Chapter 3

Proposal of Optimum Programs for Promoting EE&C

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3.1 Structure and Outline of Chapter 3

In this chapter, firstly the electricity demand forecast until 2025 including the peak demand and electricity consumption, which is the baseline for various proposals, is analyzed and explained. Secondly as core themes of this study, the proposals and study results of electricity tariff system and labeling program including incentive program for EE&C are described. Finally, awareness, and other measures for promoting EE&C are proposed. The outline of proposals and study results for each theme is described in the followings and detailed contents are explained in Section 3.2 and afterwards.

3.1.1 Baseline Scenario of Electricity Demand in 2025

The base lines of the future forecast of electricity demand until 2025, which is used in the estimation in Chapter 4, were defined by the extrapolation of the estimation until 2019 in 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 assumed that across the country electricity consumption will be 542TWh per year, peak load will be 94.8GW in 2025, and both are 3.7 times of 2010. (See Figure 3.2.2-1, and -2)
b) It is assumed 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. (See Figure 3.2.2-3, and -4)
c) Daily load curve of the Jawa-Bali will be shifted from evening and night to day peak type in the middle and long run. (See Figure 3.2.3-4)

3.1.2 Proposals of Functional Electricity Tariff System

As a countermeasure against the increasing subsidy to electricity, Indonesian government and PLN 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 customers are proposed in addition to the existing disincentives oriented tariff. In concrete terms, following measures are proposed.

(1) Amendment of TOU Tariff System in the Jawa-Bali Region (New TOU tariff system) (See Section 3.3.2)

  a) Setting 3 time zones to mitigate the coming daily peak; mid-night and early morning (incentive), daytime (disincentive), evening (disincentive)
  b) Widening the ratio of peak to off peak tariff (ranged from 2.5 to 5.0)
  c) Expansion of target group for B2 and R3. (Number of consumers; 1.7%, electricity consumption; 61.3%)

(2) Amendment of PF[1] Clause (New PF clause) (See Section 3.3.3)

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

(3) Introduction of Tariff Adjustment System by Fuel Price Fluctuation (See Section 3.3.4)

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

Moreover roadmap and action plan for formulating the functional tariff system were proposed. (See Section 3.3.5)

3.1.3 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 its 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 Frameworks are as follows. (See Section 3.4.4)

- Flexible management of testing institution
- High energy efficiency of ACs with inverter[2]
- Special consideration to domestic 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

It is proposed to investigate the risk of accidents, which might be caused by the increasing harmonics induced by promoting inverter technology. (See Section 3.4.5)

c) Establishment of EE Performance Database

Prototype of EE performance database for refrigerators, ACs, and TVs was completed and transferred to MEMR. The prototype can contribute as the basis of data accumulation and analysis. (See Section 3.4.6).

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[1] Refer Section 1.4.4 (1)

[2] Refer Section 1.4.4 (2)

d) Roadmap and Action Plan

Roadmap and action plan for implementing EE labeling program were proposed. (See Section 3.4.7)

e) Others

Issues on formulating and operating Labeling Program were pointed. (See Section 3.4.8)

3.1.4 Establishment of Incentive Scheme to Disseminate Highly-efficient Appliances

Indonesia provides the subsidy for electricity and the electricity tariff is kept low. This reduces 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. (See Figure 3.5-1)

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 in the country and this leads to the reduction of CO_2 emission and electricity subsidy ultimately. Therefore, the incentive provision for EE&C together with increase of electricity tariff is effective in Indonesia to get out of the current vicious circle. (See Figure 3.5-2)

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

a) Interest reduction scheme for credit card (See Figure 3.5.1-1)
b) VAT reduction scheme (See Figure 3.5.1-3)
c) Rebate scheme (See Figure 3.5.1-4, -5, and -6)

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 (See Figure 3.5.2-1)
b) Scheme through PIP (See Figure 3.5.2-2)

In addition, roadmap and action plan for implementing incentive program to disseminate highly-efficient appliances and equipment were proposed. (See Section 3.5.3) And the issues to formulate incentive program were summarized. (See Section 3.5.4)

3.1.5 Dissemination, Awareness, and Others

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

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)　(See Section 3.6.1 (1))

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.　(See Section 3.6.1 (2))

c) Formulation of everybody's participating EE&C program by target setting and information dissemination with governmental leadership

And due to the earth quake and devastating tsunami, which hit Japan directly on 11 March 2011, approximately 40% of the total capacity of TEPCO power plant was shut down. In order to reduce electricity demand to meet the supply capacity, a) Japanese government set target (minus 15% compared with 2010) and b) asked for consumers' cooperation c) by disclosing the electricity consumption pattern by each consumer category.

As a result, Japanese government was able to reduce the electricity demand by 15 %. From Japanese experience, applicable key factors for effective EE&C promotion in Indonesia are described below.

a) Government leadership to achieve EE&C
b) Information provision for EE&C implementation
c) Establishment of frame work for everybody's participation　(See Section 3.6.1 (3))

Besides from the global point of view, it is suggested that the contribution of EE&C is highly effective to the reduction of CO_2 emission in future.　(See Section 3.6.2)

3.2 Baseline Scenerio of Electricity Demand in 2025 (BAU: Business As Usual)

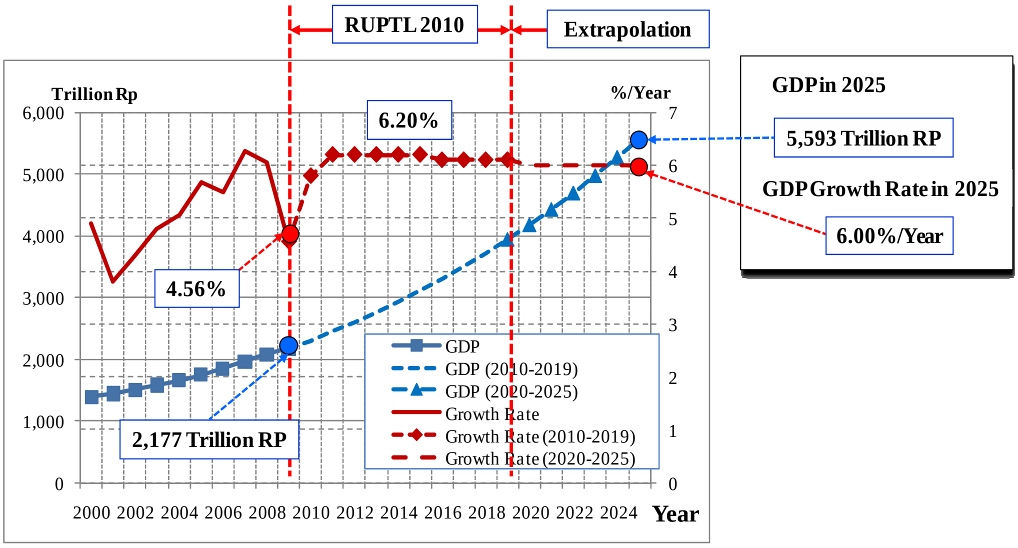
The electricity demand until 2025, as the baseline (BAU) for the effect analysis in Chapter 4, was estimated. The results are described in the followings. The forecast of electricity demand was illustrated based on Rencana Usaha Penyediaan Tenaga Listrik ("Electricity Supply Business Plan", hereinafter to as "RUPTL") 2010 by PLN. To supplement RUPTL 2010, Rencana Usaha Penyediaan Tenaga Listrik ("National General Electricity Plan", hereinafter to as "RUKN") 2008-2027 by MEMR and field survey information under this study were utilized.

3.2.1 Conditions to Estimate Electricity Demand

Electricity demand was estimated based on RUPTL 2010. As RUPTL 2010 estimates the demand only until 2019, the demand after 2020 to 2025 is extrapolated using RUPTL data described in the followings.

(1) Indonesian GDP Growth Rate

Figure 3.2.1-1 shows GDP and its annual growth rate. The growth rate of 2009 is 4.56%. RUPTL 2010 forecasts GDP growth rate from 2010 to 2019 as 6.2%. The Study Team set the annual growth rate from 2019 to 2025 as 6.0%. Accordingly, GDP of 2025 reaches about 2.6 times of 2009.

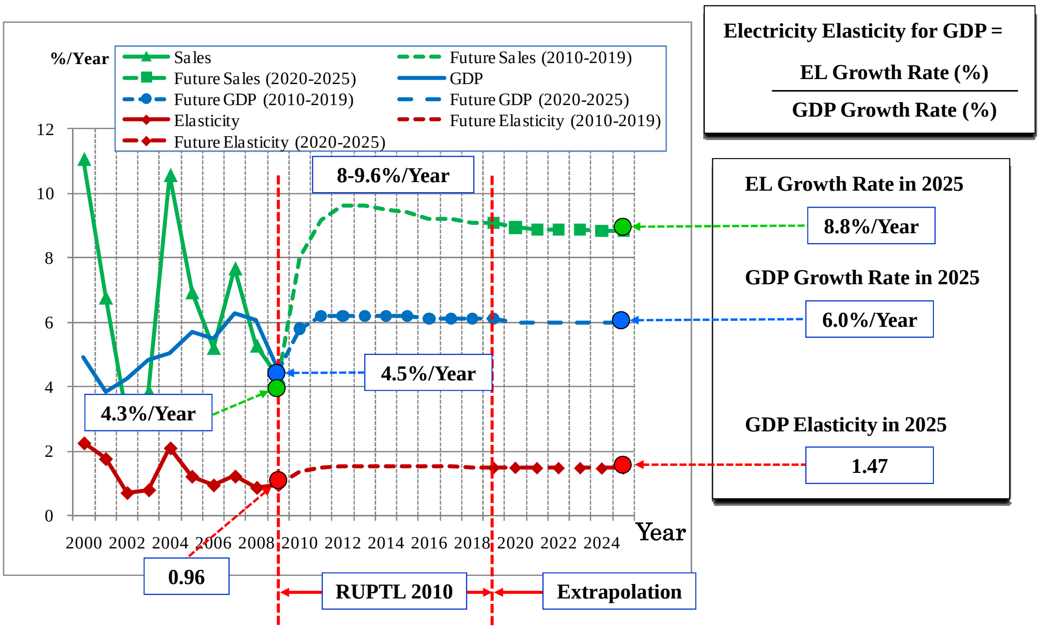


Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

Figure 3.2.1-1 Estimation of GDP Growth Rate

(2) Indonesian Electricity Elasticity to GDP

Figure 3.2.1-2 shows GDP growth rate and electricity/GDP elasticity. Using this value, electricity demand growth was calculated. Electricity growth rate is assumed as 8.8% in 2025.



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

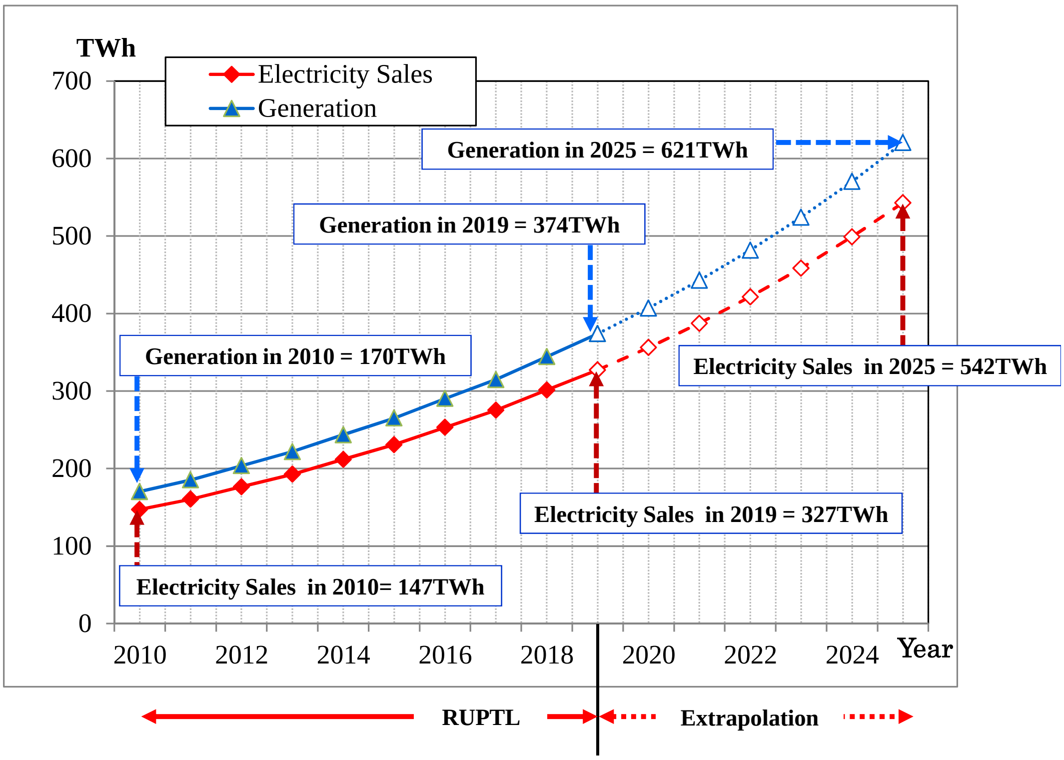
Figure 3.2.1-2 Forecast of Electricity Elasticity to GDP

3.2.2 Demand and Supply Capacity Forecast of Indonesia and Surveyed Regions

(1) Indonesia

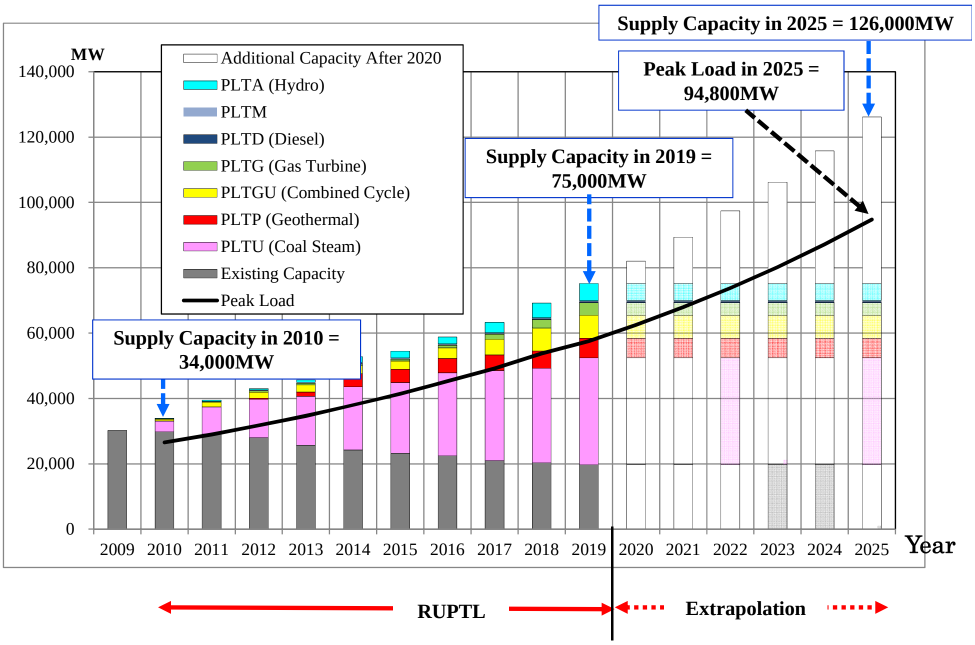
Based on the conditions described in Section 3.2.1, Indonesian electricity demand in 2025 is estimated to be 542TWh and reaches 3.7 times of 2009 value. (See Figure 3.2.2-1)

And Figure 3.2.2-2 shows the forecast of electricity supply capacity estimation, based on existing and new/additional capacity plan described in RUPTL 2010. As there is no description of new and additional plan after 2020, growth rate of capacity expansion is assumed as 9.0%. (GDP growth rate multiplies elasticity 1.5) The estimated peak demand and supply capacity will be 94.8GW and 126GW respectively.



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

Figure 3.2.2-1 Forecast of Electricity Demand in Indonesia



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

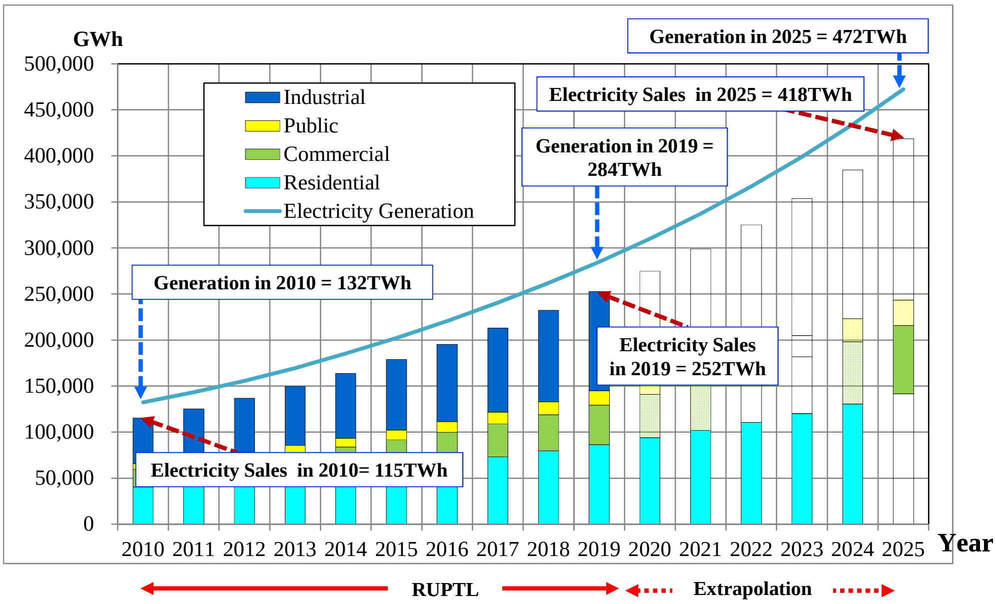
Figure 3.2.2-2 Forecast of Electricity Peak Demand and Supply Capacity in Indonesia

(2) Jawa-Bali

The conditions of electricity demand forecast in the Jawa-Bali region from 2010 to 2019, prescribed in RUPTL 2010, are as follows.

- Economic growth rate: 6.2%/year
- Population growth rate: 0.74%/year
- Electrification rate in 2019: 98.2%

Figure 3.2.2-3 shows the forecast of electricity demand of the Jawa-Bali region by sector described in RUPTL 2010. The electricity demand in 2010 and 2019 is 115TWh and 252TWh respectively. The electricity demand after 2020 is extrapolated using the same methodology as whole Indonesia forecast. The demand in 2025 will be 418TWh, corresponding 3.6 times of 2010 value. The yearly demand growth rate from 2019 to 2025 is set at 9.1% of 2019.

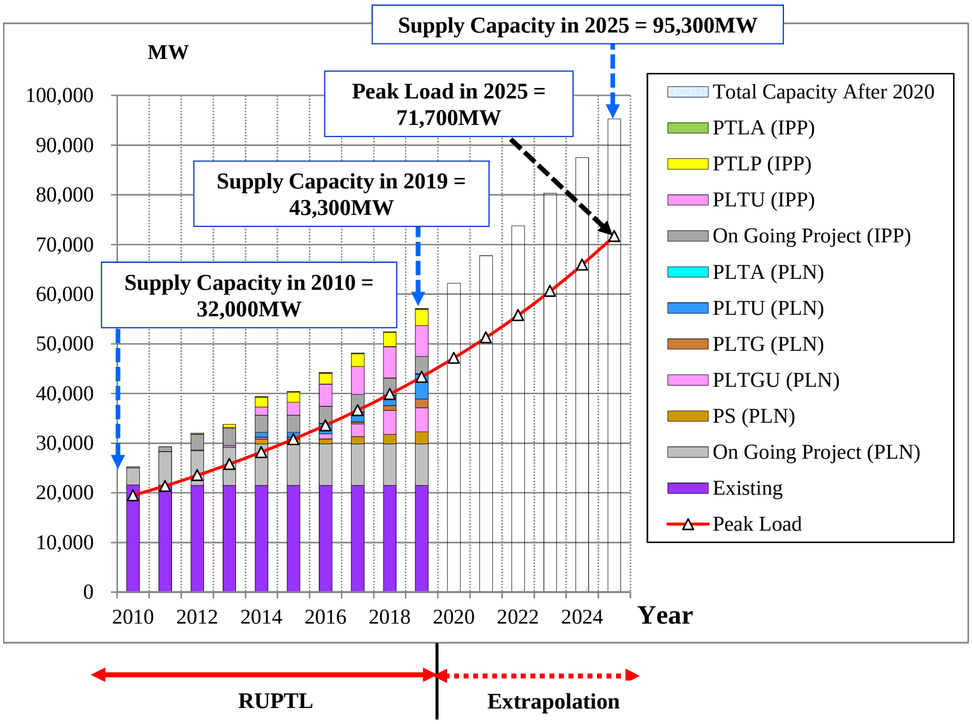


Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

Figure 3.2.2-3 Forecast of Electricity Demand in Jawa-Bali

Figure 3.2.2-4 shows the electricity peak demand and supply capacity of the Jawa-Bali region by generation type described in RUPTL 2010. The supply capacity after 2020 is extrapolated using the same methodology as whole Indonesia forecast. The peak demand and the supply capacity in 2025 will be 95.3GW and 71.7GW respectively. The yearly demand growth rate from 2019 to 2025 is set at 8.8% of 2019.

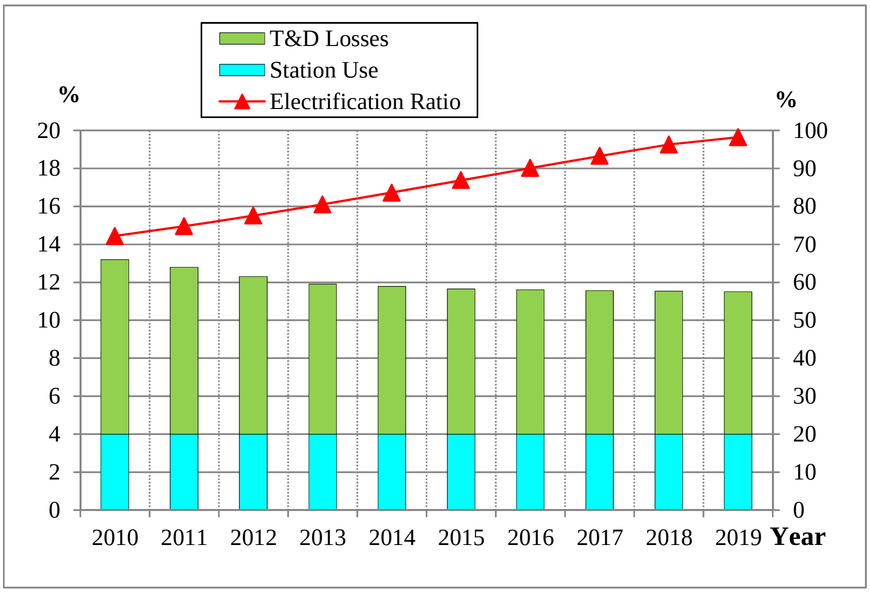
Coal and gas turbine are main generation methods followed by hydro and geothermal after 2014. Capacity of diesel will be only 326MW at the year of 2019.



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

Figure 3.2.2-4 Forecast of Electricity Peak Demand and Capacity by Generation Type in Jawa-Bali

Figure 3.2.2-5 shows the forecast of self-power consumption rate in power plants, loss in transmission and distribution lines and electrification rate. At the year of 2019, the loss will be decreased to 11% from 13% and electrification rate will be reached to 98.2% (Target).



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

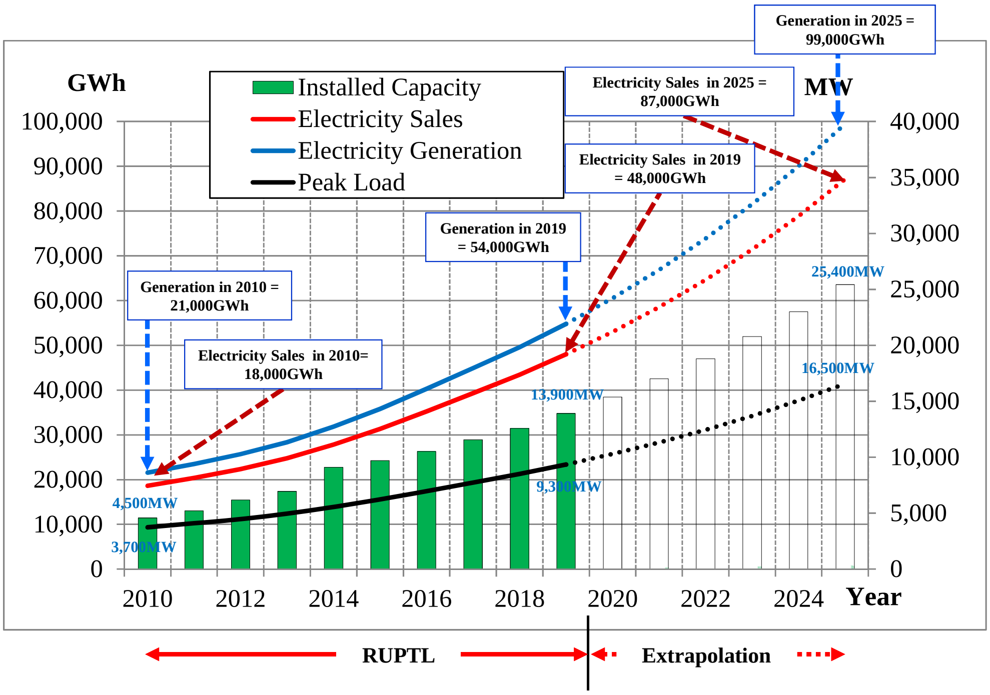
Figure 3.2.2-5 Forecast of Self-Electricty Consumption in Power Plants, Loss in the Transmission and Distribution Lines, and Electification in Jawa-Bali

(3) Sumatra Region

The conditions of electricity demand forecast in the Sumatra region from 2010 to 2019, prescribed in RUPTL 2010, are as follows.

- Population growth rate: 1.4%/year
- Electrification rate in 2019: 98.0% (64.3% in 2009)

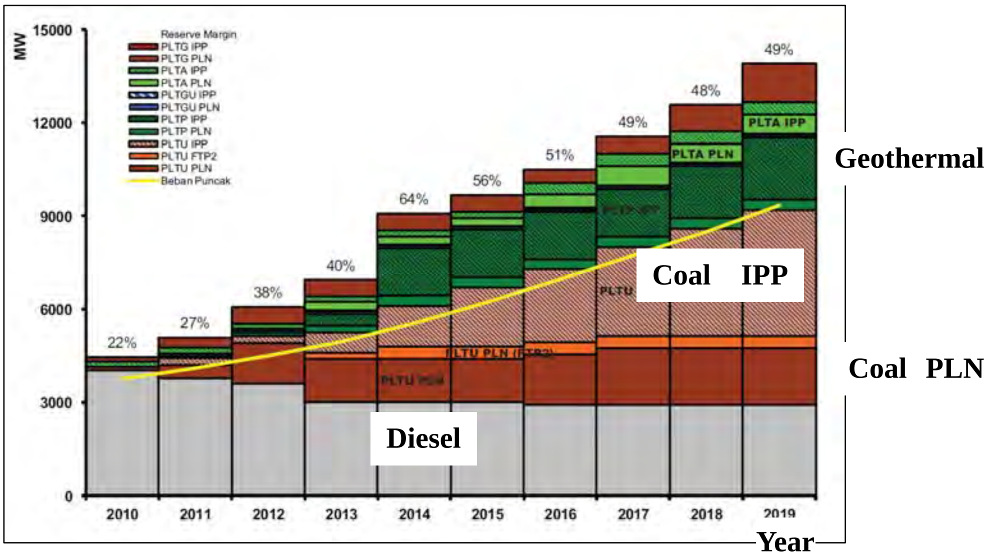
Figure 3.2.2-6 shows the forecast of electricity demand in the Sumatra region described in RUPTL 2010. The electricity demand in 2010 and 2019 is 18TWh and 48TWh respectively. The electricity demand after 2020 is extrapolated using the same methodology as whole Indonesia forecast. The demand in 2025 will be 87TWh, corresponding 4.8 times of 2010 value. The yearly demand growth rate from 2019 to 2025 is set at 10.5% of 2019.



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

Figure 3.2.2-6 Forecast of Electricity Demand and Supply Capacity in Sumatra

Figure 3.2.2-7 shows the forecast of electricity peak demand and supply capacity in the Sumatra region by generation type described in RUPTL 2010. Coal will be main generation source, followed by geothermal, hydro, and gas.



Source: RUPTL 2010

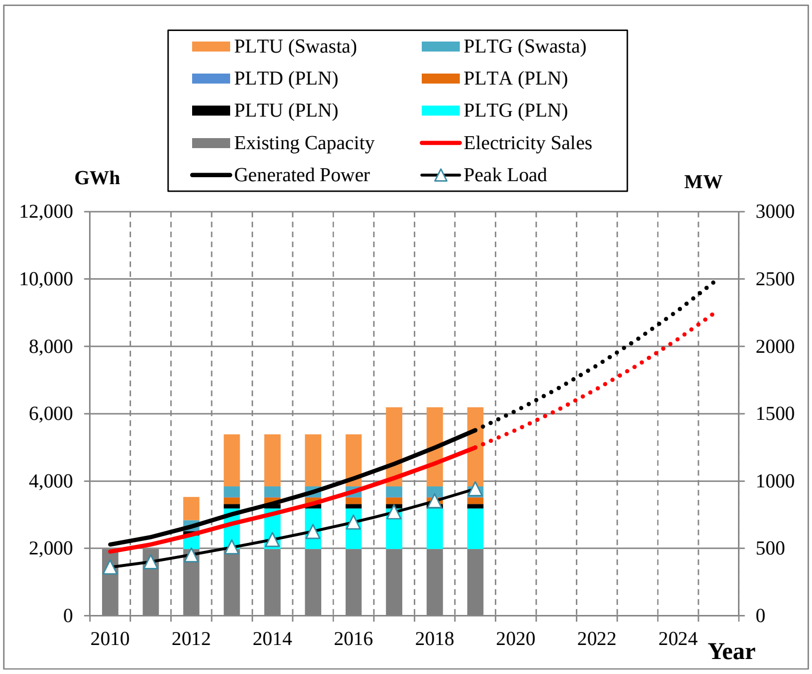
Figure 3.2.2-7 Forecast of Peak Load and Capacity by Power Generation Type in Sumatra

(4) East Kalimantan Region

The conditions of electricity demand forecast in the East Kalimantan region from 2010 to 2019, prescribed in RUPTL 2010, are as follows.

- Economic growth rate: 6.0~6.5%/year
- Population growth rate: 1.88%/year
- Electrification rate in 2019: 93.5% (53.2% in 2009)

Figure 3.2.2-8 shows the forecast of electricity demand, peak demand, and generation capacity in the East Kalimantan region described in RUPTL 2010. The electricity demand in 2010 and 2019 is 1.9TWh and 5.0TWh respectively. The electricity demand after 2020 is extrapolated using the same methodology as whole Indonesia forecast. The demand in 2025 will be 9.1TWh, corresponding 4.8 times of 2010 value. The yearly demand growth rate from 2019 to 2025 is set at 10.5% of 2019. As generation shortage has been continued since 2009, new and/or additional capacity in 2012 to 2013 is highly expected.



Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

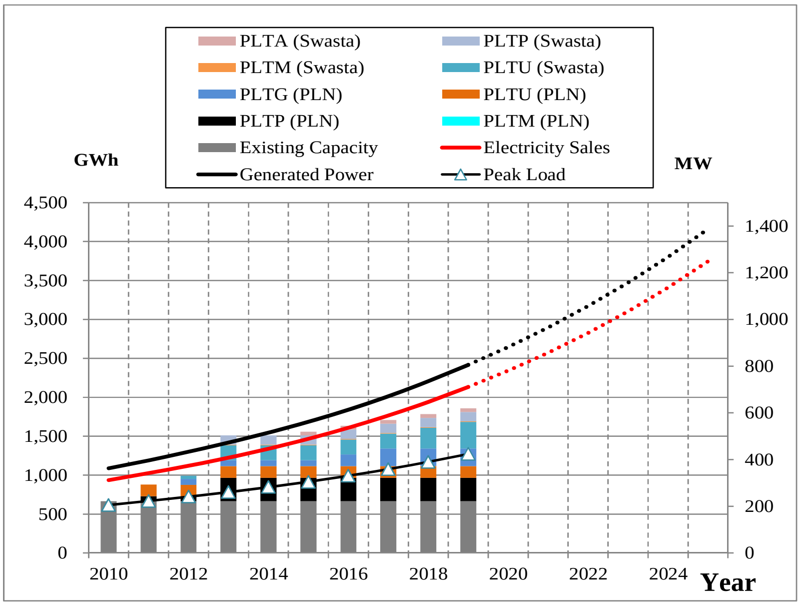
Figure 3.2.2-8 Forecast of Electricity Demand, Generation Capacity, and Peak Load in East Kalimantan

(5) North Sulawesi Region

The conditions of electricity demand forecast in the North Sulawesi region from 2010 to 2019, prescribed in RUPTL 2010, are as follows.

- Economic growth rate: 5.1%/year
- Population growth rate: 0.79%/year
- Electrification rate in 2019: 83%

Figure 3.2.2-9 shows the electricity demand, the peak demand, and the generation capacity forecast in the North Sulawesi region described in RUPTL 2010. The electricity demand in 2010 and 2019 is 0.9TWh and 2.1TWh respectively. The electricity demand after 2020 is extrapolated using the same methodology as whole Indonesia forecast. The demand in 2025 will be 3.7TWh, corresponding 4.1 times of 2010 value. The yearly demand growth rate from 2019 to 2025 is set at 9.5% of 2019. As generation shortage has been continued since 2009, new and/or additional capacity in 2012 to 2013 is highly expected.



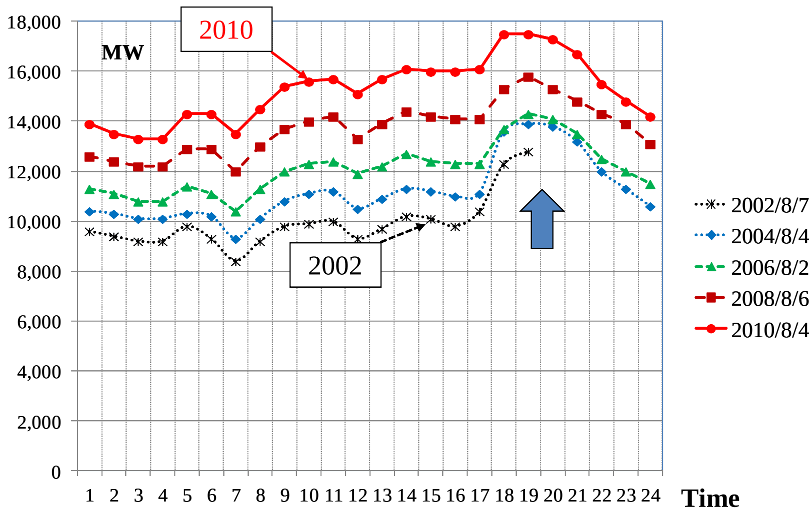
Source: RUPTL 2010 (Extrapolated after 2020 by the Study Team)

Figure 3.2.2-9 Forecast of Electricity Demand, Generation Capacity and Peak Load in North Sulawesi

3.2.3 Daily Load Curve Forecast

(1) Jawa-Bali Region

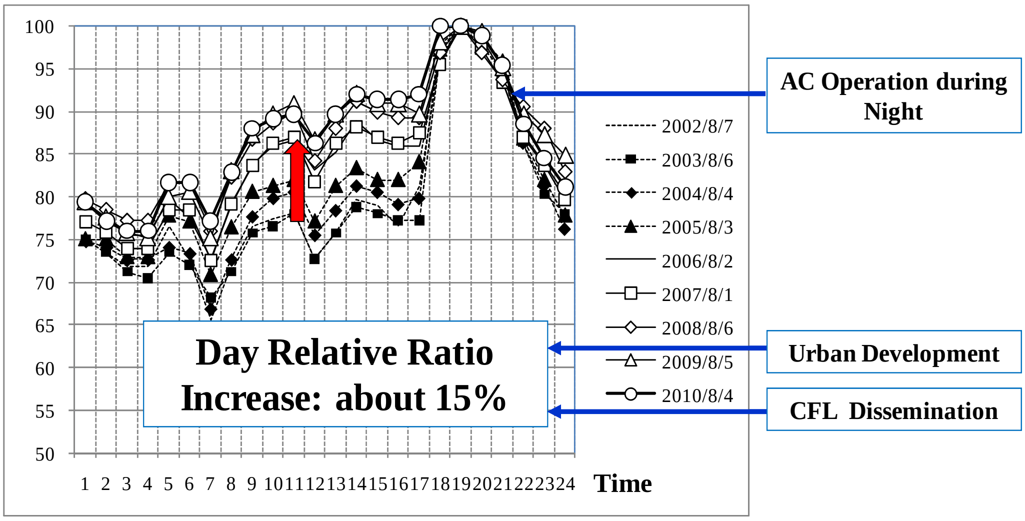
Figure 3.2.3-1 shows the daily load curve of August 1st Wednesday from 2002 to 2010. The electricity consumption throughout the day increased year by year. And peak still emerges in evening time.



Source: Products of the Study Team based on PLN website data

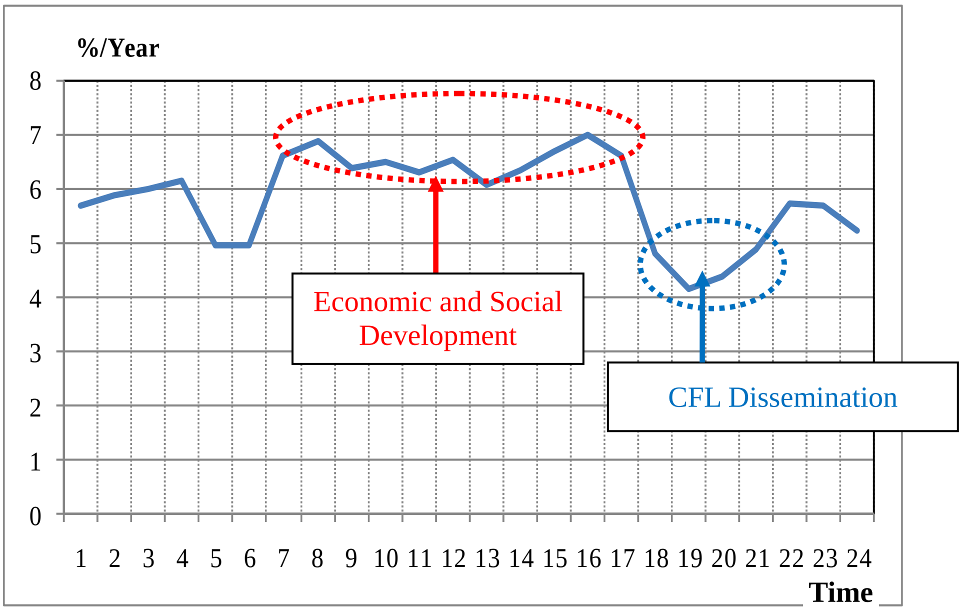
Figure 3.2.3-1 Trend of Yearly Daily Load Curve in Jawa-Bali

Figure 3.2.3-2 shows the yearly trend of daily load curve ratio, setting 19:00 peak as 100. And Figure 3.2.3-3 shows the yearly average growth by time zone. (From 2002 to 2010) The growth during daytime is higher than the other time zone, about 15% increase from 75% to 90%. It could be deemed that growing industrial and commercial activities raised day time consumption, and dissemination of CFL reduced evening lighting consumption in households. And the utilization of ACs for sleeping is contributing the consumption increase during the night.



Source: Products of the Study Team based on PLN website data

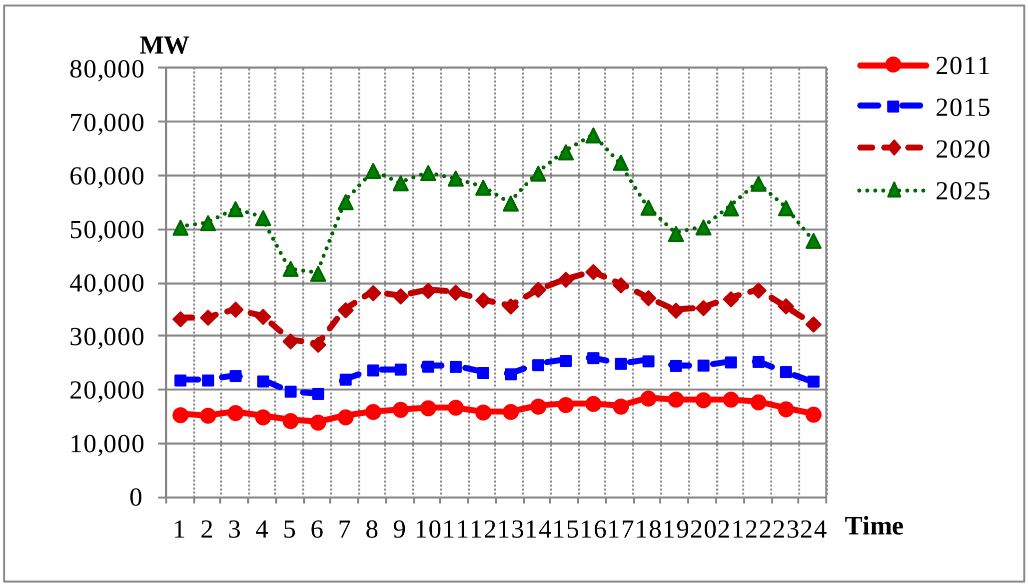
Figure 3.2.3-2 Trend of Yearly Daily Load Curve Indicator in Jawa-Bali (Set peak as 100)



Source: Products of the Study Team based on PLN website data

Figure 3.2.3-3 Growth Rate of Electricity Consumption in Jawa-Bali (2002-2010)

The average growth rate of electricity consumption during past 8 years is 5.9%. On the other hand, the growth rate until 2025 is estimated as about 9.0% based on RUPTL information. Figure 3.2.3-4 shows the forecast of daily load curve until 2025 which was calculated by considering the past 8 years growth rate of each time zone and the growth rate difference between past 8yeras and future estimation (9.0%/5.9%). It is estimated that the day peak will be higher than the evening peak around 2015.



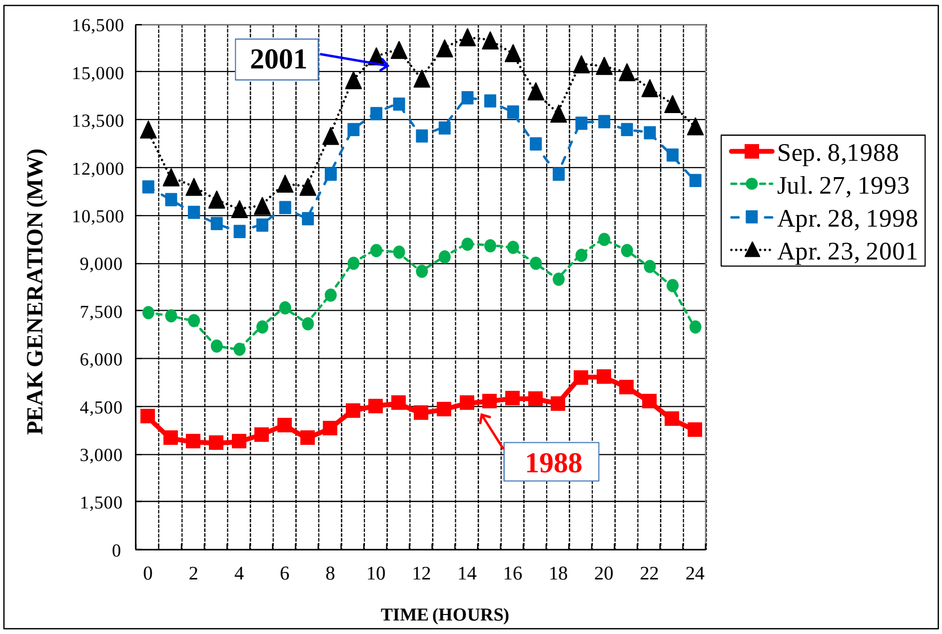
Source: Products of the Study Team based on PLN website data

Figure 3.2.3-4 Forecast of Daily Load Curves in Jawa-Bali

1) Daily load curves in the Jawa-Bali region: Comparison with Thailand

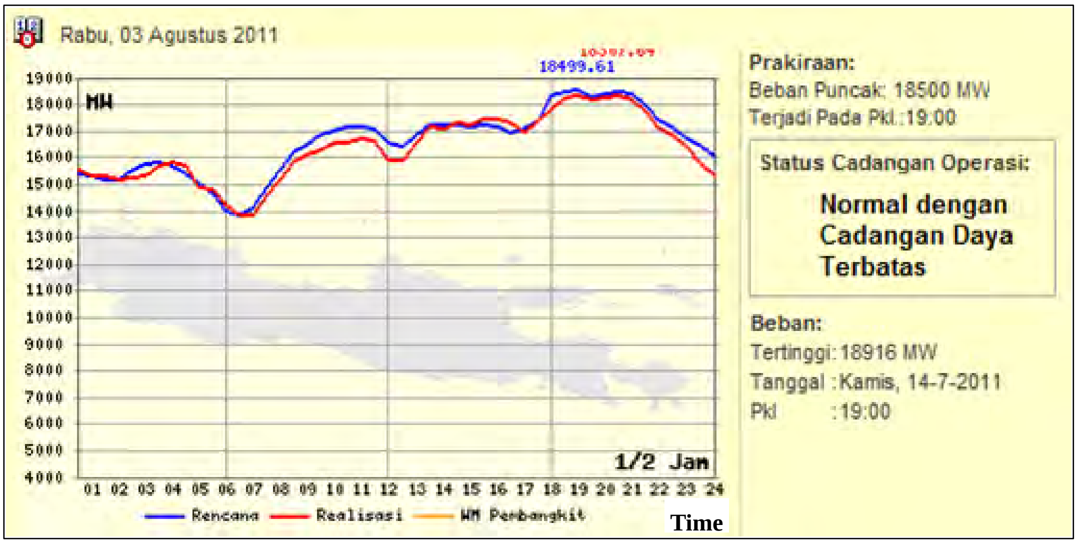
The forecast that daily load curves in the Jawa-Bali region will be transformed into the day peak from the evening peak, which are typical in developing countries, could give a large impact on power development plan and DSM strategy.

The load curves of Thailand are surveyed as a reference for the forecast in Indonesia. Figure 3.2.3-5 shows the yearly trend of daily load curve from 1988 to 2001. The curve of Thailand in 1988 closely resembles to the current one in the Jawa-Bali region (See Figure 3.2.3-6).



Source: Thailand EGAT Website

Figure 3.2.3-5 Yearly Trend of EGAT in Thailand from 1988 to 2001

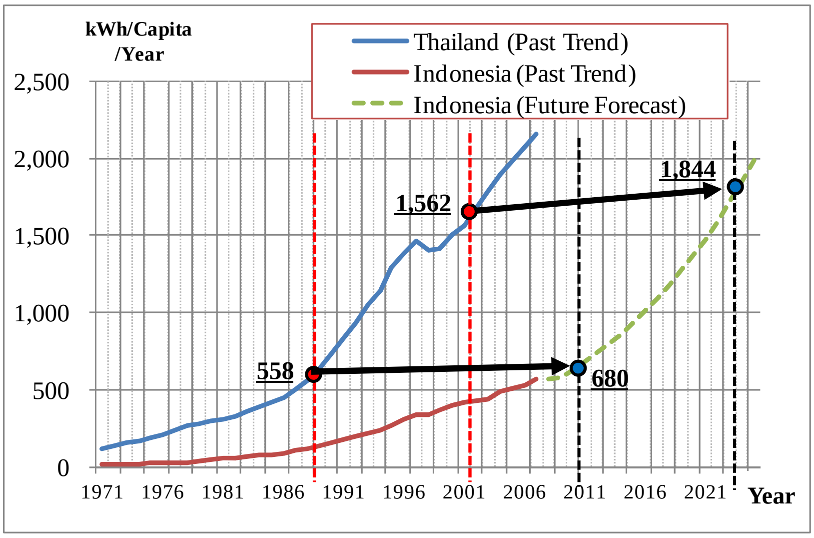


Source: PLN Website

Figure 3.2.3-6 Daily Load Curves in Jawa-Bali (August 2011)

On the hand, the yearly electricity consumption per capita of Thailand in 1988 and Indonesia in 2011 are almost the same level of 558kWh and 680kWh respectively as shown in Figure 3.2.3-7. And after 13 years, yearly consumptions per capita of Thailand in 2001 (actual result) and Indonesia in 2024 (forecast) are in the close range of 1,562kWh and 1,844kWh respectively.

