Ministry of Energy and Mineral Resources
in the Republic of Indonesia

The Study for Promoting Practical Demand Side Management Program in Indonesia

Final Report

February 2012

Japan International Cooperation Agency
Electric Power Development Co., Ltd.

ILD
JR
12-020

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Abbreviations

AC	Air Conditioner
ACE	ASEAN Center for Energy
ADB	Asian Development Bank
AESIEAP	Association of the Electricity Supply Industry of East Asia and the Western Pacific
AFD	Agence Francaise de Development
AOTS	The Association for Overseas Technical Scholarship
APP	Asia-Pacific Partnership Program on Clean Development and Climate
APEC	Asia-Pacific Economic Cooperation
APEC EGEE&C	APEC Expert Group on Energy Efficiency and Conservation
APEC SCSC	APEC Sub-Committee on Standards and Conformance
APF	Annual Performance Factor
APLAC	Asia Pacific Laboratory Accreditation Cooperation
APO	Asian Productivity Organization
ASEAN	Association of Southeast Asian Nations
BAPPENAS	The State Ministry of National Development Planning/National Development Planning Agency
BAU	Business as Usual
BEE	Bureau of Energy Efficiency (India)
BNI	Bank Negara Indonesia
BPMBEI	Laboratory for Quality Testing of Export and Import Goods
BPPT	Agency for Assessment and Application of Technology
BPS	Statistics Indonesia
BRESL	Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling Project
BRI	Bank Rakyat Indonesia
BSN	National Standardization Body of Indonesia
BTU	British Thermal Unit
B4T	Quality Management System Certification Institution
CBTL	Certification Body Testing Laboratory (IECEE)
CC	Coordination Committee
CCI	Clinton Climate Initiative
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CLASP	Collaborative Labeling and Appliance Standards Programme
CNIS	China National Institute of Standardization
CO_2	Carbon Dioxide
COP	Co-efficient of Performance
C/P	Counterparts (MEMR and PLN)
CPA	CDM Programme of Activity
CSC	China Standard Certification Center
DANIDA	Danish International Development Assistance
DB	Database
DEDE	Department of Alternative Energy Development and Efficiency (Thailand)
DEN	National Energy Board
DFI	Development Financial Institution
DGEEU	Directorate General of Electricity and Energy Utilization
DOE	Department of Education
DOI	Department of Industry

DPP	Day Peak Period
DSM	Demand Side Management
EC	Energy Conservation
ECC	Energy Conservation Center
ECCJ	The Energy Conservation Center, Japan
EE	Energy Efficiency
EE＆C	Energy Efficiency Improvement & Conservation
EELP	Energy Efficiency Loan Program
EER	Energy Efficiency Ratio
EGAT	Electricity Generating Authority of Thailand
ELI	Efficient Lighting Initiative
EMI	PT. Energy Management Indonesia
ERIA	Economic Research Institute for ASEAN and East Asia
ESCO	Energy Service Company
FI	Financial Institution
GABEL	Indonesian Electronics Association
GDP	Gross Domestic Product
GEC	Global Environment Centre Foundation
GEF	Global Environment Facility
GHG	Green House Gas
GTZ	Deutsche Gesellschaft Technische Zusammenarbeit
GW	Gigawatt
HSD	High Speed Diesel Oil
ICA	International Copper Association
IDR	Indonesian Rupiah
IE	Institute of Energy (Vietnam)
IEA	International Energy Agency
IEC	International Electro Technical Commission
IECEE	IEC System for Conformity Testing to Standards for Safety of Electrical Equipment.
IIEC	International Institute for Energy Conservation
IL	Incandescent Lamp
ILAC	International Laboratory Accreditation Cooperation
IPCC	Intergovernmental Panel on Climate Change
IPEEC	International Partnership for Energy Efficiency Cooperation
IPP	Independent Power Producer
IRP	Integrated Resource Planning
ISO	International Organization for Standardization
IT	Information Technology
JASEW	Japanese Business Alliance for Smart Energy Worldwide
JATL	Japan Air Conditioning and Refrigeration Testing Laboratory
JBIC	Japan Bank for International Cooperation
JEMA	The Japan Electrical Manufacturer's Association
JEITA	Japan Electronics and Information Technology Industries Association
JET	Japan Electrical Safety & Environment Technology Laboratories
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
JRAIA	The Japan Refrigeration and Air Conditioning Industry Association
KADIN	Chamber of Commerce and Industry
KAN	National Accreditation Body
KONEBA	PT. Konservasi Energi Abadi, Indonesia

KEMCO	Korea Energy Management Corporation
KfW	Development Bank of the Federal Republic and Federal States
LED	Light Emitting Diode
LIFE	Leading Investment to Future Environment
LIPI	Indonesian Institute of Science
MEMR	Ministry of Energy and Mineral Resources
MEPS	Minimum Energy Performance Standard
METI	Ministry of Economy, Trade and Industry
MFO	Marine Fuel Oil
MOE	Ministry of Environment
MOF	Ministry of Finance
MOI	Ministry of Industry
MOIT	Ministry of Industry and Trade
MRA	Mutual Recognition Arrangement (Agreement)
MW	Megawatt
N/A	Not Applicable
NAEEEC	National Appliance and Equipment Energy Efficiency Committee (Australia)
NCB	National Certification Body (IECEE)
NCCC	National Council on Climate Change
NEA	National Environment Agency (Singapore)
NEDO	New Energy and Industrial Technology Development Organization
NPO	Non Profit Organization
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OPLT	Off Peak Load Time
OPP	Off Peak Period
PDD	Project Design Document
PF	Power Factor
PIP	Pusat Investasi Pemerintah (Government Investment Unit)
PLN	Perusahaan Listik Negara (State Electricity Company)
PLT	Peak Load Time
PLTA	Pusat Listrik Tenaga Air （Hydro Power Plant）
PLTD	Pusat Listrik Tenaga Diesel (Diesel Power Plant)
PLTG	Pusat Listrik Tenaga Gas (Gas Turbine Power Plant)
PLTGU	Pusat Listik Tenaga Gas & Uap (Combined Cycle Power Plant)
PLTP	Pusat Listrik Tenaga Panas Bumi (Geothermal Power Plant)
PLTU	Pusat Listrik Tenaga Uap (Steam Power Plant)
PMU	Project Management Unit
PNM	Permodalan Nasional Madani
POA	Programme of Activities
PP	Peak Period
PV	Photovoltaic
REI	Indonesian Association of Realtors
RGDP	Regional Gross Domestic Product

RIKEN	Rencana Induk Konservasi Energi Nasional (National Energy Conservation Plan)
RM	Ringgit Malaysia
RUKN	Rencana Umum Ketenagalistrikan Nasional (National General Electricity Plan)
RUPTL	Rencana Usaha Penyediaan Tenaga Listrik) (The Electrical Power Supply Business Plan)
SAARC	South Asia Association for Regional Cooperation
SC	Steering Committee
SEER	Seasonal Energy Efficiency Ratio
SFP	Standard Fuel Price
S/L	Standards & Labeling
SME	Small Medium Enterprises
SNI	Indonesian National Standard
SOB	State Owned Bank
TA	Technical Assistance
TDL	Tarif Dasar Listrik (Basic Tariff of Electricity)
TEPCO	Tokyo Electric Power Co., Inc.
THD	Total Harmonic Distortion
TOE	Ton of Oil Equivalent
TOR	Terms of Reference
TOU	Time of Use
TSL	Two-step Loan
TUV	Technical Inspection and Monitoring Union
TV	Television
TWG	Technical Working Group
UNDP	United Nations Development Program
UNFCCC	U.N. Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US	United States
USAID	United States Agency for International Development
USD	US Dollar
VAT	Value-added Tax
VDB	Vietnam Development Bank
WB	World Bank

Chapter 1

Introduction

Chapter 1 Introduction

1.1 Structure and Outline of Chapter 2

This report consists of four chapters, and Chapter 1 focuses on the background and outline of this study, Chapter 2 on the analysis result of present state, Chapter 3 on the proposed measures, and Chapter 4 on the estimation of effect by the introduction of proposed measures.

In this chapter the background, purpose, structure, and outline of this study are described. And at the end of this chapter main technical terms used in this report are explained.

1.2 Background of the Study

In spite of the world financial crisis, Republic of Indonesia (hereinafter to as "Indonesia"), is estimated to achieve over 8% annual energy consumption growth. Here, the stringency of the electricity supply and demand becomes a big concern.

Along with securing the energy sources, strengthening Energy Efficiency Improvement and Conservation (Hereinafter to as "EE&C") is one of the highest priorities in Indonesia.

Focusing on the electricity use, it is strongly expected to implement effective measures for the load leveling to answer the electricity supply shortage in the evening. Besides Indonesia is facing the problem of increasing governmental subsidy to balance between the electricity price and the generation cost, which exceeds the price. The annual electricity subsidy becomes 50 - 70 trillion Rp. And it is impossible for the government to afford more subsidies.

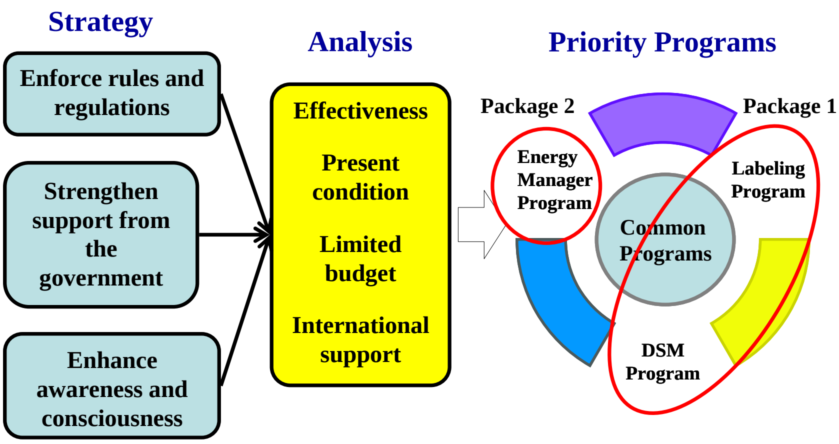
In order to realize the subsidy reduction and load leveling, the rational use of electricity in the commercial, business, and residential sectors, whose electricity consumptions are increasing rapidly, is becoming the top priority issue of the government. Under these conditions, Indonesian government asked JICA to support the promotion of a rational use on electricity. Replying the request, this study was carried out.

1.3 Purpose of the Study

This study, "The Study for Promoting Practical Demand Side Management (hereinafter to as "DSM") Program", was implemented in order to accelerate the activity for electricity conservation and peak-cut and/or -shift in Indonesia. Through the investigation on electricity consumption and present conditions for EE&C in commercial, business, and residential sectors in Indonesia, the followings were implemented.

i) To propose a functional electricity tariff system and support to establish Energy Efficiency (hereinafter to as "EE") labeling program
ii) To propose an incentive programs for promoting EE&C
iii) To estimate the effect of the introduction of the above mentioned measures

It is quite effective to implement national EE labeling program, which can contribute to reduce the electricity consumption, along with DSM program of Perusahaan Listik Negara (hereinafter to as "PLN") to improve its' financial condition. (See Figure 1.3-1) Throughout the study the Study Team made efforts to enhance the capacity of staffs of C/P[1], Ministry of Energy and Mineral Resources (hereinafter to as "MEMR") and, PLN and relevant organizations.



Source: J-POWER/JICA Report

Figure 1.3-1 Priority Programs Proposed in the Previous JICA Study

1.4 Outline of the Study

1.4.1 Structure and Concept of the Study

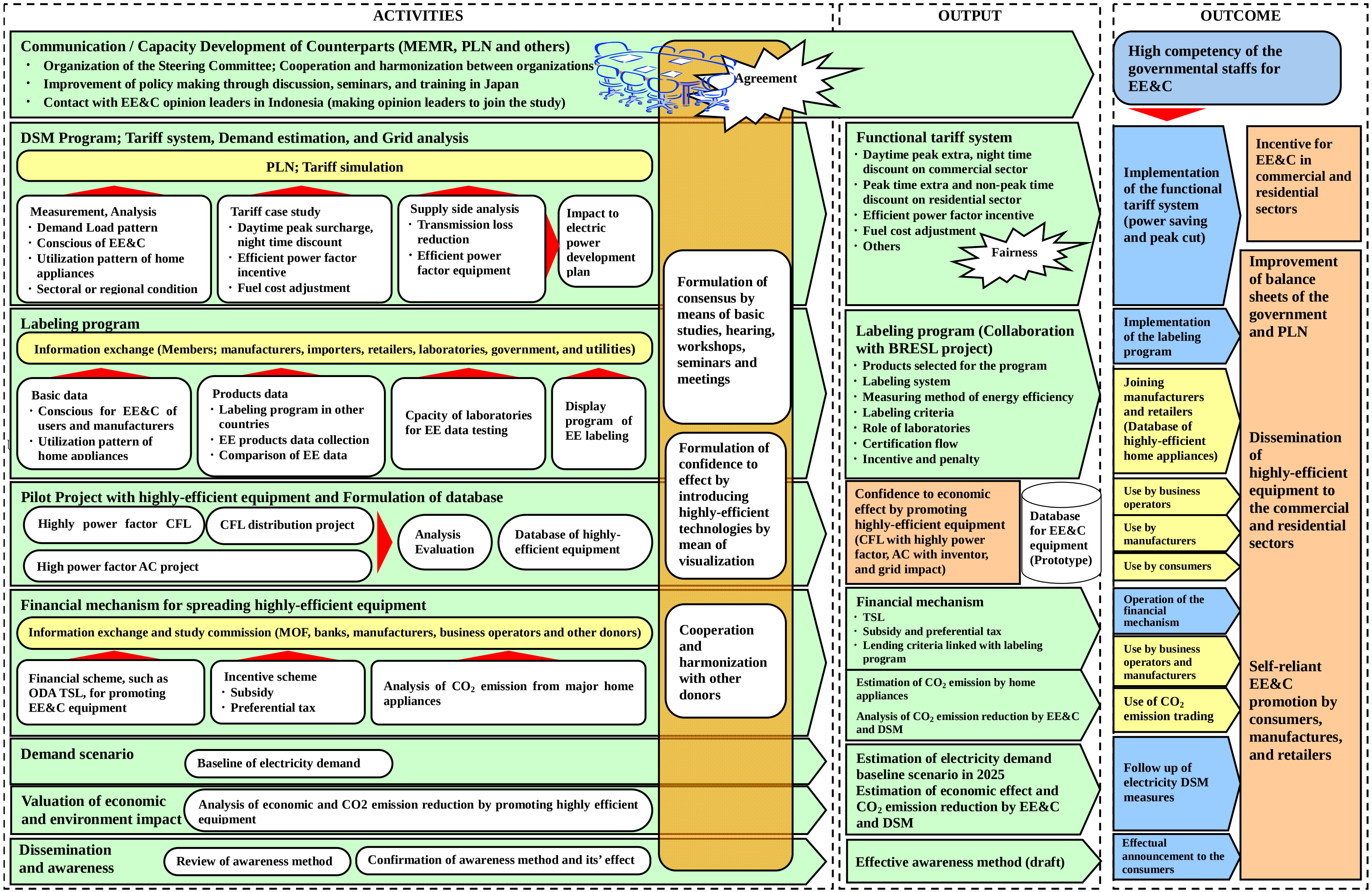
Structure of the study is shown in Figure 1.4.1-1 and Concept of the study is shown in Table 1.4.1-1.

[1] C/P means Counterparts, MEMR and PLN

- Proposal of Functional Tariff
  - Basic Study and Analysis of Present Status
    - Survey of Electricity Usage
    - Reseach of Tariff Systems in Neighboring Countries
    - Analysis of Tariff Revisions in 2010 and 2011
  - Proposal of Functional Tariff System
    - TOU Tariff System
    - Power Factor Clause
    - Tariff Adjustment System by Fuel Price Fluctuation
    - Roadmap and Action Plan
  - Analysis of Economic and CO_2 Emission Reduction Effect
- Promotion for Formulating EE Labeling Program
  - Basic Study and Analysis of Present Status
    - Research of Market and Electricity Usage
    - Electricity Consumption and CO_2 Emission of Major Home Appliances
    - Research of EE Labeling Systems in Neighboring Countries
    - Movement for Formulating EE Labeling System in Indonesia
    - Movement of International Harmonization
    - Activites of Associations in Japan
    - Assessment of Testing Laboratories' Capacity
    - Pilot Projects
  - Promotion for Formulating EE Labeling System
    - Technical Meetings on EE Labeling System
    - Draft Framework of EE Labeling Programs for Refrigerator, AC, and TV
    - Proposal of Harmonic Distortion Control
    - Establishment of EE Performance Database on Major Home Appliances
    - Loadmap and Action Plan
    - Issues for Formulating and Operating EE Labeling System
  - Analysis of Economic and CO2 Emission Reduction Effect
- Proposal of Incentive Programs for Disseminating Highly-efficent Equipment
  - Basic Study and Analysis of Present Status
    - Research of Incentive Programs in Japan and Other Countries
    - Movement for Formulating Incentive Program in Indonesia
  - Proposal of Incentive Programs
    - Incentive Scheme for Promoting Highly-efficient Appliances
    - Low Interest Loan on EE&C Investment in Commercial and Industrial Sectors
    - Preparation of Loadmap and Action Plan
    - Issues for Developing Incentive Programs
- Proposal of Dissemination, Awareness, and Others
  - Basic Study and Analysis of Present Status
    - Movement for Dissmination and Awareness of EE&C in Indonesia
    - Trainings in Japan and Seminars in Indonesia
  - Other Proposals
    - Effective EE&C Dissemination and Awareness
    - Contribution of EE&C Technologies for CO_2 Emission Reduction

Figure 1.4.1-1 Structure of the Study

Table 1.4.1-1 Concept of the Study



1.4.2 Activites and Achievements of the Study

Major activities and achievements of the study are shown in the Table 1.4.2-1.

Table 1.4.2-1 Major Activities and Achievements of the Study

Item	Major Activities and Achievements
Common	➢ 1stCC (Coordination Committee); April, 2010 ➢ 1st Workshop; April, 2010 ➢ Seminars of climate change remedies and carbon market in Indonesia University for students and in MEMR for government officers and industry participants; April, 2010 ➢ 2nd CC; July, 2010 ➢ 3rd CC; October, 2010 ➢ 4th CC; December, 2010 ➢ 2nd Workshop; February, 2011 ➢ Seminar of Brazilian experiences on EE&C, RE, and ESCO development; February, 2011 ➢ Presentation in the AESIEAP 2011 CEO Conference on i) Japan's DSM measures and ii) international activities for the reduction of CO_2 emission and key findings in the JICA DSM Study; October 2011 ➢ 3rd Workshop; November, 2011
Tariff system	➢ Analyzing the tariff revision in July 2010 and in April 2011 ➢ Introduction to and information exchange with PLN on the neighboring countries' tariff system ➢ On-site survey of electricity tariff system in five areas ➢ Proposal of and discussion on recommended tariff system plans
Labeling program	➢ Market research of home appliances ➢ Information exchange with the Jakarta Japan Club (JJC) and Japanese makers ➢ Information exchange with METI, JEMA, JRAIA, JASEW, and so on ➢ Estimation of electricity consumption and CO_2 emission on the major home appliances (refrigerators, ACs, TVs, and lightings) in the Jawa region ➢ Surveys on EE labeling program in other countries, such as Singapore/Malaysia (May, 2011) and Thailand (July, 2011) ➢ Survey on movement of the international standards for EE measurement, such as ISO and IEC ➢ Survey on testing facilities including Sucofindo, BPPT, LIPI, and BPMBEI ➢ Discussion with BRESL team, UNDP, and METI ➢ 1st Technical Meeting on the EE labeling program; December, 2010 ➢ 2nd Technical Meeting on the EE labeling program; February, 2011 ➢ 3rd Technical Meeting on the EE labeling program; July, 2011 ➢ 4th Technical Meeting on the EE labeling program; November, 2011 ➢ Preparation of prototype database for highly-efficient equipment and transfer to MEMR; November, 2011
Pilot project	➢ Preparation of CFL simulation board ➢ Implementation and analysis of the CFL field distribution pilot project ➢ Implementation and analysis of the AC field pilot project (BPPT's office and households) ➢ Problem presentation on the influence by harmonic distortion in the Power Quality Benchmark Workshop; December, 2011
Incentive program	➢ Research on international cooperation agencies' and NPOs' activities for EE&C ➢ Surveys on financial programs for promoting EE&C in other countries, such as Thailand and Malaysia; September, 2011 ➢ Confirmation of the former Indonesian experience for EE&C finance; CFL distribution program by PLN

Item	Major Activities and Achievements
	➢ Information gathering and hearing about the options of finance system for EE&C from the related organizations ➢ Hearing from PIP, Eximbank, Bank Mandiri, etc. about the interest and experiences for EE&C finance ➢ Feasibility study to formulate EE&C loan for industrial and commercial sectors ➢ Hearing of market strategies and equipment performance from Japanese and domestic suppliers of EE&C equipment ➢ Development of the EE&C equipment list
Estimation of economic, and CO_2 emission reduction effect	➢ Current state and problem of CO_2 emission factor for electricity ➢ Analysis of economic effect ➢ Analysis of estimation of CO_2 emission reduction effect
Dissemination, awareness, and others	➢ Consciousness research in Jakarta and remote islands ➢ EE&C Training in Japan for 10 high class officers; August, 2010 ➢ EE&C Training in Japan for 11 working class officers; July, 2011 ➢ Seminar on the DSM in Japan after the Great East Japan Earthquake

1.4.3 Outline of this Study Result

Points from Chapter 2 to Chapter 4 are described below.

Chapter2 Basic Survey and Present Status

2.1 Basic Survey

It is assumed that the electricity consumption of three major appliances, televisions (hereinafter to as "TV"), refrigerators, and air conditioners (hereinafter to as "AC") occupies about 50 % of the total electricity consumption in households. With the increase of living standard, the upsizing of appliances is supposed to be in advance. Besides the penetration ratio of Compact Fluorescent Lamp (hereinafter to as "CFL") is almost 100% in households, and electricity consumption by CFL is estimated over 70% of the lighting electricity consumption. And in the commercial sector, the electricity consumption of ACs is estimated to be almost 50% of the total electricity consumption in buildings. It became clear that the main target of EE&C in the commercial sector is ACs.

2.2 Electricity Tariff

Neighboring countries' tariff was investigated. Major findings are as follows.

a) Compared with neighboring countries, Indonesian tariff level is still lower.
b) Countries except Indonesia have introduced day time tariff in addition to evening time tariff.
c) The difference between peak and off-peak tariff in Indonesia is the smallest, as compared with the neighboring countries'. It is concerned that TOU tariff system does not function to promote peak-shift and -cut.
d) In some countries Power Factor[2] (hereinafter to as "PF") incentive scheme has been introduced.

The new tariff systems, which were introduced in July 2010 and April 2011 were analyzed. Especially the amended tariff, to encourage the electricity peak shift to off-peak time, in April 2011 is a

[2] Refer Section1.4.4（1）

reasonable measure taking in advance of the Study Team's proposal

2.3 Energy Efficiency Labeling Program

Market survey was conducted. And regarding the market share of home appliances, the largest share is occupied by Japanese manufacturers, the second largest share by Korean, and the third by the domestic.

The electricity consumption and CO_2 emission of lightings, TVs, ACs and refrigerators in households in the Jawa-Bali region was estimated. And it was estimated that the electricity consumption of these four appliances occupies 18.2% of the total electricity consumption in the Jawa-Bali region. If 20% reduction of these four appliances could be achieved, then 3.6% of the total electricity consumption in the Jawa-Bali region would be expected to be reduced. CO_2 emission from these four appliances is estimated to be 18.7mil t-CO_2/y.

Interview surveys were conducted for Singapore, Malaysia and Thailand, which have already introduced and operating Energy Efficiency (hereinafter to as "EE") labeling programs.. These countries are positive to collaborate with Indonesia in the operation of EE labeling program.

Besides activities for formulating the labeling program in Indonesia was summarized. Moreover the current situation on various movement for formulating an international standard of measurement methodology on energy efficiency, (harmonization of Standard and Labeling (hereinafter to as "S/L")), and Japanese organizations' movements were also summarized.

The capacity of governmental testing laboratories, which should take quite important roles in the operation of EE labeling program, was analyzed. It was pointed that there exist large issues for governmental testing laboratories, such as Indonesia Insitute of Sience (hereinafter to as "LIPI"), Quality Management System Certification Institute (hereinafter to as "B4T") and Agency for Assessment and Application of Technology (hereinafter to as "BPPT"), to secure appropriate measurement equipments, which meet the above-mentioned international standard.

2.4 Pilot Projects

CFL simulation board was assembled to visualize the in-efficiency of low PF CFL as "difference of current" for consumers, who are not familiar with technology. The field measurement for existing households was conducted. And the voltage drop at the end of power distribution network is observed quite large. Besides the field measurement test of ACs was conducted in living rooms in household and in offices. And inverter[3] technology was measured to be effective for offices, whose cooling demand is lower than ACs' capacity (i.e. non-inverter ACs repeat ON/OFF operation.). ACs in bedrooms and refrigerators in Indonesia were also found being operated in fluent ON/OFF mode, i.e. their actual demand is lower than the appliances capacity. The potential of promoting EE&C by introducing inverter technology was considered to be large for them. Moreover the penetration ratio of condensers in household, which can contribute to improve PF, is observed comparatively high. It is necessary to analyze the future risk of condenser accidents including burnt-out, caused by harmonics

[3] Refer Section 1.4.4（2）

generated from inverters, which will be spread in Indonesia soon.

2.5 Incentive Program

Japanese and the other countries' incentive programs for EE&C were investigated. Besides interview surveys were conducted for Malaysia and Thailand, which have already introduced incentive programs.. And it was confirmed that there are a lot of examples of incentive scheme for appliances, which are operated in accordance with EE labeling program. Also the activities to formulate incentive program by C/P and the other international cooperation agencies were reviewed.

2.6 Dissemination, Awareness, and Others

The movement of dissemination and awareness for EE&C in Indonesia was investigated. And it was clarified that various activities have been carried out in Indonesia. However it is also confirmed that, except CFL dissemination and promotion program, the other programs has not always led to EE&C activities of consumers.

And the Study Team conducted two seminars in Japan, and several seminars focusing on specified themes. Through these seminars, Japanese, Brazilian, and International movements for EE&C were shared with C/P.

Chapter 3 Proposal of Optimum Programs for Promoting EE&C

3.1 Baseline Scenario of Electricity Demand in 2025

The base lines of future forecast of electricity demand until 2025, which is used in the estimation in Chapter 4, were defined by the extrapolation of Rencana Usaha Penyediaan Tenaga Listrik ("Electricity Supply Business Plan", hereinafter to as "RUPTL") 2010 by PLN.

Three following major pictures are highlighted.

a) It is estimated that the electricity consumption will be 542TWh, peak load will be 94.8GW in 2025, and both are 3.7 times of 2010 across the country.
b) It is estimated that in the Jawa-Bali region electricity consumption will be 418TWh (3.6 times of 2010) and peak load will be 71.7GW (3.0 times of 2010) in 2025.
c) Electricity daily peak time of the Jawa-Bali region will be shifted from evening to daytime around 2015.

3.2 Proposals of Functional Electricity Tariff System

As a countermeasure against the increasing subsidy to electricity, C/P are intend to increase electricity tariff gradually until 2015. Besides a lot of consumers and associations are strongly opposing the tariff raise. Under these conflicts, not only one-sided tariff raise but also the tariff options to reduce the amount of raise by consumers' effort should be introduced. Incentive tariff systems for cunsumers are proposed in addition to the existing disincentives oriented tariff. In concrete terms, following measures are proposed.

a) Amendment of TOU tariff system in the Jawa-Bali region (New TOU tariff system)
   - Setting 3 time zones to mitigate the coming daily peak ; mid-night and early morning

(discount), daytime (disincentive), evening (disincentive)

- Widening the ratio of peak to off peak tariff (ranged from 2.5 to 5.0)
- Expansion of target group for B2 and R3. (Expansion to 1.7% of consumers in number, and 61.3% in electricity consumption)

b) Amendment of PF Clause across the country (New PF clause)

- Increasing standard PF from 85% to 90%, promoting loss reduction.
- Introduction of incentive clause for PF improvement; 2% discount for 1% increase
- Expansion of target groups for B2 (Expansion to 1.3% of consumers in number, and 49.5% in electricity consumption)

c) Tariff adjustment system by fuel price fluctuation

In addition to the above two measures, tariff adjustment system by fuel price fluctuation is proposed after 2015, making the fuel price fluctuation transparent to customers.

Moreover roadmap and action plan for formulating the functional tariff system were proposed.

3.3 Promotion for Formulating Energy Efficiency Labeling Program

Throughout the study term, the Study Team led and supported the activities for formulating EE labeling program. The major results and proposals are described below.

a) Draft framework of refrigerators, ACs, and TVs

The Study Team proposed to establish the Technical Meeting hosted by MEMR for formulating EE labeling program, and supported it's operation. During the study term the Technical Meetings were held four times. And the Draft Framework of refrigerators, ACs, and TVs has been summarized. Key points of Draft Framework are as follows.

- Flexible management of testing institution
- High energy efficiency of ACs with inverter[4]
- Special consideration to local manufacturers (not too high standard. i.e. In the framework of ACs, not only criteria for inverter ACs, but also that for non-inverter ACs were adopted, in consideration of domestic manufacturers, who don't produce inverter ACs.))

b) Proposal of controlling total harmonic distortion

The advantage of inverter technology for EE&C was confirmed. And the implementation will be promoted in cooperation with the enforcement of EE labeling program. On the other hand, in current situation a lot of condensers are installed in houses in Indonesia. And inverter technology produces harmonics. And in the future it is concerned that harmonics causes the burnt-out of condensers. It is not necessary to tackle Total Harmonic Distortion (hereinafter to as "THD ") immediately; however the continuous field survey and monitoring should be carried out. Replying the result of the monitoring, it is important to formulate the national guideline and/or regulation for THD like Japan. And it is needed to prepare the countermeasures in advance, because it will take a long time to settle the lots of target appliances, spread in existing households. In parallel it is effective to hold workshops and awareness events focusing on THD.

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[4] Refer Section 1.4.4（2）

c) Establishment of EE performance database

A prototype of EE performance database of refrigerators, ACs and TVs was completed and transferred to MEMR. The prototype can contribute as the basis of data accumulation and analysis.

d) Roadmap and action plan

Roadmap and action plan for implementing EE labeling program were proposed. And the issues to formulate and operate EE labeling program were summarized.

e) Others

Periodical monitoring and amendment of labeling criteria, which reflects the future improvement of appliances performance, expansion of target appliances, and continuous maintenance of EE Database are strongly recommended.

The following structure is recommended to be realized.

- Getting the participation of as much as manufacturers with not so high criteria at the beginning
- Giving manufacturers' incentive for efficiency improvement

3.4 Establishment of Incentive Scheme to Disseminate Highly-efficient Appliances

Indonesia is providing the subsidy to electricity. And the electricity price is being kept lower than the cost. This spoils the electricity consumer's incentive for EE&C and increases electricity consumption in the country. As a result, both of CO_2 emission and electricity subsidy is increasing and this is in a vicious circle.

On the other hand, in case that the incentive for EE&C is provided instead of electricity subsidy, electricity consumption is expected to be reduced and this leads to the reduction of CO_2 emission and electricity subsidy ultimately. Therefore, the incentive provision for EE&C together with the increase of electricity price is effective in Indonesia to get out of the current vicious circle.

