6}. To this end, the waste of resources and energy arising from urban sprawl should be minimized by utilizing and refurbishing existing buildings and infrastructures and also by transforming urban areas into compact cities.

2 Observation and utilization of the local climate in building design

Japan has a variety of climate zones, by which buildings are significantly influenced. Passive building designs and town-scaping methods conforming to the local climate and/or micro-climate may reduce energy demands for heating and cooling. Furthermore, intensive use of regional resources, materials and renewable energy sources may contribute not only to mitigating global warming, but also to creating buildings and cities/regions specific to their local environment.

3 Promote forests as carbon storage

Forests store carbon, and therefore should be carefully used and nursed on the basis of a long-term program. Although the building industry is the largest consumer of wood, the lumber used in buildings functions as a carbon sink for the life of the building. Given this, we can contribute to promoting forest carbon storage through the appropriate use of wood in buildings. This includes banning the use of illegally logged timbers and encouraging intensive use of domestic wood including trees thinned from forests.

4 Utilize information and economic systems

Free access to information on greenhouse gas emissions and the visualization of built environment performance through a standardized labeling and evaluation system are very effective in moving social

awareness towards carbon-neutralization. Such initiatives have recently been promoted and used in the real estate market to appraise the value of properties. While regulatory control of buildings is an effective measure, financial incentives that provide benefits are also indispensable when seeking to achieve higher goals. Once fully operational, complementary methods, such as certification, carbon credits, and credit procurement, will create a very flexible system capable of reducing CO₂e for each building.

5 Lifestyle reform

Those using the built environment have demanded greater comfort and convenience, which has created a lifestyle of high energy use and separation from nature. In order to achieve carbon-neutralization, it is necessary for building-related experts not only to improve building performance but also to propose a lifestyle^{*7} which does not rely on carbon energy, as well as to practice this lifestyle together with users and occupants. It is also important to provide a healthy living environment to users and occupants throughout their lives and to create a lifestyle in accordance with nature.

6 Share the long-term vision of each city/region and society

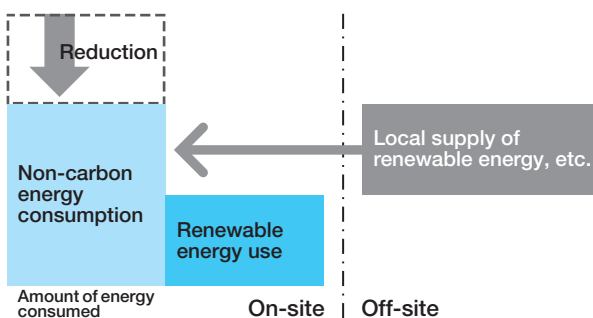
Japan is already encountering depopulation due to an extremely low birthrate and aging society. For quite some time, Japan has been suffering from the decline and depopulation of provincial city centers and agricultural and fishing communities, which has become a serious social issue. The time has already come to reconsider our current social structure and plans for the future, which are based on the assumption of continuous population growth. This represents a totally new paradigm. The measures needed to counteract global warming extend over time and are inevitably linked to social reform. Therefore, it is necessary to share the vision we have for buildings and cities/regions with the citizens concerned.

*6 Proposals of the measures to mitigate urban heat islands, Architectural Institute of Japan, 2005

*7 Action plan to promote a lifestyle to counteract global warming, Architectural Institute of Japan, 2005

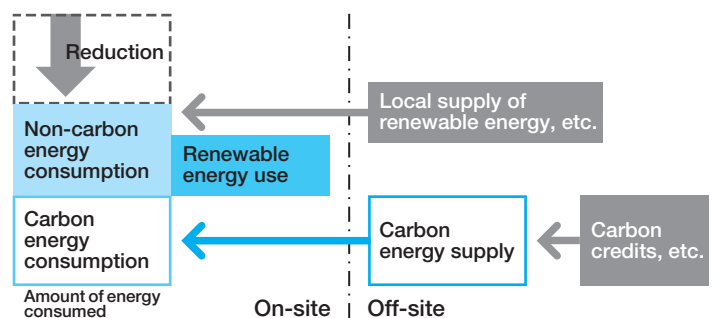
3 Zero carbon building

Achieve zero consumption of energy from fossil fuel sources while adopting renewable energy sources to meet energy requirements



4 Carbon neutral building

Achieve carbon-neutralization by adopting off-site measures as well



III.

Framework of the Action Plan

A building should protect the life and private property of its owner and occupants. It should also be regarded a part of social property that contributes to protecting the environment at regional and even global levels (e.g. preventing global warming). Furthermore, a building and a city/region can also possess a highly public aspect through carbon-neutralization, which largely contributes to mitigating global warming by reducing CO₂e.

Because of the intrinsically deep connections between lifestyle, society and the built environment, not only building owners and experts, but all members of society must engage in measures to counteract global warming. Following from this viewpoint, we hereby propose for society “**Vision 2050: Building-related Measures to Counteract Global Warming**” as an expression of the will of all parties involved in the building-related sector. We also hereby declare our own action plan to realize “Vision 2050”. The framework of the action plan is as follows.

1 Research and development

Technological development and integrated research will be conducted to increase energy efficiency, intensify adoption of renewable energy sources, and lengthen the lifespan of buildings. In addition, a roadmap to actualize countermeasures will be created by envisioning a building and city/region image, associated with an entire scenario for society in 2050.

2 Policy proposition

In order to ensure the effective execution of the building-related measures to counteract global warming, we will elaborate and propose policies regarding information and economic systems, including regulatory and incentive methods, considering case studies from abroad. How to bear the necessary costs arising from applying these measures will also be examined and reflected in the policy proposition.