Accordingly, the daily load curve of the Jawa-Bali region in 2020s could be similar to one of Thailand shown in Figure 3.2.3-5. Figure 3.2.3-4 and Figure 3.2.3-5 comes from different estimation method, however their daily pattern is quite similar with double peaks, so the accuracy of the forecast in Figure 3.2.3-4 is considered to be high.



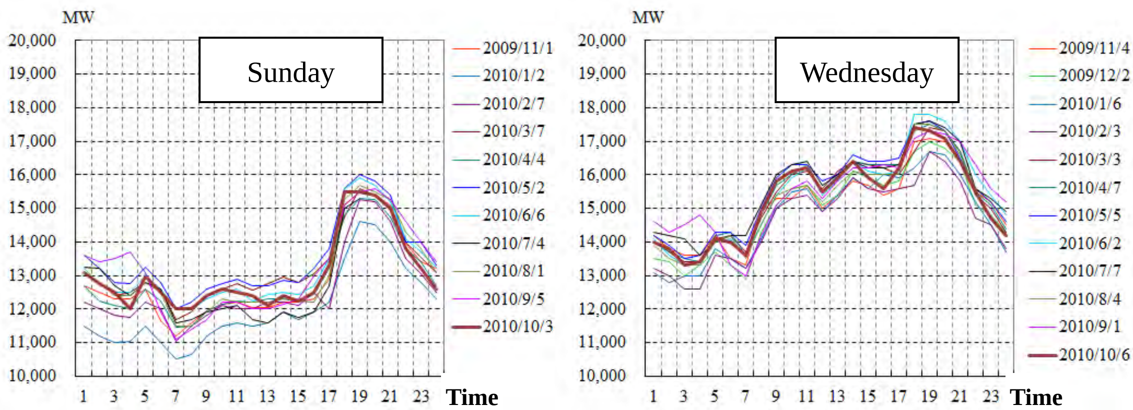
Source: Products of the Study Team based on IEA Energy Balance 2009 and RUPTL 2010

Figure 3.2.3-7 Yearly Power Consumption per Capita in Thailand and Indonesia

2) Seasonal daily load curve fluctuation in the Jawa-Bali region

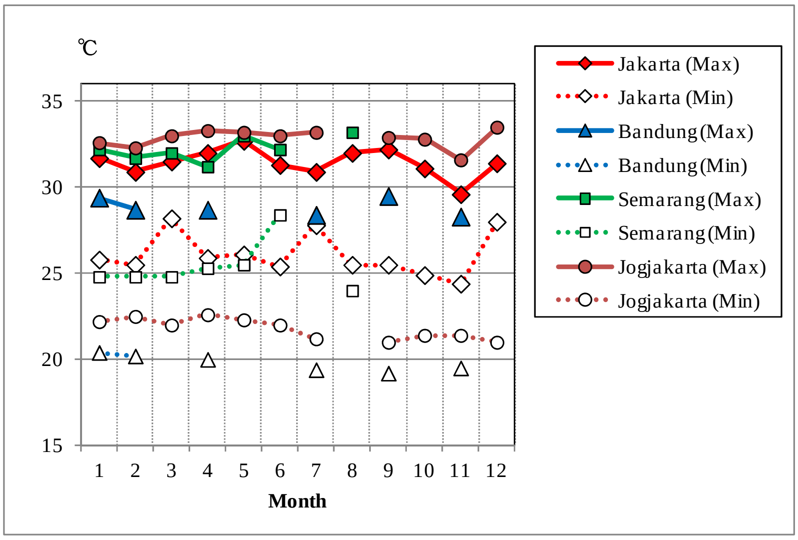
Figure 3.2.3-8 shows the seasonal daily load curve fluctuation in the Jawa-Bali region around one year on the first Sunday and the first Wednesday of each month. Seasonal change of daily load curve is rather small, besides load difference between weekday and Sunday/Saturday is large.

Figure 3.2.3-9 shows that the monthly maximum temperature and the minimum temperature of various regions of the Jawa-Bali region changes within the range of several degrees, comparatively small, throughout the year. The seasonal tariff system is applied in Japan, where daily load curve changes greatly by season. On the other hand, the fixed TOU system could be applied in Indonesia.



Source: Products of the Study Team based on PLN website data

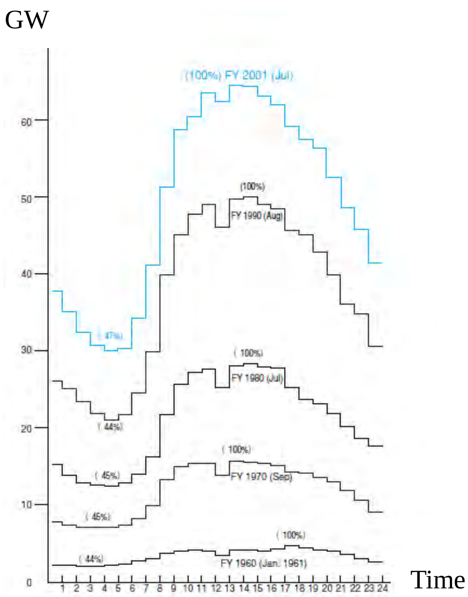
Figure 3.2.3-8 Seasonal Daily Load Curve Fluctuation in Jawa-Bali



Source: http://yorozu.indosite.org/iijc/sakasita/stats.html

Figure 3.2.3-9 Monthly Maximum and Minimum Temperature of Each Region in Jawa-Bali

In Japan TOU tariff system is applied mainly targeting summer, because load curve fluctuates tremendously by season. The difference between peak and off peak increased year by year. It is a concern that the difference between peak and off peak in the Jawa-Bali region would increase in future. Figure 3.2.3-10 shows the trend on yearly daily load curve trend of TEPCO for reference.



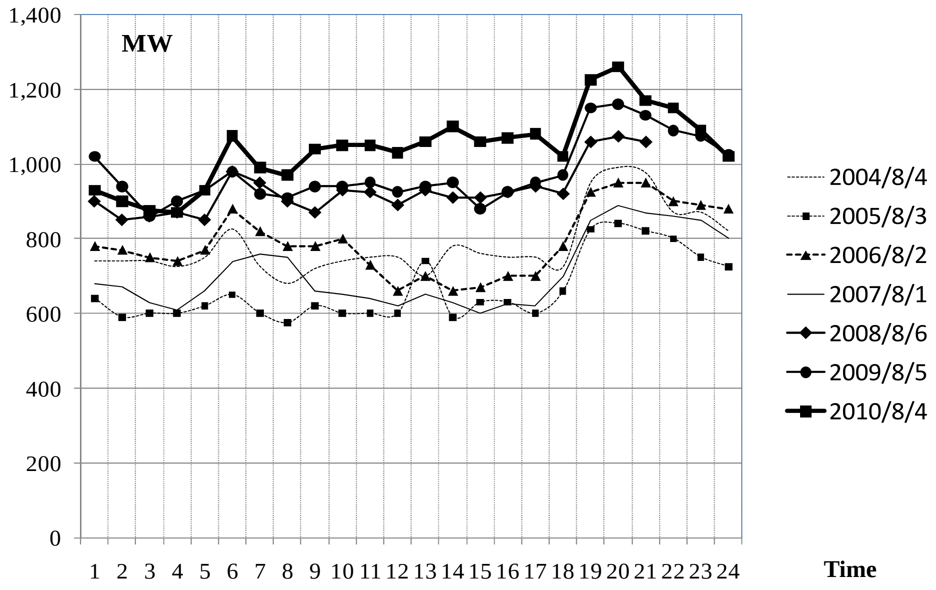
Source: TEPCO Illustrated 2009

Figure 3.2.3-10 Trend of Daily Load Curve in TEPCO (1960 ~ 2001)

(2) South Sumatra Region

Figure 3.2.3-11 shows the trend on daily load curve on first Wednesday from 2004 to 2010.

Although the electricity consumption of each time zone increases, it shows typical the evening peak pattern. Less industrial structure change is assumed in the South Sumatra region, this pattern will continue in future.

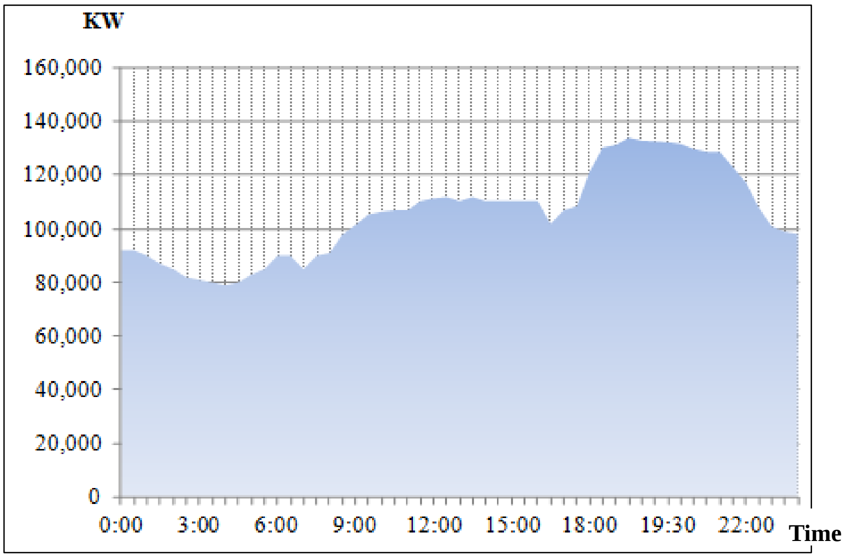


Source: Products of the Study Team based on PLN website data

Figure 3.2.3-11 Yearly Trend of Daily Load Curves in South Sumatra

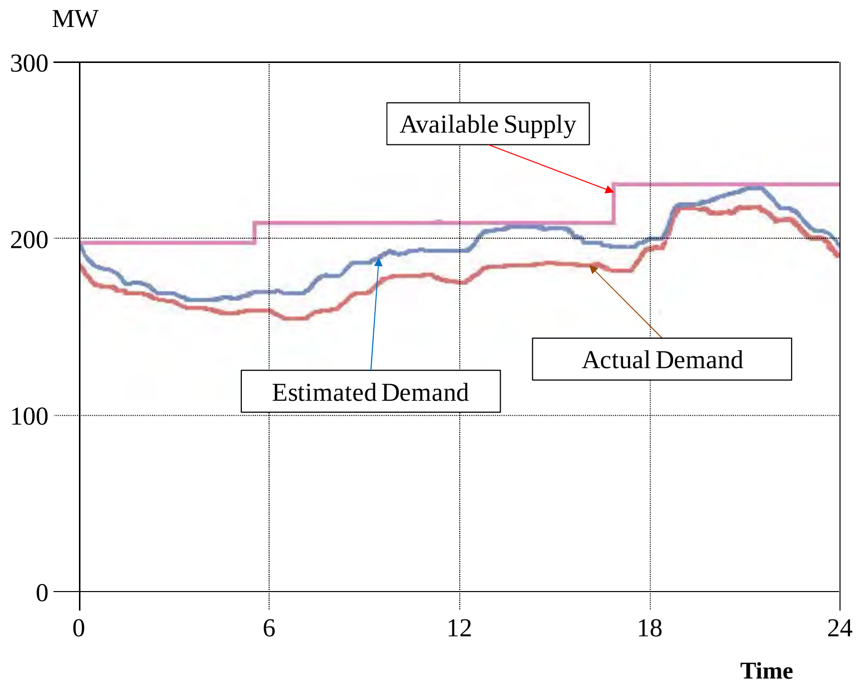
(3) North Sulawesi and Balikpapan

The daily load curves of the north Sulawesi and Balikpapan are shown in Figure 3.2.3-12 and -13 respectively. They are obtained in the field survey. Both regions show the same pattern of evening peak. Same as the Sumatra region, less industrial structure change is assumed in Sulawesi, this pattern will continue in future



Source: PLN Manado

Figure 3.2.3-12 Daily Load Curve in North Sulawesi (5th May 2010)



Source: PLN Balikpapan

Figure 3.2.3-13 Daily Load Curves in Balikpapan (3rd July 2010)

3.3 Proposal of Functional Tariff System

As explained in Chapter 2, PLN has been making efforts to revise the current tariff system, which requires a huge amount of subsidy. There are arguments for and against tariff revision, however in order to realize the healthier financial system without subsidy, it is unavoidable to raise the tariff.

The Study Team proposes tariff schemes, by which consumers can reduce their electricity bill by their effort, and in parallel PLN can reduce its supply cost. The basic concept of DSM is the collaboration between supply and demand sides for efficient electricity utilization, and the proper allocation of acquired benefit through the collaboration between both sides.

3.3.1 Three Themes for Functional Tariff System

Three measures are proposed for functional tariff system, “Amendment of TOU tariff system (New TOU tariff system)”, “Amendment of PF clause (New PF clause)”, and “Tariff adjusting system by fuel price fluctuation”. Followings are the contents of each proposal.

3.3.2 New TOU Tariff System

PLN already adopted TOU tariff system. The peak time zone of this TOU tariff system is from 18:00 to 22:00 applicable to all over Indonesia. However, as explained in Section 3.2.3, the daily peak in the Jawa-Bali region centered by Jakarta will shift into day time in the near future.

The Study Team proposes the application of the new TOU tariff system in the Jawa-Bali region, which evokes demand shift to mid-night or early morning with incentives, corresponding to the current evening peak and foreseeable day time peak.

(1) Expected Benefit by TOU Tariff System

Figure 3.3.2-1 shows the expected benefit by TOU tariff system. Peak shift of daily load curve could decrease or stop high-cost power plants' operation and increase or start low-cost power plants' operation. Cost difference between high-cost and low-cost plants is considered to be the benefit of TOU tariff system.

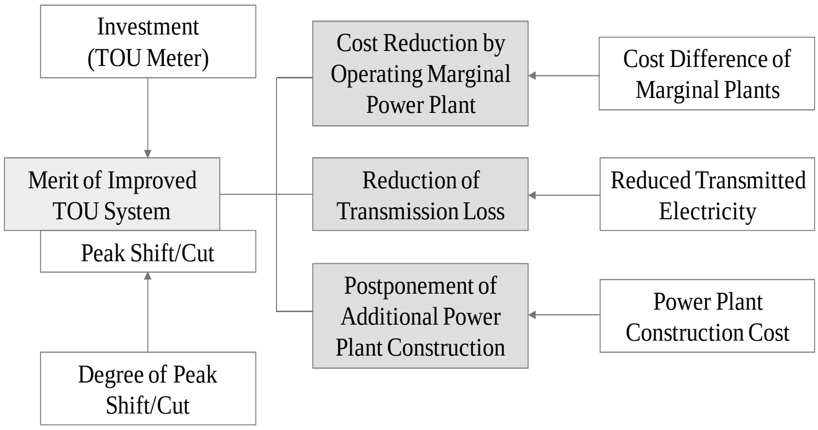


Figure 3.3.2-1 Expected Benefit by TOU Tariff System

In the long run, new TOU tariff system will put a restraint on generation capacity (peak) and postpone the construction of power plants. In the Jawa Island, to supplement the electricity demand in the western region including Jakarta during day time, there is significant electricity flow from the eastern region to the western region. TOU tariff system could mitigate such electricity flow (i.e. reducing transmission loss).

The contents of new TOU tariff system are described in the followings.

(2) Proposal of New TOU Tariff System

As new tariff system in the Jawa-Bali region, three following points are proposed.

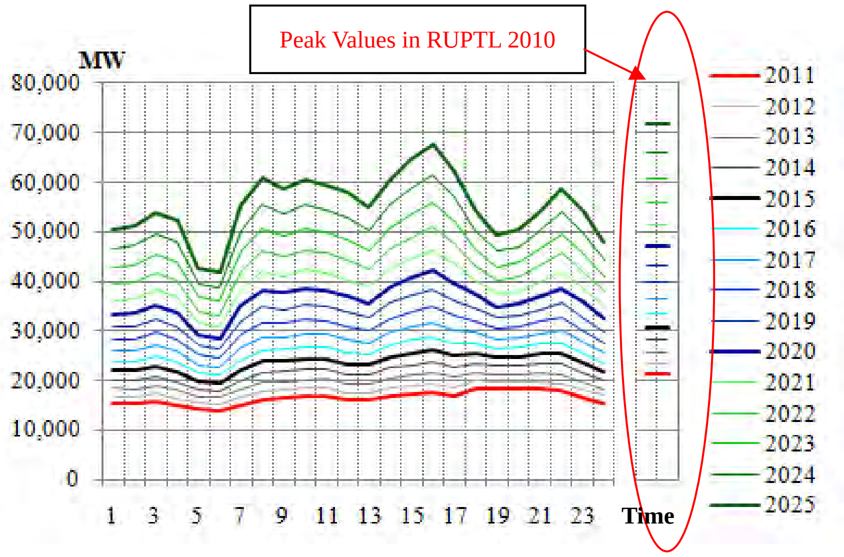
- Changing to three time zones from two time zones (See Table 3.3.2-1)
- Incentive (comparatively cheap) and Disincentive (comparatively expensive) tariffs: Increasing tariff ratio of peak divided by off peak)
- Expansion of target tariff sector and group

Table 3.3.2-1 Time Zone of Peak/Off Peak and Setting TOU Tariff

	Time Zone	TOU Tariff (Rp/kWh)	Remark
OPP (Off Peak Period)	22:00-8:00	400 (Comparatively cheap)	Incentive
DPP (Day Peak Period)	8:00-16:00	1,000	–
PP (Peak Period)	16:00-22:00	2000 (Comparatively expensive	Disincentive

1) Setting of new TOU tariff time zone

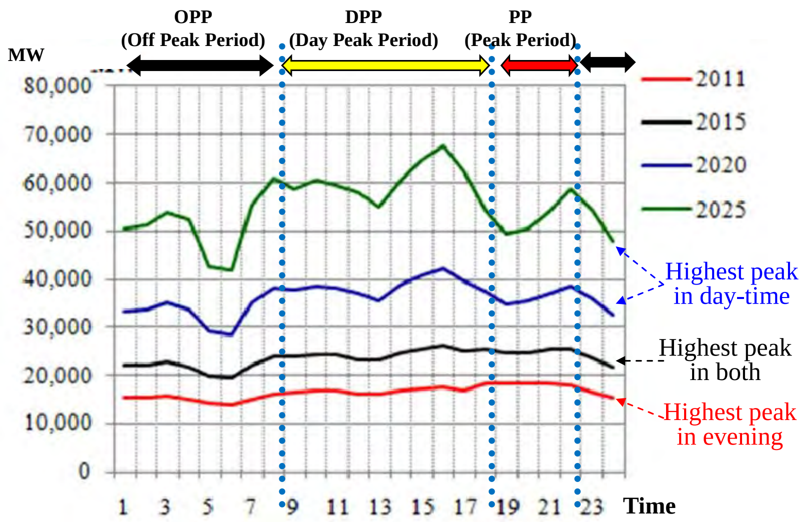
To set new TOU tariff time zone, appropriate assumption of current and future daily load curve is important. As studied in Section 3.2.3, it is foreseeable that day peak will be higher than evening peak after 2015 and the daily peak will shift into day time. Mountains and valleys become steep progressively. The estimated future daily load curve is shown in Figure 3.3.2-2. (Peak value is almost similar to or a little less than the RUPTL estimation.)



Source: Products of the Study Team

Figure 3.3.2-2 Daily Load Curve Forecast in Jawa-Bali

As shown in Figure 3.3.2-3, double peak until 2015 and day peak afterward are expected in the Jawa-Bali region. Accordingly, three time zone of evening peak (18:00 to 22:00), day peak (8 :00 to 18:00) and off peak (22:00 to 8 :00) is proposed.



Source: Products of the Study Team

Figure 3.3.2-3 TOU Tariff Time Zone Based on Daily Load Curve

2) Widening the ratio of peak to off peak tariff

To promote the leveling of daily load, setting not only disincentive tariff but also incentive tariff is effective. As explained in the examples of other countries in Section 2.3, the ratio of peak value divided by off peak one should be larger than the current value.(ranged from 2.5 to 5.0) Figure 3.3.2-4 shows the example of B3 group application.

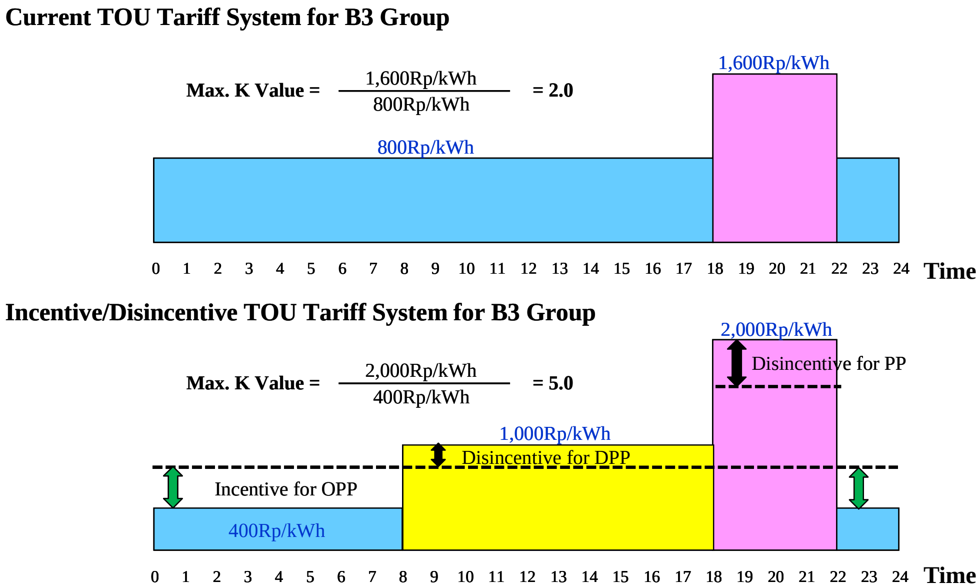


Figure 3.3.2-4 TOU Tariff Example

Peak time in the current TOU tariff system is 4 hours from 18:00 to 22:00 and K value is 2.0 at maximum (1,600Rp/ 800Rp). The values of peak and day peak divided by off peak are recommended to be expanded. (In Figure 3.3.2-4, peak/off peak 2,000Rp/400Rp = 5.0, day peak/off peak 1,000/400= 2.5)

(3) Target Region and Tariff Sector (Group)

- Target region; the Jawa-Bali[3]
- Target sector (group); Table 3.3.2-2 shows the target sectors and groups of the new TOU tariff application.

Table 3.3.2-2 Target Sectors and Groups of New TOU Tariff Application

Sector	Current TOU Target Group	Additional Group of New TOU Target Application
Household	–	+R3
Business	B3	+B2
Industry	I2, I3, I4	–

- Demand scale of target tariff sectors and groups; Table 3.3.2-3 shows the details of tariff target sectors and groups. In addition to current target of the TOU tariff system applying only to

[3] Review of TOU tariff time zone and the related regulation in other islands is not required, because the current evening peak will continue in medium and long run as studied in Section 3.2.3.

commercial and industrial sectors, the large-scale consumer in residential sector and the medium-scale consumer in commercial sector are proposed as new targets.

Table 3.3.2-3 TOU Tariff Target Sectors and Groups

Tariff Group		Customer Number	Connected VA	Yearly Electricity Consumption (kWh)			Revenue Rp.	Unit Cost Rp./kWh
				Total	OFF Peak	Peak		
Service		583,582	1,528,665,990	2,458,328,678	2,333,495,896	124,832,782	1,433,204,607,004	583
R.1 / ~ 450 VA	TR	13,243,942	5,961,275,699	12,579,723,695	12,579,723,695	0	5,201,645,456,311	413
R.1 / 900 VA	TR	7,953,587	7,158,558,631	11,497,329,748	11,497,329,748	0	6,936,965,437,143	603
R.1 / 1.300 VA	TR	2,487,360	3,234,275,514	6,034,460,459	6,034,460,459	0	4,018,484,906,017	666
R.1 / 2.200 VA	TR	959,555	2,111,102,596	4,089,562,597	4,089,562,597	0	2,740,252,975,657	670
R.2 / > 2.200 ~ 6.600 VA	TR	404,938	1,739,411,572	3,110,760,969	3,110,760,969	0	2,410,928,778,094	775
R.3 / > 6.600 VA	TR	84,034	1,202,617,400	1,676,722,061	1,676,722,061	0	1,957,359,449,236	1,167
Residence		25,133,416	21,407,241,412	38,988,559,529	38,988,559,529	0	23,265,637,002,458	597
B.1 / s/d 450 VA	TR	244,455	110,007,408	196,159,841	196,159,841	0	102,924,930,534	525
B.1 / 900 VA	TR	184,136	165,725,100	288,030,033	288,030,033	0	183,582,532,287	637
B.1 / 1.300 VA	TR	178,031	231,462,823	402,043,253	402,043,253	0	279,324,544,877	695
B.1 / 2.200 VA	TR	179,863	395,695,579	627,695,315	627,695,315	0	473,547,014,564	754
B.2 / > 2.200 ~ 200 kVA	TR	320,639	4,680,039,979	7,287,261,077	7,287,261,077	0	7,623,163,136,913	1,046
B.3 / > 200 kVA	TM	3,225	3,840,935,500	8,998,891,220	7,465,771,707	1,533,119,514	7,146,624,844,812	794
Commercial		1,110,349	9,423,866,389	17,800,080,740	16,266,961,227	1,533,119,514	15,809,167,003,987	888
I.1 / 450 VA	TR	86	38,700	89,338	89,338	0	41,145,960	461
I.1 / 900 VA	TR	289	260,100	464,452	464,452	0	273,434,589	589
I.1 / 1.300 VA	TR	395	513,500	865,217	865,217	0	604,502,098	699
I.1 / 2.200 VA	TR	845	3,437,500	2,785,601	2,785,601	0	2,093,688,897	752
I.1 / 2.200 ~ 14 kVA	TR	8,044	76,761,000	89,249,259	89,249,259	0	73,706,273,898	826
I.2 / > 14 kVA ~ 200 kVA	TR	21,658	1,698,893,900	2,955,819,900	2,528,700,407	427,119,493	2,373,380,319,887	803
I.3 / > 200 kVA	TM	7,102	8,964,842,000	28,422,265,812	24,285,627,694	4,136,638,118	18,219,690,912,276	641
I.4 / > 30.000 kVA	TT	49	2,168,255,000	9,639,838,906	8,400,542,607	1,239,296,299	5,135,111,933,350	533
Industry		38,468	12,913,001,700	41,111,378,485	35,308,324,575	5,803,053,910	25,804,902,210,955	628
Public		134,304	1,601,073,181	3,231,203,655	3,115,570,044	115,633,611	2,375,841,976,127	735
T/C/M		88,163	240,112,700	518,162,843	503,144,258	15,018,585	546,616,179,267	1,055
Target Sector/Group Total		26,282,233	43,744,109,501	97,900,018,754	90,563,845,331	7,336,173,424	64,879,706,217,400	663
Total		27,088,282	47,113,961,372	104,107,713,930	96,516,055,529	7,591,658,401	69,235,368,979,798	665

Source: PSO Tariff Mechanism (PLN) 2009

Table 3.3.2-4 shows TOU tariff target sectors and groups extracted from Table 3.3.2-3 (Blue color: current applied, yellow color: additional applied) The ratios of customer number, power consumption, and PLN revenue of target sectors and groups for the total of Jawa-Bali are 1.7%, 56.7%, and 61.3% respectively. Although the target customer number is small, the power consumption and the revenue amount of TOU tariff system is significant.

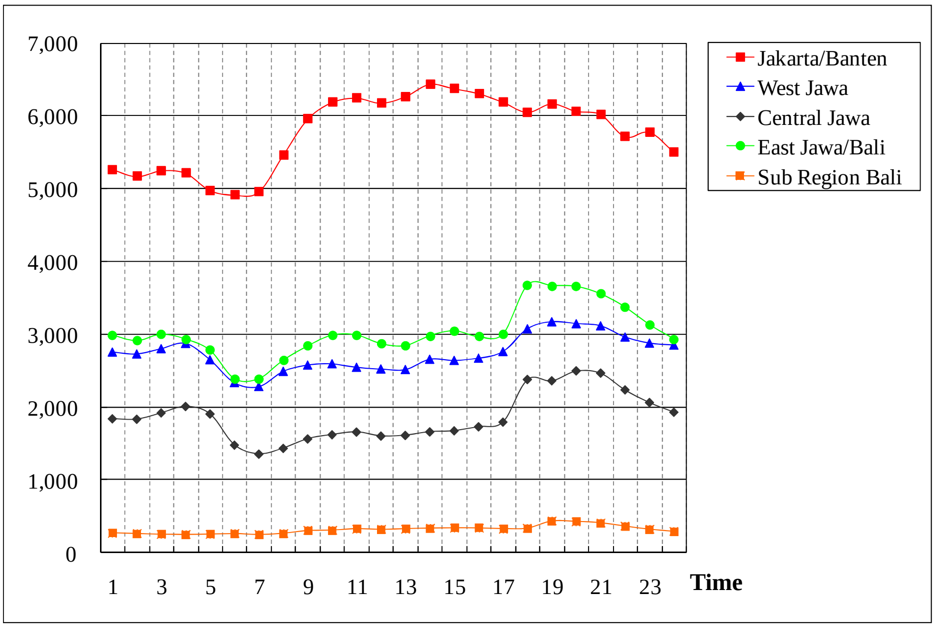
Table 3.3.2-4 TOU Tariff Target Sectors/Groups and Ratio for Total

Tariff Sector/Group		Customer Number	Connected kVA	Yearly Electricity Consumption (GWh)			Revenue Million Rp.
				Total	OFF Peak	Peak	
Jawa-Bali Total		27,088,282	47,113,961	104,108	96,516	7,592	69,235,369
Existing TOU Sector/Group		32,034	16,672,926	50,017	42,681	7,336	32,874,808
Extended TOU Sector/Grouo		404,673	5,882,657	8,964	8,964	0	9,580,523
Total		436,707	22,555,584	58,981	51,645	7,336	42,455,331
Existing TOU Sector/Group	%	0.1	35.4	48.0	44.2	96.6	47.5
Extended TOU Sector/Grouo		1.5	12.5	8.6	9.3	0.0	13.8
Total		1.7	47.9	56.7	53.5	96.6	61.3

Source: PSO Tariff Mechanism (PLN) 2009

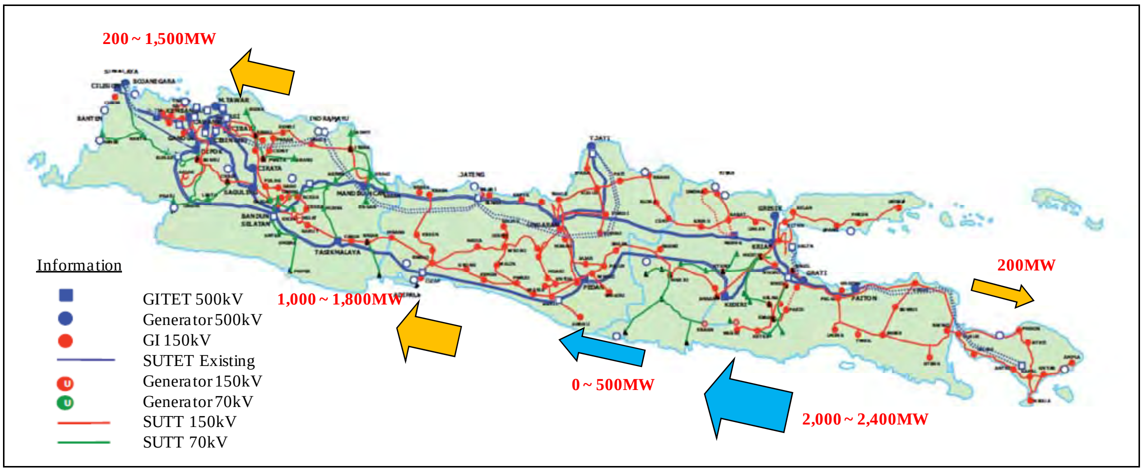
(4) Effect of Current Flow Reduction from East to West

Figure 3.3.2-5 shows the daily load curve of each region. Judging from these curves, it is observed that there exists a large current flow from the eastern regions to the western regions (especially Jakarta and Banten) in the Jawa-Bali region. (See Figure 3.3.2-6) The Western Jakarta and the Banten region consume more electricity in day time. Besides the eastern region consumes electricity in the evening . New TOU tariff system can mitigate the current flow between the east and west regions by promoting peak cut, peak shift and bottom up (Reduction of day time consumption in Jakarta and the Banten regions and evening time consumption in the other regions.)



Source: Products of the Study Team based on PLN website data

Figure 3.3.2-5 District-wise Daily Load Curves in Jawa-Bali



Source: Products of the Study Team based on RUPTL 2010 data

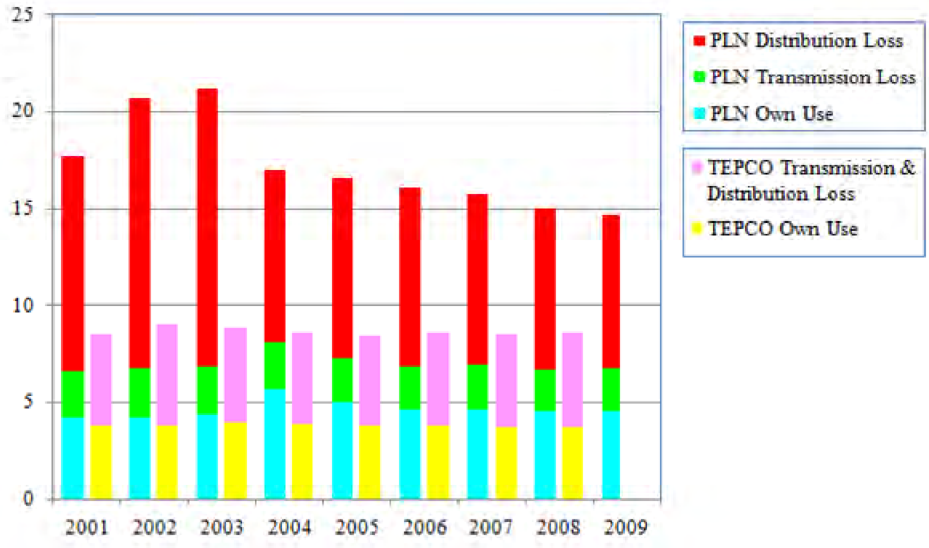
Figure 3.3.2-6 Current Flow in the Jawa-Bali Region

3.3.3 New Power Factor (PF) Clause

PF improvement contributes to reduce the loss in transmission and distribution lines of PLN. Current PF adjusting system has only disincentive clause, imposing penalty on reactive power. And there is no incentive clause in it. Introduction of incentive clause for PF improvement and review of standard PF value were proposed.

(1) Expected Benefit by New PF Clause

Figure 3.3.3-1 shows the trend of generation, transmission, and distribution loss of PLN and TEPCO. Especially the distribution loss of PLN is still high at 8% in 2009. PF improvement is effective for loss reduction. And in the long run, it is effective to subdue generation capacity (peak) and postpone power plant construction.



Source: PLN Statistics 2009 and TEPCO Illustrated 2010

Figure 3.3.3-1 Comparison of Generation, Transmission, and Distribution Loss between PLN and TEPCO

Followings are effects of PF improvement.

- Effective utilization of facilities (Generator, Transformer, etc.)
- Effective utilization of power lines
- Reduction of power loss in the system
- Reduction of voltage drop in the cable

Trial Calculation Example of the Benefit by PF Increase

Followings are the trial calculation example of effect analysis in case when PF is improved 10% from 80 to 90%. Reduction of distribution loss by 21% and capacity by 11% are expected. In Chapter 4, economic analysis is calculated utilizing these values.

1) Trial calculation of transmission and distribution loss

- Condition of trial calculation;

  Yearly total transmission and distribution loss: P_L=15,047GWh/year

  Transmission loss ratio: 2.2%

  Distribution loss ratio: 7.7%

Transmission and distribution loss ratio: 9.9%

Current average PF: cosφ$_1$=80%

Average PF after improvement: cosφ$_2$=90%

- Trial calculation result;

Current distribution loss: PLD1＝11,703GWh/year

Distribution loss after power improvement: PLD2 = 9,247GWh/year

Loss reduction ratio against before improvement: About 21%

Current average distribution loss: PLD1=PL * 7.7/9.9=11,703GWh/year

Distribution loss reduction by PF improvement: P⊿LD

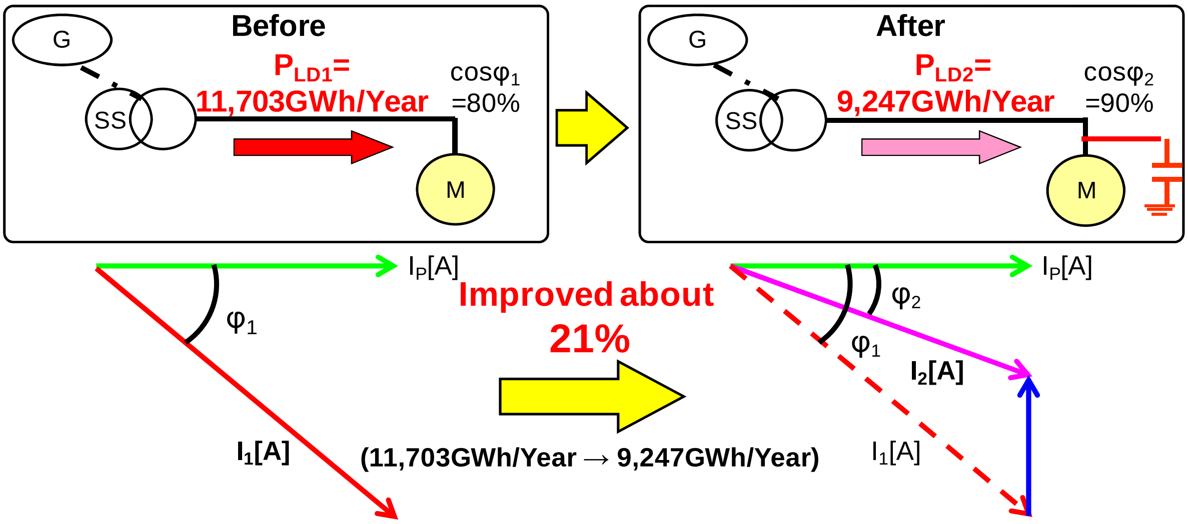
P⊿LD = PLD1 * 3R(I12-I22)/3RI12

= PLD1 * (I12-I22)/I12

= PLD1 * (1-(cosφ1/ cosφ2) 2)

= 11,703 * (1-(0.8/0.9)2)

= 2,456GWh/Year → PLD2 = 9,247GWh/year



Source: Documents of Shikoku Electric Power Co., Inc.

Figure 3.3.3-2 Distribution Loss Reduction by Power Factor Improvement

2) Trial calculation of capacity reduction

- Condition of trial calculation;

Maximum power: 18,000MW

Current average PF: 80% (Assumption)

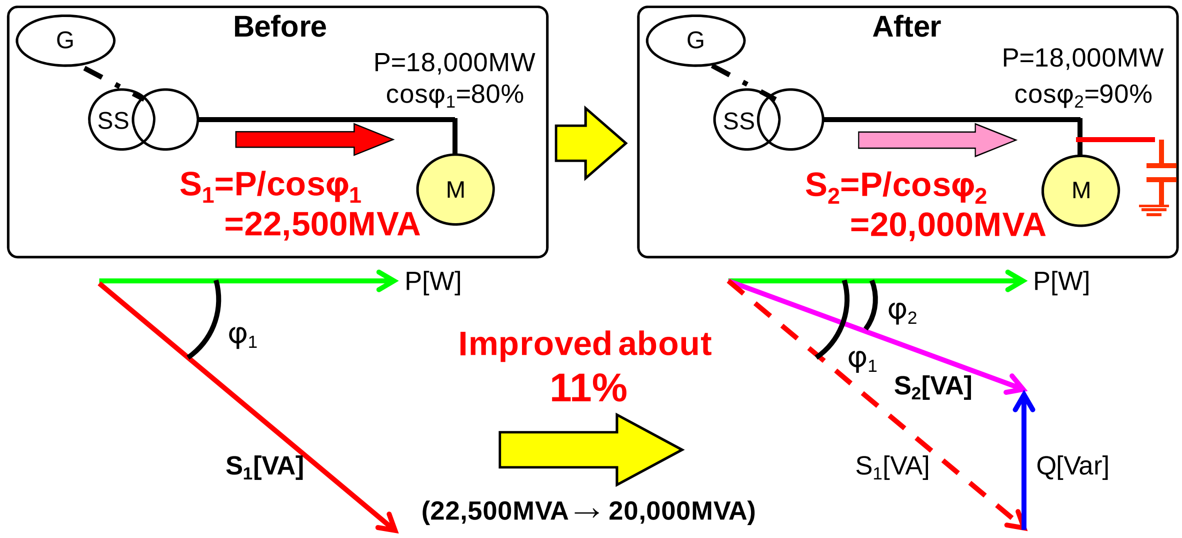
Average PF after improvement: 90% (Assumption)

- Trial calculation result;

Current maximum apparent power: S1＝22,500MVA

Maximum apparent power after improvement: S2＝20,000MVA

Real capacity reduction ratio: About 11%



Source: Documents of Shikoku Electric Power Co., Inc.

Figure 3.3.3-3 Capacity Reduction by Power Factor Improvement

Following is the outline of proposal of new PF Clause.

(2) Proposal of New PF Clause

Targeting whole Indonesia, upward revision of threshold of PF value, introduction of incentive system and expansion of targeting group are proposed.

1) Increasing standard PF from 85% to 90%

By the improvement of PF, the distribution loss can be decreased. Besides a lot of consumers' electricity prices will automatically increase. 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. The optional incentive (discount) clause, such as the scheme described below in Section 2), is worth being introduced in parallel. This measure should be also categorized as one solution to reduce distribution loss and raise tariff for large consumers.

2) Introduction of incentive clause for PF improvement

Setting standard PF of 90% as threshold value, 2% discount for 1% PF improvement, and 3% surcharge for 1% PF deterioration (See Table 3.3.3-1) is recommended to be introduced. In this case, without any measures to improve PF, consumer's electricity price will increase by disincentive. Introduction of incentive clause is the key issue and consumer's efforts by this clause to improve PF will result in the reduction of electricity price. The increased tariff revenue should be utilized for consumer's support to improve PF and the cost for PF meters. This measure should be also categorized as one solution to reduce distribution loss and raise tariff for large consumers.

Table 3.3.3-1 Incentive and Disincentive of New PF Clause

Monthly Average PF	Incentive & Disincentive	Rate
>90%	Discount	2%/1%PF
<90%	Surcharge	3%/1%PF

As shown in Table 2.3.1-5 in chapter 2, Philippines and Malaysia set standard value of PF and have surcharge or discount in PF clause by putting threshold value of standard PF.

Tariff system in Japan sets the standard value of PF, same as these countries. And that system sets stipulates disincentive and incentive by putting threshold value of this standard value for basic charge shown in the following formula.

$$\text{Basic Charge} = (\text{Basic Unit Price}) \times (\text{Contracted kVA}) \times \frac{(185 - PowerFactor)^{*}}{100}$$

* Incentive/Disincentive for PF

On other hand, Indonesian tariff sets the standard PF value and has the disincentive clause, but there is no incentive clause to customers for PF improvement. Current PF clause is shown in Table 3.3.3-2. It imposes extra charge for the measured re-active power, in addition to the charge for the active power, which is stipulated in the standard tariff table.

Table 3.3.3-2 Disincentive of Current PF Clause

Tariff Group	VA	Minimum Average PF	Rp/kVArh
B-3/MV	>200,000	<0.85	905
I-2/LV			875
I-3/MV	>200,000		735
I-4/HV	>30,000,000		605

Source: PLN tariff table 2010/7/1 TDL, kVArh means re-active power

As explained above, there are two types of incentive clause; Philippines type (Compensation by multiplying factor for the total tariff) and Japanese type (Compensation by multiplying factor only for basic charge)

On the other hand, the proportion of basic charge of Indonesian tariff decreased quite large by PLN tariff revision on July 2010 (See Table 3.3.3-3). Japanese system, which has the incentive and disincentive clause for basic charge, is not applicable to Indonesia, because of small benefit for customers. (For example, basic charge ratio of B2 group is 21% before the revision. However it dramatically decreased into 1% after the revision.)

Accordingly Philippines type, which sets incentive and disincentive for the total tariff, is suitable to Indonesia.

Table 3.3.3-3 Basic Charge Ratio Before and After PLN Tariff Revision in 2010

		Demand Charge before Revision		Min Claimed Charge after Revision	
		Rp/VA/M		Customer Number*Min Charge	
	Total Revenue Rp	Demand Charge Rp	Ratio %	Minimum Claimed Charge Rp	Ratio %
B.2 / > 2.200 s/d 200 kVA	10,535,774,614,549	2,182,001,029,003	20.71	111,080,376,000	1.05
B.3 / > 200 kVA	8,389,975,444,757	1,635,102,720,000	19.49	26,476,800,000	0.32
I.2 / > 14 kVA s/d 200 kVA	2,853,016,030,887	794,533,584,000	27.85	168,224,000,000	5.90
I.3 / > 200 kVA	20,379,531,675,655	3,611,717,214,000	17.72	45,613,800,000	0.22
I.4 / > 30.000 kVA	5,843,827,143,285	791,695,620,000	13.55	45,012,000,000	0.77

3) Expansion of target sectors and groups

Followings are target sectors and groups of new PF clause application.

- Target region: Indonesia
- Target Sector and group: Table 3.3.3-4 shows the target sectors and groups of new PF clause application.

Table 3.3.3-4 New PF Clause Target Sectors and Groups

Sector	Current Target Group	Additional Target Group
Business	B3	+B2
Industry	I2, I3, I4	−

- Demand scale of target tariff sector and group; Table 3.3.3-5 shows the detailed data of target sectors and groups. In addition to current PF applied sector and group, PF clause should apply to medium-scale consumer of commercial sector. Blue color means current PF applied groups and yellow color means additional PF applied group. By the expansion of applied group to B2, number of customers increase from 0.1% to 1.1% and yearly electricity consumption increases from 42% to 50%.

