2002 Survey Report
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Infrastructure Improvement Project for Rationalization of International Energy Use (Survey Project on Best Practices of Energy Conservation for Building in South-East Asian Countries)

March, 2003

New Energy and Industrial Technology Development Organization (NEDO)

Entrusted to The Energy Conservation Center, Japan

Infrastructure Improvement Project for Rationalization of International Energy Use (Survey Project on Best Practice of Energy Conservation for Building in South-East Asian Countries)

The Energy Conservation Center, Japan
March 2003

Study Purpose

This survey is intended to render technical assistance to develop database / benchmark / guideline for the smooth promotion of both the energy conservation and the operation of the energy conservation building award system for commercial buildings in ASEAN countries that was newly setup by ACE（ASEAN Center for Energy）in 2000, in order to reduce the increasing energy consumption by commercial buildings. The objectives of the survey are to transfer the energy conservation technologies for buildings and the technologies for evaluating buildings to be awarded and conducting the energy audits.

Preface

In recent years, the challenge of preventing the global warming has become an issue of the utmost concern for the whole human race, while there has been an equally strong need for sustainable economic development. It is thus crucial to reconcile these conflicting interests in order to find a solution to the severe problems we face.

Under these conditions, what is needed, in particular, is the technological innovation that will create methods of using energy more efficiently and minimizing the environmental load, as well as developing such forms of energy as will cause no environmental load.

To contribute to the well-harmonized achievement between economic development and environmental protection, it is required to provide the support that is acceptable to each country and appropriate to the country's particular circumstances through the following.

- Understanding the energy use and measures for environmental protection
- Investigating the status of infrastructure establishment, lifestyle and means of livelihood

Under the situations mentioned above, in the fiscal year of 2002, the project activities concentrated on the establishment of the organization and basis to develop the database / benchmark / guideline to systematically implement improvements for energy conservation in the future in ASEAN countries. The activities are based both on the assistance in performing the award system for energy conservation buildings of commercial use and on the results of energy audits for buildings including the technology transfer.

In 2002, four buildings, or buildings of quite different types of "Best Practice" and "Retrofit" at two countries, were chosen and the energy audits including actual measurement were conducted at these four building.

Especially, in order to ensure the technology transfer, the energy audits of demonstration type in field on a basis of OJT (On the Job Training) were conducted and the workshops for participants to experience processing collected data by simulation was applied.

Among ASEAN countries, Vietnam and Myanmar are the countries more probable to be further developed in the future, accordingly, it is expected that new buildings will be constructed and the existing buildings will be revamped. In this sense, it is believed that the project activities in these two countries were very fruitful to obtain a large effect toward the future.

Moreover, it is also highly evaluated that the future direction of the project activities could be specifically shown by the establishment of the basis for promoting further energy conservation through initiating to develop database / benchmark / guideline for buildings, based on the actual results of activities for these three years.

We sincerely hope that this project will contribute to energy conservation and environmental protection in ASEAN countries. Additionally, we hope that those countries will continue to follow the path of environmentally friendly sustainable development. At the same time, it is expected that this project will serve as a vehicle for technological exchange and friendship between Japan and ASEAN countries.

March 2003

The Energy Conservation Center, Japan

Contents

Summary

The ASEAN economies are continuing to grow at a brisk pace, and accordingly their energy consumption is also anticipated to increase rapidly from now on. In this context, it will be vital to use energy more efficiently, as well as to give due consideration to global warming.

This project has entered its third year, and the ASEAN Center for Energy (hereinafter referred to as "ACE"), our counterpart, is engaged in increasingly full-fledged and substantial energy conservation activities, thereby contributing to the spread of awareness of the need for energy conservation among the people in ASEAN countries.

It is particularly notable that in the year 2002 which is supposed to be a turning point of the project, the achievements from the past project activities were reviewed and earnest discussions were held on the future direction of activities with Japanese specialists joining in the panel. Specifically, it is underlined that discussions on the evaluation system such as the award system further developed into the actual commencement of preparations for formulating database, benchmarks and guidelines in order to share the achievements accumulated during the past three years among ASEAN member countries. In other words, in the Inception Workshop held immediately after the commencement of the 2002 project and in the Workshop held at the end of February 2003 on completion of the 2002 field operations, positive and extensive discussions were held focusing on the development of database, benchmarks and guidelines in the future. In addition, in the Workshop at the end of February 2003, it was resolved that a working group would be formed by delegates from the respective ASEAN countries. This means that the ASEAN has established a substantial system in which achievements and results of the project can continuously be followed up in the future by developing database, benchmarks and guidelines.

Specific details of activities through this project for this year are as follows;

November 25 to November 26, 2002; Participation in the "Inception Workshop of the SOME-METI Project on PROMEEC - Buildings and PROMEEC - Industries" (Singapore)

(1) Introduction to energy conservation promotion measures, energy management and typical energy conservation technologies employed in buildings and in the industrial sector in Japan
(2) Explanation and discussions on the action plans to be implemented in the 2002 project (buildings and major industries)
(3) Discussions on scheduling and local arrangements for the planned field surveys on buildings and major industries
(4) Discussions on the plan to develop benchmarks for energy consumption in buildings
(5) Exchange of views on future project plan

January 6 to January 17, 2003; 1st Site Survey in Vietnam and Myanmar
(1) Introduction to energy conservation technologies used in buildings in Japan (Vietnam and Myanmar)

(2) Energy audits of two buildings in Hanoi, Vietnam
(3) Energy audits of two buildings in Yangon, Myanmar

February 17 to February 27, 2003; 2nd Site Survey in Vietnam and Myanmar

(1) Explanation/discussion on the results of the energy audits of two buildings in Hanoi, Vietnam and additional surveys
(2) Explanation/discussion on the results of the energy audits of two buildings in Yangon, Myanmar and additional surveys
(3) Workshop for development of database and benchmarks (Vietnam and Myanmar)

February 28 to March 1, 2003; Participation in the “Workshop of The Working Group for Benchmarking and Audit Guideline Development Projects, SOME-METI Work Program” (Yangon, Myanmar)

(1) Report and discussions on the results of the 2002 building audits (Vietnam, Myanmar)
(2) Report and discussions on the results of the 2002 industrial factory audits (iron and steel industry in Philippine and apparel manufacturing in Cambodia)
(3) Introduction to the status quo of Japan in connection with the development of database, benchmarks and guidelines and subsequent discussions
(4) Case study in Vietnam and Myanmar for the development of database, benchmarks and guidelines
(5) Introduction to the ASEAN’s view of the benchmarking concept, its implementation status and action plans and subsequent discussions
(6) Discussions on the future direction and proposed plans regarding the PROMEEC project (buildings and major industrial fields)

We gained good cooperation in Vietnam and Myanmar where we implemented surveys in the fiscal year 2002. In Hanoi in Vietnam, we practiced the energy audit of Hotel Nikko Hanoi and Lake Side Hotel respectively for a “Best Practice Building” and a “Retrofit Building”. In Myanmar, at the same time, we carried out the energy audits of FCI Center and Pansea Hotel respectively for a “Best Practice Building” and a “Retrofit Building”. As both Vietnam and Myanmar are yet in the process of further development among ASEAN countries, the number of large-sized modern buildings in their capitals is very small compared with Singapore, Thailand, etc. In this sense, as the buildings that we are able to survey is very limited, we deeply appreciate ACE and the governments of the both countries for their efforts to locate and determine the target buildings for our audit.

In either county, representatives from two or three ASEAN countries other than the countries concerned and delegates of the ACE as well as government ministries in charge, ministries, agencies and organizations concerned and the hotel staff concerned proactively participated in the audit and we were impressed with their serious attitude and readiness to learn from Japanese experts’ experience and knowledge. In the current year, we implemented our surveys also focusing on giving “OJT (On the Job Training) in Field” to local survey participants.

Specifically, using mainly a demonstration approach, Japanese experts gave participants concrete instructions on how to carry out an audit on the site while actually proceeding with their survey duties on the spot, starting from how to reply to a preliminary survey form and how to enter data. In the second site survey, they tried a simulation where by the workshop method, the results of the audit were actually input in a computer as data and audit parameters were calculated to analyze the results. Although it took quite a time and work for Japanese experts to make preparations for such training, their strenuous efforts made it happen. Their efforts and seriousness were probably felt by local participants and the results obtained were fruitful to both sides.

We sincerely hope that the recommendations proposed in this report will be realized at an early opportunity, furthermore that these materials and the experience described above will be effectively utilized and all results and achievements will be accumulated and disseminated to ASEAN countries so as to serve a basis for their future activities, thereby contributing to the promotion of both energy conservation and environmental protection in ASEAN countries.

We reiterate our most sincere gratitude for the generous cooperation rendered by the various relevant organizations of respective countries, including ACE, and by persons in charge of the buildings concerned.

I. Purposes and Background of the Survey

This project was set up in 2000 with the aim of reducing energy consumption in commercial buildings that continue to emerge in the ASEAN region with the cooperation of ASEAN Center for Energy that served as the core organization. This project supports the award system for the best practice building for energy consumption that targets business use buildings in ASEAN countries in its technical and operational aspects.

The secretariat of ASEAN Center for Energy that serves as a representative of ASEAN countries for this project understand the purposes of this project as follows;

1. Enhancing even more the cooperative relationship between ASEAN countries and Japan in the field of energy
2. Promoting energy efficiency and energy conservation in buildings in ASEAN countries
3. Promoting transfer of Japanese technologies in this particular field and introduction of successful energy-saving cases realized in Japan to ASEAN countries
4. Improving qualities of ASEAN countries through energy use audits on a basis of OJT
5. Developing and establishing Guideline, Database and Benchmark for the energy audit in ASEAN countries

Based on the discussion with ASEAN members including ACE, this cooperative project is considered to consist of the three stages as follows. The activities in this fiscal year should bridge the first and second stages, reviewing achievements made during the past two years and determining the direction of the activities in the next stage.

1st stage 2000-2002	Transfer of technologies and experience from Japan to ASEAN countries
2nd stage 2003-2006	Cooperative work interacting between Japan and ASEAN counties
3rd stage 2007-	Advancement in energy conservation through ASEAN countries' self efforts

Surveys on the actual condition of energy management were implemented specifically by the following process.

① Checking of the overall conditions of a building
② Checking of the overall conditions of facilities and systems
③ Checking in details of the condition of energy management according to the replies to the questionnaire on energy management which had been requested to prepare beforehand, and confirming the operation record if necessary.

④ Presenting the recommended improvements in facilities and energy management for the reduction of energy consumption based on the results obtained from the steps mentioned above.

Database, benchmarks and guidelines that provide rough standards of energy consumption in buildings should differ from country to country due to their differences in climate, lifestyle, established infrastructure, etc. Accordingly, as it is impossible to establish unified standards for all ASEAN countries from the beginning, we suggested that respective countries establish their own standards independently in the first place, then work together to complete standards that can be used commonly by ASEAN countries. This year, as a first step, we organized how to proceed with the plan and conducted training in the creation of database in Vietnam and Myanmar.

II. Vietnam

1. Summary of Audits

Site survey and audit periods

1st Site Survey : January 6 through 11, 2003

2nd Site Survey : February 17 through 21, 2003

Participants from the International Engineering Department of the Energy Conservation Center, Japan. (ECCJ)

•	Kazuhiko Yoshida (General Manager)	January 6 through 7, 2003
•	Akira Ueda (Technical Expert)	January 6 through 11 and February 17 through 21
•	Akira Kobayashi (Technical Expert)	January 6 through 11 and February 17 through 21

(1st Site Survey)

Date	Events, destination, etc.	Description
Jan. 6 (Mon.)	Workshop (Hotel Nikko Hanoi 84 Tran Nhan Tong St. Hanoi)	• Welcome Remarks • Opening Statement • Introduction of ECCJ • Presentation on the current energy conservation technology and experience in buildings in Japan • Presentation on the procedure of auditing buildings Participants Mr. Vu Van Thai (Deputy Director General Department of International Cooperation) Mr. Le Tuan Phong (Ministry of Industry) Mr. Phuong Hoang Kim (Ministry of Industry) Ms. Ho Kim Nga (Electricity of Vietnam) Mr. Antonio B. Dizon (Chief Engineer Hotel Nikko Hanoi) Mr. Thang (Engineer Lakeside Hotel) Mr. Tam (Engineer Lakeside Hotel) Mr. Mohd Muhtazam Noordin (Malaysia Energy Centre) Mr. Christopher Zamora (ACE) and 5 other persons

Date	Events, destination, etc.	Description
Jan. 7 (Tue.)	Hotel Nikko Hanoi (Best Practice Building) Survey/audit (in Hanoi City)	• Provided OJT in auditing to participants through the survey/audit of Hotel Nikko as Best Practice Building Use of building: Hotel (260 rooms) Size: 1 basement and 17 floors above the ground Total floor area: 29,164 m^2 • Survey on the overall condition of the building by documents/interviewing • Survey on the overall condition of the equipment by documents/interviewing • Survey on energy consumption by documents/ interviewing • On-site investigation There were many participants from various fields. Participants: Mr. Le Tuan Phong Mr. Phuong Hoang Kim Ms. Ho Kim Nga Mr. Antonio B. Dizon Mr. Thang Mr. Tam Mr. Mohd Muhtazam Noordin Mr. Christopher Zamora and 6 other persons
Jan. 8 (Wed.)	Lakeside Hotel (Retrofit Building) Survey/audit (in Honoi city)	• Provided OJT in auditing to participants through the survey/audit of Lakeside Hotel as “Retrofit Building” • Use of building: Hotel (76 rooms) Size: 5 floors above the ground Total floor area: 6,981 m^2 • Survey on the overall condition of the building by documents/interviewing • Survey on the overall condition of the equipment by documents/interviewing • Survey on energy consumption by documents/ interviewing • On-site investigation Participants: Mr. Le Tuan Phong Mr. Phuong Hoang Kim Ms. Ho Kim Nga Mr. Antonio B. Dizon Mr. Thang Mr. Tam Mr. Mohd Muhtazam Noordin Mr. Christopher Zamora and 8 other persons

Date	Events, destination, etc.	Description
Jan. 9 (Thu.)	Audits of Hotel Nikko Hanoi and Lakeside Hotel	• Conducted a survey for reconfirmation of data on Hotel Nikko Hanoi (Best Practice Building) and Lakeside Hotel (Retrofit Building) Participants: Hotel Nikko Hanoi Mr. Antonio B. Dizon and 2 other persons Lakeside Hotel Mr. Tam Ms. Nguyen Thuy Hai and 2 other persons
Jan. 10 (Fri.)	Wrap-up meeting (Hotel Nikko Hanoi)	• Summarized the preliminary results of surveys/audits of Hotel Nikko Hanoi and Lakeside Hotel and reported to participants. Participants: Mr. Le Tuan Phong Mr. Phuong Hoang Kim Ms. Ho Kim Nga Mr. Antonio B. Dizon Mr. Thang Mr. Tam Mr. Mohd Muhtazam Noordin Mr. Christopher Zamora and 6 other persons

(2nd Site Survey)

Date	Events, destination, etc.	Description
Feb. 17 (Mon.)	Pre-report meeting Interim reports on the audit results for Hotel Nikko Hanoi and Lakeside Hotel (Hotel Nikko Hanoi)	• Made interim reports based on the results of the 1st surveys/audits of Hotel Nikko Hanoi and Lakeside Hotel (Major contents) Hotel Nikko Hanoi • Analysis of the current condition Power consumption, total energy consumption, energy composition, trends in annual energy consumption, daily power consumption, comparisons with other buildings, water consumption data • Recommendations and expected effects Improvement in the chilled water temperature, application of the variable flow rate control system to the current cold water pumps, improvement in air ratios for boilers, renewal to high efficiency lighting fixtures, improvement in heat insulation of steam pipes and valves and introduction of cogeneration system. Lakeside Hotel • Analysis of the current condition Trends in monthly power consumption, energy composition, annual power consumption and comparisons with other buildings • Recommendations Improvement in setup temperature for hot-water supply and review of heat source for hot-water supply Participants: Mr. Le Tuan Phong Mr. Phuong Hoang Kim Ms. Ho Kim Nga Mr. Antonio B. Dizon Mr. Thang Mr. Tam Mr. Mohd Muhtazam Noordin and 2 other persons
Feb. 18 (Tue.)	Survey of Hotel Nikko Hanoi	• Carried out the secondary survey on Hotel Nikko Hanoi • Out of the energy saving measures proposed in the wrap-up meeting in January, some improvements have been realized including “heat insulation of steam pipes and bare tubes of valves”, “change in chilled water outlet temperature of chillers”, etc. Participants: Mr. Antonio B. Dizon and 2 other persons

Date	Events, destination, etc.	Description
Feb. 19 (Wed.)	Survey of Lakeside Hotel	• Carried out the secondary survey on Lakeside Hotel focusing on solar-powered hot water supply system Participants: Mr. Tam Ms. Nguyen Thuy Hai and 2 other persons
Feb. 20 (Thu.)	Hotel Nikko Hanoi Workshop on database and benchmark development	• Made a presentation on benchmarks and databases established in Japan • Had interviews to get information regarding the status of benchmarks and databases in buildings in Vietnam • Had discussions on the current condition in Vietnam having Mr. Le Tuan Phong of M.O.I. as M.C. • Although there was no benchmarking and database system, 14 buildings had already been audited under supervision of Hydro Quebec International Co. in Canada. Participants: Mr. Le Tuan Phong Mr. Phuong Hoang Kim Ms. Ho Kim Nga Mr. Antonio B. Dizon Mr. Thang Mr. Tam and 6 other persons
Feb. 21 (Fri.)	Benchmark and database creation in Vietnam Institute of Energy	• Created database and benchmarks in Vietnam using energy audit results of 14 buildings collected by Institute of Energy Participants: Mr. Le Tuan Phong and 2 others persons

2. Political and Economic Conditions in Vietnam

(1) National indicators, political system and economic indicator

1) National indicators

Country name:	Socialist Republic of Vietnam
Area:	331,688 km^2 (approx. 0.87 times the area of Japan)
Population:	Approx. 78.69 million (as of the end of 2001) Hanoi: 2.72 million, Ho Chi Minh: 5.13 million
Capital city:	Hanoi
Ethnic distribution:	Vietnamese group (87%), Chinese (1.3%), Khmer (Cambodian) (1%) and others for a total of 50 ethnic groups mainly residing in mountainous areas
Languages:	Vietnamese (official language spoken by approximately 90% of the population)
Religion:	80% Mahayana Buddhism, 9% Catholic, Cao Dai, Hoa Hao and others
Climate:	Sub-tropical climate in the north Tropical monsoon in the south

2) Political system

Form of government:	Socialist Republic
Head of state:	Tran Duc Luong (inaugurated in September 1997)
Political parties:	Communist Party of Vietnam (Single party)
Chairman of the Communist party:	Nong Duc Manh (Elected in May 2002)
Legislature:	National Assembly: unicameral with 5-year terms, consisting of 498 seats) National Assembly Chairman: Nguyen Van Anh
Administration:	Prime Minister Phan Van Khai (inaugurated in September 1997)
Administrative district:	4 directly administered cities, 57 provinces
Governmental ministries and departments:	Office of Government, Ministry of Defense, Ministry of Police, Ministry of Foreign Affairs, Ministry of Justice, Ministry of Planning and Investment, Ministry of Finance, Ministry of Commerce, Ministry of Agriculture and Rural Development, Ministry of Transportation and Communication, Ministry of Construction, Ministry of

Industry, Ministry of Fishery, Ministry of Labor, War Invalids and Social Affairs, Ministry of Science, Technology and Environment, Ministry of Culture and Information, Ministry of Education and Training and Ministry of Public Health and Welfare

3) Economic indicators

Item	Unit	1996	1997	1998	1999	2000	2001
GDP (Nominal)	billion VND	272,036	313,623	361,468	399,942	444,646	484,493
Actual GDP growth rate	%	9.3	8.2	5.8	4.8	6.8	6.8
GDP per capita	US$	311	320	340	372	390	391
Rate of increase in consumer prices (compared with the end of December)	%				0.1	-0.6	0.8
Exports	million US$				11,541	14,483	15,027
Imports	million US$				11,742	15,637	16,162
Exports to Japan	million US$				1,786	2,575	2,510
Imports from Japan	million US$				1,618	2,301	2,215
Direct investments received	million US$				1,567	1,989	2,472

Current balance (balance of international payments base)	US$563 million in 2000
Trade balance (balance of international payments base)	US $500 million in 2000
Foreign currency reserves	US$3,674.57 million in 2001
Outstanding foreign debt	US$12,787 million in 2000
Exchange rate (term average) against the US$	US$14,725.2 in 2001
Exchange rate (term-end value) against the US$	US$15,084 in 2001

Reference: "'99 Latest Vietnam Statistics"; Vietnam Economic Research Institute, data from Vietnam Statistics Bureau

(2) Political condition

The policy of economic reforms (Doi Moi) centering around the transition from a centralized planned economy to a market economy was implemented following its approval by the sixth Communist Party Congress in 1986. The Doi Moi policy can be broken down into the following four points.

- Re-evaluation of socialist policy line
  A break from the traditional line of extremist radical socialism

- Change in industrial policy

  The previous policy to prioritize the heavy industry was reexamined, and the present a policy more prioritize the agriculture and light industry. Of these, the three items of food and food products, consumable goods and import substitutes were targeted for increased production, with 60% of all investments concentrated in these industrial areas, to facilitate their growth.
- Introduction of a market economy

  Introduction of market mechanisms was introduced to facilitate economic reform. Diverse forms of ownership are tolerated, with the traditional centralized form of planned re-distributive economy reexamined.

  The existence of managerial arrangements other than national and public entities such as capitalist management and private management is tolerated.
- Participation in international cooperation

  Enthusiastic participation in international regimes of specialization and cooperation. Contribution not only to peace on the Indo-China Peninsula, but also to achieving world peace and global economic growth is aimed at. (From a conflict coexistence stance)

Under this policy, reforms have been enhanced since 1988, namely the establishment of new foreign capital legislation, financial and banking reforms, reforms of national corporations, deregulation of production and distribution, deregulation of price control, and deregulation of controls on trade and foreign exchange, etc. This movement has been accelerated significantly along with the generation change in political leadership and the law amendment that took place in 1998.

In the 9th Communist Party Assembly in 2001, the succession of the previous basic policy of maintaining the socialist regime controlled by the Communist Party as the single political party and continuing “Doi Moi (reforms)” line was confirmed while streamlining of the leadership of the party through various measures for eradicating corruption of the party members, the reduction in the number of regular staff of the Central Committee and political bureau, etc. was proposed. In this Congress, Nong Duc Manh, Speaker of National Assembly, was elected the new Chairman of the Party.

(3) Foreign relationships

The country joined the United Nations in 1977. In 1995, the country normalized relations with the United States. Following the war with China, relations with its northern neighbor were normalized in November of 1991. Vietnam joined ASEAN in 1995 and APEC in 1998. Although membership of the WTO has been sought since they applied for it in January 1995, the country was required by the WTO to reform the import/export license system, are still in the process of preparing.

As for realization of AFTA (the ASEAN Free Trade Area), which is Vietnam’s gateway to international trade, the country has agreed, in principle, in 1999, to reduce duties on trade within the area to 5% or below by 2003, and with certain exceptions, to eliminate import duties levied on all products in principle by 2015.

(4) Economic conditions

The export of primary products such as crude oil and rice had been in good condition for the period from 1992 to 1996. At that time, the domestic demand expanded, mainly owing to direct investment from foreign countries and private-sector consumption, thus the country registered a real GDP average growth rate of 8.9%. In the first half of 1997, while the growth of domestic private-sector consumption temporarily declined and the economic growth tended to slow down, an economic growth rate of 9% was achieved with an extremely low inflation rate. Affected by the Asian economic crisis, however, the growth rate leveled off at 5.8% in 1998 and 4.8% in 1999 because of a slump in exports and a decrease in direct investment from foreign counties. In 2000, the growth rate picked up to 6.7% due to the expansion of business in the mining and industrial sectors and for other positive reasons and showed a steady growth rate of 6.8% in 2001 while other ASEAN economies were slowing down due to a slump in the IT industry.

With agriculture as the main industry (23% of GDP, employing 72% of total labor force), the primary industry also including fishery, forestry, mining (petroleum, anthracite, apatite, iron ore, chrome ore, tin ore) are the main locomotives of the economy. Although industrialization has been promoted since the adoption of the Doi Moi Policy, the DGP rate of growth in both industry and agriculture has been declining since 1995. GDP per capita reached US$ 350 in 1999, but this is only one-tenth that of the leading nations such as Thailand and Malaysia. The effect of the Asian economic crisis was small when compared to other Southeast Asian nations, as trade had not been completely opened.

Trade, which consists of the export of the primary products and the import of the secondary and tertiary products, is that of a typical agricultural country. As for the trading, the main export items include clothes, textiles, crude oil, rice, footwear and so on, while the import items include machinery, petroleum products, fabrics and so on.

The Foreign Investment Law (concerning the investment from other countries) was revised in November 1996, to adopt measures, including the reduction of assessment period (from 90 days to 60 days), unification of the investment license and operation registration certificate, and transfer of investment approval rights to certain domestic authorities. The revision of the taxation system enforced in January 1999 has incorporated many measures devised to address long-standing problems. The effectiveness of such measures will be evaluated by future foreign investment trends.

(5) Privatization of state-run enterprises

The policy to introduce a market economy after the adoption of the Doi Moi policy has led to the approval of the existence of capitalistic and individual private forms of management other than national and public management, thereby facilitating the privatization (incorporation) of state-owned and public enterprises. The number of state-owned enterprises in 2000 was 5,280. According to the 1999 statistics, the breakdown in form of management of gross production by domestic enterprises was 40% for state-owned enterprises, 9% for joint-ventured enterprises, 41% for private enterprises and households combined, and 10% for foreign-affiliated companies. Almost half of gross production is associated with state-run enterprises.

By 1999, 300 national and public enterprises had been privatized (only 24 of which had been owned and operated by the Ministry of Industry; a very low rate), and additional 320 enterprises plan to be privatized by 2000. Moreover, it is planned that the number of national and public enterprises will be cut to 3000 by 2003 and to 2000 by 2005 through the mergers and closures.

3. Procedure of Energy Audit for Buildings

3.1 General Process

The energy audit for buildings is generally proceeded in the 6-step sequence described below.

In STEP 1 and STEP 2, general information and data on the building and equipment concerned are collected and the energy consumption data obtained is analyzed.

In the present audit, the participants collaborated with Japanese experts in STEP 1 to 3. In the wrap-up meeting held on completion of the 1st site survey, ECCJ specialists outlined points for improvement for STEP 4. In the interim report meeting in the 2nd site survey, then the results of the study on the methods of improvement and expected effects were explained, and for further confirmation, additional surveys were conducted. This report reflects the results of the 2nd site survey.

- STEP-1 Gathering and confirming general information and data on the building
- STEP-2 Gathering and confirming general information and data on the equipment
- STEP-3 Gathering and evaluating data on energy consumption
- STEP-4 Identifying points for improvement by data analysis and evaluation
- STEP-5 Studying recommendations for improvement including expected effects
- STEP-6 Determining and explaining the recommendations to be implemented

3.2 Description of Each Step

Major survey items of each step are as follows:

(1) STEP-1 Gathering and confirming general information and data on the building

1) Year of construction completed
2) Size: Gross floor area (area for major use, indoor parking area), Number of stories, structure
3) Use
4) Owner
5) Number of employees, Number of clients (business days, holidays), and other items

(2) STEP-2 Gathering and confirming general information and data on the equipment

1) Air-conditioning systems, electrical systems, sanitary facilities, etc.
2) Specifications of equipment
3) Operation management status: Operating hours, setting of room temperature, and other items

(3) STEP-3 Gathering and Evaluating data on energy consumption

1) Monthly energy consumption
2) Changes in yearly energy consumption
3) Energy consumption by day of the week
4) Energy consumption by hour of the day
5) Energy consumption by use
6) Data on water consumption, and other items

(4) STEP-4 Identifying points for improvement by data analysis and evaluation

1) Comparison of the total energy consumption of the building concerned with that of similar buildings
2) Comparison of its energy consumption by use with that of similar buildings
3) Analysis of its monthly energy consumption trends
4) Analysis of changes in energy consumption for a period of several years
5) Analysis of its energy consumption by day of the week and hour of the day
6) Confirmation of room environment: Temperature, humidity, CO_2 concentration, luminance
7) Confirmation of operation log: Operation status during peak load hours, operation status during light load hours, Number of equipment units in operation, operation time and operation temperature conditions
8) On-site inspection: Operation status of equipment, temperature indicators, ammeters, voltmeters and power factor indicators, valve condition, damper condition, heat insulation, layout of equipment, maintenance of equipment and piping
9) Determination of how the facilities and equipment are actually used: Density of people in a room, condition of OA equipment, identification of locations of energy loss, and other items

(5) STEP-5 Studying recommendations for improvement including expected effects

1) Studying improvement plans: Application of other successful improvement cases and most-advanced technologies
2) Estimation of effects for improvement: Reduced energy consumption and costs
3) Estimation of costs for improvement

(6) STEP-6 Determining and explaining the recommendations to be implemented

1) Determination of the recommendations to be applied
2) Preparation of a report
3) Explaining the report

3.3 On-site Auditing Procedure

The energy audits for the building concerned were conducted in accordance with the following procedure.

(1) Interviewing
  1) General description of the building
  2) General description of the equipment
  3) How the building is used and the operation status of equipment
  4) Data and information on overall energy use

(2) Confirmation on drawings and reference materials
  1) Building design drawing
  2) Equipment drawings including drawings of air-conditioning systems, electrical systems and sanitary facilities
  3) Operation log
  4) Energy consumption data
  5) Room environment data

(3) On-site confirmation
  1) Typical room
  2) Machine room
  3) Electrical room
  4) Outdoor facilities and equipment (placed on rooftop and on the ground)

(4) Simple measurements (if possible)
  1) Temperature, humidity and luminance
  2) Electric current
  3) CO_2 concentration, etc.

4. Audits of Buildings in Vietnam

4.1 Hotel Nikko Hanoi

(1) Outline of the building

1) Name: Hotel Nikko Hanoi

2) Use: Hotel (260 rooms)

3) Size: 1 basement and 17 floors above the ground
Total floor area; 29,164 m^2

4) Age of the building: 4.5 years

5) Outline of electrical systems:
Receiving voltage 10 kV, Transformer capacity 1,500 kVA × 2 sets
Power generator 810 kVA × 2 sets (water-cooled type)
Elevator 18 kW × 3, Service elevator 18 kW × 1 set

6) Outline of air-conditioning systems:
Turbo chiller 300 RT (199 kW) × 3 sets,
Air-conditioning equipment + fan coil unit system

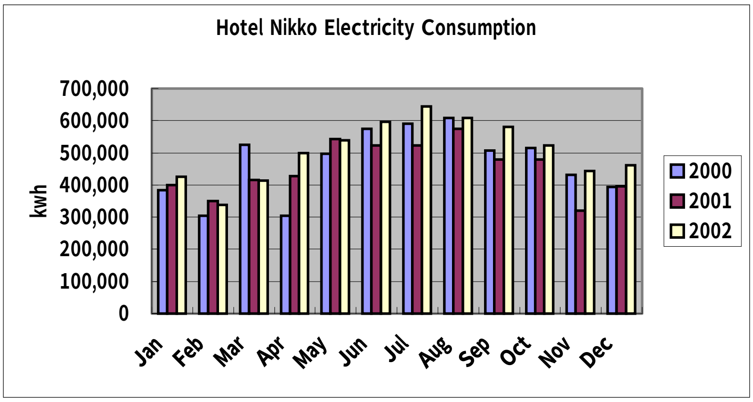
7) Sanitary facilities:
Steam boiler (diesel oil) 8 kg/cm^2 × 2,400 kg/h × 2 sets,
Water receiving tank 225 m^3 × 2 sets (city water, well water), Lifting pump 30 kW × 2 sets, Lifted water tank 100 m^3

(2) Analysis of current energy consumption status

1) Monthly energy consumption

a. Power consumption (2000-2002)

As the graph below shows, power consumption peaks around in July and drops most in February throughout each year. The power consumption in February 2002 was almost 52% of that in July 2002.

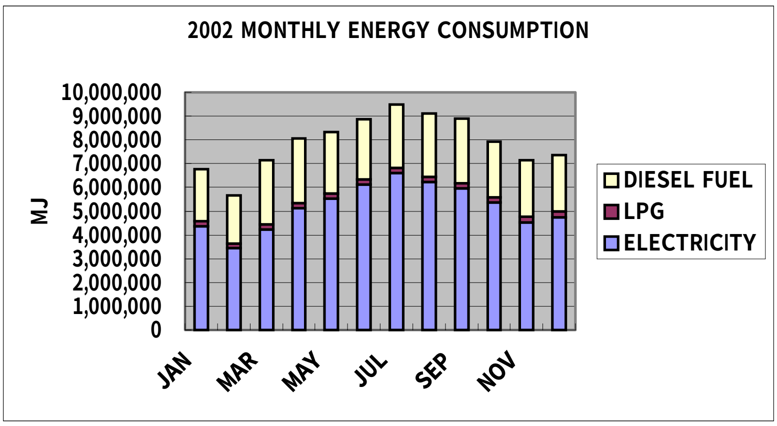


b. Total energy consumption (2002)

The graph below shows monthly total numbers of electricity, diesel oil and LPG consumptions using the respective conversion factors in the following table. (Note: The conversion factor for electricity is the number currently used in Japan, which has been derived taking power generation efficiency at the power plant, etc. into account. Therefore the conversion factor for Vietnam should be determined separately. The conversion factor used herein is derived through dividing power unit (1 kWh = 3.6 MJ) by the average power generating efficiency of approximately 35% at power companies in Japan.)

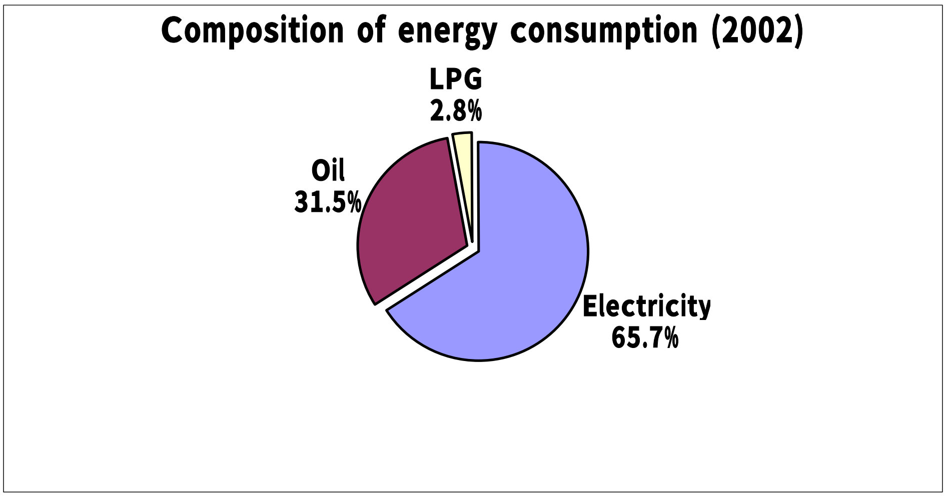
According to the graph, electricity consumption changes from month to month while changes in diesel oil and LPD consumptions are small. Total energy consumption also peaks in July and hits the bottom in February.

	Primary energy conversion factor	
Electricity	10.256	MJ/kWh
Diesel oil	38.937	MJ/L
LPG	27.617	MJ/L

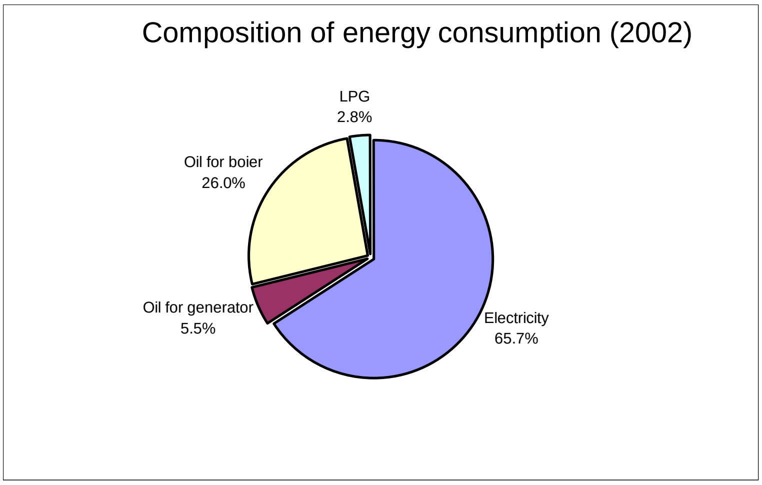


2) Energy composition by type

In Hotel Nikko Hanoi, electricity, diesel oil and LPG are the energy sources. The percentage of each energy consumption is shown in the circular graph below. Electricity and diesel oil consumptions respectively respectively share about 66% and 32% of the total while the consumption of LPG currently used only for kitchen shares only 2.8%.



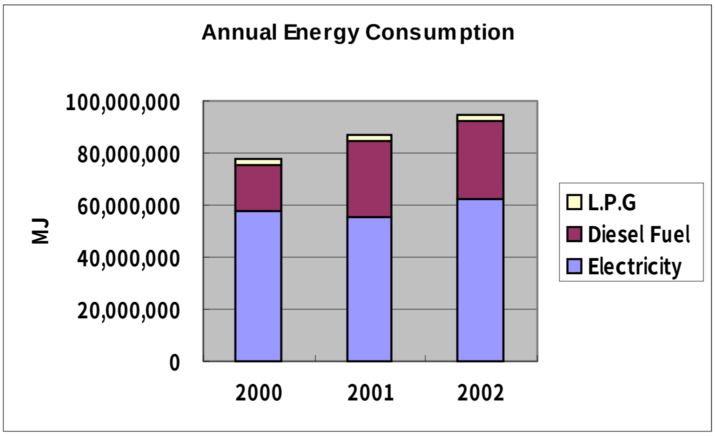
Diesel oil is used for boilers and power generators, and its breakdown is as shown in the graph below. As shown in the graph below, oil for boilers accounts for 26% of the total energy consumption. Boilers are used for supplying hot water, steam for laundry and heat source for air-conditioning. In order to reduce the overall energy consumption, the efficient boiler operation is essential.

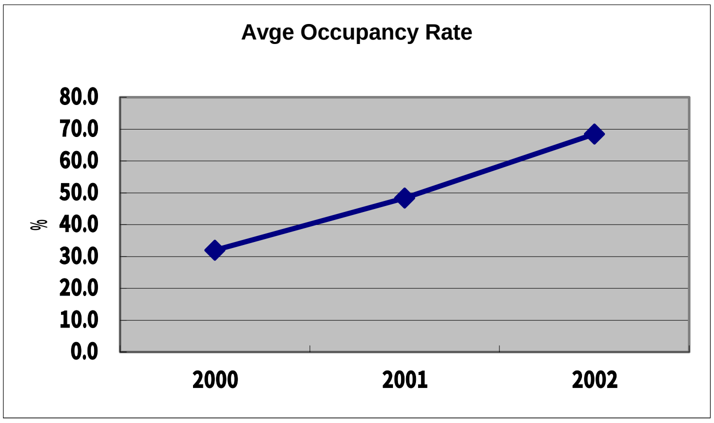


3) Trends of yearly energy consumption and occupancy rates of the hotel

Changes in the energy consumption and occupancy rates of the hotel during the past 3 years are shown below.

If the total energy consumption in 2000 is normalized at 100, those of 2001 and 2002 are respectively 112 and 122. As the annual average occupancy rate increased from 31.9% to 48.3% and up to 68.5%, increases in the total energy consumption can be explained by the increase in the occupancy rate.





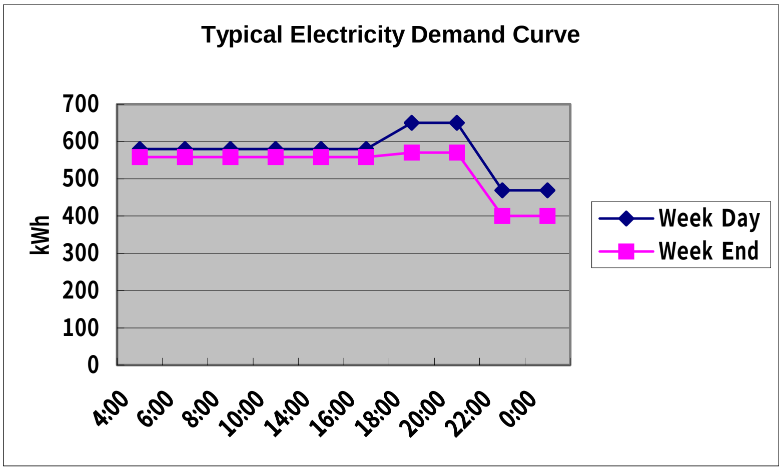
4) Daily power consumption

Typical 24-hour electricity demand curves for weekday and weekend are shown below.

In weekdays, the peak of electricity demand appears at between 18:00 and 20:00 and the hourly fare of electricity is most expensive during three hours of a day. Measures to reduce power consumption during these hours of the day will, therefore, critically impact the total electricity costs.

In fact, power generators have been in operation during these hours, which contribute to reducing electric power costs. This fact proves high management capability of technical managers.

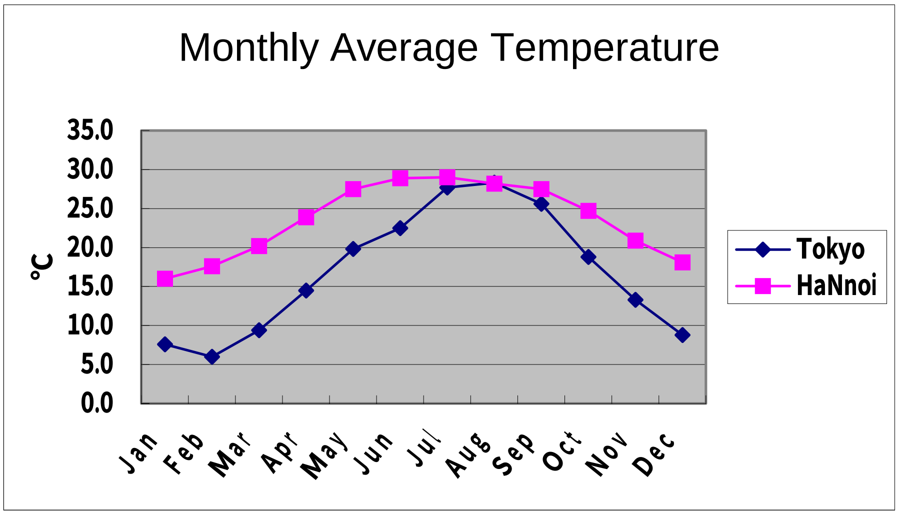
As power consumption is high also for early hours in the morning, some measures for this time period should be studied.



5) Comparison with other buildings

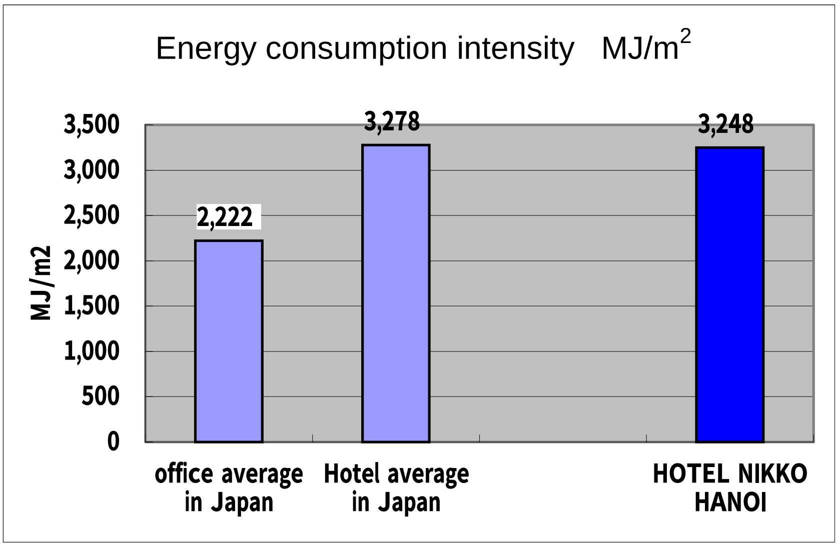
a. Comparison of ambient temperatures between Hanoi and Tokyo

As no comparable data for evaluation of energy consumption was available for Hanoi, ambient temperatures that affect energy consumption for air-conditioning systems were compared prior to comparing energy consumption per unit area for the hotel with that of buildings in Japan. Monthly average ambient temperatures in Tokyo and Hanoi are shown below.



b. Comparison of energy intensity with that of buildings in Japan

While the average energy intensity value for hotels in Japan is 3,278 MJ/m^2, the value for Hotel Nikko Hanoi is 3,248 MJ/m^2. Both are little different. It is estimated that the value is almost the same as Japanese because this hotel was designed by a Japanese design firm and mainly used by Japanese guests.

