Aiming for Environmentally-Friendly Facilities (Eco-Schools) Renovation at Every School

Collection of Case Examples to Make Existing School Facilities More Ecological
Preface

How to cope with global warming is now a major universal concern for the sake of the survival and prosperity of human beings in the future, and is one of the most significant issues for each country to tackle, mobilizing all of its available resources. Japan has also set a medium-term goal of reducing greenhouse gasses by 25% compared to 1990 by 2020. It is necessary for us to make even more efforts toward realization of a low-carbon society.

Given these circumstances, Ministry of Education, Culture, Sports, Science and Technology (MEXT) has been working toward building and promoting the environmentally-friendly school facilities (eco-schools) since fiscal 1997, certifying about 1,100 public elementary and junior high schools for the eco-school model project. Also, in 2007, MEXT requested its council of advisers to investigate how to promote eco-schools in the future, and the council conducted survey research on the changing circumstances of school facilities, the most recent actual condition of energy consumption, the long-term perspectives of energy consumption, and so on. In March 2009, the council submitted its report, which stressed the importance of aiming for eco-school renovation at all schools in the future, and suggested measures to promote the renovation.

Meanwhile, about 80% of the buildings of public elementary and junior high schools are more than 20 years old, and they require huge amounts of renovation and maintenance for their aging facilities, in addition to seismic reinforcement. When a school building is renovated and upgraded, in addition to seismic reinforcement, it is common to try to improve the quality of indoor conditions in order to secure a proper learning environment, and try to enhance the facilities to allow multipurpose uses in order to make schools open to people in the community. As a result, unless some environmental measures are taken, the energy consumption of the whole school may increase after renovation.

Therefore, in implementation of new construction, reconstruction, or renovation and upgrading of school facilities, it is important to actively pursue “eco-school renovation” by conducting measures for energy conservation and CO₂ reduction, while securing a comfortable learning environment for children.

The purpose of this collection of case examples is to contribute to the promotion of eco-school renovation for existing school facilities. It introduces the basic philosophy and procedures for renovation projects and includes case examples of individual schools and school installation personnel that are making efforts to create advanced eco-schools.

We hope that this collection of case examples will be utilized by schools and school installation personnel, in order to promote the eco-school renovation for existing school facilities and help provide environment and energy education for children and the community, aiming for the realization of a low-carbon society.

May 2010
Aiming for Environmentally-Friendly Facilities (Eco-Schools) Renovation at Every School
~ Collection of Case Examples to Make Existing School Facilities More Ecological ~

-- CONTENTS --

Preface

I Situations and Issues at Present: Why Eco-School Renovation for Existing School Facilities Now?
1 Global Warming and Our Countermeasures in the Past  ..................  1
   (1) Present Situation of Japan’s Global Warming Countermeasures
   (2) Efforts of the Ministry of Education, Culture, Sports, Science and Technology
2 Issues Concerning Eco-School Renovation for Existing School Facilities  ..................  3
   (1) Fundamental Issues of Existing School Facilities
   (2) Issues Concerning the Eco-School Renovation for Existing School Facilities

II Procedures of Eco-School Renovation for Existing School Facilities: Where Should We Start?
1 Fundamental philosophies  ..................  5
   • To understand the actual conditions and aim for efficient facility management
   • To aim for equal emphasis on ensuring the level of facilities and on reducing the environmental burden
   • To aim to become a hub of environment/energy education in the community
2 Procedures for and Main Points in Creating Eco-Schools  ..................  7
   • Preparation Stage
   • Planning of Eco-School Renovation
   • Study and Implementation of Renovation and Upgrading
   • Utilization of the Renovated Facilities for Environment/Energy Education
   • Affiliation with Related Organizations and Dissemination of the Results
Reference 1: The Concrete Process of Eco-School Renovation for Existing School Facilities (Images)
Reference 2: Reports and Related Measures Concerning Eco-Schools

III Case Examples of Efforts toward Eco-School Renovation: Learning from Advanced Efforts
1 Local Governments’ Efforts to Promote Eco-School Renovation at Every School  ..................  12
   Case Example 1 Suginami Ward, Tokyo  ..................  13
   Case Example 2 Fujisawa City, Kanagawa  ..................  19
2 Efforts to Renovate Existing School Facilities to Make Eco-Schools
   Examples of Comprehensive Efforts
   Case Example 3 Dai-Nana Haketa Elementary School of Arakawa Ward, Tokyo  ..................  25
   Case Example 4 Kita Elementary School of Takayama City, Gifu  ..................  31
   Effective Ideas to Make Eco-Schools
   Case Example 5 An Example to Facilitate the Assessment of Actual Energy Consumption and to Aim for Efficient Management of Facilities  ..................  37
   Case Example 6 An Example to Aim for Equal Emphasis on Ensuring the Level of Facilities and on Reducing the Environmental Burden  ..................  39
   Case Example 7 An Example to Aim to Become a Hub of Environment/Energy Education in the Community  ..................  43

IV References  ..................  46
I Situations and Issues at Present: Why Eco-School Renovation for Existing School Facilities Now?

1 Global Warming and Our Countermeasures in the Past

In Japan, countermeasures against global warming implemented in non-business sectors (including schools) and households are especially important, because carbon emissions in these sectors are significantly increasing. Also, since Japan has set the goal of reducing its greenhouse gases by 25% by 2020, it is necessary for us to reduce emissions continuously over the long term.

Given these circumstances, MEXT has been promoting the creation of environmentally friendly school facilities (eco-schools), and at the same time promoting the utilization of facilities as environmental education materials for students.

(1) Present Situation of Japan’s Global Warming Countermeasures

How to cope with global warming is one of the most urgent global environmental issues. Japan has set a medium-term goal of reducing greenhouse gases by 25% compared to 1990 by 2020, based on the formulation of a fair and viable international framework by all major countries and their agreement on ambitious goals.

However, Japanese emissions of greenhouse gases in 2008 were 1.9% more than those of the base year of the Kyoto Protocol (1990). It is especially necessary to dramatically enhance countermeasures in non-business sectors (including schools) and households (see Figure 1), where carbon emissions are significantly increasing.

Against such a background, the Act on the Rational Use of Energy, revised in May 2008, has introduced the idea of energy management by each business. As a result, each board of education is now required to submit regular reports and medium- to long-term plans, while smaller buildings (300–2000 m2) are now obliged to report their energy-saving measures.

Also, the Act on Promotion of Global Warming Countermeasures, revised in June 2008, introduced the obligation for each business to calculate and report its greenhouse gas emissions. It also requires prefectures, ordinance-designated cities, core cities and special cities, to formulate a greenhouse gas reduction plan covering their entire respective regions and stipulates a nonbinding target for other municipalities. In order to promote a long-term and continuous reduction of emissions toward realizing a low-carbon society, it is ultimately necessary to reduce dependence on petroleum-based fuels. We should aim to construct a low-carbon society by creating innovative environment/energy technologies, such as those for renewable energy, as well as by accelerating the spread of proven effective measures and existing technologies.

Increase Especially in Non-business Sectors and Households

Figure 1 Changes in Carbon-Dioxide Emissions by Sector in Japan (1990–2007)

Changes in carbon-dioxide emissions by sector in Japan (1990–2007)

<table>
<thead>
<tr>
<th>Year</th>
<th>Industrial sector</th>
<th>Transportation sector</th>
<th>Non-business sector</th>
<th>Household sector</th>
<th>Energy conversion sector</th>
<th>Industrial process</th>
<th>Waste product</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>500</td>
<td>300</td>
<td>200</td>
<td>100</td>
<td>50</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>91</td>
<td>450</td>
<td>250</td>
<td>150</td>
<td>90</td>
<td>40</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>92</td>
<td>400</td>
<td>200</td>
<td>100</td>
<td>50</td>
<td>30</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>93</td>
<td>350</td>
<td>150</td>
<td>50</td>
<td>25</td>
<td>20</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>94</td>
<td>300</td>
<td>100</td>
<td>25</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>95</td>
<td>250</td>
<td>50</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>96</td>
<td>200</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>97</td>
<td>150</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>98</td>
<td>100</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>99</td>
<td>50</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>01</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>02</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>03</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>04</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>05</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>06</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>07</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

[Source] Greenhouse Gas Inventory Office
From the website of Japan Center for Climate Change Actions (http://www.jceca.org/)
(2) Efforts of the Ministry of Education, Culture, Sports, Science and Technology

The Ministry of Education, Culture, Sports, Science, and Technology (MEXT) published a research study report titled, “On Building Environmentally-Friendly Facilities (Eco-Schools)” in March 1996, and since then it has tried to reduce the environmental burden and co-exist with nature, and has promoted the building of school facilities that can be utilized for environmental education.

In the fiscal year of 1997, MEXT founded model projects (see Figure 2), and together with the Ministry of Agriculture, Forestry, and Fisheries (MAFF), the Ministry of Economy, Trade and Industry (METI), and the Ministry of the Environment (MOE), it has subsidized the public schools that are playing a leading role in these projects. As a result, 1,077 schools are certified for the model projects (as of April 2010) and are expected to play their roles as the advanced schools in their areas.

Also, in the fiscal year of 2007, MEXT requested its council of advisers to investigate how to promote eco-schools in the future, and the council conducted survey research on the changing circumstances of school facilities, the most recent actual condition of energy consumption, and long-term perspectives of energy consumption. In March 2009, the council submitted its report, which stressed the importance for every school to aim to become an eco-school, and suggested three visions and four measures for eco-school promotion.

**Future Measures for Promotion of Eco-Schools: Three Visions and Four Measures**

**Vision 1:** Further promotion of “eco-school” renovation for existing school facilities

**Vision 2:** Efficient facility management by utilizing benchmarks

**Vision 3:** Active pursuit of measures for energy conservation and CO2 reduction, along with a qualitative improvement of the learning environment

**Measure 1:** Eco-schools as educational materials and energy conservation activities at school

**Measure 2:** Visualization of energy conservation effects, etc.

**Measure 3:** Focused promotion of energy efficiency

**Measure 4:** Introduction of renewable energy, such as solar power

In fiscal 2009, based on the summary of promotion measures shown above, MEXT conducted a research study on the basic philosophy and procedures of renovation projects and examples of advanced efforts, and published this collection of case examples, so that school installation personnel can promote eco-school renovation for existing school facilities efficiently and effectively.

**Implementation of an Eco-School Model Project**

**Figure 2 Project Frame**

**MEXT**
- **Building of eco-schools**
  - Financial support for public school facilities
  - Rate of subsidy
    - Project to introduce solar power: 1/2
    - New construction and extension: 1/2
    - Reconstruction: 1/3 *
    - Seismic retrofitting: 2/3 (I.S. value = less than 0.3) : 1/2 (I.S. value = less than 0.7)
    - Drastic improvement: 1/3

*Reconstruction of a building whose I.S. value is less than 0.3 but is difficult to retrofit for compelling reasons: 1/2

**MAFF**
- **Utilization of lumber from the area**
  - Utilization of the budget related to the measures for promotion of forest improvement and forestry, etc.
  - Subsidy for improvement of school-related facilities and equipment as a part of the promotion of wooden public facilities (subsidy rate: 1/2)

**Eco-school Renovation**
- **Creation of a basic plan**
- **Improvement of buildings, etc. (facility)**
- **Maintenance and control (management)**
  - Utilization for environmental education (education)

**METI**
- **Introduction of new energy**
  - Utilization of the projects to make plans for local new energy and energy conservation vision, etc.
  - Utilization of budgets related to new energy
    - Project to promote the introduction of local new energy, etc. (subsidy rate: 1/2 or less)

**MOE**
- **Countermeasures against global warming**
  - Utilization of budgets related to countermeasures against global warming
    - Ecological renovation project of school facilities to prevent global warming (subsidy rate: 1/2)

[Source] MEXT
2 Issues Concerning Eco-School Renovation for Existing School Facilities

In order for us to reach the goal of greenhouse gas reduction, eco-school renovation is an urgent issue, because school facilities make up about 40 percent of public facilities, and there is a huge amount of nationwide stock. It is also expected that renovated school facilities can be utilized as learning materials and will become hubs to transmit information for environment/energy education in the community.

(1) Fundamental Issues of Existing School Facilities

■ Actual state of earthquake resistance and aging facilities

School facilities are not only places where children spend most of the day; they are also evacuation sites for local residents in the case of an emergency or disaster. Therefore, ensuring the safety of school facilities is extremely important. According to the research by MEXT, 67% of buildings at public elementary and junior high schools were confirmed as earthquake resistant (as of April 1, 2009; according to MEXT). Therefore, the promotion of further seismic protection of school buildings is strongly demanded.

Also, as of May 1, 2009, 79.7% of the facilities of public elementary and junior high schools are 20 years old or older (see figure 3). Especially, the aging of facilities built in the period of rapid growth in student numbers is serious and their urgent renewal and improvement is vital.

Therefore, it is necessary to promote the improvement of facilities in a well-planned manner; seismic plans should be made to facilitate complete seismic reinforcement soon for the school facilities not yet earthquake-proof, and renewal and improvement plans should be made for aging facilities.

■ Securing a healthy and comfortable classroom environment

We should secure a good environment for school facilities, with consideration given to sunshine, daylight, ventilation and so on, as a place for children to study and live. However, proper room temperature is not always secured because classrooms can sometimes get too hot in summer, due to the heat island phenomenon and other reasons. In addition, the number of school days in summer and opportunities to use the school facilities in holidays are increasing. As a result, more and more municipalities are introducing cooling installations in school facilities.

