MINISTRY OF ENERGY AND MINERAL RESOURCES
REPUBLIC OF INDONESIA

No.

THE STUDY
ON
ENERGY CONSERVATION
AND EFFICIENCY IMPROVEMENT
IN
THE REPUBLIC OF INDONESIA

FINAL REPORT
SUMMARY

AUGUST 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

ELECTRIC POWER DEVELOPMENT CO., LTD.

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ABBREVIATIONS

AC	Air Conditioner
AFD	French Development Agency
BNSP	National Professional Standard Body
BRESL	Barrier Removal to Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling Project
CFL	Compact Fluorescent Lamp
CLASP	Collaborative Labeling and Appliance Standards Programme
C/P	Counterpart
DANIDA	Danish International Development Assistance
DSM	Demand Side Management
DSM Peduli	DSM for encouraging awareness of energy saving for household consumers with load less than 900 VA
EE&C	Energy Efficiency improvement and Conservation
ETCERE	E&T Center for Electricity & New Renewable Energy
GDP	Gross Domestic Product
HAKE	Energy Conservation Specialist Association
JICA	Japan International Cooperation Agency
MEMR	Ministry of Energy and Mineral Resources
METI	Ministry of Economy, Trade and Industry
MOF	Ministry of Fund
MOI	Ministry of Industry
MW	Megawatt
NEDO	New Energy and Industrial Technology Development Organization
ODA	Official Development Assistance
PLN	Perusahaan Listik Negara (State Electricity Company)
RIKEN	Rencana Induk Konservasi Energi Nasional (National Energy Conservation Plan)
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization

Executive Summary (Proposal to Implement Optimal Program for Promoting EE&C in Indonesia)

Since August 2007, when the Study started, the Study Team has held dozens of discussions and exchanged much information with C/P, Ministry of Energy and Mineral Resources (MEMR) and related organizations. Taking into consideration these processes, a summary of the major results of analysis, confirmed issues, direction to be targeted and proposals for optimal EE&C promotion are described as follows;

1. Outline of Basic Research

Basic research was conducted to focus on 6 issues below;

(1) Data collection and analysis on Indonesian economic situation and energy supply and demand

(2) Indonesian legal framework and inter-organization structure which had been enacted and formulated in the past

(3) Activities of international and domestic organizations in support of EE&C

(4) On-site and questionnaire survey on industries and commercial buildings to understand the current conditions of EE&C implementation

(5) Market research and EE&C potential estimation for major electric appliances

(6) On the basis of the information above, clarification of the current condition and issues to be solved for promoting EE&C, mainly focus on 3 targeted fields: energy manager program, labeling program and electricity DSM program.

The key information collected and issues clarified to be solved through the Study are described below; **(→; issues to be solved)**

(1) GDP and national energy consumption growth are both expected to be 5-8％/ year

(2) The same growth is expected in national electricity consumption, and electricity supply deficit in the evening becomes an urgent and major issue (refer Fig.1)

(3) Electricity tariff has been politically set at a lower level than realistic cost. So people's incentive to reduce energy expenditure is so small that it is hard to promote EE&C. Besides, governmental subsidy on electricity tariffs is surging year by year, running over 5％of the national budget, thus creating a vicious cycle. (refer Fig.2)