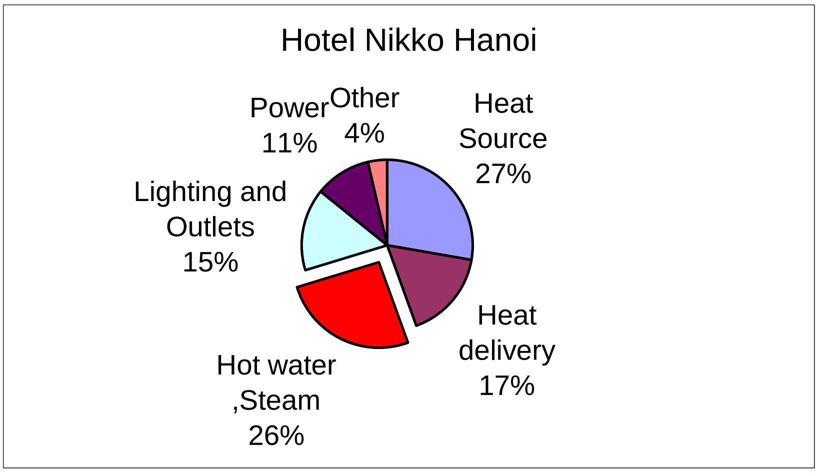


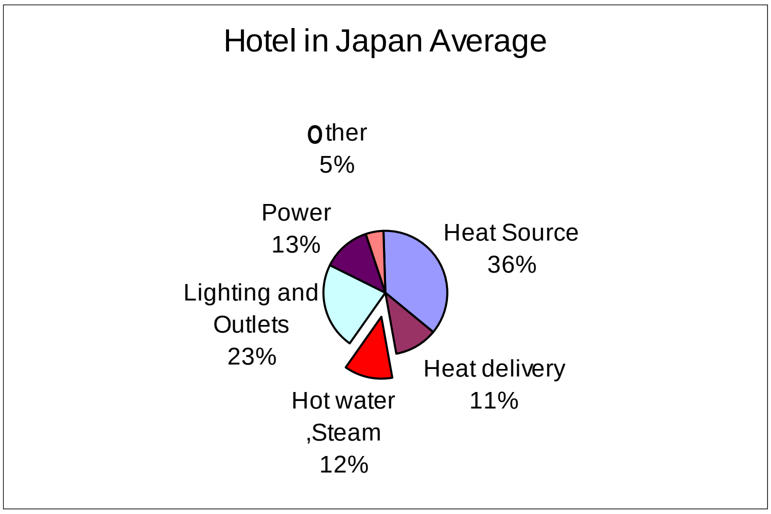
c. Comparison of energy consumption by use

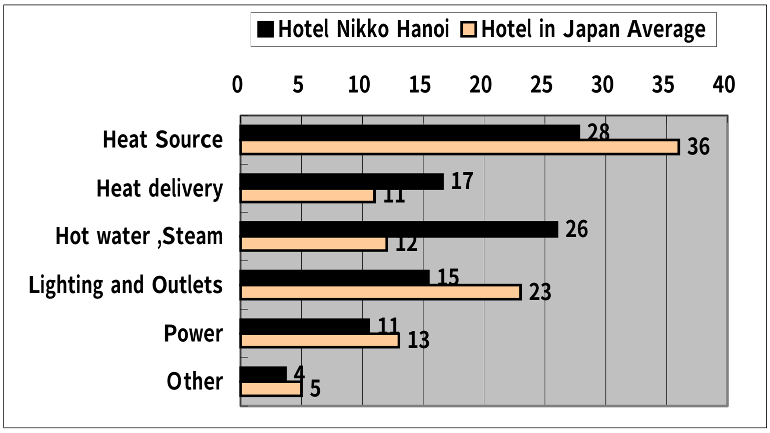
Hotel Nikko Hanoi's energy consumption by use, which was calculated based on the equipment specifications and their operating hours, is shown below. The typical energy consumption for hotels in Japan is also shown for comparison.

In comparison of the both graphs, energy consumption for "Hot water/steam" at Hotel Nikko Hanoi is 26% while the hotel in Japan average is 12%, which shows a great difference. In addition, in the item of "Heat transportation", Hotel Nikko Hanoi shows a larger value. Accordingly, it would be appropriate to study for improvement focusing on these items.

The bar chart that more clearly shows the comparison of energy consumption by use is also shown below.





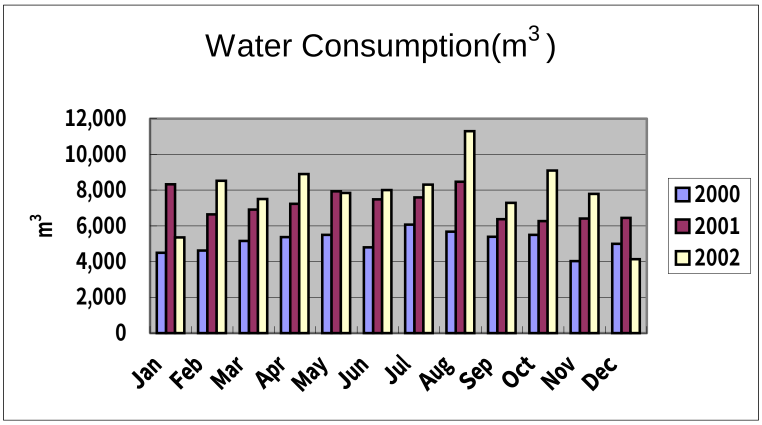


6) Water consumption data

a. Monthly water consumption

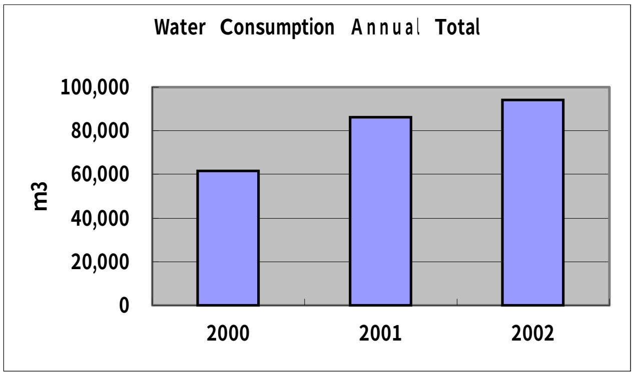
Monthly water consumptions for three years from 2000 to 2002 are shown below.

A water consumption in August 2002 seems an abnormal data. Water consumption is increasing year by year.



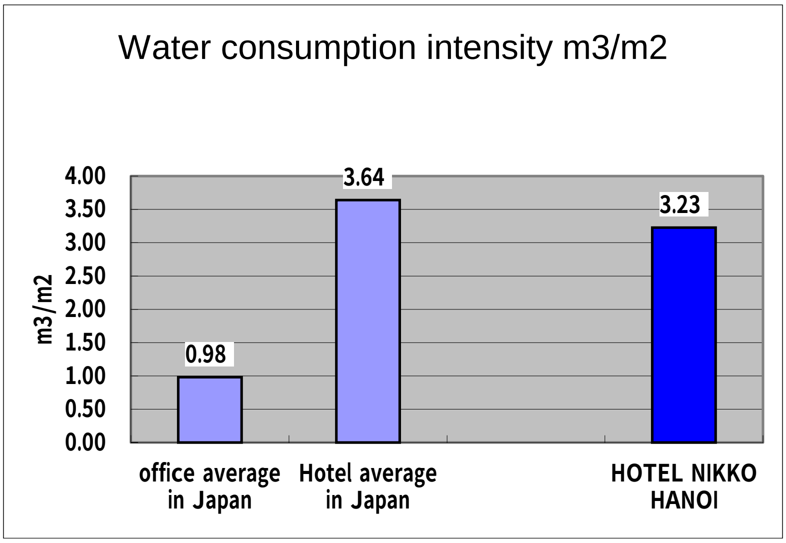
b. Trends of yearly water consumption

Yearly water consumptions were graphed below. If the water consumption in 2000 is normalized at 100, those in 2001 and 2002 are respectively 140 and 153. As mentioned previously, beeause the hotel's occupancy rate is growing year by year, this upward trend can be explained.



c. Comparison with other buildings

The water consumption for the total floor area, or water consumption intensity, should be checked for evaluating water consumption. However, as no comparable data was available in Vietnam, data of Hotel Nikko Hanoi was compared with the data for buildings in Japan investigated by ECCJ. Water consumption intensity of Hotel Nikko Hawai is 3.23 m^3/m^2 while that of Japanese hotel shows 3.64 m^3/m^2, resulting in almost no difference. It is probable that the value of Hotel Nikko Hanoi is similar to the average number for hotels in Japan because it is used by a large number of Japanese guests.



(3) Points for improvement and calculation of expected effects

1) Improvement in the temperature of chilled water

Current condition

Chillers are in automatic operation with a chilled water outlet temperature set at 7°C.

Proposed improvement

Raising the chilled water outlet temperature during the season of low cooling load to achieve a higher efficiency operation of chillers

Formula

(Power consumption by chillers) × (a saving rate as the result of improvement in the chilled water outlet temperature)

Estimation of effects

a. Conditions for estimation

Seasons of low cooling load	6 months from January to March and October to December
Chilled water outlet temperature (current temp. → improved temp.)	7°C → 10°C
Saving rate due to an improvement in the chilled water outlet temperature	7% (based on the reference material)
Average load factor during the low-cooling-load seasons	80% (Based on one chiller in operation) (Although there are 3 chillers, all three chillers are in operation for only 2 or 3 days throughout the year. Mostly one chiller is in operation when cooling load is light.)

Power of chiller 209 kW

Electricity cost 4:00~18:00 (14h) 1400 VD/kWh

18:00~22:00 (4h) 2360 VD/kWh

22:00~4:00 (6h) 760 VD/kWh

Average cost 1400 VD/kWh

b. Calculation

Reduced power consumption

209 × 0.8 × 24 × 30 × 6 = 722,304 kWh

722,304 × 0.07 = 50,561 kWh

Reduced cost

50,561 × 1,400 = 70,785,400 VD

Assuming 1US$ = 15,000 VD (1US$ = J¥120),

70,785,400 ÷ 15,000 = 4,719US$ (J¥566,280)

Reference data

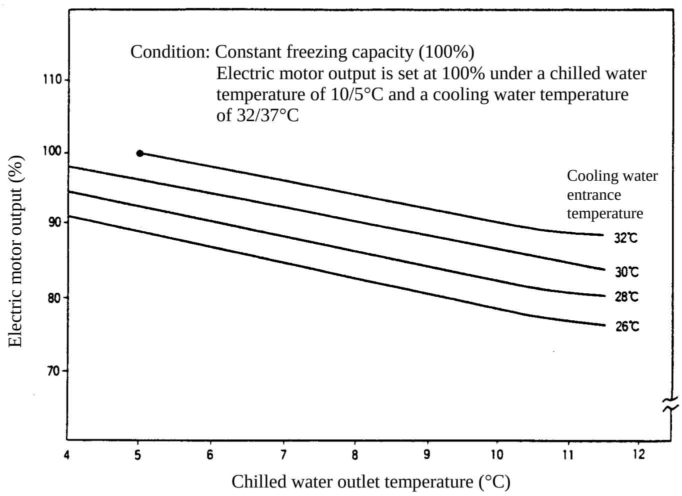


Figure 3.3 Electric Turbo Chiller
Relations among chilled water temperature, cooling water temperature and electric motor output

2) Adoption of a variable flow rate system for cold water pumps

Current condition

Three secondary cold and hot water pumps are installed and the number of pumps to operate is controlled depending on the volume of cold and hot reflux.

Proposed improvement

Adopting control of the number of operating pumps and the inverter control method to reduce pumps' power consumption

Formula

(Pump capacity) × (an inverter reduction rate) × (operating hours)

Estimation of effects

a. Conditions for estimation

Secondary cold/hot water pump capacity	55 kW × 3 sets
Pumps operating hours	24 hours × 365 days = 8,760 h

Assuming the pump's rotation frequency is reduced to 75% on the average after inverter installation.

Change in power rate	0.75 × 0.75 × 0.75 = 0.42
Power reduction rate	1 – 0.42 = 0.58

b. Calculation

Reduced power consumption

55 × 0.58 × 8,760 = 279,444 kWh

Reduced costs

279,444 × 1,400 = 391,221,600 VD

391,221,600 ÷ 15,000 = 26,081US$ (J¥3,129,720)

3) Improvement in air ratio for boiler

Current condition

Although two oil burning steam boilers are in operation, the air ratio is not controlled by measurement.

Proposed improvement

Measuring air ratios and determining on the proper ratio

Formula

(Oil consumption for boiler) × (Reduction rate by air ratio improvement)

Estimation of effects

a. Conditions for calculation

Current air ratio	Assumed at 1.5
Target air ratio	1.2
Improved air ratio	0.3
Waste gas temperature	Assumed at 200°C
Reduction rate after improvement	3.0%
Yearly oil consumption for boiler	633,081 liters
Oil price	0.22 $/liter

b. Calculation process

Reduced oil consumption after improvement in air ratio

633,081 × 0.03 = 18,992 L

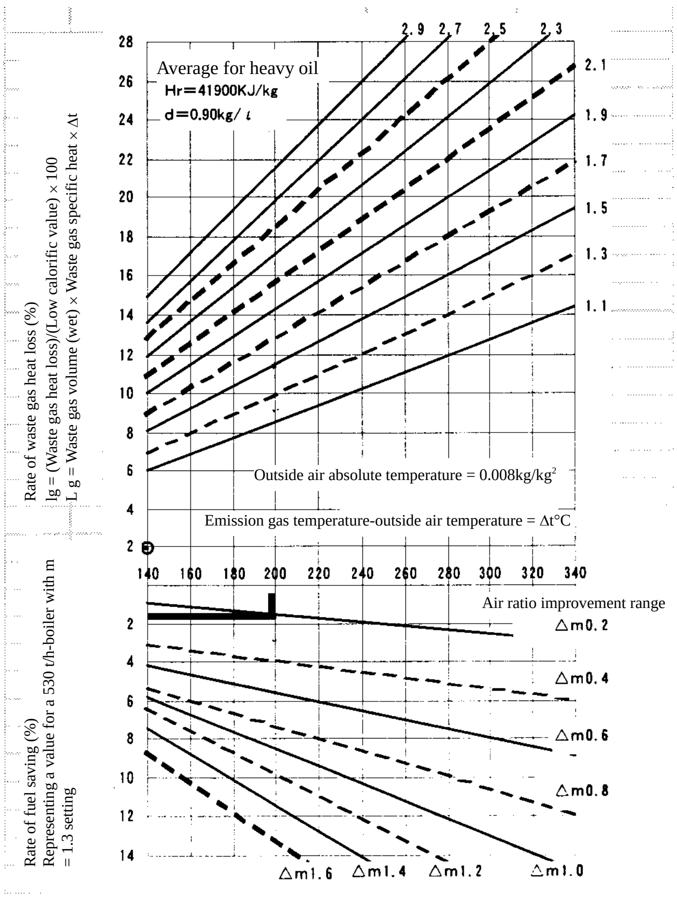
Reduced cost

18,992 × 0.22 = 4,178US$ (J¥501,360)

Reference data

Relation between rate of waste heat loss for boiler and rate of fuel reduction by improvement in air ratio

(2) Boiler emission gas heat loss rate and fuel saving rate by air ratio improvement rate



4) Replacement by high-efficiency lamps and lighting fixtures

Current condition

Although high-efficiency lighting fixtures are installed in most parts of the building, the following conventional types of lamps are still used in guest rooms and corridors of the guest room floors.

Guest room	100 W lamp	12 units/floor × 11 floors
	60 W lamp	12 units/floor × 11 floors
Corridor ceiling	60 W lamp	6 units/floor × 11 floors
Corridor walls	40 W lamp	3 units/floor × 11 floors

Proposed improvement

Replacing 100 W of lamps with 23 W of lamps, and 60 W and 40 W of lamps with 7 W of high-efficiency lamps respectively

Formula

(Power saving by high-efficiency lamp) × (No. of replacements) × (lighting hours/day) × (occupancy rate) × 365 days

Estimation of effects

a. Conditions for estimation

Lighting hours:	3 h/day for guests rooms
	24 h/day for hallway ceilings
	10 h/day for hallway walls

Guest room occupancy rate: 70%

b. Calculation

Guest rooms 100 W	(100 – 23) × 132 × 3 × 0.7 × 365 × 1/1000 = 7,791 kWh
Guest rooms 60 W	(60 – 7) × 132 × 3 × 0.7 × 365 × 1/1000 = 5,362 kWh
Corridor ceilings 60 W	(60 – 7) × 62 × 24 × 1 × 365 × 1/1000 = 28,785 kWh
Corridor walls 40 W	(40 – 7) × 35 × 10 × 1 × 365 × 1/1000= 4,216 kWh
	Total 46,154 kWh

Reduced cost

46,154 × 1,400 = 64,615,600 VD

64,515,600 VD ÷ 15,000 = 4,308US$ (J¥516,960)

5) Improvement in the insulation of steam pipes and valves

Current condition

Some parts of steam pipes, valves, flanges are not insulated and have caused energy loss due to heat radiation therefrom.

Proposed improvement

Insulating steam pipes and valves to prevent heat loss caused by heat radiation from bare pipes

Formula

Length of bare pipe × heat loss/unit length × operating hours

Estimation of effects

a. Conditions for estimation

The surface area of valves is assumed to be equivalent to 1.2m of a straight tube having its nominal diameter

No. of steam valves	0.8 MPa 100 A 6
	0.2 MPa 100 A 11
Radiated heat	100 A, 0.8 MPa, 0.95 kW/m = 3.42 MJ/mh
	100 A, 0.2 MPa, 0.6 kW/m = 2.16 MJ/mh
Boiler efficiency	70%
Calorific heat of diesel oil	38.937 MJ/ l
Operating hours	8,760 h

b. Calculation process

Reduced heat loss after insulation work

(6 × 1.2 × 3.42 + 11 × 1.2 × 2.16) × 8,760 = 465,471 MJ

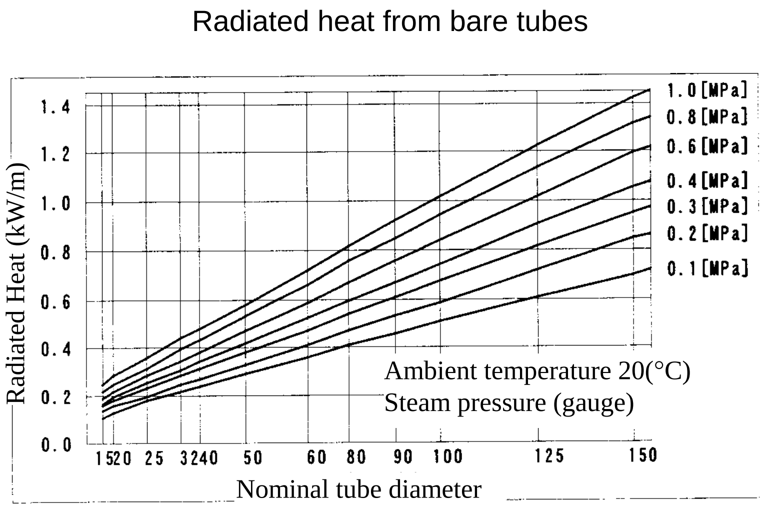
Reduced oil per year

465,471 ÷ 38.973 ÷ 0.7 = 17,062 L

Reduced cost

17,062 × 0.22 = 3,754US$ (J¥450,480)

Reference data



Comment

At the time of the second site survey in February, the insulation work of valves had already been completed as shown in the photo below. The Japanese experts felt that such a prompt reaction reflected their strong awareness of energy conservation.

6) Heat recovery from cooling water of power generator

Current condition

Although the operation of diesel power generators during the hours with an expensive electricity price contributes to reduction in power cost, exhaust heat has not been reused.

Proposed improvement

Recovering exhaust heat that is released at the cooling tower to preheat water for hot-water supply.

By leading the cooling water piping, which goes toward the cooling tower on the rooftop, up to the heat exchanger newly installed nearby the lifted water tank for heat exchange with makeup feed water going to the hot-water storage tank for a purpose of heat recovery.

Estimation of effects

a. Conditions for calculations

Specifications of cooling water pump for power generator

575.4 L/min × 70 m× 15 kW

Power generators' oil consumption

125 L/h (calorific value 38.937 MJ/L, oil unit price 0.22US$/L)

Power generators' operating hours: 4 h/day and 232 days/year

Boiler efficiency 0.85

Temperature difference of heat recovery at heat exchanger:

assumed at 5°C

b. Calculation

575.4 × 5 × 60 × 4.1868 × 4 × 232 ÷ 1,000 = 670,689 MJ/year

670,689 ÷ 085 ÷ 38.937 = 20,265 L

20,265 × 0.22 = 4,458US$/year (J¥534,960/year)

(4) Summary of effects of improvement

Comparison standard: Power consumption in 2002 6,072,900 kWh

Diesel oil consumption for boiler in 2002 633,081L

		Reduced electric power		Reduced oil		Cost effect	
		kWh	%	L	%	US$	J¥
1	Improvement in the temperature of chilled water	50,561	0.8	–	–	4,719	566,000
2	Adoption of a variable flow rate system for cold/hot water pumps	279,444	4.6	–	–	26,081	3,129,000
3	Improvement in air ratios for boiler	–	–	18,992	3.0	4,178	501,000
4	Replacement by high-efficiency lamps and lighting fixture	46,154	0.8	–	–	4,308	517,000
5	Heat insulation of steam pipes and valves	–	–	17,062	2.7	3,754	450,000
6	Heat recovery from cooling water of power generator	–	–	20,265	3.2	4,456	535,000
	Total	376,159	6.2	56,319	8.9	47,496	5,181,000

4.2 Lake Side Hotel

(1) Outline of the building

1) Name: LAKE SIDE HOTEL

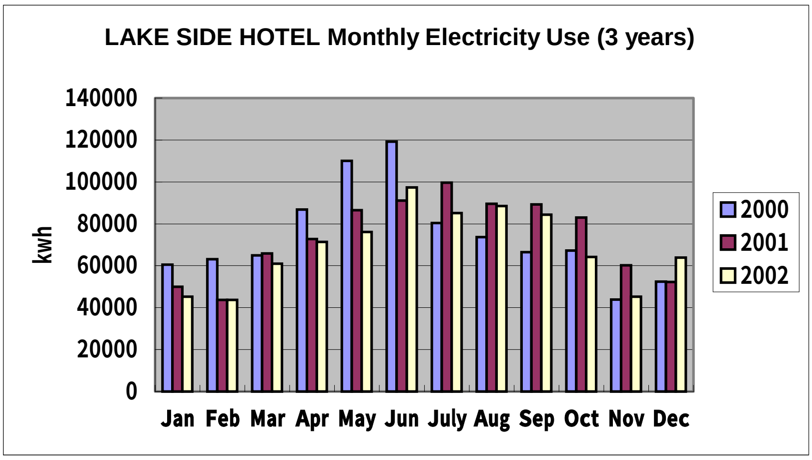
2) Use: Hotel (76 rooms)
3) Size: 5 floors above the ground without basement
Total floor area; 6,981.1 m^2
4) Age of the building: 8 years
5) Outline of electrical systems:
Receiving voltage 20 kV, Transformer capacity 1,000 kVA
Power generator (for emergency use) 800 kVA
Elevator 10.2 kW × 2 sets
6) Outline of air-conditioning systems:
Chiller 74 kW × 3 sets, fan coil unit system
7) Sanitary facilities:
Hot-water supply system: solar panel (96 panels) + electric boiler (162 kW)
Hot-water storage tank: approx. 5,400L × 4 sets

(2) Analysis of current energy consumption status

1) Monthly power consumption (2000-2002)

Monthly power consumptions for the period from 2000 to 2002 are shown in the figure below.

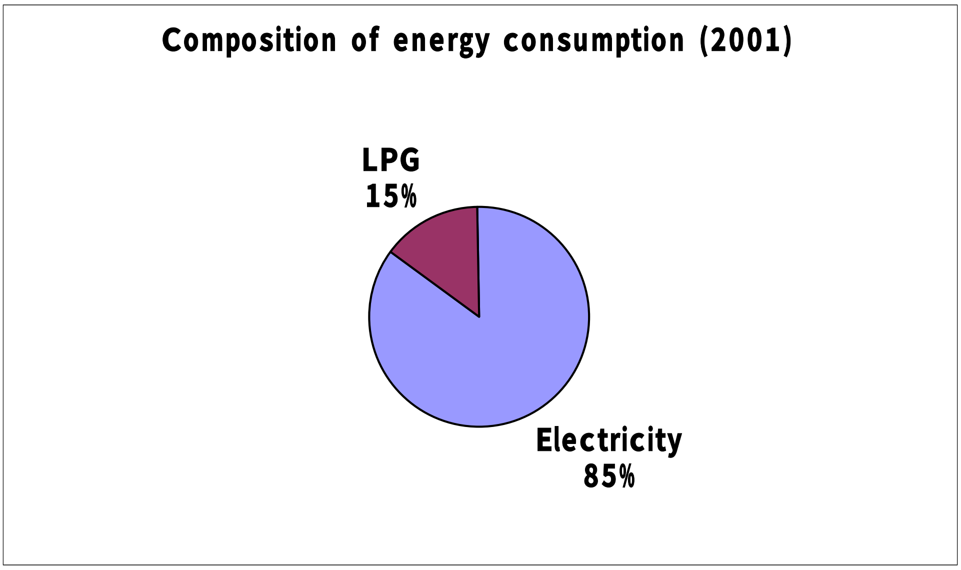
In the graph for the fiscal year of 2000, it is notable that there is a large difference in electricity use in June and July. According to the interview to the technical engineers, bulbs of lighting fixtures were changed to energy-saving type of bulbs and a campaign for switching power off at unnecessary times was started. The change in electricity use from June to July of 2000 clearly reflects the results of their energy conservation activities. In the graphs for the fiscal years of 2001 and 2002, the peak of power consumption comes in June or July and the bottom comes in February or November.



2) Energy composition by type

a. Composition ratio based on converted calorific values

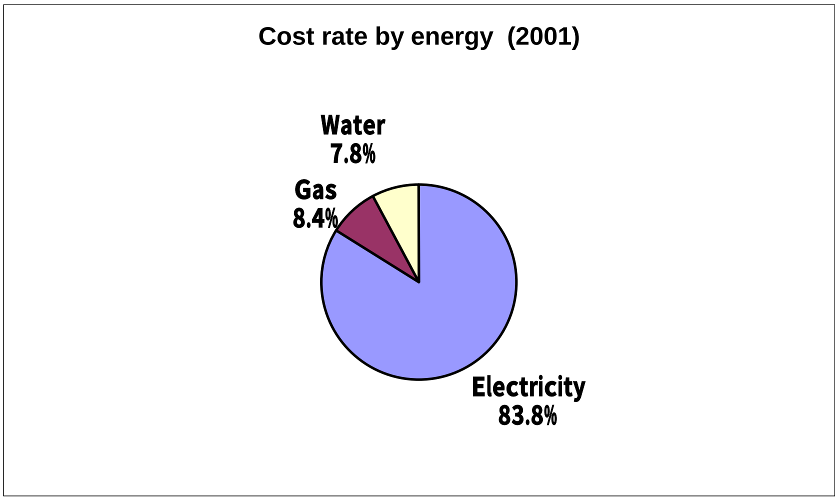
Electricity and LPG were converted into primary energy calorific values and their composition ratios against their combined total are shown in the circular graph below. Electricity makes up 85% of the total and LPG used for kitchen accounts for 15%. The consumption of oil for an emergency power generator was disregarded here because its amount was too small to make little difference to the result.



b. Composition of cost rate by energy (2001) ~ including water

The rate of energy cost including water cost is shown in the graph below. Electricity accounts for about 84% of the total cost. The average unit price of electricity for calculation is 0.18US$/kWh, which is as double expensive as the unit price for Hotel Nikko Hanoi, which is 0.09US$/kWh.

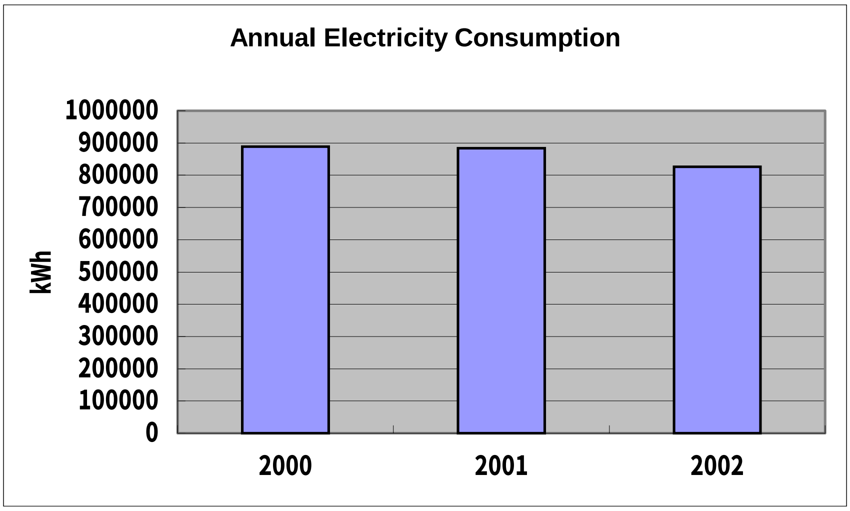
As this difference seems to come from the difference in conditions of the power contract, the possibility for improvement should be sought for by reviewing the power contract in the future.



3) Trends of yearly power consumption trends

Changes in power consumption for the past three years are shown below.

Power consumption has decreased year by year probably owing to improvements made for energy conservation in 2000 including employees' energy conservation efforts. In the meantime, the hotel's occupancy rate has continued to grow from 75% in 2000 to 82% in 2001 and 90% in 2002. It is clear that energy conservation efforts have achieved an effect that was more than the effects by an increase in the hotel's occupancy rate.



4) Energy Consumption by use

The following table shows the energy consumptions by use for Lake Side Hotel, which is calculated based on the equipment specifications and operating time. The power consumption in 2001 is calculated for comparison, assuming that the summer is between April and October and the winter is between November and March.

In the table, the overall energy consumption is shown by converting electric power to the unit of MJ and adding LPG consumption.

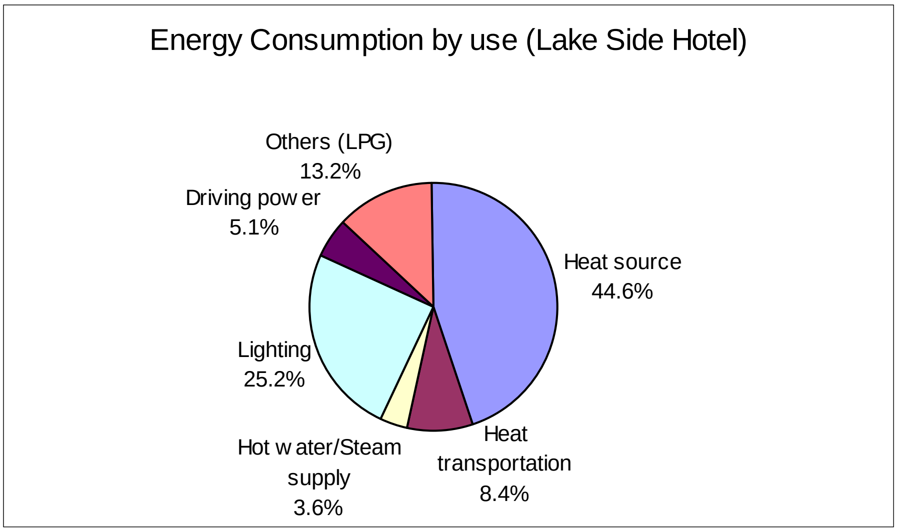
In comparison with hotels in Japan, the ratio of the heat source is larger and the ratio of the hot water/steam supply is smaller. The energy composition is shown by the circular graph below.

Power consumption by use [kwh]

	Summer (April to October)	Winter (November to March)	Sum	(%)
Heat source	358,974	93,240	452,214	51.4%
Heat transportation	65,903	19,354	85,257	9.7%
Hot water/Steam supply	7,144	28,917	36,061	4.1%
Lighting	149,119	106,514	255,633	29.0%
Driving power	29,951	21,394	51,345	5.8%
Others			0	0.0%
Total	611,092	269,418	880,510	100.0%
(Calculated)/(Actual)	99.9%	99.1%	99.6%	
Total (Actual)	611,920	272,000	883,920	

Comparison of energy consumption by use for hotel

	Lake Side Hotel	Hotels in Japan (Ave.)
	%	%
Heat source	44.6	36
Heat transportation	8.1	11
Hot water/Steam supply	3.6	12
Lighting	25.2	23
Driving power	5.1	13
Others (LPG)	13.2	5
Total	100.0	100



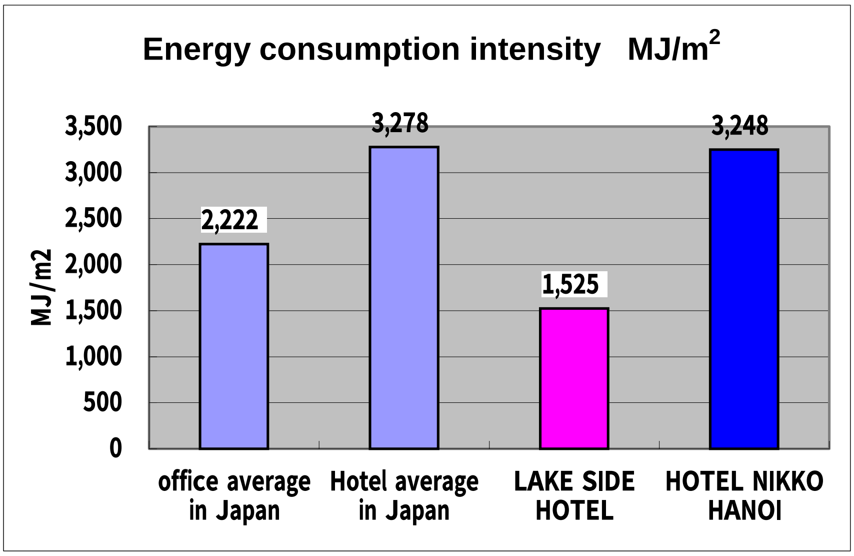
5) Comparison with other buildings

a. Comparison of energy intensity with that of buildings in Japan

Respective energy intensity values for office buildings and hotels in Japan, Lake Side Hotel and Hotel Nikko Hanoi are shown below.

The graph shows that the energy consumption in Lake Side Hotel is very low and almost half compared with that of hotels in Japan. Although a large difference in specifications of the equipment may be part of the reason, this result reflects energy efficiency-oriented operation of the equipment in Lake Side Hotel.

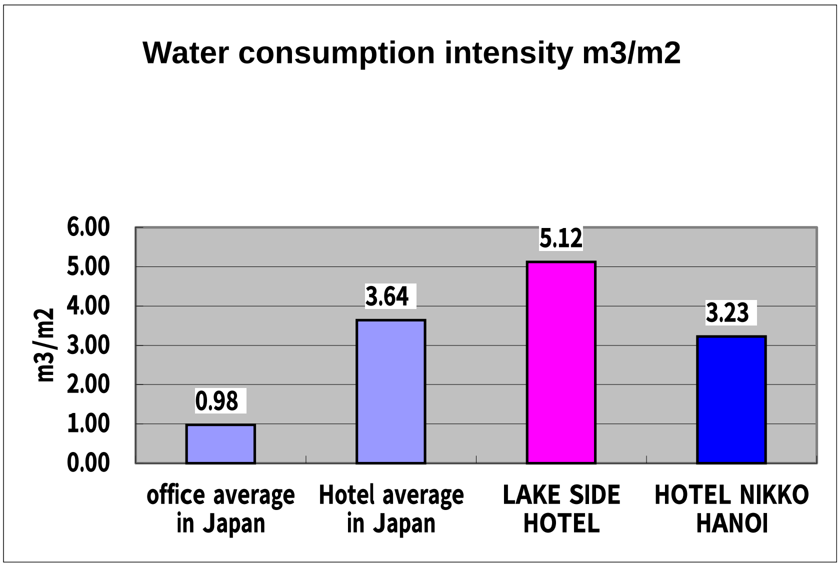
Heating of hot-water supply, for example, relies on solar panels, the supply temperature of chilled water is set at 10°C and air-conditioners in unused rooms are turned off as frequent as possible. Energy-saving operations are widely in practice.



6) Water consumption data

Water consumption intensity, which is gained from water consumption divided by the total floor area in the same way as energy consumption intensity, is shown below.

That of Lake Side Hotel is remarkably high. We could not determine the reason for it from the interviewing based on the technical report. It is probably attributed to a low unit price of water and employees' lack of awareness of water conservation.



(3) Points for improvement and calculation of expected effects

1) Improvement in the temperature of hot-water supply

Current condition

The temperature for hot-water supply is set at 80°C.

Proposed improvement

Setting the temperature at 60°C as far as the capacity of the hot-water storage tank allows and reducing heat loss from piping, etc.

Formula

- (Reduced heat loss as the result of lowering the temperature) × (length of piping × hours)

- Formula for colculating radiated heat from insulated piping

$$Q = 2\pi\,(t_1 - t_2)/\{2/(d_2 \cdot \alpha\} + 1/\lambda \times \ln\,(d_2/d_1)\}$$

Q : Radiated heat from the surface of 1-m pipe per hour [W/m]
t_1 : Temperature of fluid in the pipe 80°C, 60°C
t_2 : Outside air temperature 20°C
d_1 : Piping external diameter 0.028 m
d_2 : Heat insulation tube external diameter 0.068 m
α : Heat transfer rate $[W/(m^2 \cdot K)] = 12$
λ : Heat transfer rate of insulating material $[W/(m \cdot K)] = 0.052$

Radiated heat of value of heat diffused at 80°C Q_{80}=19.3 W/m
Radiated heat of value of heat diffused at 60°C Q_{60}=12.9 W/m
Radiated heat value reduced by lowering the temperature

ΔQ=19.3 – 12.8=6.4W/m

Estimation of effects

a. Conditions for estimation

In addition to the conditions listed above;

Representative diameter of piping 25 mm

Length of piping 500 m

Operating hours 8,760 h

It is assumed that heating for hot water supply is made by an electrical boiler.

Electric power cost 0.18US$/kWh (Average unit price in 2001)

b. Calculation process

Reduced electric power

6.4 × 500 × 8,760 = 28,032,000 W = 28,032 kW

Reduced cost

28,032 × 0.18 = 5,046US$ (J¥605,520)

2) Study on heat source for hot-water supply

Current condition

As the heat sources for the current hot-water supply system the solar panels are used for the primary heating and an electrical boiler is used for the secondary heating. The capacity of the electrical boiler is 162 kW. Its power consumption and costs are quite high.

Proposed improvement

Studying heat source other than electricity (LPG)

Estimation of effects

a. Conditions for estimation

Assumption of calorific value of the supplied hot water:

It is assumed that heating solely depends on electric heater.

Hot water used per day per room: 150 L (at 40°C), 76 rooms

Temperature of the supplied water: 20°C

Annual guest room occupancy rate: 90%

Electricity cost   0.18US$/kWh (Calorific value per 1 kWh = 3.6 MJ)
LPG cost   0.6US$/kg (Calorific value per1 kg = 27.617 MJ)

b. Calculation process

150L × 76 × (40 – 20) × 0.9 × 4.1868 × 365 ÷ 1,000 = 313,583 MJ/year

In the case of electric heating

313,583 ÷ 3.6 = 87,106 kWh,   87,106 × 0.18 = 15,679US$/year

In the case of LPG heating

313,583 ÷ 27.617 = 11,355 kg,   11,355 × 0.6 = 6,813US$/year

c. Cost effect

15,679 – 6,813 = 8,866US$/year (J¥1,063,920/year)

3) Management of power consumption

Current condition

Power consumption is not specifically managed and is confirmed by the invoices (for payment) from the power company.

Proposed improvement

Taking yearly, monthly, weekly, daily and hourly records on power consumption

Estimation of effects

The first step of promotion of energy conservation is to review the current status of electricity use. It is important to see the energy consumption by year, week, day and time in addition to on a monthly basis.

Even if consumption (kWh) cannot directly be read in some equipment, it will be possible to obtain estimated power consumption, voltages, and power factors recorded. It is recommended that hourly records and daily records be taken for a typical period of time, even not throughout the year.

(4) Summary of improvement effects

Basis for comparison: Power consumption in 2001 883,920 kWh

LPG consumption in 2001 27,263 kg

		Reduced electricity		Reduced LPG		Cost effect	
		kWh	%	Kg	%	US$	¥
1	Improvement in the temperature of hot-water supply	28,032	3.2			5,046	606,000
2	Change of heat source for hot-water supply	87,106	9.8	▲11,355	▲41.6	8,866	1,064,000
	Total	115,138	13.0	▲11,355	▲41.6	13,925	1,670,000

5. Database, Benchmarks and Guidelines for Vietnam

5.1 Current status of the Development of Database, Benchmarks and Guidelines for Buildings

- DSM program was started in 2000.
- Institute of Energy was designated to be the organization to promote energy audits.
- Under the assistance of "Hydro Quebec International Co." in Canada in audit procedure, 14 buildings were audited limited to power consumption.
- No database for the building and industrial secters has been created.
- There is no benchmark.
- More training in energy audit is yet to be provided.
- There is only a small number of large-size buildings.

5.2 Introduction of Energy Audits and Database, Benchmarks and Guidelines Regarding Buildings in Japan

We introduced energy audits, database creation & benchmarking of buildings in Japan regarding the following items.
See Energy Audit, Database & Benchmarking in Buildings for Japan Slide Outline in Table II-5-1.

Table II-5-1 Energy Audit, Database & Benchmarking for Buildings in Japan Slide Outline

No.		Title	Note
1		Energy Audit, Database & Benchmarking in Buildings in Japan	Cover
2		Outline of Presentation Introduction Energy Audit Database and Benchmarking Guidelines for Energy Efficient Buildings - Guidelines of equipment in Japan - Operating guidelines for factories and buildings Future Direction	
3		Introduction	Title
4		Trend in Final Energy Consumption by Sector	
5		Energy Audit	Title
6		Application and Process of Energy Audit in Japan	
7		Distribution of Energy Audits by Type of Buildings	
8		Proposed Measures to Identify Savings through Energy Audit	

No.		Title	Note
9		Points to Focus in Energy Saving for Buildings 1) General management	
10		Points to Focus in Energy Saving for Buildings 2) Heat source/air-conditioning equipment Heat source/air-conditioning equipment Control of fresh air intake Monitoring proper air ratio of combustion equipment Proper temperature and humidity for rooms Proper saving in water transfer by introduction of VWV Change of the pre-set outlet temperature of cold water in accordance with the season Prevention of heat emission by thermal insulation of stream valves Reduction in solar radiation loads on windows Power saving air delivery by introduction of VAV Proper segmentation and zoning for air-conditioning Required minimum ventilation in machine rooms Opening window and cooling with outside air Proper ventilation of car park through CO_2 monitoring	
11		Points to Focus in Energy Saving for Buildings 3) Hot water and water supply/Lighting/Electricity/Lifts/Load leveling • Hot water and water supply • Water saving by installation of sound-making equipment at woman lavatories • Use of water saving type valve disc or low shower head • Lighting/Electricity/Lifts • Demand-based control (automatic and manual) • Control of electric transformers demand rate and reduction in no-load losses • Use of high efficiency lumps and light • Use of inverter-control lighting fixtures and ballasts • Lighting at proper times and places • Segmentation of lamplighter insulation positions and lighting circuits • Setting of illuminance standard and proper control of the illuminance • Load leveling • Leveling of electric load by heat storage and use of gas • Introduction of CGS and optimized operation • Study of introduction of new energy including photovoltaic power generation	
12		Type of Data Collected 1) Building Information	
13		Type of Data Collected: 2) Energy Consumption	
14		Calculation of Building Energy Efficiency Index (in MJ/m^2)	
15		Database & Benchmarking System	Title

No.		Title	Note
16		Standardization of Units Conversion factors	
17		Database & Benchmarking System	
18		Benchmarks in Various Types of Buildings in Japan	
19		Information Dissemination of Database and Benchmarks	
20		Energy Efficient Buildings： Guidelines in Japan	Title
21		Obligations of Building Owners 1) Prevention of heat loss through external walls、windows, etc. of a building: 1) Efficient use of air conditioners; 2) Efficient use of mechanical ventilating equipment; 3) Efficient use of lighting facilities; 4) Efficient use of hot water supply systems; 5) Efficient use of elevators	
22		1) Prevention of heat loss through external walls, etc. of a building ■Annual thermal load of the perimeter zone (MJ/year) Total floor area of the perimeter zone (m^2) → [(Assumed load)/(Area)] (PAL): Perimeter Annual Load ■Thermal load of the ambient indoor space: Heat lost through external walls, windows, etc. for a year, total of heating and cooling load generated by heat generated in the ambient space. The quantity of open air taken in is presumed to be a constant calculated on the basis of the area, etc.	
23		2) Efficient use of air conditioners ■Quantity of energy consumed for air conditioning (MJ/year) Assumed air-conditioning load (MJ/year) →[Actually consumed energy/(Virtual load)] (CEC/AC): Coefficient of Energy Consumption for Air Conditioning *Quantity of energy consumed for air-conditioning: Quantity of energy of given air conditioner consumed to treat air conditioning loud for a year Virtual air-conditioning load (Unit: MJ/year): The quantity of open air taken in is presumed to be a constant calculated on the basis of the area, etc. Decrease in load by using exhaust heat recovery is not taken into account.	
24		Standard value of energy conservation for buildings	
25		Guidelines for the Use of Energy Efficient Equipment in Japan	Title
26		Air conditioner	
27		Fluorescent lamp	
28		Operating Guidelines for Factories and Buildings	Title

No.		Title	Note
29		Areas for Rational Use of Energy 1) Fuel combustion 2) Heating, cooling, heat transfer, etc. 3) Prevention of heat loss due to radiation, conduction, etc. 4) Recovery and utilization of waste heat 5) Rationalization in the conversion of heat to power, etc 6) Prevention of electricity loss due to resistance, etc 7) Rationalization of conversion from electricity to mechanical power, heat, etc.	
30		Standard values and target values of air ratios	
31		Future Direction	Title
32		Obligation of Building Owners	
33		■By the law ■Building data will gather 1st Category : about 1000 2nd Category : about 1000 ~ 2000 total : 2000 ~ 3000 □1st Category The reduction plan of 1% or more is made by the period average	
34		Promotion of BEMS ■BEMS: Building Energy Management System ■Subsidy of 1/3 of the total investment cost ■To avail of subsidy, energy must be measured for each of the following: 1. Heat source 2. Pump 3. Illumination/outlet 4. Others ■BEMS can determine the energy consumption of each equipment.	
35		Measurement Sample: Heat Source	
36		Energy Profile of Equipment	
37		Current and Future Program of ECCJ ■2002 ~ ■Energy audit [1] Interview/Questionnaire ■Number of Audit: Office ~ 180 buildings, others ~ 120 building ■GFA: 15,000 m^2 or more. ■Areas for investigation - Capacity of equipment and operating time - Kind of illuminator and lighting time - Amount of electric power according to feeder - Others	

No.		Title	Note
38		Current and Future Program of ECCJ [2] Measurement investigation ■Office: ~15 buildings, others～ 10 building ■Purpose ~ To check the accuracy of data To make the management standards (model of the measurement and record) ※ 2003, 2004 ~Plan to expand investigations to other type of buildings	

5.3 Development of Database and Benchmarks in Vietnam

In the course of discussions with participating members on development of database and benchmarks, it was known that energy audits at 14 buildings were completed and summaries of the results were available. The results are outlined in Table II-5-2 "Energy and Audit Commercial Sector Global Results Preliminary."

