2008 Achievement Report

International Project for Increasing the Efficient Use of Energy International Project for Improving Infrastructure for the Efficient Use of Energy (Programs for Promotion of Energy Conservation in Major Industries in ASEAN Countries)

Activity Report 2008-2009

March, 2009

The Energy Conservation Center, Japan

Preface

In recent years, prevention of global warming has become a common issue for mankind on one hand, while sustainable economic development is actively demanded on the other. Thus, we are trapped in a situation in which we must overcome two challenges that completely contradict each other. Necessary for overcoming this situation are technical innovations, such as development of technologies for the efficient use of energy, technologies for utilizing energy with minimum burden on the environment, and energies having little impact on the environment.

To contribute to the balanced development of economy and the environment in developing countries, we need to provide an assistance that is acceptable and appropriate to each country, by assessing the reality of energy usage and environmental conservation measures, and thoroughly examining the state of infrastructure development, life styles, and other national conditions in respective countries.

Under this situation, we entered a new phase of activities in 2004, with an aim to implementing energy audits and improvement measures, and strengthening the mechanism for greater dissemination, based on the results of energy audits and related technology transfers implemented between 2000 and 2003, which targeted one industry each in ten ASEAN countries.

This year, we have continued to implement and disseminate achievements obtained in the past 8 years. Specifically, we focused our attention on the food industry in Thailand, the ceramics industry in Indonesia, and the textile industries in Myanmar.

In addition, we held a seminar-workshop in each country with the participation not only of people from the host country, but also of governmental authorities and factory personnel of different industries in other countries as well. They were invited to present successful cases of energy conservation measures, to enhance information sharing in the ASEAN region and create a foundation for dissemination activities. The seminar-workshops also provided a forum for discussing the concept and formulation policies regarding the technical directory and in-house database, and some specific examples were presented.

Meanwhile, in the effort to strengthen the mechanism for implementing and disseminating our activities, we have conducted follow-up surveys in factories that were audited in the past, to assess the implementation status of recommended improvement measures, as well conducted walk-through energy audits in other factories to ensure the transfer of energy audit technologies.

Moreover, as an effective means of achieving our objectives, we have continued on-going effort to develop a technical directory and in-house database system for each industry.

On concluding this year, we made an evaluation of the PROMEEC project in the steering committee, and confirmed a foundation steadily established for energy conservation promotion in the ASEAN countries. From now on, self-help efforts are required in order to utilize the transferred technologies and to disseminate all over the country and region.

We hope this project will contribute to energy and environmental conservation in industrial sectors in the ASEAN countries, and thereby allow each country to achieve environmentally friendly and sustainable economic growth. We also hope this project will serve as a bridge of technical exchange and friendship between Japan and the ASEAN countries.

March 2009

The Energy Conservation Center, Japan

Contents

Abbreviations

ASEAN	Association of Southeast Asian Nations
APAEC	ASEAN Plan of Action for Energy Cooperation
PROMEEC	Promotion on Energy Efficiency and Conservation
ISO	International Organization for Standardization
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis and Critical Control Point
EE&C	Energy Efficiency and Conservation
TD	Technical Directory
DB/BM	Database / Benchmark
IHDB	In-House Database
OJT	On the job training
EMS	Energy Management System
SEC	Specific Energy Consumption
CSR	Corporate Social Responsibility
SCADA	Supervisory Control and Data Acquisition
COP	Coefficient of Performance
VSD	Variable Speed
SH	Sensible heat
DHCR	Direct Hot Charge Rolling
EM H/B	Energy Management Handbook
TPM	Total Production Management
ESCO	Energy Service Company
ACE	ASEAN Center for Energy
METI	Ministry of Economy, Trade and Industry
ECCJ	The Energy Conservation Center, Japan
SOME-METI	ASEAN Senior Officials Meeting on Energy - METI
EAS-ECTF	East Asia Summit - Energy Cooperation Task Force
ADB	Asia Development Bank
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
GDP	Gross Domestic Product
FP	Focal Point

Vietnam

DOE	Department of Energy
ECC-HCMC	Energy Conservation Center in Ho Chi Minh City

MOIT	Ministry of Industry and Technology
EECO	Energy Efficiency and Conservation Office
HUT	Hanoi University of Technology

Philippines

DOE	Department of Energy
PNOC	Philippines National Oil Corporation
PCIERO	Philippines Council for. Industry & Energy and Development
MERALCO	Manila Electric Railroad and Light Co.

Indonesia

BPPT	Energy Technology Center, MOST
EMI	former KONEBA
DGEEU	Directorate General for Electricity and Energy Utilization

Malaysia

PTM	Pusat Tenaga Malaysia

Thailand

DOE	Department of Energy
DEDE	Department of Alternative Energy Development and Efficiency
BSI	Bangkok Steel Industry Public Co., Ltd.
FTI/IIE	Federation of Thai Industries/Institute of Industrial Energy
ENCON	Energy Conservation
MOE	Ministry of Energy
MOF	Ministry of Finance

Myanmar

MTI	Myanmar Textile Industries

Overview

The member countries of ASEAN continue to post rapid economic growth and are expected to report dramatic increases in the volume of energy consumption in the coming years. It will likely become necessary to focus on using energy more efficiently and on preventing global warming. As this project enters its ninth year, the activities of project counterparts, ACE and ASEAN countries, become even more developed, and changes in their attitude with respect to reducing energy consumption have become widespread against the backdrop of rising energy costs in line with recent price hike of crude oil and of the ratification of the Kyoto Protocol on February 16, 2005.

As the last year of Phase 2, this year has been positioned as the year in which we will sum up the results of activities undertaken in Phase 2 over the last four years and verify the implementation and dissemination of results achieved to date through continuing self-help efforts. That is to say, it has been determined that we will aspire to establish a foundation for implementing and disseminating the results of energy audits conducted at industry factories in all ten ASEAN member countries over the last eight years, inclusive of Phase 1. Specifically, the following activities were conducted in each of three countries: Thailand (food industry), Indonesia (ceramic industry), and Myanmar (textile industry).

- ♦ Follow-up surveys and energy audits
  At factories an energy audit has been conducted in the past, a follow-up survey shall be undertaken. At factories no energy audits have been made before, an energy audit shall be undertaken.
- ♦ Holding seminars/workshops
  Factory officials, including those from other industry sub-sectors, and concerned persons from other ASEAN countries will participate and present successful cases in order to disseminate achievements in this project to ASEAN member countries, including successful cases and know-how.
- ♦ Development of technical directories (TDs)
  Technologies and successful cases will be registered and disseminated through TDs, expecting to be effective in the iron&steel industry and ceramic industries of ASEAN.
- ♦ Development of in-house databases (IHDBs)
  As conducted last year, a promotion and dissemination of IHDBs for cement, textile and food industries will be continued. In addition, development of IHDBs for iron&steel and ceramic industries shall be started for aiming at evaluating the effectiveness thereof through a trial use at the actual factories.

Through follow-up surveys conducted in each country, considering how effectively knowledge and skills concerning energy audit technologies are transferred to ASEAN engineers, firsthand guidance was provided to local concerned persons, and activities to further accelerate technology transfer were carried out. At factories where the implementation of recommended measures was slowly progressing, an examination was conducted to identify the problems against implementation of measures as well as the solutions thereof.
Seminars/workshops held in each country have attracted numerous factory and governmental participants. These seminars/workshops have fulfilled their significant role in terms of sharing and dissemination of information.

Local activities for this year were commenced through an inception workshop held in July 2008 in Port Dickson (Malaysia), which was attended by representatives (i.e., focal points) from ASEAN countries. At the workshop, implementation plans for this year, countries in which local activities were to be implemented, and preparations required for local activities were confirmed. Local activities, which included workshops in the three countries, were thereafter steadily carried out until December 2008.

As the final activity of this year, a summary/post workshop was held in Manila (Philippines) in February 2009. Focal points from ASEAN countries attended this workshop. Reports were presented to share the results of activities in the three countries among ASEAN countries and deliberations pertaining to the development of TDs and IHDBs were conducted. This workshop was concluded with a discussion of the policy governing future project initiatives, including with respect to efforts to be undertaken next year.

The main activities for this year corresponding to major industry sub-project are as follows:

I. Local activities in Thailand:
September 28 to October 4, 2008

1. An energy audit was conducted at a food factory in the province of Samutprakarn. The local audit team consisted of engineers from the Ministry of Energy, energy consultants, and engineers of the food factory. A focal point served as leader and audits were carried out on an OJT basis.
2. A seminar/workshop was attended by approximately fifty persons and a proactive exchange of information was undertaken through the following presentations and discussions:

(1) Thai and Japanese presentations pertaining to energy conservation policy and measures;
(2) Presentations of successful cases concerning energy conservation by officials from Thailand and other ASEAN countries;
(3) Presentation of energy audit results by the local audit team;
(4) Presentations by ACE and ECCJ pertaining to development of TDs and IHDBs.

II. Local activities in Indonesia:
November 17 to November 25, 2008

1. In Indonesia, an energy audit was made at a ceramic factory on the outskirts of Jakarta. Engineers from the Ministry of Energy and Mineral Resources, the Ministry of Science and Technology, a state-owned company dealing with energy conservation services, and the ceramic factory participated as members of the local audit team; unfortunately no representatives of the ceramic industry did not take part in the audit. A technological conference was held with a participation of engineers from textile factories in East Java, where audits had been conducted in the past. After briefing on the situation of implementation of proposed measures as well as the following discussion, practical advice and guidance were given by ECCJ engineers
2. Approximately 50 persons participated in a seminar/workshop. In addition to participants from industrial circles, including the ceramic industry, representatives of energy service companies were also in attendance and lively discussions were facilitated. Presentations on best practice were made by officials from ASEAN countries and a report on the results of the audit conducted at the ceramic factory were delivered, such that we believe that this seminar/workshop was meaningful for attendees.

III. Local activities in Myanmar:
November 27 to December 2, 2008

1. An energy audit was implemented at a textile factory in Yangon city. The local audit team consisted of engineers belonging to the Ministry of Industry (1), the Ministry of Industry (2), the Ministry of Energy, and the textile factory to be audited. The audit was conducted on a simplified OJT basis over 1.5 days and basic audit technologies were transferred to Myanmar engineers.
An advisory visit was paid to a pharmaceutical factory producing herbal medicines in the same city for half a day. After interviewing about the actual state of energy conservation activities, factory walk-through was followed by guidance and advice.

2. A seminar/workshop was attended by approximately 40 persons, consisting primarily of engineers belonging to state-run enterprises, and was concluded on a successful note. Presentations concerning best practices from ASEAN countries were informative for participants from the state-run enterprises of Myanmar.

IV. Summary/post workshop

February 26 to 27, 2009:

A summary/post workshop was held in Manila, Philippines, and was attended by a total of twenty-two participants: ten participants from ten ASEAN countries, five participants from ACE, three participants from ECCJ, and the remainder from host country, Philippines. As this year constitutes the last year of Phase 2, an evaluation of Phase 2 was first conducted to identify and account for the specific activities that were attained and not attained. Based on this evaluation, we verified and agreed on basic policies toward Phase 3, including project policies for the coming year.

Finally, in implementing this project, we were able to obtain the full cooperation of persons in charge at ACE and at relevant organizations and companies from each country. We hereby take this opportunity to express our sincere appreciation for their efforts.

Activity Report 2008-2009

Programs for Promotion of Energy Conservation in Major Industries in ASEAN Countries

I. Purpose and background of project

In order to promote the dissemination of energy saving technologies in major industries of ASEAN countries, this project contributes to the promotion of energy conservation and the protection of environment by supporting the activities implemented in each country

This project was commenced in 2000 with the aim of reducing energy consumption in ever-growing industrial sectors in the ASEAN region. ASEAN refers to this project as PROMEEC (Major Industries). PROMEEC project was certified at a meeting of ministers in charge of an energy portfolio in ten member countries of ASEAN. The project has been carried out in collaboration with the Ministry of Economy, Trade and Industry of Japan.

* PROMEEC stands for Promotion of Energy Efficiency and Conservation

The objectives of this project are as follows:

1. To establish close collaborative links between ASEAN countries and Japan in the energy sector;
2. To promote energy efficiency and conservation in major industries based in ASEAN countries;
3. To transfer the Japanese technologies and disseminate excellent energy conservation measures in these fields into ASEAN countries;
4. To build a capacity of engineers of ASEAN countries through energy audit and its related OJT;
5. To develop technical directories (TDs) and in-house databases (IHDBs) and formulate benchmarks (BMs) for utilizing on energy audit in ASEAN countries.

Based on the recognition that this cooperative project is to be continued to Phase 3, this year is positioned as the fourth year of Phase 2 according to consultations held to date with ACE and ASEAN countries. Based on the achievements attained in ASEAN countries in Phase 1 & 2, a foundation for deploying energy conservation activities was established within all ASEAN countries on an equal footing with one another.

Phase 1: Technologies and experiences were transferred from Japan to ASEAN countries (completed in 2003).

Phase 2: Japan and ASEAN countries implemented improvement measures jointly and disseminated the said measures within each country as well as within other countries (completed in 2008).

Phase 3: Energy conservation is promoted through the self-help efforts of ASEAN countries (started in 2009)

With Phase 2 initiated in 2004, activities for establishing a foundation to implementation and dissemination was started. A follow-up survey has started in order to monitor the implementation of EE&C measures proposed in previously-audited factories. Midst the Phase 2, activities for development of energy management tools has started, for example, technical directories (TDs), in-house database (IHDBs) for each industry by each country. This year, development and dissemination of the IHDBs were implemented for the food industry in Thailand, the ceramic and textile industries in Indonesia, and the textile industry in Myanmar. Needless to say, activities concerning energy audits and seminars/workshops have been conducted since a start of Phase 1 .