Aging of Public School Facilities

Figure 3 Areas with Non-Wooden Public Elementary and Junior High School Buildings by Age Bracket (as of May 1, 2009)

<table>
<thead>
<tr>
<th>Areas</th>
<th>(Unit: ten thousand m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio (%)</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

The areas with buildings built at least 30 years ago account for about 50% (49.8%)
The areas with buildings built 20–29 years ago account for about 30% (29.9%)
The areas with buildings built no more than 20 years ago account for about 20% (20.3%)

[Source] According to MEXT
(2) Issues Concerning Eco-School Renovation for Existing School Facilities

■ Assessment of the current status of energy consumption

About 90% of greenhouse gas emissions in Japan consist of CO2 created by energy consumption, so the promotion of energy conservation measures is one of the important countermeasures against global warming.

The volume and uses of energy consumption at school facilities vary according to the region and activities of the school (see Figures 4 and 5). Therefore, school installation personnel should consider the characteristics of the area and school, correctly assess the actual energy consumption, and utilize the energy efficiently.

■ Reduction of environmental burden through the lifecycle of building

It is important to control the emission of CO2 throughout the lifecycle of school facilities, from their construction and management to final demolishment. It is necessary to try to control the total CO2 emissions, by using the existing school facilities as long as possible, thus decreasing the amount of construction and demolishment, and by conducting the renovation and maintenance of facilities and equipment systematically.

In planning and designing facilities, we should consider the effects on the environment and choose eco-materials, which emit little CO2 during manufacture and do not include harmful materials, for the interiors and exteriors of the facilities.

Also, according to the “Law Concerning the Promotion of Contracts Considering Reduction of Emissions of Greenhouse Gases and Others by the State and Other Entities” (Green Contract Law), municipalities are supposed to make efforts to promote environmentally friendly contracts as well as the reasonable and appropriate use of energy.

■ Further utilization for environment/energy education

Based on the curriculum guidelines revised in 2008, eco-schools are expected to be utilized even further as environmental education materials through experiential activities that are appropriate for the students’ stages of development.

Since school facilities are also hubs for the local community, when they are renovated as eco-schools, they are expected to become hubs for the transmission of information on environment/energy education not only for children but also for the community, and play a leading role in the promotion and dissemination of countermeasures against global warming in the community.

The Volume and Uses of Energy Consumption Vary According to the Region of the School
Figure 4 Basic Units for Energy Consumption at Elementary Schools in Various Regions

An Example of Uses of Electric Energy in School Facilities
(In the Case of an Elementary School without a Cooling Installation in Regular Classrooms)
Figure 5 Consumption Structure of Electric Energy at a School in Kanagawa Prefecture

Regions I to IV represent the regional classification of next-generation energy-saving standards. Region I is the coldest and Region IV is the warmest.

[Source] According to Educational Facilities Research Center, National Institute for Educational Policy Research (Values as of 2006)
1 Fundamental philosophies

In renovating existing school facilities to make an environmentally-friendly facility (eco-school), it is important to investigate and analyze the actual conditions of the present school facilities and understand the characteristics and issues of the school and the surrounding community. After such an investigation, we should think about how to make an eco-school that can take advantage of strengths and improve problems, based on the Fundamental Philosophies of Eco-schools*.

*(Reference) Fundamental Philosophies of Eco-schools

Eco-schools are school facilities in which architectural elements of the facilities and the human elements of management and education function harmoniously by following the three perspectives of facilities, management, and education.

1) Facilities

- Facilities should be built gently for the users, such as children and students, the community and the earth
  - To be healthy and comfortable as a space for learning and living
  - To be in harmony with the surrounding environment
  - To be designed and built in a way to reduce the burden on the environment

2) Management

- Buildings, resources, and energy should be used wisely, for many years.
  - To pay attention to durability and flexibility
  - To make effective use of natural energy
  - To use the facilities economically and efficiently

3) Education

- Facilities, principles, and systems should be used for learning
  - To be used for environmental education as well

[Source] “(A report) On Building Environmentally-Friendly Facilities (Eco-Schools)”
By Research Study Collaborators’ Conference on Environmentally-Friendly Facilities, March 1996

To understand the actual conditions and aim for efficient facility management

- School facilities are not only places where children study and spend most of the day; they are also places used for various purposes, such as a base for activities of the local community and evacuation sites for local residents in the case of an emergency or disaster. The level of demand for school facilities from each group of users is becoming higher in accordance with changes in society and people’s lives.

- Therefore, the actual conditions of energy consumption should be grasped precisely and separately between energy consumption for school activities and energy consumption for non-school activities that use school facilities for multiple- and mixed-purposes.

- We should ascertain when, where, how much and under what conditions energy is consumed, verify the actual conditions of energy consumption by comparison with benchmarks, and use energy efficiently.
To aim for equal emphasis on ensuring the level of facilities and reducing the environmental burden

- When an existing school building is renovated in order to improve the quality of the learning environment and to enhance the facility’s multipurpose uses, such as making the school open to the people in the community, the energy consumption of all the school’s facilities may increase after renovation, unless some measures are taken.

- In order to prevent the increase of energy consumption after renovation, it is important to minimize the increase by:
  (1) improving architectural performance, such as by installing eaves to keep the sun out, securing airflow, insulating outer walls and windows; and
  (2) introducing energy-saving devices, such as light fixtures and air-conditioning systems that conserve energy.
Furthermore, we should consider introducing renewable energy such as sunlight, solar heat, wind, and biomass, comprehensively so as to restrain CO₂ emissions.

To aim to become a hub of environment/energy education in the community

- In addition to being sites for environment/energy education for students, eco-schools are expected to contribute to the community as a base for environment/energy education for local residents.

- In order to utilize eco-schools for environmental education, facilities should be arranged in such a way that children and local residents can gain hands-on learning experience at the school facilities. Also, we should consider cooperation with the community and professionals in order to utilize eco-schools as learning materials for housing conditions and energy conservation.

Eco-School Renovation for Existing School Facilities
2 Procedures and Main Points to Create Eco-Schools

In order to advance the creation of eco-schools systematically, it is important to broadly obtain the understanding and consensus of related parties, by letting the school, students’ families, and the community participate in the process and by positively transmitting information to them, while ensuring consistency with the municipality’s mid- and long-term goals for countermeasures against global warming and its facility development plans, and so on.

Also, after the renovation, it is important to verify the utilization and achievement of the eco-school for environmental education and to reflect the results in future renovation plans, as necessary.

1 Preparation Stage

Point 1: To Assess the Actual Conditions Using the Existing Data
- First, we should grasp the actual conditions and summarize the issues of facilities (aging, thermal environment, energy consumption efficiency, etc.).
- We can assess the actual conditions comparatively easily by utilizing the existing data on the facilities’ conditions and management, such as the facility ledgers of public schools and the results of school environmental health inspection.

See p 16: Case Example 1 Table of Characteristics of Existing Schools in Suginami Ward / See p 21: Case Example 2 Extraction of Points to Improve for Each of the Four Types

Point 2: To Coordinate with the Environmental Measures of the Municipality
- Since the Act on Promotion of Global Warming Countermeasures was revised (in June 2008), all the municipalities, with some exceptions, have been obligated to formulate a greenhouse gas reduction plan for their entire respective regions. Therefore, it is important to cooperate with the mayor’s agency to position the eco-school renovation as one of the environmental measures of the region.

See p 22: Case Example 2 Shift to an energy-saving/low-carbon policy for renovation

2 Planning of Eco-School Renovation

Point 3: To Restrain Environmental Burden throughout the Lifecycle
- It is important for municipalities with many schools to advance eco-school renovation systematically.
- As for existing school facilities, it is efficient to conduct eco-school renovation concurrently with other urgent issues, such as seismic reinforcement and renovation of aging buildings.
- Usually, the renovation of aging school facilities is conducted by prioritizing the sites to be improved, such as bathrooms, rooftop waterproof treatment, renewal of plumbing equipment, and so on. Therefore, eco-school renovation can be conducted in a site-by-site manner as well.
- Even for the school facilities that have exceeded their general estimated service life, we should not always rely on overall rebuilding, but should check the conditions and structural strength of each facility to see if the required function of the facility can be secured, so that we can try to renovate as much as possible and utilize the existing facilities effectively for a long time.

See p 16: Case Example 1 How to conduct eco-school renovation for existing school facilities.
See p 23: Case Example 2 Setup of a renovation menu to choose from according to the conditions of each school.

Point 4: To Make Individual Plans Suitable for Each School
- It is effective to break the stock down into patterns according to the year of construction and history of renovation, and to investigate the energy-saving measures appropriate for each pattern.
Detailed analysis takes time and effort for municipalities with many schools. In this case, it is also effective to cooperate with researchers from universities, companies, and NPOs.

It is possible to renovate a hub school into a model eco-school and diffuse the effective measures that suit the characteristics of the region into other schools and areas.

> See p 15: Case Example 1 Efforts to make existing school facilities more ecological.
> See p 20: Case Example 2 Implementation of thorough assessment of actual conditions.

### 3 Study and Implementation of Renovation and Upgrading

#### Point 5: To Involve the Related Parties in the Discussion
- In renovating existing school facilities, the related parties such as teachers and staff who will actually use the facilities can discuss and decide the specific content of renovation. Also, it is possible to cooperate with professionals in environmental education to hold workshops, check the school facilities, and suggest solutions for issues together with children, teachers, school staff, and the people in the community.

> See p 26: Case Example 3 Discussion on eco-school renovation. / See p 32: Case Example 4 Discussion on eco-school renovation.

#### Point 6: To Increase the Impact by Combining Measures
- In conducting the eco-school renovation step-by-step, environmental effects can be raised by combining measures. For example, the introduction of night-purging (night ventilation) can be more effective overall in combination with lawn growing and wall greening.

> See p 17: Case Example 1 Improvement of indoor environment by combining greening and facility renovation.

### 4 Utilization of the Renovated Facilities for Environment/Energy Education

#### Point 7: To Connect the Renovated Facilities to the Existing Educational Activities and Apply Them to Environmental Education without Further Burden
- The burden to utilize the facilities can be reduced by developing the existing educational activities, instead of starting totally new activities.
- We can try to expand the activities already conducted on a regular basis, such as planting a green curtain, turning off lights whenever possible, recycling, and so on.

> See p 28: Case Example 3 Utilization for environment/energy education. / See p 34: Case Example 4 Utilization for environment/energy education.

### 5 Affiliation with Related Organizations and Dissemination of the Results

#### Point 8: To Broaden the Circle of Efforts
- A school alone cannot do everything for efficient management of the facilities and practice of environment/energy education. Therefore, it is effective to cooperate with the administration and researchers from universities, companies, NPOs, and so on.
- Because eco-school renovation is often conducted during the school term, there are many troublesome aspects for the school, the design office, and the construction company. It is important to accumulate and communicate the experiences and results of renovations of the schools that conducted renovations earlier, and utilize them for the next eco-school renovation.

> See p 30: Case Example 3 Voices from the board of education/voices from the school. / See p 36: Case Example 4 Voices from the board of education/voices from the school"
Reference 1: The Concrete Process of Eco-School Renovation for Existing School Facilities (Images)

1. Preparation stage
   - To ascertain the climate conditions and geographical conditions
   - To collect existing data, including the facility ledger
   - To research the architectural performance and energy consumption of each school
   - To understand the environmental measures of the municipality, etc.

2. Planning of Eco-School Renovation
   - To investigate how to conduct eco-school renovation in a systematic way
   - To investigate plans suitable for each school, etc.

3. Study and Implementation of Renovation and Upgrading
   - To investigate concrete measures for improvement by related parties
   - To collect and evaluate the preceding examples, etc.

4. Utilization of the Renovated Facilities for Environment/Energy Education
   - To utilize the facilities for environment/energy education
   - To support continuous efforts
   - To send information to the community

5. Affiliation with Related Organizations and Dissemination of the Results
   - To share the information on results and tasks among related parties
   - To reflect the results and tasks on the next project, etc.

Photo 1: Sonehigashi Elementary School, Kitakyushu City, Fukuoka Prefecture

Photo 2: Nishiharu Junior High School, Nagoya City, Aichi Prefecture

Photo 3: Nishiharu Junior High School, Nagoya City, Aichi Prefecture

Photo 4: Sonehigashi Elementary School, Kitakyushu City, Fukuoka Prefecture

Photo 5: Urawahigashi Senior High School, Saitama Prefecture
Reference 2: Reports and Related Measures Concerning Eco-Schools

1. Basic philosophy of eco-schools
   - “On Building Environmentally-Friendly Facilities (Eco-Schools)”
     (A report by Research Study Collaborators’ Conference on Environmentally-Friendly Facilities, March 1996.)
   - “On the Current Status of Environmentally-Friendly Facilities (Eco-Schools) and the Prospect of Promotion of Renovation in the Future”
     (A report by Research Study Collaborators’ Conference on Environmentally-Friendly Facilities, March 2001.)

2. New ways to build school facilities in a low-carbon society
   - “On Measures to Promote Environmentally-Friendly Facilities (Eco-Schools) in the Future”
     (A report by Collaborators’ Conference on Research and Survey Relating to the Formation of Guidelines for Facility Design, March 2009.)