Table II-5-3, Monthly Electricity Consumption, shows monthly power consumption of the 3 buildings, on one of which was described in the report and on two of which was audited by ECCJ this time.

Table II-5-3 Monthly Electricity Consumption

Monthly Electricity Consumption			
Category	Hotel	Hotel	Hotel・Office
Building	N Hotel	L Hotel	HTC
Location	Hanoi	Hanoi	Hanoi
Data No	HL-1	HL-2	HO-1
Data year	2002	2002	2001
Electricity intensity[kWh/m2]	208.2	126.6	211.2
Jan	426200	49920	369370
Feb	337200	43680	380640
Mar	413600	65920	403763
Apr	499600	72800	475840
May	539200	86560	647060
Jun	597000	91040	718330
Jul	644100	99600	679730
Aug	607800	89600	765360
Sep	581200	89280	706330
Oct	522100	83040	563070
Nov	442600	60160	444070
Dec	462300	52320	393990
Total	6072900	883920	6547553

Table II-5-2 P2-Energy audits-Commercial Sector Global Results-Preliminary
Electricity of Vietnam-Institute of Energy

Type	Building	City	W*	Area	Annual consumption	Reduction of annual consumption			Savings	Cost	Pay-Back
				m^2	kWh	Lighting	Envelope	Total	US$	US$	Years
Hotel	C Hotel	Ho Chi Minh	W	9,604	1,482,647	9.1%		9.1%	12.587	22.556	1.8
Hotel	M Hotel	Ho Chi Minh		11,055	2,172,720	11.9%		11.9%	24.119	12.643	0.5
Hotel	NW Hotel	Ho Chi Minh		55,760	1,531,433	4.9%		4.9%	66.589	25.706	0.4
Hotel	SP Hotel	Ho Chi Minh	W	15,590	4,000,000	7.7%		7.7%	25.987	22.877	0.9
Hotel ,Office	HTC	Hanoi	W	31,000	6,358,000	5.0%		5.0%	33.233	42.596	1.3
Office	MIH	Hanoi		6,000	468,846	16.9%		16.9%	6.040	12.157	2.0
Office	ST	Ho Chi Minh	W	20,240	3,494,051	5.8%		5.8%	20.878	95.571	4.8
Office	PC2	Ho Chi Minh	W	3,891	738,548	15,7		15,7	6.797	20.250	3.0
Office	EVB	Hanoi	W	8,000	472,703	20.9%	6.0%	26.9%	7.199	39.551	5.5
Store	SS	Hanoi		1,000	476,717	12.0%	3.5%	15.5%	9.082	9.207	1.0
Store	M	Ho Chi Minh		19,143	2,907,895	12.1%		12.1%	31.384	56.004	1.8
School	KLS. School	Hanoi	W	5,260	63,208	25.7%		25.7%	798.000	7.592	9.5
Hospital	V Hospital	Hanoi	W	36,385	1,984,666	11.9%		11.9%	10.988	40.888	3.7
Other	HR Station	Hanoi	W	102,000	278,899	16.3%		16.3%	2.986	12.725	4.3
Total	14			330,878	40,213,223				258.585	420.325	
Average				23,634	2,872,373	12.6%		13.2%	18.470	30.023	2.9

*W=Walk-through, Blank=Detailed

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(1) Building Energy Database in Vietnam outlined in Table II-5-4 below contains the existing data on 14 buildings plus data on the two buildings audited in the current project. A new category of energy intensity that represents energy consumption per m^2 was also added to it.

Table II-5-4 Building Energy Database in Vietnam

category	Building	Location	data No	GFA [m2]	DateYear	Electricity [kWh]	Electricity intencity [kWh/m2]	oil [l]	LPG [l]	LPG [kg]	Water [m3]	Water intensity [m3/m2]
Hotel	N hanoi	Hanoi	HL-1	29,164	2002	6,072,900	208.2	766,995	94,842		94,077	3.2
	L hotel	Hanoi	HL-2	6,981	2001	883,920	126.6			27,263	35,741	5.1
	C Hotel	Ho Chi Minh	HL-3	9,604		1,482,647	154.4					
	M Hotel	Ho Chi Minh	HL-4	11,055		2,172,720	196.5					
	NW Hotel	Ho Chi Minh	HL-5	55,760		15,314,323	274.6					
	SP Hotel	Ho Chi Minh	HL-6	15,590		4,000,000	256.6					
Hotel ,Office	HTC	Hanoi	HO-1	31,000	2001	6,547,553	211.2					
Office	MIH	Hanoi	O-1	6,000		468,846	78.1					
	ST	Ho Chi Minh	O-2	20,240		3,494,051	172.6					
	PC2	Ho Chi Minh	O-3	3,891		738,548	189.8					
	EVB	Hanoi	O-4	8,000		472,703	59.1					
Store	SS	Hanoi	S-1	1,000		476,717	476.7					
	M	Ho Chi Minh	S-2	19,143		2,907,895	151.9					
School	KLS School	Hanoi	SC-1	5,260		63,208	12.0					
Hospital	V Hospital	Hanoi	HS-1	36,385		1,984,666	54.5					
Other	HR Station	Hanoi	OT-1	102,000		278,899	2.7					

(2) The results of regression analysis and trend analysis of energy consumption in Vietnam were as follows.

1) Annual electric power consumption in 16 buildings

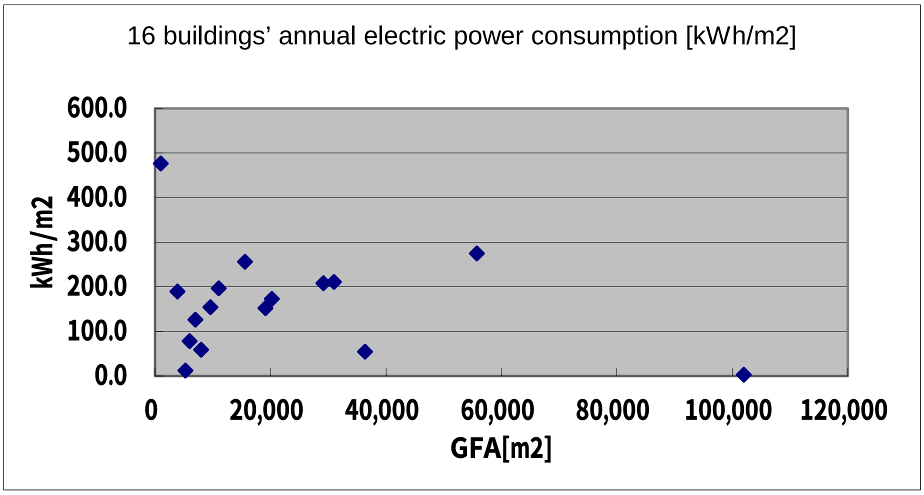


Figure II-5-1 Annual Electric Power Consumption in 16 Buildings

2) Annual electric power consumption in 6 hotels and 1 hotel and shops-combined building

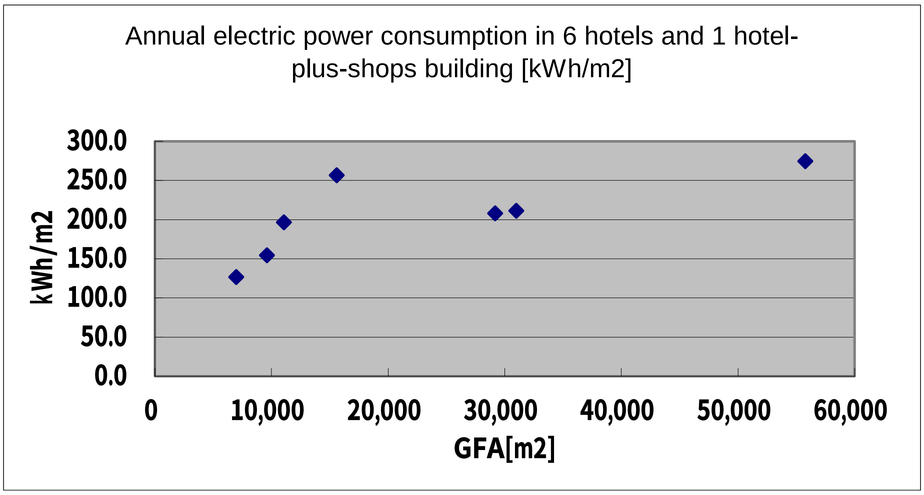


Figure II-5-2 Annual Electric Power Consumption in 6 Hotels and 1 Hotel-and-Shops Building

3)　Annual electric power consumption in office buildings

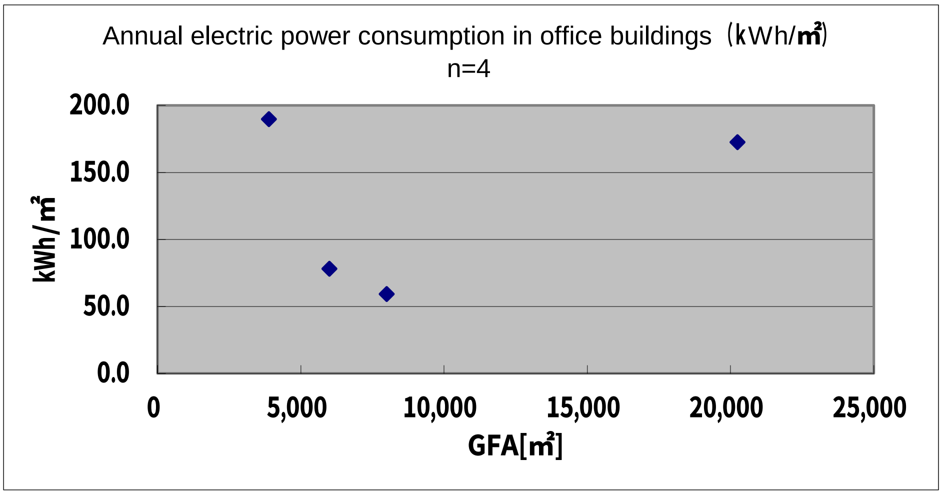


Figure II-5-3　Annual Electric Power Consumption in Office Buildings

4)　Annual water consumption

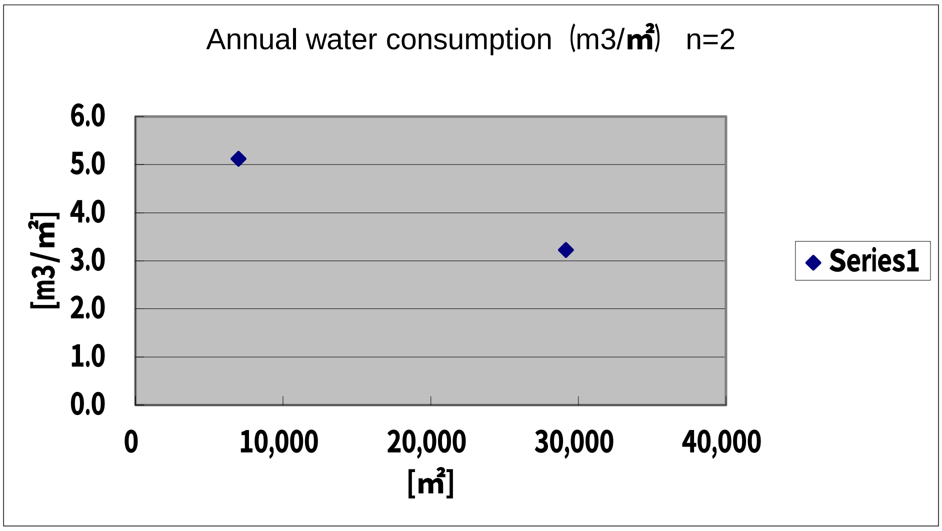


Figure II-5-4　Annual Water Consumption

5) Transition of monthly electric power consumption trends

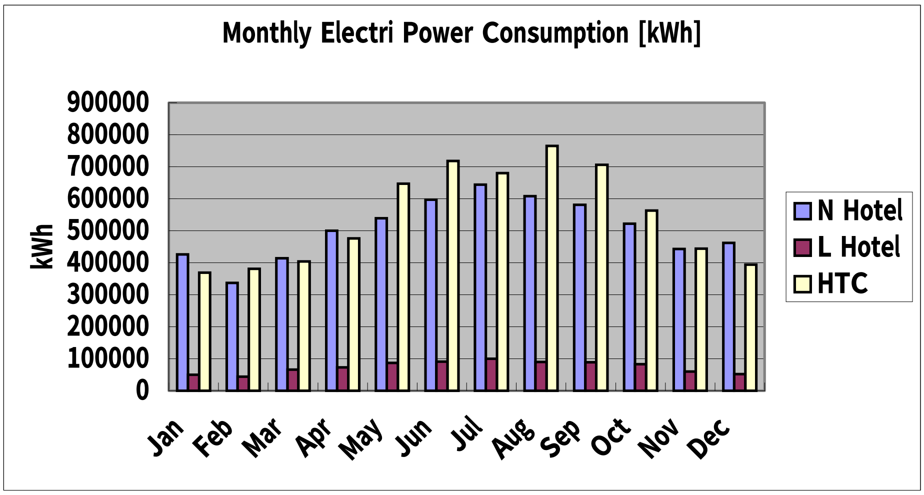


Figure II-5-5 Transition of Monthly Electric Power Consumption

III. Myanmar

1. Summary of Audits

Site Survey and Audit

1st site survey : January 13 through 17, 2003

2nd site survey : February 24 through 27, 2003

Participants from the International Engineering Department of The Energy Conservation Center, Japan (hereinafter referred to as “ECCJ”)

- Kazuhiko Yoshida (General Manager) February 26-27, 2003
- Akira Ueda (Technical Expert) January 13-17 and February 24-27, 2003
- Akira Kobayashi (Technical Expert) January 13-17 and February 24-27, 2003

(1st Site Survey)

Date	Events, destination, etc.	Description
Jan. 13 (Mon.)	Workshop (FMI Center Building #380,BogyokeAung SanRoad,Pabedan Township,Yangon)	• Welcome Remarks • Opening Statement • Introduction of ECCJ: See Table III-1-1. • Presentation on the current energy conservation technology and experience in buildings in Japan • Presentation on the procedure of auditing buildings Participants Mr. TinTun (Deputy Minister of Energy) Mr. Brig Gen Thein Aung (Deputy Minister of Energy) Mr. Soe Mint (Director General, Energy Planning Dep.) . Mr. U Thein Lwin (Deputy Director General Energy Planning Dep.) Mr. U Aung Kye (Director Construction Service) Mr. Christpher Zamora (ACE) Mr. U KyawTin (Director Dep. Electric Power) Mis.Daw Than Win (Professor Yangon Technological University) Mr. U Thang Dan (FMI Center Manager) and 19 other persons

Date	Events, destination, etc.	Description
Jan. 14 (Tue.)	FMI Center Building (Best Practice Building) Survey/audit (in Yangon City)	• Provided OJT in auditing to participants through the survey/audit of FMI Center Building as “Best Practice Building” Use of building: Offices and shops Size: 1 basement and 11 floors above the Ground Age of the building: 8 years Total floor area: 10,953 m^2 • Survey on the overall condition of the building by documents/interviewing • Survey on the overall condition of the equipment by documents/interviewing • Survey on energy consumption by documents/ interviewing • On-site investigation Participants: Mr. U Kyaw Tin (Director Dep. Eic.Power) Mr. U Thang Nyunt Ms. U Myat Ko Ko Mr. U ThantZynn Mr. U Thang Dan (FMI Center) Mr. U Thein Htwe (Pansea Hotel) Mr. U Aung Kyi and 10 other persons
Jan. 15 (Wed.)	Pansea Hotel (Retrofit Building) Survey/audit (in Yangon city)	• Provided OJT in auditing to participants through the survey/audit of Pansea Hotel as “Retrofit Building” Use of building: Hotel (50 rooms) Size: 2 basements and 5 floors above the Ground Age of the building: 80 years Total floor area: 7,111.1 m^2 • Survey on the overall condition of the building by documents/interviewing • Survey on the overall condition of the equipment by documents/interviewing • Survey on energy consumption by documents/ interviewing • On-site investigation Participants: Mr. U Kyaw Tin (Director Dep. Eic.Power) Mr. U Thang Nyunt Ms. U Myat Ko Ko Mr. U ThantZynn Mr. U Thang Dan (FMI Center) Mr. U Thein Htwe (Pansea Hotel) Mr. U Aung Kyi and 10 other persons

Date	Events, destination, etc.	Description
Jan. 16 (Thu.)	Confirmation and audits of FMI Center Building and Pansea Hotel	• Conducted a survey for reconfirmation of data on FMI Center Building (Best Practice Building) and Pansea Hotel (Retrofit Building) Participants: <u>FMI Center Building</u> Mr. U ThaungDan Mr. U Aung Myo Htun Mr. U ThaungDan and 4 other persons <u>Pansea Hotel</u> Mr. U Thein Htwe Ms. U Maw Lin and 4 other persons
Jan. 17 (Fri.)	Wrap-up meeting (FMI Center Building)	• Summarized the surveys/audits of the preliminary results of FMI Center Building and Pansea Hotel and reported to participants. Participants: Mr. U KyawTin (Dep. Electric Power) Mr. U ThanungNyunt (R&D) Mr. U Shwe Yu Kaw (Public Works) Mr. U Myat Ko Ko (Public Works) Mis. Daw Than Win (Yangon Tech. University) Mr. U Khine Win (Yangon Tech.University) Mr. U Maung Mang Aye (Yangon City) Mr. U Sein Win (FMI Center) Mr. U Aung Myo Hturn (FMI Centre) Mr..U Thang Dan (FMI Center) Mr. U Aung Kye (Industrial Construction) Mr. U Thin Htwe (Pansea Hotel) Mr. U Maw Lin (Pansea Hotel) and 8 other persons

(2nd Site Survey)

Date	Events, destination, etc.	Description
Feb. 24 (Mon.)	Pre-report meeting Interim reports on FMI Center Building and Pansea Hotel (The Grand Mee YaHta #372Bogyoke Aung San RD Pebedam Township Yangon)	• Made interim reports based on the results of the 1st surveys/audits of FMI Center Building and Pansea Hotel (Major contents) <u>FMI Center Building</u> • Analysis of the current condition (Monthly power consumption trends, yearly energy consumption trends and comparison with other buildings, comparison of temperatures between Yangon and Tokyo, comparison of energy intensity with those of buildings in Japan, energy composition by use and energy consumption by use in office buildings in Japan, comparison of energy consumption depending on days of the week and time of the day, electricity consumption in typical office buildings (measured values and simulated values, monthly water consumption, changes in yearly water consumption and comparison with water consumption in other buildings) • Recommendations and expected effects (Improvement in the temperature of chilled water, effective use of indoor exhaust air and study on application of waste heat recovery system) <u>Pansea Hotel</u> • Analysis of the current condition (Power consumption and hotel's occupancy rates, monthly energy consumption, energy consumption by use, comparison with other buildings, amount of heat source for air conditioning and comparison with that of other buildings) • Recommendations and expected effects (Replacement with high-efficiency lamps, review of hot-water supply system, improvement of power factor and water consumption management) Participants: Mr. U KyawTin (Dep. Electric Power) Mr. U ThanungNyunt (R&D) Mr. U Shwe Yu Kaw (Public Works) Mr. U Myat Ko Ko (Public Works) Mis. Daw Than Win (Yangon Tech. University) Mr. U Khine Win (Yangon Tech.University) Mr. U Maung Mang Aye (Yangon City) Mr. U Sein Win (FMI Center) Mr. U Aung Kye (Industrial Construction) Mr. U Thin Htwe (Pansea Hotel)

Date	Events, destination, etc.	Description
		Mr. Christpher Zamor (ACE) and 9 other persons
Feb. 25 (Tue.)	Surveys of FMI Center Building and Pansea Hotel	• Carried out surveys and discussions particularly focusing on the recommendations including “the cooled water outlet temperature for chiller” discussed in the pre-report meeting. Participants: FMI Center Building Mr. U ThaungDan Mr. U Aung Myo Htun and 4 other persons Pansea Hotel Mr. U Thein Htwe Ms. U Maw Lin and 4 other persons
Feb. 26 (Wed.)	Workshop on database (Hotel: The Grand Mee YaHta)	• Made a presentation on benchmark system and database established in Japan • Collected basic data on energy consumption in 11 buildings in Myanmar Participants: Mr. U KyawTin (Dep. Electric Power) Mr. U ThanungNyunt (R&D) Mr. U Shwe Yu Kaw (Public Works) Mr. U Myat Ko Ko (Public Works) Mis. Daw Than Win (Yangon Tech. University) Mr. U Khine Win (Yangon Tech.University) Mr. U Maung Mang Aye (Yangon City) Mr. U Sein Win (FMI Center) Mr. U Aung Kye (Industrial Construction) Mr. U Thin Htwe (Pansea Hotel) Mr. Christpher Zamor (ACE) and 9 other persons
Feb. 27 (Thu.)	Care study on benchmarking and database development in Myanmar	• Based on the results of the 2 audits implemented in the current schedule and the data on energy consumption in buildings prepared by the participants, the database and benchmarks for Myanmar have been studied and developed and practiced to make a protocol by participants. • Energy consumption per unit area is quite low in Myanmar’s governmental office buildings. Participants: Same members as on February 26

Table III-1-1　ECCJ 's　Activity

Slide List

No.		Title	Note
1		Profile of ECCJ	
2		History of ECCJ under Charge of Energy- related Situation	
3		ECCJ Organization Chart (out line)	
4		Budget in 2002FY	
5		Main Activity of ECCJ	
6		Energy Audit for Factories and Buildings	
7		The National Conservation of Excellent Successful Cases in Energy Conservation Activities	
8		Training course for energy management	
9		License of Energy Manager	
10		International Corporation of ECCJ	

2. Political and Economic Conditions in Myanmar

(1) National indicators, political system and economic indicator

1) National indicators

Country name:	The Union of Myanmar
Area:	678,330 km^2 (approx. 1.8 times the area of Japan)
Population:	47.75 million (mid-2000 estimate)
Capital city:	Yangon (Populations: 5.3 million as of 1997)
Ethnic distribution:	Myanmar (68%), Sham (8.9%), Karen (6.6%), Arakan race (4.4%), Kachin, Mon, and approximately 50 other ethnic minorities.
Languages:	Myanmar (official language), Sham, Karen and English
Religion:	Hinayana Buddhism (about 90%), Christianity (4.6%), Islam (3.9%), Hinduism, and Animism
Topography:	Myanmar constitutes the western part of Indochina, with the Irrawaddy River running southward through the central area of the land, thus forming an extensive alluvial plain. The country is bordered by China to the north, by India and Bangladesh to the west, and by Laos and Thailand to the east.
Climate:	A tropical climate prevails in the south facing the Bay of Bengal, with high temperatures and a great deal of rain throughout the year; in particular period from May to September, heavy rain falls due to the south-west monsoon. A temperate climate prevails in the inland area.

2) Political system

Form of government:	Federal system (military administration; provisional government since September 18, 1988)
Head of state:	Senior General Than Shwe (serving also as Chairman of State Peace and Development Council (SPDC); assumed the office in 1992 (SLORC was reorganized as SPDC in 1997)
National assembly:	People's Assembly (unicameral system; 492 seats with 4-year terms)
Cabinet:	(major cabinet ministers)

Chairman, Premier and Defense Minister	:	Than Shwe, Senior General
Minister of Finance and Revenue	:	Khin Maung Threin, Brigadiere General
Minister of Foreign Affairs	:	Win Aung
Minister of State Planning and Economic Development	:	Soe Tha

Minister of Energy : LunThi, Brigadier General
Minister of Commerce : Pyi Son, Brigadier General
Minister of Agriculture and Irrigation : Nyunt Tin, Major General
Minister of State Peace and Development Council Chairman Office:
Min Thein, Vice Admiral D.O. Abel, Lieutenant General

3) Economic indicators

Actual GDP growth rate: 13.6% (2000)

Nominal GDP total: 2,552,723 million kyat (2000)
6,287,495,073 US$ (2000) US$1 = 406 kyat (real rate)

Nominal GDP per capita: 164 US dollars (2001)

Consumer price inflation rate: minus 1.7% (2000)

Current account (international balance of payments):
Minus 526.60 million kyat (2000)
Minus 79,893,192 US$
1 US$ = 6.5913 kyat (official rate in 2000)

Trade balance (international balance of payments):
Minus 3,036 million kyat (2000)
Minus 460, 607,163 US$ (2000)
1 US$ = 6.5913 kyat (official rate)

Foreign currency reserves US$400,459,000 (2001)

Exchange rate (mid-term average) against the US$ 6.8066 kyat (2001)

Exchange rate (term-end value) against the US$ 6.8924 kyat (2001)

Export value: 17,130,700,000 kyat (2001)
2,516,777,833$ (2001)
$1 = 6.8066 kyat (official rate)

Exports to Japan: 450,700,000 kyat (2001)
66,215,144 US$ (2001)
$1 = 6.8066 kyat (official rate)

Import value: 18,377,700,000 kyat (2001)
2,699,982,370 US$ (2001)
$1 = 6.8066 kyat (official rate)

Imports from Japan: 2,390,400,000 kyat (2001)
351,188,552 US$ (2001)
$1 = 6.8066 kyat (official rate)

Direct investment received: 1,306,128,000 kyat (2000)
217,688,000 US$ (2000)

Major items in trade with Japan:

Exports to Japan: Shrimp (39.1%), copper and copper alloy (13.5%), clothes and apparel (7.3%), etc.

Imports from Japan: General machinery (49.1%), transport machines and equipment (21.7%), electrical equipment (11.0%) etc.

Features of trade with Japan: Governmental control including import regulations and foreign exchange regulations due to lack of foreign currency on the Myanmar side

Investment by Japanese enterprises: Number of cases: 24
Value: 237.6 million dollars

Cumulative total from the deregulation of foreign investment in 1988 to August 2002 based on investments approved by the Government: ranks 9th by country (in terms of the amount of money)

(2) Political condition

Mr. Ne Win resigned in 1988, and the Burmese national army assumed power in September. Sow Maung, Defense Minister as well as Chief of Staff, formed the State Law and Order Restoration Council (SLORC) and assumed the position of chairman. SLORC, which now came into power, promised the people that it would ensure the establishment of a democratic system and economic liberalization, with a view to suppress pro-democracy demonstrations. Thus, a general election based on a multiple-party scheme took place in May 1990. The National League for Democracy (NLD), led by Daw Aung San Suu Kyi, won an overwhelming victory, but in spite of this, the military administration refused to transfer power to the elected party.

In 1997, SLORC was renamed “State Peace and Development Council” (SPDC), and it has continued to run the country under that name. Direct dialog between Ms. Suu Kyi and the administration was started in October 2000. The government released more than 350 political prisoners whom it had detained over the period to August 2002 and allowed 38 NLD branches to restart their activities. SPDC also lifted restrictions imposed on Ms. Suu Kyi’s activities in May 2002.

1989	:	Burma was renamed Myanmar.
1990	:	Daw Aung San Suu Kyi won a Nobel Peace Prize.
1997	:	The country joined ASEAN.
November 2000	:	ILO Council decided to impose sanctions on Myanmar.

(3) Economic condition

The enclosure scheme resulted in the decline of the economy, and this recession was accelerated by political instability. Thus, in 1987, the Myanmar was categorized to one of the world’s poorest countries by the United Nations.

Because of the military coup d’etat in September 1988, most of supporting countries stopped their aid to Myanmar. Also in the same period, the military administration gave up the economic scheme of the Burmese socialist line, and launched economic reforms focusing on the market economy and an open-door policy. While privatization of state-owned enterprises was also started, in reality the controlled economy has continued.

The economic growth rate declined significantly by 11% in 1988 and by 0.7% in 1991. In the 4-year plan from fiscal 1992 to fiscal l995, an average 7.5% growth rate was achieved versus the target of 5.1%. Thereafter, however, the rate of economic growth slowed down to 6.4% in 1996, and 5.7% and 5.0% respectively in 1997 and 1998 due partly to the Asian currency crisis experienced during that period. In 1999 and 2000, the agricultural division achieved a certain level of growth rate due to a good condition in rice cropping.

The currency crisis reduced investment from ASEAN by half, thus accelerating the country's shortage of foreign currency reserves since 1997. In order to prevent an excessive outflow of foreign currency, the government limited the remittance of foreign currency to US$50,000 per company a month starting in July 1997, and further reduced it to US$10,000 from August 2000. In addition, strict restrictions were imposed on the acquisition of an import license, while at the same time, regulations on the import of luxury goods was strengthened in March 1998.

In May 2001, the Ministry of State Planning and Economy unofficially announced that the growth rate of GDP for the fiscal year of 2000 was 13.9%, which means that it exceeded 10.9% for the fiscal year of 1999. This figure, however, deviates from the actual severe economic situation in the country, including the slump in investment from abroad.

July 29, 1948 : The country joined GATT.

January 1, 1995 : The country joined WTO.

3. Procedure of Energy Audit for Buildings

3.1 General Process

The energy audit for buildings is generally proceeded in the 6-step sequence described below.
In STEP 1 and STEP 2, general information and data on the building and equipment concerned are collected and the energy consumption data obtained is analyzed.
In the present audit, the participants collaborated with Japanese experts in STEP 1 to 3. In the wrap-up meeting held on completion of the 1st site survey, ECCJ specialists outlined points for improvement for STEP 4. In the interim report meeting in the 2nd site survey, then the results of the study on the methods of improvement and expected effects were explained, and for further confirmation, additional surveys were conducted. This report reflects the results of the 2nd site survey.

STEP-1 Gathering and confirming general information and data on the building
STEP-2 Gathering and confirming general information and data on the equipment
STEP-3 Gathering and evaluating data on energy consumption
STEP-4 Identifying points for improvement by data analysis and evaluation
STEP-5 Studying recommendations for improvement including expected effects
STEP-6 Determining and explaining the recommendations to be implemented

3.2 Description of Each Step

Major survey items of each step are as follows.

(1) STEP-1 Gathering and confirming general information and data on the building

1) Year of construction completed
2) Size: Gross floor area (area for major use, indoor parking area), Number of stories, structure
3) Use
4) Owner
5) Number of employees, No. of clients (business days, holidays), and other items

(2) STEP-2 Gathering and confirming general information and data on the equipment

1) Air-conditioning systems, electrical systems, sanitary facilities, etc.
2) Specifications of equipment
3) Operation management status: Operating hours, setting of room temperature, and other items

(3) STEP-3 Gathering and Evaluating data on energy consumption

1) Monthly energy consumption
2) Changes in yearly energy consumption
3) Energy consumption by day of the week
4) Energy consumption by hour of the day
5) Energy consumption by use
6) Data on water consumption, and other items

(4) STEP-4 Identifying points for improvement by data analysis and evaluation

1) Comparison of the total energy consumption of the building concerned with that of similar buildings
2) Comparison of its energy consumption by use with that of similar buildings
3) Analysis of its monthly energy consumption trends
4) Analysis of changes in energy consumption for a period of several years
5) Analysis of its energy consumption by day of the week and hour of the day
6) Confirmation of room environment: Temperature, humidity, CO_2 concentration, luminance
7) Confirmation of operation log: Operation status during peak load hours, operation status during light load hours, Number of equipment units in operation, operation time and operation temperature conditions
8) On-site inspection: Operation status of equipment, temperature indicators, ammeters, voltmeters and power factor indicators, valve condition, damper condition, heat insulation, layout of equipment, maintenance of equipment and piping
9) Determination of how the facilities and equipment are actually used: Density of people in a room, condition of OA equipment, identification of locations of energy loss, and other items

(5) STEP-5 Studying recommendations for improvement including expected effects

1) Studying improvement plans: Application of other successful improvement cases and most-advanced technologies
2) Estimation of effects for improvement: Reduced energy consumption and costs
3) Estimation of costs for improvement

(6) STEP-6 Determining and explaining the recommendations to be implemented

1) Determination of the recommendations to be applied
2) Preparation of a report
3) Explaining the report

3.3 On-site Auditing Procedure

The energy audits for the building concerned were conducted in accordance with the following procedure.

(1) Interviewing
  1) General description of the building
  2) General description of the equipment
  3) How the building is used and the operation status of equipment
  4) Data and information on overall energy use

(2) Confirmation on drawings and reference materials
  1) Building design drawing
  2) Equipment drawings including drawings of air-conditioning systems, electrical systems and sanitary facilities
  3) Operation log
  4) Energy consumption data
  5) Room environment data

(3) On-site confirmation
  1) Typical room
  2) Machine room
  3) Electrical room
  4) Outdoor facilities and equipment (placed on rooftop and on the ground)

(4) Simple measurements (if possible)
  1) Temperature, humidity and luminance
  2) Electric current
  3) CO_2 concentration, etc.

4. Audits of Buildings in Myanmar

4.1 FMI Center

(1) Outline of the building

1) Name: FMI Center

2) Use: Offices and shops

3) Size: 1 basement and 11 floors above the ground
Total floor area; 10,953 m^2

4) Age of the building: 8 years

5) Outline of electrical systems:
Receiving voltage 6.6 kV, Transformer capacity 1,600 kV
Power generator (for emergency) 750 kVA
Elevator 11 kW × 2 sets, 20 kW × 1 set

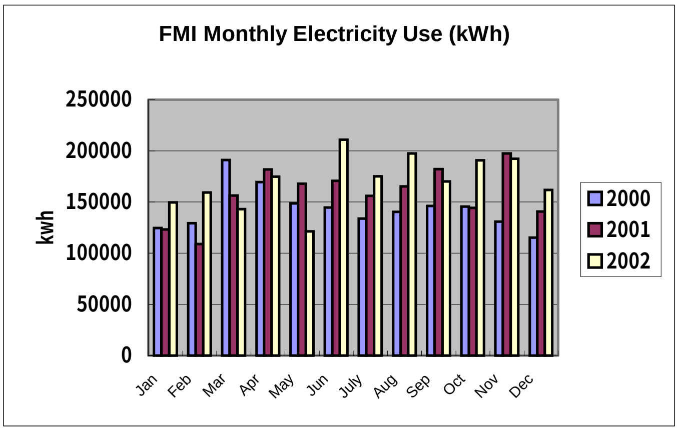
6) Outline of air-conditioning systems:
Shops: chiller 210 RT (231 kW) × 1 set, Fan coil unit (174 units)
Offices: Split type (135 units)

7) Sanitary facilities:
Lifting pump 11 kW × 2 sets, Lifted water tank 29.5 m^3

(2) Analysis of current energy consumption status

1) Monthly power consumption (2000-2002)
Changes in monthly power consumption for 3 years from 2000 to 2002 are shown in the figure below.

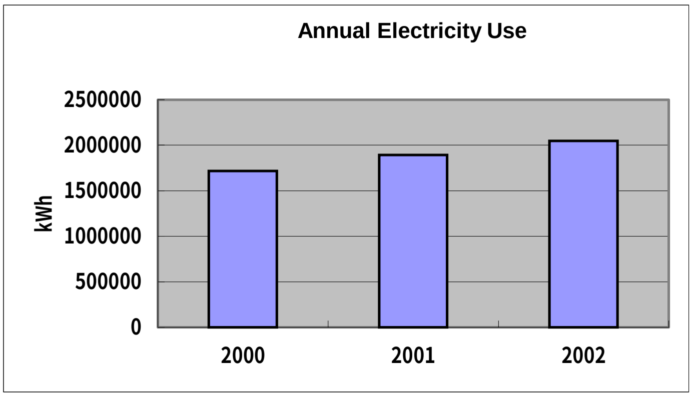
The months with a maximum consumption in 2000, 2001 and 2002 are March, November and June respectively and these are not consistent. The months with a minimum consumption in 2000, 2001 and 2002 are December, February and March respectively and they not consistent, either. Particularly, the values in May and June of 2002 differ largely and it seems that there is a problem with the way of data collection.



2) Trends of yearly power consumption trends

Changes in yearly power consumption during the period of these 3 years are shown below.

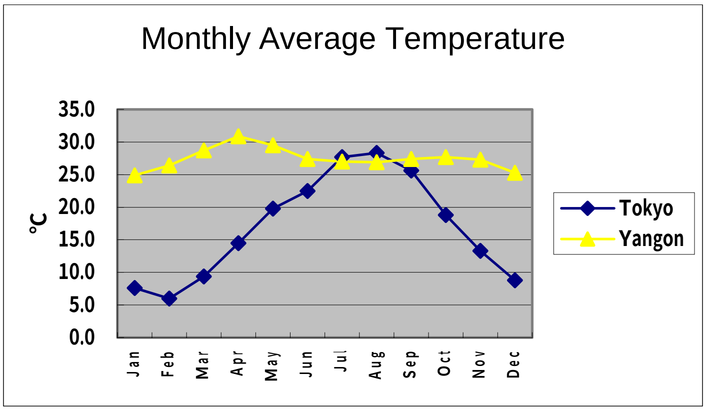
If the power consumption in 2000 is normalized at 100, those of 2001 and 2002 are respectively 110 and 119, showing an about 10% of yearly increase. As FMI Center building is a complex building for offices and shops, it is presumable that their operating intensity is increasing year by year. The same upward trend is clear in changes in yearly water consumption.



3) Comparison with other buildings

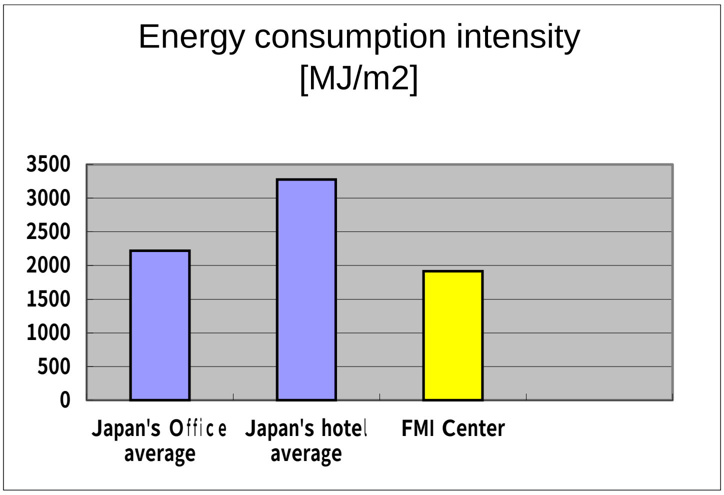
a. Comparison of temperatures between Yangon and Tokyo

As no reference data was available in Yangon for evaluation of energy consumption status, the values for analysis were compared with those of buildings in Japan. Before comparing energy consumption per unit area between the two cities, the ambient conditions that affects energy consumption for air conditioning were checked. The average monthly temperatures in Tokyo and Yangon are shown below.



b. Comparison of energy intensity with that of buildings in Japan

The energy intensity for FMI Center is 1,915 MJ/m^2 while the average value for office buildings in Japan is 2,222 MJ/m^2. It is about 86% compared with Japan. The reason why FMI Center showed a lower value despite of a large number of shops in the building may be explained by the fact that overtime working time is short and OA equipment condition is different from Japan in the FMI Center office zone.



c. Comparison of energy composition

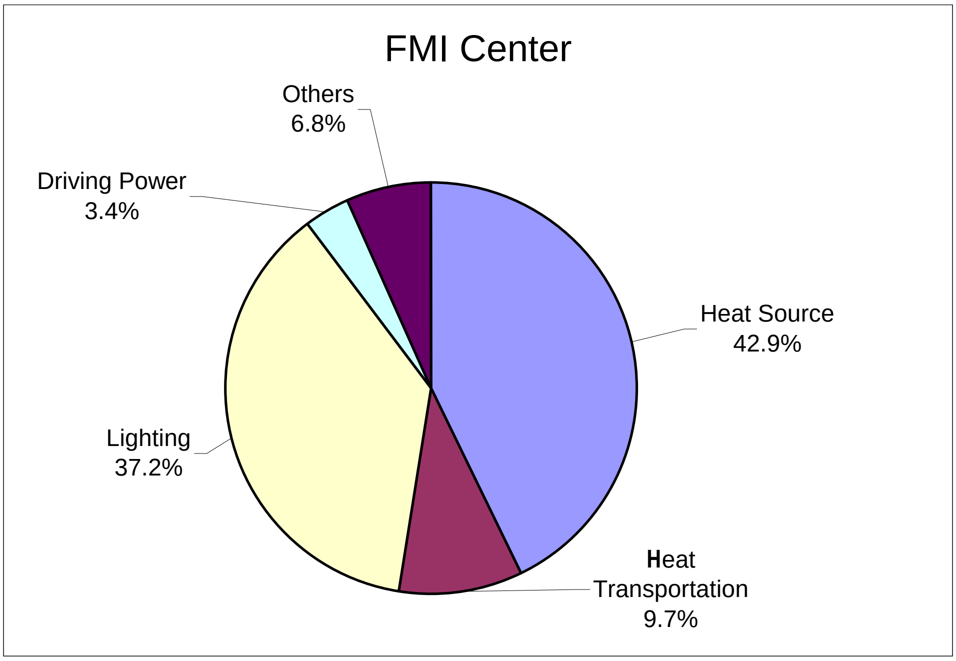
The following tables show the calculated energy consumption by use based on the specifications of equipment and operating time.

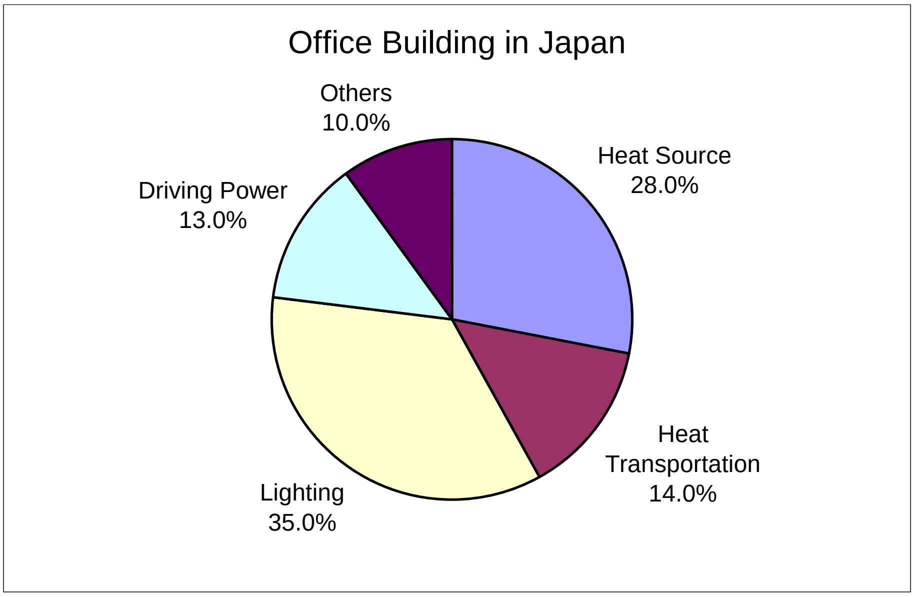
Moreover, the comparisons with those of office buildings in Japan are shown in the table and circular graph. In case of FMI Center, the energy consumption for heat source shares 42.9% versus 28.0% for the Japanese. Therefore, the improvement in heat source should be studied for saving energy.

Composition of Energy Consumption by Use (FMI Center)

	Common Use	Office	Shop	Sum	Ratio
Heat Source	361,674	521,057	0	882,731	42.9%
Water Transportation	75,168	0	0	75,168	3.7%
Heated Air Transportation	0	54,309	69,483	123,792	6.0%
Lighting	200,033	294,005	270,454	764,492	37.2%
Air Ventilation	18,792	18,478	0	37,270	1.8%
Elevator	23,177	0	0	23,177	1.1%
Driving Sanitary Equipment	8,603	0	0	8,603	0.4%
Others	140,700	0	0	140,700	6.8%
Total (Calculated)	828,147	887,849	339,937	2,055,933	100.0%
Total (Actual)	817,189	889,100	340,211	2,046,500	
(Calculated)/(Actual)	101.3%	99.9%	99.9%	100.5%	

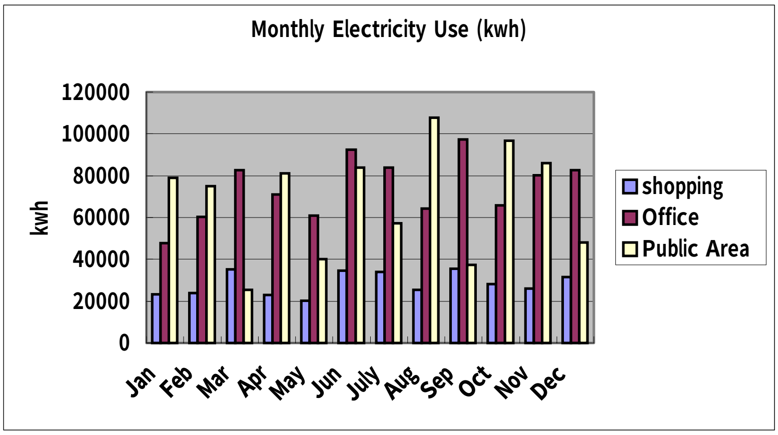
	FMI Center	Office Building in Japan
Heat Source	42.9%	28.0%
Heat Transportation	9.7%	14.0%
Lighting	37.2%	35.0%
Driving Power	3.4%	13.0%
Others	6.8%	10.0%





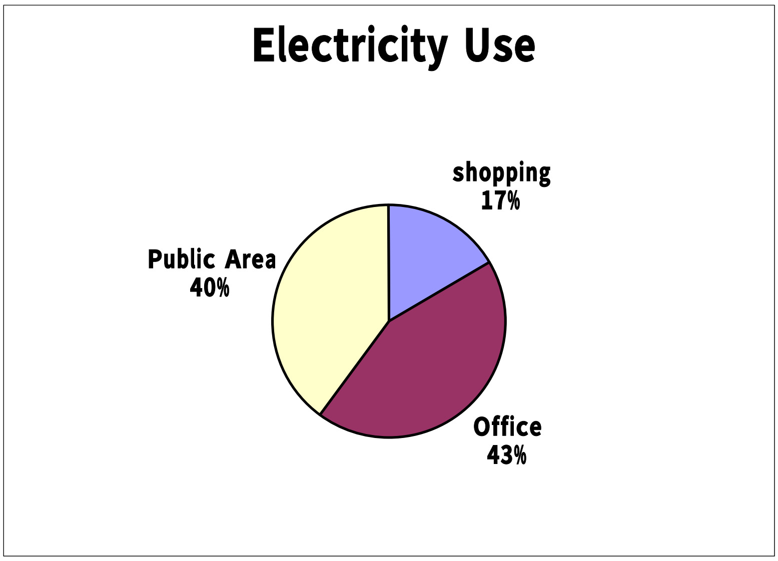
4) Energy consumption by use

The graph below shows monthly power consumptions in the public space or common-use space, offices and shops. The values for public space in March and May look unnatural and the reason may be that the measurement timing is not consistent.