II. Thailand (food industry)

1. Overview of local activities

ECCJ experts visited Thailand on official business between September 28 and October 4, and conducted an energy audit at a food factory and held a seminar/workshop with the aim of exchanging information with ASEAN countries. The energy audit was conducted with the participation of twenty-two engineers from the Ministry of Energy, an audit services company, the food factory to be audited, ECCJ, and ACE. At the factory, guidance on OJT audit was provided with respect to technologies for auditing high energy-consumption equipment consisting of refrigeration systems, cookers and fryers, rotary machineries, and systems for recovering waste heat from discharged water. A seminar/workshop was successfully held and attended by approximately 50 participants. Presentations of successful cases concerning energy conservation were given at the seminar by representatives of Malaysia, Philippines, Vietnam, and Thailand. The caliber of presentations of audit results by energy audit team was high. Based on reasonable inferences, these local activities are believed to have contributed significantly to the promotion and dissemination of energy conservation in the Thai industry

Dispatched officials: Hiroshi Kuroda, Kokichi Takeda, and Taichiro Kawase of the ECCJ International Engineering Department

Schedule of activities:

Sept. 29 – Oct. 2: OJT energy audit (May Ao Foods)
Oct. 3: Seminar/workshop

2. OJT energy audit (May Ao Foods)

(1) Participants

DEDE: 5 participants (Mr. Sarat and 4 engineers)
Arun Chaiseri Consulting Engineers Co.: 4 participants (Vice-President Mr. Panja and 3 engineers)
May Ao Foods: 8 participants (Vice-President Mr. Prasit and 7 engineers)
ACE: 2 participants (Mr. Zamora and Mr. Ninh Hai)
ECCJ: 3 participants (Mr. Kuroda, Mr. Takeda, and Mr. Kawase)

Total: 22 participants

(2) Overview of the factory

Operations started in August 1996

Situated in the Bangpoo Industrial Estate near the seacoast along the Gulf of Thailand 30 kilometers southeast of Bangkok

Product: seafood (frozen shrimp)

Production output: 4,299 tons per year (2007)

Production equipment: thawing, washing/cleaning, boiling, quick freezing, frying, packing, refrigerated storage, shipping

Energy consumption: fuel 444 kL/yr., electricity 8.71 million kWh/yr. (2006)

Employees: 850 workers, 2 shifts

Website: www.mayaogroup.com

(3) Overview of energy audit

1) Local audit team

The audit team consisted of fourteen engineers belonging to the Ministry of Energy (DEDE), the audit services company (Arun), ACE, and ECCJ and was led by focal point Mr. Sarat. Mr. Sarat and Mr. Panja (Arun) acted effectively as interpreters between Thai and English. Arun provided the measuring instruments as requested, and conducted measurement work. May Ao Foods proactively disclosed utility equipment as well as production equipment.

2) Interview

Before commencing an inspection of equipment, an oral interview was conducted with respect to the production process, recent production output and energy consumption figures, responses to a preliminary questionnaire, and problems concerning energy conservation as perceived by the factory. With the company having been granted ISO, GMP, HACCP, and various types of certification, the interview proceeded efficiently.

3) Expectations of the factory toward the audit

The factory indicated that energy conservation in its refrigeration system and water conservation were the most important issues. Reduction of refrigeration energy and water conservation are common issues in all seafood factories and not unique to this factory.

4) Equipment inspection

The audit team spent a whole day inspecting equipment. The main issues revealed through this inspection were as follows. Various types of measurement were conducted in order to further analyze these issues in detail.

- Reduced efficiency of refrigeration equipment
- Unnecessary refrigeration load
- Dissipation of heat from hot surfaces in the processing room
- Excessive lighting energy in the processing room
- Unnecessary heat sources within refrigerated stores
- Improper placement of items within refrigerated stores
- Low boiler efficiency
- Cold heat recovery from low-temperature wastewater
- Energy conservation with respect to pumps and fans

(4) Audit results

On the final day of the on-site audit, an overview of audit results was presented to the factory executives and engineers as a preliminary report. The collected data were analyzed in detail upon return to Japan of ECCJ experts, and the following conclusions were obtained. Refer to Attach II-1 (Analysis of Energy Audit Data for Heat Energy) and Attach II-2 (Analysis of Energy Audit Data for Electric Energy) for investigation details, including technical calculations.

1) State of energy management

Establishment of an energy conservation promotion committee, appointment of persons in charge of energy management, implementation of employee education programs, and other activities were indicated as being completed on the responses to questionnaire. With respect to production equipment, it was found that knowledge acquired through the process of obtaining various types of certification was taken advantage of for carrying out the methodical operations, including in terms of maintaining proper logs. With respect to utility equipment, however, it was felt that, while some measures had been undertaken, there was still room for further improvements. For example, while specific energy consumption (SEC) was monitored and managed with the prescribed targets for the factory as a whole, management by equipment had not been carried out for utility equipment, in particular for the refrigeration system. As it is believed that monitoring through use of in-house databases (IHDBs) is effective for management by equipment, IHDB input forms were provided (Attach II-3 (In-House Database for Food Industry)).

2) Identified problems in equipment inspection

a) Reduced efficiency of refrigeration equipment

Having been installed over ten years ago, the refrigeration system of the factory showed signs of aging. Specifically, it was suspected that the condensers had suffered a drop in efficiency. Various measurements were then made for evaluating the efficiency of condensers on ice-making machines (M2 factory) and the efficiency of cooling towers. These measurements verified a decline in the efficiency of condensers. Fouling of condenser tubes (water side) and air-intrusion into ammonia refrigerants were thought to account for this decline. These issues should be immediately addressed, such that full rehabilitation can be expected to reduce power consumption for refrigeration equipment by between five and ten percent. The operation of cooling tower unit was properly managed, and performance was demonstrated according to design. While other refrigeration equipment could not be audited owing to time restrictions, condenser performance is expected to have declined, which means that performance measurements should be promptly undertaken.

b) Unnecessary refrigeration loads

Several unnecessary refrigeration loads were detected where refrigeration is used. If appropriate measures were taken to address, for example, heat dissipation from hot surfaces in the processing room, excessive lighting energy in the processing room, and heat sources within refrigerated sections, these issues could be removed from the refrigeration loads. Each of these issues is described in detail below.

c) Dissipation of heat from hot surfaces in the processing room

The surfaces of cookers and fryers have not been treated for thermal insulation. As these units have been installed in the air-conditioned processing room, heat dissipation from the surfaces of equipment contributes not only to an increase in the refrigeration load but also to an increase in the air-conditioning load. In order to quantitatively evaluate the said dissipation, surface temperature measurements and other assessments were undertaken at non-thermally insulated points. As a general rule, high-temperature equipment should be kept separate from air-conditioned spaces. Partitioning by way of the use of simple plastic curtains or other such measures would be desired.

d) Excessive lighting energy in the processing room

A high ceiling in the processing room and numerous fluorescent lighting fixtures installed contribute to an increase in the air-conditioning load. In order to reduce the number of fluorescent lighting tubes, a shift from general lighting to task-ambient lighting is expected to be effective. To ascertain current energy use for lighting, the intensity of illumination in the processing room was measured. While detailed calculations have not yet been completed, the number of fluorescent lighting tubes can likely be reduced by half.

e) Unnecessary heat sources within refrigeration stores

Within refrigerated stores, there are several heat sources, for example, fan coil motors, interior lighting, heat penetration through walls, forklift power motors, outdoor air penetration through door openings, and heat release due to worker's metabolism. In order to examine these sources, the state of fan coil operations, state of interior lighting, temperature of outside walls, and the air-tightness of doors were investigated.

Where the interior temperature of refrigerated stores has been sufficiently low, fan coil motors should be either shut off or switched to low-speed mode. While it could not be confirmed whether the fans were of a type that allows for switching between low-speed and high-speed modes, these fans should be replaced by two-speed-type fans if no such option is available on existing fans. Where work is not being undertaken, lighting within refrigerated stores should in principle be turned off. For this purpose, existing lighting should be replaced with lighting linked to motion sensors. The temperature of the outside walls of refrigerated stores was measured. With the temperature of the outside walls being one to two degrees Celsius lower than the ambient air temperature, the heat insulation performance of the outside walls was determined to be normal. As for the air-tightness of the doors, no particular issue of note was observed.

f) Improper placement of items within refrigerated stores

It is important that the flow of cold air inside refrigerated stores come into contact evenly with all items. Items placed in dead zones not exposed to a flow of cold air will take time to cool down, which in turn extends the duration of operations of refrigeration equipment. Accordingly, items should be spaced apart. In addition, it is important that a passageway of air be secured in front of fan coil air outlets. While the factory has a warehouse for finished products and a warehouse for intermediate products, items were found to be piled up excessively in front of fan coil air outlets in the finished products warehouse.

g) Low boiler efficiency

Two natural gas-fired boilers are operated in the factories. The outside service company is entrusted to conducting measurement work of boiler gas emissions six times a year. This data was obtained and analyzed by the audit team. The concentration of oxygen found in gas emissions was between two and eight percent. Typically, oxygen concentration should be maintained at between 2 and 3.5 percent. There was some data exceeding this standard. it is likely that measurement work was done either at the time of low boiler load operations or immediately after combustion chamber purging operations The concentration of oxygen rises during low-load operations, which suggests that the volume of combustion air is not being adjusted. When low-load operations are ongoing, the volume of combustion air needs to be adjusted. On the other hand, the temperature of gas emissions was found to be between 150 and 200 degree Celsius. At these temperatures, it seems difficult to realize an economic payout with measures to recover heat from gas emissions, such as by way of the installation of economizers.

h) Cold heat recovery from low-temperature wastewater

In the frozen fish processing room, low-temperature wastewater with approximately 18 degree Celsius is generated from the thawing and cold-water cleaning/washing processes. At the same time, a water chiller has been installed in order to produce cold water for cleaning/washing purposes. If cold heat from low-temperature wastewater were used to pre-cool raw soft water chilling energy in the water chiller could be reduced. In this connection, estimation of the volume of low-temperature wastewater was made, and the temperature of low-temperature wastewater was measured. While the results thereof are based on many assumptions, it is expected to recover at least 30,000 kWh per year in case of the M1 plant.

i) Energy conservation with respect to pumps and fans

The factory has numerous pumps and fans operated with significant load fluctuations. As countermeasures have not been adopted to mitigate load fluctuation since the commencement of operations, the potential for energy saving through mitigation of load fluctuation was examined. To illustrate, daily fluctuation of motor power consumption of some pumps and other variables was measured. As a result, it is expected that power consumption can be cut at least by fifty percent. Supposed that other pumps and fans are similarly positioned, huge saving potential can be expected in the factory as a whole. It is recommended that measures should be taken immediately to pumps audited in this audit in collaboration with audit services company (Arun), and likewise, investigations into applicability to other pumps and fans should be undertaken.

(5) Comments

1) In contrast to OJT audits conducted until last year, this year very few participants just observed the progress in audit activities, which was carried out mainly by Japanese experts; instead most of participants behaved positively and took charge of some function or duty in the audit, for example, measurement work. The audit team constituted a well-rounded lineup, consisting of fourteen engineers from the Ministry of Energy (DEDE), the audit services company (Arun), ACE, and ECCJ. The organization of the audit team could be a model case on which to base PROMEEC activities in the future. In the OJT audit, ECCJ experts understood the excellent capacity of engineers in the energy service company (Arun) of Thailand as well as a high level of technical knowledge and skills.

2) While the responses to preliminary questionnaire were received upon arrival of the auditing team on the audit site, required questions were properly answered, and the responses were of considerable assistance in carrying out the audit activities. Measuring instruments were prepared as requested, which helped to generate quantitative results.

3) It is admirable that focal point Mr. Sarat contributed to a success of OJT audit for making thorough preparations, including organization of the audit team, provision of responses to the preliminary questionnaire, and arrangement of measuring instruments.

4) The factory also arranged requested matters perfectly for the audit. In addition, production equipment was also satisfactorily disclosed for the audit team Thanks to these efforts, various energy saving measures were proposed, taking into account actual operations of the factory as a whole. We both perceive a strong desire of top management of the factory toward energy saving measures and would like to express our appreciation for the cooperation that was extended for the audit team.

3. Overview of seminar/workshop

(1) Time and place

October 3, 2008 (08:30 to 16:40)

Ramada D'ma Bangkok Hotel

(2) Participants: approx. 50 persons

Thai government officials: 7 persons

Mr. Danai Egkamol (Director, Bereau of Energy Regulation and Conservation, DEDE)

Mrs. Amaraporn Achavangkool (DEDE)

Dr. Prasert (DEDE)

Mr. Sarat Prakobchart (Senior Engineer, DEDE)

Mr. Napha Wongpardit (Senior Engineer, DEDE)

Mr. Pinyo Tanthumart (Senior Engineer, DEDE)

Mr. Pittaya Kruakuanpet (Senior Engineer, DEDE)

Thai private-sector participants: approx. 35 persons

Audit services company:

Mr. Panja Thanghirun (Arun Chaiseri Consulting Engineers Co.)

Mr. Chartdanai (Able Consultant Co.)

Food industry:

Mr. Serresak Kodchompoo (May Ao Foods)

Mr. Thongchai Meechaiyo (May Ao Foods)

ASEAN: 3 persons

Philippines: Mr. Maximino Marquez (DOE)

Malaysia: Mr. Phubalan (PTM, Malaysia)

Vietnam: Mr. Phan Nguyen Vinh (ECC-HCMC)

Others: 5 persons

ACE	Mr. Christopher Zamora, Mr. Nguyen Ninh Hai
ECCJ	Mr. Kuroda, Mr. Takeda, Mr. Kawase

(3) Presentation overview

With Dr. Prasert presiding, presentations were given in accordance with the program outlined in Attach II-4 (Agenda of Intensive Seminar – PROMEEC Major Industry Thailand Oct. 3, 2008).

Session 1

Policy and Initiatives on EE&C in Industry Sector

1) Update of EE&C Activities in ASEAN

Mr. Christopher Zamora presented an overview of the activities of ACE according to the following breakdown of headings:

- 2004-2009 APAEC Program
- ASEAN-Japan cooperation (SOME-METI, PROMEEC, and multilateral training)
- ASEAN Best Practice Competition (Energy Conservation Division)
- ASEAN + 3 Energy Conservation and Renewable Energy Forum
- Other programs implemented in collaboration with EAS-ECTF, UNEP, the ASEAN Foundation, ADB, and CDC.

A detailed explanation was provided in regards to the 2004-2009 APAEC Program. This program consists of six program areas. Energy conservation is addressed in the fourth program area. As a key element of the fourth program area, the process and results with respect to PROMEEC activities through Phase 1 and Phase 2 were reported. An outline of how these activities unfold in Phase 3 was also presented.

(Note: These six program areas consist of the following: information sharing and networking, ASEAN energy standards and labeling, private-sector participation, capacity building, cultivation of ESCO enterprises, and transportation sector.)

2) Update of EE&C Activities in Thailand (Attach II-5)

Mrs. Amaraporn Achavangkool of DEDE presented an overview of the latest energy conservation measures in Thailand according to the following breakdown of three headings:

- Current state of energy use in Thailand
- Revisions to the Energy Conservation Promotion Act
- DEDE's energy conservation promotion measures

The growth rate in the consumption of energy in Thailand in 2007 was 3.8% on a year-on-year basis (2006). The transportation sector was the largest consumer of energy in the country. Imported energy accounted for 63% of all energy consumed and 10% of GDP. 88% of imported energy consisted of petroleum. Energy consumption per unit of GDP amounted to 15.2 kgoe/1,000 baht.

Thailand's Energy Conservation Promotion Act was revised last year, such that the prior emphasis on technological measures was shifted to an emphasis on energy management. It was also explained that there had been a paradigm shift from controls to support. The key revisions affecting industry were as follows:

- Authority with regards to energy matters was transferred to the Energy Minister.
- Measures for energy management was reinforced.
- Jurisdiction over the ENCON fund was transferred from the MOF (Ministry of Finance) to the MOE (Ministry of Energy).
- Authority of energy management auditors and auditing institutions was reinforced.

Detailed explanations were provided of energy conservation promotion measures instituted by DEDE, the competent agency in charge of promoting energy conservation. These measures consist of the following: 1) standards and regulations, 2) technical support, 3) financial support measures, 4) network cooperation among groups and organizations, and 5) raising awareness of energy conservation.