Table 3.3.3-5 New PF Clause Target Sectors and Groups

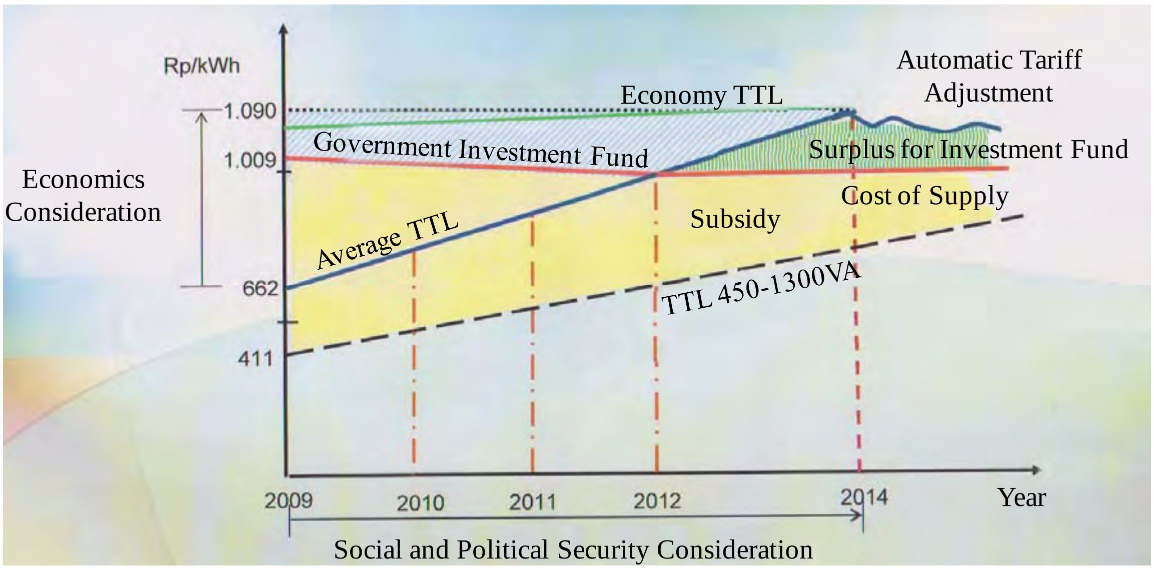
Tariff Group		Customer Number	Connected VA	Yearly Electricity Consumption (kWh)	Revenue Rp	Unit Cost Rp./kWh
Service		862,051	2,137,941,420	3,345,120,073	1,950,204,517,603	583.00
R.1 / s/d 450 VA	TR	19,273,150	8,674,350,899	18,031,667,476	7,459,326,540,159	413.68
R.1 / 900 VA	TR	12,431,350	11,188,561,481	17,539,486,635	10,584,623,299,856	603.47
R.1 / 1.300 VA	TR	3,549,520	4,615,982,732	8,428,513,736	5,648,004,776,930	670.11
R.1 / 2.200 VA	TR	1,257,795	2,767,226,296	5,299,135,364	3,557,961,654,517	671.42
R.2 / > 2.200 s/d 6.600 VA	TR	491,181	2,095,546,272	3,740,222,348	2,908,259,020,072	777.56
R.3 / > 6.600 VA	TR	95,850	1,358,029,500	1,905,063,161	2,220,476,240,744	1,165.57
Residence		37,098,846	30,699,697,180	54,944,088,720	32,378,651,532,278	589.30
B.1 / s/d 450 VA	TR	342,346	154,037,708	292,089,831	151,904,438,944	520.06
B.1 / 900 VA	TR	335,661	301,942,950	548,381,172	344,044,845,933	627.38
B.1 / 1.300 VA	TR	313,358	407,387,523	744,427,178	508,601,918,235	683.21
B.1 / 2.200 VA	TR	301,343	662,833,479	1,104,238,719	818,485,699,442	741.22
B.2 / > 2.200 s/d 200 kVA	TR	467,510	6,402,585,179	10,142,817,091	10,535,774,614,549	1,038.74
B.3 / > 200 kVA	TM	4,137	4,541,952,000	10,436,706,722	8,389,975,444,757	803.89
Business		1,764,355	12,470,738,839	23,268,660,714	20,748,786,961,860	891.71
I.1 / 450 VA	TR	164	73,800	188,696	87,157,835	461.90
I.1 / 900 VA	TR	456	410,400	715,349	425,431,254	594.72
I.1 / 1.300 VA	TR	580	754,000	1,238,923	864,743,908	697.98
I.1 / 2.200 VA	TR	1,140	4,084,300	3,736,179	2,787,806,312	746.17
I.1 / 2.200 s/d 14 kVA	TR	10,766	101,521,500	112,574,324	94,001,192,951	835.01
I.2 / > 14 kVA s/d 200 kVA	TR	26,285	2,037,265,600	3,575,659,651	2,853,016,030,887	797.90
I.3 / > 200 kVA	TM	8,447	10,202,591,000	31,616,891,594	20,379,531,675,655	644.58
I.4 / > 30.000 kVA	TT	62	2,443,505,000	10,893,209,107	5,843,827,143,285	536.47
Industry		47,900	14,790,205,600	46,204,213,823	29,174,541,182,087	631.43
Public		229,459	2,440,895,097	5,222,767,353	3,929,508,219,120	752.38
T / > 200 kVA		31	114,328,000	83,058,467	51,013,946,422	614.19
C / > 200 kVA		12	25,670,000	111,075,694	58,029,218,130	522.43
M (Multiguna)		115,031	214,304,015	1,402,998,584	1,485,655,180,182	1,058.91
Total		40,117,685	62,893,780,151	134,581,983,429	89,776,390,757,682	667.08
Current PF Applied Group		38,931	19,225,313,600	56,522,467,074	37,466,350,294,584	
	%	0.10	30.57	42.00	41.73	
Additional PF Applied Group		467,510	6,402,585,179	10,142,817,091	10,535,774,614,549	
	%	1.17	10.18	7.54	11.74	
Total PF Applied Group		506,441	25,627,898,779	66,665,284,165	48,002,124,909,133	
	%	1.26	40.75	49.54	53.47	

Source: PSO Tariff Mechanism (PLN) 2009

3.3.4 Tariff Adjustment System by Fuel Price Fluctuation

Tariff adjustment system by fuel price fluctuation is aimed to promptly reflect the fuel price fluctuation on the tariff table. In the national roadmap of tariff revision, PLN and MEMR have planned to introduce tariff adjustment system by fuel price in future. (See Figure 3.3.4-1) And Batam has already adopted tariff adjustment system.

The functional tariff adjustment system in Indonesia is proposed below, referring Japanese system.



Source: MEMR

Figure 3.3.4-1 National Road Map of Tariff Revision

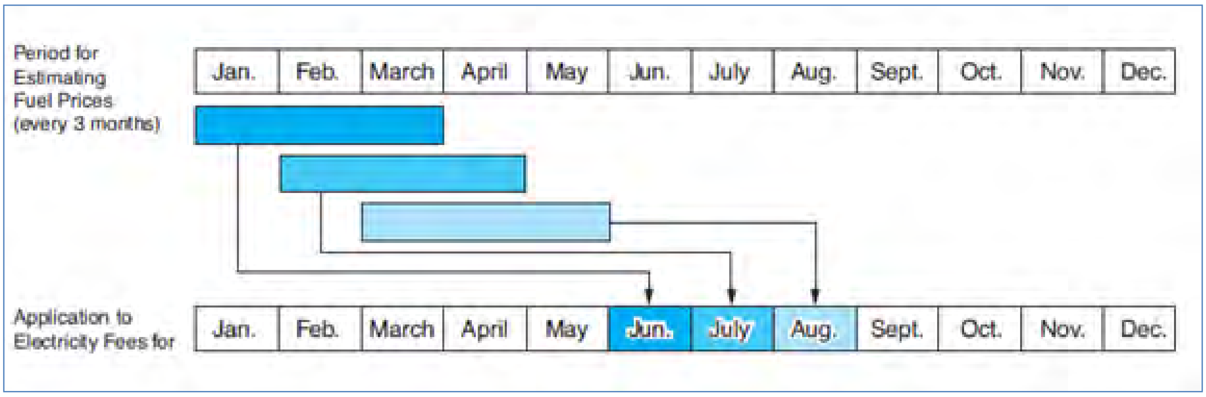
(1) Japanese Tariff Adjustment System by Fuel Price Fluctuation

Consumers are afraid of the impact to household and business economy by a rapid fluctuation of fuel price. Japanese current adjustment system by fuel price fluctuation is established in order to reflect the fuel price fluctuation promptly to tariff and to subdue the substantial change of every month. Following measures are applied in Japan.

Maximum adjustment price; Capping

Time lag setting; The price of January to March applies to the tariff of June (See Figure 3.3.4-2)

Tariff leveling by adopting 3 month average



Source: TEPCO web-site

Figure 3.3.4-2 Time Lag Setting for Tariff Adjustment

Calculation method of fuel price adjustment (See Figure 3.3.4-3)

Standard unit price; Fuel price adjustment price per 1kWh when average fuel price changes 1,000JPY/kl.

Average fuel price; Calculated unit price per 1kl of crude oil based on price of crude oil, LNG ,and coal, which are described in customs clearance statistics every three months. (Quarterly) Calculation formula is as follows;

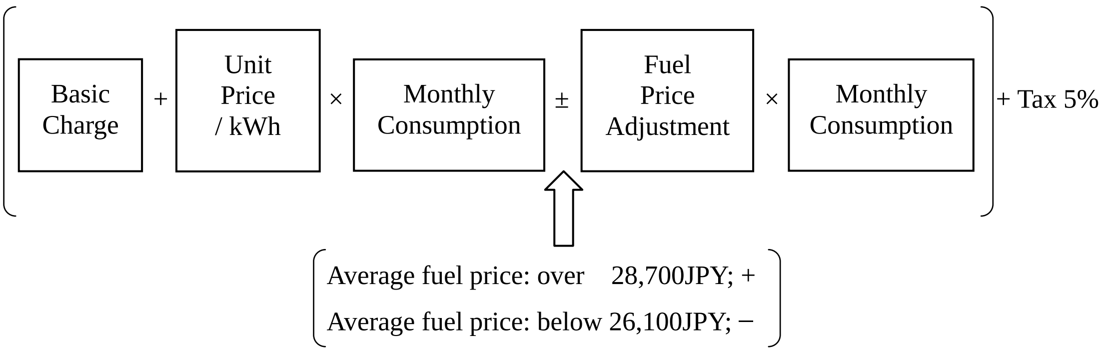
Average fuel price = A × α + B × β + C × γ (Round under 100JPY)

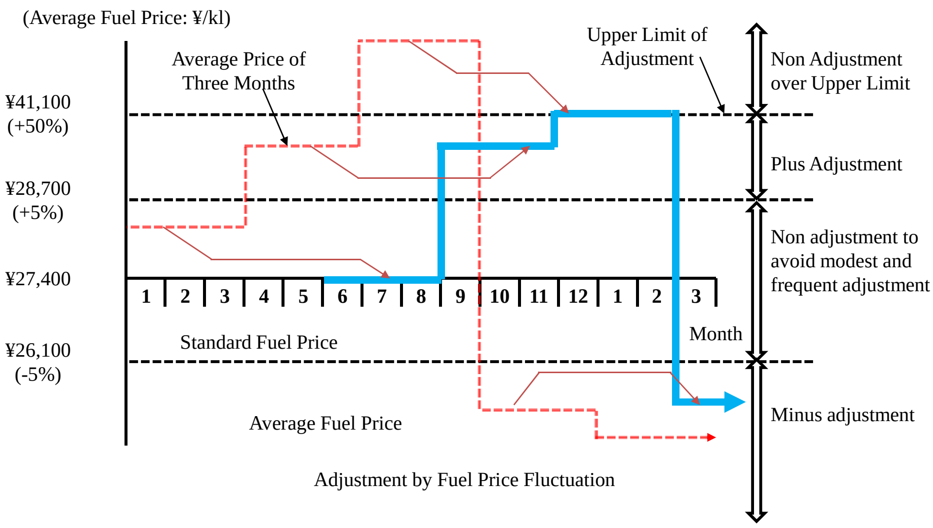
A: Average crude oil price of each quarter α : 0.1837
B: Average LNG price of each quarter β: 0.4461
C: Average coal price of each quarter γ: 0.2582

Fuel price adjustment is calculated by average fuel price and standard price.

- When average fuel price is below 26,100JPY,
  Fuel adjustment price = (27,400 - Average fuel price) × Standard unit price ÷ 1,000
- When average fuel price is over 28,700JPY and below 41,100JPY,
  Fuel adjustment price = (Average fuel price - 28,700) × Standard unit price ÷ 1,000
- When average fuel price is over 41,000JPY,
  Fuel adjustment price = (41,100 JPY- 27,400JPY) × Standard unit price ÷ 1,000

Tariff calculation method by fuel price adjustment system (one month)





Source: TEPCO Illustrated 2009

Figure 3.3.4-3 Calculation Method of Fuel Price Adjustment

(2) Fuel Cost Analysis of Indonesian Tariff System

As explained above, Japanese fuel price adjustment is calculated on fuel ratio of power generation, calorific value of fuel and fuel price. Followings are the calculation procedure of fuel adjustment unit price in case of introducing Japanese system.

Confirmation of fuel composition, fuel price, and calorific value of each fuel

Table 3.3.4-1 shows fuel consumption and cost of PLN in 2009.

Table 3.3.4-1 Fuel Consumption and Cost of PLN in 2009

Fuel	Consumption		Unit Price		Amount (Rp)
HSD (High Speed Diesel Oil)	kilo liter	6,365,116	Rp/liter	5,601.07	35,651,460,274,120
MFO (Marine Fuel Oil)		3,032,657		4,315.86	13,088,523,040,020
Coal	Ton	21,604,464	Rp/kg	732.32	15,821,381,076,480
Natural Gas	MMSCF	266,539	Rp/MSCF	37,998.48	10,128,076,860,720
Total	—		—		74,689,441,251,340

Source: PLN Statistics 2009

Table 3.3.4-2 shows net heating value of fuel used in Indonesia.

Table 3.3.4-2 Net Heating Value of Fuels

Fuel	Net Heating Value	
HSD (High Speed Diesel Oil)	kJ/liter	36.542
MFO (Marine Fuel Oil)	kJ/liter	40.767
Coal	kJ/kg	27.444
Natural Gas	BTU/SCF	1148.1

Source: PLN Documents

The calculation result of the total heating value by fuel, the fuel cost per unit heating value, and the fuel cost per ton oil equivalent is shown in Table 3.3.4-3.

Table 3.3.4-3 Total Heating Value by Fuel, Fuel Cost per Unit Heating Value, and Fuel Cost per Ton Oil Equivalent

Fuel	GJ	Rp/GJ	Rp/TOE
HSD (High Speed Diesel Oil)	232,594	153,277,598	3,649,467
MFO (Marine Fuel Oil)	123,632	105,866,510	2,520,631
Coal	592,913	26,684,157	635,337
Natural Gas	323,113	31,345,265	746,316
Total	1,272,253	58,706,448	1,397,773

Source: PLN Documents

Accordingly, the average ton oil equivalent of all fuel is 1,400,000Rp/TOE.

Standard fuel price (hereinafter to as "SFP") is defined as follows, putting fuel price as variables.

This SFP value is the index of tariff adjustment. As fuel composition always changes, the calculation formula should be revised every now and then.

Setting each fuel price as variable, ton oil equivalent is calculated in the following formula.

SFP = 0.119×HSDp + 0.057×MFOp + 0.404×COALp + 0.005×NGp

Fuel Cost of Ton Oil Equivalent (Standard Fuel Price): SFP (Rp/TOE)

HSD Price: SDp (Rp/Liter)

MFO Price: MFOp (Rp/Liter)

Coal Price: COALp (Rp/kg)

Natural Gas Price: NGp (Rp/MSCF)

(3) Indonesian Tariff Adjustment System by Fuel Price Fluctuation (Draft)

Based on the above mentioned cost analysis of Indonesian electricity, the Study Team proposes to apply Japanese style tariff adjustment system to Indonesia after 2015.

The basic concept is as follows. (See Figure 3.3.4-4)

a) Three month time delay of adjustment (Example: Price of January to March applies to the adjustment price of June to August)

b) Plus and minus 5%: No tariff compensation

c) Decrease below 5%: Total compensation

d) Increase: Capping over 20% for avoiding rapid tariff raise for protecting customers

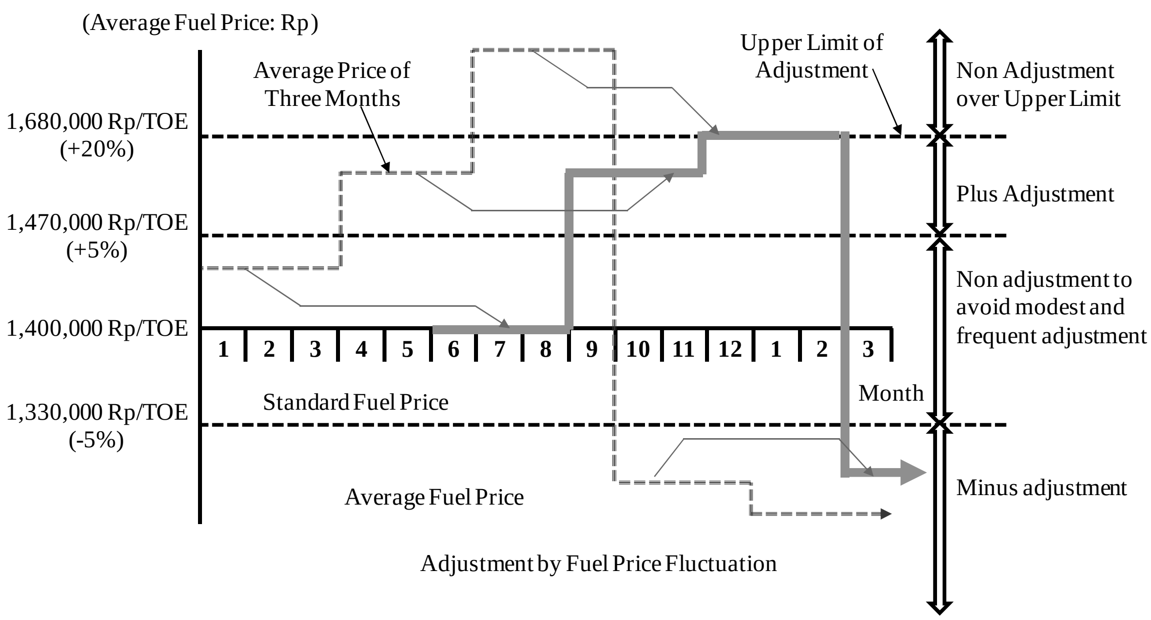


Figure 3.3.4-4 Indonesian Tariff Adjustment System by Fuel Price Fluctuation (Draft)

3.3.5 Roadmap and Action Plan

(1) Introduction of New TOU Tariff System in the Jawa-Bali Region

PLN introduced amended TOU tariff system in the Jawa-Bali region in April 2011 on the voluntary base, referring the information exchange and discussion with the Study Team. The direction of this proposal and PLN tariff revision are similar. The next step is improvement and expansion of the existing TOU tariff system. And, before that, a detailed study for advanced TOU tariff system, design, law revision, and advertisement to customers should be implemented. Moreover, monitoring, assessment, and amendment cycle should be conducted for continuous improvement after the implementation.

Roadmap and action plan for formulating the new TOU tariff system are described in Table 3.3.5-1 and Table 3.3.5-2 respectively. Early starting of the preparation for expansion and amendment of TOU tariff scheme, which was amended and implemented by PLN in April 2011, is proposed.

Table 3.3.5-1 Roadmap to Introduce New TOU Tariff System in Jawa-Bali

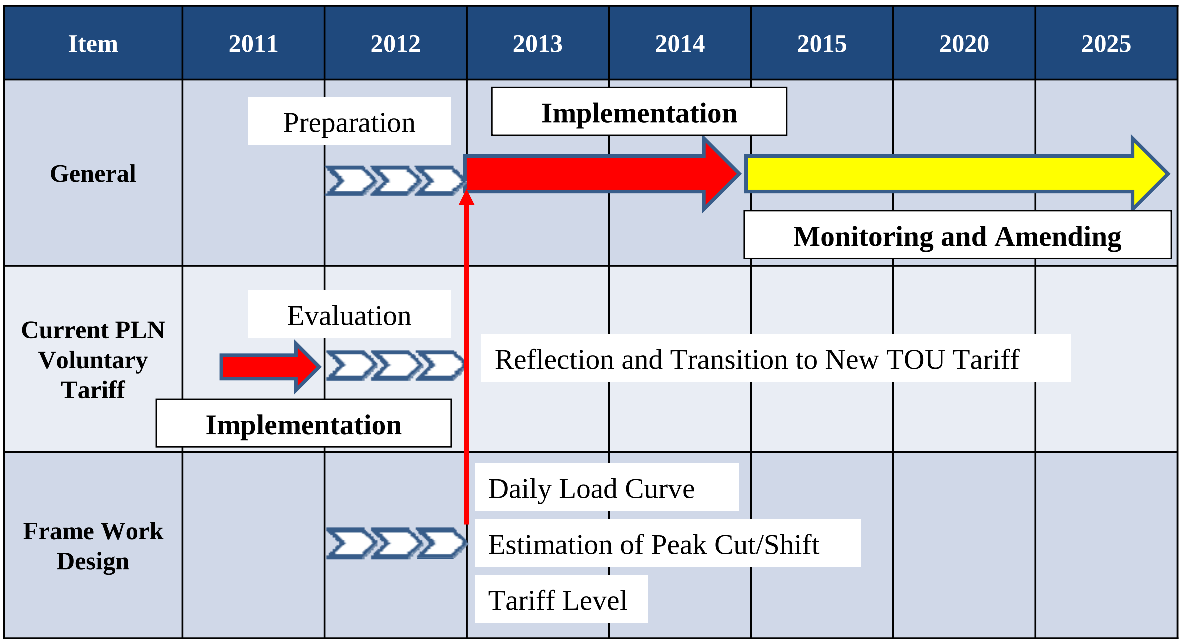


Table 3.3.5-2 Action Plan to Introduce New TOU Tariif System in Jawa-Bali

Item	Organization	2012	2013	2014	2015	2016~
System Design	PLN	Preparation ➢Tariff Structure ➢Economics ➢Investment ➢Profit ➢Technology	➢Implementation	➢Evaluation and Monitoring		
	MEMR/PLN	➢Dispatching Overseas Delegation				
Law Revision	MENR	➢Provision of Law Revision ➢Approval by the Government	➢Minor Amendment	➢Minor Amendment		
Advertisement	MEMR/PLN	➢Advertisement of Incentive TOU Tariff				

(2) Introduction of New PF Clause

PLN is well aware of the effectiveness to introduce incentive scheme in PF clause. It is expected to introduce it in early stage, after examining carefully of PF improvement effects (technological and economical).

Roadmap and action plan for formulating the new PF clause are described in Table 3.3.5-3 and -4 respectively. Monitoring, assessment and amendment cycle should be conducted for continuous improvement after implementation. An up-ward amendment of incentive clause leads to the increase of PLN's revenue in short and middle term. And by this clause, consumer's efforts to improve PF can result in the reduction of electricity bill. (Refer Chapter 4) The increased tariff revenue should be utilized for consumer's support to improve PF. This measure should be also categorized as one solution to reduce distribution loss and raise tariff for large consumers. Early starting of preparation for amendment of PF clause is proposed.

Table 3.3.5-3 Roadmap to Introduce New PF Clause in Indonesia

Item	2011	2012	2013	2014	2015	2020	2025
General		Preparation	**Implementation**		**Monitoring and Amending**		
Current PLN PF System		Evaluation					
Frame Work Design			Minimum Average PF Incentive PF Clause Other Countries Information				

Table 3.3.5-4 Action Plan to Introduce New PF Clause in Indonesia

Item	Organization	2012	2013	2014	2015	2016~
System Design	PLN	Preparation ➢Tariff Structure ➢Economics ➢Investment ➢Profit ➢Technology	➢Implementation	➢Evaluation and Monitoring		
	MEMR/PLN	➢Dispatching Overseas Delegation				
Law Revision	MENR	➢Provision of Law Revision ➢Approval by the Government	➢Minor Amendment	➢Minor Amendment		
Advertisement	MEMR/PLN	➢Advertisement of Incentive PF Tariff	➢Support for Consumers to improve PF	➢Support for Consumers to improve PF		

(3) Introduction of Tariff Adjustment System for Fuel Price Fluctuation

Tariff adjustment system has already drawn in the national roadmap of tariff revision. PLN already started the study of tariff adjustment system, referring the information provided by the Study Team. Japanese adjustment system contains measures for avoiding rapid influence to customers by price hike. PLN is interested in Japanese system. It is proposed to implement fuel price adjustment system just after 2015. (See Table 3.5.5-5 and -6)

Table 3.3.5-5 Roadmap of Tariff Adjustment System by Fuel Price Fluctuation in Indonesia

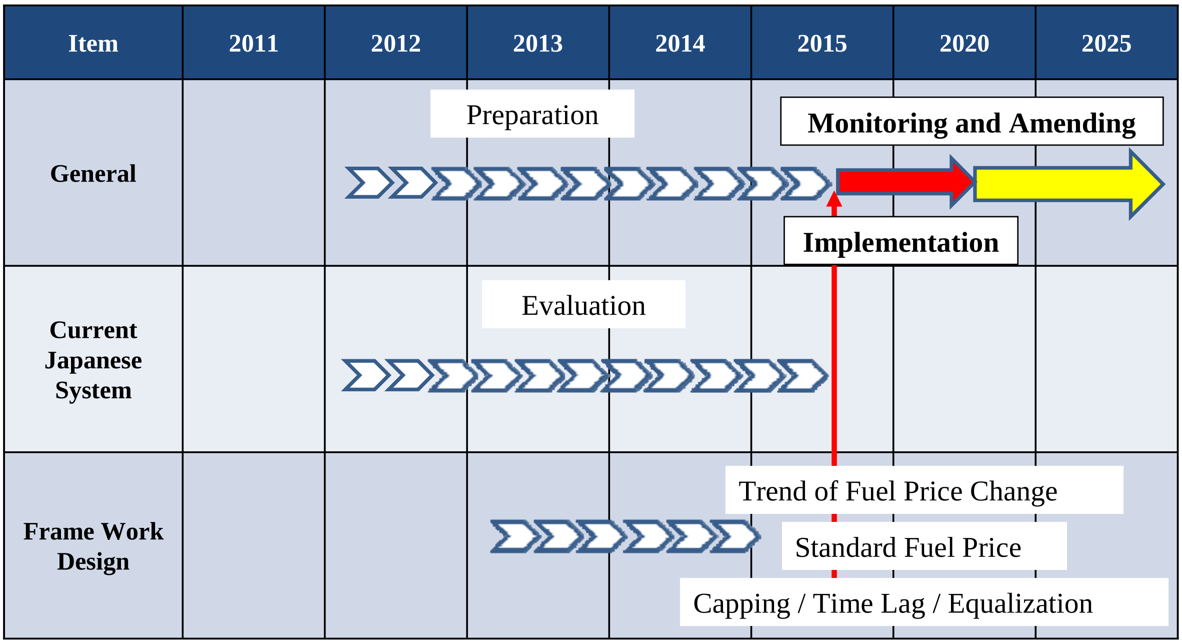


Table 3.3.5-6 Action Plan of Tariff Adjustment System by Fuel Price Fluctuation in Indonesia

Item	Organization	2012	2013 -2014	2015	2016~
System Design	PLN		Preparation ➢Tariff Structure ➢Economics ➢Accounting System ➢Profit ➢Technology	➢Implementation	➢Evaluation and Monitoring
	MEMR/PLN		➢Dispatching Overseas Delegation (Japan)		
Law Revision	MENR		➢Provision of Law Revision ➢Approval by the Government	➢Minor Amendment	
Advertisement	MEMR/PLN		➢Advertisement of Fuel Price Adjustment System		

3.4 Promotion of Energy Efficiency Labeling Program

3.4.1 Work Flow for Formulating Labeling Program

The study for formulating EE labeling program has been conducted with the leadership of GABEL and MEMR. The main role of the Study Team was supporting the earlier drafting out of framework of EE labeling for refrigerator, ACs, and TVs. And the study has been carried out in accordance with BRESL Project, which started almost same time as this study.

Table 3.4.1-1 shows the main work flow for formulating EE labeling program.

Table 3.4.1-1 Work Flow for Formulating Labeling Program

Time	Events
Latter half of 2009	MEMR drafted the measurement method and labeling criteria for refrigerators, ACs, and TVs. These drafts were delivered to the manufacturers, but consensus between MEMR and manufacturers had not been built. The draft paper was left until 2011.
First half of 2010	Commencement of BRESL Project and JICA DSM Study
Oct. 2010	BRESL 1st regional TWG was held in Bangkok. Methodology of the project was discussed. Members of TWG in Indonesia were assigned.
21st Dec. 2010	MEMR held 1st Technical Meeting. The Study Team showed “Framework draft” of EE labeling for refrigerators, ACs, and TVs. The meeting was held to collect manufacturer’s opinion for the draft.
16th Feb. 2011	MEMR held 2nd Technical Meeting. Before the meeting the Study Team had collected manufacturer’s opinion for the draft Framework, and presented it. . Participants shared the manufacture’s opinion.
Apr. 2011	BRESL 2nd Regional TWG was held in Bali.
March to July 2011	GABEL held several internal meetings with MOI. Discussions were held referring MEMR’s draft 2009, not JICA’s draft. BRESL joined the meeting after the middle of 2011.
26th July 2011	MEMR held 3rd Technical Meeting. JICA DSM Study presented the draft framework rev. 2. GABEL presented its own draft, based on MEMR’s draft.
Aug. – Oct. 2011	GABEL, BRESL, MEMR, and MOI had several meetings. The testing methodology of ACs and criteria of labeling were discussed. GABEL submitted consented opinion for refrigerator, AC, and TV.
25th Nov. 2011	MEMR held 4th Technical Meeting. Referring GABEL’s draft framework and JICA’s draft, Official draft framework of EE labeling on refrigerators, ACs, and TVs was approved.

3.4.2 Members and Issues of the Technical Meetings

Technical Meetings were held four times by MEMR hosting. The Study Team supported the preparation and operation of the meetings. Participation organizations are as follows;

Governmental organization; MEMR (Chair), MOI (Co-chair), MOT, and KAN/BSN

Testing laboratory; BPPT, LIPI, BPMBEI, and Sucofindo

Manufacturers; 18 manufacturers and GABEL

Consultants and others; BRESL Project Team, JICA Study Team, and EMI.

Appendix 1-1 shows the participant list of Technical Meetings. Figure 3.4.2-1 shows the photos of the Technical Meetings.

Figure 3.4.2-1 Photos of Technical Meetings

Table 3.4.2-1 shows the issues of the Technical Meetings.

Table 3.4.2-1 Issues of Technical Meetings

Item	Content
General	Purpose, Definition of terms, and Roles of the stakeholders
EE measurement method	EE indicator, EE test protocol, and standards
Labeling criteria	Star rating criteria
Mandatory display	Mandatory EE data display on the product, package, and catalogues
Data verification method	Roles of governmental laboratories, manufacturer's laboratories, and third party laboratories. Accreditation method for the laboratories
Penalty	Penalty on illegal labeling and false data submission
Program review	Period and method of review

3.4.3 Reflection of Opinions from the Related Stakeholders for the Draft Framework

Table 3.4.3-1 shows the major opinions, which have collected in the Technical Meetings and GABEL/BRESL meetings. There are some difficulties to solve and unify all opinions, because of the limited time and lack of referential data. These opinions were stated as "Note (attention)" in the Draft Framework.

Table 3.4.3-1 Opinions and Reflection to the Draft Framework

Item	Opinion	Reflection
Labeling program general	(GABEL) GABEL agrees with voluntary labeling program, but strongly opposes mandatory program. (MEMR) Initially, labeling program should start voluntarily. But if the program doesn't spread to the market, the program should be applied mandatorily. (JICA Study Team) Mandatory program can be applied provided that third party laboratory has enough test ability.	Definition of mandatory /voluntary program is noted. (Part 1 General) Mandatory program will be introduced, 27 months after the introduction of voluntary program

Item	Opinion	Reflection
Importing foreign programs	(MOI) MOI opposes that program is made importing foreign programs directly, because market and industry conditions are different from other countries. (JICA Study) EE data collection for designing labeling criteria needs long time and testing facilities. Importing foreign programs is an option when Indonesian government rushes to apply the program. The program can be reviewed latter as establishment of laboratories and market research are available.	Indonesian own labeling criteria is being made
Adoption of manufacturer's test data	(GABEL) Manufacturer's test data should be adopted under their SDoC (Self Declaration of Conformity). (Some manufacturers) They cannot believe that all manufacturers submit correct data. All data should be tested by third party laboratories by product types.	Witness test by third party laboratories at manufacturer's laboratories was approved.
Accreditation of manufacturer's laboratory.	(GABEL) Accreditation under the condition of ISO17025 takes longtime and cost. GABEL opposes such accreditation.	Annual inspection by third party laboratories can substitute the accreditation.
Authority of the labeling program	(GABEL) MOI should be the authority for the labeling program. (JICA Study Team, LIPI) In that case, labeling criteria and other requirement on energy efficiency should be designed by MEMR. MEMR has to request it to MOI. MEMR coordinate other ministries plan and activity on EE&C, and monitor the performance and impact.	MEMR is preparing for ministerial decree.
Display of SNI on safety and performance	(GABEL) The contents of SNI on safety and performance are unclear. It should be well coordinated with the EE labeling program.	Before implementing mandatory EE labeling program, SNI on safety and performance program must be implemented.
Cost baring	(GABEL) Manufacturers are worried about the cost for application and test. (MEMR) MEMR wants free of charge on them, the cost should be bared by the national budget. This matter should be discussed in the government.	Discussion on actual cost has not yet been held.
Labeling criteria (Star rating criteria)	(Some manufacturers) Data spread chart for the labeling criteria in Draft Framework may be formed by the data from manufacturer's catalogue. Such data cannot be recognized true, because manufacturers conduct their own measurement method. True data collection should be done by third party laboratories under a specified method, even if it would take long time (Another manufacturer)	Implementation of the program, capacity development of testing laboratories and manufacturer's voluntary participation for the program will be carried out in parallel.

Item	Opinion	Reflection
	Temporary criteria can be acceptable. Labeling program should be applied in the early stage. The criteria should be reviewed later based on the third party laboratory data.	

3.4.4 Draft Framework

The outline of Draft Framework of EE labeling for refrigerator, AC and TV is described below. And Draft Framework Rev. 3 (Part 1 - 4) is attached in Appendix 1-2, -3, -4 and -5. It should be used as the basis (principle) for formulating actual regulation of the labeling program such as the governmental or ministerial degree. Table 3.4.4-1 shows the main structure of the draft Framework.

Table 3.4.4-1 Contents of the Draft Framework

Framework	Contents
Part 1: General	■ Purpose of the document ■ Operation of the program ■ Definition of the terms ■ Roles of the stakeholders ■ Incentive and disincentive ■ Maintenance of the program (Review)
Part 2: Refrigerator Part 3: AC Part 4: TV	■ Scope of the product ■ EE Indicator and measurement method ■ Star rating criteria ■ Verification of EE data ■ Mandatory display

(1) Draft Framework for Refrigerators

The outline of Draft Framework for refrigerators is shown in Figure3.4.4-1. Two categories (with/without freezer) are provided. Energy efficiency indicator for refrigerators is calculated by annual electricity consumption per inner volume. However this data is not described in Indonesian manufacturers' catalogues. In order to collect this data, the measurement method for electricity consumption and inner volume should be defined. And manufacturers must collect data based on the defined method.

SNI standard is applied for the measurement of electricity consumption. Compared with ISO/IEC standard, SNI is simpler (no need for preparing dummy load). ISO/IEC is applied for the calculation of inner volume.

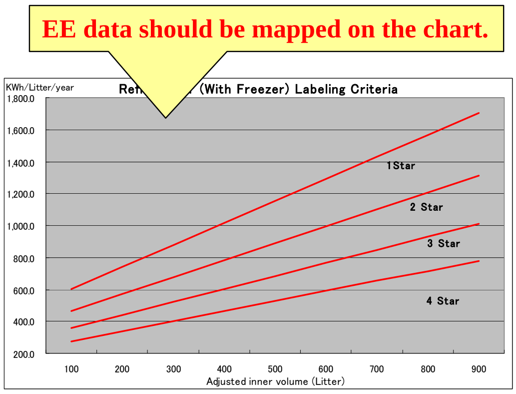
Electricity consumption criteria were decided without actual measured data, referring neighboring countries' schemes and some hearing from manufacturers in Indonesia. It will be needed to re-evaluate the criteria with collecting the above data from now.

1. Refrigerator without freezer

Star rating	Formula
4 Star	≤ 3 Star x 0.77
3 Star	≤ 2 Star x 0.77
2 Star	≤ 1 Star x 0.77
1 Star	≤ 465 + 1.378 x V_{adj} x 1.15

2. Refrigerator with freezer

Star rating	Formula
4 Star	≤ 3 Star x 0.77
3 Star	≤ 2 Star x 0.77
2 Star	≤ 1 Star x 0.77
1 Star	≤ 465 + 1.378 x V_{adj} x 1.55



EE measurement method;
SNI-ISO 04-15502-2008 / IEC/ISO 62552-2007

Source: 4th Technical Meeting

Figure 3.4.4-1 Outline of Draft Framework for Refrigerators

(2) Draft Framework for ACs

The outline of Draft Framework for ACs is shown in Figure3.4.4-2. Referring Japanese and Singapore program, the superiority of inverter technology is applied. However not an unique evaluation method like Japan, but evaluation methods for inverter and non-inverter ACs (two categories) were provided, in consideration of domestic manufacturers, who don't produce inverter ACs. Advantage of inverter should be displayed apart from the number of stars of EE labeling..

Energy efficiency of ACs with inverter is given by "COP weighted". Singapore has such evaluation method for ACs with inverter. (Malaysia also has a plan to introduce the same method)

COP of ACs is described in the catalogue of manufacturers. By mapping the COP data on the chart, the number of stars of EE labeling for the product can be judged. However the measurement method is not clear in many products, cross checking (certification) by the governmental organization or third party testing laboratories should be needed.

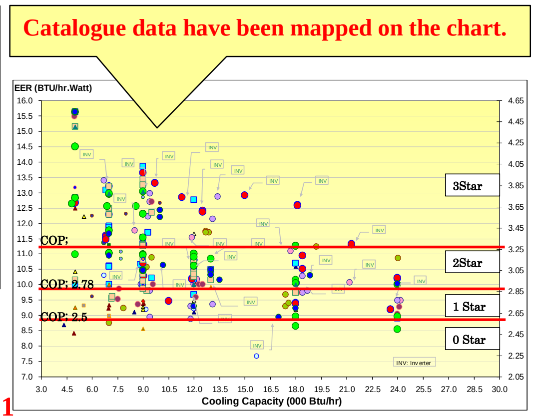
SNI/ISO is applied for testing (SNI is similar to ISO).

	Inverter COP weighted	Non-inverter COP
4 Star	3.76 ≤ COP	3,05 ≤ COP
3 Star	3.34 ≤ COP < 3.76	2.92 ≤ COP < 3,05
2 Star	2.92 ≤ COP < 3.34	2,64 ≤ COP < 2.92
1 Star	2,64 ≤ COP < 2.92	2,50 ≤ COP < 2,64

COP weighted

= 0.4 x (COP full load) + 0.6 x (COP half load)

EE Measurement Method; SNI 19-6713-2002, ISO 5151



Source: 4th Technical Meeting

Figure 3.4.4-2 Outline of Draft Framework for ACs

(3) Draft Framework for TVs

The outline of Draft Framework for TVs is shown in Figure3.4.4-3. CRT TVs are still sold in the market. However they are categorized as out of the target of EE labeling, because LCD TVs are rapidly disseminating and many manufacturers decided to quit the production of CRT. Energy efficiency indicator for TVs is calculated by annual electricity consumption per screen area. In the calculation of annul electricity consumption, the average ON mode time per day should be decided. And in Indonesia, 8h/day was adopted. It is different by country (Japan; 4.5h, Malaysia; 5h, India; 6h), The accuracy should be reviewed, surveying the actual condition.

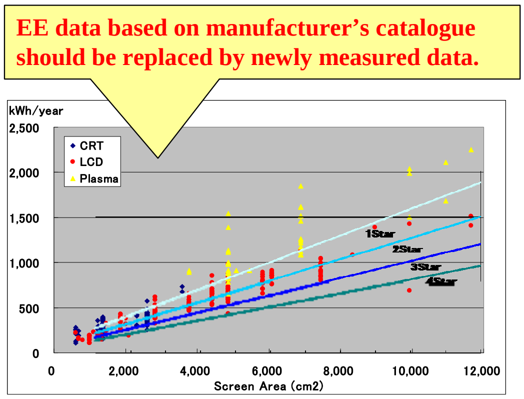
IEC standard, which is most popular in the countries introducing EE labeling for TVs, is applied for testing.

Star rating criteria

Rating	E; Annual Energy Consumption
4 Star	E < 65 + 0.047 * SA
3 Star	65 + 0.047 * SA < E < 82 + 0.058 * SA
2 Star	82 + 0.058 * SA < E < 102 + 0.073 * SA
1 Star	102 + 0.073 * SA < E < 128 + 0.091 * SA
0 Star	128 + 0.091 * SA < E

$$E = \frac{(P_o - \frac{PA}{4}) \text{ x t1} + \text{Ps x t2}}{1000} \times 365$$

E; Annual energy consumption (kWh/year)
Po; Power at ON mode (W)
Ps; Power at active standby mode (W)
PA; Energy saving function power reduction (W)
t1; ON mode time (8h/day)
t2; Active standby mode time (16h/day)



EE measurement method; IEC62301(2006), IEC62087(2008), SNI04-6958(2003)

Source: 4th Technical Meeting

Figure 3.4.4-3 Outline of Draft Framework for TVs

3.4.5 Proposal of Controlling Total Harmonic Distortion

(1) Back ground

Through the pilot project, the energy saving effect of inverter technology was confirmed. And it is supposed to be spread in Indonesia. Besides, the inverter is known to reflux harmonics into the electricity distribution lines. And through the distribution lines, appliances in consumers are exposed by the harmonics.

On the other hand, as described in Section 2.5.6, it was also observed that there are a lot of condensers named “Energy Saver” etc in households, which are always plugged in the outlet, to avoid the limiter trip by PF improvement. And appliances with condensers, which are always connected to the power line, are also becoming popular.

It is said that condensers without proper capacity and specification, which meet the condition of connected power line and ripple harmonics, cause over heating, burnt-out or short life time. Thus it becomes a concern that condensers accident and burnt-out might be caused by the harmonics generated by the future penetration of inverter technology. The same concern exists in the case of reactors connected to the power line.

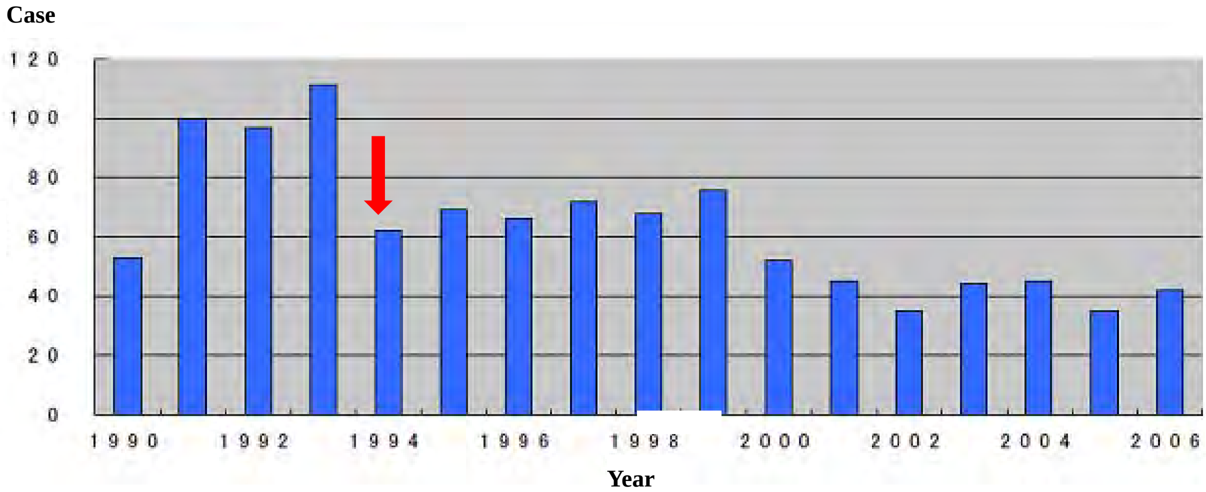
In the early penetration stage of inverter technology in Japan, there were fluent accidents and burnt-out. Here examples of total harmonic distortion (hereinafter to as “THD”) troubles in Japan, and Japanese Guideline for reduction of harmonic emission are explained. And the direction of countermeasures against THD in Indonesia is proposed.

(2) Transition of the Number of THD Troubles in Japan

Transition of the numbers of THD troubles in Japan is shown in Figure 3.4.5-1 , Attacked equipments by THD are shown in Figure 3.4.5-2 The breakdown of condenser troubles are shown in Figure 3.4.5-3.

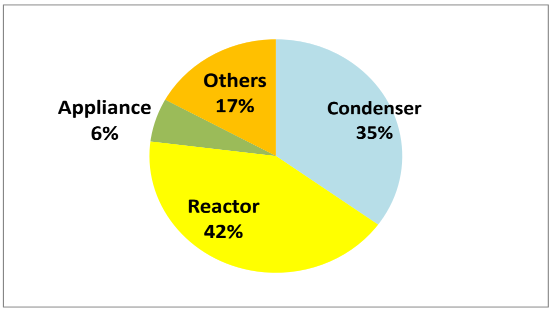
The followings are recognized by these figures.

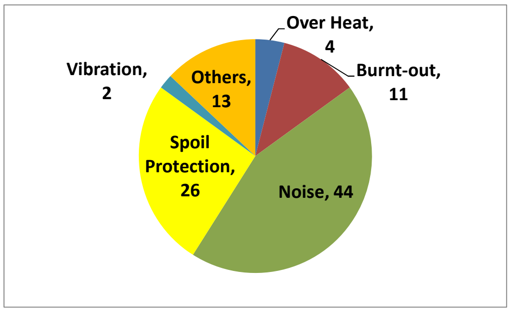
- In 1994 when Japanese Guideline for reduction of harmonic emission was enacted, the number of THD trouble in Japan reduced much.
- Condenser and reactor were mainly affected by THD.
- The most fluent Condenser Troubles are proved to be Burnt-out, Noise, and Spoil Protection.



Source: Document of Federation of Electric Power Companies of Japan

Figure 3.4.5-1 Number of THD Troubles in Japan





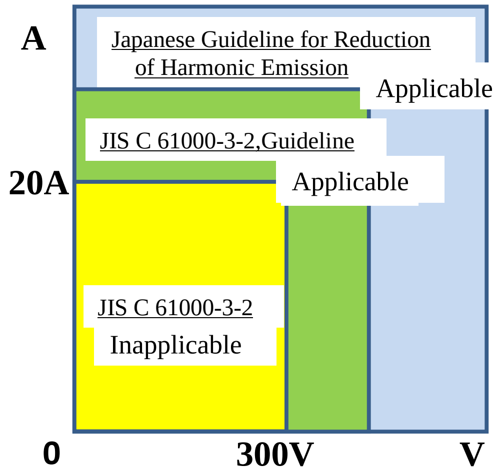
Source: Document of Federation of Electric Power Companies of Japan

Figure 3.4.5-2 Attacked Equipment by THD

Figure 3.4.5-3 Condenser Troubles by THD

(3) Formulation of Japanese Guideline for Reduction of Harmonic Emission and JIS

In order to suppress the generating and outflow of harmonics, Japanese Guideline for Reduction of Harmonic Emission was formulated in 1994. The composition of Japanese Guideline is shown in Figure 3.4.5-4.



Source: Document of Federation of Electric Power Companies of Japan

Figure 3.4.5-4 Component of Japanese Guideline for Reduction of THD

The guideline is consists of two components below.

1) Guideline for reduction of harmonic emission for high voltage receiving customer and the special high voltage receiving customer

   In the guideline i) it is mentioned that reactor should be connected to PF improvement condenser in series and ii) the capacity of the condenser should be adjusted to the load situation.

2) Guideline for home electronics and commodity equipments.

   In this Guideline the control measures are regulated for equipment, of which input current per one phase are less than or equal to 20 A.

   In 2004 Guideline for Home Electronics and Commodity Equipments was converted into JIS C 61000-3-2.

(4) Current Situation and Future Direction of Indonesia.

As mentioned before, 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 as shown in Japanese case, inverter technology produces harmonics. And in the future it is concerned that harmonics cause the burnt-out of condensers.

In accordance with the current situation and concern, the following two countermeasures are suggested.