→ **To formulate a countermeasure for this distortion is the biggest issue**

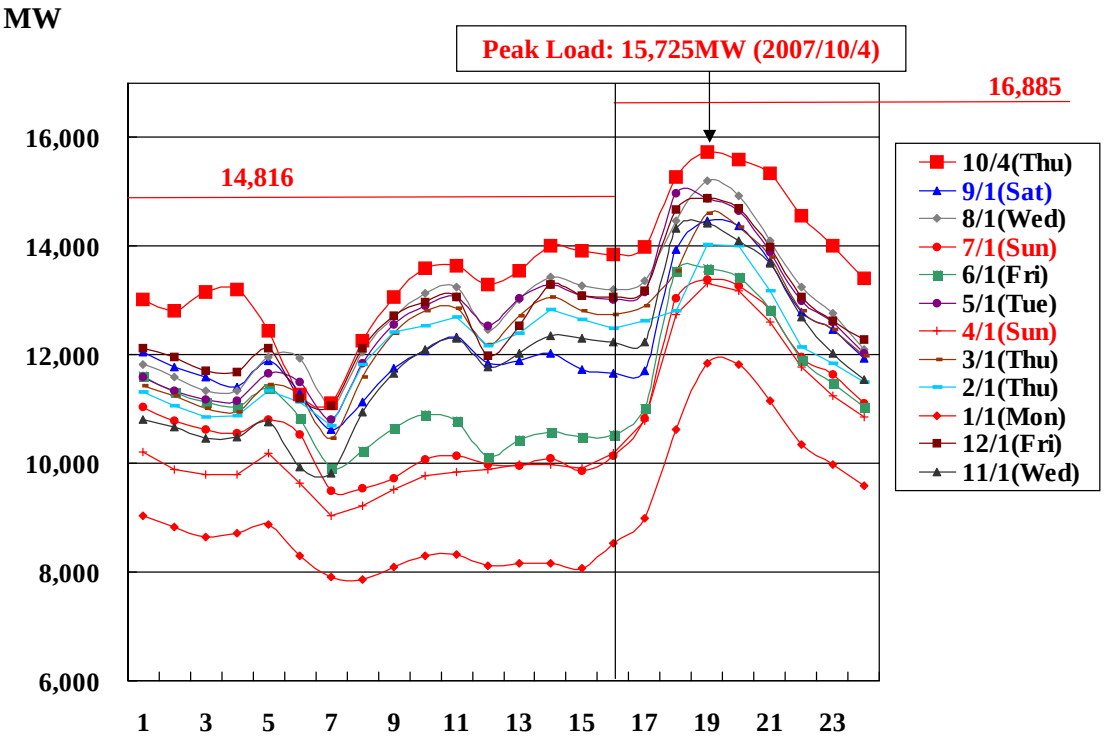

Fig. 1 Daily Electricity Load Curve of PLN

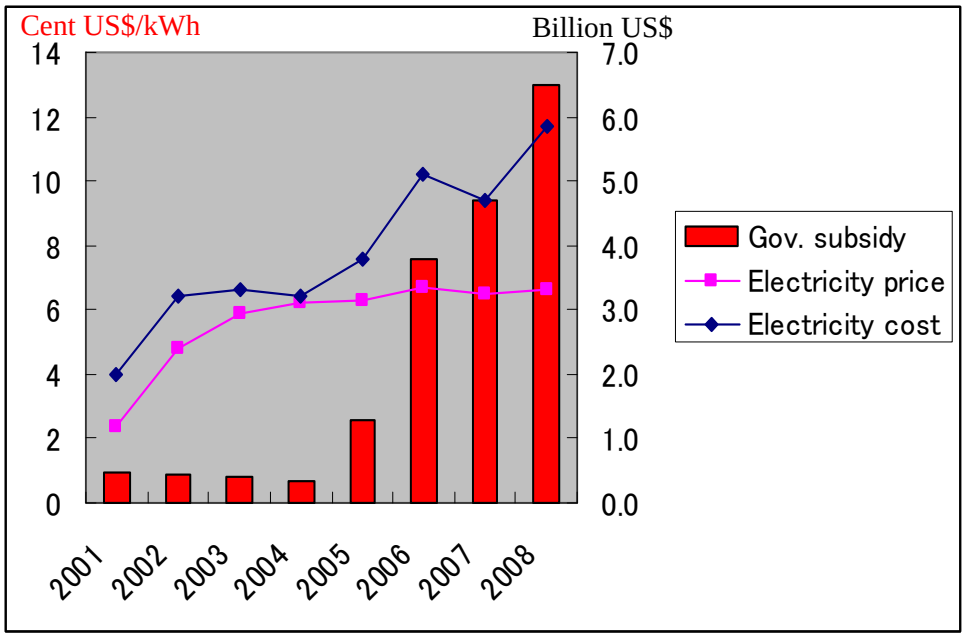

Fig. 2 Trend of Average Electricity Price (Tariff), Cost and Subsidy from Government

(4) Fuel switching from oil to coal is on-going

(5) The Indonesian government is concentrating on formulating legal frameworks to implement energy manager and labeling program for EE&C, which was stipulated in the Energy Law enacted in August 2007.

(6) Regarding the energy manager program, it has been decided that MEMR has a responsibility for enacting and operating this program collaborated with Ministry of Industry (MOI). And the competency standard of certified energy manager for commercial buildings has been decided. The Education and Training Center of MEMR (ETCERE) has been chosen as an executing agency for EE&C training.

(7) Energy Conservation Specialist Association (HAKE) is expected to be accredited as an agency for certificating an energy manager license in the discussion between MEMR and National Professional Standard Body (BNSP).

→ **However the practical tools and materials to operate the program has not been prepared yet. This becomes an urgent issue.**

(8) The labeling program for CFLs has been finalized as the first such program in Indonesia. And from now on MEMR has a plan to formulate labeling programs on refrigerator, air conditioner and TV, whose energy consumption is increasing rapidly.

(9) The major programs drawn up, proposed and supported by international organizations are as follows:

UNIDO; International energy manager program (ISO 50000 basis) 2009-2013

UNDP; International labeling program 2009-2013

DANIDA; Implementation of clearing house for EE&C and related supporting programs 2009-2013

AFD; Co-financing on Cool Earth Program Loan which is proposed by Japanese government 2008-

→ **Functional linkage among these international organizations is an indispensable issue for Indonesian EE&C.**

(10) On the basis of on-site and questionnaire surveys, the state of the implementation of EE&C practices in factories and buildings was analyzed. The results of the analysis are summarized as follows. The interrelations among the constraints analyzed are also shown in Fig. 3.