3) Japan's Energy Conservation Policy and Measures for Industrial Sector

ECCJ's Mr. Taichiro Kawase presented an overview of energy conservation policies in Japan and measures applicable to industrial sectors according to the following breakdown of five headings:

- Changes in energy consumption by industrial sector in Japan
- Legal measures and energy conservation policies applicable to industrial sectors in Japan
- Voluntary activities on the private-sector companies and organizations in industrial sectors
- Roles and main activities of ECCJ
- Successful cases at food factories as accumulated through collaborative initiatives carried out by ASEAN and ECCJ

Session 2

EE&C Best Practices in Food Industry

4) Successful Cases from Malaysia

Mr. Phubalan of Malaysia Energy Center (PTM) presented two cases of energy conservation in Malaysia (palm oil factory and pouch-packed food factory). In the case concerning a palm oil factory, the following numerous measures were reported: stearic acid tank temperature management, steam leakage management, steam trap management, condensate recovery, recovery of waste heat from deodorized oil as a pre-heat source for oil bleaching, measures to prevent compressed air leaks, thermal insulation applied to high-temperature surfaces of processing equipment, and changing boiler fuel.

In the case concerning a pouch-packed food factory, various measures, including the following, were proposed: improving boiler efficiency, improving the COP of refrigeration equipment, reinforcing the thermal insulation of outside walls of the refrigerated warehouse, applying thermal insulation to the high-temperature surfaces of boilers and sterilizers, and lowering the discharge pressure of air compressors.

5) Successful Cases from the Philippines

Mr. Marlon Domingo of the Philippine's Department of Energy (DOE) reported on energy audit activities being conducted by DOE, and on energy saving measures for food factories implemented in the Philippines utility by utility (lighting, refrigeration equipment, exhaust gas fans, heat recovery, pumps, boilers, and air compressors).

Cases concerning pineapple-processing were also reported, with particular focus placed on technologically advanced energy saving measures relating to refrigeration equipment and steam co-generation. These cases could be highly informative for factories seeking to promote energy conservation as it applies to refrigeration equipment. It seems worthwhile registering in technical directories (TDs), which constitute an ASEAN energy management tools.

6) Successful Cases from Vietnam

Mr. Phan Nguyen Vinh of Energy Conservation Center of Ho Chi Minh City (ECC-HCMC) in Vietnam reported an overview of the activities of ECC-HCMC in addition to an overview of energy saving measures applicable to industrial sectors in Vietnam. According to Mr. Vinh's report, the energy saving potential in food processing factories in Vietnam is estimated to be 20%. In addition, ECC-HCMC has actively engaged in audit activities, having audited 288 factories between 2001 and 2008. This figure includes 34 food processing factories, 22 textile factories, 16 pulp and paper factories, and 8 ceramic factories.

Next, a case concerning energy conservation at a beer factory was reported. The factory is small in that it produces 4,700 kiloliters of beer per year (in 2006). As a result of conducting an energy audit, the following six measures were implemented, production capacity rose by 25%, and consumption of coal and electricity declined by 30% and 43%, respectively:

- Establish an energy management system.
- Replace fluorescent lamps (T10 with T8) and adopt high-efficiency ballasts.
- Cool hot wort with soft water (pre-heated soft water is used as hot water for cleaning/washing and boiler feed water).
- Replace piston-type refrigeration compressors with screw-type refrigeration compressors (improve COP).
- Introduce a water heat-storage system.
- Lower the discharge pressure on air compressors and adopt VSD drives.

7) Successful Cases from Thailand (Attach II-6)

Mr. Panja Thanghirun of Arun Chaiseri Consulting Engineers Co., an energy audit services company, reported on a case concerning an audit conducted at the food factory in Thailand. This case was highly informative and presented technologies that we believe should be disseminated to ASEAN member countries:

- Recover cold heat from low-temperature wastewater.
- Recover waste heat from refrigeration condensers.
- Clean boiler tubes (combustion gas side).
- Heat heavy fuel oil (viscosity control).
- Apply automatic control to sterilization tank.
- Clean refrigeration equipment condenser tubes (coolant water side).
- Treat coolant water with ozone or low-frequency waves.
- Replace cooling tower fans with light weight fans (use FRP blades).
- Enable use of inverters with cooling tower fans and pumps.
- Employ evaporative cooling.
- Dry cans and bottles using an air knife.
- Replace fluorescent lighting (T10 with T8).
- Replace discharge lamps (mercury lamps with metal halide lamps).

8) Tentative Result of Audit of May Ao Foods (Attach II-7)

Mr. Hiroshi Kuroda of ECCJ reported on the following suggestions concerning the results of energy audit conducted at May Ao Foods:

- Insulate the high-temperature surfaces of cookers and surrounding pipes with 50 degree Celsius or higher.
- Utilize cold waste heat from low-temperature wastewater as a pre-cooling heat source.
- Install an inverter-controlled motor in the municipal water pump and eliminate inefficiencies during low-load period.
- Apply load-fluctuation countermeasures to all air-conditioning equipment; specifically, use an inverter-controlled motors with cold water and coolant water pumps and eliminate inefficiencies during low-load period.
- Change the lighting system used in the processing room from general lighting to task-ambient lighting.
- Clean the coolant side of condenser tubes in refrigeration equipment and also purge air contaminated in refrigerant fluid.
- Investigate into replacement of the current shell-and-tube condensers with evaporative condensers.
- Minimize heat sources in cold stores and batch freezer units.
- Convert the fan coil motors used in cold stores and batch freezer units to two-speed-type motors and prevent unnecessary chilling.

9) Successful Cases from Japan

Mr. Kokichi Takeda of the ECCJ presented successful cases (electrical energy conservation) achieved in Japanese food processing factories:

- Case concerning a beer factory (inverters were incorporated into refrigeration equipment pumps)
- Case concerning a starch factory (water hammer prevention, remote on/off operations)
- Case concerning a food oil factory (VSD feature was incorporated into boiler fans, and several dust-collection fans were integrated)
- Case concerning a food oil factory (air compressors were reduced in size)
- Case concerning a tobacco factory (inverters were installed in air-conditioning units

to accommodate low loads during off-season)

• Case concerning a beer factory (high-efficiency refrigeration equipment replaced older equipment and refrigerant superheat settings were relaxed)

Session 3

Energy Management Tools and the Way Forward

10) Updating on Development of Technical Directory & Updating of In-House Data Base, Energy Management System Cyber Search

Mr. Nguyen Ninh Hai of the ASEAN Center for Energy (ACE) gave, with respect to ASEAN energy management tools, a briefing on the purpose of technical directories (TDs), the method of developing TDs, the input format applicable to TDs, and other relevant topics, as well as presented the example of actual TD sheet. Furthermore, he explained the purpose and content of in-house databases (IHDBs) using the input format for textile industry as an illustrative example.

11) Introduction to Trial Use of In-house Database in Food Industry

Mr. Taichiro Kawase of ECCJ gave a briefing on in-house databases (IHDBs) designed specifically for food industry. IHDBs are notable for monitoring important operating parameters and energy efficiency benchmarks, as well as production data, energy consumption data, and equipment data. The databases provide reference information for engaging in energy efficient operations at every level within a factory. In order to disseminate the databases to all ASEAN countries, their proactive adoption was urged for food processing factories in Thailand.

(4) Remarks

1) It was beneficial to have an active communication with all the audit participants and exchange various information and skills throughout the seminar. The technical expertise presented by one engineer from Thai energy service company was marvelous at a significantly advanced level. Japanese experts including ECCJ experts must continue to polish their expertise in order to satisfy developed ASEAN engineers.

2) The latest energy conservation measures adopted in Thailand was highly instructive as briefed by Mrs. Amaraporn Achavangkool of DEDE. Last year's amendment of the Energy Conservation Promotion Act indicates that Thailand shifted a gravity of EE&C policy & measures from technology to energy management. Also it shows a steady growth and development of Thai industry since an enforcement of the first generation of ENCON promotion Act in 1992.

3) It is unfortunate that number of participants was less than expected, and Q&A session was very calm.

Seminar/workshop

Mr. Danai (DEDE), fifth from the right

Mrs. Amaraporn (DEDE), third from the right

May Ao Foods

Mr. Prasit (Vice-President), sixth from the right
Mr. Sarat (DEDE), eighth from the right

4. Attached documents

II-１. Analysis of Energy Audit Data for Heat Energy
II-２. Analysis of Energy Audit Data for Electric Energy
II-３. In-House Data Base for Food Industry
II-４. Agenda of Intensive Seminar – PROMEEC Major Industry Thailand Oct. 3, 2008
II-５. Update of EE&C Activities in Thailand
II-６. Successful Cases from Thailand
II-７. Tentative result on Audit of May Ao Feeds

III. Indonesia (ceramic industry)

1. Overview of local activities

ECCJ experts visited Indonesia on official business between November 17 and 25, 2008 and conducted an energy audit at a ceramic factory, carried out a follow-up survey at a textile factory, and held a seminar/workshop with the aim of exchanging information with ASEAN countries.

The energy audit was conducted with the participation of twenty-six engineers from the Ministry of Energy and Mineral Resources, the Ministry of Science and Technology, a state-owned company dealing with energy conservation services, the ceramic factory to be audited, ECCJ, and ACE. As a result of energy audit, it was found that as much as 20 to 30% of energy saving is expected by taking several measures such as improvement of thermal efficiency of ceramic kilns. Approximately fifty persons took part in the seminar/workshop, where several best practices concerning energy conservation were reported by representatives of ASEAN countries and results of OJT audit was reported. .

Dispatched officials: Kenjiro Hata, Kokichi Takeda, and Taichiro Kawase of ECCJ International Engineering Department

Schedule of activities:
Nov. 17 – 21: OJT energy audit (LIK)
Nov. 24: Follow-up survey ISN:(Industri Sandang Nusantara)
Nov. 25: Seminar/workshop

2. OJT energy audit (LIK)

(1) Participants
DGEEU: 4 participants (Ms. Feby, Ms. Devi, and 2 engineers)
BPPT: 5 participants (Mr. Kito, Mr. Diding, Mr. Fahruddin, and 2 engineers)
EMI (formerly KONEBA): 1 participant (Mr. Kelik)
LIK: 10 participants (factory manager, principal contact, and 8 engineers)
ACE: 3 participants (Mr. Ivan, Mr. Junianto, and Mr. Bernard)
ECCJ: 3 participants (Mr. Hata, Mr. Takeda, and Mr. Kawase)
Total: 26 participants

Notes: BPPT: Energy Technology Center, MOST
EMI: former KONEBA

(2) Outline of the factory

Location: Kota Tangerang, 35 kilometers west of Jakarta

Product: tableware

Production output: 21,008 tons per year (2007)

Customers: 80% domestic, 20% overseas (exported)

Production equipment: 11 kilns (3 biscuit kilns, 4 glost kilns, 2 decorator kilns, and 2 micro-kilns; both biscuit kilns and glost kilns are tunnel kiln). All kilns were made by Takasago Industry (based in Gifu Prefecture, Japan).

Energy consumption: natural gas 15,362 cubic meters/yr., electricity 7,639 MWh/yr (2007)

Employees: 1,800 , 3 shifts

(3) Overview of energy audit

1) Local audit team

The audit team consisted of twenty-six persons from Ministry of Energy and Mineral Resources, Ministry of Science and Technology, the state-owned company dealing with energy conservation services, the ceramic factory to be audited, ECCJ, and ACE. DGEEU's Ms. Feby and ACE's Mr. Ivan served as facilitators of OJT audit since a leader was not appointed. In actual, ECCJ experts conducted a substantial part of audit work except for measurement work.

2) Interview

Before commencing an inspection of equipment, an interview was made with respect to the production process, recent production output and energy consumption data, and problems concerning energy conservation as perceived by the factory. Next, responses to the preliminary questionnaire were checked.

3) Expectations of the factory toward the audit

The factory expected (1) to learn methods of energy conservation, (2) to know feasible measures of energy conservation, and (3) in particular, to have an audit conducted with respect to kilns and dryers. The factory stated that it had never before been audited by an outside consultant.

4) On-site inspection and measurements

One biscuit kiln and one dryer attached to glost kilns were intensively inspected. A general inspection was conducted on the first day, and a detailed inspection was conducted on the following two days, using measuring instruments. The factory arranged several engineers on full time basis during the audit. It also extended significant cooperation in other ways, such as by providing a manometer and high-temperature thermometer, and by preparing temporary measuring holes in kiln exhaust duct. EMI and BPPT engineers made a measuring work in scorchingly-hot environment. In addition to the kiln and dryer, ball mills, filter presses, water system and dust collectors were inspected in a short-cut manner.

5) data analysis and reporting

On the final day, gathered data were analyzed, missing data were collected, and the results were reported to top management of the factory. The factory manager, who learned material science in the United Kingdom, asked many questions from managerial, operational and technical standpoints.

(4) Energy saving measures and energy saving effects

	Energy saving measures	Energy saving effects	Investment scale
Kiln	<u>Reduction of kiln exhaust gas loss:</u> (1)maintain sand seal gutter (2)prevent outside air from entering the kiln (3) manage combustion air (4)adjust exhaust-gas dampers on fans	<u>Kiln fuel saving:</u> 22.2% (not including effect of adjusting dampers)	Medium scale (repair of sand seal gutter)
	<u>Effective use of cooling zone cooling gas:</u> (1)use as secondary air for kiln burners (2)use as heat source for dryer	<u>Kiln fuel saving:</u> 1.8% (accounted for effect of secondary air)	Small scale (addition of ducts)
Dryer	<u>Uniform temperature profile inside kiln for preventing uneven burning:</u> (1)install an internal gas circulation fan (2)make dryer entrance and exit airtight	Improvement in yield and shortening of burning time (energy saving effects not calculated)	Medium scale (addition of circulation fan)

	Recover heat by recirculating exhaust gas :	Dryer fuel saving : 50%	Small scale (addition of recirculation fan)
	(3. Suspend dryer operations)	Dryer fuel saving : 100%	Medium scale (addition of circulation fan)
Pumps & fans	Incorporate variable speed control: feature into over-capacity pumps & fans	Elec power saving : Usually 50%	Small scale (addition of simple inverter)

(5) Results of OJT audit

1) Identifying energy saving opportunities through on-site inspection

a) Analyzing energy consumption data

Regression analysis was undertaken based on production output data and energy consumption data for the period from 2006 to 2008 as provided by LIK. It was thereby revealed that specific fuel consumption ranges between 19.0 and 23.0 GJ/t, and that specific electric power consumption ranges between 280 and 380 kWh/t.

According to the report issued by the American-based Lawrence Barkley National Laboratory (Report No. LBNL46990), specific fuel consumption in the latest-designed tunnel kilns is 2.43 to 4.44 GJ/t as best case ,and 10.8 GJ/t in average case. This means that specific fuel consumption for LIK is such that approximately double the amount of energy is consumed as consumed in the latest equipment. See Attach III-1 (Regression Analysis of Energy Consumption) for more details on the regression analysis.

b) On-site inspection

Investigation on energy saving potentials was conducted in the firing process (kiln) and drying process (dryer). 60% of all energy use is accounted for the kiln, while 20% is the dryer. In addition, the material milling process and rotary machines, including pumps and fans, were examined. 40% of all electrical energy use is accounted for the material milling process.