1) Implementation of field survey, analysis for THD

   A workshop, which was hosted by BPPT, concerning the benchmark of electricity quality was held on 3 November 2011. There the result of filed surveys on THD, and the approach by MEME and BPPT for THD were presented. According to the workshop, it is not necessary to tackle THD immediately; however continuous field survey and monitoring should be carried out.

2) Clarification of the necessity of establishing national guideline and/or regulation for THD

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.

3.4.6 Establishment of EE Performance Database

As described in 3.4.4, accumulation and analysis of EE performance for target appliances are necessary for formulating EE labeling. Beside in Indonesia there is quite less data on this field. So this study intended to complete a prototype of EE performance database for refrigerators, ACs, and TVs, which can contribute as the basis of data accumulation and analysis. (Sub-contract to EMI)

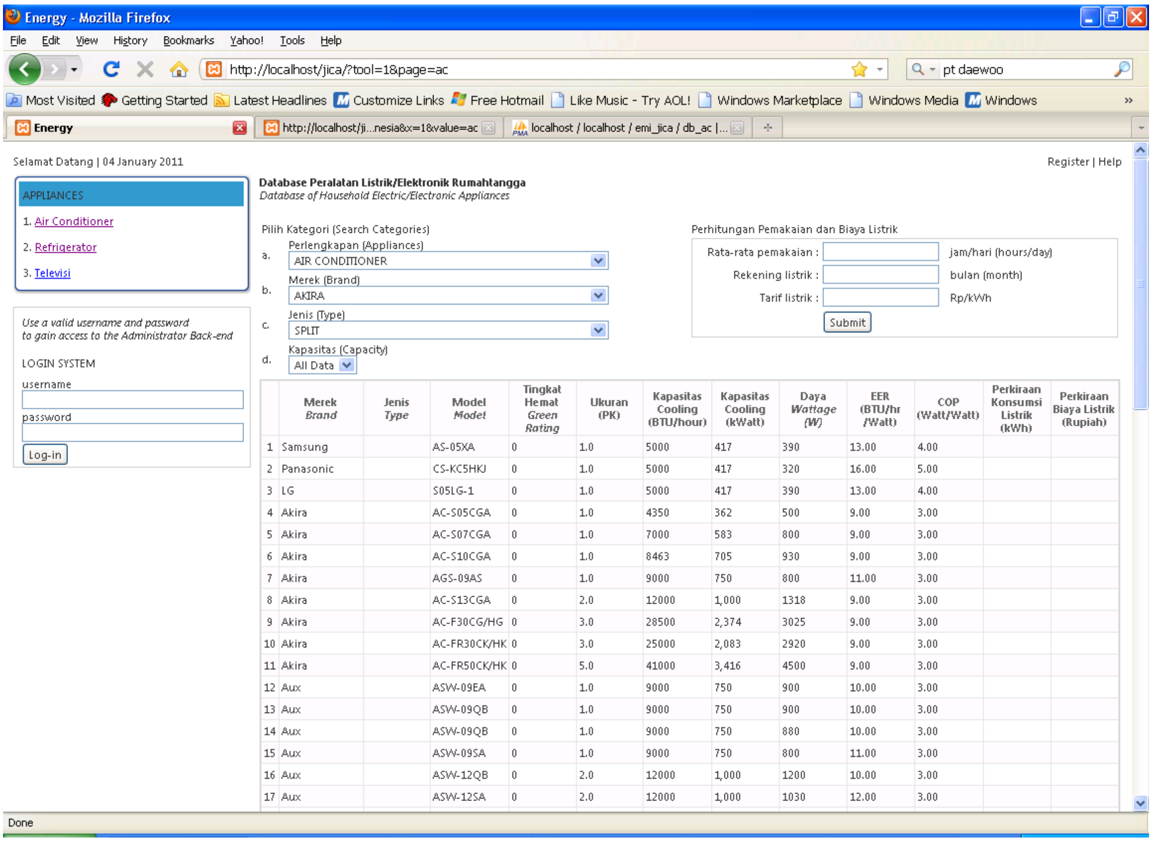
This database was displayed in the 4th Technical Meeting, and transferred to MEMR.

Basic specification of the product EE database is as shown in Table 3.4.6-1. Figure 3.4.6-1 shows the typical data form. Installed data covers the dominant appliances (Refrigerators, ACs, and TVs), which are sold in Jakarta in 2011. By giving ID and pass word for manufacturers (Managed by MEMR), manufacturers can maintain their own data. MEMR can check and process all data. End-users can get the information of the performance data of appliances through web-site.

It is expected that this database (prototype) should be maintained, up-dated periodically, and utilized by the government, manufacturers, and end-users.

Table 3.4.6-1 Basic Specification of EE Performance Database

Item	Content
Data uploading	■ Manufacturers can directly access to the database and upload and/or replace data. (ID and pass word are prepared by MEMR)
Data	■ Data supplier, Upload/replace date, Product name and type, Energy consumption, Rated power, Energy efficiency, Place of EE test, Tested data, EE measurement method, Accreditation of the laboratory, Star rating, etc.
Display (for MEMR administrator)	■ All initial data and processed data
Display (for manufacturer and end-user)	■ Usually, general information will be displayed. Specific information can be also displayed by optional method. (By inputting ID and pass word, manufacturers can maintain their own data)
Data processing (under consideration)	■ Automatic data plotting on the data spread chart (for example; COP of ACs) ■ Automatic energy consumption calculation, selecting type and giving condition of usage (Singapore and Australian site have such function)



Energy - Mozilla Firefox

Selamat Datang | 04 January 2011 — Register | Help

APPLIANCES
1. Air Conditioner
2. Refrigerator
3. Televisi

Use a valid username and password to gain access to the Administrator Back-end

LOGIN SYSTEM
username
password
Log-in

Database Peralatan Listrik/Elektronik Rumahtangga
Database of Household Electric/Electronic Appliances

Pilih Kategori (Search Categories)
a. Perlengkapan (Appliances): AIR CONDITIONER
b. Merek (Brand): AKIRA
c. Jenis (Type): SPLIT
d. Kapasitas (Capacity): All Data

Perhitungan Pemakaian dan Biaya Listrik
Rata-rata pemakaian : jam/hari (hours/day)
Rekening listrik : bulan (month)
Tarif listrik : Rp/kWh
Submit

	Merek *Brand*	Jenis *Type*	Model *Model*	Tingkat Hemat *Green Rating*	Ukuran (PK)	Kapasitas Cooling (BTU/hour)	Kapasitas Cooling (kWatt)	Daya *Wattage (W)*	EER (BTU/hr /Watt)	COP (Watt/Watt)	Perkiraan Konsumsi Listrik (kWh)	Perkiraan Biaya Listrik (Rupiah)
1	Samsung		AS-05XA	0	1.0	5000	417	390	13.00	4.00		
2	Panasonic		CS-KC5HKJ	0	1.0	5000	417	320	16.00	5.00		
3	LG		S05LG-1	0	1.0	5000	417	390	13.00	4.00		
4	Akira		AC-S05CGA	0	1.0	4350	362	500	9.00	3.00		
5	Akira		AC-S07CGA	0	1.0	7000	583	800	9.00	3.00		
6	Akira		AC-S10CGA	0	1.0	8463	705	930	9.00	3.00		
7	Akira		AGS-09AS	0	1.0	9000	750	800	11.00	3.00		
8	Akira		AC-S13CGA	0	2.0	12000	1,000	1318	9.00	3.00		
9	Akira		AC-F30CG/HG	0	3.0	28500	2,374	3025	9.00	3.00		
10	Akira		AC-FR30CK/HK	0	3.0	25000	2,083	2920	9.00	3.00		
11	Akira		AC-FR50CK/HK	0	5.0	41000	3,416	4500	9.00	3.00		
12	Aux		ASW-09EA	0	1.0	9000	750	900	10.00	3.00		
13	Aux		ASW-09QB	0	1.0	9000	750	900	10.00	3.00		
14	Aux		ASW-09QB	0	1.0	9000	750	880	10.00	3.00		
15	Aux		ASW-09SA	0	1.0	9000	750	800	11.00	3.00		
16	Aux		ASW-12QB	0	2.0	12000	1,000	1200	10.00	3.00		
17	Aux		ASW-12SA	0	2.0	12000	1,000	1030	12.00	3.00		

Done

Figure 3.4.6-1 Typical Data Form of Products EE Database (AC)

3.4.7 Roadmap and Action Plan for Implementing EE Labeling Program

Table 3.4.7-1 shows roadmap of the labeling program for refrigerators, ACs, and TVs. Based on the Draft Framework, which was summarized by the support of the Study Team, MEMR is preparing for enacting new ministerial decree. The capacity development of the government and third party testing laboratories are necessary and it is also the main issue of BRESL Project in 2012. After the implementation of labeling program, periodical monitoring, and amendment of labeling criteria, which reflects the improvement of appliance performance, expansion of target appliances and continuous maintenance of EE Database are strongly recommended.

Action plan, which describes the annual governmental budget estimate, is shown in the Table 3.4.7-2. The estimate (draft) shows the direct cost for formulating EE labeling program, and doesn't include the labor cost.

Table 3.4.7-1 Roadmap of EE Labeling Program

Item	2011	2012	2013	2014	2015	2016
Common	EE database for home appliances	Awareness, Dissemination and Expansion **EE labeling program becomes popular across the country**		Continuous maintenance		
Refrigerator		Laboratory test training **Voluntary program**	Laboratory test equipment	**Mandatory program**	Monitoring & Amendment	
AC	Laboratory test equipment	Laboratory test training **Voluntary program**		**Mandatory program**	Monitoring & Amendment	
TV	Labeling criteria	**Voluntary program**		**Mandatory program**	Monitoring & Amendment	

Table 3.4.7-2 Action Plan of EE Labeling Program

Item	Activity	Annual budget (USD)				
		2012	2013	2014	2015	2016～
Policy making	Committees, Workshops	Ref, AC, TV 10,000	Fan, Motor, Pump 10,000	Other 3,000	Other 3,000	Other 3,000
	Study mission for abroad	BRESL 10,000				
Dissemination	Media, For household, shops	Brochure, poster 10,000	Brochure, poster 10,000	Brochure, poster 5,000	Brochure, poster 5,000	Brochure, poster 5,000
Database	Making, maintenance	Installation 3,000	Maintenance 1,000	Maintenance 1,000	Maintenance 1,000	Maintenance 1,000
Review of labeling program	Market research, workshops				Ref, AC, TV 10,000	Fan, Motor, Pump 10,000
Capacity building of laboratories	Workshops	3,000	1,000	1,000	1,000	1,000
	Refrigerator test facility,	500,000	10,000	10,000	10,000	10,000
	Training	5,000				
	AC test facility,	1,000,000	10,000	10,000	10,000	10,000
	Training	5,000				
	TV test facility,	10,000	500	500	500	500
	Training	500				
	other		Fan 10,000	Motor 500,000		
Certification test of label	Bared by the manufacturers	0	0	0	0	0
total		1,556,500	52,500	530,500	40,500	40,500

3.4.8 Issues on Formulating and Operating Labeling Program

Followings are the issues of each parties and organizations on formulating and operating the labeling program which were recognized through this study including Technical meetings.

(1) The Government (as the Authority of the Labeling Program)

Internal discussion between MEMR and MOI (or including MOT and MOE) about who should be responsible for the establishment and operation of Labeling Program and how to collaborate effectively must be conducted. EE&C and the global warming are not the theme managed by only one ministry, but all ministries have to deal with them. They do not belong to only one ministry. MEMR should be the authority, which totally plan and conduct national policy on EE&C and achieve national target on it. However to formulate a functional labeling program speedy, the linkage and practical role share between MEMR and MOI should be defined more clearly

On the other hand, MOI should set the target for EE improvement of the products in the policy of industrial development and growth. Apart from EE labeling, the implementation of energy management program on industry should be MOI's another large issue. MOI should strongly lead the industries to promote EE&C cooperating with MEMR.

When formulating EE labeling program, it is needed to prepare criteria, interfacing opinions of various stakeholders, such as foreign and domestic manufactures, which are in different positions.

The following structure is recommended to be realized.

a) Getting the participation of as much as manufacturers with not so high criteria at the beginning

b) Formulating the system which the market can change for promoting EE&C and making more highly-efficient products

It is indispensable to up-date the labeling criteria periodically along with the advancement of technologies. Labeling criteria without periodical amendment spoils the promotion of EE&C.

GABEL and the member manufacturers played quite important roles for formulating the Draft Framework of EE labeling. They held several meetings and reported their unified draft idea on the labeling program including measurement method and labeling criteria. And their draft became the main contents of the framework. MEMR and MOI should prepare the organizational structure, where GABEL and manufacturers can play a leading role for labeling.

(2) Laboratories

Many people in the government, laboratories, accreditation bodies, and manufacturers recognize that so many laboratories, which can conduct tests of electric and electronic appliances, are available under the government and ministries, and the roles of them are not well coordinated. In Thailand and Malaysia, many laboratories existed in the past, but have already consolidated each other and finally become a comprehensive laboratory for electric and electronic appliances with the latest testing facilities. Formulating labeling program is a good chance to discuss about the re-organization of the laboratories.

The Study Team and Japanese experts assessed the capacity of governmental testing laboratories. And referring the international collaboration and movement for standardizing of measurement method, it was pointed that there exist a lot of hurdles for LIPI, B4T, and BPPT to be cleared to tune with the international direction. (Refer Section 2.4.8)

On the other hand, the governmental laboratories, the private laboratories can be the accredited third party laboratories. Private third party laboratories have roles of data verification in Singapore and Thailand. Some worldwide laboratories such as Intertek and TUV are watching Indonesia as a new market of their business.

(3) GABEL and Manufacturers

Regarding the manufacturers, it is strongly expected that they will participate the Technical Meeting continuously for formulating a healthy labeling program. In case of some conflict among the manufacturers or between the government and manufacturers, GABEL should play a coordinating role from the viewpoint of protecting and developing the appliance industry.

(4) Accreditation and Standardization Body (KAN/BSN)

Role of the authority on the labeling program is to accredit laboratories such as third parties private laboratories, governmental laboratories, and manufacturer’s laboratories. The laboratories include the ones, which are located in foreign countries. Therefore the authority should deal with the accreditation, which is issued in other countries considering about the mutual recognition agreement (hereinafter to as “MRA”). Accreditation criteria are shown in the Frameworks. The authority should prepare the detail procedure and pricing for the actual accreditation.

On the other hand, EE measurement methods are quoted from SNI and/or ISO/IEC. Renewal of SNI linking to ISO/IEC should be timely implemented by the authority considering international or regional movement of revision on some appliances, such as ACs and refrigerators. Also amendment of the standard for EE measurement should be followed according to the movement on the international standard and/or the manufacturer’s request

(5) Retailer Shops and Consumer Associations

Retail shops and consumer associations are not included in the Technical Meeting member. Public comments from these stakeholders should be necessarily collected before implementing the program. The design, size, and display method of EE label are also important to appeal the consumers. Current design of the label has much white space and star mark is relatively small. And four star rating is rare as compared with surrounding countries’. As a mid-term issue, the amendment of design and display should be considered.

3.5 Establishment of Incentive Scheme to Disseminate Highly-efficient Appliances

Indonesia provides the subsidy to electricity and the electricity tariff is kept low. This reduces 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 increase and this is in a vicious circle. (See Figure 3.5-1)

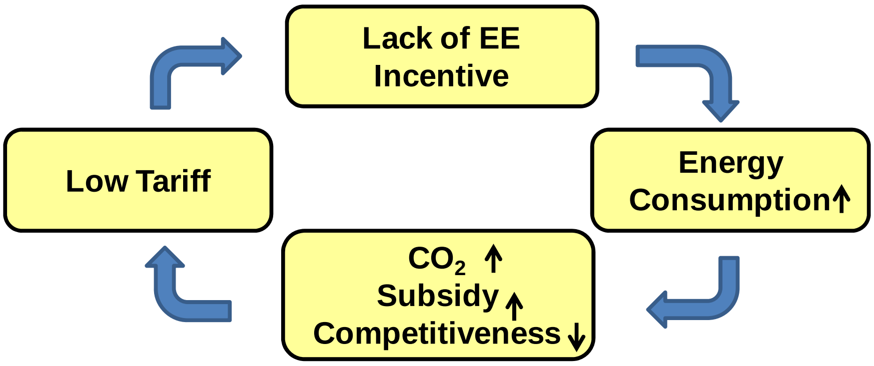


Figure 3.5-1 Vicious Circle due to Electricity Subsidy

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 in the country and this leads to the reduction of CO_2 emission and electricity subsidy ultimately. Therefore, the incentive provision for EE&C together with increase of electricity tariff is effective in Indonesia to get out of the current vicious circle. (See Figure 3.5-2)

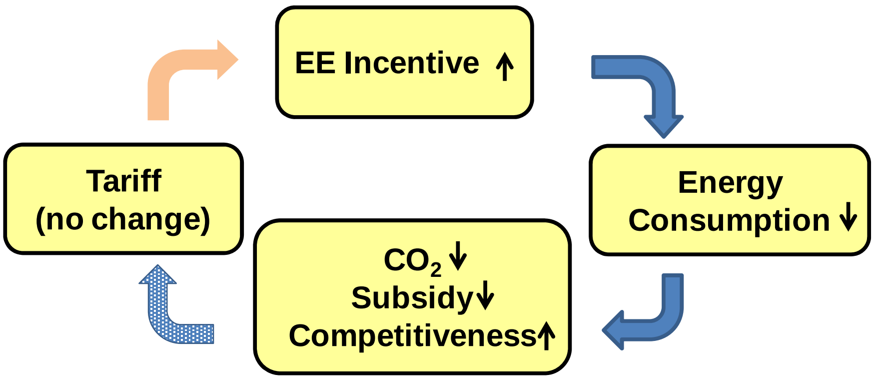


Figure 3.5-2 Exit from Vicious Circle by Incentive Provision for EE&C

As the incentive program for promoting EE&C, the following 2 schemes are proposed.

a) Incentive scheme to promote highly-efficient appliances, which is operated in accordance with EE labeling program

b) Low interest loan on investment for EE&C in commercial and industrial sectors

3.5.1 Incentive Scheme to Promote Highly-efficient Appliances

(1) Interest Reduction Scheme for Credit Card

In this scheme, the interest rate for the credit card payment is reduced when the consumers purchase highly-efficient appliances (such as ACs, refrigerators, and TVs with certain stars of EE label). In general, the interest rate for the credit card payment with installment is 1.5-3.0%/month (approximately 20-40%/year) and reduction of this interest rate could be the strong incentive for the price-conscious consumers. In fact, the marketing with 0% interest rate is also conducted as the manufacturer's sales promotion. The incentive in this scheme comes from the lower interests than the commercial interests and it requires the capital with low interest to financial institutions (hereinafter to as "FI"). Therefore, use of ODA loan can be the option if Indonesian government adopts this scheme. (See Figure 3.5.1-1)

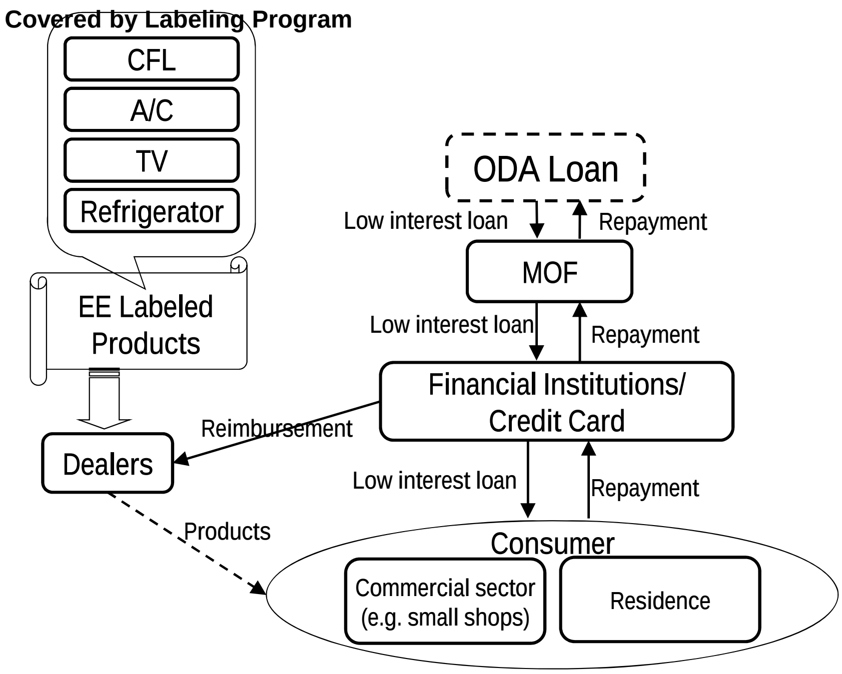
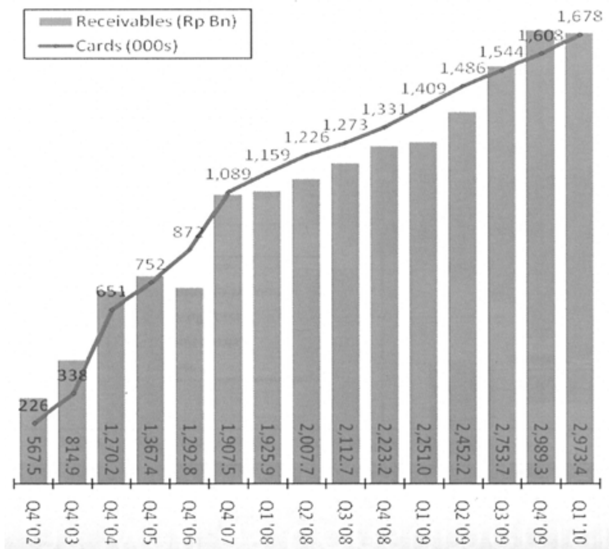


Figure 3.5.1-1 Interest Reduction Scheme for Credit Card

According to the hearing from the FIs and PLN, the use of the installment payment through credit cards in Indonesia is increasing. Though the data below is not limited to the appliances, Figure 3.5.1-2 illustrates the rapid penetration of credit cards in the country.



Source: PT Bank Mandiri (Persero) Tbk Q1 2010, Result Presentation

Figure 3.5.1-2 Trend of Mandiri Visa and MasterCard (Number of Cards and Amount)

According to the report[4] by JETRO, the settlement by credit card in Indonesia in 2010 is 161.38 trillion Rp in terms of the amount (28 % increase from the previous year) and 1,964.1 billion by the number of transactions (16% increase from the previous year) and the number of card issuance is 1.34 million cards (10% increase from the previous year). In addition, according to Bank Indonesia, "the number of credit card issuance is 18% increasing annually in average for the last five years". However, according to the questionnaires and interviews with retail shops and consumers, the installment payment upon the purchase of electric appliances in Indonesia is 20% of the total purchase. In this case, the policy impact may be limited even if the incentive is provided for the installment payment using credit cards.

The potential intermediary FIs

As discussed above, provision of the incentive through credit card use is not necessarily effective now, considering the current consumer's purchase modality in Indonesia. However, the implementation of this scheme may be the option in future, as the purchase modality will change in future in Indonesia and credit case use with installment payment will increase. In this case, the potential intermediary FIs are as follows. (See Table 3.5.1-1)

[4] "Asia ni okeru retail kinyuu chosa"(Study about retail finance in Asia) (JETRO oversea study department , March 2011) http://www.jetro.go.jp/jfile/report/07000671/retail_financial_market.pdf

Table 3.5.1-1 Potential Intermediary FIs

Financial Institution (FI)	Situation
Eximbank	Category: 100% state-owned FI for export promotion Experience of Consumer finance: N/A Others ➢ Either directly or indirectly, a project needs to contribute to export promotion. According to the bank, it is possible for the bank to involve in a project targeted at the electrical appliances, if it could be explained that the project is part of the national policy and can lead to nurture Indonesian domestic enterprises and ultimately to export industry. ➢ The on-lending to commercial banks is possible, but the negotiation to keep the interest low is not easy.
Bank Mandiri	Category: FI owned more than half by the state. (66.76% as of 31 Mar 2010) Experience of Consumer finance: Applicable (Issuing credit cards)
BNI	Category: FI owned more than half by the state. (76.36% as of 31 December 2009) Experience of Consumer finance: Applicable (Issuing credit cards)
BRI	Category: FI owned more than half by the state. (56.77% as of 31 December 2009) Experience of Consumer finance: Applicable (Issuing credit cards)
PNM (Permodalan Nasional Madani)	Category: 100 % state-owned FI Experience of Consumer finance: None Mainly the loans for small and medium enterprises (microfinance)
Bank DKI	Category: FI 99.83% owned by Jakarta provincial government Experience of Consumer finance: Applicable (Not issuing credit card, but providing housing loans and auto loans) However, this bank is limited to Jakarta and if the nation-wide coverage is needed, it is not suitable.

According to State Finance Law (UU17/2003), the institutions, to which MOF can on-lend ODA money are limited to the state-owned banks. Considering the establishment law of the institutions above, three banks, Bank Mandiri, BNI and BRI among the state FIs above, can be the intermediary FIs, since they are allowed to be involved in consumer finance and issuing credit cards. As for PIP in MOF, which is one of the candidates to manage ODA loan for EE&C, consumer finance is not allowed under PIP's establishment law

(2) VAT Reduction Scheme

In this scheme, Value-added Tax (hereinafter to as "VAT) will be reduced when consumers purchase highly-efficient appliances (such as ACs, refrigerators, and TVs with certain stars of EE label and highly-efficient air-conditioner in buildings). (See Figure 3.5.1-3)

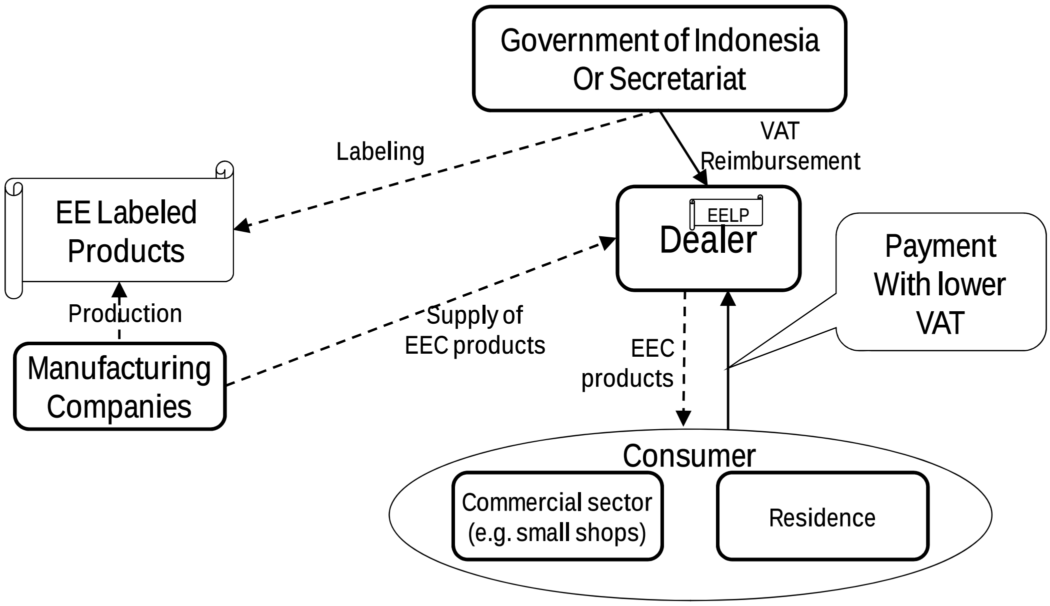


Figure 3.5.1-3 VAT Reduction Scheme

In Indonesia, consumers are obliged to pay 10% of the product price as VAT when it purchases the appliances. The scheme to reduce/exempt VAT is introduced in U.K. (the eligible equipment is boilers etc.) and under consideration in India etc. Through this scheme, the state revenue will be decreased temporarily; however there is a possibility of net positive impact on Indonesian national finance, when the decrease in state revenue is smaller than the reduction amount of subsidy paid to PLN to maintain the current electricity tariff. In Indonesia, the budget to exempt VAT was allocated in order to promote the replacement of LP gas equipment in July 2010, and the effect to lead the policy through tax is recognized in the country. (This VAT exemption for LP gas has not yet implemented.)

The transaction cost in this scheme is relatively small compared with the other schemes discussed before and the feasibility is higher. However, according to the interviews during this study, there are small shops, which are exempted to pay VAT by law and the preventive measures against the misuse of the scheme are essential, since there are concerns to misuse the scheme. Furthermore, according to the announcement by MOF, out of domestic companies (22.6 million companies), the companies which have tax identification number are approximately 6.7% and the taxpaying companies are 2.1% (466,000 companies) only[5]. Therefore, to ensure effectiveness of the scheme is not easy, when the incentive is implemented through VAT reimbursement.

(3) Rebate Scheme

By duplicating the rebate program, such as Eco-point Program in Japan, in New Mexico in USA, and “the save program” in Malaysia, partial cost is subsidized in this scheme, when consumers buy highly-efficient appliances with EE label satisfying the certain level. Generally speaking, highly-efficient appliances tend to be more expensive than standard ones, but through this program, the burden on consumers can be mitigated. According to the interviews with the

[5] JETRO “Nikkan Tsusho Koho” 29 Aug 2011 News from Jakarta

manufacturers, the consumers in Indonesia have higher sensitivity for the discount upon the purchase than the interest rate reduction for the installment payment. Therefore, it is presumed that the impact on the consumer's behavior is higher in case of the reduction of purchase price using rebate program than interest rate reduction for credit cards. In the meanwhile, the subsidy will increase, however the reduction of the subsidy to PLN can be expected by reducing the electricity demand through dissemination of highly-efficient appliances. As the rebate programs, the various schemes could be designed, and from the other countries' experience, most appropriate three schemes are described in Table. 3.5.1-2 and Figure 3.5.1-4, -5, and - 6.

Table 3.5.1-2 Rebate Schemes for Highly-efficient Appliances

	Scheme 1	**Scheme 2**	**Scheme 3**
Scheme	Consumers will apply for the reimbursement (rebate) to the government or the secretariat outsourced by the government, after they purchase highly-efficient appliances. The rebate can be the cash voucher or exchange with the products.	The reliable shops are registered and these shops will discount the sale prices on behalf of the government only when the consumers purchase the highly-efficient appliances at these registered shops. The discount amount will be reimbursed by the government later.	The manufacturers discount the sales price when they ship out the products to the shops and the government will reimburse this discount amount later.
Advantage	The consumers can actually feel that they participate in the program for EE&C.	Like “Scheme 3”, the number of shops is much smaller than the ones of the consumers; therefore, it is less administrative workload compared with processing the applications from all consumers.	Since the number of the manufacturers is much smaller than the ones of the consumers and shops, the government’s administrative workload is much smaller in this scheme compared with the other schemes. In addition, since the negative impact on the brand image and business will be large in case of the manufacturer’s misuse of the incentive scheme, the manufacturers will be less inclined to misuse the incentive scheme.
Disadvantage and Risks	For this scheme, the enormous administrative workload will be necessary to process the applications from the consumers. Therefore, the transaction costs will be higher and the hurdle for the feasibility is also higher compared with VAT reduction scheme, despite that the same economic effect on the consumers can be expected from VAT reduction scheme as well.	In order to avoid misuse of the incentive scheme, we have to count on the moral of the shops and the costs for the monitoring will be high.	In case of the products of which the price is fast to fall, there are the cases that the stocks of the old models are discounted as the new models come in the market. In case that the price is discounted when a product is shipped out from a manufacturer, the price of the discounted products from the stocks may be lower than the price under the incentive scheme. As a result, there is the concern that the effects of the incentive scheme are lost.

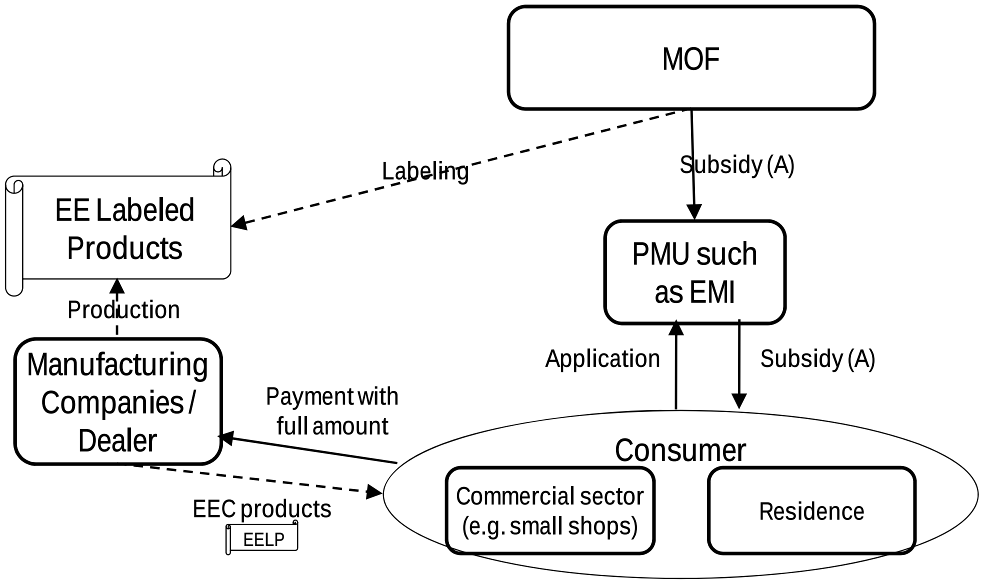


Figure 3.5.1-4　Rebate Scheme for Highly-efficient Appliances 1

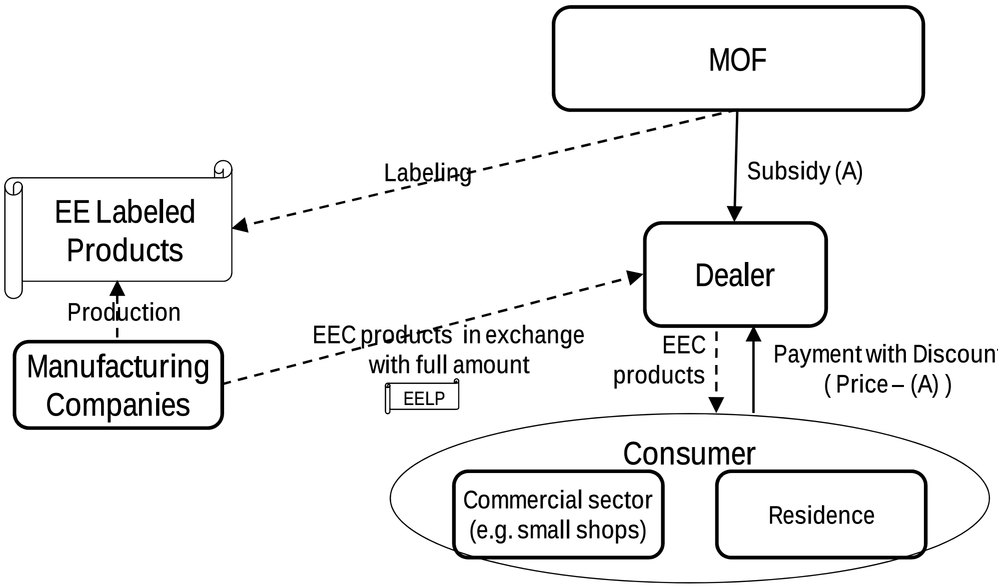


Figure 3.5.1-5　Rebate Scheme for Highly-efficient Appliances 2

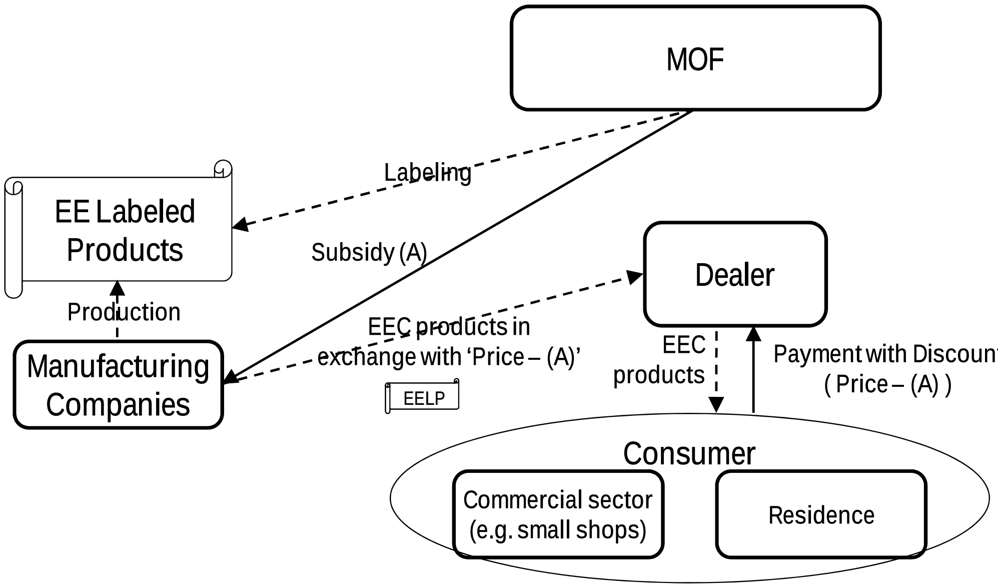


Figure 3.5.1-6 Rebate Scheme for Highly-efficient Appliances 3

In the incentive scheme of VAT reimbursement, the transaction cost is relatively low and more effective policy effect can be expected. However, considering the current situation of the tax collection in Indonesia as discussed earlier, more effectiveness can be expected from the rebate program. But to implement this program, the mechanism to avoid misuse in the shops is needed such as the reliable shops are registered and the incentive schemes are implemented through these registered shops. As described earlier in Section 2.6.1 (7), this scheme is adopted in Malaysia. Therefore, to design this mechanism, the experience of Malaysia can be the good example to be used.

Indonesian government is working hard to address the issue of taxpaying ratio mentioned above and this issue may be improved over the time. Therefore, it is desirable for either of VAT reduction scheme or rebate scheme to be selected considering the situation of taxpaying ratio, when the incentive scheme will be implemented in the future.

3.5.2 Low Interest Loan on Investment for EE&C in Commercial and Industrial Sectors

As incentive schemes to promote EE&C in commercial and industrial sectors, low interest loan on investment, for using ODA fund, are proposed.

(1) Low Interest Loan Scheme

In order to promote EE&C in Indonesia, to provide the incentive not only to appliances but also to commercial and industrial sectors is to be highly effective. As the incentives to the commercial and industrial sectors, the low interest loan, subsidy, tax incentive, and credit guarantee can be options. Considering the impact on the country's fiscal position and easiness to implement the policy and possibility for ODA fund use, the low interest loan is the most feasible and relatively small burden on the country's fiscal position.

However, the technical appraisal for EE&C project is a challenge in Indonesia where the EE&C investment is limited in the commercial and industrial sectors. In this case, the listing approach applied in Japan, India, and Vietnam can be considered effective. In the listing approach, machinery, equipment, and materiel used for EE&C improvement renovation are identified in the list and banks appraise EE&C loan using the list from the technical aspect.

(2) Potential Intermediary Institutions

Like the scheme to reduce the interest for credit cards, in order to explore the possibility to mobilize ODA loans through this scheme, it is necessary to identify the potential first-step institutions, which could be the recipient of ODA loans. The potential institutions are as follows. (See Table 3.5.2-1)

Table 3.5.2-1 Potential Intermediary Institutions

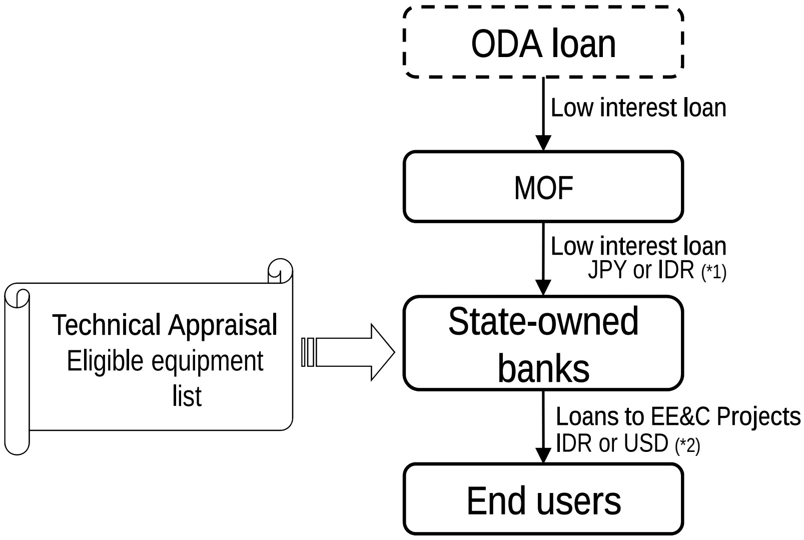
Institution	Situation
PIP	Category: Part of MOF Experience of the loans for commercial and industrial sectors: Yes Interest : Yes Others ➢ Loan and equity investment are possible. ➢ Capacity for appraisal and project formulation is unknown.
PNM (Permodalan Nasional Madani)	Category: 100% State-owned FI Experience of the loans for commercial and industrial sectors: Mainly loans for micro and small enterprises including working capital The targeted company is micro and small enterprises which tend to be low energy consumption industry.
Eximbank	Category: 100%: State-owned FI for export promotion Experience of the loans for commercial and industrial sectors: Yes Interest: Yes Others ➢ Either directly or indirectly, a project needs to contribute to export promotion. (For example, not only export companies, but also the supporting industries such as the power generation project in the export-oriented industrial park) ➢ Functioning as an apex bank in the two or three step loan provided by KfW (Industry Energy Pollution Control) ➢ The flexibility in the scheme to allow Eximbank to extend the loan directly to the end users is preferred, since the negotiation over the on-lending interest rate to the commercial banks is not easy according to the bank’s experience. ➢ TA such as use of consultants is necessary for EE&C project formulation. ➢ If the adopted scheme utilize ODA loans and this bank bears the exchange rate risk, whether the bank can provide the low interest loan to the companies or not depends on the rate provided by the currency swap market. ➢ ADB extended the loan for EE&C on non-sovereign basis.
Bank Mandiri	Category: FI owned more than half by the state. (66.76% as of 31 Mar 2010) Experience of the loans for commercial and industrial sector: Applicable Interest: Yes Others ➢ AFD extended the loan for renewable energy. (Non-sovereign basis) ➢ The technical assistance (e.g. to use consultants) will be necessary to formulate EE&C projects. ➢ If the adopted scheme utilize ODA loans and this bank bears the exchange rate risk, whether the bank can provide the low interest loan to the companies or not

Institution	Situation
	depends on the rate provided by the currency swap market. ➢ Total asset is the largest in Indonesia and the credit amount is the 2nd largest[6]. ➢ The bank willingly participates in the meetings for the low interest loan scheme led by the government.
BNI	Category: FI owned more than half by the state. (76.36% as of 31 December 2009) Experience of the loans for commercial/ industrial sector: Applicable Interest: Yes Others ➢ KfW is providing the two or three step loan for pollution control (Industry Energy Pollution control) and the bank is functioning as apex bank. The next project is also under consideration. ➢ The technical assistance (e.g. to use consultants) will be necessary to formulate EE&C projects. ➢ If the adopted scheme utilize ODA loans and this bank bears the exchange rate risk, whether the bank can provide the low interest loan to the companies or not depends on the rate provided by the currency swap market. ➢ The bank declares itself as green bank and puts efforts on environment field. Total asset and the credit amount are the 4th largest in Indonesia (Among the state-owned banks, the 3rd in both total asset and credit amount)[6].
BRI	Category: FI owned more than half by the state. (56.77% as of 31 December 2009) Experience of the loans for commercial/industrial sector: Applicable Interest: Yes (However, waiting for the reply from the department in charge of the two step loans) Others: ➢ There was experience for two-step loans for export oriented agriculture. ➢ If the adopted scheme utilize ODA loans and this bank bears the exchange rate risk, whether the bank can provide the low interest loan to the companies or not depends on the rate provided by the currency swap market. ➢ 60-70% of borrowers are agriculture related. ➢ Total asset is the 2nd largest in Indonesia and the largest in credit amount[6].
Bank DKI	Category: FI 99.83% owned by Jakarta provincial government Experience of the loans for commercial and industrial sector: Applicable Interest: Yes Others: ➢ Regional development bank targeted at Jakarta. Able to on-lend to regional development banks in other provinces. ➢ If the adopted scheme utilize ODA loans and this bank bears the exchange rate risk, whether the bank can provide the low interest loan to the companies or not depends on the rate provided by the currency swap market. ➢ Many of loans are for light manufacturing industry.

Note: “Interest”: It is based on the interview and not the official opinion obtained in writing from each institution.

Among the institutions mentioned above, Bank Mandiri and BNI have relatively high market share in loans to the companies who have high possibilities for EE&C investment. The scheme in this case is illustrated in Figure 3.5.2-1.

[6] Source: Indonesian Banking Statistics (Oct 2010)



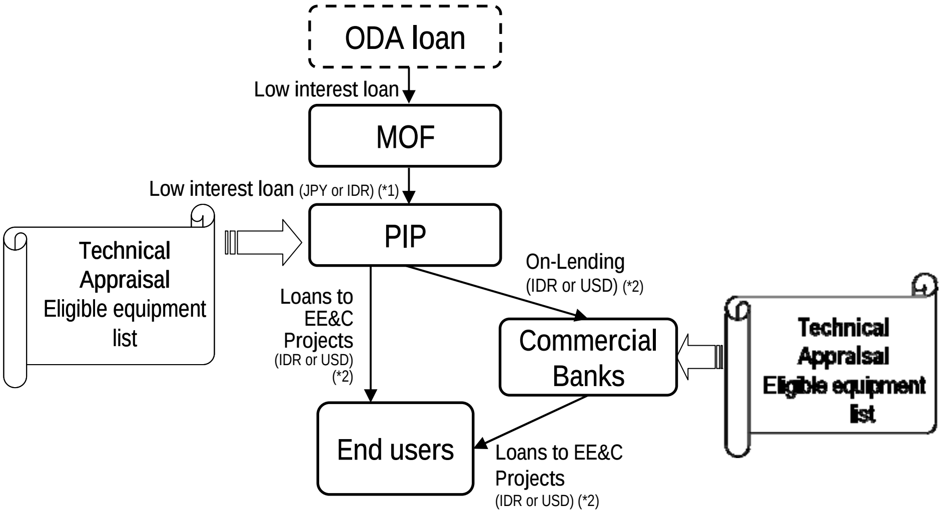
*1: This currency options are based on MOF Regulation No. 259/KMK.017./1993, which is under revision. (JPY is in case of JICA loan.)

*2: These currency options are up to the decision by State-owned banks. IDR and USD are mentioned as an example in the chart, since they are the two major lending currencies from state-owned banks to the companies according to the interviews.

Figure 3.5.2-1 Low Interest Loan Scheme for EE&C Investment in Commercial and Industrial Sectors: Through the State-owned Banks

However, the funding cost for State Owned Bank (hereinafter to as "SOB") may be higher than its usual funding cost depending on the rates in the currency swap market, in case that this scheme utilizes ODA loan and SOB bears the exchange rate risk. In this case, there is a possibility that SOB cannot provide low interest as incentive to the companies and the scheme utilizing PIP can be the option as illustrated in Figure 3.5.2-2.

According to the interview with PIP, PIP does not have experiences to involve in the foreign currency related transaction. Nevertheless, it is one of the departments in MOF. Therefore, if the importance of EE&C's promotion is recognized by MOF (ultimately the impact on the electricity subsidy reduction) and the approval from MOF can be obtained, PIP has the possibility to bear the exchange rate risk and provide low interest rate as incentive to companies and commercial banks (ultimately to the clients of these banks).



*1: This currency options are based on the assumption that the money transfer from MOF to PIP using ODA loan can follow the conditions described in MOF Regulation No. 259/KMK.017./1993 which is under revision. (JPY is in case of JICA loan.)

*2: These currency options and maximum repayment period are up to the decision by PIP and commercial banks. IDR and USD are mentioned as an example in the chart, since they are the two major lending currencies used in Indonesia from the banks to companies according to the interviews.