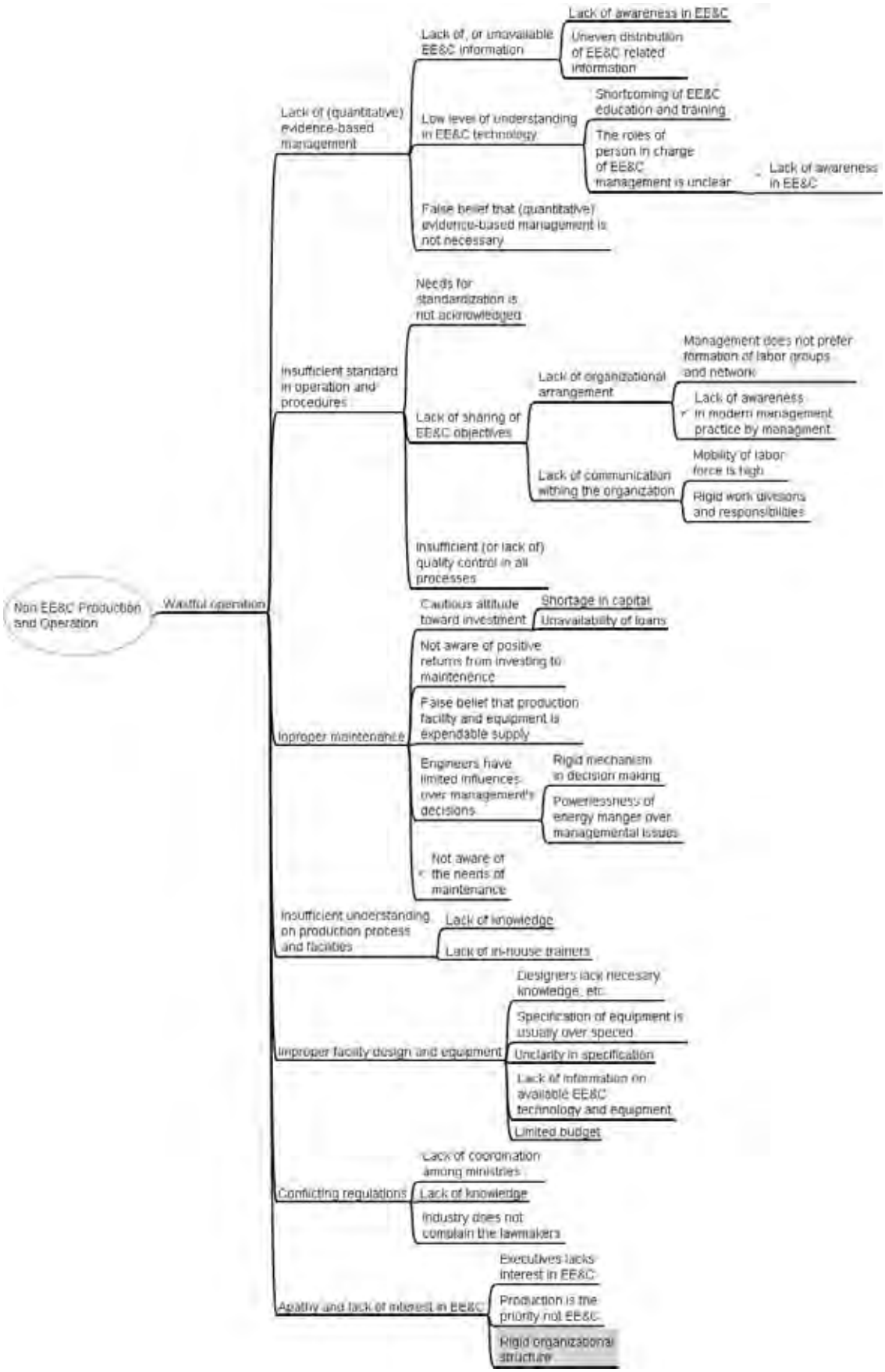

Fig. 3 Problem Tree (Analysis of the Constraints of EE&C Promotion in Indonesia)

1) Lack of (quantitative) evidence-based management
2) Insufficient standards in operations and procedures
3) Improper maintenance
4) Insufficient understanding of production process and facilities
5) Improper facility design and equipment
6) Conflicting rules and regulations (Regulation on Hospital room temperature etc)
7) Apathy and lack of interest in EE&C (especially in top management)

→ **Practical countermeasures to breakthrough these 7 issues should be formulated**

(11) Outline of results of market research and EE&C potential estimation are described as follows;

1) Conversion from incandescent lamps to CFLs has the quite comprehensive effect of achieving not only EE&C but also electricity peak cut, financial benefits for users and reduction of governmental subsidy to PLN (reduction of electricity cost).