3 Development of human resources

Among the experts and students involved in planning, design,

construction and operation of the built environment, we will develop human resources with the relevant knowledge and skills necessary to comprehend the building sector’s countermeasures to global warming.

4 Information dissemination

Efforts should be made to provide the general public with information on the importance and effective role of building-related measures to counteract global warming in a tangible way, for instance, by using a standardized labeling and evaluation system. Using opportunities in environmental education, all people must be made aware that civil life in the built environment, including life in buildings, cities and regions, influences global warming.

5 Cross-lateral cooperation

In order to promote building-related measures to counteract global warming, cooperation and a common understanding is indispensable among various stakeholders including construction and maintenance experts, building material manufacturers and suppliers, equipment makers, energy providers, as well as building clients, users, neighborhood residents, administrators, real estate developers and financiers. Therefore, cross-lateral cooperation among all stakeholders will be facilitated.

6 International cooperation

In order to share and actualize the common goal of carbon-neutralization of buildings to prevent global warming, close and continuous cooperation among countries and regions from around the world should be promoted. This goal can be achieved, while both preserving the unique architectural and urban/regional culture of Japan fostered by its specific climate and region and providing diverse solutions to buildings and regions around the world.

Image by Centre National d'Etudes Spatiales, NASA Images.

IV.

Background

1 Warning of global warming

The Fourth Assessment Report of IPCC warned in the most serious tone ever that “global warming is likely attributed to human activity” and “there is no longer any doubt that global warming is occurring”. We must sincerely accept this warning, which is the outcome of extensive and scientific research, and then devote ourselves to the implementation of preventive measures to mitigate global warming, which is likely to threaten the existence of human beings on earth.

2 Our ultimate goal is to stabilize climate change

The Kyoto Protocol, adopted at COP3*₈ in 1997, was internationally the historic first step to cope with global warming. However, our ultimate goal must be to resolve “how we as humans can stabilize climate change?” Based on the Fourth Assessment Report of IPCC, in order to reduce the amount of anthropogenic emissions to the same level as natural absorption, it is now widely accepted to set the goal of reducing global greenhouse gas emissions by 50% by the year 2050.

3 Recent goal of Japan

Although coping with global warming is a global issue common to all nations, it is now widely recognized that developed and developing countries have different responsibilities both qualitatively and quantitatively. As a result, some developed countries have set their goals to reduce emissions by even more than 50%. In July 2008, Japan’s Cabinet adopted the “Action Plan for Building a Low-Carbon Society”, which proposes to reduce CO₂e by 60 to 80% by the year 2050.

4 Realization of a “Low-Carbon Society”

The technical possibility of reducing CO₂e by 60 to 80% is being examined from various viewpoints using diverse approaches. However, given present circumstances, such a significant reduction in CO₂e is a challenging goal and impossible to achieve by applying a single existing measure or technical development. Drastic transformations in the market, socio-economic structure and lifestyle, etc. are absolutely required. In addition, current discussions are now focused on how to achieve a real “Low-carbon Society”, which complements the national efforts to formulate an overall framework with local initiatives conforming to regional characteristics.

5 The responsibility of the building-related sector

The building sector is responsible for approximately 30% of global CO₂e. IPCC’s Fourth Assessment Report also points out that the building sector has the largest potential to reduce CO₂e through short- and mid-term effective measures. While the manufacturing sector is significantly influenced by the geographical and local social conditions and international competition, the building sector can be controlled by relatively stable domestic measures.

With full knowledge of the above mentioned issues, we, those involved in the building-related sector, must be aware of our very important role of implementing architectural measures to counteract global warming.

6 Utilization of sustainable resources

Global warming is the result of the massive use of fossil fuels such as coal, petroleum and natural gas. However, considering we rely heavily on exhaustible non-renewable energy sources, the world’s population is increasing, and developing countries are experiencing rapid economic growth, our future looks more and more uncertain. Therefore, buildings that consume enormous amounts of energy and resources throughout their lifespan should be designed and transformed to effectively utilize renewable resources and for cyclical use in order to neutralize CO₂e as much as possible during production, operation and disposal.

7 Constructing a sustainable society

Due to an extremely low birthrate, the population of Japan is decreasing while the number of elderly is increasing. Moreover, the decline of provincial local city centers and agricultural and fishing communities has long been a social issue. Facing such rapid social change, a new perspective towards sustainable reorganization of regional and urban areas is needed. In order to obtain a new perspective to counteract global warming, the “Backcasting” method can be used for planning and design initiatives. In contrast to “Forecasting”, backcasting is a reverse process that first creates a concrete vision of the future, and then retraces the needed steps back to the present to create strategies and initiatives that will contribute to building local communities and a sustainable society.

8 Prevention of global warming and the social capital value of buildings

Assuming that lifespan of current buildings is longer than 50 years, the building sector must begin working towards 2050 to prevent global warming. Moreover, it is most important to extend the lifespan of buildings, as well as to improve the generally poor performance of the tremendous amount of existing building stock.

Even though a building may be private property, architectural measures to counteract global warming, such as energy efficiency, utilization of renewable resources and extending the lifespan of a building, may provide public benefits by contributing greatly to the creation of a low-carbon society. In this sense, buildings should be regarded as a part of social capital.

9 Global trends in the building and city/region sector

Prevention of global warming has been recognized as the building sector’s top priority not only in Europe and the U.S., but also in Asian countries. Japan should establish a network of building-related associations from around the world including Asia, which will help to create a low-carbon society on a global scale through the exchange of information and people, sharing goals, and transferring technology.

*8 COP3 The 3rd Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change

Drafter

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The Society of Heating, Air-conditioning and Sanitary Engineers of Japan
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