As Incentive schemes to promote highly-efficient home appliances, the following 3 schemes are proposed.

a) Interest reduction scheme for the credit card payment
b) VAT reduction scheme
c) Rebate scheme

Moreover, as incentive schemes to promote EE&C to commercial and industrial sectors by EE&C equipment list approach based on using ODA fund, the following 2 schemes are proposed.

a) Scheme through the state-owned banks
b) Scheme through PIP

Moreover roadmap and action plan for implementing incentive program to disseminate highly-efficient appliances and equipment were proposed. And issues to be considered for formulating incentive program were also summarized.

It is recommended that firstly the low interest loan scheme for commercial and industrial sectors should be implemented. And the incentive scheme for home appliances in accordance with EE labeling program should be implemented next. It is useful to apply other countries' success cases, however reflecting the existing Indonesian financial condition, the implementation structure and timing should be clarified.

3.5 Proposal of Effective EE&C Dissemination, Awareness, and Others

As described in Chapter 2, various kinds of dissemination and awareness activity for EE&C have been implemented in Indonesia. However they have not always led to EE&C activities of customers.

Taking into account of current awareness activity for EE&C in Indonesia, success case in Sri Lanka, and electricity conservation activity in Japan after 11th March 2011, following important and effective issues are proposed.

a) Implementation of EE&C dissemination and awareness program only focusing on power leveling, tariff system for EE&C (i.e. cost saving), and electricity consuming home appliances (refrigerators, ACs, TVs and lightings.) (Synergy with government important policy)
b) Implementation of EE&C award program for priority sectors. The implementation cost of award programs is comparatively small and the award programs can lead and expand EE&C implementation in the same sectors.
c) Formulation of everybody's participating EE&C program by target setting and information dissemination with governmental leadership

Besides from the global point of view, it is suggested that the contribution of EE&C is highly effective for the reduction of CO_2 emission in future.

Chapter 4 Estimation of Economic and CO_2 Emission Reduction Effect

4.1 Analysis of Economic Effect

The estimation of economic benefits for the proposed functional tariff system (new TOU tariff system and new PF clause) are summarized in comparison with BAU in 2025 as follows;

Peak shift	3,290 – 9,869 GWh (0.6 - 1.8%of total electricity sales of Indonesia)
Reduction of electricity demand	1,145 - 3,434 GWh (0.2 - 0.6%of total electricity sales of Indonesia)
Capacity saving	3,000 - 9,000 MW (2.4 - 7.1% of supply capacity of Indonesia)

The cumulative total values until 2025 are estimated as follows;

Cost reduction and increase of revenue	40 - 220 Trillion Rp
Deferred construction cost	30 - 100 Trillion Rp

Tariff adjustment system by fuel price fluctuation plays a very important role as a safety net for PLN revenue.

The estimated economic benefits for highly-efficient home appliances are summarized in comparison with BAU in 2025 in the Java-Bali region as follows;

Reduction of electricity demand	14,100 GWh (equivalent to 900 Billion Rp) (3.4%of electricity sales in the Jawa-Bali region)
Capacity saving	2,150 MW (equivalent to 25 Trillion Rp) (2.5% of supply capacity of the Jawa-Bali region)

4.2 Analysis of CO2 Emission Reduction Effect

The estimated CO_2 emission reduction in 2025 is summarized as follows;

By new TOU tariff system and new PF clause	1 - 3 Million t- CO_2/y
By highly-efficient home appliances	Round 10 Million t- CO_2/y

1.4.4 Main Technical Terms

The main technical terms used in this chapter are as follows.

(1) Power Factor

Power Factor (PF) is defined as the ratio of the real power flowing to the load over the apparent power in the circuit and is a dimensionless number between 0 and 1. High PF means high real power ratio for the apparent power. Real power is the capacity of the circuit for performing work in a particular time. Apparent power is the product of the current and voltage of the circuit. Part of re-active power, which is not consumed in the circuit, becomes distribution loss (See Figure 1.4.4-1). Improvement of PF also contributes the reduction of distribution loss to utilities.

PF can be managed by controlling the phase difference between voltage and current. A lot of equipments have inductive characteristics, (current waveform lagging the voltage). In order to adjust the lagging (i.e. increase PF), condensers are usually being installed. Besides some equipments have capacitive characteristics (current phase leading the voltage).

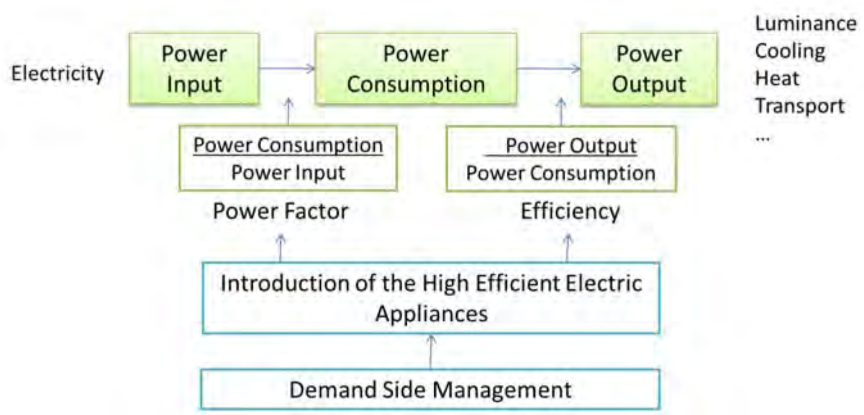
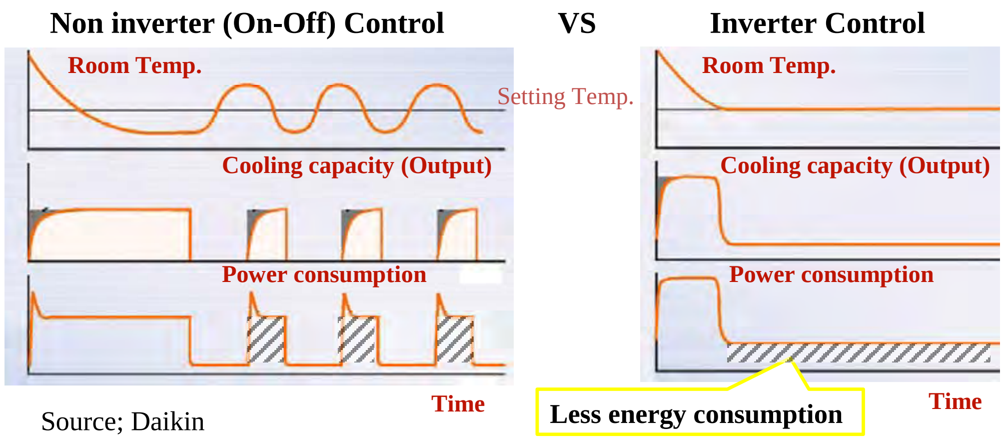


Figure 1.4.4-1 Concept of Power Factor

(2) Inverter

Inverter technology is applied to increase the efficiency of partial load operation equipment in liquid control. Especially for ACs with inverters, the efficiency of partial load operation is higher than that of 100% load operation. It means that for the cooling (or heating) demand, which is lower than the AC capacity, inverter ACs' efficiency is higher that of traditional ON/ OFF control ACs. In addition compared with traditional ON/ OFF control, inverter control can achieve an smooth operation. (See Figure 1.4.4-2) In total the electricity consumption can be saved by introducing inverter.



Source; Daikin

Figure 1.4.4-2 Concept of Inverter

(3) COP

Co-efficient of performance (hereinafter to as "COP") is a scale meaning energy efficiency. It is calculated as cooling (heating) capacity (kW) divided by input electricity (kW) (dimensionless). Higher COP means higher efficiency. In western countries Energy Efficiency Ratio (hereinafter to as "EER") is used instead of COP. COP1.0 is equals to EER3.4.

Chapter 2

Basic Survey and Analysis of Present Status

Chapter 2 Basic Survey and Analysis of Present Status

2.1 Structure and Outline of Chapter 2

In this chapter the basic information needed to create functional proposals in Chapter 3 is summarized. The current Indonesian status was investigated through the cooperation with C/P and the sub-contracts to local consultants. The outline of investigated results is described in Section 2.1 and the details are described in Section 2.2 and afterwards.

2.1.1 Basic Survey

The electricity usage of residential and commercial sectors was investigated by the sampling survey. The results are as follows. (Sub-contract to PT. Energy Management Indonesia (hereinafter to as "EMI"))

a) It is assumed that the electricity consumption of three major appliances, TVs, refrigerators and ACs, occupies about 50 % of the total electricity consumption in households. (See Figure 2.2.1-4)
b) With the increase of living standard, the upsizing of appliances is supposed to be in advance. (See Figure 2.2.1-5, -7, -8 and -9)
c) The penetration ratio of CFL is almost 100% in households, and electricity consumption by CFL is estimated over 70% of the lighting electricity consumption. (See Figure 2.2.1-6) And CFLs are supposed to be contributing to reduce the evening electricity demand. MEMR puts on the first priority to start national EE labeling program with CFL, securing its' quality. The effectiveness of the strategy focusing on CFL was clarified by this result.
d) In the commercial sector, the electricity consumption of AC is estimated to be almost 50% of the total electricity consumtion in buildings. It became clear that the main target of EE&C in the commercial sector is ACs. (See Figure 2.2.2-1)

2.1.2 Electricity Tariff

Neighboring countries' tariff was investigated. Major findings are as follows.

a) Compared with the neighboring countries, Indonesian tariff level is still lower. (See Figure 2.3.1-2, -3, and - 4)
b) Countries except Indonesia have introduced day time tariff, whose tariff level is the highest or second highest in a day. (See Figure 2.3.1-5)
c) The difference between peak and off-peak tariff in Indonesia is the smallest. And it is concerned that TOU tariff system does not function to promote peak-shift and -cut. (See Figure 2.3.1-6)
d) In some countries Power Factor[1] (hereinafter to as "PF") incentive scheme has been introduced. (See Table 2.3.1-5)

[1] Refer Section1.4.4（1）

The new tariff systems, which were introduced in July 2010 and April 2011, were analyzed. Especially the amended tariff, to encourage the electricity peak shift to off-peak time, in April 2011 is considered to be a reasonable measure taking in advance of the Study Team proposal (See Figure 2.3.3-1)

2.1.3 Energy Efficiency Labeling Program

Market survey was conducted. And regarding the market share of home appliances, the largest share is occupied by Japanese manufacturers, the second largest share by Korean, and the third by the domestic. (See Table 2.4.1-2) (Subcontract to EMI)

Measurement and questionnaire survey for main home appliances were conducted in parallel. And utilising the survey results, the electricity consumption of lightings, TVs, ACs, and refrigerators in households in the Jawa-Bali region was estimated. And the following figures are illustrated. (Subcontract to PT. Asia Carbon (hereinafter to as “Asia Carbon”))

a) The electricity consumption of these four appliances occupies 18.2% of the total Jawa-Bali consumption.(See Figure 2.4.2-5, and -6)
b) If 20% reduction of electricity consumption of these four appliances could be achieved, 3.6% of the total electricity consumption in the Jawa-Bali region would be supposed to be reduced.
c) CO_2 emission from these four appliances is estimated to be 18.7mil. t-CO_2/y. （See Table 2.4.2-7）

The following surveys and analysis were conducted.

a) The present status in the neighboring countries was investigated. Especially interview surveys were conducted for Singapore, Malaysia and Thailand, which have already introduced and are operating EE labeling programs. And the way how to decide the labeling criteria and the outline of incentive programs linked to labeling program were investigated. These countries are positive to collaborate with Indonesia in the operation of EE labeling program. (See Table 2.4.3-3, and -4)

b) Activities of relative organizations for formulating the labeling program in Indonesia were summarized. (See Table 2.4.4-1)

c) Current situation on the various movement for formulating an international standard of measurement methodology on energy efficiency, (harmonization of S/L) and Japanese organizations’ movements were also summarized. (See Section 2.4.6, and 2.4.7)

d) The capacity of governmental testing laboratories, which should take a quite important role in the operation of EE labeling program, was analyzed. It was pointed that there exist large issues for governmental testing laboratories, such as Indonesia Institute of Science (hereinafter to as “LIPI”), Quality Management System Certification Institute (hereinafter to as “B4T”) and Agency for Assessment and Application of Technology (hereinafter to as “BPPT”), to secure appropriate measurement equipments, which meet the above –mentioned international standard. (See Section 2.4.8)

2.1.4 Pilot Plojects

The results of pilot projects are described below. (Sub-contract to BPPT)

a) CFL simulation board was assembled to visualize the in-efficiency of low PF CFL as "difference of current" for consumers who are not familiar with technology. （See Section 2.5.2）
b) The field measurement for existing households was conducted. And the quite large voltage drop at the end of power distribution network was observed. （See Section 2.5.3）
c) The field measurement test of ACs was conducted in living rooms in household and in offices. And inverter[2] technology was measured to be effective for offices, whose cooling demand is lower than ACs' capacity. (i.e. non-inverter ACs repeat ON/OFF operation.) (See Figure 2.5.4-7)
d) ACs in bedrooms and refrigerators, which are spreading rapidly in Indonesia, were also found being operated in fluent ON/OFF mode, i.e. their actual demand is lower than the appliances capacity..The potential of promoting EE&C by introducing inverter technology was considered to be large for them. (See Figure2.5.4-13, -14, -15, -16, -17, and 2.5.5-5)
e) The penetration ratio of condensers in household, which can contribute to improve PF, is observed comparatively high. It is necessary to analyze the future risk of condenser accidents including burnt-out, caused by harmonics generated from inverters, which will be spread in Indonesia soon.And it is also necessary to maintain and control the quality of limiter. （See Section 2.5.6）

2.1.5 Incentive Program

Japanese and the other countries' incentive programs for EE&C were investigated. Besides interview surveys were conducted for Malaysia and Thailand, which have already introduced incentive programs. And it was confirmed that there are a lot of examples of incentive scheme for appliances, which are operated in accordance with EE labeling program. (See Section 2.6.1) Also the activities to formulate incentive program by C/P and the other international cooperation agencies were reviewed. （See Section 2.6.2）

2.1.6 Dissemination, Awareness, and Others

The movement of dissemination and awareness for EE&C in Indonesia was investigated. And it was clarified that various activities have been carried out in Indonesia. However it is also confirmed that, except CFL dissemination and promotion program, the other programs has not always led to EE&C activities of consumers. (See Section 2.7)

And the Study Team conducted two seminars in Japan (See Section 2.7.2), and several seminars focusing on specified theme. (See Section 2.7.3)Through these seminars, Japanese, Brazilian, and International movements for EE&C were shared with C/P.

[2] Refer Section 1.4.4（2）

2.2 Basic Survey

For the purpose of collecting the basic information in order to formulate EE Labeling Program for home appliances and new tariff system in residential and commercial sectors, the electricity usage survey in these sectors was conducted.

2.2.1 Survey of Electricity Consumption and Home Appliances Usage in Residential Sector

For grasping the usage of electricity consumption in the residential sector, the measurement of electricity consumption and survey of home appliances' usage were conducted.

Regarding the measurement of electricity consumption, electricity consumption for three major home appliances (TV, refrigerator, and AC) and the total in household were measured by household.

Regarding the usage of home appliances, penetration ratio for home appliances (TV, refrigerator, AC, wash machine, rice cocker, iron, well pump, CFL, Incandescent lamp, other lamps, and fan) were surveyed. Electricity consumption by appliance was estimated considering their usage condition.

(1) Survey Target and Measurement Method

1) Survey on electricity consumption and usage of home appliances in 2010

Field surveys were conducted in five regions (Jakarta, Palembang, Balikpapan, Manado, and Denpasar), for the purpose of grasping information in the whole of Indonesia. The survey targets were households in five tariff categories (R-1 (450VA), R-1 (900VA), R-1 (1,300VA), R-1 (2,200VA), and R-2 (2,200VA - 6,600VA)) of PLN's electricity contracts in the residential sector. Study regions for field surveys were shown in Figure 2.2.1-1, the number of consumers and electricity consumption by tariff category in the residential sector in Table 2.2.1-1, and the survey targets by region and tariff category in Table 2.2.1-2.

Figure 2.2.1-1 Study Regions for Field Surveys

Table 2.2.1-1 Number of Cunsumers and Electricity Consumption by Tariff Category in Residential Sector in 2009

Tariff Category (VA)		Number of Cunsumers	Annual Electricity Consumption (kWh)
R-1	450	19,273,150	18,031,667,476
R-1	900	12,431,350	17,539,486,635
R-1	1,300	3,549,520	8,428,513,736
R-1	2,200	1,257,795	5,299,135,364
R-2	>2,200, ≦6,600[3]	491,181	3,740,222,348
R-3	>6,600	95,850	1,905,063,161
Total		37,098,846	54,944,088,720

Source: PLN Electricity Sales Report in 2009

Table 2.2.1-2 Survey Targets in 2010

Tariff Category (VA)		Number of Survey Targets by Region				
		Jakarta	Palembang	Balikpapan	Manado	Denpasar
R-1	450	7	10	8	10	9
R-1	900	11	10	11	10	10
R-1	1,300	8	10	10	10	10
R-1	2,200	8	14	19	12	2
R-2	>2,200, ≦6,600	14	6	4	8	15
Total		48	50	52	50	46

Electricity Consumption and usage of home appliances by household were surveyed. Regarding the total electricity consumption in household, PLN's bills were used as the substitute for direct measurement. Electricity consumption by appliance was estimated by multiplying the rated input (W) by operating hours and operating condition, which were interviewed in this survey.

2) Survey on electricity consumption and usage of home appliances in 2011

In order to strictly grasp the electricity consumption of three major appliances (TV, refrigerator, and AC), 89 households in Jakarta and the neighboring areas (See Table 2.2.1-3) were selected as the survey targets, and the survey was conducted. Concretely, regarding the total electricity consumption in household, PLN's watt-hour meters (See Figure 2.2.1-2) were used in order to collect the data. And regarding electricity consumption of three major appliances, socket-type maters (See Figure 2.2.1-3) were installed between appliances and outlets and the electricity consumption data was collected.

[3] R2 and R3 of tariff category were slightly amended according to tariff revision in July, 2010. Tariff category, which was used when this study started, is used in this report.

Table 2.2.1-3　Survey Targets in 2011

Tariff Category (VA)		Number of Survey Targets	Effective Number of Survey Targets
R-1	450	14	10
R-1	900	21	16
R-1	1,300	47	36
R-1	2,200	27	21
R-2	>2,200, ≤6,600	6	6
Total		115	89

Figure 2.2.1-2　PLN's Watt-hour Meter (Measuring the Total Electricity Consumption)

Figure 2.2.1-3　Socket-Type Watt-hour Meter (Measuring Electricity Consumption by Appliance)

(2)　Electricity Consumption and Penetration Ratios of Three Major Appliances

1)　TV, refrigerator, and AC

The Results of the survey, which was conducted in the whole of Indonesia in 2010, were shown in Table 2.2.1-4. They show that electricity consumption of three major appliances (TV, refrigerator, and AC) occupies about 50%[4] of the total in household in every region.

Table 2.2.1-4　Comparison of Electricity Consumption of Home Appliances by Region (Survey in 2011)

No.	City (Number of Study Targets)	Electricity Consumption Rates of Home Appliances for Total in Household (%)													
		Lighting	Refrigerator	TV	AC	Wash Machine	Rice Cooker	Dispenser	Elect. Kitchen	Water Pump	Computer	Water Heater	Elect. Iron	Fan	Others
1	Jakarta (48)	13.1%	17.9%	12.3%	19.0%	2.4%	9.3%	0.6%	0.0%	12.8%	0.6%	0.2%	5.7%	5.1%	0.9%
2	Palembang (50)	18.2%	22.4%	11.5%	10.5%	3.1%	11.7%	1.9%	0.0%	3.5%	2.7%	0.1%	6.3%	6.7%	1.3%
3	Balikpapan (52)	14.8%	21.4%	15.4%	22.4%	3.1%	5.6%	2.4%	0.1%	1.4%	3.2%	0.0%	5.3%	3.9%	1.0%
4	Manado (50)	14.7%	16.4%	15.1%	19.7%	1.9%	8.0%	6.3%	0.2%	6.0%	3.1%	0.1%	5.5%	1.9%	1.1%
5	Denpasar (46)	20.0%	18.3%	9.4%	16.0%	3.5%	11.5%	2.5%	0.0%	5.3%	2.3%	1.3%	6.9%	1.9%	1.1%
All		16.1%	19.5%	13.2%	17.2%	2.8%	9.5%	2.6%	0.1%	5.6%	2.4%	0.2%	5.9%	3.9%	1.1%

[4] Estimated values from questionnaires and field survey

Following the above result, the detailed survey for three major appliances was conducted in 2011. From the results of the survey in 2011, the electricity consumption ratios of TVs, refrigerators, and ACs for the total in households by tariff category are shown in Table 2.2.1-5 and Figure 2.2.1-4.

Same as the survey result in 2010, the survey in 2011 shows that electricity consumption ratios of three major appliances for the total in household occupies 40 to 60 %.

Table 2.2.1-5 Electricity Consumption Ratios of Three Major Appliances for Total in Household by Tariff Category

Tariff Category (VA)		Total Electricity Consumption (kWh/year)	Electricity Consumption Rates of Three Major Appliances for Total in Household (%)			
			TV	Refrigerator	AC	Others
R-1	450	1989.3	14.4	21.6	0.0	64.0
R-1	900	1978.8	13.9	23.6	10.4	52.1
R-1	1,300	4535.0	7.5	15.0	34.4	43.0
R-1	2,200	6037.4	8.1	13.7	36.5	41.7
R-2	>2,200, ≤6,600	9130.2	5.0	11.5	36.7	46.8

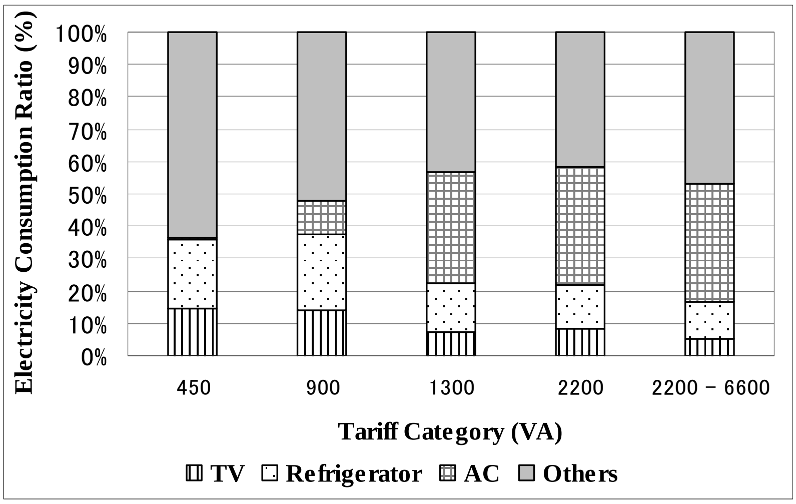


Figure 2.2.1-4 Electricity Consumption Ratios of Three Major Appliances for Total in Household by Tariff Category

Besides the penetration ratios of three major appliances are different by tariff category. Penetration ratios of them by tariff category were shown in Figure 2.2.1-5. Households with large contract demand have already owned all of three major appliances. In future, these appliances are supposed to disseminate to the households with smaller contract demand along with the improvement of living standards.

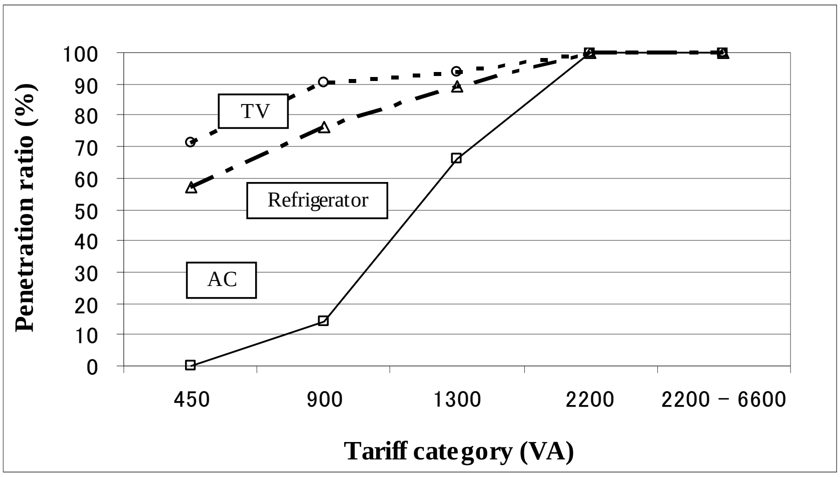


Figure 2.2.1-5 Penetration Ratios of Three Major Appliances by Tariff Category

Comparing the ratio of electricity consumption of each appliance for the total in household, which is shown in Table 2.2.1-4, the ratio of TVs, refrigerators, and ACs are 10 to 20 % respectively. Besides, that of washing machines is only 2.8 %. MEMR had been interested in formulating EE labeling program for washing machines. However, after understanding this result, MEMR lowered their priority for formulating EE labeling program for washing machines.

2) Lighting

In the survey in 2011 (See Figure 2.2.1-4), the electricity consumption ratio of lightings for the total in household is estimated to be 16.1 %. CFL, Incandescent lamp, and fluorescent lamp were mainly used for lightings.

The ratio of electricity consumption by lighting type in households in the survey in 2011 is shown in Figure 2.2.1-6. It shows that the electricity consumption of CFLs for the total occupies 76.1%, about three fourth. This is supposed to be contributing the reduction of evening peak demand. On the other hand, that of Incandescent lamps is only 10.8% and lower-than-expected. Therefore, they seem to be used for the limited purposes. MEMR puts on the first priority to start national EE labeling program with CFLs, securing its' quality. The effectiveness of the strategy focusing on CFLs was clarified by this. High penetration ratio of CFLs is assumed to have come from the EE&C promotion activities by the government and the relative associations.

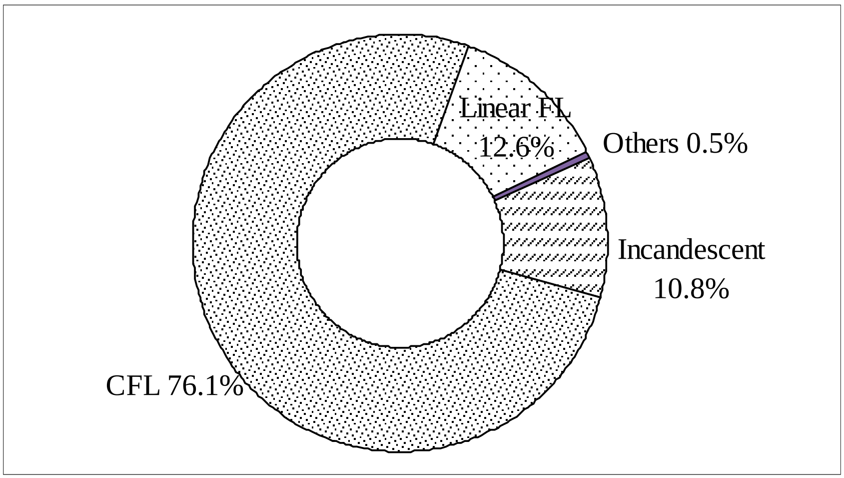


Figure 2.2.1-6 Electricity Consumption Ratio by Lighting Type in Households

3) Others

a) Rice cocker and iron

In the survey in 2010, the penetration ratios of rice cockers and irons were found to be high as 82.9% and 98.2% respectively. However, the ratios of electricity consumption of them for the total in household are less 9.5% and 5.9% respectively, as compared with three major appliances. (See Table 2.2.1-4) From the above-mentioned result, their priorities for formulating EE labeling program are considered to be low.

b) Well pump and fan

In the survey in 2010, the penetration ratio of well pumps was 63.3%. However, in future, the ratio is estimated to be decreased by the dissemination of public water supply and the increase of apartments.

Also, fans were spread in more than 65% of households. However, in future, they are supposed to be replaced by ACs. The ratios of electricity consumption of well pumps and fans for the total in household are also less as 5.6% and 3.9% respectively, compared with three major appliances. (See Table 2.2.1-4) Therefore, their priorities for formulating EE labeling program are considered to be low.

(3) Trend of Home Appliances

1) TV

In general, TVs' size is getting larger and larger. TV types, which are owned by households, by tariff category are shown in Figure 2.2.1-7. It shows the trend that households with large contract demand own large size TVs, such as LCDs or plasmas.

In future, this upsizing trend is supposed to proceed along with the improvement of living standards. And the existing CRTs will be replaced by larger LCDs. Besides the electricity consumption per unit screen size is smaller in LCDs than in CRTs. Considering these, it is supposed that the electricity consumption by TV will not increase in proportion with the upsizing of screen size. Therefore, the increasing ratio of electricity consumption is considered to be limited to a certain level by the dissemination of high efficient LCDs.

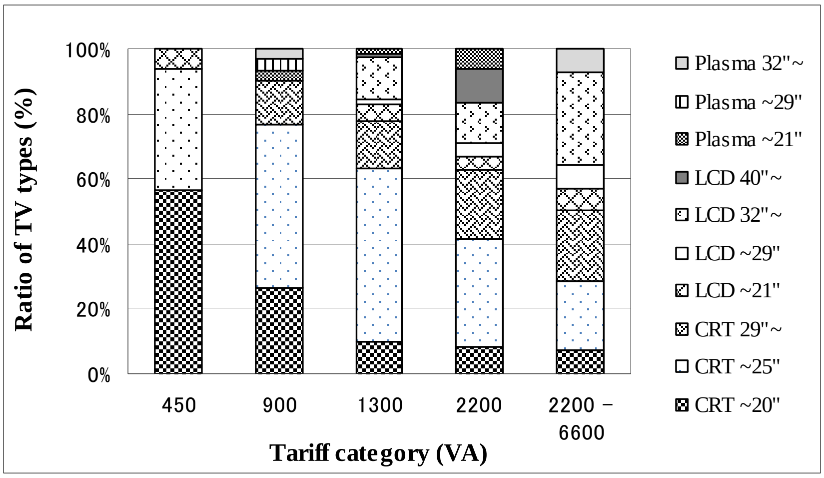


Figure 2.2.1-7 TVs Ownership by Tariff Category

2) Refrigerator

Refrigerator types, which are owned by households, by tariff category, are shown in Figure 2.2.1-8. It shows that households with large contract demand own 2-door-types. At present refrigerators of 100 liters to 150 liters are dominant in Indonesia. However it is expected that the upsizing of refrigerators and change from 1-door-type without freezer to 2-door-type with freezer are in progress, along with the improvement of living standards. On the other hand, the improvement of EE technologies on refrigerators is noticeable, and the electricity consumption of refrigerators doesn't increase in proportion with their sizes. Considering these, it is supposed that the electricity consumption by refrigerator will not increase in proportion with the upsizing. Therefore, the increasing ratio of electricity consumption is considered to be limited to a certain level, same as TVs.