→ **Promoting CFL dissemination is a quite promising countermeasures for EE&C**

2) EE&C potential in cooling is the largest in commercial buildings

→ **Promoting high efficiency air conditioners and chillers is also promising. A major issue to be clarified is the dissemination speed (scenario) of the inverter type**

3) Formulating labeling programs for TVs and refrigerators before their full scale spread is an effective countermeasure to mitigate the future growth of electricity consumption.

4) The EE&C potential of introducing high efficiency motors is quite large.

2. Major Contents of Discussion with C/P and Technology Transfer during the Study Term

During the study period, not only 3 targeted fields: energy manager program, labeling program and electricity DSM program, but also the methodology for economic and EE&C potential analysis and indicators was discussed and transferred to C/P and related organizations. As illustrated in Fig. 4, the Study has been conducted through three steps. As the first step, Analysis 1 centering on market survey of electrical products and Analysis 2 centering on energy audit and questionnaire survey were taken with an eye to acquiring basic data and information reflecting the country's energy conservation potential. The studies in the two Analysis were reinforced by a study on the introduction of DSM system. As the second step, energy conservation potential and CO_2 reduction potential were estimated based on results of the Study in the first step, and were compared with the expected effect of the government's existing energy conservation master-plans. And finally in the third step, recommendations featured with a roadmap and action plans were presented to the Indonesian government.

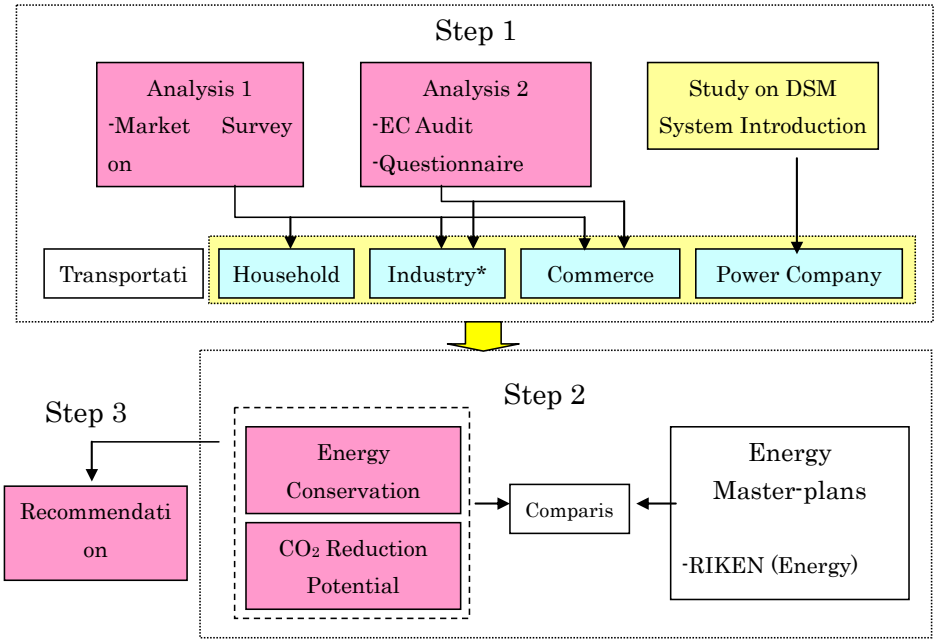

Fig. 4 Steps of the Study

Fig. 5 visualizes the scope of the Study whereby to clarify the interrelationship between the Study and existing energy conservation master-plans made by the Indonesian government, as well as the relationship between Analysis 1 and Analysis 2 within the Study. Additional reference needs to be made to the scope of Blueprint for Electricity Conservation (Draft). Although it is defined as part of the larger area covered by Analysis 2 of the Study, strictly speaking, it should extend beyond the boundary of Analysis 2's area, as sectors like transportation and construction also consume a certain portion of electricity. However, since this portion is relatively insignificant, it is consciously neglected here to make the picture visually easy to understand.