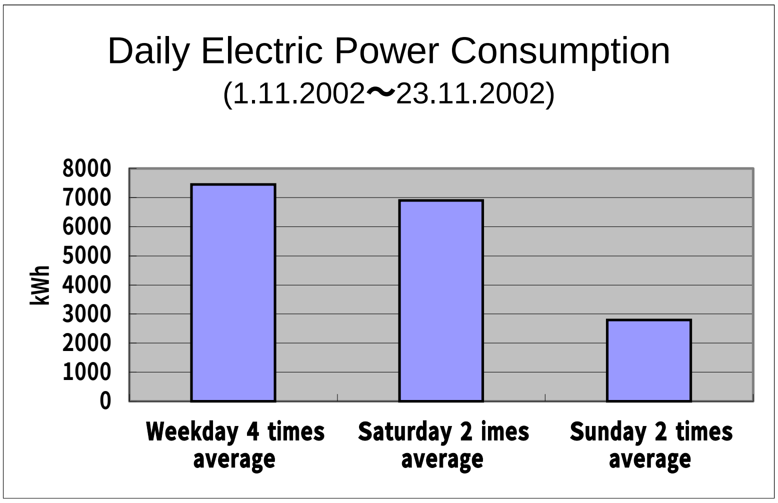
The energy consumption distribution by zone is shown in the following circular graph.

It should be noted that the value for the public space includes energy consumption by chillers for the shop zone.



5) Comparison by day of the week

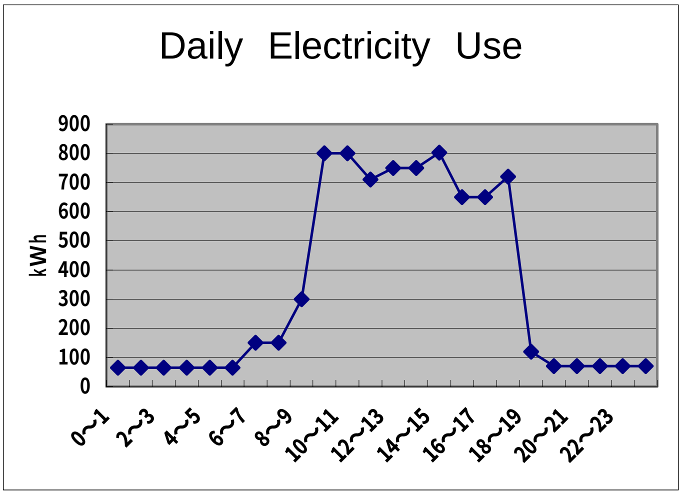
The office zone is used half a day on Saturdays and not used on Sundays. The shop zone is open also on weekends and closed only on holidays. As the shop zone area accounts for about 40% of the total floor area, it is anticipated that the energy consumptions in the building on Saturdays and Sundays will be respectively around 70% and 40% of the total on weekdays. The figure below shows energy consumption on weekends. The measurement of energy consumption is carried out at different times everyday, thus the data obtained is hardly utilized. It was not possible to confirm anticipated values.



6) Energy consumption by time of the day

The load curb over 24 hours of a typical day of May is shown below.

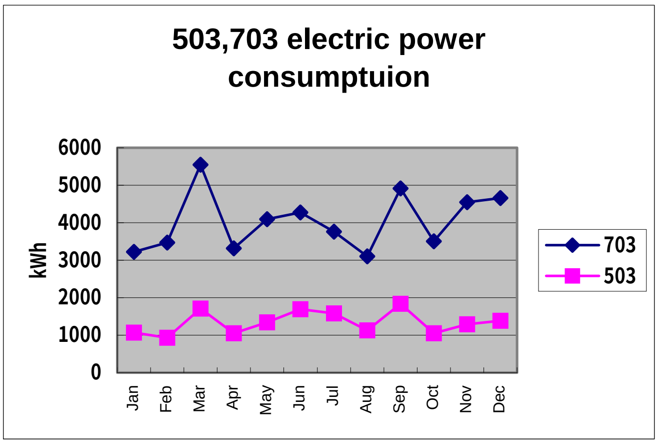
In the graph, the value of peaked hourly consumption is 800 kWh, which is almost the peak energy consumption value of the year for this building. The power consumption rapidly decreases immediately after the closing time of the day at around 6 o'clock in the evening and this shows that workers do not work overtime very much. The power consumption at midnight, which is around 70 kW, is also less than one tenth of the consumption during the day time.



7) Power consumption in typical office rooms

a. Measurement values

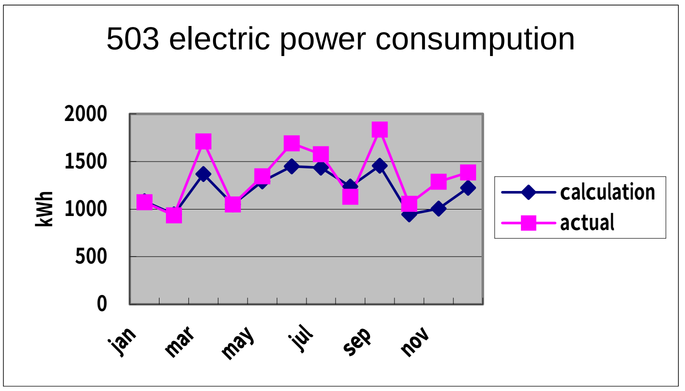
The figure below shows monthly power consumption in 2 typical officer rooms. Both rooms show the similar trends including prominently high power consumption in March and September. As each room is air-conditioned using a split-type air conditioner and the power consumption for air-conditioning is reflected in the graph below, the major factor for the similar trends may be the temperature outside the building.



b. Simulation graph

The graph below shows a simulation of monthly electricity consumption in the room No. 503 above, calculated based on the fixed power consumption by lighting fixtures and office equipment and the varied power consumption by air conditioners set as a load factor with month. The simulation graph shows similar values to the actual line.

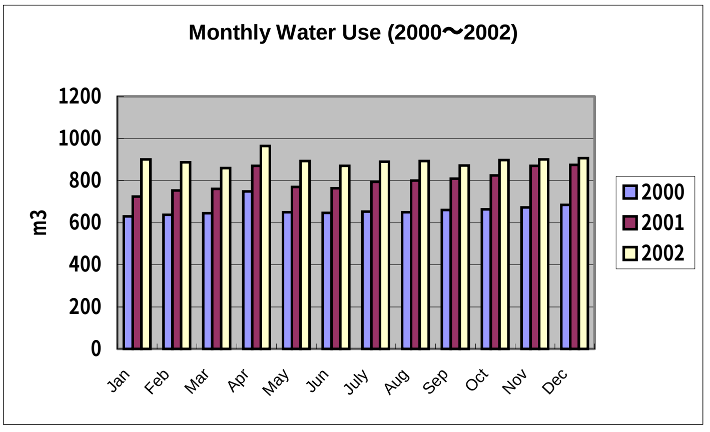
The appropriateness of assumption was confirmed.



8) Water consumption data

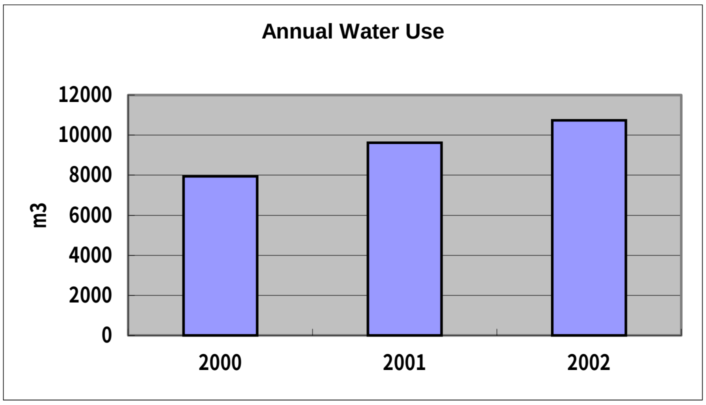
a. Monthly water consumption (2000-2002)

Monthly water consumptions for the period of 3 years from 2000 to 2002 are shown below. Although monthly changes are not so large, it is clear that overall water consumption is increasing year by year.



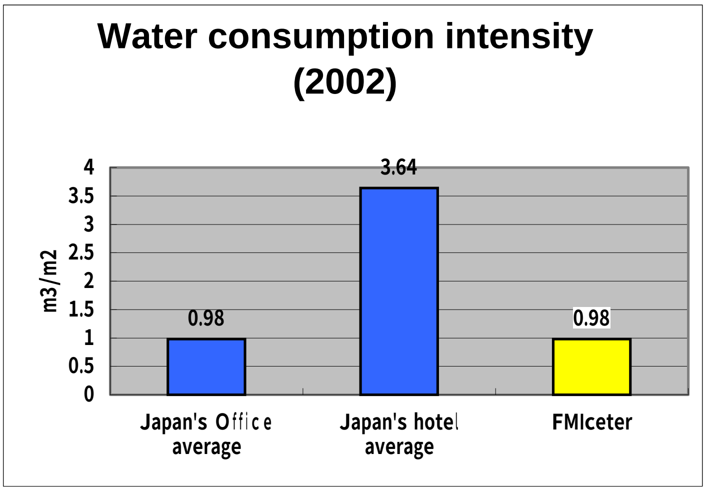
b. Changes in annual water consumption

Annual water consumptions for the same period are shown below. If the water consumption in 2000 is normalized at 100, that of 2001 and 2002 will be respectively 121 and 135, showing a large yearly increases. As the refrigeration facilities of FMI Center is air-cooling chillers, there is no water consumption in cooling towers and thus the water consumption in the building is considered to be the water use by people. Hence, it is assumed that the number of users in the offices and shops has dramatically been increasing.



c. Comparison with other buildings

The graph below shows water consumption of FMI Center compared with that of office buildings in Japan. Both shows the same water consumption intensity of 0.98 m^3/m^2.



(3) Points for improvement and calculation of expected effects

1) Improvement in the temperature of chilled water

Current condition

Chillers are in operation with the temperature setting of the chilled water outlet temperature at a low temperature even during the light-load seasons.

Proposed improvement

Raising the chilled water outlet temperature during the season of low cooling load to achieve high efficiency operation of chillers

Formula

(Power consumption by chillers) × (Saving rate as the result of improvement in the chilled water outlet temperature)

Estimation of effects

a. Conditions for estimation

Seasons of low cooling load

9 months from January to March and July to December

Chilled water outlet temperature

6°C (some data show 4°C) → 9°C

Saving rate due to an improvement in the chilled water outlet temperature

9% (See the reference graph)

Average load factor during the low-cooling-load seasons   40%

Business days of the shopping zone in a year

264 days,   365 – (30+31+30) –10 = 264

Business hours/day of the shopping zone   9 h

Chillers' compressor power   100 kWB × 2 sets

Chillers' motor efficiency   0.86

b. Calculation

Power consumption for 9 months

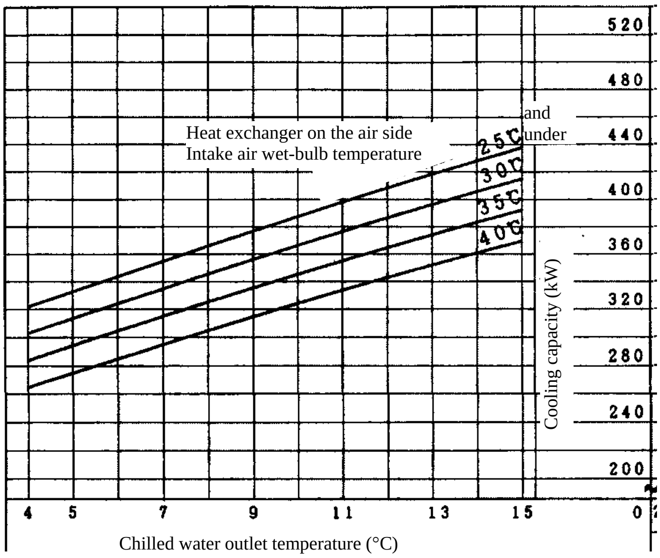
$100 \times 2/0.86 \times 0.4 \times 9 \times 264 = 211{,}023$ kWh

Reduced power consumption

$211{,}023 \times 0.09 = 18{,}992$ kWh

This amount corresponds to 2.3% of power consumption in the public area in 2002 that is 817,189 kWh and 0.9% of the total power consumption of the building that is 2,046,500 kWh.

Reference graph



2) Effective use of indoor exhaust air
(Improvement in efficiency of separate-type package)
Current condition
Outdoor equipment of the split-type air-conditioners is installed in void space inside building and the efficiency of air-conditioners is falling due to high-temperature of intake air.

Proposed improvement
By directing indoor exhaust air released above outdoor equipment down toward the outdoor equipment, in-take air temperature for the outdoor equipment can be lowered and eventually its efficiency can improve.
Formula
(Power consumption by air-conditioners) × (Input power reduction rate as the result of improvement in the temperature of the outdoor equipment intake air)

Estimation of effects

a. Conditions for estimation

Operating hours of the office zone

For 1 month: 20 days × 9 h + 4 days × 3.5 h = 194 h

For 1 year: 194 h × 12 = 2,328 h

Rated power of air conditioners	473 kW (total of 135 units)
Average load factor	40%
Improvement range of intake air temperature	2°C
Improvement rate of input power	3% (Reference graph)

b. Calculation

Yearly air-conditioners' power

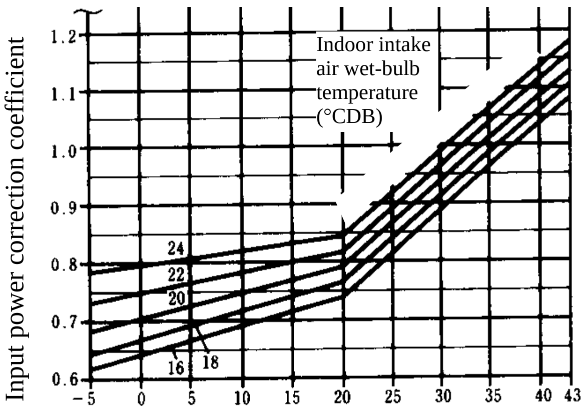
473 × 0.4 × 2,328 = 440,458 kWh

Reduced power consumption

440,458 × 0.03 = 13,214 kWh

This amount corresponds to 1.5% of power consumption in the office zone in 2002 that is 889,100 kWh and 0.6% of the total power consumption of the building that is 2,046,500 kWh.

Reference graph



3) Introduction of total enthalpy heat exchanger

Current condition

Air supplying and exhausting systems for the shopping zone work independently and the waste air heat is not effectively used.

Proposed improvement

Recovering cryogenic heat of exhaust air by total enthalpy heat exchanger to cool supply air

Estimation of effects

a. Conditions for estimation

Outside air intake quantity (based on the existing design drawing)

10,000 m^3/h (assumed)

Exhaust air quantity (based on the existing design drawing)

9,576 m^3/h

Condition of outside air during the peak demand hours

35°C, 65% → 97 kJ/kg

Indoor condition 26°C, 50% → 53 kJ/kg

Outside air load during the peak demand hours

10,000 × 1.2 × (97–53) = 528,000 kJ = 528 MJ

Yearly load factor 0.4

No. of business days/year at the shopping zone	348 days (365–17=348)
No. of business hours/day at the shopping zone	9h
Heat recovery efficiency	(assumed at 0.6)
COP of chillers	(assumed at 3.0)

b. Calculation

Heat quantity to be recovered

528 × 0.4 × 9 × 348 × 0.6 = 396,887 MJ

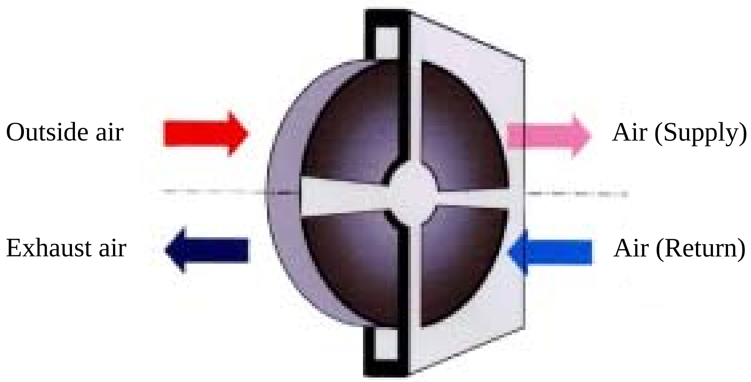
Reduced power of chillers

396,887 ÷ 3.0 = 132,296 MJ

132,296 ÷ 3.6 = 36,749 kWh

This amount corresponds to 4.8% of power consumption in the public area in 2002 that is 817,189 kWh and 1.8% of the total power consumption of the building that is 2,046,500 kWh.

Reference figure



(4) Summary of improvement effects

Standard for comparison: power consumption in 2002 2,046,600 kWh

		Reduced power	
		kWh	%
1	Improvement in the chilled water temperature	18,992	0.9
2	Effective use of indoor exhaust air	13,214	0.6
3	Introduction of total enthalpy heat exchanger	36,749	1.8
	Total	68,955	3.3

4.2 Pansea Hotel

(1) Outline of the building

1) Name: Pansea Hotel

2) Use: Hotel (50 guest rooms)

3) Size: 2 basements and 3 floors above the ground

Total floor area; 7,111.1 m^2

4) Age of the building: 80 years

5) Outline of electrical systems:

Receiving voltage 6.6 kV × 50 Hz, Transformer capacity 500 kVA

Power generator (for emergency) 315 kVA

6) Outline of air-conditioning systems:

Split type air-conditioner (62 units)

7) Sanitary facilities:

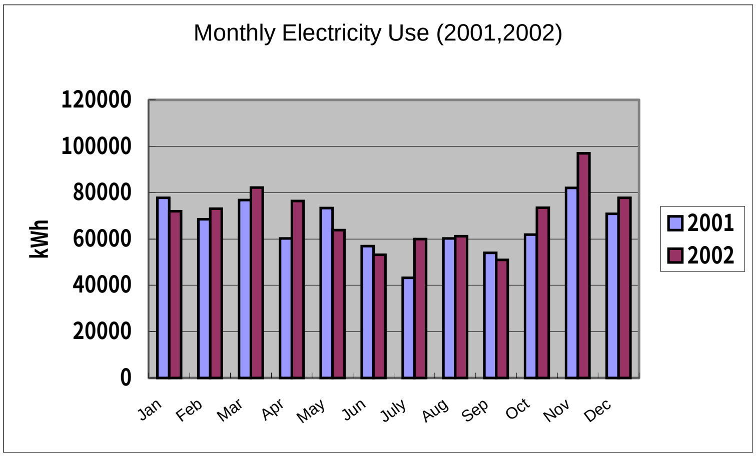
Well pump	1.1 kW × 1, 0.56 kW × 1 set,
Underground water receiving tank	36.4 m^3
Booster pump	4.1 kW × 2, 1.9 kW × 2 sets,
Hot water storage-type electric water heater in guest rooms	
	50 l × 1.8 kW

(2) Analysis of current energy consumption status

1) Monthly power consumption (2001, 2002)

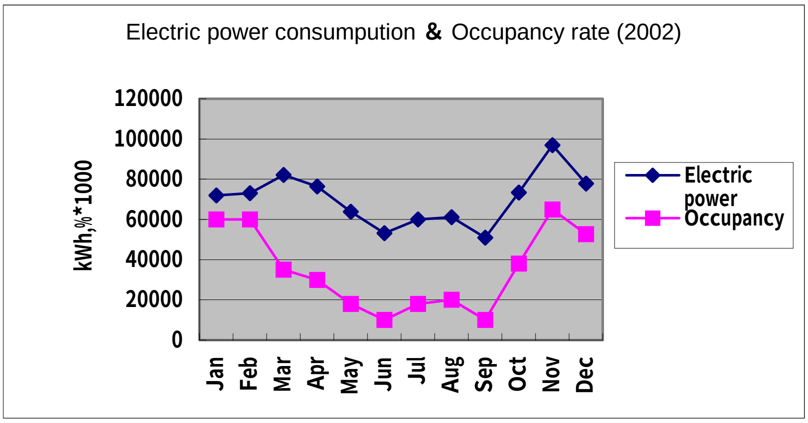
Changes in monthly power consumption in 2000 and 2002 are shown in the figure below.

Both years show almost the same power consumption trends. Power consumption peaks in November and March and falls during the period from June to September.



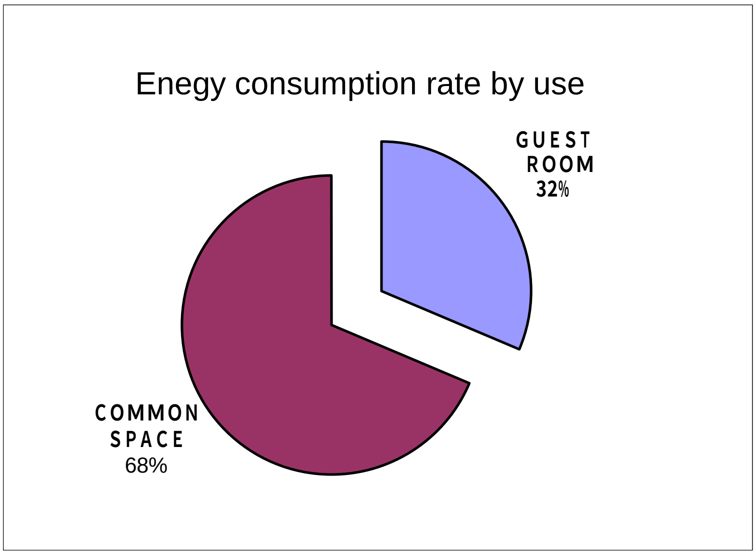
2) Power consumption and hotel's occupancy rate

The relation between power consumption and the hotel's occupancy rate in 2002 is shown in the figure below. Sequential line graphs show the same trends except in March and April in which they move in a slightly different way. According to the explanation by the chief engineer, the hotel underwent refurbishing construction of the rooms in March and April when the hotel's occupancy rate was low. He clearly analyzed that the use of air-conditioning during the construction might be reflected in the power consumption at that time.

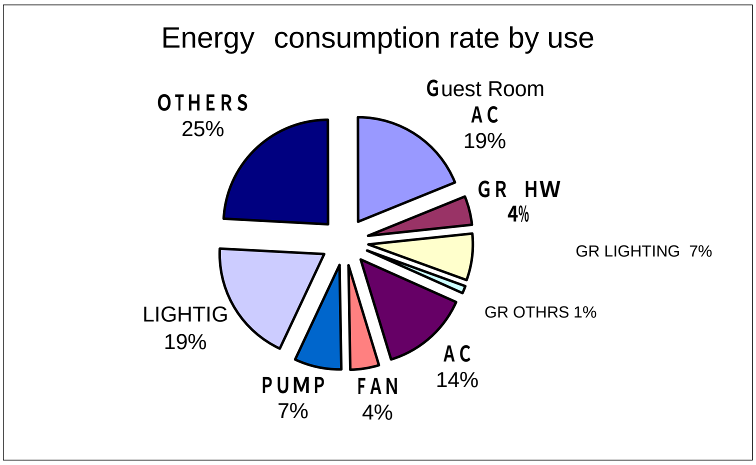


3) Energy consumption by use

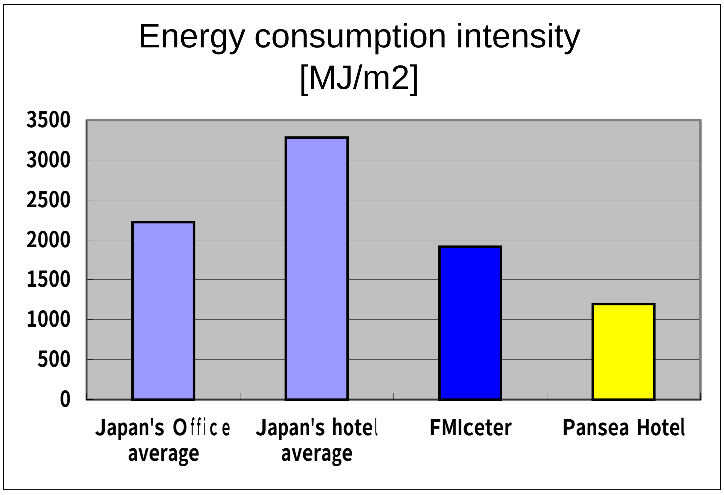
The figure below shows energy consumption distribution percentage by use estimated based on capacities of the respective equipment and their operation hours. It is estimated that 32% of the energy is consumed in guest rooms and the remaining 68% is consumed in the common space.



The further breakdown of the above circular graph is shown below. The air-conditioning equipment for guest rooms consumes 19% of the total energy. Hot water supply system and guest room's lighting fixtures respectively consume 4% and 7% of the total energy. The reason why others combined make up 25% is that equipment of large electric capacity is used in kitchen and laundry.



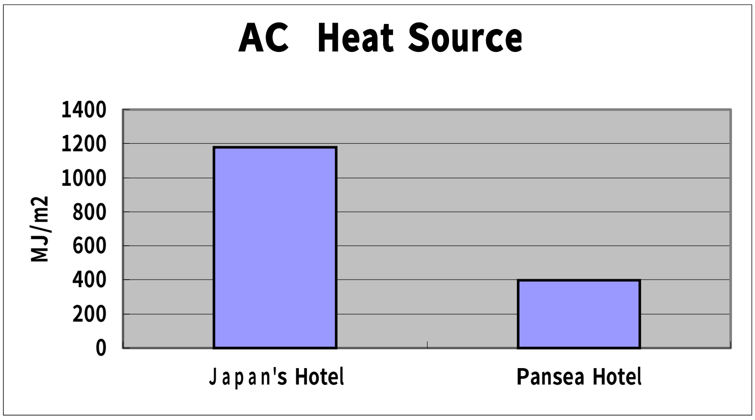
4) Comparison with other buildings: total energy consumption
Energy consumption intensity of Pansea Hotel is 1,196 MJ/m^2, which is about one third (1/3) of the average energy consumption intensity value for hotels in Japan, i.e. 3,278 MJ/m^2.



5) Comparison with other buildings: air-conditioning heat source energy consumption

The reason why the hotel's energy consumption is extremely low is that the building's design itself is excellent and the hotel is designed based on a concept of passive design to be in a comfortable condition without air-conditioning by maximizing the advantage of nature.

The following chart compares air-conditioning-related energy consumptions between Pansea Hotels and hotels in Japan. Energy consumption of Pansea Hotel is also about one third (1/3) of that of hotels in Japan.



(3) Points for improvement/calculation of expected effects

1) Replacement with high-efficiency lamp

Current situation

In each guest room and its entrance, conventional-type filament lamps are used as follows;

Guest room	40 W lighting fixture	4 units × 50 rooms
Guest room entrance	40 W lighting fixture	2 units × 50 rooms
Corridor	40 W lighting fixture	10 units

Proposed improvement

Replacing the current 40 W filament lamps with 7 W high-efficiency lamps

Formula

(Energy saved by high-efficiency lamps) × (No. of lamps replaced) × (lighting hours/day) × (occupancy rate) × 365

Estimation of effects

a. Conditions of estimation

Lighting hours Guest rooms: 10 hours/day
Guest room occupancy rate: 32%, 365 days
Guest room entrance and corridor: 12 hours/day, 365 days

40 watt → 7 watt

Replacement of 310 lamps

b. Calculation

Reduced power consumption

Guest rooms

$(40 - 7) \times (200 \times 10 \times 0.32) \times 365 \div 1{,}000 = 7{,}709$ kWh

Guest room entrance and corridor

$(40 - 7) \times (110 \times 12) \times 365/1{,}000 = 15{,}899$ kWh

Total 23,608 kWh

2) Review of hot water supply system

Current condition

A 50-liter hot water storage-type of electric water heater supplies hot water to each guest room. The temperature of hot water drops when hot water is used for the bathtub.

Proposed improvement

Ensuring a comfortable temperature level even when hot water is used to fill the bathtub

Conditions for calculation

Current hot water storage capacity and temperature	50 l, 60°C
Supplied water temperature	20°C
Bathtub volume	200 l

a. Bathtub temperature under the current condition x°C

$x = (60 \times 50 + 20 \times 150) \div 200 = 30 \rightarrow x = 30°C$

b. Hot water storage capacity required to retain the temperature of the bathtub hot water at 40°C y l

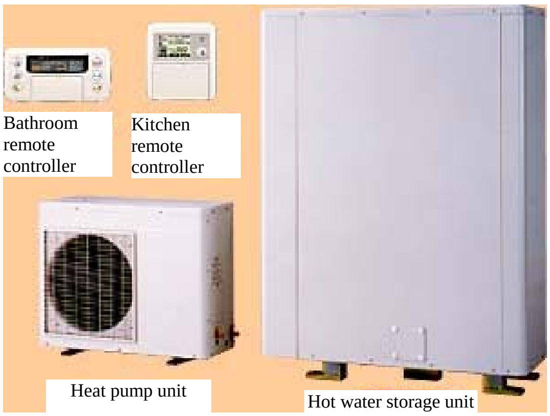
$200 \times 40 = 60y + 20 \times (200 - y)$

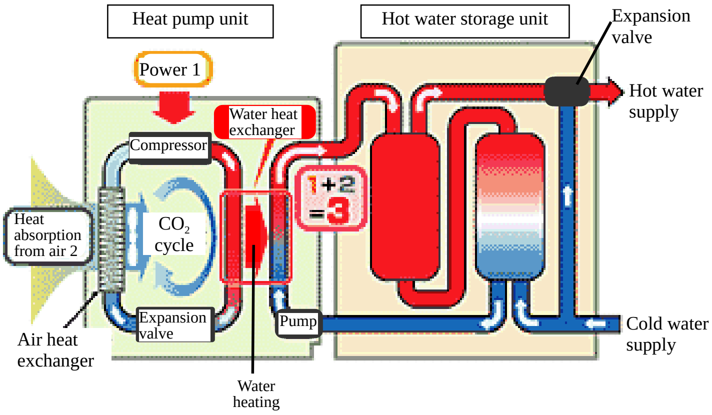
$y = (8{,}000 - 4{,}000) \div 40 = 100 \rightarrow 100$ l

The current problem can be solved by installing two units of 50-liter water heater.

Reference material

In Japan, hot water supply equipment using heat pump with CO_2 coolant came into use.





COP of this equipment is 3.0 and its energy consumption is one third (1/3) of the currently used electric water heater.

Expected effects realized by the installation of this equipment for Pansea Hotel were estimated.

Estimation of effects

a. Estimation of yearly power consumption of the current electric water heater

Assumed that:

- One guest room consumes 50 liters of hot water 1.7 times in a day, and
- The Hotel's average occupancy rate is 50%.

No. of guest rooms is 50.

$50 \times (60 - 20) \times 1.7 \times 50 \times 0.5 = 85{,}000$ kcal $\quad 85{,}000 \div 860 = 98.8$ kWh

$98.8 \times 365 = 36{,}062$ kWh

This amount accounts for 4.3% of Pansea Hotel's total power consumption in 2002, i.e. 840,882 kWh.

b. Effects expected by the adoption of heat pump water heating system

Power consumption of heat pump equipment

$36{,}062 \div 3 = 12{,}021$ kW

Reduced power

$36{,}062 - 12{,}021 = 24{,}041$ kWh

This value corresponds to 2.9% of the hotel's yearly power consumption.

3) Improvement in power factor

Current situation

The equipment was in operation at a power factor of 85%.

Proposed improvement

Retaining power factor at near 100% by the automatic control of power factor

Expected effects

As power factor improves to closer to 100%, load current decreases. As a result, power distribution channel loss decreases and reactive power decreases accordingly, thus contributing to energy saving.

Although it is reported that power factor is not linked with electric power charge in Myanmar, the improvement in power factor definitely helps energy conservation in the view of f overall power system.

4) Water volume management

Current situation

Water used in the hotel is pumped by 2 sets of well pumps. The volume of water used is unknown, however, because no measurement is carried out.

Proposed improvement

Measuring and recording water volumes by installing water flow meter

Expected effects

Pansea Hotel has a big swimming pool and consuming a large volume of water.

Measuring water volumes will help management of operation of well pumps and booster pumps as well as early detection of water leakage from piping and the pool.

(4) Summary of improvement effects

Comparison standard: Power consumption in 2002 840,882 kWh

		Reduced electricity	
		kWh	%
1	Replacements with high-efficiency lamps and equipment	23,608	2.8
2	Utilization of heat pump hot water supply system	24,041	2.8
	Total	39,940	4.7

5. Database, Benchmarks and Guidelines for Myanmar

5.1 Energy audits for energy conservation and the development of database, benchmarks and guidelines for buildings in Japan were introduced. (Almost the same content as those introduced in Vietnam)

5.2 Development of Database and Benchmarks in Myanmar

(1) As any compiled data were not found in Myanmar, we requested participants of the workshop to prepare and submit data on the buildings they had. Based on these data and materials, all the participants were trained through studying to develop database and benchmarks. The submitted data consist of 11 cases shown in Table III-5-1, namely the data of 9 buildings prepared by the participants and the data of 2 buildings in which the energy audits were conducted in the current survey.

Table III-5-1 Sample Buildings Used for Database Development

Use of Category	Number	Remarks
Government Office	6	
Temple	1	
Hospital	2	
Commercial Office	1	ECCJ Audit
Hotel	1	ECCJ Audit

(2) Information on energy consumption for the respective buildings was collected to the extent possible using Table III-5-2 “Energy Consumption Data” and Table III-5-3 “Building Information”.

Table III-5-2 Energy Consumption Data

	Electricity (kWh)	Demand Peak (KW)	LPG (Kg)	OIL (L)	Water (m^3)
Jan	24,811				
Feb	25,132				
Mar	29,744				
Apr	27,956				
May	29,224				
Jun	26,656				
Jul	27,232				
Aug	26,958				
Sep	273,123				
Oct	25,002				
Nov	18,550				
Dec	16,320				

Table III-5-3 Building Information

・Name of the Building:		Public Works		
Address		60 shwedagonpagoda road		
・Category of Usage:				
	・Landload building or Tenant building	Landload building		
・Age of Building:		30		
・Size：				
	・Total gross floor	11044	m^2	
	・Number of stories	4	F	
	・Basement Stories	0	F	
・Electrical facilities:				
	Receiving voltage	6.6	kV	
	Agreement capacity	-		
	Transformer capacity	500	kVA	
・Air conditioning facility:				
	Heat source capacity for cooling	-		
	Main equipment	-		
	Heat source capacity for heating	-		
	Main equipment	-		
	Air conditioning system	Split unit		
・Sanitary facility:				
	Water supply system	City,well		
	Hot water supply system	-		
・Air conditioner setting temperature and humidity:				
	Summer °C	24	°C	
	%	50	%	
・Working hour:				
	Week day	8	H	
	Saturday	0	H	
	Sunday	0	H	

The data obtained was summarized in Table III-5-4 “Building Energy Database in Myanmar (1)” and Table III-5-4 “Building Energy Database in Myanmar (2)” including data on the 2 buildings that ECCJ audited, in terms of the energy intensity, or the energy consumption per $1m^2$ of gross floor area.

Table III-5-4 Building Energy Database in Myanmar (1)

No.	Category	Category No.	Location	GFA [Ft2]	GFA [m^2]	Date [Year]	Electricity [kWh]	Electricity intensity [kWh/m^2]
1	Government Office	GO-1	Yangon		5,244	2002	152,837	29.1
2	Government Office	GO-2	Yangon	43,680	4,058	2002	221,314	54.5
3	Government Office	GO-3	Yangon		3,866	2002	66,086	17.1
4	Government Office	GO-4	Yangon	21,600	2,007	2002	45,500	22.7
5	Government Office	GO-5	Yangon	20,000	1,858	2002	58,610	31.5
6	Government Office	GO-6	Yangon		11,044	2002	304,798	27.6
7	Temple	TE-1	Yangon		10,115	2002	96,071	9.5
8	Commercial Office	CO-1	Yangon		10,953	2002	2,046,500	186.8
9	Hotel	HL-1	Yangon		7,111	2002	840,882	118.3
10	Hospital	HS-1	Yangon		13,998	2002	315,632	22.5
11	Hospital	HS-2	Yangon		12,865	2002	1,143,648	88.9

Table III-5-5 Building Energy Database in Myanmar (2)
Electricity Monthly Consumption [kWh]

Ccategory	Category No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Government Office	GO-1	15764	15764	15764	10100	8868	14499	15948	17352	14962	12760	5368	5688	152837
Government Office	GO-2	17234	23227	22953	32186	31100	23151	22263	18325	13664	6462	5524	5225	221314
Government Office	GO-3	5080	5488	5488	5488	6604	6226	7156	6304	6174	5656	5420	1002	66086
Government Office	GO-4	3600	3800	3700	3950	3900	4000	3600	3450	3800	3700	3900	4100	45500
Government Office	GO-5	4640	4880	5200	5060	4890	5340	4700	4300	4700	4500	5100	5300	58610
Government Office	GO-6	24811	25132	29744	27956	29224	26656	27132	26958	27313	25002	18550	16320	304798
Temple	TE-1	6292	4554	6721	12309	12969	8502	7535	7359	7027	7777	8690	6336	96071
Commercial Office	CO-1	149600	159200	143100	175000	121200	210700	175200	197500	170100	190800	192300	161900	2046600
Hotel	HL-1	72000	73002	82200	76398	63780	53190	59976	61176	51006	73410	96960	77784	840882
Hospital	HS-1	12256	15048	16500	18810	19206	10032	10758	8712	9434	21516	104544	68816	315632
Hospital	HS-2	81576	84480	76560	147048	103752	106128	121440	92400	111408	74976	83160	60720	1143648

(3) Results of regression analysis of data for Myanmar

The analysis is summarized as follows.

1) Electricity Intensity in Myanmar

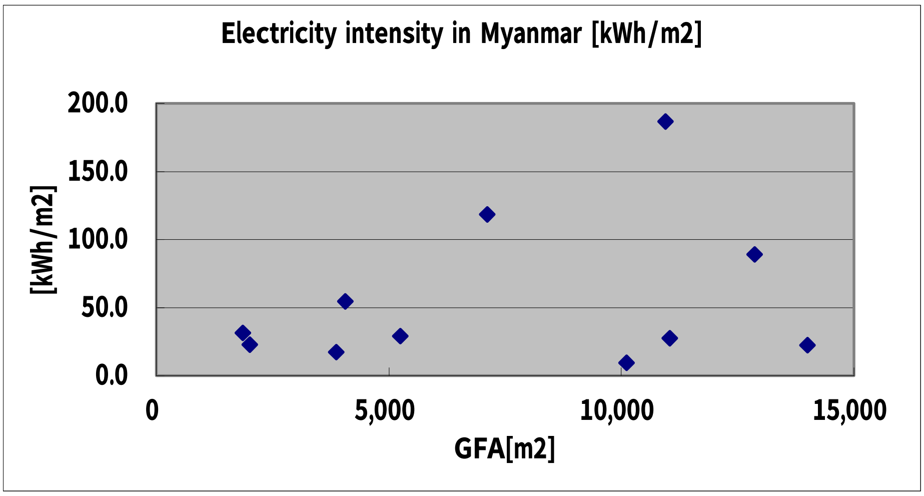


Figure III-5-1 Electricity Intensity in Myanmar

2) Electricity Intensity for Government Office

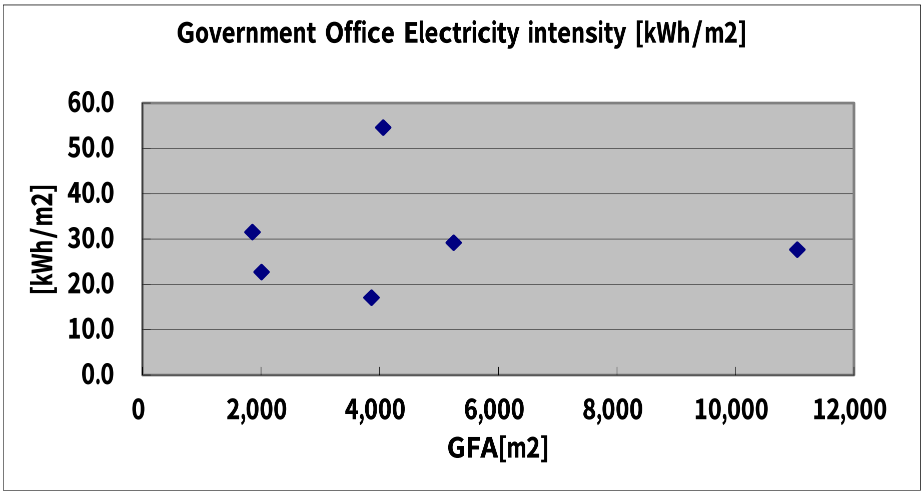


Figure III-5-2 Electricity Intensity for Government Office

3) Monthly Electric Power Consumption for Government Office

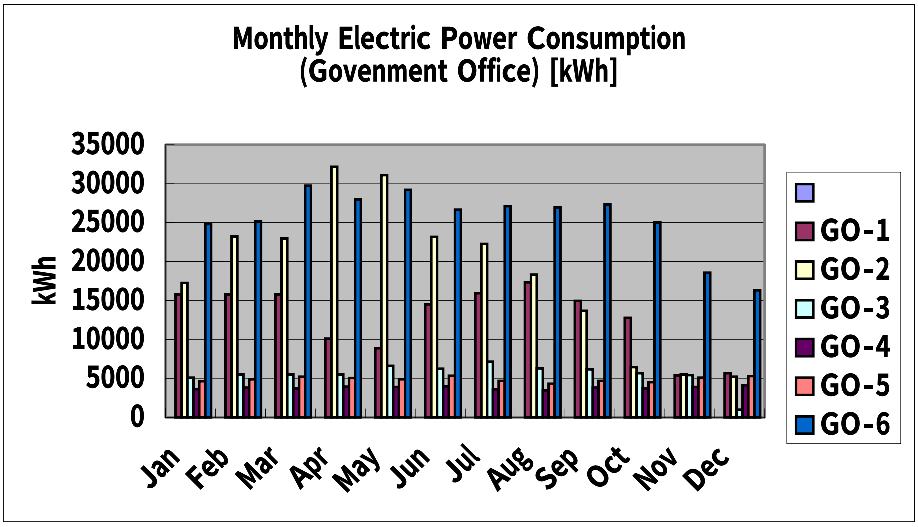


Figure III-5-3 Monthly Electric Power Consumption for Government Office

IV. ASEAN Activities

1. Summary of ASEAN Workshop

Date: February 28 and March 1, 2003
Participants from ECCJ: • Kazuhiko Yoshida; General Manager, International Engineering Department • Akira Ueda; Technical Expert, International Engineering Department • Akira Kobayashi; Technical Expert, International Engineering Department

Date	Events, Location, etc.	Activity
February 28 (Fri.) & March 1 (Sat.)	ASEAN Workshop (At the Grand Mee YaHta)	• ECCJ members participated in the ASEAN Workshop held over 2 days and reported on the following matters. Reported items ① Results of the surveys and energy audits of buildings in Vietnam and Myanmar See Table IV-1-1 “PROMMEC Buildings Slide List”. The presentation material is attached herewith. Item 1. “Report on the results of the audits” of buildings of Section V. “Materials”. ② Current status of developing of database, benchmarks and guideline in Japan See Table IV-1-2 “Development of database Slide List” and Table IV-1-3 “Energy Audit, Database & Benchmark in Buildings in Japan Slide List”. The presentation materials are attached herewith. Item 2. “Promotion of database development” and Item 3. “Database in Japan” of Section V. “Materials”. ③ Current situation regarding the development of database, benchmarks and guideline in Myanmar See Table IV-1-4 “Energy Audit, Database & Benchmarking in Buildings in Vietnam Slide List”. The presentation material is attached hereto. Item 4. “Database in Vietnam and Myanmar” of Section V. “Material”. • These reports were well evaluated and followed by active discussions on the subjects by all the participants;

Date	Events, Location, etc.	Activity
		Participants from ASEAN countries Mr. Tin Tun (Guest, Myanmar) (Deputy Minister, Ministry of Energy) Mr. Pravit Teetakeaw (Chairman, Thailand) (Executive Director, Ministry of Energy) Ms. Swanee Saratuni, (Thailand) Mr. Parlindungan (Indonesia) Dr. LeeSiewEang (Singapore) Mr. Majid Hajid Hajai Sapar (Singapore) Mr. Abdul Rashid B Ibrahim (Singapore) Ms. Azah Ahmad (Malaysia) Mr. Artemio P.Habitan (Philippine) Mr. Le Tuan Phong (Vietnam) Mr. LiengVuthy (Cambodia) Mr. Anousak Phongsavath (Lao PDR) Mr. AungKyi (Myanmar) Mr. U TheinLwin (Myanmar) Mr. U Aye Kyaw Mr. Maung Maw Mr. Kyaw T Dr. Sein Myint Mr. Christpher Zamora (ACE) and 5 others persons

Table IV-1-1 PROMEC Building (Slide List)

No.		Title	Note
1		PROMEEC-Building Activities in Vietnam and Myanmar	Cover
2		Outline of Presentation	
3		Overview of Activities	
4		PROMEEC-Building Activities in Vietnam and Myanmar	
5		Energy Conservation Technologies	
6		Workshop in Vietnam	
7		Workshop in Myanmar	
8		Workshop on Energy Conservation Technologies: Objectives	
9		Workshop on Energy Conservation Technologies: Talking	
10		Energy Audit and on the Job Training	Title
11		The Audit Buildings	
12		The Audit Approach: Data gathered	
13		The Audit Approach: On-Site investigation	
14		The Audit Approach: Calculation of Energy Savings	
15		Simulation by Calculation	
16		Energy Data & Performance Indicators 1	

No.		Title	Note
17		Energy Data & Performance Indicators 2	
18		Energy Data & Performance Indicators 3	
19		Energy Data & Performance Indicators 4	
20		Energy Data & Performance Indicators 5	
21		Energy Data & Performance Indicators 6	
22		Energy Data & Performance Indicators 7	
23		Energy Data & Performance Indicators 8	
24		Energy Data & Performance Indicators 9	
25		Energy Data & Performance Indicators 10	
26		Energy Data & Performance Indicators 11	
27		Improvement Plan and Recommendation	Title
28		Summary of Energy Saving Measures	
29		Change of Chiller water outlet temperature	
30		Reference Data	
31		Use of Indoor Exhaust Air	
32		Reference Data	
33		Improvement of Heat Exchanger and Cool Supply air	
34		Collect exhaust air heat energy by heat exchange and cool supply air	
35		Heat pump Hot water Supply System	
36		Current Practice Good Case	
37		Use of Solar Water Heater	
38		Excellent Passive Design for Tropical Building	
39		Good to excellent Active Design and Management	
40		Speedy Improvement	
41		Benchmarking & Database Development	
42		Benchmarking & Database Development: Bench Marks for Various Buildings in Japan	
43		Benchmarking & Database Development	

Table IV-1-2 Development of Database/Benchmark/Guideline (Slide List)

No.		Title	Note
1		Workshop: Case Study Development of Database/Benchmark /Guideline	Cover
2		Development of Database/Benchmark/Guideline	Title
3		Development Process: Database/Benchmark/Guideline	
4		Database Development (Building)	
5		Statistical Processing (Building)	
6		Benchmark/Criteria Setting Analysis (Building)-1	
7		Benchmark/Criteria Setting Analysis (Building)-2	
8		Study to Setup Guideline (Building)	
9		Basic Approach for database/Benchmark/Guideline Development	

Table IV-1-3 Energy Audit, Database & Benchmarking for Buildings in Japan (Slide List)

No.		Title	Note
1		Energy Audit, Database & Benchmarking in Buildings in Japan	
2		Outline of Presentation	
3		Introduction	
4		Trend in Final Energy Consumption by Sector	
5		Energy Audit	
6		Application and Process of Energy Audit in Japan	
7		Distribution of Energy Audits by Type of Building	
8		Proposed Measures to Identify Savings through Energy Audit	
9		Points to Focus in Energy Saving for Buildings 1)	
10		Points to Focus in Energy Saving for Buildings 2)	
11		Points to Focus in Energy Saving for Buildings 3)	
12		Type of Data Collected 1)	
13		Type of Data Collected 2)	
14		Calculation of Building Energy Efficiency Index (in MJ/m2)	
15		Database & Benchmarking System	
16		Standardization of Units	
17		Database & Benchmarking System	
18		Benchmarking in Various Types of Buildings in Japan	
19		Information Dissemination of Database & Benchmarks	
20		Energy Efficiency Buildings: Guidelines in Japan	
21		Obligation of Building Owners	
22		1) Prevention of heat loss through external walls, etc	
23		2) Efficient use of air conditioners	
24		Standard value of energy conservation for building	
25		Guidelines for the Use of Energy Efficient Equipment in Japan	
26		Air conditioner	
27		Fluorescent lamp	
28		Operating Guidelines for Factories and Buildings	
29		Areas for Rational Use of Energy	
30		Standard values and target values of air rations	
31		Future Direction	
32		Obligation of Building Owners	
33		By the Law	
34		Promotion of BEMS	
35		Measurement Sample: Heat Source	
36		Energy Profile of Equipment	

Table IV-1-4 Energy Audit, Database & Benchmarking for Buildings in Vietnam & Myanmar (Slide List)

No.		Title	Note
1		Energy Audit, Database & Benchmarking in Buildings in Vietnam & Myanmar	
2		Outline of Presentation	
3		Overview of Activities	
4		Case Study for Building in Japan	
5		Exercise in Vietnam	
6		The Participants	
7		Building Audit Report of EVV & IE	
8		Sample Size: 14 + 2 Buildings	
9		Data Management 1	
10		Data Management 2	
11		Energy Efficiency Index of 16 Buildings	
12		EE Index of 6 Hotels + 1 Mixed Use Buildings	
13		EE Index of Office Buildings	
14		Performance Indicator: Water Intensity	
15		Data Management	
16		Exercise in Myanmar	
17		The Participants	
18		Sample Size: 11Buildings	
19		Data Management: Building Information Sheet	
20		Data Management: Energy Consumption Data Sheet	
21		Energy Efficiency Index of 11 Buildings	
22		Energy Efficiency Index of Government Office	
23		Performance Indicator: Government Office Buildings Monthly Data	
24		Comments	

2. Energy Audit for Buildings

2.1 Actual Achievements

Energy audits for buildings were carried out in the fiscal years of 2002 and 2001 consecutively and the actual energy audits for the following buildings were implemented by 2002.