3. Promotion of eco-school renovation
   - “Model Project of Eco-Schools”
   - “Pamphlet on Eco-Schools” *Annually prepared

4. Technical research on eco-schools
   - A guidebook for introduction of solar energy generation into schools (July 2009)
   - A guidebook to utilize new energy at schools (March 2010)
   - “Promoting Environment-focused Renovations of School Buildings”
     (A report published in February 2008)
   - “Toward the Promotion of Ecological Renovation for School Buildings”
     (A report published in August 2009)

5. Energy-saving measures at school facilities
   - “What We Can Do for the Global Environment”
     (For teachers) (A pamphlet published in March 2008)
   - A pamphlet “Visions of Control and Management”
     (For managers) (A pamphlet published in March 2008)

6. Reports, etc. based on the Act on the Rational Use of Energy
   - Preparation and submission of regular reports and medium- to long-term plans
     (Submission is obligatory if qualified as a specified corporation)

7. Verification of the effects
   - “Evaluation Methods of Comprehensive Environmental Performance of School Facilities”
     (in progress)

Comprehensive sites

1. “Promotion of Building Environmentally-Friendly Facilities (Eco-Schools)”
   http://www.mext.go.jp/a_menu/shisetu/ecoschool/index.htm
   http://www.ecoflow.go.jp/
3. ECO Study Library (a database for environmental education/environmental learning)
   http://www.eeel.go.jp/
III Case Examples of Efforts toward Eco-School Renovation: Learning from Advanced Efforts

1 Local Governments’ Efforts to Promote Eco-School Renovation at Every School

**Case Example 1:** Suginami Ward, Tokyo ................................. 13
A systematic effort to utilize natural energy and secure a comfortable learning environment

**Case Example 2:** Fujisawa City, Kanagawa ................................. 19
How to make an environmentally conscious renovation policy by thorough assessment of actual conditions and classification

2 Efforts to Renovate Existing School Facilities to Make Eco-Schools

- **Examples of Comprehensive Efforts**
  - **Case Example 3:** Dai-Nana Haketa Elementary School of Arakawa Ward, Tokyo ................................. 25
  How to make an eco-school as a leading model of the region utilizing the natural bounty

- **Case Example 4:** Kita Elementary School of Takayama City, Gifu ................................. 31
  How to make an eco-school while improving its learning environment under a harsh climatic condition

- **Effective Ideas to Make Eco-Schools**
  - **Case Example 5:** An Example to Facilitate the Assessment of Actual Energy Consumption and to Aim for Efficient Management of Facilities ................................. 37
    01 Visualization of energy consumption
    02 Focused promotion of energy use efficiency

  - **Case Example 6:** An Example to Aim for Equal Emphasis on Ensuring the Level of Facilities and Reducing the Environmental Burden ................................. 39
    01 Revamping and ecological renovation at the same time
    02 Learning environment improvement and ecological renovation at the same time

  - **Case Example 7:** An Example to Aim to Become a Hub of Environment/Energy Education in the Community ................................. 43
    01 Utilization of eco-schools as learning materials
    02 Utilization of the renovation process
    03 Hub to transmit information to the local community
    04 Affiliation with administration, companies, NPOs, etc.
Local Governments’ Efforts to Promote Eco-School Renovation at Every School

Case Example 1: Suginami Ward, Tokyo

A systematic effort to utilize natural energy and secure a comfortable learning environment

From Battles with Heat to Environmentally-Friendly Facilities (Eco-Schools) Renovation

Lately, the heat island phenomenon in cities is becoming significant. In fiscal 2005, Suginami Ward investigated how to make school facilities more comfortable in summer and yet environmentally conscious, based on the results of greening activities at their schools.

The Ward developed the content of this investigation further with outside committee members, discussing the vision of an eco-school (school facilities that coexist harmoniously with the environment) that promotes school management and environmental education in an integrated manner, and published a report in 2006 and another in 2007.

In the light of the content of these reports, Suginami Ward is promoting eco-school renovation in a focused and systematic way, based on the Ward’s comprehensive plan, the Suginami Ward Implementation Plan.

Lately, the heat island phenomenon in cities is becoming significant. In the fiscal year of 2005,

About Suginami Ward

Suginami Ward is on the Musashino plateau, located on the west side of Tokyo’s 23 wards. It is roughly square-shaped and the eighth largest of Tokyo’s 23 wards. It is a residential area with comparatively bountiful nature.

- Area: 34.02 km²
- Population: 539,211 (As of April 1, 2010)

<table>
<thead>
<tr>
<th>Number of schools</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>elementary schools</td>
<td>43</td>
</tr>
<tr>
<td>junior high schools</td>
<td>23</td>
</tr>
<tr>
<td>total</td>
<td>66</td>
</tr>
</tbody>
</table>
2. Making a Policy to Promote Eco-School Renovation at Every School in the Ward

Gradual and Continuous Investigation

Since fiscal 2001, Suginami Ward has made efforts to create green areas in elementary and junior high schools by making green spaces in schoolyards, rooftops, and along the walls, and by installing biotope spaces.

As the countermeasures against the urban heat island effect became an important issue, Suginami Ward investigated the eco-school renovation gradually over three years, beginning in 2005, and summarized the ideas and concrete methods of Suginami-style eco-schools.

An Eco-School that Aims for a Reduction of the Burden on the Environment
(A report produced by the Exploratory Council for Eco-School Renovation: March 2007)

Aiming to build school facilities with a good educational environment that place a small burden on the environment all year, not just in summer, Suginami Ward formed an exploratory council with professionals in environmental architecture, to investigate the ideas of eco-school and architectural methods of eco-school renovation, especially how to utilize natural energy.

The renovated schools are supposed to promote the utilization of natural energy, such as geothermal energy, and make efforts to create green areas, shield sunshine, install insulation, reject heat by ventilation, and so on.

Also, existing schools are supposed to shield sunshine through greening and reject heat through ventilation, according to the conditions of the facility.

Challenges for the future include ascertaining the level of environmental performance of existing schools in order to make individual plans for each school, and verifying the achievements of renovated schools to be utilized for environmental education.

Suginami-Style Eco-Schools

1. To make facilities that can create an indoor thermal environment desirable for learning, while controlling the burden on the environment.
2. To conduct school management (environmentally conscious actions) that can reduce the burden on the environment.
3. To provide environmental education that leads to environmentally conscious actions, not only for students but also for their families and the people in the community, using the school as the hub of activities.
3. Efforts for Eco-School Renovation for Each Existing School Facility

Investigation into Eco-School Renovation for Existing School Facilities


Based on the issues shown in the first report (March 2007), Suginami Ward formed another exploratory council with academic experts, members of environmental groups, and principles of elementary and junior high schools, to investigate the ideas of eco-school renovation for existing school facilities and connections with environmental education.

The council defined how to promote eco-school renovation, created the Table of Characteristics of Existing Schools in Suginami Ward to summarize the present greening conditions, structure of the buildings, surrounding environment, ventilation, etc. for each school, and made the Renovation Menu Sheet to help examining the details of renovation according to those characteristics.

How to Promote Eco-School Renovation

1. Keep track of the durability and renovation status of all the schools.
2. In planning the renovation of facilities, fully understand the present condition of the school to be renovated, including its site and surrounding environment.
3. Try to renovate efficiently; for example, large-scale revamping and environmental upgrading should be conducted at the same time.
4. Make a list of adoptable techniques and utilize them as much as possible according to the conditions of each facility, including its geographical conditions.
5. Considering the meteorological conditions of Suginami Ward and its characteristic of facilities without cooling devices in classrooms, prioritize the installment of devices to control solar radiation, such as eaves and light shelves for classroom windows.
6. Improve the insulation of windows and other parts, not only for heat in summer but also for the burden on the environment produced by winter heating.
7. Discuss thoroughly with the teachers and staff of the school and consider the requests of students in conducting renovation, including concrete techniques.
8. Clearly explain the purpose and effects of the adopted techniques and how to use the facilities. Also, let the facilities be utilized for environmental education by, for example, displaying their conditions in real time.
9. Fully investigate and seek the understanding of the residents of the ward about the cost of renovating the facilities, on the assumption that the present standard of performance of school facilities is not high enough and that the facilities will become the hub of the region in the future.

TOPICS Conditions of School Facilities

In Suginami Ward, public elementary and junior high schools began reconstruction to make the wooden buildings fireproof from the 1960s to the first half of the 1970s.

In addition, new schools were built and buildings were expanded to have more classrooms to respond to a rapid increase in the number of children. Also, specific classrooms and facilities for school lunches were added to improve education.

On the other hand, facilities are aging as well. There are 54 schools (of the 66 elementary and junior high schools in the ward) that will become over 50 years old during the 16 years starting from 2007.

The cost to renovate these elementary and junior high schools will be about 92 billion yen, even at their current sizes.

Therefore, throughout the entire lifecycle of school facilities, from new construction, expansion, reconstruction, management & control, and revamping, to demolition, it is essential to pay attention to the cost as well as environmentally conscious measures from now on.

Figure 1-3 Estimation of Renovation Cost in the Next Two Decades (for Full-Scale Rebuilding)
Methods of Eco-School Renovation for Existing School Facilities

In order to promote eco-school renovation of existing school facilities, Suginami Ward has made a menu of options for ecological renovation, such as insulation, greening, utilization of natural energy, energy conservation, etc., and summarized their characteristics, points to remember, maintenance, and costs. This ecological renovation menu helps each school in choosing appropriate items for the condition of each school and promotes renovation in an integrated manner.

### Examples of Renovation Menu

<table>
<thead>
<tr>
<th>Basic Items</th>
<th>Elective Items 1</th>
<th>Elective Items 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Greening of schoolyard</td>
<td>(1) Installation of eaves</td>
<td>(1) Water-saving improvement of toilets and hand-washing apparatus</td>
</tr>
<tr>
<td>(2) Greening of rooftops</td>
<td>(2) External insulation</td>
<td>(2) Installation of infrared sensor for lighting</td>
</tr>
<tr>
<td>(3) Greening of walls</td>
<td>(3) Double-glazed glasses / improvement of sash</td>
<td>(3) Installation of highly efficient lighting fixture*</td>
</tr>
<tr>
<td>(4) Night purge (ventilation at night)</td>
<td>(4) Opening of classrooms (to secure ventilation by removing the partition walls between classrooms and hallways)</td>
<td></td>
</tr>
</tbody>
</table>

* Highly efficient (Hf) lighting fixture: lighting fixture that can provide the same illumination as that of existing fluorescent lights with less electricity.

---

**Photo 1-2 Schoolyard with green turf and greening of walls using nets (Wada Elementary School)**

---


4. Results of Efforts

Improvement of Indoor Environment by Combining Greening with the Renovation of Facilities

(Photograph at the Seventh Suginami Elementary School)

The Seventh Suginami Elementary School has greened the school gradually, greening rooftops in 2004, and growing a lawn on its schoolyard and installing a biotope in 2005.

In August 2006, it upgraded the rooftop greening and also introduced some non-greening renovation techniques, such as night purge to take cool air from outside into classrooms at night and the installation of eaves to control solar radiation in summer. Thus, it tried to improve the indoor thermal environment by combining greening with the renovation of facilities.

When the walls of school buildings are covered by plants, it can decrease the surface temperature of the walls, reduce the heat stored in the structure, and prevent the reflection of the heat on the surrounding environment.

Night purge is a measure against the summer heat in classrooms. At night, it takes cool air from outside into the school buildings and circulates it, so that the heat stored in the structure can be diffused.

Louvers are installed on the windows facing the schoolyard, and low-speed fans are installed on the hallway-side transom windows of classrooms and in hallways, which operate automatically at night.

It has been confirmed that in summer, the surface temperature of the ceiling in a top-floor classroom with rooftop greening is about 3 degrees (C) lower than that of one in a room without greening.

Also in summer, the daytime temperature of a classroom with wall greening was about 2 degrees (C) lower than a room without greening.
Efforts to Maintain the Greening

The grass of the schoolyard is maintained by the managing organization of each school, made up of the school, parents, and local residents. They cut the grass regularly when it is necessary and conduct simple supplemental planting.

At the same time, maintenance contractors conduct professional maintenance, such as root cutting and fertilization throughout the year, and hold workshops and provide guidance about mowing as advisors of the managing organization.

5. Important Points about Eco-School Renovation from the Case Example

- The environmentally conscious renovation is set at an affordable level, tailored to the present condition of each existing school facility.
- The combination of greening of the schoolyard and walls with night purging is working effectively. It is a good example of hybrid renovation. It is easy to start in existing school facilities and its effects are easy to understand.
- For greening projects, it is necessary to carefully investigate beforehand whether the school can continuously work on the maintenance with the help of the community.

Opinions from the Board of Education

- Eco-school renovation has many effects: improved indoor thermal environment, children’s surging interest in natural energy, and children’s playing outside more often due to the planting of grass on the schoolyard.
- As regional cooperation is strengthened through the parents’ and local residents’ participation in mowing the lawn, eco-school renovation is now a prioritized measure to promote one of the important policies of Suginami Ward, namely, the Education-Oriented Ward Led by the Community.
- Although the maintenance in terms of hardware does cost money, we should keep promoting eco-school renovation efficiently and effectively, by making plans to combine the eco-school renovation with other repair work to maintain the facilities. At the same time, we should verify the effects of eco-school renovation, further enrich the environmental education for children and local residents utilizing the eco-schools, and steadily promote the Creation of Facilities and Towns that Coexist with the Environment.

Opinions from the Schools

- When we first introduced the grass on the schoolyard, it did not grow as expected and it was rubbed down, so we experienced some difficulties. However, we tried to solve the issues together with the children, think about how to take care of the grass, and think about and practice the rules of ball playing and the proper use of soccer goals. Through these efforts, children have come to regard the grass as a living thing and they have been nurtured to be actively involved in the natural environment.
- We have focused on both greening and the reduction of waste at the same time, which has made a tangible effect. In fiscal 2009, the waste was reduced to almost half the amount of the previous year. I think this is a good example to show how children’s mental growth has been manifested in new actions.
- Although only the hardware side of eco-school renovation tends to attract attention, the real renovation starts in the school when the construction is finished. I hope that further research will be promoted so that the renovated facilities can be utilized better for environmental education.
1. Summary

Toward the Planning of a Renovation Policy after the Completion of Seismic Reinforcement

In Fujisawa City, most of the public facilities were built 30 or more years ago and were aging. In November 2008, the city published the Management of Public Facilities White Paper, which discussed the present situations and problems of the facilities in order to effectively utilize the public facilities under a severe financial situation.

As for school facilities, since seismic reinforcement was going to be completed in 2009, it was necessary to investigate the renovation policy of facilities afterward.

Therefore, Fujisawa City, in cooperation with an NPO, formed an exploratory committee in the fiscal years of 2008 and 2009, as a project assisted by MEXT and an individual project of the city. The committee made a thorough assessment of the present situations and investigated the maintenance policy and renovation menu corresponding to an energy-saving/low-carbon age.