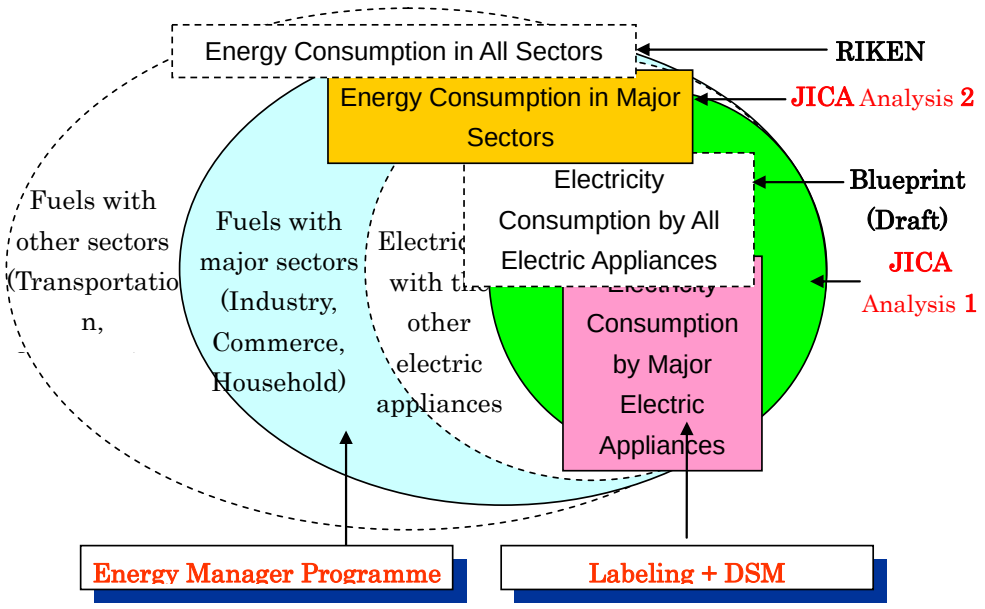

Fig. 5 Scope of the Study

Major contents of discussion with C/P and technology transfer list is attached in Table1.

Table 1 Major Contents of Discussion with C/P and Technology Transfer

Theme	Transfer to	Timing	C/P apply
Common			
Economic Analysis			
Intensity/elasticity	MEMR	3rd mission	Shared
Procedure of economic analysis	MEMR/EMI	1st, 2nd	PPT
EE&C,CO2 potential	MEMR/EMI	3rd, 4th ,5th,7th,8th	EXCEL table
Economic analysis	MEMR/EMI	4th ,5th	EXCEL table
Future Direction	MEMR	5th	
Training in Japan	MEMR/ETC/BPPT/EM	2008.Novem.	
Energy Management			
Legal Framework	MEMR/ETCERE		
Japanese Periodecal report		3rd, 4th	WORD
Middle & long term plan		3rd, 4th	WORD
EM training curriculum		2nd, 3rd	WORD
Outline of EM training		2nd, 3rd	WORD
Example of test paper		between 2nd and 3rd	WORD
Punisshument		2nd, 3rd	WORD
EM program	MEMR/ETCERE		
Outline of surrounding countries		2nd, 3rd	WORD
Number of candidate factories		2nd, 3rd	Applied
Competency for Industrial		4th	
EA program	MEMR/ETCERE		
Competency fot EA		4th	WORD
Guideline	MEMR/ETCERE/EMI/ BPPT	4th, 5th	To be discussed
Energy Management			WORD
Audit, measurement			WORD
Guideline			
Auditing（8 spots）	MEMR/BPPT	2nd, 3rd	Introduction of EMS
Potential Next project	MEMR/ETCERE	4th,5th,6th,7th,8th	To be discussed
Labeling program	MEMR		
Japanese labeling system		1st, 2nd, 3rd	WORD
Comparison & proposal （Lamp、Ref.、AC、TV）		3rd, 4th	PPT
Japanese testing Meth.		3rd, 4th	WORD
Outline of surrounding countries		3rd, 4th	WORD
EE&C potential estimation		3rd	EXEL
DSM program			
Japanese DSM、electricity tariff	PLN/MEMR	3rd, 4th	PPT
EPP/CDM	MEMR/PLN	2nd, 3rd	PPT
Proposal of CFL programatic CDM	PLN	between 2nd and 3rd	Applied
Potential estimation	PLN	3rd, 4th	EXEL
Energy auditing support system	PLN/MEMR	3rd, 4th	PPT
Proposal of EPP	PLN/MEMR	4th, 5th	PPT
Potential Next project	MEMR/PLN	4th,5th,6th,7th,8th	To be discussed
Roadmap & Actionplan	MEMR/ETCERE/PLN	4th, 5th,6th,7th	

3. Proposal of Roadmap and Action Plan for Indonesian EE&C

On the basis of the results of the Study, the "Basic Strategy for Promoting EE&C" was figured out in Fig.6, focusing on 3 strategic fields, namely "Enhancement of Awareness and Consciousness of EE&C", "Strengthening Support from the Government", and "Enforcing Rules and Regulations". And under these 3 strategies, the measures to be taken for introducing functional EE&C were illustrated. They are listed in 14 programs. The summary of these programs and projects is contained in Table 3.