Figure 3.5.2-2 Low Interest Loan Scheme for EE&C Investment in Commercial and Industrial Sectors: Through PIP

3.5.3 Roadmap and Action Plan

(1) Roadmap and Action Plan

In order to promote EE&C in Indonesia, the incentive to control electricity consumption is limited, since the electricity tariff is kept low. In this regard, while the increase of electricity tariff is sought, to provide the incentive using the other policy will be desirable to complement this process. However, the budget, which can be allocated to EE&C is not inexhaustible; therefore, it is realistic to promote EE&C by providing the incentives over the long term plan, instead of providing the incentives in all segments of the country (i.e. residential, public and commercial/industrial) in the short period. For example, the incentive program in Thailand has been covering many segments in the country, but it has been implemented over 10 years.

The appliances discussed above are targeted mainly in the residential sector, but in terms of EE&C promotion, commercial, industrial, and public sectors need to be taken into consideration as well. In order to provide incentives for highly-efficient appliances and design its program, the national labeling program needs to be established first. In addition, the penetration rate of appliances, especially the energy consuming products, such as ACs and large refrigerators, is still relatively low at household level. However, the growth rate of the penetration is significant, thus the policy to address EE&C for this segment is necessary. In this regard, the Study Team recommends that the scheme to provide the incentive for appliances be agreed by the government for the residential sector and this sector be covered in mid-long term, while the incentive is provided first to commercial and industrial sectors in short term. Figure 3.5.3-1 and -2 show the roadmap and action plan to formulate the incentive programs promoting highly-efficient appliances.

Table 3.5.3-1 Roadmap to Introduce Incentive Program for Energy Efficiency

Item	2012	2013	2014	2015	2020	2025
Commercial /Industrial sector	Preparation of equipment list **Soft loan program based on the list** Fostering ESCOs		**Soft loan program based on energy audit**			
Electric Appliances	Establishment of labeling program Preparation of the incentive program		**Incentive program**			

Table 3.5.3-2 Action Plan to Introduce Incentive Program for Energy Efficiency (For Appliances in Residential Sector)

Item	Organization / Activity	Annual budget (USD)				
		2012	2013	2014	2015	2016～
Establishment of the scheme (Department in charge of deciding the policy)	➢ Meetings for consensus formation (Eligibility of electrical appliances for incentives, the scheme to provide incentive and the incentive amount)	0	6,000	0	0	0
	➢ Development and renewal of the website (Monitoring of misuse)	0	20,000	20,000	20,000	20,000
	➢ To register the participating shops	0	6,000	10,000	4,000	0
Awareness campaign	(Department in charge of deciding the policy) ➢ Explain the program to shops and consumers through posters, brochures, newspaper/magazine and TV advertisement.	0	900,000	900,000	900,000	450,000
Revision of the program	(Department in charge of deciding the policy) ➢ Confirmation of the penetration of the program and its impact Revision of the program along with the revision of the labeling scheme (Conduct meetings for this purpose)	0	3,000	3,000	3,000	9,000

(2) Issues to Be Considered to Design the Scheme

It is useful to apply the other countries' success cases, however reflecting the existing Indonesian financial condition, the implementation structure and timing should be clarified.

1) Eligible appliances for incentive

After the framework of labeling is agreed, the eligible appliances for incentive (number of energy stars) need to be decided to provide the incentives. In order to promote highly-efficient appliances, it is desirable to provide the incentives to the highest labeled appliances (like the case of Thailand). (In the current draft of the labeling framework, the highest is 4 stars.) However, if the population of the product with 4 stars is too small after the implementation of EE labeling program, there occurs a concern that the policy impact is small. In this case, the option to expand the target products for incentive from only 4 stars to 3 - 4 stars should be considered.

2) Discount amount of the appliances by incentive

The policy impact from the incentive provision is affected by the discount level of the appliances. The larger the price reduction becomes, the more the impact to affect consumer's behavior can be expected. On the other hand, this leads to the higher fiscal burden to provide the incentive (budget). In order to precisely forecast the incentive's impact on consumer behavior, the raw data is needed, such as the consumer's price sensitivity and the price difference between different labels. However, it was not possible to obtain these data in reality due to the lack of data . Therefore, the Study Team conducted interviews with manufacturers about the desirable incentive amount and the price difference between efficient appliances and standard appliances. (Malaysian government decided the ratio of incentive based on the interviews with manufacturers as well.)

The framework of labeling program has not been agreed yet by the government; therefore, in order to conduct the interviews about the price difference of the products, the Study Team assumed that for ACs and the refrigerators, the products with inverter are efficient and for TVs, the products with LED backlight are efficient ones.

According to the interviews, the price difference between efficient equipment and the others is 20-50% for ACs and refrigerators and 20-30% for TVs. In addition, the price sensitivity of consumers in Indonesia tends to be high. Therefore, there is the following tendency: for 15% price difference, the cheaper one is chosen. On the other hand, in case of 10% price difference, it is hard to forecast the consumer's choice, and if it is 5%, the more expensive/ highly-efficient one is chosen. In order to fill the price gap between the efficient appliances and the others, 20%-50% of incentive amount is needed. However, it is not easy to reduce 50% of the price using the governmental financial budget. Therefore, the price difference is assumed at 20% first. In this case, if the prices of the efficient appliances are reduced by 20%, it is possible to affect the consumer's behavior even if the efficient appliances are more expensive by 20-25%. In addition, according to the interviews with retail shops, the consumers have the behaviors to consider not only the impact of investment, but also the impact on electricity bills when they purchase ACs. Therefore, the campaign about the expected electricity bill saving caused by the reduction of electricity consumption is effective in order to expand the incentive's impact, together with the direct price reduction through the incentive program.

The incentive program for electric appliances should be introduced after the completion of the frameworks of EE labeling. The Study Team recommends MEMR to decide the discount amount of the incentive program in future, through interviews with manufacturers based on the agreed framework, since the price difference between efficient appliances and the others may change over time.

3.5.4 Issues on Formulating Incentive Program

In this study, series of discussions were held with retail shops for appliances, manufacturers, and the government. In this process, to satisfy the following prerequisites is considered to be important for implementing incentive programs

First of all, the largest concern to implement the incentive program for appliances is misuse of the program and it is essential to ensure the mechanism to avoid misuse upon the program's formulation and operation. As reported in mass media, some consumers fraudulently receive the fuel subsidies in Indonesia and it becomes the social problem. In the incentive provision to individuals, such as for appliances (regardless of VAT reduction/exemption or rebates), the individual amount is small but the number is large, compared with the incentive such as the soft loan for companies in commercial and industrial sectors. Therefore, while the prevention measures for misuse is needed to be incorporated in the incentive program (e.g. an applicant is obliged to submit the product's serial number upon the application of the incentive), the meticulous care is necessary during the operation period; the sufficient staff is to be allocated to avoid fraudulently receiving the incentive, such as to check authenticity of this serial number and to levy fines in case of misuse.

As the incentive program for appliances, the incentive program by VAT reduction and exemption has the great advantage of low transaction cost, since it does not have money transfer from the government and is simpler in the scheme, compared with rebate program. However, as mentioned earlier, the tax collection rate remains low in Indonesia; therefore, viability of this scheme is questionable as of now. On the other hand, Indonesian government is actively taking the countermeasures to improve the tax collection rate, and the viability of the VAT reduction and exemption scheme will be increased as this countermeasures start to work effectively.

Furthermore, there is the concern in the government that the incentive program for appliances is the policy for rich. Therefore, the campaign is necessary to disseminate that this incentive program leads to EE&C, which in turn benefits the society as a whole.

Due to the issues discussed above, the government puts the priority to implement the incentive for EE&C in industrial and commercial sectors first as of now and the incentive program for appliances next. This direction is considered to be appropriate.

3.6 Dissemination, Awareness, and Others

3.6.1 Proposal of Effective EE&C Dissemination and Awareness

As described in Section 2.7.1, various activities for dissemination and awareness of EE&C have been carried out in Indonesia. However they are not directly reflected in consumers' activities for EE&C.

Based on the survey result on electricity usage pattern in Indonesia, the success case in Sri Lanka, and the electricity saving experience in Japan after March 11^{th} 2011, following three dissemination and awareness measures are proposed.

(1) 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)

(2) Implementation of EE&C award program for priority sectors

(3) Formulation of everybody's participating EE&C program by target setting and information dissemination with governmental leadership

The outline of each proposal above is described below.

(1) Implementation of EE&C Dissemination and Awareness Program Focusing on Power Leveling, Tariff System for EE&C, and Electricity Consuming Home Appliances (Synergy with Government important policy)

1) Instruction of EE&C usage for home appliances

Through this study, lightings, refrigerators, ACs, and TVs were confirmed of large electricity consumption. Therefore, at first, the dissemination and awareness program packaged with EE labeling program for these appliances is proposed. Concretely, the introduction of EE&C usage of these appliances, which contribute to reduce electricity bill and information dissemination through school education and MEMR web page are effective.

Although people understand the meaning of EE&C and have the desire to save electricity bill, useful information for consumers to act for EE&C is so limited. Practical measures to save energy and their impact for monthly bill should be informed. For example, changing the brightness and sharpness of TV screen, and pulling out the plug from the outlet to omit standby power, etc. By studying the adequate usage of appliances, EE&C will be recognized and implemented in daily life. An example of on-site instruction for EE&C is shown in Figure 3.6.1-1.

Figure 3.6.1-1 On-site Instruction for EE & C

2) EE&C dissemination and awareness activities for buildings

EE&C and water saving promotion for governmental buildings is instructed under National Energy Management of Presidential Regulation. Its expansion for private sectors is also planned. EE&C activities in cooperation with this on-going policy should be enforced.

In many governmental and commercial buildings in Jakarta, activities for EE&C have already started and the persons in charge of EE&C were appointed. However to improve the level for EE&C, higher-leveled EE&C activities should be implemented (not only the introduction of highly-efficient equipment) For higher-leveled EE&C implementation, formulating social and in-house system to implement and operate these activities is proposed.

a) Encouragement of group discussion/activities for EE&C
b) Program formulation to develop the skill of energy managers
c) Energy audit by experts
d) Formulation of middle-long term EE&C plan based on the energy audit

An example of group discussion for EE&C is shown in Figure3.6.1-2

Figure 3.6.1-2 Group Discussion for EE& C Promotion

3) Delivery of stickers for promoting EE&C activity

To promote EE&C and water saving under National Energy Management of Presidential Regulation, participation of general public is necessary. The activity of EE&C dissemination and awareness conducted by PLN has been understood by the participants as an Ad-hoc event. And it has not led to the continuous EE&C activities.

"Putting off the switch, if you don't need the electricity", and "Using water carefully, do not leave it out". To disseminate the basic attitude in daily life, some what visual notice and/or warning, such as "putting stickers on the wall in the offices", might be effective. They were delivered to the companies, for which on-site surveys and questionnaire surveys were conducted under the study. Figure 3.6.1-3 is an example of the delivered stickers.

Figure 3.6.1-3 Example of Stickers for Promoting EE & C and Water Saving

(2) Implementation of Award Program for Priority Sectors

Implementation of EE&C award program for priority sectors is recommended. The implementation cost of award programs is comparatively small and the award programs can lead and expand EE&C implementation in the same sectors.

In Sri Lanka, the first national EE&C award ceremony was held in August 2010 with participation of the President of Sri Lanka. Exhibitions and symposiums were held along with the ceremony.

SLEMA (Sri Lanka Energy Management Association) had implemented these events for a long time. And it became upgraded to national award for promoting EE&C and developing ESCO business. The targets of the award were limited into 5 fields, including Industrial facilities, government buildings, commercial buildings, hotels, and hospitals. The number of applications was more than 50. About 20 excellent projects were awarded in total (by sector and by building scale). Moreover, not only the award was conducted but also follow-up workshop was held several months later of the award. This program was planed to utilize the award as a starting event to disseminate EE&C in the target sectors.

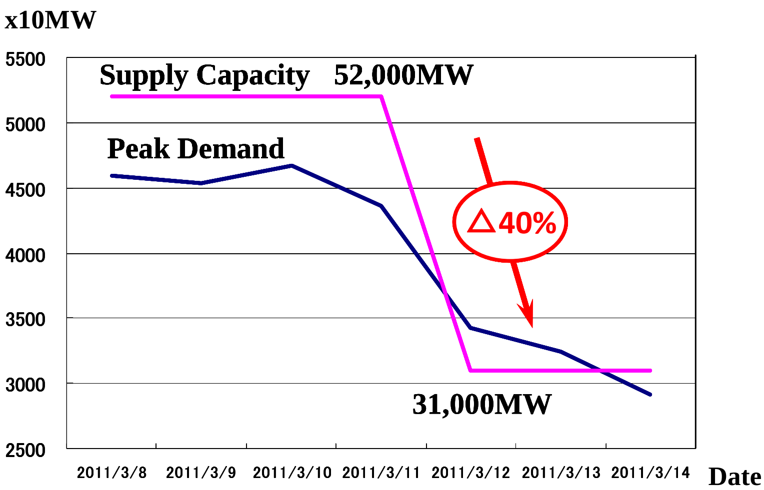
Taking into the cost effectiveness and spillover effect, implementation of integrated EE&C award customized in Indonesia is worth considering.

(3) Formulation of Everybody's Participating EE&C Program by Target Setting and Information Dissemination with Governmental Leadership

The earthquake and Tsunami of the Great East Japan Earthquake hit Japan directly on 11 March 2011. And due to the earth quake and devastating tsunami, approximately 40% of the total capacity of TEPCO power plant was shut down. The damage situation by Tsunami with the Great East Japan Earthquake and the depression of supply capacity in TEPCO are shown in Figure 3.6.1-4 and 5.

Source: The Atlantic

Figure 3.6.1-4 The Damage Situation by Tsunami with the Great East Japan Earthquake

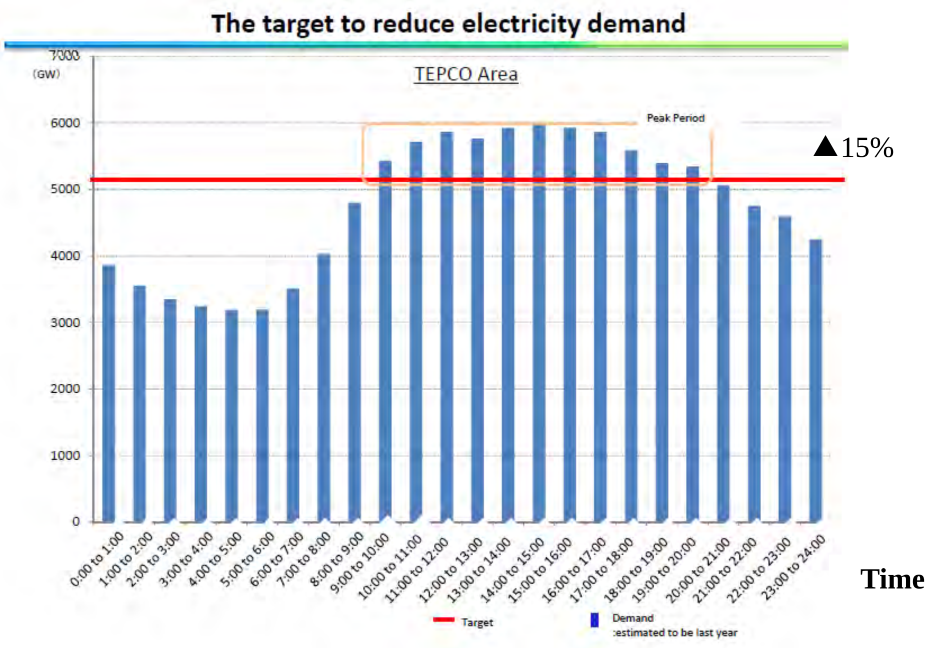


Source: METI web-site

Figure 3.6.1-5 Depression of Supply Capacity in TEPCO with the Great East Japan Earthquake

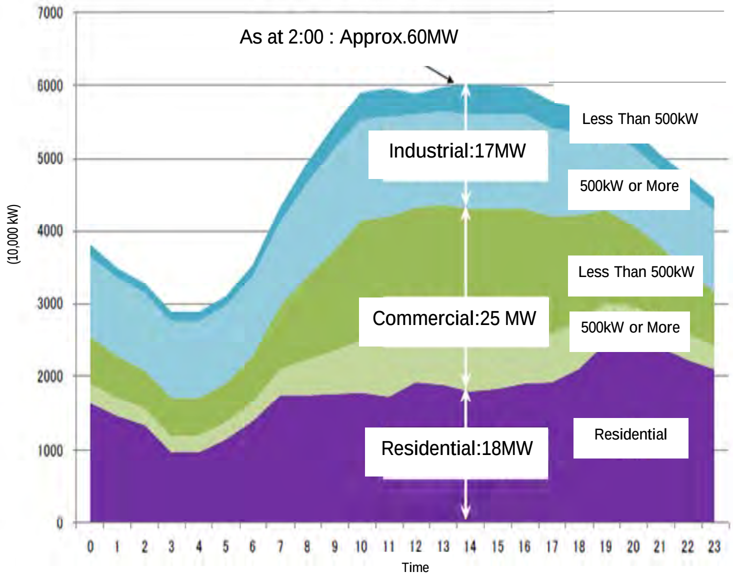
In order to reduce electricity demand to meet the supply capacity after 3.11, Japanese government set target (minus 15% compared with 2010) and asked for consumers' cooperation by disclosing the electricity consumption pattern by each consumer category.

Examples of disseminated information are shown in Figure3.5.1-6 to -9.



Source: METI Web Site

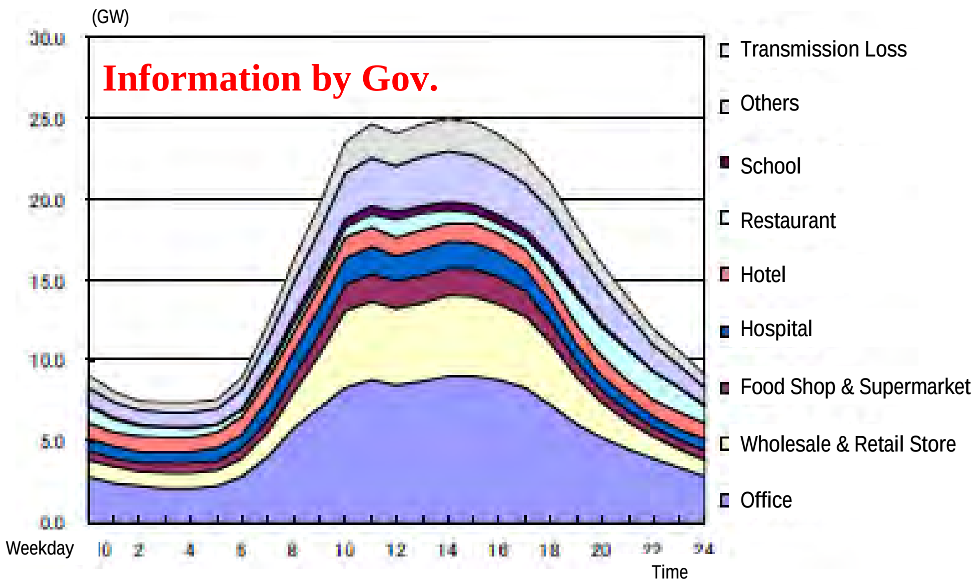
Figure 3.6.1-6 Government's Target of 15% Reduction of Electricity Demand in TEPCO Area



Remark ; Transmission loss 10% Is included.
2:00 means the average from 2 to 3

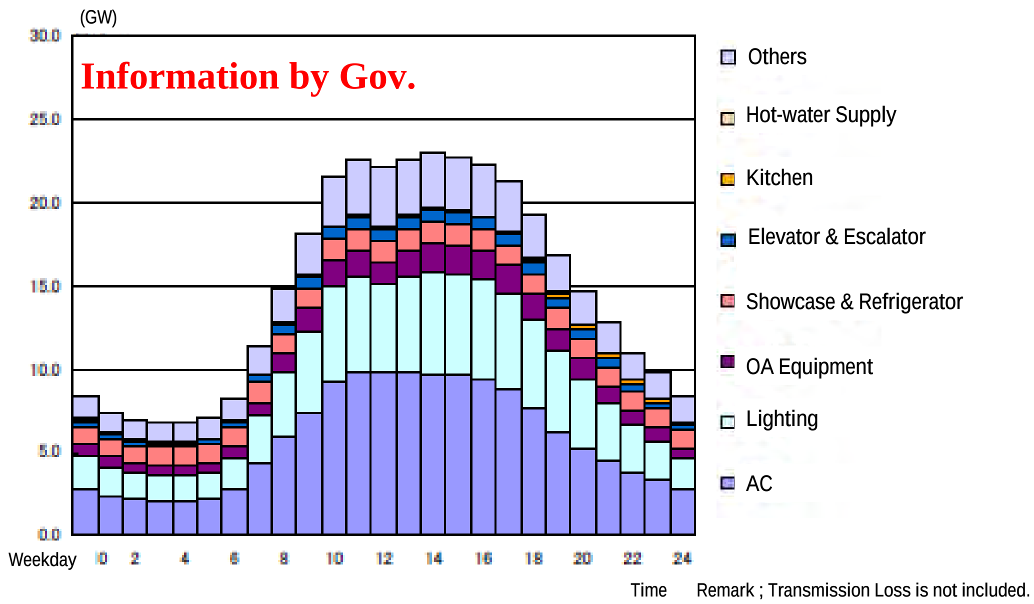
Source: METI Web site

Figure 3.6.1-7 Information of Electricity Consumption Pattern by Sector



Source: METI Web site

Figure 3.6.1-8 Information of Electricity Consumption Pattern by Building Use



Source: METI Web site

Figure 3.6.1-9 Information of Electricity Consumption Pattern by Final Use

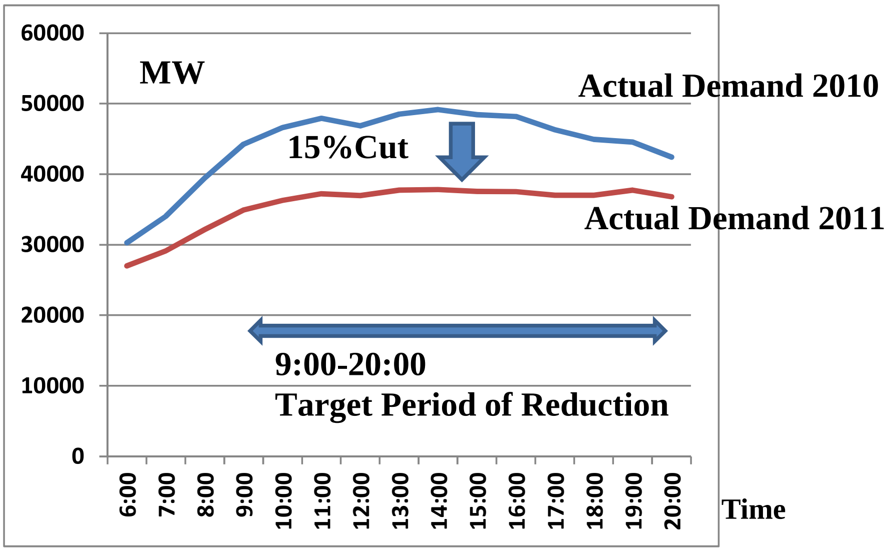
As a result, Japanese government was able to reduce the electricity demand by 15 %. (See Figure 3.6.1-10)

From Japanese experience, applicable key factors for effective EE&C promotion in Indonesia are;

a) Government Leadership to achieve EE&C,

b) Information provision for EE&C Implementation, and

c) Establishment of frame work for Everybody's Participation



Maximum temperature Year 2011 33.9 degree / Year 2010 31.0 degree

Source: TEPCO Home Page

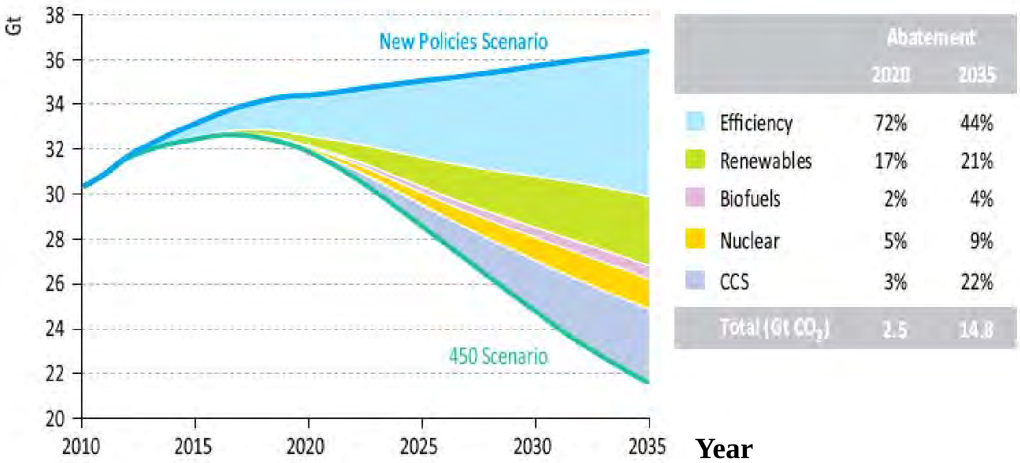
Figure 3.6.1-10 Transition of Electricity Consumption in TEPCO Area (on 2 July of Year 2010 and 2011)

3.6.2 Contribution of EE&C Technology for Reduction of CO_2 Emission

During the study term several specified seminars were held in Jakarta. In these seminars the following two issues were strongly focused.

(1) Contribution of EE&C Technology for Reduction of CO_2 Emission

The projection on the reduction of CO_2 emission by technology is shown in Figure 3.6.2-1, which was calculated by IEA. EE&C technology is the most effective method to reduce CO2 emission.



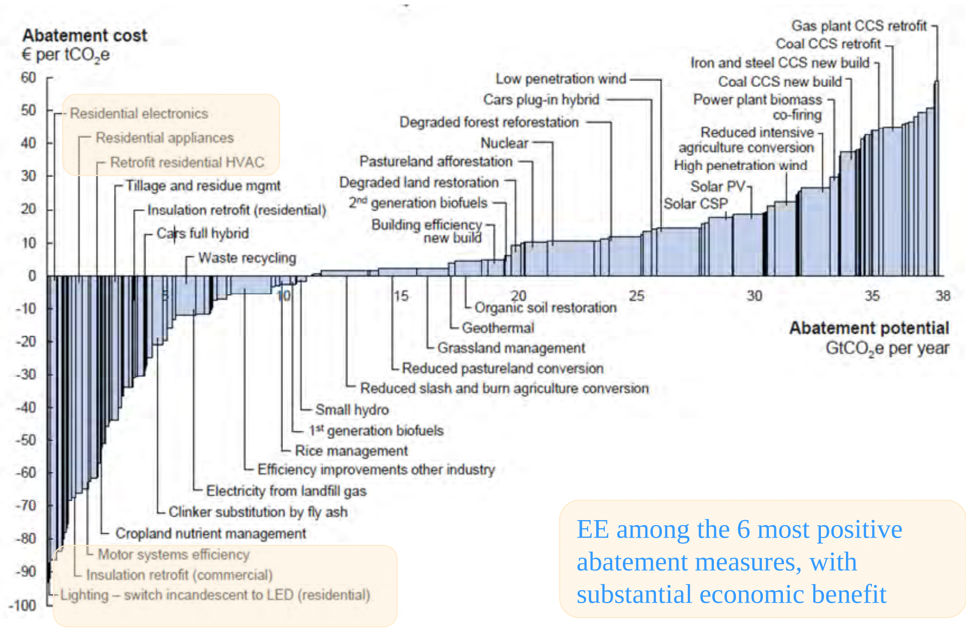
Source: IEA World Energy Outlook 2011

Figure 3.6.2-1 Reduction Potential of CO_2 Emission by Technology

(2) Economic Rationality of EE & C Technology to Reduce CO_2 Emission

CO_2 Abatement Cost Curve in the world is shown in Figure 3.6.2-2

Vertical axis shows the cost effectiveness by implementation of the technology (o or less means benefit). Horizontal axis shows the reduction potential of CO_2 emission. Economic rationality of EE&C technologies to reduce CO_2 emission is considered to be the highest among the listed technologies



Source: McKinsey, 2009

Figure 3.6.2-2 CO_2 Abatement Cost Curve in the World

Indonesian government set 26 % as the target for reduction of CO_2 emission by year 2020. In order to promote CO_2 emission reduction effectively, much more concern and effort for EE&C implementation is strongly recommended.

Chapter 4

Analysis and Evaluation of Economic and CO_2 Emission Reduction Effect

Chapter 4 Analysis and Evaluation of Economic and CO_2 Emission Reduction Effect

4.1 Structure and Outline of Chapter 4

The economic benefit, especially the reduction of subsidies to PLN, the construction cost reduction on new power plants, and CO_2 reduction in Indonesia are analyzed and evaluated, when the Indonesian government introduces the functional electricity tariff system and highly-efficient home appliances promotion programs, such as EE labeling program and incentive measures for financing, proposed in this study. The outline is described as follows and the detailed contents are explained in Section 4.2 and afterwards.

4.1.1 Analysis of Economic Effect

The estimated economic benefits for the functional tariff system (new TOU tariff system and new PF clause), which were proposed in Chapter3, 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 the 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. （See Section 4.2.1（4））

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 in the Jawa-Bali region)

（See Section 4.2.2 (2)）

4.1.2 Analysis of CO_2 Reduction Effect

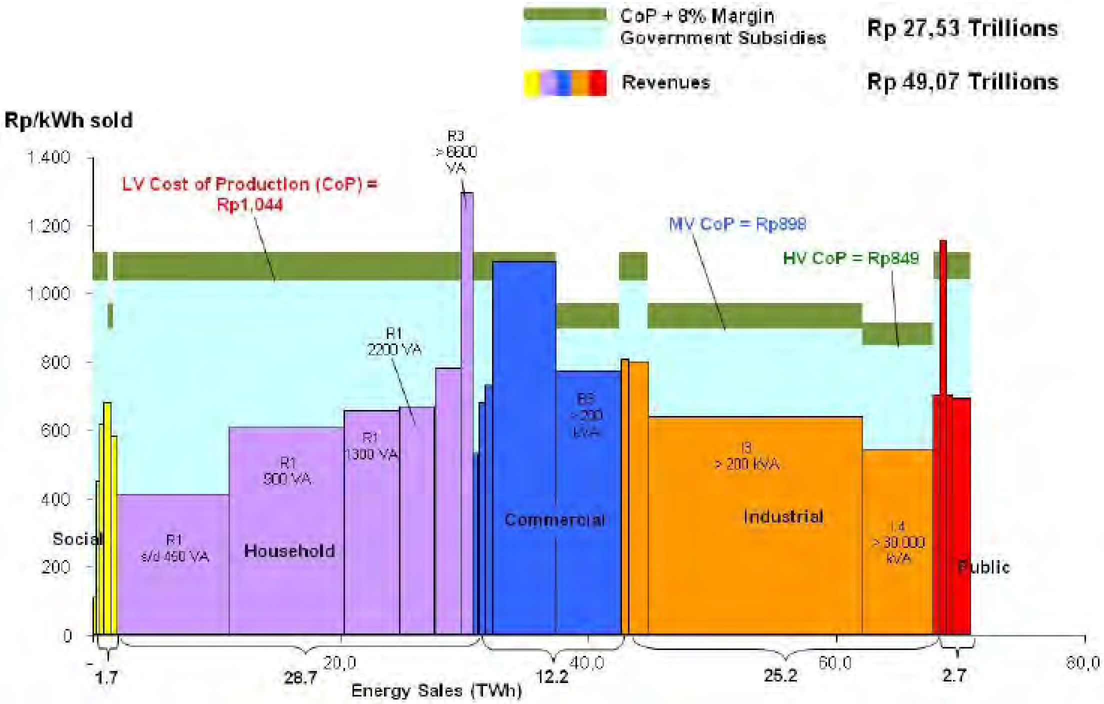
The estimated CO_2 emission reduction in 2025 is summarized as follows;

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

（See Section 4.3.3）

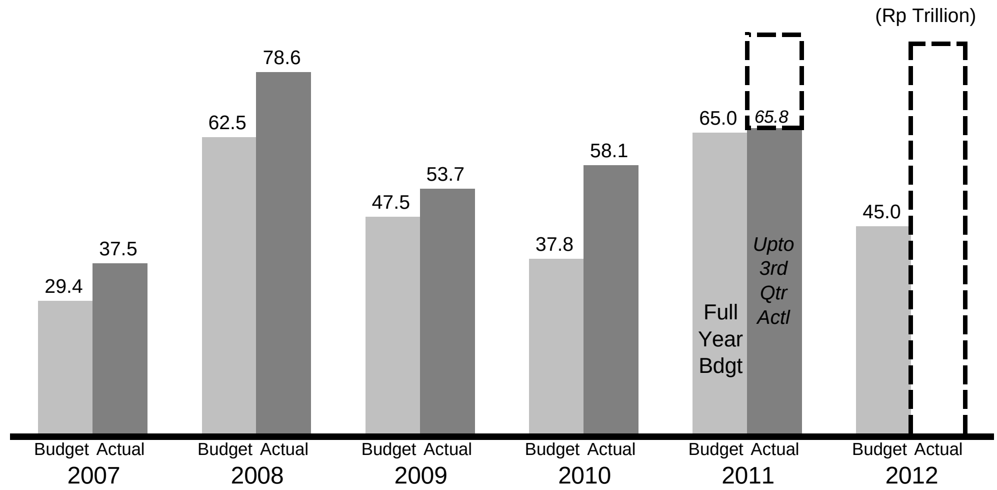
4.2 Analysis and Evaluation of Economic Effect

Indonesian government is obliged to continue to keep the low electricity price so that PLN constantly receives government subsidy to compensate the imbalance between their revenue and generating cost. (See Figure 4.2-1) The government subsidy received by PLN in 2008 reached as much as 78.6 Trillion Rp, and that of 2011 may reach the same amount. (See Figure 4.2-2) The functional electricity tariff and EE labeling program proposed in this study brings the reduction and peak-shift of electricity demand and decreasing risk for fuel price increase burden. It contributes the reduction of governmental subsidy to PLN.



Source: PLN 1st H Investor Update, light blue is subsidy

Figure 4.2-1 Breakdown of Governmental Subsidy for Electricity (as of First Half of 2010)



Source: presented by PLN on 24 November 2011 at Renewable Energy Conference, and MEMR

Figure 4.2-2 Trend of Governmental Subsidy for Electricity

4.2.1 The Functional Tariff System

(1) New TOU Tariff System

As described in Chapter 3, new TOU tariff system is to be applied for 5 consumer groups (B3, I2, I3, I4, R3, and B2) in the Java-Bali region and 24 hours/day are divided to 3 time zones, (day peak 08:00-18:00, evening peak 18:00-22:00, off peak 22:00-08:00). The influence on the revenue of PLN was estimated.

1) Conditions for calculation

The new TOU tariff system is preconditioned as follows;

Day peak tariff / Off peak tariff = 2.3 - 3.0
Evening peak tariff / Off peak tariff = 2.5 - 5.0
Off peak tariff: almost 50 % decrease to 2010 tariff
Total sales revenue increases by 0.2 % compared to 2010 tariff.

Since the new TOU tariff system serves as price increase of electricity charge on peak hours with discount price on off peak hours for target groups, it makes target groups adopt the countermeasures (peak shift and/or power saving) for making their electricity charge cheaper. The effect of a peak shift is estimated as the cost differential of fuel for the marginal power plant. However, it is not simple, taking into the actual net work conditions for transmission and reserved power plant capacity.

a) Electricity generation cost for the marginal power plant

Electricity generated by diesel power plants will decrease sharply as shown in Table 4.2.1-1 and Table 4.2.1-2. Accordingly, gas turbine power plants are set as the marginal plants, because their fuel cost is the most expensive except for that of diesel power plants. Economic benefit of this new TOU tariff system is calculated by the difference of fuel cost between gas turbine and combined cycle (1198－667＝531Rp/kWh) as shown in Table 4.2.1-3.

Table 4.2.1-1 Electricity Production by Type of Fuel for Jawa-Bali

(GWh)

No.	FUEL TYPE	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	HSD	10,333	5,098	4,475	3,672	3,442	3,310	3,189	3,116	3,242	3,446
2	MFO	784	518	361	358	383	396	379	403	378	378
3	GAS	40,574	35,821	43,188	51,850	51,275	50,941	52,010	51,961	57,514	57,479
4	LNG			5,266	5,365	5,441	5,508	5,585	10,727	13,456	13,482
5	Batubara	65,503	86,762	85,945	88,745	96,649	110,461	125,387	137,314	147,499	167,608
6	Hydro	5,273	5,273	5,262	5,087	5,469	5,528	5,763	5,889	5,893	5,985
	Pumped Storage	-	-	-	-	477	645	724	1,079	1,424	1,149
7	Geothermal	9,823	9,795	11,197	14,453	22,124	25,559	27,563	30,046	32,583	35,397
8	Nuklir	-	-	-	-	-	-	-	-	-	-
	TOTAL	132,290	143,267	155,695	169,533	185,234	202,336	220,616	240,512	262,015	284,924

Source: RUPTL 2010

Table 4.2.1-2 Fuel Requirements for Jawa-Bali Electricity Grid

No.	FUEL TYPE	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	HSD (x 10^3 kL)	2,931.1	1,424.9	1,345.4	1,007.7	909.7	843.3	800.2	799.3	852.0	970.0
2	MFO (x 10^3 kL)	226.1	149.1	103.7	103.5	102.7	110.0	113.8	108.8	115.7	108.5
3	GAS (bcf)	375.8	315.1	375.1	442.4	437.3	434.6	443.2	442.8	485.0	484.7
4	LNG (bcf)			41.0	41.8	42.3	42.8	43.4	82.4	103.1	103.3
5	Batubara (10^3 TON)	33,697.2	41,750.6	41,063.5	42,349.5	46,128.5	52,017.4	58,592.6	64,364.0	68,988.5	77,233.7

Source: RUPTL 2010

Table 4.2.1-3 Average Generation Cost in 2009

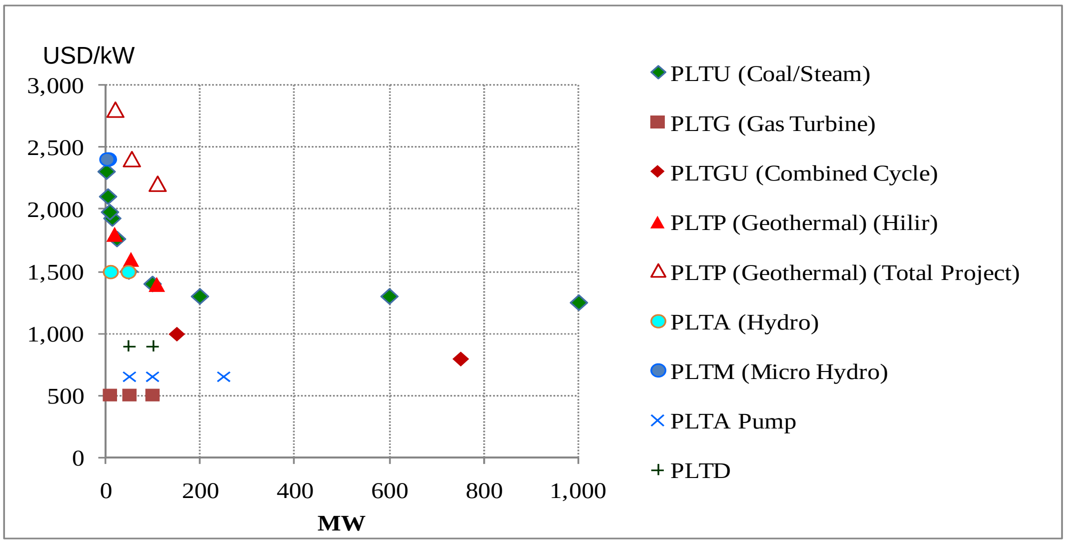
(Rp/kWh)

Generation Method	Fuel	Maintenance	Depreciation	Others	Labor	Total
Hydro	11.88	22.62	82.27	5.07	17.65	139.48
Steam	518.00	20.49	52.24	2.27	5.31	598.31
Diesel	2,324.89	213.56	85.28	11.16	61.63	2696.52
Gas Turbine	1,198.24	114.63	97.71	3.23	8.89	1,422.71
Geothermal	560.79	12.09	49.50	2.40	15.09	639.87
Combined Cycle	667.35	18.84	47.52	3.09	2.99	739.79
Average	660.52	36.49	58.24	3.30	9.23	767.79

Source: PLN Statistics 2009

b) Construction cost by fuel

An effect of capacity down for daily load curve is estimated as slow down effect for supply capacity development program, converted to reduction of investment cost by using PLTU (Coal/Steam) construction cost (USD 1,300/kW) as shown in Figure 4.2.1-1



Source: PLN Data May 2011

Figure 4.2.1-1 Power Plant Construction Cost

c) Theoretical maximum peak shift (GWh) and peak cut amount (MW)

The gap between the hourly peak and the average in daily load curve shown in Figure 4.2.1-2 makes the hourly maximum peak shift potential. Until 2015 it is estimated that the reduction potential of evening is the highest. Besides after 2015 it is estimated that the reduction potential of daytime peak and night time valley are increasing rapidly.

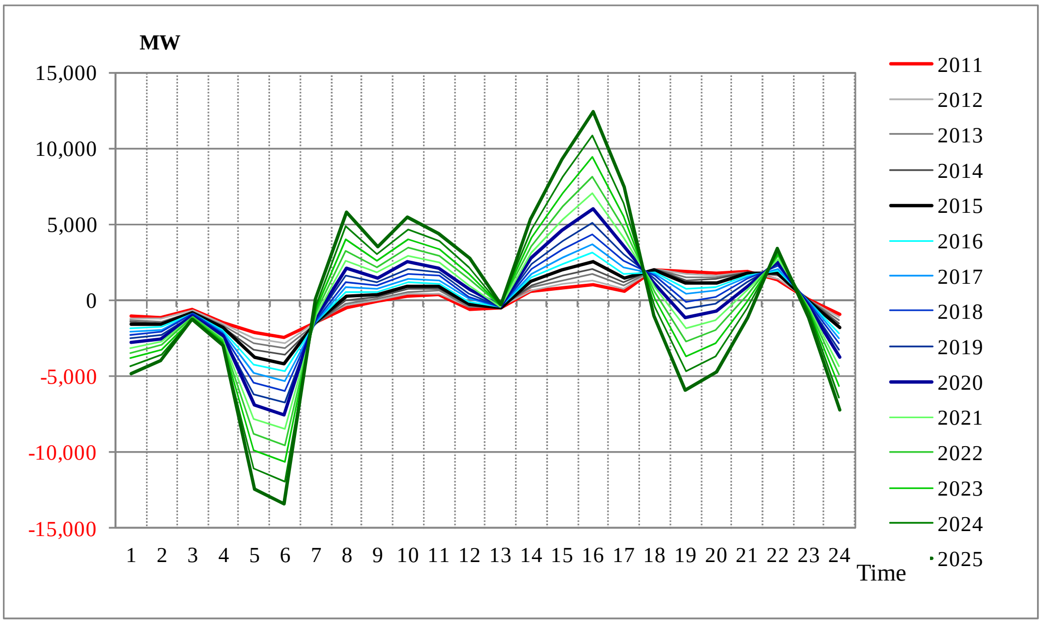


Figure 4.2.1-2 Theoretical Maximum Potential of Peak Shift by Hour (2011-2025)

Table 4.2.1-4 shows the maximum potential of daily peak shift, yearly peak shift, it's ratio for the total yearly consumption, and the difference between peak and average demand (MW). The peak shift potential is estimated to increase year by year.

Table 4.2.1-4 Theoretical Maximum Daily/Annual Peak Shift Potential (GWh) and Peak Cut Potential (MW)

	Daily Max Peakshift	Yearly Max Peakshift (A)	Total Yearly Consumption (B)	Peak Shift Ratio (A)/(B)	Difference between Peak Daily Peak and Average
	MW/day	GWh/year		%	MW
2011	12,650	4,617	125,199	3.69	2,063
2012	13,644	4,980	136,807	3.64	2,064
2013	14,776	5,393	149,618	3.60	2,052
2014	16,048	5,857	163,688	3.58	2,111
2015	17,648	6,442	179,053	3.60	2,575
2016	19,362	7,067	195,314	3.62	3,101
2017	21,328	7,785	213,021	3.65	3,703
2018	23,626	8,624	232,167	3.71	4,388
2019	26,790	9,778	252,548	3.87	5,159
2020	30,616	11,175	274,772	4.07	6,036
2021	34,910	12,742	298,952	4.26	7,030
2022	39,723	14,499	325,259	4.46	8,155
2023	45,204	16,499	353,882	4.66	9,427
2024	52,147	19,034	385,024	4.94	10,864
2025	60,083	21,930	418,906	5.24	12,485

d) New TOU meter

New TOU meter is necessary for the introduction of the new TOU tariff system. The unit cost for the meter is estimated to be 80USD from the information given by a major manufacturer of electric power meters (See Table 4.2.1-5)

Table 4.2.1-5 New TOU Meter

Category	Estimated Customer Number in 2025	Meter Cost (USD)
R3	148,670	8,920,200
B2, B3	822,728	49,363,680
I2, 3,4	31,202	1,872,120
Total	1,002,600	60,156,000

2) Expected benefit

The benefit was estimated for the following 3 cases.

Case 1 25 % of the maximum theoretical peak shift volume (GWh) is shifted from the peak time zone to the off peak time zone in 2025. (Gradually increasing until 2025)

Case 2 50 % of the maximum theoretical peak shift volume (GWh) is shifted from the peak time zone to the off peak time zone in 2025 (ditto).

Case 3 75 % of the maximum theoretical peak shift volume (GWh) is shifted from the peak time zone to the off peak time zone in 2025 (ditto)

Figure 4.2.1-3 and Table 4.2.1-6 shows the summary. The volume of peak shift in 2025 is estimated to be 3,290 - 9,896 GWh (0.6 -1.8% of total electricity sales in Indonesia). Capacity saving is estimated to 1,873 - 5,618MW (1.5 - 4.4% of total installed capacity in Indonesia). The cumulative economic benefit from 2013 to 2025 amounts to 22 - 58 trillion Rp, consisting of fuel cost reduction (0.1 - 7 Trillion Rp), and capacity saving (21 - 65 Trillion Rp). It shows, if the shift volume from the belt during a peak hour to an off-peak time zone becomes large, the merit by the difference of fuel cost is offset by the decrease in tariff revenue. In case 2 (50% shift) cumulative fuel cost margins become smaller than cumulative decrease in tariff revenue. On the other hand the slow down effect for the supply capacity development program is relative to the shifted volume.