For the firing process, it was found that exhaust gas can be decreased by suppressing the infiltration of outside air, and energy consumption can be reduced by recovering waste heat from exhaust gases.

For the drying process, this investigation revealed that vertical temperature profile in the dryer can be rendered uniform by way of the installation of internal circulation fans, which reduces uneven drying and shortens drying time. Accordingly, uniform vertical temperature profile inside the dryer leads to fuel saving in the dryer. In addition, an opportunity of dryer fuel saving was pointed out when exhaust gas from the cooling zone of firing kiln can be used as heat source of drying process.

For rotary machines, it was found that there is a possibility of electric power saving in pumps and fans if variable speed drives (VSD) are incorporated into exhaust gas fans, combustion air fans and grinder dust-collection fans.

c) Data collection and measurements

In order to estimate energy saving effects, several measurements were made.

For the firing process, residual oxygen content and temperature of gases passing through the pre-heat zone of the kiln were measured so that thermal efficiency was calculated. In addition, the pressure and temperature at several points inside the kiln were measured in order to analyze the flow of combustion gas inside the kiln.

For the drying process, vertical temperature profile at the entrance and exit of the dryer were measured so as to confirm the uniformity of vertical temperature profile inside the dryer. In order to estimate the moisture content of exhaust gas, dry-bulb temperature and wet-bulb temperature inside the kiln near the exit were measured.

In order to ascertain whether there are any opportunities for energy saving in rotary machines, electric current of motors in several fans and the opening/closing status of dampers were measured.

d) Identification of problems affecting EE&C

<u>Firing process (kiln)</u>

- Poor maintenance of sand seal gutter, which causes an infiltration of outside air through breaches in the sand seal gutter (a cause of reduced kiln efficiency).
- Cool outside air is used as combustion air in the firing zone burner, where hot exhaust gas leaving the cooling zone in the firing should be effectively used (a cause of reduced kiln efficiency).
- No management in flow rate and pressure of natural gas in the firing zone burner (manometer is broken).
- No management in pressure profile throughout the kiln. For example, current exhaust gas fans installed in the pre-heat zone are too powerful and draw excessive gases than

necessary (damper adjustments are required; a cause of reduced kiln efficiency).

- Although there are two suction ports drawing kiln inside gas in the pre-heat zone, only the upper port is used in actual operation (a cause of non-uniform vertical temperature profile).
- Gap between kiln carts and kiln wall is large and uneven (uneven firing due to non-uniform velocity profile of gas flow inside the kiln, which in turn is a cause of irrational extension of firing time).
- No internal circulation fan has been installed inside the kiln (a cause of non-uniform vertical temperature profile).

Drying process (dryer)

- Uneven drying is caused by non-uniform vertical temperature profile (a primary cause of occurrence of defective goods).
- Drying temperature are not adjusted (a cause of occurrence of defective goods).
- Exhaust gas heat is not recovered (a cause of reduced dryer efficiency).

Raw material preparation process

- No operation manual for ball mill section (Ball mill charge volume, Ball make-up volume, ball size management, and idling stop management).
- No operation manual for filter press section (no measurement of moisture content).

Rotary machines (fans and pumps)

- Numerous fans, including kiln combustion air fans and grinder dust-collection fans, are oversized.
- Suction dampers are being throttled (leading to a loss of power).

2) Data analysis and energy saving measures in the firing process

a) Heat balance of No. 4 glost kiln

A heat balance was calculated with an aim of quantification concerning how much energy is inputted and consumed in where in the firing process, especially to clarify how much energy is used effectively for firing purpose and how much energy is wasted in where. The following conclusions were drawn with detailed calculations shown in Attach III-2 (Heat Balance of No. 4 Glost Kiln).

Based on results of heat balance calculation, it was determined that loss of exhaust gas leaving the preheat zone of the kiln (34.8%), the loss of exhaust gas leaving the cooling zone of the kiln (32.7%), and the loss of heat radiation from the kiln surface and other points (28.1%) were significant. In addition, while quantitatively insignificant, the heat carried over with kiln carts accounts for to 3.8% of all energy consumed in the kiln. To reduce these losses, the following measures can be considered.

Heat Balance of No. 4 Glost Kiln — Production (ton/mo) : 228.5

heat input	103kcal/t	%	heat output	103kcal/t	%
heat of combustion	5183.9	100.0	SH of fired goods	32.0	0.6
SH of wet fired goods	0.0	0.0	SH of saggar	101.3	2.0
SH of saggar	0.0	0.0	SH of kiln car refractory	65.9	1.3
SH of kiln car refractory	0.0	0.0	SH of kiln car iron part	25.4	0.5
SH of kiln car iron part	0.0	0.0	SH of waste gas from cooling zone	1697.2	32.7
			SH of combustion exhaust gas	1803.5	34.8
			other losses (radiation, etc)	1458	28.1
input total	5183.9	100.0	output total	5183.9	100.0

b) Reduction of kiln exhaust gas loss and energy saving effect

Residual oxygen content in the kiln exhaust gas is measured to 17% at the inlet of exhaust gas fans. High oxygen content is a result of several causes, including the infiltration of outside air through the broken sand seal gutter, the infiltration of outside air through the entrance of the kiln, the excessive gas aspiration due to oversized exhaust gas fans, and the excessive infusion of combustion air due to improper damper management of combustion air fans. By eliminating these causes, oxygen content can be reduced to about 9 to 12%, which is a current level measured in Japan. Heat balance was calculated as the following, assuming that oxygen content of kiln exhaust gas is reduced to 12% :

Heat Balance of No. 4 Glost Kiln — Production (ton/mo) : 228.5

heat input	103kcal/t	%	heat output	103kcal/t	%
heat of combustion	4035.0	100.0	SH of fired goods	32.0	0.8
SH of wet fired goods	0.0	0.0	SH of saggar	101.3	2.5
SH of saggar	0.0	0.0	SH of kiln car refractory	65.9	1.6
SH of kiln car refractory	0.0	0.0	SH of kiln car iron part	25.4	0.6
SH of kiln car iron part	0.0	0.0	SH of waste gas from cooling zone	1697.2	42.1
			SH of combustion exhaust gas	655.1	16.2
			other losses (radiation, etc)	1458	36.1
input total	4035.0	100.0	output total	4035.0	100.0

Accordingly, amount of natural gas saving was calculated to be 438 x 10^3 m^3-gas/yr, which corresponds to an energy saving of 22.2%.

228.5 tons/mo x 12 x 5183.8 x 10^3 kcal/ton = 14213980 x 10^3 kcal/yr

228.5 tons/mo x 12 x (1803.5-655.1) = 3148913 x 10^3 kcal/yr

= 438 x 10^3 m^3-gas/yr (natural gas)

3148913 x 10^3/14213980 x 10^3 x 100 = 22.2%

In the above calculation, some of variables and parameters are an estimated number, based on design specification and operation data in the similar type of kilns in the certain ASEAN country. When actual data can be obtained, the above result has to be recalculated according to the calculation procedure outlined in Attach III-2.

c) Effective use of exhaust cooling gas leaving the cooling zone and energy saving effect

Energy loss of exhaust cooling gas leaving the cooling zone in the kiln was estimated to account for 32.7% of all energy used in the kiln. As the cooling gas fan is installed in the kiln, some of exhaust cooling gas can be supplied to the firing zone and the rest is to the adjacent dryer.

However, this fan is presently out of service for unknown reason, such that it is believed that most of exhaust heat of the cooling gas is either discarded into the atmosphere or released into the atmosphere from the preheat zone of the kiln via the firing zone. Probably the volume of the cooling gas supplied to the firing zone or the adjacent dryer is small.

With recent models of kiln, heat of exhaust cooling gas is typically used as secondary air to the firing burners or as hot air fed to the preheat zone, or as dryer heat source. In this audit, measurement data concerning how much the cooling gas went to the dryer were not obtained due to unavailability of gas flow instrument. It is recommended to measure the volume of the cooling gas going to the dryer under an assistance of BPPT or energy service companies in order to know how much energy is recoverable.

Energy saving effect expected in case that the cooling gas is made used of as secondary air is estimated to be approximately 1.8% in terms of kiln fuel consumed. This is corresponding to natural gas of 34.9 x 103 m^3-gas/yr. For more details on the calculation process, see Attach III-3 (Heat Recovery of Kiln Cooling Gas Waste Heat).

d) Reduction of heat radiation loss from hot surfaces of the kiln and energy saving effect

Heat balance revealed that loss of heat radiation from hot surface of the kiln is as significant as 28.1%. However, authors of the report did not feel it is overly hot when touched by hand, although surface temperature was not measured due to time restriction. Reason of the difference is not clear.

Japan's Energy Conservation Law illustrates a guideline regarding as thermal insulation measures to industrial furnaces as shown below. Where surface temperature is 110-160 degree Celsius or higher in the firing zone, and/or 70-90 degree Celsius or above in the preheat zone or cooling zone, addition of insulation should be considered.

Guideline for furnace insulation (Japanese Encon Law)

inside temp, deg C	surface temp, deg C		
	ceiling	side wall	bottom
1300 or higher	120	110	160
1100 - 1300	110	100	135
900 - 1100	100	90	110
900 or lower	80	70	90

3) Data analysis and energy saving measures in the drying process

a) Heat recovery through exhaust gas recirculation in the drying process

Exhaust gas temperature is normally 200 degC or higher in the dryers of ceramics factory. It is as high as worthwhile recovering waste heat of dryer exhaust gas. Generally in case that drying temperature is 140 degC or higher, exhaust gas recirculation is very effective measure for energy saving. The technical ground is that relative humidity drops very low under such high temperature and accelerate a drying speed. In fact, there are many cases reported in which the exhaust gas is recirculated, combined with high temperature drying. Attach III-4 (Exhaust Gas Recirculation in Dryer of No. 3 Biscuit Kiln) outlines the estimation procedure for energy saving effect with exhaust gas recirculation. According to the result, drying speed remains nearly unchanged even when 50% of exhaust gas is recirculated. Therefore, 50% reduction in the fuel consumption can be expected.

b) Causes for uneven drying/firing and installation of internal gas circulation fans

In the dryer linked to No. 3 biscuit kiln, there is a problem of uneven drying, which brings about both low yield of dried goods and irrational extension of drying time. Non-uniform vertical temperature profile could be one conceivable cause of this uneven drying. In this connection, vertical cross-sectional temperature profile was measured at the entrance of the dryer. As a result, the upper temperatures was 70 degC or more, while the lower temperatures equaled to 55 degC or less. This can likely suggest a shortcoming in vertical circulation of dryer internal gas. While vertical temperature profile was not measured near the center of dryer, it is expected that there is the same situation in the center as at the entrance. It would be effective to install a internal gas circulation fan at three longitudinal locations inside the dryer.

In the firing kiln, there is a problem of uneven firing. This could be also caused by ineffectiveness of vertical gas circulation. If uneven firing is eliminated, improved product yield and shorter firing time are attained. Additional data and measurement are necessary to estimate energy saving effect by even firing.

c) Improper horizontal temperature profile in the dryer

Ordinary dryers are designed to have internal temperatures gradually rise as ceramic items move from the entrance of the dryer to the exit (horizontal temperature profile) in order to minimize thermal shocks to ceramic items.

However, in this dryer, the drying air temperature is high at the entrance while the drying air temperature is low at the exit. As thin ceramic items are produced in the factory, few cracks develop at the entrance even at the high temperature environment. However, there is a risk of cracking where bricks or other thick items are being dried.

To resolve this issue, drying air temperature should be adjusted through damper opening adjustment, such that the temperature at the entrance is lowered and the temperature at the exit is raised.

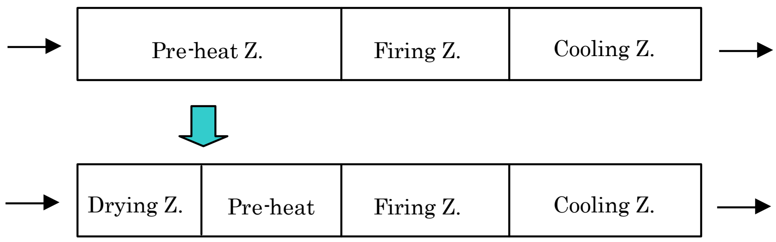
In addition, as temperature variation is large between top and bottom of kiln carts (vertical temperature profile), products placed at the bottom of kiln carts are not being sufficiently dried. To resolve this issue, internal circulation fans should be installed as indicated above in order to secure the vertical, internal circulation of hot air.

See Attach III-5 (Effect of Temperature Profile in Dryer against Product Quality) for details regarding b) and c) above.

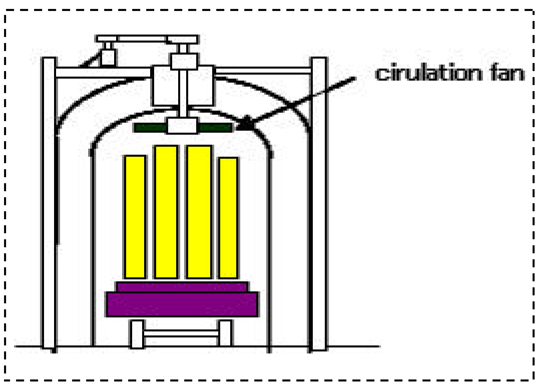
4) Feasibility of shutting down the dryer

(by converting a part of the pre-heat zone into a drying zone)

In Japan, there are cases where dryers have been shut down by using a part of the kiln pre-heat zone as a drying zone. This is possible where the kiln has room to spare along its length. In the factory, there is a feasibility of shutting down the dryer, because the firing kiln, at nearly 100 meters in length, is sufficiently long for producing thin tableware. In addition, the actual temperature profile in the kiln pre-heat zone is similar to the temperature profile of the dryer. In this case, the length of required drying zone is expected to be about 20 meters. In order to shorten the duration of pre-heating process and make up the room for drying process, it is necessary to eliminate the above-mentioned inefficiencies, such as by minimizing infiltration of outside air into the kiln, improving the circulation of gas inside the kiln, and rendering uniform the temperature profile at the top and bottom of the kiln. All energy consumed in the dryer could be crossed out. Although a quantitative study is yet to be conducted, it is anticipated that fuel saving of at least 20 to 30 percent can be achieved.



As explained in the dryer section, it is recommended that sand seal gutter be repaired in order to minimize the infiltration of outside air into the dryer, and that a circulation fan be installed in order to improve the circulation of internal gas.