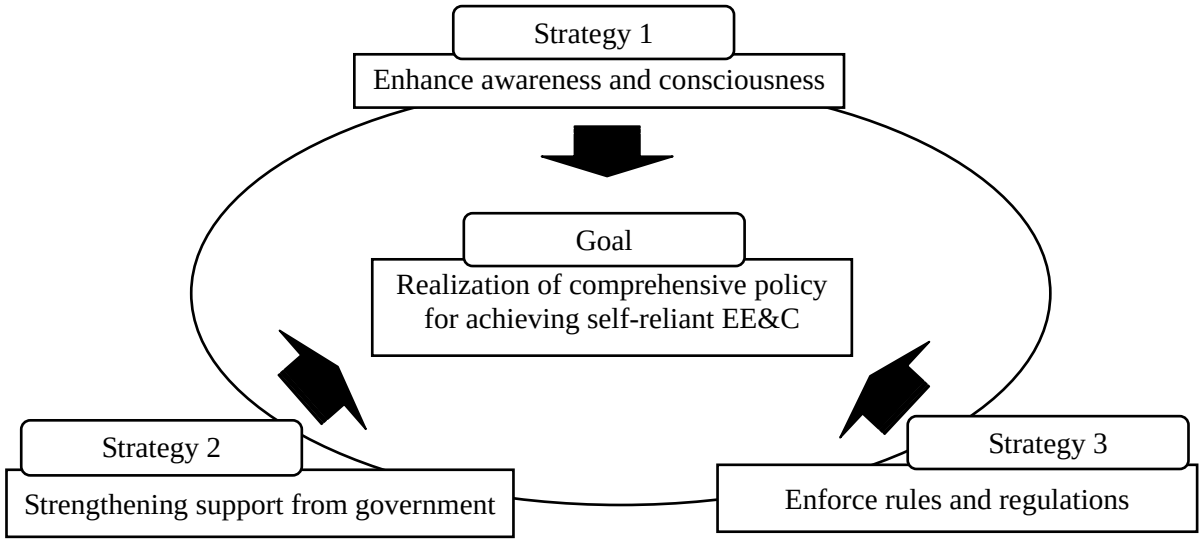

Fig. 6 Basic Strategy for Promoting EE&C

Basic grounds for proposed programs and projects are as follows;

Compared with Japan and surrounding countries, national budget & resources for EE&C activity per capita and GDP in Indonesia is quite small. In order to achieve national target of EE&C level, it is necessary to invest at least several times larger financial resources. And to achieve the target, firstly road map (total figure) for EE&C promotion should be prepared. Then to secure the budget needed, functional linkage among eligible international supporting programs (organizations) should be formulated.

Until 2015 utilizing international organizations support, the government should concentrate on 1) formulating national energy manager certification program and introducing the concept of energy management in factories and buildings, 2) disseminate labeling program of selected electric appliances and 3) accelerating DSM measures in electricity field. These programs are not so costly, and with these prioritized measures, 10％EE&C will be achievable.

From Japanese experiences by introducing energy management system and steadily operating it (PDCA cycle), at least 5 % EE&C can be got. Indonesian government should continue and accelerate the preparation and enactment for legal frame work of national energy management program. And also Government should strongly focus on awareness program for governmental organizations and private companies about the merit of introducing energy management system.

Following up the labeling program on CFL, it is quite effective to formulate next labeling program on

AC, TV and refrigerator etc. and go into steady operation, which will be sure to be spread in the near future in Indonesia, before their popularization. There are several failures in other countries without controlling the energy efficiency criteria on these electricity appliances.

DSM in electricity becomes quite effective and speedy measure when applied with functional electricity tariff mechanism. The expected benefit is not only achieving EE&C, mitigating peak demand but also works to reduce increasing governmental subsidy to PLN.

Priority main programs and the Study approach to reach them are shown in Fig. 7.

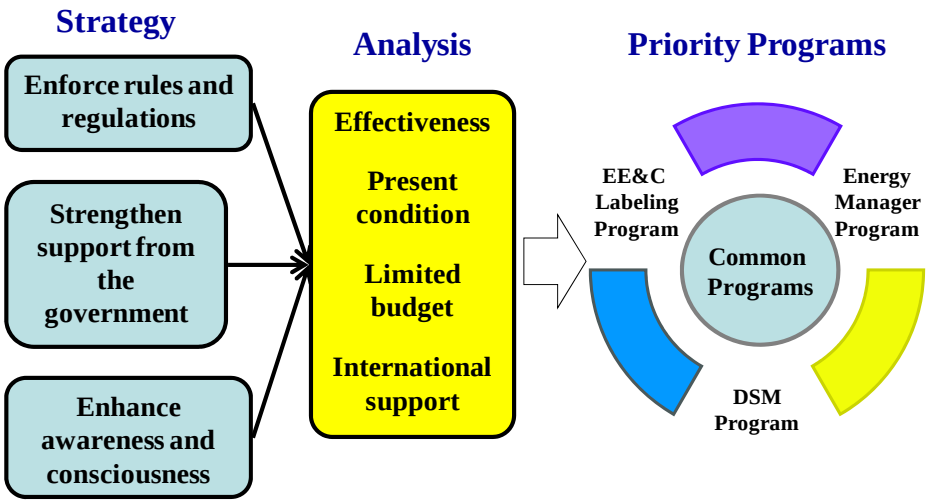

Fig. 7 Approach to the Priority Programs

There is a trend for decentralization in Indonesia, but up to 2015 central government should play a leadership to show the national direction for EE&C, prepare guideline and formulate national framework.