About Fujisawa City

Fujisawa City is in the center of the coastal area of Kanagawa Prefecture. It is located in an area surrounded by greenery with a moderate climate, but within 50 km from central Tokyo. It is a city with traffic convenience and a good residential environment.

- Number of schools
  - elementary schools: 35
  - junior high schools: 19
  - special-needs school: 1
  - total: 55
2. Implementation of Thorough Assessment of Present Situation

Construction of the Investigation System

In the fiscal years of 2008 and 2009, Fujisawa City formed an exploratory committee made of the Board of Education, the Mayor’s Agency, schools, and an NPO, to investigate the maintenance policy of school facilities after the completion of seismic reinforcement.

The committee made an assessment of the actual status of energy consumption, measured the thermal environment in classrooms, ran a simulation of environmental measures, and worked on a detailed study among parties based on the data. The NPO and university laboratories cooperated in the assessment and investigation.

Four-Type Classification Based on the Level of Facility Maintenance

The committee ascertained the maintenance conditions of each of the 55 public schools in Fujisawa City, such as the year of construction, seismic reinforcement, and the renovation of aging facilities.

Of those 55 public schools, 33 were 30 or more years old and their architectural area accounted for 56% of the total area of the public schools.

The committee ascertained the characteristics and problems of the school facilities based on their construction years and maintenance conditions, classified the schools in the city into four types, considering elementary schools and junior high schools separately, and conducted a detailed analysis on eight schools.

<table>
<thead>
<tr>
<th>Classification into Four Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>T1</td>
</tr>
<tr>
<td>T2</td>
</tr>
<tr>
<td>T3</td>
</tr>
<tr>
<td>T4</td>
</tr>
</tbody>
</table>

Figure 2-3 Conditions of Maintenance by the Year of Construction

Total: 33 schools / 216,471 m² (56%)
The committee has examined in detail the status of energy consumption, shapes of the buildings, finish of each section, equipment, energy-saving performance, etc., and extracted the points to improve to reduce the burden on the environment.

**Rooftop and exterior walls**
- Rooftops are not insulated in many schools.
- Exterior walls are not insulated.

**Openings**
- Schools tend to have large openings, but clear glass is used for openings. Both insulation efficiency and the capacity to shield from solar radiation are low.
- Three of the four schools have balconies.
- The capacity to shield solar radiation is secured.

**Equipment**
- Administrative offices are given priority in the installation of air-conditioning equipment.
- The schools renovated most recently have introduced whole-school air-conditioning, but most of the schools have only forced-flue (FF) stoves in regular classrooms.

Whether the school buildings are new or old, rooftops and exterior walls are rarely insulated.

### Assessment of the Status of Energy Consumption at Each School

All schools in Fujisawa were examined about the present status of energy consumption. The combined energy consumption of all the schools per year was 109,145 GJ/year, or about 2,816 kl/year in crude oil equivalent. This amount should be included in the regular report stipulated by the Energy Saving Act (1,500 kl/year or more).

The Committee has calculated the energy consumption units of each school, compared the years of construction and the number of students, and grasped the tendencies of each school.

### Extraction of Points to Improve for Each of the Four Types

#### Rooftop and exterior walls
- Rooftops are not insulated in many schools.
- Exterior walls are not insulated.

#### Openings
- Schools tend to have large openings, but clear glass is used for openings. Both insulation efficiency and the capacity to shield from solar radiation are low.
- Three of the four schools have balconies.
- The capacity to shield solar radiation is secured.

---

**Figure 2-4 Comparison of Specs by Sections and Energy Consumption**

**Figure 2-5 Annual Energy Use per Floor Space of the Buildings**
### Understanding the Characteristics of the Thermal Environment in Classrooms, etc.

The committee gained an understanding of the characteristics and problems of the thermal environment in classrooms, by measuring the temperature and humidity in the classroom in summer and winter, and conducting a questionnaire aimed at teachers.

1. The management sets the temperature in the classroom.
2. The areas around the schools are open and well-ventilated.
3. The month of August, when the cooling load is the greatest, is the time of a long vacation.
4. There are some periods when classrooms are not occupied, as the students have a P.E. class or use a different specific-use classroom.

### 3. Planning of Renovation Policy

#### Shift to a Renovation Policy That Corresponds to an Energy-Saving/Low-Carbon Era

Based on the actual conditions and results of investigation, the exploratory committee has summarized five policies centering on saving energy and reducing carbon emissions as well as improving the educational and living environment for the renovation plan after the completion of seismic reinforcement, in order to utilize the limited resources effectively and respond to the needs of the times.

These policies are to be placed in the overall plan of the city in the future.
Setup of the Renovation Menu to Choose from in Accordance to the Situation of Each School

Based on the actual conditions and results of investigation, the exploratory committee set up the renovation menu to save energy and reduce carbon emissions, while affirming the effects of the increase in energy-saving performance and the improvement of the classroom thermal environment. According to the trial calculation, if all the schools implement the mandate items from the renovation menu, it will cost about 35 thousand yen more per square meter.

Solar energy generation was already introduced to all the schools in 2009.

**Ideas of the Renovation Menu**

1. Renovation will focus on the exterior finishing and equipment that can increase the performance index, such as PAL value*1 and ERR.*2

2. Priorities are given to the items effective for the improvement of the indoor environment, such as classrooms.

3. The red sections of the chart are mandatory for all the schools, and other renovation items can be chosen according to the circumstances of each school (geographical conditions, architectural performance, needs of the users, etc.)

**Figure 2-8 Renovation Menu for Saving Energy and Reducing Carbon Emissions**

- Individual schools can choose from the Renovation Menu for Saving Energy and Reducing Carbon Emissions depending on their needs and conditions.

**4. Verification of Environmental Effects of Renovation Menu by Model Plans**

The committee has run a simulation using a model school building (see the table) in order to verify the environmental effects, such as those of an increase in energy-saving performance and an improvement of the thermal environment in classrooms, when the renovation plan is implemented. The results of the simulation have been fed back into the setup of the renovation menu.

**Figure 2-9 Each Renovation Menu’s Effects on Reducing the Primary Energy Consumption**

- The committee verified the environmental effects when rooftop insulation, double-glazed glass, high-efficiency lighting, and renewal of air-conditioning equipment (EHP: Electric Heat Pump) were all used in combination.
  - Primary energy consumption ▲33.5%
  - CO₂ emission ▲57.0%
  - Utility cost ▲48.3%

- This calculation is based on a model school building that has only classrooms and a hallway. In reality, we have to take into consideration the effects of energy consumption in administrative offices, gyms, playgrounds and so on.

*1 PAL value: Perimeter Annual Load / An index related to the prevention of calorific loss through exterior walls and windows of a building.
*2 ERR: Energy Efficiency Ratio / The value of energy measured and calculated through the methods designated by the specific criteria for respective equipment.
Management of Public Facilities White Paper

In November 2008, Fujisawa City formulated the Management of Public Facilities White Paper, which summarized the present situations, management, and usage of public facilities.

The White Paper is designed to be easy for citizens to understand. It is regarded as the basic data for the citizens and the administration together to verify the effectiveness of the administrative work and projects from a management standpoint and to think about ideas for improvement to utilize the facilities more effectively.

School facilities occupy about 48% (total floor area) of the public facilities, so it is important to ascertain the actual conditions of school facilities and try to share information about them.

White Paper:

5. Important Points about Eco-School Renovation from the Case Example

- While aiming to become a low-carbon society, promoting the qualitative improvement of aging school buildings, and trying to extend the lifespan of facilities, we now have school facilities that are 50 to 60 years old. From now on, we would like to grapple with the issue of school facility maintenance based on the situation of each school, making a selection between reconstruction and renovation, such as qualitative improvement.
- At present, Fujisawa City is facing quite a severe financial situation as well. In the future, we should think about the balance between reconstruction and renovation, run a simulation by giving priorities to the items in the energy-saving/low-carbon renovation menu, and make facility maintenance plans and budget strategies.

- It was excellent for the security of our children that the seismic reinforcement of school facilities was completed in fiscal 2009. Next, we would like to ask for the systematic renovation of facilities to let the children have a comfortable and safe school life, through, for example, the environmentally conscious upgrading of toilets and air-conditioning equipment.
- In Fujisawa City, public schools are working on a project of environmental education called “Children’s Environmental ISO / Challenge Kawasemi (=Alcyon),” through which children review their own school lives to reduce environmental burden. A solar energy generation system will be installed in each of the schools in the city. We would like the city to keep making efforts to provide facilities that can be used for children to experience hands-on learning, connecting their lives and the environment.
2 | Efforts to Renovate Existing School Facilities to Make Eco-Schools

### Case Example 3: Dai-Nana Haketa Elementary School of Arakawa Ward, Tokyo

Eco-School Renovation that Utilizes Natural Bounty as a Model School of the Region

Photo 3-1 Outlook of the School Building after Renovation

1. Summary

#### Measures against Aging as an Opportunity

The school buildings of Dai-nana Haketa Elementary School are about 40 years old. Although seismic reinforcement was conducted in 2000, measures against age-related deterioration were required.

In 2005, the school was designated as a model school of the MOE’s School Eco-Renovation and Environmental Education Program, and began eco-school renovation and environmental education that utilizes the process of renovation and renovated school facilities as learning materials.

The school, local residents, professionals, and the city administration together discussed the content of eco-school renovation that would fit the climate and geographical conditions, and they took advantage of the biotope space, which had been worked on for some time.

The renovation began in July 2007, and finished in March 2008. Now, the renovated facilities are utilized as the base of eco-school renovation and environmental education of the region.

### About Dai-nana Haketa Elementary School

- Location: 8-9-12 Machiya, Arakawa-Ward, Tokyo
- Number of students: 315 (12 classes in 2007)
- Area: School building 4,507 m², Gym 530 m²
- Buildings:
  - School building / RC / 4-story / Built during 1965–1972 (Seismic reinforcement completed in fiscal 2000)
  - Gym building / steel structure / built in 1963

<table>
<thead>
<tr>
<th>Number of schools in Arakawa-Ward</th>
</tr>
</thead>
<tbody>
<tr>
<td>elementary schools</td>
</tr>
<tr>
<td>junior high schools</td>
</tr>
<tr>
<td>total</td>
</tr>
</tbody>
</table>
2. Discussion on Eco-School Renovation

Thinking and Suggesting Ideas Together

In order to implement the School Eco-Renovation and Environmental Education Program, the school setup the Study Group on Ecological School Renovation to investigate enlightenment about environmentally friendly actions and the idea of ecological renovation, as well as the Study Group on Environmental Education to promote the environmental education programs.

The Study Group on Ecological School Renovation held eight meetings during fiscal 2005 and 2006. They had study sessions and workshops about environmentally friendly buildings and the structure of the school buildings, discussed renovation that contributes to the improvement of the learning environment and environmentally friendliness, and suggested some ideas about the ecological renovation of Dai-nana Haketa Elementary School.

The Study Group on Environmental Education held 31 meetings from fiscal 2005 to 2007, and made annual guidance plans for environmental education.

Difficulties in the Study Groups

- At the beginning stage of the study group, it was difficult to decide how to conduct our activities.
- I was expecting a study group where people can have a lively exchange of unique views, but in reality, we started with the study of the energy and renovation techniques available to us.
- The renovation techniques were so new to me that I had many questions and sometimes had difficulty in following the discussion. However, as the members of the study group could actually feel the effects of the techniques, we began to understand the techniques more deeply.
- We formed panels concerning renovation methods and suggestions. Through the formation of these panels and their presentations, we could ascertain a picture of ecological renovations and examine their operability and effectiveness.

Merits of Thinking Together

- We could provide an opportunity for the community to think about ecological renovation and acquire ecological knowledge, and also try to nurture the will to create our town together.
- When the members of the research group inspected the construction, they could feel responsibility and a sense of accomplishment about the adopted ideas they suggested.

Ideas Suggested in the Study Groups

1. Investigation of a way to take in the natural wind from the Sumida River (The upper part of the staircase was renovated and utilized as a wind tower to take in the natural wind.)
2. Investigation of biotope space that utilizes the water of the Sumida River
3. Investigation of using energy from the Sun
4. Investigation of heating equipment that utilizes geothermal heat
5. Investigation of the use of double skin for exterior walls for both a shielding effect and environmental education

Photo 3-2 A View of the Playground from the School Building
The gym and the swimming pool are at the back of the playground. The Sumida River runs behind the pool.
3. Contents of Eco-School Renovation

Increasing the Performance of Envelope Parts (Outside the School Building)

In order to shield the building from the heat and cold outside, an exterior thermal insulation method was adopted. The window sashes were improved by a covering method and double insulating glass was introduced. Also, eaves were newly installed to block excessive sunlight and to function as a light shelf,* so that natural light could enter the classrooms. Waterproofing and insulation were added to the rooftop for renovation, and rooftop greening was introduced.

Improvement of Learning Environment (Inside the School Building)

In order to shield the classrooms from the cold air in the staircase in winter, doors were installed between the staircase and hallway. Light fixtures in classrooms were exchanged to high-efficiency fluorescent lights in order to reduce power consumption and CO₂ emissions.

A room that had been used as a conference room was renovated and became a classroom for environmental education.

* Light shelf: One of the ways to utilize natural energy, in which the sunlight is actively introduced into the room by eaves, etc., in order to shorten the time to turn on the artificial illumination.
Improvement of Thermal Environment of the Arena (in the Gym)

A low-temperature solar-based pneumatic floor heating system was installed in the gym, in order to improve the thermal environment there. In winter, the warm air accumulated in the attic is sent to the under-floor space, while in summer, radiation heat from the roof is shielded and the heat in the under-floor space and the attic is released outside. Solar batteries installed on top of the roof supply power for the ventilation fan.

Also, in order to shield the gym from heat and cold, an exterior thermal insulation method was adopted for the renovation of exterior walls.