2000	Thailand	Office building
	Singapore	Complex-use building
2001	Cambodia	Hotel building
	Indonesia	Office building
	Philippine	Office building
2002	Vietnam	Hotel buildings (2)
	Myanmar	1 complex-use building (offices and shops) and 1 hotel building

Energy audits conducted in 2000 and 2001 focused on transferring technologies to advance energy conservation and the results are summarized in the reports.

In 2002, energy audits were carried out at 2 buildings each country in 2 countries (total 4 buildings). These energy audits are particularly characterized by focusing on OJT (On the Job Training) in field to participants in addition to the actual energy audit by Japanese experts.

During the interviews with persons from the audited buildings, participant attended the interviews to understand what points to ask, and they joined the actual survey in field, for the purpose of checking auditing points. On the following day of the 1st survey, the wrap-up meeting was held to report on the points for improvement found in the survey on the previous day and had discussions with the participants.

In the 2nd site survey, the additional surveys were conducted to raise the preciseness of calculations while giving participants lectures about the methods to calculate expected improvement effects.

Based on the actual results, we believe that about 20 engineers from the two countries where the energy audits were conducted in 2002 could understand and acquire auditing technique and procedure through these activities.

2.2 Future Direction

Regarding the procedure of the energy audit, based on the results of the project activities in the fiscal year of 2002, it is recommended to conduct the energy audit on a basis of OJT. Through this procedure, the transfer of the technologies realized in Japan to engineers from ASEAN countries can be ensured, which will result in larger effects.

Concerning the time schedule of the project implementation, it is also recommended to set up time frame sufficient for analysis and study between the completion of the investigation at buildings and the wrap-up meeting where the audit results and recommendation shall be satisfactorily and fruitfully discussed.

3. Database, Benchmarks and Guideline

In the fiscal year of 2002, the project activities consisted of not only the energy audits of buildings but also the case studies to discuss and experience developing the database, benchmarks and guideline for buildings in Vietnam and Myanmar.

In Myanmar, for example, the participants were requested to obtain data on total floor area and energy consumption of the buildings concerned prior to the site survey. And, on the day of audit training, the respective persons in charge reported on the features and energy consumption status of the buildings in front of other participants. Based on the same understanding of all the participants about the general background knowledge of the buildings, the energy intensities of the respective buildings were studied and discussed.

Although it was the first time to apply the case study which was conducted on the trial and error basis, the whole process was very meaningful and fruitful owing to participants' strong awareness. In the countries having a limited number of buildings, the activities created a valuable benchmark and because local participants joined in and created it by themselves, they were successfully able to establish the foundation for the future activity.

In the ASEAN Workshop also, it was decided to organize the task force to develop the database, benchmarks and guidelines for ASEAN in the future. For the countries where the energy audits for buildings will be conducted in the future, it is recommended to develop the activities coincident with those of the ASEAN task force and to establish the database, benchmark and guideline reflecting the actual local conditions of the respective countries.

V. Attached Reference Materials

Material – 1	**:**	**PROMEEC-Building Activities in Vietnam and Myanmar**
Material – 2	**:**	**(Workshop : Case Study) Development of Database / Benchmark / Guideline**
Material – 3	**:**	**Energy Audit, Database & Benchmarking in Buildings in Japan**
Material – 4	**:**	**Energy Audit, Database & Benchmarking in Buildings in Vietnam & Myanmar**
Material – 5	**:**	**Data and Information Political and Technical**

Material – 1

PROMEEC-Building Activities in Vietnam and Myanmar

PROMEEC - Building Activities in Vietnam and Myanmar

Akira Kobayashi

The Energy Conservation Center, Japan

28 February 2003

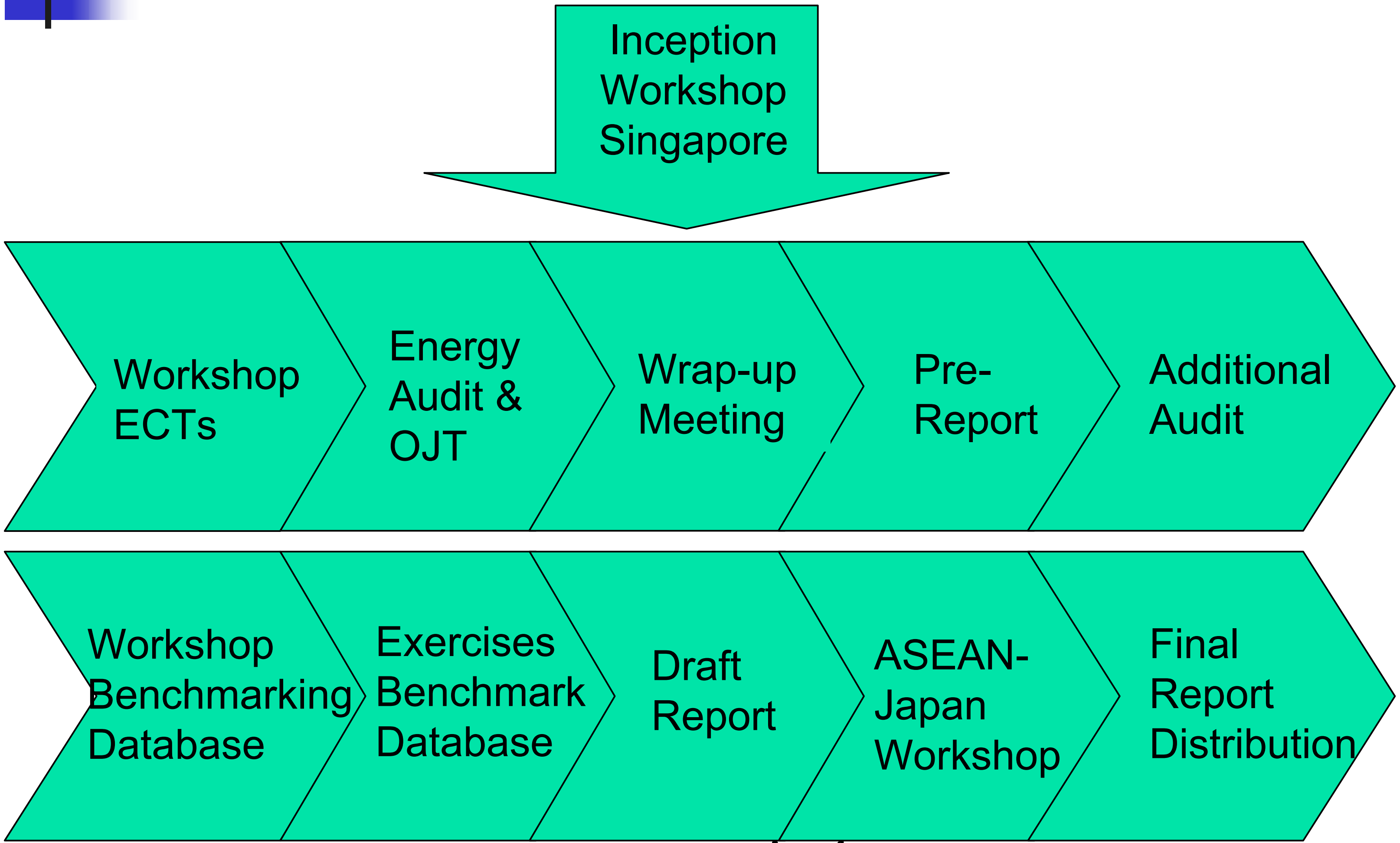
Presented during the 2nd PROMEEC Workshop, Yangon, Myanmar, 28 February – 1 March 2003.

Outline of Presentation

- Overview of Activities
- Workshop on EC Technologies
- Energy Audit and On-the-Job Training
- Improvement Plan & Recommendation
- Benchmarking & Database

Overview of Activities

PROMEEC–Building Activities in Vietnam and Myanmar



Workshop on Energy Conservation Technologies

Workshop in Vietnam

25 PARTICIPANTS

- MOI
- EVN
- IE
- HOTEL NIKKO H.
- LAKESIDE HOTEL
- PTM (Malaysia)

COORDINATOR

ECCJ & ACE

Workshop in Myanmar

25 PARTICIPANTS

- MOE MEPE
- MOI MOST
- MOC YCDC
- ACG YTU
- SEL FMIC
- Pansea Hotel

COORDINATOR

- ECCJ & ACE

A

Workshop on Energy Conservation Technologies

OBJECTIVES

- ***To share Japan's overall energy efficiency and conservation programs and activities.***
- ***To introduce energy conservation technologies** adopted **in buildings in Japan to the ASEAN countries.***
- ***To develop national capacities in conducting energy audit in buildings.***
- ***To introduce techniques and procedures in energy auditing, benchmarking, and database development as applied in Japan.***

Workshop on Energy Conservation Technologies

TALKING POINTS

- *ACE Plans & Programs on EE&C*
- *Policy, Plans, and Programs on EE&C of Japan*
- *Energy Situation in Japan*
- *Energy Conservation Law of Japan*
- *Recent energy conservation technologies for buildings (e.g. air flow window, high performance paints, ice storage, large temperature differential for AC, high efficiency chiller, etc.)*
- *Feedbacks, comments, & suggestions from participants*

Energy Audit and On-the-Job Training

The Audited Buildings

Building A Vietnam	Building B Vietnam	Building A Myanmar	Building B Myanmar
76-Rm Hotel	260-Rm Hotel	Office, Shop	50-Rm Hotel
	1 BF	1 BF	2 BF
5 storeys	17 Storeys	11 Storeys	3 Storeys
6,981.1 m2	29,164 m2	10,953m2	7,111.1 m2
8 years	4.5 years	8 years	80 years

The Audit Approach

1. DISCUSSION WITH KEY STAFF OF BUILDINGS; ENGINEERS & PLANNERS PARTICIPATING

Data gathered:

- Building Data
- Equipment Data
- Energy Data
- Drawings
- Operation & Maintenance Data
- Others

The Audit Approach

2. ON-SITE INVESTIGATION & SIMPLE MEASUREMENT

To check condition of equipment, facilities, and lay-out

To verify accuracy of records and data

To explain to the trainees the key points of audit

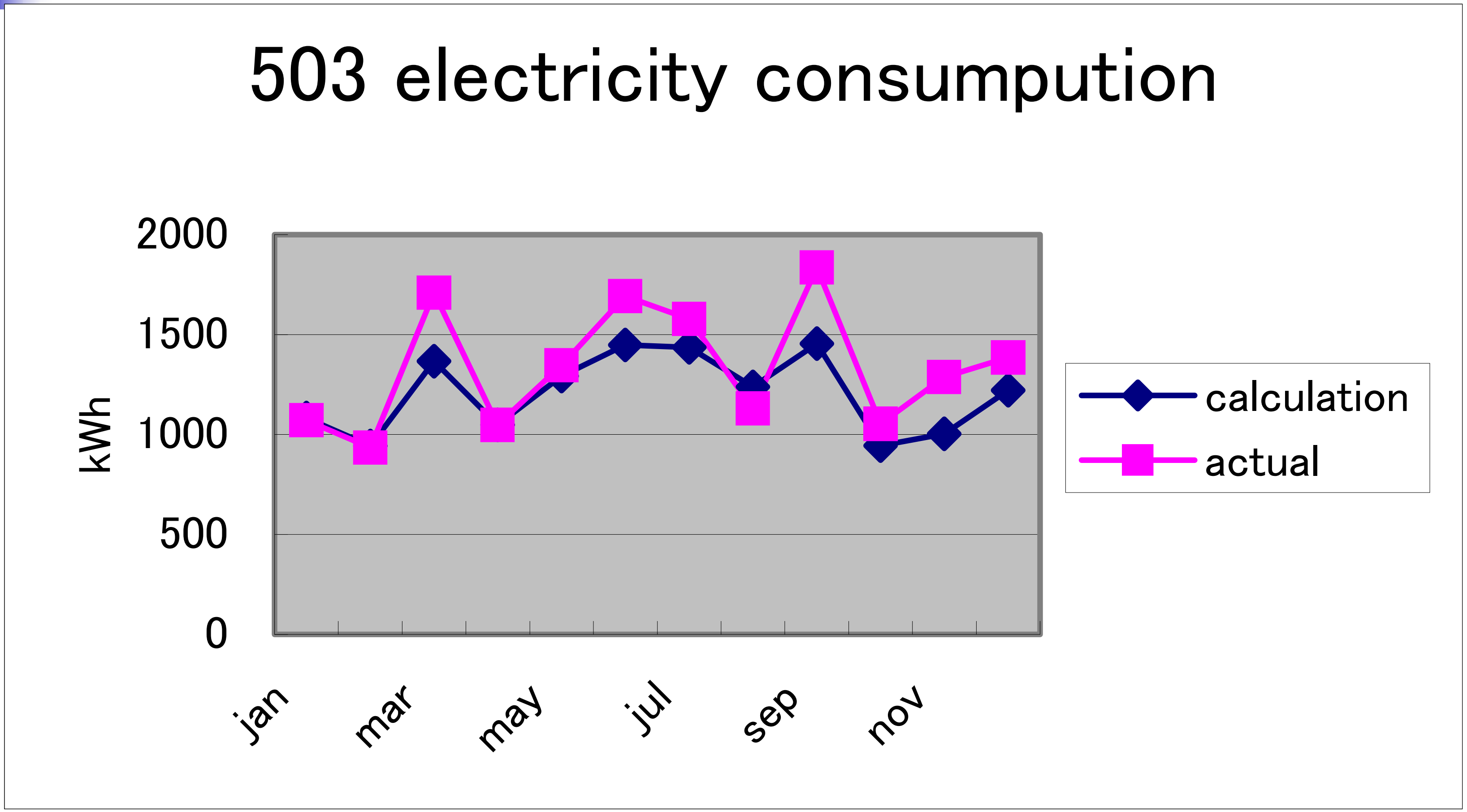
The Audit Approach

3. CALCULATION OF ENERGY SAVINGS

- ANALYSIS
- FORMULATION OF IMPROVEMENT PLAN
- WRAP – UP MEETING
  Presentation of Results
- REPORT

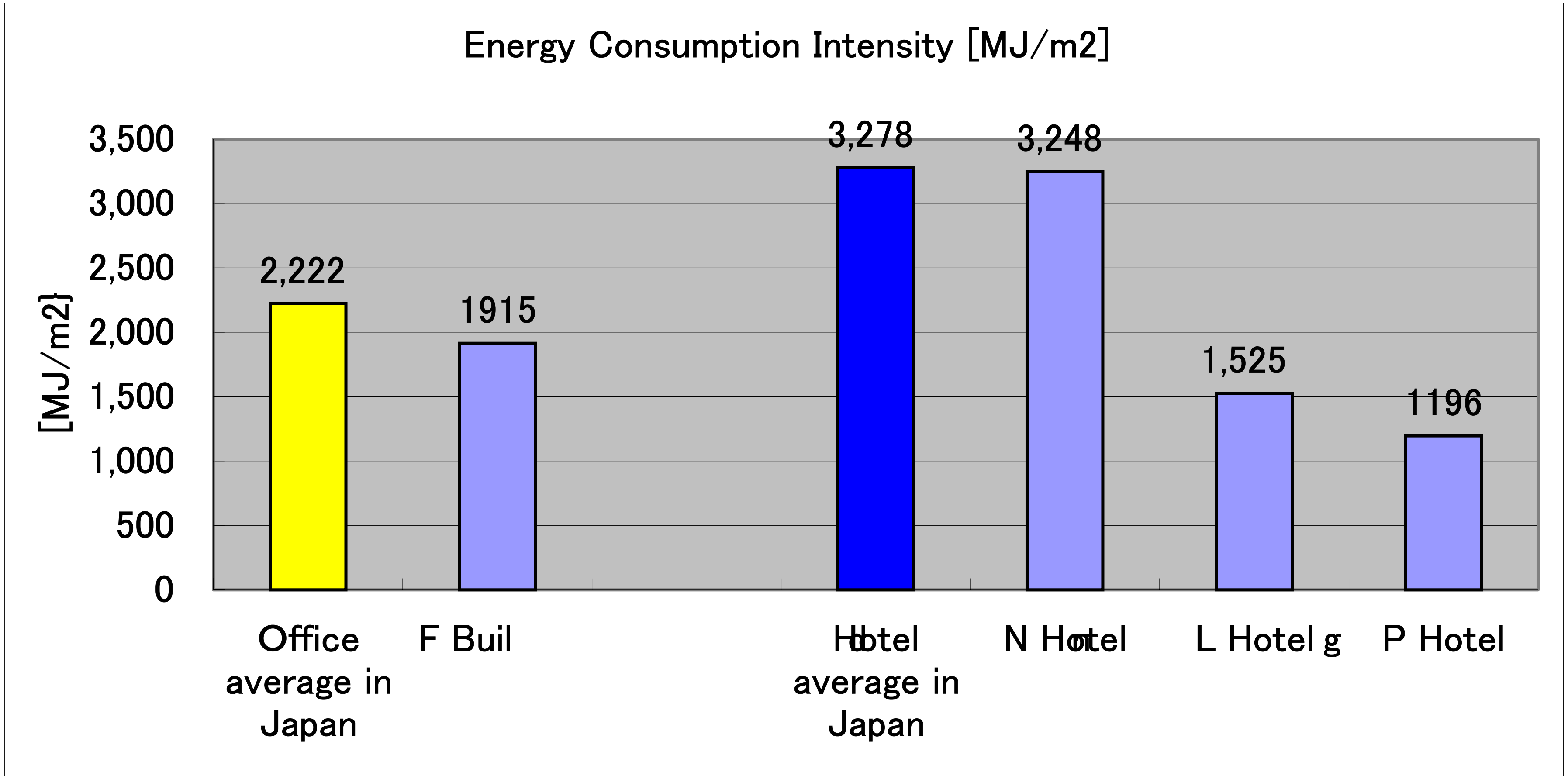
The Audit Approach

Simulation by calculation

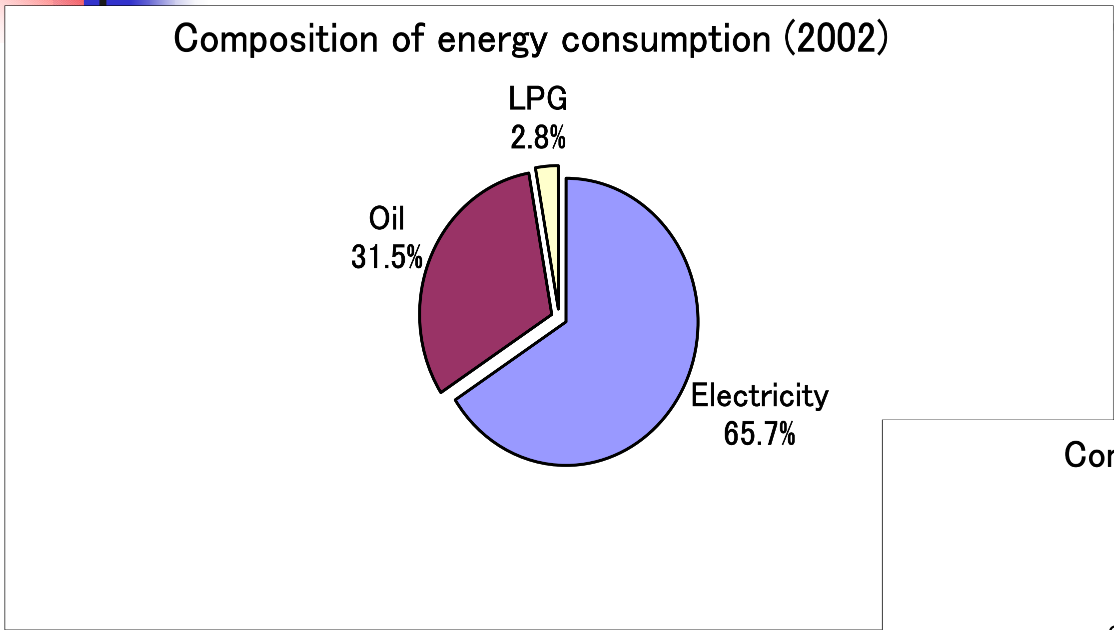


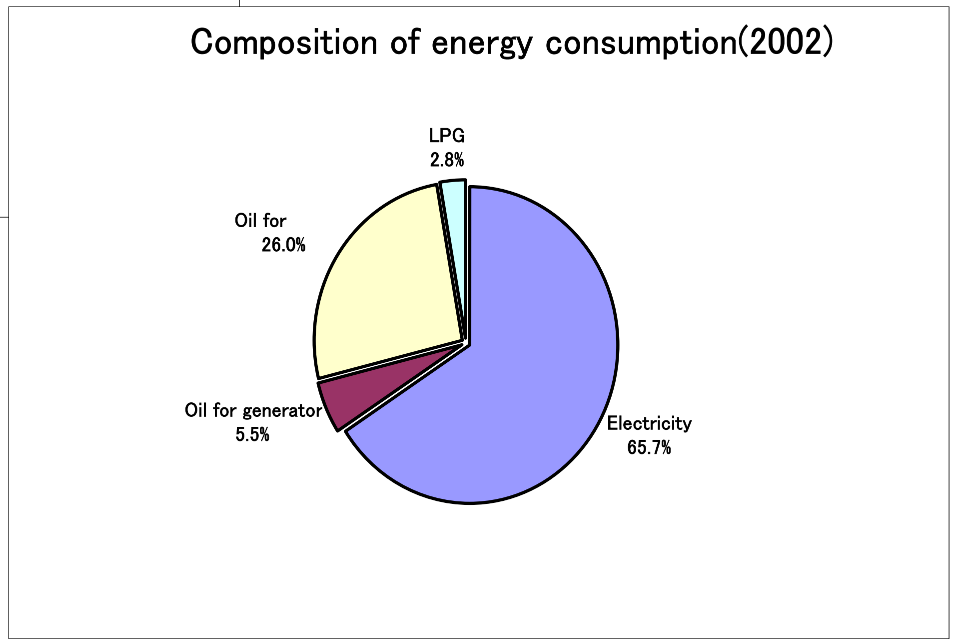
ENERGY DATA & PERFORMANCE INDICATORS

Energy Data & Performance Indicators



Energy Data & Performance Indicators





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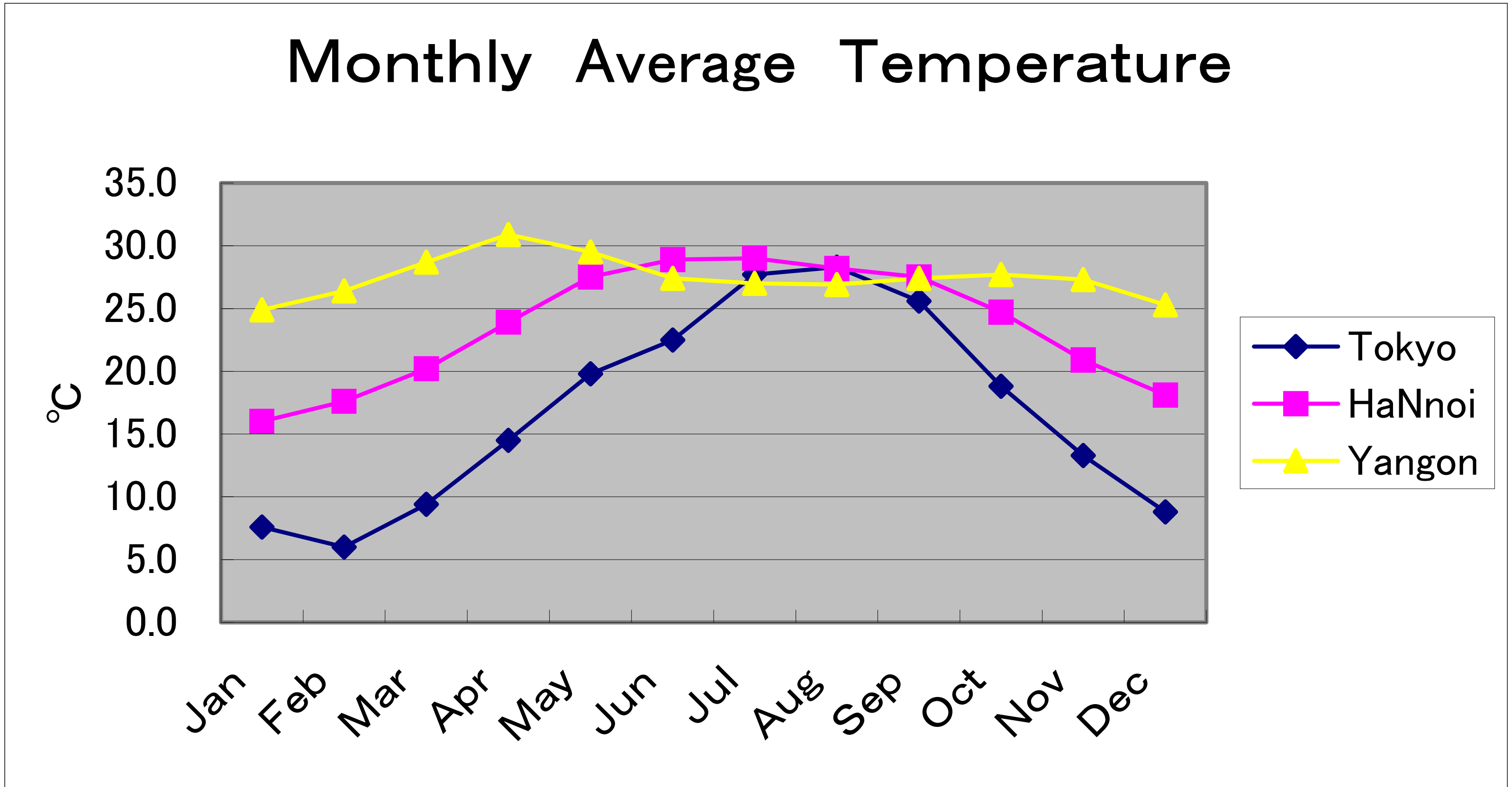

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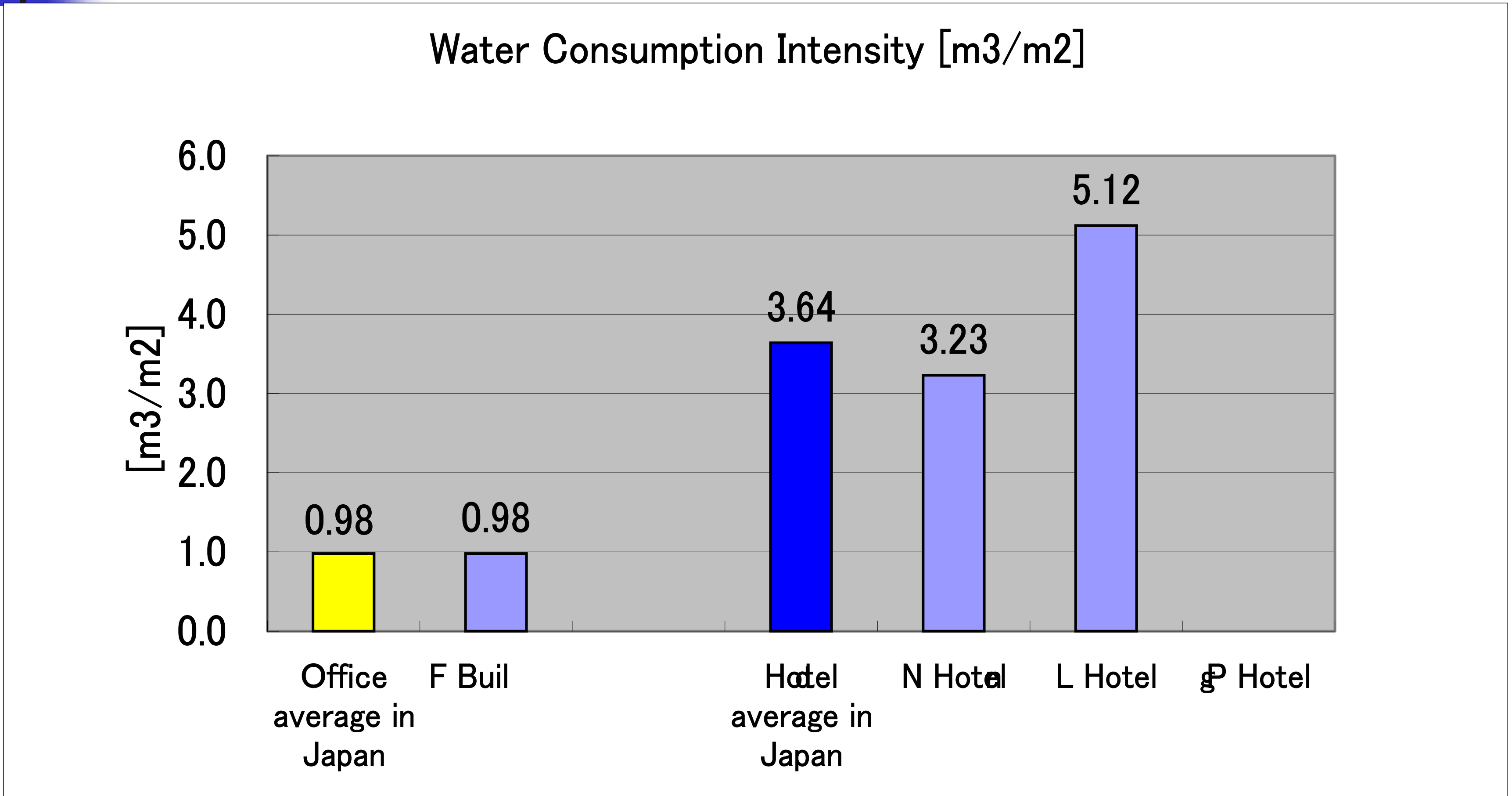

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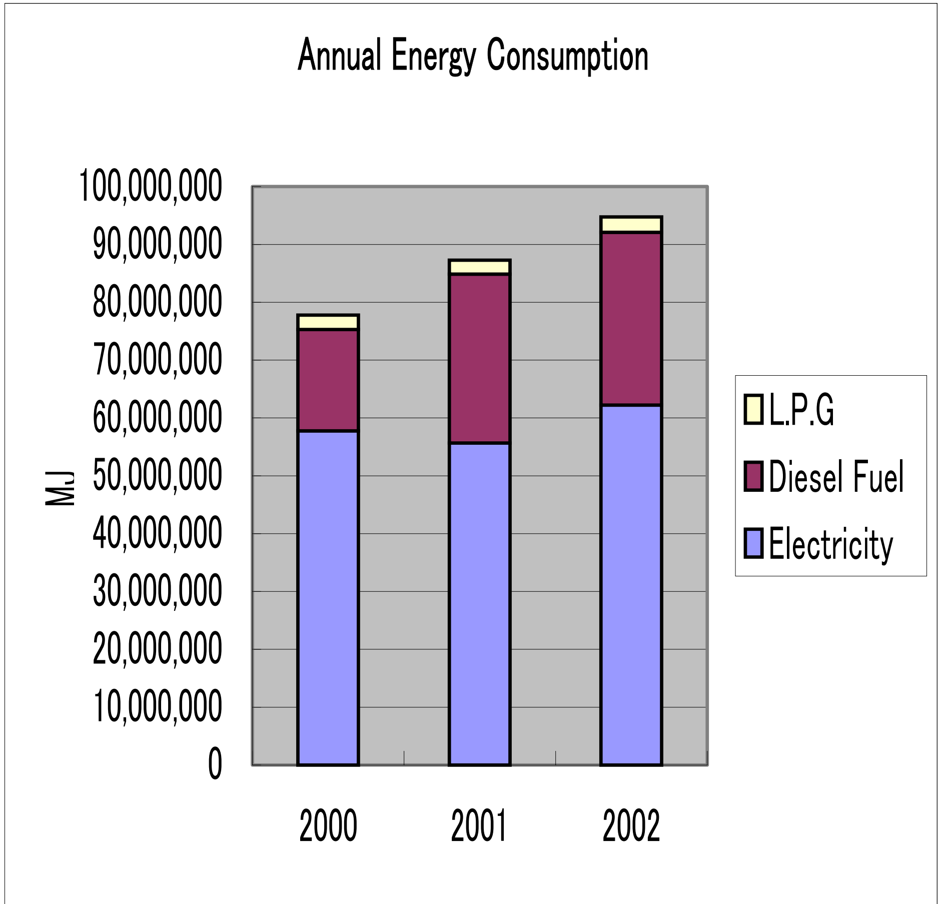
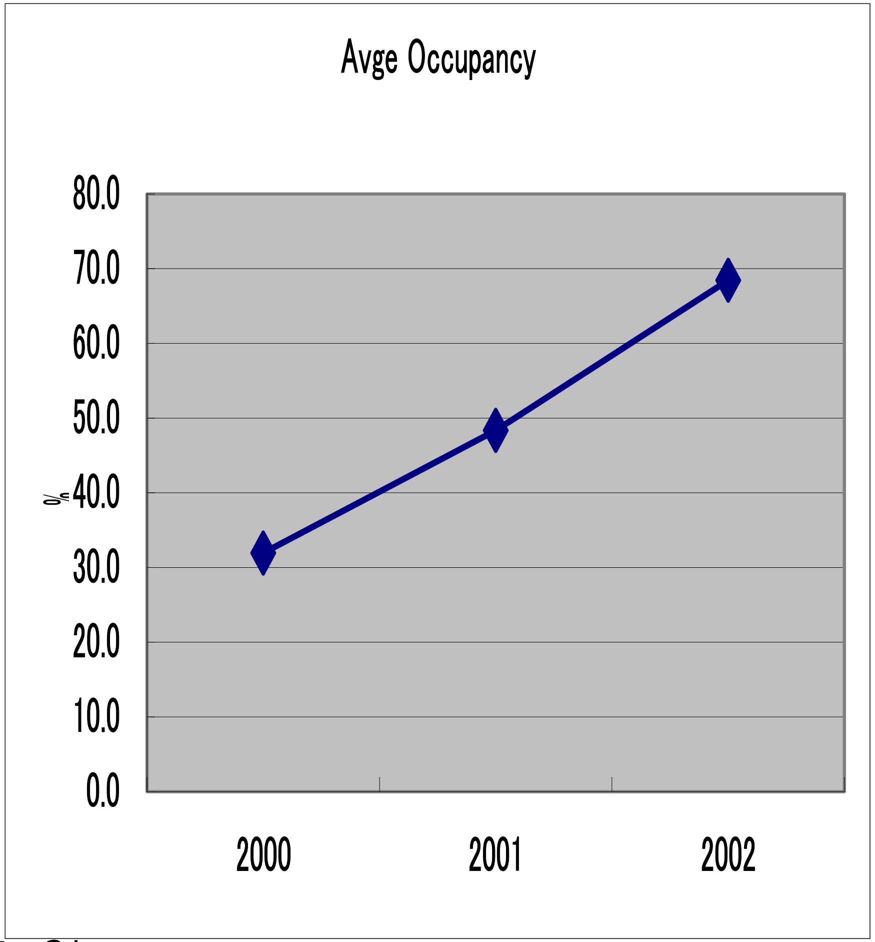
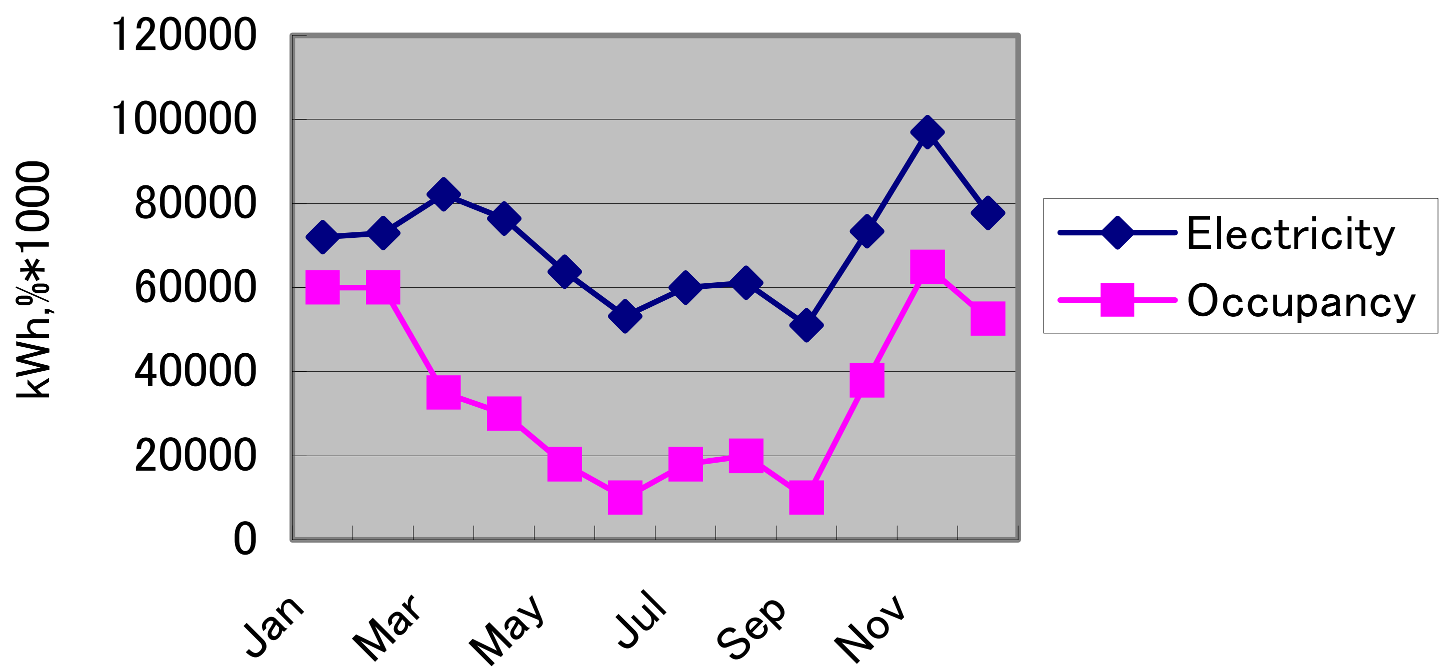


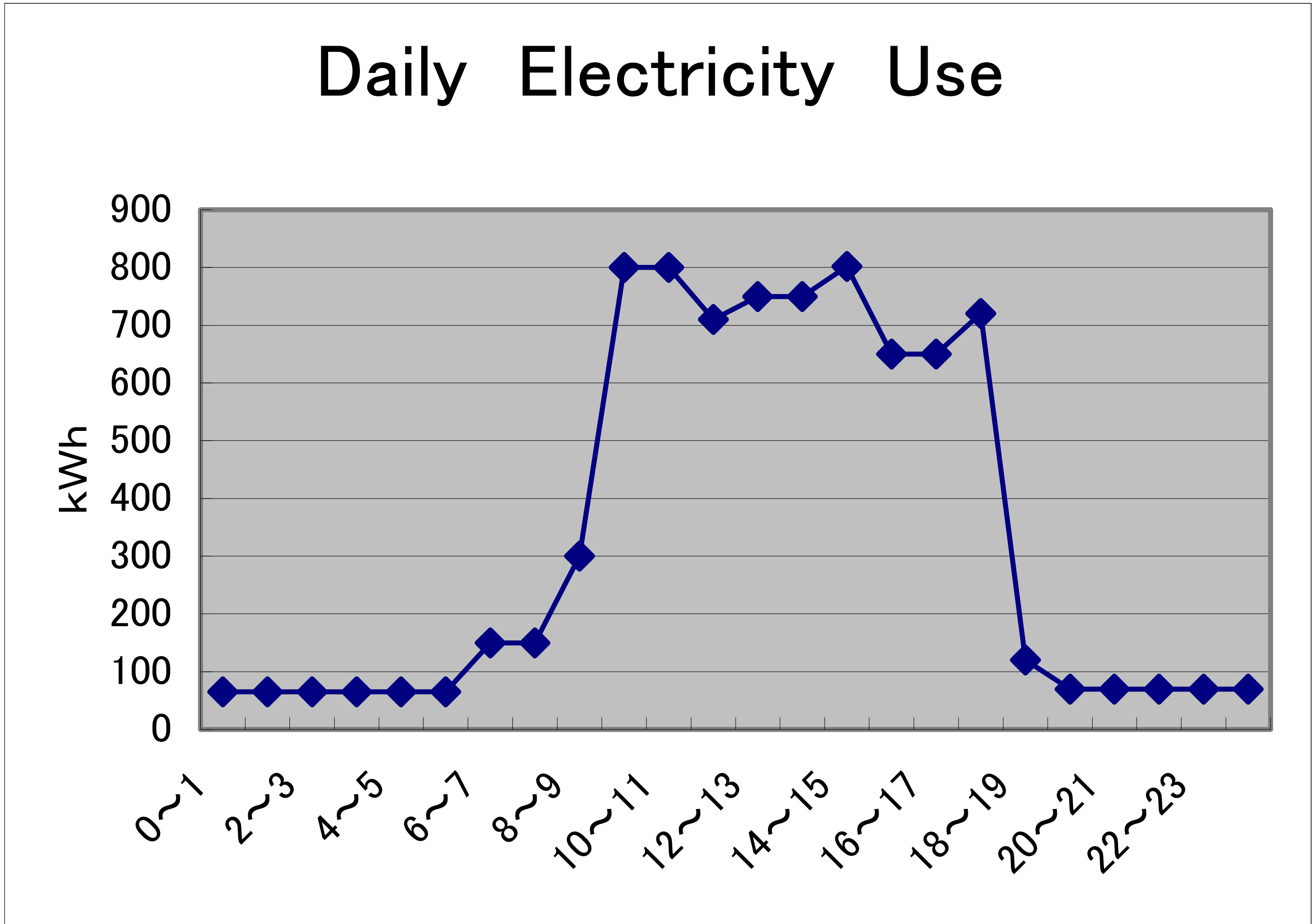


Energy Data & Performance Indicators

Electricity consumption & Occupancy rate (2002)