5) Energy saving measures concerning operational management and equipment maintenance

As indicated above, on-site inspection revealed that energy consumption was rising due to insufficient operational management and insufficient maintenance. the following individual measures had better be implemented promptly. See Attach III-6 (Management of Operation and Maintenance in Kiln & Dryer) for details.

a) Maintenance of Sand Seal Gutter – Restore Sand-seal Function

Sand seal gutter is an important component for preventing the infiltration of outside air into the kiln. However, on-site inspection revealed that grains of sand in use were too large to enable sand seal gutter to be effectively used as a air seal, and that sand itself had not been properly placed in the gutter. This situation thus allowed large amounts of air to seep into the kiln. In addition, heated air flowing from the firing zone should be prevented from infiltrating the underside of kiln carts. In this connection, it is recommended that sand seal gutter be fully replenished with sand of which grain size should be between 1 and 5 millimeters in diameter.

b)Maintenance of Sand Seal Gutter – Relocate Shooter and Optimize Sand Management

Sand had not been supplied to a section of the preheat zone with approximately 30 meters in length. The sand shooter should be relocated near the inlet part of preheat zone. As a shortage of sand will prevent sand seal gutter from functioning properly, the seal height of sand seal gutter should be properly set.

c) Prevention of Air Leakage through Gaps between Carts

Air leaks tend to occur through two types of gap at the connection between carts : one is in a labyrinth at the connection, and the other is at the bottom part of carts. The labyrinth gap should be padded with ceramic fibers, while the bottom gap should be covered with aluminum foil made of solidified water glass.

d) Sealing of Entrance Door for Air-tightening purpose

While a door is installed at the entrance to the kiln, there are many gaps between the door and the kiln wall, such that hot inside air blows out. In order to ensure an airtight door, seals should be secured on both ends of the door and that a pusher for pushing the door into the kiln wall should be installed. Push and release actions can be enabled by rotating the pusher cam.

e) Installation of Air-curtain at Kiln Exit

A significant volume of hot inside air was escaping through the kiln exit. In order to prevent gas escaping, installation of forced draft fan and air curtain are recommended..

f) Optimization of Internal Gas Flow for Achieving Uniform Vertical Temperature Profile

There are two air supply ports—an upper one and a lower one—for gas that circulates inside the kiln. The preferable use of a lower air supply port is recommended for the purpose of optimizing the internal gas flow. This would enable hot gas to circulate up to the upside of kiln cars inside the kiln and achieve a uniform vertical temperature profile. Besides, sand that accumulated on port inlet should be removed when in maintenance time.

g) Optimization of Stacking Items for Preventing Uneven Gas Flow – Flattop
In order to prevent uneven gas flow inside the kiln, it is important to stack ceramic items on the carts in such a manner that stacked pile forms a flattop. At the LIK factory, ceramic items are stacked on a flattop basis and the management thereof looks sound.

h) Installation of Circulation Fan for Enhancing Heat Transfer to Materials
No circulation fan had been installed in either the kiln or the dryer. For this reason, the vertical temperature profile in the kiln is rendered non-uniform, which leads to uneven firing or drying. This also accounts for longer firing time beyond what should be required. In order to resolve this issue, a circulation fan is recommended to install. Circulation fan can be installed either inside the kiln or outside the kiln, depending on site-specific restrictions like site geometry or available capital.

i) Reduction of Thermal Mass of Cart Furniture
It is important to make heat-resistant supports of each kiln cart as light-weighted as possible. Replacing solid refractory bricks conventionally employed with hollow-core

refractory bricks would help to achieve energy conservation. On-site production method of hollow-core refractory bricks implemented in Japan was provided for reference purposes. While hollow-core bricks and light-weighted insulation bricks have already been adopted at the LIK factory, there is still room to make each kiln cart more light-weighted. For that purpose, donut-shaped Scabbards or thin-walled metal Scabbards could be introduced.

j) Burner Management (Monitoring of Fuel Gas Pressure)

It is important that firing rate of each burner is uniform. To this end, the pressure of fuel gas and combustion air needs to be maintained at a required level. However, on-site pressure gauges were broken and not in working condition. Proper maintenance and burner management are to be needed.

6) Energy conservation for fans and pumps

There are many rotary machines with significant load fluctuations at the LIK factory which forces the factory to pay unnecessary expenses. However, in actual few countermeasures are undertaken except for adjusting suction and discharge dampers. In this connection, study on identifying energy saving opportunities was implemented for rotary machines, including application of variable speed adjustment to electric motors of fans.

Investigation on motor power input and extent of load fluctuation was made for the following machines: exhaust gas fans in No. 4 glost kiln, combustion air fans in the same kiln, and grinder dust-collection fans. Measurement work was conducted by engineers from EMI and other Indonesian organizations. After gathered data were analyzed, it was found that current fans have excess capacity than required. In order to cut excess fan capacity, replacement of belt drive pulley to smaller one was recommended mainly for economical reasons.

Energy saving effects of this measures are estimated approximately as follows: 23,000 kWh/yr., 37,400 kWh/yr., and 22,400 kWh/yr., respectively. Prompt implementation in collaboration with technological services company EMI should be explored. No pumps and other machines which the same measures are applicable to were found in this study.

a) Kiln exhaust gas fan

Energy audit on exhaust gas fan in No. 4 glost kiln

<table>
<tr><td colspan="2">Data collection and measurement</td><td>Input power: average 9.53 kW (as shaft power:8.23 kW),
Load fluctuation: 9.1 to 10.1 kW
Suction damper opening: 50%
Air velocity at entrance door when entrance door left open: 1 to 6 m/sec</td></tr>
<tr><td colspan="2">Energy saving opportunities</td><td>Reduction of power wasted in suction damper</td></tr>
<tr><td colspan="2">Energy saving measures (example)</td><td>Decreasing fan rotation speed by replacement of belt drive pulley to smaller size</td></tr>
<tr><td rowspan="3">Esti-mation</td><td>Assumptions</td><td>Performance curve is estimated based on similar type of fans (actual curve is not available)</td></tr>
<tr><td>Calculation results</td><td>Revolution after measure: 82.2% of rated revolution
Shaft power after measures: 5.83 kW
(as input power: 6.90 kW)</td></tr>
<tr><td>Power saving</td><td>2.63 kW (28% reduction),
23,000 kWh/y (operation: 8,760 h/y)</td></tr>
<tr><td colspan="2">Other options for energy saving</td><td>Reinforce air-tight sealing around entrance door
Kiln pressure control feature (manual or automatic)</td></tr>
</table>

b) Kiln combustion air fans

Energy audit on combustion air fans in No. 4 glost kiln

<table>
<tr><td colspan="2"></td><td>No. 1 combustion air fan</td><td>No. 2 combustion air fan</td></tr>
<tr><td>Data collection and measurement</td><td>Input power
Damper opening</td><td>7.86 kW (as shaft power: 6.64 kW)
Disc.damper: 50% open</td><td>9.07 kW (as shaft power: 7.66 kW)
Disc.dampers: 53% open</td></tr>
<tr><td colspan="2">Energy saving opportunities</td><td colspan="2">Reduction of power wasted in suction damper</td></tr>
<tr><td colspan="2">Energy saving measures (example)</td><td colspan="2">Decreasing fan rotation speed by replacement of belt drive pulley to smaller size</td></tr>
<tr><td rowspan="3">Esti-mation</td><td>Assumptions</td><td colspan="2">Combust air pressure: 4,903 Pa (500 mmAq),
Kiln pressure: 49 Pa (5 mmAq)
Piping resistance: 490 Pa (50 mmAq)
Performance curve is estimated based on similar type of fans (actual curve is not available)</td></tr>
<tr><td>Calculation results
Revolutions
Shaft power</td><td>86.9% of rated revol’n
4.82 kW
(as input: 5.94 kW)</td><td>85.9% of rated revol’n
5.45 kW
(as input: 6.72 kW)</td></tr>
<tr><td>Power saving</td><td colspan="2">4.27 kW (No. 1: 1.92, No. 2: 2.35);
(25% reduction after measures).
37,400 kWh/y (operation: 8,760 h/y)</td></tr>
<tr><td colspan="2">Other options for energy saving</td><td colspan="2">Minimization of damper loss by application of VSD</td></tr>
</table>

c) Grinder dust-collection fans

Energy audit on grinder dust-collection fans

Data collection and measurement		Input power: 17.8 kW (as shaft power: 15.2 kW), Load fluctuation: 15.2 to 18.4 kW No suction damper Air handling rate: 91.2 m^3/min (air velocity was measured at 8 inlets)
Energy saving opportunities		Reduction of power wasted in suction damper
Energy saving measures (example)		Decreasing fan rotation speed by replacement of belt drive pulley to smaller size
Esti-mation	Assumptions	Performance curve is estimated based on similar type of fans (actual curve is not available). System resistance curve shall remain unchanged.
	Calculation results	Revolution after measure: 90% of rated revolutions Shaft power after measure: 13.3 kW
	Power saving	4.5 kW (25% reduction), 22,400 kWh/y (operation: 4,970 h/y)
Other options for energy saving		In case of one grinder operation, fully close suction damper of air fan of the other grinder.

(6) Comments

1) Preparatory work was excellently conducted before local activity through excellent collaborative ties with DGEEU and ACE. Local audit team was appropriately constituted by participant engineers from Ministry of Energy and Mineral Resources, Ministry of Science and Technology, a state-owned energy service company and the LIK factory. Concerning measuring instruments, BPPT and EMI provided a gas analyzer, thermometers, anemometer and electric power monitor. The factory also provided a manometer, and high-temperature thermometer as well as instrument engineers. Although some area of the factory was prohibited to enter or take photographs, maximum cooperation was given by the factory with regards to equipment inspection and measurement work. In addition, coordinators from DGEEU and ACE served as competent facilitator, including a briefing of PROMEEC project.

2) Responses to preliminary questionnaire arrived in Japan just prior to our departure for Indonesia. Responses concerning production output, fuel and electrical power consumption were satisfactory. However, responses regarding production equipment and implementation of energy saving measures were incomplete and imprecise. On the other hand, currently-used questionnaire is a bit complex and difficult to answer. Early

revision of input format is requested to make respondent easy to understand and answer.

3) There are still remaining plenty of energy saving measures that have yet to be undertaken in the LIK factory. For example, no energy conservation team has been organized, no operational management standards has been prepared, important operating variables have not been monitored.

4) The author of the report would like to express our great appreciation to the DGEEU officials, who, as a focal point, made all necessary preparatory arrangements, such as by organizing the audit team, providing answers to the preliminary questionnaire, and setting up measuring instruments.

3. Follow-up survey (textile industry)

(1) Background

Follow-up survey was conducted for the Surabaja factory of ISN where an audit was made in 2005. Generally follow-up survey is held in a manner of visiting the factory. However, according to request from ISN, this survey was conducted as an information exchange meeting with participation of the concerned parties. The meeting was held in the conference room of ACE office in Jakarta. Five engineers from ISN participated in the meeting together with officials from DGEEU, ACE staffs and ECCJ experts. The meeting was chaired by Ms. Indarti, director of DGEEU..

(2) Participants

DGEEU: 2 participants (Ms. Indarti, Ms. Feby)

ISN: 5 participants (3 from the Bekasi factory, 1 from the Surabaja factory, and 1 from head office)

ACE: 2 participants (Mr. Ivan, Mr. Bernard)

ECCJ: 3 participants (Mr. Hata, Mr. Takeda, Mr. Kawase)

Total: 12 participants

(3) Overview of 2005 audit

The following recommendations were made in 2005 audit.

Ventilation system

・Energy saving by raising the temperature of chilled water (in air washer unit)

・Energy saving by adjusting the temperature of cooling water (in chilled water unit)

Compressed air system

・Lowering air compressor discharge pressure

・Preventing air leakage from compressed air piping system

Management of specific energy consumption

・Measuring electric power and analyzing data

(4) Follow-up results

First, responses to preliminary questionnaire were checked. Responses consisted only of specifications key equipment at the Surabaja factory (polyester yarn manufacturing), but included no operational information required for the purpose of follow-up survey. Therefore, follow-up survey was carried out by way of asking questions and answering them. Key energy-using equipment at the Surabaja factory consists of the ventilation system, air compressors, fiber-spinning machines, water supply and treatment system, and power-receiving equipment.

a) Ventilation system

Ventilation system maintains air conditions (temperature and humidity) within a prescribed range in order to prevent thread breakage and constitutes a key energy-using system in the spinning process. The system includes chilled water production equipment as well as peripheral equipment consisting of a cooling tower, air-supply fans, and circulating air fans.

The chilled water production equipment supplies chilled water for use in air showers only during dry season when atmospheric temperatures are particularly high. Most of the time (including rainy season), the chilled water production equipment is shut down, and cooling water is directly supplied to the air washers. Target temperature of air in the spinning room ranges between 25 and 35 degC and target relative humidity ranges between 55 and 65%.

Air-supply fans and circulating air fans are operated at a constant velocity and airflow is controlled by adjusting damper openings. Operators monitors air conditions in the spinning room daily with a hygro-thermograph, and adjusts manually the openings of air-supply dampers and circulating air dampers according to prepared tables. Therefore, the ventilation system is operated in a energy-efficient manner. Also, proposals made in 2005, to raise the temperature of chilled water and to adjust the cooling water

temperature , was not implemented due to the short duration during which the chilled water production equipment is operated.
Additional comments for the ventilation system were made by ECCJ experts as the following;
i) application of variable speed drives, optimally inverters, to circulating air fans in order to reduce energy wasted in dampers, and (ii) investigation of cooling tower performance in case there is 5 degC or lower of temperature difference in circulation water between at cooling tower inlet and at outlet (for example, check mineral concentration of water, check water channeling, and inspect plugging of spray nozzles).

b) Compressed air system

In the spinning process, large volume of compressed air is used for auto-coner drive and for air-jet room drive. No special measures were implemented to prevent air leakages from compressed air piping system. At the same time, measures to lower the discharge pressure on air compressor have being taken. That is to say, the discharge pressure was reduced from the previous 8 bar to 6.8 bar. The required pressure is 6 bar for the auto-coner equipment. Considering that the difference in pressure between air compressor and the far process end is, generally speaking, 0.5 bar or less, it is understood that certain measures has been taken. In order to further reduce the discharge pressure, employment of a loop-type air supply system and elimination of fluid resistance such as undersized pipes and something else are required to study.

c) Management of specific energy consumption

Concerning electric power management, power consumption in the factory as a whole is measured and recorded, but process-wise consumption is not known. Processing and analysis of collected data are not conducted. Visualization of monthly power consumption and production output on the graph is helpful to monitor trend of power usage in the factory.
Visualization by graph makes data analysis easy. Graph shows there are a fixed part and a variable part in energy usage. The fixed part is independent of production output. It is energy to be consumed even during off-production period. For example, energy for lighting and air conditioning is classified in the category of fixed energy. Reduction of the fixed energy is the most effective measures towards energy conservation.
The variable part is proportional to production output. In other words, as production increases, energy consumption goes up. Supposing linear relationship between production output and power consumption, the slope of line means incremental energy

per unit of production, so called specific energy consumption. In order to reduce the variable energy, the slope has to be gentle. Installation of heat recovery equipment is one example.