Utilization for the Environment/Energy Education

Eco-school renovation became a good opportunity for children to learn about detailed renovation techniques from professionals, backed by the experiments and hands-on experiences, such as warming themselves up.

Children could understand difficult renovation techniques by comparing the renovated school building with their bodies.

Experiencing the Effects of Renovation

Creating a Green Curtain

The fourth graders made Green Curtains along the support pillars of connecting corridors, using balsam apples and gourds they had planted in their science class. In July, the children set up supporting nets and replanted the seedlings to planters. During the summer vacation, they took turns coming to school to water the plants and observe their growth.
4. Results of the Efforts, etc.

Effects of the Increased Performance of Envelope Parts of School Buildings

In order to confirm the effects of exterior wall insulation and double glass insulation, we examined the average differences between the ambient temperature and the temperature of the central room of each floor, before and after the ecological renovation.

In winter, the average difference was 5.6°C higher than the ambient temperature before renovation, and 7.0°C after renovation, so the insulation effect was 1.4°C.

In summer, the temperature increased 2.7°C before renovation, but it increased only 1.4°C after renovation, so the room temperature became less susceptible to the weather and ambient temperature.

Figure 3-3 Comparison between Ambient Temperature and the Temperature of the Central Room of Each Floor (in winter/before and after the ecological renovation)

Effects of the Reduction of CO₂ Emissions

We compared the CO₂ emissions between the planning time of ecological renovation and the time after the renovation (2008).

During the planning time, we estimated that the CO₂ emissions of the whole school would be reduced by 25%; however, the reduction turned out to be only 3% after renovation. (If we do not include the school lunch kitchen and the pool, which consume a lot of energy and have not yet been renovated, the reduction rate was 13%).

According to the monthly data on CO₂ emissions, the emissions increased in May, June, and October, that is, the time between summer and winter. Therefore, it seems that the reason for the increase was not the heating and cooling equipment (which have effects only in summer and winter), but lighting or other factors.

The Board of Education is going to continue verifying the management conditions, specs of equipment, and meteorological conditions, in order to understand the issues.

Source: “Ecological Renovation of Schools and Environmental Education Projects: Business Report for the Fiscal Year of 2008” (MOE / Organic Table Co., Ltd.)

Summary of the Construction

<table>
<thead>
<tr>
<th>Area of renovation</th>
<th>School building: 4,507 m², Gym: 530 m²</th>
<th>Total Cost</th>
<th>443 million yen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of renovation</td>
<td>January–March 2007, Biotope space</td>
<td>Renovation cost</td>
<td>391,169 thousand yen</td>
</tr>
<tr>
<td></td>
<td>January–March 2008, Playground</td>
<td>Clerical and research cost</td>
<td>23,226 thousand yen</td>
</tr>
<tr>
<td>Architect</td>
<td>Arcom Co., Ltd. (Setagaya Ward, Tokyo)</td>
<td>Water</td>
<td>5</td>
</tr>
<tr>
<td>Builder</td>
<td>Ecological renovation: Consortium of Shinkoh and ADEKA</td>
<td>Gas</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Machinery equipment renovation: Sanki Air-Conditioning Engineering Co., Ltd.</td>
<td>25% reduction</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Electric equipment renovation: Mitsubishi Electric Building Techno-Service Co., Ltd.</td>
<td>Electricity</td>
<td>3% reduction</td>
</tr>
</tbody>
</table>

Opinions from the Board of Education

Judgment between reconstruction and renovation
I wonder if the life-span of a building frame can be much longer than the usual reconstruction cycle if it is maintained well. Unless the capacity of a facility is not sufficient for its purpose or a drastic change of educational content makes it impossible for the building space to respond, it is ecologically correct to extend the life of the facility and keep using it.

How to implement renovation while using the facilities
The long summer vacation should be used effectively. Construction work involving operations that make school life difficult, such as noise, water stoppages, and electric outages, should be scheduled for during this period. Meanwhile, some of the construction work (such as waterproofing work) does not cause any problems in school management. Therefore, it is necessary to examine the kinds and scheduling of various construction works.

Limitation of existing school facilities and Response to related regulations such as barrier-free measures
Due to the repeated revisions of architectural regulations, the older the building is, the more likely it is regarded as an existing inadequate building. When a building is regarded as an existing inadequate building, we cannot make extensions to the building and the content of renovation will be limited. In the same way, some barrier-free measures are not possible for structural and legal reasons (such as making extensions to a building in order to install an elevator), so sometimes we must be satisfied with limited barrier-free options.

Considerations about budget
Cost-effectiveness is difficult to predict in a project without previous examples. Although we need to design the project with predicted figures, unexpected things may happen. It is necessary to make a system that can tolerate such overspending to some extent and use it to improve the next renovation.

Support and verification after the renovation
It is natural that the operator of the renovated school is required to seek a life style that makes the most of ecological renovation and is certainly expected to provide information about the fruits of renovation. Also, construction work for improvement based on the verification of the effects would be somewhat difficult unless it would be conducted by the companies that renovated the facility. The period of verification is not only the first year after the renovation. It is important to keep devising ways to take advantage of the renovation in daily life and verify the results of renovation. It is necessary to have a multiple-year period of verification.

Opinions from the Schools

Utilization for environment/energy education and its effects
One of the ways to utilize the eco-school for environmental education is to connect it to the learning activities of each grade. In our school, we had grown kenaf for some time, but after the renovation, we started to grow it in the rooftop garden installed during the ecological renovation and it has now become the tradition of our school to make graduation certificates from kenaf paper.
(Examples of environmental education)
- Third graders: Working on the rooftop greening and growing vegetables
- Fourth graders: Observation in the biotope and conservation of nature
- Fifth graders: Wonders of kenaf
- Sixth graders: Secrets of eco-school, Nana-Hake Elementary

Thanks to the louvers installed in the openings, sunlight was shielded and the cooling equipment was used for a shorter amount of time in summer. Also, as we learned that the electricity use is largely connected to the use of lighting, we are trying to turn off our lights whenever possible on a daily basis. On sunny days, we do not use the lights on the schoolyard-side of the classroom.

Continuous efforts
In order to work on environmental education smoothly, we need to secure the budget and human resources.

5. Important Points about Eco-School Renovation from the Case Example

It is necessary to remember that light shelves cannot be effective unless we reconsider the way we use lighting when the light shelves are installed.

In planning the space for environmental education, it is important to investigate its operation method as well.

When we work on the eco-school renovation of existing school facilities, it is important to verify the conditions of the improvement of the indoor environment and the changes in children’s learning at the same time.
1. Summary

Renovation Triggered by Assurance of Quake Resistance and Measures against Deterioration

The school buildings of Kita Elementary School, built between 1971 and 1980, became rather old and required the assurance of quake resistance and measures against deterioration.

Also, the classrooms were hot in summer, cold in winter, and rather dark. The toilets smelled bad and the roof leaked. Renovation was necessary to solve these problems.

In 2005, the school was designated as a model school of the School Eco-Renovation and Environmental Education Program by MOE, and eco-school renovation was begun as a countermeasure to global warming based on the characteristics of the region and the school.

Renovation was conducted in two phases, in fiscal 2007 and 2008, and completed in March 2009.

About Kita Elementary School

- Location: 2-21 Kiryumachi, Takayama-City, Gifu Prefecture
- Number of students: 745 (as of May 2009)
- Area: school building 6,455m²
- Buildings: East wing of northern school building
  - RC / 4-story / built in 1971–1975
  - West wing of northern school building
  - RC / 4-story / built in 1980
  - Southern school building
  - RC / 4-story / built in 1984
  (Seismic reinforcement is not necessary for the southern school building)
- Number of schools in Takayama-City

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary schools</td>
<td>19</td>
</tr>
<tr>
<td>Junior high schools</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
</tr>
</tbody>
</table>
2. Discussion on Eco-School Renovation

Creating a Classroom Design Appropriate for the Climate and Landscape

In order to implement the School Eco-Renovation and Environmental Education Program, the school setup the Exploratory Committee on Ecological School Renovation to develop the basic concept of the content of renovation at Kita Elementary School through workshops, and the Exploratory Committee on Environmental Education to make the implementation policy of environmental education.

The Exploratory Committee on Ecological School Renovation consisted of professionals, the city administration, the school personnel, and local residents, and it held six meetings during fiscal 2005. The committee investigated how to create a rich educational space at Kita Elementary School, while studying the area’s natural background and architectural environment, and its safety.

Figure 4-1 Policies on Promoting the Project

![Exploratory Committee on Ecological School Renovation](image1.png)

**Exploratory Committee on Ecological School Renovation**

**How to Perceive the Ecological Renovation**

It is not something that ends with the completion of construction; it continues into the future

**How to Promote the Ecological Renovation**

“Let’s plant the seeds of ecology together!” Promoting the renovation while holding workshops with students, teachers, parents, and neighbors

**Criteria for selection from the ecological renovation menu for Kita Elementary**

Introduction of ecological technologies (hardware) that can be seen, felt, and nurtured

---

**Exploratory Committee on Environmental Education**

Exchange of ideas among the teachers and school staff on their concepts of environmental education

- I want to nurture the feeling of cherishing what we have.
- I want to raise children who will sense and appreciate the change of seasons.
- I want to raise children who will think about and feel the changes in their surroundings as their own issues.
- I want the children to realize the positive effects of renovation using visible data, etc.
- We will have a great opportunity to provide environmental education by utilizing the renovated school.
- Ecology and convenience sometimes conflict with each other. I wonder how we can teach children that.

---

**Figure 4-2 Proposals**

Facilities that give consideration to a people-friendly environment (from a part of the Proposals)

"Garden of Growing": a place for environmental education for both children and the community to study continuously together

Let’s redevelop the existing garden in front of the entrance, the animal square, and the playground little-by-little into a unified garden of ecology!

**Wooden interior and indoor plants**

Let’s introduce trees, soil, and plants, focusing on their environmental benefits, in order to create a warm and comfortable learning environment!!

- Continuous greening together
- Various kinds of trees
- Growing plants along the walls
- Various plants such as groundcovers and herbs
- Rainwater tank
- Growing plants: light shelves
- Japanese cypress panel
- Clay walk (light color)
- Ceiling fans
- Floor board of compressed cedar
- Zelkova center line
- Permeable pavement
- Marsh waterfront
- Rocky stretch
- Marsh
- Earthworm compost
- Hard hill
- Biotopes

The renovation menu was examined based on the idea that ecological renovation should be continued into the future, aiming to utilize the eco-school as an extension of school activities, such as class observation days, resource-recycling activities, hours for comprehensive studies, science, and social studies, so that the burden on teachers and parents will be as little as possible.
3. Details of Eco-School Renovation

Increasing Safety and Environmental Performance of School Buildings

The school buildings that require seismic reinforcement were strengthened through the installation of braces and the addition of walls. A double roof was introduced for insulation and measures against leaks. The load increase caused by the double roof was taken into consideration in designing the seismic reinforcement.

Eaves and light shelves, installed with braces, can shield the buildings from direct sunlight in summer and yet bring the sunshine to the back of the classrooms.

Improvement of Learning Environment of School Buildings

Improvement of the Classroom Environment

In order to keep classrooms warmer, double-glazed glass was introduced. Wooden boards were used as interior thermal insulation for classroom walls, hallways, and stairs.

Light shelves reflect natural light into the classrooms, and shades were installed as a measure against the heat.

As for light fixtures, high-efficiency devices were installed.

Creating a comfortable learning environment utilizing the blessings of nature, such as sunlight and heat
Toilets on each floor were changed into water-saving toilets. As for the interior, wood was used for the lower part of walls, and diatomite was applied above, thus improving the deodorization and insulation effects. Also, differences were eliminated in floor height to make the toilets barrier-free.

Pellet stoves use biomass energy instead of fossil fuels. It can reduce CO\textsubscript{2} emissions, contribute to providing environmental education, and raise children’s awareness.

Utilization for Environment/Energy Education

Students are making a survey on creatures in the nearby river, studying the effect of water-saving plumbing, and carbon dioxide absorption through growing kenaf. (The picture shows the children harvesting kenaf leaves.)

We invite the local residents to the Ecological Awareness Festival, which we hold in March every year. Fifth graders form groups and are assigned different issues to study for one year. They make presentations about the results of their environmental study at the festival. Also, we are transmitting the information widely to the local community to promote electricity and water conservation and to show the results of our environmental renovation.
4. Results of the Efforts, etc.

Experiencing the Effects of Renovation

We feel the effects of insulation through the wooden materials used for floors and walls, and of the replacement of sashes with double-glazed glass.

Thanks to the improvement in insulation, we can now provide enough heat for classrooms with pellet stoves, which have a calorific value only a little lower than that of a kerosene stoves but are better for the environment. Children’s interest in the environment has been raised as well.

Effects of Reducing CO₂ Emissions

We compared the CO₂ emissions between the planning stage of ecological renovation and after renovation (2008). (The second phase of renovation was conducted in 2008, so it is necessary to continue the verification.)

During the planning, we estimated that the reduction rate of CO₂ emissions would be 30%; the actual reduction after renovation was 34%.

Of the 41 stoves at Kita Elementary School, 30 in the regular classrooms were replaced by pellet stoves. As a result, CO₂ emissions were greatly reduced, with zero emissions from classroom heating.

<table>
<thead>
<tr>
<th>Summary of the Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>School buildings for renovation</td>
</tr>
<tr>
<td>Area of renovation</td>
</tr>
<tr>
<td>Period of renovation</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Architect</td>
</tr>
<tr>
<td>Builder</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

[Source] “School Eco-Renovation and Environmental Education Program: Business Report for FY2008” (MOE / Organic Table Co., Ltd.)