Energy Data & Performance Indicators



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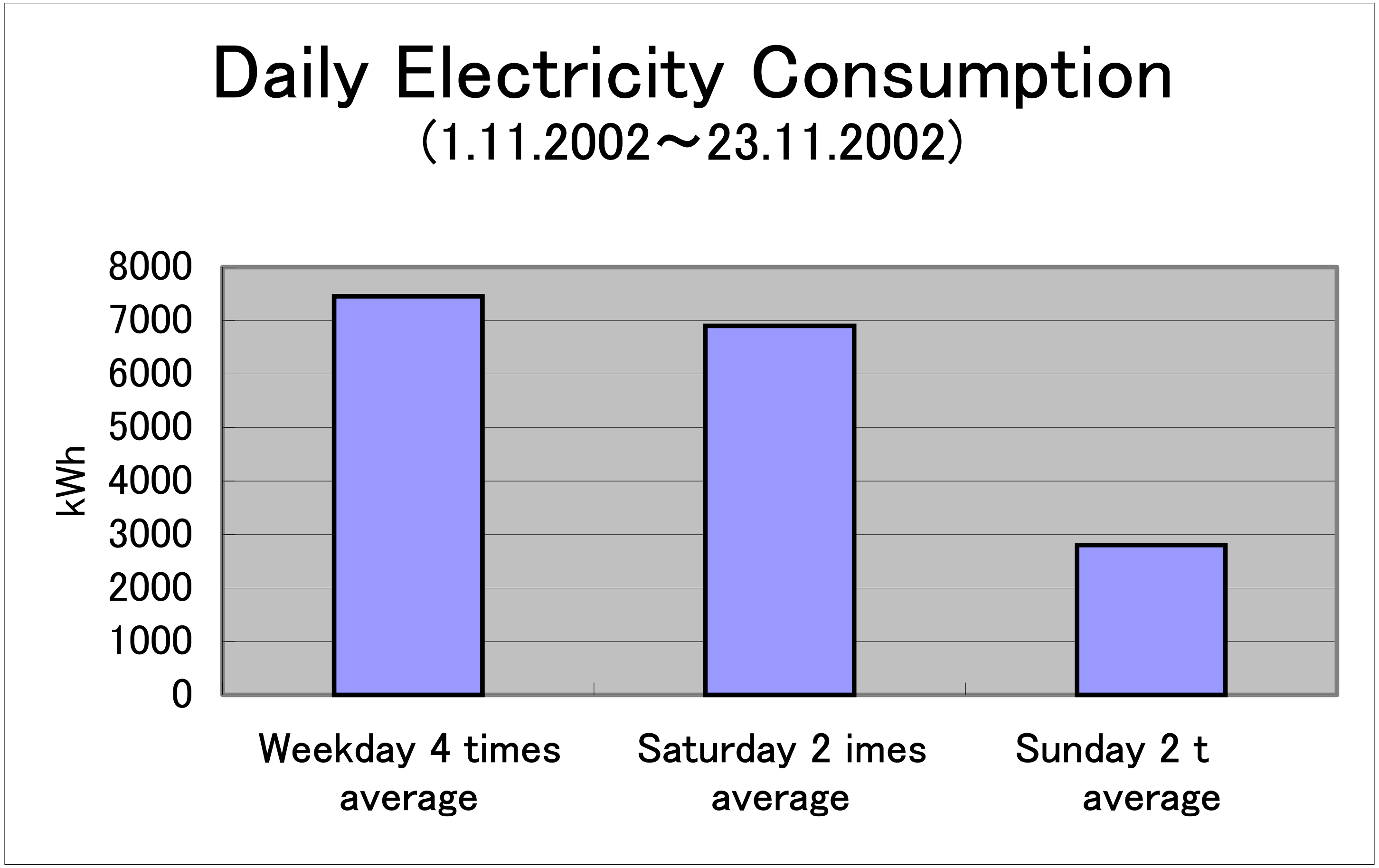

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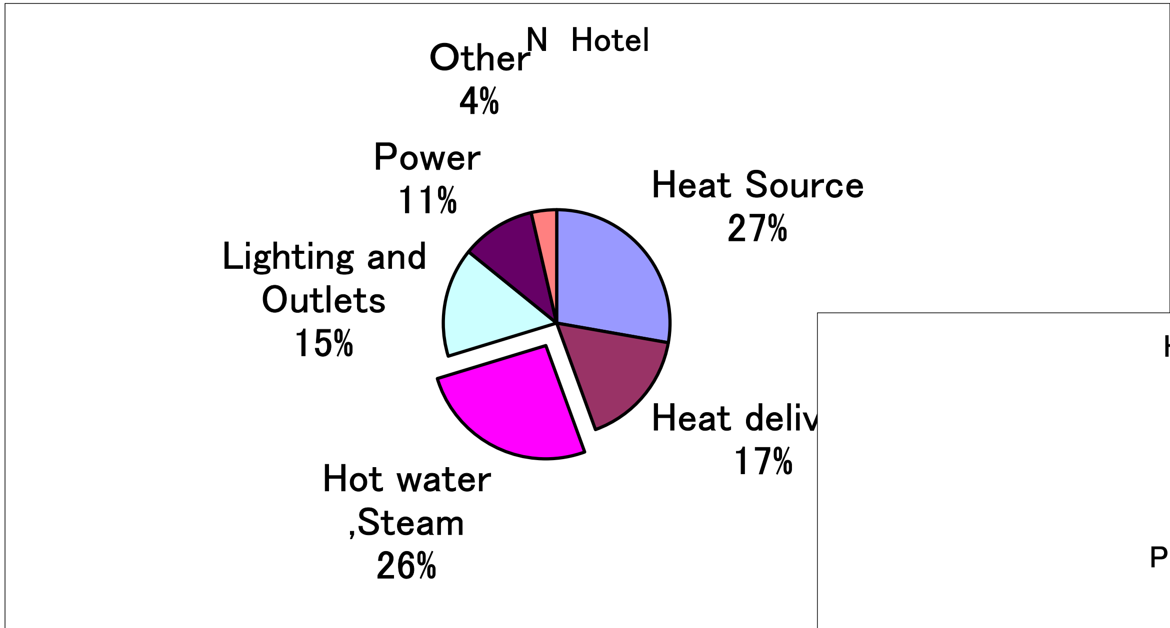

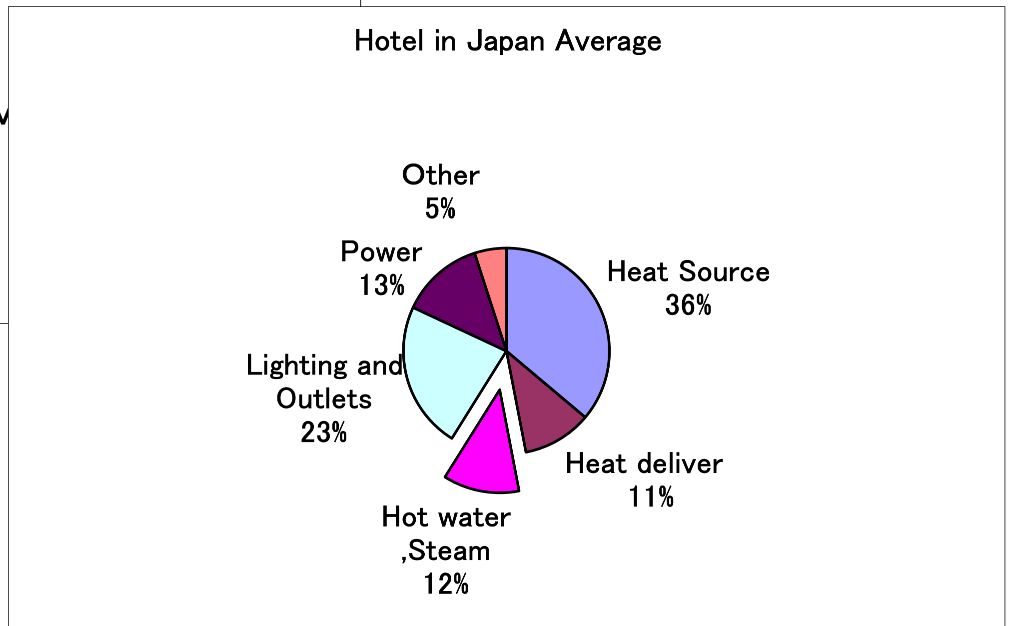

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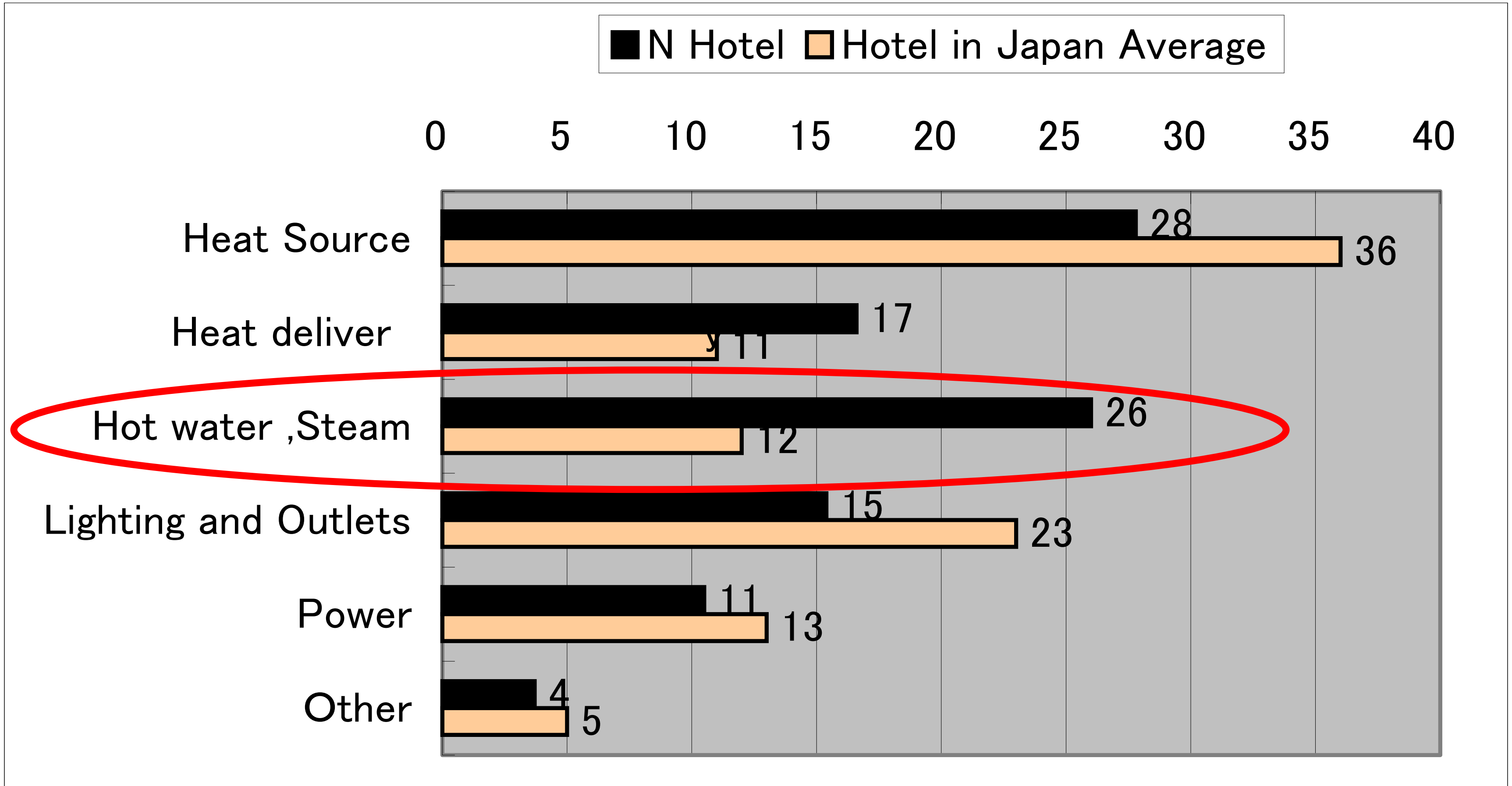


IMPROVEMENT PLAN & RECOMMENDATION

Summary of Energy Saving Measures
(Interim Report)

		Energy Savings in %			
	Measures	V-B	V-A	M-A	M-B
1	Change of chiller water temperature	0.8		0.8	
2	Chilled water pump VWV	4.6			
3	Lamp replacement	2.4			1.4
4	Improvement of air ratio	3.0			
5	Insulation of steam valves	0.3			
6	Change of hot water temperature		3.2		
7	Effective use of indoor exhaust air			0.6	
8	Examination of heat exchanger			2.3	
9	Heat pump hot water supply system				2.9

Change of chiller water outlet temperature

- **Change the set point**

Reference Data

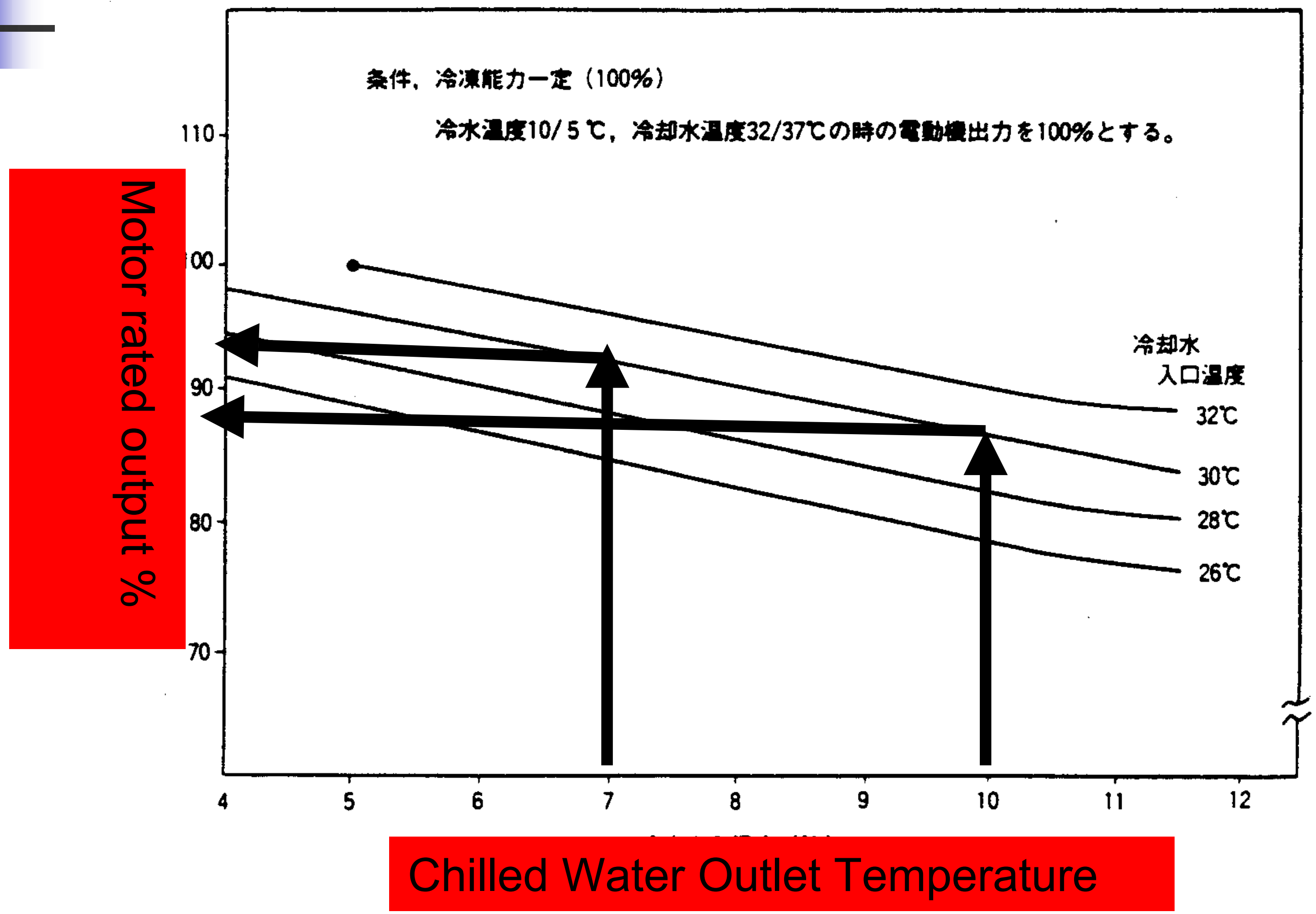
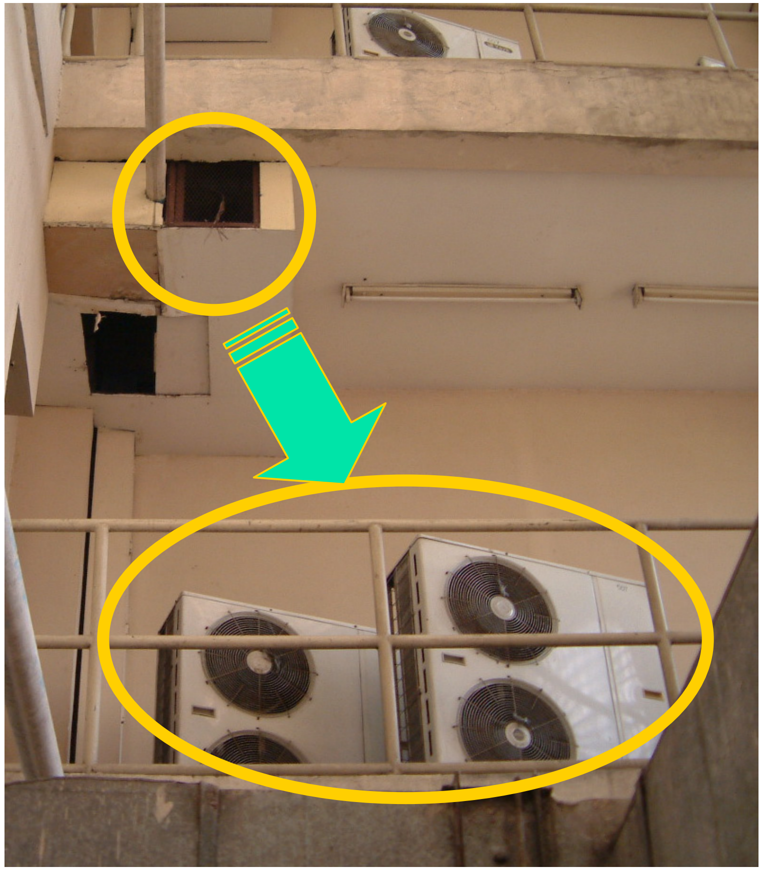


図3．3　電動ターボ冷凍機

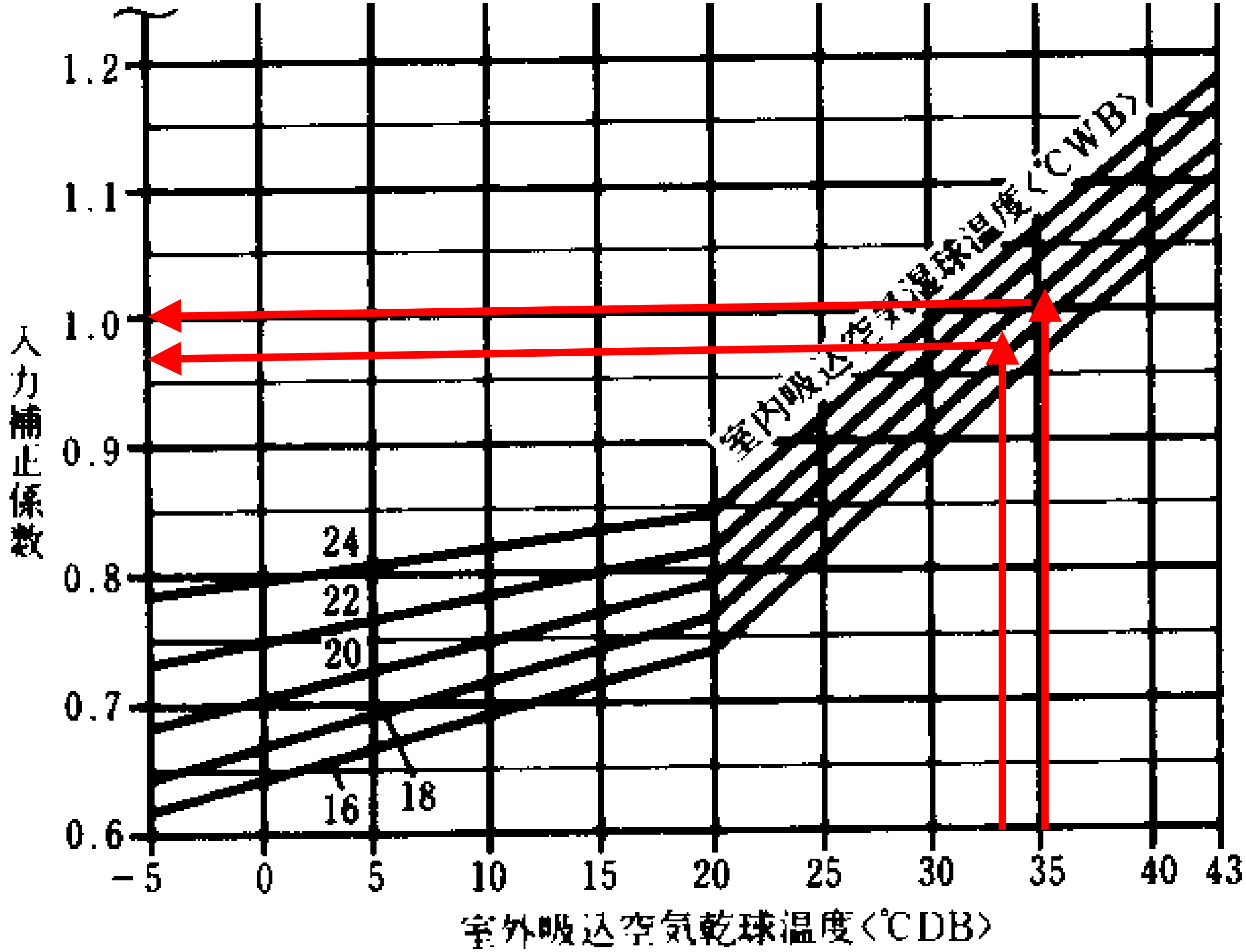
冷水温度、冷却水温度と電動機出力の関係

Use of Indoor Exhaust Air

- **Use the exhaust-air which come from indoor.**
- **The exhaust air comes from upper side of outdoor machine.**
- **Improvement range of suction temperature 2℃ （assumption）**
- **Improvement rate of input 3%**



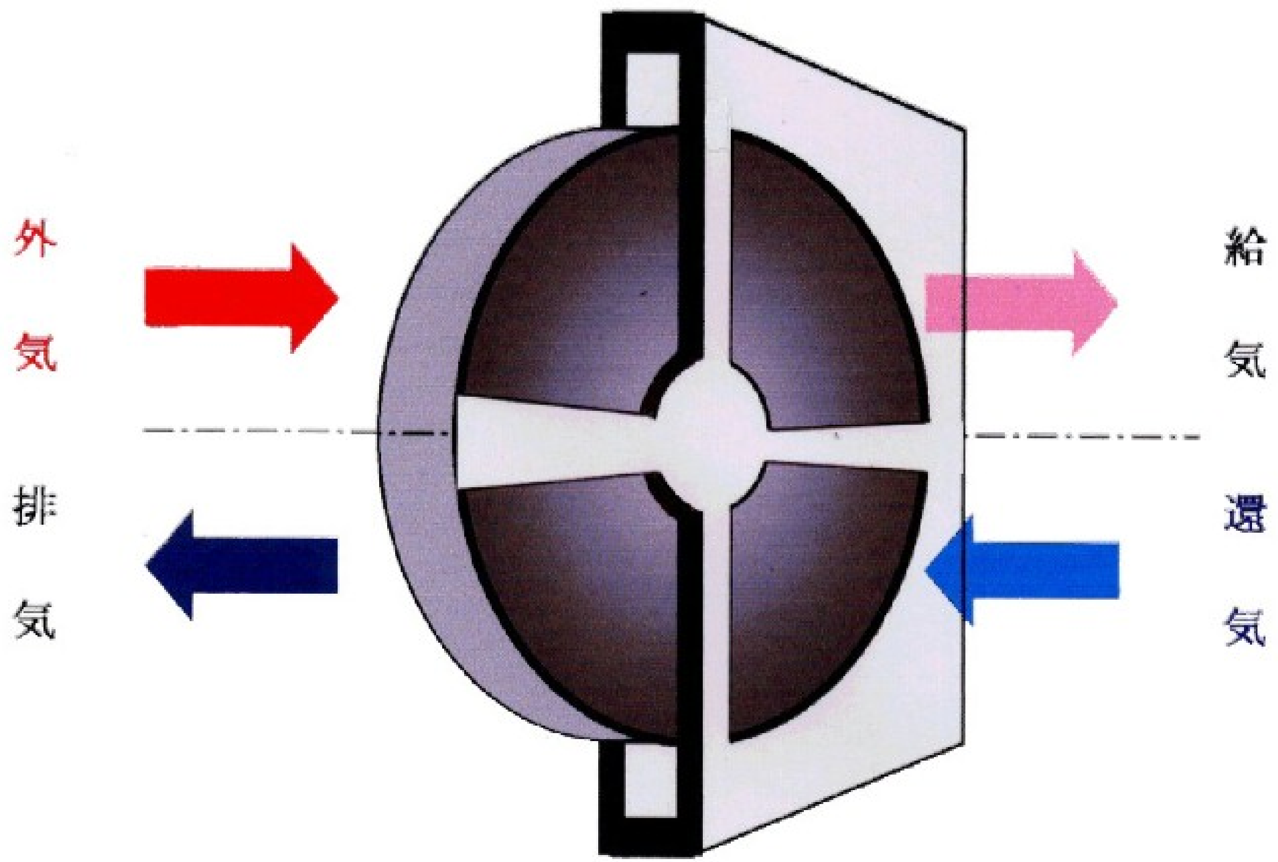
Reference data



Improvement of Heat Exchanger

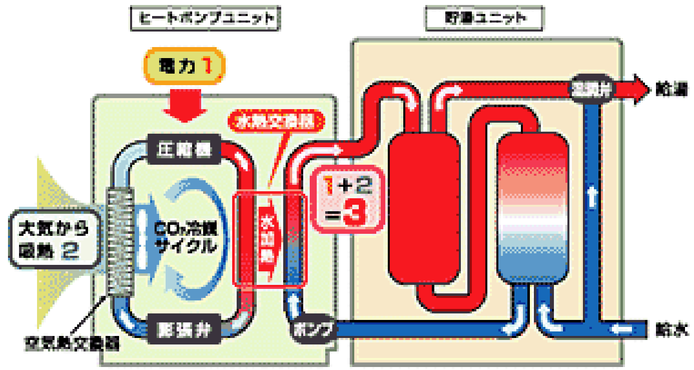
- **Supply air and exhaust air system are operated independent**

Collect exhaust air heat energy by heat exchanger and cool supply air



Heat Pump Hot Water Supply System

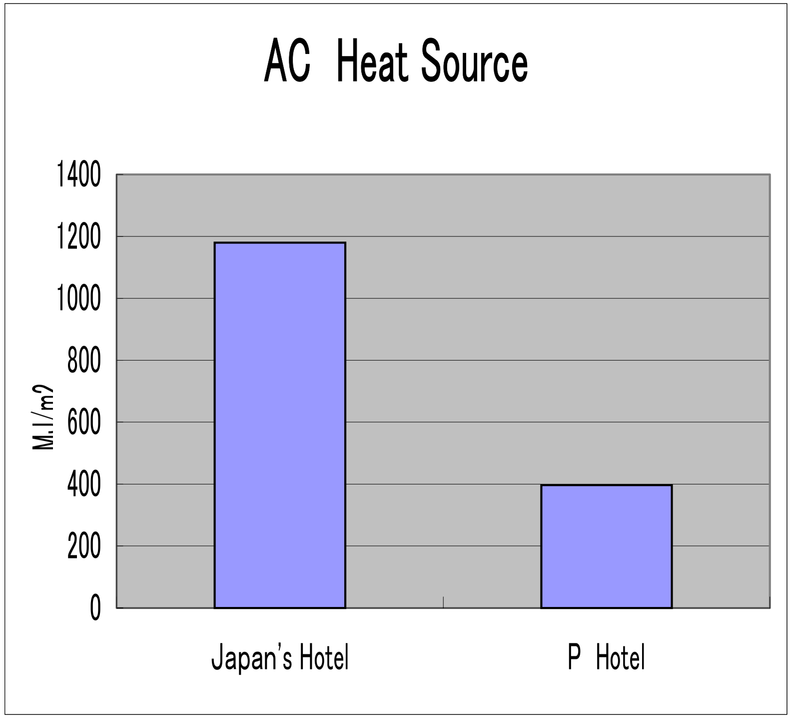
- **Heat pump hot water supply equipment with CO_2 refrigerant in Japan**
- **COP is 3.0**



Current Practices: Good case

Use of Solar Water Heater

Excellent Passive Design for Tropical Building



Good to Excellent Active Design and Management

Key Card System

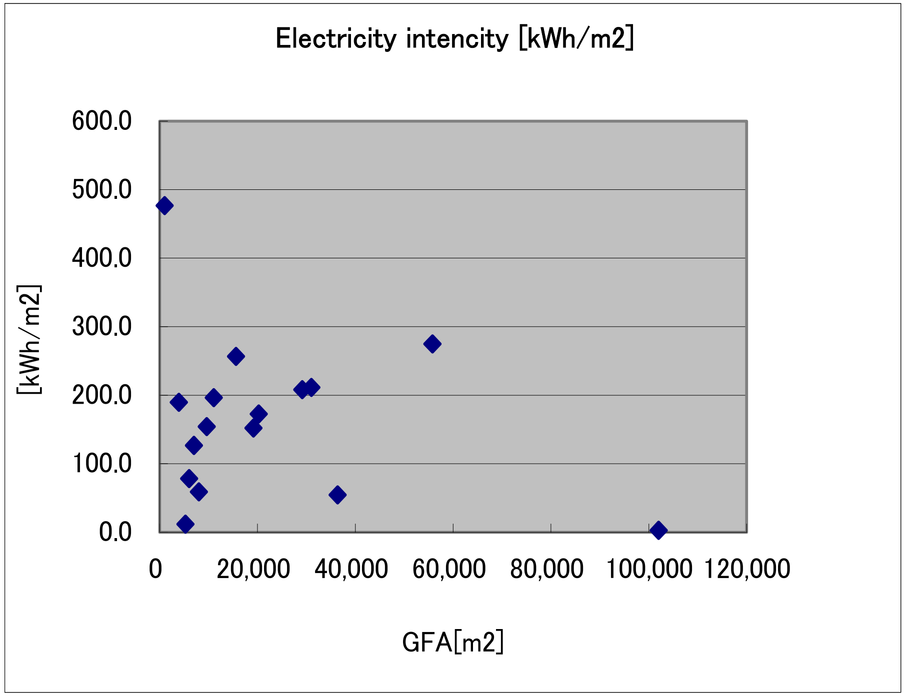
Power Management

Speedy Improvement

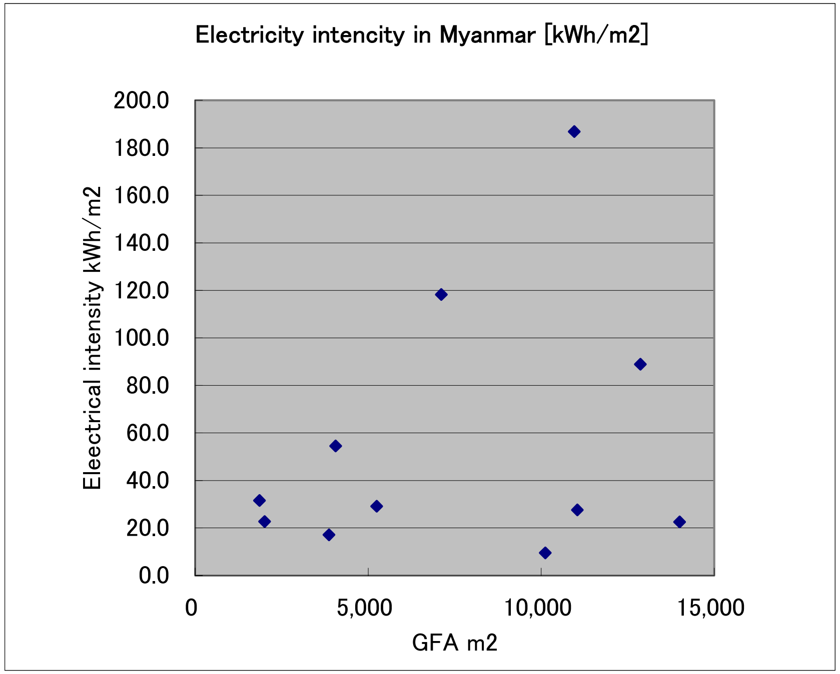
January: during the audit

February: Suggestion Adopted

Benchmarking & Database Development

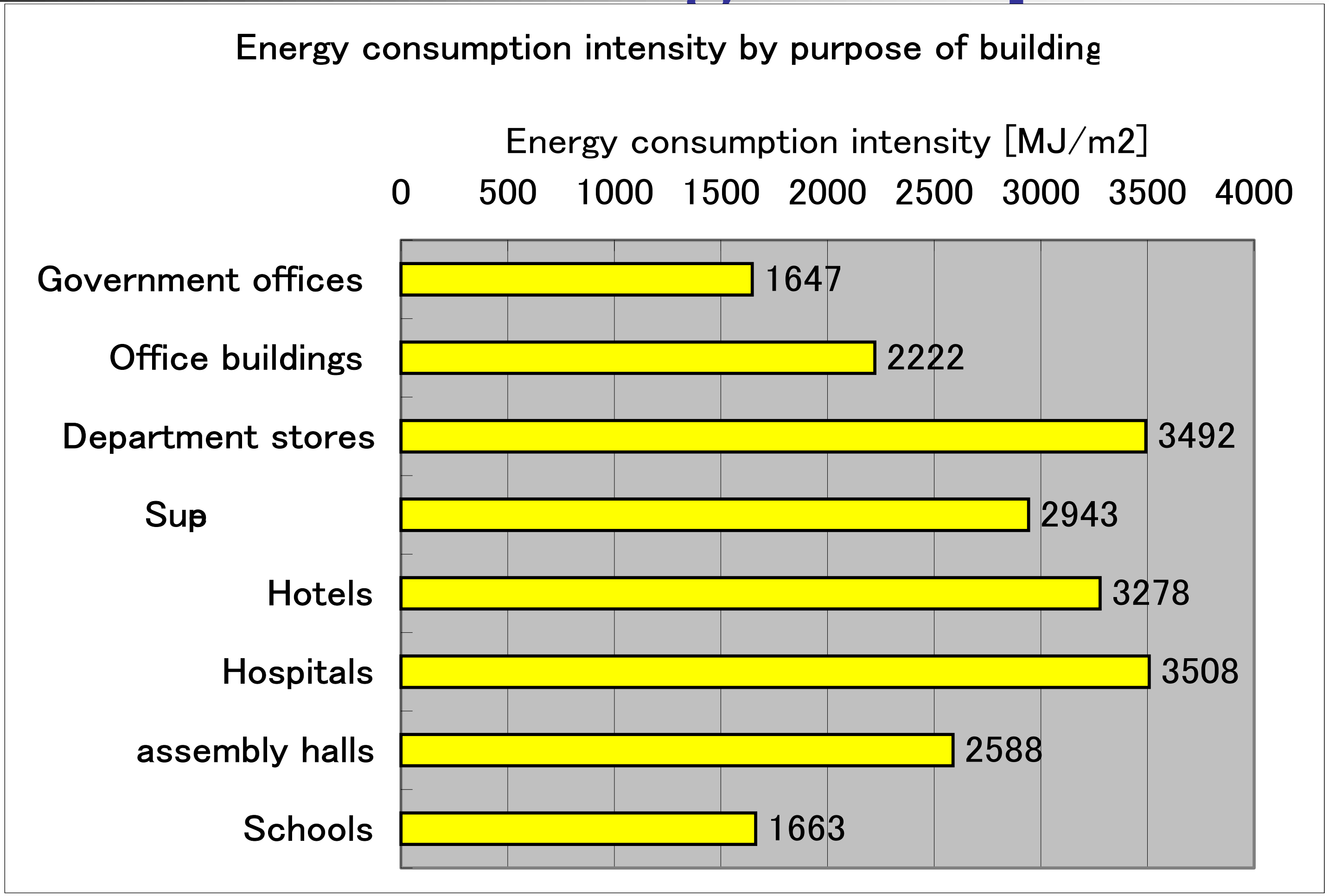


Vietnam



Myanmar

Benchmarking & Database Development: Benchmarks for Various Buildings in Japan



Total No. Buildings Audited: nearly 800

Benchmarking & Database Development

・Name of the Building :	Public Works		
・Address	60 shwedagonpagoda road		
・Category of Usage:			
・ Landload building or Tenant building	Landload building		
・Age of Building:	30		
・Size :			
・Total gross floor	11044	m2	
・Number of stories	4	F	
・BasementStories	0	F	
・Electrical facilities:			
Receiving voltage	6.6	kV	
Agreement capacity	–		
Transformer capacity	500	kVA	
・Air conditioning facility:			
Heat source capacity for cooling	–		
Main equipment	–		
Heat source capacity for heating	–		
Main equipment	–		
Air conditioning system	spl	u t	
・Sanitary facility:			
Water supply system	city,well		
Hot water spply system	–		
・Air conditioner setting temperature and humidity:			
Summer ℃	24	℃	
%	50	%	
・Working hour:			
Week day	8	H	
Sat day	0	H	
Sun day	0	H	

	Electricity	LPG	OIL	Water
	kWh	kg	L	m3
Jan	24811			
Feb	25132			
Mar	29744			
Apr	27956			
May	29224			
Jun	26656			
Jul	27132			
Aug	26958			
Sep	27313			
Oct	25002			
Nov	18550			
Dec	16320			
Total	304798			

Thank you

The Energy Conservation Center, Japan

Material – 2

(Workshop : Case Study)

Development of Database / Benchmark/ Guideline

Workshop : Case Study

Development of

Database / Benchmark / Guideline

February 28, 2003

The Energy Conservation Center, Japan

〔ECCJ〕

Development of

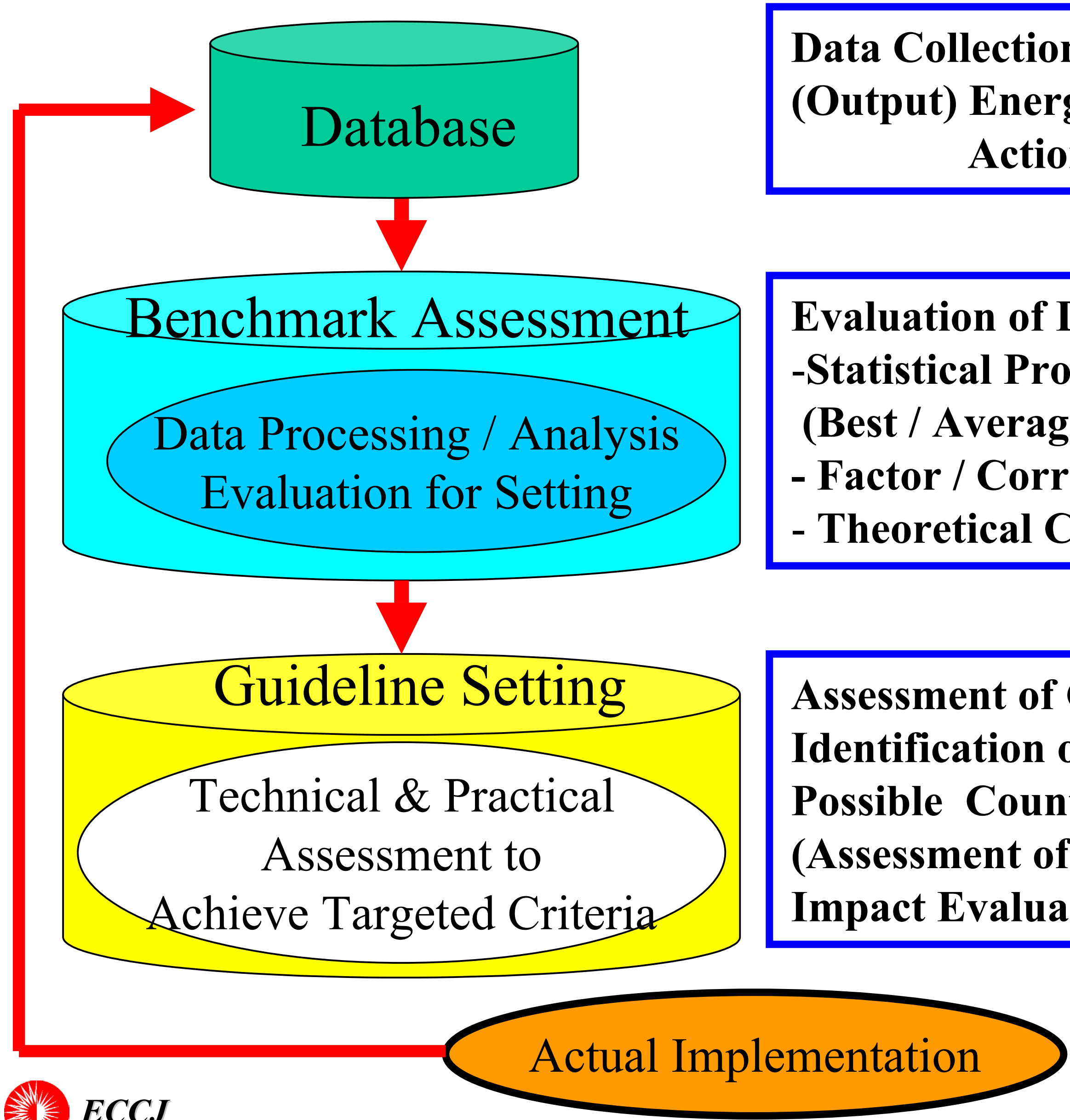
Database / Benchmark / Guideline

Conceptual Understanding

of

Development Process

Development Process : Database / Benchmark / Guideline

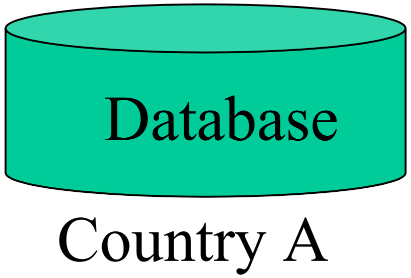


Data Collection by Audit
(Output) Energy Balance / PFD
Action / Business Plan to Improve

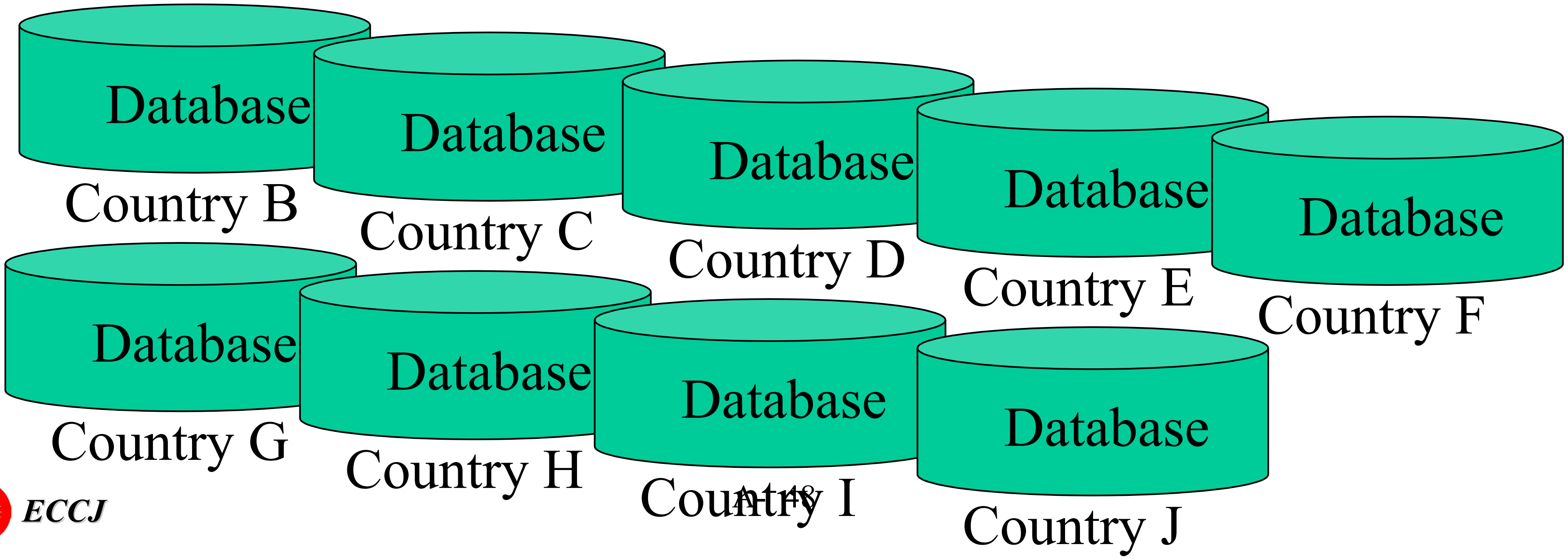
Evaluation of Data To Be Controlled
-Statistical Processing
(Best / Average / Standard Deviation)
- Factor / Correlation / Comparison / Analysis
- Theoretical Consideration, etc.