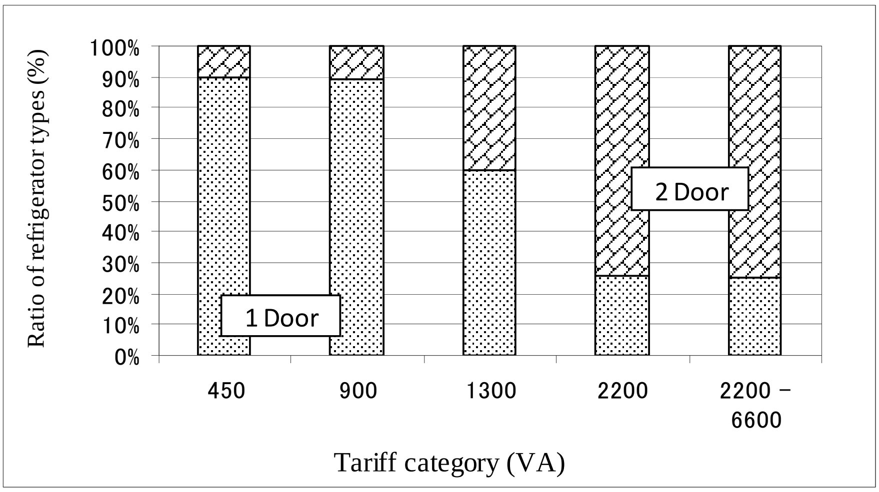


Figure 2.2.1-8 Refrigerators Ownership by Tariff Category

3) AC

Cooling capacity (HP[5]) of ACs, which were owned by households, by tariff category is shown in Figure 2.2.1-9. Households with 450 VA contract didn't have ACs. Households with 900 VA contract had 1/2 HP or 3/4 HP of ACs and households with more than 1300 VA owned 1 HP or 1.5 HP of ACs.

Trend of ACs by ownership, which was surveyed by EMI for households in Jakarta, is shown in Figure 2.2.1-10. It shows that dissemination of ACs is proceeding rapidly in one year.

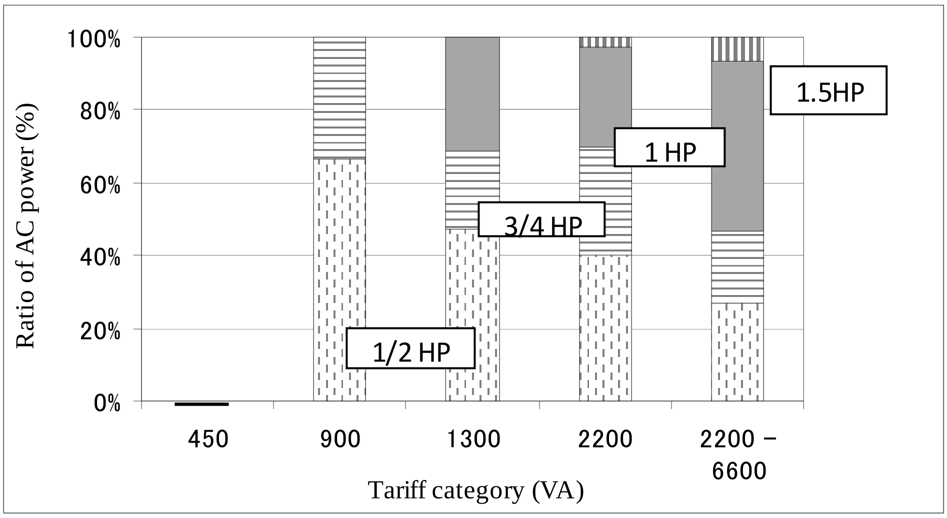


Figure 2.2.1-9 ACs Ownership by Tariff Category

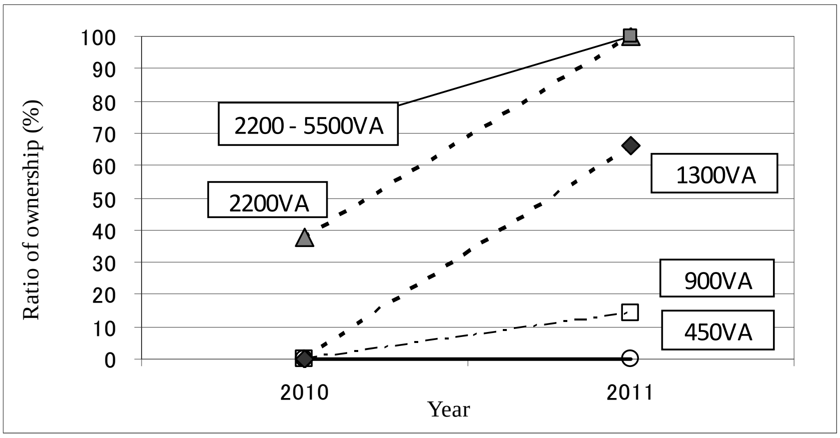


Figure 2.2.1-10 Trend of ACs Ownership from 2010 to 2011

2.2.2 Survey of Electricity Consumption in Commercial Sector

For grasping the usage of electricity consumption for commercial buildings, the field surveys were conducted in Jakarta and neighboring areas in 2010. Survey targets are offices, shopping centers, hotels, and hospitals of tariff category B2, B3, and P2. And 42 facilities were selected as survey

[5] AC's capacity is explained in HP (air conditioning HP). AC 1HP is equivalent to 2.5-2.8kW cooling capacity. It is different from motor 1HP (=0.75kW)

targets. The Number of consumers and electricity consumption by tariff category in Indonesian commercial sector were shown in Table 2.2.2-1. Survey targets by tariff category and building purpose were shown in Table 2.2.2-2. Survey items are electricity consumption and usage situation of equipment. Electricity consumption of equipment was estimated by multiplying the rated input (W) by operating hours and operating condition, which were collected by interviews in the filed surveys.

Table 2.2.2-1 Number of Consumers and Electricity Consumption by Tariff Category in Commercial Sector in 2009

Tariff Category (VA)			Number of Consumers	Annul Electricity Consumption (kWh)
Business	B-1	450VA	342,346	292,089,831
	B-1	900VA	335,661	548,381,172
	B-1	1,300VA	313,358	744,427,178
	B-1	2,200VA	301,343	1,104,238,719
	B-2	>2,200, ≦200kVA	467,510	10,142,817,091
	B-3	>200kVA	4,137	10,436,706,722
Public	P-2	>200kVA	981	1,128,975,481
Total			1,764,355	23,268,660,714

Source: PLN Electricity Sales Report in 2009

Table 2.2.2-2 Survey Targets in 2010

Tariff Category	Purpose of Buildings	Number of Buildings
B2 (>2200VA, ≦200kVA)	Private Office	8
	Shopping Center	3
B3 (>200kVA)	Private Office	5
	Hotel	10
	Hospital	4
	Shopping Center	9
P2 (>200kVA)	Public Building	3
Total		42

The results of the survey of electricity consumption are followings

The purpose of electricity use in surveyed buildings is shown in Figure 2.2.2-1. ACs occupy the biggest part, about 50% of electricity consumption. It is obvious that ACs are the main targets for EE&C promotion in the commercial sector. Besides the ratio of electricity consumption of ACs for the total in building is around 30% in Japan. (Cooling and heating demand)

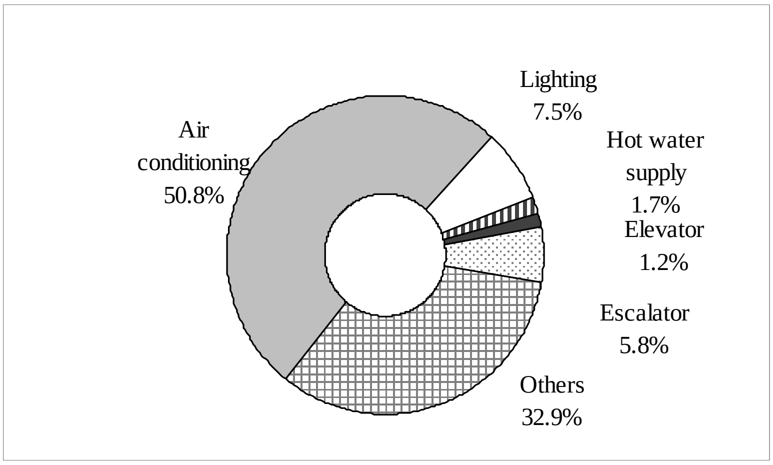


Figure 2.2.2-1 Purpose of Electricity Use in Surveyed Buildings

(1) AC

The temperature setting in the surveyed buildings was comparative low to feel cool.

The ratios of electricity consumption by AC system for the total AC electricity consumption were shown in Figure 2.2.2-2. It is said that in Indonesia, room ACs are mainly installed in buildings. However, from the results of the survey, packaged ACs occupy 52.6%, and central ACs (chiller system) 31.5%. Besides room ACs occupy only 15.5%.

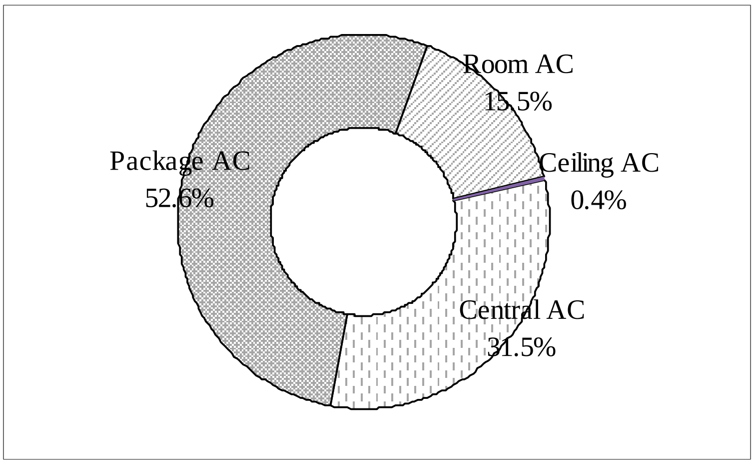


Figure 2.2.2-2 AC System in Surveyed Buildings

(2) Lighting

The ratio of electricity consumption by lighting fixture type for the total lighting electricity consumption is shown in Figure 2.2.2-3. Linear fluorescent lamps occupy about 50%. Incandescent lamps and CFL occupy less than 10% respectively.

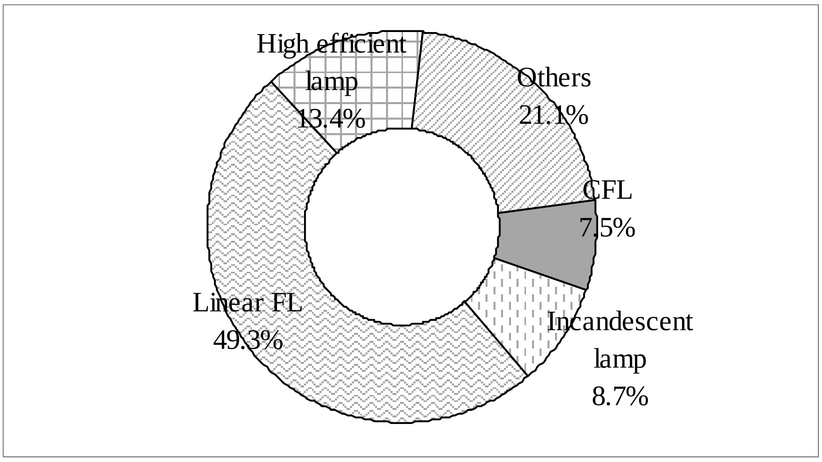


Figure 2.2.2-3 Lighting Fixtures in Surveyed Buildings

2.3 Tariff System

2.3.1 Introduction of Tariff System in Neighboring Countries and Comparison with Indonesian Tariff System

(1) Comparison of Economic Indicator with Neighboring Countries

Before referring the neighboring countries' tariff system, the economic indicators of six countries (Indonesia, Malaysia, Philippine, Sri Lanka, Thailand, and Vietnam) are compared. Table 2.3.1-1 shows the basic information of these countries. Indonesia shows the highest population, land area, and GDP. As for GDP per capita (indicator of comparative economic power), Malaysia and Thailand show the largest values and Indonesia shows about 1,000USD, same as Philippines and Sri Lanka.

Table 2.3.1-1 Basic Information of Neighboring Asian Countries（2009）

Country	Population (Million)	Area (km^2)	GDP (Billion USD)	GDP/Capita (USD)
Indonesia	229.965	1,904,596	258.494	1,124
Malaysia	27.468	329,847	137.13	4,992
Philippines	91.983	300,000	111.737	1,215
Sri Lanka	20.303	65,607	25.025	1,233
Thailand	67.764	513,115	173.92	2,567
Vietnam	87.28	331,689	58.841	674

Source: IEA Energy Balance 2011, GDP; year2000 base

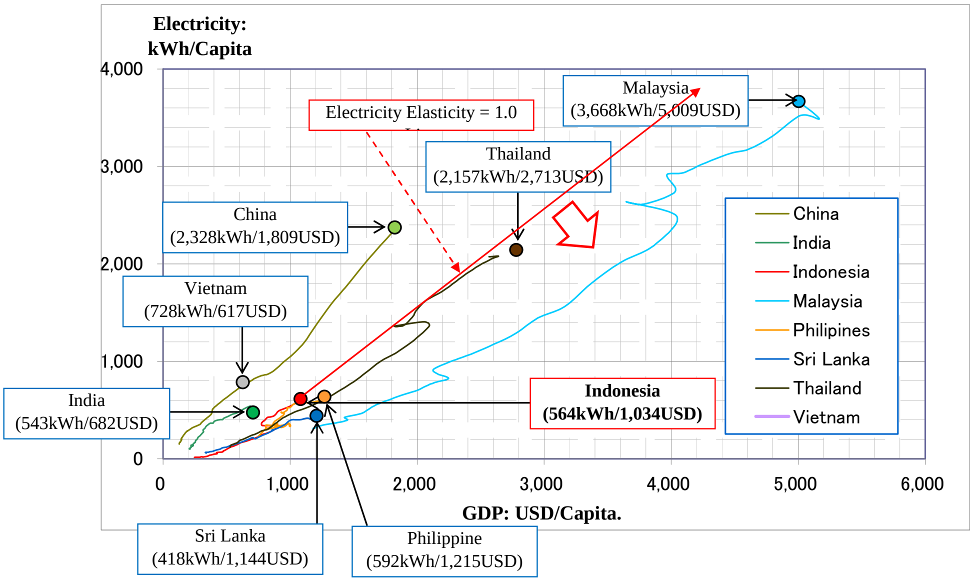
Table 2.3.1-2 shows the energy related information of compared countries. Energy and electricity consumption per capita are comparatively high in Malaysia and Thailand. It is indispensible to increase GDP and energy consumption for improving people's living standard. The issue is how to harmonize EE&C and GDP increase.

Table 2.3.1-2 Basic Energy Information of Neighboring Asian Countries (2009)

Country	Total Primary Energy Supply	Electricity Consumption	TPE/GDP	TPE/Capita	Electricity Consumption /GDP	Electricity Consumption /Capita
	Mtoe	TWh	Toe/1,000USD	Toe/Capita	kWh/ USD	kWh/Capita
Indonesia	201.999	140.111	0.78	0.88	0.54	609
Malaysia	66.826	100.996	0.49	2.43	0.74	3,677
Philippine	38.842	54.422	0.35	0.42	0.49	592
Sri Lanka	9.281	8.443	0.37	0.46	0.34	416
Thailand	103.316	140.492	0.59	1.52	0.81	2,073
Vietnam	64.048	78.934	1.09	0.73	1.34	904

Source: IEA Energy Balance 2011, Toe; Ton of oil equivalent, GDP; year 2000 base

Figure 2.3.1-1 shows the trend of GDP per capita and electricity consumption per capita from 1971 to 2009. Indonesia's elasticity of electricity consumption per GDP is in the same range with Philippines and Sri Lanka and smaller than China, Vietnam, and India. The red line shows the future trend in case of 1.0 electricity elasticity value to GDP. To realize the same electricity elasticity as Malaysia, further improvement in electricity use is needed in Indonesia. (GDP: year 2000 value)



Source: Products of the Study Team based on IEA Energy Balance 2011

Figure 2.3.1-1 Trend of GDP/Capita and Electricity/GDP Elasticity

In order to propose functional tariff system for Indonesia, corresponding tariff systems in Asian countries are surveyed. To convert each country currency to Indonesian Rupiah (Rp), the currency exchange rate of each country, shown in Table 2.3.1-3, is applied. (Rp value for one unit of each country's currency)

Table 2.3.1-3 Currency Exchange Rate (August 10th 2010)

Country	Currency	Rate (Rp)	Country	Currency	Rate (Rp)
Malaysia	RM	2,836	Indonesia	Rp	1
Philippine	Peso	199	Thailand	Baht	279
Sri Lanka	LKR	79.6	Vietnam	Don	0.468

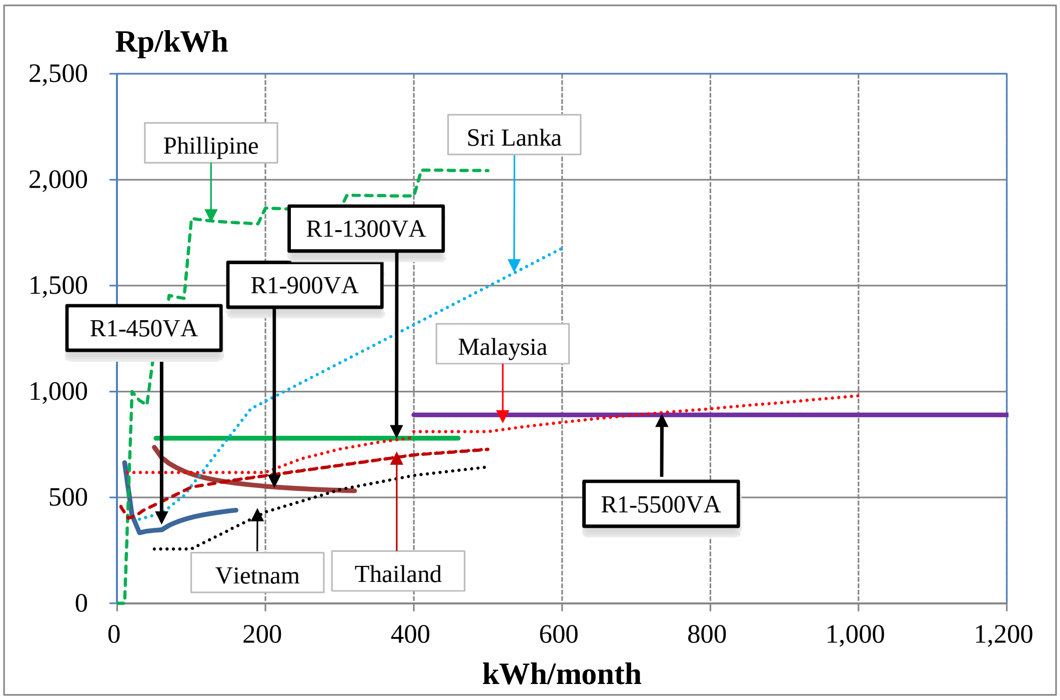
Source: Bloomberg.co.jp

(2) Tariff Comparison by Sector

1) Residential sector

Figure 2.3.1-2 shows the international comparison of residential tariff. These could be classified into two groups, the progressive tariffs in Philippine and Sri Lanka and the stable low tariffs in Malaysia, Indonesia, Thailand, and Vietnam.

Sri Lanka and Philippine supply electricity to low-income and/or low consumption consumers at free or low price. But the tariff for medium and high consumers is significantly high. The other four countries with low tariff eventually produce oil, gas, and/or coal.

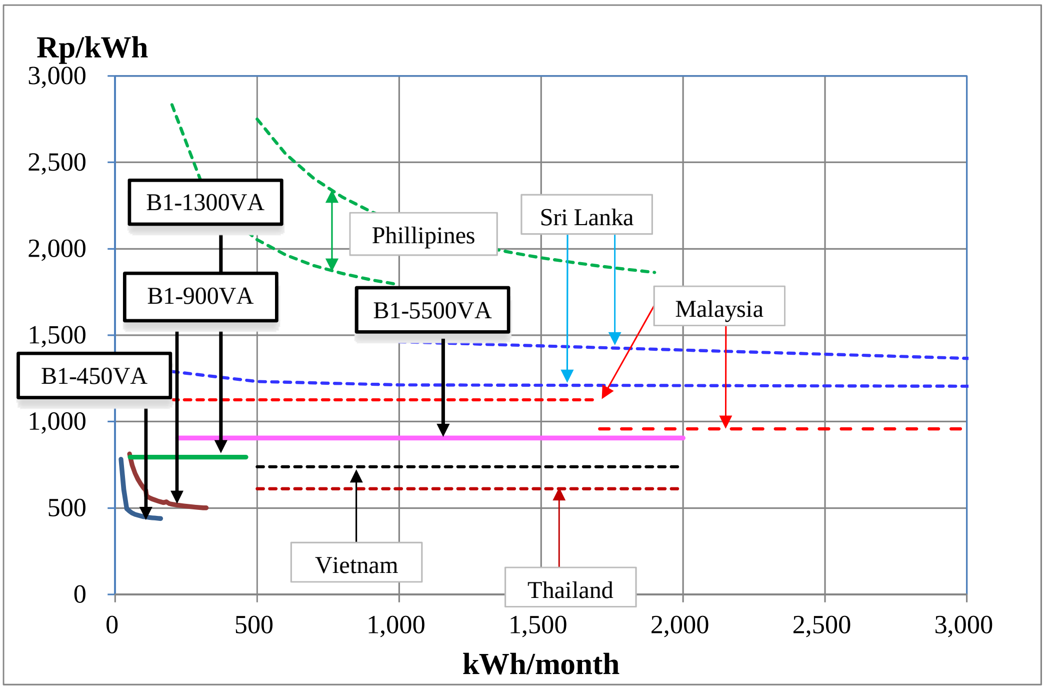


Source: Products of the Study Team based on tariff tables of each country

Figure 2.3.1-2 International Comparison of Residential Tariff

2) Commercial sector

Figure 2.3.1-3 shows the international comparison of commercial tariff. The tariffs of Philippines and Sri Lanka are comparatively high. The tariffs of Malaysia, Thailand, and Vietnam are almost constant, because of the low basic charge. The tariff of Indonesia, Vietnam, and Thailand is comparatively low.

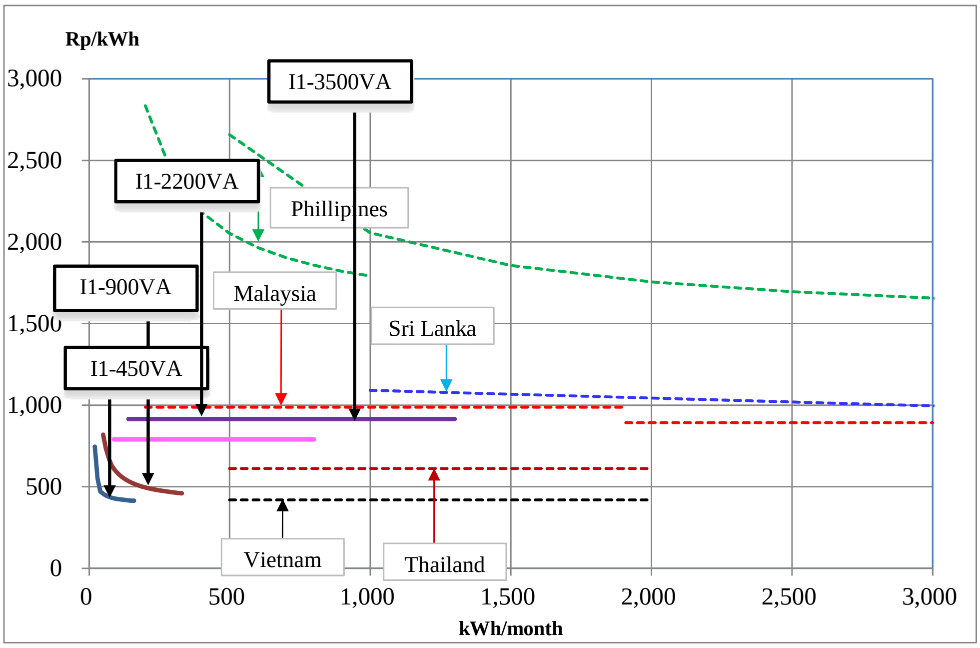


Source: Products of the Study Team based on tariff tables of each country

Figure 2.3.1-3 International Comparison of Commercial Tariff

3) Industrial sector

Figure 2.3.1-4 shows the international comparison of industrial tariff. The tariff of Philippines is high, same as the other sectors. In order to promote the activities in industry, the tariffs for industrial sectors in Sri Lanka and Vietnam are set at lower price than those for residential and commercial sectors.



Source: Study Team formulated based on tariff tables of each country

Figure 2.3.1-4 International Comparison of Industrial Tariff

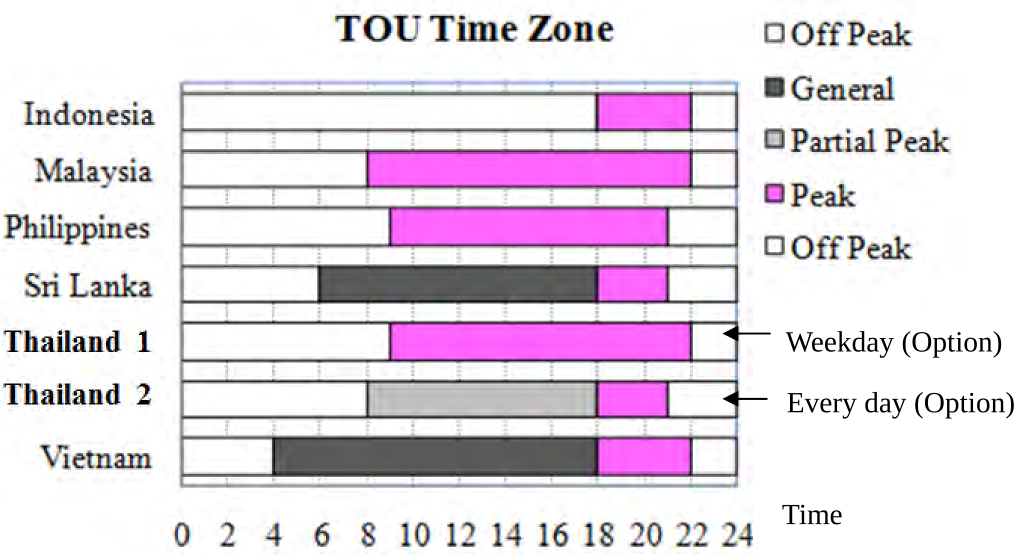
(2) TOU (Time of Use) Tariff System

Table 2.3.1-4 and Figure 2.3.1-5 show the outline of TOU tariff system for the surveyed countries. All six countries adopt TOU tariff system, mainly to commercial and industrial sectors. Sri Lanka applies it to only the industrial sector and Philippines also applies it to the residential sector. All countries except Indonesia set daytime (around 8:00 until 18:00) tariff higher than midnight/early morning (around 22:00 until 8:00) to promote peak-shift. Instead of two time zones of peak and off-peak, Sri Lanka and Vietnam adopt three time zones by adding a daytime zone.

Table 2.3.1-4 International Comparison of Time Zone for TOU Tariff System

Country	Sector	Category	Peak	Off-Peak	Day
Malaysia	Commercial Industrial	Medium (6.6~66kV) & High Voltage (>66kV)	8:00 – 22:00	22:00 – 8:00	-
Philippines	Commercial Industrial	12-month Average peak demand of at least 750kW	8:00 – 21:00	21:00 – 8:00	-
Sri Lanka	Industrial	230/400V, 11/33/132kV	18:30 – 21:30 18:30 – 22:30	21:30 – 18:30 22:30 – 4:30	- 4:30 – 18:30
Indonesia	Commercial Industrial	>200kVA 14 – 200kVA, >200kVA	18:00 – 22:00	22:00 – 18:00	-
Thailand	Residential Commercial Industrial	All	9:00 – 22:00	2:200 – 9:00	-
Vietnam	Commercial Industrial	All	18:00 – 22:00	22:00 – 4:00	4:00 – 8:00

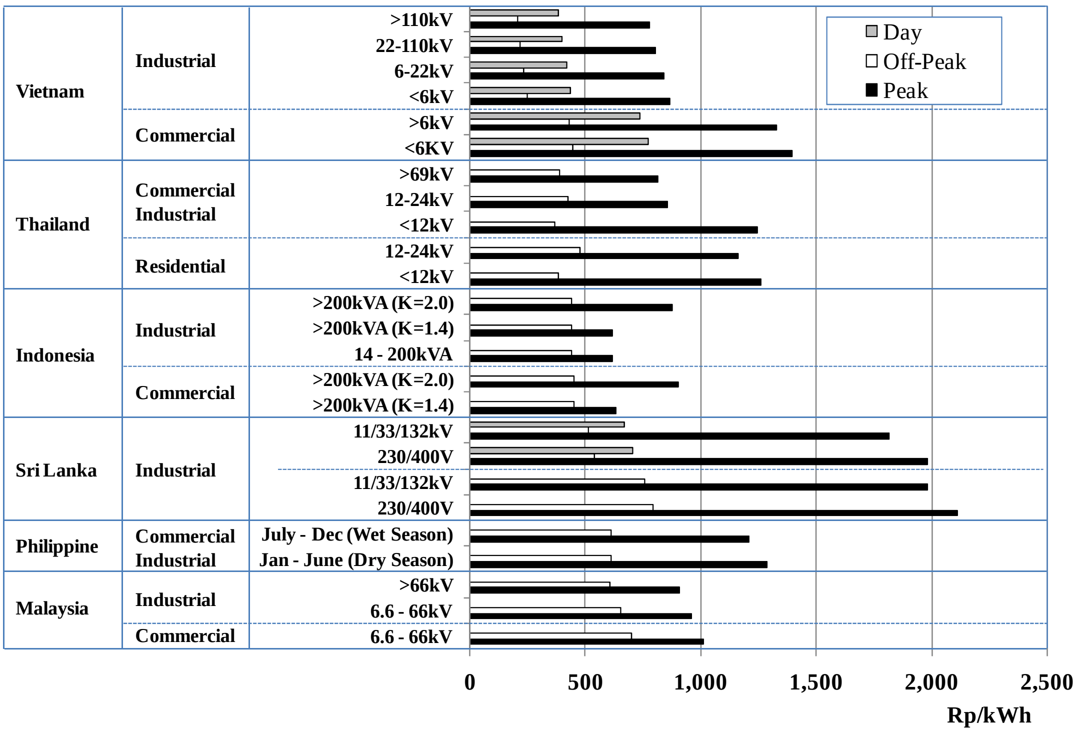
Source: Products of the Study Team based on tariff tables of each country



Source: Products of the Study Team based on tariff tables of each country

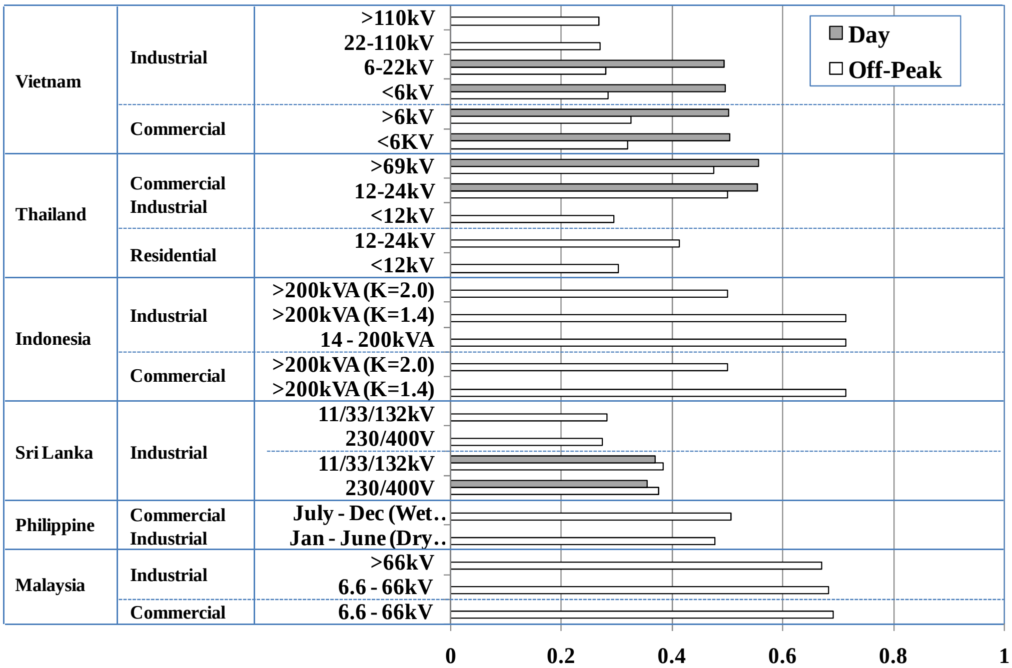
Figure 2.3.1-5 TOU Time Zone by Country

Figure 2.3.1-6 shows the international comparison of TOU tariff in Indonesian Rp. Figure 2.3.1-7 shows the tariff ratios of off peak/day peak to peak. Indonesian ratio of off peak to peak ranges from 0.5 (K value = 2.0) to 0.714 (K value = 1.4). In other words, the difference between peak and off peak is small, and it is concerned that TOU tariff system does not function to promote peak-shift and -cut. The ratio of off peak to peak is about 0.3 in Vietnam, Thailand, and Sri Lanka. (K value = about 3.0)



Source: Products of the Study Team based on tariff tables of each country

Figure 2.3.1-6 International Comparison of TOU Tariff



Source: Products of the Study Team based on tariff tables of each country

Figure 2.3.1-7 TOU Tariff Ratios of Off Peak/Day Peak to Evening Peak

3) PF[6] Clause in Tariff System

Table 2.3.1-5 shows PF clauses in Malaysia, Philippines, and Indonesia. Three countries out of the surveyed six countries have PF clauses. Only Philippines adopts incentive PF clause.