In this context more resources should be allocated in central government than provincial. And reflecting national direction, related ministry, provinces and private sectors will be able to formulate their original plan. And following it, they can prepare their own budget for EE&C and go into implementation stage.

Up to 2015, it is also effective to clarify eligible EE&C technologies, which is effective but costly, and conduct demonstrative projects of these specified technologies and formulate supporting programs to incite private company's investment in these technologies.

After 2015 the dissemination of these specified technologies should be accelerated mainly by private sectors. The governmental role should be limited in awareness and support.

The tentative incremental realization scenario of EE&C & CO_2 reduction potential for all the major sectors is reflected in Table 2. (Notice needs to be taken that while the energy types of industry sector include fuels and electricity, commerce and household sector only focus on electricity.)

Table 2 EE&C & CO_2 reduction Potential Incremental Realization Scenario for All the Major Sectors

Item / Sector	Focused Energy Source	EE&C/ CO2 reduction Potential (%)			
		Approach1	Approach2	Approach3	Total
		Mainly 2005~15	Mainly 2016~20	Mainly 2021~25	2005~25
Food	Multi	5 5	5 5	5 5	15 15
Iron & Steel	Multi	10 10	7 7	13 13	30 30
Textile	Multi	10 10	5 5	15 15	30 30
Cement	Multi	4 2	2 2	4 2	10 6
Other Indus.	Multi	8	4	11	23
Commerce	Electricity	10	5	10	25
Household	Electricity	10	10	10	30

Source:: Based on field study, NEDO report and MEMR report. Data of food and

Note:: Regarding the proportion of electricity consumption among total energy consumption in the commercial sector, it is expected to be 62% in Year 2025 with the BAU Case, and 55% with the EC Case. As for the proportion of electricity consumption in the household sector, it is expected to be 28% in the same year with the BAU Case, and 22% with the EC Case. The parts colored red represent sectors within the scope of the Study.

The main points of the above-mentioned tentative EE&C potential incremental realization scenario are summed up as follows:

a) Approach-1 and Approach-2

- With reinforcement of energy management（Zero cost for users and low cost for the government) , modification and addition of parts (cost of minor investment）, it is assumed to be possible to achieve EE&C by 10-20% within a period of 5 to 10 years.
- At present, problems of incomplete energy management system on the factory floor and mid-level managers' lack of expertise and experience remain obstacles to the promotion of EE&C.

b) Approach-3

As far as the analysed sectors of this study, more significant EE&C could possibly be achieved by investment of larger scale to replace existent equipment with energy-efficient one. EE&C of respective sectors could be achieved in the following ways:

- Iron & steel : 10% plus EE&C by introducing high-efficiency reheating furnace would be possible.

- Textile : 20% EE&C mainly through heat recovery in dyeing process would be possible.
- Food, cement and others : It looks promising to utilize the results of NEDO pilot projects in the fields of heat recovery, cooling and biomass technology, etc.
- Building : 10% plus EE&C by BEMS could also be possible.
- Household : 30% EE&C could be possible mainly in AC and refrigerator with inverter, TV and lighting; though introduction of Labeling system is urgently needed.
- Two-step loan or project financing loan using ODA soft loan from international financial institutions like JICA, ADB and the World Bank would be effective options for the introduction of promising though costly EE&C technologies such as the technologies which have been implemented as NEDO's pilot projects or study etc.

Table 3 Summary of the Road Map for EE&C C Dissemination and Promotion

No	Main Program	Program	Description/Issues	Measures	Priority	C/P (Implementing Agencies)	Schedule
1	Energy Manager Program	Education and Training (on EE&C for senior executives, etc)	Relevance and feasibility of EE&C investment are not fully understood by the management. (Difference of effect and controllability between sales increase caused by interaction with consumers and cost down that can be achieved by in house EE&C activity) Adopting proposed ISO 50001 (Energy Management System) through participating EE&C promotion programs proposed by UNIDO	Various seminars and training events for senior managers made available to teach the feasibility of EE&C investment. EE&C should become a major indicator for good management. Creating a positive corporate image of an eco-friendly company.	A	MEMR （ETCERE）	Highest priority among all programs/projects. Complete in Stage 1
2		Development of the Network of Designated Factories and Energy Mangers	Absence of forum aiming at technology exchange and transfer across industry. Technical information on EE&C and its advancement is not easily distributed in Indonesia. No connection with other energy managers. Lack of information on a good practice and effective measures, etc.	Seminars for Energy Managers Preparation for examination for certification Technology transfer.	A	MEMR, ECTC	Implement ASAP HAKE has been established as a professional association for Energy Managers