Assessment of Criteria to Be Targeted
Identification of Problems
Possible Countermeasures
(Assessment of Action / Business Plans)
Impact Evaluation of Each Countermeasure

Database Development (Building)



Category		Hotel					Office					Hospital					....			
		A	B	C	..		A	B	C	..		A	B	C	..		A	..	..	
Archtechtual Design	Wall Insulation																			
	Window																			
	:																			
	:																			
Equipment	Elevetor																			
	Air Conditioner																			
	Lighting																			
	Transformer																			
	:																			
	:																			



ECCJ

Statistical Processing (Building)

Index A

Country	Hotel				Office				Hospital				・・・・・
	Max.	Min.	Ave.	Standard Deviation	Max.	Min.	Ave.	Standard Deviation	Max.	Min.	Ave.	Standard Deviation	
A													
B													
C													
D													
E													
F													
G													
H													
I													
J													
ASEAN													
Maximum													
Minimum													
Average													

Index B

Index C

Index D

:

ECCJ

Benchmark / Criteria Setting Analysis (Building) - 1

Hotel

Country	Index A	Index B	・・・・・	Affecting Factors							
				Temperature			Humidity			Working Hours	・・・・・
				Max.	Min.	Ave.	Max.	Min.	Ave.		
A											
B											
C											
D											
E											
F											
G											
H											
I											
J											
ASEAN											
Best											
Worst											
Average											

Office

Hospital

:

ECCJ

Benchmark / Criteria Setting Analysis (Building) - 2

Facility / Equipment (Item 1)

Country	Situation Analyses									Theoretical Consideration	Targeted Criteria for Improvement		
	Actual Index A	Actual Index B	......	Climatic Factor		Social Factor		Cultural Factor					
				Temp.	Humidity	Working H	......	Religion	......		Index A	Index B	.....
A													
B													
C													
D													
E													
:													
:													
										ASEAN			

:

:

Study to Setup Guideline (Building)

Facility / Equipment Item - 1

Country	Index	Criteria		Critical	Identification of Bottle Neck		Action to Achieve Criteria
		Actual	Targeted	Condition	Technological	Practical	
A	Index A						
	Index B						
	:						
B	Index A						
	Index B						
	:						
C	Index A						
	Index B						
	:						
D	Index A						
	Index B						
	:						
E	Index A						
	Index B						
	:						
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
				ASEAN			

:

Basic Approach for Database / Benchmark / Guideline Development

- Activity Based on Country by Country
- Establishment of Systematic Data Collection
  - Establish Audit / Reporting System (Law ?)
  - Utilization of Data Collected To Date
- Sharing data among 10 ASEAN countries
  - Regular Workshop
- Organization of Taskforce
  - Standardized Procedure for Analysis and Study
  - Regular Assessment of Study Results

Material – 3

Energy Audit, Database & Benchmarking

in Buildings in Japan

Energy Audit, Database & Benchmarking in Buildings in Japan

PROMEEC – BUILDING

SOME-METI WORK PROGRAMME 2002-2003

Akira Kobayashi
The Energy Conservation Center, Japan

26 February 2003

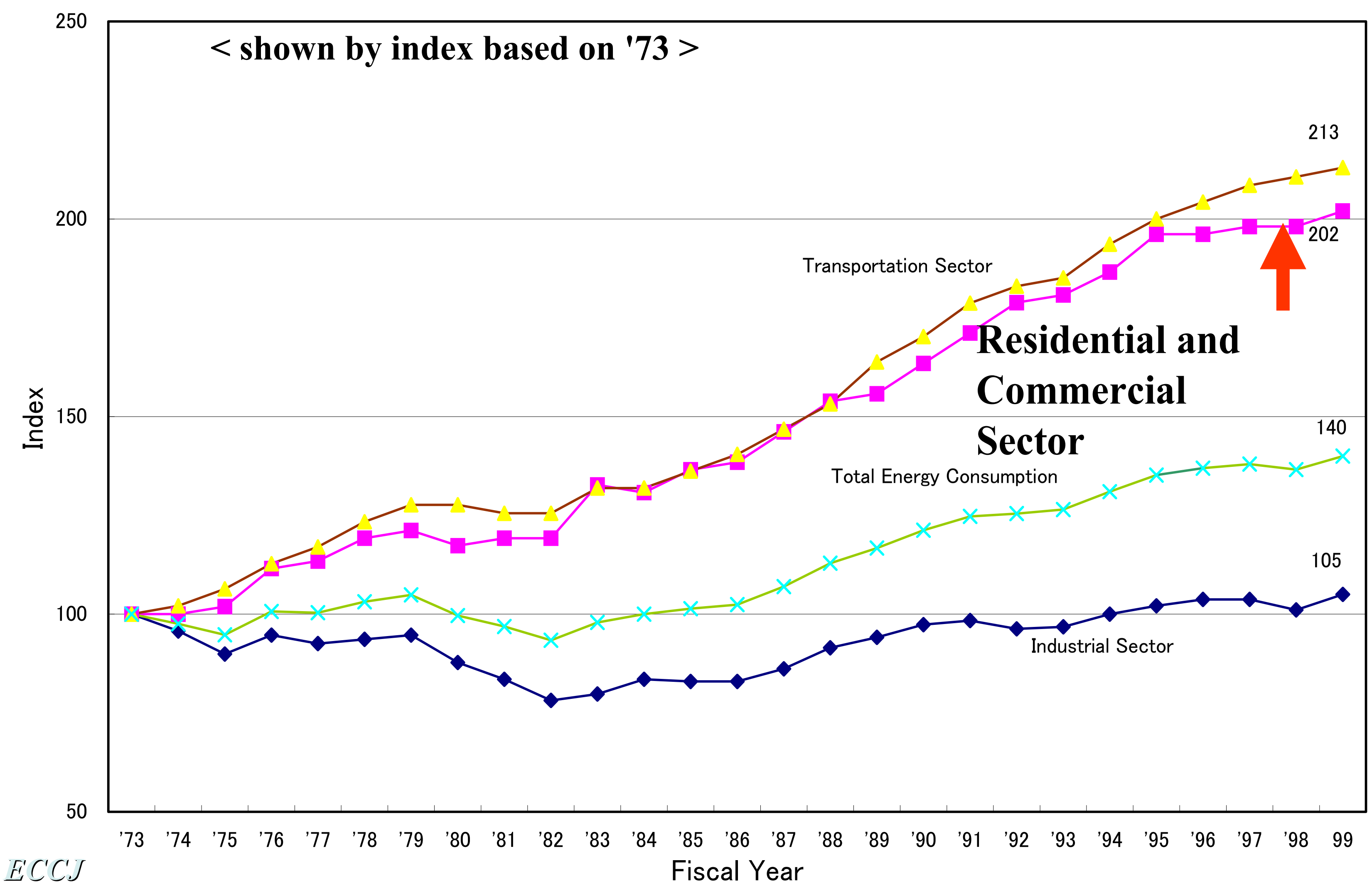
Outline of Presentation

- Introduction
- Energy Audit
- Database and Benchmarking
- Guidelines for Energy Efficient Buildings
  - Guidelines of equipment in Japan
  - Operating guidelines for factories and buildings
- Future Direction

Introduction

Trend in Final Energy Consumption by Sector

(1999)



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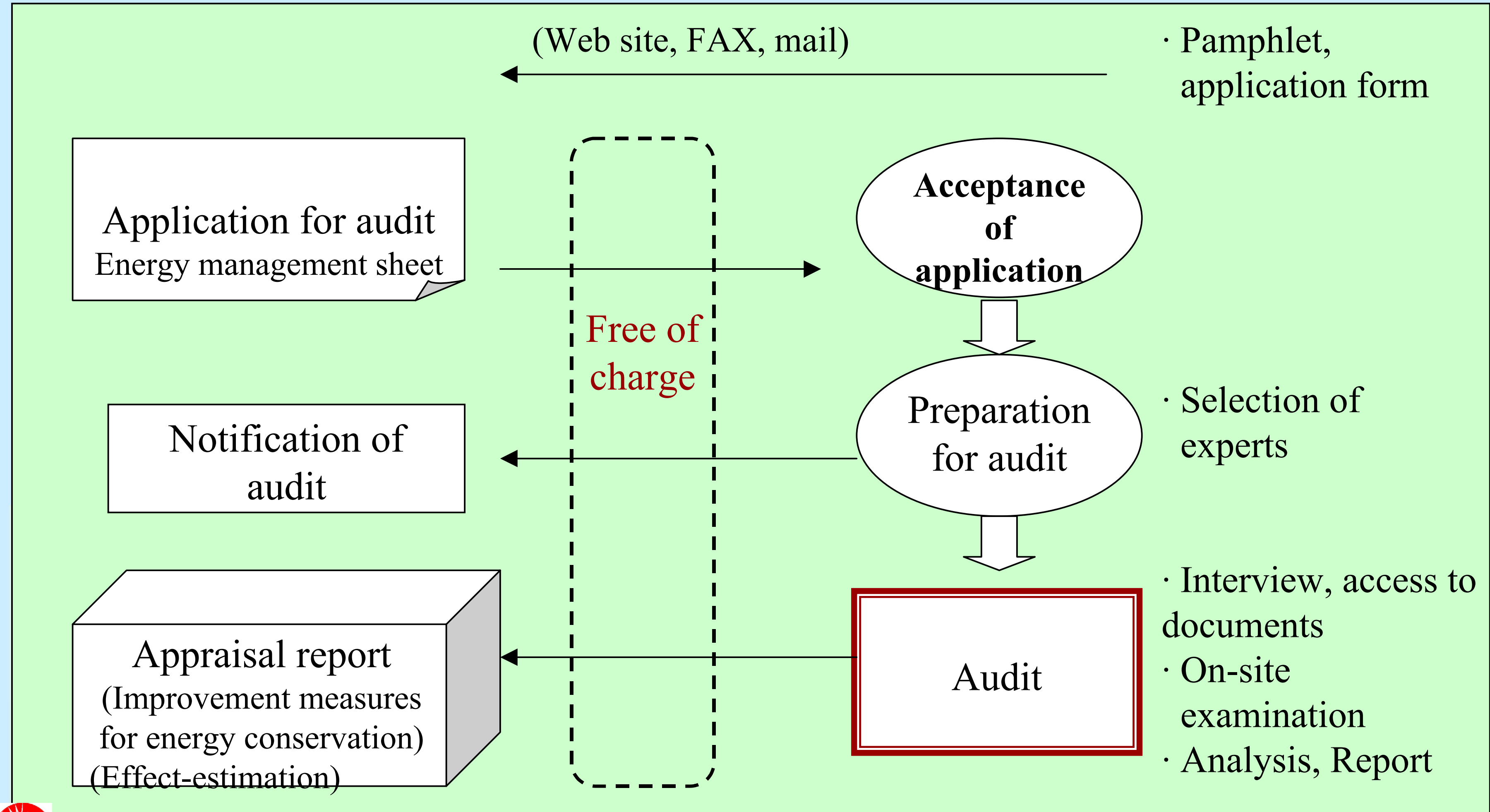
Energy Audit

Application and Process of Energy Audit in Japan

- **one-day on-site examination by thermal and electric experts**
- **free of charge ----- subsidized by Japanese Government**



ECCJ

Distribution of Energy Audits by Type of Buildings

Type of Building	Number
•Government Office	132
•Office	165
•Department Stores	101
•Supermarket	109
•Hotel	92
•Hospitals	125
•Assembly Hall	22
•School	41

Total	787

Proposed Measures to Identify Savings through Energy Audit

1. Elimination of waste
2. Energy saving while maintaining comfortable condition
3. Reduction in energy losses from buildings and facilities
4. Waste heat recovery
5. Demand-based flexible supply contract energy suppliers
6. Enhancement of equipment and facilities efficiency
7. Active use of natural energy

Points to Focus in Energy Saving for Buildings

1) General management

1. Record and utilization of energy data
2. Regular repair and maintenance of equipment
3. Developing and establishment of energy management system
4. Management of energy intensity
5. Setting of management target for energy conservation

Points to Focus in Energy Saving for Buildings

2) Heat source/air-conditioning equipment

- Heat source/air-conditioning equipment
- Control of fresh air intake
- Monitoring proper air ratio of combustion equipment
- Proper temperature and humidity for rooms
- Proper saving in water transfer by introduction of VWV
- Change of the pre-set outlet temperature of cold water in accordance with the season
- Prevention of heat emission by thermal insulation of stream valves
- Reduction in solar radiation loads on windows
- Power saving air delivery by introduction of VAV
- Proper segmentation and zoning for air-conditioning
- Required minimum ventilation in machine rooms
- Opening window and cooling with outside air
- Proper ventilation of car park through CO2 monitoring

Points to Focus in Energy Saving for Buildings
3) Hot water and water supply/Lighting/Electricity/Lifts /Load leveling

- Hot water and water supply
- Water saving by installation of sound-making equipment at woman lavatories
- Use of water saving type valve disc or low shower head
- Lighting/Electricity/Lifts
- Demand-based control(automatic and manual)
- Control of electric transformers demand rate and reduction in no-load losses
- Use of high efficiency lumps and light
- Use of inverter-control lighting fixtures and ballasts
- Lighting at proper times and places
- Segmentation of lamplighter insulation positions and lighting circuits
- Setting of illuminance standard and proper control of the illuminance
- Load leveling
- Leveling of electric load by heat storage and use of gas
- Introduction of CGS and optimized operation
- Study of introduction of new energy including photovoltaic power generation

Type of Data Collected
1) Building Information

Building Information Sheet

・Name d s e h : e
・Category of Usage:
Landload building or Tenant building
・Age of Building:
・Size:
Total gross floor area m2
Number of stories ・Basement Stories
・Electrical facilities:
Receiving voltage、 Agreement capacity
Transformer capacity
・Air conditioning facility:
Heat source capacity for cooling
Main equipment
Heat source capacity for heating and hotwater
Main equipment
Air conditioning system
・Sanitary facility:
Water supply system Hot water spply system
・Air conditioner setting temperature and humidity:
Summer ℃ %, Winter ℃ %
・Working hour:
Week day , Sata day , Sun day

Type of Data Collected:
2) Energy Consumption

	Electricity				City gas	LPG	Oil	District heat and cooling		Water service	
	Maxim um	Dayti me	Nightti me	generat or				Cold water	Stea m	Water supply	Well
month	kW	kWh	kWh	kWh	m3	kg	kL	GJ	GJ	M3	m3
Apr											
May											
Jun											
Jul											
Aug											
Sep											
Oct											
Nov											
Dec											
Jan											
Feb											
Mar											
Total											

Calculation of Building Energy Efficiency Index (in MJ/m2)

Calculation of Energy Intensity

Energy			Annual consumption		Heat equivalent			
Kind	Classification	Unit			MJ/unit		MJ/year	
Electricity		kWh		×	10.25	=		
City gas	13A	m2		×	46.054	=		
	12A	m2		×	41.86	=		
LPG		kg		×	50.242	=		
Heavy oil	A	kL		×	38.937	=		
	B	kL		×	40.193	=		
Total consumed							A	MJ/year
Total gross floor area							B	m2
Energy consumption intensity (annual bassis):					A/B	=	C	MJ/m2 year

Database & Benchmarking System

Standardization of Units

conversion factors

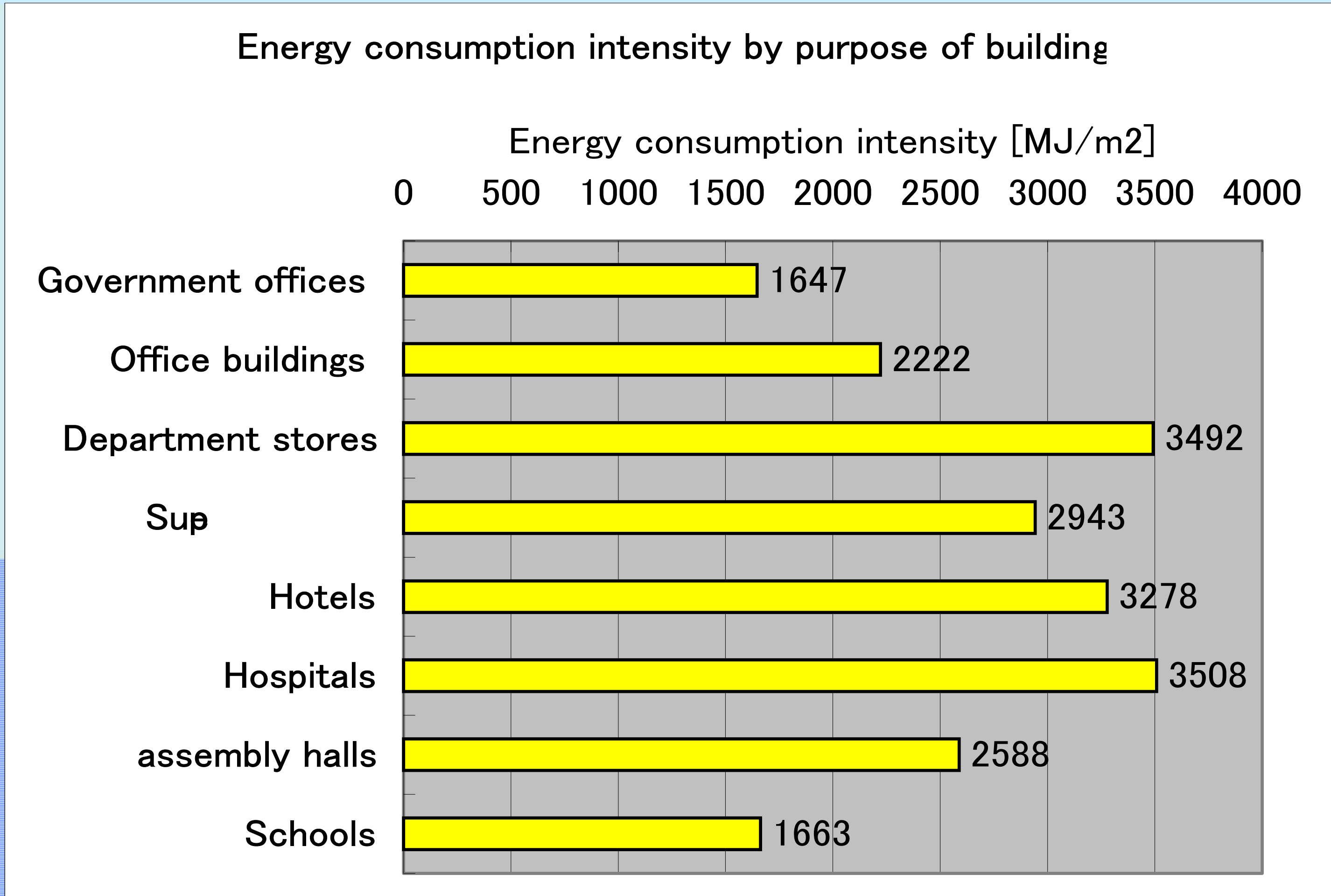
	unit	conversion coefficient [MJ/unit]
Electricity	kWh	10.250
City gas 13A	m3	46.054
City gas 12A	m4	41.860
City gas 6A	m5	29.370
City gas 6B	m6	18.837
LPG	kg	50.242
Heavy oil A	kl	38.937
Heavy oil B	kl	40.193

Database & Benchmarking System

What is a Benchmark?

- It is the average of building energy efficiency indices of audited buildings, expressed in terms of MJ/m2.
- It also serves as the reference point to indicate energy efficient buildings

Benchmarks in Various Types of Buildings in Japan



I will show how do we make it.

Information Dissemination of Database and Benchmarks

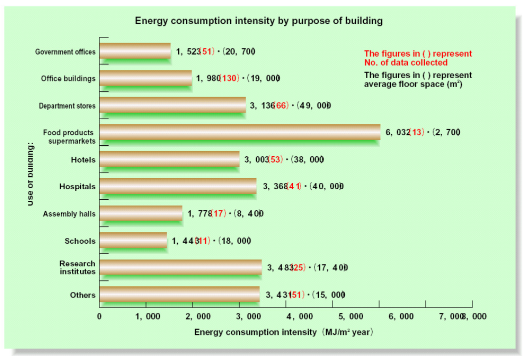
Energy data on buildings

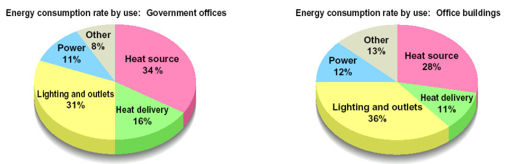
Energy consumption intensity of building by category and consumption rates for each user

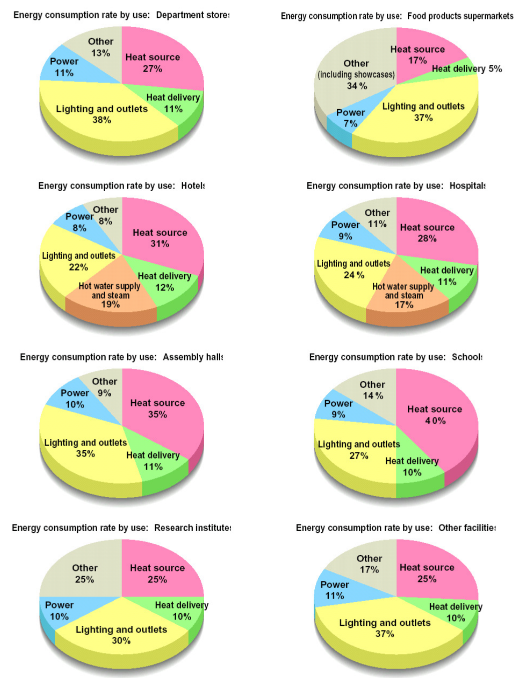
Energy consumption and its distribution largely differ depending on what purpose the building concerned is used for. In order to identify energy saving points for specific buildings, it is quite critical to be completely acquainted with this background information.

The graphs below show building category-specific energy consumption intensity and consumption details. The data was obtained from the survey titled " Energy Efficiency Audits for Buildings" conducted by The Energy Conservation Center, Japan from 1997 through 2000.

None of the buildings surveyed had recorded their energy consumption by purpose. Because the data, however, was deemed critical to planning of energy saving measures, the Center estimated these figures based on the results of the survey that included monthly energy consumption, heat source, air-conditioning system, capacities of major pieces of equipment, operation system and time.







Energy Efficient Buildings : Guidelines in Japan

Obligations of Building Owners

1) Prevention of heat loss through external walls、windows, etc. of a building:
2) Efficient use of air conditioners;
3) Efficient use of mechanical ventilating equipment;
4) Efficient use of lighting facilities;
5) Efficient use of hot water supply systems;
6) Efficient use of elevators

1) Prevention of heat loss through external walls, etc. of a building

- Annual thermal load of the perimeter zone (MJ/year)

  Total floor area of the perimeter zone (m2)

  →[(Virtual load)/(Area)]

  (PAL) : Perimeter Annual Load

- *Thermal load of the ambient indoor space:

  Heat lost through external walls, windows, etc. for a year, total of heating and cooling load generated by heat generated in the ambient space.

  The quantity of open air taken in is presumed to be a constant calculated on the basis of the area, etc.

2) Efficient use of air conditioners

- Quantity of energy consumed for air conditioning (MJ/year)
  Virtual air-conditioning load (MJ/year)

→[Actually consumed energy/(Virtual load)]

(CEC/AC): Coefficient of Energy Consumption for Air Conditioning

*Quantity of energy consumed for air-conditioning:

Quantity of energy of given air conditioner consumed to treat air conditioning loud for a year

Virtual air-conditioning load (Unit: MJ/year):

The quantity of open air taken in is presumed to be a constant calculated on the basis of the area, etc.

Decrease in load by using exhaust heat recovery is not taken into account.

Standard value of energy conservation for buildings

	Hotels	Hospitals	Stores	Offices	Schools	Restaurant
1)PAL	420	340	380	300	320	550
2)CEC/AC	2.5	2.5	1.7	1.5	1.5	2.2
3)CEC/V	1.0	1..0	0.9	1.0	0.8	1.5
4)CEC/L	1.0	1.0	1.0	1.0	1.0	1.0
5)CEC/HW	1.5	1.7	1.7	-	-	-
6)CEC/EV	1.0	-	-	1.0	-	-

Note) In the case of 1), values obtained by multiplying the above values by the scale correction factor shall be standard ones. (Scale correction factor: a factor for correcting standard values to relax controls of small scale buildings, etc)

Guidelines for the Use of Energy Efficient Equipment in Japan

Air conditioner

1) Target range

Both cooling systems and heating and cooling systems

2) Target Value

Classsification		Target standared value (COP)				
(Cooling ability; kW)		～2.5	～3.2	～4.00	～7.10	～28.00
Cooling	Wind-wall type	2.67				
	Separate type	3.64	3.64	3.08	2.91	2.81
	Direct blowing type and others	2.88			2.85	2.85
	Duct typ	2.72			2.71	2.71
	Multi typ e	3.23			3.23	2.47

Fluorescent lamp

1) Target range

Lighting equipment with fluorescent lamps as the main light source

2) Target value

Classification			Target standard value (lm/w)
Straight tube type	One with 110-type		79.0
	40-type	One with high-frequency lighting lamps	86.5
		One with rapid start fluorescent lamps	71.0
		One with starter-type fluorescent lamps	60.5

Operating Guidelines for Factories and Buildings

Areas for Rational Use of Energy

1) Fuel combustion
2) Heating, cooling, heat transfer, etc.
3) Prevention of heat loss due to radiation, conduction, etc.
4) Recovery and utilization of waste heat
5) Rationalization in the conversion of heat to power, etc
6) Prevention of electricity loss due to resistance, etc
7) Rationalization of conversion from electricity to mechanical power, heat, etc.

Standard values and target values of air ratios

Classification				Air ratio	
Boiler	Item			Liquid Fuel	Gas fl
	Standard	For electric utility		1.05–1.20	1.05–1.10
		Other (quantity of evaporation)	30t/h	1.10–1.30	1.10–1.20
			10 to less than 30th	1.15–1.30	1.15–1.30
			5 to less than 10t/h	1.20–1.30	1.20–1.30
			less than 5t/h	1.20–1.30	1.20–1.30
	Target	For electric utility		1.05–1.10	1.05–1.20
		Other (quantity of evaporation)	30t/h	1.10–1.15	1.10–1.15
			10 to less than 30th	1.15–1.25	1.15–1.25
			5 to less than 10t/h	1.15–1.30	1.15–1.25
			less than 5t/h	1.15–1.30	1.15–1.25

Future Direction

Obligation of Building Owners

Annual Energy Consumption		Classification	
Heat (Fuel)	Power		
3,000 kL	12 Million kWh	1st Category	1.Obligation to report the status of energy consumption every year 2.Obligation to submit medium-to-long term improving plan under the supervision of energy manager
1,500 kL	6 Million kWh	2nd Category	1.Obligation to report the status of energy consumption every year
0 kL	0 kWh		

By the law

- Building data will gather

  1st Category : about 1000

  2nd Category : about 1000～2000

  total : 2000～3000

- 1st Category

  The reduction plan of 1% or more is made by the period average

Promotion of BEMS

- BEMS : Building Energy Management System
- Subsidy of 1/3 of the total investment cost
- To avail of subsidy, energy must be measured for each of the following:

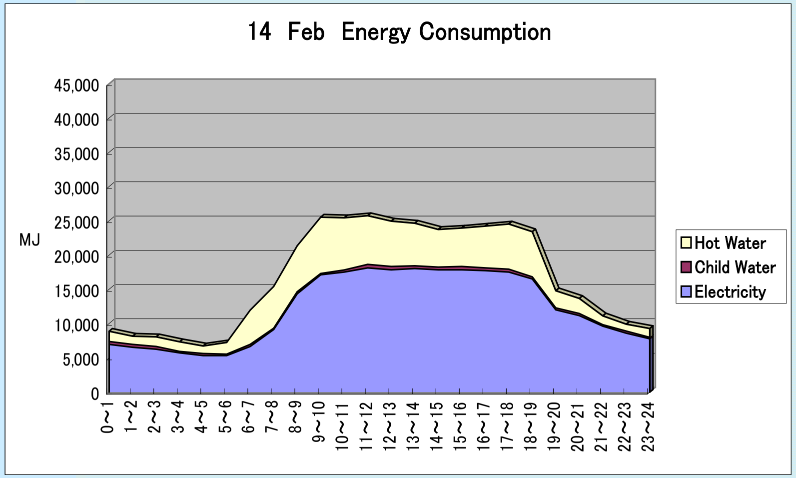
  1.Heat source

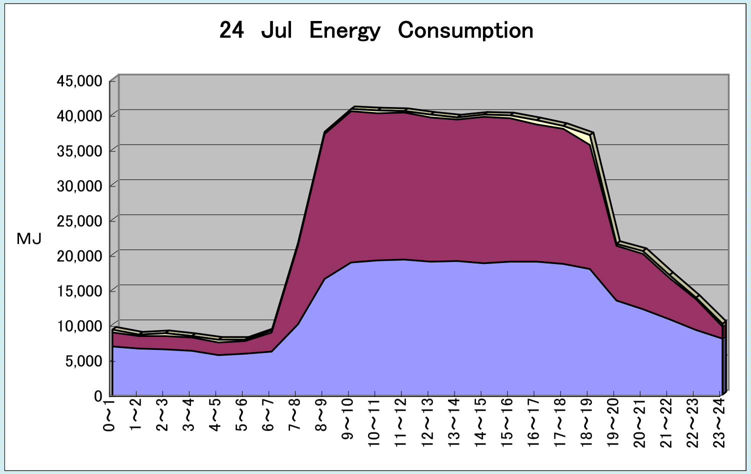
  2.Pump

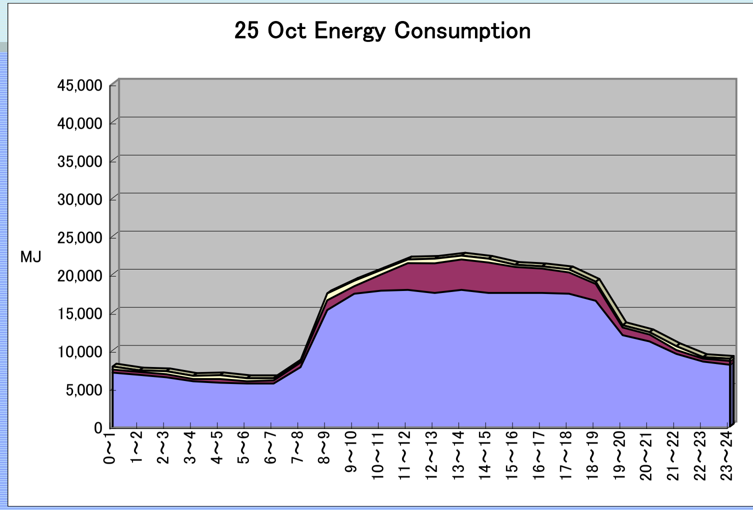
  3.Illumination /outlet

  4.Others
- BEMS can determine the energy consumption of each equipment.

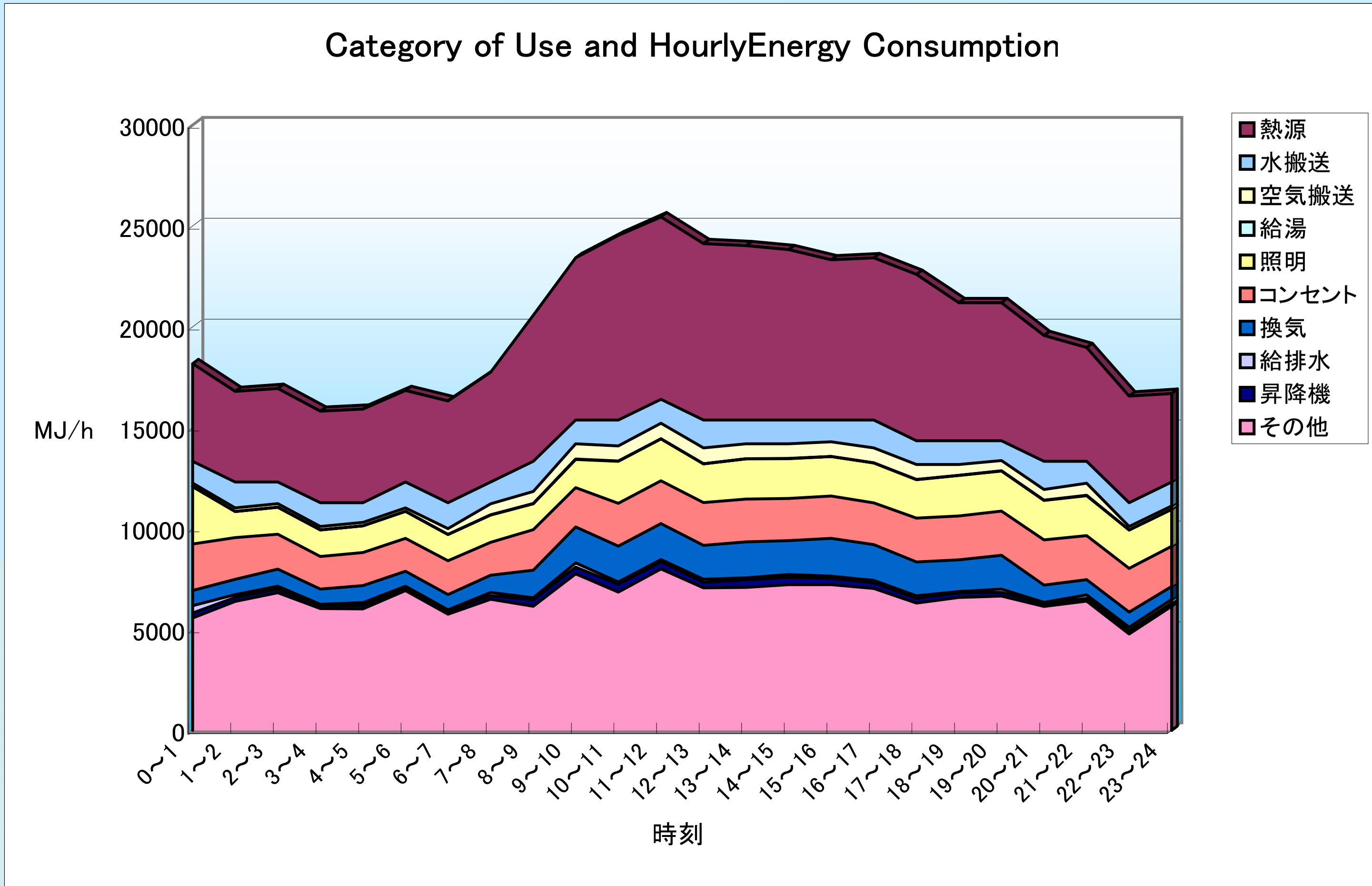
Measurement Sample: Heat Source







Energy Profile of Equipment



Heat Source
Water Delivery
Air delivery
Hot water
Lighting
Outlet
Ventilation
Sanitary
Elevator
Others

Current and Future Program of ECCJ

- 2002 ～
- **Energy audit**

［1］ **Interview/Questionnaire**

- Number of Audit: Office～180 buildings, others～ 120 building
- GFA: 15,000m2 or more.
- Areas for investigation
  - Capacity of equipment and operating time
  - Kind of illuminator and lighting time
  - Amount of electric power according to feeder
  - Others

Current and Future Program of ECCJ

［2］ **Measurement investigation**

- Office: ～15 buildings, others～ 10 building
- Purpose～

To check the accuracy of data

To make the management standards (model of the measurement and record)

※ 2003,2004 ～Plan to expand investigations to other type of buildings

Thank you

The Energy Conservation Center, Japan

Material – 4

Energy Audit, Database & Benchmarking

in Buildings in Vietnam & Myanmar

Energy Audit, Database & Benchmarking in Buildings in Vietnam & Myanmar

PROMEEC – BUILDING

SOME-METI WORK PROGRAMME 2002-2003

Akira Kobayashi
The Energy Conservation Center, Japan
28 February 2003

Outline of Presentation

- Overview of Activities
- Case Study for Building in Japan
- Exercise
  - in Vietnam
  - in Myanmar
- Comments

Overview of Activities

1st Day

- 1) Case Study for Building in Japan
- 2) Discussion

2nd Day

- 1) Adjustment of data
- 2) Database and Benchmark Making

Case Study for Building in Japan

- **Energy Audit**
- **Database and Benchmarking**
- **Guidelines for Energy Efficient Buildings**
  - **- Guidelines of equipment in Japan**
  - **- Operating guidelines for factories and buildings**
- **Future Direction**

Exercise
- in Vietnam

The Participants

Building Audit Report of EVN&IE

- Walk-through Energy Audit Report
  (Electricity of Vietnam , Institute of Energy)
- Building Use
  25 storey Hotel/Apartment Block
  13 storey Office Block
- Total Gross floor area 36,950m2
- 3 Years Monthly Electricity Consumption
- Proposals and recommendations on energy recovery and conservation
- Remarks
  No information about fuel, gas, and water

Sample Size: 14+2 Buildings

	Hanoi	Ho Chi Minh	Total
Hotel	0	4	4
Hotel & Office	1	0	1
Office	2	2	4
Store	1	1	2
School	1	0	1
Hospital	1	0	1
Station	1	0	1
Sub Total	7	7	14
Hotel (by ECCJ)	2	0	2
Total	9	7	16

Data Management

Building Energy Database in Vietnam

category	Building	Location	data No	GFA [m2]	DateYear	Electricity [kWh]	Electricity intencity [kWh	oil [l]	LPG [l]	LPG [kg]	Water [m3]	Water intensity [m3/m2]
Hotel	N hanoi	Hanoi	HL−1	29,164	2002	6,072,900	208.2	766,995	94,842		94,077	3.2
	L hotel	Hanoi	HL−2	6,981	2001	883,920	126.6			27,263	35,741	5.1
	C Hotel	Ho Chi Min	HL−3	h9,604		1,482,647	154.4					
	M Hotel	Ho Chi Min	HL−4	h1,055		2,172,720	196.5					
	NW Hotel	Ho Chi Min	HL−5	55,760		15,314,323	274.6					
	SP Hotel	Ho Chi Min	HL−6	h5,590		4,000,000	256.6					
Hotel ,Office	HTC	Hanoi	HO−1	31,000	2001	6,547,553	211.2					
Office	MIH	Hanoi	O−1	6,000		468,846	78.1					
	ST	Ho Chi Min	O−2	20,240		3,494,051	172.6					
	PC2	Ho Chi Min	O−3	h3,891		738,548	189.8					
	EVB	Hanoi	O−4	8,000		472,703	59.1					
Store	SS	Hanoi	S−1	1,000		476,717	476.7					
	M	Ho Chi Min	S−2	h9,143		2,907,895	151.9					
School	KLS School	Hanoi	SC−1	5,260		63,208	12.0					
Hospital	V Hospital	Hanoi	HS−1	36,385		1,984,666	54.5					
Other	HR Station	Hanoi	OT−1	102,000		278,899	2.7					

Data Management

category	Building	Location	data No	GFA [m2]	Date Year	Electricity [kWh]	Electricity intensity [kWh/m2]
Hotel	N hanoi	Hanoi	HL−1	29,164	2002	6,072,900	208.2
	L hotel	Hanoi	HL−2	6,981	2001	883,920	126.6
Hotel ,Office	HTC	Hanoi	HO−1	31,000	2001	6,547,553	211.2

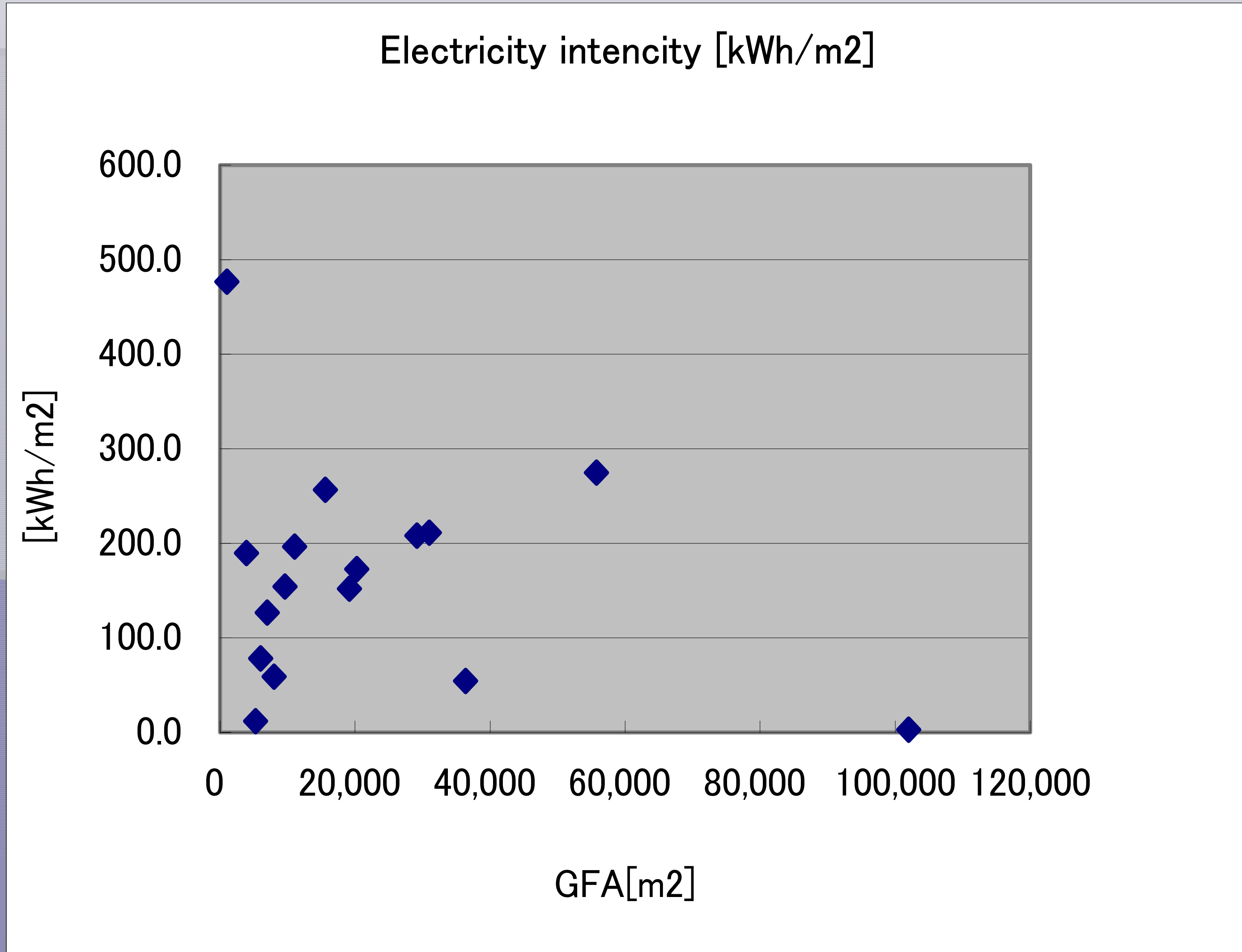
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
426,200	337,200	413,600	499,600	539,200	597,000	644,100	607,800	581,200	522,100	442,600	462,300	6,072,900
49,920	43,680	65,920	72,800	86,560	91,040	99,600	89,600	89,280	83,040	60,160	52,320	883,920
369,370	380,640	403,763	475,840	647,060.0	718,330	679,730	765,360	706,330	563,070	444,070	393,990	6,547,553