Historical trend of energy consumption can be easily understood on the graph. The movement of energy consumption data on the graph is helpful for prediction of a future direction. It can be a tool for setting a target of energy conservation activities. It is effective to share energy data and to raise awareness of all employees in the factory.

d) Spinning machinery

Spinning machinery is generally operated with a fixed-speed motor. Production output is adjusted by changing a number of machines in service. At the same time, the fluff generated through the spinning process is removed by dust-collecting machines. Dust-collecting machines are also generally operated with a fixed-speed motor. When the volume of fluff to be removed is low, efficiency of dust removal is going down and some energy use is wasted. The adoption of an inverter control is recommended for enabling to adjust dust-collection capacity according to the fluctuating volume of fluff. Manually-adjustable inverter is preferable because it is cheap and precise adjustment is not required. Other options of energy saving measures applicable in the spinning process are outlined in Attach III-7 (Energy Saving Measures in Spinning and Weaving Processes).

e) Water pumps

Water consumption tends to fluctuate according to production plans. For this reason, water pumps are generally designed to allow for flexibility to accommodate fluctuations of water requirement. In reality, production output falls frequently below production plan and inefficiency in pumping machineries is brought about according to low-load operation. In order to prevent a decrease in energy efficiency in such a case, pumps should be operated on a variable speed basis. Manually-adjustable inverter is preferable. Opening of discharge valves can be an indicator of whether required pump load is low or not.

f) Power receiving station

Under the Indonesian electric tariff system, a penalty is levied where power factor is 0.9 or under. Where power factor is 0.9 or above, improvement of power factor does not earn a bonus. Power factor at the receiving end is normally 0.92. Accordingly, there are no problems in power factor management. As no information are available concerning the load factor of transformers, no assessment is presented in this report.

(5) Comments

1) Engineers from ISN's two factories and head office gathered and were able to engage in a meaningful exchange of information. Although the visit to the Surabaja factory was cancelled, the follow-up meeting was meaningful with many useful information shared among participants.

2) While the participating engineers are in charge of production and energy management, their understanding of the factory facilities had better be improved in terms of energy use. For example, there was an engineer who did not know why humidity control was required, despite the fact that the ventilation system constitutes the biggest consumer of energy at the spinning process. Knowledge about the processes had better be brushed up to a further extent. In addition, inverters are an item with which participants should be familiar. While they are familiar with the word "inverter", they do not know where and how inverters are applied. Knowledge is not properly linked to practice.

4. Overview of Seminar/workshop

(1) Time and place

November 25, 2008 (08:30 to 17:00)

Maharadja Hotel, Jakarta

(2) Participants: approx. 60 persons

Indonesian government officials

- Ms. Indarti (DGEEU, Ministry of Energy & Mineral Resources)
- Ms. Feby (DGEEU, Ministry of Energy & Mineral Resources)
- Ms. Devi (DGEEU, Ministry of Energy & Mineral Resources)
- Mr. Edi H (BPPT, Energy Technology Center)
- Mr. Immanuel Kelik (PT.EMI)
- Mr. Iwan Rustandi (PT.EMI)
- Others

Indonesian private-sector participants

- Mr. Pandithakorale (P.T. LIK, General Manager)

Mr. T.A. Kularatne (P.T. LIK, Product Advisor)
Mr. Badwi (P.T. LIK, Coordinator)
Numerous others

Case presenters (ASEAN member countries)

Philippines Mr. Marlon Domingo (read by Mr. Nguyen Ninh Hai (ACE))
Vietnam Mr. Phuong Hoang Kim (EECO, Ministry of Energy)
Indonesia Mr. Subagyo (Leces Pulp & Paper Mill, Indonesia)

ACE (ASEAN Center for Energy)

Mr. Christopher Zamora
Mr. Nguyen Ninh Hai
Others

ECCJ (The Energy Conservation Center, Japan)

Mr. Kenjiro Hata (Technical Expert)
Mr. Kokichi Takeda (Technical Expert)
Mr. Taichiro Kawase (General Manager)

(3) Presentation overview

With a chairmanship of Ms. Maureen Balamiento, presentations were given in accordance with the program outlined in Attach III-8 (Agenda of Intensive Seminar – PROMEEC Major Industry Indonesia Nov. 25, 2008). An overview of presentations given is indicated as follows:

Session 1: Policy and Initiatives on EE&C in Major Industries

1) Overview of ASEAN Energy Efficiency Promotion Activities

Mr. Christopher Zamora presented an overview of activities of ACE according to the following headings:

- 2004-2009 APAEC Program
- ASEAN-Japan cooperation (SOME-METI, PROMEEC, and multilateral training)
- ASEAN Best Practice Competition (Energy Efficiency Division)
- ASEAN + 3 Energy Efficiency and Renewable Energy Forum
- Other programs implemented in collaboration with EAS-ECTF, UNEP, the ASEAN Foundation, ADB, and CDC.

A detailed explanation was provided in regards to the 2004-2009 APAEC Program. This program consists of six program areas. Energy conservation is addressed in the fourth program area. As a key element of the fourth program area, the process and results with respect to PROMEEC activities through Phase 1 and Phase 2 were reported An outline of how these activities unfold in Phase 3 was also presented.

(Note: These six program areas consist of the following: information sharing and networking, ASEAN energy standards and labeling, private-sector participation, capacity building, cultivation of ESCO enterprises, and transportation sector.)

2) Overview of Plans & Programme on EE&C in Indonesia (Attach III-9)

Ms. Indarti Suharto of DGEEU presented an overview of the latest energy conservation policies and measures in Indonesia according to the following items:

- Indonesian energy consumption trends
- Recent energy conservation policies
- Measures to promote energy conservation in industrial sectors

With respect to energy consumption trends in Indonesia, energy consumption increased rapidly in line with economic growth, such that it grew by 7.8% between 1970 and 2006. Energy consumption per unit of product is quite high in industrial sectors when compared to one in developed and neighboring countries. In particular, improvement in energy efficiency is lagging in the iron-making, cement, ceramics, glass, textile, and tire sectors. For example, the energy consumption in the ceramics sector in Indonesia has reached 16.6 GJ/ton compared to 12.9 GJ/ton in Vietnam. Accordingly, the potential for energy saving is high, which is estimated to be between 15 and 30% for industrial sectors.

With respect to recent energy conservation policies in Indonesia, Presidential Regulation No. 5, which stipulates a target for energy elasticity of 1 or less by 2025, was issued in 2006. Article 25 of Energy Law No. 30, which was promulgated in 2007, sets forth incentives and disincentives for the promotion of energy conservation. Presidential Regulation No. 2, which was proclaimed this year, calls on the central and regional governments to implement specific measures concerning air conditioning, lighting, and other matters in order to promote the conservation of energy and water. In the same Regulation, it was provided that a national team was organized to pursue these goals.

In terms of the promotion of energy conservation in industrial sectors, it is notable that the shifting of weekday power loads to Saturdays has been made obligatory through the collaborative efforts of five concerned ministries. Details, such as the identity of these five ministries and the specific means by which this shifting is to be undertaken, are unclear. In addition, projects tied to ASEAN, JICA, UNDP, UNIDO, Denmark, and Holland were briefly introduced as projects connected to foreign donors (detailed information unavailable).

3) Japan's Energy Conservation Policy & Measures for Industrial Sector

ECCJ's Mr. Taichiro Kawase presented an overview of energy conservation policies in Japan and measures applicable to industrial sectors according to the following headings:

- Changes in specific energy consumption by industrial sector in Japan
- Policies and energy conservation measures in industrial sector in Japan
- Voluntary activities of the private companies and organization in industrial sector
- Roles of ECCJ and overview of its activities
- Energy conservation measures and best practices at the Japanese ceramic factories

Session 2: EE&C Best Practices in Industries

4) EE&C Practices in Philippines Food Companies

Energy audit activities conducted by Energy Ministry and energy saving measures in food factories implemented in the Philippines were reported utility by utility (lighting, refrigeration equipment, exhaust gas fans, heat recovery, pumps, boilers, and air compressors).

Cases concerning pineapple-processing factory were also reported, with particular focus placed on technologically advanced energy saving measures relating to refrigeration equipment and steam co-generation. These cases could be highly informative for factories seeking to promote energy conservation as it applies to refrigeration equipment. It is believed that there is worthwhile including these cases in technical directories (TDs), one of the ASEAN energy management tools.

As Mr. Marlon Domingo of the Philippine's Department of Energy (DOE) was unable to visit Indonesia, Mr. Nguyen Ninh Hai of ACE read on his behalf.

5) Best Practices for EE&C: Case Study of Ceramic industry in Viet Nam

Mr. Phuong Hoang Kim of Energy Efficiency and Conservation Office (EECO), an office belonging to Vietnam's Department of Energy (DOE), presented an energy saving case concerning a ceramic factory. This case involves a factory that was subject to an energy audit in 2000 and a follow-up investigation in 2004.

Overview of the Hai Duong Porcelain factory:

- Public-private joint enterprise; produces ceramics; annual output of 14 million units; workforce of 955 employees
- Production process: raw materials grinding, mixing, preparation, forming, drying, inspetion, and shipping
- 5 kilns: 1 tunnel kiln, 2 decoration kilns, and 2 shuttle kilns

The current state of implementation of improvement measures proposed as part of the PROMEEC project is as follows:

a) Tunnel kiln

- Reduce the heat loss by adding ceramic fiber insulation: This measure was investigated but has yet to be implemented (no reason given for non-implementation).
- Reduce the exhaust gas loss by repairing sand seal gutters and adjusting the internal kiln pressure: These measures have been implemented.
- Reduce the infiltration of air into the kiln from the bottom of kiln carts by optimizing the volume of sand in sand seal gutters: This measure has been implemented.
- Improve the internal temperature profile by securing clearance between the saggar and kiln carts and the height of saggar: These measures have been implemented.
- Prevent the infiltration of outside air by installing a kiln entrance door: As an alternative, an air-curtain with FD fans has been installed.
- Shift two or three burners to operate in an oxidizing atmosphere: This measure was not implemented because such a shift would not be possible as it requires a temperature adjustment in order to maintain product quality.

b) Roller hearth kilns

- Maintain the kiln pressure at a slightly positive and prevent the infiltration of outside air: These measures have been implemented.
- Shorten firing time by introducing a biscuit firing approach: This measure has been implemented.

c) Shuttle kilns

- Shorten firing time by introducing high-speed burners: This measure has been implemented.

6) Experience & Application of EE&C in LECES Pulp & Paper Mill

Mr. Subagyo of LECES gave a report on energy conservation activities in the papermaking mill in Indonesia. This mill is situated in East Java and an integrated papermaking mill of which processes encompass everything from tree and pulp to paper. Main products consist of liner paper, printing paper, newsprint, and sanitary paper. Main equipment consist of bagasse pulp equipment, de-inking equipment, five papermaking machines, wastewater treatment equipment, and a power plant. Energy cost accounts for 24% of production cost.
Rehabilitation project of inefficient aged steam-power plant was reported In the boilers, the surface of fireside tubes was severely corroded., In the steam turbine, cracks on the turbine shaft occurred. Power factor was as low as 0.74 in the power receiving station. To overcome these problems, boiler fuel was converted from crude oil to natural gas. Steam turbine was repaired and capacitors were installed in transformer station. In addition, various other measures were undertaken, including the installation of economizers, incorporation of steam extraction control in the steam turbine, steam trap management, and steam leakage management. These measures helped reduce energy cost from 22.05 millionUSD to 11.45 millionUSD and improve the power factor from 0.74 to 0.90.

7) Results of OJT Audit in one Indonesian Ceramic Factory

Mr. Kenjiro Hata presented a report on the results of energy audit conducted at LIK. See Attach III-10 (Results of OJT Audit in one Indonesian Ceramic Factory) for details.

8) Best Practices in Japanese Ceramic industry (Electrical Energy)

Mr. Kokichi Takeda of ECCJ presented successful cases achieved in Japanese ceramic factories (electrical energy saving):

- Shut down existing electrical heaters by reinforcing the recovery of kiln waste heat
- Install inverters into tunnel kiln fan motors;
- Install inverters into motors of water pumps and exhaust gas fan in the boilers

- Install inverters into fan motors in the dust-collecting machines
- Install inverters into ventilation fan motors in the air-conditioning equipment
- Integration of transformers and air compressors
- Energy conservation in lighting (high-efficiency ballasts, task-ambient lighting, and lighting management)

See Attach III-11 (Best practices in Japanese Ceramic Factory (Electrical Energy)) for details.

Session 3: Energy Management Tools

9) Updates on Technical Directory

Mr. Junianto M of ASEAN Energy Center (ACE) gave a briefing on the purpose of technical directories (TDs), which constitute an ASEAN energy management tool, and on the method of developing TDs and the format applicable to TDs, as well as presented an example of the actual TD sheet.

10) Updates on the In-House Database and Cyber Search system

Mr. Junianto M of ACE gave a briefing on the purpose of in-house databases (IHDBs) and the Cyber Search system, which constitute ASEAN energy management tools, and on the method of producing these tools, the input format applicable to these tools, and other relevant topics, as well as presented an example of an inputted sheet.

11) In-House Database system for Ceramics Factory

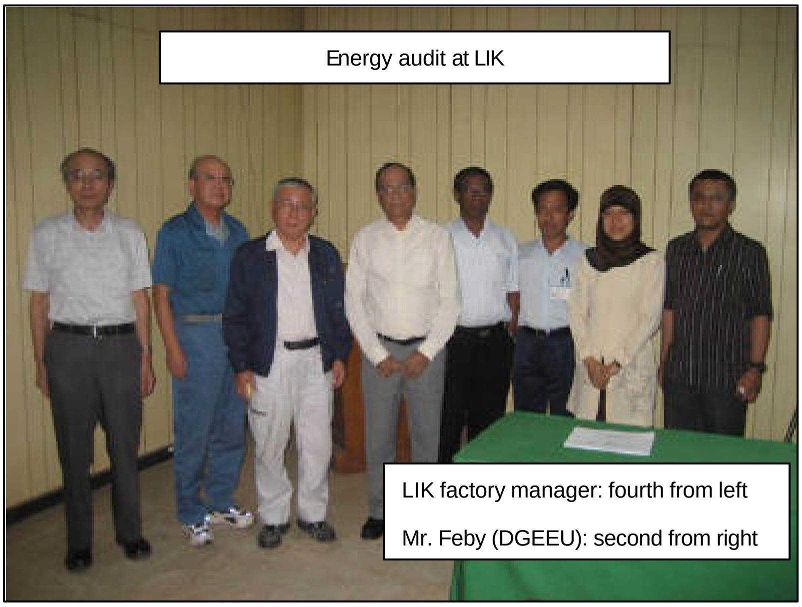
Mr. Taichiro Kawase of ECCJ gave a briefing on the development of in-house databases (IHDBs) for use in ceramic factories. An IHDB consists of production data, energy data, equipment data, important operational parameters, energy efficiency indicators, and more. Accumulated data are provided to the production section, technology section, maintenance section, and others within the factory. PROMEEC project aims at disseminating the developed IHDB to all ASEAN countries. A proactive adoption of this system by ceramic factories in Indonesia is strongly recommended. See Attach III-12 (In-House Database System for Ceramic Factory) for more information.