Table 2.3.1-5 Power Factor Clause in Tariff System

Country	Category	PF Value	Incentive and Disincentive
Malaysia	High Voltage	Minimum PF = 0.90	
		0.90 – 0.80	1.5% Surcharge / 0.01 PF
		< 0.80	3.0% Surcharge / 0.01 PF
	Others	Minimum PF = 0.85	
		0.85 – 0.75	1.5% Surcharge / 0.01 PF
		< 0.75	3.0% Surcharge / 0.01 PF
Philippine	Industrial	Minimum PF = 0.85	
		< 0.85	6% Surcharge / 0.01 PF
		> 0.85	3% Discount / 0.01 PF
Indonesia	S-3/B-3/I-2~4/P-2	Minimum PF = 0.85	
		< 0.85	507~693Rp/kVArh

Source: Products of the Study Team based on tariff tables of each country

2.3.2 Analisis of PLN's Tariff Revision

As of July 1st, 2010, amended electricity tariff (hereinafter to as "TDL") was issued by the ministerial order. The previous revision was implemented in 2003. The revision contents on residential, business,

6 Refer Section 1.4.4 (1)

and industrial sectors are described in the followings.

(1) Residential Sector

Table 2.3.2-1 shows the contents of tariff revision in the residential sector. Tariff for 450VA and 900VA categories has not been revised. For the tariff of above 1,300 VA categories, the demand charge was abolished and the minimum claimed charge was introduced.

Table 2.3.2-1 Tariff Revision in Residential Sector

Tariff Category (VA)		Revision	Demand Charge	Min. Claimed Charge	Energy Charge					
			Rp./kVA/M	Rp/M	Rp/kWh					
					Block 1		Block 2		Block 3	
R-1/LV	450	Before / After	11,000	-	0 ~ 30 kWh	169	30 ~ 60 kWh	360	>60 kWh	495
R-1/LV	900	Before / After	20,000	-	0 ~ 20 kWh	275	20 ~ 60 kWh	445	>60 kWh	495
R-1/LV	1,300	Before	30,100	-	0 ~ 20	385	20 ~ 60	445	>60	495
		After	0	41,080 (*1)	790					
R-1/LV	2,200	Before	30,200	-	0 ~ 20 kWh	390	20 ~ 60 kWh	445	>60 kWh	495
		After	0	69,960 (*2)	795					
R-2/LV	3,500	Before	30,400	-	560					
		After	0	124,600 (*3)	890					
	5,500	Before	30,400	-	560					
		After	0	195,800 (*3)	890					
R-3/LV	>6,600	Before	34,260	-	621					
		After	0	234,960 (*4)	Block 1	H1×890 (*5)	Block 2	H2×1,380 (*5)		

*1:= 40 (hours)×1.3 (kVA)×790 (Rp/kWh)
*2:= 40 (hours)×2.2 (kVA)×795 (Rp/kWh)
*3:= 40 (hours)×(3.5-5.5kVA)×890 (Rp/kWh)
*4:= 40 (hours)×6.6 (kVA)×890
*5:=

$$H1 = \frac{(Full - load\ equivalent\ operating\ hours : hours)}{(National\ average\ full - load\ equivalent\ operating\ hours : 116 hour)} \times 100 \times (monthly\ consumption : kWh)$$

$$H2 = (monthly\ consumption : kWh) - H1$$

Source: TDL revision on July 1st, 2010

(2) Commercial Sector

Table 2.3.2-2 shows the contents of tariff revision in the commercial sector. Tariff for 450VA and 900VA categories has not been revised. For the tariff above 1,300 VA categories, the demand charge was abolished and the minimum claimed charge was introduced. The target of TOU tariff remains for B2 and B3 categories. And PF disincentive for B-3 category (penalty tariff for re-active power) was raised 47% from 616Rp/kVArh to 905Rp/kVarh. Average PF for B3 category has not calculated by PLN, however consumers with PF below 0.85 are paying penalty[7].

Table 2.3.2-2 Tariff Revision in Commercial Sector

Tariff Category (VA)		Revision	Demand Charge	Min. Claimed Charge	Energy Charge			
			Rp./kVA/M	Rp/M	Rp/kWh			
					Block 1		Block 2	
B-1/LV	450	Before	23,500	-	0 ~ 30kWh	254	>30kWh	420
		After						
B-1/LV	900	Before	26,500	-	0 ~ 108kWh	420	>108kWh	465
		After						
B-1/LV	1,300	Before	28,200	-	0 ~ 146kWh	470	>146kWh	473
		After	0	41,340(*1)	795			
B-1/LV	2,200	Before	29,200	-	0 ~ 264	480	>264	518
	2,200	After	0	79,640 (*2)	905			
	5,500			199,100 (*2)				
B-2/LV	2,200 ~ 200,000	Before	30,000	-	0 ~ 100hours	520	>100hours	545
	6,600	After	0	237,600 (*3)	Block 1	H1× 900 (*5)	Block 2	H2× 1380 (*5)
	200,000			7,200,000 (*3)				
B-3 /MV	> 200,000	Before	28,400	-	Block PP	K×452	Block OPP	452
		After	0	6,400,000 (*4)	Block 1	K×800	Block 2	800
		Before	-	-	Minimum Average PF	0.85	kVArh	616
		After						905

*1:= 40 (hours)×1.3 (kVA)×790 (Rp/kWh)
*2:= 40 (hours)×(2.2~5.5kVA)×905 (Rp/kWh)
*3:= 40 (hours)×(6.6~200kVA)×900 (Rp/kWh)
*4:= 40 (hours)×200 (kVA)×800 (Rp/kWh)
*5:=

$$H1 = \frac{(Full-load\ equivalent\ operating\ hours : hours)}{(National\ average\ full-load\ equivalent\ operating\ hours : 133\,hour)} \times 100 \times (monthly\ consumption :\ kWh)$$

$$H2 = (monthly\ consumption : kWh) - H1$$

K; Disincentive factor for peak hours

Source: TDL revision on July 1st, 2010

(3) Industrial Sector

Table 2.3.2-3 shows the contents of tariff revision in the industrial sector. Tariff for 450VA and 900VA categories have not been revised. For the tariff of above 1,300 VA categories, the demand charge has been abolished and the minimum claimed charge has been introduced. And PF disincentive of I-2/3/4 category has been raised. The target of TOU tariff remains for I2-I4 categories. And PF disincentive for I2-I4categories (penalty tariff for re-active power) was raised 6-26%. Average PF for I2-I4 categories is has not calculated by PLN, however

7 Source; Hearing from PLN in September 2011. The PF was ranged from 0.5 to 1.0 in the field survey conducted by Indomas Mulia in 2010.

consumers with PF below 0.85 are paying penalty[8].

Table 2.3.2-3 Tariff Revision in Industrial Sector

Tariff Category (VA)		Revision	Demand Charge	Min. Claimed Charge	Energy Charge			
			Rp./kVA/M	Rp/M	Rp/kWh			
					Block 1		Block 2	
I-1/LV	450	Before	26,000	-	0 ~ 30kWh	160	>30kWh	395
		After						
I-1/LV	900	Before	31,500	-	0 ~ 72kWh	315	>72kWh	405
		After						
I-1/LV	1,300	Before	31,800	-	0 ~104kWh	450	>104kWh	460
		After	0	39,780(*1)	765			
I-1/LV	2,200	Before	32,000	-	0 ~ 196	455	>196	460
		After	0	69,520(*2)	790			
I-1/LV	3,500 ~14,000	Before	32,200	-	0 ~ 80hours	455	>80hours	460
	3,500	After	0	128,100(*3)	915			
	14,000			512,400(*3)				
I-2/LV	>14,000 ~200,000	Before	32,500	-	Block PP	K×440	Block OPP	440
	14,000	After	0	448,000(*4)		K×800		800
	200,000			6,400,000(*4)				
	>14,000 ~200,000	Before	-	-	Minimum Average PF	0.85	kVArh	693
		After						875
I-3/MV	>200,000	Before	29,500	-	0 ~350hours Block PP	K×439	>350hours Block PP	439
							Block OPP	
		After	0	5,440,000(*5)	Block PP	K×680	Block OPP	680
		Before	-	-	Minimum Average PF	0.85	kVArh	693
		After						735
I-4/HV	>30,000,000	Before	27,000	-	434			
		After	0	726,000,000(*6)	Block PP	K×605	Block OPP	605
		Before	-	-	Minimum Average PF	0.85	kVArh	507
		After						605

*1:= 40 (hours) × 1.3 (kVA) × 765 (Rp/kWh)
*2:= 40 (hours) × 2.2 (kVA) × 790 (Rp/kWh)
*3:= 40 (hours) × (3.5~14kVA) × 915 (Rp/kWh)
*4:= 40 (hours) × (14~200kVA) × 800 (Rp/kWh)
*5:= 40 (hours) × 200 (kVA) × 680 (Rp/kWh)
*6:= 40 (hours) × 30,000 (kVA) ×605 (Rp/kWh)

K; Disincentive factor for peak hours

Source: TDL revision on July 1st, 2010

(4) Introduction of Pre-paid System

This tariff revision introduced pre-paid system to make the bill collection easier and promote electricity conservation. Currently (July 2011) about 2 million customers, mainly in the residential sector, utilize this pre-paid system. And the number of pre-paid customers is

8 Source; Hearing from PLN in September 2011. The PF was ranged from 0.5 to 1.0 in the field survey conducted by BPPT in 2008.

expected to increase to 5 million in 2012 and 10 million in future. Table 2.3.2-4 shows the sectors and the groups, for which pre-paid and TOU tariff system are applied. The pre-paid system is not applied for the sectors and groups, for which TOU tariff system has been already applied.

Table 2.3.2-4 Tariff for Pre-paid and TOU System

Sector		VA	Prepaid Tariff (Rp/kWh)	TOU Tariff (Rp/kWh)
Service	S1	220	-	-
	S2	450	325	-
		900	455	-
		1300	605	-
		2200	650	-
		3500-200kVA	755	-
	S3	>200kVA	-	605×K×P
Residence	R1	450	415	-
		900	605	-
		1300	790	-
		2200	795	-
	R2	3500-5500	890	-
	R3	>6600	1,330	-
Business	B1	450	535	-
		900	630	-
		1300	795	-
		2200-5500	905	-
	B2	6600-200kVA	1,100	-
	B3	>200kVA	-	K×800
Industry	I1	450	485	-
		900	600	-
		1300	765	-
		2200	790	-
		3500-14kVA	915	-
	I2	14kVA-200kVA	-	K×800
	I3	>200kVA	-	K×680
	I4	>30000kVA	-	605
Public	P1	450	685	-
		900	760	-
		1300	880	-
		2200-5500	885	-
		6600-200kVA	1,200	-
	P2	>200kVA	-	K×885
	P3	-	820	-

K; Disincentive factor for peak hours
P; Adjustment factor for purpose

Source: TDL revision on July 1st, 2010

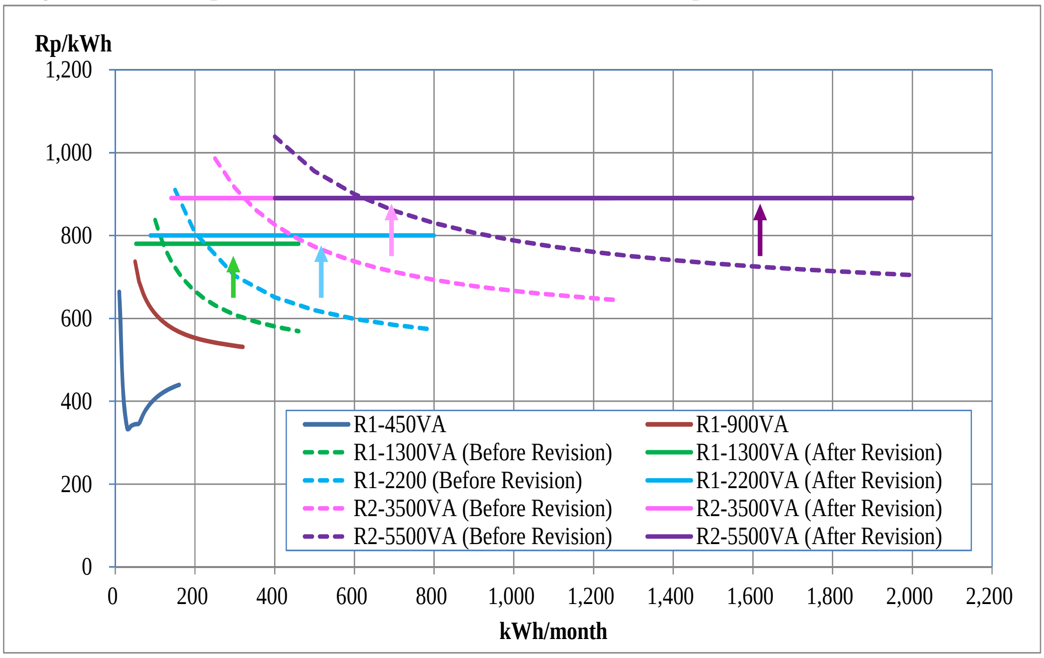
The price of a pre-paid meter is about 20USD. And this system is operated on the voluntary basis. For expansion of TOU tariff system to applying sectors and groups, existing meters could not be utilized. Pre-paid system only requires the data of power consumption. TOU tariff system needs power consumption meter by time zone. (Electronic meter or two magnetic meters with timer)

(5) Analysis of Tariff Revision

Figure 2.3.2-1, -2, and -3 show the revision contents of residential, business, and industrial sectors. The price increase ratio is about 10% for the total. The feature of this tariff revision was to freeze the tariff for small-scale consumers and, on the other hand, to raise that for medium and large-scale consumers.

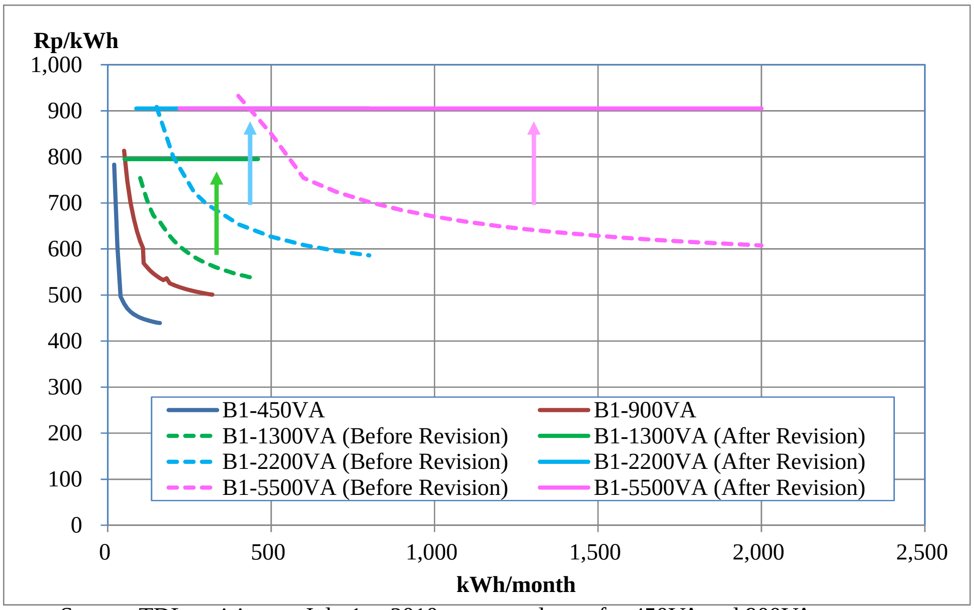
To raise tariff for medium and large scale consumers is considered to be reasonable as an effective measure of EE&C.

Indonesian electricity tariff system is reasonable as the historical result of totally taking into account of social, and economical situation, and international competition. However to promote the electricity peak shift and EE&C, more simplified tariff system, eg. Integration of tariff categories and simplification of tariff calculation should be pursued.



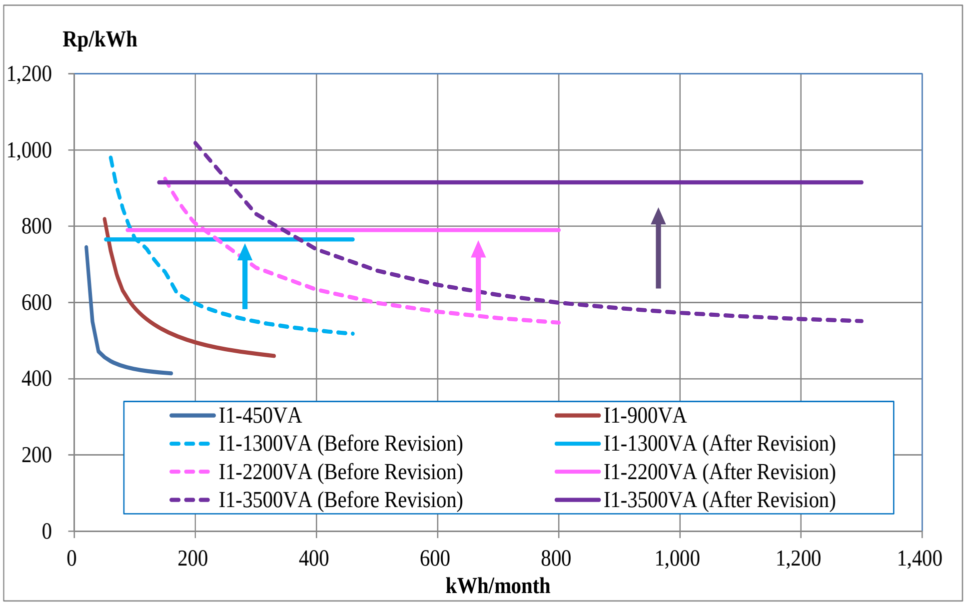
Source: TDL revision on July 1st, 2010, no amendment for 450VA and 900VA

Figure 2.3.2-1 Tariff Revision in Residential Sector



Source: TDL revision on July 1st, 2010, no amendment for 450VA and 900VA

Figure 2.3.2-2 Tariff Revision in Commercial Sector



Source: TDL revision on July 1st, 2010, no amendment for 450VA and 900VA

Figure 2.3.2-3 Tariff Revision in Industrial Sector

2.3.3 New TOU Tariff System in Industrial and Commercial Sectors in 2011

PLN has issued the new TOU tariff system in industrial and commercial sectors in the Jawa-Bali region from April 2011. It aims to achieve 400 MW reduction of peak power within several years. Table 2.3.3-1 shows the outline of new TOU tariff system. Target sectors and region are the industrial and commercial sectors and the Jawa-Bali region. The past TOU tariff system adopts two time zones with peak time from 18:00 to 22:00 (4 hours) across the country. On the other hand, new system adopts three time zones. As methodology of TOU tariff system, incentive and disincentive of peak shift, peak cut, and bottom-up are stipulated. In addition, PLN recommends operating captive power generation to decrease the electricity supply from PLN. It is considered to be a reasonable measure taking in advance of the Study Team proposal[9], the introduction of different tariff system in the Jawa-Bali region and of three time zone TOU tariff system. Confirming the effectiveness and validity of this system, this experience should be applied in the future tariff revision.

[9] Described in Chapter 3

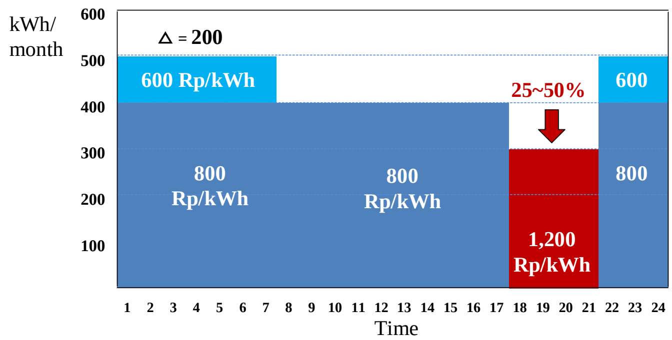
Table 2.3.3-1 New TOU Tariff System by PLN (Voluntary Base)

Target Sector		Industrial and Business Sectors	
Region		Java-Bali	
Time Zone		PLT (Peak Load Time)	18:00 to 22:00
		OPLT-1 (Off Peak Load Time – 1)	22:00 to 8:00
		OPLT-2 (Off Peak Load Time – 2)	8:00 to 18:00
Scheme		PLT	OPLT-1
Peak Shift	Scheme - 1a	Consumed Electricity 25 - 50% Reduction	Increased Electricity Price 25% Discount
	Scheme - 1b	Consumed Electricity 50% More Reduction	Increased Electricity Price 50% Discount
Peak Cut	Scheme - 2a	Consumed Electricity 25 - 50% Reduction	Same Amount of Reduced Electricity Price 20% Discount
	Scheme - 2b	Consumed Electricity 50% More Reduction	Same Amount of Reduced Electricity Price 40% Discount
Bottom Up	Scheme – 3	No Change	Increased Electricity Price 20% Discount
Own Generation	Scheme – 4	Own Generation Starting up by the Request of PLN	PLN bears Cost Difference (Own Generation – PLN)

Source: PLN Document 2011.07

Concrete example is explained in Fig 2.3.3-1. When a company with over 200 kVA contract decreases 25-50% of electricity consumption during peak period, as compared to the consumption in the same month of the previous year, and shifts to off peak period 1 (OPLT-1), the electricity price for shifted electricity decreases to 600Rp/kWh from 800Rp/kWh.

Scheme-1a: For 200kVA above Business



Electricity Price for Scheme-1a Ex for tariff B-3 in PLT decrease 25~50%	Rp/kWh
Price in PLT	1,200
Price in OPLT-1	800
Price for Usage Decrease in OPLT-1	600
Price in OPLT-2	800

Source: PLN Document 2011.07

Figure 2.3.3-1 Example of Promoting Electricity Load Shift into Night & Early Morning

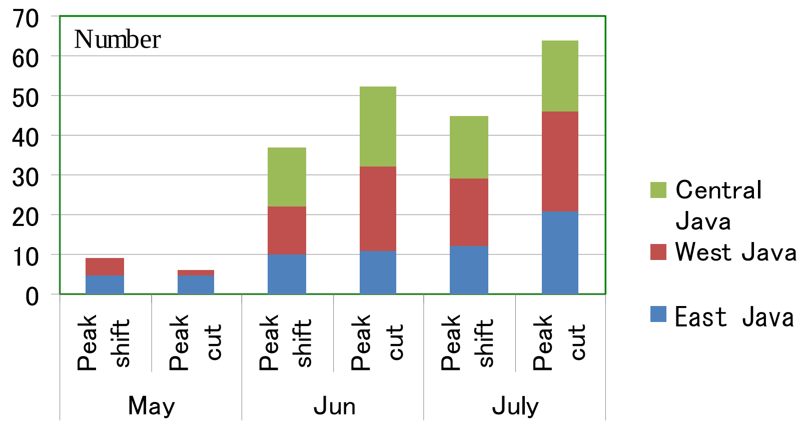
Figure2.3.3-2 shows the trend of participating companies, total 213 companies in 3 months. The number of participants was a little smaller than PLN's expectation. And it was assumed that the incentive is not enough and the shift of working time was not easy for dominant consumers,.

Figure 2.3.3-3 shows the effect of electricity conservation. 91 companies with peak shift incentive (off peak discount) decreased 2.75% (average) of electricity consumption during peak period. Besides 102 companies with peak cut incentive (lower incentive than peak shift tariff), decreased only 0.39%. Incentive clause is considered to be functioning well.

The features of this tariff system are:

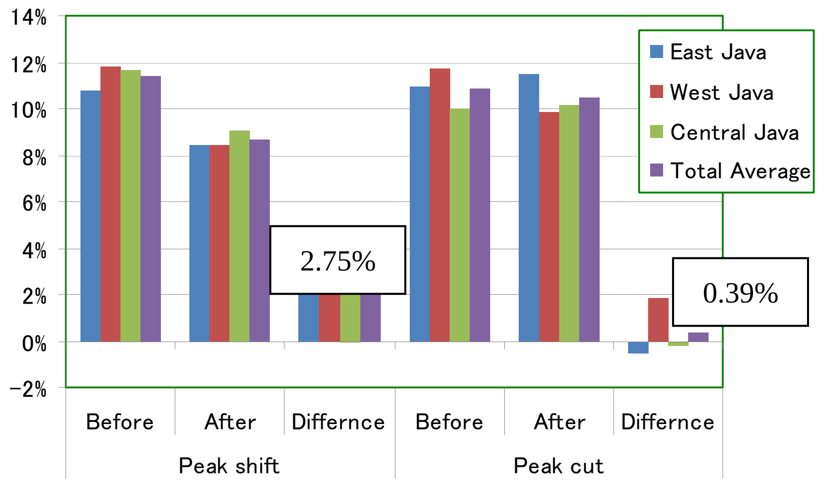
- Limited to Jawa-Bali region
- Voluntary base
- Three time zones (PLT, OPLT-1, and OPLT-2): two time zones at present

Although this new tariff system intended to promote the captive power generation, on the contrary PLN power supply increased, because of the supply deficit of gas and of the oil price hike .



Source: PLN Information 2011.09

Figure 2.3.3-2 Trend of Participating Companies in New TOU Tariff System (213 Companies at the End of July 2011)



Source: PLN Information 2011.09

Figure 2.3.3-3 Peak Reduction Ratios in New TOU Tariff System

2.4 Energy Efficiency Labeling Program

2.4.1 Research on Home Appliance Market and Electricity Consumption

Several researches shown in Table 2.4.1-1 were conducted for the purpose of collecting the basic data to formulate a functional labeling program and to estimate the impact of electricity consumption reduction caused by the policies on dissemination of highly-efficient appliance/equipment. The researches were conducted by EMI and Asia Carbon. Table2.4.1-2 shows the market share by manufacturer for major appliances (refrigerators, ACs, and TVs). The market share of Sharp, Panasonic, and Sanyo[10] (Japanese), LG and Samsung (Korean), and Polytron (Indonesian) is found to be large.

Table 2.4.1-1 Purpose and Output of Researches

Item	Purpose	Output
Sales amount by appliance, market share by manufacturer (2010)	Grasping the manufactures who shall be invited to the Technical Meetings.	The market share by manufacturer was recognized. Major manufacturers were invited to the Technical Meetings.
Sales and production by appliance, specification including energy efficiency (EE) (2010)	Grasping Energy Efficiency (EE) data, which is necessary for setting labeling (star rating) criteria.	EE data of AC (COP) and TV (Rated W and Standby W) were collected. Data distribution charts were used for the discussion at Technical Meetings. (Refer 3.4.4)
Manufacturer’s conscious for EE&C (2010)	Grasping manufacturer’s opinion on the labeling program and their sales plan of high efficiency appliances.	Almost all manufacturers are positive to formulate labeling program.
Electricity consumption and CO_2 emission of major home appliances (2011)	Estimation of electricity consumption growth and impact of policies to promote highly-efficient appliances. (Estimation on present and 2025 figures of electricity consumption and CO_2 emission of major appliances)	Based on the survey result of BPPT,EMI,Indomas Mulia and Asia Carbon (2010), and EMI (2010 &2011) , future electricity consumption and the impact of policies are estimated. (Refer 2.4.2 and 4.2.2)

Table 2.4.1-2 Market Share of Major Home Appliances

Refrigerator		AC		TV	
Sharp	31%	LG	32%	Sharp	33%
LG	29%	Panasonic	29%	LG	28%
Sanyo	13%	Sharp	20%	Samsung	19%
Panasonic	12 %	Samsung	10%	Panasonic	11%
Samsung	6%	Polytron	2%	Polytron	5%
Polytron	4%	—	—	—	—
Others	5%	Others	7%	Others	4%

Source: Researched by EMI in 2010

[10] As of 2010 (surveyed year). In 2012 Sanyo was absorbed by Panasonic and Haier..

2.4.2 Estimation of Electricity Consumption and CO_2 Emission of Major Appliances

(1) General

In this study CO_2 emission of major appliances; lightings, TVs, ACs, and refrigerators was estimated. The study scope is for households in the Java-Bali region.

In Indonesia the existing data for calculation is so few that the Study Team referred not only the existing data from Statistics Indonesia (hereinafter to as "BPS"), MEMR, EMI, and PLN, but also the data collected in 2010 by EMI (Market research and questionnaire survey for household and buildings), BPPT (Pilot projects for ACs and CFLs), and Indomas Mulia (Electricity load measurement for households) under this study (sub-contracts).

(2) Calculation Methodologies

Calculation methodologies for electricity consumption and CO_2 emission of appliances are as follows.

Electricity consumption (kWh/day) = Penetration level (%) x Number of households (n1)

x Number of appliances in one household (n2) x Daily electricity consumption per one

appliance (kWh/unit day) x (1- Grid loss) (%) x 365days/year

Besides daily electricity consumption per one appliance was calculated as follows.

For lightings and TVs; Specific Wattage (W) x Average operating hours (h/day)

For AC and refrigerator; Measured data of daily electricity consumption by academy

Regarding CO_2 emission, the calculation formula is described below.

CO_2 emission = Electricity consumption (kWh/day) x CO_2 emission factor in the Jawa-Bali

Grid (t- CO_2/GWh)

(3) Conditions for Calculation

As conditions for calculation of electricity consumption and CO_2 emission of lightings, TVs, ACs, and refrigerators in the Jawa-Bali region, the following conditions are fixed. (Based on the existing research data and the result of sub-contract under this study, lacking data was supplemented by estimation.)