5. Important Points about Eco-School Renovation from the Case Example

- In places with cold climates, such as Takayama City, it is important to focus on measures for heating energy in winter.
- Fuel for pellet stoves comes from local thinning. In introducing pellet stoves, it is necessary to examine how to secure a stable system to supply pellets.
- Considering the size of the facilities, the energy use at elementary and junior high schools is usually rather small to begin with. Therefore, energy use tends to increase after a large-scale renovation. It is necessary to make plans and designs that would find the balance between the quality and performance of school facilities and the reduction of the burden on the environment.
- The case example of Kita Elementary School serves as a useful reference about how to devise the work period and work process in order to implement renovation while using the facilities without constructing an impromptu school building.
**Effective Ideas for Making Eco-Schools**

**Case Example 5: An Example to Facilitate the Assessment of Actual Energy Consumption and to Aim for Efficient Management of Facilities**

### 01 Visualization of energy consumption

**Comparing the actual energy consumption**

**Assessment of actual energy consumption using the Web**

Seirou Junior High School, Seirou-Machi, Niigata Prefecture

The school’s Website lists the school’s yearly, monthly, and daily energy consumption and electric power supply generated by solar energy, which anyone can check anytime.

### 02 Focused promotion of energy use efficiency

**Checking the ways energy is used**

**Assessment of the breakdown of electric consumption**

Dai-Nana Haketa Elementary School, Arakawa-Ward, Tokyo

By understanding when, where, and how much energy is consumed, and assessing the actual status of architectural performance and equipment, effective energy-saving measures suitable for the school’s situation can be decided.
Since 2006, monitors to measure electric power have been installed at about 300 public kindergartens, elementary, junior high, senior high, and special-needs schools in Kyoto City ("Energy Management System"). Based on the visualized real-time data of electricity use, Kyoto City is working on various energy-saving activities.

**Installation of energy-saving navigators**

Suma Gakuen Junior and Senior High School

An energy-saving navigator is installed on each floor, so students can check the electricity use and prices in real time.

Visualization makes it possible to see if there is any wasteful energy consumption and contributes to the efficient management of the facility.

**Introduction of energy-saving light fixtures and adjustment of sunshine**

Dai-Nana Haketa Elementary School, Arakawa-Ward, Tokyo

The introduction of high-efficiency lighting fixtures and the separation of switches makes it possible to turn off the lights on the bright-window side of classrooms. Also, light shelves reflect light onto the ceiling.

**Floor heating with pellets**

Mikata Junior High School, Wakasa-cho, Fukui Prefecture

Floor heating with pellets is introduced in order to control the CO₂ emissions caused by heating in winter.

- Energy should be used efficiently, by understanding the differences in energy consumption and use based on the region and activities of the school.
- In order to use energy effectively, passive energy-saving measures that use nature cleverly, such as the installation of eaves and improvement of insulation performance, etc. can be investigated.
Effective Ideas for Making Eco-Schools

Case Example 6: An Example to Aim for Equal Emphasis on Ensuring the Level of Facilities and Reducing the Environmental Burden

01 Revamping and ecological renovation at the same time

Securing safety and ecological renovation at the same time

Simultaneous seismic reinforcement and greening of rooftops and walls, installation of double roofs, and use of solar heat
Nishiharu Junior High School, Kitanagoya City, Aichi Prefecture

By adopting seismic reinforcement with the outside-frame construction method, it is possible to provide environmental education utilizing the frames.

Measures against aging and ecological renovation at the same time

Improvement of classroom environment utilizing lumber
Urawa High School, Saitama Prefecture

Aging walls, floors, and partitions of classrooms are renovated with lumber grown in the prefecture, and the classrooms are changed into a warm studying and learning environment with pleasant air humidity.
**Use of solar heat**
A low-temperature solar-based pneumatic floor-heating system is installed in the double roof. The warm air heated by the sun is sent to the under-floor space of libraries, etc., where it is used for floor heating.

**Greening of rooftops and walls**
The installation of seismic frames is combined with rooftop greening. Also, children can utilize the frames and work on the wall greening themselves after renovation.

**Installation of double roofs**
The installation of seismic braces is combined with the installation of double roofs. It aims for the improvement of durability of rooftop waterproofing and the reduction of thermal load.

**Rooftop greening for insulation as well**
Urawa High School, Saitama Prefecture

The renewal of the aging waterproof layer on rooftops is combined with rooftop greening. In addition to reducing solar radiation heat it has also become a place for students to relax.

**Reused building materials**
Sonehigashi Elementary School, Kitakyushu City, Fukuoka Prefecture

Only joinery parts are newly made, and other parts are refinished and reused.

**Improvement of toilets**
Nishiharu Junior High School, Kitanagoya City, Aichi Prefecture

Sanitary equipment and a flushing system that both conserve water have been introduced. Soft natural light comes through glass blocks and makes toilets look fresh and clean.

**POINT**
- When seismic reinforcement is implemented, the improvement of exterior wall insulation, the exchange of double glass window sashes, etc. can be considered at the same time.
- Some schools are trying to utilize seismic reinforcement materials for environmental education after renovation.

**POINT**
- Aging sections are repaired regularly based on the construction year and geographical conditions. For this reason, it is important to try to reduce the environmental burden while implementing these repairs.
02 Learning environment improvement and ecological renovation at the same time

Ensuring a healthy and comfortable classroom environment

Improvement of ventilation route through temperature difference ventilation
Sone-higashi Elementary School, Kitakyushu City, Fukuoka Prefecture

Installing ventilation equipment that functions through temperature difference ventilation using solar heat and constant wind induction from the beach, in order to improve the ventilation route within the school building.

Adjustment of sunlight with an exterior louver
Tamron-higashi Junior High School, Kobe City, Hyogo Prefecture

A combination of parallel and slanted louvers, called “eco-louvers,” is installed in openings. In summer, the eco-louvers screen the strong sunshine on the window side and illuminate the classroom ceiling thanks to the parallel louvers. In winter, warm sunlight fills the whole classroom. By turning off the lights on the window side and opening or closing the windows, lighting energy can be reduced and the thermal environment of the classroom can be improved.

Eco-louvers
A glass exhaust tower and skylight called a “solar chimney” is installed on top of the staircase.

Sashes with slits and partitions that can open wide are adopted in the classrooms, so that natural winds can pass through.

Mobile partitions are installed based on considerations of improving the thermal environment of classrooms through daylight and ventilation. Partitions and aluminum sashes in hallways can be partially opened to ensure the ventilation route within the school building.

In order to maintain the indoor environment, for example temperature and luminance, within a proper range, we can consider utilizing natural energy as much as possible.

As a countermeasure against heat in summer, the ventilation route can be ensured while insulating the exterior walls in order to prevent a rise in room temperature, and eaves can block direct sunlight.

Solar power generation panels that also work as eaves

In order to prevent the penetration of sunshine, solar power generation panels (10 kW × 2) that also work as eaves are installed above the openings of the southern side of classrooms.
01 Utilization of eco-schools as learning materials

How to promote the utilization

Environment/energy education materials throughout school buildings
Nishiharu Junior High School, Kitanagoya City, Aichi Prefecture

Experiencing the effects of transparent pipes

The school has displayed equipment that allows the students to gain hands-on experience of the environmental techniques adopted for ecological renovation at various spots through the school buildings.

In the picture at left, the pipe to send the air heated by the low-temperature solar-based pneumatic floor heating system to the under-floor space is transparent. Feathers have been put inside the pipe, so that the students can see the movement of air. Also, they can put their hands inside the pipe to touch the warm air heated by the solar heat.

02 Utilization of the renovation process

Making efforts while confirming the effects

The hub of environmental education made together with children
Higashisone Elementary School, Kitakyushu City, Fukuoka Prefecture

The environmental study space is created based on the model suggested by the children. Ecological renovation of the school buildings and a record of children’s ecological activities are exhibited here.
Joinery before renovation (on the right) is used as it was.

A part of the pre-renovation finish is left and is covered by glass. This part is called a “memorial box.”

**Visualization of the rainwater storage tank**
Mikata Junior High School, Wakasa-cho, Fukui Prefecture

A glass window is installed so that the students can see the inside of the rainwater storage tank placed under the floor.

**Installation of hand-operated louvers**
Noichi Elementary School, Konan City, Kochi Prefecture

Students can make a lighting environment suited to each season by using hand-operated louvers.

**Confirming the environmental effects using models**
Tamonhigashi Junior High School, Kobe City, Hyogo Prefecture

In choosing the finishing material for the rooflop, many small models with different specs are used to confirm the thermal quality.

**Trial to improve the insulation performance of glass windows**
Nishiharu Junior High School, Kitanagoya City, Aichi Prefecture

Students are trying to attach bubble wrap to glass windows to confirm the change of indoor temperature.

In order to nurture interest and motivation to learn about the environment, the school has made efforts to make facilities with hands-on learning materials for children to touch and learn from. For example, explanation panels can be put up, a space to observe the instruments can be created, and machines to measure energy consumption can be installed.

All the students can think about details carefully and make proposals, if the material is the space in front of their eyes. Also, the project can be worked on during holidays, such as the summer vacation, so that renovation can progress gradually and continuously while students can keep confirming the effects.
03 Hub to transmit information to the local community

Visualizing and transmitting information on the results of environmental education and the effects of the eco-school to the local community and society

Transmitting information on the eco-school project to the local community
Tamonhigashi Junior High School, Kobe City, Hyogo Prefecture

The school holds satoyama tours together with local residents, and students make presentations about the efforts to make an eco-school.

Installing the solar energy generation monitor in a prominent place for visitors
Hita City, Oita Prefecture

An energy generation monitor is installed in a prominent section of the entrance. Pamphlets on solar energy generation are distributed and its effects are introduced in the PTA newsletters, etc.

An eco-school is a place for learning for local residents as well, and can enlighten them and improve their environmental awareness.

04 Affiliation with administration, companies, NPOs, etc.

Conducting environment/energy education with the cooperation of local professionals

Delivery lectures by administrative officers
Ichikawa City, Chiba Prefecture

Environmental officers are conducting an environmental study program, utilizing the hybrid wind and solar energy generator that the school has installed. Children’s opinions and comments are also utilized to train the lecturing officers.

Lectures by NPO staff
Oyabe Elementary School, Yokosuka City, Kanagawa Prefecture

Outside experts are conducting a hands-on environmental study program, utilizing the solar panels, etc., and also cooperate with the working meeting on environmental education at school.
IV References

Reference 1 “On Measures to Promote Environmentally-Friendly Facilities (Eco-Schools) in the Future”  
—New ways to build school facilities in a low-carbon society—  

Reference 2 On Actual Conditions of Energy Consumption at School Facilities, etc. ……48  
(1) Actual Conditions of Energy Consumption at School Facilities  
(2) An Estimate of CO₂ Emissions at School Facilities

Reference 3 “Results of a Simulation of Environmental Measures in Model Plans” ……49  
(A summary of the report by Educational Facilities Research Center, National Institute for Educational Policy Research, September 2009)

Reference 4 Financial Support for Eco-School Renovation (for Public Schools) ……52

Reference 5 Financial Support for Eco-School Renovation (for Private Schools) ……53

Reference 6 Regulations Related to the Environment of School Facilities ……53  
(1) Summary of the Revisions of the Act on the Rational Use of Energy (revised in May 2008)  
(2) Summary of the Revisions of the Act on Promotion of Global Warming Countermeasures (revised in June 2008)  
(3) Summary of the Act on Promotion of Contracts of National Governments and Other Entities Involving Due Care for Reduction of Greenhouse Gas Emissions

Reference 7 Research Studies on the Visions of School Facilities ……55

Reference 8 Research Studies on the Visions of School Facilities  
The List of Members of the Working Groups to Build Environmentally Friendly Schools ……57

Reference 9 The Development of Discussion of the Working Groups to Build Environmentally Friendly Schools ……58
In fiscal 2007 and 2008, the Collaborators’ Conference investigated the changing circumstances of school facilities, the actual conditions of energy consumption at school facilities, and the long-term perspectives of energy consumption, and summarized the measures to plan and design the reduction of environmental burden while securing the proper educational environment and the measures to promote eco-schools in the future.

**Background and Actual Condition of Energy Consumption at School Facilities, etc.**

1. Present situation of Japan’s global warming countermeasures
   - Achievement of the goal of the Kyoto Protocol (-6%)
   - Long-term reduction of greenhouse gas emissions (-60–80%)
2. Promotion of eco-schools
   - Implementation of eco-school model project (794 schools)
   - Implementation of a large number of renovation constructions for seismic reinforcement, etc.
3. Changes of the environment leading to an increase of energy consumption
   - Aggravation of indoor thermal environment of classrooms due to the heat island phenomenon, etc.
   - Response to the multi-purpose use of open schools, etc.

**Actual Condition of Energy Consumption, etc. at School Facilities**

- Power consumption rate is less than other facilities.
- Most of the power consumption is in the form of electricity and is for lighting, etc.

**Estimate of CO₂ Emissions at School Facilities**

- An estimate of CO₂ emissions at school facilities in 2050 (compared to 1990)
  1. Estimation of about 10% increase with standard energy-saving measures only
  2. It is estimated that a significant reduction is possible, with the most recent environmental measures, environmental measures of future innovations, and efforts in the area of electricity. (It is necessary to discuss this issue from a broader point of view, including cost, etc. in the future.)

**Issues involved in Global Warming Countermeasures at School Facilities**

- Improvement of efficiency of energy consumption
- Qualitative improvement and measures against global warming
- Reduction of environmental burden during construction
- Further utilization for environmental education

**Measures to Promote Eco-Schools in the Future**

**Aiming for Eco-School Renovation at Every School to Realize a Low-Carbon Society**

**Vision 1**
Further promotion of eco-school renovation for existing school facilities

**Vision 2**
Efficient facility management by utilizing benchmarks

**Vision 3**
Active pursuit of measures for energy conservation and CO₂ reduction, along with qualitative improvement of the learning environment

**Measure 1**
Eco-schools as educational materials and energy conservation activities at school
- Promotion of efforts that can be approached easily in daily activities, such as green curtains
- Practice of energy-saving activities at schools, such as the assessment of energy consumption

**Measure 2**
Visualization of energy conservation effects, etc.
- Assessment of the condition of energy consumption, inspection of possible wastefalness
- Streamlining and presentation of benchmarks, etc.