No	Main Program	Program	Description/Issues	Measures	Priority	C/P (Implementing Agencies)	Schedule
3		Energy Audit Partnership Program (Continuation and Expansion of the Existing Program)	Weak capacity in auditing There is no professional certification for energy managers Less implementation after auditing	Training for Auditors, program on strengthen auditing skill Compilation and publication of the analysis and audit results	A	MEMR	Stage 1 Enhancement of PROMEEC and existing programs
4		Implementation of Seminars, Education and Training on EE&C	Access to the technical information is very limited. The knowledge of the regulation is limited.	A variety of technical seminars and training programs targeting various levels.	A	ETCERE、local government, conglomerate	Introductory levels in Stage 1 (2009-15) Technologically advanced contents may be introduced in the succeeding stages
5		Target-Setting Agreement with Designated Factory	There is no regulatory framework for overseeing energy use of industry and building, etc. There is no functional incentive for adopting EE&C because of low energy prices driven by politics. Adopting proposed ISO 50001 (Energy Management System) through participating EE&C promotion programs proposed by UNIDO	Introduction of target-setting agreement program Mandatory reporting on energy use Nomination of an energy manager	A	MEMR	Stage 1. (Implementation of Energy Manager Program, which has been prepared to enact, is one of the highest priorities)

No	Main Program	Program	Description/Issues	Measures	Priority	C/P (Implementing Agencies)	Schedule
6	Labeling Program	Promotion of Energy Labeling Program	Functional Labeling Program has not been implemented, Lack of information on useful EE&C technology. Lack of awareness program	Establishment of testing methodology and testing organizations, Specified technologies Establishment of sustainable developing program	A	MEMR, Accredited testing laboratory, Label Certification Body, ECTC, Clearinghouse	Stage 1 (Mainly focus on CFL,AC, refrigerator and TV etc. which are effective in the short term) Utilizing BRESL and CLASP program which are supported by international cooperation organizations
7	DSM Program	Promotion of Electricity Demand Side Management (DSM) Program	Absence of incentives and disincentives based on electricity usage	Introduction of sustainable and functional electricity tariff schedule Provision of incentives to adopt measures for DSM	A	PLN, (MEMR)	Should be implemented in Stage 1 utilizing the proposed JICA supporting program
8	Common Program	Establishment and expansion of award program for achievement of EE&C activities (targeting industries, commercial buildings, machinery and equipment, school and children)	Lack of incentives for adapting EE&C. Weak attitude to carry out EE&C	Stronger publicity for EE&C. Incentives through getting a good name.	A	MEMR（ACE, MOI and MOE）, ECTC	The current award program may be carried out soon. Develop a new award program in the separate areas in the mid and long term activities.
9		Promoting EE&C design and use of EE&C goods and materials	There is no one stop access to technical information, etc on EE&C Hard to access useful EE&C information	Provision of so-called “one-stop service” (establishment of the clearing house) Establishment of EE&C information collection and dissemination mechanism (future linkage to program 10)	A	MEMR	Stage 1 Utilizing DANIDA program

No	Main Program	Program	Description/Issues	Measures	Priority	C/P (Implementing Agencies)	Schedule
10		Energy Conservation Technology Center (ECTC)	There is no functioning central agency to promote EE&C	Present and promote EE&C technology	B	MEMR	Stage 2 (after 2015) and the following (after the institutional arrangement is completed) Support from industry is indispensable
11		Establishment of financial mechanisms to support EE&C promotion and dissemination.	Financial support for implementing EE&C is lacking. Weak incentive for promoting EE&C measures	Study on establishment of Energy Conservation Fund whose source is derived from tax on electricity and fossil energy consumption. Provision of subsidies (e.g. low-interest loan, etc.). Tax relief for EE&C investment Lower import tax.	A	MEMR（MOF）	For the near term utilizing international cooperative program as much as possible. Launch supporting measures that can start earliest. Implementing tax reform in the early stage is the highest priority.
12		Promotion and Acceleration of Research and Development	Dependence on foreign EE&C technology. No room for fostering technology originating in Indonesia	Presenting EE&C policy directions suitable for the socio-economic system of Indonesia. Collaboration among universities and industries. Development of technology unique to tropical climate.	B	MEMR, Ministry of Education	Initial emphasis will be on behavioral sciences (laws, organizational development, policy areas) in Stage 1. Engineering development may come in Stages 2 and 3.

No	Main Program	Program	Description/Issues	Measures	Priority	C/P (Implementing Agencies)	Schedule
13		Preparation of Laws, Regulations and Standards for Promotion and Dissemination of EE&C	Various ministries prepare laws and regulations without close coordination and consultation	Coherent implementation of EE&C laws and regulations	A	MEMR、MOI	Should be implemented in Stage 1.
14		Establishment of common database of EE&C.	Common database of EE&C has not been established.	Establishment of national basic data base. Formulation of functional data collection and analyzing mechanism. Implementation of master plan based on the above database.	A	MEMR、MOI, ECTC	Should be implemented in Stage 1. Cool Earth Partnership Program, which is supported by JICA and AFD, should be utilized to establish CO_2 road map on industries.