- The common conditions are described in Table 2.4.2-1 and followings.

Table 2.4.2-1 Number of Households in Jawa-Bali

Contract Category VA				
450	900	1300	2200	>2200
22,354,000	10,519,000	2,553,000	667,000	292,000

Source: RUPTL 2010, BPS

Transmission and distribution loss 9.64 % (Source; PLN Statistics2009)

Electricity Grid CO_2 emission factor 0.891kg-CO_2/kWh (Source; Feb.2009 MEMR、EX-ANTE EF Jamali 2006)

- The conditions for calculation of electricity consumption and CO_2 emission caused by lightings are shown in Table 2.4.2-2.

Table 2.4.2-2 Condition of Electricity Consumption and CO_2 Emission Calculation (Lightings)

PENETRATION RATE	Source : EMI Survey 2010	POWER (VA)				
		450	900	1300	2200	>2200
LAMP TYPE	CFL	72%	76%	73%	67%	79%
	Non CFL	28%	24%	27%	33%	21%

NUMBER OF LAMPS/HH	Source : EMI Survey 2010					
	AVERAGE	4	8	6	13	17

CFL; 13～22W, 8-10h/day use, Non CFL; 22-29W, 7-8h/day use (Source: EMI 2010)

- The conditions for calculation of electricity consumption and CO_2 emission caused by TVs is shown in Table 2.4.2-3

Table 2.4.2-3 Conditions of Electricity Consumption and CO_2 Emission Calculation (TVs)

PENETRATION RATE	Source : PLN & BPS 2007; EMI 2010		POWER (VA)				
			450	900	1300	2200	>2200
	TV Ownership		95%	95%	97%	96%	95%
	TV Type	CRT	100%	100%	100%	100%	68%
		LCD	0.00	0.00	0%	0%	30%
		Plasma	0.00	0.00	0%	0%	3%

NUMBER OF TVs / HH	Source : EMI 2010	AVERAGE	1	1	1	2	3

TV; 94～350W, 6-9h/day use (Source: EMI 2010)

- The conditions for calculation of electricity consumption and CO_2 emission caused by ACs is shown in Table 2.4.2-4

Table 2.4.2-4 Conditions of Electricity Consumption and CO_2 Emission Calculation (ACs)

PENETRATION RATE	Source : PLN & BPS 2007; EMI 2010		POWER (VA)				
			450	900	1300	2200	>2200
	AC Ownership		0%	4.67%	8.33%	52.17%	63.16%
	AC Type	Split	0%	100%	100%	100%	98%
		Window	0%	0%	0%	0%	3%

NUMBER OF ACs / HH	Source : EMI2010 AVERAGE	0	1	1	1	4

AC; 5.1～6.6kWh/day use (Source: Indonesia University 2010)

- The conditions for calculation of electricity consumption and CO_2 emission caused by refrigerators are shown in Table 2.4.2-5.

Table 2.4.2-5 Conditions of Electricity Consumption and CO_2 Emission Calculation (Refrigerators.)

PENETRATION RA	Source : EMI 2010					
		POWER (VA)				
		450	900	1300	2200	>2200
	Ownership*	10.00%	90.00%	100.00%	100.00%	100.00%
	REFRIGERATOR Ty 1 door	67%	83.3%	50%	90%	61%
	2 doors	33%	16.7%	50%	10%	39%

NUMBER OF Refrigerator/ HH	Source : EMI 2010	AVERAGE	1	1	1	1	1

Refrigerator: 100～200W (Source: EMI 2010), 17h/day use (Source: BPPT 2006)

(4) Result of Calculations

The results of calculation of CO_2 emission by appliance and by electricity contract size are described below.

1) CFL and other lightings

Electricity consumption of CFLs and other lightings are shown in Figure 2.4.2-1. The contribution of small households below 900VA contracts is high, these consumers are the main target for EE&C.

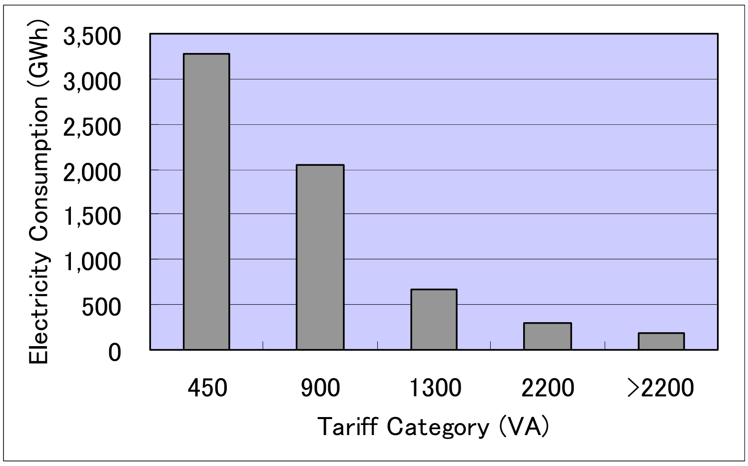


Figure 2.4.2-1 Electricity Consumption of Lightings (Household in Jawa-Bali)

2) TV

Electricity consumption of TVs is shown in Figure 2.4.2-2. Same as lightings, the contribution of small households below 900VA contracts is high, these consumers are the main target for EE&C.

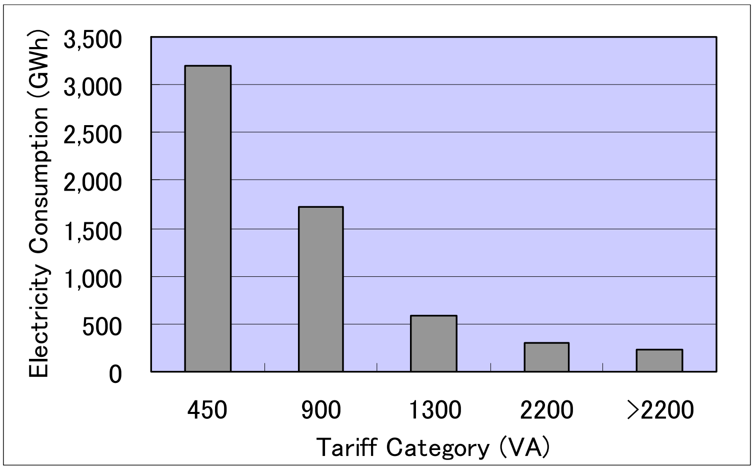


Figure 2.4.2-2 Electricity Consumption of TVs (Household in Jawa-Bali)

3) AC

The CO_2 emission of ACs is shown in Figure 2.4.2-3 Deferent from CFL and TV, the contribution of large households over 2,200VA contracts is high, these are the main target for EE&C.

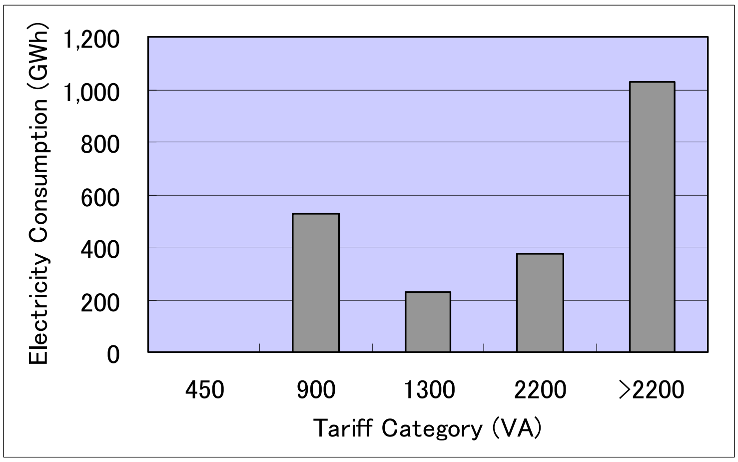


Figure 2.4.2-3 Electricity Consumption of ACs (Household in Jawa-Bali)

4) Refrigerator

Electricity consumption of refrigerators is shown in Figure 2.4.2-4. Deferent from CFLs, TVs and ACs, the contribution of middle households of 900 and 1,300VA contracts is high, these consumers are the main target for EE&C.

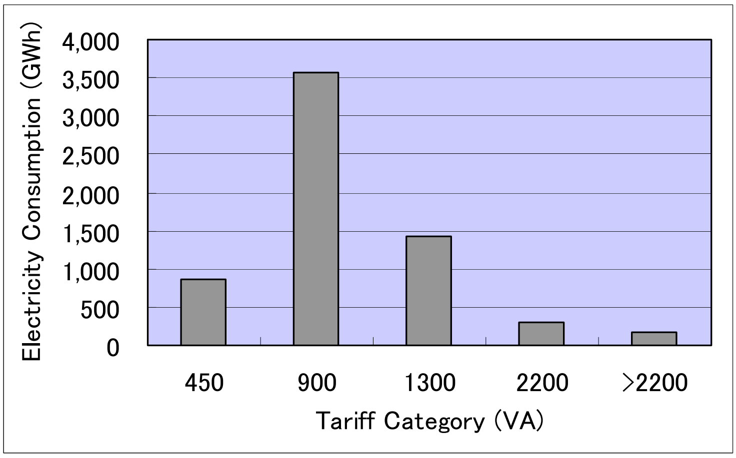


Figure 2.4.2-4 Electricity Consumption of Refrigerators (Household in Jawa-Bali)

(5) Summary

The eatimated electricity consumption of lightings, TVs, ACs and refrigerators is shown in Table 2.4.2-6, and Figure 2.4.2-5. The estimated CO_2 emission from these four appliances is shown in Table 2.4.2-7. . The total electricity consumption of these four appliances is estimated about 21.0TWh. And it is 18.2% of the total electricity consumption in the Jawa-Bali region (115.1TWh). （See Figure2.4.2-6） Suppose 20% of these appliances' electricity consumption reduced 20%, then 3.6% of the total electricity consumption of the Jawa-Bali region is expected to be reduced. Besides CO_2 emission from these four appliances is estimated to be 18.7mil. t-CO_2/y. （See Table 2.4.2-7）

The data used for calculation is based on the limited number of samples. This means that the calculation result could not reflect the reality. However, this result can be used as the preliminary information for further study. Therefore, it is strongly recommended that a successive survey be conducted and related more data should be accumulated.

Table 2.4.2-6 Electricity Consumption of Four Home Appliances（Jawa-Bali）

Home Appliances Category	Electricity Consumption (GWh/y)
Lighting	6,481
TV	6,043
AC	2,163
Refrigerator	6,333
Total	21,020

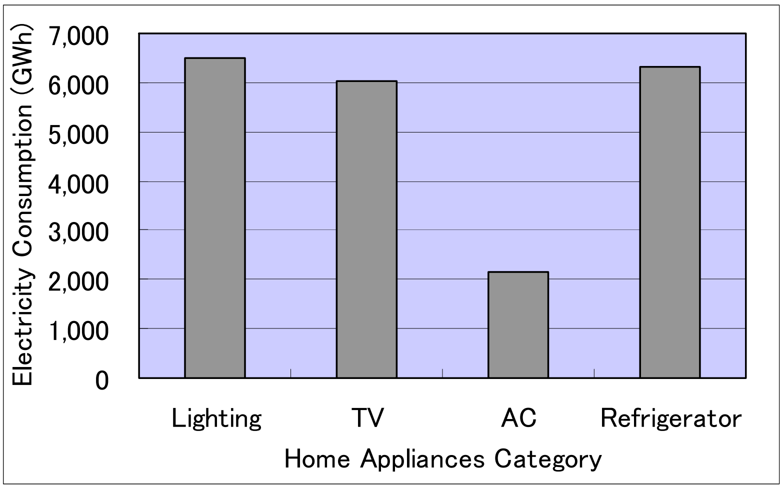


Figure 2.4.2-5 Electricity Consumption of Four Home Appliances in Jawa-Bali

Table 2.4.2-7 CO_2 Emission from Four Home Appliances in Jawa-Bali

Home Appliances Category	CO_2 Emission (1000t-CO_2/y)
Lighting	5,775
TV	5,384
AC	1,927
Refrigerator	5,643
Total	18,729

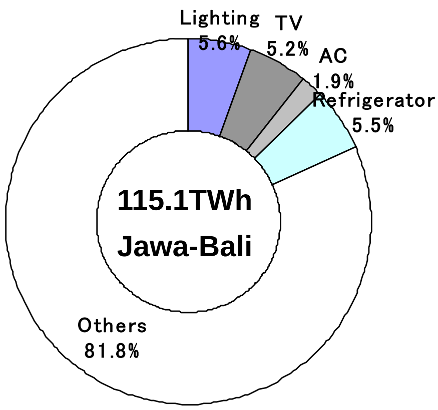


Figure 2.4.2-6 Electricity Consumption Ratio of Four Home Appliances for Total Electricity Consumption in Jawa-Bali

2.4.3 Research on Neighboring Country's Labeling Programs

Table 2.4.3-1 shows the present situation of EE labeling programs in Asian countries. Among the neighboring countries of Indonesia, Singapore, Malaysia and Thailand have already introduced labeling programs. The Study Team visited these three countries and investigated the way how to decide the labeling criteria and the outline of incentive programs linked to the labeling programs. Table 2.4.3-2 shows the authorities, which the Study Team visited.

Table 2.4.3-1 Labeling Programs Applied in Asian Countries

Country		Refrigerator	AC	TV	Lighting
Indonesia					M (Oct. 2011)
Japan		V	V	V	V
China		M	M		M
Korea		M	M	M	M
Malaysia		M	M	V	M
Singapore	Comparison	M	M		
	MEPS	M (Sep. 2011)	M (Sep. 2011)		
Thailand	Comparison	V	V	V	V
	MEPS	M	M		
India		M	M (Inc. MEPS)	M	M
Australia		M	M	M	M

V; Voluntary M; Mandatory MEPS; Minimum Energy Performance Standard

Table 2.4.3-2 Authorities which the Study Team Visited

Country	Authorities which the Study Team visited	Date
Singapore	NEA (National Energy Agency); Administration body	10, May 2011
	TUV PSB; Private third party laboratory	10, May 2011
Malaysia	EC (Energy Commission); administration body	11, May 2011
	SIRIM; National third party laboratory	11, May 2011
Thailand	EGAT (Electricity Generating Authority of Thailand) ;Administration body of EGAT comparison label	22, July 2011
	TISI (Thai Industrial Standards Institute, Ministry of Industry) ; Administration body of TISI mark (MEPS, HEPS)	21, July 2011
	EEI (Electrical & Electronic Institute, Foundation for Industrial Development); National third party laboratory	20, July 2011

Table 2.4.3-3 shows the outline of labeling programs in Singapore, Malaysia and Thailand.

Thailand has already established several private third party laboratories, because it passed nearly 10 years since the introduction of labeling program. They can conduct energy efficiency tests by product category, and they don’t adopt manufacturer’s data. On the other hand, Singapore’s and Malaysia’s third party laboratories cannot conduct test for AC, and they adopt manufacturer’s tested data under the witness of third party laboratories. Singapore has no plan to equip with testing chamber for AC, because it is relatively costly considering to the small nation scale (market size). Besides Malaysia is now planning to install it ,because the sales of AC is rapidly increasing. These countries are positive to collaborate with Indonesia in the operation of EE labeling program.

Table 2.4.3-3 Outline of Labeling Programs in Singapore, Malaysia, and Thailand

<table>
<tr><th colspan="2">Item</th><th>Singapore</th><th>Malaysia</th><th>Thailand</th></tr>
<tr><td rowspan="2">Organization</td><td>Authority</td><td>NEA</td><td>EC</td><td>EGAT</td></tr>
<tr><td>Laboratory</td><td>TUB-PSB</td><td>SIRIM</td><td>EEI, Intertek</td></tr>
<tr><td colspan="2">Star rating</td><td>1-4 tics</td><td>1-5 star</td><td>1-5 star</td></tr>
<tr><td colspan="2">MEPS (Minimum Efficiency Performance Standard)</td><td>Start from Sep. 2011</td><td>-</td><td>Refrigerator, AC</td></tr>
<tr><td rowspan="4">Appliances</td><td>Refrigerator</td><td>Mandatory</td><td>Voluntary</td><td>Voluntary</td></tr>
<tr><td>AC</td><td>Mandatory</td><td>Voluntary</td><td>Voluntary</td></tr>
<tr><td>TV</td><td>Mandatory</td><td>Voluntary</td><td>Voluntary</td></tr>
<tr><td>Other appliances</td><td>Cloth dryer</td><td>Fan, ballast, lamp, motor</td><td>Fan, ballast, CFL, T5 FL, motor, rice cooker, potable water heater, PC monitor</td></tr>
<tr><td rowspan="3">Data verification</td><td>Refrigerator</td><td colspan="2">At a third party laboratory, or at a manufacturer’s laboratory under witness of the third party laboratory officer. Manufacturer’s laboratories can be accredited by the third party laboratory with annual inspection. In this case, witness of the third party laboratory can be omitted.</td><td>At a third party laboratory only</td></tr>
<tr><td>AC</td><td colspan="2">At manufacturer’s laboratory under witness of the third party laboratory officer. Manufacturer’s laboratories can be accredited by the third party laboratory with annual inspection. In this case, witness of the third party laboratory can be omitted.</td><td>At a third party laboratory only</td></tr>
<tr><td>TV</td><td>-</td><td>At a third party laboratory only</td><td>At a third party laboratory only</td></tr>
<tr><td colspan="2">Incentive</td><td>-</td><td>Sales tax exemption on highly efficient appliances</td><td>5% discount on high efficient appliances</td></tr>
</table>

Points from the surveys in neighboring country’s for labeling programs are summarized in Table 2.4.3-4.

Table 2.4.3-4 Points on the Labeling Programs from Neghboring Countries’ Surveys

Item	Points
Data verification	Considering Indonesian market size, it should have its own testing facilities for all home appliances. However it is impossible to conduct all tests in third party laboratories. So at the beginning of labeling program, it could introduce the same method as Singapore and Malaysia, which adopt manufacturer’s tested data under the condition of the witness of third party laboratory.
Making labeling criteria (star rating)	After specifying EE measurement method, actual EE data should be collected by the test in third party laboratory and/or manufacturer’s laboratory. Labeling (star rating) criteria should be designed reflecting the collected data, in order that the criteria would suit to the market condition. It takes long time to accumulate the data, however labeling criteria should not be directly imported from the other countries, because of the difference of market condition.
Monitoring of the program	Sales of highly-efficient products are different between urban and rural area. In Thailand, almost all ACs and refrigerators have 5 stars in Bangkok, it makes

Item	Points
	urban people think that labeling criteria is quite low. Besides products have no labels in rural area, because highly-efficient products have not yet penetrated there. Thailand utility (EGAT) aims to up-grade the labeling criteria when the proportion of the products labeled with 5 stars exceeds 30 % of all products. So, nationwide continuous market monitoring is necessary in program operation.

2.4.4 Activities for Formulating Labeling Program in Indonesia

Table 2.4.4-1 shows the present activities of related parties such as the government, Indonesia Electronics Association (hereinafter to as "GABEL"), laboratories, accreditation bodies, and international cooperation Agency (UNDP BRESL Program), etc.

Table 2.4.4-1 Activities for Formulating Labeling Program in Indonesia

Party/Organization	Activity
MEMR JICA DSM Study BRESL Project	➢ MEMR has issued CFL labeling program. The program is scheduled to commence in 2012. ➢ MEMR has drafted the measurement method and labeling criteria in 2009. (Under the Ministerial order). ➢ JICA Study Team pushed MEMR to hold Technical Meetings, to which major manufacturers were invited and laboratories and the labeling program was discussed totally. Four Technical Meetings were held within one year. (See Chapter 3 in details) ➢ BRESL Project activity is as following. 1st regional TWG (Oct. 2010 in Bangkok) 2nd regional TWG (Apr. 2011 in Bali) 2011 TWG meetings with GABEL Training in China (June 2011)
MOI	➢ MOI becomes much interested in the labeling program and is having tight connection with GABEL. ➢ Director General Triharso is the co-chairman of MEMR Technical Meeting.
MOT	➢ MOT leads AHEEERR (ASEAN Harmonization of Electric and Electronic Equipment Regulatory Regime) cooperating with MOI, MEMR. ➢ BPMBEI (laboratory under MOT) participates the MEMR Technical Meetings on behalf of MOT.
GABEL	➢ GABEL held technical working group (TWG) on the labeling program under MOI. ➢ The TWG involves BRESL staffs as TWG members.
Laboratories	➢ There are 19 governmental or private laboratories. ➢ BPPT and LIPI etc. are contributing to draft labeling framework. ➢ Major laboratories are joining MEMR Technical Meetings and also BRESL TWG.
KAN/BSN	➢ It participates MEMR Technical Meetings and BABEL/BRESL TWG. ➢ KAN/BSN certifies the testing laboratories.

2.4.5 Progress of BRESL Project

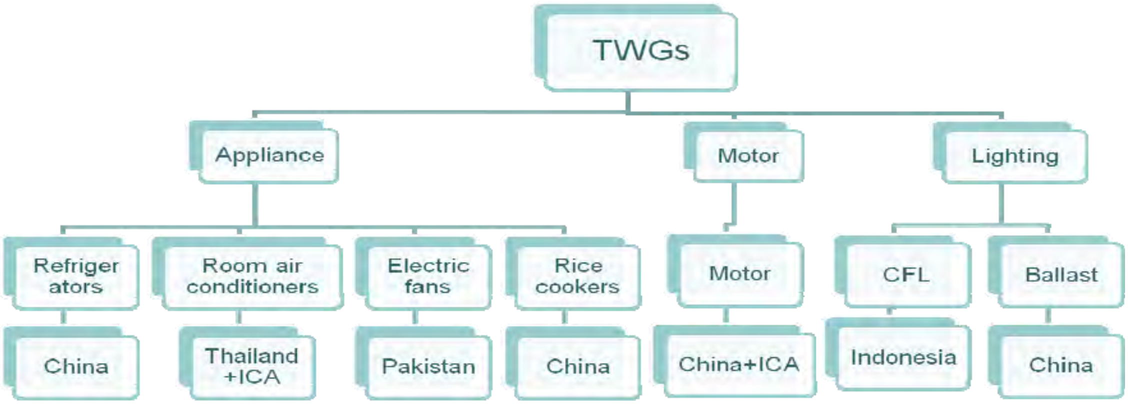
BRESL Project is operating technical working group (hereinafter to as "TWG"), targeting on refrigerators, ACs, motors, ballasts, fans, CFLs and rice cookers. Members of BRESL Project TWG are shown in Table2.4.5-1. Manufacturers and academy are included, and the government and governmental testing laboratories are the dominant. (Gray colored is the coordinators) The 1st TWG was held in November 2010.

Table 2.4.5-1 BRESL TWG Member List

Organization	Refrigerator.	AC	Motor	Ballast	Fan	Lamp	Rice Cooker
BPPT	1	1	1	1	2	2	
LIPI-P2SMTP	2	2		1	2		2
BPMBEI-Dep Perdagangan	1					2	1
BARISTAND-SBY							
P3KEBT ESDM						1	1
Sucofindo		1	2	1	2	1	2
Panasonic	1	1			1		1
Maspion	1						
ITB	1	1					
Univercity Indonesia	1	1	1	1			
Poloteknik Negeri Jakarta	1	1	1		1		
Pustand Kemperin		1			1		
Altasia Utama			1				
STT PLN			1				
Yayasan PUIL			1	1			
MEMR	3	3	3	3	3	3	2
MOI	1	1	1	1	1	1	1
Total	13	13	12	9	13	10	10

The 1st regional TWG was held in Thailand in November 2011, with the participants from China, Indonesia, Thailand, Vietnam, Pakistan and Bangladesh. Main topics of the meeting were how to implement the project and present situation in members' countries. Practical idea for EE indicator, EE measurement method and labeling criteria have not yet been discussed. Figure 2.4.5-1 shows the assignment of the leader country or team by appliance.

According to Figure 2.4.5-1, refrigerators are led by China and ACs by Thailand (with ICA: International Copper Association (hereinafter to as "ICA")). In January 2012, collaborations among Indonesia and these countries have not been started.



Source: Ms. Li Tienan in CTA-RPMU

Figure 2.4.5-1 Structure of BRESL TWG

In April 2011, the BRESL Project structure was changed and the procedure has been accelerated. BRESL Project Team had several meetings with GABEL.

"Japan Fund (JPF)" to supplement BERSL Project was approved by UNDP in May 2011. Total budget is 491,558 USD, which is donated by UNDP Japan. The program aims the capacity development of laboratories, which are expected to conduct EE measurement needed for the labeling program. The program includes the training of EE measurement tests for refrigerators and ACs. Some budget can be used for supplementing equipment for laboratory test. Dispatch of Japanese experts and a training in Japan will be implemented early 2012 utilizing this fund.

2.4.6 Movement of International Standard & Labeling Harmonization

Current situation of international S/L is shown in Table 2.4.6-1. Recently, many international cooperation agencies including JICA, UNDP and also private sectors are joining to S/L programs. This movement for harmonization and standardization should be taken into account in formulating the national labeling program.

Table 2.4.6-2 shows the related organizations, which have roles and responsibilities for operating labeling program by country. Some organizations are joining the international S/L programs mentioned above.

Table 2.4.6-1 Movement of International S/L Harmonization

Item	Content
APEC 8th Conference on Standards and Conformance for Green Harmonization	➢ APEC's three sub-committees relating to EE&C and S/L were held joint meeting in Sep. 2010. Three sub-committees are followings. Sub-Committee on Standards and Conformance (SCSC) Expert Group on Energy Efficiency and Conservation (EGEE&C) Market Access Group NTB (Non Tariff Barrier) including energy efficiency standards has been discussed. Necessity of harmonization on EE indicators and measurement method has been recognized, but "APEC EE Label" was rejected. ➢ Linkage between ACs and smart grid was discussed in October 2011 in Seoul, LED lamps in November 2011 in Singapore, Testing method for ACs and highly-efficient transformers in November 2011.
ASEAN AHEEERR EE MRA	➢ AHEEERR (ASEAN Harmonized Electric＆Electronic Equipment Regulatory Regime) and EE MRA (Sectoral Mutual Recognition Arrangement for Electrical & Electronic Equipment) were held to discuss harmonization, standardization, and mutual recognition about display of safety and energy performance. Committee name is JSC EEE (Joint Sectoral Committee for Electric and Electronic Equipment) ➢ "Harmonization of Energy Efficiency Standards in Southeast Asia- Air Conditioner, Kick-off Meeting" is planned to be held in January 2012 in Jakarta
UNEP (United Nations Environment Program)	➢ Dissemination workshop named "Harmonization of Energy Efficiency Standards in Southeast Asia for Air Conditioners and Refrigerators" was held in 17th Jan. 2011 in Kuala Lumpur. SEEA (Seasonal EER) was discussed as a new indicator for energy efficiency of AC.
APP (Asia-Pacific Partnership Program)	➢ APP has a regional meeting for global warming countermeasures. A committee of BATF (Building and Appliance Task Force) deals a theme "Harmonization of test procedures". Measurement method for highly-efficient products is discussed. Following is the target appliances and leader countries Motor, motor system and lighting; Australia AC; Korea Refrigerator; Japan Electronics; USA CFL; Australia and USA TV is included in "Electronic", but practical discussion has not yet been held. Besides the above theme, labeling program is talked in "Market transformation"
OECD	➢ OECD is also studying removal of NTB (Non Tariff Barrier) on EGS (Environment Goods and Service) same as APEC
CLASP (Collaborative Labeling and Appliance Standard Program)	➢ CLASP conducts researches on S/L and supports making labeling programs in several countries. It holds and operates website for worldwide information on labeling programs, but details of actual programs cannot be seen in the website.
ICA (International Copper Association)	➢ ICA participates and supports several international and regional S/L programs held by APEC, UNDP, UNEP, etc. ➢ ICA is supporting the efficiency improvement of copper heat exchanger and pipes of ACs and refrigerators ➢ Japanese member of ICA is from mining industries, not from electric appliance manufacturers

Table 2.4.6-2 Organizations for Labeling Program by Country

Country	Organization	Role/Activity
China	CSC	China Standard Certification Center; Labeling authority in China. It dispatches staffs to BRESL Project
	CNIS	China National Institute of Standardization; Standardization body, which issue GBI. CSC belongs to CNIS. "Asia Energy Efficiency Standards and Labeling (S&L) Forum" was held in Shanghai in November 2011.
	NDRC	National Development and Reform Commission; It participates RPSC (Regional Project Steering Committee) in BRESL Project
Korea	KEMCO	Korea Energy Management Corporation; It participates the meetings in APEC, APP
	KTL	Korea Testing Laboratory
Singapore	NEA	National Environment Agency; Labeling authority. It belongs to MOEW (Ministry of the Environment and Water Resources)
	TUV PSB	It is a private third party laboratory. Head office is in Germany. It can conduct refrigerator test.
Malaysia	EC	Energy Commission (Suruhanjaya Tenaga); Labeling authority
	SIRIM	National third party laboratory; It can conduct refrigerator test, now it is planning to conduct AC test.
Thailand	EGAT	Electricity Generating Authority of Thailand Labeling authority of EGAT comparison label
	TISI	Thai Industrial Standards Institute, Ministry of Industry; Authority of TISI mark, which stipulates MEPS, HEPS. It operates committees for the labeling program.
	EEI	Electrical & Electronic Institute, Foundation for Industrial Development; National third party laboratory, it can conduct AC and refrigerator tests.
	Intertek -TH	Private third party laboratory; it can conduct refrigerator test.
	Other	Thailand Greenhouse Gas Management Organization joins to BRESL Project.
India	BEE	Bureau of Energy Efficiency; Labeling authority
	NABL	National Accreditation Board for Testing and Calibration Laboratories; Accreditation body
USA	EPA	Environmental Protection Agency Authority of "Energy Star" mark
	Lawrence Berkeley National Laboratory	Research center under DOE (Department of Energy. Making a lot of presentation in S/L international conference. Strong linkage to CLASP.
	ICF International	Private consulting company; It joins to APP BATF and S/L program in India.
	UL	Underwriters Laboratories Inc.; Authority of "UL certificate", which is private accreditation of safety on electric appliances.
	NRDC	Natural Resources Defense Council NPO It is commissioned research work from APP BATF

2.4.7 Activities on S/L in Japan

Table 2.4.7-1 shows several parties' activities on S/L in Japan. There is no activity of international harmonization on TVs.

Table 2.4.7-1 Organizations for Labeling Program in Japan

Category	Party/Organization	Activity
General	METI (Ministry of Economy, Trade and Industry)	"Asia-Pacific S/L cooperation program" aims to spread Japanese method of measurement and evaluation concerning on EE&C and renewable energy.
	IEEJ (Institute of Energy Economics, Japan)	Assisting the procedures for formulating functional national labeling programs in Asian countries (sub-contract under METI)
	IS-INOTEK (International Standard Innovation Technology Research Association)	Founded in January 2011. R&D, technical assistance and training for international standardization are conducted by it.
	ECCJ (Energy Conservation Center Japan)	It operates and maintains EE database of home appliances. It has researched and reported labeling programs in other countries.
	JETRO (Japan External Trade Organization)	It researched and reported labeling programs in China, Thailand and India, which include consumer's conscious and purchase activity of high efficiency products. (March 2011)
Refrigerator	JEMA (Japan Electric manufacturers Association)	Linkage to "Asia-Pacific S/L cooperation program" under METI Round robin test[11] with Thailand and Malaysia is under preparation
	JASEW (Japanese Business Alliance for Smart Energy Worldwide)	Heat-pump and inverter WG is focusing on ACs and refrigerator. Different approach from JEMA
AC	JRAIA (Japan Refrigeration and Air Conditioning Industry Association)	Technical coordination meetings on air-conditioning and AC are held by JRAIA.
	JATL (Japan Air Conditioning and Refrigeration Testing Laboratory)	Separated from JRAIA in 2011. The organization in charge of the calibration on AC testing equipment of the member companies and annual certification exams for AC It has also the training facility in Atsugi Laboratory (not only for domestic but foreign agencies).
	JASEW (Japanese Business Alliance for Smart Energy Worldwide)	Heat-pump and inverter WG is focusing on the pilot project in Vietnam. (ACs and refrigerator) Discussion is continuing.
TV	JEITA (Japan Electronics and Information Technology Industries Association)	Member of "Harmonization of Test Procedures" electronics (TV and PC etc.) WG under APP. But the WG is not so active.