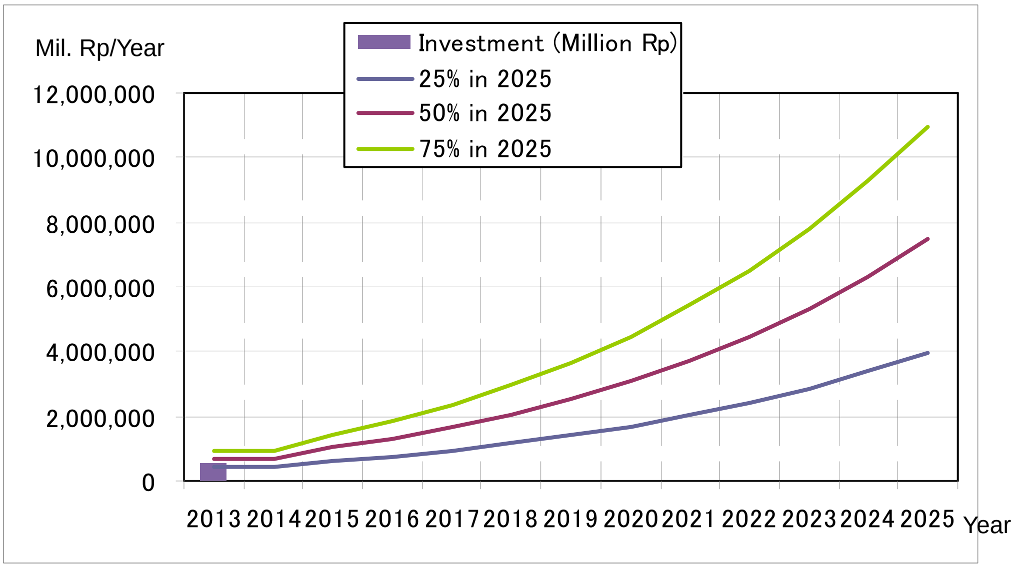


Figure 4.2.1-3 Economic Benefit for New TOU Tariff System
(Fuel Cost Merit and Capacity Saving)

Table 4.2.1-6 Summary of Case Studies for New TOU Tariff System

Case	Item		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Cumulative
Case 1 (25%)	Shifted Electricity (GWh)		62	135	223	326	449	597	790	1,032	1,323	1,673	2,094	2,635	3,290	
	Peak Load Down (MW)		24	49	89	143	214	304	417	557	730	941	1,197	1,504	1,873	
	Cost Down Impact	Sales down (Billion Rp)	117	76	26	-35	-110	-203	-329	-490	-687	-927	-1,219	-1,601	-2,066	
		Fuel cost reduction (Billion Rp)	33	72	118	173	238	317	419	548	703	888	1,112	1,399	1,747	
		Meter investment cost (Billion Rp)	-179													
		Sub total 1	-30	148	144	138	129	114	91	58	15	-39	-107	-202	-320	140
		Construction Cost Reduction (Billion Rp)	275	291	470	628	820	1,048	1,313	1,632	2,009	2,452	2,970	3,577	4,283	21,767
		Total effect (Billion Rp)	246	439	614	766	948	1,162	1,403	1,690	2,024	2,413	2,863	3,375	3,964	
		Cumulative effect (Billion Rp)	246	685	1,299	2,065	3,013	4,175	5,578	7,269	9,293	11,706	14,569	17,944	21,907	
Case 2 (50%)	Shifted Electricity (GWh)		124	270	446	652	898	1,194	1,580	2,063	2,646	3,346	4,188	5,271	6,579	
	Peak Load Down (MW)		47	97	178	286	427	608	833	1,114	1,460	1,882	2,393	3,008	3,745	
	Cost Down Impact	Sales down (Billion Rp)	69	-27	-145	-286	-455	-661	-936	-1,283	-1,704	-2,213	-2,829	-3,627	-4,595	
		Fuel cost reduction (Billion Rp)	66	144	237	346	477	634	839	1,095	1,405	1,777	2,224	2,799	3,494	
		Meter investment cost (Billion Rp)	-359													
		Sub total 1	-224	116	92	61	22	-27	-97	-187	-299	-436	-605	-828	-1,101	-3,513
		Construction Cost Reduction (Billion Rp)	550	582	940	1,255	1,639	2,096	2,625	3,265	4,018	4,903	5,941	7,153	8,567	43,535
		Total effect (Billion Rp)	327	698	1,031	1,316	1,662	2,068	2,528	3,078	3,719	4,467	5,336	6,326	7,465	
		Cumulative effect (Billion Rp)	327	1,025	2,056	3,372	5,034	7,102	9,631	12,708	16,427	20,894	26,231	32,556	40,022	
Case 3 (75%)	Shifted Electricity (GWh)		187	406	669	979	1,347	1,791	2,369	3,095	3,970	5,019	6,282	7,906	9,869	
	Peak Load Down (MW)		71	146	267	429	641	911	1,250	1,672	2,190	2,823	3,590	4,513	5,618	
	Cost Down Impact	Sales down (Billion Rp)	21	-131	-316	-536	-800	-1,120	-1,543	-2,075	-2,721	-3,499	-4,438	-5,652	-7,123	
		Fuel cost reduction (Billion Rp)	99	215	355	520	715	951	1,258	1,643	2,108	2,665	3,336	4,198	5,240	
		Meter investment cost (Billion Rp)	-538													
		Sub total 1	-417	84	39	-16	-84	-169	-284	-432	-613	-834	-1,102	-1,454	-1,882	-7,166
		Construction Cost Reduction (Billion Rp)	825	873	1,409	1,883	2,459	3,144	3,938	4,897	6,027	7,355	8,911	10,730	12,850	65,302
		Total effect (Billion Rp)	408	957	1,448	1,867	2,375	2,975	3,653	4,465	5,414	6,522	7,809	9,276	10,967	
		Cumulative effect (Billion Rp)	408	1,365	2,813	4,680	7,055	10,030	13,683	18,148	23,562	30,083	37,893	47,169	58,136	

(2) New PF Clause

For the purpose of improving PF, which is described in Section 3.3, economic benefit for the proposed new PF clause is estimated.

1) Conditions for calculation

a) Distribution loss and construction cost saving

Capacity saving is estimated as the slow down effect for the supply capacity development program, converted to reduction of investment cost by using PLTU construction cost (1,300USD/kW) as the same as TOU tariff. Economic value for the reduction of distribution loss is estimated as fuel cost reduction by means of 660Rp/kWh (average fuel cost in 2009).

b) Target

The Study Team assumes the average PF at present as follows;

Existing PF Group 0.85
New Group (B2) 0.80
The target for each group is set as follows;

Existing PF Group 0.95 (increase by 0.1)

New Group (B2) 0.90 (increase by 0.1)

As the Study Team estimates in Section 3.3.3, the distribution loss decreases by 21 % and the supply capacity can be reduced by 11 % if the power factor increases by 0.10.

c) PF meter

Table 4.2.1-7 shows the cost for PF meter. The unit cost of the PF meter is assumed 200 USD according to the information from a major manufacturer of electric power meters.

Table 4.2.1-7 PF Meter Investment

Category	Estimated Consumer Number in 2025	Meter Unit Cost (USD/Unit)	Meter Cost	
			(USD)	(Mil. Rp)
B2	1,187,640	200	237,528,000	2,123,738

d) Incentive and disincentive

0.90 is set as the threshold value for the tariff incentive (discount) and disincentive (surcharge). (See Table 4.2.1-8)

Table 4.2.1-8 PF Incentive and Disincentive

Monthly Average PF	Incentive & Disincentive	Rate
>0.90	Discount	2%/0.01 PF
<0.90	Surcharge	3%/0.01 PF

The Study Team assumes that PF improves at an even pace toward 2025.

When α% of existing PF group achieves the 0.95 target, remaining existing group consists of 2 parties; one party who improves PF to 0.90 and the other whose PF is 0.85. The proportion of the one and the other is α to (100 – α).

When β% of the new PF group achieves the 0.90 target, they consists of 2 parties, the advanced one who improves PF to 0.95 and the other whose PF is 0.90. The proportion of the advanced one and the other is β to (100 – β). The remaining (100 – β) % of new group consists of 2 parties, the one who improves PF to 0.85 and the other whose PF is 0.80. The proportion of the one and the other is β to (100 – β)

2) Expected benefit

The benefit was estimated in the following 3 cases.

Case 1 25 % of the target consumers achieve 10% PF increase in 2025

Case 2 50 % of the target consumers achieve 10% PF increase in 2025

Case 3 75 % of the target consumers achieve 10% PF increase in 2025

Figure 4.2.1-4 and Table 4.2.1-9 shows the summary. Expected distribution loss and capacity saving in 2025 are estimated at 1,145 - 3,434 GWh (0.2 - 0.6 % of total electricity sales in Indonesia), 1,126 - 3,377 MW (0.9 - 2.7 % of total installed capacity in Indonesia). The amount of Surcharge keeps as high as 10 Trillion Rp per year while the target achievement ratio is low. In Case 3 (75% achievement) the discount amount is surpassing the surcharge amount year by year. Cumulative economic benefit from 2013 to 2025 is estimated at 90 - 236 Trillion Rp (reduction of distribution loss 3 - 11 trillion Rp, Surcharge 219 - 39 Trillion Rp, Capacity saving 13 - 39 Trillion Rp). Surcharge is expected to use for promotion activities to speed up the spread of power factor improvement

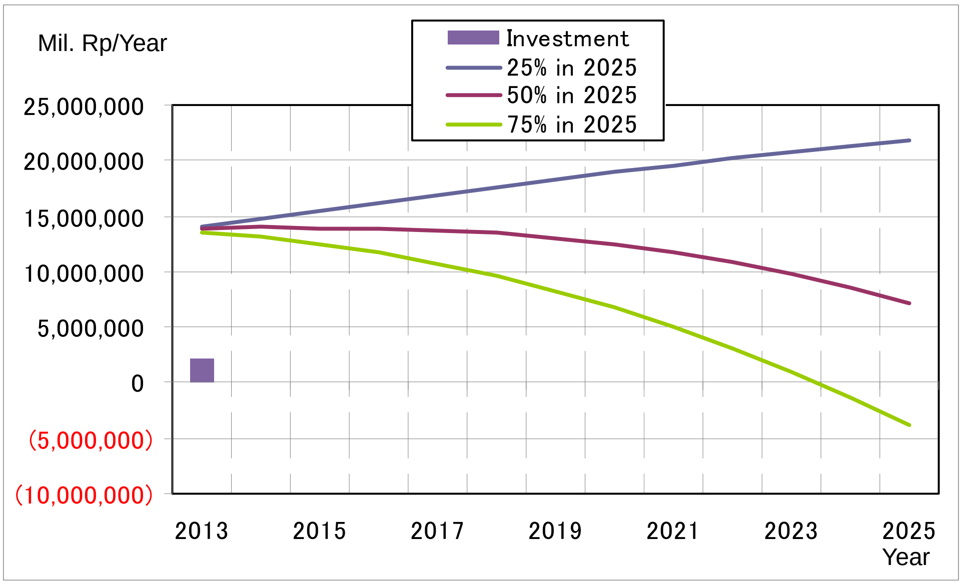


Figure 4.2.1-4 Economic Benefit for New PF Clause (Fuel Cost Merit and Capacity Saving)

Table 4.2.1-9 Summary of Case Studies for New PF Clause

			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Cumulative
Loss Reduction	Case1 25% in 2025	GWh	33	70	114	166	224	293	372	462	566	684	818	971	1,145	
	Case2 50% in 2025		65	140	228	332	448	586	743	924	1,131	1,367	1,637	1,942	2,290	
	Case 3 75% in 2025		98	211	342	498	673	880	1,115	1,386	1,697	2,051	2,455	2,914	3,434	
Fuel Cost Reduction	Case1 25% in 2025	Million Rp	21,464	46,318	75,299	109,452	147,994	193,527	245,265	304,970	373,283	451,258	540,066	641,009	755,536	3,905,440
	Case2 50% in 2025		42,928	92,636	150,598	218,903	295,987	387,055	490,531	609,940	746,567	902,516	1,080,131	1,282,017	1,511,071	7,810,881
	Case 3 75% in 2025		64,392	138,954	225,897	328,355	443,981	580,582	735,796	914,910	1,119,850	1,353,774	1,620,197	1,923,026	2,266,607	11,716,321
Peak Reduction	Case1 25% in 2025	MW	31	68	110	161	220	288	365	454	556	672	805	955	1,126	
	Case2 50% in 2025		61	135	221	323	439	577	731	909	1,112	1,345	1,609	1,910	2,251	
	Case 3 75% in 2025		92	203	331	484	659	865	1,096	1,363	1,668	2,017	2,414	2,865	3,377	
Yearly Construction Cost Reduction	Case1 25% in 2025	Million Rp	357,230	427,860	498,491	592,850	675,345	799,550	895,948	1,033,908	1,182,985	1,350,293	1,537,886	1,748,038	1,983,268	13,083,651
	Case2 50% in 2025		714,460	855,721	996,981	1,185,700	1,350,689	1,599,100	1,791,897	2,067,816	2,365,969	2,700,585	3,075,771	3,496,076	3,966,537	26,167,302
	Case 3 75% in 2025		1,071,690	1,283,581	1,495,472	1,778,549	2,026,034	2,398,650	2,687,845	3,101,723	3,548,954	4,050,878	4,613,657	5,244,115	5,949,805	39,250,954
Incentive / Disincentive	Case1 25% in 2025	Million Rp	13,650,039	14,325,974	14,889,833	15,540,391	16,063,783	16,670,120	17,132,183	17,591,488	18,014,241	18,391,797	18,714,392	18,971,021	19,149,306	219,104,568
	Case2 50% in 2025		13,037,144	13,004,061	12,769,545	12,500,691	12,011,512	11,455,112	10,658,547	9,710,543	8,574,281	7,229,348	5,653,672	3,823,424	1,712,930	122,140,810
	Case 3 75% in 2025		12,431,850	11,715,559	10,731,192	9,620,697	8,230,725	6,667,961	4,817,525	2,728,581	372,221	-2,270,340	-5,218,058	-8,489,846	-12,104,327	39,233,741
Total	Case1 25% in 2025	Million Rp	14,028,733	14,800,152	15,463,623	16,242,692	16,887,121	17,663,198	18,273,397	18,930,366	19,570,509	20,193,348	20,792,343	21,360,068	21,888,110	236,093,660
	Case2 50% in 2025		13,794,532	13,952,418	13,917,124	13,905,293	13,658,189	13,441,267	12,940,975	12,388,298	11,686,817	10,832,450	9,809,574	8,601,518	7,190,538	156,118,993
	Case 3 75% in 2025		13,567,931	13,138,095	12,452,561	11,727,602	10,700,739	9,647,193	8,241,167	6,745,215	5,041,025	3,134,311	1,015,796	-1,322,705	-3,887,914	90,201,015
Investment		Million Rp	2,123,738													

(3) Tariff Adjustment System by Fuel Price Fluctuation

Fluctuation of fuel price is inevitable because fuel price is decided by the international market. Tariff adjustment system by fuel price fluctuation has not been worked in Indonesia. This situation means PLN takes the risk of fuel price fluctuation and the risk is passed through to Indonesian government as the governmental subsidy to PLN. This situation should be changed

It is shown in Table 4.2.1-10, the comparison between 2007 and 2008, a big fuel price hike happened. It is calculated that the average fuel cost for generation in 2008 was 1,011.08 Rp/kWh on the basis of PLN Statistics. If fuel prices in 2008 had been the same as those of 2007, the average fuel cost for generation in 2008 might have been 637.88 Rp/kWh. The fuel price hike in 2008 increased the average fuel cost for generation by 58.5%. If tariff adjustment system by fuel price fluctuation had worked in 2008, PLN's revenue would have increased 14,491 billion Rp, the subsidies to PLN would have been decrease by 18.4 %. This system is expected to make the customers save electricity consumption.

Table 4.2.1-10 Fuel Cost Comparison 2007 vs. 2008

	2008 consumption		2008 unit price		amount (million Rp)	
HSD	kilo litter	8,127,546	Rp/liter	8,738	71,020,529	
IDO	kilo litter	28,989	Rp/liter	8,650	250,762	
MFO	kilo litter	3,163,954	Rp/liter	5,762	18,231,019	
Coal	ton	20,999,521	Rp/kg	489	10,273,596	
Natural Gas	MMSCF	181,661	Rp/MSCF	29,128	5,291,451	
Total	—		—		105,067,356	
				A	1,011	Rp/kWh

	2008 consumption		2007 unit price		amount (million Rp)	
HSD	kilo litter	8,127,546	Rp/liter	5,350	43,479,201	
IDO	kilo litter	28,989	Rp/liter	5,275	152,929	
MFO	kilo litter	3,163,954	Rp/liter	3,563	11,274,465	
Coal	ton	20,999,521	Rp/kg	339	7,113,798	
Natural Gas	MMSCF	181,661	Rp/MSCF	23,481	4,265,580	
Total	—		—		66,285,974	
	2007 price			B	638	Rp/kWh
				A-B=	373	Rp/kWh

2008 Average selling price	653	Rp/kWh
2008 Energy sold	129,019	GWh
Estimated benefit for 20% Fuel price adjustment in 2008	14,491	billion Rp

(4) Summary

The effects of new TOU tariff system and new PF clause are summarized in Figure 4.2.1-5 and Table 4.2.1-11. The volume of peak shift in 2025 is estimated to be 3,290 - 9,869 GWh (0.6 - 1.8% of total electricity sales in Indonesia). The reduction of power generation is estimated at

1,145 - 3,434 GWh (2.4 - 7.1 % of total electricity sales in Indonesia). Capacity saving is estimated at 3,000 - 9,000 MW (2.4 - 7.1% of total installed capacity in Indonesia). The cumulative economic benefit from 2013 to 2025 amounts to 250 - 140 Trillion Rp, consisting of fuel cost reduction / revenue increase (40 - 220 Trillion Rp) and capacity saving (30 - 100 Trillion Rp). Tariff adjustment system by fuel price fluctuation plays a very important role as a safety net for PLN's revenue.

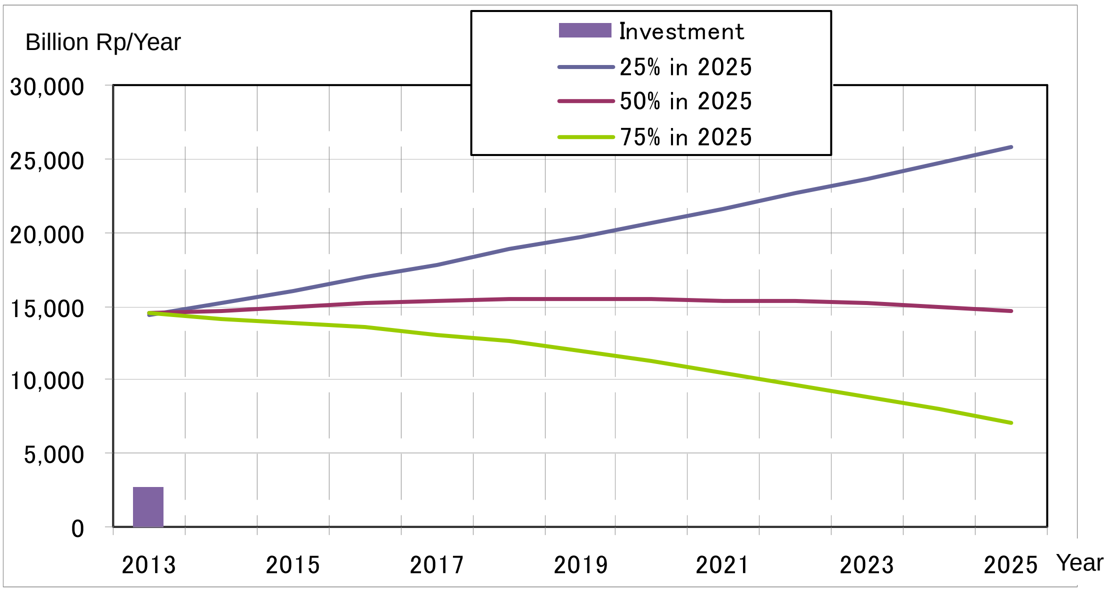


Figure 4.2.1-5 Economic Benefit for New TOU Tariff System and New PF Clause

Table 4.2.1-11 Summary of Case Studies for New TOU Tariff System and New PF Clause

			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Cumulative
Shifted + Decreased Electricity (GWh/year)	TOU (Shifted)	Case1 25% in 2025	62	135	223	326	449	597	790	1,032	1,323	1,673	2,094	2,635	3,290	
		Case2 50% in 2025	124	270	446	652	898	1,194	1,580	2,063	2,646	3,346	4,188	5,271	6,579	
		Case3 75% in 2025	187	406	669	979	1,347	1,791	2,369	3,095	3,970	5,019	6,282	7,906	9,869	
	PF (Decreased)	Case1 25% in 2025	33	70	114	166	224	293	372	462	566	684	818	971	1,145	
		Case2 50% in 2025	65	140	228	332	448	586	743	924	1,131	1,367	1,637	1,942	2,290	
		Case3 75% in 2025	98	211	342	498	673	880	1,115	1,386	1,697	2,051	2,455	2,914	3,434	
	TOU+PF	Case1 25% in 2025	95	205	337	492	673	890	1,161	1,494	1,889	2,357	2,912	3,607	4,434	
		Case2 50% in 2025	189	411	674	984	1,347	1,780	2,323	2,987	3,778	4,713	5,825	7,213	8,869	
		Case3 75% in 2025	284	616	1,011	1,476	2,020	2,671	3,484	4,481	5,666	7,070	8,737	10,820	13,303	
Cumulative Capacity Reduction (MW/year)	TOU	Case1 25% in 2025	24	49	89	143	214	304	417	557	730	941	1,197	1,504	1,873	
		Case2 50% in 2025	47	97	178	286	427	608	833	1,114	1,460	1,882	2,393	3,008	3,745	
		Case3 75% in 2025	71	146	267	429	641	911	1,250	1,672	2,190	2,823	3,590	4,513	5,618	
	PF	Case1 25% in 2025	31	68	110	161	220	288	365	454	556	672	805	955	1,126	
		Case2 50% in 2025	61	135	221	323	439	577	731	909	1,112	1,345	1,609	1,910	2,251	
		Case3 75% in 2025	92	203	331	484	659	865	1,096	1,363	1,668	2,017	2,414	2,865	3,377	
	TOU+PF	Case1 25% in 2025	54	116	200	305	433	592	782	1,012	1,286	1,613	2,001	2,459	2,998	
		Case2 50% in 2025	109	233	399	609	866	1,184	1,564	2,023	2,572	3,227	4,002	4,918	5,997	
		Case3 75% in 2025	163	349	599	914	1,300	1,776	2,346	3,035	3,858	4,840	6,003	7,378	8,995	
Cost Reduction/ Saving for Construction (Billion Rp/year)	TOU	Case1 25% in 2025	425	439	614	766	948	1,162	1,403	1,690	2,024	2,413	2,863	3,375	3,964	22,087
		Case2 50% in 2025	685	698	1,031	1,316	1,662	2,068	2,528	3,078	3,719	4,467	5,336	6,326	7,465	40,380
		Case3 75% in 2025	946	957	1,448	1,867	2,375	2,975	3,653	4,465	5,414	6,522	7,809	9,276	10,967	58,674
		Investment	538													
	PF	Case1 25% in 2025	14,029	14,800	15,464	16,243	16,887	17,663	18,273	18,930	19,571	20,193	20,792	21,360	21,888	236,094
		Case2 50% in 2025	13,795	13,952	13,917	13,905	13,658	13,441	12,941	12,388	11,687	10,832	9,810	8,602	7,191	156,119
		Case3 75% in 2025	13,568	13,138	12,453	11,728	10,701	9,647	8,241	6,745	5,041	3,134	1,016	-1,323	-3,888	90,201
		Investment	2,124													
	TOU+PF	Case1 25% in 2025	14,454	15,239	16,078	17,008	17,835	18,825	19,677	20,621	21,595	22,606	23,655	24,735	25,852	258,180
		Case2 50% in 2025	14,480	14,651	14,948	15,221	15,320	15,510	15,469	15,466	15,406	15,300	15,146	14,927	14,656	196,499
		Case3 75% in 2025	14,514	14,095	13,901	13,594	13,076	12,622	11,895	11,210	10,455	9,656	8,825	7,954	7,079	148,875
		Investment	2,662													

4.2.2 Highly-efficient Home Appliance Promotion Program

Table 4.2.2-1 shows the total electricity consumption of four home appliances (Lighting, TV, refrigerator, and AC). It is estimated about 21.0TWh as described in Section 2.4.2. The volume is 18.3% of total electricity consumption in the Java-Bali region (115.1TWh).

Table 4.2.2-1 Electricity Consumption of Major Appliances in Jawa-Bali in 2010

Home Appliances Category	Electricity Consumption (GWh/y)
Lighting	6,482
TV	6,043
AC	2,163
Refrigerator	6,334
Total	21,022

Based on the 2010 baseline above, the electricity consumption and CO_2 emission in 2025 were estimated. The conditions for estimation were decided by the following procedures:

a) Basic data collection; EMI survey 2010, BPS/PLN statistics, EMC/KADIN data etc

b) Discussion with EMI, Asia Carbon, BPPT (local consultants), and PLN

c) Consensus building with MEMR

(1) Conditions for Calculation of 2025 Model

Table 4.2.2-1 is the baseline of 2010 figure for calculation of electricity consumption volume for four appliances in 2025.

Table 4.2.2-2 shows the number of households in 2025, estimated on the assumption that the average annual growth rate is 1 % per year during 2011 to 2025 (average growth rate of BPS statistics 2007 – 2010). RUPTL 2010-2019 estimates transmission and distribution loss in 2019 is 8 %. We assume 8% is unchangeable until 2025.

Table 4.2.2-2 Number of Households by Type of Voltage in 2025

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

Economic benefit is estimated as the cost differential between average fuel cost for generation and average selling price for the residential sector (661 - 597 = 64 Rp/KWh).

1) Lighting

Table 4.2.2-3 shows the conditions for calculation of electricity consumption of lightings. And other conditions are as follows;

- CFL usage rate is 10 % increase in 2025 compared with 2010 in every contract category
- As a baseline all lighting apparatus efficiency improves 10 %
- CFL; 13-22 W/lamp, 8-10h/day ;baseline (source; EMI2010)
- Non-CFL; 22-29W/lamp,7-8h/day; baseline (source; EMI2010)

Table 4.2.2-3 Conditions for Estimation of Electricity Consumption of Lightings in 2025

PENETRATION RATE	Source : Improvement of 10% on EMI 2010						
			POWER (VA)				
			450	900	1300	2200	>2200
	CFL Type	CFL	79.1%	83.9%	80.8%	73.2%	87.2%
		Non CFL	20.9%	16.1%	19.2%	26.8%	12.8%
NUMBER OF LAMPS/HH	Source : EMI2010		4	8	6	13	17

2) TV

The conditions for calculation of the electricity consumption of TVs are shown in Table 4.2.2-4.

The ownership ratio of TVs and breakdown of type (CRT, LCD, and Plasma) was decided through the discussion with consultants and C/P, checking EMI 2010 data and KADIN trend data etc respectively.

And other conditions are as follows;

- The growth rate of TV at home is, 26.2 %/y (ave. of KADIN2008-2010)
- Electricity consumption of TVs is as follows. (Source: EMI 2010 survey data)

  CRT; 188-258W, LCD; 362W, Plasma; 700W

  Stand-bye electricity consumption; 9 -35W

  Daily watching time; 6-8hours

- Electricity consumption will reduce 30%/unit in 2025 as a mixed result of enlargement of the size and improvement of efficiency (labeling program etc).

Table 4.2.2-4 Conditions for Estimation of Electricity Consumption of TVs in 2025

PENETRATION RATE Source : KADIN 2003-2010, EMI 2010 etc

		POWER (VA)				
		450	900	1300	2200	>2200
TV Ownership		95.3%	95.3%	96.7%	95.7%	94.7%
TV Type	CRT	30.0%	30.0%	20.0%	20.0%	0.0%
	LCD	70.0%	70.0%	80.0%	80.0%	90.0%
	Plasma	0.0%	0.0%	0.0%	0.0%	10.0%

NUMBER OF TV / HH Source : EMI2010, KADIN2007	1	1	1	2	3

3) Refrigerator

The conditions for calculation of electricity consumption of refrigerators are shown in Table 4.2.2-5.

The ownership ratio of refrigerator was decided through the discussion with consultants and C/P, checking d KADIN trend data etc.

The conditions are as follows;

- The growth rate of refrigerator at home is 9 %/year (KADIN data)
- Electricity consumption of refrigerator will 50% decrease in 2025 as a mixed result of enlargement of the size and improvement of efficiency.

Table 4.2.2-5 Conditions for Estimation of Electricity Consumption by Refrigerators in 2025

PENETRATION RATE Source : EMI 2010 (EMC, KADIN etc)

		POWER (VA)				
		450VA	900VA	1300VA	2200VA	>2200VA
Refrigerator Ownership		10.0%	90.0%	100.0%	100.0%	100.0%
Type	1 door	54.0%	54.0%	54.0%	54.0%	54.0%
	2 doors	46.0%	46.0%	46.0%	46.0%	46.0%

NUMBER OF REF/ HH Source : EMI2010	1	1	1	1	1

4) AC

The conditions for calculation of the electricity consumption of ACs are shown in Table 4.2.2-6.

The ownership ratio of ACs was decided through the discussion with consultants and C/P, checking KADIN trend data etc.

The conditions are as follows;

- The growth rate of air conditioner at home is, 15 %/y (KADINdata 2008-2010)
- As the baseline 10 % electricity saving will be achieved in 2025 (4.2-6.0kWh/.day/unit)
- Compared with the baseline, electricity consumption of ACs will 30% decrease in 2025 by EE labeling program, etc.

Table 4.2.2-6 Conditions for Estimation of Electricity Consumption of ACs in 2025

PENETRATION R/	Source : EMI 2010 (KADIN, EMC etc)						
			POWER (VA)				
			450	900	1300	2200	>2200
	AC Ownership		0.0%	5.6%	10.0%	62.6%	75.8%
	AC Type	Split	0.0%	100.0%	100.0%	100.0%	81.0%
		Window	0.0%	0.0%	0.0%	0.0%	19.0%
NUMBER OF AC/HH	Source : EMI2010		0	1	1	1	4

Table 4.2.2-7 shows the results of the calculation of the electricity consumption for four home appliances in 2025.

Table 4.2.2-7 Estimation of Electricity Consumption by Four Appliances in Jawa-Bali (Baseline in 2025)

Home Appliance Category	Electricity Consumption BAU (GWh/year)
Lighting	10,963
TV	21,279
AC	4,054
Refrigerator	11,393
Total	47,689

This volume is equivalent to 11.4% of total electricity consumption in the Java-Bali region in 2025.

(2) The Effect of Highly-efficient Home Appliances Promotion Program

The framework of EE labeling has not been authorized yet and the study for incentive programs for promoting highly-efficient home appliances has just started. It is difficult to foresee a short term progress of penetration ratio for highly-efficient home appliances. However, it is reasonable that labeling program with the improvement of consumer's awareness for electricity saving will keep out in-efficient products from the markets in future.

The result of calculation is summarized in Table 4.2.2-8

Table 4.2.2-8 Estimation of Electricity Consumption of Four Appliances in Jawa-Bali (Labeling in 2025)

Home Appliance Category	Electricity Consumption (GWh/year)	
	BAU	Labeling Program
Lighting	10,963	10,125
TV	21,279	14,896
AC	4,054	2,838
Refrigerator	11,393	5,696
Total	47,689	33,555

The volume of reduced 14,134GWh (47,689 – 33,555) is 3.4% of total electricity consumption in the Java-Bali region (418TWh) Also 14,134 GWh is equivalent to yearly electricity generation by 2,150 MW power plant. It is estimated that 25 Trillion Rp of the construction cost for 2,150 MW would be saved.

Maximum capacity saving effect in 2025 reaches 11,150 MW (130 Trillion Rp), including 9,000 MW for new TOU tariff and new PF clause.

4.3 Effect of CO_2 Emission Reduction

CO_2 emission reduction for the reduction of electricity consumption, which is estimated in Section 4.2.1 and 4.2.2, is calculated.

Table 4.3-1 shows officially issued emission factor in Indonesia. The emission factor in the Java-Bali region in 2006 is 0.891 kg/kWh.

Table 4.3-1 Officially Issued Emission Factors Value of Indonesian Grid

GRID (Year)	EX-POST	EX-ANTE	GOVERNMENT LETTER NO.
JAMALI (2006)	0.902	0.891	B-277/Dep. III/LH/01/2009 494/21/650.1/2009
SUMATERA (2007)	-	0.743	
WEST KALIMANTAN (2008)	0.786	0.775	B-25/DNPI/03/2010
EAST KALIMANTA (2008)	0.715	0.742	B-25/DNPI/03/2010
SOUTH CENTRAL KALIMANTAN (2008)	1.280	1.273	B-25/DNPI/03/2010
SULUTTENGGO (2008)	0.121	0.161	B-25/DNPI/03/2010
SULTANBATARA (2008)	0.267	0.269	B-25/DNPI/03/2010

Source: MEMR 2010

Table 4.3-2 shows the present and future emission factors described in RUPTL 2010. The Study Team assumes emission factors in 2025 are the same as that of 2019. For Jawa-Bali Grid; 0.663kg/t - CO_2.

Table 4.3-2 CO_2 Emission Factor in Indonesia

Region	2010	2019
Jawa-Bali	0.731	0.663
Western Indonesia	0.688	0.699
Eastern Indonesia	0.735	0.742
Average Indonesia	0.725	0.675

Source: RUPTL 2010

4.3.1 CO_2 Emission Reduction by Functional Tariff System

(1) New TOU Tariff System

The shift from gas turbine at peak time zone to gas combined at off peak might reduce gas consumption and CO_2 emission if the thermal efficiency of gas combined is better than gas turbine. CO_2 emission reduction merit was calculated on the assumption that 10 % of shifted electricity consumption would be achieved by peak cut (power saving). Case 1 reduces 2.5 %, Case 2 reduces 5.0 %, and Case 3 reduces 7.5 % of shifted electricity consumption. The result is summarized in Table 4.3.1-1. The reduced amount is to be 218 - 654 thousand t-CO_2/year in 2025. (Case 1, Case 2, and Case 3 are 3 cases, which are described in Section 4.2.1, and cases of peak shift 25%, 50%, and 75% respectively.)

Table 4.3.1-1 CO_2 Emission Reduction Effect by New TOU Tariff System in Jawa-Bali (-2025)

			2014	2020	2025
Case 1	10% peak cut	GWh	33	103	329
		t-CO_2/y	24,000	68,000	218,000
Case 2	10% peak cut	GWh	65	206	658
		t-CO_2/y	48,000	137,000	436,000
Case 3	10% peak cut	GWh	98	309	987
		t-CO_2/y	72,000	205,000	654,000

(2) New PF Clause

Table 4.3.1-2 shows the summary of estimation. The reduced amount is to be 773 - 2,318 thousand t- CO_2/y in 2025. (Case 1, Case 2, and Case 3 are 3 cases, which are described in Section 4.2.1, and cases of peak shift 25%, 50%, and 75% respectively.)

Table 4.3.1-2 CO_2 Emission Reduction Effect by New PF Clause in Indonesia (-2025)

		2014	2020	2025
Case 1	GWh	70	460	1,150
	t-CO_2/y	51,000	312,000	773,000
Case 2	GWh	140	920	2,290
	t-CO_2/y	101,000	625,000	1,545,000
Case 3	GWh	210	1,380	3,440
	t-CO_2/y	152,000	937,000	2,318,000

4.3.2 CO_2 Emission Reduction by Highly-efficient Home Appliances

Table 4.3.2-1 shows CO_2 emission reduction volume derived from four appliances in the Java-Bali region.

Table 4.3.2-1 CO_2 Emission Reduction Effect by the Penetration of Highly-efficient Home Appliances in Jawa-Bali (2025)

Home Appliance Category	CO_2 Emission (t-CO_2/y)	
	BAU	Labeling Program
Lighting	7,901,000	7,297,000
TV	15,335,000	10,735,000
AC	2,922,000	2,045,000
Refrigerator	8,210,000	4,105,000
Total	34,368,000	24,182,000

In 2025 of the effect of the penetration of highly-efficient home appliances counts 10 million t-CO_2/year reductions. It means only 16.7% emission increase compared with the baseline increase of 65.8%.

4.3.3 Summary

The CO_2 reduction effect by the functional tariff system and the penetration of highly-efficient appliances is summarized in Table 4.3.3-1 and Figure 4.3.3-1.

It shows that reduced electricity consumption is to be 15.5 - 18.5 TWh and reduced CO_2 emission is to be 11- 13 million t-CO_2 /year in 2025. (Case 1, Case 2, and Case 3 are 3 cases, which are described in Section 4.2.1, and cases of peak shift 25%, 50%, and 75% respectively.)

Table 4.3.3-1 CO_2 Emission Reduction Effect by the Functional Tariff System and the Penetration of Highly-efficient Home Appliances (-2025)

		Case 1	Case 2	Case 3
New TOU Tariff System	GWh	300	700	1,000
	t-CO_2/y	220,000	440,000	650,000
New PF Clause	GWh	1,100	2,300	3,400
	t-CO_2/y	770,000	1,550,000	2,320,000
4 Highly-Efficient Home Appliances	GWh	14,100		
	t-CO_2/y	10,190,000		
Total	GWh	15,500	17,100	18,500
	t-CO_2/y	11,180,000	12,180,000	13,160,000

（Note）Regarding new PF clause, the target region is all Indonesia. Besides regarding new TOU tariff system and highly efficient appliances, the target region is Jawa-Bali. Total is sum of these.

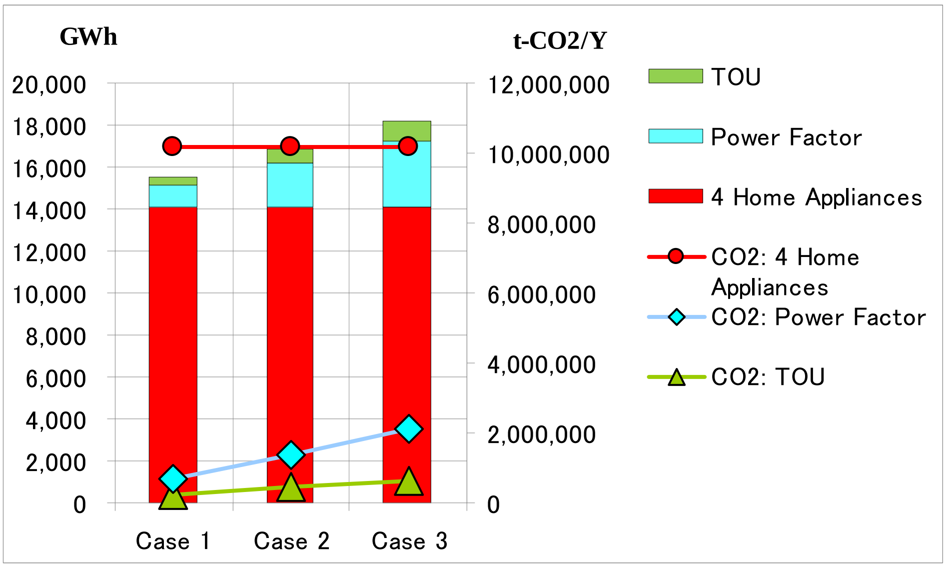


Figure 4.3.3-1 CO_2 Emission Reduction Effect by the Functional Tariff System and the Penetration of Highly-efficient Home Appliances (-2025)

Appendix 1

Labeling

Appendix 1-1 **Member List of the "Technical Meetings on EE Labeling Program"**

Appendix 1-2 **FRAMEWORK of ENERGY EFFICIENCY LABELING PROGRAM PART 1: GENERAL PROVISION (DRAFT) Rev. 3rd November, 2011 Technical Meeting for EE Labeling Program in Indonesia**

Appendix 1-3 **FRAMEWORK of ENERGY EFFICIENCY LABELING PROGRAM PART 2: TECHNICAL PROVISION for REFRIGERATOR (DRAFT) Rev. 3rd November, 2011 Technical Meeting for EE Labeling Program in Indonesia**

Appendix 1-4 **FRAMEWORK of ENERGY EFFICIENCY LABELING PROGRAM PART 3: TECHNICAL PROVISION for AC (Air Conditioner) (DRAFT) Rev. 3rd November, 2011 Technical Meeting for EE Labeling Program in Indonesia**

Appendix 1-5 **PROCEDURE and REQUIREMENTS of PERFORMANCE TEST on TV (Television) for THE PURPOSE of ENERGY SAVING LEVEL LABELLING (DRAFT) October, 2011 Technical Meeting for EE Labeling Program in Indonesia**

Member List of the "Technical Meetings on EE Labeling Program"

1st	2nd	3rd		Name	Organization, Status
○	○	○		Heru Santoso	PT Panasonic Mfg Indonesia, General Secretary – Vice President Director, (GABEL)
	○	○		T. Houman	PT. Panasonic Mfg Indonesia
○				Tanimoto Toshiharu	PT. Panasonic Mfg Indonesia, AC BC, Chief Operating Officer
○				Kimihiro Nishiyama	PT. Panasonic Mfg Indonesia, Ref. BC, Chief Operating Officer
○				Diah Tri H.	PT. Panasonic Mfg Indonesia, Env. Section Chief
○				Hermanu	PT. Panasonic Lab Testing, Manager Teknik
	○			Rubiyono	PT. Panasonic Mfg Indonesia, AC BU, QA Manager
○				Jusuf G.	PT. Sanyo Indonesia, CRM
○	○			Hadi Yuliawan	PT. Sanyo Indonesia, SPV BP
		○		Nurul Huda	PT. Sanyo Indonesia, Staff R&D
○	○			Masanobu Kishida	PT. Sharp Electronics Indonesia, General Manager
	○	○		A. Takatori	PT. Sharp Electronics Indonesia
○	○	○		Dian Kurniawan	PT. Sharp Electronics Indonesia, Engineering
○	○			Cecep S.	PT. Sharp Electronics Indonesia, Engineering
○		○		Dian T.B.	PT. Sharp Electronics Indonesia, Engineering
		○		Sukiatno H.	PT. Sharp Electronics Indonesia, Admin GM
				Sukito	PT. Sharp Electronics Indonesia, staff
○				Nanri Satoshi	PT. Topjaya (Toshiba), Advisor
○	○			Yoshiharu Osumi	PT. Topjaya (Toshiba), Advisor
	○	○		Primnove M.	PT. Topjaya (Toshiba), QA Manager
	○	○		M. Faizal	PT. Topjaya (Toshiba), GA
	○	○		T. Sowa	PT. Topjaya (Toshiba), Design
	○			Williatmo T	PT. Topjaya (Toshiba), Mncmt
				Arthur Palar	PT. Topjaya (Toshiba), Manager
○				Yuzo Tsuchiya	PT. Toshiba Consumer Products (TV), President Director
○	○	○		Suparmo	PT. Toshiba Consumer Products (TV), Manager Mechanical Engineering
				Nanang Ruhiyat	PT. Toshiba Consumer Products (TV)
		○		Agus Setyawan	PT. Toshiba Consumer Products (TV)
		○		Nanang Ruhiyat	PT. Toshiba Consumer Products (TV)
				Yasuo Mizutani	PT. Hitachi Modern Sales ID, President
○		○		Pujianto	PT. Hitachi Modern Sales ID, Assist Manager
	○			Dekki S.	PT. Hitachi Modern Sales ID, Service Manager
○				Ramdan Adli Pitra	LG Electronics Indonesia
○				Dedik Hermanto	LG Electronics Indonesia
○	○			Erli Puspita	LG Electronics Indonesia
		○		Joko Sutikno	LG Electronics Indonesia, Safety Engineer
		○		Tengku Abdul H.	LG Electronics Indonesia, Cicuit Engineer
	○	○		Jefri Panjaitan	LG Electronics Indonesia
				Sumber Agustinus	LG Electronics Indonesia
○				Wisnu	PT. Samsung Electronics Indonesia, Legal Manager
○				Alhamd	PT. Samsung Electronics Indonesia, Import Controller

1st	2nd	3rd		Name	Organization, Status
○				Tedy Handoko	PT. Samsung Electronics Indonesia, Sr. Engineer R&D, (EMC & Safety)
○				Hendra Nurdian	PT. Samsung Electronics Indonesia, R&D Dept., Asst. Manager
○				Josaphat Bagus.	PT. Hartono Istana Teknologi (Polytron)
○	○			Paulus	PT. Maspion
○				Boy	PT. Maspion
○		○		Sudjarwo I.W	PT. Sanken Argadwija, QC Manager
○				Budianto	PT. Sanken Argadwija, Production Audio Video
		○		Sukarja	PT. Sanken Argadwija, Engineer
		○		Suyanto	PT. Sanken Argadwija, FM
				Irvan Pratama	PT. Sanken Argadwija, Regulator Coordinator
○		○		Ali Soebroto	PT. Panggung Electric Citabuana (AKARI), Chairman – Managing Director, (GABEL)
	○			Rudy Sugiono	PT. Panggung Electric Citabuana (AKARI)
○				Tjahjadi Djaja	PT. Sarana Aircon Utama (Carrier), Sales Manager
○	○			Welly	PT. Sarana Aircon Utama (Carrier), Marketing
				Satoru Arai	PT. Sony Indonesia, President Director
○				Weindy Jonatan	PT. Sony Indonesia, Visual Eng.
	○	○		Freddy Tirtonady	PT Sony Indonesia, CSD Head
○				Andy Widjaja	PT. Berkat Andijaya Elektrindo (AUX)
	○			Dimas	PT. Berkat Andijaya Elektrindo (AUX), Legal
				Donny P	PT. Berkat Andijaya Elektrindo (AUX), Product Manager
○	○	○		Syaiful Hadi	GABEL, Executive Secretary
○				Hendrarto	PT. Star Cosmos (GABEL)
○				Takashi Aso	PT. Metbelosa, President Director (JJC)
		○		Bartien Sayoso	YPUIL
				Sudirman	B2TE-BPPT
				Hadi Surachman	B2TE-BPPT, Energy Technology Center
				Agus Fanar Syukri	P2SMTP-LIPI
○				R. Harry Arjadi	P2SMTP-LIPI, Researcher
		○		Ir. Puji Winarni, M.A	P2SMTP-LIPI
		○		Hari Tjahyono	P2SMTP-LIPI, MT Lab
				Dr.Dini Andiani	P2SMTP-LIPI
○		○		OK Teguh	PPMB-MOT (BPMBEI), Quality Manager
○				Siti Hasbiyatuddhuha	PPMB-MOT (BPMBEI), Executive Staff
	○			Verly Wahyu	PPMB-MOT (BPMBEI)
	○			Eny Tulak	PPMB-MOT (BPMBEI)
	○			Rieneke G.W.	PPMB-MOT (BPMBEI)
	○	○		Yeni Ariyani	PPMB-MOT (BPMBEI)
		○		Harnaini	PPMB-MOT (BPMBEI), MT Lab
		○		M. Aziz Abdullah	PPMB-MOT (BPMBEI)
	○			Rivai	P3TEK (MEMR)
		○		Sarimin Emo	P3TKEBTK (MEMR), Lab
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		○		Sriwidjojo	STT-PLN
○				Fandy Fermadi	SUCOFINDO
	○	○		Riki Suferdi	SUCOFINDO, Engineer
		○		Ali Imron	SUCOFINDO, Technician
○				Joko Karyanto	PT. EMI (Persero)
○	○			Atim N	PT. EMI (Persero), Engineer
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	○			Roosalinda M (Lienda Loebis)	(MOI), Dir. ITE – IUBTT
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	○			Aribianto	MOT
○	○			Maryam Ayuni	MEMR, Ditjen EBTKE
				Agus Triboesono	MEMR, Director for Electricity Engineering & Environment, BRESL National Project Director
○		○		Indarti	MEMR, DJEBTKE-KESDM
				Supriyadi	MEMR, Ditjen EBTKE (Labeling)
	○			Devi L.Z.	MEMR, Ditjen EBTKE
	○			Andriah FM	MEMR, Ditjen EBTKE
○				Gita Lestari	MEMR, DJEBTKE-KESDM
○	○			Wanhar	MEMR, DJK
○		○		Kunaefi	MEMR, DJEBTKE-KESDM
○				Nida Ul K	MEMR, DJEBTKE-KESDM
	○			Budiono	MEMR, Ditjen Kelistrikan
		○		Agi Triwijaya	MEMR, EBTKE-KESDM
				Helmi	MEMR
		○		F. Danang Wijaya	Technical Faculty of UGM, BRESL Team
		○		D. Mustofa A.	Politechnic Jakarta (PNJ), Machine Technical

1st	2nd	3rd		Name	Organization, Status
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		○		James	BRESL, Team leader
		○		Hiroshi Sasaki	JEMA, IEC/SC61B&C Chairman
		○		Jun Nakamura	JEMA (Panasonic)
○	○	○		Kiyoshi Takashima	JICA Study Team, Team Member, (JPOWER)
		○		Kimio Yoshida	JICA Study Team, Team Leader, (JPOWER)
		○		Masahiro Tanimoto	JICA Study Team, Team Member, (JPOWER)
		○		Yukiko Uchiyama	JICA Study Team, Team Member
		○		Yoshio Hirayama	JICA Study Team, Team Member
		○		Yoichi Isobe	JICA Study Team, Team Member
	○			Yukihiko Nakagawa	JICA Study Team, Team Member, (JPOWER)
○	○	○		Amalia	JICA Study Team, Secretary, (JPOWER)
	○	○		Sudaryanto	Interpreter
○	○			Anky C.J. Padmadinata	B2TE-BPPT, Head of Energy Analysis & Optimization Division
○				Alihuddin	Ditjeu-KTL (MEMR)
○				Mustofa Said	DJEBTKE-KESDM (MEMR)
○				Nasrullah Salim	BRESL, Team Leader
○				Sasono	Interpreter
○	○			Boy Sjamsulhadi Sjarif	BSN/ KAN, BRESL, Former NPM

************; The person who left

Appendix 1-2

FRAMEWORK
of
ENERGY EFFICIENCY LABELING PROGRAM
PART 1: GENERAL PROVISION
(DRAFT) Rev. 3rd

November, 2011

Prepared by;

Technical Meeting for EE Labeling Program in Indonesia

Introduction

Energy efficiency labeling program has been under preparation by Indonesian government. This document named “Framework” has been being made in order to summarize up opinion and idea of stakeholders who are concerning on the energy efficiency labeling program. The framework is the basic structure of the regulation for the voluntary labeling program showing how to apply and maintain energy efficiency label on the home appliances to the manufacturers, importers, retailers, consumers and the government. Therefore, the documents shall be used as the recommendation to the government on making nation-wide regulation for the operation and maintenance of the program.