Energy Efficiency Index of 16 Buildings

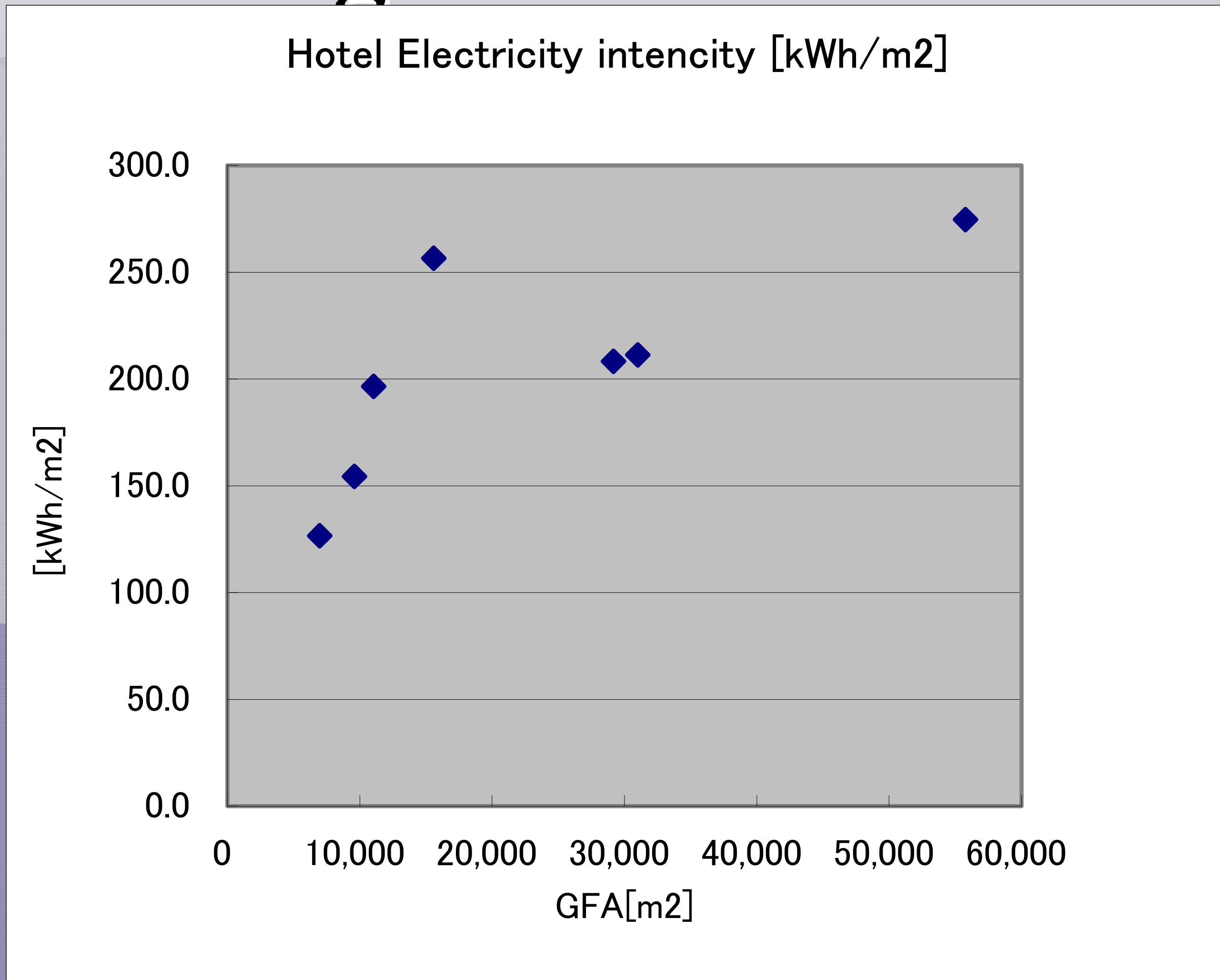
Electricity:

Annual Electricity Consumption /

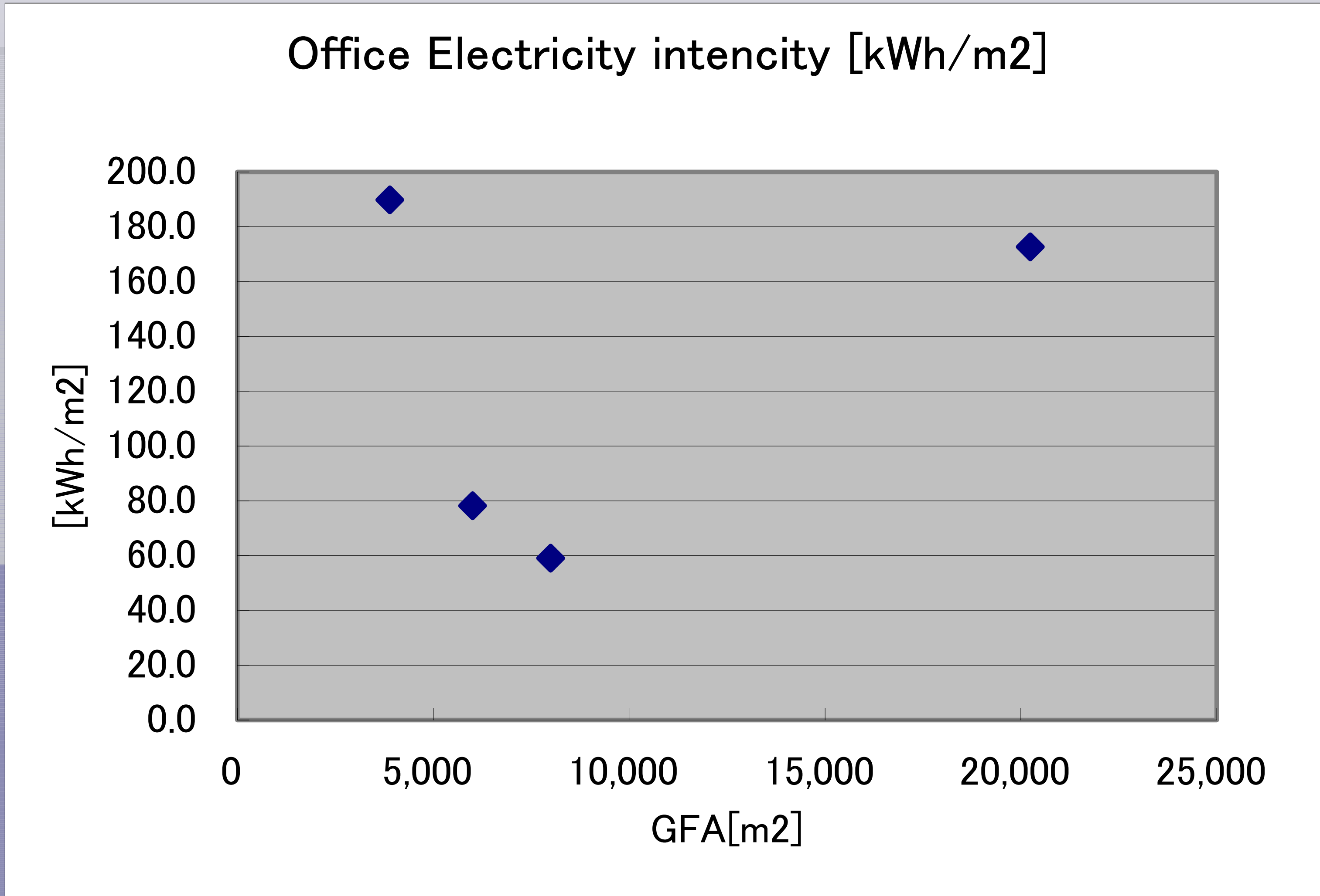
GFA



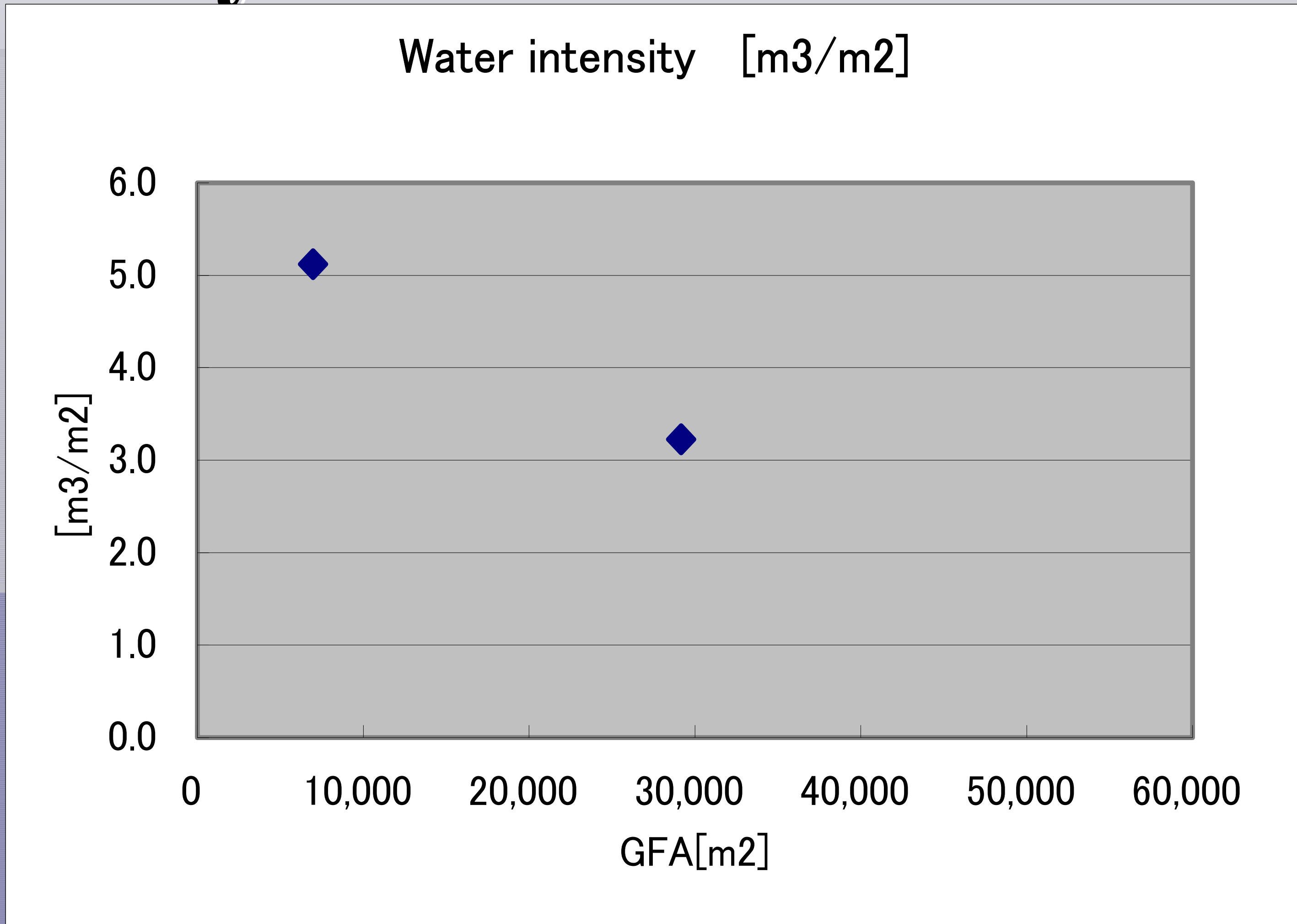
EE Index of 6 Hotels + 1 Mixed Use Building



EE Index of Office Building



Performance Indicator: Water Intensity



Data Management

Energy Conservation measure table

category	Building	Location	data No	GFA [m2]	DateYear	Electricity		oil	
		No	measure			Reduction Wh]	Reduction %	Reduction[l]	Reduction %
Hotel	N hanoi	Hanoi	HL-1	29,164	2002	6,072,900		766,995	
		1	Improvement chiller water temperature			50,561	0.83%		
		2	Improvement chilled water pump VWV			279,444	4.60%		
		3	Incandescent Lamp high efficiency lamp			129,845	2.14%		
		4	High efficiency fluorescent lamp			19,895	0.33%		
		5	Improvement Boiler air ratio					18,992	2.5%
		6	Steam valve insulation					17,062	2.2%
Hotel	L hotel	Hanoi	HL-2	6,981	2001	883,920			
		1	Hot water temperature reduction			28,032	3.17%		
Hotel	C Hotel	Ho Chi Min	HL-3	h9,604		1,482,647			
		1	Improvement of lighting			134,921	9.10%		
Hotel	M Hotel	Ho Chi Min	HL-4	h11,055		2,172,720			
		1	Improvement of lighting			258,554	11.90%		
Hotel	NW Hotel	Ho Chi Min	HL-5	h55,760		15,314,323			
		1	Improvement of lighting			750,402	4.90%		
Hotel	SP Hotel	Ho Chi Min	HL-6	h15,590		4,000,000			
		1	Improvement of lighting			308,000	7.70%		
Hotel ,Office	HTC	Hanoi	HO-1	31,000	2001	6,547,553	5.00%		
		1	Replace incandescent lamp			4,261	0.07%		
		2	New energy efficient ballas			131,227	2.00%		
		3	Replace Fluorescent tube			69,497	1.06%		
		4	Effect on cooling			43,925	0.67%		

Exercise
- in Myanmar

The Participants

Sample Size: 11 Buildings

Government Office	6	
Temple	1	
Hospital	2	
Commercial Office	1	ECCJ Audit
Hotel	1	ECCJ Audit

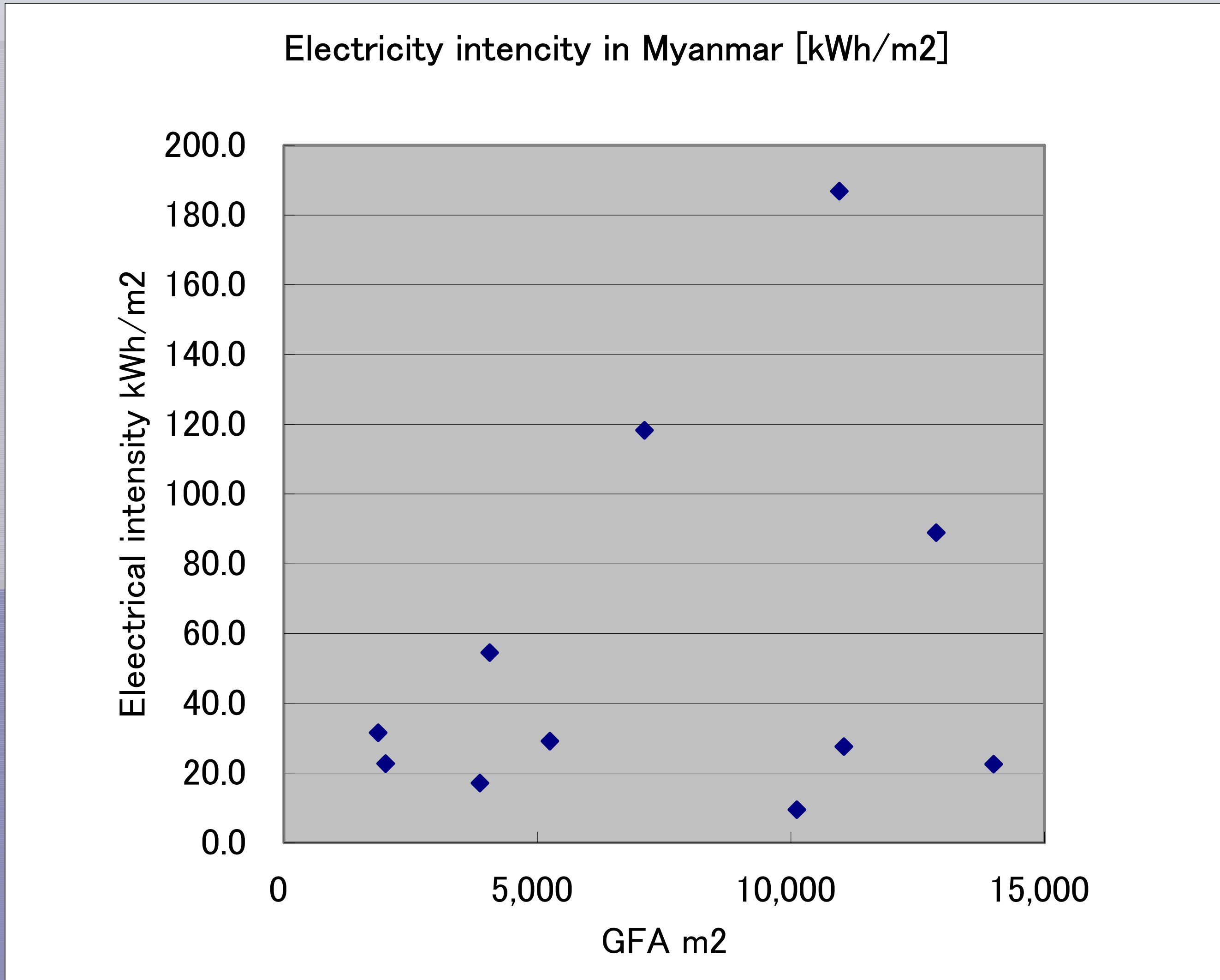
Data Management: Building Information Sheet

・Name of the Building :		Public Works		
・Address		60 shwedagonpagoda road		
・Category of Usage:				
	・ Landload building or Tenant building	Landload building		
・Age of Building:		30		
・Size :				
	・Total gross floor	11044	m2	
	・Number of stories	4	F	
	・BasementStories	0	F	
・Electrical facilities:				
	Receiving voltage	6.6	kV	
	Agreement capacity	–		
	Transformer capacity	500	kVA	
・Air conditioning facility:				
	Heat source capacity for cooling	–		
	Main equipment	–		
	Heat source capacity for heating	–		
	Main equipment	–		
	Air conditioning system	spl	u t	
・Sanitary facility:				
	Water supply system	city,well		
	Hot water spply system	–		
・Air conditioner setting temperature and humidity:				
	Summer ℃	24	℃	
	%	50	%	
・Working hour:				
	Week day	8	H	
	Sat day	0	H	
	Sun day	0	H	

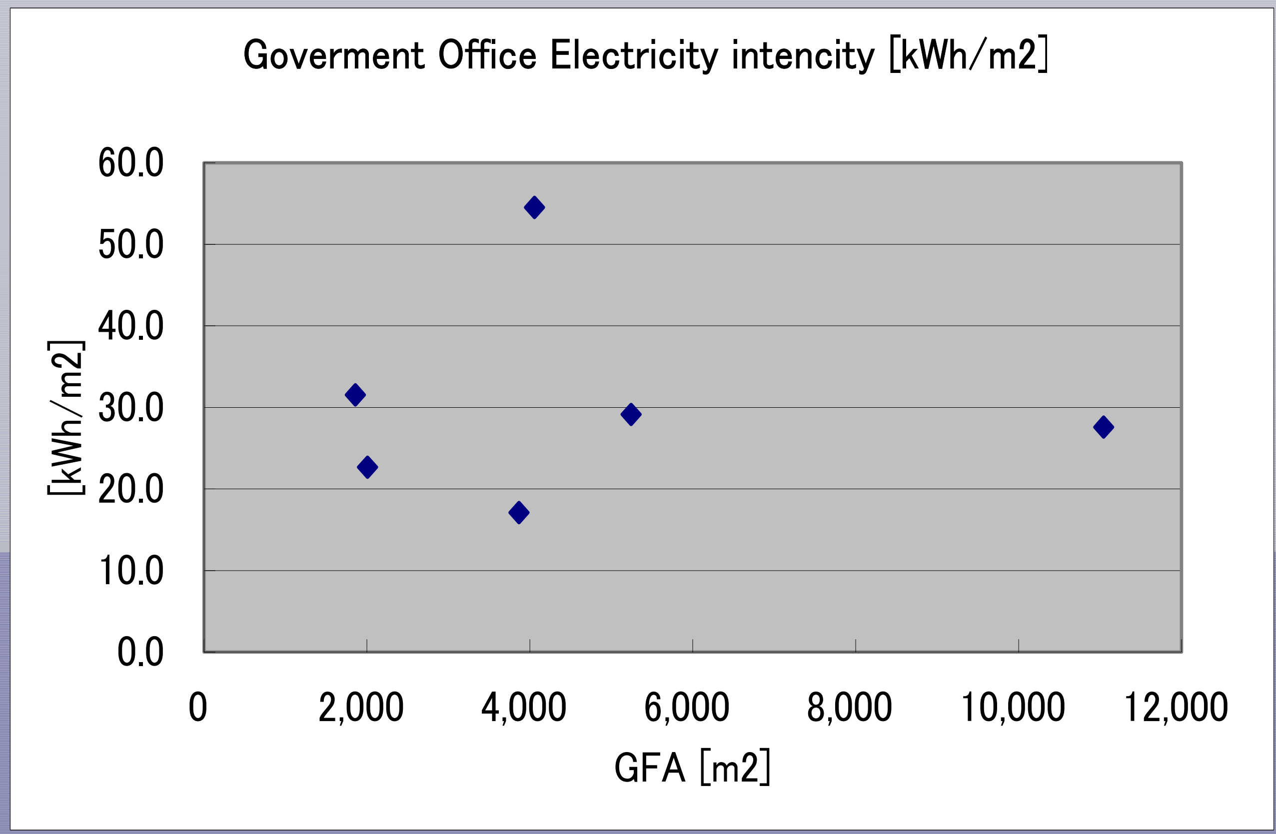
Data Management:
Energy Consumption Data Sheet

	Electricity	Demand Peak	LPG	OIL	Water
	kWh	kW	kg	L	m3
Jan	24811				
Feb	25132				
Mar	29744				
Apr	27956				
May	29224				
Jun	26656				
Jul	27132				
Aug	26958				
Sep	27313				
Oct	25002				
Nov	18550				
Dec	16320				
Total	304798				

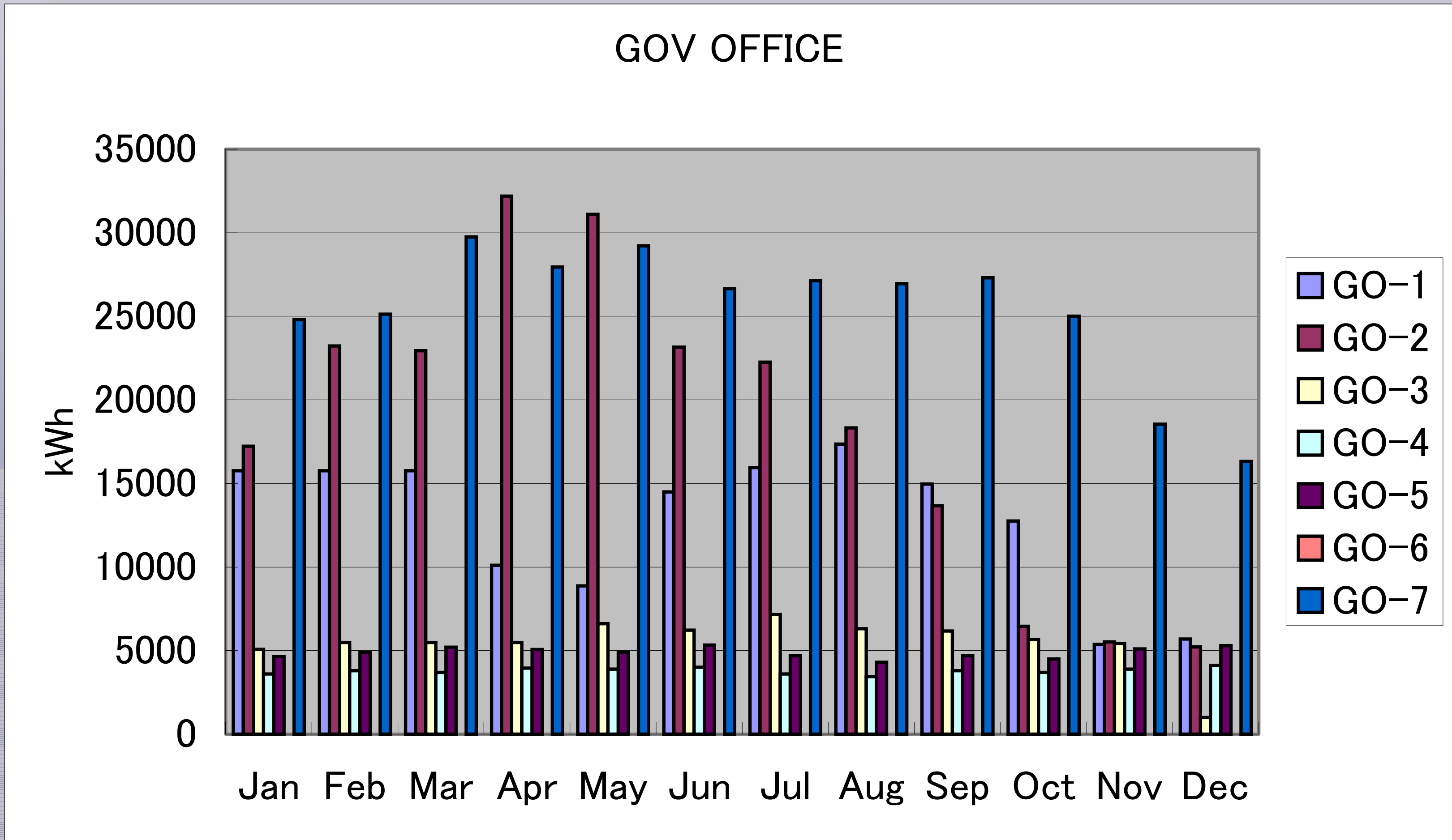
Energy Efficiency Index of 11 Buildings



Energy Efficiency Index of Government Office



Performance Indicator: Government Office Buildings Monthly Data



Comments

- Establish Data Collection System
- Employ statistical methods
  - sampling method
  - sample size
  - analysis, etc.
- Establish a database
- Conduct more trainings
- Develop benchmarks
- Promotion and publication

Thank you

The Energy Conservation Center, Japan

Material – 5

Data and Information Political and Technical

(1) Data and Information (Vietnam)

(2) Data and Information (Myanmar)

V. Attached Reference Materials

V.5 (1)

Data and Information Political and Technical

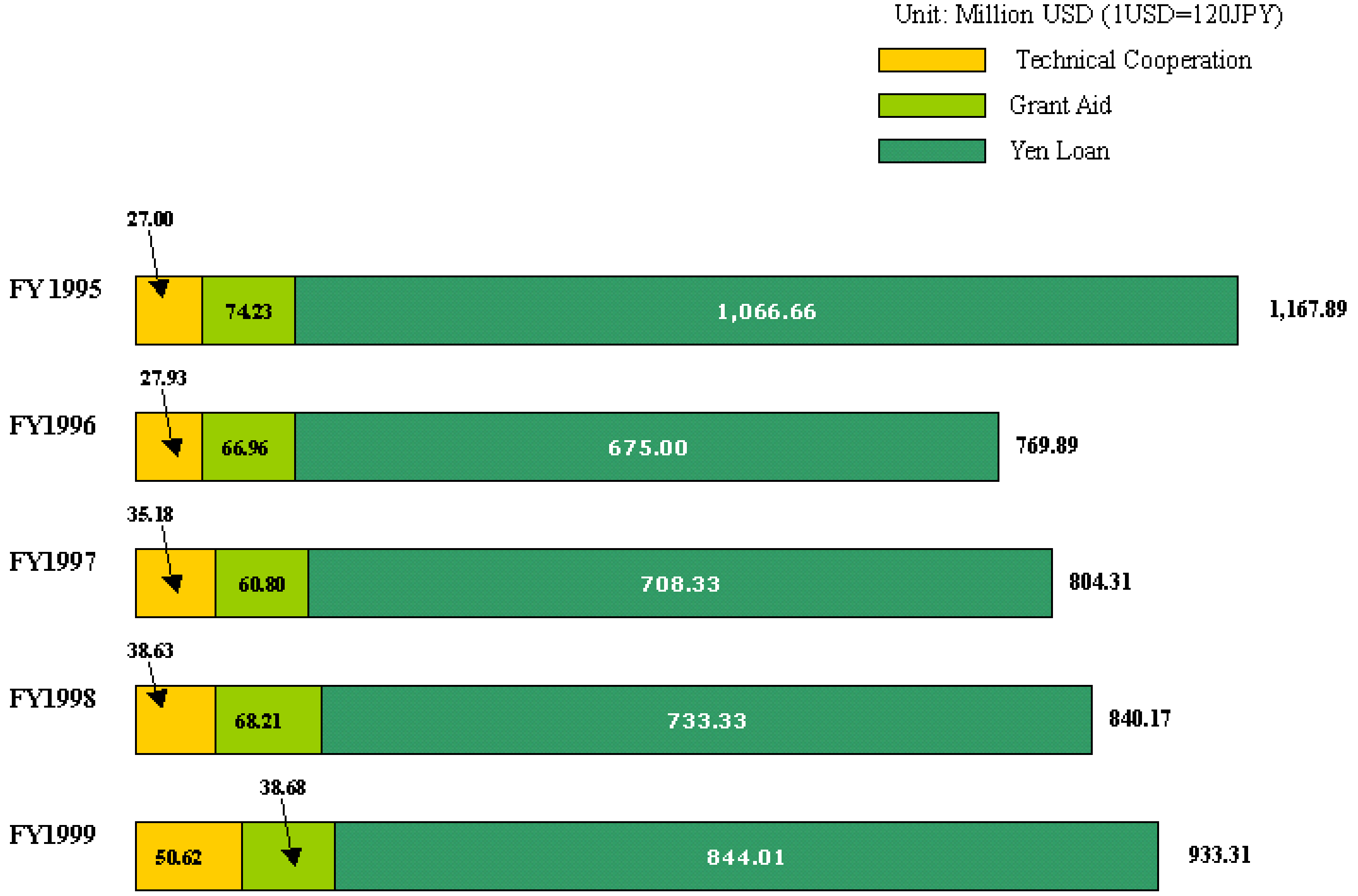
(Vietnam)

Prepared by ASEAN Center for Energy

Japan as the top donor in Vietnam

Japan resumed the Technical Cooperation of the bilateral Official Development Assistance (ODA) for Vietnam in 1991 and the Loan in 1992. Since then Japan's ODA has significantly been increasing and especially since 1995 Japan has been the top ODA donor in Vietnam. Japan's ODA for Vietnam in FY1999 was 111,996,000,000 JPY (933,300,000USD: 1USD=120JPY) and the accumulated disbursement of Japan's ODA from FY 1992 to FY 1999 reached 657,228,000,000 JPY (5,476,900,000 USD: 1USD=120JPY). The total disbursement of Japan's ODA in 1998 shares about 55% of that of the bilateral donors (DAC: Development Assistance Committee) in Vietnam. Furthermore, Vietnam was ranked at 4 for Japan's worldwide bilateral aid in 1999. The above figures show Japan's deep concern for Vietnam.

Japan's ODA commitment to Vietnam in recent years



Japan's ODA total from FY1992 up to FY1999

Technical Cooperation : 162.28
Grant Aid : 421.63
Yen Loan : 4,842.38
....
Total 5,426.29

August 26, 2002
JICA Vietnam

Dialogue on JICA's Country Assistance Program to Vietnam JICA Project Confirmation Mission

The Japan International Cooperation Agency (JICA) sent the mission headed by Mr. Takeshi Nakano, Deputy Managing Director of Asian I Department of JICA to Vietnam from July 23 to 25, 2002 in order to discuss Vietnam's socio-economic development and the direction of JICA's technical assistance with the Ministry of Planning and Investment (MPI) and other relevant government agencies. The main results of a series of discussions are as follows:

1. JICA pledged strong commitment to the contribution to Vietnam's rapid and sustainable economic growth and poverty reduction. This commitment was based on the Vietnam's Ten-year Socio-economic Development Strategy for the period 2001~2010, Five-year Socio-economic Development Plan for the period 2001~2005, sectoral development strategy, provincial- and regional-development strategy, and CPRGS as the general guideline for implementation of those strategies. At the meeting, JICA introduced the main features of its **Country Assistance Program** vis-à-vis Vietnam, which was developed based on the overall Country Assistance Strategy developed by the Ministry of Foreign Affairs of Japan. **The high priority areas of JICA's technical assistance vis-à-vis Vietnam confirmed by both sides at the discussion are as follows:**

(i) Human Resources Development and Institutional Building, especially, in the field of economic management,
(ii) Economic Infrastructure, such as Transport, Power Development, and Telecommunications,
(iii) Agriculture and Rural Development,
(iv) Health and Education, and
(v) Environment.

2. Regarding **ODA effectiveness, both sides reached consensus in making efforts to upgrade ODA effectiveness and efficiency.** Both sides also confirmed the harmonization of ODA procedures is not synonymous with unification, and it had better to seek harmonization and simplification in diversity, and that it should be pursued in a productive and pragmatic way, respecting existing diversities of donors' procedures. For example, it is necessary to identify the areas where the huge administrative burdens are incurred, why those costs are incurred, and who actually bears those costs.

3. **In the Human Resources Development and Institutional Building (especially, support of transition toward a market-oriented economy)**, the Vietnamese government and JICA confirmed that (i) economic management, and (ii) governance continued to be focused in their bilateral cooperation.

Regarding Economic Management aspect, there are two-holds: policy advice and capacity building for the government agencies.

From 1995~March 2001, the MPI/Development Strategy Institute (DSI) and JICA conducted ISHIKAWA Project to provide policy advices for the Government of Vietnam in drafting five-year socio-economic development plan 1996~2000 as well as the 2001~2005 five year development plan. Based on the results of this study, JICA has been conducting a series of joint researches with the government agencies concerned since mid-2001. For example, the research on "Growing sub-sector in Vietnam's agricultural development" is being conducted with MPI, the research on "Introducing the Personal Income Tax in Vietnam" with the Ministry of Finance, or the research on "Monetary policy under partial dollarization in Vietnam" with the State Bank of Vietnam, and the research on "Industrialization strategy in the age of international integration" with the National Economics University in Hanoi in a close collaboration of the relevant line ministries.

The Vietnamese government and JICA exchanged the visions on how best to utilize Japanese intellectual assistance toward Vietnam in implementing its economic reform agenda.

Regarding **Governance aspect, JICA will continue its assistance in (i) legal and judicial development, based on the recommendation of the Legal Needs Assessment (LNA), in which JICA also deeply involved, and (ii) support to WTO accession, especially, customs administration and industrial property administration system.**

4. **In the Economic Infrastructure**, the Vietnamese side and JICA confirmed that transport, power development, and telecommunication were **the key elements for Vietnam to achieve economic growth as well as poverty reduction.**

Regarding **Power Sector**, the followings are critical issues: (i) capacity building of the Government to design electric power development plan, (ii) capacity building for operation and maintenance of transmission/distribution network and power plant, and (iii) upgrading efficiency of management of electric companies. In concrete, the Vietnamese government and JICA will explore the possibility of the best mixture in the context of Vietnam, among various alternatives, such as hydro power, thermal power, rural electrification utilizing renewable energy, and enhancing transmission network connecting the North and the South of Vietnam, enhancing regional electric power network with Cambodia, Laos and Vietnam. Besides that, it is necessary to monitor the progress of the 5th Electric Power Development Master Plan, which was developed by EVN based on the demand forecast until 2020, and to develop capacity of EVN to implement it. Given the increasing necessity to expand the capacity of power generation, transmission and distribution network to meet the electricity demand, it is also necessary to develop human resources in charge of operation and maintenance of the power plants built by Yen Loan.

Regarding **Transport sector**, the Ministry of Transport and JICA conducted the study on the National Transport Development in the Socialistic Republic of Vietnam (so-called “VITRANSS”). The Study presented the mid-term and long-term directions of transport sector development and covers all transport sub-sectors, such as road, railway, in-land waterways, port and shipping, and air transport. The outputs of VTRANSS are utilized for the Vietnamese Government to draft its own ten-year transport sector strategy. The both sides also highlighted the importance of urban transport issues to deal with the increasing number of traffic accidents and heavy traffic jams. To this end, it is necessary to develop comprehensive urban transport master plan, which expectedly includes the introduction of urban public transport system and measures to secure traffic safety. The need on capacity building for effective operations and maintenance of the transport system was also discussed.

Regarding **Telecommunication sector**, enhancing telecommunications network to meet the demand for IT industry was considered as the critical issue. Capacity building in this sector continues to be prioritized in JICA’s programs.

5. In the Agriculture and Rural Development, both sides confirmed that this sector had an important function in poverty reduction as well accelerating economic growth, taking into consideration of remarkable achievements in the poverty reduction in Vietnam during 1990s.

The Ministry of Agriculture and Rural Development (MARD) and JICA regarded the followings as critical issues: (i) upgrading infrastructure, developing capacity for operation and maintenance, developing off-farming industries, diversifying agricultural products, improving distribution network, and strengthening agricultural cooperatives for the raising income level of agricultural household, (ii) promoting research and development (R&D) and developing capacity for policy planning, and strengthening higher education in this field. This issues mentioned in item (ii) were also recommended in the Public Expenditure Review (PER) Report published in 2000.

6. In the Health and Education Sectors, particularly Education sector, the Japanese government has committed to upgrading and modernizing facility of primary schools in the Northern Mountainous Regions and in flood regions since mid 1990s. To maximize the effectiveness of the combination between technical assistance and grant aid, since 2001, the Ministry of Education and Training (MOET) and JICA have been conducting “Support

Program on Primary Education Development in Vietnam" to support MOET in materializing Ten-year Education and Training Development Strategy for the period 2001~2010. In term of primary education, MOET and JICA are considering the most appropriate approach, such as: (i) upgrading and modernizing facility of primary schools, (ii) teachers' training, and (iii) improving education administration. Regarding higher education, JICA has assisted universities to improve the training and research quality in the field of engineering through the Southeast Asia Engineering Education Network (SEED-NET). The Japanese Government, through JICA, has also conducted the Japan's Grant Aid for Human Resources Development Scholarship (JDS) for master degrees in five key fields for Vietnam's transition towards a market-oriented economy.

In the **Health sector**, both sides considered **it necessary to upgrade medical technique and enhancing referral system in Vietnam.** To this end, the Ministry of Health (MOH) and JICA are conducing in-country training program at Cho Ray Hospital in the Southern Region. MOH and JICA are upgrading Bach Mai Hospital as the top referral in the Northern Region, and now conducting a project formulation study to develop the top referral in the central region. **Based on these hospitals, MOH and JICA intended to develop capacity of health workers at central-, district-, and commune levels, who are supposed to engage in supporting the poor to have a better access to health care services.** Besides that, MOH and JICA agreed to enhance maternal and children health care services (including reproductive health), and reducing infectious diseases (including HIV/AIDS).

7. In the Environment Sector, both sides recognized environment as the key element for sustainable development (Note: The international community is scheduled to organize the World Summit for the Sustainable Development (WSSD) in the South Africa in August 2002). **One of the critical issues identified by both sides was to strengthen the monitoring capacity to assess the actual situation of environment in Vietnam.** In addition, **JICA will continue to contribute to the Planting of Five million Hectares of Forest.**

Contactpoints:

JICA Vietnam Office

V. Attached Reference Materials

V.5 (2)

Data and Information Political and Technical

(Myanmar)

Prepared by ASEAN Center for Energy

Myanmar Energy Sector

Myanmar is basically an agricultural country, however recent development trends are geared towards striking a balance between emphasis on agriculture and industry. During the past decade, significant progress have been achieved in the nation's economic and the social sectors. These achievements are due to initiatives taken by the state to liberalize the existing economic policy and transform the structure of the economy to a market oriented and private sector dominated structure. The state has made tremendous efforts to improve the nation's basic infrastructure such as roads, bridges and communication systems. The shift of the economic system and the intensive development of the basic infrastructure , created many economic activities leading to increasing demand for energy, especially electric power and petroleum – based liquid fuels.

Myanmar's total energy consumption is contributed by energy generated from fossil fuels and water resources which comes under the term commercial energy. Under these circumstances the need for increased consumption of commercial energy cannot be over emphasized taking into account the volume and density of developments presently taking places, as the nation progresses in its efforts to build a strong national economy.

Commencing from early 1989, the Oil & Gas Sector has made available 46 blocks on-shore and 25 blocks off-shore to foreign international oil companies and has since 30 on -show and 14 off- shore contracts. At present , the Yadana Gas Field having a reserves of 6.5 trillions cubic feet and Yetagun Gas Field having a reserves of 3 trillions cubic feet .The gas produced from both fields is currently exported to Thailand across the border .

During the past decade, the Myanmar Power Sector has made intensive efforts to expand its power systems in the grid areas as well as off grid areas. Previously constraints such as low tariff rates, heavy line losses and currency repatriation problems prevented the participation of the private sector. However following the latest revision of tariff rates , local private sector has shown interest in selected power projects that would benifit to the state as well as private sector. As a breakthrough, two local private companies have interested in one 12 Megawatt Coal fired power plant in Southern Shan State and one 24 Megawatt Hydropower plant in Kachin State.

Hydropower, main power source for electricity, Myanmar has an available total capacity of 39,720 MW. At present 391 MW – only 1 % of total identified resources is exploited . Myanmar has a very ambitious programme of implementing 2000 MW of electricity, mostly hydropower within the next five years time.

The Union of Myanmar is endowed with abundant and varied energy resources of which some are still unexplored and some are known but untapped. The Energy Conservation is emphasized in order to save energy through effective management practices.

Chart- I

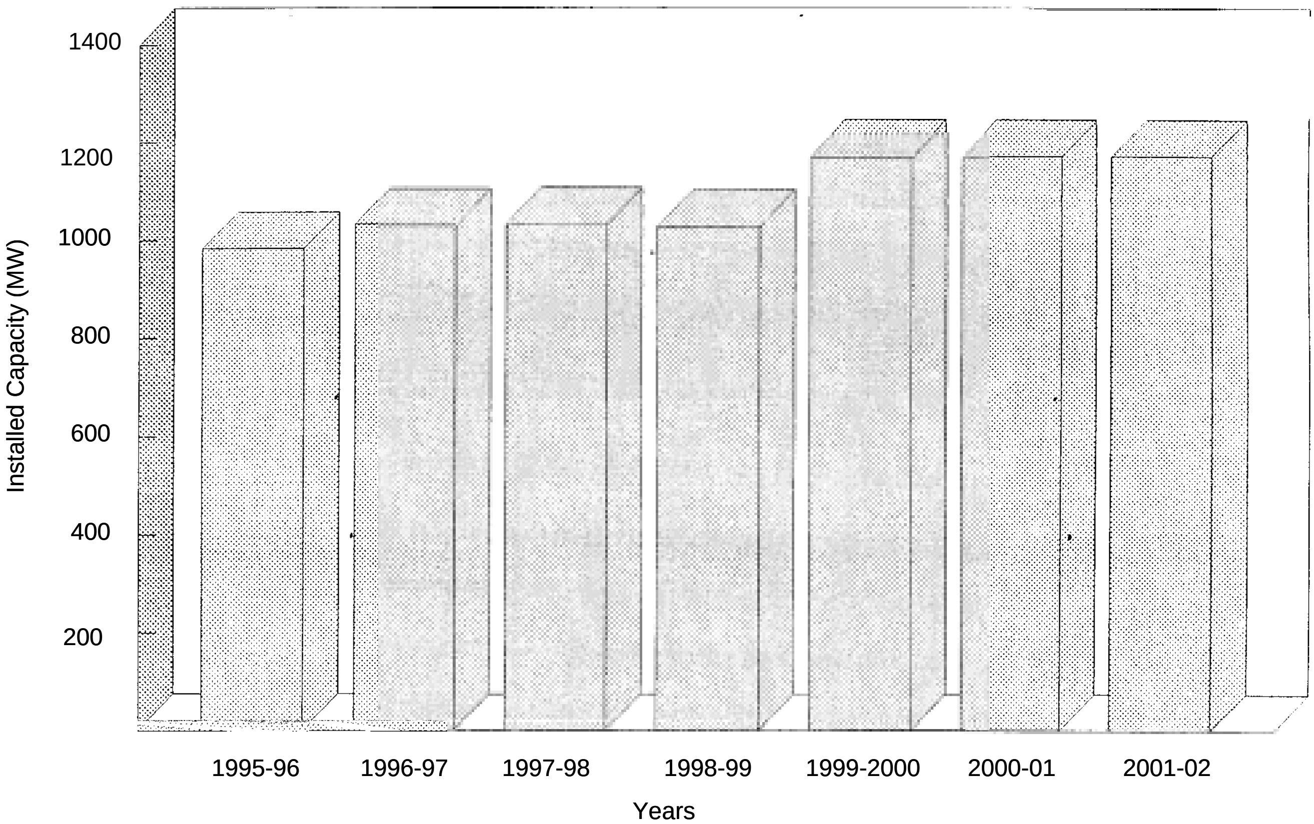
ELECTRIC POWER GENERATED AND SOLD BY
THE MYANMA ELECTRIC POWER ENTERPRISE

FY	Installed Capacity (Megawatts)	Units Generated (Million kwh)	Units Sold (Million kwh)					Values Of Sales (Kyat (Kyat Million)
			General	Indus-trial	Bulk	Others	Total	
1995-1996	982	3762.33	972.3	875.7	340.2	74.2	2262.4	2827.3
1996-1997	1033	4130.31	1089.2	875.7	392.5	76.4	2433.8	3086.3
1997-1998	1036	4550.46	1206.5	914.0	472.9	82.7	2676.1	3530.0
1998-1999	1031	4139.44	1132.3	956.1	537.3	90.7	2716.4	4084.8
1999-2000	1172	4788.31	1327.1	1342.6	591.0	105.8	3366.5	19743.4
2000-2001	1172	5020.43	1464.5	1482.7	652.0	115.9	3715.1	21976.2
2001-2002 (April - December),	1172	3572.50	824.5	1078.3	273.1	58.8	2235.3	1071.7

Source: Selected Monthly Economic Indicators (January-February 2002) from Central Statistical Organization

Chart- II

INSTALLED ELECTRIC POWER GENERATION



Attached here is the article in ' Myanmar Times- Vol:8, No. 150- about Japan-Myanmar Cooperation.

" Japan has had friendly relations with Myanmar for a long time and Japanese Government has cooperate Myanmar in its endeavour to bring about social development and to estiblish a modern state by annually inviting some 300 state scholars and trainees and giving them training in human resources development. Moreover, Japan is also carrying out development projects with priority being given to basic education and health- such as Myanmar-Japan human resources development centre, donations of medical equipment to Yangon General Hospital; projects for eradicating epidemics such as HIV/AIDS and leprosy. Japan is also assisting Myanmar's fight against narcotic drugs by providing technical in growing substitute crops. All together 93 grassroots projects were implemented in the fiscal year 2001: 11 in the health scetor, 16 for ensuring sufficient water supply, 14 projects for constructing school buildings for disable children & orphans and one project for relief and resettlement for victims of natural disasters also The Belu Chaung hydropower plant reparation is well advanced and Japan is also carrying out the Debt Relief Grant Programmes. As the year 2003 is proclaim as the year for ASEAN- Japan Exchange year and each ASEAN country has been designated a key coordinator for a month in 2003, Myanmar is responsible for March. "

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