[11] An interlaboratory test (measurement, analysis, or experiment) performed independently several times.

2.4.8 Assessment of the Capacity of Testing Laboratories

Table 2.4.8-1 shows the analysis result on the capacity of governmental testing laboratories, which should take a quite important role in the operation of EE labeling program. Besides the laboratories described in the table, there are several governmental testing laboratories in rural districts. Including university's testing laboratories, the candidates of testing laboratories for appliances counts to be around 20.

Table 2.4.8-1 EE Measurement Ability of Laboratories

Laboratory	Refrige rator.	AC	TV	Motor	Ballast Lamp	Fan	Rice cooker	Washing machine
B2TE-BPPT	×	△	△		△	△	△	△
LIPI-P2SMTP	△	×	△		○	△	△	△
BPMBEI	×	×	△		○	△	△	△
BARISTAN-SBY								
PT.Scofindo	×	×	△			△	△	△
B4T-Deprin	×	×	△					
PLN-LITBANG	×	×	△		○	△	△	△
P3TKEBT	×	×	△		○	△	△	△

○: Possible △: Possible provided of additional equipment and skill ×: Impossible

Referring the movement for international harmonization, which was described in Section 2.4.6 and 7, it was pointed that there exist large issues for governmental testing laboratories, such as LIPI, B4T, and BPPT, to secure appropriate measurement equipments, to meet the above-mentioned international standard. .The outline of the issues are as follows.

(1) Refrigerator

LIPI's climate chamber is larger than those in the other testing laboratories. However it cannot clear the IEC/ISO standard, because the chamber was introduced not having targeted to conduct refrigerator tests, the air supply outlet is set on the wall, and the velocity of the air supply is too fast to keep the minimum requirement of ambient air flow specified in IEC/ISO standard. Double floor and double ceiling, which can keep the ambient air velocity is to be prepared, however the chamber height is not enough to add an additional floor and a ceiling. (Figure 2.4.8-1)

Figure 2.4.8-1 Climate Chamber in LIPI

(2) AC

In September 2011, Quality Management System Certification Institution (hereinafter to as "B4T") (in Bandung under Ministry of Industry (hereinafter to as "MOI")) introduced a cyclometric chamber. And it became possible to conduct an energy efficiency test. (Figure 2.4.8-2) However in order to conduct a reliable test, another cyclometric chamber should be installed to realize the calibrated to each other.

Agency for Assessment and Application of Technology (hereinafter to as "BPPT") is now constructing a testing chamber for ACs. It must be necessary to improve air-tightness and heat-insulation in order to conduct accurate test as required by ISO standard. (Figure 2.4.8-3)

Figure 2.4.8-2 Testing Chamber in B4T

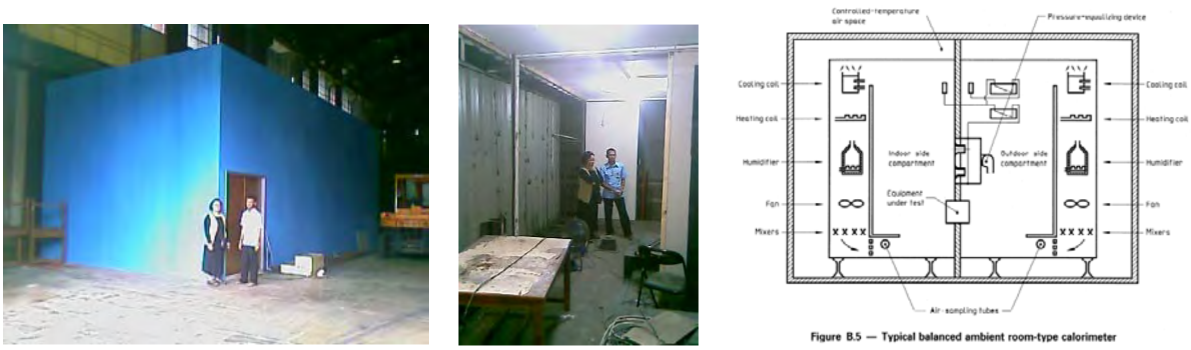


Figure 2.4.8-3 Testing Chamber in BPPT

(3) TV

Almost all laboratories can conduct EE measurement test on TVs, because special testing equipment is not needed for the testing for TVs.

2.5 Pilot Project of Highly-efficient Appliances

2.5.1 General

The target sectors for the pilot projects are decided to be the small households (less than or equal to 900VA) and medium-scale commercial and business facilities (more than or equal to 2.2kVA). And target technologies in household were decide to be CFL and AC, and the target technology in commercial and business sectors is decided to be AC. Also, the investigation for the actual refrigerator operation was added on the study target in 2011, because the electricity consumption of refrigerators was proved to be large in the study in 2010.

The major findings of the pilot projects are reported below. And the detail of the pilot project results is described in Section 2.5.2 to 2.5.6

(1) Pilot Project on CFL

Regarding CFLs, CFL simulation board was assembled and the distribution test of CFLs for existing households was conducted.

Indonesian government is encouraging the conversion from the incandescent lamp to CFL under the 1st national EE labeling program. Besides PF[12] of an incandescent lamp is 100%, but PF of a popular CFL in Indonesia is about 50-60%. PF, which influences the distribution loss of utility company, cannot be recognized in consumer's daily life. The simulation board was assembled to visualize the in-efficiency of low PF CFLs, as "difference of current" for consumers, who are not familiar with technology.

Not only the electricity consumption (active power), but supply electricity (apparent power) can be recognized by this simulation board.

The distribution test of CFLs for existing households was implemented to grasp the effect of the voltage drop with the low PF CFL popularization. However, regardless of PF of CFLs, the voltage drop at the end of power distribution network is observed quite large, exceeding 30%, in some cases. The counter measure against this huge voltage drop is the higher priority issue from the viewpoint of promoting EE&C and securing the quality of electricity.

(2) Pilot Project on AC

There are two major EE&C technologies for ACs; one is "high COP (EER)" and the other is "inverter[13] drives". Besides ACs are one of the main targets of governmental EE labeling program. Field measurement test of ACs was conducted in order to visualize the effect of higher COP and introduction of inverter technology. Specifically three types of AC; popular (standard COP[14]), high COP without inverter, and high COP with inverter were installed in the existing office and households. And power consumption of them was measured. Also the operating time and mode of ACs in the bedrooms were measured in parallel, because introduction of ACs in bedrooms is becoming popular recent years.

The result of the measurement is as follows.

a) Inverter technology is effective for offices and bedrooms, whose cooling demand is lower than ACs' capacity. (i.e. Non-inverter ACs repeat ON/OF operation fluently.).
b) Inverter technology is not effective for living rooms in household, whose operation pattern is almost flat (100%) because of daily short operation hours.

12 Refer Section 1.4.4（1）
13 Refer Section 1.4.4（2）
14 Refer Section 1.4.4（3）

(3) Pilot Project on Refrigerator

Recently the penetration ratio of refrigerators is so high in Indonesia. In Japan almost all refrigerators are equipped with inverter, besides in Indonesia almost all refrigerators are operated by ON/OFF control without inverter.

Refrigerators are also the main target of governmental EE labeling program. Field measurement test of refrigerators was conducted for one week in order to visualize their actual operation pattern.

As the result of the measurement, refrigerators in Indonesia were found being operated in fluent ON/OFF mode, i.e. the cooling demand is lower than the refrigerator's capacity. The potential of promoting EE&C by introducing inverter technology was proved to be large.

(4) Other Findings

Through the pilot projects following issues, on which Indonesian government should focus, have been recognized.

a) The penetration ratio of condensers in households is comparatively high.
b) It is necessary to analyze the future risk of condenser fire caused by harmonics from inverters, which will be spread in Indonesia soon.
c) On the other hand, there exist limiters, which do not trip even if the electricity consumption exceeds the rated capacity of limiter.

2.5.2 Assembly of CFL Simulation Board

(1) The Detail of the Simulation Board

The schematic of the developed simulation board is shown in Figure 2.5.2-1. The whole view of the board is shown in Figure 2.5.2-2. The influence of low PF CFLs could be understood as the difference of current consumption.

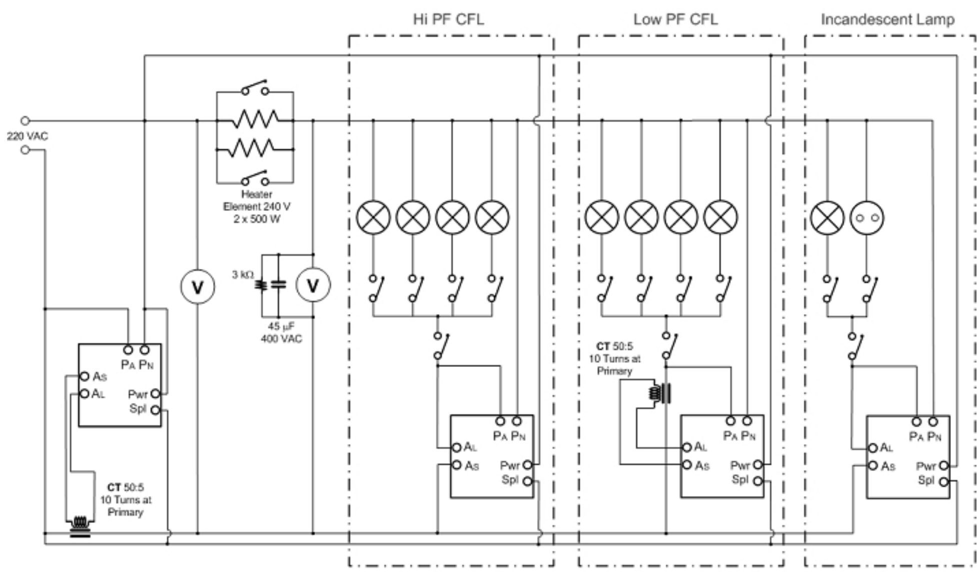


Figure 2.5.2-1 Schematic of Simulation Board

Figure 2.5.2-2 Facade of Simulation Board

(2) Measured Data of CFL

Using this simulation board, the measurement of CFLs, which were purchased in Jakarta has been done. PF of them are 0.54-0.63 capacitive. Besides PF of high PF CFLs, which are supplied by Ecobulb Inc. in New Zealand were imported and measured. PF of them are 0.89-0.96 capacitive. (See Table 2.5.2-1) The CFLs sold in Indonesian market are proved to be low PF ones. Blue colored ones are Indonesian and red colored are high PF CFLs. (See Figure 2.5.2-3). The result of measurement is shown in Appendix 2-1.

Table 2.5.2-1 Measuerd Data of High PF CFL

No	Specification	Measurement Value						
	Brand	U	I	P	COS φ		THD	
	CFLs	Volt	Ampere	Watt	PF	DPF	V %	I %
1	Ecobulb 15 watt/220V/AC/50 Hz	220	0.066	13	-0.929	-0.972	2.3	28.3
2	Ecobulb 15 watt/220V/AC/50 Hz	220	0.076	15	-0.894	-0.972	2.4	40.1
3	Ecobulb 15 watt/220V/AC/50 Hz	220	0.060	13	-0.945	-0.981	2.4	23.1
4	Ecobulb 15 watt/220V/AC/50 Hz	220	0.056	12	-0.955	-0.984	2.5	20.8
5	Ecobulb 15 watt/220V/AC/50 Hz	220	0.063	13	-0.936	-0.979	2.5	26.7

THD; Total harmonic Distortion

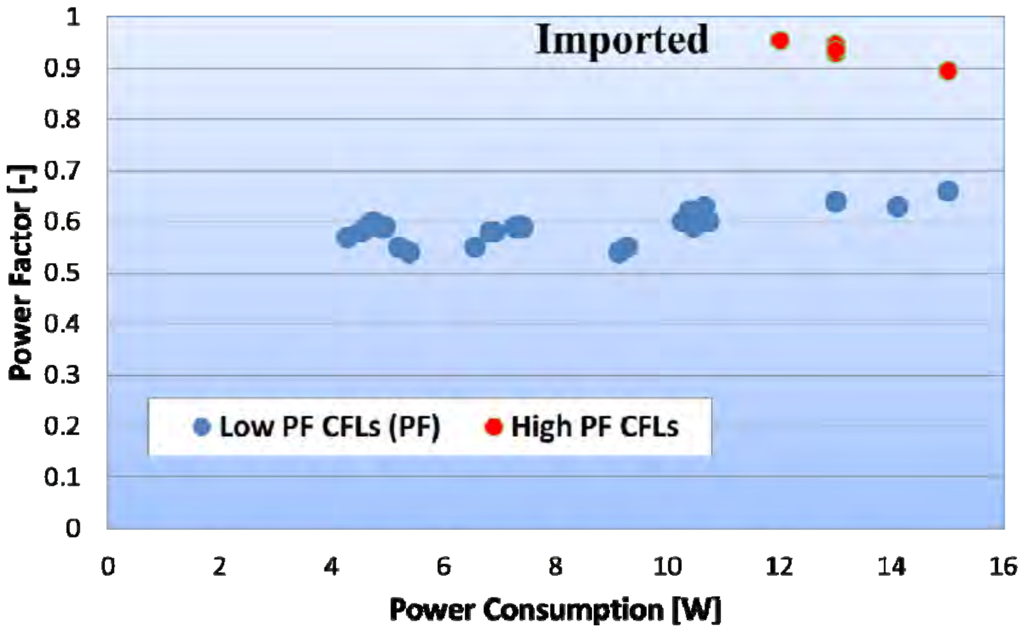


Figure 2.5.2-3 Power Factor of CFLs

Table 2.5.2-2 shows the measurement result of voltage, ampere and PF for incandescent lamps, low PF CFL and high PF CFL. In general CFL's electricity consumption is about 80% smaller than that of incandescent lamps (active power basis). Besides it is shown in the left column of the table that for 50-70W active power consumption (=lighting), incandescent lamps and high PF CFLs need 50-60VA apparent power (=supply electricity). On the other hand, low PF CFLs need 100-110VA apparent power.

In the CFL field test described in Section 2.5.3, Ecobulb's CFLs were applied as high PF ones and domestic CFLs were applied as low PF ones.

Table 2.5.2-2 Results of Measurement of Incandescent Lamp, Low PF CFL, and High PF CFL

Without Transmission Compensator			
Main Line Voltage : 224,2 / 225,1 / 223,4	Incandescent Lamp	Low PF CFL	Hi PF CFL
Voltage (V)	224.6	223.9	224.0
	225.2	224.5	224.9
	223.3	223.2	223.3
Current (A)	0.244	0.476	0.267
	0.244	0.482	0.276
	0.243	0.436	0.280
Active Power (W)	54.8	65.7	55.8
	55.1	63.9	57.3
	54.4	61.2	58.1
Apparent Power (VA)	54.8	106.3	59.6
	55.0	108.2	60.6
	54.6	104.2	61.6
Power Factor	1.00	0.59	0.935
	1.00	0.58	0.936
	1.00	0.60	0.923

With Transmission Compensator			
Main Line Voltage : 224,3 / 222,2 / 223,1	Incandescent Lamp	Low PF CFL	Hi PF CFL
Voltage (V)	179.3	173.0	175.6
	177.6	172.2	174.7
	178.6	172.0	174.8
Current (A)	0.216	0.441	0.29
	0.215	0.417	0.29
	0.216	0.419	0.289
Active Power (W)	38.7	47.8	46.9
	38.2	46.8	46.8
	38.5	47.7	46.7
Apparent Power (VA)	38.6	75.6	50.8
	38.2	73.4	50.6
	38.6	74.0	50.6
Power Factor	1.00	0.632	0.919
	1.00	0.635	0.923
	1.00	0.660	0.920

2.5.3 CFL Field Distribution Test

(1) Selection of the Candidate District

To grasp the influence of a low PF CFLs, the desirable testing district is to be selected, where less electricity usage of another appliances (i.e. electricity consumption ratio of lighting is high). So the district, where the dominant electricity contracts are 450 VA (the smallest category), was selected.

With the cooperation of PLN, several districts in Jakarta were listed up as candidates of the field test. For these districts, present voltage, current, and PF condition at the distribution transformer had been measured for one week. And Cihuni district, whose correlation between voltage and current value is higher than others, was selected as the testing site. Figure 2.5.3-1 shows the outline of the site. The number of the houses under the distribution transformer is 400 - 450. For these houses firstly low PF CFLs were distributed, and secondary high PF CFLs were distributed.

And the measurements were conducted for both conditions.

In Parallel, questionnaire survey of appliances' usage was conducted for the same households under the distribution transformer. The questionnaire sheet is attached as Appendix 2-2

Cihuni District; Small village in Serpong , 37 km southwest from Jakarta
Transformer Capacity; 340 kVA, 20/400 V
Load; 400-450 houses (estimation)
PLN contract generally; 900 VA-2200 VA

Figure 2.5.3-1 Photos of Field Testing Site Cihuni District

(2) Selection of CFL

As described in Section 2.5.2 (2), Ecobulb's CFLs were selected as high PF ones and domestic CFLs were selected as low PF ones.

(3) Power Distribution Network in Cihuni District and Measurement Points

The power line is divided into four terminal lines under the distribution transformer. The distance from the transformer to each terminal house ranges from 300 to 600m. (See Figure 2.5.3-2)

In this field test, the actual voltage drop was grasped by measuring the distribution transformer voltage and each line's terminal house's voltage.

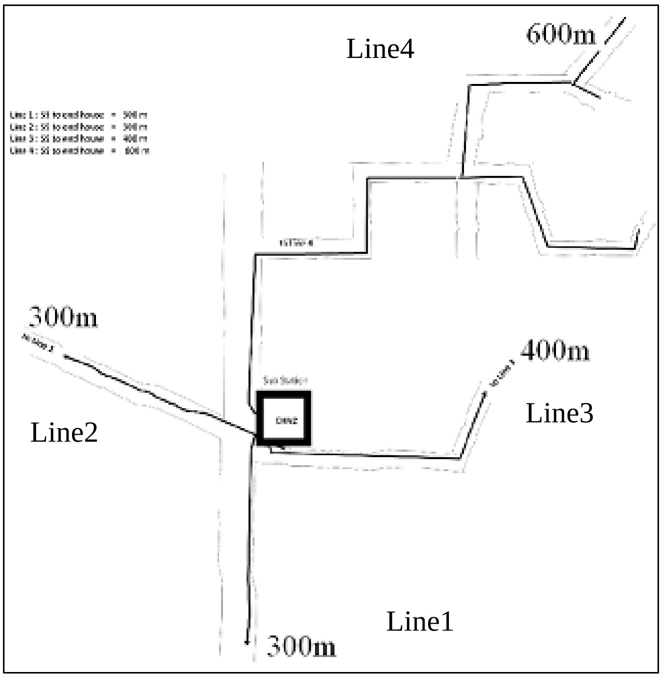


Figure 2.5.3-2 Power Distribution Network in Cihuni District

(4) The Result of Measurement and Questionnaire Survey

The breakdown of electric power contract in Cihuni district is shown in Figure 2.5.3-3.

Half of the houses in the district belongs to the category of 450 VA contract. 68 % houses have experienced blackout sometimes or often. And 63 % have experienced limiter trips. (See Figure 2.5.3-4, and -5).

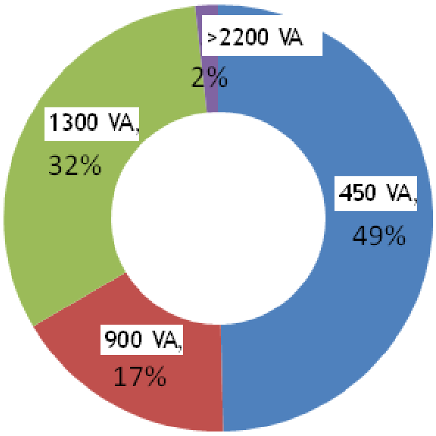


Figure 2.5.3-3 Breakdown of PLN Electric Power Contract

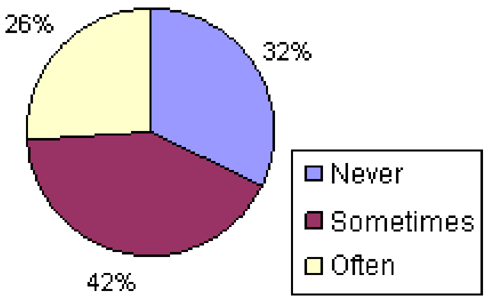


Figure 2.5.3-4 Experience of Blackout

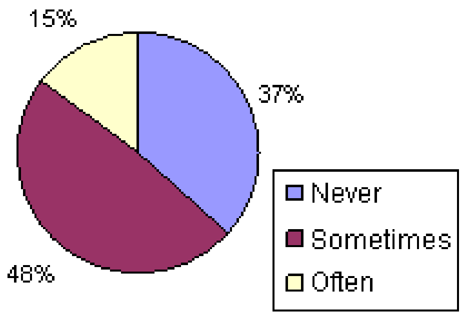


Figure 2.5.3-5 Experience of Limiter Trip

The current at the distribution transformer and the terminal house in each line were measured; Each line's voltage drop between the transformer and the terminal house is shown in Figure 2.5.3-6, -7, -8, and -9.

This distribution test of CFLs was implemented to grasp the effect of voltage drop with low PF CFL popularization. However less difference was observed on the re-active current and the voltage drop between low PF CFLs and high PF ones. Rather than that, the voltage drop at the end of power distribution network is observed quite large, exceeding 30 %. The counter measure against this huge voltage drop is the higher priority issue from the viewpoint of promoting EE&C and securing the quality of electricity.

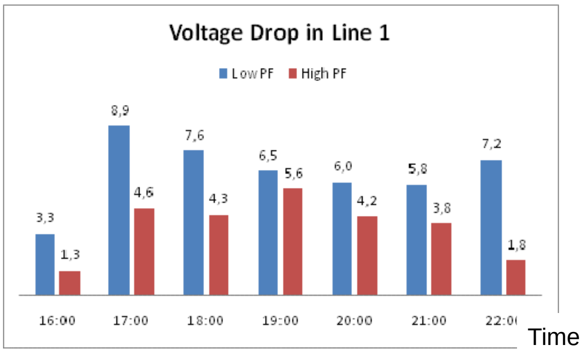


Figure 2.5.3-6 Voltage Drop in Line 1

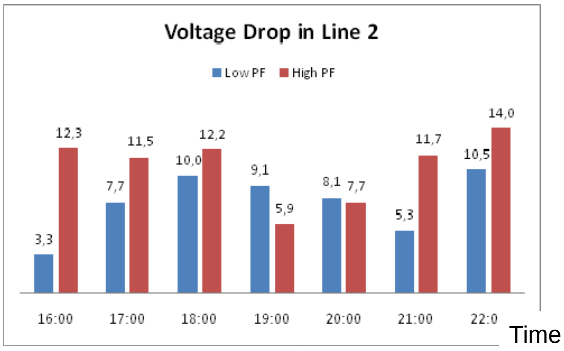


Figure 2.5.3-7 Voltage Drop in Line 2

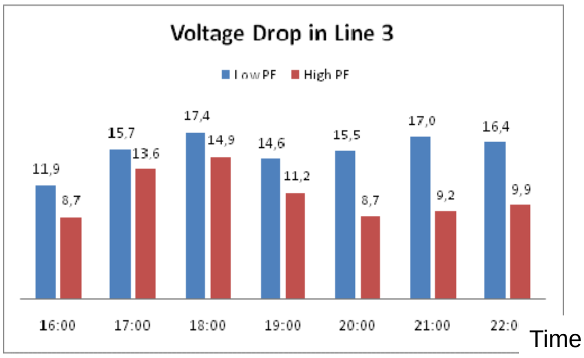


Figure 2.5.3-8 Voltage Drop in Line 3

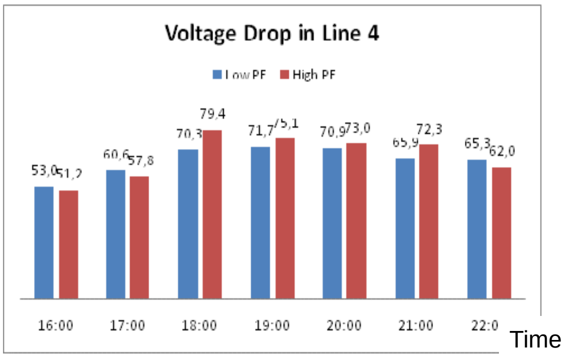


Figure 2.5.3-9 Voltage Drop in Line 4

The penetration ratios of appliances, which have low inductive PF, are as follows;

Fluorescent lamps, which use magnetic ballasts, Pumps: 69 %, Refrigerators: 53 %, Electric fans: 73 %, Washing machines: 21 %, and ACs: 2 %. Capacitive PF equipment is expected to improve PF of inductive low PF appliances. However, the capacitive PF appliances, which are seen in the district, are only TVs and CFLs.

The penetration ratios of the other appliances are Rice cookers: 65 % and Irons: 89 %. (Refer Appendix 2-3). On the other hand PF at distribution transformer is observed higher than expected and the rise of demand seems to improve PF.

The reason why the improvement of voltage drop was not observed in the field test is considered to be as follows.

a) Capacitive PF of CFLs and TVs is canceling the other appliances inductive PF
b) About 70% of households experienced limiter trip and in order to avoid the trip they had introduced condensers

2.5.4 Pilot Project of AC

(1) Measurement Methodology

Three types of ACs; popular (standard COP), high COP with non-inverter, and high COP with inverter control were installed in an office, and the living rooms of two houses. And power consumption of them was measured.

Power consumption and operation state of ACs is mainly influenced by the outdoor temperature and humidity. To reject these external distortion, the measurement was conducted for long term and rotatively.

ACs in the office and houses have been changed rotatively in every two weeks and in every month respectively. The power consumption of each AC was accumulated throughout the year.

In addition, the actual operation pattern of ACs in bedrooms was measured. (Recently introduction of ACs in bedrooms is becoming popular in Indonesia.)

(2) Selection of ACs

To make the comparison of technologies easier, the same manufacture's (Panasonic) different models, whose rated capacity is around 1HP (9,000Btu/h), were selected. Panasonic is one of the top share manufacturers and has a factory in Indonesia. Selected AC models are as follows.

a) Popular (standard COP) model: CS/CU- PC9JKJ, 9,000 Bth/h, 2.64kW, COP 2.9 [15]
b) High COP with non-inverter model: CS/CU- KC9KKJ 9,000 Btu/h, 2.65kW, COP 3.9
c) High COP with inverter control model: CS/CU- S10KKP 9,720 Btu/h, 2.85kW, COP 3.6

(3) Selection of Testing Sites

As mentioned above, in order to change and measure ACs so often and to get better understanding of the test by the residents, the testing sites were selected in BPPT.

1) Office

Testing site of the office was selected in BPPT. 1HP ACs, which are popular in Indonesian office, were applied. (See Figure 2.5.4-1)

MCTAP Room 8 m × 5 m = 40m^2

Figure 2.5.4-1 AC Testing Site (Office in BPPT)

2) Household

Typical living room in Indonesia is designed as open space such as Figure 2.5.4-2.

Generally in Indonesia, natural ventilation is designed for living rooms, and the floor, which is

15 Dominant COP of ACs sold in Indonesia ranged from 2.5-3.0.. And COP for highly-efficient ones ranged from 3.0-4.0. In this measurement, the best-selling AC of COP2.9 was categorized as standard COP model, the same capacity with highest efficiency of COP3.9 was categorized as high COP model.

usually made of tiles, makes the air cool. So the introduction of ACs into the living room is considered to be a secondary choice. Introduction of ACs is applied first in bedrooms in many cases. However along with the economic development, the design of houses is changing and the introduction of ACs into the living rooms will be more popular in future.

ACs had been already introduced in the living rooms of the measured houses (A and B). These ACs were replaced by the above mentioned 3 models of AC, and the electricity consumption was measured in rotation. Figure 2.4.5-3 shows the living room of House A, which was equipped with widows and curtains to use ACs.

Figure 2.5.4-2 Popular Living Room In Indonesia

(7.5 m x 3 m = 22.5 m^2)

Figure 2.5.4-3 Living Room of House A

Also, the measurement of actual operating condition of ACs in the bed rooms was conducted.

Figure2.5.4-4, -5 and -6 show the outline of the two houses, which were measured (A and B) The specification of the ACs in bed rooms are as follows.

House A: AH-AP5HHL (SHARP) 0.5HP

House B: (LG) 0.5HP

Figure 2.5.4-4 Facade of House A

Figure 2.5.4-5 Bedroom of House A (4 m × 3 m = 12 m^2)

Figure 2.5.4-6 Façade and Bedroom of House B (6 m × 3 m = 18 m^2)

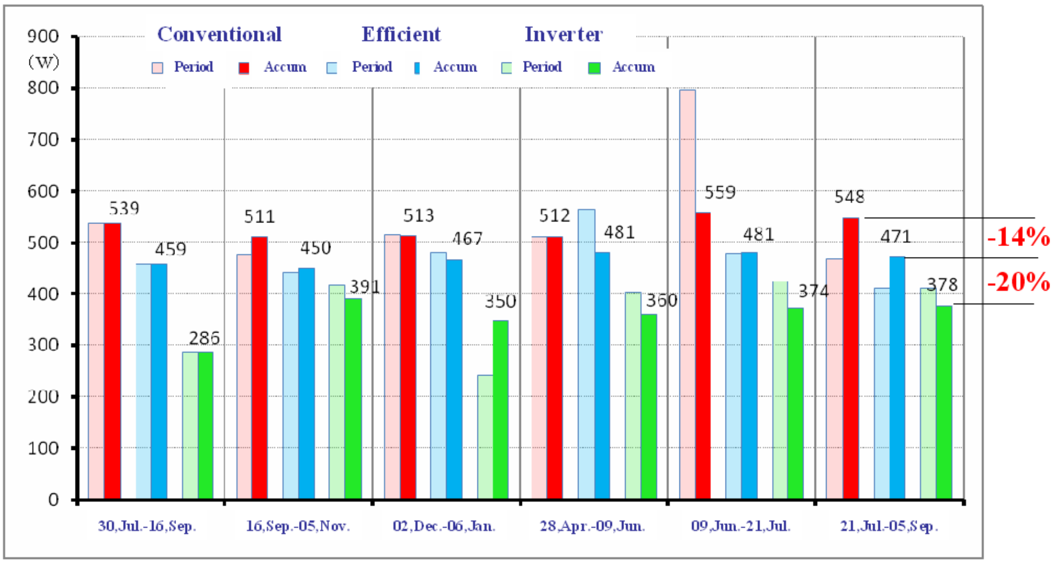
(4) The Result of Measurements

1) Office

The electricity consumption of ACs in the office is shown in Figure 2.5.4-7. From July 2010 to September 2011, 6 cycles of consecutive 2 weeks measurement for three ACs were conducted. "Period" in the figure means the average electricity consumption in one unit (2 weeks). "Accum" means the average electricity consumption of cumulative past consumption. During working hours, the average electricity consumption of each AC is a) 548W in standard type, b) 471W in high COP with non-inverter type, and c) 378W in high COP with inverter type respectively. High COP with non-inverter type consumed 14％ less electricity[16] than the standard type, and high COP with inverter type consumed further 20％[17] less electricity than the high COP with non-inverter type. The daily fluctuation of electricity consumption of the high COP with non-inverter type is shown in Figure 2.5.4-8. And that of high COP with inverter type is shown in Figure 2.5.4-9. Non inverter type is repeating ON/OFF frequently during the operating time. On the other hand, inverter type works with the maximum capacity at starting. And after that, it is working with about 30 % of maximum capacity. It was proved when AC's capacity is larger than the cooling demand and non-inverter ACs repeat ON/OFF operation fluently, the inverter technology is quite effective to save electricity.