“Technical Meeting for EE Labeling Program in Indonesia” was organized as a stakeholders meeting in order to discuss the issues above mentioned and accomplish the Framework.

Technical Meeting for EE Labeling Program in Indonesia

Member;

Ministry of Energy and Mineral Resources (MEMR)

Ministry of Industry (MOI)

Ministry of Trade (MOT)

National Accreditation Body (KAN)

Agency for the Assessment and Application of Technology (BPPT)

Indonesian Institute of Sciences (LIPI)

Laboratory for Quality Testing of Export and Import Goods (BPMBEI)

Dir. ITE – IUBTT

The Indonesia Electronic and Electrical Appliance Industries Association (GABEL)

PT. Berkat Andijaya Elektrindo

PT. Hitachi Modern Sales Indonesia

PT. LG Electronics Indonesia

PT. Maspion Group

PT. Panasonic Manufacturing Indonesia

PT. Panggung Electric Citabuana

PT. Polytron

PT. Samsung Electronics Indonesia

PT. Sanken Argadwija

PT. SANYO Indonesia

PT. Sarana Aircon Utama

PT. Sharp Electronics Indonesia

PT. Sony Indonesia

PT. Star Cosmos

PT. Sucofindo

PT. Toshiba Consumer products Indonesia

PT. Topjaya Antariksa Electronics

BRESL National Project Unit

JICA DSM Study Team

1. Purpose

The purpose of the energy labeling is to make the buyers aware of the energy efficiency level of the product so that he/she will be able to compare energy efficiency of different brands of the specified product and make accurate purchase decisions to select more energy efficient products without just take into consideration the capital cost of the product. Furthermore labeling encourages the manufacturers and importers of the products to tend towards manufacturing and trading higher energy efficiency products in the market.

2. Operation of the labeling Program

The labeling program shall be conducted by the government cooperated with the stakeholders including manufacturers and importers, laboratories, retailers and consumers. The labeling program should not be mandatory program, but voluntary program.

Note.

Mandatory program; Manufacturers and importers cannot sale products which have no energy efficiency label on the market. The labeling should be applied under relevant regulation issued by the government. Violation to the regulation must be punished.

Voluntary program; Manufacturers and importers can sale products which have no energy efficiency label on the market. When the manufacturers and importers intend to put the label on their products to sale, they have to follow the relevant regulation. Violation to the regulation must be punished as well.

3. Definitions

3.1 Label

"Label" is the energy efficiency label with maximum 4 stars rating. The design has been issued as SNI 04-6958-2003.

3.2 Products

"Products" are the designated home appliances to be applied label.

Specific definition of the product will be made in PART 2, 3 and 4 of the series document.

3.3 Manufacturers and Importers

"Manufacturers and importers" are the individuals or the organizations who manufacture, assemble the product locally or import the products from foreign countries, and supply the product to Indonesian market.

3.4 Consumers

"Consumers" are the individuals or the organizations who buy the products in the domestic market and use them for their own purpose.

3.5 Retailers

"Retailers" are the individuals or the organizations who sale the products in the domestic market to the consumers.

3.6 Label certification body

"Label certification body" is the administrative body who is an agent of the government and issue the label certificate to the manufacturers and importers. Label certification body shall be accredited by KAN/BSN and assigned by the government.

3.7 Accredited laboratory

"Accredited laboratory" is the laboratory which is accredited by KAN/BSN and assigned by the government to carry out tests for energy efficiency measurements of the products.

3.8 Equivalent laboratory

"Equivalent laboratory" is the laboratory which is not accredited by KAN/BSN, but recognized that it must have enough competency of conducting energy efficiency measurements tests. Criteria for evaluation will be specified respectively in PART 2, 3, 4 of the series document.

3rd party laboratories and manufacturer's in-house laboratories which are located in foreign countries and accredited by foreign authorities can be the candidate of "Equivalent laboratory"

3.9 Energy efficiency and Energy efficiency indicator

"Energy efficiency indicator" is the specified unit of the energy efficiency. "Energy efficiency" is the actual value of energy efficiency of the product. Actual energy efficiency indicators for the products will be specified respectively in PART 2, 3, 4 of the series document.

3.10 Designated (EE) measurement method

"Designated (EE) measurement method" is the unified testing and calculation method and condition for energy efficiency measurement of the products especially designated for the labeling program. The designated measurement method is often given by the existing industrial standards such as ISO/IEC, INS and JIS.

3.11 Star rating

"Star rating" is the common term used to express energy efficiency rating in the label given to the product based on the actual value of the energy efficiency. Star rating is indicated in the label as the number of star. Minimum star rating is 1 star, and maximum 4 stars.

3.12 Star rating criteria

"Star rating criteria" is the criteria which definite scopes of 1 star to 4 star label. Star rating criteria should be given by the level of the energy efficiency of the products. Actual star rating criteria will be shown in PART 2, 3 and 4 of the series documents.

3.13 Test and test report

"Test" is the test for energy efficiency measurement of the products conducted under the designated measurement method. "Test report" is the documentation of result of the test issued by the accredited laboratories or the equivalent laboratories.

3.14 Label certificate

"Label certificate" is the certificate issued by the label certification body to the manufacturers and importers which certify the energy efficiency, number of stars in the label, validity period, issue date and expiration date.

3.15 Technical committee

"Technical committee" is the committee formulated and commissioned by the government in order to review the labeling program and give recommendation for the improvement of the program to the government.

4. Roles

4.1 Manufacturers and importers

Application for the label certificate

- The manufacturers and importers shall submit application form for label certification to the label certification body attached with the necessary document.
- When manufacturers and importers want to use their in-house laboratory test data for the labeling, they have to submit the data to the label certification body. In that case, the laboratories shall be “Accredited laboratory” or “Equivalent laboratory”. The manufacturers and importers shall submit the relevant document which proofs it.
- The manufacturers and importers which want to leave test to the accredited laboratory shall submit samples to the accredited test laboratory together with the application. A copy of the application shall be forwarded to the label certification body. The manufacturers and importers shall bind to bear the test fee including transportation of the samples.

Affix of label

- On receiving the label certificate from the label certification body, the manufacturers and importers shall affix the label as per the given format and the dimensions stipulated in SNI 04-6958-2003 on the product or the package of the product.
- The manufacturers and importers can also mention about the label on catalogs or other information of the products.
- The manufacturers and importers shall renew the label certificate on the termination of its validity period which is mentioned on the product or the package of the product.
- Apart from the label, the manufacturers and importers shall display/mark necessary information of the product on the product and/or the package as mentioned in PART 2, 3 and 4 of the series document. (Mandatory display)

Other

- The manufacturers and importers shall not mislead the consumers by affixing similar label which is not certified by the label certification body or displaying incorrect information of the product.
- The manufacturers and importers shall make efforts to produce or import higher energy efficiency products.
- The manufacturers and importers shall make efforts to indicate the energy efficiency value of the product on catalogs, web pages, and other media.
- The manufacturers and importers are expected to disclose sales/production data of the labeled products to the government or label certification body.

4.2 Retailer

Instruction to the consumers

- The retailers are expected to deeply understand of the labeling program and accurately instruct it to the consumers.
- The retailer shall not mislead the consumers by providing inaccurate information of the energy performance of the product.

Other

- The retailer shall make efforts to sale higher energy efficiency products with the label.
- The retailers are expected to disclose sales data of the labeled products to the government or label certification body.

4.3 Label certification body

Accreditation

- The candidates of label certification body shall apply of label certification body to KAN/BSN, and shall be finally accredited.

Certification

- The label certification body shall issue certificate to the manufacturers and importers after enough evaluation of manufacturer's relevant document and accurate assessment of star rating basing on the test data and conforming to the specified star rating criteria.
- The label certification body shall issue certificate to the manufacturers and importers by 2 weeks after receiving application from them or test report from accredited laboratory.
- When the label certification body cannot issue certification, it shall inform the reason to the manufacturers and importers by 2 weeks after receiving application from them or receiving test report from accredited laboratory, and/or asking them for additional documents needed for the issue.

Monitoring and inspection

- The label certification body shall monitor the labeling program on the product in the market. When it finds any illegal labeling, it shall report the fact to the government.
- The label certification body shall submit annual report of the labeling program which mention about the manufacturer's application of label and issue of the label certification.

4.4 Accredited laboratory, Equivalent laboratory

Accreditation

- The candidates of accredited laboratory shall apply of accreditation to KAN/BSN, and shall be finally accredited.

EE measurement

- The accredited laboratory and the equivalent laboratory shall conduct tests accurately as per the designated measurement method and submit test report to the label certification body and/or the manufacturers and importers.
- The accredited laboratory and the equivalent laboratory shall maintain and calibrate the test facility and instruments required to conduct tests as per the designated measurement method. Also the test staffs shall maintain test skill in order to conduct accurate tests.
- The accredited laboratory shall conduct inspection tests as per the designated measurement method in case that the label certification body or government request.
- The accredited laboratory shall get agreement of price and duration of test with the manufacturers and importers, certification body or government, before conducting test.

Witness to the tests at manufacturer's in-house laboratory

- As the manufacturer's requests, the accredited laboratory shall dispatch qualified test staffs to manufacturer's laboratory for the witness of the tests. The witness can be recognized as the substitution of accreditation on the manufacturer's laboratory. The staffs shall submit witness report to the manufacturer's laboratory.

4.5 Government

Legislation

- The government shall issue and enforce the regulation on the labeling program. The regulation shall include the following items.

Content of the regulation

Item	Remarks
Procedure	Application, test, label certification, inspection, maintenance, data verification
Accreditation	Accreditation of laboratory and certification body
EE indicator	Definition of the EE indicator
Measurement method	Designation of the measurement method (Citation of existing standards)
Star rating criteria	Definition of the criteria If necessary, setting of MEPS (Minimum Energy Performance Standard)

Item	Remarks
Mandatory display	Display of EE data and other information
Penalty	Penalty to illegal labeling and false display or announcement
Review of the labeling program	Periodical review of the program
Fee	Application, test

Accreditation and Commission of Label Certification Body

- The government shall commission the accreditation of label certification bodies to KAN/BSN.
- The government shall commission of the label certification to the label certification bodies after their accreditation.

Formulation of the Technical committee

- The government shall formulate the Technical committee inviting members from stakeholders, and commission advisory for improvement of the labeling program.
- The government shall prepare annual report of labeling program for the discussion in the committee.
- The government shall record of the discussion in the committee.

Administration and penalty

- The government shall announce of the labeling program to the manufacturers and importers, retailers and also the consumers and make them to join to the program.
- The government shall give administrative recommendation, direction and order to the manufacturers and importers or retailers if necessary.
- The government shall put penalty to the manufacturers and importers or retailers on their contravention activities.

Monitoring and review

- The government shall conduct market survey in order to discover the market penetration of those products with high energy efficiency. The information thus collected shall be used for the review of the energy labeling program.
- The government shall review the labeling program including regulation periodically, and improve the program by revising the regulation.

4.6 Technical committee

Formation

- The members of committee shall consist of manufacturers and importers, accredited labolatory, label certification body, consumer, association government and other stakeholders.

- The chairman of the committee shall be selected among the members.

Recommendation to the government

- Technical committee shall review the labeling program and report to the government as the reccomendation.

4.7 KAN/ BSN (National Standardization Agency of Indonesia)

Accreditation of Label Certification Body

- KAN/BSN shall accredit label certification body within 3 weeks after receiving application.
- KAN/BSN shall disclose evaluation criteria for the accreditation.

Accreditation of Accredited Laboratory

- KAN/BSN shall accredit accredited laboratory 3 weeks after receiving application.
- KAN/BSN shall disclose evaluation criteria for the accreditation.

Standardization

- BSN shall issue the standard of EE measurement method which is requested by the government or industrial parties for convenient implement of the labeling program.
- The standards for EE measurement method shall be made considering of the test ability of the laboratories which are expected to be in charge of the labeling program.
- The standards for EE measurement method shall be made considering of the current international or regional movement on the standardization/harmonization.

5. Incentive and Disincentive

5.1 Incentive

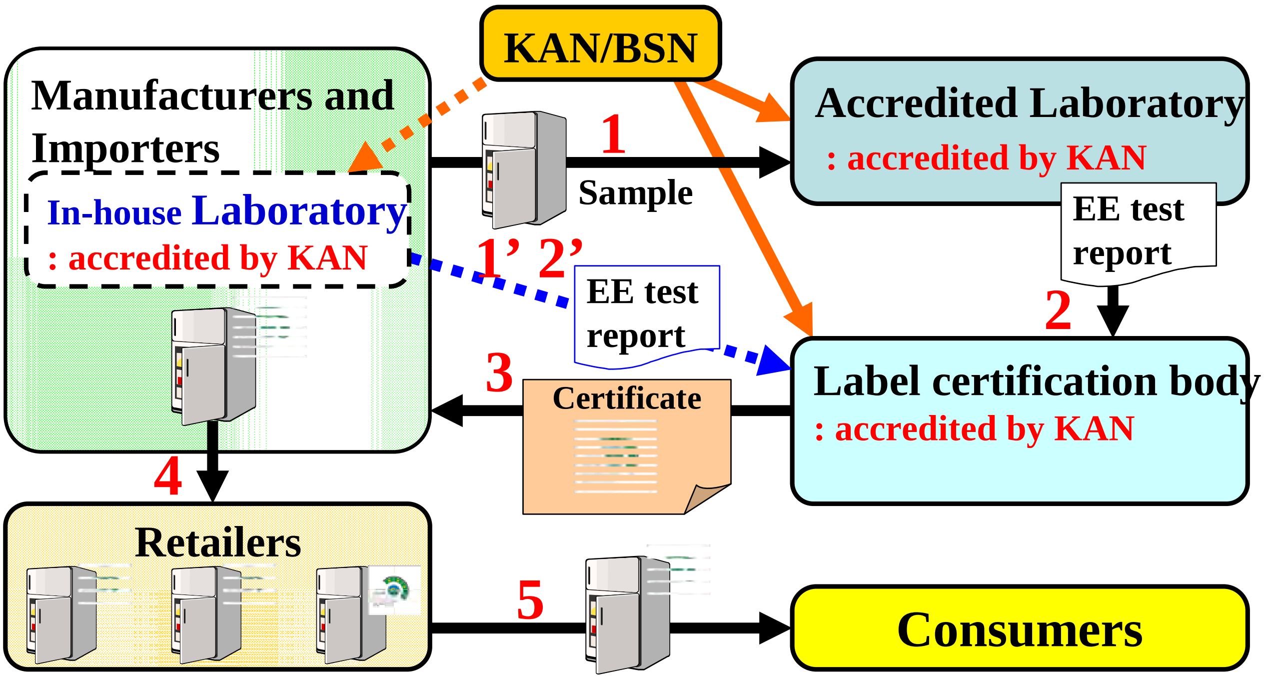
- The government shall provide incentive programs for the highly labeled product and the manufacturers and importers who deal with such products.
- Following incentive shall be provided.
    - Official announcement of highly labeled product to the consumers
    - Putting priority on highly labeled product to be adopted in official purchase

5.2 Disincentive

- The government shall provide penalty on the manufacturers and importers who deal the products attached with false labels or give wrong information to the consumers
- Following administrative action shall be provided
    - Administrative recommendation and order to the manufacturers and importers mentioned above

- Disclosure of the name of the manufacturers and importers mentioned above
- Monetary punishment on the manufacturers and importers mentioned above

Flow of the Program



Note; in case that manufacturer’s in-house laboratory is not accredited, tests under the witness of the accredited laboratory can substitute the accreditation.

Appendix 1-3

FRAMEWORK

of

ENERGY EFFICIENCY LABELING PROGRAM

PART 2: TECHNICAL PROVISION

for

REFRIGERATOR

(DRAFT) Rev. 3rd

November, 2011

Prepared by;

Technical Meeting for EE Labeling Program in Indonesia

1. Type and Scope of Products

Refrigerator referred is the refrigerator that has obtained a Certificate of safety from Indonesian National Standard (SNI) in accordance with SNI number 04-6710-2002 or its revision, with a class T tropical climate corresponding with ISO 04-15502-2008, and has a frozen food storage compartment with/ without freezing capacity.

The scope of this performance test include:

1) determination of linear dimensions, volume, and extent

2) energy consumption with load.

2. Category

Measurement methods and criteria to determine EE labeling star rating should be based on the following criteria:

Table 2-1 Refrigerator labeling Category

	Measurement method
Category	1. With freezing capacity 2. Without freezing capacity

3. Energy Efficiency Indicator

Indicator of energy efficiency is the "energy consumption in each year per adjusted inner volume". (kWh / year / liter)

4. Energy Efficiency Measurement Method

Energy Consumption

Procedures and requirements for energy consumption performance test is applicable to the refrigerator with a tropical climate (T) class according to Standard SNI 04-6710-2002 and SNI 04-6711-2001. Refrigerator's level of energy efficiency is determined based on the value of energy consumption per year (kWh / year) obtained through testing procedures (point 5.2). The energy consumption per year is calculated by multiplying the 24 hours kWh by 365 days.

For test and procedures for refrigerator's energy consumption, refer to Appendix 1.

Adjusted inner volume

Adjusted inner volume is an inner volume inside the refrigerator. Measurement method of the inner volume inside must be in line with ISO 04-6711 (2002) and in accordance with clause 5.

5. Criteria of Energy Efficiency Rating

Criteria of energy efficiency rating is based on electric power output that is utilized by consumers compared to the consumed electric power input, or the use of electric power for a certain period. Refrigerator's Energy Efficiency Rating Criteria is determined based on the value of energy consumption per year (kWh / year)

Determining energy efficiency stars is distinguished between refrigerator with and without a freezer, using the following formula:

5.2.1. Without a freezer

Star rate	Formula
1 Star	$\leq$ 465 + 1.378 x V_{adj} x 1.15
2 Star	$\leq$ 1 Star x 0.77
3 Star	$\leq$ 2 Star x 0.77
4 Star	$\leq$ 3 Star x 0.77

5.2.2. With a freezer

Star rate	Formula
1 Star	$\leq$ 465 + 1.378 x V_{adj} x 1.55
2 Star	$\leq$ 1 Star x 0.77
3 Star	$\leq$ 2 Star x 0.77
4 Star	$\leq$ 3 Star x 0.77

Testing the air conditioning devices performance should refer to SNI-ISO 04-15502-2008 or IEC 62552-2007. Energy efficiency rating criteria serves as base to determine the number of stars that should be included in the label.

Formula to determine the energy efficiency star rate:

Adjusted Volume (V_{adj}),

$$V_{\mathrm{adj}} = \Sigma V_{\mathrm{i}} \cdot \Omega$$

- V_i = storage volume in each compartment
- Ω = Load factor:

$$\Omega = \frac{T_a - T_i}{T_a - T_r}$$

- T_a = T class ambience temperature (32 °C based on SNI/ ISO 15502).
- T_i = Rated temperature in each tested compartment
- T_r = Rated temperature in fresh food compartment (5°C).

6. Data verification

6.1 Test Laboratory

Data for affixing energy efficiency labels must be obtained from an accredited/ equivalent laboratory. Certification of the government, third party and manufacturer's laboratories is carried by KAN (ISO 17025) with a competence test to meet SNI 04-6710 (2002) and ISO 04-6711 (2002) standards.

The third party or manufacturer's owned laboratory located overseas must meet ISO 5151 competency standards and certified by JRAIA (Japan Refrigeration and Air Conditioning Industry Association) or in accordance with ISO 17025 and certified by the competent authorities of the concerned country.

Competency and certification test that must be performed by a laboratory test in Indonesia and overseas are as follows:

Table 6.1-1 Test Laboratory Qualification in Indonesia

Laboratory	Competency test	Certification
Government	SNI 04-6710 (2002), SNI 04-6711 (2002)	ISO 17025 issued by KAN
Third party	SNI 04-6710 (2002), SNI 04-6711 (2002)	ISO 17025 issued by KAN
Manufacturer	SNI 04-6710 (2002), SNI 04-6711 (2002)	ISO 17025 issued by KAN

Table 6.1-2 Test Laboratory Qualification in Overseas

Laboratory	Competency test	Certification
Third party	IEC 62552 (2007)/ISO 15502 (2005)	ISO 17025 from competent authorities of the concerned country.
Manufacturer	IEC 62552 (2007)/ISO 15502 (2005)	ISO 17025 from competent authorities of the concerned country.
Countries: Japan , Korea, China, Thailand, Malaysia, India, US, and Canada		

6.2 Witness in Manufacturer's Laboratory

Testing performed in manufacturer's laboratories witnessed by the staff of laboratory that have been accredited, can replace the manufacturer's laboratory accreditation process. The presence of witnesses required for each type and model of the product. In cases where asesment of accredited laboratory recognize manufacturer's validity in measurement of energy efficiency, then the existence of witnesses for each type and model of the product can be replaced with an annual inspection. The annual inspection should include the testimony of actual product testing.

6.3 Testing Procedure

Testing procedures carried out as follows:

1) Verify that sample matches the specifications of the submission sheet
2) Take over the sample and sign the submission sheet
3) The samples are labeled that is filled according to the current condition of the sample
4) Tested samples are stored in sample storage area
5) Samples are stored until the complaint period validity is completed. Period of validity expires 3 months after test results submitted to the producers.

6.3 Validity Period of the Data

Test results data are valid for products sold in the markets of Indonesia. This does not include products sold in secondhand goods shops.

6.4 Inspection Test (Sample Test in the Market)

The government shall conduct inspection tests in order to maintain validity of the data displayed on the products and/or catalogs. Following method can be applied.

- Government conducts testing on government-owned test laboratory or accredited third party laboratory or laboratory that has equivalent qualifications.
- The governments testify to the tests performed in laboratories owned by manufacturers. Producers or manufacturers must invite a government witness, 3 times in one year.

Note:

"Third party laboratory" is a laboratory that has no business relationship with manufacturers whose products will be tested. The laboratory (local/oversea) must have the ability/ certification as described above.

6.5 Tolerance of EE Data

Energy efficiency data reported by the manufacturer at the time of applying for energy efficiency labels, or data displayed on products, packaging, and catalogs need to receive tolerance from the test data resulted from accredited test laboratory or data from the test testimony performed at manufacturer's owned laboratory, as tolerance value below:

Table 6.6-1 Tolerance data of energy efficiency test

Item	Test data	
	Label certification	Sample test in the market
Adjusted Inner Volume (Litter)	95%-105% x Declared data	95%-105% x Declared data
Maximum Power (kW)	110% x Declared data	110% x Declared data
Annual Power Consumption (kWh/year)	90% x Declared data	90% x Declared data

6.6 Test Reports

The entire test results must be stored and documented as Assessment Report, which contains refrigerator type, measurement data; ambience temperature, freezer temperature, fresh food compartment, cellar compartment temperature, power voltage, electricity consumption, performance cycle (24 hours on-off percentage). Copies of reports should be stored in a test laboratory as a reference.

7. Label Affixing Rules

7.1 Label Design

Basically, energy efficiency labels must comply with SNI 04-6958-2003 sized 80 square mm. With addition of some details as below:

- Model Number.
- Name of manufacturer
- Adjusted inner volume (Litter)
- Annual electricity consumption (kWh/year)
- Input power (W)

Energy efficiency label design for refrigerators products in Figure 7.1-1 below:

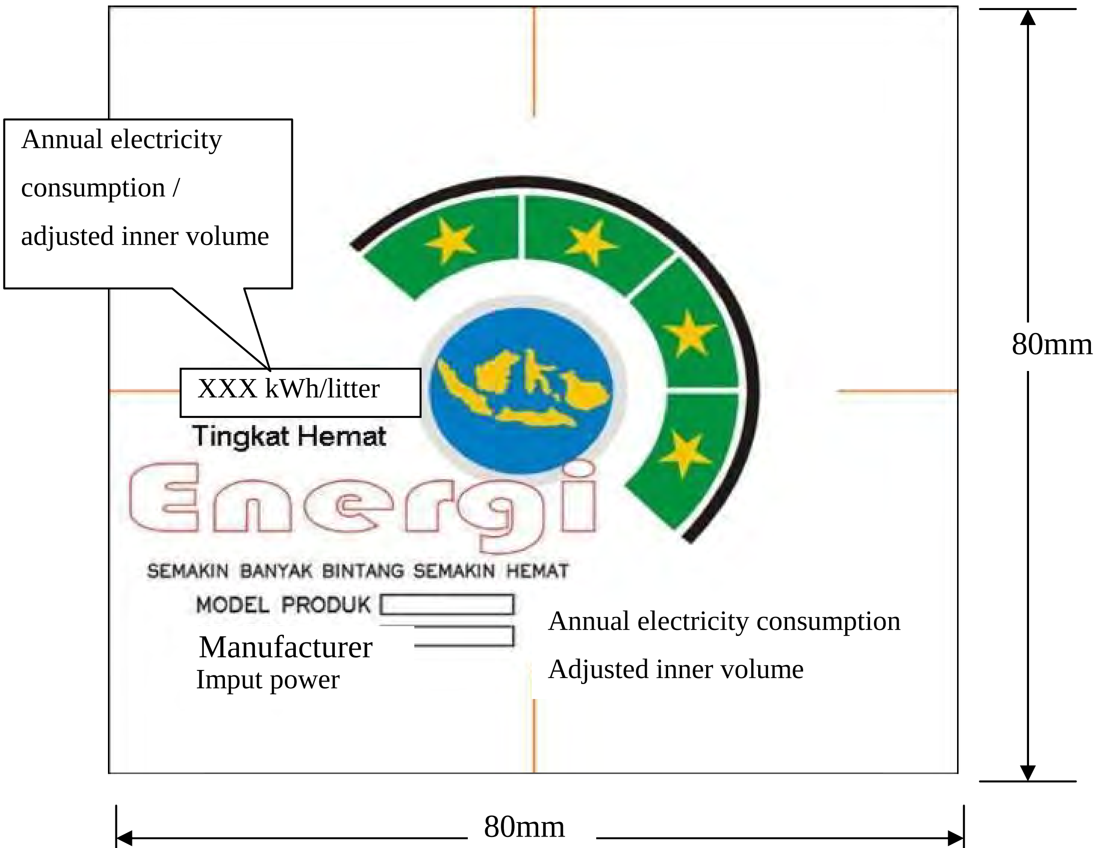


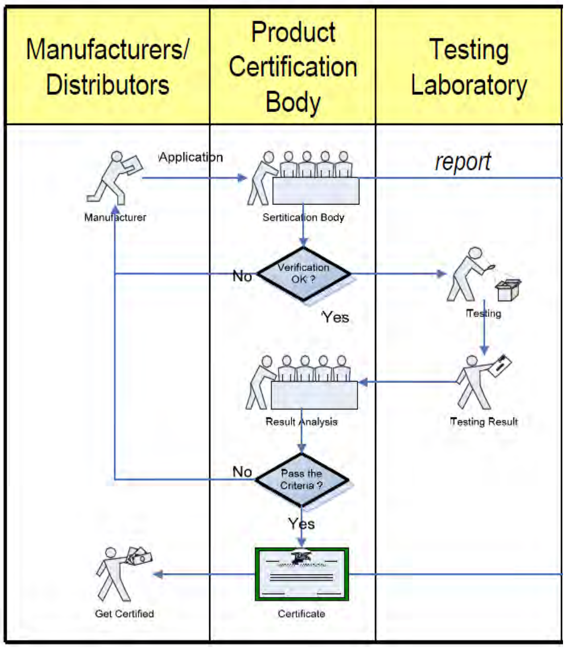
Figure 8.1-1 Design of label for refrigerator

7.2 Location

Labels must be placed on the front surface of refrigerator door, can also be displayed on the packaging, catalogs, web site pages, and other media without any size restriction.

7.3 Energy saving labeling Chart flow

Basically the chart flow of energy saving labeling on refrigerator products is as follows:



Explanation :

Request to affix labels on energy saving products started by Manufacturer or distributor. At the time of application, energy-efficient data is included as one of the requirements in the process. Energy saving tests performed in laboratory (described in point 6.1). For test report preparation refers to the explanation in points 7.3 and 7.4. The report is the basis of affixing energy efficient labels on refrigerators products.

8. Product Information

Besides EE labeling mentioned above, product information as listed below should be stated on the product, operation/maintenance document, catalogues, webpages, etc.

- Manufacturer's name / brand
- Model / type
- Batch Number
- Outside dimension
- *Gross Volume*
- Voltage
- Power
- Electricity flow
- Total *Gross Volume*
- Annual energy consumption
- Performance Frequency
- Refrigerant type

APPENDIX 1; Condition of Test and Calculation

1. Condition

a. Testing Voltage is product's voltage with a tolerance of ± 1%

b. Air conditioned room temperature is at 32 ± 1 degrees Celsius and relative humidity between 45% and 75%.

c. The voltage frequency at the time of testing is 50 Hzd. Retrieval of measurement data is made when the conditions in the air conditioned room has been met and the temperature in each compartment of the refrigerator in a stable state:

2. Testing

2.1 Tests to determine linear dimensions and volume (see ISO 04-6710:2002 point 7.1 and 7.2)

2.2 Energy consumption test with/ without load (see SNI 04-6710:2002 point 15)

2.3 Temperature rise test (see SNI 04-6710:2002 point 16)

3. Necessary instrument:

3.1 Use temperature measuring instrument with an accuracy of ± 0.3 K.

Temperature should be measured by temperature measurer. The measured temperature should be noted or recorded.

3.2 Use the relative humidity measuring device which has an accuracy of ± 3%.

3.3 Use a kWh meter that reads to 0.01 kWh and its accuracy is ± 1%.

3.4 Use a Watt meter that reads up to 0.1 W and accuracy of ± 1%.

4. Preparation

4.1 Create a partition (as shown in Figure 1) following these steps:

Refer to the ISO, including the drawing. Prepare a wooden platform with top solid on the floor of the test chamber, measuring of 300 mm, and extended at least 300 mm, not more than 600 mm over all sides of equipment, except on the back that extends toward the vertical partition.

a) The bottom of the wooden platform should be open for air circulation.

b) Paint the top of the wooden platform with dark black color.

c) Prepare 3 vertical partitions which size is adjusted to dimensions of the refrigerator to be tested and then paint it black.

d) Put one of the partitions parallel to the back of the refrigerator to be tested, opposing to stops or a distance specified by the manufacturer in relation to the whole room.

e) Put the two other partitions parallel to the side of the refrigerator to be tested and built on the platform measuring 300 mm from the side of the refrigerator; with 300 mm width.

f) The three vertical partitions made without connection, the height should be t stand out at least 300 mm above the top of the refrigerator to be tested.

g) Place the refrigerator to be tested in a partition that has been made in the air conditioned space

4.2 Prepare the necessary equipment to measure the use of current, power and energy of the refrigerators.

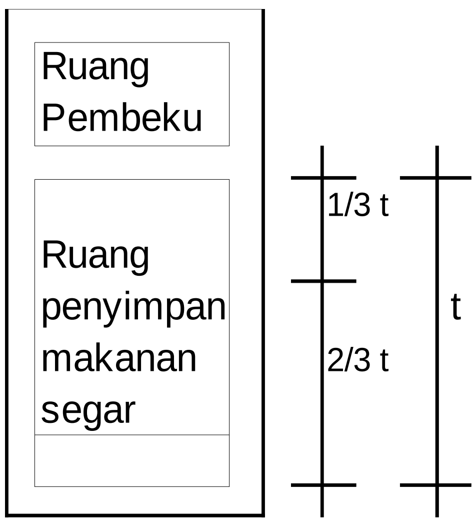
5. Measurement of Energy Consumption

5.1 Place the refrigerator to be tested between the partitions referring to Figure 1. Follow the ISO, including the drawing.

5.2 Place the temperature sensor at the measurement points on each refrigerator; in the frozen food (tf) and the fresh food (tm) compartments. Where to mount the temperature sensor in each refrigerator compartment is shown in Figure 2, Figure 3 and Figure 4.

5.3 Attach the ambient temperature sensor around the refrigerator, at two points (TA1 and TA2) at a distance of 350 mm from the vertical center line of the side wall, 1 m above the floor line (testing equipment configuration for refrigerators can be seen in Figure 5).

5.4 Make sure the thermometer (tm) placement is at 1 / 3 t of the bottom freezer, t is the distance to the bottom of the freezer compartment of refrigerator. For fresh food storage compartment, refrigerator Thermostat is set at a temperature of 5 ° C. Make sure the placement of thermometers (tf) is in the middle of frozen food storage compartment. Temperature is set depends on the type of frozen food storage compartment. (picture attached)



5.5 Connect the refrigerator to the power source.

5.6 Check and make sure the measurement data parameter is read properly.

5.7 Set the ambient temperature at a temperature of +32 °C for refrigerators class T. Temperature used to determine energy consumption must be within ± 1 °C.

5.8 Set the relative humidity between 45% and 75%

5.9 Measuring equipment should be adjusted to record data simultaneously and concurrently.

5.10 Ensure that the relative humidity between 45% and 75% air conditioned room has been

5.11 Measure / record temperature measurements at each of the refrigerator is in the frozen food (tf) and the fresh food space (tm), every 1 minute during the test period. Testing period performed at least for 24 hours after steady state is achieved.

5.12 Measure / record the ambient temperature around the refrigerator (TA1 and TA2) every 1 minute during the test period. Testing period performed at least for 24 hours after steady state is achieved.

5.13 Measure the power during the time of or during the steady state is achieved.

5.14 records the energy consumption during the test period. Period of test should last at least 24 hours after steady state is achieved.

5.15 Perform recorded data analysis to find energy consumption in 24 hours of (kWh). Energy consumption is calculated based on the amount of energy in a day (kWh/24 hours).

Appendix 1-4

FRAMEWORK
ENERGY EFFICIENCY LABELING PROGRAM
PART 3: TECHNICAL PROVISION
for
AC (Air Conditioner)
(DRAFT) Rev. 3rd

November, 2011

Prepared by;

Technical Meeting for EE Labeling Program in Indonesia

1. Scope and Product Type

The scope of the air conditioners without channel is a sealed unit that is designed, to be mounted on a window, or on a wall, or as a console that is designed primarily to deliver conditioned air freely into an enclosed room or rooms (air conditioned space), and includes in which the main source of refrigeration for cooling and humidity reducing. Type and scope of products, as in the table below:

Table 1-1 Type and scope of AC labeling product

Type	Cooling capacity
Split, Wall Mounted type	Max. 27,000BTU/h (7,913kW)

2. Category

Star rating criteria and measurement methods should be based on the following categories:

Table 2-1 Category of labeling on AC

	Measurement Methods	Star rating criteria
Category	1. Non-inverter type 2. Inverter type	1. Non-inverter type 2. Inverter type

3. Energy efficiency indicator

Indicator of energy efficiency is determined by the COP (Coefficient of Performance). COP is a result of dividing the cooling capacity with air conditioner's power consumption. Measurements on both types of air-conditioners are:

a. Non-inverter type: Measuring at full load, and the indicators used are full-load COP

b. Inverter Type: Measuring at full load and at half load. The indicator used is COP weighted, with the formula:

   COP weighted = 0.4 x COP (100% load) + 0.6 x COP (50% load)

4. Measurement Method Reference

Measurement method of energy efficiency indicators for air conditioner should be conducted in accordance to the following table:

Table 4-1 Measurement Method Reference for AC

No.	Category/ Type	Measurement Method Reference
1	Non-Inverter Type	SNI 19-6713-2002 as the adoption of ISO 5151 for full load cooling capacity
2	Inverter Type	ISO 5151 for full load cooling capacity. Test at 50% load to be carried out, paying attention to rotation of the compressor and maintain cooling at 50% load.

5. Energy Efficiency Rating Criteria

Energy efficiency rating criteria is based on the value of Coefficient of Performance (COP). COP is a result of dividing cooling capacity with AC power consumption. COP measurements are:

a. Non-inverter type: Measuring at full load, and the indicator used is full-load COP.

b. Inverter Type: Measuring at full load and at half load. The indicator used is COP loading, with the formula:

COP weighted = 0.4 x COP (100% load) + 0.6 x COP (50% load)

50% load is determined based on the AC condition while producing a minimum of 95% from 50% listed nominal capacity.

Criteria to determine the energy-saving rate is taken from the COP test results as in the following table:

Table 5-1 Energy efficiency rating criteria

Type	*	**	***	****
Inverter (COP $_{weighted}$)	2,64 ≤ COP < 2.92	2.92 ≤ COP < 3.34	3.34 ≤ COP < 3.76	3.76 ≤ COP
Non-inverter	2,50 ≤ COP < 2,64	2,64 ≤ COP < 2.92	2.92 ≤ COP < 3,05	3,05 ≤ COP

EER in accordance with the catalog and star rating as shown below:

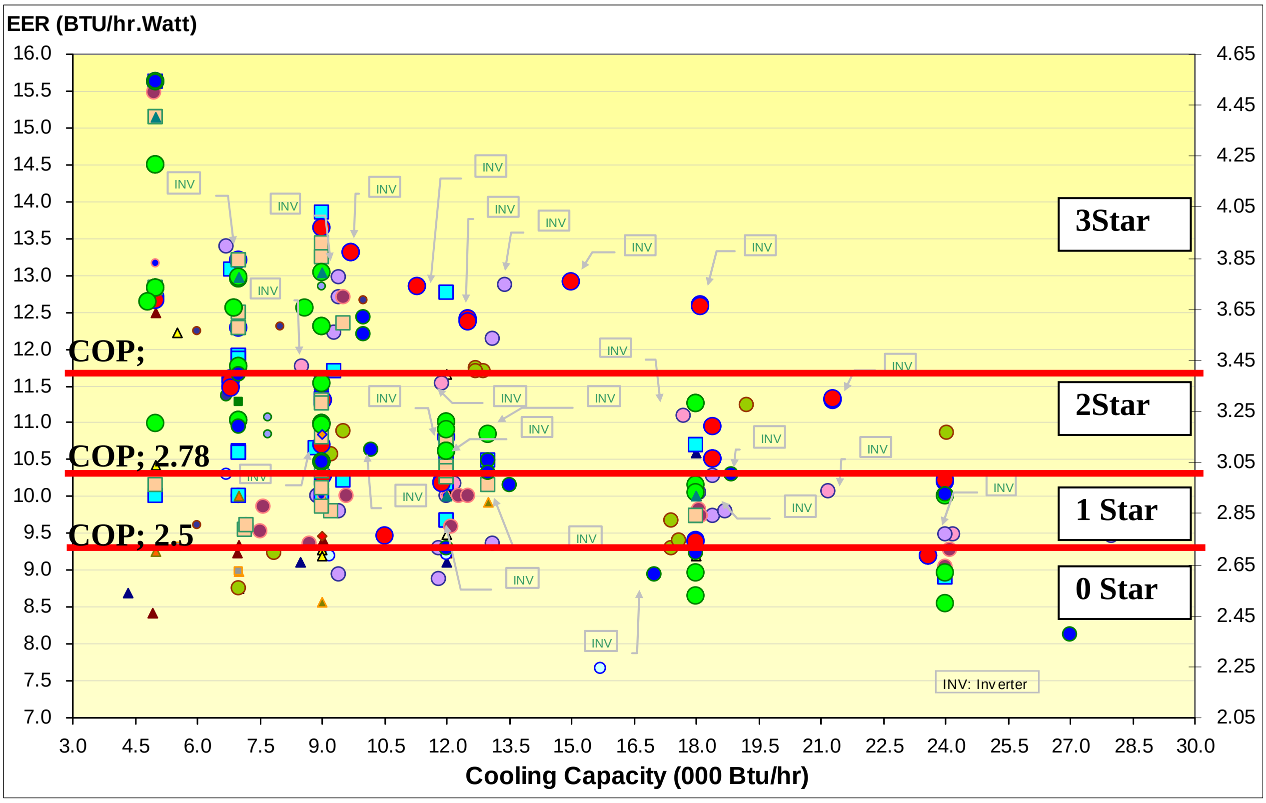


Figure 5-1 Non inverter AC Star Rating

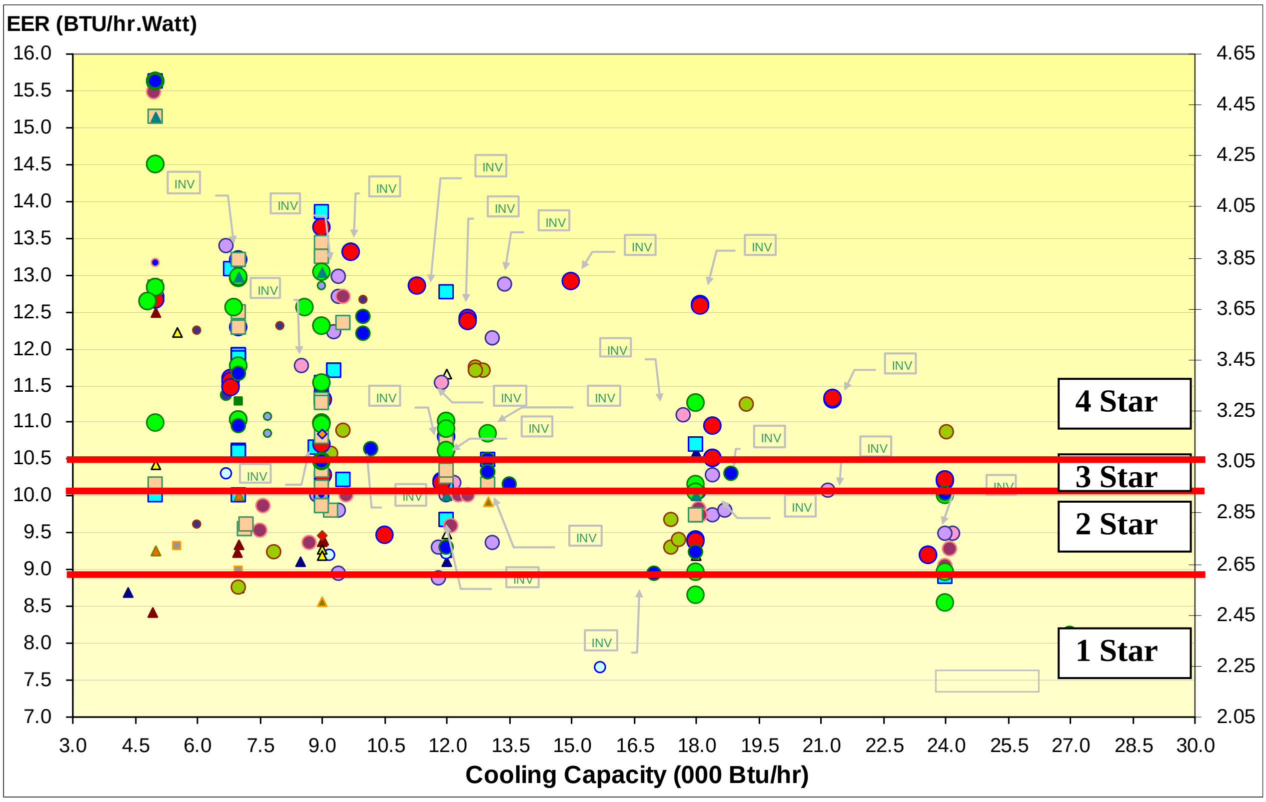


Figure 5-2 AC inverter star rating (based on COP)

6. Data Verification

6.1 Laboratory test

To affix energy-efficiency label, data must be obtained from an accredited/ equivalent laboratory. Government laboratories and third-party manufacturers can be an accredited/ equivalent laboratory. Certification of government and third-party manufacturers laboratory is carried by KAN (ISO 17025) or Japan Refrigeration and Air Conditioning Industry Association or by CSA (Canada Standards Association), with a test of competence to meet standard of SNI 19-6713 - 2002 or ISO 5151.

Laboratory owned by a third party or manufacturer located outside Indonesia must meet the ISO 5151 standards and certified by JRAIA (Japan Refrigeration and Air Conditioning Industry Association) or according to ISO 17025 and certified by the competent authorities in the concerned country.

Competency test and certification that must be performed by a laboratory test in Indonesia are as follows:

Table 6.1-1 Testing Laboratory Qualification (Indonesia)

Laboratory	Competency test	Certificate
Government	ISO 5151	ISO 17025 published by KAN, or certificate issued by JRAIA, CSA
Third party		
Manufacturer		
Note: JRAIA: the Japan Refrigeration and Air Conditioning Industry Association CSA: Canada Standard Association		

For overseas laboratories, competency testing and certification that must be done:

Table 6.1-2 Testing Laboratory Qualification (Oversea)

Laboratory	Competency test	Certificate
Third party	ISO 5151	ISO 17025 issued by authorities in concerned countries (refer to note), or certification issued by JRAIA, CSA
Manufacturer		
Note: Japan, Korea, China, Thailand, Malaysia, India, US and Canada		

6.2 Witness Test at Manufacturer's Laboratory

Tests conducted in the manufacturer laboratory and witnessed by an accredited laboratory staff, can replace manufacturers laboratory accreditation mentioned in point 6.1. The presence of witnesses required for each type and model of the product. In cases where asesment of accredited laboratory recognize manufacturer`s validity in measurement of energy efficiency testing, then the existence of witnesses for each type and model of the product can be replaced with an annual inspection. The annual inspection should include the testimony of the actual product testing.

6.3 The validity of test results

Test results data are valid for products sold in the markets of Indonesia. This does not include products sold in secondhand goods shops.

6.4 Inspection test (Sample Test in the Market)

The government shall conduct inspection tests in order to maintain validity of the data displayed on the products and/or catalogs. Following method can be applied.

- Government conducts testing on government-owned test laboratory or accredited third party laboratory or laboratory that has equivalent qualifications.
- The governments testify to the tests performed in laboratories owned by manufacturers. Producers or manufacturers must invite a government witness, 3 times in one year. Note:

“Third party laboratory” is a laboratory that has no business relationship with manufacturers whose products will be tested. The laboratory (local/oversea) must have the ability/ certification as described above.

6.5 Tolerance data of energy efficiency test

Energy-efficiency data reported by the manufacturer at the time of applying for energy-saving labels, or data displayed on products, packaging, and catalogs need to receive tolerance from the test data resulted from accredited test laboratory or data from the test testimony performed at manufacturer’s owned laboratory, as tolerance value below:

Table 6.5-1 Tolerance data of energy efficiency test

Item	Test Data	
	Label certification	Sample test in the market
Minimum Cooling Capacity (kW)	95% x Declared data	90% x Declared data
Maximum Power (kW)	110% x Declared data	110% x Declared data
Minimum COP listed value	90% x Declared data	90% x Declared data
Weighted COP value/ minimum (EER)	90% x Declared data	90% x Declared data

6.6 Test Reports

The entire test results must be stored and documented as Assessment Report, which contains the results of measurement data, performance characteristics and other details including necessary retest reports. Copies of reports should be stored in a test laboratory as a reference. Test report format enclosed in Appendix-1.