(4) Comments

1) Sixty participants gathered at the seminar/workshop. It was more than expected and extra chairs had to be brought into the seminar room. Considerable interests were drawn to presentations by officials from other countries and reporting of energy audit conducted at the LIK factory. Unfortunately, less questions were asked than expected.

2) Presentation regarding recent policies on energy conservation in Indonesia given by Ms. Indarti Suharto of DGEEU was highly significant. In particular, it was impressive to know efforts to shift weekday power loads to Saturdays through the collaborative efforts of five concerned ministries. It signaled that the promotion of energy conservation in Indonesia stepped up to more developed stage where various measures produces a real crop, however small i is.

Reference photographs



Dryer audit

Textiles follow-up investigation

Ms. Feby & Ms. Indarti (DGEEU): fifth and sixth from the right side

Seminar: presentation by field expert

Seminar: group photo

5. Attached documents

III-1. Regression analysis of energy consumption
III-2. Heat balance of No. 4 glost kiln
III-3. Heat Recovery of kiln cooling gas waste heat
III-4. Exhaust gas recirculation in dryer of No. 3 biscuit kiln
III-5. Effect of Temperature Profile in Dryer against Product Quality
III-6. Management of Operation and Maintenance in Kiln & Dryer
III-7. Energy saving measures in spinning and weaving processes
III-8. Agenda of Seminar/Seminar –PROMEEC Major Industry Indonesia Nov. 25, 2008
III-9. Overview of Plans & Programme on EE&C in Indonesia
III-10. Results of OJT Audit in one Indonesian Ceramic Factory
III-11. Best Practices in Japanese Ceramic industry (Electrical Energy)
III-12. In-House Database System for Ceramics Factory

IV. Myanmar (textile industry)

1. Overview of activities

Local activity of 2008 in Myanmar was implemented in Yangon between November 27 and December 2, in which two ECCJ experts took part as an advisor. Local activity included three events as followings; OJT audit, advisory visit and seminar/workshop. Energy audit was made at the state-run textile factory in collaboration with the local audit team which was organized for the OJT audit. Advisory visit was paid to a private-sector pharmaceutical factory for making brief factory tour, discussing the findings and problems, and giving an advice and guidance. Seventeen engineers participated in the OJT audit, who are coming from Ministry of Industry 1, Ministry of Industry 2, Ministry of Energy, ECCJ, and ACE. In the textile factory, various problems were identified mainly resulting from aged factory equipment and poor energy management, and poor maintenance practices. On the final day of local activity, seminar/workshop was held with the aim of exchanging information among participants and disseminating best practices and useful energy management tools into ASEAN countries. Approximately forty persons were present at the seminar/workshop, most of participants were engineers coming from state-run companies.

Dispatched officials: Kokichi Takeda, Taichiro Kawase of the ECCJ International Engineering Department

Schedule of activities:
Nov. 27 – Nov. 28 (morning): energy audit (conducted at Mayangone Textile (1))
Nov. 28 (afternoon): advisory visit (paid to FAME Pharmaceuticals)
Dec. 1: Seminar/workshop

2. OJT energy audit (Mayangone Textile (1))

(1) Participants (17 persons)

Ministry of Industry (2):	7 participants (Mr. San Lynn (focal point) and 6 engineers)
Ministry of Industry (1):	5 participants (Ms. Ni Ni (factory manager) and 4 engineers)
Ministry of Energy:	2 participants (Mr. Soe Naing (Than Lyin oil refinery) And 1 engineer)
ACE:	1 participant (Ms. Maureen Balamiento)

ECCJ: 2 participants (Mr. Takeda and Mr. Kawase)

(2) Overview of the factory

Ms. Ni Ni, the factory manager provided an overview of the factory based on Attach IV-1 (Summary of Mayangone Textile (1) Factory).

Factory: one of twenty-four factories operated by MTI (Myanmar Textile Industries, state-run textile company). The factory is located in Mayangone district of Yangone city. MTI is under the jurisdiction of Ministry of Industry 1. A Toyota weaving machine was introduced in 1979; no major replacement in equipment has been made since then.

Products: fabric for suits, fabric for shirts, and fabric for lonji

Production output: 356,400 m^2 of fabric for suits, 631,629 m^2 of fabric for shirts, and 24,685 m^2 of fabric for lonji (2006)

Customers: 100% domestic

Production process: yarn twisting ? cone winding ? weaving ? warping ? sizing ? calendering

Energy consumption: crude oil 98,064 L/yr. (unit price: 2,643 kyat),
electricity 243,700 kWh/yr. (unit price: 25 kyat)
(reference: 0.09 JPY = 1 kyat, as of December 2008)

Employees: 207

(3) Overview of energy audit

1) Local audit team

Local audit team consisted of twelve engineers from Ministry of Industry 1, Ministry of Industry 2, and Ministry of Energy. Participants were an engineer and belonging to various state-run enterprises which produces respectively textiles, food products, beer, sugar, pulp and paper, tools and electricity, trucks and diesel fuel, and tires and rubber. Ms. Ni Ni was appointed as a leader and a presenter in the seminar.

2) On-site inspection and measurements

Led by ECCJ experts, this audit was conducted on a walk-through basis. In order to investigate the performance of ventilation system in the spinning process, measurement of the following points were performed; temperature and humidity of outside air around the refrigeration equipment, temperature of chilled water and cooling water, and electrical power supplied to pumps and fans. Measuring instruments were provided by ECCJ and Myanmar government; portable thermometer (ECCJ) and power monitor (Myanmar government). The observations gleaned from the walk-through were reported to factory executives the following day.

3) Data Analysis and reporting

Collected data were analyzed substantially by ECCJ experts. As shown below, various measures for energy saving were found and summarized as recommendations. These recommendations were reported on a preliminary basis to factory executives on the second day of energy audit. Further, the preliminary report was presented by factory manager Ms. Ni Ni at the seminar/workshop.

a) Findings and recommendations regarding energy saving measures

- Power-receiving equipment
  Current load factor is extremely as low as 14%. Transformer rating should be reduced, for example, to 50% of current capacity.
- Boilers
  Viscosity of fuel oil is not managed. Target temperature of fuel oil should be set Correlation data regarding temperature vs fuel oil viscosity is provided by ECCJ experts. Floor around boiler was found to be wet with black fuel oil. Maintenance of fuel oil piping should be performed to prevent oil leakage. Exhaust gas ducts are severely corroded and punctuated by a large hole. Therefore flue gas stack does not generate drafting power. Urgent maintenance is expected.
- Underground water pump
  Water is leaking from the head tank, and falling down like rain. Urgent maintenance is expected.
- Steam piping
  Insulation is torn down and some part of piping is with nearly bare surface which is wasting huge steam energy and in turn increasing boiler fuel consumption. Urgent maintenance is expected.
- Cooling tower
  Channeling of falling water was observed beneath the plastic fills zone in the cooling tower. Measurement data of water temperature, etc around cooling tower suggested very poor cooling tower efficiency. Cleaning of spray nozzles and replacing of plastic fills are urgently expected.

Motor power input was measured and compared with rated power input, as a result, chilled water pump and IDF fan have considerably large capacity compared with actual power requirement. Replacement of current pump to smaller pump and/or impeller trimming are effective to reduction of current machine capacity.

- Ventilation system

  Many defects and problems were observed, including complete blockage of cool air fan filter, malfunctioning of humidity sensors, and a large hole in the ceiling of the weaving room. As a result, the ventilation system is not functioning at all. In other words, shutdown of the ventilation system does not impede weaving operation. The ventilation system can be shut down at least during the dry season and at night time. It is worthwhile trying a shutdown.

- Sizing equipment

  Degraded insulation, fallen-off insulation, and steam leakage were observed in the steam pipes. (Maintenance work should be undertaken.)

  Temperature of sizing tank seems too high which causes energy loss from the surface of sizing tank. Set a target of sizing tank and perform temperature management. Moreover, steam condensate is not recovered, which should be reused as make-up water to the sizing tank.

- Calendering machine

  Degraded insulation, fallen-off insulation, and steam leakage were observed in the steam pipes. (Maintenance work should be undertaken.)

- Lighting

  Task-ambient lighting is thoroughly utilized in the spinning/weaving room. Fluorescent lamp reflectors are dirty and maintenance work should be undertaken.

b) Comments regarding energy management

- Establishment of energy management system

  The first to do is to organize an energy conservation promotion committee and to declare a strong support of top management towards EE&C to all employees. A person in charge of energy should be appointed for each process of the factory. Education of employees, particularly workers, is very important and strongly recommended. The support of concerned government officials should be sought.

- Equipment maintenance

  Equipment and parts are not being effectively maintained at all, especially with respect to boilers, thermal insulation, steam leaks, cooling tower, the ventilation system, and lighting fixtures. Early repair is expected.

・Measurements and records

Important energy-consumption variables should be monitored and recorded; for this purpose, an in-house database could be helpful.

(4) Comments

1) Preparations made by focal point, Mr. San Lynn, and officials from Ministry of Industry 2 were excellent. It was notable that the local audit team consisted of many engineers from concerned ministries and government offices with jurisdictional ties to industrial sectors. A measuring instrument (a power monitor) contributed greatly to the successful audit. The factory welcome visitors and extended kindly all possible cooperation. For example, the factory manager presented an overview of its EE&C activities excellently with well-designed PowerPoint documents. Consequently, the time for interview session was shortened, and spared time was effectively used for an inspection of equipment.

2) Unfortunately, efforts to promote energy conservation in the factory have, for the most part, not always been successful to date. In particular, the concept of energy management has yet to penetrate, and maintenance activities have been nearly neglected. Various no-cost or low-cost energy saving measures were pointed out in the course of the walk-through investigation. These measures should be implemented promptly.

3) Many engineers from other industrial sectors participated in the OJT audit. The authors of this report believes that they learned about significance of energy management, importance of maintenance, and no-cost and low-cost energy saving measures.

3. Advisory visit (FAME Pharmaceuticals)

(1) Background

Though not initially planned, a visit to FAME Pharmaceuticals was paid in response to a request from Myanmar officials. An outline of the factory is described below:

Product: herbal medicines (30% exported)

Production process: raw materials drying (solar), extraction (with alcohol), concentration (solar or electric heater)

Energy consumption: electricity 218,400 kWh/yr.

Employees: 250

(2) Date and participants

November 28 (afternoon)

17 participants (Mayangone Textile Factory (1), all of OJT audit participants)

(3) Energy conservation activities

The factory is one of winners in ASEAN Energy Conservation Award 2008. The factory is making positive effort to promote energy conservation as the following;

- Solar drying of raw herbs
- Evaporation of solvent alcohol by solar heat
- Reuse of clean discharged water (for lawn watering)
- Day-lighting (reducing lighting energy)
- Lighting management by lux meters
- Power factor compensators
- Management of air conditioning units (adjusting temperature and humidity)

(4) Walk-through results

- Two biggest energy-consuming equipment are alcohol-based solvent evaporators and air-conditioning units.
- Evaporation of solvent is carried out through two-stage process, i.e., solar heating and an electric heating. Electric heater was sufficiently insulated.
- 68 packaged air conditioning units have been installed mainly in the production room and the warehouse. Internal room conditions are manually controlled by adjusting a number of units in service.
- Heat infiltration through walls and/or windows into air-conditioned spaces was examined. Outside surface has nearly the same temperature as outdoor air temperature. It was found that wall is insulated with enough thickness.
- Ordinary glass was used for window glass. Window is one of the places where heat intrudes into air conditioned space. Double-glazed glass or thermal insulated glass are recommended.
- Motors and lighting increases a required load of air conditioning units as an internal heat source. Heat load due to motor operation seems not so large because not so many motors are used. Also, Lighting load is not a large load because it was managed

excellently with light sensors.

- The room temperature in the office was maintained at twenty-seven degC, an appropriate level.

(5) Comments

- Energy management has been made excellently with less room of energy conservation measures remaining. It was understood that the factory was nominated for an ASEAN energy conservation award.
- While energy saving effect was small owing to the small size of this factory, the measures employed are very helpful. It is expected that the experiences are spread overn Myanmar as a model of energy conservation for buildings, in particular air conditioning unit.

4. Overview of Seminar/workshop

(1) Time and place

December 1, 2008 (08:30 to 17:00)

Chatrium Hotel, Yangon, Myanmar

(2) Participants: approx. 40 persons

Ministry of Industry (2): 10 persons

Mr. Kyaw Swa Khine, Deputy Minister

Mr. San Lynn, Director, Myanmar Industrial Construction Services (current focal point)

Engineers form state-run factories (tools and electricity, trucks and diesel fuel, and tires and rubber)

Ministry of Industry (1): 13 persons

Ms. Ni Ni, Factory Manager, Mayangone Textile Factory (1)

Ms. San San, Factory Manager, Than Lyin Textile Factory

Engineers from state-run factories (textiles, food products, beer, sugar, pulp and paper)

Ministry of Energy: 6 persons

Mr. Maung Maung Ohn Thaw, Assistant Director, Energy Planning Department

Mr. Soe Naing, Maintenance Engineer, Thanlyin Oil Refinery

Other technical staffs

Ministry of Electric Power (2): 1 person

Ms. San San Win, Deputy Director

Ministry of Forestry: 1 person

Mr. Ne Win, Office of National Environment Commission

Ministry of Science & Technology: 2 persons

Dr. Thet Htoo Han, Deputy Professor, University of Technology (Kyauk-se)

Dr. Min Zaw Aung, Acting Principal, University of Technology (Pakok ku)

Myanmar Engineering Society: 1 person

Mr. Ohn Myint, Director, Central Executive Committee (former focal point)

Myanmar Economic Corporation: 1 person

Mr. Yin Maung Nyunt, Deputy General Manager

Myanmar Engineering Society: 3 persons

Mr. Aung Myint, Joint General Secretary

ASEAN (speakers): 3 persons

Mr. Zul Azri Bin Hamidon, Expert, PTM, Malaysia

Mr. Marlon Romulo Domingo, Senior Specialist, DOE, The Philippines

Mr. Le Duc Huy, Executive Director, ECC-HCMC, Vietnam

ASEAN Center for Energy (ACE): 1 person

Ms. Maureen Cruz Balamiento, IT specialist

The Energy Conservation Center, Japan (ECCJ): 2 persons

Mr. Taichiro Kawase, General Manager, International Engineering department

Mr. Kokichi Takeda, Technical Expert, International Engineering department

(3) Presentation overview

One official of Ministry of Industry (2) chaired in accordance with the program outlined in Attach IV-2 (Agenda of Intensive Seminar - ROMEEC Major Industry Myanmar Dec. 1, 2008).

Session 1: Policy and Initiatives on EE&C in Major Industries

1) Overview of ASEAN Energy Efficiency (EE&C) Activities (Attach IV-3)

Ms. Maureen Balamiento presented an overview of activities of ACE according to the following headings:

- 2004-2009 APAEC Program
- ASEAN-Japan cooperation (SOME-METI, PROMEEC, and multilateral training)
- ASEAN Best Practice Competition (Energy Conservation Division)
- ASEAN + 3 Energy Conservation and Renewable Energy Forum
- Other programs implemented in collaboration with EAS-ECTF, UNEP, the ASEAN Foundation, ADB, and CDC.