[16] The difference of electricity consumption (14%) was smaller than the difference of COP（34％）.

[17] COP of AC with inverter was 8% lower than that of AC with non-inverter, besides the electricity consumption of AC with inverter was 20% lower than that of AC with non-inverter.



Period: Average power consumption in each testing period

Accum: Average power consumption in total testing period

Figure 2.5.4-7 Averaged Electricity Consumption of ACs in Office

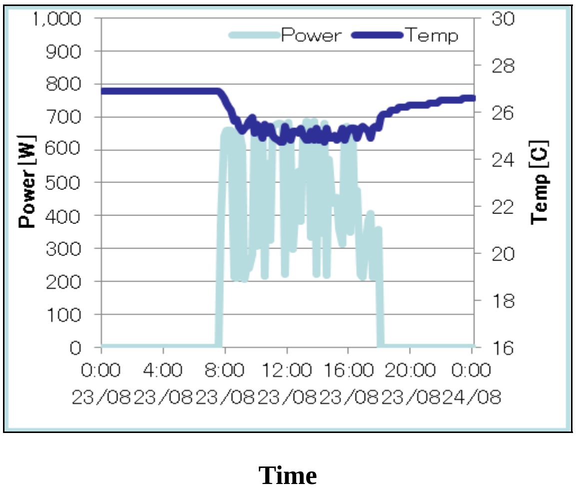


Figure 2.5.4-8 Electricity Consumption of High COP with Non-inverter Type AC

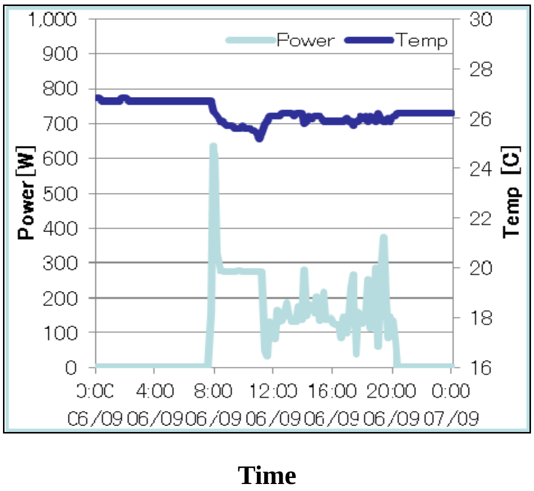


Figure 2.5.4-9 Electricity Consumption of High COP with Inverter Type AC

Beisdes ACs are also becoming popular in Ruko[18], which is the popular commercial facility in Indonesia. (See Figure 2.5.4-10)

Ruko is seen not only in the city but in the rural districts, and is the core of city development. In this study the effectiveness of inverter technology for office was confirmed. The effectiveness of inverter technology for commercial buildings (Ruko) is expected to be investigated next.

[18] Ruko means Ruma"house" and Toko, "shop".

Figure 2.5.4-10 Ruko's Facade and Example of AC Installation

2) Household (Living room)

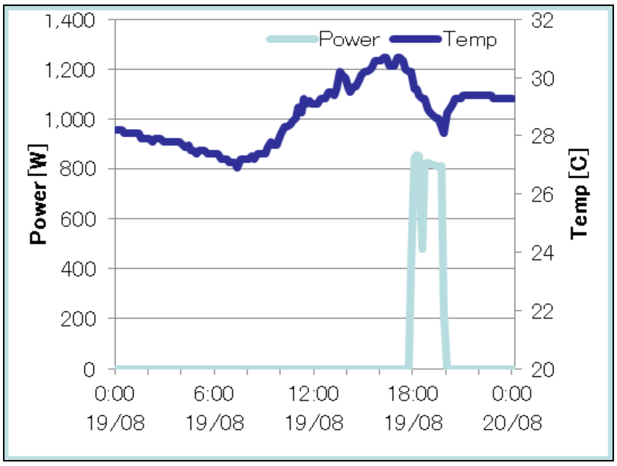
Electricity consumption in living rooms is shown in Table 2.5.4-1. The operating time of ACs is 2-4hours per day. And it is operated intermittently depending on the cooling demand.

The average electricity consumption of each AC is a）757.2W in standard type, b）524.6Win high COP with non-inverter and c）642.7W in high COP with inverter. The high COP with non-inverter AC consumes 30% less electricity than the standard type. On the other hand, here observed no advantage of the inverter type. The electricity consumption pattern of the standard type is shown in Figure 2.5.4-11. And that of the high COP non-inverter type is shown in Figure 2.5.4-12. It is said that in case of short operating time of ACs, and ACs are operated at almost their rated capacity, (i.e. less partial load operation), then it is difficult to get the benefit of inverter control. And in this case the efficiency (COP) of ACs directly influences the electricity consumption[19].

Table 2.5.4-1 Comparison of Electricity Consumption of ACs in Living Rooms

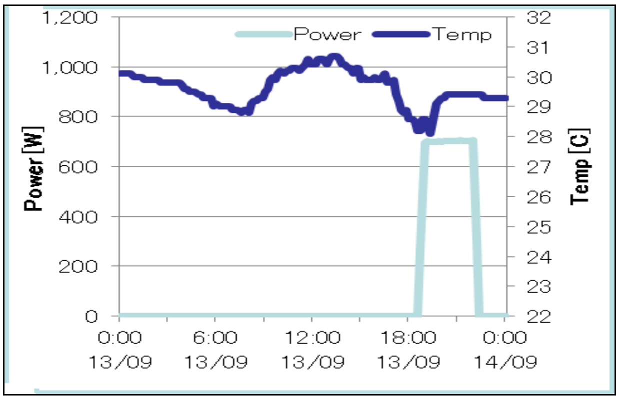
Item	Standard	High COP Non-inverter	High COP Inverter
Running Days (Days)	25	10	20
Running Hours (Hrs)	63.3	40.2	43.5
Energy Consumption (Wh/day)	1.918	2.107	1.398
Average Power (W)	757.2	524.6	642.7
Average daily running hours (hrs)	2.5	4.0	2.2

19 In this case COP of AC with non-inverter is a little higher than that of AC with inverter.



Time

Figure 2.5.4-11 Electricity Consumption of Curve of Standard AC



Time

Figure 2.5.4-12 Electricity Consumption Curve of High COP Non-inverter AC

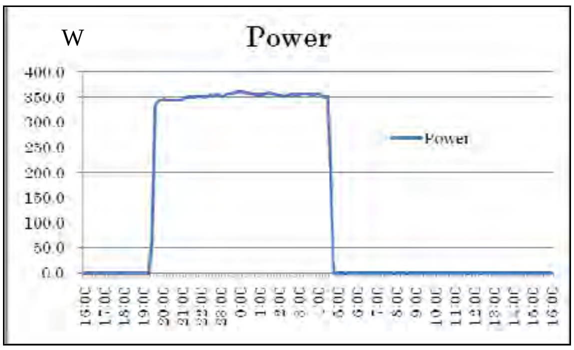
3) Household (Bedroom)

Regarding the measurement of ACs for bed rooms, the measurements were conducted for two houses in two seasons (dry in July 2010 and rainy in January 2011). ACs work from the evening to the morning for 8-11 hours/day to get a comfortable sleep. (See Table 2.5.4-2) Figure 2.5.4-13, -14. -15, and -16 show the results of the measurement.

Table 2.5.4-2 AC Operation Pattern in Bedrooms (July 2010)

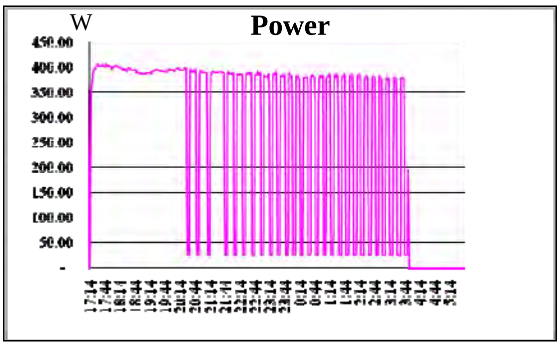
Item	House A	House B
Running Hours (hrs)	10:4	9:4
Energy Consumption (Wh/day)	1.918	3.317
Average Electricity Consumption (W)	288.3	352.9

Source: BPPT 2011



Time

Figure 2.5.4-13 Electricity Consumption of the Bed Room AC in House A (July 2010)



Time

Figure 2.5.4-14 Electricity Consumption of the Bed Room AC in House B (July 2010)

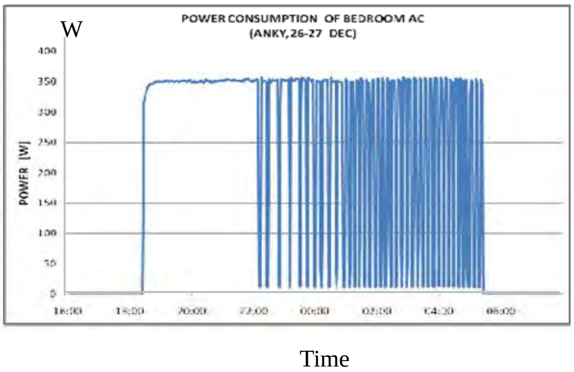


Figure 2.5.4-15 Electricity Consumption of Bed Room AC in House A (January 2011)

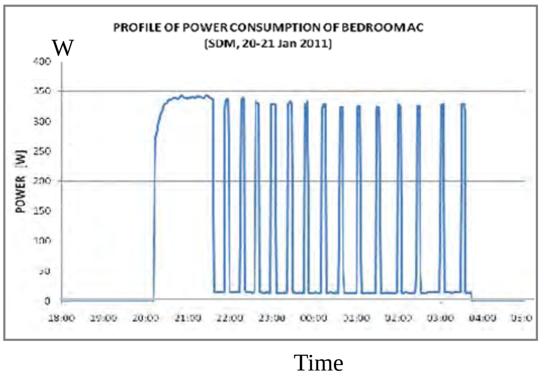


Figure 2.5.4-16 Electricity Consumption of Bed Room AC in House B (January 2011)

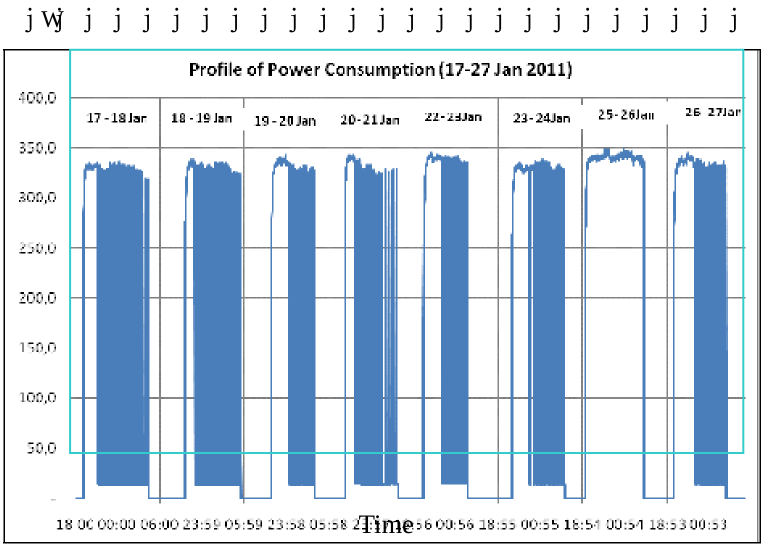


Figure 2.5.4-17 Electricity Consumption of the Bed Room AC (1week)

In July 2010 the AC in House A worked at the almost continuous operation, besides that of House B repeated ON/OFF operation. The continuous one week measurement data in House B is shown in Figure 2.5.4-17. The AC repeaed ON/OFF almost all nights, but in one night it worked in continuous operation. Besides the House A set the AC temperature at 25 °C and House B at 26 °C. And it is supposed that 25 °C or 26 °C of AC temperature setting is close to the threshold of continuous operation or ON/OFF operation. With the better consciousness for EE&C, the setting temperature will increase, and ACs in bedrooms is expected to repeat more fluent ON/OFF mode. And it means that the cooling demand is kept much lower than the capacity of ACs, and non-inverter ACs repeat ON/OFF operation fluently. Inverter technology is effective for these operation modes. (In January 2012 only one manufacturer sells 0.5HP ACs with inverters, whose size is suitable for bedrooms in Indonesia).

2.5.5 .... Pilot Project of Refrigerator

(1) The Measurement Method

The measurement of electricity consumption of refrigerators was conducted continuously for seven days in 20 houses. In order to keep the accurate measurement and safety, the measurement fixture shown in Figure 2.5.5-1, and -2 was applied. The electricity consumption of the main line, refrigerators, TVs, and ACs in addition to refrigerators was also measured at the same time.

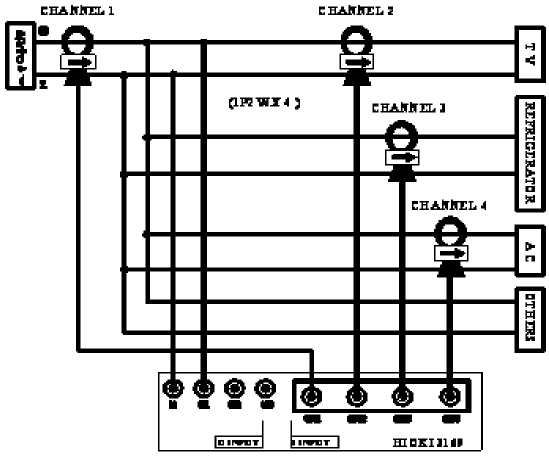


Figure 2.5.5-1 Measurement Fixture **Figure 2.5.5-2 Schematic of Measurement**

(2) Selection of the Target Houses

The target houses are decided to be the same houses of CFL distribution test and questionnaire survey in order to make a cross-cutting analysis.

One of the measured houses, the refrigerator, and TV are shown in Figure 2.5.5-3. (Information of the other houses is shown in Appendix 2-4)

Figure 2.5.5-3 One of Measured Houses, Refrigerators, and TVs

(3) The Measurement Result

The result of one house, which shows the typical pattern, is shown in Figure 2.5.5-4, and -5.

Figure 2.5.5-4 shows the continuous seven days measurement result and Figure 2.5.5-5 shows the detailed data of one day of the week. Green line shows the main power line consumption. Red line shows the refrigerator consumption. Besides blue line is the TV consumption. Regarding the the refrigerator, it repeats ON/OFF operation every day (especially night time). This means that the cooling capacity of refrigerator is larger than the actual cooling demand; so ON/OFF operation controlled by the thermostat is repeated fluently. In case that the capacity of appliances is larger than the demand, and the appliances repeat ON/OFF operation fluently, inverter technology is effective to improve efficiency. Electricity consumption ratio of refrigerators in houses is around 20％. And if 20% of electricity saving by the introduction of inverter technology were realized, it is expected that the electricity conservation ratio in houses is about 4.0 %. And in case of the introduction of inverter, a high efficient motor is expected to be introduced at the same time, then the expected total improved efficiency ratio is 30%. Then 6.0 % saving of the total can be expected. (The details of the measured data are in shown in Appendix 2-5.)

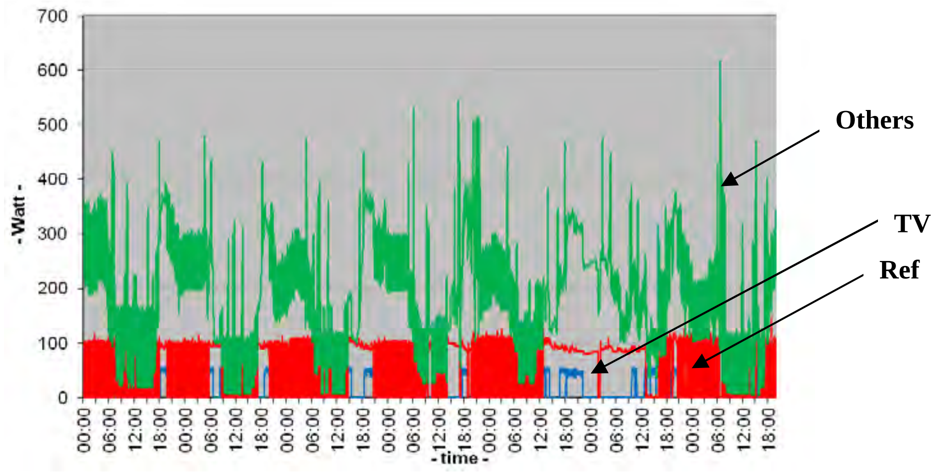


Figure 2.5.5-4 Refrigerator Operating Pattern (1Week)

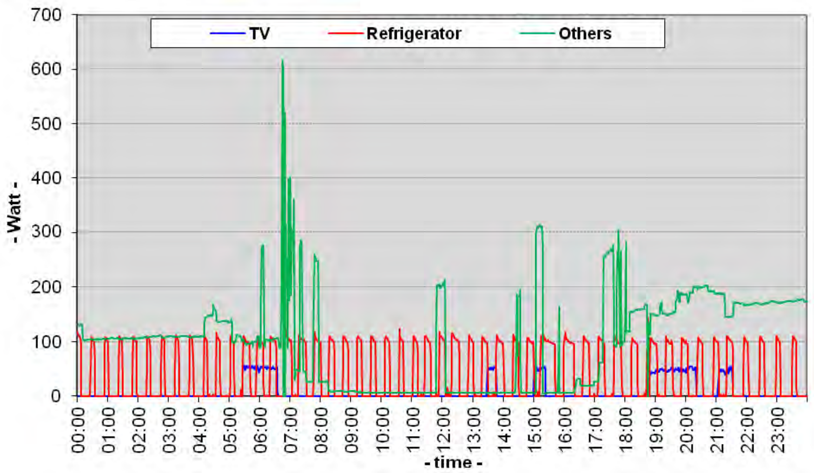


Figure 2.5.5-5 Refrigerator Operating Pattern (1Day)

2.5.6 Other Findings

(1) Penetration of Condensers in Houses

In general PF of the motor-use equipment, such as pumps, fans, and refrigerators and of the conventional fluorescent lamps are low, and they need more current (apparent power) than the rated current (real power). (See Section 2.5.2 (2)) Therefore these appliances are often operated carefully not to cause the limiter trip, i.e. not to excess the contracted ampere) in households. (See Section 2.5.3, and 4)

And in order to avoid the limiter trip, condensers[20], named "Energy Saver" or "Light Power ", which are always plugged in the outlet, are sold in the market and being penetrating in households. (See Figure 2.5.6-1, -2, and -3). Besides appliances with condensers, which are always connected with the power line, are also becoming popular.

It can be said that a lot of condensers, which is expected to improve PF, are disseminating but not being controlled. This is the present power distribution network situation in Indonesian residential area.

From the viewpoint of promoting EE&C, the inverter technology application is recommended for refrigerators and ACs. However, in parallel the burnt-out risk of condensers caused by harmonics generated from inverter equipment should be investigated more. (Described in Section 3.4.5)

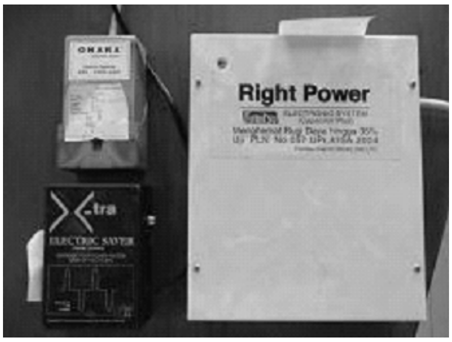


Figure 2.5.6-1 Example of Condensers

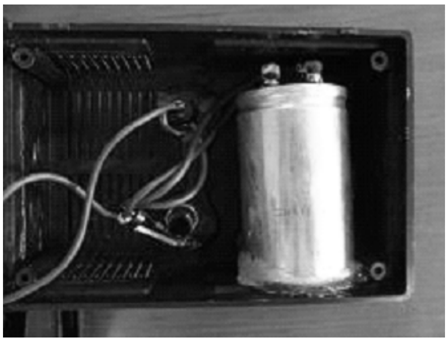


Figure 2.5.6-2 Inside of Condenser

Figure 2.5.6-3 Condensers Sold in Retail Shop

[20] Condensers can improve PF and mitigate limiter trips.

(2) Lack of Quality Control of Limiter

On the other hand, there exist limiters, which do not trip even if the electricity consumption exceeds the rated capacity of limiter. Limiter capacity might not meet the rated contract correctly. In the case of Figure 2.5.6-4, the consumer could receive electricity over 2A, the contract frame, so frequently in 7 days. Figure 2.5.6.5 shows the detail of daily pattern. From 8:00 to 9:00, the consumer is receiving electricity over the contract frame.

The reasons why the electricity consumption exceeds PLN contract are considered to be as follows.

a) Limiters out of the standard are used
b) Limiters meet the standard, however quality control is not rigid (variation of quality)
c) Wires are used bypassing the limiter

Figure2.5.6-6 shows the result of the limiter trip test, which has PLN's certificate and sold in the market. The rated capacity of the limiter is 2A, however 4.7A was measured without trip. From the viewpoint of electricity saving, the quality control of limiter should be focused more.

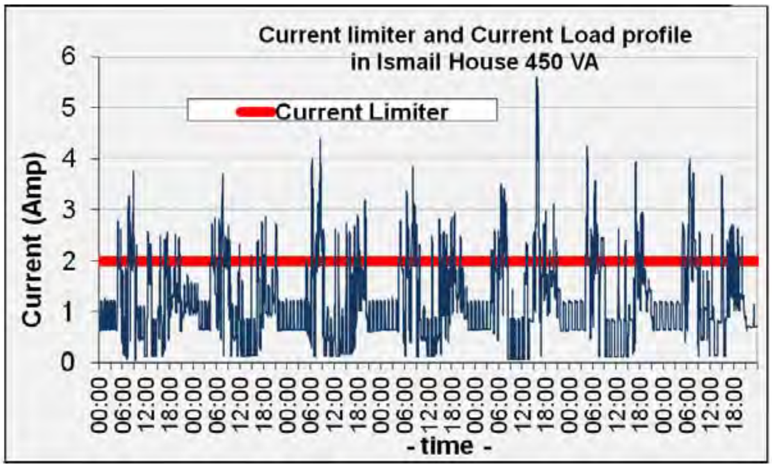


Figure 2.5.6-4 Weekly Fluctuation of Electricity Consumption at 450VA Contract Household

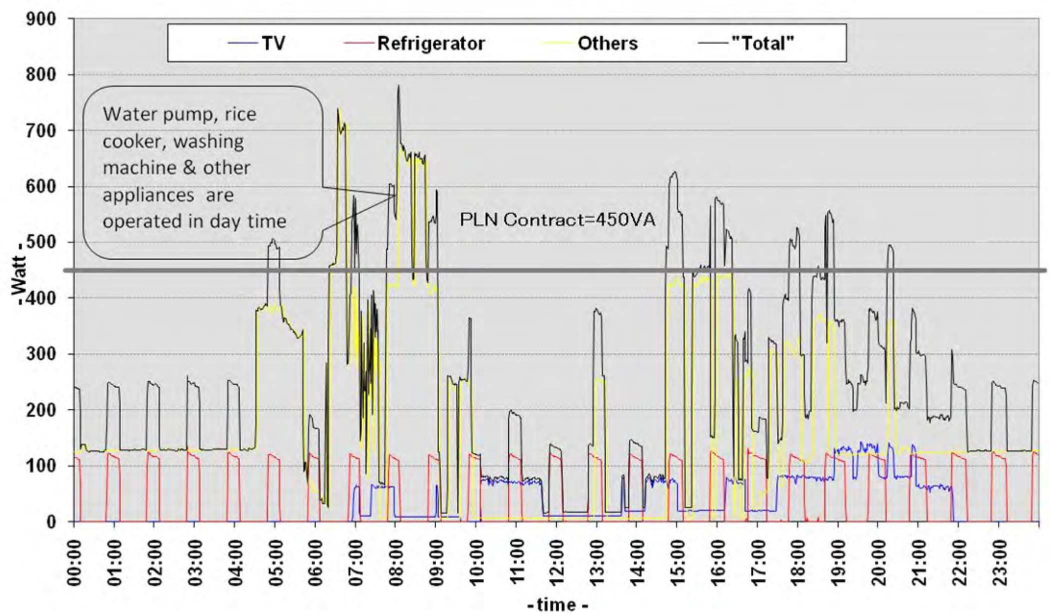


Figure 2.5.6-5 Daily Fluctuation of Electricity Consumption at 450VA Contract Household

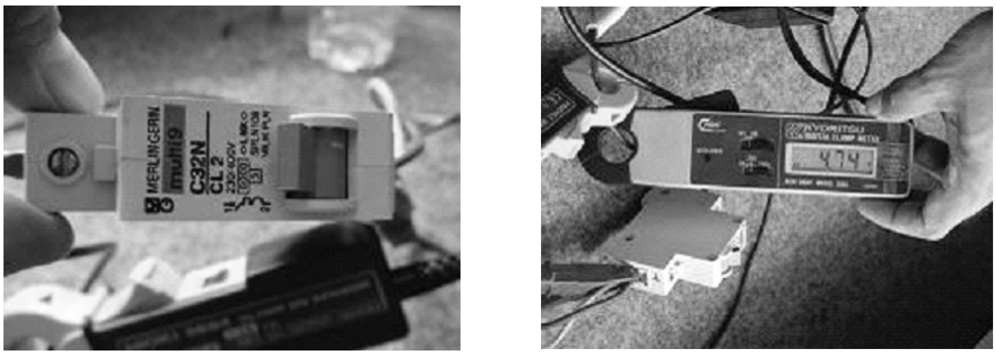


Figure 2.5.6-6 Test of Limiter Trip

2.6 Incentive Program

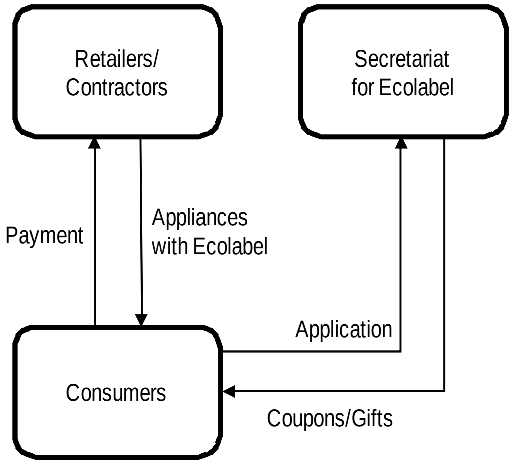
2.6.1 Experiences of Japan and the Other Countries (for Electrical Appliances)

Japan and several countries have been implementing the incentive measures to promote dissemination of highly-efficient appliances. These examples will be useful for Indonesia to design the incentive programs. The typical referential examples abroad are described below.

(1) Japan: Eco-point Program Using Eco Labeling (Promotion for Green Electrical Appliances Dissemination Using Eco-point)

In order to promote the countermeasures against the global warming, economic revitalization, and penetration of terrestrial digital media broadcasting compliant TV, this program was implemented in Japan from 2009 to 2011. “Electric appliance’s eco points”, which can be exchanged with various products and services when the “Green Electrical Appliances” were purchased, were provided. "Green Electric Appliances"[21] means terrestrial digital media broadcasting compliant TV, AC, and refrigerator with four stars or above of EE label established by the government.

The purchasers of green electric appliances mail to Secretariat for Ecolabel, application forms, warranty certificates issued by manufacturers (copy), receipts (original), and copies of vouchers to prove electric appliance's recycling (in case of applying eco-points for recycling). Eco-points are issued after evaluation of Secretariat. The amounts of Eco-points are determined depending on the capacity of appliances and the amounts are added, if the appliances to be disposed are recycled in case of replacement. The applicants can exchange these eco-points with various gifts/coupons. (See Figure 2.6.1-1）



Source: Products of the Study Team based on the public information

Figure 2.6.1-1 Eco-point Program Using Eco-label (Japan)

The issued cumulative Eco-point amounts for individuals (i.e. except corporations) reached to 26.94 million cases, approximately 402 billion points (equivalent to 402 billion JPY) from July 2009 to the end of November 2010.

(2) New Mexico: Rebate Program for Home Appliances with Energy Star

In New Mexico in the United States, the program was implemented to reimburse part of the costs for electric appliances with Energy Star, which shows high efficiency of appliances. The target covers home appliances, which were purchased from April to May in 2010. This budget was allocated from US Department of Energy to State of New Mexico, following American Recovery and Reinvestment Act. Through this program, 622,596kWh, 166,448 therm (4,200GJ), 77.6 million liters of water are expected to be saved. The reimbursed amount and number of home appliances are as follows. (See Table 2.6.1-1)

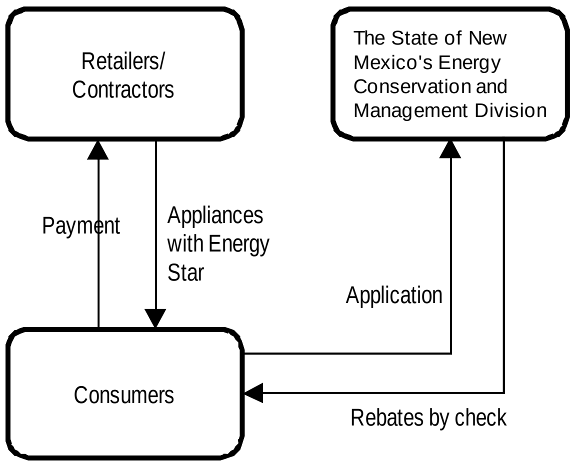
[21] From the purchase after 1st January 2011, the eligibility criteria for application will be changed to the products with the standard five stars for replacement and recycle".

Table 2.6.1-1 Reimbursed Amount and Number for the Targeted Electric Appliances

Targeted Appliance	Reimbursed Amount per Appliance	Number
Washing machine	200USD	3,000
Fridge	200USD	3,000
Gas furnace	200USD	2,315
Total	1,663,000USD	

Source: "New Mexico Appliance Rebate Program" EMNRD Energy Conservation and Management Division (4th November 2009)

Applicants send original receipts and/or invoices, which describe the purchased date, price, and model of the appliances together with the application forms downloaded from the web sites, to The State of New Mexico's Energy Conservation and Management Division. After evaluation, the checks are sent to applicants, if there are no problems. (See Figure 2.6.1-2)



Source: Products of the Study Team based on the public information

Figure 2.6.1-2 Rebate Program for Home Appliances with Energy Star (US)

The program allows only one replaced appliances per one postal address. In addition, the rebates are distributed on the first-come-first-served basis and the program is completed, when the initial funding is exhausted. In order to ensure the fair opportunity, the purchase by the landlord was considered ineligible. The eligible appliances are washing machines, refrigerators and gas furnaces and they were selected considering the energy saving impact and the rebate's potential impact based on the price difference between highly-efficient appliances and the other ones.