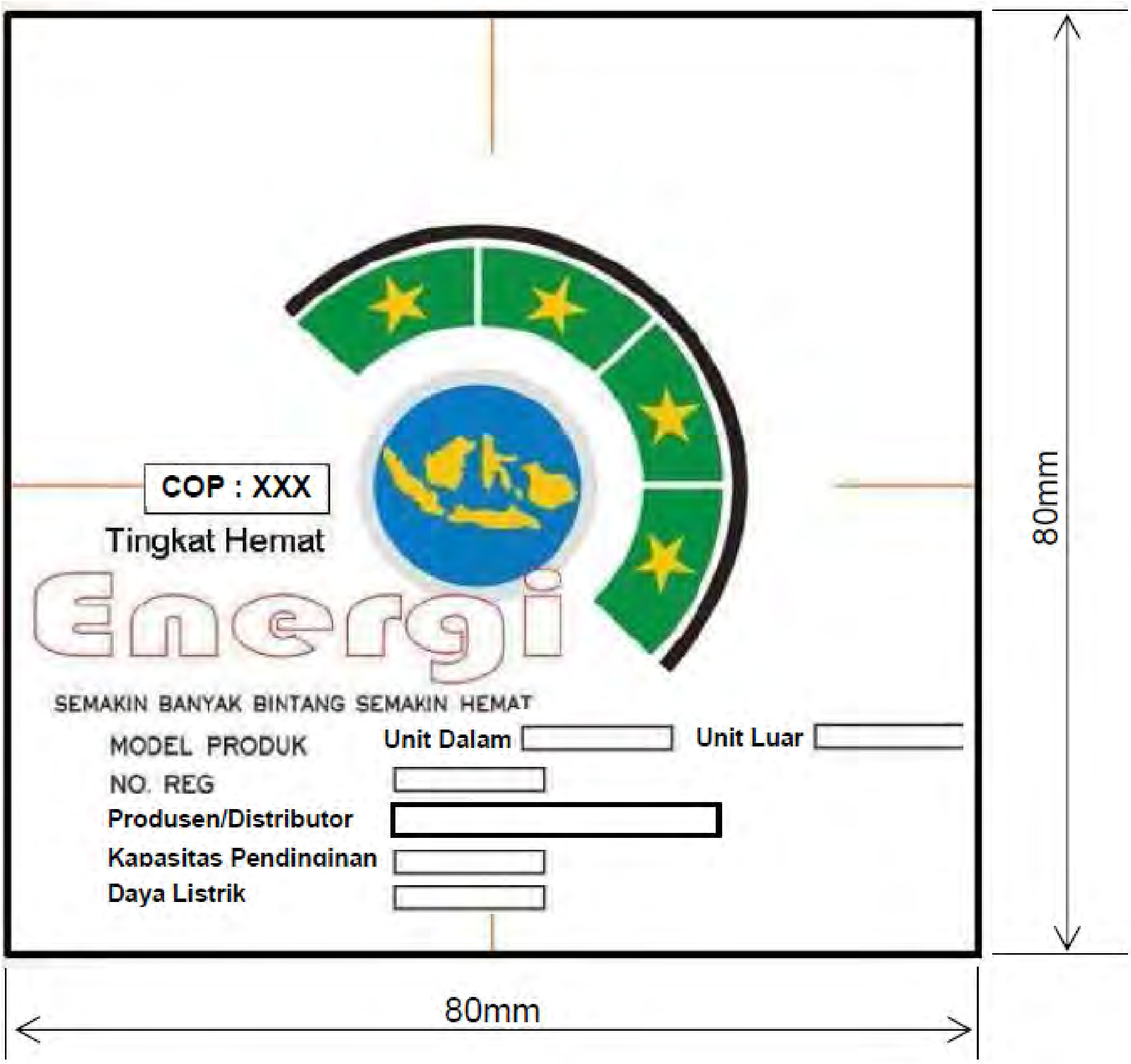
7. Label Affixing Rule

7.1 Label Design

Basically, energy-saving labels must comply with SNI 04-6958-2003 with the addition of some details as below:

- COP
- Product Model, either indoor/ outdoor model unit
- Register Number
- Name of Manufacturer or Distributor
- Cooling Capacity (kW)
- Power (kW)

Energy-efficiency label design for air conditioning products in Figure 7.1-1 below:



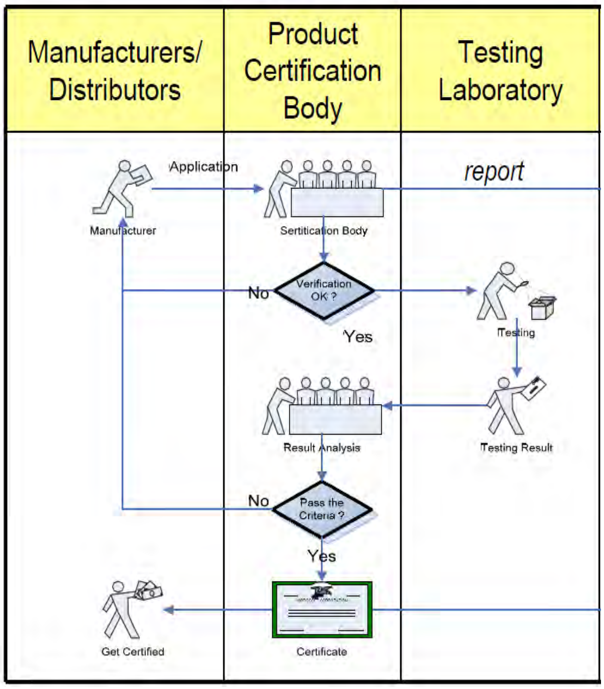
Picture 7.1-1 AC design label

7.2 Placement of Energy-efficient label

Labels must be placed on the front surface of indoor unit, can also be displayed on the outdoor unit, packaging, catalogs, web site pages, and other media without any restriction in size.

7.3 Energy saving labeling Chart flow

Basically the chart flow of energy saving labeling on air conditioning products is as follows:



Explanation:

Request to affix labels on energy saving products started by Manufacturer or distributor. At the time of application, energy-efficiency data is included as one of the requirements in the process. Energy saving tests performed in laboratory (described in point 6.1). For test report preparation refers to the explanation in points 7.3 and 7.4. The report is the basis of affixing energy efficiency labels on air conditioner products.

Attachment-1

a. Test report: Calorimeter method

TEST REPORT of AIR-CONDITIONER
(CALORIMETER METHOD)

Air-Conditioner test report:

Report code:

Part 1: Test Laboratory

1) Date of test (day/month/year)	
2) Name of Laboratory	
3) Location of test Laboratory	
4) Name of Tester	
5) Head of Laboratory	

Part 2: Product Specification

1) Brand		
2) Indoor unit model		
3) Outdoor unit model		
4) Country of origin		
5) Refrigerant		
6) Refrigerant load (kg)		
7) Volt (V)		
8) Frequency (Hz)		
9) Electricity (A)		
10) Inside Unit weight / Unit Luar (kg)		
11) Dimension of (inside) Unit (h x w x d) (mm)		
12) Dimension of (outside) Unit (h x w x d) (mm)		
13) Cooling capacity (W)		
14) Power (W)		

Part 3: Cooling capacity test

1) Test Standard	
2) Test Method	Calorimeter

	100% load	50% load[1]
3) Volt (V)		
4) Frequency (Hz)		
5) Electric flow (A)		
6) Time of test (hr)		
7) Total cooling capacity (W)		
8) Sensible cooling capacity (W)		
9) Latent cooling capacity(W)		
10) Total power (W)		
11) COP - Coefficient of Performance (W/W)		
12) Barometric pressure (kPa)		
13) Inside Unit: Fan felocity (s) (RPM)		
14) Inside Unit: Airflow velocity (m^3/s of standard air)		
15) External Resistance of airflow in Inside Unit (Pa)		
16) Airflow Volume that goes through measuring nozzle (m^3/s)		
17) Static air pressure difference that separates calorimeter compartment (Pa)		
18) Temperature of Dry and wet ball (º C) (The compartment inside calorimeter)		
19) Temperature of Dry and wet ball (º C) (The compartment outside calorimeter)		
20) The average air temperature outside the calorimeter (º C)		
21) The amount of water that evaporates in Humidifier (kg)		
22) Cooling water flow rate that go through Outside compartment of coil heat-rejection (P/s)		
23) Cold water flow temperature rate that go through Outside compartment of coil heat-rejection (P/s)		
24) Cold water flow temperature rate that go through outside of Outside compartment of coil heat-rejection (P/s)		
25) Mass of condensed water from product (kg)		
26) Condensed water temperature (ºC)		

[1] Inverter type AC only

Part 4: Sign

- Name and signature of tester in charge of testing

- Date :

Attachment A – Photo

• Color photos that show the inside and outside units of tested products
• Color photos that show the number of connectors on the outside unit
• Color photo of the product nameplate

Attachment B – Schema

The schematic image that clearly shows the of the main components of the product

Attachment C – Component list

Technical specifications and product’s main components list

b. Test Report for Air-Enthalpy Method

TEST REPORT FOR AIR-CONDITIONER
(AIR-ENTHALPY METHOD)

Test Report of Air-Conditioner Model :

No. Report:

Part 1: Laboratory Test

1) Date of test (day/month/year)	
2) Name of Laboratory	
3) Location of test Laboratory	
4) Name of Tester	
5) Head of Laboratory	

Part 2: Product Specification

1) Brand		
2) Indoor unit model		
3) Outdoor unit model		
4) Country of origin		
5) Refrigerant		
6) Refrigerant load (kg)		
7) Volt (V)		
8) Frequency (Hz)		
9) Electricity (A)		
10) Inside Unit weight / Unit Luar (kg)		
11) Dimension of (inside) Unit (h x w x d) (mm)		
12) Dimension of (outside) Unit (h x w x d) (mm)		
13) Cooling capacity (W)		
14) Power (W)		

Part 3: Cooling Capacity test

a) Standard Test	
b) Method Test	Air enthalpy

	100% load	50% load[1]
3) Volt (V)		
4) Frequency (Hz)		
5) Total Ampere (A)		
6) Time of test (hr)		
7) Total cooling capacity (W)		
8) Sensible cooling capacity (W)		
9) Latent cooling capacity(W)		
10) Total power (W)		
11) COP - Coefficient of Performance (W/W)		
12) Barometric pressure (kPa)		
13) Inside Unit: Fan velocity (s) (RPM)		
14) Inside Unit: Airflow velocity (m^3/s of standard air)		
15) External Resistance of airflow in Inside Unit (Pa)		
16) Airflow Volume and all measurement related to calculation (m^3/s)		
18) Temperature of dry ball air that goes to inside Unit (ºC)		
19) Temperature of wet ball air that goes to inside Unit (ºC)		
20) Temperature of dry ball air that goes outside inside Unit (ºC)		
21) Temperature of wet ball air that goes outside inside Unit (ºC)		
22) Temperature of dry ball wet ball of outside Unit (ºC)		

[1] Only for Inverter type AC

Part 4: Sign

- Name and signature of tester in charge of testing
- Date :

Attachment A – Photo

- Color photos that show the inside and outside units of tested products
- Color photos that show the number of connectors on the outside unit
- Color photo of the product nameplate

Attachment B – Schema

The schematic image that clearly shows the of the main components of the product

Attachment C – Component list

Technical specifications and product`s main components list

Appendix 1-5

PROCEDURE and REQUIREMENTS
of
PERFORMANCE TEST on TV (Television)
for
THE PURPOSE of ENERGY SAVING LEVEL LABELLING

Result of 3rd WG of TV on 26 October 2011

(DRAFT)

November, 2011

Prepared by;

Technical Meeting for EE Labeling Program in Indonesia

Department of energy mineral resources of the republic of Indonesia directorate general of electricity and energy utilization Jakarta, 2011

1. Scope

Procedures and requirements of performance test of this energy consumption for household television use electrical energy.

The scope of this performance test includes:

- Determining the size of the screen linear dimensions
- Energy consumption during operation
- Energy consumption during stand-by

2. Objective

The purpose of procedures and requirements performance test of this energy consumption is to determine the level of energy efficiency of the television according test conditions established, for the purpose of affixing labels energy-efficient level of SNI 04-6958-2003.

3. Reference

This procedure refers to:

- IEC 62301 (2006)
- IEC 62087 (2008)
- JIS C 6101 → check the JIS version
- SNI 04-6253-2003 (Safety Audio Video)
- SNI 04-6958-2003

4. Definition

a) Product

The product is limited to a TV set LCD TV (Liquid Crystal Display TVs), plasma TVs, and TVs LED (Light Emitting Diodes TV) that use an AC power source voltage with a frequency of 50Hz and 220V

b) Manufacturer (manufacturing)

Manufacturing is the industry producing the product

c) Importer

Importers are the people who import goods and then sell it in Indonesia.

d) Retailers

Retailers are the people who sell goods to consumers directly.

e) Energy label

Energy label is an indication of energy efficiency performance presented / displayed on products made by manufacturers or importers.

f) Energy efficiency performance

Energy efficiency performance is the level of electricity consumption of a unit kWh / year.

g) Test laboratory

Test Laboratory should demonstrate measurement of energy performance and data submitted refers to the label certification based on established methods and procedures. Laboratory tests must be accredited by KAN.

5. Methods of measuring energy efficiency performance

5.1 Determination of energy consumption efficiency

Efficiency of energy consumption expressed in the value of kWh / year, calculated by the formula:

$$E = \frac{(P_o - \frac{PA}{4}) \text{ x } t1 + Ps \text{ x } t2}{1000}$$

In this formula, E, Po, Ps, PA, t1, t2 are representing:
E: Annual energy consumption [kWh / yr]
Po: Operational Power [W]
Ps: Power on standby [W]
PA: The reduction in power consumption due to energy-saving function [W]
t1: annual operating standard time [hours] 2920 (365 days × 8 hours)
t2: annual standby condition standard time [hours] 5840 (365 days × 16 hours)

5.2 Amount of test sample

It takes two sample tests. The result of measurements taken from the lower value.

5.3 Measurement Method

5.3.1 Power Operations

5.3.1.1 Static Power Operations; Po (W)

Operational power is the average electrical power consumed by TV while producing flat level white signal (Pw) and the TV power consumption when producing flat level black signal (Pb). For LCD TVs, Plasma TVs, LED TVs, the average value calculated beside the power consumption on the two conditions, plus the power consumed by TV when producing color line signal (Pc) and the three colors lines signal (Pt). All measurements were conducted during the energy saving function is not active. So that the operational power to the TV can be calculated by the following formula:

LCD TVs, Plasma TVs, and LED TVs :
$$P_O = \frac{\frac{P_w + P_b}{2} + P_c + P_t}{3}$$

5.3.1.2 Operational Dynamic Power; Po (W)

Measurements using a dynamic broadcast video signal content.

Full duration of "The dynamic broadcast-content video signal" signal is used to measure TV power consumption when the television is used to view the content of broadcast TV. The measurement results must average power consumed for ten minutes in a row.

"The dynamic broadcast-content video signal" should be used to produce stability and measurement and shall be produced from one source of video content available from the IEC in a compatible format with the set input being tested.

(see IEC 62087:2008 content DVD 50 through IEC 62087:2008 Video content BD) video signal with a duration of ten minutes.

5.3.2 Power on standby; Ps (W)

Power on standby mode is the average power consumed when the TV is turned off from the main button (PS1) and the power consumed when switched off using the remote control on the main key condition is still on. If the TV can only be turned off / turned on by using one way, then the standby power used the power consumed when the button is turned off

$$P_S = \frac{P_{S1} + P_{S2}}{2}$$

5.3.3 Decrease in power consumption for energy efficiency function; PA (W)

Decrease in power consumption due to energy saving function is taken from a larger value between the PA1 or PA2, when the video signal at signal color line.

(a) PA1: reduced power consumption automatically due to adjustment of lighting levels in the vicinity (called "automatic adjustment of brightness function") (W).

PA1 is the difference between the power consumption when vicinity lighting level is equal to 0 lx (PA1Min) with the smallest power consumption when the vicinity lighting level is bigger or equal to 300 lx and energy saving function is turned off (PA1Max).

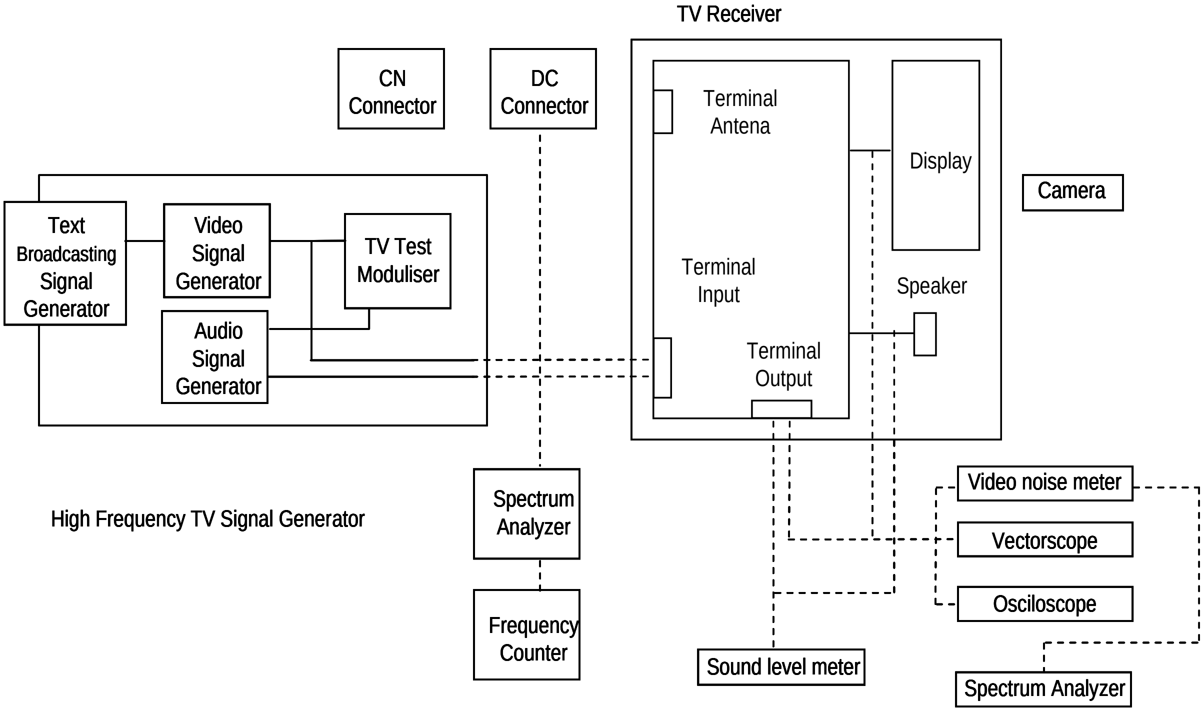
$$P_{A1} = P_{A1Max} - P_{A1Min}$$

(b) PA2: reduced power consumption through the energy savings button (W)

PA2 is the difference between the power consumption when energy saving function is turned on (PA2Min) and power consumption when energy saving function is turned off (PA2Max).

$$P_{A2} = P_{A2Max} - P_{A2Min}$$

5.4 The used equipment



Measurement:

a) Spectrum Analyzer, b) Frequency Counter, c) Video Noise meters, d) Vectorscope, e) Oscilloscope, f) Lx-meter, and g) Sound Level Meter were confirmed by the respective manufacturer of next week (June 22, 2011)

5.5 Measurement Condition

5.5.1 Voltage and Frequency Action: accordance with the standard AC

Voltage 220 V + 10%, 50Hz.

5.5.2 Temperature and Humidity

Temp: 20 - 35oC

Humidity: 45-75%

5.5.3 Input Signal

Power consumption measurements conducted with the input signal as follows

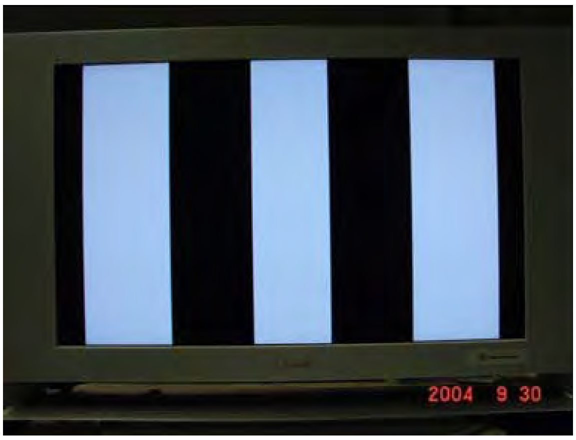
5.5.3.1 Measurement with the input signal through a terrestrial wave band signal (analog or digital) or baseband signal.

(1) Video Input Signal: flat level white signal, flat level black signal, the color line signal and three colors signal line, refer to JIS C6101-1 (checked how many %). TV Condition when the input signal shown in the following pictures:

Picture of flat level white signal

Picture of flat level black signal

Picture of color line signal



Picture of three color line signal

(2) Audio Input Signals: sinusoidal signal with a frequency of 1kHz, at level 150 mVr.ms

(3) Analog Input Signal:

a. Through terrestrial wave band signal

Signal level used is equal to 70 dB (UV) measured at 75Ω input terminal. This value is equivalent to the power of-39dB (mW)

b. Through the baseband signal

Baseband input voltage is measured at baseband terminals at 1 Vp-p against a white signal level flat.

(4) Input Signal Digital: the input signal used is a signal that accordance with standard transmission method used by digital TV broadcasting stations and high-definition broadcasts. Input signal level is -49 dB (mW).

5.5.3.2 Measurement with input via satellite broadcast wave signal (analog or digital)

I. Video Input Signal: flat level white signal, flat level black signal, color line signal and three colors line signal , refer to JIS C6101-1.

II. Audio Input signal: 1kHz sinusoidal signal with modulation factor from PCM for-18dB compared to the peak point.

III. Signal which converted into intermediate frequency accordance with the transmission method standard and high definition by satellite broadcasters.

IV. Signal which converted into intermediate frequency accordance with the transmission method standard and high definition TV broadcast by the station, ultra short-wave broadcasts, and broadcasts the data with a frequency range between 11.7-12.2 GHz. Input signal level of-45dB (mW).

5.5.4 The value of contrast, brightness and backlight

For the measurement of Po and Ps, the TV settings must be set so that power consumption when receiving flat level white signal is the maximum.

5.5.5 Output Audio

TV audio output must be set in such way to produce the output power of 50 mW with a 1 kHz audio input signal.

5.5.6 Additional Functions

A variety of additional functions which can be on and off by themselves should be turned off first.

5.5.7 Measurement

Measurements conducted during the TV condition were stable (minimum 15 minutes). For plasma TVs, measurements were carried out before the fire protection function is activated.

6. Television's Energy-efficiency Level Criteria

Star rating criteria shall be given in the following table.

Table 6-1 Star rating criteria

Star rating	Energy efficiency indicator (E)
4 Star	E < 65 + 0.047 * SA
3 Star	65 + 0.047 * SA < E < 82 + 0.058 * SA
2 Star	82 + 0.058 * SA < E < 102 + 0.073 * SA
1 Star	102 + 0.073 * SA < E < 128 + 0.091 * SA
0 Star	128 + 0.091 * SA < E

SA = Screen Area (cm^2)

7. Testing report

The entire test results must be stored and documented in Assessment Report, which contains the results of measurement data, performance characteristics and details of all the obstacles that occur, damage or retest. Copies of reports should be stored in a test laboratory as reference.

Appendix 2

Pilot Project

Appendix 2-1：Power Factor of CFL in Indonesian Market

Appendix 2-2：Questionnaire for Field Test

Appendix 2-3：Penetration Rate of Major Appliances

Appendix 2-4：Study Target Facilities

Appendix 2-5：Details of Appliances in the Surveyed Household

Appendix 2-1：Power Factor of CFL in Indonesian Market

MEASUREMENT RESULT CFL LAMP

POWER INSTRUMENT	: STABILILIZER VOLT REGULATOR	DATE	: July 12
		TEMPERATURE	: 26.0 ºC
MEASURE INSTRUMENT	: HIOKI 3169	HUMIDITY	: 52.3 %

NO	SPECIFICATION		MEASUREMENT VALUE						
	BRAND	P	U	I	P	COS φ		THD	
	CFLs	WATT	Volt	Ampere	Watt	PF	DPF	V %	I %
1	Shukaku 0506	5	220	0.0446	5.38	-0.54	-0.91	2.34	80.09
2	Klauss 04-6504-2001	5	221	0.0362	4.85	-0.59	-0.87	2.29	72.17
3	Tungsram FLE5W/DBX/864/E27TU	5	220	0.0346	4.52	-0.58	-0.89	2.51	74.78
4	Shukaku 0606	5	220	0.0429	5.19	-0.55	-0.92	2.34	80.17
5	Tungsram FLE5W/DBX/864/E27TU	5	220	0.0331	4.28	-0.57	-0.89	2.30	75.78
6	Klauss 04-6504-2001	5	220	0.0372	4.96	-0.59	-0.88	2.29	72.77
7	Klauss 04-6504-2001	5	220	0.0349	4.72	-0.60	-0.87	2.32	71.61
8	Philips	5	220	0.0353	4.62	-0.59	-0.88	2.37	74.53
1	Shukaku 0608	8	220	0.0545	6.56	-0.55	-0.92	2.25	80.31
2	Eterna	8	220	0.0563	7.26	-0.59	-0.88	2.36	75.61
3	Eclat U06	8	220	0.0567	7.41	-0.59	-0.88	2.29	74.32
4	Eterna	8	220	0.0547	6.91	-0.58	-0.89	2.30	76.51
5	Eclat U06	8	220	0.0571	7.34	-0.59	-0.89	2.30	75.61
6	Eterna	8	220	0.0538	6.82	-0.58	-0.89	2.25	76.39
1	Philips	11	221	0.0795	10.7	-0.60	-0.89	2.22	73.36
2	OSRAM 648	11	220	0.0768	10.7	-0.63	-0.86	2.31	60.30
3	HITACHI	11	220	0.0755	9.13	-0.54	-0.85	2.25	75.78
4	Eclat U06	11	220	0.0792	10.5	-0.59	-0.89	2.18	73.84
5	HITACHI	11	220	0.0757	9.26	-0.55	-0.85	2.22	75.08
6	Eclat U06	11	220	0.0774	10.3	-0.60	-0.89	2.28	73.84
7	Eclat U06	11	220	0.0773	10.3	-0.60	-0.89	2.24	73.23
8	OSRAM 648	11	220	0.0751	10.4	-0.62	-0.87	2.14	69.51
9	MEGAMAN 0439	14	220	0.100	14.1	-0.63	-0.88	2.21	70.5

PF = (Power Factor) is the ratio apparent power to active power. Its calculation includes all frequency components, so large harmonic components result in a small power factor.

DPF = (Displacement Power Factor) is the cosine of the phase difference between the fundamental voltage and current waveforms. Its calculation includes only fundamental waveforms contents, so harmonics have no effect.

Appendix 2-2 : Questionaire for Field Test

	QUESTIONNAIRE Household Sector (To Support National Energy Efficiency Program and Energy Saving Awareness)

Objective:	*To Contribute in Implementing National Energy Efficiency Programs through Study on Electricity Demand Evaluation and Consumer Awareness on Energy Saving.*
Surveyor Company:	**B2TE - BPPT**
Name of Surveyor:	

Date of Survey:	
Name of Respondent:	
Address and Phone Number (home/mobile):	
Status of Respondent:	☐ Husband ☐ Wife ☐ Son/Daughter ☐ Home Owner ☐ Family/Relatives ☐ Home Loaner
Respondent Education:	☐ Some School ☐ High School Graduate ☐ Some College ☐ University/College Graduate ☐ Others ………………………………………
Respondent Job:	☐ Private employee ☐ Government employee ☐ Private Business ☐ Others ………………………………………………
Number of Family:	………………………… (living in the same address)
Monthly Income (Rp.):	☐ < 3 million ☐ 3 ~ 5 million ☐ > 5 million
Monthly Expenditure (Rp):	☐ < 500.000 ☐ 500.000 ~ 1 million ☐ > 1 million
Type of Residential:	☐ Single House ☐ Housing Estate ☐ Others………………
Area of House:	☐ ≤ 36 m^2 ☐ >36 ~ 70 m^2 ☐ > 70 m^2
Electricity Contract:	☐ 450 VA ☐ 900 VA ☐ 1300 VA ☐ 2200 VA ☐ ≥ 6600 VA
Customer ID:	………………………………………………
Annual and Monthly Electricity Consumption and Cost:	………………………kWh/year (average), Rp. ………………………………/year (average) ………………………kWh/month (average), Rp. ………………………/month (average)
Number of Low Power Factor CFL distributed	☐ 8 Watt ☐ 12 Watt ☐ 15 Watt ☐ 20 Watt ☐ …… Watt (total)
Number of High Power Factor CFL distributed	☐ 8 Watt ☐ 12 Watt ☐ 15 Watt ☐ 20 Watt ☐ …… Watt (total)

No	How to manage the use of electrical appliances in your house	
1	Before you buy the electrical appliances	Do you think of the limiter trip and consider it? ☐ No ☐ Yes Where do you get the information about the appliances you want to buy? ☐ from the catalogue ☐ from your family or friend ☐ from the seller (shop staff) or ☐ other
2	Trip	Because of the limited power : ☐ Never ☐ Sometimes (1-3 time in a month) ☐ Often (more than 3 times in a month) Because of PLN : ☐ Never ☐ Sometimes (1-3 time in a month) ☐ Often (more than 3 times in a month)
3	In case of often trip because of the limited power	Do you turn off other electrical equipments to avoid the limiter trip? ☐ No ☐ Yes Do you think of the usage time and consider it to avoid the limiter trip? ☐ No ☐ Yes

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QUESTIONNAIRE
Household Sector

(To Support National Energy Efficiency Program and Energy Saving Awareness)

No	Electrical Appliances														
1.	Lighting fittings:	CFL			Incandescent			Linear FL (T10/T12)			Oil Lamp		Others................		
		.... points			.... points			.... points			.... points		.... points		
	Lighting :	CFL			Incandescent			Linear FL (T10/T12)			Oil Lamp		Others................		
		Watt	Num.	hour/ day	Watt	Num.	hour/ day	Watt	Num.	hour/ day	Num.	hour/ day	Watt	Num.	hour/ day

No	Electrical Appliances	
2.	Refrigera-tor:	a) Number; ...., b) Capacity; ...., ...liter c) Brands; ...., ... e) Input Power; ...., ...W, f) Doors; ......, ..., g) Purchasing year; ....(.......years ago)
3.	Television (TV):	☐ CRT ☐ LCD ☐ Plasma Number; ....., Size; ...., ...inch, Brands; ...., ..., hours/day; ......, ... Input Power; ...., ...W, Purchasing Year; ...., ... (1 / 2 / ......, ...years ago)
4.	Air Con-ditioner (AC):	☐ No ☐ Yes, if yes, filled out the followings; ☐ Split ☐ Window Number; ...., Capacity; ...., ..., ...PK, Brands; ...., ..., ... Input Power; ...., ..., ...W, COP / EER; ...., ..., ..., Hours/day; ......, ..., ... Purchasing Year; ...., ..., ... (1 / 2 / ......, ..., ..., years ago)
5.	Washing Machine:	☐ No ☐ Yes, Type; 1 / 2 drums, Input Power; ....W, Hours/day; .... (average)
6.	Rice Cooker /Magic Jar:	☐ No ☐ Yes, Type; big / small, Input Power; ....W, Hours/day; .... (average)
7.	Dispen-ser:	☐ No ☐ Yes, Type; no electricity / hot & cold, Input Power; ....W
8.	Kitchen Cooker:	☐ No ☐ Yes, Type; gas / electric, Input Power; ....W, Hours/day; .... (average)
9.	Water Pump:	☐ No ☐ Yes, Type; manual / automatic control, Input Power; ....W, Hours/day; .... (avrg)
10.	Personal Computer:	☐ No ☐ Yes, Number; ...., Hours/day; .... (average)
11.	Water Heater :	☐ No ☐ Yes, Type; gas / electric, Input Power; ....W, Hours/day; .... (average)
12.	Electric Iron:	☐ No ☐ Yes, Input Power; ....W, Hours/day; .... (average)
13.	Fan:	☐ No ☐ Yes, Input Power; ....W, Hours/day; .... (average)

Respondent Surveyor Field Coordinator

(................................) (................................) (................................)

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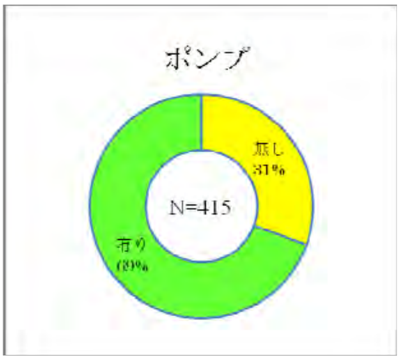
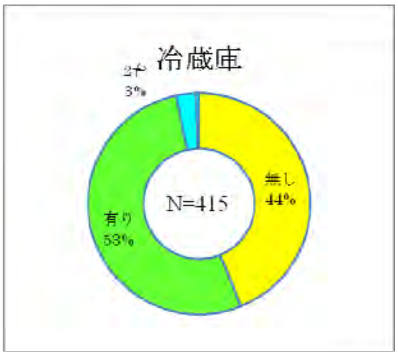
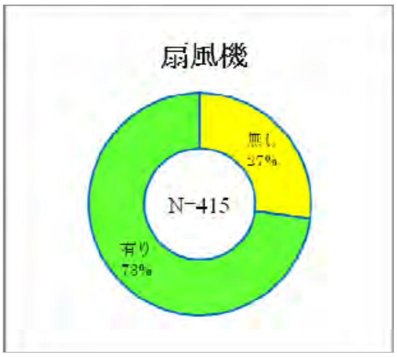
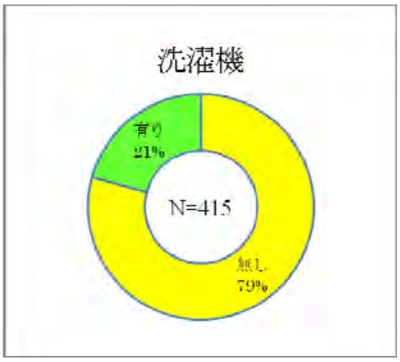
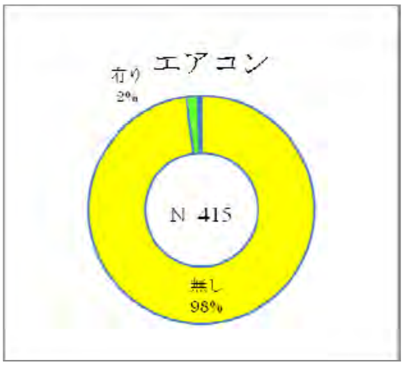
Appendix 2-3：Penetration Rate of Major Appliances

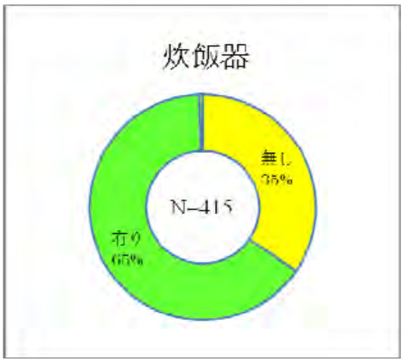


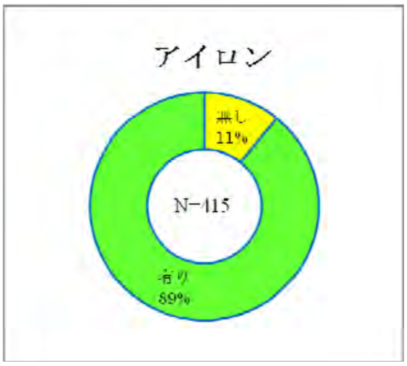






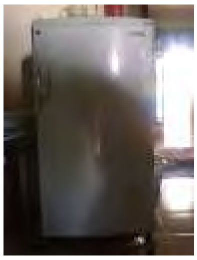
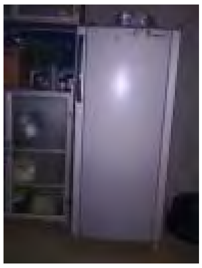
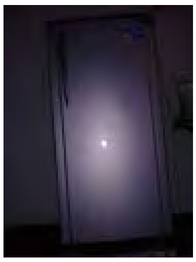




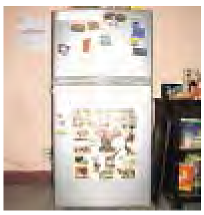


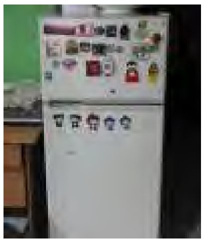
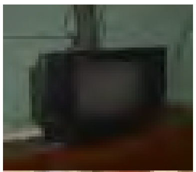
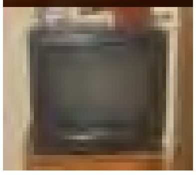
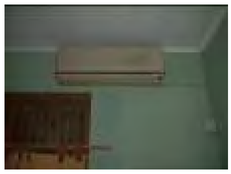
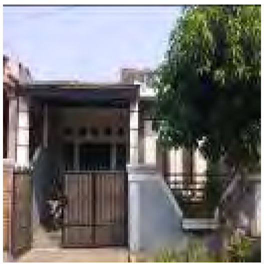
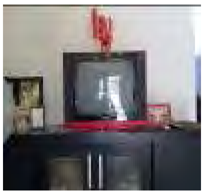
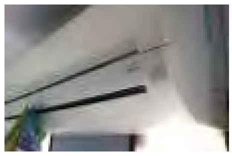
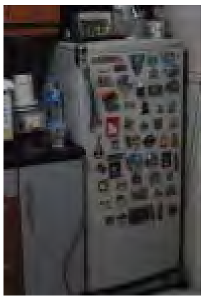
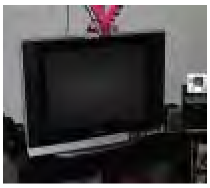
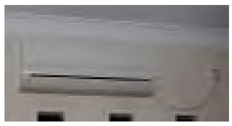
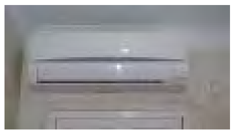
Appendix 2-4：Study Target Facilities

A.1 Profile of Survey 20 Houses

No	House Owner (PLN Contract)	Photo of House	Photo of Appliances		
			Refrigerator	Television	AC
1	I****** (450VA)				None--
2	S****** (450VA)				None --
3	A****** (450VA)				None --
4	N****** (450VA)				None --
5	S****** (450VA)				None --

No	House Owner (PLN Contract)	Photo of House	Photo of Appliances		
			Refrigerator	Television	AC
6	D****** (450VA)				None --
7	N****** (450VA)				None --
8	N****** (450VA)				None --
9	S****** (450VA)			 	None --
10	M****** (450VA)			 	None --

No	House Owner (PLN Contract)	Photo of House	Photo of Appliances		
			Refrigerator	Television	AC
11	E****** (900VA)				None --
12	D****** (900VA)				None --
13	Y****** (900VA)				None --
14	S****** (900VA)			  	
15	A****** (1300VA)				

No	House Owner (PLN Contract)	Photo of House	Photo of Appliances		
			Refrigerator	Television	AC
16	C****** (1300VA)				
17	B****** (1300VA)			  	
18	D****** (1300VA)				
19	H****** (2200VA)		 	  	 

No	House Owner (PLN Contract)	Photo of House	Photo of Appliances		
			Refrigerator	Television	AC
20	H****** (2200VA)			 	 

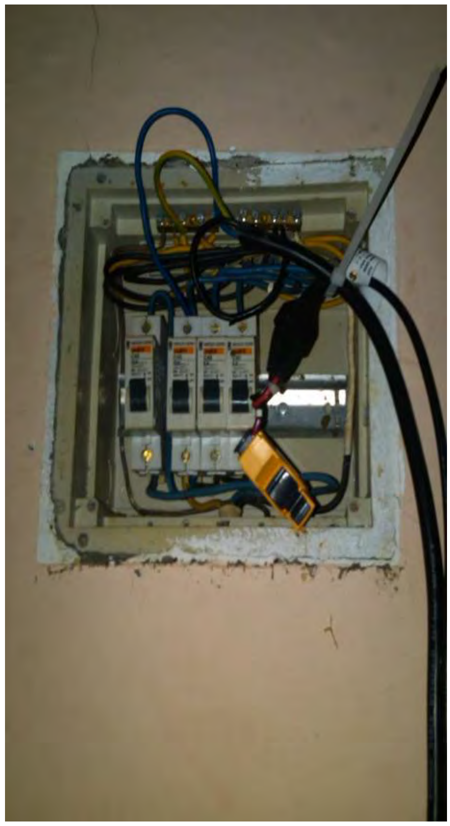
A.2 Current Limiter of House



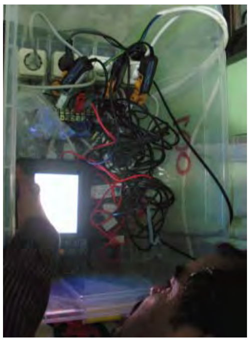
MELCOINDA
3 3 8 0 5
kWh METER
APL SERPONG
546200223566
KP KARANGGAN RT 10/4 SERPONG

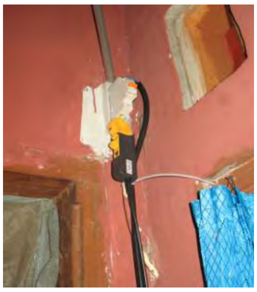
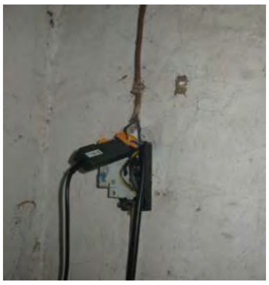

MERLIN GERIN
multi 9


APL SERPONG
546200393376
KP KARANGGAN RT 10/4 SERPONG
PT P L N (PERSERO)
DISTRIBUSI JAKARTA RAYA DAN TANGERANG
CABANG :
R
NO. KONTRAK
NO. PELANGGAN
JANGAN DILEPAS



A.3 Measurement Devices

No	Date of measurement House Owner (PLN Contract)	Location	Photos
1	06-14/07/2011 Sudirman (900 Watt)	Komplek Batan	 
2	06-14/07/2011 Ismail (450 Watt)	Desa Kerangan	 
3	06-14/07/2011 Asmin (450 Watt)	Desa Kerangan	 
4	06-14/07/2011 Suwarno (450 Watt)	Desa Kerangan	 

No	Date of measurement House Owner (PLN Contract)	Location	Photos
5	06-14/07/2011 Soleh (450 Watt)	Desa Kerangan	 
6	14-22/07/2011 Sardian (450 Watt)	Desa Kerangan	 
7	14-22/07/2011 Dahlan (450 Watt)	Desa Kerangan	 
8	14-22/07/2011 Nurhafi (450 Watt)	Desa Kerangan	 
9	14-22/07/2011 Diding (900 Watt)	Kompleks Perumahan Puspiptek	 

No	Date of measurement House Owner (PLN Contract)	Location	Photos
10	14-22/07/2011 Hariyanto (2200 Watt)	Kompleks Perumahan Puspiptek	 

Appendix 2-5：Details of Appliances in the Surveyed Households

No	Power Contract (VA)	Load Type			
		TV	Refrigerator	AC	Others
1	450	21", 21" / 80W,88W	Sanyo/ 65W	No	Lamps,vwell water pump/125W, iron /300W, washing machine/199W, rice cooker/350 W, Fan/65W
		14.6%	19.4%		69%%
2	450	21" (Polytron) / 80W	Samsung/ 65W	No	Lamps, well water pump/125W, iron /350W, fan / 45W, rice cooker 350W.
		15%	18%		67%
3	450	21" (Sanyo) / 80W	Sanyo/65W	No	Lamps, well water pump/125W, iron /300W, fan / 65W, rice cooker 350W
		4.3%	21.1%		74.6%
4	450	21" (Samsung) / 80W	Toshiba / 50W	No	Lamps, well water pump/125W, iron 300W, fan 45W, rice cooker 350W.
		4%	26.4%		69.6%
5	450	21" (Polytron) / 80W	Sanyo/65W	No	Lamps, well water pump/125W, iron /300W, fan/45W, rice cooker 350W.
		12%	27.8%		60.2%
6	450	21" (Polytron) / 80W	Samsung/115 W	No	Lamps, well water pump/125W, iron /300W, fan/45W, rice cooker 350W
		6.7%	53%		40.4%
7	450	21" (Polytron) / 80W	Sanyo/65W	No	Lamps, well water pump/125W, iron /300W, fan/45W, rice cooker 350W
		31%	25%		44%
8	450	21" (Changhong) / 80W	Toshiba / 65W	No	Lamps, well water pump/125W, iron /300W, fan/45W, rice cooker 350W
		17.1%	25.3%		57.5%
9	450	21" (Samsung) / 80W	Asatron / 115W	No	Lamps, well water pump/125W, iron /300W, fan/45W, rice cooker 350W
		11%	43.9%		45.1%
10	450	21" (Fujitec) / 80W	*Cooler / 210W	No	Lamps, well water pump/125W, iron /300W, fan/45W, rice cooker 350W
		26.5%	43.1%		30.4%
11	900	21" (Samsung) / 80W	Sharp / 100W	No	Lamps, iron /350W, rice cooker 350W,washing machine100W,Dispenser 420W, fan/50W
		7.2%	13.9%		78.9%
12	900	21" (Panasonic,Sharp) / 80W,80W	Sanyo/65W	No	Lamps, iron /300W, washing machine 100W, rice cooker 350 W, dispenser 350W,Computer 400W,Fan1 10W/ Fan2 10W
		15%	18%		67%

No	Power Contract (VA)	Load Type			
		TV	Refrigerator	AC	Others
13	900	21" (Ichiko) / 80W	LG / 115W	No	Lamps, Dispenser 450W, and iron /350W, washing machine 100W, rice cooker 450 W.,fan 75W
		8.8%	17.9%		73.2%
14	900	21",21",14" (Sony,Sanyo, Sanken) / 80W, 80W, 56W	LG / 115W	LG,1/2 pk /320W	Lamps, and iron /300W, washing machine 220W, rice cooker 350 W, fan 8W
		16%	18%	30%	36%
15	1300	29" (Sanken) 90W	Sharp / 135W	LG, 1/2 pk /350W	Lamps, washing machine 100W, rice cooker 450 W,Dispenser 300W ,iron /350W, fan 50W
		14%	18%	9%	59%
16	1300	21" (Toshiba) 80W	National / 115W	1/2 pk/ 350W	Lamps, well water pump/125W, rice cooker 350W,washing machine 200W,iron /300W, fan 75/W,
		7%	19%	43%	31%
17	1300	21" (Sanyo) / 80W	Panasonic / 105	3/4 pk /640W	Lamps,well water pump/125W, and iron /300W, washing machine 200W, rice cooker 350 W, ,Computer, Fan 30W.
		15%	15%	47%	23%
18	1300	21" (Sanken) / 80W	Sharp / 115W	1/2 pk /350W	Lamps,well water pump/450W, iron /300W, fan/75W, rice cooker 350W,washing machine 200W
		8%	32%	29%	31%
19	2200	14",21",29" (Samsung),,60 W/80W80W	Panasonic / 125,110W	Panasonic, LG, Sharp 0.75pk,0.5pk , 0.5pk	Lamps,iron /300W, washing machine 200W, rice cooker 350 W, fan 16W,Dispenser 300W,Oven 200W/ Microwave 980 W ,well water pump/125W,Computer 400W,Water Heater 500W.
		3%	15%	32%	50%
20	2200	21",29" (Samsung,LG) / 80W,60W	Toshiba /70 W	1/2pk,1/2pk /350W,350 W	Lamps, and iron /300W, washing machine 200W, rice cooker 350 W, fan 75W, Toaster 300W , Computer
		6%	19%	8%	67%