**Measure 3**
Focused promotion of energy efficiency
- Promotion of eco-school renovation with consideration given to the characteristics of the area and the school
- Construction of a database of cost-effective renovation methods
- Consideration of introducing equipment that measures and displays energy consumption, etc.

**Measure 4**
Introduction of renewable energy, such as solar power
- Active consideration of introducing the energy from solar light, solar heat, biomass, etc.
- Attention to the renovated facility’s utilization for environmental education and its role as the leader in the community, etc.

**Further promotion of eco-schools**

- Installation of solar energy generation equipment
- Planting grass on schoolyards
(1) Actual Conditions of Energy Consumption at School Facilities (power consumption rate by building use)

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Primary Energy Consumption per Floor Area (MJ/year/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merchandise stores</td>
<td>3225</td>
</tr>
<tr>
<td>Restaurants</td>
<td>2923</td>
</tr>
<tr>
<td>Hotels</td>
<td>2918</td>
</tr>
<tr>
<td>Hospitals</td>
<td>2399</td>
</tr>
<tr>
<td>Meeting places</td>
<td>2212</td>
</tr>
<tr>
<td>Offices</td>
<td>1936</td>
</tr>
<tr>
<td>Universities, etc.</td>
<td>1209</td>
</tr>
<tr>
<td>Junior high schools</td>
<td>302</td>
</tr>
<tr>
<td>Elementary schools</td>
<td>292</td>
</tr>
</tbody>
</table>

Primary energy consumption of elementary and junior high schools is 25% of that of universities, etc., and from 10 to 25% of that of operational buildings such as offices and stores.

(2) An Estimate of CO₂ Emissions at School Facilities (various cases of measures)

- **CO₂ emissions (million tons-CO₂/year)**
  - Status quo: 10% increase in the case of status quo (compared to 1990)
  - Mid- and long-term environmental measures: 22% decrease (compared to 1990)
  - Most recent environmental measures: 47% decrease (compared to 1990)
  - Efforts in the area of electricity: 70% decrease (compared to 1990)

### Summary of the setup of environmental measures

<table>
<thead>
<tr>
<th>Case</th>
<th>Summary of the setup of environmental measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Status quo</td>
<td>Without implementation of insulation or use of energy-saving equipment or renewable energy, etc.</td>
</tr>
<tr>
<td>2 Most recent</td>
<td>Utilization of daylight, insulation, energy-saving equipment and renewable energy, etc.</td>
</tr>
<tr>
<td>environmental</td>
<td>measures</td>
</tr>
<tr>
<td>measures</td>
<td></td>
</tr>
<tr>
<td>3 Mid- and long-term</td>
<td>Utilization of daylight, highly efficient insulation, highly efficient energy-saving equipment and aggressive use of renewable energy, etc.</td>
</tr>
<tr>
<td>environmental measures</td>
<td>(available through future innovations)</td>
</tr>
<tr>
<td>4 Efforts in the area</td>
<td>Reduction of CO₂ power consumption rate by the efforts of electric suppliers</td>
</tr>
<tr>
<td>of electricity</td>
<td></td>
</tr>
</tbody>
</table>

- It is estimated that CO₂ emissions from school facilities will increase about 10% compared to value of the standard year (1990), if only the present standard energy-saving measures are implemented.
- It is estimated that a significant reduction of CO₂ emissions from school facilities is possible, if the most recent environmental measures, mid- and long-term environmental measures through future innovations, and efforts in the area of electricity are combined. (It is necessary to discuss this issue from a broader point of view, including cost, etc. in the future.)

(Source) “Collaborators’ Conference on Research and Survey Relating to the Formation of Guidelines for School Facility Design (Fiscal Year 2008),” by Mr. Ikaga, a member of the Conference
Reference 3  “Results of a Simulation of Environmental Measures in Model Plans”
(A summary of the report by Educational Facilities Research Center, National Institute for Educational Policy Research, September 2009)

Promoting Environment-focused Renovations of School Buildings
—Results of a Simulation of Environmental Measures in Model Plans—

September 2009
Working Group on a Fundamental Study of School Facility Environments
Educational Facilities Research Center
National Institute for Educational Policy Research, Japan

Overview of the Existing School Building Model

<table>
<thead>
<tr>
<th>Type</th>
<th>Elementary School (about 35 years have passed since construction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure and Number of Floors</td>
<td>Reinforced concrete (RC) structure with 4 stories</td>
</tr>
<tr>
<td>Total Floor Area</td>
<td>About 5,100m²</td>
</tr>
<tr>
<td>Number of classrooms</td>
<td>Existing School Building</td>
</tr>
<tr>
<td></td>
<td>26 ordinary classrooms, as well as special-needs classrooms and specific classrooms</td>
</tr>
<tr>
<td>School Building After Renovation</td>
<td>12 ordinary classrooms, as well as special-needs classrooms and specific classrooms</td>
</tr>
<tr>
<td>Equipment</td>
<td>The air conditioning equipment was upgraded 20 years after the building was constructed.</td>
</tr>
</tbody>
</table>

Note 1: Please note that, in this simulation, the calculation of CO₂ emissions is limited to school buildings, not including the CO₂ emissions of the gym and swimming pool or CO₂ emissions generated during open days and school lunch cooking, concerning which, the management of facilities and methods vary greatly between schools.

Note 2: This simulation does not include the introduction of new energy, such as solar energy and pellet stoves; if such equipment is introduced, further effects on the reduction of CO₂ emissions can be expected.

Power consumption rate by the region of the school (MJ/year/m²)

<2006 fiscal year>


Heating Degree Days in Each Region (18°C)
- Region I (at least 3,500 degree days)
- Region II (3,000–3,500 degree days)
- Region III (2,500–3,000 degree days)
- Region IV (1,500–2,500 degree days)
- Region V (500–1,500 degree days)
- Region VI (fewer than 500 degree days)

Heating degree days: The absolute value of the difference between the average indoor temperature and the average outdoor temperature on a day when a heater is being used is referred to as that day’s heating degree day. If the difference between the average indoor and outdoor temperature on a particular day is 1 °C, it is 1 degree day. In general, the total of each day’s degree days during the period when heating is used is called the heating degree days.

[Source] Japan Center for Climate Change Actions website http://www.jccca.org/
In the Case of a Warmer Region* (Model Plans A1 [without a cooling device in regular classrooms] and A2 [with a cooling device in regular classrooms])

* Region IV in the regional classification of energy-saving standard (assumed to be the model for regions with the largest number of schools)

![Diagram showing the Plan Overview]

<table>
<thead>
<tr>
<th>Plan Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plan A1</strong></td>
</tr>
<tr>
<td>Staff/multipurpose classroom: [heating &amp; cooling] high-efficiency HP air conditioner (2008 level)</td>
</tr>
<tr>
<td>Classrooms/multi-purpose space: [heating &amp; cooling] high-efficiency HP air conditioner (2008 level)</td>
</tr>
</tbody>
</table>

| **Plan A2** |
| Staff/multipurpose classroom: [heating] FF-style oil heaters, [cooling] none |
| Classrooms/multi-purpose space: [heating] FF-style oil heaters, [cooling] none |

**Table of Environment-focused Renovations**

<table>
<thead>
<tr>
<th>Target area</th>
<th>Before renovation</th>
<th>Environment-focused renovation (W/coolers used in classrooms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior walls</td>
<td></td>
<td>Insulation, sunscreens on Type 10 and Type 11 walls</td>
</tr>
<tr>
<td>Windows</td>
<td>Aluminum sashes, float glass</td>
<td>Insulation, sunscreens on Type 10 and Type 11 walls</td>
</tr>
<tr>
<td>Roof</td>
<td>Shaded asphalt sheet with built-in fire protection system</td>
<td>Insulation, sunscreens on Type 10 and Type 11 walls</td>
</tr>
<tr>
<td>Air conditioning zones</td>
<td>(classrooms, foyer, etc.)</td>
<td>Artificial ventilation (solar heat recovery)</td>
</tr>
<tr>
<td>Partitioning (windows)</td>
<td>with insulation and double glazing</td>
<td>Internal windows with insulation and double glazing</td>
</tr>
</tbody>
</table>

**Annual CO₂ Emissions**

- **35 t-CO₂/year**
- **About 37–38% reduction**

**Estimated Construction Costs per Unit of Floor Area (¥/m² [excluding tax])**

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Main Content</th>
<th>Conventional renovation</th>
<th>Environment-focused renovation (HP oil heating + air circulation)</th>
<th>(Coolers used in classrooms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction cost</td>
<td>Demolition work &amp; excavation work for renovating the interior and exterior of the building and the interior of the building</td>
<td>633,200</td>
<td>98,700</td>
<td>98,700</td>
</tr>
<tr>
<td>Mechanical equipment work</td>
<td>Equipment installation work</td>
<td>20,600</td>
<td>20,700</td>
<td>21,900</td>
</tr>
<tr>
<td>Electrical equipment work</td>
<td>Lighting equipment work</td>
<td>8,300</td>
<td>3,700</td>
<td>4,900</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>87,000</td>
<td>120,100</td>
<td>122,500</td>
</tr>
</tbody>
</table>

- The unit cost of environment-focused renovations (excluding tax) implemented in conjunction with earthquake-proof reinforcement, qualitative improvements and improvements to dilapidated facilities is around 120–123 thousand yen/m².
- The increase in unit cost attributable to adopting environmental measures is around 33–36 thousand yen/m².

**Estimated Construction Costs**

![Diagram showing the Estimated Construction Costs]

**A profound effect on the reduction of energy for heating in winter**
**In the Case of a Colder Region** (Model Plan B)

- Region II in the regional classification of energy-saving standard (assumed to be the model for cold weather regions)

### Plan Overview

- **External walls:**
  - Toilet basins: with flushing sound device / Urinals: with automatic flush
  - Windows (ordinary classrooms, corridor): Power saving equipment (with motion sensors)

### Table of Environment-focused Renovations

<table>
<thead>
<tr>
<th>Target area</th>
<th>Before Renovation</th>
<th>Environment-focused Renovation</th>
<th>Type of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>External walls</td>
<td>-</td>
<td>External insulation and polyurethane boards (heat recovery)</td>
<td>Insulation</td>
</tr>
<tr>
<td>Windows</td>
<td>Aluminium sashes, float glass</td>
<td>Aluminum sashes, float glass, double glazing, thermal break sashes</td>
<td>Windows</td>
</tr>
<tr>
<td>Roof</td>
<td>-</td>
<td>Modified asphalt shingled roofing with insulation (heat recovery)</td>
<td>Roofing</td>
</tr>
<tr>
<td>Air conditioning zones (classrooms, foyer, etc.)</td>
<td>-</td>
<td>Permanently open fire doors, installing doors that can be opened and closed</td>
<td>Doors</td>
</tr>
<tr>
<td>Partitioning walls</td>
<td>-</td>
<td>Installing movable partitions</td>
<td>Partitioning walls</td>
</tr>
</tbody>
</table>

### Estimated Construction Costs

#### Estimated Construction Costs per Unit of Floor Area (¥/m² [excluding tax])

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Main Content</th>
<th>Conventional renovation (¥/m²)</th>
<th>Environment-focused renovation (¥/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction cost</strong></td>
<td>Demolition work</td>
<td>63,200</td>
<td>109,300</td>
</tr>
<tr>
<td></td>
<td>Renovation work (Updating the interior and exterior of the building and its electrical equipment)</td>
<td>20,800</td>
<td>23,200</td>
</tr>
<tr>
<td></td>
<td>Earthquake-proof reinforcement</td>
<td>3,900</td>
<td>3,700</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>87,900</td>
<td>136,200</td>
</tr>
</tbody>
</table>

The unit cost of environment-focused renovations (excluding tax) implemented in conjunction with earthquake-proof reinforcement, qualitative improvements and improvements to dilapidated facilities are around 136 thousand yen/m². (The increase in unit cost attributable to adopting environmental measures is around 49 thousand yen/m².)
Reference 4  Financial Support for Eco-School Renovation (for Public Schools)

- Schools to be supported
  - Elementary schools, junior high schools, secondary schools (first phase), schools for special needs education

- Government subsidies will be granted for the cost for the projects below to conduct eco-school renovation.