(3) Thailand: Tax Incentive for Companies and Professionals (April 2011- April 2013)

In Thailand, Department of Alternative Energy Development and Efficiency (hereinafter to as "DEDE") is leading the program to exempt the corporate tax by the amount equivalent to 25% of the expenses to purchase 19 kinds of the specified equipment with 5 stars of EE label, cooperating with the Revenue Department. The target equipment includes foreign manufactures' ones. The eligible applicants are private companies and individuals with certain professional skills. The procedure is to fill in the application form attached to the documents to prove purchase of the specified equipment, upon filing the income tax returns. After this process, the amount equivalent to 25% of the expenses is deducted from the tax payable without any other additional applications.

(4) Thailand: 555 Projects (Incentive Program with 5% Discount for Individuals (April to May in 2008)

In Thailand, 5% discount program was implemented by EGAT for the home appliances with five stars (the highest ranks) for two months from April to May 2008 (hot season in Thailand). The expenses of this 5 % discount are borne by the manufacturers and EGAT covered the expenses for the campaigning. The scheme was that the consumers purchase the eligible appliances in the Green shops, which were registered in advance, and each Green shop can be reimbursed 5% of the price from the manufacturers. There are 1055 Green shops nationwide and the registration can be made in EGAT for free of charge. According to the interview, using this registration system, misusage of the incentive scheme could be avoided. Once a Green shop is registered, it is only updated the status. Apart from that, EGAT seeks for the cooperation from Green shops when it launches the new program.

(5) Thailand: T5 Lamp Program

In Thailand, EGAT led to promote the introduction of T5 (efficient) lamps. It invited the companies who were interested in introducing T5 lamps, through the newspaper announcement. EGAT installed T5 lamps in the interested companies. These companies repaid this expense to EGAT over 24 month installment without interest. The number of the participated companies was approximately 300. Once the company decided to install the lamps, the company asked the bank to issue the guarantee and submitted it to EGAT. (EGAT is a power company, however involving in the installment transaction is permitted, as long as it was confirmed in the interview) EGAT borrowed the expenses to install the lamps (principal to lend to the participating companies) from ENCON fund[22] at 0% interest. At present, DEDE focuses more on replacing the lamps in the governmental facilities, so this EGAT T5 scheme is not used any more.

(6) Thailand: EGAT Yellow Box

EGAT conducted the campaign for "EGAT yellow box", which is packed in the highly visible yellow boxes. The eligible product for this "EGAT yellow box" is an electric appliance with five stars, for which the product's manufacturer agrees to discount the certain amount. Sometimes, the campaign was conducted with the lotteries attached to this box, of which the prize was the gold products.

[22] A fund promoting EE&C, whose financial source comes from part of oil tax

(7) Malaysia: Rebate Program for Energy Efficient Electric Appliances (Save Program)

In Malaysia, the rebate program is implemented to provide the rebates for the purchase of electric appliances with 5 stars. The rebate will be distributed to the shops, which are pre-registered for the program, through the power company. In order to select the reliable shops, the government asked the manufacturers to submit the list of the reliable shops and contacted the shops in this list, whether they would be interested in participating in the program. The registered shops are more than 12,000 all over Malaysia.

The scheme of the program is as follows. A consumer registers to purchase a highly-efficient appliance on the dedicated program website and prints a voucher by itself. Then, he or she brings this voucher and purchases the eligible product at the participating shops for the program. The shop confirms whether this voucher is true, and connects on this program's website checking the serial number. If the shop can confirm that the voucher is authentic, the shop sells the product at the discounted amount. Later, the shop submits the vouchers in a bundle to the power company and be reimbursed for the amount equivalent to the discounts. In order to avoid misuse of the vouchers (i.e. use one voucher several times), the number of a voucher and its issue date and used date are managed in the website. (The used date is input by the shop.) The amount of the rebates was designed in cooperate with the manufacturers and the information such as the sales forecast of electric appliances is also obtained from the manufacturers. The eligible equipment and amount are: 200RM/unit (approximately 5,000JPY) for refrigerator, 100RM/unit (approximately 2,500JPY) for ACs and 200RMunit (approximately 5,000JPY) for chillers. The program is planned to complete as all initial budget is distributed.

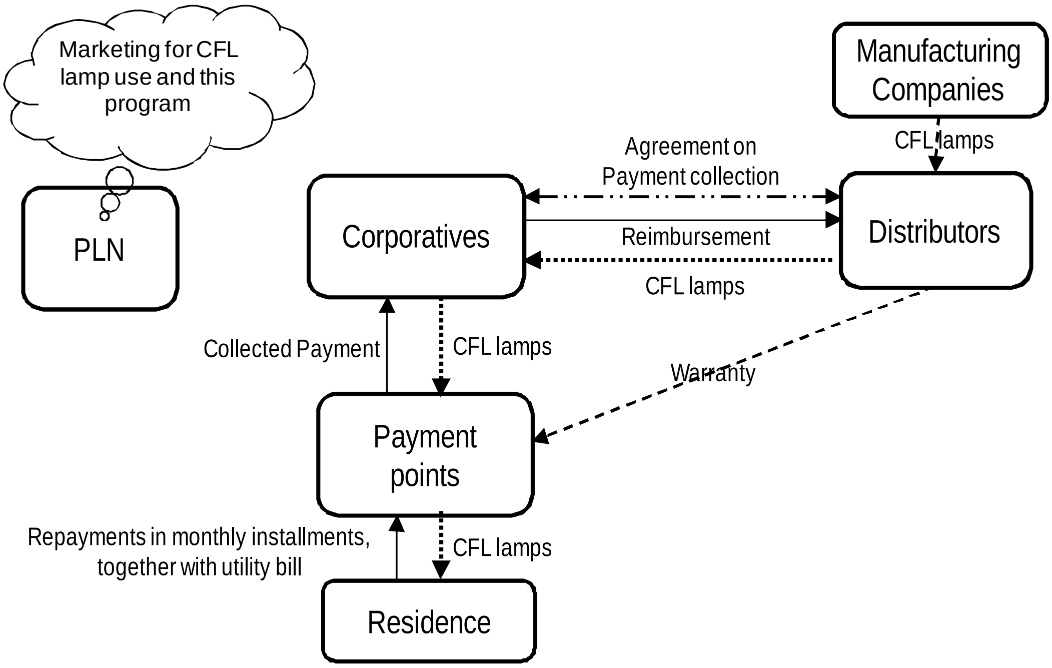
2.6.2 Movement for Formulation of Incentive Programs in Indonesia

(1) Regulation Related to the Incentives to Promote Energy Efficiency (Government Regulation)

According to the law regarding environment protection and management in 2009 (UU32/2009), establishment of the incentive program for environment protection economic activities, including EE&C, has been determined. Currently, Ministry of Environment (hereinafter to as "MOE") is preparing Government Regulation for the incentives including energy efficiency promotion, following this law. Apart from this, the programs implementd to promote efficient appliances in Indonesia are as follows.

(2) CFL Dissemination Program

In this program, in cooperation with PLN's cooperatives (Cooperative consisted of PLN staff as members), PLN sold CFLs to consumers and the consumers repaid the expense together with the electricity bill through the installment payment. This approach was taken in Sri Lanka as well, and the high recovery rate could be achieved, since collecting the installment together with the electricity bill acted as the disincentive not to pay the installment, due to the consumers' concern that non-payment might lead to the electricity supply cut. In case of Indonesia, it was difficult to combine the system of electricity bill and payment collection for CFLs, therefore the invoices were issued separately. However, the implicit incentive worked and there was no problem for installment payment, according to the interview with the related parties. (See Figure 2.6.2-1)



Source: Products of the Study Team based on the interviews

Figure 2.6.2-1 Promotion Program to Disseminate CFL

In this scheme, the cooperative established in each PLN branch decide either of cash-and-carry (goods in exchange of payment) and installment payment. The price of CFLs was discounted compared with the market price, since CFL manufacturers consider this scheme as the sales promotion and agreed to discount. Furthermore, in order to limit the maximum number of the discounted lamps for each household (two per household), the exchange voucher for the lamp was attached to the electricity bill. At the same time, PLN took the role of marketing.

(3) Incentive Program for Commercial and Industrial Sectors

In Indonesia, the provision of the incentive program for the commercial and industrial sectors is stipulated in the regulation (PP No. 70/2009) and MEMR is preparing the regulations for its implementation. The EE&C promotion measures adopted in the past is the soft loan program for pollution control and EE&C by Development Bank of the Federal Republic and Federal States (hereinafter to as "KfW") together with MOE. KfW is preparing the subsequent soft loan program specialized in EE&C. However, this loan size is expected to be 20 million EURO (approximately 14.4 million USD) and this single project will not be able to capture the sufficient EE&C investment demand, considering this demand is estimated as about 1 billion USD in commercial and industrial sectors[23]. In terms of the on-going EE&C promotion program, there is the loan program provided by Bank Mandiri using fund of Agence Francaise de Development (hereinafter to as "AFD"). However, the target in this program includes the

[23] Estimation by the Study Team. For the background information, please refer to the separate volume of the finance report.

renewable energy, this component is likely to account for the certain portion, and the interest rate to the companies is not concessional.

2.7 Dissemination, Awarenee, and Others

The Study Team investigated the activities on dissemination and awareness for EE&C, it was clarified that various activities have been carried out in Indonesia. However it is also confirmed that, except CFL dissemination and promotion program, the other programs has not always led to EE&C activities of consumers. Followings are typical examples of consumer's consciousness for EE&C. Also, Indonesian government, PLN, BPPT, and EMI activities of dissemination and awareness for EE&C are shown in Section 2.7.1.

a) Almost every categories of consumers desires to reduce electricity bill, however over 60% of consumers has set AC operating temperature equal to or lower than 25 °C. (It is said that electricity consumption could be reduced by about 10% with 1 degree increase) (EMI investigation 2010)

b) The majority of consumer recognizes that refrigerators, TVs, and ACs consume a lot of electricity, however they have not taken any measures to save electricity yet. And they do not know the electricity consumption ratios of these appliances in total consumption and cost down effect of electricity saving. (EMI investigation 2011)

Besides, during the study, two training courses in Japan and several special seminars in Indonesia were held, focusing on dissemination and awareness of EE&C activities in Japan and Brazil and by international cooperation agencies. Through these events, Japanese and international movement were shared with C/P. The outline of these activities is shown in Section 2.7.2 and -3.

2.7.1 Dissemination and Awareness Activities for EE&C in Indonesia

(1) Measures on Promoting Dissemination and Awareness for EE&C

For promoting EE&C and developing awareness, there could be four measures; "laws and regulations", "communication", "capacity building", and "rewards and punishment". (See Figure 2.7.1-1) Measure of "laws and regulation" is enforcing target parties to comply with them, while the other measures are some sorts of trigger to implement EE&C programs. Following (2) to (5) show the activities taken by related parties of Indonesian government. DSM program, awareness program for EE&C, and electricity conservation program by PLN are also overviewed.

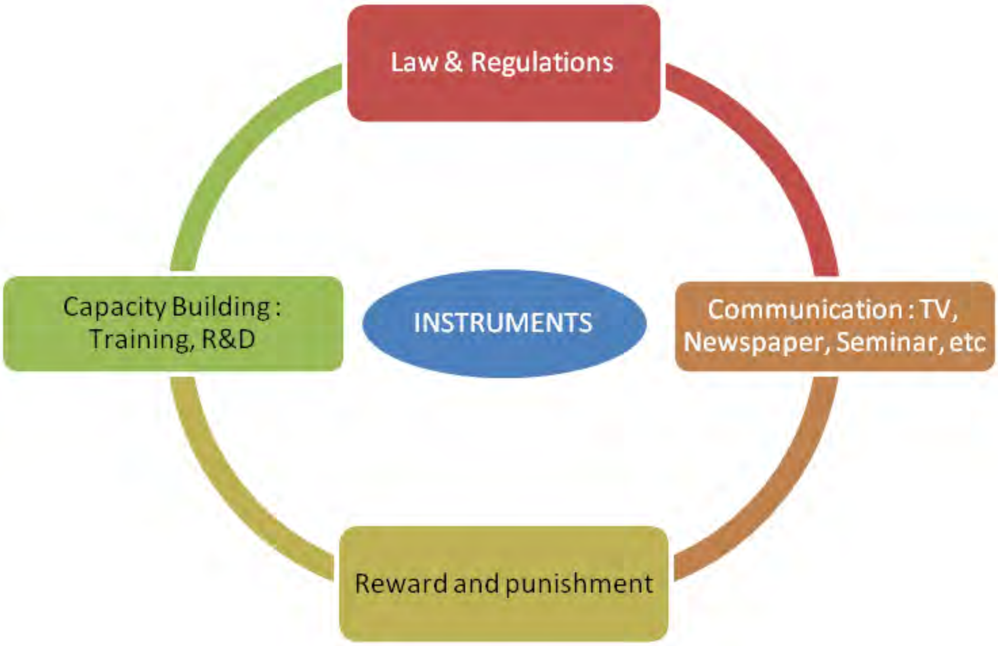


Figure 2.7.1-1 Measures of Developing Awareness for EE&C

(2) Regulations, Reward, and Punishment Programs by Indonesian Government

For promoting EE&C, the enforcement of laws is required and effictive. Followings are the outline of related laws implemented recently in Indonesia.

1) Energy Law No. 30 (2007)

The Energy Law No. 30 is the basis to derive EE&C program in Indonesia. The law consists of energy resources management, environment/energy, energy pricing, and the viewpoint of international cooperation. And also formulation of the energy policy , energy business, and rights/responsibilities of organization are specified.

2) Governmental Regulation (Peraturan Pemerintah) No. 70 (2009)

On 16th November 2009, MEMR issued Governmental Regulation (Peraturan Pemerintah) No. 70/2009 on EE&C under the Energy Law.

The Regulation consists of;

a) The formulation of Rencana Induk Konservasi Energi Nasional, National EE&C Master Plan (hereinafter to as "RIKEN"), which is to be updated every five years or annually as required.
b) The assignment of an energy manager, conducting an energy audit, and drawing an energy conservtion plan are the mandatory duties for business enterprizes consuming 6,000 toe or more yearly.
c) Implementation of mandatory EE standard and EE labelling program
d) Implementation of tax exemption and financial incentives for importing energy-saving

equipment/appliances and special low interest loan for EE&C investment

e) Implementation of punishment programs for non-compliance including written notice, public announcement, fine, and interruption of energy supply

MEMR is currently drafting a detailed regulation and regulatory frameworks under the Governmental Regulation No. 70/2009.

3) National Energy Management No.2/2008

National Energy Management No.2/2008, which is a revision of the National Energy Policy of Presidential Regulation No. 5/2006, elaborates on the energy policy including on EE&C. It instructs Ministers and Governors (head of district regions) to use "energy and water "

efficiently in central and regional governmental facilities. Followings are the concrete contents.

a) Implementation of EE&C on lightings, ACs, electricity equipments, and office vehicles
b) Implementation of water conservation in all activities using water
c) Implementation of programs and activities on efficient use of energy and water in line with governmental policies
d) Evoking people's awareness to conserve energy and water by promoting systemization, dissimination, and education
e) Launching action team in each project to monitor efficient use of energy and water
f) Launching national organization for efficient use of energy and water

4) National Energy Management of Presidential Regulation No. 13/2011

National Energy Management of Presidential Regulation No. 13/2011, which is the revision of Presidential Regulation No. 2/2008, sets concrete targets of electricity saving, subsidy reduction, and water conservation as 20%, 10%, and 10% respectively.

5) Ministerial Decree No.6/2011

Ministerial Decree No.6/2011, under Ministerial Decree No.6/2011 on EE labeling for CFLs, appliance efficiency and labeling standard, has been established. There is no product with label in the market yet.

(3) Dissemination and Capacity Development Programs by Indonesian Government

MEMR has been implementing several activities to develop dissemination and awareness for EE&C. For instance, MEMR holds seminars, workshops and talk shows, publishes public advertising, and issues brochures and leaflets. These are mainly targetted to promote EE&C in households, buildings, specific industries, and transportation.

MEMR supports the implementation of public trainings for energy managers in private companies. Currently, the establishment of the national energy manager certification program is progressing. Present training program is implemented for Government officials, who are responsible for EE&C and energy use reporting in their office. Those who are interested in capacity development for EE&C in factories and commercial buildings could participate the training. The Centre of Education and Training on Electricity and Renewable Energy in MEMR is preparing to implement the EE&C training for governmental officers and private companies. The centre is also responsible for the training of energy managers and energy auditors.

(4) DSM and Dissemination/Awareness Program for EE&C by PLN

Since 2002, PLN launched DSM task force team and released action plan in Integrated Resource Planing (hereinafter to as "IRP"). This team has prioritized the program for clipping the peak load and purchase the captive power.

From 2002 to 2003, "DSM Terang Program" was introduced. The objectives of this program were replacing incandescent lamp into CFL and reducing CFL retail price to be affordable for residential consumers.

PLN in cooperation with five CFL producers distributed about 1 million CFL at the 50 % lower price than the market. (add on the monthly bill)

In 2004, the next program called "DSM Peduli" was released, providing discounted CFLs for low-income consumers.

In 2005, PLN released TOU tariff system for large-scale customer in commercial and industrial sectors to clip down electricity demand during the peak load period.

In 2007, PLN introduced CFL donation program, that was distributing three free CFLs to low-income customers of about 17 million.

PLN's DSM programs from 2002 to 2007 could be categorized into "Priority" and "Advancement" programs.

Priority program consists of;

a) Surplus electricity purchase from captive power in the area which electricity supply and demand balance is tight,
b) Introduction of highly-efficient lightings for the residential sector and the street lighting, and
c) Mediating CFL sale for low-income customers.

Advance program consists of;

a) Energy audit for commercial and industrial sectors,
b) Information provision for households about electric/electronic product and appliances, and
c) Introduction of TOU tariff systems and incentive programs.

PLN's DSM program "Terang" (blight) and "Peduli" (proven) have been somewhat succesfully operated by introducing CFLs in the residential sector and also decreasing the retail price, by increasing the market volume. The peak demand of Jawa Bali system was estimated to bed reduced from 192 to 184 MW in 2004 By this program.

(5) PLN's Program for EE&C

In the past ten years, PLN has been involved in DSM programs as a pioneer of EE&C promotion. Since 2008, PLN has been conducting intensively electricity saving programs, specifically for the residential sector.

The programs have been implemented in all regions and branches of PLN and still been continued until now. The goal of the program is to increase consumer's awareness and consciousness especially for the efficient use of electricity.

The prioritized targets of PLN's dissemination and awareness program are elementary schools and and the residential sector.

The outline of major dissemination and awareness programs for EE&C is described as follows.;

a) Campaign to request electricity saving of 50 to 100 watt everyday in residential sector, through mass media, brochure, sticker, and specific event called "kawasan terang PLN",
b) Education and cultivation of "Genematrik" (electricity-sarving generation) for instructing elementary school students on efficient energy utilization,
c) Opening "Forum Hemat Listrik" (electricity-saving forum) on PLN website, which gives tips and guidance on how to use electric/electronic appliances efficiently and safely,
d) EE&C campaigns and awarding events on regional basis, and
e) Supporting EE&C activities of private companies

(6) Activities of BPPT and EMI for promoting EE&C

BPPT had equiped an vehicle with energy audit divices for energy auditing. BPPT is utilizing it for the audit of factories and commercial buildings across the country.

And on the technical subject concerning EE&C, BPPT holds seminars and workshops, in which the related governmental organizations, academic experts, and private enterprises were invited.

EMI, which is in charge of the secretariat and chairman of EE&C Promotion Supporting Association in Indonesia, supports EE&C activities of private companies. Moreover, EMI supports holding various seminars and workshops of EE&C hosted by MEMR and MOI.

2.7.2 C/P Training in Japan

During two-year study period, the Study Team coordinated C/P training for EE&C in Japan twice. The training curriculums are shown in Table 2.7.2-1 and -2, and photos of training course are shown in Figure 2.7.2-1.

1) First training for high class officers: August, 2010

Participants; Five persons from MEMR, one from Ministry of Finance (hereinafter to as

"MOF", one from MOI, one from The State Ministry of National Development Planning/National Development Planning Agency (hereinafter to as "BAPPENAS"), one from PLN, and one from EMI, ten in total

Main theme of training course; Legal framework, EE labeling program, finance mechanism, and DSM

Lecturers; Ministry of Economy, Trade and Industry (hereinafter to as "METI") (Information exchange), The Energy Conservation Center, Japan (hereinafter to as "ECCJ"), JICA (Information exchange), Electric Power Development Co., Ltd. (hereinafter to as "J-POWER"), and Japan Economic Research Institute Inc. (hereinafter to as "JERI")

Places of visit; Panasonic Tokyo Center, Isogo Thermal Power Station, Akihabara electric city

2) Second training for working-level: July, 2011

Participants; Five persons from MEMR, one from MOF, one from Indonesian Institute of Science (hereinafter to as "LIPI"), one from BPPT, two from PLN, and one from EMI, eleven in total

Main theme of training course; Legal framework, EE labeling program, finance mechanism, and DSM

Lecturer; ECCJ, J-POWER, JERI, Shikoku Electric Power Co., Inc., Techno Soft Co., Ltd., Hitachi Metal, Ltd.

Places of visit; Panasonic Tokyo Center, Isogo Thermal Power Station, Akihabara electric city

Table 2.7.2-1 Training Curriculum (The First Time in August, 2010 for High Class)

Date	Time	Curriculum	Place
8/19(Thu)	AM PM	Narita Arrival JICA Briefing Program Orientation	 TIC
8/20(Fri)	AM PM	10:00-12:00（ECCJ） "Outline of Japanese EE&C policy & strategy (Focused on total figure, Energy Manager ,Labeling and Benchmark)" 13:30-16:30（Panasonic） "Visiting Panasonic showroom" 17:00-19:00 Visiting Akihabara (Labeling)	J-POWER Panasonic Akihabara
8/21/22(Sat, Sun)			
8/23(Mon)	AM PM	11:00-12:00 (METI) Visiting METI (information exchange) 14:00-16:00（Isogo PS） "Visiting Isogo Thermal P/S（high efficient）"	METI J-POWER
8/24(Tues)	AM PM	10:00-12:00 (JERI) "Financial Mechanism, DSM measures" 14:00-15:30（JICA） JICA Evaluation	J-POWER JICA
8/25(Wed)	AM	Narita Departure	

Training course at J-POWER

Discussion with JICA

Figure 2.7.2-1 Photos of Training Course

Table 2.7.2-2 Training Curriculum (The Second Time in July, 2011 for Working Level)

Date	Time	Curriculum	Place
7/10 (Sun)	AM PM	Arrival JICA Briefing	 TIC
7/11(Mon)	AM PM	9:30-10:00 Program Orientation 10:00-12:00（ECCJ） “Overviews of Policy and Act on EC in Japan” 13:30-14:30（Hitachi Metals） “Amorphous Alloys for Distribution Transformers” 14：30-17：00（ECCJ） “Dissemination and Promotion of EC Activities in Japan”	J-POWER
7/12(Tue)	AM PM	10:00-12:00（Isogo PS） Visitingg Isogo Thermal P/S 14:00-16:00 (J-POWER) Session Meeting Group A（Shikoku EPCo, TechnoSoft） “Electricity Tariff and Distribution System in Japan” “For Functional DSM Tariff System” Group B（JERI） “Financial / Fiscal Incentives for Energy Efficiency” Group C (J-POWER) “Energy Efficiency Labeling” 16:00 Get on JICA bus 16:30 Visiting Akihabara (Labeling)	J-POWER Isogo P/S J-POWER Akihabara
7/13(Wed)	AM PM	9:30-10:30（J-POWER） “Additional Information, Japanese DSM Measures 2011” 10:15 Move to Panasonic by JICA bus 10:45-13 :00（Panasonic） Visit to Panasonic Center Tokyo 13:00 Get on a JICA bus 14:00-17:00 Group Discussion and Drafting Action Plans (Group A,B, and C)	J-POWER Panasonic Center Tokyo J-POWER
7/14 (Thu)	AM PM	9:30-12:00 ditto 13:30-15:00 Presentation of Action Plans by Group A, B, and C 15:00-16:00 JICA Evaluation	J-POWER
7/15(Fri)		Narita Departure	

2.7.3 Implementation of Seminars

Several kind of following seminars were held for targeting governmental organizations, PLN, and universities for evocating awareness and understanding on each theme.

(1) Seminar on Climate Change, EE&C and Carbon Market

Seminar of climate change and EE&C and carbon market was held on 23rd April, 2010 in Indonesia University, inviting academic experts and students. (Host; Indonesia University, EMI, and Asia Carbon. Cooperation; JICA)

The lecturer of the seminar was Prof. Moreira[24] (Professor of Sao Paulo University in Brazil) who is one of JICA team members and was a leading author of IPCC at that time. The number of participants was nearly 100 persons. (See Figure 2.7.3-1 and Section 3.6.2)

And on 26th April, 2010, the same seminar was held in MEMR, inviting governmental officials and the related consulting companies. The number of participants was nearly 60 persons.

Figure 2.7.3-1 Seminar on Climate Change, EE&C, and Carbon Market

(2) Seminar on Renewable Energy and EE&C in Brazil (Past and Present)

Seminar on Renewable Energy and EE&C in Brazil (Past and Present) was held on 17th February 2011 at MEMR inviting the related governmental officials and industries. (Host; MEMR. Cooperation; JICA)

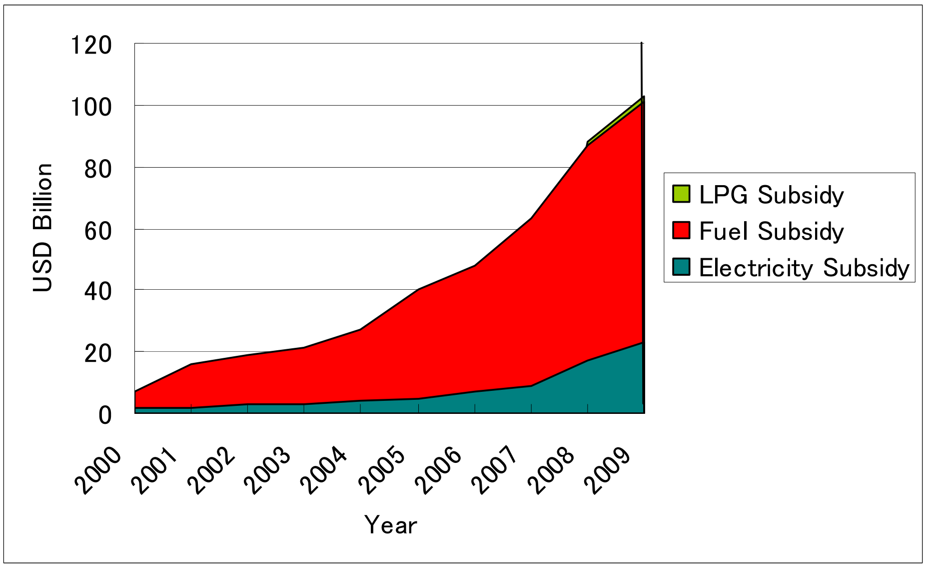
The lecturer was Prof. Moreira, and the participants were nearly 60 persons. Although the population of Brazil and Indonesia was almost same, Brazil is ahead of Indonesia in the fields of renewable energy utilization and EE&C activities. As Indonesia is at standstill situation, proactive questions, answers, and discussion were exchanged.

Especially, the audience became uproar when it was claimed that the subsidy for energy in Indonesia is 100 billion USD during recent 10 years, on the other hand that in Brazil is 35

[24] Prof. Moreira resigned the lead author of IPCC in the middle of 2011. He was one of the leading authors of IPCC when IPCC crowned the Novel Prize in 2007.

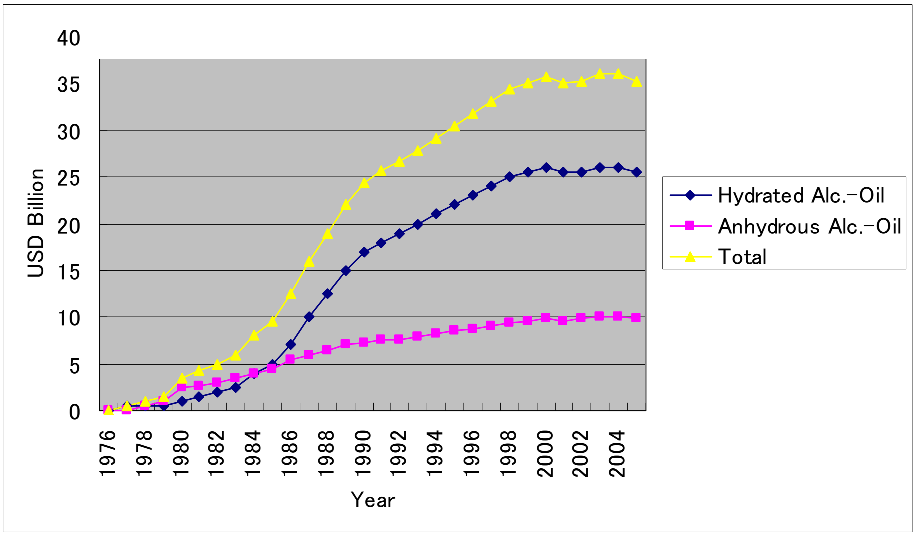
billion USD during resent 30 years. (See Figure 2.7.3-2 and -3 concerning the content of suggestion)

The lecturer from third country like this case is one of potential options for JICA technical assistance.



Source: Products of the Study Team based on MEMR documents

Figure 2.7.3-2 Accumulated Energy Subsidy for 10 Years in Indonesia



Source: Products of the Study Team based on document of government officials in Brazil

Figure 2.7.3-3 Accumulated Energy Subsidy for 30 Years in Brazil

(3) Seminar Concerning DSM Activity after the Great East Japan Earthquake in Japan

Seminar concerning DSM activity after the Great East Japan Earthquake in Japan was held on 22nd July 2011 at PLN. (Host; PLN, Cooperation; JICA)

The lecturer was Dr. Yoshida, who is the leader of the Study Team. And the participants were nearly 30 persons. (Refer Section 3.6.1 concerning the content of suggestion) Moreover, on 25th July, 2011, the same seminar was held in MEMR, inviting governmental officials and the related consulting companies. The number of participants was nearly 40 persons.

(4) Presentation at CEO Conference Hosted by AESIEAP

In the CEO Conference Hosted by The Association of the Electricity Supply Industry of East Asia and the Western Pacific (hereinafter to as "AESIEAP") and held at Manado on 31st October 2011, following presentations were conducted.

a) DSM activities in Japan after 11th March 2011
b) International trend for CO2 emission reduction
c) The result of JICA DSM Study

Dr. Yoshida made a presentation concerning a) and c) and Prof Moreira made a presentation concerning b). (Refer Section 3.6.1 and 3.6.2 regarding the content of the presentation)

(5) Presentation Concerning Harmonic Distortion at Workshop of Electricity Quality Benchmark

In this workshop held at BPPT on 3rd November 2011, Dr.Yoshida made a presentation about the concern of harmonic distortion. (Refer Section 3.4.5 regarding the content of the presentation)