A detailed explanation was provided in regards to the 2004-2009 APAEC Program. This program consists of six program areas. Energy conservation is addressed in the fourth program area. As a key element of the fourth program area, the process and results with respect to PROMEEC activities through Phase 1 and Phase 2 were reported An outline of how these activities unfold in Phase 3 was also presented.

(Note: These six program areas consist of the following: information sharing and networking, ASEAN energy standards and labeling, private-sector participation, capacity building, cultivation of ESCO enterprises, and transportation sector.)

2) Overview of Plans & Programme on EE&C in Myanmar (Attach IV-4)

Ms. Soe Soe Nyein of Ministry of Energy presented an overview of the latest energy conservation measures in Myanmar according to the following headings:

- Focus of energy policies
- Organizations in charge of energy sectors
- Energy conservation measures

The energy policies in Myanmar is focused on energy self-sufficiency, use of renewable energy, promotion of energy conservation, and promotion of alternative fuels for household use.

Organizations in charge of each energy sector are as follows:

- Petroleum and gas: Ministry of Energy (focal point of PROMEEC project)
- Electricity (hydro power): Ministry of Electric Power (1)
- Electricity (thermal power, power transmission): Ministry of Electric Power (2)
- Coal: Ministry of Mines
- Biomass: Ministry of Forestry, Ministry of Agriculture and Irrigation

・Renewable energy: Ministry of Science & Technology
・Nuclear power: Ministry of Science & Technology

Past energy conservation activities

・UNDP/ADB project (1991, energy audit and seminar)
・UNESCAP seminars (3 times, energy conservation)
・PROMEEC project (training, audit, seminar), currently on-going

3) Japan's Energy Conservation Policy & Measures for Industrial Sector (Attach IV-5)

ECCJ's Mr. Taichiro Kawase presented an overview of energy conservation policies in Japan and measures applicable to industrial sectors according to the following headings:

・Changes in specific energy consumption by industrial sector in Japan
・Policies and energy conservation measures in industrial sector in Japan
・Voluntary activities of the private companies and organization in industrial sector
・Roles of ECCJ and overview of its activities
・Energy saving measures and best practices at the Japanese ceramic factories

Session 2: EE&C Best Practices in Industries

(4) EE&C in Textile and Glass Industries in Malaysia

JG Containers, which first began operations in 1972, produces 150 tons per day of glass containers for food, medical, and other uses. Fuel used to melt glass accounts for 85% of energy consumption. The fuel consumption of the factory (8.0 GJ/ton), was considerably high, compared to 5.0 GJ/ton, typically in Europe and the United States. Three audits have been conducted in the past; the following measures have been implemented based on the results of these audits, such that the fuel consumption rate has declined to 5.7 GJ/ton.

・Revamp of the melting furnace (added a furnace control system)
・Revamp of the annealing oven
・Fuel conversion in the annealing oven
・Reuse of cullet cleaning water (installed a filter)

(5) EE&C in Pulp & Paper and Cement Industries in Philippines

Mr. Marlon Domingo reported energy saving measures which was identified in the energy audits for cement and pulp and paper factories carried by DOE of the Philippines. There are seventeen cement factories, ranging from small factories with an annual output of 100,000 tons to 2,000,000 tons. Most of factories employ dry process, though semi-dry processes are still used in part. Identified energy saving measures are as follows;

・Modification of semi-dry kiln into a dry kiln
・Capacity increase by adding pre-calciners
・Modification of clinker coolers
・Installation of high-efficiency fans into clinker coolers
・Installation of 5-stage NSP
・Introduction of vertical roller mill
・Introduction of VSD in place of damper control
・Fuel conversion (use of rice-husks)

Exhaust heat recovery-based power generation system are being studied as a possible energy saving measure in the future. An exhaust gas from clinker coolers or suspension pre-heaters are utilized as a source of heat recovery

With respect to pulp and paper factories, an introduction of circulating fluidized bed boilers has been facilitated in order to enable the use of inexpensive coal and /or biomasses.

(6) Best Practices in Textile and Food Industries in Viet Nam

The presenter of this topic was unable to enter Myanmar due to cancellation of the flight. An overview of the presentation materials is outlined below;

・The activities of Energy Conservation Center in Ho Chi Minh City were briefed ,including energy audits, training, and public relations.
・The 288 factories were audited between 2002 and 2007 (pulp and paper, machinery, textile, food products, etc).
・The textile industry in Vietnam accounts for 28% of aggregate production output and 15% of aggregate added value. The potential for energy saving in this industry is estimated at 30%. The result of OJT audit made as the last year's PROMEEC activity

was reported.

・The food industry in Vietnam accounts for 15% of aggregate production output and 17% of aggregate added value. The potential for energy saving in this industry is estimated at 20%. The successful case involving a beer factory were reported as an audit case.

(7) Results of OJT Audit in Mayangone Textile Factory (1) (Attach IV-6)

Ms. Ni Ni, a local team leader and factory manager, presented a report on results of energy audit conducted at Mayangone Textile Factory (1). Proposed measures focus primarily on the maintenance of aged equipment and on the energy management system. The presentation is believed to have been highly informative for the engineers of other state-run factorys in attendance at this seminar.

(8) Best Practices in Japanese Ceramic industry (Electrical Energy) (Attach IV-7)

Mr. Kokichi Takeda of ECCJ presented successful cases, in particular, electrical energy saving in Japanese textile factories:

・Reducing the capacity of solvent gas blowers and introducing high-efficiency blowers at the acetate manufacturing factory
・Reducing unloading losses from air compressors by introducing inverter machines
・Energy saving applied to ventilation systems (using outside air, incorporating an inverter control system into fans, and utilizing a humidification system)

Session 3: Energy Management Tools

(9) Updates on Technical Directory, In-house Database, Cyber Search System

Mr. Junianto M of ASEAN Energy Center (ACE) gave a briefing on the purpose of three ASEAN energy management tools—namely, technical directories, in-house databases, and the Cyber Search system—and on the method of developing these tools, as well as presented an example of how data is tinputted with respect to these tools.

(10) Trial Use of In-House Database for Textile Factory, and TPM for Equipment Maintenance (Attach IV-8)

Mr. Taichiro Kawase of ECCJ gave a briefing on in-house databases (IHDBs) used in the textile industry. IHDBs are used as energy monitoring tool inside a factory. They accumulate various kinds of information, for example, production data, energy usage data, equipment data important operation data and energy performance indicators. Beneficiaries are factory management, technical staffs, accounting staffs as well as operational personnel. The presenter asked audiences to adopt the tools not only in the Myanmar industrial sector but also ASEAN region.
In addition,

(4) Comments

1) The seminar/workshop was attended by many attendants from the public sector, while no participant from the private sector.

2) Many questions were asked, covering a broad range of topics, although most are fundamental. For example, what is the advantage of pre-grinding in the cement factory?, which process is the cheapest, chemical or mechanical in the paper factory?, what are the energy saving measures available in the truck assembly factory?, and Can Japan comply with the commitment in the Kyoto Protocol?

3) The author exchanged information with engineers from state-run factories during the break of presentations. Three of them learned in the Japanese universities, and a pro-Japanese. Their knowledge reached a necessary level enough for promoting energy conservation. The next is to put their knowledge into actual practice in the factory or missions and to accumulate as practical skills and experiences.

OJT audit at Mayangone Textile Factory (2)

Ms. Ni Ni (factory head), sixth from the left side

Mr. San Lynn (focal point), fifth from the left side

Audit of cooling tower

Mr. San Lynn (focal point), middle row, second from the left side

5. Attached documentation

IV-1. Summary of Mayangone Textile Factory (1)
IV-2. Agenda of Intensive Seminar – PROMEEC Major Industry Myanmar Dec 1, 2008
IV-3. Overview of ASEAN Energy Efficiency (EE&C) Activities
IV-4. Overview of Plans & Programme on EE&C in Myanmar
IV-5. Japan's Energy Conservation Policy & Measures for Industrial Sector
IV-6. Results of OJT Audit in Mayangone Textile Factory (1)
IV-7. Best Practices in Japanese Textile Industry (Electrical Energy)
IV-8. Trial Use of In-House Database for Textile Factory, and TPM for Equipment Maintenance

V. Summary/post workshop

1. Overview of workshop

This workshop was attended by twenty-two participants consisting of focal points from the ten ASEAN countries, ACE officials, ECCJ officials, and officials from host country the Philippines.

The year 2008 was a transient year when project phase stepped up from Phase 2 to Phase 3. In other words, this year project activities moves from technology transfer from Japan to self-help energy conservation by the ASEAN countries

From this standpoint, this year's project activities were evaluated, its achievements were shared with ASEAN countries. Further, basic policies towards Phase 3 were formulated, discussed and agreed.

In conclusion, local activities to be implemented in 2009 are proposed by each country, and forwarded to ACE till a deadline of the May the first week. Considering the proposed local activities, ECCJ and ACE make a draft implementation plan which are finalized in the inception/workshop slated to be held at the beginning of July later this year.

(1) Time and Place

Schedule: February 26 (Thu.) to 27 (Fri.), 2009

Richmonde Hotel: Ortigas Center, Pasig City, Philippines

(2) Participants:

ASEAN officials: 14 participants

Ms. Loreta G. Ayson, Undersecretary, Department of Energy, Philippines

Mr. Prasert Sinsukuprasert, Director, DEDE, MOE Thailand (Chairman)

Mr.Ahmad bin Haji Mohamad, Special Duty Officer, Energy Division, Prime Minister's Office, Brunei Darussalam

Mr. Lien Vuthy, Head of Energy Efficiency and Standard Office, MINE, Cambodia

Ms. Devi Laksmi, EC Division, Ministry of Energy and Mineral Resources (MEMR), Indonesia

Mr. Bouathep Malaykham, Director of Electric Power Management Division, Ministry of Energy and Mines

Ms. Norhasliza Mohd Mokhtar, Program Manager, PTM, Malaysia

Mr. Thaung Nyunt, General Manager, No. 1 Machine & Machine Tool Factory, MOI (2), Myanmar

Mr. Jesus C. Anunciacion, Chief Science Research Specialist, EE&C Division, DOE, Philippines

Mr. Malon Domingo, EE&C Division, Department of Energy, Philippines

Mr. Abdul Rashid B. Ibrahim, Deputy Director, Energy Market Authority, Singapore

Mr. Nguyen Van Long, Officer, Science and Technology dept., MOIT, Vietnam

2 officials, Department of Energy, Philippines Government

ACE: 5 participants

Mr. Manh Hung, Executive Director, ACE

Mr. Christopher Zamora, Manager, ACE

Mr. Ivan Ismed, Project Officer, ACE

Ms. Maureen C. Balamiento, Database and IT Specialist, ACE

Mr. Junianto M., IT Staff, ACE

ECCJ: 3 participants

Mr. Tsuzuru Nuibe, Director General

Mr. Kazuhiko Yoshida, General Manager

Mr. Yoshitaka Ushio, General Manager)

2. Activity report for 2008 and action policies for 2009

The local activity implemented in 2008 was reported by the focal point of each country. Next, ECCJ gave a briefing on action policies in 2009, which was agreed to by all participants;

(1) Countries implemented local activity

Thailand (food industry)

Indonesia (ceramics industry)

Myanmar (textile industry)

(2) Results of local activities and evaluation thereof

1) Local audit teams were well organized as planned, and great improvements were undertaken especially in energy audit and follow-up survey. Most participants made an positive effort to understand a basic process principle.

2) Seminars/workshops gathered many participants and induced active discussions, and as a result, attained the aim for dissemination of the project achievements.

Successful cases from countries other than the host country were also helpful to participants.

3) Great progress was made in the development of energy management tools. thirty-five technical items were added in the TD ,and 145 technologies were disclosed in the website of ACE. In-house databases (IHDBs) pertaining to iron/steel and ceramics sectors are currently being developed by ACE. These tools, including IHDBs previously completed for the cement, food, and textile sectors, are presently being applied on a trial basis through OJT in each country.

4) Points to be improved

- In some countries, ECCJ experts made an audit substantially. More self-help effort is required by the local team.
- Some have suggested that one-day training sessions is provided on the first day of OJT energy audit in each country.
- More participants should be invited to seminar/workshop from the same or related industries as the industry to which the audit venue belongs.
- Efficient preparation by ACE are required for more use of IHDBs and feedback on problems on its usage are important.
- In order to raise reliability, TD should receive a technical review by ASEAN experts.
- For successful cases registered in TD, consideration should be given to allow award examples to be cited.
- Accessibility should be improved to TD and IHDBs.

(3) Action policies for 2009

1) Request a proposal of local activity from each country, satisfying the following terms. Activities shall be undertaken in countries that can commit themselves to fulfilling these terms:

- Reflection of the aforementioned points to be improved.
- A Call for enhanced OJT energy audit, thorough follow-up survey, and/or well-organized seminar/workshop.
- Local audit team with reliable and workable organization
- Selection of industrial sector from the standpoint of securing sustainability and effective dissemination.
- Reliable pre-investigation preparations shall be undertaken.
- Fundamental understanding of industrial processes principles.
- Submission of basic idea of audit training program

2) Preparation of training tools for OJT and improvement activities;
- Process handbooks for major industries
- Revision of In-house databases by industry
- Improvement of technical directories

3) Skeletal framework of activities in each country:
- Countries where local activity is implemented: maximum three countries
- Duration of local activity: maximum 7 days,
- Duration of each activity;
  OJT energy audit: maximum 4 working days
  Follow-up survey: maximum 2 working days
  Seminar/workshop: 1day

3. Basic policies towards Phase 3

Presently, a draft concerning the ASEAN Plan of Action for Energy Cooperation for the next term (APAEC 2010-2015) is currently under investigation. The PROMEEC project constitutes an important set of activities in the APAEC 2010-2015 for cultivating human resources concerning energy conservation. Accordingly, assistance is increasingly important in the PROMEEC project in order to make sure implementation and dissemination of the transferred technologies. At the same time, policy measures are taken in each country to support the assistance.

Under these circumstances, Phase 3 of this project will call on concerned parties to aim at reaching a higher level of engagement in independent, constructive activities according to results achieved to date. To this end, the following basic policies have been verified and shared among participants:

1) Development of human resources
2) Provision of system and tools contributing to human resources development
3) Undertaking of measures in each ASEAN country to support the above two policies

In accordance with the above basic policies, the following four points are to be established as specific activities for sustaining and disseminating the transferred technologies:

1) Organizing a trainer group in each country
2) Elaborating a basic plan for energy audit training program in each country
3) Self-help implementation of the transferred technologies and follow-up of the results

4) Improving necessary basic tools

A basic plan was discussed and agreed to, according to the outcome of the aforementioned discussion. Generally speaking, it was acknowledged that the first priority for Phase 3 is to enhance current activities, and in order to do that, important are to identify the activities to be concentrated, to strengthen the synergy of three sub-projects ,and to set a target and apply a verification method.