<table>
<thead>
<tr>
<th>Project name</th>
<th>Subsidy rate</th>
<th>Summary</th>
<th>Construction to be supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of solar energy generation</td>
<td>1/2</td>
<td>(Lower limit: 4 million yen)</td>
<td>○ Construction to make joinery, outer walls and rooftops well-sealed and well-insulated ○ Construction to control sunshine by screens (eaves/louvers) ○ Construction for the greening of buildings (rooftops and walls) ○ Construction to introduce high-efficiency light fixtures, etc.</td>
</tr>
<tr>
<td>New construction and extension ★</td>
<td>1/2</td>
<td></td>
<td>○ Construction to introduce energy-saving air conditioners (heating and cooling equipment) ○ Construction to introduce the facilities to use rainwater or reuse the discharged water ○ Construction to introduce new energy, such as facilities to use solar energy, solar heat, etc.</td>
</tr>
<tr>
<td>Reconstruction ★</td>
<td>1/3</td>
<td></td>
<td>○ Construction to make joinery, outer walls and rooftops well-sealed and well-insulated ○ Construction to introduce high-efficiency light fixtures, etc. ○ Construction to introduce high-efficiency light fixtures, etc. ○ Construction to introduce energy-saving air conditioners (heating and cooling equipment), etc.</td>
</tr>
<tr>
<td>Large-scale renovation (aging) ★</td>
<td>1/3</td>
<td>Overall renovation of a building that is 20 or more years old (Lower limit: 70 million yen)</td>
<td>○ Construction to make joinery, outer walls and rooftops well-sealed and well-insulated ○ Construction to introduce high-efficiency light fixtures, etc. ○ Construction to introduce energy-saving air conditioners (heating and cooling equipment), etc. ○ Construction to introduce new energy, such as facilities to use solar energy, solar heat, etc.</td>
</tr>
<tr>
<td>Large-scale renovation (educational content, etc.)</td>
<td>1/3</td>
<td>Renovation to improve the indoor environment of a building (Lower limit: 20 million yen)</td>
<td>○ Construction to make joinery well-sealed and well-insulated ○ Construction to introduce high-efficiency light fixtures, etc. ○ Construction to introduce energy-saving air conditioners (heating and cooling equipment), etc.</td>
</tr>
<tr>
<td>Creation of environment and facilities for outdoor education</td>
<td>1/3</td>
<td>Construction to create a place for various hands-on activities in an outdoor space (Lower limit: 10 million yen)</td>
<td>○ Construction to maintain playgrounds (planting grass, etc.) ○ Construction to create school biotopes, observation forests, gardens for learning, etc. ○ Construction for the greening of buildings (rooftops and walls)</td>
</tr>
</tbody>
</table>

*1 Added by the fiscal 2009 supplementary budget (No. 1)
*2 Reconstruction of a building whose I.S. value is less than 0.3 but is difficult to retrofit for compelling reasons: 1/2

★ Eco-School Pilot Model Program
In order to diffuse eco-schools, MEXT is implementing subsidies in cooperation with METI, MAFF, and MOE. When a public school is certified for the model project in new construction, extension, reconstruction, or large-scale renovation of aging buildings, the school can receive an increased unit value for the subsidy and preferential addition of the area for the subsidy.

Ministry of Economy, Trade and Industry (METI)
New Energy Introduction Support Project at the Local Level
Summary: To subsidize local governments’ projects to introduce advanced facilities. To subsidize projects to introduce advanced mega-solar facilities, etc. implemented by private businesses, etc. in cooperation with local public agencies.
Subsidy rate: Up to 1/2

Ministry of the Environment (MOE)
Ecological Renovation Project of School Facilities to Prevent Global Warming
Summary: To subsidize the cost to conduct energy-saving renovation or introduce energy-saving equipment (“ecological school renovation”) that is effective and in accordance with the characteristics of the school.
Subsidy rate: 1/2
Note: As for fiscal 2010, only continued projects are subsidized and no new applications are received.

Forestry Agency
Building of Wooden Public Facilities <Subsidy for the Creation of a Forest, Forestry, and Lumber Industry>
Summary: To build a model wooden facility for a public building that would have a particularly high display effect and thereby promote local lumber

<table>
<thead>
<tr>
<th>Project item</th>
<th>Content of the project</th>
<th>Subsidy rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building of facilities related to schools</td>
<td>This project is for the wooden interiors of converted surplus classrooms, wooden public facilities built in connection with schools, wooden facilities surrounding schools (such as clubrooms and outdoor structures), wooden learning facilities for interregional exchanges, and wooden interiors of school facilities renovated as a model project of environmentally conscious schools (eco-schools).</td>
<td>1/2</td>
</tr>
</tbody>
</table>
Eco-Campus Promotion Project

To subsidize a part of the cost of renovation to make environmentally conscious school facilities, such as the installation of solar energy generation equipment, the utilization of new energy, the improvement of insulation and air-conditioning equipment, etc., and the greening of inside and outside school buildings, conducted by private schools in order to control the emission of greenhouse gasses, etc.

◆ Private high schools, middle schools, junior high schools, elementary schools, and schools for special needs education
  ● Project cost for subsidy: upper limit of 200 million yen, lower limit of 10 million yen
  ● Subsidy rate: up to 1/3

◆ Private universities, junior colleges, technical colleges
  ● Project cost for subsidy: lower limit 10 million yen
  ● Subsidy rate: up to 1/2

Reference 6 Regulations Related to the Environment of School Facilities

(1) Summary of the Revisions of the Act on the Rational Use of Energy (revised in May 2008)

- Introduction of the energy management obligation for business operators
  (Due to the revision from the management obligation for individual businesses to the management obligation for business operators, the Board of Education is now obliged to submit a regular report, etc., as well)
- Expansion of the buildings subject to notification regarding energy-saving measures
  (Small- and mid-scale buildings are now targeted as well [changed from 2,000 m² or larger to 300 m² or larger].)
(2) Summary of the Revisions of the Act on Promotion of Global Warming Countermeasures (revised in June 2008)

- Introduction of calculation and report of greenhouse gas emissions by business operator
  (due to the revision from the obligation for individual businesses to the obligation for business operators, the Board of Education is now obliged to conduct calculations and reports as well.)
- Planning of the policy to control emissions
  (presentation of measures required to control greenhouse gas emissions caused by business activities)
- Fulfillment of the action plans of local public agencies
  (making plans to control greenhouse gas emissions in accordance with natural and social conditions of the area), etc.

(3) Summary of the Act on Promotion of Contracts of National Governments and Other Entities Involving Due Care for Reduction of Greenhouse Gas Emissions

Local Public Agencies, etc.: Duty of Diligent Efforts

- Efforts to conserve energy (rational and proper use of energy, etc.)
  Reduction of energy use through the efforts of consumers (utility customers)
- Promotion of environmentally conscious contracts (on the supply side)
  Working on the supply side

Promotion of environmentally conscious contracts (Article 11 of the Act)

- Making policies on the promotion of environmentally conscious contracts (Paragraph 1)
  It is possible (and rational) to include the contract policy in the annual procurement policy and basic policy based on the Act on Promoting Green Purchasing.
- The contract policy should establish a type contract that is environmentally conscious (Paragraph 2)
  The item legally required to be stated is only what type of contract (electricity, automobile, ship, ESCO, architecture, etc.) the contract is.
- Necessary measures based on the contract policy (Paragraph 3)
  Making and publishing the summary of actual conclusion of environmentally conscious contracts (Paragraph 4)

1 Purpose
To conduct research studies on the visions and policies of school facilities in the future, in order to respond to the recent changes in society.

2 Items for the research study
(1) Visions of school facilities in the future
(2) Making of policies on improvement of school facilities
(3) Other

3 Method of implementation
(1) With the help of academic experts listed in Attachment 1, the research studies on the items listed on Clause 2 above shall be conducted.
(2) In addition to (1), in order to understand the status of investigation and research on the basic issues related to educational policies, the special collaborators listed in Attachment 2 shall participate in the research study.
(3) It is possible to ask for the cooperation of other related parties as necessary.

4 Terms

5 Other
General affairs related to this research study shall be conducted by Facilities Planning Division, Department of Facilities Planning and Administration, Minister’s Secretariat.
### The List of Collaborators of Research Studies on the Visions of School Facilities

<table>
<thead>
<tr>
<th>Name</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuichi Iwai</td>
<td>Principal, Tokyo Metropolitan Seicho School for Special Needs Education</td>
</tr>
<tr>
<td></td>
<td>President, National Association of Principal of Schools for Special Needs Education</td>
</tr>
<tr>
<td>Jun Ueno</td>
<td>Vice President, Tokyo Metropolitan University</td>
</tr>
<tr>
<td>Takeshi Unno</td>
<td>Director, Office for Promotion of Educational Environment Improvement, Board of Education, Kawasaki City</td>
</tr>
<tr>
<td>Takashi Eto</td>
<td>Professor, Graduate School of Education, the University of Tokyo</td>
</tr>
<tr>
<td></td>
<td>Director, Center for Barrier-Free Education attached to the Graduate School of Education</td>
</tr>
<tr>
<td>Kimiko Ozasa</td>
<td>Principal, Chogo Junior High School, Fujisawa City</td>
</tr>
<tr>
<td>Kazumi Kudo</td>
<td>President, Coelacanth K&amp;H Architects Inc.</td>
</tr>
<tr>
<td></td>
<td>Professor, Faculty of Science &amp; Engineering, Toyo University</td>
</tr>
<tr>
<td>Tsutomu Kenmochi</td>
<td>Principal, Koganei Daiichi Elementary School, Koganei City</td>
</tr>
<tr>
<td>Takehiko Sugiyama</td>
<td>President, Hitotsubashi University</td>
</tr>
<tr>
<td>Itsuko Takagiwa</td>
<td>Vice Principal, Shibuya Junior &amp; Senior High School</td>
</tr>
<tr>
<td>Satoru Nagasawa</td>
<td>Professor, Faculty of Science &amp; Engineering, Toyo University</td>
</tr>
<tr>
<td>Yoshiaki Nakano</td>
<td>Professor, Institute of Industrial Science, the University of Tokyo</td>
</tr>
<tr>
<td>Yukio Narita</td>
<td>Professor, Faculty of Education, Gifu Shotoku Gakuen University</td>
</tr>
<tr>
<td>Shinichi Masuya</td>
<td>Ex-Vice President, Congress of Parents and Teachers Association of Japan</td>
</tr>
<tr>
<td></td>
<td>Advisor, Chiba Prefecture PTA Liaison Council</td>
</tr>
<tr>
<td>Kazuko Matsumura</td>
<td>Professor, Faculty of Human Studies, Bunkyo Gakui University</td>
</tr>
<tr>
<td></td>
<td>Principal, Bunkyo Gakuin Fujimino Kindergarten</td>
</tr>
<tr>
<td>Yasushi Mitarai</td>
<td>Chairperson, the University of the Air Foundation</td>
</tr>
<tr>
<td>Hidenori Miyazaki</td>
<td>Professor, Faculty of Literature, Toyo University</td>
</tr>
<tr>
<td></td>
<td>Director, Autism Society Japan</td>
</tr>
<tr>
<td>Kaname Yanagisawa</td>
<td>Associate Professor, Graduate School &amp; Faculty of Engineering, Chiba University</td>
</tr>
<tr>
<td>Shinji Yamashige</td>
<td>Associate Professor, Graduate School of Economics, Hitotsubashi University</td>
</tr>
<tr>
<td>Junichi Yamanishi</td>
<td>Professor, Faculty of Human Development, University of Toyama</td>
</tr>
<tr>
<td>Fumio Wada</td>
<td>Principal, Tokyo Metropolitan Hamura High School</td>
</tr>
</tbody>
</table>

(20 members in total; in order of the Japanese syllabary)
1. Study Group

(Members of the Study Group)

Toshiharu Ikaga   Professor, Faculty of Science and Technology, Keio University
Tomotada Ito  Chief, Facility Division, Secretariat of the Board of Education, Setagaya Ward
Kazuko Oshio   Principal, Nijuku Elementary School, Katsushika Ward
Osamu Koizumi   Manager, Project Coordination Headquarters, Nihon Sekkei, Inc.
Hiromi Komine   Professor, Faculty of Engineering, Chiba Institute of Technology
Mitsumasa Shimada  Chief, Planning Coordination Division, Urban and Global Environment Department, Bureau of Environment, Tokyo Metropolitan Government
○Satoru Nagasawa  Professor, Faculty of Science & Engineering, Toyo University

(Special Collaborators for the Study Group)

Takeshi Unno   Director, Office for Promotion of Educational Environment Improvement, Board of Education, Kawasaki City
Koichi Shinpo   Director, Educational Facilities Research Center, National Institute for Educational Policy Research
Yasutaka Muraoka   Manager, Educational General Affairs Department, Board of Education, Fujisawa City

(10 members in total; in order of the Japanese syllabary)
(○: Head)

2. Working Group

(Fundamental examination of the comprehensive evaluation techniques for environmental performance at school facilities)

○Toshiharu Ikaga   Professor, Faculty of Science and Technology, Keio University
Takeshi Isoyama  Senior Researcher, Educational Facilities Research Center, National Institute for Educational Policy Research
Junko Endo     Nikken Sekkei Research Institute
Sachiko Zenyouji   Organic Table. Co., Ltd.

(4 members in total; in order of the Japanese syllabary)
(○: Head)
The Development of Discussion at the Working Groups to Build Environmentally Friendly Schools

Collaborators’ Conference (No. 1) [June 26, 2009]
- On Establishment of the Study Group to Build Environmentally Friendly Schools, etc.

○ Study Group Meeting (No. 1) [July 22]
- On present situations and issues about eco-school renovation for existing school facilities, etc. (Field Study)
  - September 2 Suginami Ward Board of Education, Tokyo, Suginami Dai-nana Elementary School, Ogikubo Elementary School
  - September 3 Tokyo Metropolitan Government’s Finance Department and Environment Department
  - September 7 Kita Elementary School, Minami Elementary School, and Nakayama Elementary School of Takayama City, Gifu Prefecture
  - September 15 Dai-nana Haketa Elementary School, Arakawa Ward, Tokyo

○ Study Group Meeting (No. 2) [October 13]
- On the direction of the collection of case examples about eco-school renovation for existing school facilities, etc.

Collaborators’ Conference (No. 2) [October 30, 2009]
- On the direction of the collection of case examples about eco-school renovation for existing school facilities, etc.

○ Study Group Meeting (No. 3) [December 7]
- On “Collection of Case Examples to Make Existing School Facilities More Ecological” (draft outline), etc.

Collaborators’ Conference (No. 3) [December 11, 2009]
- On “Collection of Case Examples to Make Existing School Facilities More Ecological” (draft outline), etc.

○ Study Group Meeting (No. 4) [January 19]
- On “Collection of Case Examples to Make Existing School Facilities More Ecological” (rough draft), etc.

Collaborators’ Conference (No. 4) [January 27 2010]
- On “Collection of Case Examples to Make Existing School Facilities More Ecological” (rough draft), etc.

○ Study Group Meeting (No. 5) [March 8]
- On “Collection of Case Examples to Make Existing School Facilities More Ecological” (draft), etc.

Collaborators’ Conference (No. 5) [March 25 2010]
- On “Collection of Case Examples to Make Existing School Facilities More Ecological” (draft), etc.